

# Appendices

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## Masterton Wastewater Treatment Plant and Disposal System Long-Term Upgrade

**Masterton District Council**



**15 August 2008**



- Appendix A    Gazette Notice & Certificates of Title**
- Appendix B    Water Quality & Water Quality Guidelines**
- Appendix C    Plans showing Distances from Scheme to Immediate Neighbours  
& Conceptual Stream Remedial Planting Design**
- Appendix D    Designation Plan & Scheme Drawings**
- Appendix E    Aerial Photo's showing the Upper Ruamahanga Te Ore Ore River  
Management Scheme**
- Appendix F    Draft Land Treatment Management Plan**



## **Appendix A**

**Gazette Notice & Certificates of Title**

## SCHEDULE

## NORTH AUCKLAND LAND DISTRICT

ALL that piece of land containing 12.5 perches situated in Block VIII, Rangitoto Survey District, City of Auckland, North Auckland R.D., and being part Lot 13, D.P. 146. All certificate of title, Volume 156, folio 17, North Auckland Land Registry.

Dated at Wellington this 8th day of February 1972.

PERCY B. ALLEN, Minister of Works.

(P.W. 71/2/7/0; Ak. D.O. 71/2/7/0)

*Declaring Land Taken for Better Utilisation in the Borough of Mount Roskill*

PURSUANT to section 32 of the Public Works Act 1928, the Minister of Works hereby declares that, a sufficient agreement to that effect having been entered into, the land described in the Schedule hereto is hereby taken for better utilisation from and after the 28th day of February 1972.

## SCHEDULE

## NORTH AUCKLAND LAND DISTRICT

ALL that piece of land containing 32 perches situated in Block IV, Titirangi Survey District, Borough of Mount Roskill, North Auckland R.D., and being Lot 373, D.P. 19327. All certificate of title, Volume 699, folio 332, North Auckland Land Registry.

Dated at Wellington this 8th day of February 1972.

PERCY B. ALLEN, Minister of Works.

(P.W. 71/2/15/0; Ak. D.O. 71/2/15/0)

*Declaring Land Taken for Better Utilisation in the Borough of Mount Roskill*

PURSUANT to section 32 of the Public Works Act 1928, the Minister of Works hereby declares that, a sufficient agreement to that effect having been entered into, the land described in the Schedule hereto is hereby taken for better utilisation from and after the 28th day of February 1972.

## SCHEDULE

## NORTH AUCKLAND LAND DISTRICT

ALL that piece of land containing 2 roods and 21.1 perches situated in Block IV, Waitemata Survey District, Borough of Mount Roskill, North Auckland R.D., and being Lot 6, D.P. 51400. All certificate of title, No. 1C/107, North Auckland Land Registry.

Dated at Wellington this 11th day of February 1972.

PERCY B. ALLEN, Minister of Works.

(P.W. 71/2/15/0; Ak. D.O. 71/2/15/0)

*Declaring Land Taken for the Purposes of a Sewage Treatment Plant in Block V, Otahoua Survey District, Masterton County*

PURSUANT to section 32 of the Public Works Act 1928, the Minister of Works hereby declares that, sufficient agreements to that effect having been entered into, the land described in the Schedule hereto is hereby taken for the purposes of a sewage treatment plant and shall vest in the Mayor, Councilors, and Citizens of the Borough of Masterton from and after the 28th day of February 1972.

## SCHEDULE

## WELLINGTON LAND DISTRICT

ALL those pieces of land situated in Block V, Otahoua Survey District, Wellington R.D., described as follows:

A.	R.	P.	Being
0	2	10	Part Lot 5, D.P. 2412, being part Section 42, Manaia District; coloured orange on plan.
19	2	0	Part old river bed; coloured orange on plan.
3	3	20	Part Lot 5, D.P. 2412, being part Sections 41 and 42, Manaia District; coloured orange on plan.
13	2	30	Part land in D.P. 1384, being parts Taumata-kaihuka B3 and B4; coloured orange on plan.
4	0	0	Part land in D.P. 1384, being part Taumata-kaihuka B4; coloured orange on plan.

## A. R. P.

## Being

8	1	0	Part land in D.P. 1384, being part Taumata-kaihuka B4; coloured red on plan.
3	1	0	Part old river bed; coloured red on plan.
3	0	0	Part Lot 5, D.P. 2412, being part Section 42, Manaia District; coloured sepia on plan.
7	1	20	Part old river bed; coloured sepia on plan.
1	0	10.2	Part Lots 4 and 5, D.P. 2412, being part Sections 40 and 41, Manaia District; coloured blue on plan.
15	2	30	Part Lot 5, D.P. 2412, being part Sections 41 and 42, Manaia District; coloured sepia on plan.
1	3	15	Part land in D.P. 1384, being part Taumata-kaihuka B4; coloured red on plan.

As the same are more particularly delineated on the plan marked M.O.W. 25952 (S.O. 27745) deposited in the office of the Minister of Works at Wellington, and thereon coloured as above-mentioned.

Dated at Wellington this 14th day of February 1972.

PERCY B. ALLEN, Minister of Works.

(P.W. 53/466/0; Wn. D.O. 19/2/7/0)

*Declaring Land Taken for Better Utilisation in Block I, Paekakariki Survey District, Hutt County, Subject to a Middle Line Proclamation*

PURSUANT to section 32 of the Public Works Act 1928, the Minister of Works hereby declares that, a sufficient agreement to that effect having been entered into, the land described in the First, Second, Third, Fourth, Fifth, and Sixth Schedules hereto, are hereby taken, subject to Proclamation 5508, defining the middle line of a portion of the Wellington-Foxton Motorway, for better utilisation from and after the 28th day of February 1972.

## FIRST SCHEDULE

## WELLINGTON LAND DISTRICT

AN undivided one-fifth share in all that piece of land containing 28 acres 3 roods 33.28 perches situated in Block I, Paekakariki Survey District, Wellington R.D., being Sections 80 and 81 and parts Sections 3 and 16, Wainui District, part being also Lot 9 and part Lot 22, Block IV, D.P. 2391. All certificate of title, Volume 536, folio 78, Wellington Land Registry.

## SECOND SCHEDULE

## WELLINGTON LAND DISTRICT

ONE undivided one-fifth share in all that piece of land containing 28 acres 3 roods 33.28 perches situated in Block I, Paekakariki Survey District, Wellington R.D., being Sections 80 and 81 and parts Sections 3 and 16, Wainui District, part being also Lot 9 and part Lot 22, Block IV, D.P. 2391. All certificate of title, Volume 543, folio 182, Wellington Land Registry.

## THIRD SCHEDULE

## WELLINGTON LAND DISTRICT

AN undivided one-fifth share in all that piece of land containing 28 acres 3 roods 33.28 perches situated in Block I, Paekakariki Survey District, Wellington R.D., being Sections 80 and 81 and parts Sections 3 and 16, Wainui District, part of the said land being also Lot 9 and part Lot 22, Block IV, D.P. 2391. All certificate of title, Volume 562, folio 147, Wellington Land Registry.

## FOURTH SCHEDULE

## WELLINGTON LAND DISTRICT

TWO undivided one-fifth shares in all that piece of land containing 10 acres situated in Block I, Paekakariki Survey District, Wellington R.D., being part Section 3, Wainui District, being Lot 9, Block IV, D.P. 2391. All certificate of title, Volume 209, folio 278, Wellington Land Registry.

## FIFTH SCHEDULE

## WELLINGTON LAND DISTRICT

TWO undivided one-fifth shares in all that piece of land containing 18 acres 2 roods 35.06 perches situated in Block I, Paekakariki Survey District, Wellington R.D., being parts Sections 3 and 16, Wainui District, and being also part Lot 22, Block IV, D.P. 2391. Balance certificate of title, Volume 312, folio 18, Wellington Land Registry.

SCHEDULE  
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ALL that piece of land containing 12.5 perches situated in Block VIII, Rangitoto Survey District, City of Auckland, North Auckland R.D., and being part Lot 13, D.P. 146. All certificate of title, Volume 156, folio 17, North Auckland Land Registry.

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A. R. P.	Being
0 2 10	Part Lot 5, D.P. 2412, being part Section 42, Maniaia District; coloured orange on plan.
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8 1 0	Part land in D.P. 1384, being part Taumatākahuka B4; coloured red on plan.
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7 1 20	Part old river bed; coloured sepia on plan.
1 0 10.2	Part Lots 4 and 5, D.P. 2412, being part Sections 40 and 41, Maniaia District; coloured blue on plan.
15 2 30	Part Lot 5, D.P. 2412, being part Sections 41 and 42, Maniaia District; coloured sepia on plan.
1 3 15	Part land in D.P. 1384, being part Taumatākahuka B4; coloured red on plan.

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SECOND SCHEDULE

WELLINGTON LAND DISTRICT

ONE undivided one-fifth share in all that piece of land containing 28 acres 3 roods 33.28 perches situated in Block I, Paekakariki Survey District, Wellington R.D., being Sections 80 and 81 and parts Sections 3 and 16, Wainui District, part being also Lot 9 and part Lot 22, Block IV, D.P. 2391. All certificate of title, Volume 543, folio 182, Wellington Land Registry.

THIRD SCHEDULE

WELLINGTON LAND DISTRICT

AN undivided one-fifth share in all that piece of land containing 28 acres 3 roods 33.28 perches situated in Block I, Paekakariki Survey District, Wellington R.D., being Sections 80 and 81 and parts Sections 3 and 16, Wainui District, part of the said land being also Lot 9 and part Lot 22, Block IV, D.P. 2391. All certificate of title, Volume 562, folio 147, Wellington Land Registry.

FOURTH SCHEDULE

WELLINGTON LAND DISTRICT

Two undivided one-fifth shares in all that piece of land containing 10 acres situated in Block I, Paekakariki Survey District, Wellington R.D., being part Section 3, Wainui District, being Lot 9, Block IV, D.P. 2391. All certificate of title, Volume 209, folio 278, Wellington Land Registry.

FIFTH SCHEDULE

WELLINGTON LAND DISTRICT

Two undivided one-fifth shares in all that piece of land containing 18 acres 2 roods 35.06 perches situated in Block I, Paekakariki Survey District, Wellington R.D., being parts Sections 3 and 16, Wainui District, and being also part Lot 22, Block IV, D.P. 2391. Balance certificate of title, Volume 312, folio 18, Wellington Land Registry.



**COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952**



Search Copy

  
R. W. Muir  
Registrar-General  
of Land

**Identifier** WN300/245  
**Land Registration District** Wellington  
**Date Issued** 05 May 1923

**Prior References**

WN203/120 WNPROC 1129

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**Estate** Fee Simple  
**Area** 8.0196 hectares more or less  
**Legal Description** Part Lot 4-5 Deposited Plan 2412

**Proprietors**

The Masterton Borough Council

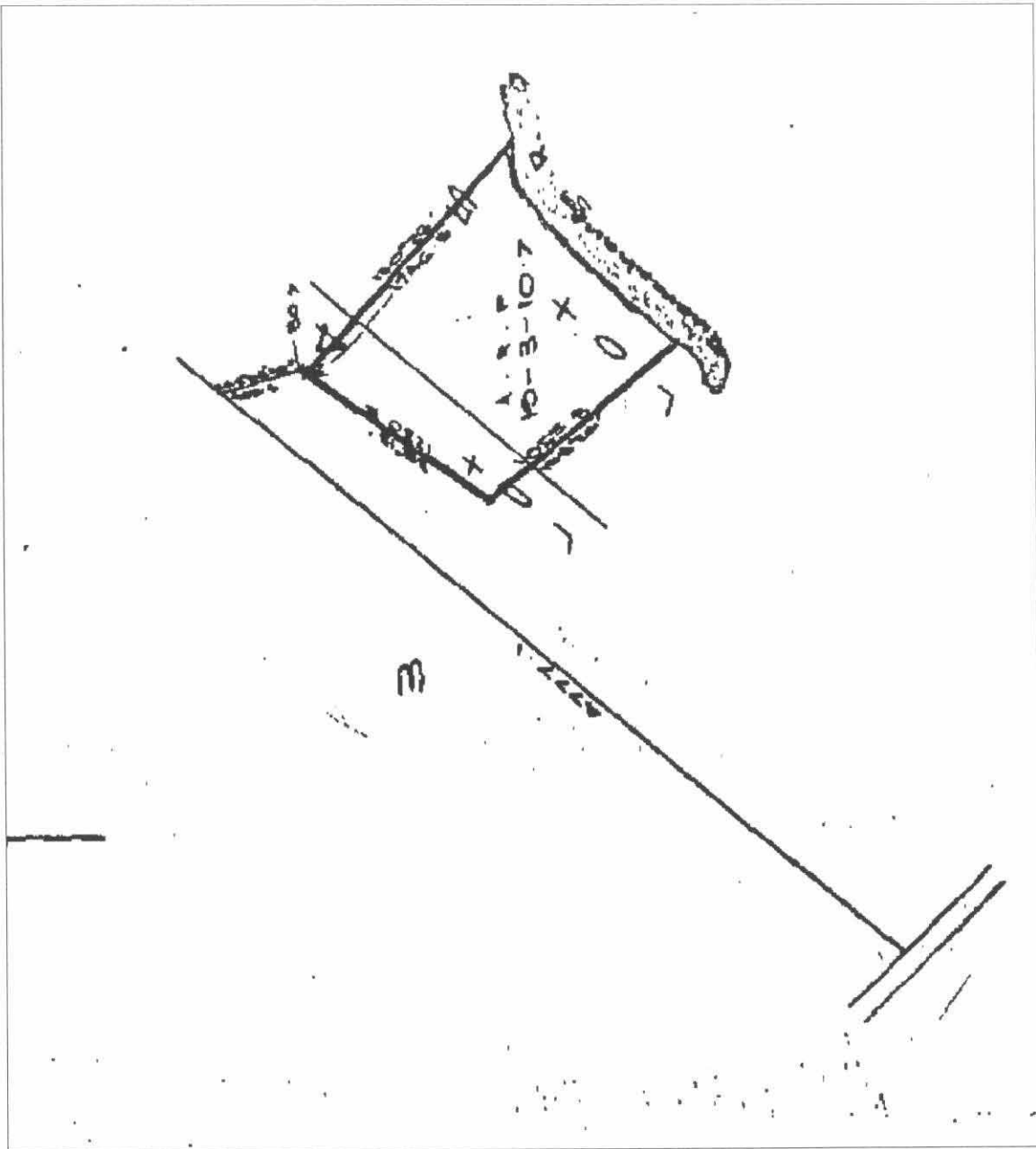
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**Interests**

Appurtenant hereto are drain pipe rights created by Transfer 130240

Identifier

WN300/245





**COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952**



Search Copy

  
R. W. Muir  
Registrar-General  
of Land

**Identifier** **WN11B/301**  
**Land Registration District** **Wellington**  
**Date Issued** 19 March 1973

**Prior References**

WN10B/132

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<b>Estate</b>	Fee Simple
<b>Area</b>	16.8880 hectares more or less
<b>Legal Description</b>	Lot 1 Deposited Plan 4333 and Part Lot 1 Application Plan 2698

**Proprietors**

Masterton District Council

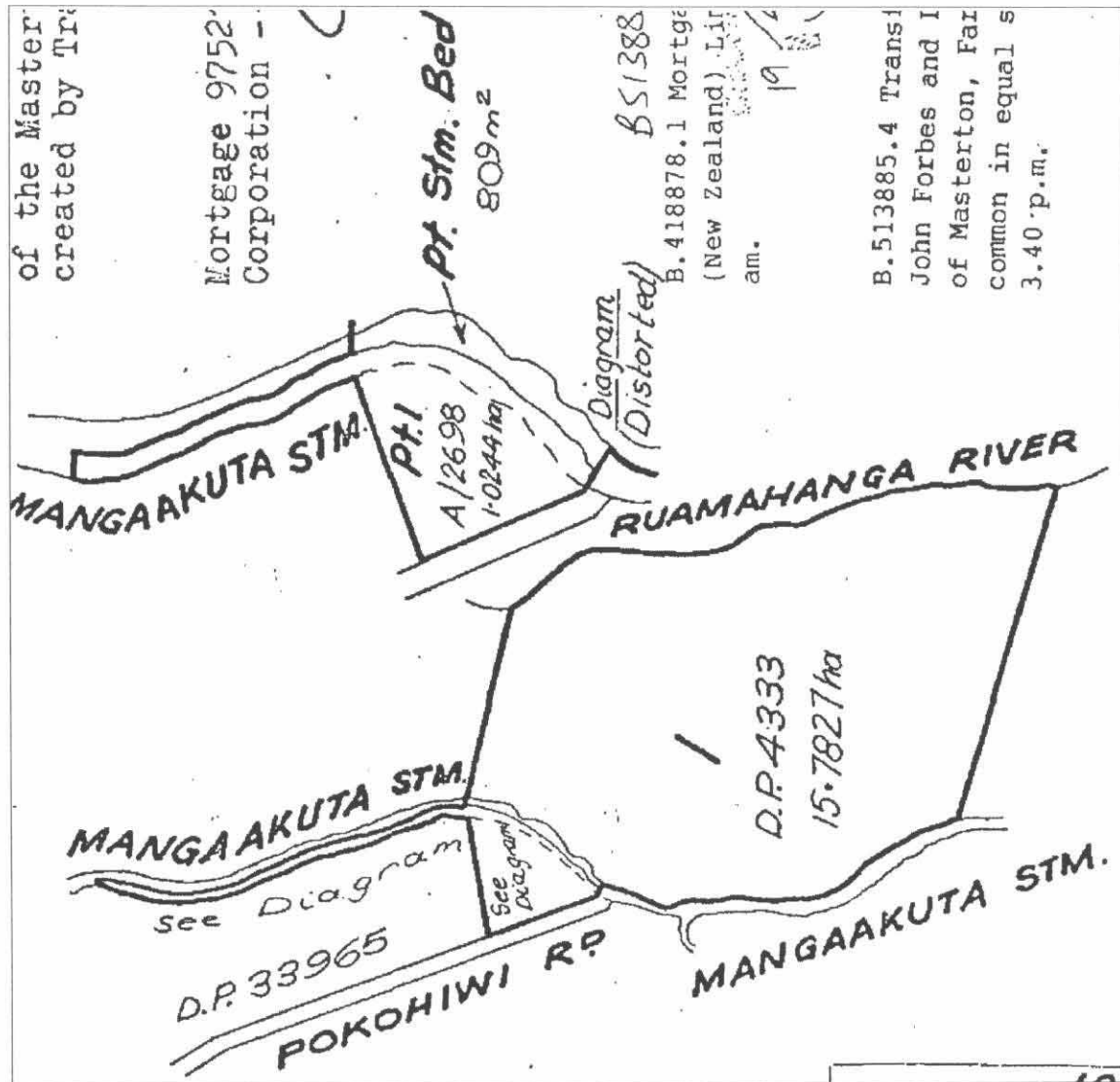
**Interests**

Subject to drainage rights (in gross) over part in favour of The Masterton Borough Council created by Transfer 130241(affects Lot 1 DP 4333)



Identifier

WN11B/301





**COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952**



Search Copy

Identifier **WN48B/596**  
Land Registration District **Wellington**  
Date Issued 19 July 1996

**Part-Cancelled**

**Prior References**

WN400/88

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**Estate** Fee Simple  
**Area** 45.9862 hectares more or less  
**Legal Description** Part Lot 1-3 Deposited Plan 9928

**Proprietors**

Masterton District Council

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**Interests**

Subject to a right of way over parts coloured blue and yellow on DP 24225 created by Transfer 607802

Subject to a right of way over part marked A on DP 9928 created by Transfer B529540.4 - 19.7.1996 at 9.05 am (affects Lot 2 on DP 9928)

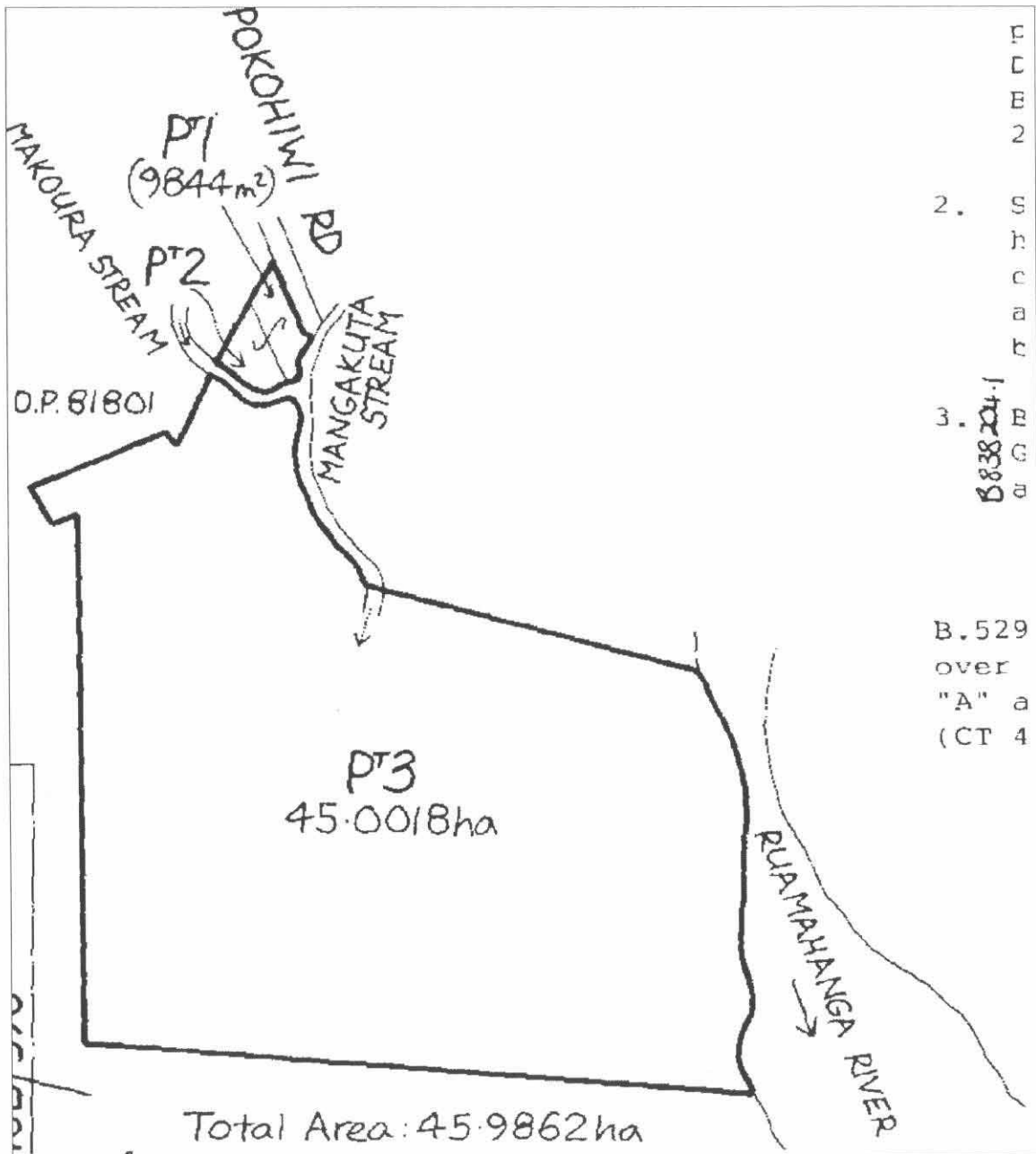
7239211.6 Transfer of Lot 2 DP 351720 to Homebush Dairying Company Limited - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

7239211.9 CTs issued - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

<b>Legal Description</b>	<b>Title</b>
Lot 1 Deposited Plan 351720	212321
Lot 2 Deposited Plan 351720	212322

Identifier

WN48B/596





**COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952**



**Search Copy**

**Identifier** 212321  
**Land Registration District** Wellington  
**Date Issued** 24 April 2007

**Prior References**  
WN48B/596

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**Estate** Fee Simple  
**Area** 22.4334 hectares more or less  
**Legal Description** Lot 1 Deposited Plan 351720

**Proprietors**  
Masterton District Council

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**Interests**

Subject to a right (in gross) to lay and maintain pipelines over parts marked B and I on DP 351720 in favour of the Masterton Borough Council created by Transfer 213967

