

DISCHARGE OF PLANNING CONDITIONS 3, 4, 5, 7 AND 8.

GLASSHOUSES, 2 ANCILLARY OUTBUILDINGS, DRAINAGE POND, ASSOCIATED DRAINAGE WORKS, EXTERNAL HARDSTANDING FOR VEHICLE PARKING, ACCESS AND TURNING.

PLANNING APPLICATION REF: F/30/18/PL

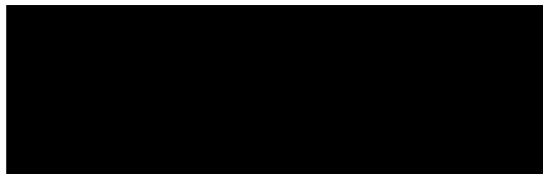
WICKS FARM, FORD LANE, FORD, BN18 0DF.

For

Wicks Farm
Ford Lane
Ford
BN18 0DF

By

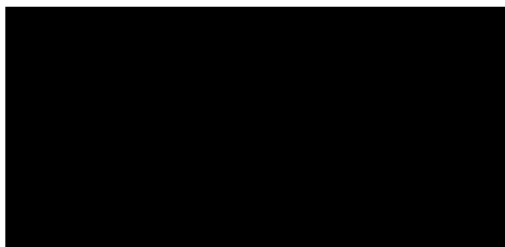
Envireau Water
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envireau^W
WATER

&

Jackson Purdue Lever
8 Pride Point Drive
Pride Park
Derby
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Jackson
purdue lever

Ref: P19-227 Moore - Wicks Farm Cond \ RPT - DoC
March 2020

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Revision	Details	Completed by	Date
REV01	Final	MW (JPL) & LC (EW)	27/03/2020

DISCHARGE OF PLANNING CONDITIONS 3, 4, 5, 7 AND 8.

WICKS FARM, FORD LANE, FORD, BN18 0DF.

Planning Application Ref: F/30/18/PL

Glasshouses, 2 Ancillary Outbuildings, Drainage Pond, Associated Drainage Works, External Hardstanding For Vehicle Parking, Access And Turning.

1 INTRODUCTION

Planning permission has been granted for the development land at Wicks Farm (the Site). The permission had conditions relating to the surface water flooding and drainage at the development. These conditions were planning conditions 3, 4, 5, 7 and 8.

This document presents drawings and information for the discharge of these planning conditions.

2 CONDITION 3

2.1 Wording of Condition

The wording for Condition 3 is provided below.

“Development shall not commence, other than works of site survey and investigation, until full details of the proposed surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority. The design should follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations, and the recommendations of the SuDS Manual produced by CIRIA.

Winter groundwater monitoring to establish highest annual ground water levels and winter Percolation testing to BRE 365, or similar approved, will be required to support the design of any Infiltration drainage. No building / No part of the extended building shall be occupied until the complete surface water drainage system serving the property has been implemented in accordance with the agreed details and the details so agreed shall be maintained in good working order in perpetuity.”



2.2 Winter Groundwater Monitoring

Three groundwater monitoring boreholes were installed at the Site in October 2019. The location of these boreholes is shown on Figure 1 and a borehole schematic provided in Figure 2. The borehole construction details varied dependent on the geology / hydrogeology encountered. The construction details for each borehole are provided in Appendix 1 along with a description of the geology encountered.

During the borehole drilling, water strikes occurred at depths from 4 to 5.2mbgl, with rest water levels at depths of 2.3 to 4.6mbgl.

The general geology encountered were sandy CLAYS overlying weathered CHALK.

Vented pressure transducers and data loggers (In Situ) were installed into the three boreholes on 21st October 2019. These loggers were subsequently removed from the boreholes on 25th March 2020.

During this period, heavy persistent rain occurred throughout the winter. Data from the Meteorological Weather Station located at Eastbourne has been sourced. The data is from 1959 to 2020. Average annual rainfall for this period is 799mm. The 2019 rainfall was above this average at 908mm and shows that 2019 was a wet year.

Table 1 shows summary rainfall data for the Eastbourne weather station.

Table 1 Summary of Eastbourne monthly rainfall (1959 to 2020)

Month	Average Rainfall (mm)	Winter 2019/2020 Rainfall (mm)
January	83	67
February	55	135
March	55	Data not yet available
April	48	
May	48	
June	48	
July	51	
August	59	
September	65	
October	93	122
November	101	161
December	93	142

Table 1 demonstrates that the monthly rainfall for the 2019/2020 is greater than the long term monthly average except for January 2020.

The long term average winter rainfall (October to February) is 480mm. The 2019/2020 winter rainfall (October to February) was 627mm demonstrating above average rainfall. Out of 61 years' worth of data, the 2019/2020 winter was the ninth wettest for the data record.

Based on the above, it is reasonable to assume that the groundwater levels recorded at the Site for the 2019/2020 winter would represent a wet winter and high groundwater levels.

The groundwater level data is shown on Figure 3. This is for the data period 22/10/2019 until 13/01/2020. A longer data period has been recorded, up to 25/03/2020. The remaining data will be forwarded onto the council once processed.

A peak in groundwater level occurs on 22nd December 2019. Groundwater levels had been generally rising up to this point in time and subsequently began to fall and appeared to stabilise at circa. 0.3 to 0.4m below the peak around the 13th January.

The highest groundwater level was recorded at borehole 2, registering a level of 2.633mAOD (1.15mbgl). Borehole 1 had the second highest groundwater level recorded as 2.74mAOD. However, this borehole is located on higher ground and therefore has the greatest depth to water level (3.83mbgl).

The general hydraulic gradient at the Site is towards the east / northeast.

The groundwater level data provided information to support the drainage and SuDS design.

2.3 Infiltration Testing

Infiltration testing was undertaken at the Site. Four Test pits were excavated to allow the infiltrations tests to take place at locations across the site. The locations of the test pits are presented in Figure 1.

Infiltration tests were carried out on the test pits in accordance with the methodology detailed in British Research Establishment (BRE) Digest 365 'Soakaway Design'. Details of the test pits are provided in Table 2.

Table 2 Test Pit Details

Test Pit	National Grid Reference	Length (m)	Width (m)	Depth (m)
TP 1	SU 99097 04324	1.7	0.5	1.2
TP 2	SU 98917 04150	1.5	0.45	1.2
TP 3	SU 98866 04137	1.5	0.7	1.2
TP 4	SU 98862 04324	1.6	0.7	1.2

The test pits were filled with quartzose gravel prior to the commencement of the testing programme. The porosity of the gravel was calculated as 30%. The test pit was then filled with water and the time that it took for the water level to fall within the test pit from 75% to 25% full was recorded. Second and third tests were then completed on the test pit.

Soil infiltration rates have been calculated based on the following formula:

$$\text{Soil infiltration rate, } f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

where:

V_{p75-25} is the effective storage volume in the test pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the test pit up to 50% of the effective depth and including the base area; and

t_{p75-25} is the time for the water level in the test pit to fall from 75% to 25% effective depth.

The calculated infiltration rates are presented in Table 3. The calculated infiltration rates are based on the time taken for the water level to fall from 75% to 25% of the maximum water level achieved in the tests. The effective area of loss was then calculated at 50% of the maximum depth achieved, in accordance with BRE 365 [Ref. 1].

Table 3 **Calculated Soil Infiltration Rates**

Parameter	Unit	Test Pit (TP 1)			Test Pit (TP 2)		
		Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Effective depth	m ³	0.75	0.75	0.75	0.75	0.75	0.75
Effective storage volume (V_{p75-25})	m ³	0.15	0.15	0.15	0.12	0.12	0.12
Internal surface area (a_{p50})	m ²	3.76	3.76	3.76	3.46	3.46	3.46
Time to fall from 75% to 25% full (t_{p75-25})	s	6906	7740	6510	10452	15600	15150
Infiltration rate (f)	m/s	5.89x10 ⁻⁶	5.26x10 ⁻⁶	6.25x10 ⁻⁶	3.37x10 ⁻⁶	2.25x10 ⁻⁶	2.27x10 ⁻⁶

Parameter	Unit	Test Pit (TP 3)			Test Pit (TP 4)		
		Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Effective depth	m ³	0.75	0.75	0.75	0.75	0.75	0.75
Effective storage volume (V_{p75-25})	m ³	0.19	0.19	0.19	0.19	0.19	0.19
Internal surface area (a_{p50})	m ²	3.76	3.76	3.76	2.89	2.89	2.89
Time to fall from 75% to 25% full (t_{p75-25})	s	F	F	55200	F	F	103200
Infiltration rate (f)	m/s	F	F	9.01x10 ⁻⁷	F	F	6.67x10 ⁻⁷

F = Failed Test

Infiltration rates are generally low at the Site with Test Pits 3 and 4 producing two failed tests out of the three tests. The highest recorded infiltration rate occurred in test pit 1 recording a rate of 5.26x10⁻⁶ m/s.

The results of the infiltration testing provided information for the drainage and SuDS design.

2.4 Surface Water Drainage Scheme

The SuDS assessment and full details of the proposed surface water drainage scheme are provided in Appendix 2.

Hydraulic modelling calculations using the software package Causeway Flow have been provided in Appendix 3 to support the drainage design.

3 CONDITION 4

The wording for Condition 4 is provided below.

“The development shall not proceed until details have been submitted to and approved in writing by the Local Planning Authority for any proposals: to discharge flows to watercourses; or for the culverting, diversion, infilling or obstruction of any watercourse on or adjacent to the site. Any discharge to a watercourse must be at a rate no greater than the pre-development run-off values. No construction is permitted, which will restrict current and future land owners from undertaking their riparian maintenance responsibilities in respect to any watercourse or culvert on or adjacent to the site.”

The surface water drainage scheme will discharge to the local watercourse. There are two points of discharge, one from the reservoir to the watercourse, and one from the Pond 1 discharge channel. Outflows from the reservoir and Pond 1 are restricted to 20 l/s and 13 l/s respectively. This rate is no greater than the pre-development run-off values.

The proposed surface water drainage scheme results in no watercourse on or adjacent to the Site being culverted, diverted, infilled or obstructed.

4 CONDITION 5

The wording for Condition 5 is provided below.

“Development shall not commence until full details of the maintenance and management of the surface water drainage system is set out in a site-specific maintenance manual and submitted to, and approved in writing, by the Local Planning Authority. The manual is to include details of financial management and arrangements for the replacement of major components at the end of the manufacturer's recommended design life. Upon completed construction of the surface water drainage system, the owner or management company shall strictly adhere to and implement the recommendations contained within the manual.”

The maintenance and management plan of the surface water drainage system for the Site is provided in Appendix 4.

5 CONDITION 7

The wording for Condition 7 is provided below.

“The development hereby permitted must not be commenced until such time as a scheme to ensure that the loss of compensation area (level for level, volume for volume) from the irrigation reservoir within Flood Zone 3 is replicated as per Section 5.3.1 and Appendices 10 of the Civil Engineering Practice Flood Risk Assessment has been submitted to, and approved in writing by, the Local Planning Authority.”

As stated within the condition, the construction of the irrigation reservoir within Flood Zone 3 will result in a loss of floodplain area. Design drawings provided in Appendix 5 shows the area to the north of the Site and to the west of the reservoir where this compensation will be provided.

Level for level compensation has been provided for the compensation area replicating that presented in Appendix 10 of the Civil Engineering Practice Flood Risk Assessment.

6 CONDITION 8

The wording for Condition 8 is provided below.

“The development shall not proceed until formal consent has been approved in writing from the Lead Local Flood Authority (WSCC) or its agent (ADC) for the discharge of any flows to watercourses, or the culverting, diversion, infilling or obstruction of any watercourse on the site. Any discharge to a watercourse must be at a rate no greater than the pre-development run-off values.”

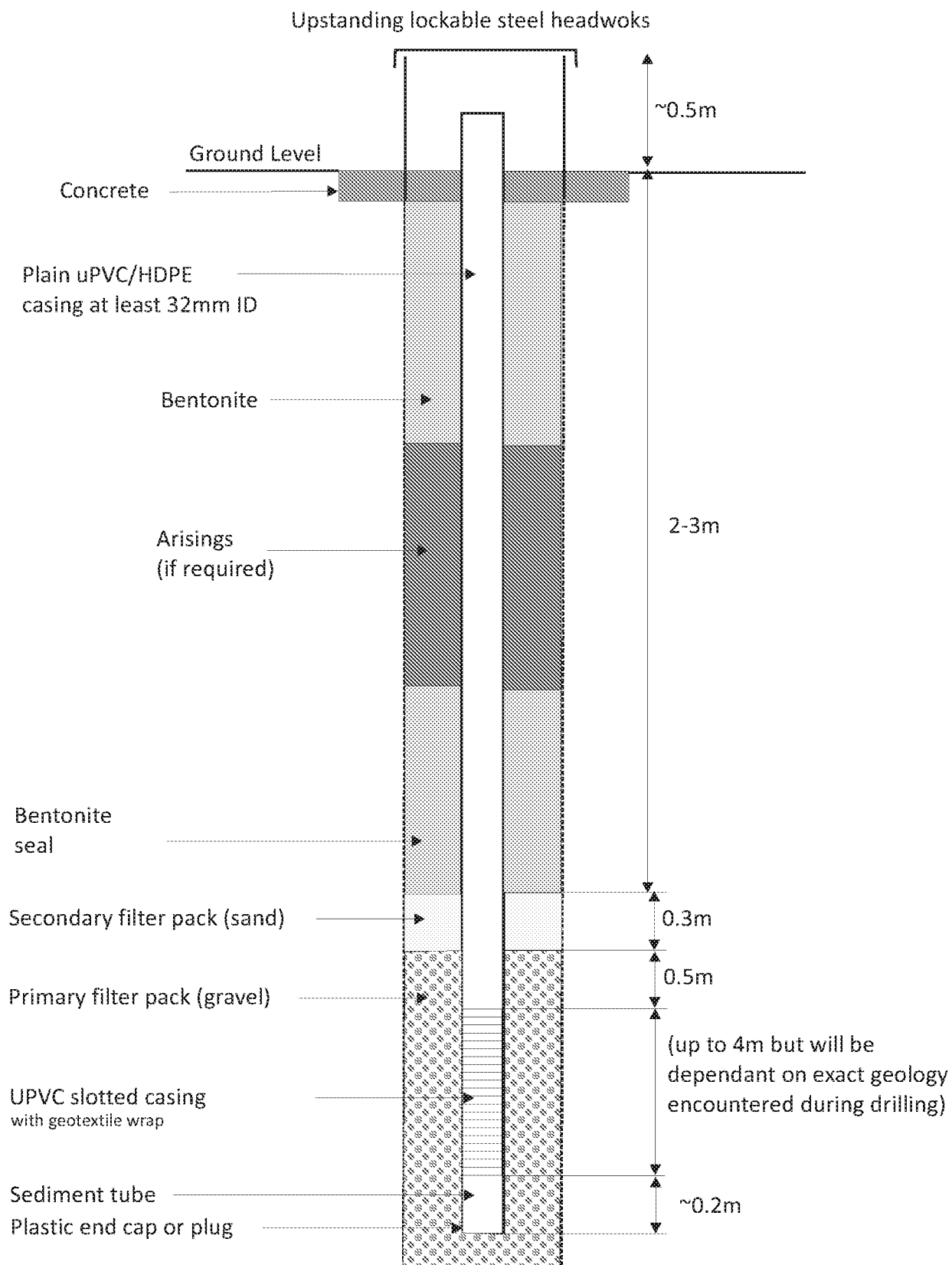
The surface water drainage scheme will discharge to the local watercourse. There are two points of discharge, one from the reservoir to the watercourse, and one from the Pond 1 discharge channel. Outflows from the reservoir and Pond 1 are restricted to 20 l/s and 13 l/s respectively. This rate is no greater than the pre-development run-off values.

The proposed surface water drainage scheme results in no watercourse on or adjacent to the Site being culverted, diverted, infilled or obstructed.

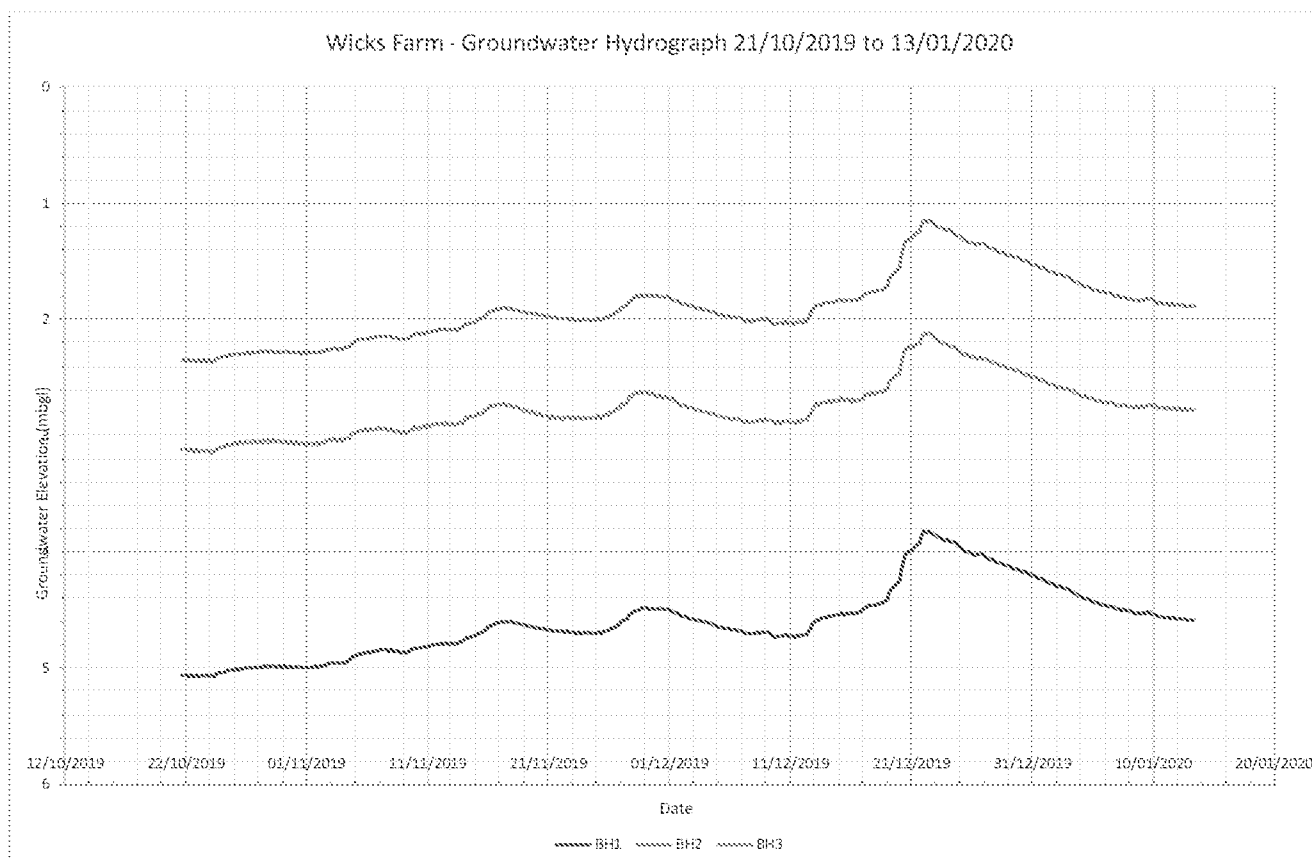
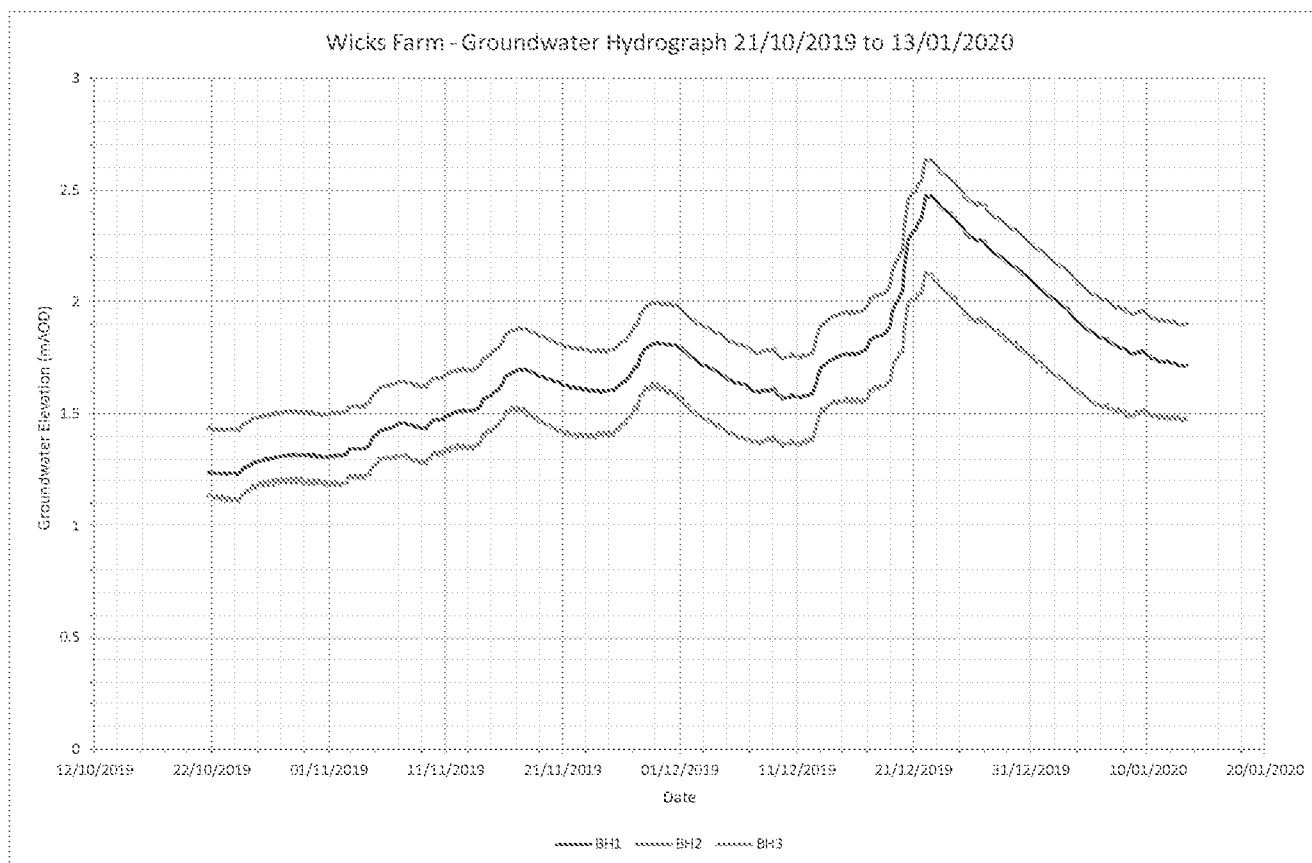
Base on the above, it is considered that WSCC or ADC are in a position to provide a formal consent for the discharge of flows from the Site to the local watercourse.

