AGRICULTURAL BENEFIT STATEMENT FOR THE USE OF INERT MINERAL WASTE AND GREEN WASTE COMPOST TO RESTORE DISTURBED GROUND WITHIN THE 'GREEN LINE' BOUNDARY AT GARTH ISAF FARM, EFAIL ISAF, PONTYPRIDD, RHONDDA CYNON TAFF, CF38 1SN.

INCLUDING AGRICULTURAL LAND CLASSIFICATION AND ASSESSMENT OF FERTILISER NEEDS TO UNDISTURBED AREAS WITHIN THE 'BLUE LINE' BOUNDARY AT THE FARM

Final report 28th January 2019

Document prepared by Nigel Bending B.Sc. (Hons), M.Sc., Ph.D.

Progressive Restoration
Spring Cottage
Walterstone Common
Herefordshire
HR2 0DT

GARTH ISAF FARM – EFAIL ISAF

AGRICULTURAL BENEFIT STATEMENT

FARM DETAILS INCLUDING POSTCODE.

1.1 PERSON WITH APPROPRIATE TECHNICAL EXPERTISE AND PERMIT DETAILS GIVE US A BRIEF INTRODUCTION INCLUDING:

- **who you are**

This Agricultural Benefit Statement has been prepared by Dr Nigel Bending, Senior Consultant, Progressive Restoration Limited

- **relevant qualifications**

Dr Nigel Bending holds a Ph.D. in Soil Science awarded by the Faculty of Science at the University of East London, an M.Sc. in Rural Resource Management awarded in 1998 by the University College of North Wales and a B.Sc. (Hons) degree in Geography and Geology awarded by Keele University in 1987.

- **brief summary of your experience in this field**

Dr Nigel Bending has 25 year's experience as a soil scientist specialising in the restoration of derelict land, mineral workings and landfill sites to a wide range of afteruses including agriculture. He has an exceptional knowledge of soil forming processes in man-made soils and a particular interest in natural soils of the lower Taff Valley having grown up in Radyr, Cardiff.

Dr Nigel Bending was employed between 1996 and 2000 as a post-doctoral Researcher by the University of London, Wye College School of Agriculture to carry out a research project funded by DEFRA to investigate the use of soil-forming materials in restoration. Dr Nigel Bending was employed as a post-doctoral Researcher by Forestry Commission, Research Division between 1994 and 1996 to carry our research funded by DEFRA to carry out research to provide updated guidance on tree establishment on landfill sites. Dr Nigel Bending undertook research funded by WRAP under their trailblazer project between 2008 and 2012 to investigate the use of green waste compost as a soil amendment in the production of performance engineering soils at the former Ebbw Vale steel works.

Dr Nigel Bending has extensive experience in the use of organic amendments in land restoration including cake and liquid sewage sludge, thermally dried sewage sludge, paper mill sludge, green waste compost and wood fibre. He has published extensively in scientific periodicals and industry journals and presented papers at numerous conferences. His particular interest is in nutrient release characteristics of organic amendments and their role in promoting soil structural development.

- **permit number under which this deployment application is being made.**

This Agricultural Benefit forms part of an application for a Bespoke permit (Site based permit) for the use of waste materials for the restoration of areas subject to infilling both historically and actively. The permit number is therefore unknown as the application has yet to be determined by NRW.

1.2 WHERE THE WASTE IS TO BE SPREAD

- **Farm address:**

Garth Isaf Farm
Efail Isaf
Pontypridd
Rhondda Cynon Taff
CF38 1SN

- **Stock pile grid reference:**

The location of stockpiles of inert mineral wastes and green waste compost are yet to be determined. Five areas have been identified as requiring restoration following infilling. These are listed in Table 2 and identified on Drawing number GIF-AGCL-Proposed 01 Rev3. A single stockpile of inert mineral waste shall be maintained on the site at any point in time and this will be located on the next area identified for restoration. The sequencing of restoration shall be by agreement with NRW. The presumption shall be to import and store sufficient inert mineral waste to meet the requirements for restoration of the whole of an area prior to commencing soil placement. To reduce the quantity of stored materials the central aggregate processing area will be split into two for the purpose of restoration with the gallop dividing the northern and southern parts.

Green waste compost will be stored in a single stockpile which shall be located nearby, but not upon, the next area identified for restoration in order not to interfere with the spreading of inert mineral waste. The presumption shall be to minimise the quantity of compost stored for an extended period on site and to stockpile compost in the 3 months preceding the planned restoration of any area.

The quantity of inert mineral waste and green waste compost stockpiled on any area shall not exceed the quantity identified in Table 12 as strictly necessary for the restoration of that area.

- **Area of the receiving land:**

The total disturbed area of land requiring restoration is 10.021.

The farm includes an additional 15.588 ha of undisturbed ground which possesses a natural soil cover. This is under grassland and utilised for the production of silage. This area will not be subject to waste application but details have been included in the Agricultural Benefits Statement as it provides the basis on which the restoration proposals for the disturbed area have been developed.

- **Quantity to be stored at any one time:**

The maximum quantity of inert mineral wastes that will be stored at any one time will be 24,000 tonnes. However, the disturbed area will be restored progressively and as each of the five area is completed the quantity of inert mineral waste stockpiled will return to zero. It will then rise again as inert mineral waste is imported and stockpiled to permit restoration of the next available area.

The maximum quantity of green waste compost that will be stored at any one time will be 500 tonnes.

- **Total quantity to be spread:**

The total quantities of wastes to be spread are as follows:

Inert mineral waste = 98,101 tonnes

Green waste compost = 4,089 tonnes

Full details of how these totals have been calculated are presented in Table 12.

It should be noted that half of the total of green waste compost will be spread immediately prior to seeding following the construction of restored soil profiles using inert mineral wastes. The remainder will be spread as 'part and parcel' of the green manuring of the temporary ley grassland 2 years after restoration and the reseeding of areas with a permanent ley grassland.

It should be noted that the quantity of inert mineral waste required will be less than the total identified above in the event of (a) a proportion of inert mineral wastes already in situ being proven to be suitable for use as soils in restoration, and (b) soils removed prior to filling being recovered from peripheral areas within the site.

- **Location maps showing the field and receptors, temporary tank position and spreading control measures : reference numbers**

The location of infilled areas requiring restoration within Garth Isaf Farm are shown on Drawing number GIF-AGCL-Proposed 01 Rev3 'Field management proposed improvements'). Detailed information on each area is given in Table 2.

All wastes proposed for use in the restoration are solid. No tank facilities or spreading control measures appropriate to the use of liquid wastes are therefore required.

1.3 WHAT IS THE WASTE TO BE SPREAD

- **Waste producer: name and address**

The waste producers are unknown at the present time.

Inert mineral wastes will be imported predominantly from development sites within the locality. These can be assumed to be within a maximum 20-mile radius. The development sites may include those for industrial, commercial and housing and may be on brownfield or greenfield land.

The inert mineral wastes will only be obtained from sites which possess the soil series and / or drift types identified in Table 6a and which meet the standard required to allow their use for restoration purposes which is presented in Table 5.

Inert mineral wastes will be accepted only from licensed waste carriers.

Green Waste composts will be obtained only from Compost Certification Scheme producers. This may include amongst others:

Cowbridge Compost Ltd, Penllyn Estates, Cowbridge, Vale of Glamorgan, CF71 7FF.

- **EWC code: selected from the relevant tables in your mobile plant permit**

The EWC codes of the inert mineral wastes which will be imported as mixed soils for restoration purposes are given in Table 6b.

Off specification green waste compost is included in Table 6b.

- **Waste description: please expand upon the simple description in the waste lists.**

The inert mineral wastes will comprise of subsoil and drift (fluvioglacial and glacial) with incidental topsoil.

It is expected that the wastes will be removed by bulk excavation and as such will contain variable proportions of subsoil, drift and topsoil. The wastes 'as received' may include massive blocks of indurated drift.

It is expected that some inert mineral wastes comprised of a high proportion of drift will fail to meet the minimum standard for use as soil in restoration because of an excess of stone. These wastes may be accepted, but will be subject to screening on site to remove stone in order to increase the fines content (<2 mm fraction) to address this limitation and allow their use (only where all other requirements are met)

While all green waste compost will be produced in accordance with the Quality Protocol for compost (BS PAS 100:2011) the use of composts which fail to meet the accompanying standard on the basis of certain parameters e.g. grading, pathogens or stone content may be used.

- **Additional information: any other relevant information on the production process the waste arises from and other information for example is the waste classified as Animal Byproducts?**

All inert mineral wastes will need to possess an acidic pH and be loamy in texture in order to match the characteristics of natural soils on undisturbed ground elsewhere with the Garth Isaf Farm. Only a subset of the inert mineral wastes potentially available will be suitable. Clays will be unsuitable.

1.4 OPERATIONAL DETAILS

Cropping details:

- **current crop including projected yield if known,**

None

- **is the straw removed (cereals, OSR, pulse crops),**

Not applicable

- **the following crop and any sensitive crops within the rotation which you amending the soil for in good time.**

The inert mineral waste and green waste compost will be spread in order to construct restored soils on filled areas. The restored soil profiles will be sown with a 2 year - Festolium silage ley in order to promote soil structural development and with white clover and birdsfoot trefoil added to build nitrogen capital.

- **when do you intend to apply this waste, post harvest - pre ploughing, during seed bed cultivations, on the stubble over winter**

Inert mineral wastes will be spread during the summer months (June-September). Infilled areas onto which inert mineral wastes are spread will have achieved approved final levels

beforehand and sufficient inert mineral wastes will have been stored to meet the restoration requirements for the area concerned. The spreading and incorporation of green waste compost into the inert mineral wastes will be carried out immediately following the completion of the spreading of the inert mineral waste and prior to seedbed preparation and sowing.

– **how is the waste to be stored e.g. mobile tank or field heap?**

Inert mineral wastes will be stored in soil mounds. These will be constructed in accordance with MAFF guidance on 'Good Practice for Soil Handling' (MAFF 2000). This document contains a series of method based specifications for soil handling using different earth moving equipment.

The method described in Sheet 2 'Building soil storage mounds with excavators and dump will be employed for constructing storage mounds containing inert mineral wastes. The system is designed to minimise soil compaction by prohibiting dump trucks from traversing soils.

Storage mounds of inert mineral wastes will be located on well drained ground and orientated with their long axis parallel to the dip of the slope to allow surface water to discharge in the aisles between mounds. Individual mounds will be 12 m in width, 4 m in height and upto 30 m in length. The side slopes of the mounds will be graded to 1 in 1 giving a 4.0 m wide top. The volume of each mound will nominally be 1,000 m3 (1,800 tonnes). A minimum 3.0 m break will be left between the ends and sides, of each mound, to allow surface water to be discharged laterally, to provide access to equipment and to allow individual mounds to be identified for the purpose of sampling and testing.