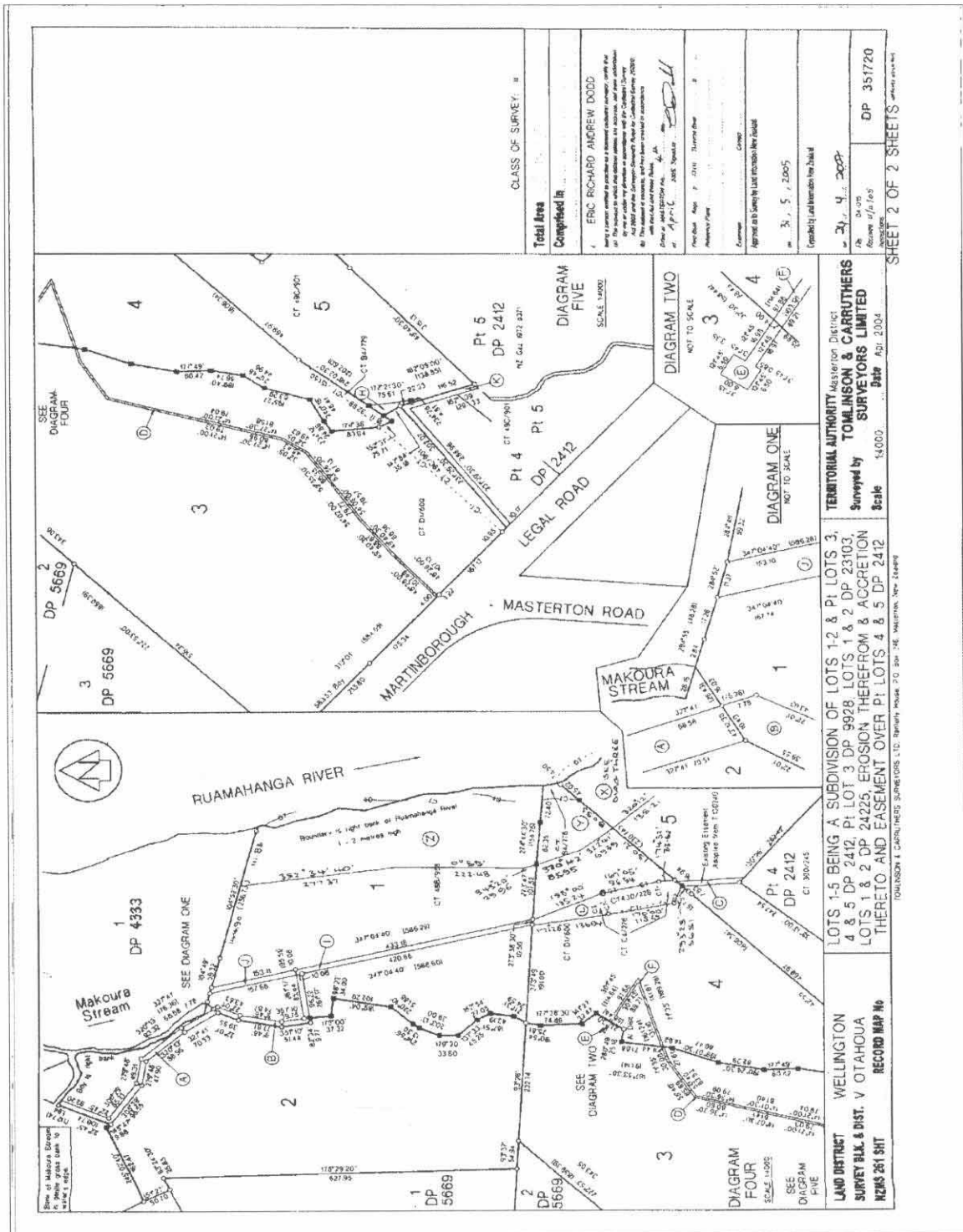
Subject to a right of way over parts marked B and I on DP 351720 created by Transfer 607802

7239211.4 Consent Notice pursuant to Section 221 Resource Management Act 1991 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

Subject to a right of way over part marked B on DP 351720 created by Easement Instrument 7239211.10 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

Appurtenant hereto is a right to convey water created by Easement Instrument 7239211.10 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am







COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952



Search Copy

Identifier **212324**  
Land Registration District **Wellington**  
Date Issued 24 April 2007

**Prior References**

WN430/228	WN49C/901	WNB4/778
WNB4/779	WNC4/276	WND1/600

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**Estate** Fee Simple  
**Area** 18.5690 hectares more or less  
**Legal Description** Lot 4 Deposited Plan 351720

**Proprietors**

Masterton District Council

**Interests**

Appurtenant hereto is a right of way created by Transfer 607802 - 30.9.1964 at 12.11 pm (Affects part formerly in CT WNC4/276)

7239211.4 Consent Notice pursuant to Section 221 Resource Management Act 1991 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

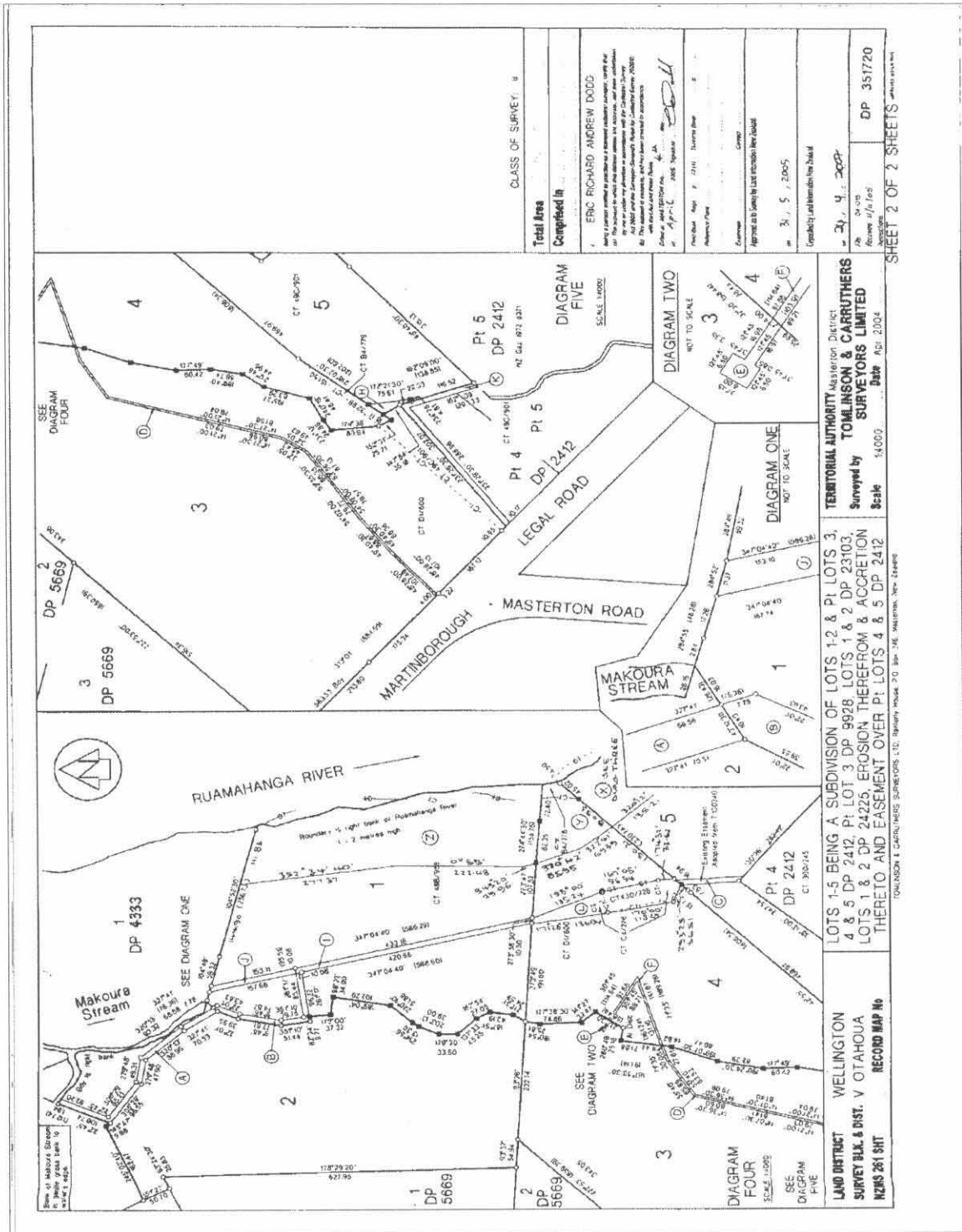
Subject to a right to convey electricity over part marked F and a right of way, right to lay and maintain line of pipes (in gross) over part marked L on DP 351720 in favour of Masterton District Council created by Easement Instrument 7239211.10 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

Appurtenant hereto is a right of way and rights to convey electricity and water created by Easement Instrument 7239211.10 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

The right of way over part marked H created by Easement Instrument 7239211.10 is subject to Section 243 (a) Resource Management Act 1991









**COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952**



Search Copy

  
R. W. Muir  
Registrar-General  
of Land

**Identifier** 212325  
**Land Registration District** Wellington  
**Date Issued** 24 April 2007

**Prior References**  
WN49C/901

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**Estate** Fee Simple  
**Area** 32.3550 hectares more or less  
**Legal Description** Lot 5 Deposited Plan 351720

**Proprietors**  
Masterton District Council

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**Interests**

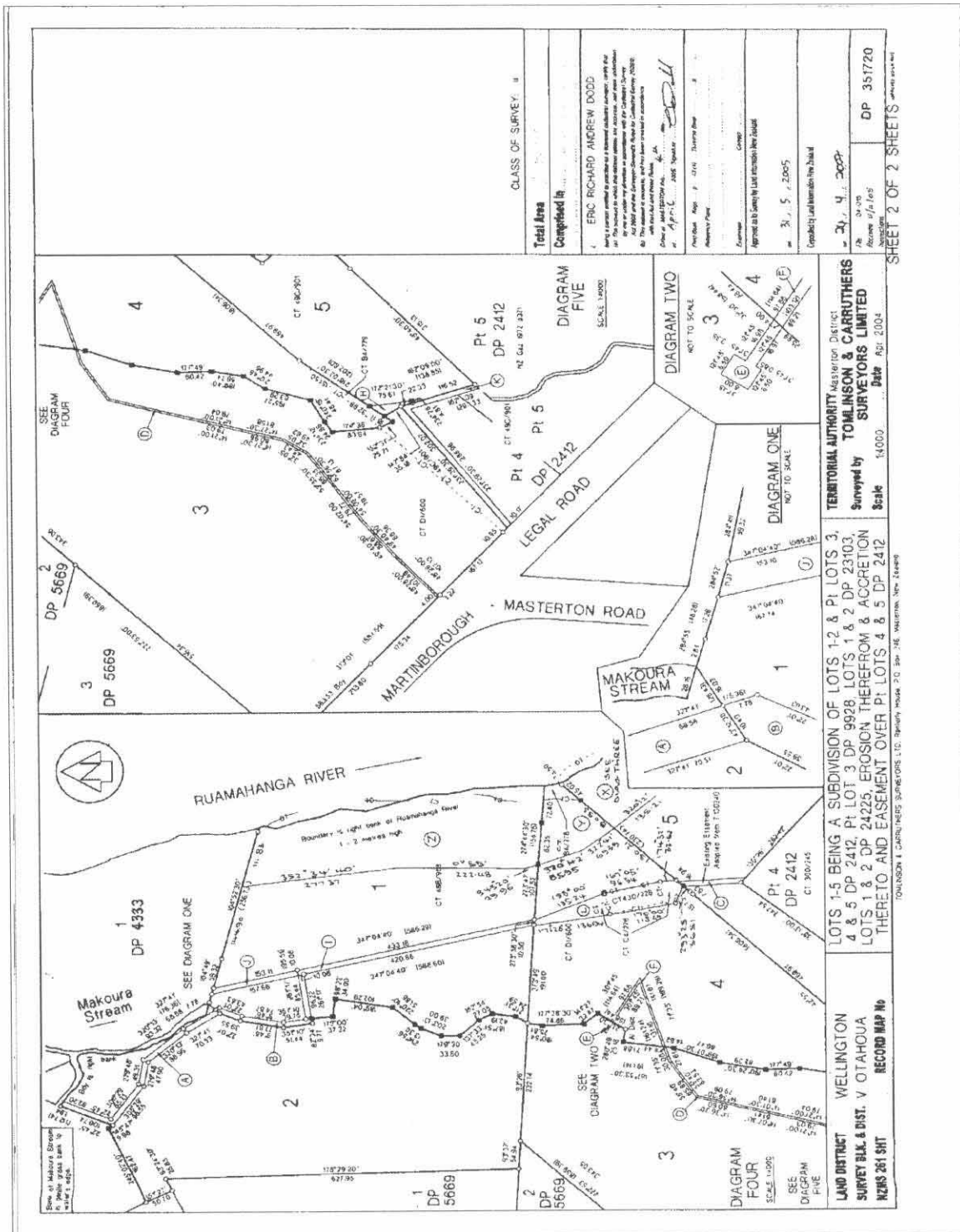
Subject to rights of way and rights of drainage (in gross) over part marked C on DP 351720 in favour of The Masterton Borough Council created by Transfer and Grant of Easement 130240

Subject to a right of way over part marked H on DP 351720 created by Easement Instrument 7239211.10 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

Appurtenant hereto is a right of way and a right to convey water created by Easement Instrument 7239211.10 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

The right of way over part marked H created by Easement Instrument 7239211.10 is subject to Section 243 (a) Resource Management Act 1991







**COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952**



Search Copy

  
R.W. Muir  
Registrar-General  
of Land

Identifier **WN291/82**  
Land Registration District **Wellington**  
Date Issued 13 June 1922

**Part-Cancelled**

**Prior References**

WN289/190

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**Estate** Fee Simple  
**Area** 13.1852 hectares more or less  
**Legal Description** Lot 3 Deposited Plan 5669

**Proprietors**

Homebush Dairying Company Limited

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**Interests**

2537 Proclamation proclaiming as road the part coloured red on the plan hereon - 18.2.1937 at 10:00 am  
5076219.2 Mortgage to The National Bank of New Zealand Limited - 29.8.2001 at 9:00 am

Identifier

WN291/82

H. WILMOT SURVEYOR-GENERAL  
FOR SURVEYS UNDER THE LAND TRANSFER ACT ONLY.  
NASTERTON COUNTY

5669

DEPOSITED this 13<sup>th</sup> day  
of April, 1982.  
[Signature]  
District Land Registrar.

LAND TRANSFER OFFICE  
RECEIVED 3/13/82 PROV. NO. J229  
TITLE REF. 416/82-4927  
REferred to DRAUGHTSMAN 1/16/82  
L.T. DRAUGHTSMAN  
EXAMINED: R. O. Street  
TRAY. RECD. VOL. 2741, PDL 102-127  
FIELD BOOK: 160, 161, 162, 163, 164, 165, 166  
CORR. Pt. No. REPORT No.  
REF. PLAN: the year 1982.

FILE: 29

NGATUERE'S RES.  
DP. 9928  
[Signatures]  
[Table of Areas]

Lot	Area
1	61 5 55/100
2	93 1 33/100
3	32 2 18/100
4	25 3 32/100
<b>Total</b>	<b>212 1 19/100</b>

Approved,  
[Signature]  
District Land Registrar

Comprised in  
Plan of Sec 37 & 38, Manaiia Block, Block V, Otagova S.D.

Surveyed by: [Signature], Licensed Surveyor  
(Field-work by: [Signature], Authorized Assistant)

DECLARATION:  
[Signature] Licensed Surveyor, do solemnly and sincerely swear that this plan has been made from surveys executed by me (or under my personal supervision) in accordance with the regulations of the Surveyors' Board, dated the 28th day of August 1967.  
Deponent: [Signature]  
Witness: [Signature]



**COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952**



Search Copy

  
R. W. Muir  
Registrar-General  
of Land

**Identifier** 212322  
**Land Registration District** Wellington  
**Date Issued** 24 April 2007

**Prior References**

WN48B/596

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**Estate** Fee Simple  
**Area** 22.6771 hectares more or less  
**Legal Description** Lot 2 Deposited Plan 351720

**Proprietors**

Homebush Dairying Company Limited

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**Interests**

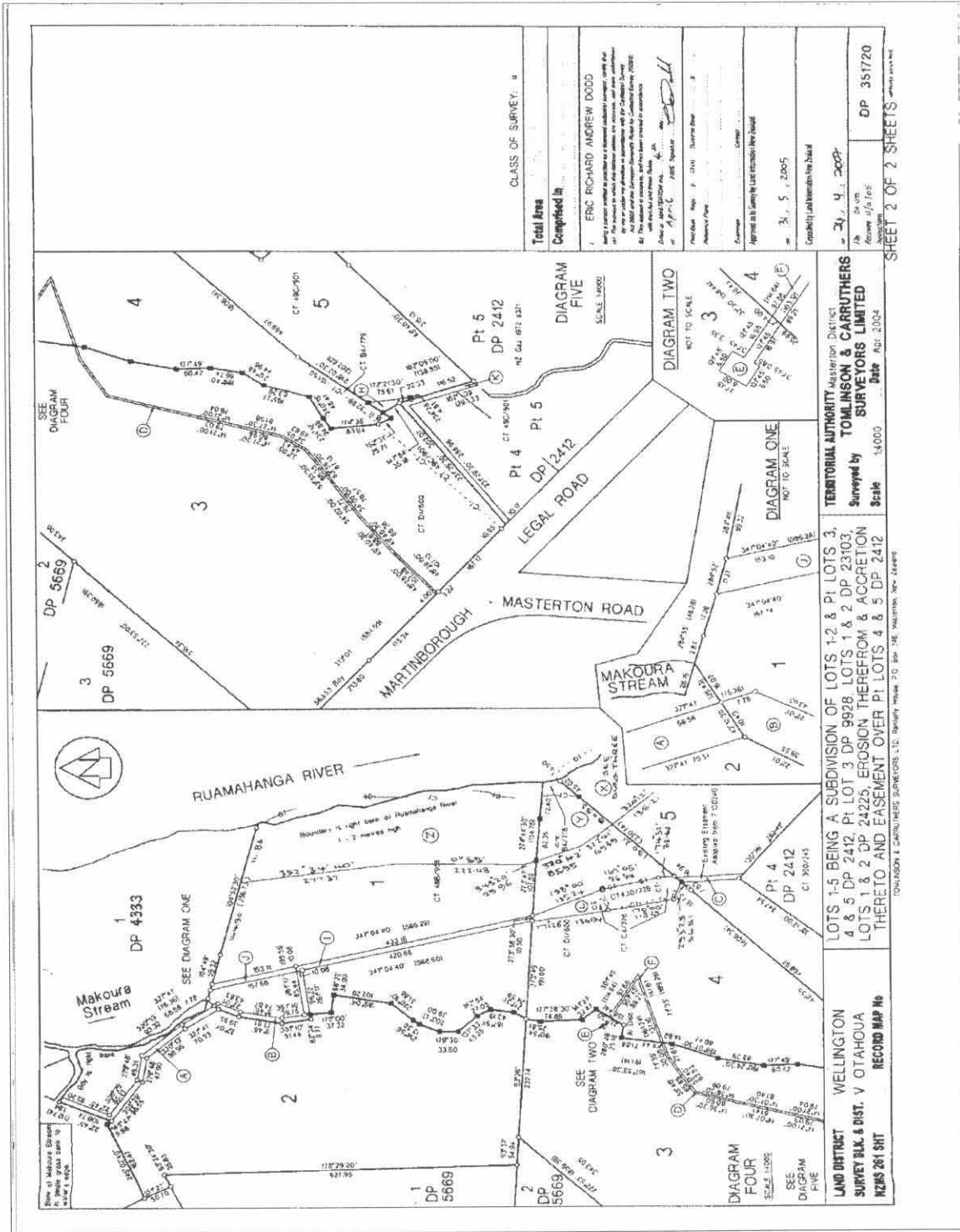
Subject to a right of way over part marked A on DP 351720 created by Transfer 607802

7239211.4 Consent Notice pursuant to Section 221 Resource Management Act 1991 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

Appurtenant hereto is a right of way created by Easement Instrument 7239211.10 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am









**COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952**



Search Copy

**Identifier** 212323  
**Land Registration District** Wellington  
**Date Issued** 24 April 2007

**Prior References**

WN49C/901 WND1/600

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**Estate** Fee Simple  
**Area** 43.0839 hectares more or less  
**Legal Description** Lot 3 Deposited Plan 351720

**Proprietors**

Homebush Dairying Company Limited

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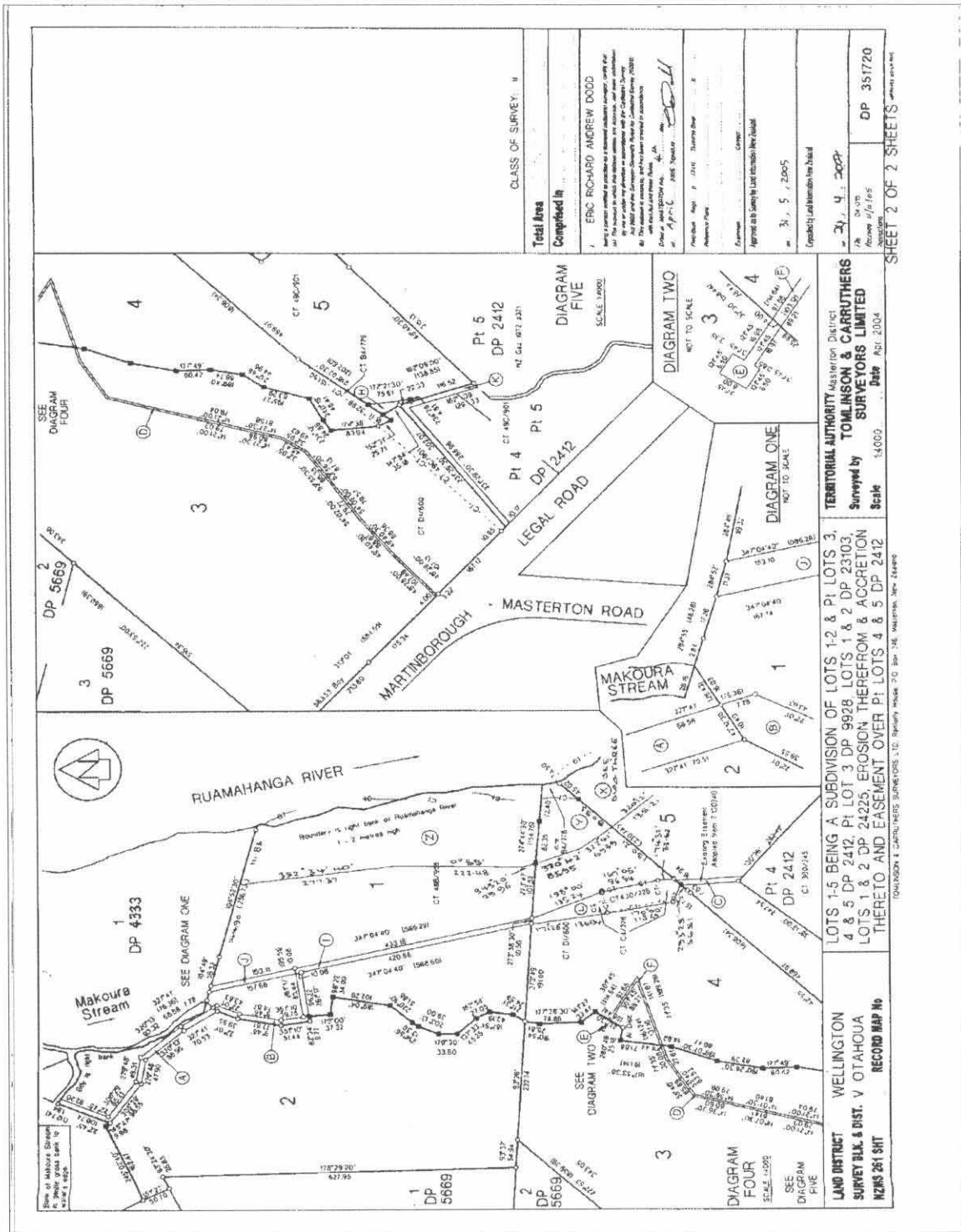
**Interests**

7239211.4 Consent Notice pursuant to Section 221 Resource Management Act 1991 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am

Subject to rights to convey electricity over parts marked D and E and a right to convey water over part marked E on DP 351720 created by Easement Instrument 7239211.10 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am\

Appurtenant hereto is a right to convey electricity created by Easement Instrument 7239211.10 - produced 19.2.2007 at 9.00 am and entered 24.4.2007 at 9.00 am







**COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952**



Search Copy

  
R. W. Muir  
Registrar-General  
of Land

**Identifier** 240139  
**Land Registration District** Wellington  
**Date Issued** 23 November 2005

**Prior References**

WN43A/110

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**Estate** Fee Simple  
**Area** 21.5484 hectares more or less  
**Legal Description** Lot 1 Deposited Plan 358970

