Surface Water Management Plan

St Clere's Hall Pit Landfill Permit Application

Danbury Haulage (St Clere's) Ltd

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GEMCO
Green Earth Management Co Ltd

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Appendix 1	Greenfield Run-Off Rate Calculation and Monthly Rainfall Data
Appendix 2	Backfill Phasing Drawings and Restoration Plan

ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations	
Acronym / Abbreviation	**Definition**
ACM or PACM	Asbestos or potential asbestos containing material
ADE	Average Daily Exposure
ASPT	Average Score Per Taxon
BOD	Biochemical Oxygen Demand
BGS	British Geological Survey
BH	Borehole
BS	British Standard
BTEX	Benzene, Toluene, Ethyl benzene and Xylenes
CAT	Cable avoidance tool
CIRIA	Construction Industry Research and Information Association
CLEA	Contaminated Land Exposure Assessment
CLR	Contaminated Land Research reports
Defra	Department of the Environment, Food and Rural Affairs (formerly the DoE and DETR)
DETR	Department of the Environment, Transport and the Regions (formerly the DoE and now Defra)
DO	Dissolved oxygen
DoE	Department of the Environment (then DETR and later Defra)
DQRA	Detailed quantitative risk assessment (Tier 2)
EA	Environment Agency
EPH	Extractable Petroleum Hydrocarbons
EQI	Environmental Quality Index
EQS	Environmental Quality Standards
FID	Flame ionisation detector
GAC	Generic assessment criteria
GC	Gas chromatography
GEMCO	Green Earth Management Co Ltd
GQA	General quality assessment
GQRA	Generic quantitative risk assessment (Tier 1)
ha	Hectare
HCV	Health criteria value
HHRA	Human health risk assessment
HV	High Voltage
ICRCL	Interdepartmental Committee on the Redevelopment of Contaminated Land
ID	Index dose
LEL	Lower explosive limit
LOD	Limit of detection
m	Metres
mAOD	Metres above ordnance datum
mbgl	Metres below ground level
MCERTS	Monitoring Certification Scheme

Acronyms and Abbreviations	
Acronym / Abbreviation	**Definition**
MDI	Mean daily intake
MTBE	Methyl tertiary butyl ether
NGR	National grid reference
NHBC	National House Building Council
NRA	National Rivers Authority (now the Environment Agency)
PACM	Potentially asbestos containing material
PAH	Polyaromatic hydrocarbon (a.k.a. polynuclear aromatic hydrocarbon)
pH	A measure of the acidity or basicity of an aqueous solution. Defined as the negative logarithm of the concentration of hydrogen ions in a substance
PID	Photo Ionisation Detector
PPE	Personal Protective Equipment
PPL	Potential Pollution Linkage
RBCA	Risk-based contamination assessment
RMS	Remediation Method Statement
RQO	River Quality Objective
S4UL	Suitable for Use Level
SGV	Soil Guideline Value
SNIFFER	Scotland and Northern Ireland Forum for Environmental Research
SPT	Standard penetration test
SSTL	Site-specific target level
SVOC	Semi Volatile Organic Compounds
QRA	Quantitative risk assessment
TDI	Tolerable daily intake
TDSI	Tolerable daily soil intake
TP	Trial pit
TPH	Total petroleum hydrocarbon
TPHCWG	Total petroleum hydrocarbon criteria working group
TOX	CLR 9 Toxicological Reports
UKAS	United Kingdom Accreditation Service
USEPA	United States Environmental Protection Agency
UXB	Unexploded Bomb
VOC (TVOC)	Volatile Organic Compounds (Total VOC)
WHO	World Health Organisation
WQS	Water Quality Standards
WS	Window sample

1 INTRODUCTION

1.1. Project Details

Green Earth Management Company Limited (GEMCO) was commissioned by Danbury Haulage (St Clere's) Limited (the Client) to prepare a Surface Water Management Plan (SWMP) to support the application for a bespoke Environmental Permit for the restoration of an existing void at St Clere's Hall Pit ('The Site') by the permanent deposit of inert waste as a disposal activity.

The site location and the proposed site boundary are presented in drawings DW2018-346LC and DW2018-346SB. Table 1.1 below summarises the site location and the proposed site activities.

Table 1.1. Site details	
Site address	St Clere's Hall Pit, Main Road, Danbury, Essex, CM3 4AR
National Grid Reference (approx.)	576445 205767
Area (approx.)	8 ha
Proposed site use	Inert landfill and inert recycling facility in order to restore site to original ground levels.

The site is subject to planning consent ESS/63/10/CHL granted by Essex County Council for the following activities:

1. Mineral extraction (now ceased);
2. Infilling of existing void with inert waste (construction waste, soils, and clays);
3. Recycling of inert materials to recover secondary aggregates and soils; and
4. Restoration to species rich grassland in line with Essex Biodiversity Habitat Action Plan.

The SWMP is required to support an application for an environmental permit made in accordance with the Environmental Permitting Regulations (2016).

The SWMP sets out the preferred surface water management strategy for surface water run-off from the site.

1.2. Information Sources

The information contained within this report has been derived from sources including the following:

- GEMCO report, 'Conceptual Site Model, Environmental Setting and Site Design, Inert Recycling and Landfill Facility, St Clere's Hall Pit, Danbury', ref. 694 R04 ESSD V1, dated November 2017;
- GEMCO report 'Hydrogeological Risk Assessment, St Clere's Hall Pit Landfill Permit Application' ref. 694 R04 HRA Issue 1, dated November 2017;
- Containment Quality Associates Ltd. Report 'St Clere's Pit, Danbury, Permission for backfilling with inert waste: Response to planning conditions 26 and 38, dated June 2012;
- Landmark, Envirocheck report 93498388_1_1, dated 12th August 2016;
- Environment Agency 'Landfill (EPR 5.02): How to comply with your environmental permit' dated 2009.

- Environment Agency 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water' ref. LFTGN02, dated 2003;
- Environment Agency, 'Rainfall runoff management for developments', report SC030219, October 2013;
- The British Geological Survey (BGS) online geological records database;
- British Geological Survey (BGS) 1:50,000 map of Chelmsford (Sheet 241: Chelmsford Solid and Drift Edition; and
- Environment Agency's 'What's in your backyard' online database;
- UK SuDs online tools for the design and evaluation of sustainable drainage; and
- Centre for Ecology and Hydrology online CEH-GEAR rainfall database.

1.3. Objectives

The objectives of the SWMP are to:

- Set out the surface water management strategy for the site to ensure that surface water run-off from the site is controlled at all stages of site development;
- Support the environmental permit application at St. Clere's Hall Pit by Danbury Haulage (St. Clere's) Limited, for a bespoke environmental permit to restore the land.

2 SITE DETAILS

2.1. Site Setting

2.1.1. Site Location

St Clere's Hall Pit is located on the western outskirts of the village of Danbury in Essex, centred on approximate NGR 576445, 205767 as detailed in Table 1.1 and shown in drawing DW2018-346LC. The main body of the site is located approximately 150m north of the A414 road, and approximately 1.6km east of Junction 18 of the A12 Chelmsford Bypass.

