BLBB CONSULTING LTD

WASTE WATER TREATMENT SPECIALISTS

Heyford WWTW Capital Improvements Required to Match Development

Introduction

This document is provided as an explanatory document to the Environment Agency in support of the request for the Discharge of Condition 13 of Planning submission 16/02446/F

Summary

In 2016 the development team at Heyford instructed BLBB Consulting Limited to produce an upgrade plan to identify the optimum solution for process plant required to provide additional treatment capacity at the WWTW to enable the increasing flows and loads to be treated to the required consent standards as the catchment grows in line with the Masterplan that is now emerging for the site. This plan has been updated on a regular basis and has been informed by annual Load and Flow surveys at the WWTW to enable the actual loads and flows treated at the works to be determined such that increased process plant could be installed and commissioned when required and thus ensure that the works maintains full consent compliance at all times.

Report Prepared by W A LILLY

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20 April 2021


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Introduction

The development team at Heyford instructed BLBB to produce a detailed plan that identifies additional process plant required to provide treatment capacity at the WWTW to enable the increasing flows and loads to be treated to the required consent standards as the catchment grows in line with the Masterplan that is now emerging for the site.

A detailed spreadsheet has been developed that allows the increasing flows and loads to be calculated in line with the house build programme together with the other ongoing increases anticipated from growth in the commercial development areas and other activities such as school and nursery number increases.
This is supported by annual load and flow surveys where for 7 days samples of Crude Sewage, Settled Sewage and Final Effluent are collected every 15 minutes and bulked daily samples are submitted for a detailed analysis such that a reliable determination of the actual flows and loads treated at the works can be established.

A detailed spreadsheet (Appendix 1) that takes account of the assumptions on growth to enable capacity increases in process plant required over time has been developed and is used by the Heyford Team to determine when additional process plant needs to be provided at the WWTW.

Where possible increased numbers in all areas have been converted to a household unit size based on 2.4 Pe occupancy rate and 150 litres per head daily discharge volumes. Some work has been undertaken to establish that these numbers are realistic by cross checking with previous growth in house numbers and flow rates. If, in future build any changes in occupancy rate or volumes of wastewater produced is expected a reduced growth figure can be used.

The timing and numbers of additional process plant in the form of Rotating Biological Contactor (RBC) units is also linked to an assumed current and future capacity provided by the existing process plant. At 2025 the provision of a third RBC is also linked with a significant improvement scheme to convert the existing filter beds to a tertiary treatment process as well as to convert the existing sludge lagoons to reedbeds. The existing Primary sedimentation tanks will be removed from service and converted to provide on-site flow balancing which will enable the increased flows to be treated. This is also part of the strategy to move the more odorous treatment processes away from the boundary which adjoins the site where future house build is planned.

The 2021 provision of a first RBC is currently ongoing with a second RBC required on stream by 2023 and a third by 2025.

RBC 1 Technical Details

A contract is currently ongoing at the WWTW to provide a Rotating Biological Contactor (RBC) at Heyford WWTW. The RBC is being provided by Tuke and Bell and is designed to Water Industry Standards. The RBC is due to be delivered to site in June 2021 and will be commissioned by September 2021.

The RBC is designed to treat a maximum permissible peak flow of 594.24 m^3/day. The Heyford Park Unit is a 3.8 Meter Diameter RBC unit, and a detailed data Sheet summarises the specification of the proposed RBC unit and layout (Full design details can be provided on request).

Tuke and Bell proposed an RBC which will treat the required flow and load to full comply with the consent limits of 20 mg/L BOD, 30 mg/L TSS and 20 mg/L ammoniacal nitrogen, and provide primary settlement and a biozone, with final settlement provided by an existing standalone humus tank.

The RBC is designed and manufactured to a high quality, including removable covers to allow for manual sludge and scum removal, primary settlement zone fixed sludge removal pipework, a 3.8 m rotor containing 10,400 m^2 of effective biological treatment area, an orifice plate to control flow from the biozone to the external humus tank and a control panel to automate the treatment process.

Tuke and Bell will also include a three-way flow splitter, constructed from GRP and steel which comes with individually adjustable weirs to evenly split the flow for future RBC units when required. A motorised rake is provided as well to keep the weirs free from obstruction.

The RBC will have a maximum treatment capacity of up to 1000 Pe. However, the additional Phase 9 includes for up to 296 properties which at an occupation rate of 2.4 Pe will only increase numbers by a maximum of 710 Pe therefore the additional spare capacity provided will be taken into consideration for future developments. Flows at the works will be side streamed using automatic control valves and flow metering such that the correct portion of flow passes to the RBC unit for full treatment. All other flows will continue to be treated at the existing WWTW.

A typical Installation of a Tuke and Bell RBC unit is shown below identical to unit being provided at Heyford WWTW as part of ongoing contract due to be commissioned in September 2021.

Typical RBC installation nearing completion with front apron (Heyford RBC will not have the small green compressor kiosk)

Ongoing work to Reduce Water Ingress (Infiltration)

Work is ongoing to repair or replace network sewerage problems as they are identified. A full CCTV survey of the site was completed in 2018 and high priority issues were dealt with by relining sections of the system where high levels of surface water ingress were found.
Below we have listed a summary of the work that has been undertaken over the past 3 years together with current 2021 improvement plans.

