MOTT MACDONALD

Featherston Wastewater Treatment Plant

Resource Consent and Assessment of Effects on the Environment

28 February 2017

South Wairarapa District Council

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A	18/08/2016	Sarah Sunich	Emma Hammond	Jason Ewert	Draft for South Wairarapa District Council Comment
B	31/08/2016	Sarah Sunich Craig Campbell	Sarah Sunich Jason Ewert	Jason Ewert	Draft submitted to Greater Wellington Regional Council
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D	28/02/2017	Sarah Sunich Craig Campbell	Sarah Sunich Jason Ewert	Jason Ewert	Final Submitted to Greater Wellington Regional Council

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Contents

Tables

Figures

Glossary

AAF	Annual Average Flow
Air Plan	Greater Wellington Regional Council Operative Regional Air Quality Management Plan (2000).
BOD_5	5 day Biological Oxygen Demand
BPO	Best Practicable Option
CDC	Carterton District Council
CIA	Cultural Impact Assessment
CLAWD	Combined Land and Water Discharge
Discharges to Land Plan	Greater Wellington Regional Council Operative Regional Plan for Discharges to Land (1999)
DIN	Dissolved Inorganic Nitrogen
DO	Dissolved Oxygen
DRP	Dissolved Reactive Phosphorous
EC	Electrical Conductivity
EDC	Endocrine Disrupting Chemicals
Freshwater Plan	Greater Wellington Regional Council Operative Freshwater Plan (2014)
FWWTP	Featherston Wastewater Treatment Plant
GWRC	Greater Wellington Regional Council
GWWTP	Greytown Wastewater Treatment Plant
HMF	Half Median Flow
HRT	Hydraulic Retention Time
I&I	Inflow and Infiltration
IIRMP	Inflow and Infiltration Reduction Management Plan
LEI	Lowe Environmental Impact Ltd
LTP	Long Term Plan
MCI	Macroinvertebrate Community Index
MfE	Ministry for Environment
MWWTP	Martinborough Wastewater Treatment Plant
NES-CS	National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011
NES-DW	National Environmental Standard for Sources of Drinking Water of Human drinking Water 2007
NH_4-N	Ammoniacal Nitrogen

NO_3-N	Nitrate Nitrogen
NOF	National Objectives Frameworks
NPS-FM	National Policy Statement for Freshwater Management 2011
OMM	Operations Maintenance Manual
OMP	Odour Management Plan
PGWES	Professional Ground Water and Environmental Services Ltd
PNRP	Greater Wellington Regional Council Proposed Natural Resources Plan (notified 2016)
QEII	Queen Elizabeth II
QMCI	Quantitative Macroinvertebrate Community Index
RMA	Resource Management Act (1991), including subsequent amendments
RPS	Wellington Regional Policy Statement
$scBOD_5$	5 day soluble carbonaceous Biological Oxygen Demand
SWDC	South Wairarapa District Council
TNH_4-N	Total Ammoniacal Nitrogen
TN	Total Nitrogen
TON	Total Oxidised Nitrogen
TP	Total Phosphorous
TSS	Total Suspended Solids
WCDP	Wairarapa Combined District Plan, Updated Version Operative in Part (2011)
WWTP	Wastewater Treatment Plant

Part One: A – Resource Consent Application Form

FORM 9

APPLICATION FOR RESOURCE CONSENTS

UNDER SECTION 88 OF THE RESOURCE MANAGAMENT ACT 1991

To: Greater Wellington Regional Council
34 Chapel St
PO Box 41
Masterton, 5840

Attn: Nicola Arneson / Shaun Adrewartha
Environmental Regulation

APPLICATION FOR RESOURCE CONSENTS ASSOCIATED WITH THE FEATHERSTON WASTEWATER TREATMENT PLANT

1. **SOUTH WAIRARAPA DISTRICT COUNCIL** applies for the resource consents for the activities described below.

2. The activity to which the resource consents relate is the ongoing operation (including discharge of treated effluent), maintenance, and upgrade of the Featherston Wastewater Treatment Plant (including ancillary activities), as described in the Descriptions and Assessment of Effects that accompanies this application.

3. The names and addresses of the owner of the land to which the activity applies are:

   South Wairarapa District Council
   PO Box 6
   MARTINBOROUGH 5741
   c/- Paul Crimp, Chief Executive Officer

4. The location of the proposed activity, shown in Part One: C – Proposed Consent Conditions Schedule 8: Figure 3, is:
   a. Featherston Wastewater Treatment Plant, Donald Street, Featherston - Legal Description: Pt Sec 258 (Gazette Notice 1914/1258) Section 330-331 Featherston Urban (CT WN349/159),
   b. Site A – 65 Longwood West Road, Featherston – Legal Description: Lot 2 DP342631 (CT 175087)
   c. Site B – 270 Murphys Line, Featherston – Legal Description: Lots 5 & 7 DP482853 (CT 679923); Lot 2 DP88643 (CT WN56B/343); Lots 17-25 Pt Lot 26 and Part Lot 28 Deeds Plan 317, Suburban Section 320-321, Suburban Section 324-325, Suburban Section 328-329, Suburban Section 332-333 and Suburban Section 336-337 and Suburban Section 340-341 and Suburban Section 345 and Suburban Section 349 (excluding areas C, D, E, F, G, H, I, J, K, L) Township of Featherston and Part Rural

Section 414, Part Rural Section 416, Part Rural Section 418 and Part Rural Section 420 Township of Featherston (CT WN56B/344).

5. The type of resource consents sought are:
   a. A discharge permit for the discharge of contaminants to Donald Creek through the term of the consent (being treated effluent from the Featherston Wastewater Treatment Plant);
   b. A discharge permit for the discharge of contaminants to land and water for the term of consent (being treated effluent via seepage from the ponds and channel associated with the Featherson Wastewater Treatment Plant);
   c. A discharge permit for the discharge of treated effluent to land and water (being land application of treated effluent from the Featherston Wastewater Treatment Plant); and,
   d. A discharge permit for the discharge of contaminants to air (being odour from the WWTP ponds, channel and treatment process (excluding pond desludging); and discharge to air of effluent associated with land application).

6. Attached, in accordance with Schedule 4 of the RMA, is a Description and Assessment of Effects on the Environment in the detail that corresponds with the scale and significance of the effects that the proposed activity may have on the environment, including information required in terms of the various Regional Plans.

7. The term of consent which is sought for all of the consents is 35 years.

Signed on behalf of South Wairarapa District Council

28 February, 2017

Date

Address for service of Applicant

c/- Sarah Sunich
Mott MacDonald Ltd
PO Box 37525
Parnell, Auckland 1151

Phone: 021 446 925
Email: sarah.sunich@mottmac.com

Part One: B – Certificate of Titles

Part One: C – Proposed Consent Conditions

Definitions

In the following conditions, the expressions below have the meaning given:

Definitions:	
WWTP	Wastewater Treatment Plant
FWWTP	Featherston Wastewater Treatment Plant
BOD_5	Five days Total Biochemical Oxygen Demand
$scBOD_5$	Five days soluble carbonaceous Biochemical Oxygen Demand
NH_4-N	Total Ammoniacal Nitrogen
NO_x-N	Total oxidised nitrogen
TN	Total Nitrogen
TP	Total Phosphorus
DRP	Dissolved Reactive Phosphorous
TSS	Total Suspended Solids
E.coli	*Escherichia coli*
DO	Dissolved oxygen
UV	Ultra-violet
g/m^3	Grams per cubic metre
L/s	Litres per second
Manager	Manager Environmental Regulation, Wellington Regional Council

Schedule 1: General Conditions for WAR120294 [31760, 31761, XXXXX and 31762]

1. Except as otherwise required by any other condition of these consents, the activity authorised by this Wastewater Discharge Permit shall be carried out generally in accordance with the following information provided by the applicant:

   - Featherston Wastewater Treatment Plant Proposed operation, upgrade and maintenance to 2051; Application for Resource Consents, Activity Description and Assessment of Environmental Effects; Mott MacDonald; DATE TBC, including Appendices 1 to 17;
   - ***[to be completed with relevant additional information requested by GWRC through the consent process, if any]***
   - any additional information and changes to the proposal provided by the Applicant by way of written evidence or submissions.

   Where there are inconsistencies between the application and the further information provided by the applicant, the most recent information applies. In addition, if there are inconsistencies between information provided by the applicant and conditions of the permit, the conditions apply.

   Advice Note 1: *Any change from the location, design concepts and parameters, implementation and/or operation may require change of consent conditions pursuant to Section 127 of the Resource Management Act 1991, or, if the changes exceed the scope of change of conditions, a new consent under section 13 of the Act.*

Upgrade Staging

2. The treatment system shall be upgraded in stages as follows:

Table 1: Land Management Stage Commissioning Programme

Stage Name	Stage Description	Stage to commence (time from commencement of consents):
Stage 1 (1A and 1B)	Plant Optimisation and minor capital works; Discharge of treated effluent to 8ha of Site A and 70ha of Site B; and commencement of Sewerage Network Rehabilitation Programme	2 years (commencing November of that year)
Stage 2A	Discharge of treated effluent to up to 116ha of Site B (without deferred storage) and completion of Sewerage Network Rehabilitation Programme	10 years
Stage 2B	Discharge of treated effluent to up to 116ha of Site B with deferred storage	20 years

Advice Note 2: *The location of Sites A and B are presented in Schedule 7: Figure 3. Discharges of treated effluent to Site A may continue as part of Stages 2A and 2B to the extent allow for in the Discharge to Land Management Plan required under Schedule 1: Condition 3.*

Management and Operations Plans

3. The Consent Holder shall prepare, within the timeframes stated, the management and monitoring plans/manuals listed in Table 2 below. The plans:
   a. shall give effect to the relevant requirements outlined in the conditions in Schedules 1, 2, 3, 4 and 5; and
   b. may be prepared as separate plans; or
   c. where approved in writing by the Manager, Environmental Regulation, Wellington Regional Council, one or more plans may be combined as a single plan; and,
   d. each plan shall detail which consent conditions the plan is giving effect to.

Table 2: Management Plans

Management Plan	Due (time from commencement of consents)
Featherston WWTP Operations and Maintenance Manual	6 Months
Odour Management Plan	6 Months
Inflow and Infiltration Reduction Management Plan	12 Months
Environmental Monitoring Plan	12 Months
Tangata Whenua Values Monitoring Plan	18 Months
Discharge to Land and Water Management Plan	18 Months

4. The Consent Holder shall submit a draft copy of each of the manuals and plans listed in Schedule 1: Condition 3 Table 2 to the Wellington Regional Council at least 20 working days before it is submitted to the Manager, for technical certification in compliance with Schedule 1: Condition 5. Comments received from the Regional Council shall be addressed and clearly incorporated into the final copy of each of the manuals and plans, along with a clear explanation of where any suggestions have not been incorporated and the reasons why. Final plans and explanations shall be supplied to the Manager, within their respective timeframes listed in Schedule 1: Condition 3.

   Advice Note 3: *For the purpose of this condition, the Council has 5 working days to provide its comments to the consent holder to enable the consent holder sufficient time to make changes to the plan in response to the comments received from Council and have these changes reviewed by a suitably qualified independent person prior to submission to the Manager for technical certification.*

5. The manuals and plans listed in Schedule 1: Condition 3 Table 2 shall be submitted within their respective timeframes to the Manager, Environmental Regulation, Wellington Regional Council for their written technical certification.

   a. Certification shall not be unreasonably withheld. Should certification of any manual or plan be withheld, the Consent Holder shall submit a revised or reviewed manual or plan to the Manager, for technical certification as soon as is practicable. Should certification of the revised or reviewed manual or plan be again withheld then the Consent Holder shall engage a suitably qualified mutually acceptable independent person for resolution of the matters of dispute and his or her decision on those matters shall be final. The costs of dispute resolution shall be shared equally between the Consent Holder and Wellington Regional Council;

   b. Except with the written approval of the Consent Authority, activities which are subject to a plan shall not commence until the plan has received technical certification. This does not apply to the Featherston WWTP Operations and Maintenance Manual;

   c. The manuals and plans are subject to periodic review and updating as set out in Schedule 1: Condition 9. The certification process for updating or making variation to a manual or plan shall follow the process outlined above; and

   d. The Consent Holder shall exercise this consent in accordance with, and comply with, the provisions of any certified manual or plan (including any certified variation) at all times.

   Advice Note 4: *For the purpose of this condition "technical certification" means confirmation that the management or monitoring plan:*

   a) achieves the objectives of the plan listed in Schedule 1: Condition 6 Table 3; and

   b) provides for the minimum contents for the plan as listed in Schedule 1: Condition 7 Table 4.

6. The objectives of the manuals and plans are set out in Table 3.

Table 3: Objectives of the Management and Maintenance Plans

Management or Monitoring Plan	Objective of the Management Plan
Featherston WWTP Operations and Maintenance Manual	To outline the operation and maintenance of the Featherston WWTP and wastewater discharge systems.
Odour Management Plan	To minimise the risk of nuisance odours and aerosols beyond the boundaries of the site and achieve the requirements of Schedule 3: Conditions 1 to 4 of these consents. The Plan must: a. Identify the potential risks associated with odour and aerosols associated with the operation of the Featherston WWTP and land treatment system, including procedures to minimise those effects; and b. Protocols for responding to complaints and other incidents.
Tangata Whenua Values Monitoring Plan	To develop, in consultation with Kahungunu ki Wairarapa and Rangitane o Wairarapa, a monitoring programme that is responsive to the effects of the Featherston WWTP and its discharges to water and land that are of concern to these iwi entities.
Inflow and Infiltration Reduction Management Plan	To determine the extent of inflow and infiltration into the sewer network outline the investigation process for determining the most efficient, cost effective and non-disruptive manner for sewer network rehabilitation, outline the proposed rehabilitation works and measure and report on the effectiveness of the improvements in terms of reducing influent flows to the FWWTP.
Environmental Monitoring Plan	To document the environmental monitoring to be undertaken to monitor the effects of the Featherston WWTP on the environment from the activities authorised by these consents and document the reporting requirements.
Discharge to Land and Water Management Plan	To maximise the discharge of treated wastewater to land within the constraints of the conditions of these consents and the constraints of: land availability, wastewater storage, soil and groundwater conditions, odour and aerosol control, and the avoidance of risks to human health. The Plan must: a. Address the specific site conditions and limitations for all land discharge areas which are proposed to receive wastewater; (including those listed above). b. Detail the Featherston WWTP wastewater discharge to land methods and systems; c. Define storage volumes for Stage 2B; d. Establish a discharge regime for Stage 2B contingency discharges of treated wastewater to target when Donald Creek flows are greater than 3x median and wherever practicable greater than 2x median most of the time; and

7. The Schedule 1: Condition 6 Table 3 plans and manuals shall:
    a. Be developed to achieve the following over-riding objectives.
        i. From Stage 1 onwards minimise treated wastewater discharges to Donald Creek so far as is reasonably practicable within the constraints of the conditions of this consent, land availability on the Stage 1 sites and storage within the existing ponds at their existing bund level; and
        ii. From Stage 2A onwards minimise treated wastewater discharges to Donald Creek, so far as is reasonably practicable within the constraints of the conditions of this consent, land availability on the Stage 1 and 2A sites and storage within the existing ponds at their existing bund level; and
        iii. From Stage 2B onwards, avoid where practicable, wastewater discharges to the Donald Creek at times of stream flow less than 2 times median flow and target stream flow greater than 3 times median flow measured in Donald Creek at Longwood Road West (or other location deemed suitable).

b. As a minimum include, but not be limited to, the information listed in Schedule 1: Condition 7 Table 4.

Table 4: Minimum contents of Management and Monitoring Plans

Management Plan	Minimum Contents
Featherston WWTP Operations and Maintenance Manual	a. WWTP overview. b. WWTP operating procedures. c. Description of 'normal operating conditions' d. Operational and compliance monitoring. e. Plant condition inspections and maintenance. f. Trouble shooting guide. g. Roles and responsibilities. h. On-site staff training procedures. i. Details of a complaints register. j. How emergency discharges will be dealt with. k. A protocol (and programme) for reviewing the effectiveness of the manual.
Odour Management Plan	a. A description of the Stage 1 and 2 WWTP system components and their operation relevant to the management of odours and aerosols including the inlet screen, wastewater ponds, and irrigation infrastructure. b. Routine odour monitoring. c. Complaints receipt, investigation and reporting procedures. d. Contingency measures to manage adverse odours or aerosols. e. A protocol (and programme) for reviewing the effectiveness of the management plan.
Tangata Whenua Values Monitoring Plan	a. Effects of the Featherston WWTP that are of concern to Kahungunu ki Wairarapa and Rangitane o Wairarapa. b. A description (including spatial extent where possible) of the cultural values of the land occupied by the Featherston WWTP, the land discharge area, Donald's Creek and Lake Wairarapa. c. Any opportunities for Kahungunu ki Wairarapa and Rangitane o Wairarapa to be involved in monitoring of the effects of the WWTP discharges. d. Outcomes expected from ongoing consultation. e. A protocol (and programme) for reviewing the effectiveness of the monitoring plan.
Inflow and Infiltration Reduction Management Plan	a. Issue identification and quantification, including a summary of results from preliminary investigations (catchment flow monitoring, infiltration and inflow assessment) and field investigations (infiltration source detection, inflow source detection). b. Priority works and actions. c. Ongoing works and actions, including a prioritised sewer renewal/rehablitation programme, an education programme (general public, building inspectors), and a review of guidance material. d. Information collection and record keeping and an annual reporting procedure. e. Roles and responsibilities. f. A protocol (and programme) for reviewing and reporting on the effectiveness of the inflow and infiltration reduction initiatives over time.
Environmental Monitoring Plan	a. Influent and wastewater discharge quantity and quality monitoring. b. Monitoring required under Schedule 2 of these consents including Donald Creek flow and quality monitoring and Abbot Creek quality monitoring. c. Donald and Abbot Creek ecological monitoring including macroinvertebrate and periphyton monitoring. d. Groundwater monitoring including for the land discharge areas, pond seepage, nearby bores and wells. e. Soil and pasture health monitoring. f. Method to determine the Land Application Area annual site nitrogen budget giving the nitrogen inputs and removal for each month as well as the deficit/surplus each month. g. Reporting of data, effects and consent compliance. h. A protocol (and programme) for reviewing the effectiveness of the monitoring plan.

Management Plan	Minimum Contents
Discharge to Land and Water Management Plan	a. Description of Site A and B including any watercourses present; the pumping, conveyance and discharge infrastructure; and the land discharge regime. b. Wastewater discharge to land management including: i. weather and climate reporting; ii. soil moisture monitoring; iii. soil management including maintaining soil structure; iv. wastewater flow rate monitoring; v. wastewater hydraulic application rates; vi. nutrient loading rates; vii. pasture and crop management; viii. fertiliser management (including grazing and buffer zones); ix. high speed wind shutdown; x. odour and aerosol management; xi. system maintenance; xii. public health risk management; and xiii. access restrictions to land receiving wastewater. c. Wastewater discharge to water management including: i. Wastewater flow rate monitoring; ii. Donald Creek flow monitoring details including stage recorder and rating curve details; iii. For Stage 2B Donald Creek flows below which wastewater discharges will be avoided, so far as is practicable; and iv. For Stage 2B maximum wastewater discharge rates. v. Wastewater discharge channel maintenance. d. Wastewater Storage Management i. Details (by December 2040) of the additional storage volume required for Stage 2B; ii. Procedures for pond level management; e. Land discharge area site inspections including: i. regular walkovers; ii. inspections after heavy rain, and iii. odour monitoring. f. Water discharge area site inspections including: i. Wastewater discharge channel. g. A protocol (and programme) for reviewing the effectiveness of the management plan.

8. All the plans and manuals listed in Schedule 1: Condition 3 Table 2, shall be prepared by a suitably qualified and experienced person or persons with expertise in the matters that the individual documents address.

9. All the plans and manuals listed in Schedule 1: Condition 3 Table 2, shall be reviewed and where necessary updated either:
   a. annually within one month of the anniversary of the commencement date of these consents; or
   b. Within three months of implementing a new stage as defined in Schedule 1: Condition 2, Table 1; or
   c. Where environmental monitoring supports a change. Any change shall be subject to the written technical certification of the Manager, Environmental Regulation, Wellington Regional Council.

10. Where there are any contradictions or inconsistencies between the certified plans and manuals listed in Schedule 1: Condition 3 Table 2 and conditions of these consents, then the technically certified management plan or manual shall prevail.

***Advice Note 5**: The intent of this condition is to ensure that procedures and appropriate industry methodologies certified by Council can be applied over the term of consent without the need for an unnecessary variation to conditions.*

Use of treated effluent on crops intended for human consumption

11. The following (or similar wording with the same intent and outcome) shall be included within the Discharge to Land and Water Management Plan to be prepared in accordance with Schedule 1: Conditions 3, 6 and 7:

    The Consent Holder shall not allow, or enter into any contract or arrangement which would knowingly allow, the discharge of treated effluent by land discharge directly to crops being grown for the express purpose of human consumption. (Note: The land discharge of treated wastewater to crops (including pasture) for consumption by ruminant animals, irrespective of any intended potential use of those animals for human consumption (including meat, milk, or other product), is not restricted by this condition).

Monitoring and Recording

12. The Consent Holder shall monitor and record wastewater flow and quality according to the frequency and constituents specified in Schedule 6: Table 1, at:

    a. the locations specified in Schedule 1: Condition 16, and Schedule 6: Table 2 and Figure 1 (until such time as the Environmental Monitoring Plan is certified pursuant to Schedule 1: Condition 5) for monitoring flows; and,
    b. the locations specified in Schedule 2: Condition 9, Schedule 4: Condition 12, and Schedule 6: Table 2 and Figure 1 (until such time as the Environmental Monitoring Plan is certified pursuant to Schedule 1: Condition 5) for monitoring wastewater quality; and
    c. the monitoring locations specified in the Environmental Monitoring Plan (following its certification pursuant to Schedule 1: Condition 5).

13. To enable the sampling of the treated wastewater, easy and safe access to a sampling port(s) shall be provided by the Consent Holder and maintained as close as is practicable to those sampling locations specified in Schedule 1: Condition 12.

14. The Consent Holder shall keep inspection records and operational logs which record regular inspections, identify changes in the operating procedures and record unusual events that occur at the plant. Copies of these records shall be supplied to the Manager, Environmental Regulation, Wellington Regional Council, within 20 working days of a written request by the Manager.

15. In respect of monitoring required by these consents, the following shall apply:

    a. all monitoring techniques employed in respect of the conditions of these consents shall be carried out by suitably experienced and qualified persons;
    b. all analytical testing undertaken in connection with these consents shall be performed by a laboratory that is IANZ accredited for the analytical tests;
    c. all soil and water sample analyses shall be undertaken in accordance with the methods detailed in the “Standard Methods For The Examination Of Water And Waste Water, 2012” 22nd edition by A.P.H.A. and A.W.W.A. and W.E.F., or any other method approved in advance in writing by the Manager, Environmental Regulation, Wellington Regional Council; and
    d. if any monitoring sites are identified as unsuitable, alternative monitoring sites shall be identified and developed after consultation with the Manager, Environmental Regulation, Wellington Regional Council.

Wastewater Volume Measurement

16. The Consent Holder shall fit measuring equipment to monitor the wastewater flows at the following points and within the timeframes specified:

a. inlet inflow	From commencement of these consents
b. discharge outflow to Donald Creek	From commencement of these consents
c. land treatment volume	Prior to any discharge of treated effluent to land (for all Stages)

17. From commencement of these consents, the Consent Holder shall install a datalogger and flow measuring device at all wastewater discharge flow measurement points that is compatible with the Wellington Regional Council's Water Data Management System. The datalogger shall record the treated wastewater discharge averaged over time intervals of no less than 15 minutes. The data shall be provided automatically on a daily basis in a format compatible with the Water Use Data Management System; and

18. Where the flow measuring device measures flow in a pipe, measurement error is to be no more than +/- 5% as an average across the flow range, and where installed at a weir or open channel, measurement error is to be no more than +/- 10% as an average across the flow range. The measuring equipment must:

    a. be able to measure cumulative discharge;
    b. be able to measure instantaneous flow rate;
    c. be installed in accordance with the manufacturer's specifications; and
    d. be calibrated annually.

19. The Consent Holder shall verify the accuracy of the flow measuring device required under Schedule 1: Conditions 16 and 18 by:

    a. Inlet inflow - October 2019.
    b. Discharge outflow to Donald Creek – March 2017.
    c. Land Treatment volume - Installation of the flow measuring device.

    and a minimum of every five years thereafter, and as directed by the Manager, Environmental Regulation, Wellington Regional Council for the duration of this consent to determine if the actual volume of discharge is within the margin of error stated in Schedule 1: Condition 18.

    d. Any verification of the flow measuring device under this condition must be performed by a suitably qualified person, and to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council; and
    e. A copy of the verification certificate/and or evidence documenting the calibration as completed by the person who undertook the verification shall be incorporated and submitted in the next Annual Monitoring Report following the calibration (Schedule 1: Condition 22).

20. Flow volume measuring equipment and datalogger units installed to comply with Schedule 1: Conditions 16, 17 and 18 shall be maintained by a suitably qualified person in accordance with the Featherston WWTP Operations and Maintenance Manual (which shall include reference to manufacturer's specifications and industry best practice guidelines) for the duration of these consents.

Reporting

21. The Consent Holder shall provide a Quarterly Data and Exception Report for each three-month period ending 31 March, 30 June, 30 September and 31 December to the Manager, Environmental Regulation, Wellington Regional Council, within 30 working days of the end of each three-month period. The quarterly report shall be provided in electronic format. The quarterly report shall include, but not be limited to, the following:

    a. The results of all monitoring undertaken in accordance with the conditions of this consent, with all monitoring data provided in a suitable electronic format; and

    b. A brief commentary on any exceptions identified from the data and reasons for difficulties in achieving compliance with the conditions of this consent; and

    c. Subject to Schedule 1: Condition 22 a schedule summarising any complaints received during the quarter.

    Where agreed in writing with the Manager, Environmental Regulation, Wellington Regional Council, up to two quarterly reports may be combined into a single report for any such specified reporting period(s).

    Advice Note 6: *The Quarterly Data and Exception Report required under this condition on 30 September of any year may be incorporated into the Annual Report, but where it is incorporated, it shall be clearly separately identified for compliance monitoring purposes.*

22. The Consent Holder shall provide to the Manager, Environmental Regulation, Wellington Regional Council, an Annual Report by 30 September each year, summarising compliance with the conditions of these consents for the previous compliance year (1 July to 30 June inclusive). The Annual Report shall be provided in electronic format and shall include as a minimum:

    a. a summary including analysis of all monitoring (including trends within the annual period and compared to previous years) undertaken in accordance with the conditions of these consents or any management plan prepared under the conditions of this consent, and shall make particular reference to whether any data trends may be indicative of significant adverse effects on aquatic life after reasonable mixing or any other significant adverse effect on the environment;

    b. where non-compliance with conditions of these consents results, reasons for this non-compliance shall be given, a discussion on the potential significance of this non-compliance including any corresponding trends or changes in environmental effects evident from the monitoring data (both within the annual period and compared to previous years), and actions taken;

    c. any measures that have been undertaken, or are proposed to be undertaken in the upcoming 12 months, to improve the environmental performance of the wastewater treatment and disposal system;

    d. any recommendations on alterations/additions to the monitoring programmes and/or any proposed changes to any management plan following any review in accordance with Schedule 1: Condition 9;

    e. a schedule of any complaints recorded during the year and any follow up actions undertaken;

    f. any other issues considered important by the Consent Holder; and

    g. A copy of the Annual Report shall be made available to the Community Liaison Group within 10 working days of submission to the Wellington Regional Council.

Communications and Liaison

23. Within three months of the commencement of these consents, the Consent Holder shall commence the process to establish a Community Liaison Group (CLG) in accordance with the Terms of Reference included as Schedule 7 to these consents.

Advice Note 7: *In order to achieve compliance with this condition, the Consent Holder shall be required to establish the CLG and organise meetings (including venues). Where invitees choose not to attend CLG meetings or otherwise be involved, this shall not be regarded as a matter of non-compliance.*

24. The Terms of Reference shall be incorporated into the Featherston WWTP Discharge to Land and Water Management Plan, and amendments to the Term of Reference may be undertaken and incorporated within the Featherston WWTP Discharge to Land and Water Management Plan, without the need to vary the conditions of these consents.

25. Within 1 month of commencement of this consent a Featherston WWTP liaison person shall be appointed by the Consent Holder to be the main and readily accessible point of contact. The Consent Holder shall take appropriate steps to seek to advise all stakeholders and interested persons of the stakeholder liaison person's name and contact details. If the liaison person will not be available for any reason, an alternative person shall be nominated by the Consent Holder.

Signage

26. For the duration of these consents, the Consent Holder shall:

    a. maintain signage on the true right stream banks of Donald Creek in the immediate vicinity of the treated wastewater outfall which shall at all times:
        i. provide clear identification of the location and nature of the discharge;
        ii. indicate the general frequency and duration of the discharge;
        iii. provide a 24-hour contact phone number; and
        iv. be visible to the public visiting the area and legible from a distance of 20 metres without unnecessarily detracting from the visual amenity of the area.
    b. Maintain appropriate signage on boundaries of the WWTP site, Site A and Site B, which shall be legible to a person during dayilght hours, warning that partially treated wastewater is discharged to land and may be present at the site. Such signage shall be clearly visiable at all vehicle entry points to the sites from public roads.

27. The Consent Holder shall consult with Regional Public Health and provide a copy of their written approval regarding the wording of the signs prior to submitting them for approval to Wellington Regional Council. Written confirmation of the signage placement accompanied by photographs of the signage shall also be provided to the Manger, Environmental Regulation, Wellington Regional Council, within one month of the erection of the signs.

Access

28. The vehicle access gate to the Featherston WWTP site shall remain locked at all times that operational staff of the Consent Holder (which shall include authorised contractors) are not present on site, to prevent unauthorised access.

29. Stock access to the Featherston WWTP oxidation ponds and discharge channel shall be restricted, except that grazing of the embankments of the ponds by stock shall be permitted under the management of the Consent Holder. All fences or other barriers shall be maintained by the Consent Holder to be of suitable stock proof standard at all times.

30. The Consent Holder shall install and maintain fencing within the boundaries of Site A and Site B to restrict stock access to:

a. the true left and right banks of Donald Creek and Abbot Creek from the commencement of Stage 1; and

b. the deferred storage pond(s) for treated wastewater following the commissioning of the Stage 2B upgrade of the Featherston WWTP, except that grazing of the embankment by stock shall be permitted under the management of the Consent Holder.

On-site meeting with WWTP Operations Contractor

31. The consent holder shall arrange and conduct a consent information meeting within two months of the date of commencement of these consents. The purpose of the meeting shall be to confirm the conditions of the consents and the responsibilities of the contractor. The Consent Holder shall invite, with a minimum of 10 working days notice, the Wellington Regional Council and a representative from each key contractor operating the activity.

Complaints Register

32. The Consent Holder shall keep a record of any complaints that are received with respect to the operation of the Featherston WWTP including any associated discharge to land area. The record shall contain the following details:

    a. name and address of the complainant (unless withheld by the complainant);

    b. identification of the nature of the complaint;

    c. date and time of the complaint and of the alleged event;

    d. weather conditions at the time of the complaint (including approximately wind speed and direction);

    e. any measures taken to address the cause of the complaint;

    f. details of any follow-up communications with the complainant.

    A schedule of all complaints shall be provided with the quarterly report required by Schedule 1: Condition 21 including the details listed above.

33. The Consent Holder shall notify the Manager, Environmental Regulation, Wellington Regional Council of all complaints relating to the exercise of these consents which result from a non-compliance with the conditions of these consents, within 24 hours of being received by the Consent Holder, or the next working day.

34. The Consent Holder shall forward to the Manager, Environmental Regulation, Wellington Regional Council, a summary of any complaints received, any outstanding follow-up items, or report on any operational aspects resulting in persistent complaints in the annual report required by Schedule 1: Condition 22.

System Failure

35. The WWTP system shall be maintained in an efficient operating condition at all times. In the event of any treatment failure that is likely to result in deterioration in the quality of the discharge which would affect the receiving environment, and be in breach of any condition of these consents, the Consent Holder shall:

    a. Take immediate steps to remedy and mitigate any adverse effects on the environment caused by the failure;

    b. Notify the Manager, Environmental Regulation, Wellington Regional Council, within **24 hours** after the malfunction has been detected, detailing the manner and cause of that malfunction and the steps taken to mitigate its effects and to prevent recurrence. Notification can be sent to the

Wellington Regional Council at notifications@gw.govt.nz and shall include the consent reference and the name and phone number of a contact person;

c. Notify Regional Public Health within 24 hours of the malfunction being detected.

d. Notify the members of the Community Liaison Group within **48 hours** of the malfunction has been detected;

e. Forward an incident report to the Manager, Environmental Regulation, Wellington Regional Council, within **seven working days** of the incident occurring, unless otherwise agreed with the Manager, Environmental Regulation, Wellington Regional Council. The report shall describe the manner and cause of the incident, measures taken to mitigate/control the incident (and/or illegal discharge), and measures to prevent recurrence; and

36. Notification in accordance with Schedule 1: Condition 35 (b) and (e) shall include but not be limited to:

a. The nature of the discharge;
b. Location of the discharge;
c. Start date and estimated time of the discharges;
d. End date and estimated time of the discharge (if known at the time of notification);
e. Estimated duration of the discharge (hours);
f. Maximum discharge flow (litres/second) or estimate thereof;
g. Mean discharge flow (litres/second) or estimate thereof;
h. Estimated discharge volume (m^3);
i. Cause of overflow/discharge;
j. Action taken (including signs, notification of interested parties, clean-up of stream; and
k. The contact details of the person reporting the notification.

Review of Conditions

37. Wellington Regional Council may review any or all of the conditions of these consents by giving notice of its intention to do so pursuant to Section 128 of the Resource Management Act 1991, in December of each year of this consent for any of the following purposes:

a. to deal with any adverse effects on the environment which may arise from the exercise of these consents, and which it is appropriate to deal with at a later stage;
b. to review the adequacy of any monitoring requirement(s) so as to incorporate into the consents any modification to any plan(s) or monitoring requirement(s) which may become necessary to deal with any adverse effects on the environment arising from the exercise of these consents;
c. to alter the monitoring requirement(s) in light of the results obtained from any previous monitoring; and

38. No later than 3 years from the commencement of Stages 1 Land Treatment the Consent Holder shall provide to the Manager, Environmental Regulation, Wellington Regional Council, an independent report, prepared by a suitably qualified and experienced person or persons, reviewing the efficacy of Stage 1 land treatment in order to assist the Consent Holder in deciding whether or not the commencement of Stage 2B should be advanced to the following timeframe:

a. Stage 2A – Reduced from 10 years to 7 years from consent commencement
b. Stage 2B - Reduced from 20 years to 15 years from consent commencement.

39. The review and report required by Schedule 1: Condition 38 shall include, but not be restricted to, the following:

    a. The conclusions and recommendations of any technical reports undertaken in relation to Stage 1;
    b. A description of any changes required to the land discharge regime, since the commissioning of Stage 1, including:
        i. reasons why any such changes were required;
        ii. specifically, what effects (or operational constraints) those changes were required to mitigate;
        iii. the effectiveness of those changes in terms of the specified effect or constraint; and
        iv. any programmed or identified future changes and/or works required to mitigate identified adverse effects, including the purpose for each of those changes and/or works.
    c. An assessment of the effectiveness and effects, including environmental improvements, of the Stage 1 land discharge regime since its commissioning, supported by monitoring data;
    d. An assessment of actual adverse effects of odours and aerosols;
    e. Any other matter considered relevant by the Consent Holder.

40. No later than 3 years from the commencement of Stage 2B the Consent Holder shall provide to the Manager, Environmental Regulation, Wellington Regional Council, an independent report prepared by a suitably qualified and experienced person or persons, reviewing the efficacy of the Stage 2B land treatment in terms of avoiding, remedying or mitigating adverse effects of the discharges to the environment.

41. The review and report required by Schedule 1: Condition 40 shall include, but not be restricted to, the following:

    a. The conclusions and recommendations of any technical reports undertaken in relation to the Stage 2A or Stage 2B discharges;
    b. A description of any changes required to the land discharge regime, since the commissioning of Stage 2B, including:
        i. reasons why any such changes were required;
        ii. specifically, what effects (or operational constraints) those changes were required to mitigate;
        iii. the effectiveness of those changes in terms of the specified effect or constraint; and
        iv. any programmed or identified future changes and/or works required to mitigate identified adverse effects, including the purpose for each of those changes and/or works.
    c. An assessment of the effectiveness and effects, including environmental improvements, of the Stage 2B land discharge scheme since its commissioning, supported by monitoring data;
    d. An assessment of actual adverse effects of odour and aerosols;
    e. Any other matter considered relevant by the Consent Holder.

42. A copy of each review report shall be provided to the Community Liaison Group within one month of it being provided to the Manager, Environmental Regulation, Wellington Regional Council and to any other persons or parties who were consulted as part of the review.

Resource Management Charges

43. A resource management charge, set in accordance with section 36(2) of the Resource Management Act 1991 shall be paid to Wellington Regional Council for the carrying out of its functions in relation to the

administration, monitoring and supervision of the resource consents and for the carrying out of its functions under section 35 (duty to gather information, monitor and keep records) of the Act.

Schedule 2: Conditions for WAR 120294 [31760] - Discharge permit to discharge treated wastewater from the Featherston WWTP, and any stormwater which enters the treated or untreated wastewater stream prior to discharge, to Donald Creek

Discharge Rate, Parameters and Regime

1. Following confirmation of commencement of Stage 1 and 2A Land discharge in accordance with Schedule 1: Condition 2, these consents authorise the discharge of treated wastewater to Donald Creek of up to:

Table 1: Discharge Volumes

	Annual Average Daily Flow (m^3/d)	90%ile (m^3/d)
Prior to Stage 2A commencement	3,300	7,700
Following Stage 2A commencement	1,400	5,200

2. Following confirmation of commencement of Stage 2B Land Discharge in accordance with Schedule 1: Condition 2:

   a. There shall be no discharge of treated effluent to Donald Creek during summer months.

   b. Discharges of treated effluent to Donald Creek shall not exceed a maximum discharge rate of 6,000 m^3/d or 70 l/s.

   c. So far as is reasonably practicable, discharges of treated effluent to Donald Creek shall in order of priority, target discharges when Donald Creek flows are greater than 3x median, and preclude discharges to Donald Creek at flows less than 2x median.

   Advice Note 1: *Three times and two times median flow will be determined from stream flow monitoring data collected in accordance with Condition 10.*

3. Any treated wastewater discharged to Donald Creek up to one year following the commencement of the proposed inflow and infiltration sewer rehabilitation works shall meet the following wastewater discharge standards:

   d. The concentration of BOD_5 shall not exceed 35 g/m^3 in more than 3 out of any 12 consecutive monthly test results;

   a. The concentration of TSS shall not exceed 100 g/m^3 in more than 3 out of any 12 consecutive monthly test results;

   b. The concentration of Total Ammonia-nitrogen (NH_4-N) shall not exceed 12 g/m^3 in more than 3 out of any 12 consecutive monthly test results; and

   c. The concentration of TN shall not exceed 15 g/m^3 in more than 3 out of any 12 consecutive monthly test results.

   d. The concentration of DRP shall not exceed 4 g/m_3 in more than 3 out of any 12 consecutive monthly test results.

4. One year following the commencement of the proposed inflow and infiltration sewer rehabilitation works any treated wastewater discharge to Donald Creek shall meet the following wastewater discharge standards:

   a. The concentration of BOD_5 shall not exceed 35 g/m^3 in more than 3 out of any 12 consecutive monthly test results;

   e. The concentration of TSS shall not exceed 100 g/m^3 in more than 3 out of any 12 consecutive monthly test results;

f. The concentration of Total Ammonia-nitrogen (NH_4-N) shall not exceed 18 g/m^3 in more than 3 out of any 12 consecutive monthly test results; and

g. The concentration of TN shall not exceed 25 g/m^3 in more than 3 out of any 12 consecutive monthly test results.

h. The concentration of DRP shall not exceed 6 g/m^3 in more than 3 out of any 12 consecutive monthly test results.

Advice Note 2: *Compliance will be demonstrated based on the monthly samples as set out in Schedule 6: Table 1.*

5. The following UV treatment standards shall apply:

   a. For discharges up to 140L/s no more than 5 of 10 consecutive E.coli values shall exceed 100 cfu per 100 millilitres, and no more than 2 out of 10 consecutive values shall exceed 1,400 cfu per 100 millilitres; or

   b. For discharges over 140L/s, UV treatment shall be applied to a minimum of 140L/s and the remaining flow may have no UV treatment.

6. All discharges to Donald Creek under Featherston WWTP normal operating conditions shall be made via the existing surface discharge channel at the location identified in Schedule 6: Figure 1.

7. The following monitoring targets shall be used to assist with assessing the effects of the wastewater discharge to Donald Creek for the purpose of triggering Schedule 2 Condition 8:

   a. Following commencement of Stage 1 and Stage 2B, the pH adjusted annual concentration values for total ammoniacal nitrogen listed in Table 2.

   b. Following commencement of Stage 1, periphyton cover as measured by the Peri WCC index of less than 30% cover at the downstream site unless this value is exceeded at the upstream site.

   c. Following commencement of Stage 1, the QMCI reduced as a result of the discharge by more than 20% between similar sites upstream and downstream of the discharge.

   d. Following commencement of Stage 2B, the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials.

   e. Following commencement of Stage 2B, the presence of bacterial and / or fungal slime growths visible to the naked eye as plumose growths or mats.

   The monitoring targets shall apply at the water quality and ecological monitoring sites downstream of the Featherston WWTP, as shown on Schedule 6: Figure 1 and 2.

   Advice Note 3: *The percentage change in QMCI shall be calculated from the average of the two upstream and two downstream sites.*

Table 2: Total Ammoniacal Nitrogen Trigger Values for different Stages of development

Stage	Following Competition of Stage 1				Following Competition of Stage 2B	
Source	NPS National Bottom Line		NIWA Indicative Guideline for protection of the Fingernail Clam		NIWA Indicative Guideline for protection of Freshwater Mussels	
Statistic for assessment	Annual Median[1]	Annual Maximum[1]	Annual Median[1]	Annual 95th percentile[1]	Annual Median[1]	Annual 95th percentile[1]
pH	Concentration (g/m3)					
6.7	2.38	5.81	1.43	2.43	0.63	1.06
6.8	2.33	5.70	1.40	2.38	0.62	1.04
6.9	2.26	5.52	1.36	2.31	0.60	1.00
7.0	2.18	5.32	1.31	2.23	0.58	0.97
7.1	2.08	5.08	1.25	2.13	0.55	0.92
7.2	1.99	4.86	1.19	2.03	0.53	0.88
7.3	1.88	4.60	1.13	1.92	0.50	0.84
7.4	1.75	4.27	1.05	1.78	0.47	0.78
7.5	1.61	3.94	0.97	1.65	0.43	0.72
7.6	1.47	3.59	0.88	1.50	0.39	0.65
7.7	1.32	3.23	0.79	1.35	0.35	0.59
7.8	1.18	2.88	0.71	1.21	0.31	0.52
7.9	1.03	2.51	0.62	1.05	0.27	0.46
8.0	0.90	2.20	0.54	0.92	0.24	0.40
8.1	0.78	1.91	0.47	0.80	0.21	0.35
8.2	0.66	1.61	0.39	0.67	0.18	0.29
8.3	0.56	1.36	0.33	0.57	0.15	0.25

Note 1 - Based on a minimum of 12 samples per year collected monthly.

8. If monitoring undertaken under the conditions of these consents demonstrates any of the Schedule 2: Condition 7 trigger values are exceeded then the Consent Holder shall undertake an investigation into the effects of the discharge from the Featherston WWTP, taking into account the likely effects of upstream contamination and having regard to the extent of any improvements in QMCI and MCI upstream and downstream of the discharge since the consents commenced. The findings shall be reported in the annual report required by Schedule 1: Condition 22.

9. The discharge of treated wastewater to Donald Creek shall occur in accordance with the certified Discharge to Land and Water Management Plan (Schedule 1: Condition 3, Table 2).

Monitoring

Wastewater Quality Monitoring

10. The Consent Holder shall monitor wastewater quality discharged to Donald Creek from the outlet of the UV plant on a monthly basis in accordance with Schedule 6: Table 1 and maintain records in accordance with the approved Discharge to Land and Water Management Plan (Schedule 1: Condition 3, Table 2).

Stream Flow Monitoring

11. The Consent Holder shall establish a permanent telemetered flow gauging site and measure stream flow for Donald Creek at a suitable location upstream of the Featherston wastewater treatment plant discharge

point within 2 years of the commencement of consent. The method of establishment, measurement and operation including calibration of the flow gauge shall:

a. comply with standard AS3778 and

b. be detailed in the Environmental Monitoring Plan in accordance with Schedule 1: Condition 3.

c. be maintained using the following method:

i. Regular flow gauging of the site as per Schedule 6, Table 1 (monthly in Table 1)

ii. If the site reading differs from the flow gauging then the flow gauge profile shall be updated within 72 hours.

d. Collect flow monitoring data continuously every 15 minutes.

Results shall be submitted quarterly in accordance with Schedule 1: Condition 21.

Receiving Water Quality Sampling

12. Subject to Schedule 1: Conditions 15, the Consent Holder shall collect representative grab samples from Donald Creek according to the frequency, and constituents, and locations specified in Schedule 6: Table 1 and Figure 1, at:

a. The monitoring locations specified in Schedule 6: Table 2 and Figure 1 (until such time as the Environmental Monitoring Plan is certified pursuant to Schedule 1: Condition 6); and

b. The monitoring locations specified in the Environmental Monitoring Plan (following its certification approval pursuant to Schedule 1: Condition 6); and

c. All sites shall be sampled on the same day and the surface water sampling day shall coincide with the wastewater effluent sampling day pursuant to Schedule 1: Condition 12.

d. Following commencement of Stage 2B, the discharge shall be monitored during the months of July and August and a sample taken when discharge is occurring. If discharge does not occur during these months, a sample shall be taken on the last working day of that month.

Macroinvertebrate, Periphyton, Algae and Deposited Sediment Sampling

13. The Consent Holder shall have an appropriately qualified and experienced ecologist undertake a summer and winter ecological survey of Donald Creek to determine the effect of the discharge on the aquatic ecosystem. The survey shall be undertaken within one year of implementing Stage 1 and annually for three years. The frequency of survey thereafter shall decrease to every five years.

These surveys should be conducted after at least a two week period without a significant flood event (defined as an instantaneous river flow exceeding three times the estimated median flow in Donald Creek) and following at least two days of discharge in the two weeks preceding the discharge.

The ecology survey on Donald Creek shall be undertaken at two sites upstream and two sites downstream of the discharge.

Detailed methods for the survey shall be provided in the Environmental Monitoring Plan certified pursuant to Schedule 1: Condition 5. As a minimum the survey shall include assessment of:

a. Periphyton cover and biomass at sites upstream and downstream of the discharge.

b. The presence and cover of any nuisance heterotrophic growths on the stream bed.

c. Aquatic macroinvertebrate community by collecting a minimum of five replicate Surber samples at each site using Protocol C3 of Stark et al. (2001)

d. The amount of fine sediment on the stream bed using the Shuffle Index.

Advice Note 4: *If suitable flow and discharge conditions do not occur to allow a survey then the survey may be postponed until the following year.*

Reporting

14. The findings and results of monitoring undertaken in accordance with Schedule 2: Condition13 (including assessment against the parameters in Schedule 2: Condition 7) shall be incorporated and submitted in annual reports, as required by Schedule 1: Condition 22.

Review of monitoring sites

15. The Consent Holder shall undertake an assessment of the appropriateness of historic water quality and ecological monitoring sites in terms of providing meaningful and robust monitoring data to achieve the intent of these conditions. Any recommendations for additional, reduced, or relocated monitoring locations shall form part of the draft Environmental Monitoring Plan submitted to the Manager, Environmental Regulation, Wellington Regional Council in accordance with Schedule 1: Condition 4.

Schedule 3: Conditions for WAR120294 [31761] - Discharge permit to discharge contaminants and odours to air from oxidation ponds and other operational activities and from land discharge of treated effluent.

1. There shall be no discharges of odour to air that are noxious, dangerous, offensive or objectionable resulting from the operation of the Featherston WWTP, at or beyond the boundary of the WWTP site as designated in the Wairarapa Combined District Plan.

2. There shall be no discharges of odour to air that are noxious, dangerous, offensive or objectionable resulting from the discharge of wastewater to either Site A or Site B Land Treatment sites, at or beyond the boundary of the respective wastewater discharge area.

3. There shall be no spray drift that is noxious, dangerous, offensive or objectionable resulting from the discharge of wastewater to either Site A or Site B Land Treatment sites, at or beyond the boundary of the respective wastewater discharge area (but excluding any effects from discharge to land with the boundary of the designated WWTP site.

4. The management of odour from the Featherston WWTP shall be undertaken in accordance with the certified Odour Management Plan (Schedule 1: Condition 3, Table 2).

Schedule 4: Conditions for WAR12094 [XXXXX] - Discharge permit to discharge treated wastewater to land via a land discharge system

Discharge Rate and Quality

1. Except as allowed for in the Discharge to Land and Water Management Plan required in accordance with Schedule 1: Condition 3, the discharge of treated wastewater to land shall not exceed the following rates:
   a. Stage 1 Land Treatment: Site A 1,520 m^3/day, Site B 4,950 m^3/day
   b. Stage 2 Land Treatment: Site A 1,520 m^3/day, Site B 7,975 m^3/day

2. The wastewater hydraulic loading rate shall not exceed the following:
   a. 19 mm in any 24 hour period to Site A; and
   b. 55 mm depth per week, and no more than 55 mm in any 24 hour period to Site B.

3. Any treated wastewater discharged shall meet the following standards:
   a. The concentration of BOD_5 shall not exceed 35 g/m^3 in more than 3 out of any 12 consecutive monthly test results;
   b. The concentration of TSS shall not exceed 100 g/m^3 in more than 3 out of any 12 consecutive monthly test results;
   c. E coli values shall not exceed 100 cfu per 100 millilitres in more than 5 of 10 consecutive monthly test results;
   d. The nitrogen loading rate, as a consequence of:
      i. The exercise of this permit; and/or
      ii. The application of nitrogen based fertiliser; and/or
      iii. The disposal of any other waste.

   shall not exceed a maximum of 300 kgN/ha/yr from any source and is to be determined from the average of 12 consecutive monthly effluent quality test results and the average monthly discharge volume applied to land, collected in accordance with Schedule 4 Conditions 11 and 12 and any applied rates of other sources, except as described in Condition 4.

4. Should the nutrient loading rates in Condition 3 be exceeded, the equivalent additional mass of nutrient loading over and above that in Condition 3 shall be removed from the area to which it has been applied in harvested material.

   Advice Note 1: *Nutrient loading over and above the grazed maximum requires harvesting as hay or silage, or some form of crop removal. The efficacy of the additional removal shall be demonstrated by recording the mass of herbage or crop removed and its nutrient concentration in accordance with the Environmental Monitoring Plan (Schedule 1: Condition 3 Table 2). The details of this harvesting regime shall be detailed in the Discharge to Land and Water Management Plan (Schedule 1: Condition 3 Table 2).*

5. The detailed design of the land discharge proposed for Stage 1 shall be included in the Discharge to Land and Water Management Plan (Schedule 1: Condition 3, Table 2).

6. The detailed design for Stages 2A and 2B land discharge shall be included within any revision to the Discharge to Land and Water Management Plan in accordance with Schedule 1: Condition 9.

7. The land discharge for all Stages shall be designed, where practicable, to ensure that the discharge of treated wastewater to the land discharge areas shall:
   a. Be evenly distributed to the entire area being utilised for land discharge;

b. Not cause runoff or surface ponding;

c. Not lead to the development of anaerobic soil conditions; and

d. Avoids the discharge of wastewater to land within 125m of the property boundary, except that wastewater may be discharged to land within 25m from the property boundary where:

i. Median E. Coli. concentrations meet or are less than 100cfu/100ml; and

ii. Irrigation is at low pressure (less than 1.4 bar);

iii. Where wind speed does not exceed 12m/s (or 4 m/s sustained for a period of 15 minutes or more) in a direction toward an existing dwelling (at the time of commencement of these consents) on an adjoining site within 150m of the irrigation area.

8. The discharge of treated wastewater to land discharge areas shall occur in accordance with the certified Discharge to Land and Water Management Plan (Schedule 1: Condition 3, Table 2).

Confirmation of Land Treatment

9. The Consent Holder shall confirm in writing to the Manager, Environmental Regulation, Wellington Regional Council the commencement date of any land discharge in all Stages, including any transitional operational requirements to give effect to land discharge. This confirmation shall be provided no less than 20 working days prior to any discharge occurring on the respective land treatment site.

10. A copy of the confirmation required by Schedule 2: Condition 9 shall also be provided to the members of the Community Liaison Group no less than five working days after the Manager, Environmental Regulation, Wellington Regional Council, has been advised.

Monitoring

11. The Consent Holder shall continuously measure and maintain daily records of wastewater flows entering the Featherston WWTP and the volume and location of treated wastewater discharged to land discharge areas.

12. The Consent Holder shall monitor the quality of the wastewater to be discharged to the land discharge areas from the outlet of the UV plant in accordance with Schedule 6: Table 1 and maintain records in accordance with the approved Discharge to Land and Water Management Plan (Schedule 1: Condition 3, Table 2).

13. The Consent Holder shall record crop and pasture management practices across the land discharge areas in accordance with the approved Discharge to Land and Water Management Plan (Schedule 1: Condition 3, Table 2), including:

a. Stock type, number and location

b. Cultivation date;

c. Sowing date;

d. Fertiliser applications;

e. Harvesting; and

f. Any other management practices

14. The Consent Holder shall carry out groundwater sampling according to the constituents and frequency specified in the Environmental Monitoring Plan (Schedule 1: Condition 3, Table 2); and samples shall be taken in accordance with the most recent version of Wellington Regional Council's groundwater sampling protocol.

15. During all Stages, the Consent Holder shall undertake soil monitoring in accordance with the Environmental Monitoring Plan (Schedule 1: Condition 3, Table 2) during the period of September and October every second year to assess soil health and performance of the land discharge scheme.

Reporting

16. The findings and results of monitoring undertaken under Schedule 4: Conditions 11 to 15 shall be incorporated and submitted in the Quarterly and Annual Reports (Schedule 1: Condition 21 and 22) including an overall monthly site nitrogen budget, outlining the nitrogen inputs and outputs for each month, as well as the deficit/surplus each month, collected in accordance with Schedule 4: Condition 3.

Schedule 5: Conditions for WAR12094 [31762] - Discharge permit to discharge treated wastewater to land via seepage from FWWTP oxidation ponds and discharge channel

Discharge Rate

1. The rate of discharge to land (and subsequently groundwater) from the base and sides of the oxidation and maturation ponds and base and sides of the discharge channel via seepage is for 24 hours per day, 7 days per week, 52 weeks per year.

Monitoring

2. The consent holder shall complete, on a 10 yearly basis, a pond water balance assessment to determine the volume of seepage that may be occurring. The first of these assessments shall be completed within 36 months of the date of commencement of these consents.

Reporting

3. Results shall be analysed and reported to Wellington Regional Council including any recommended actions, such as groundwater monitoring, as part of the first Annual Report (Schedule 1: Condition 23) following the conclusion of the each water balance assessment and analysis required by Schedule 5: Condition 2.

Schedule 6: Monitoring Summary

Table 1: Sampling Parameters, Frequency and Location

Location	Plant Inlet	Plant Outlet	Land discharge area	Donald Creek	Groundwater sampling (Land discharge area)
Constituent	Pre inlet to pond	Post UV		At locations in Table 2 and Figure 1 until the Environmental Monitoring Plan is certified in accordance with Schedule 1: Condition 5	At locations set out in the Environmental Monitoring Plan certified in accordance with Schedule 1: Condition 5.
Flow	Every 15 minutes	Every 15 minutes	Daily		Water level below top of casing monthly
Inspection	Daily	Daily	Daily		Monthly
Pond level		Daily			
UV Dosage			Daily		
Total Biological Oxygen Demand (BOD_5)		Monthly		Monthly	
Soluble carbonaceous Biological Oxygen Demand ($scBOD_5$)		Monthly		Monthly	
Suspended Solids (TSS)		Monthly		Monthly	
E. coli		Monthly		Monthly	
Ammoniacal Nitrogen (NH4-N)		Monthly		Monthly	April and September
Nitrate-Nitrite Nitrogen (NOx-N)		Monthly		Monthly	April and September
Total Nitrogen (TN)		Monthly		Monthly	April and September
Total Phosphorus (TP)		Monthly		Monthly	April and September
Dissolved Reactive Phosphorus (DRP)		Monthly		Monthly	April and September
pH		Monthly		Monthly	
Conductivity		Monthly		Monthly	
Temperature		Monthly		Monthly	
Clarity (black disc)		Monthly		Monthly	
Dissolved Oxygen (DO)		Monthly		Monthly	
Colour				Monthly	

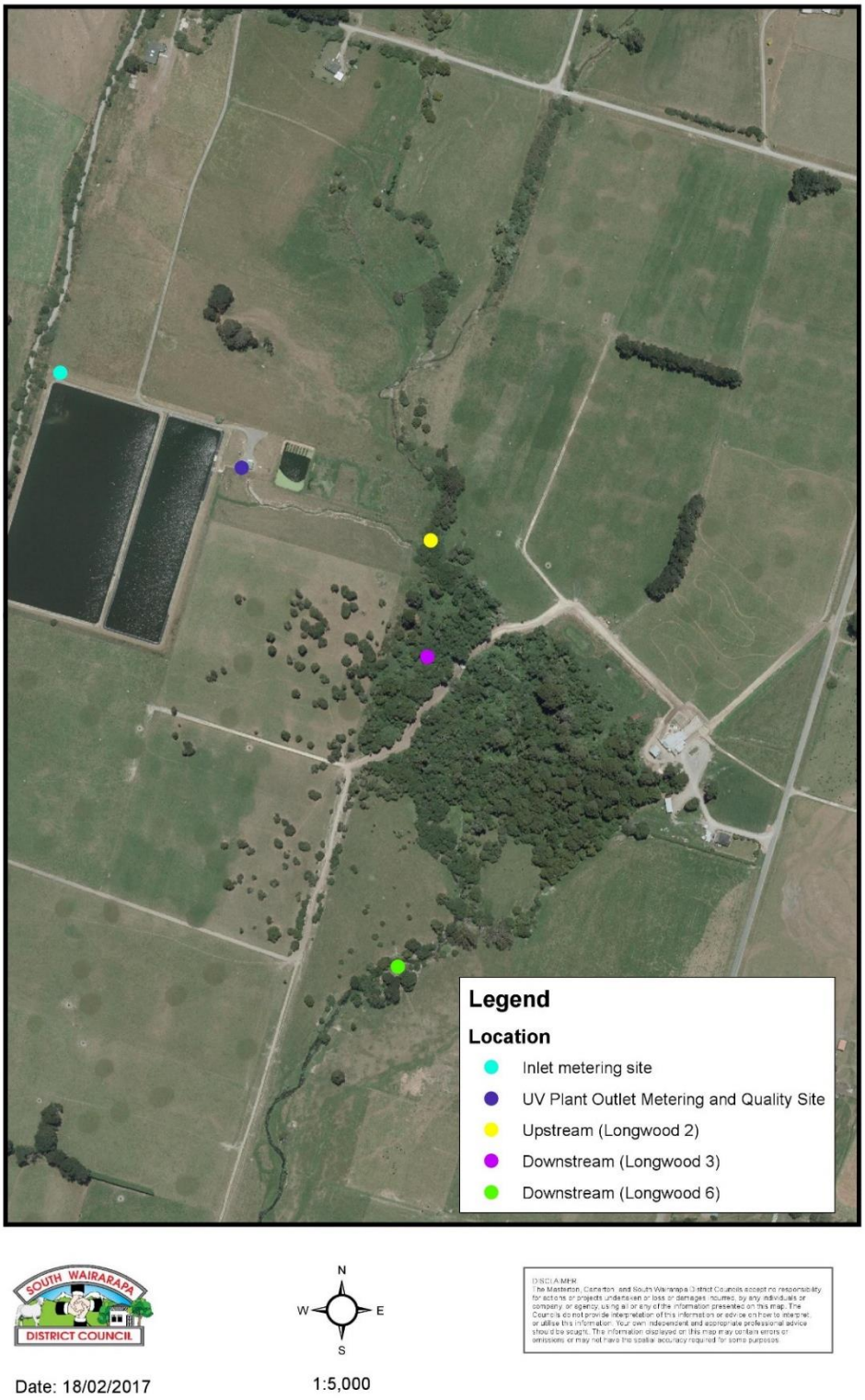
Advice Note 1*: Schedule 1: Condition 12 applies to Schedule 6: Table 1 to the extent that where an approved management plan or manual (including any review in accordance with Schedule 1:Condition 9) contains a parameter, frequency, or detection limit which differs from those specific methodologies contained within this table, the management plan or manual methodology shall prevail. This is to ensure that current appropriate industry methodologies can be applied without the need for an unnecessary variation to conditions (subject to the endorsement of the Manager, Environmental Regulation, Wellington Regional Council).*

Table 2: Monitoring Sites

APPROXIMATE SAMPLING SITE LOCATION	NZTM N	NZTM E
A. Wastewater Sampling Site		
UV Treatment Plant Outlet	5443488	1795090
B. Featherston Receiving Water (Donald Creek)		
Featherston Upstream (Longwood 2)	5443416	1795270
Featherston Downstream (Longwood 3)	5443361	1795297
Featherston Downstream (Longwood 6)	1795241	5442983
C. Macroinvertebrate Monitoring Sampling Sites		
Featherston 100 m Upstream (Site 1)	5443729.8	1795256.3
Featherston 25 m Upstream (Site 2)	5443644.1	1795288.8
Featherston 50 m Downstream (Site 4)	5443113.1	1795283.4
Featherston 450 m Downstream (Site 5)	5443115.6	1795191.1
D. Groundwater Sampling Sites		
[To be confirmed in the Environmental Monitoring Plan]		

***Advice Note 2**: Schedule 1: Condition 12 applies to Schedule 6: Table 2 to the extent that where an approved management plan or manual (including any review in accordance with Schedule 1: Condition 9) contains a monitoring location which differs from those specific methodologies contained within this table, the management plan or manual methodology shall prevail. This is to ensure that current appropriate industry methodologies can be applied without the need for an unnecessary variation to conditions (subject to the endorsement of the Manager, Environmental Regulation, Wellington Regional Council).*

Figure 1: Indicative WWTP flow and water quality monitoring site locations



***Advice Note 3**: Schedule 1: Condition 12 applies to Schedule 6: Figure 1 to the extent that where an approved management plan or manual (including any review in accordance with Schedule 1: Condition 9) contains a monitoring location which differs from those shown on Figure 1, the management plan shall prevail.*

Figure 2: Indicative ecological monitoring site locations

Advice Note 4: *All Sites refer to 25m long reaches of the Creek that have been sampled under previous consents, and are included here to ensure consistency).*

Advice Note 5*: Schedule 1: Condition 12 applies to Schedule 6: Figure 2 to the extent that where an approved management plan or manual (including any review in accordance with Schedule 1: Condition 9) contains a monitoring location which differs from those shown on Figure 2, the management plan shall prevail.*

Schedule 7: Community Liaison Group Terms of Reference

Purpose

The purpose of the Community Liaison Group (CLG) is to provide a forum for discussion and the exchange of information and to create and maintain channels of communication between the community, South Wairarapa District Council (SWDC), and Greater Wellington Regional Council (GWRC) on any issues or developments arising from the operation of the Featherston Wastewater Treatment Plant (FWWTP) and the discharge of treated effluent to land both at the FWWTP adjacent Site A and Site B. The CLG does not have a regulatory function.

The CLG will work in a collaborative manner with the CLGs for the Greytown and Martinborough WWTP's, including joint meetings and resourcing. This is intended to provide efficiency, and also facilitate the catchment approach outlined in the SWDC Wastewater Strategy.

Membership

The CLG will be open to the following members:

- Featherston Community Board (1 representative)
- Featherston residents (Any submitter and/or resident - two representatives)
- South Wairarapa District Council (1 representative)
- Wellington Regional Council (1 representative)
- Kahungungu ki Wairarapa (1 representative)
- Rangitane o Wairarapa iwi (1 representative)

Where a community representative steps down, the position will be filled with a replacement person agreed by the majority of the remainder of the CLG. The Chairperson will be appointed by a majority of the CLG, provided however, that if considered necessary and appropriate, SWDC may appoint an independent Chairperson from outside of the CLG membership.

Activities

The CLG meetings will provide a forum for:

a. Updating CLG members about Featherston WWTP and its upgrade and operation, including progress and notice of any changes to work schedules and/or general compliance with resource consents;
b. Discussion of specific questions and/or issues arising from the operation and upgrade of Featherston WWTP on behalf of the community;
c. Explaining technical matters to the members of the CLG;
d. Collating comments to be provided to GWRC on any of the management plans set out in the conditions of these resource consents, within the required Schedule 1: Condition 4 Table 2 timeframe;
e. To discuss compliance/non-compliance with conditions of consent and for SWDC to explain actions taken or to be taken to comply with conditions; and
f. Identifying relevant items to be included on the relevant SWDC website project page

Role/responsibility of SWDC

a. Organise administrative support at meetings, including recording of minutes and circulating minutes within appropriate timeframes;

b. Maintain and regularly update the SWDC website to include relevant information relating to the FWWTP;
c. Provide project staff/advisers to attend meetings as required to respond to technical questions raised;
d. Make technical staff available to the CLG to explain any technical reports, management plans, technical processes and current FWWTP upgrading status;
e. Provide copies of the reports and plans required by Schedule 1 to the CLG members. Where appropriate this will be email link rather than hard copy;
f. Follow up relevant action items in an appropriate timeframe; and
g. Advise the CLG of actions I feedback following any issues raised in this forum

Role/responsibility of Chairperson

Advice Note 1: *The suggested role of the Chairperson is:*

a. The orderly running of the meetings in a fair and independent way.
b. Ensure adherence to the agenda and enforcement of the Group's Terms of Reference.
c. Manage the collation and distribution of comments from the CLG on the various management plans;
d. Work with CLG members to set meeting agenda items;
e. Monitor progress on action items to ensure they are undertaken within
f. appropriate timeframes; and
g. Final sign-off and authority for any matters on behalf of the CLG.

Role/responsibility of GWRC member

Advice Note 2: *The suggested role of the GWRC is:*

a. Providing a conduit between SWDC and the GWRC by disseminating information from the CLG and keeping colleagues informed;
b. Making technical staff available to the CLG as required;
c. Keeping the CLG informed of compliance / non-compliance with conditions; and
d. Explaining any reasons for compliance decisions or actions taken by GWRC.

Role/responsibility of iwi and community representative members

Advice Note 3: *The suggested role of iwi and community representatives is:*

a. Representing their iwi, communities, organisations or interest groups and bringing forward issues, concerns and ideas raised by their members to CLG meetings;
b. Providing a conduit between SWDC, iwi, and the community by disseminating information from the CLG and bringing feedback to meetings;
c. Passing updates and information discussed at the meetings to iwi and the community;
d. Reporting iwi and community concerns and issues to the CLG;
e. Assisting the CLG with any relevant local knowledge;
f. Providing input into the FWWTP project updates for the SWDC website; and
g. Co-ordinating iwi and community input into the Schedule 1 Management Plans and assisting with providing related comments to GWRC through required reporting.

General role/responsibility of all CLG members

Advice Note 4: *The suggested role of all CLG representatives is:*

a. Committing to abide by the Terms of Reference;
b. Regularly attending and participating in CLG meetings;
c. Advising the Chairperson in advance if they are not attending a meeting;

d. Suggesting agenda items for discussion at CLG meetings;

e. Respecting the confidentiality of items of business which SWDC may determine are confidential in nature;

f. Abiding by the CLG's media and public speaking protocol; and

g. Ensuring that any define timeframes are met.

Meeting procedure

a. The CLG will meet quarterly from its inauguration or as otherwise agreed by the CLG members. Members who cannot attend a meeting should give their apologies in advance to the Chairperson. Community representatives may send a nominee to a meeting in their place.

b. All questions asked during or in between meetings should be directed via the Chairperson. Questions without notice received during meetings may be addressed if possible, otherwise added to the agenda for a later meeting.

c. SWDC will provide the secretariat for the CLG. SWDC is responsible for the cost of all administration of the meetings.

d. Detailed minutes will be kept by SWDC as a record of the meeting and these will be ratified at the following meeting, subject to any amendment proposed by any member of the CLG.

e. Meeting agendas, papers and notes will be distributed by SWDC to CLG members no less than three days prior to or following each meeting.

f. Confirmed agendas and minutes will be loaded into the FWWTP project webpage by SWDC. CLG members may distribute these confirmed documents more widely.

g. Members of the public wishing to attend a meeting should advise a CLG representative and/or the Chairperson in advance. The Chairperson should advise the rest of the CLG of this in advance of the meeting commencing.

h. Members of the public will have no speaking rights. Any questions from members of the public should be sent in advance to the Chairperson or should be directed through a CLG community representative. The CLG retains the right to revert to closed meetings at any time and also close the meeting to the public for parts of the meeting at any time.

Remuneration

SWDC will not be responsible for any remuneration payable to CLG members for attendance at or participation in the CLG.

Featherston WWTP Project Updates

SWDC will develop and maintain a project webpage highlighting programs, status, and issues relating to the FWWTP project. The cost of producing and maintaining the webpage will be met by SWDC.

Media and public speaking

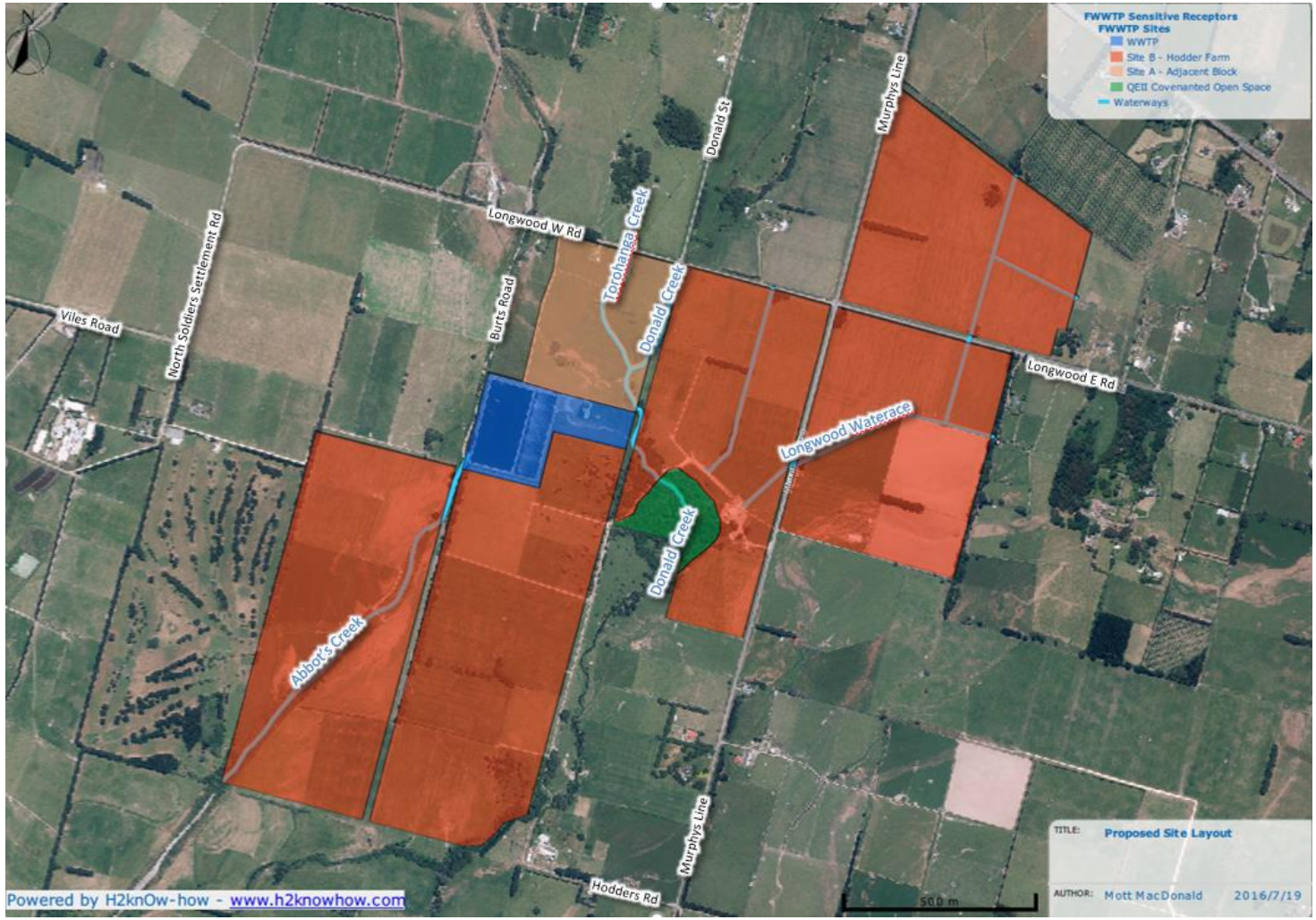
All media enquiries should be directed directly to SWDC. Community representatives, including the chair of the CLG approached to provide comment on the project, consents, or the CLG should make clear their response is a personal *view,* rather than the collective *view* of the CLG. As a courtesy, community representatives asked for media or public comment, should advise the Chairperson prior to providing comment, or as soon as possible afterwards (if it is not practicable to *advise* prior).