2.1.2. Site Description

The site layout and boundary plans are presented in drawing DW2018-346SB.

The site comprises a void created by the extraction of sand and gravel, with site offices and an associated carpark located towards the southwest of the area. The deepest part of the void is to the north, where approximately 4-5m of water has collected within the pit. Danbury Haulage Ltd currently occupy the southernmost area, where they have operated a HGV depot since approximately 1998.

The site was formerly part of a larger area of quarrying which occupied some 20ha. This permit application only concerns the most recently excavated void and immediate surrounding area however, which occupies approximately 8ha.

The original ground level of the site varied between 40m and 50m above Ordnance Datum (AOD). The pit is approximately 25m deep relative to this ground level, with the base of the void sitting on London Clay Formation at approximately 15-25mAOD. The side slopes of the pit appear steep, with an estimated slope gradient of 1V:2H or greater. The north, west, and southern slopes of the pit comprise sands and gravels, with a ridge of clay apparent along the eastern site boundary.

The southernmost extent of the proposed landfill area was previously incorporated within an old inert landfill occupying approximately 1.7ha, and extending south of the proposed site. The old landfill was licenced under WML 226/92 (now EAWML 70318), issued on the 9th November 1992. Landfilling ceased around 1994, and the site was restored and grassed circa 1996. The northern area of the old landfill, within the current proposed operation area now comprises a grassed slope, decreasing in elevation towards the void noted above. This slope has been incorporated into the proposed landfill site in order to restore the site to original ground levels.

There are former extraction pits immediately east and west of the site, some of which now comprise ponds.

There are 3 (no.) ponds approximately 45m east of the eastern site boundary. The southernmost pond is a silt lagoon, currently used for operational purposes of the quarry. Water from the southern pond drains into the central pond, which eventually drains into the northernmost pond. The northern lagoon has been utilised as a fishing lake for many years.

In addition, there are 3 (no.) ponds approximately 115m west of the western site boundary, inter-connected by a drain. It is understood that they were formerly used as part of a former concrete batching plant which was located adjacent to St Clere's Hall Pit.

2.1.3. Surrounding Area

The site is located approximately half-way up Danbury Hill. The surrounding ground level decreases to the west, and increases to the east. Much of the surrounding area comprises a mixture of woodland and agricultural land use. An area of ancient woodland, Hall Wood, is situated ~60m northwest of the site at its closest point. Around 600m west of the site is a stream (Sandon Book); this lies at approximately 20mAOD. The village of Danbury, approximately 1km east, lies at approximately 100mAOD.

2.2. Site History

Historically the site comprised open land close to St Clere's Hall until around the early 1960s after which the site was part of a larger area of sand and gravel workings which extended north and east of the application site. It is understood the site was granted planning permission for the excavation of sands and gravels in 1954.

2.3. Proposed Development

The proposed development is for an inert landfill to reclaim the void at the site and an inert recycling facility to support the landfill operation. The latter is for a sorting and recycling operation to pre-treat incoming inert waste where technically feasible and for recovered materials to be re-used on site or sold for off-site usage.

The development details, waste characteristic and operational details are set out in detail elsewhere (R1).

The pit will be backfilled in phases as set out in the Backfill Phasing plans presented in Appendix 2. The original ground levels (prior to the gravel extraction operations) will be restored with a non-engineered soil capping layer (not impermeable) placed as the final layer. The final levels are shown on the Restoration Plan presented in Appendix 2.

The final levels will be restored in a phased manner from north to south. The drainage off the restored area will be generally to the north-west, away from the operational area and as per the pre-gravel extraction drainage pattern.

2.4. Geological Setting

The geological setting has been derived from a review of British Geological Survey (BGS) online records and geological mapping 1:50,000 Series, Sheet 241, Chelmsford, solid and Drift Edition.

The site is underlain by glaciofluvial sand and gravel deposits (superficial geology) in turn underlain by London Clay Formation (bedrock geology).

The mapping indicates that the superficial deposits to be absent along the eastern side of the site.

The sand and gravel deposits on site have been extensively worked and removed by mineral extraction operations.

There is a band of alluvial deposits to the north of the site associated with a stream approximately 175m north of the northern site boundary.

2.5. Hydrogeological Setting

The superficial sand and gravel deposits are classified as a Secondary A aquifer.

The London Clay is classified as unproductive strata.

The site is not located within an Environment Agency groundwater Source Protection Zone (SPZ).

It is understood the deepest part of the quarry may lie below the groundwater table in the superficial aquifer.

2.6. Hydrological Setting

The excavated void on-site currently holds water in its deepest part toward the northern end. The resting water level is around 25.3m AOD.

There are 3 (no.) ponds approximately 45m east of the eastern site boundary, refer to drawing DW2018-346SD. The southernmost pond is a silt lagoon, currently used for operational purposes of the quarry. Water used for gravel washing, as well as from dewatering processes, is pumped into the lagoon where the suspended solids can settle. Water from the southern pond drains into the central pond, which eventually drains into the northernmost pond. The northern lagoon has been utilised as a fishing lake for many years. The water / silt level in the silt pond is around 44.4m AOD; the water level in the central pond is around 36.7m AOD and the water level in the fishing pond is around 32.1m AOD.

There are 3 (no.) linked ponds approximately 115m west of the application site boundary inter-connected by a drain (). It is understood that they were formerly used as part of a former concrete batching plant which was located adjacent to St Clere's Hall Pit. The water levels range from around 32.7m AOD to 29.3m AOD, decreasing in successive ponds to the west.

There is another pond in a depression to the south of these, around 120m west of the application site boundary (drawing ref. DW2018-346SD). The resting water level in this pond is around 29.7m AOD. It is proposed to use this pond as the surface water attenuation pond for surface water drainage from the application site.

The nearest surface watercourse is a small stream that flows in an east-to-west direction around 150m north of the northern application site boundary through the nearby Hall Wood. It is noted that in the region of the site the stream is at a higher elevation than the water levels on site and at a similar elevation to the highest site ground levels.

The stream through Hall Wood enters and the Sandon Brook around 650m west of the site. The latter is classified as a primary river and flows south to north, to the west of the site, around 650m from the site at its closest.

The site is not located within an area subject to flooding according to the Environment Agency flood mapping data (R4).

3 SURFACE WATER MANAGEMENT AND DISCHARGE PROPOSALS

3.1. Introduction

It is proposed that surface water run-off will be collected by open surface water drains on the western periphery of the application site and directed to a surface water attenuation pond around 120m to the west of the application site boundary. The drainage system layout is shown in drawing DW2018-346SD.

The system will rely on gravity and the site topography plus the drain system to manage any surface water flow.

The system will be regularly checked and maintained throughout the life of the site including during aftercare to ensure their effectiveness (see Section 4).

The drainage system has been designed to ensure that it has sufficient capacity to safely control and discharge run-off without impairing the stability of the restoration, constructed lining / capping systems or monitoring installations.