The storage mound will be created by block tipping inert mineral wastes in closely overlapping piles in front of a 360-degree tracked excavator (18-24 tonnes), which may traverse the soils to form the mound. The excavator will employ a 'haymaking' system to lift, and cast, the inert mineral wastes up to the full height of the mound using a toothed digging bucket.

The excavator will stand on the top of the mound to grade the side slopes to 1 in 1 and these will be sealed using the back rounded surface of the bucket to prevent the ingress of water. The top of the mound will be trimmed to provide a 10% shedding gradient from its centre point to each side with the surface again sealed.

Storage mounds will be made up to their full height each day, shaped and the sides sealed to protect the inert mineral wastes from poor weather.

Green waste compost will be stored windrows. These shall be located on well drained ground a minimum of 10 m from any watercourse and orientated with their long axis parallel to the dip of the slope to allow surface water to discharge in the aisles between windrows. Individual windrows will be 6 m in width, 3 m in height and ordinarily 20 m in length. The side slopes will be graded to 1 in 1 giving a pointed top (much like a 'Toblerone' chocolate bar). The volume of each windrow will nominally be 250 tonnes of compost (approximately 180 m^3). The top and sides of windrows are to be sealed to reduce water through flow and this will be carried out by light pressure applied by the rounded back surface of a grading bucket.

Windrows will be created by block tipping green waste compost in closely overlapping piles in front of a 360-degree tracked excavator (18-24 tonnes), which will not traverse the compost to form the windrow. The excavator will employ a 'haymaking' system to lift, and cast, the green waste up to the full height of the mound using a grading bucket.

Exposed faces will be left in a stable condition free of loose compost at the end of each working day.

- **where is the waste to be stored prior to spreading (grid reference)?**

The location of stockpiles of inert mineral wastes and green waste compost are yet to be determined. Five areas have been identified as requiring restoration following infilling. These are listed in Table 2 and identified on Drawing number GIF-AGCL-Proposed 01 Rev3. A single stockpile of inert mineral waste shall be maintained on the site at any point in time and this will be located on the next area identified for restoration.

Green waste compost will be stored in a single stockpile which shall be located nearby, but not upon, the next area identified for restoration in order not to interfere with the spreading of inert mineral waste

- **why was this storage location chosen?**

The storage of separate stockpiles of inert mineral wastes on each area identified for spreading is intended to ensure that restored soil profiles can be constructed efficiently during periods of favourable weather. Having the wastes 'close to hand' minimises the distance over which the wastes must be transported allowing a rapid turnaround of dump trucks reducing the number of dump trucks involved and their carrying capacity. Other benefits include a reduced risk of pollution as the distance of travel by dump trucks over the bare exposed fill surface is minimised. Supervision is also easier where all equipment involved in the spreading operation operate from within a tightly contained area.

The storage of a separate stockpile of green waste compost near to, but not upon, each area identified for restoration ensures the material is accessible but will not interfere with the spreading of the inert mineral waste. It should be noted that this operation will be completed over the whole of the surface of any area prior to the spreading of the green waste compost.

- **how is the waste to be spread and why is it to be spread that way?**

The inert mineral waste will be spread as soil-forming materials over the graded infill formation on disturbed ground as a uniform layer 500 mm (plus 12.5% to allow for settlement) in thickness in order to provide a restored soil profile. Green waste compost will subsequently be spread and incorporated into the inert mineral waste to a depth of 250 mm in order to add organic matter to assist in re-establishing vegetation.

Restored soil profiles will be constructed by loose tipping in order to avoid compaction. The operation will be carried out in accordance with MAFF guidance on 'Good Practice for Soil Handling' (MAFF 2000). This document contains a series of method based specifications for soil handling using different earth moving equipment. Those methods that avoid soil compaction, rather than cause soil compaction, and then seek to redress this by cultivation, are generally accepted to be more desirable.

The method described in Sheet 4 'Soil replacement with excavators and dump trucks' within the aforementioned MAFF guidance will be employed for constructing soil profiles using the inert mineral wastes. The system involves the progressive and sequential placement of soils in strips across a designated area. Strips are ordinarily 6.0 m wide which is the effective working reach of a 18-24 tonne excavator.

The compact graded infill formation will be scarified in strips in two directions, using the teeth of a digging bucket, to produce a 'diamond' pattern prior to placing the inert mineral wastes as soil-forming materials. The strips will be orientated parallel to the dip of the slope to prevent surface water becoming impounded at the junction between the formation and the newly constructed soil profiles.

The inert mineral waste be deposited upon the scarified strip. Dump trucks will reverse up to the edge of the strip and deposit their loads in conical mounds spaced at centres which reflect depth of cover required which will be 500 mm (+12.5% to allow for settlement). This will give an as laid thickness of 562.5 mm. Inert mineral waste which is accidentally deposited on the unscarified formation at the front of the strip in the course of vehicles pulling away will be re-lifted by the excavator and placed on the part soiled strip to avoid loss. The inert mineral waste will be spread and levelled to the required thickness using the excavator, which will be fitted with a toothed digging bucket. The excavator will stand upon the unscarified formation at all times and operate from a 'side-on' position with the tracks of the equipment orientated parallel to the strip

A quality assurance system will operate to ensure that levels accurately marry between successive strips and that the required soil profile thickness is uniform at the outer and inner edges of each strip. Any stones exposed on the final surface greater than 75 mm in any dimension should be removed and placed on the surface of the formation to be buried in the course of soiling the next strip.

Green waste will spread green waste compost onto restored soil profiles containing loose tipped inert mineral waste as soil-forming material. This will be carried out using a conventional agricultural muck spreader (side or rear discharging) unit towed by a four-wheel drive tractor. The equipment will be fitted with wide 'high flotation' tyres, or dual wheels to minimise compaction.

The equipment will be properly calibrated to spread 300 m^3 green waste compost. This is equivalent to 30 litres per m^2 and a layer 30 mm in thickness. The green waste compost will be applied in a minimum of two separate passes at right angles to one another in order to achieve the best possible coverage. The first application will be completed over the entire soiled area before the second commences.

– **how do you plan to incorporate the waste following application?**

Green waste compost will be incorporated into the inert mineral waste using a set of heavy duty agricultural discs. Discing is considered preferable to ploughing in order achieve the intimate mix between the organic and mineral fractions necessary to promote particle aggregation and to prevent any risk of anaerobism. This can occur where compost is buried as a discrete layer or accumulates in lenses.

Green waste will be incorporated into inert mineral waste using a medium to heavy duty disc assembly towed by a four-wheel drive tractor. The equipment will be fitted with wide 'high flotation' tyres, or dual wheels to minimise compaction.

The discs will be set to a depth of 200 mm in order to distribute the green waste compost evenly within the top 200 mm of the restored soil profile. However, some gradation in the amount of compost at each increment is inevitable and considered desirable to avoid its wholesale dilution. The operation will be carried out in a minimum of two separate passes at right angles to one another in order to achieve the best possible results. The first application will be completed over the entire soiled area before the second commences.

The discing operation will assist in generating a fine tilth for the seedbed. This is considered preferable to the use of a 'power harrow' which entirely disaggregates soil particles. This promotes packing and crusting rendering the bare soil surface especially susceptible to scour and erosion until such time as a protective vegetation cover is established.

- **With liquid wastes is there any mole draining or sub-soiling planned are there land drains in the field (this is important where wastes are injected especially during or following dry weather when the ground may have fissured)?**

Not applicable. All wastes are solid.

- **Other operational details for example: is the stubble to be left to protect emerging seedlings?**

The method described in Sheet 3: 'Excavation of soil storage mounds with excavators and dump trucks' contained within MAFF guidance on 'Good Practice for Soil Handling' (MAFF 2000 will be followed in removing inert mineral wastes from storage mounds. The operation will be carried out using an excavator (18-24 tonnes) fitted with a digging bucket. The excavator may stand on the top of the mound in order to carefully prepare the inert mineral wastes for use as soil-forming material in advance of loading into dump trucks (12-25 tonnes).

A vertical face will be created on one side of the mound for this purpose and the soils 'combed off' by gently drawing up the boom from an extended position at the base of the mound upwards towards the machine using the teeth and cutting edge of the bucket to remove a thin layer of inert mineral waste that tumbles down into the bucket. The wastes will be 'turned out' and deposited at the base of the face and the action repeated as necessary until any large clods (>200 mm in any dimension) of inert mineral waste are broken up. The excavator will continue this combing process unabated in time gaps between loading dump trucks in order to ensure the inert mineral waste is loose and friable to allow its use as a soil-forming material. If, and when, wet materials are encountered (which are difficult to work) the face will be left exposed to dry and a new face developed.

1.5 COMPLIANCE WITH NVZ REQUIREMENTS

- **does the site fall within a designated NVZ?**

The site is not shown on the Lle geo-portal for Wales as being located in a Nitrate Vulnerable Zone.

- **do closed periods apply for waste type?**

The green waste compost does not have a high readily available content. Closed periods do not understood to operate for this waste type, furthermore the site is not within a NVC. Nonetheless the presumption will be to complete restoration within an area and to undertake seeding by the middle of September in any years to avoid bare soil surface being exposed over the winter months.

- **will application rates comply with crop requirement and field/whole farm limit?**

The site is not within a NVC. However, the proposed application rate of first year available nitrogen from the green waste compost is estimated to be 73 kgs. This is well below the 300 N-max limit that would apply to a grassland in an NVZ.

- **have other organic waste/manure applications been taken into account?**

Not applicable site is not within a NVC. However, the inert mineral wastes are expected to comprise ostensibly of subsoil and drift and will not have previously received organic waste and manure applications.

- **has adequate justification been included to cover NVZ requirements?**

Not applicable site is not within a NVC.

- **has information for the land owners recording requirements been provided?**

Not applicable site is not within a NVC. However, the proposals are sufficiently conservative they actually do in large meet NVC requirements.

1.6 BENEFITS AND NUTRIENTS SUPPLIED TO THE SOIL OR CROP FROM THIS APPLICATION

This is where you need to tell us what the benefits of this application will be.

You will need to provide justification based on the waste and soil analysis, the crop nutrient requirement and the nutrient status of the receiving soil. You will need to provide details of:

- **nutrients supplied by the waste (kg/Ha)**

A minimum standard for the green waste compost that will be used as an organic amendment to allow the inert mineral wastes to be used as soil-forming materials in the construction of restored soil profiles is given in Table 7. The PAS 100:2011 standard is concerned more with the feedstocks used and the processes involved in compost production rather than the properties of the compost itself. The standard presented identifies upper and lower limits for the most important parameters that affect the nutrient value of the compost and in particular dry solid and organic matter content. An analysis of a compost from an accredited local supplier is included for comparative purposes.

