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REDMER DEVELOPMENTS
RESIDENTIAL DEVELOPMENT
LAND OFF MAIN ROAD, WELLOW,
YARMOUTH, IW

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

JULY 2023

the journey is the reward

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Redmer Developments
Residential Development
Land Off Main Road, Wellow, Yarmouth, IW
Flood Risk Assessment & Drainage Strategy

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1 Development Description and Location

Introduction

1.1 This Flood Risk Assessment has been undertaken in accordance with paragraphs 167 to 169 of the National Planning Policy Framework (NPPF) revised July 2021 (**Ref. 1**) and the associated Planning Practice Guidance, entitled Flood Risk and Coastal Change, published online on the 6th March 2014, updated most recently on the 25th August 2022. (**Ref. 2**). As past guidance retains key elements from "Planning Policy Statement 25: Development and Flood Risk (PPS 25)" (**Ref. 3**) published by Communities and Local Government in December 2006 it may also be referenced where appropriate. This is of particular significance as the Environment Agency's published guidance in relation to flood risk consideration previously referenced this document despite the introduction of the NPPF. 'Development and Flood Risk: A Practice Guide Companion to PPS25' (**Ref. 4**) published by the Department for Communities and Local Government in February 2007, is also referenced, as is the Isle of Wight Council's Strategic Flood Risk Assessment Mk 2 June 2010 produced by Entec Consultants **(Ref 5)** and, to a lesser extent, the Preliminary Flood Risk Assessment produced by Amec on behalf of the Isle of Wight Council and dated November 2011 **(Ref 6)**. Policy DM14 Flood Risk of the Core Strategy Island Plan adopted March 2012 **(Ref 7)** (which also references PPS 25) is also considered and finally, in its draft form, the emerging Island Planning Strategy Development plan, published for consultation July 2021; specifically, section EV 14, Managing Flood Risk in New Development **(Ref 8)**.

1.2 This Flood Risk Assessment considers both whether the proposed development is appropriate in planning terms and the impact of the proposal on the local hydraulic regime, in accordance with, inter alia, the above referenced documents. The conditions currently existing in the area of the site are described, together with the methods used to identify and assess potential impacts from the proposals. The mitigation measures proposed to avoid or reduce the impacts are identified including the strategy for the drainage of both foul and surface water flows arising from the site.

1.3 The following questions/headings are based on the site specific flood risk Assessment checklist located on the National Planning Practice Guidance webpage (https://www.gov.uk/guidance/flood-risk-and-coastal-change#Site-Specific-Flood-Risk-Assessment-checklist-section) The headings have been rearranged and amended to allow the best presentation of the document and reflect previous guidance referred to in other local documents. As this document serves as both a Site Specific Flood Risk

Assessment and a Drainage Strategy, the document also includes expansion and additions to these main points, where necessary, to provide further insight into the drainage strategy for the site.

1a - What type of development is proposed and where will it be located?

1.4 It is proposed to develop an area of land off Main Road, Wellow, IW for a residential development. This document is intended to accompany an outline planning application for up to 16 units. Access to the proposal will be via Main Road, Wellow. The site is undeveloped greenfield land.

1.5 As shown in **Figure 1.1** below, the development site is located to the south of Main Road.

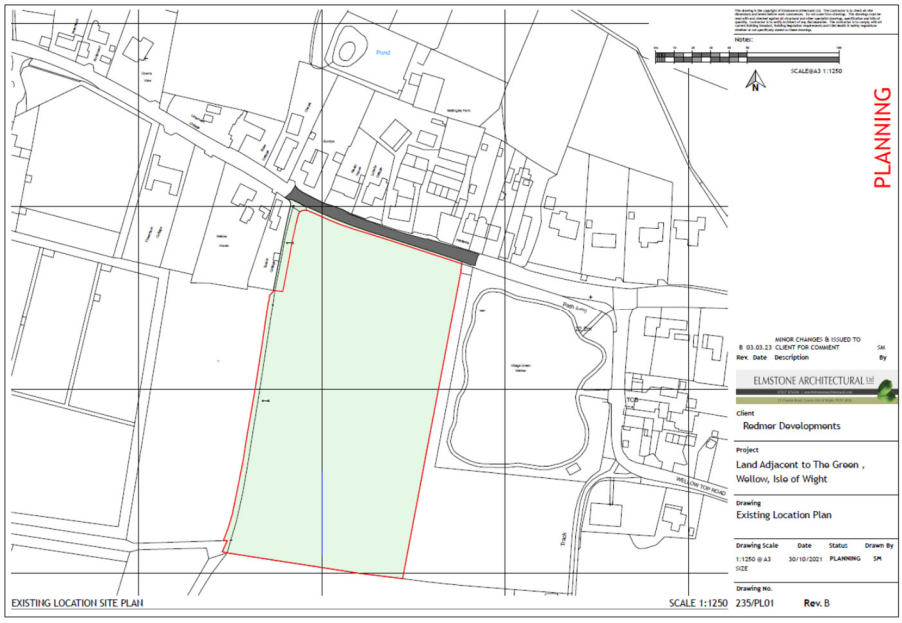

Figure 1.1. Location Plan

1.6 The area of the site is approximately 1.8 ha, although for the purposes of calculating QBAR, in the light of recent comments by Island Roads on this matter we will use only the developable area for the calculation. The developable site area is 1.284 ha.

1.7 Existing levels for the site range from approximately 20.50 mAOD in the north-western corner of the site, to a highest level of around 28.50 mAOD in the south-eastern corner.

1b - What is the vulnerability classification?

1.8 The proposed development is of a residential nature. The flood risk vulnerability classification of such a development proposal, according to Annexe 3 of the NPPF, is 'More Vulnerable'. More Vulnerable developments are appropriate for Flood Zones 1 and 2, but should only be permitted in Flood Zone 3 if the Exception Test is passed.

1c – Is the proposed development consistent with the Local Framework Documents?

1.9 The proposed development is consistent with the objectives of the Island Plan Core Strategy document. Further insight in this regard can be found within the Design, Access and Planning Statement produced by BCM LLP.

1.10 Locally, Planning Policy DM14 relating to Flood Risk, taken from the Island Plan: Core Strategy (March 2012) reads as follows:

"The Council will expect development proposals to reduce the overall and local risk of flooding on the Island. Development proposals will be expected to:

1. Demonstrably meet the aims and objectives of the Council's Strategic Flood Risk Assessment. When undertaking FRAs in Flood Zones 2 and 3, an allowance for climate change has to be provided. PPS25 requires this allowance to be a minimum of 100 years.

