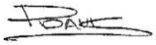
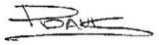
technical note

elliottwood

Title:	Proposed Great Wolf Lodge, Chesterton, Bicester	Date Approved:	October 2022
Discipline:	Civils	Author:	Harry Hunter
Note Ref:	2180501-EWP-XX-ZZ-TN-C-0006		

			Issued for information				
revision:	P2	prepared by:	Harry Hunter BEng (Hons)	checked by:	Paul Davis BEng (Hons) MSc CEng MICE	approved by:	Paul Davis BEng (Hons) MSc CEng MICE
date:	07.10.22	signature:		signature:		signature:	

Introduction

This technical note has been prepared in response to the Lead Local Flood Authority (LLFA) comments on Condition 16 of application number 22/01815/DISC dated 15.09.22.

Main Note

We understand that each sub section of this condition has now either been discharged, or is under review following the submission of additional information on the 3rd of August 2022.

LLFA Comment:

h) Full details of the design and proposed location of the tank and the pipes and the conduits to be installed to convey water to and from the tank, such details to include the materials from which the tank, pipes and conduits are to be made.

EWP Response:

It is currently proposed for the attenuation tank to be constructed using Pre-cast reinforced concrete using the FP McCann Stormtank system, along with the conveying pipework to and from the attenuation tank, with SDS providing the smart flow control systems.

FPMcCann have provided detailed drawings for the proposed attenuation tank and are included in **Appendix A** of this document.

LLFA Comment:

i) full details of the proposals for the installation of the tank, including the means by which the tank will be anchored.

EWP Response:

As the proposed main contractor for this development, Sisk have produced an outline statement for the intention of how they propose to construct the attenuation tank. Please note however that the final details for the construction of the attenuation tank are to be provided by the respective groundworks contractor upon appointment.

"We will be carrying out the excavation works for the rainwater harvesting tanks during early summer so the ground will be relatively dry. There is water at approximately 2m below ground level so we will be excavating through this for the formation level of the tanks.

We will carry out de-watering by excavating a swamp pit as a catchment area and will employ portable pumps to control the water within the tank excavation area. The excavation is not sufficiently deep to require a cofferdam with corner bracing and neither the ground conditions or depth of excavation warrant a piled retaining wall, however we will batter the excavation sides.

The underground tank is to be precast concrete which will be installed in sections, on a concrete blinded formation. The designer of the precast concrete will consider buoyancy effect of the tank due to high water table, generally the self-weight of the tank equalising the buoyancy forces.

On completion of the tank construction, we will backfill the excavation in layers in line with the engineers' specification. As this is a precast concrete tank, there will not be a requirement for anti-flotation measures however if necessary we can fill the tank with water before the backfilling commences"

LLFA Comment:

j) full details of the proposed means of operation of the tank, including the control of discharge

EWP Response:

The primary method for restricting the offsite discharge is via a HydroBrake vortex flow control chamber as detailed in the Proposed Below Ground Drainage drawings and accompanying Planning Condition 16 Discharge report ref 2180501-EWP-ZZ-XX-RP-C-0004 P1 as previously submitted. Details for the HydroBrake chamber are provided in Appendix B.

In addition to the HydroBrake flow control chamber, it is proposed to implement an SDS Intellistorm Smart Flow control system. This will retain surface water runoff within the attenuation tank for reuse within the building for greywater harvesting. The Intellistorm system operates by using a telemetry system which tracks the predicted weather forecast, and optimises the storage in the tank for both attenuation and for greywater reuse. The smart flow control will operate upstream of the HydroBrake and will feature an overflow pipe between the HydroBrake Chamber and the smart flow control to ensure flooding will not occur in the event of the system failing.

The details of the Smart flow control system provided by SDS Ltd are contained in Appendix C.

Appendix A

StormTank™

PRECAST ATTENUATION SYSTEM

Project Ref.	121792
Quote Ref.	307936

SUMMARY

Item	Project Name	Client	Total Price
1	Bicester	Sisk Builders Contractors	£333,766.00

Quotation

Project Code: 121792 Quote Number: 307936 Rev: P01
Drawing Ref: BIC-FPM-ZZ-XX-DR-X-0001-P01
Your Reference: Bicester

www.fpmccann.co.uk

September 20, 2022

Sisk Builders Contractors

For the attention of Adrian Dayman

Dear **Adrian**

Re: Bicester - Storage Volume = 2354m^3

Thank you for your recent enquiry, referenced above. We have the pleasure in enclosing our quotation for the Design, Manufacture, Deliver, Install and mastic seal precast attentuation tank, scope of works document and the enclose marked up drawings.

FPM To Supply:

1. Design – £3,100.00
2. Manufacture and Supply of Precast Concrete – £236,047.00
3. Manufacture and Supply of In-situ Reinforcement – £39,900.00
4. Installation – £54,718.00

Total FPM Supply Cost: £333,765.00
All costs exclude VAT.

Client to Supply the Following extra Over Items for Installation:
Crane, contract lift, mobile or crawler, 150t, subject to lift radius which may increase crane size – 11 days
Concrete Pump – 3 days
Roof leading edge protection – 4 days
In situ concrete C20/20mm/S3 – 57m^3
In situ concrete C40/20mm/S3 – 297m^3

Scope of Works:
Our Quotation is based upon the following details, contained within information provided via email and customer drawings and specifications:

Programme:

- Based on current commitments our anticipated lead in time to commence on site is expected to be 6-8 weeks from receipt of an order and Construction Status (frozen) co-ordinated Architects and Structural Engineers drawings (including any MEP, builder's work requirements, etc) in DWG format.
- Notwithstanding the above, the programme is to be discussed and agreed at the time of placement of order.
- Please see GA drawing for install program.

Client's Responsibility:

- Acceptance of the FP McCann H&S documentation, RAMs etc.
- Ensure safe access to the proposed installation location for all deliveries.
- Ensure the works area is available and unobstructed on the agreed dates. In the event that installation be delayed or interrupted by the failure of the client to adhere to the installation programme agreed with FP McCann delay cost will be charged at a minimum rate of £1,600 per day.
- Ground water control and water ingress during the contract.
- Ground Preparation to meet required ground bearing capacity stated in the calculations and issued Drawings.
- The client shall set-out the external corner locations of the tank, any requested intermediate points and provide a level datum at formation. An engineer from the client should also be available during installation for verifying setting out etc.
- Provide all necessary plant and materials as outlined, of sufficient capacity. Provide access to forklift to remove key ancillary items.
- Main contractor to provide additional drainage to mitigate floatation if necessary as outlined in design calculations.
- Any additional waterproofing of external faces of tank (i.e a bitumen coat)
- Any temporary works.
- Ensure an adequate crane base is in place and suitable access road for crane and delivery vehicles.
- Provide adequate waste disposal facilities unless otherwise agreed.
- Power and water supply to be within 50m of FPM working area.

FPM will accept no reasonability for any additional costs the Client incurs if any of the above conditions are not complied with/ deemed satisfactory.

