evolution
PLANNING DEVELOPMENT REGENERATION

RESPONSE TO ExA'S FURTHER QUESTIONS

On behalf of

GREENSFORGE SAILING CLUB
DEADLINE 7

Submission 7th August 2019

Appendix 2: Applicant response to Greensforge Sailing Club

Response to ExQ2.13.5 on behalf of Greensforge Sailing Club	Applicant Response
GENERAL COMMENT	
The Applicant has attempted to further engage with Greensforge Sailing Club since the meeting of 20th May 2019 (the minutes of which are included in the sailing club's response REP5-055). As noted in these minutes the applicant proposed to prepare a draft statement of common ground (SoCG) and the intention was that the agreed form of these minutes could form a basis for a draft SoCG. The applicant issued the minute meetings on the 28th May 2019, which included additional post meeting information as requested by the sailing club, and asked for any comments or queries on these minutes. The applicant received no response. Subsequently the applicant has followed up with emails and telephone calls in an attempt to continue dialogue with the sailing club with no response to date. The Applicants' attempts at further engagement comprise both emails and phone calls on 6th and 13th June. For the former the Club's Planning Advisor was out of the country and was not available for response on the latter. No further communication took place until the 4th July when the Applicant forwarded their response to Deadline 5. The Club's response to Deadline 5 indicates the significant concerns the Club has in relation to the work undertaken, and the disappointment and despair it felt upon realizing that the Applicants had dismissed or refuted every request the Club had made during the conversation on 20th May, despite assurances being given that the points raised would be given reasonable consideration. Greensforge Sailing Club would like the ExA to note that the Club was supplied with a copy of the proposed Statement of Common Ground for the first time on August 7th 2019, despite requesting that it be produced on 31st July. This was to ensure that the Club could have an appropriate length of time to respond prior to their Planning Advisor's period of leave between 8th/9th August, and again from 15th August - 3rd September. Whilst the Club is willing to try to respond to the ExA's request, we note that in effect the Club has been given a period of four working days to fully consider the Applicants' proposed SOCG, and consider this an incredibly short period of time, especially since the Applicant indicated in early July that the SOCG was drafted. The Sailing Club are not aware of any specific reason why the SOCG was withheld for so long. It is confirmed that the Sailing Club will consider the drafted proposal and will respond accordingly. The Club will endeavor to respond to respond to the ExA's request as soon as practically possible and aims to keep to the timetable set out by the ExA. However, it cannot guarantee that the timescale	

proposed by the ExA will be met for the reasons outlined above. The Club's response to the remainder of the Applicant's Deadline 6 submission is set out in blue below.			
RELEVANT EXPERIENCE OF ADVISORS			
2.2	***"RWDI appear to have engineering experience in relation to designing buildings whilst accommodating comfort at the ground level for pedestrians (see references in Section 1 of the report). They also make reference to generalised windflow patterns in Section 5 of the report which refer to down-washing, channelling and acceleration around corners. All of these conditions refer to the impact of obstacles such as buildings on its windward side. This is not applicable in this case, as the reservoir is located on the leeward side of the proposed buildings."***	2.2	RWDI has been studying how buildings and the wind interact for more than forty years. RWDI has helped clients understand the effects of these interactions on every continent, and at scales ranging from individual buildings to recent work conducting physical and computational wind modelling within the entire City of London. RWDI are recognised experts in wind engineering. The RWDI assessment (REP4-013) does consider effects on leeward side of proposed buildings. While downwashing is an impact occurring on the windward side of a structure, corner accelerations and channelling are problems which can occur downwind of a structure (i.e. on the leeward side). Furthermore, the wake zones

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	Whilst down-washing and channeling impacts are noted and recognized, the RWDI report does not specifically identify the resultant leeward shadowing (i.e. "Wind Shadow or Wake Zones") as a specific response, as it has with both down-washing and channeling, as these effects are the only ones shown in the commentary. The key issue with this is that it is exactly the Wind Shadow created as a result of the imposition of large impermeable structure downwind of the reservoir that generate the Club's greatest concern. The lack of specific reference to this being part of the effect arising from obstructions is therefore misleading.		highlighted in the RWDI report denote areas on the leeward side where the influence of the structures may be experienced.
2.3	***"We note that the applicant has previously disputed the earlier submissions by Greensforge Sailing Club which shows the potential impact on windflow on the leeward side of an obstacle on the basis that this is identified as being relevant to wind turbines only. This shows a misunderstanding of the point being made, which is not how to ascertain clean wind for a wind turbine, but to identify the impact of the windflow once an obstacle is placed upwind."*** The significance of leeward sailing effects is the main concern to the Sailing Club, and for this reason the use of references which indicate	2.3	The Applicant has not misunderstood the point and is in agreement with the principle of potential effects from obstacles. However, it is not considered that comparison of the significance of leeward sailing effects on the reservoir are directly comparable with measures which are intended to optimise the siting of a wind turbine. By inference a wind turbine will still operate in a less than optimum location. Furthermore, the wind turbine example is a rule of thumb (a simplified approach) and the reason to use computational fluid dynamic (CFD) simulation is to adopt a more rigorous approach to assess impacts which also has the benefit of taking into account local features/topography.

	what happens to wind-flow when leeward of an obstruction is a significant material consideration in this case. The references used by the Sailing Club are intended to demonstrate what happens to the wind as a result of downwind obstructions, and the impact that this has on the leeward side (i.e. the reservoir). The consideration of the impact on wind flow on the leeward side of an obstruction is therefore directly and properly relevant to this assessment. In order to assist the ExA in understanding the issue at hand, significant research has been undertaken to provide credible references and examples to demonstrate the points being made. The selected examples are taken from reliable Government backed sources from Denmark. Additional research was undertaken on similar work backed by the US Government, but given the relative repetitive nature of the US research it was felt that the Danish example provided sufficient clarity on the points at issue. There is nothing to suggest that the research utilized is demonstrating a "rule of thumb' approach, and given its international Government backing is considered a robust consideration of the leeward impact of an obstruction - in this case buildings.		
2.6	***"A key publication from this organisation is the "Small Wind Guidebook" (https://windexchange.energy.gov/small-wind-guidebook). Whilst this provides a detailed level of guidance on determining whether the use of wind energy is achievable, it specifically provides detailed guidance on choosing the best site for the location of a turbine. Within this section, details of how the wind becomes more turbulent on the leeward side of an obstruction is identified. Importantly, it advises that the further away from the obstruction the less turbulence will be encountered."***	2.6	Refer to response 2.2 above. The principle of effects on the leeward side of a structure is not disputed. The concern is directly equating optimisation of a wind turbine location with sailing effects; the referenced publication does not state applicability to a sailing assessment.