2. Provide appropriate on-site sustainable draining systems (SuDS) for the disposal of surface water in order to ensure there is no net loss of flood storage capacity or impact on water quality. This will need to meet national and local standards for SuDS to a sufficient level so as to gain approval by the SuDS Approving Body.

3. In addition to national requirements for a Flood Risk Assessment, planning applications for all new developments on sites over 0.25 hectares in Flood Zone 1 should be accompanied by a Drainage Strategy.

4. Where a proposal is in an identified Flood Risk Area, as defined by the Council under its responsibilities as a Lead Local Flood Authority, the Council will expect it to support the objectives and measures of the relevant flood risk management plans and strategy.

SuDS should be sensitively designed and located to promote biodiversity, enhanced landscape and good quality spaces that improve public amenities in the area. Proposed SuDS schemes should demonstrate consideration of the contribution they can make to the Island's Green Infrastructure Strategy. The contribution made to the GI network should be proportionate to the scheme proposal and any wider environmental mitigation requirements the proposed development associated with the SuDS scheme requires.

On greenfield sites, SuDS will be required to achieve no increase in the relevant net runoff rate to that prior to development. All other sites should aim to achieve a reduction from the existing run-off rate but must at least result in no net additional increase in run off rates. All developments will be expected to maintain and improve (wherever possible) river and groundwater quality. For specific locations around the Island, a Flood Risk and Vulnerable Coastal Communities SPD will be developed which will address the specific flood risk related issues that will need to be considered by development proposals within

areas covered by the SPD. The SPD will outline what measures will need to be demonstrated so that new developments would not be at risk of flooding as a result of climate change, or would not worsen flood risk elsewhere."

1.11 Nationally, in respect of flood risk consideration of development proposals paragraphs 167 to 169 of the NPPF state that:

"When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;

c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Applications for some minor development and changes of use should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 54.

Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

a) take account of advice from the lead local flood authority;

b) have appropriate proposed minimum operational standards;

c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

d) where possible, provide multifunctional benefits."

1d - Please provide evidence that the Sequential Test or Exception Test has been applied in the selection of this development type.

1.12 The risk-based Sequential Test should be typically applied at all stages of planning. Its aim is to steer new development to areas at the lowest risk of flooding, i.e. Flood Zone 1. Strategic Flood Risk Assessments (SFRA) provide the basis of applying the Sequential Test, at the time of the production of that document this was on the basis of the Zones in Table D.1 of PPS 25. Table 1: Flood Zones of the NPPF Technical Guidance then provided this information, which is now available on line as part of the planning practice guidance for flood risk and coastal change available at www.gov.uk.

1.13 In this instance, due to the site's location and flood zone classification, specific sequential and exception testing is not required in respect of flood risk considerations. The site is located entirely within Flood Zone 1, which is at the lowest risk of flooding. A local SFRA document was prepared by Entec Consultants in November 2007, with an update in June 2010, on behalf of the Council. Separate appendices were produced for various areas across the Island. There is no mention of Wellow within this documentation and no specific separate mapping. The western end of Wellow appears in some of the mapping for Yarmouth, though not this site.

1.14 However, online Environment Agency flood mapping, called, 'Flood Maps for Planning' demonstrates that the site is not within any of the problematic flood zones (2 & 3). Please see **Figure 1.2** below for an extract from this mapping.

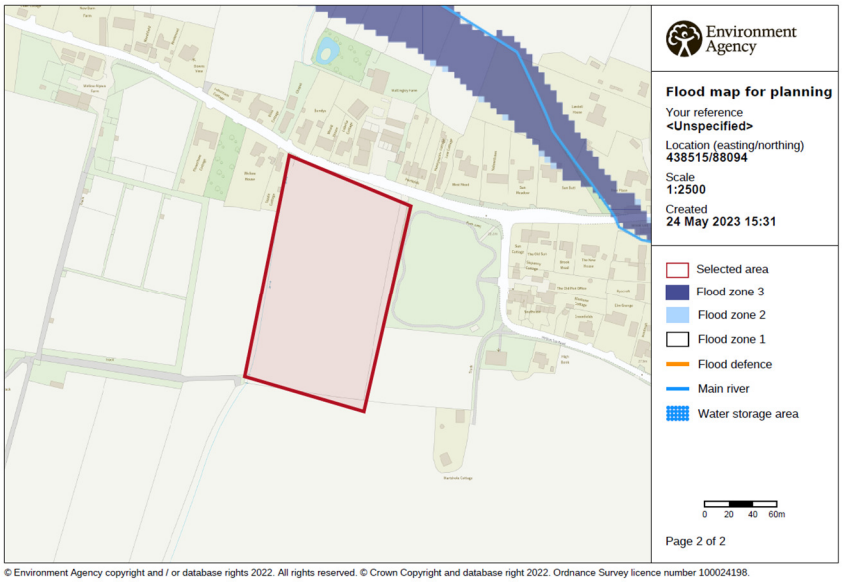

Figure 1.2. Flood Maps for Planning map extract.

1.15 The eastern edge of the application site area sits over 150 metres from the more problematic flood extents, shown dark blue on the attached. It is also worthy of note that the lighter blue line denotes the route of the main channel of Thorley Brook.

1.16 On the basis of the above map, further broad advice and insight within the main SFRA Mk 2 document and the advice given within the NPPF, it was not considered necessary to produce a specific Sequential and Exception Test document in respect of the consideration of flood risks.

1.17 Regardless of the requirement or otherwise for Sequential and Exception testing this Flood Risk Assessment will demonstrate that the proposed development is safe.

2 Definition of a Flood Hazard

2a - What sources of flooding could affect the site?

Potential source of flooding	Yes / No
Fluvial flooding	Yes
Tidal flooding	No
Groundwater flooding	Yes
Overland flow flooding	Yes
Failure of the urban drainage system	Yes
Failure of local infrastructure	No

2a - For each identified source, describe how flooding would occur, with reference to any historic records wherever these are available

2.1 A critical potential source of flooding to the site could be the ditch system that is effectively a tributary of Thorley Brook. An extreme flood could cause levels in the ditch system to rise significantly and cause flooding in the vicinity of the site.

