

**Drainage Statement
Green Plan Energy Ltd.**

Biomass Plant - Plot 1 Wrexham Business Park

Shepherd Gilmour Infrastructure Ltd.
Castlefield House
29 Ellesmere Street
Manchester
M15 4LZ

C602/SBS/JTJ/T0239
July 2010

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1.0 Introduction

Shepherd Gilmour Infrastructure Ltd. has been instructed by Green Energy Plan Ltd. to prepare a Drainage Statement in support of the planning application for their Biomass Plant sited at Wrexham Business Park.

The Drainage Statement will describe the outline proposals for the disposal of foul and surface water from the site. It will also include preliminary surface water storage calculations and report on discussions and agreements reached with Welsh Water in respect of disposal of foul flows.

All plans and scheme drawings referred to in the text are included in Appendix A. The outline surface water volume storage calculation sheets are included in Appendix B.

1.2 The Site

Wrexham Business Park lies to the east of Bryn Lane, on the edge of the Wrexham Industrial Estate as shown on the Wrexham Business Park Site Location Plan C602/304A. The site for the Biomass Plant is located within Plot 1 which lies immediately to the west of the existing industrial building with Bryn Lane forming its western boundary as shown on Wrexham Business Park Plot Area Schedule Plan C602/305A. The Biomass Plant will occupy the southern part of this parcel of land as shown on the Biomass Plant Location Plan C602/403.

The majority of the site has been filled and graded to a level approximately 2.5m above the adjacent natural ground level. Ponds and trees are present on the plot boundaries.

Ground levels vary within the Biomass development plateau between 32.3m and 30.0m with a mean level between 31.5m and 32.0m. Channel levels on Bryn Lane vary between 28.7m (N.W. corner) and 29.9m (S.W. corner) with 29.3m at the proposed entrance.

An existing foul drain, which serves the TDG building on Plot 2, crosses the plot for the Biomass Plant and will need to be diverted.

1.3 The Proposed Development

The Biomass development proposals are shown on drawing C602/404. The whole plot is measured at 1.4 ha and the impermeable area of roofs and hardstandings is

0.69ha. The whole development will be constructed at a uniform platform level and the area around the building/storage platform will be used for landscaping, surface water storage and mitigation.

The development will be accessed from Bryn Lane approximately 2.5m below the level of the existing platform within the development plot.

It is anticipated that employee numbers, on a shift rota over 24 hours will be between 12-15 FTE.

The process will have a trade effluent discharge and a consent to discharge shall be sought at the appropriate time.

2.0 Surface Water Assessment

The whole of the Wrexham Business Park site is located within Flood Zone A as shown on the Development Advice Maps (see Flood Map C602/306B) i.e. the site lies outside the extent of the extreme flood. Generally this means that the chance of flooding each year from rivers or the sea is 0.1 % (1 in 1000) or less.

Although the vulnerability classification is low, consultation with the E.A. has confirmed that the E.A. require a surface water drainage statement for the site which demonstrates that the proposals would not increase flooding downstream of the site. Discharges would therefore need to be constrained at or below the existing greenfield run off rates.

2.1 Existing Surface Water Features and Topography

The existing surface water features on the Business Park site are shown on drawing C602/301C. The surface water from the Biomass plot runs off in a northerly direction and is collected in Pond A. The outflow from Pond A is culverted under the existing access road and discharges into an overgrown stream which flows north adjacent to Bryn Lane before turning to run east through the wooded area which bisects this northern site. The stream crosses the Plot 3 boundary and continues in an easterly direction crossing the B5130.

Plot 1 contains a number of ponds. Ponds A and B which both lie outside the Biomass plot boundary support small GCN populations. The pond water levels shown are those recorded at the time of the topographical survey on 13.02.2008.

2.2 The Proposed Surface Water Network

An outline surface water network is shown on drawing C602/405.

The vast majority of the Biomass site has been filled and graded to the levels shown using a gravelly clay. Below this made ground lies stiff clays and therefore infiltration drainage systems would not be effective.

Pond C (see C602/301C) extends into the Biomass site but it is likely that the finished floor levels selected for the Plant would preclude the discharge into that pond. It is therefore envisaged that the discharge point for the Biomass Plant would be Pond A (see C602/301C).

All surface water flows will be collected via pipes, channels, french drains etc and passed through Class 1 separators or approved settlement chambers. Flows will then pass into the attenuation pond which outfalls through a flow control chamber where the pass on rate will be restricted to the appropriate greenfield runoff for the plot. Flows from the control chamber will be directed via ditches and pipes into Pond A.

2.3 Attenuation Pond Design

The attenuation pond shall be designed to accommodate attenuated water resulting from the critical 1 in 100 year event plus climate change. The pond shall also be designed to be GCN friendly. The pond will feature a residual water depth not greater than 300mm and side slopes with a maximum gradient of 1 in 5. A minimum 300mm freeboard under maximum storage conditions shall also apply.

2.4 Calculation of Storage Volumes

The peak greenfield flood flows have been calculated using the Micro Drainage Source Control software ICP SUDS Method. This method is based on the approach outlined in the Institute of Hydrology 1994 IH Report 124 – Flood Estimation for Smaller Catchments. The method is applied to a 50 ha site and the results multiplied by a scale factor equal to the site area divided by 50.

The Micro Drainage results listing the I.H 124 Mean Annual Flood greenfield flow rates for the full range of return periods for a 50 ha site at this location are included in Appendix B. Table 1 also shows the permissible greenfield runoff rate for the Biomass Plot measured at 1.3989 ha.

For a 1 in 2 yr return period storm the greenfield flow rate equates to 6.6 litres/sec. For a 1 in 100 yr return period storm the rate equates to 15.5 litres/sec.

In the absence of final drainage details the storage volumes required for a 1 in 100 year storm plus climate change have been calculated using the Micro Drainage Storage Estimate Software. The results of these calculations will be robust and conservative as the volume ranges quoted ignore the available capacity within the on plot networks. The required storage volume ranges for 2 yr, 10 yr, 30 yr and 100 yr plus 20% are included in Appendix B.

The results of the storage calculation show the range of storage volumes for the 1 in 100 yr event plus climate change are as follows;

Plot Area	Impermeable Area	Allowable Discharge	Storage Range
1.3989 ha	0.69ha	15.503 l/s	209 m ³ - 328m ³

The maximum figure can be accommodated in the storage pond indicated on C602/405.

2.5 Detailed Design

The purpose of this statement is not to design the drainage network, but to demonstrate that the indicated drainage strategy is feasible given the development proposals and the land available. However, when the final drainage network is being developed the following issues must be addressed.

