

[Redacted]

Richard Castro-Parker
Senior Planning Officer (Contract)
Arun District Council

[Redacted]

Can these please be uploaded and refer to in discharge notice.

Thanks

[Redacted]

[Redacted]

Hi Juan,

This is the latest version of the drainage documents that I have seen. Please ensure that the applicant has submitted this version for the portal as they are the basis for the recommendation from Roger.

Thanks

Sarah

[Redacted]

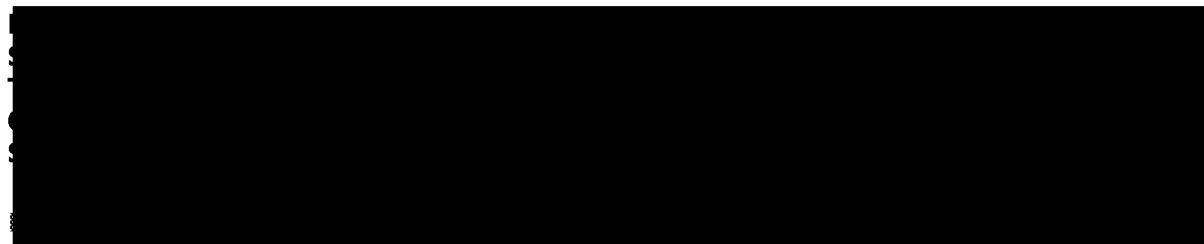
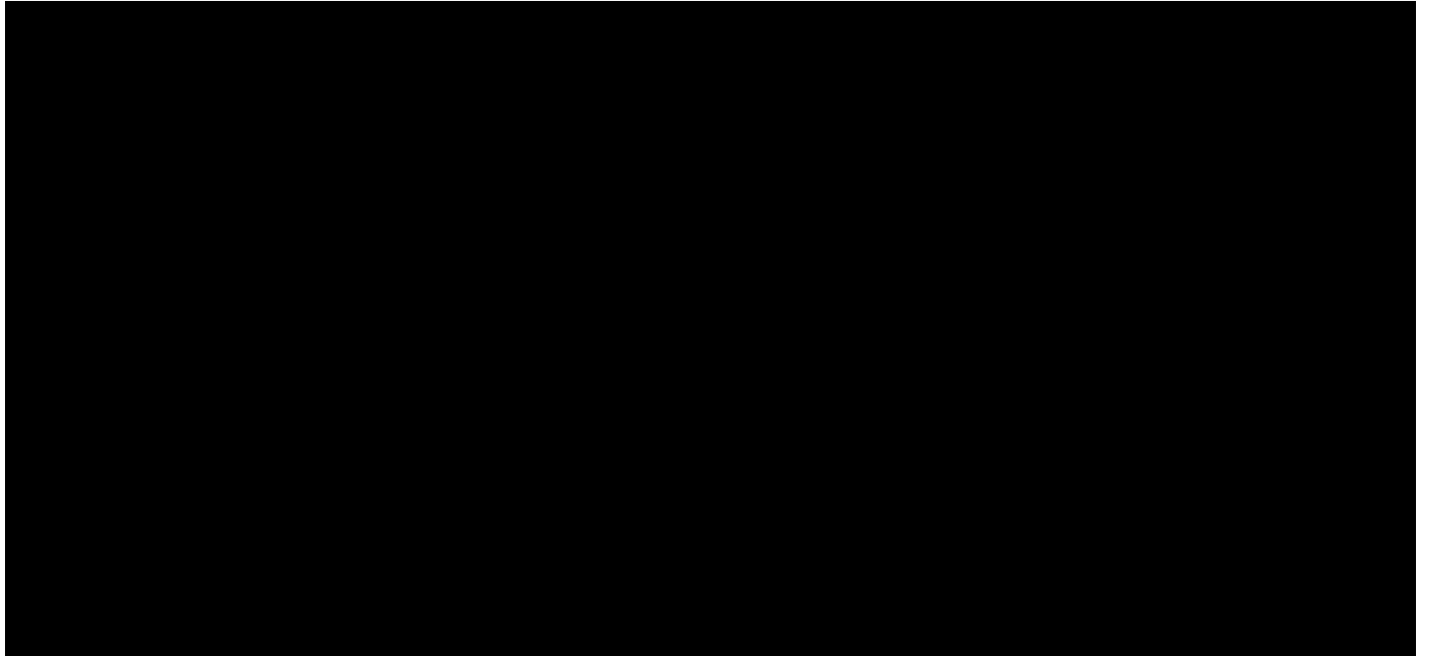
Hi Sarah

As requested, I attach the latest drainage maintenance plan addressing the risks identified by Laura.

The associated drawings are included in the various appendices.

This should provide all the information you need in one document.

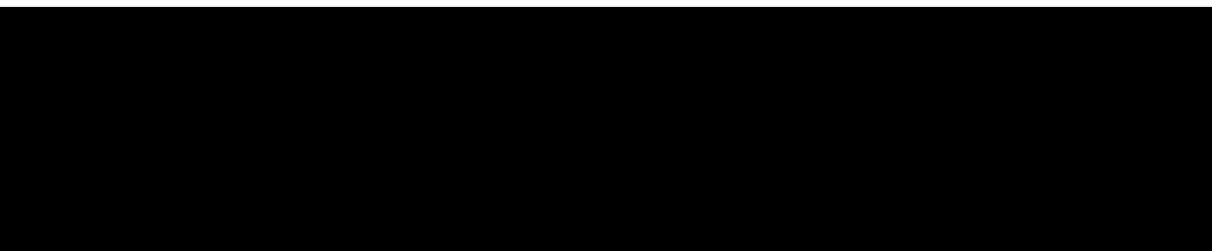
Regards



Thank you for confirming your acceptance of our design.

Please find attached the Maintenance and Management Plan updated with reference to CCTV inspections and a risk assessment for the maintenance activities, and including all the latest revisions of the drawings. This has also been sent to be formally uploaded to planning to discharge the drainage conditions.

