Appendix A4.7 Earthworks Summary Technical Note

JACOBS

Technical Note

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Project Name	**Kerdiffstown Landfill Remediation Project**
Subject	**Earthworks Summary Technical Note**
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1. Introduction

1.1 Background

This Technical Note has been prepared to summarise the earthworks proposals which have been developed in sufficient detail to support a planning application for the remediation of Kerdiffstown Landfill site and to inform an associated Environmental Impact Assessment (EIA). The aim of this note is to provide confirmation and a summary of the following:

- The objectives and rationale for the earthworks proposals;
- Proposed site re-profiling and material movements;
- Capping proposals;
- Material importation requirements;
- Outline construction phasing; and
- A high level assessment of anticipated construction plant and required on and off-site plant / vehicle movements.

1.2 Objectives

The project has a number of key objectives. For earthworks and remediation proposals these include:

- Remove risks to public health and safety;
- Reduce environmental risk profile to an acceptable level;
- Deliver a solution that is accepted by the community;
- Complete within 8 years; and
- Embedded sustainability in both remediation and post closure stages.

The earthworks proposals have therefore been developed taking cognisance of the project objectives and to satisfy the following remediation objectives:

- Site profiles which provide adequate slope stability for waste reprofiling and capping whilst being able to accommodate anticipated long term settlement of the waste mass;
- An earthworks balance for site reprofiling works;
- Minimise import requirements associated with capping of the site, as far as practicable;
- Accommodate proposed end use development; and
- Provide cost effective, valued engineered proposals.

1.3 Sources of information

The earthworks proposals have been developed from various sources of information including the following, based on reasonable assessment of the available data:

- Ground based topographical survey, Coastway, February 2012;
- Aerial topographical survey, Baseline Surveys, February 2016;
- Kerdiffstown Landfill Preliminary Ground Investigation, Priority, March 2012 (Ref: P11114);
- Kerdiffstown Landfill Phase 2 Ground Investigation, IGSL, November 2012 (Ref: 16412);
- Historical aerial photography; and
- Observations made during a site walkover by Jacobs' Geotechnical Engineers, January – July 2016.

1.4 Limitations

Landfill sites and in particular lining systems are complex engineering structures requiring detailed design and construction quality assurance (CQA). Risk assessment has shown that the remediation solution for Kerdiffstown requires a capping design, which is directly affected by the nature of wastes including composition, degradation rate and moisture content. Whilst the design proposals have been developed on the basis of available information, principally ground investigation data, there remain unknowns and/ or uncertainties due to the size and volume of the site. As a result some relevant aspects may not be finalised until later stages (during detailed design, pre-construction preparation/ contractual engagement or during the construction period).

The earthworks proposals have been sufficiently developed for the purposes of the planning application and have been informed site specific ground investigations, including a supplementary ground investigation completed in March 2017. Estimated quantities are however, approximate, based on the preliminary design and available information.

Some environmental impacts associated with the extraction and transport of primary raw materials and manufactured products would occur off-site. The source and processing/manufacture cannot be determined at this stage and the production of these materials is likely to have been the subject of separate consent procedures (such as applications for planning permission), which may have included environmental assessment. Therefore, it is currently outwith the scope of this assessment to consider the environmental impacts associated with the extraction of raw materials and the manufacture of products.

1.5 Supporting Information

This note should be read in conjunction with the following supporting information.

Document ref	Rev	Type	Title
32EW5604-DOC-0035	0	TN	Waste Settlement Potential Assessment
32EW5604-DOC-0036	0	TN	Capping and Waste Slope Stability Assessment
32EW5604-00-019	0	D	Re-profiled Site Contours
32EW5604-00-020	0	D	Isopachytes – EGL to Re-profiled Site Contours
32EW5604-00-021	0	D	Remediation Contours
32EW5604-00-022	0	D	Post Settlement Contours
32EW5604-00-023	0	D	Cross Sections (Sheet 1 of 2)
32EW5604-00-024	0	D	Cross Sections (Sheet 2 of 2)

Document ref	Rev	Type	Title
32EW5604-00-025	0	D	Typical Remediation Details
32EW5604-00-026	0	D	Outline Construction Phasing (Sheet 1 of 2)
32EW5604-00-027	0	D	Outline Construction Phasing (Sheet 2 of 2)
Earthworks Schedule	03	E	Earthwork balance summary table*
Earthworks Schedule	03	E	Earthworks phasing summary table*
Earthworks Schedule	03	E	Earthworks volume summary graph*
Earthworks Schedule	03	E	Earthworks vehicle movements summary graph*
Earthworks Schedule	03	E	Earthworks stockpiling summary graph*
Earthworks Schedule	03	E	Earthworks cut and fill by zone and phase tables*
Earthworks Schedule	03	E	Earthworks cut and fill by zone and phase graphs*

Key:
Document Type: D = Drawing; R = Report; TN = Technical Note; MP = Management Plan; E = Excel Spreadsheet / Table/ Graph; * Included in Appendix A.

2. Site Zoning and Remediation Works Phasing

2.1 Site zoning

The original zoning of the site was established in the Remedial Options Report in July 2013 largely to reflect geographical coverage of the Site. The zoning has now been revisited as part of the hydrogeological/ groundwater assessment task based on a review of waste types and the groundwater monitoring undertaken over the past few years. New zonal references and boundaries are now proposed, although largely co-incident with the previously defined zones to then relate to the proposed remediation solutions.

The zones are summarised in the following table and indicated on relevant drawings.

Zone No.	Description
1 (& 1A)	Zone 1 represents the largest volumes of waste at the Site. This area is uncapped. Waste reported to largely comprise MSW, with although some C&D waste also reported to be present. MSW is located over most of the zone, although more C&D waste is apparent in the north-west corner of the zone (now designated as Zone 1A). Throughout the zone, where waste is encountered, it is considered that there is sufficient putrescible material present to class the wastes as non-hazardous biodegradable waste.
2A & 2B	Both zones are relatively flat and broadly coincident with surrounding natural ground levels. The zones are underlain by waste materials largely concealed by large concrete hard standings / former building footprints. The wastes in Zone 2A comprise more MSW than that in the Zone 2B. Initial gas readings in Zone 2A show relatively high concentrations of methane and carbon dioxide. The majority of waste in Zone 2B is reported to comprise unprocessed non-hazardous mixed C&D waste but mixed with MSW also present at varying depths. Methane results from boreholes in Zone 2B show lower concentrations than Zone 2A. Borehole logs indicate that hazardous wastes are not present within the waste mass.

Zone No.	Description
3	Zone 3 comprises a partially filled lined cell. Full details of the waste contained in the cell are uncertain. However, the wastes in this area are likely to be similar to the wastes elsewhere on site and thought to comprise processed non-hazardous C&D materials with domestic waste mixed through.
4	This zone comprises large stockpiles, steep sided slopes to the site perimeter and large concrete hard standings/ former building/ structure footprints, overlying waste materials. The majority of waste is reported to comprise C&D waste with a high proportion of inert material (dominantly reported as gravelly clay) with varying amounts of plastic, timber, textiles, steel, concrete, brick, PVC pipes. It is not considered that MSW (by definition) is present within this zone. Available gas readings show an absence or limited presence of methane and carbon dioxide concentrations.

Previous zoning of the Site included Zone 5. A large part of this zone currently has houses present and it is considered that no waste is present in this zone and is therefore not assessed as requiring remedial works. Construction works are proposed in this area as outlined in the sections below.

2.2 Works Phasing

The proposed phasing of works on site is shown on Drawing Numbers 32EW5604-026 and 027 Outline Remediation Phasing (Sheets 1 and 2) and summarised in tabular format as listed in Section 1.5 Supporting Information and contained in Appendix A.

Remediation Works

Completion of the remediation works is predicted to take place over a 3.5 year period, during seven phases each lasting approximately six months in duration. These phases are dependent on a number of factors, including the period at which a planning decision is granted, legal agreements for land purchase, availability of suitable materials for importation, procurement approach for the works, hours of operation and ecological constraints. The durations are also likely to be subject to conditions, to restrict works where impacts and nuisance may be prevalent including inclement weather giving rise to surface water run-off, and dust and odour generation through waste excavation works. The construction contract(s) would be structured to include management and mitigation of such impacts in line with the findings and recommendations of the EIS.

The phasing of the remediation works has been developed considering the following constraints and requirements:

- The need for initial enabling works (e.g. construction of a new site entrance to facilitate the safe import of materials);
- Re-profiling of the site, achieving a cut / fill balance and associated bulk handling / movement of materials;
- Material import needs and space restrictions for temporary stockpiling of materials required to complete the restoration works;
- Surface water management during, prior to and following final remediation of the site;
- Landfill gas and leachate management; and
- Sequential restoration of the site to achieve a progressive reduction in associated health, safety and environmental risks during completion of the remediation works.

Separate management plans have been developed for landfill gas, leachate and surface water with other aspects to be addressed through a Construction Environmental Management Plan, to embrace mitigation techniques determined through the preparation of chapters in the EIS.

The phasing proposals are also intended to provide contingency for:

- Possible variations in earthworks volumes;
- Broad allowance for seasonal earthworks restrictions (e.g. suspension of works during adverse weather); and
- Unforeseen occurrences such as encountering materials that require removal from the site.

End-Use Construction

Following completion of the remediation works it is assumed that end-use construction works will commence. However, there is an opportunity for end-use works to be undertaken in parallel or as part of the remediation works, such as drainage installation and landscaping as a minimum.

2.3 Opportunities

Whilst review of available data such as borehole logs indicate 'waste' the nature of this waste and its classification in terms of risk to the environment presents a potential opportunity in the development of the site. For example, a large stockpile is present in Zone 4, adjacent to the lined cell, and had been determined to be waste. However, excavations undertaken on this stockpile to utilise the material in the Demolition and Waste Removal Works contract in 2016 has shown a significant proportion of this material to be clayey or sandy. Processing of this stockpile and other apparent sources of waste to remove the waste fraction and assess suitability of the remaining material, from geotechnical and geo-environmental perspectives, would offer a reduction in the volume of material to be emplaced below the cap, whilst potentially producing material suitable for re-use in the landscaping of the site.

The approach to the earthworks proposals is seen to be conservative by assuming a 'worst case' for material importation to facilitate remediation of the site. Review of landscaping proposals may identify a need for additional soils to facilitate landscaping; however, it is considered that this requirement may be off-set by the re-processing of site won materials, subject to appropriate testing and CQA.

3. Enabling Works

To facilitate the overall remediation of the site a number of initial enabling works are proposed as summarised in the following sections.

3.1 Site Entrance

Remediation of the site and most notably capping of the waste materials will require a substantial import of earthworks materials as there is insufficient material available on site to facilitate such. The existing site entrance has restricted visibility splays and would require crossing of a secondary road by heavy goods vehicles. Consequently, to facilitate the safe import earthworks materials and to link with proposed end use proposals, it proposed to construct a new site entrance comprising a roundabout arrangement.

Construction of this new entrance has been identified as a first stage in the enabling works, requiring land purchase agreements and temporary use of adjacent lands to facilitate tie-in of the road network.

3.2 Landfill Infrastructure Compound

Long term management of landfill gas and leachate through the life-cycle of the site requires the relocation of current management facilities. With the remediation proposals and taking cognisance of the proposed end-use it is proposed that a new, secure landfill infrastructure compound will be constructed in a single location. Due to the nature of the site and risks to the environment should any such facilities fail, the new compound has been positioned off-waste such that ground conditions are not liable to settlement due to waste degradation or loading. The new compound will be located immediately adjacent to the new site entrance.

Similarly the new (buried) pipeline required to discharge treated leachate to the local sewer network can be positioned predominately off-waste, along the boundary of the site, extending south-east to Johnstown Pumping Station. This pipeline is proposed to be commissioned at an early stage in the remediation works to reduce current leachate tankering costs and risks to the environment through road usage.

3.3 Baseline / Residual Demolition Works

Following removal of unsafe buildings and structures in 2016 located in Zones 2B and 4 only concrete walls and surface intrusions remain. Walls of previously demolished buildings in Zone 2A also remain presently.

To facilitate the site re-profiling works and provide an area for temporary stockpiling of materials, these residual concrete structures located within Zones 2A, 2B and 4 will require demolition. Additionally, facilitation and construction of the new site entrance and landfill infrastructure compound will require the demolition of two existing residential dwellings located off Kerdiffstown Road to the east of the existing site entrance.

On-site concrete structures are envisaged to be demolished by pneumatic breakers fitted to excavators. It is proposed that the broken out material will be processed using mobile crushing and screening plant to be located in Zone 2B, due to its reduced exposure to surrounding environs compared to Zone 2A.

It is envisaged that fines produced from the crushing and screening operations will be disposed to the site (below cap), reinforcing steel extracted for recycling (off-site) and aggregate produced for re-use in drainage (subject to appropriate geotechnical and geo-environmental testing).

4. Waste Re-profiling

4.1 Existing and proposed heights

Excluding areas of existing hard standing in Zones 2A, 2B and 4, existing surface profiles are typically undulating with a number of large voids and surface stockpiles present. In addition, the majority of the existing boundary slopes have been formed at relatively steep gradients of up to 1v:1.5h.

Re-profiling of the site will be required to provide acceptable remediation profiles and stable slopes with respect to capping placement/ construction, long term stability and post construction settlement. This will also be required to accommodate end use proposals and drainage run-off.

The following maximum re-profiled levels are proposed in Zone 1 (as the most significant profile at the site):

- Existing top of site: 113.5mOD (Malin Head)
- Re-profiled top of waste: 114.5mOD (Malin Head)
- Top of Remediation profile: 115.15mOD (Malin Head)
- Post-settlement profile: 110.5mOD (Malin Head)

It should be noted that the positioning of the top levels are not directly correlated, i.e. the proposed top of cap is not directly above the existing top of site.

Re-profiling works in Zones 2A and 2B are limited given the proposed end-use and the location of multi-use sports pitches in these locations. Earthworks will be required to enable placement of low permeable soils and in the end-use construction to facilitate drainage run-off.

4.2 Waste slope stability

A preliminary waste stability assessment (refer to document number 32EW5604-DOC-0036) has been completed adopting typical geotechnical parameters for waste materials from published sources. The assessment demonstrates that the permanent slopes to be formed in waste materials will need a maximum slope gradient of 1 in 2.5 to provide acceptable long term stability. The minimum slope gradient (post-settlement) has been assessed to be 1 in 30, sufficient to maintain drainage run-off.

4.3 Waste screening

Waste materials present at the site typically contain a high proportion of C&D wastes, including large blocks of demolition rubble. Re-profiling of the site is expected to require the selected removal of oversize materials at the point of excavation and where encountered at proposed formation levels in areas of proposed capping construction. It is proposed that the oversize material will be crushed and screened to an acceptable grading to facilitate its re-use as bulk fill, or used to fill large voids. Crushing and screening and temporary stockpiling prior to re-use is proposed to be undertaken in the Zone 2B site won materials processing and stockpiling area.

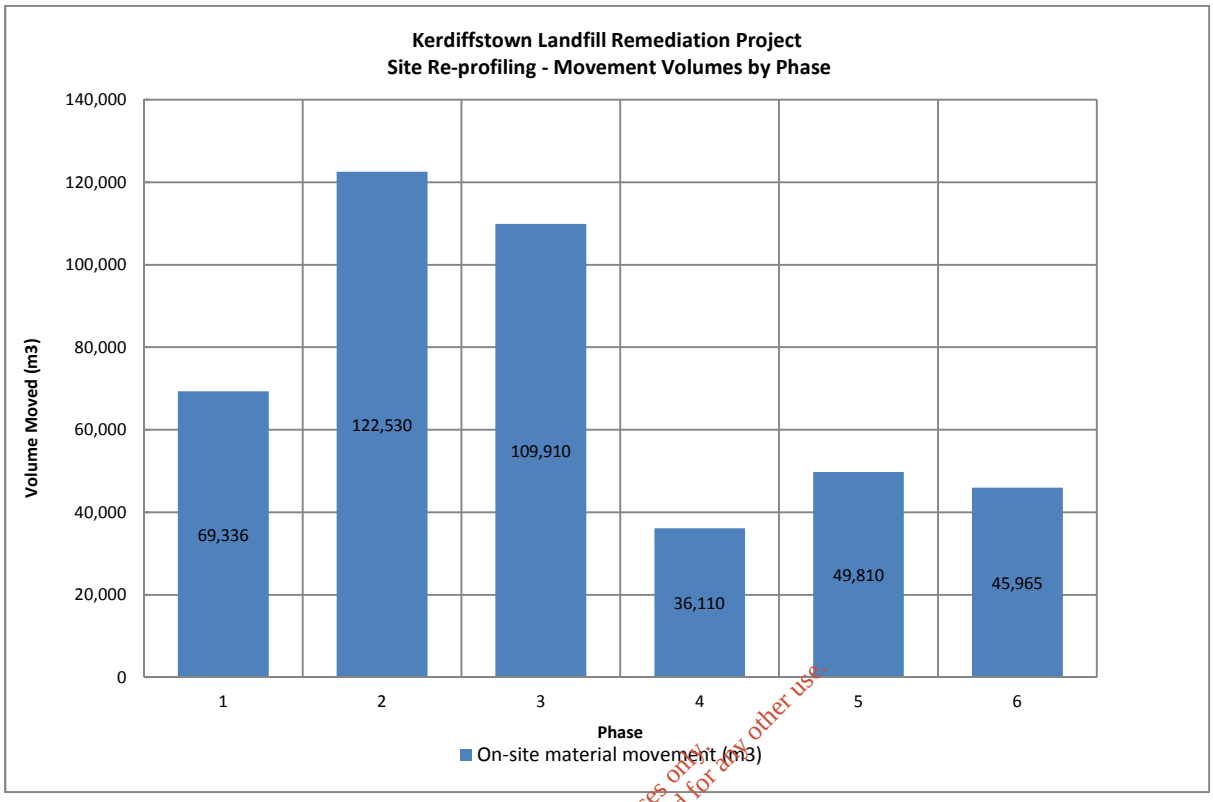
The site was previously licensed to only accept non-hazardous and inert wastes. Based on historical knowledge of the site and current ground investigation information, including chemical testing, the risk of encountering hazardous waste is therefore considered low, though the possibility of encountering isolated occurrences of hazardous waste during the re-profiling works cannot be discounted.