Also note that prior to interception by the drain system general good practice measures will be used to minimise surface water run-off.

The surface water management plans adopt a SuDS approach as opposed to a conventional drainage system; this will provide the following benefits:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding offsite;
- Reducing the volumes and frequency of water flowing directly into watercourses or sewers from St.Clere's Hall Pit;
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained; and
- Allowing settlement of solids on the site, within the drains system and within the attenuation pond to improve the water quality of any surface water discharged from the pond.

3.2. Surface Water Run-Off

Surface water on the application site will dominantly originate from precipitation falling within the application site boundary. There is unlikely to be a significant contribution to run-off originating from outside the site boundary due to the relative topography.

It is anticipated that most precipitation will be accommodated by infiltration and evapotranspiration. During heavier periods of rainfall there maybe surface run-off may occur.

3.2.1. Restored Areas

The finished levels restore the original ground levels with drainage generally to the north-west. Most precipitation will be accommodated by infiltration (soil moisture deficiency) and evapotranspiration. Surface water flows may occur after heavy rain etc. Surplus water will be collected by open surface water drains and directed to the surface water attenuation pond. Additional temporary ditches may be required

during some phases to direct surface water flows to protect the working areas or prevent erosion of recently restored areas.

3.2.2. Recycling Areas and Roadway

Hard packed surfaces may act as pavement during periods of moderate to heavy precipitation and surface water run-off is expected. This will either soak into the ground around the edge of the areas, run into the tipping area (see below) or be collected by open surface water drains and directed to the surface water attenuation pond.

3.2.3. Tipping Areas

Any precipitation into the landfill void or process areas that drain toward it will generally be accommodated by infiltration and evapotranspiration. Any excess water will be addressed by operational responses such as the formation of temporary ponds or modification of the tipping area to maintain dry conditions. Excess water will not be pumped out unless absolutely necessary in which case it will be dealt with as detailed in the dewatering plans (R1, Appendix 5).

3.2.4. Other Internal Areas

Most precipitation will continue to be dealt with by infiltration and evapotranspiration. Any surface water flow will soak away in other areas or find its way to the tipping area or the surface water drains for the recycling area or roadway and be directed to the surface water attenuation pond.

3.3. Good Practice Site Surface Water Management

3.3.1. Prevention

The use of good site design and housekeeping measures will be used to prevent runoff and thereby minimise water reaching the perimeter drains and the surface water attenuation pond. These will include:

- Minimise topsoil stripping and earthworks in previously undisturbed areas;
- Ensure that areas which are subject to earthworks are restored as quickly as possible by dressing with topsoil and planting in accordance with the site restoration plan;
- Any long-term stockpiles or bare earth slopes will be stabilised by either; mulching, covering with matting, temporary planting, or an alternative stabilisation technique;
- Slope roughening and benching of stockpiles to encourage infiltration and reduce run-off velocities; and
- All temporary access roads will where feasible drain laterally rather than along the roads length.

3.3.2. Source Control

Similarly measures to control runoff at or very near its source will be used to minimise the flows to the drains and attenuation pond where practicably possible:

- A buffer zone of established vegetation will, if possible, be allowed between any earthworks and lagoons or drainage ditches;

- All runoff from areas of earthworks will whenever possible be channelled to areas of established vegetation using as short a route as possible;
- All runoff from temporary roads will when possible be managed in open drains incorporating check dams at regular intervals; and
- Silt fences and straw bales will be used as and when necessary at the base of any bare earth slopes to provide temporary filtering of runoff.

3.4. Perimeter Drains

The layout of the drainage system is shown in drawing DW2018-346SD.

The perimeter drains will be excavated as open trapezoidal channels and will be no less than 0.5m deep. The drains will have a base of 0.5m width and be cut with 1v:2h side-slopes.

The open surface water drains will utilise the topography, although may be required to be graded to ensure successful gravity drainage.

The perimeter drains will not be artificially lined.

Where necessary the drains will be piped under operational areas; e.g. where vehicle movements are required across the line of the drainage system.

Excavated spoil from the ditches will be spread evenly over the adjacent ground.

3.5. Surface Water Attenuation Pond

The surface water attenuation pond is shown in drawing DW2018-346SD. The chosen strategy takes advantage of a large pre-existing pond / depression within a previously restored area of the wider gravel extraction area.

On the basis of the topographical survey (drawing ref. DW2018-346SD) the current resting water level is around 29.7m AOD and the pond surface area around (50m x 45m) 2250m^2.

The water levels could rise by in excess of 2m before overtopping the bank to the north; the lowest point is around 32.5mAOD.

A rudimentary but conservative estimate of the attenuation storage volume has been made by estimating the additional volume between the 30m and 32m contours in the attenuation pond area (drawing ref. DW2018-346SD). At around 32mAOD the surface area of the ponded water would reach around 7000m^2, with a corresponding increase in volume of around 9000m^3.

The surface water attenuation pond is within an already restored area of former gravel extraction. The pit is not lined, and excess water will gradually drain into the gravel body or evaporate from the pit during drier periods.

It is considered very unlikely that the surface water attenuation pond would ever overflow given its capacity as detailed in Section 3.6 below.

3.6. Potential Surface Water Flows vs. Attenuation Capacity

As noted above it is expected that most precipitation will be accommodated by infiltration and evapotranspiration. It is noted that the site does not currently experience excessive surface water flows or build-up of water in the main void (above the normal resting level) during periods of rainfall.

Several basic calculations on the basis of simple assumptions have been performed to demonstrate that the storage volume in the surface water attenuation pond (around 9000m^3) is significantly more than the expected inputs.

3.6.1. Greenfield Run-off Rates

Upon restoration the run-off rates at the site should be restored to around those expected for an undeveloped greenfield site (an un-engineered soil cap is to be placed which will mimic this scenario).

Prior to completion of the restoration the unrestored area will largely drain into the void with much smaller contributions from road areas that are not within the depression to be filled so the overall flow rates off the site to the drainage system will be lower than after restoration.

Using the UK SuDS online tools (www.uksuds.com) the green field run off rate for the site has been estimated. The calculation output sheet is included as Appendix ###. The peak flow rates for the site are:

1 in 1yr event: Q_{1yr} = 9.57 l/s
1 in 30yr event: Q_{30yr} = 25.88 l/s
1 in 100yr event: Q_{100yr} = 35.9 l/s (= 129 m^3/hr)

Simplistically the drainage volume for the 100yr, 6hr storm would be around 774m^3; much smaller than the potential storage volume (9000m^3). The attenuation pond could accept this rate of input for around 70hrs.

3.6.2. 100yr Storm Rainfall Depth

The 1 in 100yr 6hr storm rainfall depth is around 63mm (R7, Appendix 1). Across the whole of the site (8 ha) this amounts to 5040m^3. This is a significant proportion of the attenuation volume *if* all that water were to enter the attenuation pond, i.e. without infiltration into the site or loss to other areas and without any allowance for infiltration of water in the pond into the surrounding soils; all of which is which is plainly unrealistic. Regardless, this volume would not over-top the attenuation pond.

