

**Whitely Hill Winery, Newsells Park Estate,
nr Barkway, Hertfordshire SG8 8DY**

Proposed Foul Drainage Strategy



View of the Existing Site looking NW.
Bare area is where winery will be sited amongst the vines.

REPORT TO BE READ IN CONJUNCTION WITH DRAWING NO.s 1315-101B & 112

AUTHOR

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Director

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1.0 INTRODUCTION

The purpose of this document is to describe the foul drainage strategy for a proposed new winery to be built at Whitely Hill, nr Barkway, Hertfordshire. The winery is located at approx. grid reference TL379389 and is sited on the Newsells Park Estate, SG8 8DY.

The report is intended to provide adequate information to the local planning authority so that they are able to discharge planning condition no. 19 of the planning permission, reference 23/01420/FP.

2.0 PROPOSED FOUL WATER DRAINAGE SYSTEM

The foul water drainage system treats and disposes of all foul waters emanating from the development on site using a combination of industrial processing coupled with ecological treatment processes; the latter providing great benefits in terms of biodiversity and environmental enhancement.

It should be noted that winery waste is considerably more toxic than domestic human foul waste and is thus treated separately to the normal foul wastewater. A schematic drawing (1315-300) of the system is shown in Appendix I.

The winery estate is treated using an aeration plant to reduce the biological oxygen demand and filter out solids. From there it passes through a natural biofilter and then combines with the foul wastewater and flows into the same wetlands and Willow tree coppice.

The proposed drainage system is shown on drawings 1315-100A and 101B in Appendix II.
The treatment of each separate foul water flow is described below.

2.1 Domestic Human Foul Wastewater

There are no mains sewers in the vicinity of the rural development site. Accordingly, the foul wastewater is to be treated on site using a package treatment plant. The domestic human foul water will be treated on site by a specialist Biodigester PA40 S1 nitrification special (NS) sewage treatment plant in accordance with BS EN 12566-3. After treatment the effluent is mixed with the partially treated winery effluent which is then passed through a series of ecological wetlands that culminates in a Willow tree coppice.

The expected occupancy of the Biodigester PA40 S1 (NS) sewage treatment plant, quotation and data sheet are shown in Appendix III. This will produce a Ammoniacal Nitrogen level to a stringent standard of 5mg/l that is less than the normal EA standard of 20mg/l when discharging to drainage fields or water courses.

This treated waste will be sent to a pumping station where it will mix with the partially treated winery waste that will then be pumped to the ecological treatment ponds. The ecological treatment system has been designed by a specialist, Living Water Ecosystems Ltd; their design documents are shown in Appendix III.

2.2 Winery Hardstanding

The winery hardstanding is an agricultural area that will potentially be a dirty working area. An area of the hard standing is allocated for grape receipt during the picking season and this area is connected to the winery waste system.

2.3 Winery Wastewater

The winery wastewater has a significantly higher level of toxicity than normal domestic foul wastewater. It is generally characterised by a low pH of 3-4, high biological oxygen demand (BOD) (up to 10,000 mg/L), high turbidity (with TSS up to 2,500 mg/L), and high Nitrogen (up to 500 mg/L).

A significant source of the contaminants is in the solids in the wastewater (e.g., skins, pips and stalks). So, stage one is to remove these solids using simple sieves and strainers with the collected solid waste going to a composting site for re-use on the land.

After removal of the solids the wastewater is treated in an underground aeration plant to primarily reduce the BOD and turbidity. This is a large 280000-liter capacity tank that has banks of aeration diffusers set within it that ensure that the waste is kept moving and aerated at all times. The tank vents through pipes located adjacent to the biofilter that discharge any gases at high level.

The aerated effluent is then pumped to a biofilter that uses straw bales to filter the effluent and allows fungi and bacteria to further treat the wastewater. The biofilter uses straw bales as a growing medium for the bacteria and fungi. A drawing of the proposed biofilter is shown on the waste is then run to the pump station used to collect the foul wastewater. From here it follows the same path and process as the foul wastewater as a combined discharge.

4.0 NATURAL TREATMENT OF WASTEWATERS

The scheme utilises natural ecological wetlands and a willow coppice for the final treatment of the combined foul wastewaters. This is very much favoured by The Environment Agency as it will encourage biodiversity whilst treating toxic wastewater. The design of such ecosystems is a very specialist area of expertise that has been provided by Living Water Ecosystems Ltd. A summary of the scheme is attached in Appendix IV.

5.0 SAMPLING OF WASTEWATERS

The scheme will have several sampling points for effluent to ensure the system is working satisfactorily and in line with performance targets.

The sampling points are shown on drawing 1315-101B and will be:-

- Domestic human waste

 - Post-treatment by sewage plant

- Wine Waste

 - Post-aeration

 - Post-biofilter

- Combined Waster

 - Post-wetland 1

 - Post-wetland 2

 - Post-wetland 3

6.0 RISKS

There are some risks to the operation of the system.

6.1 Pump Failure

The design uses several pumps to move the effluent around the system. In all cases the pump sets are duplicated so that a single pump failure will not render the system inoperable. All pumps will be on an alarm system and be subject to a 24hr service contract.

6.2 Aeration Failure

The aeration of the effluent will use air blowers. These will be banked so that one failure will not cause a complete failure of the system. All air blowers will be subject to a 24-hour service contract.

6.3 Power Failure

A total power failure will render the system inoperable as the pumps and air blowers will not work. The winery will have other critical systems such as wine tank temperature control and these can be reinstated using a standby generator set that is either brought in or maintained on site as a permanent back up. During a full power outage the load imposed on the system would be minimal.

6.4 System Fails to deliver Effluent Quality

The regular sampling of the effluent together with service contracts will ensure that the system does not exceed the performance targets. The system has been designed to deliver a very high-quality effluent with headroom that will ensure that any deviations are discovered before the system delivers unacceptable effluent quality.

6.5 Wetlands become Inundated with Rainfall

The edges of the wetland cells are banked to provide a minimum free board of 400mm. Any rain washing down the hill from above will divert around the cells. The soil type is also natural chalk that infiltrates rainwater meaning that significant cross land flows at higher ground levels are unlikely.

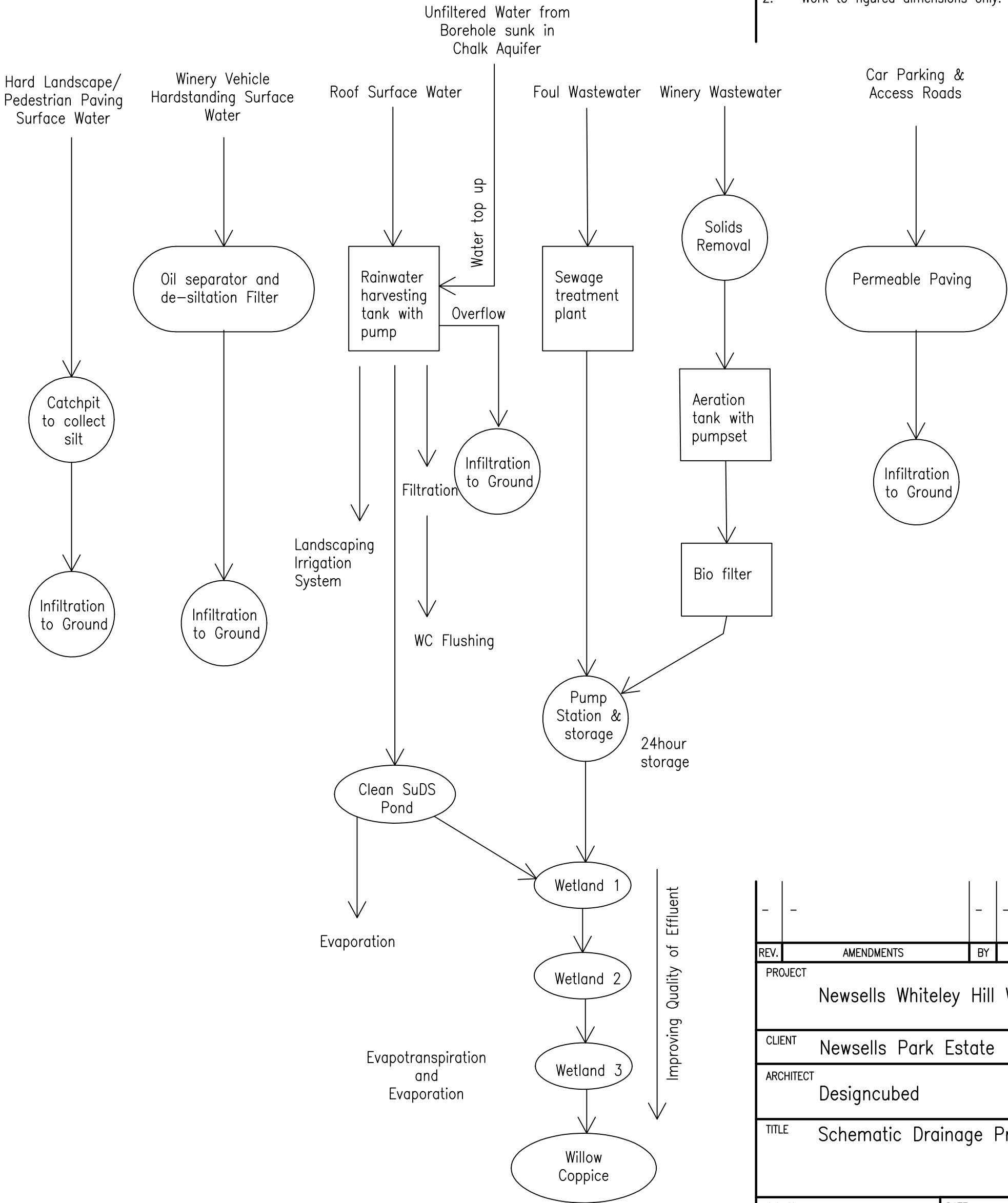
Steve Baldwin
Director
MBA, MEng, CEng MICE

APPENDIX I – DRAINAGE SCHEMATIC

1315-300 – Schematic of the Drainage Process

Notes.

- © This drawing is the copyright of SOLUTION Consulting Engineers Ltd
1. This drawing is to be read in conjunction with the specification and all other relevant Engineer's, Architect's and specialist subcontractor's drawings.
2. Work to figured dimensions only.



