RECYCLED WATER SCHEME
ANNUAL REPORT

2007

Updated: 31 March, 2008

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1. INTRODUCTION

This report is our third under the Regional Environmental Improvement Plan and covers the 2007 calendar year.

The Werribee Irrigation District is an important vegetable growing area on the western fringe of metropolitan Melbourne. Using water from the Werribee River and the aquifer below, over 200 growers produce lettuce, broccoli and cabbages for local consumption and export.

Victorian Minister for Water, John Thwaites, announced the Werribee Irrigation District Recycled Water Scheme on 8 January 2004. The Scheme was designed to overcome a severe water shortage due to drought and to secure water for greater production in the future.

During 2004 grower representatives, project partners (Department of Sustainability & Environment, Department of Primary Industries, Melbourne Water and Southern Rural Water), and regulators (EPA Victoria and Department of Human Services) took up the challenge of bringing the Scheme to fruition.

More than $20 million was invested in additional water treatment at Melbourne Water's Western Treatment Plant, a connecting pipeline into the Werribee Irrigation District, environmental investigations and approvals, and the operating arrangements for the Scheme. Growers received the first deliveries of Class A recycled water under the Scheme in January 2005.

The Class A recycled water supplied by Melbourne Water from the Western Treatment Plant, is delivered to participating growers by Southern Rural Water through its existing irrigation channels and pipelines. The recycled water is treated through the standard wastewater treatment system and two additional disinfections systems - chlorination and ultra violet light. The Department of Human Services has certified the Class A recycled water as safe for irrigation of food crops. Victorian standards for Class A Recycled Water comply with strict national guidelines set by the National Health and Medical Research Council. They are also consistent with standards in the United States, and exceed the international standards for the use of recycled water set by the World Health Organization. The Department of Human Services requires an extensive verification process to ensure Class A quality can be guaranteed, and has endorsed Melbourne Water's recycled water as Class A. EPA Victoria has approved the Environment Improvement Plan for the Scheme, which ensures good environmental practice under the Scheme.

2007 saw a continuation of the exceptionally difficult conditions from the year that preceded it. The surface water allocation was 10% for the July to June period – the lowest allocation on record in the irrigation districts history. This continued with the second half of the year with a starting allocation for the 2007/08 season of 0% water right, and only rising to 8% by 31 December - again setting a new low record for December allocations. River water salinity post July 2006 was consistently in excess of 2000EC. Declining groundwater levels meant that a 75% restriction in licensed volume was established and continued from 2006, and a total ban on groundwater extraction was established on 28 June 2007 which remained in place at the end of the period. In this context, the availability of recycled water was even more critical for the continued production of the district. We continued to sign on customers to the scheme over the year and worked closely with Melbourne Water to ensure reliable supply of the maximum volume available. Demand for recycled water consistently exceeded supply during the warmer months, even with SRW running recycled (shandy) water six days per week, 24 hours per day and Melbourne Water being able to increase the daily flow to an average of about 61ML day, from 55ML day which was of significant benefit.

The continuation of reduced rainfall, limited availability of groundwater and higher salinity (river and recycled water) has contributed to the continued increase in average soil salinity. While this is a district wide phenomena (not being confined to the recycled water users), it is of significant concern. During 2007 Melbourne Water also announced that they would not be proceeding with the desalination plant, meaning salt reduced water (down to 1000EC) will not be available on 1 July 2009, which was a key planning assumption for the scheme.

Our response to this issue has been to establish strategies to address these issues in both the short and the long term.

A key part of our short term response has been to establish the Land and "on farm" management committee. The committee involves local growers, agronomists and scientists with a goal of identifying, validating and communicating best practices in managing soils using recycled water. This committee has met on several occasions and in early 2008 we were advised that we were successful in our application for funding of several demonstration sites. A second part of our short term response was to work toward providing some low salinity water to shandy with the recycled water – both to reduce the average salinity of the water and also to increase the volume available to growers – particularly during the summer months. This initiative required considerable work with growers, agencies and government and we announced to the district during December 2008 that we had secured 1000ML of water from the Thomson reservoir for use in the district this season. Supply commenced on 7 January 2008.

Our long term response has been to initiate a major strategic planning project for both of our irrigation districts in the Werribee Basin, called "Western Irrigation Futures". The objective of this plan is to establish a "whole of government" plan for the future of the irrigation districts, recognizing the challenges of climate change, drought, reduced water yield from traditional water sources, competing land use objectives and ageing supply infrastructure. The project has commenced with stakeholder briefings undertaken and completion is expected in 2009.

2. SCHEME OVERVIEW

2.1 SHANDY RULES

Southern Rural Water (SRW) is required to supply a mix of recycled and river water to recycled water customers suitable for sustainable farming in the WID. As the Melbourne Water Treatment Plant supplies recycled water at levels exceeding 1600 EC, and the EC of the Werribee River varies considerably, it is necessary to Shandy recycled water in varying ratios to meet quality targets commensurate with the Environment Improvement Plan (EIP). The Shandy rules in the table below outline the EC targets for mixed water under differing district water entitlement allocations.

2.2 TABLE 1: SHANDY LIMITS

		River Water Salinity		
Seasonal Allocation	Shandy Target	Less than Shandy Target	Between Shandy Target and 1,800EC	Greater than 1,800EC
Up to 50%	1,800EC	Shandy Target	River Water Salinity	Salinity with maximum practical Recycled Water
51% - 75%	1,600EC	Shandy Target	River Water Salinity	Salinity with maximum practical Recycled Water
76% -100%	1,400EC	Shandy Target	River Water Salinity	Salinity with maximum practical Recycled Water
Above 100%	1,000EC	Shandy Target	River Water Salinity	Salinity with maximum practical Recycled Water

From January 2007 to December 2007 the River water EC levels commenced above the EC level of the recycled water and due to another poor yield in the catchments areas, the EC values of the river water remained very high and never fell below the recycled water EC. SRW conduct river water EC monitoring every Thursday in conjunction with a Weir Dam Safety Inspection.

SRW must provide a mix of river and recycled water of a quality (EC) that complies with the Shandy Rules. To achieve the Shandy targets, SRW consider the ratio of river water to recycled water required to provide the maximum amount of recycled water without exceeding the EC target. Mixed Water under the shandy rules was not supplied to customers during the 2007 irrigation season. River water was used as a contingency supply to assisting with the flushing flow requirement and provides a contingency supply if the recycled water supply was interrupted. Recycled water was supplied straight to customers as the EC value of the recycled supply was the lesser of the 2 products supplied to customers.

At the start of 2007 the recycled supply EC was around 1950 and this varied throughout the season with a low of 1750EC in August and a high of 1960Ec in December 2007.

Appendix 1 provides the data for all supply periods

2.3 SALINITY MONITORING

The salinity probes have been able to provide accurate real time data during 2007 at the main channel at the Princes freeway underpass and the 4/1 recycled connection point of supply. The shandy rules have not been required during 2007 as the seasonal allocation have remained below 50% allocation. The probes have been used to monitor the straight recycled supply from the western treatment plant and report on the EC levels to the Werribee & Bacchus Marsh Customer Consultative Committee.

The quality of water received at the customers supply point will be of the same quality as that provided at the interface points from the Western Treatment Plant.

3. MONITORING

3.1 DRAIN FLOW AND WATER QUALITY MONITORING

Southern Rural Water has been running a drain monitoring program in the Werribee irrigation District since 2000. This monitoring program surveys water quality and flow in Drain Number 5, as well as Drains 6 and 11, in accordance with the Regional Environment Improvement Plan. It should be noted that the installation of monitoring stations on Drains 6 and 11 has only been recently finalised, hence only flow data for Drain 5 has been used to estimate total flows from the district, assuming drainage is relative to the drain's catchment area.

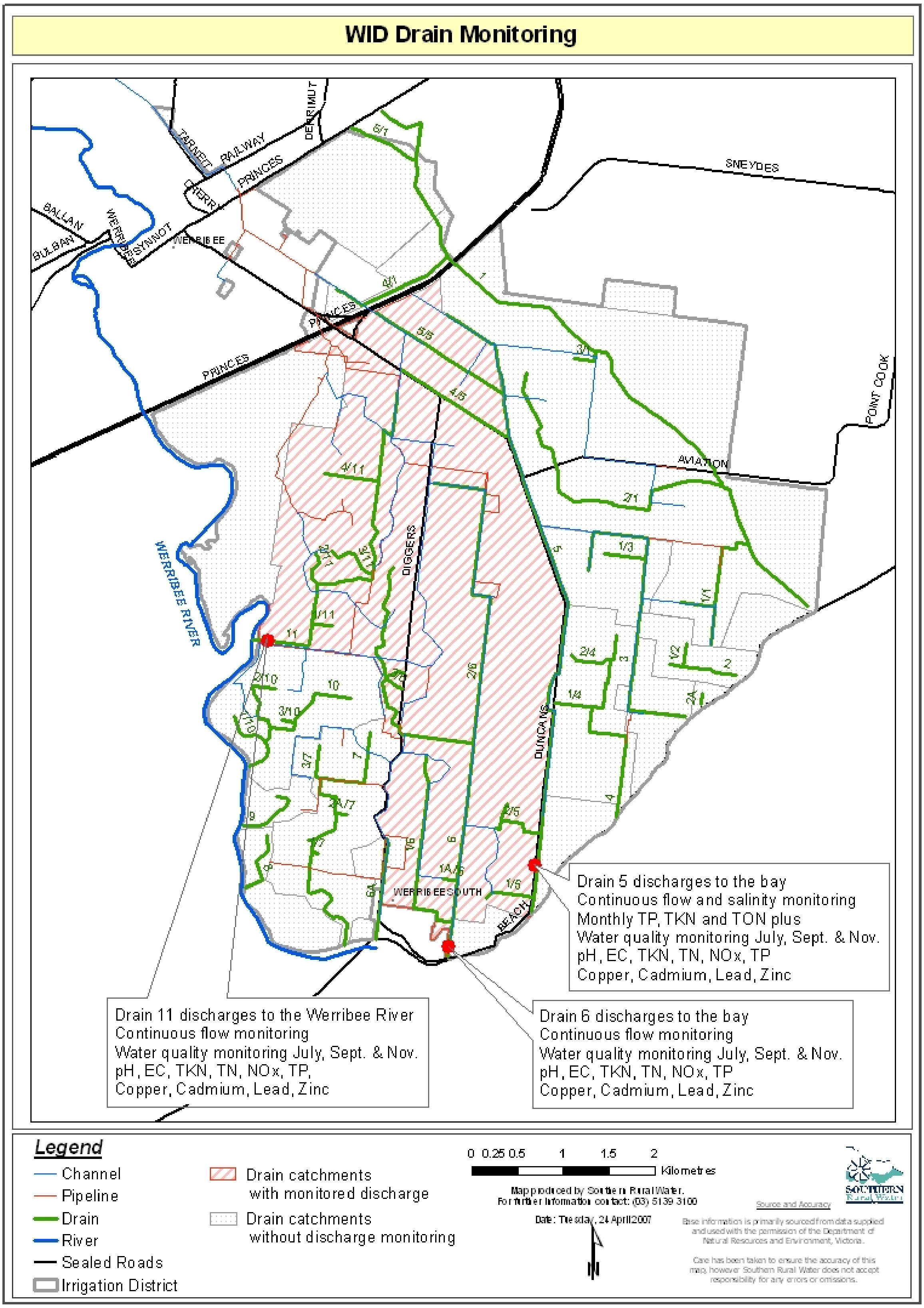
Grab sampling for water quality is undertaken at Drains 5, 6 and 11, three months of the year when the drains are flowing. The REIP states that only water quality data from Drain 5 will be used to estimate nutrient loading in all other drains, however, all water quality information collected will be discussed here.

The Drain 5 catchment covers 19% of the total district drain catchments, Drain 6 another 16% and Drain 11 about 10%, so the current drain monitoring program captures 45% of the district's drainage catchments.

In addition to our drain monitoring, some monitoring also occurs on the Werribee River, mainly at the Werribee Diversion Weir, prior to river water entering the irrigation system. Although results of the river monitoring are discussed elsewhere, salinity readings at the weir are discussed here, as they give some background information to interpret the readings obtained in the drainage system.