- i) GCN's are present on or near the site and measures must be specified to prevent or discourage GCNs from entering the drainage system. Special attention should be paid to the types of grating to be used on linear channels and gullies and the siting of those units. Trapped units should not be used. Shallow swales are preferred to piped systems.
- ii) Where new flows are discharged into existing watercourses care must be taken to ensure that discharge velocities are kept low to minimise any adverse impact on the existing stream or pond environment.
- iii) The flow control arrangement must be kept as simple as possible requiring the minimum level of routine maintenance. The final flow control arrangement and pond profile must ensure that the permissible discharge rates for the shorter return period storms are not exceeded. The use of the Micro Drainage - Complex Control Builder is recommended.
- iv) Plot 1 contains ponds, mounds and trees. The detailed drainage network and associated discharge arrangements and storage pond should avoid these existing features wherever possible.

3.0 Foul Water Assessment

Welsh Water has a foul/combined sewer network in the vicinity of the site. The Welsh Water network is shown on plan C602/307. The Welsh Water network extends into Plot 1 and the existing private foul network which serves the existing upstream development and connects to the Welsh Water network at manhole SJ38509102 is shown on drawing C602/406.

3.1 Consultation With Welsh Water

In 2008 at the request of Kingmoor Park Properties Ltd. Welsh Water carried out a hydraulic analysis of their network to assess the impact of estimated peak foul flows from the as yet undeveloped areas of the business park, including Plot 1, as outlined within the sites allocation of the UDP.

Welsh Water's initial report concluded that the estimated future flows... "cause deterioration in the level of service, locally within the sewerage network" and downstream upgrades were proposed. Welsh Water's modelling had applied a peak pumped flow rate of 5.2 l/s as an additional base flow throughout the 120 minute critical network storm.

The modelling method and findings were discussed with Welsh Water (Mr David Hancock) at a meeting held on 15th October 2008 when it was concluded that a further modelling exercise would be commissioned from Welsh Water in which the impact of foul flows from the site would be more accurately reflected by applying the estimated average dry weather flow as an additional base flow throughout the 120 minute critical storm.

The findings of this study were recorded in Report No RS0551-08-0C prepared by Forthview Ltd for Welsh Water. The network results were shown in Table 3.1 of that report with the text..."the level of service in the sewerage network downstream of the development has deteriorated slightly. However it is considered that the minimal changes are within modelling tolerances, and will offer no actual hydraulic detriment.". These findings were discussed with Welsh Water (Mr David Hancock) who confirmed that no upgrade to the Welsh Water network would be required.

3.2 Foul Water Flow Rates

Domestic foul flow rates from the Biomass Plant development will be at a very low level : less than 1000 l/day, and well within the estimated flow rates per hectare adopted for Welsh Water's modelling for the whole of the Business Park.

The process will have a trade effluent discharge. The effluent will comprise the condensate which drops out from the gas during cooling. It is anticipated that the effluent will be treated and monitored on site and the consent will allow the treated effluent to be discharged into Welsh Water Ltd.'s foul water drainage network.

On average a 500kWe plant would produce 80 l/hr of condensate. Once fully developed, and working at full capacity, the plant would generate condensate at a rate of 0.13 l/s. This flow rate should not adversely affect the performance of the existing drainage network.

For the record, it was estimated that the undeveloped areas of the business park, as outlined within the sites allocation of the UDP, would accommodate up to 600 employees. The foul drainage was estimated at up to 30,000 litres/day with an average dry weather flow of 0.83 litres/sec over a 10 hour day. This flow rate was rounded up to 1 l/s for the purposes of Welsh Water's modelling analysis referred to in 3.1 above.

3.3 The Proposed Foul Water Network

An outline foul water drainage layout is shown on C602/407. This plan shows an indicative diversion of the existing foul water drain upstream of Welsh Water's manhole SJ38509102. The plan also shows a private connection from the south into the into W.W.'s manhole. The line, level connectivity and condition of all existing drains within the site shall be confirmed prior to completing the final design.

The diversion shown shall be sited within a 6m (min) wide maintenance easement and shall cater for existing flows together with the projected flows from the remainder of Plot 1.

The existing drain from the south will pass under the access road to the plant and therefore its structural condition, depth and load bearing capacity shall be checked as a part of the detailed design. Allowance should be made for replacing the section of drain under the access road and into W.W.'s outfall manhole.

Detailed internal foul water drainage requirements are uncertain at this time, but it is known that capacity within the adopted network is available and the invert level of the existing sewer is adequate to enable the Biomass Plant to drain via gravity.

4.0 Conclusions & Recommendations

Plot 1 lies outside the extent of the 1 in 1000 extreme flood. The site is underlain by clay at shallow depth and is unsuitable for infiltration drainage.

A surface water drainage scheme for the development, which restricts discharge flow rates to current greenfield rates, can be accommodated within the plot boundaries. Storage of attenuated flows in ponds is recommended, with ponds designed to provide habitat for GCNs which are present near the site.

It is recommended that the final drainage scheme should incorporate swales, ditches and french drains together with additional detailed measures to minimise the impact on the existing landscape and ecological environment.

The development will necessitate the diversion of an existing private foul sewer. A convenient diversion route is available.

Welsh Water's foul/combined sewer network extends into Wrexham Business Park with available capacity for the development. W.W.'s network has been modelled to assess the impact of foul flows from the whole of the proposed business park. The modelling confirmed that no upgrade of the down stream Welsh Water network would be required.

