



DRAINAGE STRATEGY

PROPOSED EXTENSION AT COLLIERS PARK, WREXHAM

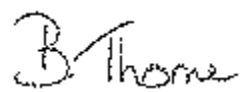
February 2018

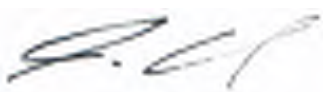
Prepared for:
Wales Football Association

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REVISION	DATE	DESCRIPTION	BY	CHECKED	REVIEWED
A	15/02/18	Add treatment plant soakaway trench and re arrange drainage layouts.	K.B.	B.T.	I.R.

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1.0 Introduction

1.1 Project Background

- 1.1.1 Bingham Rawlings Partnership Limited were appointed by the Welsh Football Association (WFA) to provide a Drainage Strategy for the proposed construction of an extension off the existing building, and additional parking at Colliers Park, Wrexham, LL12 8PW. The proposal is contained within a site area of approximately 47,158m². The site is located at national grid reference: **SJ343541** Refer to the attached drawing 3829 – EW01 for the proposed site location plan (**Appendix A**).
- 1.1.2 Bingham Rawlings Partnership Limited reserve the right to undertake further investigation into the adequacy of the drainage reports based on changes in regulations, if works on site have not commenced twelve months following the issue of this report.

1.2 Scope of Proposed Drainage Strategy

- 1.2.1 This Drainage Report aims to provide a suitable drainage strategy for the discharge of surface water and foul effluent generated by the proposed development.
- 1.2.2 The purpose of these calculations and accompanying details are to produce a drainage layout that complies with the relevant legislation of TAN 15, SuDS hierarchy and Approved Document H of the Building Regulations 2010.

1.3 Existing Site Information

- 1.3.1 The proposal site is a training ground for Wales Football Club which includes an AstroTurf football pitches and 2 grass pitches.

1.4 Existing Hydrology

1.4.1 As expected with its use the site has very little falls across its entirety however, the low point is located in the most North Eastern corner and surface water generally flows this way., football clubhouse and associated parking.

1.4.2 **Historical mapping**, combined with current day maps indicate there are no land drainage features within the curtilage of the site.

1.5 Existing Drainage

The current drainage arrangement for the clubhouse discharges all surface water flows from the existing hard standing areas into separate ring soakaway chamber soakaways.

All foul drainage from the existing clubhouse discharges into an existing Klargester Bio Disc treatment plant before then discharging into a drainage field.

2.0 Design Criteria

2.0.1 The following design criteria will apply for the surface water run-off and foul discharge design of the site:

- Approved Document H, Building Regulations
- TAN 15
- BRE Digest 365
- Flood and Water Management Act
- IHR 124
- Modified Rational Method
- Wallingford Procedure
- CIRIA C753 - 'The SuDS Manual' (2015)

3.0 Surface Water Drainage Design

3.1 Design Philosophy

- 3.1.1 The disposal of surface water should be designed in strict accordance with the provision of TAN15, the Flood and Water Management Act 2010 and best practice documents such as the recently published SUDS Manual from CIRIA.
- 3.1.2 In accordance with the SuDS Hierarchy surface water should be designed and constructed disposing of run off volumes into the ground via infiltration systems where possible. To determine the adequacy of the below ground strata for the use of infiltration systems porosity tests should be carried out on site.

3.2 Porosity Tests

- 3.2.1 A site investigation has been undertaken by Earth Science Partnership Consulting Engineers. Thirteen trial holes were excavated but only three Soakaway infiltration tests were undertaken across the northern margins of the site (TP11, TP12 and TP13). Sufficient infiltration was achieved within the test to allow an infiltration rate to be calculated for three fills in both Test Pits TP13 and TP12, and for two fills in TP11. See results of testing below.

TP11 - $5 \times 10^{-3} \text{m/s}$

TP12 - $2 \times 10^{-4} \text{m/s}$

TP13 - $3 \times 10^{-3} \text{m/s}$

Based on the 3 results Earth Science Partnership Consulting Engineers recommended an infiltration rate of 10^{-4}m/s would be viable.

For information on the porosity testing ref Earth Science Partnership Consulting Engineers Site investigation report.

3.3 Climate Change

3.5.1 TAN15 references a table derived from Defra FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts, October 2006, which considers the effects of climate change for different design criteria.

3.3.2 The proposed development will have a design life of 100 years, based upon the table 1 below this would equate to a climate change factor of 30% applied to peak rainfall intensity.

Table 1 – Climate Change Requirements

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak Rainfall Intensity	+5%	+10%	+20%	+30%
Peak River Flow	+10%	+20%		
Offshore Wind Speed	+5%		+10%	
Extreme Wave Height	+5%		+10%	

3.3.3 Table extract taken from the Defra FCDPAG3 publication – Table B.2

3.3.4 Design storm Event - 1 in 100 years

3.3.5 Climate Change Factor - 30 %

3.3.6 The tables on the following page summarise the existing and proposed effective areas with their corresponding run off coefficients as per the Wallingford procedure, IHR 124 and the Modified Rational Method.

3.4 Corresponding Run Off Coefficients

3.4.1 Reference should be made to the attached calculations (**Appendix C**) for Estimated Greenfield run off rates which are summarised as follows:

Table 2 – Greenfield Run Off Rates

Reference	1 in 1 year	1 in 100 years
Existing	0.163 L/s	0.403 L/s
Proposed	0.212 L/s	0.526 L/s

3.4.2 The volume of run for the existing and proposed development for the 6 hours 1 in 100-year event is attached in (**Appendix C**). These calculations are summarised below.

Table 3 - Existing Areas

Surface	Total Area	Coefficient	Effective Area
Grassed	44757.819m ²	0.35	15,665.237m ²
Roofed	340.274m ²	1.00	340.274m ²
Tarmac (Road/Paths)	1901.907m ²	0.60	1,141.144m ²

Table 4 - Proposed Areas

Surface	Total Area	Coefficient	Effective Area
Roofed	895.588m ²	1.00	895.588m ²
Gravel (Parking)	748.921m ²	0.60	449.353m ²
Tarmac (Road/Parking)	1606.272m ²	0.75	1,204.704m ²
Grassed	41,876m ²	0.35	14,656m ²

Table 5 – Volumetric Increase

Reference	Volume run off 1 in 100 years
Existing	1,290.360m ³
Proposed	1,294.840m ³

3.4.5 The increase of volumetric run off equates to: **4.480m³**

- 3.4.6 TAN15 requires no increase in volumetric run off as a result of the proposed development and the risk of flooding on site and adjacent properties must not increase. To mitigate the increase in run off, storage should be provided on site equating to the increase. Therefore, a minimum storage requirement for each of the storm events as shown above should be provided to mitigate against the increase of run off.

3.5 Soakaway Design

- 3.5.1 As the proposals include the construction a proposed extension with associated parking & connecting access roads and football pitches a surface water drainage layout should be design in accordance with Approved Document H of the Building Regulations 2010 and in line with National Resources Wales recommendations.
- 3.5.2 The surface water run-off from all hardstanding surfaces from the highway collected by a series gutters and gullies, which will discharge into the ground via system 1 soakaway trench located to the Northern side of the site and run off from all handstanding surfaces from the existing building and proposed extension will be collected by a series of gutters and gullies which will then discharge into soakaway system 2 located at Southern side of the site. Calculations are provided within **(Appendix I)**. Refer to Drawing 38297 EW03, EW04, EW05 & EW06 for the proposed drainage arrangement **(Appendix H)**.
- 3.5.3 The surface water drainage systems, as designed will accommodate the surface water run-off generated by the proposed developed area of the site, including the parking areas, roofed areas and house paths areas and the large greenfield area which is to remain untouched due to the presence of badger habitats. Refer to **(Appendix G)** run off calculation.
- 3.5.4 Enclosed **(Appendix I)** are the design calculations for the infiltration systems. In accordance with National Resources Wales' guidelines the soakaway calculations have been completed using a threshold event of 1 in 100 year + 30% for climate change.