**Proprietors**

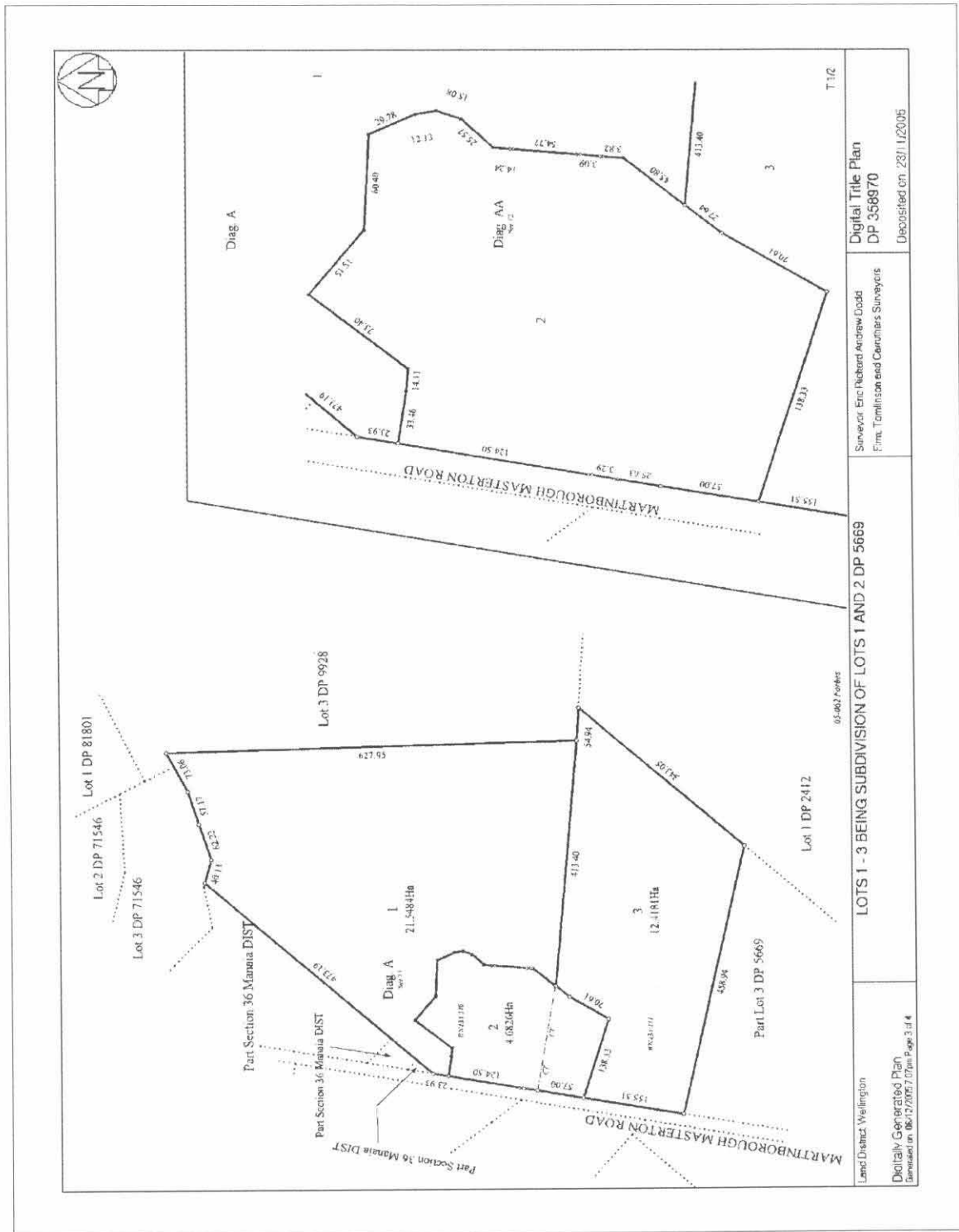
Homebush Dairying Company Limited

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**Interests**

5076219.2 Mortgage to The National Bank of New Zealand Limited - 29.8.2001 at 9:00 am

Appurtenant hereto is a right to supply water, electricity & telecommunications created by Easement Instrument 6660327.3 - 23.11.2005 at 9:00 am



Land District Wellington  
 Digitally Generated Plan  
 Generated on: 06/12/2005 7:07 am Page 3 of 4

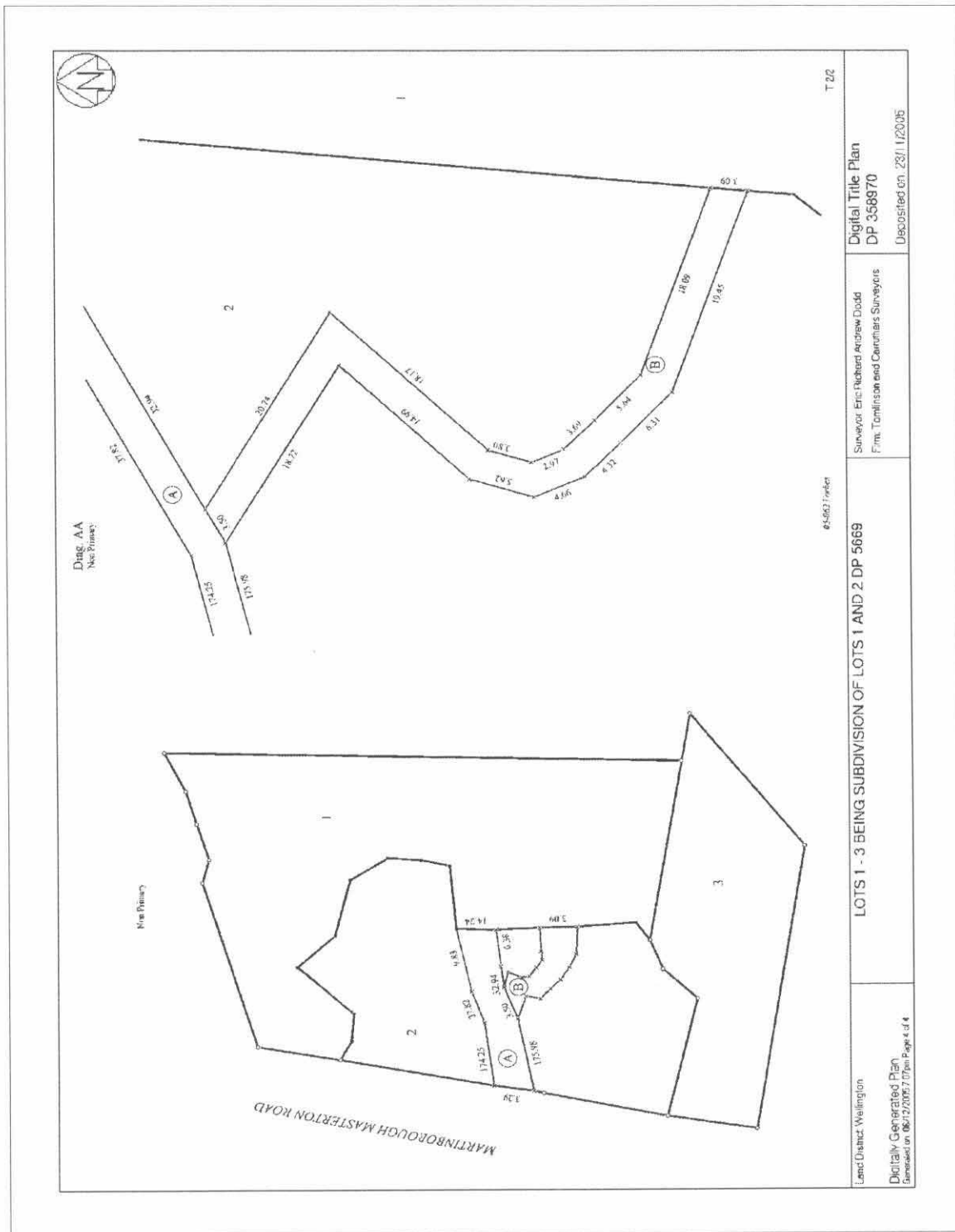
LOTS 1 - 3 BEING SUBDIVISION OF LOTS 1 AND 2 DP 5669

Surveyor: Eric Richard Andrew Dodd  
 Firm: Tamplin and Gardner's Surveyors

Digital Title Plan  
 DP 358970  
 Deposited on: 23/11/2005

Identifier

240139





**COMPUTER FREEHOLD REGISTER  
UNDER LAND TRANSFER ACT 1952**



Search Copy

  
R. W. Muir  
Registrar-General  
of Land

**Identifier** 240141  
**Land Registration District** Wellington  
**Date Issued** 23 November 2005

**Prior References**

WN43A/111

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**Estate** Fee Simple  
**Area** 12.4181 hectares more or less  
**Legal Description** Lot 3 Deposited Plan 358970

**Proprietors**

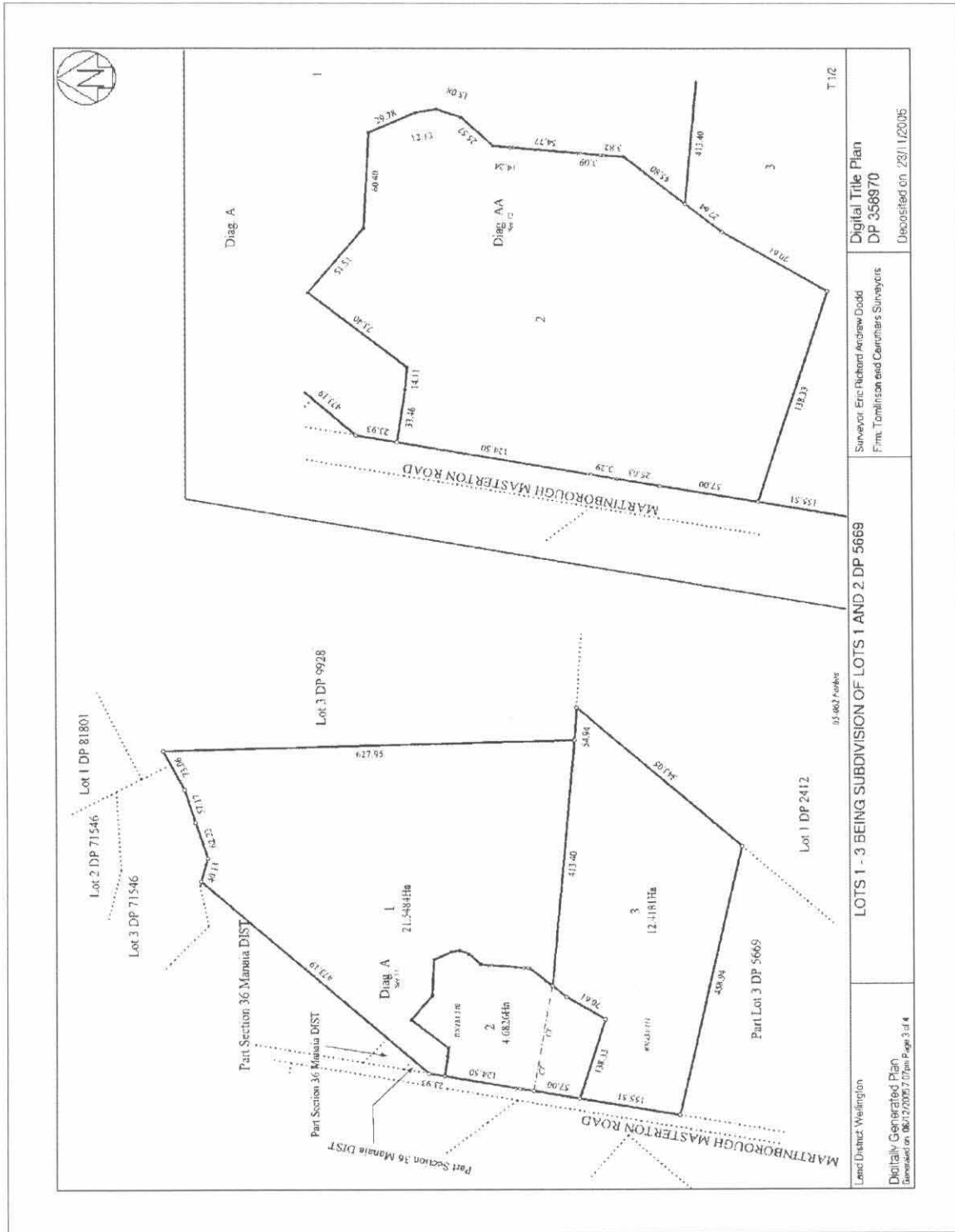
Homebush Dairying Company Limited

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**Interests**

5076219.2 Mortgage to The National Bank of New Zealand Limited - 29.8.2001 at 9:00 am





Digital Title Plan  
DP 356970  
Decrested on 29/11/2005

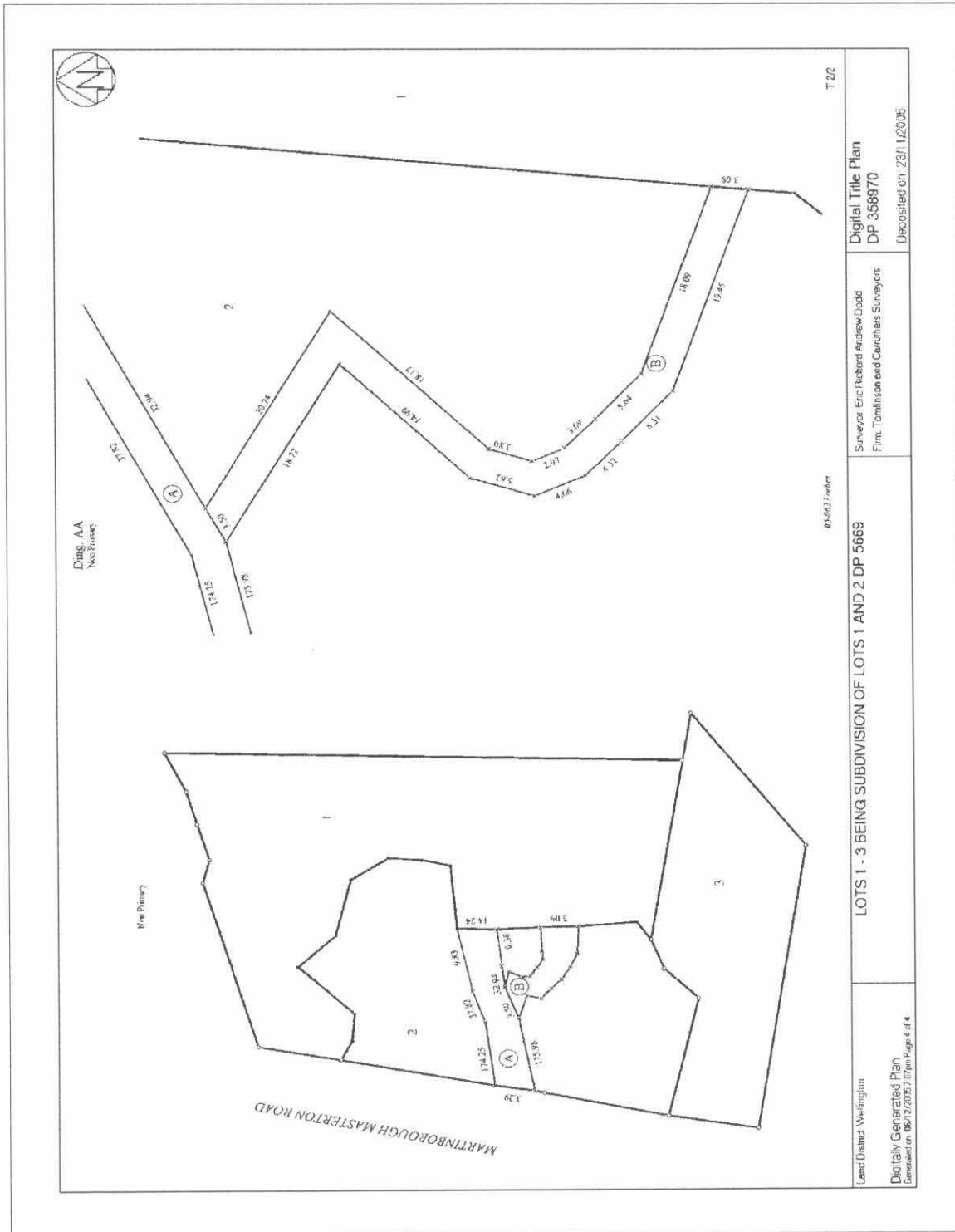
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Firm: Tomlinson and Cawthra's Surveyors

LOTS 1 - 3 BEING SUBDIVISION OF LOTS 1 AND 2 DP 5669

Land District: Wellington  
Digitally Generated Plan  
Generated on: 06/12/2005 7:07am Page 3 of 4

Identifier

240141





## **Appendix B**

### **Water Quality & Water Quality Guidelines**

## Appendix B1 Surface Water Quality Information

Figure B1.1 Location of Water Quality Monitoring Sites

(Also refer A3 topographical maps attached at the end of this appendix)



Figure B1.2 Waterways Management Classes under the RFW<sup>1</sup>

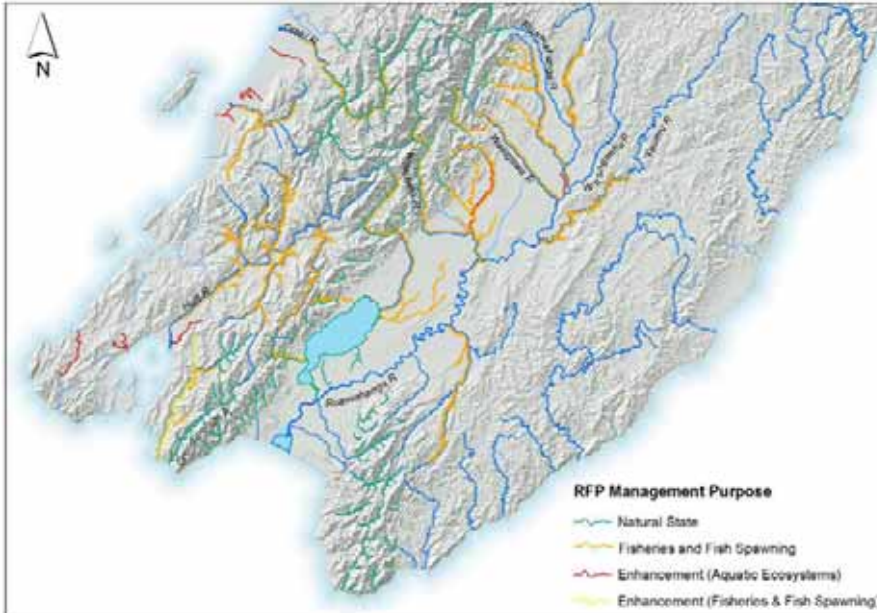
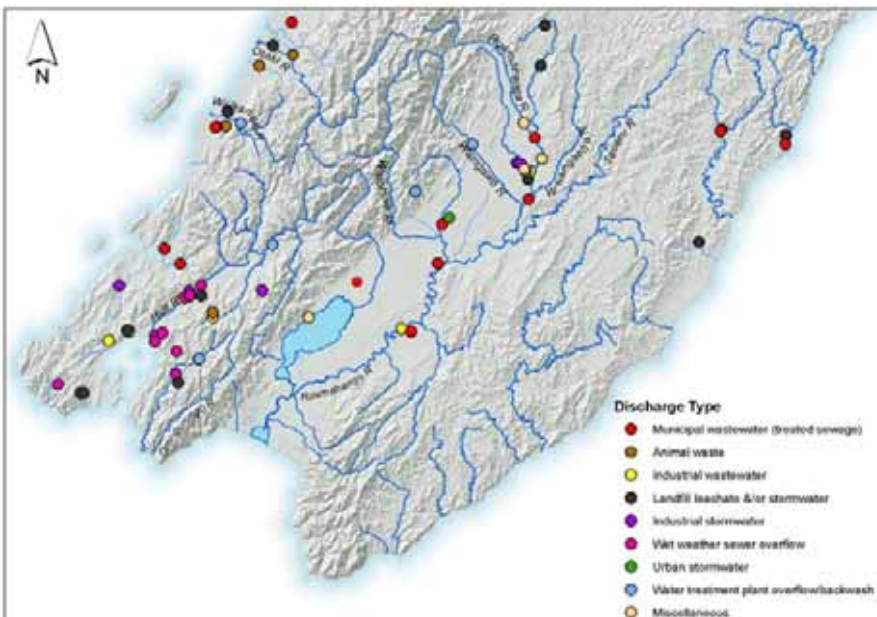


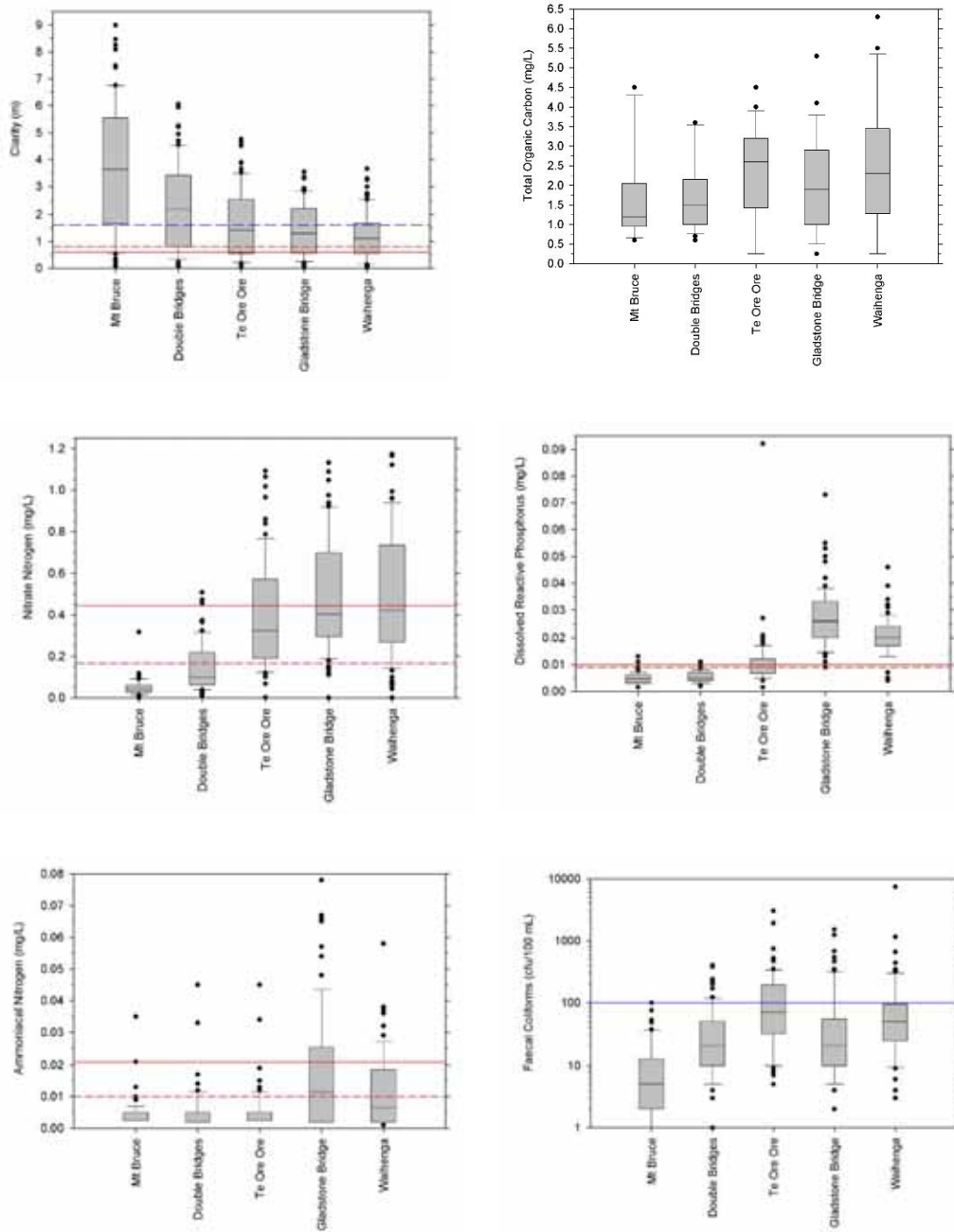
Figure B1.3 Major Authorised Discharges to Surface Waters in the Wellington Region<sup>2</sup>



<sup>1</sup> Source: Milne & Perrie 2005.

<sup>2</sup> Source: Milne & Perrie 2005.

