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Meece 1 Landfill

Surface Water Risk Assessment

Biffa Waste Services Limited

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1 Introduction

1.1 Background

ByrneLooby Partners (UK) Limited (ByrneLooby) have been commissioned by Biffa Waste Services Limited to produce a Surface Water Risk Assessment to support a Permit Variation Application for Environmental Permit Ref. EPR/BV4967IW.

Meece 1 Landfill is operated by Biffa under Environmental Permit ref. EPR/BV4967IW along with a hazardous soils treatment facility (STF) which has been developed with the eastern part of the permitted area. The site is operated by Biffa Waste Services Limited (Biffa), which is hereafter referred to as the Operator.

The site is located at Swynnerton, Cold Meece, Stone, Staffordshire, ST15 0QN. Landfilling at the site commenced prior to 1996 with the site to date developed as twelve cells (Phase 0 to Phase 7 and 13A). Meece 1 was mothballed in 2008 following the completion of Phase 7. The eastern part of the site therefore remains as void space.

A Permit Variation Application is being submitted to allow Biffa to discharge trade effluent associated with the permitted operations to sewer. This H1 and the associated application has been prepared on the recommendation by the site's regulating Environment Agency officer during a recent site visit. Trade effluent from the site is to be discharged to sewer in accordance with the Trade Effluent Discharge Consent (TEDC) Ref. 009226V (issued on 30th March 2021) which Biffa have negotiated with Severn Trent to allow the discharge of trade effluent to the public sewer.

The discharged trade effluent will be discharged to sewer and treated at the Eccleshall and Sturbridge Wastewater Treatment Works (WwTW) following mixing along the length of the sewer line with other inputs from a variety of sources. The treated effluent will be discharged to the River Sow.

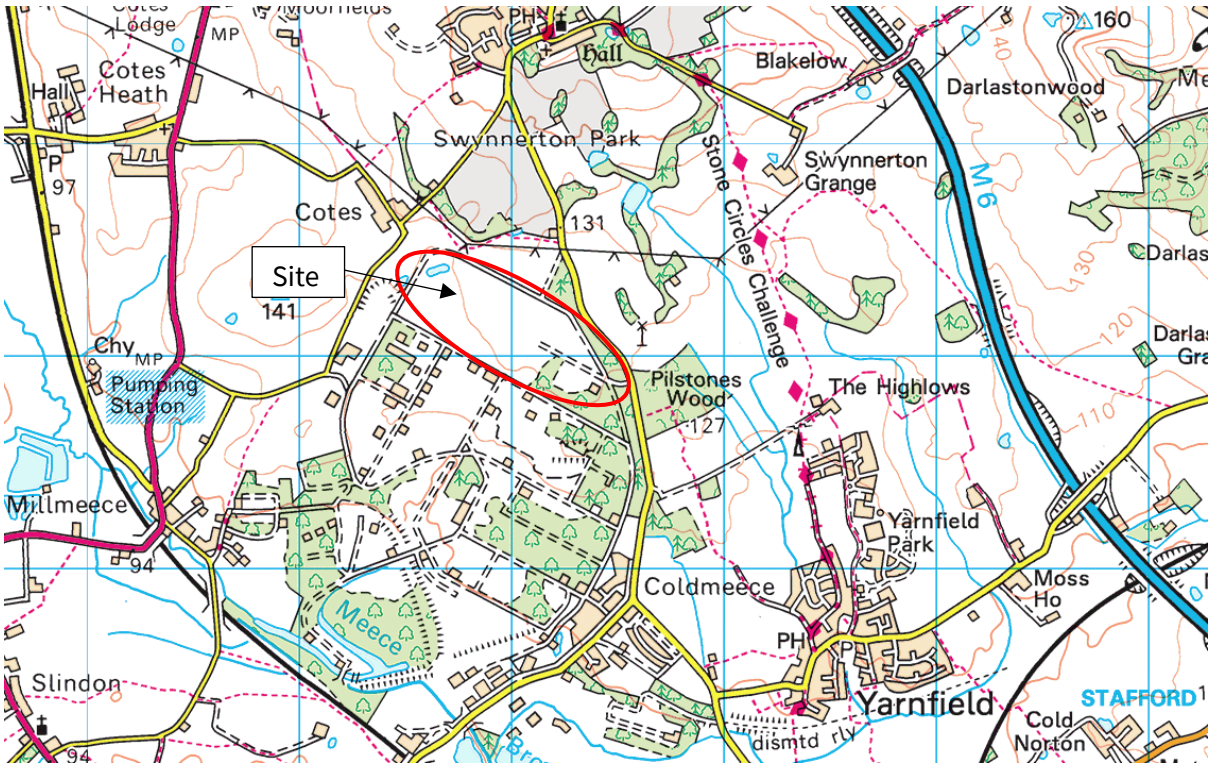
This report has been prepared to assess the potential environmental impact of the proposed changes to the Permit and final discharge on the receiving waters. A Surface Water Risk Assessment has been produced in accordance with the Environment Agency's online guidance on '*Surface water pollution risk assessment for your environmental permit*'[1]. This report briefly summarises the site context and subsequently outlines the source-pathway-receptor framework for assessment.