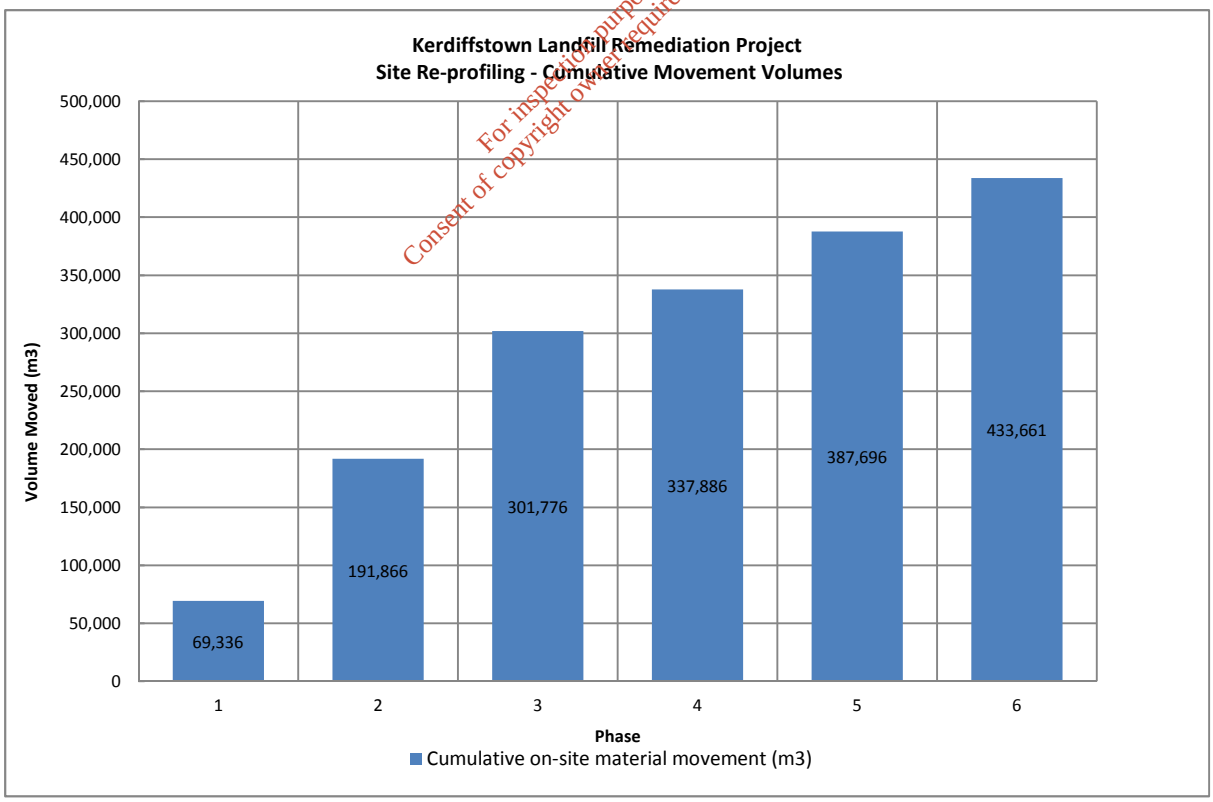
To manage the risk of hazardous materials all excavated and exposed waste materials will be subject to visual screening. Any materials suspected to be potentially hazardous shall be subject to temporary stockpiling and chemical testing to confirm their waste classification prior to placement as fill in the regrading works. Any material confirmed as hazardous will be disposed off-site to a suitably licensed facility.

4.4 Waste re-profiling volumes

It is likely that volumes calculated for re-profiling works may adjust during detailed design and / or construction works due to the nature of the material exposed. It is considered from borehole logs that a large proportion of the waste mass comprises construction and demolition wastes, where rubble and concrete blocks may be anticipated. Encountering such materials to then remove may generate a greater volume of material to be disposed to the site and materials required for backfill. Similarly, there is an opportunity to re-use site won soils in the remediation works, subject to appropriate testing and classification.

Currently anticipated total and cumulative earthwork volumes to be moved during each phase of the re-profiling works are summarised in the following charts.





A detailed breakdown of cut / fill volumes associated with the waste re-profiling works, including the movement of waste materials between different zones of the site is included in Appendix A.

The phasing of works may be adjusted based on the procurement approach adopted, availability of suitable capping materials and findings on site during construction works, such as highly odorous wastes (reduction in open areas slowing progress).

5. Remediation Proposals

5.1 Capping options

The remediation proposals include capping of exposed waste following the waste re-profiling works to reduce risks to human health and the environment by reducing the potential for future surface water infiltration and associated leachate generation and controlling gas migration.

The components of a landfill capping system may include:

- topsoil;
- subsoil;
- drainage layer;
- barrier (infiltration) layer; and
- gas drainage layer.

The capping system assessment is further discussed blow.

Various options are available for the construction of a barrier layer, such as use of a flexible membrane liner (FML), geosynthetic clay liner (GCL) or clay (including bentonite enriched soils (BES)). Each has benefits and constraints when assessing stability, settlement and integration with requisite landfill infrastructure as well as effects on the proposed end-use proposals. These elements have been assessed to determine the proposed capping solutions which vary between the different zones of the site as shown below.

Zone	Proposed Capping Solution
1 & 1A	New multilayer capping (FML)
2A & 2B	Retained concrete hardstanding & low permeability cap (clay)
3	New multilayer capping (FML)
4	Low permeability soil cover

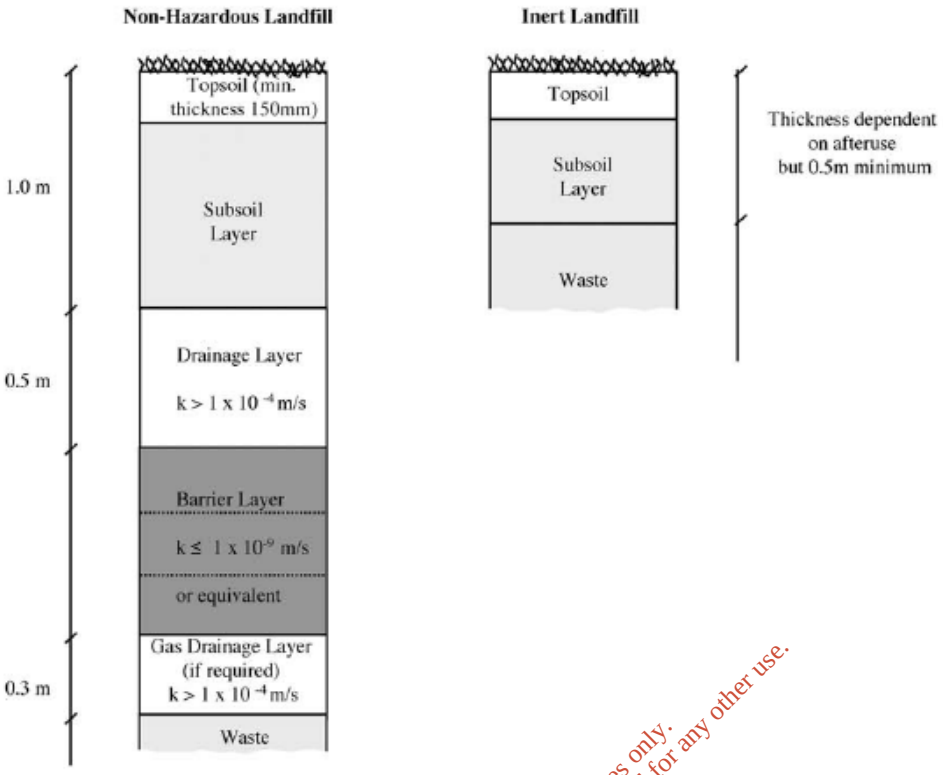
The variation in capping solutions reflects the assessed risk to groundwater from surface water infiltration following re-profiling works in different areas of the site. This considers the nature and thickness of waste materials present and the proposed maintenance of cover to waste materials by the retention of existing areas of concrete hardstanding in Zones 2A and 2B.

5.2 Retained concrete hard standings (Zones 2A & 2B)

The utilisation of existing hard standing areas in Zones 2A and 2B to provide a capping function assumes that minor remedial sealing works will be undertaken to restrict possible future infiltration. This includes inspection for and remediation of surface cracks, sealing of construction joints, filling and capping over voids and grouting up of redundant drainage.

5.3 Multilayer capping system (Zones 1 & 3)

The EPA Landfill Manual guidance series on Site Design provides a recommended capping system for landfill sites in receipt of non-hazardous and inert waste, as shown below.



Application of the recommended non-hazardous waste capping system would give an approximate depth of soils of about 2.4m. A source of suitable capping materials to construct the above capping system is not available at the site therefore the solution would require substantial material import.

Assessment of capping options has therefore been undertaken taking cognisance of the EPA guidance. The guidance states that the components of the capping system and the materials to be used should be evaluated on a case by case basis, and that not all components will be necessary for every site. Given the proposed works comprise the remediation of a former site, i.e. not a new development, derogation to the guidance is proposed as outlined below, whilst meeting risk mitigation objectives. The following alterative capping system is proposed for Zones 1 and 3.

Layer	Thickness
Top soil / soil forming material cover	150mm
Subsoil	350mm
Geosynthetic drainage layer	Negligible combined thickness (<15mm)
Geosynthetic barrier layer	
Geosynthetic gas drainage layer	
Regulation layer	150mm
Total thickness	**~ 650mm**

The proposed alternative capping solution will provide a 1.75m reduction in the total thickness of the capping system and a 75% reduction in required imported soil volumes and associated vehicle movements.

5.4 Low permeability capping (Zones 2A and 2B)

A low permeability capping solution is proposed for Zones 2A and 2B where separation to waste materials will not be provided by retention of concrete hardstanding areas. The proposed capping solution for Zones 2A and 2B is summarised in the following table.

Layer	Thickness
Top soil / soil forming material cover	150mm
Low permeability clay cap	350mm
Total thickness	**500mm**

The proposed solution reflects an assessed lower risk to groundwater from surface water infiltration in Zones 2A and 2B resulting from a combination of reduced waste thicknesses and predominant C&D waste composition with a reduced proportion of MSW compared to Zones 1 and 3.

5.5 Low permeability soils (Zone 4)

A low permeability soil cover solution is proposed for Zone 4 as summarised in the following table.

Layer	Thickness
Top soil / soil forming material cover	150mm
Low permeability subsoil	350mm
Total thickness	**500mm**

The proposed solution reflects an assessed lower risk to groundwater from surface water infiltration in Zone 4 resulting from a combination of reduced waste thicknesses, predominant C&D waste composition with minimal MSW, proposed removal of wastes encountered in the remediation of slopes, slope gradients and the use geosynthetic liner in the new surface water management pond covering a large area of the zone.

5.6 Capping profiles

Proposed top of capping levels at the end of the remediation works (pre-settlement) are shown on Drawing Number 32EW5604-021 Remediation Contours.

6. Capping and Waste Stability

A preliminary stability assessment has been undertaken for the site to support the proposed remediation waste and capping profiles, based on available data (refer to document number 32EW5604-DOC-0036). The use of the term waste is representative of the materials present in Zones 1, 2A, 2B and 3 and not to be inferred as each occurrence of waste, such as isolated pockets of wood, re-bar etc.

6.1 Waste stability

The preliminary assessment of slopes formed in waste has been undertaken by adopting typical geotechnical parameters for waste materials from published sources. The assessment, demonstrates that the required permanent slopes to be formed in waste materials will need a slope gradient of 1 in 2.5 or shallower to provide acceptable long term stability.

6.2 Multi-layer capping stability

A numerical assessment multi-layer capping stability has been undertaken for the following variables:

- Required slope gradient (1 in 2, 1 in 2.5 & 1 in 3)
- Material parameters ('typical' and 'best case' based on typically published values
- Thickness of cover soils (0.5m & 1.0m)
- Geosynthetic barrier layer (FML & GCL)*
- With or without the provision of a drainage layer.

Permissible multi-layer capping options determined from the preliminary stability assessment are summarised in the following table.

Slope Gradient	Permissible Multilayer Capping Solution	
	'Typical' Material Parameters	'Best Case' Material Parameters
>1 in 2.5	• No solution feasible.	• No solution feasible.
1 in 2.5 to 1 in 3	• HDPE option with 0.5m max. cover soils, geo-grid reinforcement and a drainage layer. • GCL option not feasible.	• HDPE option with 0.5m max. cover soils and a geo-grid reinforcement but possible omission of drainage layer. • GCL option with 0.5m max. cover soils and geo-grid reinforcement with or without drainage layer.
<1 in 3	• HDPE option with 1.0m max. cover soils and no requirement for drainage or geo-grid reinforcement layers. • GCL option with 1.0m max. cover soils and geo-grid reinforcement but no requirement for a drainage layer.	• HDPE option with 1.0m max. cover soils and no requirement geo-grid reinforcement or drainage layer. • GCL option with 1.0m max cover soils and geo-grid reinforcement but no requirement for a drainage layer. • GCL option with 0.5m max cover soils and no requirement for geo-grid reinforcement or drainage layer.

Due to the unknown source of capping materials there is a risk that 'best case' material parameters may not be achievable. Consequently, a HDPE multi-layer capping solution based on the use of 'typical' material parameters is currently proposed.

6.3 Low permeability capping (clay)

Stability calculations have not been undertaken for the low permeability soil capping options as this option will be restricted to gradients of 1 in 3 or shallower, hence, subject to the appropriate specification and placement of the soil materials is expected to provide adequate stability.

7. Post remediation settlement

7.1 Requirement

Settlement of the remediated waste mass will occur as a result of the decomposition of biodegradable waste within the landfill. Settlement values of between 10 and 25% are typically expected for municipal waste landfills. Settlement continues, gradually reducing with time, until the waste is stabilised, although the degree and rate of waste settlement are difficult to estimate especially where waste composition and infilling records and not available.

Consideration of potential settlement is required to ensure that the proposed remediation profiles remain acceptable over the long term. This includes:

- The maintenance of acceptable surface gradients and avoidance of low spots to prevent possible surface water ponding; and
- Excessive deformation of the capping which could result in a loss of capping integrity.

Settlement of the site may be induced by:

- Loading of waste materials by proposed re-profiling works;
- Long term waste degradation and associated loss of mass;
- Loading of waste materials by capping works; and
- Any loads applied to the ground surface.

7.2 Assessment

To confirm acceptable post-settlement profiles will be maintained, a preliminary settlement assessment has been undertaken for the site (refer to document number 32EW5604-DOC-0035). This assessment is based on the following assumptions:

- Due to the generally high permeability and relatively free draining characteristics of the types of waste indicted to be present at the site, settlement induced by the site re-profiling works will occur during the re-profiling works and will not substantially contribute to post remediation settlement;
- The limited thickness of the proposed capping solution will result in limited loading of any underlying wastes and any minor settlement induced will be 'built out' during capping construction; and
- Substantial loading above the capping system will not occur.

Reflecting the above assumptions the preliminary settlement assessment has focussed on settlement due to long term waste degradation. Post remediation settlement predictions have been made by the application of Jacob's in house numerical predictive waste settlement model which is related to the anticipated composition and age of the waste materials present at the site.

7.3 Settlement predictions (Zones 1 and 3)

Post remediation settlement due to waste degradation in Zones 1 and 3 is predicted to be in the order of 14% with settlement expected to be substantially complete by 2150.

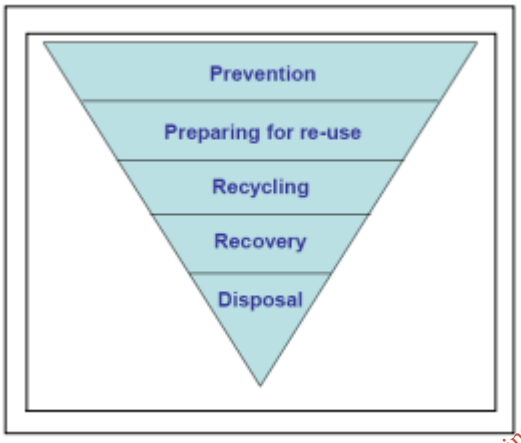
The predicted settlement percentage has been applied to post re-profiling waste thicknesses to predict actual settlement across the site. Through an iterative process, the proposed remediation profiles were adjusted until no post-settlement low spots occurred and a minimum gradient of 1 in 30 was achieved for all areas of proposed capping, providing suitably profiles for surface water management and complying with EPA guidance. This excluded the retained hardstanding areas which have are assumed to be drained separately as part of end use proposals.

The required remediation profile is shown on Drawing Number 32EW5604-00-021 Remediation Contours and the predicted post settlement profile shown on Drawing Number 32EW5604-00-022 Post Settlement Contours.