	We note the applicant accepts the principle effects on the leeward side of a structure is not disputed. The reference above is intended to highlight the issue that the wind becomes more turbulent on the leeward side of the obstruction, and that the further away the obstruction the less turbulence will be encountered. The key point is the effect on the wind on the leeward site of an obstruction. Essentially, the Sailing Club is highlighting to the ExA the fact that the closer the obstructions (i.e. buildings) are located to the reservoir, the more turbulent conditions will become. This is relevant given the proposed proximity of large buildings close to the reservoir in the current context. From the outset the Club have identified that the extent of this turbulence is one of the critical factors in determining whether safe sailing can proceed, both for novice and experienced sailors. The reference to the impact of a downwind obstruction is therefore entirely relevant.		

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2.7	***"Further advice from the Danish Wind Industry Association explains clearly what happens to the wind when an obstacle is put in its path and is shown in Figure 2 below. Specifically, it suggests the level of turbulence generated from an obstacle can be as much as three times the height, and that turbulence is more pronounced behind the obstacle than in front of it. It advises that major obstacles should be avoided, especially if they are upwind."*** The Sailing Club dispute the Applicants inference in this context. The Club has stated, quite clearly, in previous submissions (see Para 2.6 of the Submission, and Response to ExA Question 1.14.7 (v) and (vi) (Deadline 2, April 2019 Page 7) that the tree cover particularly on the south west boundary of the reservoir has no significant impact on sailing in that area between the seasons. This single line of trees are fully mature Silver Birch trees, and the lack of impact arises as a result of the porosity of the leaf cover which permits the wind to penetrate through the tree cover. This is very different from the very southerly part of the reservoir, where tree cover over the years has become far more dense, and has resulted in limited sailing activity in the part of the reservoir indicated in the original submission. The Applicants continue to place significant emphasis on the assertion that sailing is significantly affected in this part of the reservoir, and the Club can only assume that this assertion is generated from reliance upon the CFD model. This assertion has been categorically and consistently refuted by the Sailing Club, who know the site very well. The Club do not accept the Applicant's assertion. This also illustrates the Club's concerns regarding the fact that the CFD	2.7	The example provided doesn't take account of existing constraints. The reservoir is not an area of open water with no existing obstacles. In particular, it is significantly screened by trees, which have a profound effect on the sailing quality on the reservoir.

	analysis does not fully recognize site conditions in its base assessment, and therefore total reliance upon its results should be treated with some caution.		
APPROACH TO COMPUTATIONAL ANALYSIS			
2.9	***"It is noted that the RWDI report, despite discussion with the applicant, makes no specific reference to the wind speed utilised in the modelling. This is of significant concern, given that the overall purpose of the report is to identify the potential impact on windflow arising from the proposed development."***	2.9	As noted in the RWDI report (REP4-013), the steady-state nature of the CFD assessment means that the flow patterns will generally be consistent regardless of the wind speed applied at the boundary of the study area. Though the magnitude of the resulting flow would change. The 80th percentile wind speed (i.e. a speed that would be exceeded only 20% of the time) was selected in order to present the resultant speeds for a relatively high wind speed which would be at a reasonable frequency and where the effects of any change might be more readily felt. The reference conditions are reproduced below alone with the corresponding wind speed at 10 m (which is the typical measurement height for wind speeds)

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The Sailing Club notes that the figures in these tables are measured as metres/second, and therefore an appropriate conversion to knot speed is required in order to fully understand what these figures mean. These are shown in blue on the attached and have been determined by using an online conversion calculator.

It is noted that the Wolfson Unit indicate that the figures utilized in their assessment is based on a range of 3 to 9 knots. However, it is clear from the conversion that the Wolfson Unit have not considered the 80th percentile figures identified in the RWDI report, which at 10m height range from 10.8 knots to 14.77 knots.

As a result, the Wolfson Unit report fails to consider the impact on sailing conditions at the 80th percentile wind speed, and the conclusions found in that report are based on incorrect assumptions.

Direction	W (270)	WSW (250-260)	SW (210-240)	SSW (190-200)	S (180)	SSE (160-170)
80% speed (m/s @ 600m)	13.5	13.4	12.2	11.8	10.5	10.4
Knots	26.2	26	23.7	22.9	20.4	20.2
80% speed (m/s @ 10m)	7.6	7.6	6.5	6.3	5.6	5.9
Knots	14.77	14.77	12.6	12.2	10.8	11.4