[1] https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit

1.2 Site Location and Development

Meece 1 Landfill is located at National Grid Reference (NGR) SJ 384960 334104 and is situated in a predominantly rural area comprising small villages, wooded areas and agricultural fields. The site is bound to the south by the Swynnerton Training area, a former Ministry of Defence site, and to the east by Swynnerton Road. To the north of the site are agricultural fields and ~300m to the west lies the village of Cotes. The site location and surrounding features are illustrated on Figure 1.

Figure 1 – Site Location and Surrounding Features



Meece Landfill was developed on part of the old Ministry of Defence site which housed the munition depot. Historically Meece Landfill was operated as a hazardous co-disposal site from 1986 until 2004 when it was split into two areas, Meece 1 and Meece 2. Meece 1 continued to receive the non-hazardous component of the waste streams. Meece 2 is authorised under a separate Permit (Reference EPR/BW0096IJ) for the receipt of hazardous wastes. It authorises the disposal of air pollution control residues from waste incinerator. However, to date landfilling in this part of the site has not commenced.

A hazardous soils treatment facility (STF) is operated on the eastern part of the landfill complex (*i.e.* across the undeveloped Phase 11 and 12 footprints) and this activity is authorised under Environmental Permit ref. EPR/BV4967IW, *i.e.* the Meece 1 non-hazardous landfill Permit. A separate Permit (Ref. EPR/EB360FM) has also been issued for an aggregate treatment recycling facility at the site which processes street cleaning residues.

2 Source Term

2.1 Trade Effluent Quality and Quantity

Severn Trent have set out within Appendix I of the TEDC, quality conditions for the proposed Trade Effluent discharge. The TEDC stipulates that the maximum volume of trade effluent to be discharged in any continuous period of 24 hours shall not exceed 100m^3 at a rate of 1.2L/s.

In accordance with Appendix I of the TEDC, the following limits are not to be exceeded:

- Chemical Oxygen Demand (COD) – 350mg/l
- Suspended Solids – 350mg/l
- Ammoniacal- N – 75mg/l
- Phosphorous – 25mg/l
- Sulphate – 1,000mg/l
- Chloride – 2,000mg/l
- Physically separable oil - None

The TEDC is a regulated discharge which limits the nature and strength of the trade effluent discharge to the limits prescribed within the discharge consent.

2.2 Disposal Route

Trade effluent will be discharged to the public sewer at foul manhole 5101 positioned at NGR SJ 85422 33830. The sewer flows in a south-easterly direction from the site, running adjacent to Meece Avenue as illustrated on Figure 2.

The trade effluent is then treated at Eccleshall and Sturbridge WwTW positioned some 4.7km to the south-west of the discharge point at NGR SJ8363 229424 (Figure 3). The treatment works is classified as a Crude Sewage Activated Sludge (CSAS) works serving a population of greater than 2000 people and is operated by Severn Trent Water. The treated discharge Eccleshall and Sturbridge WwTW is released into the River Sow in accordance with Environmental Permit Ref. MI/T/02/35657/R/007.