Design:

The work is based upon the dimensions listed within the original tender enquiry and subsequently shown within the quotation. If as part of our offer we are including for the 'design' we have made the following assumptions:

- The loading will allow for the overburden and the worst case variable loadings of:
  - Eurocode NA Articulated Vehicle - 38 tonne, five axle articulated - UK National Annex to BS EN 1991-2:2003 (Traffic loads on bridges)
  - 10kN/m^2 as a UDL
  - Accidental vehicle in line with BS EN 1991-2:2003 (Traffic loads on bridges).
  - Min overburden of 1m is assumed
  - Max overburden of 2m is assumed

- Total allowable loading approximates to 50kN/m2 (max).
- Roof slabs can be either standard precast reinforced or pre-stressed.
- Designed to Water Tightness Class 1 (Table 7.105 of BS EN 1992-3).
- If required, water testing responsibilities to be reviewed & agreed.
- FP McCann does not provide ground engineering design and are not accountable for ground conditions and/or underlying services.
- FP McCann have no responsibility for design & formation of ground to meet the required ground bearing.
- This quotes T&C's to take precedence unless otherwise agreed, available on request.
- Should detailed design reveal: poor ground conditions, greater levels of overburden or heavier imposed loads than stated above then the structure will be repriced accordingly once the design phase is complete.

Manufacture:

- External faces will be to a “Type A” finish along with any trowelled surface finish as defined in BS 8110. Unit will receive a trowelled finish to their soffit.
- Our standard 'Grey' C40/50 DC2 factory mix design has been allowed for, any deviation from this will need to be agreed, and if there is any cost implication we reserve the right to re-price.
- If visual appearance is important FP McCann strongly recommends an agreed finishing standard is signed off prior to commencement of casting by means of a sample panel, which will aid in means of reference during the project. If not specified prior to manufacture the default ‘Type A’ finish will be produced as stated above.

Delivery:

- Precast units will be delivered during normal working hours on articulated trailers of 13.5m in length and with a gross weight of 44 tonnes. Where access restrictions on site, or at the customer’s request, or for any other restriction outside the control of FP McCann, dictate a reduction in the size of vehicle or a change in the vehicle specification, such changes will be subject to availability and at an additional cost.
- An additional charge of £50 per hour will be incurred for any excessive waiting for one of our delivery vehicles on site to be unloaded. FP McCann allow for a period of 1 hour for delivering and unloading on site. Extended waiting periods can be accommodated if pre-agreed within the package and our delivery process. Any returned loads due to contractor not being able to accept our agreed deliveries will be charged. Return loads will incur full costs from our haulier plus a £65 admin and restocking fee per load.
- Any road closures or traffic management required is the responsibility of the main contractor and FP McCann will not pay for any such occurrences as part of the works package.

Lifting:

- Units will include provision for lifting and installing (by others), utilising a suitable proprietary cast in lifting system. We have allowed for one set of lifters within our quotation to be delivered to site with the first load of units.
- Any additional lifters would be supplied at an additional cost which would be dependant of the lifting system chosen to be incorporated within the units.
- In the design of lifting anchors, we have adopted a Dynamic Factor = 1.3 (Stationary Crane / Mobile Crane, (Hoisting speed > 90m/min).

Storage:

- Manufactured goods can be stored in our yard. Should delay occur in taking the units in accordance with the agreed programme charges will be made at a rate of £5 per tonne per week for storage, together with any additional handling costs associated.

Terms and conditions:

- This quotation is not an offer capable of acceptance and any purported "acceptance" of it does not give rise to a legally binding contract. Any contract subsequently entered into for the supply only of goods will be subject to our standard Conditions of Sale [with technical assistance]. (https://fpmccann.co.uk/conditions-of-sale-purchase/)
- Following on from the point above any contract entered into for supply and install of goods will be subject to our standard JCT amendments.
- We do not provide a Performance Bond.
- We do not provide retention or Retention Bond. If required we can supply a Letter of Indemnity.
- FPM accept no liability for additional crane days due to breakdowns/ adverse weather conditions etc.
- Payment will be required for materials off site in our factory. A vesting certificate for materials will be issued and these materials will be clearly marked to identify title in materials. Title in the materials will only transfer upon receipt of payment by FP McCann Limited.
- This price is based on the date of the quote and is fixed for 30 days. If an order is received after this date we reserve the right to review our price.
- If a design order is issued an invoice will be sent once design is complete and sent off for approval.
- A regular review of your account will be carried out and the credit limit may be adjusted up or down based on market conditions and credit agency reports. You will be advised of any changes should this be necessary.

Warranty:

- FP McCann offer a one year warranty from tank completion and handover date, whereby FP McCann will fix defect(s), providing the tank has been used in accordance with its design.
- FP McCann design, manufacture and installation are protected by professional indemnity insurance and collateral warranty at an additional cost.

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We trust the above is in accordance with your requirements but if you have any queries please do not hesitate to contact the undersigned.

Yours faithfully
For FP McCann Limited

Igor Skoro
Precast Tanks
+44(0)7860 204893
ISkoro@fpmccann.co.uk

Attachments

- Appendix 1: Bill of Quantities

wrc approved™
PT/433/0119
Valid: 31 Jan 2019 - 31 Dec 2024

DO NOT SCALE, IF IN DOUBT PLEASE ASK.

Internal Wall Thickness (m)	External Wall Thickness (m)	Base Thickness (m)	Roof Slab Thickness (m)	Insitu Roof Thickness (m)	Internal Tank Dimensions		
					Length (m)	Width (m)	Height (m)
0.275	0.250	0.250	0.120	0.120	59.2	13.725	3

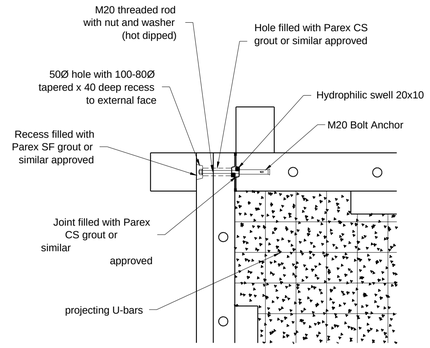
Insitu Roof Volume (m^3)	Insitu Base Volume (m^3)	Blinding Volume (m^3)	Total Insitu (m^3)	Insitu Rebar (tonnes)	Precast Weight (tonnes)	Storage Volume (m3)
99.5	197.9	56.6	353.9	20.3	781.7	2354

Excavation Requirements	
Length (m)	62.100
Width (m)	16.625
Height (m)	TBC

* Blinding to cover full extent of excavation
** Minimum dimensions at base of excavation

Precast Installation Program	
Estimated Duration	5 - 6 weeks

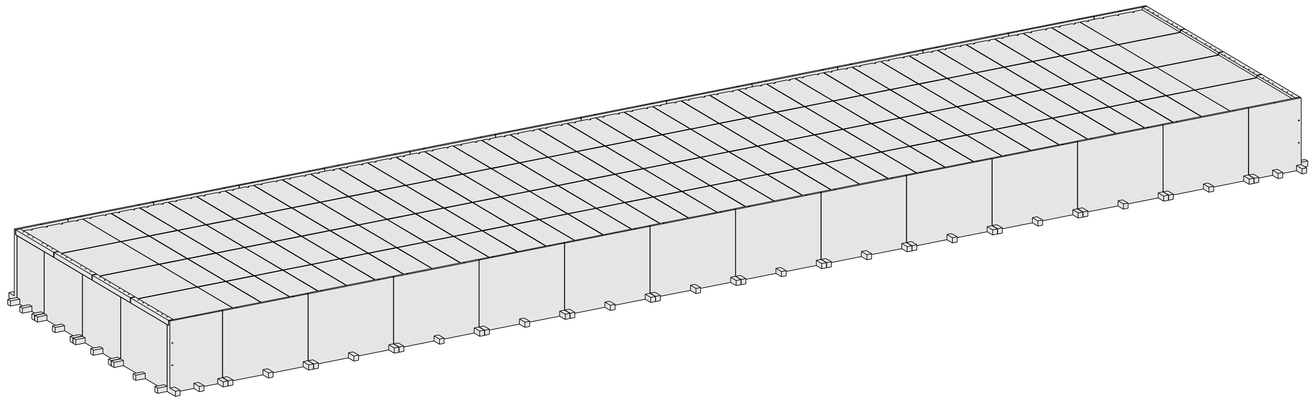
*** Duration of works is weather dependent