Following recommendations from the DPI report into the lettuce crop incident in late 2006, sampling and storage of river water was introduced in November 2007. Samples are taken whenever river water is delivered to the district and then securely stored for a period of up to six months. This ensures that in the case of a crop incident within the Werribee Irrigation District, potential pollutants accessing the district through river water can be quantified through analysis of the stored sample.

The figure below indicates the location of the current monitoring stations, as well as parameters analysed and frequency of sampling.



3.1.1 Drain Discharge:

Drain 5 flows are used to estimate the total flows discharged from the Werribee Irrigation District. The total annual discharge from Drain 5 continued to fall in 2007 and was about 183ML (compared with 230ML for 2006 and 500ML for 2005). The maximum average daily discharge for drain 5 in 2007 was 28.7ML on 4th November, with a smaller yet significant drain flow also on 21st December (14.1ML).

Drain flows are largely impacted by rainfall runoff. The rainfall event in November represented 16% of the annual discharge over one day.

With the Drain 5 catchment representing 19% of the WID drainage catchments, we estimate the total discharge for all district drains at about **963ML** for the year 2007.

3.1.2 Water Quality:

Salinity

Electrical Conductivity (EC) of drain discharge for 2007 averages at about 2,040 µS/cm which is again higher than the 2006 and 2005 averages of 1,650µS/cm and 1,245µS/cm respectively. This is similar, although slightly lower, to the average for the Werribee River for the same period (about 2,542µS/cm), as shown in figure Y below.

Comparing these results with the 2006 results, we can see **an increase in salinity of about 23% in drain water and 44% in river water**. This large increase is undoubtedly due to low rainfall in the catchment causing low flows in the river and the drains, as well as higher groundwater interaction.

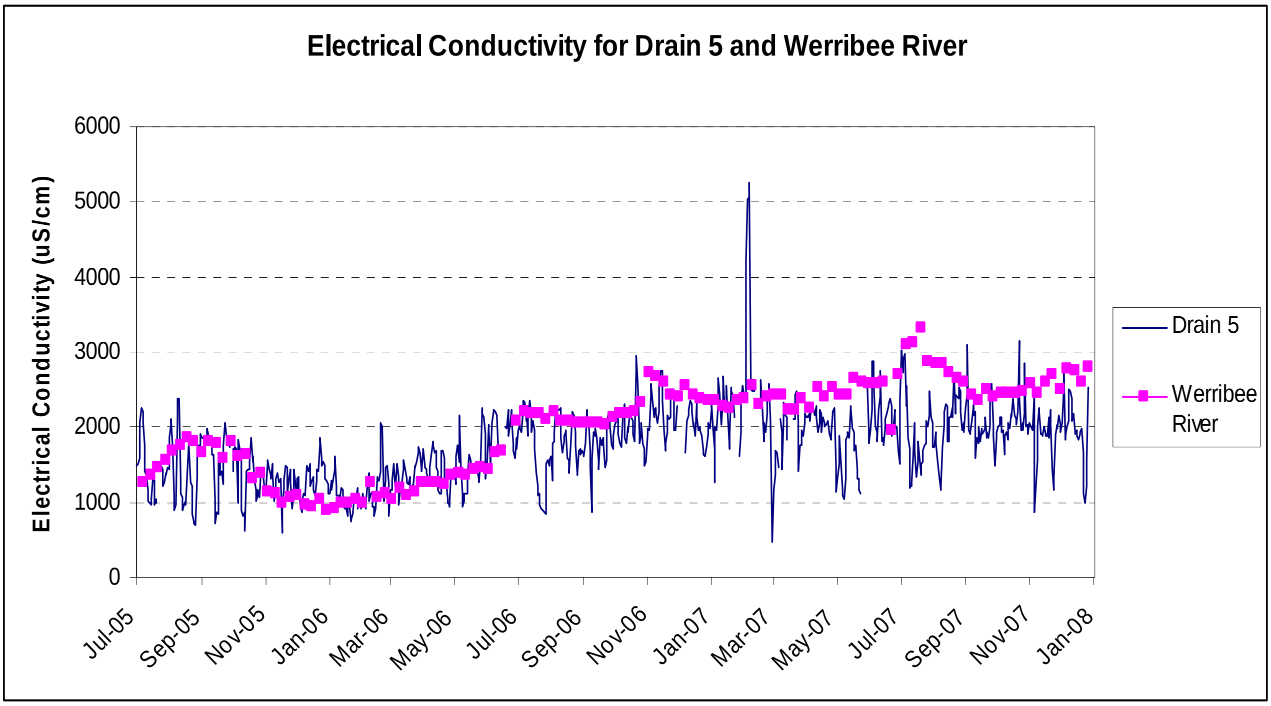


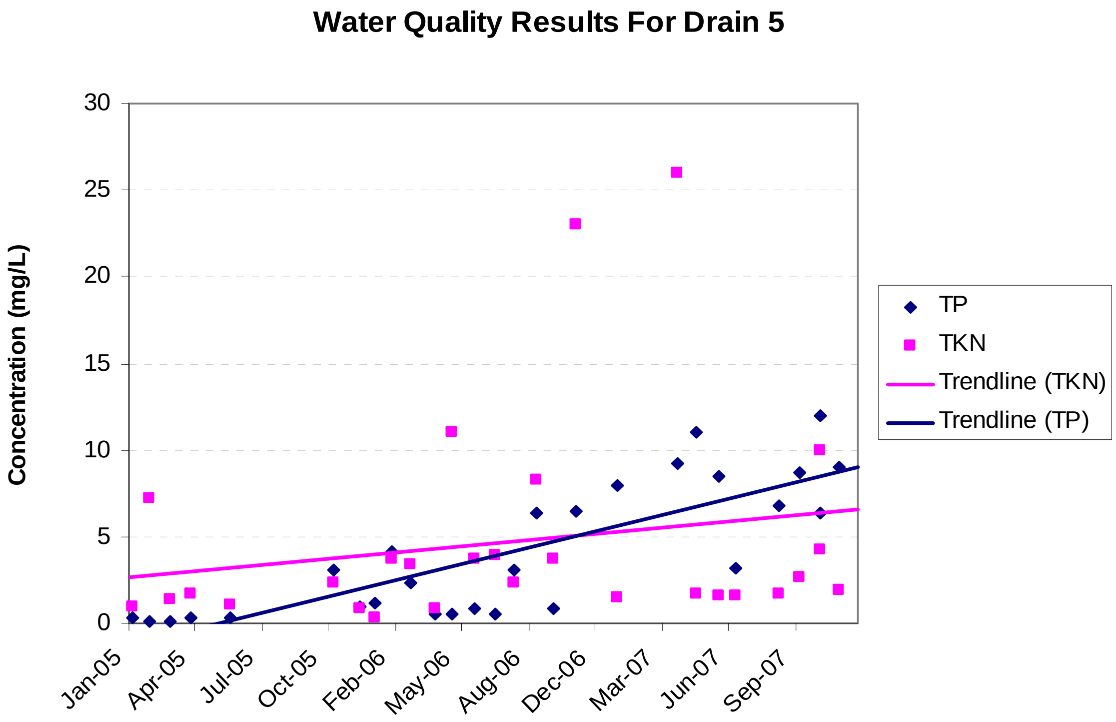
Figure Y – EC Results

Nutrients

Water quality data on Drain 5 was collected during nine months of the year, with the drain not flowing during January and February 2007 and hence no water quality data collected. No sample was taken during August 2007. Figure Z below presents the results for Total Phosphorus (TP) and Total Nitrogen (TKN+TON) in Drain 5 since the start of the recycled water scheme.

Both TP and TN concentrations show an increasing trend, with an average TP concentration of 8.27mg/L, an average TKN concentration of 5.28mg/L and an average TON concentration of 14.6mg/L for 2007.

It is important to note that the high readings are most likely due to the extremely low flows experienced and subsequent sampling of stagnant pools, which might slightly skew the load calculations.



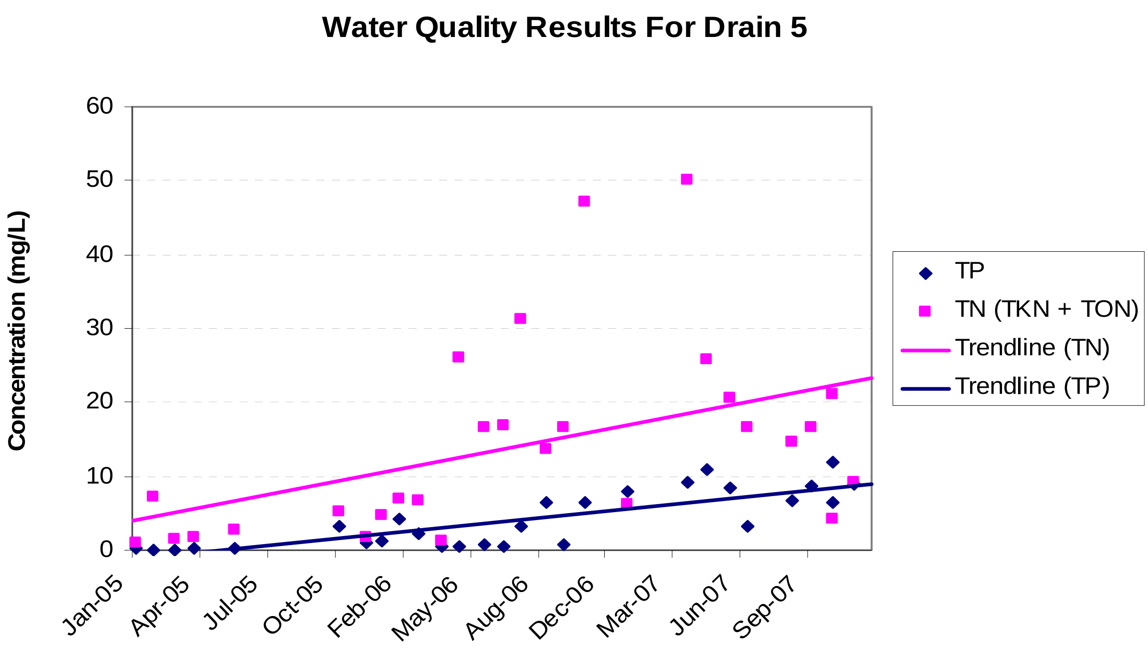


Figure Z – Water quality results for drain 5

Loads

Two calculation methodologies have been applied to calculate Total Phosphorus (TP) and Total Nitrogen (TN) discharge.

The first method is a basic average load calculation, where concentrations are averaged for the whole year, and multiplied by the estimated total drainage discharge to obtain the average load for the year (remembering that total discharge is estimated using Drain 5, which captures about 19% of the drainage system):

L=Av Cc * (Drain 5 Vol *100/19)

With this method, the total annual drain TP discharge for the whole district is 9 Tonnes. The same method returns a TN annual load of 18 Tonnes.

The second method used here is the interval concentration discharge method. For this method, concentrations measured at the beginning and end of an interval are averaged and multiplied by the discharge over this interval. Successive interval loads are summed to produce a sum estimate for the whole year on Drain 5, and then divided by 19% to estimate a total load discharge for the whole district.

The second calculation is presumably the most accurate as it relates water quality results to the volumes discharged for a similar period. Results using this method were extremely similar to method 1, with a TP load of 8T and TN load of 16T.

It should be noted that the current load calculation methodology only uses flow information from Drain 5. With two additional monitoring stations now in place, future load calculations will integrate drain flow information covering about 45% of the whole district, which would give us a far better picture of what is actually being discharged.

3.2 SOIL MONITORING

3.2.1 Introduction

When the Werribee Recycled Water Scheme was commissioned for operation in the Werribee district in December 2004, the procedures for supply of recycled water were designed around the presumed availability of irrigation water from the Werribee river system (*river water*). The procedures for applying recycled water were predicated upon shandying recycled water with the river and were designed to achieve significant supply volume while minimizing the total salinity of the combined water stream. It was envisaged that the shandying rules would see recycled water comprising up to about 25 % of individual farm supply through a normal irrigation season.