REV.	AMENDMENTS	BY	DATE	CHECKED
-	-	-	-	-
PROJECT				
Newsells Whiteley Hill Winery				
CLIENT				
Newsells Park Estate				
ARCHITECT				
Designcubed				
TITLE				
Schematic Drainage Process				
Job No.	1315	DATE	12.05.2023	
		SCALE	nts@A3	
DRAWING No.	300	DRAWN	LC	
		CHECKED	SRB	

SOLUTION

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APPENDIX II – DRAINAGE SCHEME DRAWINGS

Drawing nos.	1315-101B	Underground Drainage Layout – sht 2
	1315-112	Straw Bale Bio Filter Details

Notes.

- © This drawing is the copyright of SOLUTION Consulting Engineers Ltd
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 - Work to figured dimensions only.

NOTES (Underground Drainage)

- All drainage to conform to current British and/or European Standards and Part H of The Building Regulations. All fittings shall hold a current Agreement Certificate and be compliant with the appropriate British Standard for that item.
- All internal foul drainage runs are to be 100mmØ pipework laid at a minimum of 1:40 fall.
- Manhole cover levels are indicative and are to match the proposed ground levels.
- All foul stacks/vent pipes are to have long radius rest bends.
- All foul and rainwater pipes to have rodding access just above ground floor level.
- All internal channels/gullies to be roddable.
- Locations of Stub Stacks (SS), Soil Vent Pipes (SVP), Floor Sockets (FS) & Floor Gullies (FG) are schematic. Refer to M&E/Architects drawings for exact setting out.
- M&E Contractor to ensure the heads of the foul system are vented to open air.
- For above ground building drainage details refer to M&E drawings.
- All existing pipes that are to be retained are to be surveyed for condition and repaired/replaced where necessary.

KEY	
	Manhole reference
	Indicates a 100Ø floor socket
	Indicates a 225Ø Yard Gully
	Indicates a 450Ø PCC Road Gully with D400 hinged cover (DUS88C by Durel)
	Indicates a channel drain
	Indicates a sampling point
	Wine Waste Drain
	Foul Water Drain
	Surface Water Drain
	Drain to be removed

MANHOLE COVER KEY	
D400x600sq	D400x600sq class D400 solid top cast iron cover
D400x450sq	D400x450sq class B125 solid top cast iron cover
B125x450sq	B125x450sq class B125 solid top cast iron cover
B125x450sq	B125x450sq class B125 recessed gully cover
Cover references by Durel Castings Ltd (01324 272424)	

NOTE
ALL NEW SURFACE WATER PIPES TO BE 150Ø uPVC UNO.
ALL NEW FOUL WATER PIPES TO BE 110Ø uPVC UNO.

All Drainage Details shown on drawing 1315-110

KERB KEY	
EF Edging	50x150 PCC edging
HB kerb	250x125 H2 PCC kerb
BN kerb	125x125BN bullnose PCC kerb
TK kerb	Transition between BN & H2

NOTE
Levels to HB, TK, BN kerbs are relative to the wetroom levels NOT the top of kerb. If in doubt ask.

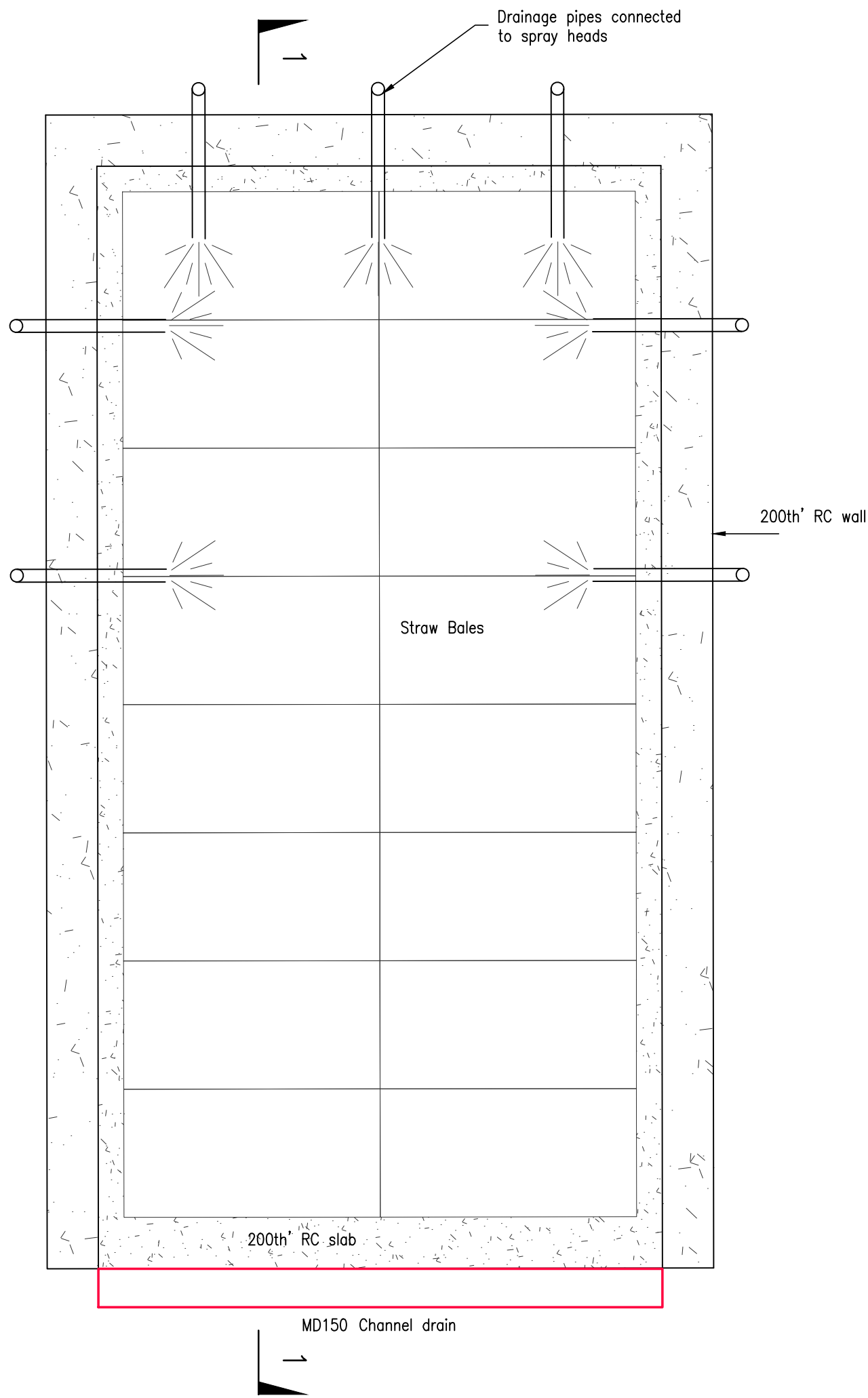
KEY	
	Permeable Surface
	Bound Gravel
	Rock Setts
	Concrete
	Wetlands
	Landscaping
	Permeable Paving
	Porcelain Paving
	Asphalt Bitumast

Manhole Schedule									
MHREF	TYPE	CL	COVERTYPE	IL	IL	Easting	Northing		
F01	1050ØPC	CL 80.82	D400x600sq	IL 79.46	537919.74	239011.22			
F02	1050ØPC	CL 80.82	D400x600sq	IL 79.26	537931.63	239021.93			
F03	1200ØPC	CL 80.82	D400x600sq	IL 79.83	537921.86	239001.04			
F04	1350ØPC	CL 80.81	D400x600sq	IL 79.70	537923.71	239999.01			
S01	1200ØPC	CL 84.20	B125x450sq	IL 80.25	537906.67	239009.56			
S02	1200ØPC	CL 80.84	D400x600sq	IL 80.14	537910.78	239011.06			
S03	450ØPPC	CL 80.80	B125x450sq	IL 80.20	537926.20	239033.75			
S04	450ØPPC	CL 80.84	D400x450sq	IL 80.09	537933.72	239025.40			
S05	1050ØPC	CL 80.84	D400x600sq	IL 79.90	537916.01	239005.25			
S06	1050ØPC	CL 80.85	D400x600sq	IL 80.00	537923.21	239004.20			
S07	1200ØPC	CL 80.85	D400x600sq	IL 79.70	537938.71	239016.15			
S08	1200ØPC	CL 80.87	D400x600sq	IL 79.60	537924.31	238996.14			
S09	1200ØPC	CL 80.87	D400x600sq	IL 79.20	537941.63	239011.68			
S10	450ØPPC	CL 84.35	B125x450sq	IL 83.50	537902.18	238960.34			
S11	1200ØPC	CL 80.83	D400x600sq	IL 79.50	537952.41	239002.49			
S12	1200ØPC	CL 84.40	B125x600sq	IL 80.20	537936.71	238980.95			
S13	1200ØPC	CL 80.80	B125x450sq	IL 79.96	537954.67	238997.12			
S14	450ØPPC	CL 80.85	B125x450sq	IL 80.25	537923.82	238962.51			
S15	1050ØPC	CL 80.80	D400x600sq	IL 80.16	537917.96	239008.12			
S16	600ØGRP	CL 80.84	D400x600sq	IL 79.05	537945.56	239015.24			
S17	600ØGRP	CL 80.84	D400x600sq	IL 78.95	537953.18	239022.10			
S18	1200ØPC	CL 79.90	D400x600sq	IL 78.85	537972.70	238999.93			
S20	1500ØPC	CL 80.84	D400x600sq	IL 79.05	537944.50	239014.28			
S21	1500ØPC	CL 80.30	B125x600sq	IL 78.80	537962.76	238990.99			
S22	1500ØPC	CL 80.84	B125x600sq	IL 78.50	537937.65	238968.37			
S23	1500ØPC	CL 80.75	B125x600sq	IL 78.30	537942.01	238949.45			
S24	1800ØPC	CL 79.30	B125x600sq	IL 77.70	537957.89	238931.82			
S25	1500ØPC	CL 80.30	B125x600sq	IL 78.85	537964.27	238992.34			
S401	2400Ø Spokeway	CL 82.00	B125x450sq	Base IL 78.00	537912.61	238948.75			
W01	450ØPPC	CL 80.81	D400x450sq	IL 79.83	537913.08	239009.27			
W02	1050ØPC	CL 80.85	D400x600sq	IL 79.65	537919.64	239005.86			
W03	1200ØPC	CL 80.87	D400x600sq	IL 78.84	537925.35	239011.00			
W04	450ØPPC	CL 80.85	D400x450sq	IL 79.85	537920.70	239001.33			
W05	450ØPPC	CL 80.84	D400x450sq	IL 80.20	537925.96	238998.84			
W06	1200ØPC	CL 80.87	D400x600sq	IL 78.96	537931.78	239004.08			
W07	1200ØPC	CL 80.87	D400x600sq	IL 79.05	537938.91	239010.50			
W08	1050ØPC	CL 80.80	D400x600sq	IL 79.34	537946.25	239002.40			
W09	1050ØPC	CL 80.83	D400x600sq	IL 79.44	537948.90	238999.46			
W10	1200ØPC	CL 84.48	B125x600sq	IL 80.30	537932.27	238975.52			
W11	1050ØPC	CL 80.85	D400x600sq	IL 79.60	537953.16	238994.73			

