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Environmental Permitting (England and Wales) Regulations

Benefit statement for restoration of land at Scarcewater Tip, Melbur China Clay Works for ecological/agricultural improvement

Person with appropriate technical expertise

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I am a professional Soil Scientist with 20 years of experience undertaking research and strategic consultancy work for Defra, the Environment Agency, other government departments and corporate clients (*i.e.* waste management companies, water utilities *etc.*). My Chartered Scientist (CSci) status is with respect to the impacts of treating and recycling organic 'waste' materials (*e.g.* biosolids, paper crumble, biowaste, compost, MBT outputs *etc*.) to land. I have worked on an extensive portfolio of projects and presented, both mine and others work, at international conferences plus refereed articles in scientific journals.

This benefit statement is written in association with a Bespoke Permit application being made to the Environment Agency by IMERYS Minerals Ltd for the restoration of land at Scarewater Tip.

Location of where the waste is to be spread

Site address: Scarcewater Tip, Melbur China Clay Works, St Stephen, Truro, Cornwall, TR2 4EY

Size of the notified area: 85 hectares

Quantity of waste to be stored at any one time: Maximum of 3,000 tonnes per stockpile at any one time

Total quantity of waste to be spread: *c.* 212,500 tonnes

What waste is to be spread

Waste producer: Variety of sources of materials depending on availability at time of restoration phases.

EWC code: Various – see WRP for list

Waste description: Various to include composts, biosolids, paper wastes, anaerobic digestates, cement dusts, gypsum.

Background

For many years there has been an ongoing programme of land restoration on the China Clay Tips within Cornwall using the *in situ* china clay waste. However, the china clay waste consists predominantly of sands and grits, together with the micaceous material consisting mainly of silt. Due to the mineralogical origin of these materials, the sediment is inherently devoid of plant nutrients and organic matter and weakly developed with no inherent physical structure. Over the last 10 years, through a series of Environment Agency approved environmental permits, IMERYS Minerals Ltd have and successfully moved to a methodology of on-site Tip restoration using a mixture of on-site soil mineral forming materials (*i.e.* sand, grits and micaceous materials) alongside imported wastes materials *e.g.* composts, gypsum, marine dredgings *etc*.

Scarcewater Tip, part of IMERYS Minerals Ltd workings at the Melbur China Clay Works and has been used for a number of years for the deposit of waste resulting from the extraction of China Clay. The site has several detailed planning permissions in place, the last issued by Cornwall County Council on 20th December 2018 (PA18/06494), allows for the "..progressive restoration and landscaping" of the Scarcewater Tip Melbur China Clay Works St Stephen Truro and requires completion by 31st July 2024.

In order to comply with the requirements of their approved planning permission, IMERYS Minerals Ltd intend to use similar methodologies to those used on neighbouring China Clay Tips *e.g.* Dubbers, Carrancarrow and import waste materials to use with on-site soil mineral forming materials to create topsoil areas suitable for required landscape end-uses namely heathland, pasture, woodland and grass/scrub.

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Soil mineral forming material analysis results

The mineral soil forming material, for the restoration of Scarcewater Tip was sampled from on-site materials on 21st November 2019 by myself and sent for appropriate analysis by NRM Laboratories, Bracknell. The results are presented in Table 1. The samples submitted for analysis was a composite sample taken from the mineral waste stored on site to form individual composite sample for analysis.

Table 1 – Scarcewater Tip mineral soil forming material analysis (Nov 2019)

Soil property	*Melbur North*	*Melbur South*
Texture	Sand	Sand
pH	8.9	8.6
Organic matter (%)	< 0.5	< 0.5
Extractable P (mg/l)	< 2.5 (ADAS Index 0)	< 2.5 (ADAS Index 0)
Extractable K (mg/l)	35.9 (ADAS Index 0)	38.7 (ADAS Index 0)
Extractable Mg (mg/l)	19.7 (ADAS Index 0)	16.0 (ADAS Index 0)
Total Zn (mg/kg)	< 10	< 10
Total Cu (mg/kg)	2.6	2.7
Total Pb (mg/kg)	< 5	< 5
Total Ni (mg/kg)	< 10	20.3
Total Cr (mg/kg)	76.9	97.3
Total As (mg/kg)	< 3	< 3
Total Cd (mg/kg)	< 0.1	< 0.1
Total Hg (mg/kg)	< 0.2	< 0.2
Total Se (mg/kg)	< 0.09	< 0.09
Total Mo (mg/kg)	1.1	3.4
Total F (mg/kg)	9.7	17.0

The soil mineral forming material is near pure sand (> 90%), with an alkaline pH, which will ensure any soil heavy metal additions do not compromise vegetation growth through conversion to immobile forms during soil creation.