3.5.5 A summary of the calculations attached in (**Appendix I**) is found below and on the following page:

Soakaway System 1 (Highway & Parking)

Effective Area: = 1,654.057m²

Storage Requirement 1 in 100yr event + 30% (c.c) = 23.745 m³

Soakaway Provision

76.000m x 0.600m x 0.750m Deep x 35% Void Ratio = 23.940 m³

Number of Trenches = 2

Soakaway System 2 (Roof)

Effective Area: = 895.588m²

Storage Requirement 1 in 100yr event + 30% (c.c) = 14.293 m³

Soakaway Provision

50.000m x 0.900m x 1.000m Deep x 35% Void Ratio = 15.750 m³

Number of Trenches = 1

Treatment Plant Trench

Effective Area: = 895.588m²

Storage Requirement 1 in 100yr event + 30% (c.c) = 14.293 m³

Soakaway Provision

50.000m x 0.900m x 1.000m Deep x 35% Void Ratio = 15.750 m³

Number of Trenches = 1

3.6 Extreme Event

- 3.6.1 The Extreme event relates to an event over and above the threshold event. Surface water run-off generated up to the extreme event shall follow away from the building and flow into the proposed gullies, and discharge into the proposed soakaway systems as noted in footnote 3.7.4. Refer to drawing 3829 – EW12 & 3829 – EW13 (**Appendix E**) for the proposed and existing surface water flood routing.
- 3.6.2 During the extreme event, once the system has achieved capacity additional run-off will flow away from the buildings and onto the pitches, then infiltrate into the ground or collect at the low point in the most North Eastern corner of the mimicking the existing surface water run off route for the site.

3.7 Surface Water Treatment

- 3.7.1 In accordance with the CIRIA C753 publication ‘The SuDS Manual’ (2015), residential roofs have a ‘very low’ pollution hazard level, with low traffic roads classified as having a ‘low’ pollution hazard level. Table 6 below shows the pollution hazard indices for each land use.

Table 6 – Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Soils	Metals	Hydrocarbons
Residential Roofs	very low	0.2	0.2	0.05
Low traffic Roads	low	0.5	0.4	0.4

- 3.7.2 Table extract taken from the CIRIA C753 publication ‘The SuDS Manual’ – Table 26.2* Indices values range from 0-1.
- 3.7.3 Based on the table on the previous page the proposed development the site will have the following levels of pollutants within the surface water runoff.

Table 7 – Pollution Mitigation Indices

Type of SuDS Component	Total Suspended Solids	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Basin	0.5	0.6	0.6
Bioretention System	0.8	0.8	0.8
Permeable Pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wet Land	0.8	0.8	0.8
Proprietary Treatment Systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1-year return period event, for inflow concentrations relevant to the contributing drainage.		

3.7.4 Table extract taken from the CIRIA C753 publication ‘The SuDS Manual’ – Table 26.3* Indices mitigation methods for the treatment of the surface water generated from the proposed development.

3.7.5 As noted within footnote 5.5.2. and 5.5.3. the proposal involves disposing of all surface water generated from the highways into soakaway trench system 1, and all plot drainage into soakaway trench system 2 for the 1 in 100-year event + an allowance of 30%. Soakaway provides suitable pollution mitigation measures.

4.0 Surface Water Maintenance

- 4.0.1 CIRIA C753 publication 'The SuDS Manual' (2015) requires appropriate measures to be in place to the maintenance of surface water drainage systems and Suds features.
- 4.0.2 Usually surface water drainage systems are offered for adoption to the sewerage undertaker, in this case being welsh water, however Welsh Water will adopt soakaway structures or pipework within a site which only takes 1 property. Therefore the surface water drainage system it so remain private and be maintained by the client.
- 4.0.3 Operation and maintenance requirements for all the drainage pipe work, associated inlets and structures is to be in strict accordance with this document and with The Suds Manual CIRIA C753.
- 4.0.4 Provided preventive maintenance measures are conscientiously undertaken, the need for corrective maintenance should rarely arise.
- 4.0.5 Maintenance activities should be detailed in the contractors Health and Safety Plan and Risk Assessments undertaken and updated on a regular basis.

4.1 Soakaway Maintenance Schedule

- 4.1.1 The following maintenance schedule has been derived in strict accordance with Chapter 32 of The Suds Manual CIRIA C753 and from risk assessed approach during the design stage. This schedule is not exhaustive and should be reassessed at regular intervals to determine if any additional maintenance requirements have arisen during the use of the structure.
- 4.1.2 The maintenance schedule includes regular maintenance activities, occasional maintenance activities and remedial actions as part of the future successful operation of the swale structure. Reference should be made to table 10 below

Table 8 – Basin Maintenance Schedule

4.1.3	Maintenance Schedule	Required Action	Typical Frequency
	Regular Maintenance	Removal of silt build up within highway gullies.	6-month interval
		Removal of silt build up within the inspection pipes in trench soakaways.	6-month interval

Remedial action to the soakaways should be identified from routine inspections and undertaken to suit.

4.2 Surface Water Drainage Maintenance

4.2.1 In addition as the soakaways as the surface water systems will not be adopted by Welsh Water, the system will require maintaining a maintenance plan for this is given below.

Table 9 – Surface Water Drainage Maintenance Schedule

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Removal of silt build up within Catch pits Chambers and highway gullies, refer to the chamber schedule attached (Appendix B).	12 month interval

5.0 Foul Drainage Design

5.1 Method of Disposal

Discharge into a Public Foul Sewerage System - Welsh Water Mapping indicates there are no foul sewerage systems within the vicinity of the site ref map attached (**Appendix G**), therefore a connection cannot be sought.

- Discharge into a Private sewerage system,
 - Discharge into a Public Sewer System,
 - Discharge using treatment plant into an infiltration systems,
 - Discharge using treatment plant into a watercourse, and
 - Discharge into a holding tank.
- The Building Regulations will not now allow the installation of a septic tank unless it can be demonstrated that it would not be "reasonably practical" to connect to a public sewer or a private sewer.
- There is sign of any private sewerage systems within the area as the previous property utilized a large holding tank which was then emptied when required as a method foul effluent disposal.
- Welsh Water Mapping software indicates there is no sewerage systems within the vicinity of the site refer to (**Appendix B**), therefore a connection cannot be sought.
- The underlying strata of the site does not provide a suitable infiltration rate to discharge treated foul effluent into the ground via a soakaway, the tests result also show the water level during the test fluctuated, due to ground water being present. The results can be seen in the Site Investigation report attached (**Appendix C**).
- There are no watercourses located within the vicinity of the site.

As all other means of foul effluent disposal have been discounted the most suitable method of foul effluent disposal is using a treatment plant into an infiltration system.

5.2 Flow Rate Design

5.2.1 Design of the foul sewers included within the proposal from domestic units have been carried out in accordance with BS EN 12056 Part 2. The design flow rate for foul from each property is calculated in the table below:

Table 10 – Extension

(Discharge units from BS EN 12056 : Part 2).			
Fitting Type	No. Fittings	Flow Rate (l/s/fitting)	Cum. Discharge Units
Water Closet	35	2.5	87.5
Wash Hand Basin	34	0.5	17
Shower	44	0.6	26.4
Kitchen Sink	6	0.8	4.8
Washing Machine	2	0.8	1.6
Total DU			137.3

Table 24 – Entire Site Discharge Rate

Total Discharge Unit	137.3
K	0.5
Convert Du to l/s	$0.5\sqrt{137.3} = 5.86 \text{ l/s}$

5.2.3 In accordance with Sewers for Adoption 7th clause B4.1. as the site contains 1 dwelling with a proposed extension, all foul effluent generated from the developments can be accommodated within a Ø 100mm.

5.2.4 In accordance with Sewers for Adoption 7th clause B4.9 all Ø 100mm pipework should be laid no flatter than 1/80.

5.2.5 The design of the Surface Water and Foul drainage is illustrated in drawing 3829 – EW03, EW04, EW05 & EW06 (**Appendix B**).

5.3 Foul Treatment Plant Soakaway Trench

Utilising the infiltration rate given by Tp-11, TP-12 & TP-13 and based on a discharge from the treatment plan of 4.5cm^3 / day a soakaway trench provision of:

2500mm x 450mm x 450mm Deep is considered suitable.

Reference should be made to **Appendix H** for calculations.