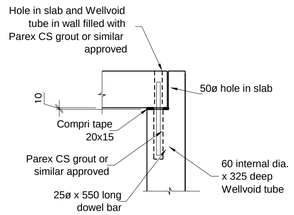
Detail A

External Wall Corner Connection

(1:20)



Unit Type:	Qty	Combined Weight (T)
Coverslab	148	247.7
External Wall	36	325.7
Internal Wall	42	208.3
	Total	781.7

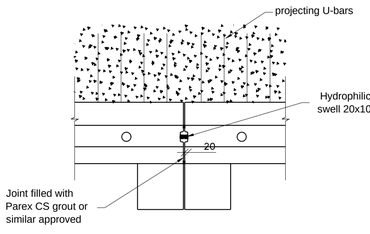


Detail B

Roof Slab to Wall Connection

(1:20)

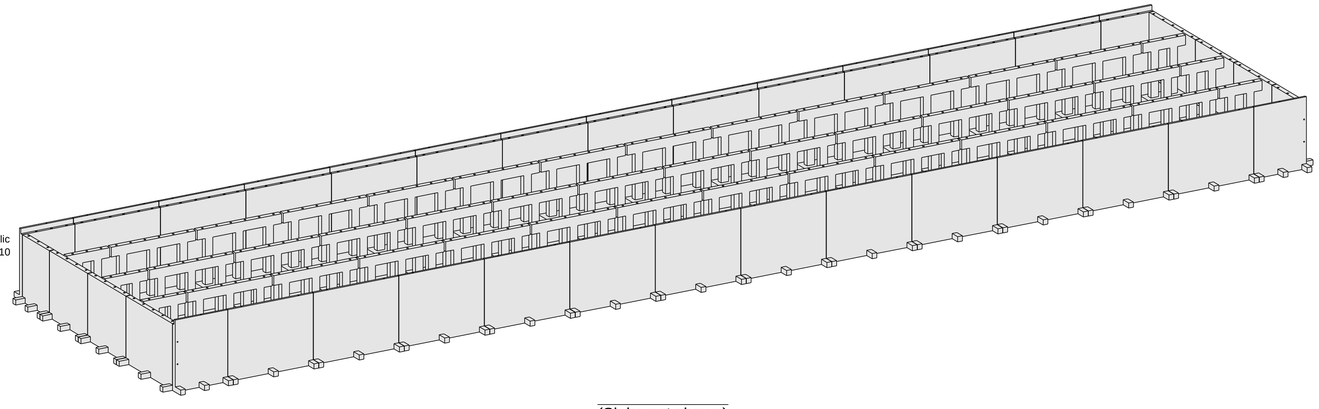
Unit Ref:	Qty	Individual Weight (t)	Total Weight (t)
CU-0001	2	3.9	7.8
CU-0002	4	3.9	15.6
CU-0003	2	3.9	7.8
ET-0001	2	6.2	12.4
ET-0002	2	6.2	12.4
ET-3001	24	10.1	241.5
ET-3002	4	7.6	30.4
ET-3003	2	9.1	18.2
ET-3004	2	5.4	10.7
IT-3001	36	5.3	190.8
IT-3005	6	2.9	17.4
PS-3455	70	1.5	108.1
PS-3456	70	1.6	108.5
	Total		781.7



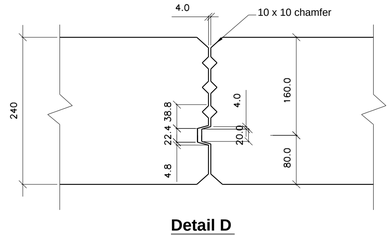
Detail C

External Wall Joint

(1:20)



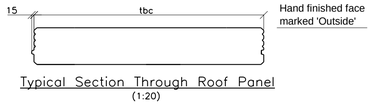
(Slabs not shown)



Detail D

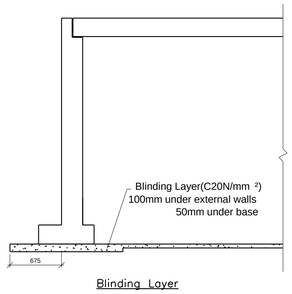
Roof Panel Connection

(1:5)



Typical Section Through Roof Panel

(1:20)



Blinding Layer

(1:40)

FP McCann Precast Tank Installation Guide:

https://www.youtube.com/watch?v=yuEKwqdGjJw&feature=youtu.be

The Construction (Design & Management) Regulations 2015

a) If you are unsure about your responsibilities please refer to the HSE Website.

b) The notes below and design details (S) should be read by all CDM duty holders alongside the Tank layout, section details and additional notes. Potential hazard/ risks are identified and should be assessed accordingly by the main contractor and his design team prior to any site works commencing.

c) The FP McCann GA should be read in conjunction with all other relevant drawings from the contract design team e.g. Engineers, M&E sub-contractors.

Installation

The units should be lifted using only the lifting equipment noted in (1), all elements must be lifted with the installation method (RAMS) provided by FP McCann.

Bearings

It is the responsibility of the overall scheme designer to ensure that the bearings provided are structurally adequate in both temporary and final condition, for the support of the precast units, please also refer to the sections on the GA. Applied bearing pressure due to ULS/SLS load conditions shown in structural calculations.

Voids & Openings

Where pre-formed voids and holes are provided, suitable edge protection or temporary cover should be supplied, installed and maintained by others. The provision and installation of cover, frames and any insitu pipe connections are to be by others.

Dry Weather Flow

To be added as requested by relevant Water Authority.

1. Handling "Hazard"

a) Volume/ Weight (based on a concrete density of 2.5 t/m^3):
See individual unit drawings - (+5% is recommended for sizing lifting equipment)

b) All lifting points shall be used as specified.

c) Also refer to Lifting & handling Instructions Diagram on Drawing

d) Anchor Recesses to be filled by others on site

e) Site Lifting: Spherical-Head Clutch fitted to spherical head anchor

f) Site Lifting: Rotating Clutch fitted to wavy tail anchor (200mm wall)

g) Refer to individual unit drawings for anchor quantities and setting out.

h) In the design of the lifting anchors, we have adopted a Dynamic Factor = 1.3 (Stationary Crane/Mobile Crane, (Hoisting speed >90m/min).

2. Concrete (Precast)

a) Lifting strength based on 2 cubes = 25N/mm2.

b) Characteristic 28 day cube strength = 50N/mm2.

3. Reinforcement

a) Reinforcement (500B or C) to BS4449.

b) Scheduling, dimensioning, bending and cutting to BS8666.

c) Cage to be tack welded and/ or tied with 17 gauge annealed tying wire.