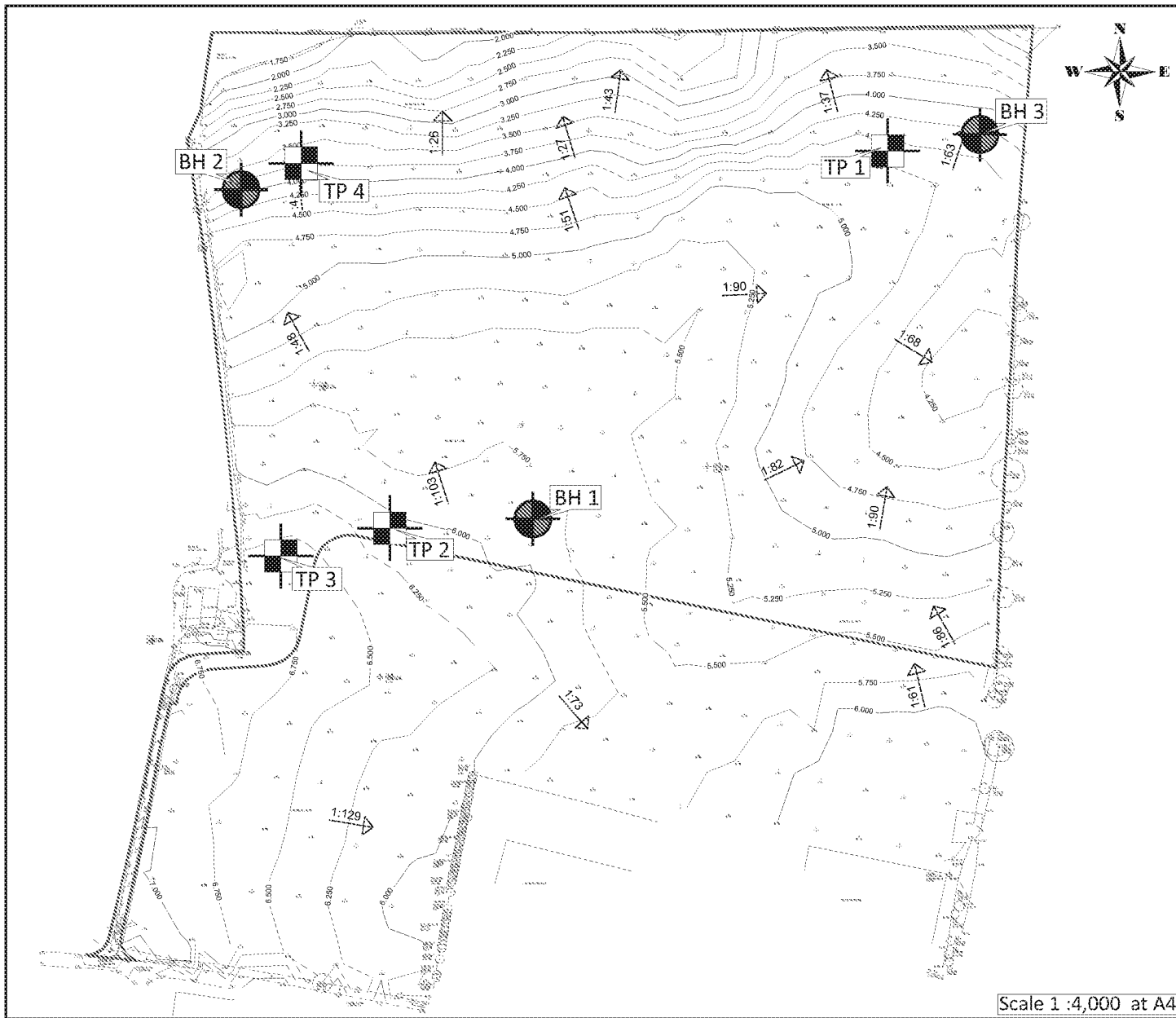
Envireau Water
27/03/2020

FIGURES



Not To Scale





KEY

- Site Location (Boundary)
- Groundwater Monitoring Borehole Location
- Test Pit Location

APPENDIX 1
MONITORING BOREHOLE CONSTRUCTION DETAILS

Monitoring Borehole Construction Details

BH Name:	BH1		
Grid Ref:	SU 98965 04159		
Estimated Ground Level Elevation:	5.8mAOD		
Water Strike:	5.2mbgl		
Water Level On completion:	4.58mbgl		
Drilling Method:	Rotary		
Depth (m)		Thickness (m)	Description
From	To		
0	1	1	Brown very silty sandy CLAY with occasional fine and medium gravel of flint.
1	3	2	Light brown very silty very sandy CLAY with occasional gravel including flint.
3	9	>5	Weak weathered white CHALK recovered as fine to coarse sub angular to angular gravel of chalk and flint.
Depth (mbgl)		Thickness (m)	Casing
From	To		
-0.5	5	5.5	Plain
5	7	2	Slotted
Depth (mbgl)		Thickness (m)	Construction
From	To		
0	3	3	Bentonite
3	3.5	0.5	Sand
3.5	7	3.5	Gravel

BH Name:	BH2		
Grid Ref:	SU 98834 04318		
Estimated Ground Level Elevation:	4mAOD		
Water Strike:	~4mbgl		
Water Level On completion:	2.33mbgl		
Drilling Method:	Rotary		
Depth (m)		Thickness (m)	Description
From	To		
0	0.4	0.4	Brown sandy SILT/CLAY with occasional fine to coarse angular to sub rounded gravel of flint.
0.4	1.2	0.8	Light brown buff cream clayey sandy SILT with occasional fine to coarse gravel of flint.
1.2	4	2.8	Very weak weathered chalk recovered as fine to coarse sub rounded to angular gravel of chalk and silty sandy clay with rare fine angular gravel of flint.
4	6	>2	Weak weather CHALK recovered as silty sandy fine to coarse angular gravel of chalk and flint.
Depth (mbgl)		Thickness (m)	Casing
From	To		
-0.5	4	4.5	Plain
4	6	2	Slotted
Depth (mbgl)		Thickness (m)	Construction
From	To		
0	3	3	Bentonite
3	3.5	0.5	Sand
3.5	6	2.5	Gravel

BH Name:	BH3		
Grid Ref:	SU 99148 04348		
Estimated Ground Level Elevation:	4.25mAOD		
Water Strike:	~4.2mbgl		
Water Level On completion:	3.1mbgl		
Drilling Method:	Rotary		
Depth (m)		Thickness (m)	Description
From	To		
0	0.4	0.4	Brown sandy SILT/CLAY with occasional fine to coarse angular to sub rounded gravel of flint.
0.4	0.5	0.1	Light brown buff cream clayey sandy SILT
0.5	6	>5.5	Weak weathered white CHALK recovered as fine to coarse sub angular to angular gravel of chalk and flint.
Depth (mbgl)		Thickness (m)	Casing
From	To		
-0.5	3.3	3.8	Plain
3.3	5.3	2	Slotted
Depth (mbgl)		Thickness (m)	Construction
From	To		
0	2.5	2.5	Bentonite
2.5	3.2	0.7	Arisings /Sand
3.2	5.3	2.1	Gravel

APPENDIX 2
SURFACE WATER DRAINAGE SCHEME



SuDS Assessment

Drainage Design
Wicks Farm, Arundel
JDI01679-1HI





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1.0 Terms of Reference

1.1 Report Details

Jackson Purdue Lever has been appointed by Envireau Water to prepare a site-specific SuDS assessment. No liability is accepted to any third party for all or part of this report in connection with this or any other development.

This document has been prepared to reflect the requirements of the National Planning Policy Framework 2019 and guidance documents.

The report relates to the proposed redevelopment of the site including the construction of greenhouses and associated external works.

The report is based on the following information:

- Digital mapping
- Environment Agency mapping
- Internal Drainage Board mapping
- Sewerage Undertaker mapping
- Site visit undertaken by Jackson Purdue Lever

1.2 Report History

Status Revision	Author	Approved	Issued Date	Purpose
A1-C01	MPW	TSL	27/03/2020	Issued for Planning



2.0 Site Details

2.1 Existing Site Description

The proposed development site is located behind Wicks Farm on Ford Lane, Ford and currently consists of open fields bounded to the north by a railway line.

A site location plan and aerial photograph are provided below in Figures 1 and 2.

Table 1- Site Summary

Address	Wicks Farm, Ford Lane, Ford, BN18 0DF	
OS Grid Reference	E: 498991	N: 104194
Site Area	9.73 Ha	
Development Type	Commercial	
EA Development Control Area	Solent and South Downs	
Local Planning Authority	Arun District Council	

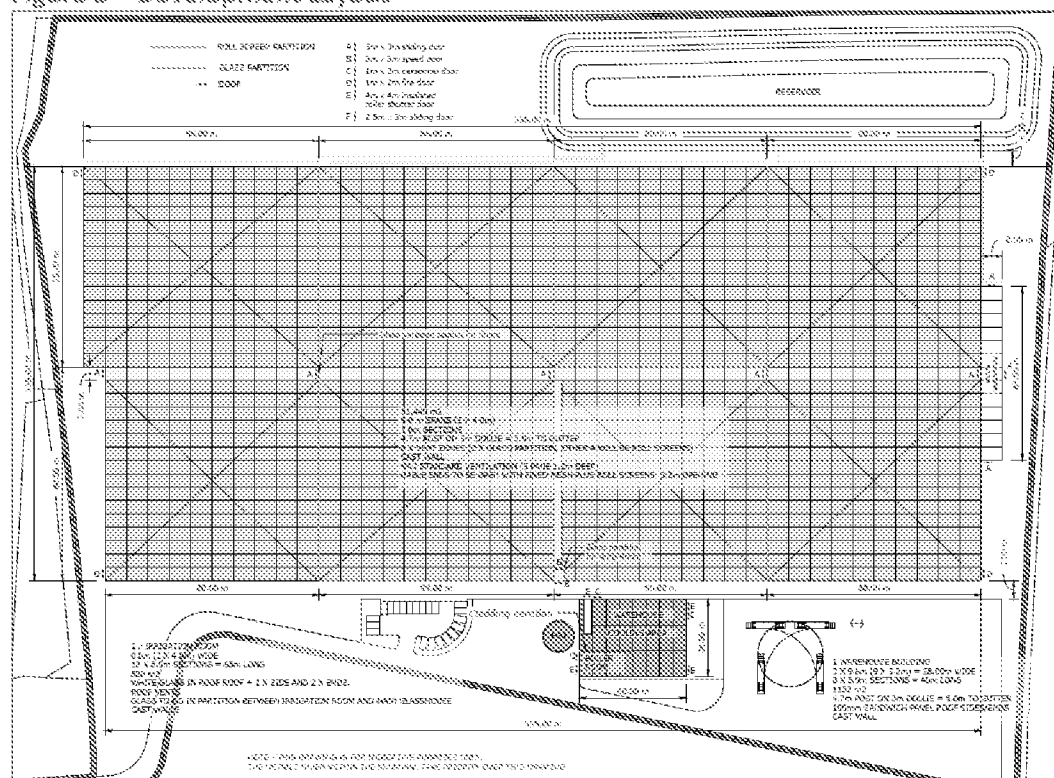
Figure 1 – Site Location Plan





The proposed development comprises the construction of greenhouses and associated external servicing areas.

Figure 3 – Development Layout





3.0 SuDS Component Suitability

3.1 Location and Description

The National Planning Policy Framework Technical Guidance seeks to promote the use of Sustainable Drainage Systems (SuDS) for new developments to limit both peak discharges and the volumes of surface water leaving sites.

CIRIA C753 The SuDS Manual defines numerous SuDS components which should be used in combination to create a SuDS Management Train to control the frequency of runoff, the flow rates and volume of runoff and to reduce concentrations of contaminants to acceptable levels. Consideration of suitable development drainage proposals has been undertaken with consideration being given to these components and commentary in relation to the decision making process is presented below in Table 2.

Table 2 – Consideration of Appropriate SuDS Components

Component Type	Commentary	Suitability
Rainwater Harvesting	An open reservoir pond is within the scheme and collects all of the surface water from the greenhouse roof for re-use within the site irrigation system. A high level overflow to the adjacent ditch is provided to control excessive rainfall.	✓
Green Roofs	Not suitable for use on a greenhouse.	X
Infiltration	Infiltration testing has been undertaken and identified insufficient infiltration rates.	X
Proprietary Treatment Systems	Not proposed within the scheme.	X
Filter Strips/Drains	Not proposed within the scheme.	X
Swales	Swales have been incorporated into the drainage scheme both for conveyance and direct collection of water from hard surfacing.	✓
Bioretention Systems	Not proposed within the scheme.	X
Trees	Not proposed within the scheme.	X
Pervious Pavements	A small area of pervious surfacing is proposed for the car parking.	✓
Attenuation Storage Tanks	Below ground storage has not been incorporated into the scheme due to open storage providing sufficient attenuation.	X
Detention Basins	Detention basins have not been incorporated into the scheme due to open storage providing sufficient attenuation.	X
Ponds and Wetlands	Open storage has been incorporated to attenuate the yard drainage and a separate pond is proposed to be used as a reservoir for re-use within the site irrigation system.	✓

4.0 Water Quality Management

Table 3 – Minimum Water Quality Management Requirements

Land Use	Pollution Hazard Level	Requirements for discharge to Surface Waters, including Coasts and Estuaries	Requirements for discharge to Groundwater
Residential roofs	Very Low	Removal of gross solids and sediments only	
Individual property driveways, roofs (excluding residential), residential car parks, low traffic roads (e.g. cul-de-sacs, home zones, general access roads), non-residential car parking within infrequent change (e.g. schools, offices)	Low	Simple index approach (Note: extra measures may be required for discharges to protected resources)	
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	Simple index approach (Note: extra measures may be required for discharges to protected resources)	Simple index approach (Note: extra measures may be required for discharges to protected resources) In England and Wales, Risk Screening must be undertaken first to determine whether consultation with the environmental regulator is required In Northern Ireland the need for Risk Screening should be agreed with the environmental regulator
Trunk roads and motorways	High	Follow the guidance and risk assessment process set out in HA (2009)	
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured, industrial sites	High	Discharges may require an environmental licence or permit. Obtain pre-permitting advice from the environmental regulator. Risk assessment is likely to be required.	

Note: Table recreated from Table 4.3 of the CIRIA C753, The SuDS Manual; 2015.

Based on Table 3 above the development proposals would be considered to be Medium and therefore a simple approach to the assessment of water quality improvement is appropriate.

Table 4 – Pollution Hazard Indices for Different Land Use Classifications

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, home zones, general access roads), non-residential car parking within infrequent change (e.g. schools, offices) i.e. <300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured, industrial sites, trunk roads and motorways	High	0.8	0.8	0.9

Note: Table recreated from Table 25.2 of the CIRIA C/53, The SuDS Manual; 2015.

Based on Table 4 above the appropriate SuDS mitigation Index required for the site are as highlighted above.

4.1 Simple Index Approach

Table 5 – Indicative SuDS Mitigation Indices for Discharges to Surface Waters

Type of SuDS Component	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	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
Wetland	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 area.		

Note: Table recreated from Table 26.3 of the CIRIA C753, The SuDS Manual; 2015.

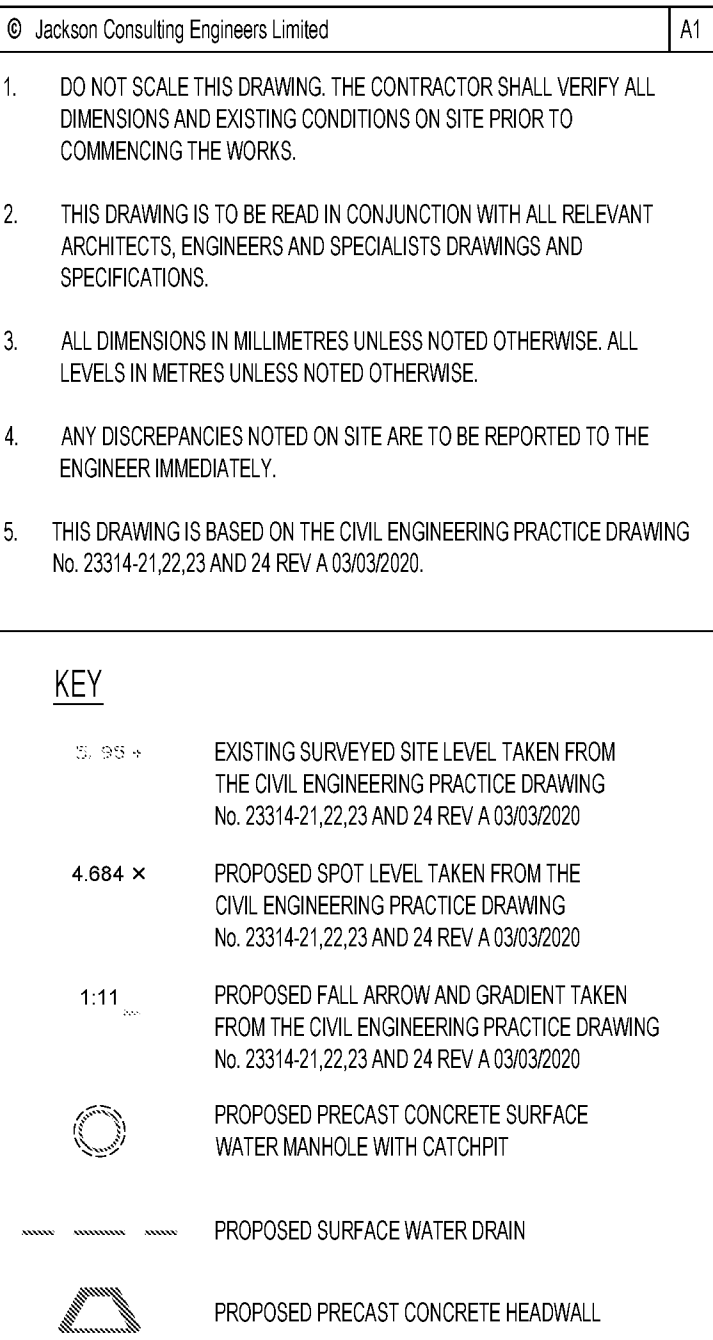
Table 6 – Proposed SuDS Mitigation Indices

Type of SuDS Component	Mitigation Indices		
	TSS	Metals	Hydrocarbons
Swale	0.5	0.6	0.6
Pond	$0.7/2 = 0.35$	$0.7/2 = 0.35$	$0.5/2 = 0.25$
Swale	$0.5/2 = 0.25$	$0.6/2 = 0.3$	$0.6/2 = 0.3$
Total	1.1	1.25	1.15

The proposed total mitigation indices in Table 6 above are greater than the required indices indicated in Table 4 and therefore the proposed SuDS features and drainage scheme provides adequate treatment.