Kind regards



Charlotte,

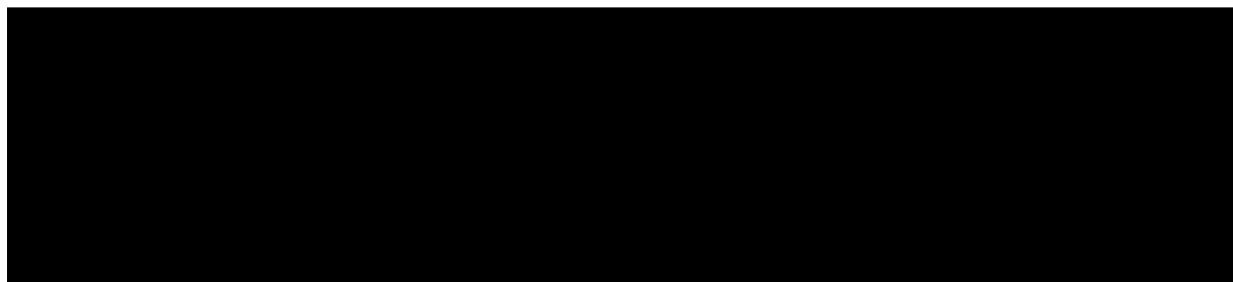
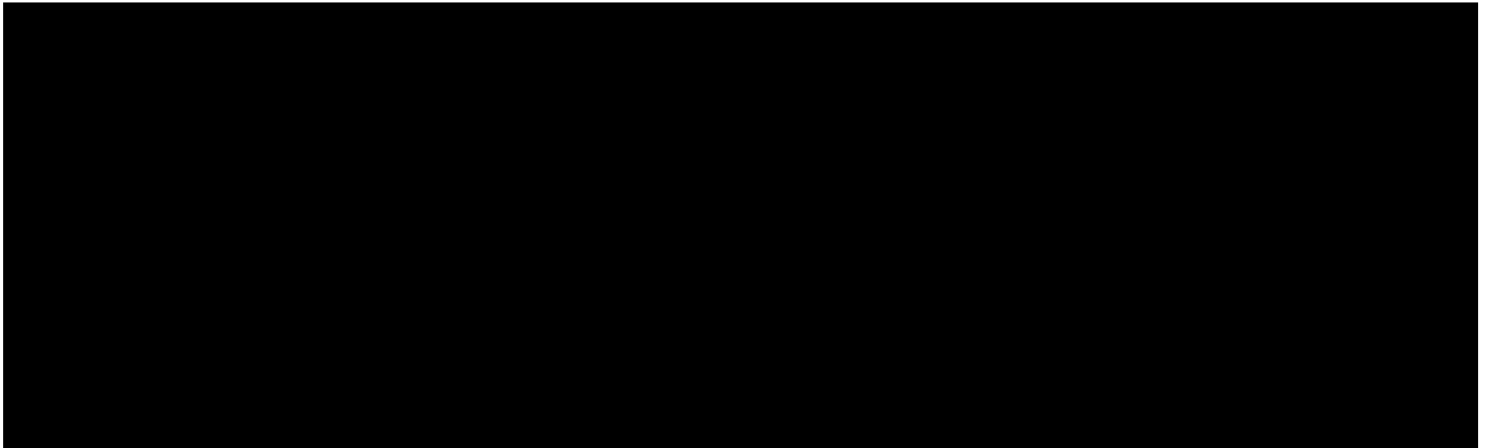
We still have significant concerns regarding the long term suitability of the solution and the risks involved with maintenance. But, it appears that we aren't really getting anywhere. In this instance we will just have to accept the solution but in any formal approval we would still highlight our concerns.

To manage the risks associated with the proposals we would like the following items clearly detailed within a maintenance manual:

- Confined space entry, potential for noxious gasses, working at height and in a water environment when maintaining the hydrobrake.
- Frequent CCTV inspections of pipework and remedial works as required to address any differential settlement that may lead to displaced joints, blockages, etc.

Please submit all relevant details formally to planning to discharge drainage conditions.

Thanks,

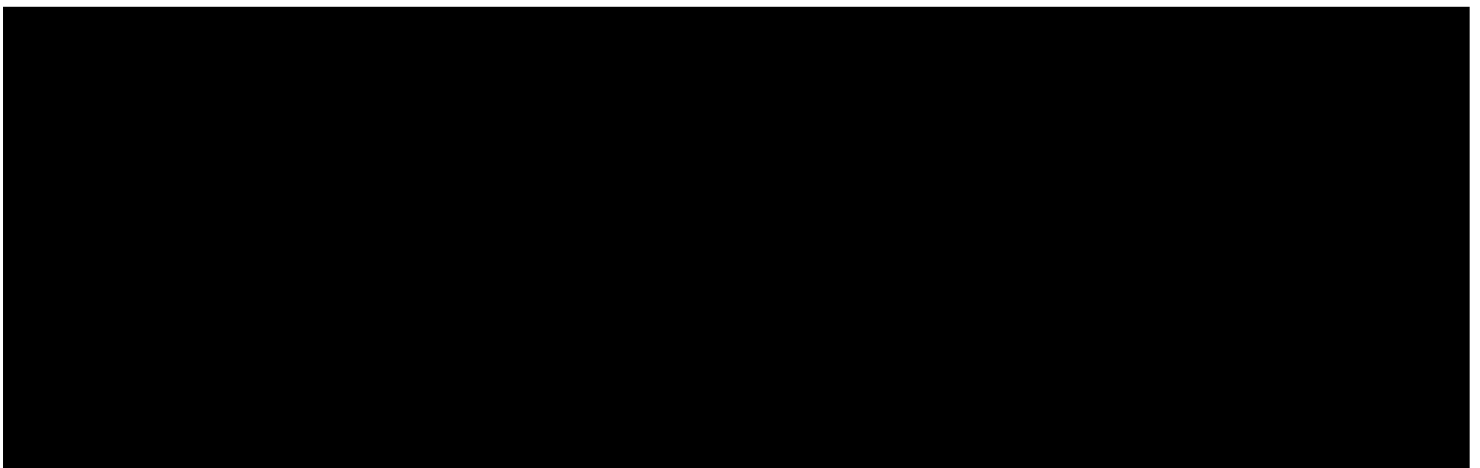


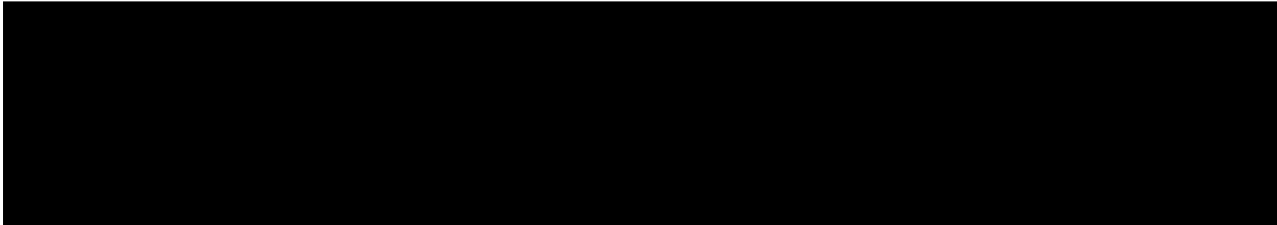
Hi Laura

Please find our response in red below and relevant information and updated drawings attached.

We are aware that Building Regulation approval will be required, which is a separate process to the discharge of planning conditions. Any further information that may be required to obtain Building Regulation approval for the drainage system will be provided at the appropriate time, but this should not prevent or delay the discharge of the relevant pre-commencement planning condition related to surface water drainage.