4. Manufacture

a) Manufactured to BS EN 13369:2013

b) Tolerances to BS EN 13369:2013 & BS EN 13670:2009

c) Finishes as indicated below unless otherwise detailed on unit;
- Top (As Cast) Surface: *Steel Trowelled*
- Front Face & Sides (Struck from Steel/ Timber Mould): *Type A*

d) Prestressed or reinforced roof slabs used as required

5. Installation

a) Refer to site specific installation guide.

6. Sealing

a) As shown on General Arrangement drawing.

7. Insitu-Concrete

a) Min. required characteristic 28 day cube strength = 37N/mm^2.

b) Concrete mix specification to incorporate min. cement content = 360kg/m^3 max, w/c ratio = 0.45 and material specification to achieve class DC2.

8. Temporary Works

a) FP McCann are responsible for the temporary works associated with the erection of the precast only. All temporary works design to be by others.

b) The main contractor is responsible for the provision of required temporary works to ensure a stable excavation is maintained for the full period of the tank installation.

c) Due consideration is required with regard to the nature of the backfill and type/ size of plant used.

d) Protection of precast units during temporary works (backfilling) is the responsibility of others.

e) Any plant used for backfilling or subsequent works, around or over tank, should be suitably sized to ensure that the net applied loads are no greater than the permanent design loads.

f) Any temporary works should be designed/ installed/ removed to ensure that the net applied loads are no greater than the permanent design loads.

9. Design

a) Water Tightness: Class 1 to BS EN 1992-3

b) Refer to Design calculations for details.

Rev	Date	Revision Detail	By	Chk	App
P01	20-09-22	Initial Drawing	JC		

Status: Suitable for Costing

Suitability: D1

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BT45 8QA
Tel: +44 (0) 28 7964 2558
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Client.

Project.

Bicester

Title.

General Arrangement of StormTank MPS
59.2 x 13.725 x 3 m

Drawn:	Checked:	Approved:
JC		
Internal Ref: 121792	Date: 20-09-22	Scale: NTS

Drawing No : BIC-FPM-ZZ-XX-DR-X-0001

Rev: P01

To be inserted as **"NUMBERED DOCUMENT 1 - SCHEDULE OF MODIFICATIONS" to JCT Design and Build Sub-Contract 2011**

General Obligations

Clause 2.1.4 For the avoidance of doubt, any fire protection required to any supporting structural steel work to satisfy any Statutory Requirements of the Main Contract, designed and supplied by the Subcontractor, will remain the responsibility of the Contractor. The Sub-Contractor shall not be responsible for any fire protection to any structural steel".

Sub-Contractor's Designed Works

Clause 2.2, 1st line After the word "shall" insert the text ", using reasonable skill, care and diligence".

Compliance with the Main Contract and indemnity

Clause 2.5.1, 1st line Remove "as identified in or by the Schedule of Information"

Clause 2.5.1, 2nd line After "them," insert "particulars of which are specified in the Schedule of Information"

Clause 2.5.1, 6th line After "shall" insert ", subject to clauses 3.15.2 and 3.15.3, "

Clause 2.5.1.1, 2nd line After "Main Contract" insert "providing always that the Sub-Contractor is notified of, and is given opportunity to correct any breaches, non-observances or non-performances as soon as they become known to the Contractor. "

Clause 2.5.1.2 After "Main Contract" insert "providing always that the Sub-Contractor is notified of, and is given opportunity to correct any such acts or omissions as soon as they become known to the Contractor."

Design liabilities and limitation

Clause 2.13.1, 7th line Delete "holding himself out as competent to take on work" and insert "exercising reasonable skill, care and diligence"

Unfixed Materials and Goods

Clause 2.15.2, 3rd line After "Employer" insert ", and an amount properly representing the value of those materials has been paid to the Sub-Contractor by the Contractor,"

Failure of Sub-Contractor to complete on time

Clause 2.21 Delete existing clause 2.21 in its entirety. Insert replacement clause as follows:

2.21 .1 If the Sub-Contractor fails to complete the Sub-Contract Works or such works in any Section within the relevant period or periods for completion and:

.1 the Contractor gives notice to that effect to the Sub-Contractor within a reasonable time of the expiry of the period or periods; and

.2 the Contractor has notified the Sub-Contractor before the due date for the final payment under clause 4.12.1 that he may require payment of, or may withhold or deduct, liquidated damages,

the Contractor may, not later than 5 days before the final date for payment of the amount payable under clause 4.12, give notice to the Sub-Contractor in the terms set out in clause 2.21.2.

.2 A notice from the Contractor under clause 2.21.1 shall state that for the period between the end of the relevant period or periods for completion of the Sub-Contract Works or that Section and the date of practical completion of the Sub-Contract Works or that Section:

.1 he requires the Sub-Contractor to pay liquidated damages at the rate stated in the Sub-Contract Particulars, or lesser rate stated in the notice, in which event the Contractor may recover the same as a debt; and/or

.2 that he will withhold or deduct liquidated damages at the rate stated in the Sub-Contract Particulars, or at such lesser stated rate, from sums due to the Sub-Contractor.

.3 If the Contractor fixes a later date for the end of the relevant period or periods for completion of the Sub-Contract Works or a Section, the Contractor shall pay or repay to the Sub-Contractor any amounts recovered, allowed or paid under clause 2.21 for the period up to that later date for the end of the relevant period or periods for completion.

.4 Any amounts due, withheld or deducted from the Sub-Contractor under clause 2.21 will be the only monies due from the Sub-Contractor for failure to complete the Sub-Contract Works or such works in any Section within the relevant period or periods for completion.

Corresponding amendment to the Sub-Contract Particulars is required.

Insert new item in Sub-Contract Particulars:

18 Liquidated damages

18.1	Liquidated damages (*where completion by Sections does not apply*)	at the rate of £_____ per _____
	Sections: rate of liquidated damages for each Section	Section____ :£ _____ per _____ Section____ :£ _____ per _____ Section____ :£ _____ per _____

Deductions under the Main Contract Conditions

Clause 2.23, 6th line — After "debt " insert "providing always that the Sub-Contractor is notified of, and is given opportunity to correct any defects or other faults as soon as they become known to the Contractor."

Collateral Warranties

Clause 2.26.1 — Last line after "request" insert ". The Sub-Contractor will not be obliged under this clause to provide any warranty that would bestow on him a greater obligation to a beneficiary than he has to the Contractor under this Sub-Contract. Any request for amendment by the Sub-Contractor in order to comply with the Sub-Contractor's insurance policy or other requirement of its insurers will be deemed to be reasonable and shall not be declined by the Contractor."

Non-compliance with directions

Clause 3.6, 5th line — After "deduction" insert "representing the additional costs reasonably and properly incurred"

Instructions and deductions under the Main Contract

Clause 3.12.2, 3rd line — Add after "deduction" the words "representing the costs reasonably and properly incurred in overcoming non-compliant work".

Indemnity by Sub-Contractor

Clause 3.15 — Renumber to Clause 3.15.1

Renumbered Clause 3.15.1, 1st line — Delete the word "The" and insert "Subject to clauses 3.15.2 and 3.15.3, the"

Insert new Clause 3.15.2 — Insert new clause "The Sub-Contractor's total liability under or in connection with this Sub-Contract, whether in contract, tort, (including negligence), for breach of statutory duty or otherwise shall be limited to an amount not exceeding 10% of the Sub-Contract Sum, provided always that the foregoing shall not exclude or limit the liability of the Sub-Contractor for:

- death or personal injury caused by the Sub-Contractor's negligence;
- any matter for which it would be illegal for the Sub-Contractor to exclude or attempt to exclude its liability;
- fraud or fraudulent misrepresentation;
- wilful default; or
- any loss or damage for which the Sub-Contractor is required by this Sub-Contract to take out and maintain insurance."