3.6.3. Wettest Recorded Month 2013 - 2015

Using the Centre for Hydrology online UK rainfall data (https://eip.ceh.ac.uk/apps/rainfall/gb.html) the highest rainfall recorded for any month for the site area between January 2013 and December 2015 was 122.8mm in January 2014. The monthly rainfall data for this period are reproduced in Appendix 1. Over the area of the site (8 ha) this rainfall amounts to 9800m^3. This is comparable to the attenuation pond volume (which has been conservatively estimated). It is however extremely unlikely that the whole months rainfall would enter the attenuation pond quickly enough that infiltration in the ground on route to the pond or infiltration of water from the pond into the surrounding soils would not be significant.

3.6.4. Summary

Overall it is considered that the calculations presented in the preceding sections (the latter two in particular based on very conservative assumptions that insignificant infiltration would take place on site or from the pond area) show that the attenuation pond volume far exceeds the likely required capacity and that it is very unlikely that the pond would over top its banks except in the most extreme rainfall events.

4 INSPECTION AND MAINTENANCE

4.1. Inspection

The open surface water drains will be inspected weekly and more frequently after heavy rainfall to determine if any erosion has occurred.

The surfaces of the restored areas, particularly recently restored areas, will be inspected weekly and more frequently during and immediately after periods of heavy rainfall for evidence of erosion.

A daily inspection of the surface water attenuation pond will be undertaken for visual indicators of water quality and of water levels. Particular attention will be paid to the suspended solids concentration and the presence of any free hydrocarbon products on the surface.

Metrological forecasts will be monitored daily to identify possible periods of future heavy rainfall.

Checks shall be in accordance with the Environmental Management System.

4.2. Maintenance

In the event that excessive erosion of the restored surfaces is identified measures will immediately be taken to minimise this to prevent further damage to the slopes and transit of soils / silts to the surface water drainage system. This may take the form of (for example):

- Direct repair of the surface and channelling of surface water run-off away from the affected area, particularly to areas with established vegetation;
- Use of silt fences and straw bales to provide temporary filtering or run-off and disruption of surface water flows;
- Use of check dams in temporary channels to disrupt flow of silts etc.

Routine maintenance of the drainage ditches is needed to ensure that settled solids or other debris do not block the open surface water drains. Any potential blocking of the system may cause surface water to be diverted away from the surface water attenuation pond.

- Any excessive sedimentation (e.g. silt accumulation) and flow restrictions such as litter or debris including fallen vegetation will be removed as soon as practicably possible;
- In the event of significant erosion, the ditch profile will be restored as soon as practicably possible; and
- Any damage caused by operational activities or burrowing animals will be repaired as soon as practicably possible.

4.3. Record Keeping

Inspection and maintenance activities will be recorded on the Daily and Weekly Check Sheets which form part of the site Environment Management System.

5 RISK ASSESSMENT

5.1. Hydrogeological Risk Assessment

A Hydrogeological Risk Assessment Report (R2) has been prepared for Danbury Haulage (St. Clere's) Limited and will be submitted as part of the Landfill Permit Application. The report concluded that the operations are unlikely to present a significant risk to controlled waters and that the risk assessment was in compliance with the Landfill Directive and Groundwater Regulations 2009.

5.2. Flood Risk Assessment

The site is located in a Flood Zone 1 (R4) area and has a very low probability of flooding. The site is not affected by sources of other flooding (R4).

The surface water management system drains to an attenuation pond. Run-off is stored prior to natural dispersion; no pumping to off-site drains will take place. Water levels within the attenuation pond are expected to rise and fall over the course of the year; i.e. during autumn and winter water levels will be higher due rainfall, and during spring and summer water levels will decrease due to evaporation, infiltration and less rainfall.

The risk of overflow of the attenuation pond is considered to be very low given the very high capacity of the pond area before over-topping of the banks to the north (low point).

5.3. Hydrological Risk Assessment (Water Quality)

The SWMP creates a closed system with respect to surface waters; i.e. there is not expected to be any out flow from the system to external surface waters. Water will gradually dissipate from the system by evaporation and by infiltration into the gravel aquifer (see Section 5.1).

Furthermore, waters entering the surface water attenuation system will be rainwater run-off dominantly from the restored surfaces during the operation and entirely from the restored soil surfaces post-operation. As the operation only deals with inert wastes and the materials within the soil capping layer will be controlled it is very unlikely that run-off water would present a significant risk to the environment.

Overall, there is not considered to be any risk to surface waters as a result of the SWMP.

It is considered that environmental monitoring (i.e. water sampling and analytical testing) is not required unless the inspection regime identifies evidence of adverse conditions or contamination.

6 REFERENCES

R1. GEMCO report 'Conceptual Site Model, Environmental Setting and Site Design, Inert recycling and Landfill Facility, St Clere's Hall Pit, Danbury' ref. 694 R04 ESSD V1, dated November 2017;

R2. GEMCO report 'Hydrogeological Risk Assessment, St Clere's Hall Pit Landfill Permit Application' ref. 694 R04 HRA Issue 1, dated November 2017;

R3. Containment Quality Associates Ltd. Report 'St Clere's Pit, Danbury, Permission for backfilling with inert waste: Response to planning conditions 26 and 38, dated June 2012;

R4. Landmark Envirocheck Report ref. 93498388_1_1 dated 12th August 2016 (included as Appendix 4 of the ESSD report; 694_R04_ESSD)