Figure 2 – Discharge Location (Extract from TEDC Ref. 009226V)

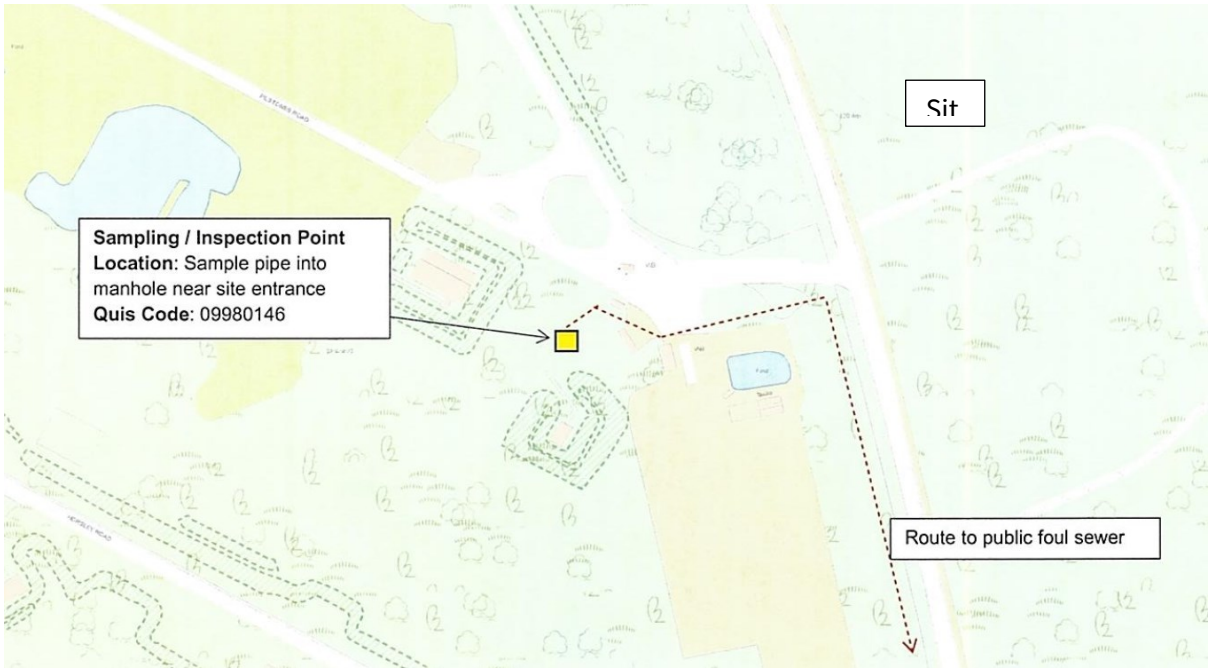
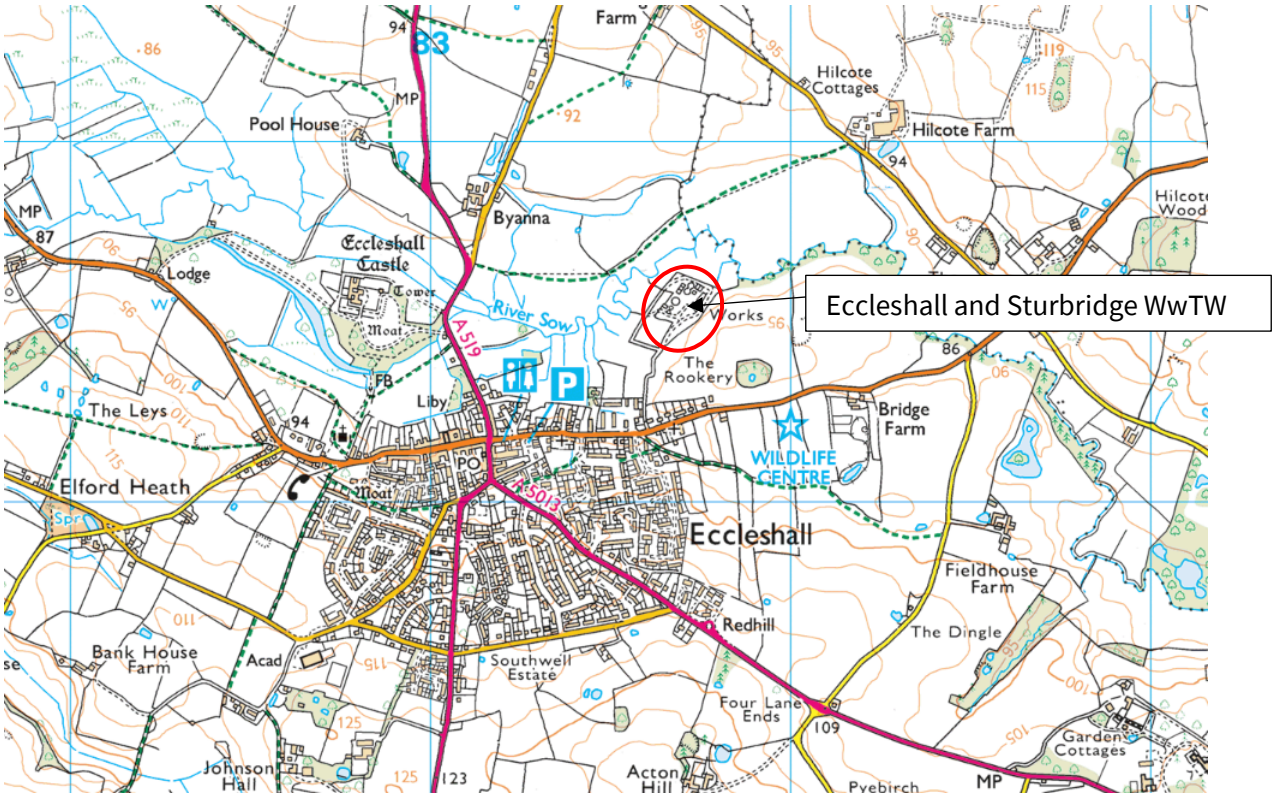