Kind regards



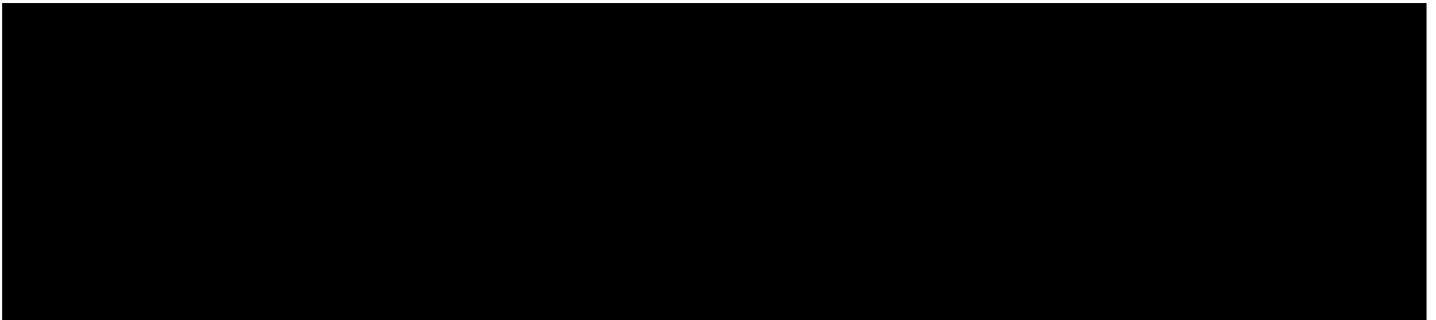


Hi Charlotte,

Thank you for sending through the revised information. My comments are in *green* below.

Kind Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)



Thanks for your comments. Please see my responses in blue below and updated plans / calculations attached.

Please note that the Maintenance Plan and accompanying drawings / calculations sent over last week have already been submitted to discharge the planning conditions. We will await your approval in principle via email prior to collating these into the Maintenance Plan report again and resubmitting to planning.

Kind regards

Charlotte Salt BEng
Engineer - Civil Engineering

Hi Charlotte,

Thank you for providing the details, I have the following comments:

1. Please provide a manhole schedule printout from MicroDrainage to facilitate my review.
This has now been added to the calculation results pdf, with the manhole references matching the references shown on the Technical Layout. *There are a few discrepancies between plan and calculations, however these are minor and do not impact upon the overall results.*
2. Invert level of inlets to upper crate are inconsistent between plan and calculations.
These have been adjusted to match, and revised calculation results attached. *Okay.*
3. Please provide half drain time calculations in a format that can be reviewed by myself.
Please find attached hand calculation. *Okay, point closed.*
4. Are you satisfied that the construction details for pipe bedding and surround and manholes etc. are sufficient given the potential for differential settlement?

Yes. The construction details with the Tensar Geogrid layers have been developed with Tensar and the geo-environmental consultant (GESL) and we are satisfied that this is a suitable design for the site conditions. As previously mentioned, minimum pipe gradients have also been increased in order to mitigate the risk of differential settlement. Drawing M637/16.002 shows the Geogrid installed within the trench below the drainage, but drawing M637_15.003 shows details of cutting and reinstating the Geogrid, which would indicate the majority of the drainage will be below the proposed Tensar geogrid layers? Therefore, not actually supporting the pipework, please confirm.

To clarify, there are two different uses of the Tensar geogrid: as a pipe bedding stabilisation detail; and as a Mechanically Stabilised Layer (MSL) at the base of the road construction. Drawing 16.002 (Tensar Geogrid Plan) shows both of these uses: where Tensar layers are used in the bedding of the pipes, as per the details on 15.004 (Drainage Details Sheet 1); and where the MSL is used at the base of the road construction. All pipes are located below the MSL, hence why a detail has been provided for reinstatement of the geogrid (should this be required), which is the one you refer to on 15.003 (Engineering Details Sheet 3).

I have significant concerns even if pipes are located above the Tensar Geogrid; the site is unstable in its nature due to previous land use and the additional disruption of piled foundations and heavy traffic will result in a significant potential for settlement to occur. I would recommend that you refer to BS EN 1610:2015, particularly clause 7.3 Special methods of bedding or support.

Please provide supporting structural design calculations.

Tensar have provided some comments on this as follows: "This solution has been used on many projects where there is concern that settlement in the pipe work will cause traps and blockages in the drainage runs. In this case the use of a TriAx geogrid within a granular well graded fill will mitigate any differential settlement (it will not stop overall settlement) along the pipe run. This in conjunction with the increased fall of the drainage runs will in my experience be an effective solution."

Other mitigation measures against the risk of pipe settlement have also been used, such as increasing pipe gradients, and using 6m pipe lengths rather than shorter lengths.

In addition, whilst we acknowledge that additional loading on the landfill can promote further settlement, it is also worth noting that the landfill is only 1.5-2.7m deep, is void of significant proportions of organic matter, and was closed several decades ago (studies suggest that 90% of settlement usually occurs in the first 5 years after closure of a landfill). Given this, the statement from Tensar and the mitigation measures outlined above, further settlement affecting pipe performance and integrity is considered to be a very low risk to the future performance of the drainage system. Therefore, we do not consider it necessary to provide structural calculations in order to support the design.

5. Will pipe materials be okay given the likely contaminants present?

Given the likely contaminants present and the pipe / bedding specification, GESL have confirmed that they are satisfied that the drainage pipes will be suitable for placement in the made ground. This of course may require a review based on any unforeseen contamination encountered during the works, as reported under the implementation of the Discovery Strategy. Please provide details of the proposed drainage materials i.e. plastic/clay and supporting manufacturers details confirming the material is suitable for landfill usage. Please see BS EN 752:2008 clauses 8.6.4 Materials selection and 9.5.3 Prevention of septicity

The Technical Layout states that all pipes are to be plastic. The manufacturer will be Polypipe, and I have attached the relevant specification documents provided by them. I have also attached an email from Polypipe which confirms that their pipes meet the requirements of the necessary British Standards, with reference to the site-specific soil conditions and made ground. As already mentioned, GESL have also confirmed that Polypipe's pipes meet the necessary requirements to be placed in the made ground.

6. How is the integrity of the capping process going to be ensured given the countless incisions that are going to have to occur for the surface water network.

Tensar expressed no concerns with isolated breaks in the geogrid layers for pipes/manholes. Nevertheless, we have designed both the foul and surface water drainage networks such that the pipework is laid below the capping, and manholes located within soft landscaping in order to avoid multiple cuts being made into the geogrid layers which may affect its integrity. The only locations where pipes will cut through the geogrid will be gullies (and their pipe connections), for which a specific detail (developed with Tensar) has been provided (refer to Drainage Details Sheet 2 M637_15.005). A geogrid reinstatement detail (as provided by Tensar and shown on Engineering Details Sheet 3 M637_15.003) has also been provided for where cutting and reinstatement of the geogrid is required. As such we are satisfied that the integrity of the capping/geogrid layers is maintained. Drawing M637_15.003 refers to cutting and reinstatement of the capping layer, to install pipework. Please provide sealing details of where any inspection chambers, pipes or gullies penetrate the Geogrid.