Figure B1.4 Clarity, total organic carbon, dissolved nutrient and faecal coliform values



**Note:** Recorded at RSoE monitoring sites on the Ruamahanga River during routine monthly sampling over July 1997 to July 2003 inclusive (from Milne & Perrie 2005).

----- ANZECC (2000) Upland Trigger Value  
 ----- ANZECC (2000) Lowland Trigger Value

----- MfE (1994) Guideline for Bathing  
 ----- ANZECC (2000) Stockwater trigger value

**Table B1.1. Macroinvertebrate characteristics from NRQMN dataset for Ruamahanga River sites (1989 – 2001)**

Site (Code)	Taxa Number	Abundance	EPT abundance	% EPT	Deleatidium abundance	% Deleatidium	% Elmidae	% Aoteapsyche	% Chironomid
SH2 (WN5)	13 (10-24)	742 (242-2658)	377 (151-1606)	62 (34-88)	350 (124-1467)	52 (31-77)	15 (9-49)	0.2 (0-1.7)	2 (0.1-48)
Wardells (WN4)	23 (12-30)	2271 (794-15382)	1059 (180-3611)	42 (4-73)	672 (67-1300)	25 (1-71)	33 (5-85)	4.2 (0.2-18)	8 (0-62)
Waihenga (WN3)	16 (10-25)	2898 (954-7821)	1386 (283-3065)	43 (16-68)	960 (181-1912)	30 (7-67)	32 (18-76)	1.8 (0-48)	14 (0-48)

Note:

Sites: WN 5 = Ruamahanga @ SH2 (Mt Bruce; catchment 78 km<sup>2</sup>; 135 km from mouth); WN 4 = Ruamahanga @ Wardells (below MWTP discharge; catchment 640 km<sup>2</sup>; 95 km from mouth);. WN3 = Ruamahanga @ Waihenga (catchment 2368 km<sup>2</sup>; 42 km from mouth).

EPT = Ephemeroptera (mayflies), Plecoptera (Stoneflies), Trichoptera (Caddisflies).

All data is median for 0.7 m<sup>2</sup>, 5 – 95%ile bracketed.

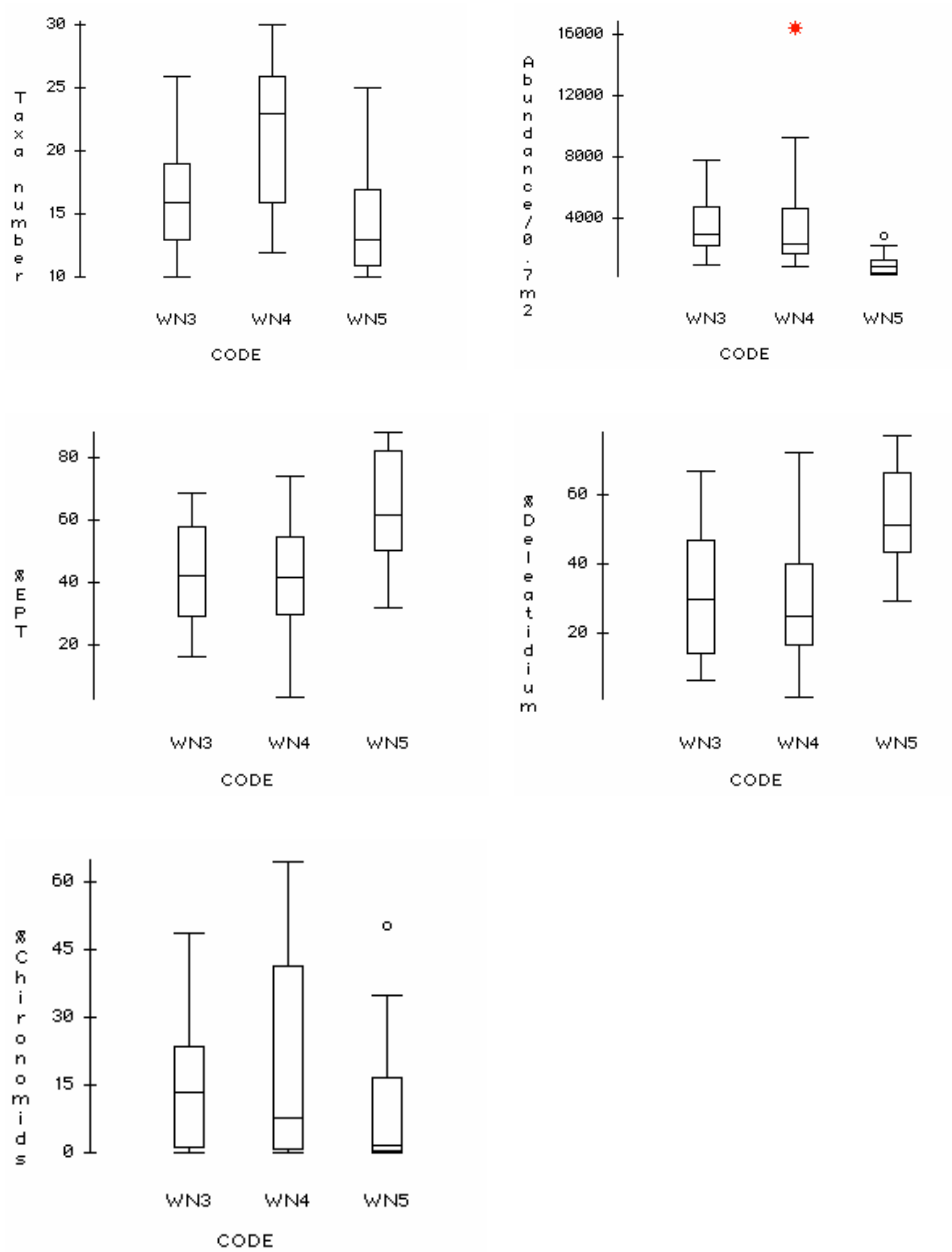
**Table B1.2. Summary of dissolved inorganic nitrogen monitoring data for the Ruamahanga River between 1994 and 2001**

Site	Samples	Mean	Median	Minimum	Maximum	20%ile	80%ile
Annual							
Rua_1	76	567	501	0	1353	324	833
Rua_2	75	1000	869	0	2779	568	1433
Summer							
Rua_1	37	435	479	0	717	307	555
Rua_2	36	857	857	0	1758	519	1124

**Table B1.3. Summary of dissolved phosphorus monitoring data for the Ruamahanga River between 1994 and 2001**

Site	Samples	Mean	Median	Minimum	Maximum	20%ile	80%ile
Annual							
Rua_1	75	11.4	10	3	31	7.5	15
Rua_2	75	132	106	10	441	62	172
Summer							
Rua_1	36	10.1	9.5	3	27	6	12
Rua_2	36	179	146	13	441	83	307

**Figure B1.5 Selected macroinvertebrate characteristics from NRQMN dataset for Ruamahanga River sites (1989 – 2001)**

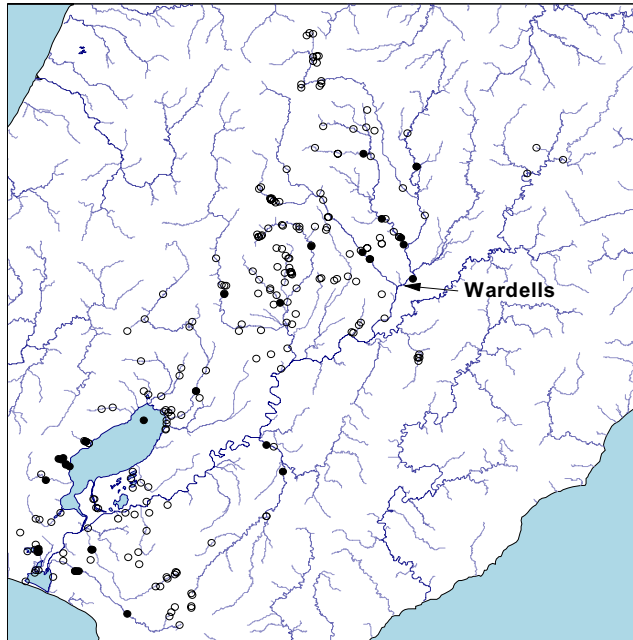




**Table B1.4. Fish species in 249 NZFFD records for the Ruamahanga River catchment, retrieved on 19/12/05. Wardells is about 98 km inland**

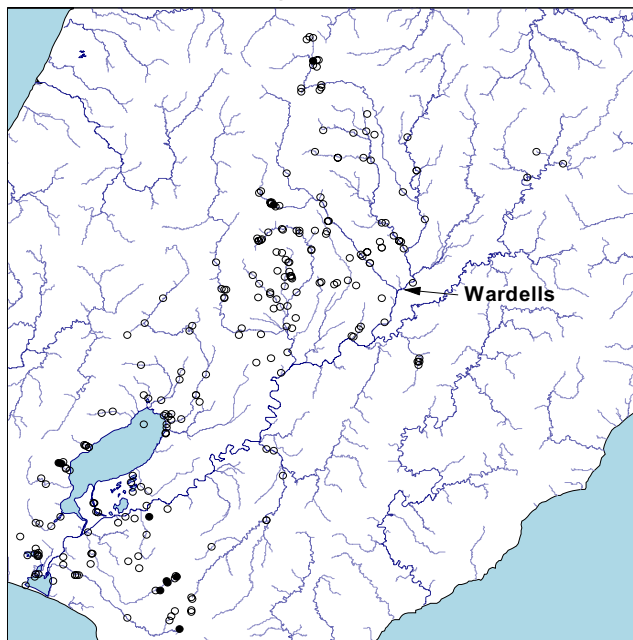
Species		Count	Diadromous?	Above Wardells?	In Waingawa?	Max penet (km)
<i>Aldrichetta forsteri</i>	Yelloweyed mullet	2	Y	N	N	3
<i>Mugil cephalus</i>	Grey mullet	1	Y	N	N	3
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	1	Y	N	N	3
<i>Rhombosolea retiaria</i>	Black flounder	1	Y	N	N	3
<i>Galaxias postvectis</i>	Shortjaw kokopu	1	Y	N	N	9
<i>Gobiomorphus hubbsi</i>	Bluegill bully	3	Y	N	N	27
<i>Carassius auratus</i>	Goldfish	4	N	N	N	31
<i>Scardinius erythrophthalmus</i>	Rudd	8	N	N	N	36
<i>Gobiomorphus gobioides</i>	Giant bully	1	Y	N	N	37
<i>Galaxias maculatus</i>	Inanga	21	Y	N	N	80
<i>Galaxias argenteus</i>	Giant kokopu	15	Y	N	N	87
<i>Perca fluviatilis</i>	Perch	13	N	N	N	102
<i>Tinca tinca</i>	Tench	4	N	N	N	102
<i>Oncorhynchus mykiss</i>	Rainbow trout	4	N	N	N	103
<i>Retropinna retropinna</i>	Common smelt	11	Y	N	Y	106
<i>Gobiomorphus cotidianus</i>	Common bully	58	Y	Y	Y	124
<i>Gobiomorphus huttoni</i>	Redfin bully	25	Y	Y	Y	124
<i>Cheimarrichthys fosteri</i>	Torrentfish	34	Y	Y	Y	125
<i>Geotria australis</i>	Lamprey	11	Y	Y	N	131
<i>Galaxias divergens</i>	Dwarf galaxias	6	N	Y	N	131
<i>Gobiomorphus breviceps</i>	Upland bully	46	N	Y	Y	131
<i>Neochanna apoda</i>	Brown mudfish	45	N	Y	Y	131
<i>Galaxias brevipinnis</i>	Koaro	10	Y	Y	Y	149
<i>Galaxias fasciatus</i>	Banded kokopu	8	Y	Y	N	150
<i>Anguilla australis</i>	Shortfin eel	67	Y	Y	Y	165
<i>Anguilla dieffenbachii</i>	Longfin eel	129	Y	Y	Y	165
<i>Gobiomorphus basalis</i>	Crans bully	10	N	Y	N	165
<i>Salmo trutta</i>	Brown trout	84	N	Y	Y	165

**Figure B1.5 Distribution map for torrentfish *Cheimarrichthys fosteri* in the Ruamahanga River catchment**



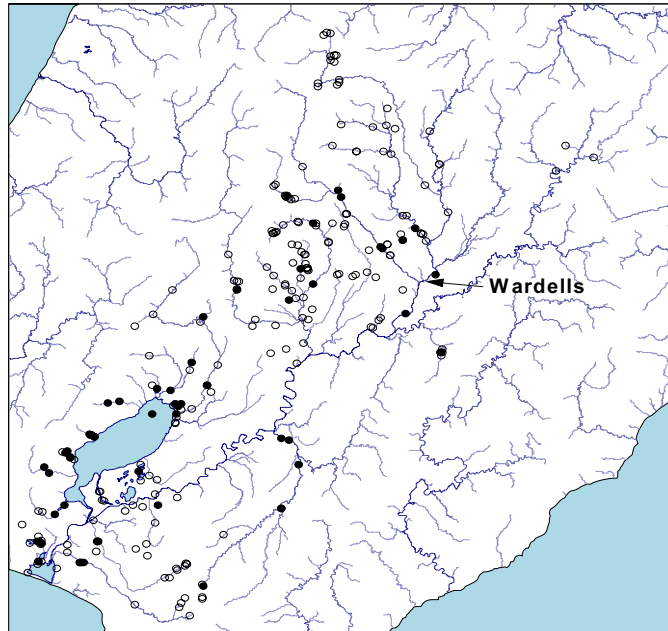
*Note: Open circles are sites sampled, solid circles are sites where torrentfish were present.*

**Figure B1.6 Distribution map for koaro *Galaxias brevipinnis* in the Ruamahanga River catchment**



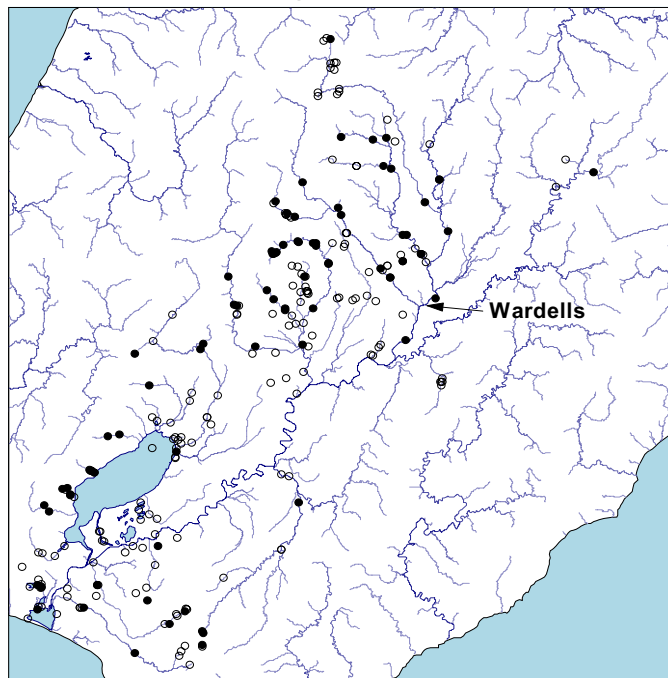
*Note: Open circles are sites sampled, solid circles are sites where koaro were present.*

**Figure B1.7 Distribution map for common bully *Gobiomorphus cotidianus* in the Ruamahanga River catchment**



*Note: Open circles are sites sampled, solid circles are sites where common bully was present.*

**Figure B1.8 Distribution map for brown trout *Salmo trutta* in the Ruamahanga River catchment**



*Note: Open circles are sites sampled, solid circles are sites where brown trout were present (Hickey 2006).*

Figure B1.9 Recreational water quality guidelines compliance<sup>3</sup>

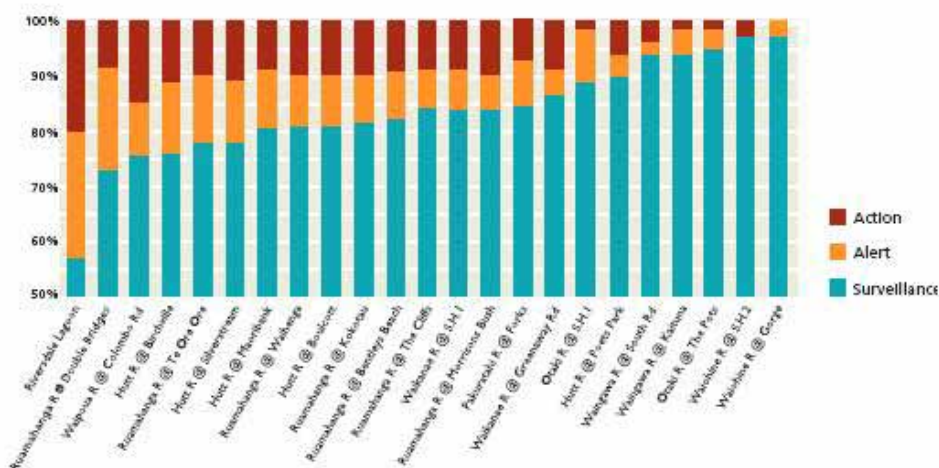
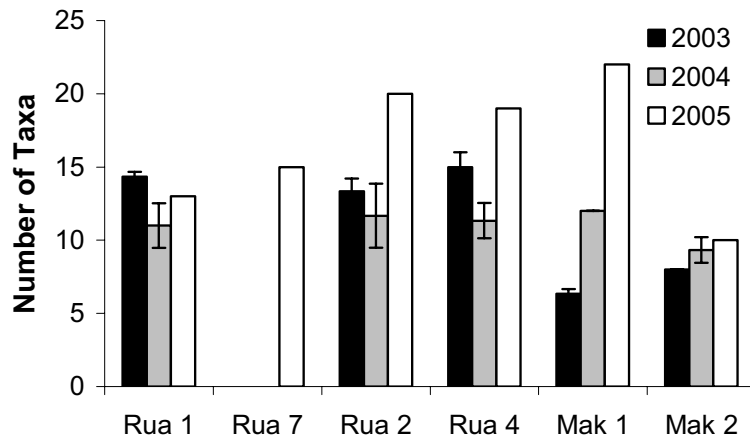


Table B1.5. Macroinvertebrate results from April 2002 monitoring (Table 3 from Bioresearches 2002)

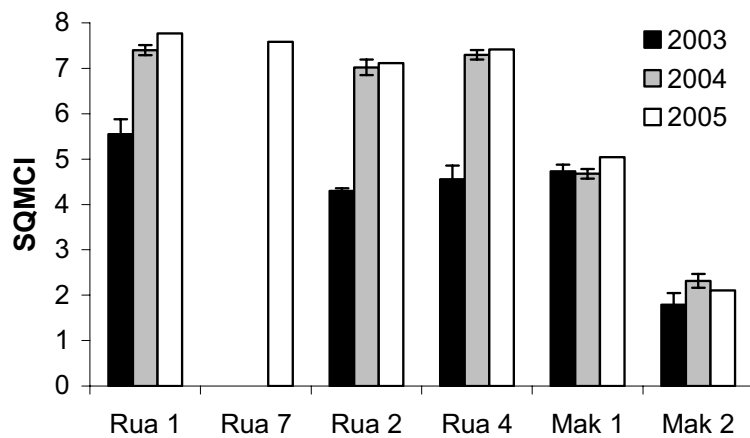
Site	Mean N° of Individuals (per 960 cm <sup>2</sup> )	Mean N° of taxa (per 960 cm <sup>2</sup> )	Dominant Species	% EPT	QMCI
1 (~Rua 1)	367	11.8	Elmidae: Beetles (58%)	41	6.3
2	136	7.4	Elmidae: Beetles (56%)	40	6.2
<b>Discharge</b>					
3 (Rua 2)	788	13.8	Elmidae: Beetles (75%)	20	5.8
4 (Rua_2+400m)	288	13.6	Elmidae: Beetles (80%)	17	5.9
5 (Rua 2+800m)	91	7	Elmidae: Beetles (63%)	34	6.3
<b>Waingawa River</b>					
6	71	7	Leptophlebiidae Mayflies (35%)	61	6.7

<sup>3</sup> Expressed as a percentage of total samples over the last four summer seasons. Source: 2005 State of the Environment Report (GW, 2006 cited in Ball, 2006)

**Figure B1.10 Mean Number of Taxa for Ruamahanga River (Rua) and Makoura (Mak) Stream upstream and downstream of the WWTP for 2003-2004<sup>4</sup>**



**Figure B1.11 Mean SQMCI calculated for Ruamahanga River (Rua) and Makoura (Mak) Stream upstream and downstream of the WWTP for 2003-2004<sup>5</sup>**



<sup>4</sup> Note: with Standard Deviation. Mean Number of Taxa was not calculated in 2005 as only single handnets were collected at each site. (Figure 3 from Cawthron 2005).

<sup>5</sup> Note: with Standard Deviation. Mean Number of Taxa was not calculated in 2005 as only single handnets were collected at each site. (Figure 3 from Cawthron 2005).

**Table B1.6. Mean macroinvertebrate index scores for RSoE monitoring sites on the Ruamahanga River sampled annually over 1999-2003.<sup>6</sup>**

Site Name	MCI		SQMCI		% EPT (taxa)		% EPT (animals)	
	Mean Score	SE	Mean Score	SE	Mean Score	SE	Mean Score	SE
Mt Bruce	126.3	5.7	6.50	0.47	56.6	3.8	57.2	5.0
Double Bridges	117.6	3.2	6.10	0.49	46.8	4.6	54.7	10.4
Te Ore Ore	112.2	3.9	4.68	0.79	47.4	2.0	31.7	13.7
Gladstone Bridge	107.4	3.4	5.47	0.46	41.8	2.3	27.9	6.3
Waihenga	110.2	3.0	5.73	0.34	45.8	4.6	32.7	11.1

**Table B1.7. Predicted clarity changes for a 30-fold dilution of wastewater**

Name	$y_d$	$Q_u$	$y_{eff}$	$y_u$	%redn $y_u$ of $y_d$
Minimum	-0.04	10.00	0.07	-0.04	
Maximum	5.70	14.20	0.81	9.91	
Mean	1.09	12.10	0.21	1.51	-28
Std Deviation	0.80	1.21	0.08	1.50	
Variance	0.65	1.47	0.01	2.26	
Skewness	1.29	0.00	1.29	2.16	
Kurtosis	4.93	1.80	5.76	8.70	
Errors Calculated	0	0	0	0	
Mode	0.69	10.32	0.17	0.43	
5% Perc	0.17	10.21	0.12	0.17	0.3
10% Perc	0.27	10.42	0.13	0.27	-0.8
15% Perc	0.34	10.63	0.14	0.35	-2.7
20% Perc	0.42	10.84	0.15	0.44	-4.0
25% Perc	0.49	11.05	0.16	0.52	-5.4
30% Perc	0.57	11.26	0.17	0.61	-6.5
35% Perc	0.64	11.47	0.17	0.70	-8.4
40% Perc	0.72	11.68	0.18	0.80	-9.3
45% Perc	0.81	11.89	0.19	0.90	-10.8
50% Perc	0.89	12.10	0.20	1.02	-12.8
55% Perc	1.00	12.31	0.21	1.16	-13.9

<sup>6</sup> With Standard Deviation (from Milne & Perrie 2005).

