ENVIRONMENTAL PERMIT APPLICATION
MINING WASTE FACILITY

WASTE MANAGEMENT PLAN

STURTON LE STEEPLE QUARRY
STURTON LE STEEPLE
RETFORD
NOTTINGHAMSHIRE
DN22 9HW

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Information Sheet

ENVIRONMENTAL PERMIT APPLICATION: MINING WASTE FACILITY – WASTE MANAGEMENT PLAN: STURTON LE STEEPLE QUARRY, RETFORD, NOTTINGHAMSHIRE, DN22 9HW

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ENVIRONMENTAL PERMIT APPLICATION

WASTE MANAGEMENT PLAN

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1.0 INTRODUCTION

1.1 Sirius Environmental Limited ('Sirius') have been commissioned by Aggregate Industries UK Limited ('AI') to prepare an application for an Environmental Permit to operate a Mining Waste Facility associated with operation of mineral extraction and processing activities at Sturton le Steeple Quarry, near Retford, Nottinghamshire.

1.2 AI proposes to develop a sand and gravel quarry at a greenfield site approximately 2km east of Sturton le Steeple, Nottinghamshire. The c. 113 hectare site will operate as a sand and gravel quarry, utilising the nearby River Trent to load the processed mineral onto barges for transportation. The quarry will be connected to the public road network via an entrance junction on Gainsborough Road. It is estimated the quarry will produce approximately 6.7 million cubic metres of sand and gravel. The quarry is proposed to be worked in seven phases beginning in the south and will also contain overburden stockpiles, processing plant, silt lagoons and mineral stockpiles. It is proposed to restore the quarry to a wetland habitat area once the operations have ceased. Operation of the quarry and the processing of mineral reserve will generate extractive waste which will fall under the scope of the Mining Waste Directive and therefore an Environmental Permit is required.

1.3 This document comprises Aggregate Industries' Waste Management Plan to support its Environmental Permit Application. In the case where information has already been produced it will be referred to under the appropriate headings below and the existing data have been included as an appendix.

1.4 The purpose of this Waste Management Plan is to ensure that in operating the mineral activities AI will prevent or reduce waste production and its harmfulness, promote backfilling of the excavation void and recovery of waste, and ensure the short and long term safe disposal of the extractive waste generated at the facility.

2.0 FACILITY CLASSIFICATION

2.1 The proposed facility is not considered to be a Category A facility as it will not contain hazardous waste or dangerous substances. For further details on waste classification refer to Section 3 below.

2.2 In addition, a risk assessment (*Doc. Ref.: AI1017/07)* has been carried out over the entire lifecycle of the facility which demonstrates that the predicted consequences of failure due to loss of structural integrity (of the proposed heaps and silt lagoons) are insignificant in terms of loss of life, danger to human health or environmental impact. The risk assessment has been undertaken in accordance with the Approved Code of Practice for The Quarries Regulations and it covers all of the requirements detailed in Appendix 2 of the Environment Agency's guidance *"How to comply with your environmental permit additional guidance for: mining waste operations*" (Date: February 2011).

2.3 The risk assessment demonstrates with regard to the proposed design, operation and maintenance of the facility, even in the event of an accident, the mining waste facility will be able to contain the waste within the boundaries of the facility in the manner for which it was designed.

3.0 WASTE PREVENTION AND REDUCTION

3.1 The proposed extraction activities have been designed to consider waste production and reduce, where possible, the quantities generated. The phasing plan for the site defines the nature of extraction operations and contains a materials balance plan which presents the estimated quantities and rate of waste to be generated over the life of the quarry. Copies of these are included in the Supporting Statement to this Application (*Doc. Ref.: AI1017/08*).

3.2 The nature of the site operations and the treatment processes have been designed to minimise waste production through consideration of the phasing sequence, mineral extraction method and selection of plant and machinery. Further reductions in waste production from that detailed in the materials balance plan are not anticipated due to the nature of the geological strata, i.e. the waste to mineral ratio.

3.3 A key control for waste prevention will be the removal and appropriate storage of topsoil and subsoil (which are not defined as waste) in separate stockpiles to other extractive wastes, as illustrated in **Drawing No. AI1017/05/03.** It is proposed to utilise these soils to support subsequent restoration of the quarry. Consequently, it is not envisaged that other re-use options will be required. The materials balance plan in the Supporting Statement (*Doc. Ref.: AI1017/08)* indicates the quantity of soils estimated that will need to be removed and then stored pending reuse for restoration purposes.

3.4 It is not proposed to use chemicals to treat the extracted material and, therefore, the use of less dangerous substances is not a consideration at this site.

3.5 During the operation of the facility, further measures to reduce the quantity of waste generated will be considered as necessary, e.g. during review of the Waste Management Plan and / or when plant or machinery needs replacing.

4.0 WASTE CHARACTERISATION

4.1 Aggregate Industries proposes to operate a sand and gravel quarry with the extracted material being processed on-site via a washing process to remove silt from the sand and gravel. The finished product will be supplied to the construction industry.

4.2 Detailed geological information about the resource presented in **Appendix 1**.

4.3 The extraction of sand and gravel will generate both extractive waste and non-waste material. The non-waste will comprise of the soil and subsoil which needs to be removed to access the mineral reserve. The mining/extractive wastes will comprise of process fines (silt) which will be separated out from the required mineral product (i.e. sand and gravel) during the on-site processing operations. It is estimated that approximately 480,000 m^3 of extractive waste will be generated during the operational phase of the quarry. The silt will be washed out of the sand and gravel and accumulated in lagoons to settle out of suspension. The soil and peat overburden material will be transported to on-site stockpiles using dump trucks.

4.4 Silt will be separated out from the product during the washing process; the silt will be settled out in a series of lagoons before the water is recycled back to the washing plant. The silt will not be removed from the lagoons, which are the permitted mining waste operation. Surface water runoff will be treated to remove suspended solids before discharge to the adjacent waterways if necessary. Full

details on the proposed methods of mineral extraction and processing have been provided to the Mineral Planning Authority to support the planning application for the site; an extract containing the relevant information is provided in **Appendix 2**. A detailed surface water management plan has been developed to support the planning application and a copy is provided in **Appendix 5**; this includes details of the location, design, capacity, and flow rates etc. of the surface water management system.

4.5 The following waste types are expected to be generated:

- 01 04 12 tailings and other wastes from washing and cleaning of minerals other than those mentioned in 01 04 07 and 01 04 11

5.0 SITE OPERATIONS AND WASTE TREATMENT

5.1 As mentioned in **Section 3** above, details of the proposed waste treatment are provided in **Appendix 2**. The operations have been designed to prevent or reduce waste production and, where waste will be generated, to recover the waste where it is environmentally desirable (refer to **Section 6**).

6.0 ENVIRONMENTAL RISK ASSESSMENT

6.1 An Environmental & Accidents Risk Assessment (*Doc. Ref.: AI1017/07*) has been prepared in accordance with the template provided in the Environment Agency's risk assessment guidance.

6.2 The environmental risk assessment considers the changes that the waste may undergo whilst being exposed to conditions above ground and the environmental impact of returning waste to the void (based on the identification of sources-pathways-receptors).

6.3 The environmental risk assessment demonstrates that the proposed mitigation measures will ensure the safe disposal of mining waste in both the short and long term.

7.0 RISK MITIGATION

7.1 The Environmental & Accidents Risk Assessment (*Doc. Ref.: AI1017/07*) details the proposed risk mitigation measures which AI propose to put in place at Sturton le Steeple Quarry. Aggregate Industries' Environmental Management System complies with the requirements of ISO 14001:2004.

8.0 CONTROL AND MONITORING

8.1 The Environmental & Accidents Risk Assessment (*Doc. Ref.: AI1017/07*) demonstrates that, due to the nature of the waste to be generated (inert) and the proposed mitigation measures, there will be no significant risk from leachate, particulate matter, mud, odour, noise/vibration or accidents at the site. Therefore, no quantitative monitoring of these parameters is proposed.

8.2 It is proposed that there will be a point discharge to the New Ings Drain from the freshwater lagoons, which will take settled water from the silt lagoons. The settlement ponds will collect silt from the product washing process and surface water run-off from the site. A detailed surface water management plan has been developed to support the planning application as detailed in **Appendix 5.**

Details of the location, design, sizing etc. of the settlement lagoons can be seen in **Drawing No. AI1017/05/03**. Quarterly monitoring for suspended solids and visible oil and grease is proposed at the point where the discharge leaves the Environmental Permit boundary.

9.0 PROPOSED PLAN FOR CLOSURE

9.1 The development plan for the site that has been produced as part of the planning application, sets out the plan for closure and restoration of the site. An excerpt of the Restoration Plan presented in support of the planning application are presented in **Appendix 3**.

10.0 MEASURES FOR THE PREVENTION OF ENVIRONMENTAL POLLUTION

10.1 The environmental risk assessment discussed in **Section 6** above has identified all of the potential hazards and pollution linkages at the site, the risks they pose and the risk management measures which AI proposes to implement in order to mitigate those risks. The proposed risk mitigation measures are considered to meet the requirements of the Mining Waste Directive, including the need to prevent water pollution.

10.2 The Environmental Risk Assessment (**Section 6**) considers the potential for leachate to be generated over the life of the site (in order to prevent the contamination of soil, groundwater and surface water). The risk assessment has demonstrated that, as the wastes to be generated will be inert, there will be no source to generate polluting leachate. Therefore, it will not be necessary to collect or treat leachate at the site.

APPENDIX 1
Geological Summary

7.0 GEOLOGY

Introduction

7.1 The geology of the Application Site has been investigated in detail and is described within this section in the context of its regional and local settings. The investigations have been undertaken on the basis of a desk study of all the available geological data.

Regional Geology

7.2 The following sources of information, which detail the geology of the application site and the surrounding area, have been consulted as part of this review:

- British Geological Survey Sheet 1:50,000 scale, No. 101 (Solid and drift) – East Retford (1967) and Sheet No 102 (Solid and Drift) Market Rasen (2000).

- Institute of Geological Sciences Mineral Assessment Report 1:25,000 scale. Resource sheet SK88 and part of SK78 - The sand and gravel resources of the country south of Gainsborough, Lincolnshire.

7.3 The regional geological setting of the Application Site is shown on Drawing SLS3/1a, which is an excerpt from geological maps No.101 and 102 (solid and drift).

Drift Geology

7.4 The geological sheet shows that the application site, which is entirely within the Trent valley is overlain by alluvium and a mask of primary terrace deposits consisting of sands and gravels in varying proportions with a small percentage of fines. These grade laterally into silts and clays, particularly along its western extremity. The primary terrace deposits are associated directly with the river Trent which is orientated north to south located approximately 1 kilometre to the application site.

7.5 The first terrace consists predominantly of sand and gravel deposits which show considerable lateral and vertical variation in composition. The sand component predominate the south west of the area although in areas where there is alluvial cover, pebbly sands, sandy gravels and gravel are also common. The mean gradings of all the samples taken from the first terrace throughout the area are: 3% fines (silt), 77% sand, and 20% gravel. However sand and fines components below the water table are often thought to be present in somewhat higher percentages. The gravels are typically sub-rounded to well rounded fine and coarse grained and occasionally have a basal horizon of cobbles. Many of the clasts are well rounded, hard brown and purple quartzites, which are probably derived from the Permo-Trias and Carboniferous Formations in the area. Other principal constituents in terms of abundance are vein quartz followed by flints and cherts which have been

dated in the range from Cretaceous to Carboniferous in age. There are also small amounts of red and brown sandstones, and locally derived siltstones and mudstones, together with some Carboniferous and Jurassic limestone gravel. However, the latter only contribute a small percentage of the sequence and are generally present only in fine gravel horizons within the deposit. Other infrequent gravel constituents include conglomeritic, metamorphic and dark fine grained igneous rocks.

7.6 The sand within the deposit ranges from fine to coarse grained with the medium grade usually dominant. The sands typically consists of sub-rounded to well rounded quartz grains with subordinate sub-angular to rounded lithic rock fragments which are generally coarser than the quartz grains. The fines present within this particular deposit consist of reddish brown silt.

7.7 Overburden is widely distributed across the area, and is usually comprised of a combination of topsoil lying above clay and attaining a maximum vertical thickness of approximately 0.6 metres.

7.8 To the west of the mask of primary terrace deposit, the drift is less extensive, and often completely absent, and only small pockets of Boulder Clay-Wragby Till, glacial sands and gravels, and some alluvium in small river valleys such as that between North Wheatley and South Wheatly are present. In places there are small and discontinuous deposits of glacial sand and gravel.

7.9 The greater part of the Trent valley in this area is overlain by the First (or primary) Terrace deposit, which is often overlain further by alluvium. The valley ranges from between 2 kilometres wide to the southeast of Gainsborough to 3.5 kilometres wide approximately 4 kilometres south of the application site.

7.10 To the east of the River Trent the drift deposits are much more variable and patchy in their nature. There are some deposits of alluvium however these are significantly reduced in their lateral extent when compared to those of the west, and attain an average lateral width of only 0.5 kilometres. However to the east of this area is located a further more substantial deposit of glacial sand and gravel, which extend from the south of Gainsborough almost continuously southwards, with just a few small marginal deposits of river terrace material. To the immediate west of the application site the drift deposits have a lateral width of approximately 2 kilometres. Further east the deposits appear quite patchy initially, although gradually deposits of Boulder Clay, known locally as the Wragby Till, become more extensive. This till is commonly comprised of a chalky clay diamicton, which extends eastwards over much of the low ground to the north of Wouldingham-by-Stow.

7.11 To the south of this area only small deposits of drift occur, and these are notably of glacial sands and gravels, alluvium, boulder clay and river terrace deposits.

Solid Geology

7.12 Permo-Triassic rocks comprise the vast majority of the solid geology within the Sturton Le Steeple District. Triassic strata found within the region include Keuper Marl (KM) and Tea-green Marl (TGM) of the Mercia Mudstone (Keuper subdivision), and the Rhaetic Beds (RB).

7.13 Beneath the drift deposits in the Sturton Le Steeple area the bedrock comprises of the Keuper Marl Formation (also known more latterly as the Mercia Mudstone (MM) -an important division of the later part of the Keuper Series, which is part of the Upper Triassic).

7.14 Mercia Mudstone Formation marls are frequently red to reddish-brown, hard and blocky in character, sometimes mottled with green and interbedded subordinate green marls. There are often hard bands of red and green 'marlstones' and fine-grained, pale coloured sandstone bands. The 'marlstones' are frequently dolomitic, and in thin section show rhombs of dolomite with subordinate calcite, with or without angular grains of quartz and feldspar. The accompanying sandstone bands are often grey, flaggy, and micaceous and they often have impressions of rock-salt cubes. Ripple-marks and rain-pit's are frequent and they are often associated with thin ribs and films of gypsum. The dip to these beds is variable, but approximates to a gentle eastward to south eastward dip of less than 10 ° (2-5 ° locally).

7.15 Gypsum can be found in thicker and even sometimes economical deposits within the Mercia Mudstone. These beds are known locally as the Clarborough Beds (ClB) these outcrop the west of the application site just to the west of North Wheatley: these form a north-south trending outcrop, which strikes parallel to the Trent valley.

7.16 Towards the base of the Mercia Mudstone there is often a series of harder green sandstones and siltstones, which are termed 'Keuper Waterstones' or 'Skerries'. These beds vary in their extent and thickness and are often completely absent. Underlying the Mercia Mudstone are the Bunter Pebble Beds, these are also Triassic in age and a characterized by the presence of many conglomeritic horizons often of substantial thicknesses and have been worked economically in the past as a source of sand and gravel. These beds are described typically as; a coarse loosely cemented conglomerate, with clasts from 2-10 cm consisting of predominantly quartzite, vein quartz and basic fine grained igneous pebbles in a reddish brown sand matrix.

7.17 To the east of the Trent valley the Triassic Mercia mudstones are still evident at sub-surface for a short distance before giving way to the overlying limestones of the Lower Lias. The regional strata have a younging direction to the east, with the Lower Lias, being overlain by Upper Jurassic strata including the Kimmeridge Clay, Oxford Clay and the Great Oolite series. Further to the east still the strata are overlain by Cretaceous chalk.

7.18 The summary characteristics of the geological succession are shown in Table 7/1.

Table 7/1: Geological Succession

	Formation	Characteristics
1	Overburden	Consists of topsoil and clay, which has a maximum thickness of 0.6m
2	Alluvium	A thin mask of alluvium consisting of clay, which is often overlain by peat. ~ 6m.
3	1st Terrace	First terrace deposits are composed of pebbly sands and sandy gravels.
4	Keuper Marl Formation (KM) Also known as Mercia Mudstone.	Red to reddish brown, hard and blocky in character, sometimes mottled with green and interbedded with subordinate green marls.
5	Bunter Pebble Beds	Coarse loosely cemented conglomerate, with clasts from 2-10cm consisting of predominantly quartzite, vein quartz and basic fine grained igneous pebbles in a reddish brown sand matrix.

Site Specific Geology

7.19 In general the application site is dominated by alluvium and overlying terrace deposits originating from the palaeo-channels associated with the course of the present-day River Trent. The deposits include only the primary terraces of sand and gravel that are underlain by the Mercia Mudstone bedrock. All the materials with any economical and workable mineral prospects within the site are part of the sequences of sand and gravels from the First or Primary Terrace deposits.

7.20 The immediate locality of the application site has been subject to the drilling of several series of public domain reconnaissance boreholes. The location of these boreholes is shown on Drawing SLS 3/2. These boreholes were drilled primarily in the 1970's. Four of these boreholes are within the vicinity of the site boundary. These are NW55, SW9, NW53, and SW3. All four of these boreholes were drilled to the base of the First Terrace deposits, or the top of the bedrock, which is the Keuper Marl.

7.21 The alluvium is present only in the east of the application site, which is the closest point to the River Trent. This is generally between 9 metres (NW55), 5.6 metres (SW09), 4.89 metres (NW53), and 3 metres thick (SW03) and largely consists of pale brown clay to approximately 4m depth. Below this is dark and peaty with occasional sand pockets.

7.22 The surface elevations of the first terrace lie between 3.4 and 5.2 mAOD and generally have an average basal elevation of 12.03 mBOD. This fills a deep valley which follows the approximate course of the river Trent

7.23 Borehole NW53 was drilled in December 1971, and is located approximately 900m to the west of the application site. This borehole revealed a thickness of 4.8 metres of alluvium of which the uppermost 1.9 metres was pale brown clay, and the remaining 2.9 metres was pale mottled brown and black silt. Below this was found to be 3.9 metres of First Terrace deposits, which consisted of medium well rounded to sub angular quartzitic sand, which became pebbly towards the base. The pebbles consisted of sub rounded quartz and quartzite. The base of this deposit in this borehole was found to be 8.7 metres below ground level, which is the top of the Mercia Mudstone.

7.24 Borehole NW55 is located in the north east corner of the application site. This borehole was also drilled in December 1971. In this location the alluvium was found to be 9 metres thick, which comprised of pale brown clay to 4 metres with a further section of peaty clay and associated sand lenses below. Underlying the alluvium was the First Terrace deposits, which were found to have a similar thickness to those in NW53 at 3.3 metres. These are described as clayey and sandy coarse to fine gravel of sub rounded to well rounded quartz quartzite and chert. The top of this sequence is predominantly sand, which is medium grained, sub rounded to sub angular quartz with rock clasts and coal. This directly overlies the Mercia Mudstone bedrock at 12.3 metres below ground level. Borehole SW09 was also drilled in December 1971. This revealed an overburden of 0.3 metres consisting of topsoil above a further 5.6 metres of alluvium, consisting of clay and peat. This was underlain by 8.4 metres of First Terrace deposits consisting of sands and gravel (similar to Borehole NW53). The Mercia Mudstone bedrock was encountered at 14.3 metres below ground level.

7.25 The final borehole in the 1971 Series which is of interest is SW3, which is located just outside the eastern most boundary of the application site (The Mother Drain).

7.26 Samples from all three of these boreholes were graded and the results were as follows;

	Borehole	Gravel %	Sand %	Fines %
1	NW55	52	41	7
2	NW53	4	93	3
3	SW09	43	54	3
4	SW03	25	74	1

7.27 A more recent series of boreholes have been drilled within the site boundary itself by Metcalfe Bros in the August-September period of 1999. This revealed that only a minor propotion of the original exploration area was underlain by what can be described as a deep buried channel. This channel is filled with deposits of sand and gravel of the First Terrace. Eight out of a total of nineteen boreholes failed to determine viable thicknesses of sand and gravel. A further fourteen boreholes were advanced during September 2003 in order to better define the geology of the mineral resource, as determined during the 1999 series of borehole drilling.

7.28 A total of nine boreholes belonging to 2003 suite of drilling are located within or on the application site boundary. Borehole SE03/1 is located on the northern boundary of the application site, and has indicated a considerable thickness of overburden, which extends to an approximate depth of 7.2mBGL, below which only 2.3 metres of sand and gravel were proven because the drillers did had insufficient casing to drill to any greater depth. It is thought that the mineral deposit is likely to extend to a greater depth in this location. At the nearby borehole, SE03/2 the workable sand and gravel horizon has a total thickness of 8.8m and extends to 10.5mBGL.

7.29 Boreholes SE03/2, SE03/4, SE03/7, and SE03/9 are located to the east of the application site and were situated within the river terrace deposits, whereas boreholes SE03/8, SE03/10, SE03/11, SE03/5, and SE03/1 are located in the west of the application site, and are situated on 'Flood Plain' Alluvial deposits.

7.30 These boreholes show a varying thickness of overburden, ranging from 0.7m thick in SE03/4 and SE03/7 at the western margin of the application site to 7.6m in SE03/5 towards the east. The overburden appears to be relatively thin towards the northwest. However in borehole SE3/01, which is situated on the northern extent of the permitted extraction boundary, the peat reaches a thickness of 7.2m, and therefore indicates the somewhat hetrogenous character of the peat distribution and thickness.

7.31 The vertical thickness's of the sand and gravel deposits, within the proposed, extraction boundary do not appear to vary on an inverse basis when correlated with the peat thickness distribution. The sand and gravel deposits reach their maximum thickness in the central portion of the application site, as depicted by boreholes RW6, SW09, and RW7, showing thickness's of 8.6m, 8.4m, and 8.3m respectively. In these locations in both RW6 and SW09 peat was present, although it is completely absent in RW7.

7.32 Borehole SE03/7 in the far west of the application site demonstrates a distinct absence of gravel, and is described as silty fine to medium sand, with very thin soft clay bands, and occasional charcoal and pebbles, whereas borehole SE03/5 on the eastern extraction boundary, shows a high percentage of gravel, in both the sand horizons and the peat. This correlation, which shows apparent paucity of the gravel content to the west, and is likely to be indicative of the absence of the buried gravel channel. This conclusion can be further demonstrated in several boreholes notably SE03/2P, SE5 both of which are located in the vicinity of the western extraction boundary.

7.33 The site specific drilling determined that the overburden on the site consists of topsoil and subsoil, which usually overlie the silts and the clay attributed to the deposition of alluvium. The overburden appears to be thicker in the north eastern part of the application site, where a channel feature is present. This superficials geology of the application site varies on the basis of both lithology and thickness between the west of the application site which is dominated by 'Terrace deposits' and the east of the application site which is

predominantly consists of alluvial floodplain deposits. The overburden in the terrace area is underlain by an average of 4.75 m of fine 'mortar' grade sand, which is further underlain by gravels of the First Terrace deposit. The 'mortar' sand may constitute part of the overburden if it is found to have limited conformity to BS EN standards. The most significant part of the mineral resource is located within the buried channel area, which contains variable thicknesses of sand of concreting grade, together with gravels. The reported thicknesses of these materials lie in the range between 0 m and 8.6 m. The limits of the buried channel area form the basis of the geological constraint on the development of the application site.

