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WSP Opus
Palmerston North Office
L4, The Square Centre, 478 Main Street
PO Box 1472, PN Central, Palmerston North 4440
New Zealand

+64 6 350 2500
www.wsp-opus.co.nz

Horizons Regional Council
Private Bag 11025
Manawatu Mail Centre
Palmerston North 4442

Ref: 5-P0531.02

Response to Section 92 Request for Application APP-2010014267.02

This letter is in response to the request for further information obtained from the Horizons Regional Council on 18th September 2018. The request for further information is in relation to Tararua District Council's resource consent application for the Woodville Wastewater Treatment Plant (APP-2010014267.02). Please see below our response:

Infiltration and Inflow (I & I)

1. There is more influent entering the pond than anticipated (2x theoretical in summer, 5x in winter). This suggests significant infiltration. Is there a proposal to rectify this?

Response:

Yes, TDC's Long Term Plan 2018-2028 includes a strategy to reduce infiltration and inflow into the district's reticulation networks, building on previous work by TDC in relation to these issues. Options for implementing the strategy as set out in the LTP include such activities as leak detection through smoke testing, video or laser profiling inspection, acoustic inspections and leak repairs. It would also include the administrative functions of enforcing remediation and compliance actions by private asset owners. Council has committed in Year 1-3 in the LTP $1.17m.

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2. Would reduction of the infiltration result in enhanced treatment with the proposed plant and, if so, to what extent?

Response:
A reduction in infiltration will have some impact on the performance of the plant insofar as the concentration of incoming nutrients will be increased. This increase will be offset by the longer retention time in the pond and extended treatment by the pond biosystem.

Thus, we can expect an increase in NH_3 (ammonia) concentration in winter when biological treatment is minimal due to temperature and sunlight, and a reduction in summer as the longer retention time increases removal of ammonia. The net effect will be no significant change in average ammonia concentrations.

Nitrate and nitrite are not present in the incoming wastewater, so inlet concentrations will not be affected by a change in infiltration. When nitrification occurs, denitrification can also occur. Therefore, by reducing inflow and increasing both ammonia concentrations and retention time, the opportunity for ammonia oxidation will increase as the low numbers of nitrifying bacteria have longer contact. The numbers of these bacteria are very low in pond systems and will not contribute significantly to removal of nitrogen. With longer retention *times, denitrification will increase and reduce the concentrations of nitrite and nitrate. Thus, no significant change to the nitrate and nitrite concentration can be expected.*

Phosphorous will be more concentrated in the influent. Only in summer when the active algal population is able to work on the DRP will a reduction in it be seen, which with a longer retention time will reduce the summer DRP discharge (Pre-tertiary treatment). However, in winter when little microbial activity occurs, the increase in concentration by reduction in infiltration will increase winter concentrations. The DRP in the final effluent is controlled by the chemical dosing system, so the required concentration can be maintained even with variability in influent. This means no significant change in DRP concentration is expected.

In summary, the reduction of infiltration will not result in significant changes in average ammonia concentrations, nitrate and nitrite concentrations or DRP concentrations. Therefore, enhanced treatment of the wastewater is not expected to occur as a result of the reduction in infiltration. That said, a decrease in loads being processed through the WWTP would result in decreases in operational costs, therefore TDC is incentivised to reduce its infiltration and inflows using the methods outlined in the previous section.

3. Are the various pieces of tertiary treatment equipment (such as the plate clarifier) likely to be able to handle the high volumes of influent that occur in winter, or is there be a proposal to bypass these?

Response:

The tertiary treatment plant is capable of a maximum flow of 22 l/s but is usually operated at 18 l/s.

It should be noted that the historic data for Woodville WWTP from 2015 to 2017 shows seasonal variation in DRP concentration. Concentrations in effluent with NO chemical dosing were up to 2.1 mg/l with flows of monthly average 812 m3/d whereas in August with an average flow of 3637 m3/d the concentration of DRP in the effluent was < 0.25 mg/l. By treating 18 l/s (1555 m3/d) and removing DRP from a blended stream (as demonstrated in the mass balance provided in Appendix 1 of this letter) the blend of effluent will achieve an annual average of 0.5 mg/l DRP.

In short, the tertiary treatment plant will be equipped to deal with the average 18 l/s flows.