2.2 Clearly there would be no flood risk to the site directly from the sea – however, the ditch adjacent to the site drains to Thorley Brook which in turn joins the Western Yar, to ultimately discharge to The Solent. Even allowing for climate change adjustments, any tidal influence on the river would be very limited and would not likely impact the site. Even the upper (southern) reaches of Thorley Brook are not considered to be tidally influenced. According to the Council`s SFRA document, tide levels are predicted at around 3.8 m to 3.6 mAOD in a 2115 climate change adjusted scenario, in the estuarine area where the river meets the sea. The Environment Agency have relatively recently amended their guidance on climate change allowances, here - 'Flood risk assessments: climate change allowances'. This amended stance will be considered in more detail later in this document.

2.3 Flooding from groundwater could be a source of flooding to the site should the existing levels in the underlying groundwater table prove to be high. Severe storm events could cause groundwater levels to rise above ground level.

2.4 With this in mind, overland flows could affect the development during times of severe storms, if design levels of the development do not consider overland flow paths of flood waters.

2.5 Local urban drainage should be considered as every drainage system has a design capacity, which at some point can be exceeded. Severe storm events can cause the failure of the local urban drainage. It should be noted that there is no gravity public sewerage infrastructure in the vicinity of the site. There is a public rising main crossing the site, which forms part of the Seaclean Wight foul treatment infrastructure. This is a sealed system, so this should not be an issue.

2.6 No specific infrastructure protects the site from flood risk (flood defences, etc.), so other than the local drainage system it is not considered that any such risks exist at the site. Whilst there may be various minor areas of bank protection along the ditch, including the concrete channels at the northern end of the ditch system, these could not be construed as specifically protecting the site here, considering the topography described above.

2.7 There are specific appendices within the Isle of Wight Council's SFRA Mk 2 identifying various surface flooding events recorded by Southern Water. This mapping shows historically reported incidents, however, as stated above, there is no specific mapping for Wellow. We are not aware of any specific flooding incidents impacting this site

2.8 There is no evidence of an existing public gravity sewer network in the vicinity of the site. There is a public sewerage network to the west of the site, draining to a standalone sewage treatment works. However, this is 750-900 metres from the site and, as such, does not represent a reasonable proposition for connection of foul flows from this site, or constitute a flooding threat. It is worthy of note at this point that the consideration of whether a site should be connected to the public sewer is based upon a 30 metre per new dwelling distance rule. This measurement was originally derived from the Environment Agency document entitled, 'Effluent disposal in sewered areas', issued 19/12/08. This has effectively been superseded by the same calculation being included in online government guidance at www.gov.uk. So, for the maximum sixteen dwellings proposed, a 480-metre distance would represent the radius where sewer connection may be considered. This proposal could not reasonably be expected to connect to this infrastructure.

2a - What are the existing surface drainage arrangements for the site?

2.9 The site is undeveloped and as such there is no formal piped surface water drainage system within it. Surface water currently drains via a combination of infiltration and direct runoff to the ditch on the western flank of the site. This drains to a concrete channel in

the north western corner of the site, to a culvert beneath the highway carriageway, which ultimately enjoys a confluence with Thorley Brook. We have undertaken an analysis of the QBar (mean annual flood event) runoff value from the site for the sixteen units using Microdrainage drainage software. QBar is calculated as 6.6 l/s. To reiterate, in the light of recent discussions with Island Roads around what should or should not be included within the area used for a Qbar calculation, this calculation is based on only that area being specifically developed.

3 Probability

3a – Which flood zone is the site within?

3.1 The area of the site proposed to be developed is located within Flood Zone 1 of the Environment Agency (EA) Flood Zone Maps as available at www.environment-agency.gov.uk. The site is not intersected by either of the more problematic EA Flood Zones, 2 or 3. As of 1st July 2004, Flood Zones replaced the Indicative Floodplain Map as the main constraint map to inform Local Planning Authorities when to consult the EA on flood risk in development control decisions. These maps are available online, where the extract map shown in Figure 1.2 is taken from.

3b– If there is a strategic Flood Risk Assessment covering the site what does it show?

3.2 As stated above, a Strategic Flood Risk Assessment was undertaken by Entec Consultants in November 2007 on behalf of the Isle of Wight Council and subsequently updated in June 2010. This document assesses the Island with regard to flood risk issues by providing an island-wide view, as well as separate appendices for each settlement identified as part of the spatial strategy for regeneration and growth through the Core Strategy.

3.3 Sources of flooding and the effects of climate change are assessed, along with flood risk management and mitigation measures. However, as stated above, there is no separate appendix for Wellow and no specific mention of the area in the overarching document. However, the pertinent issues of the SFRA Mk2 reflect germinal flood risk considerations so, by proxy, this report will issue consider that which would have been included in the SFRA had the Isle of Wight Council specifically studied the area.

3b - What is the probability of the site flooding taking account of the contents of the SFRA and of any further site specific Assessment?

3.4 It could be construed that flood risks to the area are so limited that further specific analysis was not required in the SFRA Mk 2. Regardless, whilst the SFRA itself does not provide specific advice in terms of the probability of the site flooding, the Environment Agency Flood Zone 1 status is persuasive.

3.5 Flood Zone 1, as described in Table 1: Flood Zones of the online 'Flood Risk and Coastal Change', guidance pertaining to flooding, has a low probability of flooding and comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%). However, it is still important to examine each potential source of flood risk in terms of likelihood, to ensure the development proposal is safe.

3.6 Flood Zone 2, as described in Table 1 of the online Flood Risk and Coastal Change guidance, has a medium probability of flooding and comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.

3.7 Flood Zone 3a, also as described in Table 1, has a high probability of flooding and comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

3.8 As stated previously, flooding from tidal sources and infrastructure failure is not considered to represent a tangible risk to the site.

3.9 Looking first at fluvial flooding, an extreme flood could cause water levels to rise significantly within Thorley Brook and limit the ability of the ditch adjacent to the site to drain. This could also coincide with a particularly high tide in The Solent backing up the network of river and streams within the area and potentially impacting subtly upon the ability of Thorley Brook to discharge, even this far inland, or simply exceeding the capacity of the channel itself, effectively tide-locking the ditch system. Whilst it is remotely possible that this could coincide with a prolonged or frequent severe storm event – given the capacity, layout, catchment area and distances involved; we find it hard to envisage a situation where this would occur and exceed the worst-case scenario modelling undertaken by both the EA and Entec on behalf of the Council.

3.10 To inform consideration of fluvial flooding impacts in both the present day and future, we investigated the possibility of requesting flood level (Product 4) information from the Environment Agency. However, due to the site's location in Flood Zone 1, no such information is available.