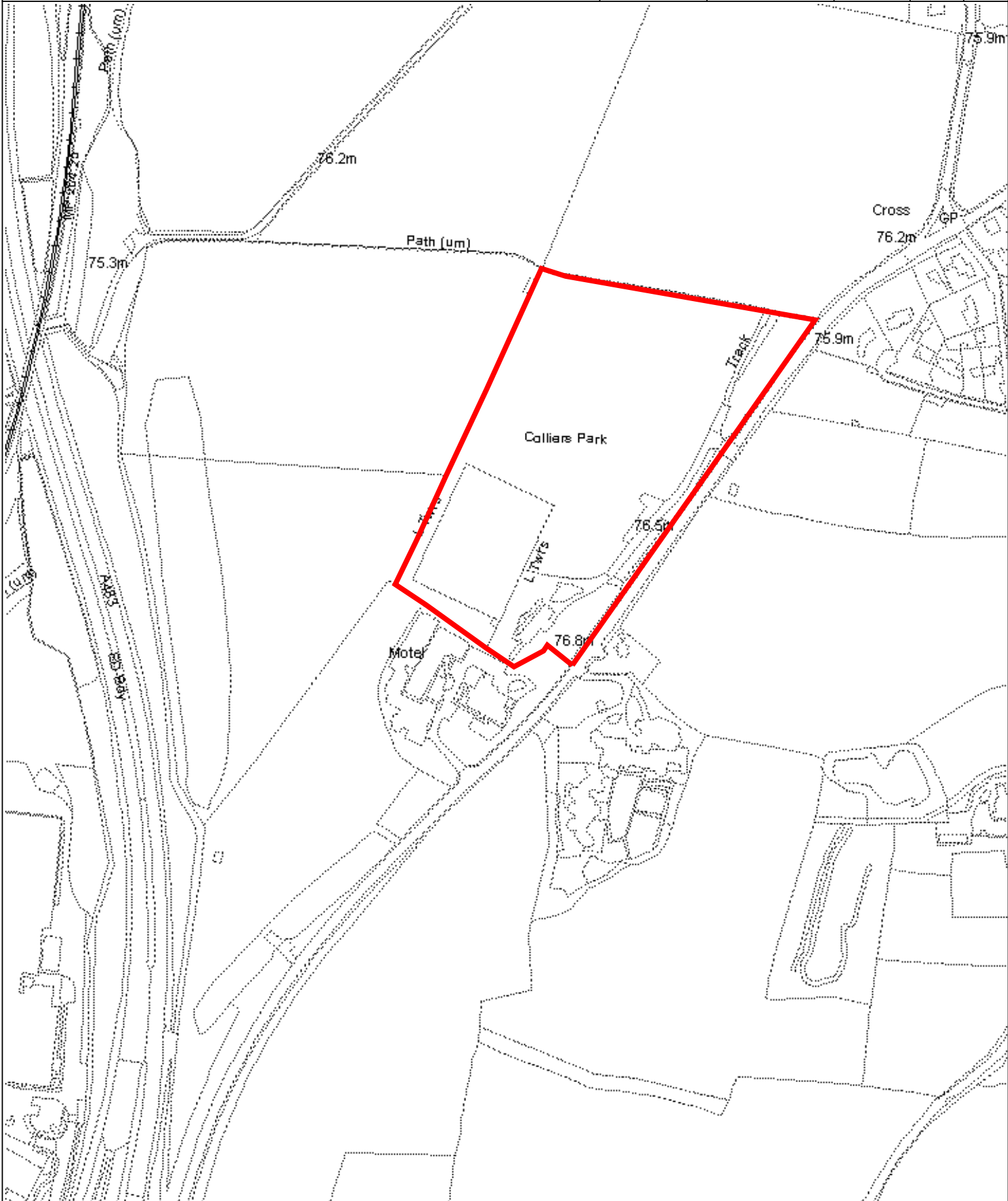
APPENDICES

APPENDIX A – SITE LOCATION PLAN

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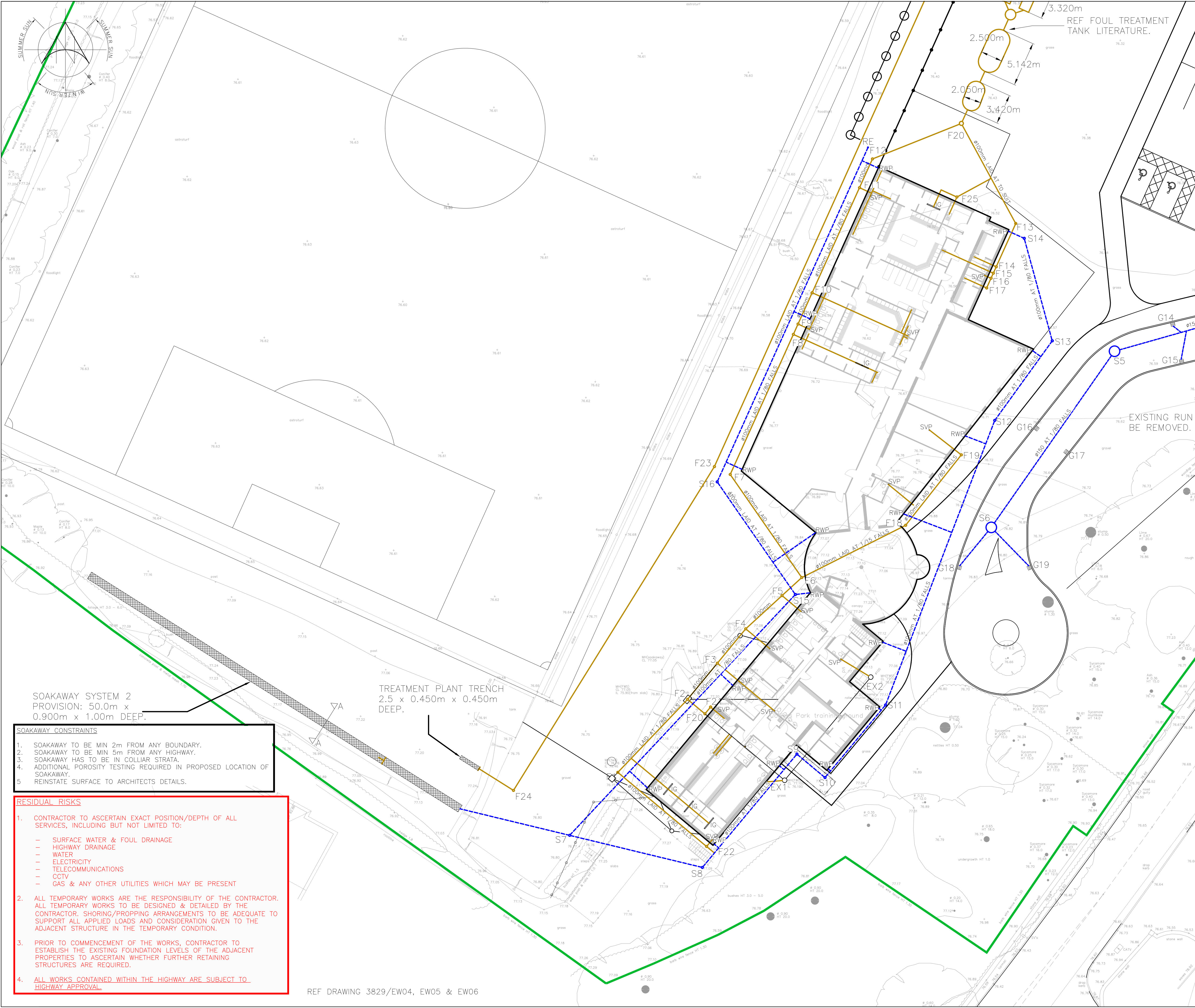


Project COLLIERS PARK, WREXHAM				
Detail SITE LOCATION PLAN				
Project No.	Drawing No.	Scale	By	Rev.
3829	EW01	NTS	B.T.	*



This drawing is to be read in conjunction with all relevant architects drawings and specifications.
Do not scale – use written dimensions only !

APPENDIX B – SITE LAYOUT



- NOTES**
- DO NOT SCALE FROM THIS DRAWING.
 - ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.
 - PLEASE REFER TO ARCHITECTS DRAWINGS FOR FINAL BUILDING LOCATION.
 - ALL DRAINAGE COMPONENTS ARE TO COMPLY WITH CURRENT BRITISH STANDARDS AND BUILDING REGULATIONS REQUIREMENTS.
 - ALL WORKS TO IN ACCORDANCE WITH ROADS FOR ADOPTION IN WREXHAM.
 - ALL WORKS AND MATERIALS TO BE IN ACCORDANCE WITH THE SPECIFICATION FOR HIGHWAY WORKS (SHW SERIES 500).
 - DRAIN PIPE THROUGH WALLS OR BENEATH FOUNDATIONS (SPREAD ONLY) TO HAVE R.C BRIDGE LINTELS OVER AND PIPE SURROUNDED IN FLEXIBLE MATERIAL (50mm).
 - FINAL LOCATIONS AND DETAILS OF SOIL VENT PIPES, STUB STACKS, RAINWATER DOWN PIPES, GULLIES ETC. TO BE CONFIRMED BY REFERENCE TO ARCHITECT' DRAWINGS.
 - ALL THRESHOLD DRAIN DETAILS TO BE TO ARCHITECT' DETAILS.
 - ALL PIPES INTO CHAMBERS TO SOFFIT TO SOFFIT U.N.O.
 - AT ALL OUTFALL POINTS TO AN EXISTING NETWORK, THE POSITION AND INVERT LEVEL OF EXISTING DRAINS MUST BE CONFIRMED WELL IN ADVANCE OF THE PROGRAMMED DATE FOR INSTALLING ANY OF THE UPSTREAM DRAINAGE, OR ORDERING OF ANY MATERIALS, IN ORDER TO ALLOW TIME FOR ANY NECESSARY REVISIONS TO THE HYDRAULIC DESIGN.
 - ALL GRAVITY UPVC PIPEWORK TO BE TO BS 4660 OR BS 5481 WHERE RELEVANT UNLESS NOTED OTHERWISE.
 - ALL NON ADOPTABLE DOMESTIC FOUL AND SURFACE WATER PIPE RUNS SHALL CONSIST OF 100mm DIA. PIPES LAID AT NO FLATTER THAN 1 IN 80 FALLS U.N.O.
 - ALL CONNECTIONS FROM HIGHWAY GULLIES & ACO SUMPS TO BE 150mm DIA. LAID AT FALLS OF BETWEEN 1 IN 20 AND 1 IN 100 WITH TYPE S BED AND SURROUND TO ALL CONNECTIONS WITH MIN. 1.20m COVER, TYPE Z BED AND SURROUND TO ALL OTHER CONNECTIONS.
 - THERMOPLASTIC PIPES & FITTINGS:**
THERMOPLASTIC PIPES, JOINTS & FITTINGS FOR GRAVITY SEWERS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 1401-1, BS EN 1852 & BS EN 12666-1.
 - THERMOPLASTIC STRUCTURED WALL PIPE:**
THERMOPLASTIC STRUCTURED WALL SEWER PIPE SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 13476-1 & WIS 4-35-01 AND BS EN 13476-2 OR BS EN 13476-3. PIPES SHALL BE BSI KITEMARKED OR HAVE EQUIVALENT THIRD PARTY CERTIFICATION. PIPES LESS THAN OR EQUAL TO 500mm IN DIAMETER SHALL HAVE NOMINAL SHORT-TERM RING STIFFNESS NOT LESS THAN 8kN/m² (SN8) OR BE SUBJECT TO A QUALITY SYSTEM FOR STORAGE & EMBEDMENT.