Review

These terms of reference may be reviewed and amended, as agreed by all CLG members.

Schedule 8: Irrigation Area Layout Plan

Figure 3: Proposed Featherston Land Application Scheme Layout Plan



1 Introduction

South Wairarapa District Council ("SWDC") is legally responsible for the operation of wastewater treatment and disposal facilities throughout the District. These include facilities in Featherston, Martinborough, and Greytown, as well as a small community scheme at the Lake Ferry township. Resource consents for Martinborough and Greytown have recently been granted, whilst Featherston requires replacement resource consents to continue operating.

There are increasing demands and pressures on authorities to decrease the actual and potential effects of wastewater treatment and disposal on the environment, coupled with the increasing financial pressures on small community ratepayers. SWDC has responded to this challenge by developing a comprehensive long-term integrated strategy for wastewater management in the District. The Strategy is focussed on the treatment of wastewater through land, and removal of effluent from local rivers and streams.

This document outlines the proposal to undertake a two-staged upgrade to the Featherston Wastewater Treatment Plant (**"FWWTP"**) to an irrigation based land treatment regime (**"the Project"**), including upgrades to the Featherston underground sewerage network.

The first stage of the Project (**"Stage 1"** – within 2 years of consent commencement) involves a comprehensive programme of rehabilitation of the underground sewerage network. Investigations have indicated that as much as 74% of the wastewater reaching the treatment plant is groundwater or stormwater which has entered the network (termed inflow and infiltration or **"I&I"**). This is likely to be a mix of illegal stormwater connections and "leaky" pipes. To adequately treat this volume of wastewater is not affordable for the South Wairarapa community. Stage 1 therefore involves the rehabilitation of the underground network, targeting areas where the leakage is greatest.

Some minor upgrades to the existing pond system are also proposed to ensure it is performing at its optimal level and an initial phase of land treatment will be commissioned. The initial land treatment will see approximately 56% of the annual treated wastewater removed from Donald Creek and applied to 78ha of land adjacent to the existing WWTP ("Site A") and "Hodder Farm" ("Site B") when soil moisture allows, with a majority of the discharge removed from Donald Creek during summer months (**Stages 1A and 1B**).

The second stage of the project (**"Stage 2"**) will see the land treatment scheme expanded to between 70 - 116ha of Site A and B for treated wastewater irrigation (**Stage 2A** – 10 years from consent commencement), with additional wastewater storage to follow (**Stage 2B** – 20 years from consent commencement).

As a consequence of the high flows received at the plant (even following the proposed targeted reduction in network leakage), the storage required to enable a "full" land treatment scheme has been determined as unfeasible in terms of cost to the South Wairarapa Community, constructability and ongoing operation. Therefore, for Featherston a land treatment scheme with allowance for contingency for discharge to Donald Creek above the 90th percentile storage requirements is proposed. Such contingency discharges are predicted to occur during the winter months of July and August and 8 years out of 11 modelled. The contingency discharge will target stream flows within Donald Creek above 3 x median and 2 x median in order of priority as far as practicable to mitigate effects on the environment.

The Project takes full recognition of the limitations of the existing wastewater treatment networks, actual and potential effects of the Project on the receiving environment, and the expectations and significant financial constraints faced by the South Wairarapa Community. The proposal represents the best practicable option (**"BPO"**) in terms of the Resource Management Act 1991 (**"RMA"**), and more importantly is a fully considered and sustainable proposal which will avoid impacts on the long-term economic wellbeing of the South Wairarapa community while providing for their health and safety.

1.1 SWDC District Wide Wastewater Management Strategy

This section outlines the strategic approach to wastewater management adopted by SWDC.

Following extensive review of historic practices and the WWTP assets, community consultation was undertaken to confirm constraints, opportunities, and priorities. The outcome was the SWDC Wastewater Strategy[1] (**"the Strategy"**). A copy of this document is included as Appendix 1.

The Strategy is recognised and implemented through SWDC's management documents, including the Long Term Plan and Annual Plan. The Strategy has been the guiding principle in developing the Project for which consents are now sought.

The key aspects of the Strategy in terms of this Project are outlined below.

1.1.1 The SWDC Long Term Plan and Project Vision

The SWDC Long Term Plan[2] ("**LTP**") states SWDC's goal with respect to the Significant Activity of Waste Water. This goal has been adopted as the 'Project Vision' for the urban WWTP upgrade programme:

> *To collect, treat, and discharge wastewater from the urban areas of Featherston, Greytown, and Martinborough and the coastal settlement of Lake Ferry so as to provide public health protection with minimal effects on the environment.*

1.1.2 SWDC's Strategic Approach to Wastewater Treatment and Disposal

The key aspects of the Strategy adopted are as follows:

- Due to the significant capital costs involved and financial constraints of the SWDC community, to take a long-term view of solutions (50+ year horizon) in an integrated way across all three urban WWTP's.
- The need to develop the best practicable option[3] (**"BPO"**) for each site and on a combined basis, offering a high degree of performance certainty fundamentally based on parameters of; risk, public health, environmental effects, and community affordability.

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1 The Wastewater Strategy remains in a 'final draft' form. It will be reviewed following grant of the current consents for all three urban plants to ensure that review is fully informed.

2 SWDC Long Term Plan 2015-25 (Adopted 24 June 2015); P58

3 Best Practicable Option is defined in the Resource Management Act 1991 as

"in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—

(a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and
(b) the financial implications, and the effects on the environment, of that option when compared with other options; and
(c) the current state of technical knowledge and the likelihood that the option can be successfully applied"

- To ensure continued consultation with key stakeholders, including iwi, and community groups (which has been ongoing since 2008), and Greater Wellington Regional Council (**"GWRC"**, as the regulator) in developing and implementing the preferred long-term options.
- To obtain the required degree of certainty through a commitment in the short-term to optimise performance of the existing plant where practicable, and implement the preliminary stages of the best practicable option at each site.
- Deliver sustainable projects based on the philosophy of implementing the best practicable option and "Do it once – Do it Right".

These overriding principles underlie the proposed activity as described in this report, and the respective separate proposals for the WWTP's at Martinborough and Greytown.

1.1.3 SWDC approach to developing the WWTP Projects

SWDC have undertaken a comprehensive process in developing the Project at the three sites extending over four years of reviews, technical investigations and option assessments, consultation and engagement with key stakeholders. These are outlined in detail as relevant throughout the report, but the following were fundamental in determining the Project.

1.1.3.1 Affordability

The South Wairarapa community is one of the smallest and most economically constrained in New Zealand. In addition, it has not one but three full urban WWTP's to operate, maintain, and upgrade as regulations and expectations change. Following the development of the Wastewater Strategy, SWDC have identified a budget of over $31million for its implementation across all three sites. The assumption through this process is that works will be fully funded by ratepayers as no government or other subsidy is currently available nor confirmed as proposed, and "public-private partnerships" have proven difficult and unsuccessful for similar schemes throughout NZ. As a result, the spending must be spread over a sufficient timeframe so as to not result in unaffordable increases in rates (either from direct spending or the cost of borrowing).

The affordability assessment concluded that the new capital funding must be spread over at least 28 years (from 2012 to 2040) in order to be sustainable, which is reflected in the capital programme proposed.

1.1.3.2 Assessment of Available Treatment Upgrade Options

A comprehensive assessment of the available options for the Featherston WWTP has been undertaken by SWDC (refer Appendix 2 & 3, and Section 7.3). Whilst there are upgrade options which technically could achieve significant improvements quickly, the affordability of those options over a short timeframe has made them unfeasible. For example, both full land treatment and a new high rate treatment plant were considered at current volumes, but these options are simply cost prohibitive. In addition, a combined scheme for all three sites was considered, including an option to convey treated wastewater from Carterton District, but these combined scheme options are significantly more costly and also include their own environmental, cultural, and consentability risks associated with higher volume and mixed wastewater. Short-term capital improvements to the ponds were considered to improve treatment at the plant until such time land treatment could be commenced (e.g. installing additional treatment during Stage 1) however this approach would require extending the programme to deliver the land treatment scheme (due to affordability), and therefore were discounted. In addition, some of the short-term treatment improvement options available would

become redundant under a land treatment regime, further increasing “sunk” costs and pushing out the implementation of the long-term solution.

For the Featherston plant a wide range of treatment upgrade and land based options were considered, prior to adopting the preferred option of land treatment. At Martinborough, alternative land disposal sites were investigated prior to the decision to use Pain Farm, and adopt storage to provide a full land treatment scheme. Similarly in Greytown, a range of options were considered, including piping the discharge directly to the Ruamahanga River (bypassing the Papawai Stream) in the short term, however, following purchase of the Papawai Farm, the option of full land treatment with deferred storage was adopted.

Refer to Section 7.3 for further description of the alternatives considered for Featherston WWTP.

1.1.3.3 Simultaneous vs Sequential Facility Upgrade, Prioritisation of Works & Catchment Approach

Following the affordability criteria and the best technical option at each facility being determined, the most appropriate construction programme over the three sites was considered. There are two possible programming scenarios:

Simultaneous development – where all three sites are developed at the same time;

or

Sequential development – where one facility is fully upgraded, then upon completion, the next facility is upgraded, and then the third facility following.

Sequential development would require SWDC to prioritise between the Ruamahanga River and Lake Onoke (Greytown and Martinborough), the Papawai Stream (Greytown), and Donald Creek, Abbot Creek and Lake Wairarapa (Featherston). There are a number of criteria which could be adopted to determine a priority, including for example sensitivity of the receiving environment to wastewater discharge, relative effects on the receiving environment, cultural significance, recreational use, and relative cost.

However, given the affordability criteria outlined above, the timeframe between each site would be approximately 10 years, meaning the third site would effectively require adopting a “do nothing” option for 20 years. It is considered that this would be inconsistent with the purpose of the RMA, and would not represent the BPO.

It has therefore been determined that the most appropriate programme is a catchment based one with a programme of managed incremental improvements across the three sites in a manner which optimises the improvement over the catchment in terms of the available budget.

The simultaneous catchment based upgrade programme adopted recognises that:

i. All three receiving environments ultimately discharge to Lake Onoke (Greytown and Martinborough via the Ruamahanga River & Papawai Stream; and Featherston via Donald Creek, Abbot Creek and Lake Wairarapa);
ii. All three sites have equally important (although different) cultural, community, and environmental significance which are inappropriate to arbitrarily prioritise;
iii. Water quality in all three receiving environments upstream of the discharge is significantly compromised by upstream point source and diffuse discharges outside of SWDC control, and which are subject to a complex but necessary much wider, long-term, and regionally integrated strategy;

iv. Although the contributing load of nutrients to the surface water is relatively low in terms of cumulative discharges in the wider catchments, the removal of nutrients in the short term during low-flow conditions will significantly decrease the contribution of nutrients from the wastewater discharges in terms of water quality for contact recreation and aquatic habitat, both key considerations across all three sites within the Wellington Regional Freshwater Plan objectives and policies;

v. All three plants[4] have existing land at the WWTP which is readily available and suitable for land treatment during low flow conditions;

vi. The Featherston sewerage network requires significant rehabilitation before any feasible long-term upgrade can be implemented, with a minimum ten-year timeframe;

vii. The Featherston discharge contributes to the mass loading of nutrients in Lake Wairarapa, a recognised significant water body. Deferring the commencement of improvement programmes for effluent quantity and quality would be inconsistent with the Regional Policy Statement and regional plans.

On balance, and considering relative risk, the improvements that can be achieved on an individual and catchment wide basis through a simultaneous upgrade programme are considered to provide the framework for the BPO.

1.1.4 Term of Consent

The implementation of the Strategy relies upon a level of certainty which can best be provided by a long term consent. As such, the applications seek the maximum term of 35 years. A full explanation and rationale of the proposed maximum term is included in Section 4.9 of this report.

1.1.5 Proposed Staging

The overall Strategy implementation is separated into two stages. These stages have been determined primarily on the basis of SWDC funding approval processes.

- **Stage 1** is the **"Short Term"** programme from the grant of consent **until June 30, 2025**, aligned to the current SWDC Long Term Plan (2015 – 2025).
- **Stage 2** is the "Medium Term" programme from **1 July, 2025 to 30 June, 2035**.

A third **"Long Term"** stage is identified, outside the term of this current application to "50 years plus", which continues the SWDC long-term Strategy.

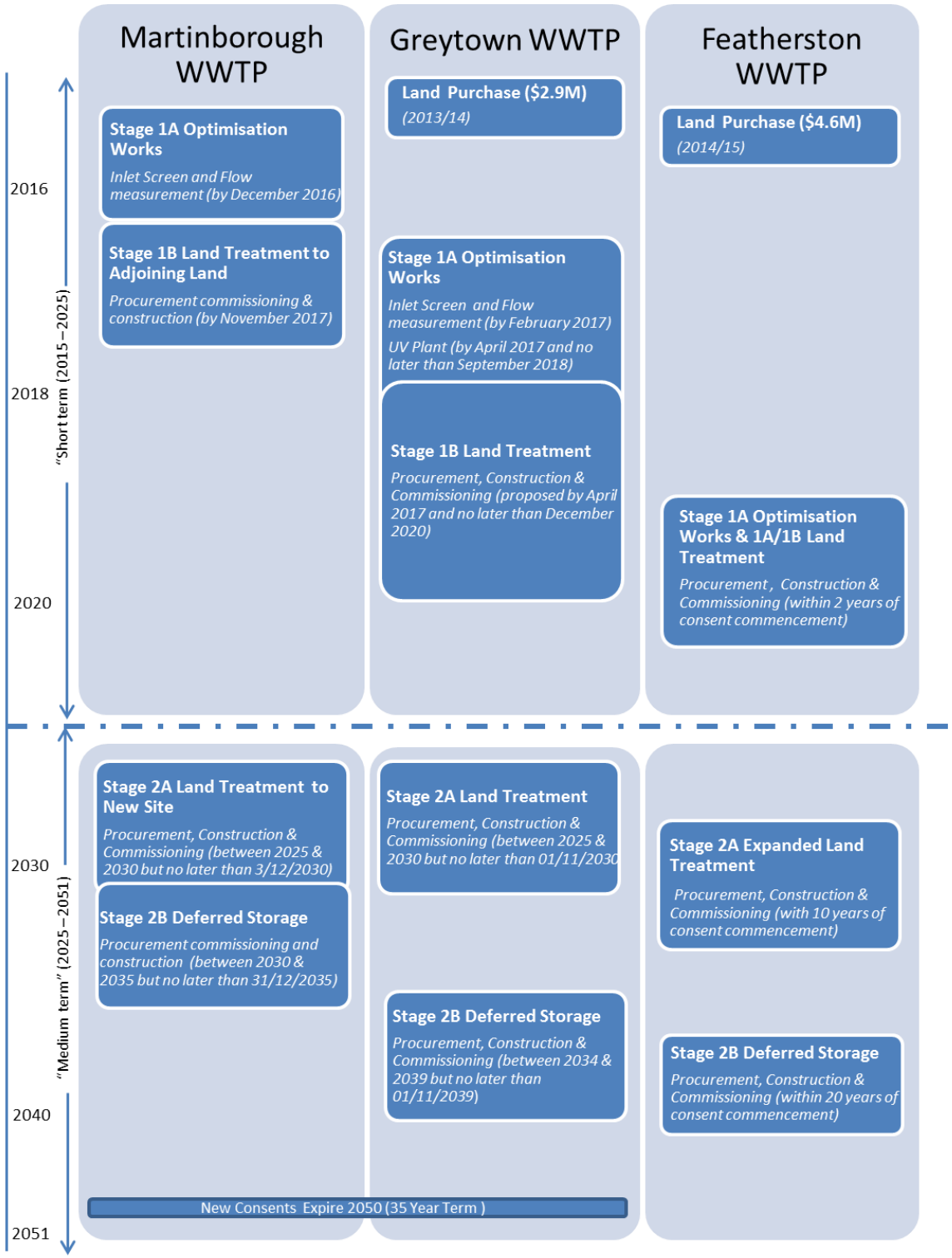
The proposed capital works within Stage's 1 and 2 have been developed through a process of:

- Determining relative adverse effects on the receiving environment across each of the three urban WWTP's ;
- Existing asset optimisation and performance; and,
- A review of feasible alternatives for sustainable long-term wastewater treatment at all three sites.

A prioritised programme of optimisation works and treatment upgrades was then developed across all three sites to deliver the BPO for each site, and deliver them collectively. Figure 1 below provides a summary of the works programme. This illustrates the Featherston upgrade in the context of the integrated programme across all three sites, as described above.

[4] Hodder Farm became available in Featherston and was purchased by SWDC in 2014.

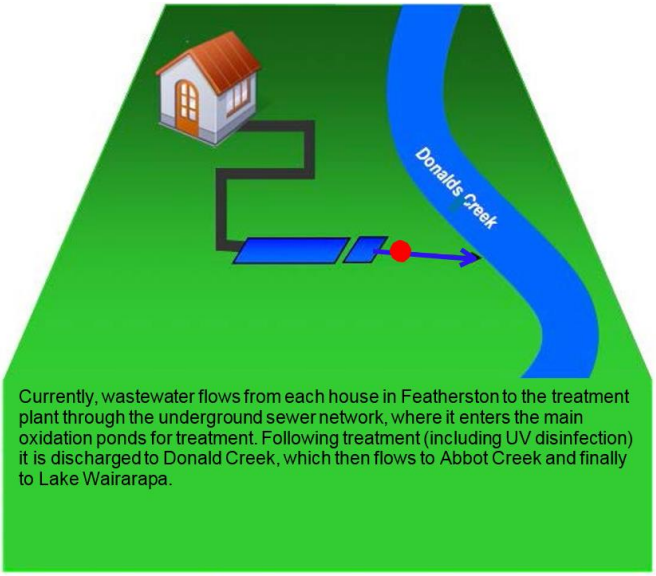
Figure 1: SWDC WWTP Upgrade Works Programme



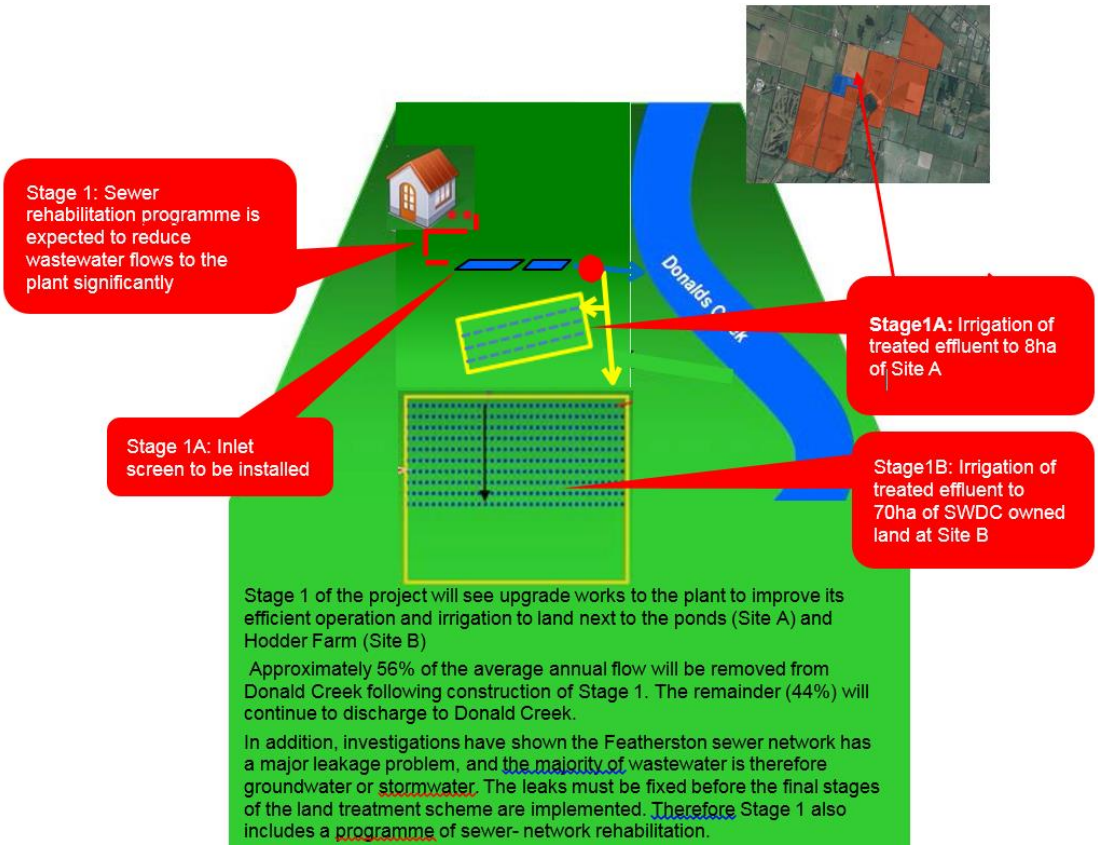
A schematic illustration of the proposed Project upgrades is provided in Figure 2.

Figure 2: Schematic of existing wastewater treatment process and proposed staged upgrade

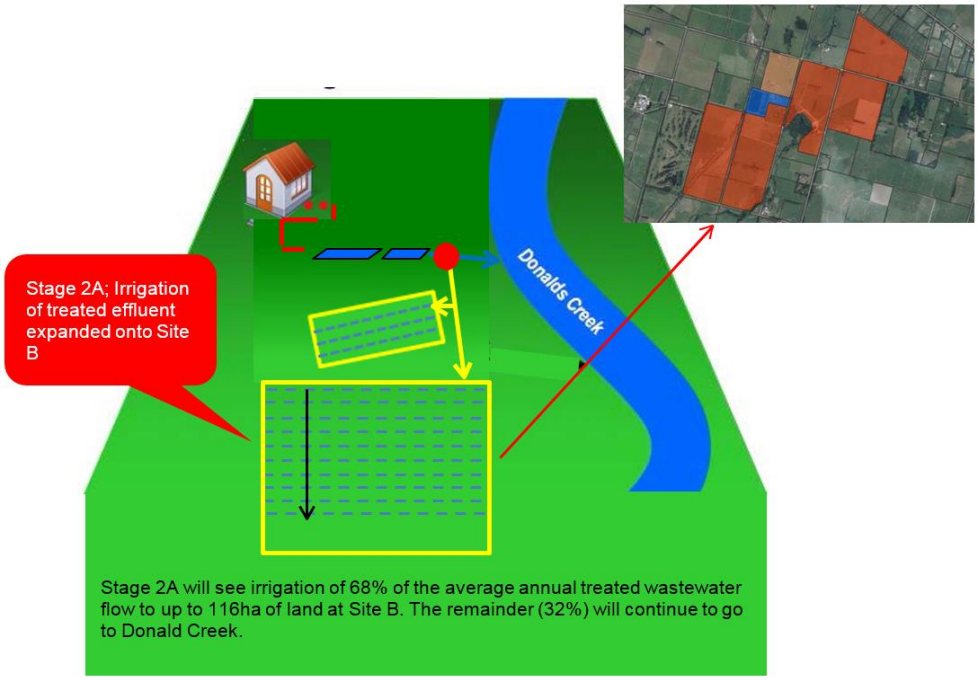
(a) Featherston WWTP Existing Situation



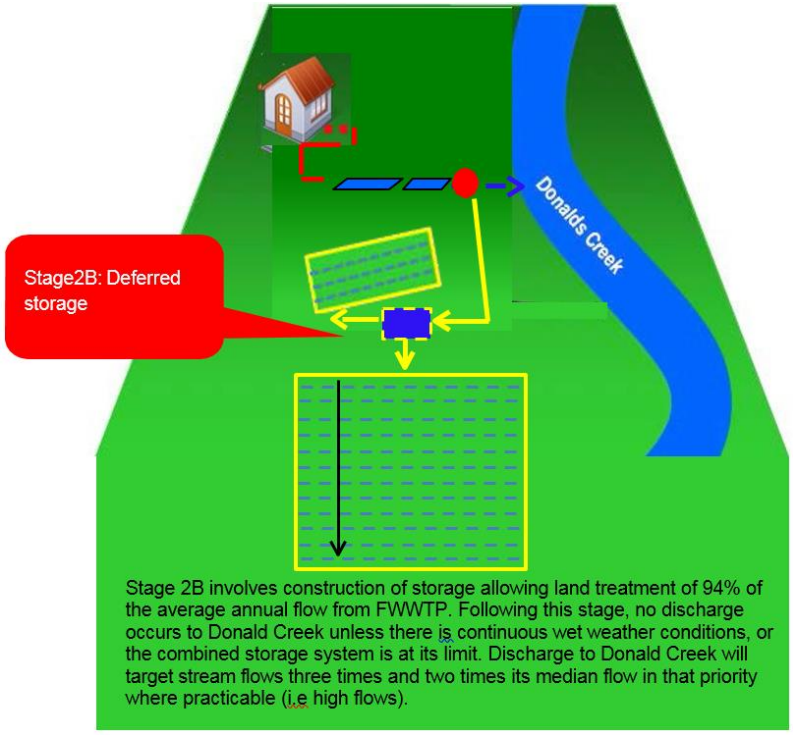
(b) Featherston WWTP: Stage 1



(c) Featherston WWTP: Stage 2A



(d) Featherston WWTP: Stage 2B



A detailed description of each stage of the Project is provided in Section 4.

Figure 3 and Figure 4 illustrate the predicted decrease in annual nutrient loads from the FWWTP to Donald Creek following the commissioning of the land treatment stages for two identified primary nutrients of concern (dissolved reactive phosphorus, and total nitrogen) (refer

to the line graph). Whereas the pie charts show the treatment plants fully mixed downstream seasonal nutrient load contributions to Donald Creek.

Figure 3: Indicative reduction in annual DRP load to the receiving environment as a result of the proposed staged upgrades

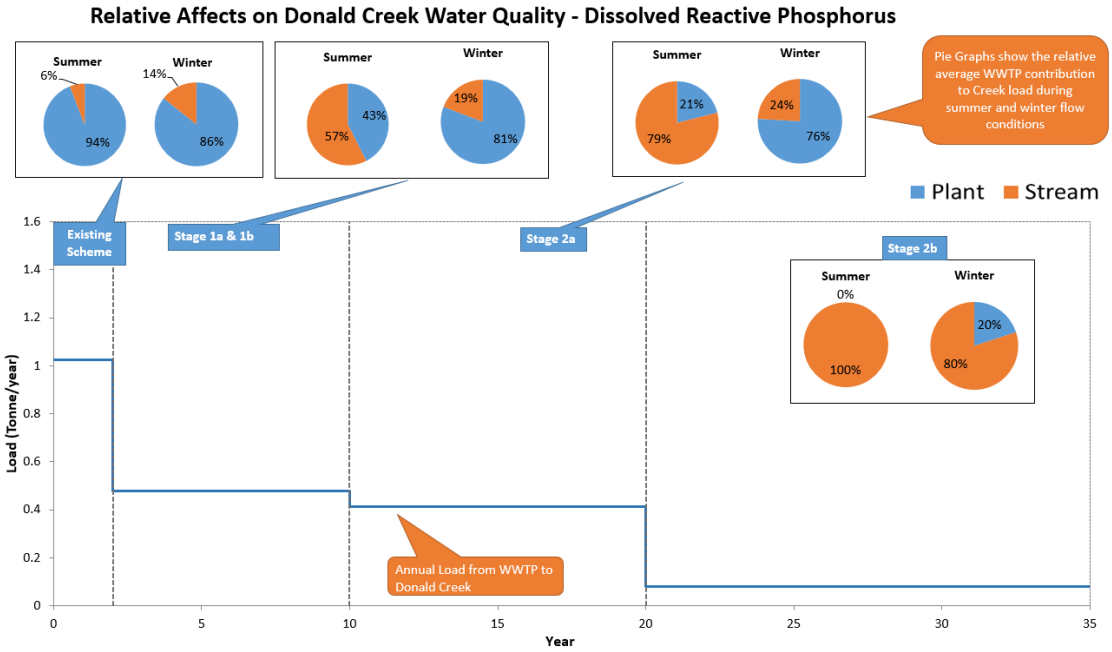


Figure 4: Indicative reduction in annual TN load to the receiving environment as a result of the proposed staged upgrades

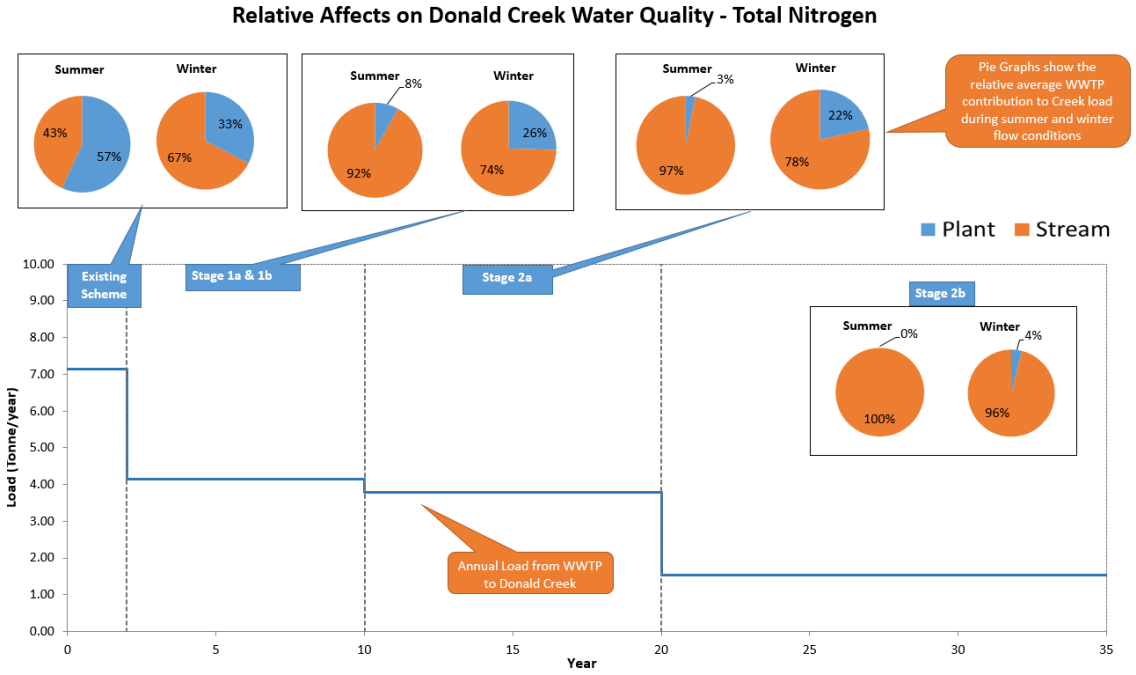


Table 1 below provides an additional summary of predicted plant effluent nutrient loads and the projected reduction in mass loads per year to Donald Creek across the proposed stages.

Table 1: Indicative reduction in annual nutrient loads to the receiving environment as a result of the proposed staged upgrades

		Loads (Tonnes/yr)				Annual % Reduction in Load			
	Existing	Stage 1a	Stage 1b	Stage 2a	Stage 2b[5]	Stage 1a	Stage 1B	Stage 2A	Stage 2B
Ammonia	3.9	3.8	2.3	2.0	0.39	2.3	42	50	90
TP	1.4	1.3	0.64	0.56	0.11	5.0	54	60	92
DRP	1.02	0.97	0.48	0.41	0.081	4.9	53	60	92
TN	7.1	6.9	4.1	3.8	1.5	2.9	42	47	79

The project will have a significant reduction in nutrient contributions from the FWWTP to Donald Creek and to a much lesser extent, a reduction in overall nutrient contribution to Lake Wairarapa. A full description of these improvements is included in the assessment of effects (see Section 6). The proposed staging is therefore consistent with the intent of the Regional Policy Statement ("**RPS**"), the Regional Freshwater Plan ("**Freshwater Plan**") and the Proposed Natural Resources Plan ("**PNRP**") (for detailed statutory assessment see Section 5).

It is important to note that these predictions are made based on a number of assumptions described in greater detail in Section 6 (Assessment of Effects). The proposed monitoring and reporting (refer Part 1C proposed conditions) should track and quantify the load reductions from the FWWTP to the environment.

1.2 Purpose of this Document

The purpose of this document is to provide a description and assessment of effects on the environment for the proposed discharges to water, land and air in respect of the operation of the FWWTP for the foreseeable future.

As outlined above, the proposal for the FWWTP must also be considered in the wider context of the Martinborough and Greytown wastewater schemes, which also require significant investment and for which SWDC has recently obtained 35 year term resource consents. This long-term and integrated district-wide asset management strategy is a key aspect to all three applications.

This document has been prepared in accordance with Section 88(2) and the Fourth Schedule of the RMA. The document includes:

- A description of the current and proposed activities (Section 2 and Section 4) and the sites to which the activity is to occur (Section 3),
- An analysis of the statutory framework within which the application must be considered by the consenting authority (Section 5),
- An assessment of the actual and potential effects on the environment, including proposed mitigation (Section 6), and
- A description of possible alternative locations or methods for undertaking the activity (Section 7) and summary of consultation undertaken.

[5] Leaching of nitrogen to groundwater has been accounted for as provided by LEI (2017) see Appendix 7.

1.3 Featherston WWTP – Existing Resource Consents

The FWWTP is operated under existing resource consent WAR970080. In particular, this consent enables the operation of the FWWTP, including the treatment and disposal of wastewater associated with the facility, by providing for the discharge of contaminants to water, land, and air, subject to a number of specified conditions.

These current consents had an effective date of 25 August 2009, and expired on 25 August, 2012. A variation was granted by GWRC in November 2010 which enabled changes to the previously prescribed method of treatment, and also the timing and reporting of proposed treatment options and trials. The activity is currently continuing under the existing consents until a decision is made on this application.

A copy of the existing consents (including variation) is provided as Appendix 5 to this report.

1.4 Status of previous application

SWDC first lodged an application for the new resource consent with GWRC in May 2012, 3 months prior to expiry of consent WAR970080. Following preliminary assessment, GWRC requested additional information on the proposed activity in accordance with the RMA.

A wide range of options for the FWWTP have been considered in the interim. In July 2014 a revised application was lodged with GWRC proposing the staged upgrade of the FWWTP, which included I&I reduction and minor pond enhancements in the short-term and High Rate Treatment in the medium term with a continued discharge to Donald Creek proposed. This was considered the BPO for Featherston in the absence of any suitable land available to implement a land treatment scheme. This application was notified on 6 August 2014 and eighteen (18) submissions received. A number of these highlighted concerns regarding the ongoing discharge to water.

Following the notification period, an area of land adjacent to the Featherston WWTP site became available for purchase (known as ‘Hodder Farm’). SWDC requested the application be put on hold, in accordance with s37 of the RMA, to enable Council time to undertake the necessary site investigations to confirm whether land was suitable for wastewater irrigation and would provide for a land treatment scheme.

An extension to timeframes was confirmed by GWRC on 4 March 2015 and 11 February 2016 to enable:

- the technical reporting required for this application to be completed;
- engagement with the community at large through the current LTP consultation processes and engagement with submitters on the change in approach; and
- the preparation of a revised consent application and supporting documentation for lodgement prior to 31 August 2016.

This document provides the necessary information to support a new suite of consent applications for the proposed scheme. This document replaces any previous applications, supersedes previous applications, proposals and information supplied to GWRC. This application should therefore be read in preference to and in isolation from any previous documentation.

1.5 Exercise of existing resource consents while this application is being processed.

Section 124(2) of the RMA provides for an activity to continue to operate until the application for replacement consent for the same activity is determined where:

g. a resource consent is due to expire; and
h. the holder of the consent applies for a new consent for the same activity; and
i. the application is made to the appropriate consent authority; and
j. the application is made in the period that—
    i. begins 6 months before the expiry of the existing consent; and
    ii. ends 3 months before the expiry of the existing consent; and
k. the authority, in its discretion, allows the holder to continue to operate.

The current resource consent has expired. An application for resource consent was lodged with GWRC 3 months prior to the expiry of the existing consent. SWDC has requested GWRC apply the principle of Section 124(2)(e) and Section 37 of the RMA to enable ongoing operation under the existing consent. GWRC has accepted this request, and the FWWTP can therefore operate lawfully under the existing consent until these new applications are determined.

1.6 Consents Sought

SWDC seeks the following resource consents from GWRC:

- Discharge of a contaminant to water pursuant to section 15(1)(a) of the RMA and Rule 5 of the Regional Freshwater Plan and Rule 61 of the Proposed Natural Resources Plan for the Wellington Region
- Discharge of contaminants to land pursuant to section 15(1)(b) of the RMA and Rule 8 of the Regional Plan for Discharges to Land and Rule 93 of the Proposed Natural Resources Plan for the Wellington Region
- Discharge of contaminants to air pursuant to section 15(2) of the RMA and Rule 23 of the Regional Air Quality Management Plan and Rule 41 of the Proposed Natural Resources Plan for the Wellington Region

Each application should be determined as a '**Discretionary Activity**' in terms of the Act[6].

The application for discharge of effluent to land is sought to provide certainty over the term of this consent in regards to effluent discharging to ground from the discharge channel and seepage from the pond. No discharge to land consent was required by GWRC for this aspect with the previous resource consent process, and it is not considered this represents a matter of any outstanding non-compliance.

6 A full assessment of the proposed activity against relevant plans is included at Section 5.2 of this report.

2 Existing Scheme Description

This section of the report summarises the current operation of the FWWTP in terms of its inputs, treatment and operational processes, and the discharge.

2.1 Site Location and Access

SWDC administers and manages the districts four wastewater systems [7], including the Featherston Wastewater Treatment Plant (FWWTP).

The FWWTP is located approximately 2km south of Featherston township, on the property legally described as Section 330-331 (CT WN349/159), and Pt Sec 258 (Gazette Notice 1914/1258) Township of Featherston (refer to Figure 5). The FWWTP site is 7.3ha and owned by SWDC. The site is designated [8] in the Wairarapa Combined District Plan (WCDP) in favour of SWDC for 'Sewage Disposal' purposes.

The oxidation pond system was originally constructed between Abbot Creek [9] and Donald Creek [10] circa. 1975, and has provided for the treatment and disposal of sewage from the Featherston urban area since.

The site itself is regularly shaped, generally of flat topography, and largely devoid of significant vegetation other than that bordering the adjoining streams and a small number of mature specimen trees.

Legal access to the site is provided from Longwood Road (West) and is restricted to SWDC staff and approved persons only, in accordance with the existing consent[11].

The wastewater is collected via approximately 25km of reticulated sewer network which feeds by gravity down to the FWWTP site.

7 SWDC has treatment plants at Featherston, Greytown and Martinborough, and a small community system at Lake Ferry.

8 Refer WCDP - Appendix 6 - Designation (Ds066); also illustrated on Planning Map 62.

9 Abbot Creek is also known as the 'Otaiura Stream' and variations on Abbot Creek. Abbot Creek is used for consistency throughout this document.

10 Donald Creek is also known as 'Boar Creek' and variations on Donald Creek. Donald Creek is used for consistency throughout this document.

11 Condition 29 – The access gate on Longwood West Road shall remain locked at all times to prevent public access.

Figure 5: Location of the FWWTP and Featherston Sewage Network

2.2 Current Inputs

2.2.1 Input Sources

The Featherston oxidation pond receives sewage from the Featherston urban area only. Featherston has an assessed connected population to the wastewater system of 2,253 occupying 996 dwellings[12]. The flows are predominantly domestic with a small commercial contribution from local industry. This contribution has been estimated to be a maximum 5% of flows[13].

All discharges to the sewerage system are subject to the provisions of the Masterton District Council and South Wairarapa District Council Consolidated Bylaw 2012: Part 12 – Trade waste[14], adopted by SWDC on July 31, 2013.

[12] Based on statistics received from the 2013 population census.

[13] As advised by NZET / SWDC

[14] A copy of the Trade Waste Bylaw can be obtained from http://www.swdc.govt.nz/policies-plans-and-bylaws

2.2.2 Input Volumes

The theoretical daily dry weather flow from a population of 2,253 is 563m^3/day (based on 250 litres of wastewater generated per person per day). Inflow data collected from March 2005 to August 2012[15] shows that the ponds have an average annual daily inflow of 2,721m^3/d, with a measured peak of 4,669m^3/d.

When compared with the theoretical daily flow volumes, the actual FWWTP input volumes are clearly very high for the size of the population being served by the plant. A chief cause of the high influent volumes to the plant is from rainfall inflow (otherwise referred to as stormwater) and groundwater infiltrating the sewerage system. This is termed 'inflow and infiltration', or "**I&I**". The system suffers from I&I during wet periods and predominantly during the winter season when groundwater levels in the area are high resulting in groundwater submergence of the sewerage reticulation pipes. The causes of I&I are principally from:

- The deteriorating condition of underground sewerage pipework allowing groundwater to leak into the pipes; and
- The cross connection of rainwater downpipes with foul sewer connections.

Both of these are due to old, possibly poorly constructed, and certainly deteriorating wastewater collection systems. I&I in Featherston is estimated at 74% of the annual average flow (AWT, 2013a – see Appendix 3). This issue has been recognised by SWDC, and provision made for a comprehensive investigation, repair and replacement programme in the SWDC 10-year capital works plan.

The significant infiltration is the single most influencing factor in determining long-term treatment and disposal options. Until the inflow and infiltration of groundwater and stormwater has been significantly reduced, an increased level of treatment is cost prohibitive, the final actual quantity and quality of effluent required to be treated cannot be accurately determined, and the size of the treatment plant/land treatment scheme and final discharge parameters cannot be confirmed. The SWDC integrated wastewater strategy seeks specifically to address this significant issue.

2.2.3 Input Characteristics

Routine monitoring of the influent entering the ponds is not a condition of the current consent. The input sources summarised above suggest that the influent is largely domestic in nature, with some commercial and minor industrial input.

2.2.4 Impacts of Population Growth on Input

A population decrease in Featherston of 3.2% has occurred since the 2001 Census (Statistics NZ, 2013). The 2013 Census counted 996 occupied dwellings in the Featherston Urban Area in 2013. The average household size was found to be 2.3 people, which is lower than the Wellington region average of 2.6 people.

Over the term of the consent, zero-growth has been assumed on the basis of the 2012 Statistics New Zealand subnational population projections to 2031. Statistics NZ projects growth in South Wairarapa to be between -0.2% & 0.5% through this period, and for the resident population to age relative to existing, with 2.31 people over the age of 65 for every child (aged 0-14). The resident population at 2031 is also projected however to live in a slightly increased number of dwellings (up to 0.4% increase), although dwelling size will reduce, with a projected average

[15] Post August 2012 it was identified the meter was not operating correctly and thus was subsequently replaced in 2014.

household of between 2.0 and 2.1 people. This indicates less young families will be living in the district from 2031(Jackson, 2012).

At a higher level, the Wellington Regional Strategy assumes growth through the Wairarapa to be from increased primary industry and tourism sector productivity, rather than actual population growth.

Based on these projections, the projected growth to 2031 is in the order of 20-30 people, and an increase of actual dwelling numbers no more than single figures.

Although the assumption of zero growth has been made for the purpose of option development, there is inherent provision for some growth through a combination of the conservative approach taken to land treatment design, and an assumption that flow reduction in the order of one-third will be targeted through the I&I rehabilitation programme. Any major changes in population within urban Featherston (although considered unlikely on the basis of current knowledge) will be monitored and where necessary factored into the design and operation of the scheme at each stage. In the event that population increases to the extent that the proposed solution will have insufficient capacity through the term of consent, SWDC would need to look at the implications at the time. The proposed monitoring programme and annual reporting will identify any risk well in advance.

Although the forecasts do not align directly with the consent term, the associated risk is considered very minor.

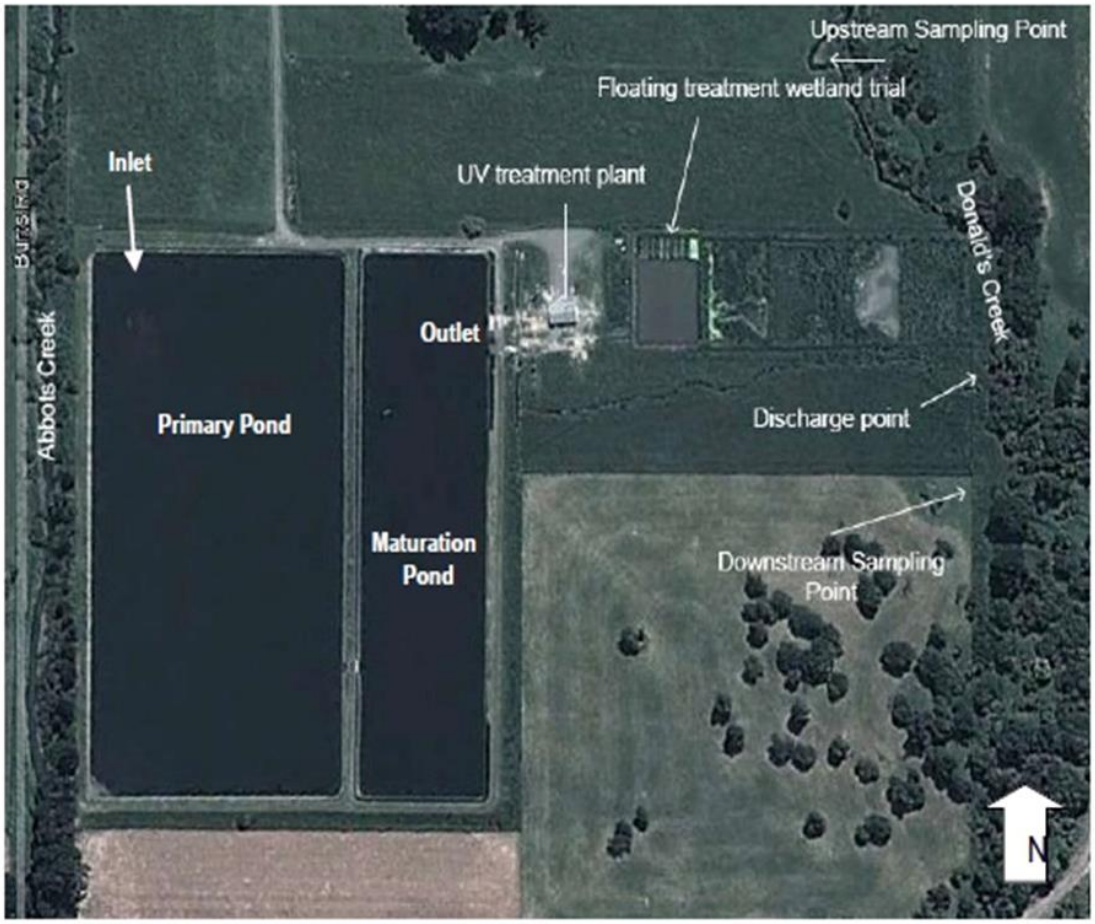
2.3 Treatment Process

The FWWTP is a relatively simple oxidation pond system typical of many small municipal systems constructed in the 1970's in New Zealand.

The FWWTP system consists of the following key components:

- Two unlined oxidation ponds in series with a total surface area of approximately 38,900m^2. Based on the nominal depth of 1.2m, the volume of the ponds is calculated as 47,400m^3. Sewage is fed to the northwest corner of the first pond via a gravity pipeline. Diagonally opposite the inlet, it flows through a channel into the second pond. At average flow and normal water level, the pond has a hydraulic retention design time of 45 days. At peak flows, this can reduce to below 10 days. Oxidation ponds treat sewage using biological activity to remove contaminants and Ultraviolet (UV) light from the sun to kill pathogens.
- The first pond has concrete wave bands, with an imported clay base. The second pond has Butynol rubber wave bands and a lime cement base (Opus, 2013b). There was some seepage from the southeast corner of the second pond. This has been traced to old drainage lines at this point. SWDC sealed the leaks in late 2002. There is currently no known significant leakage. G2E (2013) notes in their review of the treatment plant that overall the treatment ponds appear to have been well built with very consistently flat bases.
- In December 2011, a UV disinfection system was installed and commissioned. UV disinfection is used instead of chlorine, ozone, or other chemicals. Because no chemicals are used, the treated water has no associated adverse effect on organisms that later consume it, as may be the case with other methods. UV radiation causes damage to the genetic structure of bacteria, viruses, and other pathogens, making them incapable of reproduction.
- The effluent is discharged from the UV Plant into an open channel which flows directly to Donald Creek.

Figure 6: Schematic of FWWTP treatment process



Note: The flowing treatment wetland trial no longer exists.

Figure 7: The channel through which treated effluent is discharged to Donald Creek and Donald Creek downstream of discharge, at or about the nominated point of reasonable mixing.

2.3.1 On-site Treatment Alternative Trials

A 'Floating Treatment Wetland' (FTW) was trialled on site to determine whether it could be a useful option to improve the quality of wastewater being discharged. The FTW has been reported by manufacturers to reduce BOD and suspended solids in effluent, with some associated nutrient reduction. The system is used increasingly by other local authorities throughout New Zealand with varying levels of success. FTW has been evaluated as part of the options assessment provided in Appendix 2, which also provides further detail on the wetland trials undertaken. The floating mats have been transferred to Martinborough to be used as a barrier to sunlight on the maturation ponds to assist in managing algae growth.

A trial on the PETRO[16] process undertaken in accordance with the previous conditions of consent was abandoned after approximately 12 months due to repeated failures in the delivery system producing inconclusive results.

2.4 Site Operations and Maintenance

The FWWTP is managed and operated by CityCare Limited ('CityCare') under the terms of an Operations and Maintenance Contract ('OMC') signed in October 2012. The contractor is required to ensure that the FWWTP is operated in strict compliance with relevant resource consents. This will include resource consents associated with this current application.

Although a well-defined operations process exists on site managed by CityCare, there is currently no specific Operations and Maintenance Manual ("OMM") in place. OMM's are currently being prepared through CityCare under the OMC for all of SWDC's WWTP's and Water Treatment Plants. An OMM for FWWTP will be completed within six months of commencement of the consent[17].

2.4.1 Pond Maintenance

The following maintenance procedures are undertaken weekly:

- Checking the perimeter of the site; including checking perimeter fencing and access gates, and maintaining clear warning signs;
- Checking the ponds, including cleaning of inlet/outlet structures as required, checking valve settings, checking general pond operation (for dead spots, algal blooms etc.), removal of floating debris;
- Checking structural integrity of concrete wavebands and cleaning if required;
- Maintain pond surrounds including weed and vermin control;
- Discharge inspection – clearing weeds as required to ensure free flow and rapid mixing with receiving waters;
- Checking dissolved oxygen in the pond, and flow measurements in the inlet chamber.

The following are constantly monitored:

- Inlet flows

[16] 'Pond Enhanced Treatment and Operation' system utilises a multiple pond system in conjunction with a trickling filter or activated sludge process. The primary pond-based stage of the process is aimed at removing a substantial portion of the organic load. The secondary trickling filter or activated sludge process stage is aimed at nutrient removal followed by a solids/liquids separation system.

[17] Refer proposed conditions provided in Part 1 Schedule 1: Condition 3.

- Outlet flows[18]
- UV transmissivity of effluent
- UV dosage

At weekly intervals SWDC monitor Temperature, Dissolved oxygen, pH, Electrical conductivity, Colour (visual observation), Foam and Scum (visual observation) in the discharge to Donald Creek.[19]

At three monthly intervals in February, May, August and November each year SWDC collect representative grab samples of the treated wastewater immediately prior to discharge to Donald Creek for analysis of BOD_5, TSS, *E.coli*, NH_4-N, NO_2-N, NO_3-N, TKN, TN, DRP and TP.[20]

2.4.2 Emergency Discharge Flow Bypass

There is an emergency discharge flow bypass downstream of Pond 2 and prior to the UV disinfection plant. The operator manually initiates the bypass, and the bypass is only to be used in situations where:

- there is a major breakdown of the UV unit which requires it to be taken out of service and no flow to enable repair or remediation and in the event that all buffer storage within the ponds has been used.
- the ponds are about to overflow (visual observation) as a result of outflow volumes from the secondary pond exceeding the hydraulic capacity of the UV unit and feed / discharge pipeline (140 L/sec) and pond volume, or from inflow meter readings and known pond levels suggesting that pond capacity will become an issue.

The use of the bypass will be managed under the OMM and will be a revision of the existing Standard Operating Procedure. SWDC advises the bypass has not been used since the commissioning of the UV plant, suggesting the management regime is working with reasonable effectiveness.

There are no other bypass flows in the current process.

2.4.3 Odour Control

No requirement for any odour control processes has been identified at the FWWTP. SWDC advises there is no record of any significant odour issue either through compliance monitoring, site operations, or reports through SWDC complaints monitoring. The GWRC Consent Compliance Monitoring Reports also confirm that there have been no records of any odour related complaints.

2.4.4 Sludge Management

It is typically apparent if sludge accumulation is limiting the effective operation of a pond system and desludging may be required. Typical ‘symptoms’ of this might include:

- belching of solids due to accelerated anaerobic decomposition;
- re-entrainment of solids due to wave and current action; and

[18] Inlet and Outlet monitoring is undertaken in accordance with Condition 15 of Consent WAR970080

[19] Weekly monitoring is undertaken in accordance with Condition 17 of Consent WAR970080

[20] Quarterly monitoring is undertaken in accordance with Condition 18 of Consent WAR970080

- reduced hydraulic retention time in the ponds and therefore pond performance due to the loss of the volume taken up by the accumulated sludge

None of these symptoms have been evident at FWWTP[21]. To assist with asset planning and this project, SWDC commissioned a survey of existing sludge accumulation and an assessment of its impact on plant efficiency and effluent quality (Opus, 2013a). This has concluded that sludge accumulation is surprisingly low and indicates that the ponds must have been desludged at least once since construction (although no record of this exists) and that sludge is not currently impacting pond efficiency or performance (g2e, 2013)

2.5 Treatment Plant Performance

A detailed review of the effluent flow and quality is provided in Appendix 8 to this report. A summary of this review is provided in the following sections. Further analysis of effects of these monitoring results as relevant to the Project is included in Section 6.

2.5.1 Effluent Volumes

As discussed in Section 2.2.2, the flows into the plant are strongly influenced by significant I&I. This is also reflected in the effluent volumes from the plant. Table 2 presents a summary of the flow statistics from the plant from the period 2005 to 2016. FWWTP inflow volumes of wastewater vary from outflow due to pond buffering, evaporation, rainfall and pond leakage (although as noted in section 2.3, pond leakage is considered to be minimal at FWWTP).

When comparing flows each year, it is noted that 2008 was a particularly wet year and therefore this annual variability should be factored in when deriving proposed consent limits.

Table 2: Current Effluent Volumes from FWWTP

	Median	Mean	90th%ile	95th%ile	Maximum
			m^3/d		
Current Annual[1]	1,907	2,271	4,233	5,272	13,432
Summer	1,157	1,495		2,584	10,076
Winter	2587	3,021		4,971	13,432

Source: SWDC Monitoring Data

Note: Based on outflow data collected between March 2005 and May 2016 (n=4263).

2.5.2 Effluent Quality

The annual FWWTP effluent quality statistics are summarised from data collected from 2006 to 2016[22]. Further analysis of effluent quality data and discussion on seasonality in discharge quality is provided in Appendix 8.

Table 3: Current Effluent Quality from FWWTP

Parameter	# of Samples	25th percentile	Mean	Median	90th percentile	95th percentile
BOD_5 (g O_2/m^3)	76	11	17.6	16.7	30.1	32
TSS (g/m^3)	76	18	44.1	35	95.4	125.4
TN (g/m^3)	73	7.4	13	8.7	13	15.3
NH_4-N (g/m^3)	75	2.7	5.1	4.4	8.7	11.5

[21] Pers. Comm. Stu Clark, NZET.

[22] E.coli based on data collected following UV disinfection installation in 2011

Parameter	# of Samples	25th percentile	Mean	Median	90th percentile	95th percentile
DIN (g/m^3)	75	3.8	5.9	5.4	9.3	12
NO_3-N (g/m^3)	75	0.18	0.66	0.49	1.58	2.05
DRP (g/m^3)	75	0.8	1.66	1.49	3.32	3.91
TP (g/m^3)	72	1.18	2.18	1.81	4.21	4.52
E.coli	21	-	-	24	-	820
pH	71	7.2	7.4	7.4	7.9	8.1
DO (mg/L)	68	6.4	7.8	8.2	11	11.3
Conductivity	70	186	231	228	312	393
Temperature	39	10	13.9	13.3	20	21.9

Note: Based on effluent quality data collected between February 2006 and May 2016.

Based on a review of the treatment plant performance by g2e (2013) it was concluded that "the Featherston plant does currently achieve treatment standards in line with a normal, two-pond facultative pond system. It will therefore be difficult to reach much improved treatment standards solely with the implementation of some basic and simple upgrade options".

A verification of the current treatment results with the theoretical treatment capacity of the ponds using the calculated remaining treatment volume (original volume minus sludge volume) was undertaken to estimate what the plant could potentially achieve in optimal conditions. Overall the analysis confirmed that the plant is already operating quite close to its theoretical treatment quality, however results were quite variable. Desludging in order to achieve better treatment results was not recommended and the most significant issue for the plant was I&I into the sewer network being responsible for the treatment fluctuations observed. The I&I dilutes the influent wastewater and also significantly affects the residence time of the wastewater through the pond treatment system.

The dataset post UV installation is small but provides an indication that the plant will not exceed mean pathogen counts of 100cfu/100ml. Further assessment of the discharge against the relevant MfE/MoH (2003) contact recreational guidelines and PNRP are provided in Section 6.

2.5.3 GW Consent Compliance Reporting

This section considers the performance of the FWWTP from the perspective of the level of compliance with the existing consents[23]. Where actual or potential non-compliance with conditions of consent is identified, the effects of and relevant non-compliance are considered in detail in the assessment at Section 6 of this report, in the context of the Project.

The GWRC compliance reports all confirm that the plant is fully complying with the discharge effluent quality parameters contained in the consent (condition 16, i.e. pH, $cBOD_5$, TSS, NH_4-N, TN, DRP, TP and E.coli). The volume of wastewater being discharged has at times exceeded consent limits. This may be either as a result of the significant infiltration issue or meter error as around the time most of the exceedences occurred the meter was found to be measuring incorrectly and was replaced.

The recent GWRC report (2013/14) also identifies technical non-compliances with:

- conditions requiring specific technology (trickling filters) to be installed at the site (technology which testing proved to be ineffective at Featherston);
- reporting frequencies;

[23] It is acknowledged that assessment against consent conditions does not provide a complete consideration of plant performance.

- meeting with a specific working group; and
- hosting an annual site visit to the WWTP.

GWRC recognised that these technical non-compliances could be resolved in the current application, which SWDC has sought to do through the proposed scheme upgrades as described in Section 4.

The compliance reports also identified some concerns with the level of analysis contained within the annual report. Although not a compliance issue, this matter has also been rectified through the conditions of consent proposed relating to environmental monitoring, and quarterly and annual reporting[24].

2.5.4 Public complaints

SWDC is required to hold and maintain a complaints register under Condition 5 of the current consent.

A verbal complaint was received in May 2012 regarding turbidity from the discharge in Donald Creek. SWDC responded immediately and confirmed that turbidity at the site at the time of monitoring was within consent limits. This was reported back to the complainant.

SWDC advise that no other complaints have been received or registered since in respect of the FWWTP.

[24] Refer proposed Conditions provided in Part 1 Schedule 1: Condition 21 and 22.

3 Environmental Context

This section provides a description of the existing site and receiving environments for the proposed discharge.

3.1 Project Site Description

The site location is described in Section 2 above. The use of existing facilities at the FWWTP also as described in section 2 is proposed to continue.

Figure 8 illustrates the location and layout of the proposed Site. The Site comprises two properties which are both located adjacent to the FWWTP.

“Site A”, comprises a 12.6ha block of land owned by SWDC located between the FWWTP and Longwood West Road.

“Site B”, is used to describe the recently purchased land also known as Hodder Farm, which comprises of 166ha including 3.6ha of covenanted QEII Open Space.

With regard to the proposed land treatment scheme, The Site is located approximately 1.5km from Featherston township. It is bisected by Murphy’s Line and Longwood Road West. A number of watercourse pass through the property including the Longwood water race system, Torohanga Creek which flows into Donald Creek[25] and subsequently Abbot Creek[26] before flowing into lake Wairarapa approximately 5km to the south from the FWWTP discharge point.

The legal description of each site is presented in Table 4.

Table 4: Site Legal Description

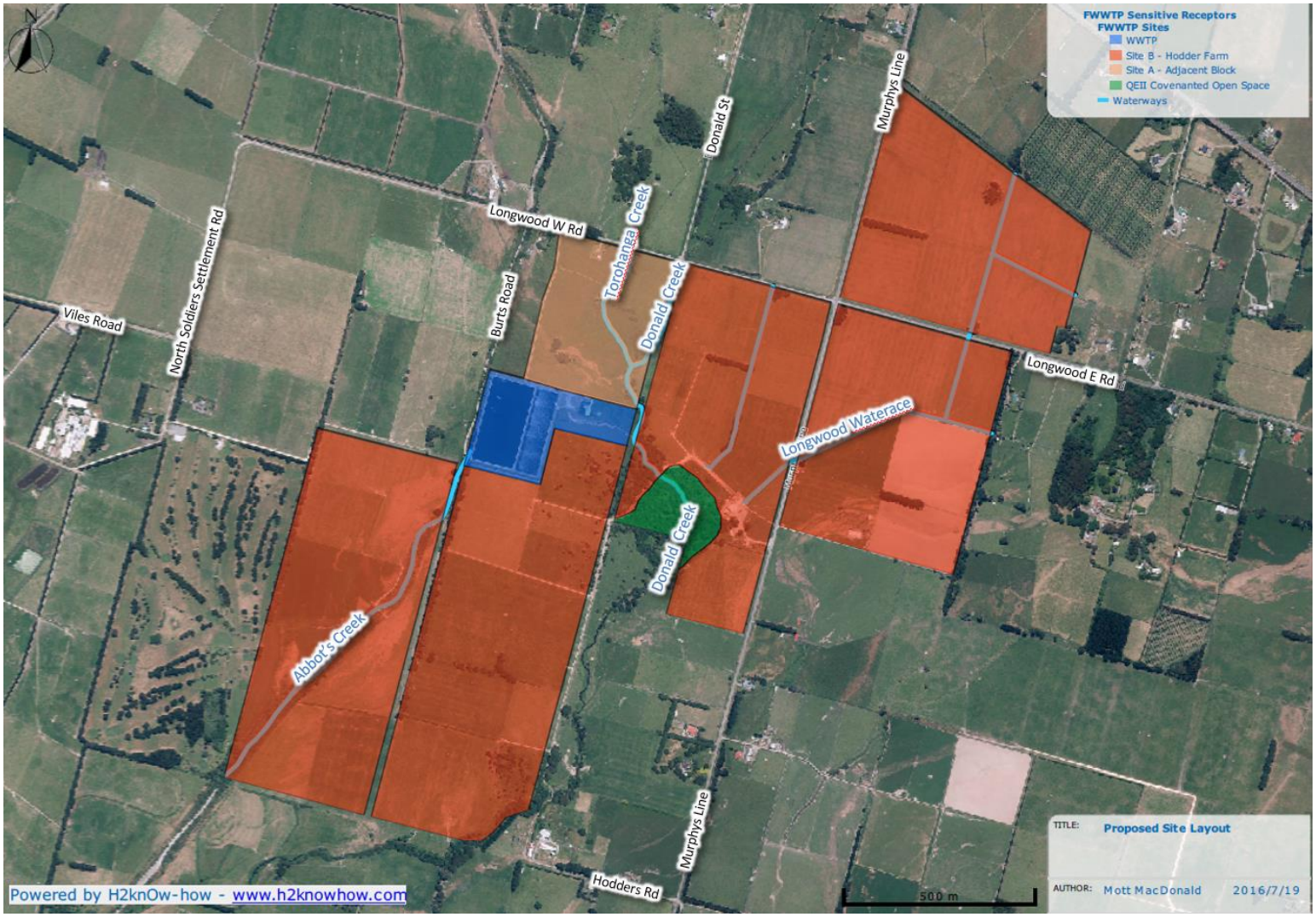
Site ID	Legal Description	Owner	Address	Map Reference	Area (ha)
Site A – Adjacent Block	LOT 2 DP 342631	SWDC	65 Longwood Rd West	-41.134445, 175.324826	12.58
Site B – Hodder Farm	LOTS 5 & 7 DP482853 LOT 2 DP88643 LOTS 17-25 PT LOTS 26 & 28 DEEDS PLAN 317 Suburban Section 320-321, 324-325, 328-329, 332-333 and 336-337 and 340-341 and 345 (excluding areas C - L), and 349 Township of Featherston and Part Rural Section 414, Part Rural Section 416, Part Rural Section 418 and Part Rural Section 420 Township of Featherston	SWDC	270 Murphys Line	-41.138342, 175.325098	162.61
QEII Covenanted Open Space	LOTS 17-25 PT LOTS 26 28 DEEDS PLAN 317 Areas C - L on Suburban Section 332, 336, 340-341, 345	SWDC	270 Murphys Line	-41.139063, 175.328044	3.59
WWTP	PT SEC 258 SECS 330-331 FEATHERSTON SUBURBAN	SWDC	Donald Street,	-41.136782, 175.323395	7.35

Source: LEI (2017)

[25] Also referred to as Boar Creek

[26] Also referred to as Otauira Stream

Figure 8: Layout of the proposed land treatment site



3.2 Land Use

3.2.1 Site Land Use

Site A is currently grazed by drystock whilst Site B is currently used for dairy production and arable cropping. The stony soils of the site are well-suited to carrying stock but provide limited ability for cultivation and therefore cropping is restricted to areas with fewer stones (LEI, 2017 – see Appendix 7). Approximately 70ha of the Hodder Farm (Site B) is irrigated with small moveable impact irrigators supplied by two bores as shown in Figure 9. The dwelling on Site A is to be relocated and the bore located near Paddock 16 is to be decommissioned as part of the proposed scheme.

The existing treatment pond site is designated (Ds066) for sewage disposal purposes with an underlying Rural Special zone extending in a 500m radius from the site. This Rural special zone is to provide protection to the operational requirements of key infrastructure such as the FWWTP from inappropriate development. Sites A and B that lie outside this Rural Special Zone are zoned for Primary Production. A designation of Donald Creek Floodplain and Drain area (Ds016) for the purpose of the conveyance of water for flood mitigation purposes extends through the Site either side of Donald Creek.

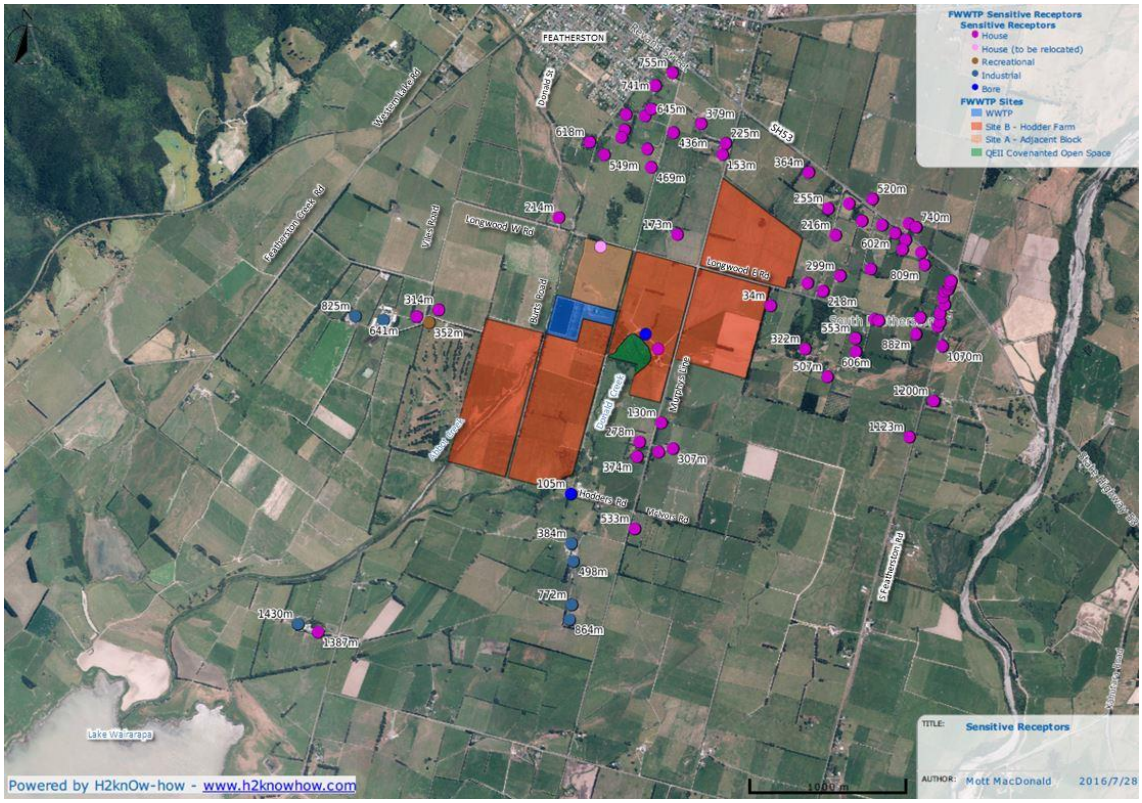
Figure 9: Existing Irrigation Layout, Existing bore (yellow dot) to be decommissioned and Existing dwelling (yellow circle) to be relocated.

3.2.2 Land Use of Surrounding Area

Being 0.75km from the Featherston township (at the closest point), the surrounding landuse is predominantly rural and dominated by primary production. Dairying units and a few lifestyle blocks lie to the north, east and south of the site. The Featherston golf course abuts the western boundary of the site, south of the FWWTP. Further west on the opposite side of the golf course is a dairy farm and piggery (Windy Farm). Figure 10 illustrates the location of

potentially sensitive landuse in the vicinity of the site including dwellings, recreational sites, industrial sites and the location of the two bores acquired as part of the purchase of Site B[27].

Figure 10: Potentially sensitive landuses in the vicinity of the Site



No dwellings outside the site boundary are located within 500m of the FWWTP ponds. The golf course, one bore and a small number of dwellings are located within 150m of the proposed land application areas. To mitigate any potential effects on these sensitive receptors, appropriate buffer distances have been proposed in conjunction with consent conditions restricting land application to prescriptive wind speed and direction criteria[28]. These mitigation measures are discussed further in Section 4.

Other key features in the surrounding area include the foothills of the Tararua Forest Park and Rimutaka Ranges which begin 1.8 km west of the Site and Lake Wairarapa which is situated 2.2 km to the south of the Site. The Tauherenikau River located approximately 1.7km to the east of the site flows north to south and enters Lake Wairarapa where a large wetland is situated. This wetland is of international importance for the flora and fauna; and ranked as significant for habitat values (LEI, 2017).

3.3 Geology, Topography and Geomorphology

Featherston is on the western side of the Wairarapa valley, an alluvial floodplain some 20 km wide at this point.

The FWWTP is located roughly in the middle of a floodplain stretching from the Rimutaka Ranges across to the Tauherenikau River. The valley drains from the Tararua Ranges

[27] The location of all other bores within a 1.5 – 2km radius is presented in Section 3.6.2

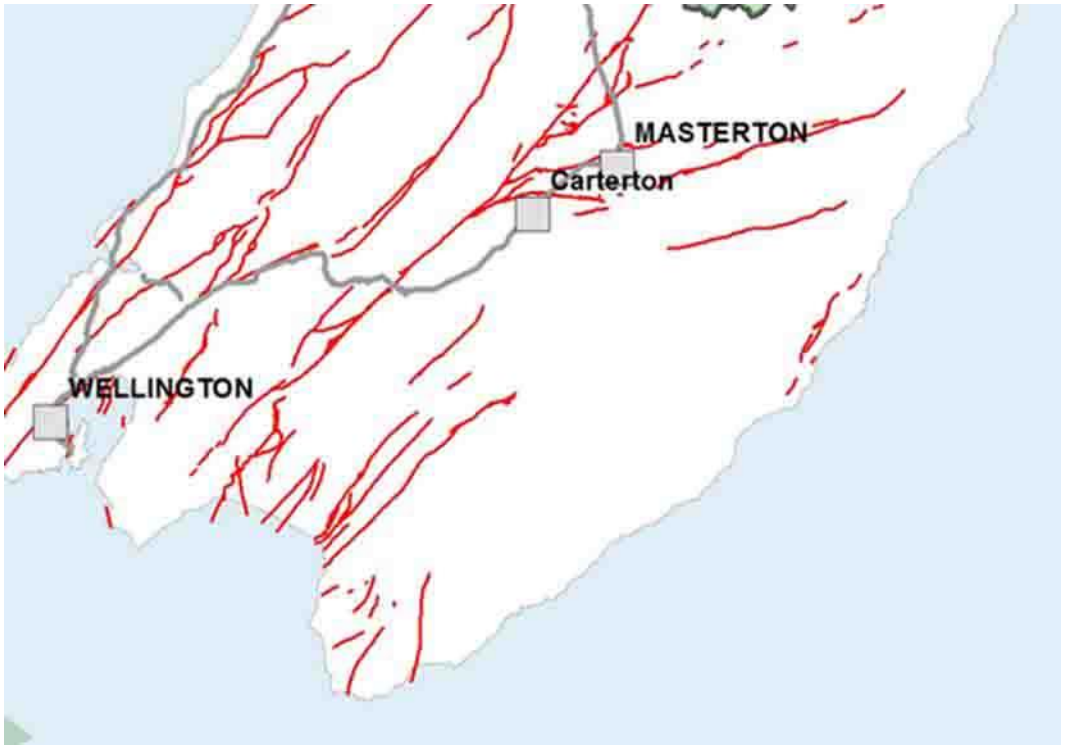
[28] Refer proposed Conditions provided in Part 1C Schedule 4: Condition 7

gradually in a south-westerly direction, down to Lake Wairarapa, continuing down to the south Wairarapa coastline. The dominant mineralogy of the area is greywacke alluvial sediments. The site geology is described as late Pleistocene river deposits being, poorly to moderately sorted gravel with minor sand or silt underlying terraces and includes minor fan gravel. The boundary where the geology changes to Holocene swamp deposits is directly south of the farm boundary (LEI, 2017).