Name	$y_d$	$Q_u$	$y_{eff}$	$y_u$	%redn $y_u$ of $y_d$
60% Perc	1.10	12.52	0.22	1.31	-15.8
65% Perc	1.22	12.73	0.23	1.48	-17.9
70% Perc	1.35	12.94	0.24	1.69	-20.3
75% Perc	1.49	13.15	0.25	1.95	-23.3
80% Perc	1.68	13.36	0.27	2.28	-26.0
85% Perc	1.90	13.57	0.29	2.72	-30.1
90% Perc	2.20	13.78	0.32	3.39	-35.2
95% Perc	2.67	13.99	0.36	4.63	-42.4

**Figure B1.12 Photographs of the Ruamahanga River at Various Flows**

Ruamahanga River at Te Ore Ore Bridge, 24 November 2005, approximately half median flow ( $7 \text{ m}^3/\text{s}$ )



Ruamahanga River at Wardells Bridge, 24 November 2005, approximately half median flow ( $7 \text{ m}^3/\text{s}$ )



Ruamahanga River at The Cliffs, 24 November 2005, approximately half median flow ( $7 \text{ m}^3/\text{s}$ )





Ruamahanga River at Te Ore Ore Bridge, 20 December 2005, approximately median flow (11 m<sup>3</sup>/s)



Ruamahanga River at Wardells Bridge, 20 December 2005, approximately median flow (11 m<sup>3</sup>/s)



Ruamahanga River at The Cliffs, 20 December 2005, approximately median flow (11 m<sup>3</sup>/s)



Ruamahanga River at Te Ore Ore Bridge 5 December 2005, river in flood (90 m<sup>3</sup>/s)



Ruamahanga River at Wardells Bridge, 5 December 2005, river in flood (90 m<sup>3</sup>/s)



Ruamahanga River at The Cliffs, 5 December 2005, river in flood (90 m<sup>3</sup>/s)



**Appendix B2 Groundwater Information**

**Figure B2.1 Locations of wells, test pits and bore holes at and in the vicinity of the Masterton WWTP site.**

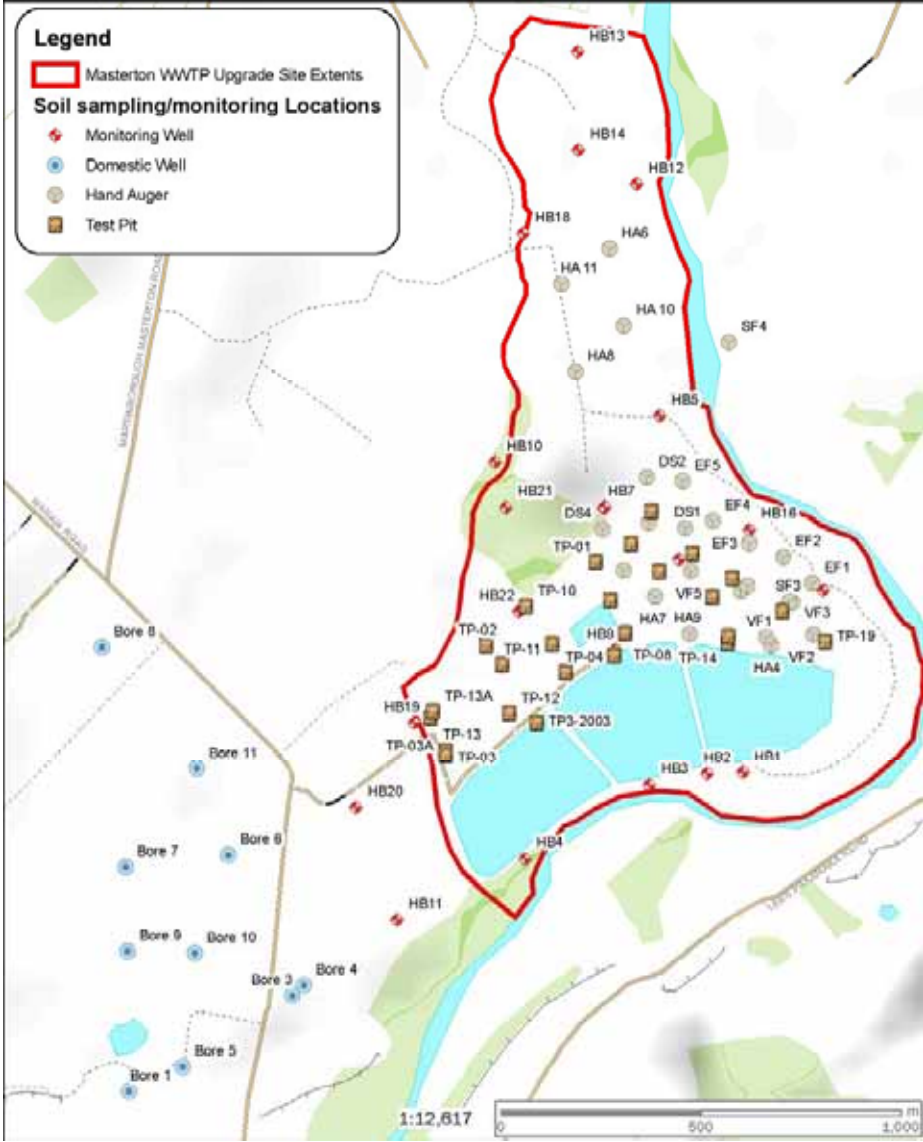
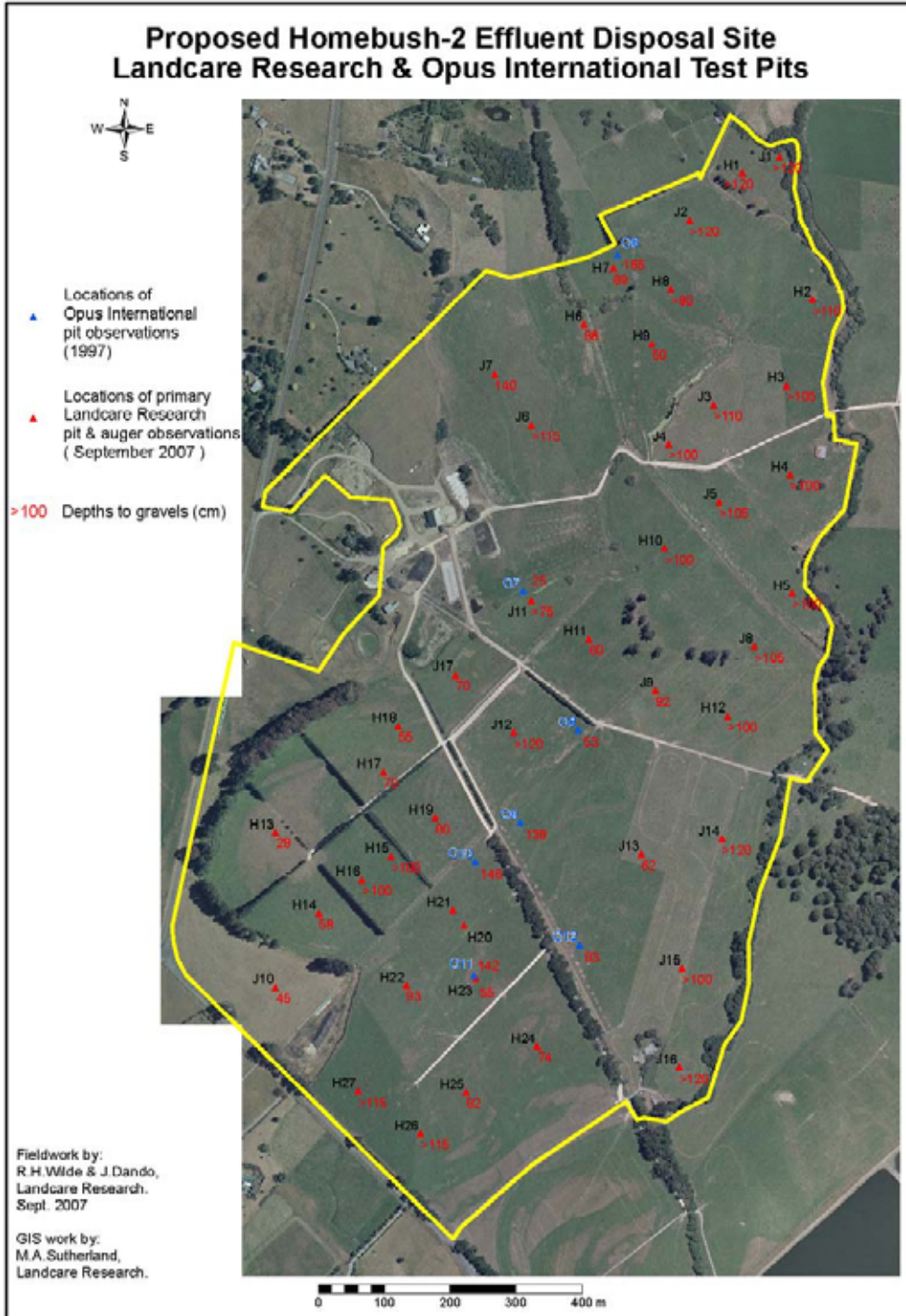


Figure B2.2 Landcare Research & Opus International Test Pits



## Appendix B3 Surface Water Quality Guidelines

### Physico-chemical, macroinvertebrate and microbiological guidelines for Receiving Water Quality

Variable (units)	Guideline Value	Guideline type	Reference
Water clarity (m)	1.6, 20% change for Class A waters where clarity is an important characteristic	Aesthetic	MfE (1994)
Water colour – Hue (Munsell points)	10 <sup>a</sup> (for Class A waters )	Aesthetic	MfE (1994)
Livestock drinking – nutrients (N, g/m <sup>3</sup> )	90 for nitrate; 9 for nitrite	Livestock health	ANZECC (2000)
Livestock drinking – microbial toxins (microcystins, µg/L)	2.3	Livestock health	ANZECC (2000)
Aquatic life – total ammonia-nitrogen (N, g/m <sup>3</sup> )	1.61 @ pH 7.5	Ecological protection	ANZECC (2000) <sup>b</sup>
Aquatic life – nitrate-nitrogen (N, g/m <sup>3</sup> )	7.2	Ecological protection	ANZECC (2000) <sup>c</sup>
Macroinvertebrate (species and macroinvertebrate community index (MCI) and semi-quantitative index (SQMCI))	Descriptors with assessment relative to upstream site	Ecological protection	Stark (1998)
Periphyton taxonomic and biomass (Species richness)	Descriptors with assessment relative to upstream site	Ecological protection	-
Temperature change (°C)	3	Ecological protection	WRFP A8.2(2)
pH range	6.5 – 9.0	Ecological protection	ANZECC (1992)
Dissolved oxygen (%saturation)	≥80	Ecological protection	RMA 1991 Third schedule
Periphyton cover – aesthetics/recreation (%cover); biomass (Chlorophyll a; mg/m <sup>2</sup> )	>60% mat cover >30% filamentous cover 120 Chlorophyll	Aesthetic (nuisance growths)	MfE (2000)
Periphyton cover: nutrients – recreation (DRP, mg/m <sup>3</sup> )	30	Aesthetic (nuisance growths)	MfE (2000) <sup>d</sup>
Bathing water quality – microbiological ( <i>E. coli</i> , cfu/100mL)	130 'Surveillance mode' 260 'Alert mode' 550 'Action mode'	Human health	MfE (2003)
Drinking water quality – microbial toxins (microcystins, µg/L; cells/mL)	1.0 20,000	Human health	WHO (1998)

<sup>a</sup> A 5 Munsell point change is recommended for Class A waters where hue is an important characteristic of the water body (MfE 1994, p35), with a 10 point change for other waters. The optically shallow Ruamahanga River is dominated by bed colour and a 10 point change is considered appropriate.

<sup>b</sup> Guideline for a "slightly-moderately disturbed" ecosystem for a 95% level of protection (ANZECC 2000, Table 8.3.7)

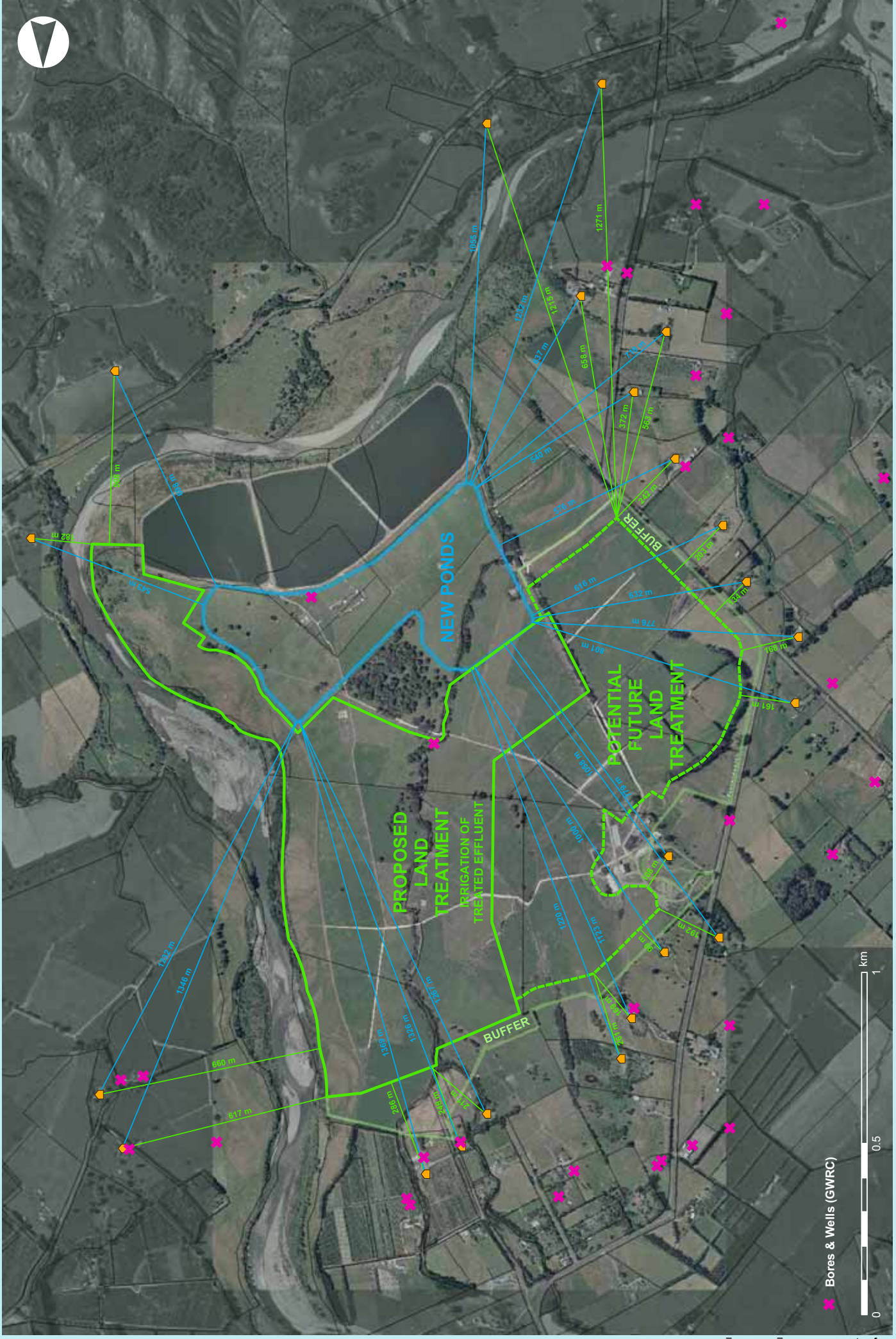
<sup>c</sup> Value recalculated from ANZECC (2000) Table 3.4.1; see correction: <http://www.mfe.govt.nz/publications/water/anzecc-water-quality-guide-02/anzecc-nitrate-correction-sep02.html>

<sup>d</sup> Site-specific guideline value for low-flow discharges (NIWA 2003x)



## **Appendix C**

**Plans showing Distances from Scheme to Immediate Neighbours & Conceptual  
Stream Remedial Planting Design**



Bores & Wells (GWRC)

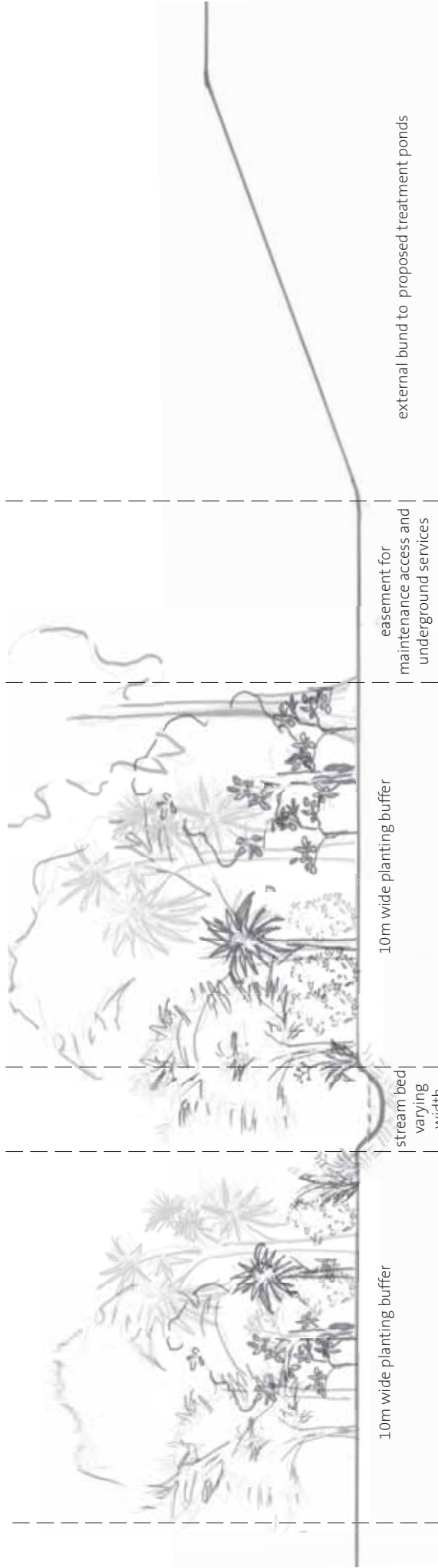


# MASTERTON WASTEWATER TREATMENT PLANT - PROPOSED UPGRADE

## DISTANCES TO IMMEDIATE NEIGHBOURS

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Indicative Cross Section through diverted Makoura Stream  
Scale 1:100 @ A3



Indicative Planting Plan Transect  
Scale 1:100 @ A3

\*Note that these numbers are approximate only and are based on a 10x10m of buffer planting along both sides of the stream as shown in the plan transect



Prepared by Boffa Miskell  
August 2008

# Makoura Stream Diversion: Indicative Planting Plan Masterton Wastewater Treatment Plant & Disposal System Long-Term Upgrade





## **Appendix D**

### **Designation Plan & Scheme Drawings**

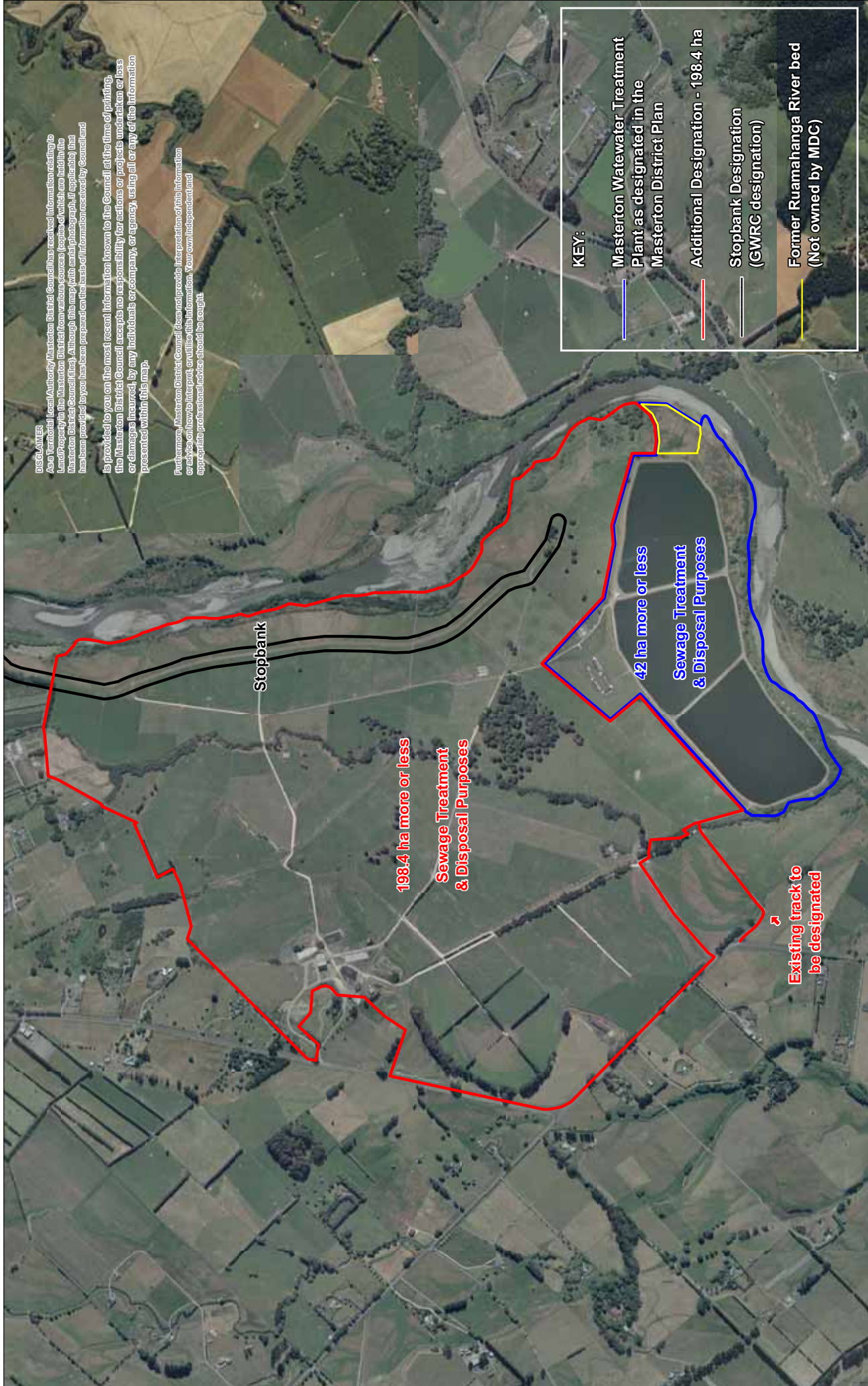
Aerial photos show the design channel with the outer lines representing the buffer zones.

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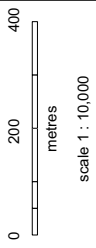
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Furthermore, Masterton District Council does not provide interpretation of this information or advice on how to interpret, or utilize, the information. Your own independent and appropriate professional advice should be sought.