Emplacement of wastes should be specified in any future contractual agreement to meet performance specifications and density targets, or by method specification as agreed through trials. Should substantial loading of the capping system be required, supplementary settlement calculations will be required to confirm resulting deformation of the capping system remains within acceptable tolerances.

8. Material import & export

The application of key material and waste management principles, such as the waste management hierarchy (shown below), will reduce the effects on natural resources. In particular, this will be achieved by re-using existing soils, with appropriate processing and assessment.



In considering material resources use and waste management, it is important to define when, under current legislation and understanding, a material is considered to be a waste. The Waste Framework Directive (European Directive 2006/12/EC, as amended by Directive 2008/98/EC) defines waste as any substance or object that the holder discards or is required to discharge. The Waste Framework Directive is implemented by European Communities (Waste Directive) Regulation (S.I. No. 126/2011). Once a material has become waste, it remains waste until it has been fully recovered and no longer poses a potential threat to the environment or to human health, at which point it is no longer subject to the controls and other measures required by the Directive. These principles are applied by the EPA to waste used as aggregate/construction material in civil engineering applications, which ceases to be waste once it is incorporated in the construction.

Proposals for material management are to be set out in a Construction Environmental Management Plan (CEMP), required as part of the EIS and planning process.

8.1 Export volumes

The significant export of materials from the site is not expected to be required during the site remediation works. It is proposed that waste materials would be inspected at the point of excavation and where deemed to be suspected as non-compliant, would be subject to the relevant waste acceptance criteria process in accordance with Article 16 and Annex II of the Landfill Directive. The Landfill Directive is implemented by Article 50 of Waste Management (Licensing) Regulations 2004 (S.I. No. 395/2004). Waste would be classified as being hazardous when it displays one or more of the hazardous properties listed in the Second Schedule of the Waste Management Act as amended (European Communities (Waste Directive) Regulations 2011 (S.I. 126 of 2011)). On completion of the classification, the correct European Waste Catalogue (EWC) code referenced from the List of Waste (LoW) 37 would be assigned. LoWs are listed in the EPA document “Waste Classification List of Waste & Determining if Waste is Hazardous or Non-hazardous”, valid from 1st June 2015.

Materials that may require removal from site are therefore expected to be restricted to:

- materials with a re-sale value generated from the residual demolition works (e.g. reinforcing steel; tyres); and
- non-compliant or hazardous wastes, if encountered during the site re-profiling works, which require disposal to a suitably licensed, off-site facility as determined through the above process.

8.2 Import volumes

The site will not be operated as a landfill site. No waste materials will be imported to the site as part of the remediation works, except where that material is defined as waste as outlined above.

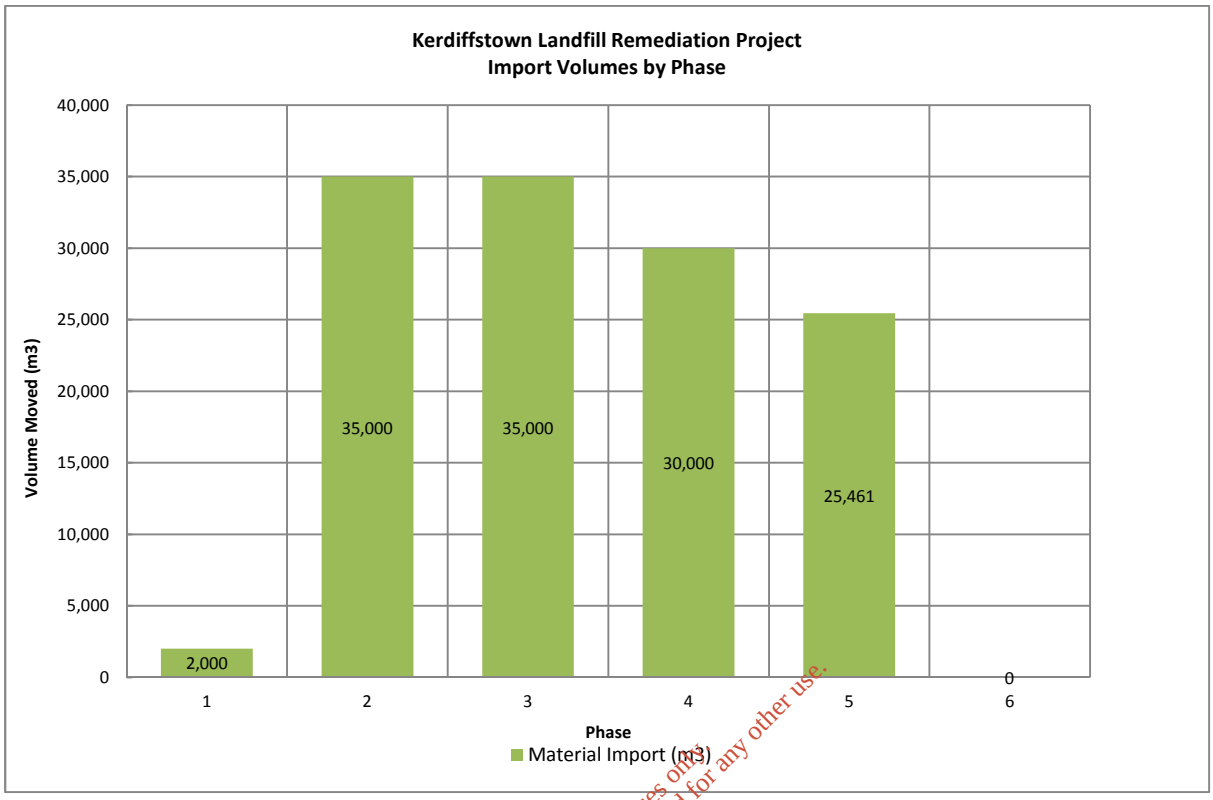
With the exception of a limited stockpile of sub-soil material located adjacent to the existing site entrance, no other materials suitable for capping construction are available on site. Capping of the site will therefore require a substantial import of soil materials with an associated high number of vehicle movements, albeit this has been significantly reduced through assessment of capping options.

The total volume of soil materials required to construct the capping has been calculated by applying the proposed construction thicknesses to the required capping areas. Additional import of engineering fill is proposed for the construction of bunds to Zone 3 and the Zone 4 ponds.

The approximate material import volumes are summarised in the following table.

Material		Import volumes (m³)
Capping	Topsoil	29,300
	Sub-soil	68,300
	Regulation layer (sand)	16,500
Engineered bunds		13,300
Total volume		**127,400**

Currently anticipated import volumes during each phase of the re-profiling works are summarised in the following chart.



It is envisaged that further material import may be necessary to offer mitigation to landscape and visual impacts as well as in the construction of the end-use proposals. However, the volumes are unlikely to be significantly above that indicated as required to facilitate the remediation works, where these figures are considered to be conservative with opportunities to reduce import volumes through re-processing of on-site materials.

A review of mitigations proposed in EIS chapters will be required to be undertaken to assess impacts.

9. Temporary Stockpiling

Completion of the remediation works will require the temporary stockpiling of site won and imported materials at various phases during the works. Proposals for stockpile management are to be set out in a Construction Environmental Management Plan (CEMP), required as part of the EIS and planning process.

9.1 Stockpiling approach

To prevent possible contamination of clean materials by site wastes is proposed to establish separate stockpiling areas for imported materials and site won materials.

Proposed stockpiling arrangements are summarised in the following table with stockpile locations shown indicatively on Drawing Numbers 32EW5604-023 and 024 – Outline Remediation Phasing (Sheets 1 and 2).

Stockpile locations are retained on existing concrete hardstanding areas as far as practicable, to offer a separation to and protection of the underlying materials.

Stockpile	Proposed Location	Proposed uses
Existing sub-soil	Retained adjacent to existing site entrance.	Zones 1 and 4 capping
Imported 'clean' soils	Zone 2A	Zone 3 toe bund Zone 4 pond bunds Zones 1 to 4 capping.
Crushed / screened concrete (aggregate)	Zone 2B	Gas wells, access tracks.
Site wastes (including fines from crushing of concrete)	Zone 2B	Infill to Zones 1 and 3 Export from site if classified as hazardous during waste classification

Other areas will require to be designated on site, such as holding areas, quarantine areas and storage of unprocessed waste. Storage of processed waste is unlikely to be necessary as it would be transported to the infill area (typically Zones 1 and 3) immediately to reduce the need for double handling.

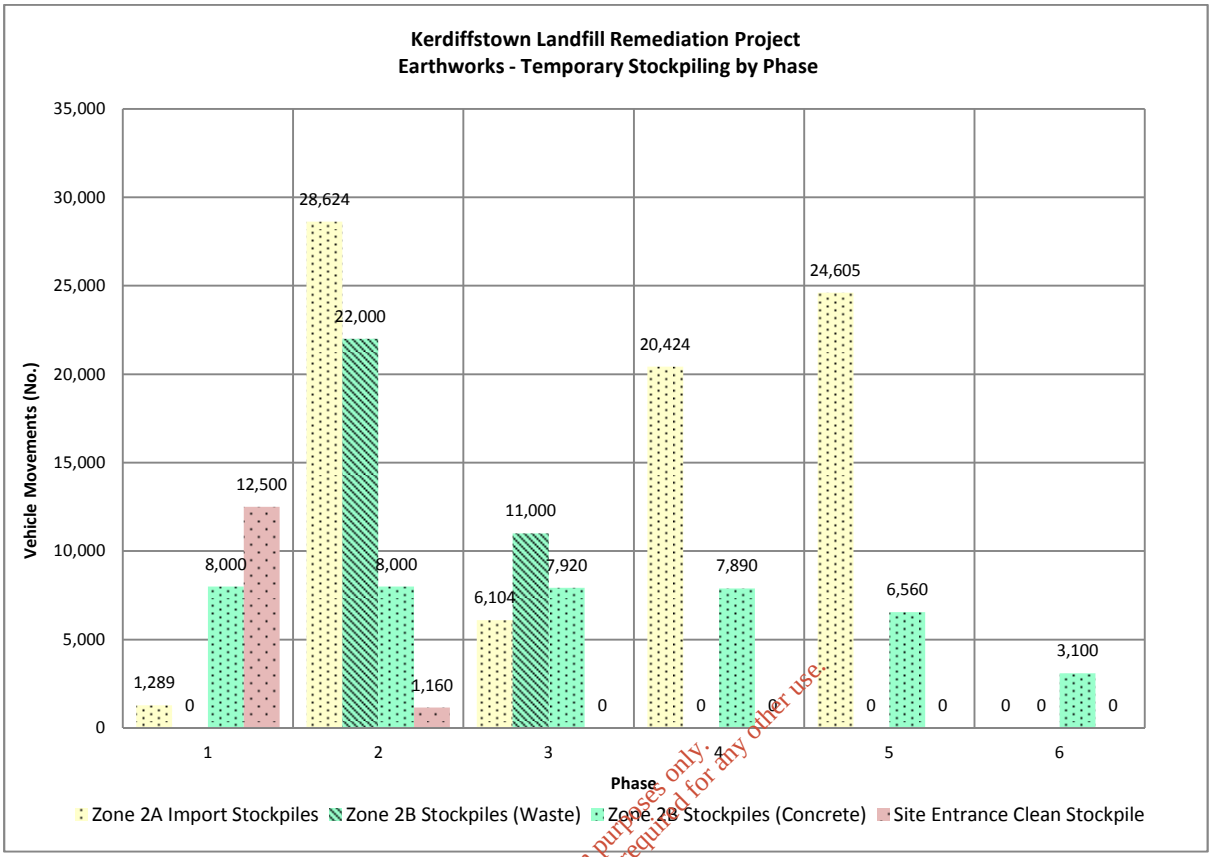
The general segregation imported clean materials and site material stockpiles between Zones 2A and 2B respectively will also limit the risk of cross contamination of clean materials by avoiding the need for road going vehicles to directly traffic on or though areas containing exposed waste materials.

Surface water management proposals indicate that there will be no discharge from the site permitted during the remediation works. The Zone 4 ponds will be adopted as retention ponds during the construction works, and it is anticipated that the contractor would be required to utilise silt-buster traps as is typical on earthworks/ construction projects.

To further mitigate the risk of off-site contamination, it is proposed that all road going vehicles which access stockpile areas will be required to pass through a wheel washing facility prior to exiting the site. Further, site access roads including Kerdiffstown Road would be subject to regular road sweeping as and when required.

9.2 Stockpile volumes

Sizing of stockpiles cannot be determined at this stage as it is dependent on the availability of suitable material for import, the programming of the works, subject to planning approval being granted, and the procurement approach adopted. However, a high level assessment of anticipated volumes of materials stored in each stockpile during the different phases of the remediation works are summarised on the following graph.



A detailed breakdown of the source and proposed end location by zone of stockpiled materials is also included in Appendix A.

9.3 Stockpile management

It is envisaged that stockpiling of materials will be undertaken in accordance with *'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites'* published by the UK Department for Environment Food and Rural Affairs or equivalent Irish guidelines.

As a minimum stockpile management shall include:

- Visual screening for potential contaminated materials;
- Segregation of material suspected to be contaminated from clean materials ;
- Stockpiling of materials at appropriate heights / batters to prevent potential instability;
- Protection of stockpiled materials from scour / erosion;
- The provision of adequate drainage to limit and control potential contaminated surface water run-off, including silt mitigation;
- The avoidance of un-necessary trafficking / handling of stockpiled materials;

The following additional measures shall be applied to topsoil stockpiles:

- A limitation on stockpile height to prevent degradation of the topsoil structure; and
- Adequate control of weed growth.

9.4 Stockpile heights

With the exception of top soil (or soil forming materials), stockpile heights are proposed to be restricted to a maximum of 4m to facilitate adequate management during the works.

A reduced stockpile height of 2m will apply to any top soil / soil forming materials to prevent possible degradation of soil structure.

10. Construction plant and vehicle movements

10.1 Site plant requirements

Anticipated site plant requirements to complete the remediation works are summarised in the following table.

Site Plant	Use / requirement	No. of Plant Required					
		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Tracked excavator (21t)	Bulk excavation & loading	4	4	4	4	3	3
Tracked long reach excavator (21t)	Re-profiling of side slopes	1	1	1	1	0	0
Tracked excavator with pneumatic breaker (21t)	Demolition works	2	0	0	0	0	0
Mobile crushing and screening plant	Crushing and screening of material generated from demolition works and oversized materials encountered during the site re-profiling works	1	1	1	1	0	0
Articulated dump trucks (Moxy)	Mass haul of bulk earthworks materials including site wastes and capping soils.	4	8	8	4	5	4
Bulldozer and towed compactor	Bulk re-profiling, spreading and compaction of waste and capping materials	3	3	3	2	2	2
Dumper (6t)	Movement of low volume materials (e.g. drainage stone)	1	1	1	1	1	1
Road sweeper	Cleaning of site access tracks / highway at site entrance.	1	1	1	1	1	1
Tractor and water bowser	Damping down of site access tracks.	1	1	1	1	1	1

10.2 Anticipated import & on-site vehicle movements

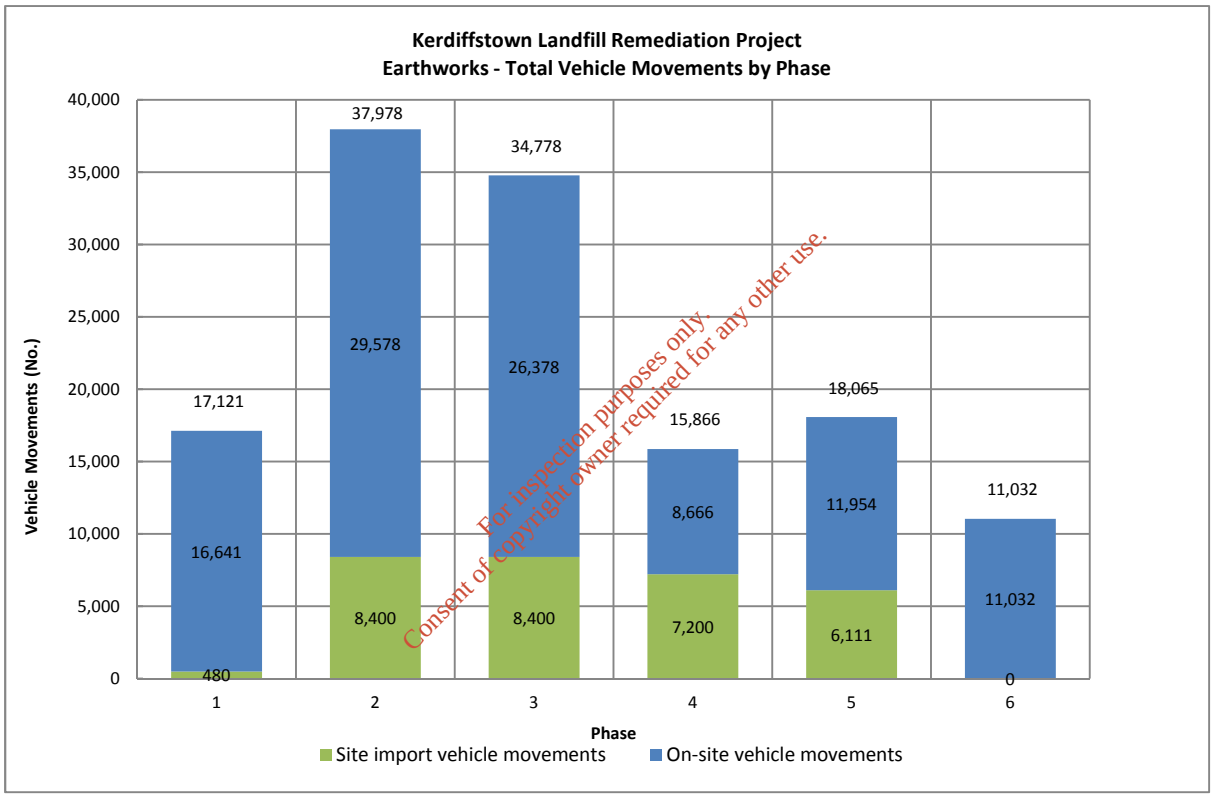
The source of the proposed capping materials is currently unknown but is likely to be from a combination of other construction projects with a net surplus of soil materials and / or material from virgin mineral extraction.