The site has an elevation of around 20 m above mean sea level and is predominantly flat with a gentle fall towards Donald and Abbot Creeks. There is minor topographic variation due to the low (<0.5 m) hummock and swale topography associated with the alluvial plain on which the site is located.

The Wairarapa Basin is crossed by a series of north-east to east north-east striking, active faults, including the Carterton and Greytown Faults, which are splays off the Wairarapa Fault. The Wairarapa Fault is considered to be the most active in this region and is located approximately 5km from the Site. It is expected to generate a major event at a recurrence interval of <2000 years.

Figure 11: Mapped active fault lines in the vicinity



Source: GNS Science; Hazard Mapping 2012

3.4 Soils

3.4.1 Soil type

Site investigations have been conducted by LEI for Site A (February 2014) and Site B (November 2015), including soil mapping and field testing of soil hydraulic properties.

LEI (2017) identified for Site A, the dominant soil series was an Opaki brown stony loam (Mottled Orthic Brown Soil). Across the site, finer grained soils were observed in swales and

coarser grained soils were found on hummocks. Lower lying soils were noted to be strongly gleyed below 70 cm, indicating soil saturation is frequent beyond this depth.

For Site B, the identified soil series correspond to Tauherenikau shallow stony silt loam (Typic Firm Brown Soil) and Ahikouka silt loam (Typic Recent Gley Soil).

Based on these soil observations, LEI (2017) identified the following benefits and constraints for irrigation at the Site:

- Presence of gravel over most areas will assist to avoid compaction and will provide some "winter dry" areas;
- Mottling indicates seasonal wetness in lower lying areas of the site which may be exacerbated if winter irrigation occurred to these areas; and
- There was noted variation at depth, including lenses of clay dominated material. This suggests that water movement may be horizontal as well as vertical and so discharge rates should be slow enough to avoid rapid drainage.

3.4.2 Soil Fertility

Based on the results of soil fertility testing undertaken for Site B in 2013 and 2014, LEI (2017) advise the implications for the use of Site B for wastewater irrigation are:

- The land is not constrained by fertility issues, but should be monitored to determine if supplemental SO_4-S or K needs to be applied to maintain optimal pasture growth;
- Olsen P is not excessive indicating that saturation of P sorption sites is unlikely to occur in the near future; and
- Application of sodium (Na) in wastewater is unlikely to cause the soils exchangeable sodium percentage to exceed trigger values for soil structural health due to current low Na and high Ca and Mg.

3.4.3 Soil Physical Properties

Soil physical properties evaluated by LEI for the site included bulk density (Site B only), porosity (Site B only), macroporosity (Site B only), saturated hydraulic conductivity (K_{sat}) and unsaturated hydraulic conductivity (K_{-40mm}). Results of the unsaturated hydraulic conductivity testing have been used to determine an appropriate design irrigation rate (DIR). A value between 10 % and 30 % of the unsaturated hydraulic conductivity has been proposed for the reasons given by LEI (2017), as a conservative approach to determining an appropriate DIR. The following DIR have been proposed for each site:

- **Site A: 8mm/hr = 192mm/d * 10% = DIR of 19 mm/d**
- **Site B: 8mm/hr = 192mm/d * 30% = DIR of 55 mm/d (rounded)**

3.5 Terrestrial Ecology

The FWWTP is located on an alluvial floodplain which is devoid of any significant vegetation. The site is not identified in either the Wairarapa Combined District Plan or any Regional Plan as having significant flora and/or fauna associated with it.

The immediate riparian margin of Donald Creek was dominated by Apium sp, pasture grasses, buttercup (Ranunculus sp.). As noted earlier in Section 3.1, there is a small block of land (3.6ha) that has recently been covenanted as QEII Open Space (regenerating bush area), willow, black berry and the pest plant wandering jew (Tradescantia sp.) was common here. Moderate

riparian margin exists alongside Abbot Creek, *Apium* sp. extended up on to the riparian margins where buttercup (*Ranunculus* sp.), black berry and willow were also common (Hamill, 2017)

As with most WWTPs', the surface of the ponds does attract a range of fauna to its surface.

3.6 Groundwater

3.6.1 Groundwater Aquifer Characteristics

The site is located within the South Featherston Water Zone. This zone is located near the toe of a coalescent alluvial fan formed by the Tauherenikau and Waiohine Rivers. The sands and gravels of the alluvial fan are generally fairly poorly sorted and contain a high percentage of silts and clays. With increasing distance from the Tararua Ranges the grading of these sediments does tend to improve. Approximately 2 km to the south of the Site, the sands and gravels start to intercalate with thick silt and clay sequences of the Lower Valley ground water zone (PGWES, 2003).

Available bore log information was used to construct a hydrological section in the vicinity of the ponds. An unconfined or semi-confined aquifer (groundwater bearing horizon) is located to depths of approximately 20 – 30 metres. This aquifer (Aquifer 1) appears to be very stratified, with good water bearing layers interspersed with layers of much lower hydraulic conductivity. A deeper aquifer is identified at the depths of approximately 50 – 60 metres (Aquifer 2) (PGWES, 2003).

An indicative piezometric contour map for 'Aquifer 1' in the vicinity of the site based on limited data collected in 2003 indicated that the likely direction of the groundwater flow is in a generally southerly direction. The hydraulic gradient of Aquifer 1 has been estimated at approximately 1:180 (PGWES, 2003).

Based on groundwater level monitoring undertaken in 2003 from two piezometers installed between the existing ponds and Donald Creek (referred to as "Western" and "Eastern"), seasonal groundwater levels have been estimated to vary between approximately 1.0 – 3.0 metres below ground level at the Site (PGWES, 2003). A more recent assessment of GWRC piezometric surface data by LEI (2012), combined with recent field experience confirms seasonally high groundwater through the area.

Due to the generally poor grading of sands and gravels in Aquifer 1, and the presence of silts and clays, the aquifer is considered to have a generally low to moderate ability to transmit groundwater. Average transmissivity[29] of Aquifer 1 derived from bore pump tests is approximately 350 m^2/day.

Groundwater quality samples were collected in 2003 from the two test bores and limited chemical tests completed. In addition, LEI identified three further piezometers within the land application area that are understood to have been installed around the same time as the 2003 groundwater investigations. LEI during their site investigations (November 2015) carried out depth readings and water quality sampling from these three piezometers. Results are presented in Table 5 and the location of each piezometer is presented in Figure 12.

Aquifer 1 is recharged from rainfall infiltration on the plains to the north of the site and probably also leakage from Abbot Creek and the top end of Donald Creek (PGWES, 2003). The relatively low nitrate levels recorded in the test bores is indicative of aquifers with a high percentage of river recharge. Furthermore, water quality results suggest groundwater quality in the vicinity of

[29] 'Transmissivity' is defined as a rate of ground water flow through a unit strip of aquifer under hydraulic gradient.

the Site is not adversely impacted by the current activities. South of the WWTP site, Donald Creek gains water from the groundwater.

Table 5: Groundwater depth and quality near the site.

Bore	Total Depth	Depth to Water	Temp	Conductivity	Chloride	NH_4-N	NO_2-N	NO_3-N
	m	m	°C	µs/cm @25 oC	g/m^3	g/m^3	g/m^3	g/m^3
Western*	4.01	2.86	16	111	16.9	<0.005	0.013	0.510
Eastern*	3.21	2.17	16	136	17.1	<0.005	0.015	0.045
LEI 1**	4.40	1.34	11	124	17.4	0.034		1.47
LEI 2 **	4.54	1.48	11.3	121	17.1	0.017		1.24
LEI 3**	4.14	0.88	11.5	122	17.3	0.018		1.68

*Sampled by PGWES March 2003
**Sampled by LEI Nov 2015, LEI 2017 provides explanation for the variation in groundwater levels (see Appendix 7).

Figure 12: Location of piezometers on-site

3.6.2 Groundwater Users

The location of known bores and consented takes within 2 km of the Site boundary are shown in Figure 13[30]. This data is primarily derived from the GWRC's groundwater database and 98 bores have been identified. The majority of bores are shallow (less than 10 metres deep) and used for domestic and stock water supplies. Deeper bores (15 – 70 metres) are generally used for irrigation water supply. Of the 98 bores, fifteen are located between the Site and Lake Wairarapa and are therefore likely to be downgradient of the Site. Of the fifteen downgradient bores, five are shallower than 10m, the shallowest being 4m[31].

For those bores which have an associated take consent, Table 6 describes the consent purpose/use and bore information where available. All consented takes relate to irrigation activities. This information is important when considering the impacts on groundwater and its users from the proposed scheme upgrades described in Section 4.

[30] It is noted that LEI (2017) undertook a similar review and assessed bores within a 2km radius of the WWTP.

[31] It is noted that GWRC records do not hold depths for all bores.

Figure 13: Location of granted groundwater takes and bores in the vicinity of FWWTP

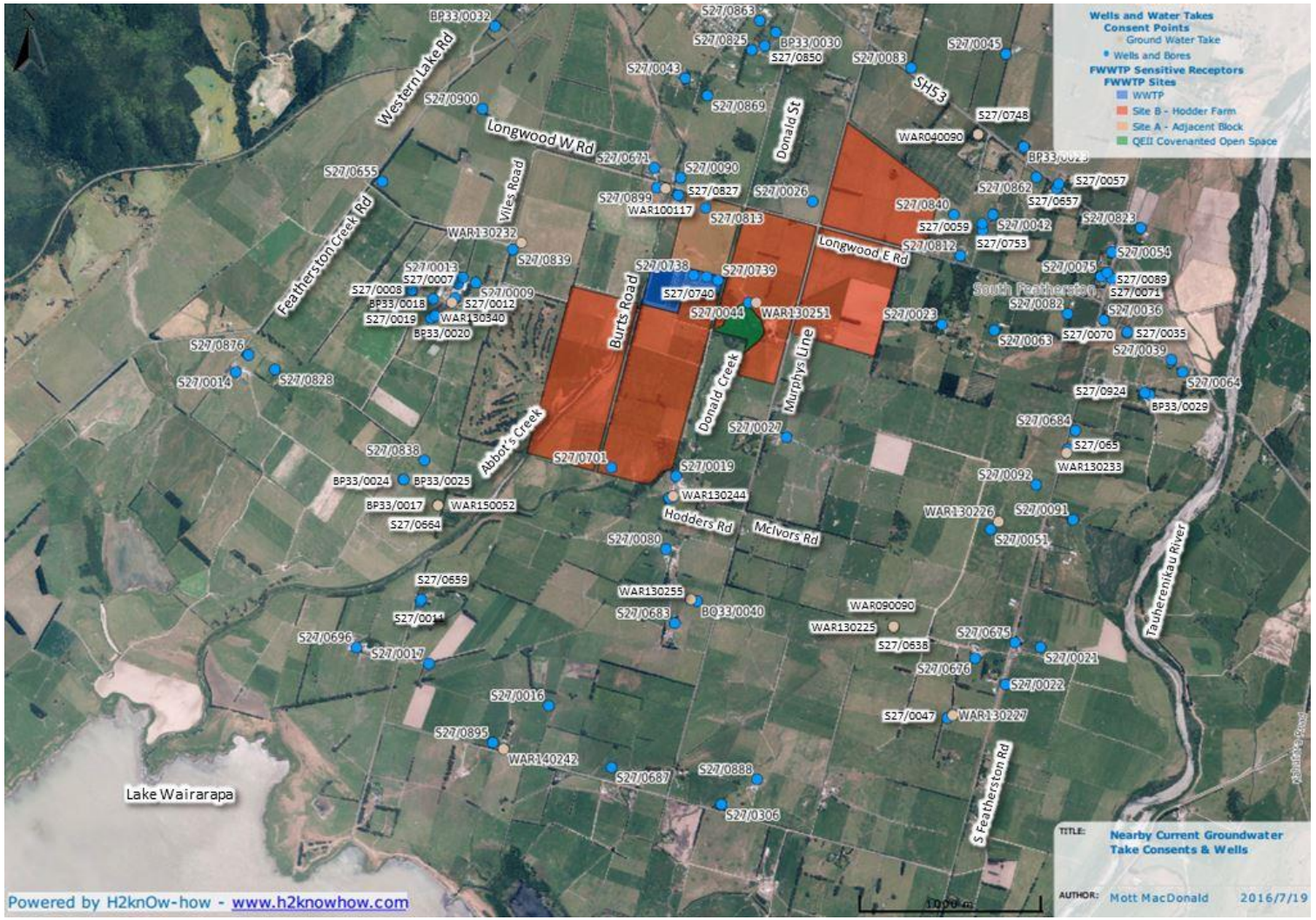


Table 6: Consented Groundwater takes (* indicates take downstream of Site)[32]

Consent ID	Consent Expiry	Consent Purpose	Consented Take (l/s)	Distance from Land Application Sites (m)	TOS^ (m bgl^^)	BOS^ (m bgl)
WAR040090	Expired	to take groundwater from bore S27/0748 (5E/89/10/I) for irrigation of olives		385	-	-
WAR090090 *	30/09/2016	to take groundwater from bore 3J/184/18/DS (Wells No. S26/0705) for irrigation of pasture	11.5	1493	-	-
WAR100117	30/09/2023	to take and use groundwater from a bore S27/0899 (5D/25/93/I) for irrigation purposes	20	119	86.5	92.5
WAR130225 *	30/09/2020	to take and use groundwater from bore S27/0638 (5E/78/18/I) for irrigation of pasture	67	1499	14	18
WAR130226 *	30/09/2020	to take groundwater from bore S27/0051 (5E/39/24/I) for irrigation of pasture	15	1146	19.5	23.5
WAR130227 *	30/09/2020	to take and use groundwater from bore S27/0047 (5E/35/19/I) for irrigation of pasture	23	2032	11	15
WAR130232	30/09/2020	to take and use groundwater from the northern bore (5D/22/66/I, Wells No. S27/0839) for irrigation of pasture	20	371	63	66
WAR130233 *	30/09/2020	to take and use groundwater from bore S27/0065 (5E/53/21(27)/I) for irrigation of pasture	33	1195	11.8	13.6
WAR130244 *	30/09/2020	to take and use groundwater from bore S27/0010 (5D/13/24/I) for irrigation of pasture	25	137	17.7	23.7
WAR130251 33	30/09/2020	to take groundwater from bore S27/0044 (5E/32/5.5/I) for irrigation of pasture	5	0	4.9	5.5
WAR130255 *	30/09/2020	to take and use groundwater from bore S27/0772 (5E/92/33/I) for irrigation of pasture	12	685	27	33
WAR130340	30/09/2020	to take and use groundwater from a bore S27/0012 (5D/3/66/SI) for irrigation of pasture	18	621	63.9	66.5
WAR140242 *	30/09/2020	to take and use groundwater from bore S27/0895 (5D/24/60/I) located in the Lower Valley Groundwater Zone for irrigation of pasture	20	1616	57	60
WAR150052 *	30/09/2020	to take and use groundwater from an existing bore S27/0664 (5D/16/24/I) located in the Lower Valley Groundwater Zone for irrigation purposes	35	574	18	24

Source: GWRC

^ TOS: top of screen; BOS: bottom of screen. ^^ bgl: below ground level.

[32] Groundwater and Surface Water Takes information sourced from GWRC, Jo Pritchard (Contact Centre) via email, 12 May 2016

[33] To be cancelled on commencement of Stage 1B.

3.7 Surface Waters

3.7.1 Donald Creek

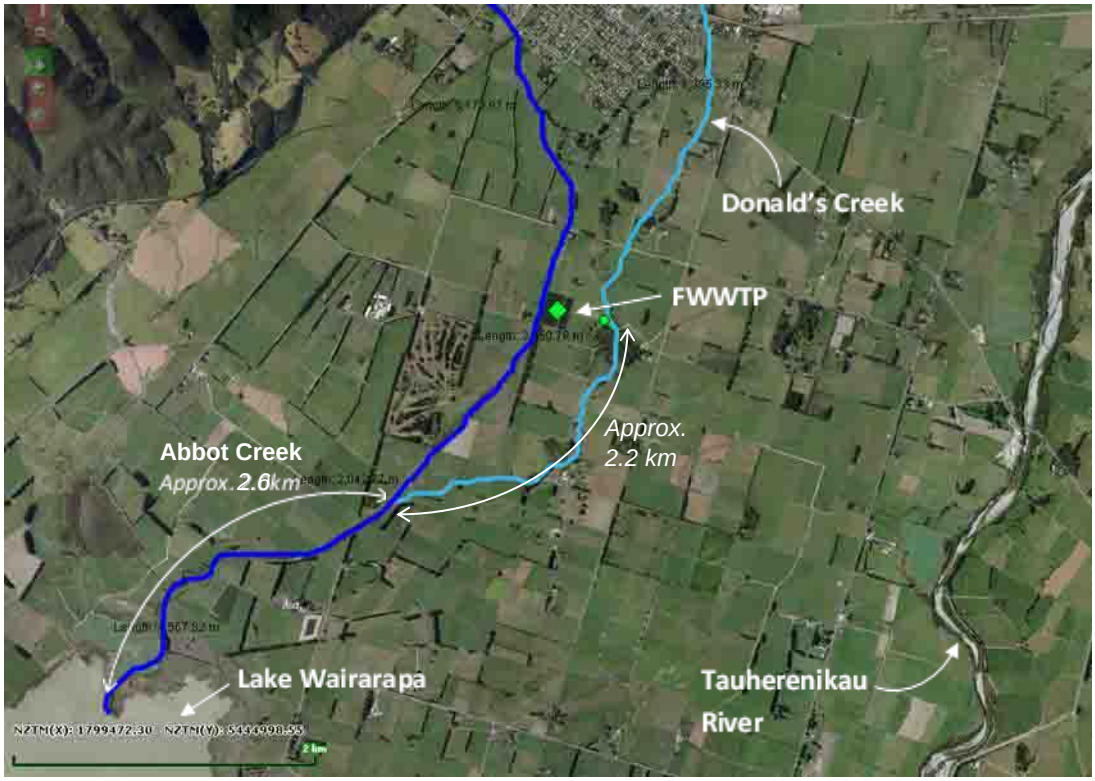
3.7.1.1 Creek Values

Neither the GWRC Regional Policy Statement (RPS), Freshwater Plan or Proposed Natural Resources Plan (PNRP) identify Donald Creek with any specific values of importance. In the PNRP it is classified as a River Class 5 - Lowland, large, draining plains and eastern Wairarapa.

3.7.1.2 Creek Hydrology

The treated effluent from FWWTP discharges directly into Donald Creek. This is a relatively small stream which originates in the foothills of the Tararua Ranges to the north of Featherston. A major tributary (Boar Creek) is located in this upper catchment, which has a total area of approximately 10.5km^2. Upon leaving the foothills, the creek meanders through approximately 6km of primary productive land (including dairy), before combining with Abbot Creek approximately 2.2km south of the discharge point, and thence discharging to the northern end of Lake Wairarapa a further 2.6km downstream (approximately) (refer to Figure 14).

Figure 14: FWWTP site in relation to predominant surface water bodies in the vicinity



Upon leaving the foothills, Donald Creek losses water to groundwater. In the vicinity of State Highway 2 the creek is often dry during the summer months. The downstream section of Donald Creek gains water from groundwater inflow. The spring feed Torohanga Creek (which flows through Site A) joins Donald Creek just north of the discharge point. Minor discharges from the Longwood water race (which cross through Site B) are also received by Donald Creek. The section of Donald Creek immediately adjacent to the WWTP ponds appears to be relatively

neutral, that is, it neither gains nor losses water to groundwater (PGWES, 2016a – see Appendix 6A).

There has been no continuous flow monitoring undertaken in Donald Creek catchment. However, SWDC have been monitoring Donald Creek flows on a regular basis as part of its FWWTP consenting requirements. In addition, a temporary flow monitoring site was established upstream of the discharge point in February 2016 and a number of readings were taken to calibrate the temporary gauge (PGWES, 2016b – see Appendix 6B). Analysis of flow monitoring results from February 2010 till June 2016 are summarised below.

Table 7: Flow records upstream and downstream of the treated discharge point in Donald Creek

	Flow 20m US (l/s)	Flow 100m DS (l/s)	Change in flow between US and DS (l/s)
Minimum	15	26.6	4
1/2 Median	80.5	98	
Median	161	196	13
Average	218	301	27
Maximum	757	847	109
Count	37	23	23

Source: SWDC Monitoring Data and PGWES (2016a and b). Data analysed from February 2010 to June 2016. Change in flow between US and DS is determined from pairing those US and DS flows taken on the same day and time.

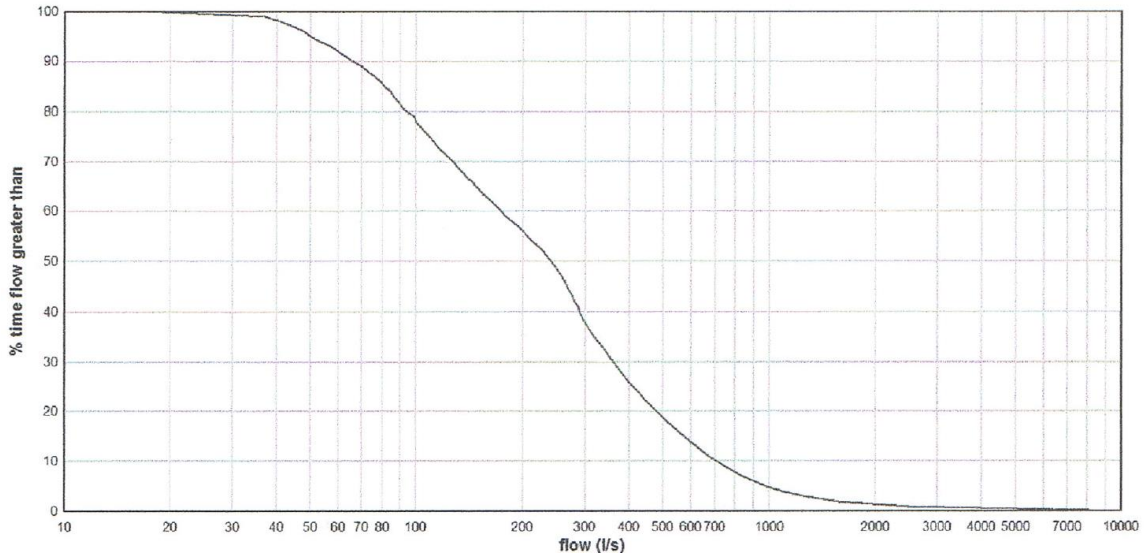
Mean gauged flow for the monitoring site upstream of the discharge is 218 l/s, ranging from 15 to 757 l/s. During low flow conditions the majority, or all, of the flow at this site is from the Torohanga Stream tributary. A current water permit allows pumping of up to 16 l/s from the Torohanga Stream for irrigation purposes onto a neighbouring farm. Some of the historical low flow gauging results therefore will be influenced by this water take. It is noted however that the water take did not occur in the 2015/16 irrigation season as irrigation water was sourced from a new deep bore (PGWES, 2016a).

In an attempt to obtain a more robust flow record for Donald Creek, flow gauging data for the upstream WWTP monitoring site was correlated with several other GWRC river or groundwater level sites with longer term continuous records to develop a synthetic hydrograph. Flow statistics derived from 15 years of synthetic flow data is presented below in Table 8 and Figure 15 (PGWES, 2016a).

Table 8: Mean Monthly flows in L/s (14/1/2000 – 7/10/2015).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Min	47	45	43	52	86	84	171	207	154	215	122	83	229
Mean	142	137	143	171	261	478	633	715	478	471	241	203	354
Max	303	882	474	538	580	978	1045	1511	961	1020	398	535	444

Figure 15: Donald Creek Flow Distribution Curve



Based on the synthetic flow hydrograph, flows in Donald Creek just upstream of the WWTP outfall, are always greater than 19l/s, with an estimated median flow of 241 l/s and flows exceeding 707 l/s 90% of the time. The flow in Donald Creek is very seasonal with an estimated median flow in the months January to March of 75 L/s (PGWES, 2016a).

In November 2016, data collected from the temporary flow monitoring gauge (from 22/2/2016 to 7/11/2016) was compared against the synthetic record for the same period. Reasonable agreement was obtained and the synthetic data was found to have underestimated the true flows providing a safety margin in terms of the proposal being assessed (PGWES, 2016c – See Appendix 6C).

3.7.1.3 Creek Physical Habitat Characteristics

Hamill (2017a & b) provide a detailed account of the physical habitat characteristics of Donald Creek (See Appendix 11) which is summarised below.

To the north of the FWWTP discharge point Donald Creek flows through open farmland. In the downstream section of Donald Creek, starting abeam of the FWWTP, it flows under a remnant of protected bush for a several hundred metres, then through open farmland once more before entering Abbot Creek. A small tributary (Longburn water race) enters Donald Creek from the true left about 430m downstream of the discharge. Groundwater inputs and tributaries continue to augment Donald Creek before it enters Abbot Creek.

Donald Creek has similar water depth between upstream and downstream sites but there was a general increase in stream width, decrease in water velocity and reduction in substrate size. The Creek substrate is dominated by gravel stones and sand upstream and downstream of the Featherston WWTP although at the most downstream site surveyed (650m ds) had noticeably slower flows and smaller substrate than the other sites (large gravels represent 28% of the substrate at the upstream sites but is absent from the 650m downstream site). At this downstream site, cattle were in the stream and the stream margins were heavily pugged.

Total habitat scores were highest for sites located in the bush remnant, where the riparian vegetation provided more shade, better diversity of fish cover, less bank erosion. The habitat

condition was lowest at the downstream site where the flow was uniform and cattle had access to the stream.

3.7.1.4 Creek Water Quality

The water quality in Donald Creek is clearly influenced by the rural land use within the catchment. SWDC have been monitoring the quality of Donald Creek approximately 20m upstream of the discharge point (referred to a "Longwood Water Race 2") on a regular basis as part of its FWWTP consenting requirements. The results of monitoring from 2005 to 2016 is presented in Table 9.

The stream was characterised by near neutral pH, high DO and good water clarity. The nitrogen and phosphorus are elevated above guideline values and background concentrations (NIWA, 2016). The concentration of nitrate and ammonia were below relevant guidelines (NIWA, 2013 and 2014).

To avoid repetition, an assessment of the upstream water quality and effects of the existing discharge is provided in Section 6 and Appendix 8 of this report.

Table 9: Donald Creek upstream water quality (2005 -2016)

Parameter	Minimum	Median	Maximum	Sample number
Conductivity	55	109	150	92
DO Field (g/m^3)	6.3	10	13	88
pH field	5.7	7.3	8.3	92
pH Lab	6.5	6.6	6.9	5
Temp	7.3	13	18	61
Black Disc (m)	1.1	2.57	3.5	19
Total suspended solids (g/m^3)	<1	3	79	95
Turbidity (NTU)	0.71	1.92	36	89
Total Biochemical oxygen demand (g/m^3)	0.13	0.6	3	0
Nitrate-N (g/m^3)	<0.01	0.8	1.85	89
Nitrite-N (g/m^3)	0.0001	0.0030	0.68	89
Total oxidised -N (g/m3)	0.0093	0.80	1.85	89
Total ammoniacal nitrogen (g/m^3)	<0.01	0.020	0.30	88
Total phosphorus (g/m^3)	0.0057	0.026	0.22	91
Dissolved reactive phosphorous (g/m^3)	<0.01	0.011	0.092	89
Total Nitrogen (g/m^3)	0.35	0.97	2.4	96
Ecoli (cfu/100ml)	20	270	12960	95
Dissolved inorganic nitrogen (g/m^3)	0.014	0.84	1.9	89

Source: SWDC Monitoring data

3.7.1.5 Creek Ecological Health

Hamill (2017a & b) provides a detailed account of the ecological health of Donald Creek which has been summarised below.

A useful indicator of the quality of water and ecological condition of Donald Creek is provided by the Macroinvertebrate Community Index (MCI) score and Quantitative Macroinvertebrate Community Index (QMCI). Past sampling of Donald Creek has found the upstream site to have MCI and QMCI scores indicative of 'poor' to 'fair' ecological condition (MCI scores of 70 to 98, QMCI scores of 2.7 to 4.6).

Periphyton cover and biomass upstream of the discharge has been within guideline values for protection of aesthetic value and trout habitat. Periphyton cover was elevated at sites downstream of the discharge but not as much as expected based on changes in nutrient concentrations, and periphyton biomass is probably being controlled by factors other than nutrients.

The stream had low macrophyte cover in the shaded sections, about 8-16% cover upstream of the discharge and about 15-30% cover at the downstream site. The dominant macrophyte was the sprawling emergent *Apium nodifolrum* (water celery).

Donald Creek supports populations of large longfin eel and common bully. Two medium sized rainbow trout were also observed in Donald Creek. No kākahi were found at any of the sites, however, the fingernail clam was found at all the Donald Creek sites and at greatest abundances at the 650m downstream site.

The effects of the existing discharge are provided in further detail in Section 6.

3.7.2 Abbot Creek

The headwaters and middle reaches of Abbot Creek are also in the bush clad Tararua Ranges to the west of Featherston and run parallel to State Highway 2 before emerging into the urban area of Featherston. The stream then runs through open farmland in its lower reaches before discharging into Lake Wairarapa.

The PNRP classifies Abbot Creek as a River Class 4 - Lowland, large, draining ranges, with significant indigenous ecosystems [34]. In particular its Creek and tributaries upstream of the confluence with Donald Creek have high macroinvertebrate community health. Upstream and downstream of the confluence with Donald Creek it is identified as a habitat for indigenous threatened/at risk fish species [35]. Furthermore, Abbot Creek is also identified as an important trout spawning water[36].

GWRC have undertaken some low flow gauging in Abbot Creek, although the data set is very small (12 samples in total) with a mean low flow of 263m^3/s recorded. Some of the flow records have been logged during times when irrigation (i.e. stream take) is known to be occurring. It is also worth noting that Abbot Creek upstream of the confluence with Donald Creek (in the vicinity of the FWWTP) is dry during dry weather summer conditions.

No known useful water quality or ecological information exists for with Abbot Creek except that collected by Hamill (2017a) during a spring survey in October and November 2016 (See Appendix 11) and is summarised below.

A set of grab samples were collected for water quality on 12 October 2016 and the results are presented in Table 6.17. Both DRP and SIN were likely to be limiting periphyton growth upstream of the confluence, while downstream the DIN was in excess of periphyton growth requirements and the DRP was likely to exert only a little control on periphyton growth.

In Abbot Creek the periphyton cover and biomass was higher upstream of the confluence with Donald Creek in October 2016, this was surprising given the difference in nutrient concentrations but may have reflected low grazing pressure by invertebrates at this site. During November periphyton cover and biomass was higher downstream of the confluence, but

[34] PNRP, Schedule F1

[35] PNRP, Schedule F1

[36] PNRP, Schedule I

remained low and well within guidelines for maintaining trout habitat (i.e. chlorophyll-a was 48 mg/m^2, AFDM 12 g/m^2 and PeriWCC was 0%).

Upstream of the confluence with Donald Creek, Abbot Creek had macroinvertebrate communities indicative of 'fair' ecological condition and 'probably moderate pollution' based on MCI scores (range 95 to 98); but QMCI scores indicated poorer ecological conditions (range 2.1 to 3.0). No kākahi were found at any sites and the fingernail clam was only found downstream of the confluence.

The fish community in Abbot Stream was dominated by longfin eel and common bully, and had greater diversity to that observed in Donald Creek, and included shortfin, inanga and a small rainbow trout. Most of the eel caught in the fyke nets were large, seven of the longfin eel were over 1m long (Hamill 2017a & b).

The effects of the existing discharge are provided in further detail in Section 6.

3.7.3 Lake Wairarapa

The description and importance of Lake Wairarapa is well documented (Perrie & Milne, 2012), as are the effects of landuse on its water quality.

3.7.3.1 Lake Values

Lake Wairarapa itself is identified in the PNRP as a water body with outstanding indigenous wild life ecosystem values[37] and is listed in both the PNRP and RPS as a lake with significant indigenous ecosystems[38]. Lake tributaries (including Abbot Creek and its tributaries although excluding Donald Creek[39]) are identified in both the PNRP and RPS as significant indigenous ecosystems (habitat for indigenous and threatened fish species and/or high macroinvertebrate community health). The Freshwater Plan also identifies Lake Wairarapa as a water body to be managed for aquatic ecosystem purposes [40] and as a waterbody with nationally threatened indigenous fish recorded in the catchment [41] (although does not include Abbot Creek and its tributaries).

Lake Wairarapa is part of the largest wetland complex in the southern North Island. The northern and eastern Wetlands of Lake Wairarapa are identified as being significant natural wetlands with outstanding indigenous biodiversity values[42].

Lake Wairarapa itself is identified as a water body with regionally important amenity and recreational values requiring protection [43], in particular for fishing, kayaking, canoeing, boating, duck shooting, birdwatching, walking, and photography. However, the most recent GWRC Report on the state and trends of recreational water quality in the Wellington region (Greenfield

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37 PNRP, Schedule A2.

38 PNRP, Schedule F1 and RPS Appendix 1, Table 16

39 With regard to the definition of Abbots Creek and its tributaries and whether this includes Donald Creek, we sought clarification from Summer Greenfield who advised "My interpretation is that Abbotts Creek above the Donalds Creek confluence is significant but that Donalds Creek is not. Yes agree there is conflict between the table and the map. I would go off the map rather than the table". (email dated 25/5/16 to Sarah Sunich).

40 Freshwater Plan, Appendix 2 Part B, Figure 2.8.

41 Freshwater Plan, Appendix 3 Part A, Figure 3.15.

42 PNRP, Schedule F3 and Schedule A3.

43 RPS; Appendix 1, Table 15; and Freshwater Plan: Appendix 5; and PNRP, Schedule H1. In the Freshwater Plan, Lake Wairarapa is excluded from the management of water quality for contact recreation purposes as water quality for the Lake is managed in accordance with Policies 5.2.2 (To manage water quality in Lake Wairarapa in accordance with the National Water Conservation (Lake Wairarapa) Order 1989) and 5.2.6 (for aquatic ecosystem purposes).

et al., 2012) has focussed on rivers and coastal recreational spots, and does not include any additional information on Lake Wairarapa.

Tangata Whenua Values are identified in the PNRP and are provided in Table 10 below [44].

Table 10: Ngā Taonga Nui a Kiwa

Ngā Mahi a ngā Tīpuna:
Wairarapa Moana for tangata whenua comprises Lake Onoke and Lake Wairarapa. Lake Wairarapa is the freshwater eye of the 'Fish of Maui'. Its discovery is attributed to Kupe and also to Haunui a Nanaia. A taniwha in the form of a log signalled the lakes' closing to the sea in former times and also tragedies. Iwi occupation around the lakes has occurred from earliest settlement and subsequent to the time when the lakes were gifted to the Crown in the late 19th Century.
Te Mahinga Kai:
The Wairarapa Moana fishery was the most abundant in the entire Wairarapa and the tuna fishing in particular was comparable with the cod-fish of Newfoundland. When Wairarapa Moana was gifted to the Crown, the Crown promised to protect and preserve its fishery and guaranteed iwi permanent access to it. The vast wetlands provided many natural resources.
Wāhi Whakarite:
Wairarapa Moana and its wetlands, coastal borders and the Ruamāhanga River have for generations supported the cultural, spiritual and physical well-being of whanāu, hapū and iwi.
Te Mana o te Tangata:
Marae communities from throughout the Wairarapa met at Lake Onoke during the annual eel migration to fish with large quantities being prepared and stored for future consumption and also trade.
Te Manawaroa o te Wai:
The health of Wairarapa Moana is adversely affected by the diversion of the Ruamāhanga River, farming practices and urban pollution including human sewage. However it remains a significant resource for ongoing cultural, recreational, environmental and commercial activities and interest.
Te Mana o te Wai:
Wairarapa Moana is integral to our identity as Māori and its health is vitally important to us.

In summary, Lake Wairarapa is considered to be of both national and international importance due to its significant cultural, ecological, recreational and natural character values. A National Water Conservation Order was placed on Lake Wairarapa in 1989 recognising the high ecological values of the area (Perrie & Milne, 2012).

3.7.3.2 Lake Physical Characteristics

Lake Wairarapa is the largest lake in the Wellington region (~7,850 ha) and it is the only lake that has had its water quality routinely monitored to date. It is typically very shallow – only around 2.5 m at its deepest point – and is considered to be isothermal (ie, does not thermally stratify).

The lake has been significantly modified through flood protection and drainage activities carried out under the Lower Wairarapa Valley Development Scheme (LWVDS). The most significant changes included the diversion of the Ruamahanga River from its direct course into Lake Wairarapa, across the Kumenga Peninsula directly into Lake Onoke and the drainage of large areas of wetlands. Barrage gates were also installed at the outlet of Lake Wairarapa to regulate lake water levels.

The main surface inflow into the lake is the Tauherenikau River and at times, flood flows from the Ruamahanga River can enter the lake via the Oporua Floodway. Lake Wairarapa's outlet is situated at its southern end where lake water 'discharges' into the lower reaches of the

[44] PNRP, Schedule B.

Ruamahanga River prior to entering Lake Onoke. Backflow from Lake Onoke into Lake Wairarapa can also occur on occasion (Perrie & Milnle, 2012).

3.7.3.3 Lake Water Quality

Water quality monitoring by GWRC indicates Lake Wairarapa is in a degraded state with typically elevated levels of nutrients and phytoplankton biomass, and poor water clarity (Perrie & Milne, 2012). The lake is classed as supertrophic (or very high in nutrients and could lead to algal blooms) and has remained in a relatively stable, yet poor, state since 1994 (Perrie *et al.* 2015).

Results are reported to be "significantly influenced" by re-suspension of lakebed sediments (which influences Secchi depth (measure of water clarity) and total phosphorus) and potentially the lake would be more appropriately classified as eutrophic/supertrophic.

Lake water quality is affected by the large component of agricultural land use in the catchment; including intensive farming around its margins. Inputs from urban land use and, indirectly, discharges from FWWTP also contribute to the nutrient loading. Some influence is also experienced from the backflow of saline water from Lake Onoke.

GWRC confirm that *"As yet, the relative contributions from external sources of nutrients are not well understood ... Similarly, the role of internal nutrient cycling – a potentially significant factor for all three lakes – has not been quantified. Investigations into nutrient inputs is a high priority, particularly for Lakes Wairarapa … given that further land use intensification is expected in the Wairarapa Valley"* (Perrie & Milne, 2012).

Figure 16 below provides a summary of water quality in Lake Wairarapa.

Figure 16: Summary of physico-chemical and microbiological water quality in lake Wairarapa

Variable	National median values	Median	Minimum	Maximum	% n <D.L.
Water temperature (°C)	—	13.1	7.7	17.7	—
Dissolved oxygen (% saturation)	—	98.6	92.5	117	—
Dissolved oxygen (mg/L)	—	10.4	8.2	13.8	—
pH	7.7	7.5	6.7	7.9	—
Conductivity (µS/cm)	192	774	136	3,200	—
Secchi depth (m)	2.0	0.24	0.09	1.23	—
Turbidity (NTU)	3.2	51.5	3.2	220	0
Total suspended solids (mg/L)	—	48.5	10	230	0
Volatile suspended solids (mg/L)	—	5.5	<2.0	24	16
Total nitrogen (mg/L)	0.773	0.52	0.07	1.48	0
Nitrite nitrogen (mg/L)	—	0.001	<0.002	0.004	75
Nitrite-nitrate nitrogen (mg/L)	—	0.053	<0.002	0.943	32
Ammoniacal nitrogen (mg/L)	0.013	0.016	<0.01	0.320	38
Total phosphorus (mg/L)	0.037	0.080	0.030	0.290	0
Dissolved reactive phosphorus (mg/L)	0.003	0.005	<0.004	0.029	33
5-day biochemical oxygen demand (mg/L)	—	0.40	0.24	4.2	34
Chlorophyll a (mg/m^3)	8.8	5.95	<1.90	31	18
E. coli (cfu/100 mL)	—	10	<1	150	16
Faecal coliforms (cfu/100 mL)	—	11	<1	190	11

Source: Perrie and Milne (2012), Table 3.2

Note: Results are based on 14 sampling occasions during 2006 to 2010 (data pooled from all four sites). National median values for lakes in catchments dominated by pastoral land cover are also presented (taken from verburg et al. 2010). D.L. = detection limit.

The potential for the FWWTP discharge to have some contribution to the cumulative effect on the water quality of Lake Wairarapa is acknowledged by SWDC. Due to the complexity of the factors affecting Lake water quality, as acknowledged by GWRC, determining the level of effect with any accuracy is extremely difficult, if at all possible. Cumulative effects are addressed in the assessment below in Section 6 with an estimate of nutrient load contribution from the existing plant and future scheme.

SWDC are committed in achieving a long term sustainable outcome for the FWWTP, however, it is considered that the removal of all FWWTP contaminant load to Lake Wairarapa (if it were possible) would be unlikely to have a measurable improvement on Lake Wairarapa water quality.

3.7.3.4 Lake Ecological Health

Lake Wairarapa is a habitat for indigenous threatened/at risk fish species and is habitat for six or more migratory indigenous fish species [45]. Indigenous fish species recorded in Lake Wairarapa catchment include (but may not be limited to) [46]:

- Banded kokopu,
- *black flounder*,
- *common bully*,
- *common smelt*,
- *giant kokopu*,
- *grey mullet*,
- *inanga*,
- ***lamprey***,
- *longfin eel*,
- *shortfin eel* and
- *torrentfish*

Lake Wairarapa is also identified as a habitat for indigenous birds[47].

> *"Lake Wairarapa provides winter (non-breeding) habitat for close to 100% of the regional populations of black-billed gulls, banded dotterels and black-fronted dotterels and up to 60% of the regional population of pied stilts.*
> *It also provides summer (non-breeding) habitat for close to 100% of the regional population of bar-tailed godwits, Pacific golden plovers, sharp-tailed sandpipers and pectoral sandpipers.*
> *This habitat provides foraging and roosting habitat for close to 100% of the Wellington Region's breeding population of Caspian terns.*
> *At least twelve threatened or at risk species are resident or regular visitors to this site: NZ dabchick, Australasian bittern, white heron, royal spoonbill, black shag, little black shag, banded dotterel, variable oystercatcher, bar-tailed godwit, pied stilt, black-billed gull and Caspian tern.*

[45] PNRP, Schedule F1

[46] Migratory species are indicated in italics and the conservation status of "At Risk" and "Nationally Vulnerable" species are underlined and in bold, respectively)

[47] PNRP, Schedule F2b.

Indigenous diadromous fish migrating to and from the rivers draining to Lake Wairarapa pass through the lake during their migration. Burlings Stream, Brocketts Stream, the Taukerenikau River and their tributaries are recognised for their migratory indigenous fish values."

3.7.4 Lake Onoke

Both Lake Onoke and Palliser Bay are considered to be too far field to be influenced by the discharge from the FWWTP. Although it is worth noting that Lake Onoke is classed as eutrophic (or high in nutrients) and has very similar water quality to Lake Wairarapa. Thus Lake Onoke faces the same sorts of issues as Lake Wairarapa.

3.7.5 Surface Water Users

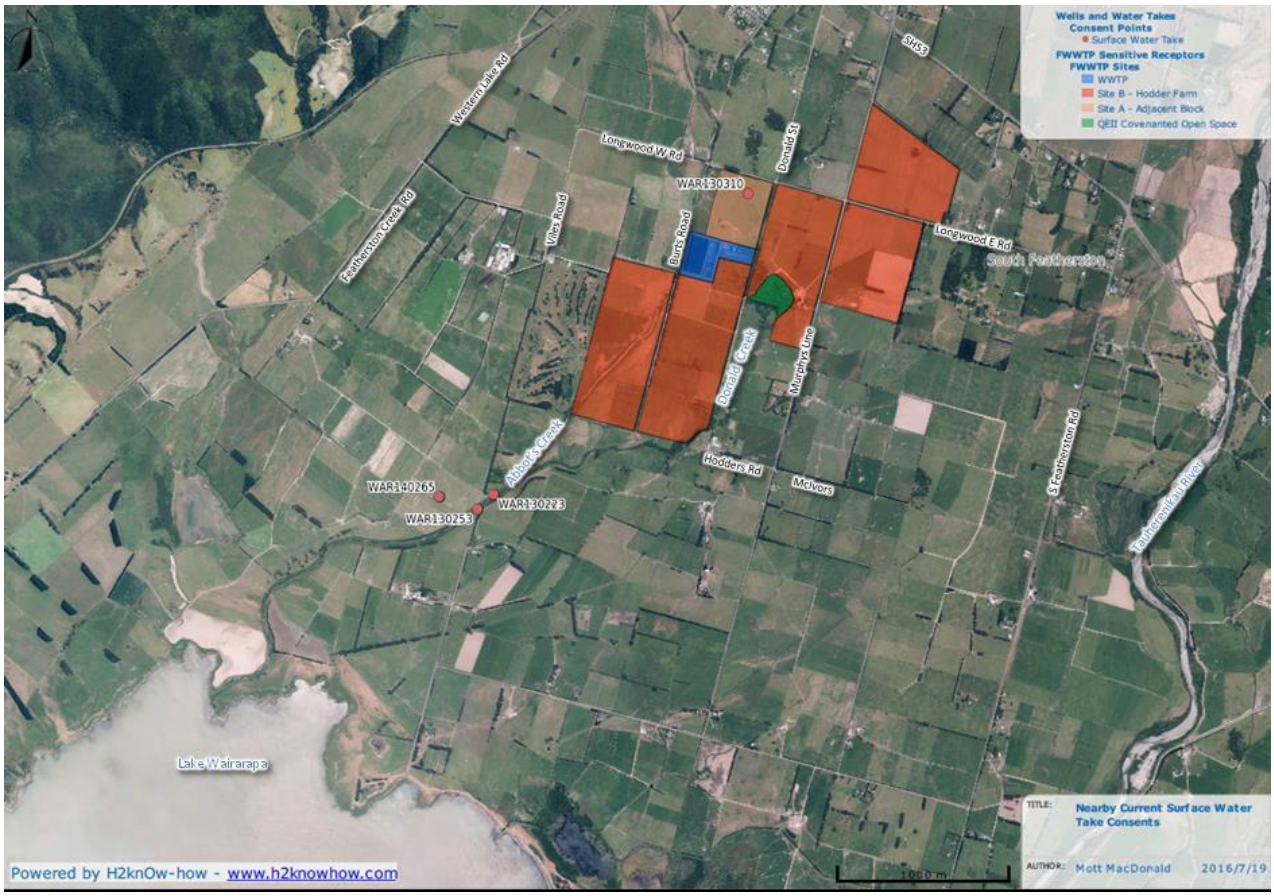
There are a number of existing granted consents for surface water takes in the vicinity of FWWTP which have the potential to impact upon flows in Donald Creek or assimilative capacity downstream of the discharge. These consents are tabulated and shown in Table 11 and Figure 17 below.

Table 11: Current water use consents (instantaneous take) granted by GWRC in the vicinity of Donald Creek

Consent ID	Expiry date	Purpose	Permitted take (l/s)	Distance (m)
WAR120050	30/09/2030	to take surface water from Boar Bush Stream for an emergency public water supply (SWDC)	60	
WAR130253*	30/09/2020	to take and use surface water from Abbotts Creek for irrigation of pasture	17	789
WAR130223*	30/09/2020	to take and use surface water from Abbot Creek for irrigation of pasture	20	660
WAR130310	30/09/2020	to take surface water from Abbot Creek/Torohanga Stream for irrigation of pasture	16	98
WAR140265*	30/09/2020	to take and use surface water from an unnamed tributary of Turners Lagoon for irrigation purposes	18	920

* indicates take downstream of FWWTP discharge

Figure 17: Location of granted surface water takes in the vicinity of FWWTP



3.7.6 Site Flooding

The FWWTP is not located in or in close proximity to the flood hazard zone identified by the WCDP. Furthermore, SWDC advises there is no record of flood waters inundating the ponds, or ponds overtopping. Figure 18 presents the extent of a 50 year flood event.

Some water from Donald Creek begins to enter the Site on the northern side and may extend further if a 100 year flood event is experienced [48]. And some minor flooding has occurred in the past during particularly heavy rainfall events on what is referred to as Paddocks 11 and 12 north east of the covenanted bush area, but which drains away in approximately 24 hours.

Donald Creek as it passes through the site is designated within the WCDP for the conveyance of water for flood mitigation purposes (DS016 – Donald Creek Floodplain and Drain Area).

[48] GWRC online GIS mapping tool

Figure 18: Extent of Flooding in a 50 year Event

3.7.7 Site Drainage and Riparian Management

Donald Creek where it passes through the Site is predominantly fenced on Site B but not within Site A (including the Torohanga Stream) (LEI, 2017). With exception to the willow swamp, there is no specific riparian planting along the banks of Donald Creek.

Abbot Creek where it runs through the site to the south of the FWWTP is fenced off creating a 20m riparian buffer each side. A stock race runs along one embankment inside the 20m buffer. and vegetation within the buffer area includes willow, lupin, gorse and fennel.

The Longwood Water Race which runs through the north-eastern paddocks of Site B is not fenced and is likely to act as a drainage network for the site.

Artificial drainage has been installed in the south-east corner of the site and covers around 8ha.

Large wet areas exist on paddocks west of Abbot Creek (adjacent to the golf course). Careful management of these areas as part of the land treatment scheme is proposed.

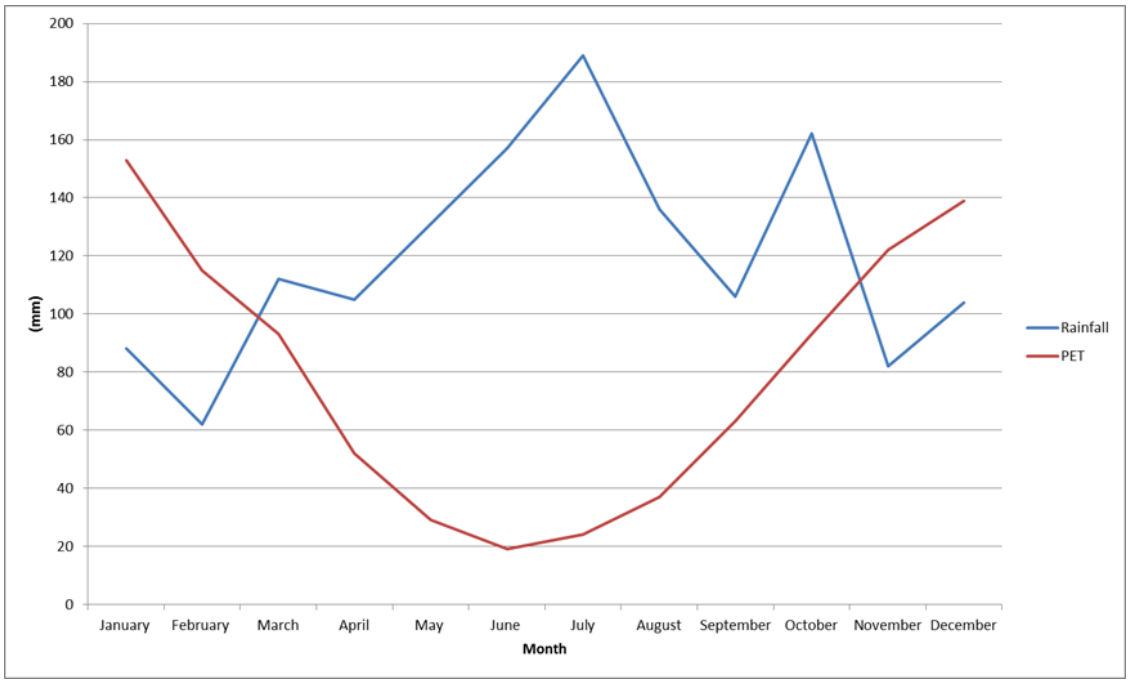
3.7.8 Climate and Climate Change

South Featherston is located at the western foothills of the Rimutaka and Tararua Ranges, which influences its climate. Extreme weather patterns are rare, although the area is prone to frequent rain and windy conditions.

The prevailing wind direction[49] is from the north-north-east (16% of the time) and are dominantly light <2 m/s. North-west (13%) and south-west (13%) are the next most common directions and they are stronger than the prevailing NNE winds. 80% of the time wind speeds are less than 4m/s (14.4 km/hr); and 93% of the time, 6m/s (21.6 km/hr). The overall average wind speed is 2.1 m/s (7.5km/h) (LEI, 2017).

Daily rainfall data and daily potential evapotranspiration (PET) data is given in Figure 19. This data has been sourced from the Virtual Climate Station for South Wairarapa (NIWA/28201); 1km north of the Site and is considered the best representation for the site. Featherston is located within the mean annual rainfall zone of 1,200 to 1,400 mm with an average annual rainfall of 1,434 mm and PET of 937 mm recorded between 1993 and 2014.

Figure 19: Monthly Average Climate Data for South Wairarapa (1993 – 2014)



The effects of climate change in New Zealand are slow, but well documented. Although no specific information is available for South Featherston, in terms of the Wairarapa the following conditions could be expected by 2090 relative to 1995 levels[50,51]:

- Increased days per year where maximum temperatures exceed 25°C with fewer frosts;
- The largest changes in rainfall will be for particular seasons rather than annually with Masterton likely to experience up to 7 % less rainfall in winter. Furthermore, the Wairarapa is not expected to experience a significant change in the frequency of extreme rainy days as a result of climate change.

[49] Data from the Tauherenikau at Alloa climate station sourced from GWRC for the period September 1999 to March 2013. This was the closest record available with sufficient time span of data and is considered to be representative of conditions at Featherston that are less than 5km north east of the Site.

[50] http://www.mfe.govt.nz/climate-change/how-climate-change-affects-nz/how-might-climate-change-affect-my-region/wellington - last reviewed 30 June 2016

[51] GWRC 2014 Summary report for Ruamahanga Whaitua Committee. Greater Wellington Regional Council. Sourced http://www.gw.govt.nz/assets/Plans--Publications/Regional-Plan- Review/Whaitua/SUMMARY-REPORT-The-climate-of-the-Ruamahanga-catchment.pdf Retrieved: 18 December 2015

- The frequency of extremely windy days is likely to increase by 2 to 3 per cent. There may be an increase in westerly wind flow during winter, and north-easterly wind flow during summer.
- Future changes in the frequency of storms are likely to be small compared to natural inter-annual variability. Some increase in storm intensity, local wind extremes and thunderstorms is likely to occur.
- Drought increase and severe drought to occur twice as often by 2100.
- Seasonal temperature and rainfall changes as per Table 12:

Table 12: Predicted climate change in Masterton by 2090

Season	Temperature Rise
Spring	0.6°C to 2.7°C temperature rise 3 per cent less to 2 per cent more rainfall in Masterton
Summer	0.7°C to 3.1°C temperature rise 1 per cent less to 8 per cent more rainfall in Masterton
Autumn	0.7°C to 3.1°C temperature rise No change to 3 per cent more rainfall in Masterton
Winter	0.7°C to 3.2°C temperature rise 7 per cent less to 1 per cent more rainfall in Masterton

Although there will likely be some changes experienced during the term of consent, the proposal will not exacerbate climate change nor will the effects of climate change increase the intensity of the effects experienced by it.

3.7.9 Air Quality

GWRC is responsible for monitoring air quality in the region. No specific ambient air quality monitoring is undertaken in Featherston or its surrounds (Mitchell, 2016).

SWDC are not aware of any localised air quality issue (i.e. odour) in the vicinity of the Site associated with the FWWTP. There is no record of any complaints or indication of adverse effects on air quality from the operation of the FWWTP.

3.7.10 Cultural Values

As assessment of the proposed activity and approach with respect to cultural values and perspectives has been commissioned by SWDC (Smith, 2014 – see Appendix 12). This, first and foremost identifies that the typical assessment afforded cultural values in terms of section 6, 7, and 8 of the RMA often do not enable consideration of the wider picture.

The assessment identifies that indigenous studies amongst Maori theorisers has examined what was needed for full Maori research. Six Kaupapa Maori principles have been identified which will better enable Maori to benefit from any research that they are involved in. The benefits of this approach are expected to extend past the conceptual to the transformative.

The six principles are:

1. **Tino Rangatiratanga** transformative principle that seeks transformative action;
2. **Whanau** principle that seeks benefit for all parts of the community
3. **Raruraru o te Kainga** socio economic principle that acknowledges the difficulties whanau face
4. **Taonga Tuku Iho** principle that acknowledges what we have been passed down to us
5. **The Ako Maori** principle that acknowledges the preferred way Maori want to transmit knowledge

6. **Moemoea** The kaupapa principle of a collective vision from the people going forward

The assessment has identified the need to resolve the breaches of the Treaty of Waitangi by the Crown in order to enable the full involvement of Wairarapa Maori as an affected party.

SWDC supports the Treaty Claim process, and also looks forward to the settlement of claims within the District.

The assessment has considered the proposed activity in terms of these principles, and has also considered the relevant RMA policy frameworks. It has not raised any significant concerns from a cultural perspective on the application itself. The assessment does however raise the following key issues:

1. That improvement in water quality is a long term process which needs to be done correctly,
2. The need for integrated catchment management
3. The importance of enabling participation of Maori in their own right
4. The key need to improve water quality in Lake Wairarapa
5. The importance of maintaining and enhancing water quality in waterways
6. Recognising the issues associated with infiltration into the system reducing the efficiency
7. The intrinsic values Maori afford water, and the contrary nature of introducing human effluent into water

SWDC acknowledges all of these key points, and has attempted to address them in its proposal. Specific reference is provided through the assessment below.

3.7.11 Local Amenity and Recreation Values

SWDC are not aware of any documented recreational values associated with Donald Creek downstream of the discharge. It is a very small stream with restricted public access which inherently limits the potential for recreational use and values.

Neither Donald Creek nor Abbot Creek are monitored as part of the GWRC Recreational Water Quality monitoring (Morar & Greenfield, 2016). In addition, neither Creek is identified in the Freshwater Plan, PNRP or the RPS as having recreational values. It is likely that there are some recreational uses of parts of Abbot Creek, but there is no evidence of this occurring to any significant degree. It is possible that some minor recreational use of Donald Creek does occur. SWDC have signage indicating the location of the current discharge point, which is proposed to continue as a condition of consent.

As noted earlier in Section 3.7.3, Lake Wairarapa is recognised as a water body having recreational and amenity values requiring protection[52].

[52] RPS (2013); Appendix 1, Table 15.

4 Proposed Activity Description

A comprehensive range of alternatives was considered in developing the Project, including consideration of how the FWWTP works would integrate with the plant upgrades for Greytown and Martinborough. A detailed assessment of alternatives is provided in Section 7.3 and Appendix 2 of this Report. This section outlines the activity as proposed.

Treatment of wastewater will continue to be provided from the existing oxidation pond and UV disinfection plant. However, a significant improvement will be implemented through the reduction in I&I flows entering the Featherston sewerage system and a staged land treatment scheme over the term of the consent which will ultimately see an average of 94% of treated FWWTP flows discharged to land.

The proposed stages can be summarised as follows:

- **Stage 1 (1A & 1B)[53]:** Minor treatment pond improvements and commissioning of land treatment to 8ha of land at Site A and 70ha of Site B within 2 years of the commencement of this consent. It is predicted that this would achieve a reduction in current average annual discharge volume directly to surface waters of up to 56%. In addition a comprehensive rehabilitation programme of the underground sewerage network will commence to reduce stormwater inflow and groundwater infiltration (I&I);
- **Stage 2A:** The area of irrigation is further increased to between 70ha and 116ha of Site B within 10 years of the commencement of this consent. It is predicted that his would achieve a reduction in current average annual discharge volume directly to surface waters of up to 68%. During this stage almost all effluent discharged to Donald Creek would occur during winter. The majority of I&I rehabilitation work is expected to have been completed by the commencement of Stage 2A which may result in not all of the available 116ha being required;
- **Stage 2B**: Construction of additional storage and a contingency overflow facility to enable land treatment of all flows up to the 90th percentile storage requirement within 20 years of the commencement of this consent. It is predicted the buffering would achieve a reduction in current average annual discharge volume direct to surface waters of approximately 94%. During this stage discharge to Donald Creek would occur infrequently and in winter only with discharges targeting, in order of priority, 3 x median and 2 x median stream flow where practicable. The maximum discharge rate is proposed to be restricted to a maximum of 6,000m^3/day.

The proposed project staging was initially defined by SWDC based on economic and community affordability considerations. The initial staging was as follows:

- Stage 1A – one to two years following commencement of the consent;
- Stage 1B – five years following commencement of the consent;
- Stage 2A – eighteen years following commencement of the consent; and
- Stage 2B – twenty eight years following commencement of the consent.

[53] Previously it was proposed to separate Stages 1A and 1B and implement these stages over a 5 year period, however based on the assessment of environmental effects it has since been proposed to combine these two stages and in particular implement Stage 1B earlier in order to gain greater improvements to the receiving waters.

The assessment of effects on water quality and ecology as set out in Section 6 of this report determined that Stage 1A would result in minimal improvement over the current situation as only approximately 3% of the existing discharge volume would be applied to land. However, it was determined that by Stage 1B there would be significant improvements to water quality and reduced impacts on aquatic ecology. This is due to approximately 45% of the discharge volume being applied to land, with the majority of the discharge occurring in winter, when there is overall higher upstream flow and current effects on ecology are not considered significant. Therefore, the staging was revised to combine Stage 1A and 1B such that these stages were complete within two years of the commencement of the consent and the overall staging reduced in time. The proposed staging is as follows:

- Stage 1 (1A and 1B) – two years following commencement of the consent;
- Stage 2A - ten years following commencement of the consent; and
- Stage 2B – twenty years following commencement of the consent.

The Project staging has been proposed on the basis of the following:

i. Any plant optimisation works must be beneficial to the long-term proposal to minimise unnecessary and "sunk" capital costs;
ii. I&I is significant in the Featherston sewerage network, and a fast-tracked programme to address this issue has been proposed prior to finalising the design of the Stage 2 land treatment scheme;
iii. The Stage 1 land treatment stages should be as early as possible and should target eliminating or minimising WWTP discharges to water during low stream flows in the receiving environment to maximise benefits to water quality for aquatic ecosystems;
iv. Stage 2A land treatment marks the planned completion of the I&I rehabilitation works. Expansion and optimisation of the land treatment scheme at this stage should occur prior to construction of the additional storage capacity to enable almost all discharges to Donald Creek to be eliminated during summer months. The implementation of Stage 2A will also enable full monitoring to occur to confirm the required volume of deferred storage prior to design of the final land treatment Stage 2B.

4.1 Proposed Effluent Treatment Process (including Staging)

The underlying principle of the proposed scheme is to maximise the potential application of treated wastewater to land whilst reducing and if possible eliminating the majority of all discharges to Donald Creek due to its limited assimilative capacity to receive the FWWTP discharge. The land available has the potential to receive 100 % of the annual wastewater flow from FWWTP, but requires a substantial storage volume to enable this flow to be discharged sustainably. A land application option has been developed to reduce the storage to an affordable and manageable size while maximising the amount of wastewater that is discharged to land. As a result, a staged approach to the development of a land application scheme has been proposed which eventually sees an annual average of 94% of treated FWWTP wastewater discharged to land.

In order to determine the proportion of wastewater that can be applied to the proposed sites and the amount of storage required for Stage 2B, a water balance approach has been used to develop the proposed land application regime. This water balance methodology is described in Section 4.6 of the LEI (2017) report provided in Appendix 7. In summary, based on site investigations it was determined that land discharge would be constrained by hydraulic application rates (i.e. the ability of the soil to take the volume of wastewater) and not nutrient

loads. Based on this information, key design criteria used as part of the water and nutrient budget are summarised as follows:

- land application is considered the priority before storage or alternative discharge;
- design irrigation rates at which the soil/plant system can sustainably receive wastewater are proposed;
- sustainable design irrigation rates to avoid prolonged drainage from the site are proposed;
- maximum annual loading rates of nitrogen to land of no more than 300 kgN/ha/yr and Phosphorus of 40 kgP/ha/yr are proposed and allow for supplementary nutrients to be applied in specially formulated fertiliser to optimise plant growth and uptake of the applied wastewater nitrogen and phosphorus into the plant biomass.

A monthly summary of the average proportion of the discharged wastewater flow that goes to water and consequently to land for all Stages is presented in Table 13.

Table 13: Modelled percentage of current volume discharged to Donald Creek for all Stages

Flow statistic	Current Discharge	Stage 1A	Stage 1B	Stage 2A	Stage 2B
January	5%	3.7%	0.056%	0.0075%	0%
February	4%	2.6%	0.069%	0.013%	0%
March	4%	4.1%	0.23%	0.23%	0%
April	6%	6.2%	1.9%	0.77%	0%
May	9%	9.4%	4.0%	1.4%	0%
June	10%	10.6%	11%	7.1%	0%
July	14%	14.4%	14%	10%	1.6%
August	13%	13.8%	14%	9.1%	4.9%
September	11%	10.7%	5.3%	2.2%	0%
October	11%	10.5%	5.1%	2.1%	0%
November	8%	6.7%	0.40%	0.025%	0%
December	6%	4.7%	0.25%	0.025%	0%
Total	**100%**	**97%**	**56%**	**32%**	**6%**

Source: Data provided by LEI in 2017

4.1.1 Stage One: Targeted I&I Reduction, Pond Optimisation Works and Partial Land Treatment

4.1.1.1 Stage 1 - Infiltration and Inflow ("I&I") Reduction

A typical small community in New Zealand will produce in the order of 210 – 475 litres per person per day of wastewater. The FWWTP receives an average of 1,163 L/person/day. Of this, on average, investigations estimate that 74% of the Average Daily Flow (ADF) is from inflow of stormwater and infiltration of groundwater into the sewerage network.

Figure 20: Night flows observed in the early hours of the morning during night flow isolation I&I investigations (note clarity of sewer flow

The single largest constraint and influence on cost and affordability for the FWWTP long term solution is therefore the sheer volume of wastewater reaching the plant, due primarily to the high level of I&I. As shown in Figure 20, night flows observed during a night flow isolation I&I investigation in late 2013 illustrates the near clean nature and continuous high volume of the water being delivered to the FWWTP (AWT 2013a, see Appendix 4A). To treat all of the flow currently received would be cost prohibitive, at up to $6.8M more than an equivalent system where targeted rehabilitation has been carried out. The best practicable option for the FWWTP is therefore heavily influenced by the cost of treatment of high quantities of effluent balanced against the cost of rehabilitating the sewer network to specifically target reduction in I&I inputs.

Rehabilitation cost and expected percentage reductions in ADF for the top five ranked catchments[54] was used to calculate and compare the estimated Net Present Value (NPV) of a High Rate Treatment Plant Scenario and Full Land Disposal Scheme Scenario for Featherston at different levels of I&I rehabilitation, to find the optimum financial solution (AWT, 2013b, see Appendix 4B). Following sensitivity analysis, it was determined (based on current knowledge) the most economical High Rate Treatment scenario would need to target 31% reduction in ADF through rehabilitation of public sewers in the top 3 catchments or rehabilitation of public and private laterals in the top 2 catchments to achieve an overall $2.63M NPV saving. Comparatively the most economical “Full” Land Disposal scenario would need to target 35% reduction in ADF (overall $4.96M NPV savings) and would require rehabilitation of public sewers in the top six catchments or rehabilitation of public and private laterals in the top three catchments.

Reduced ADF not only has an impact on cost for SWDC, but would result in improved conveyance and quality of the network infrastructure and increased retention times in the oxidation ponds. Increased retention times would in the short-term lead to expected reductions in the discharged mass of BOD_5 and TSS.

[54] The 2013 night-flow investigation identified five key (‘leakiest’) catchments that comprise 23% of the network and are estimated to contribute approximately 85% of the I&I. Details are provided in the report by AWT Water, “Featherston Groundwater Infiltration Investigation”, December 2013, see Appendix 4A.

Therefore SWDC propose to focus over the short-term (current LTP) on I&I rehabilitation, targeting a reduction in ADF of 35%, over a ten year period up to the commencement of Stage 2A. An Inflow and Infiltration Reduction Management Plan ("IIRMP") is to be developed within 12 months of commencement of the consent that will provide a detailed programme of the investigations and be regularly updated to indicate the rehabilitation works to be undertaken and mechanism to report on the success of the rehabilitation programme[55]. The general steps for developing and implementing the proposed IIRMP is discussed below.

Flow Monitoring Study

Night flow characterisation is very specific to infiltration, and although providing very useful high-level information to determine the extent of the problem, it does not give an overall picture of the system response to rainfall, or the dry weather flow characteristics.

A catchment wide continuous flow monitoring study will therefore be undertaken to supplement the night flow isolation results. This will complete the full I&I analysis. Flow monitoring allows more detailed assessment of wet weather I&I parameters, such as flow peaks, maximum flow rates and actual percentages of ingress. Dry weather characteristics will also be determined to contribute to the dataset. This full set of factors is needed to design the required programme of inspections, rehabilitation, and inform the detail design of the proposed land treatment scheme.

Development of an optimised IIRMP

The results from the night-flow isolation study and the flow monitoring study in conjunction with CCTV, property inspections, lateral testing and inspection would be used to specifically determine the extent and type of rehabilitation required to achieve the desired overall flow reduction. There are a wide range of options for addressing the level of ingress, from basic rehabilitation (e.g. joint sealing or relining or 'sleeving' broken pipes), through to complete replacement of small or large sections of pipe where required. It is important to identify which method is the most appropriate for each section of pipe to be rehabilitated to avoid unnecessary costs being incurred.

In addition to developing an optimised rehabilitation plan, an accurate long term gauge has been established at the WWTP inlet to monitor the effectiveness of the remedial works.

The optimised programme for rehabilitation will be managed and implemented in accordance with the proposed IIRMP.

Implementation of the rehabilitation programme.

In recognition of the issue at Featherston, SWDC have accelerated the rehabilitation programme, committing funding in the Long Term Plan[56]. Annually the inflow data and works undertaken will be assessed to determine the overall reduction in I&I achieved. The results of the I&I work will be reported to GWRC on an annual basis[57]. It is important to note that ADF reduction targets are based on the implementation of a network rehabilitation programme targeting rainfall dependent infiltration and groundwater infiltration. Infiltration contributes additional flow volume following rainfall or when groundwater levels submerge the network seasonally and the effect (and effectiveness of rehabilitation) is best observed over a long time

[55] Refer proposed Condition provided in Part 1 Schedule 1: Condition 3.

[56] SWDC has prioritised renewals work on the trunk main between Featherston township and the WWTP, which will be required irrespective of the outcomes of the flow monitoring study.

[57] Refer proposed Conditions provided in Part 1 Schedule 1: Condition 7.

period. It is therefore, recommended that ADF target reductions are assessed on an annual basis.

4.1.1.2 Stage 1A – Optimisation works

The FWWTP pond system will remain largely as existing, as the primary receptor of effluent from the sewer network. However, some minor optimisation works are proposed to ensure the existing pond system is operating at an optimal level as part of Stage 1A.

- **Inlet screening** is proposed to remove gross solids, rubbish, stringy and fibrous material and debris prior to the oxidation pond. Removal of this material up-front of the treatment process will assist in: (i) improving sludge management (by reducing its accumulation in the pond and therefore reducing the overall sludge volume); (ii) preventing future pond desludging difficulties (desludging equipment blockage and non-acceptance of sludge as a potential soil conditioner due to litter content); and (iii) in the case of proposed land treatment, protection of irrigation pumps (reducing the risk of blockage). Screened solids will, in the short term at least, be collected and disposed of at an appropriately approved and consented landfill facility. Inlet screening will be undertaken prior to the commissioning of the proposed land treatment system at an estimated cost of $200k.
- Recent sludge surveys indicate that current sludge accumulation is not affecting pond performance (Conhur 2012 and Opus 2013). A **follow up sludge survey** will be undertaken toward the end of Stage 1. Following this, if required, a desludging programme, methodology and sludge disposal process would then be determined. Any additional short term resource consents required to enable that process would be obtained upon confirmation for any desludging process and prior to any work taking place.