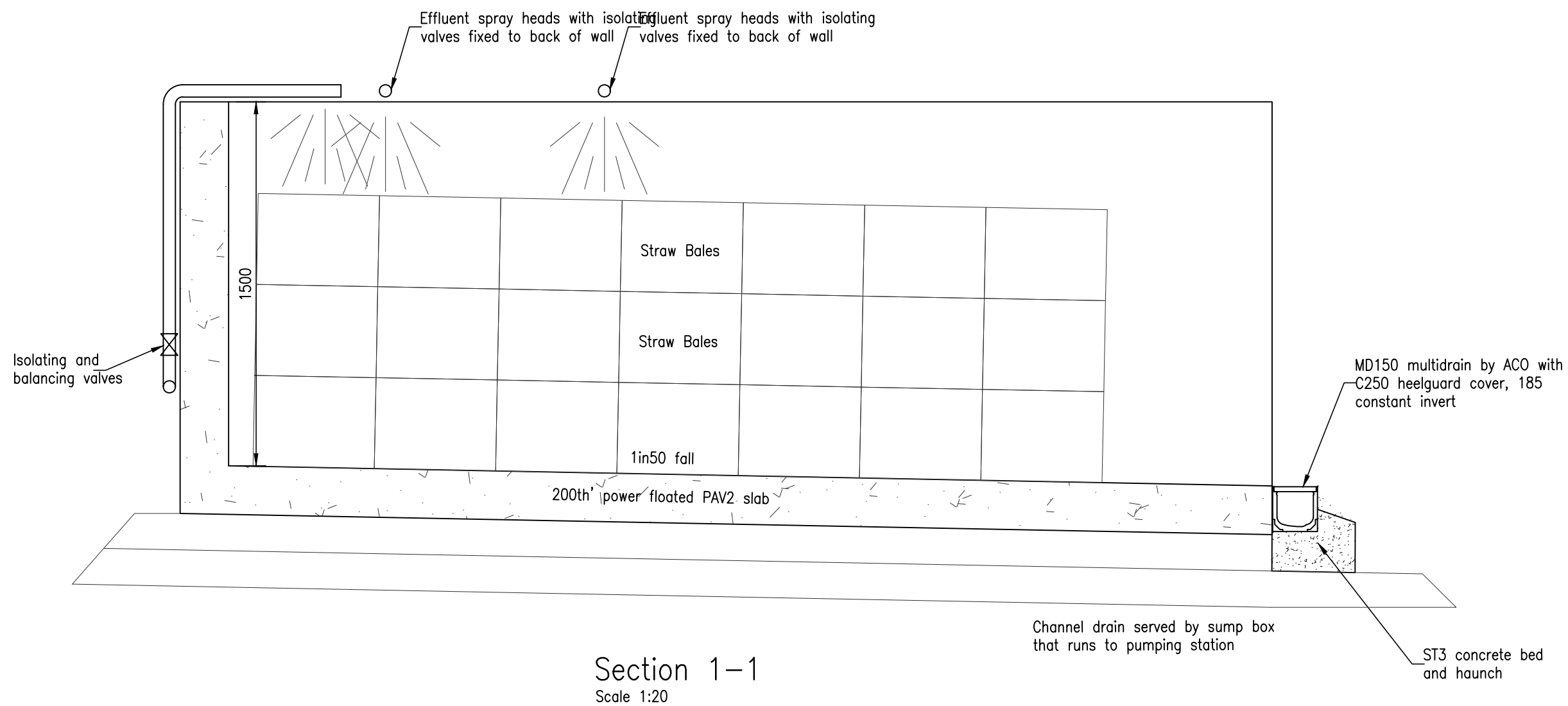
B General design updates.		LC	10.10.24	SRB
A Updated to suit LFA design criteria.		LC	23.05.24	SRB
REV	AMENDMENTS	BY	DATE	CHECKED
STATUS PLANNING				
PROJECT Whiteley Hill Winery				
CLIENT Newsells Park Estate				
ARCHITECT Designcubed				
TITLE Underground Drainage and Externals Plan Sheet 2 of 3				
Job No:	1315	DATE	03.04.2023	
DRAWING No:	101B	SCALE	1:1000AD	
		DRAWN	LC	
		CHECKED	SRB	
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 - Work to figured dimensions only.



Plan of Straw Bale Filter
Scale 1:20



Section 1-1
Scale 1:20

-	-	-	-	-
REV.	AMENDMENTS	BY	DATE	CHECKED
STATUS PLANNING				
PROJECT Whiteley Hill Winery				
CLIENT Newsells Park Estate				
ARCHITECT Designcubed				
TITLE Straw Bale Bio Filter Details				
Job No.	1315	DATE	10.06.2024	
		SCALE	1:20/A1	
DRAWING No.	112	DRAWN	LC	
		CHECKED	SRB	

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APPENDIX III – SEWAGE TREATMENT PLANT

Biodigester Quotation Ref 24Q033 and data sheet



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27 Brightstowe Road
Burnham-on-Sea
Somerset
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Tel: +44(0)1278-786104
Email: sales@biodigester.com

28 May 2024

Our Ref: 24Q033

To: Solution Consulting Engineers Ltd

Dear Laura

NEWSSELLS WINERY
PA40S1 – NITRIFICATION SPECIAL (NS)

I am pleased to set out below our quotation for a Special Biodigester PA40S1 designed for reduction of Ammoniacal Nitrogen as N to the stringent standard of 5mg/l.

Biodigester Products is an established family owned business with 50 years' experience and is one of the UK's leading manufacturers and suppliers of package sewage treatment plants.

The Biodigester PA is constructed in a robust polypropylene tank and is designed for unobtrusive underground installation.

The Biodigester PA is an established product and has been tested in accordance with EN/BS12566 Pt3.

The sewage treatment process has three process stages. The first chamber within the Biodigester PA is for the primary settlement of solids. The secondary treatment process consists of a submerged filter continuously fed with air from a small blower, as a consequence aerobic breakdown of the sewage occurs as a continuous process. Prior to discharge the effluent passes through the final settling chamber where additional settlement of solids occurs. Sludge is automatically returned to the primary settlement chamber and recycling is incorporated for process stability and flow balancing. Please refer to the attached information.

The simplicity of the highly efficient Biodigester PA sewage treatment plant makes maintenance straightforward and economical without the need for specialized personnel. All Biodigester PA's are covered by a two year warranty.

Our company's standard conditions of quotation and contract are enclosed.

Please do not hesitate to contact us if you have any queries or require further information regarding the Biodigester products or their applications.

Yours sincerely



Mark Newbery BA
Director



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Email: sales@biodigester.com

28 May 2023

Our Ref: 24Q033

QUOTATION

NEWSSELLS WINERY

BIODIGESTER PA40 S1 NITRIFICATION SPECIAL (NS) SEWAGE TREATMENT PLANT

Item 1 BIODIGESTER PA40 S1 (NS) SEWAGE TREATMENT PLANT

1 No Biodigester PA40 S1 (NS) package sewage treatment plant manufactured in polypropylene and ready for installation. Complete with one single phase air blower, automatic sludge return with recycling. Control panel housing and alarm system. Specification as stated on the attached data sheet and drawing.

PRICE.....FOR THE SUPPLY AND DELIVERY OF THE ABOVE ITEM:-

£ 14,165

EXCLUDING VALUE ADDED TAX

Availability:- 4 – 6 weeks from the receipt of an official order.

Terms of Payment: 50% deposit with order and balance cleared before delivery or despatch, or in the event of a delay, upon completion of the order.

Validity:- The quotation is valid for a period of 60 days from the date of issue.

Options:-

1. Four heavy duty covers. Up to 40 tons loading for use in a re-inforced slab over the Biodigester sewage treatment plant. Total £1600 + VAT.

2. Integral effluent pumping system.

3. Sample Chamber



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Email: sales@biodigester.com

SCHEME DATA SHEET

SITE:	-	Newsells Winery
		Office or Factory Worker with
		canteen 10
		Drinkers 100

LOAD ESTIMATES:			
SEWAGE FLOW	-	2.20	Cu M/Day
POLLUTING LOAD BOD5	-	1.88	Kg/Day
AMMONIACAL NITROGEN as N	-	0.55	Kg/Day

POPULATION EQUIVALENTS (PE)			
SEWAGE FLOW	-	15	PE
POLLUTING LOAD BOD5	-	32	PE
AMMONIACAL NITROGEN as N	-	69	PE

BIODIGESTER PA40 S1 (NS) SEWAGE TREATMENT PLANT

BIODIGESTER PA MODEL SPECIFIED	-	Biodigester PA40 S1(NS)
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BIODIGESTER PA CAPACITY:			
SEWAGE FLOW	-	6.00	Cu M/Day
POLLUTING LOAD BOD5	-	2.40	Kg/Day
AMMONIACAL NITROGEN as N	-	0.56	Kg/Day

FINAL EFFLUENT QUALITY:			
POLLUTING LOAD BOD5	-	20	Mg/L
SUSPENDED SOLIDS	-	30	Mg/L
AMMONIACAL NITROGEN as N	-	5	Mg/L

BLOWER RATING	-	550	Watts Single Phase
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DESLUDGING FREQUENCY	-	4 - 8	Months approx. – Fully Loaded
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LENGTH	-	4.50	Metres
WIDTH	-	2.124	Metres
HEIGHT	-	1.912	Metres
WEIGHT EMPTY	-	2.2	Tonnes

INLET DRAIN DEPTH	-	600	mm
OUTLET DRAIN DEPTH	-	700	mm

NOTE:- The data provided above is dependent upon exclusion of garbage grinding/waste disposal units, grease and surface water. No toxic substances or biological inhibitors are to be present in the incoming sewage and sufficient alkalinity must be available in the influent. If necessary please contact Biodigester Products for advice.