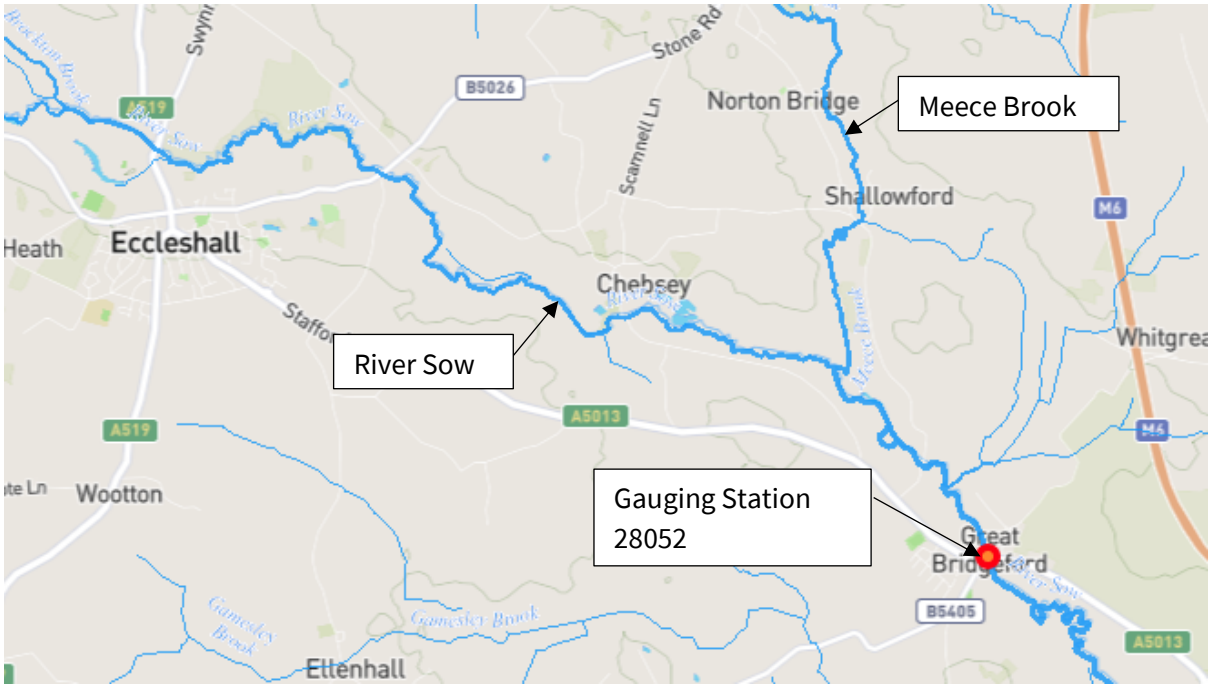
Figure 3 – Eccleshall and Sturbridge WwTW Location