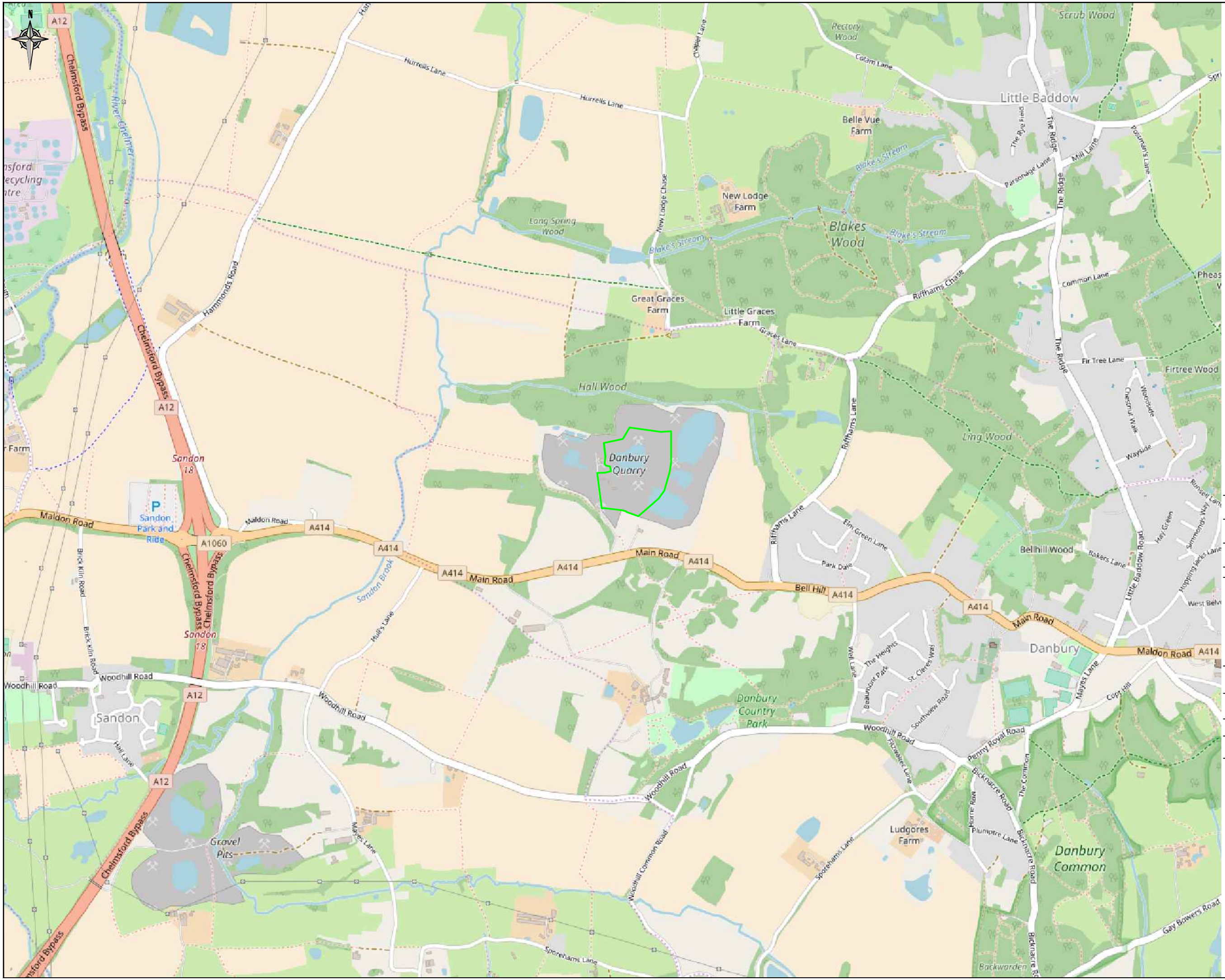
R5. Environment Agency 'Landfill (EPR 5.02): How to comply with your environmental permit' dated 2009;

R6. Environment Agency 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water' ref. LFTGN02, dated 2003;

R7. Environment Agency, 'Rainfall runoff management for developments', report SC030219, October 2013.

FIGURES

DW2018-346LC: Site Location Plan
DW2018-346SB: Site Layout and Boundary Plan
DW2018-346SD: Surface Water Management Plan



SITE BOUNDARY (APPROXIMATE)

The contractor must check and verify all site and building dimensions, levels, utilities, drainage details and connections prior to commencing work.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated. Do not scale from this drawing.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work by means of open excavations.

REV.	DESCRIPTION:	BY:	CKD.	APP:	DATE:

DANBURY HAULAGE LTD

SITE ADDRESS: ST CLERES QUARRY DANBURY

TITLE: SITE LOCATION

DATE:	SURVEYED:	DRAWN:	CHECKED:	APPROVED:
11/2017				

SCALE AT A1:	DRAWING NO:	REVISION:
NTS	DW2018-346LC	

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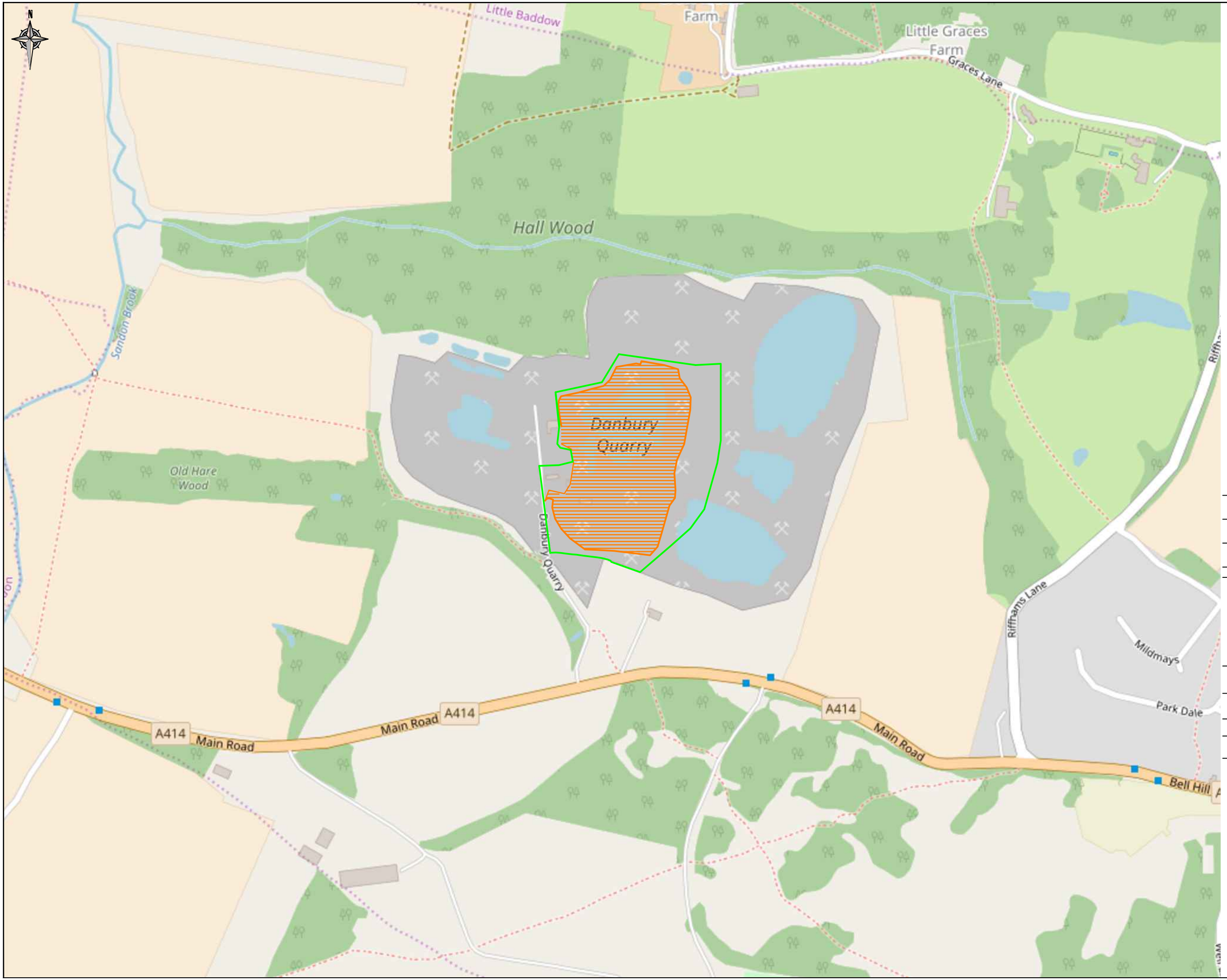
Wakes Colne, Colchester, Essex, CO6 2BY
T 01787 698 014 E info@survatec.com



SITE BOUNDARY (PROPOSED PERMITTED BOUNDARY)

The contractor must check and verify all site and building dimensions, levels, utilities, drainage details and connections prior to commencing work.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated. Do not scale from this drawing.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work by means of open excavations.