Table 8 confirms nutrients supplied per tonne of wet (as received) of green waste compost and provides an estimate of availability for the three years following application. Total quantities of nutrients supplied per 200 wet (as received) of green waste compost have also been calculated. It should be noted that the 'year on year' increasing availability of nitrogen is based on the expectation that mineralisation rates will improve as soil microbial activity increases.

Estimates of nutrient availability for phosphorus and potassium are based on those contained within the Agriculture & Horticulture Development Board (2017) Nutrient Management Guide (RB209). However, it should be noted that these are based largely on research conducted on manures and sewage sludge and are likely to over-estimate release from green waste composts.

- **nutrient status of the receiving soil**

A minimum standard for inert mineral wastes to be imported for use as soil-forming materials to allow restoration of infilled areas is presented in Table 5. The standard is focused on obtaining subsoil and drift material that are loamy in texture and moderately acidic in their pH to match those of the natural soils on site, which are brown earths belonging to the Radyr series. The standard is accepting of materials that contain very low concentrations of nitrogen, phosphorus and potassium. The successful use of inert mineral wastes as soil-forming materials in entirely dependent on the spreading and incorporation of green waste compost to address these limitations.

- **application rate (t/Ha)**

The application rate of inert mineral waste is 9,789 tonnes per ha. This is sufficient to construct restored soil profiles 500 mm in thickness (after settlement). Soil profiles belonging to the

Radyr series are extremely variable in depth ranging from 51 cm to 122 cm (excluding B/C horizons). The 50-cm thickness is deemed the minimum necessary to achieve an acceptable Agricultural Land Classification.

The application rate of green waste compost of 408 tonnes per hectare. This will be applied in two equal applications. The first application will be made in the course of soil profile construction immediately following the spreading of inert mineral wastes prior to the first establishing a temporary ley grass cover. The second application will be made in the course of reseeding with a permanent grass cover at the beginning of the third year of aftercare.

Soil analysis will be carried out to confirm that a second application of green waste compost is required and that the planned application rate is appropriate.

- **nutrient requirement for the proposed crop**

The proposed crop is a Festulolium Silage Ley - 2 Year Dry Land Ley with added white clover and birdsfoot trefoil. The application of green waste compost is required to establish the crop and then to maintain it. The crop is sacrificial and will be ploughed in as a green manure after 2 years. Festolium which is a cross between ryegrass and fescue species and has been chosen for use on the basis of its ability to develop comparatively deep extensive root systems. The crop will be cut annually but with arisings finely fragmented and left on the surface to decompose. White clover and birdsfoot trefoil have been chosen on the basis of their ability to fix nitrogen to augment that provided by the green waste compost and to utilise any surplus phosphate and potash.

The application rate of compost has been calculated to provide a total of 50 tonnes of organic matter in the course of the two applications.

It is estimated that each 200 tonne application of compost will provide: 73kgs 1st year available N, 348 kgs available P as P_2O_5) and 376 kgs available K as K_20. These results are based on Nutrient release estimates contained within the Agriculture & Horticulture Development Board (2017) Nutrient Management Guide (RB209). In the absence of research data for green waste composts estimates have been extrapolated from data for manures and sewage sludges.

It is estimated that the nutrient requirement of the grasses will be follows: 110kgs 1st year available N, 125 kgs available P as P_2O_5) and 260 kgs available K as K_20. The nutrient requirement for the legumes will be in addition to the above.

A great deal of uncertainty exists surrounding the availability of phosphate from green waste compost. While the availability of phosphate in manures and sewage sludge may well be 50% this figure is certainly an over estimate for availability from mature green waste compost. Research by The National Institute of Agricultural Botany (NIAB) and Rothamsted Research suggests that the first year availability of nutrients in green waste compost is 2.5% for N, 15% for P_2O_5 and 80% for K_20.

If these lower estimates are used the application of compost would provide: 37 kgs 1st year available N, 104 kgs available P as P_2O_5) and 376 kgs available K as K_20.

It would seem sensible given the uncertainty that exists to assume that nutrient availability will fall within the range of values identified above. A whole host of factors will actually govern phosphate availability and these include the maturation of the compost, the proportion of organic and inorganic phosphate, soil pH, mineralisation rates, the balance of soil aerobism and anaerobism and the activity of hydrous oxides of Fe, Al and Mn, silicate minerals and carbonate minerals.

It should be noted that phosphate available that is apparently in 'excess' of that needed to meet the nutrient requirement of any crop will not necessarily be subject to leaching. Phosphate in soils is in a constant state of flux with soluble or plant available forms of phosphate in the soil solution being re absorbed into slowly soluble and insoluble forms of phosphorus. In addition, significant quantities of phosphorus in the soil solution will be utilised by soil microorganisms in the course of the mineralisation of organic matter.

- **additional fertiliser or manure inputs will need to be recognised if the waste does not supply all the crop requirements.**

Visual assessment of herbage will be carried out to identify any nutrient deficiencies with chemical analysis of herbage used to confirm diagnosis. Soil analysis will be carried out to confirm to what extent the properties of the soil-forming materials (inert mineral wastes plus green waste compost) have achieved the standard presented in Table 9.

Where additional fertiliser is required this will be supplied using a straight inorganic fertiliser or if multiple deficiencies are identified an appropriate compound inorganic fertiliser.

1.7 POTENTIAL NEGATIVE IMPACTS TO THE SOIL OR CROP FROM THIS APPLICATION

IN THIS SECTION YOU NEED TO ADDRESS ANY POTENTIALLY NEGATIVE IMPACTS THAT MAY ARISE FROM THE APPLICATION OF THE WASTE.

- **potentially toxic elements additions to the soil may require additional justification**

A minimum standard for the green waste compost that will be used as an organic amendment to allow the inert mineral wastes to be used as soil-forming materials in the construction of restored soil profiles is given in Table 7. The PAS 100:2011 standard is concerned more with the feedstocks used and the processes involved in compost production rather than the properties of the compost itself. The standard presented identifies maximum concentrations for potentially toxic elements. An analysis of a compost from an accredited local supplier is included for comparative purposes.

Table 8 confirms the quantity of potentially toxic elements supplied per tonne of wet (as received) of green waste compost and the total additions per 200 wet (as received) tonnes of green waste compost. In the absence of guidance on permissible additions of potentially toxic elements for green waste compost those 10 year totals stipulated in The Sludge (Use in Agriculture) Regulations 1989 have been included. The additions shown are as a percentage of the maximum permitted per 200 tonne wet (as received) tonnes of green waste compost. The results indicate elevated zinc concentrations in the green waste compost and to a lesser extent of lead, copper and nickel. However, only in the case of zinc do these result in an addition which makes any significant inroad into the 10 year permitted loading. This equals 18.1% per application or 36.2% for the two applications planned. Loadings for all other potentially elements remain below 20% for the two applications planned.

It should be noted that zinc is an essential micro nutrient and important in the growth and development of higher plants. It is anticipated that the small increase in soil concentration of zinc that will arise from application of green waste compost will be beneficial.

12/30

- **site topography, slopes and other natural features that affect the operation**

Site limitations for each of the five individual disturbed areas on which wastes are to be spread are given in Table 2. This provides an assessment of the potential Agricultural Land Classification of areas following infilling, restoration and aftercare. Information on gradient, micro relief and flooding risk are presented based on the predicted final landform. Maximum gradients are expected to be less than 12% and will not present any operational difficulties. The final landform will be graded to be smooth and flowing and free from hazards.

Notwithstanding the above the disturbed area is irregular in outline and the need to reconcile restored and existing ground levels at the margins will provide a challenge. This will especially be the case in close proximity to the steeply incised valleys above watercourses where the ground has been surcharged. However, the use of tracked excavators for the spreading of inert wastes should allow the detailed feathering and trimming required to be undertaken satisfactorily.

- **any characteristics of the waste that may affect the receiving land and any mitigation to justify or reduce their effects, for example: pH, oils and fats, conductivity and salt content**

Minimum standards have been developed in the course of preparing proposals for the use of inert mineral waste and green waste compost on the site. These are intended to ensure that restored soil profiles on disturbed ground replicate those of natural soils on undisturbed ground. The stipulation that inert mineral wastes must possess a loamy texture and be slightly acidic in pH is clearly illustrative of this point. The minimum standard for green waste compost far exceeds that presented under PAS 100:2011 with the requirement that dry solid content, organic matter content and nutrient concentrations fall within prescribed limits seeking to ensure that planned nutrient additions are met, but not exceeded.

- **impact of the operations on the receiving soil for example wheel ruts, compaction, structural damage, soil erosion and run-off**

The adoption of MAFF guidance on 'Good Practice for Soil Handling' (MAFF 2000) is designed to ensure that inert mineral wastes do not suffer structural damage during the construction of soil profiles. Loose tipping is recognised as preferable in placing soils as it avoids earth moving plant, and especially dump trucks, traversing soils.

Storing inert mineral wastes to allow restoration to be carried out during the summer months is intended to ensure soils are placed in the driest possible state and are in the optimum condition to receive green waste compost.

The risk of compaction during the spreading of green waste compost will be reduced by the use of agricultural equipment fitted with wide 'high flotation' tyres and / or dual wheels.

The risk of soil erosion will be minimised by constructing all new parts of the surface water drainage system prior to placing soils and also ensuring the existing system is well maintained. Soil erosion will also be reduced by ensuring bare soil surfaces are not only seeded prior to the winter months but given sufficient time for a grass sward to develop.

Loose tipping of soils is designed to encourage the infiltration, percolation and storage of precipitation within restored soil profiles thereby reducing the volume of surface water runoff and the potential for erosion. The addition of green waste compost to inert waste will reduce the soils propensity to crust which promotes surface water runoff.

Loss of green waste compost in surface water runoff will be prevented by combining the spreading and incorporation of green waste compost into a single operation

- **odour and noise control**

The inert mineral waste is essentially odour free as are mature composts.

The disturbed areas are located centrally within the Garth Isaf Farm and someway distant (>500 m) from the village of Efail Isaf.

The risk of noise nuisance will be minimised by maintain equipment in good working order and ensuring that silencers are fitted.

- **any other potential negative impacts from the operation, for example: traffic management, anti-vandalism measures.**

The stockpiling of inert mineral wastes and green waste in advance of the restoration of each area will avoid large peaks in traffic movement. Ryan Jones Group own and operate their own plant and so no increase in plant movements to and from the site before and after each phase of the restoration will occur.