3 Receiving Water

The River Sow flows in an eastwards direction some 4.6km south of the site and is a tributary of the River Trent. There is a National River Flow Archive (NRFA) gauging station for the River Sow downstream of the discharge point from the WwTW at NGR SJ 883269 (Figure 4). River flow data for this gauging station (ref. 28052) has been obtained from the Centre for Ecology and Hydrology (CEH) [2]. The mean flow rate for the River Sow is 1.2m^3/s for the period 1971-2021. Over this same period a low flow Q95 has been recorded as 0.34m^3/s.

Figure 4 – River Sow and Nearest Gauging Station 28052



Water quality information for the receiving watercourse has been obtained from the Environment Agency[3] both upstream and downstream of the discharge from the WwTW. The most recent data available for the receiving water is summarised in Table 1.

[2] https://nrfa.ceh.ac.uk/data/station/info/28052
[3] https://environment.data.gov.uk/water-quality/view/sampling-point/MD-70262820

Table 1 - River Sow Water Quality Summary

Substance	Unit	Upstream of Discharge Perhsall (2019 - 2021)			Downstream of Discharge Chebsby (2012 - 2013)		
		Min	Ave	Max	Min	Ave	Max
Temperature	°C	3.8	11.0	18.2	3.2	10.6	17.8
Oxygen, Dissolved	mg/l	7.1	9.7	14.0	5.2	8.5	11.3
pH		7.5	7.9	8.4	7.6	7.8	8.1
Electrical Conductivity	µS/cm	314	544	718			
Ammoniacal-N	mg/l	0.03	0.07	0.12	0.04	0.09	0.45
Nitrate	mg/l	1.7	4.1	6.0			
Nitrite	mg/l	0.01	0.04	0.07	0.02	0.04	0.15
Orthophosphate, reactive as P	mg/l	0.05	0.10	0.15			
Alkalinity	mg/l	97	169	190			
Copper, Dissolved	µg/l				1.4	2.0	2.8
Zinc	µg/l				5.7	10.8	22.1

4 Risk Screening

The procedures as set out in the web-based Environment Agency guidance "Surface water pollution risk assessment for your environmental permit" [4], along with reference to Environment Agency guidance 'Risk assessments for your environmental permit'[5] has been used to assess the potential impact of the discharge under the TEDC conditions on the River Sow.

Trade effluent will be disposed of to the public sewer in accordance with the agreed TEDC for the site. Therefore, the prescribed limits set out in Section 2.1 above are representative of the "worst-case" effluent quality which could be disposed of to the WwTW. For completeness, consideration has also been given the potential impact from priority metals.

The receiving works is an aerobic biological treatment plant, and therefore it is expected that there will be as a minimum the removal of any anaerobic products, (*e.g.* ammonium), along with the reduction in the organic and nutrient content of the trade effluent.

[4] Environment Agency (2016) Guidance: Surface water pollution risk assessment for your environmental permit. https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit. Last updated February 2022.

[5] Environment Agency (2016) Guidance: Risk assessments for your environmental permit https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit. Last updated August 2022.

4.1 Screening Assessment - Methodology

The risk assessment process is a mechanism which applies a series of steps to screening and determining the significance of a potential emission taking into account the loading of individual substances onto a receiving water course, background water quality, flow and mixing within the receiving watercourse. The objective of the risk assessment is to identify where an emission of a substance would have an unacceptable impact (measured against EQS).

The risk assessment consists of up to 4 tests or steps that assess whether or not the effluent is a risk to the environment. Each step is designed to screen out substances which are not considered to pose an environmental risk and these substances are not then carried forward to the next step. The various steps are detailed below.

Test 1

The initial screening step (Test 1) involves assessing if the concentration of the potential "targeted" pollutant in the discharge is more than 10% of the environmental quality standard (EQS).

If it is less than 10% you do not need to collect the data for the next 3 tests - you do not need to do anything more as your pollutant is not a risk to the environment. If it is more than 10% of the EQS then, carry out Test 2.