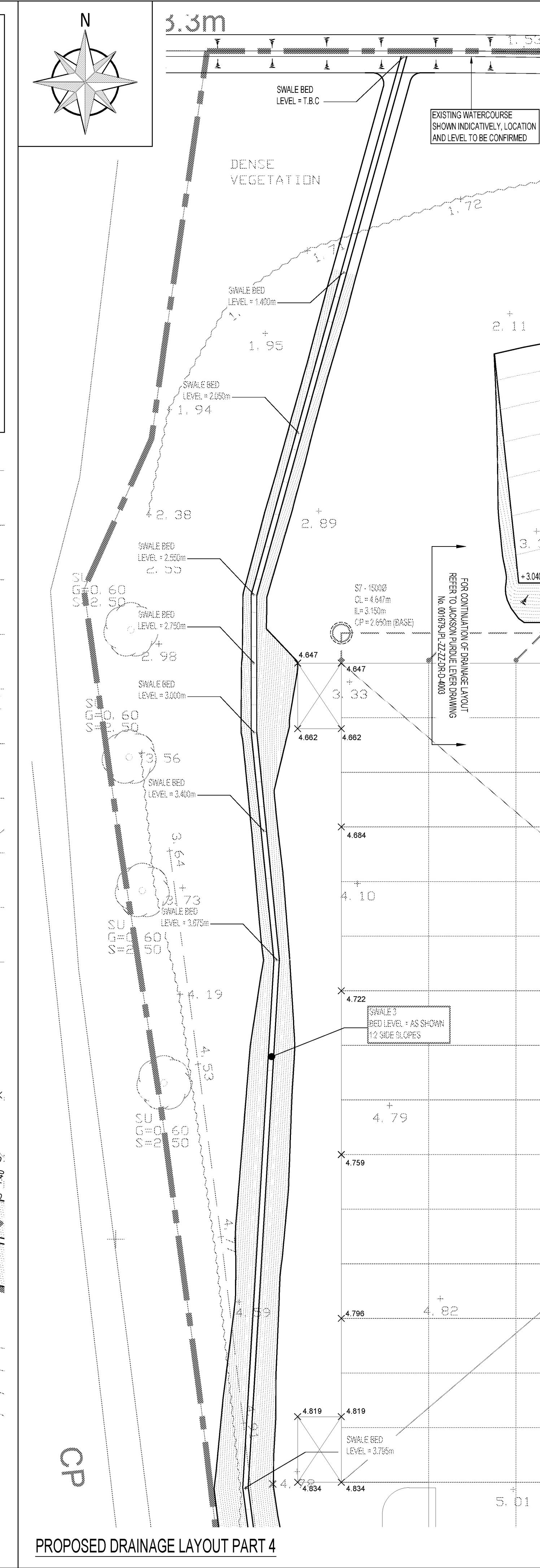
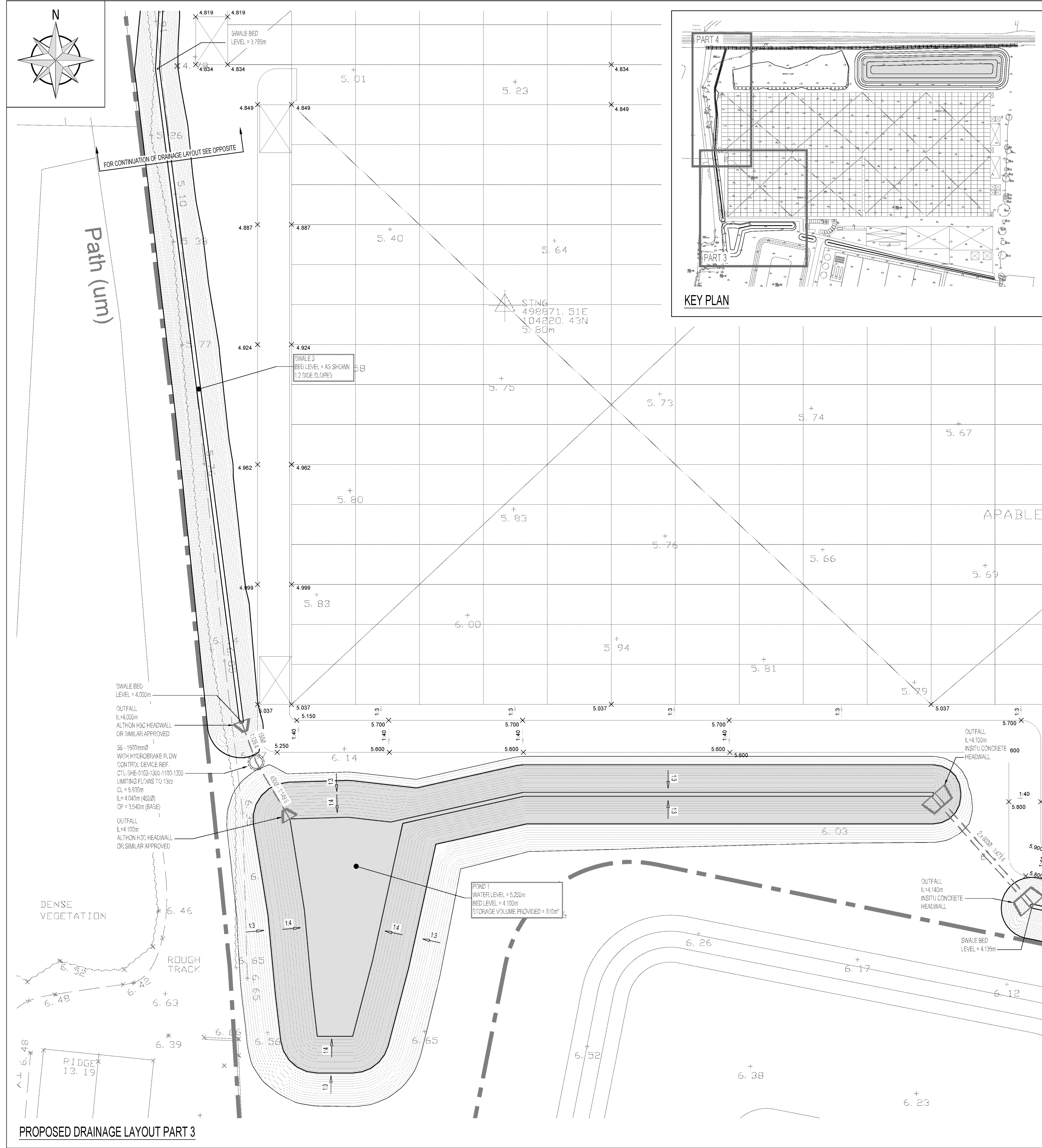
Appendix A

Proposed Drainage Layout



FOR PROPOSED DRAINAGE DETAILS
REFER TO JACKSON PURDUE LEVER
DRAWING No.
001679-JPL-ZZ-ZZ-DR-D-4021 - 4023

FOR PROPOSED SECTIONS REFER TO
JACKSON PURDUE LEVER DRAWING No.
001679-JPL-ZZ-ZZ-DR-D-4031



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A1

1. DO NOT SCALE THIS DRAWING. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS ON SITE PRIOR TO COMMENCING THE WORKS.

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.

3. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METRES UNLESS NOTED OTHERWISE.

4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

5. THIS DRAWING IS BASED ON THE CIVIL ENGINEERING PRACTICE DRAWING No. 23314-21.22.23 AND 24 REV A 03/03/2020.

KEY

5.95 +

EXISTING SURVEYED SITE LEVEL TAKEN FROM THE CIVIL ENGINEERING PRACTICE DRAWING No. 23314-21.22.23 AND 24 REV A 03/03/2020

4.684 x

PROPOSED SPOT LEVEL TAKEN FROM THE CIVIL ENGINEERING PRACTICE DRAWING No. 23314-21.22.23 AND 24 REV A 03/03/2020

1:11

PROPOSED FALL ARROW AND GRADIENT TAKEN FROM THE CIVIL ENGINEERING PRACTICE DRAWING No. 23314-21.22.23 AND 24 REV A 03/03/2020

PROPOSED PRECAST CONCRETE SURFACE WATER MANHOLE WITH CATCHPIT

PROPOSED SURFACE WATER DRAIN

PROPOSED PRECAST CONCRETE HEADWALL

FOR PROPOSED DRAINAGE DETAILS REFER TO JACKSON PURDUE LEVER DRAWING No. 001679-JPL-ZZ-ZZ-DR-D-4021 - 4023

FOR PROPOSED SECTIONS REFER TO JACKSON PURDUE LEVER DRAWING No. 001679-JPL-ZZ-ZZ-DR-D-4031

CD1	27.03.20	ISSUED FOR INFORMATION	MMh	MPW
Rev.	Date	Revision Description	Drawn	Auth'd
Client				

ENVIREAUWATER

Project Title

WICKS FARM

Description

PROPOSED DRAINAGE LAYOUT SHEET 2

Date	MAR 2020	Drawn	MMh
Scale	1:250 @A1	Authorised	MPW
JPL Ref.	JD101679		

BIM Ref.

Project	Orig.	Vol.	Level	Type	Role	Number
001679	JPL	ZZ	ZZ	DR	D	4002

Suitability

A2 - CONCEPT DESIGN

Revision

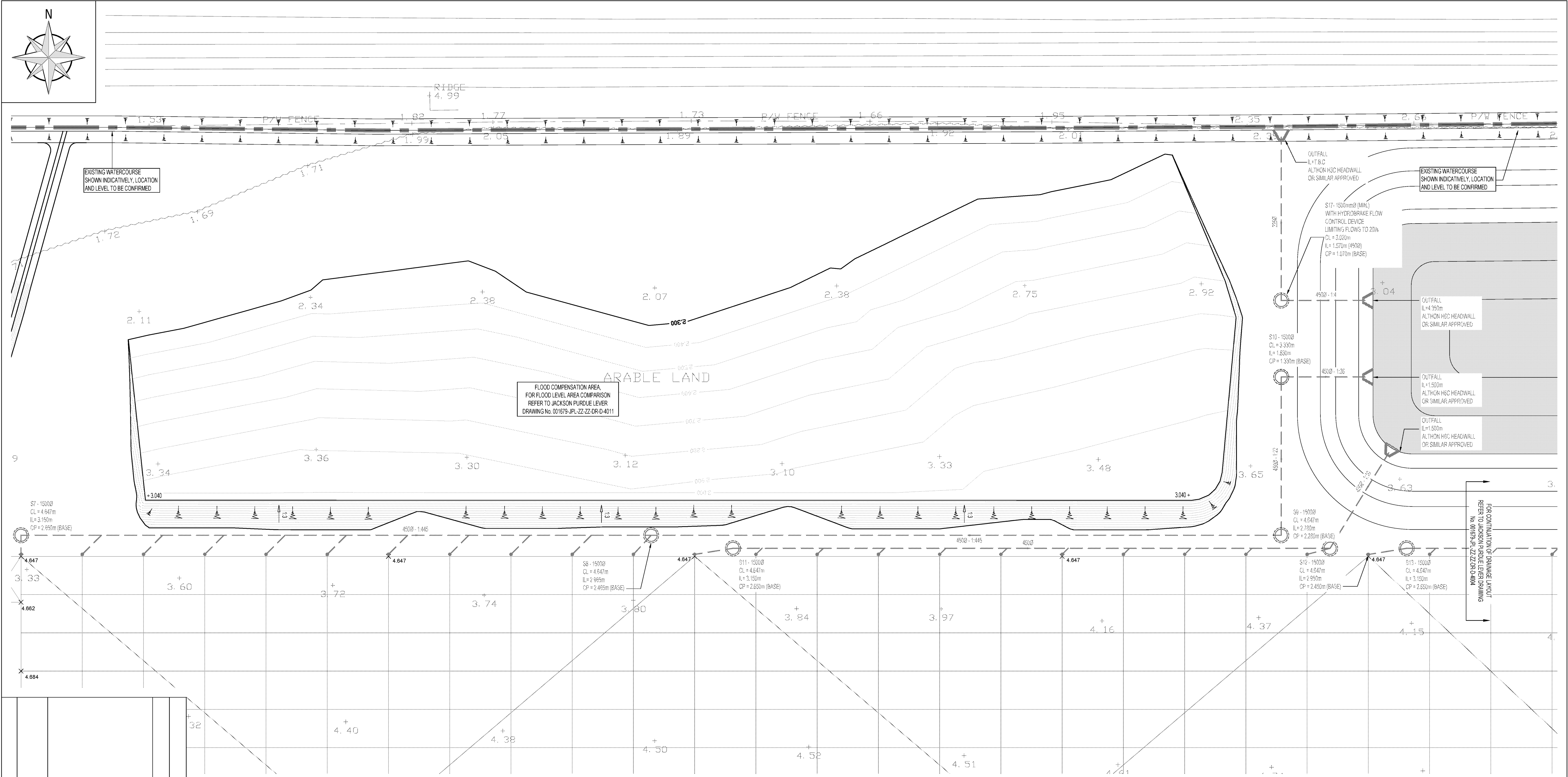
C01

Jackson

purdue lever

8 Ploton Point Drive, Pridmore Park, Oatley, NSW 2224, Australia

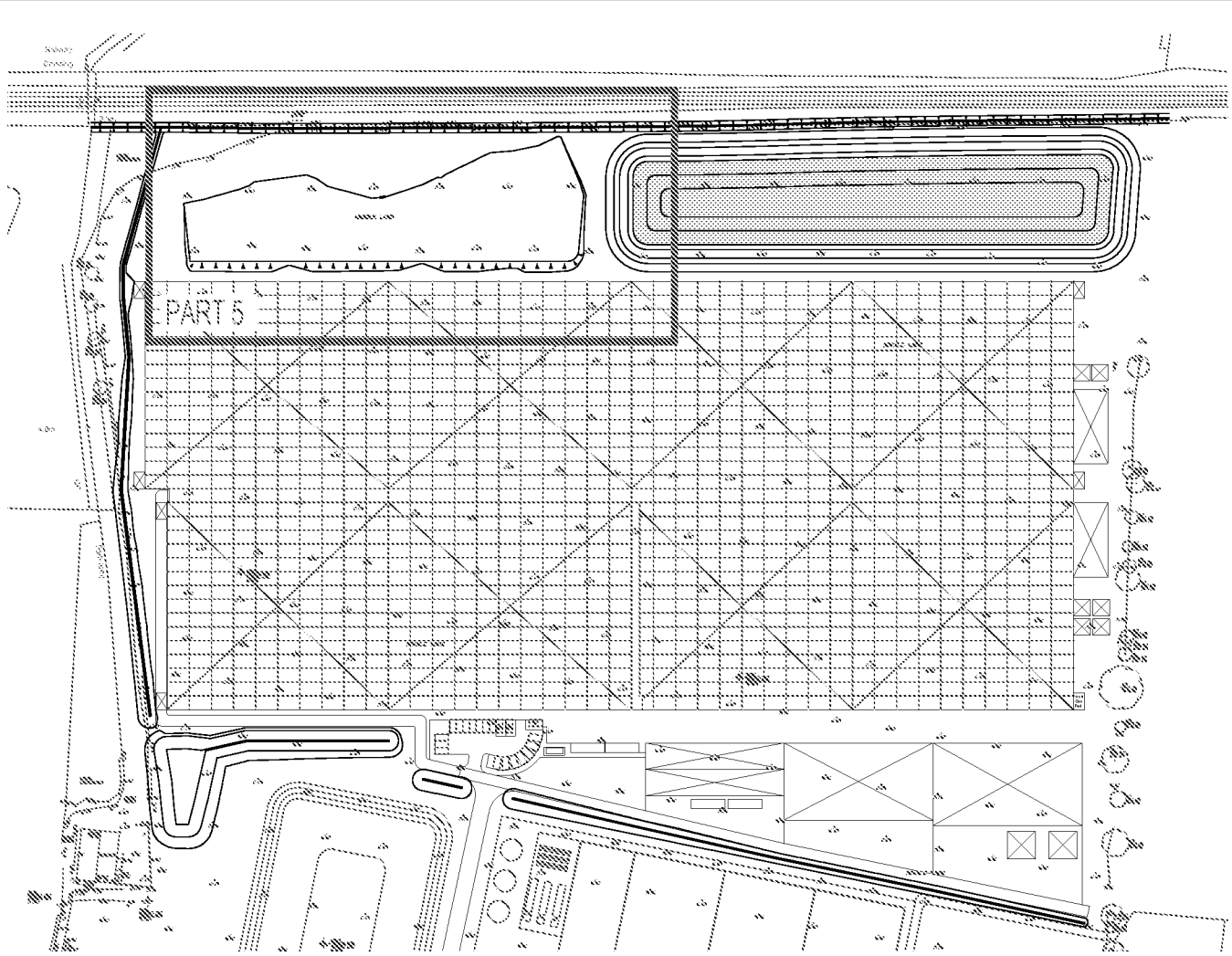
Tel: 02 952 36475



C01		27.03.20		ISSUED FOR INFORMATION		MWh		MPW	
Rev		Date		Revision Description		Drawn		Auth'd	
Description									
PROPOSED DRAINAGE LAYOUT SHEET 3									
Date		MAR 2020		Drawn		MWh			
Scale		1:250 @A1		Authorised		MPW			
JPL Ref		JD01679							
BIM Ref									
Project		Orig.		Vol.		Level		Type	
001679		JPL		ZZ		ZZ		DR D	
Sustainability		A2 - CONCEPT DESIGN		Revision		C01			
Jackson purdue lever PROPOSED DRAINAGE LAYOUT PART 5									

PROPOSED DRAINAGE LAYOUT PART 5

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- A1
- DO NOT SCALE THIS DRAWING. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS ON SITE PRIOR TO COMMENCING THE WORKS.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
 - ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METRES UNLESS NOTED OTHERWISE.
 - ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
 - THIS DRAWING IS BASED ON THE CIVIL ENGINEERING PRACTICE DRAWING No. 23314-21.22.23 AND 24 REV A 03/03/2020.
- Client
- ENVIREAUWATER
- Project Title
- WICKS FARM