Nom. SHORT TERM RING STIFFNESS OF 2kN/m² (SN2) IS ACCEPTABLE FOR PIPES GREATER THAN ø500mm, SUBJECT TO SUPPORTING STRUCTURAL DESIGN LOAD CALCULATIONS BEING PROVIDED.
- TRANSPORTATION, HANDLING, STORAGE AND LAYING SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
- WHERE A FITTING IS INSTALLED ON A SEWER LENGTH, IT SHALL HAVE THE SAME INTERNAL BORE AS THE SEWER. Max. LENGTH OF PIPE FOR LAYING IS 3.0m OR ø x 10, WHICHEVER IS THE GREATER, UNLESS WELDED JOINTS ARE USED.

- CONNECTION TO THE PUBLIC SEWER**
A SECTION 106 APPLICATION TO CONNECT MUST BE MADE TO DCWW. THE DEVELOPER SHALL GIVE 21 DAYS NOTICE PRIOR TO CONNECTION, THE WORKS MAY ONLY BE UNDERTAKEN BY A DCWW HEALTH AND SAFETY APPROVED CONTRACTOR.
- OPTIMUM TRENCH WIDTH**
OPTIMUM TRENCH WIDTH = PIPE + 300mm. CONTRACTOR TO ENSURE TRENCH WALLS ARE SUITABLY PROPPED.

- KEY**
- DENOTES PROPOSED PRIVATE FOUL CHAMBER & PIPE RUN.
 - DENOTES PROPOSED PRIVATE SURFACE WATER CHAMBER & PIPE RUN.
 - DENOTES PROPOSED RODDING EYE.
 - DENOTES PROPOSED HIGHWAY GULLY (ø150mm CONNECTION).
 - DENOTES PROPOSED EXISTING DRAINAGE TO BE REMOVED.
 - DENOTES RAINWATER PIPES & GULLY.

Revisions.				
Revision	Made by	Date	Checked	Description
A	K.B.	15/02/18	B.T.	ADD TREATMENT PLANT TRENCH AND AMEND POSITION OF TANK.

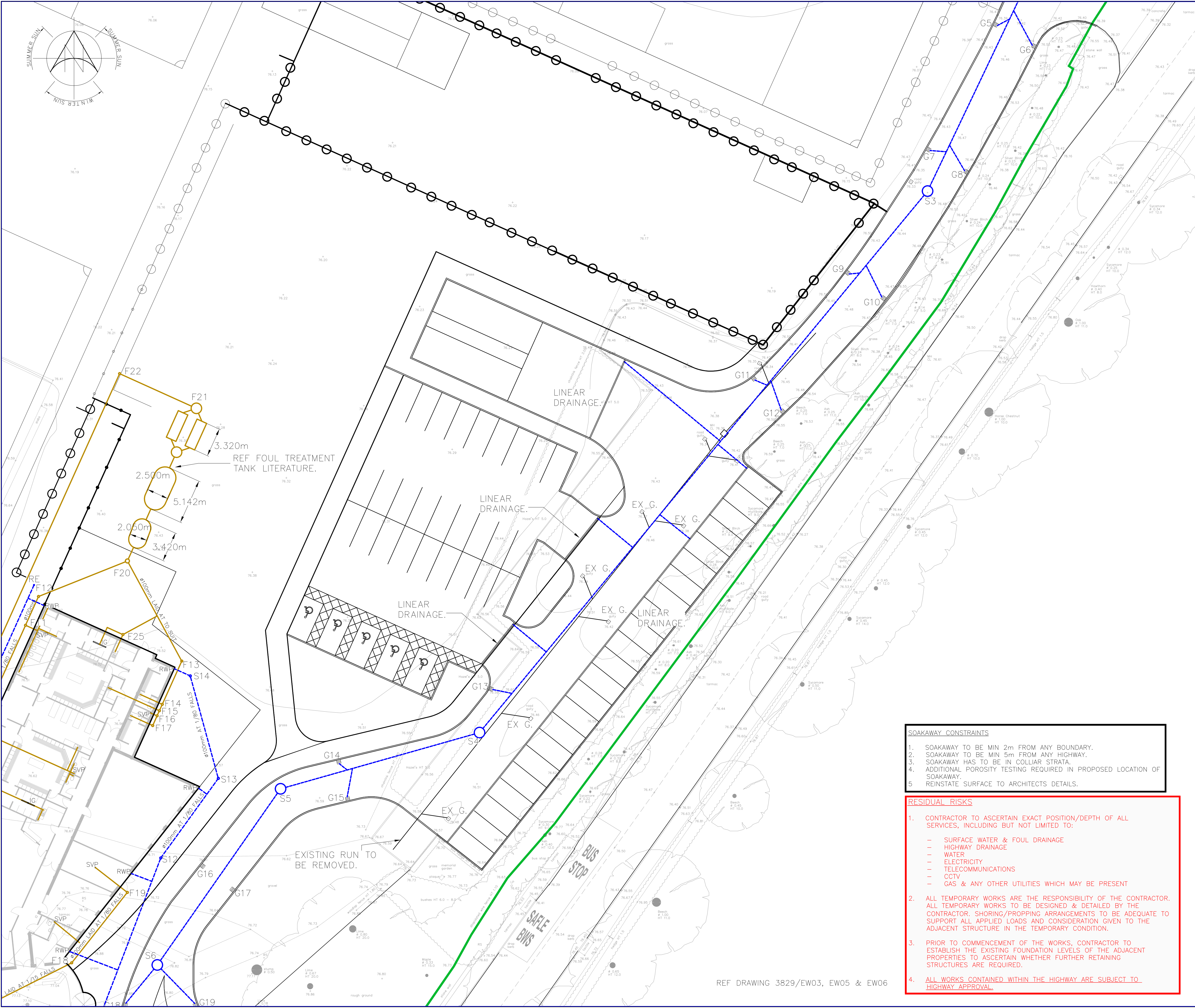
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b.r.p
Bingham Rawlings Partnership Limited

Project		COLLIERS PARK, WREXHAM.							
Drawing Title		PROPOSED DRAINAGE LAYOUT ZONE A.							
Architect		LAWRAY ARCHITECTS							
Client		WALES FOOTBALL ASSOCIATION							
Scale		1/200				Revision			
Drawn		B.Thorne				A			
Date		26/01/18							
Checked		I.Rowlands							

- SOAKAWAY SYSTEM 2**
PROVISION: 50.0m x 0.900m x 1.00m DEEP.
- SOAKAWAY CONSTRAINTS**
- SOAKAWAY TO BE MIN 2m FROM ANY BOUNDARY.
 - SOAKAWAY TO BE MIN 5m FROM ANY HIGHWAY.
 - SOAKAWAY HAS TO BE IN COLLIER STRATA.
 - ADDITIONAL POROSITY TESTING REQUIRED IN PROPOSED LOCATION OF SOAKAWAY.
 - REINSTATE SURFACE TO ARCHITECTS DETAILS.