Test 2

The second step (test 2) introduces the dilution available in the receiving water. It involves checking if the process contribution (diluted concentration) of the pollutant is more than 4% of the EQS. The process contribution is calculated using Equation 1 below:

$$PC = \frac{EFR\ x\ (RC\ x\ STRF)}{EFR+RFR} \qquad \text{(Equation 1)}$$

Where PC = Process Contribution
EFR = Effluent Flow Rate
RC = Release Concentration
RFR = River Flow Rate
STRF = Sewage Treatment Reduction Factor

The process contribution calculation provides a methodology for estimating the concentration in the receiving surface water course independent of other contributions, whether agricultural, industrial or municipal.

The environmental significance of the release can therefore be established by a direct comparison with relevant Environmental Quality Standards (EQS). Environment Agency guidance states that a process contribution of <4% of a substances EQS level will have a negligible contribution to the environmental quality of a receiving watercourse.

If the value for PC is 4% or less of the EQS, no further steps are required. If the PC is more than 4% of the EQS, carry out Test 3 and Test 4.

Test 3

The third step is to check whether the discharge increases the concentration of the pollutant in the river downstream of the discharge by more than 10% of the chemicals EQS value. This is calculated by adding the PC (process contribution) to the BC (background concentration) in order to calculate the PEC (predicted environmental concentration).

If the difference between BC and PEC is less than 10% of the EQS, you can proceed to carry out test 4.

Test 4

The final step is to check whether the PEC (predicted environmental concentration) is higher than the EQS.

4.2 Calculation of Predicted No-Effect Concentration for Bioavailable Metals

The EQS values for copper, nickel, zinc, manganese and lead relate to the bioavailable concentration. The UK Technical Advisory Group (UKTAG) for WFD[6] note that the EQS values for many metals were developed based on the biotoxicity of those metals, which was at the time thought to be controlled primarily through the hardness of the water. It is now known that a number of other water quality parameters control the biotoxicity and bioavailability of metals within the water, namely pH and dissolved organic carbon (DOC). The UKTAG have therefore developed a tool (MBAT – Metal Bioavailability Assessment Tool) for calculating a site specific EQS value for some of these substances including copper, nickel, zinc, manganese based on the pH, DOC and calcium concentrations of the waterbody. The M-BAT reports this as a Predicted No-Effect Concentration (PNEC), which is the Biotic Ligand Modelled concentration derived from ecotoxicological data and site-specific data.

PNEC values have been derived using the M-BAT tool for copper, nickel, zinc, manganese and lead within the River Sow and these are presented in Table 2 below. The PNEC values have been calculated using the following data source:

- pH value of 7.9 based on upstream average taken from Table 1 above.
- Calcium concentration of 114mg/l which is the average value taken over the period 2018 to 2020 for various sampling points in the River Sow including River Sow at Milford, River Sow at St Thomas Bridge and River Sow at Broad Eye Bridge (no data after 2020 is available)
- DOC concentration of 6mg/l which is the average value taken over the period 2018 to 2022 for various sampling points in the River Sow including River Sow at Milford, River Sow at Milford Gauging Station and River Sow at Broad Eye Bridge

[6] WFD-UKTAG 2014, UKTAG River and Lake Assessment Method Specific Pollutants (Metals): Metal Bioavailability Assessment Tool (M-BAT)

Table 2 - m-BAT PNEC Values

Determinand	River Sow
Copper	21.46 µg/l
Nickel	13.04 µg/l
Zinc	32.19 µg/l
Manganese	266.45 µg/l
Lad	7.20 µg/l

The calculated PNEC values have been utilised within the screening assessment.

4.3 Screening Assessment – Evaluation of Results

The screening assessment has been based on the following conditions:

- A discharge rate of 0.0012m^3/s (100m^3 per day) which is the maximum discharge volume to be released
- A Q95 receiving water flow rate of 0.34m^3/s
- A dilution factor of 295

A screening assessment has been carried out to determine the maximum concentrations which could be discharged to the sewer in order to Pass Test 3 under low flow conditions and assuming a maximum discharge of 100m^3 per day.

A summary of the results is provided in Table 3.