As already noted, both the foul and surface water drainage has been specifically designed such that chambers will be located outside of hard-paved areas using the MSL, and pipes located below the MSL. The only locations where pipes will cut through the geogrid will be gullies, for which a specific detail (developed with Tensar) has been provided on drawing 15.005 (refer to Drainage Details Sheet 2). This detail demonstrates how the geogrid will be cut and "sealed" in these instances. This detail would also apply in any other instances where drainage or other features could penetrate the MSL.

7. Sub-base for permeable paving should be no fines, not just reduced fines

Noted, this has been amended on all relevant drawings. Construction detail still states reduced fines.

Noted, this has now been amended correctly – updated drawings are attached.

8. Please provide a construction detail drawing of the lower crate access.

This has been added to Drainage Details Sheet 2 M637_15.005. On review, please consider the safety of access/ maintenance and consider if a standard inspection chamber (no catchpit) could provide a means of maintenance for the majority of occasions without having to send a man down the inspection chamber.

Noted. Chamber S50 has been amended to remove the sump – updated drawings are attached.

9. Please extend the riser pipe slightly more, currently the calculations state that you have a maximum water level in the 100 year plus cc event of 6.588 and a top of riser level of 6.600. Please provide greater freeboard than 2mm.

The riser pipe and weir wall levels have been raised to 6.900mAOD, providing 300mm freeboard above the 1:100yr+40%CC level. *Okay, point closed.*

Kind Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)



Hi Laura

Please find attached the Drainage Maintenance and Management Plan, which includes full technical layouts and details in the appendices. I have also attached the hydraulic calculations and a mark-up of the pipe references used by MicroDrainage.

The revised design is as per the parameters that we have discussed, and incorporates the details that you have requested. The calculations demonstrate that there is no flooding in the 1 in 100 year +40% climate change scenario. The calculations also demonstrate that in the 1 in 10 year plus 40% climate change scenario, the infiltration crates fill to just 94mm and as such (using the equation specified in the SuDS Manual) the infiltration crates have a half-drain time of less than 24 hours.

I look forward to receiving your detailed response and hope that you are able to confirm that the revised design is acceptable and that you foresee no issues in being able to discharge the relevant planning conditions on this basis.

Kind regards

Charlotte Salt BEng
Engineer - Civil Engineering



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Hi Charlotte,

Can you please send over the full details of the proposal, i.e. calculations, layout drawing and technical drawings. This will enable us to review the proposals fully and provide a more detailed response.

Thanks,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

Hi Laura

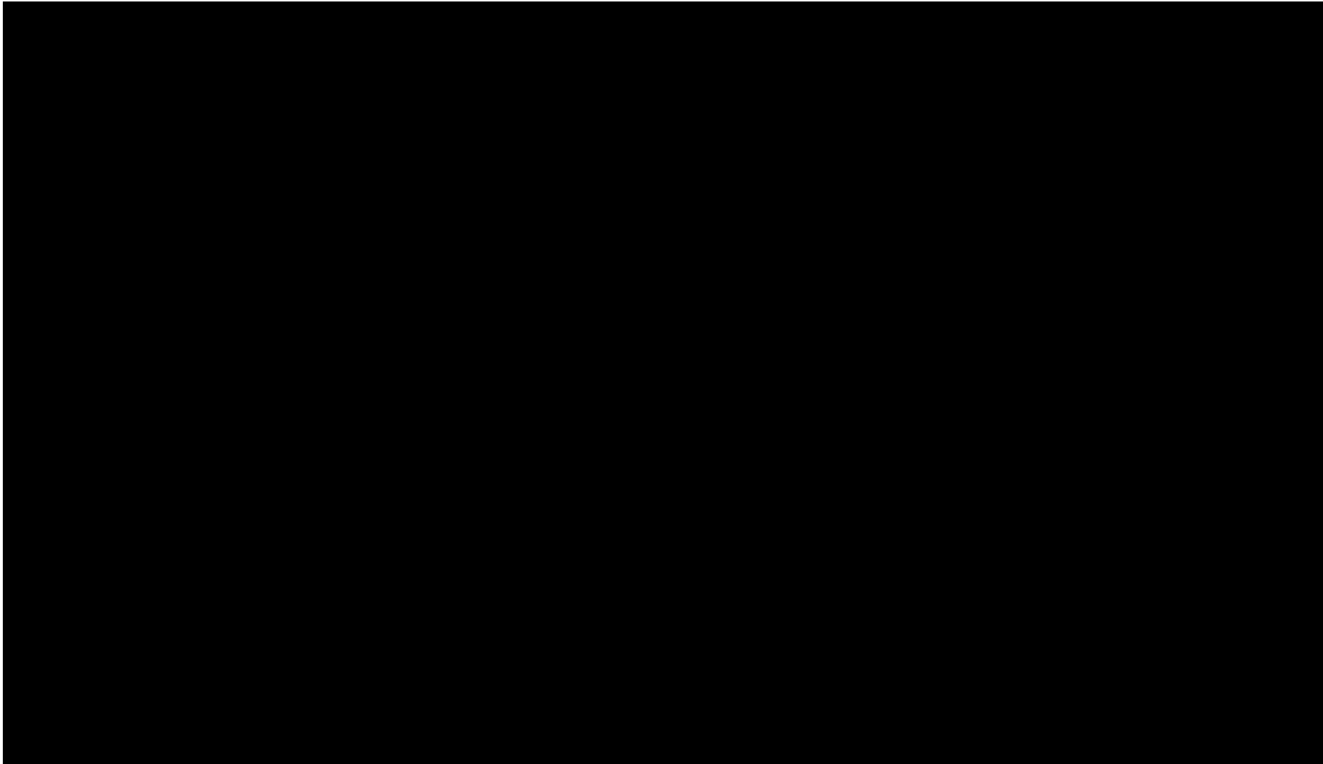
To clarify with regards to the network design, given that the site is built on landfill, pipe gradients have been steepened from standard minimum gradients in order to safeguard against the potential effects of differential settlement (e.g. 100dia. to 1:60, 150dia. to 1:90, 225dia. to 1:135, and 300dia. to 1:180). A similar exercise has been undertaken on the foul design, which is also constrained by the invert level of the outfall point, and as such the surface water network has been designed slightly deeper in some locations in order to avoid clashing with the foul network. In addition, the sewer networks have been designed to be located outside of hard paved areas as much as possible, again in order to safeguard against the effects of differential settlement of the manholes and the road (designed with a Tensar system preventing differential settlement), which means that pipe runs are longer than you would usually expect for a site this size. The topography of the site is also a factor, with ground levels highest in the centre of the site and falling towards the boundaries, with root protection areas around the boundaries which must be considered in the proposed levels design. As such, the storage cannot be raised any higher without impacting on the design or performance of the upstream network.

A 4.5m deep manhole is similar to the standard Type 1 manhole (3-6m deep) specified (and therefore considered acceptable) by Sewers for Adoption (7th Edition).

We accept having manholes at this depth is not preferred, however, as noted, the site constraints have dictated the invert levels and requirement for the flow control, and as such it is fixed at this depth. The hazard which arises from having deep manholes will be covered in the Designer's Risk Assessment and in the Health and Safety File.