Insert new clause 3.15.3 — "The Sub-Contractor's total liability under or in connection with this Sub-Contract in respect of loss or damage for which the Sub-Contractor is required to take out and maintain insurance will be limited to an amount equal to the losses and damages that are fully covered and recoverable under the Sub-Contractor's insurance policy."

Insert new clause 3.15.4 — "The Contractor shall have no recourse or claim against the Sub-Contractor in the event that:

- the proceeds from the insurances that the Sub-Contractor is required to effect and maintain are insufficient to indemnify the Contractor in respect of its losses, costs, damages and/or expenses suffered as a consequence of the occurrence of a given risk;
- the relevant insurer or underwriter refuses or delays payment of any insurance proceeds;
- insurances that the Sub-Contractor is required to effect and maintain insurances that the Sub-Contractor is required to effect and maintain become irrecoverable in whole or in part;
- insurance proceeds (in whole or in part) are not received by the Sub-Contractor for any other reason,

Final Sub-Contract Sum – Adjustment Basis

Clause 4.3.2.3	Insert at the beginning of this sub-clause "subject to clauses 3.15.2 and 3.15.3,"

Final Sub-Contract Sum – Remeasurement Basis

Clause 4.4.6	Insert at the beginning of this sub-clause "subject to clauses 3.15.2 and 3.15.3,"

Interim payments – final date and notices

Clause 4.10.5, 6th line	After "due in the notice." insert " The Contractor shall make all payments to the Sub-Contractor without any deduction by way of set-off , counterclaim or withholding under this or any other contract."

Final payment

Clause 4.12.5, 2nd line	After "due in the notice." insert " The Contractor shall make all payments to the Sub-Contractor without any deduction by way of set-off, counterclaim or withholding under this or any other contract."

Rules governing Retentions

Clause 4.15	Delete this clause in its entirety. Insert the words "Not used".
Sub-Contract Particulars, item 9	Delete this item in its entirety. Insert the words "Not used"

Retention Bond

Clause 4.16	Delete this clause in its entirety. Insert the words "Not used".

Relevant Sub-Contract Matters

Clause 4.20.9	Delay in receipt of design information and/or approvals resulting in lost production. Lost production will be payable by the Contractor to the Sub-Contractor at a rate of £100 per tonne per day (except for sandwich panels , for which the rate shall be £200 per tonne per day).
Clause 4.20.10	storage of product by the Sub-Contractor beyond 4 weeks of the Sub-Contractors programmed delivery dates due to any delay caused by the Contractor shall be payable by the Contractor to the Sub-Contractor at a rate of £5.00 per tonne per week or part thereof.

Contractor's reimbursement

Clause 4.21	Delete this clause in its entirety. Insert the words "Not used".

Appendix B

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.000	27.300
Flush-Flo™	0.369	27.281
Kick-Flo®	0.740	23.642
Mean Flow		22.652

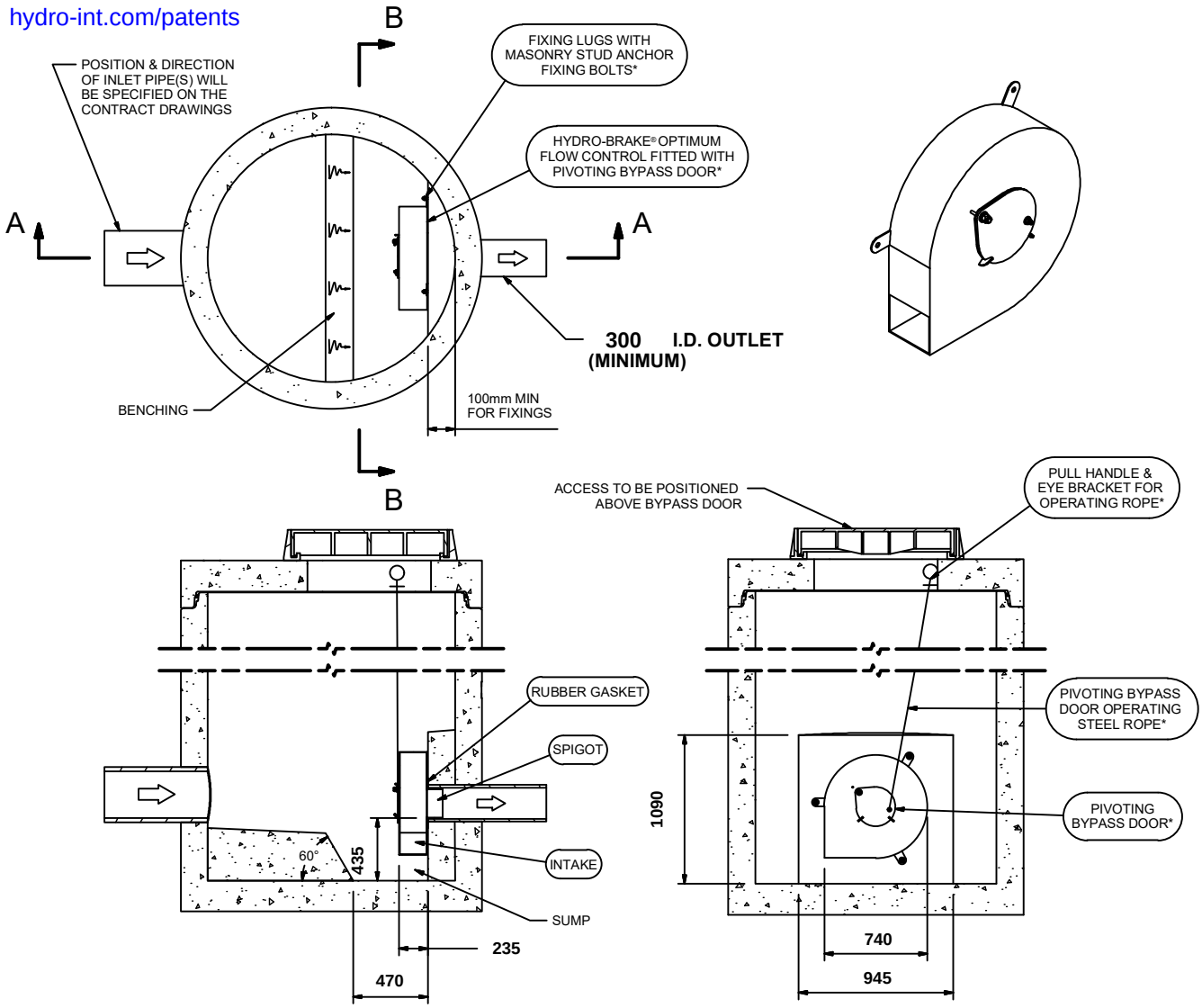
Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 264 kg

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRc Approved PT/329/0412

hydro-int.com/patents



SECTION A-A

SECTION B-B

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE

The head/flow characteristics of this SHE-0227-2730-1000-2730 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