Table 3 - Surface Water Risk Assessment Screening Test Results – River Sow, Maximum Discharge & Q95 Low Flow

Substance	Discharge Conc (Site)	Discharge Rate	River Flow Rate	WwTW Reduction Factor	Discharge Conc (to River)	Background Conc (River)	Process Contribution	Conc After Mixing	EQS	Test 1 (% of EQS)	Test 2	Test 3	Test 4
	RC-Source	EFR	RFR	STRF	RC-Process	BC	PC	PEC		Test Threshold 10%	Test Threshold 4%	Test Threshold 10%	+ / -
Major Components	mg/l	m^3/s	m^3/s		mg/l	mg/l	mg/l	mg/l	mg/l				
Ammoniacal-N	221	0.0012	0.34	0.08	18	0.07	0.06	0.13	0.60	2947%	10%	Pass	Pass
COD	2,464	0.0012	0.34	0.60	1,478	5.0	5	10	50	2957%	10%	Pass	Pass
Chloride	7,394	0.0012	0.34	1.00	7,394	25.0	25	50	250	2958%	10%	Pass	Pass
Sulphate	11,830	0.0012	0.34	1.00	11,830	40.0	40	80	400	2958%	10%	Pass	Pass
Phosphorus	4.5	0.0012	0.34	0.80	3.6	0.10	0.01	0.11	0.12	3000%	10%	Pass	Pass
Minor Components	µg/l	m^3/s	m^3/s		µg/l	µg/l	µg/l	µg/l	µg/l				
Cadmium	7.1	0.0012	0.34	0.37	2.6	0.01	0.01	0.02	0.09	2919%	10%	Pass	Pass
Lead	1,252	0.0012	0.34	0.17	213	0.7	0.7	1.4	7.2	2956%	10%	Pass	Pass
Chromium	868	0.0012	0.34	0.16	139	0.5	0.5	0.9	4.7	2955%	10%	Pass	Pass
Copper	3,020	0.0012	0.34	0.21	634	1.7	2.2	3.9	21.5	2955%	10%	Pass	Pass
Nickel	507	0.0012	0.34	0.76	385	1.3	1.3	2.6	13.0	2955%	10%	Pass	Pass
Zinc	2,904	0.0012	0.34	0.33	958	9.7	3.3	12.9	32.2	2977%	10%	Pass	Pass
Manganese	7,880	0.0012	0.34	1.00	7,880	26.6	27	53	266	2957%	10%	Pass	Pass
Iron	61,610	0.0012	0.34	0.48	29,573	100	101	200	1000	2957%	10%	Pass	Pass

Green highlighted = based on activated sludge treatment, Blue highlighted = 10% of EQS, Pink highlighted = background data, Red values = failed screening test

Table 4 - Surface Water Risk Assessment Screening Test Results – River Sow, Maximum Discharge (Phosphorus)

Substance	Discharge Conc (Site)	Discharge Rate	River Flow Rate	WwTW Reduction Factor	Discharge Conc (to River)	Background Conc (River)	Process Contribution	Conc After Mixing	EQS	Test 1 (% of EQS)	Test 2	Test 3	Test 4
	RC-Source	EFR	RFR	STRF	RC-Process	BC	PC	PEC		Test Threshold 10%	Test Threshold 4%	Test Threshold 10%	+ / -
Major Components	mg/l	m^3/s	m^3/s		mg/l	mg/l	mg/l	mg/l	mg/l				
Q95 Low Flow													
Phosphorus (TEDC)	25.0	0.0012	0.34	0.80	20	0.10	0.07	0.17	0.12	16667%	57%	56%	-0.05
Phosphorus (Test 3 Pass)	4.5	0.0012	0.34	0.80	3.6	0.10	0.01	0.11	0.12	3000%	10%	Pass	Pass
Mean Flow													
Phosphorus (TEDC)	25.0	0.0012	1.20	0.80	20	0.10	0.02	0.12	0.12	16667%	16%	16%	Pass
Phosphorus (Test 3 Pass)	15.6	0.0012	1.20	0.80	12	0.10	0.01	0.11	0.12	10400%	10%	Pass	Pass

Green highlighted = based on activated sludge treatment, Blue highlighted = 10% of EQS, Red values = failed screening test

The screening assessment demonstrates that the proposed discharge limits are significantly below the concentration values required to pass Test 3 for ammoniacal-N, COD, chloride and sulphate (Table 5).