3.11 In terms of groundwater flooding, the bedrock geology beneath the site is the Bembridge Limestone Formation. This is comprised of varying quantities of limestones, clayey limestones, lime rich muds, mudstones and clays. It is often associated with the Bembridge Marls Member, which features heavy clays, silt, and sand. Limestone is predominantly permeable; however the level of permeability can be highly variable due to the occurrence of clays and mudstone. As such they may not be considered suitable for either direct infiltration drainage (i.e., soakaways) or surface water drainage disposal over a wider area (i.e., permeable surfacing).

3.12 It is also worthy of note that the IOW SFRA states (Section 3.3, page 22) that :

"Groundwater flooding on the Isle of Wight is not considered by the Environment Agency as a significant issue"

3.13 The SFRA does not identify any sites within the immediate vicinity of the site that have been subject to flooding from surface water. Moreover, the current landowner is not aware of any flooding incidents impacting upon the site during their ownership.

3.14 Surface water flooding has been linked to some of the flooded properties during the 2000 floods on the Island. A recurring theme has been drains not being able to discharge because of raised river levels and thus the capacity of the drains was soon exceeded resulting in surface water flooding. The localised and site specific nature of these flooding incidents does not lend them to being assessed at the strategic level and they were not included within the SFRA.

3.15 The current levels across the site ensure that during severe storm events, flooding from a failure in the local urban drainage system is unlikely to occur or impact upon the site. In general, overland flow flooding should not be an issue – either to the site or for downstream receptors – due to the topography of the site and the formal drainage systems that would be designed and installed in the site. Provided the site is appropriately maintained in its developed state and the effects of climate change are factored into the design of any drainage system (as they will be), we do not envisage any issues with urban drainage failure or overland flooding.

3.16 Having considered all of the flood risks associated with the proposed use of the site it is considered that, for each potential source of flooding identified in Section 2a, the probability of flood risk is as follows:

Probability of flooding	Low / Medium / High
Fluvial flooding	Low
Tidal flooding	Low
Groundwater flooding	Low
Overland flow flooding	Low
Failure of the urban drainage system	Low
Failure of local infrastructure	Low

3.17 The above findings reflect the site's position predominantly in Flood Zone 1 with a limited chance of flooding to the developable area in both present day and climate change adjusted scenarios.

3d - What are the existing rates and volumes of run-off generated from the site?

3.18 The site is a greenfield undeveloped site and considering the underlying geology, has variable impermeability. Whilst some surface water is disposed of via evapotranspiration, interception and infiltration, the majority will be drained via either direct runoff or permeation to the ditch. Therefore, for the purpose of a broad assessment the runoff from the site could broadly be considered to be higher than average, possibly in excess of 5 litres per second per hectare.

3.19 In order to clarify this, as stated above, we have undertaken an analysis of the QBar (mean annual flood event) run off value from the developed part of the total site area for the proposal. The Microdrainage output is included in **Appendix A** and discussed in paragraph 2.9.

4 Climate Change

4a - How is flood risk at the site likely to be affected by climate change?

4.1 The detrimental effect of climate change in terms of pluvial considerations is taken into account within PPS 25 with a 20% increase in rainfall intensity. The NPPF Technical Guidance (In Table 5, page 11) uses an additional 30% increase for rainfall between 2085 and 2115, as does the EA. This rate is now set at 40%. However, where the development proposal falls within Zone 1 the effects of climate change are not generally considered significant enough to cause concern. Considering Figure 3.2 (above) of the Council's SFRA Mk 2, where the effect of climate change has been modelled on zone 3 extents, it should be noted that this has no impact upon the site area.

4.2 Regardless, the design/modelling of the surface water drainage system and associated attenuation measures (to limit discharge rates and run off velocity where required) will allow for the aforementioned 40% increase in the rainfall intensity due to climate change, over given storm events.

4.3 However, whilst we have stated that the impact of climate change will be minimal, the Environment Agency have relatively recently changed their guidance on its consideration. Rather than considering climate change impact to 2115, as in the Council's SFRA, they are now looking toward 2125. This is based upon a generally accepted residential design life of 100 years.

4.4 Where appropriate, our FRAs include further calculations using the EA`s revised guidance based on available Product 4 data. In this instance, where the site is within Flood zone 1, no product 4 data is available. As such, it is neither possible nor necessary to undertake this further analysis of the EA`s revised consideration in terms of the epoch of climate change impacts.

4.5 This is not to say that we have not considered climate change impacts. It is our considered opinion that the location of the development and the use of a standard 40% allowance for climate change in the design of the surface water drainage scheme will protect the site and any downstream receptors from any future impacts.

4.6 Whilst the potential effects of climate change are acknowledged, the impact upon this proposal will likely be limited.

5 Detailed Development Proposals

5a Please provide details of the development layout, referring to the relevant drawings including foul and surface water drainage arrangements.

5.1 The development proposal is for the construction of a residential development together with associated infrastructure, including access roads and parking areas. This document is intended to accompany an outline application for 16 residential units.

5.2 Full details of the layout can be found in the drawings produced by BCM, forming part of the planning submissions. Mayer Brown have also produced a drawing, referenced 26825/01 showing indicative details of the foul and surface water drainage proposals, including the size and position of the attenuation storage required.

5.3 Looking first at surface water, as discussed above, we do not consider that the ground conditions in the area will be particularly favourable for drainage via infiltration. The Geology of Britain Viewer from the BGS website has been referred to, which as the name suggests, details drift/superficial deposits and underlying geology across Britain, including the Isle of Wight.

5.4 As mentioned above, the bedrock geology beneath the site is the Bembridge Limestone Formation. This is comprised of varying quantities of limestones, clayey limestones, lime rich muds, mudstones and clays. It is often associated with the Bembridge Marls Member, which features heavy clays, silt, and sand. Limestone is predominantly permeable; however the level of permeability can be highly variable due to the occurrence of clays and mudstone. As such, they may not be considered suitable for either direct infiltration drainage (i.e., soakaways) or surface water drainage disposal over a wider area (i.e., permeable surfacing). Though we would suggest that, prior to detailed design, it may be worthwhile undertaking permeability testing, as there may be some permeability that could be used in the final surface water drainage scheme – most likely in the form of permeable paving. This would reduce the reliance on attenuation storage solutions, with a throttled outfall, which is likely to be the preferred option here.