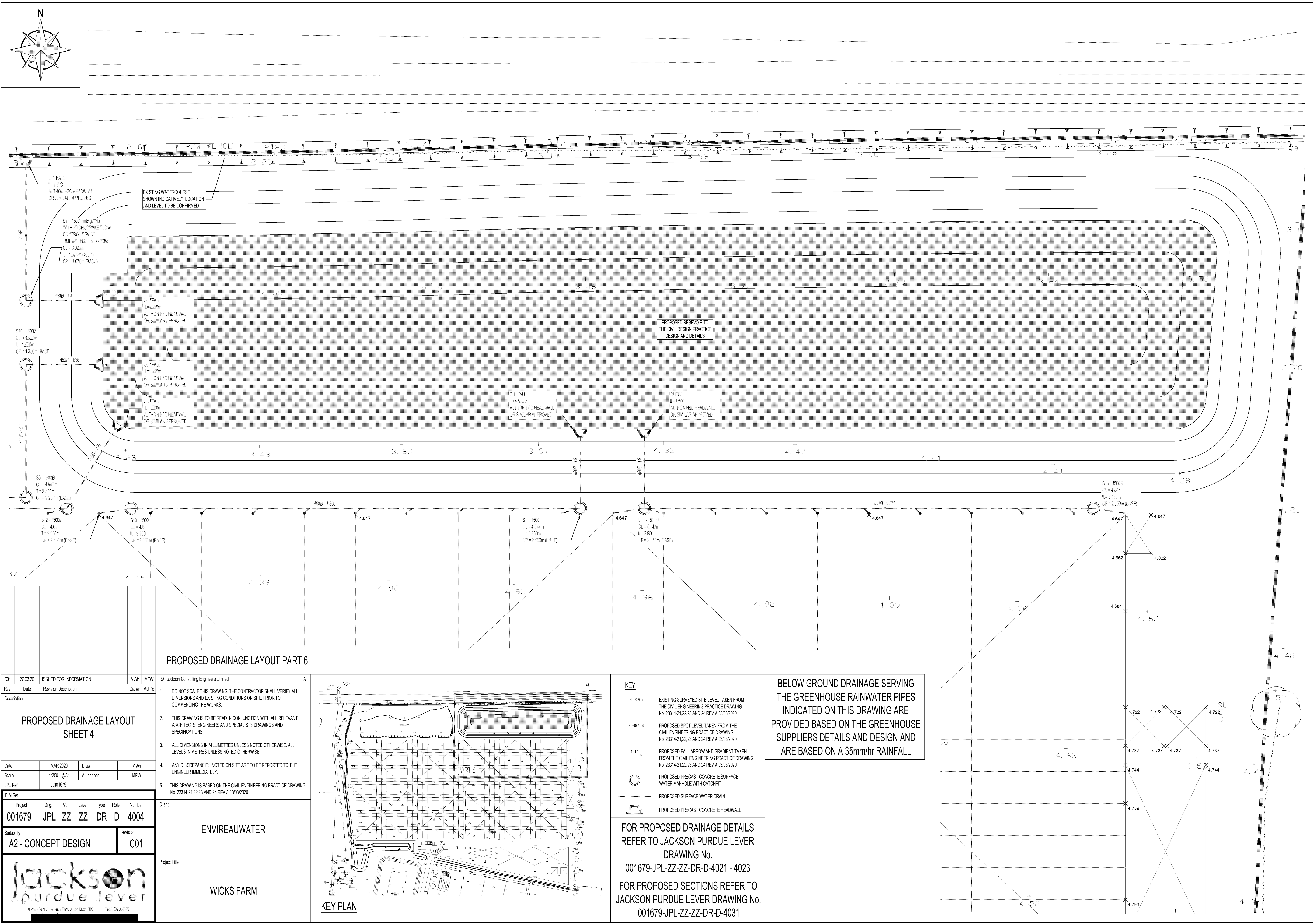
KEY PLAN

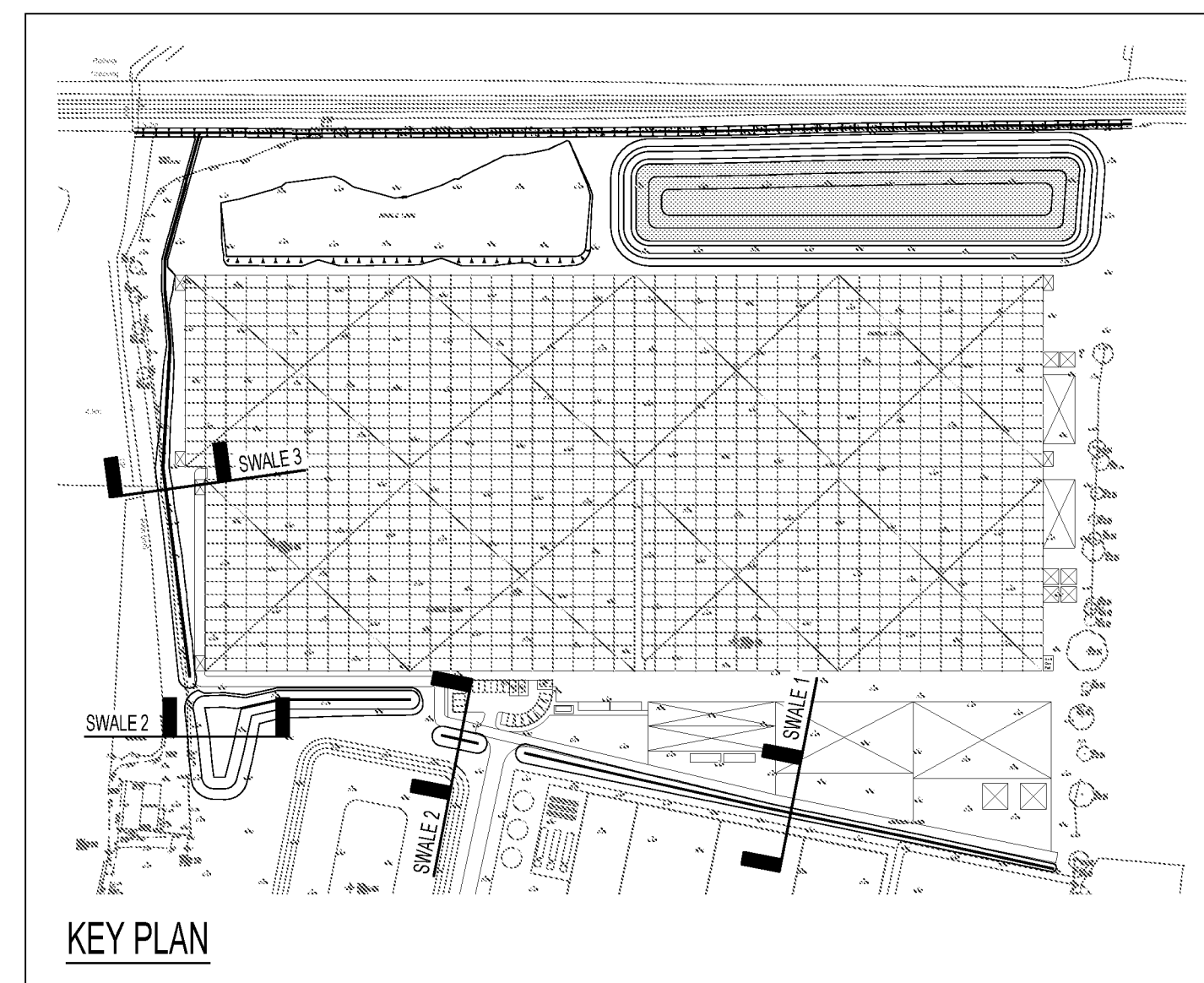
- KEY
- 3.95 x
 - 4.684 x
 - 1:11
 - PROPOSED PRECAST CONCRETE SURFACE WATER MANHOLE WITH CATCHPIT
 - PROPOSED SURFACE WATER DRAIN
 - PROPOSED PRECAST CONCRETE HEADWALL

FOR PROPOSED DRAINAGE DETAILS
REFER TO JACKSON PURDUE LEVER
DRAWING No.
001679-JPL-ZZ-ZZ-DR-D-4021 - 4023

FOR PROPOSED SECTIONS REFER TO
JACKSON PURDUE LEVER DRAWING No.
001679-JPL-ZZ-ZZ-DR-D-4031

BELOW GROUND DRAINAGE SERVING
THE GREENHOUSE RAINWATER PIPES
INDICATED ON THIS DRAWING ARE
PROVIDED BASED ON THE GREENHOUSE
SUPPLIERS DETAILS AND DESIGN AND
ARE BASED ON A 35mm/hr RAINFALL





- FOR PROPOSED DRAINAGE LAYOUT
REFER TO JACKSON PURDUE LEVER
DRAWING No.
001679-JPL-ZZ-ZZ-DR-D-4001 - 4004

FOR PROPOSED DRAINAGE DETAILS
REFER TO JACKSON PURDUE LEVER
DRAWING No.
001679-JPL-ZZ-ZZ-DR-D-4021 - 4023

ENVIREAUWATER

Project Title	
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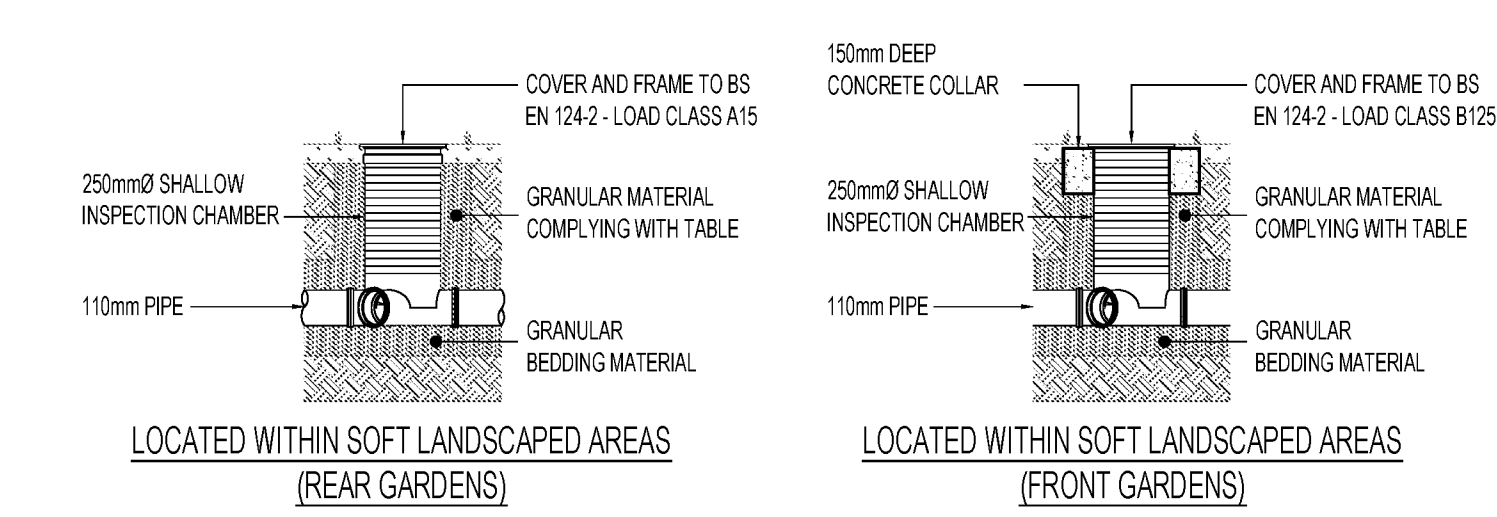
WICKS FARM

Description

PROPOSED SWALE AND POND SECTIONS

BIM Ref.						
Project	Orig.	Vol.	Level	Type	Role	Number
001679	JPL	ZZ	ZZ	DR	D	4031

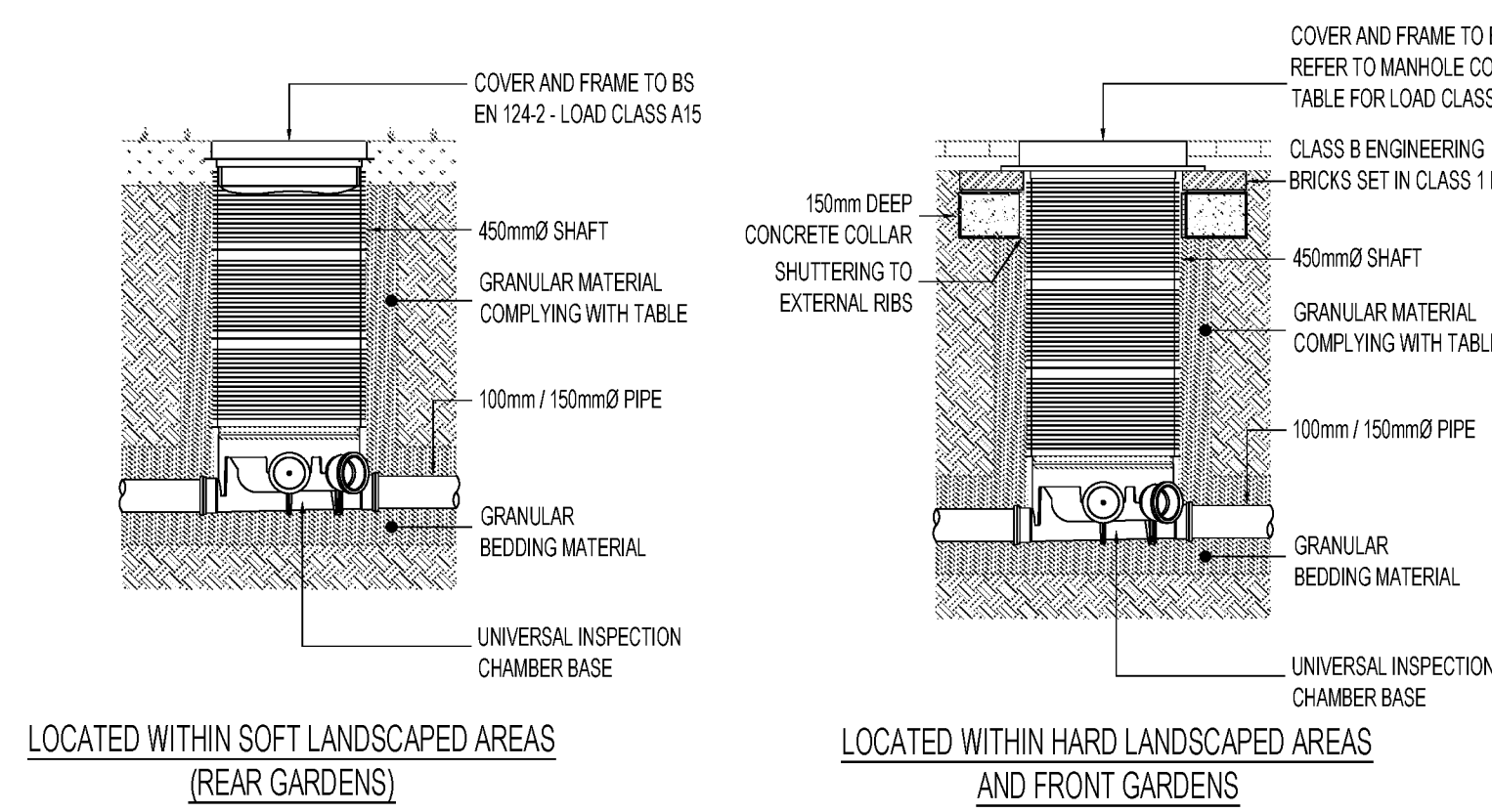
Suitability	Revision
A2 - CONCEPT DESIGN	C01



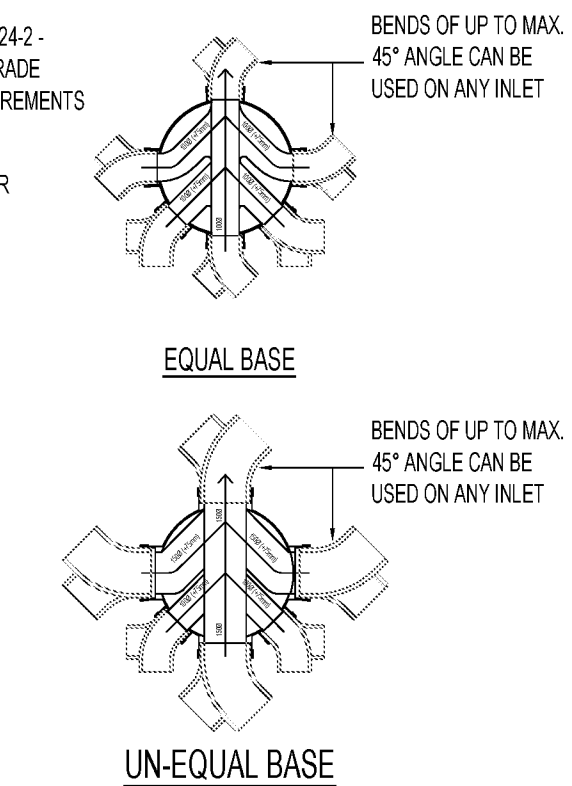
SHALLOW INSPECTION CHAMBER - (SIC)
(OSMA SHALLOW INSPECTION CHAMBER OR SIMILAR APPROVED)
MAXIMUM DEPTH TO INVERT 0.6m
(SCALE 1:25)



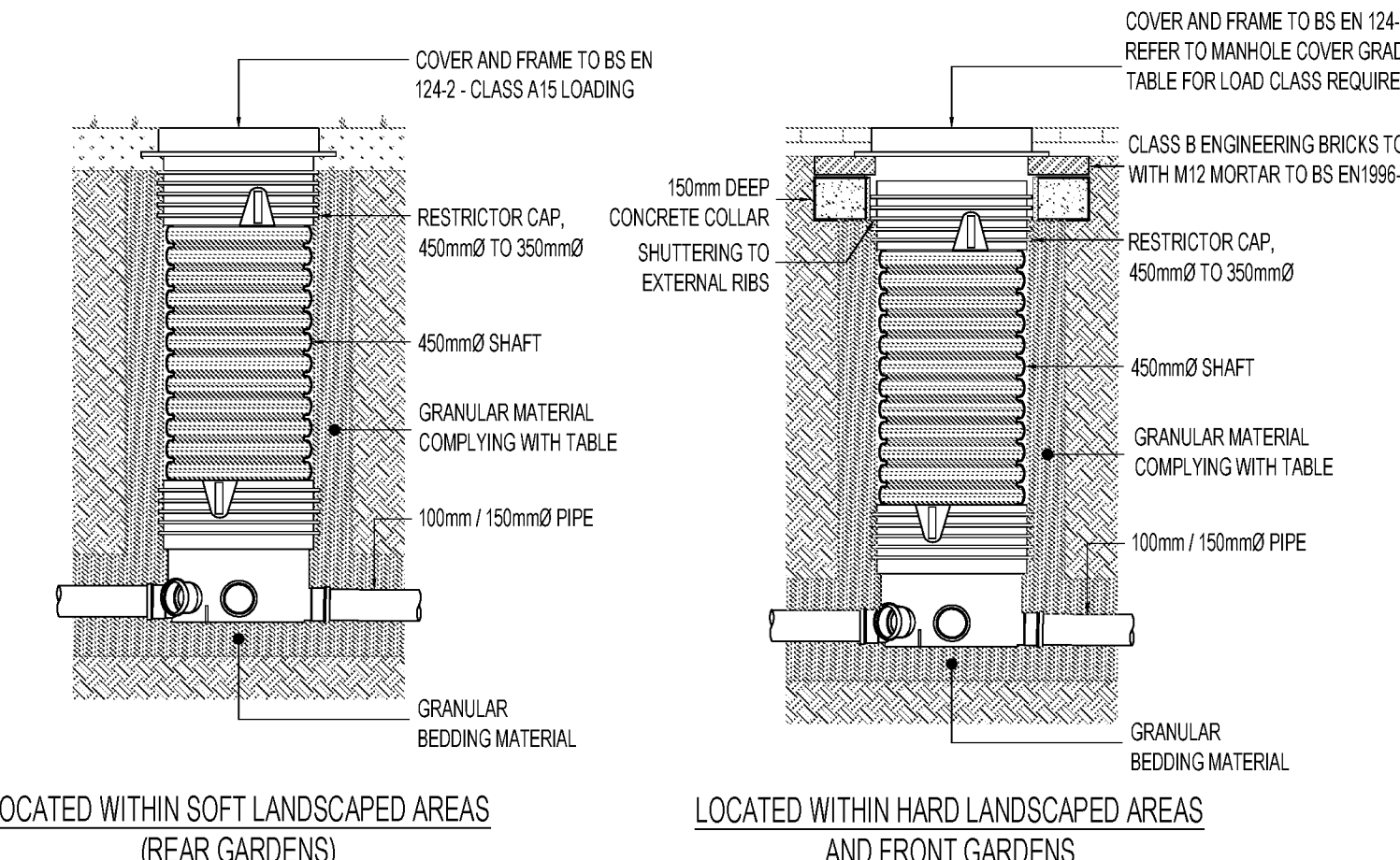
TYPICAL PLAN OVER SIC BASE



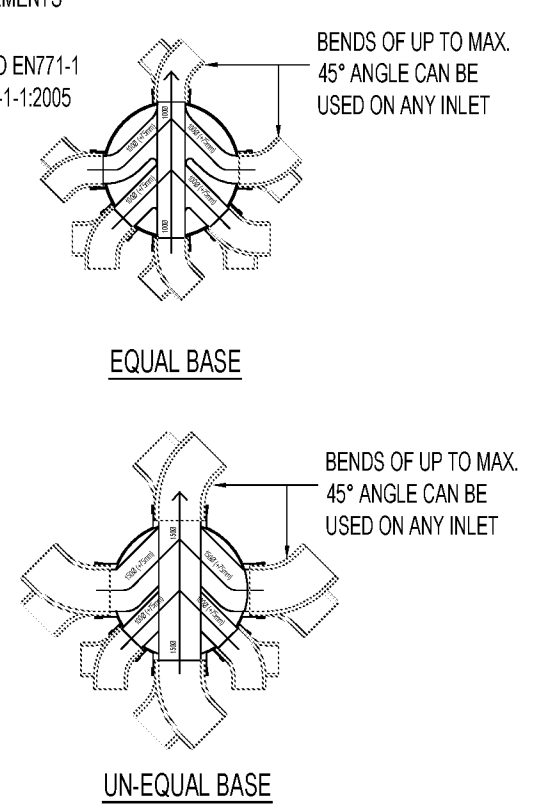
POLYPROPYLENE INSPECTION CHAMBER - (PPIC-1)
(OSMA UNIVERSAL INSPECTION CHAMBER OR SIMILAR APPROVED)
MAXIMUM DEPTH TO INVERT 1.2m
(SCALE 1:25)