1.8 SENSITIVE HUMAN AND ENVIRONMENTAL RECEPTORS

Sensitive human receptor

- **dwellings**

The nearest dwelling, aside from Garth Farm itself, is 500 m to the west of those areas which will receive wastes, excepting two small outliers (Areas 3 and 4) which will be subject to improvement. The potential for dwellings to be impacted given that the dominant wind direction is west to east is minimal. It is unlikely residents will notice any increase in activity on the site while restoration works are underway.

- **business premises**

The nearest business, aside from Garth Farm itself, is at least 500 m to the west of those areas which will receive wastes.

- **footpaths**

The nearest public right of way is Footpath 66 which is to the north of the working area. It is 100 m at its closest point to areas to receive waste and screened by mature trees. The risk of users being impacted is slight.

- **amenity areas**

There are no amenity areas within Garth Isaf farm which is private land.

- **boreholes, wells springs or private water supplies.**

No record of boreholes, wells springs or private water supplies have been found. The risk to potable water supplies in any event is very small given only solid wastes are to be spread and the nutrient content is low.

Sensitive environmental receptors

- **surface water, groundwater source protection zones**

A number of watercourses run in steeply incised valleys alongside areas on which wastes are to be spread. However, the areas which are to receive wastes are generally substantially elevated and plateaued. Green waste compost will not be spread within 10 m of any watercourse.

The site is not within a ground water source protection zone as far as can be ascertained.

- **habitats, designated areas**

The site is not within 800 m of a site of Special Site Interest, National Nature Reserve or Local Nature Reserve.

- **hedge lines and ditches.**

The site contains a number of mature hedgerows but ecological survey has confirmed that these do not support populations of dormice, reptiles or amphibians.

The ditches on the site are man-made and subject to regular cleaning. There ecological valley is low. Most are dry during the summer months when wastes will be spread.

1.9 PRACTICES TO REDUCE THE IMPACTS OF THE OPERATION ON IDENTIFIED SENSITIVE RECEPTORS

Measures to be taken to reduce the impact of the operation on the receptors identified

The areas identified for waste spreading are located with an operating inert waste tip and aggregate recycling facility. The site employs a wide range of environmental controls to minimise impact on environmental receptors and avoid nuisance to neighbours. These provisions govern for example working hours, dust suppression and noise and will extend to cover the use of inert mineral waste and green waste compost as soil-forming materials in the construction of restored soil profiles.

The need to reduce environmental impacts have been considered in every aspect of designing the works from the selection of wastes types, the development of minimum standards for the wastes to be used, application rates and the method and equipment to be employed in spreading and incorporating the wastes.

The principal risks are considered to be odour and noise but even these risks will be slight given that Efail Isaf is 500 m to the west of the site and the prevailing wind direction is west to east. This will result in any odour or nuisance being blown away from, rather than to the settlement.

The spreading of inert mineral waste will not give rise to dust but the cultivations involved in incorporating and compost and preparing a seedbed could. In the event dust is produced and wind is blowing particulates towards properties the operation would be suspended.

Checks will be made at the point of delivery to ensure all green waste compost is stable and mature and incapable of generating significant odour.

Protection of natural undisturbed soils on natural ground will be achieved by the following:

1. Avoiding traversing over natural soils and where this is otherwise impossible to gain access by the shortest practical route, removing soils from any roadways to allow there re use in the course of reinstatement.
2. Ensuring that buffering strips to receptors are properly demarcated.
3. Prohibiting equipment from turning on undisturbed area and being used as headlands,

Tool box talks will be carried out to explain the working methods and importance of the protection measures (1-3).

1.9. PRACTICES TO REDUCE THE IMPACTS ON SENSITIVE RECEPTORS

Bunds will be installed alongside the steeply incised valleys alongside watercourses as a physical barrier to prevent stones, boulders and large soil clods from tumbling into them whilst being placed and spread.

2.0. CONTINGENCY PLANNING

Garth Isaf Farm is owned by the Ryan Jones Group. The company own and operate an extensive array or modern earthmoving and agricultural equipment most of which is maintained by their own fitters. Staff are direct employees of the company. The identification, selection, importation, spreading and incorporation of wastes will be carried out 'in house'. This is intended to ensure effective control can be maintained on all aspects of the 'day to day' operation and that accurate records can be maintained.

Directors of the Ryan Jones Group have a personal interest, as the owners and occupiers of Garth Isaf Farm, in overseeing the return of disturbed ground to agricultural use and the attainment of Agricultural Land Classification's for areas restored to grades commensurate with those of the surrounding undisturbed ground.

In circumstances where poor weather, staff shortage, unavailability of green waste compost or equipment breakdown prevent work being carried out to a satisfactory standard operations will be suspended.

BIBLIOGRAPHY

Agriculture & Horticulture Development Board (2017) Nutrient Management Guide (RB209). Electronic publication via an App.

Bending, N.A.D., McRae, S.G. and Moffat, A.J. (1999). The use of soil-forming materials in land reclamation. Department of the Environment, Transport and the Regions, Stationery Office, London. 237pp.

British Standards Institute. (2007). Specification for topsoil and requirements for use. BS 3882:2007. British Standards Institution, London. 21pp.

British Standards Institution. 2013. British Standard 8601:2013. Specification for subsoil and requirements for use. British Standards Institution, London. 21pp.

British Standards Institute. (2011). Specification for composted materials. PAS 100:2011. British Standards Institution, London. 57pp.

Crampton, C.B. (1972) Soils of the Vale of Glamorgan (Sheets 262 and 263) Memoirs of the Soil Survey of Great Britain. Soil Survey of England and Wales, Harpenden, 87pp.

Department of the Environment (1989) The sludge (use in agriculture) regulations 1994. Statutory Instrument 1263. HMSO, London.

Ministry of Agriculture, Fisheries and Food (MAFF) (2000). Good practice guide for soil handling. Forest and Rural Conservation Agency, Cambridge. 200pp.

Moffat, A.J. and Bending, N.A.D. (2000) Replacement of soil and soil-forming materials by loose tipping in reclamation to woodland. Soil Use and Management, 16, pp. 75-81

Prasad, M., Lee, A. and Gaffney, M.T. (2012). A detailed chemical and nutrient characterisation of compost and digestate fibre including a comparative release of nitrogen and phosphorus. Research report MDR0598 Prp0021. Rethink, Recycle, Remake. Dun Laoghaire, County Dublin. 37pp

Waste and Resources Action Programme (WRAP) and the Environment Agency (2009). Uncontaminated topsoil. A technical report on the use of both naturally occurring and manufactured uncontaminated topsoil. Waste Protocols Project. WRAP, Banbury. 32pp.

Waste and Resources Action Programme (WRAP) and the Environment Agency (2011). Guidelines for the specification of quality compost for use in growing media WRAP, Banbury. 13pp.

LIST OF TABLES

Table 1. Determination of Agricultural Land Classification for undisturbed ground with natural soil cover (Actual)

		Garth Isaf Farm (Field)								Total
TEMPORARY FIELD REFERENCE (see Drawing number GIF-AGCL-Proposed 01 Rev3 'Field management proposed improvements')		*Front upper field*		*Front middle field*		*Front lower field*		*Farm field*		
	2015 FIELD REFERENCE	ST0984 1443		ST0984 1443		ST0984 0932		ST0984 7316 & ST0984 7203		
	LOCATION	North of gallop		Central area enclosed by gallop		South of gallop		Behind farmhouse		
	AREA (ha)	4.785		6.287		2.466		2.05		15.588
	ALTITUDE (m)	150		150		150		150		
	GROUND STATUS	Undisturbed		Undisturbed		Undisturbed		Undisturbed		
	SOIL TYPE	Acid brown earth		Acid brown earth		Acid brown earth		Acid brown earth		
	SOIL SERIES	Radyr Series		Radyr Series		Radyr Series		Radyr Series		
	CROP TYPE	Grassland (silage)		Grassland (silage)		Grassland (silage)		Grassland (permanent pasture)		
	SOIL SAMPLE	GF TP1 TS1		GF TP2 TS1		-		GF TP3 TS1		
A.	**CLIMATIC LIMITATIONS:**									
1	Annual Average rainfall	1,400 mm	3a	1,400 mm	3a	1,400 mm	3a	1,450 mm	3b	
2	Median Accumulated Temperature above 0 deg C	1,450 (Day °C)	3a	1,450 (Day °C)	3a	1,450 (Day °C)	3a	1,400 (Day °C)	3b	
3	Local climatic factors									
	Aspect	Moderately good - predominantly west facing	plus	Moderately good - predominantly west facing	plus	Moderately good - predominantly west facing	plus	Moderately good - predominantly west facing	plus	
	Topography (frost hollow)	Moderate risk - surrounded by higher ground to south and east	minus	Moderate risk - surrounded by higher ground to south and east	minus	Moderate risk - surrounded by higher ground to south and east	minus	Moderate risk - surrounded by higher ground to south and east	minus	
B.	**SITE LIMITATIONS:**									
1	Gradient	12%	3a	8%	1	10%	1	20%	4	
2	Microrelief	No rocks outcrops, sink hollows or frequent changes of slope angle and direction	plus	No rocks outcrops, sink hollows or frequent changes of slope angle and direction	plus	No rocks outcrops, sink hollows or frequent changes of slope angle and direction	plus	No rocks outcrops, sink hollows or frequent changes of slope angle and direction	plus	
3	Flooding risk									
	Summer	Rare / short	1	Rare / short	1	Rare / short	2	Rare / short	1	
	Winter	Rare / short	1	Rare / short	1	Occasional / short	2	Rare / short	1	
C.	**SOIL LIMITATIONS:**									
1	Soil texture and structure	Loamy or Coarse loamy - crumb structure (Ap) / Sub angular blocky	2	Loamy or Coarse loamy - crumb structure (Ap) / Sub angular blocky	2	Loamy or Coarse loamy - crumb structure (Ap) / Sub angular blocky	2	Loamy or Coarse loamy - crumb structure (Ap) / Sub angular blocky	2	
2	Soil depth	30 cm	3a	30 cm	3a	30 cm	3a	30 cm	3a	
3	Stoniness	Common stones (6-15%) larger than 2 cm within 25 cm soil surface	3a	Common stones (6-15%) larger than 2 cm within 25 cm soil surface	3a	Common stones (6-15%) larger than 2 cm within 25 cm soil surface	3a	Common stones (6-15%) larger than 2 cm within 25 cm soil surface	3a	
4	Chemical limitations	Slightly acidic and low in phosphate	3a	Slightly acidic and low in phosphate	3a	Slightly acidic and low in phosphate	3a	Slightly acidic and low in phosphate	3a	
D.	**INTERACTIVE LIMITATIONS:**									
1	Soil wetness: Wetness Class	FCD 250 - 300 days / Slowly permeable layer @300 mm / Loam - Wetness	3b	FCD 250 - 300 days / Slowly permeable layer @300 mm / Loam - Wetness	3b	FCD 250 - 300 days / Slowly permeable layer @300 mm / Loam - Wetness	3b	FCD 250 - 300 days / Slowly permeable layer @300 mm / Loam - Wetness	3b	
2	Droughtiness: Potential Soil Moisture Deficit (PSMD) mm	PSMD 100 - 75 mm	1	PSMD 100 - 75 mm	1	PSMD 100 - 75 mm	1	PSMD 100 - 75 mm	1	
3	Soil erosion risk	Low / moderate risk	2	Low / moderate risk	2	Low / moderate risk	2	Low / moderate risk	2	
E.	**OTHER:**									
1	Status	Natural soil profile	1	Natural soil profile	1	Natural soil profile	1	Natural soil profile	1	
SUMMARY			3b		3b		3b		4	