7.34 On the 'Floodplain' the average thickness of the clays and silts is approximately 2.21m, however this is underlain by an average value of 5.02 m of peat, which amounts to an average total cumulative overburden thickness of 6.01 m.

7.35 Based upon the three recent drilling investigations conducted from 1971 to 2003, the typical average properties for the whole application site are as follows:

- Mean Overburden Thickness (m)=4.96 (western terrace-if mortar sand included)
- Mean Overburden Thickness (m)=6.01 (eastern floodplain)
- Mean Mineral Thickness (m)=5.54 (western terrace)
- Mean Mineral Thickness (m)=5.88 (eastern floodplain)
- Mean Mineral Thickness (m)=5.714

7.36 Based upon borehole data from the 1971 series the mineral proportions are as follows:

- Gravel Proportion%=40
- Sand Proportion%=58
- Fines Proportion%=2

7.37 The boundary used to separate the western and eastern parts of the site is the western extent of the alluvium deposits which overlie the First Terrace as defined by the original regional surveys

7.38 The sand arising from the terrace deposit is generally found to conform to the requirements of British Standards and is classified as medium grained concreting sand. (67% of it passes the 600μm sieve). The mortar sand unit is typically fine to medium grained and complies in grain size distribution terms with the required specification.

7.39 The gravel fraction is comprised mainly of quartz, quartzite and flint pebbles with some marl and siltstone.

7.40 It is envisaged that any deleterious components would be selectively removed during mineral processing.

7.41 In summary the characteristics of the site specific geology are shown in Table 7/2.

Table 7/2: Site Specific Geology

	Formation	Characteristics
1	Top soil	Light brown silt with fine sand variable thickness.
2	Alluvium	Silty brown clays, silt, and Peat
3	1st Terrace	Fine to medium well rounded quartzitic sands with some gravel, overlying well rounded to subrounded gravels of mostly quartz, quartzite and flint.
4	Mercia Mudstone bedrock(MM)	Red to reddish brown, hard and blocky in character, sometimes mottled with green and interbedded with subordinate green marls.

Conclusions

7.42 The geological setting of the proposed extraction site at Sturton Le Steeple has been investigated in order to determine its potential for development as a source of high value aggregate products.

BGS Sheet 101

BGS Sheet 102

NOTES

SEE DRAWING No. SLS7-1A FOR KEY

LAFARGE AGGREGATES

Site	STURTON LE STEEPLE
Project	ENVIRONMENTAL STATEMENT
Drawing	**Extract from Solid & Drift Geological Sheet**
Date	AUGUST 2006
Drawing No.	**SLS7/1**
Scale	1:50,000

403-0164-00060_0806_ES_SLS7-1_0 403SW

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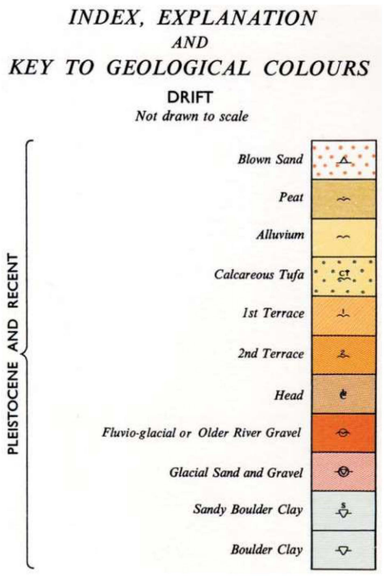
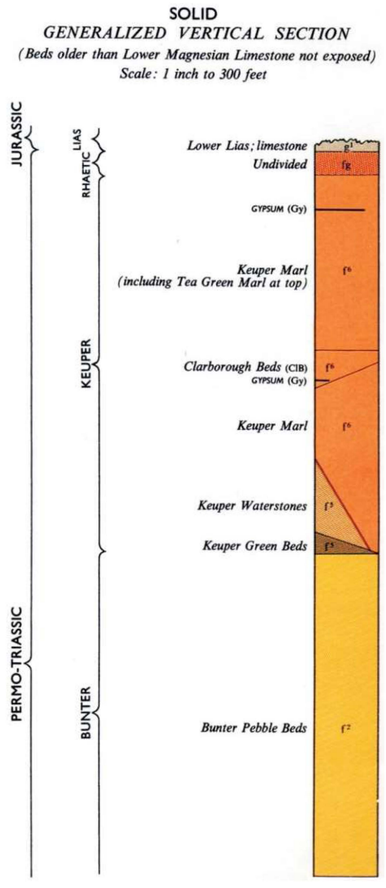
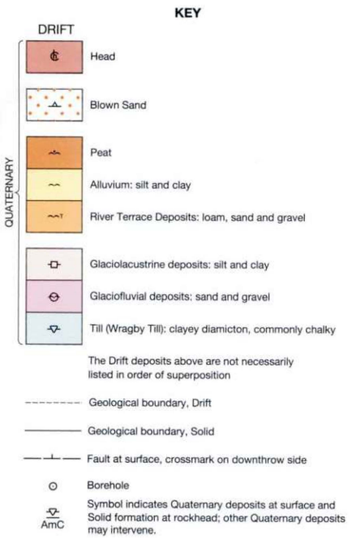
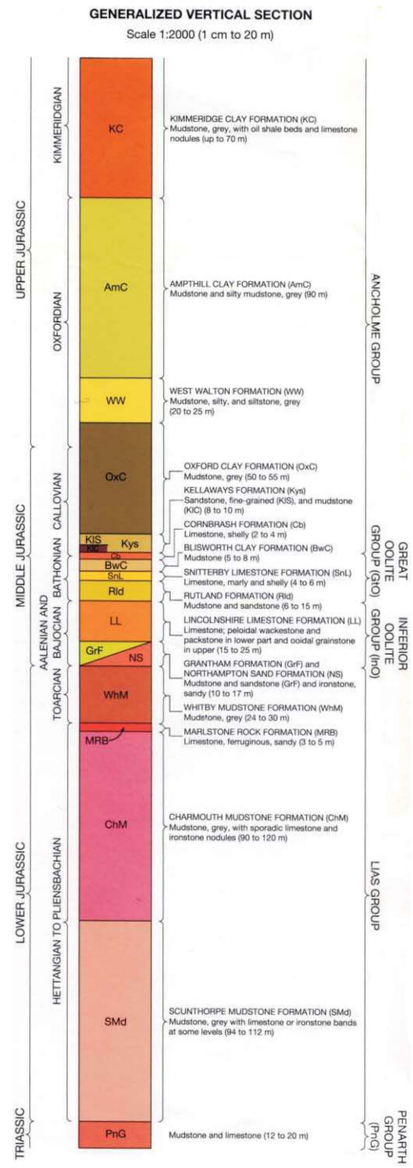
Solid & Drift Keys for BGS Sheet 101







Solid & Drift Keys for BGS Sheet 102



NOTES

SEE DRAWING No. SLS7-1 FOR SOLID & DRIFT GELOGY MAP

LAFARGE AGGREGATES

Site: STURTON LE STEEPLE

Project: ENVIRONMENTAL STATEMENT

Drawing
Extract from Solid & Drift Geological Sheet - Keys

Date: AUGUST 2006

Drawing No.: **SLS7/1A**

Scale: AS SHOWN

403-0164-00060_0806_ES_SLS7-1A_0 403SW

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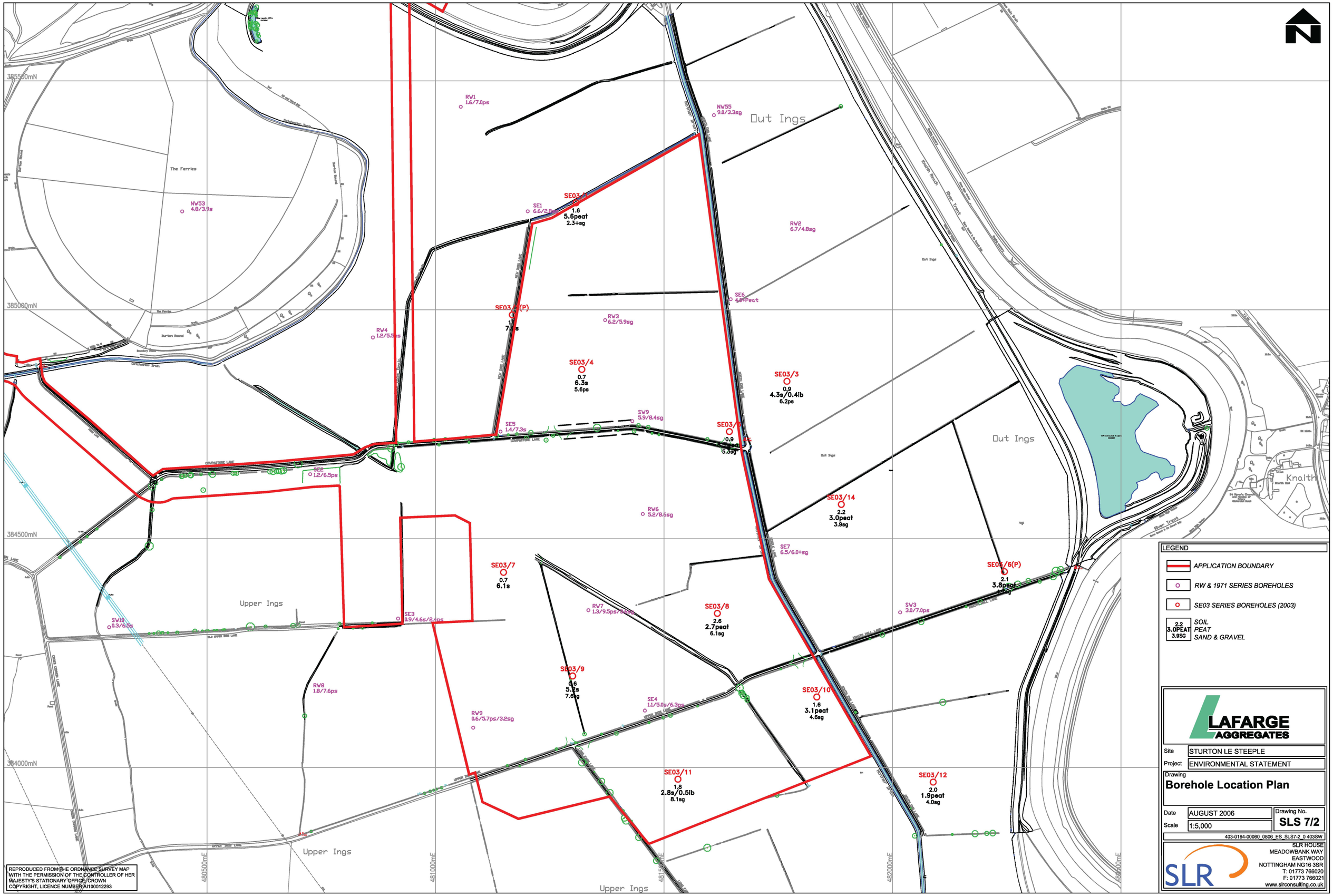

LEGEND

- APPLICATION BOUNDARY
- RW & 1971 SERIES BOREHOLES
- SE03 SERIES BOREHOLES (2003)
- 2.2 SOIL
- 3.0PEAT PEAT
- 3.9SG SAND & GRAVEL

LAFARGE AGGREGATES

Site: STURTON LE STEEPLE

Project: ENVIRONMENTAL STATEMENT

Drawing: **Borehole Location Plan**

Date: AUGUST 2006

Drawing No.: **SLS 7/2**

Scale: 1:5,000

403-0164-00060_0806_ES_SLS7-2_0_403SW

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APPENDIX 2
Phase Working and Restoration Summary

5.5 This section should be read in conjunction with Drawings SLS 5/1 to SLS 5/8 inclusive. Details relating to the restoration of the application site are set out in the following section (Section 6), which should be read alongside Drawings SLS 6/1 and SLS 6/2.

Overview of the Development Proposals

5.6 The development proposals seek to extract approximately 7.5Mt of sand and gravel from an area of around 61.3 ha. Excavated materials would be transported from the working face to the plant site by dump trucks using dedicated haulage routes within the working area. The processing plant would comprise crushing, washing and screening plant, together with sand classifiers, and would 'sort' the excavated material into a range of saleable sands and gravels, graded by size. Processed aggregates would be stored in open stockpiles, pending distribution. The prime mode of distribution would be by road, however, the proposals make provision for the establishment of a wharf on the River Trent to allow barges to be loaded with aggregates.

5.7 A number of ancillary development and infrastructure works would be required to support the proposals, most notably the construction of a new access onto Gainsborough Road and an internal access road linking the plant site with the public highway. Other ancillary developments would include office accommodation, weighbridge, wheel cleaning facilities, fencing and landscaping works.

5.8 Drawing SLS 5/1 shows the general layout of the application site, identifying the mineral extraction area, subdivided into seven phases, plant site, freshwater and silt lagoons, soil storage areas and access road. It also shows the location of the proposed wharf and conveyor linking the wharf with the plant site.

5.9 The development of the application site can therefore be described in three distinct phases:

- The construction of the access onto Gainsborough Road, the internal access road, and plant site and associated infrastructure, including aggregates wharf.
- The phased extraction of minerals together with progressive restoration
- The final restoration of the site.

Initial Site Development

5.10 Before any mineral extraction operations could commence a number of initial operations (termed site preparation works) would be required. These initial site preparation works are illustrated on Drawing SLS 5/2 and would take approximately six to twelve months to complete.

Construction of Access and Access Road

5.11 The new access on to the 'c class' road (Gainsborough Road) would be constructed in accordance with the details set out in Section 11, and in particular, as shown on drawing 63239/008. The access would be designed such that quarry traffic would be engineered to turn right from the access road onto Gainsborough Road towards the A620. The applicant would be prepared to enter into an appropriate routing agreement.

5.12 Topsoil (TS) and subsoil (SS) would be stripped from along the line of the proposed access road to accommodate the laying of the pavement, and placed within small soil storage banks (TS Banks A-D and SS Banks A and B). These storage banks would be approximately 1.5m to 3.0m in height and situated along the line of the access road, as shown on Drawing SLS 5/2. In particular, to help prevent glare from headlights of lorries affecting properties to the north of Sturton-le-Steeple (mainly during the winter months) a 2.5m high topsoil bank (TS bank A) with shallow outer gradients (1:10 v/h) would be placed along a small section of the southern boundary to the access road (where the road bends to the south adjacent to the West Burton SINC), whilst a 3m high bank (SS Bank A) would be located adjacent to Gainsborough Road to help screen the access road from the public highway.

5.13 The internal access road would be approximately 2.8km in length, linking the proposed plant site with the site entrance. The access road would be constructed from bituminous bound materials (tarmac) and incorporate all necessary drainage measures. The line of the road, being illustrated on Drawing SLS 5/2, follows field boundaries wherever possible to avoid the severance of agricultural land. The proposals for the access road also involve creating two bridging points over a small ditch as well as the main Catchwater Drain. In addition crossing points for Footpaths Sturton-le-Steeple (SLS) 16 and 17 and Bridleways SLS 11/13 would be provided: the latter would include lockable gates to help prevent trespass along the route of the access road. Accommodation works (i.e. gates) would be installed as appropriate to facilitate adjoining farmers access.

5.14 Additional tree, shrub and hedgerow planting would be undertaken within the vicinity of the site entrance to provide a 'landscaped' site entrance as well as screen the road from Sturton-le-Steeple.

5.15 Following construction of the access road an agricultural fence would be erected along the southern boundary of the road to ensure that the maximum area of land is preserved for agricultural use. A small section of close-boarded fence would be erected adjacent to the gap in the boundary hedge immediately to the south of St. Ives bungalow to provide additional visual and accoustic screening to the property. The grassland areas within the access road corridor would be managed. Finally, the plant site and freshwater and silt ponds would also be fenced off in accordance with Mines and Quarries legislation.

Construction of Plant Site

5.16 Soils would be stripped from the footprint of the plant site, silt and fresh water lagoons and internal access roads to the southern extraction areas, and placed within the soil storage/screening banks around the plant site and adjacent to the haul road to the east of Phase 2 (shown as TS Banks 1-3 and SS Bank 1 on Drawings SLS 5/1 to 5/8).

5.17 Following soil stripping, concrete foundations would be laid and the processing plant and ancillary buildings and structures erected within the plant site. This would be followed by the surfacing of vehicular manoeuvring areas. The proposed plant layout is shown on drawing MP300.

5.18 Finally, mineral would be excavated from an area to the south of the plant site to create the freshwater and silt lagoons.

Wharf Construction

5.19 The proposed wharf would be located to the north of the plant site on the southern bank of the River Trent. The wharf would be fed by conveyor from the plant site where processed material would be discharged directly to barges for onwards transportation. The proposed alignment of the conveyor route and location of the wharf is shown on drawing number SLS 5/1; it is proposed that soils from this area would be placed alongside the line of the conveyor. The proposed constructional and elevational detail is shown on Drawing 63239/009

Phased Mineral Extraction

5.20 As set out in Section 2, the application site is crossed by two bridleways (routed along Cowpasture Lane and Upper Ings Lane). The proposals allow for the retention of these public rights of way, and thus the application site can be divided into three resource blocks.

5.21 It is proposed that sand and gravel would be extracted in a series of seven phases progressing in a general northerly direction from the southern boundary of the application site. The mineral would be dug using a 360° hydraulic excavator, loading the 'as dug' material into the back of articulated dump trucks for transportation to the plant site. At the maximum proposed production rate of 500,000 tonnes per annum it would take approximately 15 years to extract the mineral and complete the final restoration of the application site.

5.22 Key elements of the proposed development include:

- The plant site has been located central to the mineral deposit but not located on mineral as far from built development as possible having regard to other constraints. The existing woodland would either provide screening or the plant site would be set against a backdrop of woodland dependant upon the direction of the view.

- The removal of peat from the extraction area to expose archaeological information and to be used in the proposed restoration of the site.
- The mineral would be worked dry by de-watering in turn the individual phases of the extraction area separately. Water would be pumped into silt lagoons to settle out any suspended solids to prevent pollution prior to discharge into the surrounding water courses (subject to appropriate consents).
- Extensive archaeological work has been undertaken at the application site in the preparation of these proposals and, whilst within the flood plain, features of Bronze Age interest have been found, including a potential causeway structure, which would be subject to detailed archaeological recording.
- Other potential sites of archaeological interest exist either adjacent to, or within the confines of the application site. The area adjacent to the plant site would be protected and preserved. Other potential sites within the application site would be recorded by archaeologists prior to excavation.
- In order to prevent any potential damage to the Scheduled Ancient Monument associated with the site of the Roman Town of *Segelocum*, a stand-off of 1 km from the southern resource block (Phases 1 and 3) is proposed. To further prevent any possibility of damage by de-watering, a deep recharge trench would be dug along the southern boundaries of Phases 1 and 3 and kept full of water during the operational life of these Phases.

5.23 The material audit relating to each of the Phases is summarised in Table 5/1 below.

Table 5/1
Summary of materials

Phase number	Soil Volumes	Clay overburden volumes	Peat overburden volumes	Total Silts (Sand and S&G)	Sand (Saleable Tonnes)	S&G (Saleable Tonnes)	Estimated life
Init. Dev.	115,600m³						
1	48,500m³	11,800m³	0m³	46,100m³	282,700st	438,100st	1.40yrs
2	61,700m³	0m³	0m³	59,700m³	883,600st	0st	1.80yrs
3	26,800m³	7,200m³	70,300m³	9,700m³	5,100st	151,700st	0.30yrs
4	128,200m³	99,700m³	361,800m³	76,200m³	118,900st	1,103,400st	2.40yrs
5	66,300m³	0m³	0m³	77,900m³	499,300st	715,700st	2.40yrs
6	94,400m³	28,000m³	46,800m³	101,000m³	572,400st	1,009,900st	3.20yrs
7	196,300m³	38,000m³	730,100m³	108,200m³	212,700st	1,519,800st	3.50yrs
TOTALS	**737,800m³**	**184,700m³**	**1,209,000m³**	**478,800m³**	**2,574,700st**	**4,938,600st**	**15.00yrs**

Note: Operational years based on saleable tonnes per annum of 500,000 tonnes.

Summary of Working and Restoration by Phase

5.24 As set out in paragraph 5.8 above, the overall phasing of the proposed development is shown on Drawing SLS 5/1. This Drawing shows the position of the site entrance, the route of the access road, the location of the plant site and barge loading facilities, as well as the two main soil storage areas and the archaeological areas and the extraction phases.

5.25 The subsequent drawings, numbered SLS 5/3 to SLS 5/8, show a phase by phase progression of the development through the 15 year life of the quarry. Drawings numbered SLS 6/1 and SLS 6/2 (contained in Section 6) show the final restoration concept of the application site. The former shows an overview of the whole development and the later concentrates on the restoration of the plant site and extraction areas at a larger scale.

5.26 The following paragraphs give a brief summary of the key elements of the development during the operational life of the site following the phased sequence of drawings described above. These are shown as a series of stages of the proposed development. Development can take place in more than one phase in any given stage.

Stage 1 - Phases 1 and 2 (Drawing SLS 5/3)

5.27 Before any works in Phase 1 commence, a gated entrance splay to the phase from the internal haul road where it crosses Upper Ings Lane, to the east of Phase 2, would be constructed. This crossing point and entrance would be located at the north western corner of the Phase.

5.28 Phase 2 has been found to contain just sand deposits. In view of this it is necessary to work this phase in parallel with other phases that contain a gravel fraction to enable an appropriate mix of aggregates to be produced. Phase 2 would therefore be worked alongside Phases 1, 3 and 4. In addition this area is required to create a suitable area to receive peat as part of progressive restoration.

5.29 Top and sub soils would be progressively stripped from the Phase 1 and Phase 2 areas to expose the underlying sand and gravel (the extent of land stripped would be sufficient to sustain around 18 months working). Stripped soils would be placed within the adjacent soil storage/screening banks (TS Banks 4-8 and SS Bank 2), to the west and south of Phase 2 and to the west and north of Phase 1. These storage banks vary in height from 1.5m to 3.0m. A recharge trench to the south of Phase 1 would also be excavated.

5.30 The extraction of sand and gravel from Phase 1, and sands from Phase 2 would then commence. In both cases, extraction operations would start at the eastern boundary of the phase and progress in a general westerly direction towards the design limit. Water pumped from the mineral workings, as described above, would be pumped to the recharge trench as necessary and initial silt lagoons to the north.

Stage 2 -Phases 2 and 3

5.31 On completion of Phase 1, the extraction of sand and gravel would move to Phase 3, located immediately to the east of Phase 1 and west of Mother Drain/South End Lane. As before, it would be necessary to construct a gated entrance splay into the phase where the haul road crosses Upper Ings Lane. This entrance and crossing would be located at the north eastern corner of the phase, with the haul road running [parallel, and to the north of Upper Ings Lane].

5.32 Top and sub soils would be separately stripped from the extraction area and placed into storage banks located on either side of Upper Ings Lane to the north of the phase (TS Banks 9 and 10), together with the existing top and sub soil mounds created in the previous phase (TS Bank 4 and SS Bank 2) west of Phase 1. In addition, the recharge ditch excavated to the south of Phase 1 would be extended along the southern boundary of Phase 3.

5.33 Sand and gravel would then be extracted from the Phase 3 area, starting at the western boundary and progressing eastwards towards the Mother Drain/South End Lane. Concurrently, sand would be extracted from Phase 2, advancing the working face further westwards into the site.

5.34 As with the previous phase of working, clays and excess peat would be progressively placed within the worked out void of Phases 1 and 2 to create internal silt pond walls and commence restoration within the Phase 2 area respectively. Overburden encountered would be placed against the sides of the void in Phase 1.