4. In Figure 5-1 there is a bypass of pond 2 in the diagram. Please explain the purpose of this.

Response:

The bypass of pond 2 was created historically. This has been used when pond 2 was taken out of service to install the pond liner, and then used again when the ground water issue below the liner was resolved. This is not routinely used as part of the process.

The Wetland

1. The wetland is noted in several places throughout the application as being a significant treatment for several parameters, particularly in regards total nitrogen and ammoniacal nitrogen. Mention is made of the wetland of in terms of treatment capability of the plant. Is the wetland intended to be part of the treatment system? Does the discharge quality rely on the treatment service of the wetland?

Response:

Well designed, constructed and maintained wetlands are able to reduce nitrate and ammoniacal nitrogen concentrations in a significant way. The proposed Woodville three-bay wetland will reduce both types of nitrogen, and in doing this it will serve to further enhance the quality of the discharge after it leaves the plant. It will serve as a safeguard in the event that either ammoniacal N or nitrate concentrations should enter the wetland in an elevated state, however in terms of the in-stream effects of the discharge, the wetland is not relied on for treatment of discharge quality. The wetland's primary purpose, in addition to ensuring commonality across the Council's three sets of wastewater treatment plant upgrades in the District, is to meet Policy 5-11 of the One Plan by providing for application of treated wastewater "onto or into land" or for "flow overland" before it enters water.

Note: the ammoniacal nitrogen and nitrate concentrations can only be reduced in separate wetland bays, each designed differently. This has been taken into account in the design of the wetland system.

It is proposed that the effluent standards, with the exception of E.coli, are measured at the end of the surface flow wetland.

2. In section 9 it is noted that end of pipe monitoring is proposed for downstream of the UV clarifier. Given the above question, is this still appropriate (i.e. as opposed to the bottom end of the wetland)? Is the intention to have monitoring at the wetland outlet?

Response:

As above it is proposed to have the compliance point post surface wetland.

If there is a requirement for the discharge quality to be measured after passing through the wetland, which given the compliance monitoring point being post surface wetland might be used for maintenance management, then it is recommended that only ammoniacal N and nitrate concentrations are monitored and that monitoring occurs at the outlet from the nitrate bay (surface flow bay of the wetland and before the biodiversity bay (if any). However, the applicant does not see the need for management monitoring.

This is because wetlands are not effective at removing nutrients other than ammonium and nitrate and because waterfowl using any open water areas in a biodiversity wetland bay may elevate faecal bacteria levels, an occurrence that is unrelated to the effective treatment performance of the plant or the wetland.

3. What is the alternative position if it is not possible to secure the land required for the wetland?

Response:

Land ownership is not a pre-requisite for obtaining resource consent under the Resource Management Act 1991. The Council is in negotiations with the owners of the land on which the proposed wetland would be located to obtain access. Should access to the land not be obtained through these negotiations, the Council will consider compulsory acquisition under the Public Works Act 1981.

4. If the wetland is constructed at site 1 due to the unavailability of site 2, will the discharge be piped to the Mangaatua post wetland for final discharge?

Response:

We understand that this question relates to determining appropriate monitoring. This is addressed in the response below. If further detail is still required please confirm.

5. If the wetland is constructed at site 1 and features an infiltration bed at its end, how will the effects of the discharge on the Mangaatua be measured in isolation from other inputs with confidence (given the groundwater movement and the location of the tributaries)?

Response:

The location of the monitoring sites will depend on the exact location of the wetland and any associated infiltration bed / discharge structure.
In Option 1, the intention is to locate the final infiltration bed/ discharge structure very close to the Mangaatua Stream's banks and downstream of the current "first" downstream monitoring site. Should Option 1 be implemented, it is intended that this monitoring site will be used as the future "upstream" monitoring site. Adequate and comparable monitoring site(s) are available further downstream, in the vicinity of the current "second" downstream monitoring site (refer to Figure 1 of the Aquanet report).
Should Option 1 be adopted:

- *The proposed "upstream" monitoring site is located downstream of the unnamed tributary confluence with the Mangaatua Stream;*
- *There does not appear to be any significant inputs/inflows between the proposed "upstream" and "downstream" monitoring sites.*

On that basis, comparison of monitoring results obtained at these sites will, in principle, enable a robust characterisation of the Woodville WWTP discharge's effects in isolation from other influences (as opposed to the effects of the WWTP discharge plus inputs from the unnamed tributary as is currently the case).