There were widespread failures of autumn and spring rainfall across Victoria in 2006, with record low flows into major water storages around the state. The volume of *river water* available for shandying was negligible, and the supply available from storages such as Pykes Creek and Lake Merrimu was so low that the normal dilution of some of the spring fed high salinity flow within the Werribee River did not occur. At most times, the salinity of the *river water* from the Werribee river system was high and exceeded the salinity of the recycled water. The shandy rules sensibly stipulated that if the salinity of the river water was higher than the salinity of the recycled water, the recycled water would be supplied undiluted. Virtually all deliveries of recycled water to Werribee South farms during the 2006/07 irrigation season were made as undiluted recycled water.

The absence of river water for irrigation meant that the district was highly dependent on recycled water for crop production. Recycled water was delivered undiluted and the total volumes supplied were close to the full irrigation requirements for many of the farms.

This situation was not envisaged when the Werribee Recycled Water Scheme was designed. It was expected that some river water would be available for shandying with the recycled water, or alternatively that farm operators could use the river water in rotation with the recycled shandy water to balance the salt load within the soil. For the 2006/2007 irrigation season, many district farmers have grown their crops solely using recycled water, or using a combination of recycled water and bore water, the latter of which often has very high salinity

Each farm that has been registered for the recycled water scheme is primarily identified by the outlet number under which it operates for receiving water from Southern Rural Water. By December 2006, 177 farms had registered for the receipt of recycled water and 221 soil reference sites had been established in the district. A small number of registrations have occurred since that time, and there are now very few Werribee South farms that have not formally registered with the recycled water scheme. Virtually all of the 177 registered farms received some recycled water during the 2006/07 irrigation season. However some farm operators have elected to receive only a minor supply of recycled water, and presumably these farms either relied on bores or curtailed the cropped area to more closely align with the small allocation of river water that each farm received. There were 28 farms where the supply of recycled water for 2006/2007 would have given an average irrigation loading across the property of below 1.5 ML/ha. The other 149 farms used more than 1.5 ML per hectare. For the 2007 soil monitoring program, only those farms that received recycled water volumes such that the soil hydraulic load would have been greater than 1.5 ML per hectare averaged across the farm were included in the monitoring program. There were a couple of exceptions to this where a farm had received some modest volumes of recycled water in both 2005/06 and 2006/07, but fell below the threshold for soil monitoring in both seasons. As any detrimental effects of the recycled water are potentially cumulative, it was considered prudent to include any additional farms where the cumulative use exceeded 2.0 Ml/ha over both seasons.

A list of the farms that were part of the 2007 soil monitoring program is provided in Table 1, together with the soil type represented by the sampling site and the average hydraulic load for recycled water during the 2006/07 irrigation season.

Table 1 Soil Monitoring Sites

Outlet No	Soil Type	Water use ML/ha	Outlet No	Soil Type	Water use ML/ha	Outlet No	Soil Type	Water use ML/ha
57	Red brown earth	1.3	311	Red brown earth	3.2	38	Red brown earth	4.5
174	Red brown earth	1.3	34	Red brown earth	3.2	262A	Red brown earth	4.5
212	Red brown earth	1.5	55	Red brown earth	3.2	307A	Red brown earth	4.5
119	Red brown earth	1.5	163	Red brown earth	3.2	294A	Red brown earth	4.5
37	Red brown earth	1.5	381	Uniform clay loam	3.2	63	Red brown earth	4.6
54	Red brown earth	1.5	33	Red brown earth	3.2	282	Red brown earth	4.7
121	Red brown earth	1.5	224D	Yell-brown duplex	3.3	282	Red brown earth	4.7
294	Red brown earth	1.5	25	Red brown earth	3.4	201	Red brown earth	4.7
222B	Yell-brown duplex	1.5	375	Red brown earth	3.4	23	Red brown earth	4.8
271	Red brown earth	1.5	375	Red brown earth	3.4	228	Red brown earth	4.8
57	Red brown earth	1.6	223A	Red brown earth	3.4	228	Red brown earth	4.8
295A	Red brown earth	1.6	36	Red brown earth	3.4	274B	Red brown earth	4.8
243	Red brown earth	1.6	374	Red brown earth	3.4	276	Red brown earth	4.8
224A	Yell-brown duplex	1.7	298	Red brown earth	3.4	278	Red brown earth	4.8
303	Red brown earth	1.7	403	Uniform clay loam	3.4	257	Red brown earth	4.9
134	Red brown earth	1.8	27	Red brown earth	3.5	362	Red brown earth	5.3
140	Red brown earth	1.9	199B	Yell-brown duplex	3.5	199C	Yell-brown duplex	5.3
140	Red brown earth	1.9	197	Red brown earth	3.5	209	Red brown earth	5.3
143	Red brown earth	2.0	191	Red brown earth	3.6	253A	Red brown earth	5.3
294B	Red brown earth	2.0	369	Red brown earth	3.7	263	Yell-brown duplex	5.4
246	Red brown earth	2.1	370	Uniform clay loam	3.7	200A	Red brown earth	5.4
167	Red brown earth	2.1	219	Yell-brown duplex	3.7	210	Red brown earth	5.4
401	Red brown earth	2.1	219	Red brown earth	3.7	232	Red brown earth	5.4
285	Red brown earth	2.1	351	Red brown earth	3.8	235	Red brown earth	5.4
287	Red brown earth	2.2	280	Red brown earth	3.9	240	Red brown earth	5.4
358	Red brown earth	2.3	327	Uniform clay loam	3.9	241	Red brown earth	5.4
355	Red brown earth	2.3	365A	Uniform clay loam	3.9	264	Red brown earth	5.4
363	Red brown earth	2.4	146	Red brown earth	3.9	283	Red brown earth	5.4
260	Yell-brown duplex	2.4	252	Red brown earth	4.0	196	Red brown earth	5.5
274	Yell-brown earth	2.5	400A	Red brown earth	4.0	350	Red brown earth	5.6

Outlet No	Soil Type	Water use ML/ha	Outlet No	Soil Type	Water use ML/ha	Outlet No	Soil Type	Water use ML/ha
237	Red brown earth	2.5	379	Red brown earth	4.0	114	Red brown earth	5.8
211	Red brown earth	2.6	341	Red brown earth	4.0	293A	Red brown earth	5.9
396	Red brown earth	2.6	293	Red brown earth	4.0	213	Red brown earth	5.9
304	Red brown earth	2.7	344	Red brown earth	4.0	193	Red brown earth	6.1
273	Red brown earth	2.7	190	Red brown earth	4.1	200	Red brown earth	6.3
124	Red brown earth	2.7	299	Red brown earth	4.1	26	Red brown earth	6.3
380	Red brown earth	2.8	229	Red brown earth	4.1	211A	Red brown earth	6.5
402	Red brown earth	2.8	196A	Red brown earth	4.2	225E	Yell-brown duplex	6.5
44	Red brown earth	2.8	335	Red brown earth	4.2	223	Red brown earth	6.6
61	Red brown earth	2.9	22	Red brown earth	4.2	203	Red brown earth	7.3
261	Yell-brown duplex	2.9	377	Red brown earth	4.2	236	Red brown earth	7.3
29	Red brown earth	2.9	333	Red brown earth	4.2	234	Red brown earth	7.3
168	Red brown earth	3.0	198	Yell-brown duplex	4.3	205	Red brown earth	7.3
202	Red brown earth	3.0	198	Red brown earth	4.3	208	Red brown earth	7.3
32	Red brown earth	3.0	224B	Yell-brown duplex	4.3	212A	Yell-brown duplex	7.4
288	Red brown earth	3.1	225	Yell-brown duplex	4.3	62	Red brown earth	7.4
147	Red brown earth	3.1	225B	Red brown earth	4.3	293B	Red brown earth	7.4
378	Red brown earth	3.1	39	Red brown earth	4.4	174	Red brown earth	7.5
244	Red brown earth	3.1	215	Red brown earth	4.4	126	Red brown earth	7.5
35	Red brown earth	3.1	187A	Yell-brown duplex	4.4	122	Red brown earth	7.7
253	Red brown earth	3.2	214	Yell-brown duplex	4.4			
226	Red brown earth	3.2	24	Red brown earth	4.5			

3.2.2. Water Quality

The average salinity for recycled water through the period January 2007 to April 2007 was around 1800 uS/cm or 1150 mg per litre (Table 2). This is slightly higher than the average salinity for recycled water for the 2005/06 irrigation season which was 900 mg/litre. The water would be classified as *slightly saline* under the classification system adopted by Rhoades, Kandiah and Mashali (1992). The dominant cation was sodium and the dominant anion was chloride which account for 72 % and 63 % respectively of the measured salinity. The balance of the measured salinity was then comprised of roughly equal quantities of potassium, calcium and magnesium for cations. For the anions, both nitrate and phosphate were significant, each accounting for 2 % of the total of all anions in the recycled water. The remaining anions account for 23 % of the measured salinity and it is likely that both sulphate and bicarbonate would account for this balance. These anions have not been measured.

There was no detectable level of cadmium in any of the water samples collected. The other metal ions which registered consistently in the recycled water were boron, copper, iron and manganese. These are all plant nutrients and were present at levels that are well below the potential for nutrient removal in a vegetable cropping system (see below). Traces of Zinc and Nickel were also detected, but at very low levels.

The analytical parameters for monitoring water quality of the recycled water be extended to include sulphate and also to include carbonate.

Table 2 Western Treatment Plant Water Quality for Recycled Water (Pre Treatment)

Parameter	Units	January 2007	February 2007	March 2007	April 2007	Mean
Salinity measures						
TDS	mg/l	1100	1100	1175	1200	1150
TDS (inorganic)	mg/l	115	113	158	212	150
Sodium	mg/l	294	300	300	292	296
Potassium	mg/l	29	30	34	31	31
Calcium	mg/l	35	36	37	34	36
Magnesium	mg/l	24	26	27	25	26
Chloride	mg/l	360	430	448	362	400
pH		8.3	8.4	7.6	7.4	7.9
Total nitrogen	mg/l	15	13	18	29	19
Total phosphorus	mg/l	11	11	12	31	16
SAR		9.2	9.4	9.2	9.3	9.3
Metals						
Boron	mg/l	0.21	0.22	0.32	0.28	0.26
Cadmium	mg/l	0*	0*	0*	0*	<0.0002
Copper	mg/l	0.009	0.005	0.0068	0.0062	0.0068
Iron	mg/l	0.11	0.15	0.12	0.11	0.13
Manganese	mg/l	0.039	0.08	0.088	0.062	0.067
Nickel	mg/l	0.013	0.02	0.019	0.018	0.018
Zinc	mg/l	0.027	0.011	0.012	0.017	0.017

* Below detectable limit of 0.0002 mg/l.

The 2006 soil monitoring report described the recycled water as being of fair to poor quality water for irrigation by itself. The chloride level in particular is at the threshold whereby it could cause cuticle damage to the foliage of particularly sensitive crops such as lettuce, celery, onion and capsicum. Whether or not damage occurs would depend upon the conditions under which the water is applied. If the water is applied under very hot and windy conditions, or is applied with a poor uniformity across the crop, damage is more likely to occur. Irrigation systems which produce more misting also induce a higher risk of foliar damage, and if the soil itself is slightly saline, the plant has less ability to withstand the potential damage from chloride toxicity to the foliage. There have been instances where some foliage damage has occurred over the past 12 months, some of which has been observed by the writer and some of which has been observed by the farmers and anecdotally described. There has also been a lot of good observation by growers as to how to limit the damage from direct chloride on the foliage:

- Avoid irrigation in the morning as temperatures and evaporative losses are rapidly rising.
- Apply plenty of water with each irrigation
- Maintain enough operating pressure to ensure good uniformity in the applied water, without overdoing it and creating too much mist.