18/4/20

Table 2. Determination of Agricultural Land Classification for disturbed ground with man-made soil cover (Projected)

	Garth Isaf Farm (Field)												Total
TEMPORARY FIELD REFERENCE (see Drawing number GIF-AGCL-Proposed 01 Rev3 'Field management proposed improvements')	1		2		3		4		5		A		
2015 FIELD REFERENCE	ST0984 4832, ST0984 5713, ST0984 4824, ST0984 2716, ST0984 3727		ST0984 8413		ST0984 3736, ST0984 4832, ST0984 3727		ST0984 1879		ST0984 705		ST0984 6232		
LOCATION	Central aggregate processing area		Infilled area in eastern corner		Disturbed inlier within central area enclosed by gallop		Disturbed inlier within field to south of gallop		Plant yard to the south of farmhouse		Infilled area to the north of farmhouse		
AREA (ha)	4.736		1.541		0.699		0.58		0.332		2.133		10.021
ALTITUDE (m)	150		180		150		135		160		175		
GROUND STATUS	Disturbed		Disturbed		Disturbed		Disturbed		Disturbed		Disturbed		
SOIL TYPE	Imported mixed		Imported mixed		Imported mixed		Imported mixed		Imported mixed		Imported mixed		
SOIL SERIES	Man-made		Man-made		Man-made		Man-made		Man-made		Man-made		
CROP TYPE	Grass reseed		Grass reseed		Grass reseed		Grass reseed		Grass reseed		Grass reseed		
SOIL STANDARD	see Table 4 'Minimum standard for imported mixed soils for use in the restoration of filled areas'		see Table 4 'Minimum standard for imported mixed soils for use in the restoration of filled areas'		see Table 4 'Minimum standard for imported mixed soils for use in the restoration of filled areas'		see Table 4 'Minimum standard for imported mixed soils for use in the restoration of filled areas'		see Table 4 'Minimum standard for imported mixed soils for use in the restoration of filled areas'		see Table 4 'Minimum standard for imported mixed soils for use in the restoration of filled areas'		
A. **CLIMATIC LIMITATIONS:**													
1 Annual Average rainfall	1,400 mm	3a	1,450 mm	3b	1,400 mm	3a	1,450 mm	3b	1,450 mm	3b	1,450 mm	3b	
2 Median Accumulated Temperature above 0 deg C	1,450 (Day ^{0}C)	3a	1,400 (Day ^{0}C)	3b	1,450 (Day ^{0}C)	3a	1,400 (Day ^{0}C)	3b	1,400 (Day ^{0}C)	3b	1,400 (Day ^{0}C)	3b	
3 Local climatic factors													
Aspect	Very good - predominantly south-west facing	plus	Moderately good - predominantly west facing	plus	Moderately good - predominantly west facing	plus	Moderately good - predominantly west facing	plus	Moderately good - predominantly west facing	plus	Moderately good - predominantly west facing	plus	
Topography (frost hollow)	Moderate risk - surrounded by higher ground to south and east	minus	Moderate risk - surrounded by higher ground to south and east	minus	Moderate risk - surrounded by higher ground to south and east	minus	Moderate risk - surrounded by higher ground to south and east	minus	Moderate risk - surrounded by higher ground to south and east	minus	Moderate risk - surrounded by higher ground to south and east	minus	
B. **SITE LIMITATIONS:**													
1 Gradient	12%	1	12%	3a	8%	1	10%	1	5%	1	12%	3a	
2 Microrelief	No gas vents, well heads or obstructions. Minor risk only of differential settlement. No frequent changes of slope and direction	plus	No gas vents, well heads or obstructions. Minor risk only of differential settlement. No frequent changes of slope and direction	plus	No gas vents, well heads or obstructions. Minor risk only of differential settlement. No frequent changes of slope and direction	plus	No gas vents, well heads or obstructions. Minor risk only of differential settlement. No frequent changes of slope and direction	plus	No gas vents, well heads or obstructions. Minor risk only of differential settlement. No frequent changes of slope and direction	plus	No gas vents, well heads or obstructions. Minor risk only of differential settlement. No frequent changes of slope and direction	plus	
3 Flooding risk													
Summer	Rare / short	1	Rare / short	1	Rare / short	1	Rare / short	2	Rare / short	1	Rare / short	1	
Winter	Rare / short	1	Rare / short	1	Rare / short	1	Occasional / short	2	Rare / short	1	Rare / short	1	
C. **SOIL LIMITATIONS:**													
1 Soil texture and structure	Silty, Loamy or Coarse loamy - weak to moderately developed coarse prismatic, coarse angular blocky or coarse sub angular blocky structure with added compost (A) .	2	Silty, Loamy or Coarse loamy - weak to moderately developed coarse prismatic, coarse angular blocky or coarse sub angular blocky structure with added compost (A) .	2	Silty, Loamy or Coarse loamy - weak to moderately developed coarse prismatic, coarse angular blocky or coarse sub angular blocky structure with added compost (A) .	2	Silty, Loamy or Coarse loamy - weak to moderately developed coarse prismatic, coarse angular blocky or coarse sub angular blocky structure with added compost (A) .	2	Silty, Loamy or Coarse loamy - weak to moderately developed coarse prismatic, coarse angular blocky or coarse sub angular blocky structure with added compost (A) .	2	Silty, Loamy or Coarse loamy - weak to moderately developed coarse prismatic, coarse angular blocky or coarse sub angular blocky structure with added compost (A) .	2	
2 Soil depth	50 cm	2	50 cm	2	50 cm	2	50 cm	2	50 cm	2	50 cm	2	
3 Stoniness	Many stones (16-35%) larger than 2 cm within 25 cm soil surface, no stones greater than 7.5 cm	3b	Many stones (16-35%) larger than 2 cm within 25 cm soil surface, no stones greater than 7.5 cm	3b	Many stones (16-35%) larger than 2 cm within 25 cm soil surface, no stones greater than 7.5 cm	3b	Many stones (16-35%) larger than 2 cm within 25 cm soil surface, no stones greater than 7.5 cm	3b	Many stones (16-35%) larger than 2 cm within 25 cm soil surface, no stones greater than 7.5 cm	3b	Many stones (16-35%) larger than 2 cm within 25 cm soil surface, no stones greater than 7.5 cm	3b	
4 Chemical limitations	Neutral to slightly acidic; chemical contaminants below	3a	Neutral to slightly acidic; chemical contaminants below	3a	Neutral to slightly acidic; chemical contaminants below	3a	Neutral to slightly acidic; chemical contaminants below	3a	Neutral to slightly acidic; chemical contaminants below	3a	Neutral to slightly acidic; chemical contaminants below	3a	
D. **INTERACTIVE LIMITATIONS:**													
1 Soil wetness: Wetness Class	FCD 250 - 300 days / Slowly permeable layer @300 mm / Loam - Wetness	3b	FCD 250 - 300 days / Slowly permeable layer @300 mm / Loam - Wetness	3b	FCD 250 - 300 days / Slowly permeable layer @300 mm / Loam - Wetness	3b	FCD 250 - 300 days / Slowly permeable layer @300 mm / Loam - Wetness	3b	FCD 250 - 300 days / Slowly permeable layer @300 mm / Loam - Wetness	3b	FCD 250 - 300 days / Slowly permeable layer @300 mm / Loam - Wetness	3b	
2 Droughtiness: Potential Soil Moisture Deficit (PSMD) mm	PSMD 100 - 75 mm	1	PSMD 100 - 75 mm	1	PSMD 100 - 75 mm	1	PSMD 100 - 75 mm	1	PSMD 100 - 75 mm	1	PSMD 100 - 75 mm	1	
3 Soil erosion risk	Moderate risk	3a	Moderate risk	3a	Moderate risk	3a	Moderate risk	3a	Moderate risk	3a	Moderate risk	3a	
E. **OTHER:**													
1 Status	Man made soil profile	4	Man made soil profile	4	Man made soil profile	4	Man made soil profile	4	Man made soil profile	4	Man made soil profile	4	
SUMMARY Achieved on completion of restoration		4		4		4		4		4		4	
Potential on completion of 5 year aftercare		3b		3b		3b		3b		3b		3b	

Table 3. Results of laboratory analysis for natural topsoil samples (0-150 mm) taken from undisturbed ground (grassland)

Parameter	Garth Isaf Farm - natural topsoil (sampled 11/12/18)	Garth Isaf Farm - natural topsoil (sampled 11/12/18)	Garth Isaf Farm - natural topsoil (sampled 11/12/18)	British Standard
	NRM Laboratories Report number ENV 48903	NRM Laboratories Report number ENV 48903	NRM Laboratories Report number ENV 48903	Topsoil BS3882-2007 (Multipurpose)
	Sample reference GF TP1 TS1	Sample reference GF TP2 TS1	Sample reference GF TP3 TS1	
Texture:				
sand (2.0-0.06 mm) (% m/m)	48	47	45	85% m/m max. / 30% m/m min.
silt (0.06-0.002 mm) (% m/m)	32	32	34	65% m/m max. / 0% m/m
clay (<0.002 mm) (% m/m)	20	21	21	35% m/m max / 5% m/m min.
Textural class (Soil Survey of England and Wales)	Loam	Loam	Loam	-
Stoniness (by mass):				
Less than 2 mm (% mm)	93.4	94.4	87.1	70% m/m min.
2-20 mm (% m/m)	2.3	1.2	3.1	30% m/m max.
20-50 mm (% m/m)	4.3	4.4	9.8	10% m/m max.
Greater than 50 mm (% m/m)	0	0	0	0% m/m max.
pH (1:2.5 soil/water):	6.6	6.3	6.2	3.5 min. / 9.0 max.
Electrical conductivity (1:2.5 soil/water) (uS/cm)	84	50	68	Below 1,000 uS/cm
Organic carbon (DUMAS) (% m/m):	3.9	3.4	3.4	-
Soil organic matter content (% m/m):	6.7	5.8	5.9	5-20% m/m
Total nitrogen (% w/w):	0.31	0.28	0.29	Above 0.15% m/m
Available phosphorus (mg/l):	13 (1)	5 (0)	3 (0)	16-100 mg/l (ADAS index 2-5)
Available potassium (mg/l):	38 (0)	42 (0)	56 (0)	121-900 mg/l (ADAS index 2-5)
Available magnesium (mg/l):	105 (3)	107 (3)	127 (3)	51-600 mg/l (ADAS index 2-6)
Carbon:Nitrogen ratio:	13:1	12:1	12:1	<20:1
Sulphate content (mg/kg):	433	603	328	-