- RESIDUAL RISKS**
- CONTRACTOR TO ASCERTAIN EXACT POSITION/DEPTH OF ALL SERVICES, INCLUDING BUT NOT LIMITED TO:
 - SURFACE WATER & FOUL DRAINAGE
 - HIGHWAY DRAINAGE
 - WATER
 - ELECTRICITY
 - TELECOMMUNICATIONS
 - CCTV
 - GAS & ANY OTHER UTILITIES WHICH MAY BE PRESENT
 - ALL TEMPORARY WORKS ARE THE RESPONSIBILITY OF THE CONTRACTOR. ALL TEMPORARY WORKS TO BE DESIGNED & DETAILED BY THE CONTRACTOR. SHORING/PROPPING ARRANGEMENTS TO BE ADEQUATE TO SUPPORT ALL APPLIED LOADS AND CONSIDERATION GIVEN TO THE ADJACENT STRUCTURE IN THE TEMPORARY CONDITION.
 - PRIOR TO COMMENCEMENT OF THE WORKS, CONTRACTOR TO ESTABLISH THE EXISTING FOUNDATION LEVELS OF THE ADJACENT PROPERTIES TO ASCERTAIN WHETHER FURTHER RETAINING STRUCTURES ARE REQUIRED.
 - ALL WORKS CONTAINED WITHIN THE HIGHWAY ARE SUBJECT TO HIGHWAY APPROVAL.



- NOTES**
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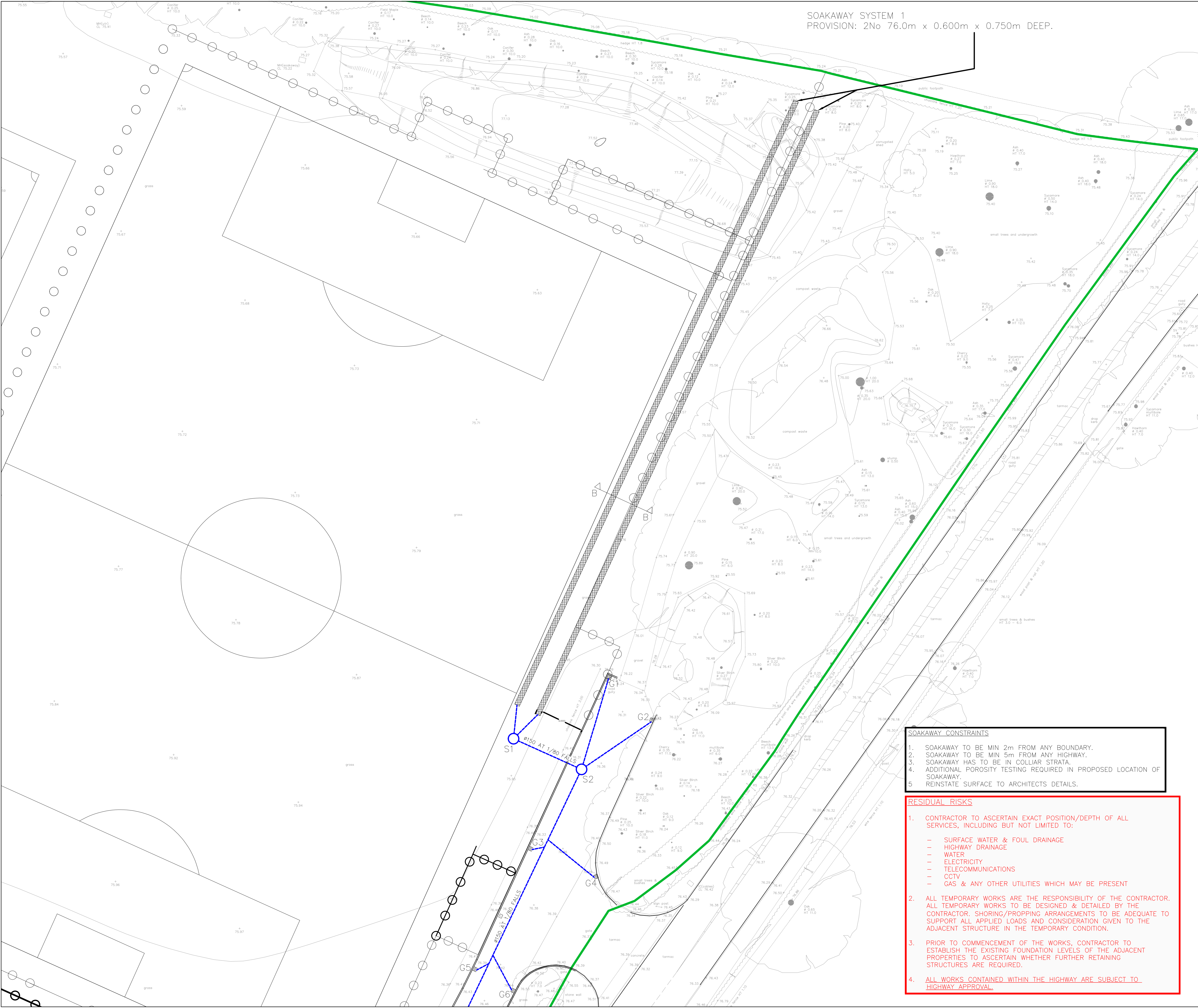


Project		COLLIERS PARK, WREXHAM.								
Drawing Title		PROPOSED DRAINAGE LAYOUT ZONE B.								
Architect		LAWRAY ARCHITECTS								
Client		WALES FOOTBALL ASSOCIATION								
Scale 1/200		3829 EW04				Revision				
Drawn B.Thorne						A				
Date 26/01/18										
Checked I.Rowlands										

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REF DRAWING 3829/EW03, EW05 & EW06



SOAKAWAY SYSTEM 1
PROVISION: 2No 76.0m x 0.600m x 0.750m DEEP.

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b.r.p
Bingham Rawlings Partnership Limited

Project COLLIERS PARK, WREXHAM.

Drawing Title PROPOSED DRAINAGE LAYOUT ZONE C.

Architect	LAWRAY ARCHITECTS
Client	WALES FOOTBALL ASSOCIATION
Scale	1/200
Drawn	B.Thorne
Date	26/01/18
Checked	I.Rowlands

Revision	A				

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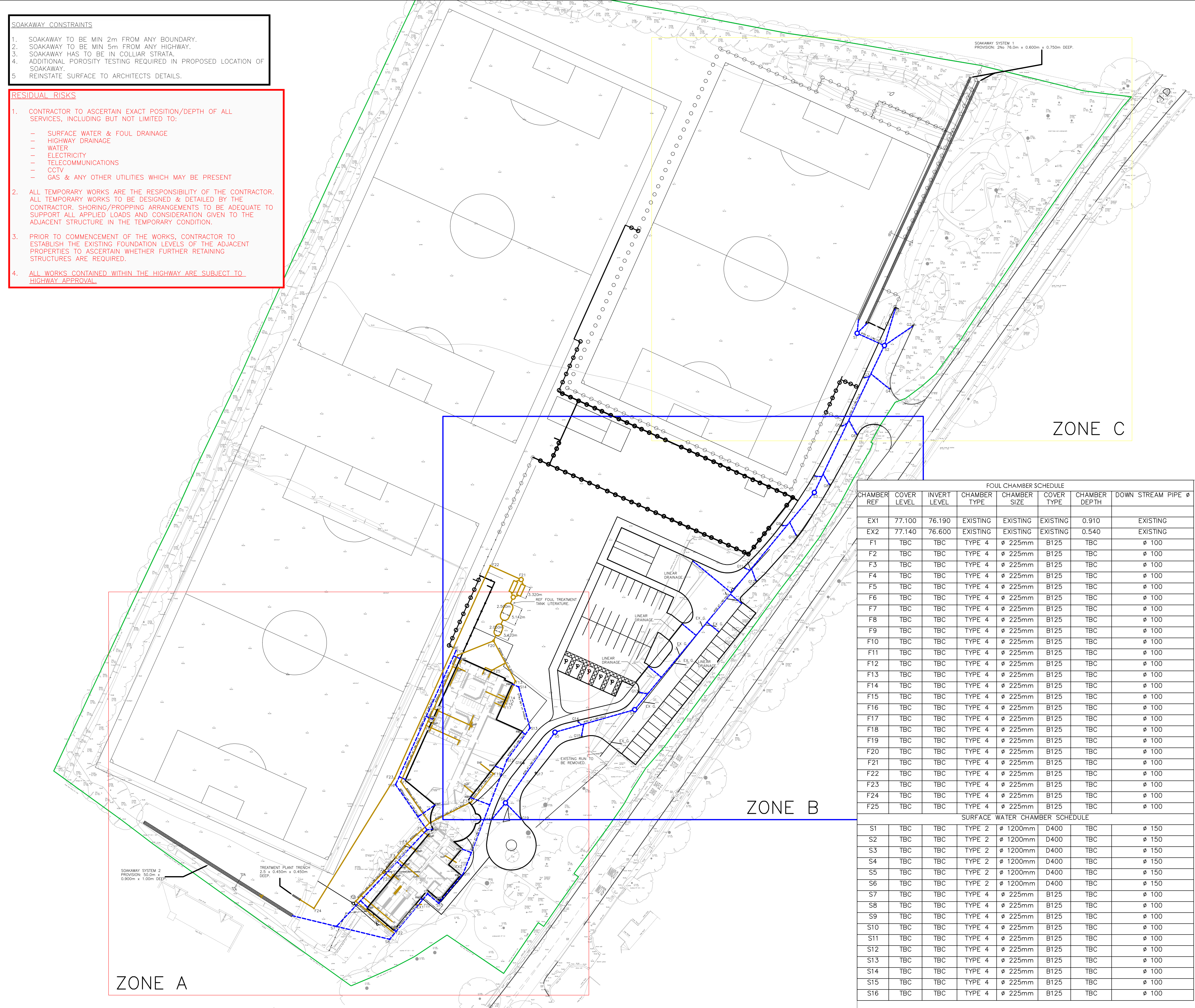
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Project		COLLIERS PARK, WREXHAM.						
Drawing Title		PROPOSED DRAINAGE LAYOUT OVERALL.						
Architect		LAWRAY ARCHITECTS						
Client		WALES FOOTBALL ASSOCIATION						
Scale 1/500		3829 EW06			Revision			
Drawn B.Thorne					A			
Date 26/01/18								
Checked I.Rowlands								