5.5 Such methods of surface water disposal are considered to fall under the heading of Sustainable Urban Drainage Systems. These systems attempt to replicate, as far as possible, the natural drainage characteristics of an undeveloped site. Through the use of such simple techniques as allowing surface water to naturally percolate into the ground within the site, the aim should be to limit the level of surface water flow entering formal drainage systems to that in the pre-development situation.

5.6 A plethora of guidance on the design and application of sustainable drainage systems has been published by the former DETR (now known as the DTLR), Environment Agency, Susdrain and other bodies. These all provide guidance on the design of various forms of sustainable drainage systems.

5.7 As surface water drainage via infiltration may not be possible, draining to the ditch on the western flank of the site, via attenuation storage and a flow control device, is a further SUDS-compliant option for the disposal of surface water flows from the hard surfaced areas of the site.

5.8 Referring to the aforementioned drawing, in terms of surface water flows from the proposal, it is proposed to create a single attenuation tank, utilising Aquacell type crates (or similar). This feature will be 'on-line', with a Hydrobrake flow control activating during heavy storm events in peak flow scenarios to limit the flow rate, filling the tank and allowing water to be discharged to ditch at a controlled rate.

5.9 The required storage has been designed on the basis of MicroDrainage analysis of the likely contributing areas arising from the construction of the development. The extracts below show an approximate storage calculation (QSE – Quick Storage Estimate) for the proposal. It is worthy of note that the values are estimates only. Detailed design of the surface water network would consider a variety of other factors, including storage available in the piped network itself, to give a lower total storage requirement.

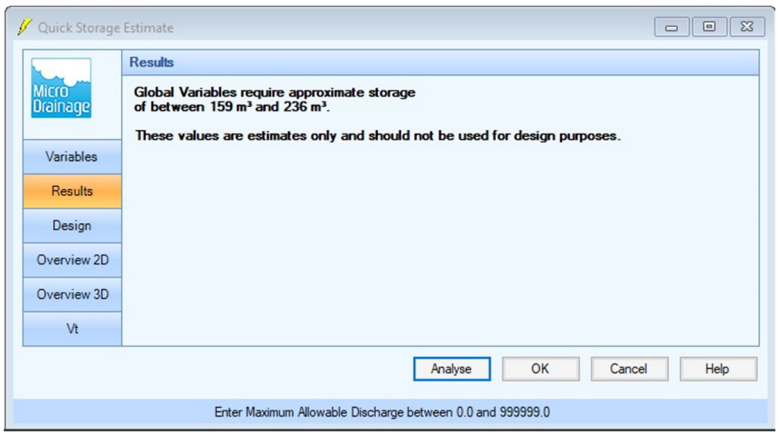

Figure 5.1 Attenuation Storage Estimate

5.10 The QSE studies are based upon the QBar analysis for the proposal (6.6 l/s) and a likely impermeable contributing area, comprising roads, paths and roofs (See Drawing 26825/2). For clarity, the required attenuation storage is 159 - 236 m^3 for a sixteen-unit proposal.

5.11 The flow rate from the site will be reduced to match the existing flow rate by use of a 'Hydrobrake' Flow Control (or similar) in conjunction with the attenuation storage. The use of such devices to restrict discharge rates is preferable over simple orifice plates as they allow the use of a larger aperture in normal low flow conditions. The design of the Hydrobrake uses back pressure from trapped air and the creation of a vortex at higher flow rates to restrict the cross sectional area available for outfall. This larger orifice provides easier future maintenance as it is less prone to blocking amongst other benefits.

5.12 The required attenuation storage could be provided in a number of ways. We have shown it as a 'Aquacell' type crates, and this will likely be how it is delivered for the scheme, though sub-base storage, swales, ponds and oversized pipes would all be suitable. Attenuation features could be spread throughout the site, but will likely be concentrated within a single area, as shown in our drawing. With this in mind, submission of final details can be covered by an appropriately worded condition, in the knowledge that a workable solution is available.

5.13 An indicative formal piped drainage network has been designed, for planning purposes, showing only sewer lengths. All designs will be in accordance with relevant guidance, including but not limited to, Design & Construction Guidance (which replaces Sewers for Adoption 7) and Approved Document H from the Building Regulations suite of documents. Surface water runoff from roads will be collected and fed to the piped network via standard road gullies.

5.14 It is considered that the measures outlined above will create a SUDS and Building Regulations compliant surface water drainage design acceptably dealing with such flows. Our client is happy to accept appropriately worded planning conditions covering the above work.

5.15 In terms of foul drainage, approximately the following flows will result from the maximum development yield of 16 dwellings.

5.16 The calculated peak foul discharge from the developed site will be 0.75 l/s, calculated in accordance with the Design & Construction Guidance, as shown below:

Design peak flow		= 4000 litres/day/dwelling
Litres/ second / dwelling		= 4000 / 24 / 3600
		= 0.0463
Total Proposed foul water flow rate for 16 dwellings		= 0.0463 x 16 = 0.7508
	Qfp	= 0.75l/s

5.17 It is proposed to deal with foul flows arising from the site through the use of a package sewage treatment plant. These self-contained plants use a range of mechanical and biological components and processes to break down solids and treat liquid effluent to give a 95% clean discharge which is suitable for disposal into local watercourses, ditches or land drainage, subject to Environment Agency consent.

5.18 There are a range of systems available, using a variety of techniques – trickle filters, submerged aerated filtration, activated sludge process, etc. However, in general terms the process involves wastewater being fed into a primary settlement chamber where solids and liquids are separated, with the liquor fed into a 'biozone' chamber. In this chamber the waste is aerated, encouraging the formation of good bacteria that digest the organic matter naturally, purifying the effluent. Solids are predominantly broken down by bacteria colonising the various chambers, however the plant will require periodic emptying by tanker. Additional treatment is often included (further settlement, UV sterilisation, etc).

5.19 The system selected for use in this instance is a provided by Advanced Aeration Ltd, a well-respected market leader in the production and supply of drainage solutions. The system is part of their dual tank Bio-Bubble range, The wastewater will undergo biological treatment within the reactor chamber/tank prior to being batch discharged, after settlement, into the final outfall system. This unit has been selected due to both its excellent general treatment of foul waste, but also due to how well it treats Total Nitrogen. This is a key component of the nutrients that Natural England are concerned have created environmental issues in The Solent. BCM have commented more fully on this matter in their Nutrient Budget and accompanying documentation.

5.20 The final treated effluent from the unit will be discharged to the ditch on the western flank of the site. The discharge will require a bespoke permit to be secured from the Environment Agency, though we do not consider that this will be a problem.