Kind regards

Charlotte Salt BEng
Engineer - Civil Engineering



thomas.richards@thakeham.com; mark.wild@thakeham.com

Subject: RE: LU/330/18/PPL – Land at Cornfield Close, Littlehampton

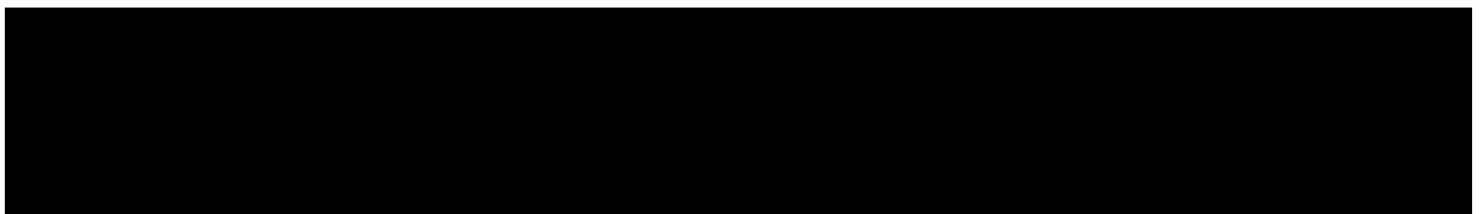
Hi Charlotte,

I understand that the hydrobrake needs to be located downstream of the storage crates. What I am struggling to understand is why such depth (in excess of 3m) is required given that the site is not that extensive. Could you please provide a revised technical layout drawing, showing falls of pipes etc.

Stating there are no concerns with accessing a hydrobrake at 4.5m depth is a little perplexing, working from height in a confined space in a water environment seems like a hazard that should be designed out.

Thanks,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)



Hi Laura

Further to your email, we have now looked at the arrangement of the system proposed in greater detail. Please find attached a sketch with our indicative design for your review, which incorporates your comments with regard to the perforated riser.

The HydroBrake must be located downstream of the storage crates and as such must therefore be located at a certain depth below ground. The attached design is based on the storage crates located directly on top of the soakaway crates, which places the HydroBrake c. 4.5m below ground level. The flow control will be mounted on a weir wall within a chamber large enough to accommodate ladder access either side of the weir wall. As such there are no concerns with regard to the access to or maintenance of the HydroBrake at this depth.

If the storage crates were to be raised (i.e. "separating" them from the soakaway crates below), due to the required levels and gradients of the upstream network the maximum the lined storage (and therefore HydroBrake) could be raised would be just 1m above the levels shown on the attached. There would therefore be no significant reduction in depth by amending the design, and as such, stacking the crates directly over each other as in the attached sketch is our preferred option.

Multiple storage features (such as porous paving) with multiple flow controls will not provide the restriction required to achieve the required half drain time.

Please could you review the attached and confirm that this arrangement is acceptable?

Thanks

Kind regards

Charlotte Salt BEng
Engineer - Civil Engineering

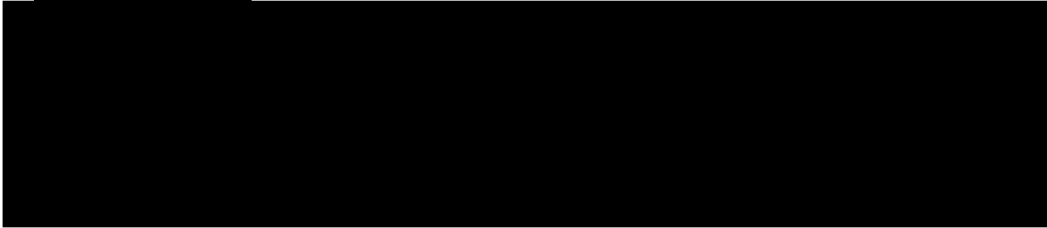


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Hi Charlotte,

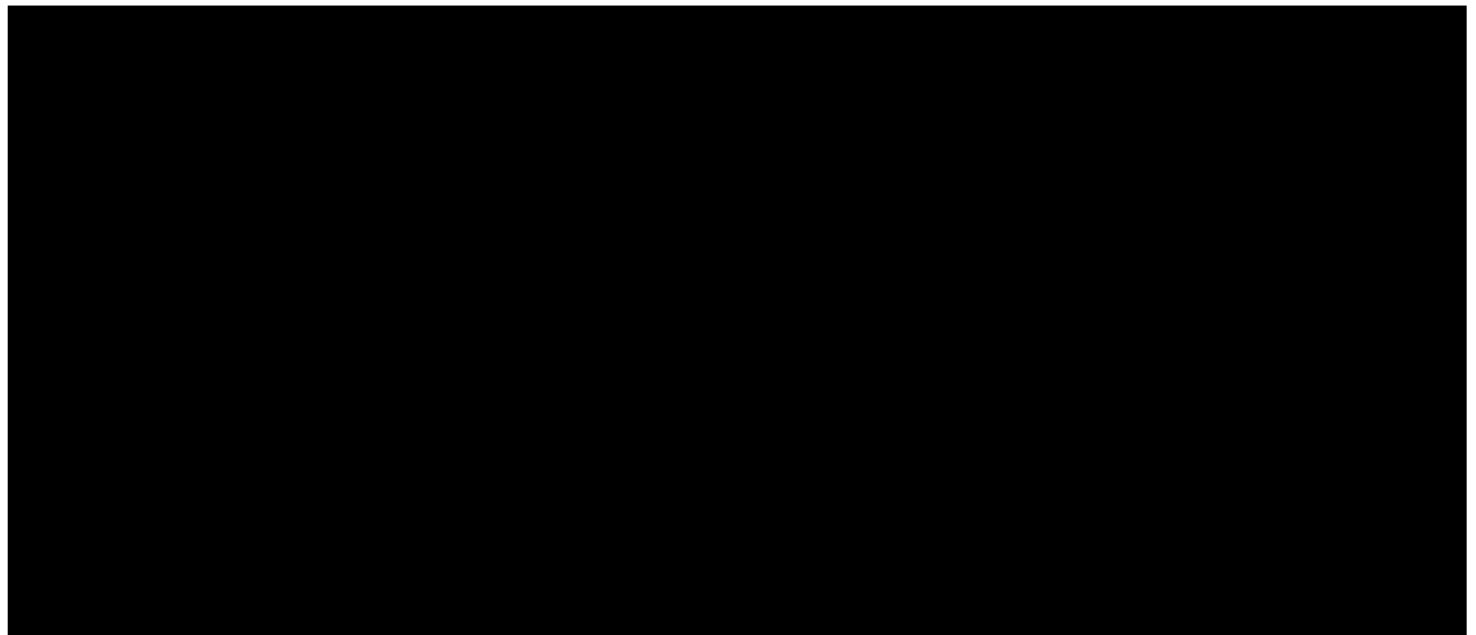
A 39mm diameter aperture does not meet our minimum requirements (50mm). However, as a compromise we would need extra measures to be provided to minimise the risk of blockage.