4.1.1.3 Stage 1A and 1B– Partial Land Treatment

Following the commencement of Stage 1A and 1B it is proposed that irrigation will be applied to the land identified as Site A and Site B[58].

Of the 12.6 ha Site A, 8 ha was deemed irrigable following the exclusion of boundary and waterway buffers. Investigations have determined that a rate of up to 19 mm/d of wastewater from the FWWTP could be assimilated by the soils of the site. The proposed DIR will restrict irrigation water movement through the soil to matrix flow thereby maximising the travel time in the soil and contact with soil particles. This is intended to maximise sorption, filtration and plant removal of applied nutrients and pathogens. Maximising soil treatment is further enhanced using an irrigation rate not exceeding the lowest K_{-40mm} of 3 mm/h for Site A. This will also avoid ponding and run-off. The design irrigation depths and rates presented here are the maxima for Site A and there is potential to reduce the per event application rate to fit in with land management requirements and to optimise the discharged volumes.

A deficit system[59] has been adopted for Site A since no rotation around the block is proposed (no resting period). A small amount of nutrient leaching can be expected, but the amount leached is expected to be equivalent to or less than occurs under the surrounding (predominantly dairy) land use. To maximise the removal of nutrients from wastewater, the following decision criteria is proposed to determine on any day whether application to Site A can occur:

- *Soil moisture status*: Irrigation will not cause the soil moisture to exceed field capacity;

[58] For further details on the proposed land application scheme, please refer to LEI, Assessment of Environmental Effects of Discharge of Featherston Treated Wastewater to Land, February 2017, see Appendix 7.

[59] Represents a regime similar to fresh water irrigation that is common in the district

- *Application rate control:* Vary the application depth to "top-up" a deficit whenever it occurs;
- *Depth to groundwater:* Irrigation should not occur when the groundwater table is less than 1 m from the soil surface;
- *Wind speed and direction:* Irrigation may occur if wind speed is less than 12m/s, or less than 4 m/s in the direction of any dwelling within 300 m of the irrigated area. For the later, irrigation can still occur by maintaining a 125m buffer and meeting the other permitted activity criteria set out in Rule 4.5.2(m)(ii) of the Wairarapa Combined District Plan (WCDP);
- *Previous rainfall:* Irrigation may occur if less than 50 mm rain has fallen in the preceding 3 days; and
- *Crop condition / harvest schedule / animal rotation:* Harvest or grazing should not occur within 48 h of irrigation ceasing, and irrigation should not be commenced within 24 h of completion of harvest or removal of stock.

The establishment of land application of treated wastewater to Site B, is most likely to occur to an area of around 70ha which contains existing irrigation infrastructure deemed suitable for wastewater irrigation in the short to medium term. In addition, irrigation to Site A is likely to continue.

Investigations have determined that a rate of up to 55 mm/d of wastewater from the FWWTP could be assimilated by the soils on Site B where a sufficient soil moisture deficit exists. Maximising soil treatment is further enhanced using an irrigation rate not exceeding the lowest $K\text{-}_{40mm}$ of 8 mm/h for Site B. This will also avoid ponding and run-off.

A deferred, non-deficit system[60] has been adopted for Site B due to the large area available enabling a return period for irrigation (i.e. irrigation rotation with suitable resting periods). The proposed discharge regime will result in a larger depth of drainage from the site due to the adoption of a deferred application which allows a discharge beyond the soil field capacity. Some nutrient loss is expected from the site and management of the irrigation and land as described below will be designed to avoid excessive loss, resulting in rates of loss that are no more than would occur currently for the site managed as a dairy unit where industry good practice is adopted. The portion of applied nitrogen leached to groundwater and ultimately surface water will enter surface water as a diffuse discharge and at a substantially lower mass loading than currently occurs as a direct discharge from the FWWTP.

To maximise the removal of nutrients from wastewater, the following decision criteria has been used to determine on any day whether application to land (Site B) can occur:

- *Soil moisture status*: Irrigation will not cause the soil to exceed field capacity by more than 3°mm per event;
- *Application rate control*: Vary the discharge rate to match the soil moisture criteria;
- *Depth to groundwater*: Irrigation should not occur when the groundwater table is less than 1°m from the soil surface;
- *Wind speed and direction*: Irrigation may occur if wind speed is less than 12 m/s, or less than 4 m/s in the direction of any dwelling within 300 m of the irrigated area. For the later irrigation can still occur by maintaining a 125m buffer and meeting the other permitted activity criteria set out in Rule 4.5.2(m)(ii) of the WCDP. It is noted that the existing irrigation infrastructure installed on part of the Site B land does not meet the low pressure criteria prescribed in the District Plan of <1.4bar, therefore any existing irrigation equipment within 125m of the

[60] Represents a regime which maximises the volume of discharge to land while protecting the land from damage by over-watering, and avoiding excessive leaching to groundwater or surface water.

boundary will be replaced with new low pressure equipment to ensure a reduced buffer of 25m can be applied as a permitted activity in the WCDP;

- *Previous rainfall:* Irrigation may occur if less than 2 mm rain has fallen in the 24 hours prior to commencement of irrigation; and
- *Crop condition / harvest schedule / animal rotation*: Harvest or grazing should not occur within 48 h of irrigation ceasing, and irrigation should not be commenced within 24 h of completion of harvest or removal of stock.

The regime outcomes assume that no I&I reduction to wastewater flows will have occurred, no storage is available to withhold irrigation (to be confirmed) and the remaining UV disinfected treated wastewater to be discharged goes to Donald Creek. This corresponds to a total annual average flow ("AAF") of effluent irrigation which can be discharged to land in a sustainable manner of approximately 385,000 m^3/yr and average daily flow of 1,420 m^3/d. This volume equates to 44% of the current average annual flow discharged to land over a typical year with the majority of the remaining discharge to Donald Creek occurring between April and October.

Nitrogen and Phosphorus mass loadings of 42 kgN/ha/yr and 8 kgP/ha/yr have been predicted. Thus the nutrient loading proposed, and volume of water applied does not restrict the type of land use adopted for the site.

The water balance also identifies that an absence of storage, limits the amount of wastewater that can be discharged to land on an annual basis. For example, during summer dry weather periods there may be sufficient capacity for the land to receive up to 4,520m^3/d (as controlled by the rotation of irrigation blocks) when conditions are right and irrigation can occur, however at the same time the inflow and outflow from the FWWTP is likely to be less than this due to low groundwater levels, no rainfall in the catchment and hence low I&I.

Planning for the irrigation infrastructure for Stage 1 will commence on the granting of this consent with design and construction of irrigation infrastructure. Infrastructure is likely to include the following:

- Pipes – rising mains, sub-mains etc;
- Irrigation pumps and filtration (likely to be located within the existing UV treatment building);
- New irrigation equipment using low pressure surface irrigation technology and modification to the existing Bosch lateral sprinkler system including automation for wind cut-off criteria and soil monitoring systems.

It is proposed that this will enable Stage 1 land treatment to commence no later than 2 years from the commencement of consent, in time to avoid or minimise discharge to Donald Creek during the 2019/2020 summer creek low flows.

A Discharge to Land and Water Management Plan will be prepared and submitted to GWRC within 18 months of granting of consent and will include design details of Stage 1 land treatment scheme[61].

It is proposed that Site A and B land and pasture will be managed as follows:

- Directly by Council or under contract arrangement;
- Establishment of 8-9 ha irrigation blocks (to assist with stock or harvest management);

[61] Refer to Part 1, Schedule 1, Condition 3.

- Within Site B irrigation blocks a 3 day minimum return for irrigation and an approximate 8 day rotation with a total of up to 55 mm applied over 8 days[62];
- Pasture managed in a 4 - 6 week rotation over the irrigation period, comprised of 3 – 5 weeks of irrigation and then 1 week for harvest (or grazing by stock); and
- Over the winter, non-irrigated period it is recommended that land is lightly grazed to maintain pasture quality.

The decision to continue irrigation to Site A, or alternatively use this land for future pond storage capacity will be confirmed prior to Stage 2B.

The proposed regime is intended to be sustainable for the lifetime of the land application scheme.

4.1.2 Stage Two: Expansion of Land Treatment and Deferred Storage

4.1.2.1 Stage 2A - Land Treatment Expansion

Following the commencement of Stage 2A continued discharge to 70 ha of Site B is proposed with the potential expansion to up to 116 ha of Site B if there is sufficient wastewater after I&I rehabilitation works to require it. Site A will also remain available for land irrigation if necessary. This stage assumes the targeted I&I reduction has been achieved and accounts for the reduced ADF from the plant in the water balance predictions. Furthermore, the nutrient concentration of the discharge (but not the total mass) is expected to increase as a direct result of the I&I reductions (refer to Section 4.4.3).

The regime outcomes assume no storage is available within the existing ponds to withhold irrigation (to be confirmed) and the remaining treated and UV disinfected wastewater to be discharged goes to Donald Creek.

This corresponds to a total AAF of effluent irrigation which can be discharged to land in a sustainable manner of 305,200 m^3/yr and average daily flow of 1,220 m^3/d. This equates to 68% of the current average annual flow discharged to land over a typical year and almost all discharges removed from Donald Creek during summer months (November – April).

Nitrogen and Phosphorus mass loadings of 42 kgN/ha/yr and 8° kgP/ha/yr have been predicted. Thus the nutrient loading proposed, and volume of water applied does not restrict the type of land use adopted for the site. As for the previous stage, the absence of storage, limits the total annual amount of wastewater that is able to be discharged to land.

The proposed irrigation and pasture management for Stage 2A is the same for that summarised in Stage 1.

It is also proposed that Stage 2A land treatment commence no later than 10 years from the commencement of consent.

[62] This allows flexibility to tailor the irrigation to the soil moisture status e.g. within an 8-9 ha irrigation block a total of 55 mm could be applied as one application with 7 day resting period where a significant deficit exists in the soil, or it might be applied sequentially to parts of the block at perhaps 15-20 mm every 3 days up to a maximum total of 55 mm in any 8 day period.

4.1.2.2 Stage 2B – Deferred Storage

Stage 2B provides for the inclusion of 'deferred'[63] storage of approximately 186,000m^3 (plus freeboard)[64] and any further expansion of the irrigated land area to a total of 116ha if necessary[65]. The storage to be constructed will hold the 90th percentile storage requirement, with treated and UV disinfected wastewater volumes beyond the 90th percentile discharged to Donald Creek. The adoption of the 90th percentile storage volume will; avoid the construction of infrastructure that is redundant for long periods of time, take less land and be of a more manageable size, and will help manage costs of the scheme. As a result, some contingency discharge to Donald Creek during July and August will occur on most years (i.e. 3 of the 11 years modelled result in no discharge to the Creek).

Deferred storage has the following advantages:

- Ensures the discharge to land is sustainable by directing wastewater to storage during wet periods when discharge to land might cause ponding, deterioration in soil properties due to prolonged soil saturation or excessive nutrient leaching;
- Minimises the need to discharge wastewater directly to surface water; and
- Enables the discharge to land to occur when maximum productive benefit can be achieved i.e. by storing wastewater during wet winter months when highest flows enter the WWTP, for irrigation in the summer (water short) months.

The conditions to discharge to land are the same as proposed in earlier Stages.

For contingency discharges to water, a stream flow regime is proposed restricting discharge to Donald Creek where practicable to periods when stream flow is greater than 2x median and by preference when stream flow is greater than 3x median. The 2x median flow is theoretically (i.e. 482l/s based on the synthetic hydrograph information prepared by PGWES, (2016a)) a slightly greater flow than the 20th flow exceedance percentile which is applied in some other regions as an acceptable flow above which contaminant trigger standards such as E.coli, DRP and DIN do not apply. It is acknowledged that based on the theoretical water balance modelling that discharge may at times occur at stream flow <2x median but that these events will be infrequent (0.32% of the time or 8.5% of discharge days) and are not predicted to occur at stream flows less than median flow conditions.

In order to achieve the above stream flow regime and maintain suitable buffering within the storage pond, a release of discharge from the pond when volumes reach 140,000m^3 and a maximum discharge volume to Donald Creek of 6,000m^3/d is required. The maximum discharge volume proposed is currently experienced from the plant during winter months. This discharge is expected to occur on average 15 days per year and only during the months of July and August and in some years no discharge will result. The proposed discharge regime would be carefully managed by monitoring stream flow, soil moisture and pond levels.

For Stage 2B this corresponds to a total AAF of effluent irrigation which can be discharged to land in a sustainable manner of 510,300 m^3/yr and average daily flow of 4,440 m^3/d[66]. This volume equates to 94% of the current annual average flow discharged to land over a typical year.

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63 Deferred storage is comprised of additional wastewater storage facilities (e.g. storage ponds) which enable effluent to be held in storage when soil conditions will not support deferred irrigation.

64 Based on the LEI conceptual water balance outputs refer to Appendix 7.

65 Area requirements will depend on the success of the I&I rehabilitation programme.

66 Irrigation draws down on the volume stored over the winter months.

Nitrogen and Phosphorus mass loadings of 51 kgN/ha/yr and 10 kgP/ha/yr have been predicted. Thus the nutrient loading proposed, and volume of water applied does not restrict the type of land use adopted for the site.

The proposed additional storage, pumping and irrigation infrastructure will be contained within Council owned land. The specific location and design of new infrastructure will be confirmed as part of Stage 2B detailed design and included in the Discharge to Land and Water Management Plan[67] and respective Plan revisions. To reduce pumping requirements and maximise gravity flow from the existing plant it is likely the deferred storage will be located adjacent to the existing FWWTP ponds. Efficiencies can potentially be achieved by designing the Stage 1 land treatment scheme to be easily extended for the Stage 2A & 2B scheme, for example, sharing the same pump station and rising main from the FWWTP outlet. These efficiencies will be considered as part of the Stage 1 revision to the Land Discharge Management Plan.

The irrigation land and pasture management proposed for Stage 2B is the same as that proposed for the earlier stages of the project.

It is also proposed that Stage 2B deferred storage would commence no later than 20 years from the commencement of consent.

4.1.3 Buffers

Buffers around sensitive receptors have been proposed for the site to minimise the potential effects of aerosol drift and odour. The proposed buffers from the perimeter of the irrigation area are:

- Boundary – 25 m (although this may increase to 125m depending on wind strength and nozzle type selected)[68];
- Existing dwellings – 150 m;
- Waterways – 20 m either side; and
- Bores – 50 m.

4.1.4 Summary of Discharge Regime

Key design parameters and outcomes for the proposed discharge regime of FWWTP wastewater at the site are given in Table 14 for each of the proposed Stages.

Table 14: Key Design Parameters and outcomes for the proposed discharge regime at FWWTP

Parameter	Average Year			
	Stage 1A (Deficit)	Stage 1B (Deferred)	Stage 2A (Deferred)	Stage 2B (Deferred)
Storage volume (m3) – to satisfy 90th percentile flow conditions	None	None	None	186,000
Average annual outflow from FWWTP (m3)	~830,000	~830,000	~538,000	~538,000
Irrigated Site	Site A	Site B (and potentially Site A)	Site B (and potentially Site A)	Site B (and potentially Site A)
Irrigation Regime	Site A: Deficit	Site A: Deficit	Site A: Deficit	Site A: Deficit

[67] Refer proposed Conditions provided in Part 1C Schedule 1: Condition 3.

[68] Refer proposed Conditions provided in Part 1C: Schedule 4: Condition 7.

Parameter	Average Year			
	Stage 1A (Deficit)	Stage 1B (Deferred)	Stage 2A (Deferred)	Stage 2B (Deferred)
		Site B: Deferred	Site B: Deferred	Site B: Deferred
Total area (ha)	12	166-178	166-178	166-178
Irrigable area (ha)	8	70	70-116	70-116
Irrigated area per discharge event (ha)	8	8	8	8
DIR per event (mm/event)	up to 19	up to 55	up to 55	up to 55
Average annual application Volume (m3/y)	32,500	385,000	305,200	510,300
Average annual application depth (mm)	406	480	360	447
Wastewater N load (kg N/ha/y)	35	42	42	51
Wastewater P load (kg P/ha/y)	7	8	8	10
Farm Management current	Stock Grazing	Dairy (Site B)		
Farm Management Proposed	Pasture for removal (cut and carry)	Stock grazing and/or Cropping and/or Pasture for removal (cut and carry)		
Vegetation current	Pasture			
Vegetation proposed	Pasture and/or Cropping			
Restrictions to Creek Discharge	None	None	None	max discharge volume of 6,000m3/d & target stream flows greater than 3x median and 2x median in order of priority.

Source: Modified from LEI, 2017.

Drainage losses from the site and nitrogen leaching rates have also been predicted for Stage 2B. Stage 2B represents the worst case for effects assessment associated with discharge to land as this final stage of the scheme applies the largest volume and nutrient loads to land. Nitrogen leaching estimates for Stage 2B have assumed supplementation of nitrogen from fertiliser for land management purposes will be needed.

Calculations indicate the following (refer to LEI, 2017 Appendix 7):

- An increase in drainage of 31% over the entire site could be expected when compared against assumed current land management practices.
- This increased drainage equates to a depth of 450 mm/yr.
- The overall site average nitrogen load would be approximately 237 kgN/ha/yr with 28.8 kgN/ha/yr (5,130 kgN/y) of nitrogen leached.
- This leached nitrogen is equivalent to 12% of the applied nitrogen.
- Assuming all leached nitrogen eventually enters the surface water environment, the land application regime at Stage 2B could result in a reduction in 79% of the nitrogen discharged to surface water compared with the current direct discharge to Donald Creek (See Table).
- A post development increase in nitrogen leaching load of 7% when compared to the existing land use and farm management.

Although a net increase in nitrogen leached has been determined based on land management changes proposed, the overall reduction in nitrogen load entering the water catchment due to implementation of the land treatment scheme is significant as illustrated in Figure 4 in Section 1 and as discussed further in Section 6.

With regard to phosphorus losses, it is considered the low rate of phosphorus application will meet all plant uptake requirements, thus the site life for phosphorus is considered unlimited under the proposed application regime (LEI, 2017).

4.1.5 Stage 2 Adaptive Management

The assessment of effects provided in Section 6 indicates that the proposed land treatment scheme will result in the effects on the receiving environment being moderate to minor at the completion of Stage 1 and no more than minor at the completion of Stage 2. However, it is acknowledged that the assessment of effects has largely been based on theoretical modelling and there remain uncertainties associated with matters pertaining to actual effects, design and management of each stage, including:

- the significance of effects following the implementation of Stage1;
- the degree of flow reduction achievable through I&I reduction and thus actual pond storage requirements;
- the complexity of managing large storage ponds for land irrigation;
- the actual effects of I&I reduction on effluent quality; and,
- general limitations with existing receiving environment data.

SWDC have therefore taken a precautionary approach and will apply the principles of adaptive management through the following:

1. Committing to the firm programme for commissioning the land treatment scheme;
2. Comprehensive monitoring of the sewer system and pond performance;
3. Comprehensive monitoring of the receiving environment (Donald Creek), land treatment areas and groundwater with triggers for appropriate management action;
4. Quarterly exception reporting;
5. The proposed annual reporting process, including a full review of system performance, I&I reduction results, and include a risk analysis of the proposed land treatment scheme at that point in time;
6. A review of the efficacy of Stage 1 land treatment (within 3 years of its implementation) in order to determine whether or not the commencement of Stages 2A and 2B should be advanced; and
7. A review of the efficacy of the Stage 2B land treatment (within 3 years of its implementation) in terms of avoiding, remedying or mitigating adverse effects of the discharges to the environment.
8. The collaborative approach proposed with stakeholders (through the CLG) and GWRC (through the Consent Implementation Partnership (refer sections 4.7 and 4.9)) will provide a “no surprises” approach in this regard, with regular formal performance and risk feedback.

If the Stage 1 Review confirms the effects on the environment, and in particular water quality and ecological effects remain significant then implementation of Stage 2A will be brought forward from 10 years to 7 years and Stage 2B from 20 years to 15 years from commencement of the consent.

If the Stage 1 Review confirms the targeted reduction in ADF due to I&I rehabilitation works will not be achieved (based on works undertaken to date) and the risks of constructing the deferred storage are unattainable or other unforeseen design and management difficulties are identified that are unresolvable, then the Review Report will confirm one of the following[69] (or any other suitable alternative identified at the time) as the substitute long-term solution supported by the necessary evidence:

- A combined land and water discharge with contingency discharge flows directed to the Tauherenikau River;
- A land discharge with excess flows directed to Rapid Infiltration;
- Re-reticulation of the network with land treatment;
- Combination summer land application and high rate treatment for discharges to Donald Creek.

Where an alternative approach is required, a programme will be included in the Stage 1 Review Report, variation to consents will be obtained, and full commissioning of that solution would be undertaken within 15 years of the commencement of this consent. This process will ensure that the best practicable option will be commissioned within the proposed timeframes, but provides the ability for evidence based adaptive management.

4.1.6 Preventative Action

The FWWTP has provision for the discharge of effluent from the ponds directly to water during emergency situations. The Operations and Maintenance Manual ("**OMM**") will include operational procedures to actively manage capacity through a range of operational conditions to avoid the risk of overtopping or other adverse effect during exceptional situations. However, there will be circumstances where there is the potential for preventative action.

Preventative action to avoid adverse effects on the environment during emergency conditions are specifically provided for under s330 of the RMA, including the requirement to obtain retrospective resource consents under s330A. This regime includes foreseeable events (s330(1A)).

Although not forming part of the proposal, preventative action is acknowledged and included here for completeness.

4.2 Proposed Discharge to Air

The continuation of the discharge to air from the FWWTP ponds is proposed. The discharge will be comprised of general odour and other aerosols from the ponds and discharge channel with the potential for additional odour generation from the proposed primary inlet screening and Stage 2B deferred storage pond (the latter is likely to be located adjacent to the existing ponds to minimise pumping costs).

Irrigation for all stages (Sites A and B) is proposed to be via spray irrigation. There will be a potential discharge to air both of contaminants (i.e. pathogens) and of odour. Tertiary treatment of the wastewater and careful design of the irrigation infrastructure including suitable buffer distances and wind cut-off criteria will mitigate potential effects associated with spray drift of

[69] These options have been identified as higher scoring as part of the multi-criteria analysis undertaken as part of the Options Evaluation – See Appendix 2.

aerosols[70] and odour. Furthermore, all site operations will be undertaken in strict accordance with the proposed Discharge to Land and Water Management Plan.

In addition, an Odour Management Plan ("**OMP**") will be developed and include procedures for minimising the risk of nuisance odours and aerosols beyond the boundaries of the site(s) from both the ponds and irrigation infrastructure[71]. The OMP will clearly identify the potential risks with odour and aerosols associated with the operation of the scheme for all Stages, including procedures to minimise those risks and potential effects. The OMP will define a routine odour monitoring programme, protocols for responding to complaints and other incidents; identify contingency measures to manage adverse odours or aerosols, and a protocol for reviewing the effectiveness of the management plan[72].

The OMP will be reviewed and updated within three months of implementing a new Stage in accordance with the proposed management plan review conditions of these consents[73].

4.3 Operations and Maintenance

A detailed OMM will be developed for FWWTP within six months of the commencement of consent and all future scheme operations and maintenance will adhere to the OMM.

The OMM will clearly outline the operation and maintenance of the FWWTP and wastewater discharge systems, including: a description of the treatment and disposal system operating procedures (including manufacturer's specifications), roles and responsibilities for on-site activities and on-site staff training procedures, condition inspection and maintenance schedules, operational and compliance monitoring procedures; a description of 'normal operating conditions' and procedures for dealing with emergency discharge events, complaints, and a protocol for reviewing the effectiveness of the manual .

The OMM will be reviewed and updated within three months of implementing a new Stage in accordance with the proposed management plan review conditions of these consents. This document will be written in a co-ordinated manner with the Discharge to Land and Water Management Plan and OMP.

4.4 Performance and Environmental Monitoring

4.4.1 Influent Wastewater Monitoring

Ongoing influent monitoring is proposed to enable incoming volume and quality to be determined. This will enable accurate monitoring and analysis of both pond performance and the reporting of the incremental effectiveness of the Stage 1 sewer network rehabilitation programme as it progresses in terms of the reduction in I&I being achieved.

Other initiatives to reduce the volume of wastewater being generated will continue as part of the proposed I&I investigations and rehabilitation work, with an objective to see a relative reduction over time in ADF prior to implementing the Stage 2 land treatment scheme. Initiatives will include not only physical works, but community education and advice programmes and ongoing advocacy, particularly for central government funding initiatives. This process will be encapsulated within the IIRMP and will be undertaken across all three urban areas.

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70 Plan Change 3 to the WCDP specifically considered these matters. Further discussion on this is included at Section 5.2.4

71 Refer to Part 1, Schedule 1, Condition 3.

72 Refer to Part 1, Schedule 1, Conditions 7.

73 Review to Part 1, Schedule 1, Condition 9.

The discharge entering the FWWTP will be limited (as far as is practicable) to treated municipal waste. Best endeavours will continue to be used to ensure that no high-strength industrial effluent is discharged into the FWWTP through the ongoing implementation of the Masterton District Council and South Wairarapa District Council Consolidated Bylaw 2012: Part 12 – Trade waste.

Initiatives and results will be reported annually as a condition of consent, as part of the proposed Annual Report[74].

4.4.2 Treated Discharge Volumes to Land or Donald Creek

Based on the current performance of the plant; an annual targeted reduction in ADF of 35% following the proposed I&I sewer network rehabilitation programme; and the staged implementation of the proposed land treatment scheme; the following treated discharge volumes to water and land have been proposed:

Table 15: Proposed Discharge Volumes to Water and Land

Stage	Discharge volume to Donald Creek			Discharge to Land	
	Mean	90%ile	Maximum	Site A Maximum	Site B Maximum
Stage 1	3,300 (m^3/d)	7,700 (m^3/d)			4,950 (m^3/d) 31,640 (m^3/wk)
Stage 2A	1,400 (m^3/d)	5,200 (m^3/d)			
Stage 2B			6,000 (m^3/d)	1,520 (m^3/d) 10,640 (m^3/wk)	7,975 (m^3/d) 50,980 (m^3/wk)

Note: The values in the above table for proposed discharge volumes to Donald Creek are based on an analysis of current and modelled (LEI, 2017) effluent flow data for each year between 2005 and 2016. The highest flows were experienced during 2008 and therefore the proposed limits are primarily based on that year.

The proposed discharge volumes prior to the implementation of Stage 2A are based on statistical analysis of flow data collected over a 10-year period between 2005 and 2015. The proposed limits have included a factor of safety by rounding the flow values measured. These values have been applied in mass balance calculations discussed further in Section 6.

4.4.3 Treated Discharge Effluent Quality Characteristics

No significant upgrades to the FWWTP pond system process are proposed. As such, during Stage 1 SWDC propose consent effluent quality limits that reflect the current plant performance.

Based on pond capacity modelling undertaken by Mott MacDonald, it has been determined that some changes in effluent quality concentrations may occur as a result of reduced inflow and infiltration during Stage 1. The potential changes in effluent quality are the function of a range of biological processes that are affected by environmental variables such as temperature, wind and sunlight, and as such are very difficult to determine with any certainty. Therefore the effluent quality concentrations following the commencement of the I&I works are considered to be conservative estimates[75]. These are presented below in Table 16.

[74] Refer to Part 1, Schedule 1, Condition 22.

[75] Please refer to Appendix 2, for further discussion on the derivative of proposed effluent quality following I/I works, and further discussion on the effluent quality inputs used in the water quality modelling is described in Appendix 8 section 5.2.3.

Table 16: Proposed Treated Effluent Quality

Parameter		E.coli cfu/100mL	BOD_5 mg/L	TSS mg/L	Total N mg/L	NH_4-N mg/L	DRP mg/L
Criteria	Discharges < 6,000 m^3/d 5 of 10 consecutive monthly test results shall not exceed	Discharges > 6,000 m^3/d 2 of 10 consecutive monthly test results shall not exceed	in more than 3 out of any 12 consecutive monthly test results the effluent concentration shall not exceed				
Pre I/I works	100	1,400	35	100	15	12	4
Post I/I works	100	1,400	35	100	25	18	6

The proposed 3 out of 12 consecutive sampling regime approach taken has been applied to all three SWDC plants for consistency purposes.

4.4.4 Environmental Monitoring Plan

An Environmental Monitoring Plan ("**EMP**") is to be prepared providing details on all monitoring to be undertaken in accordance with the consent conditions, the methods to be used, frequency, and monitoring site locations[76]. A process for responding to non-compliances or concerning monitoring data trends will also be included. In summary, the proposed monitoring is to include:

- Wastewater influent and effluent quantity monitoring;
- Donald Creek water quality and stream health monitoring;
- Groundwater monitoring include for the land discharge areas and pond seepage;
- Soil health monitoring;
- Odour and aerosol monitoring;
- Receiving and investigation of complaints, remedial measures, follow up with complainant and documentation;
- Reporting of data, effects, complaints and consent compliance; and
- A protocol for reviewing the effectiveness of the EMP.

Monitoring data will be provided to GWRC on a quarterly basis, including a brief commentary on any exceptions identified from the data for the duration of the proposed consent period[77].

A detailed Annual Report[78] will be prepared summarising all monitoring undertaken including a critical analysis of the information in terms of compliance and actual and potential adverse environmental effects. The annual report will also include a discussion of any trends or changes in environmental effects evident from the monitoring data, any identified non-compliance, any actions that have been undertaken to address non-compliance or improve environmental performance, any proposed changes to the monitoring program, and any other issues considered important by SWDC.

[76] Refer to Part 1, Schedule 1, Condition 7.

[77] Refer to Part 1, Schedule 1, Condition 21.

[78] Refer to Part 1, Schedule 1, Condition 22.

4.5 Proposed Management Plans

The activity will be undertaken in accordance with a suite of detailed management plans, as referred to throughout this report. These will be finalised following the grant of consent to ensure all relevant details of the granted consent are fully provided for, in accordance with the following programme[79]:

Table 17: Proposed Management Plans

Management Plan	Due (time from commencement of consent)
Operations and Maintenance Manual	6 Months
Odour Management Plan	6 Months
Inflow and Infiltration Reduction Management Plan	12 Months
Environmental Monitoring Plan	12 Months
Tangata Whenua Values Monitoring Plan	18 Months
Discharge to Land and Water Management Plan	18 Months

The Management Plans may be separate documents or combined within one or more documents, depending upon the conditions of consent, and operational requirements and efficiencies. The Management Plans will undergo regular review to incorporate details on each upgrade stage and/or relevant information gained from baseline monitoring necessary to inform the staged upgrades.

By way of summary, the purpose of the various proposed plans is outlined below. Each of the plans will be developed by suitably qualified person, with input from relevant key stakeholders where necessary, and will be submitted to GWRC as a draft for comment prior to receiving technical certification[80].

Operations and Maintenance Manual (OMM) – The purpose and structure of the OMM is described in Section 4.3.

Odour Management Plan (OMP) – The purpose and structure of the OMP is described in Section 4.2.

Tangata Whenua Values Monitoring Plan ("TWVMP") – The TWVMP will be developed in a joint process with Kahungunu ki Wairarapa and Rangitaane o Wairarapa and shall include the following considerations:

a. What cultural health indicators tangata whenua would like monitored within the Donald's Creek environment associated with the FWWTP discharge;
b. The methodology of how the identified cultural health indicators will be sampled/evaluated;
c. The monitoring responsibility and frequency for the identified cultural health indicators; and,
d. A map showing the location of the identified cultural health indicators sampling point(s).

The cultural health indicators and methodology will be developed in accordance with the Ministry for the Environment's '*Cultural Health Index for Streams and Waterways, 2006*' as appropriate or any other relevant guideline jointly agreed between the Consent Holder, Kahungunu ki Wairarapa and Rangitaane o Wairarapa.

[79] Refer to Part 1, Schedule 1, Condition 3.
[80] Refer to Part 1, Schedule 1, Conditions 4, 5 and 6.

The TWVMP will be one process and tool to help facilitate (i.e. not replace) the partnership approach SWDC seeks to build with tangata whenua.

Inflow & Infiltration Reduction Management Plan (IIRMP) – The IIRMP will contain the methodologies for determining the extent of Inflow and Infiltration into the sewer network, outline the investigation process for determining the most efficient, cost effective, and non-disruptive manner for rehabilitation, detail the rehabilitation programme through Stage 1 and monitoring and reporting of I&I reduction. The proposed investigations to be undertaken are described in Section 4.1.1.1.

Environmental Monitoring Plan (EMP) – The purpose and structure of the EMP is described in Section 4.4.4 above.

Discharge to Land and Water Management Plan (DLWMP) – The objective of this plan is to define the best practicable option to maximise the discharge of treated wastewater to land for all Stages within the constraints of the proposed consent conditions, land availability, wastewater storage, soil and groundwater conditions, odour and aerosol control whilst avoiding risks to human health. The plan will:

- Detail the specific site conditions and limitations for all land discharge areas to receive wastewater. Detail the land discharge methods and systems, and overall system management including:
    - weather and climate reporting;
    - soil moisture monitoring;
    - soil management including maintaining soil structure;
    - wastewater flow rate monitoring;
    - wastewater hydraulic application rates;
    - nutrient loading rates;
    - pasture and crop management;
    - fertiliser management (grazing and buffer zones);
    - high speed wind shutdown;
    - odour and aerosol management;
    - system maintenance;
    - public health risk management; and
    - access restrictions to land receiving wastewater.
- Detail the management of all water discharges including:
    - wastewater flow rate monitoring;
    - stream flow monitoring;
    - Define storage volumes and confirm a water discharge regime linked to Donald Creek flows for Stage 2B including specific methods to minimise the frequency and duration of water discharge events.
- Define in collaboration with the EMP, monitoring programmes and reporting requirements for:
    - water quality and ecological health within Donald Creek;
    - soil and pastoral health within the land application area; and
    - groundwater quality beneath and downstream of the site.

- Detail general site maintenance and inspection procedures (i.e. water discharge channel maintenance).
- Description of contingency measures and procedures to manage abnormal operating conditions.
- Provide a protocol (and programme) for reviewing the effectiveness of the management plan.

4.6 Ongoing Stakeholder Engagement

SWDC is committed to ongoing engagement with key stakeholders and the community.

A Community Liaison Group (CLG) will be established in accordance with a proposed Terms of Reference included as Schedule 7 to these consents[81]. The CLG will be kept advised of progress through the scheme stages through regular communication, including receiving copies of the Annual Report and Management Plans, as desired. SWDC views the CLG as an important contributor in implementing and achieving its long term Wastewater Strategy.

In addition, SWDC will nominate and make known a single point of contact for any queries or concerns regarding the FWWTP[82].

4.7 Consent Compliance

SWDC acknowledges that as with most WWTPs, detailed performance and compliance data could have been documented and reported more proactively by SWDC in the past. To rectify this, SWDC have established a comprehensive compliance monitoring system, and will nominate a key contact person responsible for consent compliance monitoring.

4.8 Consent Implementation Partnership

SWDC acknowledge that there may be a perception of some risks associated with the proposal, and in particular where there is not a positive and collaborative approach to the implementation of the consents between SWDC and GWRC. SWDC intend to work in an open and transparent manner to ensure a "no surprises" relationship with GWRC. It is considered this collaborative approach will be supported, in particular through, the Discharge to Land and Water Management Plan review procedure, annual performance and risk reporting, and the proposed Stage 1 and 2 review reporting[83]. SWDC will work with GWRC to develop the framework within which this partnership will operate.

4.9 Proposed Term of Consent

The proposed term of consent is **35 years.**

There is no formula or strict criteria to calculate the term of a resource consent. There is however some assistance from the Environment Court over a number of separate and specific cases. The relevant factors are well summarised in *PVL Proteins Ltd v Auckland Regional Council*[84], which include:

- A decision on what is the appropriate term of the resource consent is to be made for the purpose of the Act, having regard to:

81 Refer to Part 1, Schedule 1, Condition 23.

82 Refer to Part 1, Schedule 1, Condition 25.

83 Refer to Part 1, Schedule 1, Conditions 37-42.

84 PVL Proteins Limited v Auckland Regional Council (Environment Court A61/2001)

  - the actual and potential effects on the environment and relevant provisions of applicable instruments under the Act;
  - the nature of the discharge;
  - the sensitivity of the receiving environment to adverse effects;
  - the applicant's reasons; and,
  - any possible alternative methods of discharge, including to another receiving environment.
- Relevant factors in making a decision on the term of the resource consent include that conditions may be imposed requiring:
  - adoption of the best practicable option;
  - requiring supply of information relating to the exercise of the consent;
  - requiring observance of minimum standards of quality in the receiving environment; and,
  - reserving power to review the conditions.

The same decision advises that a longer consent term is appropriate where a short term will create uncertainty for an applicant, and where there is a need for an applicant to protect its investment with as much security as is consistent with sustainable management (as defined in Part II of the RMA), and/or where there are known and minor effects on the environment on a constant basis.

Conversely, a shorter term is suggested as more appropriate where there is:

- expected significant future change in the vicinity;
- uncertainty about the effectiveness of conditions to protect the environment;
- fluctuating or variable effects on the environment;
- dependence upon human intervention or management for maintaining satisfactory performance, or reliance on standards that have altered in the past and may be expected to change again in future.

The most likely potential significant change affecting the plant is significant population growth in the short term. All indicators are for at most, only minor growth over the term of the consent and beyond. Significant growth is unlikely. In the event that growth does occur, Council would be in a position to take financial contributions from developers to upgrade the plant accordingly and the new infrastructure will be less likely to contribute to I&I which is demonstrated to be one of the major issues to address.

The Project and overall WWTP Strategy programme is a significant capital investment for SWDC. SWDC need a level of certainty over the consent term to facilitate this investment. A short-term consent would create significant (and unnecessary) uncertainty for SWDC.

The proposed upgrade to land treatment is consistent with the purpose of the RMA, the principles of sustainable management within the RMA and the relevant provisions of national and regional planning documents. The assessment has concluded that the proposal is also the best practicable option currently available.

The proposed upgrade to land treatment contains no significant uncertainty for GWRC or stakeholders in terms of effects to land. Land irrigation technology is simple and readily available, comprised effectively of pumping and irrigation equipment. A comprehensive suite of conditions has been proposed which do not contain any level of real risk of being ineffective. The conditions do not rely on unproven technology or capital commitment beyond the ability of

SWDC. The staged approach will ensure that long term storage and land application rates are appropriate. Management Plans will be prepared by appropriately qualified persons, and upgrades will be designed by experts with appropriate experience. All Management Plans and designs require stakeholder input (through the CLG) and GWRC technical certification. Monitoring will be extensive and reporting regular and informative.

Furthermore, comprehensive review conditions following the implementation of Stages 1 and 2B are proposed and will enable a full review of the activity, and in particular the effectiveness of Stage 2B which will at that stage have been operating for at least 3 years. This will give GWRC the ability at that point to make a fully informed decision on the long term sustainability of the proposal under the policy framework and technical advice available at the time. In addition, a review condition is proposed, enabling GWRC and SWDC to collectively review the key conditions of consent on an annual basis for the term of the consent[85]. Collectively, this will ensure that conditions do not become outdated, irrelevant, or inadequate.

The pond system, when built in the 1970's, was accepted best practice. Through the 1980's and 1990's some upgrades were made to improve performance, including splitting the previously single facultative pond into two ponds, an overland effluent 'sheeting' land treatment system, and increasing pond wave band height. As environmental challenges and community expectations have evolved in more recent times, SWDC has responded by making improvements and trialling alternative technologies and approaches to attempt to mitigate potential adverse effects. For example, SWDC have:

- installed and trialled a rapid-infiltration land-discharge system (2005/06);
- installed and trialled PETRO technology (2010/11);
- installed and trialled a floating media /wetland treatment on site (2010 – 2013);
- developed the long-term wastewater strategy (2011);
- installed the UV disinfection plant (2012); and
- investigated the feasibility of land based treatment and other available options (2010-14).

Following this extended period of trialling and investigation, SWDC has reached the conclusion that retrofitting the existing ponds with minor improvements is unlikely to achieve with an acceptable level of certainty its long-term goal either environmentally or financially. The proposed land treatment based activity is a rational, responsible and sustainable response to these challenges.

SWDC have committed to remove 44% of the current average annual wastewater volume from Donald Creek within 2 years of consent (Stage 1), with a focus to removing discharges to the Creek during low flow summer conditions when effects are likely to be greatest. Similarly, Stage 2A and 2B land treatment is required to be commissioned by 10 and 20 years respectively from the commencement of the consent. However, until the I&I rehabilitation programme is completed, Stage 2 cannot be achieved without a significant impact on the economic wellbeing of the community. A shorter term of consent will not have any benefit in this respect.

The proposed staging will ensure affordability is maintained, and that the risk of unaffordability is mitigated. Additional, if these stages are not achieved, SWDC will be in breach of their consent.

Actual and potential adverse effects have been identified, and have been quantified (as far as practicable) across the term of the consent as being: currently significant, reducing to moderate at Stage 1 and to less than minor at Stage 2B. It is acknowledged that there will be some localised effects on aquatic ecosystems resulting from the discharge continuing through

[85] Refer to Part 1, Schedule 1, Condition 37.

proposed Stage 1 and Stage 2A. These effects are understood, and will not be permanent. On balance, the proposal is consistent with the purpose of the RMA.

A shorter term of consent will not achieve any significant additional benefits or provide any additional safeguard against known and consistent environmental effects.

On this basis, the term of consent requested for all consents required for the FWWTP upgrade of 35 years is considered reasonable.

5 Statutory Assessment

5.1 Resource Management Act 1991 - Part III (Duties and Restrictions)

The following limitations apply under the RMA (paraphrased):

> *Section 15 – in relation to discharges, no person may release:*
>
> - *a contaminant into water; or*
> - *a contaminant onto or into land which may result in the contaminant entering water; or*
> - *a contaminant from an industrial or trade premise into air; or*
> - *a contaminant from an industrial or trade premise onto or into land,*
>
> *unless expressly allowed by a national environmental standard or other regulation, a rule in a regional plan, or a resource consent (note that an industrial or trade premise include premises used for disposal of waste materials).*

Thus for the proposed activity, a range of regional consents may be needed for each proposed stage, depending on the contents of the relevant regional plans.

5.2 Planning Rules for the Wellington Region

The relevant plans to be considered include:

- The Operative Regional Freshwater Plan ('Freshwater Plan') as updated at July 2014.
- The Operative Regional Plan for Discharges to Land ('Discharges to Land Plan') 1999.
- The Operative Regional Air Quality Management Plan ('Air Plan') 2000.
- The Proposed Natural Resources Plan ('PNRP') as notified at July 2015. Submissions on the PNRP have been received therefore the PNRP must be given considerable weight.
- The Wairarapa Combined District Plan ('WCDP') Updated Version Operative in Part 25 May 2011.

5.2.1 Discharge of Treated Wastewater to Water

Treated wastewater is proposed to be discharged to Donald Creek throughout the term of consent, with the frequency and volume changing as described in Section 4.

Rule 5 of the Freshwater Plan specifies the following:

> *The discharge of any contaminant or water into fresh water:*
>
> - *that is not provided for in Rules 1, 2, 3, and 4; and*
> - *which cannot meet the requirements of Rules 1, 2, 3, and 4; and*
> - *which is not a non-complying activity in Rule 6;*
>
> *is a **Discretionary Activity**.*

The proposed discharge is not provided for within Rules 1 to 4 (which relate to minor discharges, stormwater and contamination only by heat).

Rule 6 provides for *Discharges to wetlands, lakes and rivers, with surface water to be managed in its natural state* as a Non-complying activity. These water bodies are specified in Appendix 2 (Part A) of the Freshwater Plan. Donald Creek is not specified in that schedule. Rule 6 is therefore not applicable.

Rule 5 does not contain any quantity or quality thresholds which would alter the status of the activity.

The proposed discharge of treated effluent to Donald Creek therefore requires consent pursuant to Rule 5 of the Freshwater Plan, to be assessed as a Discretionary Activity.

Rule R61 of the PNRP states:

> *The discharge of wastewater:*
>
> *a. into coastal water, or*
> *b. that is an existing discharge into fresh water*
>
> *is a **discretionary activity.***

The proposed discharge of treated wastewater from the FWWTP to Donald Creek is an existing activity, therefore requires consent pursuant to Rule 61 of the PNRP, to be assessed as a ***Discretionary Activity***.

The proposed discharge regime requires flow in Donald Creek to be measured. To measure flow, a 'stage level recorder' will need to be installed within the body of the stream and a weir may need to be installed. The consent requirements for the stage recorder will be determined when further investigations have been undertaken to determine the preferred stage recorder arrangement. If required, consents for the structure(s), works and ancillary enabling activities, will be applied for. The timing for such an application will be in time to collect the required flow data to inform the discharge regime (and before the stage recorder is installed). The applicant has proposed an installation date within 2 years of consent commencement. At this point in time, the proposed stage recorder is most likely to be a traditional pressure transducer and will occupy no more than 10 m^2. Therefore the activity is likely to be a permitted under Rule 29 of the Freshwater Plan and Rule 117 of the PNRP.

5.2.2 Discharge of Treated Effluent to Land

The proposal includes discharges of treated effluent to land as follows:

- The discharge of effluent into land through the open channel which discharges the treated effluent from the FWWTP to Donald Creek; and
- The potential discharge to land of effluent through the bottom and sides of the FWWTP ponds; and
- The discharge of treated effluent to land on Site A and Site B within 2 years of consent commencement.

The Discharges to Land Plan contains rules relating specifically to the discharge of treated wastewater to Land. Rule 8 of that Plan provides a 'catch all' rule for all discharges containing human sewage not otherwise provided for. Rule 8 states that

> *Any discharge containing human sewage onto or into land is a Discretionary Activity unless the discharge is allowed by Rule 3, 5, 6, or 7.*

Rule 8 therefore captures any discharge to land that contains human sewage which is not a pit latrine (Rule 5), controlled discharge of aerobically treated sewage (Rule 6), or smaller scale on-site treatment and disposal (Rule 7).

Due to the scale of the FWWTP it is unlikely that Rules 3, 5, 6, or 7 apply, and also it cannot be guaranteed that the proposed activity would comply with the respective permitted activity standards at all times.

The presence or extent of any discharge from the open channel or base of the FWWTP ponds is not known (although as noted in Section 2.3, pond leakage is likely to be minimal at FWWTP). To provide certainty however, resource consent for these activities is applied for under Rule 8 of the Discharges to Land Plan for these potential discharges along with the proposed discharges to land as part of the land treatment scheme.

The proposed discharge of treated effluent to land therefore requires consent pursuant to Rule 8 of the Discharge to Land Plan, to be assessed as a Discretionary Activity. Rule R93 of the PRNP applies to the discharge of treated wastewater to land and states that:

> *The discharge of contaminants onto or into land that are not permitted, controlled, restricted discretionary, or non-complying is a discretionary activity.*

An assessment of the proposed land irrigation activity against Rule 79 (Controlled Activity) and Rule 80 (Restricted Discretionary Activity) is provided in Table 18 below.

Table 18: PRNP Rule 79 and 80 Assessment

Rule Ref	Condition	Condition met?	Comment
Rule 79	The discharge of treated wastewater onto or into land, and the associated discharge of odour is a controlled activity, provided the conditions are met.		
a)	the discharge is not located within a community drinking water supply protection area as shown on Map 26, Map 27a, Map 27b, or Map 27c, and	Yes.	The discharge is not located within a community drinking water supply protection area.
b)	the discharge shall contain no more than 10% trade wastes based on daily dry weather flow, averaged over a calendar year, and	Yes.	It is understood that the daily dry weather flow comprises of approximately 5% trade waste.
c)	the discharge shall meet the following criteria: i) the concentration of soluble carbonaceous five day biochemical oxygen demand shall not exceed 30mg/L in more than eight out of 12 consecutive samples, or exceed 50mg/L in more than two out of 12 consecutive samples, and ii) the concentration of total suspended solids shall not exceed 50mg/L for more than eight out of 12 consecutive samples, or exceed 80mg/L in more than two out of 12 consecutive samples, and	No	Median BOD (Total) and TSS values are = 17mg/l and 35mg/l respectively and 95%ile values are = 32mg/l and 125mg/l respectively (based on data collected between Feb 2006 and May 2016). Although it is noted that irrigation filtration will be put in place prior to discharge to land.
d)	the pathogen concentration in wastewater shall have been reduced to a level commensurate with it having been treated to a tertiary level before discharge for surface application and secondary level for subsurface irrigation, and shall not exceed an Escherichia coli (E.coli) concentration of 2,000cfu/100mL, and	A majority of the time	E.coli compliance records taken since the UV plant was installed in Dec 2011 up until May 2016 result in a median of 24 cfu / 100ml (21 samples), however on one occasion in April 2013 an exceedance of the 2,000 cfu/100mL was measured (2,100 cfu/100mL).

Rule Ref	Condition	Condition met?	Comment
e)	the application method is either a subsurface or surface drip irrigation or low pressure spray irrigation system less than or equal to 1.5m above ground surface, and	Yes in part.	All new irrigation equipment will be designed to ensure low pressure spray with nozzles set at l less than 1.5 above ground surface. The existing irrigation system currently has high pressure nozzles, thus those sprinklers within 125m of the boundary will be replaced with low pressure sprinkler heads.
f)	the hydraulic loading rate shall not exceed 5mm/hr or 15mm per application event and can only occur when soil moisture deficit is greater than the application event, and	No.	Proposed loading rate exceeds 15 mm per application event.
g)	the distribution uniformity of the spray irrigation system shall be greater than or equal to 80%, with drip irrigation emitters at a minimum spacing of 0.6m x 1m, and	Yes.	Proposed irrigation system will be at least 80% efficient in regard to distribution uniformity.
h)	the application shall not result in significant ponding (areas of ponded effluent on the ground surface greater than $10m^2$ for a period greater than 12 hours) or runoff (visible overland flow); and	Yes.	The proposed DIR and discharge regime will ensure ponding is avoided.
i)	the nitrogen loading rate of the wastewater applied shall not exceed the following limits for the specified land uses: i) 150kg N/ha/year if mown without grass removal, or grazed, or ii) 300kg N/ha/year if cut, harvested and removed, and	Yes.	Nitrogen loading rate will not exceed 300kg N/ha/year with a mixture of grazing and cut and carry farm management proposed.
j)	the phosphorus loading rate of the wastewater applied shall not exceed the following limits for the specified land uses: i) 30kg P/ha/year if mown without grass removal, or grazed, or ii) 50kg P/ha/year if cut, harvested and removed, and	Yes.	Phosphorous loading rate will not exceed 50 kg P/ha/year with a mixture of grazing and cut and carry farm management proposed.
k)	the application must be onto actively growing vegetation which is not dormant. Application shall not be onto fallow land or areas that have no vegetative growth, and	Yes.	
l)	for spray irrigation, the discharge is not located within: i) 50m of a surface water body, coastal marine area or property boundary, or ii) 150m of any marae, schools, shops, playgrounds, bore used for water abstraction for potable supply, places of work or residential dwellings not on the application property; and	No.	There will be a 20m separation distance provided to any surface water body. 150m separation distance will be provided to all existing neighbouring residential dwellings.
m)	for surface and subsurface drip irrigation, the discharge is not located within: i) 5m of a surface water body, coastal marine area or property boundary, or ii) 150m of a bore used for water abstraction for potable supply, and	NA.	
n)	there shall be a minimum depth to groundwater of at least 1m below the point of application, and	No.	At times of the year this separation distance may not be met, although it is proposed that irrigation will be avoided during winter months when the groundwater levels are expected to be at their highest.
o)	a deficit irrigation regime is used for the application of treated wastewater to land, and	No.	A deficit irrigation regime is proposed for Site A and

Rule Ref	Condition	Condition met?	Comment
			deferred irrigation regime for Site B
p)	the application of wastewater to land by spray irritation shall have automated shut off controls so that there shall be no irrigation when the wind speed 10 minute average exceeds 6m/s, and	In part.	The proposed scheme will have automated shutoff controls when the wind speed 10 minute average exceeds 12m/s or 4m/s sustained in a direction toward an existing dwelling on an adjoining site within 300m of the irrigation area.
q)	the normal droplet size delivered by wastewater irrigation shall not have a volume median diameter less than 1,700µm or an equivalent volume mean diameter, and	No.	The use of the existing infrastructure on Site B is unlikely to comply with this droplet size requirement. Any future irrigation equipment will be designed to ensure Droplets will be greater than 200 µm in size. Droplets this size do not travel far and typically do not form aerosols.
r)	the discharge of odour is not offensive or objectionable beyond the boundary of the property.	Yes.	
Rule 80	The discharge of treated wastewater onto or into land, and the associated discharge of odour that does not meet the conditions of Rule R79 is a restricted discretionary activity provided the following conditions are met:		
a)	the application method is either a subsurface or surface drip irrigation or low pressure spray irrigation system, less than or equal to 1.5m above ground surface, and	Yes	
b)	the application must be onto actively growing vegetation. Application shall not be onto fallow land or areas that have no vegetative growth, and	Yes	
c)	a deficit irrigation regime is used for the application of treated wastewater to land, and	No	A deficit irrigation regime is proposed for Site A and deferred irrigation regime for Site B.
d)	the discharge of odour is not offensive or objectionable beyond the boundary of the property.	Yes	

As the assessment of the proposed activity (discharge of treated wastewater to land through seepage from the ponds and discharge channel and irrigation) against Rules 79 and 80 shows that not all criteria have been met, a consent is required pursuant to Rule 93 of the PNRP, to be assessed as **Discretionary Activities.**

5.2.3 Discharge to Air

The Air Plan contains a specific rule (Rule 21) on the discharge of contaminants to air from sewage disposal as a permitted activity. This however specifically excludes municipal sewage treatment. The explanation to the Rule specifies that:

> *The discharge of contaminants to air arising from the treatment of municipal sewage or liquid or liquid-borne trade wastes is explicitly excluded from Rule 21 and requires a resource consent under Rule 23.*

Rule 23 is a general rule stipulating activities not otherwise permitted will require resource consent as a Discretionary Activity.

The discharge of contaminants into air from:

(1) any process or activity explicitly excluded from Rules 1-22

is a Discretionary Activity

The potential discharge of contaminants to air arising from the oxidation ponds, deferred storage pond and land treatment system requires consent pursuant to Rule 23 of the Air Plan, to be assessed as Discretionary Activities.

Rule 41 of the PNRP states that:

> *The discharge of contaminants into air that are not permitted, controlled, discretionary, non-complying or prohibited is a discretionary activity.*

There are no specific rules in the PRNP that apply to the discharge of odour or aerosols from the proposed FWWTP and land application scheme. The proposed activities require consent pursuant to Rule 41 of the PNRP to be assessed as Discretionary Activities.

5.2.4 Wairarapa Combined District Plan

5.2.4.1 FWWTP Operation, Maintenance and Upgrade

The FWWTP operates under an existing designation[86] in the District Plan in favour of SWDC for 'Sewage Disposal' purposes. The proposed continuation of operations and inlet screen upgrade at the FWWTP falls within the existing designated purpose.

It is also noted that:

- there are no changes to the proposed activity which would require an amendment to the existing designation at this stage[87];
- there are no landuse activities[88] proposed within the FWWTP designation which fall outside of the 'Sewage Disposal' purpose, and therefore no additional landuse consents are required under the district plan provisions. An Outline Plan of Works[89] will be submitted prior to any works on site associated with the upgrade of the FWWTP;
- Any works (e.g. inlet screen works) that trigger consent under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011 ('NES-CS') will be assessed and applied for if required during the detailed design phase

It is also noted for completeness, that the FWWTP is within a Rural 'Special' Zone. This zone was established for reasons including to specifically provide long term certainty to the operation of key community infrastructure, and in particular protect against potential reverse sensitivity effects. This is considered in further detail later in the assessment.

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86 Refer WCDP, Appendix 6 - Designation (Ds066); also illustrated on Planning Map 62.

87 An amendment to the designation will be required should the SWDC decide to include the land treatment area within the designated area. SWDC are under no obligation to do this, but a decision will be made at a later date on this matter.

88 Landuse activity in this respect is as defined in section 9 of the RMA.

89 An Outline Plan of Works is required under section 176A of the RMA, unless a waiver is obtained. A waiver may be sought by the Applicant if appropriate.

5.2.4.2 Proposed Land Treatment

The irrigation areas (Site A and Site B) and associated infrastructure, including the future storage pond, will not be located within the existing FWWTP designated area[90]. No new designation is proposed at this stage for the irrigation areas. Any land-use consents required under the District Plan and NES-CS for the establishment of the irrigation infrastructure (including storage ponds, pump stations and in-ground pipes) will be obtained from SWDC prior to implementation of each Stage), when detailed design has been completed.

Plan Change 3 to the District Plan[91] introduced new rules relating to the discharge of treated wastewater to land. Of relevance to this application is Rule 4.5.2(m)(i)(a) and (ii)(a). This provides permitted setback distance standards from the property boundary of 125 m for spray irrigation of treated wastewater with median E.Coli concentrations less than 2000 cfu/100ml or 25 m for spray irrigation of treated wastewater with median E.Coli concentrations less than 100 cfu/100ml where an irrigation system is:

a. Low pressure (less than 1.4 bar); and
b. Has a low boom height (less than 1.52m from the ground);
c. Does not have end spray guns; and
d. Where irrigation will not occur during wind speeds exceeding 4m/s (14.4km/hr).

Effluent quality achieved from the existing UV plant meets the median E.Coli concentration of less than 100cfu/100ml. However the existing irrigation equipment located on Site B land does not meet the low pressure criteria. It is therefore proposed that the existing impact sprinkler system located within the 125 m buffer zones is replaced with a suitable system that complies with the above criteria to enable the reduced 25 m setback criteria to be met. Any new irrigation equipment will be designed to meet the above criteria to enable reduced setbacks of 25 m and compliant wind speed-cutoff criteria incorporated into the scheme operations. As such, no land use consent is sought (or necessary[92]) under the District Plan.

5.2.4.3 Sewer network upgrade

Rule 24.1.24(a)(vii) of the WCDP provides for the construction, maintenance and upgrading of ‘underground pumping stations and pipe networks for the conveyance or drainage of water or sewage, and necessary incidental equipment’ as a permitted activity. No consent is therefore required from the District Council for the Stage 1 I&I remediation programme.

The likely sections of the sewer network which will be rehabilitated are not contained within any identified planning Management Area overlays. There is however a small possibility that some of the works may fall within a Management area for which earthworks trigger the need for consent. These will be isolated individual areas and any temporary adverse effects can be mitigated on site using standard construction methodologies, as they would with any normal pipe replacement programme. If any specific sections of the upgrade do require consent from a technical perspective, these will be obtained prior to those works taking place. No consent is sought as part of this current application.

90 The only exception may be the pumping infrastructure, subject to detailed design and site master planning.

91 The decision on Plan Change 3 was released on May 12, 2012.

92 If, following detailed design, standards cannot be fully complied with resource consent will be obtained prior to any works.

5.2.4.4 Other Consents

No other consents are expected to be required for the project other than highlighted above. Prior to the start of works, 'contaminated land assessments' will be undertaken in accordance with *Contaminated Land Management Guidelines No. 5: Site Investigation and Analysis of Soils* (2011) and *Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Land* (2011). From these assessments any consents relating to contaminated land required under the NES-CS, Operative Regional Soil Plan or PNRP will be applied for as the project progresses and at this point in time, no consents are expected to be required, with exception for the inlet works which is located on the current WWTP HAIL site[93]. The proposed deferred storage pond is to be located within either Site A or B and neither site is considered a HAIL site. A preliminary site investigation (PSI) and detailed site investigation (DSI) (if required) will be undertaken to confirm any contamination at the proposed buffer storage pond site of works.

5.2.5 Summary of Resource Consents required for the proposed activity

From the assessment of the relevant regional plans and district plan, it is considered that the proposed continuation of the operation of FWWTP and new land treatment scheme as proposed requires the following consents:

- **Discharge of a contaminant to water** for the discharge of treated effluent to Donald Creek pursuant to section 15(1)(a) of the RMA, Rule 5 of the Freshwater Plan and Rule 61 of the PNRP;
- **Discharge of contaminant to land and which may enter water** for the discharge of wastewater to land through the base and sides of the treatment ponds) and discharge channel pursuant to section 15(1)(b) of the RMA and Rule 8 of the Freshwater Plan and Rule 93 of the PNRP;
- **Discharge of a contaminant to land and which may enter water** for the discharge of treated effluent to Site A and Site B which may enter groundwater, in terms of section 15(1)(b) of the RMA and Rule 8 of the Freshwater Plan and Rule 93 of the PNRP);
- **Discharge to contaminants to air** (odour) pursuant to section 15(2A) of the RMA and Rule 23 of the Air Plan and Rule 41 of the PNRP.

The consents should be determined as 'Discretionary Activity' in terms of the Act. A proposed consent framework is included in Part 1C, with suggested conditions of consent.

5.3 Resource Management Act 1991 – Part VI (Resource Consents)

Part 6 of the RMA sets out the process for an applicant to apply for resource consent, and the process for a consent authority, in this case GWRC, to determine that application.

This application has been prepared in accordance with the relevant provisions of the Act (in particular section 88).

5.3.1 Section 104 – Consideration of Applications

Section 104 clarifies that for a discretionary activity, the consenting authority has the ability to accept the application and grant consent (including attaching relevant conditions under the guidance of s108), or decline the consent.

[93] A HAIL site is one that is listed on the 'Hazardous Activities Industries List' (HAIL). The NESCS requires that earthworks for more than 25 m^3 per 500 m^2 on a HAIL site requires an NES-CS consent as either a controlled or discretionary activity.

A discretionary activity requiring consent must be assessed against the relevant policy provisions which sets out the long term objectives and outcomes sought, and then the specific actual or potential effects of the proposed activity on the receiving environment considered on that basis. Both of these factors must be considered in the overall context of 'sustainable management'[94], and the balance required to be achieved between the environment and the well-being of the community. Only then can a decision as to the appropriateness of the proposed activity be made.

The relevant policy provisions are set-out and assessed in Section 5.4 below. The actual and potential effects on the environment of allowing the activities are addressed in Section 6 of this Report.

5.3.2 Section 105

Section 105 of the RMA outlines a number of other specific matters the consent authority must have regard to in respect of a discharge consent. These matters are:

a. the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and
b. the applicant's reasons for the proposed choice; and
c. any possible alternative methods of discharge, including discharge into any other receiving environment.

The nature of the discharge and the receiving environment are described in Sections 3 and 4 respectively. The reasons for the proposal are outlined in the discussion on the SWDC Wastewater Strategy in Section 1. A comprehensive assessment of alternatives has been undertaken, as described in Section 1.1 and 7.3 of this report.

5.3.3 Section 107

Section 107(1) of the RMA is restrictive in nature, providing if any of the following effects are likely to result from a discharge to water, after reasonable mixing, consent shall not be granted:

a. the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials,
b. any conspicuous change in the colour or visual clarity,
c. any emission of objectionable odour,
d. the rendering of fresh water unsuitable for consumption by farm animals, or
e. any significant adverse effects on aquatic life.

Section 107(2) specifies the situations in which a consent authority can grant consent if the criteria in s.107(1) are not met, provided it is consistent with the purpose of the Act (section 5 of the RMA) to do so. These are not in addition to the s107 criteria, but provide specified exceptions to those criteria. Section 107(2) provides that:

2. A consent authority may grant a discharge permit ... to do something that would otherwise contravene section 15 ... that may allow any of the effects described in subsection (1) if it is satisfied—
    a. *that exceptional circumstances justify the granting of the permit; or*
    b. *that the discharge is of a temporary nature; or*

[94] The Purpose and Principles of the RMA, including a definition of 'Sustainable management' for the purposes of the Act, are included in Part II of the Act (ss.5-8).

c. *that the discharge is associated with necessary maintenance work—*

d. *and that it is consistent with the purpose of this Act to do so*.

In the event consent is granted, s107(3) provides the ability for GWRC to include conditions enabling works to be staged to ensure that the requirements of s107(1) outlined above can be met.

The effects listed in RMA Section 107(1) are discussed in Section 6.4 of this report. The assessment of effects has concluded, it is expected with mitigation, that s107 criteria can be met following commissioning of the Stage 2B land treatment discharge regime within 20 years of consent commencement and that most criteria if not all may be met following the commissioning of the Stage 1 within 2 years of the consent commencement. An adaptive management programme has also been outlined (refer section 4.2.4) which will ensure that these criteria are met, including a suite of management plans and rigorous certification process, detailed annual reporting, and two scheme review reports at key stages during the term of consent. For completeness, an assessment against the exceptions provided in s107(2) is provided below.

5.3.3.1 Section 107(2)(a) – exceptional circumstances

There is no strict legal test for what constitutes "exceptional circumstances" in terms of s.107. Whilst it needs to be considered on a case specific basis, this assessment is commonly applied for wastewater discharge applications throughout New Zealand. Commonly referred to case law includes Paokahu Trust v Gisborne District Council A162/03, which related to the Gisborne District community wastewater coastal outfall. In that case the Court found that the consequences of refusing a consent (i.e. that the Council could not lawfully use its wastewater system), were 'out of the ordinary' and granted consent on that basis.

This approach has been adopted locally, with the recent grant of discharge consents for SWDC's Martinborough and Greytown WWTP's. The decision of the Commissioners[95] in that application includes the following:

> *"Nevertheless, to the extent that any of the section 107(1) effects occur in the Ruamahanga River as a result of the SWDC proposal, we allow those effects under section 107(2) because we are satisfied that granting the discharge permits constitutes an exceptional circumstance (section 107(2)(a)). We make that finding because to decline the discharge permits would leave Martinborough without an authorised wastewater treatment system. That would not, in our view, promote sustainable management, particularly in light of the SWDC's commendable commitment to move to a full land treatment system at Martinborough in the medium term, coupled with the SWDC's strategic approach to its three WWTPs (Martinborough, Greytown and Featherston)."*
>
> *"To the extent that any of the section 107(1) effects occur in the Papawai Stream as a result of the SWDC proposal, we allow those effects under section 107(2) because we are satisfied that granting the discharge permits constitutes an exceptional circumstance (section 107(2)(a)). We make that finding because to decline the discharge permits would leave Greytown without an authorised wastewater treatment system. That would not, in our view, promote sustainable management, particularly in light of the SWDC's commendable commitment to move to a full land treatment system at Greytown in the medium term, coupled with the SWDC's strategic approach to its three WWTPs (Greytown, Martinborough and Featherston)."*

[95] Decision on Application by SWDC to Wellington Regional Council: WAR0080254 & WAR1202258; 11 February 2016;

The same considerations apply in terms of this current consent and the potential circumstances of not granting consent would be equally exceptional and contrary to the purpose of the Act.

5.3.3.2 Section 107(2)(b) – the discharge is of a temporary nature

There is some guidance in case law, providing that "temporary" is case specific, and that the intent of the RMA and relevant policy framework are relevant considerations[96]. The Project is intended to enable the implementation of a long-term strategy to significantly reduce the potential adverse effects of treated wastewater discharges from surface water.

In terms of the current application, there is specific provision within the proposal to potentially decrease the extent of adverse effect through Stage 1 and then significantly in Stage 2. The effect of the proposal is therefore not permanent.

5.3.3.3 Section 107(2)(c) – associated with necessary maintenance work

The proposed discharge to Donald Creek is not associated with necessary maintenance work. Any inadvertent discharge to water during the Stage 1 sewerage rehabilitation programme will fall within the intent of this exception.

5.3.3.4 Consistency with the Purpose of the Act

The overriding requirement to grant consent under the exceptions provided in s107(2) still remains that the proposal be consistent with the purpose of the Act. The SWDC strategy (as outlined in section 1.1) and this Project are directly consistent with the purpose and the principles of the Act.

5.4 Policy Framework

This section outlines the relevant policy documents and provisions. It covers relevant national, regional, and local policy. This is useful in order to put the proposal into the wider context of what the national and regional policy frameworks are seeking to achieve in the short and long term. The full wording of each planning policy and objective referenced is provided in Appendix 13A.

5.4.1 National Policy Statement Freshwater Management 2011

The National Policy Statement for Freshwater Management 2011 ("NPS-FM") came into effect on 1 July 2011. From that date, decision-makers under the RMA must have regard to the NPS-FM in consenting decisions. The NPS sets out objectives and policies that direct local government to manage water in an integrated and sustainable way, while providing for economic growth within set water quantity and quality limits.

The relevant objectives and policies of the NPS-FM are outlined below.

Water Quality

Part A of the NPS-FM directs the development of enforceable water quantity and quality limits.

Objective A1 *To safeguard: (a) the life-supporting capacity, ...ecosystems, of freshwater and (b) the health of people and communities, at least as affected by secondary contact with fresh water; in sustainably managing the use and development of land, and of discharges of contaminants.*

[96] Fletcher Property Ltd v America's Cup Village Ltd A050/99

Objective A2 The overall quality of fresh water … is maintained or improved …

The Freshwater NPS-FM contains two transitional policies requiring Regional Councils to amend their Plans to be consistent with the policies for freshwater quality (A4) and quantity (B7) directly into regional plans. Plan Change 4 (December 2011) to the operative Freshwater Plan saw the insertion of two transitional policies (5.2.10A and 6.2.4A) which gave effect to the NPS-FM policies. Policy 5.2.10A relates to water quality thus is of relevance to this application. In addition, the NPS-FM is also given effect through the Discharge to Land Plan transitional policy 4.2.24A. The PNRP also contains the relevant NPS-FM provisions that must be considered (policy 66). The assessment of consistency in that respect can therefore be limited to the relevant provisions of the Freshwater Plan, Discharge to Land Plan and PNRP (see Section 5.4.4, 5.4.5 and 5.4.7).

Integrated management

Part C of the NPS-FM directs the integrated management of freshwater on a catchment basis.

Objective C1 To improve integrated management of fresh water and the use and development of land in whole catchments, including the interactions between fresh water, land, associated ecosystems and the coastal environment.

Policy C1 By every regional council managing fresh water and land use and development in catchments in an integrated and sustainable way, so as to avoid, remedy or mitigate adverse effects, including cumulative effects.

Policy C2 By every regional council making or changing regional policy statements to the extent needed to provide for the integrated management of the effects of the use and development of land on fresh water, including encouraging the co-ordination and sequencing of regional and/or urban growth, land use and development and the provision of infrastructure.

The proposed activity is founded on the strategic approach outlined in Section 1. These include:

- Taking a long term view of solutions (20-50+ year horizon).
- Developing the best practicable option across all three sites in an integrated and sustainable manner.
- Developing long-term technical options with a high degree of performance certainty fundamentally based on balanced parameters of risk, public health, environmental effect, and financial affordability.
- Providing continued engagement with key stakeholders, including iwi and community groups, (which has been ongoing since 2008) in considering and developing the preferred long-term options.

The proposal is therefore not inconsistent with the principles of integrated catchment based resource management and Part C of the NPS-FM.

Tāngata whenua roles and interests

The NPS-FM contains specific recognition of the importance of providing for the involvement of tangata whenua in decision-making on freshwater resources and related ecosystems.

Objective D1 To provide for the involvement of iwi and hapū, and to ensure that tāngata whenua values and interests are identified and reflected in the management of fresh water including associated ecosystems, and decision-making regarding

freshwater planning, including on how all other objectives of this national policy statement are given effect to.

Policy D1 *Local authorities shall take reasonable steps to:*

a. *involve iwi and hapū in the management of fresh water and freshwater ecosystems in the region*

b. *work with iwi and hapū to identify tāngata whenua values and interests in fresh water and freshwater ecosystems in the region and*

c. *reflect tāngata whenua values and interests in the management of, and decision-making regarding, fresh water and freshwater ecosystems in the region.*

The applicant has engaged with iwi representatives from Rangitaane o Wairarapa and Kahungunu ki Wairarapa during the process of developing this resource consent application and the longer term aspiration to remove discharge from Donald Creek.

The Cultural Assessment commissioned by SWDC generally agrees with the intent of these policies, and seeks to find ways in which Maori can be actively engaged in the decision making process.

SWDC has proposed a condition to develop a Tangata Whenua Values Management Plan[97]. This will ensure the operational practices adopted recognise the key role and values of tangata whenua as kaitiaki, and include provision for identification of cultural health indices and monitoring. This will include an ongoing commitment to work with iwi and hapū through the Wastewater Steering Group, but more importantly provide an opportunity for iwi and hapū to input into forming key decisions.

The proposed activity is therefore considered to generally reflect and provide for the intent of Section D of the Freshwater NPS.

5.4.2 National Environmental Standards (NES)

5.4.2.1 NES for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011 (NES-CS)

The NES-CS came into effect on 1 January 2012. The purpose of the NES-CS is to ensure that land affected by contaminants in soil is appropriately identified and assessed before it is developed, and if necessary the land is remediated or the contaminants contained to make the land safe for human use

The NES-CS applies where land is used for one of 53 listed hazardous activities or industries (HAIL) which are considered likely to cause land contamination. The HAIL includes land used for wastewater treatment.

SWDC has proposed a condition to develop a Discharge to Water and Land Management Plan[98] in which, consideration will be made to ensure the discharge system is designed to minimise contaminant levels in soil to ensure human health is protected.

[97] Refer to Part 1C Schedule 1: Condition 2.

[98] Refer to Part 1 Schedule 1: Condition 2.