	Without a proper assessment being undertaken based on the wind speeds generated in the RWDI report, any outcome of the Wolfson report should be treated with extreme caution.		
2.10	**"At the meeting held on 20th May (see Appendix 1), Sailing Club members advised the applicant about the 'usual' wind conditions on the reservoir. This was intended to assist their understanding of the conditions usually realised, and to ensure that the model accurately reflected this position. It is noted that RWDI nor Wolfson Unit have chosen to visit the site prior to the issue of the reports, in order that they can confirm that the conditions identified in the modelling accurately reflect site reality."** The Sailing Club note that neither RWDI nor the Wolfson Unit have taken the opportunity to sail at the Club to consider the wind conditions for themselves before or after undertaking the computational analysis. The Club firmly believe that a prior site visit by both consultancies would have assisted their understanding of the site and the way in which the wind behaves across the reservoir, The Sailing Club note that the Wolfson Unit visit for the meeting on 20th May was to discuss the results of the analysis only. No specific interest in the reservoir or conditions impacting upon it was demonstrated during that visit. On 31st July 2019, the wind was directly westward, and as a result the Club members took measurements of wind direction relative to north whilst sailing on the lake. The results are mapped on the plan in Appendix One. This clearly shows that the wind curves across the site, and that the original suggestion to the Applicant was indeed accurate. This primary empirical evidence is important in understanding how the wind behaves across the site.	2.10	Using the proposed approach, which is considered a reasonable scientific method, a prior site visit would not have provided any benefit to the modelling. The visits on-site have assisted the applicant with understanding the operations / activities at the sailing club and interpreting the effects of the results, although this doesn't affect the CFD modelling undertaken. It is considered best to use a recognised modelling approach for the consistency of the output, which in this instance is based on 30 years (1995-2015) of wind data, rather than use an arbitrary site visit.

	It is not appropriate for the applicants to dismiss this outright on the basis that the CFD analysis suggests this effect does not take place. The Club is concerned that the basis of the CFD analysis is not reflective of the true conditions on the reservoir, and consequently these inaccuracies will be reflected in the results.		
2.11	***"In a post-meeting note prepared by the applicant (See Appendix 1) it is noted that RWDI have not been able to confirm "anecdotal***	2.11	Refer to response to 2.10 above.

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	evidence' in relation to wind conditions offered by sailors who have regularly sailed on the reservoir over the last 30 -40 years, quoting that the computational model doesn't identify this as the reasoning for their response."		
2.12	***"This suggests the applicant would rather rely on computational analysis over local knowledge and site experience, without the benefit of having visited the site to ensure the computational baseline conditions accurately reflect the conditions experienced on site."***	2.12	The author of the Wolfson Unit report (REP4-012) holds a PhD in naval architecture and has over 20 years experience as a consultant engineer at the Wolfson Unit for Marine Technology and Industrial Aerodynamics conducting consultancy and applied research. His specialist areas include: • Yacht performance prediction • Experimental hydrodynamics and aerodynamics Clients include America's Cup teams, race yacht and superyacht designers, national and governing bodies. Previous positions held by the author: • Royal Yachting Association (RYA): Technical Committee Member • Royal Institute of Naval Architects (RINA): Small Craft Group Member • J Class Association: Technical Director Current Positions: • Royal Ocean Racing Club (RORC): Technical Sub-committee member • University of Southampton: Lecturer "Sailing yacht design" module • Club dinghy sailor

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	The Sailing Club disagree that the scientific approach cannot take account of the anecdotal information provided – which is now been confirmed with primary data detailed in Appendix 1. In order to properly and accurately assess the impact of the proposed development on the wind conditions on the reservoir, the scientific approach assessing that impact should replicate the baseline conditions in the first instance. The Wolfson Unit state that there are *" no adequate regulatory parameters or guidelines …that can be used to assess the sailing quality on a particular location across a range of wind speeds, directions and duration of time."* It goes on to state that they have applied some quantitative parameters to a relatively qualitative subject area and have utilized criteria based on other examples elsewhere.		As part of the assessment the reservoir has been simplified to a grid of points and matched to data sample points in the RWDI CFD Study. Previously developed sailing quality criteria have been applied to each of the discrete wind angle data sets from the RWDI CFD Study and combined with historic statistically valid wind rose data to assess the proportion of 'good' sailing quality time when the wind is within the SSE to W range. As for any defensible environmental assessment, there is a need to follow a recognised approach. Any deviation from a standard approach would be open to question. It's not a question of dismissing 'local knowledge', but that the scientific approach cannot take account of anecdotal information provided.

	The approach taken is therefore not a determined scientific approach, nor is it standardized. It is a relatively qualitative issue, which Wolfson also accept.		
CALMING EFFECT OF COMPUTATION			
2.13	***"It is noted, and confirmed by the applicant, that the computational analysis reflects 'steady state conditions', i.e. that the wind is constant across the reservoir at all times and wind speeds are effectively 'averaged". However, in reality the wind is very seldom in steady state, and gusts do occur. The consideration of steady state conditions result in a 'smoothing' or calming impact on the wind conditions in all preand post-development scenarios."***	2.13	The applicant accepts there are some limitations to CFD modelling (as there is for any modelling technique), however the method overall is considered appropriate. Also, it is considered beneficial to utilise scientific assessment to better understand effects rather than not undertake any modelling, otherwise consideration of the issues would be more subjective While steady state approaches cannot fully capture transient phenomena like gusts, due to the mathematics involved they do not always produce more 'calm' conditions. For example, a steady-state analysis will predict a corner acceleration occurring in a