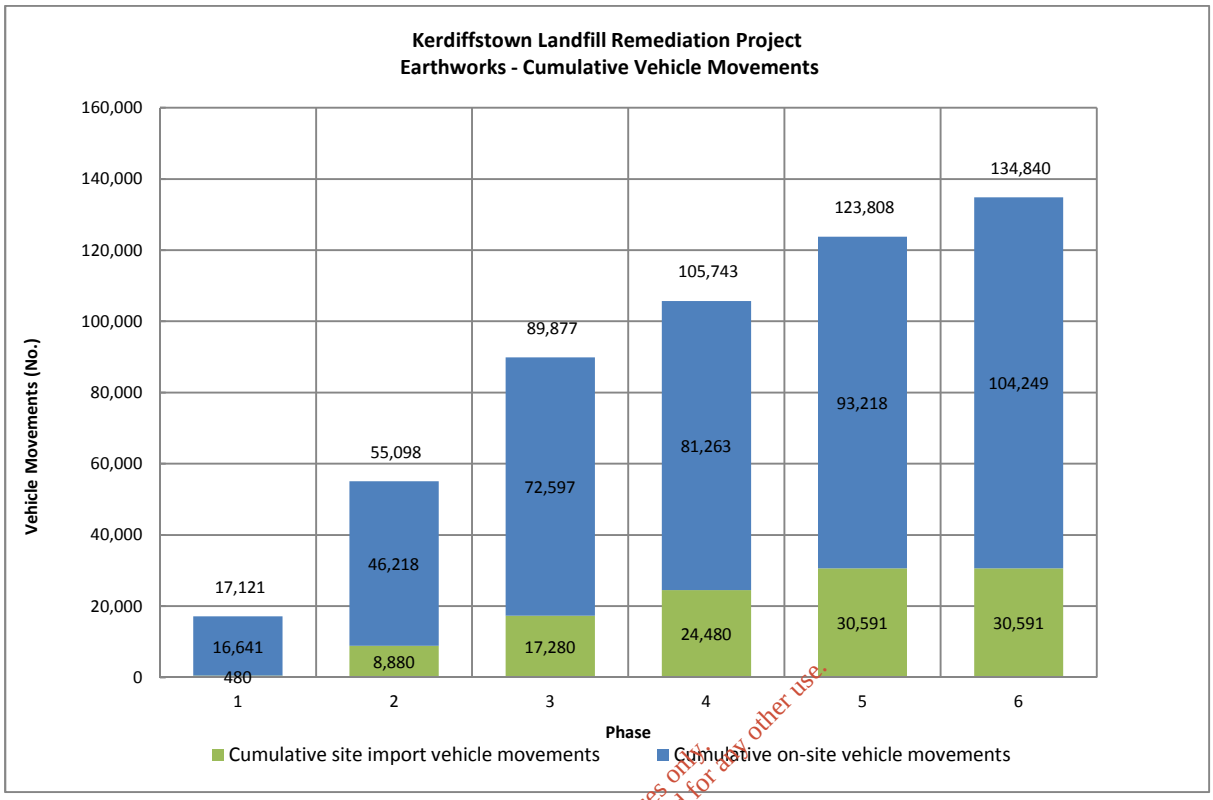
The haulage of materials to the site is expected to be from the M7 and Johnstown Road via the new site entrance to be constructed as part of the initial enabling works.

On-site vehicle movements will principally include those associated with:

- Movement of material generated by demolition works for crushing and screening;
- Re-profiling and the bulk movement of materials between different zones of the site;
- Temporary stockpiling and screening of waste materials;
- The use of stockpiled capping materials; and
- The movement of selected / specialist fills (e.g. materials used for drainage and access track construction).

Anticipated total and cumulative on-site and import vehicle movements by each restoration phase are summarised in the following charts.

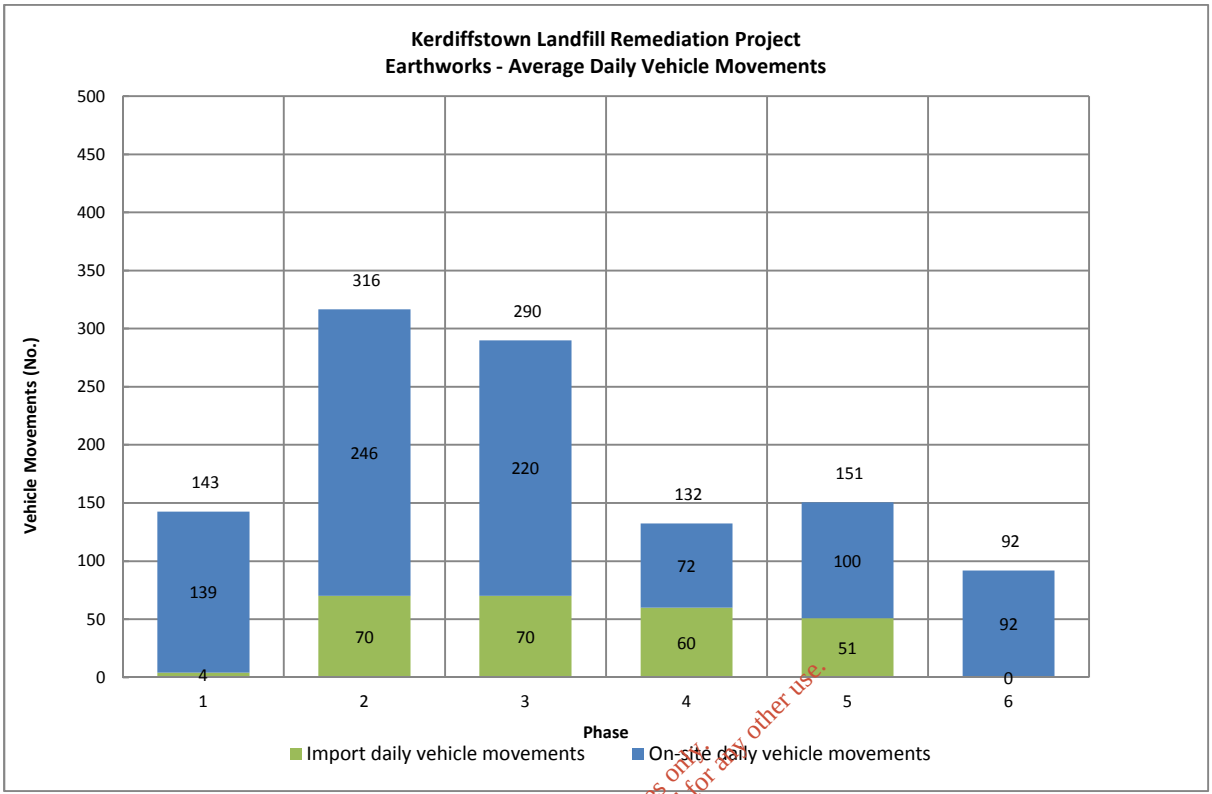




The number of vehicle movements required has been determined applying the following assumptions:

- Import of soil materials will be undertaken by 20t road going tipper lorries with a 12m^3 capacity;
- The bulk movement of materials on site will be undertaken by articulated dump trucks with a 12m^3 capacity;
- 20% bulking of materials during transportation (imported and on-site material movements);
- Vehicle movements are for single journeys (i.e. either loaded to site or empty away from site)

Anticipated daily vehicle movements are summarised in the following chart and are based on each phase having 120 working days (24 working weeks and 5 working days per week).



11. Construction Quality Assurance (CQA)

Construction Quality Assurance (CQA) is defined as a planned system of activities that provide assurance that the facility was constructed in accordance with the contract and technical specifications.

To enable overall quality management it is proposed that the remediation works will be governed by a comprehensive Construction Quality Assurance (CQA) Plan, prepared for submission to and review by the EPA. The CQA Plan should set out construction quality control (CQC) procedures to ensure materials and workmanship meet design specifications. Where geosynthetic materials are used manufacturing quality assurance (MQA) and manufacturing quality control (MQC) documentation should be supplied by the manufacturers for each product, and assessed for compliance with the design requirements. This is important with respect capping system stability assessments for Zones 1 and 3.

The CQA Plan should also set out procedures for implementing quality control, such as through inspection activities that include visual observations, field testing and measurements, laboratory testing, and evaluation of the test data.

The CQA programme relies on the technical specification and the conditions of contract drawn up by the designer. These should include minimum (or maximum) requirements for materials and tests to be undertaken to verify the materials and/or the construction are meeting the specified standards. Where assessing suitability of soils for import to the site geotechnical and geo-environmental testing will require to be specified, such that compliance with typical earthworks specifications (e.g. NRA Specification for Roadworks) and waste acceptance criteria can be clearly identified.

The CQA Plan should also set out roles and responsibilities for the remediation works. This is not a contractual document but should be used to inform contractual arrangements and obligations. The Construction Environmental Management Plan may also inform and be informed by the CQA Plan.

On completion of the remediation works a Validation Report should be prepared, to demonstrate that the liner system(s) and associated components comply with the specification as set out in the CQA Plan.

12. Summary and Recommendations

Assessment of earthworks proposals associated with the remediation of Kerdiffstown has indicated that:

- Risk assessments undertaken offer a reduced capping thickness whilst achieving a reduction in risk to the environment and human health;
- A high level assessment of construction phasing indicates that remediation works would be required to be completed over a 3-4 year period;
- Opportunities exist to reduce material import through the processing of on-site materials and adoption of waste classification processes;
- A significant volume of material is required to be imported to the site to facilitate the remediation works, having an impact on the environment in the short term;
- A high level assessment of on-site vehicle movements has been undertaken based on a series of assumptions to determine indicative plant that may be required to facilitate the remediation works and the approximate movements, requiring mitigation of nuisance on site (dust, odour, litter etc.);
- Remediation works shall be subject to CQA processes, typical for landfill construction projects.

It is recommended that further review of appropriate procurement approaches is undertaken in advance of the remediation works, focusing on the need for and specification of particular materials for designated purposes (subgrade preparation, drainage, capping, growing medium). The findings of this assessment including outline construction phasing may require to be revisited on the basis of that review.

Appendix A – Earthworks Summary Information

Earthwork balance summary table
Earthworks phasing summary table
Earthworks volume summary graph
Earthworks volumes & vehicle movements by phase
Earthworks vehicle movements summary graphs
Earthworks stockpiling summary graph
Earthworks cut and fill by zone and phase – tables & graphs

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Technical Note

Earthworks Summary Technical Note

Project:	Kerdiffstown Landfill Remediation Project	**By:**	JPB
Project No:	32EW5604	**Date:**	24/11/2016
Task:	B - Earthworks Design	**Check:**	RT
Description:	Ewks Balance	**Date:**	14/03/2017

Final Restoration

Column Ref.	B=E+F+G+L+W	C=H+Q+V	D=B-C	E	F	G	H	I=E+F-H	J	K	L=J+K	M	N	O	P	Q=N+O+P	R	S	T	U	V=R+S+T+U	W=Q+V-L	X=G
	Totals			Site Waste Materials					Site Won Clean Materials			Capping Materials					Misc. Selected Materials					Total Material Import	Total Material Export
	Bulk Cut / Import	Bulk Fill	Bulk Balance	Surface Wastes	Cut Inert / Non-Hazardous	Cut - Hazardous	Fill	Balance	Concrete	Subsoils	Sub-total	Area	Topsoil 0.15	Subsoil 0.35	Reg. Layer 0.15	Sub-total	Engineered Bunds	Access Tracks	Drainage Stone	Gas Wells / Trench Backfill	Sub-total		
Units	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m2	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
Zone 1	108,925	173,425	-64,500	0	47,000	0	111,500	-64,500	0	0	0	93,500	14,025	32,725	14,025	60,775	0	1,000	0	150	1,150	61,925	0
Zone 2A	22,350	20,150	2,200	0	8,500	0	6,300	2,200	*2,500*	0	2,500	24,900	3,735	8,715	0	12,450	0	0	0	1,400	1,400	11,350	0
Zone 2B	28,225	24,025	4,200	0	17,800	0	13,600	4,200	*3,600*	0	3,600	18,250	2,738	6,388	0	9,125	0	0	0	1,300	1,300	6,825	0
Zone 3	11,811	97,311	-85,500	0	0	0	85,500	-85,500	0	0	0	17,000	2,550	5,950	2,550	11,050	711	0	0	50	761	11,811	0
Zone 4	197,700	28,700	169,000	0	183,000	0	14,000	169,000	*1,900*	0	1,900	27,400	4,110	9,590	0	13,700	0	1,000	0	0	1,000	12,800	0
Zone 4 ponds (incl.backfill)	32,150	54,150	-22,000	0	0	0	22,000	-22,000	0	0	0	14,100	2,115	4,935	0	7,050	25,100	0	0	0	25,100	32,150	0
Site Entrance Area	0	0	0	0	0	0	0	0	0	2,500	2,500	0	0	0	0	0	0	0	0	0	0	-2,500	0
Clean stockpile	0	0	0	0	0	0	0	0	0	10,000	10,000	0	0	0	0	0	0	0	0	0	0	-10,000	0
Totals	401,161	397,761	3,400	0	256,300	0	252,900	3,400	8,000	12,500	20,500	195,150	29,273	68,303	16,575	114,150	25,811	2,000	0	2,900	30,711	127,461	0

Earthwork balance summary table

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Technical Note

Earthworks Summary Technical Note

Project:	Kerdiffstown Landfill Remediation Project	**By:**	JPB
Project No:	32EW5604	**Date:**	23/11/2016
Task:	B - Earthworks Design	**Check:**	RT
Description:	Outline Restoration Phasing - First Issue	**Date:**	14/03/2017

		Remediation							End use
	Year	1		2		3		4	4+
	Remediation Phase	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
	Site Entrance Area, Infrastructure & Offsite Works								
0.1	New site boundary fence								
0.2	New site entrance								
0.3	New site compound								
0.4	Permanent leachate infrastructure installation & commissioning								
0.5	Leachate discharge pipeline construction								
0.6	Permanent gas infrastructure installation & commissioning								
0.7	Construction of surface water discharge to the Morell River								
0.8	Temporary surface water management measures (progressive)								
0.9	Clean stockpile use								
	Zone 1								
1.1	Waste filling (surplus 4 materials)								
1.2	Capping of NW zone								
1.3	Construction of surface water management pond								
1.4	NE slope boundary drainage								
1.5	Remediation of NE slopes incl. capping								
1.6	Removal of existing flare stack								
1.7	Remediation / capping of remaining outer slopes								
1.8	Removal of SW screening bund								
1.9	Final restoration / capping of central area								
1.10	Gas wells installed								
1.11	Construction of soakaway								
1.12	Cleaning of ponds & commissioning.								
	Zone 2A (Import area)								
2A.1	Demolition of buildings								
2A.2	Fill import / stockpiling								
2A.3	Stockpiled material use (incl. existing clean stockpile)								
2A.4	Re-profiling & capping								
2A.5	Vent trenches / gas management measures								
	Zone 2B (Processing area)								
2B.1	Demolition of buildings & structures								
2B.2	Crushing and screening of demolition arisings								
2B.3	Demolition material stockpiling								
2B.4	Temporary stockpiling of Zone 4 wastes								
2B.5	Re-profiling & capping								
2B.7	Vent trenches / gas management measures								
	Zone 3								
3.1	Toe bund construction								
3.2	Waste filling								
3.3	Capping								
3.4	Gas wells installed								
	Zone 4								
4.1	Demolition of buildings / retaining wall								
4.2	Slope remediation & waste screening								
4.3	Construction of surface water management ponds (for remediation phase)								
4.4	Final restoration / capping (backfilling of ponds)								
4.5	Cleaning of ponds; installation of ecological enhancements to ponds								

Earthworks phasing summary table

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Technical Note

Earthworks Summary Technical Note

Project:	Kerdiffstown Landfill Remediation Project	**By:**	JPB
Project No:	32EW5604	**Date:**	10/11/2016
Task:	B - Earthworks Design	**Check:**	RT
Description:	Phase 1 Volumes & Vehicle Movements	**Date:**	14/03/2017

Material Movement

	Fill Move To												
Fill Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vol. moved from during phase**	**Cumulative vol. moved**
Site Entrance & New Compound	-	-	-	-	-	-	-	2,500	-	-	-	**2,500**	**2,500**
Zone 1	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Zone 2A	-	-	-	-	-	-	-	-	-	-	2,500	**2,500**	**2,500**
Zone 2B	-	-	-	-	-	-	-	-	-	-	3,600	**3,600**	**3,600**
Zone 3	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Zone 4	-	15,375	-	-	42,750	-	-	-	-	-	1,900	**60,025**	**60,025**
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Zone 2A Import Stockpiles	-	-	-	-	711	-	-	-	-	-	-	**711**	**711**
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Zone 2B Stockpiles (Concrete)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Site Import	-	-	-	-	-	-	-	-	2,000	-	-	**2,000**	**2,000**
Vol. carried over from previous phase	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		
Vol. moved during phase	**-**	**15,375**	**-**	**-**	**43,461**	**-**	**-**	**2,500**	**2,000**	**-**	**8,000**	**71,336**	
Cumulative vol. moved	**-**	**15,375**	**-**	**-**	**43,461**	**-**	**-**	**2,500**	**2,000**	**-**	**8,000**		**71,336**
Vol. stockpiled at start of phase								**10,000**	**-**	**-**	**-**	**10,000**	
Vol. stockpiled at end of phase								**12,500**	**1,289**	**-**	**8,000**	**21,789**	

