Thakeham Tiles
Potable Water Feasibility Review

Prepared for:
Thakeham Tiles Ltd.

Prepared by:
Callum Rowe

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Issued by	**Stantec Hydrock Limited** 100 Barbirolli Square Manchester M2 3PW UNITED KINGDOM stantec.com	+44 161 245 8900 hydrock.com
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1 Introduction

Thakeham Tiles Ltd are proposing to re-develop their site on Rock Road, Storrington, Pulborough for a residential development. The site is located within the Hardham Basin of the Arun and Western Streams abstraction licensing area and the Sussex North Water Resource Zone. There is concern that large groundwater abstractions from the Folkstone Formation within the Hardham Basin exceed the sustainable limit for the aquifer. This is potentially impacting on the designated wildlife sites within the Arun Valley (SAC. SPA, SSSIs and Ramsar site) and resulted in a Position Statement by Natural England for all new developments to achieve water neutrality to help reduce pressure on the Folkstone Formation aquifer.

The proposed development includes 108 dwellings of various occupancies and sizes. Separate works have been undertaken by others to identify the feasibility of providing potable water to the site through use of a local borehole and water treatment plant to adhere to the water neutrality requirements.

The purpose of this report is to review the feasibility of utilising the water, abstracted from the borehole, to provide the potable water requirements of the proposed development.

We will assess the following anticipated elements:

- Peak simultaneous flow rates to the site
- Borehole abstraction flow rate
- Daily and hourly usage patterns
- Storage requirements
- Possible infrastructure routing

2 Basis of Assessment

Below are the listed assumptions used as the basis of this assessment:

- The site plan, as provided by the client.
    - It is assumed the naming convention of the building types is [bedrooms]B[bathrooms], so 3B2 is a three-bedroom, two-bathroom dwelling. This is to be checked by Chris Ingram at Thrive Architects
- It is assumed there is no sprinkler requirements for this development.
- Information provided by H2OGeo via email relating to borehole water abstraction rates.
    - 52.5 m^3/day
- Information provided by Stantec in Water Supply Borehole Investigation report 08347-HYD-XX-XX-RP-GE-1005 (Rev P02, issued 11/12/2024) relating to borehole water abstraction rates:
    - 84 m^3/day
- The daily and hourly water usage patterns will be estimated using the guidance in CIBSE and CIPHE guides.
- Water storage requirements will be estimated using the guidance in CIBSE and CIPHE guides.
- Peak potable water flow rates to the site will be estimated using BS EN 806 loading units in table 1.
- The assumed provision of sanitary fittings for each type of dwelling is outlined in table 2.

Table 1 identifies the loading units for each type of sanitary fitting based on BS EN 806. These values are used in the calculations.

Type / Fitting	WC	Bath	Shower	Kitchen Sink	Wash Hand Basin	Bib tap	Washing Machine	Dish-washer
Hot	0	4	2	2	1	0	0	0
Cold	1	4	2	2	1	5	2	2
Total	1	8	4	4	2	5	2	2

Table 1 – BS EN 806 Sanitary fittings loading units

Table 2 shows the dwelling numbers, assumed occupant numbers ascertained from the site plan. Also provided is an estimate of the provision of sanitary fittings throughout the development.

Type / Fitting	*1BF*	*2B*	*3B1*	*3B2*	*3B3*	*3B4*	*4B1*	*4B2*	*4B3*	*4B4*	*Plant*
WC	1	2	2	2	3	4	1	2	3	4	0
Bath	0	1	1	1	1	2	1	1	1	2	0
Shower	1	1	1	1	1	2	1	1	2	2	0
Kitchen Sink	1	1	1	1	1	1	1	1	1	1	0
Wash Hand Basin	1	1	1	2	3	4	1	2	3	4	0
Bib Tap	1	1	1	1	1	1	1	1	1	1	1
Washing Machine	1	1	1	1	1	1	1	1	1	1	0
Dishwasher	1	1	1	1	1	1	1	1	1	1	0
No.	4	36	13	17	21	2	9	2	2	2	1
Occupancy	2	4	5	5	5	5	7	7	7	7	0

Table 2 – Dwelling numbers, occupant numbers, and sanitary fittings numbers

3 Calculation Findings

3.1 Simultaneous Peak Flow Rate

Domestic water usage is intermittent and therefore does not result in a constant flow rate.

The estimated simultaneous peak flow rate for the development has been determined based on:

- The loading units calculation method outlined in BS EN 806, as indicated in table 1.
- The allocation of sanitary fittings indicated in table 2.

The borehole abstraction rate is based on daily usage estimates (provided out by H2OGeo) and averaged at a constant flow rate.

The key outcomes of the calculations are laid out below:

- Simultaneous peak flow rate to the site: 7.05 l/s
- Borehole abstraction flow rate (derived from H2OGeo hourly flow rate): 0.6 l/s

As there is a significant difference between borehole abstraction flow rate and simultaneous peak flow rate to the site, there is a requirement to accommodate this by providing a cold water storage tank between the borehole and the site.