The direct damage to leaf cuticles by chloride however is not the main concern in using the recycled water. This problem can be overcome with some keen observation and some changes to management. A more significant issue is the total salt load that is being applied to the soil, and the potential for the salt to accumulate to toxic levels within the root zone. The average salinity of the recycled water is 1150 mg per litre, which means that for every 1000 litres, 1150 grams or 1.15 Kg of salt is being applied to the soil. For every Megalitre of recycled water, 1150 kg or 1.15 tonnes of salt is being applied. The hydraulic loading from recycled water on Werribee South farms over the past 12 months has varied from quite low values up to as high as 7.7 ML/ha (see Table 2). At the higher level of hydraulic loading, the total salt load approaches or exceeds 8 tonnes per hectare (Table 4).

Table 4 examines the inputs of total salts (expressed as total inorganic solids), and sodium, chloride and other measured parameters at three application rates of recycled water for the year. The application rate of 2.0 ML/ha represents a low application of recycled water across the farm. The middle application rate of 4.5 ML/ha represents the median use of recycled water for the 2006/07 season. The highest value in Table 4 is 7.0 ML/ha and represents about 30 farms which had high recycled water loads for 200/07 irrigation season.

These salt and nutrient inputs from the recycled water are compared in Table 4 with an application of 1500 kg/ha of *Nitrophoska Blue Special*, which is the type of fertilizer and rate commonly used to grow a cauliflower crop in the Werribee district. Broccoli and cabbage crops are grown with similar fertilizer but at slightly lower application rates. The comparison shows that the total salt input from the recycled water is comparable with the total input from the fertilizer at the lower hydraulic loading of 2.0 Ml/ha, but that at higher loadings the impact of recycled water is greater. If the hydraulic load of 4.5 ML/ha however represents 2 or more crops in a 12 month period, then the total salt loads between the fertilizer inputs and the recycled water are similar. If 7.0 ML/ha represents 3 cropping cycles then the total salt loads are again comparable. The salinity inputs from recycled water are certainly not the only source of salt coming onto the farm, and management of total salinity requires a consideration of all salt inputs including fertilizer as well as recycled water, bore water and river water.

Apart from being a salt and affecting the total salinity within the soil, sodium can detrimentally affect soil structure and soil permeability. For this reason sodium concentration within the recycled water is important with regard to its balance with other metal ions (cations). This balance is reflected in the sodium adsorption ratio (SAR) and a high value means that the sodium may detrimentally have long term impacts on soil structure. If the SAR is below 6.0 the impact is usually of no concern. If the SAR is above 6.0 and up to about 12.0, some special management may be required to avoid too much sodium in the soil. If the SAR is above 12, there are major difficulties with the long term use of the water for irrigation. The SAR value for the past 12 months has a mean value of 9.3 (Table 3) which means that some detrimental impacts on soil structure are likely to occur.

Table 4Mass inflow of nutrients at different irrigation application rates

Parameter	Mass Inflow @ 2.0 ML/Ha (kg/ha)	Mass Inflow @ 4.5 ML/Ha (kg/ha)	Mass Inflow @ 7.0 ML/Ha (kg/ha)	Quantity of elements applied in *Nitrophoska Blue Special* @1500 kg/ha (kg/ha)
Salinity measures				
Total inorganic solids	2300	5200	8000	1500
Sodium	590	1330	2070	<10
Potassium	60	130	200	212
Calcium	70	160	250	37
Magnesium	50	120	180	18
Chloride	800	1800	2800	<10
Total nitrogen	38	86	130	177
Nitrate	32	72	112	177
Total phosphorus	32	72	112	57
Metals				
Boron	0.5	1.2	1.8	3
Cadmium	<0.0004	<0.001	<0.0014	0.01
Copper	0.014	0.03	0.05	Trace
Iron	0.26	0.6	0.9	Trace
Manganese	0.13	0.3	0.47	Trace
Nickel	0.036	0.08	0.13	Nil
Zinc	0.034	0.077	0.12	Trace

The data in Table 3 and Table 4 provides the phosphorus and nitrogen inputs from the recycled water. At hydraulic loads of 4.5 ML/ha the recycled water is supplying 86 Kg/ha of nitrogen and 72 Kg/ha of phosphorus. The higher hydraulic load of 7.0 Ml/ha supplies 130 Kg/ha of nitrogen and 112 Kg/ha of phosphorus. These are significant and would contribute substantially to crop nutritional requirements. Depending on the crops being grown, the recycled water may be in fact supplying enough phosphorus to meet the full maintenance requirement for the cropping program. The nitrogen applied is unlikely to meet the full requirements, but unless the planting and side dressing fertilizers take account of this source of nitrogen, over fertilization particular with nitrate is a probable consequence.

Cadmium has been at non detectable levels throughout the year. There is no detrimental impact of Cadmium on the soil from recycled water. Nickel is the only heavy metal that is not a crop nutrient and has consistently registered at above the detection limit in the water monitoring, but even at hydraulic loads of 7.0 ML/ha, the total input of Nickel from recycled water is about 130 grams per hectare.

The boron concentration within the recycled water warrants some consideration. It is a plant nutrient, but is required in only small amounts, and there is often a narrow range for some crops between adequate levels and too much. It can cause toxic responses within certain crops if supplied significantly in excess of requirements. Published literature on boron toxicity cites the most sensitive crops to excess boron as citrus, particularly lemon, and berry fruits. These can be sensitive to Boron concentrations within irrigation water at concentrations below 0.5 mg/l, and the recycled water contains about 0.28 mg/l but up to 0.32 mg/l (Table 3). No vegetable crops are in this highly sensitive group. However born can also accumulate within the soil and several vegetable crops can be sensitive to high soil boron. This is discussed in more detail below.

Copper, Zinc, Iron and Manganese are all plant nutrients, and the supply within the recycled water would be less than the removal rate in a normal cropping system. Manganese is the most prevalent within the recycled water and 7.0 ML of recycled water would supply 470 grams of manganese. The harvest of Broccoli would conservatively remove 250 gram of Manganese per hectare, and up to 1500 gram in a high yielding crop with no restriction to Manganese uptake. Lettuce has a higher requirement and a higher rate of removal. There is no supply input of these minor and trace elements from the recycled water beyond the ability of the crops to utilise them within their normal nutritional uptake.

3.2.3 Sample Collection and Processing

3.2.3.1 Procedures on Farms

For each property that has become part of the recycled water scheme, a reference site of approximately 6 metres in diameter has been created for the collection and analyses of soils. Where the farmer or farm owner has indicated significant soil variation on the property, more than one reference site has been created with each site being representative of a particular soil type. Baseline soil samples have been collected as bulked samples from four separate hand drilled auger holes with the samples collected from the standard depths of:

0 to 30 cm (regular cultivation zone for these soils) referred to as surface soils,
30 to 45 cm (immediately below the cultivation zone), and
85 to 100 cm (below the root zone) referred to as subsoils.

Each reference site is identified with latitude and longitude coordinates taken from a hand held GPS receiver using the ADG 66 datum. The GPS coordinates are used to locate each reference site, and each location is normally cross checked against written notes and sketch maps of each property.

For 2007 annual soils monitoring, surface soil samples from 0 to 30 cm depth were collected and bulked together from 4 separate hand augured sampling holes at each reference site. Where more than 1 reference site had been created on a property due to soil type or other variation, the farm operator was given the option as to whether to sample just one site or all sites, and if the former, to nominate which site was monitored. The soil samples were stored in cool boxes in the field and in a coolroom at 3^0C until transferred to PivoTest and WSL Ecowise Laboratories for processing.

The procedures for entering properties and collecting soil samples, together with farm hygiene precautions that are observed when entering properties are provided in Appendix I.

3.2.3.1 Laboratory Procedures

Each bulked soil sample was removed from the coolroom and thoroughly mixed prior to subsampling for different laboratories. Approximately 600 g of soil was forwarded to PivoTest Laboratory at Werribee for the following analyses:

Soil pH (in water)
Soil pH (in Calcium chloride)
Electrical conductivity
Available phosphorus (Colwell method)
Phosphorus Buffer Index
Nitrate
Exchangeable cations
Boron (hot water extraction)
Chloride
Slaking
Dispersion index

A smaller subsample of approximately 100 g of soil forwarded to WSL Ecowise laboratory at Mt Waverley for Cadmium residue analysis.

Analytical test methods and extraction methods used are provided in Appendix II.

3.2.3.3 Reporting to the Farmer

Individual 2007 soil monitoring reports have been prepared for each of the sites and forwarded to the farm operator via the offices of Southern Rural Water at Werribee. The 2007 soils monitoring report gives the results of the May/June soil sampling plus the baseline data for the surface soils alongside for comparison. Where data exists for 2005 monitoring and 2006 monitoring as well as baseline, the critical parameters of soil pH, exchangeable sodium, total salinity and chloride has been presented in a graphical format for the farmer. Where data does not exist for 2005 or 2006 monitoring, a tabular report only has been prepared for the farmer. The district average and the "normal" range based on the 10^{th} and 90^{th} percentile limits are included in the tabular report. A short two page narrative and summary *Interpretation Guide to Accompany the 2006 Soils Report 0 to 30 cm depth* has been prepared to assist each farm operator in interpreting his/her own report and is attached as Appendix III.

3.2.4 Results from the 2007 Soils Data

3.2.4.1 Data Summary

The analytical data for each monitoring site is provided in Appendix IV together with the outlet number for that site. This data is also in excel spreadsheet format, with one copy held by the Senior Project Officer of Southern Rural Water and the other copy under password access at Ag-Challenge Consulting.

The data has been examined at a number of levels. The more important soil parameters of salinity, sodicity, chloride and soil pH are examined in turn below. Consideration has also been given to soil boron, soil available phosphorus and soil nitrate levels. Of most interest is how the soils have changed since the introduction of recycled water. Table 5 enables a direct comparison of this change by a collation of the average value across all sites of the key soil parameters from the baseline sampling and from the 2007 soil monitoring. Note that the baseline mean values may be slightly different from those reported in the original baseline report, as there is now a larger group of monitoring sites and the recent additional sites have caused an adjustment to some of the mean values

While the data in Table 5 shows that changes in the chemical profile of the soils are occurring, the changes are less than could be expected, given that these soils have received up to 8 tonnes per hectare of soluble salts via recycled water. There has been an increase in average salinity as would be expected, but most soils would still be classed as mildly saline. There has been an increase in chloride, but not to such a level as to cause general chloride toxicity. There are some specific site problems with chloride and this is discussed in more detail in section 5.3. Nitrates and Phosphorus have increased slightly. Boron has declined. The changes indicate certain trends that would be expected and the most notable feature of the data is the modest level by which these changes have occurred.

Table 5 Comparison of key soil parameters with baseline values

Parameter	Units	Mean Value Baseline sampling	Standard Deviation Baseline sampling	Mean Value May/June 2007	Standard Deviation, May/June 2007
Electrical conductivity	dS/m	0.46	0.23	0.60	0.3
E.C.E.	dS/m	3.5	1.8	4.5	1.9
Chloride	mg/kg	186	149	320	176
Cation Exchange Capacity	meq/100g	18.8	5.1	18.2	4.9
Exchangeable Sodium	meq/100g	1.7	1.0	2.2	0.9
Exchangeable Sodium Percentage	%	9.3	4.3	12.4	3.5
pH (in water)	pH units	8.1	0.4	8.2	0.7
Available phosphorus	mg/kg	432	179	446	169
Exchangeable potassium	mg/kg	1.2	0.5	1.2	0.4
Nitrate	mg/kg	40	38	59	37.3
Boron	mg/kg	3.2	1.0	3.0	0.9

Recycled water has been used at different levels during the 2006/07 irrigation season, ranging from quite low levels up to as high as 7.7 ML/ha. The 154 monitoring sites from which soil samples have been collected in 2007 have been separated into three groups based on this hydraulic load. The three groups are those sites with a hydraulic load of less than 3.0 Ml/ha, those with between 3.0 ML/ha and 5.0 ML/ha, and those with more than 5.0 Ml/ha of water use. Thus they represent low, moderate and high water users. They may also represent different irrigation management, in that the low water users may only be applying a minimal amount of irrigation to keep soils moist, while the high water users may be applying more than the crop needs and are thus including a leaching component in their irrigation management. While this is not a definite feature of the high water use group, it is more likely that leaching is part of the irrigation management among these high water use sites than in the low water use sites.