Soil phosphorus, potassium and magnesium reserves (all ADAS Index 0) within the on-site soil mineral forming materials are all ‘deficient’ for plant growth and plant nutrients are required in order to facilitate vegetation establishment and growth.

The soil mineral forming materials are devoid of any organic matter content and therefore valuable amounts of organic matter will be required to kickstart and sustain soil biological, chemical and physical processes which are required in order to create topsoil and subsoil horizons.

Waste properties

As listed in the accompanying Waste Recovery Plan, IMERYS Minerals Limited propose to use a range of potential waste streams, in line with previous/current clay tip restoration projects in Devon and Cornwall. Suitable materials sourced from a potential range of waste treatment activities are proposed to be used in the restoration of the 85ha area of Scarewater Tip through the creation of appropriate soil profile horizons (topsoil and subsoil) suitable for intended end uses of acid grassland, woodland and heathland. Waste suppliers/producers will provide IMERYS Minerals Ltd with appropriate analytical results for determination of suitability and a means of calculating appropriate waste blending/application rates to create appropriate soil profile horizons. The general properties and benefits of using waste streams are summarised below:

- Nutrient supply: All of the proposed waste streams provide a valuable source of major plant nutrients (*i.e.* nitrogen, phosphate, potash, magnesium and sulphur) to a lesser or greater extent. For the majority of the proposed waste streams any readily available N content would be regarded as a low readily available N material (*i.e.* < 20% of total), with the vast majority of the nitrogen present in slow release (organic) forms. As the nitrogen is present in slowly available forms, the risks of nitrate leaching losses are low. However, Bending *et al.* (1999) indicated that in order to sustain plant growth and produce a viable growing medium in land restoration projects at least 1,500 kg of total nitrogen (N) per hectare is required. The phosphate and potash applied with the waste streams will ensure that soil P and K status are adequate for vegetation establishment and growth.
- Organic matter: The majority of the proposed waste streams will provide a valuable source of organic matter which will be particularly beneficial in a land restoration/reclamation situation and will help to create a sustainable growing medium. Following incorporation and mixing of the waste streams it is intended to create topsoil (0-50cm) organic matter level of *c.* 5-10% and subsoil (50-75cm) organic matter contents of *c.* 2%, in line with published soil specification documents *i.e.* BS3882:2015 and BS8601:2013 for topsoil and subsoil, respectively.
- Liming value: Some of waste materials potentially to be used provide a source of neutralising material. These waste streams will

be sourced and used to help to ensure that acidic soil conditions are not created *e.g.* following dredging applications which may generate acidic soil conditions and will not compromise vegetation establishment and growth.

- Heavy metals: Waste materials have potential to contain heavy metals. As a consequence, careful consideration will be given to the potential soil heavy metal concentrations post topsoil/subsoil formation. However, following all waste blending/application activities the soil heavy metals concentrations will be calculated to maintain levels below maximum permissible concentrations specified in the Sludge (Use in Agriculture) Regulations (SUiAR) (SI, 1989) – see Appendix 1 for calculated topsoil metals concentrations for a topsoil created using IMERYS Minerals Ltd on-site soil mineral forming material blended with green waste compost (700 t/ha), biosolids (500 t/ha) nd mixed waste compost (800 t/ha).
- Salt content: The electrical conductivity of some of the proposed waste streams could be elevated, however with careful monitoring of incoming waste streams and following blending with on-site soil mineral forming materials, the resulting conductivity levels will not compromise vegetation establishment or growth.
- Contaminants: Some of the proposed waste streams may contain a low level of physical contamination (*e.g.* glass, plastic) owing to the source of materials *e.g.* non-source segregated compost/anaerobic digestates. Clearly, the presence of plastic/glass will not cause any problems in terms of vegetation establishment and growth, as both are inert. However, plastic could be visually unattractive and glass would pose a small risk to human health, but as public access to the site is not permitted, and the proposed application rate will create a soil with any contamination level significantly less than that laid down in the British Standards for topsoil and subsoil (*i.e.* BS3882:2015 and BS8601:2013) the issue of physical contaminants has not been an issue on neighbouring IMERYS Minerals restoration sites, and will not cause an issue on Scarcewater Tip.