REV:	DESCRIPTION:	BY:	CKD:	APP:	DATE:

DANBURY HAULAGE LTD

SITE ADDRESS:
ST CLERES QUARRY
DANBURY

TITLE:
SITE BOUNDARY

DATE:	SURVEYED:	DRAWN:	CHECKED:	APPROVED:
11/2017				

SCALE AT A1:	DRAWING NO:	REVISION:
NTS	DW2018-346SB	

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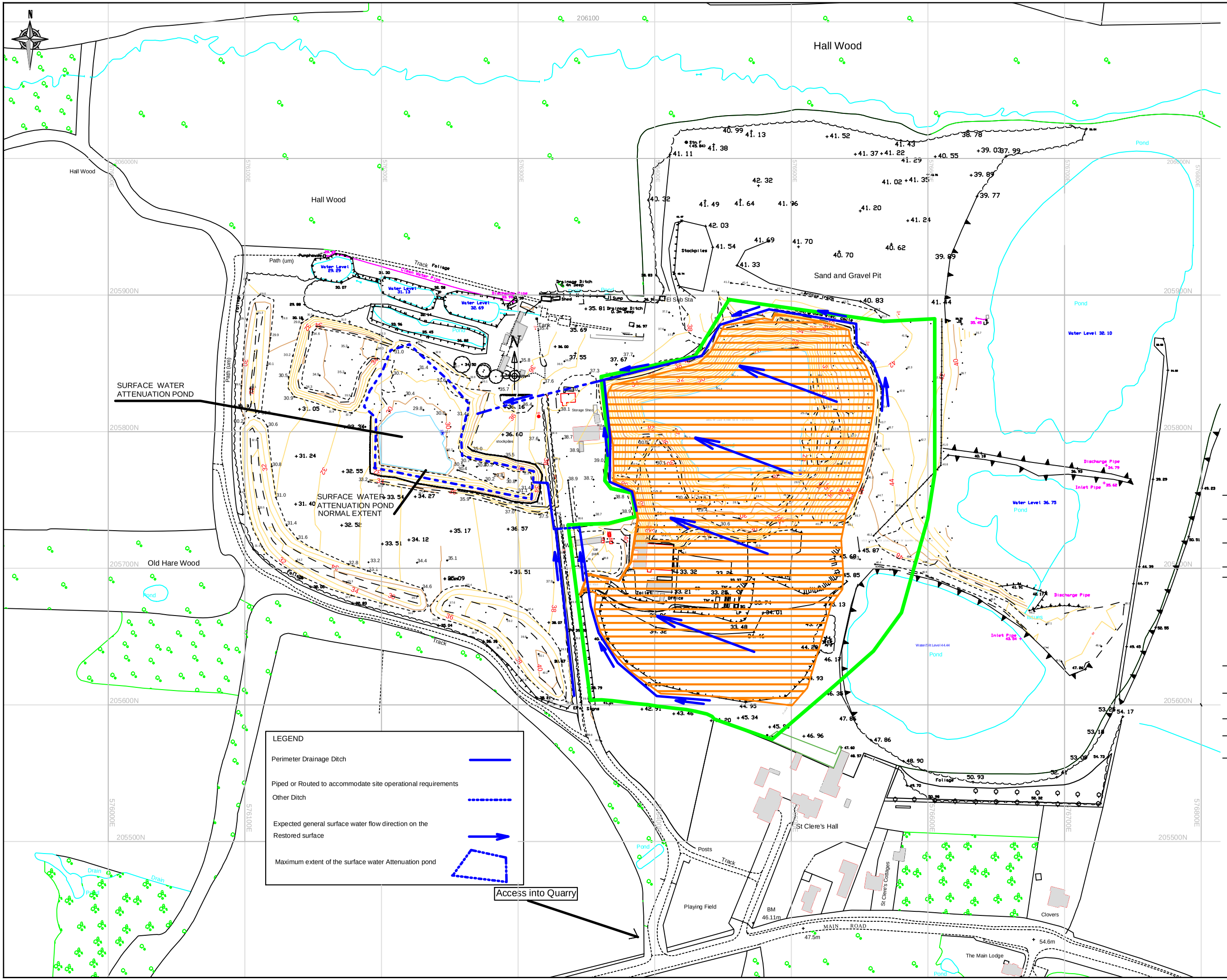

LEGEND

Perimeter Drainage Ditch

Piped or Routed to accommodate site operational requirements

Other Ditch

Expected general surface water flow direction on the Restored surface

Maximum extent of the surface water Attenuation pond

The contractor must check and verify all site and building dimensions, levels, utilities, drainage details and connections prior to commencing work.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated. Do not scale from this drawing.

All below-ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work by means of open excavations.

REV:	DESCRIPTION:	BY:	CKD:	APP:	DATE:

DANBURY HAULAGE LTD

SITE ADDRESS:
ST CLERES QUARRY
DANBURY

TITLE:
SITE DRAINAGE SCHEMATIC

DATE:	SURVEYED:	DRAWN:	CHECKED:	APPROVED:
11/2017				

SCALE AT A1:	DRAWING NO:	REVISION:
1:2500	DW2018-346SD	

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APPENDIX 1

GREENFIELD RUN-OFF RATE CALCULATION AND MONTHLY RAINFALL DATA

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Philip Taylor
Site name:	St Clere's Hall Pit
Site location:	Danbury

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	51.72383° N
Longitude:	0.55321° E

Reference:	6168202
Date:	2017-11-16T18:39:37

Methodology	IH124

Site characteristics

Total site area (ha)	8

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	2
HOST class	---	---
SPR/SPRHOST	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm)	561	561
Hydrological region	6	6
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

Normally limiting discharge rates which are less than 2.0 l/s/ha are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	11.25	11.25
1 in 1 year (l/s)	9.57	9.57
1 in 30 years (l/s)	25.88	25.88
1 in 100 years (l/s)	35.9	35.9

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for use of this data in the design or operational characteristics of any drainage scheme.