5.4.2.2 NES for Sources of Drinking Water of Human Drinking Water 2007 (NES-DW)

The NES-DW came into effect on 20 June 2008. The purpose of the NES is to reduce the risk of human drinking water sources becoming contaminated. A human drinking water source is a natural water body such as a lake, river or groundwater, used to supply a community with drinking water. The standard applies to source water before it is treated and only sources used to supplying human drinking water i.e., not stock or other animals. Section 7 of the regulation states as follows:

> *"A regional council must not grant a water permit or discharge permit for an activity that will occur upstream of an abstraction point where the drinking water concerned meets the health quality criteria if the activity is likely to -*
>
> a. *introduce or increase the concentration of any determinands in the drinking water, so that, after existing treatment, it no longer meets the health quality criteria; or*
> b. *introduce or increase the concentration of any aesthetic determinands in the drinking water so that, after existing treatment, it contains aesthetic determinands at values exceeding the guideline values."*

The proposed FWWTP Scheme and registered drinking water sources (based on GWRC Online GIS) in the area are shown in Figure 21 below. The nearest registered drinking source is the South Featherston School Well that is located 1 km to the west of the FWWTP Scheme, although it is unclear whether this registered drinking-water supply provides no fewer than 501 people[99]. Even so, given the distance to this well, the southward groundwater flow direction and expected leaching rates from the land treatment scheme, the South Featherston School well is unlikely to be affected by the scheme. Overall, the proposal is considered to comply with this NES.

[99] … Regulation 7 and 8 only apply to an activity that has the potential to affect a registered drinking-water supply that provides no fewer than 501 people with drinking water for not less than 60 days each calendar year

Figure 21: Proposed FWWTP Scheme and Known Drinking Water Sources

5.4.3 Wellington Regional Policy Statement 2013

The Regional Policy Statement ("RPS") is a high level policy document which all regional and district plans within the region are required to give effect to. The intent of the RPS is to integrate the management of natural and physical resources across the region to achieve the stated community outcomes.

Infrastructure and waste

Within the RPS, the local authority wastewater network and treatment plants are identified and defined as "Regionally Significant Infrastructure"[100] .The RPS supports this priority by outlining a number of provisions which require specific recognition of the benefits of regionally significant infrastructure (including public health and safety - refer RPS **Objective 10**; and **Policy 7**), and require Councils to provide for regionally significant infrastructure to maintain public health and safety (e.g. refer RPS **Policy 39**), even if it affects public access to surface water (refer, for example, RPS Policy 53). Where there are competing demands, such as in this case, the RPS identifies that whilst the benefits of regionally important infrastructure must be recognised, the potential effects must also be considered, and appropriateness determined on a case specific basis (see explanation, Policy 39).

[100] RPS; Appendix 3 - Definitions

Freshwater (including public access)

The RPS does not schedule Donald Creek as a water body of significance.

Abbot Creek (including all its tributaries but excluding Donald Creek) is however identified as having significant values associated with indigenous ecosystems, for having high macro-invertebrate health and being a habitat for threatened indigenous fish species[101], apparently on account of its proximity to Lake Wairarapa.

Lake Wairarapa itself is identified as a water body with values requiring protection, having recreational and amenity values[102] , in particular for fishing, kayaking, canoeing, boating, duck shooting, birdwatching, walking, and photography. It is also identified that Lake Wairarapa is an identified habitat for threatened indigenous fish species, and for six or more migratory indigenous fish species.

Objective 12 of the RPS seeks to manage freshwater to meet the range of uses and values for which water is required, safeguard the life supporting capacity of water bodies and meet the reasonably foreseeable needs of future generations. Downstream from the proposed discharge, Donald Creek provides ecological habitat for indigenous fish, Abbot Creek is used for irrigation water and is valued for its significant indigenous ecosystem as is Lake Wairarapa.

The proposed scheme is expected to significantly improve water quality and ecological health on these downstream water bodies as the direct discharge to water during summer months is minimised considerably at Stage 1 and eventually avoided on commencement of the proposed Stage 2B scheme. Winter discharges will continue at Stage 1 most of the time but reduce to July and August at Stage 2B, and no discharge will occur on some years. The volume discharged will reduce to 6% of the current average annual volume.

The adverse effects on Donald Creek at Stage 1, within two years of the consent commencement, are predicted to reduce from significant to minor in terms of ammonia chronic toxicity with no exceedances of the National Bottom Line predicted and a suitable level of protection for the fingernail claim achieved. Furthermore, nutrient concentrations will reduce to levels similar to background levels during summer when the risk of increased periphyton growth is greatest. At Stage 2B, all effects relating to the discharge are expected to be minor or less than minor with the concentration of ammonia downstream achieving levels conducive to the protection of juvenile mussels on most years and discharge occurring only in winter months under high flow conditions when periphyton growth is unlikely to occur.

The effect of the discharge on Lake Wairarapa is considered to be less than minor, with contributions of nutrients to the Lake estimated to be low currently (<2%) and loads to reduce to less than 1% as the project proceeds.

Objective 13 of the RPS states that “The region’s rivers, lakes and wetlands support healthy functioning ecosystems”. The policy framework supports this objective by directing regional plans to include provisions that maintain or enhance amenity and recreational values (**Policy 19a**) and protect significant indigenous ecosystems and habitats (**Policy 19b**). Whilst not directly relevant to consent applications, this indicates the intent of the RPS.

Policy 16 promotes the discharge of contaminants to land while maintaining groundwater quality and soil health. Applying wastewater at sustainable rates when soil moisture conditions suit, will ensure groundwater quality and soil health are maintained. Policy 16 considers well

101 RPS; Appendix 1, Table 16.

102 RPS; Appendix 1, Table 15.

managed land-based discharges can avoid or mitigate adverse effects on water bodies, including degradation of the mauri of water bodies, and this application seeks to achieve this.

Policy 40 requires particular regard to be given to managing water bodies for their identified purposes in regional plans, however for all surface water bodies ecosystem health shall be safeguarded and as a minimum aquatic ecosystem health shall be maintained or enhanced. The proposal seeks to enhance aquatic ecosystem health with the progressive removal of discharge from Donald Creek particularly during summer months, when effects are greatest, at Stage 1 and in some years by Stage 2B no discharge to water will occur. There will be a significant reduction in the load of treated wastewater discharged directly to Donald Creek, Abbot Creek and Lake Wairarapa over the term of consent, therefore it is considered that aquatic ecosystem health will as a minimum be enhanced.

Another purpose relevant to Lake Wairarapa is amenity and recreational values. It is anticipated that overall the water quality upon which these values rely will be enhanced by the proposal to remove wastewater from surface waters, particularly during summer months.

Policy 43 seeks to protect aquatic ecological function of water bodies. The relevant parts of this policy are in relation to (a) maintain and enhancing ecosystems, (b) maintain and enhancing ecological functions of riparian margins (d) maintain and enhancing amenity/recreational values; (e) protecting significant indigenous ecosystems and habitats (g) maintaining fish passage and (h) protecting and reinstating riparian habitat.

Ecosystem values are expected to be enhanced within 2 years of the commencement of consent as a result of the significant reduction in discharge to the stream proposed during summer months. Some effect of the discharge will remain until such time as the final Stage 2B is commenced but the level of effect is predicted to achieve protection of the Fingernail Clam (the most sensitive species identified in Donald Creek) present downstream of the discharge for most years. By Stage 2B, greater confidence on the protection of freshwater mussels, a species more sensitive to ammonia than the Fingernail Clam, but not previously found in Donald or Abbot Creek will be achieved on most years. Recreational and amenity values will also be enhanced as a result of the reduced discharge to water particularly during summer month when periphyton growth and recreational activity is greatest. However, it is noted Donald Creek is not known to have high recreational value. No restrictions to fish passage have been proposed. Ecological functions of riparian margins will be enhanced by the fencing and exclusion of stock as a condition of consent and protecting the covenanted block of open space around Donald Creek from future development.

Indigenous Ecosystems

Objective 16 requires that indigenous ecosystems and habitats with significant biodiversity values (i.e. Abbot Creek and Lake Wairarapa) are maintained and restored to a healthy functioning state.

Policy 47 seeks to manage the effects on indigenous ecosystems and habitats with significant indigenous biodiversity values. The relevant parts of this policy are in relation to (f) protecting the life supporting capacity of indigenous ecosystems and habitats; (g) remedying or mitigating adverse effects on the indigenous biodiversity values where avoiding adverse effects is not practicably achievable; and (h) the need for a precautionary approach when assessing the potential for adverse effects on indigenous ecosystems and habitats.

Abbot Creek flow is intermittent, and information on water quality and ecological health is limited to a single survey undertaken in Spring 2016 (Hamill, 2017a – see Appendix 11). The fish community in Abbot Creek was dominated by longfin eel and common bully and had

macroinvertebrate communities' indicative of fair to poor water quality based on MCI and QMCI scores. Lake Wairarapa has been identified to be in a eutrophic to supertrophic state and it is thought that greater than 95% of the nutrient loads entering the lake are from other sources than the Featherston WWTP. The proposal seeks to remove over time a majority of plant contaminant loads to Abbot Creek and Lake Wairarapa thus meeting the intent of this policy, however the overall improvement to the Lake is unlikely to be measurable. Moderate to minor adverse effects will continue over the short-medium term in Abbot Creek and cannot be avoided due to financial constraints on the community. The proposal seeks to mitigate these adverse effects by taking a staged approach with particular focus on prioritising land application during summer months when the effects on indigenous ecosystem are at their greatest.

A precautionary approach has been adopted through the development of a conservative land treatment design, a comprehensive suite of proposed monitoring conditions and management plans, and an overall objective to remove as much of the discharge from surface waters as practicable. However, as the activity is existing and the discharge volumes to manage are large, a pragmatic approach is required and a stage approach to reducing the effects on freshwater is proposed.

Public Access

The RPS also seeks to protect access to and along rivers (**Objective: 8** and **Policy 53**), but recognises that there will be exceptions, including for the health and safety of people (Policy 53(d)), and to protect the integrity and security of regionally significant infrastructure (Policy 53(f)). Public access to Donald Creek is only restricted as much as necessary through appropriate signage, for public health reasons.

Resource Management with Tangata Whenua

Importantly and appropriately, the RPS identifies the importance of cultural values, and the importance of the water resource to Maori, and seeks to provide for its enhancement. **Objective 24** and **Policy 48** requires that applicants have particular regard to Te Tiriti o Waitangi (Treaty of Waitangi), Waitangi Tribunal reports and settlement decisions relating to the Wellington Region. The strong relationship that Maori have with whenua (land) and wai (water) is of significant importance, and SWDC recognise this relationship. Hence consultation has been undertaken with relevant tangata whenua and proposed conditions seek to include Maori so that this policy is met.

In particular the potential impact of sewage on the mauri of the water resource is identified (**Policy 49**). This aligns with the SWDC strategy of reducing wastewater discharge to Donald Creek. It is considered that Stage 2B of the proposal is generally consistent with the RPS, however during winter months when a discharge of treated wastewater to Donald Creek could occur, the mauri of water may be potentially impacted. To confirm the level of effect on Mauri of this water resource, the applicant proposes the development of cultural health indices and monitoring of cultural values over the term of consent.

RPS Assessment Summary

The proposal seeks to improve water quality through the removal of 94% of the current annual average volume discharged to water (and in some years the total discharge volume) and apply this land, which will in turn enhance other values associated with freshwater. Overall it is considered that the proposed activities meet the intent of the RPS.

5.4.4 Regional Freshwater Plan 2014

The operative Freshwater Plan for the Wellington Region (December 1999; updated July 2014) has a number of general objectives and policies, and then more specific objectives and policies that relate to the aspects for which specific rules have been developed.

The Freshwater Plan lists Lake Wairarapa[103], as a Lake with a high degree of natural character and with surface water to be managed for aquatic ecosystem purposes. Figure 2.8 of the Freshwater Plan identifies the Lake catchment for the purpose of Appendix 2, which excludes the site, Donald Creek, and Abbot Creek.

The Freshwater Plan also identifies the National Water Conservation (Lake Wairarapa) Order 1989[104]. The Water Conservation Order prohibits the diversion of water from Lake Wairarapa, which is irrelevant to the Project.

The general objectives and policies are directed at protecting the mauri of water and respecting the relationship of tāngata whenua with waterbodies (**Objectives 4.1.1 to 4.1.3**), protecting natural character; protecting ecosystem habitat values and the life-supporting capacity of water and aquatic ecosystems (**Objectives 4.1.4 to 4.1.6**); maintaining or enhancing amenity and recreational values associated with water (**Objectives 4.1.7** and **4.1.8**); and providing for the use and development of freshwater resources, subject to managing adverse effects and enabling community involvement (**Objectives 4.1.11, 4.1.12** and **4.1.15**).

These general objectives are expanded through numerous policies. Principle amongst them in relation to the FWWTP project are summarised and assessed below:

The relationship of tangata whenua with freshwater

- to avoid, remedy, or mitigate the adverse effects of the use and development of water bodies and river and lake beds on the habitats of species traditionally harvested by the tangata whenua (**Policy 4.24**).

  Longfin Eel were common in Donald and Abbot Creek. Inanga and Trout were also present, however no kākahi (freshwater mussel) were observed. The proposal seeks to significant improve water quality and thus ecosystem health by way of the proposed staged removal of discharges from water to land. The ultimate Stage 2B scenario is predicted to achieve a level of water quality that should provide greater confidence in the protection of kākahi to allow the future potential for the recruitment into the stream.

- to have regard to the values and customary knowledge of the tangata whenua (**Policy 4.24**).

  The intent of this policy has been largely achieved through the preparation of the Cultural Impact Assessment (CIA) and consultation which aligns with the district Wastewater Strategy.

- to encourage and support, where appropriate, tangata whenua participation in monitoring the effects of activities that may potentially adversely affect sites or values of importance to the tangata whenua (**Policy 4.2.7**).

  Proposed conditions of consent are expected to encourage participation and involve tangata whenua in monitoring the effects of the discharge.

103 Freshwater Plan, Appendix 2, Part B

104 Freshwater Plan, Appendix 11.

Natural Values

- To avoid, remedy or mitigate adverse effects on aquatic habitats and freshwater ecosystems by having regard to maintaining biological and physical processes; feeding, breeding and sheltering habitat; diversity of aquatic life; fish life-cycles; and preventing irreversible adverse effects (**Policy 4.2.11**);

  The proposal involves a staged removal of approximately 44% of the average annually discharge volume at Stage 1 from surface water bodies, with a particular focus on the removal of the discharge during summer months when the effects of the discharge are greatest. This will significantly mitigate the effects on aquatic ecology. At Stage 2B all summer discharges to water are avoided with discharges occurring during winter under high flow conditions (75% of the time above 3x median flow and >90% of the time above 2x median flow) and on some years no discharge at all. Stage 2B therefore avoids adverse effects on aquatic habits and freshwater ecosystems during summer and the proposed discharge regime will remedy any potential adverse effects during winter.

- to promote maintenance and enhancement of aquatic habitats and ecosystems when considering land use outside of the river bed (**Policy 4.2.12**);

  An area of remnant bush within Site B has also been covenanted for the purpose of Queen Elizabeth II (QEII) open space. Good habitat is provided for fish where the stream passes through the bush remnant by riparian cover, and woody debris in the stream creating a diversity of hydraulic regimes. Ecological functions of riparian margins will be further enhanced by the proposed fencing and exclusion of stock.

- To protect the nationally threatened indigenous aquatic plants identified in Part B of Appendix 3 and to protect nationally threatened freshwater fauna (**Policy 4.2.13**) in the water bodies identified in Part A of Appendix 3 by various methods;

  Flora and fauna will be protected by way of improving water quality through the reduced discharge to water over time, and protecting the margins of Donald and Abbot Creek with fencing for stock exclusion. By Stage 1 it is expected the National Bottom Line for Ammonia acute toxicity will be met at all times and protection of the fingernail clam will be achieved for most years. By Stage 2B a greater level of confidence for the protection of kākahi, a species more sensitive to ammonia than the Fingernail Clam, will also be achieved on most years.

Amenity values and access

- To avoid, remedy, or mitigate any adverse effects on water bodies identified as regionally important for amenity and recreational values by managing effects and timing activities to minimise effects on amenity and recreational use (**Policy 4.2.15**);

  UV disinfection and staged removal of discharge to waterbodies prioritised to reduce and avoid discharge during summer months will ensure effects on recreational values in terms of pubic health risks from pathogens is minimised and effects an amenity values in terms of periphyton growths and undesirable sewage fungus growths are also minimised by Stage 1 and avoided at Stage 2B.

- To restrict public access to river beds only where exceptional circumstances exist, including to provide for public health and safety (**Policy 4.2.16**);

  Public access to Donald Creek is only restricted as much as necessary through appropriate signage for public health and safety reasons.

Use and development

- To have regard to the effects on other established activities (**Policy 4.2.24**);

Downstream from the proposed discharge, Abbot Creek is used for irrigation water and is valued as a trout spawning fishery, Lake Wairarapa is used for recreational purposes, thus the staged removal of the discharge will benefit these uses.

- To encourage users of freshwater to adopt an ethic of guardianship for future generations (**Policy 4.2.25**);

  The ethic of guardianship has been adopted and this will be achieved through the proposed conditions.

- To adopt a precautionary approach to the management of freshwater where information is incomplete (**Policy 4.2.26**);

  The precautionary approach has been adopted through the development of a conservative land treatment design, a comprehensive suite of proposed monitoring conditions and management plans, and an overall objective to remove as much of the discharge from Donald Creek as practicable. However, as the activity is existing and the discharge volumes to manage are large, the financial costs to the community are large, a pragmatic approach is required. Therefore, a stage approach to reducing the effects on freshwater is proposed with a focus of implementing Stage 1 within 2 years of consent commencement.

- Encouraging the restoration or rehabilitation of freshwater resources, including wetlands, where appropriate (**Policy 4.2.27**);

  The proposal aims to enhance the freshwater resources of Donald Creek and downstream freshwater environments.

- To recognise the needs of existing lawful users of freshwater by allowing users to upgrade progressively their environmental performance where improvements are needed and to prioritise existing users over new users (**Policy 4.2.29**);

  Existing lawful users of freshwater such as consent holders to take and use water for irrigation from Abbot Creek have been considered and are unlikely to be affected by the proposal.

- To work with other relevant agencies and tangata whenua in order to achieve the integrated management of fresh water (**Policy 4.2.30**);

  The activity meets this policy by the proposed conditions relating to the establishment of a community liaison group[105].

- To ensure that the process for making decisions relating to the management of fresh water is fair and transparent. In particular to ensure that as far as practicable, all interested people and communities have the opportunity to be involved in freshwater resource management processes, including significant resource consents **(Policy 4.2.31);**

  SWDC have attempted to be all inclusive in their consultation to date (see Section 7.4 and Appendix 14 for greater detail on the consultation undertaken to date) and are proposing the application be notified.

- To apply appropriate conditions **(Policy 4.2.35 and 4.2.36).**

  A comprehensive suite of conditions of consent have been proposed (see Part 1C) and are considered appropriate.

[105] See Part 1C Proposed conditions Schedule 1: Condition 23.

Receiving Water Quality

Freshwater Plan Chapter 5, **Objectives 5.1.1, 5.1.2 and 5.1.3** specifically relate to water quality and seek for the quality of freshwater to: meet the range of uses and values for which it is required while safeguarding the life supporting capacity of water and aquatic ecosystems, and to meet the reasonably foreseeable needs of future generations; and be as far as practicable, consistent with the values of the tāngata whenua. The proposal seeks to meet these objectives by staging the removal of the existing discharge from freshwater to land resulting in significant improvement in water quality and ecological health of the receiving water bodies and other related values and uses.

Specific policies that relate to **water quality** that are relevant to the application are summarised below:

- To manage water quality in its natural state in identified water bodies (subject to Policy 5.2.10) (**Policy 5.2.1**), that is, Lake Wairarapa.
- To manage water quality in Lake Wairarapa in accordance with the National Water Conservation (Lake Wairarapa) Order 1989 (subject to **Policy 5.2.10**) (**Policy 5.2.2**).
- To manage water quality for contact recreation purposes in identified water bodies (subject to **Policy 5.2.10**) (**Policy 5.2.4**), with relevance to Lake Wairarapa.

  The proposal will meet the above policies through the application of UV disinfection on the discharge and staged removal of discharge from surface water bodies whilst managing a land treatment scheme that minimises leaching to groundwater within the Lake Wairarapa Catchment. On review of E.coli numbers downstream of the discharge, only one occasion since UV disinfection was installed resulted in an exceedance in the MfE (2004) “Red Mode” guideline indicating the Creek would not be suitable for recreation. It is considered unlikely that this would have resulted in an exceedance in the MfE guideline in Lake Wairarapa located approximately 5km downstream from the discharge. Therefore with the staged implementation of land application the effect of the discharge on E.Coli numbers and risk of illness to recreational users in the Lake are likely to be less than minor. The overall load of contaminants to Lake Wairarapa are currently estimated to be 2% or less, thus the effect of the discharge to Lake water quality is currently less than minor. Loads will be significantly reduced as presented in Table 1 of this Report, thus future effects on Lake water quality will be negligible.

- Except for identified rivers and streams, to manage the water quality of all surface water bodies in the Region for aquatic ecosystem purposes (**Policy 5.2.6**), with relevance to Donald and Abbot Creeks.

  The existing discharge is shown to be having significant adverse effects on water quality and aquatic ecosystem health and these effects are expected to continue for the first 2 years following consent commencement until Stage 1 is complete. Stage 1 is expected to primarily address ammonia toxicity, eutrophication and other undesirable issues associated with the discharge during summer months when the greatest effects are observed, such as >20% decline in QMCI between upstream and downstream survey sites, some exceedance in periphyton growth guidelines, presence of heterotrophic growth, foaming and discolouration. The summer water quality following Stage 1 is expected to be significantly improved resulting in adverse effects on water quality that are predicted to be moderate to minor whilst achieving compliance with the NPS Bottom Line ammonia toxicity criteria and protection of fingernail clam in most years. Effects in winter may persist but based on survey results these effects are currently subtle and will be avoided in some years following the

implementation of Stage 2B and mitigated in other years under the proposed discharge regime whereby discharge to the Creek will target high stream flows.

- To manage all groundwater in the Wellington Region so that there are no net adverse effects on its quality as a result of discharges to surface water or groundwater (**Policy 5.2.7**).

  The application of treated wastewater to land will be managed at sustainable rates that will ensure drainage to groundwater is minimised and the effects on groundwater quality are no more than minor.
- To have regard to specified water quality standards in Appendix 8 (subject to Policy 5.2.10) (**Policy 5.2.8**);

  Appendix 8 provides predominantly narrative standards as given in the Act to guide applicants when seeking resource consents for discharge consents to water. Regard has been given to Appendix 8 and is assessed in detail in Section 6 and tabled in Appendix 13B. The overall proposal at Stage 1 to be implemented two years following the commencement of consent is considered consistent with this policy.

- To allow contaminant discharges which do not satisfy the above policies only in specified circumstances, including that the discharges are temporary and/or associated with necessary maintenance, or that exceptional circumstances justify granting the permits, and that it is consistent with the RMA's purpose to grant consent (**Policy 5.2.10**);
- When considering resource consent applications, the consent authority will have regard to the extent to which the discharge will avoid contamination that will have an adverse effect on the life-supporting capacity of freshwater (**Policy 5.2.10A**);

  In regard to the above policies, it is expected that the significant adverse effects from the current discharge will continue to occur for the first 2 years of the proposed scheme, however these are considered to be temporary, and will be subsequently reduced following implementation of Stages 1, 2A and 2B to the extent the effects of the discharge on water quality following Stage 2B will be no more than minor. Comprehensive monitoring and review conditions are proposed to ensure the efficacy of the proposal and to confirm the level of improvement in effects from the activity at Stage 1 to determine whether Stage 2 needs advancing.

Mixing Zones

- to ensure that mixing zones of reasonable mixing for contaminants in a receiving water body are determined by having regard to the purpose for which it is being managed, tangata whenua values that may be affected, volume of water or concentration of contaminants being discharged and the area of receiving water that could be potentially affected, the physical, hydraulic and hydrological characteristics of the receiving water (**Policy 5.2.11**);

  The ca. 50m required to obtain full mixing is considered reasonable for this stream because the effluent plume along the true right bank did not interfere with the confluence of any tributary, the habitat value on the true right bank were similar to those on the true left, and the site is difficult for the public to access so the zone of non-compliance is not interfering with recreation or aesthetic values (Hamill, 2017a).

Discharges Containing Sewage

- To allow discharges containing sewage directly to freshwater without passing through land where consultation with iwi and the community has been undertaken and it better meets the purpose of the Act than disposal to land (**Policy 5.2.12**);

The discharge of treated sewage to land is understood to be the preferred method of disposal for the community and tangata whenua rather than direct discharge to a surface water body and land treatment is proposed for a majority of flows. At the final stage of land treatment implementation a direct discharge to Donald Creek is predicted to occur in 8 out of 11 years when land application is not considered appropriate due to high groundwater levels, storage is exceeded and there is sufficient stream flow so as to minimise adverse effects on the receiving waters to a tolerable level. Investigation of high rate application to land during winter months was considered, however groundwater mounding and potential downstream contamination of bores were identified as potential risks warranting extensive further investigations to confirm otherwise. Thus a direct discharge was considered to better meet the purpose of the Act than a diffuse discharge in terms of the management of potential effects.

Discharges to Land

- to encourage discharges to land where there are less adverse effects than discharging to water and there are no significant constraints to doing so (**Policy 5.2.13**); and,

  The main constraint with regard to Featherston WWTP is the extremely large storage required to contain all flows to enable a sustainable land treatment regime. As such the proposal has focused on the removal of discharges from freshwater during periods when the effects are considered greatest and retained a discharge to water when effects to freshwater are less, thereby achieving a scheme that is not only manageable but meets the policy requirements.

Freshwater Plan Assessment Summary

Overall it is considered that the proposal is consistent with the relevant objectives and policies of the Freshwater Plan.

5.4.5 Regional Plan for Discharges to Land 1999

The Discharge to Land Plan has a range of objectives and policies addressing primarily land contamination, hazardous substances, and waste discharges.

The Plan recognises the importance to tangata whenua and the wider community of removing sewage from water for discharge to land, and the benefits of land based discharges, but also recognises that poorly designed systems, overloading soils or discharging industrial waste can have an adverse effect on the soil resource (**Issue 2.1.3 & 2.3.1**). Overall, the Plan recognises a preference to discharge sewage to land.

The Plan recognises that there are a large number of small scale domestic discharges to land in the region, the significant effects of which need to be managed (**Objective 4.1.4**) and more generally that the adverse effects of discharges of liquid contaminants are avoided, remedied or mitigated (**Objective 4.1.5**). It is considered that the proposed activity will meet these objectives as the discharge to land is expected to have effects on groundwater and soils that will be no more than minor.

Policies seek to:

- Give particular consideration to any relevant iwi management plans or statements of tangata whenua views (**Policy 4.2.12**).

  Consideration to iwi management plans is provided in Section 5.4.9 and tangata whenua views as provided in the Cultural Impact Assessment (Appendix 12) and through consultation are addressed in Section 6 and 7 of this Report.

- Give particular regard to the certain matters when assessing applications for permits to discharge contaminants to land (**Policy 4.2.13**), these matters include; the nature of the contaminants entering the system, any trade waste present, extent to which stormwater can enter the system, the management of the system, the location of the site and the hydrogeology, the extent to which the effluent is treated, any odour effects, human health and amenity effects, public health guidelines.

  The nature of the contaminants entering the system and management of trade waste are addressed in Sections 2.2.1 and are considered to be a small percentage of the largely domestic wastewater stream. The management of stormwater inflow is an important component of the proposed scheme upgrades and will be addressed through a targeted I&I rehabilitation programme. The characteristics of the site and discharge are provided in Sections 2 and 3. Odour, human health and amenity effects have been appropriately mitigated through proposed buffer distances to the land treatment site from sensitive receptors, wind cut off triggers for irrigation, and appropriate treatment of the effluent prior to discharge.

- To require discharges to land from reticulated sewerage systems to be managed in accordance with a site-specific discharge management plan (**Policy 4.2.14**).

  A site specific Discharge to Land and Water Management Plan is to be prepared as proposed through conditions of consent.

- To have regard to whether the discharge would avoid contamination that will have an adverse effect on life supporting capacity of freshwater (**Policy 4.2.42A**). This policy was inserted as a result of the NPS-FM.

  The scheme will be operated in a sustainable manner in which ponding and surface runoff will be avoided, and leaching to groundwater will be minimised. Nitrogen leaching losses are predicted to increase by approximately 7 % compared to the existing land use and farm management, however there will be a significant reduction in nitrogen entering the freshwater catchment overall from the proposed removal of approximately 94% of the average annual volume from the Creek.

The Project also seeks provision for a minor discharge to land (seepage from pond and/or channel), which includes a comprehensive process for the development of detailed management plans to ensure each of the above matters will be given regard.

Discharge to Land Plan Assessment Summary

Overall it is considered that the proposal is consistent with the relevant policies of the Discharge to Land Plan.

5.4.6 Regional Air Quality Management Plan for the Wellington Region 2000

This Air Plan seeks to manage the potential effects of discharges on air quality. With respect to the Project, the general policy (**Objective 4.1.2**) relating to managing discharges to air in a way which enables people and communities to provide for the social and cultural wellbeing, and for health and safety while ensuring effects on human health, tangata whenua, and amenity are avoided, remedied or mitigated, is relevant.

Specific policies of relevance are:

- To ensure mitigation takes into consideration the sensitivity of the receiving environment (**Policy 4.2.6**)

The proposed mitigation measures including the proposed land treatment area buffers, automated wind cut-off criteria on the irrigation system and proposed management plans which all take into consideration the sensitivity of the receiving environment discussed in Section 4.2 of this report.

- To require the following where appropriate (**policy 4.2.10**):
  - Best Practicable Option (BPO) to be adopted;
  - operations manual and contingency plans;
  - effects based monitoring.

  The BPO approach has been adopted and is addressed below in Section 7.3 and Appendix 2. The proposed conditions include the requirement for an operations manual, contingency plans and effects based monitoring.

- To avoid, remedy or mitigate any adverse effects, (including on human health or amenity values) which arise as a result of the frequency, intensity, duration, offensiveness, time and location of the discharge to air of odorous contaminants (**Policy 4.2.14**).

  Section 6.5 of this AEE concludes that the effects on the people near to the plant and discharge to land areas (Site A and B), and the wider community of Featherston, will be no more than minor. A number of mitigation measures are proposed which will ensure that any potential effects will be avoided on all other activities.

Air Plan Assessment Summary

Overall it is considered that the proposed activities are consistent with the relevant policies and meets the intent of the Air Plan.

5.4.7 Proposed Natural Resources Plan (PNRP) 2015

The PNRP was publicly notified on 31 July 2015 and took immediate legal effect from this date. The objectives and policies of the PNRP are therefore relevant for the Section 104(1)(b) assessment.

The following objectives of the PNRP are considered relevant to this application and are assessed as follows:

Ki uta ki Tai: mountains to the sea

The objectives (**O3, O4 and O5**) are directed at protecting the mauri of water, recognising intrinsic values of freshwater and safeguarding the values of waterbodies. The discharge of treated human wastewater to land is understood to be the preferred method of disposal for tangata whenua rather than direct discharge to a surface water body. This proposed approach will ensure that these objectives are largely met although it is acknowledged that there will still be a discharge to water during winter months on 8 of the 11 years modelled, therefore mauri and other values are still affected.

Beneficial use and development

The objectives (**O7, O9, O10, O11 and O12**) are directed at the very least to maintaining water quality for livestock and the recreational and Maori customary use values of waterbodies, whilst recognising that the FWWTP provides a range of benefits. The proposal is considered consistent with these objectives by reducing the effects on such values and uses whilst providing a vital piece of infrastructure for the community that has a myriad of benefits.

Maori relationships

Objective 14 seeks to (as a minimum) recognise Maori relationships with air, land and water. The proposed consent conditions include the development and implementation of a Tangata Whenua Values Monitoring Plan which is intended to provide a collaborative process for Maori to participate in and from which core values for monitoring will be identified in recognition of their relationship with the environment.

Water quality

The relevant water quality objectives (**O23 and O24**) seek to maintain or enhance water quality and require freshwater to be suitable for contact recreation and Māori customary use by meeting primary or secondary contact water quality criteria depending on the significance of the water body for contact recreation. Donald and Abbot Creek fall within the bracket of "all other rivers" and therefore must meet as a minimum the secondary contact water quality criteria prescribed in Table 3.2 of the Plan which require median E.coli <1,000 cfu/100ml and a low risk of health effects from exposure to benthic cyanobacteria.

The UV disinfection currently reduce E.coli concentrations to a median less than 100 cfu/100ml. A survey in late summer (2010 and 2013) found benthic cyanobacteria (Phormidium sp) was present at several sites in Donald Creek and Abbot Creek, but it had very low cover (up to 5% cover) and usually consisted of only occasional patches.

There is no evidence provided in the CIA that Donald Creek is used for Maori customary use. Even so, the high quality of effluent in terms of pathogen removal in conjunction with the proposal to eliminate direct discharges to water in all but winter months ensures the proposal meets the intent of this policy.

The current effects of the discharge on contact recreation and Maori customary use in Lake Wairarapa are considered to be no more than minor.

Biodiversity, aquatic ecosystem health and mahinga kai

Objective 25 lists a number of standards (Table 3.4 – 3.6) which need to be meet to safeguard the aquatic ecosystem health and mahinga kai in freshwater bodies.

The macrophyte community in Donald Creek is dominated by exotic species, however the native submerged moss (Drepanocladus adnuncus) and a native stonewort (Nitella hookeri) are present downstream of the discharge (Coffey, 2013) and appear to be resilient.

During late summer, Coffey (2010 and 2013) found periphyton cover and biomass was significantly higher downstream of the discharge, particularly at unshaded sites. Forbes (2013) sampled periphyton monthly and found all sites were clear of periphyton during November 2012 and that the amount of periphyton cover increased during the summer - particularly at the downstream sites. In February 2013, the periphyton guideline of 120mg/l was exceeded (138 mg chlorophyll-a/m^2) [106].

The October and November 2016 survey found a small increase in cover of filamentous algae but little or no difference in periphyton biomass between upstream and downstream and downstream sites were within guideline values. In Abbot Creek the periphyton cover and biomass was higher upstream of the confluence with Donald Creek in October 2016 and may have reflected low grazing pressure by invertebrate at this site. During November 2016

[106] Note that the method of calculating compliance with the periphyton objectives (for Abbot Creek shall not be exceeded by more than 17% of samples; and for Donald Creek to be exceeded by no more than 8% of samples based on a minimum of three years of monthly sampling) was not applied as insufficient sampling information has been collected.

periphyton cover and biomass was higher downstream of the confluence, but remained low and well within guidelines.

The removal of the discharge during summer months will minimise the potential for increased periphyton growth downstream of the discharge in Donald and Abbot Creeks and the Stage 2B targeted winter discharge when temperatures are low and at high stream flows (where practicable target stream flows of 3x median and 2x median in order of priority) when scouring is more likely to occur is expected to reduce the effect of the discharge on periphyton growth to minor or less.

Upstream and downstream of the discharge in Donald Creek the Macroinvertebrate Community Index (MCI) of 100[107] was not met on any of the four sample occasions. During late summer, surveys found statistically significant deterioration of all measured macroinvertebrate metrics downstream of the discharge. The declines in MCI and QMCI were substantial and corresponded to the almost complete loss from the community of some sensitive taxa such as mayfly. The two surveys during late spring 2016 (October and November) found the effect of the discharge to be relatively mild compared to those observed during late summer. The macroinvertebrate community had slightly lower, but not ecologically significant) MCI scores at the two downstream sites (statistically significant but only 7% lower), and no consistent upstream to downstream difference in QMCI scores. Upstream and downstream of the confluence with Donald Creek the Macroinvertebrate Community Index (MCI) of 110 in Abbot Creek was not met. The removal of the discharge during summer months will result in a significant improvement in MCI scores downstream but it is unlikely that the objectives set in Table 3.4 will be met due to upstream influences in both Creeks.

Indigenous fish communities and mahinga kai species were found in both Donald Creek and Abbot Creek during Spring surveys however no summer fish surveys have been completed. NPS-FM National Bottom Line values for Acute Ammonia toxicity have been exceeded from time to time and thus it is not likely to have had an impact on fish at the levels and frequency measured but it may have impacted on invertebrate communities and thus indirectly on fish food sources. The proposal seeks to improve water quality in a staged manner and water quality modelling indicates the National Bottom Line shall be met following the implementation of Stage 1B and that greater confidence on the protection of freshwater mussels on most years will be achieved at Stage 2B.

The proposal seeks to significantly reduce nutrient loads to Lake Wairarapa, however it has estimated that the WWTP is a relatively small contributor to the Lakes overall nutrient load. Therefore, any reduction in load from the plant is unlikely to result in any measurable improvement in water quality or any change in trophic level.

Groundwater is directly connected with surface waters and land application will be managed to minimise potential leaching to acceptable levels through the means of a Discharge to Land and Water Management Plan and monthly nutrient budgeting.

Objective 27 seeks to establish and maintain vegetated riparian margins, **O29** seeks to provide for the passage of fish and koura, and maintain and improve trout habitat (**O30**). Fencing of all riparian margins and exclusion of stock from these areas is proposed. No restrictions to fish passage are proposed. Trout were observed in both Donald and Abbot Creek during the Spring survey by Hamill (2017a) and the staged removal of the discharge is expected to improve trout habitat in both Creeks.

[107] Note that the method of calculating compliance with this target using a rolling median based on a minimum of three years of annual samples collected during summer or autumn was not applied.

Air

Objective 41 seeks to reduce the adverse effects of odour on amenity values and people's well-being. The development of an Odour Management Plan is proposed which is designed to minimise the risk of nuisance odours and aerosols beyond the boundaries of the site.

Discharges

Objectives 46, **49** and **50** seek to reduce the runoff or leaching of contaminants to water, promote discharges of wastewater to land over discharges to freshwater, and encourage discharges of wastewater to freshwater to be progressively reduced. Treated wastewater will be applied to land at sustainable rates that minimise runoff and leaching. The proposal seeks to remove approximately 94% of the current average annual discharge from surface water and discharge it to land.

The relevant policies of the PNRP are assessed below.

Ki uta ki Tai and integrated catchment management

Policy 1 requires that land and water resources are managed recognising ki uta ki tai by using principles of integrated catchment management. The proposed activities have taken into account the principles of integrated catchment management within the overall scheme design and recognise links between environmental, social, cultural and economic sustainability. The proposal is considered consistent with this policy.

Precautionary Approach & Minimising Adverse Effects

Policy P3 and P4 guides applicants and the regulatory authority to manage activities by taking a precautionary approach, to consider alternatives and to mitigate adverse effects on the environment.

The precautionary approach has been adopted through the development of a conservative land treatment design, a comprehensive suite of proposed monitoring conditions and management plans, and an overall objective to remove as much of the discharge from surface waters as practicable. However as the activity is existing and the discharge volumes to manage are large, a pragmatic approach is also required. Therefore a staged approach to reducing the effects on freshwater is proposed. A comprehensive alternatives assessment has been undertaken and is provided in Appendix 2 and Section 7.3 of this report. This alternatives assessment, coupled with community aspirations, has resulted in the location and method of the proposed activity. The available information on Donald Creek suggests that this surface water body is compromised upstream of the current discharge point as a result of upstream landuse and which is therefore outside the control of the Applicant. The proposal therefore seeks to mitigate the adverse effects of the discharge downstream as far as practicable. Overall, given the proposed mitigation measures, it is considered that the proposal is consistent with these policies.

Uses of land and water

Policy P7 presents a long list of uses of land and water that shall be recognised. The proposal is considered consistent with this policy as it is likely to have cultural, social and economic benefits whilst recognising the benefits of the uses listed in Policy P7.

Public Access to Rivers

Policy P9 requires that public access to the beds of rivers is not reduced. The proposal is consistent with this policy by providing public access to Donald Creek in so far as only restricting public access for protecting public health and safety.

Contact recreation and Māori customary use

Policy P10 requires that freshwater bodies provide for contact recreation and Māori customary use and it is considered that the proposal meets this policy by meeting the relevant numerical guidelines for water quality prescribed in Objective 24 Table 3.2.

Regionally Significant Infrastructure

Policies P12 and P13 require that the benefits of regionally significant infrastructure are recognised and generally appropriate. It is considered that the proposal is indeed appropriate and necessary for the wellbeing of the Featherston community.

Mana Whenua Relationship, Values and Kaitiakitanga

Policies P17, P18, P19, P20 and P82 are directed at maintaining and considering mauri and Maori values, and recognising kaitiaki. The proposal aims to meet Maori aspirations by applying a majority of the existing discharge to land by Stage 2B, and involves kaitiaki in monitoring the effects of the activity. Policy 18 requires the consideration of Lake Wairapapa which is listed in Schedule B as Nga Taonga Nui a Kiwa. Overall given that the effects on mauri of the waters in Donald Creek following the implementation of Stage 2B are not expected to be significant and the effect on Lake Wairarapa will be less than minor; the proposal is considered consistent with these policies.

Biodiversity, Aquatic Ecosystem Health and Mahinga Kai

Policies P31, P32, P33 and P36 seek to maintain or restore ecosystem and mahinga kai health by managing the effects of activities.

Policy P31(c) seeks to minimise adverse effects on habitats that are important to the lifecycle and survival of aquatic species. The freshwater habitat of Donald Creek is impacted by the discharge but upstream it is also impacted by its intermittent flow (upstream of the confluence with the Torohanga Creek, Donald Creek can run dry in summer months). The proposal will enhance aquatic habitat through fencing and stock exclusion to the margins of Donald and Abbot Creek in conjunction with a staged reduction in the volume and frequency of discharge and overall contaminant load to the Creeks. Policy P31(d) seeks to minimise adverse effects at times which will most affect the breeding, spawning, and dispersal or migration of aquatic species, and this policy is met after Stage 2B with discharges limited to winter months and high stream flows to minimise effects on ecology.

Policy P32(k) requires that where residual adverse effects remain, it is appropriate to consider the use of biodiversity offsets. It is acknowledged that although the majority of the discharge after Stage 2B will be to land (i.e. 94% of flow and 79% reduction in TN load to water) residual adverse effects on surface water may remain during times of contingency discharge flows. It is considered that post Stage 2B residual effects are likely to be at a scale that are sustainable and not significant, therefore such residual effects are not considered to warrant biodiversity offsetting.

Policy P33 requires that more than minor adverse effects of discharges of contaminants on the species known to be present in Abbot Creek (Schedule F1) and Lake Wairarapa (Schedule F1) are avoided. At Stage 2B discharges to surface waters will be avoided in summer. The proposed contingency discharge is likely to occur on most years (8 out of 11 modelled) during the months of July and August and the effect of which will be less than that currently occurring in winter. Based on the water quality modelling and spring ecological surveys the effects of the contingency discharge on aquatic species is expected to be minor or less and the improvements

to water quality may in the long-term result in the recruitment of kākahi. Overall the proposal is considered consistent with these policies.

Sites with significant values

Policies P39, P40, P41 and P42 and waterbodies listed in Schedules A, F1 and F2 require further consideration for offsetting. Abbot Creek is listed in Schedule F1 (significant indigenous ecosystems) for threatened or at risk fish habitat. Lake Wairarapa is listed In Schedule A (lakes with outstanding indigenous ecosystem values) for wildlife habitat and Schedule F2 for indigenous bird habitat.

Policy P39 requires that the adverse effects on outstanding water bodies and their significant values identified in Lake Wairarapa shall be avoided. The overall proposal seeks to reduce the already low nutrient load contributions from the WWTP to the Lake significantly as a result of the staged land application scheme. Thus the current effects of the discharge to Lake Wairarapa are considered to be less than minor and will reduce to negligible as part of the proposal and largely be avoided.

Policy P40 and P41 requires the protection and restoration of ecosystems and habitats with significant indigenous biodiversity such as Abbot Creek and Lake Wairarapa. In the absence of any summer survey (Abbot Creek was dry in 2015/16) and based on the spring survey undertaken by Hamill (2017a) and water quality modelling (Appendix 8), the current effects of the discharge in respect to ammonia toxicity, periphyton growth, sewage fungus and clarity of Abbot Creek are considered to be potentially significant in summer. These effects are expected to reduce to minor or less than minor at Stage 2B therefore providing the necessary protection to ecosystems and habitats prescribed by these policies, and in particular protection of the fingernail clam and potentially the freshwater mussel (not currently present).

Policy P41 requires where residual adverse effects remain it is appropriate to consider the use of biodiversity offsets. As discussed, above (see Policy P32(k)) biodiversity offsetting is not considered warranted, as following Stage 2B, the discharge to surface water throughout most of the year is largely avoided and on some years will be completely avoided. A comprehensive monitoring programme will be undertaken to ensure the effects are no more than minor and review reporting of the efficacy of the scheme 3 years following the commencement of Stage 1 and 2B has been proposed.

Managing Air Amenity

Policy P55 seeks to reduce the adverse effects of odour on amenity values in rural areas. The proposal includes the preparation of an Odour Management Plan that is designed to minimise the risk of offensive or objectionable odour.

Discharges to Land and Water

Policy P62 encourages the discharge of contaminants to land over direct discharges to water. The proposal is consistent with this policy as the discharge will be progressively move from water to land over time.

Policies P66, P67 and P95 consider the effects of activities on freshwater and land, and require that the adverse effects of discharges of contaminants to land and water will be minimised. The proposal is considered consistent with these policies as land-based treatment is to be implemented with application rates to land that are considered appropriate for the capacity of the soil and to meet plant uptake requirements whilst ensuring leaching of contaminants is minimised.

Specifically, **P66** sets out the requirements stemming from the NPS-FM and requires that adverse effects from discharges on freshwater, people and aquatic ecology are adequately managed and seeks to generally avoid discharge of contaminants that have adverse effects that are considered inappropriate. The overall proposal targets a net reduction in discharges to freshwater and scheme that will be operated in a sustainable manner in which ponding and surface runoff will be avoided and leaching to groundwater will be minimised. The adverse effects of the current discharge will be significantly minimised following the implementation of Stage 1, although the level of effect is considered to remain moderate to minor and will be further reduced following the implementation of Stage 2B to a level considered appropriate for achieving a sustainable level of protection to aquatic ecology and people.

Policy P67 requires that adverse effects of discharges of contaminants to land and water will be minimised by a list of matters. Policy P67(a) suggests avoiding the production of the contaminant, and this is not considered feasible due to the nature of the activity i.e. municipal wastewater. Policy P67(b) suggests reusing, recovering or recycling the contaminant, and this will be achieved in part by the proposed land treatment scheme. Policy P67(c) seeks to minimise the volume of the discharge and this will be achieved by the I&I reduction programme. Policy P67(d) requires using land-based treatment to treat contaminants prior to discharge where appropriate and this is key part of the proposal. Irrespective of actions taken in accordance with Policy P67 (a) to (d) above, Policy P67(e) requires that where a point source discharge to a river or stream occurs, the discharge must achieve the water quality standards in Policy P71 after reasonable mixing. It is considered that these standards would largely be met at Stage 2B with exception to water clarity, where there remains uncertainty about the potential compliance with this standard (<33% change in clarity) during winter discharge events. A significant improvement in water clarity will be achieved through the removal of the discharge during summer and shoulder months. There may however be some potential for reduced clarity and changes in colour downstream of the discharge in winter months when discharge occurs. This is likely to occur when upstream clarity and colour is already being negatively impacted. Donald Creek is not known to have high recreational value and even so, recreational use of the stream would be low at times when the contingency discharge occurs. Monitoring is proposed to confirm compliance with P71 water quality standards.

Policy P68 requires that discharges of untreated wastewater to freshwater (except as a result of extreme weather-related overflows or wastewater system failures) is avoided. The current and proposed activities are expected to meet this policy. There is an emergency discharge flow bypass downstream of Pond 2 and prior to the UV disinfection plant. As discussed in Section 2.4.2, to date, this bypass has not been used, and if it were, the discharge will have received a secondary level of treatment.

Policy P69 requires that the adverse effects from discharges to land and water on the quality of community drinking water supplies and group drinking water supplies shall be avoided to the extent practicable. As discussed in Section 5.4.2 above, community drinking water supplies are not expected to be affected by the proposal.

Policy P70 requires that point source discharges to water require good management practice and conditions on the resource consent to reduce the adverse effects on the water body if Objective O25 is not met. Regardless of whether or not the proposal meets Objective 25, SWDC will meet this policy as the proposal involves a comprehensive programme of work for upgrading the existing scheme which in the long term is expected to result in a significant improvement in water quality.

Policy P71 sets out the water quality standards in the receiving water that must be met after the zone of reasonable mixing. Policy 72 sets out guidance for determining the zone of reasonable

mixing. The reasonable mixing zone based on the findings by Hamill (2017) is approximately 50m and compliance against the water quality standards in P71 is provided in Appendix 13B and discussed above (see Policy 67 above).

Stormwater and Wastewater

Policy P76 and P81 encourages the reduction of I&I of stormwater and groundwater from entering the wastewater network, the quality of discharges to be progressively improved and the quantity of discharges to be progressively reduced. As detailed in Section 4 above, the proposal includes a comprehensive rehabilitation programme of the underground sewerage network to be undertaken during Stage 1 and a staged improvement in water quality achieved through land treatment.

Policy P80 is especially relevant to the proposal. This policy sets out five important matters for applicants to identify when replacing existing resource consents to discharge wastewater to freshwater. Policy P80(a) requires that objectives, limits and targets for the receiving environment are considered. As discussed above in this section, an assessment of the proposal against the relevant PNRP water standards is provided in Section 6 and Appendix 13B. Policy P80 (b, c, d and e) requires consultation results are identified (and presumably considered) and short and long term goals are set and met. As discussed in Section 7 of this report below, comprehensive consultation has been undertaken and the community has communicated a will for a land based wastewater scheme. The SWDC wastewater strategy has set clear short and long term goals through the staged approach (set out in Section 4) whilst considering the implication of upgrades to other South Wairarapa community wastewater treatment plants as part of a district wide scheme.

Activities in beds of lakes and rivers

Policy P105 requires that particular regard is given to the protection of trout habitat in rivers with important trout habitat identified in Schedule I. Abbot Creek is identified in Schedule I however this stretch of Creek appears to be located upstream of the confluence with Donald Creek, therefore this policy is not considered relevant.

PNRP Assessment Summary

The proposal seeks to remove a high proportion of the current discharge from surface water and discharge it to land. This in turn is expected to improve water quality and mitigate adverse effects on aquatic ecosystems and enhance contact recreational values. In addition to this, the FWWTP is considered to be regionally significant infrastructure which has social and economic benefits to the Featherston township that are considered significant.

Overall it is considered that the application largely meets the intent of the objectives and policies in the PNRP.

5.4.8 Iwi Management Plans

There are two iwi in the Wairarapa, Rangitaane o Wairarapa and Ngati Kahungunu ki Wairarapa. As outlined in the PNRP, iwi management plans (IMP) have been prepared by the treaty partner iwi in the Wellington Region. These must be, and have been, taken into account in the preparation of the PNRP. As such, we consider that the accompanying CIA and assessment against relevant objectives and policies of the PNRP and RPS is sufficient for the purpose of assessing consistency with these IMPs.

5.5 Resource Management Act 1991

5.5.1 Purpose and Principles

The decision on the application must be consistent with Part II of the RMA, the overriding purpose and principles of the RMA (**Section 5**). The stated purpose of the Act is to 'promote the sustainable management of natural and physical resources'[108]. The term 'sustainable management' is specifically defined[109]:

> *In this Act, 'sustainable management' means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—*
>
> *a. sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
> *b. safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and*
> *c. avoiding, remedying, or mitigating any adverse effects of activities on the environment.*

Sections 6, 7, and 8 of the RMA then outline the principles by which this overriding purpose should be applied. In summary:

Section 6 sets out matters that are defined to be of 'National Importance', including:

- *the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development (s.6(a)).*
- *the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers (s.6(d)).*
- *the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga (s.6(e)).*
- *protection of historic heritage from inappropriate subdivision, use, and development (s.6(f)).*
- *the protection of protected customary rights (s.6(g)).*

Section 7 identifies specific other matters which must be given particular regard in determining the application, including

- *Kaitiakitanga, and the ethic of stewardship (s.7(a) & 7(aa)).*
- *the efficient use and development of natural and physical resources (s7(b)).*
- *the maintenance and enhancement of amenity values (s.7(c)), and the intrinsic values of ecosystems (s7(c) & s7(d)).*
- *maintenance and enhancement of the quality of the environment (s.7(f)).*
- *any finite characteristics of natural and physical resources (s.7(g)).*
- *the protection of the habitat of trout and salmon (s.7(h)).*
- *the effects of climate change (s.7(i)).*

Section 8 requires that the Principles of the Treaty of Waitangi be taken into account.

108 Section 5(1), RMA

109 Section 5(2), RMA

Section 5

In regard to Section 5(a) of the RMA, the proposed activity specifically provides for the long-term economic wellbeing and health and safety of the Featherston and South Wairarapa communities through the affordable and effective treatment of municipal sewage. The existing wastewater pond facility is a substantial community investment and significant physical resource, and upgrading the plant with a land treatment scheme is an efficient and appropriate use of that asset.

The AEE clearly shows that following the implementation of Stage 2B, the proposal is not expected to affect the relevant natural and physical resources, which will be managed to meet the reasonably foreseeable needs of future generations, thus meeting Section 5b. Furthermore, the proposal will safeguard the life-supporting capacity of air, water, soil, and ecosystems through the implementation of a sustainably managed land based treatment system. It is acknowledged that the proposal, which involves a discharge of contaminants to land and water will have continued short term adverse effects on the freshwater receiving environment that are considered significant however these will be temporary and significantly mitigated within 2 years of the consent commencement. Such effects will be further reduced by Stage 2B with a majority of the discharge removed from Donald Creek resulting in adverse effects that are considered to be minor or less.

The proposal seeks to avoid a direct discharge to surface water as much as practicable. The 'King Salmon decision'[110] clarified that 'avoid' means 'not allow' or 'prevent the occurrence of'. The degree to which adverse effects are to be avoided and what is 'inappropriate' is to be assessed by reference to what is being 'protected'. In the case of Donald Creek and the downstream receiving environment, the proposal will reduce the effects of wastewater on the environment. In particular, the proposal will enhance water quality downstream of the discharge, particularly in Donald Creek and to some degree in Abbot Creek. The effects currently on Lake Wairarapa water quality are considered minor and will reduce to negligible as a result of the proposed scheme. The proposal will not avoid adverse effects per se, but it is considered that the potential adverse effects following Stage 2B are to be suitably mitigated proportionate to the receiving environments overall values, and would be considered less than minor.

The I&I reduction programme proposed will enable the upgrade to be undertaken in a manner which is affordable and efficient, and which will not increase any adverse effect in the short term.

Section 6

In regard to Section 6(a), the proposal is not considered inappropriate. The proposal does not impact on any outstanding natural features and landscapes (section 6(b)) or areas of significant indigenous vegetation or significant habitats of indigenous fauna (section 6(c)). Sections 6(e) and 6(g) have been largely addressed by way of consultation and a genuine attempt to remove the majority of the discharge from surface water and treat it via land application. It is acknowledged that there are adverse effects on cultural values however it is considered that they will be adequately managed through the Tangata Whenua Value Monitoring Plan implementation and Community Liaison Group. Section 6(f) has been satisfied by avoiding the land discharge from adjacent historic sites.

Section 7

[110] Environmental Defence Society Inc v The New Zealand King Salmon Co Ltd [2014] NZSC 38.

In regard to Section 7a (RMA) the comprehensive suite of conditions proposed are considered effective in ensuring full monitoring of the receiving environment that embraces kaitiakitanga and Tangata Whenua values. Monitoring will also enable comprehensive quarterly and annual reporting on the operation of the FWWTP and receiving environment, which will support the preparation and annual review of the proposed management plans. SWDC have embraced the ethic of stewardship (Section 7 aa) through the overarching wastewater strategy that seeks to protect the environment and will enhance the quality of the environment (Section 7 f).

The proposed conditions will develop a consistent set of data through Stage 1 to fully inform the proposed Design of Stage 2 land treatment system, and this, coupled with utilising the existing pond system, will ensure the efficient use and development of natural and physical resources (Section 7 b). Amenity values and intrinsic values of ecosystems will be enhanced by the proposal (section 7 c & d). Trout (Section 7h) are not listed downstream of the proposed discharge although they were observed in both Donald and Abbot Creeks during a spring survey (Hamill, 2017a), nevertheless the proposal seeks to mitigate adverse effects on aquatic ecology. The effects of climate change have been considered as part of the wastewater scheme as a whole (Section 7 i).

Section 8

A cultural impact assessment was undertaken and considered Section 8 (RMA). Consultation has been undertaken as discussed in Section 7 of this report. The amount of consultation is considered adequate for the scale of the activity. The extent of consultation for this proposal with Maori has been balanced by the involvement of that Tangata Whenua in the development of the PNRP that sought to protect Maori interests. To conclude, it is considered that Section 8 (RMA) has largely been met given that consultation has been undertaken and proposed conditions include monitoring Tangata Whenua values.

Part II (RMA) Conclusion

Overall, it is considered that the proposed activities are consistent with Part II (RMA).

6 Assessment of Effects and Proposed Mitigation

This section provides an assessment of the potential effects of the proposed activity on the receiving environment and a description of the mitigation measures to be undertaken to help prevent or reduce the actual or potential effects.

Actual or potential effects of the discharge upon the environment considered include the following:

- Positive Effects;
- Effects on soil and plants;
- Effects on groundwater flow and quality;
- Effects on surface water quality and aquatic ecosystems;
- Effects on air quality; and
- Effects on cultural values, community and amenity values.

6.1 Positive Effects

The consideration of "effects" associated with the Project includes any positive effect[111].

There are obvious benefits to the Featherston and South Wairarapa community of having an operating and efficient wastewater treatment network. SWDC and the urban Featherston community rely on the wastewater treatment and disposal system to function sustainably and to maintain public health standards. An inability to continue to operate the wastewater network would have significant consequences on the wellbeing of the community, and on their health and safety. This is recognised in the Regional Policy Statement with the inclusion of the Plant as "regionally significant infrastructure".

The project has also been integrated with the necessary wastewater upgrade projects at Greytown and Martinborough. This has ensured that all three communities will receive the necessary investment and all three receiving environments a reduction in the adverse effects associated with wastewater treatment over the terms of their respective consents. The adopted strategy and capital programme across all three wastewater schemes has also necessarily taken into consideration the financial constraints of the South Wairarapa communities. Exceeding the financial capacity of the community would have significant adverse effect on both current and future generations, and the proposed strategy will avoid that. The proposal has the benefit of being affordable, whilst achieving significant improvements.

The proposed activity will significantly reduce the actual adverse effects on Donald Creek and Lake Wairarapa from the wastewater discharge. Although there are acknowledged existing water quality issues both upstream and downstream of the FWWTP which are outside the Applicant's control, the proposal will have a clear benefit to the water quality across the term of the consent, and beyond.

Overall the project achieves a sustainable balance in enabling the community to provide for its wellbeing, and providing considerable benefits to the environment.

[111] RMA: Section 3 – Meaning of Effect.

6.2 Effect on Soil and Plants

The potential contaminants of concern when assessing effects on soil and plants from the proposed land application of treated wastewater are:

- Organic material;
- Nitrogen (Ammoniacal nitrogen, organic nitrogen and nitrite/nitrate nitrogen);
- Phosphorus;
- Pathogens; and
- Water.

The potential impact of the discharge on the soil and plant systems relate to the potential reduction in soil quality and compromised soil structure, erosion potential and contamination which can reduce future land use options, and potential for loss of productivity leading to poor plant growth on the site. Investigations by LEI in 2013 and 2015 have established that the use of the agricultural land known as Sites A and B, are suitable for land treatment of treated wastewater and that the sites are currently constrained by the hydraulic loading of the soil. Whilst the immediate receiving environment for the discharged treated wastewater is the soil in the application area (where the irrigation infrastructure will be placed), wastewater components that move beyond the soil have the potential to impact groundwater (discussed in section 6.3), or surface water in Donald and Abbot Creeks and Lake Wairarapa (addressed in section 6.4).

In designing a hydraulic loading rate, LEI sought to address two critical concerns:

- The rate at which the soil/plant system can sustainably receive wastewater; and
- The avoidance of prolonged drainage from the site.

Having identified that the hydraulic loading rate of the soil was the limiting factor in the design of the irrigation regime, LEI then prepared a water balance for the site to:

- Determine the annual volume of wastewater that can be discharged to the sites in a sustainable manner; and
- Determine the corresponding nutrient loading to the sites.

Based on these investigations, LEI have identified the parameters and outcomes for the land treatment regime which have been presented earlier in Table 14.

LEI (2017[112]) provides a detailed assessment of effects of the proposed land discharge on the soil and plant resource (see Appendix 7). The following provides a summary of these effects.

6.2.1 Sensitivity of the Receiving Environment

The land application areas are not considered to be sensitive to wastewater irrigation and the application of wastewater can be managed to ensure it will not adversely affect farming operations and groundwater quality (LEI, 2017).

6.2.2 Effect of Water on Soil and Plants

Excessive irrigation has the potential to initiate soil structural degradation. If the soil remains at a high soil moisture content or saturation for prolonged periods, damage to soil structure may occur through animal pugging, mechanical damage by heavy farming/irrigation equipment and/or, anaerobic conditions leading to chemical and biological damage. As the soil structure

[112] Section 5.5 p37

degrades, drainage and root passage can become impeded which then leads to increased risk for ponding, a loss of productivity and reduction in soil quality.

To avoid such adverse effects the proposed land treatment scheme will be operated with application rates 3 to 6 times below soil unsaturated hydraulic conductivity with 8 day return times, appropriate withholding periods for stock and irrigation following rainfall, flooding or other prolonged wetness. Furthermore, the site selected has a predominantly gravelly subsoil texture which is unlikely to be susceptible to pugging. Proposed on-site soil moisture monitoring will indicate when soil moisture conditions allow for irrigation in accordance with the deficit and deferred irrigation criteria discussed in Section 4.1 and regular inspection of the irrigation areas for ponding are to be undertaken in accordance with a certified Discharge to Land and Water Management Plan.

It is considered that the effect of the hydraulic component of treated wastewater application on the soils and plants will be no more than minor (LEI, 2017).

6.2.3 Effect of Cations on Soil

Sodium accumulation in soil can cause the soil clay component to disperse weakening the soil structure. Although sodium has not been tested in the FWWTP discharge, municipal wastewater derived from non-coastal communities is typically low in sodium when compared to industrial wastes. This low sodium content in conjunction with sufficiently high rainfall to flush accumulated sodium through the soil profile means the effect of wastewater derived cations on the soil is expected to be less than minor (LEI, 2017).

6.2.4 Effect of Organic Material on Soil and Plants

Potential adverse effects of organic solids, as measured by $cBOD_5$ on the soil and associated crops of the land application sites, include the generation of anaerobic conditions in the soil as oxygen is consumed. Anaerobic conditions can result in surface slimes and lead to plant die off, the production of undesirable odours, degradation of soil structure and reduced soil infiltration capacity.

Based on the proposed application rates, the BOD loads to the land application areas will be around 192 kgBOD/ha/year for an average year. The BOD applied will be well below the assimilative capacity of a healthy soil environment of 600 kgBOD/ha/day. Therefore, the effects of organic material on soil and plants are expected to be less than minor (LEI, 2017).

6.2.5 Effect of Nutrients on Soil and Plants

Potential adverse effects of high nutrient loading on soil and plants can result in leaching and/or runoff of nutrients to groundwater or surface waters leading to eutrophication of waterways, and plant damage due to high ammonia concentrations.

The proposed nitrogen loading to the sites from wastewater will be on average 51 kgN/ha/yr. Pasture has shown to be capable of removing 186 - 437 kgN/ha/yr from the effluent. Based on the proposed application regime, it is considered that most of the nitrogen applied will be removed by soil microbe use, plant uptake, short-term soil storage and gaseous losses (volatilisation and denitrification).

Although the nitrogen loading rate is low, limited leaching may still occur due to the function of natural systems. However, the proposed conservative rates of application will ensure that leaching will not be more than occurs under the surrounding landuse that receives fertiliser application.

Targeted fertilisation to manage pasture or crop production may be needed and a loading rate of up to 300 kgN/ha/y from all sources (applied in accordance with best practice) is proposed to enable SWDC flexibility to manage the site as a productive farming unit. In the event this loading rate is applied, the estimated nitrogen leaching from the site is shown to potentially increase by 7% when compared with the current land use. This is equivalent to 1.9kg N/ha/y which is expected to cause a negligible change to the groundwater nitrogen concentration. The effect of this additional nitrogen whether it be additional wastewater or fertiliser will be positive for soil and plant system by allowing maximum growth.

The proposed phosphorus loading to the sites from wastewater application will be on average 10 kgP/ha/yr and is low for a productive system. It is expected that all P applied in wastewater will be utilised by the plants on the site and any P not removed by the plant and animal system is expected to be adsorbed to the soil or incorporated into the soil organic matter. Because all applied phosphorus is able to be utilised by plants, the site life for phosphorus application is unlimited. Supplementary phosphorus fertilisation may be needed and this will be controlled using soil tests to predict plant requirements and identify if excess phosphorus is present in the soil or if a deficit exists requiring supplemental phosphorus application to maximise growth.

Based on the above, the effects of nitrogen and phosphorous loading due to wastewater application and additional sources are expected to be less than minor on the sites soil and plants (LEI, 2017).

6.2.6 Effects of Pathogens on Soil and Plants

The risk of pathogens in the soil sourced from the application of treated wastewater occurs when they enter the food chain. Under normal operation and at flows less than 140L/s[113], UV disinfection of all wastewater flows applied to land is proposed with a target median *E.coli* count of 100 cfu/100ml. For the remaining pathogens, soil filtration, adsorption and natural attrition will ensure that up to 92 - 99.9 % of applied microbes are removed in the top 10 mm of the soil profile. Soils such as those seen at the land application sites are very efficient removers of microbial contaminants. These soil characteristics in conjunction with the application rates proposed will ensure matrix flow though the soil occurs. Matrix flow maximises the contact between soil particles and bacteria enabling adsorption and/or filtration processes to limit bacterial movement, hence ensuring the effect of pathogens on the site soil and plants will be less than minor.

Furthermore, any potential effect on animal health will be avoided by applying appropriate farm management practices and stand-down periods of 48 hours following irrigation events before harvesting or grazing can commence (LEI, 2017).

6.2.7 Proposed Mitigation

The assessment above concludes that there will be no adverse effects which are any more than minor from the proposed land application of treated wastewater to soils and plants. Methods adopted to ensure the effects on soils and plants of the Site assessed can be adhered to include:

- Suitable soils dominated by gravelly subsoils;
- Conservative application rates which are 3 to 6 times less than the soil unsaturated hydraulic conductivity when applications are at the maximum proposed 55 mm per event;

[113] Maximum flow rate that can pass through the UV disinfection unit.

- Appropriate return times of at least 8 days for Site B to enable wetting and drying cycles to occur;
- 2 day stock exclusion from the last irrigation event and frequent stock rotation; and
- Withholding irrigation when rainfall, flooding or other prolonged wetness occurs.

The proposed irrigation regime and overall system management will be comprehensively documented in the Discharge to Land and Water Management Plan to ensure that soil and plants are not damaged whilst maximising the renovation of the wastewater. Effects on soil and plant will be appropriately monitored in accordance with the site Environmental Monitoring Plan. Key matters to be addressed in these Management Plans shall include (but not be limited to):

- soil moisture and climatic condition monitoring;
- crop selection and pasture management practices including: stand-down periods, harvesting, fertiliser application and/or grazing regimes;
- equipment, crop and soils inspections;
- quality and quantity monitoring of effluent applied to measure the quantity of material being received and applied to confirm the appropriate loading rates are being applied for the plant requirements; and
- Quality and quantity monitoring of crops harvested for determining nutrient balances and crop quality and health.

The proposed land application scheme is in itself a mitigation measure to improve and enhance the receiving water environments through the direct removal of wastewater discharges to Donald Creek and Lake Wairarapa waterbodies. The controlled discharge of treated wastewater to land is designed to minimise overall adverse effects on the environment.

6.3 Effect on Groundwater

The actual and potential effects of the proposed discharge of treated wastewater to land and potential seepage from the existing ponds on groundwater are twofold:

- Mounding impact which can result in changes to the direction of groundwater flow thereby changing the groundwater properties of adjacent land users, reducing the aerated zone of the soil and potentially limiting the ability of the soil to treat some applied contaminants, reducing the rooting zone of the overlying soil, and resulting in seeps or springs in low lying areas.
- Changes to groundwater quality which may have an effect if the groundwater is abstracted for use or if groundwater enters surface water.

Groundwater from the FWWTP and land application Site is expected to enter Donald Creek and potentially Abbot Creek down gradient of the Site. A bore search around the site from GWRC records indicates there are 7 groundwater and 4 surface water abstractions consented for irrigation purposes, close to the FWWTP which are downgradient from the Site. Within a 2km boundary from the Site (including wets to the Tauherenikau River and South to Lake Wairarapa) there are an additional 15 potential groundwater takes and 4 surface water takes according to GWRC records.

LEI (2017) have proposed application rates based on the Site soil characteristics that will minimise the potential for preferential flow and loss of applied contaminants directly to groundwater and groundwater mounding. LEI (2017) provides a detailed assessment of effects of the proposed land discharge on the groundwater resource (see Appendix 7, s5.6). The following provides a summary of these effects.

6.3.1 Sensitivity of the Receiving Environment

Groundwater depths within the area are relatively shallow varying from almost 3m to less than 1m from the soil surface. Water quality results suggest that groundwater quality in the vicinity of the site is not adversely impacted by the current activities, although some elevation in background concentrations of nitrogen (3 g/m^3 and up to 5.74 g/m^3 – not exceeding drinking water standards) from shallow bores near an existing land discharge from a Piggery to the south west of the Hodders Farm has been recorded (Tidswell, 2008). Current groundwater quality is unlikely to prevent any use. There are a number of groundwater takes and surface water takes within the vicinity of the site as noted above.

Therefore, from a perspective of mounding, nutrients and microbiological contaminants, groundwater in the vicinity of the land application scheme would be considered a sensitive environment.

6.3.2 Effect of Land Application on Groundwater Mounding

Mounding occurs if drainage from the irrigation area reaches groundwater at a rate in excess of the ability for groundwater to move it away from the site.

Some drainage to groundwater in excess of the natural drainage from the site is predicted, however, rapid gravitation drainage to groundwater in all conditions except the onset of high rainfall events following irrigation will be avoided as a result of the conservative application rates proposed. A potential mound height of 3mm at the centre of the irrigation area is estimated. Overall the effects of water from wastewater irrigation on groundwater mounding and movement are expected to be no more than minor (LEI, 2017).

6.3.3 Effect of Land Application on Groundwater Quality

6.3.3.1 Effect of Organic Material on Groundwater

High BOD causes a reduction in dissolved oxygen, which can result in anaerobic conditions in groundwater. Anaerobic conditions can result in an unpleasant taste or odour if groundwater reaches the surface through a bore. Or if groundwater reaches surface water, mortality of freshwater flora and fauna, and growth of undesirable flora and fauna can arise.

The proposed low rate of application of around 192 kgBOD/ha/year will ensure that the BOD applied to land can be ameliorated by the soil. Therefore, it is considered that BOD entering groundwater will be negligible and the effect of BOD on groundwater is expected to be less than minor (LEI, 2017).

6.3.3.2 Effect of Nutrients on Groundwater

Potential adverse effects from nutrients occur when groundwater enters surface water under which conditions it can contribute to eutrophication, or in the case of Nitrate when it is abstracted from a bore for use (public health risk).

The land application regime looks to apply a majority of the treated wastewater during summer when plant growth is greatest, thus a substantial proportion of applied nutrients will be taken up by plants, sequestered by soil, and in the case of nitrogen volatised/denitrified.

A cap to supplementary nitrogen applied to meet plant requirements of 300kg N/ha/y is proposed and will be managed adopting best practice for nutrient application. The supply of nutrients and water at a rate to meet plant needs will enable a level of confidence that leaching

will not be more than occurs under the surrounding land use that receives fertiliser application and animal excreta.

The conservatively estimated nitrogen lost to groundwater represents an increase of 7% (equivalent to 1.9kg N/ha/y) over the current land use, and is likely to cause a negligible change in groundwater nitrogen concentrations. Therefore the effect to groundwater users in a down-gradient position is expected to be no more than currently experienced.

Plant uptake and removal are the main mechanism for avoiding phosphorus loss from the proposed land application scheme due to a low to medium phosphorus retention capacity in the Site soils. Phosphorus loading from wastewater application will be low and entirely utilised by the plant matter. Any supplementary phosphorus will be applied at a rate which does not cause the soils Olsen P to exceed the recommended range for sedimentary soils of 20 – 30 mgP/l of soil.

Low phosphorus concentrations in the groundwater (<0.1mg/L) have been monitored in the past from bores near the site. The amount of phosphorus entering groundwater is expected to be negligible and adverse effects due to phosphorus entering groundwater are therefore expected to be negligible (LEI, 2017).