FOUL CHAMBER SCHEDULE						
CHAMBER REF	COVER LEVEL	INVERT LEVEL	CHAMBER TYPE	CHAMBER SIZE	COVER TYPE	CHAMBER DEPTH
EX1	77.100	76.190	EXISTING	EXISTING	EXISTING	0.910
EX2	77.140	76.600	EXISTING	EXISTING	EXISTING	0.540
F1	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F2	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F3	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F4	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F5	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F6	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F7	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F8	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F9	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F10	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F11	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F12	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F13	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F14	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F15	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F16	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F17	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F18	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F19	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
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F22	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F23	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F24	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
F25	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
SURFACE WATER CHAMBER SCHEDULE						
S1	TBC	TBC	TYPE 2	ø 1200mm	D400	TBC
S2	TBC	TBC	TYPE 2	ø 1200mm	D400	TBC
S3	TBC	TBC	TYPE 2	ø 1200mm	D400	TBC
S4	TBC	TBC	TYPE 2	ø 1200mm	D400	TBC
S5	TBC	TBC	TYPE 2	ø 1200mm	D400	TBC
S6	TBC	TBC	TYPE 2	ø 1200mm	D400	TBC
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S11	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
S12	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
S13	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
S14	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
S15	TBC	TBC	TYPE 4	ø 225mm	B125	TBC
S16	TBC	TBC	TYPE 4	ø 225mm	B125	TBC



APPENDIX C – COEFFICIENT RUN OFF CALCULATIONS

SITE:	Colliers Park, Wrexham	Job No:	3829
PAGE:	01	Date:	26/11/18
BY:	K.Blackwell	Checked:	I.R.

The following design calculations summarise the peak Greenfield Run-off rates for the following various storm events as summarised below. The design calculations have been compiled in strict compliance with IHR 124 - flood estimation for small catchments.

Storm Events:

1 in 1 Year

1 in 100 Year return period

Due to the location of the proposal being classed as 'RURAL' the peak run-off is calculated using the following -:

$$Q_{BAR} = 0.0108 \times AREA^{(0.89)} \times SAAR^{(1.17)} \times SOIL^{(2.17)}$$

The site specific data has been collated using the FEH and is summarised as follows :

Site Area -	50	SAAR -	739	SOIL	1
M5-60 -	17mm	r -	0.3	SPR	0.1

Although a soil classification of 2 is given for the site within the Wallingford soil classification maps, a value of 4 has been taken because the underlying strata for the site consists of firm clay with very low permeability as confirmed within the Site Investigation.

Pre Development:

$$Q_{BAR} (RURAL) = (0.0108 \times (50^{0.89}) \times (739^{1.17}) \times (0.1^{2.17}))$$

$$= \begin{array}{|c|c|} \hline 5.393 & \text{L/S/50Ha} \\ \hline 0.108 & \text{L/S/Ha} \\ \hline \end{array}$$

The pre development site Run-off coefficients are as follows :-

Greenfield = 0.35 = 35% Macadam = 0.75 = 75% Hardstanding = 1.0 = 100%

The pre development site area measures as follows:-

Greenfield	44,757.819	0.35	15,665.237 m ²
Roofed	340.274	1.00	340.274 m ²
Tarmac (Road/Path)	1,901.907	0.60	1,141.144 m ²
Total Site Measures :	17,146.65 m ²	or	1.715 Ha

SITE:	Colliers Park, Wrexham	Job No:	3829
PAGE:	2	Date:	26/11/18
BY:	K.Blackwell	Checked:	I.R.

Post Development:

The post development site run-off coefficients are as follows :-

Greenfield - 0.35 = 35%
Roofs - 1.0 = 100%
Footpaths - 1.0 = 100%
Housepaths - 1.0 = 100%
Roads - 1.0 = 100%

The proposal site areas measures as follows :

Roofed	895.588	1.00	895.588 m ²
Gravel (Parking)	748.921	0.60	449.353 m ²
Tarmac (Roads/Parking)	1,606.272	0.75	1,204.704 m ²
Grassed	41,876.000	0.35	14,656.600 m ²

Total Site Measures :	17,206.24 m ²	or	1.721 Ha
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Run-off

Using growth charts the actual predicted run-off can be calculated for both storm events Pre and Post development.

In accordance with PPS25 a climate change factor should be included :

$Q_{BAR} (RURAL) = 1.721 \times 1.3 = 2.2373$ (30% Climate change)

Pre Development

1 in 1 Year =	$0.88 \times (0.108 \times 1.715) =$	0.163 L/S
----------------------	--------------------------------------	-----------

1 in 100 Year =	$2.18 \times (0.108 \times 1.715) =$	0.403 L/S
------------------------	--------------------------------------	-----------

Post Development

1 in 1 Year =	$0.88 \times (0.108 \times 2.373) =$	0.212 L/S
----------------------	--------------------------------------	-----------

1 in 100 Year =	$2.18 \times (0.108 \times 2.373) =$	0.526 L/S
------------------------	--------------------------------------	-----------

The resulted increase in run-off will need to be mitigated.

SITE:	Colliers Park, Wrexham	Job No:	3829
PAGE:	3	Date:	26/11/18
BY:	K.Blackwell	Checked:	I.R.

Run-off Volume

The Increase in run-off demonstrated through calculation will lead to an inevitable increase in the volumetric run-off. The volumetric run-off, both pre and post development are calculated using the modified rational method. Reference is made to the attached calculations summarised below:

Pre development volume run-off =	1290.360 m ³
---	-------------------------

Post development volume run-off =	1294.840 m ³
--	-------------------------

Note:- The above volumetric run-off's are calculated for the 6 hour 1 in 100 year event.

The Increase in Volumetric run-off is calculated as:- **4.480** m³

The volumetric increase must be contained within site. Therefore the proposed attenuation must be sized such to accommodate the calculated additional volume.

APPENDIX D – SOAKAWAY REQUIREMENT CALCULATIONS

	Soakaway calculations to BRE Digest 365			
	Project:	Colliers Park, Wrexham		
	Job Reference:	15417	Done By:	Kieran Blackwell
	Location:	Car Park & Road	Date	31/01/2018

1 In 100 Year + 30% For Climate Change

M5-60min 17.0

M5-60min + 30% **22.1**

Runoff Coefficients

Roofed	895.588 m ²
Gravel (Parking)	748.921 m ²
Tarmac (Roads/Parking)	1606.272 m ²
Grassed	41876 m ²

Effective Area **1654.057 m²**

0	Hardstanding
0.6	Gravel
0.75	Tarmacadam
0	Greenfield

Duration (min)	M5-60min (mm)	r	Z1	M5-D (mm)	Z2	M100-D (mm)	I (mm/hr)	Area (sq m)	Inflow (cu m)	Outflow (cu m)	Storage (cu m)
5.0	22.1	0.3	0.34	7.5	1.85	13.9	166.84	1654.06	23.01	6.18	16.831
10.0	22.1	0.3	0.50	10.9	1.93	21.1	126.35	1654.06	34.87	12.37	22.501
15.0	22.1	0.3	0.59	13.0	1.96	25.5	102.15	1654.06	42.29	18.55	23.745
30.0	22.1	0.3	0.78	17.2	2.01	34.6	69.22	1654.06	57.36	37.10	20.257
60.0	22.1	0.3	1.00	22.1	2.02	44.7	44.68	1654.06	74.11	74.20	-0.088
120.0	22.1	0.3	1.24	27.4	1.99	54.6	27.28	1654.06	90.65	148.39	-57.737
240.0	22.1	0.3	1.55	34.3	1.94	66.3	16.58	1654.06	110.53	296.78	-186.258
360.0	22.1	0.3	1.80	39.8	1.89	75.3	12.54	1654.06	125.73	445.18	-319.448
600.0	22.1	0.3	2.13	47.1	1.83	86.3	8.63	1654.06	144.84	741.96	-597.120
1440.0	22.1	0.3	2.79	61.7	1.73	106.7	4.45	1654.06	181.52	1780.70	-1599.181