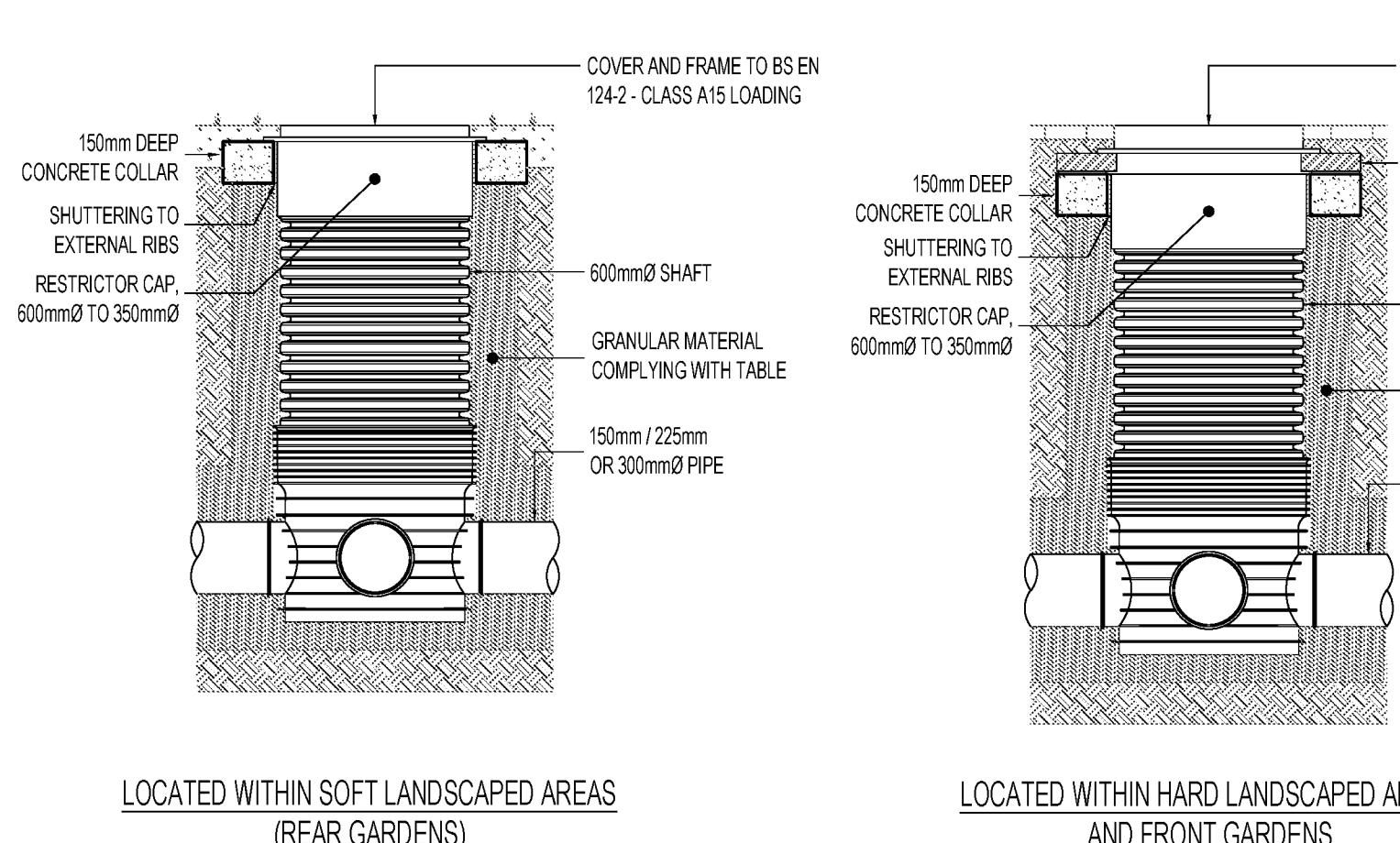
TYPICAL PLAN OVER PPIC-1 BASE



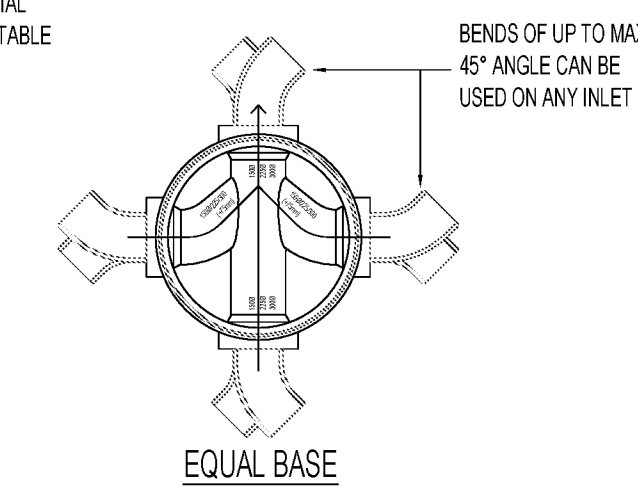
POLYPROPYLENE INSPECTION CHAMBER - (PPIC-2)
(WAVIN RANGE 450 IC OR SIMILAR APPROVED)
MAX. DEPTH TO INVERT 1.2m - 3.0m
(SCALE 1:25)



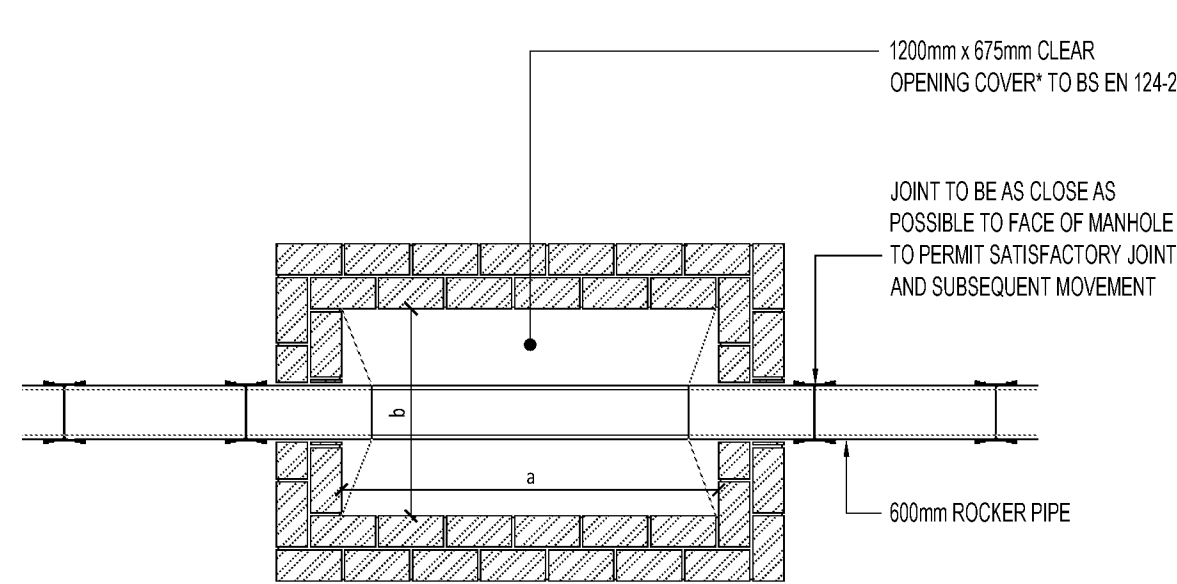
TYPICAL PLAN OVER PPIC-2 BASE



POLYPROPYLENE INSPECTION CHAMBER - (PPIC-3)
(WAVIN RANGE 600 IC OR SIMILAR APPROVED)
MAX. DEPTH TO INVERT 5.0m
(SCALE 1:25)

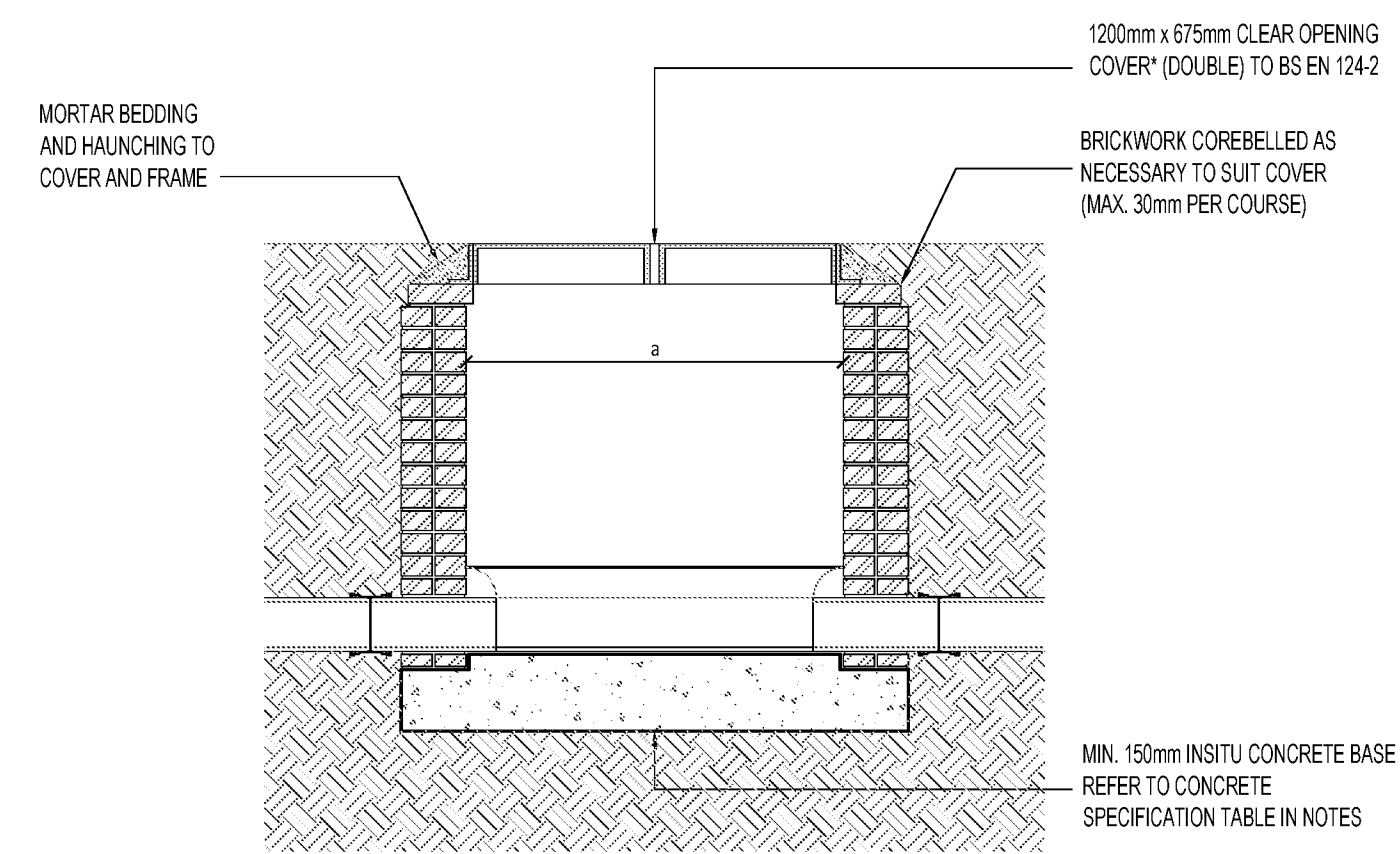


TYPICAL PLAN OVER PPIC-3 BASE



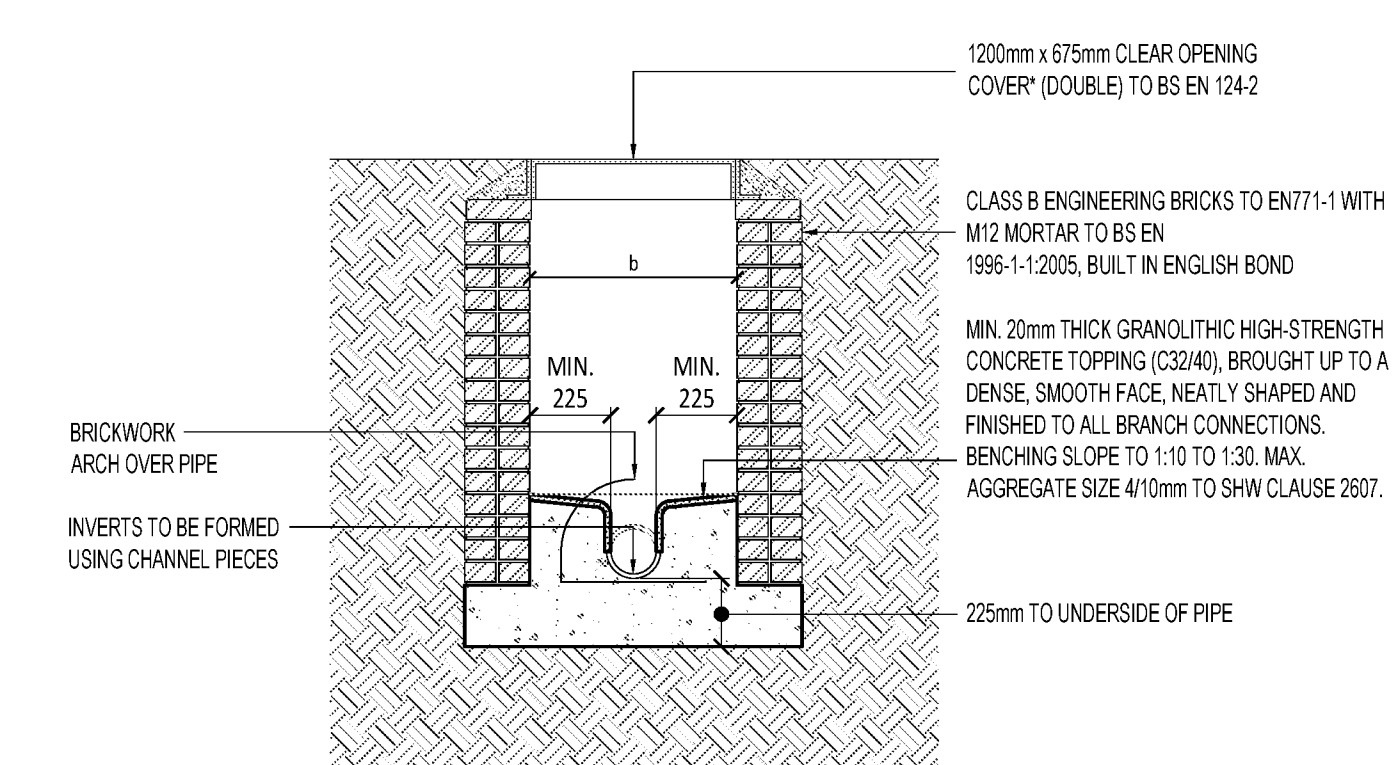
MANHOLE TYPE V SIZE TABLE		
DIAMETER OF DRAIN (mm)	DIMENSION (mm)	
	a	b
225	1240	675
< 300	1240	750

PLAN OVER MANHOLE TYPE V
(SCALE 1:25)



SECTION A-A

PRIVATE MANHOLE DETAIL TYPE V
MAX. DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE 1.5m
MAX. SEWER DIAMETER 300mm
(SCALE 1:25)



SECTION B-B

PRIVATE DRAINAGE DETAIL NOTES

ALL WORK TO PRIVATE SEWERS IS TO BE UNDERTAKEN IN ACCORDANCE WITH THE CURRENT BRITISH STANDARDS, BUILDING REGULATIONS AND EUROCODES.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING THE EXISTING LINE, INVERT LEVEL, AND PIPE DIAMETER OF THE EXISTING CONNECTION POINTS FOR BOTH THE Foul AND SURFACE WATER SYSTEMS, PRIOR TO UNDERTAKING INSTALLATION OF ANY NEW DRAINAGE WORKS. ANY DEVIATION TO THE LEVELS AND POSITIONS INDICATED ON THE DRAWING SHOULD BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE PROJECT ENGINEER.

FOR DETAILS OF GROUND CONDITIONS REFER TO THE GROUND INVESTIGATION REPORT.

THE FOLLOWING PIPE STRENGTHS SHALL BE ADOPTED UNLESS NOTED OTHERWISE:-

PRIVATE PIPES UP TO AND INCLUDING 300mm DIAMETER TO BE CLAY WARE TO BS EN295 CLASS 180 OR PLASTIC TO BS EN 1401:2009 AND BS EN 13598.

PRIVATE PIPES OVER 300mm DIAMETER TO BE CONCRETE TO BS EN 12459 CLASS M.

WHERE PIPES AND OTHER DRAINAGE COMPONENTS ARE TO RECEIVE TRADE EFFLUENT THE PRINCIPAL CONTRACTOR SHALL ENSURE THEY ARE ADEQUATE TO RECEIVE THE DISPOSAL OF CHEMICALS AS LISTED IN THE CONTRACT DOCUMENTS.

ALL PIPE RUNS TO BE LAID WITH FLEXIBLE JOINTS.

PIPES LOCATED IN HIGHWAYS TO BE LAID A MINIMUM OF 1m FROM THE KERB EDGE. THE OUTSIDE EDGE OF MANHOLES TO BE A MINIMUM OF 0.5m FROM THE KERB EDGE.

ALL PIPES ENTERING AND EXITING MANHOLES ARE TO BE CONNECTED WITH PIPE SOFFITS LEVEL UNLESS NOTED OTHERWISE.

ALL INVERTS SPECIFIED ARE OUTGOING (EXCEPT BACKCROP).

CONNECTIONS TO BE MADE BY PURPOSE MADE JUNCTIONS AS FAR AS PRACTICABLE, OR USING PIPE BENDS TO BE TURNED IN DIRECTION OF FLOW.

ALL DRAINS TO BE PRESSURE TESTED PRIOR TO BACKFILLING, AND UPON COMPLETION OF SURFACING, ALL DRAINS TO BE INSPECTED BY CCTV IMMEDIATELY PRIOR TO PRACTICAL COMPLETION.

PRE-FORMED CHANNELS ARE TO BE USED IN MANHOLES WHERE APPLICABLE.

GRANULITHIC CONCRETE BENCHING TO BE STEEL TROWELLED TO A DENSE SMOOTH FACE NEATLY SHAPED AND FINISHED TO ALL BRANCH CONNECTIONS.

THE FIRST MANHOLE UPSTREAM FROM THE CONNECTION TO THE CONNECTION TO THE EXISTING DRAINAGE SHOULD BE FITTED WITH A SCREEN IN ORDER TO PREVENT DEBRIS ENTERING THE EXISTING SEWER/DRAIN. THE SCREEN SHOULD NOT BE REMOVED UNTIL IMMEDIATELY PRIOR TO THE OCCUPATION OF THE PREMISES TO BE SERVED BY THE SEWER.

ROAD GULLY CONNECTIONS TO BE 150mm DIAMETER LAID AT A MINIMUM GRADIENT OF 1:50 UNLESS NOTED OTHERWISE.

ALL PETROL INTERCEPTORS ARE TO BE INSTALLED STRICTLY IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. ADDITIONAL MANUFACTURER'S REQUIREMENTS FOR TRAFFICKED AREAS TO BE ACCOMMODATED.

ALL DRAINAGE WORKS WITHIN THE ZONE OF INFLUENCE OF TREES ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE WHIC STANDARDS AND ARBORICULTURAL REPORT.

CONCRETE MIXES

THE FOLLOWING CONCRETE MIXES ARE TO BE USED (IN ACCORDANCE WITH BS 8000):-

CONCRETE SPECIFICATION	
DC CLASS	CONCRETE MIX
DC1	ST4 / GEN 3
DC2	FND 2
DC2	FND 2
DC3	FND 3
DC3	FND 3
DC4	FND 4
DC4	FND 4
DC4	FND 4
SUMP CLASS S3 FOR ALL DRAINAGE WORKS	

CONCRETE SPECIFICATION	
DC CLASS	CONCRETE MIX
DC1	ST4 / GEN 3
DC2	FND 2
DC2	FND 2
DC3	FND 3
DC3	FND 3
DC4	FND 4
DC4	FND 4
DC4	FND 4
SUMP CLASS S3 FOR ALL DRAINAGE WORKS	

MANHOLE COVER REQUIREMENTS

ALL COVERS TO BE IN ACCORDANCE WITH BS EN 124. MATERIAL AND COVER TYPE TO SUIT ARCHITECTURAL FINISHES.

LOAD CLASS REQUIREMENTS	
LOCATION	CLASS
REAR GARDENS	A15
FRONT GARDENS	B125
FOOTPATHS / PRIVATE DRIVES	B125
PARKING AREAS / CARRIAGEWAYS	D400

ROCKER PIPE REQUIREMENTS

ROCKER PIPE TABLE	
PIPE DIAMETER (mm)	ROCKER PIPE LENGTH (mm)
150-600	600
675-750	1000
OVER 750	1250

MANHOLE CHAMBER DIAMETER

MANHOLE CHAMBER SIZES	
DIA. OF LARGER PIPE IN MH	INTERNAL CHAMBER DIA. (mm)
LESS THAN 375mm	1200
375mm-700mm	1500
750mm-900mm	1800
GREATER THAN 900mm	PIPE DIA. + 300

TRENCH WIDTH REQUIREMENTS

TRENCH WIDTHS TABLE	
DIAMETER OF DRAIN (mm)	TRENCH WIDTH (mm)
100	550
150	600
225	700
300	750

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A1

1. DO NOT SCALE THIS DRAWING. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS ON SITE PRIOR TO COMMENCING THE WORKS.

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4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

FOR PROPOSED DRAINAGE LAYOUT

REFER TO JACKSON PURDUE LEVER

DRAWING No.

001679-JPL-ZZ-ZZ-DR-D-4001 - 4004

Client

ENVIREAUWATER

Project Title

WICKS FARM

Description

PRIVATE DRAINAGE DETAILS

SHEET 2

Date

MAR 2020

Drawn

MMh

Scale

VARIES @A1

Authorised

MPW

JPL Ref.