Table 4. Results of laboratory analysis for natural subsoil samples (300-450 mm) taken from undisturbed ground (grassland)

Parameter	Garth Isaf Farm - natural topsoil (sampled 11/12/18)	Garth Isaf Farm - natural topsoil (sampled 11/12/18)	Garth Isaf Farm - natural topsoil (sampled 11/12/18)	British Standard
	NRM Laboratories Report number ENV 48904	NRM Laboratories Report number ENV 48906	NRM Laboratories Report number ENV 48908	Subsoil BS8601-2013
	Sample reference GF TP1 SS1	Sample reference GF TP2 SS1	Sample reference GF TP3 SS1	
Texture:				
sand (2.0-0.06 mm) (% m/m)	49	53	49	85% m/m max. / 30% m/m min.
silt (0.06-0.002 mm) (% m/m)	32	29	32	65% m/m max. / 0% m/m
clay (<0.002 mm) (% m/m)	19	18	19	35% m/m max / 5% m/m min.
Textural class (Soil Survey of England and Wales)	Loam	Loam	Loam	-
Stoniness (by mass):				
Less than 2 mm (% mm)	79.2	90.9	84.8	50% m/m min.
2-20 mm (% m/m)	3.3	2.3	4.8	50% m/m max.
20-50 mm (% m/m)	17.5	6.8	10.4	
50-75 mm (% m/m)	0	0	0	
Greater than 75 mm (% m/m)	0	0	0	0% m/m max.
pH (1:2.5 soil/water):	6.1	5.9	6.3	5.0 min. / 8.2 max.
Electrical conductivity (CaSO4 extract) (uS/cm)	50	50	53	-
Organic carbon (DUMAS) (% m/m):	1.5	1.6	1.7	-
Soil organic matter content (% m/m):	2.6	2.7	2.8	-
Total nitrogen (% w/w):	0.14	0.16	0.15	-
Available phosphorus (mg/l):	4 (0)	4 (0)	3 (0)	-
Available potassium (mg/l):	23 (0)	30 (0)	59 (0)	-
Available magnesium (mg/l):	117 (3)	91 (2)	114 (3)	-
Carbon:Nitrogen ratio:	11:1	10:1	11:1	-
Sulphate content (mg/kg):	261	330	593	Below 1,200 mg/kg

Table 5. Minimum standard for imported inert mineral waste for use as soil-forming material in restoration

Parameter	Inert mineral waste	British Standard (for comparative purpose only)	
		Topsoil BS3882-2007 (Specific purpose - low fertility)	Subsoil BS8601-2013
Texture:			
sand (2.0-0.06 mm)	70% m/m max. / 30% m/m min.	85% m/m max. / 30% m/m min.	85% m/m max. / 40% m/m min.
silt (0.06-0.002 mm)	50% m/m max. / 20% m/m min.	65% m/m max. / 0% m/m min.	50% m/m max. / 5% m/m min.
clay (<0.002 mm)	30% m/m max / 10% m/m min.	35% m/m max / 5% m/m min.	27% m/m max / 5% m/m min.
Stoniness (by mass):			
Less than 2 mm	65% m/m min	70% m/m min.	50% m/m min.
greater than 2 mm	35% m/m max	30% m/m max.	50% m/m max.
greater than 20 mm		10% m/m max.	
greater than 50 mm	20 m/m max	0% m/m max.	
greater than 100 mm	0 m/m	0% m/m max.	0% m/m max.
Maximum stone size	200 mm in any dimension	50 mm in any dimension	75 mm in any dimension
pH (1:2.5 soil/water):	6.0 min. / 7.0 max.	3.5 min. / 9.0 max.	5.0 min. / 8.2 max.
Electrical conductivity (1:2.5 soil/water)	1,000 uS/cm max	-	-
Soil organic matter content (% m/m):	>0.1 % m/m		
Total nitrogen (% w/w):	>0.01 % m/m		
Available phosphorus	>1 mg/l (0)	<15 (ADAS index 0-1)	-
Available potassium:	>1 mg/l (0)	<120 (ADAS index 0-1)	-
Available magnesium:	>51 mg/l (2) / >600 mg/l (6)	<600 (ADAS index 0-6)	-
Sulphate content:	1,200 mg/kg max.	-	1,200 mg/kg max.
Sulphur:	500 mg/kg max.	-	500 mg/kg max.
Inorganic contaminants:			
Total Arsenic	20 mg/kg max.	-	20 mg/kg max.
Water soluble Boron	3.0mg/kg max.	-	3.0mg/kg max.
Total Cadmium	1.0 mg/kg max.	-	1.0 mg/kg max.
Total Chromium	130 mg/kg max.	-	130 mg/kg max.
Total Copper	100 mg/kg max.	100-200 mg/kg max (depending on soil pH)	190 mg/kg max.
Total Mercury	8 mg/kg max.	-	8 mg/kg max.
Total Nickel	60 mg/kg max.	60-110 mg/kg max (depending on soil pH)	50 mg/kg max.
Total Lead	450 mg/kg max.	-	450 mg/kg max.
Total Zinc	200mg/kg max.	200-300 mg/kg max (depending on soil pH)	300 mg/kg max.
Organic contaminants:			
Total Thiocyanate	20 mg/kg max.	-	-
Total Cyanide	20 mg/kg max.	-	20 mg/kg max.
Free Cyanide	20 mg/kg max.	-	-
Total of 16 Polyaromatic hydrocarbons (EPA16)	40 mg/kg max.	-	-
Extractable Petroleum Hydrocarbons (C10-C40)	100 mg/kg max. (sum C6-C40)	-	100 mg/kg max. (sum C6-C40)
Total Phenols	3 mg/kg max. (mono)	-	3 mg/kg max. (mono)
Total Toluene	15 mg/kg max.	-	-
Total Benzo[a]pyrene	2 mg/kg max.	-	-
Behavioral properties:			
Consistence	Granular (friable)	-	-
Liquid limit (LL)	50 max.	-	-
Plastic index (PI)	35 max.	-	-
Other:			
Asbestos:	absent	-	-
Litter:	Must not contain refuse and rubbish, including glass, paper, textiles, rubber, metal and plastic		
Addition of amendments:	No soil amendments (e.g. anaerobic digestate, green waste compost, paper mill sludge, dredgings etc.) to have been applied within previous 2 years		
General obstructions:	Must not contain demolition waste and fly tipped wastes		
Weed content:	Must not contain invasive and injurious weed seed, viable shoot fragments or root suckers, including most notably of the following species: Himalayan balsam, Giant hogweed and Japanese knotweed and Ragwort		

Note:

Limits for inorganic and organic contaminants are strictly provisional and require separate discussion between NRW and Ryan Jones Group.

Table 6. Soil series and geological materials from which inert mineral wastes may derive and waste codes

Table 6a. Soil series and geological materials from which inert mineral wastes may be derived

Main heading	Soil Group	Description	Waste Code	Frequency
Natural soils (topsoil & subsoil) and soil parent material (drift)	Acid brown earth	Coarse loamy, locally gravelly; brownish fluvioglacial drift mainly from Carboniferous rocks	RADYR	Abundant
		Loamy, locally gravelly; reddish fluvioglacial drift mainly from Devonian rocks	CASTLETON	Rare
		Loamy; over Carboniferous sandstones and shales	NEATH	Rare
		Coarse loamy, over Devonian fine-grained sandstones	EARDISTON	Occasional
	Gleyed brown earths	Loamy: brownish drift mainly from Carboniferous rocks	MISKIN	Common
		Loamy; reddish drift mainly from Devonian rocks	MARSHFIELD	Rare
	Non calcareous gley soils	Loamy, drift mainly from Carboniferous rocks	PENDOYLAN	Occasional
		Loamy, drift mainly from Devonian rocks	FROG MOOR	Occasional

Table 6b Waste codes for restoration materials

Main heading	Sub heading	Description	Waste Code	Frequency
Wastes resulting from exploration, mining, quarrying, and physical and chemical treatment of minerals	Wastes from mineral non-metalliferous excavation	Waste overburden	01 01 02	Occasional
	Wastes from physical and chemical processing of non-metalliferous minerals	Waste gravel and crushed rocks other than those containing hazardous substances	01 04 08	Rare
Construction and demolition wastes (including excavated soil from contaminated sites)	Soil (including excavated soil from contaminated sites), stone and dredging spoil)	Soil and stones not containing hazardous substances	17 05 04	Abundant
Wastes from waste management facilities, off site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use	Wastes from the mechanical treatment of waste (for example sorting, crushing, compacting and pelletising) not otherwise specified	Soil substitutes other than that containing dangerous substances only	19 12 12	Common
Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions	Garden and park wastes (including cemetery waste)	Soil and stones	20 02 02	Occasional
Off specification compost	Green waste compost	Compost derived from input types allowed by the Quality Protocol under PAS100:2011	19 05 03	Common

Source:

Waste Classification: Guidance on the classification and assessment of waste (1st Edition 2015). Technical Guidance WM3 (Environment Agency,

Table 7. Minimum standard for green waste compost for use as an organic amendment to inert mineral wastes