CEH EIP Rainfall Data
Accessed at https://eip.ceh.ac.uk/apps/rainfall/gb.html
Accessed on: 16th November 2017

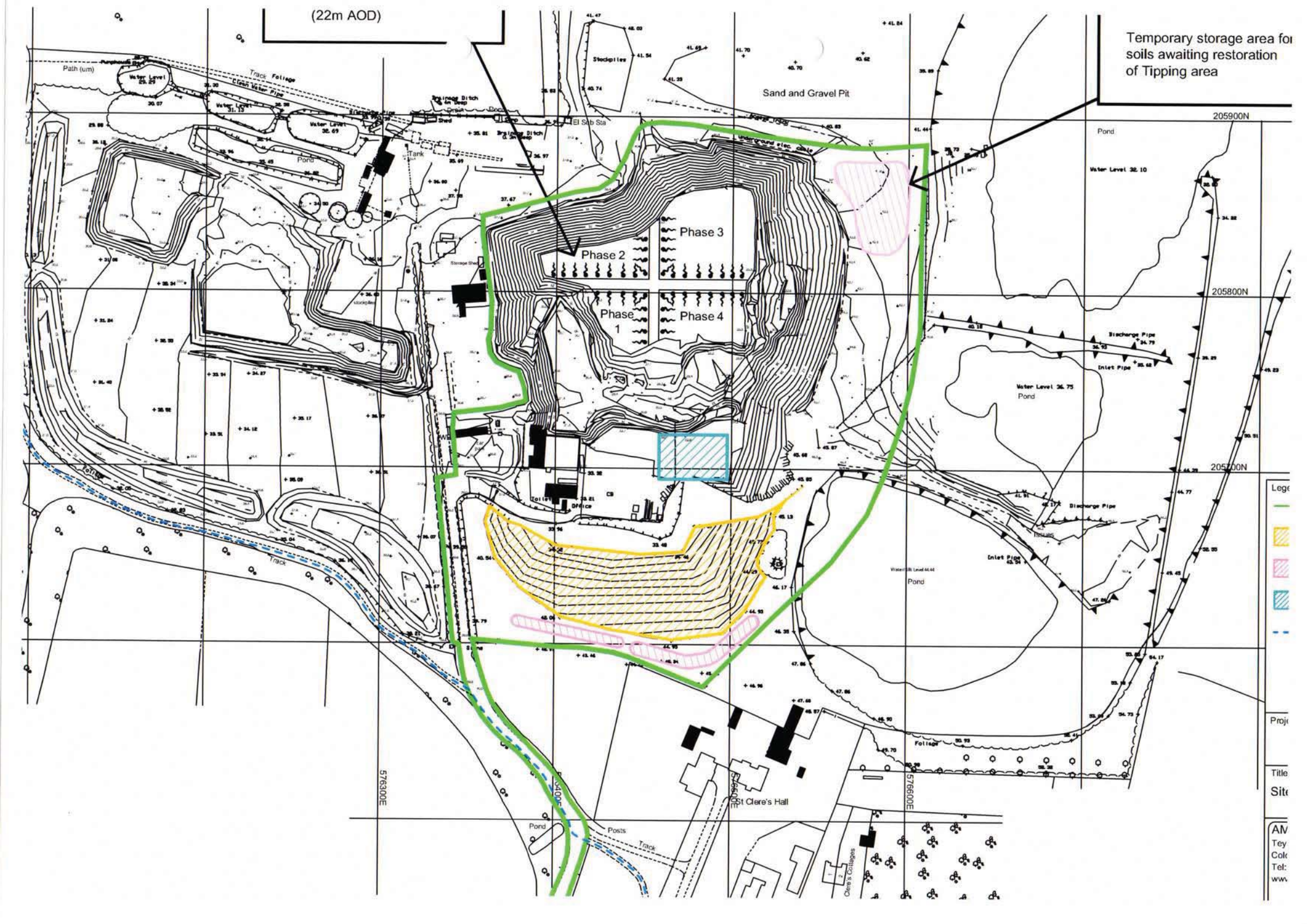
Monthly Rainfall Data

location	Site	East (East of Danbury)	West (East side of Chelmsford)
Coordinates	x576400y205687	x580888y205565	x572628y206141
DATES	Rainfall (mm)	Rainfall (mm)	Rainfall (mm)
01/01/2013	42.3	44.1	41.1
01/02/2013	30.6	34.9	27.9
01/03/2013	44.3	45.9	41.2
01/04/2013	31.2	36.1	27.3
01/05/2013	36.5	38.6	34.4
01/06/2013	21.5	23	20.7
01/07/2013	35.6	40.6	34.4
01/08/2013	60.2	69.9	54.2
01/09/2013	43.4	45.5	42.2
01/10/2013	101.3	110.2	94.3
01/11/2013	49	57	42.9
01/12/2013	89.6	96.2	84
01/01/2014	122.8	122.1	121
01/02/2014	75.6	82.3	72.3
01/03/2014	20.8	23.9	19.6
01/04/2014	21.7	28.6	18.8
01/05/2014	56.3	60.9	54.5
01/06/2014	10.3	12	10.2
01/07/2014	81.6	73.9	78.7
01/08/2014	111.6	104.7	122.3
01/09/2014	44.5	35	51.6
01/10/2014	94.7	95.3	91.1
01/11/2014	97.6	98.3	97
01/12/2014	45.7	48.8	43.7
01/01/2015	62.4	68.4	59.6
01/02/2015	31.6	33.3	30.3
01/03/2015	28.3	22.6	30
01/04/2015	18.3	20.9	17
01/05/2015	50.9	49.2	51.7
01/06/2015	16	18.8	13.3
01/07/2015	54.8	54.9	55.3
01/08/2015	66.6	76.5	64.3
01/09/2015	57.1	55.4	57.4
01/10/2015	32.7	33	33.5
01/11/2015	53.1	58.9	51.1
01/12/2015	37.1	42.1	35

Metadata URL: https://catalogue.ceh.ac.uk/documents/33604ea0-c238-4488-813d-0ad9ab7c51ca
Terms & Conditions: http://eidchub.ceh.ac.uk/administration-folder/tools/ceh-standard-licence-texts/integrated-hydrological-units-of-the-united-kingdom-web-service/plain

APPENDIX 2

BACKFILL PHASING DRAWINGS AND RESTORATION PLAN



(22m AOD)
Temporary storage area for soils awaiting restoration of Tipping area
Sand and Gravel Pit
Phase 1
Phase 2
Phase 3
Phase 4
205900N
205800N
205700N
576300E
576400E
576500E
576600E
Pond
Track
Path (um)
Water Level 32.10
Water Level 36.75
Discharge Pipe
Inlet Pipe
Stockpiles
Tank
Storage Shed
Toilet
Office
Posts
St Clere's Hall
Clere's Cottages
Legend
Project
Title
Site