5.35 Finally, the two archaeological investigation areas located within Phase 4 would be progressively stripped of soils in parallel with a scheme of archaeological investigation (refer to Section 15). Stripped materials would be either placed into storage banks (TS Bank 4 and 11) or directly placed within Phase 2 as part of the on going restoration works.

Stage 3 - Phases 2 and 4

5.36 Following the completion of extraction operations within Phase 3, the void would be allowed to fill with water to create a new freshwater lagoon. Sand and gravel extraction would move north of Upper Ings Lane into Phase 4. Phase 4 lies adjacent to Mother Drain and between Cowpasture and Upper Ings Lanes. With the undertaking of the archaeological investigations, soils would be progressively stripped and placed in storage mounds located to the north and west of the phase (TS Banks 12 and 13). These storage banks would be approximately 2.5m in height.

5.37 Extraction of sand and gravel would start at the southern boundary, adjacent to Upper Ings Lane and advance in a northerly direction. Operations would generally progress faster along the perimeter of Phase 4 to allow for the direct placement of restoration materials as well as to reduce impacts to

users of the surrounding network of public rights of way. As with the earlier phases, sand would continue to be extracted from Phase 2, with the working face advancing westwards towards the phase boundary.

5.38 Excess clay and peat extracted from the phase would be progressively placed within the worked out voids of Phases 2 and 4 to complete the restoration of the former and commence progressive restoration of the latter. Following the completion of peat removal and placement within the Phase 2 void, the water level would be allowed to return to complete the restoration of this area.

Stage 4 - Phase 5

5.39 On completion of Phases 2 and 4, all sand and gravel extraction would move to a single phase (Phase 5), located immediately north of Upper Ings Lane, and between Phases 2 and 4. As with the previous phases, soils would be stripped in advance of mineral extraction, with stripped soils initially directly placed within the void of Phase 4 to complete its progressive restoration. Soils from subsequent strips would be used to restore the southern and western margins of Phase 5.

5.40 In addition to soils stripped from Phase 5, soils stored in the southern part of TS Bank 2 (part), 12 and 13 would also be excavated and placed within the worked out void of Phase 4 as part of the restoration works.

5.41 The extraction of sand and gravel would start at the south eastern corner of the phase and initially progress westwards, parallel to Upper Ings Lane, to allow for the direct placement of restoration materials as well as reducing the impact to users of nearby rights of way. The direction of workings would then advance northwards.

5.42 During the development of Phase 5 an archaeological investigation area located within Phase 6 would be progressively stripped of soils in parallel with a scheme of archaeological investigation (refer to Section 15). Stripped materials would be directly placed within Phase 4 as part of the on going restoration works.

Stage 5 - Phase 6

5.43 Prior to commencing the extraction of sand and gravel, soils would be progressively stripped from the Phase 6 area. Stripped soils, together with soils in storage (part of TS Bank 2 and TS Bank 11), would be used in the restoration of the Phase 5 void. Excavation of TS Bank 2 would be delayed for as long as possible to maximise the screening effect of the Fresh Water and Silt Ponds as well as sections of the plant site.

5.44 Extraction of sand and gravel would commence at the southern edge of the phase and progress in a northerly direction towards Cowpasture Lane. Again, the extraction of minerals would generally progress faster along the

western perimeter of the phase to allow for the direct placement of restoration materials. Excess material from this area (clay and peat) would be progressively placed within the worked out void of Phase 5 to continue progressive restoration.

5.45 As with earlier phases, soils would be progressively stripped from the archaeological investigation area located in Phase 7 in parallel with a scheme of archaeological investigations. Stripped materials would be placed within the adjacent soil storage/screening banks (TS Bank 14 and 15) to the south and west of Phase 7, being some 2.5 metres in height.

Stage 6 - Phase 7

5.46 The final phase of mineral extraction lies to the north of Cowpasture Lane and bounded by New Ings Lane to the west and New Ings and Mother Drains to the north and east respectively. To access this area a new haul road would be constructed into this area along the western boundary of the phase, with a gated splay and crossing point constructed at the south western corner of the phase.

5.47 Soils would be progressively stripped from the Phase 7 extraction area and partly placed within the worked out voids of Phases 5, 6 and 7 to either continue or commence progressive restoration. Topsoil from the northern section of TS Bank 2 would only be excavated and placed within the worked out voids of Phase 6 (to complete progressive restoration) when the extraction of Phase 7 is nearing completion so as to maximise the screening effect of the plant site.

5.48 The extraction of sand and gravel would start at the southern boundary of the phase and advance northwards towards New Ings Drain. Again, extraction of minerals would generally progress faster around the perimeter of the phase to allow for the direct placement of restoration materials. Excess material from this area, (clay and peat) would be progressively placed within the worked out voids of Phases 5 and 6 to complete the progressive restoration of these areas, or within the Phase 7 to create the edges to the future lake. Following completion of peat removal and placement within Phases 5 and 6, these areas would be allowed to fill with water to complete restoration of the central area.

Stage 7 - Final Restoration

5.49 Following completion of mineral extraction within Phase 7, the topsoil banks to the south of the phase (TS Banks 14 and 15), along with some subsoil from subsoil bank SS Bank 1 would be excavated to restore Phase 7.

5.50 The structures and supports associated with the Plant Site, conveyor and Barge Loading facility would be dismantled and removed off-site.

5.51 The silt and fresh water ponds and bank edges, both to the south of the plant site as well as those associated with extraction Phases 1 and 3, would be partially capped and regraded to a configuration suitable for restoration to reedbeds utilising the silt pond walls as well as the adjacent soil banks.

5.52 The remaining soil banks, including those located alongside the access road (TS Banks A-D and SS Banks A and B) would be excavated and utilised to restore internal haul roads, the access to the barge loading facility, as well as the floor of the plant site and around the silt and fresh water ponds.

5.53 The main access road would remain upon completion of restoration, this would provide access to the site for restored areas and adjoining agricultural fields.

Soil Stripping Protocols

5.54 All soil handling would be carried out in accordance with the guidance set out in the "*Good Practice Guide for Handling Soils*" (MAFF April 2000)[10] and Minerals Planning Guidance Note 7 "*Reclamation of Mineral Workings*" (November 1996) (MPG7)[11]. Further details are also set out in Section 6 below.

5.55 In particular, soils would only be stripped when they are in a dry and friable condition, generally between the months of April to September or in appropriate dry periods outside of that period. The machinery used for stripping and placement of soils would be hydraulic 'back-hoe' excavator and articulated dump truck in accordance with modern thoughts on best practice for achieving high quality restoration. The direction of working has been designed to facilitate the progressive restoration through direct placement of soils and overburden in their final restoration location wherever possible, and not into temporary store.

5.56 Topsoil stored within top soil banks TS Banks A-D, TS Banks 1, 3, 5, 6, 9 and part of TS Bank 2, plus subsoil within SS Banks A and B and SS Bank 1, would be remain in store throughout the operational life of the quarry. The remaining soil banks are temporary in nature, generally only remaining in place for 2-3 years. All topsoil banks would not exceed 3m in height, with the majority being between 1.5m to 2.5m high.

5.57 All soil storage bunds would be seeded with a grass mix to stabilise the surface, maintain soil fertility and limit the growth of noxious weeds. Following successful germination and establishment, the grass would be maintained throughout the life of the site.

[10] http://www.defra.gov.uk/environ/landuse/soilguid/
[11] http://www.odpm.gov.uk/index.asp?id=1144192

Plant Area

5.58 The processing plant would utilise a number of different mobile and static plant items. The following lists the principle fixed plant, mobile plant and ancillary plant and buildings which would be used for the extraction, transportation and processing of the extracted mineral from the site.

- site office and weighbridge;
- washing, crushing and screening plant
- work shop
- canteen and switch room
- powerhouse/substation
- dust suppression bowser;
- sand and gravel stocking areas;
- field conveyor to the barge loading facilities;
- feed hopper for the barge loading facilities;
- 4 wheeled front loading shovels;
- a 360° hydraulic back-acting excavator;
- 3 no. 6 wheeled articulated dump trucks;
- loading stand;
- ancillary site vehicles.

5.59 Silt from the washing process would initially be pumped to the silt lagoons located immediately to the south of the plant site to settle out suspended solids. As these lagoons become full, the silt would be pumped to the silt lagoon created in Phase 1. This lagoon would have sufficient capacity for the duration of the proposed operations.

Access

5.60 Sole access vehicles to and from the site would be via the new quarry entrance. All quarry traffic exiting the site would by engineering design only be allowed to turn right from the access road onto Gainsborough Road and thence onto the A620 main road. The site's main internal haul road would run north-south to the east of the plant site and joining with Upper Ings Lane. Junctions onto this Lane would be constructed within Phases 1, 3 and 4 to allow quarry traffic to cross this bridleway safely. This haul road would be used to gain access to Phases 1-6, as well as the silt and fresh water lagoons to be constructed within Phases 1 and 3.

5.61 Toward the latter stages of the development associated with Phase 7, an additional haul road would also be constructed along the western boundary

of this Phase with new junctions constructed to cross Cowpasture Lane from the Plant Site.

Hours of Work

5.62 The operational hours associated with the extraction, processing and transportation of sand and gravel at the site would between the following hours:

07:00 – 19:00 hours Mondays to Fridays
07:00 – 13:00 hours Saturdays

5.63 No operations are proposed on Sundays, Bank or public holidays except for maintenance with the exeption of the operation of dewatering pumps.

5.64 Operation of the wharf facility would be between the hours of:

06:00 – 21:00 hours Mondays to Fridays
07:00 – 14:00 hours Staurdays

5.65 It is proposed to that all future mineral extraction; processing and transportation operations would be carried out in accordance with the permitted hours.

Employment

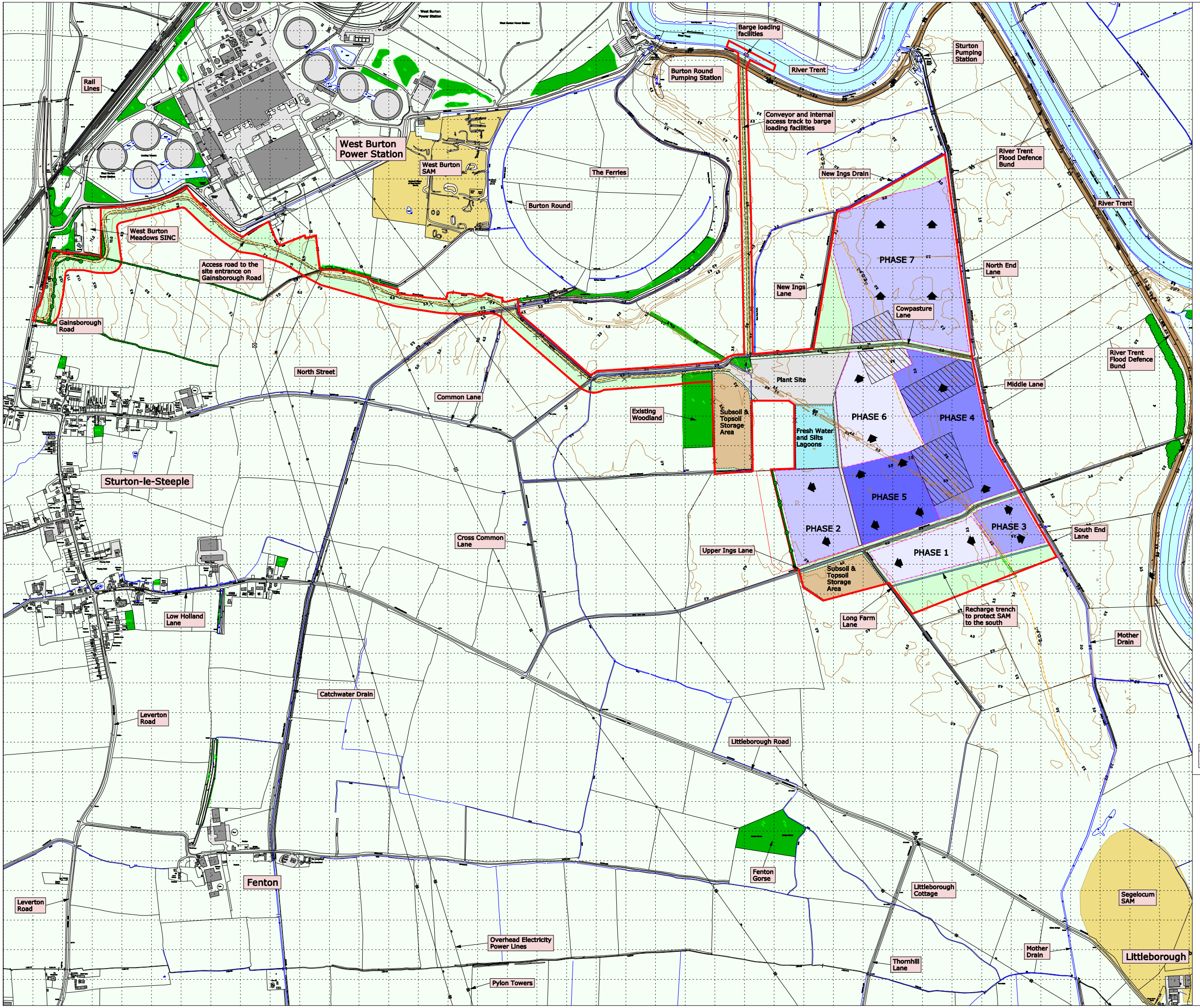
5.66 The operations at the site is expected to provide full time employment for 6 people plus an additional 5 people when soils/overburden is moved as part of the soil stripping and resoration activities.

Lighting

5.67 External lighting would be required around the plant site during the winter months. Lighting would be mounted on buildings and poles. All lights would be directional in order to minimize light spill, glare and sky glow, and would be aligned to ensure that the upper limit of the main beam does not project upwards. In particular, guidance provided by the Institution of Lighting Engineers[12] and the Good Planning Guide (GPG) 10 "*Lighting in the Countryside*" would be adhered to.

5.68 It is not proposed to excavate the sand and gravel after dusk and thus no lighting would be required within the extraction area.

[12] Guidance Notes for the Reduction of Obtrusive Light (GN01) (2005). http://www.ile.org.uk/documents/RLP%202005.pdf



Legend

- Application boundary
- River Trent
- Local agricultural land
- Land managed for agriculture within application boundary
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Proposed new vehicle access route
- Proposed fence along access road corridor
- Detailed Archeological Investigation Area
- Scheduled Ancient Monument
- Approximate extent of peat overburden
- Phased extraction boundaries
- Direction of working arrows

PLEYDELL SMITHYMAN LIMITED

PROJECT	Sturton-le-Steeple	
CLIENT	Lafarge Aggregates Ltd	
TITLE	Block Phasing	
LAFARGE AGGREGATES	DATE Jun 2006	SCALE 1 : 12,500
	DRAWN AH	CHECKED DB
	DRAW NO. SLS 5/1	REVISION

20a THE WHARFAGE, IRONBRIDGE, TELFORD, TF8 7NH.
TEL : 01952 - 433211 FAX : 01952 433323
EMAIL : psl@pleydellsmithyman.co.uk

Rail Lines
West Burton Power Station
West Burton SAM
TS Bank C 700m³
TS Bank B 500m³
West Burton Meadows SINC
SS Bank B 9500m³
Small section of close boarded fence
Small woodland blocks planted between access road and site boundry
Land within access road corridor managed as acidic grassland
Access road to the site entrance on Gainsborough Road
TS Bank A 2500m³
SS Bank A 3017m³
TS Bank D 1664m³
New hedgerow planted between access road and agricultural land
2.5m High soil bank with shallow outer gradient (1:10) to south of access road to prevent glare from headlights causing light pollution to residents of Sturton-le-Steeple
Access road corridor fenced off from agricultural land to south
Burton Round
Burton Round Pumping Station
Barge loading facilities
River Trent
Conveyor and internal access track to barge loading facilities
New Ings Drain
New Ings Lane
Feed Hopper for Barge Loading Facilities
Plant Site
Office
Weighbridge
Soil Store Screening Bund
Fresh water lagoon
Silt lagoon
Silt lagoon
Existing Woodland
Subsoil & Topsoil Storage Area
Gainsborough Road
North Street
Common Lane
Sturton-le-Steeple

Legend

- Application boundary
- Proposed new vehicle access route
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways / Footpaths
- Overhead electricity power lines and Pylon towers
- Existing woodland / Scrubland
- Proposed tree block planting
- Field boundaries
- Drains
- River Trent flood defence bunds
- Proposed fence along access road corridor
- Land managed for agriculture within the application boundary
- Land north of access road corridor managed as acidic grassland
- Subsoil Banks
- Topsoil Banks
- Scheduled Ancient Monument

PLEYDELL SMITHYMAN LIMITED

PROJECT	Sturton-le-Steeple
CLIENT	Lafarge Aggregates Ltd
TITLE	Initial Development Access Road and Plant Site

LAFARGE AGGREGATES

DATE	SCALE
Jun 2006	1 : 7500
DRAWN LMB	CHECKED DB
DRAW NO. SLS 5/2	REVISION

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Barge loading facilities
River Trent
Sturton Pumping Station
Burton Round Pumping Station
Conveyor and internal access track to barge loading facilities
River Trent Flood Defence Bund
River Trent
The Ferries
New Ings Drain
Burton Round
North End Lane
New Ings Lane
Cowpasture Lane
TS Bank 3 2400m³
Feed Hopper for Barge Loading Facilities
Access road to the site entrance on Gainsborough Road
Plant Site
Office
Weighbridge
River Trent Flood Defence Bund
Access road fenced off from agricultural land to the south
Middle Lane
Soil Store Screening Bund
Common Lane
Existing Woodland
Fresh water lagoon
Silt lagoon
Silt lagoon
TS Bank 2 17407m³
SS Bank 1 68436m³
TS Bank 1 31605m³
Access Road
Phase 2
TS Bank 5 2200m³
TS Bank 8 1700m³
TS Bank 7 2500m³
South End Lane
Phase 1
Upper Ings Lane
Cross Common Lane
TS Bank 6 743m³
Mother Drain
TS Bank 4 7200m³
SS Bank 2 33916m³
Long Farm Lane

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Proposed fence along access road corridor
- Approximate extent of peat overburden
- Land managed for agriculture within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Progressive restoration underway

PLEYDELL SMITHYMAN LIMITED

PROJECT	Sturton-le-Steeple	
CLIENT	Lafarge Aggregates Ltd	
TITLE	Working and Restoration Phases 1 and 2	
LAFARGE AGGREGATES	DATE Jun 2006	SCALE 1 : 7,500
	DRAWN AH	CHECKED DB
	DRAW NO. SLS 5/3	REVISION

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River Trent
Sturton Pumping Station
Burton Round Pumping Station
Conveyor and internal access track to barge loading facilities
River Trent Flood Defence Bund
River Trent
The Ferries
New Ings Drain
Burton Round
North End Lane
New Ings Lane
Cowpasture Lane
TS Bank 3 2400m³
Feed Hopper for Barge Loading Facilities
Access road to the site entrance on Gainsborough Road
River Trent Flood Defence Bund
Plant Site
Office
Weighbridge
Access road fenced off from agricultural land to the south
Middle Lane
Common Lane
Soil Store Screening Bund
Existing Woodland
Fresh water lagoon
Silt lagoon
Silt lagoon
TS Bank 2 17407m³
TS Bank 10 1000m³
SS Bank 1 68436m³
TS Bank 1 31605m³
Access Road
PHASE 2
TS Bank 9 1113m³
TS Bank 5 2200m³
TS Bank 8 1700m³
PHASE 3
TS Bank 7 2500m³
South End Lane
Silt lagoon
Upper Ings Lane
TS Bank 11 3434m³
Cross Common Lane
TS Bank 6 743m³
Mother Drain
TS Bank 4 13000m³
SS Bank 2 33916m³
Long Farm Lane

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Detailed archaeological investigation area
- Approximate extent of peat overburden
- Land managed for agriculture within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Progressive restoration underway

PLEYDELL SMITHYMAN LIMITED

PROJECT	Sturton-le-Steeple
CLIENT	Lafarge Aggregates Ltd
TITLE	Working and Restoration Phases 2 and 3

LAFARGE AGGREGATES

DATE Jun 2006	SCALE 1 : 7,500
DRAWN AH	CHECKED DB
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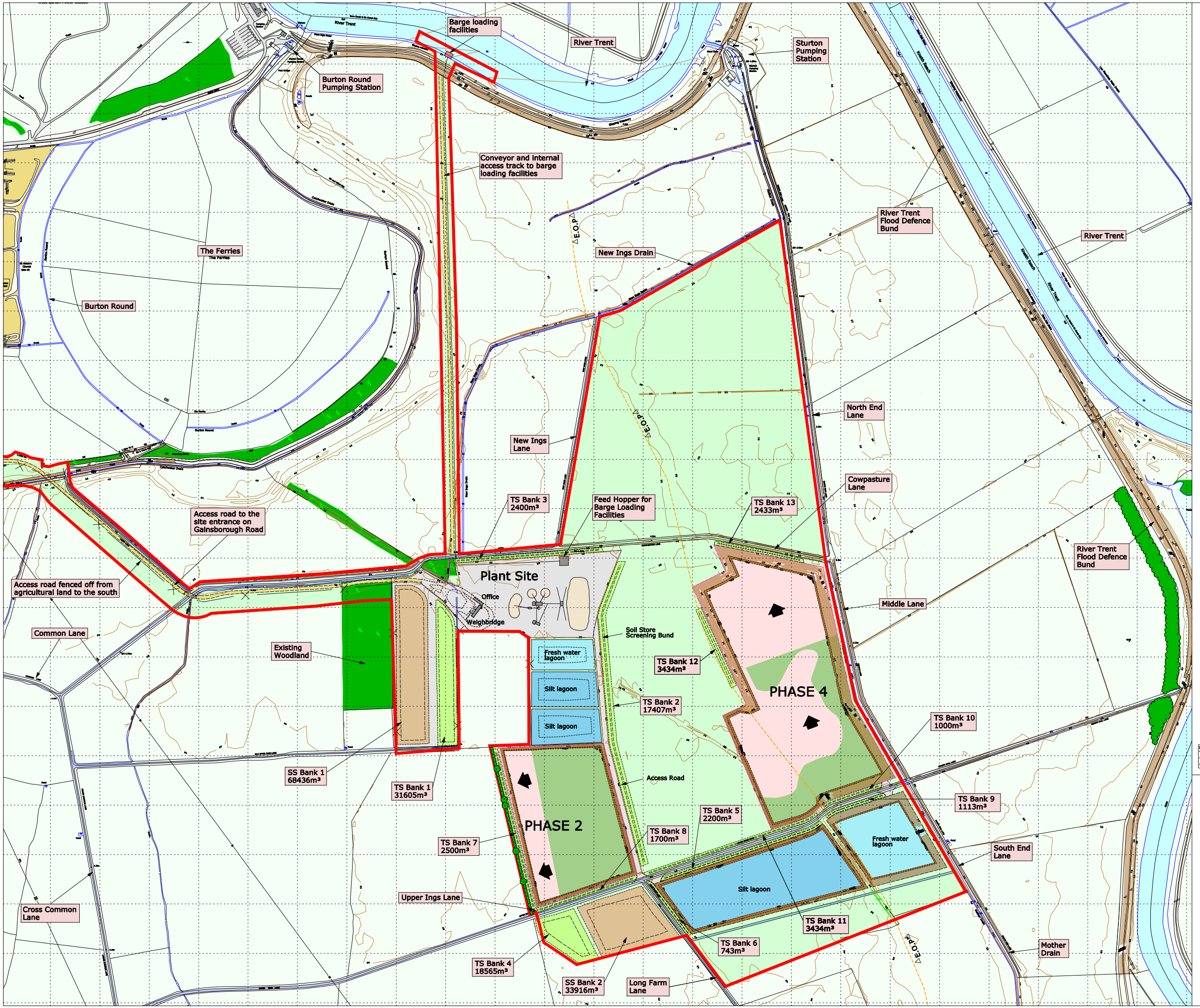