JD16179

BIM Ref.

Project

Orig.

Vol.

Level

Type

Role

Number

001679

JPL

ZZ

ZZ

DR

D

4022

Suitability

A2 - CONCEPT DESIGN

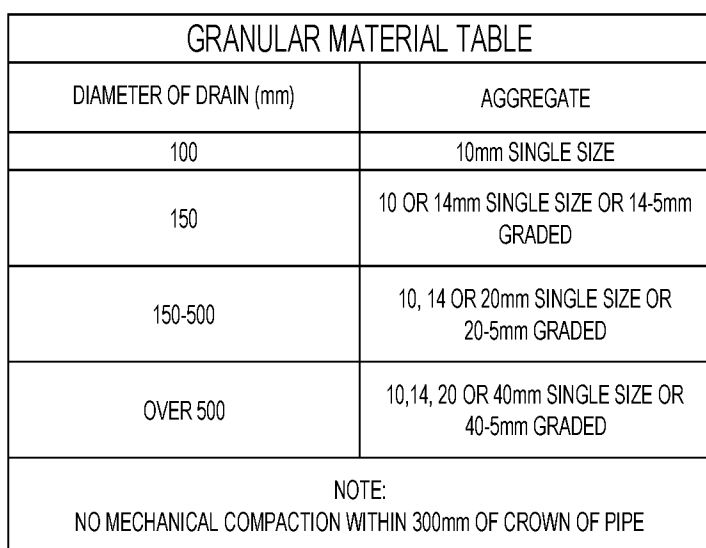
Revision

C01

Jackson

purdue lever

8 Plot Print Office Plot Print Order 16231 2614 Top16231 161679



CONCRETE SPECIFICATION	
DC-CLASS	CONCRETE MIX
DC1	ST4 / GEN 3
DC2	FND 2
DC2:	FND 2:
DC3	FND 3
DC3:	FND 3:
DC4	FND 4
DC4:	FND 4:
DC4	FND 4:
SUMP CLASS S3 FOR ALL DRAINAGE WORKS	

LOAD CLASS REQUIREMENTS	
LOCATION	CLASS
REAR GARDENS	A15
FRONT GARDENS	B125
FOOTPATHS / PRIVATE DRIVES	B125
PARKING AREAS / CARRIAGEWAYS	D400

ROCKER PIPE TABLE	
PIPE DIAMETER (mm)	ROCKER PIPE LENGTH (mm)
150-600	600
675-750	1000
OVER 750	1250

MANHOLE CHAMBER SIZES	
DIA. OF LARGER PIPE IN MH	INTERNAL CHAMBER DIA. (mm)
LESS THAN 375mm	1200
375mm-700mm	1500
750mm-900mm	1800
GREATER THAN 900mm	PIPE DIA. + 900

DIAMETER OF DRAIN (mm)	TRENCH WIDTH (mm)
100	550
150	600
225	700
300	750

FOR PROPOSED DRAINAGE LAYOUT
REFER TO JACKSON PURDUE LEVER
DRAWING No.
001679-JPL-ZZ-ZZ-DR-D-4001 - 4004

C01	27.03.20	ISSUED FOR INFORMATION	MW	MPW
Rev.	Date	Revision Description	Drawn	Auto

ENVIREAUWATER

Project Title

WICKS FARM

Description

PRIVATE DRAINAGE DETAILS
SHEET 3

Date	MAR 2020	Drawn	MWh
Scale	VARIES @A1	Authorised	MPW
JPL Ref.	JDI01679		

BIM Ref.						
Project	Orig.	Vol.	Level	Type	Role	Number
001679	JPL	ZZ	ZZ	DR	D	4023

Suitability	Revision
A2 - CONCEPT DESIGN	C01

APPENDIX 3
HYDRAULIC MODELLING CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	3.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.023	3.00	5.700		499176.727	104093.652	0.520
2	0.162	3.00	5.760	1200	499124.683	104127.398	0.895
3	0.125	3.00	5.760	1200	499124.271	104112.363	0.950
4	0.022	3.00	5.500		499122.755	104105.020	0.716
5	0.247	3.00	5.400	1200	499065.471	104138.210	0.860
6	0.132	3.00	5.400	1200	499065.471	104123.882	0.910
7	0.021	3.00	5.300		499063.933	104117.170	0.837
8	0.090	3.00	5.500		499015.938	104127.769	1.161
9			5.900		498969.837	104137.690	1.680
10	0.056	3.00	6.000	1200	498950.763	104151.135	1.200
11	0.008	3.00	5.900		498951.237	104141.840	1.730
12			5.900		498937.379	104144.900	1.760
13			5.600		498925.091	104159.306	1.500
14		3.00	5.600		498844.603	104156.227	1.500
15			6.050	1500	498840.060	104163.968	2.010
16			5.200		498837.448	104168.297	1.200
17			4.800		498830.527	104250.389	1.005
18			3.000		498829.070	104331.734	0.450
19			1.700		498837.134	104361.604	0.300

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	4	55.156	0.350	5.180	4.784	0.396	139.3	520	11.80	35.5
2.000	2	3	15.041	0.600	4.865	4.810	0.055	273.5	300	3.27	50.0
2.001	3	4	7.498	0.600	4.810	4.784	0.026	288.4	300	3.40	50.0
1.001	4	7	60.064	0.350	4.784	4.463	0.321	187.1	716	21.04	25.3
3.000	5	6	14.328	0.600	4.540	4.490	0.050	286.6	300	3.26	50.0
3.001	6	7	6.886	0.600	4.490	4.463	0.027	255.0	300	3.38	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.104	83.6	2.2	0.000	0.196	0.023	0.0	85	0.039
2.000	0.046	66.8	22.0	0.595	0.650	0.162	0.0	118	0.850
2.001	0.021	130.1	38.9	0.650	0.416	0.287	0.0	112	0.807
1.001	0.108	149.9	22.7	0.000	0.121	0.332	0.0	305	0.067
3.000	0.024	130.6	33.5	0.560	0.610	0.247	0.0	103	0.777
3.001	0.080	138.5	51.4	0.610	0.537	0.379	0.0	126	0.909

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.002	7	8	49.151	0.350	4.463	4.339	0.124	396.4	837	30.00	20.2
1.003	8	9	47.156	0.350	4.339	4.220	0.119	396.3	1161	30.00	20.2
1.004	9	11	19.057	0.600	4.220	4.170	0.050	381.1	600	30.00	20.2
4.000	10	11	9.307	0.600	4.800	4.170	0.630	14.8	225	3.05	50.0
1.005	11	12	14.192	0.350	4.170	4.140	0.030	473.1	1730	30.00	20.2
1.006	12	13	18.935	0.600	4.140	4.100	0.040	473.4	600	30.00	20.2
5.000	14	15	8.976	0.600	4.100	4.040	0.060	149.6	450	3.09	50.0
5.001	15	16	5.056	0.600	4.040	4.000	0.040	126.4	150	3.18	50.0
5.002	16	17	82.383	0.350	4.000	3.795	0.205	401.9	1005	18.37	27.5
5.003	17	18	81.358	0.350	3.795	2.550	1.245	65.3	450	23.02	21.1
5.004	18	19	30.939	0.350	2.550	1.400	1.150	26.9	300	30.00	20.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.002	0.082	148.5	40.1	0.000	0.324	0.732	0.0	473	0.059
1.003	0.099	325.4	45.0	0.000	0.519	0.822	0.0	498	0.060
1.004	0.074	13.6	45.0	1.090	1.130	0.822	0.0	600	0.024
4.000	3.421	136.0	7.6	0.975	1.505	0.056	0.0	36	1.853
1.005	0.116	795.9	48.5	0.000	0.030	0.886	0.0	536	0.058
1.006	0.072	12.2	48.5	1.160	0.900	0.886	0.0	600	0.022
5.000	1.660	264.0	0.0	1.050	1.560	0.000	0.0	0	0.000
5.001	0.892	15.8	0.0	1.860	1.050	0.000	0.0	0	0.000
5.002	0.090	228.0	0.0	0.195	0.000	0.000	0.0	0	0.000
5.003	0.141	88.5	0.0	0.555	0.000	0.000	0.0	0	0.000
5.004	0.175	57.8	0.0	0.150	0.000	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	55.156	139.3	520	Swale	5.700	5.180	0.000	5.500	4.784	0.196
2.000	15.041	273.5	300	Pipe	5.760	4.865	0.595	5.760	4.810	0.650
2.001	7.498	288.4	300	Twin 300mm	5.760	4.810	0.650	5.500	4.784	0.416
1.001	60.064	187.1	716	Swale	5.500	4.784	0.000	5.300	4.463	0.121
3.000	14.328	286.6	300	Twin 300mm	5.400	4.540	0.560	5.400	4.490	0.610
3.001	6.886	255.0	300	Twin 300mm	5.400	4.490	0.610	5.300	4.463	0.587
1.002	49.151	396.4	837	Swale	5.300	4.463	0.000	5.500	4.339	0.324
1.003	47.156	396.3	1161	Swale	5.500	4.339	0.000	5.900	4.220	0.519
1.004	19.057	381.1	600	Twin Pipes	5.900	4.220	1.090	5.900	4.170	1.130

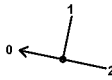
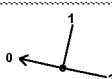
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1		Junction		4		Junction	
2.000	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
2.001	3	1200	Manhole	Adoptable	4		Junction	
1.001	4		Junction		7		Junction	
3.000	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
3.001	6	1200	Manhole	Adoptable	7		Junction	
1.002	7		Junction		8		Junction	
1.003	8		Junction		9		Junction	
1.004	9		Junction		11		Junction	

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.000	9.307	14.8	225	Pipe	6.000	4.800	0.975	5.900	4.170	1.505
1.005	14.192	473.1	1730	Swale	5.900	4.170	0.000	5.900	4.140	0.030
1.006	18.935	473.4	600	Twin Pipes	5.900	4.140	1.160	5.600	4.100	0.900
5.000	8.976	149.6	450	Pipe	5.600	4.100	1.050	6.050	4.040	1.560
5.001	5.056	126.4	150	Pipe	6.050	4.040	1.860	5.200	4.000	1.050
5.002	82.383	401.9	1005	Swale	5.200	4.000	0.195	4.800	3.795	0.000
5.003	81.358	65.3	450	Swale	4.800	3.795	0.555	3.000	2.550	0.000
5.004	30.939	26.9	300	Swale	3.000	2.550	0.150	1.700	1.400	0.000

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.000	10	1200	Manhole	Adoptable	11		Junction	
1.005	11		Junction		12		Junction	
1.006	12		Junction		13		Junction	
5.000	14		Junction		15	1500	Manhole	Adoptable
5.001	15	1500	Manhole	Adoptable	16		Junction	
5.002	16		Junction		17		Junction	
5.003	17		Junction		18		Junction	
5.004	18		Junction		19		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	499176.727	104093.652	5.700	0.520					
							0	1.000	5.180 520
2	499124.683	104127.398	5.760	0.895	1200				
							0	2.000	4.865 300
3	499124.271	104112.363	5.760	0.950	1200		1	2.000	4.810 300
							0	2.001	4.810 300
4	499122.755	104105.020	5.500	0.716			1	2.001	4.784 300
							2	1.000	4.784 520
							0	1.001	4.784 716
5	499065.471	104138.210	5.400	0.860	1200				
							0	3.000	4.540 300
6	499065.471	104123.882	5.400	0.910	1200		1	3.000	4.490 300
							0	3.001	4.490 300
7	499063.933	104117.170	5.300	0.837			1	3.001	4.463 300
							2	1.001	4.463 716
							0	1.002	4.463 837

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
8	499015.938	104127.769	5.500	1.161		0 ← 1	1 1.002	4.339	837
9	498969.837	104137.690	5.900	1.680		0 ← 1	0 1.003 4.339 1161 1 1.003 4.220 1161		
10	498950.763	104151.135	6.000	1.200	1200	0 ← 1	0 1.004 4.220 600		
11	498951.237	104141.840	5.900	1.730		0 ↓ 1 0 ← 2	0 4.000 4.800 225 1 4.000 4.170 225 2 1.004 4.170 600		
12	498937.379	104144.900	5.900	1.760		0 ← 1	0 1.005 4.170 1730 1 1.005 4.140 1730		
13	498925.091	104159.306	5.600	1.500		0 ← 1	0 1.006 4.140 600 1 1.006 4.100 600		
14	498844.603	104156.227	5.600	1.500		0 ← 1	0 5.000 4.100 450		
15	498840.060	104163.968	6.050	2.010	1500	0 ← 1	0 5.000 4.040 450 1 5.001 4.040 150		
16	498837.448	104168.297	5.200	1.200		0 ← 1	0 5.001 4.000 150 1 5.002 4.000 1005		
17	498830.527	104250.389	4.800	1.005		0 ← 1	0 5.002 3.795 1005 1 5.003 3.795 450		
18	498829.070	104331.734	3.000	0.450		0 ← 1	0 5.003 2.550 450 1 5.004 2.550 300		
19	498837.134	104361.604	1.700	0.300		0 ← 1	0 5.004 1.400 300		

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m ³ /ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node 14 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	4.100	Product Number	CTL-SHE-0163-1300-1100-1300
Design Depth (m)	1.100	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	13.0	Min Node Diameter (mm)	1200

Node 14 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	80.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	4.100	Main Channel Slope (1:X)	99999.0
Safety Factor	2.0	Time to half empty (mins)	0	Main Channel n	0.350

Inlets

13

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	287.0	0.0	0.400	572.0	0.0	0.800	869.0	0.0	1.200	1140.0	0.0
0.100	357.0	0.0	0.500	644.0	0.0	0.900	945.0	0.0	1.300	1177.0	0.0
0.200	428.0	0.0	0.600	718.0	0.0	1.000	1022.0	0.0	1.400	1247.0	0.0
0.300	499.0	0.0	0.700	793.0	0.0	1.100	1101.0	0.0	1.500	1317.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.26%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	22	5.237	0.057	2.6	0.0506	0.0000	OK
30 minute winter	2	23	5.027	0.162	18.4	0.7705	0.0000	OK
30 minute winter	3	23	5.027	0.217	31.7	0.8172	0.0000	OK
30 minute winter	4	23	5.027	0.243	32.3	0.1496	0.0000	OK
60 minute winter	5	43	4.838	0.298	18.4	2.0470	0.0000	OK
60 minute winter	6	43	4.838	0.348	25.6	1.4019	0.0000	SURCHARGED
60 minute winter	7	43	4.838	0.375	36.0	0.1880	0.0000	OK
120 minute winter	8	96	4.706	0.367	24.9	0.5684	0.0000	OK
120 minute winter	9	104	4.668	0.448	20.4	0.0000	0.0000	OK
15 minute summer	10	9	4.840	0.040	9.7	0.0834	0.0000	OK
120 minute winter	11	108	4.582	0.412	16.2	0.0379	0.0000	OK
120 minute winter	12	108	4.573	0.433	15.8	0.0000	0.0000	OK
480 minute winter	13	424	4.333	0.233	12.4	0.0000	0.0000	OK
480 minute winter	14	432	4.330	0.230	9.6	0.0000	0.0000	OK
480 minute winter	15	432	4.230	0.190	5.9	0.3359	0.0000	SURCHARGED
480 minute winter	16	432	4.223	0.223	5.9	0.0000	0.0000	OK
480 minute winter	17	456	3.912	0.117	5.8	0.0000	0.0000	OK
480 minute winter	18	472	2.705	0.155	5.8	0.0000	0.0000	OK
480 minute winter	19	472	1.423	0.023	5.8	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	1.000	4	1.1	0.009	0.013	7.5841	
15 minute summer	2	2.000	3	26.6	0.831	0.397	0.5693	
15 minute summer	3	2.001	4	45.1	0.901	0.346	0.7420	
30 minute winter	4	1.001	7	14.2	0.045	0.095	20.1843	
15 minute summer	5	3.000	6	39.5	0.592	0.303	1.7604	
15 minute summer	6	3.001	7	55.7	0.943	0.402	0.9466	
60 minute winter	7	1.002	8	24.6	0.060	0.166	21.5751	
60 minute winter	8	1.003	9	22.1	0.061	0.068	23.3364	
120 minute winter	9	1.004	11	15.5	0.038	1.139	8.2304	
15 minute summer	10	4.000	11	9.6	1.316	0.070	0.1851	
180 minute winter	11	1.005	12	15.9	0.029	0.020	7.9120	
120 minute winter	12	1.006	13	16.1	0.062	1.319	5.1793	
180 minute winter	13	Flow through pond	14	13.5	0.023	0.162	76.1828	
480 minute winter	14	Hydro-Brake®	15	5.9				
480 minute winter	15	5.001	16	5.9	0.462	0.371	0.0890	
480 minute winter	16	5.002	17	5.8	0.041	0.026	12.1989	
480 minute winter	17	5.003	18	5.8	0.062	0.066	8.5884	
480 minute winter	18	5.004	19	5.8	0.096	0.100	2.1356	112.1

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.26%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	21	5.284	0.104	6.4	0.0919	0.0000	OK
30 minute winter	2	20	5.213	0.348	45.1	1.6556	0.0000	SURCHARGED
30 minute winter	3	21	5.203	0.393	77.4	1.4790	0.0000	SURCHARGED
30 minute winter	4	22	5.201	0.417	84.0	0.2563	0.0000	OK
30 minute winter	5	23	5.072	0.532	68.8	3.6592	0.0000	SURCHARGED
30 minute winter	6	23	5.071	0.581	100.2	2.3426	0.0000	SURCHARGED
30 minute winter	7	23	5.069	0.606	132.9	0.3043	0.0000	OK
120 minute winter	8	94	4.992	0.653	65.7	1.0123	0.0000	OK
120 minute winter	9	96	4.982	0.762	45.3	0.0000	0.0000	SURCHARGED
15 minute summer	10	9	4.863	0.063	23.9	0.1308	0.0000	OK
120 minute winter	11	92	4.741	0.571	31.5	0.0525	0.0000	OK
120 minute winter	12	92	4.733	0.593	31.1	0.0000	0.0000	OK
360 minute winter	13	360	4.518	0.418	27.8	0.0000	0.0000	OK
360 minute winter	14	360	4.517	0.417	19.2	0.0000	0.0000	OK
360 minute winter	15	368	4.338	0.298	12.1	0.5269	0.0000	SURCHARGED
360 minute winter	16	368	4.307	0.307	12.1	0.0000	0.0000	OK
360 minute winter	17	384	3.967	0.172	12.1	0.0000	0.0000	OK
360 minute winter	18	400	2.775	0.225	12.1	0.0000	0.0000	OK
360 minute winter	19	400	1.437	0.037	12.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	1.000	4	3.2	0.012	0.038	17.3517	
15 minute summer	2	2.000	3	63.4	0.946	0.948	1.0592	
15 minute summer	3	2.001	4	109.2	1.098	0.839	1.0560	
30 minute winter	4	1.001	7	44.2	0.058	0.295	47.6590	
15 minute summer	5	3.000	6	89.6	0.636	0.686	2.0179	
15 minute summer	6	3.001	7	138.4	1.167	0.999	0.9698	
30 minute winter	7	1.002	8	77.6	0.091	0.523	46.2853	
30 minute winter	8	1.003	9	63.0	0.089	0.194	51.2954	
30 minute winter	9	1.004	11	30.6	0.058	2.249	10.4382	
15 minute summer	10	4.000	11	23.7	1.630	0.174	0.2276	
120 minute winter	11	1.005	12	31.1	0.036	0.039	13.7373	
120 minute winter	12	1.006	13	31.2	0.080	2.553	7.8860	
120 minute winter	13	Flow through pond	14	26.8	0.032	0.322	154.8864	
360 minute winter	14	Hydro-Brake®	15	12.1				
360 minute winter	15	5.001	16	12.1	0.687	0.767	0.0890	
360 minute winter	16	5.002	17	12.1	0.052	0.053	20.0446	
360 minute winter	17	5.003	18	12.1	0.074	0.136	14.5708	
360 minute winter	18	5.004	19	12.0	0.121	0.208	3.6285	215.1

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.26%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	22	5.375	0.195	14.5	0.1725	0.0000	OK
15 minute winter	2	10	5.554	0.689	117.3	3.2736	0.0000	FLOOD RISK
30 minute winter	3	21	5.383	0.573	143.3	2.1564	0.0000	SURCHARGED
30 minute winter	4	22	5.372	0.588	156.8	0.3614	0.0000	OK
15 minute winter	5	10	5.341	0.801	179.0	5.5075	0.0000	FLOOD RISK
30 minute winter	6	21	5.298	0.808	186.9	3.2565	0.0000	FLOOD RISK
120 minute winter	7	94	5.291	0.828	126.2	0.4155	0.0000	OK
120 minute winter	8	96	5.286	0.947	116.4	1.4676	0.0000	OK
120 minute winter	9	96	5.283	1.063	63.7	0.0000	0.0000	SURCHARGED
15 minute summer	10	9	4.887	0.087	43.4	0.1802	0.0000	OK
120 minute winter	11	90	4.876	0.706	43.1	0.0650	0.0000	OK
120 minute winter	12	90	4.871	0.731	41.4	0.0000	0.0000	SURCHARGED
480 minute winter	13	512	4.742	0.642	34.4	0.0000	0.0000	OK
480 minute winter	14	512	4.742	0.642	23.3	0.0000	0.0000	SURCHARGED
360 minute winter	15	352	4.352	0.312	13.0	0.5516	0.0000	SURCHARGED
360 minute winter	16	360	4.316	0.316	13.0	0.0000	0.0000	OK
600 minute summer	17	570	3.973	0.178	13.0	0.0000	0.0000	OK
600 minute summer	18	600	2.783	0.233	13.0	0.0000	0.0000	OK
600 minute summer	19	600	1.439	0.039	13.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	1.000	4	8.2	0.019	0.098	31.9335	
15 minute summer	2	2.000	3	110.9	1.575	1.659	1.0592	
15 minute summer	3	2.001	4	200.5	1.423	1.540	1.0560	
15 minute winter	4	1.001	7	78.5	0.069	0.524	76.1493	
15 minute summer	5	3.000	6	168.3	1.195	1.289	2.0179	
15 minute summer	6	3.001	7	259.6	1.843	1.874	0.9698	
30 minute winter	7	1.002	8	163.7	0.114	1.103	82.2862	
30 minute winter	8	1.003	9	128.6	0.111	0.395	99.4916	
120 minute winter	9	1.004	11	37.3	0.066	2.738	10.7358	
15 minute summer	10	4.000	11	42.9	1.734	0.315	0.2513	
120 minute winter	11	1.005	12	41.4	0.039	0.052	19.7692	
120 minute winter	12	1.006	13	40.7	0.089	3.326	10.4418	
120 minute winter	13	Flow through pond	14	34.9	0.036	0.419	269.5947	
600 minute summer	14	Hydro-Brake®	15	13.0				
600 minute summer	15	5.001	16	13.0	0.737	0.823	0.0890	
240 minute winter	16	5.002	17	13.0	0.053	0.057	21.0474	
600 minute summer	17	5.003	18	13.0	0.069	0.147	15.3846	
600 minute summer	18	5.004	19	13.0	0.124	0.225	3.8325	389.1

APPENDIX 4
MAINTENANCE AND MANAGEMENT PLAN OF THE SURFACE WATER DRAINAGE SCHEME



SuDS Operation and Maintenance Statement

Drainage Design
Wicks Farm, Arundel
JDI01679-1HI



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Appendices

A	Proposed Drainage Layout
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1.0 Terms of Reference

1.1 Report Details

Jackson Purdue Lever has been appointed by Envireau to prepare a SuDS Operation and Maintenance Statement. No liability is accepted to any third party for all or part of this report in connection with this or any other development.