For each of these groups of monitoring sites, the average value for the key soil parameters has been calculated and compared with the average baseline value for the same group. This data is presented in table 6 for those sites in the low water use group (less than 3.0 Ml/ha). The same parameters have been presented in table 7 for the moderate water use sites (3.0 to 5.0 ML/ha) and in Table 8 for the high water use sites (more than 5.0 ML/ha). The data provides a comparison of the change that has occurred since the commencement of irrigation with recycled water. Note that a number of sites have received significant quantities of recycled water prior to the 2006/2007 irrigation season, but there are only 20 monitoring sites overall that received more than 2.0 ML/ha prior to the 2006/2007 irrigation season, and all of these are in the high water use group. Thus the magnitude of the change in soil parameters in tables 6,7 and 8 are indicative of sites that have received low, moderate and high volumes of recycled water since the commencement of the recycled water scheme.

Table 6 Average Soil Parameters from Sites with Low Use of Recycled Water (<3.0 ML/ha)

Parameter	Units	Mean Value Baseline sampling	Mean Value May/June 2007
Electrical conductivity	dS/m	0.42	0.57
E.C.E.	dS/m	3.2	3.8
Chloride	mg/kg	176	295
Cation Exchange Capacity	meq/100g	19.1	18.2
Exchangeable Sodium	meq/100g	1.8	2.3
Exchangeable Sodium Percentage	%	9.5	12.9
pH (in water)	pH units	8.1	8.3
Available phosphorus	mg/kg	441	433
Exchangeable potassium	mg/kg	1.3	1.2
Nitrate	mg/kg	39	51
Boron	mg/kg	3.3	2.9

Table 7 Average Soil Parameters from Sites with Moderate Recycled Water Use (3 ML/ha to 5 ML/ha)

Parameter	Units	Mean Value Baseline sampling	Mean Value May/June 2007
Electrical conductivity	dS/m	0.50	0.70
E.C.E.	dS/m	3.8	4.9
Chloride	mg/kg	222	351
Cation Exchange Capacity	meq/100g	18.5	18.0
Exchangeable Sodium	meq/100g	1.9	2.3
Exchangeable Sodium Percentage	%	10.2	12.8
pH (in water)	pH units	8.1	8.2
Available phosphorus	mg/kg	426	453
Exchangeable potassium	mg/kg	1.2	1.1
Nitrate	mg/kg	39	62
Boron	mg/kg	3.1	2.9

Table 8 Average Soil Parameters from Sites with High Recycled Water Use (Above 5 ML/ha)

Parameter	Units	Mean Value Baseline sampling	Mean Value May/June 2007
Electrical conductivity	dS/m	0.41	0.63
E.C.E.	dS/m	3.1	4.2
Chloride	mg/kg	118	282
Cation Exchange Capacity	meq/100g	18.9	18.5
Exchangeable Sodium	meq/100g	1.3	2.0
Exchangeable Sodium Percentage	%	6.9	10.9
pH (in water)	pH units	8.1	8.1
Available phosphorus	mg/kg	436	444
Exchangeable potassium	mg/kg	1.3	1.3
Nitrate	mg/kg	42	63
Boron	mg/kg	3.6	3.3

The data in tables 6, 7 and 8 is discussed in more detail below under the headings of salinity, sodicity, nitrate, phosphate and boron. The most important collective feature for Tables 6, 7 and 8 is the lack of substantial difference between the trends. Whether a farm received 2.0 Ml/ha per hectare 7.0 ML/ha of recycled water, the chemical response of the soil is on average similar. The inputs are quite different (see Table 4) but the outcome is much the same.

3.2.4.2 Salinity

The salt content of the soil is critical for long term sustainability for irrigation. The salt content is measured by the electrical conductivity of a soil and water suspension and expressed as a measure of resistance to electrical current in decisiemens per metre. A refinement of this measurement is the calculated value for the electrical conductivity of the soil saturated extract (E.C.E.). Both parameters are a measure of the concentration of dissolved salts in the soil. The E.C.E. value is derived from electrical conductivity of a soil and water suspension with adjustment for soil texture, and allows a more direct comparison with known plant responses to toxic levels of total salinity.

Prior to commencement of the recycled irrigation scheme at Werribee, the district soils were already mildly saline, and many of the monitoring sites had soils at or beyond the threshold for yield loss for many of the district crops being grown (Pitt AJ, 2005). Published E.C.E. values for some of the more commonly grown vegetable crops in the district are listed in Table 9 (Ayers & Westcott 1994, Landon 1984) and it can be seen that the average E.C.E value was above some of these threshold values for minor yield loss <u>before</u> the commencement of the recycled water scheme. Any increase in E.C.E., however small, will add to an existing district problem of high soil salinity. The average E.C.E. for the district is now 4.5 dS/m which is a rise for the district as a whole, and is a critical issue for the commercial operations within the district as a whole.

Table 9 Critical E.C.E. Values: Source: Ayers & Westcott 1991, Landon 1984)

Vegetable	Critical E.C.E. Value for 10 % Yield Reduction	Critical E.C.E. Value for 25% Yield Reduction
Broccoli	3.9	5.5
Cabbage	2.8	4.4
Celery	3.4	5.8
Lettuce	2.1	3.2

A review of the data in Tables 6, 7 and 8 shows that there appears to be some relationship with the total amount of recycled water used and the magnitude of the increase in E.C.E. The low water use group had an average increase of 0.6 dS/m, the moderate users had an increase of 1.1 dS/m, and the high water use group had an increase of 1.1 dS/m. Compared to the very marked differences in total salt load between these groups, these differences are small. The surface soils of the high water use sites in particular are not retaining any more salt than the moderate water use sites and only marginally more than the low water users.

With reference to Appendix IV, it can be seen that there are a large number of individual sites where total salinity has declined, although these are obviously in a minority when compared to those sites where salinity has increased. In total there are 40 monitoring sites where the E.C.E. value is now lower than at the time of baseline sampling. Eleven of these are in the high water use group and actually comprise a third of the monitoring sites within this group. The different response is presumably reflecting different management and the inherent responsiveness of Werribee soils to management. A critical aspect of soil management for controlling salinity is soil drainage and a twelve point guide was prepared to accompany the soil monitoring reports to the farm operators this season. The twelve points are listed in the box.

There are nine monitoring sites where the increase in the E.C.E. value is more than 4 dS/m. Two of these nine sites are located on the river terraces of the Werribee River and are within a lower part of the landscape that may be a discharge area for saline groundwater. The other seven sites are within the main part of the district. A change in salinity of more than 4 dS/m should be highly apparent to the operator. Crop performance would be affected and the impact would be lower quality or reduced yield, and possibly both. It is not possible to determine whether the change is in part or wholly due to the use of recycled water, but in each case the farm operator has been contacted and alerted to the magnitude of the change. The other influences are over-use of fertilizer, use of saline groundwater, use of saline river water, poor irrigation technique, recent application of gypsum, but the most important is probably the lack of soil drainage. The impact that management can have is illustrated by comparing the response of these 9 sites with the 40 sites where E.C.E values have declined. Management appears to be a critical factor in determining whether salinity will rise or fall.

In 2005/2006 60 monitoring sites were sampled on 43 separate farms all of which received moderate levels of recycled water during the irrigation season. These sites were the Group A sites in the 2006 Soils Monitoring Report. These 43 farms were all sampled again in 2007 for the soil monitoring program, with only 1 site per farm. Table 10 lists the average salinity (E.C.E.) for these 43 sites compared to the value for the same sites during the 2006 monitoring, and the original value at the time of baseline sampling. The data shows a rise in the average E.C.E. value each year from 3.0 dS/m at baseline, to 3.9 dS/m in 2006 and to 4.7 dS/m now in 2007.

These 43 sites mostly fall within the high water use group. The change in average E.C.E. value shows a stable or possibly decreasing rate of increase as the water use rises. Thus in 2005/06 the average water use across these 43 sites was 1.6 Ml/ha and the change in soil salinity was 0.9 dS/m. In 2007 the average water use was 4.9 Ml/ha and the change in salinity was a further 0.8 dS/m. This levelling out may indicate that average salinity level is adjusting to a new level with recycled water at somewhere near or slightly above the current average value of 4.7 dS/m.

Table 10 Comparative data of 43 monitoring (2006 Monitoring Group A Sites)

Parameter	Units	Mean Value Baseline sampling	Mean Value May/June 2006	Mean Value May/June 2007
Electrical conductivity	dS/m	0.38	0.51	0.67
E.C.E.	dS/m	3.0	3.9	4.7
Chloride	mg/kg	114	208	318
Cation Exchange Capacity	meq/100g	17.5	17.7	18.0
Exchangeable Sodium	meq/100g	1.2	1.5	2.0
Exchangeable Sodium Percentage	%	6.8	8.5	11.3
pH (in water)	pH units	8.1	8.1	8.2
Available phosphorus	mg/kg	443	402	445
Exchangeable potassium	mg/kg	1.2	1.2	1.2
Nitrate	mg/kg	39	46	67
Boron	mg/kg	3.3	3.0	3.1

There are some individual sites in this group of 43 that do not follow this trend. The soils data for outlet numbers 234, 205, 226, 311, and 210 all show no change in E.C.E. value since the commencement of irrigation with recycled water. Outlet number 236 shows a decrease. These sites are all within the high water use group and are confined to just 3 separate farm operators. It could be instructive to examine the irrigation and soil management being used by these three farmers, and possibly compare this to other sites where the increase in E.C.E. is above average.

WERIBBEE IRRIGATION DISTRICT RECYCLED WATER SCHEME

Critical ECE value for Lettuce: 3.2 dS/m
Critical ECE value for Broccoli: 5.5 dS/m

If your soils have values above this, there will some affect on both yield and quality of your crops.

Twelve ways to reduce the salt accumulation in Werribee South Soils.

1. Clean our all surface drains and ensure that surface runoff leaves the property and does not pond.

2. Clean the lower end of the tractor wheel rows between beds, so that they shed surface water out of the furrows and into the farm drains. Don't give water the opportunity to sit in the paddock.

3. When paddocks are fallow, plough them *rough* and leave them *rough* for as long as possible.

4. Use more water than the crop requires so that some of the irrigation water moves vertically downward beyond the root zone.

5. Check the water distribution uniformity from the irrigation system. If you can see variation in the crop related to the geometry of the irrigation layout, then there is a problem with distribution uniformity. Should aim for 90% uniformity and some systems are only giving 60%! If you have poor uniformity, you are wasting water and cannot use the extra water to flush the salt from the root zone. If necessary, use a specialist to fix.

6. Use gypsum in the non cropping part of your rotation. Apply at least 2.5 tonnes per hectare.

7. Deep rip the soil in conjunction with the gypsum application. Rip as deep as possible. The base of the clay layer on most of the red brown earth soils goes to about 60 cm below the surface. The rippers should go to the base of this layer.

8. Critically examine your fertilizer needs with a skilled agronomist. Reduce or eliminate fertilizers that are not beneficial. Do not use muriate of potash at all, and review whether any potassium fertilizer is necessary.

9. If you have a deep open drain along one side of the paddock, consider laying mole drains across the paddock feeding into this open drain. Lay the moles at about 4 metres apart and with a slight fall toward the open drain. The moles need to be at least 60 cm below the soil surface. They can be an inexpensive way to make a major improvement in salinity.

10. If there is no open drain, you can still lay mole drains into a collector. Need a 150 mm or 200 mm slotted PVC drain for a collector. Probably best to use a specialist contractor.

11. If there is not enough fall for open drains or collectors to work in a paddock, consider creating a drainage sump with a float activated switch to an electric transfer pump.

12. A more permanent solution is to install slotted PVC drains at 70 to 120 cm depth in drainage grid. Moderately expensive but will improve all year round access to paddocks.

The farming community is being engaged in a cooperative approach to identifying and promoting best farm practice for management strategies to the control soil salinity on farms in the district, through one on one discussions on their soil results and the initiatives of the Land and on farm management committee.