Vehicle Movements

Transport bulking	20	%
Lorry capacity	10	m3
including return journey	yes	yes / no

(Assumed A25 Moxy onsite or 20t road tipper import)

	Vehicle Move To												
Vehicle Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vehicle movements during phase**	**Cumulative vehicle movements**
Site Entrance & New Compound	-	-	-	-	-	-	-	600	-	-	-	**600**	**600**
Zone 1	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Zone 2A	-	-	-	-	-	-	-	-	-	-	600	**600**	**600**
Zone 2B	-	-	-	-	-	-	-	-	-	-	864	**864**	**864**
Zone 3	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Zone 4	-	3,690	-	-	10,260	-	-	-	-	-	456	**14,406**	**14,406**
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Zone 2A Import Stockpiles	-	-	-	-	171	-	-	-	-	-	-	**171**	**171**
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Zone 2B Stockpiles (Concrete)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**
Site Import	-	-	-	-	-	-	-	-	480	-	-	**480**	**480**
Vehicle movements during phase	**-**	**3,690**	**-**	**-**	**10,431**	**-**	**-**	**600**	**480**	**-**	**1,920**	**17,121**	
Cumulative vehicle movements	**-**	**3,690**	**-**	**-**	**10,431**	**-**	**-**	**600**	**480**	**-**	**1,920**		**17,121**

Earthworks volumes & vehicle movements (Phase 1)

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Technical Note

Earthworks Summary Technical Note

Project:	Kerdiffstown Landfill Remediation Project	**By:**	JPB
Project No:	32EW5604	**Date:**	10/11/2016
Task:	B - Earthworks Design	**Check:**	RT
Description:	Phase 2 Volumes & Vehicle Movements	**Date:**	14/03/2017

Material Movement

	Fill Move To												
Fill Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vol. moved from during phase**	**Cumulative vol. moved**
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-	-	2,500
Zone 1	-	9,400	-	-	-	-	-	-	-	-	-	9,400	9,400
Zone 2A	-	-	-	-	-	-	-	-	-	-	-	-	2,500
Zone 2B	-	-	-	-	-	-	-	-	-	-	-	-	3,600
Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	15,375	-	-	42,750	14,000	-	-	-	22,000	-	94,125	154,150
Site Entrance Stockpile	-	6,545	-	-	-	4,795	-	-	-	-	-	11,340	11,340
Zone 2A Import Stockpiles	-	5,610	-	-	-	2,055	-	-	-	-	-	7,665	8,376
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 2B Stockpiles (Concrete)	-	-	-	-	-	-	-	-	-	-	-	-	-
Site Import	-	-	-	-	-	-	-	-	35,000	-	-	35,000	37,000
Vol. carried over from previous phase	-	15,375	-	-	43,461	-	-	2,500	2,000	-	8,000		
Vol. moved during phase	-	36,930	-	-	42,750	20,850	-	-	35,000	22,000	-	157,530	
Cumulative vol. moved	-	52,305	-	-	86,211	20,850	-	2,500	37,000	22,000	8,000		228,866
Vol. stockpiled at start of phase								12,500	1,289	-	8,000	21,789	
Vol. stockpiled at end of phase								1,160	28,624	22,000	8,000	59,784	

Vehicle Movements

Transport bulking	20	%
Lorry capacity	10	m3
including return journey	yes	yes / no

(Assumed A25 Moxy onsite or 20t road tipper import)

	Vehicle Move To												
Vehicle Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vehicle movements during phase**	**Cumulative vehicle movements**
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-	-	600
Zone 1	-	2,256	-	-	-	-	-	-	-	-	-	2,256	2,256
Zone 2A	-	-	-	-	-	-	-	-	-	-	-	-	600
Zone 2B	-	-	-	-	-	-	-	-	-	-	-	-	864
Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	3,690	-	-	10,260	3,360	-	-	-	5,280	-	22,590	36,996
Site Entrance Stockpile	-	1,571	-	-	-	1,151	-	-	-	-	-	2,722	2,722
Zone 2A Import Stockpiles	-	1,346	-	-	171	493	-	-	-	-	-	2,010	2,181
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 2B Stockpiles (Concrete)	-	-	-	-	-	-	-	-	-	-	-	-	-
Site Import	-	-	-	-	-	-	-	-	8,400	-	-	8,400	8,880
Vehicle movements during phase	-	8,863	-	-	10,431	5,004	-	-	8,400	5,280	-	37,978	
Cumulative vehicle movements	-	12,553	-	-	20,861	5,004	-	600	8,880	5,280	1,920		55,098

Earthworks volumes & vehicle movements (Phase 2)

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Technical Note

Earthworks Summary Technical Note

Project:	Kerdiffstown Landfill Remediation Project	**By:**	JPB
Project No:	32EW5604	**Date:**	10/11/2016
Task:	B - Earthworks Design	**Check:**	RT
Description:	Phase 3 Volumes & Vehicle Movements	**Date:**	14/03/2017

Material Movement

	Fill Move To												
Fill Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vol. moved from during phase**	**Cumulative vol. moved**
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-	-	2,500
Zone 1	-	9,400	-	-	-	-	-	-	-	-	-	9,400	18,800
Zone 2A	-	-	-	-	-	-	-	-	-	-	-	-	2,500
Zone 2B	-	-	-	-	-	-	-	-	-	-	-	-	3,600
Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	30,750	-	-	-	-	-	-	-	-	-	30,750	184,900
Site Entrance Stockpile	-	1,160	-	-	-	-	-	-	-	-	-	1,160	12,500
Zone 2A Import Stockpiles	-	10,995	-	-	11,050	6,850	28,625	-	-	-	-	57,520	65,896
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	11,000	-	-	-	-	11,000	11,000
Zone 2B Stockpiles (Concrete)	-	30	-	-	50	-	-	-	-	-	-	80	80
Site Import	-	-	-	-	-	-	-	-	35,000	-	-	35,000	72,000
Vol. carried over from previous phase	-	52,305	-	-	86,211	20,850	-	2,500	37,000	22,000	8,000		
Vol. moved during phase	-	52,335	-	-	11,100	6,850	39,625	-	35,000	-	-	144,910	
Cumulative vol. moved	-	104,640	-	-	97,311	27,700	39,625	2,500	72,000	22,000	8,000		373,776
Vol. stockpiled at start of phase								1,160	28,624	22,000	8,000	59,784	
Vol. stockpiled at end of phase								-	6,104	11,000	7,920	25,024	

Vehicle Movements

Transport bulking	20	%
Lorry capacity	10	m3
including return journey	yes	yes / no

(Assumed A25 Moxy onsite or 20t road tipper import)

	Vehicle Move To												
Vehicle Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vehicle movements during phase**	**Cumulative vehicle movements**
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-	-	600
Zone 1	-	2,256	-	-	-	-	-	-	-	-	-	2,256	4,512
Zone 2A	-	-	-	-	-	-	-	-	-	-	-	-	600
Zone 2B	-	-	-	-	-	-	-	-	-	-	-	-	864
Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	7,380	-	-	-	-	-	-	-	-	-	7,380	44,376
Site Entrance Stockpile	-	278	-	-	-	-	-	-	-	-	-	278	3,000
Zone 2A Import Stockpiles	-	2,639	-	-	2,652	1,644	6,870	-	-	-	-	13,805	15,986
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	2,640	-	-	-	-	2,640	2,640
Zone 2B Stockpiles (Concrete)	-	7	-	-	12	-	-	-	-	-	-	19	19
Site Import	-	-	-	-	-	-	-	-	8,400	-	-	8,400	17,280
Vehicle movements during phase	-	12,560	-	-	2,664	1,644	9,510	-	8,400	-	-	34,778	
Cumulative vehicle movements	-	25,114	-	-	23,525	6,648	9,510	600	17,280	5,280	1,920		89,877

Earthworks volumes & vehicle movements (Phase 3)

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Technical Note

Earthworks Summary Technical Note

Project:	Kerdiffstown Landfill Remediation Project	**By:**	JPB
Project No:	32EW5604	**Date:**	10/11/2016
Task:	B - Earthworks Design	**Check:**	RT
Description:	Phase 4 Volumes & Vehicle Movements	**Date:**	14/03/2017

Material Movement

	Fill Move To												
Fill Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Ponds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vol. moved from during phase**	**Cumulative vol. moved**
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-	-	2,500
Zone 1	-	9,400	-	-	-	-	-	-	-	-	-	9,400	28,200
Zone 2A	-	-	-	-	-	-	-	-	-	-	-	-	2,500
Zone 2B	-	-	-	-	-	-	-	-	-	-	-	-	3,600
Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	-	-	-	-	-	-	-	-	-	-	-	184,900
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-	-	12,500
Zone 2A Import Stockpiles	-	12,155	-	-	-	-	3,525	-	-	-	-	15,680	81,576
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	11,000	-	-	-	-	11,000	22,000
Zone 2B Stockpiles (Concrete)	-	30	-	-	-	-	-	-	-	-	-	30	110
Site Import	-	-	-	-	-	-	-	-	30,000	-	-	30,000	102,000
Vol. carried over from previous phase	-	104,640	-	-	97,311	27,700	39,625	2,500	72,000	22,000	8,000		
Vol. moved during phase	-	21,585	-	-	-	-	14,525	-	30,000	-	-	66,110	
Cumulative vol. moved	-	126,225	-	-	97,311	27,700	54,150	2,500	102,000	22,000	8,000		439,886
Vol. stockpiled at start of phase								-	6,104	11,000	7,920	25,024	
Vol. stockpiled at end of phase								-	20,424	-	7,890	28,314	

Vehicle Movements

Transport bulking	20	%
Lorry capacity	10	m3
including return journey	yes	yes / no

(Assumed A25 Moxy onsite or 20t road tipper import)

	Vehicle Move To												
Vehicle Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vehicle movements during phase**	**Cumulative vehicle movements**
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-	-	600
Zone 1	-	2,256	-	-	-	-	-	-	-	-	-	2,256	6,768
Zone 2A	-	-	-	-	-	-	-	-	-	-	-	-	600
Zone 2B	-	-	-	-	-	-	-	-	-	-	-	-	864
Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	-	-	-	-	-	-	-	-	-	-	-	44,376
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-	-	3,000
Zone 2A Import Stockpiles	-	2,917	-	-	-	-	846	-	-	-	-	3,763	19,749
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	2,640	-	-	-	-	2,640	5,280
Zone 2B Stockpiles (Concrete)	-	7	-	-	-	-	-	-	-	-	-	7	26
Site Import	-	-	-	-	-	-	-	-	7,200	-	-	7,200	24,480
Vehicle movements during phase	-	5,180	-	-	-	-	3,486	-	7,200	-	-	15,866	
Cumulative vehicle movements	-	30,294	-	-	23,525	6,648	12,996	600	24,480	5,280	1,920		105,743

Earthworks volumes & vehicle movements (Phase 4)

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Technical Note

Earthworks Summary Technical Note

Project:	Kerdiffstown Landfill Remediation Project	**By:**	JPB
Project No:	32EW5604	**Date:**	10/11/2016
Task:	B - Earthworks Design	**Check:**	RT
Description:	Phase 5 Volumes & Vehicle Movements	**Date:**	14/03/2017

Material Movement

	Fill Move To												
Fill Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vol. moved from during phase**	**Cumulative vol. moved**
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-	-	2,500
Zone 1	-	9,400	-	-	-	-	-	-	-	-	-	9,400	37,600
Zone 2A	-	-	-	-	-	-	-	-	-	-	-	-	2,500
Zone 2B	-	4,200	-	13,600	-	-	-	-	-	-	-	17,800	21,400
Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	-	-	-	-	-	-	-	-	-	-	-	184,900
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-	-	12,500
Zone 2A Import Stockpiles	-	12,155	-	9,125	-	-	-	-	-	-	-	21,280	102,856
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-	-	22,000
Zone 2B Stockpiles (Concrete)	-	30	-	1,300	-	-	-	-	-	-	-	1,330	1,440
Site Import	-	-	-	-	-	-	-	-	25,461	-	-	25,461	127,461
Vol. carried over from previous phase	-	126,225	-	-	97,311	27,700	54,150	2,500	102,000	22,000	8,000		
Vol. moved during phase	-	25,785	-	24,025	-	-	-	-	25,461	-	-	75,271	
Cumulative vol. moved	-	152,010	-	24,025	97,311	27,700	54,150	2,500	127,461	22,000	8,000		515,157
Vol. stockpiled at start of phase								-	20,424	-	7,890	28,314	
Vol. stockpiled at end of phase								-	24,605	-	6,560	31,165	

Vehicle Movements

Transport bulking	20	%
Lorry capacity	10	m3
including return journey	yes	yes / no

(Assumed A25 Moxy onsite or 20t road tipper import)

	Vehicle Move To												
Vehicle Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vehicle movements during phase**	**Cumulative vehicle movements**
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-	-	600
Zone 1	-	2,256	-	-	-	-	-	-	-	-	-	2,256	9,024
Zone 2A	-	-	-	-	-	-	-	-	-	-	-	-	600
Zone 2B	-	1,008	-	3,264	-	-	-	-	-	-	-	4,272	5,136
Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	-	-	-	-	-	-	-	-	-	-	-	44,376
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-	-	3,000
Zone 2A Import Stockpiles	-	2,917	-	2,190	-	-	-	-	-	-	-	5,107	24,856
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-	-	5,280
Zone 2B Stockpiles (Concrete)	-	7	-	312	-	-	-	-	-	-	-	319	346
Site Import	-	-	-	-	-	-	-	-	6,111	-	-	6,111	30,591
Vehicle movements during phase	-	6,188	-	5,766	-	-	-	-	6,111	-	-	18,065	
Cumulative vehicle movements	-	36,482	-	5,766	23,525	6,648	12,996	600	30,591	5,280	1,920	123,808	123,808

Earthworks volumes & vehicle movements (Phase 5)

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Technical Note

Earthworks Summary Technical Note

Project:	Kerdiffstown Landfill Remediation Project	**By:**	JPB
Project No:	32EW5604	**Date:**	10/11/2016
Task:	B - Earthworks Design	**Check:**	RT
Description:	Phase 6 Volumes & Vehicle Movements	**Date:**	14/03/2017

Material Movement

	Fill Move To												
Fill Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vol. moved from during phase**	**Cumulative vol. moved**
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-	-	2,500
Zone 1	-	9,400	-	-	-	-	-	-	-	-	-	9,400	47,000
Zone 2A	-	2,200	6,300	-	-	-	-	-	-	-	-	8,500	11,000
Zone 2B	-	-	-		-	-	-	-	-	-	-	-	21,400
Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	-	-	-	-	-	-	-	-	-	-	-	184,900
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-	-	12,500
Zone 2A Import Stockpiles	-	12,155	12,450		-	-	-	-	-	-	-	24,605	127,461
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-	-	22,000
Zone 2B Stockpiles (Concrete)	-	1,060	1,400	-	-	1,000	-	-	-	-	-	3,460	4,900
Site Import	-	-	-	-	-	-	-	-	-	-	-	-	127,461
Vol. carried over from previous phase	-	152,010	-	24,025	97,311	27,700	54,150	2,500	127,461	22,000	8,000		
Vol. moved during phase	-	24,815	20,150	-	-	1,000	-	-	-	-	-	45,965	
Cumulative vol. moved	-	176,825	20,150	24,025	97,311	28,700	54,150	2,500	127,461	22,000	8,000		561,122
Vol. stockpiled at start of phase								-	24,605	-	6,560	31,165	
Vol. stockpiled at end of phase								-	-	-	3,100	3,100	