Based on the Ordnance Survey map with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright Reserved Licence No 100018848
Placement of Subsoils and Topsoils obtained from recycling operations
Temporary storage area for soils awaiting restoration of Tipping area
Hall Wood
Sand and Gravel Pit
Old Hare Wood
St Clere's Hall
Playing Field
MAIN ROAD
205900N
205800N
205700N
205600N
205500N
570000E
570500E
571000E
Legend
Installation Boundary
Tipping and restoration completed to original ground levels
Tipping face
Topsoil/subsoil storage bunds
Proposed recycling area
Definitive line of Footpath No.4
Project
Danbury Haulage (St. Clere's) Ltd. - Environmental Permit Application - Inert Landfill and Recycling Facility
Title
Site Layout and Waste Deposition - Phas e 5
AMEC Earth & Environmental Eastern Office
Tey Grove, Elm Lane, Feering,
Colchester, Essex, CO5 9ES
Tel: +44 (0)1376 572582 Fax: +44 (0)1376 572700
www.amec.com
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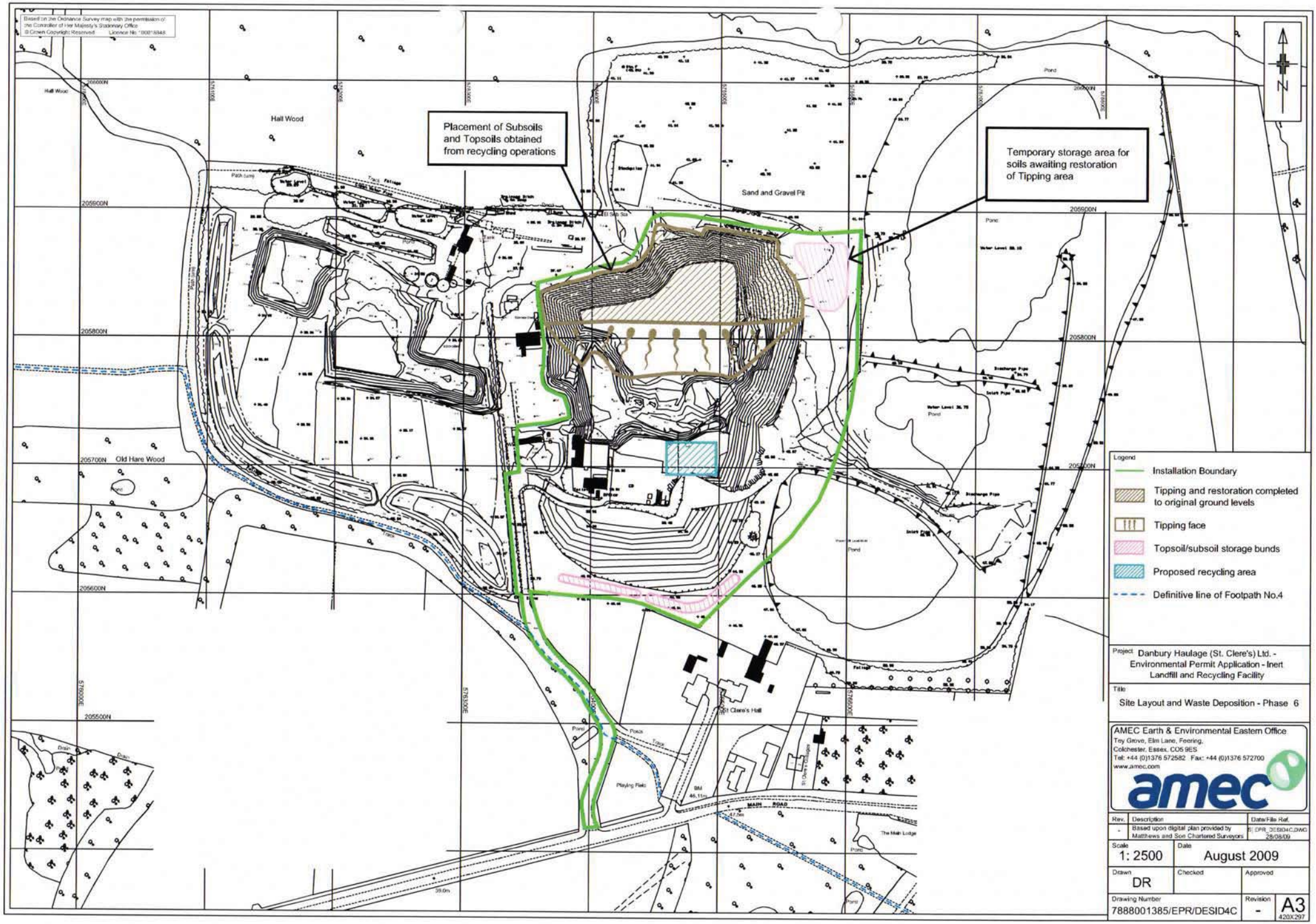
Date August 2009
Drawn DR
Checked
Approved
Drawing Number 7888001385/EPR/DESID4B
Revision -
A3 420X297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Placement of Subsoils and Topsoils obtained from recycling operations
Temporary storage area for soils awaiting restoration of Tipping area
Hall Wood
Sand and Gravel Pit
Old Hare Wood
St Clere's Hall
Playing Field
MAIN ROAD
205900N
205800N
205700N
205600N
205500N
576000E
576500E
577000E
N
Legend
Installation Boundary
Tipping and restoration completed to original ground levels
Tipping face
Topsoil/subsoil storage bunds
Proposed recycling area
Definitive line of Footpath No.4
Project Danbury Haulage (St. Clere's) Ltd. - Environmental Permit Application - Inert Landfill and Recycling Facility
Title Site Layout and Waste Deposition - Phase 6
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Placement of Subsoils and Topsoils obtained from recycling operations
Temporary storage area for soils awaiting restoration of Tipping area
Hall Wood
Old Hare Wood
Sand and Gravel Pit
St Clere's Hall
MAIN ROAD
205900N
205800N
205700N
205600N
205500N
576000E
576500E
Legend
Installation Boundary
Tipping and restoration completed to original ground levels
Tipping face
Topsoil/subsoil storage bunds
Proposed recycling area
Definitive line of Footpath No.4
Project
Danbury Haulage (St. Clere's) Ltd. - Environmental Permit Application - Inert Landfill and Recycling Facility
Title
Site Layout and Waste Deposition - Phase 7
AMEC Earth & Environmental Eastern Office
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Drawing Number: 7888001385/EPR/DESID4D
Revision: -
A3 420X297

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Title: Site Layout and Waste Deposition - Phase 8

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Scale	Date
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Drawn	Checked	Approved
DR		

Drawing Number	Revision	
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Placement of Subsoils and Topsoils obtained from recycling operations
Hall Wood
Sand and Gravel Pit
Old Hare Wood
St Clere's Hall
Playing Field
MAIN ROAD
The Main Lodge
Pond
Track
Path (um)
Drain
Legend
Installation Boundary
Tipping completed to original ground levels
Definitive line of Footpath No.4
Project Danbury Haulage (St. Clere's) Ltd. - Environmental Permit Application - Inert Landfill and Recycling Facility
Title
Site Layout and Waste Deposition - Phase 9
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Approved
Drawing Number 7888001385/EPR/DESID4F
Revision -
A3 420X297

Legend

- Installation Boundary
- 1st phase of woodland planting years 5-6 shown...
- 2nd phase of woodland planting years 8-10 shown...
- 3rd phase of woodland planting years 13-14 shown...
- Peripheral areas to be grassed shown...
- Definitive line of Footpath No.4

Finished contours shown at 1m intervals.

Project: Danbury Haulage (St. Clere's) Ltd. - Environmental Permit Application - Inert Landfill and Recycling Facility

Title: Proposed Restoration Plan

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