For example we would not accept the hydrobrake being as deep as it is shown on your cross section. We would prefer an additional hydrobrake chamber to be set higher, with an external backdrop connecting the additional chamber to your proposed deeper chamber. Within the additional chamber we would also be keen to see a split chamber arrangement with a significant diameter (e.g. 300mm) stainless steel riser pipe (see figure 28.19 in the SuDs manual) or similar used to filter the water before it reaches the hydrobrake. The size of the apertures on the riser would have to be less than 39mm (say 20mm). The top of the riser would have to be set at a level suitable to act as an emergency overflow. There would need to be a cap or mesh put on top of the riser to ensure no large debris is washed through in overflow scenarios. The riser would need to be fixed to the wall with brackets and formed of good quality stainless steel to avoid rust. These proposals would need to be fully detailed for approval.

Alternatively, would providing lined permeable paving with orifice plates on each plot provide the storage you require?

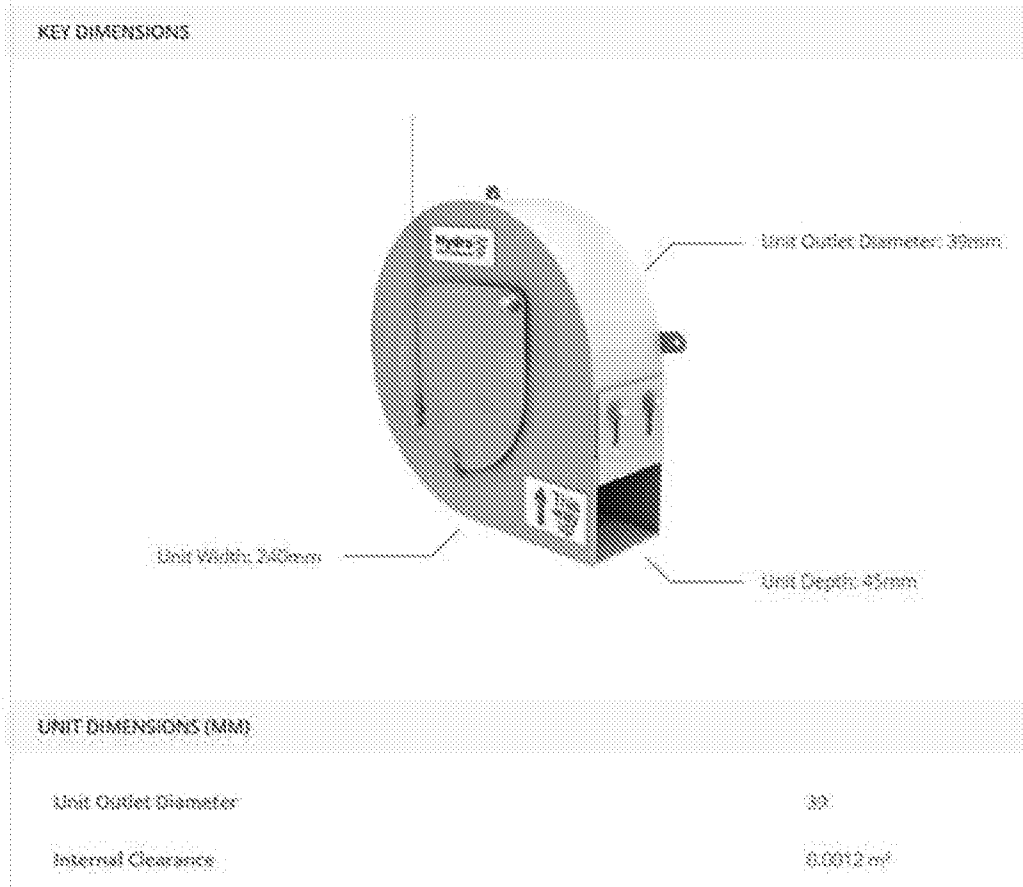
Thanks,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)



Hi Laura

The product would be a HydroBrake Optimum which is a specialist product designed to minimise the risk of blockages, as opposed to a simple orifice plate. I have attached and pasted below the product specification from the manufacturer - the orifice is 39mm diameter.



Kind regards

Charlotte Salt BEng
Engineer - Civil Engineering

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[REDACTED]

Hi Charlotte,

Please provide details of the potential orifice size for this flow restriction.

Kind Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

[REDACTED]

[REDACTED]

Hi Laura

The flow control would be a HydroBrake Optimum, which the manufacturer states can restrict flow down to 0.7 l/s and has low blockage risk.

The relationship between the two sets of crates has been considered in terms of loadings and construction details; we are yet to finalise this with the manufacturer however are confident that there is a workable solution.

Kind regards

Charlotte Salt BEng
Engineer - Civil Engineering

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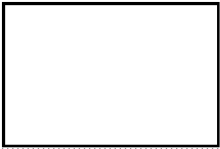


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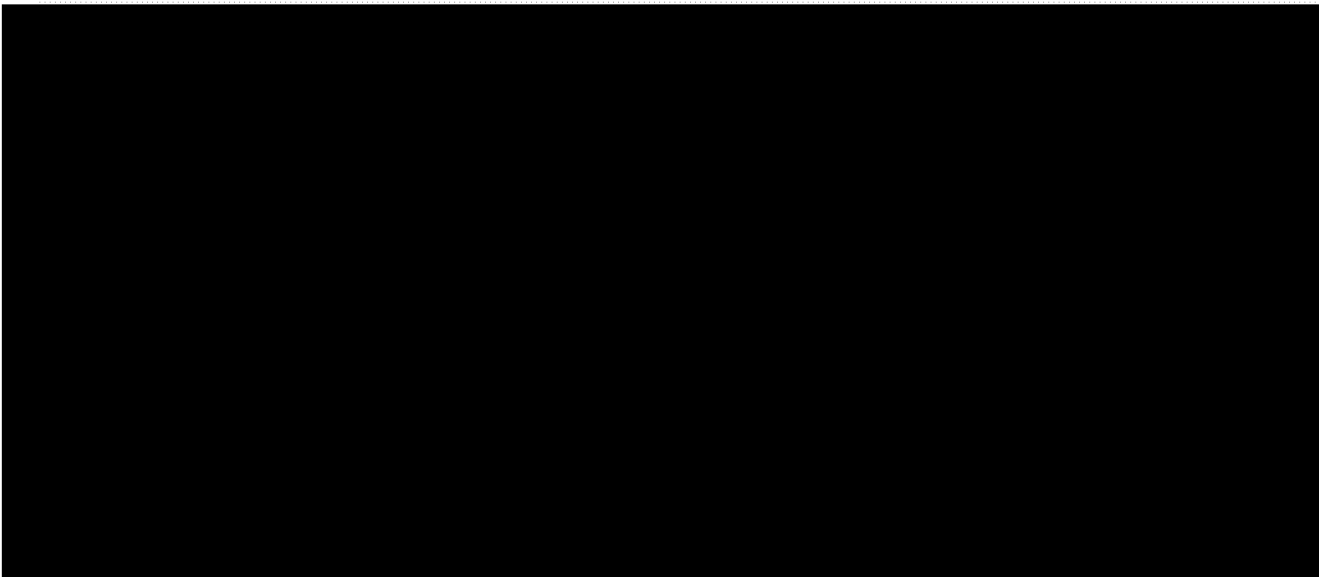


Hi Charlotte,

We normally only allow flow constrictions down to 2l/s due to the risk of blockage. Please can you provide further details on what the size of the orifice will be for this restriction? I presume loadings upon the tanks have been fully considered and that the proposals will comply with manufacturers requirements.