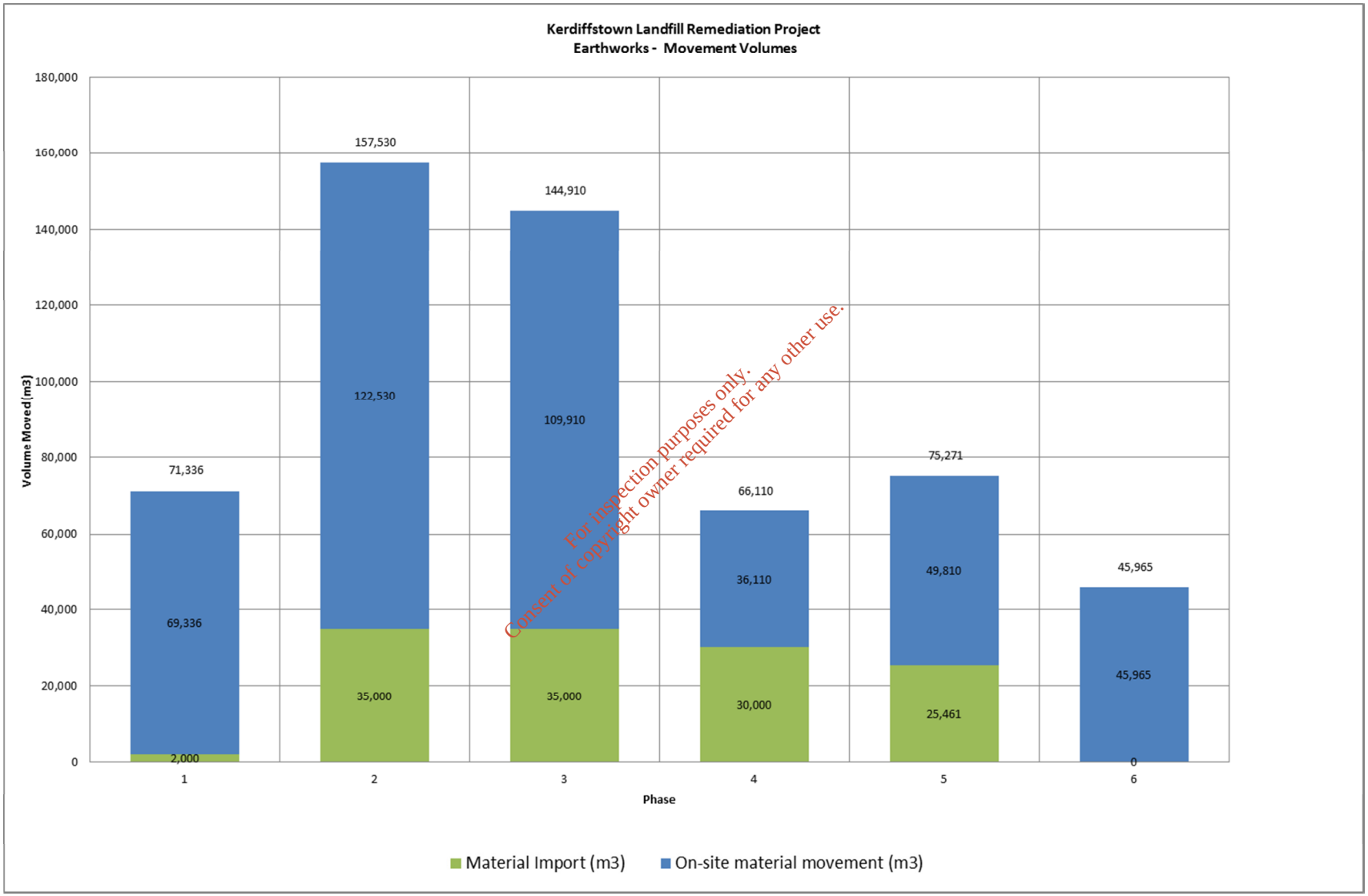
Vehicle Movements

Transport bulking	20	%
Lorry capacity	10	m3
including return journey	yes	yes / no

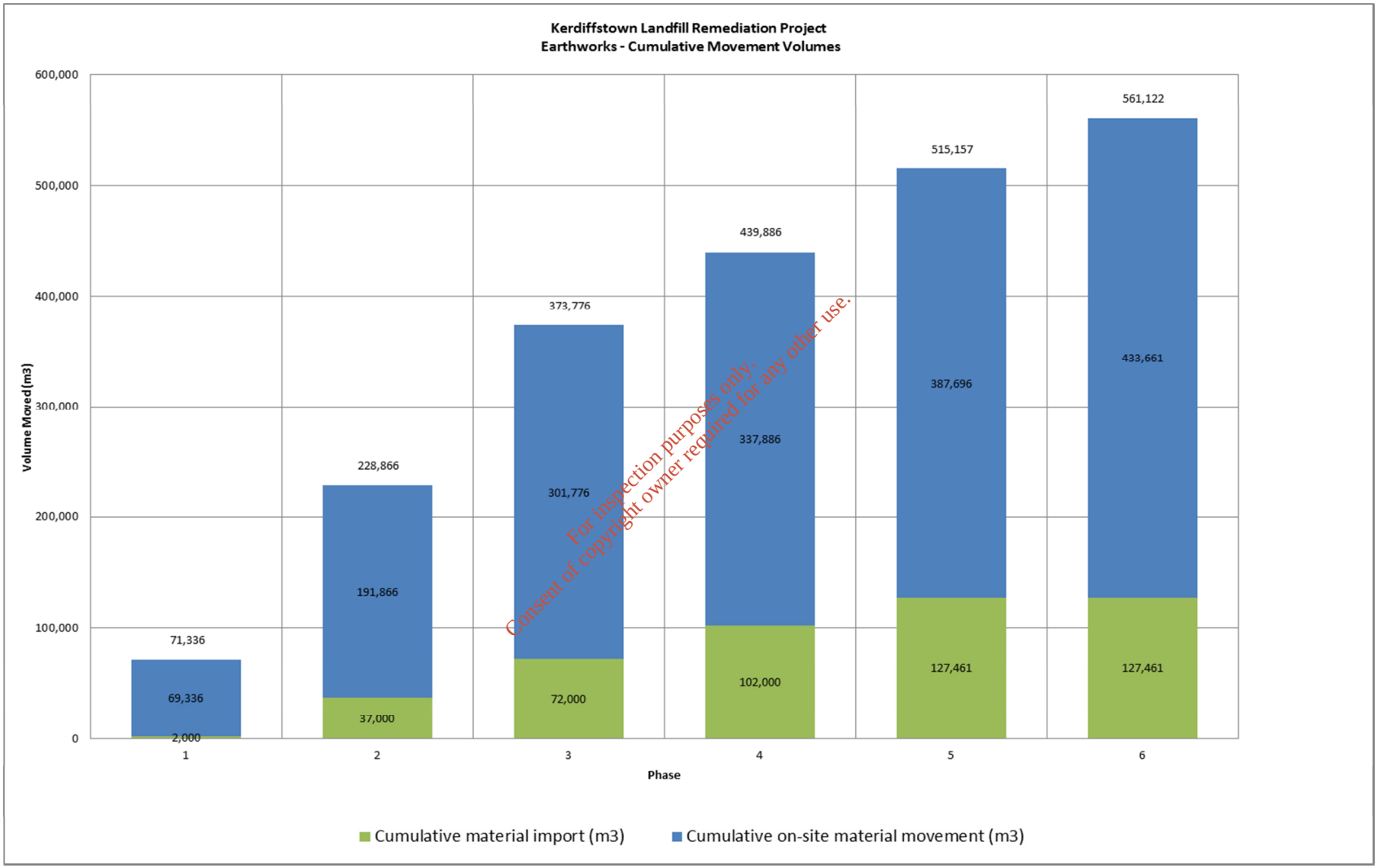
(Assumed A25 Moxy onsite or 20t road tipper import)

	Vehicle Move To												
Vehicle Move From	**Site Entrance & New Compound**	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3**	**Zone 4**	**Zone 4 (Pond Bunds)**	**Site Entrance Stockpile**	**Zone 2A Import Stockpiles**	**Zone 2B Stockpiles (Waste)**	**Zone 2B Stockpiles (Concrete)**	**Vehicle movements during phase**	**Cumulative vehicle movements**
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-	-	600
Zone 1	-	2,256	-	-		-	-	-	-	-	-	2,256	11,280
Zone 2A	-	528	1,512	-		-	-	-	-	-	-	2,040	2,640
Zone 2B	-	-	-	-		-	-	-	-	-	-	-	5,136
Zone 3	-	-	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	-	-		-	-	-	-	-	-	-	-	44,376
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-	-	3,000
Zone 2A Import Stockpiles	-	2,917	2,988	-	-	-	-	-	-	-	-	5,905	30,761
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-	-	5,280
Zone 2B Stockpiles (Concrete)	-	254	336	-	-	240	-	-	-	-	-	830	1,176
Site Import	-	-	-	-	-	-	-	-	-	-	-	-	30,591
Vehicle movements during phase	-	5,956	4,836	-	-	240	-	-	-	-	-	11,032	
Cumulative vehicle movements	-	42,438	4,836	5,766	23,525	6,888	12,996	600	30,591	5,280	1,920		134,840

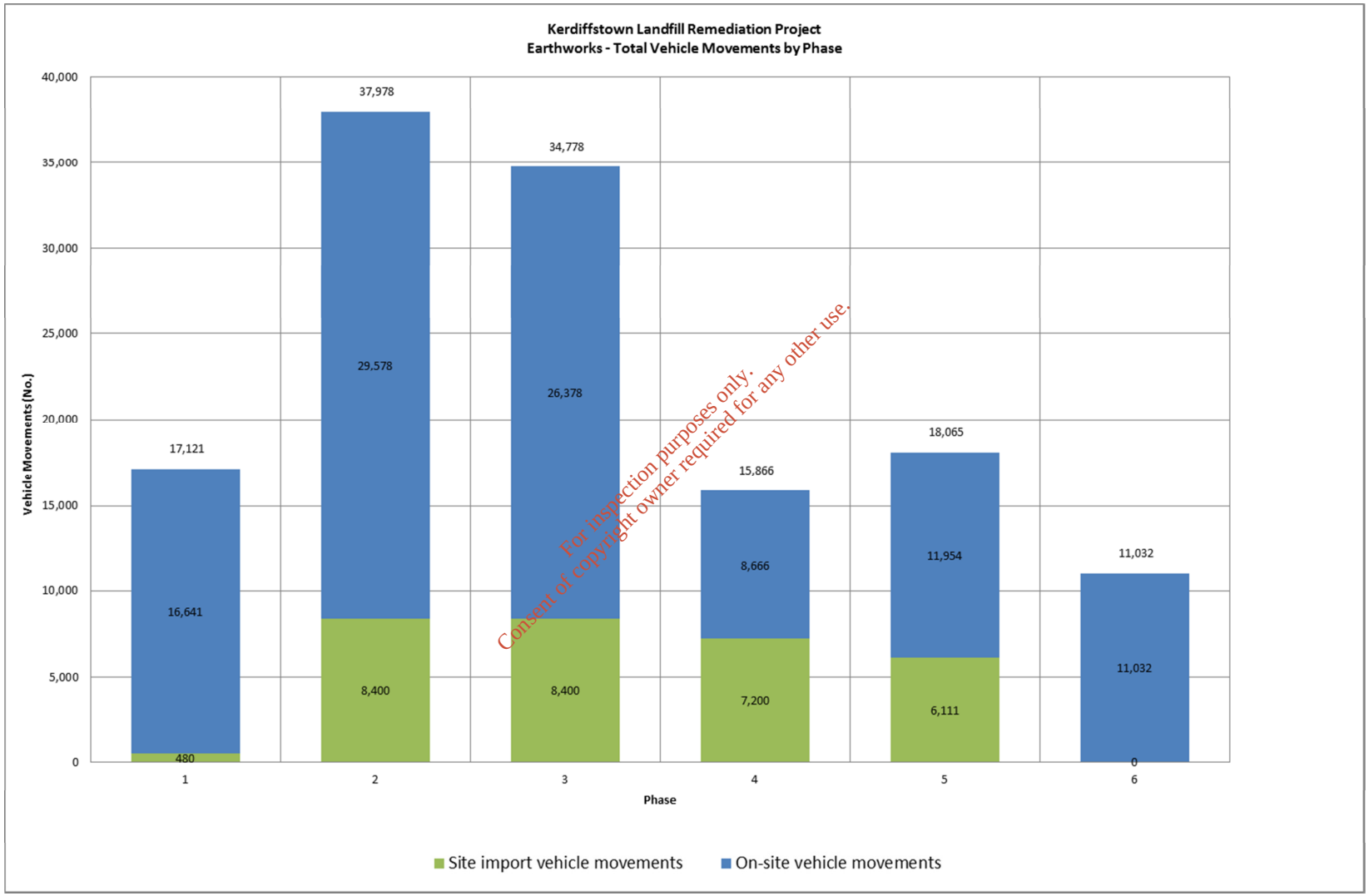
Earthworks volumes & vehicle movements (Phase 6)



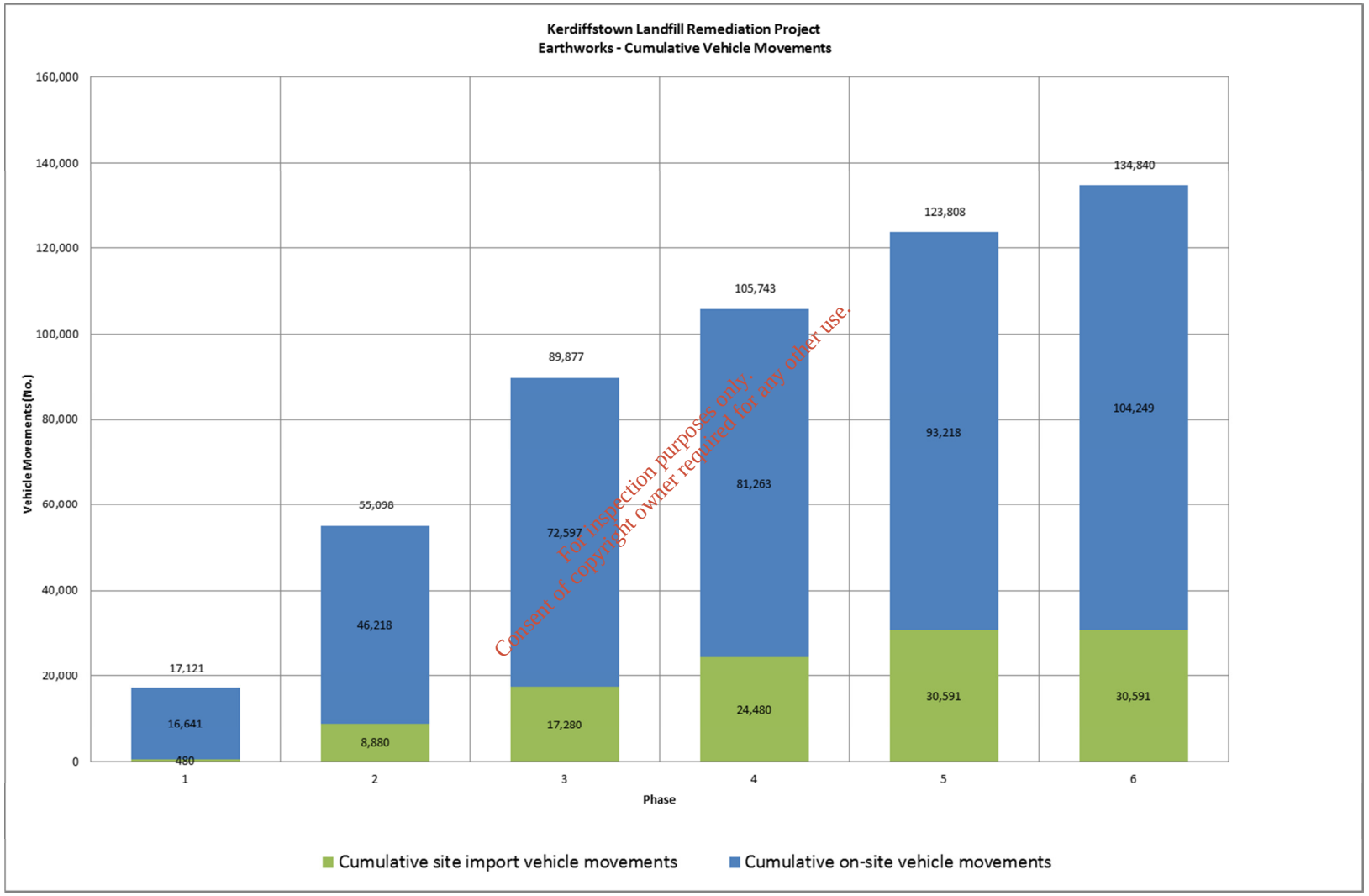
Earthworks vehicle movements summary graph



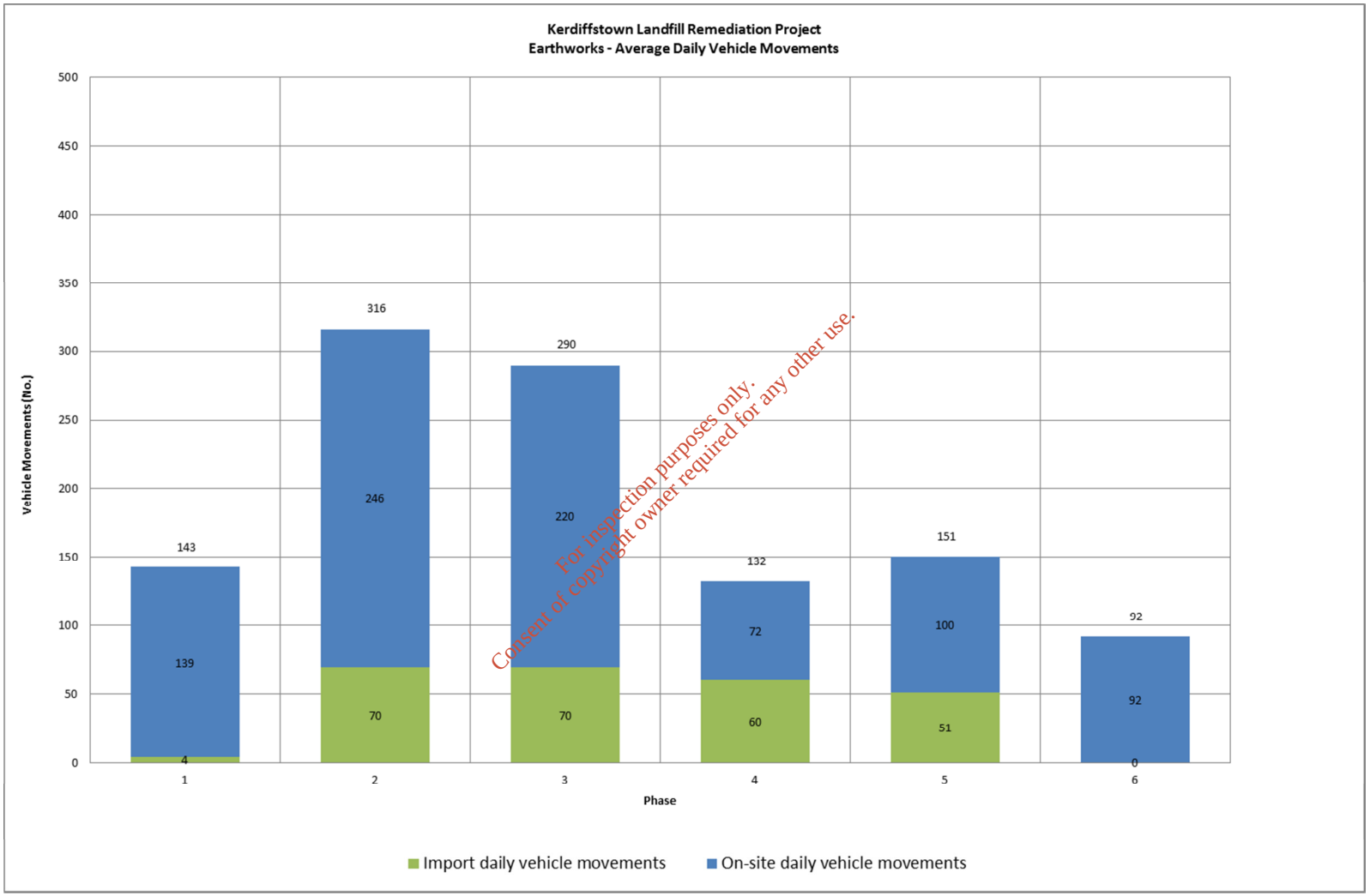
Earthworks cumulative vehicle movements summary graph