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			specific location. However, in reality the unsteady nature of the wind would result in an acceleration zone which moves. Thus, if the actual average wind speed was measured at a specific location, the situation could arise where the CFD prediction of 'mean' speed was higher than the experimental results. Acknowledging gusts and other turbulence based phenomena would require the use of what is called 'transient' CFD. The use of transient in built environment applications is still in its infancy. There is a myriad of technical hurdles which need to be overcome before time dependent CFD simulations would be appropriate in this application.
2.14	***"Such an approach will result in a distortion of the results in a beneficial manner. Particularly, it will not consider the potential turbulent effects arising from the changes in wind flow following the installation of an obstacle such as a building for example. Again, this was discussed at the meeting on 20th May, and whilst it is accepted that the impact of turbulence on the reservoir is difficult to assess, it is this turbulence that will make the conditions for sailing more challenging."*** Reference response 2.7 above.	2.14	Refer to response to 2.13 above. Also areas of higher turbulence in either the existing or proposed scenarios may lead to zones of local wind speeds and direction changes that will not satisfy the sailing quality criteria, therefore through inference the approach has some ability to capture some properties of increased turbulence. The existing scenario will already have a level of turbulence due to the upstream tree cover.
2.15	***"In particular turbulent wind conditions the changes in wind speed and direction become a significant challenge for any sailor. More experienced sailors can usually overcome such challenges although this does depend on the circumstances. For less experienced sailors, turbulent conditions are likely to act as a deterrent to enjoyment,***	2.15	The sailing quality criteria in the Wolfson Unit assessment (REP4-012) are purposely set to a cautious level to include some allowance for other effects. The allowable wind direction and speed change criteria are conservative, 30% and 20 degrees

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	if not a potential danger. The applicants have made no attempt to demonstrate what impact turbulence will have on sailing conditions. The use of 'steady state' assumptions will result in 'steady state' outcomes."		respectively. The maximum wind speed limit is low to adequate to accommodate the impact of gusts upon novice sailors

DETERMINATION OF WIND SPEED			
2.16	***"The RWDI report was prepared to provide an assessment of the wind conditions in and around the proposed development, in order to provide initial estimates of the effects of the development on sailing conditions across the reservoir. In doing so, it makes reference to the determination of wind speed as being that of the 80th percentile wind speed for each direction studied. However, it fails to specifically state exactly what that speed is."***	2.16	Refer to response to 2.9 above.
2.17	***"The Wolfson Unit report identifies that their assessment has considered wind speeds in a range between 3 and 9 knots (5.5km/hr and 16km/hr or 3.5miles/hr and 10miles/hr). It makes no specific reference as to whether these speeds have been derived from the assumptions in the RWDI report. It is also noted that the RWDI report does not provide any results of assessment which show consideration of a range of wind speeds as well as directional analysis. The lack of evidence base in this regard generates a great degree of uncertainty as to how this information has been sourced and determined, and the speeds utilised in their assessment."*** Please refer to comments at 2.9 in relation to the difference between	2.17	The RWDI data has been divided by the relevant ambient wind speed to create a ratio of point wind speed to a reference (in flow) wind speed measured at a height of 10m, this is then combined with the wind rose ambient wind speed data and statistical processes to evaluate the point for point wind speeds. The steady-state nature of the simulations allows the assessment to scale the results to any required ambient condition to be reviewed.

	the 80th percentile wind speeds utilized in the RWDI report, and the wind speeds assumed within the Wolfson report, which are significantly lower.		

2.18	***"The Wolfson Unit report suggests that speeds of 3 to 9 knots are suitable for beginners and novice sailors. Figure 3 shows the physical conditions felt in relation to wind speed. Specifically, at an equivalent of 3 knots, light air conditions would be noted. At this point, sailing becomes difficult due to the lack of sufficient wind to fill the sail to generate movement, even for experienced sailors."***	2.18	Figure 6 of the Wolfson Unit Assessment (REP4-012) shows the existing situation. So in effect the assessment is comparing the same wind speeds for the baseline conditions versus the proposed development scenarios.
2.19	***"At an equivalent of 9 knots, a gentle breeze is noted - the point at which leaves and twigs will move and flags flutter. Sailing is more feasible at this wind speed and is considered appropriate for beginners. However, it is still considered to be a light sailing wind by experienced sailors, who can feasibly and frequently sail in wind speeds up to 15 - 20 knots (28km/hr – 37km/hr or 17miles/hr - 23miles/hr)."*** The Club is concerned that the focus of the assessment has been based on wind speeds that are appropriate for novice sailors and has not considered what happens to the wind at greater wind speeds. Comparison between the wind speeds assessed in the Wolfson Unit report compared to the wind speeds identified in the RWDI report (as detailed at 2.9 above) clearly shows that the assessment has failed to consider the impact of the proposed development at greater wind speeds. It is noted that the 80th percentile wind speeds detailed at 2.9 above are more reflective of the conditions suitable for more experienced sailors, which make up a significant part of the Club. However, the omission of consideration of the 80th percentile wind speeds results in a failure to provide an accurate assessment of what the overall impact of the proposed development may be.	2.19	The applicant accepts that 9 knots is a 'light' wind for experienced sailors. The assessments focused on novices as they would be the cohort least able to adapt to wind condition changes. However, using the 80th percentile captures conditions for all sailors and is reasonably representative of worst case effects.

2.21	***"On the basis of the evidence in Figure 3, it is clear that RWDI are incorrect in their assertion that wind speeds of between 3 and 9 knots can be considered as 'high' wind conditions (see post meeting note in Appendix 1)."***	2.21	The stated reference to "high" is related to the 80th percentile data, which is independent of the 3-9 knots range.
2.22	***"The assessment has only considered a range of speeds which only reflect very light wind speeds, and therefore very gentle sailing conditions. We note that the Wolfson Unit indicate that their assessment is based upon conditions for beginners and novice sailors. However, this approach fails to recognise a significant number of experienced sailors who are also Club members. Consequently, the analysis fails to provide a robust assessment of the potential impact on a wide range of sailing conditions."*** See Below 2.23	2.22	The approach still incorporates the impact of localised changes of wind direction and speed which would affect both novices or experienced sailors regardless of wind speed. Part of the sailing criteria identifies the areas of high variation in speed and direction, which is independent of ambient wind speed, so applicable for all sailors and wind speed ranges.
CONSIDERATION OF A WIDER RANGE OF WIND SPEED			