Based on initial observations it is acknowledged there could be groundwater influence on the Mangaatua Stream. It is suggested that an upgradient and downgradient monitoring bore be installed as part of the overall monitoring programme.

6. Given the final wetland bay is intended to have large open areas of water, is it likely that E. coli will increase in the discharge as a result of this? What about other parameters such as phosphorus? What management is intended for this area?

Response:

Yes, any open water areas are likely to attract water fowl, especially ducks, and this will result in elevated faecal bacteria concentrations including E coli. The only ways to reduce this effect are to minimise the area of open water by planting most of it; position the open water areas at the upstream end of the biodiversity wetland and have sizeable areas of sedges and reeds between the open water and the outflow from the wetland. However, if ducks should decide they like the open water sections of the wetland it will not be possible to prevent elevated E coli concentrations flowing over the outlet. It is a reality that water fowl in the area will produce waste, whether it is in the vicinity of the wetland or elsewhere in the catchment.

Wetlands are not able to remove Phosphorus (P) concentrations over medium to long periods, but neither should a well-maintained wetland be a significant net contributor of P. P can get stored in the wetland sediments, which can lead to periods of reduced P in outflow, but once the P concentrations bound to sediment reach capacity and once the wetland plants reach full growth the amount of P released from the wetland can be expected to match that in the inflow.

There will be less active management of this bay of the wetland system than for the preceding two bays. Weed species, especially willows, will be controlled but the planted native plants will be left to grow once well established and over time some succession of plant species is likely to occur as in any natural wetland.

Water quality

1. DRP currently exceeds the One Plan Schedule E target upstream of the discharge. A reduction in DRP by approximately half (to 0.5mg/L) is proposed. Is it possible for this to be reduced further?

Response:

By increasing the dosage for chemical removal lower concentrations can be achieved. As demonstrated in the Mass Balance (Appendix 1), to achieve this standard of 0.5 mg/l the tertiary treatment is only required to treat 18 -20 l/s within the capacity of the equipment. To achieve tighter DRP standards additional investment in equipment would be required as all flow would need further treatment and the blend approach would be insufficient. This would include replacement of process units, pumps, pipelines and chemical systems with larger capacity systems. Additional inline pre and post chemical analysers with real time control would be required. Upgrades to control pumps and control systems, upgrade to flash mixing and flocculator, and owing to the increase in solids generation from additional chemical may require additional solids removal upgrades to prevent discharge of solid related phosphorous to the environment.

2. In regards ammoniacal-N, there is a change between NPS-FM band A upstream to band B downstream. This change can be largely attributed to the discharge. How is this proposed to be resolved? Will this be relying in large part on the wetland?

Response:

The One Plan sets in-stream targets relative to ammoniacal nitrogen. These were based on the ANZECC Guidelines (2000) protection level framework and associated Trigger Values (TV). In each of the One Plan's Water Management sub-Zone (WMsZ), a level of protection (either 99% species protection or 95% species protection) was defined based on each sub-zone's characteristics.

The ANZECC Guidelines recommend assigning one of three levels of protection

- *The 99% species protection for high conservation/ecological value ecosystems;*
- *The 95% species protection for slightly to moderately modified ecosystems; or*
- *The 90 and 80% protection levels for highly modified ecosystem.*

The Mangaatua WMsZ was attributed a 95% species protection level for both ammoniacal-nitrogen and "other toxicants" (One Plan, Schedule E, pE-5).

The NPSFM "bands" are equivalent to the ANZECC Guidelines protection levels: Band A corresponds to the 99% species protection level and Band B corresponds to the 95% protection level.

Concentrations in the Mangaatua Stream meet the One Plan targets for ammoniacal nitrogen and are within NPSFM Band B, which is consistent with the level of protection sought for this WMsZ under the One Plan.

Wastewater engineering

Process Flow Diagram Figure 5-1.

1. Please clarify the process flow from the tertiary drum filter. The flow appears to recycle back to Maturation pond 2 from the Tephra filter which does not make sense.

Response:

The manhole in the maturation pond is sealed off so from the Tephra filter the flow goes back into the manhole that has the pipe connected through to the UV unit then the discharge.