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Approximate extent of peat overburden
- Land managed for agricultural within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Progressive restoration underway

PLEYDELL SMITHYMAN LIMITED

PROJECT	Sturton-le-Steeple	
CLIENT	Lafarge Aggregates Ltd	
TITLE	Working and Restoration Phases 2 and 4	
LAFARGE AGGREGATES	DATE Jun 2006	SCALE 1 : 7,500
	DRAWN AH	CHECKED DB
	DRAW NO. SLS 5/5	REVISION

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River Trent
Sturton Pumping Station
Burton Round Pumping Station
Conveyor and internal access track to barge loading facilities
River Trent Flood Defence Bund
River Trent
The Ferries
New Ings Drain
Burton Round
North End Lane
New Ings Lane
Cowpasture Lane
TS Bank 3 2400m³
Feed Hopper for Barge Loading Facilities
Access road to the site entrance on Gainsborough Road
River Trent Flood Defence Bund
Plant Site
Office
Weighbridge
Access road fenced off from agricultural land to the south
Middle Lane
Soil Store Screening Bund
Common Lane
Existing Woodland
Fresh water lagoon
Silt lagoon
Silt lagoon
Sub & Top Soil Storage
TS Bank 2 10407m³
SS Bank 1 68436m³
TS Bank 1 31605m³
Access Road
PHASE 5
TS Bank 9 1113m³
Fresh water lagoon
South End Lane
Silt lagoon
Upper Ings Lane
Cross Common Lane
TS Bank 5 2200m³
TS Bank 11 3434m³
TS Bank 6 743m³
Mother Drain
Long Farm Lane

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Detailed archeological investigation area
- Approximate extent of peat overburden
- Land managed for agriculture within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Worked out void
- Progressive restoration underway
- Restoration to wetland habitats including herb rich fen and vegetated shallows
- Restoration to wet grassland

PLEYDELL SMITHYMAN LIMITED

PROJECT	Sturton-le-Steeple
CLIENT	Lafarge Aggregates Ltd
TITLE	Working and Restoration Phase 5

LAFARGE AGGREGATES

DATE Jun 2006	SCALE 1 : 7,500
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Barge loading facilities
River Trent
Sturton Pumping Station
Burton Round Pumping Station
Conveyor and internal access track to barge loading facilities
River Trent Flood Defence Bund
River Trent
The Ferries
New Ings Drain
Burton Round
North End Lane
New Ings Lane
Cowpasture Lane
TS Bank 3 2400m³
Feed Hopper for Barge Loading Facilities
Access road to the site entrance on Gainsborough Road
River Trent Flood Defence Bund
Plant Site
Office
Weighbridge
Access road fenced off from agricultural land to the south
Middle Lane
Common Lane
Existing Woodland
Fresh water lagoon
Silt lagoon
Silt lagoon
PHASE 6
TS Bank 2 10407m³
Soil Store Screening Bund
SS Bank 1 68436m³
TS Bank 1 31605m³
TS Bank 9 1113m³
TS Bank 5 2200m³
Fresh water lagoon
South End Lane
Silt lagoon
Upper Ings Lane
Cross Common Lane
TS Bank 6 743m³
Mother Drain
Long Farm Lane

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Detailed archeological investigation area
- Approximate extent of peat overburden
- Agricultural managed land within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Worked out void
- Progressive restoration underway
- Restoration to wetland habitats including herb rich fen and vegetated shallows
- Restoration to wet grassland

PLEYDELL SMITHYMAN LIMITED

N

PROJECT	Sturton-le-Steeple
CLIENT	Lafarge Aggregates Ltd
TITLE	Working and Restoration Phase 6

LAFARGE AGGREGATES

DATE Jun 2006	SCALE 1 : 7,500
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Burton Round Pumping Station
Conveyor and internal access track to barge loading facilities
River Trent Flood Defence Bund
River Trent
New Ings Drain
The Ferries
Burton Round
North End Lane
Access Road
PHASE 7
TS Bank 15 7200m³
New Ings Lane
TS Bank 14 4200m³
Cowpasture Lane
TS Bank 3 2400m³
Feed Hopper for Barge Loading Facilities
Access road to the site entrance on Gainsborough Road
River Trent Flood Defence Bund
Plant Site
Office
Weighbridge
TS Bank 2 5200m³
Middle Lane
Access road fenced off from agricultural land to the south
Soil Store Screening Bund
Common Lane
Existing Woodland
Fresh water lagoon
Silt lagoon
Silt lagoon
SS Bank 1 68436m³
TS Bank 1 31605m³
Access Road
TS Bank 9 1113m³
TS Bank 5 2200m³
Fresh water lagoon
South End Lane
Silt lagoon
Upper Ings Lane
Cross Common Lane
TS Bank 6 743m³
Mother Drain
Long Farm Lane

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Approximate extent of peat overburden
- Land managed for agriculture within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Progressive restoration underway
- Restoration to wetland habitats including herb rich fen and vegetated shallows
- Restoration to wet grassland

PLEYDELL SMITHYMAN LIMITED

PROJECT	Sturton-le-Steeple
CLIENT	Lafarge Aggregates Ltd
TITLE	Working and Restoration Phase 7

LAFARGE AGGREGATES

DATE Jun 2006	SCALE 1 : 7,500
DRAWN AH	CHECKED DB
DRAW NO. SLS 5/8	REVISION

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APPENDIX 3
Restoration Plan

6.0 RESTORATION

Introduction

6.1 This section of the Environmental Statement describes the proposed restoration scheme for the application site. The main aim of the restoration scheme is to produce a landform and land uses which are in character and scale with the surrounding landscape as far as the physical and operating constraints of the proposed development allow. The restoration features relating to conservation afteruses have been designed to maximise habitat creation and biodiversity potential.

Restoration Details

6.2 The restoration proposals have been guided by the studies carried out for the following sections:

- Section 9 – Landscape and Visual Assessment; and
- Section 10 – Ecology.

6.3 These studies have identified the types of physical features, landscape character and Biodiversity Action Plan (BAP) priorities and opportunities that could be incorporated into the restoration scheme.

6.4 The application site is characteristic of the local landscape character found with the *Trent Washlands* Regional Character Area (RCA) and the *River Meadowlands* Visual Character Area (VCA) subset, and as such its restoration has been designed to have regard of that character as far as is practical and/or possible. However, the nature of the mineral extraction creates specific restrictions in terms of the extent and type of restoration as discussed below.

6.5 A number of basic design decisions have been made with regard to the proposals. Land immediately adjacent to the proposed mineral extraction boundary is included within the planning application boundary. This is required for three reasons:

- Allow the management and maintenance of existing hedgerows to ensure the physical screening afforded by the existing hedges is maintained and strengthened throughout the proposed extraction period.
- To maintain and strengthen local landscape character features and elements including site peripheral field patterns.
- To link restoration proposals into existing vegetation and surface water ditch features.

6.6 Mineral is to be extracted from below the ground water table. All restoration material would be derived from within the site and there are no proposals to import external fill material onto the site for restoration purposes. Therefore the majority of the extraction void would result in low-lying wetland areas and water based after use.

6.7 The proposed restoration of the application site would be to the land uses/habitat types shown in Table 6/1.

Table 6/1 Summary of Restoration Afteruse

Restored Landuses/Habitat Types	Area of Restored Land (Hectares)
Agriculture	2.8
Lowland Dry Acidic Grassland/Lowland Heathland	7.8
Lowland Wet Grassland (including ephemeral ponding)	14.4
Mesotrophic Peat Bogs	9.8
Reedbeds	2.9
Aquatic and semi-aquatic marginal vegetation	9.6
Wet Broadleaved Woodland	3.8
Open water bodies	25.1
Sub Total	**76.2**
Land either unaffected by the development to remain in current landuses, including agriculture, woodland, hedges, drains and tracks, or forms that part of the access road to be retained	33.8
Total	**110.0**

6.8 These proposed habitats would help towards meeting local BAP targets as identified in Section 10.

6.9 The application area totals some 110 hectares and includes the access road, plant site, extraction areas, soil storage areas and areas to remain in agricultural use. The total disturbed area equates to some 78 hectares, of which some 1.8 hectares is occupied by the access road; some 7.8 hectares by the Plant Site and initial Silt ponds; some 0.8 hectares by the conveyor and Barge Loading facilities; some 6.3 hectares by soil storage areas; and 61.3 hectares by mineral extraction areas.

6.10 The total area of land disturbed through the excavation of sand and gravel would cover around 61.3 hectares. The base of the proposed excavation would vary between approximately -6.0m AOD and -10.9m AOD. The peripheral land surrounding the excavation would remain at original ground levels of approximately 2.6m to 4.0m AOD.

6.11 Approximately 44.5 hectares of the extraction area and some 2.9 hectares of the silt ponds, would be utilised to create a series of lakes and wetland habitats. The water levels of the lake would be controlled at between 1.8-2.4metres AOD by proposed outlets connecting to the existing system of ditches running around the boundaries of the site.

6.12 The southern lake area, associated with Phases 1 and 3 and the Fresh Water and Silt Ponds comprise some 1.6 hectares of open water, 1.7 hectares of shallows, with a further 1.7 hectares of reedbed. The central lake area, associated with Phases 2-6 and the initial Fresh Water and Silt Ponds comprise some 9.2 hectares of open water, 8.3 hectares of shallows, 8.3 hectares of peat bog, with a further 1.2 hectares of reedbed. The northern lake, to be used primarily for leisure activities would comprise some 14.3 hectares of open water and some 1.3 hectares of shallows.

6.13 The wetland areas that comprise peat bog would be either at water level or slightly higher; the areas of shallows, would be less than 1.0 metre deep situated around the periphery of the deeper water areas; the areas of reedbed would be generally less than 300mm deep; and the deep water areas that would range from ~9 -12 metres in depth. The peripheral areas to these wetland habitats would be restored by the regrading of the landform and/or the placement of soils to create a variety of habitats ranging from Lowland Wet Grassland, containing both small permanent and ephemeral ponds, varying in height from 2.7 metres to 3.5 metres AOD to Lowland Dry Acidic Grassland and Lowland Heathland, varying in height from 3.5 metres to 12.0 metres AOD.

6.14 The Nottinghamshire BAP acknowledges that the Trent Washlands are not only of enormous conservation importance but are also under serious threat through the under-drainage of fields, in-filling of wetland and open water, and engineered river margins through flood protection works. Traditional floodplain meadows are also under threat by farm intensification, as well as by mineral extraction with large areas being returned to eutrophic water bodies. Many of the habitat types recognised as being under threat within the Trent Washlands are proposed within the restoration scheme for the application site and include:

- Mesotrophic Standing Water
- Reedbed
- Wet Broadleaved Woodland
- Lowland Wet Grassland
- Lowland Dry Acidic Grassland
- Lowland Heathland

Habitat Creation

Mesotrophic Standing Water

6.15 These habitats are now rare within Nottinghamshire, with many former ponds and lakes becoming artificially eutrophic due to run-off from intensively managed farmland. The eutrophication process can lead to prolific growth of algae with the subsequent death of fish plants and invertebrates. The creation and retention of Mesotrophic areas would

therefore be highly desirable within the Trent Valley. These areas not only include water bodies themselves but also the related marginal vegetation, bogs, mires and grasslands.

6.16 Species that may benefit from the inclusion of this habitat type include:

Water vole	Great crested newt
Bats	Common frog
Black-necked grebe	Common toad
Gadwall	Rush wainscot moth
Shoveler	Red-eyed damselfly
Teal	Fen pondweed
Kingfisher	Watercress
Sand martin	

Reedbed

6.17 Nationally, reedbeds have suffered huge declines since the war as the result of flood protection schemes, land drainage, agricultural intensification and water abstraction. Those that do remain have also suffered from lack of management and reduction in water quality leading to a general decline in habitat quality and scrub succession.

6.18 Species that may benefit from the inclusion of this habitat type include:

Bearded tit	Reed bunting
Bittern	Short eared owl
Black-necked grebe	Water rail
Common tern	Common hawker dragonfly
Fieldfare	Black-tailed skimmer
Grey heron	Obscure wainscot moth
Jack snipe	Brown-veined wainscot moth
Kingfisher	Silky wainscot moth
Marsh harrier	Sea club rush
Redshank	Cyperus sedge

Wet Broadleaved Woodland

6.19 Wet broadleaved woodlands occur on poorly drained or seasonally wet soils within river valley floodplains, generally characterised by a canopy of alder or wouldow, with a wide variety of plant species making up the ground flora. A high diversity of invertebrates are associated with this woodland. The habitat also provides an important source for food and shelter for a wide variety of vertebrates. Insect-feeding find bountiful winter feeding in the trees whilst the dense ground layer and tree roots can provide cover for otters and woodcock.

6.20 Due to modifications to the Trent floodplain relating to flood prevention and loss of stands of woodland to agricultural intensification, all ancient wet woodland has been lost, leaving stands which are much younger and smaller than those which might be found in pristine lowland river systems, although examples of old wouldow holts are still in existence, but many of them are neglected.

6.21 Species that may benefit from the inclusion of this habitat type include:

Otter	Lesser spotted woodpecker
Bats	Dragonflies
Grasshopper warbler	Poplar kitten moth
Long-eared owl	Cream-bordered green pea moth
Tree pipit	Alternate leaved golden saxifrage
Woodcock	

Lowland Wet Grassland

6.22 Lowland wet grassland consists of periodically flooded pasture or meadow, and includes floodplain grassland, washlands and water meadows, with traditional management based on grazing and cutting for hay or silage. Such areas typically possess ditches, with areas of seasonal water-filled hollows and permanent ponds.

6.23 Nationally, this habitat has decreased in extent by more than 40% since 1930, primarily as a result of drainage and agricultural improvements. In Nottinghamshire, before post World War Two land drainage, flood protection and agricultural intensification schemes, the immense floodplain of the River Trent, along with those of its key tributaries are likely to have included significant areas of wet grassland, but is now a very scarce resource in Nottinghamshire.

6.24 Species that may benefit from the inclusion of this habitat type include:

Otter	Wigeon
Water vole	Teal
Grass snake	Bewick's swan
Snipe	Spined loach
Lapwing	Early marsh orchid
Curlew	Parsley water dropwort
Redshank	

Lowland Dry Acidic Grassland

6.25 Dry acidic grassland in Nottinghamshire is characterised by the occurrence of plants such as wavy hair-grass, common bent, sheep's fescue, heath bedstraw and pill sedge and occurs on nutrient-poor soils. Nottinghamshire

falls between the acid upland grasslands of the Pennines and the lowland grasslands of Lincolnshire. As a consequence the Nottinghamshire acid grasslands include upland elements, such as mat grass, but lack some of the typical lichen components found further east. In the East Nottinghamshire Sandlands, small fragments of a dune-like habitat support a number of plants typical of inland dune systems. Lowland acid grasslands are of value for a range of specialist, scarce or declining fauna, including bees and wasps, spiders, reptiles and birds. Some species are dependent upon habitat mosaics, for instance a mixture of acid grassland, heathland and woodland.

6.26 Nationally between 1930 and 1984 unimproved lowland grassland of all types decreased by an estimated 97%, with losses continuing at a rate of ~2-10% per annum in some counties. The East Midlands has a particularly high rate of loss, and it is estimated that Nottinghamshire's unimproved grassland has declined by 97-99% since 1930.

6.27 Species that may benefit from the inclusion of this habitat type include:

Brown hare	Common lizard
Common shrew	Broom tip moth
Barn owl	Light brocade moth
Common buzzard	Blue fescue
Curlew	Fragrant agrimony
Grey partridge	Prickly sedge
Lapwing	Sand sedge

Lowland Heathland

6.28 Lowland heathland is characterised by the presence of plants of the heather family, found below 300m in altitude and within Nottinghamshire are generally of a 'grass heath' type, with ling and bell heather interspersed with fine grasses such as wavy hair-grass, and shrubs such as gorse. They are characteristic of the poor acid soils of the *East Nottinghamshire Sandlands* RCA.

6.29 Lowland heathland is an internationally rare and threatened habitat, identified as a priority under European law. Britain supports one fifth of the world's lowland heathland, despite a decline of 75% in the national resource since 1800. Nottinghamshire has lost around 90% of heathland since 1922, and today only about 250ha exists within the County, (0.4% of the total UK area).

6.30 Species that may benefit from the inclusion of this habitat type include:

Adder	Ling pug moth
Common lizard	Small chocolate tip moth
Grey partridge	Smoky wave moth
Hen harrier	Annulet moth
Nightjar	White colon moth
Common ground hopper	Creeping wouldow
Clouded buff moth	Cross-leaved heath
Grass wave moth	Greater broomrape
Large red-belted clearwing moth	Heath cudweed

Handling of Materials

6.31 In order to ensure that restoration soils are stripped, stored and directly placed to maintain their quality, soil handling would be undertaken in accordance with guidance set out in the Department for the Environment, Food and Rural Affairs (DEFRA) 'Code of Good agricultural Practice for the Protection of Soil' (1998) and Minerals Planning Guidance Note 7 "Reclamation of Mineral Workings" (November 1996) (MPG7) : in particular:

- Soils would be moved in accordance with a detailed scheme of integrated working and restoration based on known soil requirements and resources, and where appropriate, upon the recommended methods contained in DEFRA's Good practice guide for the handling of soils'.
- Soils would be placed by hydraulic excavator and dump truck in such a way to minimise traffic over them.
- General soil handling would be minimised to reduce potential damage and would be restricted to periods when the soil is dry, friable and below its plastic limit.
- Following the final placement of soils by loose tipping, to avoid compaction, the soils would be lightly firmed and the surface lightly cultivated to achieve a fine tilth.

Surface Water Management

6.32 In order to prevent the eutrophication of the areas of mesotrophic standing water, the existing network of drains and the excavation of new drains as appropriate would be used to prevent nutrient rich water from the surrounding arable fields from ingressing into the main water bodies.

Aftercare and Management

6.33 All restoration works would be subject to a statutory 5 year aftercare plan in addition to this Lafarge Aggregates Limited has confirmed that they are prepared to extend this for a further 5 years.

Weeds

6.34 Under the provisions of the Weeds Act 1959 and the Ragwort Control Act 2004, it is the responsibility of all occupiers of land, whether used for agriculture or not, to control injurious weeds, so that they do not spread. For all areas, weeds would be controlled by the appropriate application of herbicides by a certified competent person, according to manufacturer's instructions or, in areas of grass, by cutting or grazing.

Proposed Planting Specification and Management

6.35 All tree and shrub species would be planted as 'cell-grown' plants 0.3-0.6 metres high, pit planted with non-peat based compost and organic fertilisers. A 0.6 metre wide radius around the base of trees would be kept weed-free by applying an appropriate herbicide twice every year if required, following guidelines as set out in the Pesticide Control Act 1996. Plants, guards and canes which become loose, over-tight or broken would be re-firmed and adjusted on an annual basis. All planting/seeding failures would be replaced on an annual basis, during the first two years of aftercare, to ensure 100% maintenance to the agreed densities/land cover. All replacements would use plants of the same species or other such species as may be agreed with the planning authority. If abnormal plant or tree failure persists then investigations and proposals for the remedying of site conditions would be prepared and agreed with the planning authority.

Marginal Aquatic Vegetation

6.36 During the aftercare period, the main requirement would be the thinning and control of dominant wetland species to ensure variety of species/habitat. Material removed in this process would be used to transplant and distribute wetland species from the early restoration phases to latter ones.

Management Plan

6.37 Throughout the aftercare period the restored site would be managed in accordance with a management plan, formulated in accordance with the recommendations of MPG7 (1996). The management plan would consist of an outline scheme, providing the overall objectives for the management of the site and the main maintenance operations proposed. A more detailed scheme would be submitted on an annular basis to the mineral planning authority in late winter prior to an annual aftercare meeting. This aftercare meeting would be held on an annual basis to discuss the condition of the site and to agree the aftercare requirements for that season. It would be attended by the developer, landowner (and/or their representative) and the mineral planning authority.

Restoration Materials

6.38 The restoration material would comprise stripped topsoil, subsoil, clay overburden and peat from the extraction areas available quantities of soils throught the development are shown in Table 6/2

6.39 Geologically the sand and gravel in and around the Sturton-Le-Steeple site is part of an extensive spread of fluvio-glacial and alluvial deposits forming terraces and floodplains associated with the River Trent. In relation to the overlying soils, the application site has been classified using the DEFRA guidelines for agricultural land classification and by Climatologically Data. Identified land ranges from Grades 3A to 3B within the Site. Section 14 provides further details of the soil quality.

Table 6/2 – Restoration Materials

Phase number	Topsoil volumes	Subsoil volumes	Total Soil Volumes
Init. Dev.	34,700m³	80,900m³	**115,600m³**
1	14,500m³	34,000m³	**48,500m³**
2	18,500m³	43,200m³	**61,700m³**
3	8,100m³	18,700m³	**26,800m³**
4	38,500m³	89,700m³	**128,200m³**
5	19,900m³	46,400m³	**66,300m³**
6	28,300m³	66,100m³	**94,400m³**
7	58,900m³	137,400m³	**196,300m³**
TOTALS	**221,400m³**	**516,400m³**	**737,800m³**

Barge Loading Facilities Removed
River Trent
Sturton Pumping Station
Burton Round Pumping Station
Agricultural land reinstated along the access road to the barge loading facilities and the route of the field conveyor
River Trent Flood Defence Bund
River Trent
The Ferries
New Ings Drain
Burton Round
WL 1.8
North End Lane
Cowpasture Lane
Access road retained on to Gainsborough Road
River Trent Flood Defence Bund
Access road fenced off from agricultural land to the south
Middle Lane
Common Lane
Existing Woodland
WL 2.3
WL 2.3
WL 2.4
South End Lane
Upper Ings Lane
Cross Common Lane
Mother Drain
Long Farm Lane

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing and proposed planting of new hedgerows and woodland blocks
- Vehicle access route retained
- Proposed fence along access road corridor
- Scheduled Ancient Monument
- Wet Broadleaf Woodland
- Wet grassland with scrapes plus lowering of ground levels to form ridge and furrows
- Acidic Grassland or Lowland Heath
- Agriculture
- Herb rich Fen established on Peat
- Vegetated shallows with aquatic and semi-aquatic vegetation
- Reedbeds established on former silt lagoons
- Open Water Bodies
- Lake used for low key leisure activities

PLEYDELL SMITHYMAN LIMITED

PROJECT	Sturton-le-Steeple	
CLIENT	Lafarge Aggregates Ltd	
TITLE	Concept Restoration - Wetland Area	
LAFARGE AGGREGATES	DATE Jun 2006	SCALE 1 : 7,500
	DRAWN LAS	CHECKED DB
	DRAW NO. SLS 6/2	REVISION

20a THE WHARFAGE, IRONBRIDGE, TELFORD, TF8 7NH.
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APPENDIX 4
Extractive Materials Management Plan

APPENDIX 3 - EXTRACTIVE MATERIALS MANAGEMENT PLAN

Site Details	
Site Name	Sturton le Steeple Quarry
Address	Gainsborough Road, Sturton le Steeple
Site Manager	Rhobert Lugg
Phone Number	07717422605
Email Address	rhobert.lugg@aggregate.com
Primary mineral(s) produced at site	Sand and Gravel
Quantity of extractive material assessed as not waste (m^3)	Soils: 737,800 Clay overburden: 184,700 Peat overburden: 1,209,000
Maximum storage time of any extractive material before final deposit	10 years
Expected date for completion of operations at the site.	2035

Overview of production process		
Description of the operations	Planning permission was granted by Nottinghamshire County Council (reference 1/46/06/00014) to allow the extraction of sand and gravel at the site. Mineral extraction will take place below the water table in the superficial deposits and therefore dewatering will be undertaken to ensure safe and efficient working conditions are maintained. The sand and gravel will be extracted using a tracked excavator and dump truck where it will be placed into the designated stockpiles located in the processing area. The sand and gravel will then be washed mechanically and separated into different grades. Any silt laden water that is generated from the washing process will be discharged into settlement lagoons (via pipeline). Key Points: • The extractive materials: soils, overburden and silt are the result of overburden stripping and mineral washing respectively. • Silt is deposited into settlement lagoons. • All the soils and overburden will be used in site restoration.	
Extractive materials produced	Extractive material:	Volume (m^3)
	Soils:	737,800
	Clay overburden:	184,700
	Peat overburden:	1,209,000
	Waste silts:	478,800

Overview of production process	
Description of the use of extractive materials	Topsoil and overburden will be stripped and stored on the wider quarry site and used to restore the site to a wetland habitat once the quarry operations are over. The silt waste will also be used to create reedbed areas as part of the wider restoration.
Description of areas for temporary storage of extractive materials	The storage area for the non-waste overburdens are within the wider quarry area. The wastes will be stored within the lagoons, inside the permitted area boundaries.