2.23	***"The applicant was requested to consider providing an assessment of a wider range of wind speeds at the meeting on 20th May, in order that a fuller range of sailing conditions that may be understood in the context of the proposed development, and to identify the potential impact arising for a broader range of sailing experience within the Club."*** The Applicant's response is disputed, especially given the errors identified in 2.9 above. No evidence has been provided to demonstrate that the applicants assertion is correct. It is imperative that the sailing quality approach reflects the wider range of conditions, as these would reflect the conditions identified as being the 8oth percentile identified in the RWDI report. This is not reflected in the Wolfson Unit report. Therefore it is not possible to state with any certainty what the impact of the development would be at greater wind speeds. The Applicants have therefore failed to provide a robust assessment.	2.23	A wider range of wind speeds wouldn't make significant differences to the outcome of the existing assessment. For example, if the sailing quality approach were to be extended to a greater range of speeds, i.e. 3 knots – 16 knots for instance then the relative differences between existing and development scenario conclusions are likely to be similar.
2.25	***"It is noted in the quotation above that the applicants assert that consideration of a different wind speed would be arbitrary, and that the results overall would not change. The Sailing Club disagree with this statement and consider that when greater wind-speeds are realised the impact of obstructions would be greater."***	2.25	The relative impact of the obstructions will not change (ignoring higher order effects) with increasing wind speed. The extent of the wake/flow field is primarily driven by the position and scale of the obstruction.
2.27	***"The Association have produced a Wind Shadow Calculator (http://drømstørre.dk/wpcontent/wind/miller/windpower%20web/en/tour/wres/shelter/index.htm) which indicates the percentage reduction in wind speed in the leeward side of an obstacle. The parameters of the proposed scheme have been considered at differing wind speeds utilising this model."***	2.27	The applicant couldn't open the link provided. However, this modelling method isn't considered appropriate (refer to further details in 2.28 below (the 'second' time paragraph 2.28 is used). In summary, this method is considered less rigorous than the CFD modelling undertaken by the applicant.

	The use of this model was to demonstrate to the ExA the impact arising from an obstruction at differing wind speeds, given the applicants refusal to consider these. The model shows the proportion of the original wind speed that would result at specific points beyond the obstacle. The use of this model was not intended to provide a comparison to the CFD model or to suggest that this approach was better. It was purely utilized to demonstrate the leeward impact of greater wind speeds. Please see 2.28 below.		
2.28	***"It is noted that in the RWDI report, building heights of 34m have been utilised, with the applicant advising the Club that this figure was used in the model "to ensure there was a conservative bias adopted in the assessment." (see post meeting note in Appendix 1). The Club note that the height selected for the RWDI assessment outweighs that identified in the parameters plan. Such an approach effectively deflects the wind at a greater height, and this will result in dispersed impacts on the leeward side. Consequently, this approach generates a result which favours the applicants' assertions."*** The issue here was the concern that utilizing building heights in the CFD model that are greater than those of the parameters plan will, in effect disperse the wind turbulence further across the reservoir as a result of the upward dispersal being generated from taller buildings. This means that the CFD analysis 'dumbs down' the potential impact on those areas closer to the proposed buildings, as the dispersal will be realized over a longer distance from the buildings. The Club have been consistent in its approach in suggesting that the presence of any buildings of the heights proposed within close proximity of the reservoir will have a significant impact on sailing conditions. We note that buildings of lower heights have not been fully tested in the	2.28	The applicant doesn't understand this point. It is not clear how a greater height of buildings would result in lesser effects. Also this is inconsistent with the case made for the Club at paragraph 2.7, which asserts that taller buildings have greater effects. This also means that it is not at all obvious what actions the Club consider would mitigate any effects – higher or lower buildings?

	Applicants submissions, so we are not able to comment on whether these would also impact on sailing to a greater or lesser degree.		

2.29	***"Greensforge Sailing Club have utilised the Wind Shadow calculator to demonstrate what the impact of the proposed development would be at higher wind speeds/Specific inputs include assumptions of a 30m high building extending 50m in width, at wind speeds of 9, 15 and 20 knots, thus reflecting a range of typical conditions that will be found should the development proceed. A height of 10m has been assumed to represent the top of a mast – although this is a maximum height above the water level that could be expected for dinghy sailing. Whether or not the resultant impact would be greater with buildings of lower height has not been determined, although considered possible."*** Please note response to 2.7 above in respect of the surrounding tree cover, and 2.27 in relation to the purpose for using the model.	2.29	This approach is not modelling Calf Heath Reservoir, it is modelling an open reservoir with no existing obstacles around it which is not the case for the location in question. In reality this reservoir is already significantly affected by substantial tree screening.

2.28	***"The results are shown in Appendix 2 and are summarised in the table below. In short, the numbers on the grids shown in Appendix 2 represent the percentage of the original wind speed that will be achieved once an obstacle is put in place compared to that prior to its installation. Where the figures are blank there is insufficient wind to be measured."***	2.28	(*Paragraph 2.28 is used twice in the document, this response refers to the second time 2.28 is used*) The applicant's wind specialists are not aware of the method proposed. However, a version of the calculator was found following an internet search. The data in Appendix 2 appears to be a simple analytic correlation which assumes an incoming wind speed profile that is disrupted by a rectangular obstacle perpendicular to the flow. However there are some points to note, the guide to the calculator states that results will be inaccurate if the turbine is within 5 heights of the obstacle which means the stated 114m figures are too close to be reliable. Furthermore, two of the tables in Appendix 2 refer to loss in wind energy while the first table is reduction in speed. This is important because wind energy scales with speed to the power of 3. This means that small changes in wind speed will create large energy reductions (i.e. 1/2 the speed results in 1/8 the