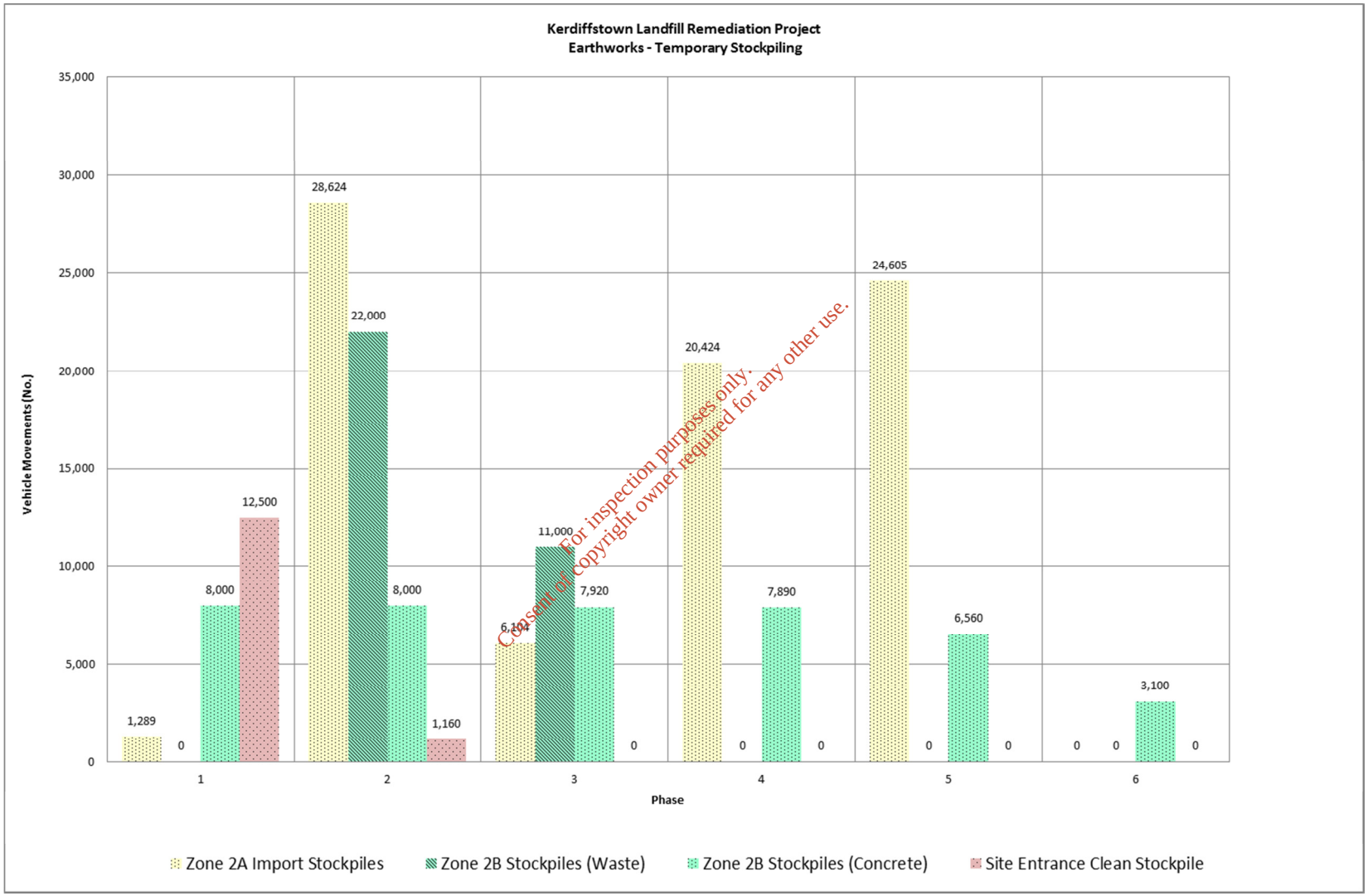
Earthworks total vehicle movements summary graph by phase



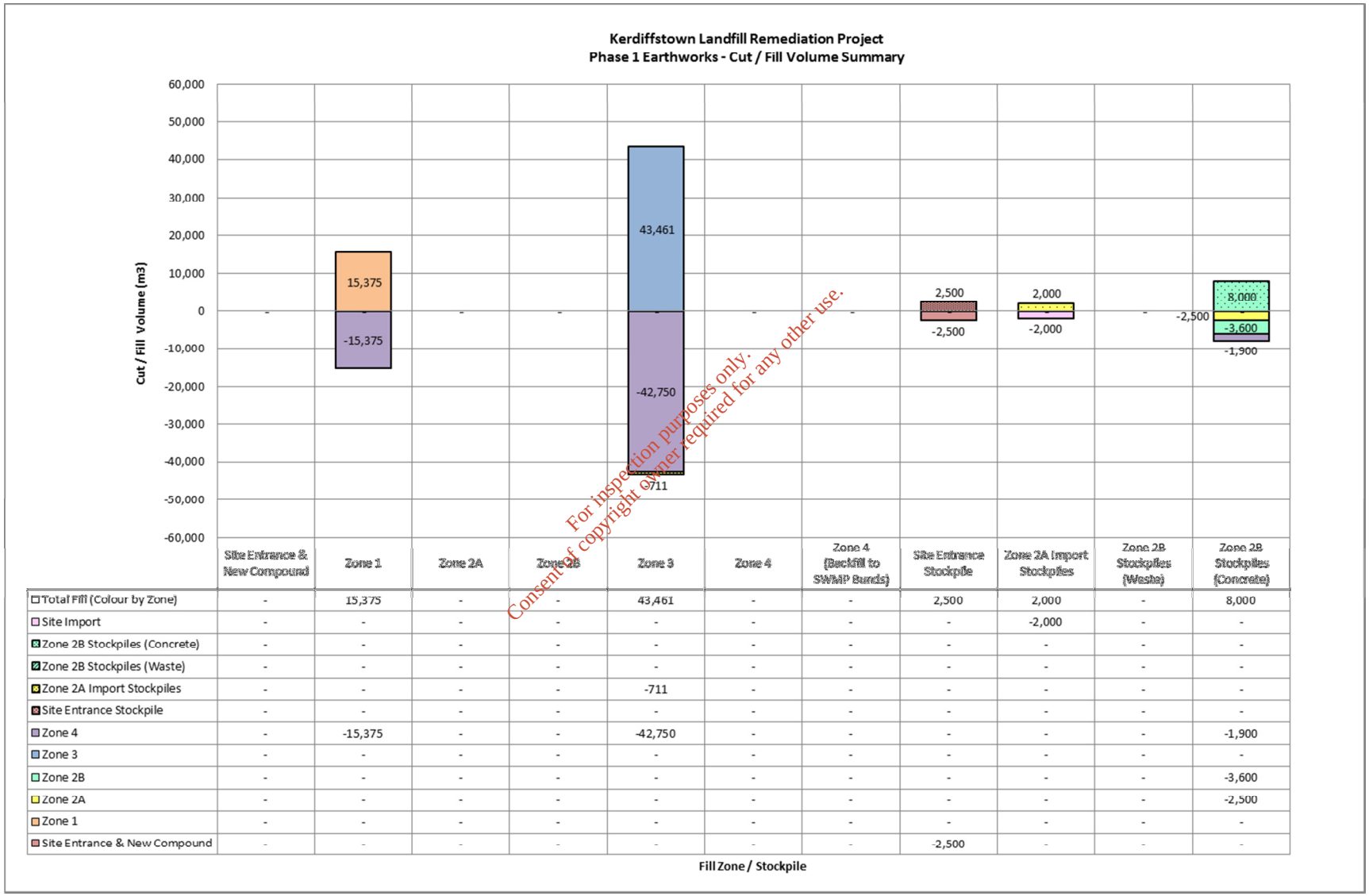
Earthworks cumulative vehicle movements by phase



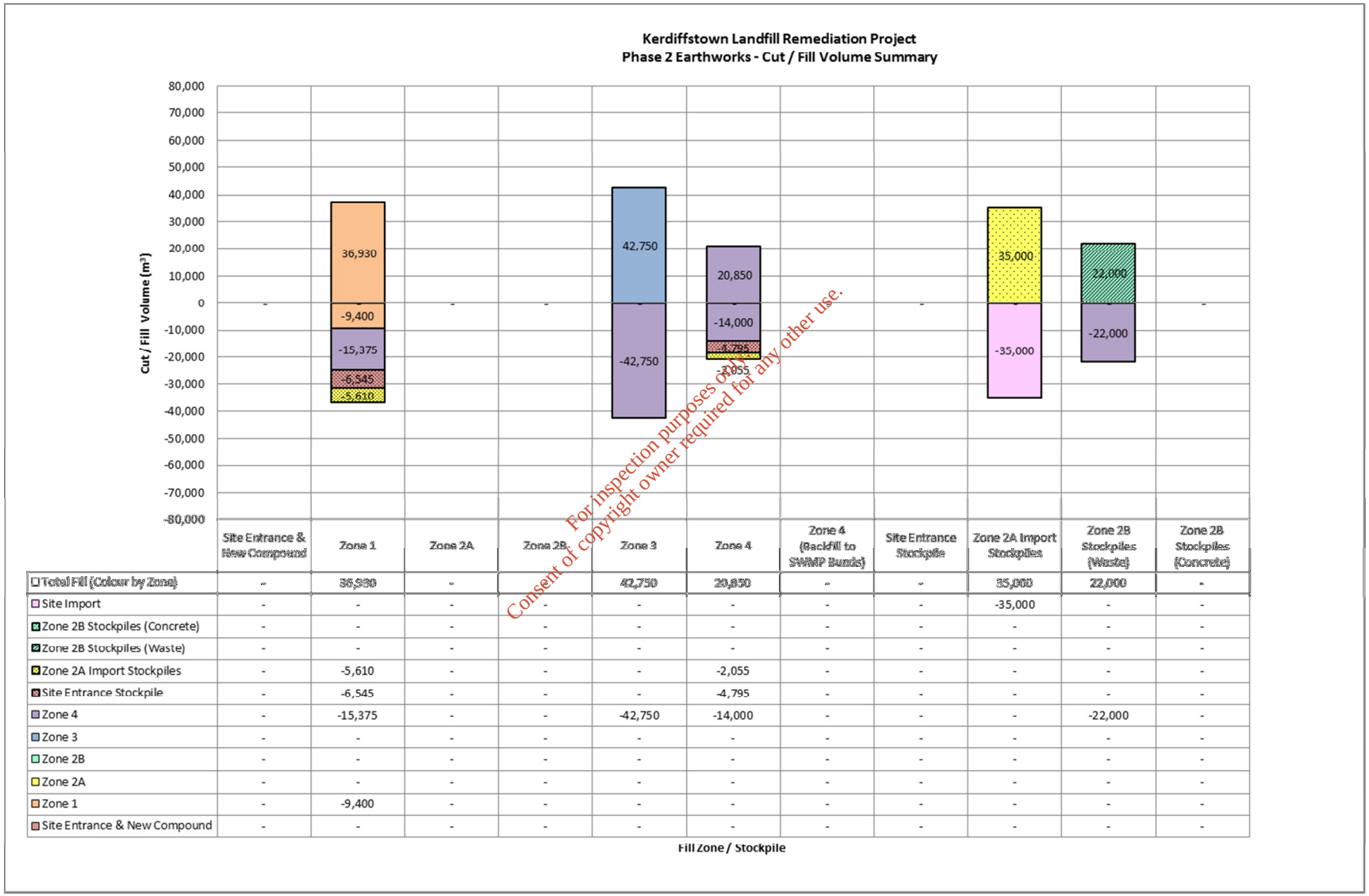
Earthworks average daily vehicle movements



Earthworks stockpiling summary graph

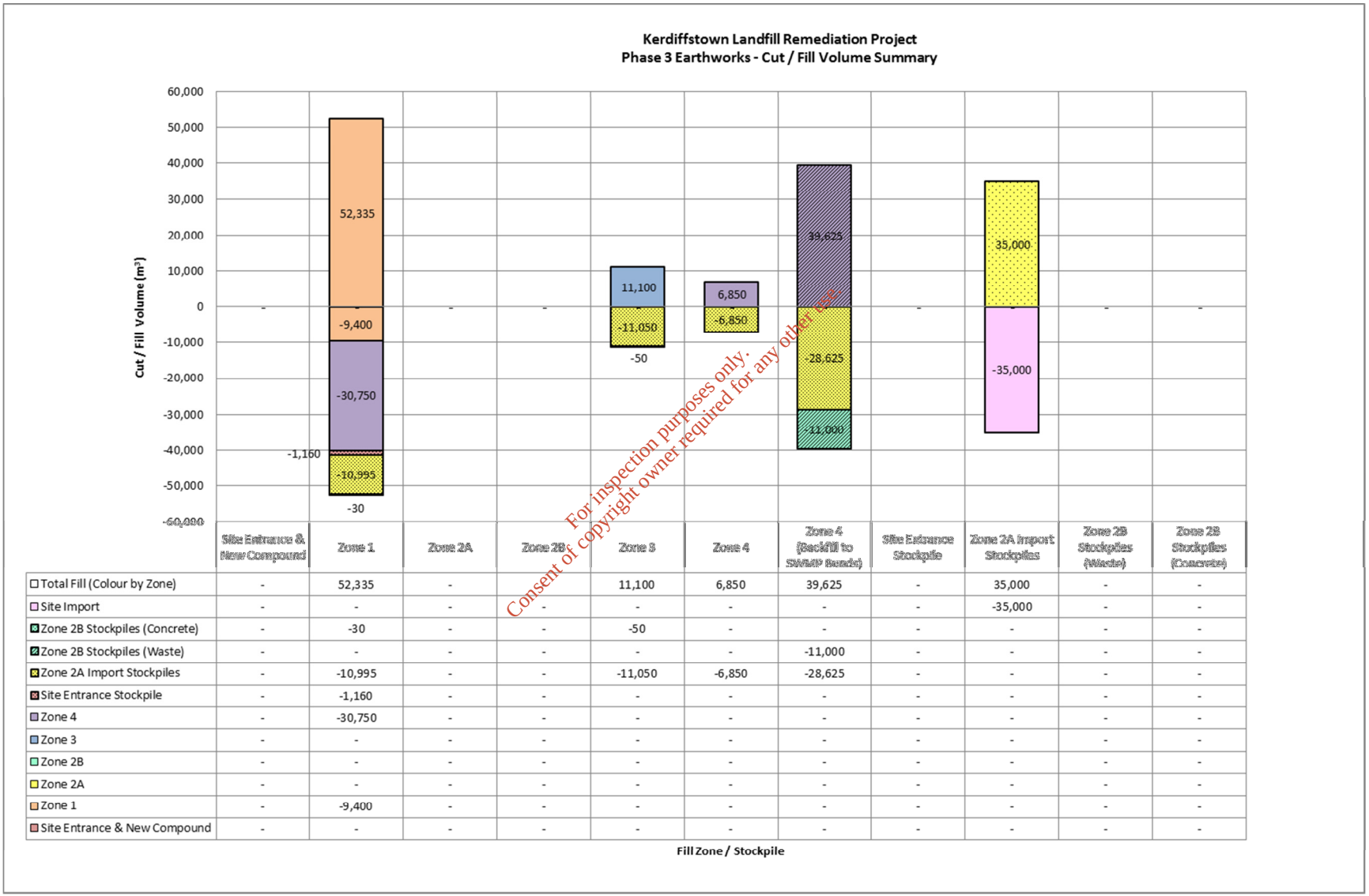


Earthworks cut and fill by zone (Phase 1)