3.2.4.3 Chloride

The chloride values for the 2007 soils monitoring demonstrate the different responses that the Werribee South soils can make to irrigation. Chloride is the most toxic of the anions to plant growth. At a molecular level it has a low hydrogenation in water and a correspondingly high charge density. It presents a higher risk of disrupting membranes and soft tissue within the plant, particularly root hairs. It can damage the leaf cuticle if the concentration of chloride becomes high enough on the leaf surface, the result being a necrotic burn to the leaf margins and the younger and softer leaves. This is a specific hazard for the chloride concentration in the irrigation water, although there is some interaction with soil chloride for foliage. It is also highly soluble and is among the most mobile ion in soil water. Soil chloride values above 400 mg/kg indicate that a toxicity problem may be occurring, and values of 600mg/kg would be of concern.

In general the soil chloride values have increased form a mean value of 186 mg/kg at the time of baseline sampling to 320 mg/kg for May/June 2007. The increase is significant although it is uncertain as to whether the increase is solely due to the use of recycled water or is in part also due to chloride in the bore water and due to higher levels of chloride in the river water. It would be useful to have data on the average chloride values in the river water and average chloride values in the bore water.

A review of Tables 6, 7 and 8 appears to show that the magnitude of the change in soil chloride is similar for each user group – low, moderate and high hydraulic loads for the recycled water. Each group has an average increase of 119mg/kg, 129 mg/kg and 154 mg/kg respectively for the low moderate and high categories. However examination of the individual sites within each group reveals that within the moderate water use group there are now 19 sites where soil chloride in the surface soil is approaching toxic levels (above 400mg/kg) and 9 of these have values that are likely to be of concern (above 600 mg/kg). In comparison the high water use group has 5 sites with where soil chloride in the surface soil is above 400mg/kg and only one of these is of concern. The low water use group had 8 sites with chloride above 400 mg/kg and one of these was above 600 mg/kg. Thus 25 % of the soil monitoring sites in the moderate use group and 20% of the monitoring sites in low water use group had chloride values of concern. Within the high water use group the incidence of chloride values above 400 mg/kg was 15 % of sites. The inference that is drawn from this data is that chloride problems decrease as water use increases. The highly mobile nature of chloride means that it should be very responsive to leaching, and the higher water use probably includes a significant leaching component which is removing the chloride beyond the root zone.

3.2.4.4 Sodicity

Surface sealing, reduced aeration, reduced permeability, tendency to disperse, and difficulty in getting the right moisture content for cultivation are all negative properties of Werribee soils that are a direct consequence of sodicity.

A soil is deemed to be sodic if more than 6 % of the exchangeable cations are sodium ions, and strongly sodic if the sodium ions comprise more than 15 % of the total exchange capacity. During the baseline sampling of these soils, approximately 80 % of the district soils were sodic at the soil surface and there were 13 sites where the soil was strongly sodic at the soil surface (Appendix IV)

All soil reference sites are now sodic with more than 6 % ESP. The mean value for ESP across the 154 monitoring sites is now 12.4 % compared with a mean of 9.3 % for the same 154 sites at the time of baseline sampling. The mean change from 9.3% to 12.4 % can be converted to a quantitative value for retained sodium of around 400 kg/ha, making a few assumptions on soil bulk density (assume 1.2 tonne per cubic metre). The quantity of sodium applied in the recycled water depends on the hydraulic load. For 2006/2007 the sodium input varied from around 500 kg/ha to 2000 kg/ha (Table 4). For those farms that also received significant quantities of recycled water in 2005/2006, there would have been additional sodium inputs. In general terms there has been a significant quantity of applied sodium from the recycled water retained within the topsoil.

The magnitude of the retention varies with the level of water use. At low water use the retention of sodium is on average about 400kg/ha which is almost 60 % of the sodium input from the recycled water. At moderate water use the retention is around 350 kg/ha on average which is around 30 % of the sodium input from recycled water. In the high water use group the retention of sodium is around 580 kg/ha which is around 25 % of the sodium applied. Note that a number of the sites in the high water use group include additional sodium from irrigation in the 2005/06 irrigation season.

The increase in sodicity of soils irrigated with recycled water is undesirable. Some of the increase may be from sources other than recycled water. The data obtained shows that even with a comparatively low use of recycled water there are significant chemical changes occurring in these soils. The changes in soil chemistry will precede changes in soil physical properties. These changes can be rectified with the use of gypsum, but the data obtained indicates that insufficient action is currently being taken. A communication campaign is required to alert farmers to the changes that are occurring and advise as to what measures are required.

Annual reports to farmers include information on the undesirable consequences of sodicity and how to reverse increase sodicity through the use of gypsum and effective deep ripping.

3.2.4.5 Soil pH

There has been no substantial change in soil pH across the monitoring sites. There is minor variation in some of the sites with both increases and decreases in the order of 0.1 to 0.3 pH units. These variations are most likely due to high levels of acidifying fertilizer or the application of lime. The impact of the wastewater is likely to be low, given that it has a slightly alkaline pH which is similar to the mean soil pH across all reference sites.

There is a potential problem with very high soil pH negating the impact of gypsum. At pH values above 8.5, free carbonate ions can potentially bind with the soluble Calcium ions from the gypsum and form the relatively insoluble salt of calcium carbonate. Calcium carbonate would then precipitate fairly rapidly out of solution making the calcium unavailable for cation exchange with sodium on the clay lattice. Farm operators should avoid liming their soils to a pH level above 8.5. If lime is necessary for the purpose of soil borne disease suppression, an option could be to band the lime into narrow widths along transplant rows rather apply the lime to the whole of the cultivated area.

Farm operators will be alerted to the problems associated with excessive use of lime and the practical management strategies for salinity control include soil pH management, specifically to avoid the over-use of lime

3.2.4.6 Soil Nitrogen

Nitrogen is an important plant nutrient and has to be at adequate levels in the soil for optimum plant growth. In vegetable cropping, most growers tend to err on the cautious side and apply excessive levels of fertilizer nitrogen to ensure that there is no possible restriction to plant growth rates.

Nitrate tests are an imperfect assessment of soil nitrogen. Nitrate values are constantly changing within the soil in response to microbiological activity, rainfall, crop uptake and fertilizer applications. Accepting this limitation to the empirical data for nitrate, the nitrate values appear to be increasing with the use of recycled water, so that even the mean value across all sites is now within the excessive range.

Low values for nitrate are normally around 15 mg/kg or less, and a high value is greater than 50 mg/kg. Outside these extremes the soil could be either in need of additional nitrogen, or to have excess nitrogen. A total of 79, or approximately half the monitored soils for 2007, had excessive levels of nitrate in the surface soil, and there were eleven sites which had unusually low nitrogen (see Appendix IV). Of these eleven, all but three were also unusually low during the baseline sampling, indicating that these farm operators may be more closely monitoring their soils and their crops to tailor applied nitrogen to the crop requirements. Many of the operators have observed quality problems in some of their crops which could be related to excessive levels of nitrate. There would appear to be significant opportunity on many of the farms to more closely monitor soil and crop nitrogen and make more use of the soil reserves of nitrate in crop production.

The supply of nitrogen from the recycled water will depend on the amount of water applied to the crop, but even at 2.0Ml/ha, there is an input of 38 kg/ha of nitrogen, 32 kg of which is highly available nitrate (Table 4). If this amount of recycled water was applied to a Broccoli, the recycled water is potentially contributing around one third of the nitrogen requirements for the crop (see Table 11). For other crops the percentage can be higher, as cauliflowers for example may require 3.5 ML/ha to complete the growth cycle to harvest, and the total nitrogen contribution from 3.5 ML/ha would be around 67 kg/ha, or 50 % of the crop removal. If these sources of crop nutrients are not taken into account, there will be an accumulation in the soils, and potentially losses to surface runoff and groundwater.

Table 11 Crop removal rates of major plant nutrients (source:EIP)

Crop	Harvest Yield (Wet) Tonnes/Ha	Nitrogen removed Kg/ha	Phosphorus removed Kg/ha	Potassium removed Kg/ha
Broccoli	20	90	13	180
Cauliflower	50	119	23	225
Lettuce	50	100	18	180
Onions	60	108	21	180
Cabbage	50	147	24	147
Celery	190	308	79	700

3.2.4.7 Soil Available Phosphorus

Soil available phosphorus is a moderately reliable indicator of soil fertility in that it does not vary significantly with soil temperature and rainfall. However it may not be a completely reliable measurement of true phosphorus availability on alkaline soils, as there can be a chemical locking up of soluble phosphorus from the soil water into insoluble calcium phosphate. The Colwell soil available phosphorus test does not adequately detect this chemical process.

There were no low values for soil available phosphorus in the 2007 data – the lowest individual value was 110 mg/kg which is still a moderately high value. There are only eight test values across all 154 sites with soil available phosphorus less than 200 mg/kg. The other sites all had test values for soil available phosphorus higher than 200 mg/kg. Accepting that the test may be overestimating soil available phosphorus, these data would still indicate that considerable opportunity exists for reducing phosphorus in the applied fertilizer, as most district soils appear to have very high reserves.

The data in Table 11 reaffirms this. The level of phosphorus removal ranges from 13 kg/ha to 79 kg/ha depending on the crop being grown. Additional phosphorus from applied fertilizer may be unnecessary as the amount removed in the crop is generally below the amount of phosphorus being applied through the recycled water. This could constitute substantial savings in production cost, as fertilizer is one of the major farm inputs for vegetable production. Without accounting for these reserves in the cropping fertilizer program, there is a tendency to apply far more fertilizer phosphorus than the crop requires. Crop monitoring will be the best determinant as to whether reducing applied phosphate will lead to any reduction in phosphorus levels in plant tissue. Potential cost savings to the growers are considerable if phosphate fertilizer levels can be reduced. Potential environmental effects are positive as effective crop monitoring will lead to less phosphate migration.

The Land and "On Farm" Management Committee is engaging fertilizer distributors and agronomists to alert them to the nutrient content of recycled water and consider ways to reduce total fertilizer use within the Werribee South district.

3.2.4.8 Boron

Boron has been included in the annual soils monitoring program because it is at moderate levels within the recycled water (Table 3) and because it can be finely balanced for many crops between inadequate levels (and crop boron deficiency) and at excessive levels (and crop boron toxicity). However while Boron is at a measurable level within the recycled water, this is low when compared to the amount of Boron that would be applied during a normal cropping program using Nitrphoska Blue Special as the applied fertilizer (Table 4). The application of this fertilizer at 1500 kg/ha would add almost double the amount of Boron that would be applied in 7.0 ML/ha of recycled water. Even at the heaviest application of recycled water, the mass inflow of Boron is still lower than the level applied in commonly applied fertilizer.

During the baseline sampling there were three farms which had soil boron levels at more than 6.0 ppm. This is the level at which Boron toxicity can become an issue for most crops (Landon 1984). There are some very sensitive crops such as artichoke that can show mild toxicity to Boron at 3.0 mg/kg (Lorenz & Maynard, 1980), but Boron toxicity is often complicated by an interaction with soil Calcium and /or soil Potassium, both of which are high in Werribee soils. Thus 6.0 mg/kg should be regarded as an indicative where problems may start to occur, and should be confirmed with foliar analyses if some level of toxicity is suspected.

The 2007 monitoring of the surface soils confirmed just a single site where Boron was above 6.0 mg/kg. The water quality data and comparison with fertilizer analysis (Table 4) indicates that the recycled water is unlikely to be the source for the high Boron. It is probably accumulating form repetitive use of fertilizers with trace element additives. For annual monitoring of district soils for the recycled water scheme, the soil test for Boron is probably unnecessary and is adding extra expense to the monitoring program that may not be justified. However from a farm management perspective, this test may be identifying data relevant to soil nutrient balance that would otherwise be undetected.

Advice from our Soil Testing Consultant is this test is unnecessary for annual soils monitoring from a regulatory and environmental perspective. This will be discussed with our Werribee and Bacchus Marsh Customer Consultative Committee and the EPA with a view to withdrawing it from future testing.