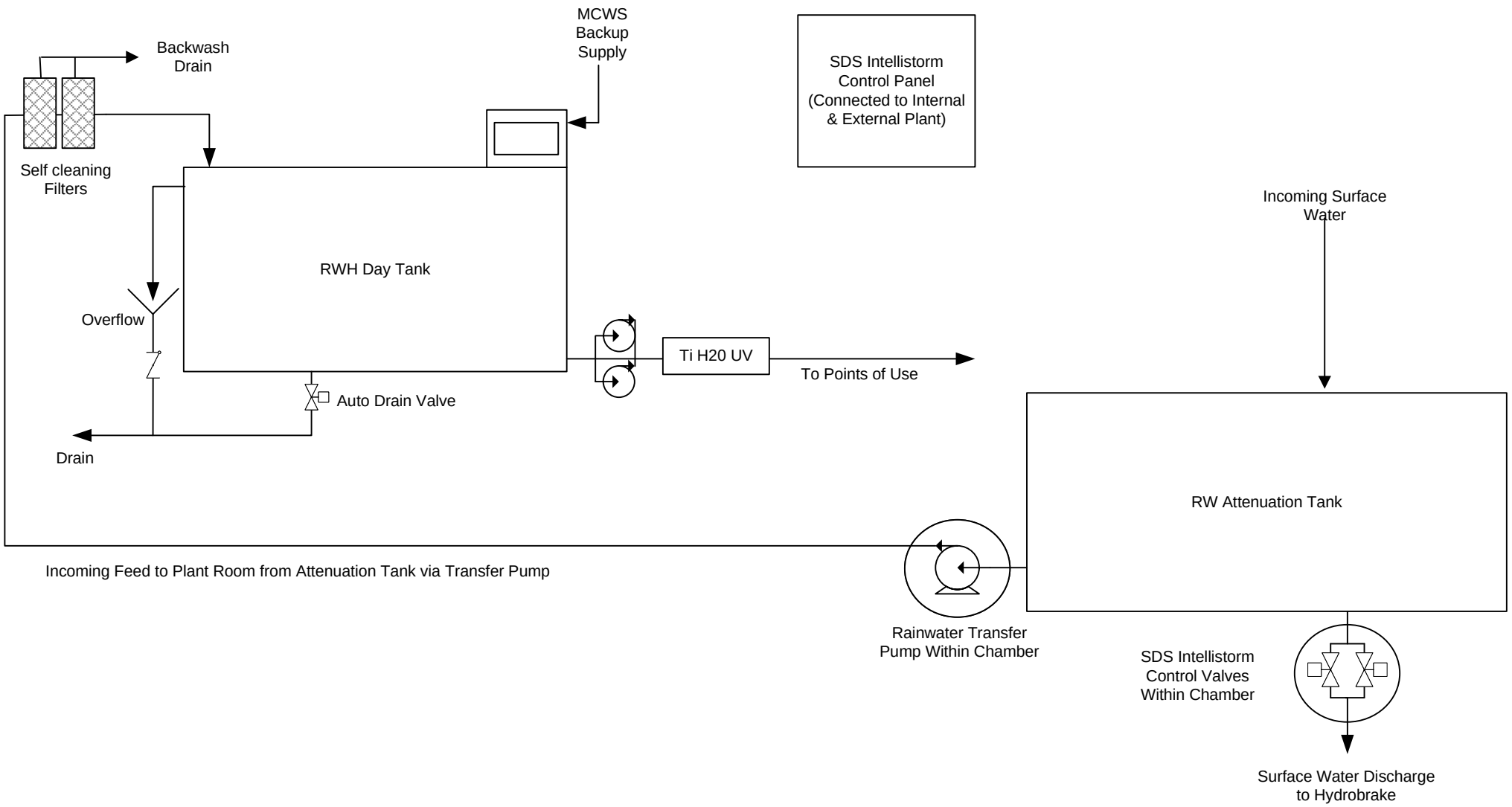
Hydro International®

DATE	22/09/2022 16:16
SITE	Great Wolf
DESIGNER	Harry Hunter
REF	2180501

SHE-0227-2730-1000-2730
Hydro-Brake® Optimum

h.hunter@elliottwood.co.uk

Appendix C



Client	Hoare Lea / Elliott Wood	Details
Project Name	Great Wolf	
Type	Basic Schematic	
Date	27.09.2022	
Drawing no.	E306919_01	
Revision	A	

Notes:

This Drawing is to be read in conjunction with all relevant Architect, Engineers and Specialists drawings and specifications.

Do not scale from the drawing in either paper or digital form. Use written dimensions only.

SDS Water Infrastructure Systems

SDS Intellistorm

SDS
Water Infrastructure Systems

Introduction

This document outlines the controls specification for the Intellistorm Attenuation Control system as required. The following outlines the key control arrangements for the system.

Summary

The Intellistorm system is designed to manage and control stormwater attenuation systems in an intelligent, responsive manner, enabling local stormwater re-use. Intellistorm is coupled with a range of assets, including pumps, tanks, water treatment and instrumentation to achieve total stormwater management and re-use.

The system operates two parallel sub-systems. These systems are designed to operate separately thus ensuring a simple and secure control methodology of the most important function, stormwater attenuation.

1. Attenuation Control - All rainwater falling upon a site, building or hardstanding is directed to the attenuation storage tank. This tank's level is monitored in real time by the main Intellistorm control system by way of level switches, sensors, and a remote relay panel.

The Intellistorm system receives a daily update of rainfall forecast via a gsm connection covered by a contract connection managed by SDS Ltd. A daily SMS informs the system of the incoming rainfall for the following 24-hour period in a mm rainfall format.

Intellistorm uses this information, combined with the known site surface rainfall collection area to calculate an incoming rainfall volume. This is then actioned as a required tank void and thus a target tank level (available capacity within the attenuation tank).

Connected attenuation pumps / Valves are activated to empty the tank to the correct level and thereafter monitor the tank level, ensuring the void is maintained.

2. Water Reuse - A transfer pump is connected to the attenuation to transfer water to the break tank or point of use (e.g. Irrigation System). This pump delivers water for treatment and re-use. This pump cannot interact with tank level and simply receives data from the control system indicating "water is available for reuse".

The delivery path for water reuse in this instance, delivers water untreated, direct to the untreated greywater tank, thereafter, all treatment and control is undertaken by the greywater system, using the submersible macerator supply pump interconnected to the GWOD system.

Design

Key Attributes

1. Reliability

Due to the nature of the system, reliability is the most important factor of any design and must be considered at every stage of the design process. Beginning with component selection and future availability, through to longevity of materials and overall control theory incorporating failsafe redundancy.

2. Ease of installation

Systems are installed in partnership by SDS Ltd and several mechanical and electrical companies. Simple steps, ranging from superior labelling through to common sense arrangement of system connections will enable a more fluid and overall more cost effective onsite installation process both for SDS ltd and its clients.

3. Ease of Operation

Due to the end user nature (Facilities Management) any system must ultimately present itself to the client in an easy to understand manner, this will in turn benefit the client through simple onsite rectification of minor issues and benefit SDS Ltd through the ability to provide telephone support where historically a site visit may have been required.

4. Low Maintenance

The system is designed in line with two maintenance visits per annum per site.

System Design

For clarity, the equipment concerned is separated into two unique physical locations, with attenuation and pumping equipment located in the tank area and the main body of Intellistorm controls located outside of the tank where specified within the design.