5.21 Full details of the system designed by Advanced Aeration, including loadings for a slightly larger scheme, to ensure a suitably conservative approach allowing for larger dwellings, are attached in **Appendix B.**

5.22 Advanced Aeration Ltd have designed the proposed treatment plant in line with all relevant guidance and usual Environment Agency requirements. However, it would appear expedient to break down the considerations involved to ensure a full explanation of the design process.

5.23 The most pertinent documentation in regard to the design of sewage treatment plants is the British Water Code of Practice, Flows and Load – 4, 'Sizing Criteria, Treatment Capacity for Sewage Treatment Systems. Package Sewage Treatment Plants are designed on the basis of the likely size of population (P) served with rates given for different types and sizes of dwelling.

5.24 The Flows and Loads document allow for various coefficients and reductions to be used where larger sites are proposed to be drained to a package treatment plant. The plant designed by Advanced Aeration Ltd has a significant factor of safety built into to its operation, as is built into the calculations within the Flows and Loads.

5.25 The quality of the liquid effluent discharged from the plant is measured by the occurrence of three main indicators – Biochemical Oxygen Demand (BOD), Ammonia (NH3) and Suspended Solids (SS). These are measured in mg/l. The generally accepted standard discharge quality (as advised by the Environment Agency) is 20 / 30 / 20, as BOD / SS / NH3. This plant's level of treatment results in a discharge that is better than this standard quality. It also treats Total Nitrogen to a level of only 2.5 mg/l, though 5.5 mg/l is generally used as the design point, due to Natural England's requirement to be as precautionary as possible.

5.26 Whilst unlikely, if the Environment Agency require further treatment of the effluent discharge arising from the sewage treatment plant, this can be incorporated into a final design secured by an appropriately worded planning condition.

5.27 For clarity, to reiterate that stated above, we are using a package sewage treatment plant, rather than connecting to the public sewer, due to the distance from the site to the public sewer network. Whilst there is public sewerage infrastructure crossing the site, this is a rising main, installed as part of the Seaclean Wight Scheme, ultimately moving foul flows from the west of the Island to Sandown Wastewater Treatment Works. A rising main is a pumped sealed system and as such connections cannot be made direct to it.

5.28 However, there is a standalone public sewer network to the west of the site, in the area of and serving the ex-Council housing stock known as Northview. This system is around 750 metres (as the crow flies) from the site to a section of the sewer system of it in rear gardens of private properties. To reach a section of the sewer system in public highway, it is 900 metres from the site, along the line of the road.

5.29 The Environment Agency use a rule originally stated in their guidance entitled, *'Effluent Disposal In Sewered Areas'* (Issued 19/12/08). This is the 30 metre rule (per property – now included in the New Discharges: additional rules, section here - https://www.gov.uk/guidance/general-binding-rules-small-sewage-discharge-to-the-

ground), that the EA use to decide whether a sewer connection or STP is applicable here. The scheme should only be considered for connection to public sewerage infrastructure if such exists within 480 metres of the site (16 x 30). So, the scheme is substantially outside of the range where such a connection would be considered, hence the use of the package sewage treatment plant.

5.30 In terms of the internal layout of the foul drainage, a piped network has been broadly designed for the proposal, included on **drawing no. 26825/1**.. All designs will be in line with the current Design & Construction Guidance drainage design document, Flows and Loads 4 and Approved Document H from the Building Regulations suite of documents.

5b Where appropriate, demonstrate how land uses most sensitive to flood damage have been placed within the site that are at least risk of flooding.

5.31 A residential use such as that proposed is considered to be a 'More Vulnerable' use and as such, the Zone 1 category of the site means that it has been appropriately located in view of flood risk considerations.

6 Flood Risk Management Measures

6a How will the site be protected from flooding, including the potential impacts of climate change, over the development's lifetime?

6.1 There will be no specific ongoing flood risk management measures required for this development as it falls within Flood Zone 1, which has a limited probability of being affected by flooding. Whilst it is accepted that climate change will have an impact upon the hydraulic regime at this site and within the vicinity, this proposal does not represent a detrimental change to that regime.

7 Off Site Impacts

7a How will the proposals ensure that the proposed development and the measures to protect the site from flooding will not increase flood risk elsewhere?

7.1 Due to its position within Flood Zone 1, it is not considered necessary to introduce specific measures to protect the site from flooding. As such, there will be no change to the hydraulic flow characteristics in the channel of the ditch on the western side of the site. The proposals to provide attenuation storage for surface water flows, based on calculations from industry standard design software (Microdrainage) using a 40% allowance for climate change, will ensure that the proposal will not increase flood risk elsewhere.

7b How will the proposals prevent run-off from the completed development causing an impact elsewhere?

7.2 Clearly the proposal will result in an increase in hard surfaced areas in the form of necessary infrastructure. However, it is considered that the Local Planning Authority could request the precise details of the surface water drainage system via an appropriately worded condition, based on the details supplied. This report has demonstrated that there is the means to dispose of such flows. Such a scheme ensures that no undue additional pressures are placed on the hydrological regime in the vicinity of the site and in particular downstream receptors. Matching the existing and proposed runoff rates, with a 40% allowance for climate change incorporated into the calculations, can be achieved through the use of attenuation storage and flow control in an appropriate form within the site.

8 Residual Risk

8a - What flood-related risks will remain after the proposals have been implemented to protect the site from flooding?

8.1 The site's location within Flood Zone 1, with its acknowledged low probability of flooding, means that there will be no residual flooding risks following development of the site.

8.2 To prevent flooding from failure of the local urban drainage system, regular maintenance should be undertaken of the gullies, sewers and laterals in the vicinity of, and within, the site. Defences, weirs, river confluences, ditches and channels should also be maintained to prevent flooding from occurring for storm events.

8b - How, and by whom, will these risks be managed over the lifetime of the development?

8.3 The long term maintenance of the surface water sewers and road gullies within the site will be the responsibility of the developer, landowner or a management company which may be set up to maintain the site, or in the event of the roads being adopted at some future date, this duty may pass to the Isle of Wight Council / Island Roads as highway authority.

REFERENCES

1. Communities and Local Government (2021) National Planning Policy Framework (NPPF)

2. Planning Practice Guidance, Flood Risk and Coastal Change, 6th March 2014, updated most recently on the 25th August 2022.