Percolation factor	(m/s)	1.00E-04
---------------------------	--------------	----------

Granular Trench Soakaway Dimension		
No of Trenches	(nr)	2.000
Soakaway Length	(m)	76.000
Soakaway Width	(m)	0.600
Effective Depth	(m)	0.750
Eff Area of soakaway	(sq m)	206.100
Total Storage provided	(cu m)	23.940

0.0

	Soakaway calculations to BRE Digest 365			
	Project:	Colliers Park, Wrexham		
	Job Reference:	15417	Done By:	Kieran Blackwell
	Location:	Roofed	Date	31/01/2018

1 In 100 Year + 30% For Climate Change

M5-60min 17.0

M5-60min + 30% **22.1**

Runoff Coefficients

Roofed	895.588 m ²
Gravel (Parking)	748.921 m ²
Tarmac (Roads/Parking)	1606.272 m ²
Grassed	41876 m ²

1	Hardstanding
0	Gravel
0	Tarmacadam
0	Greenifield

Effective Area **895.588 m²**

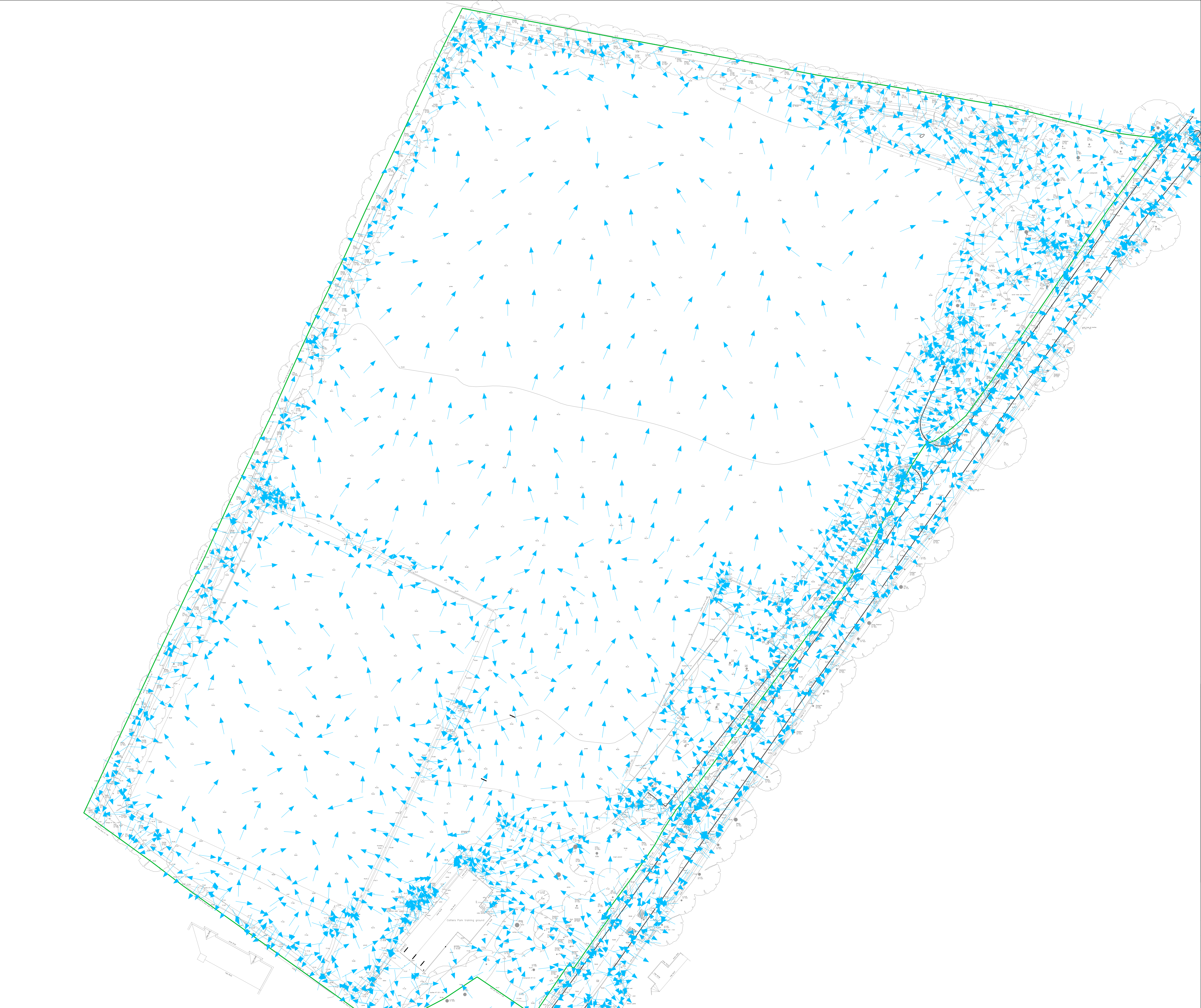
Duration (min)	M5-60min (mm)	r	Z1	M5-D (mm)	Z2	M100-D (mm)	I (mm/hr)	Area (sq m)	Inflow (cu m)	Outflow (cu m)	Storage (cu m)
5.0	22.1	0.3	0.34	7.5	1.85	13.9	166.84	895.59	12.47	2.88	9.592
10.0	22.1	0.3	0.50	10.9	1.93	21.1	126.35	895.59	18.89	5.75	13.141
15.0	22.1	0.3	0.59	13.0	1.96	25.5	102.15	895.59	22.92	8.63	14.293
30.0	22.1	0.3	0.78	17.2	2.01	34.6	69.22	895.59	31.10	17.26	13.841
60.0	22.1	0.3	1.00	22.1	2.02	44.7	44.68	895.59	40.22	34.52	5.697
120.0	22.1	0.3	1.24	27.4	1.99	54.6	27.28	895.59	49.28	69.05	-19.772
240.0	22.1	0.3	1.55	34.3	1.94	66.3	16.58	895.59	60.23	138.10	-77.869
360.0	22.1	0.3	1.80	39.8	1.89	75.3	12.54	895.59	68.65	207.14	-138.494
600.0	22.1	0.3	2.13	47.1	1.83	86.3	8.63	895.59	79.38	345.24	-265.859
1440.0	22.1	0.3	2.79	61.7	1.73	106.7	4.45	895.59	100.58	828.58	-727.993

Percolation factor	(m/s)	1.00E-04
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Granular Trench Soakaway Dimension		
No of Trenches	(nr)	1.000
Soakaway Length	(m)	50.000
Soakaway Width	(m)	0.900
Effective Depth	(m)	1.000
Eff Area of soakaway	(sq m)	95.900
Total Storage provided	(cu m)	15.750

0.0

APPENDIX E – SURFACE WATER FLOOD ROUTING



NOTES

1. DO NOT SCALE FROM THIS DRAWING.

2. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.

3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.

4. PLEASE REFER TO ARCHITECTS DRAWINGS FOR FINAL BUILDING LOCATION.

KEY



DENOTES DIRECTION OF SURFACE WATER FLOW.

Revisions.

Revision	Made by	Date	Checked	Description

Bingham Rawlings Partnership Limited

Consulting Civil & Structural Engineers

The Stables

1 Grosvenor Road Wrexham LL11 1BS

Telephone:(01978) 353522

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e-mail : consult@brp2000.co.uk

b.r.p

Bingham Rawlings Partnership Limited

Project

COLLIERS PARK, WREXHAM.