**KEY:**

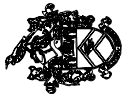
-  Masterton Wastewater Treatment Plant as designated in the Masterton District Plan
-  Additional Designation - 198.4 ha
-  Stopbank Designation (GWRC designation)
-  Former Ruamahanga River bed (Not owned by MDC)



Photos taken in/on: 2001, 2002, 2002.  
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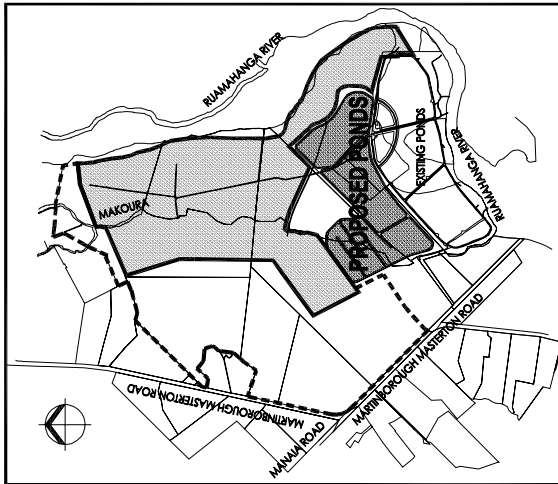


**DESIGNATION PLAN**



**Masterton District Council**  
SERVING THE COMMUNITY

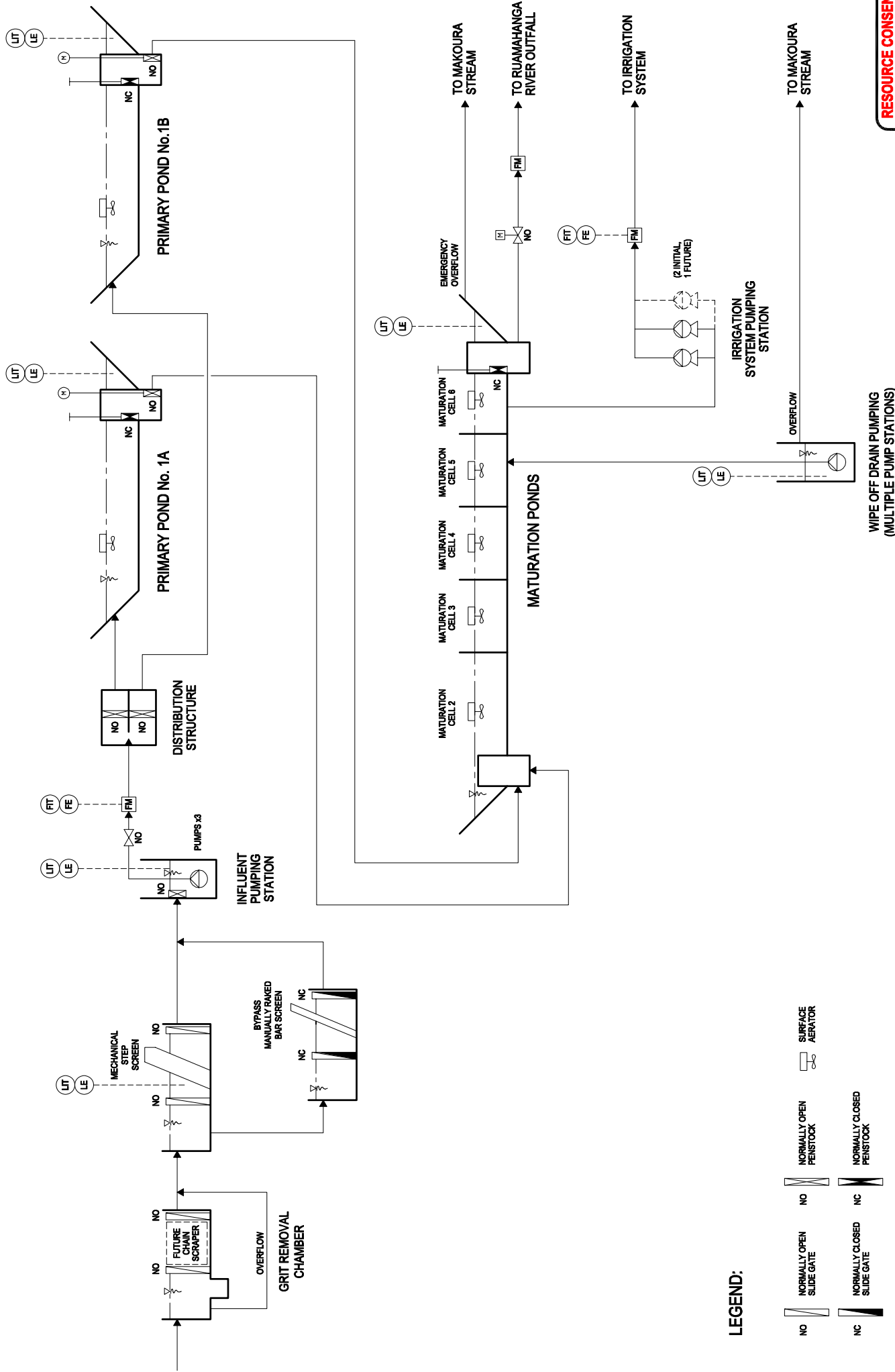
# MASTERTON WASTEWATER TREATMENT PLANT NEW PONDS AND LAND TREATMENT AREA (2008)



**SITE PLAN**  
N.T.S.

SHEET NO	TITLE
PR100	PROCESS FLOW DIAGRAM
C-600	BOUNDARY PLAN AND IRRIGATION BUFFER ZONES LAYOUT PLAN
C-601	PROPOSED AND POTENTIAL FUTURE LAND TREATMENT AREA LAYOUT PLAN
C-602	PROPOSED POND LAYOUT PLAN
C-603	POTENTIAL FUTURE LAND TREATMENT AREA DETAIL LAYOUT PLAN
C-604	PROPOSED LAND TREATMENT AREA DETAIL LAYOUT PLAN
C-605	POND AND LAND TREATMENT SECTIONS
C-606	POND OUTLET PIPE AND FLOW CONTROL
C-607	RIVER OUTFALL DIFFUSER DETAILS
C-608	POND AND EMBANKMENT SECTIONS
C-609	INLET WORKS LAYOUT PLAN
C-610	INLET WORKS DETAIL PLAN SHEET 1 OF 3
C-611	INLET WORKS DETAIL PLAN SHEET 2 OF 3
C-612	INLET WORKS DETAIL PLAN SHEET 3 OF 3
C-613	INLET WORKS SECTIONS
C-614	POND OUTLET STRUCTURE TYPICAL SECTION
C-615	RECYCLE PUMP STATION SECTION
C-616	STREAM CROSS SECTIONS
C-617	POND CROSS SECTIONS SHEET 1 OF 3
C-618	POND CROSS SECTIONS SHEET 2 OF 3
C-619	POND CROSS SECTIONS SHEET 3 OF 3
C-620	IRRIGATION PUMP STATION SECTIONS
C-621	RUAMAHANGA RIVER FLOOD LEVELS
C-622	SITE CROSS SECTIONS - SHEET 1 OF 2
C-623	SITE CROSS SECTIONS - SHEET 2 OF 2
C-624	PROPOSED AND POTENTIAL FUTURE LAND TREATMENT AREA LAYOUT AND AREA SCHEDULE
C-625	GRAVEL BORROW AREA SECTIONS
NOTE: SHADED DRAWINGS PROVIDED FOR RESOURCE CONSENT APPLICATION	

**RESOURCE CONSENT**  
NOT FOR CONSTRUCTION



**LEGEND:**

- NO / ◯ / ◯ : NORMALLY OPEN SLIDE GATE
- NC / ◯ / ◯ : NORMALLY CLOSED SLIDE GATE
- NO / ◯ / ◯ : NORMALLY OPEN PENSTOCK
- NC / ◯ / ◯ : NORMALLY CLOSED PENSTOCK
- ◯ : SURFACE AERATOR

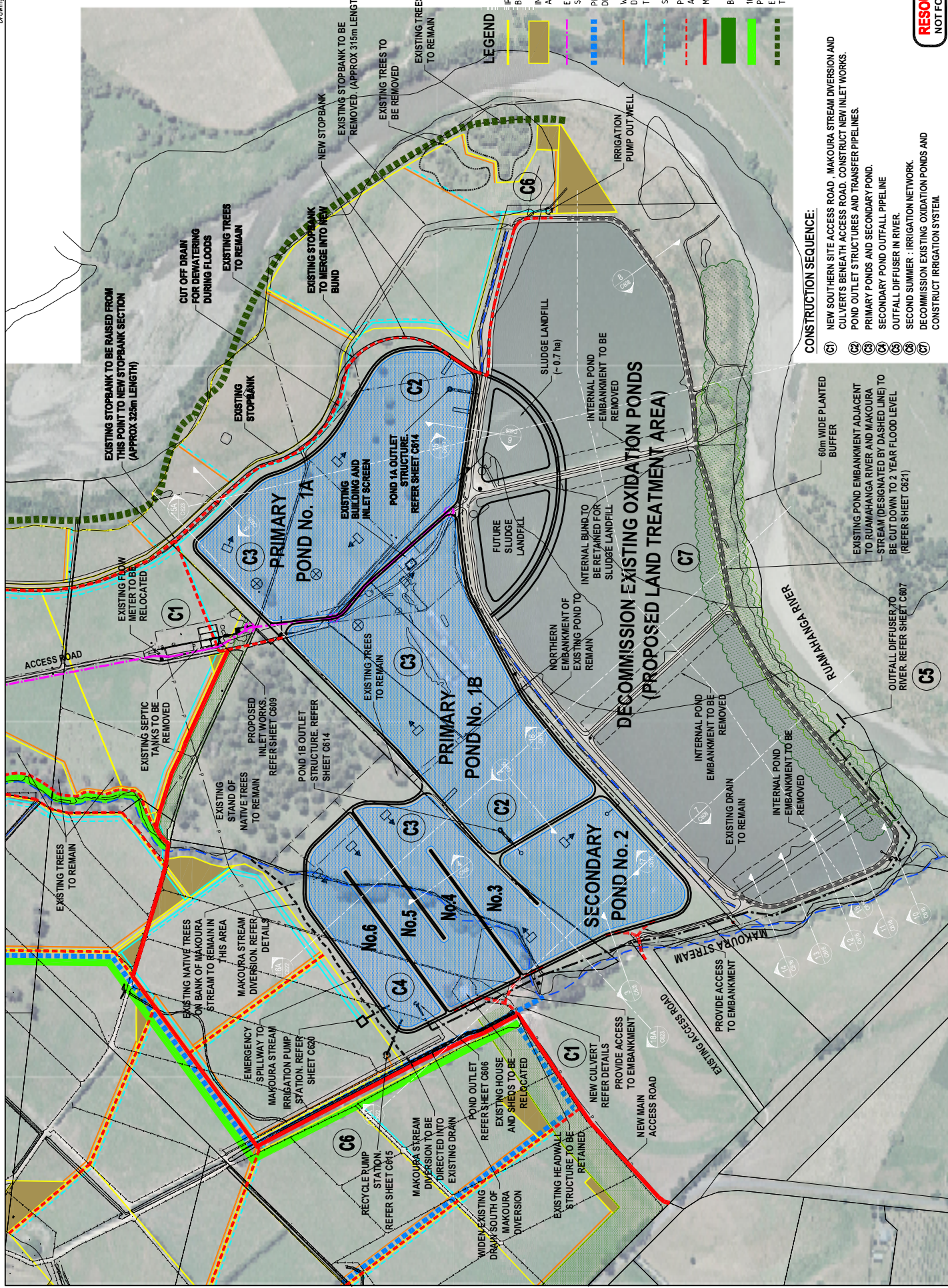
**WIPE OFF DRAIN PUMPING (MULTIPLE PUMP STATIONS)**

**RESOURCE CONSENT NOT FOR CONSTRUCTION**

No.	Revision		Date	By	Chk.	Apprd.	Date		Drawing Engineer: <b>EBCO</b>	Design: Scale (A1) Scale (A2) Scale (A3)	Design Scale (A1) Scale (A2) Scale (A3)	GR GR GR	23/03/08 23/03/08 23/03/08	Approved for Construction Date 23/03/08	Approved for Construction Date 23/03/08	Project: MASTERTON WWTP NEW PONDS AND LAND TREATMENT AREA (2008)	Client: Masterton District Council SERVING THE COMMUNITY	Title: PROCESS FLOW DIAGRAM	Discipline: PROCESS	Drawing No. 32022/16-560-PR100	Rev: C	No.
	Revision																					
	Revision																					
	Revision																					







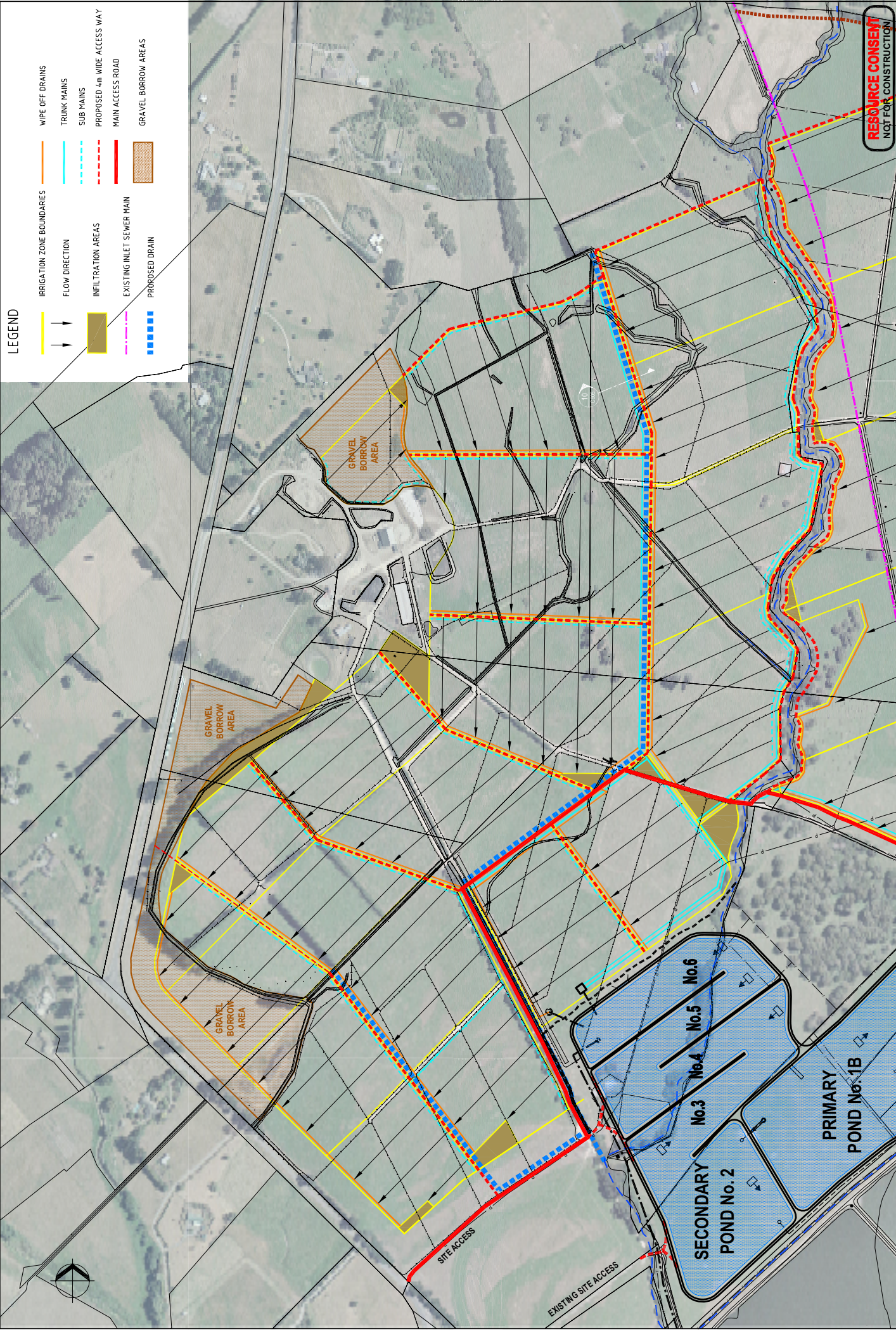
**LEGEND**

- IRRIGATION ZONE BOUNDARIES
- INFILTRATION AREAS
- EXISTING INLET SEWER MAIN
- PROPOSED DRAIN
- WIPE OFF DRAINS
- TRUNK MAINS
- SUB MAINS
- PROPOSED 4m WIDE ACCESS WAY
- MAIN ACCESS ROAD
- BUFFER ZONE
- 10m BUFFER ZONE TO BE PLANTED
- EXISTING WILLOWS BUFFER TO BE ENHANCED

**CONSTRUCTION SEQUENCE:**

- (C1) NEW SOUTHERN SITE ACCESS ROAD, MAKOURA STREAM DIVERSION AND CULVERTS BENEATH ACCESS ROAD. CONSTRUCT NEW INLET WORKS.
- (C2) POND OUTLET STRUCTURES AND TRANSFER PIPELINES.
- (C3) PRIMARY PONDS AND SECONDARY POND.
- (C4) SECONDARY POND OUTFALL PIPELINE
- (C5) OUTFALL DIFFUSER IN RIVER.
- (C6) SECOND SUMMER - IRRIGATION NETWORK
- (C7) DECOMMISSION EXISTING OXIDATION PONDS AND CONSTRUCT IRRIGATION SYSTEM.

<p><b>RESOURCE CONSENT NOT FOR CONSTRUCTION</b></p>	
<p>Discipline: CIVIL</p> <p>Drawing No: 3202216-560-C602   C</p>	<p>Title: PROPOSED POND LAYOUT PLAN</p>
<p>Client: Masterton District Council SERVING THE COMMUNITY</p>	<p>Project: MASTERTON WWTP NEW PONDS AND LAND TREATMENT AREA (2008)</p>
<p>Scale: AS1500                  Design: AS1500                  Construction: AS1500                  Date: 24/01/24                  Drawn: [Name]                  Checked: [Name]                  Approved: [Name]</p>	<p>NO NOT SCALE</p>



**LEGEND**

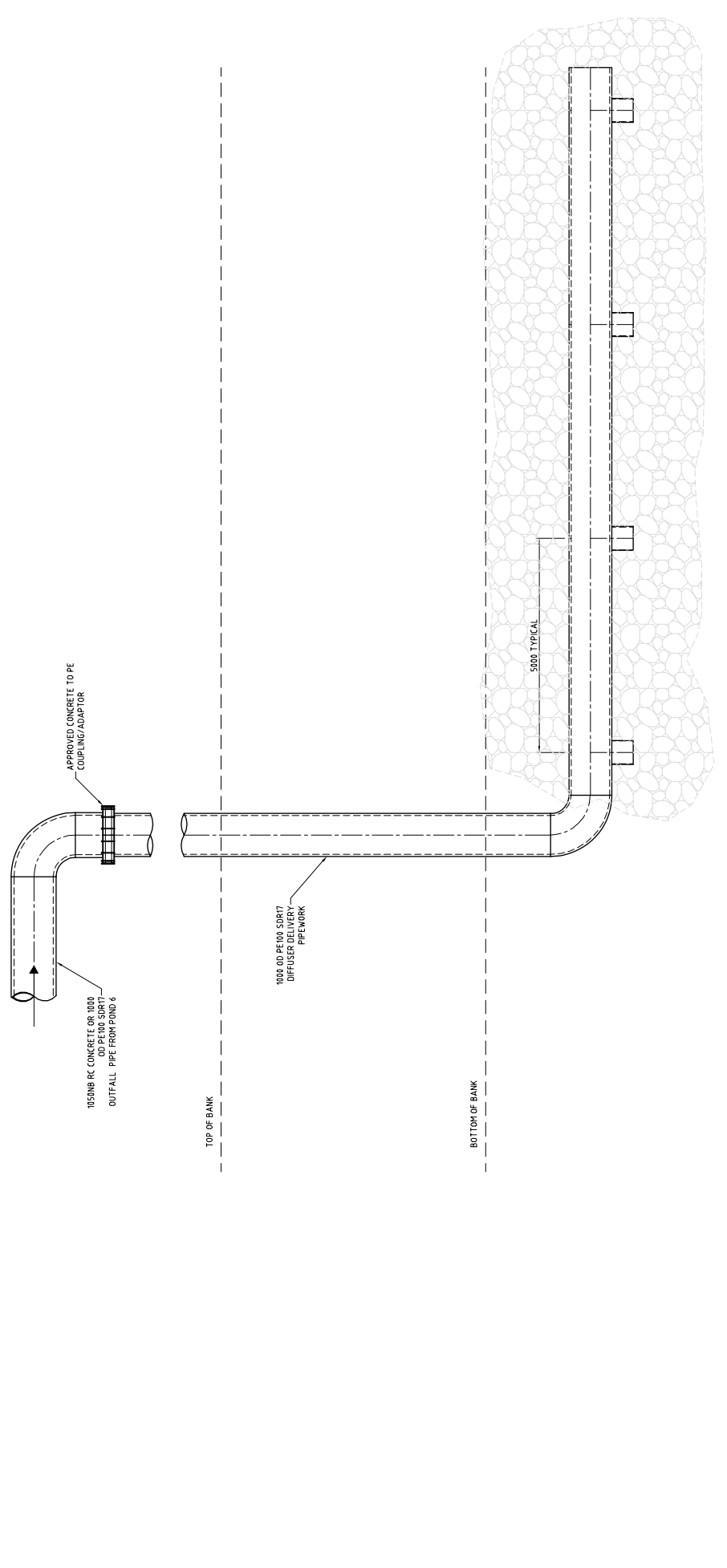
- IRRIGATION ZONE BOUNDARIES
- WIPE OFF DRAINS
- TRUNK MAINS
- SUB MAINS
- PROPOSED 4m WIDE ACCESS WAY
- MAIN ACCESS ROAD
- GRAVEL BORROW AREAS
- INFILTRATION AREAS
- EXISTING INLET SEWER MAIN
- PROPOSED DRAIN
- FLOW DIRECTION

<p><b>Resource Consent</b> NOT FOR CONSTRUCTION</p>	
<p>Discipline: CIVIL Drawing No: 3202216-560-C603 Rev: C</p>	
<p>Title: POTENTIAL FUTURE LAND TREATMENT AREA DETAIL LAYOUT PLAN</p>	
<p>Project: MASTERTON WWTP NEW PONDS AND LAND TREATMENT AREA (2008)</p>	
<p>Client: <b>Masterton District Council</b> SERVING THE COMMUNITY</p>	
<p>Scale (A) 1:1500 Scale (A3) 1:1500</p>	<p>Design Date: 30/03/08 Design Scale: 1:1500</p>
<p>Drawn By: [Signature] Checked By: [Signature]</p>	<p>Drawn Date: 23/07/08 Checked Date: 23/07/08</p>
<p>Revision: [Table with columns: No., Description, By, Ck, Appd, Date]</p>	
<p>Drawn By: [Signature] Checked By: [Signature]</p>	
<p>Engineers = Planners = Managers <b>EBOD</b></p>	



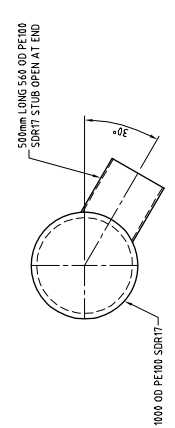






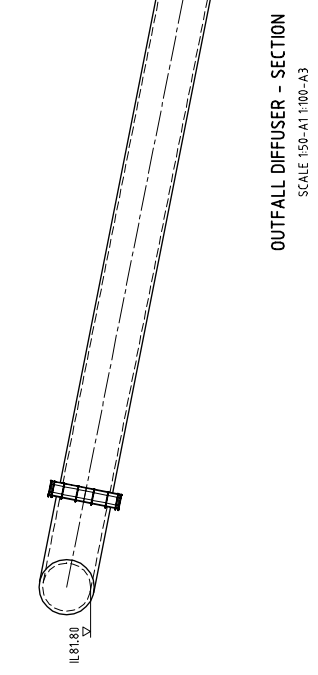
OUTFALL DIFFUSER - PLAN  
SCALE 1:50-A1 1:100-A3

RUAMAHANGA RIVER  
FLOW



A DIFFUSER OUTLET DETAIL  
SCALE 1:25-A1

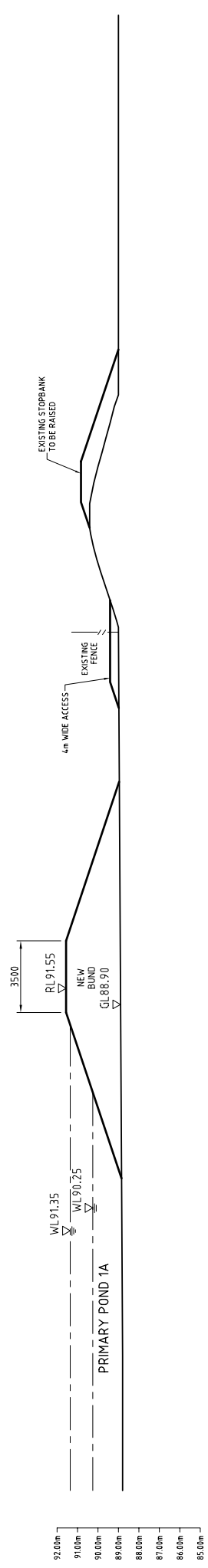
EXISTING GROUND SURFACE



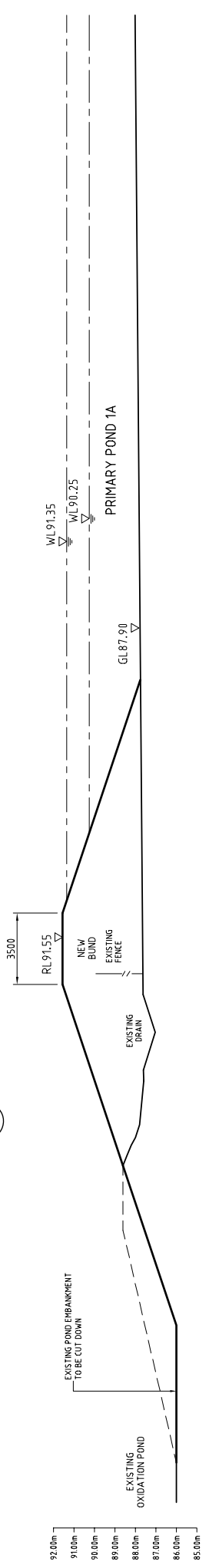
OUTFALL DIFFUSER - SECTION  
SCALE 1:50-A1 1:100-A3

