Letter of support Wastewater strategy

North Sprowston & Old Catton Development, Norfolk

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Date: 13/07/2023

ST Connect

SEVERN TRENT

Letter of support: Wastewater strategy

ONSITE WASTEWATER STRATEGY FOR NORTH SPROWSTON & OLD CATTON DEVELOPMENT, NORFOLK.

ST Connect have been appointed by Stretton Beeston Limited to work alongside their technical advisors to develop a feasible foul water drainage and treatment strategy, at their proposed development known as North Sprowston & Old Catton Development near Beeston, Norfolk.

ST Connect

ST Connect are an Ofwat-regulated water company appointed by the Secretary of State to provide wastewater and surface water management services in England and Wales. We have a strong track record for designing, building, owning and operating wastewater treatment assets (including foul and surface sewerage infrastructure) and are part of the wider Severn Trent Group, which in its portfolio has one of the UK's largest water and sewerage companies.

We are familiar with the environmental challenges to developments resulting from both a chronic lack of available sewerage capacity, and nutrient pollution; as a result, we are helping our clients to develop effective wastewater management strategies. The company is well placed to do this, given our experience and effective relationships with the statutory environmental regulators.

Proposed wastewater treatment and disposal strategy summary

Foul sewage from all properties will be collected and conveyed through a separate foul-only sewerage system to the onsite water recycling centre (WRC). Following treatment to the required standards, final effluent will be discharged into a drainage system out falling into a purpose-built nutrient treatment wetland for further solids removal before being released to the Dobbs' Beck, a tributary of River Bure.

In our role as environmental stewards having both assessed all relevant site constraints and considering the scale of the development, we are confident that a WRC can be delivered and adopted on this site.

Our treatment strategy will comprise of an ST Connect designed and built onsite WRC; which shall be adopted, maintained, and operated in the long-term by ST Connect in our capacity as the local statutory wastewater undertaker.

The WRC requires a minimum level of flows and organic loads for the biological treatment processes to become self-sustaining and fully effective, we've determined this to be the equivalent of the effluent generated from around 200 dwellings. To provide onsite

wastewater treatment services prior to this threshold being met, we propose to construct a smaller, temporary facility to provide treatment from around 20 to 200 dwellings, after which, the main WRC would be commissioned, and the smaller facility decommissioned.

ST Connect would operate the WRC in compliance with the requirements of a site-specific Environmental Permit as determined by the Environment Agency (EA). Nitrogen and Phosphorous removal limits will be in accordance with the Nutrient Neutrality requirements of 10mg/l Total Nitrogen and 0.15mg/l Total Phosphorous. NOTE that the environmental permit requirements for the temporary treatment works may be different to the permanent WRC – this will be confirmed by the EA and Natural England.

Asset and treatment process resilience

Detailed designs of the WRC have not yet commenced, however ST Connect, will propose to construct a state-of-the-art facility, based on an advanced form of activated sludge treatment, see Design Statement below.

The system is particularly resilient to catchment contamination events or natural variation of inbound wastewater concentration, due to the significant dilution factors provided by the large balancing tank at the head of the works. The treatment processes will be configured to allow for bolt-on technologies to meet more stringent permits; should they become required in the future.

We will design in capacity and asset redundancy which shall all but remove the risk of permit compliance failure. In a worst-case scenario of significant system failure, raw and/or part-treated sewage shall be isolated and tankered to a suitable off-site facility for safe treatment and disposal.

CSOs and river pollution events

Combined Sewer Overflows (CSOs) are assets designed to divert blended foul and surface water sewage to nearby watercourses during intense rainfall to protect properties, sewerage networks, and sewage treatment works from hydraulic overloading. CSOs will not be installed at this development as surface waters will be collected and managed in their own drainage and attenuation systems – separate from the foul water drainage networks. As a result of this, there is no risk of untreated sewage entering the water environment during storm events.

Sludge management

Organic sludges generated during the treatment process which cannot be treated onsite will be periodically removed by tanker for further processing at a nearby sludge treatment centre to generate sustainable energy from biogas. The remaining by-product, sludge cake is sold as an organic fertiliser. It should be noted that were farmers within the Broads catchment to use this source of fertiliser, it would act as a direct replacement of other sources of fertilisers (such as inorganic chemical fertilisers).

Long-term asset performance

The onsite treatment system will be designed and built to our adoptable standards, and therefore be owned and operated by ST Connect in its capacity as the local wastewater undertaker; subject to a licence variation being granted by Ofwat. The assets will therefore be considered "public" assets by the EA, which the company shall have a duty to maintain and operate effectively in perpetuity in line with its licence obligations.