Work Completed

- Off Site- replacement of all foul drainage crossing third party owned land.
- Phase 1- Removal of existing buildings and drainage and replacement with new foul and surface water sewers
- Phase 2- Removal of existing buildings and drainage and replacement with new foul and surface water sewers including addition of an attenuation pond and controlled discharge of surface water
- Phases 3 to 6- Removal of existing buildings and drainage and replacement with new foul and surface water sewers including addition of an attenuation pond and controlled discharge of surface water.
- Phase 14- Removal of existing buildings and drainage and replacement with new foul and surface water sewers including controlled discharge of surface water. This area

was identified as having excessive infiltration into the existing foul network which, as of March 2021 was replaced with new sewers and has greatly reduced infiltration.

- Trident area-
    - Phase 8B- Removal of existing buildings and drainage and replacement with new foul and surface water sewers
    - Phase 8A- Removal of existing buildings and drainage completed.
    - Phase B4A (Bovis)- Removal of existing buildings and drainage completed
    - Phase B4B (Bovis)- Removal of existing buildings and drainage completed. New foul drainage completed to replace existing
- Phase 9- Removal of existing buildings and drainage completed
- Southern Residential area- entire foul drainage network surveyed in 2019 to identify any area of infiltration
    - Major infiltration identified adjacent to existing bungalow at 33 Harris Road. Sewer was relined to reduce infiltration in the area
    - Major infiltration discovered in 2020 on foul sewer from the school specialisms campus- Surveying and additional repairs scheduled for July/ August 2021 (during school summer holidays.)
- Main sewage plant – Infiltration identified on pipework adjacent to wet well- Relining carried out in 2018 to reduce infiltration

Pumping Station Improvements

- Pump stations- all pump stations now have a telemetry link which will allow monitoring of pumping and any anomalies on pumping volumes (which could be due to infiltration) can be further investigated.

Planned work on infiltration surveying and repairs

- Cheshire Drive/ Roper Drive- potential infiltration area to be excavated and if found- pipe to be repaired. Works planned for later in 2021.
- School campus- Investigation to take place July/ August 2021. Depending on survey results it may be possible to carry out localised repairs. This sewer is due to made redundant in 2023 as Phase 9 develops.
    - Medium infiltration identified at junction of Cheshire Drive and Roper Road to be repaired.

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BLBB Consulting Limited
20 April 2021

Appendix 1 Growth Assumptions at the WWTW to align with Heyford Growth Masterplan

Heyford Load Survey Results												
		2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	
Assume DWF + 10% infiltration +TE = 151m3/d (Survey July low infiltration)	m3/d	151	151	151	151	151	151	151	151	151	151	Survey July low infiltration
Assume Trade Effluent = **E**	m3/d	65	65	65	65	65	50	65	65	65	65	Client informed
DWF + 10% infiltration =	m3/d	86	86	86	86	86	101	86	86	86	86	
Infiltration =	m3/d	8.6	8.6	8.6	8.6	8.6	10.1	8.6	8.6	8.6	8.6	
DWF =	m3/d	77.4	77.4	77.4	77.4	77.4	90.9	77.4	77.4	77.4	77.4	
DWF =	l/d	77400	77400	77400	77400	77400	90900	77400	77400	77400	77400	
Person usage =	l/d	150	150	150	150	150	150	150	150	150	150	
Person usage = **G**	m3/d	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	
Houses Built			200	200	200	80	160	160	160	160	160	
Population Growth based on new builds			480	480	480	192	384	384	384	384	384	Based upon 2.4 pop per house
Housing Population		516										Derived population based on 150l/d per person
School Population		425	130	125	130	0	0	0	0	60	60	
Derived School Population		255	78	75	78	0	0	0	0	36	36	School Pop @ 90l/h/d= 90/150*School Pop
Industrial Population							120	120	120	120	120	
Derived Industrial Population			0	0	0	0	40	40	40	40	40	Industrial Pop @ 50l/h/d= 50/150*Industrial Pop
Total Population =			558	555	558	192	424	424	424	460	460	
Cumulative Total Population = **P**		771	1329	1884	1879	2071	2495	2919	3343	3803	4263	
Derived School DWF	m3/d	38.25										
Derived Industrial DWF	m3/d	0										
Total DWF including School & Industrial	m3/d	115.65	83.7	83.25	83.7	28.8	63.6	63.6	63.6	69	69	
Cumulative DWF	m3/d		199.35	282.6	318	346.8	410.4	474	537.6	606.6	675.6	
Infiltration = 20% of Total DWF	m3/d	23.13	39.87	56.52	31.80	34.68	41.04	47.40	53.76	60.66	67.56	Infiltration estimated @ 20% until 2019 when reduces to 10%
Population Equivalent Pe:-												Based upon 1 Pe =60g/d
Crude Mean BOD	mg/l	163										
Pe= BOD x Mean Daily Flow/60g/day	Pe	410.22	480.00	480.00	480.00	192.00	384.00	384.00	384.00	384.00	384.00	
School Adjustment	KgBOD	16.15	4.94	4.75	4.94	0	0	0	0	2.28	2.28	Based upon 38g/h/d
School Adjustment	Pe	269.17	82.3333	79.167	82.3333	0	0	0	0	38	38	
Industrial Adjustment	KgBOD	0	0	0	0	0	3	3	3	3	3	
Industrial Adjustment	Pe	0	0	0	0	0	50	50	50	50	50	
Total Pe		679.38	1241.72	1800.88	1879.13	2071.13	2505.13	2939.13	3373.13	3845.13	4317.13	
Flows												
Crude BOD	kg/day	40.763	74.503	108.05	112.748	124.268	150.308	176.348	202.388	230.708	259.028	
DWF = PxG +I +E =	m3/d	203.78	304.22	404.12	318.00	410.33	465.29	550.25	620.21	696.11	772.01	
Average Flow	m3/d	254.73	380.275	505.15	397.5	512.913	581.613	687.813	775.263	870.138	965.013	