Practicalities of improving the soil forming material

As the major long-term land use on the Scarcewater Tip is a mixture of grassland, woodland and heathland the growing medium will require sufficient fertility and depth to support vegetation growth. All proposed land uses require an adequate rooting depth and a high available water capacity within the top 50 - 75cm of the soil profile to ensure optimal vegetation growth. It is therefore recommended that

the following approach to create a soil profile, suitable for establishment and growth of various vegetation species:

It is proposed that the various waste materials are laid on to the surface of the mineral soil forming material, dependent on rates/densities of the waste *e,g,* green waste compost with a density of 0.6 and a typical application rate of 700 t/ha would be laid at a depth of *c.* 12cm, and then using diggers/bucket shovels (under dry conditions) blend the wastes and soil mineral forming materials together. The process repeated for each applied waste stream to create the required soil horizons *i.e. c.*50cm depth of topsoil, and an additional 25cm of subsoil material where greater rooting depths are required *e.g.* woodland areas. The created soil profiles will then be pressed or rolled (depending on slope angle) to consolidate the materials together.

The aim of the restoration programme is to achieve a homogeneous organic-rich topsoil forming material to 50cm depth, over a suitable subsoil horizon to support rooting and establishment of deeper rooting plant species, with sufficient water holding capacity and fertility to sustain the intended vegetation end-use. The handling and placing of soil forming materials and cultivation must only be carried out in dry conditions and in line with good practice (MAFF, 2000; Defra, 2005). The blend of materials should provide adequate available water capacity and nutrient supply for vegetation establishment and growth, as well as adequate rooting depth.

Proposed Topsoil and Subsoil Specifications for Scarcewater Tip

Topsoil

Parameter	Woodland	Acid Grassland	Heathland
pH	5.5 – 8.5	5 – 6.5	5 – 6.5
Total N (%)	> 0.15	> 0.15	> 0.15
Extractable P (mg/l)	16 – 140	16 - 140	16 – 140
Extractable K (mg/l)	121 – 1,500	121 – 1,500	121 – 1,500
Extractable Mg (mg/l)	51 - 600	51 - 600	51 -600
Soil Organic Matter (%)	3 - 20	3 - 20	3 -20
C:N Ratio	< 20:1	< 20:1	< 20:1
Visible Contaminants (%)	< 0.5	< 0.5	< 0.5
Visible Plastics	< 0.25	< 0.25	< 0.25
PTE's (mg/kg)	As per SUiAR	As per SUiAR	As per SUiAR

Subsoil

Parameter	Woodland	Acid Grassland	Heathland
pH	5.5 – 8.5	5 – 6.5	5 – 6.5
Extractable P (mg/l)	0 – 45	0 - 45	0 - 45
Extractable K (mg/l)	0 – 400	0 – 400	0 – 400
Extractable Mg (mg/l)	0 - 175	0 - 175	0 -175
Soil Organic Matter (%)	< 2	< 2	< 2
C:N Ratio	< 20:1	< 20:1	< 20:1
Visible Contaminants (%)	< 0.5	< 0.5	< 0.5
Visible Plastics	< 0.25	< 0.25	< 0.25
PTE's (mg/kg)	As per SUiAR	As per SUiAR	As per SUiAR

Example calculations for a typical topsoil blend created using IMERYS Minerals Ltd on-site soil mineral forming material blended with green waste compost (700 t/ha), biosolids (500 t/ha) and mixed waste compost (800 t/ha) and compliance with above topsoil specification is given in Appendix II.

Risk assessment

I have conducted a site visit and undertaken a site-based risk assessment, which confirms the activity can be carried out without harm to the environment or human health. However, care should be taken not to spread waste materials within 10 m of any ditches on site to prevent any losses of waste through water erosion. If odour is ever an issue, as per the IMERYS Odour management plan, care should be taken not to spread any potentially odourous materials when the prevailing wind is likely to carry the odour towards the nearest local residents.

Sensitive human and environmental receptors

Sensitive human receptors

- The nearest potential human receptors are residents in cottages/houses *c.*125m to the south west of the site boundary at Sunbury Farm and 133m to the west of the site boundary on Seaview Terrace, resulting in possible sensitive receptors to odour from spreading operations, aerosol drift and proximity of spreading operations. However, any risks will be minimised by following established emission management procedures developed under previous restoration activities at neighbouring tip sites.
- A public highway (B road) runs along the western boundary of the site, resulting in possible sensitive receptors to odour from spreading operations, aerosol drift and proximity of spreading operations, if passing during operational activities, however any risks to potential highway users are minimal.