APPENDIX IV – NATURAL ECOSYSTEM DESIGN

Summary document produced by Living Water Ecosystems Ltd

Ecological System for the Treatment and Evapotranspiration of Winery Effluent and
Sewage, Surface Water Drainage Strategy Habitat Creation and Biodiversity
Enhancement for Newsells Whitely Hill Winery, Royston Hertfordshire

Ecological System for the Treatment and Evapotranspiration of Winery Effluent and Sewage
for Newsells Whitely, Royston Hertfordshire

Plants species for Living Water Ecological Treatment Systems

Willow Trees for the Ecological Treatment System

Drawings 23001-001 Z1
 23001-002-Z2
 23001-003-Z2



Carlingnose Studios, North Queensferry, Fife KY11 1ER

Tel: 01383 415215

Web: www.livingwater.org.uk.

Direct E-Mail: janes@livingwater.org.uk

Ecological System for the Treatment and Evapotranspiration of Winery Effluent and Sewage for Newsells Whitely Winery, Royston Hertfordshire

Please find set out below the design criteria and sizing for an ecological system for the treatment and evapotranspiration of winery effluent and sewage for Newsells Whitely Winery (NWW), Royston Hertfordshire.

The winery effluent has been sized on the future, full production figures, 60,000 to 80,000 75cl bottles expected to be achieved by 2025. The first production of 20,000 bottles is expected to be achieved in the first year 2024 increasing to 40,000 bottles in year 2.

The tonnage of fruit and production wastewater figures have been used to calculate the sizing of the ecological treatment system (ETS). We have also calculated the sizing of the ecological treatment system based on loading figures from French and English wineries for which we have designed ecological treatment systems and summary of these figures are set out in this proposal.

The management and treatment of the solid waste fraction, surface water and rainwater are also described.

Design Considerations

Newsells Whitely Winery (NWW) is a new winery which is expected to have its first harvest in 2024. We have based our design criteria and sizing of the ecological treatment system (ETS) on 80 tonnes of harvested fruit at full production and the other information provided.

Another key design factor is the volume of effluent generated per litre of wine produced. The figures provided are 4 to 6 litres of effluent generated per litre of wine produced. From our work with other wineries, these figures look quite high and with more efficient water management, we expect that the winery could achieve 2 to 3,5 litres of effluent generated per litre of wine produced. We have calculated the effluent on the basis of **3.5 m³** effluent produced per tonne of fruit processed which comes to **280 m³** per season / year. The storage tank should be sized to contain at least **280 m³** to enable the storage of the effluent being generated during the peak processing period which can arise within a 3-month period. Reduced effluent volume generated will enable the reduction in the size of the ETS if the loading remains the same.

The size of the ETS presented in this proposal also includes the treatment of sewage. Our calculations have allowed for 10 staff working across the winery and vineyard as well as additional administrative and hospitality staff and catering for 100 guests / clients for special events.



Living Water Ecosystems Ltd
Directors: Jane Shields and David Shields
VAT Registration Number: 502 5065 89
Registered in Scotland No 181843



For this proposal, we have designed the ETS to be able to treat the volume and loading from a 32-population equivalent discharging to the system in one day. A septic tank or package treatment plant will be required for the primary treatment and settlement of sewage so that settled and / or pre-treated sewage will discharge to the first wetland cell. The Environment Agency is likely to insist on a package sewage treatment plant for this size of development.

The daily treatment and evapotranspiration of winery effluent and settled / pre-treated sewage effluent has been accommodated in the size ETS set out on the accompanying drawing. If the design criteria change, we will need to alter our calculations and sizing of the ETS accordingly.

Raw winery effluent has a very high chemical oxygen demand (COD) (e.g., 80,000 mg/l) and we would recommend that the effluent is aerated in the storage tank to prevent odours and reduce the loading of the winery effluent. The winery effluent would be dosed daily / hourly to the ecological treatment system. Once pumped, the ETS will operate by gravity.

A Living Water Biofilter will be used as a pre-treatment prior to discharging to the ecological treatment system. This will help to remove solids and balance the pH of the incoming effluent. The spent materials will be composted along with any other biodegradable arisings of the vineyard and household can be composted together. Biofilters usually require topping up with materials due to loss of mass due to biological activity and breakdown and will rarely need replacement in full. Once a year at the end of the summer prior to the next harvest the biofilter can be assessed and materials can be replaced or composted as required.

The discharge from the Biofilter would discharge to the first wetland cell of three cascading wetland cells, which would discharge in turn, to the second and third wetland cell in series. The final wetland cell would discharge to a willow coppice which together with the wetland plants evapotranspire the water so there is no discharge to watercourse.

Rainwater and surface water can be captured for irrigation of the vines, other trees, plants or shrubs. Habitats fed by surface water, high level overflow from the rainwater harvesting tanks or the discharge from the ecological treatment system can be created to suit specific species' growth requirements.

The management and treatment of surface water is required for all new developments, and we can integrate surface water in terms of maximising its function and supporting irrigation of vines, crops, wetland habitat and increasing biodiversity.

Rainwater can be captured and recycled for secondary uses such as washing down operations, irrigation and toilet flushing without treatment.

However, if rainwater is used within the winery process, drinking or for food production you will need to treat it with ultraviolet (UV) to ensure pathogens arising from bird faeces on roof surfaces (e.g., Cryptosporidium, E-coli; Salmonella) are removed.

Design Criteria

We have based the sizing on the design criteria provided and those from our work with other French and English wineries with whom we have worked, comprising a daily loading that includes volume and strength of effluent.

There are liquid and solid waste fractions arising from the production of wine that will be treated and reused on site. Each will be discussed in turn.

Design Criteria: Winery Solid Waste

Quantity of solid waste arising from the winery will comprise the following:

The solid fraction of the grapes is estimated to be:

- Stems = 5% harvested fruit
- Skins = 15% harvested fruit
- Seeds = 2% harvested fruit

Based on the above ratios at 80 tonnes production, solid waste = 17.60 tonnes.

We recommend that the solids are composted with the aim of returning it to the soil of the vineyard or on the land. The solid waste from the press can be emptied straight into a trailer so it will not enter the drainage system. The solid fraction will comprise about 80% of the total loading. The solids arising and the must can be placed onto the Biofilter or on a separate composting pile.

The remaining liquid fraction (20%) comprising washings from handling equipment, floors etc. would discharge to the ETS comprising the biofilter, wetland cells and willow coppice).

We would recommend that drains in the processing area discharge via perforated covers to further reduce the percentage of solids in the wash-water as the solids collected will be composted and be returned to the soil. To further reduce the quantity of solids and the loading entering the ETS, a Biofilter stage will be installed. The spent materials can be composted along with the winery solids.

Other sources of material for the composting process would include vine prunings, wood chip or shavings, office paper (shredded), green cuttings from the vineyard and other nutrient rich local compostable materials.

Compost (if it is in the correct consistency) can also be used as part of the treatment process. This will be considered once the system is operational and the compost is ready for use. The system and processes will evolve to meet the vineyard's particular requirements.

Solids in Solution

There will be a small amount of this material entering the system from washing vessels after emptying although this material can also discharge via the Biofilter.

Wetland plants are extremely efficient at removing suspended solids from water and these are mineralised and incorporated into the wetland ecology. Removing the larger solid fractions will prevent the wetlands from filling up too quickly with solids and reduce their longer-term management requirements.

In general, it is better to compost the bulk of the solids arising on site as this will enable the return of the nutrients to the soil as this is the most suitable process and end point from an ecological perspective as it will allow the nutrients to be recycled. Removing the solid fraction from the effluent stream will reduce its loading and consequently will also reduce the size of ecological system needed to treat the effluent.

Design Criteria: Winery Effluent

Wash-water

Wash-water in this case is defined as the amount of water used for cleaning tanks, presses, floors and other harvesting / handling equipment.

Conventional wisdom for wineries puts this anywhere between 0.3 and 2.0 kilolitres (m³) of water per tonne of fruit processed.

The figures provided for the volume of wastewater produced per tonne of fruit processed is 3.5 litres effluent for tonne fruit processed. It is useful to define the water usage to reduce the volume of effluent produced. We recommend that water usage at each stage of wine production and processing is assessed and quantified to ensure that the figures are correct or to find more water efficient methods to reduce the volume of effluent generated.

Water efficiency should be encouraged for a wide range of reasons, but by reducing the volume of wastewater you will reduce the amount of storage necessary and the size and cost of the ecological system which will need to be larger to accommodate higher volumes and subsequent loading of the wastewater.

Although the proposed ecological system can handle high volumes of water it is worthwhile to consider maximising water efficiency as part of the winery process to reduce the volume of effluent generated.

If there is sufficient storage capacity of the winery effluent, it would be possible to dose the ecological system over a longer period to reduce the daily volume and loading thus reducing the size of ecological system required to treat the effluent.

Cleaning Chemicals

Please set out how the winery tanks are cleaned, the cleaning regime proposed and the cleaning products that are used.

Characteristics of Vineyard Effluent:

Vineyard effluent arises from three main processes which will be discussed in turn:

- Grape Harvest and Pressing: grape juice extraction.
- Racking
- Removal of Tartrates

Contaminated water also arises through bottling and washing down surfaces and floors.

The effluent consists mainly of sugars, alcohols, yeasts plus caustic soda and citric acid rinse used in washing and sanitising equipment and floors. If discharged to a watercourse, the decomposition of these materials by bacteria will consume oxygen, endangering aquatic life.

An indication of the concentration of pollutants in vineyard effluent for white wine production in the Champagne region of France is set out below. This will need to be compared to the effluent produced by the NWW Winery once in operation.

Grape Harvest and Pressing: grape juice extraction:

During the grape harvest, stalks and leaves are removed. These should be set aside for composting.

1) Crushed grapes are stored in vats to start the fermentation. Wine effluent is a result of washing the equipment and consists mainly of skins, yeasts and sugars. The solids from this process should be removed directly (without water, if possible) and used for composting or placed on the Biofilter.