Thanks,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)



Hi Laura

Thank you for your response.

You are correct in that MicroDrainage Network modelling does not automatically calculate the half drain time; I have been calculating this by taking the maximum water depth in the model results and applying the equation given in CIRIA SuDS Manual.

We have been exploring different options and have found a viable solution which achieves the 24hr half drain time requirement in the soakaway for the 1:10yr+40%CC event.

This involves restricting the inflow into the soakaway and providing storage upstream of this restriction. The details of this strategy are as follows:

- The inflow into the soakaway will be restricted to 0.7 l/s in order to achieve the required half drain time. This will be provided using a HydroBrake flow control device, which can achieve this low flow rate whilst delivering a very low blockage risk.
- Attenuation upstream of the HydroBrake flow control device will be provided in the form of lined crates located within the public open space, directly above the soakaway crates (see attached sketch).
- This attenuation/infiltration system will be designed to accommodate all events up to and including the 1:100yr+40%CC event, with shallow surface water flooding (low hazard level) in the car park / soft landscaped areas being acceptable in the 1:100yr+40%CC event only, as previously agreed with you.
- The half-drain time of the soakaway itself will be less than 24 hours for the 1:10yr+40%CC event (up to and including the 48hr duration event).

Providing the storage in this form has been found to be the most efficient storage solution compared to smaller areas of crates and/or porous paving. Nevertheless, we are proposing that some of the driveways will be converted to porous paving, which will provide additional attenuation and pollution control for these areas.

We would like to agree with you the principles of this strategy prior to us proceeding with the necessary amendments to our technical design. Please could you review the strategy I have outlined above and confirm that this is acceptable and there are no other issues that you foresee in order to discharge the relevant planning conditions in due course?

Kind regards

Charlotte Salt BEng
Engineer - Civil Engineering



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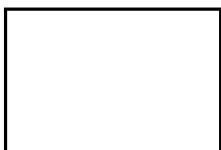
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Hi Charlotte,

The calculations you have supplied do not actually state the half drain time. As we seem to be stuck on this point I have myself done some calculations and do not believe that you can achieve half drain time however “relaxed” we let infiltration rates and factors of safety be.

We are not willing to accept an alteration to the definition of half drain time as this would be setting a dangerous precedent. It is worth noting that our request to only achieve half drain time for the 10 year plus climate change event is us being lenient. WSCC policy states that you should meet the half drain time requirement for the 100 year plus climate change event unless expressly agreed with district and borough engineers to allow the 10 year plus climate change event. I hope that this closes out this point.

Therefore, you are going to have to do something else to ensure this requirement is met. This could be providing upstream attenuation, finding a way to have an overflow, or reducing the amount of water going to the soakaway, etc.

Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

Hi Laura

Please find attached the results you requested.

If a soakaway were to be designed to the parameters we have agreed (worst case infiltration rate and safety factor of 4), in order to achieve a half drain time of 24 hours you would have to design a system where the crate would fill to a maximum depth of only 95mm (using equation from CIRIA: $HD\ time = (n * h_{max}) / (2 * (q / FoS))$) in the 1:10yr+40%CC event. By extrapolation, this system would fill to approximately 475mm in the 1:100yr+40%CC event.

Using a simple inflow-outflow model, in order to achieve a depth of water of 95mm in the soakaway, the flow into the soakaway would need to be restricted to just 2.4 l/s (for comparison QBAR=9.5 l/s for the site). This is impractical to split between the four inflows without a blockage risk. However, assuming this were achievable by combining inflows, the volume of storage required upstream of the soakaway would be very large (c.839-1161m³) and the volume of the soakaway relatively small (just 2 layers of crates over the current footprint – c.500m³), which essentially forms more of an attenuation system rather than an infiltration system. This seems counter-productive and results in a combined storage requirement much higher than designed at present, which would be very difficult to achieve within the site constraints. The upstream storage would also have no requirement to drain to half-full in 24 hours. In some cases water would therefore be stored for a long period of time in order to achieve the downstream restriction(s), and therefore the storage features would not have capacity to deal with multiple consecutive storm events. This would result in an increase in flood risk, compared to if there were no restrictions or upstream storage, and the soakaway was utilised to provide this storage as it is designed at present.

Therefore, we request that the half drain time requirement is relaxed for this site as the only design solution to achieving the 24 hours would result in a very large volume of storage which would be impractical and unreasonable

to achieve within the site constraints, as well as resulting in an increase in flood risk upstream. Therefore, one of the following options needs to be taken forward in order for the site to be viable:

- 1. defining the half drain time as the time taken from maximum depth in the 1:10yr+40%CC event to half of the total crate depth, therefore leaving sufficient space for multiple consecutive storm events;
- 2. using a design half drain time of greater than 24 hours; and/or
- 3. relaxing the requirements on the infiltration rate and/or factor of safety requirement.

We would like to discuss with you options to mitigate not achieving the standard 24 hour requirement and/or your desired infiltration rate / safety factor. Options could include:

- a) a requirement to store a certain number of consecutive storms within the system without flooding;
- b) a requirement to restrict flooding within the site to a certain depth/hazard level for a certain number of consecutive storms (as we agreed for the 1:100yr+40%CC event at our meeting the other week); and/or
- c) a high level overflow to the public foul water sewer located in Cornfield Close (subject to approval from Southern Water).

Taking forward one or more of options 1-3 alongside one or more of the migration measure options a)-c) would still result in a robust design which takes into consideration the effect of multiple consecutive storms.

I think it would be easiest to discuss these options and how we are going to move forward with this over the phone with you. We are keen to progress with a solution to this as soon as possible so it would be much appreciated if you could spare the time some time tomorrow afternoon for a phone call. Another meeting later on this week may be beneficial depending on the outcome of our phone call.

You have also mentioned the saturation of the soil where the soakaway takes many days to drain. It is worth noting that the BRE365 soakage tests take account of this to a certain extent by doing three consecutive tests, with the worst case rate being used of the three tests.

Thanks

Kind regards

Charlotte Salt BEng
Engineer - Civil Engineering

Comerstone House, 62 Foxhall Road, Didcot, Oxfordshire, OX11 7AD

Structural EngineeringCivil EngineeringTransport & HighwaysGeomatics Land SurveyBuilding SurveyingBIM

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>

Hi Charlotte,

We would like to be clear on what the impacts of using side infiltration are upon half drain time. Could you therefore please send us your full half drain time calculations (not just consecutive storm analysis) for no side infiltration, partial side infiltration, and full side infiltration?