The treatment system shall have in place both planned and reactive operations and maintenance arrangements to ensure the good upkeep of assets and effective wastewater treatment. In addition, the facility will benefit from remote telemetry and sensors to monitor site condition and treatment processes effectiveness.

Environment Agency wastewater discharge permit

An environmental permit from the EA will be required in order to operate the onsite WRC. ST Connect will apply to the EA for the required permit having undertaken the necessary studies (including a water quality and quantity study). It is important to note that as a statutory wastewater undertaker, ST Connect is able to obtain discharge permits within sewered areas (within the geographic areas of appointment of other wastewater undertakers, such as Anglian Water) – the EA don't distinguish between licence applications / variations made by ST Connect and those made by incumbent water companies.

Conclusion

ST Connect in its capacity as a competent sewerage undertaker, experienced in the construction and long-term operations of sewage treatment assets is satisfied that a public onsite wastewater treatment system can be designed, built, adopted, operated, and maintained within the North Sprowston & Old Catton Development.

We look forward to continuing to develop the wastewater treatment strategy for this development site and are happy to be able to contribute to Broadland District Council's housing delivery plans in a sustainable way.

Yours sincerely

William Mackveley
General Manager
Severn Trent Connect

Design statement

Onsite wastewater treatment works

Wastewater treatment works overview

This design statement provides an overview of the required water recycling centre (WRC) at the proposed development known as North Sprowston & Old Catton Development near Beeston, Norfolk – which is to be designed in accordance with the site-specific Nutrient Neutrality requirements, where treated final effluent shall contain not more than 10mg/l Total Nitrogen and 0.15mg/l Total Phosphorous. NOTE that this statement doesn't specifically apply to the proposed temporary treatment facility required to provide onsite treatment ahead of the minimum flows and organic loads being generated by the development for commissioning of the permanent WRC.

Indicative wastewater treatment processes

Inlet flows

Wastewater arriving at the WRC passes through the inlet works, where a series of screens remove wipes, grit, and other matter not suitable for onward treatment.

Balance tank / fermenter

The screened wastewater is transferred to the covered balance tank / fermenter (BTF). The BTF serves two distinct purposes in the treatment cycle. Firstly, it is used to balance the incoming flows prior to being passed forward for processing in the Reactors. Its second function is to act as an anaerobic fermenter; crucial to enable the Phosphorus Accumulating Organisms present in the Reactors to super absorb Phosphorus.

Reactors

The Reactors use simultaneous fill and decant, whereby the treated water is discharged using a piston effect created by the introduction of the fermented, raw, screened sewage. This influent is introduced at the bottom of the tank where it is gently mixed with the settled biomass using the hyperboloid mixer. The sludge blanket remains undisturbed, whilst the clean effluent in the top of the tank is discharged.

Once the fill/decant stage is complete, and the influent has had appropriate contact time with the biomass, the aerobic and anoxic treatment stages are carried out. The duration and timing of these phases are varied dependent on specific site conditions and permit requirements.

Sludge thickening

The sludge generated by the process can be thickened using sludge thickening equipment. Thickened sludge is held in the aerated sludge storage tank, whilst supernatant is returned to the head of works.

Aerated sludge storage

Thickened sludge is stored within this tank and periodically aerated using a coarse bubble aeration grid to prevent the sludge thickening too much at the bottom of the tank and to prevent the sludge becoming septic and causing odour issues.

Final effluent discharge

The final effluent discharged from the reactors, flows through a sample chamber prior to discharging into a purpose built nutrient treatment wetland for further solids removal before being released to the Dobbs' Beck, a tributary of River Bure.

STC3000

A detailed design of the proposed WRC has not yet commenced, however, the design will be based on ST Connect's standard designs for facilities of this scale; the closest of which is the "STC3000", which utilises the above-described treatment processes.

The rendered images below are of an STC3000 which has been proposed to serve a residential development of ca. 1,200 homes near Tonbridge, Kent.

Figure 1 STC3000 Tonbridge – overhead view

Figure 2 STC3000 Tonbridge – entrance view

Performance certificates: Nutrient removal

A twelve-month trial of maximum nutrient removal (without additional tertiary treatment). at the Petersfield demonstrator WRC was undertaken between February 2021 and February 2022. The demonstrator plant takes raw, screened sewage from Southern Water's main Petersfield WRC, for treatment at the demonstrator facility, before treated effluent is discharged back into Southern Water's main works. The table below shows the average results throughout the study (example performance certificates can be found in Appendix 01).