6.3.3.3 Effect of Pathogens on Groundwater

Pathogen contamination of groundwater can adversely affect human and animal health. As the wastewater will be UV disinfected and most applied pathogens perish within 10mm of the soil surface, the likelihood of pathogens entering the groundwater resource is low. The effect of pathogens on groundwater as a result of the proposed land irrigation is expected to be negligible (LEI, 2017).

6.3.4 Effect of Pond Seepage of Untreated Wastewater on Groundwater

As assessment of the limited groundwater data available (refer section 3.6) indicates that groundwater levels are relatively high during winter months, and that the flow of groundwater from the site will be South towards Donald Creek. As such, any potential leaching from the ponds to groundwater is likely to find its way into Donald Creek. Notwithstanding, the volume of leaching is expected to be insignificant. It is likely the accumulation of sludge in the unlined oxidation pond is providing an effective barrier to leaching.

The percolation from the distribution channel will be treated wastewater, thereby minimising any potential effects. The amount of potential leaching to groundwater has not been quantified, although monitoring of the groundwater downstream of the distribution channel on one occasion in 2015 suggests that groundwater quality in the vicinity of the site is not being adversely impacted by the current activities (LEI, 2017).

SWDC propose to undertake a pond water balance assessment of the ponds to quantify the potential leaching volume from the ponds to determine whether groundwater monitoring is warranted.

In the absence of more detailed groundwater data, it is concluded that the potential effects of pond seepage and seepage from the distribution channel on groundwater is considered likely to be no more than minor.

6.3.5 Proposed Mitigation

The assessment above concludes that there will be no adverse effects which are any more than minor from the proposed land application of treated wastewater and potential pond seepage of

untreated wastewater to groundwater. Mitigation measures which support the precautionary approach include the:

- careful design of the irrigation scheme;
- conservative and sustainable application rates proposed to minimise the risk of mounding and maximise evapotranspirative loss, maximise retention of nutrients in the unsaturated zone of soil, and maximise opportunities for filtration, attrition, and predation of pathogens;
- development of specific irrigation regimes documented in the Discharge to Land and Water Management Plan, including the limitation of the annual mass loading of nitrogen (from all sources) to 300 kgN/ha/y to ensure effects to groundwater are minimised;
- proposed groundwater monitoring to assess any potential long-term effects of the proposed discharge to land; and
- A water balance assessment to confirm or otherwise the likelihood of pond seepage and determination of environmental monitoring requirements.

6.4 Effect on Surface Water Quality and Aquatic Ecological Health

Discharges of contaminants to water or land that may enter water from wastewater treatment systems have the potential to affect the life-supporting capacity and quality of the receiving water body. Depending upon the nature of the discharge and the receiving environment, these effects can be acute in a very short timeframe if contamination is significant, or gradual and cumulative over a long period of sustained exposure.

The assessment below considers the potential effects of the proposal to Donald and Abbot Creeks and Lake Wairarapa. The assessment has been undertaken in accordance with Section 107 of the RMA, relevant technical standards, and the Water Quality Guidelines contained at Appendix 8 of the Freshwater Plan and in Policy 71 of the PNRP.

Effect of Land Application on Donald and Abbot Creeks has been discussed in Section 6.4.2 and the cumulative effects of the proposed land application and direct discharge have been considered in Sections 6.4.4, 6.4.5 and 6.4.6.

6.4.1 Sensitivity of the Receiving Environment

6.4.1.1 Donald Creek

Neither the GWRC Regional Policy Statement, Freshwater Plan or PNRP identify Donald Creek with any specific values of importance and the site is not considered to be a sensitive receiver with respect to recreational values.

The concentrations of common toxicants for aquatic environments in New Zealand agricultural catchments, ammonia and nitrate, were consistently below relevant guideline values, upstream of the discharge in Donald Creek and the Creek has the capacity to assimilate these parameters to a certain extent (see Appendix 8 for a discussion on current water quality).

However, Donald Creek upstream of the discharge has degraded water quality with respect to nutrients and frequently exceeds relevant nutrient guidelines for maintaining good water quality for angling (NIWA, 2016). The upstream water quality exceeded the DIN guideline of 0.63 g/m^3 73% of the time and the DRP guideline 50% of the time (Appendix 8). As a result, periphyton growth has been observed upstream of the site during summer ecological surveys. It is likely that the upstream elevated nutrient concentrations are due to agricultural runoff and seepage. Therefore, the Creek has limited assimilative capacity for nutrient load inputs (see Appendix 8 and Appendix 11B for descriptions of the upstream water quality and ecology).

The microbiological water quality of Donald Creek upstream of the site is currently impacted with *E.Coli* numbers exceeding the MfE (2003) recreational guidelines and therefore the Creek also has limited assimilative capacity for *E.Coli.*

Therefore, from a perspective of nutrients, microbiological contaminants, and potential for periphyton growths Donald Creek would be considered a sensitive environment.

6.4.1.2 Abbot Creek

Limited data exists regarding the water quality and ecological condition of Abbot Creek. The Creek is located in a predominately agricultural catchment and it is therefore likely that the water quality is at times elevated in nutrient load concentrations (nitrogen and phosphorus) and the stream may be sensitive to further increases of nutrient loads.

Based on the monitoring data (Table 39) Abbot Creek upstream of the confluence with Donald Creek had lower concentrations of nitrogen and phosphorus species than Donald Creek upstream of the discharge. However, the ecological monitoring also indicated that Abbot Creek upstream of the confluence with Donald Creek exhibited periphyton growth during summer months, this is most likely due to the Abbot Creek stream bed comprising of large gravel substrate. As a result, Abbot Creek would be considered a sensitive receiver, more sensitive to nutrient loads than Donald Creek.

6.4.1.3 Lake Wairarapa

Lake Wairarapa is considered to be a waterbody of national and international importance due to significant ecological, recreational and cultural value and has been under a National Conservation Order Since 1989. In addition, the Lake is currently under investigation to assess if it should be listed as a RAMSAR site. Water quality monitoring by GWRC demonstrates that the lake has been supertrophic for many years and is therefore sensitive to any increase in nutrient load. As such, overall Lake Wairarapa would be considered a highly sensitive receptor.

6.4.2 Effect of Land Application on Donald and Abbot Creeks

Treated wastewater derived contaminants have the potential to enter Donald and Abbot Creeks via either surface run-off or groundwater drainage. The potential impact of the land discharge on the surface waterways could be a reduction in habitat and recreational values by increasing the stream contaminant loading.

The operational management of the proposed land application scheme is critical in minimising potential effects on the environment from effluent ponding and overland flow. Management measures include the low rates of application proposed, maintenance of 20m buffer distances between irrigation zones and waterbodies, and minimising grazing and elimination of stock access to waterbodies. Furthermore, the use of a land treatment will result in a reduction of approximately 94% of the discharge directly discharging to the Donald Creek annually and therefore a significant reduction in contaminant load to the surface water environment as the land treatment scheme is implemented.

LEI (2017) provides a detailed assessment of effects of the proposed land treatment scheme on these surface water-bodies (see Appendix 7, s5.7). The following provides a summary of these effects.

6.4.2.1 Effect of Organic Material on Surface Water quality

The potential adverse effect of organic material on surface water is a reduction in dissolved oxygen content of the water which can lead to stress on the ecosystem and mortality of river

flora and fauna. Reducing conditions may occur in the sediment of the bed of a waterway leading to release of nutrients into the water.

The soil of the site is expected to assimilate the applied BOD due to the low rate of application (192 kgBOD/ha/yr). The potential for runoff of organic material will be mitigated by avoiding the application of wastewater to saturated soils and exclusion buffers to waterways. Thus, BOD entering groundwater and then surface water or directly to surface water from the proposed land treatment scheme, and the corresponding effects will be negligible.

6.4.2.2 Effect of Nutrients on Surface Water Quality

Increased nutrient loads can result in excessive growth of nuisance plants, reduction in dissolved oxygen, change in biodiversity and reduction in recreational amenity.

Soil microbes, plant uptake, short-term soil storage and gaseous losses (volatilisation and denitrification) within the land application areas are expected to remove the applied nitrogen. The potential for applied nitrogen to enter surface water is increased where it is not retained in the soil in a form able to be taken up by plants or microbes. Any nitrogen leached from the land application area will therefore enter the surface water environment via groundwater, whilst the inclusion of vegetated 20m buffers from waterways will assist with reducing the transport of nitrogen directly to surface waters.

Limited leaching is predicted and nitrogen entering surface waters from the catchment via groundwater will occur. Leaching of Nitrogen from the site for each stage has been accounted for in the assessment provided in Section 6.4.4. Overall, the land application will improve surface water nitrogen levels by providing a 79% reduction in N load discharged to surface water as a consequence of the reduced direct water discharge.

As with Nitrogen, plant uptake and soil occlusion (to a much lesser extent at this site) are expected to remove substantial quantities of phosphorus from the applied wastewater. Some leaching of phosphorus may occur, however the effect of wastewater applied phosphorus and additional fertiliser on surface water is considered to be less than minor (LEI, 2017).

6.4.2.3 Effect of Pathogens on Surface Water Quality

Pathogens may enter surface water from groundwater or flood flows. Avoidance of pathogen transport to surface water will be mitigated through UV disinfection, application rates that maximise soil contact and avoid surface run-off, avoidance of land treatment during prolonged wet weather when flood flows are more likely, and vegetative buffers to surface waters. It is therefore expected that the effect of pathogens from the discharge to land on surface water will be negligible (LEI, 2017).

6.4.2.4 Effect on Aquatic Ecology

The potential for contaminants to enter the local groundwater and surface water resources (both directly and indirectly) would be extremely low, due to the sustainable rate of effluent application proposed to maximise the soil absorption, treatment and utilisation of applied contaminants from the wastewater within the site. It is considered that the habitats of trout, indigenous fish species, macroinvertebrates and periphyton in the Donald and Abbot Creek are unlikely to be affected by the proposed discharge to land. The removal of wastewater from the surface water environment is expected to have a net positive effect on surface water habitats (LEI, 2017).

6.4.3 Effect of Pond Seepage of Untreated Wastewater on Donald and Abbot Creeks

No investigations have been carried out to quantify the volume of seepage from the existing ponds to groundwater and ultimately Donald and Abbot Creeks. The ponds are clay lined, thus there is a slight level of risk that pond seepage is occurring, although presently pond sludge in the base of the ponds will be assisting in minimising any such seepage.

It is therefore difficult to quantify what effects the potential pond seepage may be having on surface water bodies in the absence of any data.

SWDC therefore propose to undertake a pond water balance assessment to determine the potential volume of seepage that may be occurring. This assessment will commence within 12 months of the commencement of consent. Results will be analysed and reported to GWRC including any recommended actions.

6.4.4 Effect of Direct Discharge of Treated Wastewater to Donald Creek

6.4.4.1 Information Sources

Information has been drawn from previous effects assessments of the current discharge and includes findings from the following environmental investigations:

1. Ecological surveys of Donald Creek were undertaken at two sites in April 2010 and five sites in March 2013 to assess the effects of the WWTP (Coffey 2010, Coffey 2013). Shading by trees was thought to mask the full effect of the nutrient enrichment so additional sites were sampled in 2013. Some willows were removed after the 2013 sampling to make the stream more open. Conditions at the time of the March 2013 survey provide a conservative worst case scenario as the district at the time was experiencing a drought event. A copy of each survey is provided in Appendix 9 to this report.
2. Forbes (2013) monitored water quality and periphyton in Donald Creek about monthly between November 2012 and April 2013. This consisted of water quality samples and visual assessments of periphyton cover and analysis of periphyton relative abundance. Sites were located just upstream, about 60m downstream and about 160m downstream of the discharge. A copy of this report is provided in Appendix 10.
3. Hamill (2017a) undertook ecological surveys of Donald Creek and Abbott Creek in October and November 2016. The surveys assessed periphyton, aquatic macroinvertebrates, fish and water quality. The stream flow and discharge at the time of the surveys was typical for late spring conditions and the last large flood had occurred about four weeks prior to the October survey. At the time of both surveys the hydraulic dilution factor provided by the stream for the effluent was about 11.5 times. Hamill (2017b) has also undertaken an assessment of environmental effects analysing and comparing results from previous summer survey work and the more recent spring survey. A copy of the spring survey and ecological AEE is provided in Appendix 11.
4. Stream and effluent discharge flow and water quality sampling undertaken by SWDC collecting from upstream and downstream of the FWWTP discharge since 1994 to 2016. A summary of this data can be found in Appendix 8.
5. In January 2016 a temporary stream flow gauge was installed to aid in gathering greater resolution data on Donald Creek flows. Professional Ground Water and Environmental Services (PGWES) developed a synthetic flow record for Donald Creek based on spot gauging's in Donald Creek and long term flow records of local streams. The best correlation was used to generate a synthetic flow record for Donald Creek and has been validated

against the more recent stream flow gauging that has been undertaken. A copy of the hydrological report by PGWES is provided in Appendix 6 to this report.

6. Lowe Environmental Impact (LEI, see Appendix 7 for details) developed a land application model to determine the volume of wastewater that could be discharged to land and the remaining volume of wastewater that would require discharge to Donald Creek based on environmental conditions on a daily time step basis.
7. A mass balance model was developed to predict the downstream water quality and loads of key parameters assuming full mixing (see Appendix 8 for full details of the modelling approach). The model used the synthetic Donald Creek flow record developed by PGWES and the measured (existing) and predicted discharge volumes (provided by LEI in 2017) for the different development stages. Two overall scenarios are modelled for all stages of development (including the existing scenario), that is the:
   a. Median model: Uses median upstream and discharge concentrations for key parameters from the monitoring data.
   b. Conservative model: Uses 95th percentile upstream and discharge concentrations for key parameters from the monitoring data.

      It is therefore important to note that the Conservative model uses fixed high concentration water quality inputs and is therefore highly conservative and actual 95th percentile concentrations measured in Donald Creek are likely to be lower than those predicted by the model.
8. The mass balance model was also used to predict the seasonal and annual loads of key water quality parameters to Donald Creek. A full description of the modelling is provided in Appendix 8.
9. A Monte Carol Mass Balance Model was developed to predict the likely downstream total ammoniacal nitrogen concentrations with better accuracy than the Excel based mass balance model. This is also described in the Appendix 8 water quality assessment report.

6.4.4.2 Reasonable Mixing Zone

The RMA requires that any water quality standards imposed through s107, s69, s70 or the Third Schedule shall be met after allowing for 'reasonable mixing' of discharges. This requirement accepts that it is sometimes necessary and acceptable to allow for a zone in the receiving water to not meet water quality standards. Such a zone is called a 'non-compliance zone.' In terms of the Freshwater Plan and PNRP, the size of the zone allowed for reasonable mixing depends on the effects that noncompliance within the zone will have on the management of the receiving water. Furthermore, PNRP Policy 72 states that regard should be had to avoiding significant adverse effects within the zone of reasonable mixing.

Mixing of the effluent discharge with Donald Creek was assessed by Hamill (2017a) during the October 2016 survey. The discharge enters from the true right bank and was fully mixed across Donald Creek by 45m downstream. During summer the mixing zone may be different due to lower flows.

The 50m required to obtain full mixing is considered reasonable for Donald Creek because the effluent plume along the true right bank did not interfere with the confluence of any tributary, the habitat value on the true right bank were similar to those on the true left, and the site is difficult for the public to access so the zone of non-compliance is not interfering with recreation or aesthetic values.

In terms of effects on Donald Creek due to the discharge the monitoring site 150 m downstream of the discharge was used in the assessment as at this point the Creek is considered to be fully mixed.

6.4.4.3 Flow analysis

The interpretation of the water quality impacts existing and predicted for Stages 1A to 2B requires an understanding of the discharge and Creek flow regime. A key aspect to the overall approach is the continuous reduction of overall discharge volumes through the various stages of development, with an aim to eliminate summer discharges.

The discharge flow is measured continuously using an online flow meter as part of the sites compliance monitoring program. The average daily discharge flow from 2005 to 2016 was used as model inputs for LEI (2017). The change in discharge flow volumes to Donald Creek for, the four development stages, was then predicted by LEI using a water balance model (refer to Appendix 7 for a full description of the modelling).

Discharge flows

Table 19 presents the percentage of the current volume discharged to Donald Creek for the various scenarios by month. The overall discharge volume decreases as the staged development occurs. At Stage 1B the discharge to Donald Creek is approximately 56% of the existing discharge, dropping to 32% in Stage 2A and only 6% in Stage 2B.

Under all scenarios more discharge occurs in winter than summer. As the development proceeds the summer time discharges reduce significantly. By Stage 1B the majority of the discharge occurs in June, July and August. Once the development reaches Stage 2B discharge only occurs during July and August and in some years no discharge will occur at all.

Table 19: Percentage of current volume discharged to Donald Creek

Flow statistic	Current	Stage 1A	Stage 1B	Stage 2A	Stage 2B
January	5%	3.7%	0.056%	0.0075%	0%
February	4%	2.6%	0.069%	0.013%	0%
March	4%	4.1%	0.23%	0.23%	0%
April	6%	6.2%	1.9%	0.77%	0%
May	9%	9.4%	4.0%	1.4%	0%
June	10%	10.6%	11%	7.1%	0%
July	14%	14.4%	14%	10%	1.6%
August	13%	13.8%	14%	9.1%	4.9%
September	11%	10.7%	5.3%	2.2%	0%
October	11%	10.5%	5.1%	2.1%	0%
November	8%	6.7%	0.40%	0.025%	0%
December	6%	4.7%	0.25%	0.025%	0%
Total	**100%**	**97%**	**56%**	**32%**	**6%**

Source: Data provided by LEI in 2017

Table 20 summarises the percent of days the discharge will occur in summer and winter to Donald Creek for the various scenarios compared with the existing discharge regime. This further illustrates the significant reduction in summer day discharges at Stage 1B, and elimination at summer discharges and significant reduction in winter day discharges at Stage 2B.

Table 20: Percentage of days discharged seasonally to Donald Creek

Flow statistic	Current	Stage 1A	Stage 1B	Stage 2A	Stage 2B
Summer	97%	81%	12%	4%	0%
Winter	100%	99%	89%	76%	7%

Source: Data provided by LEI in 2017

Comparison of discharge and Donald Creek flows

Due to the lack of monitoring data a synthetic flow record for Donald Creek was developed by PGWES (Appendix 6). The synthetic flow record was established by correlating spot gaugings from Donald Creek with a number of continuous flow monitoring sites in the greater Wellington region. The best correlation was achieved with Otukura Stream and this site was used to develop a synthetic flow record from 2000 to 2016. A full description of the development of the synthetic flow record is provided in PGWS 2016 (Appendix 6).

The development of nuisance growths such as periphyton and sewage fungus (heterotrophic growths) in river systems is dependant on a number of factors including nutrient concentrations, habitat type, water temperature and flow conditions. As the flow rate of a river increases nuisance growths can be displaced from the river bed (referred to as sloughing). Under flood events total displacement of the periphyton and sewage fungus communities will occur. It is generally accepted that flood events above 3 times the median flow of a river will result in total displacement of nuisance growths (NIWA, 2000). However, it is likely that lower flow events will result in some removal of nuisance growths from a river bed.

The modelled discharge and Donald Creek data were assessed to determine the Creek flow regimes occurring when the WWTP is discharging to the Creek (Table 21 and Table 22). As the project progresses the frequency of the discharge to the Creek decreases and the proportion of time the discharge occurs during elevated Creek flows (2 x and 3 x median flow) increases.

Under the current scenario the WWTP discharges 99% of the time with the discharge occurring 13% of the time above 3 x median flow and 24% above 2 x the median flow. At Stage 1B the frequency of discharge to the Creek reduces to 51% with discharge occurring 25% of the above 3 x median flow and 46% of the time above 2 x median flow. Once Stage 2B is operational the WWTP discharges to the Creek less than 5% of the time, 75% of discharges occur while the Creek is above 3 x the median flow and over 90% of the discharges occur at 2 x median flow.

Table 21: Frequency of discharge to Donald Creek

Flow statistic	Current	Stage 1A	Stage 1B	Stage 2A	Stage 2B
<0.5x Median	27%	20%	1.8%	1.0%	0.0%
0.5x Median - 1x Median	22%	20%	6.1%	3.6%	0.0%
1x Median – 2x Median	26%	25%	19%	14%	0.32%
2x Median – 3x Median	11%	11%	11%	9.4%	0.68%
>3x Median	13%	13%	13%	13%	2.7%
Total	**99%**	**90%**	**51%**	**40%**	**3.7%**

Source: Discharge data provided by LEI in 2017 and river flow data provided by PGWES in 2016.

Table 22: Frequency of discharge to Donald Creek as a percentage of days when discharge is occurring

Flow statistic	Current	Stage 1A	Stage 1B	Stage 2A	Stage 2B
<0.5x Median	27%	23%	3.6%	2.4%	0.0%
0.5x Median - 1x Median	22%	22%	12%	9.0%	0.0%

Flow statistic	Current	Stage 1A	Stage 1B	Stage 2A	Stage 2B
1x Median – 2x Median	26%	28%	38%	34%	8.5%
2x Median – 3x Median	11%	12%	21%	23%	18%
>3x Median	13%	14%	25%	31%	73%
Total	100%	100%	100%	100%	100%

Source: Discharge data provided by LEI in 2017 and river flow data provided by PGWES in 2016.

6.4.4.4 Ammonia toxicity

Ammoniacal Nitrogen (NH_4-N) is present in human and animal wastes and is therefore present in sewage discharges. In surface water ammonia occurs as two species, the unionised form NH_3 and the ionised form NH_4^+. The ionised species is the predominant species in surface waters at typical pH and temperature ranges (pH 6-8, temperature 12 to 25) and it usually accounts for between 99% and 80% of the total NH_4-N (TNH_4-N). The relative proportion of unionised to ionised NH_4-N is pH and temperature dependant with the unionised species increasing in concentration as pH and temperature increases. This is of importance to water quality assessments as the unionised species is more toxic than the ionised form as it is capable of crossing cell membranes more effectively (ANZECC, 2000).

In order to assess the potential effects of TNH_4-N on a receiving environment it is important to consider two potential toxic effects. That is acute and chronic toxicity, acute toxicity refers to the ability of a chemical or element to cause mortality or an adverse effect in an organism from a single or short−term exposure to a chemical compound or element. Chronic toxicity refers to the ability of a chemical or element to cause an adverse effect in an organism which results from exposure to a chemical or element for a time period representing that significant portion of the natural life expectancy of that organism.

TNH_4-N Guidelines

This section summarises the currently available and reliable acute and chronic guidelines for assessing the potential for impact due to the discharge of TNH_4-N to Donald Creek.

Acute and Regulatory Guidelines

US Environmental Protection Agency Guidelines

There are no New Zealand guidelines relating to acute toxicity as it is assumed that management of a water body for chronic effects will protect against acute effects. The United States Protection Agency (USEPA) provides both acute and chronic guidelines (USEPA, 2013). The pH dependant acute guidelines from the USEPA for protection of sensitive species are presented in Table 23 assuming a temperature of 20ºC. The acute guidelines are provided for pH range typically measured downstream of the discharge in Donald Creek was pH 6.7 to 8.3.

Table 23: USEPA acute criteria for TNH4-N

pH	USEPA Acute Criteria (g/m^3)	NPS-FW (2014) Median (g/m^3)	NPS-FW (2014) Maximum (g/m^3)
6.7	21	3.4	5.8
6.8	20	3.4	5.7
6.9	18	3.3	5.5
7.0	17	3.1	5.3
7.1	15	3.0	5.1
7.2	14	2.9	4.9

pH	USEPA Acute Criteria (g/m^3)	NPS-FW (2014) Median (g/m^3)	NPS-FW (2014) Maximum (g/m^3)
7.3	12	2.7	4.6
7.4	11	2.5	4.3
7.5	9.2	2.3	3.9
7.6	7.9	2.1	3.6
7.7	6.7	1.9	3.2
7.8	5.6	1.7	2.9
7.9	4.7	1.5	2.5
8.0	3.9	1.30	2.2
8.1	3.2	1.13	1.91
8.2	2.7	0.95	1.61
8.3	2.2	0.81	1.36

Source: USEPA (2013) and NPS-FM (2014)

National Policy Statement for Freshwater Management – National Bottom Line

Objective A1 of the NPS-FM aims to safeguard the life supporting capacity of freshwater and safeguard human health at least to a level safe for secondary contact. Objective A2 is committed to improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated. Part of the NPS-FM process was to develop National Bottom Lines for various attributes.

The NPS-FM states National Bottom lines are the minimum acceptable state for freshwater system. The NPS-FM defines a National Bottom Line for TNH_4-N, in lakes or rivers, of 1.2 g/m^3 for comparison to the annual median and 2.2 g/m^3 as an annual maximum, based on a pH of 8 (see Table 23) However, NPS-FM states that these are not standards that must be achieved immediately. But where water bodies exceed national bottom lines, they will need to be improved to at least the national bottom lines over time.

Chronic Guidelines

New Zealand based guidelines for TNH_4-N are chronic guidelines derived to protect species from long term exposure. These include the ANZECC (2000) guidelines and a set of indicative guidelines derived by NIWA (2014).

ANZECC

In 2000 ANZECC released an updated set of water quality guidelines with the purpose of assisting water managers and communities to sustainably use and manage water resources in an environmental, economic and social context. These guidelines include trigger values for toxicants such as TNH_4-N. These trigger values were not intended to be simplistic threshold numbers above which a toxic effect is likely, rather they represent values below which there is a low risk that adverse biological effects will occur, and are therefore considered chronic guidelines. If exceeded, these values trigger a management response such as the incorporation of additional information or further investigation to determine if a real risk to the ecosystem exists and where possible, to adjust the trigger values into regional, local or site-specific guidelines.

It is important to note that exceedance of an ANZECC trigger value (or other guidelines) does not necessarily mean toxic effects will be occurring in the water body as numerous factors such as exposure time, species present and habitat type influence if toxic effects will be observed.

In New Zealand the ANZECC (2000) TNH_4-N trigger values are often used for water quality assessments. ANZECC (2000) provides trigger values, with pH adjustment, for different levels of protection with a 99% level of protection for pristine environments, a 95% level of protection for slightly to moderately disturbed environments and an 80% level of protection for highly degraded environments. The default level of protection is the 95% level, the pH adjusted trigger values for the 95% level of protection are summarised in Table 24.

NIWA (2014)

As part of the development of the NPS-FM the Ministry for the Environment (MfE) is developing National Objectives Frameworks (NOF) for freshwaters which include a National Bottom Line for TNH_4-N and different attribute states for lakes and rivers. Attributes are measurable characteristics of fresh water, including physical, chemical and biological properties, which supports particular values. For potentially toxic compounds such as TNH_4-N, these attribute states are ranges of concentrations developed to manage surface waters such that the water is protected from TNH_4-N toxicity.

As part of the development of the NPS-FM and NOF, NIWA (2014) have derived ammoniacal nitrogen attribute states for lakes and rivers according to the ANZECC method. NIWA updated the ANZECC TNH_4-N toxicity dataset with data for the highly sensitive species of North American fresh water mussels from the USEPA's updated guideline values (USEPA, 2013). These species have a similar sensitivity as New Zealand Freshwater Mussels (kākahi - *Echyridella menziesi*). The toxicity data relating to these species represent the lowest in the dataset with No Observable Effects Concentration (NOEC) of between 0.24 g/m^3 to 0.59 g/m^3. In addition to freshwater mussels the Fingernail Clam (*Sphaerium novaezelandiae*) is commonly found in New Zealand low land streams and is known to be sensitive to TNH_4-N concentrations with a measured NOEC (mortality) of 0.59 g/m^3. The Freshwater Clam also was considered in the NIWA assessment.

It should be noted that NIWA derivation did not include full review of the ANZECC dataset or literature review of new TNH_4-N toxicity data. Given that only new toxicity data for highly sensitive species was added to the dataset with no additional data for less sensitive species, the new NIWA guidelines would be considered highly conservative. Although the NIWA guidelines are provided for different levels of protection in line with the ANZECC method (i.e. 99%, 95% 90% and 80%), as they are conservative they may not directly relate to the levels of protection discussed in ANZECC. Therefore, it is more relevant to consider the species that the guidelines protect, with consideration of most sensitive species protected by the guideline. It is noted that the NIWA document states:

"[the 90th percentile guideline values] are protective of the native fingernail clam, though some effects are indicated for the North American juvenile mussels, which are not resident in New Zealand."

Therefore the:

- NIWA (2014) trigger for 95% level of protection would protect the most sensitive species found in lakes in rivers, that is Freshwater Mussels; and
- NIWA (2014) 90% level of protection would protect the next most sensitive species found in lakes and rivers, the Fingernail Clam.

A summary of the NIWA indicative guidelines are summarised in Table 24. It should be noted that the ANZECC (2000) guidelines are similar to the NIWA surveillance guidelines that would be protective of the fingernail clam.

Table 24: Comparison of TNH4-N Guidelines

pH	NIWA Indicative Guideline for protective of Mussels (g/m^3)		NIWA Indicative Guideline for protective of Fingernail Clam (g/m^3)		ANZECC (2000) 95% level of protection (g/m^3)
Type	Grading[1]	Surveillance[2]	Grading[1]	Surveillance[2]	
6.7	0.63	1.06	1.43	2.43	2.38
6.8	0.62	1.04	1.40	2.38	2.33
6.9	0.60	1.00	1.36	2.31	2.26
7.0	0.58	0.97	1.31	2.23	2.18
7.1	0.55	0.92	1.25	2.13	2.08
7.2	0.53	0.88	1.19	2.03	1.99
7.3	0.50	0.84	1.13	1.92	1.88
7.4	0.47	0.78	1.05	1.78	1.75
7.5	0.43	0.72	0.97	1.65	1.61
7.6	0.39	0.65	0.88	1.50	1.47
7.7	0.35	0.59	0.79	1.35	1.32
7.8	0.31	0.52	0.71	1.21	1.18
7.9	0.27	0.46	0.62	1.05	1.03
8.0	0.24	0.40	0.54	0.92	0.90
8.1	0.21	0.35	0.47	0.80	0.78
8.2	0.18	0.29	0.39	0.67	0.66
8.3	0.15	0.25	0.33	0.57	0.56

Notes: [1]Grading guidelines are for comparison to annual median. [2]Surveillance guidelines are for comparison to annual 95th percentile.

Selection of appropriate trigger values

The selection of an appropriate trigger value to assess future impacts requires consideration of water quality, flow and ecological conditions. The trigger values selected should be protective of the species present in the receiving water (Donald Creek), and should protect the most sensitive species. In addition, the goals of the NPS-FM are for continued improvement to water quality, for water bodies impacted by human activity and this requires consideration.

Ecology

Ecological surveys have been undertaken on Donald Creek, in 2010, 2013 and 2016, a full description of the studies can be found in Appendices 9 to 11 of this report. In summary:

- The most sensitive species, to TNH_4-N toxicity, identified in Donald Creek was the fingernail clam. This species was identified both upstream and downstream of the discharge in Donald Creek during the spring surveys. This indicates that prolonged exposure to elevated TNH_4-N concentrations have not resulted in permanent absence of the species;
- The fingernail clam was not identified in any summer surveys indicating that there may be effects on this species during summer both upstream and downstream of the discharge;
- No freshwater mussel species were found upstream or downstream of the WWTP during any of the surveys indicating this species has been absent from the stream for a number years; and
- The upstream and downstream MCI scores were found to be slightly lower during the spring surveys, while summer surveys had substantially lower MCI scores downstream of the discharge, indicating there may currently be some effect from the discharge during summer.

Water Quality

The water quality data from the upstream site in Donald Creek would be considered to be moderately impacted as (refer to Appendix 8):

- The upstream DIN concentration was elevated above background and the DIN periphyton guideline ("good" water quality for angling, NIWA, 2016) 73% of the time; and
- The upstream DRP concentration was above background and the DRP periphyton guideline (based on "good" water quality for angling) approximately 50% of the time.

Discharge Regime

In addition to the ecological and water quality data the changes in flow regime are also of importance with respect to effects on Donald Creek and the selection of trigger values. Currently, changes in ecological values have only been identified in summer when flows are lower and temperatures higher (resulting in increased TNH_4-N toxicity).

As the project progresses summer discharges will be reduced and by Stage 1B only 2% of the current discharge volume will be discharged in summer (in April only) and by Stage 2B discharges will only occur during July and August.

Proposed Trigger Values for TNH_4-N

It is proposed that the trigger values for the site be staged in line with the development of the wastewater treatment system, with a progressive improvement to water quality over time.

It is proposed that in the short term, after implementation of Stage 1B, no exceedances of acute USEPA guidelines or the NPS-FM National Bottom line should occur and the TNH_4-N concentrations will be below the indicative NIWA guidelines that would be protective of the Fingernail Clam.

In the long term, after implementation of Stage 2B, there will be continual improvement to water quality and Donald Creek would have TNH_4-N concentrations that would be protective of Freshwater Mussels (kākahi). Therefore, it is proposed that the more stringent guidelines protective of the Fresh Water Mussels be used as trigger values.

The proposed trigger values are presented in Table 25, these values have been used in the assessment of current and future effect discussed in the sections below.

Table 25: Proposed staged TNH_4-N trigger values

Stage	All Stages			Trigger Value Stage 1B		Trigger Values for Stage 2B	
Source	USEPA Acute (g/m^3)	NPS National Bottom Line (g/m^3)		NIWA Indicative Guideline for protection of the Fingernail Clam (g/m^3)		NIWA Indicative Guideline for protection of Freshwater Mussels (g/m^3)	
Statistic for assessment	Annual Maximum	Annual Median	Annual Maximum	Annual Median	Annual 95th percentile	Annual Median	Annual 95th percentile
pH	Concentration (g/m^3)						
6.7	21	2.38	5.81	1.43	2.43	0.63	1.06
6.8	20	2.33	5.70	1.40	2.38	0.62	1.04
6.9	18	2.26	5.52	1.36	2.31	0.60	1.00
7.0	17	2.18	5.32	1.31	2.23	0.58	0.97
7.1	15	2.08	5.08	1.25	2.13	0.55	0.92

Stage	All Stages			Trigger Value Stage 1B		Trigger Values for Stage 2B	
7.2	14	1.99	4.86	1.19	2.03	0.53	0.88
7.3	12	1.88	4.60	1.13	1.92	0.50	0.84
7.4	11	1.75	4.27	1.05	1.78	0.47	0.78
7.5	9.2	1.61	3.94	0.97	1.65	0.43	0.72
7.6	7.9	1.47	3.59	0.88	1.50	0.39	0.65
7.7	6.7	1.32	3.23	0.79	1.35	0.35	0.59
7.8	5.6	1.18	2.88	0.71	1.21	0.31	0.52
7.9	4.7	1.03	2.51	0.62	1.05	0.27	0.46
8.0	3.9	0.90	2.20	0.54	0.92	0.24	0.40
8.1	3.2	0.78	1.91	0.47	0.80	0.21	0.35
8.2	2.7	0.66	1.61	0.39	0.67	0.18	0.29
8.3	2.2	0.56	1.36	0.33	0.57	0.15	0.25

Existing Discharge Effects

The WWTP discharge to Donald Creek has been occurring for an excess of 30 years and has been negatively impacting on water quality and aquatic ecology in the Creek. The WWTP discharge contains high concentrations of TNH_4-N with a median of 4.4 g/m^3 and maximum of 15.6 g/m^3 with most values between 2 and 10 g/m^3 (Table 26).

Table 26: Summary of TNH4-N concentrations in the discharge 2005 to 2016

Statistic	Concentration (g/m^3)
Minimum	0.04
Median	4.4
95th percentile	11.5
Maximum	15.6
Sample number	76

Source: SWDC monitoring data

The monitoring data from 2006 to 2016 upstream and downstream of the discharge is summarised in Table 27 and Table 28, these tables also provide the pH adjusted NIWA (2014) guidelines for comparison. As stated above the guidelines require comparison of the annual median concentration and annual 95th percentile to the median and 95th percentile guidelines. The pH adjustment is based on the 95th percentile of the annual median pH values.

The TNH_4-N concentrations upstream of the WWTP discharge were consistently below all guideline values with concentrations in the range <0.01 g/m^3 and 0.20 g/m^3 and have consistently remained below all of the proposed trigger values (Table 27).

The concentration of TNH_4-N downstream of the site is significantly elevated above upstream concentrations and frequently exceeded guideline values (Table 28). The maximum TNH_4-N concentration downstream of the sites did not exceed the pH adjusted national bottom line. However, at times the TNH_4-N concentration was highly elevated and exceeded 2 g/m^3. When these spikes occur they are likely to reduce the abundance of sensitive species such as the Fingernail Clam and may cause impacts on some mayfly species (e.g. *Deleatidium* mayfly has a NOEC of 1.79 mg/L). It is doubtful whether this level of total TNH_4-N will have any impact on the population of longfin eel because eel are relatively tolerant of TNH_4- N and large numbers of eel have been observed within the oxidation pond itself.

The median downstream concentration of TNH_4-N exceeded the NIWA (2014) guideline for protection of Freshwater Mussels in 6 out of 10 years monitored, and the 95th percentile concentration of TNH_4-N exceeded the guideline that is protective of Freshwater Mussels in 9 out of 10 years monitored. This indicates that the most sensitive mussel species (e.g. kākahi) could be impacted if they were present in the stream. However, surveys of Donald Creek and Abbot Creek have not found any kākahi upstream or downstream of the discharge.

The median and 95th percentile downstream TNH_4-N concentration was non-compliant with the NIWA (2014) guideline that would be protective of the Fingernail Clam on two occasions (2007 and 2014). Therefore, there was potential for chronic toxicity to occur for the most sensitive species present, the Fingernail Clam. However, the majority of the years monitored the TNH_4-N concentrations downstream of the site would not be chronically toxic to the Fingernail Clam.

This is in line with the ecological monitoring data as stream surveys carried out in October and November 2016 found fingernail clam downstream of the discharge. At the time of the survey in November 2016 the total TNH_4-N concentration downstream of the discharge was 0.51 mg/L (slightly above the long term medium). This is borderline for protecting the fingernail clam if occurring long term. Nevertheless, fingernail clam were more abundant at the 650m downstream site than upstream.

Table 27: Upstream total ammoniacal nitrogen assessment

Year	Measured pH	Measured NH_4-N (g/m^3)	Measured NH_4-N (g/m^3)	Measured NH_4-N (g/m^3)	NIWA (2014) NH_4-N Guideline protective of Freshwater Mussels (g/m^3)	NIWA (2014) NH_4-N Guideline protective of Freshwater Mussels (g/m^3)	NIWA (2014) NH_4-N Guideline protective of Fingernail Clam (g/m^3)	NIWA (2014) NH_4-N Guideline protective of Fingernail Clam (g/m^3)	Number of ammonia samples
Statistic	95th percentile	Median	95th Percentile	Maximum	For comparison to Median	For comparison to 95th Percentile	For comparison to Median	For comparison to 95th Percentile	
2006	7.6	0.37	0.066	0.070	0.39	0.65	0.88	1.5	4
2007	7.4	0.040	0.073	0.086	0.47	0.78	1.05	1.78	12
2008	7.4	0.035	0.12	0.199	0.47	0.78	1.05	1.78	11
2009	7.0	0.041	0.24	0.043	0.58	0.97	1.31	2.23	8
2010	7.3	0.025	0.041	0.043	0.50	0.84	1.13	1.92	4
2011	7.4	<0.01	0.014	0.020	0.47	0.78	1.05	1.78	9
2012	7.7	<0.01	0.024	0.030	0.35	0.89	0.79	1.05	14
2013	7.9	<0.01	0.033	0.040	0.27	0.46	0.62	1.05	15
2014	7.8	<0.01	0.018	0.020	0.31	0.52	0.71	1.21	4
2015	7.4	<0.01	<0.01	0.005	0.47	0.78	1.05	1.78	4

Table 28: Downstream total ammoniacal nitrogen assessment

Year	Measured pH	Measured NH_4-N (g/m^3)	Measured NH_4-N (g/m^3)	Measured NH_4-N (g/m^3)	NIWA (2014) NH_4-N Guideline protective of Freshwater Mussels (g/m^3)	NIWA (2014) NH_4-N Guideline protective of Freshwater Mussels (g/m^3)	NIWA (2014) NH_4-N Guideline protective of Fingernail Clam (g/m^3)	NIWA (2014) NH_4-N Guideline protective of Fingernail Clam (g/m^3)	Number of TNH_4-N samples
Statistic	95th percentile	Median	95th Percentile	Maximum	For comparison to Median	For comparison to 95th Percentile	For comparison to Median	For comparison to 95th Percentile	
2006	7.6	0.28	**0.77**	0.83	0.39	0.65	0.88	1.5	10
2007	7.8	**0.99**	**2.5**	**2.6**	0.31	0.52	0.71	2.21	12
2008	7.1	**0.80**	**1.9**	2.09	0.55	0.92	1.25	2.13	12
2009	7.5	**0.45**	**0.72**	0.74	0.43	0.72	0.97	1.65	9
2010	7.4	0.32	**1.1**	1.27	0.47	0.78	1.05	1.78	4
2011	7.3	0.37	**0.90**	1.08	0.50	0.84	1.13	1.92	10
2012	7.8	**0.39**	**0.80**	0.92	0.31	0.52	0.71	1.21	12
2013	8.0	**0.40**	**0.65**	0.77	0.24	0.40	0.54	0.92	13
2014	8.3	**0.35**	**0.74**	0.79	0.15	0.25	0.33	0.57	4
2015	7.4	0.33	**0.83**	0.90	0.47	0.78	1.05	1.78	4
2016	NA	NA	NA	**3.18**	NA	NA	NA	NA	2

Note - Blue highlighted values exceed the NIWA (2014) guidelines that are protective of the Fingernail Clam. **NPS -** maximum national bottom line of 2.9 g/m^3 pH of 7.8 for 2007, and measured pH of 7.1, at the time of sampling in 2016, equating to a maximum bottom line of 5.1 g/m^3. **Bolded** values exceed the NIWA (2014) guidelines that are protective of Freshwater Mussels. NA – statistical values for the 2016 year are not applicable as at the time of writing only 2 samples were available for analysis, the maximum value measured in 2016 has been included as it is the highest measured value in the monitoring data.

Monte Carlo Mass Balance Modelling

Initially conservative mass balance modelling was undertaken with MS Excel to estimate downstream TNH_4-N concentrations. However, although this was useful for determining approximate median concentrations it was found to be significantly overestimating the maximum and 95th percentile values. Therefore, Monte Carlo mass balance modelling was undertaken using the River Quality Planning (RQP) model (MB v2.5) from the United Kingdom Environment Agency.

The model was used to predict the in river concentrations of TNH_4-N downstream of the discharge under the different stages of development. The outcome of the model is presented in Table 29 and Table 30 and a full description of the model inputs and outputs is provided in Appendix 8.

Monte Carlo simulation allows for distributions (assuming a log-normal distribution) to be used as inputs and randomly combines the distributions in a statistically valid way to generate a statistical output. In the case of the RQP model the following distributions were used:

- Synthetic river flow data – input as mean and 5th percentile of flow;
- Measured discharge data, for the existing scenario only – input as mean and standard deviation;
- Synthetic discharge data, for Stages 1B, 2A and 2B – input as mean and standard deviation;
- Upstream TNH_4-N concentrations from measured values – input as mean and standard deviation;
- Discharge TNH_4-N concentrations from measured values for Stage 1B – input as mean and standard deviation.
- Discharge TNH_4-N concentrations from measured values adjusted to account for post I&I works for Stage 2A and 2B – input as mean and standard deviation.

The model was run in continuous mode for the existing scenario, Stage 1B and Stage 2A as discharge occurs throughout the year, although considerably reduced from the existing situation in Stages 1B and 2A. Stage 2B was run as an intermittent discharge as discharge only occurs occasionally during winter.

The model runs a minimum of 1000 scenario combinations for each simulation and provides mean, 95th percentile and 99th percentile outputs.

The mean and 95th percentile outputs were compared to the NIWA guidelines that are protective of the Fingernail Clam and Freshwater Mussels. The 99th percentile was assumed to represent the maximum concentrations and was compared to the NPS-FM National Bottom Line and the USEPA acute criteria.

As the annual median pH cannot be determined for modelled scenarios the 95th percentile of the measured downstream pH was used to determine the pH adjusted NIWA guidelines. This is conservative as in reality the annual 95th percentile pH at the downstream site typically varied between 7.1 and 7.9 and therefore the guidelines had a considerable range (Table 24).

Discharge Effects Stage 1A to 2B

Stage 1A and 1B

As development of Stages 1A and 1B will occur in parallel and will be complete within two years of a consent being granted only the Stage 1B scenario, which includes the effect of Stage 1A, was modelled. The model predicts a significant decrease in median and 95th percentile

concentrations of TNH_4-N downstream of the WWTP discharge, with no exceedances of the NPS-FM national bottom line or USEPA acute guidelines (Table 29).

Comparison of the modelled concentrations with NIWA guideline that would be protective of the Fingernail Clam indicates the median guideline would be complied with in all modelled years (Table 30). The model predicts that the annual 95th percentile NIWA guideline would be exceeded in only 2008 out of 11 the years modelled. Comparison to the model run on the full dataset complies with both median and 95th percentile guidelines.

It should be noted that the 2008 year had one of the highest discharge flows, which will occur predominately in winter and one of the lowest summer low flows in Donald Creek. As such the Monte Carlo simulation, based on a full year of data, will at times combine high discharge flows with low summer flows, a situation that is unlikely to occur. Therefore, the model was run seasonally (summer and winter) for the 2008 year. Under these scenarios the predicted annual median (0.35 g/m^3) and annual 95th percentile (0.88 g/m^3) NH_4-N concentrations were predicted to be below the relevant guidelines for protection of the Fingernail Clam.

In addition, the assessment has been carried out with guideline values calculated for pH 7.9, the 95th percentile of the measured values. Should the 95th percentile pH be 7.7 or lower the 2008 year would be fully compliant with the NIWA guidelines protective of the Fingernail Clam.

Comparison of the model results to the more stringent guidelines, that would be protective of Freshwater Mussels, indicates that at Stage 1B there would be some exceedances of the median TNH_4-N guideline (5/11 years modelled) and the downstream concentration would consistently exceed the annual 95th percentile guideline.

In summary at Stage 1B:

- The WWTP will predominately discharge in winter when temperatures are lower (and TNH_4- N is less toxic) and ecological surveys have not detected significant effects.
- The modelling predicts a significant reduction in TNH_4-N concentrations in Donald Creek compared to the current scenario, with not exceedances of the NPS-FM National Bottom Line. This is consistent with the objective of the NPS-FM to progressively improve water quality and meet the National Bottom Line.
- The modelling predicts that the TNH_4-N concentration downstream of the discharge is likely to comply with the NIWA guideline that would be protective of the Fingernail Clam, but at times is close to the guideline based on the 95th percentile.
- The modelling predicts that at the downstream TNH_4-N concentration may at times exceed the more stringent guideline that would be protective of the Fresh Water Mussels.
- Freshwater Mussels have not been identified in Donald Creek, while the Fingernail Clam has been identified.

Therefore, it is likely that level of effect of TNH_4-N toxicity would be moderate to minor at Stage 1. However, as there is always uncertainty relating to modelling outcomes and treatment system performance, it is recommended that routine monitoring is undertaken for water quality and ecological parameters and that the NIWA guideline, protective of the Fingernail Clam be used as a Trigger value for Stage 1B. Should the Trigger value be exceeded in any year further investigation will be undertaken as described in the proposed consent conditions[114].

[114] See Part 1C – Proposed Consent Conditions, Schedule 2: Condition 7 and 8

Stage 2A

Implementation of Stage 2A will further reduce the frequency and volume of summer discharges and this will further reduce TNH_4-N concentrations downstream of the discharge. Compliance with appropriate guidelines is similar to Stage 1B and the impact will most likely be minor. It is proposed the Stage 1B trigger values for TNH_4-N, monitoring regime and consent conditions are applied to Stage 2A.

Stage 2B

Under Stage 2B no summer discharge occurs and discharge is only predicted to occur in July and August, thereby eliminating any potential summer effects from TNH_4-N toxicity.

The model predicts a significant decrease in 95th percentile and median TNH_4-N concentrations downstream of the WWTP, with no exceedances of the NIWA guideline protective of the Fingernail Clam, and only 1 exceedance of the NIWA 95th percentile guideline that would be protective of Freshwater Mussels. This exceedance is predicted to occur in 2008, when as discussed above (under Stage 1B) the model will be predicting some summer time discharges, when flow in Donald Creek is lower. As there will be no summer discharge under Stage 2B this is overestimating the concentrations in the Creek. As such, the model was re-run with winter Creek flows and predicts full compliance with the NIWA guidelines (mean = 0.06 g/m^3, 95th percentile = 0.34 g/m^3).

In addition, the assessment has been carried out with guideline values calculated for pH 7.9, the 95th percentile of the measured values. Should the 95th percentile pH be 7.8 or lower the 2008 year would be fully compliant with the NIWA guidelines protective of the Freshwater Mussels.

Therefore, at Stage 2B effects will be less than minor, and the water quality in Donald Creek will be significantly improved over Stage 1B/2A and TNH_4-N concentrations are likely to be at a level that the Freshwater Mussel (kākahi) found in Lake Wairarapa may recolonise in Donald Creek.

Table 29: Modelled total ammoniacal nitrogen downstream of the discharge – Measured maximum and modelled 99th percentile

Year	Measured (g/m^3)	Existing Modelled (g/m^3)	Stage 1B Modelled (g/m^3)	Stage 2A Modelled (g/m^3)	Stage 2B Modelled (g/m^3)
Statistic	Maximum	99th Percentile	99th Percentile	99th Percentile	99th Percentile
2005	-	3.1	1.2	1.1	No discharge
2006	0.83	1.9	1.9	1.7	1.3
2007	**2.6**	**2.5**	1.8	1.9	No discharge
2008	2.1	**2.8**	2.1	2.1	1.7
2009	0.74	**2.5**	1.4	1.3	0.22
2010	1.3	1.7	1.1	1.0	0.72
2011	1.1	**2.8**	1.7	1.7	0.98
2012	0.92	1.8	11	1.0	0.73
2013	0.77	**2.6**	1.5	1.2	0.23
2014	0.79	2.1	1.3	1.2	0.27
2015	0.90	**2.7**	1.6	1.6	No discharge
2016	**3.18**	**-**	-	-	-
Full dataset		**2.6**[1]	1.6	1.5	0.79

Source: Monte Carlo Mass balance model outputs, Red values equal to or exceeding the national bottom line at an assumed pH of 7.9 of 2.5 g/m^3 for the annual maximum. [1]Maximum value measured in 2016.

Table 30: Modelled total ammoniacal nitrogen concentration downstream of the discharge – median and 95th percentile

Year	Measured (g/m³)		Existing Modelled (g/m³)		Stage 1B Modelled (g/m³)		Stage 2A Modelled (g/m³) (g/m³)		Stage 2B – Modelled (g/m³)	
Statistic	Median	95th Percentile	Median	95th Percentile	Mean	95th Percentile	Mean	95th Percentile	Mean	95th Percentile
2005	-	-	**0.45**	**1.2**	0.25	**0.69**	0.21	**0.59**	No discharge	
2006	0.28	0.77	**0.63**	**1.9**	**0.33**	**1.03**	**0.28**	**0.91**	0.08	0.40
2007	**0.99**	**2.5**	**0.63**	**1.6**	0.22	**0.78**	0.21	**0.74**	No discharge	
2008	**0.80**	**1.9**	**0.44**	**1.4**	**0.39**	**1.23**	**0.36**	**1.16**	0.09	**0.51**
2009	**0.45**	**0.72**	**0.63**	**1.6**	**0.29**	**0.81**	0.24	**0.68**	0.02	0.08
2010	**0.32**	**1.1**	**0.40**	**1.1**	0.21	**0.59**	0.19	**0.55**	0.04	0.18
2011	**0.37**	**0.90**	**0.62**	**1.7**	**0.31**	**0.93**	**0.31**	**0.92**	0.05	0.22
2012	**0.39**	**0.80**	**0.44**	**1.1**	0.20	**0.58**	0.17	**0.51**	0.04	0.17
2013	**0.40**	**0.65**	**0.56**	**1.5**	**0.28**	**0.84**	0.20	**0.62**	0.02	0.08
2014	**0.35**	**0.74**	**0.48**	**1.3**	0.26	**0.74**	0.21	**0.64**	0.02	0.09
2015	**0.33**	**0.83**	**0.67**	**1.7**	**0.30**	**0.89**	0.26	**0.79**	No discharge	
Full dataset	**0.44**	**1.7**	**0.57**	**1.57**	**0.29**	**0.88**	0.24	**0.73**	0.04	0.14
Winter					**0.34**	**0.95**	**0.30**	**0.85**	0.05	0.24
Summer					0.06	0.20	0.04	0.13	NA	NA

Note – Source Monte Cralo Mass Balance Model. Blue highlighted values exceed the NIWA (2014) guidelines that are protective of the Fingernail Clam at pH 7.9: Median 0.62 g/m³, 95th percentile 1.05 g/m³. **Bolded** values exceed the NIWA (2014) guidelines that are protective of Freshwater Mussels at pH 7.9: median = 0.27 g/m³, 95th percentile = 0.46 g/m³.

6.4.4.5 Nitrate toxicity

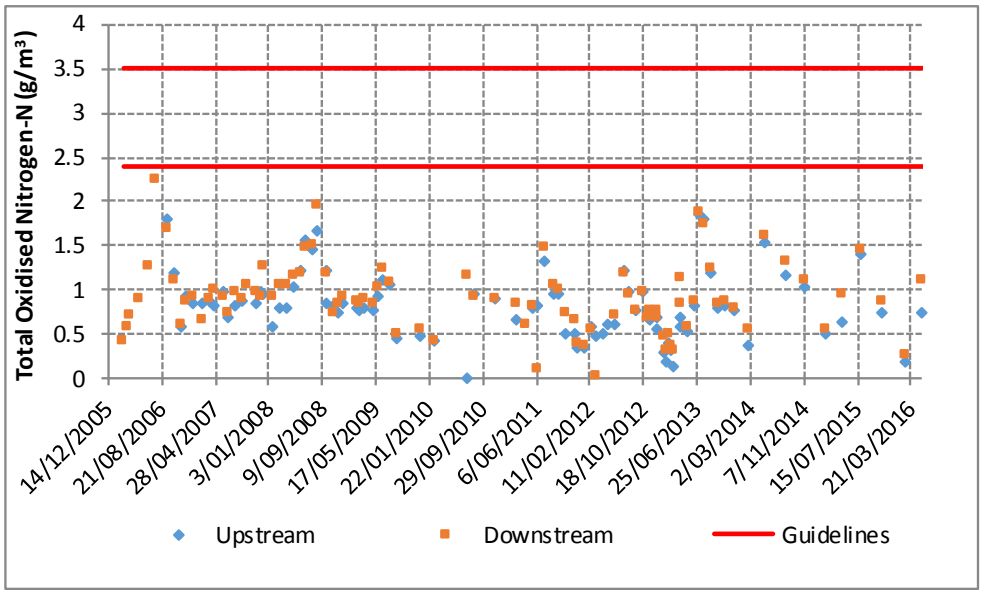
Nitrate is an essential nutrient for aquatic plants, however, at elevated concentrations nitrate can be toxic to aquatic life. The ANZECC (2000) guideline for nitrate nitrogen (nitrate-N) was revised by NIWA in 2013 to include additional toxicity data and to define guidelines for comparison to the annual median and the annual 95th percentile. The NIWA (2013) guidelines were calculated for different levels of protection as per the ANZECC (2000) approach. As Donald Creek is considered at best slightly to moderately disturbed the 95% level of protection was used for assessment of potential nitrate toxicity, that is annual median below 2.4 g/m^3 and annual 95th percentile below 3.5 g/m^3.

As the nitrite concentration in the discharge and downstream of the site is at time elevated the assessments below have been made on Total Oxidised Nitrogen (TO_xN) rather than nitrate-N.

Existing Discharge Effects

The discharge at times has TO_xN concentrations elevated above background concentrations and once the I&I reduction has been implemented these concentrations may increase (see Appendix 8). The compliance of the downstream site with the NIWA (2013) guidelines, at the 95% level of protection, is presented in Figure 22. The site complied with both the median and 95th percentile guidelines at all times and the current effect on TO_xN toxicity is less than minor.

Figure 22: Total oxidised nitrogen concentrations upstream and downstream of the discharge



Source: SWDC Monitoring data 2005 to 2016

Stage 1A to 2B Discharge Effects

A mass balance model was used to predict the in river concentrations of nitrate (based on total oxidised nitrogen) downstream of the discharge under the different stages of development. The outcome of the model are presented in Table 31 and a full description of the model inputs and outputs is provided in Appendix 8.

The model predicts that there would be full compliance with the NIWA (2013) nitrate-N guidelines for all years modelled. Therefore, given the model is highly conservative, the effect of nitrate toxicity on the aquatic life in Donald Creek would be less than minor.

In addition, the predicted concentrations downstream of the site are an order of magnitude below the ANZECC (2000) guideline for protection of livestock drinking water (nitrate N of 400 g/m^3).

Table 31: Modelled total oxidised nitrogen concentration downstream of the discharge

Year	Existing		Stage 1A		Stage 1B		Stage 2A		Stage 2B	
Statistic	Median	95th Percentile	Median	95th Percentile	Median	95th Percentile	Median	95th Percentile	Median	95th Percentile
2005	0.94	1.87	0.94	1.87	0.94	1.85	0.94	1.90	0.94	1.77
2006	0.94	1.93	0.94	1.94	0.94	1.88	0.94	1.94	0.94	1.89
2007	0.94	1.94	0.94	1.96	0.94	1.94	0.94	2.03	0.94	1.77
2008	0.94	1.89	0.94	1.89	0.94	1.88	0.94	1.94	0.94	1.89
2009	0.94	1.89	0.94	1.90	0.94	1.87	0.94	1.92	0.94	1.77
2010	0.94	1.87	0.94	1.87	0.94	1.85	0.94	1.88	0.94	1.83
2011	0.94	1.91	0.94	1.92	0.94	1.91	0.94	1.98	0.94	1.89
2012	0.94	1.86	0.94	1.87	0.94	1.85	0.94	1.89	0.94	1.77
2013	0.94	1.93	0.94	1.94	0.94	1.88	0.94	1.92	0.94	1.77
2014	0.94	1.88	0.94	1.88	0.94	1.86	0.94	1.89	0.94	1.77
2015	0.94	1.93	0.68	1.93	0.94	1.91	0.94	1.98	0.94	1.77

Source: Mass balance model outputs, median is from the median model, 95th percentile is from the conservative model. No exceedances of the median (2.4 g/m^3) or 95th percentile (3.5 g/m^3) guideline values.

6.4.4.6 Nutrients and Periphyton

Elevated nutrient concentrations in surface water bodies can cause eutrophication of the system and result in the development of nuisance aquatic plant growths (such as periphyton). Periphyton is an essential part of a healthy river ecosystem, but when it proliferates it can become a nuisance from an amenity perspective and can alter the habitat for aquatic macroinvertebrates and increase fluctuations in dissolved oxygen.

The development of nuisance growths is dependent on a number of factors including nutrient concentrations, the time period between flood events (known as the accrual period), the amount of sunlight irradiation, type of river bed (cobble vs silt bottom) and shading of the environment. In addition, overall nutrient loads to waterways provide a means of assessing long term impacts.

Nutrient Guidelines

Due to complexity regarding the development of periphyton growth (multiple factors involved) it is difficult to define appropriate concentrations of nutrients to protect the system from eutrophication and nuisance growths. In addition, many streams and rivers in New Zealand currently have concentrations of nutrients that would frequently exceed any of the available guideline values.

A number of nutrient values were considered as part of the current study with guidance taken from the NIWA review of instream plant and nutrient guidelines (NIWA, 2016 and 2012). The NIWA documents highlight the following issues with respect to using numerical guidelines for nutrients (nitrogen and phosphorous species) to assess water quality:

- The ANZECC (2000) guidelines for nutrients are based on the 20th and 80th percentiles of nitrogen and phosphorus species measured in New Zealand lowland and highland streams and are therefore not effects based; and
- The New Zealand periphyton guidelines (MfE, 2000) were developed to determine conditions required to prevent excessive growth of periphyton cover. According to NIWA (2016) these guidelines are considered to be worst case and are highly conservative.

In the NIWA review document (NIWA, 2016) less conservative nutrient guidelines were developed. These guidelines were developed to provide >85% compliance with the existing MfE (2000) periphyton guidelines based on both coverage during the growth season and angler acceptability.

As previously stated, Donald Creek upstream of the site has elevated nutrient concentrations frequently above guideline levels. Therefore, for comparative purposes only, the DIN and DRP guidelines corresponding to less than 120 mg/m^2 periphyton cover representing “good” water quality for angling, have been used in the assessment.

Periphyton guidelines

The NZ periphyton guideline (NIWA, 2000) has set guidelines to maintain ‘trout habitat and angling’ based on biomass and the percent cover of the stream bed. Peak biomass was set at <35 g AFDM/m^2 (Ash Free Dry Mass), or if measured as chlorophyll-a, <200 mg chl-a/m^2 for diatom / cyanobacteria dominated communities, and <120 mg chl-a/ m^2 for filamentous algae dominated communities.

Guidelines for periphyton cover to maintain aesthetic values are periphyton cover <30% long and <60% of streambed covered by diatoms or cyanobacteria >0.3mm thick (NIWA, 2000). These guidelines are commonly simplified by using the index Periphyton Weighted Composite Cover (PeriWCC) and an aesthetic nuisance guideline of PeriWCC 30% (Matheson et al. 2012).

Existing Discharge Effects

The key nutrients with respect to manging nuisance growths in rivers and streams are DRP and DIN. The key receptor impacted by elevated nutrient concentrations in streams and rivers is peripyton. The sections below summarise the DIN, DRP and Peripyton from the monitoring data a full description of the data can be found in Appendices 8 and 11.

Dissolved Inorganic Nitrogen

The upstream DIN concentrations were typically in the range 0.3 g/m^3 to 1.2 g/m^3, while the downstream concentrations were elevated due to elevated DIN concentrations in the discharge, with concentrations typically in the range 0.6 g/m^3 to 1.9 g/m^3 (Table 32).

The upstream DIN concentration was above the DIN periphyton guideline ("good" water quality for angling, NIWA, 2016) 73% of the time, while the downstream DIN concentration was above the guideline 90% of the time. Given the upstream concentrations are frequently above the indicative guidelines these guideline values are only useful to provide context but cannot be used to measure compliance.

Dissolved Reactive Phosphorus

The concentration of DRP upstream of the site was typically between 0.005 g/m^3 and 0.03 g/m^3, while downstream concentrations were elevated due to elevated concentrations in the discharge, with concentrations typically in the range of 0.05 g/m^3 and 0.55 g/m^3 (Table 33).

The upstream DRP concentration was above the DRP periphyton guideline (based on "good" water quality for angling) approximately 50% of the time, while the downstream DRP concentration was above the guideline 100% of the time. Given the upstream concentrations are frequently above the guideline, the guideline value is only useful to provide context and cannot be used to measure compliance.

Periphyton

Upstream of the discharge periphyton biomass is likely to be at least partially controlled by low phosphorus limitation (as concentrations of DRP were below the DRP guideline approximately 50% of the time), however, the concentrations in DIN was usually too high to exert any significant control on periphyton growth. Downstream of the discharge the concentration of DIN and DRP were usually too high to not exert any control on periphyton growth (see discussion in Hamill 2017b).

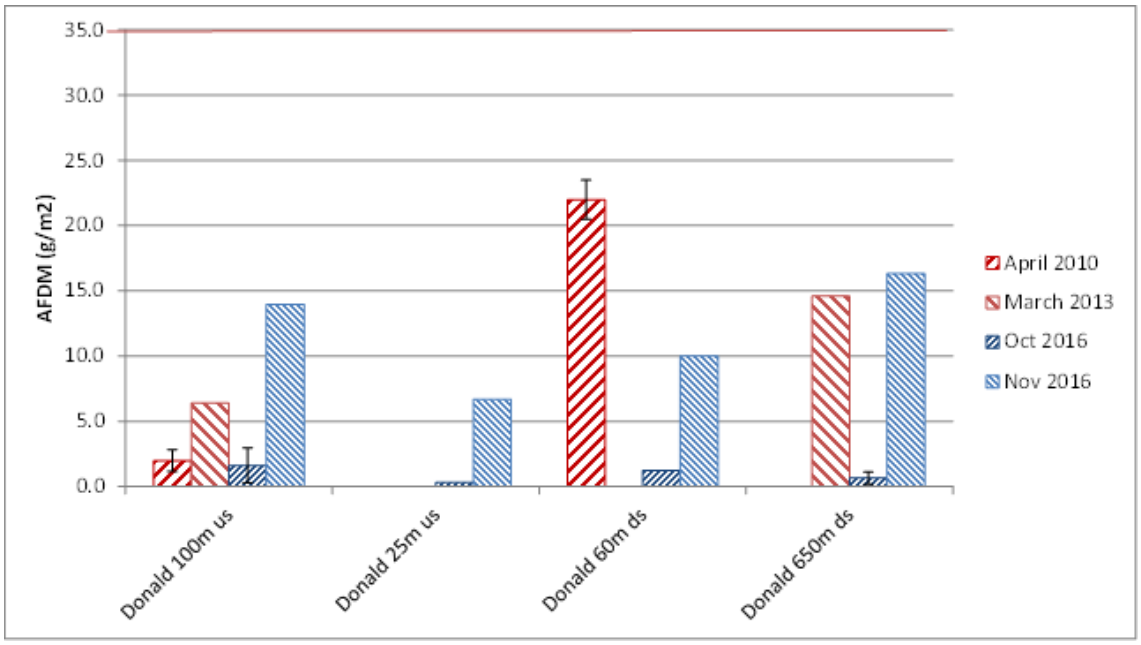
Sampling during April 2010 and March 2013 by Coffey found periphyton cover and biomass was significantly higher downstream of the discharge, particularly at unshaded sites (Figure 23 and Figure 24). Periphyton cover as measured by PeriWCC was in 2010 0.3% upstream and 15% downstream, and in 2013 15% upstream and 38% downstream.

Forbes (2013) sampled periphyton monthly and found all sites were clear of periphyton during November 2012 and that the amount of periphyton cover increased during the summer; particularly at the downstream sites. During April, 'sludge' (medium mats) covered about 10% of the bed and coarse filamentous green algae covered almost 20% of the bed at the 160 m downstream site. The highest periphyton biomass was recorded at the 160 m downstream site during February at 138 mg chlorophyll-*a*/m^2 and 42 g AFDM/m^2. This was the only occasion where the periphyton exceeded the periphyton guidelines for protection of trout habitat (NIWA, 2000).

The October and November survey found a small increase in cover (e.g. PeriWCC in November 1% upstream and 8% downstream). There was little or no difference in periphyton biomass between upstream and downstream as measured by AFDM but there was an increase in November based on chlorophyll-*a* measurements (i.e. 45 mg/m^2 upstream and 110 mg/m^2 downstream). The downstream sites were still within guideline values for protection of trout habitat (Figure 23 and Figure 24).

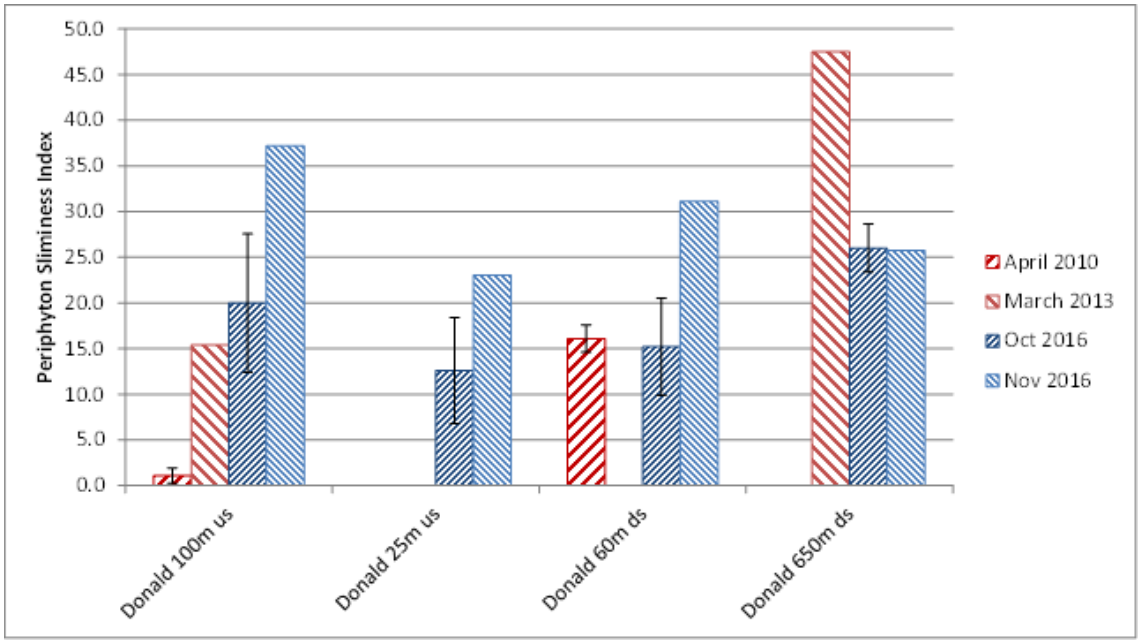
Therefore, in summary based on the ecological surveys to date, the discharge is causing an increase in periphyton biomass at the downstream site above guideline values in summer, and this effect would be considered significant. However, although there was a measurable increase in periphyton biomass downstream of the discharge in winter, guideline values were not exceeded and the effect would be considered less than minor during winter.

Figure 23: Periphyton biomass in Donald Creek measured as Ash Free Dry Mass



Notes: The AFDM for October 2016 was estimated from chlorophyll-*a* samples. The guideline for protection of trout habitat is 35 g/m^2 (NIWA, 2000).

Figure 24: Periphyton cover as measured by the Periphyton Sliminess Index



Notes: In March 2013 no periphyton was found at the 25m upstream site due to heavy shading, and none at the 60m downstream site due to deposition of phytoplankton.

Discharge Effects Stage 1A to 2B

The assessment of the potential future effects of nutrients on Donald Creek water quality was undertaken using modelled Creek flow (Appendix 8), discharge flow (Table 21 and Table 22), DIN concentrations and loads (Table 32) and DRP concentration and loads (Table 33).

A key aspect considered in the assessment is that under flood events total displacement of the periphyton communities will occur. It is generally accepted that flood events above 3 times the median flow of a river will result in total displacement of nuisance growths (NIWA, 2000). However, in many rivers, particularly those with small substrate like Donald Creek scouring can occur during lower flow events. The predicted effects on nuisance growths is summarised in the sections below.

<u>Stage 1A</u>

The model predicts no significant change in flow regime, DRP and DIN concentrations and loads, and periphyton growth is likely to be similar to the existing scenario with a significant effect in summer.

<u>Stage 1B</u>

Under Stage 1B the overall discharge to the Creek will be reduced to ~56% of the current flow with approximately 5% of the volume discharging in summer. In addition, the discharge will occur 24% of the time at above 2 x median flow and 13% of the time above 3 x median flow, at these times of high flow there is less opportunity for it to stimulate periphyton growth

There will also be significant reductions in DRP and DIN concentrations and loads as a result of the changes in discharge. The summer median DIN concentration is predicted to be similar to the background concentrations, while the winter median concentration will only have a minor decrease in comparison to the existing scenario. It is predicted there will be a 35% reduction in annual DIN load.

The median summer DRP concentration is predicted to be similar to the background median concentration (0.013 g/m^3) and a 53% reduction in DRP load is predicted. During Stage 1B the median winter DRP concentration is predicted to decrease from the existing scenario (0.094 g/m^3) to 0.061 g/m^3.

When discharges occur during low flow conditions they will stimulate periphyton growth. However, there will be long periods of time during summer when no discharge is occurring and periphyton cover and biomass is expected to stay within guideline values. Discharges will occur more frequently in winter, and downstream DRP concentrations will be higher, but the rate of periphyton growth is slower during winter and long periods of accrual are rare. Based on past sampling periphyton cover and biomass during winter is expected to stay within guideline values for protection of trout habitat. Overall the effects are expected to be minor but monitoring is recommended during this phase.

Stage 2A

Stage 2A would result in a further decrease in flows discharged to the Creek and a further decrease in DIN and DRP concentrations and loads in the discharge. However, it is expected that the potential for periphyton growth will be similar to Stage 1B, that is minor.

Stage 2B

Once Stage 2B is operational, discharge will only occur during July and August where higher stream flows occur and temperatures are low resulting in decreased potential for periphyton growth. The WWTP discharges to the Creek less than 5% of the time, 75% of discharges occur while the Creek is above 3 x the median flow and over 90% of the discharges occur at 2 x median flow.

The summer and winter median DIN and DRP concentrations are predicted to be similar to background concentrations. The annual DIN and DRP loads discharged to the Creek are estimated to reduce by 70% and 92% respectively.

The occasional winter discharges may influence periphyton growth rates, but in the context of frequent winter floods, scouring, variable shading and invertebrate grazing the overall effect on periphyton biomass or cover is expected to be minor or less for Stage 2B.