Parameter	Green waste compost		Garth Farm - green waste compost (0-30 mm) (sampled 26/2/18)
	Target	PAS 100:2011	D&F Associates Certificate number CCL-PE-0030
General properties:			
pH	within range 6.0-8.0	-	7.6
Conductivity (1:5 soil/water solution)	less than 1,500 uS/cm	-	112 uS/cm
Dry solids	70% w/w fresh weight max. / 40% w/w fresh weight min	-	48% w/w
Moisture content	60% w/w fresh weight max. / 30% w/w fresh weight min	-	52% w/w
Organic matter (Loss on ignition)	40% w/w dry weight min. / 70% w/w dry weight max.	-	27% w/w
Carbon/nitrogen ratio	18:1 max / 12:1 min.	-	10.5:1
Bulk density (fresh product)	0.40 g cm^3 min / 0.70 g cm^3 min	-	0.68g cm^3
Plant nutrients:			
Total nitrogen (Dumas)	2.0 % w/w ds max / 1.0 % w/w ds min	-	1.5% m/m
Ammonium nitrogen (fresh product - water extractable)	25 mg/l max	-	2.0 mg/l
Nitrate nitrogen (fresh product - water extractable)	100 mg/l max.	-	<1.0 mg/l
Total phosphorus	0.30% w/w ds max / 0.15% w/w ds min	-	0.31% m/m
Total phosphorus (as P_2O_5)	0.70 % w/w ds max / 0.35 % w/w ds min	-	0.71% m/m
Total potassium	1.5 % w/w ds max / 0.75 % w/w ds min	-	0.40% m/m
Total potassium (as K_2O)	1.8 % w/w ds max / 0.9 % w/w ds min	-	0.48% m/m
Potentially Toxic elements (Total):			
Zinc	400 mg/kg max.	-	278 mg/kg
Copper	200 mg/kg max.	-	60 mg/kg
Lead	200 mg kg max.	-	124 mg/kg
Nickel	50 mg kg max.	-	21 mg/kg
Chromium	100 mg kg max.	-	24 mg/kg
Cadmium	1.5 mg kg max.	-	1.3 mg/kg
Mercury	1 mg kg max.	-	<1.0 mg/kg
Arsenic	10 mg kg max.	-	Not determined
Selenium	6 mg /kg max	An analysis of	Not determined
Pathogenic micro-organisms:			
Escherichia coli (E coli or enterococci) per gram sample (dry weight)	less than 1,000 CFU g	less than 1,000 CFU g	65 CFU g
Salmonella spp (MPN in 25g sample dry weight)	Absent	Absent	Absent
Viable seed:			
Weed seeds (viable seeds per litre wet product)	0 no. max	0 no. max	0 no. max
Root fragments / suckers	none	-	-
Green vegetation matter	none	-	-
Bioassay:			
Tomato plant germination tests	80% min	80% min	97%
Tomato plant growth	80% min	80% min	144%
Tomato plant abnormalities	Absent	Absent	Absent
Physical properties:			
Process	will have undergone thermophillic decomposition (>50 degrees centigrade) by means of composting for a minimum period of 4 weeks by either an open air static pile or forced air ventilation system followed by a minimum of 6 weeks maturation	-	To be advised
Consistency	well humified, friable, homogenous, free from wet congealed masses / hard 'balls' of compost and non heating	-	To be advised
Odour	faint odour below that which would cause nuisance or create unpleasant working conditions	-	To be advised
Dust	none	-	To be advised
Glass, metal, plastic combined (% air dried sample > 2.0 mm)	0.25 % w/w max.	0.25 % w/w max.	0.14 % w/w
Plastic only (% air dried sample > 2.0 mm)	0.12 % w/w max.	0.12 % w/w max.	0.14 % w/w
Stones (% air dried sample > 4.0 mm)	8.0 % w/w max with no stones greater than 10 mm	8.0 % w/w max with no stones greater than 10 mm	6.1 % w/w
Carbon dioxide evolution rate	16.0 mg CO2 per g OM/day max.	16.0 mg CO2 per g OM/day max.	1.8 mg CO2 per g OM/day max.
Volatile fatty acids	-	-	-
Residual Biogas potential	-	-	-
Litter	cardboard fragments not readily identifiable	-	To be advised
Grading	100% to pass through relevant screen size for product concerned. Grading to follow normal distribution with all individual fractions represented	-	0-30 mm
Storage:			
Ingress of rainwater	opportunity for storage in doors or for sheeting of batches to ensure moisture content is maintained within set limits	-	To be advised
Separation of batches	physical separation of compost batches to prevent cross contamination and possible re infection of mature compost by pathogenic micro-organisms	-	To be advised
Vegetation growth	control of vegetation growth on mature stored compost by physical stripping of surface layer prior to plants self setting to prevent re introduction of viable weed seed	-	To be advised
Storage period	6 months maximum	-	To be advised
Facilities management:			
Weed control	evidence of effective management of vegetation growth, especially invasive and injurious weeds, within non operational areas of facilities to minimise the opportunity for the mechanical transfer of vegetative matter and / or windblown seed onto stored mature compost	-	To be advised
Added value:			
Screening	availability of equipment on site to rescreen stored compost prior to dispatch to meet / surpass the physical consistency requirements set	-	To be advised

Note:
Details of soil analysis are given in Appendix G, Table 2.

Table 8. Calibration of green waste compost application to inert mineral wastes

Variable	Values	Unit	Per tonne wet product		Total quantities applied	Unit
Application rate					300	m^3 ha
					0.68	g /cm
					204	t ha
pH min. (recipient soil)	6					
Dry solids content	48	%	0.48	dry tonnes	98	dry tonnes
Organic matter content	27	%	0.13	dry tonnes	26	dry tonnes
Total nitrogen	1.5	%	7.2	kilograms	1,469	kgs
1st year available (estimated)	*5.0*	*% total*	0.4	kilograms	*73*	kgs
2nd year available (estimated)	*6.0*	*% total*	0.4	kilograms	*88*	kgs
3rd year available (estimated)	*7.5*	*% total*	0.5	kilograms	*110*	kgs
Total phosphorus (as P_2O_5)	0.7	%	3.4	kilograms	695	kgs
1st year available (estimated)	*50.0*	*% total*	1.7	kilograms	*348*	kgs
2nd year available (estimated)	*25.0*	*% total*	0.9	kilograms	*174*	kgs
3rd year available (estimated)	*12.5*	*% total*	0.4	kilograms	*87*	kgs
Total potassium (as K_2O)	0.5	%	2.3	kilograms	470	kgs
1st year available (estimated)	*80.0*	*% total*	14.2	kilograms	*376*	kgs
2nd year available (estimated)	*10.0*	*% total*	1.8	kilograms	*47*	kgs
3rd year available (estimated)	*1.0*	*% total*	0.2	kilograms	*5*	kgs
Total zinc	278	mg kg^{-1}			27.2	kgs
permitted ten year loading	150	kegs per ha			18.1	% 10 yr total
Total copper	60	mg kg^{-1}			5.9	kgs
permitted ten year loading	75	kegs per ha			7.8	% 10 yr total
Total nickel	21	mg kg^{-1}			2.1	kgs
permitted ten year loading	30	kegs per ha			6.9	% 10 yr total
Total lead	124	mg kg^{-1}			12.1	kgs
permitted ten year loading	150	kegs per ha			8.1	% 10 yr total
Total mercury	1.0	mg kg^{-1}			0.10	kgs
permitted ten year loading	1.0	kegs per ha			9.8	% 10 yr total
Total cadmium	1.3	mg kg^{-1}			0.13	kgs
permitted ten year loading	1.5	kegs per ha			8.5	% 10 yr total

Note:

Nutrient release estimates are based on Agriculture & Horticulture Development Board (2017) Nutrient Management Guide (RE
The 10 year totals shown are based on The Sludge (Use in Agriculture) Regulations 1989 (for reference only)
A second application of green waste compost at 300 m^3 will be required upon reseeding mid way through the aftercare period

25/30

Table 9. Minimum standard to be attained for man-made topsoils on restored areas on completion of aftercare (5

Parameter	Man-made topsoil	British standard (for comparative purposes)
		Topsoil BS3882-2007 (Multipurpose)
Texture:		
sand (2.0-0.06 mm)	70% m/m max. / 30% m/m min.	85% m/m max. / 30% m/m min.
silt (0.06-0.002 mm)	50% m/m max. / 20% m/m min.	65% m/m max. / 0% m/m min.
clay (<0.002 mm)	30% m/m max / 10% m/m min.	35% m/m max / 5% m/m min.
Stoniness (by mass):		
Less than 2 mm	65% m/m min	70% m/m min.
greater than 2 mm	35% m/m max	30% m/m max.
greater than 20 mm		10% m/m max.
greater than 50 mm	20 m/m max	0% m/m max.
greater than 100 mm	0 m/m	0% m/m max.
Maximum stone size	75 mm in any dimension	50 mm in any dimension
pH (1:2.5 soil/water):	6.0 min. / 7.0 max.	3.5 min. / 9.0 max.
Electrical conductivity (CaSO4 extract):	100 uS cm min. / 250 uS/cm max.	-
Soil organic matter content	>3.0 % m/m	3-20% m/m (where clay content is 5-20%) / 5-20% m/m (where clay content is >20%)
Total nitrogen	0.15 % m/m min. / 0.25 % m/m max.	>0.15% m/m
Available phosphorus	10-25 mg/l (ADAS index 1-2)	16-100 mg/l (ADAS index 2-5)
Available potassium:	61-180 mg l mg/l (ADAS index 1-2)	121-900 mg/l (ADAS index 2-5)
Available magnesium:	51-175 mg/l (ADAS index 2-3)	51-600 mg/l (ADAS index 2-6)
Carbon:Nitrogen ratio	<20:1	<20:1
Sulphate content:	600 mg/kg max.	-
Sulphur:	250 mg/kg max.	-
Inorganic contaminants:		
Total Arsenic	20 mg/kg max.	-
Water soluble Boron	3.0mg/kg max.	-
Total Cadmium	1.0 mg/kg max.	-
Total Chromium	130 mg/kg max.	-
Total Copper	100 mg/kg max.	100-200 mg/kg max (depending on soil pH)
Total Mercury	8 mg/kg max.	-
Total Nickel	60 mg/kg max.	60-110 mg/kg max (depending on soil pH)
Total Lead	450 mg/kg max.	-
Total Zinc	200mg/kg max.	200-300 mg/kg max (depending on soil pH)
Organic contaminants:		
Total Thiocyanate	20 mg/kg max.	-
Total Cyanide	50 mg/kg max.	-
Free Cyanide	20 mg/kg max.	-
Total of 16 Polyaromatic hydrocarbons (EPA16)	40 mg/kg max.	-
Extractable Petroleum Hydrocarbons (C10-C40)	50 mg/kg max.	-
Total Phenols	40 mg/kg max.	-
Total Toluene	15 mg/kg max.	-
Total Benzo[a]pyrene	2 mg/kg max.	-

26/20

Table 10. Summary of restoration activity for each individual filled and / or disturbed area