Whilst pumps will contain on board control panels including variable speed drive, all start/stop control is derived from the Intellistorm system

A safety level has been agreed, the system will provide a fixed level top out at this point, ensuring tank volume never increases beyond this (except during 100yr rainfall events)

The attenuation tank system contains a single 4-20ma hydrostatic level sensor providing real time tank volume to the Intellistorm control system. The Intellistorm panel will accept both a calibration of the sensor and an adjustment of the tank volume by input of tank dimensions (all tanks are cuboid), combining to provide tank volume indication on HMI.

The level sensor is the primary point of level measurement, however in the event of a level sensor failure, the system will automatically empty the tank, using 4 x Tilt level switches which are present within the attenuation tank and continue in this fashion indefinitely.

1. Pump dry run protection – 10% (subject to calculation of outlet height)
2. Tank empty (stop pumps) - 15%
3. Tank full (start pumps) – 35%
4. Tank overflow alarm (start pumps and alarm) – 90%

Thus, allowing the system to function in attenuation only status, maintaining an empty tank until level sensor remediation.

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Rainwater Reclaim Pumps - Location: Tank Area

Each pumpset consists a single pump with integrated variable speed drive supplied by Xylem water (albeit mounted on the same baseplate as the above attenuation pumpset). These pumps receive constant power from the Intellistorm system, receive a dedicated run/stop signal and provide a fault signal back to the Intellistorm system.

These pumps supply water to the untreated greywater tank via a single outlet with demand signal received by the main Intellistorm control panel based on the operation of the demand level switch located within the untreated greywater tank. The HMI allows the user to manually operate the pump through a manual/off/auto switch function.

Controls Design

All programming is created in industry standard language and full ladder logic will be made available on demand.

Main Intellistorm Control Panel (1 of) – Location: Greywater Plant Area

The main Intellistorm Control Panel provides all user function and control of assets related to the Intellistorm System. This panel is designated Intellistorm Controller 2018-1.

A local power supply (240vac 32a) is provided to this control panel. The panel includes a rotary isolator enabling complete power shutdown of the panel and all connected assets. All other control is achieved via the Siemens HMI. The Siemens HMI (appendix 12) requires password access and allows 2 tiers of user;

1. Admin (full control)

2. Engineer (access only, no setpoint changes)

The system contains a dedicated GSM sim card and aerial allowing the system to receive daily sms input. The HMI is P&ID based in design, whereby a user can follow the overall system schematic, selecting components where appropriate.

Default Screen

The default screen resides on a simplified P&ID of the system whereby individual assets may be selected. The system defaults to screensaver mode if no activity within 5 minutes.

Attenuation Tanks Screen

This screen displays the attenuation tank and their respective volumes, in percentage capacity figures. Graphics are intuitive whereby a full tank is denoted by a tank filled with water and, an empty one devoid of water.

Pressing on an individual tank enables the user to enter a settings screen for that specific tank. The settings screen enables the user to input the following settings attributable to that tank including;

Tank dimensions, length x height x width in metres. Autocalculation of max tank volume based on above calculation (429.95M3) Level Sensor Depth range in metres 3/5/10, Surface area of site

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attributed to that tank in m2. An arrow from the main tank screen allows the user to move on to the Pumps Screen.

Pumps

This page displays all system pumps. When a pump is running (in so far as the system has signalled it to run and no fault is present) a pump will indicate as green, when in fault as red and if manually switched off, as grey.

In all cases, pumps are selectable as manually on/off/auto to enable maintenance works. In the case of the twin pump duplex pumpsets, selecting manually on serves to activate only the duty pump as controlled by the pumpset onboard controller. An arrow allows the user to select the next screen as below.

Intellistorm Settings Screen

This screen enables the user to adjust the following settings,

Intelligent/Attenuation Operation

A button enables the user to terminate intelligent operation, this will default the system to operate on the level switches only, maintaining the tank at empty status. This may be selected if the end user declines to renew subscription.

Hydrostatic Levels

Active when the system is operating in intelligent mode using the hydrostatic level sensor for control of attenuation pumps and attenuation tank level.

1. Dry Run Protection Level (%) – This is the level at which pumps will not operate due to tank low level and cause alarm output.

2. Tank Empty Level (%) – This is the level at which both the attenuation pumps and rainwater reuse pump will cease operating due to lack of water.

3. Tank Full Level (%) – This is the level at which the tank is designated full. This will be at approximately 80% of overflow level and pumping will initiate regardless of intelligent input.

4. Tank Emergency Level (%)– This is the level at which the tank has reached its maximum capacity prior to overflow and at which point it has been deemed that outlet pumping has failed and user intervention is required. This will be at approximately 90% of tank overflow level.

5. Safety Factor (%) – This is effectively the hysteresis of pump operation during intelligent control as described further later.

Details Screen

This screen displays the following details which cannot be adjusted and are for reference only;

System address: (Phone no of sim card) System postcode: Site Postcode

System Model No: Intellistorm 2019-1-CWT3 Manufacturer name: SDS Ltd

Fault Screen

A record of all faults as described later are collated within the fault area, all faults history must be manually cleared. Where a fault has not been acknowledged, it is highlighted. All fault history is downloadable via USB.

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Data and Background Program

Both the system's internal SIM card and the data input stream are covered by contract with SDS ltd for year 1 from practical completion of build (PC) continuing as part of a maintenance agreement with SDS ltd thereafter. An SMS input format has been agreed for the site based on the postcode.

This postcode ensures Intellistorm receives daily SMS weather alerts specific to the geographical area applicable to this Intellistorm System.

Daily, an SMS is automatically generated and sent to the system, received on number xxxxxxxxxxx. SMS will be in the following format: 06-07-07-2020

Where 06 denotes the mm of rainfall received by the site and 07-07-2020 denotes the 24 hr period for which the forecast pertains to.

Texts will be received the preceding day at 9am. Example. Monday 1st May at 9am, an SMS will be received as above pertaining to the 24hr period commencing 00:00 2nd may and finishing 23:59 2nd may.

Intellistorm uses the above data to interpret the sites volumetric rainfall catchment using the total surface area attributed to the attenuation tanks multiplied by the received mm of rainfall.

Example Only - During setup, input that RWH5 is a tank measuring 10m x 5m x 4m, therefore 200m3 capacity tank.

During setup, input that RWH5 is linked to a collection area of 500m2. During setup, tank full setpoint is input as 80%.

During setup, safety factor is input at 5%

At 9am on the 1st May, the system receives an SMS of 06

2/5/18

Based on the received SMS of 06mm, Intellistorm will convert the received SMS from millimetres to meters by dividing by 1000

ie. 06/1000 = 0.06m.

The system will now calculate the volume of rainfall received based on the surface area multiplied by the rainfall depth ie;

500m2 x 0.06m = 30m3

This is in turn factored into a percentage of total tank capacity required as a void. Ie. (30m3/200m3)*100 = 15%

And inverted to a target capacity. The target capacity is the "tank full setpoint" minus the percentage void required.

Ie. 80%-15% = 65% target capacity

The system will, 12 hours following SMS receipt (9pm), interrogate the tank volume of RWH5. Should this already be below target capacity ie at <65%, no action will be taken.

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Should the tank be at a level higher than this, ie. >65%, then the tank will commence emptying until the tank volume is realised lower than 65%.

There is a minimum run duration of 3 minutes (with the exception of dry run protection) to prevent pump burnout.

Tank level is then continuously monitored for the next 24 hours and should tank level exceed the safety factor+ target capacity.