3. Communities and Local Government (2006) Planning Policy Statement 25 (PPS25) – Development and Flood Risk. HMSO, London.

4. Development and Flood Risk: A Practice Guide Companion to PPS25. (Feb 2007). Communities and Local Government. HMSO, London.

5. Isle of Wight Council's Strategic Flood Risk Assessment Mk 2 (2010) produced by Entec Consultants.

6. Preliminary Flood Risk Assessment (2011) produced by Amec on behalf of the Isle of Wight Council

7. Policy DM14 Flood Risk of the Core Strategy Island Plan adopted March 2012

8. Island Planning Strategy Development plan, published for consultation July 2021, by the Isle of Wight Council.

APPENDIX A: Microdrainage Calculations (QBar)

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	1.284	Urban	0.000
SAAR (mm)	800	Region Number	Region 7

Results l/s

QBAR Rural	6.6
QBAR Urban	6.6
Q100 years	21.0
Q1 year	5.6
Q30 years	14.9
Q100 years	21.0

APPENDIX B: STP Details

PROPOSAL FOR
Redmer Developments c/o Mayer Brown
Land at Wellow, Yarmouth IOW.

gtoogood@mayerbrown.co.uk

Waste Water and Sludge Treatment Plant

Date: 31 05 2023

Advanced Aeration Ltd
Unit L
Fishers Grove
Farlington
Portsmouth
PO6 1RN

Tel: 02392 200669
Fax: 02392 387460
Email: gmccormick@bio-bubble.com
Web: http://www.bio-bubble.com

BIO-BUBBLE SBR WASTEWATER TREATMENT PLANT

DESIGN PARAMETERS

The new treatment plant design loading has been based on the following flows and loads to suit a population equivalent of 80 people from 20 homes having applied a diversification factor of 0.8 as all 3 bedroom dwelling for the purpose of design (Final approval may lead to a different mix) : -

Housing mix	20 x 3 bed 5 pop- 100pe				total PE 100 x 0.8 diversification = 80POP		
1) Loadings - Design Data							
SOURCE	No. of People	Flow per person [l/day]	Total Flow [l/day]	Organic Load per person [gBOD5/day]	Total Organic Load [gBOD5/da	Ammonia Load per person [gNH4-N/day]	Total Ammonia Load [gNH4-
Domestic Dwellings							
Low water usage (standard house)	80	150	12000	60	4800	8	640
High water usage (luxury house)	0	200	0	60	0	8	0

2) Loadings - Summary					*3)Design Discharge Quality*		
Total Daily Flow	12000	l/day	80	PE	BOD:	10	mg/L
Total Daily Organic Load	4800	$gBOD_5$/day	80	PE	SS:	20	mg/L
Organic Concentration	400	mg/l BOD_5			Ammonia:	<1	mg/L or better
Total Daily Ammonia Load	640	gNH_4-N/da					
Ammonia Concentration	53	mg/l NH_4-N					

Design Flows		
Population Equivalent	80	PE
Influent BOD Concentration	400	mg/l
Maximum Organic Loading	4.8	kg BOD/d *1
Maximum Ammonia Load	0.64	kg NH^3 /d
Maximum Hydraulic Flow @150l / hd / day	12.0	m^3/day *2
Final Effluent Quality Standards		
Biological Oxygen Demand (BOD)	10	mg/l *3
Suspended Solids 105°C (SS)	20	mg/l
Ammoniacal Nitrates NH_4 - N	<1	mg/l
Tn (Precautionary)	5.5	mg/l
To Consent Compliance	95	%

*1 kilograms *2 cubic metres per day *3 milligrams per litre

The influent to the works is assumed to have a treatable consistency of domestic sewage with no uncharacteristic inhibition or toxicity to biochemical carbonaceous oxidation and nitrification. Sufficient alkalinity and a pH of between 7 – 7.5 is required.

BIO-BUBBLE SBR WASTEWATER TREATMENT PLANT

Please be advised that we have based the following equipment selection generally on a duty only basis, loading pumps are quoted as duty standby, additional equipment is available on a standby basis please ask for separate quotations.

The hydraulic load to the plant is based on Dry Weather Flow (DWF) only, infiltration / ground water is assumed to be taken elsewhere.

The Bio-Bubble SBR has 2 modes of operation: Sleep Mode &, normal mode with 2 Discharge cycles per 24 hours from the Reactor with this application.

INLET FLOWS

We assume that the total DWF to the works are received into the existing below ground Balance Tank via gravity pipe work, where it is stored ready for treatment. If the recommended Bio Screen option is taken up the new screen chamber will be located ahead of the Balance Tank.

PROCESS BALANCE TANK

The Balance Tank has a gross volume of 18 m^3 constructed from pre-cast concrete rings with a heavy-duty cover slab. Under normal flow conditions, a Nopol KKI 300 membrane diffuser within the Balance Tank will intermittently mix the sewage to prevent settlement and alleviate variations in the incoming influent strength. The membrane diffuser receives air via a rotary vane Becker compressor housed in the control kiosk. There is approx. 36 hours of storage space within this tank to enable breakdowns or loss of power supply to be resolved. This is on the assumption that infiltration of ground water into the network has been excluded.

The Balance tank can be used to tanker from in emergency situations.

Sewage will be retained ready for transfer into the Bio-Bubble Sequencing Batch Reactor on demand from the PLC program.

PROCESS BALANCE TANK MONITORING

Twice each day the level of the Balance Tank is monitored to be sure there is enough waste to initiate a treatment cycle. The PLC control checks the status of the data window float. An additional float will indicate a high level.

REACTOR LOADING PUMPS

Wastewater will automatically be transferred into the Reactor from the Balance Tank by initiation of the duty SEG 40 or similar submersible loading pump. The Pumps situated in the base of the balance tank mounted on a galvanised lifting chain and will provide duty/standby operation and will be controlled by the level controller and Bio-Bubble SBRs patented "Intelligent Reaction" system to determine the volume of transfer. Simultaneous backup protection has also been incorporated with timed fill and discharge cycles to ensure continuous operation during wastewater transfer.

BIO-BUBBLE SBR REACTOR

A single Reactor of Gross volume 35m^3 constructed from pre-cast concrete rings is in-situ. The tank water tight test is **NOT** included in our scope of supply, and the costs associated with any repairs are also not included.

REACTOR AERATION GRID

A programmed cycle of biological treatment through a sequence of aerobic cycles utilising membrane diffusers and anoxic phases during quiescent phases will provide high quality treatment for BOD removal and nitrification will be undertaken within the Reactor. Once the process cycle is complete the liquor undergoes settlement prior to decanting of the final effluent.