Sensitive environmental receptors

- There are no identified environmental receptors within 500m of the site boundary requiring assessment for impacts from the proposed restoration activities.

Practices to reduce the impacts of the operation on identified sensitive receptors

In this section I have set out the measures that will be taken to reduce the impact of the operation on the receptors identified.

- The incorporation of organic wastes as soon after delivery to the restoration areas as possible, will reduce the potential for odour, dust and gaseous emissions from the spreading operation.
- The predominant wind direction puts the nearest sensitive human receptors

up wind of the operation this should reduce the risk of odours, bioaerosols *etc.* reaching the receptors.

- The site is suitable for direct surface application. Wastes will be surface applied using low ground pressure equipment and incorporated by double digging using bucket mixing techniques.
- Spreading will only be undertaken when weather conditions are suitable to prevent aerosol drift and odour problems. The weather assessment and decision will be recorded by the site manager in his operation day book.
- Machinery operations will run up and down any slopes as there are suitable area at the top and bottom to allow turning, the incorporation equipment will be lifted out of the ground prior to turning at the end of each run.
- Machinery turns will be routed to avoid rutting and wheel slip.
- Waste deliveries to the site will be made as required and stored in a central location ahead of use for site restoration.
- The restoration areas *i.e.* directly below the newly created soil profiles, are not underdrained, but as part of the whole tip design the tip is under drained with these drains discharging to a perimeter leat, which is monitored to comply with discharge consent.
- Consolidated mineral materials on the tip are in excess of 5m over consolidated geological material, infiltration to ground water is not identified as high risk.
- Emissions to air, post spreading, are not expected to cause an issue.
- Spreading will be even and at an application rate designed to encourage infiltration without run-off or ponding.
- Spreading restrictions within Protecting our Water, Soil and Air “A code of good agricultural practice for farmers, growers and land managers” will be followed.

All machinery is regularly serviced and spreading equipment is calibrated on an annual basis, full maintenance and calibration reports for all equipment, where applicable, are available.

Contingency planning

Machinery breakdown

- Replacement field machinery is available
- Machinery is fully serviced as per manufacturer’s instructions
- Hire vehicles will be used in the event of a transport vehicle breakdown

Staffing

- There are sufficient trained staff to maintain general sickness cover

Weather

Operations will not be carried out in the following situations;

- Heavy rain
- When heavy rain is imminent
- High winds
- Frozen or snow covered ground as defined in Protecting our water, soil and air “A code of good agricultural practice for farmers, growers and land managers”
- When weather conditions are assessed to be likely to interfere with the operations

I am satisfied that the above statements are true and accurate to the best of my knowledge.

Dr Paul Gibbs
BSc, PhD, F.I. Soil Sci., C.Sci
Principal Consultant

References

Bending, N.A.D., McRae, S.G. and Moffat, A.J. (1999). Soil Forming Materials. Their Use in Land Reclamation. DETR publication. The Stationary Office, London.

Defra (2005). *Defra Guidance for Successful Reclamation of Mineral and Waste Sites.* London, Crown Copyright, 2005.

MAFF (2000). *Good Practice Guide for Handling Soils.* Issued by the Farming and Rural Conservation Agency, Cambridge. MAFF and Crown Copyright, 2000.

Nicholson, F.A. and Chambers, B.J. (2007). *Sources and Impacts of Past, Current and Future Contamination of Soil – Appendix I: Heavy Metals.* Final Report for Defra project SP0547.

SI (1989). The Sludge (Use in Agriculture) Regulations 1989. Statutory Instrument 1989/1263

