

Wrexham AFC

Kop Development

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1. Introduction

This report has been produced by Ramboll to provide further information and clarification to support the planning application in relation to the drainage strategy and in relation to nutrient neutrality. The report is broken down into 3 sections. The first section is for surface water / SuDS drainage and clarifies the proposed strategy for managing surface water on the proposed development. The second section details the foul water calculations for the proposed development. The final section runs through the phosphorus loads generated as a result of the Kop Stand development.

This report should provide assistance to WCBC in its revised Appropriate Assessment to be submitted to Natural Resource Wales (NRW) – either as a stand-alone document and / or the provision of key supporting information.

2. Surface Water / SuDS Drainage

2.1 Introduction

The surface water drainage strategy has been developed in accordance with current best practice and UK / local policies. The surface water strategy has been developed with the SuDS hierarchy in mind and promotes water reuse for all rainwater that is collected from the Kop Stand roof. The rainwater harvesting system has been developed for use for toilet flushing.

2.2 Drainage strategy

The surface water is then proposed to be managed via infiltration for the 1 in 100-year storm event with an allowance of 40% for climate change. Soakaway testing was carried out on site in accordance with BRE Digest 365 and indicated infiltration rates ranging from 1.4×10^{-3} m/s to 7.3×10^{-4} m/s. These infiltration rates are favourable to an infiltration led surface water management as per guidance in the Ciria SuDS Manual. The external finishes have been designed to be permeable with subbase storage to omit the requirement for any attenuation tanks. The depth of the external works subbases has been designed in accordance with loading and attenuation requirements. By utilising the use of type 3 material with a void ratio (VR) of 0.3 for the subbase the volume capacity for attenuating the surface water is provided.

Rainwater is collected from the KOP Stand and will filter through a combination of green roof / traditional roof before discharging through a syphonic drainage system. The syphon will be broken at specialist syphonic break chambers and the surface water directed into the subbase via a network of perforated pipework.

Details of these works can be provided via a condition.

3. **Foul Water**

3.1 **Introduction**

The following calculations have been on architectural and MEP design layouts / information to provide an assessment of the likely foul drainage flow rates originating from the proposed development.

At this stage, the calculations are based on a number of assumptions and estimates and therefore may be subject to further refinement as the wider infrastructure and architectural design is developed through Concept and Technical Design.

3.2 **Methodology**

Due to the nature of the proposed Stand the peak foul flow rate will only occur for a short period of time on match days. Therefore, a 3.5-hour peak period will be utilised for the calculations. All below ground drainage will be designed to sustain a self-cleansing velocity during quieter periods.

At this stage, above ground flow calculations have not been undertaken / finalised so flow rates are subject to change.

To assess the foul flow calculations the population & expected probability rates as outlined within BS EN 752 & BS EN 12056 will be calculated and will be compared to gain an understanding of the flow rate.

3.2.1 **Probability Method**

The number of appliances below are as per AFL Architects layout dated 13/06/2022. Number of stacks within kitchens have been assumed, along with floor gullies assumed within plant spaces. For these calculations 'System II: Single discharge stack system with small bore discharge branch pipes' will be utilised, and a frequency factor of 1.0 will be utilised which is used for 'Congested use, e.g., in toilets and/or showers open to public'.

The breakdown of the appliances are as follows:

- Ground floor (level 0):
 - 89 WC's (1.8 DU): 160.2 DU
 - 67 Wash hand basins (0.3 DU): 20.1 DU
 - 67 Urinals (0.5 DU): 33.5 DU
 - 3 FG's (assumed) (1.5 DU): 4.5 DU
- Level 1:
 - 13 WC's (1.8 DU): 23.4 DU
 - 13 Wash hand basins (0.3 DU): 3.9 DU
 - 4 Urinals (0.5 DU): 2.0 DU
 - 1 Shower (0.6 DU): 0.6 DU
- Level 2:
 - 14 WC's (1.8 DU): 25.2 DU
 - 13 Wash hand basins (0.3 DU): 3.9 DU
 - 10 Urinals (0.5 DU): 5.0 DU
 - 4 FG's (assumed) (1.5 DU): 6.0 DU
 - 4 Sinks (assumed) (0.8 DU): 3.2 DU
 - 2 Dishwashers (assumed) (0.8 DU): 1.6 DU

Peak foul flow, Q_{ww} can be calculated as follows:

$$Q_{ww} = k\sqrt{\sum DU}$$

Therefore,

$$Q_{ww} = 1.0 * \sqrt{293.1} = \mathbf{17.12 \text{ l/s}}$$
 (Average flow 2.85 l/s)

Note, this value is based upon assumptions made at stage 2 and may increase / decrease dependent on any design changes at detailed design.

3.2.2 Population Method

The expected population for the development will vary due to the nature of the development. However, for the purpose of these calculations the maximum capacity of the stand will be utilised as this would generate the highest flow.

AFL Architects have produced a capacity schedule, and this will be utilised at this stage. The capacity schedule states a total capacity of 5500. Note this does not include staff, so for the purpose of these calculations a value of 5550 will be used to provide an allowance for the total occupation during a match event.

To establish the expected flow per person 'Flows & Loads 4' will be utilised to determine the most suitable scenario. The most applicable activity would be 'Local community sports club, e.g. squash, rugby & football' which gives a base flow of 40 litres per person per day. Applying this value to the 5550 expected capacity of the stand, a total foul flow volume can be calculated.