**RESOURCE CONSENT  
NOT FOR CONSTRUCTION**

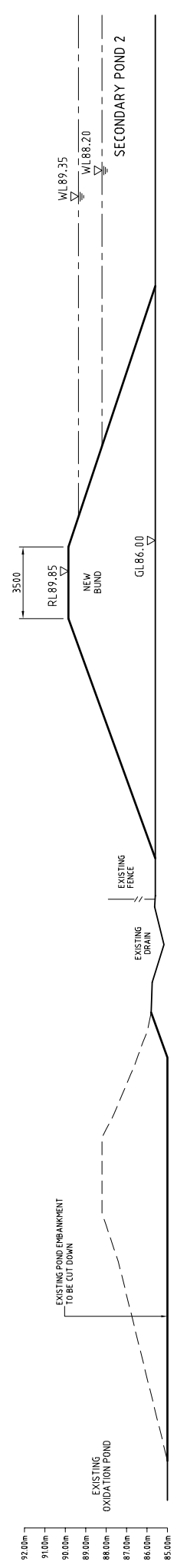
<p>Client: <b>Masterton District Council</b> SERVING THE COMMUNITY</p>		<p>Discipline: CIVIL</p>	
<p>Project: <b>MASTERTON WWTP NEW PONDS AND LAND TREATMENT AREA (2008)</b></p>		<p>Title: <b>RIVER OUTFALL DIFFUSER DETAILS</b></p>	
<p>Scale (A1): 1:50 Scale (A3): 1:100</p>		<p>Drawing No.: 3202216-560-C607 Rev: C</p>	
<p>Design: RPH Checked: RPH Drawn: RPH Scale (A3): 1:100</p>		<p>Discipline: Construction Date: 28/11/06 Scale (A3): 1:100</p>	
<p>Design Engineer: <b>EBOD</b></p>		<p>Engineers = Planners = Managers</p>	
<p>Checked: RPH Date: 28/11/06</p>		<p>Checked: RPH Date: 28/11/06</p>	
<p>By: RPH Date: 28/11/06</p>		<p>By: RPH Date: 28/11/06</p>	
<p>Revision</p>		<p>Revision</p>	



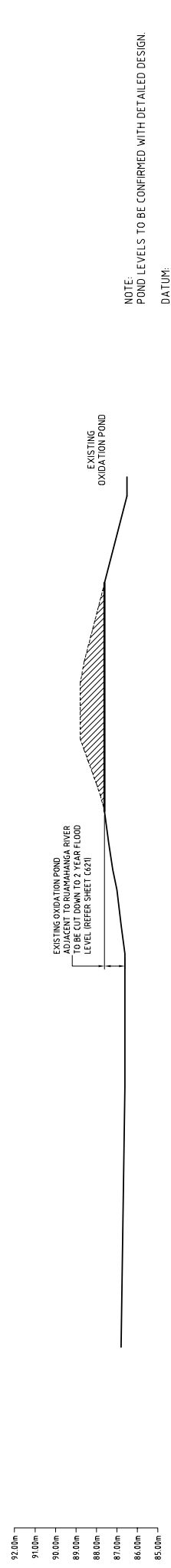
5 SECTION THROUGH EXISTING STOPBANK  
C602 1:100-A1 1:200-A3



6 SECTION THROUGH EXISTING OXIDATION POND  
C602 1:100-A1 1:200-A3



7 SECTION THROUGH EXISTING OXIDATION POND  
C602 1:100-A1 1:200-A3



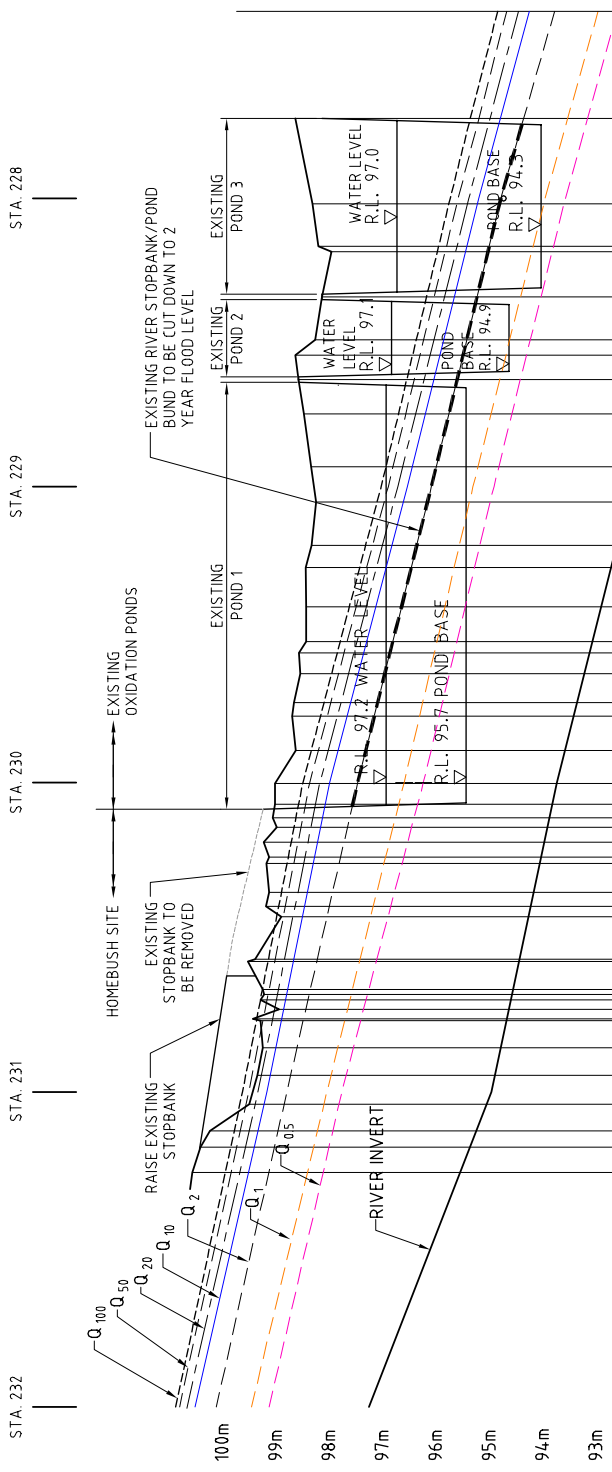
8 SECTION THROUGH EXISTING OXIDATION POND  
C602 1:100-A1 1:200-A3

NOTE:  
POND LEVELS TO BE CONFIRMED WITH DETAILED DESIGN.

DATUM:  
NEW ZEALAND GEODETIC DATUM 2000  
MEAN SEA LEVEL ELEVATION, metres  
NEW ZEALAND TRANSVERSE MERCATOR PROJECTION (NZTM2000)

**RESOURCE CONSENT  
NOT FOR CONSTRUCTION**

No.	By	Chk	Apprd	Date		Drawing Engineer: 2003108 2003108 2003108	Scale (A1) Scale (A2) Scale (A3)	Design Drawn Checked Scale (A3)	ANZI (NZS 3910) (NZS 3910) (NZS 3910)	Date of Issue 20/07/08 20/07/08 20/07/08	Date of Construction 20/07/08 20/07/08 20/07/08	Client Masterton District Council SERVING THE COMMUNITY	Project MASTERTON WWTP NEW PONDS AND LAND TREATMENT AREA (2008)	Discipline CIVIL	Drawing No. 3202216-560-C608	Rev. C



HAD = 92m

DISTANCE	98.71	98.03	97.23	96.50	95.86	94.45	93.84	93.16
$Q_{100}$ (955m <sup>3</sup> /S)	100.34	105.485	105.775	106.065	106.3425	106.620	106.900	107.160
$Q_{50}$ (877m <sup>3</sup> /S)	100.25	99.77	99.32	98.63	97.87	97.16	96.48	95.85
$Q_{20}$ (760m <sup>3</sup> /S)	100.10	99.60	99.13	98.44	97.69	96.98	96.29	95.65
$Q_{10}$ (674m <sup>3</sup> /S)	99.96	99.43	98.96	98.26	97.51	96.80	96.11	95.46
$Q_2$ (460m <sup>3</sup> /S)	99.60	99.06	98.46	97.73	97.05	96.35	95.69	95.05
$Q_{0.1}$ (237m <sup>3</sup> /S)	99.00	98.31	97.60	96.86	96.24	95.57	94.84	94.22
$Q_{0.5}$ (168m <sup>3</sup> /S)	98.71	98.03	97.23	96.50	95.86	94.45	93.84	93.16

### ALL LEVELS ARE TO WRC DATUM

NOTE: REFER TO SHEETS C622 AND C623 FOR SECTION THROUGH NEW PONDS AND RUAMAHANGA RIVER

**RESOURCE CONSENT NOT FOR CONSTRUCTION**

Discipline: CIVIL  
 Drawing No.: 3202216-560-C621 | C  
 Rev:

Title: RUAMAHANGA RIVER FLOOD LEVELS

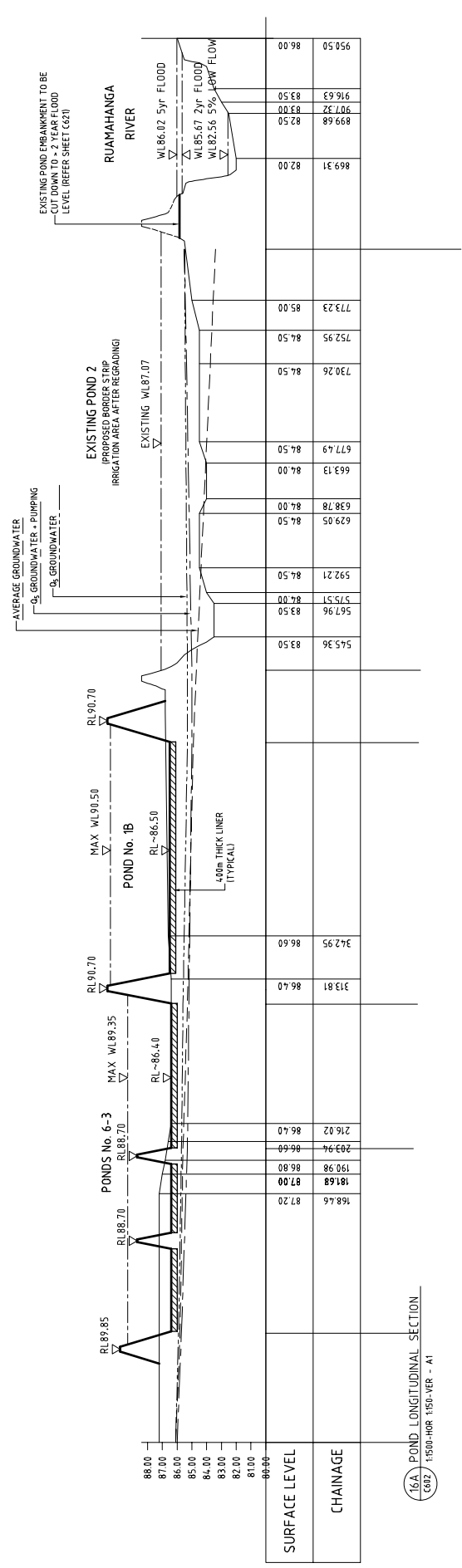
Project: MASTERTON WWTP NEW PONDS AND LAND TREATMENT AREA (2008)

Client: Masterton District Council  
 SERVING THE COMMUNITY

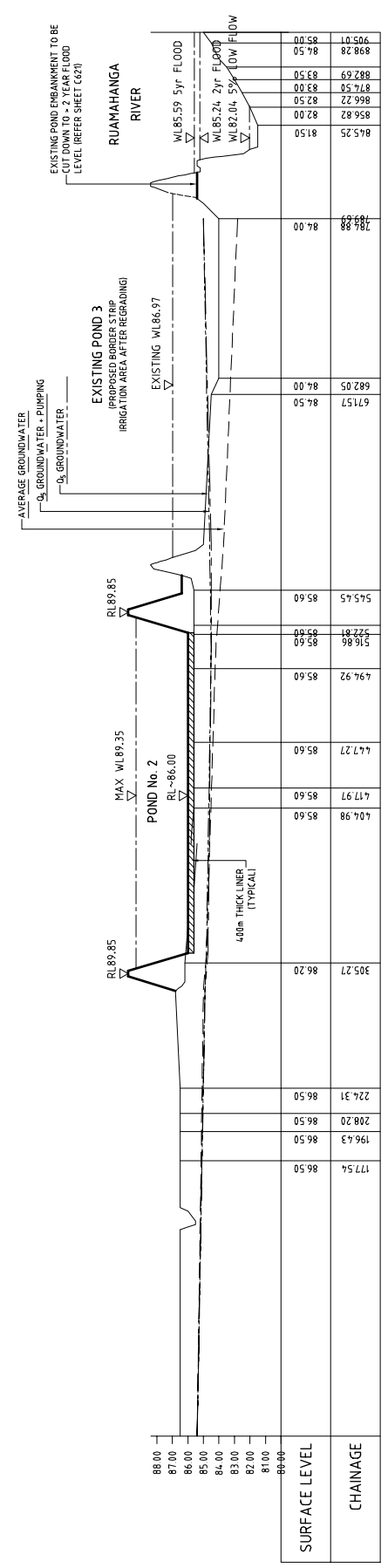
Design Scale (A1): 1:10000  
 Design Scale (A2): 1:10000  
 Design Scale (A3): 1:10000  
 Date: 21/07/08  
 Drawn: [Signature]  
 Checked: [Signature]  
 Date: 21/07/08

Designing Engineer: [Signature]  
 Engineers = Planners = Managers  
 EPCO

No.	By	Chk.	Apprd.	Date	Revision
1				21/07/08	ISSUED FOR RESOURCE CONSENT
2				21/07/08	PRELIMINARY RESOURCE CONSENT ISSUE
3				21/07/08	FOR INFORMATION



16A POND LONGITUDINAL SECTION  
1:500-HOR 1:50-VERT - A1



17A POND LONGITUDINAL SECTION  
1:500-HOR 1:50-VERT - A1

**RESOURCE CONSENT NOT FOR CONSTRUCTION**

Title	SITE CROSS SECTIONS	Discipline	CIVIL
Drawing No.	3202216-560-C622	Rev.	C

Project	MASTERTON WWTP NEW PONDS AND LAND TREATMENT AREA (2008)
Client	Maasterton District Council SERVING THE COMMUNITY

Scale (A1)	Scale (A2)	Scale (A3)	Scale (A4)	Scale (A5)	Scale (A6)
1:500	1:1000	1:2000	1:3000	1:4000	1:5000

Design	Checked	Reviewed	Approved	Date	Date

By	Chk	Apprd	Date	Date	Date

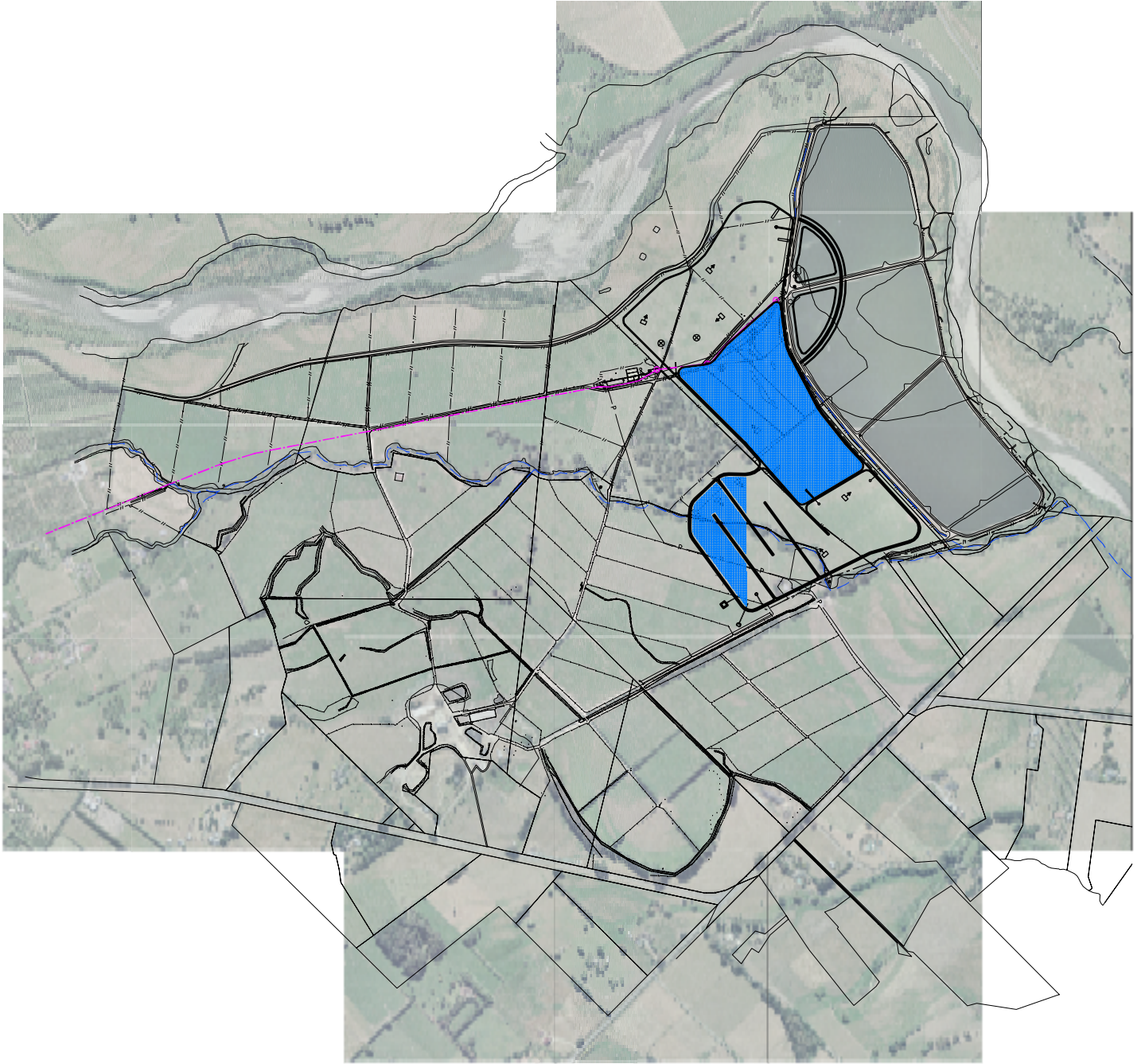
No.	Revision	Description	Date

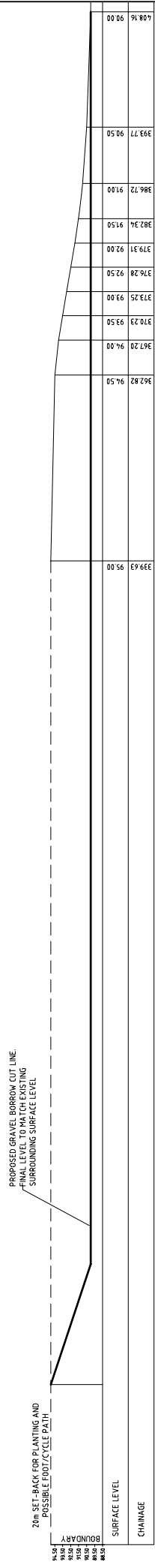
Drawing Engineer:  
**EBOD**

Engineers = Planners = Managers

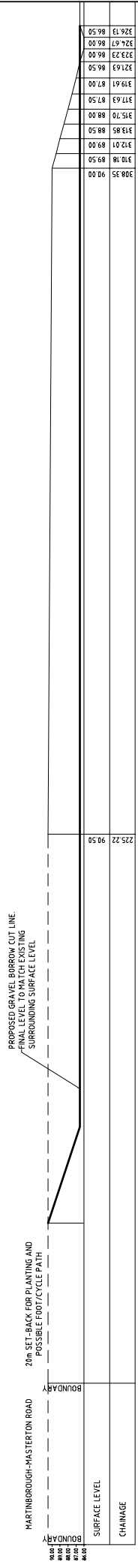




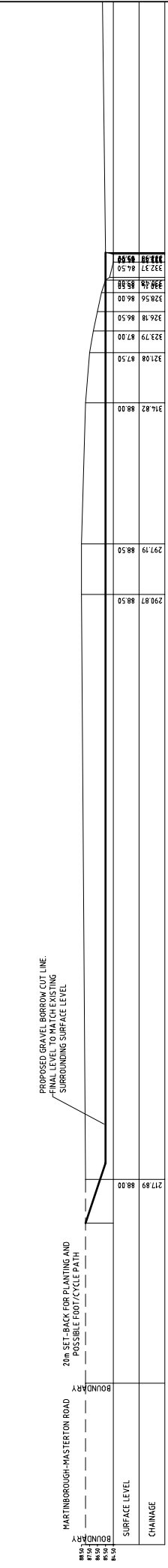




**G03** GRAVEL BORROW AREA SECTION  
 C&S / 1259-A1 1508-A3



**G02** GRAVEL BORROW AREA SECTION  
 C&S / 1259-A1 1508-A3



**G01** GRAVEL BORROW AREA SECTION  
 C&S / 1259-A1 1508-A3

<p>NO. 1</p> <p>NO. 2</p> <p>NO. 3</p> <p>NO. 4</p> <p>NO. 5</p> <p>NO. 6</p> <p>NO. 7</p> <p>NO. 8</p> <p>NO. 9</p> <p>NO. 10</p> <p>NO. 11</p> <p>NO. 12</p> <p>NO. 13</p> <p>NO. 14</p> <p>NO. 15</p> <p>NO. 16</p> <p>NO. 17</p> <p>NO. 18</p> <p>NO. 19</p> <p>NO. 20</p> <p>NO. 21</p> <p>NO. 22</p> <p>NO. 23</p> <p>NO. 24</p> <p>NO. 25</p> <p>NO. 26</p> <p>NO. 27</p> <p>NO. 28</p> <p>NO. 29</p> <p>NO. 30</p> <p>NO. 31</p> <p>NO. 32</p> <p>NO. 33</p> <p>NO. 34</p> <p>NO. 35</p> <p>NO. 36</p> <p>NO. 37</p> <p>NO. 38</p> <p>NO. 39</p> <p>NO. 40</p> <p>NO. 41</p> <p>NO. 42</p> <p>NO. 43</p> <p>NO. 44</p> <p>NO. 45</p> <p>NO. 46</p> <p>NO. 47</p> <p>NO. 48</p> <p>NO. 49</p> <p>NO. 50</p> <p>NO. 51</p> <p>NO. 52</p> <p>NO. 53</p> <p>NO. 54</p> <p>NO. 55</p> <p>NO. 56</p> <p>NO. 57</p> <p>NO. 58</p> <p>NO. 59</p> <p>NO. 60</p> <p>NO. 61</p> <p>NO. 62</p> <p>NO. 63</p> <p>NO. 64</p> <p>NO. 65</p> <p>NO. 66</p> <p>NO. 67</p> <p>NO. 68</p> <p>NO. 69</p> <p>NO. 70</p> <p>NO. 71</p> <p>NO. 72</p> <p>NO. 73</p> <p>NO. 74</p> <p>NO. 75</p> <p>NO. 76</p> <p>NO. 77</p> <p>NO. 78</p> <p>NO. 79</p> <p>NO. 80</p> <p>NO. 81</p> <p>NO. 82</p> <p>NO. 83</p> <p>NO. 84</p> <p>NO. 85</p> <p>NO. 86</p> <p>NO. 87</p> <p>NO. 88</p> <p>NO. 89</p> <p>NO. 90</p> <p>NO. 91</p> <p>NO. 92</p> <p>NO. 93</p> <p>NO. 94</p> <p>NO. 95</p> <p>NO. 96</p> <p>NO. 97</p> <p>NO. 98</p> <p>NO. 99</p> <p>NO. 100</p>	<p>NO. 1</p> <p>NO. 2</p> <p>NO. 3</p> <p>NO. 4</p> <p>NO. 5</p> <p>NO. 6</p> <p>NO. 7</p> <p>NO. 8</p> <p>NO. 9</p> <p>NO. 10</p> <p>NO. 11</p> <p>NO. 12</p> <p>NO. 13</p> <p>NO. 14</p> <p>NO. 15</p> <p>NO. 16</p> <p>NO. 17</p> <p>NO. 18</p> <p>NO. 19</p> <p>NO. 20</p> <p>NO. 21</p> <p>NO. 22</p> <p>NO. 23</p> <p>NO. 24</p> <p>NO. 25</p> <p>NO. 26</p> <p>NO. 27</p> <p>NO. 28</p> <p>NO. 29</p> <p>NO. 30</p> <p>NO. 31</p> <p>NO. 32</p> <p>NO. 33</p> <p>NO. 34</p> <p>NO. 35</p> <p>NO. 36</p> <p>NO. 37</p> <p>NO. 38</p> <p>NO. 39</p> <p>NO. 40</p> <p>NO. 41</p> <p>NO. 42</p> <p>NO. 43</p> <p>NO. 44</p> 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## **Appendix E**

**Aerial Photo's of the Upper Ruamahanga Te Ore Ore River Management Scheme**







## **Appendix F**

### **Draft Land Treatment Management Plan**

Report

# Masterton Wastewater Land Treatment Management Plan - Draft

Prepared for Masterton District Council

By Beca Carter Hollings & Ferner Ltd (Beca)

August 2008



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## Revision History

Revision N°	Prepared By	Description	Date
A	Ron Haverland	Draft for AEE	13 August 2008

## Document Acceptance

Action	Name	Signed	Date
Prepared by	Ron Haverland		13 August 2008
Reviewed by			
Approved by	Humphrey Archer		
on behalf of	Beca Carter Hollings & Ferner Ltd		

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## 1 Purpose

This Land Treatment Management Plan sets out the management practices required for the sustainable operation and maintenance of the land treatment system involving irrigation of treated effluent from the proposed new Masterton Wastewater Land Treatment Plant.