Figure 5-1 shows the flow path through the works. There are two possible routes for flow from the drum filter. The normal route is to discharge from the drum filter into a gravity line that takes excess flow from the pond 4 (maturation pond 2) overflow to the UV system. It is not possible for this to flow back to the pond due to the difference in levels. The second route is to enable flows to be pumped to the tephra filter. Flows from the tephra filter return to the gravity line from Pond 4 and pass to the UV system. This is a pipe into the outlet of pond 4.

Tephra Filter

1. Please clarify the design intent of the Tephra filter. Is this a trial process which may be abandoned if it does not provide expected treatment or is it required in order to meet the required effluent quality?

Response:

The tephra filter was first piloted on a small scale at Dannevirke in collaboration with the Massey University and Fertilizer and Lime Research Centre. It was identified as capable of removing DRP by absorption to the media. As a result, this full-size bed was installed as a full-scale pilot study but has not been operated.

If the process indicates efficiencies and the testing proves beneficial the Council will carry on with the Tephra process.

Chemical Dosing Control

1. Please provide the control philosophy of the chemical dosing system. Is there a flow meter to provide flow proportional dosing?

Response:

The current system uses a manual system for chemical dosing with fixed rate flow and manual selected dose rates. As flows are attenuated by the retention through the pond system there is little diurnal variation in flow or concentration that will require adjustment. This requires regular operational monitoring checks and occasional adjustment. This is sufficient to meet the 0.5 mg/l annual average DRP quality.

Solids Mass Balance

Please provide:

1. The expected typical chemical dose and solids precipitated (in mg/L)

Response:

A mass balance (Appendix 1) is provided that shows the effect on Total Suspended Solids and phosphorous through the plant. This does not include the effect of biological removal of phosphorous, so is considered conservative. Data from monitoring of final effluent is comparable to the outputs in this estimate.

To achieve the required quality and using a stoichiometric dose of 3:1 for iron: P, a dose rate of 3 kg of Fe per day is sufficient to remove 1 kg of DRP from the effluent. This is sufficient to meet the 0.5 mg/l. As identified in the above comment on dosing control, a higher dose may be used if required for peak concentrations, but similarly, no dose is required in winter when the concentrations are < 0.4 mg/l DRP.

2. The solids load returned from the clarifier sludge and filter backwash to Pond 1 in kg/day and as a percentage of the influent TSS load.

Response:

Solids return load is estimated in the mass balance, assuming only 50% removal across the tertiary process. Higher solids removal is expected under most conditions. This assumes that all solids produced from chemical reaction form ferric phosphate. In reality, other solids will precipitate, particularly ferric hydroxide, which will have a lower solid loading in the return stream by mass. For this demonstration, the TSS make 45% of the theoretical incoming load. Solids will be returned to Pond 2 (not as shown in process flow diagram to pond 1). For the mass balance it is assumed that TSS are reduced by 60% per pond, so no significant impact on the TSS passing to the tertiary system is noted.

UV Disinfection System

1. Please provide details of the UV disinfection system (make, model, capacity)

Response:

The Council aims to renew the UV unit in the near future.

2. Is any monitoring and telemetry proposed on the UV system to alert the plan operators of lamp or ballast failure or low UV intensity?

Response:

Currently, UV is monitored by our Scada telemetry for intensity. Lamps are replaced as per hourly usage indicated by the supplier, or if breakages occur.

It is anticipated that the above information provided satisfies the Councils request for further information in relation to APP-2010014267.02. However, for any further queries please email Tabitha.Manderson@wsp.com.

Regards

Tabitha Manderson
Principal Planner

Appendix 1:

Woodville WWTP Mass Balance Calculation

WSP Opus
Palmerston North Office
L4, The Square Centre, 478 Main Street
PO Box 1472, PN Central, Palmerston North 4440
New Zealand

+64 6 350 2500
www.wsp-opus.co.nz

	Summer Condition		Average Condition	
Average Flow	1278	m3/d	1818	m3/d
TSS to WWTP Theoretical	98.1	kg/d	98.1	kg/d
TSS Current Average Effluent	52.8	mg/l	33.0	mg/l
TSS Current Average Effluent	67.5	kg/d	40.7	kg/d
Current Average DRP effluent	1.29	kg/d	1.05	kg/d
Current Average DRP effluent	1.25	mg/l	0.8	mg/l