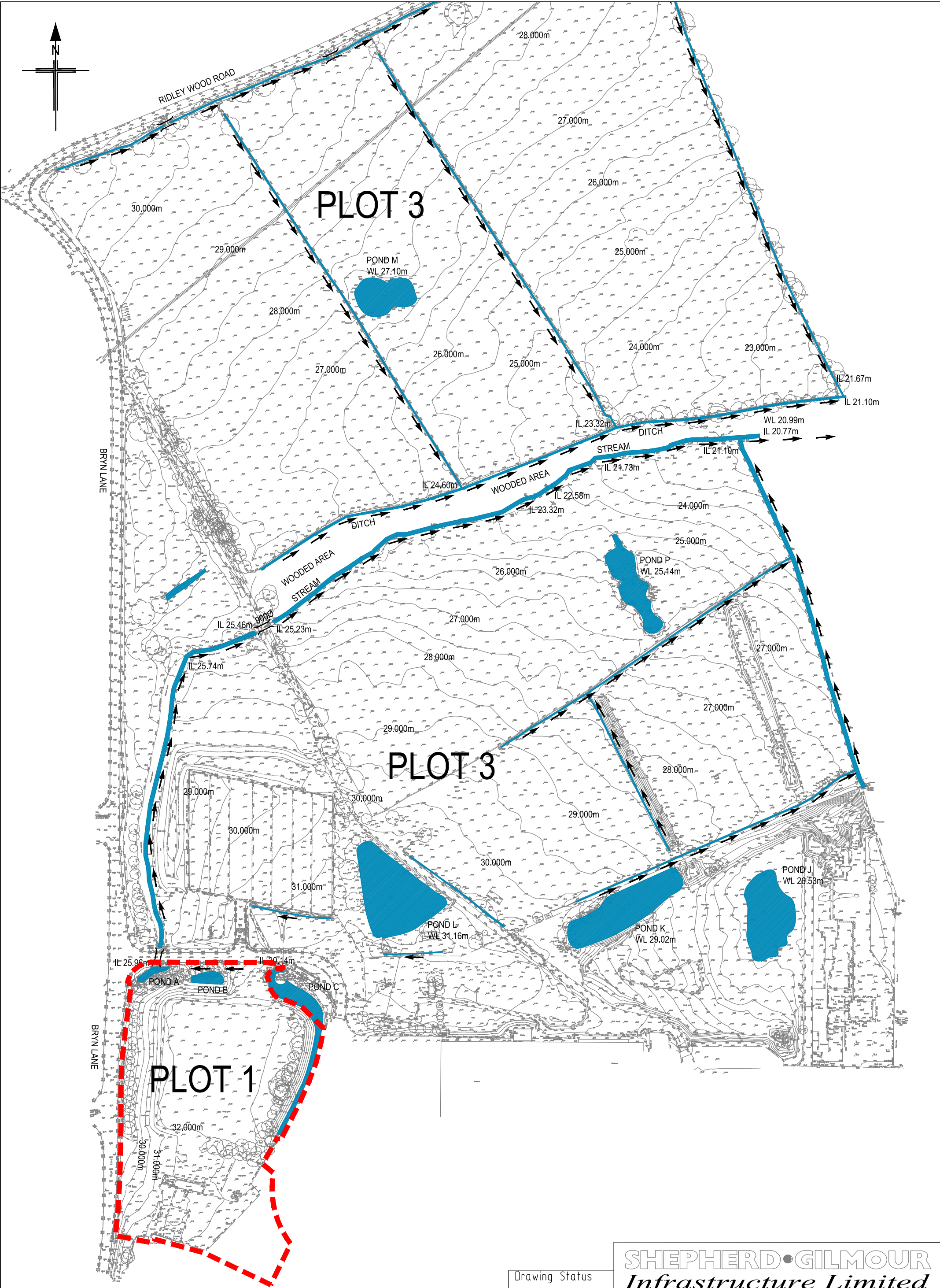
Condensate water produced in the cooling process will be treated and monitored on site. A consent to discharge to the public sewers shall be sought at the appropriate stage.

It is recommended that the foul and surface water strategy outlined in this statement should be accepted as the basis of the detailed drainage design for the Biomass Plant proposal for the southern part of Plot 1.

A detailed Statement will be required by condition for the reserved matters and will be supplied at the time when scheme specifics are known.

Appendix A - Drawings

C602/301C	Plots 1 & 3 - Existing Land Drainage Features
C602/304A	Wrexham Business Park - Location Plan
C602/305A	Wrexham Business Park - Plot Area Schedule
C602/306B	Wrexham Business Park - Flood Map
C602/307	Wrexham Business Park - Welsh Water Foul/Combined Sewer Network
C602/403	Biomass Location Plan
C602/404	Biomass Plant - General Arrangement
C602/405	Biomass Plant - Outline Surface Water Network
C602/406	Existing Drainage Network
C602/407	Biomass Plant - Outline Foul Water Network



Contract WREXHAM BUSINESS PARK

Title PLOT 1 & 3 - EXISTING LAND DRAINAGE FEATURES

Drawing Status
PRELIMINARY

Drawing No
C602/301

APPENDIX A

SHEPHERD • GILMOUR
Infrastructure Limited

Rev
C

Date
13.08.08

Scale
1/2500 (A3)