Table 1 Final effluent sampling averages – Without Tertiary Treatment

Determinand	Average	Units
BOD	2.45	mg/l
TSS	5.77	mg/l
Ammoniacal Nitrogen as N	0.157	mg/l
Phosphorous, Total	251.4	µg/l
Phosphate, Orthophosphate as P	0.04	mg/l
Nitrogen, Total	3.96	mg/l

The expected Phosphorus permit limits to meet nutrient neutrality at the Beeston development require greater removal than the levels shown above.

To further improve Total Phosphorus removal, ST Connect have carried supplemental trials of the Petersfield demonstrator WwTW with additional tertiary treatment. During the trial to-date, the site has successfully met a rolling-average compliance of <100 µg/l, in line with the requirements of an environmental discharge permit (example performance certificates can be found in Appendix 02).

Table 2 Final effluent sampling averages – With Tertiary Treatment

Determinand	Average	Units
BOD	1.18	mg/l
TSS	2.13	mg/l
Ammoniacal Nitrogen as N	0.10	mg/l
Phosphorous, Total	67.30	µg/l
Phosphate, Orthophosphate as P	0.06	mg/l
Nitrogen, Total	3.67	mg/l

Appendix 01: Example certificates, Trial without tertiary treatment

Validated

CERTIFICATE OF ANALYSIS

SDG:	210316-39	**Client Reference:**	EBNet-NUTREM Sample An	**Report Number:**	591650
Location:	NUTREM Demo Site	**Order Number:**	1291	**Superseded Report:**	

Results Legend		Customer Sample Ref.	SAMPLE 01	SAMPLE 02	SAMPLE 03	SAMPLE 03F		
A	ISO17025 accredited.							
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.	Depth (m)						
tot.unfilt	Total / unfiltered sample.	Sample Type	Treated Sewage (TS)	Untreated Sewage (US)	Treated Sewage (TS)	Treated Sewage (TS)		
*	Subcontracted - refer to subcontractor report for accreditation status.	Date Sampled	12/03/2021	15/03/2021	15/03/2021	15/03/2021		
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery.	Sample Time	16:30:00	09:00:00	09:15:00	09:15:00		
		Date Received	16/03/2021	16/03/2021	16/03/2021	16/03/2021		
		SDG Ref	210316-39	210316-39	210316-39	210316-39		
		Lab Sample No.(s)	23905514	23905515	23905516	23905517		
		AGS Reference						
Component	**LOD/Units**	**Method**						
Suspended solids, Total	<2 mg/l	TM022	5.1 #	344 #	5.65 #	2.7 #		
BOD, unfiltered	<1 mg/l	TM045	<1 @ #	227 #	3.22 #	2.3 #		
Ammoniacal Nitrogen as N (low level)	<0.01 mg/l	TM099	0.05 2	61 2	0.031 2	0.03 2		
Phosphorus (tot.unfilt)	<20 µg/l	TM152	231 2 #	9750 2 #	272 2 #	111 2 #		
Phosphate (Ortho as P)	<0.02 mg/l	TM184	0.0656 #	5.03 #	<0.02 #	<0.02 #		
Nitrogen, Total	<1 mg/l	TM212	1.62 #		1.9 #	1.9 #		

Validated

CERTIFICATE OF ANALYSIS

SDG:	210715-42	**Client Reference:**	NBIC Project	**Report Number:**	606704
Location:	NUTREM DEMO Plant	**Order Number:**	PO-0097	**Superseded Report:**	

Results Legend		Customer Sample Ref.	SAMPLE 01	SAMPLE 02	SAMPLE 03	SAMPLE 04	SAMPLE 05	
A	ISO17025 accredited.							
M	mCERTS accredited.							
aq	Aqueous / settled sample.							
diss.filt	Dissolved / filtered sample.	Depth (m)						
tot.unfilt	Total / unfiltered sample.	Sample Type	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	
*	Subcontracted - refer to subcontraction report for accreditation status.	Date Sampled	06/07/2021	06/07/2021	09/07/2021	09/07/2021	14/07/2021	
**	% recovery of the surrogate standard to check the efficacy of the method. The results of individual compounds within samples aren't corrected for the recovery.	Sample Time	13:30:00	09:30:00	10:15:00	13:30:00	13:30:00	
		Date Received	15/07/2021	15/07/2021	15/07/2021	15/07/2021	15/07/2021	
		SDG Ref	210715-42	210715-42	210715-42	210715-42	210715-42	
		Lab Sample No.(s)	24032963	24032964	24032968	24032969	24032970	
		AGS Reference						
Component	**LOD/Units**	**Method**						
Suspended solids, Total	<2 mg/l	TM022	8.7 #	7.95 #	<2 #	3.2 #	5.3 #	
BOD, unfiltered	<1 mg/l	TM045	<1 @ #	<1 @ #	<1 @ #	<1 @ #	<1 #	
Phosphorus (tot.unfilt)	<20 µg/l	TM152	184 2 #	198 2 #	97.1 2 #	157 2 #	187 2 #	
Nitrogen, Total	<1 mg/l	TM212	3.44 #	5.37 #	4.4 #	2.47 #	3.11 #	