Temporary field reference (see Drawing number GIF-AGCL)	2015 Field reference	Location	Area (ha)	Filling	Reprofiling	Preparation of existing soils	Part soil profile construction	Full soil profile construction	Spreading and incorporation of green waste compost	Seedbed preparation	Sowing of grass legume mixture
1	ST0984 4832, ST0984 5713, ST0984 4824, ST0984 2716, ST0984 3727	Central aggregate processing area	4.736	Ongoing (northern part only)	Required (southern part only)	Determination of whether the existing soil cover meets the minimum standard for imported mixed soils (see Table 5) with stone removal and subsoiling if suitable (southern part only)	Placement of reduced 250 mm soil cover if in situ soils are suitable for part soil profile construction. Utilisation of soils recovered and stored on site preferable, subject to availability (southern part only)	Placement of full 500 mm thickness of imported mixed soils (northern area). Placement of full 500 mm thickness of imported soils only if in situ soils are unsuitable (southern part)	Spreading of green waste compost by standard rear discharging muck spreader at an application rate of 400 m3 / 200 tonnes of wet product per ha and incorporation into soils by means of heavy	Light discing, spike harrowing, chain harrowing, mechanical and hand stone picking to remove stone greater than 75 mm in any dimension followed by 'Cambridge' rolling to consolidate seed bed following sowing	Sowing of Festulolium Silage Ley - 2 Year Dry Land Ley with added White clover and Birdsfoot trefoil at 60 kgs ha
2	ST0984 8413	Infilled area in eastern corner	1.541	Previously completed	Trimming alongside watercourses only	Final surface comprises of unprocessed assorted inert wastes with numerous obstructions unsuitable for use as soils	No	Placement of full 500 mm thickness of imported mixed soils	Spreading of green waste compost by standard rear discharging muck spreader at an application rate of 400 m3 / 200 tonnes of wet product per ha and incorporation into soils by means of heavy discing to 200 mm below the final surface	Light discing, spike harrowing, chain harrowing, mechanical and hand stone picking to remove stone greater than 75 mm in any dimension followed by 'Cambridge' rolling to consolidate seed bed following sowing	Sowing of Festulolium Silage Ley - 2 Year Dry Land Ley with added White clover and Birdsfoot trefoil at 60 kgs ha
3	ST0984 3736, ST0984 4832, ST0984 3727	Disturbed inlier within central area enclosed by gallop	0.699	Previously completed	Required (to match surrounding undisturbed ground)	Determination of whether the existing soil cover meets the minimum standard for imported mixed soils (see Table 5) with stone removal and subsoiling if suitable and excavation and removal if unsuitable	Placement of reduced 250 mm soil cover if in situ soils are suitable for part soil profile construction. Utilisation of soils recovered and stored on site preferable, subject to availability	Placement of full 500 mm thickness of imported soils only if in situ soils are unsuitable or additional soil cover required to marry levels to adjoining undisturbed ground	Spreading of green waste compost by standard rear discharging muck spreader at an application rate of 400 m3 / 200 tonnes of wet product per ha and incorporation into soils by means of heavy discing to 200 mm below the final surface	Light discing, spike harrowing, chain harrowing, mechanical and hand stone picking to remove stone greater than 75 mm in any dimension followed by 'Cambridge' rolling to consolidate seed bed following sowing	Sowing of Festulolium Silage Ley - 2 Year Dry Land Ley with added White clover and Birdsfoot trefoil at 60 kgs ha
4	ST0984 1879	Disturbed inlier within field to south of gallop	0.58	Previously completed	Required (to match surrounding undisturbed ground)	Determination of whether the existing soil cover meets the minimum standard for imported mixed soils (see Table 5) with stone removal and subsoiling if suitable and excavation and removal if unsuitable	Placement of reduced 250 mm soil cover if in situ soils are suitable for part soil profile construction. Utilisation of soils recovered and stored on site preferable, subject to availability	Placement of full 500 mm thickness of imported soils only if in situ soils are unsuitable or additional soil cover required to marry levels to adjoining undisturbed ground	Spreading of green waste compost by standard rear discharging muck spreader at an application rate of 400 m3 / 200 tonnes of wet product per ha and incorporation into soils by means of heavy discing to 200 mm below the final surface	Light discing, spike harrowing, chain harrowing, mechanical and hand stone picking to remove stone greater than 75 mm in any dimension followed by 'Cambridge' rolling to consolidate seed bed following sowing	Sowing of Festulolium Silage Ley - 2 Year Dry Land Ley with added White clover and Birdsfoot trefoil at 60 kgs ha
5	ST0984 705	Plant yard to the south of farmhouse	0.332	Previously completed	Construction of hard standing	Non agricultural use	Non agricultural use	Non agricultural use	Non agricultural use	Non agricultural use	Non agricultural use
A	ST0984 6232	Infilled area to the north of farmhouse	2.133	Previously completed	Trimming alongside watercourses only	Final surface comprises of screened rejects with insufficient soil fines (<2 mm fraction) to be considered suitable for use as soil	No	Placement of full 500 mm thickness of imported mixed soils	Spreading of green waste compost by standard rear discharging muck spreader at an application rate of 400 m3 / 200 tonnes of wet product per ha and incorporation into soils by means of heavy discing to 200 mm below the final surface	Light discing, spike harrowing, chain harrowing, mechanical and hand stone picking to remove stone greater than 75 mm in any dimension followed by 'Cambridge' rolling to consolidate seed bed following sowing	Sowing of Festulolium Silage Ley - 2 Year Dry Land Ley with added White clover and Birdsfoot trefoil at 60 kgs ha

Table 11. Fertiliser application to natural soils on undisturbed fields necessary to optimise silage production

Table 11a. Amount and sequencing of fertiliser application to natural soils on undisturbed fields necessary to optimise silage production

Temporary field reference (see Drawing number GIF-AGCL)	2015 Field reference	Location	Area (ha)	Total required (x2 silage cuts per years with a target yield 38 t ha)		Sequencing of application					
						Previous Autumn		Spring		Following silage cut 1	
				Phosphate (P205) (kgs/ha)	Potash (K20) (kgs/ha)	Phosphate (P205) (kgs/ha)	Potash (K20) (kgs/ha)	Phosphate (P205) (kgs/ha)	Potash (K20) (kgs/ha)	Phosphate (P205) (kgs/ha)	Potash (K20) (kgs/ha)
Front upper field	ST0984 1443	North of gallop	4.785	125	260	0	60	100	80	25	120
Front middle field	ST0984 1443	Central area	6.287	125	260	0	60	100	80	25	120
Front lower field	ST0984 0932	South of gallop	2.466	125	260	0	60	100	80	25	120
Farm field	ST0984 7316 &	Behind	2.05	125	260	0	60	100	80	25	120

Table 11b. Comparison of the efficiency of green waste compost and inorganic fertiliser in meeting cropping nutrient requirements

Fertiliser	Nutrient content		Total required (x2 silage cuts per years with a target yield 38 t ha)		Application rate (t/ha)	
	Phosphate (P205) (kgs/ha)	Potash (K20) (kgs/ha)	Phosphate (P205) (kgs/ha)	Potash (K20) (kgs/ha)	Fertiliser product (gross)	
Triple superphosphate	47%	0	125	0	0.27	0.00
Muriate of potash	0%	60%	0	260	0.00	0.43
Green waste compost	0.71%	0.48%	125	260	17.61	54.17

Note:

Soil analysis confirmed soil nitrogen concentrations to be adequate and pH to be suitable for grass production so that no net lime requirement exists

29/29

Table 12. Summary of quantities of wastes required to meet the restoration requirements identified

Temporary field reference (see Drawing number GIF-AGCL-Proposed 01 Rev3)	2015 Field reference	Location	Area (ha)	Maximum thickness of inert mineral waste for soil profile construction (mm)	Maximum volume of inert mineral waste required, including 12.5% allowance for settlement (m3)	Minimum tonnage of inert mineral waste required (t) (assumes bulk density of 1.80 g/cm3)	Application rate of green waste compost per ha (m3) (x2 300 m3 applications @ Year 1 and Year 3)	Volume of green waste compost required (m3)	Tonnage of green waste compost required (t product as received) (assumes bulk density 0.68 g/cm3)
1	ST0984 4832, ST0984 5713, ST0984 4824, ST0984 2716, ST0984 3727	Central aggregate processing area	4.736	500	26,640	47,952	600	2,842	1,932
2	ST0984 8413	Infilled area in eastern corner	1.541	500	8,668	15,603	600	925	629
3	ST0984 3736, ST0984 4832, ST0984 3727	Disturbed inlier within central area enclosed by gallop	0.699	500	3,932	7,077	600	419	285
4	ST0984 1879	Disturbed inlier within field to south of gallop	0.58	500	3,263	5,873	600	348	237
5	ST0984 705	Plant yard to the south of farmhouse	0.332	500	0	0	600	199	135
A	ST0984 6232	Infilled area to the north of farmhouse	2.133	500	11,998	21,597	600	1,280	870
Total			10.021		54,501	98,101		6,013	4,089

20/12

LEGEND

AC Agricultural Classification
(Note: Generalised description)
With Green Line Boundary overlaid

Generalised Description of the Agricultural Land Classification Grades

Grade & standard colour notations	Description of agricultural land	Detail
1	Excellent quality	No or very minor limitations on agricultural use. Wide range of agricultural and horticultural crops can be grown. High yielding and consistent.
2	Very good	Minor Limitations on crop yield, cultivations or harvesting. Wide range of crops but limitations on demanding crops (e.g. winter harvested veg). Yield high but lower than Grade 1.
3 (subdivided)	Good to moderate	Moderate limitations on crop choice, timing and type of cultivation, harvesting or level of yield. Yields lower and more variable than Grade 2.
3a	Good	Moderate to high yields of narrow range of arable crops (e.g. cereals), or moderate yields of grass, oilseed rape, potatoes, sugar beet and less demanding horticultural crops.
3b	Moderate	Moderate yields of cereals, grass and lower yields other crops. High yields of grass for grazing/ harvesting.
4	Poor	Severe limitations which restrict range and/or level of yields. Mostly grass and occasional arable (cereals and forage), but highly variable yields. Very droughty arable land included.
5	Very poor	Severe limitations which restrict use to permanent pasture or rough grazing except for pioneering forage crops.

Proposed Agricultural Improvements (Refer to Agricultural Benefit Statement for details)

Garth House
AC4
Improvement by adding provisional drainage layer 200-300mm, approximately 500mm Class 2A/2B/Compost mix to areas, seed and monitor to improve to potential AC3 Classification within three years of completion

Garth Isaf Farm
AC3
Soil samples for fertiliser/lime additives etc. to maintain classification or improve if possible.

AC5
Re-profile areas to fill in hollows and create flowing contours to blend in with surrounding hillsides. Cap revised profile with approximately 500mm Class 2A/2B/Compost mix to areas, seed and monitor to improve areas to potential AC3 classification within 3 years of completion

GARTH ISAF
EFAIL ISAF
CF38 1SN

Garth Isaf Farm and Garth House Area
Efail Isaf
Pontypridd
Rhondda Cynon Taff
CF38 1SN
T: 01443 203273

GARTH ISAF
FIELD MANAGEMENT
PROPOSED IMPROVEMENTS

GIF–AGCL-Proposed 01 Rev3b

Scale: NOT TO SCALE
Date: JAN 2019

30/30