2) Pressing – crushed grapes are pressed to extract juice; solids are sent to be distilled. The effluent is the result of washing the equipment and is mainly fermentation products.

After pressing the juice, it can be allowed to settle overnight in stainless steel tanks. It is helpful if no chemicals are added to the musts to aid settling. Tank lees could then be removed from its vessel and put into 1000 litre plastic vessel(s) for spraying back onto the vineyard and / or addition to compost piles. The use of the tank lees will reduce the loading and solids entering the ecological treatment system.

3) During the grape harvest, stalks and leaves are removed. These should be set aside for composting.

The loadings set out below and overleaf are based on traditional French wineries and we have retained these as upper guidelines until we have actual data arising from the NWW winery operations.

Grape Juice Extraction: Grape Harvest and Pressing

Parameters	Value
pH	4.1 to 6.2
Suspended Solids (mg/l)	940
BOD ₅ (mg/l)	4,800
COD (mg/l)	9,900
Total Nitrogen (mg N/l)	140
Phosphorus (mg P / l)	40
Potassium (mg/l)	290

Racking:

During racking, liquid is decanted from the sediment.

The effluent from this process will include a high portion of suspended solids with a high biochemical (BOD) and chemical oxygen demand (COD).

The solids from this process should be removed directly (without water, if possible) and composted or placed on the biofilter.

Will the wines undergo one or more racking prior to bottling? If there is one racking and no filtration or fining, this will reduce the volume and loading on the ETS.

Parameters	Value
pH	3.9 to 6.5
Suspended Solids (mg/l)	1,250
BOD ₅ (mg/l)	2,650
COD (mg/l)	5,300
Total Nitrogen (mg N/l)	220
Phosphorus (mg P / l)	25
Potassium (mg/l)	200

Removal of Tartrates:

Tartrates are crystals of tartaric salts that accumulate on the walls of wine vats. Caustic soda is used to wash the tartrates off the inside of the vats. Large volumes of water are used with caustic soda creating an effluent with a very high pH and biochemical loading. Below are two sets of parameters for vineyard effluent in France. They are quite different, but we have used the higher concentrations in our calculations.

Will a caustic soda rinse and / or a citric acid rinse be used to wash down the walls of the stainless-steel tanks?

If most of the solids have been removed in advance, this will reduce the quantity of solids and loading needing treatment and the volume of rinses needing to be used in the removal of tartrates.

The combination of the two rinses should balance the resultant discharge.

Parameters	Value
Volume	92 m ³
Effluent (litres)	1,000
Caustic Soda	35 kg
pH	12.05
BOD ₅ (mg/l)	42,500

Removal of Tartrates:

Parameters	Value
Volume	53 m ³
Effluent (litres)	400
Caustic Soda	25 kg
pH	11.60
BOD ₅ (mg/l)	84,670

From the above figures it appears that the ratio of COD₅: BOD₅ is consistently 2:1. We have calculated the loading for the wine effluent produced during harvesting, pressing and racking using figures from French vineyards as upper guidelines.

In our calculations for the sizing of the ETS, we have estimated a reduction in the loadings according to our knowledge and experience based on the sustainable practices that can be applied. There are some parameters that will not change too much and others that could change substantially.

The loading arising from the removal of tartrates is very high. If the bulk of the solids can be physically removed without the use of water so only a limited amount of water is used to wash these solids out, then the solids can be composted. This will substantially reduce the quantity of caustic soda required and the volume and loading of the effluent arising from washing the wine vats.

The practices set out above will reduce the loadings for this process and this is reflected in our sizing calculations. We are sizing the system on the basis that you will follow the above methodology which will greatly reduce the volume and loading of the effluent stream.

We propose to treat the effluent over 12 months starting when the wine processing starts and continues through the year when there is no production on site. The sizing of the treatment system is based on the above loading and flow rates. If any of the figures or assumptions changes, we will need to alter our proposal accordingly. During the detailed design we will develop the design and confirm the volume, loading and dosing rates.

In order to provide an ecological treatment system of a reduced size, we are proposing to use one or more storage tank(s) to provide sufficient storage for at least the peak flows and washing water produced during the 21 days of peak production. On our calculations the storage tank should be able to store and aerate a tank containing 280 m³. This will enable the highest volume and loading to be spread so that the ecological treatment system receives a lower volume and loading on a daily basis.

This accomplishes mixing / pH balancing and also allows us to dose the effluent into the ecological treatment system at a suitable rate. The effluent would be dosed during the 12 months with the aim to have treated the full volume over the course of the year so that it would be ready for filling when the production period commences in September.

As the loading decreases after the peak production period, the ecological treatment system can receive higher volumes on a daily basis. This allows for increased flexibility in the dosing regimen.

Wine production			
Fruit/year (te)	80		
Effluent per te (m3)	3.5		
Effluent per year (m3)	280		
Production effluent	Harvesting, pressing and racking	Other ops (washing, bottling etc)	Tartrate removal
vol per year (m3)	280	60	2
BOD (g/m3)	7500	1500	42335
BOD per year (g)	2100000	90000	84670
Total BOD (g/year)	2274670		

	g BOD/day
Winery Effluent dosed 352 days/year	6462
Winery Effluent dosed 240 days/year	9478
Winery Effluent dosed 210 days/year	10832
Domestic Wastewater	752

	g COD/ day
Winery Effluent dosed 352 days/year	9693.2
Winery Effluent dosed 240 days/year	14,216.7
Winery Effluent dosed 210 days/year	16,247.6
Domestic Wastewater	752

Sizing of Ecological Treatment System:

The raw winery effluent (with reduced solids from management) would discharge to an aerated storage tank which would be sized to hold ideally, 21 days of the peak winery production. The effluent in the storage tank would be dosed over 352 days (to the 2 Biofilter bays (46 m² / 88 m³) / (each 23 m² / 44 m³).

We have chosen to dose the peak loading over a period of 365 days. Any other effluent arising during the rest of the year would discharge via the aerated storage tank to the Biofilter which would discharge directly to the first wetland cell.

Sewage discharging from a package treatment plant would discharge to the sump after the Biofilter which would then be pumped to the top of Wetland 1.

The three wetland cells (that receive the effluent which is pre-treated in the Biofilter) would require a 300 m² area to treat the volume and loading of winery effluent plus sewage. The wetland would be divided into three, lined wetland cells in series. Each of the 3 wetland cells would have a 100 m² area.

From an ecological perspective it is better for the treated winery effluent and sewage to be discharged to trees rather than a watercourse. We achieve this by discharging the treated, high-quality water from the wetland cells into a willow coppice which comprise the Living Water ecological treatment system. The ETS provides benefits to wildlife and the environment while eliminating the need to discharge to watercourse.

In order to evapotranspire the treated water arising from the ETS as a whole, the last wetland cell in the series would discharge into a 300 m² willow coppice. The wetlands and willow coppice will provide both evapotranspiration and habitat creation.

Please refer to the attached drawings of the Ecological Treatment System:

Ecological Treatment System Layout Drawing 23001.001 Rev. B (A1 and A3 sizes).

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Ecological System for the Treatment and Evapotranspiration of Winery Effluent and Sewage, Surface Water Drainage Strategy Habitat Creation and Biodiversity Enhancement for Newsells Whitely Hill Winery, Royston Hertfordshire

The strategy for the Newsells Whitely Hill Winery development with regard to the management and treatment of trade (winery) and foul (sewage) effluent and waste plus surface water and the enhancement of biodiversity is summarised below. Please also refer to the relevant appendices for more detail and supporting information.

The aim of the ecological treatment system (ETS) and utilising a natural approach to drainage and landscaping at the Newsells Whitely Winery is to:

- To attenuate and treat winery effluent and pre-treated sewage to excellent standards on a daily basis, using a carbon neutral / negative ecological treatment system.
- Evapotranspire winery effluent and pre-treated sewage in the ecological treatment system that includes a willow coppice so that no discharge to watercourse is required.
- Capture, attenuate and treat roof and surface water to provide water for toilet flushing, recycling, irrigation and habitat creation.
- Create a new surface water wildlife pond to maximise biodiversity.
- Our diverse ecological systems are multifunctional providing substantial and diverse aquatic, wetland, shrub, tree and meadow habitats and wildlife corridors. We plant native wildflower and grass seed mixtures on the edge of our wetland and swale systems increasing biodiversity and food for insects and birds. If there are particular species or habitats required to support rare species, we can choose specific plants and design our ecological systems to meet the requirements.

Winery Effluent, Foul Drainage, Waste and Surface Water Treatment Strategy

The Ecological Approach and Ecological Treatment Systems

In nature there is no waste, since the waste of one organism is food for another. Living Water's ecological treatment systems (ETS) comprise wetland, soil and woodland ecologies which are designed to feed on the nutrients contained within the effluent or waste.

Wetlands, in nature, carry out water purification, through the trapping and transforming of sediments, nutrients and toxins and are hydrological regulators, providing flood control through moderation of storm flows. Wetland plants have evolved unique symbioses with a wide range of bacteria, fungi and invertebrates that enable them to survive in harsh and wet environments. This symbiosis consists of the plants providing a safe habitat and oxygen to the bacteria, fungi and invertebrates in anaerobic and water environments, in return for attracting and transforming water-soluble nutrients and minerals into a form that can be



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utilised by plants. Wetland plants have also developed chemical complexes that protect this symbiosis from competition, and roots and rhizomes that can attract elusive minerals and nutrients and ensure effective replication. These features are characteristic only of wetland plants.

In our constructed wetland and pond treatment systems, we utilise these characteristics and aim to mimic the natural processes occurring in wetland habitats which are applied to the treatment of contaminated water and waste. Each plant species has a different bacterial, fungi and invertebrate symbiosis and therefore will respond to the effluent differently. In our ETS we specify the best mix of species to treat a particular effluent streams and work with over 60 native wetland species in our treatment systems.

In addition to wetlands, we utilise soil and woodland habitats and plant trees which together through natural processes can remove nutrients and liquid from the effluent and waste streams arising.

The ecological treatment system designed to treat winery effluent and waste as well as sewage at Newsells Winery development comprises a biofilter utilising fungi and bacteria and three wetland cells plus a willow coppice that together treats and evapotranspires the daily discharge. Please refer to the attached layout drawing and supporting information providing further detail and specie lists.