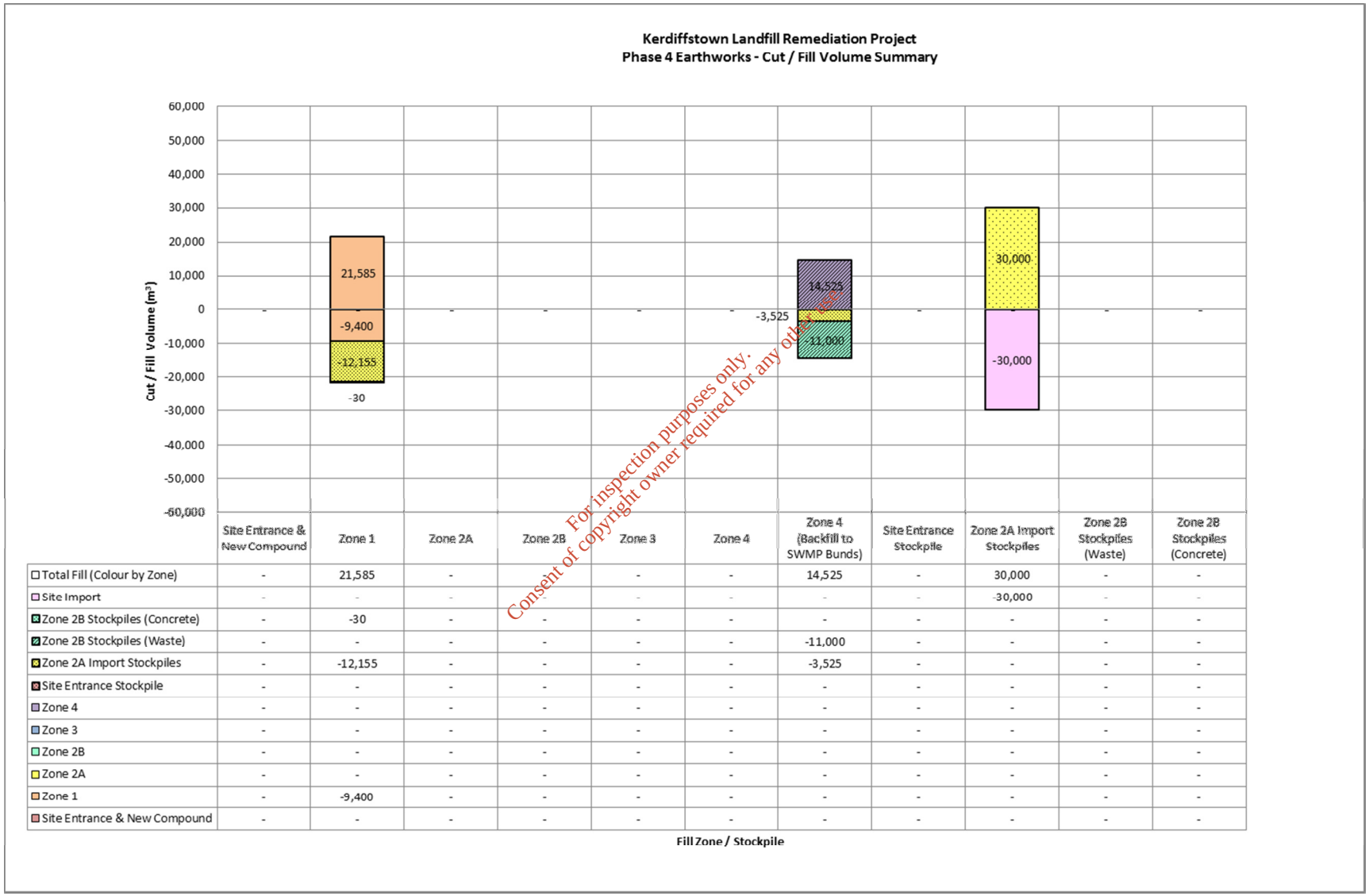
	Site Entrance & New Compound	Zone 1	Zone 2A	Zone 2B	Zone 3	Zone 4	Zone 4 (Backfill to SWMP Bunds)	Site Entrance Stockpile	Zone 2A Import Stockpiles	Zone 2B Stockpiles (Waste)	Zone 2B Stockpiles (Concrete)
Total Fill (Colour by Zone)	-	36,930	-		42,750	20,850	-	-	35,000	22,000	-
Site Import	-	-	-	-	-	-	-	-	-35,000	-	-
Zone 2B Stockpiles (Concrete)	-	-	-	-	-	-	-	-	-	-	-
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-
Zone 2A Import Stockpiles	-	-5,610	-	-	-	-2,055	-	-	-	-	-
Site Entrance Stockpile	-	-6,545	-	-	-	-4,795	-	-	-	-	-
Zone 4	-	-15,375	-	-	-42,750	-14,000	-	-	-	-22,000	-
Zone 3	-	-	-	-	-	-	-	-	-	-	-
Zone 2B	-	-	-	-	-	-	-	-	-	-	-
Zone 2A	-	-	-	-	-	-	-	-	-	-	-
Zone 1	-	-9,400	-	-	-	-	-	-	-	-	-
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-

Earthworks cut and fill by zone (Phase 2)



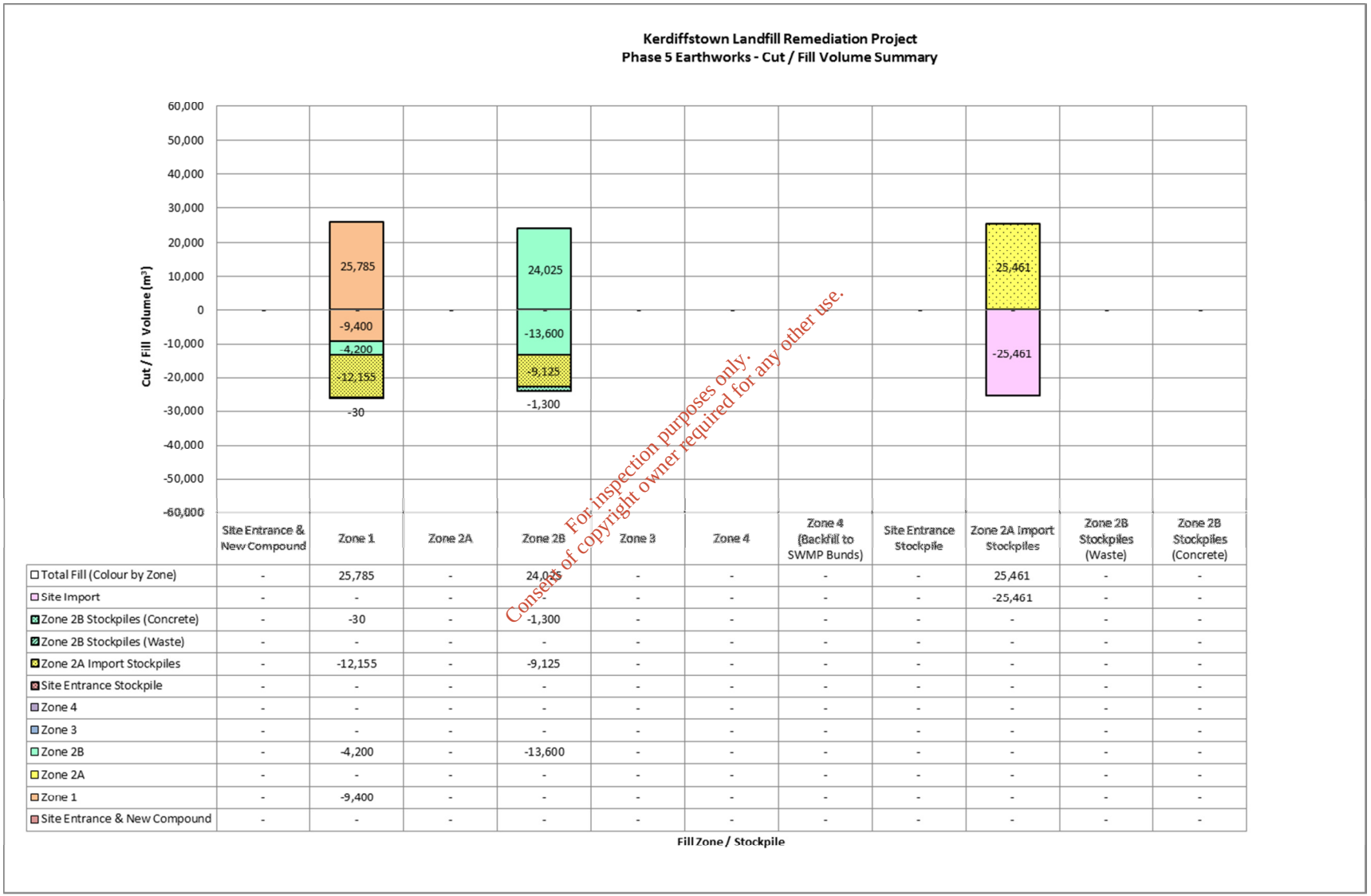
	Site Entrance & New Compound	Zone 1	Zone 2A	Zone 2B	Zone 3	Zone 4	Zone 4 (Backfill to SWMP Ponds)	Site Entrance Stockpile	Zone 2A Import Stockpiles	Zone 2B Stockpiles (Waste)	Zone 2B Stockpiles (Concrete)
Total Fill (Colour by Zone)	-	52,335	-	-	11,100	6,850	39,625	-	35,000	-	-
Site Import	-	-	-	-	-	-	-	-	-35,000	-	-
Zone 2B Stockpiles (Concrete)	-	-30	-	-	-50	-	-	-	-	-	-
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-11,000	-	-	-	-
Zone 2A Import Stockpiles	-	-10,995	-	-	-11,050	-6,850	-28,625	-	-	-	-
Site Entrance Stockpile	-	-1,160	-	-	-	-	-	-	-	-	-
Zone 4	-	-30,750	-	-	-	-	-	-	-	-	-
Zone 3	-	-	-	-	-	-	-	-	-	-	-
Zone 2B	-	-	-	-	-	-	-	-	-	-	-
Zone 2A	-	-	-	-	-	-	-	-	-	-	-
Zone 1	-	-9,400	-	-	-	-	-	-	-	-	-
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-

Earthworks cut and fill by zone (Phase 3)



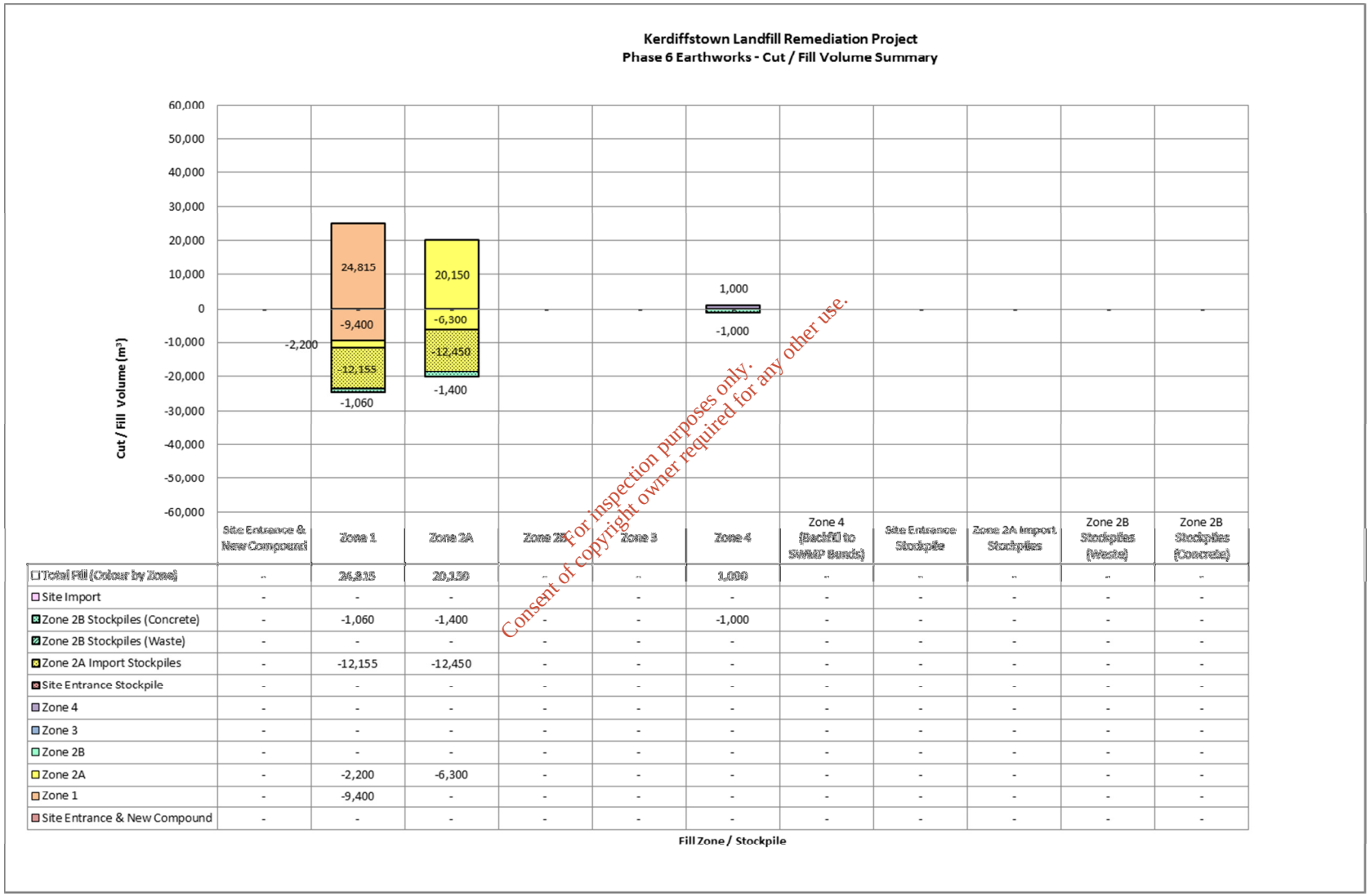
	Site Entrance & New Compound	Zone 1	Zone 2A	Zone 2B	Zone 3	Zone 4	Zone 4 (Backfill to SWMP Bunds)	Site Entrance Stockpile	Zone 2A Import Stockpiles	Zone 2B Stockpiles (Waste)	Zone 2B Stockpiles (Concrete)
Total Fill (Colour by Zone)	-	21,585	-	-	-	-	14,525	-	30,000	-	-
Site Import	-	-	-	-	-	-	-	-	-30,000	-	-
Zone 2B Stockpiles (Concrete)	-	-30	-	-	-	-	-	-	-	-	-
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-11,000	-	-	-	-
Zone 2A Import Stockpiles	-	-12,155	-	-	-	-	-3,525	-	-	-	-
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	-	-	-	-	-	-	-	-	-	-
Zone 3	-	-	-	-	-	-	-	-	-	-	-
Zone 2B	-	-	-	-	-	-	-	-	-	-	-
Zone 2A	-	-	-	-	-	-	-	-	-	-	-
Zone 1	-	-9,400	-	-	-	-	-	-	-	-	-
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-

Earthworks cut and fill by zone (Phase 4)



	Site Entrance & New Compound	Zone 1	Zone 2A	Zone 2B	Zone 3	Zone 4	Zone 4 (Backfill to SWMP Bunds)	Site Entrance Stockpile	Zone 2A Import Stockpiles	Zone 2B Stockpiles (Waste)	Zone 2B Stockpiles (Concrete)
Total Fill (Colour by Zone)	-	25,785	-	24,025	-	-	-	-	25,461	-	-
Site Import	-	-	-	-	-	-	-	-	-25,461	-	-
Zone 2B Stockpiles (Concrete)	-	-30	-	-1,300	-	-	-	-	-	-	-
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-
Zone 2A Import Stockpiles	-	-12,155	-	-9,125	-	-	-	-	-	-	-
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	-	-	-	-	-	-	-	-	-	-
Zone 3	-	-	-	-	-	-	-	-	-	-	-
Zone 2B	-	-4,200	-	-13,600	-	-	-	-	-	-	-
Zone 2A	-	-	-	-	-	-	-	-	-	-	-
Zone 1	-	-9,400	-	-	-	-	-	-	-	-	-
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-

Earthworks cut and fill by zone (Phase 5)



	Site Entrance & New Compound	Zone 1	Zone 2A	Zone 2B	Zone 3	Zone 4	Zone 4 (Backfill to SWMP Bunds)	Site Entrance Stockpile	Zone 2A Import Stockpiles	Zone 2B Stockpiles (Waste)	Zone 2B Stockpiles (Concrete)
Total Fill (Colour by Zone)	-	24,815	20,150	-	-	1,000	-	-	-	-	-
Site Import	-	-	-	-	-	-	-	-	-	-	-
Zone 2B Stockpiles (Concrete)	-	-1,060	-1,400	-	-	-1,000	-	-	-	-	-
Zone 2B Stockpiles (Waste)	-	-	-	-	-	-	-	-	-	-	-
Zone 2A Import Stockpiles	-	-12,155	-12,450	-	-	-	-	-	-	-	-
Site Entrance Stockpile	-	-	-	-	-	-	-	-	-	-	-
Zone 4	-	-	-	-	-	-	-	-	-	-	-
Zone 3	-	-	-	-	-	-	-	-	-	-	-
Zone 2B	-	-	-	-	-	-	-	-	-	-	-
Zone 2A	-	-2,200	-6,300	-	-	-	-	-	-	-	-
Zone 1	-	-9,400	-	-	-	-	-	-	-	-	-
Site Entrance & New Compound	-	-	-	-	-	-	-	-	-	-	-

Earthworks cut and fill by zone (Phase 6)