Table 32: Summary of DIN measured and modelled values – summer and winter

Scenario	Summer		Winter		Full Dataset		
	Median (g/m^3)	95th percentile (g/m^3)	Median (g/m^3)	95th percentile (g/m^3)	Exceedance of guideline (%)	Annual Load (t/year)	Reduction in Annual Load (%)
Measured upstream	0.69	1.0	0.98	1.8	72		
Measured downstream	1.2	2.7	1.6	2.4	95		
Existing – modelled	1.1	3.3	1.3	3.3	100	4.5	
Stage 1A – Modelled	1.1	3.2	1.3	3.4	100	4.4	1.8
Stage 1B – Modelled	0.69	1.4	1.2	3.3	100	2.7	40
Stage 2A – Modelled	0.69	1.0	1.2	3.3	100	2.3	48
Stage 2B – Modelled	0.69	1.0	0.98	3.3	100	0.47	89

Table 33: Summary of DRP measured and modelled values – summer and winter

Scenario	Summer		Winter		Full data set		
	Median (g/m^3)	95th percentile (g/m^3)	Median (g/m^3)	95th percentile (g/m^3)	Frequency of guideline exceedance (%)	Annual Load (t/year)	Reduction in Annual Load (%)
Measured upstream	0.013	0.036	0.011	0.031	49		
Measured downstream	0.22	0.95	0.094	0.45	100		
Existing – modelled	0.21	1.0	0.082	0.45	100	1.0	
Stage 1A – Modelled	0.19	1.0	0.082	0.48	100	0.97	4.9
Stage 1B – Modelled	0.013	0.18	0.061	0.40	95	0.48	53
Stage 2A – Modelled	0.013	0.036	0.053	0.41	88	0.41	60
Stage 2B – Modelled	0.013	0.036	0.011	0.24	53	0.08	92.1

Source: SWDC monitoring data and Appendix 8

6.4.4.7 Biochemical Oxygen Demand and Heterotrophic Growths

Heterotrophic growths (also referred to as sewage fungus) are a combination of heterotrophic bacteria and fungi that attach to substrate in the stream bed, these growths can adversely effect the recreational and ecological values of water bodies. Heterotrophic growths require organic matter to grow and it is commonly accepted that the most critical water quality monitoring parameter for managing heterotrophic growths is soluble carbonaceous biochemical oxygen demand ($scBOD_5$). Aquanet (2013) reviewed the guidelines used for management of sewage fungus in New Zealand and identified that a guideline of less than 2 g/m^3 of $ScBOD_5$ was commonly used, this guideline has been applied in this assessment.

Effects of Existing Discharge

The site has been monitoring the Total BOD_5 for many years, however, $scBOD_5$ has not been routinely monitored. The concentration of Total BOD_5 was 3 g/m^3 or below in all upstream samples (Figure 25). The concentration Total BOD_5 downstream of the discharge was highly variable with concentrations between <1 g/m^3 and 17 g/m^3 with all but one sample having a concentration of less than 9 g/m^3.

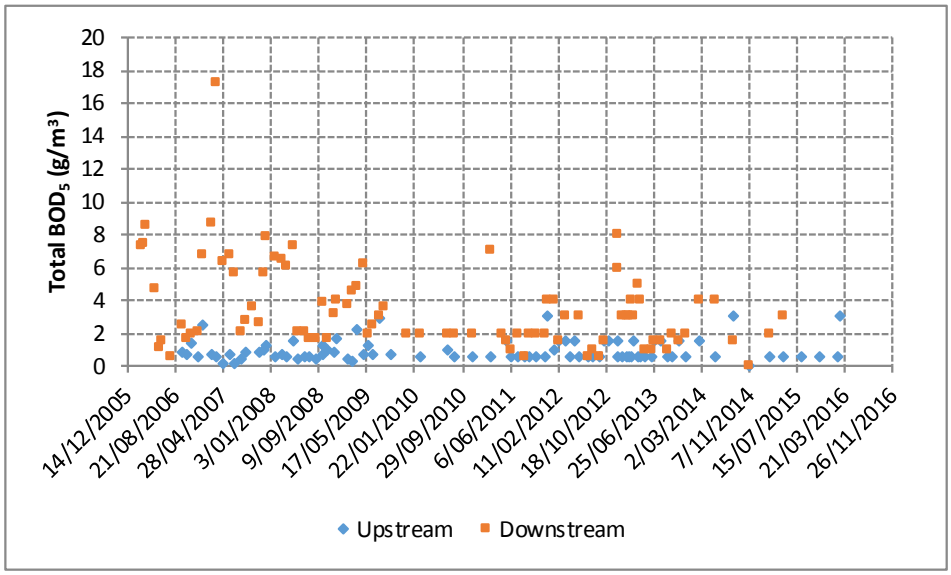
In order to fill the gap in the monitoring data a series of grab samples were made in 2016 and 2017 (Table 34), based on this data $scBOD_5$ was between 8% and 16% of the Total BOD_5 in the discharge and between 3 and 25% at the downstream site. Based on this the $scBOD_5$ concentration downstream of the site would at times exceed the guideline value of 2 g/m^3 and there would be potential for heterotrophic growths. This is consistent with the results of ecological surveys which found no heterotrophic growths during spring (Oct and Nov) but a small amount (5% cover) of heterotrophic growths during low flow conditions in late summer (April 2010 and March 2013).

Table 34: Comparison of BOD fractions in the discharge, upstream and downstream of the site

Sample/ Date	$TBOD_5$ (g/m^3)	$sBOD_5$ (g/m^3)	$cBOD_5$ (g/m^3)	$ScBOD_5$ (g/m^3)	Fraction of scBOD of $TBOD_5$ (%)
Discharge					
26/10/2016	22	<3	NA	NA	
27/10/2016	21	<3	NA	NA	
6/12/2016	37	<6	25	6	16
30/01/2017	32	3	20	3	9.4
31/01/2017	36	3	20	3	8.3
1/02/2017	26	3	25	3	12
Upstream					
24/11/2016	<1	<1	<1	<1	
30/01/2017	<1	<1	<1	<1	
31/01/2017	1	<1	1	<1	
1/02/2017	<1	<1	<1	<1	
Downstream					
24/11/2016	4	<1	4	1	25
30/01/2017	7	2	5	1	14
31/01/2017	34	1	20	1	2.9
1/02/2017	5	<1	3	<1	20[1]

Source: SWDC Monitoring. [1] Assuming sample was at detection limit (1 g/m^3)

Figure 25: TBOD5 upstream and downstream of the discharge



Source: SWDC Monitoring Data

Discharge Effects Stage 1A to 2B

The assessment of the potential future effects of BOD_5 on Donald Creek water quality was undertaken using modelled Creek flow, discharge flow and Total BOD_5 concentrations in the

discharge (Appendix 8). This is considered highly conservative as the guideline value is based on scBOD$_5$, which is estimated to be approximately 25% of the downstream total fraction.

As with the nutrient assessment discussed above, a key aspect considered in the assessment is that flood events remove heterotrophic growths. It is generally accepted that flood events above 3 times the median flow of a river will result in total displacement of nuisance growths (NIWA, 2000). However, it is likely that lower flow events will result in some removal of heterotrophic growths from a river bed. The predicted effects on nuisance growths is summarised below.

Stage 1A

The model predicts (Table 35) no significant change in flow regime or BOD$_5$ concentration and load, and the presence of heterotrophic growths is likely to be similar to the existing scenario with heterotrophic growths present during parts of the summer.

Stage 1B

Under Stage 1B the overall discharge to the Creek will be reduced to ~56% of the current flow with less than 5% of the volume discharging in summer. In addition, the discharge is modelled to occur 23% of the time at above 2x median flow and 13% of the time above 3 x median flow, at these times of high flow there is little or no opportunity for it to stimulate heterotrophic growths.

There will also be significant reductions in BOD$_5$ concentration and loads as a result of the changes in flow. The summer median BOD$_5$ concentration is predicted to be similar to the background concentrations, while the winter median concentration will only have a minor decrease in comparison to the existing scenario. It is predicted there will be a 47% reduction in annual Total BOD$_5$ load.

The reduction in the load and concentration of Total BOD$_5$ from Stage 1B will reduce the opportunity for heterotrophic growths to occur. It will be rare for there to be extended periods of time (e.g. > 7 days) under low flow conditions with scBOD greater than 2 mg/L. Therefore the overall effects are expected to be minor but monitoring is recommended during this phase.

Stage 2A

Stage 2A would result in a further decrease in flows discharged to the Creek and a further decrease in BOD$_5$ concentration and load in the discharge. However, it is expected that the potential for heterotrophic growths will be similar to Stage 1B, that is minor.

Stage 2B

Once Stage 2B is operational, discharge only occurs during July and August when higher stream flows occur and temperatures are low resulting in decreased potential for heterotrophic growth. The WWTP discharges to the Creek less than 5% of the time, of which 75% of discharges occur while the Creek is above 3 x the median flow and over 90% of the discharges occur at 2 x median flow.

The summer and winter median Total BOD$_5$ concentrations are predicted to be similar to background concentrations. The annual Total BOD$_5$ load discharged to the Creek is estimated to reduce by 94% compared to the current situation.

As a result of the changes in flow, Total BOD$_5$ loads and concentrations, the development of heterotrophic growth as a result of the discharge will be unlikely and the effects would be less than minor for Stage 2B.

Table 35: Measured and modelled Total BOD5 concentrations

Scenario	Summer		Winter		Full dataset	
	Median	95th percentile	Median	95th percentile	Annual Load	Reduction in Annual Load
	(g/m^3)	(g/m^3)	(g/m^3)	(g/m^3)	(t/year)	(%)
Measured upstream	0.60	1.7	0.58	2.8		
Measured downstream	4.0	8.4	2.0	6.1		
Existing – modelled	2.5	8.8	1.6	3.0	12.6	
Stage 1A – Modelled	2.2	8.7	1.6	3.0	12.1	3.5
Stage 1B – Modelled	0.60	2.7	1.3	2.9	6.7	47
Stage 2A – Modelled	0.60	1.68	1.0	3.1	3.8	69
Stage 2B – Modelled	0.60	1.68	0.58	2.9	0.76	94

Source: SWDC monitoring data and Appendix 8

6.4.4.8 Pathogens

The measurement of pathogens in wastewater is difficult as they only occur intermittently and can have health impacts at numbers lower than some detection limits. Therefore, the monitoring and assessment of pathogens in water bodies is carried out using indicator species. In the case of surface waters, the MfE (2003) *"Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas",* states the key indicator for monitoring microbiological quality of freshwater environments is *E.Coli* . These same MfE guidelines include trigger values as follows:

- Green Mode - acceptable for recreation: no single sample above 260 E/Coli/100mL; below this value there is an estimated risk of infection from Campylobacter of less than 1%.
- Red Mode: - not acceptable for recreation: a single sample above 550 E.Coli/100mL; above this value there would be a significant risk (>5%) of infection from Campylobacter.

In addition the NPS-FM national bottom line and PNRP prescribes an annual median of 1,000 *E.Coli*/ 100mL for secondary contact recreation. Aquanet recommend a guideline of <550 *E.Coli*/100mL for protection of stockwater. These guidelines are also considered in the assessment.

Existing Discharge Effects

The number of *E.coli* upstream of the discharge was elevated above the Green Mode guideline 53% of the time and the Red Mode guideline 23% of the time (Figure 26) but met the NPS-FM bottom line and PNRP guideline. Therefore, compliance downstream of the site has been assessed based on discharge values and changes to downstream values.

The number of *E.Coli* upstream of the discharge and downstream of the discharge was highly elevated prior to 2011. Since 2011, following installation of the UV treatment plant, the *E.Coli* numbers have decreased both in the discharge and downstream of the discharge (Figure 26). After 2011 the discharge exceeded the "Green Mode" guideline on 3 occasions (out of 20 samples) and the "Red Mode" guideline twice, but overall has met the PNRP guideline for secondary contact recreation (Table 36). Of the three exceedances of the Green Mode guideline only one exceedance resulted in an exceedance of Red Mode downstream of the discharge (12th April 2013, 7000 *E.Coli* cfu/100mL). On the other two occasions the *E.Coli*

numbers downstream of the discharge were lower than upstream and exceeded the Green Mode guideline.

Donald Creek is not considered to be of high recreational value, bathers are not common and the discharge usually complies with both the Green and Red guidelines and meets the objectives of the PNRP. However, there is still potential for the downstream *E.Coli* numbers to exceed the Red Mode guideline where there would be an increased risk of infection and the existing effect is considered more than minor.

Table 36: Summary of discharge exceedances of E.Coli

Date	Discharge	Upstream	Downstream
19 November 2012	**820**	550	320
12 April 2013	**2100**	400	**7000**
22 February 2016	470	380	320

Source: SWDC Monitoring data

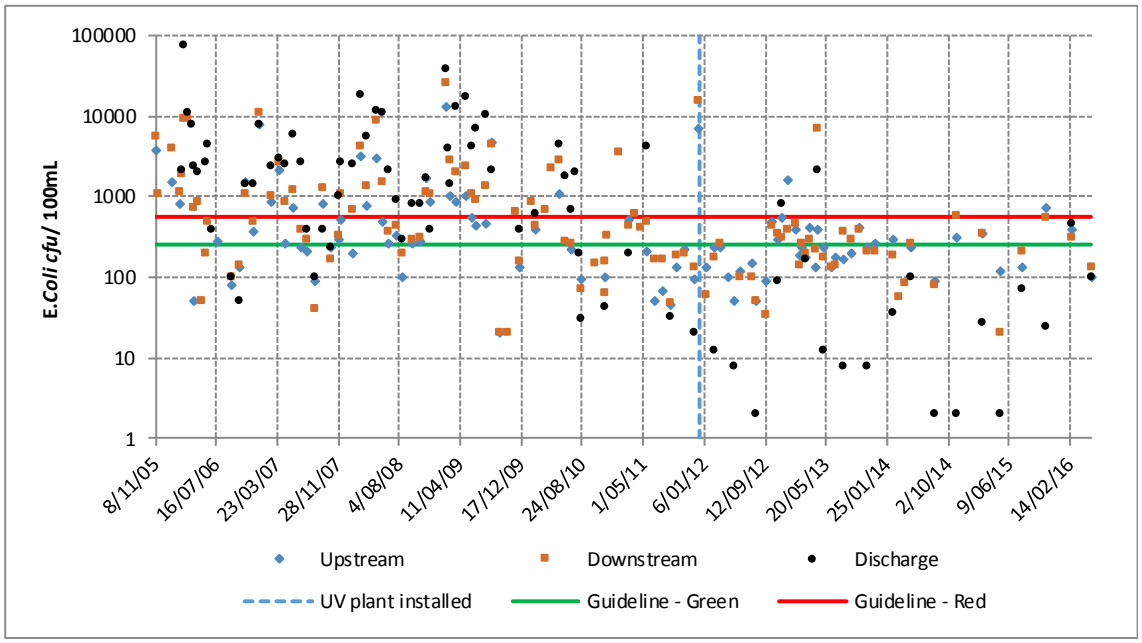
Discharge Effects Stage 1A to 2B

During Stage 1A there is no significant change in discharge regime compared to the current situation and the effect of pathogens is considered the same as current.

During Stage 1B and Stage 2A the discharge volume is reduced considerably and a majority of the discharge occurs during winter when recreational activities in Donald Creek are less likely. However, there is still some potential for *E.Coli* numbers to exceed the Red Mode guideline and the effect of the discharge on pathogens downstream of the discharge would still be considered minor to moderate.

During Stage 2B, discharge to Donald Creek is ~6% of the current discharge and the discharge only occurs in July and August, when contact recreation is unlikley. In addition in some years modelled there would be no discharge to Donald Creek. However, based on the current monitoring data there would still be some potential for the downstream *E.Coli* numbers to exceed the Red Mode while the discharge is occuring and the effect of the discharge on pathogens downstream of the discharge would be considered minor.

Figure 26: E.Coli in the discharge, upstream and downstream in Donald Creek



Source: SWDC Monitoring data

6.4.4.9 Visual Clarity and Colour

Visual clarity of a water body is of importance for water bodies that are used extensively for bathing, and the MfE (1994): *"Water Quality Guidelines No. 2: Guidelines for the Management of Water Colour and Clarity"* recommend a guideline for clarity of greater than 1.6 m (as measured using a black disc) for waters used for recreational purposes. The MfE (1994) guidelines also indicate that a change in clarity by 30% or more is typically detectable by most people.

Aquanet (2013) also provide guidance with respect to water clarity for protection of aquatic ecosystems. For a Class C6c[115] water body such as Donald Creek, Aquanet (2013) recommends the visual clarity remain above 0.5 m with a less than 33% change downstream of a discharge. This latter recommendation is prescribed in Policy 71 of the notified PNRP.

Although the above guidelines have been used in the assessment it should be noted that Donald Creek is not known to be a common location for bathing and the MfE guideline may not suitable for assessment of future compliance.

Existing Discharge Effects

The visual clarity of the upstream site was between 1.1 and 3.5 m, and was greater than the MfE recreational guideline (1.6m) 84% of the time and always above the Aquanet (2013) guidance for protection of aquatic ecosystems for a class C6c River (0.5m) (Figure 27).

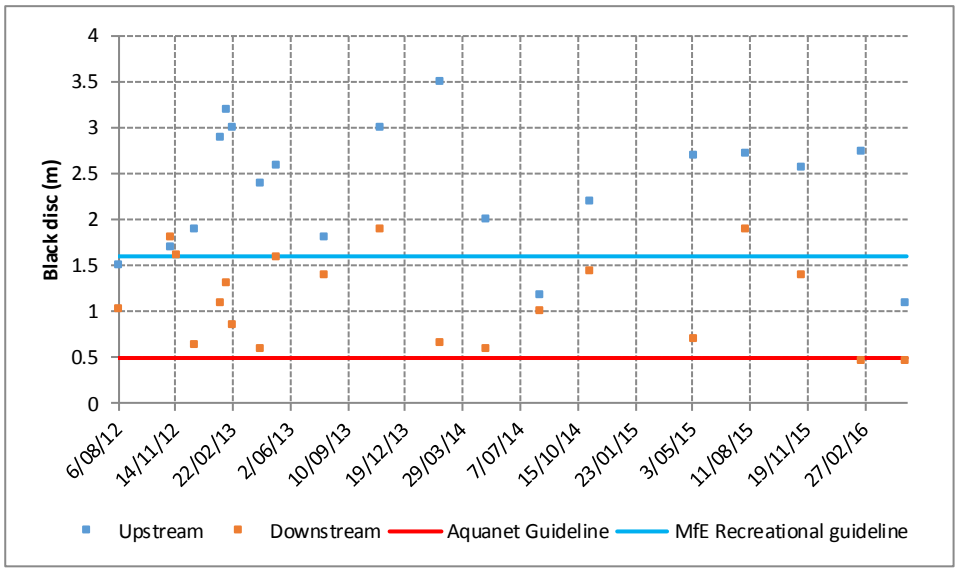
The downstream had lower visual clarity than upstream on all but one occasion, with clarity of between 0.45 m and 1.9 m. The downstream site had clarity greater than 1.6 m 4% of the time and greater than the Aquanet recommendations 90% of the time. The reduction in visual clarity downstream of the discharge was greater than 33% (the PNRP P71 water quality standards)

[115] This river classification system has been since superseded with that presented in the PNRP.

74% of the time. Overall the current discharge is having a significant effect on the visual clarity of Donald Creek (Figure 28).

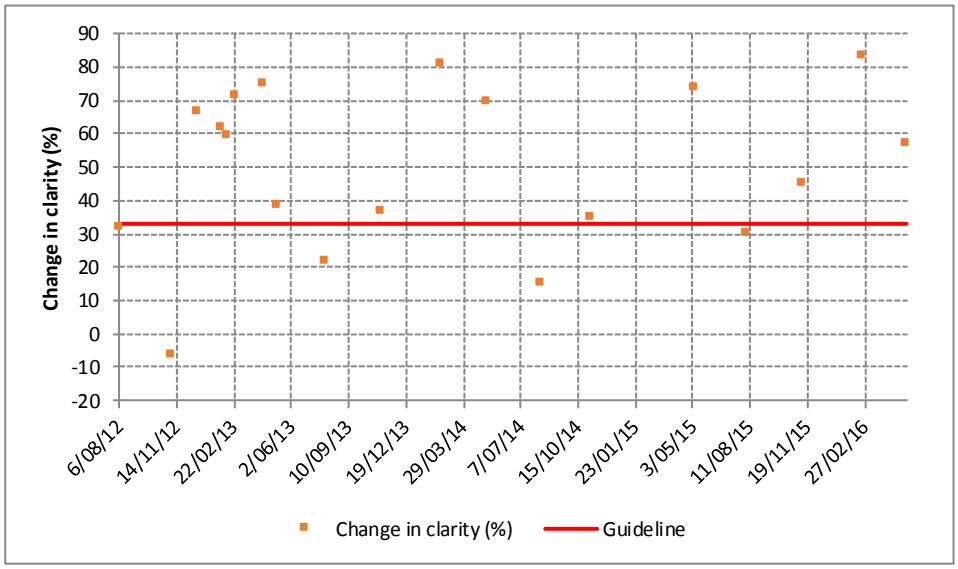
In addition, the discharge is at times visibly green due to the presence of algae and as a result Donald Creek downstream of the discharge has, been observed to have a green colour during summer surveys, but not spring surveys.

Figure 27: Visual clarity of Donald Creek



Source: SWDC monitoring data

Figure 28: Percentage change in visual clarity of Donald Creek (Upstream – Downstream)



Source: SWDC monitoring data

Discharge Effects Stage 1A to 2B

The proposed upgrades to the WWTP are not likely to significantly impact on the amount of suspended material or algae in the discharge. However, as discussed earlier the staged upgrade will result in a significant decrease in discharge to Donald Creek over time.

Stage 1A is predicted to have a similar discharge regime to the existing situation therefore no improvement in visual clarity is likely.

Stage 1B will see the discharge reduced to ~56% of the current volume with the majority of the discharge to occur in winter months (95%) when flows are higher and upstream clarity is likely to be negatively impacted by runoff from the surrounding farm land. This will result in a significant improvement to downstream water clarity and colour during the bathing season.

Stage 2A provides further reduction in discharge to the Creek (~32% of existing discharge volume) compared to Stage 1B with almost all of the discharge occurring during winter (>95%), and therefore will further reduce the effect of the discharge on visual clarity and colour of the Creek.

At Stage 2B the discharge to Donald Creek is greatly reduced and intermittent. The discharge will be ~6% of the current volume and will only occur in July and August. In 3 of the 11 years modelled it is predicted there will be no discharge to Donald Creek and it is predicted that discharge to Donald Creek will occur in July in only 4 years out of 11 years modelled. Therefore, there will be a significant improvement in water clarity compared to the existing situation. There will still be some potential for reduced clarity and change in colour downstream of the discharge, however, this will occur in winter when upstream clarity and colour is likely to be negatively impacted. Therefore the effect of the proposed discharge at Stage 2B on clarity and colour would be considered to be minor.

6.4.4.10 Sediment deposition

The deposition of sediments from point source discharges can have detrimental effects on macroinvertebrate communities due to deposition of bacterial and/or algal cells on the stream bed (Aquanet, 2013).

Existing Discharge Effects

The suspended solids upstream and downstream from the discharge are presented in Figure 29. The upstream and downstream suspended solids concentration sites were typically below 40 g/m^3. The downstream suspended solids concentrations were greater than the upstream concentrations 75% of the time, indicating that the discharge is increasing the suspended solids downstream of the site.

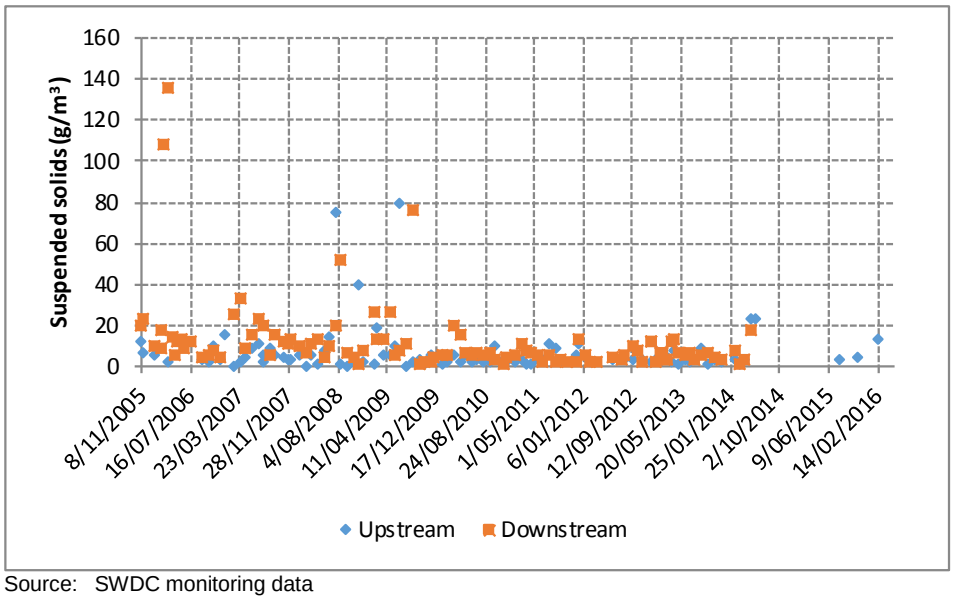
The turbidity at both the upstream and downstream sites was consistently below 12 NTU, with the majority of values below 8 NTU (Figure 30). Turbidity exhibited the same relationship as suspended solids, with the majority of downstream samples exceeding those of the upstream samples on the same day. However, the difference in upstream and downstream turbidity was typically small with differences of less than 2 NTU occurring 70% of the time.

As a result of suspended sediment in the discharge the oxidation pond discharge results in sediment deposition on the stream bed during low flows in summer but not winter. Surveys during October and November 2016 did not find fine sediment deposition attributable to the WWTP discharge (Hamill, 2017a). In contrast, sampling during summer found considerable deposition of fine organic matter on the stream bed from the oxidation ponds. Sites immediately downstream of the discharge had planktonic algae from the oxidation ponds as a scum on

substrate and moss. Planktonic green algae and Daphnia (indicative of an oxidation pond discharge) were common in the benthic invertebrate and periphyton samples (Coffey 2010, Coffey 2013).

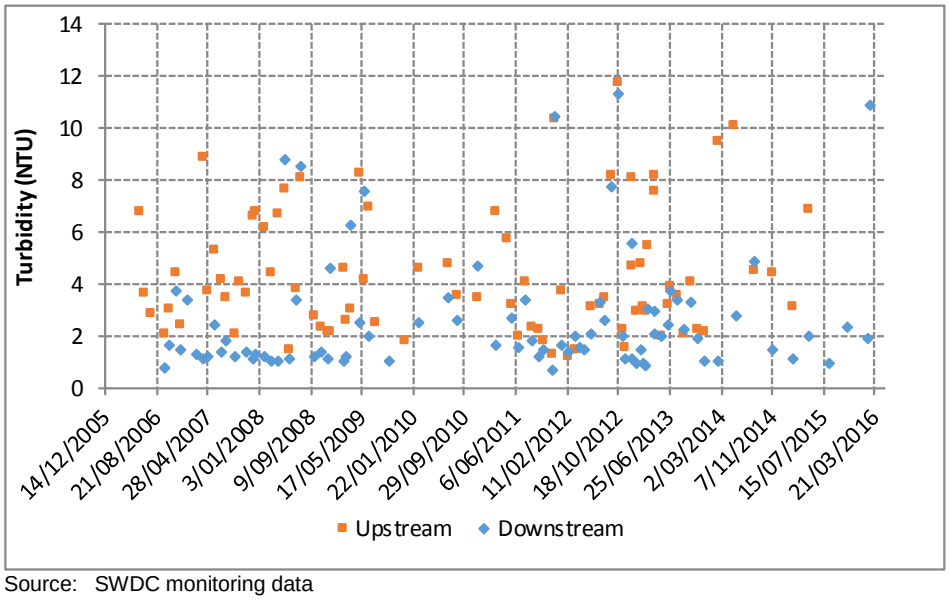
The greater sediment deposition during summer is likely to be related to lower stream flows and more phytoplankton within the effluent.

Figure 29: Suspended solids in Donald Creek



Source: SWDC monitoring data

Figure 30: Turbidity in Donald Creek



Source: SWDC monitoring data

Discharge Effects Stage 1A to 2B

Stage 1A results in no significant difference in discharge volume or quality and the effects of sediment deposition on macroinvertebrate health will be the same as the existing scenario, with significant effects in summer time.

After implementation of Stage 1B the frequency, duration, and volume of discharge to the Creek will reduce considerably, with almost no discharge during summer. This will reduce the potential for sediment deposition to impact on macroinvertebrate health. At this stage the effect on stream macroinvertebrate communities would be considered minor.

When Stage 2B is operational there will be no summer time discharge to the stream, with total discharge volume at ~6% of the current volume occurring primarily when the Creek flows are greater than 2x and 3x median flow. The potential for effects at Stage 2B due to deposition of particulate matter are therefore considered to be less than minor.

6.4.4.11 Foams

Section 107 of the RMA states that a consent authority shall not grant a discharge consent if, after resonable mixing, a contaminant or water discharged (either by itself or in combination with the same, similar, or other contaminants or water) is likely to give rise to the production of any conspicuous oil or grease films, scums or foams or floatable suspended materials.

Existing Discharge Effects

No grease or scums have been observed in Donald Creek and sediment deposition is discussed in Section 6.4.4.10.

However, surveys undertaken during the summer observed foam in Donald Creek as a result of the discharge (Coffey 2010, Coffey 2013), but the surveys undertaken in October and November 2016 found similar amounts of foam at sites upstream and downstream of the discharge (Hamill, 2017). The foam observed during spring was attributed to the breakdown of macrophytes within the stream (Hamill 2017).

Discharge Effects Stage 1A to 2B

The survey results indicate that foam caused from winter discharges will be minor or negligible compared to natural foam in the stream. The foam that has been observed during summer is expected to be minor and negligible after implementation of Stage 1B and beyond due to the short duration of the discharges during summer.

6.4.4.12 Temperature

Aquatic ecosystem physiology and functioning is regulated by temperature. Biota, and physical and chemical processes like oxygen solubility and hydrophobic interactions are sensitive to temperature changes (ANZECC, 2000). Appendix A8.2(2) of the Freshwater Plan, Policy 71 of the PNRP and Schedule 3 of the RMA requires that the natural temperature of the water shall not be changed by more than 3° Celsius[116] or exceed 25°C. There is no specific trigger level regarding temperature variation provided in ANZECC (2000).

Existing Discharge Effects

Summary statistics from 50 paired upstream and downstream surface water temperature measurements taken between 2005 and 2016 are provided below (Table 37). This data

[116] This criteria is also prescribed in the PNRP Policy 71.

demonstrates that the treated wastewater discharge has not been found to affect a significant change (i.e. >3°C) in the water temperature in Donald Creek or result in stream temperatures greater than 25°C.

Table 37: Temperature upstream and downstream of the discharge

Statistic	Upstream	Downstream	Change
Minimum	7.3	7.2	0.0
Mean	13.4	13.4	0.30
Median	13.2	13.2	0.37
Maximum	18.0	19.5	2.30

Source: SWDC monitoring data. Note – change in temperature was calculated for measurements taken on the same day only.

Discharge Effects Stage 1A to 2B

It is expected that following Stage 1A that very little change in terms of effects from the direct discharge to water will be observed. As such the effect of the Stage 1A on stream temperature is considered to be less than minor.

Increased pond hydraulic retention times are expected during and following the proposed network I/I rehabilitation works (from Stage 1 onwards). Even so, this is considered unlikely to have a significant effect on instream temperatures. For example, a 15 day retention time increased to 20 days would have negligible effect on wastewater temperature and therefore instream temperatures following discharge. Furthermore, periods of hot weather are likely to coincide with weather favourable for land treatment. Therefore, effects of the proposed Stage 1B and 2 upgrades on stream water temperature in Donald Creek are considered to be less than minor.

6.4.4.13 pH

Low or high pH can cause direct adverse effects on fish and aquatic insects and pH changes can result in the toxicity of several pollutants to significantly increase (e.g. increased pH increases ammonia toxicity) (ANZECC, 2000). Most natural freshwaters have a pH in the range 6.5 – 8.5 (ANZECC, 2000). Appendix A8.6(3)a of the Freshwater Plan requires that any change in pH shall not be allowed if it has an adverse effect on aquatic life and prescribes an acceptable range between 6.0 - 9.0 units, whilst Policy 71 of the PNRP prescribes a change in pH of no greater than $\pm$ 0.5. Almost all water quality guidelines around the world recommend that pH should be maintained in the range 6.5 to 9.0 to protect freshwater aquatic organisms.

The ANZECC (2000) Guidelines (see page 3.3-17, Table 3.3.10), for physical and chemical stressors, define pH range for slightly modified environments as pH 7.2 to pH 7.8, however, these values are based on the 20th to 80th percentile of monitoring of lowland streams and are not effects based and are not considered appropriate for assessments of effects on water quality.

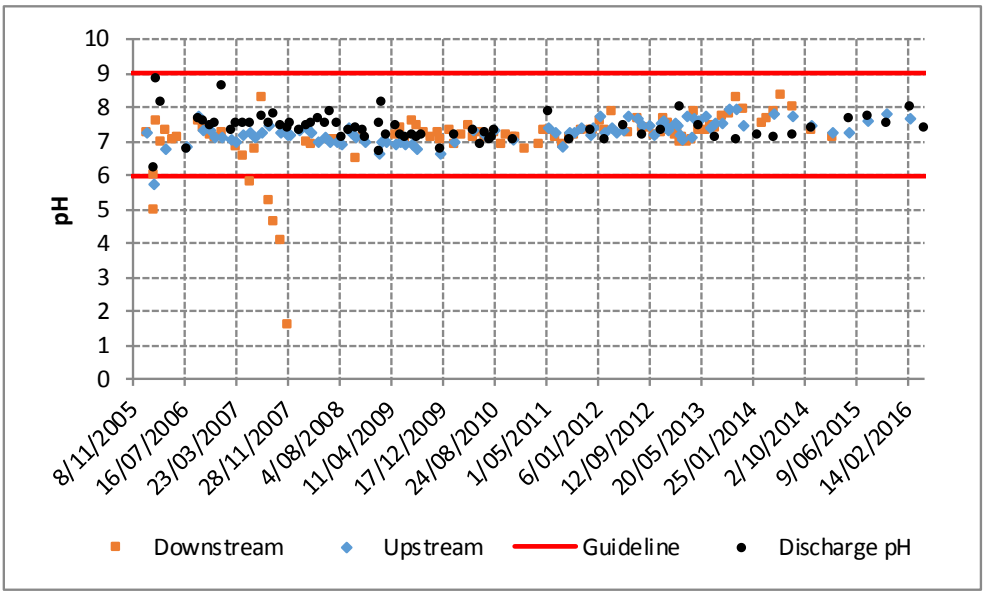
Existing Discharge Effects

The pH upstream and downstream of the discharge and the discharge pH is presented in Figure 31, along with the guideline from the Freshwater Plan of between 6 and 9. The pH in Donald Creek upstream and downstream of the discharge is typically between 6.5 and 8. There was one noncompliance (out of 99 measurements) with the lower pH guideline at the upstream site in 2006 and 6 noncompliance's with the lower pH limit at the downstream site in 2006 and 2007. However, the pH of the discharge was consistently within the 6 and 9 guideline and it is likely that the non-compliances were not as a result of the discharge.

In 2006 and 2007 some low pH values downstream of the site were measured with 4 samples having pH less than of 5 and one less than pH of 2. The reason for these low pH values is unknown but it is likely that they were due to issues with the measuring equipment, as these very low pH values do not fit with the rest of the data and pH below 5 would be unusual for surface waters unless they were receiving a very low pH discharge.

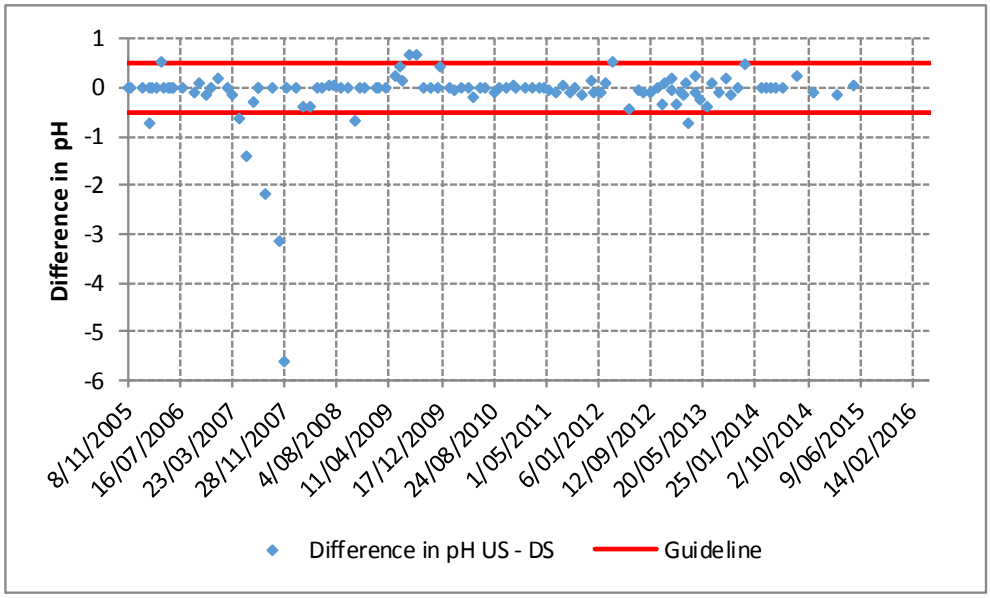
The difference between upstream and downstream pH is presented in Figure 32. The difference in pH between upstream and downstream pH was greater than 0.5 approximately 17% of the time (13 out of 77 measurements). However, the rationale for this guideline is unknown and may not be effects based.

Figure 31: Donald Creek and discharge pH



Source: SWDC monitoring data

Figure 32: Difference between upstream and downstream pH in Donald Creek



Source: SWDC monitoring data

Discharge Effects Stage 1A to 2B

Based on the above, the pH of the discharge for proposed Stage 1A and 1B, is expected to remain the same as the current pH within 6.5 and 9. Therefore any variation outside of the accepted range is unlikely to be a result of the discharge and the effect of the discharge on downstream pH is likely to be minor or less than minor.

During and following the proposed network I&I rehabilitation works (Stage 2A and 2B) the wastewater entering the plant will become less diluted and the hydraulic retention time in the ponds should increase. As pH is directly linked to algae growth, it is not possible to model the potential effect of the I&I rehabilitation work directly on pH with any certainty. It has been assumed that the nutrient loads entering the ponds are likely to be similar or slightly less pre and post I&I works (i.e. reduced flows but increased concentrations as a result of less dilution), therefore algal growth is expected to remain similar to what is currently occurring (i.e. algae growth limited by the mass load of nutrients entering the plant). Some seasonal fluctuations in pH are expected (i.e. more conducive environmental conditions for algae growth in summer), however the effect on pH is likely to be minimal and the pH of the discharge is likely to remain between 6 and 9 and will not negatively impact on downstream pH.

As with the existing discharge there will be some potential for the difference between upstream and downstream of the discharge to be greater than 0.5 pH units. However, as stated above the rationale regarding this guideline is unknown and it is recommended that the effects on water quality be assessed using the pH range in the Freshwater Plan of between 6 and 9.

Overall the discharge to the Creek will reduce considerably from Stage 1B onwards and the impacts on pH downstream of the discharge is considered to be less than minor.

6.4.4.14 Dissolved Oxygen

Dissolved oxygen (DO) is required for the majority of aquatic plants and animals, and therefore depleted oxygen levels in aquatic systems can be harmful for aquatic life. The introduction of organic matter in wastewater discharges can result in depletion of oxygen levels as aquatic bacteria consume the organic matter using oxygen in the process.

There are two measurements of importance to assessing the dissolved oxygen content of aquatic systems, that is the absolute concentration (in g/m^3) and the percentage of saturation. It should be noted that the DO saturation was calculated and presented in Figure 34 using the measured DO concentration and temperature in the stream and was not measured in the field.

The NPS-FM states a national bottomline of 4 g/m^3 DO based on a daily minimum and a guideline for an Attribute State B river as a daily minimum of 5 g/m^3. The Freshwater Plan states that discharges of contaminants to surface water should not result in a drop in DO below 5 g/m^3. The PNRP targets a 7-day mean minimum DO concentration of no lower than 5 g/m^3 and a daily minimum of no lower than 4 g/m^3. In addition, the RMA and the Freshwater Plan also state that the percentage saturation of a water body should not be allowed to drop below 80%. These guideline values have been used in the following assessment.

Existing Discharge Effects

The DO of the upstream site was consistently above the DO concentration guidelines with a minimum value of 6.3 g/m^3 (Figure 33). The downstream DO concentration was consistently above the natural bottomline value of 4 g/m^3 but below the State B attribute value of 5 g/m^3 on

one occasion out of 71 measurements. The discharge is therefore having a less than minor effect on DO concentration.

The percentage saturation was calculated based on the measured temperature and calculated theoretical 100% saturation value. The upstream DO saturation was below the RMA and Freshwater Plan guideline of 80% saturation 14% of the time (Figure 34). The downstream DO saturation was typically lower than upstream, but the differences were typically less than 10%. The downstream DO was below 80% for 24% of the time and it is possible that the discharge is having a minor effect on reducing DO saturation of Donald Creek.

Figure 33: Dissolved oxygen concentration upstream and downstream of the discharge

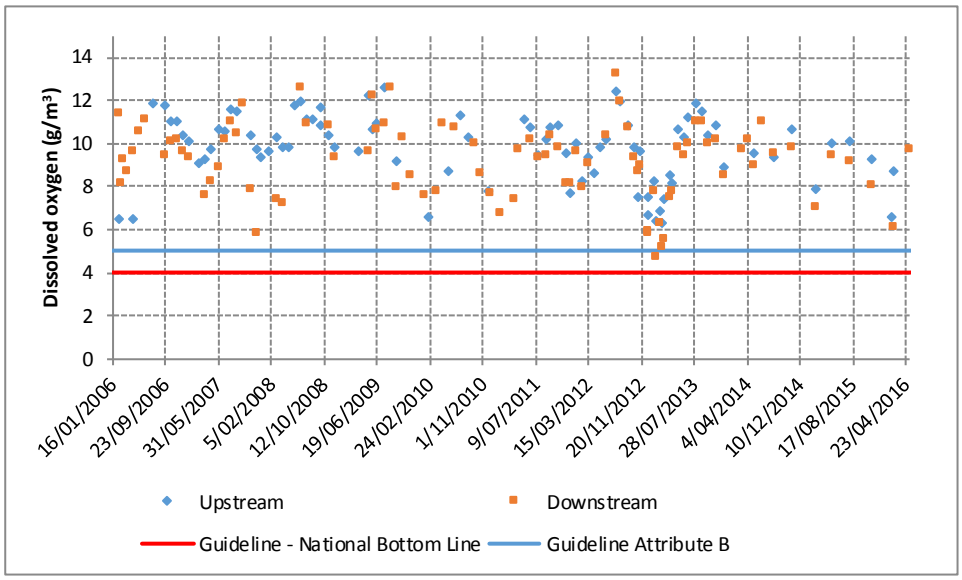
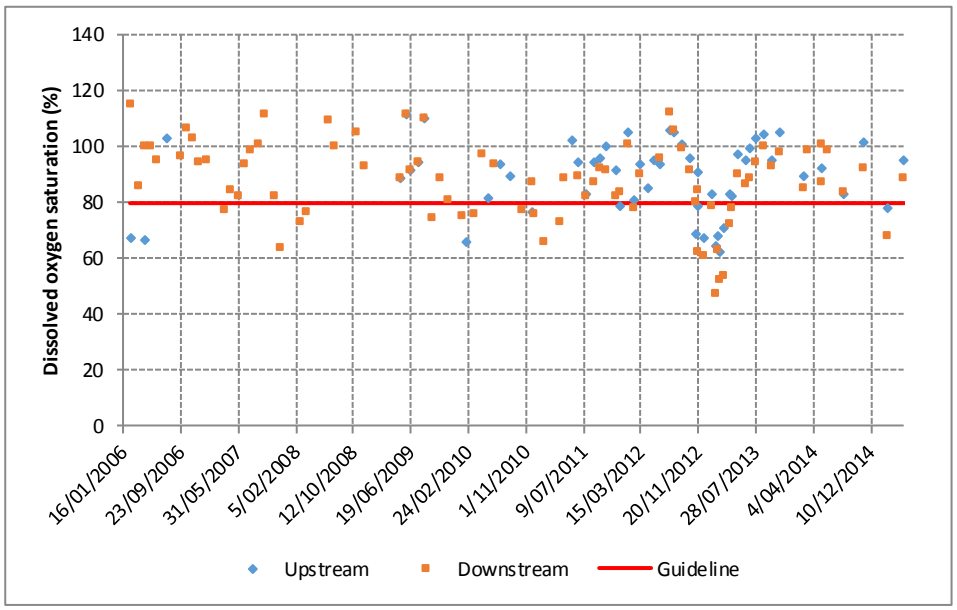


Figure 34: Dissolved oxygen saturation upstream and downstream of the discharge



Discharge Effects Stage 1A to 2B

The proposed upgrades to the WWTP are not likely to significantly impact on the concentration of organic matter in the discharge. However, as discussed earlier the staged upgrade will result in decreased discharge to Donald Creek over time.

Given the current effect on DO concentration is less than minor the effect of the discharge on DO concentration will be less than minor during all stages of the development.

In terms of DO saturation, Stage 1A is predicted to have a similar discharge regime to the existing situation, and thus is likely to have a potentially minor impact on DO saturation.

Stage 1B will see the discharge to the Creek reduced to ~56% of the current volume and the potential for impacts on DO saturation would be minor or less than minor.

Stage 2A provides further reduction in discharge to the Creek (~32% of existing discharge volume) and any impact on DO saturation is likely to be further reduced.

At Stage 2B the discharge to Donald Creek is greatly reduced and intermittent. The discharge will be ~6% of the current volume and will only occur in July and August. In 3 of the 11 years modelled there will be no discharge to Donald Creek and it is predicted that discharge to Donald Creek will occur in July in only 4 years out of 11 years modelled. Therefore, there will be a significant reduction in organic matter discharged to the Creek and the effect of the discharge on DO saturation is likely to be less than minor.

6.4.4.15 Macroinvertebrate Community Composition

The structure and composition of macroinvertebrate communities is a commonly used indicator of river condition. The presence and abundance data of invertebrate taxa can be summarised in different ways to assess ecological condition. Common indices are taxa richness, EPT abundance, Macroinvertebrate Community Index (MCI) and the Quantitative Macroinvertebrate Community Index (QMCI). The MCI and QMCI reflect the sensitivity of the macroinvertebrate community to pollution and habitat change, with higher scores indicating higher water quality. Generally accepted water quality classes for different MCI and QMCI scores and soft-bottomed version are shown in Table 38.

Table 38: Suggested quality thresholds for interpretation of the MCI & QMCI:

Quality Class	Description	MCI	QMCI
Excellent	Clean water	> 120	> 6.0
Good	Doubtful quality or possible mild pollution	100 – 120	5.0 - 6.0
Fair	Probable moderate pollution	80 – 100	4.0 – 5.0
Poor	Probable severe pollution	< 80	< 4.0

Source: Stark (1998)

Objective 25 also prescribes a number of aquatic ecosystem health and mahinga kai objectives including for River 4 and 5 classes such as Abbot Creek and Donald Creek. MCI targets of $\geq$110 and $\geq$100 respectively (based on a rolling median of a minimum of three years of annual samples collected during summer or autumn). In addition, Policy 71 of the PNRP prescribes water quality standards for point source discharges whereby the point below a discharge shall not result in a decrease in QMCI of more than 20% when compared to upstream.

Existing Discharge Effects

Upstream of the discharge Donald Creek has MCI and QMCI scores indicative of 'poor' to 'fair' ecological condition (MCI scores of 70 to 98, QMCI scores of 2.7 to 4.6) (Figure 35 and Figure 36).

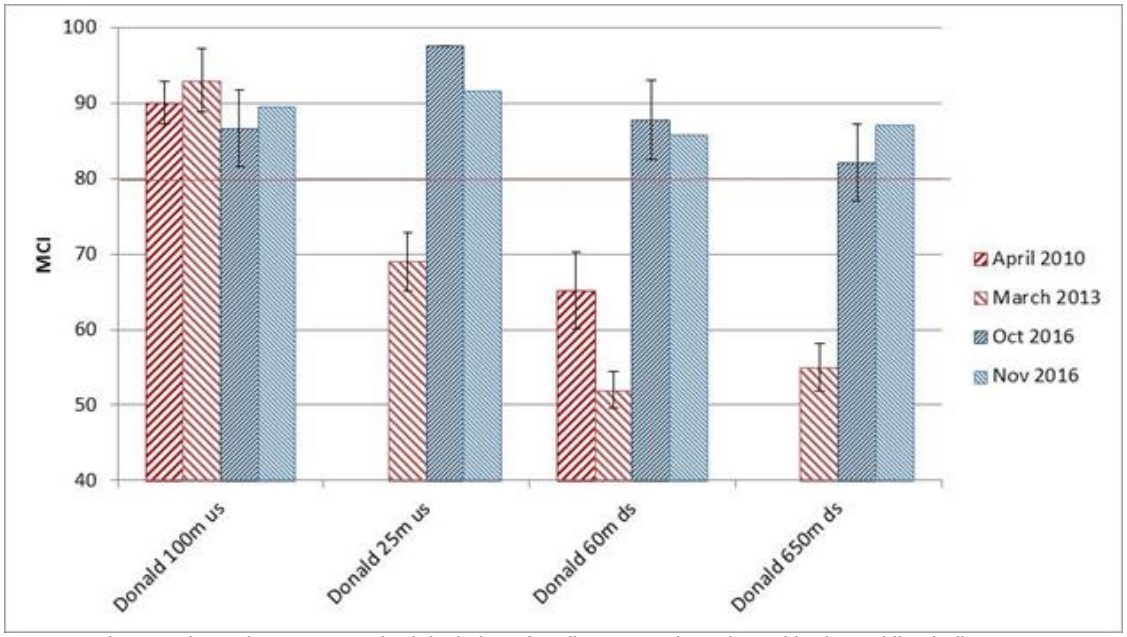
Sampling during late summer found statistically significant deterioration of all measured macroinvertebrate metrics downstream of the discharge. The declines in MCI and QMCI were substantial (greater than 20% change) and corresponded to the almost complete loss from the community of some sensitive taxa such as mayfly (Figure 35 and Figure 36).

The deterioration in aquatic macroinvertebrate community was in part explained by the deposition of fine organic matter on the stream bed from the oxidation ponds. Sites immediately downstream of the discharge had planktonic algae from the oxidation ponds as a scum on substrate and moss. Planktonic green algae and Daphnia (indicative of an oxidation pond discharge) were common in the samples (Coffey 2010, Coffey 2013).

The two surveys during late spring 2016 (October and November) found the effect of the discharge to be relatively mild compared to those observed during late summer. The macroinvertebrate community had slightly lower MCI scores at the two downstream sites (statistically significant but only 7% lower), and no consistent upstream to downstream difference in QMCI scores. No organic 'scums' were observed on the stream bed. Some of the decline in MCI at the 650m downstream site was likely to be due to pressures in addition to the WWTP discharge including smaller substrate size, localised sediment input and direct disturbance by cattle in the stream (Figure 2.1, Hamill 2017a).

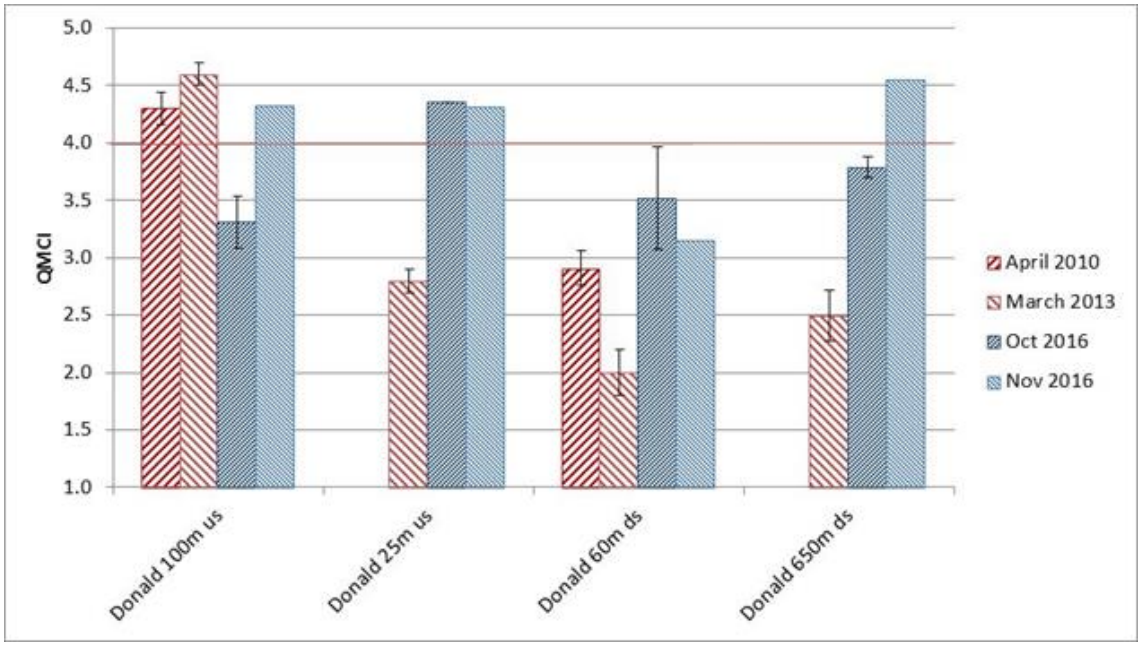
Sampling undertaken in late spring has found considerably less impact from the discharge than sampling done in late summer. This stark seasonal difference in the effect of the discharge is likely to reflect seasonal differences in stream flow (and dilution), effluent quality and water temperature. The flow in Donald Creek is highly seasonal with a distinct low flow period from about December to April (inclusive). The flow in Donald Creek at the time of the summer survey on 13 April 2010 and 4 March 2013 was 98 L/s and 50 L/s respectively – providing considerably less dilution than during winter and spring. The higher flow also causes movement of sand on the stream bed which will contribute to scouring of periphyton, reducing smothering of macroinvertebrate communities. Some aspects of effluent quality are also worse during summer, with algae proliferation within the ponds affecting the colour and turbidity of the discharge as found by Forbes (2013). Seasonal algae proliferation within the ponds will also cause more extreme dissolved oxygen fluctuations within the effluent. Furthermore, warmer water during summer months can accentuate stress on stream biota, particularly with relation to impacts from ammonia or low dissolved oxygen (Davies-Colley et al. 2013).

Figure 35: Median MCI scores for Donald Creek for surveys in April 2010 March 201, October 2016 and November 2016 (Coffey 2010, 2013 and Hamill 2017a)



Notes: The error bars show one standard deviation of replicate samples. The red horizontal line indicates scores indicative of 'poor' water quality /habitat.

Figure 36: Median QMCI scores for Donald Creek for surveys in April 2010 March 201, October 2016 and November 2016 (Coffey 2010, 2013 and Hamill 2017a)



Notes: The error bars show one standard deviation of replicate samples. The red horizontal line indicates scores indicative of 'poor' water quality /habitat.

Discharge Effects Stage 1A to 2B

Implementation of Stage 1A may reduce the most severe effects on macroinvertebrates that occur during extended periods of low stream flow, but overall the effects will be similar to the current situation.

Implementing Stage 1B will cause a substantial reduction in the frequency of discharges during summer. This will result in only minor effects on the stream during most of the summer. When discharges occur, there may be some stimulation of periphyton growth. These relatively short periods of discharge are likely to cause changes in the aquatic macroinvertebrate community composition, but the effect will be small compared to effects of the current discharge during summer because there will be insufficient time for significant deposition of material on the stream bed. The effects will also be short term, with rapid recovery after they cease. Discharges with low dilution that continue for more than a few days mostly occur in autumn (April and May), when flood flows are also common and help to reset the stream system.

Winter discharges will be less frequent. Based on past sampling during Spring the effects on the aquatic macroinvertebrate community during winter after Stage 1B will be minor. However, the modelled data indicates there may be occasions when the TNH_4-N is close to the guideline protective of the Fingernail Clam, and therefore there may be short term spikes above the guideline and it is possible there could be intermittent impacts on this species. As discussed already, this suggests effects to be minor to moderate and monitoring should occur during this phase.

Stage 2A will provide an incremental improvement, particularly during summer, but overall the effects are expected to be similar to Stage 1B.

Implementation of Stage 2B will eliminate summer discharges and the worst of the currently observed impacts of the discharge will no longer occur. Discharges will still occur in the winter about 7% of the time and mostly during flood events (75% of the time above 3 x median flow). During periods of low flow the effect of the discharge will probably still be measurable in the periphyton and aquatic macroinvertebrate community. However, these effects are likely to be minor (or less) and less than what was observed during the spring surveys because of the reduced duration and volume of discharge.

6.4.4.16 Fish

Background and Existing Discharge Effects

Donald Creek and Abbot Creek support populations of large longfin eel and common bully. Rainbow trout and inanga have also been caught in the streams. Good habitat is provided for fish where the stream passes through the bush remnant by riparian cover, and woody debris in the stream creates a diversity of hydraulic regimes.

In October, similar abundance of fish was observed in nets set upstream and downstream of the discharge. Fish abundance has not been assessed during summer but it is possible that on some occasions some more sensitive fish (e.g. trout) could become stressed. Also changes in the macroinvertebrate community (e.g. absence of mayfly downstream of the discharge during summer) are likely to reduce the quality of food supply for many fish species.

Discharge Effects Stage 1A to 2B

The main factor affecting the abundance and diversity of fish in Donald Creek is likely to be habitat. Nevertheless, improvements in the discharge is expected to benefit the fish community.

This will primarily occur through improvements in the quality of the macroinvertebrate community in the summer.

Implementation of Stage 1B will result in a substantial reduction in summer discharges sufficient for mayfly to recolinise downstream of the discharge during summer. With this occuring any effects of the discharge on the fish community are expected to be minor or less.

6.4.5 Effect of Direct Discharge of Treated Wastewater to Abbot Creek

Donald Creek converges with Abbot Creek approximately 2km downstream of the WWTP discharge and flows a further 2km until it discharges into Lake Wairarapa. Currently no routine flow or water quality or ecological monitoring is undertaken on Abbot Creek. A set of grab samples were collected for water quality on 12 October 2016 as part of the aquatic ecological assessment (Table 39) (refer also to Hamill, 2017a in Appendix 11).

Existing Discharge Effects

The water quality in Abbot Creek is currently impacted by the discharge. Nutrient, TNH_4-N, and TO_xN concentrations are all higher downstream of the confluence with Donald Creek, but lower than in Donald Creek downstream of the discharge indicating some downstream dilution is occurring. The TNH_4-N and TO_xN concentrations were below relevant guidelines at the time of sampling. All fractions of BOD were below detection limit of 2 g/m^3, and therefore below relevant the guideline concentration of 2 g/m^3 $scBOD_5$.

It is likely that DRP is the most conservative parameter in the river system as it does not change speciation (as nitrogen species do) and is not removed by sedimentation (as TP is). Based on the DRP concentrations There is an approximate 1:1 dilution of Donald Creek by upstream Abbot Creek.

Nutrient concentrations in Abbot were low upstream of the confluence with Donald Creek (0.08 mg/L and 0.005 mg/L for SIN and DRP respectively) and relatively high downstream (1.0 mg/L and 0.028 mg/L for DIN and DRP respectively). The low nutrient concentrations upstream of the confluent will reduce periphyton growth rates, but the concentrations downstream are likely to exert only a small amount of control on periphyton growth.

Sampling during spring found only minor impact of the discharge on the periphyton and macroinvertebrate community. This provides confidence that winter discharges that persist within Stages 1B, 2A and 2B will have only minor (or less) effects on Abbot Creek.

In Abbot Creek the periphyton cover and biomass was higher upstream of the confluence with Donald Creek in October 2016, this was surprising given the difference in nutrient concentrations but may have reflected low grazing pressure by invertebrate (e.g. snails and mayfly) at this site. During November periphyton cover and biomass was higher downstream of the confluence, but remained low and well within guidelines for maintaining trout habitat (i.e. chlorophyll-*a* was 48 mg/m^2, AFDM 12 g/m^2 and PeriWCC was 0%) (Hamill, 2017a).

Abbot upstream of the confluence with Donald Creek had macroinvertebrate communities indicative of ‘fair’ water quality based on MCI scores (95 – 98), but QMCI scores indicated poorer conditions (2.1 – 3.0). MCI scores were 7% lower downstream of the confluence, but other indices had an inconsistent pattern, and in October 2016 the QMCI was significantly higher at the downstream site (Hamill 2017a).

Table 39: Comparison between Donald and Abbot Creek water quality

Parameter	Donald Creek Upstream	Donald Creek Downstream	Abbot Creek Upstream	Abbot Creek Downstream
pH	7.4	7.3	7.3	7.2
Suspended Solids	<3	4	<3	3
TN	1.3	1.8	0.16	1.29
NH_4-N	<0.010	0.195	<0.01	0.048
TOx-N	1.1	1.12	0.069	0.97
TKN	0.2	0.68	<0.010	0.32
DRP	0.007	0.055	0.005	0.028
TP	0.01	0.081	0.008	0.041
Soluble $cBOD_5$	<2	<2	<2	<2
$cBOD_5$	<2	<2	<2	<2
Soluble BOD_5	<2	<2	<2	<2
Total BOD_5	<2	<2	<2	<2
E.Coli	579	461	435	649
DIN	1.1	1.3	0.070	1.0

Source: Hamill, 2017a

Discharge Effects Stage 1A to 2B

The assessment of the effect of the discharge on Abbot Creek water quality is based on the assessment of effects on Donald Creek water quality and aquatic ecology (Section 6.4.4). The overall assumption is that the concentration of nutrients, Total BOD_5, TNH_4-N and TO_xN in Abbot Creek downstream of the confluence with Donald Creek will be lower than those measured and predicted in Donald Creek. Based on the water quality results presented in Table 39 this assumption is valid.

The effects of the discharge with respect to pH, temperature, DO and TO_xN on Donald Creek are currently minor or less than minor and will decrease with the development of the treatment system. Therefore, the effect of the discharge on Abbot Creek is expected to be minor or less than minor with respect to these parameters. However, a monitoring program will be developed and implemented following the granting of the discharge consent to routinely monitor these parameters.

Reduction in effluent discharge with various stages is likely to reduce periphyton biomass in Abbot Creek with consequent improvements in aquatic macroinvertebrate metrics. However, there is still likely to be more periphyton downstream of the confluence during summer. This is because the background TO_xN concentration in Donald Creek is high, even without the discharge.

<u>Stage 1A</u>

The effects on the water quality and aquatic ecology in Abbot Creek is expected to remain the same as the existing situation, and there is potential for the development of nuisance growths (periphyton and sewage fungus) in summer, potential for TNH_4-N toxicity and changes in colour and clarity of the Creek. These effects would be considered significant.

<u>Stage 1B</u>

Under stage 1B the overall discharge to the Creek will be reduced to approximately 56% of the current flow with less than 5% of the volume discharging in summer. In addition, the discharge occur 24% of the time at above 2x median flow and 13% of the time above 3 x median flow,

limiting the length of accrual periods for periphyton and heterotrophic growths. There will be a significant decrease in the nutrient and Total BOD_5 concentrations and loads further limiting the potential for development of nuisance growths.

At this stage the annual median and 95th percentile concentrations of TNH_4-N will decrease and are expected to be compliant with the NIWA guidelines that would be protective of the Fingernail Clam (the most sensitive species identified in Donald Creek). In Donald Creek it is anticipated that there will be further dilution downstream in Abbot Creek, however, to determine this dilution would require further work to understand the hydrology of Abbot Creek.

In addition, there would still be some potential for the visual clarity and colour of Abbot Creek to be effected by the discharge and overall the potential effects on Abbot Creek water quality and aquatic ecology would be moderate to minor.

Stage 2A

In Stage 2A there will be a further reduction of discharge flow volume and frequency to Donald Creek and this will further reduce the effects on water quality and aquatic ecology in Abbot Creek. However, it is expected that the effect on the water quality and aquatic ecology in Abbot Creek will remain moderate to minor as with Stage 1B.

Stage 2B

In Stage 2B the WWTP will only discharge in July and August, the total discharge volume will be ~6% of the current volume and there will be no discharge in some years. There will be further reductions in the concentrations of nutrients and BOD, with median annual concentrations in Donald Creek being similar to upstream concentration. In addition, there will be a significant reduction in loads of nutrients and BOD discharging to the surface water and the potential for development of heterotrophic growths and periphyton will be significantly reduced compared to Stage 2A.

The predicted TNH_4-N concentrations in Donald Creek would comply with the NIWA (2014) guidelines for protection of both Freshwater Mussels and the Fingernail Clam and TNH_4-N toxicity in Abbot Creek as a result of the discharge is unlikely.

In addition, although there may be potential for impacts on the colour and clarity of Abbot Creek due to the discharge, such events will be infrequent and likely coincide when upstream clarity and colour is already negatively impacted. Furthermore, no discolouration was observed in Donald creek or Abbot Creek during the spring survey. Overall the effects of the discharge on Abbot Creek water quality and aquatic ecology during Stage 2B are expected to be minor or less than minor.

6.4.6 Effects on Lake Wairarapa

Lake Wairarapa is located in the lower reaches of the Ruamahanga River approximately 4 km downstream of the Featherston WWTP. The Lake receives inflows from a number of rivers and creeks in the area including Abbot Creek and therefore receives water from Donald Creek and the Featherston WWTP. Approximately 50% of the land use around the Lake is agricultural and thus receives agricultural runoff. The Lake has a barrage at its southern end to manage flows and prevent flooding, at times flow reversal occurs at the barrage and water flows back into the Lake.

6.4.6.1 Contaminants of concern

The effects of the discharge on Donald Creek water quality and ecology are discussed above in Section 6.4.4, and form the basis for the assessment of effects on water quality for Lake Wairarapa.

As stated earlier the current discharge is having minor or less than minor effects on the temperature, DO, pH and TO_xN in Donald Creek. In addition, the discharge is likely to be a very minor volume contribution to the Lake (refer to Section 6.4.6.2 below). Therefore, the effects of the discharge on temperature, DO, pH and TO_xN on Lake Wairarapa will also be less than minor and these parameters are not discussed further here.

However, the discharge is having significant impacts on Donald Creek water quality with respect to ammonia toxicity, nutrients (although these effects are limited to summer), and visual clarity. The current discharge is also having a moderate to minor impact on the microbial water quality of Donald Creek. These contaminants of concern have been explored further in determining the existing and potential impacts of the FWWTP discharge on Lake Wairarapa.

6.4.6.2 Lake Water Balance

The GWRC has undertaken a preliminary study into the water balance of Lake Wairarapa (GWRC, 2015). The study was undertaken primarily to determine the potential effects on the lake level of Lake Wairarapa under a number of abstraction scenarios. However, the study does provide some preliminary information regarding the Lake's water balance. The water balance modelling was carried out for the time period from 1 November 2012 to 30 September 2013, and therefore represents an 11 month period of which a summary is provided in Table 40. A monthly breakdown of values can be found in GWRC (2015).

The major inflow into the lake is from streams in the area, these streams have a total catchment of 488 km^2. Given the other inflows to the Lake including direct rainfall (with no nutrient content) and back flow from the barrage (containing water that most predominately originates from the Lake outflow), the major source of nutrient and contaminant inflow to the Lake is from stream inflow. The authors of the GWRC (2015) report that there was a poor fit with measured and modelled changes in lake level and volume and that the major source of error was in relation to uncertainty regarding stream inflow which is influenced by a number of factors. In order to obtain a better fit with the measured data the modelled stream inflows were adjusted. To do this some peak flows were scaled down by 30% and some base flows were scaled up by 30%.

Table 40: Summary of water balance model from GWRC (2015)

Parameter	Flow/Volume (Million m^3)
Rainfall	83
Stream Inflow (13 tributaries)[1]	488
Barrage Inflow	70
Barrage Outflow	-517
Evaporation	-78
Abstraction	-3.2
Modelled difference in storage	44
Actual difference in storage	30

Source: GWRC (2015). Note – [1] The stream inflow includes 1Mm^3/month from groundwater

The measured and modelled FWWTP total discharge volume was compared to the total stream inflow volume for the months November 2012 to September 2013 (Table 41). However, it was noted that according to NIWA the 2012/2013 year represented a drought of between 1 in 40 and

1 in 70 years. Therefore, the lake stream inflows were also compared to the wettest period from the modelled discharge flow data (provided by LEI) from November 2007 to September 2008.

As an additional conservative measure the stream inflow was reduced by 40% in order to account for uncertainty in the model and provide a conservative comparison. That is a total of 293 Million m^3 was assumed to be the total volume of inflow from streams during the period modelled.

Based on the preliminary water balance model the discharge volume represents a minor flow volume to the Lake compared to other stream inflows. Currently the discharge represents less than 0.4% (564,000 m^3 to 958,400 m^3) of the total stream inflow, while under Stage 2B this volume decreases considerably to less than 0.07% (6000 m^3 to 194,000 m^3), see Table 41.

Table 41: Comparison of discharge volume to total stream inflow to Lake Wairarapa

Stage	Total discharge volume[1] November 2012 – September 2013 (m^3)	Percentage of total stream inflow to Lake Wairarapa[2] (%)	Total discharge volume[1] November 2007 – September 2008 (m^3)	Percentage of total stream inflow to Lake Wairarapa[2] November 2007 – September 2008 (%)
Existing (measured)	564,400	0.19	958,400	0.33
Stage 1A	547,000	0.19	934,900	0.32
Stage 1B	329,600	0.11	682,200	0.23
Stage 2A	197,300	0.067	423,800	0.14
Stage 2B	6,000	0.0021	194,000	0.066

Notes: [1] From Mott MacDonald mass balance model (Appendix 8). [2]Total volume assumed to be 60% of total modelled stream inflow volume (293 Million m^3) from GWRC (2015)

6.4.6.3 Ammonia toxicity

The concentration of TNH_4-N downstream of the discharge is currently elevated above appropriate guideline levels in Donald Creek (see Section 6.4.4.4) and this is currently considered to be a significant effect. The effects persist into Stage 1A, but are reduced to minor to moderate under Stage 1B and are considered less than minor in Stage 2B. Therefore, there is some potential for TNH_4-N in the discharge to impact on Lake Wairarapa.

Existing and Stage 1A to Stage 2B Effects

A summary of the measured Lake TNH_4-N concentrations from GWRC (2005, 2012 and 2016) is provided in Table 42 along with the maximum pH. The pH adjusted guideline values according to NIWA (2014) are also provided in Table 42, based on the maximum pH in the dataset and using a 95% level of protection (see Section 6.4.4.4 for a discussion regarding TNH_4-N guidelines). The median and maximum TNH_4-N concentrations in Lake Wairarapa were always below both the median and 95th percentile pH adjusted guideline values indicating that TNH_4-N toxicity has not been an issue in the lake.

It should be noted that the NIWA (2014) assessment method recommends the use of the 95th percentile of the receiving water's measured pH values to be used to assign the pH adjusted guideline. As the 95th percentiles were not presented in the GWRC reports the maximum pH value has been used and this is highly conservative as the 95th percentile is likely to be lower and would have therefore provided a higher guideline concentration.

It is estimated that under the current discharge regime the discharge represents less than 0.4% of the stream inflows and any elevated TNH_4-N concentrations entering from Abbot Creek would

undergo considerable dilution. In addition, the volume of the discharge will reduce considerably as the development progresses and by Stage 1B will be ~56% of the current discharge volume and by Stage 2B ~6% of the current discharge volume.

Taking into account the fact it is unlikely that TNH_4-N toxicity has occurred in the lake (based a dataset from 2005 to 2016), the discharge represents a low proportion of the inflow into the lake, and the discharge volume will reduce considerably over time, the current and future impacts (Stage 1A to Stage 2B) of the discharge on the Lake with respect to TNH_4-N toxicity are considered less than minor.

Table 42: Lake Wairarapa TNH4-N concentrations and pH adjusted guidelines

Source (data date range)	Maximum pH	Median TNH_4-N (g/m^3)	Maximum TNH_4-N (g/m^3)	Median Guideline (pH adjusted) (g/m^3)	95th percentile Guideline (g/m^3)
GWRC 2016 Site 2 (July 2015 – June 2016)	9	<0.01	<0.01	0.048	0.080
GRWC 2016 Middle (July 2015 – June 2016)	9	<0.01	<0.01	0.048	0.080
GRWC Alsops Bay (July 2015 – June 2016)	8.6	<0.01	0.035	0.091	0.152
GWRC 2012 (2006 – 2010)	7.9	0.016	0.32	0.27	0.46
GWRC 2005 (1994 – 2005)	8.6	0.008	0.045	0.091	0.152

6.4.6.4 Nutrients and Lake Eutrophication

The nutrients of primary importance to lake systems are TN and TP, rather than DIN and DRP which are more relevant to river systems. This is due to the comparatively long residence times in lakes that allow for the particulate fraction of nitrogen and phosphorus to be redistributed into the system after it has settled in the sediment layer. Elevated concentrations of TN and TP in lake systems lead to eutrophication which can result in growth of phytoplankton scums and degrade the water quality with respect to both ecological and recreational values.