WOODVILLE WWTP SUMMER MASS BALANCE

Coagulant

Flow l/d	17
Iron kg/d as Fe	3
Fe:P 3:1	

Pond 1 → Pond 2 → Pond 3 → Pond 4 → Floculator → Clarifier/ microscreen

	Influent	Pond 2 Feed	Pond 3 Feed	Pond 4 Feed	Tertiary Feed	Clarifier Feed	Tertiary Effluent
Flow	1278	1298	1298	1298	1298.0	1298.0	1278
TSS kg/d	98.1	83.9	33.6	13.43	68.5	89.4	44.7
TSS mg/l	76.8	64.7	25.9	10.3	52.8	68.9	25.9
TP kg/d	2.94	3.88	2.57	2.04	2.19	2.19	1.26
DRP kg/d	1.68	1.69	1.69	1.69	1.69	0.69	0.69
DRP mg/l	1.31	1.30	1.30	1.30	1.30	0.54	0.54
Algae Included	NĀ	N	N	N	Y	Y	Y

Return Sludge

Flow m3/d	20
TSS kg/d	44.7
TSS mg/l	2235
TP kg/d	0.94
DRP kg/d	0.011
DRP mg/l	0.54

Assumptions

1. Influent based on theoretical per capita contributions
2. Flows used are average for sampling days only
3. Effluent from Pond 4 TSS as current performance
4. Chemical Dose based on current dosage of 3 kg Fe/d
5. All solids from Ferric reaction assumed as ferric phosphate (as most dense common product)
6. Clarifier and Microfiltration assume 50% TSS removal. May be greater
7. TSS reduced by 60% per pond from pond 1 to 3. Assumed no change in pond 4

8. Algae and bacterial production is not included in Pond solids balance.
9. Reduction of Total P by assimilation in ponds, with assumed no net change in DRP until chemical removal.
10. Max design flow to tertiary is 22 l/s. For this calculation, assumed 18 l/s.

WOODVILLE WWTP AVERAGE MASS BALANCE

	Summer Condition	Average Condition
Average Flow	1278 m3/d	1818 m3/d
TSS to WWTP Theoretical	98.1 kg/d	98.1 kg/d
TSS Current Average Effluent	52.8 mg/l	33.0 mg/l
TSS Current Average Effluent	67.5 kg/d	40.7 kg/d
Current Average DRP effluent	1.29 kg/d	1.05 kg/d
Current Average DRP effluent	1.25 mg/l	0.8 mg/l

BYPASS

Flow m3/d	282.8
TSS kg/d	9.3
TSS mg/l	33.0
TP kg/d	0.25
DRP kg/d	0.26
DRP mg/l	0.92

Coagulant

Flow l/d	17
Iron kg/d as Fe	3
Fe:P 3:1	

Influent → Pond 1 → Pond 2 Feed → Pond 2 → Pond 3 Feed → Pond 3 → Pond 4 Feed → Pond 4 → Tertiary Feed → Floculator → Clarifier Feed → Clarifier/ microscreen → Tertiary Effluent → Blend

	Influent	Pond 2 Feed	Pond 3 Feed	Pond 4 Feed	Tertiary Feed	Clarifier Feed	Tertiary Effluent	Blend	
Flow	1818	1838	1838	1838	1555.2	1555.2	1535.2	1818.0	m3/d
TSS kg/d	98.1	75.3	30.1	12.05	51.3	72.2	36.1	45.4	kg/d
TSS mg/l	54.0	41.0	16.4	6.6	33.0	46.4	23.2	25.0	mg/l
TP kg/d	2.94	3.85	2.55	2.03	1.40	1.40	0.48	0.74	kg/d
DRP kg/d	1.68	1.69	1.69	1.69	1.43	0.43	0.43	0.7	kg/d
DRP mg/l	0.9	0.92	0.92	0.92	0.92	0.28	0.28	0.38	mg/l
Algae Included	NÃ	N	N	N	Y	Y		Y	

Return Sludge

Flow m3/d	20
TSS kg/d	36.1
TSS mg/l	1805
TP kg/d	0.91
DRP kg/d	0.006
DRP mg/l	0.28