Drawn
DR

Checked

Approved



Contract WREXHAM BUSINESS PARK

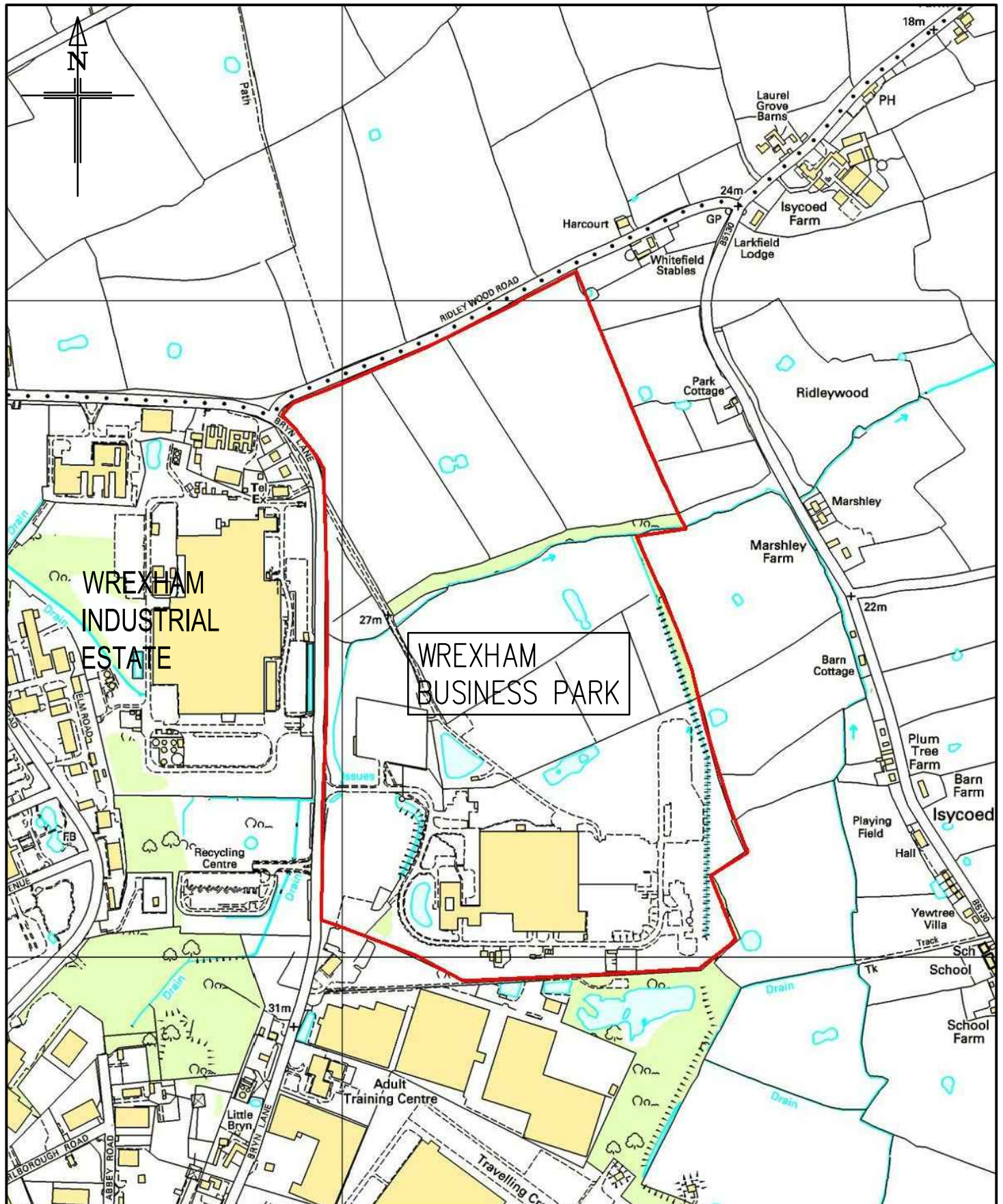
Drawing No
C602/304 - APP ARev
A

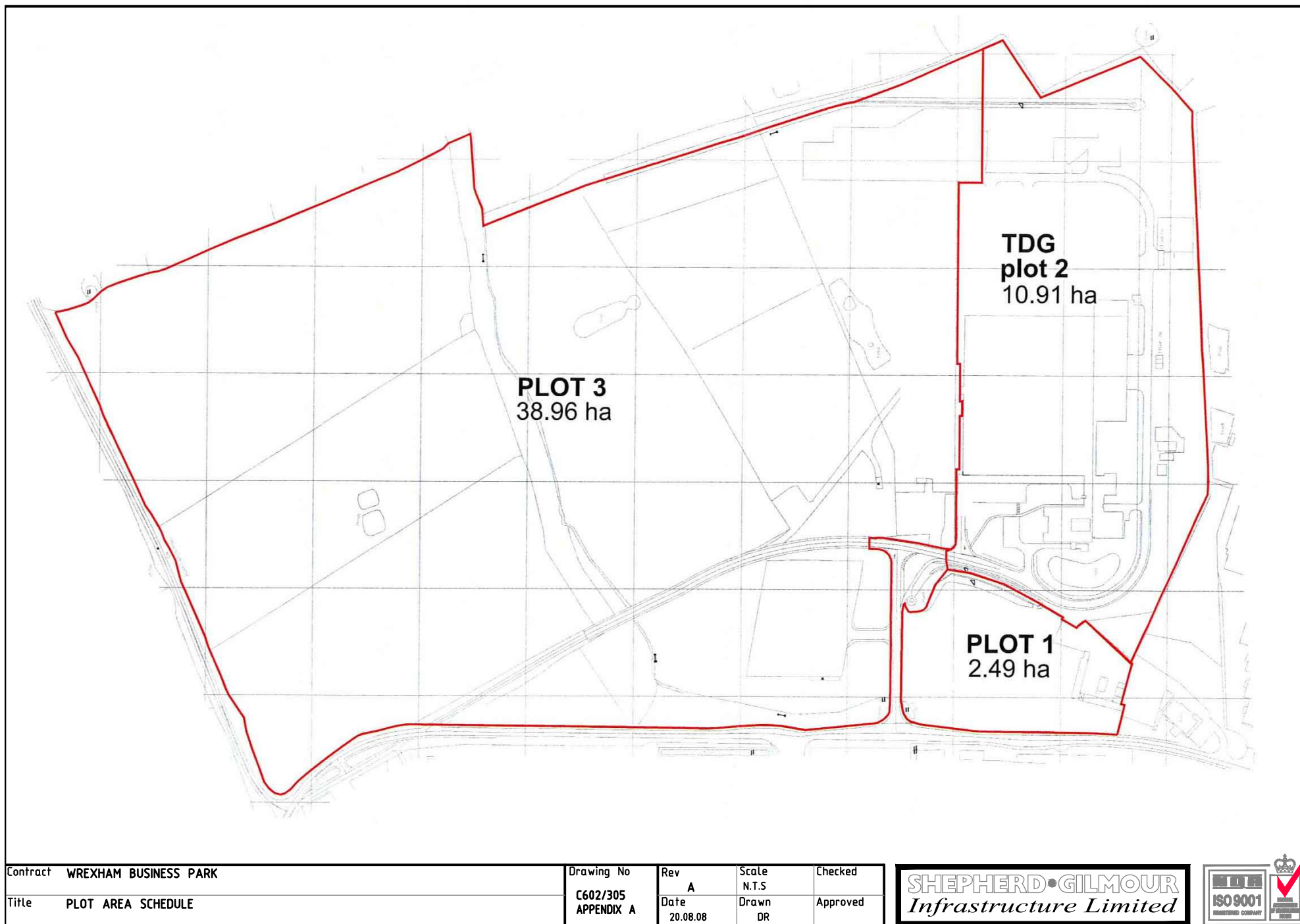
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Title SITE LOCATION PLAN

Date
20.08.08Scale
N.T.SDrawn
DR

Approved





Contract WREXHAM BUSINESS PARK

Drawing No
C602/306 - APP ARev
B

Checked

Title FLOOD PLAIN MAP

Date
20.08.08Scale
N.T.SDrawn
DR

Approved



Biomass Plant Site Boundary

Dark blue shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year.
- or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light blue shows the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.

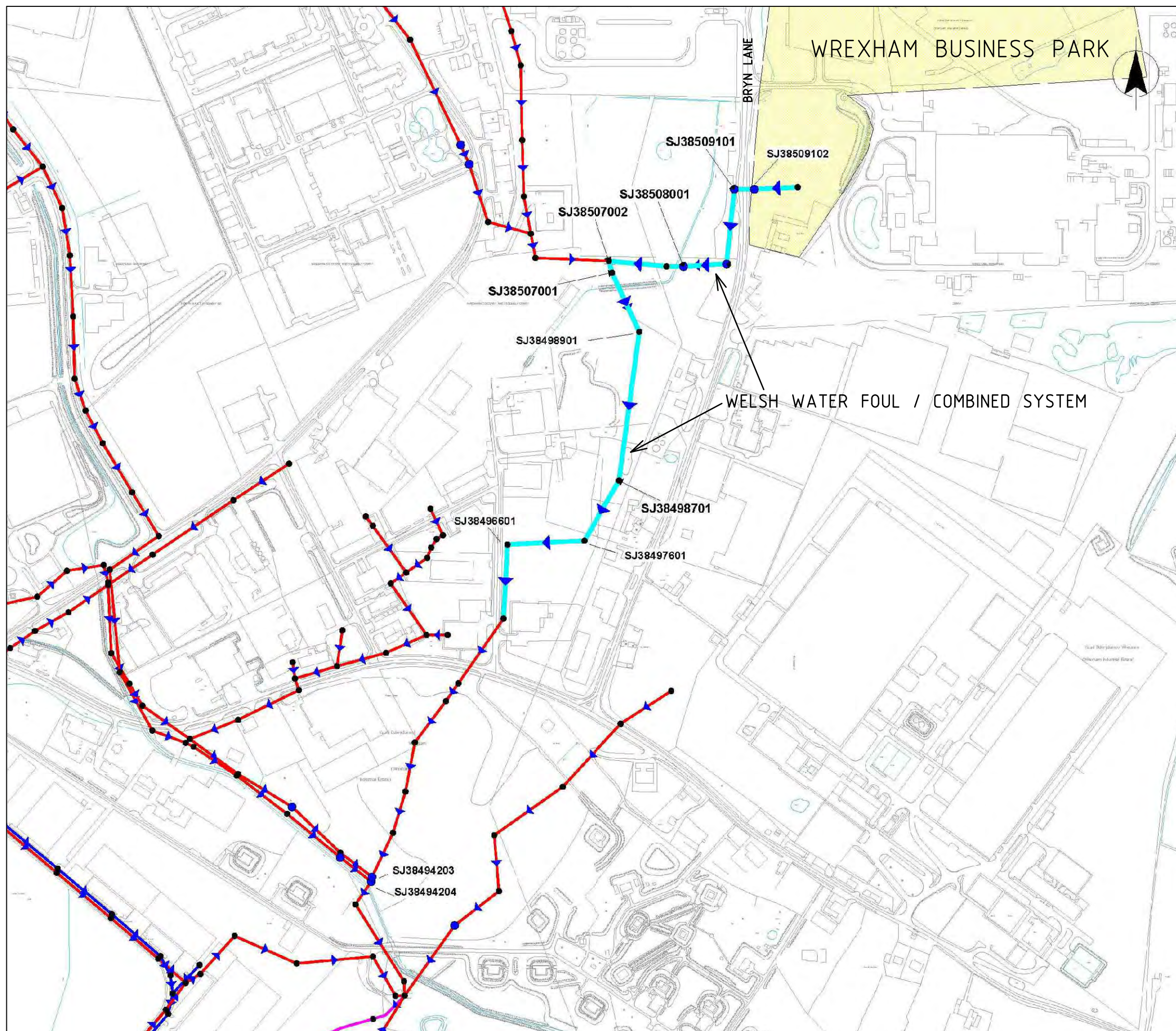
These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