BIO-BUBBLE SBR WASTEWATER TREATMENT PLANT

REACTOR AERATION BLOWER

A single Becker 4.25 rotary vane compressor located in the GRP control kiosk will provide the duty aeration to the Reactor. The blower will be controlled by ***"Intelligent Reaction"*** operating to the required cycle of events. Dependant on the level within the Balance Tank, the required cycle will be selected. By directly relating the treatment cycles to the level of flow to the plant minimizes energy usage and optimizes efficiency.

DISCHARGE PUMP

Treated effluent will eventually be discharged from the Reactor through a single AP35.40 pump or similar on a duty only basis. The pump is suspended on a galvanised lifting chain within the decant zone of the reactor. The pump will be controlled by ***"Intelligent Reaction"*** operating to the required cycle of events.

REACTOR SURPLUS SLUDGE REMOVAL

The surplus sludge will require removing from the system on a periodic basis and will be removed by suction tanker and disposed of off site, in this respect access should be provided for small tankers.

REACTOR FINAL EFFLUENT DISCHARGE

The effluent from the reactor discharges twice a day to the ditch outlet receiving point via The final effluent sample chamber depending upon site requirements or any Environment Agency stipulated changes when they consider the Bespoke Environmental Permit application.

A sample chamber if required will house a receptacle to enable the last discharge to remain in the chamber for sampling. No flow measurement is included on the final effluent drain although the control system gives indications of total daily flows.

MAINS FEED

We have assumed that an adequate single phase supply will be laid to the kiosk base by others with at least 1.5m of spare cable at the kiosk end for us to connect to our DB in the control Kiosk.

ALARM SYSTEM

All units are fitted with a malfunction warning device, compatible with most telemetry systems. The unit is fitted with a standard GSM Modem with text and email alarms to designated telephone numbers.

Remote monitoring by Bio-Bubble is also available at extra cost (see below).

TANK SIZES

Balance Tank Size (Below Ground)		
Number of Balance Tanks	1	
Tank Internal Diameter	2.4	metres
Freeboard	1.0	metre
Depth Including Freeboard	4.0	metres
Gross Capacity	18	Cubic metres

BIO-BUBBLE SBR WASTEWATER TREATMENT PLANT

Reactor Size		
Number of Reactors	1	
Reactor Internal Diameter	3.0	metres
Tank Depth (500mmFreeboard)	5.0	metres
Gross Capacity	35.0	Cubic metres

NB. Optional Bio Screen chamber will be an extra chamber 1.5 m diam. 3 meters deep if the recommended option is taken up.

GUIDE ENERGY UTILISATION

@ Maximum load 16.5 kwh per day

@ Minimum load 3.3 kwh per day

BIO-BUBBLE SLUDGE PRODUCTION

Waste sludge production is approximately 85% less than conventional treatment systems.

Estimated at 12 m^3 per year at 1.5% ds (At max load every day worst case)

Bio-Bubble's treatment philosophy positively stimulates biological reaction and can combine the processes of carbonaceous oxidation, nitrification, denitrification and phosphate removal, in addition to settlement within a single reactor. The Bio-Bubble rationale pursues the natural qualities of extended sludge age and proliferation of higher life organisms. This approach yields a high-density floc contributing to significant improvements in sludge stability. Results are reflected by a superior quality final effluent and low but concentrated sludge production; typically 0.05 kg/kg BOD removed per day, less than half produced by other treatment processes with annual surpluses greater than 0.2 kg/kg BOD/d. The stability of the sludge yields SBR humus concentrations of 3 % dry solids.

Humus is a bi-product of the Bio-Bubble process and is stable, inert, odourless substance that has a water content of approximately 85%. Humus makes an excellent organic fertilizer when pumped onto adjacent woodland, grassland or flower beds. If no land is available then annual tanker removal will be required to drop the level.

ONGOING SERVICING / MAINTENANCE

An optional service agreement is available. Signing to the maintenance / service agreement will enable you to have your plant maintained and service by an approved Bio-Bubble engineer. Maintenance ensures an emergency response to breakdowns where required with no emergency call-out fees.

For emergency situations ie where use of facilities would be limited or a pollution incident could occur, our engineers aim to respond within 24 hours of a report of a failure. Each plant has an amount of storage space which can be used in emergency conditions to enable an extended response time if necessary and therefore out of hours / weekend hours are not normally required.

The annul service undertaken will include for all mechanical and electrical equipment to be checked and tested, a process check will also be undertaken to ensure the final effluent quality continues to meet or exceed the guaranteed discharge consent.

BIO-BUBBLE SBR WASTEWATER TREATMENT PLANT

The plant will be cleaned and tidied and any parts showing wear and tear or signs of a pending failure will be replaced. Removal of the sludge at this time can also be undertaken if required, providing sufficient land is available to the engineer.

An analysis of the final effluent, tested by an independent laboratory is available at extra cost.

Free telephone technical support is available during office hours. In the event that the Broadband option remote link is taken up, then the level of monitoring required by the client needs to be determined then we can offer the price for this extended service providing status reports or whatever is required.

WARRANTY

All Bio-Bubble installations are guaranteed against faulty component parts and workmanship for 12 months from the date of commissioning recorded on the Bio-Bubble completion certificate (See warranty exclusions / conditions below).

The warranty on the installation covers replacement of failed components and the labour involved to replace that failed component. Any failures / alarms must be reported to Bio-Bubble within 24 hours. The labour cost attributed to a warranty claim is subject to the installation of the specific Bio-Bubble alarm and monitoring system as agreed. It should be noted that failure of component parts of the alarm system supplied under the contract is covered however the client must take steps to ensure alarm system does not become disconnected or remain non-operational for a duration no longer than 24 hours prior to the failure being reported.

Effluent Quality - The quality of the effluent is guaranteed to be within compliance of the standard set out above.

Bio-Bubble reserves the right to pass on costs to the client attributed to failures that result as a direct consequence of any delay or lack of warning to Bio-Bubble Ltd of such a failure that is not a direct fault of Bio-Bubble Ltd. These include but are not limited to inorganic materials being disposed of down the system, lightning strikes, flooding and interference by non-approved personnel. There is no warranty on Effluent Quality for operating the plant outside the design loading conditions.

Cost for the Supply, Installation and Commission all mechanical and electrical equipment within our scope as detailed above including radar level control:-