The purpose of this Plan is to minimise the risk to public health and environmental damage through the provision of operational guidelines for border strip irrigation of pond effluent.

This Plan is provided as supporting information to the *Masterton Wastewater Treatment Plant and Disposal System Long-Term Upgrade, Resource Consent Applications and Assessment of Effects on the Environment*. The Plan will be a 'living document' and will therefore be updated as needed to incorporate requirements of the resource consent conditions and details of the scheme following its detailed design, construction and commissioning.

This Plan shall be implemented in conjunction with the following plans;

- *Masterton Wastewater Treatment Plant at Homebush – Mitigation Plan*, which deals with the operation of the treatment plant
- *Odour, Aerosols and Noise Monitoring Plan* which deals with monitoring of the oxidation ponds and dealing with potential complaints. This plan was required by the 2003 interim resource consent conditions.
- *Masterton Wastewater Treatment Plant at Homebush – Risk Communication Strategy* which presents a strategy for public communication regarding the discharge to the Ruamahanga River and public health issues associated with that

All of the above plans will be incorporated into the one document when the new scheme is completed.

## 2 Description of the System

The proposed new treatment plant will comprise of two parallel primary oxidation ponds and five maturation ponds in-series. The ponds will either discharge treated effluent to the Ruamahanga River or to the land treatment scheme, or both simultaneously depending on the river/land conditions at the time. During river flows below half median or median (refer to Section 3) effluent will not be discharged to the river and will therefore be irrigated to land with the balance going to storage. The oxidation ponds provide a minimum storage volume of 275,000 m<sup>3</sup>. At times when irrigation is not possible due to excess soil moisture or rainfall, effluent will go to storage and/or to the river depending on river flow conditions. The land treatment scheme is the preferred means of discharge and should be used in preference to a discharge to the river or storage of effluent.

Effluent will be pumped from the final maturation pond to the land treatment scheme. The "Proposed Land Treatment" scheme (refer Drawing C-601, C-603 & C-604) will be developed as the initial scheme while the "Potential Future Land Treatment" area may be developed in the future depending on funding constraints.

The Proposed Land Treatment (referred to in this Plan as the land treatment scheme) is to be developed on two sites owned by MDC; the 91 ha site and the east portion of the 107 ha site (gross site areas). The land treatment scheme initially will have a net area for irrigation of 75 ha. The 75 ha area has been split up into 14 zones and covers the area between the Makoura Stream and the river stopbank, the river berm area, and the area on the east side of the 107 ha site.

In the two to three years following commissioning of the new ponds, the existing oxidation pond area will be converted to border strip irrigation. The area available provides an additional 22 ha i.e. a total of 97 ha of irrigation area.

The land treatment scheme will be planted in pasture for baleage or silage production.

### 3 River Discharge

Effluent will be discharged from pond storage to the Ruamahanga River whenever storage exceeds the minimum operating levels in the ponds and river flow conditions permit. Discharges to the river will be controlled automatically by the plant control system. A predictive model will be used “to overview” the discharge operation, to give more certainty that the exceedance of the river flow trigger will be sustained for a sufficient duration. This will avoid discharging when the river flow exceeds the trigger value for durations of less than about six hours. The Mt Bruce flow recorder will provide six to nine hours advance warning of the magnitude of a fresh. This flow data will be used by the automatic control system to initiate a discharge when the trigger at Wardell’s Bridge is exceeded and there is a strong likelihood that the fresh will be sustained for more than six hours. A “start to discharge” delay of 15 to 30 minutes will ensure that the river flow has comfortably exceeded the trigger value, thus overcoming any minor errors in the flow measurement data.

The discharge to the Ruamahanga River shall be operated in accordance with the following river trigger conditions and the requirements of the resource consent conditions for the scheme;

- Summer (1 Nov to 30 April); discharge to river at greater than median flow ( $12.3 \text{ m}^3/\text{s}$ )
- Winter (1 May to 31 Oct); discharge to river at greater than half median river flows ( $6.15 \text{ m}^3/\text{s}$ )
- Discharge to be maintained at a river flow:effluent ratio of 30:1
- Maximum discharge rate to be 1,200 litres/s
- No discharge above river flows greater than  $300 \text{ m}^3/\text{s}$ .

Note that prior to the development of the existing oxidation pond area into land treatment, total discharge volumes to land may be less depending on rainfall and therefore in order to not exceed the available storage volume, the river discharge trigger has been set accordingly;

- Summer and winter periods; discharge to river at greater than median river flows ( $12.3 \text{ m}^3/\text{s}$ )
- All other rules as above.

## 4 Effluent Quality

The effluent quality from the oxidation ponds is suitable for discharge to the Ruamahanga River and irrigation to land. The expected effluent quality from the Masterton oxidation ponds is set out in Table 4.1.

**Table 4.1**

### Effluent Quality

Parameter	Geometric Mean
BOD5 (g/m <sup>3</sup> )	18
Suspended solids (g/m <sup>3</sup> )	22
Dissolved reactive phosphorus (g/m <sup>3</sup> )	2.4
Total Nitrogen (g/m <sup>3</sup> )	10.1
Nitrate Nitrogen (g/m <sup>3</sup> )	0.4
Nitrite Nitrogen (g/m <sup>3</sup> )	0.1
Ammonia-Nitrogen (g/m <sup>3</sup> )	0.7 (summer) 3.0 (winter)
<i>E. coli</i> (cfu/100 mL)	485 (summer) 651 (winter)

*Note: Geometric means are provided to enable consistency with historical monitoring and trend reporting*

Effluent quality shall be monitored in accordance with the resource consent conditions contained in Appendix A.

## 5 Design Basis

### 5.2 Soil Types

In determining the irrigation depths to be applied, the operators need to have regard to the different soil types at the land treatment site. Generally the 91 ha site (between Makoura Stream and the river berm) consists of generally free draining soils are silty-textured (silt loam and silty clay loam textures) with intermittent clay-rich layers at depth.

On the river berm area the alluvium is coarser, with a tendency to have sandy textures sometimes interspersed with gravels plus fine sandy loams, sandy loams and gravelly sand textures as well as some loamy silts. These soils are free draining.

On the 107 ha site to the west of Makoura Stream, the soils are generally finer textured than those on the 91 ha site and the clay-enriched layers tend to be at shallower depth nearer the centre of the property. These clay rich soils are poorly to imperfectly drained.

Refer to the Table 5.1 for appropriate irrigation rates for the different soil types.

### 5.3 Irrigation Rates

The irrigation depth discharged to the border strips is expected to be around 70-100 mm every 7-10 days or up to 150 mm during dry conditions. Treated effluent application should be, as far as practicable, uniform over the available area for even nitrogen and phosphorus loading.

Generally, the irrigation depths will be controlled to provide an average application of effluent plus rainfall, as set out in Table 5.1.

**Table 5.1**

**Irrigation Depths and Areas for Soil Types**

Soil type	Area (ha)	Summer Average/Max (mm/day)	Winter Average/Max (mm/day)
Free draining	71	10/15	5/5
Clay rich	26	10/10	0/5
Total	97		

*Note: The application rate is the total liquid applied i.e. effluent plus rainfall. Irrigation areas include the decommissioned pond area (22 ha)*

Rainfall and soil moisture will be monitored daily and the operator will make a decision on the actual depth of effluent to be applied. An automatic rain gauge will be used to stop the irrigation pumps in the event of significant rainfall that will result in an effluent/rainfall depth greater than an average application of 10 mm/day.

## 5.4 Seasonal Discharge Pattern

Table 5.2 provides a monthly summary of the average daily volume and occurrences of discharges to land and the river based on an average year's weather, influent wastewater and river flow data (noting that there could be a simultaneous discharge to the river and to land).

**Table 5.2**

### Summary of Average Daily Discharge

Month	Daily average influent flow [m <sup>3</sup> /d]	Discharge to river	% of inflow to river	Discharge to Land	% of inflow to land	% of days with no river discharge	% days to land	% days to river	Average daily river flow [m <sup>3</sup> /d]
January	13,228	4,333	33	7,747	59	80	93	20	11.1
February	13,104	4,860	37	7,596	58	81	93	19	14.7
March	13,050	5,828	45	7,228	55	77	95	23	11.3
April	12,397	5,041	41	6,635	54	77	98	23	12.1
May	13,131	12,259	93	2,990	23	28	84	72	18.3
June	16,106	14,006	87	2,868	18	2	83	98	32.9
July	20,707	18,741	91	2,698	13	0	79	100	38.0
August	19,964	17,401	87	2,950	15	1	83	99	32.3
September	17,159	14,164	83	3,056	18	6	81	94	26.9
October	19,652	12,730	65	6,607	34	21	85	79	42.0
November	15,626	7,413	47	7,153	46	51	88	49	21.9
December	14,939	7,593	51	7,035	47	51	88	49	17.9

Note: Using data from 1 January 1997 – 3 March 2008

From Table 5.2, the average total annual volume of discharge to land is 1,963,000 m<sup>3</sup>. Over the 97 ha of irrigation land this represents an average irrigation depth of 2.0 m per year.

## **6 Border Strip Operation**

### **6.1 Pump Station Operation**

Effluent from the final maturation Pond 6 discharges through a 900 mm dia transfer pipe to supply a 900 dia header manifold for the irrigation pumps. The border strips on the decommissioned pond area are fed by gravity with a main directly from the irrigation pumps manifold.

The irrigation pump station includes the pumps, screens, filters, controls and telemetry associated with the border strip irrigation and buffer zone drip systems. The pumps are dry mounted centrifugal sewage pumps with a pump duty of up to 300 l/s at 20 m head (confirm at detailed design) to supply two bubble-up valves simultaneously. Variable speed drive (VSD) controls are required to maintain the flow rate over the varying elevations.

Three pumps supply the border strip irrigation with varied sizes to supply the different irrigation areas. Valves in the discharge manifold allow pumps to be taken out of service with the irrigation area being supplied by another pump. Removal and movement of the irrigation pumps will require the use of the gantry and hoist in the pump station building. The pumps supply three trunk mains to provide reticulation to the 91 and 107 ha sites.

### **6.2 Application Control**

The system is controlled by a series of electrically actuated zone valves and manual border strip bubble-up valves (the 14 zones in the 75 ha site, and 3 zones in the decommissioned pond area are shown on Drg C-624). These valves allow the operator to discharge to each zone and to each border strip.

The border strip treatment system is partially automated. The operator must manually open bubble-up valves in each strip to be used, and can then either manually control the discharge or schedule an automatic discharge sequence for the border strip zones. The automatic discharge sequence will start the irrigation pump and sequentially actuate the zone valves.

When visiting a zone to close/open the bubble up valves, the operator is to check the strips for ponding or signs of pasture stress, and odour emissions.

Effluent application should be managed on a rotational basis to maximise the return between applications. The application times to each border strip should be adjusted to ensure that under and over-watering is minimised. Over or under watering can result in soil and pasture damage and/or excess runoff. The sequence of applications can be set in the automatic control system. The sequence restarts at the beginning after a set time period (adjustable) is completed.

If a valve fails to open, then the next area valve in the sequence is selected and a non-urgent alarm is raised. If a valve fails to close, the pump is stopped and a non-urgent alarm is raised. If a valve is not in automatic mode, then the next zone in the sequence is selected.

Prior to the effluent advance reaching the end of each strip, the automated irrigation system will close the zone valve and open the next zone valve. The programming of the control system for sequencing will require fine-tuning during the start-up period due to the variability between each zone of soil type, strip length and slope.

The duration and area of discharge should be recorded on effluent irrigation worksheets if the cycling is being done manually, otherwise the discharge details will be logged electronically in the control system. The flow to the border strip discharge area will be monitored by the flow meter on the delivery line to the pumps.

The border strip irrigation pumps will deliver 100 to 150 l/s from each bubble-up valve. Border strips that are 24 m wide will have two bubble-up valves with a total flow in the range of 200 to 300 l/s. Opening only one valve will decrease the loading. This will need to be determined during commissioning and adjusted for changing conditions.

### **6.3 Run-off Control**

Some experience will be needed to determine the time of application required to allow the effluent to just reach the end of the border strip, and no further. These times can be adjusted by the operator seasonally if required. In the event that effluent reaches the end of the border strip, it will be discharged to the wipe-off drain for collection. Wipe-off drains will be connected to irregular shaped areas at the end of border strips which will be formed into infiltration areas. These will be excavated through to the permeable subsoils to promote the run-off infiltration to groundwater. The areas are shown on Drgs C603 & C604. This will reduce runoff pumped back to the ponds or stormwater discharges to the Makoura Stream.

The wipe-off drains will be used to collect rainfall run-off from the border-strips. If the enhanced infiltration capacity is exceeded in the wipe-off drains, the runoff from the first two hours of rainfall will go to the recycle pump station and be returned to the ponds. This period (called the first flush) allows for contaminants to be returned to the ponds for later irrigation or river discharge. Following the first flush, 'clean' stormwater will be suitable for discharge to Makoura Stream.

The wipe-off drain along the Makoura Stream will run back to a recycle pump station adjacent to Pond 6 (as indicated on Drawing C602). Wipe off drains on the river berm will extend into the layer of sandy gravels which are very permeable so any excess run-off will percolate directly into the subsoils.

The operator shall monitor the wipe-off drains routinely to determine if there is excessive run-off of effluent into the drain. Excessive run-off will require the pump operation time for that particular zone to be altered through the irrigation control system.

The operator shall routinely check the wipe-off drains for excessive weed growth which may restrict the passage of effluent and storm-water. Weeds should be removed and disposed of.

The infiltration areas will require maintaining by the operator to remove silt from run-off that accumulates and reduces the infiltration rate. Silt should be disposed at the Nursery Road clean-fill. Ripping the infiltration area and/or addition of coarse sand may be used to restore the permeability. The areas should also be kept free of excessive weeds.

### **6.4 Border Strip Management and Maintenance**

The operational philosophy for irrigating the border strips will be to maximise the volume of wastewater discharged to land, whilst minimising the amount of runoff. Given the variability of soil characteristics and environmental conditions, this philosophy will require the operator to exercise judgement and make adjustment to the automatic control where necessary.

The border strip area requires active management to manage the nutrient loading and maintain the border strip structure and pasture. The following management practices should be adopted:

- Maintain land available for the discharge of treated effluent at all times, except when pasture renewal is required.
- Maintain levees between borders in good condition to prevent spillage of effluent between borders.



- The border strip area is planted in pasture for baleage or silage production. The pasture should be a species that will actively grow and absorb nutrients during winter months. The recommended species is a perennial rye grass mix and with white and/or red clover. The pasture dry matter yield is likely to be in the range of 12,000-16,000 kg/ha/yr.
- Pasture renewal shall be limited to no more than 20% of the area at any one time. It is expected that pastures will need to be re-grassed every four to six years, using direct drilling to avoid cultivation.
- Pasture should be sown and maintained in good condition and be free of weeds.
- It is important to maintain an active sward of grass when treated effluent is applied.
- Harvesting of the pasture should occur whenever there is a yield of approximately 3,000 kg dry matter per hectare with harvesting generally confined to the months of September to May. Prior to harvesting, the pasture will be spelled (no irrigation) for as long as possible and for a period of at least ten days with no treated wastewater being applied. Low impact, wide wheels on machines will also help reduce soil compaction. It will be important to avoid having heavy harvesting equipment on the land at times of wet soil conditions.
- A schedule shall be kept of the zone number, date of cut, harvest details and tests carried out.
- Pasture should be regularly harvested (four to five times per year) and removed from the site to ensure that nitrogen uptake is maximised and minimal nitrogen recycling can occur. Table 6.1 shows an estimated nitrogen balance for the border strip area using “cut and carry” system.
- Pasture needs to be monitored, including regular nutrient budgeting. The aim will be to keep fertilising to a minimum to reduce the leaching of nutrients to groundwater. It is expected that clover will assist N deficiencies. However, if pasture growth becomes impacted by nutrient deficient soil, then fertilising will be undertaken to remediate.
- With a cut-and-carry system it is likely that potassium will become deficient and hence will need to be applied regularly to the land
- Regular monitoring of the soil/plant system is important so that potential problems can be identified and addressed before they become significant issues; such monitoring should also include the preparation of a regular nutrient budget.
- Inherent in a cut-and-carry wastewater irrigation operation is the need to exclude grazing animals, although limited use of small grazing animals (for example, sheep) will be beneficial at certain times of the year to ‘tidy up’ those areas unable to be harvested. Cattle will be excluded from the wastewater irrigated areas, because of the pugging they will cause which will reduce infiltration rates.

**Table 6.1**  
**Nitrogen Balance for Border Strip Area**

<b>Irrigation – Season<sup>2</sup></b>	<b>Nitrogen (g/m<sup>3</sup>)</b>	<b>ADF to Land (m<sup>3</sup>/d)</b>	<b>Annual N to Land (kg/season)</b>	<b>Area (ha)</b>	<b>N Loading (kg/ha/season)<sup>2</sup></b>	<b>N removed in harvest (kg/ha/harvest)<sup>1</sup></b>
Summer	11	7,243	14,500	97	150	350
Winter	11	3,543	7,100	71	100	

Notes:

1) Assumes pasture yield is 14,000 kg dry matter per hectare/per annum and pasture contains 2.5% N

2) Assumes a season is 183 days.

## 6.5 Use of the Balage or Silage

Fonterra's 2007 revised policy on human sewage application to dairy farms, only permits very high quality treated wastewater (i.e., treated with filtration and UV disinfection) being spread onto pasture fed to dairy cows. The proposed quality of the effluent from the upgraded oxidation ponds therefore will exclude the silage or baleage being fed to dairy cows. However, it has been confirmed that there will be a demand in the area locally by dry stock farmers for the harvested silage or baleage.

For the cut and carry system, it will be necessary to demonstrate that the baleage or silage is suitable to feed to cattle, without the need for a stand down period.

The baleage shall be tested for stock food value and suitability for stock feed. Tests shall include yeasts and moulds and listeria. Bales containing Listeria shall be stored separately and disposed of for composting or mulch and not sold for feed.

## 6.6 Buffer Zones

Buffer areas along the north and west boundaries of the proposed irrigation area and bounding the east side of Makoura Stream, will be established as part of the upgrade. These buffer strips will provide an appropriate setback distance from waterways and adjacent properties that is free of border strip irrigation and other MWTP operations. The planted buffers will be 10m wide and will be planted in a range of tree species, compatible with proposals for enhancing the ecological and recreational potential of the stream.

The boundary buffers will be planted to screen the site, where agreed with residents to the south, west and north of the site.

Drip irrigation of treated effluent will be used to establish and maintain the buffer planting and other areas where irrigation is needed. Drip irrigation to buffer areas, shall only occur when soil moisture drops below levels required for satisfactory growth. This will be initiated manually by the operator.

## **6.7 Power Failure**

The WWTP inlet works and inlet pump station has a backup generator in the event of a power failure. Irrigation pumps will not be provided with a backup power supply as effluent can be stored in the oxidation ponds or discharged to the Ruamahanga River in accordance with the discharge rules. In the unlikely event of a power failure occurring when the storage was full, emergency discharge provisions would apply.

## **6.8 Preventive Maintenance**

All equipment shall be routinely inspected and maintained in accordance with the suppliers recommendations. Equipment and checks should include the following;

- Irrigation pump and pump flow rate
- Automated butterfly valves for zone control
- Bubble-up valves
- Flow meters
- Weather recording instruments
- Plant PLC

## 7 Health and Safety

The Masterton District Council is bound by the Health and Safety in Employment Act 1992 to provide a safe work environment. In addition to the guidelines in this Plan, the MDC Health and Safety requirements for operations staff shall be adhered to.

Operations staff are required to wear protection appropriate for use in working with wastewater. The following precautions are recommended while working around wastewater;

- Hands and fingers should be kept away from the nose, mouth eyes and ears
- Hands and forearms up to the elbow should be washed thoroughly with disinfectant soap and hot water before eating or smoking, and after work
- Fingernails should be kept short and foreign materials should be removed from the nails with a stiff soapy brush
- Avoid smoking when handling wastewater or when in any wastewater facility
- Door knobs and other building fixtures should not be contaminated by dirty hands or gloves
- Work clothes worn in wastewater areas should be thoroughly cleaned before being put away
- Street clothes and clean clothes should be stored in a locker separate from used work clothes
- All cuts and scratches should be treated with antiseptic and covered immediately
- A shower should be taken as soon as practical after each work day.

Protective clothing should be worn appropriate to the nature of the work and the environment including the following;

- Surgical or rubber gloves should be worn when performing tasks involving direct contact with wastewater or sludge
- Hard hats - where there is potential for head injury
- Protective footwear - to protect from crushing
- Gumboots - to protect from contaminated soil, wastewater or effluent
- High visibility clothing – in areas of moving machinery or harvesting equipment
- Flotation jackets – over water
- Ear protection – in noisy environments
- Gauze type masks – in high aerosol areas
- Safety glasses or goggles – to protect from eye injury
- Harness and lifelines – to assist to safety those affected by a hazard
- Radio or mobile phone – for emergency call
- Gas meter – to monitor the atmosphere of an area
- Explosion proof torch – for use in hazards areas with poor natural light.

It is noted that the border-strip irrigation method was selected to avoid potential for aerosols in drift from spray irrigators.

Operators having regular contact with raw wastewater or treated effluent, should be immunised against Hepatitis A and B, Tetanus and Polio.

Hazards may be present due to poisonous gases, explosive gases or lack of oxygen which are particular risks at wastewater pump stations. Appropriate procedures must be followed and appropriate equipment worn when working in areas with hazardous gases.

## **8 Resource Consent Monitoring**

The following shall be monitored in accordance with the WWTP resource consent;

### **8.1 Discharge quality**

Refer to Appendix A for the consent conditions for the monitoring of the discharge quality.

### **8.2 Groundwater levels and quality**

Groundwater bores will be monitored for level on a monthly basis.

Groundwater bores shall be sampled three monthly for the first year of operation of the scheme. Following the first year and after satisfactory review, the monitoring frequency would be decreased to six monthly. Refer to Appendix A for the sampling parameters and the bore monitoring sites.

### **8.3 Discharge to Air**

It is not expected that odours will be created by the border-strip irrigation system unless the soils become saturated for periods long enough to form anoxic or anaerobic conditions. The operator will record areas of ponding or odour emissions from the soil.

### **8.4 Soil and pasture analysis.**

Refer to Appendix A for the consent conditions for soil monitoring.

In addition the following soil and pasture analysis shall be carried out;

#### **8.4.1 Soil Structure**

- i. Penetrometer readings across the site  
Take 20 measurements across a 50m transect across the site. Mean values and compare with non-irrigated sites, and to pre-irrigation measurements. Take measurements once per year in early spring.
- ii. Soil Infiltration Measurements [Clothier and White 1981]  
Measure in Spring and Autumn, six reps across the site. These measurements should indicate any deterioration in topsoil infiltration.  
Method  
A metal tube is 'carved' into the soil to give an 'undisturbed column'. A Perspex infiltrometer is placed on top of the soil column and the time for the water level to drop a given distance is recorded. The soil infiltration rate can be calculated and compared with non irrigated sites and with pre-irrigation measurements.
- iii. Soil chemical testing, quick tests [pH, calcium, phosphorous, potassium, magnesium and salt]. Test on four to five areas, once per annum.

#### **8.4.2 Health of Pastures**

- i. Pasture Quadrant Cuts  
**Method**  
A metal Quadrant of known areas [0.25m<sup>2</sup>] is placed on the ground and the pasture inside the quadrant is cut to ground level with electric shears. All the cut herbage is collected and placed in a plastic bag to prevent moisture loss.

Send samples to a laboratory for analysis. Dry matter determinations on individual samples, full chemical analysis on bulked samples. Use DM and P or N analysis to determine uptake and removal of nutrient from the area. Calculate and record harvest yields [e.g. bales of hay or tonnes of silage per ha]

#### **8.4.3 Nitrogen Loading**

TKN and Nitrate – N shall be measured to assess the loading of nitrogen on the treatment system. AgResearch shall carry out a nutrient budget each autumn using a model for assessment.

#### **8.4.4 Pasture Consultants Report**

A farm consultant visually assesses pastures and a six monthly report is obtained for pasture management. A strategy of crop management is carried out for:

- Fertiliser additions
- Insect attack
- Pasture diseases
- Pasture composition.

## **Appendices**

### **Appendix A - Monitoring for Resource Consent Conditions**

[Consent Conditions to be included following the resource consent being granted].