Validated

CERTIFICATE OF ANALYSIS

SDG: 220115-70 **Report Number:** 630420 **Superseded Report:**

Client Ref.: Not Specified **Location:** NUTREM DEMO Plant

Results Legend			Customer Sample Ref.	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4	SAMPLE 5	SAMPLE 6
A	ISO17025 accredited.		Depth (m)	-	-	-	-	-	-
M	mCERTS accredited.		Sample Type	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)
aq	Aqueous / settled sample.		Date Sampled	05/01/2022	05/01/2022	10/01/2022	11/01/2022	12/01/2022	14/01/2022
diss.fil	Dissolved / filtered sample.		Sample Time	12:15:00	12:20:00	19:45:00	13:30:00	09:30:00	09:30:00
tot.unfil	Total / unfiltered sample.		Date Received	15/01/2022	15/01/2022	15/01/2022	15/01/2022	15/01/2022	15/01/2022
*	Subcontracted - refer to subcontractor report for accreditation status.		SDG Ref	220115-70	220115-70	220115-70	220115-70	220115-70	220115-70
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples are not corrected for the recovery.		Lab Sample No.(s)	25851754	25851756	25851757	25851758	25851760	25851761
F	Trigger breach confirmed		AGS Reference						
1-Seg@	Sample deviation (see appendix)								
Component	**LOD/Units**	**Method**							
Suspended solids, Total	<2 mg/l	TM022		4.55 #	<2 #	12.3 #	4.05 #	5.15 #	3.2 #
BOD, unfiltered	<1 mg/l	TM045		<1 @ #		4.14 @ #	2.36 @ #	3.3 #	2.44 #
Ammoniacal Nitrogen as N (low level)	<0.01 mg/l	TM099		0.089 2		0.036 2	0.036 2	1.18 2	0.032 2
Phosphorus (tot.unfilt)	<20 µg/l	TM152		199 2 #	365 2 #	434 2 #	219 2 #	245 2 #	137 2 #
Phosphate (Ortho as P)	<0.02 mg/l	TM184		<0.02 #	0.206 #	<0.02 #	<0.02 #	<0.02 #	<0.02 #
Nitrogen, Total	<1 mg/l	TM212		6.21 #			3.97 #	7.75 #	5.31 #

Appendix 02: Example certificates, Trial with tertiary treatment

Validated

CERTIFICATE OF ANALYSIS

SDG: 230325-25 **Report Number:** 684570 **Superseded Report:** 684489

Client Ref.: Various **Location:** Various

Results Legend									
# ISO17025 accredited.									
M mCERTS accredited.									
aq Aqueous / settled sample.									
diss.filt Dissolved / filtered sample.									
tot.unfilt Total / unfiltered sample.									
* Subcontracted - refer to subcontractor report for accreditation status.									
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery									
(F) Trigger breach confirmed									
1-4+§@ Sample deviation (see appendix)									
	Customer Sample Ref.		SAMPLE06-CRUDE SEWAGE	SAMPLE02-PFIELD POST-FILTER	SAMPLE08-PFIELD POST-FILTER	SAMPLE10-PFIELD POST-FILTER	SAMPLE12-PFIELD POST-FILTER	SAMPLE13-PFIELD POST-FILTER	
	Depth (m)		.	.	.	.	.	.	
	Sample Type		Untreated Sewage (US)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	
	Date Sampled		22/03/2023	22/03/2023	22/03/2023	22/03/2023	22/03/2023	22/03/2023	
	Sample Time		10:35:00	09:37:00	11:13:00	13:09:00	15:50:00	17:03:00	
	Date Received		25/03/2023	25/03/2023	25/03/2023	25/03/2023	25/03/2023	25/03/2023	
	SDG Ref		230325-25	230325-25	230325-25	230325-25	230325-25	230325-25	
	Lab Sample No.(s)		27740002	27739998	27740004	27740006	27740008	27740009	
	AGS Reference								
Component	**LOD/Units**	**Method**							
Suspended solids, Total	<2 mg/l	TM022	167 #	<2 #	<2 #	<2 #	<2 #	<2 #	
BOD, unfiltered	<1 mg/l	TM045	170 @ #						
Ammoniacal Nitrogen as N (low level)	<0.01 mg/l	TM099	27.8 2						
Phosphorus (tot.unfilt)	<20 µg/l	TM152	5150 2 #	49.9 2 #	45.6 2 #	49.7 2 #	45.1 2 #	43.9 2 #	
Phosphate (Ortho as P)	<0.02 mg/l	TM184	2.79 #	<0.02 #	<0.02 #	<0.02 #	<0.02 #	<0.02 #	