This document has been produced, the contents of which are based on current best practice guidance, to demonstrate the effectiveness and longevity of the SuDS features designed within the drainage strategy.

The surface water network has been designed to accommodate the 1 in 100 year storm rainfall event plus an allowance of 40% for climate change. As the flows are generally being attenuated on site, and within SuDS features, there will be a period of time after storm events where the network is still partially or fully surcharged and is discharging runoff. Should any surcharging still be present 48 hours after the end of the storm, appropriate action should be taken as noted within the following sections.

This document is intended to give an overview of the operation and maintenance for the range of SuDS features included within the drainage strategy and in relation to typical/standard details only. Where proprietary products are specified the manufacturer's recommendations should be followed in the first instance, unless specifically noted otherwise due to project constraints.

The recommended operation and maintenance intervals are indicative only and should initially be undertaken on a more frequent basis to ensure that there are no unforeseen issues with the construction and early operation. The frequency can then be adjusted to suit the Client's wider site maintenance programme.

1.2 Report History

Status / Revision	Author	Approved	Issued Date	Purpose
A1-C01	MPW	TSL	27/03/2020	Issued for Planning



2.0 Pipes and Manholes

2.1 Location and Description

The proposed pipes and manholes are shown on the drainage layout drawing included within Appendix A.

The pipes and manholes have been designed in accordance with CIRIA C753 and all current British Standards. Where specified, proprietary products are to be installed and maintained in accordance with the manufacturer's recommendations.

2.2 Operation

The pipes are intended to be surface water conveyance features. These features are intended to be dry except during rainfall events and have been designed to be self-cleansing as a result of the gradients proposed.

Access for maintenance has been provided through inspection chambers, manholes and rodding eyes.

2.3 Inspection and Maintenance Regime

Regular inspection and maintenance are an important factor for the effective operation of these features and to identify areas which may have been obstructed/clogged and are not operating correctly.

A recommended schedule of maintenance activities is included in the table below:

Maintenance Schedule	Required Action	Typical Frequency
Occasional Maintenance	Remove or control tree roots where they are encroaching pipe runs, using recommended methods (e.g. NJUG, 2018 or BS 3998:2010)	As required
Remedial Actions	Clear pipework of blockages	As required
Monitoring	Initial inspection should be provided using a post-construction CCTV survey	Once (post-construction)
	Inspect for evidence of poor operation	Monthly (during the first year), then annually



3.0 Channel Drains

3.1 Location and Description

The proposed channel drains are shown on the drainage layout drawing included within Appendix A.

The channel drains have been designed in accordance with CIRIA C753 and all current British Standards. Where specified, proprietary products are to be installed and maintained in accordance with the manufacturer's recommendations.

3.2 Operation

The channel drains are intended to be surface water collection and conveyance features. These features are intended to be dry except during rainfall events.

The surface water should enter the drainage channel from runoff from adjacent impermeable surfaces and typically consist of a channel with a removable grate.

Access for maintenance has been provided through access chambers, rodding points and the removable cover grates.

3.3 Inspection and Maintenance Regime

Regular inspection and maintenance are an important factor for the effective operation of these features and to identify areas which may have been obstructed/clogged and are not operating correctly.

A recommended schedule of maintenance activities is included in the table below:

Maintenance Schedule	Required Action	Typical Frequency
Routine Maintenance	Remove litter and debris and inspect for sediment accumulation	Six monthly
Remedial Actions	Clear pipework of blockages	As required
Monitoring	Inspect for evidence of poor operation	Monthly (during the first year), then annually
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly (during the first year), then annually



4.0 Flow Control Chambers/Devices

4.1 Location and Description

The proposed flow control chambers/devices are shown on the drainage layout drawing included within Appendix A.

The flow control chambers/devices have been designed in accordance with CIRIA C753 and all current British Standards. Where specified, proprietary products are to be installed and maintained in accordance with the manufacturer's recommendations.

4.2 Operation

The flow control chamber/device is intended to restrict the discharge rate of surface water leaving the site to a designed rate utilising devices such as an orifice plate, vortex separator or mechanical float control.

Access for maintenance has been provided through the chamber itself.

4.3 Inspection and Maintenance Regime

Regular inspection and maintenance are an important factor for the effective operation of these features and to identify areas which may have been obstructed/clogged and are not operating correctly.

A recommended schedule of maintenance activities is included in the table below:

Maintenance Schedule	Required Action	Typical Frequency
Routine Maintenance	Remove litter and debris and inspect for sediment accumulation	Annually
Regular Maintenance	Check any penstocks and other mechanical devices	Annually
Remedial Actions	Clear pipework of blockages, utilise penstock to clear chamber if required	As required
Monitoring	Initial inspection should be provided using a post-construction CCTV survey	Once (post-construction)
	Inspect for evidence of poor operation	Monthly (during the first year), then annually



5.0 Rainwater Harvesting Systems

5.1 Location and Description

The proposed rainwater harvesting systems are shown on the drainage layout drawing included within Appendix A.

The rainwater harvesting systems have been designed in accordance with CIRIA C753 and all current British Standards. Where specified, proprietary products are to be installed and maintained in accordance with the manufacturer's recommendations.

5.2 Operation

The rainwater harvesting system is intended to collect surface water and supply the development. These features are intended to be permanently wet to provide a source for the development.

Access for maintenance is provided through access chambers on the tank itself.

5.3 Inspection and Maintenance Regime

Regular inspection and maintenance are an important factor for the effective operation of rainwater harvesting systems.

A recommended schedule of maintenance activities is included in the table below:

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspection of the tank for debris and sediment build-up, inlets/outlets/withdrawal devices, overflow areas, pumps and filters	Annually (and following poor performance)
	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris	Annually (and following poor performance)
Occasional Maintenance	Cleaning and/or replacement of any filters	Three monthly, or as required
Remedial Actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs	As required



6.0 Infiltration Systems

6.1 Location and Description

The proposed infiltration systems are shown on the drainage layout drawing included within Appendix A.

The infiltration systems have been designed in accordance with CIRIA C753 and all current British Standards. Where specified, proprietary products are to be installed and maintained in accordance with the manufacturer's recommendations.

6.2 Operation

The infiltration systems are intended to be water quality improvement and attenuation storage features. These features are intended to be dry except during and shortly after rainfall events.

The surface water should enter the infiltration system from the pipe network and permeate down through the permeable stone and into the surrounding ground.

Access for maintenance has been provided through inspection chambers.

6.3 Inspection and Maintenance Regime

Regular inspection and maintenance are an important factor for the effective operation of infiltration systems.

A recommended schedule of maintenance activities is included in the table below:

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually, or as required (based on inspections)
	Trimming any roots that may be causing blockages	Annually, or as required
Occasional Maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required (based on inspections)
Remedial Actions	Reconstruct soakaway and/or replace or clean void fill if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required



Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly (during the first year), then annually
	Check soakaway to ensure emptying is occurring	Annually



7.0 Swales

7.1 Location and Description

The proposed swales are shown on the drainage layout drawing included within Appendix A.

The swales have been designed in accordance with CIRIA C753 and all current British Standards. Where specified, proprietary products are to be installed and maintained in accordance with the manufacturer's recommendations.

7.2 Operation

The swales are intended to be surface water conveyance, water quality improvement and attenuation storage features. These features are intended to be dry except during rainfall events.

Specific access for maintenance has not been provided as the swales are open features that can be accessed from the surrounding area.

7.3 Inspection and Maintenance Regime

Regular inspection and maintenance are an important factor for the effective operation of swales.

A recommended schedule of maintenance activities is included in the table below:

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly, or as required
	Cut grass -- to retain grass height within specified design range	Monthly (during growing season), or as required.
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or as required
	Inspect vegetation coverage	Monthly for six months, quarterly for two years, then six monthly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Six monthly
Occasional Maintenance	Re-seed areas of poor vegetation growth, alter plant types to better suit conditions if required	As required, or if bare soil is exposed over 10% or more of the swale treatment area
Remedial Actions	Repair erosion or other damage by re-turfing or re-seeding	As required



	Re-level uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required



8.0 Bioretention Systems

8.1 Location and Description

The proposed bioretention systems are shown on the drainage layout drawing included within Appendix A.

The bioretention systems have been designed in accordance with CIRIA C753 and all current British Standards. Where specified, proprietary products are to be installed and maintained in accordance with the manufacturer's recommendations.

8.2 Operation

The bioretention systems are intended to be surface water conveyance and water quality improvement features. These features are typically only impacted by small regular rainfall events with the larger events being routed through overflow features. They are intended to be dry except during rainfall events.

Specific access for maintenance has not been provided as the bioretention systems are open features that can be accessed from the surrounding area.

8.3 Inspection and Maintenance Regime

Regular inspection and maintenance are an important factor for the effective operation of bioretention systems.

A recommended schedule of maintenance activities is included in the table below:

Maintenance Schedule	Required Action	Typical Frequency
Regular Inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species, etc. and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular Maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants to maintain planting density	As required



	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to six monthly
Occasional Maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial Actions	Remove and replace filter medium and vegetation above	As required, but likely to be > 20 years



9.0 Detention Basins

9.1 Location and Description

The proposed detention basins are shown on the drainage layout drawing included within Appendix A.

The detention basins have been designed in accordance with CIRIA C753 and all current British Standards. Where specified, proprietary products are to be installed and maintained in accordance with the manufacturer's recommendations.

9.2 Operation

The detention basins are intended to be surface water conveyance, water quality improvement and attenuation storage features. These features are intended to be dry except during and shortly after rainfall events.

Specific access for maintenance has not been provided as the detention basins are open features that can be accessed from the surrounding area.

9.3 Inspection and Maintenance Regime

Regular inspection and maintenance are an important factor for the effective operation of detention basins.

A recommended schedule of maintenance activities is included in the table below:

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass – for spillway and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Six monthly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start), then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc. for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly during the first year, then annually, or as required
	Check any penstocks and other mechanical devices	Annually



	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually, or as required
	Manage wetland plants in outlet pool – where provided	Annually
Occasional Maintenance	Re-seed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every two years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every five years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial Actions	Repair erosion or other damage by re-seeding or re-turfing	As required
	Realignment or riprap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Re-level uneven surfaces and reinstate design levels	As required



10.0 Ponds and Wetlands

10.1 Location and Description

The proposed ponds and wetlands are shown on the drainage layout drawing included within Appendix A.

The ponds and wetlands have been designed in accordance with CIRIA C753 and all current British Standards. Where specified, proprietary products are to be installed and maintained in accordance with the manufacturer's recommendations.

10.2 Operation

The ponds and wetlands are intended to be surface water conveyance, water quality improvement and attenuation storage features. These features are intended to be wet.

Specific access for maintenance has not been provided as the ponds and wetlands are open features that can be accessed from the surrounding area.

10.3 Inspection and Maintenance Regime

Regular inspection and maintenance are an important factor for the effective operation of ponds and wetlands.

A recommended schedule of maintenance activities is included in the table below:

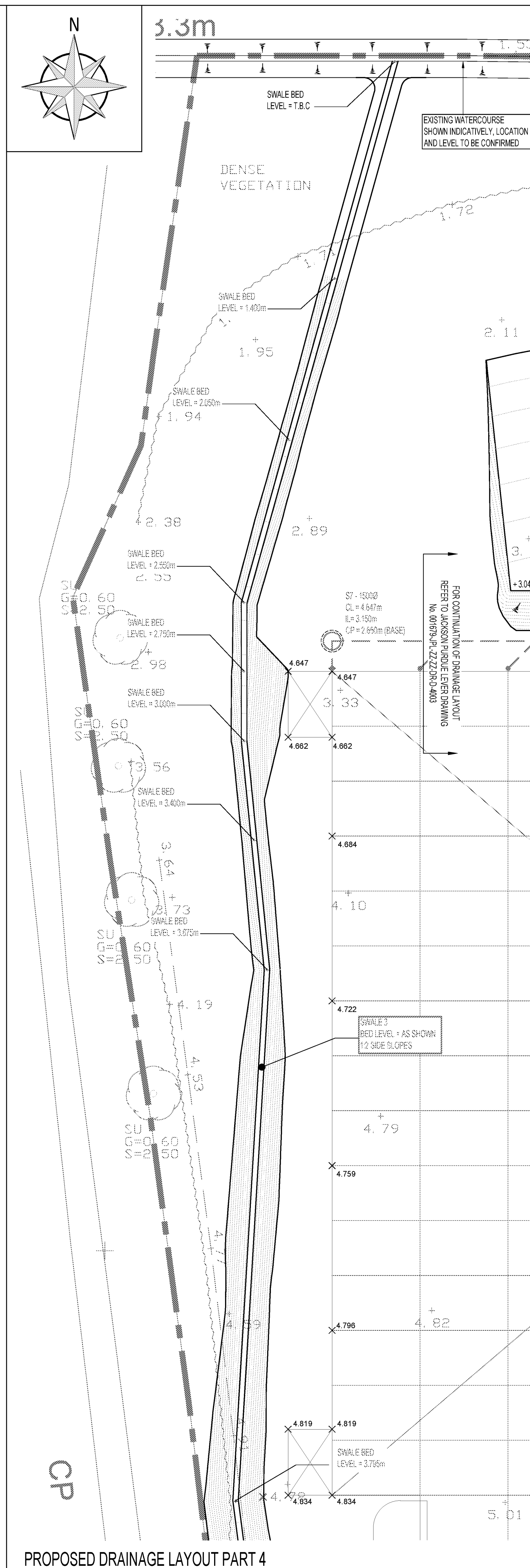
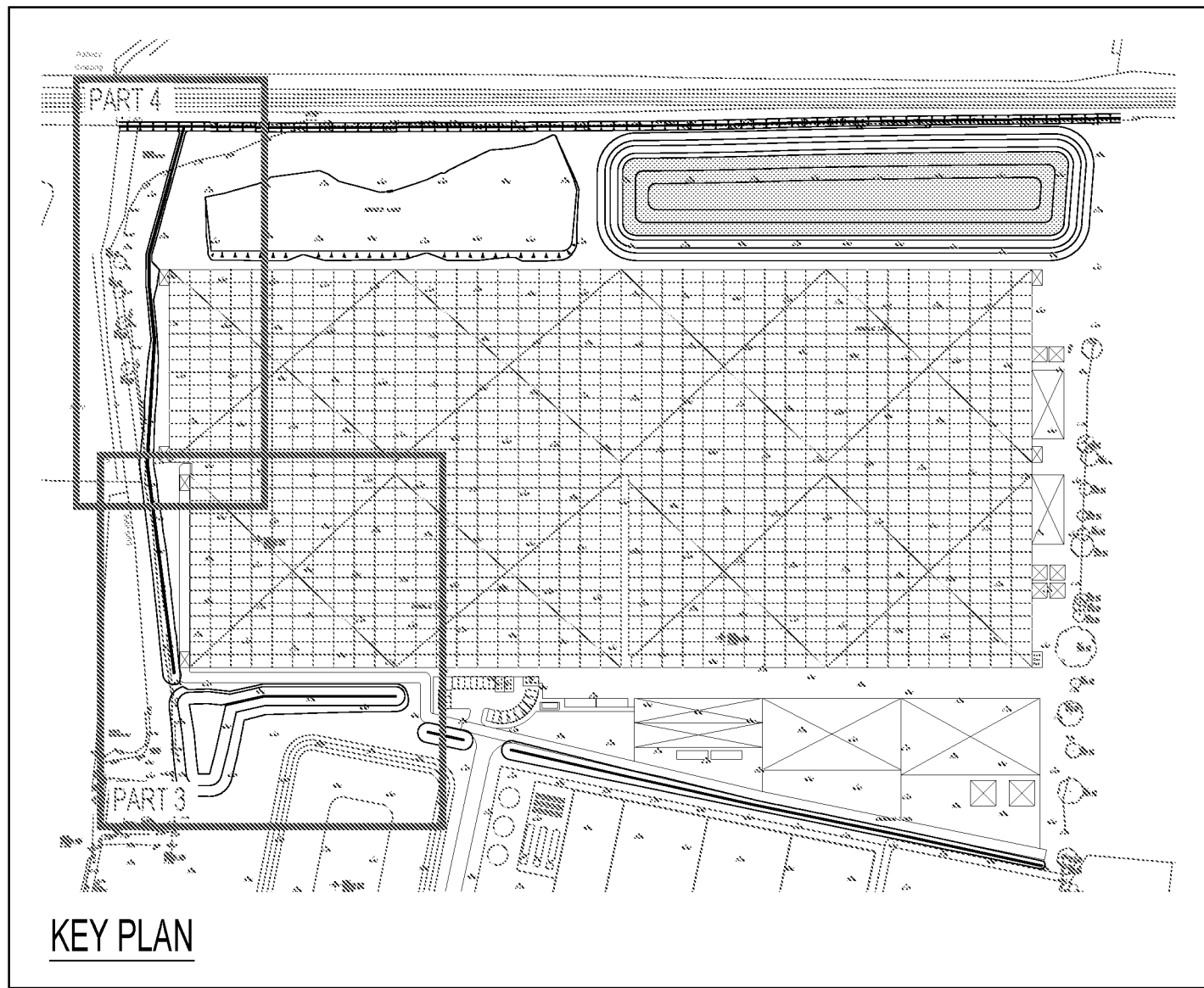
Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly, or as required
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Six monthly (spring, before nesting season and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first three years)	Monthly (at start), then as required
	Inspect inlets, outlets, banksides, structures, pipework, etc. for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May-October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Six monthly



	Check any mechanical devices, e.g. penstocks	Six monthly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include maximum 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1.0m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay	Every 1-5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every five years, or as required
Occasional Maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g. every 25-50 years
Remedial Actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign riprap or repair other damage	As required
	Repair/rehabilitate inlets, outlets and overflows	As required

Appendix A

Proposed Drainage Layout



- © Jackson Consulting Engineers Limited
1. DO NOT SCALE THIS DRAWING. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS ON SITE PRIOR TO COMMENCING THE WORKS.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METRES UNLESS NOTED OTHERWISE.
4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
5. THIS DRAWING IS BASED ON THE CIVIL ENGINEERING PRACTICE DRAWING No. 23314.21,22,23 AND 24 REV A 03/03/2020.