Assessment against the Avesta Polarit Tests	
Identification of Materials *Identification of specified types and volumes of extractive materials to be used in restoration works*	The extractive materials identified in the Waste Management Plan for which non-waste status is sought are: Soils: 737,800 m^3 Clay overburden: 184,700 m^3 Peat overburden: 1,209,000 m^3 Any soil or overburden that is stripped from the site will either be stored in the form of a screening bund (and subsequently used as part of the restoration works) or will be placed in a previously worked area as part of the restoration works.
Guarantee of Use *Guarantees of use of specified extractive materials*	Planning permission 1/46/06/00014 regulates mineral extraction. Conditions 44-52 regulate the Soil Handling, Stripping and Storage for the period of retention and conditions 53-60 regulate the Soil replacement elements of the recovery of the site. All soils and overburden are required to be retained on site and used in the restoration of the site.
Time Period for Use *Time periods for use of specified extractive materials*	Planning permission expires in 2035. Where possible, restoration will be progressive. The approved plans show the progression of the restoration.
Use as part of the Overall Operation *Confirmation that the specified extractive materials do not need further processing and that their use in restoration is an integral part of the overall operation*	Topsoil and overburden will be stripped in order to access the sand and gravel. These materials will either be stored to form a screening bund (and subsequently used as part of the restoration works) or will be placed in a previously worked area as part of the restoration works. In accordance with condition 51 of the planning permission, all soil storage bunds will be subject to regular maintenance (i.e. grassing and weeding). This will ensure that the soil can be used without further processing.

Assessment against the Avesta Polarit Tests	
Necessity and Lawfulness of Use *Confirmation of the necessity of use and lawfulness of the use of the specified extractive materials*	Sturton le Steeple Quarry is subject to planning permission 1/46/06/00014 which allows the extraction of sand and gravel with subsequent restoration. All material extracted is naturally inert. All soils will be retained for restoration of the site.

Part 3. Assessment of the status of extractive materials	
Extractive materials assessed as waste	It is anticipated that the quantity of silt (the extractive material assessed as waste) will total 480,000m3. The silt material is generated from the production process of washing target mineral and is accumulated within the settlement lagoons. It is stored entirely separately from those materials assessed as 'non-waste'. The extractive material assessed as 'waste' above is part of the production process. Therefore, it fails one of the criteria of the 'By-products test' provided in Article 5 of the Waste Framework Directive (2008/98/EC):- "The substance or object can be used directly without any further processing other than normal industrial practice".
Extractive materials assessed as not waste	Approximately 737,800 m^3 of soils, 184,700 m^3 of clay overburden and 1,209,000m^3 of peat overburden will be used to restore the site in accordance with the approved restoration scheme. With reference to the 'By-product test' provided in Article 5 of the Waste Framework Directive, the above extraction materials meet the criteria and are assessed as 'non-waste'.

APPENDIX 5
Surface Water Management Plan

April 2016

SAND AND GRAVEL EXTRACTION, STURTON LE STEEPLE

Surface Water Drainage and Monitoring

Submitted to:
David L Walker Limited
Albion House
89 Station Road
Eckington
Sheffield
S21 4FW

REPORT

Report **Number** 1543476.501/A.0

Distribution:

David L Walker - 1 copy (pdf)
Golder Associates (UK) Ltd - 1 copy

Golder Associates

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TABLES

FIGURES

No table of figures entries found.

APPENDICES

1.0 INTRODUCTION

Golder Associates (UK) Ltd has been commissioned by David L Walker Limited (Agent for Tarmac) to prepare a drainage scheme and monitoring programme to meet obligations under a legal agreement and allow the discharge of Planning Condition 41 for the proposed quarry east of Sturton Le Steeple. The obligations and planning condition are as follows:

- Planning Condition 41 – "*No development approved by this permission shall be commenced until a scheme for the provision of surface water drainage works has been submitted to and been approved in writing by the MPA (Mineral Planning Authority). The scheme shall incorporate sustainable drainage principles and shall not result in an increase in the rate of surface water discharge to the local land drainage system and provide a timetable for the implementation of these works. The drainage works shall be completed and maintained in accordance with the approved details.*"
- Obligations – "*A detailed management scheme which sets out steps to mitigate any indirect hydrological changes within the Mother Drain and New Ings Drain which shall include the collection of survey data of seasonal water levels, the methods to be used and the determinants to be measured to assess water quality, the location of sampling points, the frequency of sampling both within and between years, the duration of sampling over the operation of the Site, and the trigger levels to be adopted for water pumping (for the avoidance of doubt such mitigation scheme should be implemented during active quarry dewatering operations).*"

2.0 SITE DESCRIPTION AND DRAINAGE

The proposed extraction area is located east of Sturton Le Steeple on agricultural land that is drained by a series of surface water drains, notably Mother Drain to the east, New Ings Drain to the north and Catchwater Drain to the west of the extraction area (the Site). Laneham Internal Drainage Board (the IDB) manage these drains and also maintain the pumping station North of the Site, which are used to control water levels in the IDB drains, discharging water to the River Trent. The Site layout is presented in Appendix A.

2.1 Geology

British Geological Survey Sheet 101 (solid and drift), East Retford (1998) indicates superficial deposits are located on land east of Catchwater Drain, overlying Mercia Mudstone; to the west there are no recorded superficial deposits above the Mercia Mudstone.

The Site geology within the extraction area typically comprises of the following formations:

- Silty top soil with fine sand;
- Silty clays and silt alluvium;
- 1st Terrace, featuring fine to medium sand with some gravel, overlying gravel; and
- Mercia Mudstone bedrock.

Borehole records from WB 5/96 and WB 6/96 indicate clayey and sandy soils overlying sand, which is approximately 1 m below ground level (bgl). The borehole records are presented in Appendix B.

2.2 Groundwater Levels

Groundwater levels presented in the Environmental Statement (SLR, 2006) indicate a typically shallow depth to groundwater of approximately 1.3 m during winter recharge. The depth to groundwater increases to approximately 1.6 m along the access road and is assumed to increase as ground levels to the west increase.

2.3 Greenfield Runoff Rate

Following a conversation with the IDB, a Greenfield runoff rate of 1.4 l/s/ha has been adopted for areas east of Catchwater Drain.

Greenfield runoff rate for the Site, calculated using the Institute of Hydrology (IoH) 124 method, is approximately 3.5 l/s/ha. The underlying geology west of Catchwater Drain, comprising Mercia Mudstone, is considered less permeable, consequently the Greenfield runoff is considered to be higher and therefore a rate of 3.5 l/s/ha has been adopted for areas west of Catchwater Drain.

3.0 WATER MANAGEMENT

The proposed development of the Site will feature the construction of a 2.8 km Access Road, Plant site, Conveyor and Access Track, Wharf and Lagoons. Following construction, the mineral will be extracted in 7 phases with progressive land restoration.

3.1 Extraction and Dewatering

Sand and gravel extraction will be in a phased approach, comprising 7 phases progressing in a generally northerly direction. Phase 2 comprises just sand, therefore Phase 2 will need to be worked in parallel with Phases 1, 3 and 4, which contain a gravel fraction, in order to provide an appropriate mix of aggregates. The mineral will be worked dry by dewatering the individual phases of the extraction area. The rate of dewatering is estimated to be 10 l/s (SLR, 2006). Water will be pumped to a recharge trench south of Phase 1 as necessary and silt lagoons adjacent to the plant site, and the silt lagoon created in Phase 1. The silt lagoons will allow suspended solids to settle out prior to discharge into surrounding drains (New Ings Drain and Mother Drain), which will mitigate potential impacts of dewatering. Discharge locations will move progressively northwards in parallel with extraction and are presented in Drawing 1 and listed in Table 1. The proposed discharge locations will be revised should groundwater and surface water monitoring indicate the effects of dewatering are having a greater or lesser impact than expected.

Table 1: Pumped Discharge Locations

Phase	Pumped Discharge Location	Watercourse
1-6	A	Mother Drain
7	B	Mother Drain
1-7 (Plant Site)*	C	New Ings Drain

*See Section 3.2.1

Discharge from the Site to New Ings Drain and Mother Drain will be controlled to the Greenfield runoff rate of 1.4 l/s/ha.

3.2 Surface Water Management

This section presents the surface water management scheme for the proposed Access Road and Plant site area. Design drawings are presented in Appendix A.

3.2.1 Extraction Areas, Phases 1-7

During the planned mineral extraction phases (which are stripped of topsoil and subsoil) will necessarily create a void below existing ground level once the material has been removed. This means that the void will capture surface water runoff. Runoff collecting in the voids will naturally soakaway into the permeable sand and gravels or be pumped to a silt lagoon, prior to discharge. Surface water storage volume requirements and discharge rates during a 1 in 100 year, 24 hour storm event including an allowance for climate change are provided in Table 2. The total Greenfield discharge rate from mineral extraction, stripped soils, restored and lagoon areas during each phase are also presented to provide the total discharge from these areas. Calculations are presented in Appendix C.

Table 2: Surface Water Discharge - Operating Areas

Phase	Total Area (Extraction, Soil Stripped, Restored and Lagoons) (m^2)	Increase in Runoff (Stored in Wetland/Silt Lagoon) (m^3)	Greenfield Discharge Rate (l/s)
1	147,000	7,744	20.6
2	174,000	12,356	24.4
4	301,500	17,363	42.2
5	367,500	18,833	51.5
6	451,500	20,705	63.2
7	647,000	25,061	90.6

Phase 2 in parallel with Phases 1, 3 and 4. See Section 3.1.

3.2.2 Site Access

The Access Road is approximately 2.8 km long and approximately 8 m wide. Runoff from the impermeable road surface, which is approximately 22,400 m^2, will be managed by roadside grass filter strips, swales and check dams, providing 2 stages of water quality treatment prior to discharge. The access road is broken into three distinct drainage areas, two west of Catchwater Drain, where the relatively impermeable geology is not suitable for infiltration and will therefore feature a controlled discharge to nearby drains, and one east of Catchwater Drain, where surface water runoff will be contained within the roadside swale and infiltrate to ground. Roads will be graded towards the grass filter strip, which will be a minimum 1 m wide and sloping at 1%-5% towards the adjacent swale. The proposed swale dimensions are as follows:

- Depth = 0.4 m
- Base width = 0.4 m
- Side Slope = 1V:4H
- Top Width = 3.6 m

Check dams will be installed to promote infiltration and provide surface water storage. Surface water discharge from the two swales west of Catchwater Drain (see Drawing 1) will be controlled by a vortex control device to 2 l/s. The swale east of Catchwater Drain is subject to infiltration testing but has been designed based on a conservative infiltration rate of 1 x 10^{-6} and guidance provided in The SUDS Manual (CIRIA, 2015); nearby borehole logs indicate a sandy soil media. A shallow swale is recommended so as not to inhibit maintenance and maximise the depth to groundwater.

3.2.2.1 Access Road Drain Crossings

The proposed Access Road will cross a small drain west of the Catchwater Drain. Peak flow at this location during a 1 in 100 year, plus an allowance for climate change, is approximately 0.12 m^3/s. Peak flow has been estimated using the Revitalised Flood Hydrograph (ReFH) method. In order to convey this flow the crossing will be culverted with a minimum pipe diameter of 0.45 m. We understand that a bridge crossing will be installed over Catchwater Drain, which will be designed not to impact flow within drain.

3.2.3 Conveyor Access Track

Runoff from the Conveyor Access Track will be managed by filter strips, check dams and infiltration within a swale, as per the Site Access Road.

The Conveyor and Access Track will require the realignment of New Ings Drain and a culvert to allow access from the plant site, across Cowpasture Lane and over New Ings Drain. Peak flow at this location during a 1 in 100 year, plus an allowance for climate change, is approximately 0.24 m^3/s. Peak flow has been estimated using the ReFH method. In order to convey this flow the crossing will be culverted with a minimum pipe

diameter of 0.6 m. The dimensions of the realigned channel section of New Ings Drain will be as per the existing channel dimensions, which are approximately as follows:

- Base Width = 2 m
- Depth = 3 m
- Side Slope = 1V:1.5H

Appendix D presents the proposed channel realignment.

3.2.4 Plant Site

Runoff from the Plant Site area will be managed within the silt and fresh water lagoons to the south and discharged to New Ings Drain at a rate no greater than 1.4 l/s/ha. Based on a Plant Site area of 3.0 ha, this equates to 4.2 l/s.

The silt lagoon and freshwater lagoon will be managed to ensure a minimum volume of 2,900 m^3 is always available to accommodate surface water runoff from the Plant Site for all rainfall events up to and including the 1 in 100 year plus an allowance for climate change. Volume calculations are presented in Appendix C.

3.3 Restored Site

The proposed restoration plans for the Site are presented in Appendix E. Overburden stored during the extraction phases will be used in the restoration of the Site and all hardstanding surfaces, with the exception of the main access road, will be removed and returned to Greenfield conditions; infiltration and runoff will mimic existing conditions. Ground levels will predominantly be lower than existing, creating an open water/wetland habitat. Restoration of the site will progress as extraction moves between phases; progressive restoration will minimise the area of exposed soils, curtailing the potential for erosion. Once the Site is fully restored and vegetation becomes established, surface water quality and quantity will therefore be comparable to Greenfield conditions.

4.0 EROSION CONTROL

A range of erosion control measures can be implemented at the Site to reduce erosion of exposed soils which will promote reduced concentrations of total suspended solids in surface water at the Site. Typical measures include:

- Areas which are subject to earthworks will be restored as quickly as possible by dressing with topsoil and planting in accordance with the restoration plan;
- Long term stockpiles or bare earth slopes will be stabilised by seeding with grass seed;
- To manage erosion prior to the establishment of a vegetative cover, temporary silt fences will be installed at the base of the stockpiles located adjacent to surface water drains. Silt fences will be removed following the establishment of a vegetative cover;
- Allow for a standoff areas at the base of stockpiles to act as a buffer/filter strips. Grass should be left dense and long to maximise this benefit. An additional 9 m of standoff, is required to allow the IDB access for drain maintenance, is required for Mother Drain, New Ings Drain and Catchwater Drain;
- Large stockpiles will be developed with benches that will act as a water break, minimising the formation of rills and gullies;
- Where practicable, internal access/haul roads will be aligned to drain laterally rather than along the length of the road; and
- The beds and banks at the discharge points to Mother Drain, New Ings Drain and Catchwater Drain will be suitably protected, subject to consent from the IDB.

5.0 MAINTENANCE PLAN

A surface water drainage maintenance plan for the Site has been prepared to ensure that the surface water drainage system will be suitably maintained to remain functional during quarry operations to reduce the risk of flooding to and from the Site, and manage suspended sediment.

Accumulated sediment within surface water control features shall be removed to ensure the design capacity of surface water infrastructure is maintained. All infrastructure is to be maintained throughout operation of the Site.

Neglecting to maintain the drainage system may result in reduced performance and could lead to eventual failure (overtopping, increased risks of flooding, reduced water quality etc). Preventative maintenance will reduce costs associated with repairing and the potential replacement of surface water infrastructure. Following extreme rainfall events (outside of the deign parameters) repair to infrastructure may be necessary where it has been undermined, washed out or sediment build-up has reduced the efficiency of drains.

5.1.1 Management and Maintenance

Management and maintenance of surface water drainage for the development will be the responsibility of Tarmac as the Site operator. To ensure the reliability of the surface water drainage system, it should be inspected, maintained and repaired on a regular basis by Tarmac. In particular inspections should be undertaken prior, during and after significant rainfall or fluvial flooding events on Site. Inspection of the drainage system should be undertaken by experienced and competent personnel. A suitably experienced and competent staff member shall be appointed by Tarmac to take responsibility for the management and maintenance of the drainage system. It is recommended a secondary competent person also be appointed for instances when the primary staff member is unavailable.

5.1.2 Maintenance Programme

A maintenance programme for the surface water drainage infrastructure within the Site which includes the recommended maintenance/inspection frequency that should be undertaken is provided within Table 3.

Table 3: Surface Water Maintenance Programme

Item	Description	Frequency
Site Drainage System Inspection/Audit		
Routine site inspection/audit of the surface water drainage system	Inspection of all the components of the surface water drainage system and identify deficiencies and where maintenance and/or repair is required.	Quarterly and before/after heavy rainfall or fluvial flooding events within the Site.
Drainage channels and Swales		
Channels and swales	Inspection for scour and cleaned of silt/sediment and debris.	Monthly and before/after heavy rainfall or fluvial flooding events within the Site.
Rock check dams	Upstream of dams to be cleaned of silt/sediment and repair to rock dams where damaged or scoured.	Monthly and before/after heavy rainfall or fluvial flooding events within the Site.
Discharge control structures/outlets	Outlets to be inspected and cleaned of silt/sediment and debris.	Monthly and before/after heavy rainfall or fluvial flooding events within the Site.
Road Culverts		
Culvert pipework	Inspection for pipe blockages and cleaned of silt/sediment and debris.	Monthly and before/after heavy rainfall or fluvial flooding events within the Site.

Item	Description	Frequency
Culvert inlets and outlets	Inspection for scour and cleaned of silt/sediment and debris.	Monthly and before/after heavy rainfall or fluvial flooding events within the Site.
Sediment Control Devices		
Silt Fences	Inspection and cleaned of silt/sediment and debris	Monthly and before/after heavy rainfall or fluvial flooding events within the Site.

5.1.3 Frequency of Maintenance and Inspection

An assessment of the adequacy of the frequency of inspections and silt/sediment cleaning should be undertaken by Tarmac in one, three and twelve month periods following commissioning of the surface water drainage system. Based on this assessment a more (or less) frequent inspection and maintenance programme may be more appropriate and should be updated and implemented as required.

5.1.4 Inspection and Maintenance Records

It is recommended a written record of routine inspections and maintenance be maintained on site throughout quarry operation and should include the following:

- Date;
- Personnel;
- Items inspected/maintained;
- Maintenance/repairs undertaken;
- Recommended replacement/maintenance/repairs that couldn't be completed on record date (if any); and
- Recommendations for further inspections.

6.0 SURFACE WATER MONITORING PLAN

This section details surface water monitoring and thresholds for cessation of pumping from the mineral workings so as not to exacerbate flooding or reduce water quality in the receiving drains.

6.1 Surface Water Level Monitoring and Threshold Levels

Surface water level monitoring will be undertaken at two locations as indicated in Drawing 1. Gauge boards will be installed prior to construction and surveyed within three months of installation. Surface water levels in New Ings Drain and Mother Drain will be recorded by reading the surface water level, to the nearest 0.01 m, on the gauge board.

The provisional threshold for cessation of dewatering/pumping is presented in Table 4.

Table 4: Water Level Monitoring

Monitoring Location	Drain	Threshold (mAOD)	Monitoring Frequency
WL1	New Ings Drain	3.2 mAOD	Daily – increase frequency following prolonged and heavy rainfall if water levels approach the threshold level.
WL2	Mother Drain	2.9 mAOD	
WL3	Mother Drain	2.8 mAOD	

In the absence of seasonal water level data, the threshold levels are provisionally set approximately 100 mm below the respective drain's top-of-bank. The threshold levels will be reviewed following the availability of 12 months of water level monitoring data. Monitoring will commence prior to construction.

6.2 Water Quality Monitoring and Environmental Assessment Limits

Water quality monitoring will be undertaken at 6 locations, along Catchwater Drain, New Ings Drain and Mother Drain as indicated in Drawing 1. Discharges from Site (to New Ings Drain and Mother Drain) will also be monitored. Monitoring upstream and downstream of the Site will indicate whether activities on Site are impacting water quality.

In Situ monitoring will be undertaken monthly and will include the following field parameters:

- pH;
- Temperature;
- Electrical Conductivity;
- Dissolved Oxygen; and
- Redox Potential.

Water samples will also be sent to an accredited laboratory on a monthly basis. A comprehensive set of determinands will be analysed on a quarterly basis and a subset will be analysed monthly. Monthly and quarterly monitoring suites are presented in Table 5.

Table 5: Laboratory Water Quality Suites

Monthly	Quarterly (in addition to monthly determinands)
pH	Chloride
Electrical Conductivity	Sulphate
Biological Oxygen Demand	Chemical Oxygen Demand
Total Dissolved Solids	Total Alkalinity as CaCO3
Total Suspended Solids	Total Hardness
Nitrate as NO3	Colour
Nitrite as NO2	Hexavalent Chromium
Total Oxidised Nitrogen as N	Gasoline Range Organics (GRO)
Ortho-Phosphate as PO4	Extractable Petroleum Hydrocarbons (EPH (C8-40))
Low Level Phosphorous	Metals – As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, Fe, Mn
Ammonia un-ionised as N	

The frequency of monitoring will be reviewed after six months; water quality monitoring may be reduced to a quarterly basis following review.

There is limited baseline data on which to derive environmental assessment limits (EALs). In order to determine EALs, surface water samples will be collected and sent to a laboratory before construction begins. The EALs will represent the threshold for which adverse trends and potential pollution incidents will be investigated. A preliminary plan of action is presented in Table 6 should exceedances be identified.

Table 6: Plan of action

Step	Action
1	Notify the EA/IDB of the exceedance of the EAL.
2	Carry out an on-site inspection to identify the potential source(s) of the exceedance. Review any changes to site operations and procedures.
3	If the source is identified, carry out applicable mitigation and inform the EA/IDB of the action taken.
4	If no source is identified, repeat the measurement/analysis in upstream and downstream locations within two weeks.
5	If results of the repeat sampling also exceed the EAL and indicate the Site is a source, sampling up and downstream should continue on a fortnightly basis for 2 months. Data will be reviewed for the presence of any trends or patterns indicating an ongoing contamination event.
6	If the laboratory results from the monitoring show no indications of decline over a two month period, and the evidence indicates that site activities is the most likely cause of the decrease in water quality, then appropriate mitigation will be carried out the EA/IDB informed of the action taken.

6.3 Record Keeping

Electronic records will be kept for each monitoring round; for each monitoring location this shall include the following:

- Sampling point monitored;
- Date and time of monitoring;
- Monitoring personnel; and
- Observations, including recent/current weather.

Water level monitoring locations will include the following:

- Gauge board water level; and
- Calculated surface water elevation in mAOD.

Water quality monitoring locations will include the following:

- Field parameters (In Situ); and
- Laboratory results.

6.4 Monitoring Plan Review

The surface water monitoring plan will be reviewed on an annual basis considering performance and Site development over the monitoring period. Amendments to the monitoring plan will be agreed with the Mineral Planning Authority (MPA), Environment Agency (EA) and IDB.