3.2.4.8 Cadmium

Cadmium is a potential contaminant in vegetable crops that has received considerable attention in recent years. It is present in rock phosphate and at different levels in different phosphate deposits. Significant Cadmium levels were detected in some vegetable crops and processed vegetable products in the 1990's as a result of routine produce monitoring, and the source of the Cadmium was traced back to lower grade phosphate fertilizers, often being used in conjunction with high salinity irrigation water. Cadmium was considered to be a potential risk for the Werribee recycled water scheme because this heavy metal is present in the recycled water, and the recycled water is moderately saline. To date it has been included as a standard test for all soils.

The results obtained during baseline monitoring indicate that the Werribee soils were all well within the tolerance level for Cadmium. The highest level recorded during the baseline sampling was 0.7 mg/kg (1 site). The 2007 soils monitoring data has identified three sites with elevated Cadmium level, two of which are within the moderate to low water use group and the third is a high water use site The measured Cadmium levels are 0.9 mg/kg, 0.9 mg/kg and 1.5 mg/kg. Soil Cadmium values of around 1.0 mg/kg and above are considered to pose some level of risk for Cadmium uptake by crops, but the uptake is then dependant on the variety and cultivar of the crop being grown, and the salinity of the irrigation water. The recycled water cannot be a source for this change in Cadmium (see Table 3). Likely sources are the fertilizers and soil conditioners that have been used on these properties since the collection of baseline soil samples. There is no major change in salinity on any of the three farms, which could have been a contributing factor to mobilising existing soil Cadmium. All other monitoring sites have values for Cadmium well below the accepted risk areas and most results are below the detectable limit of 0.2 mg/kg.

3.2.5 Recommendations and Conclusions

During the design of the Werribee Recycled Water Scheme it was assumed that river water would be available for shandying with the recycled water. As such the total salinity of the combined water stream was unlikely to exceed 1000 uS/cm, the nutrient load fairly insignificant, and the sodium impact on soil structure was likely to be low.

The failure of the irrigation system to supply river water for 2006/2007 was not anticipated during the design of the scheme. Instead of receiving a shandy of river water and recycled water, most crops have been grown on 100% recycled water. The salinity has been around 1800 uS/cm and the sodium adsorption ratio has been above 9. Both of these parameters are likely to have an adverse effect on the soils, the former raising the salt content and the latter disrupting the cation balance. The use of a moderate level of 4.5 ML/ha recycled water through the season would supply 86 kg/ha of nitrogen and 72 kg/ha of phosphorus which is a substantial part of most vegetable crop fertilizer needs for these two elements.

The climatic conditions that occurred in 2006/2007 were exceptional circumstances, but that does not preclude a recurrence. Current seasonal conditions in 2007/08 are again dry and river water allocations are at a record low of 8%, and groundwater bans are in place. As such, river water for shandying is not available and crops continue to be grown with the high salinity recycled (and limited high salinity river water) water in 2007/2008.

Since the commencement of the Recycled Water Scheme the average soil salinity (E.C.E.) of monitored soils has increased from 3.5 dS/m to 4.5 dS/m. Many soils were at the threshold of salinity for the more sensitive crops such as lettuce prior to this increase. Any increase in salinity is undesirable. The likely impacts are reduced quality of produce, lower yields, and foliage damage. Nine monitoring sites show an increase in E.C.E. since initial baseline sampling of more than 4 dS/m and such an increase should be apparent to the farm operator as reduced crop performance. The increase in E.C.E. value however is not consistent across all farms, and of the 154 sites monitored in June 2007, 40 show a decline in E.C.E. since the commencement of recycled water use. There are 6 particularly interesting sites which have received some of the highest loads of recycled water and have not shown any increase in salinity. One of these has actually registered a decrease. There are three separate farm operators involved with these six sites. It is likely that irrigation and general farm management is having a significant influence on how each farm reacts to the use of recycled water.

Sodicity has increased from an average ESP value of 9.3 % prior to the commencement of recycled water use to an average of 12.4 % across the 154 sites monitored in 2007. All soils are now regarded as sodic. This change in exchangeable sodium is equivalent to the retention of an extra 400 Kg/ha of sodium in the top 30 cm of the soil profile. The level of gypsum use on farms needs to increase, so that the sodium level is controlled. Sodicity can become irreversible once the level of sodium severely impacts on infiltration and the soils become highly dispersive. There is no evidence that this is yet occurring, but there are 13 sites where the surface soils are now strongly sodic.

The average soil nitrate and soil available phosphorus in the surface soils have increased from a high base prior to the use of recycled water. There was evidence of nitrate movement and phosphorus migration to the subsoil when baseline soil samples were collected. The concentration of these nutrients in the recycled water is significant and there is an opportunity for the farming community to more accurately budget their nutrient requirements for each cropping cycle making use of the recycled water nutrients as a resource. There is a district need to modify fertilizer use.

Soil pH levels are high and there are a number of properties which have soil Ph values above 8.5 in the surface soils. Apart form affecting the availability of some of the minor plant nutrients, high soil pH can interfere with the cation exchange correction initiated by the application of gypsum. There is widespread use of burnt lime as a preplant treatment for soil borne diseases, and this is the main factor leading to such high pH values through the district. Alternative practices to the full broadcast of lime need to be developed.

The actions wither taken or in progress to address the issues from this annual review are as follows:

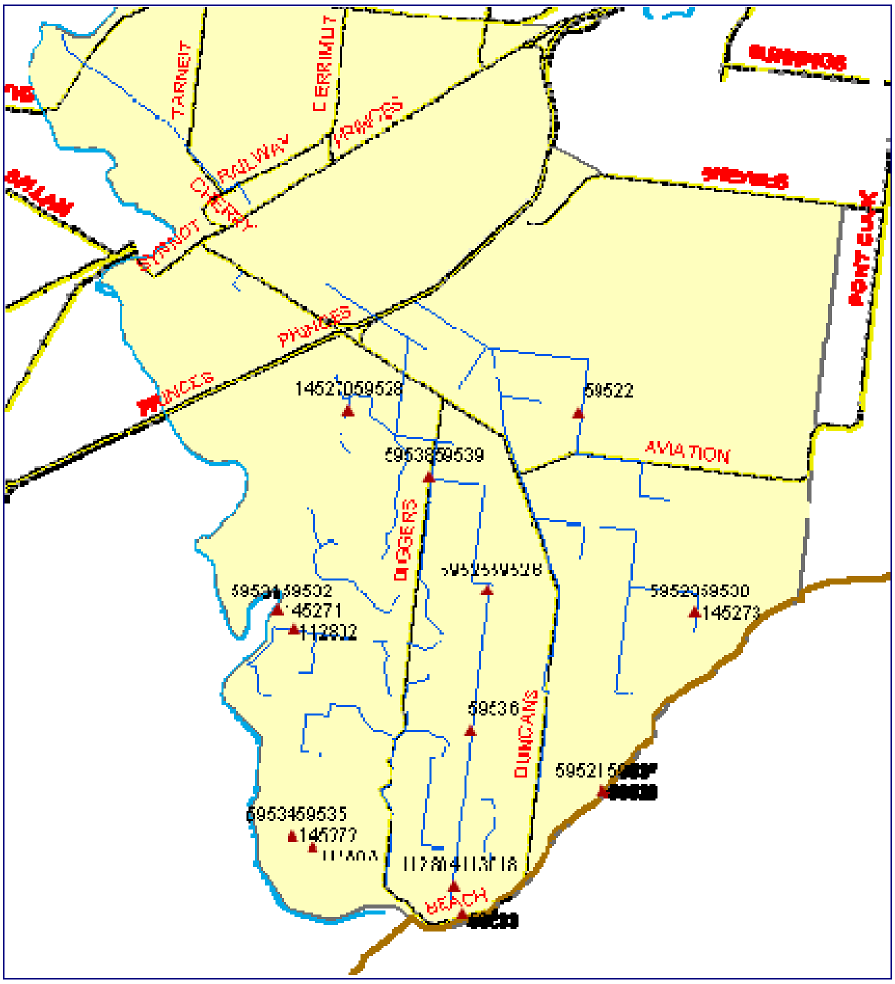
- The analytical parameters for monitoring water quality will be extended to include sulphate and carbonate, such that a more complete cation and anion balance is possible.
- Bore water (currently on ban) and river water (when supplied) will be regularly collected and sampled as required for laboratory analyses so that data on comparative water quality is available.
- If shandied water is supplied to farms for the 2007/2008 irrigation season, samples of the shandy mix will be collected for water quality analysis including pH, electrical conductivity and ionic balance.
- The farming community of Werribee South continue to be engaged in a cooperative approach to identifying and promoting best farm practice for management strategies to control salinity at a farm level.
- The scope of these practical management strategies include soil pH management, specifically to avoid the over-use of lime.
- Annual reports to farmers include information on the undesirable consequences of sodicity and how to reverse increased sodicity through the use of gypsum and deep ripping.
- The Land and "On farm" Management Committee seek to engage fertilizer distributors and agronomists to alert them to the nutrient content of recycled water and discuss the reduction in fertilizer use within Werribee South district.
- The soil boron test be referred to the Werribee and Bacchus Marsh Customer Consultative Committee and the EPA as an unnecessary test from a regulatory and environmental perspective and future inclusion in the annual monitoring be reviewed.

4. GROUNDWATER MONITORING

The Werribee Irrigation District overlays a groundwater management unit known as known as the Deutgam Water Supply Protection Area (WSPA). The WSPA covers an alluvial gravel aquifer to a depth of 40 metres, across a formation known as the Werribee Delta. Given the coastal location of the aquifer and hydraulic connection to the Werribee River and coast, the area has been managed for a number of years in respect to mitigating the risk of saline intrusion into the aquifer. At the time of reporting, the WSPA is currently under a groundwater extraction ban (including stock and domestic) given reduced levels and an elevated threat of intrusion. Some exemptions apply, predominantly for small volume users with uses such as chicken shed fogging and the underpass dewatering. There is an active compliance program in place to manage the groundwater ban, and there are a number of prosecutions currently underway for water users found in breach of the ban.

Monitoring infrastructure comprises 25 State Observation bores and a number of private bores able to be incorporated into the sampling program. Currently groundwater salinity is monitored on a monthly basis via a rotating program including private bores, with additional fortnightly groundwater level measurements. All quality sampling has an appropriate QA/QC program to ensure accuracy of results.

4.1 LOCATION OF STATE OBSERVATION BORE NETWORK



4.2 GROUNDWATER SALINITY MONITORING RESULTS

A snapshot of field EC measurements across the WSPA is presented in the following tables – an annual snapshot comparison (with bore construction details), followed by a comprehensive listing of all salinity results.

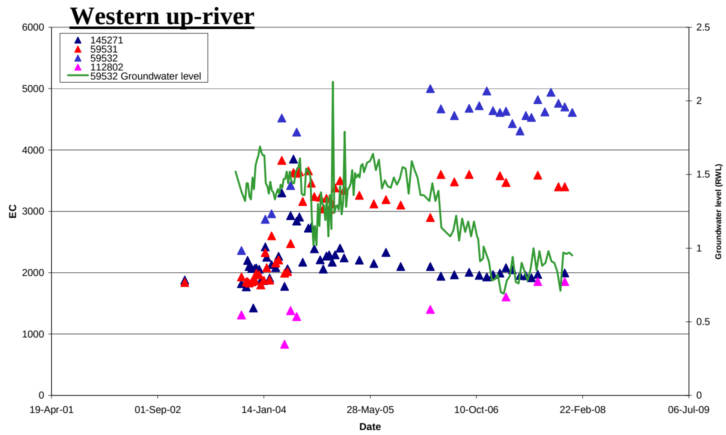
Dependent upon location, salinity levels are stable to gradually increasing across the WSPA. Increasing salinity trends are observed primarily in the areas adjacent to the coast and river at rates up to 150EC/month whilst the northern and central areas remain relatively stable. Detailed analysis of results suggests the increases are largely associated with:

- General declined level of groundwater – given the natural density stratification of groundwater, salinity increases with depth within an aquifer;
- A measure of density flow from saline sources from the sea and tidal Werribee River in response to an extended period of low groundwater levels (at or close to sea level) – indicated by larger changes being observed with depth. As a result, the groundwater ban will remain in place until July 1, 2008, with subseque

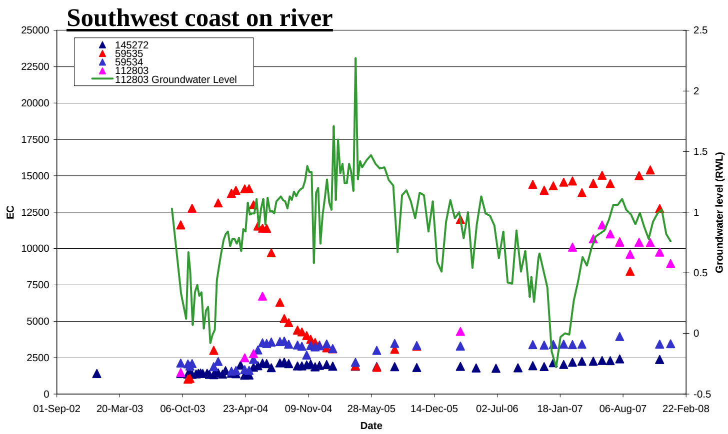
At this time, our monitoring suggests that water quality within the private bore network is stable. It is unlikely that observed salinity trends are associated with the supply of recycled water given the observed responses in nested bore sites and the location of the changes.