Therefore;

$$U = 5550 \times 40 \text{ l/p/d} = \mathbf{222,000 \text{ litres}}$$

As mentioned previously, a 3.5 hour duration for an event is being utilised for a peak value for the foul flows. The peak foul flow, Q_{pop} can be calculated as follows:

$$Q_{pop} = \frac{U \text{ (in litres)}}{t \text{ (in seconds)}} \text{ l/s}$$

Therefore,

$$Q_{pop} = \frac{222000 \text{ l}}{3.5 \times 60 \times 60 \text{ s}} = \mathbf{17.62 \text{ l/s}}$$

3.3 Summary of foul water flows

A flow rate of **17.37** l/s will be assumed as the peak flow rate from the proposed stand redevelopment as this is an approximation of the median from the two calculated peak flow rates.

The foul water drainage from the development will discharge to the Welsh Water foul sewer via a sealed piped network. The connection will be made into the foul water sewer located within the Turf Hotel car park. A GPR survey and CCTV survey has been commissioned to identify the exact locations of the receiving sewer. The discharge is proposed to be via gravity, however, should the survey identify shallow levels of the receiving sewer it may require pumping. The peak foul water flow rate is calculated to be 16 l/s and Welsh Water have confirmed capacity is available within the network.

4. Phosphates

The site is located within the catchment of the River Dee which is classified as a SAC. The foul water from the site will discharge via the Welsh Water foul water sewer to the Five Fords Wastewater Treatment Works (WWTW). The Kop Stand will be exclusively used by home fans, data collected for the transport assessment (for example informed by season ticket and match ticket purchase data) identified that 55% of the attendees are from within Wrexham and the River Dee catchment, and 45% are from areas outside of Wrexham. The proposed development will see the capacity of the KOP Stand increased from 5000 fans (based on the fallback re-use of the existing Kop Stand of 5,000, though did have higher capacities historically of 9,000 upwards) to 5500 fans which is a net increase of 500 fans.

There are additional proposed upgrades to the stadium to bring the stadium in line with UEFA guidance which could see stadium capacity reduced by a further 548 (this includes removal of seating to provide platforms for disabled spectators and media requirements). This would therefore result in a net decrease in capacity of 48 for the stadium as a whole. Note: This has not been taken into account in the calculations below.

The below calculations have been undertaken to determine the estimated phosphorus increase from the WAFC Kop Stand development. The calculation is based on the information provided within the Arcadis report (Wrexham Gateway Project – Phosphate Strategy, 17th August 2022) who were appointed by WCBC to develop solutions for understanding and mitigating the phosphorus impact from the wider Wrexham Gateway and Kop Stand development. Using the data from the Arcadis report and for the agreed capacity increases we have assessed the phosphorus increase to be the following:

4.1 Design Assumptions

- Phosphorus load per Population Equivalent (PE): 2.5g/person/day taken from Arcadis report.
- Hours at match assumed: 3.5hrs / match
- Hours at non-match event assumed: 4hrs / event
- Percentage of local contribution: 55% taken from transport assessment
- Percentage of non-local contribution: 45% taken from transport assessment
- Capacity for match events: 5500 persons
- Capacity of existing Kop Stand: 5000 persons
- Capacity for non-match events (exhibition): 600 persons
- Matches per year: 27 football, 4 rugby = 31 match events
- Non match events per year (exhibition): 74 non-match events

4.2 Phosphates generated per match event

4.2.1 Additional contributing fans for match events

$$\text{Additional fans} = 5500 - 5000 = 500 \text{ additional fans}$$

$$\text{Contributing fans from non - local contribution} = 500 \times 0.45 = 225 \text{ (non - local fans)}$$

4.2.2 Phosphate load per fan per match event

$$2.5 \times \left(\frac{3.5}{24}\right) = 0.365 \text{g/person/match}$$

4.2.3 Phosphate loading per match event

$$225 \times 0.365 = 82.125g/match$$

$$\text{phosphate loading per match} = 0.082125 \text{ kg/match}$$

4.2.4 Phosphate loading per year for all match events

$$0.082125 \times 31 = 2.55 \text{ kg/year}$$

4.3 Phosphates generated per non-match events

4.3.1 Contributing persons per non-match event

$$600 \times 0.45 = 270 \text{ persons (non – local attendees)}$$

4.3.2 Phosphates load per person per non-match event

$$2.5 \times \left(\frac{4}{24}\right) = 0.416g/person/event$$

4.3.3 Phosphates load per non-match event

$$270 \times 0.416 = 112.5g/event$$

$$\text{phosphate loading per non – match event} = 0.1125 \text{ kg/event}$$

4.3.4 Phosphate loading per year for all non-match events

$$0.1125 \times 74 = 8.325 \text{ kg/year}$$

4.4 Total combined additional phosphate loading

$$\text{Total increase in phosphate loading} = 2.55 + 8.325 = 10.875 \text{ kg/year}$$

5. Conclusion

The calculations provided within this report demonstrate that the level of additional phosphate generation, whether looked at on a per-event (match or non-match) basis or aggregated as an annual figure is very low, and of a level thought to be insignificant. When these calculations are considered alongside the technical specifications for the drainage (which form part of the Drainage SuDS submission & SAB application) the effect on the increase in phosphates generated by the Kop Stand development are demonstrated and believed to be negligible.

In the circumstances we trust WCBC and NRW will be satisfied that the design, specifications, and impacts are all acceptable.