Despite the high value associated with Lake Wairarapa the Lake has significantly degraded water quality with respect to nutrient concentration and clarity. The GWRC has analysed the lake's trophic state based on TN, TP, Chlorophyll-a and secchi depth on a number of occasions with the following findings:

- Between 1994 and 2005 (GWRC, 2005) the lake was classified as being supertrophic in all but one year from 1994 to 2005, with the lake being classified as eutrophic in 2001;
- Monitoring between 2006 and 2010 by GWRC classifies the lake as supertrophic overall, with TN and Chlorophyll-a ranking as eutrophic and TP and secchi depth as hypertrophic (Greenfield *et. al*, 2012); and
- The 2015/2016 Lakes Water Quality and Ecology monitoring programme report (GWRC, 2016) classifies the Lake as supertrophic.

Lake Wairarapa TN and TP concentrations

A summary of the TN and TP concentrations from the GWRC reports (2005, 2012 and 2016) is presented in Table 43. The concentrations of TN and TP are elevated and the corresponding trophic system is presented in Table 44. Based on median values TN concentrations would be in either eutrophic or supertrophic range and TP would be in either supertrophic or hypertrophic range.

Table 43: Summary of TN and TP concentration data from GWRC reports

Year	TN (g/m^3)	TP (g/m^3)	Source
1994 -2005	0.48	0.106	Median from GWRC (2005)
2006 - 2010	0.52	0.08	Median from GWRC (2012)
2015 - 2016	0.45	0.044	Average of medians for 3 sites from GWRC (2016
Mean – overall	0.49	0.08	Mean of the three datasets

Table 44: Lake trophic level boundaries for TN and TP

Lake type	TP (mg/m^3)	TP (mg/m^3)	Secchi Depth (m)
Ultra-microtrophic	0.84-1.8	16-34	33-25
Microtrophic	1.8-4.1	34-73	25-15
Oligotrophic	4.1-9.0	73-151	15-7.0
Mesotrophic	9.0-20	157-337	7.0-2.8
Eutrophic	20-43	337-725	2.8-1.1
Supertrophic	43-96	725-1558	1.1-0.4
Hypertrophic	>96	>1558	<0.4

Source: From Burns 2000, cited in GWRC 2005. Note – units in mg/m^3 for ease of presentation

Estimated Lake and Discharge Nutrient Loads

The GWRC is currently working on developing a nutrient load balance for Lake Wairarapa, however, at the time of writing no outcomes from this study have been published and no other source of nutrient balance for the lake exists. Therefore, a preliminary estimate of the nutrient load in Lake Wairarapa has been made.

The average long term TN and TP values from Table 44 and the volumes in Table 45 were used to calculate the average load of TN and TP in the Lake's water column at any one time and the load in the lake on an annual basis.

The annual loads of TN and TP in the discharge were estimated in the mass balance model (Appendix 8) and are presented in Table 46 along with the percentage contribution to annual load of the lake. These values are discussed further below under the existing and future discharge effects.

Table 45: Volume and residence time in Lake Wairarapa

Parameter (unit)	Value	Source
Area (Ha)	7850	GWRC (2012)
Average depth (m)	1.3	Assumed value, maximum depth is 2.3 m
Average volume (Mm^3)	102.05	Calculated from area and average depth
Residence time (days)	40	*Perscomm* email: Mike Thompson (GWRC) to Anna Whitmore (MM) 21 Sept 2016
Number of lake volumes per year	9.1	Calculated from residence time and lake volume
Total volume per year (Mm^3)	931.21	Calculated from number of volumes and total volume
TP in Lake at any time (t)	8	Calculated from average TP and lake volume
TP annual load in lake (t/year)	71	Calculated from average TP and annual lake volume
TP in Lake at any time (t)	50	Calculated from average TN and lake volume
TP annual load in lake (t/year)	452	Calculated from average TN and annual lake volume

Table 46: Discharge nutrient loads and percentage contribution to Lake Wairarapa

Stage	TP in discharge (t/year)	TP in discharge - proportion of annual lake load (%)	TN in discharge (t/year)	TN in discharge - proportion of annual lake load (%)
Existing	1.4	2.0	7.1	1.6
Stage 1A	1.3	1.9	6.9	1.5
Stage 1B	0.64	0.90	3.9	0.87
Stage 2A	0.56	0.78	3.4	0.74
Stage 2B	0.11	0.15	0.68	0.15

Existing and Stage 1A to 2B Effects

Under the existing scenario the discharge is estimated to contribute a small volume compared to the overall stream inflows into Lake Wairarapa (0.19% to 0.33%). However, the nutrient loads into the lake represent a higher proportion of the total nutrient load in the Lake. Under the existing scenario the discharge is estimated to result in 1.4 tonnes of TP being discharged to the surface water system and ultimately Lake Wairarapa, this is estimated to represent 2% of the annual load of TP to the lake. The existing discharge is also estimated to contribute 7.1 t/year of TN to the lake; approximately 1.6% of the estimated annual load in the lake. This indicates that sources other than Featherston WWTP are responsible for over 95% of the loads to the Lake. Given that over 50% of the land use in the lake's catchment is agricultural it is likely that the majority of the nutrient load to the lake is a result of diffuse runoff and groundwater seepage from agricultural land in the catchment.

It is difficult to determine the significance of the relatively low TN and TP contributions to the Lake from the discharge, however, examination of Table 44 (trophic level boundaries for TN and TP) indicates that for the Lake to move to a lower trophic level (for TN or TP) the annual average concentration would need to decrease to by approximately 50%. This would require an approximate 50% reduction of influent TN and TP loads to the lake. Given that the current contributions of load of TP and TN to the lake are 2% or less, total removal of the discharge from Donald Creek and the lake would not result in a change in trophic level and the current effect of TN and TP in the discharge on Lake Wairarapa is currently less than minor.

In addition, there will be a considerable decrease in the TN and TP loads to the Lake as the development proceeds and by Stage 2B it is estimated that less than 0.2% of the lakes TN and TP, on an annual basis, will be due to the FWWTP discharge.

6.4.6.5 Pathogens

Lake Wairarapa is consider to be significant recreational value. However, there is limited data available regarding the *E.Coli* numbers in Lake Wairarapa. *E.Coli* was monitored between 2005 and 2010 in Lake Wairarapa with a range of between <1 and 150 *E.coli*/ 100mL indicating the Lake was suitable for recreation during that time period and not negatively impacted from discharges of *E.Coli* during that monitoring period.

The discharge typically contains *E.Coli* numbers below MfE (2004) monitoring "Green mode" guideline of 260 *E.Coli*/ 100mL indicating water that is acceptable for recreation. The discharge did exceed Green Mode guideline on 3 occasions since 2011, however, the upstream *E.Coli* numbers were higher than the discharge and the discharge had no measurable effect on downstream numbers. On one occasion the discharge appeared to result in *E.Coli* numbers downstream of the discharge above the MfE (2004) "Red Mode" guideline indicating the Creek would not be suitable for the recreation. Therefore, there is some potential for the discharge to,

on occasion, result in increased pathogen numbers downstream of the site including Lake Wairarapa although the potential for decay of these pathogens and distance to the lake has not be taken into consideration.

Existing and Stage 1A to 2B Effects

Given the lake is not currently negatively impacted by discharges of *E.Coli*, the current discharge typically contains *E.Coli* numbers lower than the Green Mode MFE guideline (indicating it is suitable for recreation), and the current discharge is estimated to represent less than 0.4% of the stream inflow to the Lake, it is unlikely that the discharge is currently significantly impacting on the *E.Coli* numbers in the Lake. In addition, it is likely that the majority of recreational activities take place in summer. Once the development reaches Stage 1B there is very little discharge in summer and by Stage 2B no summer discharge will occur. Therefore, after the implementation of Stage 1B the effects of the discharge on *E.Coli* numbers and risk of illness to recreational users in Lake Wairarapa is likely to be less than minor.

6.4.6.6 Visual Clarity

The discharge currently significantly reduces the downstream clarity (as measured by Black Disk, see Section 6.4.4.9) in Donald Creek and has potential to effect the downstream clarity in Lake Wairarapa. This is likely to be due to suspended particulate matter in the discharge, predominately comprising of algae. The clarity in Lake Wairarapa was poor in all datasets presented in the GWRC's monitoring reports (GWRC, 2005, 2012 and 2016). The maximum clarity measurement, by Secchi depth was 1.5 m measured in the period from 1994 to 2005, this corresponds to the eutrophic boundary in the trophic level classification presented in Table 44. The majority of other measurements would classify as supertrophic or above.

Existing and Stage 1A to 2B Effects

Although it is difficult to predict the change in visual clarity (as measured by Secchi Depth) due to the discharge, because the current discharge is estimated to represent less than 0.4% of the stream inflow to the Lake, it is therefore considered unlikely that the discharge is currently significantly impacting on visual clarity of the Lake. Once the development reaches Stage 1B the majority of the discharge will occur in winter and by Stage 2B all the discharge will occur in winter when upstream clarity, in streams discharging to the Lake, may be impacted. Therefore, after the implementation of Stage 1B and beyond, the effects of the discharge on visual clarity in Lake Wairarapa is likely to be less than minor.

6.4.6.7 Biochemical Oxygen Demand and Heterotrophic Growths

There is potential for increased BOD to result in hetertrophic growth in lakes impairing their ecological and recreational values. The Total BOD_5 of the lake was presented in GWRC (2012) with a median of 0.4 g/m^3 and a range of 0.24 to 4.2 g/m^3, the sample number was not reported. The most widely used guideline value for management of hetertrophic growths in rivers and streams is that less than 2 g/m^3 of $scBOD_5$ as a daily maximum. Currently there is no specific guideline for lakes, and the assessment of lake water quality is typically carried out by defining a trophic state based on TN and TP (see section 6.4.6.4 above).

Existing and Stage 1A to 2B Effects

The 95th percentile of monitored Total BOD_5 downstream of the discharge in Donald Creek was 6.1 g/m^3. Based on grab samples taken in 2016 it is estimated that 25% (Table 34) of the BOD in the discharge is $scBOD_5$. Therefore, given the downstream concentration of BOD_5 is less than 6.1 g/m^3 95% of the time, it is likely that less than half of that BOD is the soluble

carbonaceous fraction. Also given the current FWWTP discharge to the lake is estimated to be less than 0.4% of the stream inflow volume, it is unlikely that the FWWTP discharge is having a measurable effect on $scBOD_5$ concentrations in the lake and the current impact on hetertrophic growths is likely to be less than minor.

The discharge volume will decrease considerably with the staged development, as such, the effect of BOD from the FWWTP is considered less than minor for all future stages.

6.4.7 Summary of actual and potential effects to aquatic ecosystems and water quality

6.4.7.1 Section 107 Effects on water quality and aquatic life

The AEE has addressed the actual and current effects on water quality and aquatic life as required under Section 107(c, d and g) of the RMA, and this is summarised below.

Existing Effects

Currently there are significant adverse effects due to the discharge including:

- Increased concentrations of TNH_4-N downstream of the discharge that are at times above relevant NIWA (2014) aquatic guidelines, and may therefore be resulting in toxic effects to sensitive species in Donald Creek;
- Increased concentration of nutrients downstream of the discharge resulting in increased periphyton growths downstream of the discharge in summer but not spring;
- Presence of heterotrophic growths downstream of the discharge in summer but not spring.
- A visible and potentially conspicuous change in colour has been observed in summer surveys, but not spring surveys; and
- A consistent change in clarity downstream of the discharge has been detected in monitoring data throughout the year.

Discharge Effects Stage 1A to 2B

The proposed staged development will result in significant improvements to the water quality in Donald Creek by progressively reducing the volume of wastewater discharged to the Creek. The most significant improvements will occur at implementation of Stage 1B and Stage 2B.

At Stage 1B the majority of the wastewater will discharge during winter at times of elevated flow in Donald Creek. At this stage the effects are likely to reduce considerably compared to the current situation in the following way:

- There will still be an increase in TNH_4-N concentration downstream of the discharge, however, modelling predicts that there will be no exceedances of the National Bottom Line or USEPA acute guidelines. Furthermore, modelling predicts that TNH_4-N concentrations downstream of the discharge is likely to comply with the NIWA guideline that would be protective of the Fingernail Clam (currently present downstream) for most years, but may at times exceed the more stringent guideline that would be protective of the Fresh Water Mussels (currently not present upstream or downstream) and therefore it is likely that the effects onTNH_4-N toxicity will be moderate to minor at this stage.
- The median concentrations of nutrients downstream of the site will reduce to levels similar to background concentrations particularly during summer, when the risk of increased periphyton growth is greatest. The discharge will result in increased nutrient concentrations downstream of the discharge in winter, however, Donald Creek is not prone to periphyton

growth in winter. Therefore, the overall effect on nutrient concentrations and periphyton growth is expected to be minor.

- The reduction in the load and concentration of Total BOD_5 from Stage 1B will reduce the opportunity for heterotrophic growths to occur. It will be rare for there to be extended periods of time (e.g. > 7 days) under low flow conditions with scBOD greater than 2 mg/L. Therefore the overall effects are expected to be minor.
- The change in colour and clarity due to the discharge will only occur intermittently and mostly in winter months and would be considered minor to moderate.
- The foam that has been observed during summer is expected to be minor and negligible after implementation of Stage 1B and beyond due to the short duration of the discharges during summer.

Once Stage 2B is operational discharges will only occur in July and August but not in all years. The overall volume of wastewater discharged will be approximately 6% of the current average annual volume. At this stage all effects relating to the discharge are expected to be minor or less than minor for the following reasons:

- The concentration of TNH_4-N downstream of the discharge is predicted to achieve a level of confidence for the protection of the Freshwater Mussel (kākahi).
- The median concentrations of nutrients downstream of the discharge is expected to be similar to background concentrations throughout the year, and will only have potential to be effected in July and August when periphyton growth is unlikely to occur; and
- Any effects on colour and clarity will only occur intermittently in winter when upstream colour and clarity is likely to be negatively impacted and recreational activities are not occurring.

6.4.7.2 Section 107 emissions of objectionable odour

Section 107(e) of the RMA states that a discharge of contaminants to water should not give rise to “any emission of objectionable odour”. Odour in the discharge and/or downstream of the discharge point has not been reported in the past and the proposed upgrades are not expected to increase the potential for emissions of objectionable odour in the discharge. As such it is considered the current discharge and any future discharges to Donald Creek will achieve this criteria.

6.4.7.3 Section 107 effects on water for drinking by farm animals

Section 107(f) of the RMA states that a discharge of contaminants to water should not “render the water unsuitable for consumption by farm animals”. This section assesses the current and future water quality of Donald Creek with respect to suitability for drinking by farm animals. It should be noted that currently Donald Creek is fenced and excludes stock from accessing the stream along the margins with Site B. However, cattle accessing Donald Creek approximately 650m downstream has been observed (Hamill, 2017a).

Water Quality Guidelines

There is limited guidance regarding acceptable water quality for farm animals in New Zealand. The following guidelines have been used for the assessment:

- pH range 6 to 9, from Aquanet (2013b);
- *E.Coli* < 550 cfu/100mL, at flows less than 3 x median flow, from Aquanet (2013b). It should be noted that ANZECC (2000) define a guideline based on thermotolerant bacteria, however, all historic microbiological monitoring of the stream has been for *E.Coli*;

- Nitrate-nitrogen <90 g/m^3 from ANZECC (2000), converted from the nitrate trigger value of 400 g/m^3;
- Nitrate-nitrogen <9.1 g/m^3 from ANZECC (2000), converted from the nitrite trigger value of 30 g/m^3; and
- TDS < 2000 g/m^3 from ANZECC (2000), this represents the most sensitive farm species poultry.

Existing Discharge Effects

The downstream pH is typically within the guideline of 6 to 9 and the discharge was consistently within the pH guideline and no effects, due to a pH change, on suitability of water for drinking for farm animals is occurring.

The maximum total oxidised nitrogen measured downstream of the site was 2.3 g/m^3 and the maximum total oxidised nitrogen measured in the discharge was 3.5 g/m^3. These values are lower than the ANZECC (2000) trigger values for nitrate-nitrogen and nitrite-nitrogen and there are no current effects from the discharge on these species.

The maximum electrical conductivity in the discharge was below 350 µs/m, this converts to approximately 235 g/m^3 of total dissolved solids (by multiplying by 0.67 as per ANZECC 2000). This is well below the most sensitive trigger value of less than 2000 g/m^3 total dissolved solids, and there is no current effect resulting from the discharge of total dissolved solids.

The *E.Coli* in the discharge has typically been below the 550 cfu/100mL, but there have been some exceedances (3 out of the past 21 monitoring events following UV installation) of this guideline value (see Section 6.4.4.8). It should be noted that the upstream water quality in Donald Creek is impacted and has exceeded the guideline approximately 50% of the time. Therefore, it is possible that the discharge is having an intermittent minor to moderate effect on the suitability of the water for drinking by farm animals by increasing the *E.Coli* numbers downstream of the site.

Discharge Effects Stage 1A to 2B

Effects due to pH change and of total dissolved solids will remain the same as current during Stage 1A to 2B, that is less than minor.

The concentration of nitrate-N and nitrite-N in the discharge will also remain the same as current during Stage 1A and 1B, and effects will therefore be less than minor. However, the concentration of nitrate-N and nitrite-N in the discharge is predicted to increase during Stage 2A and remain elevated compared to the current concentration, due to the reduction of I/I. It is estimated (see Appendix 8 for details) that the increase in concentration will be most pronounced in winter with the potential for the concentration potentially increasing by 50%. As stated above, the maximum total oxidised nitrogen concentration in the discharge was 3.5 g/m^3, indicating the maximum concentration in the discharge after I/I reduction would be 5.3 g/m^3. This is still below the ANZECC (2000) trigger values for nitrate-N and nitrite-N nitrogen and there will be no effect on the suitability of the water for drinking by farm animals in Stage 2A and 2B due to nitrate-N or nitrite-N.

The only current effect of the discharge on the suitability of Donald Creek water for drinking by farm animals is an intermittent effect of increased *E.Coli* downstream of the site. Once the development reaches Stage 1B (within two years of granting of the consent) the discharge volume is reduced and occurs mostly during winter months when stream flows are higher, and at this point the effects would be considered minor or less than minor

Once the development reaches Stage 2B the volume of discharge will be approximately 6% of the current discharge. In addition, discharge only occurs in July and August and in some years there will be no discharge. At this stage the effect of the discharge on the suitability of Donald Creek water for drinking by farm animals will be less than minor.

6.4.8 Proposed Mitigation

Mitigation of effects on water quality and aquatic health is proposed to be achieved by:

- The adopted best practicable option, involving the reduction in wastewater flow to the plant as a result of the proposed targeted I&I works and staged land application, leading to a net reduction in flow discharged directly to the stream of 9% (at Stage 2B) which is expected to enhance stream health and minimise adverse effects.
- Implementation of a land treatment scheme that applies treated wastewater to land at sustainable rates, implements adequate buffer distances to open waterways, establishes stock exclusion zones where connection to surface water is likely to occur, prioritisation of land treatment over discharge to water where practicable, and for Stage 2B application of a discharge regime for contingency discharges to the stream to target stream flows where practicable of >3x median and >2x median in order of priority.
- Implementation of Stage 1 within 2 years of the commencement of consent to eliminate almost all discharges to surface waters during summer months when the effects of the discharge are greatest.
- A comprehensive monitoring programme to enable confirmation of predicted effects and ongoing assessment of actual effects, including effluent quality, pond water balance assessment, stream and groundwater water quality monitoring, and ecological monitoring.
- A comprehensive suite of management plans which will detail procedures for operation and monitoring, communication, I&I reduction management and reporting, and responses to unexpected monitoring results or unintended discharged.
- The Stage 1 review by the end of year 5 will collate all environmental data and confirm potential adverse effects and any additional mitigation required to meet consent standards including recommendations to move forward the timing of Stage 2B if necessary.

6.5 Effects on Air Quality

The primary potential effect on air quality is in respect of odour emanating from the plant, or from the land/water discharge. Poorly managed, poorly designed or overloaded WWTP's do have the potential to create odour.

The existing ponds, proposed inlet screen and land irrigation of wastewater have the potential to release odour and aerosols into the air that can travel and potentially affect people beyond the site property boundaries.

Potential sensitive receptors to any air quality effects are likely to include:

- Several dwellings adjacent and within close proximity to the irrigation Site, particularly on the northern end;
- Featherston township which is located approximately 750m north west of the irrigation Site at its closest point;
- Recreational users of the Featherston golf course which shares the eastern boundary of the irrigation Site.

6.5.1 Effect of Odours and Aerosol from the Oxidation Ponds and Ancillary Structures to Air Quality

Oxidation ponds such as those at the FWWTP are biological systems and, as such, are sensitive to large or sudden changes, for example an increase or decrease in incoming effluent volume, or sudden dilution resulting from severe wet weather. The generation of odour can result from a lack of oxygen to the aerobic layer of the pond. Odours from anaerobic oxidation of sewage "are universally characterised as offensive and objectionable", and are quite different from 'rural' odours.

Two distinct categories of potential release of odour and aerosols to air – those associated with the normal operation of the pond, and those associated with the abnormal operation of the pond.

Under normal operating circumstances, odourous discharges to air can occur from the following:

- Potentially odorous gases from the proposed inlet screen
- Minor, fugitive emissions of odour could occur from the ponds themselves, even when operating in aerobic conditions. Whilst such emissions could be perceptible to on site staff, they would not be perceptible at any existing neighbouring residences beyond the site boundary.

With respect to abnormal operation of the ponds, odorous discharges to air could occur from the following:

- In the event of blockage of the inlet screen if unattended to in a reasonable timeframe;
- In the event of the ponds going anaerobic (in-sufficient or lack of aeration and/or pond turning), significant odour emissions from the ponds are possible;

Under normal operation the project should not generate odours that are perceptible to the site's nearest neighbours and sensitive receptors.

There is no record of any operational odour of concern associated with the FWWTP site, and no record of complaint regarding odour. The last three annual GWRC compliance reports indicate full compliance with the air discharge condition, which restricts operations to ensuring no noxious, dangerous, offensive, or objectionable odours beyond the site boundary.

In addition, the FWWTP site is located some distance from the nearest residential dwelling. The site is also located within a Rural 'Special' Zone within the WCDP, specifically (in part) for the purposes of mitigating the potential reverse sensitivity effects associated with odour from the operation of the plant. This underlying zone restricts the ability for additional residential activities to be established within the zone, and effectively mitigates sensitive activities from establishing.

No major changes to process are proposed which will increase the potential for odour to occur. It is also noted that the wider receiving environment has not been reported as having any ambient air quality issues. Any effects from the existing oxidation ponds and ancillary structure on air quality are expected to be no more than minor at the property boundaries.

6.5.2 Effect of Odours and Aerosols from the Land Treatment Scheme to Air Quality

Potential sources of odour and/or aerosols from the land treatment scheme may arise from the following:

- If there is an over application of treated wastewater to land causing anaerobic soil conditions resulting in the generation of odour that is detectable beyond the boundaries of the site;
- Production of aerosols generated by spray irrigators that are transported by wind to beyond the boundaries of the site; and
- If there are long periods between irrigation resulting in stagnant effluent in delivery pipework that results in generation of odour when it is irrigated that is detectable beyond the boundaries of the site. This is most likely following the winter period when irrigation will cease and effluent is held in storage or discharged to water.

As described by LEI (2017), irrigation of treated wastewater proposed onto Sites A and B is not considered to have any effects that are more than minor at the property boundary for the following reasons:

- Application rates proposed are sustainable and will not result in soils becoming anaerobic and thus generating odours.
- The wastewater being irrigated will be aerobic and is therefore not expected to be odourous.
- In the event effluent becomes stagnant in the irrigation lines between long periods between irrigation events that could result in potential odour issues, a flushing volume of clean water can be pumped through the irrigation lines.
- Pathogen transport by aerosols will be mitigated by through UV treatment and the design and implementation of a 25m buffer zone between the irrigation zone and property boundaries in accordance with the WCDP rules (4.5.2(m)(ii)(a)). The WCDP setback rules have been designed to specifically address the potential for properties to be adversely affected by spray irrigation from municipal wastewater;
- For all new spray irrigation equipment installed, low pressure sprinkler nozzles with nozzle orifice that produce droplet sizes greater than 200 µm in size will be specified to minimise droplet travel distances and minimise the formation of aerosols. In the event the existing “impact” gun irrigation system is used, the spray gun nozzles within the 125m property boundary buffer zone will be decommissioned and replaced with low pressure travelling irrigators.
- Automatic shut-down of the irrigators will occur when wind gusts 12 m/s or higher in any direction are detected. In addition, shut-down of irrigators will occur when wind conditions average 4 m/s for more than 15 minutes occur (with sustained gusts) in the direction of dwellings within 300m of the irrigation wetted radius. Management of the system under these wind speed limits can be automated, thus enabling discharge to be targeted to low wind conditions. Such technology comes as standard with modern irrigating systems. The prevailing winds across the site are not in the direction of the township, except for the northernmost part of the site whereby conditions under which the Site could not be irrigated would occur around 6% of the time. Therefore this shut down mechanism will not significantly compromise the ability of the scheme to discharge when soil conditions allow.

The likelihood of effects of the land discharge scheme on air quality will be negligible at the property boundary (LEI, 2017). This is supported by other land based wastewater application systems around the country which can and have operated with limited odour and aerosol problems.

6.5.3 Proposed Mitigation

As part of the best practicable option approach, in order to mitigate any actual or potential adverse effects associated with the activity, in addition to the proposed operational management plans which will document these processes, a specific Odour Management Plan

("OMP") will be developed for the site. Although not a requirement under the existing air discharge consent, SWDC have proposed the development of an OMP as part of this integrated programme, for each of the three sites.

To mitigate any actual or potential effect on air quality SWDC propose the following:

- Continue to operate the WWTP in a manner which reduces potential odour beyond the boundary.
- Installing covers on the inlet screen to minimise the potential for fugitive odour release from this potential source
- Storing solids from the inlet screen in a continuous sealed bagging system to prevent any potential release of odours from this source.
- Installation of a meteorological station to record, amongst other parameters, wind speed and wind direction at the irrigation site and impose irrigation cut-off when wind speed and direction meet the criteria suggested in Section 6.5.2 and proposed conditions of consent[117].
- The irrigation is operated using soil moisture probes to avoid over-irrigation and the potential development of anaerobic soil conditions.
- The irrigation lines to be flushed in the event treated wastewater following long periods between irrigation events become stagnant in the lines and there is a potential for odour issues arising when irrigation commences.
- The design of any new irrigation equipment will adopt as a minimum, the permitted activity standards of the WCDP to avoid effects associated with spray drift and odour.
- In conjunction with the development of an Operation and Maintenance Plan and Discharge to Land and Water Management Plan which will document the above pond and land treatment scheme operational procedures, a specific OMP is proposed to ensure that adverse effects of odour on public amenity and health will be avoided, remedied or mitigated in a timely and responsive manner in the event that odour discharges occur and to assure on-going compliance with conditions of the consents.
- Ongoing monitoring and reporting programmes, with regular review feedback.
- Training of Staff and Contractors regarding operation and consent compliance.
- Implementation of a comprehensive complaints and feedback monitoring process

6.6 Effect on Cultural Values

Traditionally water ways were seen as places of mauri or life giving places, but even amongst the freshwater infrastructure there are degrees of importance. Large places with wide life supporting characteristics like Wairarapa Moana were seen as significant to the point of being a place where hapu came together across boundaries to share in the bounty of life. Other places with a higher degree of importance for Maori with respect to mauri are springs or puna, because they are the bearers of new life including the Torohanga spring upstream from the FWWTP (see the Cultural Impact Assessment ("**CIA**") prepared by Ra Smith provided in Appendix 15 to this report, para 288). Thus the Mauri of the spring feed Torohanga Creek which feeds Donald Creek and Lake Wairarapa is of relevance and significance to Iwi. Furthermore, the FWWTP effects can "affect other sites of cultural heritage for Wairarapa Maori including battle sites around Lake Wairarapa, places where people were buried in wetlands close to the lake, the prime mahinga kai site for this area within the lake and the specific place that names the province" (see Appendix 12 para 292).

[117] Refer to proposed conditions in Part 1, Schedule 4: Condition 7.

The iconic nature of the waterways in South Wairarapa are very significant to Wairarapa Maori because how the waterways are coping, especially Wairarapa Moana is a parallel to how Wairarapa Maori are coping. The aspirations for many Wairarapa Maori are linked to improved health of the lake, such as re-establishing major recreational activities like celebratory picnics; re-establishing an indigenous fishery; working shoulder to shoulder in re-planting native flora; having the wider community recognizing the iconic nature of SWDC waterways. The PNRP recognises Maori customary use, which is the interaction of Māori with freshwater for cultural purposes. This includes the cultural and spiritual relationships with water expressed through Māori practices, recreation and the harvest of natural materials.

The discharge of human effluent, even treated effluent, is considered by Maori to degrade cultural values such as mauri, more so than effects from other landuse. The discharge of wastewater to land is not considered to have an adverse effect on the mauri of the surface water environment. The full removal of effluent from Donald Creek has been identified by Iwi as the preferred outcome. Due to the significant storage requirements needed to achieve 100% land application, alternatives to this option have been considered and a 90th percentile storage volume capable of eliminating discharges to the Creek on 3 out of 11 years modelled has been proposed in order to balance Iwi's and community desires with cost implications to the community (Refer to Appendix 2 alternatives considered). Affordability is also of importance to Iwi, whereby cost needs to be balanced with cultural wellbeing to ensure rate increases to Whanau are attainable.

The proposed scheme will achieve a significant reduction in both volume and contaminants to the freshwater environment. The CIA (Appendix 12) recognises the benefits of such a scheme whereby land disposal is prioritised and targets removal of discharge to water during summer months coinciding with a time when water levels are lower and any effects and/or levels of recreation may be increased.

The assessment of cultural values provided has considered the proposed activity in terms of identified principles, and has also considered the relevant RMA policy frameworks. The assessment has raised the following key issues:

- That improvement in water quality is a long term process which needs to be done correctly,
- The need for integrated catchment management,
- The importance of enabling participation of Maori in their own right,
- The key need to improve water quality in Donald Creek and Lake Wairarapa,
- The importance of maintaining and enhancing water quality in waterways,
- Recognising the issues associated with infiltration into the system reducing the scheme efficiency,
- The intrinsic values Maori afford water, and the contrary nature of introducing human effluent into water.

SWDC acknowledges all of these key points, and has attempted to address them in its proposal.

The CIA also makes the following recommendations which are not solely focused on a wastewater perspective but a wider water perspective (Appendix 12, para 402):

- A study be carried out to better understand the cumulative effects that will occur as a result of FWWTP's effects as a part of wider water indicators.

  This has been addressed earlier in Section 6.4.6.

- A fish survey be undertaken of the mudfish to track the effects on them of being upstream from the FWWTP.

  Monitoring of presence and abundance of fish within Donald and Abbot Creek was undertaken by Hamill (2017a) in October 2016. The results of which are provided above in Section 6.4.4.16 and Appendix 11.
- The lessening effect of effluent being discharged from the FWWTP on waterways be reported on for the community and the reasons for this lessening effect in terms of desired outcome be reported too.

  Annual reporting is proposed and will be provided to the Community Liaison Committee as a condition of consent.
- Cultural Health Indexing and Monitoring occurs from the FWWTP to Lake Wairarapa, as a part of wider water indicators,

  SWDC propose to establish a Tangata Whenua Values Management Plan within 18 months of grant of consent, and to work with iwi to identify and then monitor potential effects on Cultural Health associated with the discharge.
- State of the environment reporting for SWDC of the wider water infrastructure throughout the district.

  SWDC believe this is suitably addressed through the current regional state of the environment monitoring undertaken by GWRC.
- A shared education programme between Wairarapa Maori and SWDC about Lake Wairarapa and the FWWTP as the wider water infrastructure improvements are undertaken.

  This matter can be addressed through the development of a Tangata Whenua Values Management Plan.

It is considered that the proposed activity reaches an appropriate balance between affordability whilst giving significant consideration to cultural values and wellbeing. Despite the move to land treatment there will remain an infrequent discharge to water during winter months which is likely to result in adverse effects on cultural values that are not insignificant. Therefore it is proposed that cultural health monitoring be undertaken to ensure such effects on cultural values are not significant and facilitate positive relationships with iwi and improvements over time.

6.6.1 Proposed Mitigation

To mitigate any actual or potential effect on Cultural Values SWDC propose the following:

- Continue to recognise the cultural value associated with Donald Creek and its catchment and the role of tangata whenua.
- Implement upgrades to the treatment of wastewater in accordance with the proposed staged programme.
- Develop a Tangata Whenua Values Management Plan, including a protocol to identify and monitor effects on Cultural Health associated with the discharge.
- Continue to build positive relationships with tangata whenua and facilitate outcomes with other joint key stakeholders.

6.7 Effect on Public Health and Safety

The operation of the FWWTP has the sole function of ensuring SWDC can fulfil its role to manage public health and safety risk associated with the management of human sewage. The discharge of sewage to water and/or land, where the scheme is poorly designed or where effluent quality is poor, can have significant public health implications. Contaminants of concern

with regard to Public Health and Safety include, pathogens, nitrates in water supply (i.e. potential to cause 'blue baby syndrome') and the presence of endocrine disrupting compounds ("**EDC's**").

The potential adverse effects associated with the irrigation of effluent have been considered in previous sections, both in terms of the discharge to land, water (including groundwater) and air. The effluent will receive a high level of treatment for pathogens prior to discharge to the deferred storage pond. In addition, low nitrogen loading rates have been proposed to facilitate maximum plant uptake and minimise the potential for nitrates leaching into groundwater. Finally, irrigation will fully comply with the permitted activity standards for buffer zones and wind cutoff criteria in accordance with the District Plan, thereby mitigating any risk of exposure from aerosols.

In terms of the potential adverse effects associated with the continued discharge of effluent to Donald Creek, the relevant sections above has concluded that under normal (controlled) operating conditions the concentration of *E.Coli* will not be a risk to human health, due to the ongoing use of the UV disinfection plant prior to discharge to water and the proposed setbacks as part of the land application scheme operations. The UV plant currently achieves median pathogen indicator levels of less than 100 *E.coli* cfu/100ml, well below the secondary contact recreation standards prescribed in the PNRP for freshwater rivers. Furthermore, the assessment of effects of the current and proposed discharge on water quality has not identified any concerns with respect to human health. The mixing area has not been identified as an area for food gathering, and there has been no indication in the aquatic ecological surveys undertaken to date within Donald Creek that there are any significant populations of species normally collected for food.

There is a potential public health risk in the event of plant failure, should a significant discharge with a low (or nil) level of treatment occur directly to Donald Creek. SWDC have advised they have no record of any such event, and that its occurrence at any of the other similar plants throughout New Zealand would be extremely rare if not unlikely unless there was a significant natural event. In emergency conditions, should the plant fail and untreated sewage enter the stream, SWDC would initiate its standard emergency operating procedures in accordance with its Operations and Maintenance Manual.

Finally, a perceived potential health risk is the presence of EDC's in the environment. EDC's are compounds which disrupt endocrine systems in animals (including humans), fish, and birds. Such disruptions are thought to contribute to some cancers, birth defects, and other developmental disorders. Specifically, they are known to cause learning disabilities, severe attention deficit disorder, cognitive and brain development problems, deformations of the body (including limbs); sexual development problems, including feminising of males or masculine effects on females. Any system in the body controlled by hormones can potentially be affected by EDC's. Steroidal sex hormones have been identified as a potential source of EDC's from treated wastewater. These compounds include natural hormones from humans and animals (e.g. estrogens and testosterone) and synthetic hormones, such as those used in birth control pills.

The ANZECC water quality guidelines state that the current knowledge on EDC's is insufficient to make any recommendations on guidelines and that the outcomes of considerable ongoing international research will need to be fed into any such guideline development. The potential risk is a function of concentration of EDC's, location of discharge, and risk of exposure. The small population serviced, along with the low likelihood of prolonged exposure suggest the risk of such effects is negligible. However, without undertaking intensive studies there is no precise way to assess such effects and if needed this aspect can be looked at in the future.

The greatest potential risk to public health and safety is in the event the consent is not granted (subject to appropriate conditions), and a short term alternative treatment and disposal mechanism needs to be found and implemented. On balance, there is no data to indicate that any risk of infection or communicable disease associated with the discharge of the treated wastewater during normal operation will be any more than minor. The proposed operation regimes will ensure there is no risk to human health under normal (controlled) operating conditions.

6.7.1 Proposed Mitigation

To mitigate any actual or potential effect on public health and safety SWDC propose the following:

- Continue to provide an efficient and effective wastewater treatment plant for the Featherston community.
- Continue to operate the plant effectively, providing a high level of treatment of *E. Coli* concentrations in the effluent leaving the ponds through the effective operation of the UV plant.
- Continuing to provide appropriate signage and information on the activity and associated health risk.
- Interlocking the UV disinfection unit to the irrigation/river discharge system so that both conveyance of flow to the irrigation system or discharge to the Donald Creek cannot commence unless the UV disinfection is fully operational. An exception to this will be in the event flows greater than 140L/s occur in which bypass flows will receive no UV disinfection and discharge directly to the Creek. At the time of writing this report the manual UV bypass had not been used therefore it is considered the potential for these events will be rare.
- The design of the irrigation scheme will adopt as a minimum, the permitted activity standards of the WCDP to avoid effects associated with spray drift and odour including automatic wind shut-off functionality.
- Training of Staff and Contractors regarding consent health and safety risks, monitoring and management.
- Implementation of a comprehensive complaints and feedback monitoring process.
- In order to mitigate the potential adverse effects associated with endocrine disruption, SWDC senior management will maintain current knowledge on the subject, and any research into risks and required treatment.

6.8 Effect on Visual and Aesthetic Values

The FWWTP has been lawfully established and operating in its current location for over 40 years. SWDC has not received any complaints during the period of operation or in developing the Project as to any actual or potential adverse effect of the ongoing operation on any visual, aesthetic, or amenity values associated with the facility. The location of the site is an effective mitigation, being largely distant from the majority of offsite views, and having only limited built infrastructure.

Only minor changes to the existing treatment plant are proposed that include an inlet screen which depending on the design may be partially below ground. The irrigation schemes proposed will be similar in scale and appearance to many other agricultural irrigation schemes in the District. Some minor differences may be evident depending on the final irrigation system selected (e.g. boom height, no end gun, different spray patterns when operating), but for all intents and purposes, it will appear as any other rural irrigation scheme. The proposed storage

pond will be large and will be the most dominant change to the visual appearance of the site, although shape and size of the embankments will be similar to those of the existing pond.

The site is also located within a Rural 'Special' Zone within the District Plan, specifically (in part) for the purposes of mitigating the potential reverse sensitivity effects associated with aesthetics and amenity from the operation of the plant. No visual or landscape assessment has been completed as part of this application. Any visual impact of the plant or land treatment system and mitigation required will be considered as part of the Outline Plan of Works and/or landuse consents required, which will be prepared following detailed design.

The existing discharge does at times cause discolouration of waters flowing within Donald Creek, foaming, reduction in water clarity and undesirable heterotrophic and periphyton growth beyond the zone of reasonable mixing which can affect some people's appreciation of the stream. The assessment of effects on water quality above concludes that by Stage 1B the effects on Donald Creek visual, aesthetic and amenity values will be significantly reduced and by Stage 2B mostly eliminated as a result of the proposed upgrade.

It is expected that any adverse effect on the amenity of the receiving environment at or near the application site, following the implementation of Stage 1B will be minor.

6.8.1 Proposed Mitigation

To mitigate any actual or potential effect on visual, aesthetic, and amenity values SWDC propose the following:

- Continue to operate the plant in its current location, thereby avoiding potential effects of new significant infrastructure in a greenfield development.
- Continue signage at the site to ensure identification of onsite activities, including a contact number where there are any queries.
- Continue to maintain the site and operations in a safe and tidy manner, including boundary fencing.
- Implement upgrades to the treatment of wastewater in accordance with the proposed staged programme.
- Design new facilities, including the proposed irrigation infrastructure, to be consistent with the rural environment.

6.9 Effect on Recreational and Amenity Values

The specific reaches of Donald Creek & Abbot Creek near and downstream of the discharge point are effectively enclosed within private land and are not known as high use recreational or amenity areas. SWDC have advised they rarely see any active use of these streams. Lake Wairarapa is used for a number of recreational activities including kayaking, boating, and fishing.

GWRC report in '*Selection of rivers and lakes with significant amenity and recreational values*' (2009) the Rivers and Lakes identified as having significant amenity and recreational values throughout the region. The report does not identify either Donald or Abbot Creeks as being of significance. Lake Wairarapa is identified in the 2009 Report, RPS, Freshwater Plan and PNRP as being of both recreational and amenity significance.

More recently, GWRC completed an assessment of recreational water quality in the Region (Greenfield *et al*, 2012). Again neither Donald Creek nor Abbot Creek are identified in this

report as areas of recreational significance. Furthermore, Lake Wairarapa is also not identified, as the focus is on rivers and coastal recreational spots.

By necessity, contact recreation should be restricted at the point of discharge where wastewater is discharged. This is covered under the existing consent, and it would be appropriate to replicate similar conditions in any replacement consent.

The only attribute of relevance to recreational and amenity values is therefore 'poor water quality'. The discharge of treated effluent has the potential to have significant adverse effects on water quality in relation to discolouration, foaming and scums, undesirable heterotrophic and periphyton growths and effects on public health from pathogens.

Water quality monitoring and mass balance calculations discussed in Section 6.4.4.8 suggest the existing discharge from the FWWTP may be having a moderate effect on Donald Creek water quality in terms of pathogens (with occasional increases in *E.Coli* numbers downstream of the discharge). The proposed upgrades and staged removal of the discharge to water during summer months will significantly improve Donald Creek water quality during periods when recreational and amenity values are at their greatest however it is expected the risk to public health and thus recreational values will remain minor to moderate until Stage 2B is implemented.

Discolouration in the Creek from time to time beyond the zone of reasonable mixing and the presence of foams, and undesirable heterotrophic and periphyton growths are likely to be having a significant effect on recreational values. The proposed upgrades and staged removal of the discharge to water during summer months will significantly improve the water quality in Donald Creek during periods when recreational and amenity values are at their greatest. Stage 1B is expected to result in effects to water quality in terms of discolouration, foams and undesirable growths that are considered to be moderate to minor reducing to less than minor at Stage 2B.

The potential effects of the discharge on Lake Wairarapa are limited to potential cumulative effects associated with nutrient concentrations and the perception of risk which can result in a diminished recreational value of the Lake. As identified in the earlier assessment and by GWRC in its reporting, the actual contribution of nutrients to Lake Wairarapa from the FWWTP is reasonably low and will further reduce with time as the land treatment scheme is implemented.

It is therefore considered that adverse effects on recreational and amenity values from granting the consent will improve over time, but remain moderate after reasonable mixing from the commencement of Stage 1B when a majority of the discharge during summer will be eliminated from Donald Creek, reducing to less than minor at Stage 2B.

6.9.1 Proposed Mitigation

To mitigate any actual or potential effect on recreational and amenity values SWDC propose the following:

- Provide signage at the site to ensure identification of onsite activities and risks, including a contact number where there are any queries.
- Implement the proposed staged removal of treated wastewater from the Creek with a focus of removing all summer discharges.
- Undertaken effluent and receiving environment monitoring to assess the ongoing effects including effects on recreational and amenity values.

- Contribute to recreational surveys where applicable and appropriate.
- Establishment of a Community Liaison Group to engage the immediate community, avoid uncertainty, and ensure community involvement in the development of the Project in the long-term.

7 Additional Information

7.1 Introduction

This section provides additional information relevant to making a decision on this application, in particular

- *The 'Best Practicable Option' in terms of the RMA and the current application;*
- *The assessment of alternatives undertaken by the Applicant in reaching its proposal; and*
- *Identification of key stakeholders and consultation undertaken.*

7.2 Best Practicable Option

Section 2 of the RMA defines Best Practicable Option ('BPO') as

> *in relation to a discharge of a contaminant ... means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—*
>
> a. *the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*
> b. *the financial implications, and the effects on the environment, of that option when compared with other options; and*
> c. *the current state of technical knowledge and the likelihood that the option can be successfully applied.*

A comprehensive assessment of the options available has been undertaken. This is described at a high level in Section 1.1 and outlined in detail in Section 7.3 below. In terms of the criteria for determining the BPO, the following is of relevance:

- The proposal will result in significant improvements on the receiving environment (Donald Creek) water quality and ecological health downstream of the discharge, particularly during summer months, and see a reduction in treatment plant contributed nutrient load to Lake Wairarapa resulting from this significant infrastructure;
- Donald Creek and Lake Wairarapa is already significantly compromised as a result of the combination of the effects of intensifying land use activities within the catchment outside the Applicants control and the existing WWTP discharge. The contribution of contaminants to the Lake Wairarapa catchment from the FWWTP is low. Even permanent removal of the WWTP discharge immediately would not result in all water quality and ecological health targets being achieved. It is simply not within the abilities of the Applicant to improve Donald Creek or Lake Wairarapa to achieve the objectives of the regional planning documents in isolation, only to control the extent of the effects from its own activities, advocate for an integrated strategic catchment wide approach, and participate in relevant research and improvement programmes;
- Considering the compromised state of Donald Creek it has also been considered inappropriate to relocate the discharge where this may potentially degrade alternative receiving environments which are more pristine and carry greater overall value;
- The financial implications on the South Wairarapa community of high-rate treatment options in the short term or accelerating the land treatment scheme or combining both high-rate

treatment with a land treatment scheme are considerable. Particularly when considered in the context of the significant I & I problem, the size of the community, the relatively low environmental benefit (in terms of nutrient loadings in the receiving environment after reasonable mixing when compared with the BPO) and the fact that SWDC are responsible for two other similar urban wastewater systems each requiring significant investment;

- The assessment of options has considered the current state of technical knowledge, and the proposed option of land treatment has been shown to be successfully applied elsewhere in New Zealand.

It is considered, on the basis of the assessment of alternatives and those matters outlined above, that the proposed activity represents the BPO for the treatment and discharge of wastewater at the FWWTP in terms of the RMA.

Section 108(2)(e) provides the ability for the consent authority to attach conditions of consent requiring the BPO be adopted, in the context of the proposed discharge and the receiving environment. This concept has been adopted in the development of the proposed Conditions of consent, including:

- a proposal to provide an annual report on the wastewater reduction initiatives undertaken and proposed;
- analysis of environmental monitoring data trends to confirm (or otherwise) improvements in effects on aquatic life after reasonable mixing are being achieved as each stage is implemented; and,
- a review of the efficacy of Stage 1 land treatment in order to determine whether or not the commencement of Stage 2A and 2B should be advanced.

7.3 Alternatives considered

The RMA requires an applicant to provide a description of alternative methods, including a description of alternative available receiving environments, where the activity involves the discharge of any contaminant[118].

The Freshwater Plan and PNRP also provide guidance on the extent to which alternatives should be assessed when considering the application. Policy 5.2.13 of the Freshwater Plan states:

> *To encourage users to discharge to land as an alternative to surface water where:*
>
> - *the provisions of the Regional Plan for Discharges to Land are satisfied; and*
> - *discharging to land has less adverse environmental effects than discharging to water; and*
> - *there are no significant cultural, environmental, technical, or financial constraints associated with discharging to land*.
>
> ***Explanation.*** *This policy recognises that, where it is a feasible option, the alternative of discharging to land rather than water will be encouraged by the Council. However, it is recognised that there are times when discharge to land rather than water is not preferable. These circumstances are recognised by the bullet points in the policy. The Council will not encourage discharges to land in such circumstances. "Cultural*

[118] RMA 1991: Clause 6(1)(d)(ii), 4th Schedule – Where the activity includes the discharge of any contaminant, a description of … Any possible alternative methods of discharge, including discharge into any other receiving environment, and section 105.

constraints" recognises that discharges to land may be inappropriate for cultural reasons, such as the presence of a waahi tapu site.

"Environmental constraints" recognise that discharges to land may still contaminate water bodies (through runoff to surface water or leaching to groundwater) or have other adverse effects on the environment. "Technical constraints" recognises there are circumstances where discharges to land will be difficult using current methods. "Financial constraints" refer to a person's or community's ability to fund the discharge to land compared with the costs of a discharge to surface water.

The policy encourages anyone wishing to discharge to surface water to examine the option of discharging to land and to consider why surface water is a more appropriate receiving environment.

Policy 4 of the PNRP also states:

Where minimisation of adverse effects is required by policies in the Plan, minimisation means reducing adverse effects of the activity to the smallest amount practicable and shall include:

a. *consideration of alternative locations and methods for undertaking the activity that would have less adverse effects, and*
b. *locating the activity away from areas identified in Schedule A (outstanding water bodies), Schedule C (mana whenua), Schedule E (historic heritage), Schedule F (indigenous biodiversity), and*
c. *timing the activity, or the adverse effects of the activity, to avoid times of the year when adverse effects may be more severe, or times when receiving environments are more sensitive to adverse effects, and*
d. *using good management practices for reducing the adverse effects of the activity, and*
e. *designing the activity so that the scale or footprint of the activity is as small as practicable*.

A full description of the alternative options available and considered are included in Mott MacDonald, 2017 (see Appendix 2).

The level of investment in the existing FWWTP and system means the total relocation of the plant to an alternative "greenfields" site (even discounting consenting issues) is not economically feasible. A preliminary assessment was undertaken to determine the feasibility of an alternative facility which combined wastewater from Martinborough, Greytown and Featherston, and a second combined scheme including wastewater from Carterton. Due primarily to the cost of pumping and piping to a central treatment facility (given the distances involved), these combined scheme options are considered to be cost prohibitive (AWT, 2013a, refer Appendix 3).

SWDC have considered and assessed a long-list of alternative treatment options for upgrade at the existing FWWTP site, including "do nothing", a range of pond enhancement options to improve pond performance, a range of pond add-on options to supplement the existing treatment system, pond replacement options and land treatment. It was considered many of these options would not be acceptable as standalone solutions in the event a continued water discharge were pursued as the necessary level of contaminant removal to achieve water quality standards or show appropriate improvements in receiving water quality would be unlikely to be achieved. As such, many of the pond solutions were discounted early in the assessment

process. For comparative purposes, Mott MacDonald identified three best practical pond 'enhancement' options for the existing ponds depending on staging timeframes and the ultimate receiving environment. These pond enhancement options included a combination of primary screening, in-pond coagulation dosing or DAF, floating treatment wetlands and flow directing curtains. The pond enhancement options were considered capable of achieving a high level of phosphorus removal with polishing potential likely for other contaminants such as nitrogen. However, the degree of improvement in effluent quality for these other contaminants is difficult to quantify with any certainty and thus some disposal options were considered more favourable to others where sufficient dilution and assimilative capacity exists. High rate treatment (Membrane Bioreactor or Sequencing Batch Reactor technology) was considered to provide high levels of nitrogen reduction with a greater level of certainty.

In summary the original long-list of treatment options was shortened to 6 alternative treatment options including:

- "do nothing";
- three pond enhancement options;
- high rate treatment; and
- land treatment[119].

In conjunction with these treatment options, eight alternative disposal options were considered and combinations of disposal options. The eight primary options included:

- "do nothing" i.e. retaining the existing discharge to Donald Creek;
- Five alternative water receiving environments (Abbot Creek, Tauherenikau River, Rumahanga River and Lake Wairarapa);
- Land application (with a number of different sites considered) with storage; and,
- Beneficial reuse.

Full-time water discharge and full-time land discharge were compared against various combinations of land and water discharge options such as: land application with 10%ile storage volume contingency winter only discharges to water or high rate land application, and partial land and water discharges where discharge to water might occur during shoulder and winter months. These combined land and water options enabled reductions in stored volumes to be recognised, enabled water quality improvements to be achieved particularly during summer months in receiving water bodies and partially meet community and cultural aspirations.

Common to the success of all options considered is the issue regarding network I/I and the large volumes of effluent during winter to be managed. The assessment concluded that both high rate treatment and land treatment options are economically constrained (or even uneconomic) without first addressing I&I issues to reduce inflows to a sustainably achievable minimum level. For example, to provide sufficient storage of winter flows without I&I reduction to enable a full land treatment scheme, extremely large additional storage ponds (between 345,000 to 410,000 m^3 depending on whether a land treatment scheme operated under a deferred or deficit regime) would be necessary. To contain such flows was considered unfeasible in terms of cost, constructability and ongoing operation, with large volumes of the ponds siting redundant for most years. As such, options to reduce or eliminate I&I were also considered and included:

- network rehabilitation; and,
- re-reticulation.

[119] Land treatment is also a method of disposal and thus was primarily considered as such.

All in all, 17 combinations of pond enhancements, treatment upgrades and/or discharge alternatives were evaluated, where each option was various combinations of the following:

- Inflow and infiltration (I/I) rehabilitation and re-reticulation options
- Treatment options
  - Pond enhancements and modifications
  - Pond replacements options (high rate treatment)
  - Land treatment
- Discharge options
  - Water discharge
  - Land discharge with storage
  - Land discharge with excess flows discharged to water or to land through high rate application/rapid infiltration.
  - Beneficial Reuse

A tiered multi-criteria analysis (MCA) was used to identify the “best practical option” (BPO) to prevent or minimise the adverse effects on the environment whilst having regards to the financial implications to the community. A copy of the multi-criteria analysis is also included in Appendix 2. A summary of the key outcomes of the MCA are as follows:

- Re-reticulation of the entire sewerage network was also considered in conjunction with land treatment, although this was found to be cost prohibitive.
- All treatment options evaluated for continuous full-time discharge to Donald Creek were discounted as they were considered unlikely to achieve a satisfactorily level of improvement all year round.
- All options considering a discharge to the Ruamahanga were found to either have very high or prohibitive costs associated with them ($>21M). Any new wastewater discharge to the Ruamahanga was also considered to be inconsistent with the SWDC Wastewater Strategy, Regional Policies and Objectives, and the approach taken with upstream Treatment Plants moving to land based discharge regimes.
- The option for contingency discharge to Lake Wairarapa was discounted due to the foreseen social and cultural effects of discharging treated wastewater directly to the Lake, particularly due to the Lake’s outstanding values and already degraded state.
- Beneficial reuse was considered, in particular the irrigation of Featherston Golf Course. The site is capable of taking some of the treated wastewater, but due to higher risks of human contact, perception, and the cost of infrastructure for undergrounding irrigation system, this was discounted.
- High rate treatment plants are common in New Zealand and favoured by many Councils. Many high rate treatment processes are robust and well proven, and will have a significant improvement in effluent quality at FWWTP. Although a relatively high cost option in comparison to a pond based system, a high rate plant would provide the most reliable effluent quality and in conjunction with a discharge to the Tauherenikau River, this option is considered a feasible alternative to the proposed scheme (Top 4 ranked option).
- Other contingency discharge options in combination with land treatment for the 90th percentile storage volume were seen as favourable alternatives to the proposed scheme such as contingency discharge to land and contingency discharge to Tauherenikau under high flow conditions (Top 4 ranked options).

On balance, the proposed staged deferred irrigation scheme with high stream flow contingency winter discharge, is considered to represent the best practicable option.

7.4 Affected Persons and Consultation

SWDC have consulted with key stakeholders and the community throughout the Project development process.

Wide consultation was undertaken on the Wastewater Strategy from early 2011 including mail outs to all ratepayers, local public meetings, meetings with Council's Maori Standing Committee, and offers of one on one meetings with other people as affected.

Following confirmation of the Wastewater Strategy, attention turned to the WWTP Upgrade Projects required for the consents. Regular updates on the project, feedback on progress, and requests for input were made to the Maori Standing Committee, the SWDC Wastewater Combined Steering Committee. The Steering Committee Members include representatives from:

- Tangata Whenua
- The Maori Standing Committee
- Wellington Regional Council
- Fish and Game
- Department of Conservation
- Wairarapa Public Health
- Sustainable Wairarapa
- Adjacent landowners
- Federated Farmers
- SWDC Councillors
- Featherston, Greytown, and Martinborough Community Boards

Leading up to the lodgement of the 2014 application for the FWWTP, workshops were held for Councillors, the Maori Standing Committee and Wastewater Steering Committee, and with Wellington Regional Council. Individual meetings were held with Tangata Whenua and others where requested, with information provided and concerns taken into account.

Council Project leaders regularly asked key stakeholders for the preferred method of communication and consultation to ensure every opportunity was made available. Where a preference was provided, this method was adopted for those stakeholders. Overall a disappointing level of response was received and irrespective of this, progress updates and programmes were sent on a regular basis.

Notices were put in local papers, including calls for input, and progress reporting was updated monthly on the Council's project website.

Following lodgement in 2014, 18 submissions were received. Key points raised in these earlier submissions are summarised in the following table and addressed where relevant against the revised proposal.

Table 47: Summary of 2014 application submissions

Submission Points	Comment
Proposed term of consent (35 years) is too long	The implementation of the Strategy relies upon a level of certainty which can best be provided by a long term consent. Detail supporting a long term consent is provided in Section 4.9 of this report. It is considered a shorter term of consent would not achieve any significant additional benefits or provide any additional

Submission Points	Comment
	safeguard against known and consistent environmental effects.
Concern over lack of consultation	We believe this has been suitably addressed within this section of this report.
Concern over ability to comply with s107 requirements	We believe this has been suitably addressed within Section 6 and more specifically section 6.4.7 of this report
Concern at inconsistency with Wairarapa Moana: and that SWDC signed up to the MoU in 2010	The staged land application proposal is considered to be consistent with the Wairarapa Moana.
Effects on groundwater quality	We believe this has been suitably addressed within Section 6.3 of this report and proposed conditions of consent. Some nutrient loss is expected from the site and management of the irrigation and landuse however the scheme will be designed to avoid excessive loss, resulting in rates of loss that are no more than would occur currently for the site managed as a dairy unit where industry good practice is adopted.
Concern over cultural effects of retaining discharge to freshwater	We believe the proposal goes a long way toward addressing these cultural effects in the long-term, however in the short-term a discharge to freshwater will continue and in the long-term a small portion of the total annual discharge volume will continue during winter months. A Tangata Whenua Value Monitoring Plan to be developed in collaboration with iwi is proposed to work with iwi to identify and then monitor potential effects on Cultural Health associated with the discharge.
Effects on water quality (surface water) / proposal fails to improve water quality	We believe this proposal will significantly improve water quality downstream of the FWWTP within Donald Creek. However Donald Creek water quality will continue to be compromised by upstream landuse activities.
Effects on aquatic habitat	We believe this proposal will significantly improve ecological health of the Creek downstream of the FWWTP discharge. However it is reiterated that Donald Creek water quality will continue to be compromised by upstream landuse activities.
Concern that the term of consent will not enable alignment with outcome of the Ruamahanga Whaitua process	We agree with GWRC's position, as stated in the Greytown WWTP Officers Report that, it is not viable to defer processing this consent to wait for the plan or whaitua process to be completed. Under the RMA, GWRC has a duty to avoid unreasonable delay when processing a resource consent application. Any limits set by the Whaitua will have to go through a variation process to the regional plan which would be subject a potentially lengthy submission, further submission and potential appeal process. This delay would see the current discharge continue under the current conditions of consent without any upgrade or land treatment for an unknown duration. Should changes to regional plans occur during the term of the consent, GWRC may be able to review the affected consent conditions through a formal, public review process under Section 128 of the RMA.
Cumulative effects on Lake Wairarapa and Lake Onoke	The proposal will see a staged reduction in annual load of contaminants to Lake Wairarapa resulting in a contribution of TN and TP load of less than 0.2%. Thus the future effects of the discharge on Lake Wairarapa are considered to be negligible.
Concerns over lack of detail regarding monitoring and management regime	We believe the conditions proposed are very prescriptive and provide a clear framework from which the monitoring and management plans are to be developed.

Submission Points	Comment
Proposal inconsistent with the RMA, Regional Policy Statement and Regional Freshwater Plan	An assessment against the relevant planning policies and objectives and Part II of the Act is provided in Section 5 of this report. It is considered that the proposal is largely consistent with these policies and objectives.
Equity between rural and urban wastewater consent terms (i.e. greater restriction on rural landuse / dairy farming)	As discussed in Section 4.9 of this report the sought consent term is considered appropriate.

Following the submission process for the FWWTP 2014 application and subsequent request by SWDC to put the application on hold while it revisited the approach being taken, SWDC sought to engage with the wider community through the current (2015) Long Term Plan consultation process and submitters. The purpose of this consultation was to indicate the change in circumstances with regard to land availability at Featherston and the consequential change in approach with land treatment becoming a viable option for the future. In addition, the capital programmes for the WWTP projects have been included in the Long Term Plan and annual planning and reporting. No submissions relevant to the consent application were received through the Long Term Plan process.

Letters have been sent to all submitters setting out the Councils position on 13 April and 17 December 2015, 4 March and 9 December 2016 with regard to the proposed scheme upgrades. A meeting was held with the submitters on 15 March 2016 to discuss the proposed land treatment scheme and the work that was being undertaken by SWDC to investigate its feasibility.

Neighbouring property owners and occupiers were also sent a letter on 10 May 2016 to inform them as an adjacent neighbour to the proposed scheme of the resource consent application for the FWWTP upgrade. Only one response was received by the owner of 69 Longwood East Rd and whose concerns were satisfactorily appeased by SWDC.

A further consultation meeting, extended to include the previous submitters, adjoining neighbours, Featherston Community Board, Councillors and Mayor was held on 27 July 2016. Matters raised at this meeting are summarised in the following table.

Table 48: Consultation Feedback

Area of concern	Comment
Growth in Featherston and how this would be catered for with the proposed scheme.	There is some provision made for growth through the conservative approach taken to the land treatment regime and the assumption that flow reduction will occur during the infiltration and inflow rehabilitation programme.
Scheme Cost.	High level estimates of the scheme cost indicate the scheme may cost between $18 - $23M (including land costs and I/I rehabilitation costs)
Potential impacts on neighbouring domestic bore water quality. Who is responsible for monitoring the water quality. Actions to be taken if bore water became contaminated.	50m exclusion zones for irrigation to bores is proposed. Monthly monitoring of the nitrogen load applied to land is proposed to ensure the supply of nutrients and water are being applied at a rate to meet plant needs to ensure that leaching will be managed to not be more than occurs under the surrounding land use that receives fertiliser application and animal excreta. Groundwater monitoring is proposed, although the specifics of this monitoring programme will be confirmed through the development of the proposed Environmental Monitoring Plan, and results of this monitoring will be reported annually including analysis of data trends to identify environmental effects that are considered significant.

Area of concern	Comment
Confirmation of building restrictions on adjoining property as a result of the proposed irrigation	Replacement of the sprinkler heads on the existing irrigation system on Site B within 125m of the boundary is proposed thereby resulting in no building restrictions on adjoining properties to the land irrigation scheme and enabling a 25m buffer within the SWDC site., All future irrigation equipment and/or upgrades to the existing irrigation system would be designed to ensure low pressure nozzles capable of meeting <1.4bar would be installed.

Separate consultation is currently being progressed with representatives from Kahungunu ki Wairarapa and Rangitane O Wairarapa and any feedback received will be provided to GWRC.

All letters and meeting minutes following the notification of the 2014 application are provided in Appendix 14.

Affected persons have not been specifically identified. SWDC has engaged with all known stakeholders.

SWDC request public notification of the application to ensure that any other potentially affected party can participate in the process. SWDC are also prepared to work through the pre-hearing meeting process should GWRC consider that to be beneficial.

7.5 Affordability of the Upgrades to the South Wairarapa Community

Affordability to the SWDC community has been a significant factor for the SWDC Councillors and Executive Management Team in determining the district-wide Wastewater Strategy, and a significant factor in determining the best practicable option for each site, including the FWWTP.

The Projects original estimated cost was in excess of $30 million across the three sites over the term of this consent, which is significant for one of the smallest districts in New Zealand[120]. The option of both an increased capital investment programme (out to 50 years), and a condensed investment programme to move Stage 2 land treatment sooner has been considered.

Although there would be some environmental benefits to a shortened programme of works, given the relatively low contribution of nutrients to the Lake Wairarapa catchment, the actual environmental benefits would be comparatively low, whilst there would be a significant impact on affordability translating directly to a significant rates increase and likely reduction in level of service in other essential community services. Extending the programme would have some financial benefit to the Council and community, but would defer the cultural and environmental benefits that will be achieved.

It is acknowledged that affordability is a matter to be determined by the Applicant and not a decision to be made by the consent authority under the RMA. It is however a relevant factor in assessing the feasible alternatives and in determining the best practicable option, and a matter of relevance in assessing the application in terms of the s.107 restrictions, as outlined above.

[120] As at 2013 Census; SWDC was the 55th smallest by population of 67 local authority areas in NZ (<1% of New Zealand's population).

8 Conclusion

This application, description and assessment of effects on the environment relates to the proposed continued operation and upgrade of the Featherston Wastewater Treatment Plant as part of the Council's statutory obligation to provide essential services to the community it serves and its long term asset management planning.

The application is for consents required under the RMA from Greater Wellington Regional Council. The proposal requires no additional consents at this time. Any consents required as part of the construction works associated with each stage will be sought prior to commencing those works.

The FWWTP has been operating for in excess of four decades and along with the existing sewerage network contributes to the existing and future infrastructure of the South Wairarapa District and the Region. The proposed upgrade will ensure that SWDC can continue to provide for the sewage collection, treatment, and disposal needs into the future. The Regional Policy Statement specifically recognises wastewater treatment facilities as essential services and identifies them as Regionally Significant Infrastructure, recognising the critical nature and benefits of infrastructure to communities, and the need to reasonably balancing the management of any effects.

The proposed staging of the upgrades, in combination with the integrated and comprehensive programme with the Martinborough and Greytown WWTP's, will ensure the SWDC long-term wastewater strategy is progressed in a manner which is environmentally and financially sustainable. SWDC have identified a programme of expenditure of over $30M to give effect to the first 35 years of the Strategy, the term requested for this consent. A comprehensive review of affordability across all Council services has been undertaken, and the capital programme proposed reflects bottom-line affordability. Increasing costs or decreasing timeframes will have significant implications on affordability and on current and future South Wairarapa communities.

The term of 35 years will provide certainty to all parties. In addition, the comprehensive suite of conditions, including monitoring and reporting, a Community Liaison Group, and the development process outlined for the management plans will ensure a collaborative approach to consent implementation and review. There is no advantage to be gained from a shorter term of consent.

Donald Creek is not specifically identified as being a significant resource within the Regional Freshwater Plan, PNRP or Regional Policy Statement, but as a tributary within the Lake Wairarapa catchment has been attributed generic value under the RPS. The framework of the RPS generally requires an enhancement of water qualities within these water bodies over time. This is effectively the balance being sought within the RPS with the Regionally Significant Infrastructure outlined above. The staged proposal has been specifically developed to contribute to this overall intent over time.

Monitoring indicates that the water quality within Donald Creek is already compromised upstream of the discharge, principally as a result of the intensive agricultural use within the catchment. The discharge from the FWWTP clearly contributes to the nutrient loadings in the Creek, and ultimately to Lake Wairarapa. On a catchment basis however, the relative contributions to nutrients in Lake Wairarapa from the FWWTP are low. As acknowledged by GWRC in its state of the environment reporting the actual effects on water quality within the Lake is extremely difficult to quantify with the existing and historic monitoring regime. Equally,

quantifying the specific benefits from removing the FWWTP discharge from the Lake catchment is difficult. It is clear however that the staged decrease in discharge volumes will significantly reduce the contribution of the FWWTP on the receiving environment and even so this is unlikely to result in a change in trophic level measured in the Lake. Thus, it must be recognised that responsibility for water quality in Lake Wairarapa is a significantly wider project and a strategic responsibility that sits with GWRC, not any individual consent holder.

There are some adverse effects on water quality immediately downstream of the discharge, with the most significant being associated with ammonia. Flows in Donald Creek are so low at times that its assimilative capacity remains very limited. The assessment has concluded however, that although there will be some residual adverse effects on the water quality within Donald Creek, by Stage 1B these effects will be mitigated to ensure protection of the Fingernail Clam (present upstream and downstream of the discharge) and by Stage 2B will achieve greater confidence for the protection of freshwater mussels (not present upstream or downstream) on most years, thus recruitment downstream may be possible. In addition the staged land treatment scheme will result in significant reductions in loads of Phosphorus (92% reduction) and Nitrogen (79% reduction) to the freshwater environment. Overall, the proposed activity will result in a considerable reduction in adverse effect, and the enhancement of the near zone receiving environment and catchment.

The implementation of Stage 1 Infiltration and Inflow reduction programme is targeting a reduction in annual average daily flow at the plant of 35%. The direct and cumulative effect of the wastewater discharge will therefore likely be reduced through this period, having a direct and equivalent impact on the quantity of flows and loads. Frequent monitoring and reporting will determine the success of the programme and the impact of the programme on pond treatment performance and water quality.

An Odour Management Plan will be developed to actively manage minimisation and mitigation of effects. This is not required under the existing consent, but SWDC have identified the value of developing one.

A comprehensive assessment of alternative options has been undertaken, including alternative treatment technologies, treatment and discharge locations and facilities (including shared facilities), and alternative regimes within the preferred alternative. The best practicable option has been determined on the basis of the principles contained in the RMA, and in an integrated programme across all three urban wastewater schemes in the district.

Consultation has been undertaken with key stakeholders and will continue throughout the process. Engagement will also be continued across the term of consent with the establishment of the proposed Community Liaison Group, development and review of Management Plans, and the comprehensive reporting programme required by the proposed conditions of consent.

The Purpose and Principles of the Resource Management Act provide for a balance to be achieved in providing essential community services using existing physical infrastructure while managing the potential adverse effects of the activity. The Act also allows a level of pragmatism, enabling the affordability to communities to be a key part of the decision making process, and providing for a consent term enabling the consent holder to confidently commit significant money to the programme. Of particular relevance in this respect is the recognition of the WWTP as Regionally Significant infrastructure.

The proposed activity is a responsible programme which appropriately balances the significant costs of maintaining essential infrastructure for the long term public health and safety of Featherston's community with the potential effects of wastewater treatment on the receiving environment.

9 Reference List

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A. Appendices

A.1 South Wairarapa District Council – Wastewater Strategy (2011)

A.2 Mott MacDonald – Featherston WWTP Consideration of Alternative Treatment and Disposal Options (2016)

A.3 AWT Water – South Wairarapa District Council Integrated Wastewater Scheme Evaluation (2013)

A.4 Inflow and Infiltration Assessments

A.4.1 AWT Water – Featherston Groundwater Infiltration Investigation (2013a)

A.4.2 AWT Water, Inflow and Infiltration Workshop Presentation, (2013b).

A.5 Featherston WWTP Current Consents

A.6 Donald Creek Hydrology Reports

A.6.1 Professional Ground Water and Environmental Services (PGWES) – Hydrological Assessment of Donalds Creek, Featherston, by Greg Butcher (2016a)

A.6.2 Professional Ground Water and Environmental Services (PGWES) – Featherston Wastewater Project Donalds Creek Flow Monitoring, by Greg Butcher (2016b)

A.6.3 Professional Ground Water and Environmental Services (PGWES) – Donalds Creek Flow Data, email from Greg Butcher dated 10 November 2016 (2016c)

A.7 Lowe Environmental Impact (LEI) – Assessment of Environmental Effects of Discharge of Featherston Treated Wastewater to Land (2017)

A.8 Mott MacDonald – Featherston WWTP Discharge Consent Application – Water Quality Assessment (2017)

A.9 Ecological Surveys by Brian T Coffey

A.9.1 Brian T Coffey and Associates, Ecological Survey of Donald (Boar) Creek to meet Conditions 21 to 24 of Consent WAR970080 that permit the discharge of contaminates to water from the Featherston Wastewater Treatment Plant, (2010)

A.9.2 Brian T Coffey and Associates, Ecological Survey of Donald (Boar) Creek to meet Conditions 21 to 24 of Consent WAR 970080 that permit the discharge of contaminants to water from the Featherston Wastewater Treatment Plant (2013).

A.10 Forbes Ecology - Martinborough, Greytown, and Featherston Treated Wastewater Discharges: Low-flow Assessment of Ecological Effects, by Adam Forbes, (2013)

A.11 Ecological Surveys by River Lake Ltd

A.11.1 River Lake Ltd - Ecological survey of Donald Creek and Otauira Stream, 2016 by Keith D Hamill, (2017a)

A.11.2 River Lake Ltd - Featherston Wastewater Treatment Plant: Effects on stream ecology, by Keith D Hamill, (2017b)

A.12 Ra Smith – Cultural Impact Assessment (2014)

A.13 Relevant Planning and Policies and Objectives

A.13.1 Relevant Policies and Objectives

A.13.2 Freshwater Plan Appendix 8 and PNRP Policy 71 Assessment

A.13.3 Wairarapa Combined District Plan – Plan Change 3 Municipal Wastewater Treatment Plant and Dwelling Setback Standards Rule 4.5.2

A.14 Consultation Documentation