Validated

CERTIFICATE OF ANALYSIS

SDG: 230411-43 **Report Number:** 686260 **Superseded Report:**

Client Ref.: Petersfield 0.1 Trial **Location:** Petersfield

Results Legend			Customer Sample Ref	Sample 04 - Post Filter	Sample 08 - Post Filter	Sample 10 - Post Filter	Sample 12 - Post Filter	Sample 01 - Pre Filter	Sample 02 - Pre Filter
#	ISO17025 accredited.		Depth (m)	.	.	.	.	.	.
M	mCERTS accredited.		Sample Type	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)
aq	Aqueous / settled sample.		Date Sampled	05/04/2023	05/04/2023	06/04/2023	06/04/2023	31/03/2023	31/03/2023
diss.filt	Dissolved / filtered sample.		Sample Time	10:35:00	12:15:00	09:25:00	10:15:00	12:25:00	12:30:00
tot.unfilt	Total / unfiltered sample.		Date Received	11/04/2023	11/04/2023	11/04/2023	11/04/2023	11/04/2023	11/04/2023
*	Subcontracted - refer to subcontractor report for accreditation status.		SDG Ref	230411-43	230411-43	230411-43	230411-43	230411-43	230411-43
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery		Lab Sample No.(s)	27820051	27820054	27820057	27820058	27820045	27820047
(F)	Trigger breach confirmed		AGS Reference						
1-4+§@	Sample deviation (see appendix)								
Component		**LOD/Units**	**Method**						
Suspended solids, Total		<2 mg/l	TM022	<2 #	<2 #	<2 #	<2 #	4 @ #	3.3 @ #
Phosphorus (tot.unfilt)		<20 µg/l	TM152	59.5 2 #	49.1 2 #	51 2 #	52.5 2 #	158 2 #	132 2 #
Phosphate (Ortho as P)		<0.02 mg/l	TM184	<0.02 #	<0.02 #	<0.02 #	<0.02 #	<0.02 #	<0.02 #

Validated

CERTIFICATE OF ANALYSIS

SDG: 230318-34 **Report Number:** 683883 **Superseded Report** 683548

Client Ref.: Various **Location:** Various

Results Legend	Customer Sample Ref	SAMPLE 06 PFIELD POS T FILTER	SAMPLE 11 PFIELD POS T-FILTER	SAMPLE 14 PFIELD POS T-FILTER	SAMPLE 16 PFIELD POS T-FILTER	SAMPLE 13 PFIELD PRE -FILTER	SAMPLE 15 PFIELD PRE -FILTER
# ISO17025 accredited.							
M mCERTS accred ted.							
aq Aqueous / settled sample.							
diss.filt Dissolved / filtered sample.	Depth (m)	-	-	-	-	-	-
tot.unfilt Total / unf ltered sample.	Sample Type	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)	Treated Sewage (TS)
* Subcontracted - refer to subcontractor report for accreditation status.	Date Sampled	15/03/2023	15/03/2023	15/03/2023	15/03/2023	15/03/2023	15/03/2023
** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery	Sample Time	10:48:00	12:47:00	15:12:00	16:23:00	15:07:00	16:17:00
	Date Received	18/03/2023	18/03/2023	18/03/2023	18/03/2023	18/03/2023	18/03/2023
	SDG Ref	230318-34	230318-34	230318-34	230318-34	230318-34	230318-34
(F) Trigger breach confirmed	Lab Sample No.(s)	27703173	27703179	27703186	27703189	27703184	27703187
1-4+§@ Sample deviation (see appendix)	AGS Reference						

Component	LOD/Units	Method						
Suspended solids, Total	<2 mg/l	TM022	<2	#	<2	#	<2	#	<2	#	3.95	#	2.7	#
Phosphorus (tot.unfilt)	<20 µg/l	TM152	40.5	2 #	39.2	2 #	155	2 #	38 9	2 #	203	2 #	182	2 #
Phosphate (Ortho as P)	<0.02 mg/l	TM184	<0.02	#	<0.02	#	0.0437	#	<0.02	#	<0.02	#	<0.02	#