7.0 SUMMARY

- Surface water management during operations has been designed to control surface water runoff for all events up to and including the 1 in 100 year rainfall event, plus an allowance for climate change.
- Two stages of treatment will be provided to manage surface water runoff quality from the access road and discharge either to nearby drains or infiltrate to ground.

- Surface water runoff within the operational area of the Site will be manged by silt lagoons, settling out solids before discharging at the Greenfield runoff rate to New Ings Drain and Mother Drain.
- Preliminary threshold levels for pumping to New Ings Drain and Mother Drain have been established and will be reviewed as more data becomes available.
- Regular water level and water quality monitoring will be undertaken prior to and during operations to ensure the development does not have any direct or indirect hydrological impacts to Mother Drain and New Ings Drain.

8.0 REFERENCES

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CIRIA, 2015. The SuDS Manual. C753

IoH, 1994. Institute of Hydrology, Report No. 124, Flood Estimation for Small Catchments

SLR, 2006. Sturton Le Steeple Quarry, Environmental Impact Assessment.

Report Signature Page

GOLDER ASSOCIATES (UK) LTD

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22 April 2016

RE/MG/ss

APPENDIX A

Drawings

LEGEND

- APPROXIMATE LINE OF APPLICATION BOUNDARY
- WL — WATER LEVEL MONITORING POINTS
- WQ — WATER QUALITY MONITORING POINTS
- FILTER STRIP AND SWALE (INFILTRATION)
- FILTER STRIP AND SWALE (ATTENUATION)
- PROPOSED ROAD
- PHASE BOUNDARIES

NOT FOR CONSTRUCTION

0 | 0.5 | 1
1:25 METRES

CLIENT
DAVID L WALKER LTD

PROJECT
STURTON LE STEEPLE QUARRY

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-24
DESIGNED	RE
PREPARED	ECS
REVIEWED	MG
APPROVED	MG

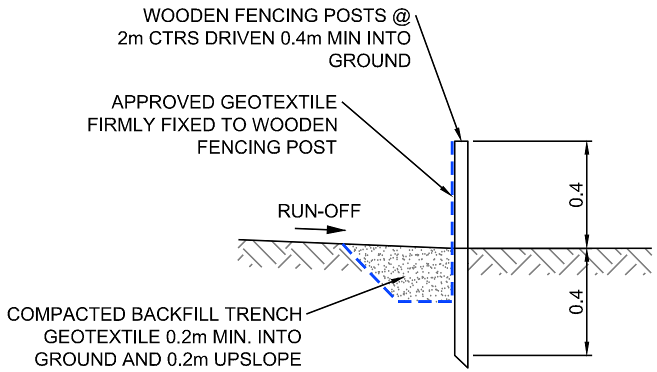
TITLE
SITE PLAN

PROJECT NO.	CONTROL	REV.	DRAWING
1543476	1001-HR-0001	A	1

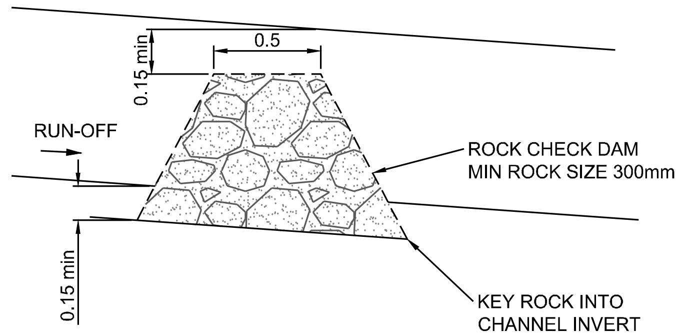
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

25 mm

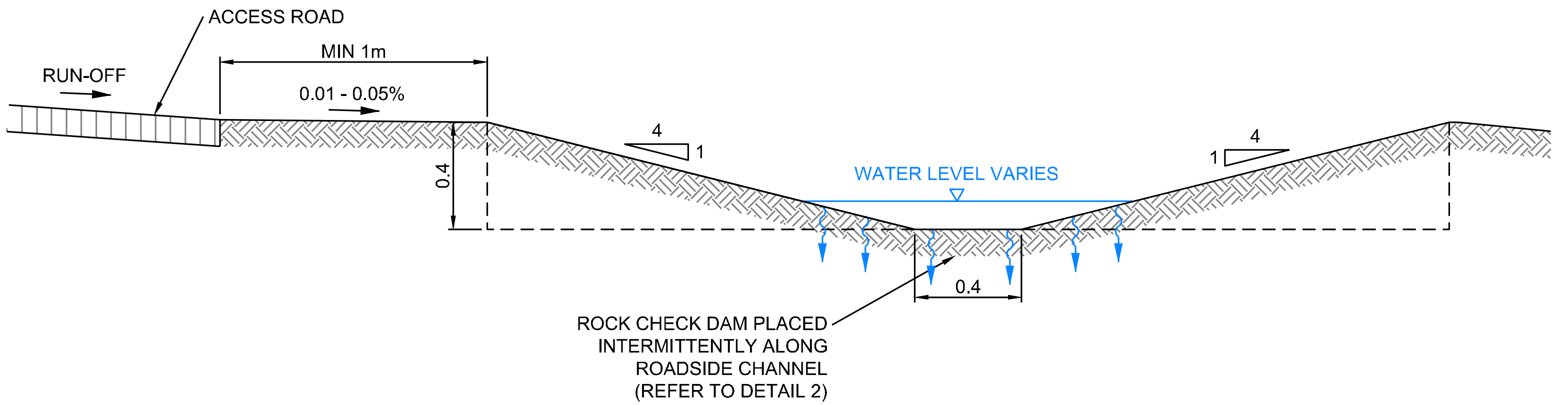
Path: \\bnd1-s-main01\CADD_GIS_GRAPHICS\Dave_L_Walker_Ltd\Sturton le Steeple Quarry\99_PROJECTS\1543476_Sturton le Steeple Quarry\1001_Hydro Report\02_PRODUCTION\DWG\ | File Name: 1543476-1001-HR-0001.dwg



DETAIL 1 - TYPICAL SILT FENCE DETAIL
SCALE 1:20



DETAIL 2 - TYPICAL ROCK CHECK DAM
SCALE 1:25



DETAIL 3 - ROADSIDE FILTER STRIP AND SWALE
SCALE 1:20

NOTES
1. ALL DIMENSIONS METRES (m) AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM (m AOD) UNLESS STATED OTHERWISE.
2. TYPICAL SILT FENCE DETAIL TO BE INCORPORATED AT THE BASE OF SLOPES AT STORAGE AREAS.
3. ROADSIDE FILTER STRIP AND SWALE ACCESS ROAD TO BE INCORPORATED ADJACENT TO SITE HAUL ROADS AND SERVICE ROADS.
4. ROCK CHECK DAM TO BE INCORPORATED INTERMITTENTLY ALONG SWALE .

NOT FOR CONSTRUCTION

0 0.5 1
1:25 METRES

0 0.5 1
1:20 METRES

CLIENT
DAVID L WALKER LTD

PROJECT
STURTON LE STEEPLE QUARRY

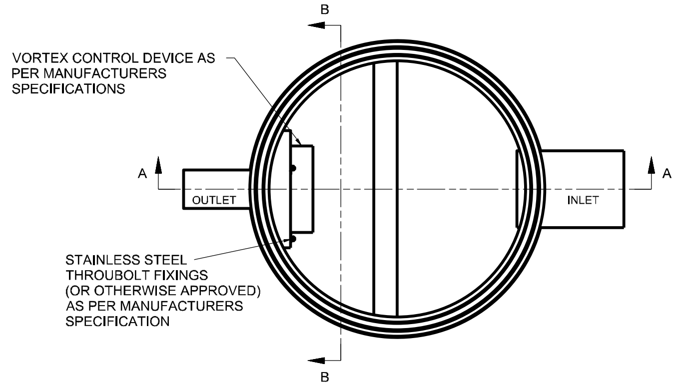
CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-23
DESIGNED	RE
PREPARED	ECS
REVIEWED	MG
APPROVED	MG

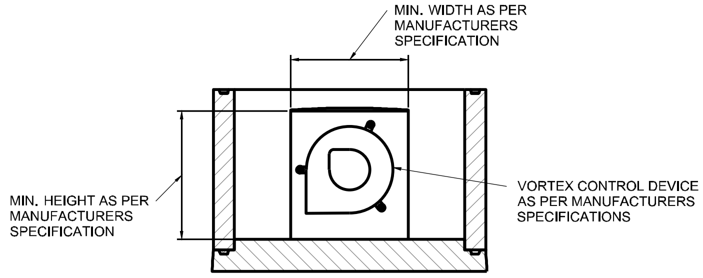
TITLE
GENERAL DETAILS

PROJECT NO.	CONTROL	REV.	DRAWING
1543476	1001-HR-0002	A	2

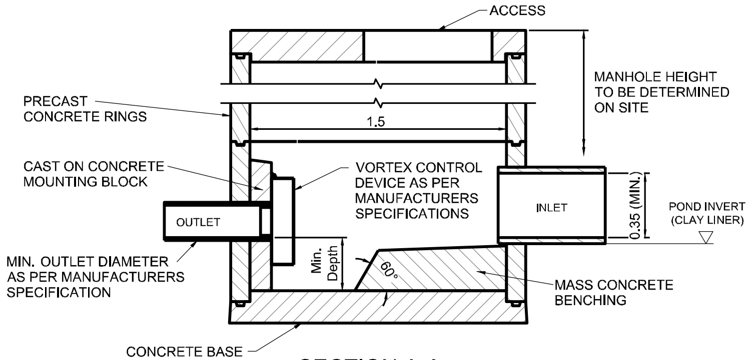
Path: \\bnd1-s-main01\CADD_GIS_GRAPHICS\dave_l_walker_ltd\sturton le steeple quarry\99_PROJECTS\1543476_Sturton le Steeple Quarry\1001_Hydro Report\02_PRODUCTION\DWG\ | File Name: 1543476-1001-HR-0002.dwg



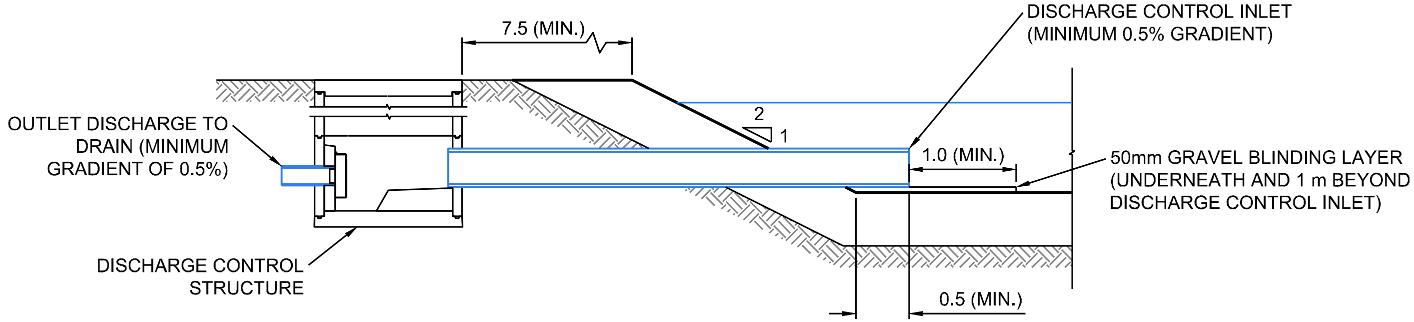
DISCHARGE CONTROL STRUCTURE - PLAN



SECTION B-B
(VIEW ON MOUNTING BLOCK)



SECTION A-A



PLANT SITE POND AND DISCHARGE CONTROL STUCTURE DETAIL
NOT TO SCALE

NOTES
1. ALL DIMENSIONS METRES (m) AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM (m AOD) UNLESS STATED OTHERWISE.
2. EXISTING GROUND LEVELS AT PROPOSED DISCHARGE CONTROL STRUCTURE TO BE CONFIRMED ON SITE.
3. INLET AND OUTLET PIPE MATERIAL AS PER MANUFACTURERS RECOMMENDATIONS.
4. OUTLET DISCHARGE PIPE INSTALLED AT AN INVERT LEVEL OF 35.0 m AOD.
5. MAXIMUM ALLOWABLE DISCHARGE THROUGH VORTEX CONTROL DEVICE = 5 L/s.

NOT FOR CONSTRUCTION

0 0.5 1
1:25 METRES

CLIENT
DAVID L WALKER LTD

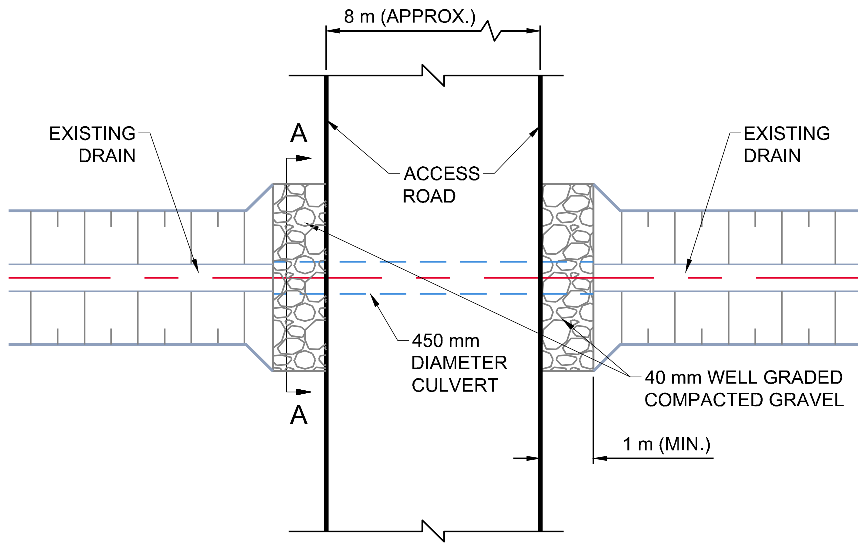
CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-23
DESIGNED	RE
PREPARED	ECS
REVIEWED	MG
APPROVED	MG

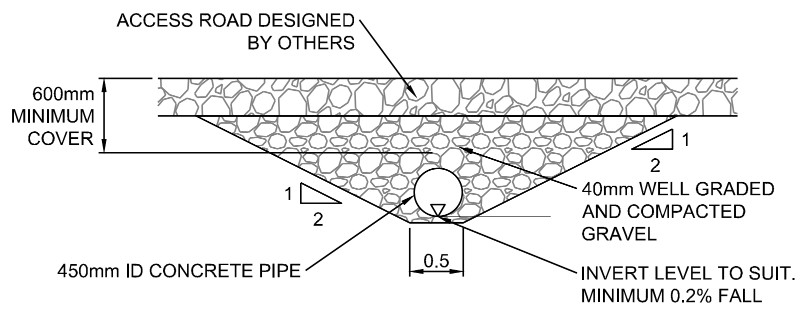
PROJECT
STURTON LE STEEPLE QUARRY

TITLE
SWALE DISCHARGE CONTROL STRUCTURE

PROJECT NO.	CONTROL	REV.	DRAWING
1543476	1001-HR-0002	A	3



ACCESS ROAD CULVERT DRAINAGE DETAIL - PLAN
SCALE 1:100



ACCESS ROAD CULVERT DRAINAGE DETAIL
SECTION A-A
SCALE 1:50

NOTES
1. ALL DIMENSIONS METRES (m) AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM (m AOD) UNLESS STATED OTHERWISE.

NOT FOR CONSTRUCTION

0 1 2
1:50 METRES

0 2.5 5
1:100 METRES

CLIENT
DAVID L WALKER LTD

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-23
DESIGNED	RE
PREPARED	ECS
REVIEWED	MG
APPROVED	MG

PROJECT
STURTON LE STEEPLE QUARRY

TITLE
DRAIN CROSSING

PROJECT NO.	CONTROL	REV.	DRAWING
1543476	1001-HR-0003	A	4

APPENDIX B

Borehole Logs

Tarmac Quarry Products (Eastern) Limited — Borehole Log — Tarmac

Site:	**West Burton, Sturton-Le-Steeple, Nr Gainsborough, North Notts.**	**Borehole No.**	**WB 05/96**
Coordinates:	**East:**	**North:**	**Elevation:**
Date drilled:	22 November 1996		
Drill rig / method:	HB90 Intermittent flight auger. Mr W Gee.	**Logged by:**	A P Wilkinson
Testing Laboratory:	TQP(E)L Matlock		
Piezometer / water levels:	Damp below 1.5m, wet below 3.0m.		

Depths From	Depths To	Description	Log	Sample depths From	Sample depths To	% Gravel	% Sand	% Silt	5.00 mm	3.35 mm	2.36 mm	1.18 mm	600 mic	300 mic	212 mic	150 mic	75 mic
0.0	0.4	TOPSOIL. Loose, brown, sandy, clayey soils.															
0.4	1.5	SANDY CLAY. Firm/loose (rubbly), brown, sandy clay.															
1.5	4.5	CLAYEY SAND. Soft/loose, orange brown, claycy, fine medium to medium grained sand. Damp below 1.5m, wet below 3.0m.		1.5 3.0	3.0 4.5												
4.5	7.4	SAND. Loose, orange brown, silty, slightly clayey, fine to medium grained sub-angular to sub-rounded sand with some rare fine sub-rounded to rounded gravel. Some lignite present. Wet.		4.5 6.0	6.0 7.5												
7.4	7.5	CLAY MARL. Stiff, blue grey and red brown, clay.															

Tarmac Quarry Products (Eastern) Limited — Borehole Log — Tarmac

Site:	West Burton, Sturton-Le-Steeple, Nr Gainsborough, North Notts.	**Borehole No.**	WB 06/96
Coordinates:	**East:** **North:**	**Elevation:**	**Date drilled:** 22 November 1996
Drill rig / method:	HE90 Intermittent flight auger. Mr W Gee.	**Logged by:** A P Wilkinson	**Testing Laboratory:** TQP(E)L Matlock
Piezometer / water levels:	Damp below 1.6m.		

Depths From	Depths To	Description	Log	Sample depths From	Sample depths To	% Gravel	% Sand	% Silt	5.00 mm	3.35 mm	2.36 mm	1.18 mm	600 mic	300 mic	212 mic	150 mic	75 mic
0.0	0.8	TOPSOIL. Loose, brown, sandy soils.															
0.8	1.6	SAND. Loose, pale orange brown, clean to slightly silty, fine medium to medium coarse sub-angular to sub-rounded sand.		0.8	1.6												
1.6	2.3	CLAYEY SAND. Loose/soft, brown, clayey, fine medium to medium grained sub-angular to sub-rounded sand. Damp.		1.6	2.3												
2.3	3.0	CLAY MARL. Stiff, blue grey and red brown, clay.															

APPENDIX C

Surface Water Runoff Calculations

IOH 124

LOCATION Sturton Le Steeple

	Parmeter	Unit	Value	GrowthFactor (100 years)	Comments
Descriptors					
	Site Area	ha	25		
		km^2	0.25		
	Calc Area	km^2	0.5		
	SAAR	mm	580		
	SOIL	4	0.45		
	Growth Factor	4		2.57	
$QBAR_{rural}$	$QBAR_{rural}$	l/s	176.27	453.02	
		l/s/ha	3.525	9.06	
		l/s (Site)	88.1	226.51	
		cumecs	0.088	0.23	
Descriptors	Hardstandng	ha	0		
	URBAN		0.000		
	CWI		78		
	CIND		32.92		
	NC		0.7808		
$QBAR_{urban}$	$QBAR_{urban}$	l/s	176.3	562.31	
		l/s/ha	3.525	11.25	
		l/s (Site)	88.1	281.16	
		cumecs	0.088	0.28	

Date: February 2016

Golder Associates

Plant Site

Calculated Greenfield Run 3.5 l/s/ha
IDB Runoff 1.4 l/s/ha
Flow Rate Q (m^3/s) = C i A
where C = coefficient of runoff; i = rainfall intensity; A = catchment area
then Runoff Volume = Q x Duration

Area 30,000 m^2
Runoff Coefficient 0.90

30 year return period		**Hardstanding**		
Duration (mins)	Rainfall (mm)	Volume of Runoff (Hardstand) (m^3)	Volume of Runoff (Greenfield) (m^3)	Storage Required to Retain Greenfield Rate (m^3)
15	25.82	697	4	693
30	32.77	885	8	877
60	38.09	1,028	15	1,013
120	43.44	1,173	30	1,143
240	49.45	1,335	60	1,275
360	53.60	1,447	91	1,356
720	61.71	1,666	181	1,485
1080	68.34	1,845	272	1,573
1440	73.56	1,986	363	1,623
2880	87.63	2,366	726	1,640
5760	98.89	2,670	1,452	1,219
8640	106.18	2,867	2,177	690
10080	109.10	2,946	2,540	406
			Maximum	**1,640**

100 year return period		**Hardstanding**		
Duration (mins)	Rainfall (mm)	Volume of Runoff (Hardstand) (m^3)	Volume of Runoff (Greenfield) (m^3)	Storage Required to Retain Greenfield Rate (m^3)
15	38.48	1,039	4	1,035
30	43.94	1,186	8	1,179
60	50.17	1,355	15	1,339
120	57.29	1,547	30	1,517
240	65.42	1,766	60	1,706
360	70.70	1,909	91	1,818
720	80.72	2,179	181	1,998
1080	89.06	2,405	272	2,132
1440	95.49	2,578	363	2,215
2880	112.97	3,050	726	2,324
5760	125.46	3,387	1,452	1,936
8640	133.41	3,602	2,177	1,425
11520	139.35	3,762	2,903	859
12960	141.85	3,830	3,266	564
			Maximum	**2,324**

100 year return period plus 20%		**Hardstanding**		
Duration (mins)	Rainfall (mm)	Volume of Runoff (Hardstand) (m^3)	Volume of Runoff (Greenfield) (m^3)	Storage Required to Retain Greenfield Rate (m^3)
15	46.18	1,247	4	1,243
30	52.73	1,424	8	1,416
60	60.20	1,626	15	1,610
120	68.75	1,856	30	1,826
240	78.50	2,120	60	2,059
360	84.84	2,291	91	2,200
720	96.86	2,615	181	2,434
1080	106.87	2,886	272	2,613
1440	114.59	3,094	363	2,731
2880	135.56	3,660	726	2,934
5760	150.55	4,065	1,452	2,613
8640	160.09	4,322	2,177	2,145
11520	167.22	4,515	2,903	1,612
12960	170.22	4,596	3,266	1,330
			Maximum	**2,934**

Date: February 2016

Golder Associates

Access Road (West of Catchwater Drain)

Calculated Greenfield Runoff 3.5 l/s/ha
Proposed Discharge 2.0 l/s
Flow Rate Q (m^3/s) = C i A
where C = coefficient of runoff; i = rainfall intensity; A = catchment area
then Runoff Volume = Q x Duration

Area 10,800 m^2
Runoff Coefficient 0.90

30 year return period		**Hardstanding**		
Duration (mins)	Rainfall (mm)	Volume of Runoff (Hardstand) (m^3)	Volume of Runoff (Greenfield) (m^3)	Storage Required to Retain Greenfield Rate (m^3)
15	25.82	251	2	249
30	32.77	319	4	315
60	38.09	370	7	363
120	43.44	422	14	408
240	49.45	481	29	452
360	53.60	521	43	478
720	61.71	600	86	513
1080	68.34	664	130	535
1440	73.56	715	173	542
2880	87.63	852	346	506
5760	98.89	961	691	270
8640	106.18	1,032	1,037	0
10080	109.10	1,060	1,210	0
			Maximum	**542**