	The Club has reviewed the applicants response in relation to this point and concede the error that has been made between wind speed and wind energy. Nevertheless, the first table in Appendix 2 shows the reduction in wind speeds at specific distances from an obstacle, and these are significant. It is noted that although the Applicant claims that there would be no difference in the results at differing wind speeds, they have chosen not to provide any evidence to support this view. Indeed, as shown at 2.9 above, the applicants assessment is determined on lighter wind speeds, and does not reflect the conditions normally felt across the reservoir. The Club, despite the error made in our submission, remain unconvinced that the Applicant's assertion in this context is accurate.		energy). The reason for this difference is unclear, but it means that the computations using these two tables is incorrect. This method is considered less sophisticated than the CFD modelling undertaken by the applicant, which models actual wind conditions on the reservoir using empirical data and taking account of obstructions and other characteristics.
2.29	***"The above evidence clearly shows that that at greater wind speeds the distance impacted by an obstacle increases. In short, in higher wind speeds, a greater proportion of the reservoir will be impacted. The utilisation of low wind speeds in the RWDI model fails to recognise this."***	2.29	(*Paragraph 2.29 is used twice in the document, this response refers to the second time 2.29 is used*) The RWDI report (REP4-013) used the 80th percentile, which means that only 20% of the conditions will be above this percentage. That is reasonably high, not low.

2.30	***"The applicant's assertion that considering differing wind speeds is arbitrary to the study on the basis that it would not result in any impact on the patterns of windflow are therefore incorrect. Additionally, this assessment demonstrates that consideration of relatively light wind-speeds only does not adequately assess the full impact on sailing conditions, and that at higher wind speeds, the impact of the proposed development will be worse than the applicants have asserted."*** Please see 2.9 above.	2.31	The RWDI ambient wind speeds are based on the 80th percentile, therefore reasonably high. They account for the majority of wind conditions and are likely to identify worst case effects. For each wind direction and location the local wind speed has been divided by the ambient to give it's ratio to ambient. It is based on the knowledge that for the purposes of the assessment that the wind environment can be scaled with wind speed. At any other ambient wind speed, the local wind speed is calculated by multiplying that ratio by the new ambient wind speed. Therefore, the properties of the flow patterns are the same regardless of wind speed. As the RWDI CFD data was run at a relatively high wind speed (80th percentile), the characteristics will be directly related to a relatively high wind speed. Based on this assertion, it will over predict the wake for the lower wind conditions.

ASSESSMENT OF SAILING QUALITY			
2.32	***"The report indicates that the 'baseline' average sailing quality on the reservoir is calculated/scored at 19.7%, and considers this to be relatively low, but not uncommon for inland sailing locations. It is not clear how the baseline calculation has been made, but when compared to a significant expanse of open water with uninterrupted wind, it is accepted that sailing conditions at Greensforge Sailing Club are not ideal."*** It is not clear whether the inaccuracies identified at 2.9 above in relation to wind speed would result in a different baseline average sailing quality, or whether the outcome of the assessment would be different.	2.32	The calculation is the summation of the sailing quality percentage values at each location (5m by 5m grid points) as a percentage of time when the wind is from the SSE-W that the various criteria are satisfied, all divided by the number of location points.
2.36	***"Irrespective of other sailing locations locally, the number of people regularly attending this sailing club to participate in sailing is the clearest indication that the conditions on site are suitable to maintain an active club over a long period of time. The implied requirement for perfect sailing conditions are therefore not a precursor to sailing enjoyment - indeed, it is the imperfection in the sailing environment that generate enjoyable sailing experiences."*** The Club would like to refer the ExA to Para 2.2 of the Original Submission. This clearly states that the Club offers grass-root entry to sailing activities, and that this differs from other local groups. The Club is very aware of other local sailing groups, and the one the applicant refers to has a very selective membership approach and has a clear focus on competitive results. It is therefore not necessarily "available" to sailors as an alternative to Greensforge Sailing Club. Indeed, it is highly unlikely that any members from Greensforge would be accepted as members of the Club identified as a result of their approach to membership and	2.36	This rather makes the applicant's point. There is another, larger sailing club available immediately across the motorway with more open water – but members choose to use Greenforge Sailing Club notwithstanding its significant limitations. The wind is already significantly screened by extensive tree cover but nevertheless popular with its members. The effect of the application proposals would be modest and would not fundamentally change the nature of the reservoir's sailing experience.

	requirements for competitive sailing. Greensforge Sailing Club do not take this approach to its promotion of sailing, and therefore remains popular in its own right for very different reasons. It is important that this entry-level sailing approach is maintained in the local area in order that opportunities for water-based recreational activities are not diminished for experienced and novice sailors as well as the many young people and those with special needs who access the reservoir regularly.		
REDUCTION IN SAILING QUALITY			
2.40	***"In summary, therefore, the Wolfson Unit report indicates that there will be a reduction in sailing quality overall by approximately 20%, that the useable sailing area impacted will be 10 – 15%, and that it is most likely to occur in what is currently considered to be the best parts of the reservoir in which to sail."*** Notwithstanding the issues identified in 2.9 above, it is noted that Table 1 in the Wolfson Unit report shows reductions in average sailing quality across the reservoir compared to the baseline, and on a proportional basis shows that Config 2 would generate a reduction in sailing quality to 0.83, and for Config 3 this is 0.79. These figures therefore represent a circa 20% reduction in overall average sailing quality. Similarly, Table 2 shows localized impacts with the proportional reductions being 0.809 and 0.735 respectively. Again, these represent reductions in sailing quality over localized areas of circa 20%. The reduction in sailing quality of 20% exceed the 15% threshold indicated by Wolfson as being "significant". It is not clear how this can be subsequently interpreted as a "modest' impact.	2.40	These are not the figures in the Wolfson report (REP4-012) – see the report or the note provided to support the applicant's answer to EXQ2.13.5 (Document 15.1, Appendix 12, REP5-005). The total percentage of 'good' quality time is based on total time available. i.e. days lost per month or year. In this case 0.51 - 0.66 days per month of increased poor quality conditions when all wind directions taken into account.