KEY

- 5.95 +
- EXISTING SURVEYED SITE LEVEL TAKEN FROM
THE CIVIL ENGINEERING PRACTICE DRAWING
No. 233.14.21,22,23 AND 24 REV A 03/03/2020
- 4.684 ×
- PROPOSED SPOT LEVEL TAKEN FROM THE
CIVIL ENGINEERING PRACTICE DRAWING
No. 233.14.21,22,23 AND 24 REV A 03/03/2020
- 1.11
- PROPOSED FALL ARROW AND GRADIENT TAKEN
FROM THE CIVIL ENGINEERING PRACTICE DRAWING
No. 233.14.21,22,23 AND 24 REV A 03/03/2020
- 
- PROPOSED PRECAST CONCRETE SURFACE
WATER MANHOLE WITH CATCHPIT
- =====
- PROPOSED SURFACE WATER DRAIN
- 
- PROPOSED PRECAST CONCRETE HEADWALL

FOR PROPOSED DRAINAGE DETAILS
REFER TO JACKSON PURDUE LEVER
DRAWING No.
001679-JPL-ZZ-ZZ-DR-D-4021 - 4023

FOR PROPOSED SECTIONS REFER TO
JACKSON PURDUE LEVER DRAWING No
001679-JPL-ZZ-ZZ-DR-D-4031

C01	27.03.20	ISSUED FOR INFORMATION	MWh	MP
Rev.	Date	Revision Description	Drawn	Auth

ENVIREAUWATER

Project Title

WICKS FARM

Description

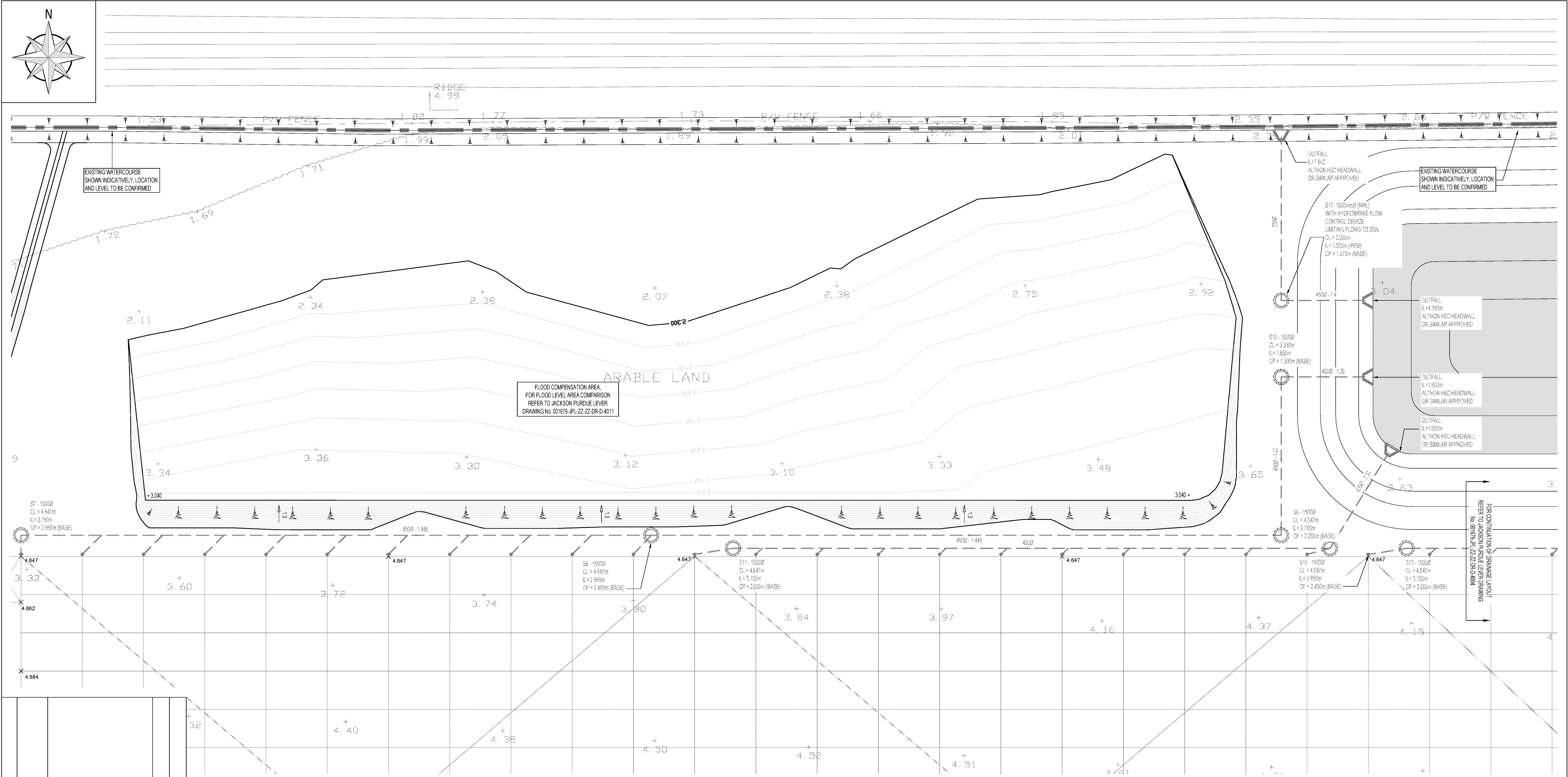
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SHEET 2

Date	MAR 2020	Drawn	MWh
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BIM Ref.						
Project	Orig.	Vol.	Level	Type	Role	Number
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Suitability	Revision
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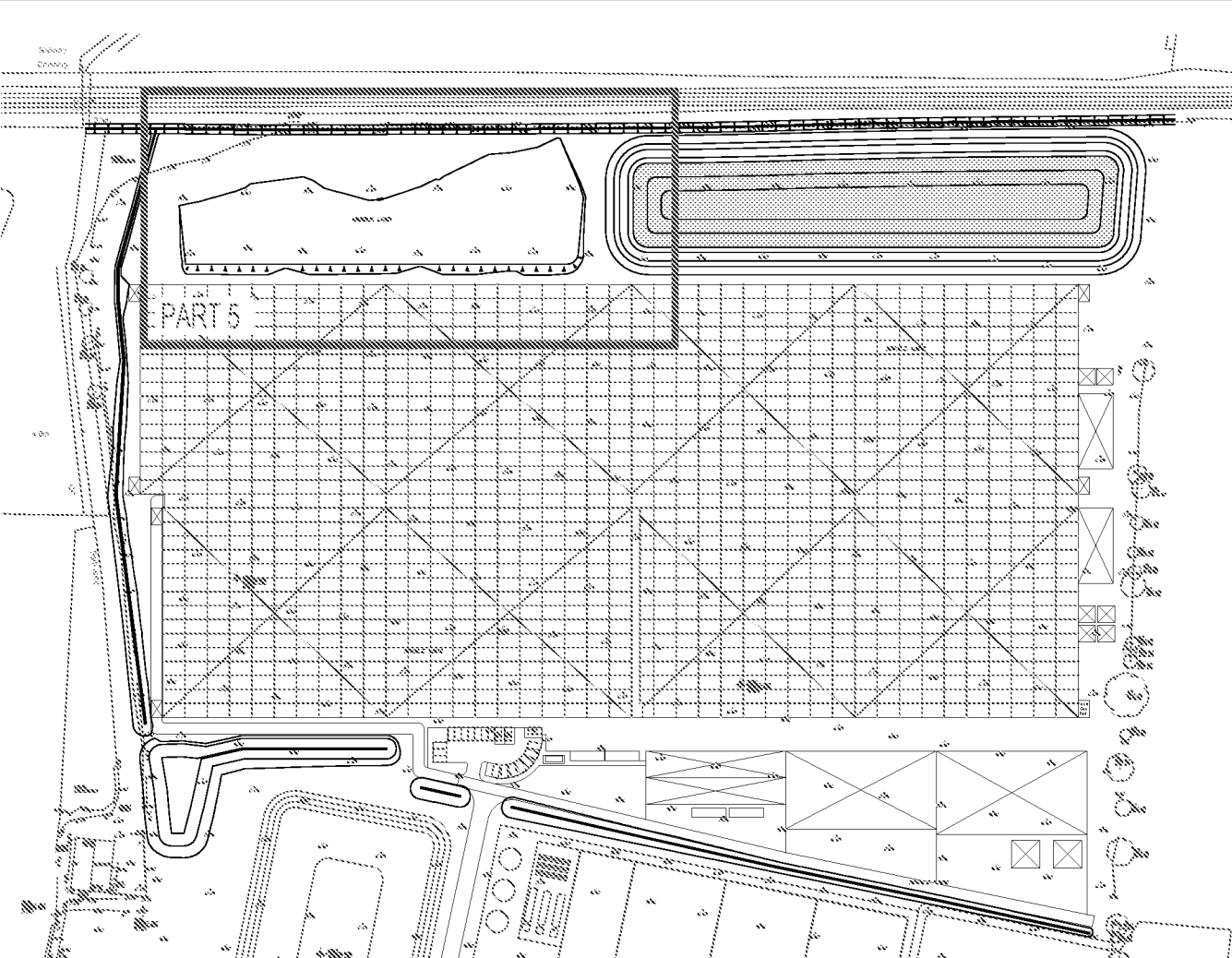
Jackson
purdue lever
6 Hyde Point Drive, Hyde Park, Derry, UZE1 3EX Tel: 01312 304070



C01		27.03.20	ISSUED FOR INFORMATION		MWh	MPW
Rev	Date	Revision Description		Drawn	Auth'd	
Description						
PROPOSED DRAINAGE LAYOUT SHEET 3						
Date	MAR 2020	Drawn	MWh			
Scale	1:250 @A1	Authorised	MPW			
JPL Ref	JD01679					
BIM Ref						
Project	Orig.	Vol.	Level	Type	Role	Number
001679	JPL	ZZ	ZZ	DR	D	4003
Suitability		Revision				
A2 - CONCEPT DESIGN		C01				
Jackson purdue lever PROPOSED DRAINAGE LAYOUT PART 5						

PROPOSED DRAINAGE LAYOUT PART 5

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- A1
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 - ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
 - THIS DRAWING IS BASED ON THE CIVIL ENGINEERING PRACTICE DRAWING No. 23314-21.22.23 AND 24 REV A 03/03/2020.
- Client
- ENVIREAUWATER
- Project Title
- WICKS FARM



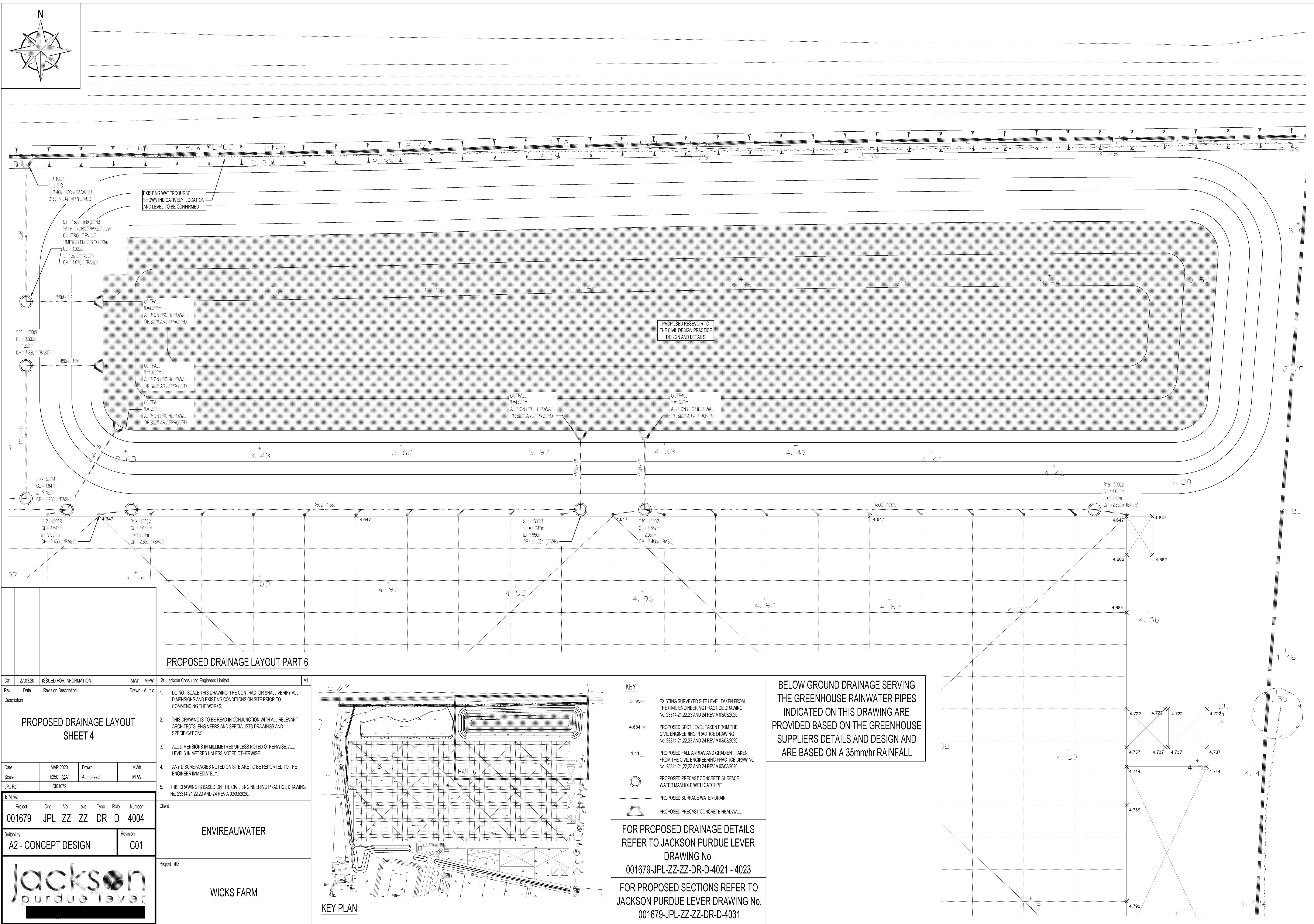
KEY PLAN

- KEY
- 3.95 x
 - 4.684 x
 - 1:11
 - PROPOSED PRECAST CONCRETE SURFACE WATER MANHOLE WITH CATCHPIT
 - PROPOSED SURFACE WATER DRAIN
 - PROPOSED PRECAST CONCRETE HEADWALL

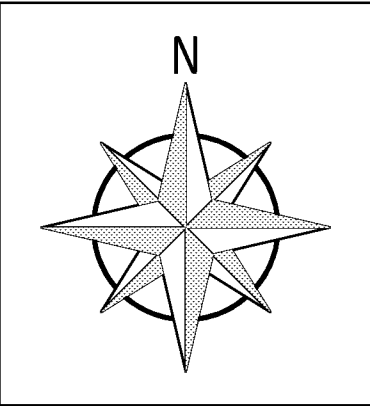
FOR PROPOSED DRAINAGE DETAILS
REFER TO JACKSON PURDUE LEVER
DRAWING No.
001679-JPL-ZZ-ZZ-DR-D-4021 - 4023

FOR PROPOSED SECTIONS REFER TO
JACKSON PURDUE LEVER DRAWING No.
001679-JPL-ZZ-ZZ-DR-D-4031

BELOW GROUND DRAINAGE SERVING
THE GREENHOUSE RAINWATER PIPES
INDICATED ON THIS DRAWING ARE
PROVIDED BASED ON THE GREENHOUSE
SUPPLIERS DETAILS AND DESIGN AND
ARE BASED ON A 35mm/hr RAINFALL

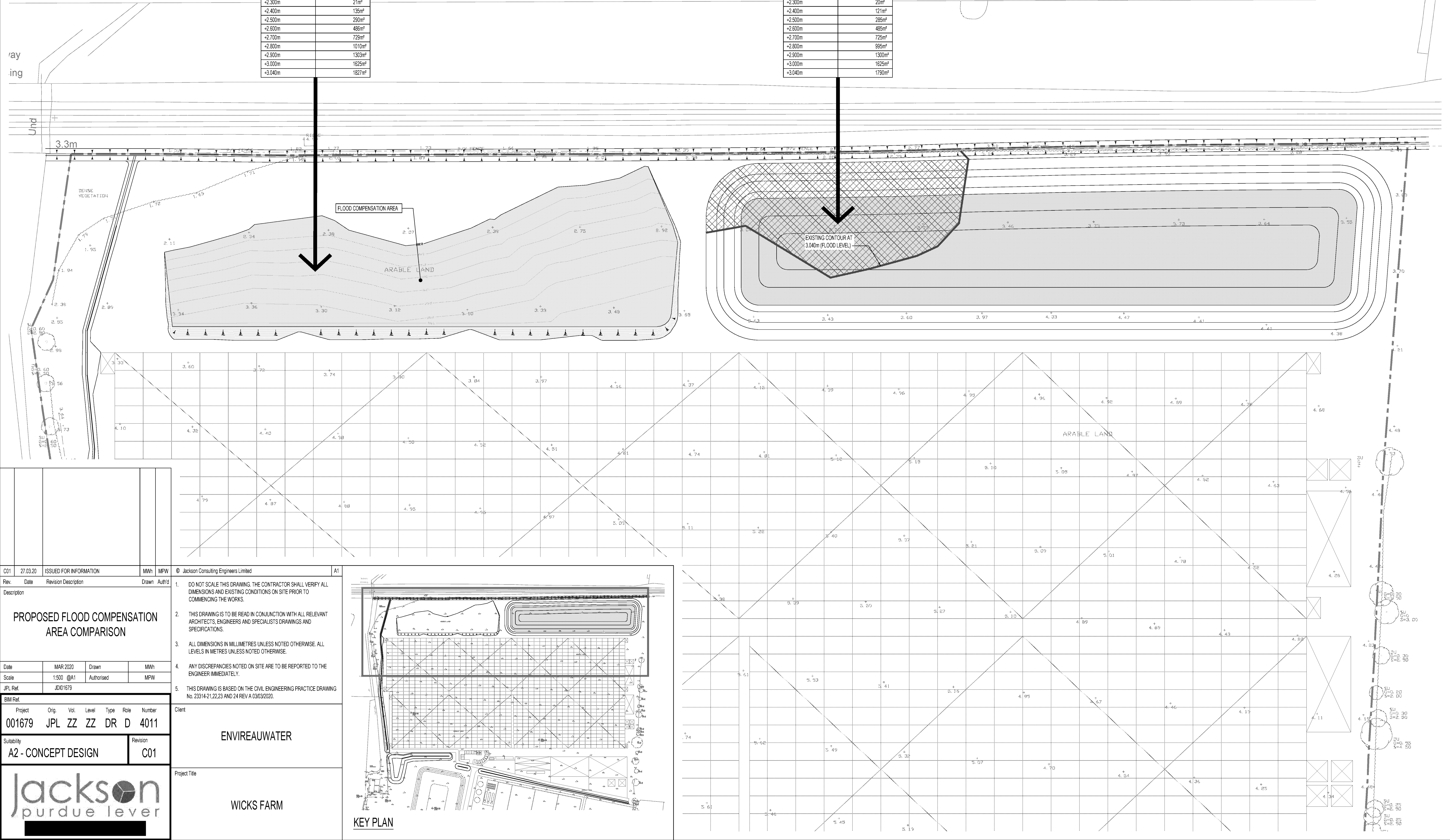


APPENDIX 5
FLOOD COMPENSATION SCHEME



GAIN OF FLOOD PLAIN AREA	
CONTOUR LEVEL	
+2.300m	21m²
+2.400m	135m²
+2.500m	290m²
+2.600m	485m²
+2.700m	725m²
+2.800m	1010m²
+2.900m	1303m²
+3.000m	1625m²
+3.040m	1827m²

LOSS OF FLOOD PLAIN AREA	
CONTOUR LEVEL	
+2.300m	20m²
+2.400m	121m²
+2.500m	285m²
+2.600m	465m²
+2.700m	725m²
+2.800m	995m²
+2.900m	1300m²
+3.000m	1625m²
+3.040m	1790m²



C01		27.03.20		ISSUED FOR INFORMATION		MWh		MPW		© Jackson Consulting Engineers Limited		A1	
Rev	Date	Revision Description				Drawn	Auth'd						
Description													
PROPOSED FLOOD COMPENSATION AREA COMPARISON													
Date	MAR 2020		Drawn			MWh							
Scale	1:500 @A1		Authorised			MPW							
JPL Ref.	J001679												
BIM Ref.													
Project	Orig.	Vol.	Level	Type	Role	Number	Client						
001679	JPL	ZZ	ZZ	DR	D	4011	ENVIREAUWATER						
Suitability							Revision						
A2 - CONCEPT DESIGN							C01						
Jackson purdue lever													

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