The purple line shows all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods. Flood defences that are not yet shown, and the areas that benefit from them, will be gradually added.

Hatched areas benefit from the flood defences shown, in the event of a river flood with a 1% (1 in 100) chance of happening each year, or a flood from the sea with a 0.5% (1 in 200) chance of happening each year. If the defences were not there, these areas would be flooded.

Flood defences do not completely remove the chance of flooding, however, and can be overtopped or fail in extreme weather conditions.





NOTE
BASED ON WELSH WATER'S REPORT
ASSESSMENT OF THE DEVELOPMENT
AT WREXHAM BUSINESS PARK,
WREXHAM - MAY 2008

Contract WREXHAM BUSINESS PARK

Title WELSH WATER FOUL / COMBINED SEWER NETWORK

Drawing No

C602/307
APPENDIX A

Rev

-
Date 20.08.08

Scale

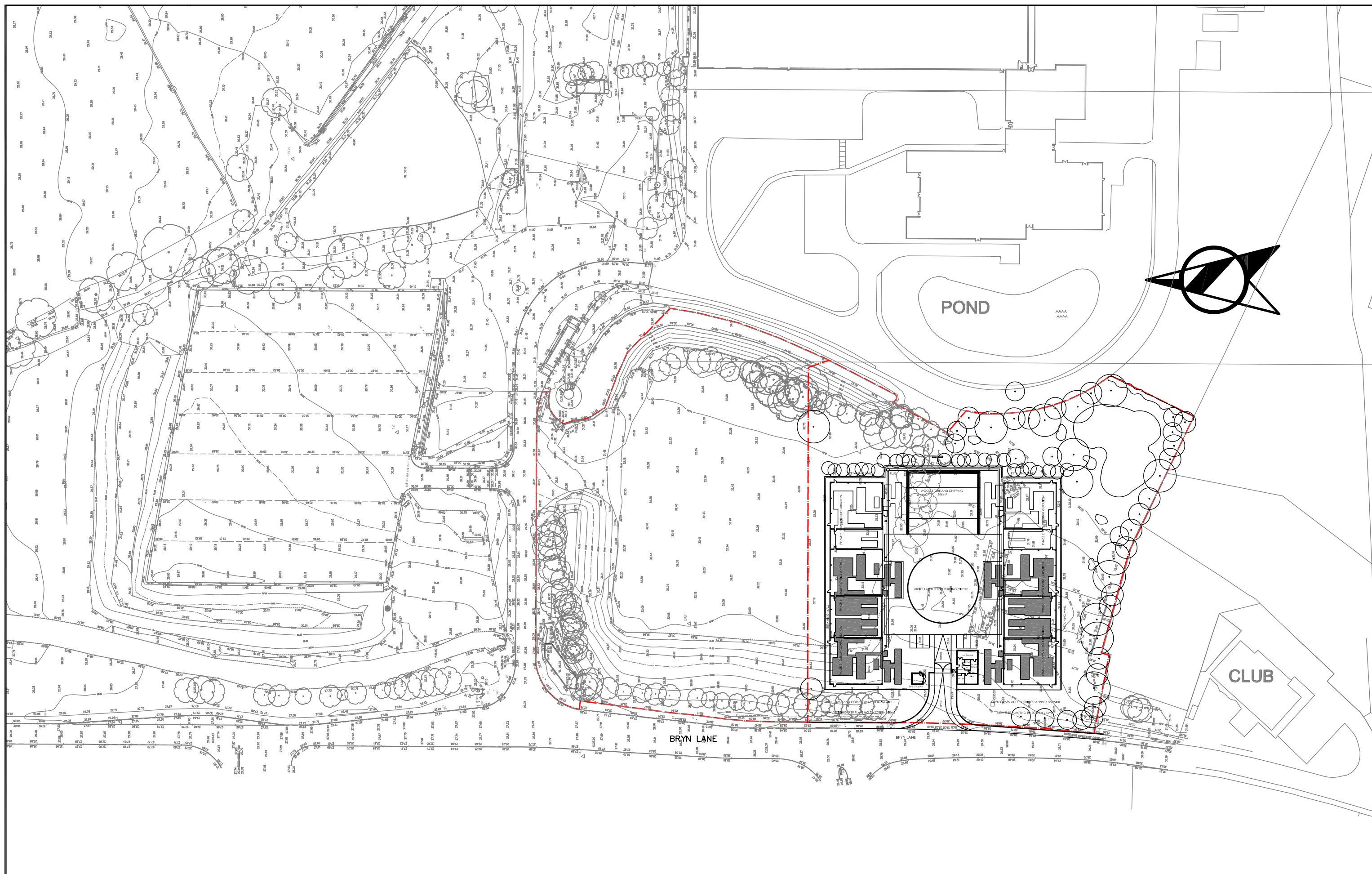
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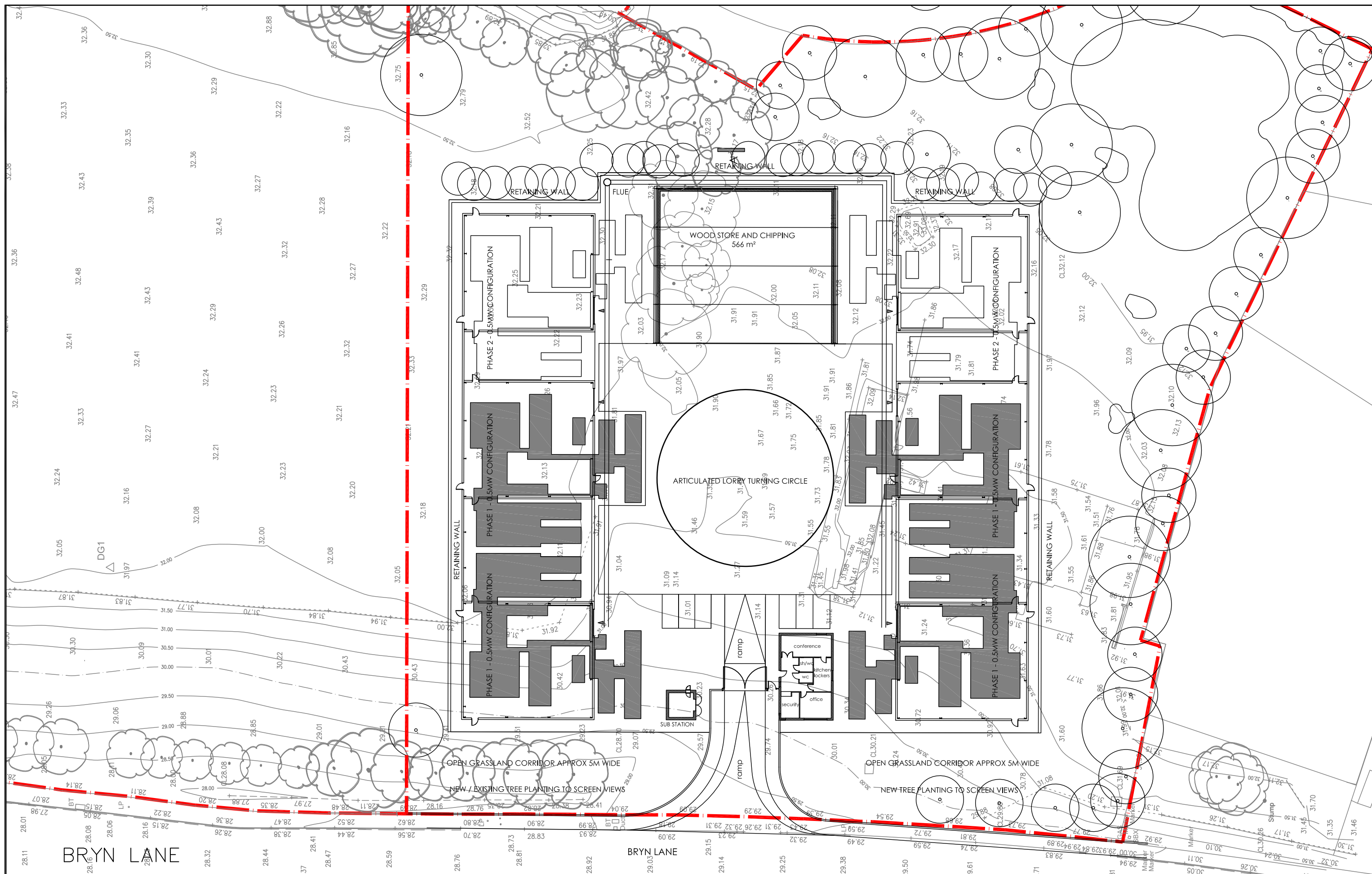
Approved