100 year return period		**Hardstanding**		
Duration (mins)	Rainfall (mm)	Volume of Runoff (Hardstand) (m^3)	Volume of Runoff (Greenfield) (m^3)	Storage Required to Retain Greenfield Rate (m^3)
15	38.48	374	2	372
30	43.94	427	4	423
60	50.17	488	7	480
120	57.29	557	14	542
240	65.42	636	29	607
360	70.70	687	43	644
720	80.72	785	86	698
1080	89.06	866	130	736
1440	95.49	928	173	755
2880	112.97	1,098	346	752
5760	125.46	1,219	691	528
8640	133.41	1,297	1,037	260
11520	139.35	1,354	1,382	0
12960	141.85	1,379	1,555	0
			Maximum	**755**

100 year return period plus 20%		**Hardstanding**		
Duration (mins)	Rainfall (mm)	Volume of Runoff (Hardstand) (m^3)	Volume of Runoff (Greenfield) (m^3)	Storage Required to Retain Greenfield Rate (m^3)
15	46.18	449	2	447
30	52.73	513	4	509
60	60.20	585	7	578
120	68.75	668	14	654
240	78.50	763	29	734
360	84.84	825	43	781
720	96.86	942	86	855
1080	106.87	1,039	130	909
1440	114.59	1,114	173	941
2880	135.56	1,318	346	972
5760	150.55	1,463	691	772
8640	160.09	1,556	1,037	519
11520	167.22	1,625	1,382	243
12960	170.22	1,655	1,555	99
			Maximum	**972**

Date: February 2016

Golder Associates

Access Road (West of Catchwater Drain)

Calculated Greenfield Runoff 3.5 l/s/ha
Proposed Discharge 2.0 l/s
Flow Rate Q (m^3/s) = C i A
where C = coefficient of runoff; i = rainfall intensity; A = catchment area
then Runoff Volume = Q x Duration

Area 4,800 m^2
Runoff Coefficient 0.90

30 year return period		**Hardstanding**		
Duration (mins)	Rainfall (mm)	Volume of Runoff (Hardstand) (m^3)	Volume of Runoff (Greenfield) (m^3)	Storage Required to Retain Greenfield Rate (m^3)
15	25.82	112	2	110
30	32.77	142	4	138
60	38.09	165	7	157
120	43.44	188	14	173
240	49.45	214	29	185
360	53.60	232	43	188
720	61.71	267	86	180
1080	68.34	295	130	166
1440	73.56	318	173	145
2880	87.63	379	346	33
5760	98.89	427	691	0
8640	106.18	459	1,037	0
10080	109.10	471	1,210	0
			Maximum	**188**

100 year return period		**Hardstanding**		
Duration (mins)	Rainfall (mm)	Volume of Runoff (Hardstand) (m^3)	Volume of Runoff (Greenfield) (m^3)	Storage Required to Retain Greenfield Rate (m^3)
15	38.48	166	2	164
30	43.94	190	4	186
60	50.17	217	7	210
120	57.29	247	14	233
240	65.42	283	29	254
360	70.70	305	43	262
720	80.72	349	86	262
1080	89.06	385	130	255
1440	95.49	413	173	240
2880	112.97	488	346	142
5760	125.46	542	691	0
8640	133.41	576	1,037	0
11520	139.35	602	1,382	0
12960	141.85	613	1,555	0
			Maximum	**262**

100 year return period plus 20%		**Hardstanding**		
Duration (mins)	Rainfall (mm)	Volume of Runoff (Hardstand) (m^3)	Volume of Runoff (Greenfield) (m^3)	Storage Required to Retain Greenfield Rate (m^3)
15	46.18	199	2	198
30	52.73	228	4	224
60	60.20	260	7	253
120	68.75	297	14	283
240	78.50	339	29	310
360	84.84	367	43	323
720	96.86	418	86	332
1080	106.87	462	130	332
1440	114.59	495	173	322
2880	135.56	586	346	240
5760	150.55	650	691	0
8640	160.09	692	1,037	0
11520	167.22	722	1,382	0
12960	170.22	735	1,555	0
			Maximum	**332**

Date: February 2016

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Access Road and Conveyor Track Infiltration

h = D/n(RI-q)

h = water depth across infiltration area (m)

R = ratio of drained area to infiltration area (R = Ad/Ab)
q = infiltration coefficient (m/h)
I = rainfall intensity (m/hr)
D = rainfall duration (hr)
Ab = base area of infiltration system (m^2)
Ad = area to be drained (m^2)
n = porosity of fill material

= input cells

Ab	4	m^2
Ad	8	m^2
soil infiltration rate	1.00E-06	m/s
n	1	
factor of safety	1.5	
q	0.0024	m/h
R	2.22	

Return Period **10**

Time (mins)	Rainfall Intensity (m/h)	h (m)	Time to Half Empty (hrs)
15	0.0712	0.04	8.1
30	0.0421	0.05	9.5
60	0.0249	0.05	11.0
120	0.0147	0.06	12.6
180	0.0108	0.06	13.5
240	0.0087	0.07	14.1
360	0.0064	0.07	14.7
540	0.0047	0.07	15.0
720	0.0038	0.07	14.9
1,080	0.0028	0.07	14.6
1,440	0.0023	0.07	13.6
2,160	0.0017	0.05	10.8
	Maximum	0.07	15.0

Return Period **100**

Time (mins)	Rainfall Intensity (m/h)	h (m)	Time to Half Empty (hrs)
15	0.1539	0.08	17.7
30	0.0879	0.10	20.1
60	0.0502	0.11	22.7
120	0.0286	0.12	25.5
180	0.0206	0.13	27.2
240	0.0164	0.14	28.3
360	0.0118	0.14	29.7
540	0.0085	0.15	30.9
720	0.0067	0.15	31.4
1,080	0.0049	0.15	32.2
1,440	0.0040	0.15	32.2
2,160	0.0029	0.15	30.8
	Maximum	0.15	32.2

Return Period **100+CC**

Time (mins)	Rainfall Intensity (m/h)	h (m)	Time to Half Empty (hrs)
15	0.1847	0.10	21.3
30	0.1055	0.12	24.2
60	0.0602	0.13	27.4
120	0.0344	0.15	30.8
180	0.0248	0.16	32.9
240	0.0196	0.16	34.3
360	0.0141	0.17	36.3
540	0.0102	0.18	37.9
720	0.0081	0.19	38.8
1,080	0.0059	0.19	40.5
1,440	0.0048	0.20	41.1
2,160	0.0035	0.19	40.5
2,880	0.0028	0.19	38.8
	Maximum	0.20	41.1

Date: February 2016

Extraction Area Storage and Discharge

Greenfield Runoff Rate	1.4 l/s/ha
Extraction Area Site Runoff Coefficient[2]	0.9
Soil Stripped Area Runoff Coefficient	0.3
Restoration Area Runoff Coefficient	0.3

100 year return period plus 20%, 24 Hour Runoff Volume										
Operational Phase	**Site Areas (m²)**					24hr Rainfall Depth[1] (mm)	Total Runoff Volume for Phase Catchment (m³)	Pre development (Existing Greenfield) Runoff Volume for Phase Catchment (m³)	Increase in Runoff (Stored in Wetland/Settlement Lagoon) (m³)	Greenfield Discharge Rate (l/s)
	Extraction	**Soil Stripped**	**Lagoon**	**Restoration**	**Total Area**					
1	30,000	87,000	30,000	0	147,000	115	9,522	1,778	7,744	20.6
3	30,000	38,000	80,000	26,000	174,000	115	14,461	2,105	12,356	24.4
4	30,000	107,500	107,000	57,000	301,500	115	21,010	3,647	17,363	42.2
5	30,000	36,000	107,000	194,500	367,500	115	23,279	4,445	18,833	51.5
6	30,000	54,000	107,000	260,500	451,500	115	26,166	5,461	20,705	63.2
7	30,000	182,500	107,000	327,500	647,000	115	32,887	7,826	25,061	90.6

Notes:

[1] 24 hr rainfall sourced from FEH CD ROM V3

[2]During extraction it is assumed all runoff is captured within the void.

Runoff Coefficients derived from FEH CD ROM V3

Extraction area runoff coefficient assumes groundwater level is at or near the surface of the base of the void

Phase 2 extracted during Phases 1, 3 and 4

Flow Rate Q (m^3/s) = C i A

where C = coefficient of runoff; i = rainfall intensity; A = catchment area

then Runoff Volume = Q x Duration

Extraction Area Storage and Discharge

Greenfield Runoff Rate	1.4 l/s/ha
Extraction Area Site Runoff Coefficient[2]	0.9
Soil Stripped Area Runoff Coefficient	0.3
Restoration Area Runoff Coefficient	0.3

100 year return period plus 20%, 7 day Runoff Volume										
Operational Phase	**Site Areas (m²)**					7 day Rainfall Depth[1] (mm)	Total Runoff Volume for Phase Catchment (m³)	Pre development (Existing Greenfield) Runoff Volume for Phase Catchment (m³)	Increase in Runoff (Stored in Wetland/Settlement Lagoon) (m³)	Greenfield Discharge Rate (l/s)
	Extraction	**Soil Stripped**	**Lagoon**	**Restoration**	**Total Area**					
1	30,000	87,000	30,000	0	147,000	164	13,618	12,447	1,171	20.6
3	30,000	38,000	80,000	26,000	174,000	164	20,681	14,733	5,948	24.4
4	30,000	107,500	107,000	57,000	301,500	164	30,046	25,529	4,517	42.2
5	30,000	36,000	107,000	194,500	367,500	164	33,291	31,117	2,174	51.5
6	30,000	54,000	107,000	260,500	451,500	164	37,420	38,229	0	63.2
7	30,000	182,500	107,000	327,500	647,000	164	47,031	54,783	0	90.6

Notes:

[1] 24 hr rainfall sourced from FEH CD ROM V3

[2]During extraction it is assumed all runoff is captured within the void.

Runoff Coefficients derived from FEH CD ROM V3

Extraction area runoff coefficient assumes groundwater level is at or near the surface of the base of the void

Phase 2 extracted during Phases 1, 3 and 4

Flow Rate Q (m^3/s) = C i A

where C = coefficient of runoff; i = rainfall intensity; A = catchment area

then Runoff Volume = Q x Duration

Date: February 2016

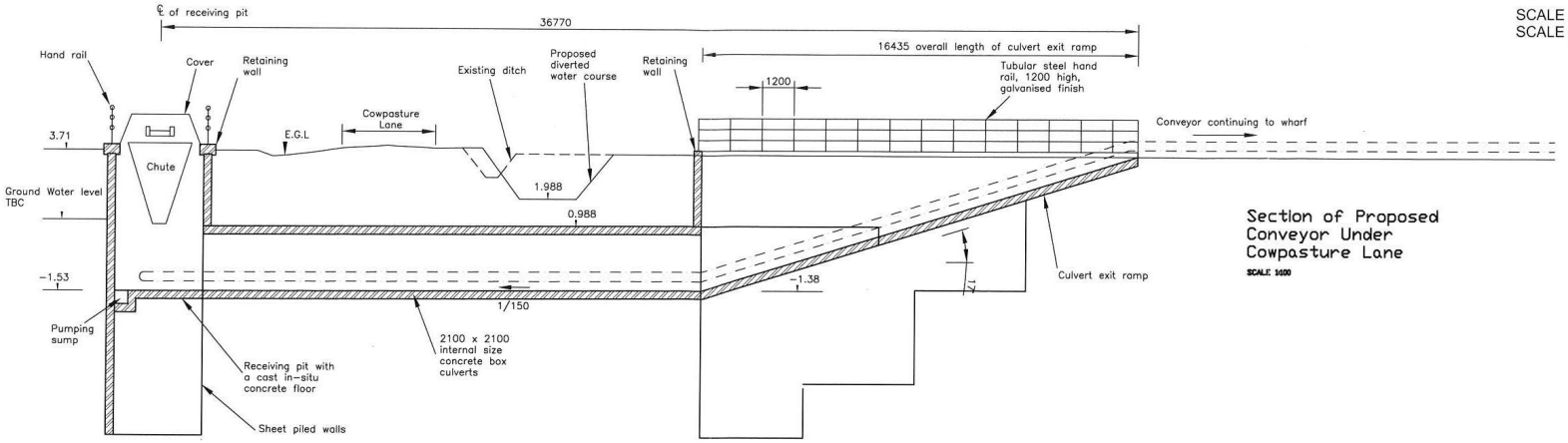
Golder Associates

APPENDIX D

Proposed Channel Realignment

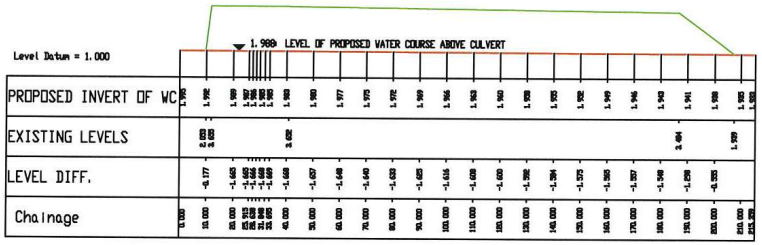
NOTE: -

SCALE @ A1: 1.:100, 1:500, 1:1000
SCALE @ A3: 1:200, 1:1000, 1:2000



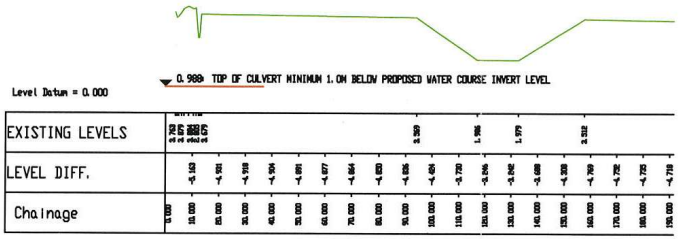
Section of Proposed Conveyor Under Cowpasture Lane

SCALE 1:100



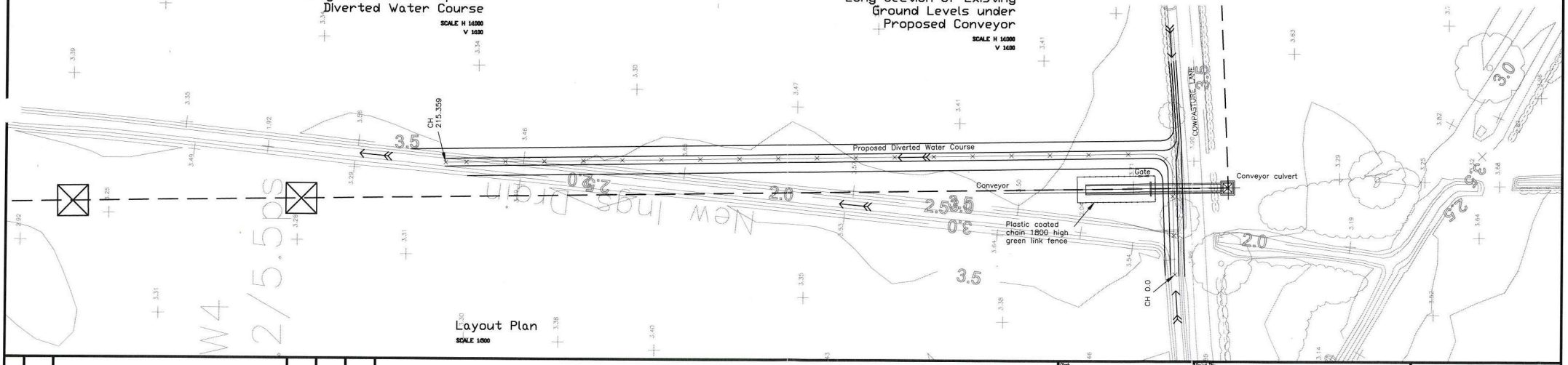
Long Section of Proposed Diverted Water Course

SCALE H 1:1000
V 1:100



Long Section of Existing Ground Levels under Proposed Conveyor

SCALE H 1:1000
V 1:100



Layout Plan

SCALE 1:500

This drawing is to be read in conjunction with WAF drawing number 63239/003 Quarry Access Road Planning Layout.

Rev.	Date	Description	Drawn	Checked	Approved

Client:

Project Title: STURTON LE STEEPLE

FAIRHURST
CONSULTING STRUCTURAL AND CIVIL ENGINEERS
Wellesbourne House, Walton Road, Wellesbourne, WARKS CV35 9JB
T: 01789 470512 F: 01789 470619

Scale at A1:	Status:	CAD File Name:
As Shown	PRELIMINARY	po00009-.dwg

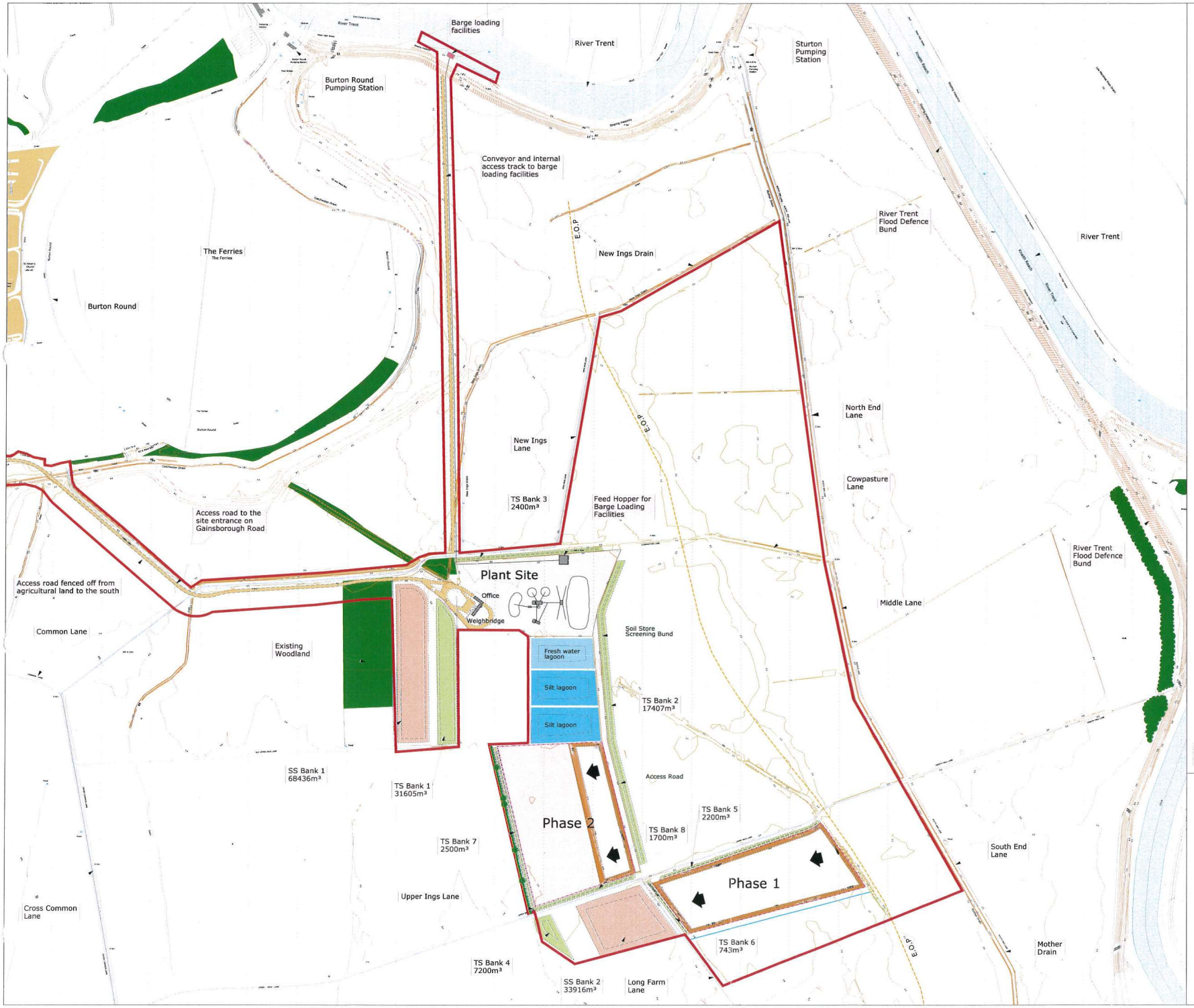
Drawing Title: DIVERSION OF WATERCOURSE AND CULVERT UNDER COWPASTURE LANE

Drawn:	Checked:	Approved:
TH	PRT	PRT
Date: 12/04/06	Date: 15/05/06	Date: 15/05/06

Drawing No.: 63239/009 Revision: –

APPENDIX E

Restoration Plans



Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Proposed fence along access road corridor
- Approximate extent of peat overburden
- Land managed for agriculture within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Progressive restoration underway

PLEYDELL SMITHYMAN LIMITED

PROJECT Sturton-le-Steeple

CLIENT Lafarge Aggregates Ltd

TITLE Working and Restoration Phases 1 and 2

DATE	SCALE
Jun 2006	1 : 7,500
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AH	DB
DRAW NO.	REVISION
SLS 5/3	

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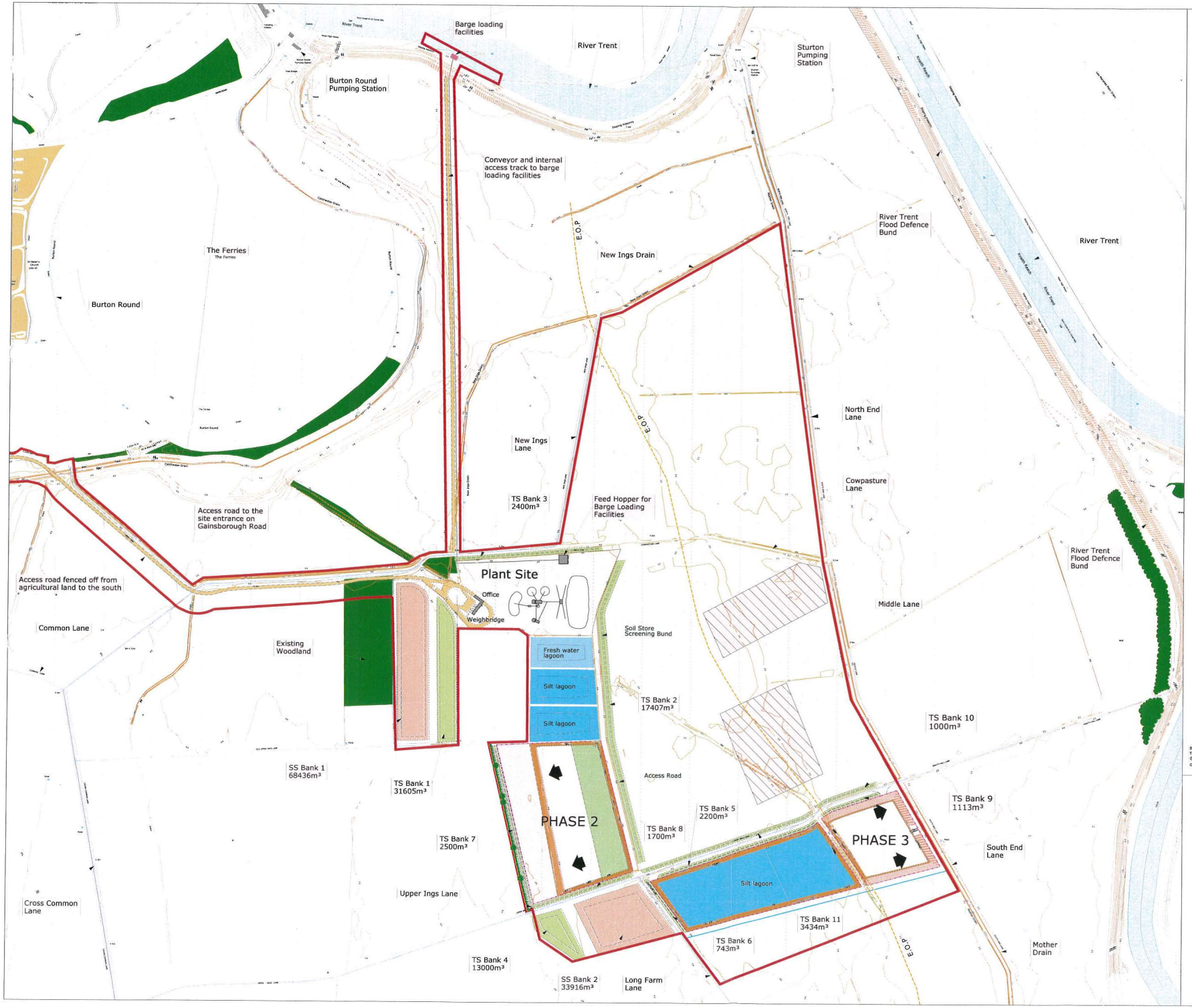