3.2 Cold Water Storage Tank Capacity

The following section outlines the cold water storage tank capacity assessment. The investigation has used multiple methods to estimate an appropriate cold-water tank capacity to accommodate the difference between incoming and outgoing flow rates, outlined in section 3.1 above.

3.2.1 CIPHE (Chartered Institute of Plumbing and Heating Engineers) Guides

The following section summarizes the calculations carried out using the CIPHE guides.

Daily water usage

The daily water usage requirements for dwellings are provided in the CIPHE guides as follows

Dwelling type (number of bedrooms)	CIPHE Daily Usage (litres/bed)	Quantity (from table 2)	Total Daily Usage (litres)
1	210	4	32,100
2	130	36	
3	100	53	
4	100	15	

Table 3 – Daily water usage calculation

Water Storage Capacity

The CIPHE guides outline recommendations for cold water storage for dwellings as follows:

- Recommended storage as a percentage of daily usage: 50%
- Water storage capacity based on 50% of daily usage (refer to table 3): 16,050 litres

Assessment of water storage capacity

In order to assess whether the storage identified above is appropriate for the proposed development, an hourly usage histogram, as outlined in CIPHE and CIBSE guides, has been considered, shown in table 4 and figure 1 below. This will identify the anticipated tank water turnover time and minimum levels during peak usage periods.

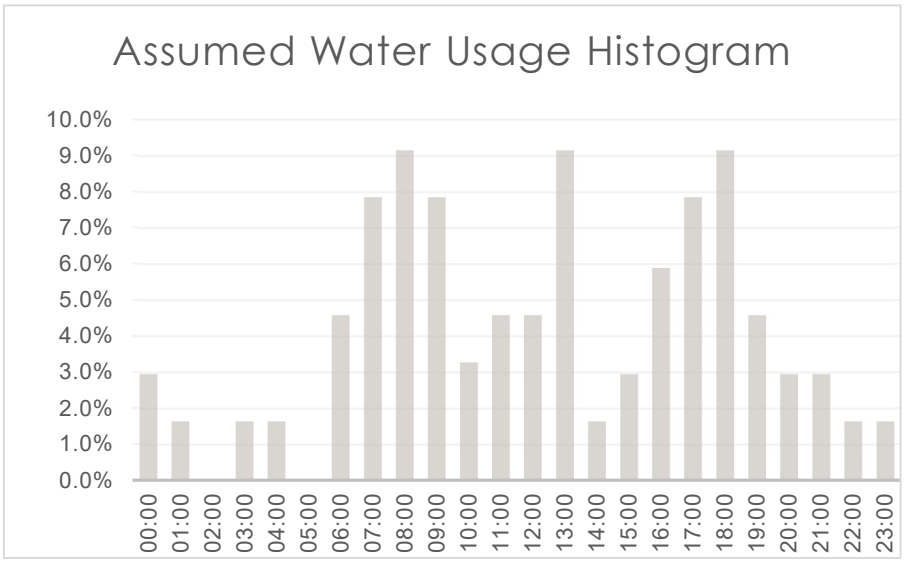


Figure 1 – Hourly water usage profile

Hour	% of Daily Water Use	Estimated Hourly Water Usage (litres)
00:00	2.9%	944
01:00	1.6%	525
02:00	0.0%	0
03:00	1.6%	525
04:00	1.6%	525
05:00	0.0%	0
06:00	4.6%	1469
07:00	7.8%	2518
08:00	9.2%	2937
09:00	7.8%	2518
10:00	3.3%	1049
11:00	4.6%	1469
12:00	4.6%	1469
13:00	9.2%	2937
14:00	1.6%	525
15:00	2.9%	944
16:00	5.9%	1888
17:00	7.8%	2518
18:00	9.2%	2937
19:00	4.6%	1469
20:00	2.9%	944
21:00	2.9%	944
22:00	1.6%	525
23:00	1.6%	525

Table 4 – Hourly water usage profile

Based on the profile above, it is expected that the tank turnover time and minimum water levels in the tank will be appropriate based on the indicative tank sizes assessed. This would need to be verified

through a future design process. On the basis that the tank is sized to store 50% of the daily usage, it is anticipated that a much larger peak usage, up to half of the daily usage within an hour, could be accommodated. The peak simultaneous flowrate would also be capable of delivering this.

3.2.2 Tank Size Recommendations

Based on the above calculations, the following indicative tank details have been deduced:

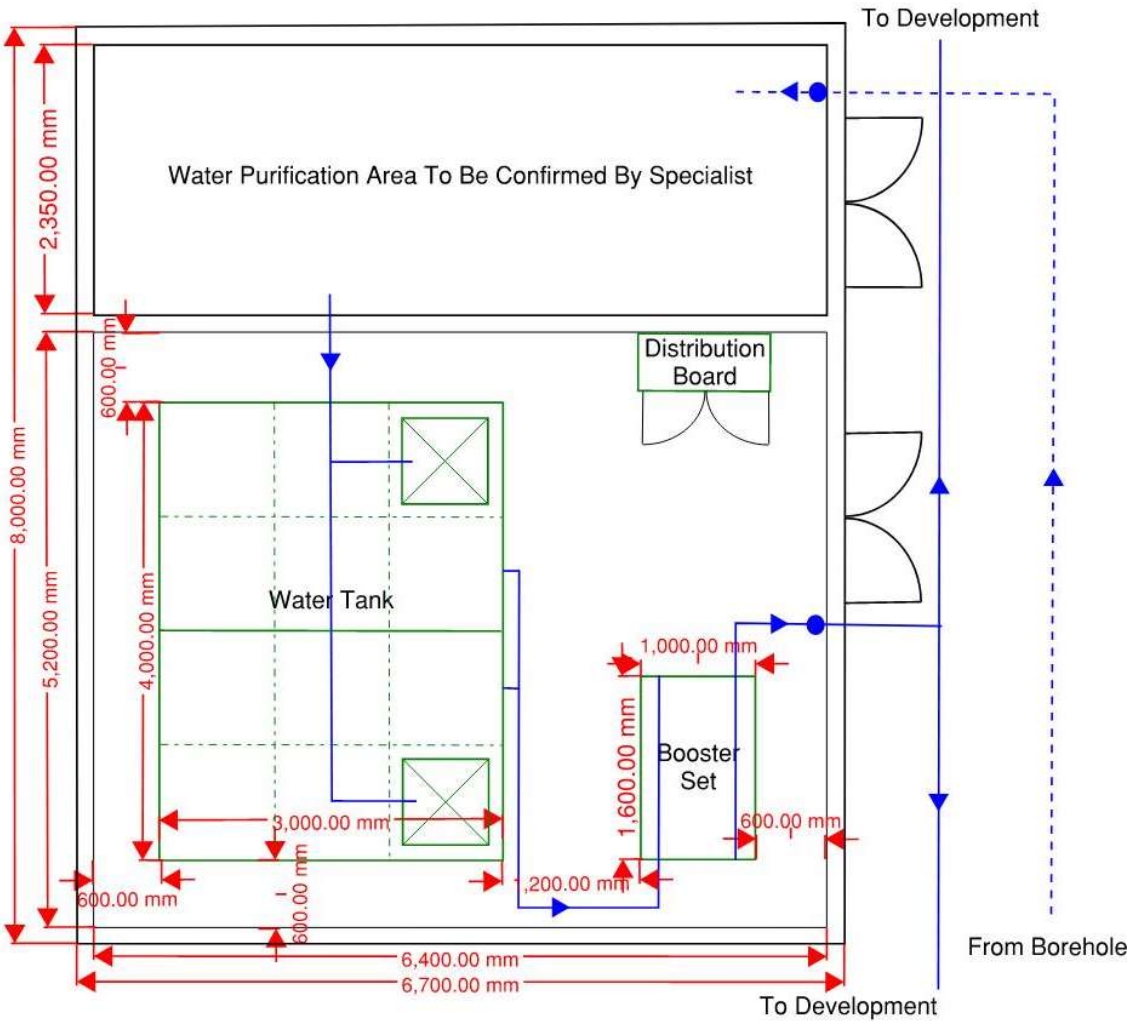
- Indicative required capacity: 16,050 litres
- Possible tank dimensions: 4m x 3m x 2m (LxWxH)
    - Actual capacity: 18,000 litres
- Tank compartments: 2
- Tank Location: above ground
- Base details: Concrete piers and steel frame to manufacturers recommendations
- Tank details and accessories subject to design

3.2.3 Tank Room Size and Location Recommendations

Based on the above calculations, the following indicative tank room details have been deduced:

- Possible plant room external dimensions (including water purification area). Refer to section 3.3 for indicative plant compound layout sketch: 6.7m x 8m x 3.7m
- Plant room louvres will be required for natural ventilation and to reduce overheating, size of louvres required to be determined in future design works
- Plant room distance from borehole is to be finalised based on the available pressure from the borehole abstraction pump.
- Plant room construction / aesthetics to be determined by others as part of the future design works
- There are no known reason why the plant room should need to be located away from dwellings other than acoustic requirements. However, it is not anticipated that the plant will generate excessive noise. This will need to be investigated as part of future works.
- Final connectivity of water treatment plant and tank / booster plant to be finalised during future design works.

3.3 Indicative Tank Room Layout



3.4 Indicative Water Infrastructure Distribution

4 Conclusion

This assessment has:

- Made assumptions on the sanitary fitting provision across the proposed site
- Assessed the resultant load of the site
- Considered the difference between the rate of the borehole abstraction and peak simultaneous flow rate to the site
- Reviewed optimal storage capacity to offset the difference
- Considered potential site distribution and tank room position, size and layout

We have determined that in order to maintain water neutrality to the development, it is possible to provide a water storage and boosting infrastructure system to meet the requirements of the dwellings.

5 Recommendations for Further Work

This assessment is limited to a feasibility review. In order to progress this to a more detailed level, further design through the RIBA plan of work stages would be required.

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Stantec UK Limited
100 Barbirolli Square
Manchester
M2 3PW
UNITED KINGDOM
stantec.com