SHEPHERD • GILMOUR
Infrastructure Limited





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										DRAWING TITLE BIOMASS PLANT LOCATION PLAN					
									Filename: K:\PROJECTS\JOB-NO5-C600-C699\C602 KINGMOOR PARK WREXHAM\PLOT 1\BIOMASS JULY 2010 FINAL\403 404 405 407 FINAL Plot Date\Title - 13/07/2010 11:15 AM	SCALE 1 : 250	ORIGINAL SIZE A/3	DRAWN BY SWM	DATE 17/06/2010	DRAWING No C602/403	REVISION



REV	DESCRIPTION	DRAWN	INITIALS	DATE	Dwg STATUS	CHECKED BY	DATE

SHEPHERD•GILMOUR
Infrastructure Limited
Castlefield House, 29 Ellesmere Street, Manchester M15 4
Phone: 0161 832 7802. Fax: 0161 832 1540.
E-mail: sgi@shepherd-gilmour.co.uk
Web: www.shepherd-gilmour.co.uk

Filename: K:\PROJECTS\JOB-NOS-C600-C699\C602 KINGMOOR PARK
WREXHAM PLOT 1\BIOMASS JULY 2010 FINAL\
403 404 405 407 FINAL
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DRAWING TITLE	

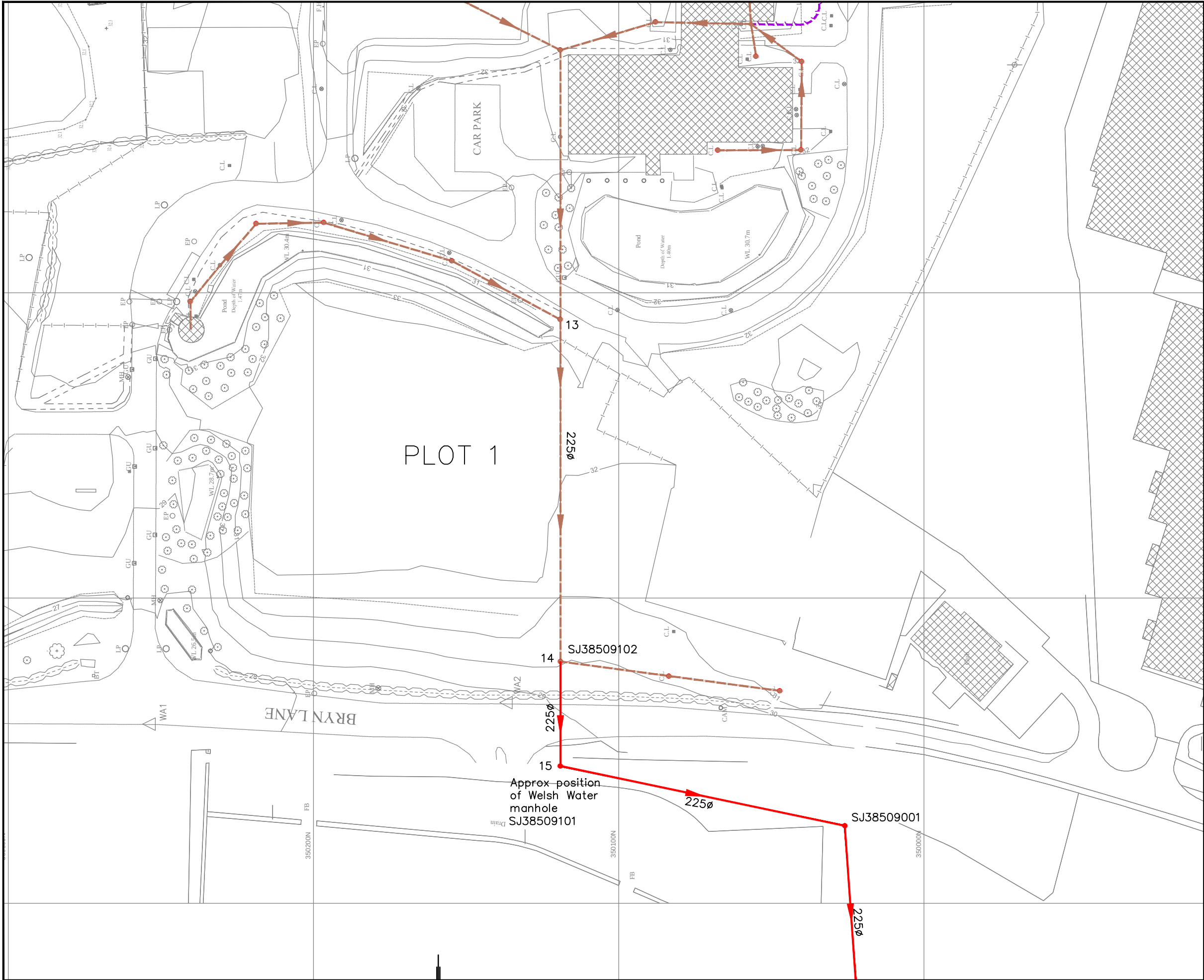
CLIENT	GREEN PLAN ENERGY LIMITED
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DRAWING TITLE