Winery Effluent Treatment Strategy

A Living Water ecological system is proposed for the treatment of winery effluent sized on the future, full production figures, 60,000 to 80,000 75cl bottles expected to be achieved by 2025. The first production of 20,000 bottles is expected to be achieved in the first year 2024, increasing to 40,000 bottles in year 2.

Vineyard effluent arises from three main processes:

- Grape Harvest and Pressing: grape juice extraction
- Racking
- Removal of Tartrates

Contaminated water also arises through bottling and washing down surfaces and floors.

The effluent consists mainly of sugars, alcohols, yeasts plus caustic soda and citric acid rinse used in washing and sanitising equipment and floors. If discharged to a watercourse, the decomposition of these materials by bacteria will consume oxygen, endangering aquatic life. However, our Living Water ecological treatment systems are designed to feed on the nutrients contained within the effluent and solid waste fractions transforming them into growth of all the inhabitants of the complex ecology.

Winery effluent and wash-water is defined as the amount of water used for cleaning tanks, presses, floors and other harvesting / handling equipment. Conventional wisdom for wineries puts this anywhere between 0.3 and 2.0 kilolitres (m³) of water per tonne of fruit processed.

Water usage at each stage of wine production and processing will be quantified and optimised to maximise water efficiency that will reduce the volume of effluent generated. Any leachate arising from the biofilter and composting process will also be treated in the ETS.

There are solid and liquid waste fractions arising from the production and bottling of wine. The solid fraction consists mainly of the stems (5% of harvested fruit), skins (15% of harvested fruit) and seeds (2% of harvested fruit). These solids and musts which can contain up to 80% of the loading, are removed prior to washing down to a Living Water Biofilter for processing.

Other sources of material for the bioremediation and composting processes can include solids captured during washdown, vine prunings, wood chip or shavings, office paper (shredded), green cuttings from the vineyard and other nutrient rich locally derived, compostable materials.

Wetland plants have evolved a unique symbiosis between a wide range of bacteria, fungi and invertebrates that enable them to survive in harsh and wet environments and our ETS utilises these plus soil and woodland ecosystems to transform effluent and waste into clean water and healthy soil, respectively. The ecological treatment system will be described separately, and in more detail, below.

Foul Drainage and Wastewater Treatment Strategy

In addition to the staff associated with Newsells Winery and Vineyard there will also be more staff working in the hospitality building containing a kitchen that will enable the client to cater for special events with up to 100 guests. The volume and loading from sewage and foul drainage arising from staff and operations have been calculated. The volume and loading of sewage are equivalent to a 66 full-time population equivalent (pe). Foul drainage will be captured and pre-treated in a sewage package treatment plant (PTP) that can achieve a secondary treatment standard. The discharge from this PTP will discharge to the ecological treatment system, which will be able to provide treatment to a very high tertiary quality that would enable the treated sewage to be safely discharged to land or a watercourse.

The winery wastewater will discharge via the Biofilter hosting fungi and bacteria that will adapt and pre-treat the winery effluent, prior to discharging to the first wetland cell. Pre-treated sewage will discharge after the biofilter and join the pre-treated winery effluent that will be discharged to the first wetland cell.

The combined winery effluent and foul drainage will be treated and evapotranspired in the ecological treatment system consisting of three wetland cells in series discharging to a willow coppice so there is no requirement for a discharge to watercourse. Please refer to the attached layout drawing and supporting information in the relevant appendices.

Surface Water Strategy

The aim of the surface water strategy is to attenuate and treat surface water arising from the development using an ecological approach to ensure that surface water can be captured and reused. All water discharging from the site will always be attenuated and high quality that will meet Environment Agency specifications and will also prevent downstream flooding.

Surface water will be collected from roofs of buildings and from a surface water drainage network that will capture and direct the water to an underground rainwater harvesting tank.

A rainwater harvesting tank will be located beneath the service apron and the water will be used for toilet flushing and other secondary uses within the hospitality building.

A borehole located to the south can be used to top-up the rainwater harvesting tank or the SUDS ponds should it be required during periods of drought.

The water extracted from the borehole will be hard water. Saltmarsh wetland plants that can tolerant high levels of salt will be planted on the pond marginal shelves. A high-level overflow from the rainwater harvesting tank will discharge to the SUDS wildlife pond or used for irrigation. The pond will be designed to maximise attenuation and wildlife habitat while also serving as a source of clean water that can be used for irrigation during periods of drought or for secondary uses. The overflow from the pond will discharge to the willow coppice.

Biodiversity Net Gain (BNG)

Biodiversity means the presence of a wide variety of life forms, both plants and animals. Life includes bacteria, invertebrates, micro-organisms, insects and fungi, all of which are essential for a healthy ecology and functioning of the major cycles of soil enrichment and cleansing. Enhancement of biodiversity requires the creation or improvement of the infrastructure or habitat on and in which the ecological food web can develop and thrive.

To increase biodiversity, it is not enough simply to improve the immediate environment; it is essential to place the habitat in its wider context. For example, if a pond is created without a marginal shelf and surrounding vegetation, it will not be able to sustain fish. Fish require plants for shelter, to lay eggs on, and in order to attract food insects. Amphibians require shallow marginal shelves and deep, damp vegetation outside the pond. If there are no fish, birds that feed on fish will also not be present. We try to encourage endangered species by designing specific habitats and planting specific plants or trees that create ideal conditions.

Freshwater habitats, meadow areas and woodlands contain food for birds, bats, fish and amphibians. On a larger scale, it is desirable to create wildlife corridors that link different habitats, enabling species to move uninhibited from one area to another, widening their range and thus their viability as a species. Land animals such as deer, badger, fox and hedgehogs all benefit from wildlife corridors linking woodlands, agricultural land, hedgerows and set-aside areas.

Our ecological treatment system and wildlife pond with a marginal shelf will increase biodiversity by improving the quality of water and providing both wetland and woodland habitat and creating wildlife corridors that can link the vineyard and the surrounding environment. Please refer to additional supporting information in the appendices.

Raingardens and ecological systems are multifunctional and in addition to providing excellent treatment and attenuation of surface water will provide landscaping, habitat creation and biodiversity enhancement.

Birds and bats attracted to woodland habitats will also feed in wetland habitats, but wetlands also attract a different selection of bird species, wild fowl, amphibians and bats suited to wetland and pond habitats because of the presence of water and insects.

Below and overleaf are a selection of birds, amphibians and bats that will be attracted to wetland habitats.

Blackbird	Greenfinch
Blue Tit	Sparrows
Bullfinch	Linnet
Chaffinch	Moorhen
Chiffchaff	Song Thrush
Collared Dove	Whitethroat
Cuckoo	Wren
Great Tit	Yellowhammer
Ducks (e.g., Mallard)	Pintail
Teal	Pochar
Gadwell	Widgeon

Swans	Reed and other Warblers
Geese	Raptors (varied range)
Owls	Kingfisher
Swallows	Water Pipit
Wagtails	Terns
Gulls	Stonechat
Sandpipers	Moorhen
Coot	Plovers
Curlew	Lapwing
Redshank	Greenshank

Wetland plants are perennial and thus can provide nutritious and varied food year-round for all types of birds, insects, bats, amphibians and reptiles. All parts of the wetland plant are edible and thus seeds, buds, stems, rhizomes and roots all provide different sources of food for the birds listed above as well as providing protection and breeding habitats for birds, fish, amphibians and insects. The wetland and water environment will attract a different selection of bird species, wild fowl, amphibians and bats because of the presence of water and insects.

The wetland habitats, pond and swales will provide additional habitats with varied food sources and will complement the woodland species proposed along the Raingardens Trail.

Amphibians that will be attracted to the Living Water ecological treatment systems include:

Common Frog	Common Toad	Smooth Newt	Pulmate Newt	Crested Newt
<i>Rana temporaria</i>	<i>Bufo bufo</i>	<i>Triturus vulgaris</i>	<i>Triturus helveticus</i>	<i>Triturus cristatus</i>

Many of the algae, floating aquatic species, marginal and emergent wetland plants and seed heads of wetland plants provide food year-round to wildfowl and other birds. Overwintering buds are eaten by wildfowl and a range of birds.

Wetland habitats provide excellent habitats for Palmate, Smooth and Crested Newts and invertebrates and provide feeding areas for fish and ducklings. Dragonflies and Damselflies thrive in wetland habitats.

Wetland habitats also attract a wide range of bats. There are 17 bats living and breeding in the UK. At least nine are hardy enough to survive in Scotland. These include:

- Soprano Pipistrelle (Scotland's most common bat)
- Common Pipistrelle
- Nathusius Pipistrelle
- Brown long-eared bats
- Noctule (biggest, noisiest & fastest bat in Scotland)
- Leisler's bat
- Daubenton's bat
- Natterer's bat
- Whiskered bat
- Brandt's bat

The following species have been chosen for their suitability to the chalk soil type found at this site and for their value in conservation for habitat creation and increasing biodiversity.

Plants and Small Trees for Hedgerows and Landscaping at Newsells Winery: Chalk Soil

Acer campestre	Field Maple
Cornus sanguinea	Dogwood
Corylus avellana	Hazel
Crataegus monogyna	Hawthorn
Euonymus europaeus	Spindle Tree
Ilex aquifolium	Holly
Ligustrum vulgare	Common Privet
Pyrus communis	Wild Pear
Quercus robur	Pedunculate Oak
Viburnum lantana	Wayfaring Tree
Viburnum opulus	Guelder Rose

John Chambers Pro Calcareous Soils 100% Wildflower Seed Mix

Product Code: 130JC8001-pro

John Chambers Pro Calcareous Soils 100% Wildflower Seed Mix has been designed and mixed with a range of wildflower seed for the professional installer, the Pro-range provides a series of mixes that have been modified to include more commonly found species to suit a wide variety of growing conditions. These mixes provide the professional installer with a beautiful wildflower habitat, encouraging biodiversity in urban landscapes and is backed up by the John Chambers promise of superior quality wildflower seed for your project. Usage: Most suited to flowering in late summer. Sowing Rate: 1 – 2 g/m²

John Chambers Pro Calcareous Soils 100% Wildflower Seed Mix – Common Bird's Foot Trefoil, Common Vetch, Common Poppy, Cowslip, Dropwort, Kidney Vetch, Lady's Bedstraw, Meadow Buttercup, Meadow Crane's-bill, Musk Mallow, Oxeye Daisy, Ribwort Plantain, Salad Burnet, Selfheal, Common Sorrel, Small Scabious, Wild Carrot, Wild Marjoram.