	The conclusions to the report indicate that the localized areas impacted equate to 11.3% and 13.5% of the sailing area respectively. Figures 14 and 15 show the areas most affected, and when compared with the baseline Figure 6 show that the best sailing areas will be most impacted. The Wolfson Unit show that in either development scenario there will be a reduction in wind speed, which in itself will have an impact upon novice sailors, who will find transition difficult to assess as well as dealing with significant gusts which also make sailing difficult. The Wolfson Unit do not consider the impact arising when the 80th percentile wind speeds are considered. This is likely to have a greater impact on more experienced sailors, who make up the majority of the Club membership. Any potential reduction in wind speeds is likely to generate significant frustration due to the lack of challenge. In addition, the experienced sailor will also suffer from the reduction in sailing quality in the best parts of the reservoir. This is likely to reduce the pleasure that experienced sailors obtain from the challenges generated by the environment. It is important in any assessment that the full range of users are properly considered. As it currently stands, the assessment fails to do this.		

2.42	***"The applicants' assertion has arisen as a result of an incorrect mathematical calculation, which merely considers the difference between current average and expected average sailing quality as calculated in Table 6 of the Wolfson Unit report. This mathematical error fails to consider what the difference in those two numbers represents as a proportion of the current sailing conditions, and thus underrepresents the impact of the development. By the Wolfson Units own parameters, the impact of the reduction in average sailing quality is significant."***	2.42	There is no mathematical error. The results are faithfully reported in the Wolfson report and in the applicant's response to EXQ2.13.5. Those results also only relate to the percentage change of total available time (when the wind is from SSE - W). The report also includes the proportional relationships in Table 1 (REP4-012) for clarity. The difference in averaged sailing quality is considered to reflect the loss of availability of good sailing conditions which directly relates to the reduction in time (or effectively days lost of best sailing conditions). Taking the proportional relationship approach to the extreme, if only 1 day a month possessed 'good' sailing quality and this reduced to 0.75 day a month, this would be considered significant under such an approach. The approach is also conservative, as it has not taken into account the conditions when wind blows from other directions (i.e. 47% of the time).
IMPACT OF SAILING QUALITY REDUCTION ON SAILING ENJOYMENT			
2.43	***"It is noted that the Wolfson Unit report has considered the impact on sailing conditions and the potential impact that would have on novice sailors. However, the assessment has completely failed to consider what impact this would have on more experienced sailors, who make up a significant part of the Club membership."*** The Club concurs that the most sensitive cohort to any changes will be novice sailors. However, consideration must be given to more experienced sailors, who make up the significant majority of the Club	2.43	The Club has presented no assessment of its own. Despite the length and tone of its response, it does not significantly dispute the outcome of the applicant's quantitative assessment – choosing instead to present those figures in a different way. The novice cohort is considered most sensitive to any changes which is why the assessment focused on this group. The before and after comparison in Wolfson Unit's Figures 6, 7 and 8

	membership. It is noted that the omission to consider the impact on conditions at the 80th percentile wind conditions means that it is not possible to reach a firm conclusion on the impact that the proposed development will have on sailing quality on the reservoir for experienced sailors. This is a significant omission. Any reduction in sailing quality and wind speed will reduce the enjoyment for experienced sailors, who will become frustrated at lower wind speeds and the any loss of sailing quality. With this frustration comes a reluctance to sail with inevitable consequences for the Club operations, its membership, and its outreach work with youth and disability groups.		

			confirms the modest nature of the projected effects across the entire reservoir, which is considered relevant for sailors of all levels of experience.
2.45	***"Similarly, sailing in lighter winds also frustrates more experienced sailors, who generally require stronger winds. Whilst the impact of greater wind speeds has not been analysed as detailed above, the evidence utilised from the Danish Wind Industry Association indicates that there is likely to be a significant reduction on higher wind speeds. Consequently, experienced sailors will not be able to realise previously achieved wind speeds. The impact of light wind speeds to the experienced sailor represents the difference between "sailing' and "floating" which will also give rise to significant de-moralisation and frustration."*** The Club maintains its stance on this issue – refer to 2.7 above. Lighter winds will equally frustrate more experienced sailors, who generally require stronger winds. For experienced sailors the difference between "floating" and "sailing" will give rise to demoralization and frustration, to the point where the enjoyment of the sport is significantly reduced. The assessment shows that the current wind speeds will be reduced across the reservoir at wind speeds significantly lower than the 80th percentile. It does not consider the impact on conditions which meet the 80th percentile criteria. The assessment fails to consider the full range of conditions that are likely to occur, and as a result the Applicants' assertions cannot be relied upon.	2.45	Refer to response 2.7 above, which outlines that existing obstacles haven't been considered by the method proposed.
MITIGATION PROPOSALS			

2.47	***"The assertion from the applicant that the impact on sailing conditions on the reservoir is negligible arises from an error in mathematical calculation, and consequently the wrong conclusion is drawn as a result. The analysis undertaken on behalf of the applicants consistently show that there will be a reduction in sailing quality over Calf Heath Reservoir, and as shown above, the details in the Wolfson Unit report indicate, that the overall impact of the proposed development is anticipated to be significant."***	2.47	Refer to response to 2.42 above.
2.49	***"Despite this, the applicant has not yet provided any details regarding any proposed mitigation which would overcome the identified impacts, despite them having considerable time to do so."*** The Club considers that from the outset it has been absolutely clear about its concerns and the mitigation that is required to satisfy those concerns. Section 4.0 of the original submission specifically requested amendments be made to the Parameters Plan which restricted the height of buildings within Development Block A4a and A4b to ensure that sailing is not impeded by disturbed wind flow. The Club specifically asked the applicants to consider the relocation of the tallest buildings to another part of the site at the meeting on 20th May 2019. The Applicants agreed to give this consideration but have since rejected this proposal with no justification. Finally, the response to ExA's Questions 2.13.5 (July 19) sought appropriate mitigation measures within the parameters plan. It is noted that no amendments have been proposed despite these numerous requests.	2.49	It is not clear from the club's response what mitigation it considers would be appropriate.