**BIOMASS PLANT
GENERAL ARRANGEMENT**

SCALE	ORIGINAL SIZE	A(3)	DRAWN BY	DATE	DRAWING No
1 : 500			SWM	17/06/2010	C602/404

REVISIO



Notes

The layout and fuction of the sewers shown shall be confirmed by site inspection.
The layout and conditions of the foul sewer connecting the former Owens Corning building to the public sewer shall be established by CCTV survey.
All manhole cover levels and invert levels to be established by site survey

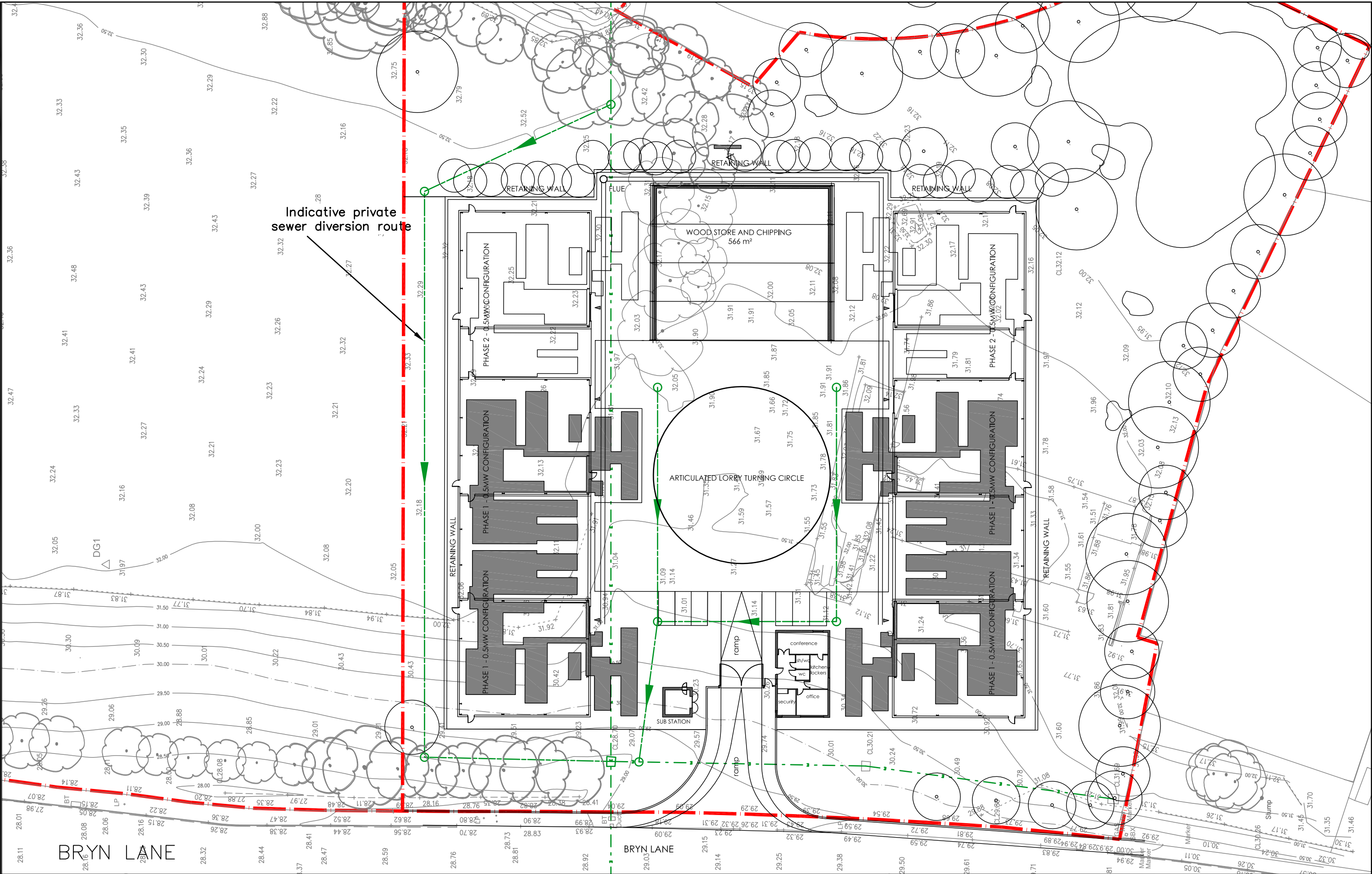
- Private Foul Sewer
- Public Foul Sewer

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								DRAWING TITLE	
								BIOMASS PLANT EXISTING DRAINAGE NETWORK	
								SCALE	ORIGINAL SIZE
								1 : 1250	A(3)
								DRAWN BY	DATE
								SWM	17/06/2010
								DRAWING No	REVISION
								C602/406	-

SHEPHERD•GILMOUR
Infrastructure Limited

Castlefield House, 29 Ellesmere Street, Manchester M15 4LZ.
Phone: 0161 832 7802. Fax: 0161 832 1540.
E-mail: sgl@shepherd-gilmour.co.uk
Web: www.shepherd-gilmour.co.uk

Filename: K:\PROJECTS\SUB-RODS-C600-C689-C602 KINGMOOR PARK
WREXHAM\PILOT 1\BIOMASS JUNE 2010\1
406
Plot Date/Time: 22/06/2010 5:02 PM