Please see the attached supporting documents and species lists that set out how wetland species support biodiversity.

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Plant species for Living Water Ecological Treatment Systems

<i>Acorus calamus</i>	Sweet-scented rush
<i>Alisma plantago</i>	Water plantain
<i>Butomus umbellatus</i>	Flowering rush
<i>Calla palustris</i>	Bog arum
<i>Caltha polypetata</i>	Petalled marsh marigold
<i>Caltha palustris</i>	Marsh marigold
<i>Carex acuta</i>	Slender-spiked sedge
<i>Carex acutiformis</i>	Lesser pond sedge
<i>Carex pendula</i>	Pendulous sedge
<i>Carex riparia</i>	Greater pond sedge
<i>Glyceria maxima</i>	Reed sweet-grass
<i>Iris pseudacorus</i>	Yellow flag
<i>Juncus effusus</i>	Soft rush
<i>Juncus ensifolius</i>	Broad-leafed rush
<i>Juncus inflexus</i>	Hard rush
<i>Mentha aquatica</i>	Water mint
<i>Mimulus guttatus</i>	Yellow monkey flower
<i>Mimulus luteus</i>	Blood-drop Emulet
<i>Phalaris arundinacea</i>	Reed canary grass
<i>Phragmites australis</i>	Common reed
<i>Rumex hydrolapathum</i>	Water dock
<i>Ranunculus flammula</i>	Lesser spearwort
<i>Ranunculus lingua</i>	Great spearwort
<i>Ranunculus peltatus</i>	Pond water crowfoot
<i>Ranunculus multiplex</i>	Spearwort
<i>Sagittaria latifolia</i>	Broad-leafed arrowhead
<i>Sagittaria sagittifolia</i>	Arrowhead
<i>Scrophularia aquatica</i>	Water figwort, water betony
<i>Scrophularia nodosa</i>	Common figwort
<i>Sparganium erectum</i>	Branched bur-reed
<i>Scirpus lacustris</i>	Common bulrush
<i>Typha angustifolia</i>	Lesser reed-mace
<i>Typha latifolia</i>	Reed-mace



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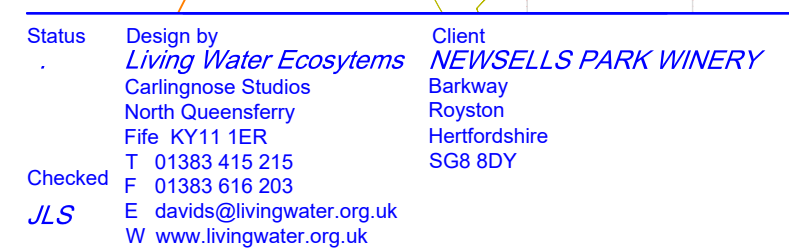
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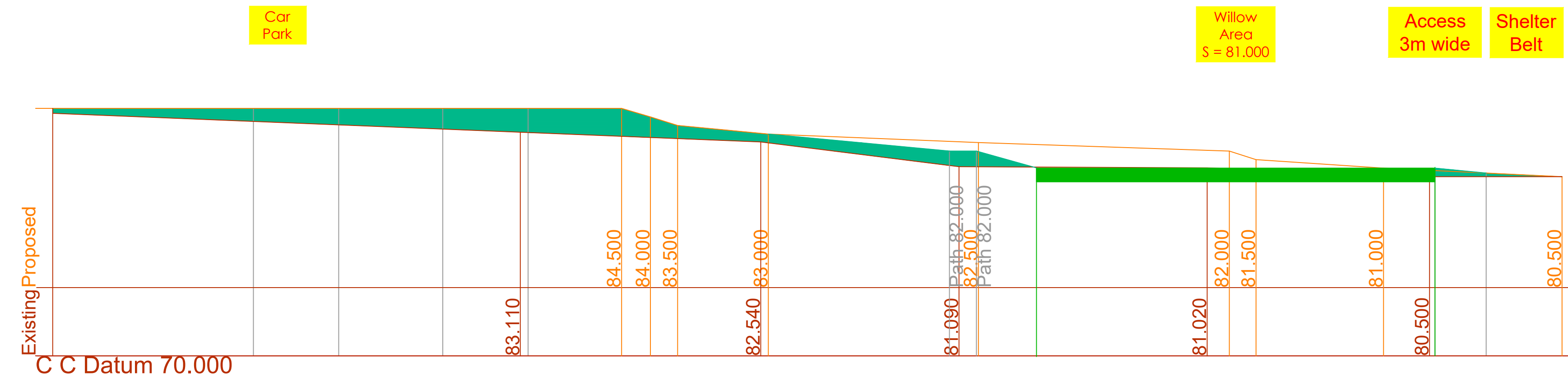
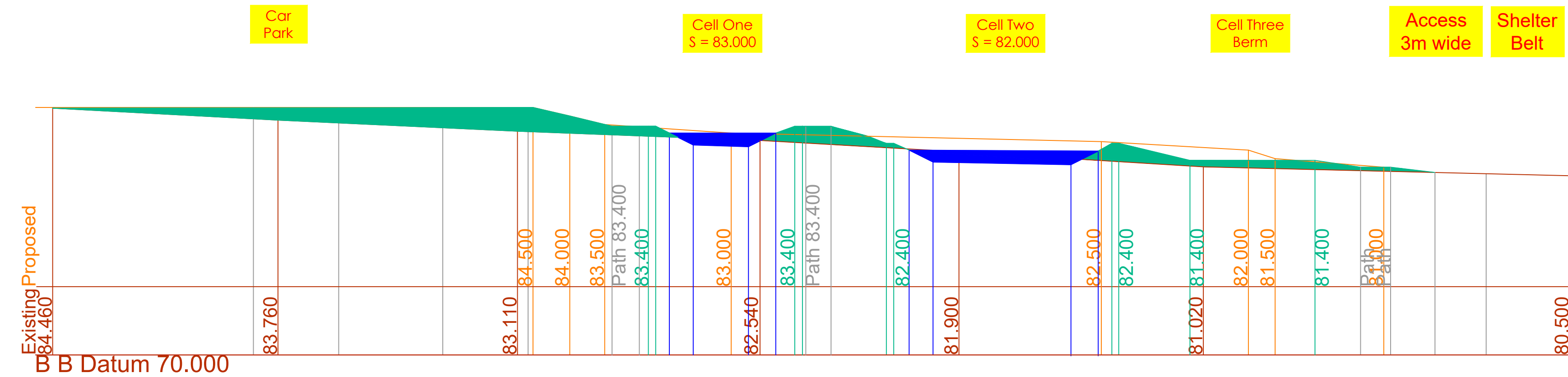
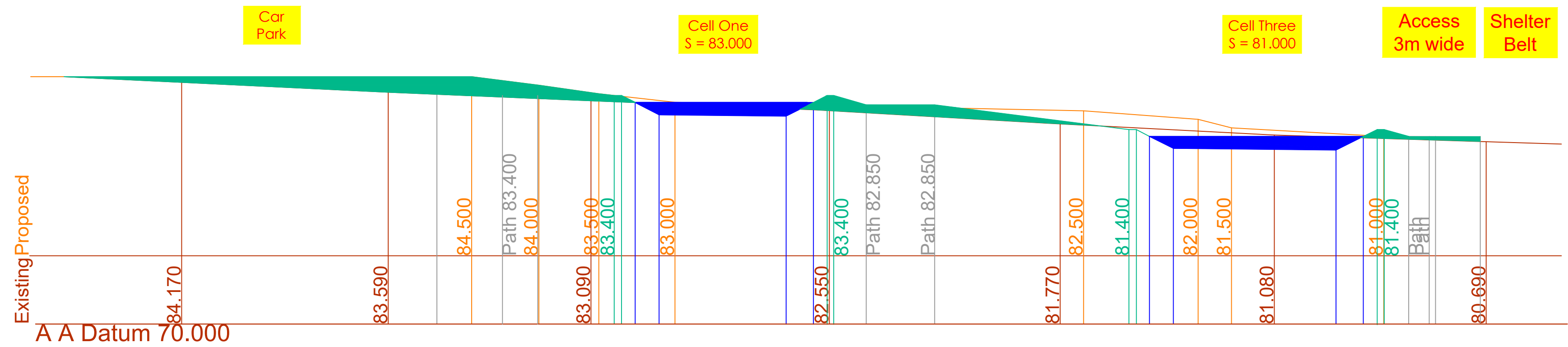
Direct E-Mail: janes@livingwater.org.uk

Willow Trees for the Ecological Treatment System

List of willow species proposed for the willow coppice at Newsells Winery

Description in Latin	Common Name
Salix alba	White willow
Salix alba Chermesina	Scarlet Willow
Salix alba Fragilis	Flanders Red
Salix alba Vitellina	Golden Willow
Salix caprea	Goat Willow
Salix cinera	Grey Willow
Salix daphnoides	Violet Willow
Salix nigricans	Black Willow
Salix pentandra	Bay Willow
Salix purpurea	Purple Osier
Salix purpurea	Cohu Blue
Salix purpurea	Green Dicks
Salix sachalinensis	Sekka
Salix tortuosa	Corkscrew Willow
Salix triandra	Almond Willow
Salix viminalis – gigantea	Gigantic Osier
Salix viminalis	Common Osier