Ie. 65% +5% = 70%

Then the pumps / Valves will be re-operated to achieve a tank volume less than target capacity. This process continues through to re-evaluation at 9pm the following day where the next target capacity is applied.

Stagnancy protection sequence inc level switch test

Every 14 days (adjustable 0-30 days on the HMI, the system performs a self-test and anti-stagnancy sequence. Whereby, a drain down of the attenuation tank will occur, taking level to the “tank empty level” on hydrostatic level sensor, which should be located below the backup L2-RWH level switch.

During this sequence, if level switch L2 fails to operate, an alarm will be reported as a warning alarm.

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Faults

Risk Register/Hazop

Fault	Cause	Consequence	Outward Alarm	Safeguards
Component Failure				
Intellistorm Weather Data Input	Subscription elapsed	Intelligent operation not possible	Warning Alarm	System defaults to remote level switch control - maintain tank empty status, std attenuation config
	GSM signal fail	Intelligent operation not possible	Warning Alarm	System defaults to remote level switch control - maintain tank empty status, std attenuation config
	Supplier data format change	Intelligent operation not possible	Warning Alarm	System defaults to remote level switch control - maintain tank empty status, std attenuation config
	software fault	Intelligent operation not possible	Warning Alarm	System defaults to remote level switch control - maintain tank empty status, std attenuation config
	user alteration	Intelligent operation not possible	Warning Alarm	System defaults to remote level switch control - maintain tank empty status, std attenuation config
Intellistorm Control Panel	External power failure	Intelligent operation not possible	Warning Alarm	System defaults to remote level switch control - maintain tank empty status, std attenuation config
	Panel component failure	Intelligent operation not possible	Warning Alarm	System defaults to remote level switch control - maintain tank empty status, std attenuation config
Rainwater Demand Level Switch	Faulty float switch	no reclaimed water use	Warning Alarm	System data indicates daily volumes of rainwater transferred to GW tank, alarms are possible for min volumes across elapsed time.
Level Transducer	Faulty transducer	Intelligent operation not possible	Warning Alarm	System defaults to remote level switch control - maintain tank empty status, std attenuation config
Level Switch High	Faulty switch	no immediate/flooding	none	14 days stagnancy protection provides for a self test sequence, self test fail raises critical alarm
Level Switch Start	Faulty switch	no immediate/flooding	none	14 days stagnancy protection provides for a self test sequence, self test fail raises critical alarm
Level Switch Stop	Faulty switch	no immediate/flooding	none	14 days stagnancy protection provides for a self test sequence, self test fail raises critical alarm
Level Switch Pump Protection	Faulty switch	no immediate/pump burnout	none	Annual ppm test
Rainwater Supply Pump	Pump fault	no reclaimed water use	Warning Alarm	System defaults to remote level switch control - maintain tank empty status, std attenuation config
	high solids load	no reclaimed water use	none	none
	high start/stop frequency	no reclaimed water use	none	none
Attenuation Pump 1	Pump fault	Various	Critical Alarm	Auto duty changeover on pumps
	high solids load	Pump motor burnout	Critical Alarm	Auto duty changeover on pumps
	high start/stop frequency	Pump motor burnout	Critical Alarm	Auto duty changeover on pumps
Attenuation Pump 2	Pump fault	Various	Critical Alarm	Auto duty changeover on pumps, in the event both pumps fail, rainwater pump can be diverted to drain and manually operated to empty tank
	high solids load	Pump motor burnout	Critical Alarm	Auto duty changeover on pumps, in the event both pumps fail, rainwater pump can be diverted to drain and manually operated to empty tank
	high start/stop frequency	Pump motor burnout	Critical Alarm	Auto duty changeover on pumps, in the event both pumps fail, rainwater pump can be diverted to drain and manually operated to empty tank
Attenuation Drain Route	solids build up	flooding	flooding	no current safeguards in place, consider "overpressure switch"
Rainwater Supply Route	solids build up	no reclaimed water use	Warning Alarm	If rw supply pumps are operational, system will search for movement on pulse watermeter, if none registers in 60 seconds, system will alarm with system blockage.
Process/Symptomatic Failure				
System leak	various	flooding/water damage	none	weekly system check includes leakage, consider 3rd party leak detection apparatus for at risk plant areas.
Other Risks				
stagnant water	lack of RW usage	poor quality water	none	14 day flush timer, if no change in tank volume detected for 14 days, system will empty tank to min level.
	Lack of new rainfall	poor quality water	none	14 day flush timer, if no change in tank volume detected for 14 days, system will empty tank to min level.
Pollutants in water eg. hydrocarbons	fuel spillage	poor quality water	none	consider introduction of hydrocarbon filter in line to CWT?

Intellistorm Calculation Operational Theory

Typical operation - Attenuation

At 9am, Intellistorm Control System receives update text message detailing the following days predicted rainfall in mm for the specific postcode

eg. on 1st september, system receives sms “E1 1BB, 20” (20mm of rainfall predicted at E1 1BB between 9am on the 2nd sept and 9am on the 3rd).

The system will be programmed with the roof area associated with each connected attenuation system eg 4560m2 for attenuation tank 1.

The system then calculates, based on collection areas and 20mm of rainfall, approximately 2m3 of rainfall will travel to tank. The system then monitors current tank volume within the attenuation tank and where necessary, commencing 9am, activates attenuation valve to reduce and maintain tank level to appropriate void. If tank level is already below desired level, system does not activate.

EG Tank1. Full level is 429.95m3, tank level at 9am on 2nd sept is 429.95m3. System activates attenuation valve to reduce level to 427.95m3, creating 2m3 void.

Using appropriate hysteresis, system continues to operate valves to maintain max tank level of 429.95m3 at all times until 9am on 3rd, where system will default to newly received data and new tank void requirement. In the event of panel failure or lack of input data, system defaults to normal attenuation, ie. complete empty of tank using normal level switches.

Typical operation – Rainwater Reclaim

The rainwater system does not communicate with the attenuation system operating as a standalone system although sharing some resource such as level switches. The rainwater system searches for available rainwater volume within attenuation tank. If water is present, and demand within the untreated greywater water tank calls for rainwater, the system will supply rainwater to meet demand.

Requirements

Intellistorm requires a continuous GSM signal. This can be achieved in-situ where plant rooms are above ground and receive sufficient coverage, or through the use of a small remote aerial mounted externally (supplied) and connected to the main control panel. Where this cannot be achieved, an option exists to reconfigure the system to utilise local network or wifi signal. This requires factory configuration and may require component changeout if performed onsite.

Intellistorm Limitations

The Intellistorm system requires a continuous GSM connection. This is received by way of an Aerial. This must be mounted in a location with signal. To this end, SDS Ltd will provide an aerial box with 20m of extension cable (Ethernet+7 core 1mm). It is the responsibility of site to both provide a continuous containment route and install this cable within said route, reaching from Intellistorm panel to signal location. Any extension to this distance is chargeable. It is important to note that the Intellistorm system has been designed for NON green/blue roof areas, inclusion of these items will negatively impact water quality and may affect system performance.

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Other

1. On power failure, the system will automatically reboot without user intervention to normal operation

2. All supplied material will meet all applicable legislation relevant to the supply of electrical equipment suitable for end user market.

3. System will be supplied with all necessary wiring diagrams, and PLC ladder diagrams and full copy of programming.

The following datasheets comprise the component materials of the Intellistorm System.

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