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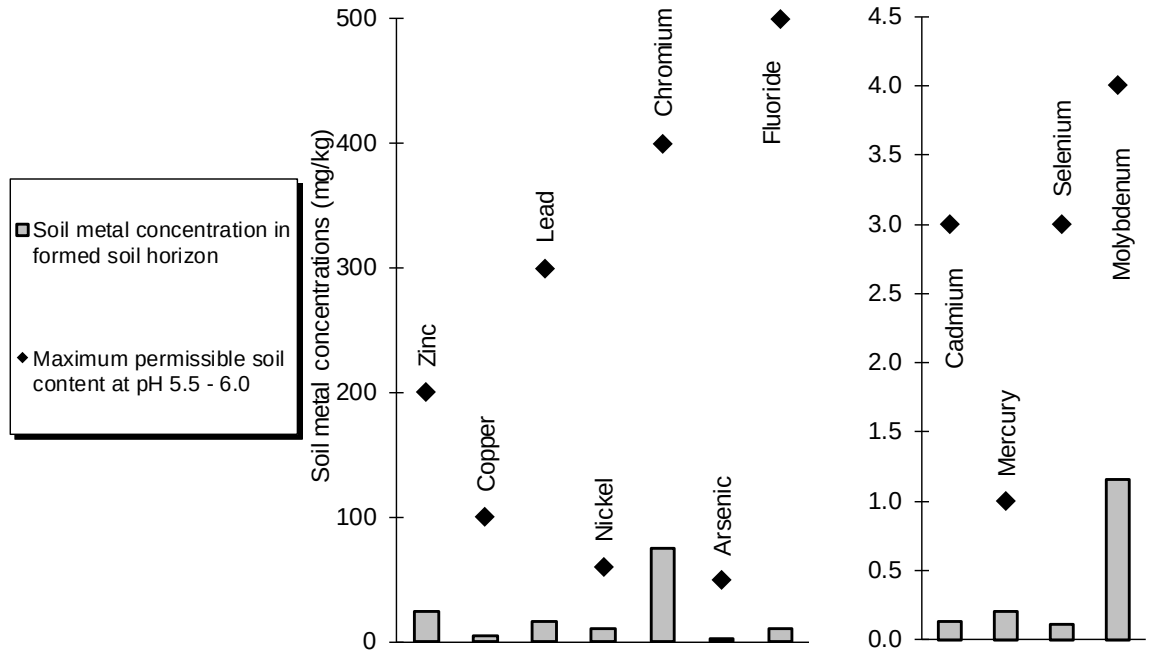
Appendix I. Calculated Topsoil (0-50cm) metal concentrations following 2000 t/ha (fresh weight) of organic waste blended with on-site mineral soil forming material.



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Appendix II **Topsoil Application Rates and Major Nutrient/Heavy Metal Applications**
Sample: Example **Date Sampled:** December 2019
Sampling methodology: Composite representative samples were taken from piles of waste material
Analytical Laboratory: NRM Ltd., Coopers Bridge, Braziers Lane, Bracknell, Berkshire RG42 6NS

Parameter	Units	Mixed Waste Compost analysis results* (fresh weight)	Green Waste Compost analysis results* (fresh weight)	Biosolids analysis results* (fresh weight)	Predicted soil metal concentration (mg/kg) (50 cm depth of incorporation)
pH		6.7	7.6	7.9	-
Dry matter	%	47	54-	24	-
Nitrogen	kg/t fw	6.7	7.3	15.4	0.3 %
Readily available N^+	kg/t fw	0.7	0.2	2.4	-
Phosphate – P_2O_5	kg/t fw	2.9	2.4	12.5	128 mg/l
Potash – K_2O	kg/t fw	2.2	4.7	0.9	295 mg/l
Magnesium – MgO	kg/t fw	2.9	2.1	2.1	131 mg/l
Sulphur – SO_3	kg/t fw	5.0	8.9	5.5	-
Organic matter	kg/t fw	99.2	229	178	5.1 %
Zinc	mg/kg dm	580	105	997	25 mg/kg
Copper	mg/kg dm	1.3	28.1	377	5 mg/kg
Cadmium	mg/kg dm	1.3	0.3	0.4	0.1 mg/kg
Nickel	mg/kg dm	40	7.4	18.6	10 mg/kg
Lead	mg/kg dm	730	50.4	78.2	17 mg/kg
Chromium	mg/kg dm	40	13.2	25.3	75 mg/kg
Arsenic	mg/kg dm	4.3	5.5	5.7	3 mg/kg
Mercury	mg/kg dm	0.6	0.1	0.7	0.2 mg/kg
Selenium	mg/kg dm	1.0	0.2	2.3	0.1 mg/kg
Molybdenum	mg/kg dm	2.0	1.7	7.6	1.2 mg/kg
Fluoride	mg/kg	50	34.4	43	11 mg/kg
Physical Contaminants	% air dry	3.6	0	0	0.02 %
Plastic	% air dry	1.2	0	0	0.01 %

$^+$ NO_3-N + NH_4—N.