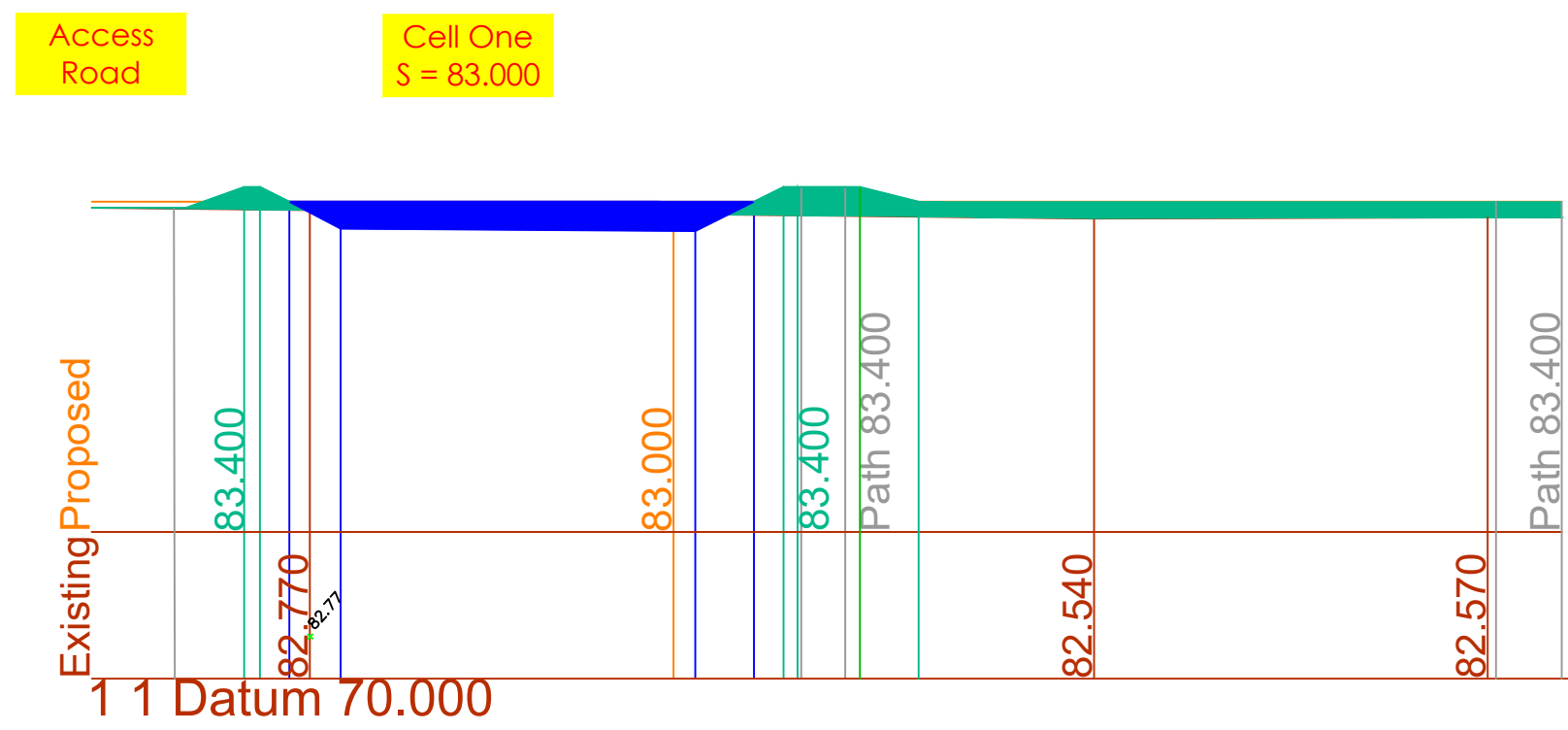
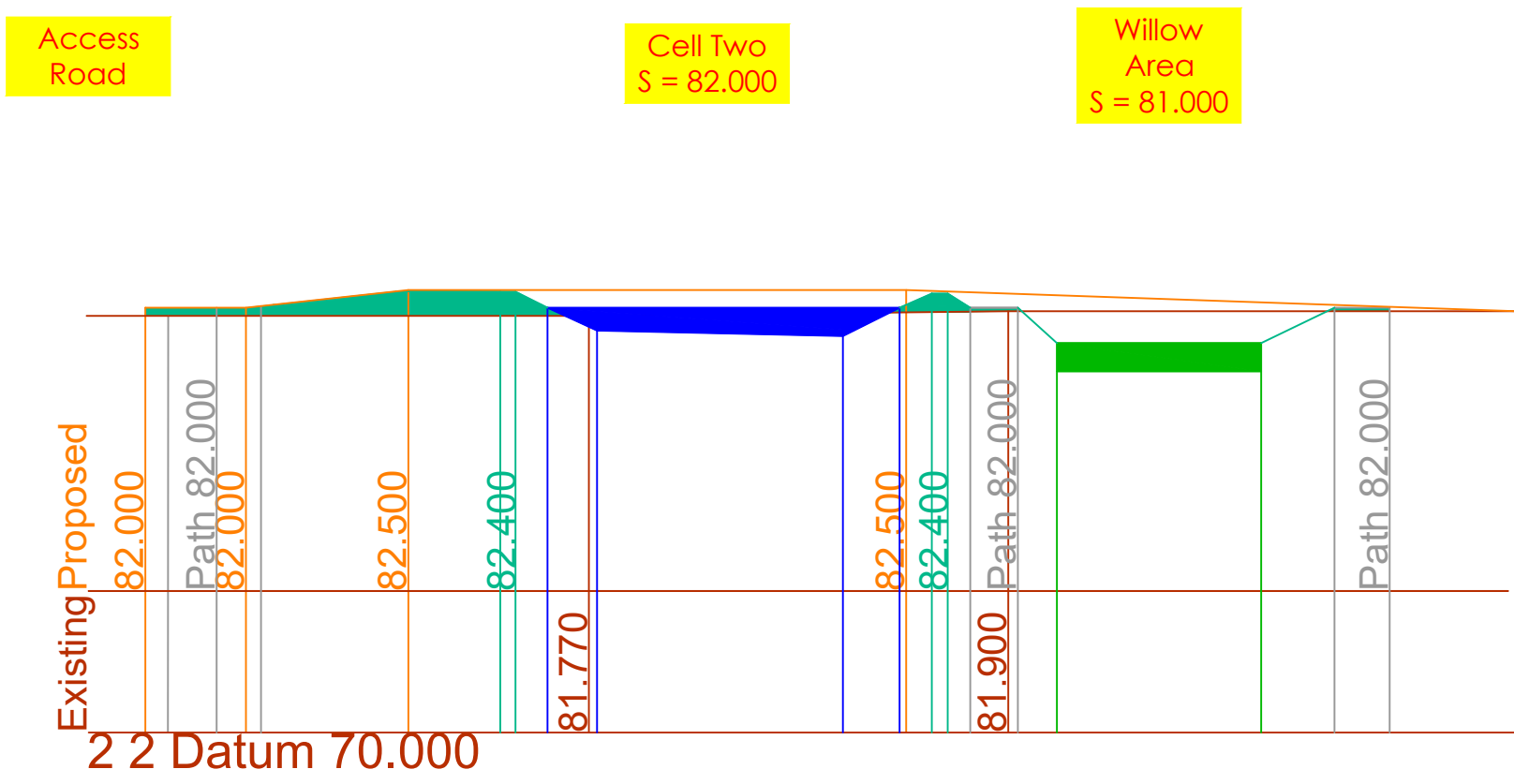
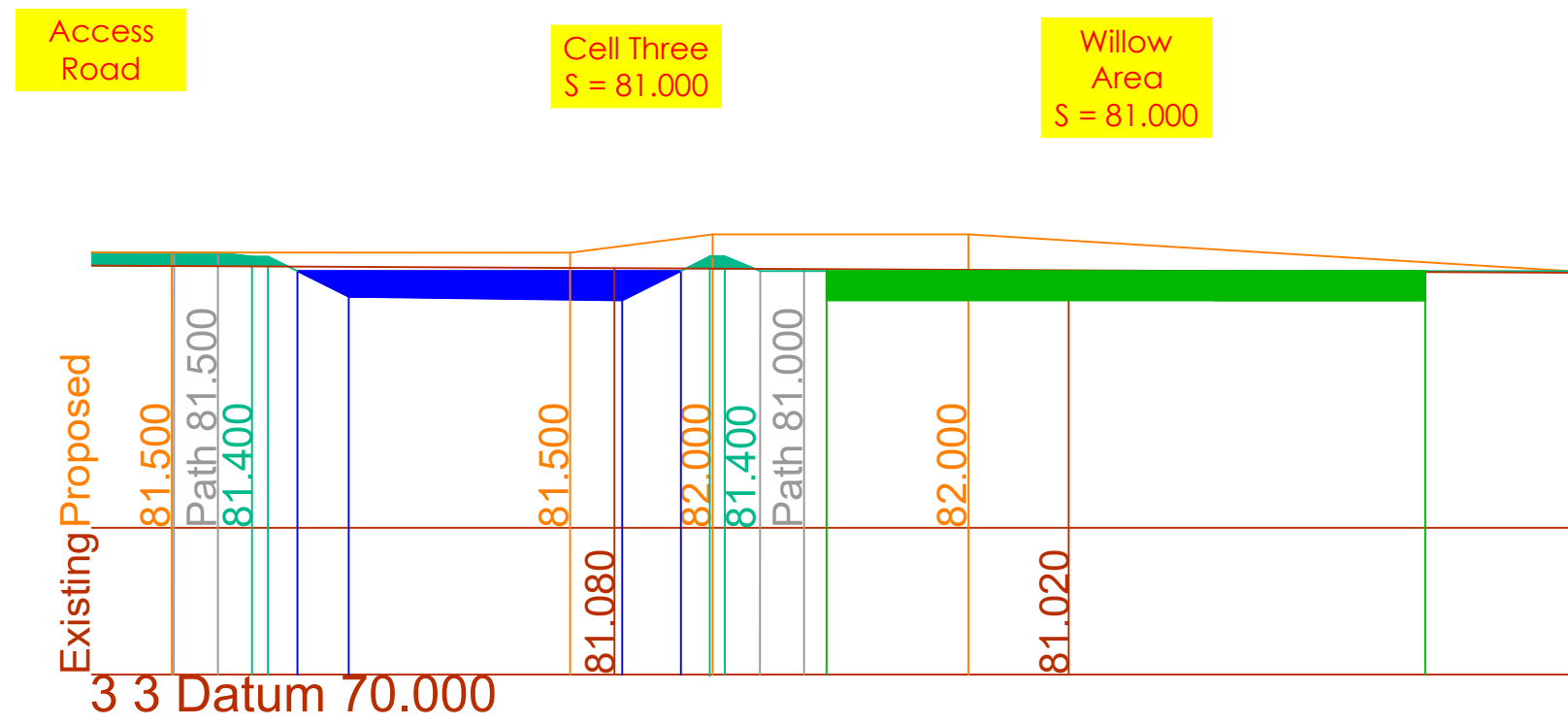




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Date
2023.05.22

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Drawing
SECTIONS
Project Number
23001
Revision
Z2
Drawing Number
002 (A1)

Status
Design by
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Carlingnose Studios
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