With regards to metals, a comparison of the site's landfill leachate priority and priority hazardous metals with that required to pass Test 3 demonstrates that these substances are unlikely to pose a risk to the environment (Table 5). It is considered that any other site derived effluent components will contain lower concentrations of these substances. The Meece 1 landfill leachate can however been utilised as a worst-case comparison and this demonstrates that significant levels of priority metals are unlikely to be present within the discharge.

Table 5 - Comparison of Proposed Effluent Quality and Screening Results

Substance	Proposed Discharge Conc (TEDC)	Discharge Conc Required to Pass Test 3	Meece 1 Landfill Leachate (20 18 – 2022 Average)
Major Components	**mg/l**	**mg/l**	
Ammoniacal-N	75	221	915
COD	350	2,464	1,579
Chloride	2,000	7,394	4,162
Sulphate	1,000	11,830	170
Phosphorus	25	1.6	6.6
Minor Components	**µg/l**	**µg/l**	**µg/l**
Cadmium	-	7.1	0.9
Lead	-	1,252	10
Chromium	-	868	84
Copper	-	3,020	140
Nickel	-	507	82
Zinc	-	2,904	135
Manganese	-	7,880	951
Iron	-	61,610	10,290

Phosphorus is the only substance which does not pass the screening tests at the TEDC maximum concentration of 25mg/l under low flow conditions, assuming the maximum discharge of 100m^3/day. Background concentrations within the River Sow for phosphorus are at 0.1mg/l and therefore the water body is considered to be of "Good" water quality with respect to the EQS. The EQS for phosphorus is however based on an annual average concentration and therefore the assessment is likely to be overly conservative for the discharge when utilising the Q95 low flow and maximum discharge conditions.

Consideration has been given to mean flow conditions in Table 4 assuming the maximum discharge of 100m^3/day at 25mg/l Phosphorus. Under mean flow conditions, the EQS for a "Good" water quality of 0.12mg/l is not exceeded. The actual process contribution from the proposed discharge is expected to be insignificant at 0.01 – 0.02mg/l when compared to the EQS with the Predicted Environmental Concentration (PEC) consistently below the 0.25mg/l EQS for a "Moderate" water quality. The status of the watercourse will therefore remain unchanged following the proposed discharge.

Phosphorus itself is non-toxic and therefore does not directly cause harm to the watercourse. Given that the 25mg/l discharge limit in the TEDC consent is an upper concentration, and significantly in excess of any individual site contributions, then it will not be possible for the EQS to be exceeded from this discharge. Further confidence should also be given to there being little significance to the discharge because there is little significance to phosphorus contents in moving water systems where the phosphorus content cannot contribute to algal growths and induce secondary artefacts.

Hence, the assessment has demonstrated that the proposed discharged is not considered to be a risk to the environment.

5 Conclusion

Biffa have negotiated a TEDC (Ref.) Ref. 009226V) with Severn Trent to allow the discharge of trade effluent to the public sewer. A Permit Variation Application is however required to allow Biffa to discharge trade effluent associated with the permitted operations to sewer under this agreement. The TEDC sets out conditions for discharge including flow and quality limits.

The environmental risks associated with a discharge of trade effluent from the site have been considered in accordance with the Environment Agency's online guidance on "Surface water pollution risk assessment for your environmental permit". This assessment demonstrates that where trade effluent is discharged to sewer in accordance with the TEDC, there is no risk to surface water. Furthermore, the assessment demonstrates that in order to fail the initial screening tests the discharge would need to contain concentrations considerably in excess of those within the Meece 1 landfill leachate for the majority of substances.

The risk assessment does not consider mixing with other inputs along the length of the sewer line prior to being treated at the WwTW and is therefore likely to be conservative.

There is considered to be a low environmental risk associated within the proposed activity and amendments to the Permit given that the final treated discharge to the River Sow is also regulated by an Environmental Permit for the Eccleshall and Sturbridge WwTW itself. Furthermore, were the sewer connection not present, the same discharge would be tankered directly to the same WwTW and therefore there are no environmental implications of the proposed changes to the Permit from the discharge.

Appendix A – Surface Water Risk Assessment Calculations

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