Legend

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- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Detailed archaeological investigation area
- Approximate extent of peat overburden
- Land managed for agriculture within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Progressive restoration underway

PLEYDELL SMITHYMAN LIMITED

PROJECT Sturton-le-Steeple

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TITLE Working and Restoration Phases 2 and 3

DATE	SCALE
Jun 2006	1 : 7,500
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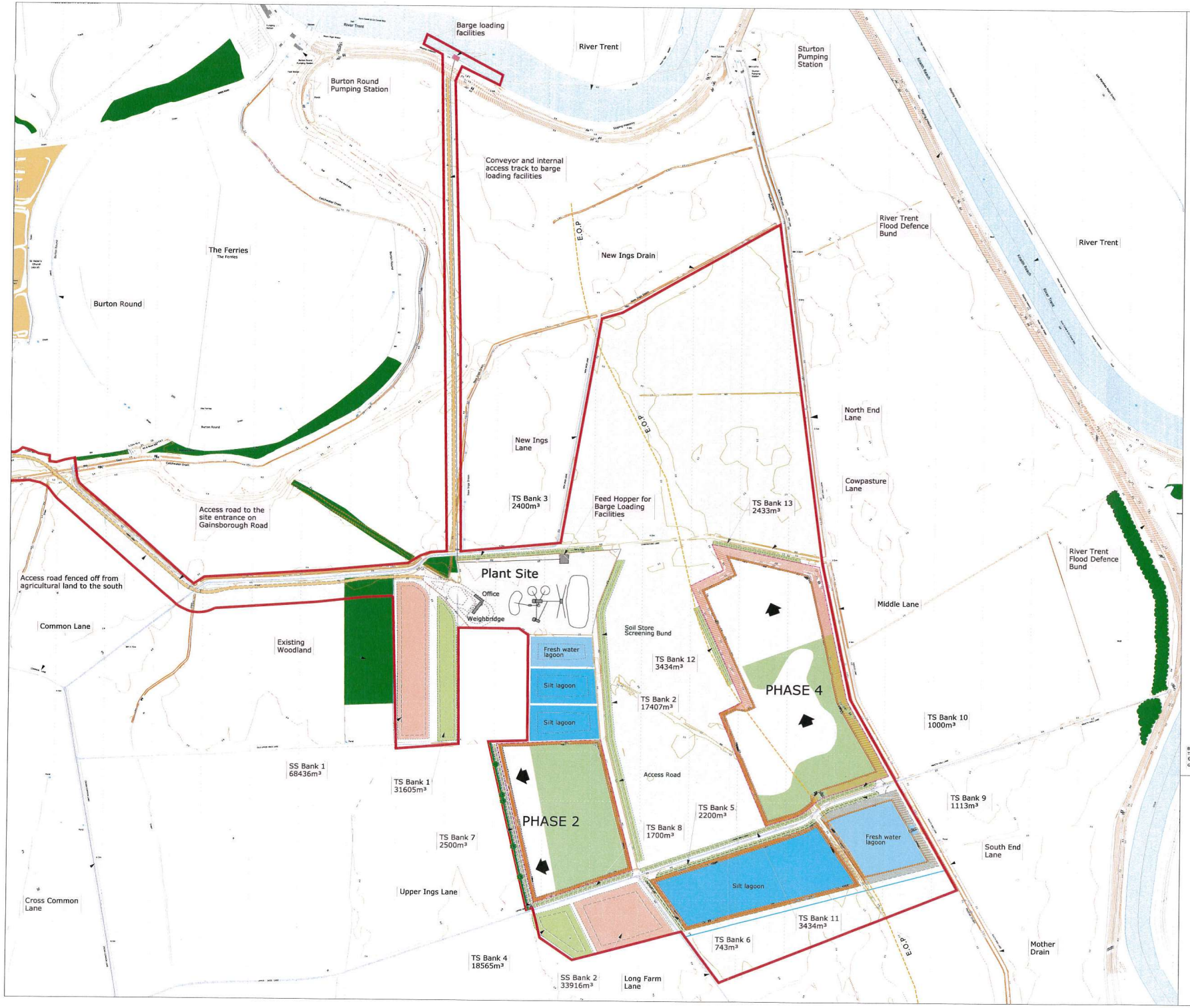

Legend

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- River Trent
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- Local roads
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- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Approximate extent of peat overburden
- Land managed for agricultural within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Progressive restoration underway

PLEYDELL SMITHYMAN LIMITED

PROJECT Sturton-le-Steeple

CLIENT Lafarge Aggregates Ltd

TITLE Working and Restoration Phases 2 and 4

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DATE	SCALE
Jun 2006	1 : 7,500
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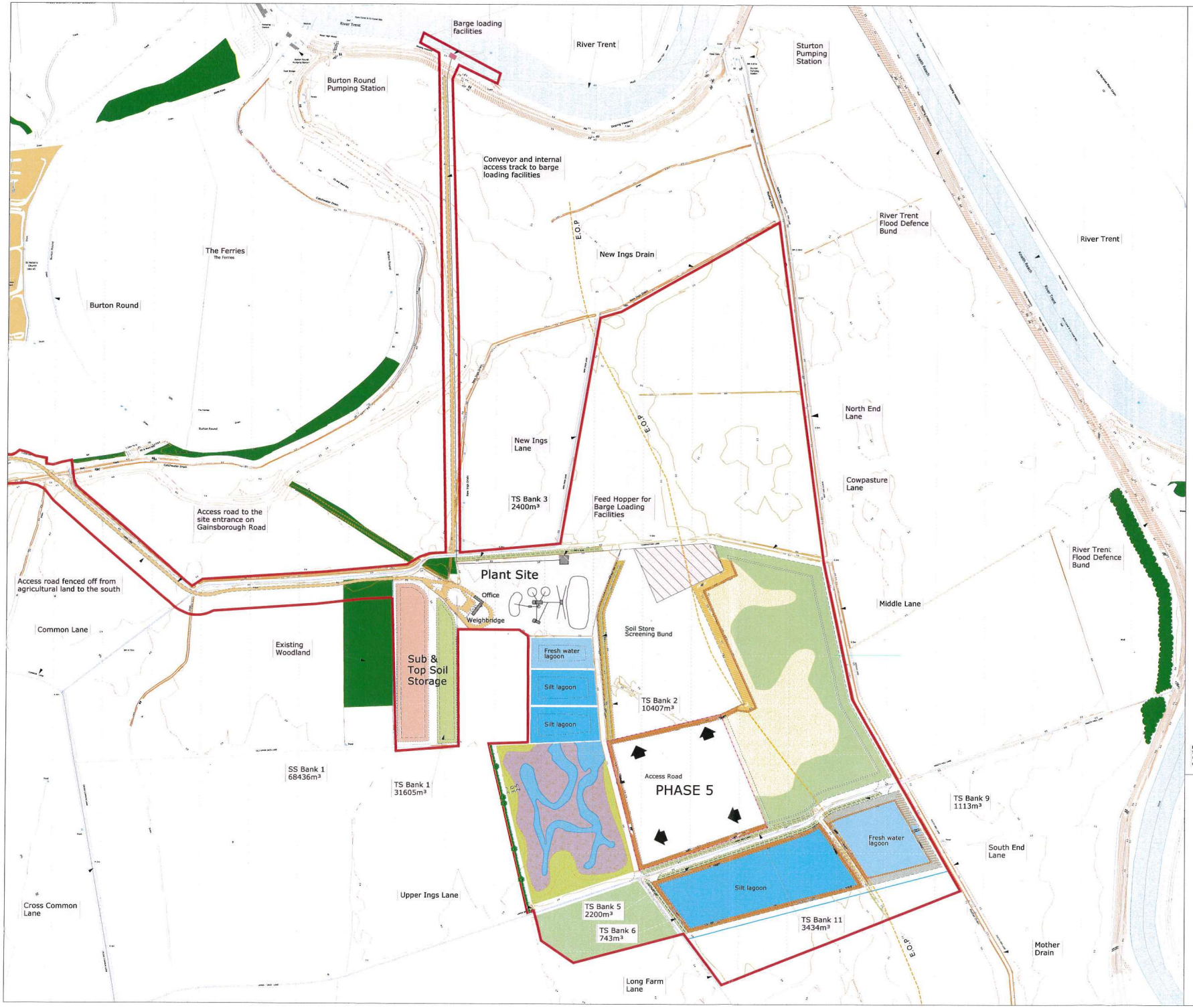

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Detailed archeological investigation area
- Approximate extent of peat overburden
- Land managed for agriculture within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Worked out void
- Progressive restoration underway
- Restoration to wetland habitats including herb rich fen and vegetated shallows
- Restoration to wet grassland

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PROJECT Sturton-le-Steeple

CLIENT Lafarge Aggregates Ltd

TITLE Working and Restoration Phase 5

DATE	SCALE
Jun 2006	1 : 7,500
DRAWN	CHECKED
AH	DB
DRAW NO.	REVISION
SLS 5/6	

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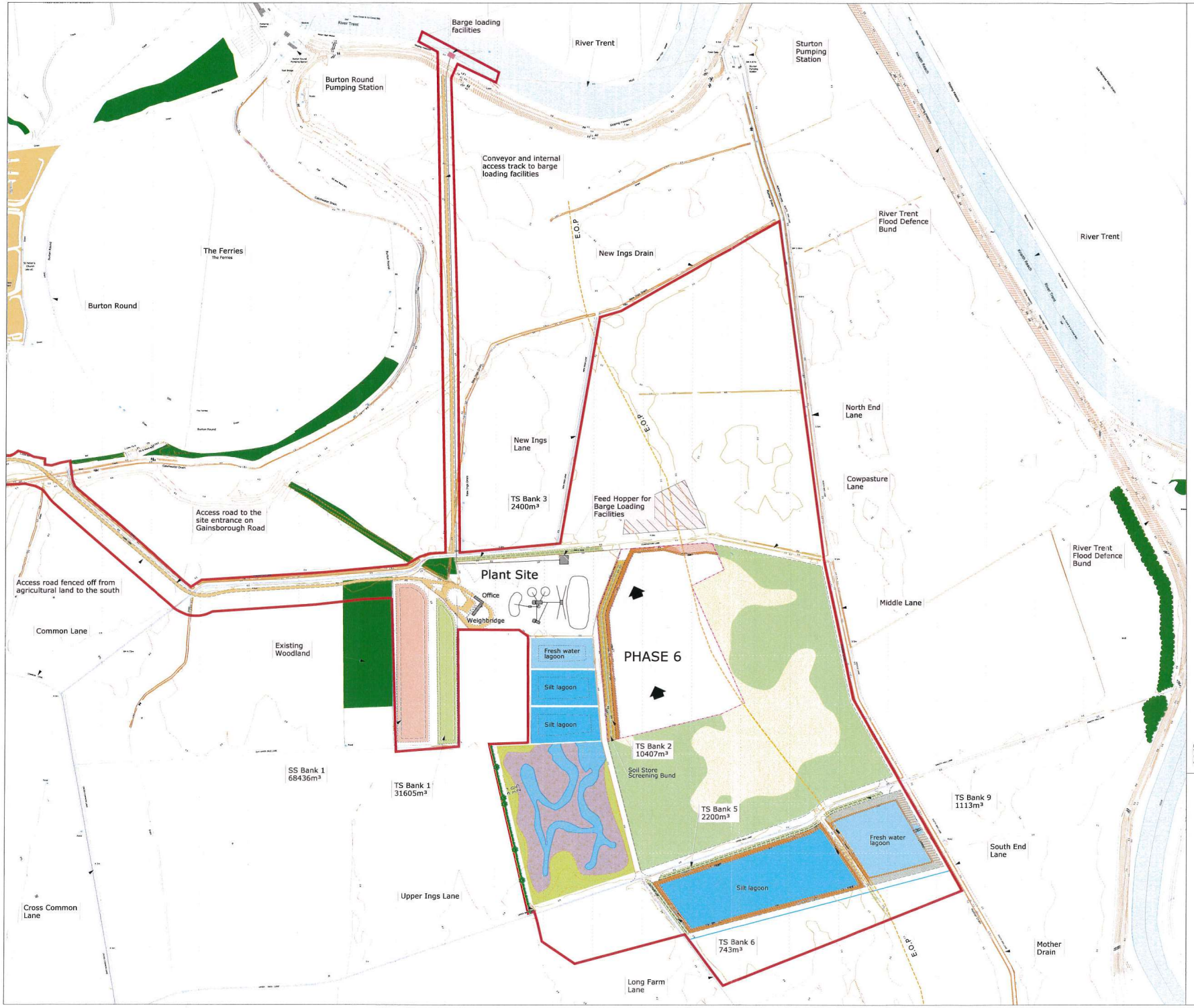

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Detailed archeological investigation area
- Approximate extent of peat overburden
- Agricultural managed land within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Worked out void
- Progressive restoration underway
- Restoration to wetland habitats including herb rich fen and vegetated shallows
- Restoration to wet grassland

PLEYDELL SMITHYMAN LIMITED

N

PROJECT Sturton-le-Steeple

CLIENT Lafarge Aggregates Ltd

TITLE Working and Restoration Phase 6

DATE	SCALE
Jun 2006	1 : 7,500
DRAWN	CHECKED
AH	DB
DRAW NO.	REVISION
SLS 5/7	

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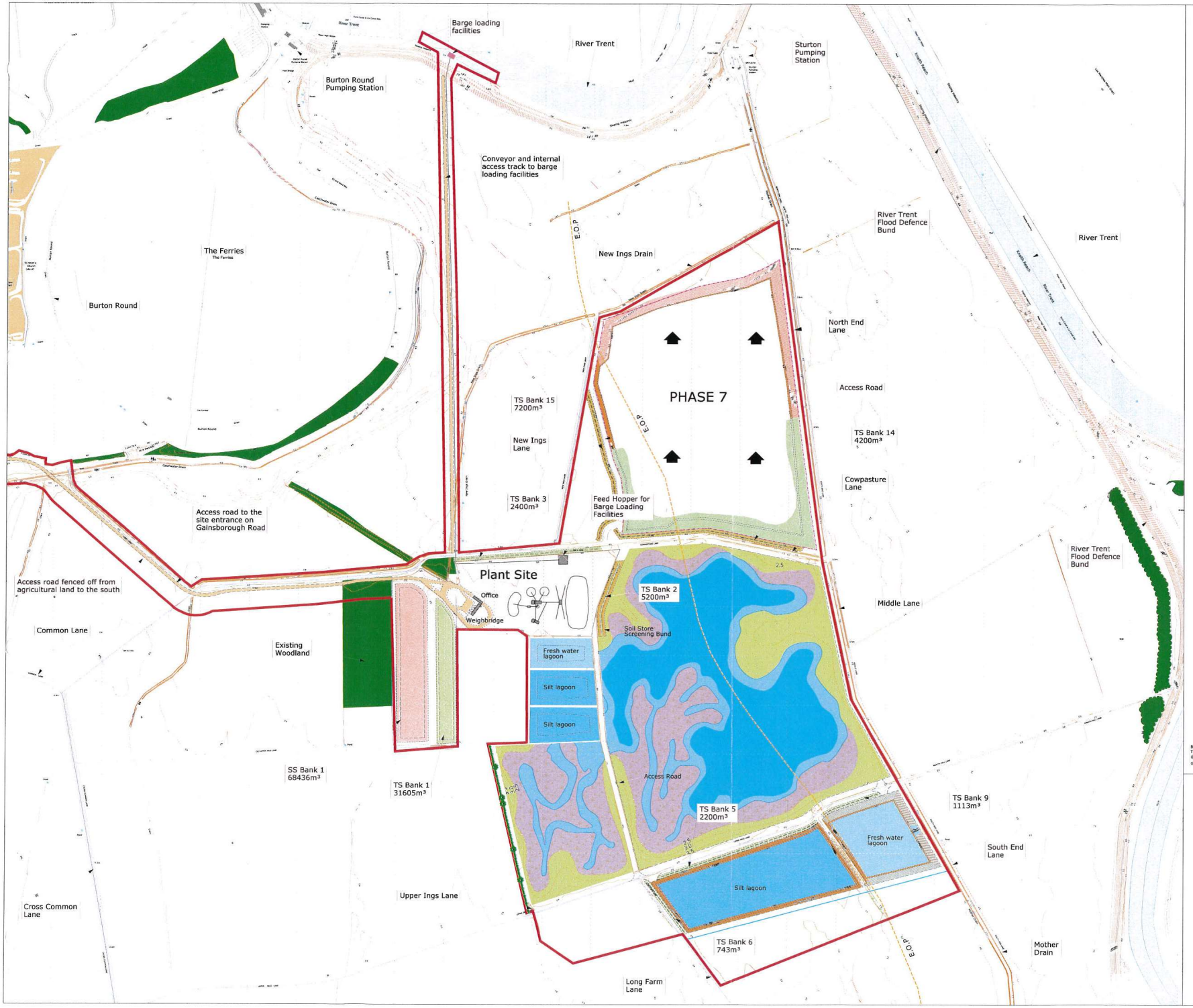

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- Field boundaries
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing advanced planting of woodland blocks
- Scheduled Ancient Monument
- Extraction area
- Proposed new vehicle access route
- Approximate extent of peat overburden
- Land managed for agriculture within the Application Boundary
- Topsoil bank
- Subsoil bank
- Area stripped of soils awaiting extraction
- Current working area with direction of working arrow
- Progressive restoration underway
- Restoration to wetland habitats including herb rich fen and vegetated shallows
- Restoration to wet grassland

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PROJECT Sturton-le-Steeple

CLIENT Lafarge Aggregates Ltd

TITLE Working and Restoration Phase 7

DATE	SCALE
Jun 2006	1 : 7,500
DRAWN	CHECKED
AH	DB
DRAW NO.	REVISION
SLS 5/8	

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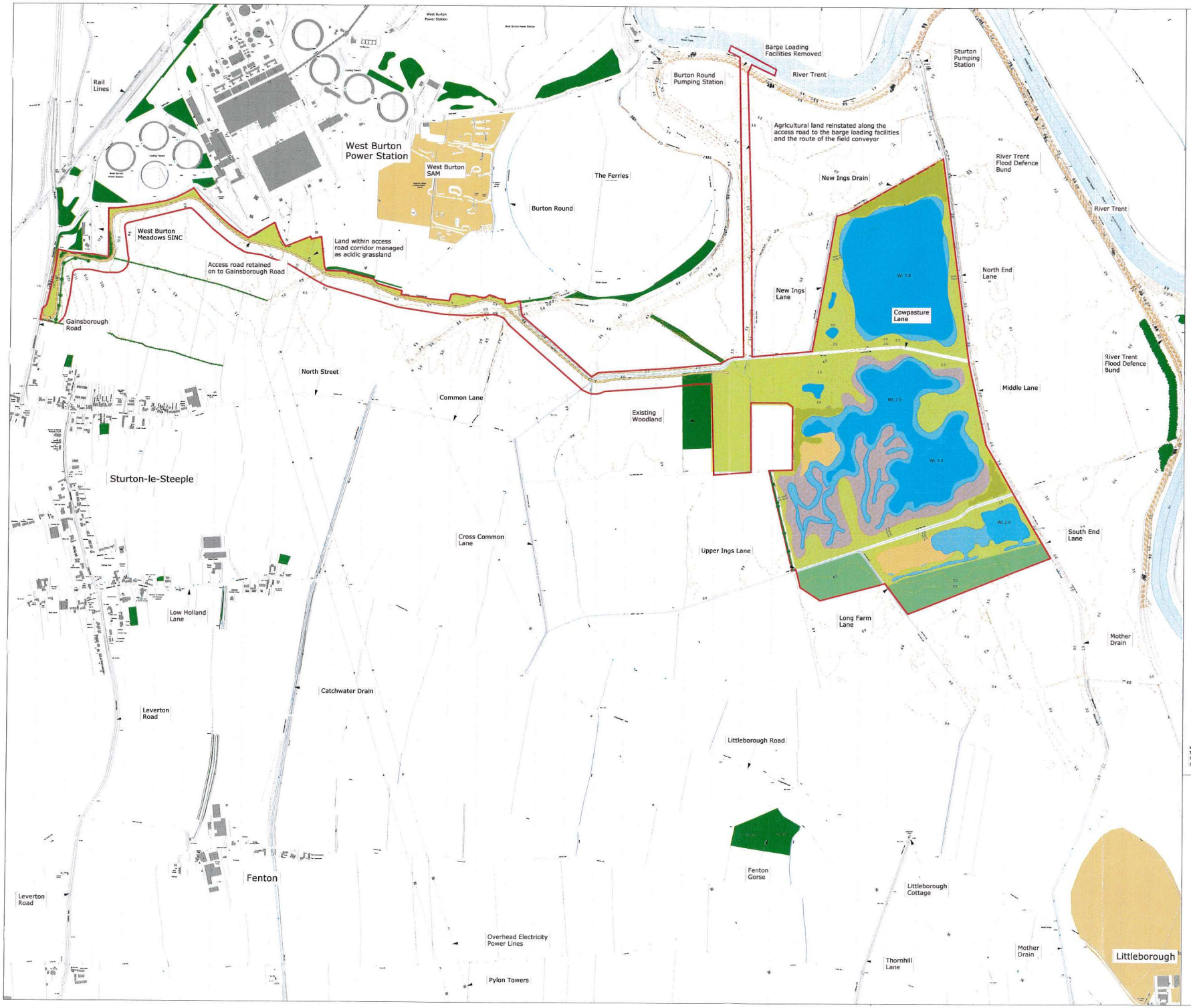

Legend

- Application boundary
- River Trent
- Local agricultural land
- Buildings / Villages
- Local roads
- Access tracks /Bridleways /Footpaths
- Drains
- River Trent flood defence bunds
- Overhead electricity power lines and Pylon towers
- Existing Woodland / Scrubland
- Existing and proposed planting of new hedgerows and woodland blocks
- Scheduled Ancient Monument
- Strengthened existing hedgerows
- Vehicle access route retained
- Proposed fence along access road corridor
- Wet Broadleaf Woodland
- Wet grassland with scrapes plus lowering of ground levels to form ridge and furrows
- Acidic Grassland or Lowland Heath
- Agriculture
- Herb rich Fen established on Peat
- Vegetated shallows with aquatic and semi-aquatic vegetation
- Reedbeds established on former silt lagoons
- Open Water Bodies
- Lake used for low key leisure activities

PLEYDELL SMITHYMAN LIMITED

PROJECT: Sturton-le-Steeple

CLIENT: Lafarge Aggregates Ltd

TITLE: Concept Restoration - Entire Site

DATE	SCALE
Jun 2006	1 : 12,500
DRAWN	CHECKED
LAS	DB
DRAW NO.	REVISION
SLS 6/1	A

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