2.50	***"This issue was discussed at the meeting on 20th May, when the Club asked if consideration could be given to locating buildings of greater height in other parts of the application site in order that the impact on sailing could be mitigated. It is noted that the applicant declined to consider this, stating that building heights would need to be determined by occupier requirements and had been informed by the visual impact strategy."*** The Club notes that the proposed development site comprises a total of 297ha and note that the only area where buildings are proposed to be up to 30m high are in development blocks A4a and A4b, immediately to the south-west of the reservoir. The Club do not accept that is it not possible to revise the internal arrangement of the site in order that the impact of such large buildings on the Sailing Club can be mitigated whilst ensuring the applicants ability to respond to market requirements. The Applicants have consistently resisted any consideration of the Sailing Club's request but have not presented any specific or reasonable argument as to why such a request cannot be accommodated. The Sailing Club consider that the request is not unreasonable and that there is sufficient flexibility within the scope of the scheme to satisfy the Sailing Club's concerns were the Applicant willing to do so.	2.50	It is important that the WMI project, which proposes nationally significant infrastructure to meet a long acknowledged regional and local need is not unnecessarily handicapped in its ability to respond to market requirements. In the light of the modest effects of the scheme the Applicant does not propose to change its application. This approach is consistent with the principle set out at paragraph 5.159 of the NPS.

2.51	***"The Club was not party to the conversations relating to the development of that Strategy, and it is considered likely that the impacts that arise from that strategy were not fully assessed at the time it was undertaken. Whilst the applicants ultimately agreed to consider the issues raised on 20th May, to date no alternative proposals have been put forward."***	2.51	See above. The applicant received representations from Greensforge Sailing Club during the consultation process and committed to undertake a desk based study on the potential impact of the Proposed Development on sailing quality at Calf Heath Reservoir, in response to concerns from Greensforge Sailing Club. The results of the desk based study have been considered fully. Subsequently the desk study findings have been further developed, based on additional assessment works undertaken by RWDI (REP4-013) and Wolfson Unit (REP4-012).
2.53	***"It is a key principle of the planning system to ensure that where significant negative impacts are identified, appropriate action is secured through the consenting process to ensure those negative impacts are not realised. Should the Consent Order be granted as currently proposed, and the negative impacts realised on the sailing club at a later date, there is no recompense for the sailing club. We believe that this would be an unfair outcome for present and future sailors."*** The Sailing Club has not been made aware that the Applicants have already proposed to reduce building heights adjacent to the reservoir and have not been able to ascertain any amendments to the Parameters Plan proposed by searching the Planning Inspectorate website library. We specifically request that the Applicant provide us with the revised proposals for our detailed consideration at their earliest convenience.	2.53	The assessed effects are not such as to warrant further restrictions on the built development proposed at WMI, where building heights are already proposed to be reduced adjacent to the reservoir.

In conclusion, the Sailing Club remain very concerned that the proposed development, which suggests that buildings of up to 30m in height will be located in very close proximity to the reservoir, and the downwind location of those buildings will impact on the sailing conditions currently experienced significantly.

The Club remain concerned that the CFD Analysis undertaken has not replicated the current conditions fully at its baseline assessment. Inaccuracies built in at the initial stage of the analysis, such as the assumptions relating to the tree line on the south-west boundary of the site, and the constant direction of wind, will be reflected in the results of the modelling. The Sailing Club does not dispute the use of the CFD approach, but considers that the baseline conditions upon which it is based should accurately reflect the baseline conditions at the outset.

The Club also remain concerned that a full assessment of sailing conditions has not been undertaken. In particular, the wind speeds considered in the Wolfson Unit report do not reflect the 80th percentile wind speeds which are evidenced as being significantly greater. The omission of an assessment of the impact of the proposed development under such conditions is a significant omission. As such the outcome of the Wolfson Unit report should be treated with extreme caution.

We note that the assessment considers relatively light wind speeds, which are acceptable for novice sailors, but in doing so it disregards any impact that may result from higher wind speeds for more experienced sailors, who make up a significant proportion of the Club's membership. The applicants have rejected any proposal to consider alternative wind speeds. This approach fails to consider the conditions identified in the RWDI report, with the consequential impact that the Sailing Assessment inadequately considers the impact of the proposed development.

Nevertheless, the Wolfson Unit assessment shows that overall the impact on Sailing Quality across the reservoir results in an average reduction of circa 20%. This is in excess of the 15% threshold identified by Wolfson as significant. In addition, they show that the best areas for sailing are most impacted. This will not only impact upon novice sailors, but experienced sailors too. A 20% reduction in sailing time equates to 1.5 days per month on the basis of 8 sailing days per month. This extent of sailing reduction is a significant proportion of Club time and will have significant consequences. The Club do not consider this impact as 'modest'.

The Club have consistently requested that the largest buildings proposed on the site should not be located in the closest proximity to the reservoir. Despite the numerous requests for this to be considered, the Applicants have refused to consider this.
We believe that given the 294ha site proposed for this development that there is sufficient scope for the tallest buildings to be located elsewhere without impacting on the Applicants requirements for market flexibility. We note the Applicants have refused outright the consideration of any other alternatives.

The Club remain unconvinced of the applicants assertion that placing an impermeable structure 30m high, in close proximity to the reservoir, immediately downwind of the prevailing wind direction will impact the sailing conditions to the limited extent the applicants assert. The failure to consider prevailing 80th percentile wind conditions in the Wolfson Unit report confirms that the Clubs concerns are sound.

We note that it is important that such considerations are resolved as part of the decision making process, as once development

progresses there will be no recompense for the Club should their concerns be realized. We therefore repeat the request that consideration is given to placing restrictions on building heights in close proximity to the reservoir.

APPENDIX ONE