Half drain time should be calculated as the time taken for water to drain from maximum volume to half of its maximum volume for a storm event, this is how MicroDrainage etc. calculate half drain time. Half drain times demonstrated to date are unacceptable. Furthermore, it is likely that with water sat in the tank for 7 days (just to half empty) for the 10 year event the underlying ground will become saturated and infiltration rates will reduce further.

Kind Regards,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

Hi Laura

Please see attached results with no side infiltration (including full model details), and with side infiltration through 1/3 of the sides (i.e. through the bottom layer of crates). These are for the 1:100yr+40%CC event and demonstrate that using this side infiltration reduces flooding by only 3m³, and the maximum level in the crates by 5mm.

Please let me know if there is anything else that you need.

Kind regards

Charlotte Salt BEng
Engineer - Civil Engineering

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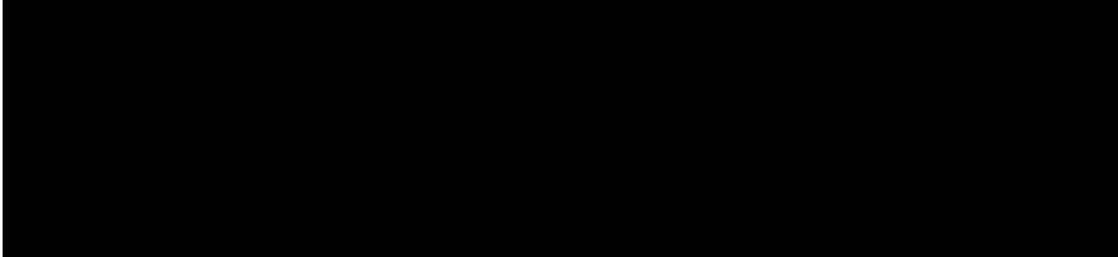


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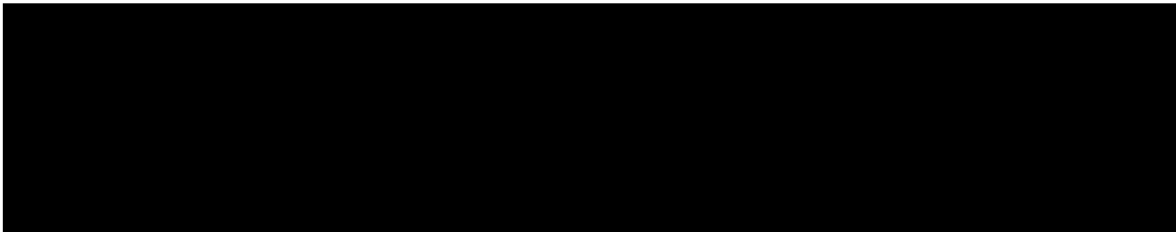
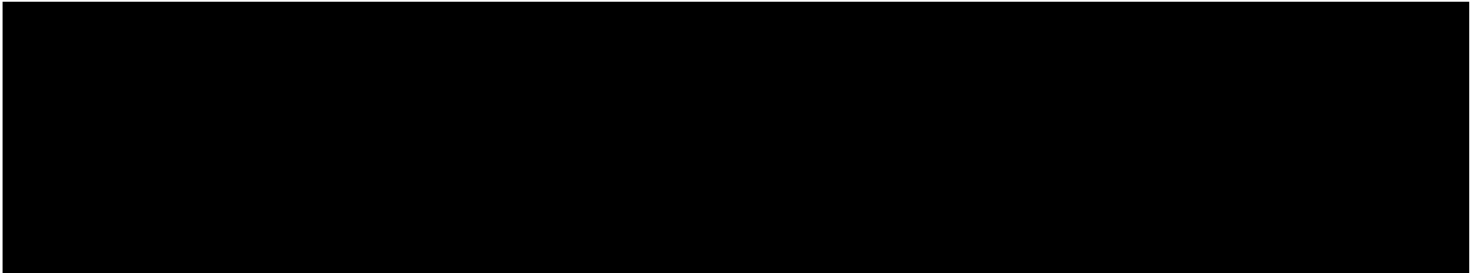
Charlotte,

Thank you for your email.

Could you please send me the results from modelling some infiltration through the sides too?

Thanks,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)



Hi Laura

It was good to meet with you the other week. I just wanted to feed back some modelling results thus far, and clarify some details with you.

Side infiltration

Even using the entirety of the sides to infiltrate has negligible effect on the results. The soakaway would also need to be deepened to utilise the sandy deposits if side infiltration were to be relied upon, which can only be done to a certain depth so as not to encroach on the 1m buffer to groundwater. As there are negligible benefits and it may require a lengthy discussion with the EA with no guarantee of approval, we do not intend to explore this option any further.

Half Drain Time

I'd like to clarify with you the definition of the half drain time. We consider this to be the time taken for the soakaway structure to drain from its maximum depth (in this case, in the design 1:10yr+40%CC event) to 50% of the total crate depth (i.e. 600mm above invert level). The SuDS Manual / Arun DC guidance refers to "full" and "total volume" when defining half drain time which indicates this to be correct:

SuDS Manual: *"The infiltration component should discharge from full to half-full within... 24 hours".*
Arun DC guidance: *"The infiltration structure should also drain 50% of its total volume in 24 hours or less..."*

If, on the other hand, you were looking to define the half drain time as the time taken for the soakaway structure to drain from its maximum depth (in the 1:10yr+40%CC event) down to 50% of this maximum depth, using the agreed infiltration rate and safety factor parameters, the soakaway would have to fill to just 95mm. There is no practical solution to achieving this on the site. In any case, assuming it were achievable, this would mean that the soakaway would only fill to 475mm in the 1:100yr+40%CC event and that the whole system would have capacity for an indefinite number of consecutive 1:100yr +40%CC events without flooding. As such it would go well beyond the 1:100yr+40%CC soakaway design requirement, as well as the requirement to account for subsequent storm events, so the system would be significantly overdesigned.

For the case where the soakaway drains to half full (600mm) within 24 hours in the 1:10yr+40%CC event, I have analysed the effect of multiple consecutive storm events as I have done before. I have attached some results which are based on a model using the agreed parameters (2.1x10⁻⁶m/s and a safety factor of 4). This model also assumes no change in the system as currently designed (i.e. no additional storage) so the soakaway doesn't quite drain to 600mm within 24 hours at the moment, however once I have done the additional storage design this will be the case and the multiple storm event analysis will have better results than the attached show. Again, the first flooding to occur in the case of multiple extreme rainfall events will be the flooding of the car park, which you have agreed is acceptable providing that in the design case flooding does not reach an unsafe depth.

Please give me a ring to discuss the half drain time once you have had the chance to review this.

Thanks

Kind regards

Charlotte Salt BEng
Engineer - Civil Engineering

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