Drawing Title

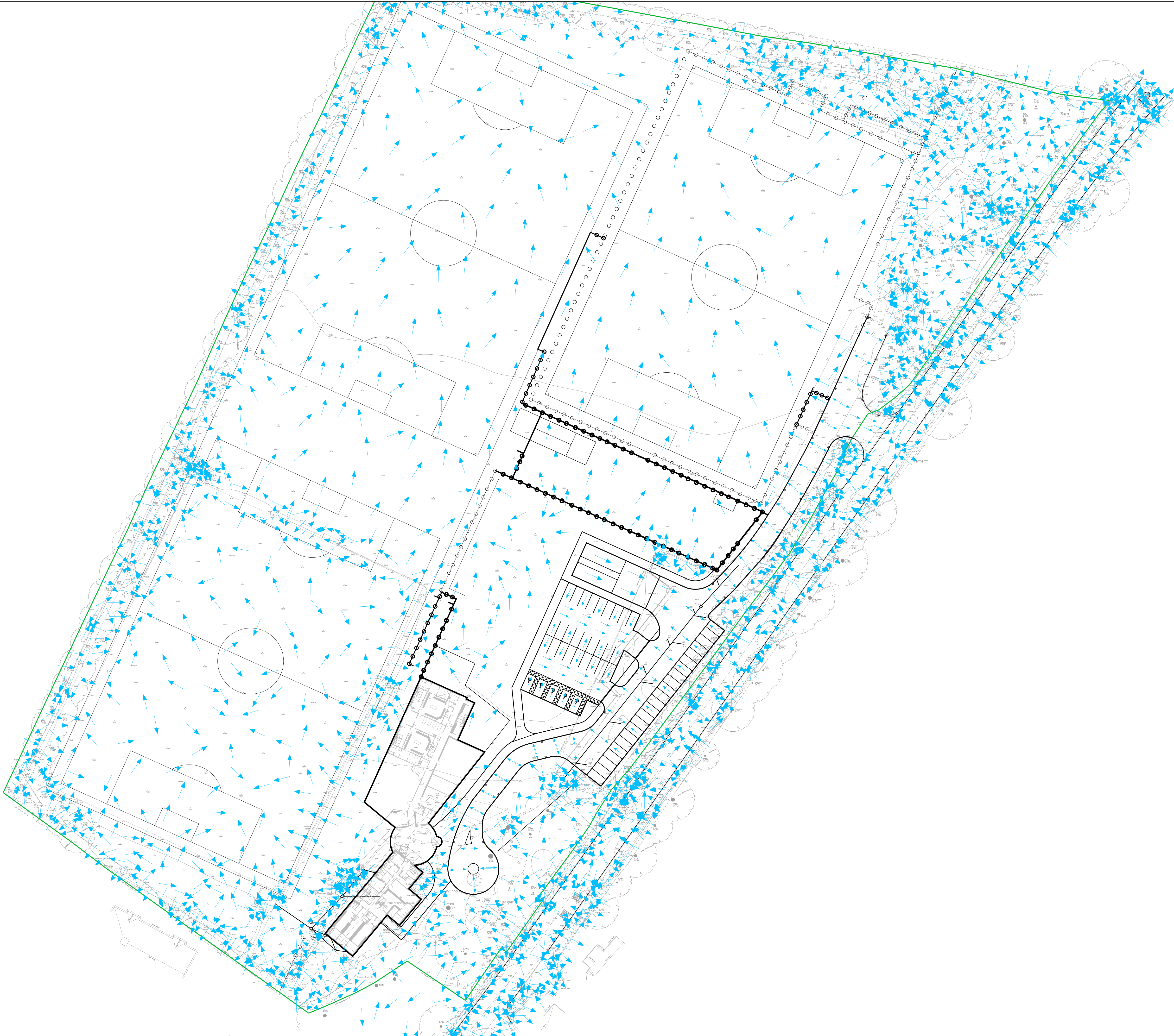
EXISTING FLOOD ROUTING.

Architect	LAWRAY ARCHITECTS
Client	WALES FOOTBALL ASSOCIATION
Scale	STATED
Drawn	B.Thorne
Date	26/01/18
Checked	I.Rowlands

3829

EW12

Revision				



NOTES

1. DO NOT SCALE FROM THIS DRAWING.

2. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.

3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.

4. PLEASE REFER TO ARCHITECTS DRAWINGS FOR FINAL BUILDING LOCATION.

KEY



DENOTES DIRECTION OF SURFACE WATER FLOW.

Revisions.

Revision	Made by	Date	Checked	Description

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b.r.p

Bingham Rawlings Partnership Limited

Project

COLLIERS PARK, WREXHAM.

Drawing Title

PROPOSED FLOOD ROUTING.

Architect	LAWRAY ARCHITECTS
Client	WALES FOOTBALL ASSOCIATION
Scale	STATED
Drawn	B.Thorne
Date	26/01/18
Checked	I.Rowlands

3829

EW13

Revision				

APPENDIX F – WELSH WATER APARATUS MAPS

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The Stables
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Project COLLIERS PARK, WREXHAM				
Detail WELSH WATER APARATUS MAP				
Project No.	Drawing No.	Scale	By	Rev.
3829	EW14	NTS	B.T.	*



This drawing is to be read in conjunction with all relevant architects drawings and specifications.
Do not scale – use written dimensions only !

APPENDIX G – FOUL TREATMENT LITERATURE

Kieran Blackwell,
Cadarn Consulting Engineers,
Yr Adwy,
Llanddeusant,
Holyhead,
Anglesey
LL65 4AD.

2nd February 2018

RE: P180170 Colliers Park

Dear Kieran,

Further to your request Premier Tech Aqua Ltd. are pleased to provide a proposal for one of our range of wastewater treatment plants for your Colliers Park development.

The unit will be manufactured using high specification Orthophthalic resin throughout with chopped-hoop glass strand matt (GRP) and HDPE.

Scheme 1

The price for the proposed Mill.8SR Septic Tank is:	£1,955.00	Exc. VAT
The price for the proposed SBR Treatment Plant is:	£8,905.00	Exc. VAT
The price for the proposed Tertiary Treatment is:	£5,096.00	Exc. VAT

This quotation is valid for 30 days from the date of issue. I trust that this equipment proposal meets your requirements, if you need any clarification or additional information please do not hesitate to contact me.

Regards,

Stuart Jones - Engineered Solutions
M: +44 (0)7898710334
E: jons@premiertech.com

Proposal Compiled by:
Daniel Espley - Proposals Engineer
Email: espd@premiertech.com

Scheme 1:

We have selected a two-tank modular wastewater treatment scheme with Tertiary treatment that will give a final effluent quality of 10 BOD, 10 Suspended Solids and 5 Ammonia. The scheme will be suitable for installation in concrete or granular backfill and will consist of the following:

- 1 N^o 8m³ Septic Tank (2.050m diameter x 3.420m in length)
- 1 N^o SBR Treatment Plant (2.5m diameter x 5.142m in length)
- 2 N^o Ecoflo 6 Tertiary treatment plants
- 1 N^o 2 way Splitter Chamber

The SBR treatment plant will consist of the following:

- 1 N^o Pumped Outlet
- 2 N^o Tube Diffusors
- 1 N^o Kiosk with controls

Drawings:

Full engineering drawings to be provided for approval prior to manufacture

Lead Time:

Drawings will normally be forwarded to you 2-3 days from receipt of order; assuming full details are available. Manufacture is usually 3-4 working weeks from receipt of approval of these drawings.

Design & Manufacturing:

Tanks will be manufactured on one of our purpose-built polished steel mandrels and will be constructed in a series of layers and types of material as necessary to comply with the design code.

Finish:

Internal finish will be a smooth resin rich surface.

Installation:

GRP tanks are suitable for underground installation in granular material as per our installation guidelines UTG9501 or in concrete surround as per UTG9502.

The tanks are designed for a maximum installation and groundwater depth (crown of the tank to ground level) of 2m. For greater tank burial depths or groundwater levels please contact our Sales Office who will be able to advise on suitable alternative designs.

APPENDIX F – FOUL TREATMENT PLANT SOAKAWAY



Soakaway calculations to BRE Digest 365

Calculation Sheet

01

Treatment Plant Soakaway

Project Colliers Park Wrexham

Ref 08115

**Duration
(min)**

5.0
10.0
15.0
30.0
60.0
120.0
240.0
360.0
600.0
1440.0
2880.0

Inflow (cu m)	Outflow (cu m)	Storage (cu m)
0.0600	0.1	-0.01
0.1200	0.1	-0.03
0.1800	0.2	-0.04
0.3600	0.4	-0.08
0.7200	0.9	-0.16
1.4400	1.8	-0.33
2.8800	3.5	-0.65
4.3200	5.3	-0.98
7.2000	8.8	-1.63
17.2800	21.2	-3.91
34.5600	42.4	-7.82

Percolation factor (m/s) 1.00E-04

Trench outflow and storage based on:		
No. of Soakaways	(No.)	1.0
Length of Trench	(m)	2.500
Width of Trench	(m)	0.45
Effective depth	(m)	0.45
Eff Area of soakaways at 50%	(sq m)	2.45
Storage per soakaway	(cu m)	0.2
Total Storage	(cu m)	0.18

Inflow From Treatment Plant is based upon discharge of 8000L / day.

Equivilant discharge = $0.0600\text{m}^3 / 5 \text{ min.}$