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									DRAWING TITLE		BIOMASS PLANT OUTLINE FOUL WATER NETWORK	
									SCALE		DRAWN BY	
									1 : 500		SWM	
									DATE		DRAWING No	
									17/06/2010		C602/407	
									REVISION			

SHEPHERD•GILMOUR
Infrastructure Limited

Castlefield House, 29 Ellesmere Street, Manchester M15 4LZ.
Phone: 0161 832 7802. Fax: 0161 832 1540.
E-mail: sgk@shepherd-gilmour.co.uk
Web: www.shepherd-gilmour.co.uk

Filename: K:\PROJECTS\SUB-ROD-C602-C603\02 KINGMOOR PARK
WREXHAM\LOT 1\BIOMASS JULY 2010 FINAL
403 404 405 407 FINAL
Plot Date/Time: 13/07/2010 11:32 AM

Appendix B - Micro Drainage Results

Mean Annual Flood Rates : Return periods 1 year → 1000 year

Approximate Storage Ranges : Return periods 2 yr, 10 yr, 30 yr & 100 yr + 20%

Shepherd Gilmour Infrastructure Ltd		Page 1
29 Ellesmere Street Manchester M15 4LZ	Wrexham Kingmoor Park Green Plan Energy	
Date 23/06/2010 09:04 File	Designed By S Mulligan Checked By	
Micro Drainage	Source Control W.12.4	

IH 124 Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	50.000	Urban	0.000
SAAR (mm)	793	Region Number	Region 9

Results l/s

QBAR Rural	254.2
QBAR Urban	254.2
Q100 years	554.1
Q1 year	223.7
Q2 years	236.1
Q5 years	307.5
Q10 years	360.9
Q20 years	414.6
Q25 years	433.1
Q30 years	448.1
Q50 years	492.1
Q100 years	554.1
Q200 years	627.8
Q250 years	653.2
Q1000 years	810.8

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IH 124 Mean Annual Flood calculated using MicroDrainage Source Control

Return Period	100	Soil	0.45
Area (Ha)	50	Urban	0
SAAR (mm)	793	Region	9

Region	QBAR	Q(100YR)	Q(1yr)	Q(2yr)	Q(5yr)	Q(10yr)	Q(20yr)	Q(25yr)	Q(30yr)	Q(50yr)	Q(100yr)	Q(200yr)	Q(250yr)	Q(1000yr)
1	254.2	630.3	216.0	231.0	305.0	367.3	434.3	459.5	480.2	539.9	630.3	714.2	742.2	922.6
2	254.2	668.5	221.1	232.3	299.9	360.9	434.0	460.6	482.2	552.6	668.5	757.4	787.9	978.6
3	254.2	528.7	218.6	239.8	317.7	368.5	417.4	433.6	446.8	481.4	528.7	599.8	622.7	772.7
4	254.2	653.2	211.0	227.8	312.6	378.7	451.8	477.3	498.0	559.7	653.2	767.6	805.7	1057.4
5	254.2	904.9	221.1	227.1	327.9	420.7	531.4	574.9	610.6	722.4	904.9	1065.0	1115.8	1464.0
6/7	254.2	810.8	216.0	223.9	325.3	411.8	509.2	546.0	576.0	665.9	810.8	953.1	998.9	1311.5
8	254.2	615.1	198.3	224.6	312.6	378.7	444.6	466.7	484.5	538.3	615.1	724.4	757.4	993.8
9	254.2	554.1	223.7	236.1	307.5	360.9	414.6	433.1	448.1	492.1	554.1	627.8	653.2	810.8
10	254.2	528.7	221.1	236.7	302.5	350.8	399.6	416.8	430.9	470.2	528.7	599.8	622.7	772.7

Pro-rata for design area 1.3989

Return Period Flow	7.112	15.503	6.259	6.606	8.603	10.097	11.600	12.117	12.537	13.768	15.503	17.565	18.275	22.685
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TABLE 1

Variables	Result	Design	Overview 2D	Overview 3D	VI
Region	England & Wales		Cv (Summer)	0.750	
Return Period (years)	2		Cv (Winter)	0.840	
Map	M5-60 (mm)	18	Impermeable Area (ha)	69	
Ratio R	334		Maximum Allowable Discharge (l/s)	6.6	
			Infill Coefficient (m/hr)		
			Safety Factor	2	
			Climate Change %	20	
					Apply

Done Help

Global Variables require approximate storage of between 82 m² and 143 m².

These values are estimates only and should not be used for design purposes.

Micro Drainage Quick Storage Estimate

2year Return Period

Variables	Result	Design	Overview 2D	Overview 3D	VI
Region	England & Wales				
Return Period (years)	10				
Map	M5-60 (mm)	18			
	Ratio R	.334			
			Cv (Summer)	0.750	
			Cv (Winter)	0.840	
			Impermeable Area (ha)	69	
			Maximum Allowable Discharge (l/s)	10.097	
			Infill Coefficient (m/hr)	2	
			Safety Factor	2	
			Climate Change %	20	
				Apply	

Done

The screenshot shows the 'Result' tab of the 'Global Variables' dialog box. The tab bar at the top includes 'Variables', 'Result' (selected), 'Design', 'Overview 2D', 'Overview 3D', and 'VI'. The main content area contains the following text:

Global Variables require approximate storage of between 118 m³ and 196 m³.

These values are estimates only and should not be used for design purposes.

At the bottom of the dialog, there are 'Done' and 'Help' buttons.

Micro Drainage Quick Storage Estimate

10year Return Period

Variables	Result	Design	Overview 2D	Overview 3D	Vf
Region	England & Wales		Cv (Summer)	0.750	
Return Period (years)	30		Cv (Winter)	0.840	
Map	M5-60 (mm)	18	Impermeable Area (ha)	69	
	Ratio R	0.334	Maximum Allowable Discharge (l/s)	12.537	
			Infill Coefficient (m/hr)		
			Safety Factor	2	
			Climate Change %	20	
				Apply	

Variables	Result	Design	Overview 2D	Overview 3D	VI
Global Variables require approximate storage of between 154 m³ and 250 m³. These values are estimates only and should not be used for design purposes.					

Micro Drainage Quick Storage Estimate

30year Return Period

Variables	Result	Design	Overview 2D	Overview 3D	VI	
Region	England & Wales					
Return Period (years)	100					
Map	M5-60 (mm)	18				
Ratio R	.334					
					Cv (Summer)	0.750
					Cv (Winter)	0.840
					Impermeable Area (ha)	69
					Maximum Allowable Discharge (l/s)	15.503
					Infill Coefficient (m/hr)	
					Safety Factor	2
					Climate Change %	20
					Apply	
Done						
Help						

Variables	Result	Design	Overview 2D	Overview 3D	VI
Global Variables require approximate storage of between 209 m³ and 328 m³. These values are estimates only and should not be used for design purposes.					
Done					
Help					

Micro Drainage Quick Storage Estimate

100year Return Period