Bore	Region	Depth	Screen from	Screen to	07-Mar-06	29-Jan-07	30-Nov-07
145271	Western River	23	18	21	2100	1992	1994
59531	Western River	26.24	19.8	26	2900	3580	3400
59532	Western River	78	31	55	5000	4610	4700
145272	SW coast/river	15	11	14	1900	2034	2374
59535	SW coast/river	31	0	30	12000	14560	12750
59534	SW coast/river	23.5	18.1	23.5	3300	3430	3430
145273	Eastern coast	11.5	7.5	10.5	2800	2273	2235
59530	Eastern coast	55	31	55	7300	6870	6590
59521	SE coast	27.5	7	12.8	33000	32100	38000
59537	SE coast	35	12	18	3900	3990	4390
59520	SE coast	28.5	26.5	28	3900	3910	3690
59533	Central coast	43	14.2	20.2	3000	3830	2940

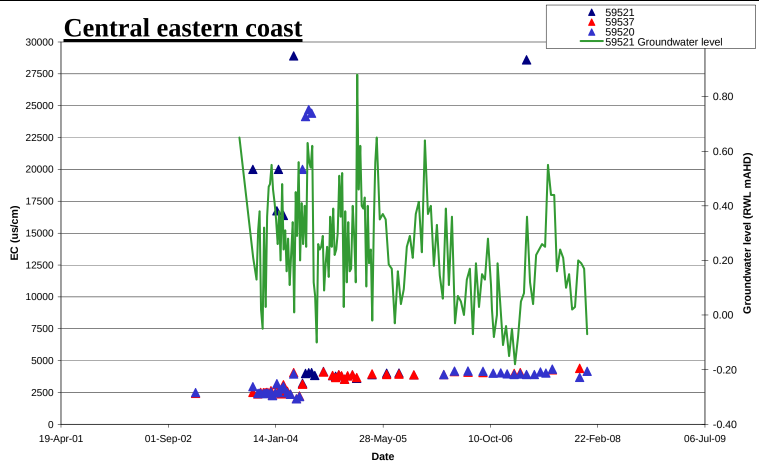
Western – river at tidal extent



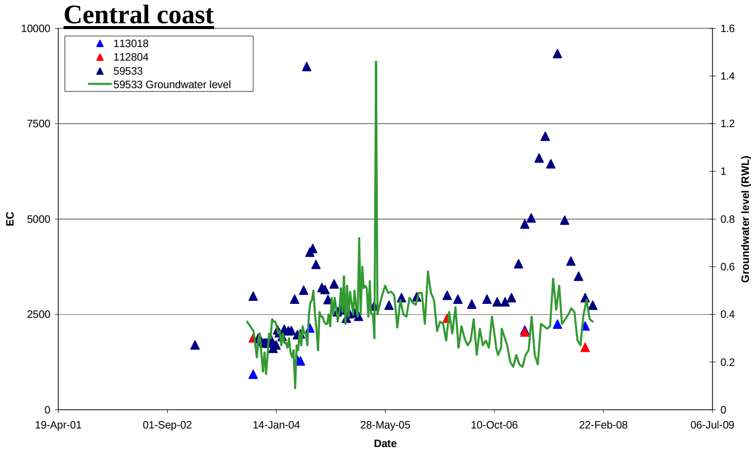
Southwest coast on river



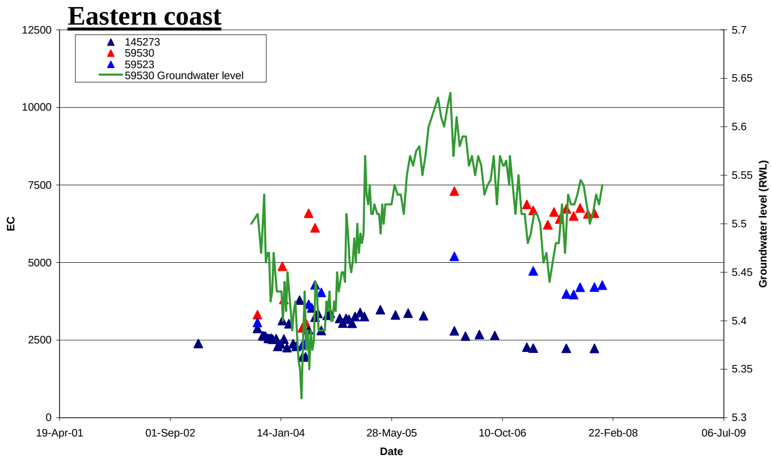
Central eastern coast



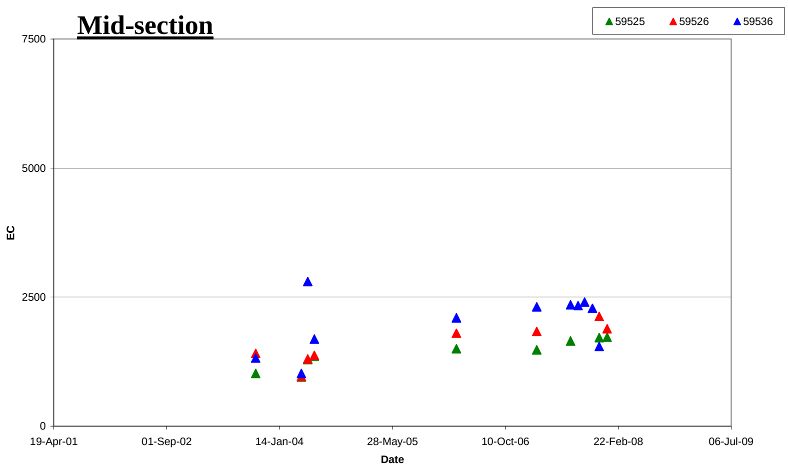
Central coast



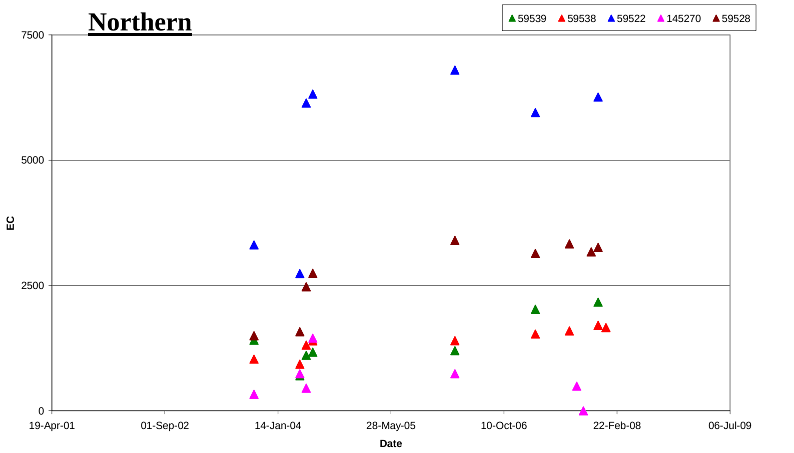
Eastern coast



Mid-section



Northern


Northern
59539
59538
59522
145270
59528
7500
5000
2500
0
EC
19-Apr-01
01-Sep-02
14-Jan-04
28-May-05
10-Oct-06
22-Feb-08
06-Jul-09
Date

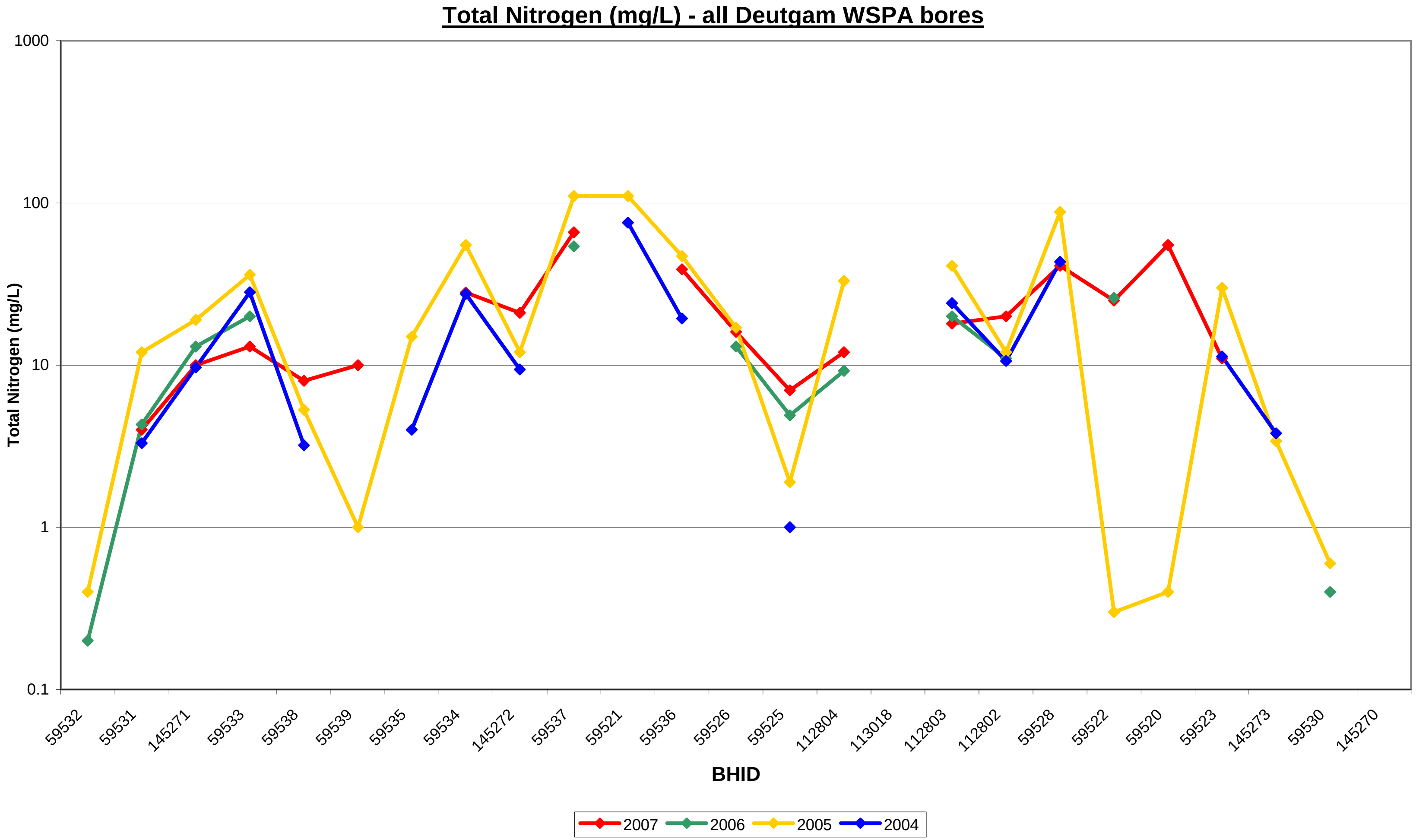
4.3 NUTRIENT & METALS MONITORING RESULTS

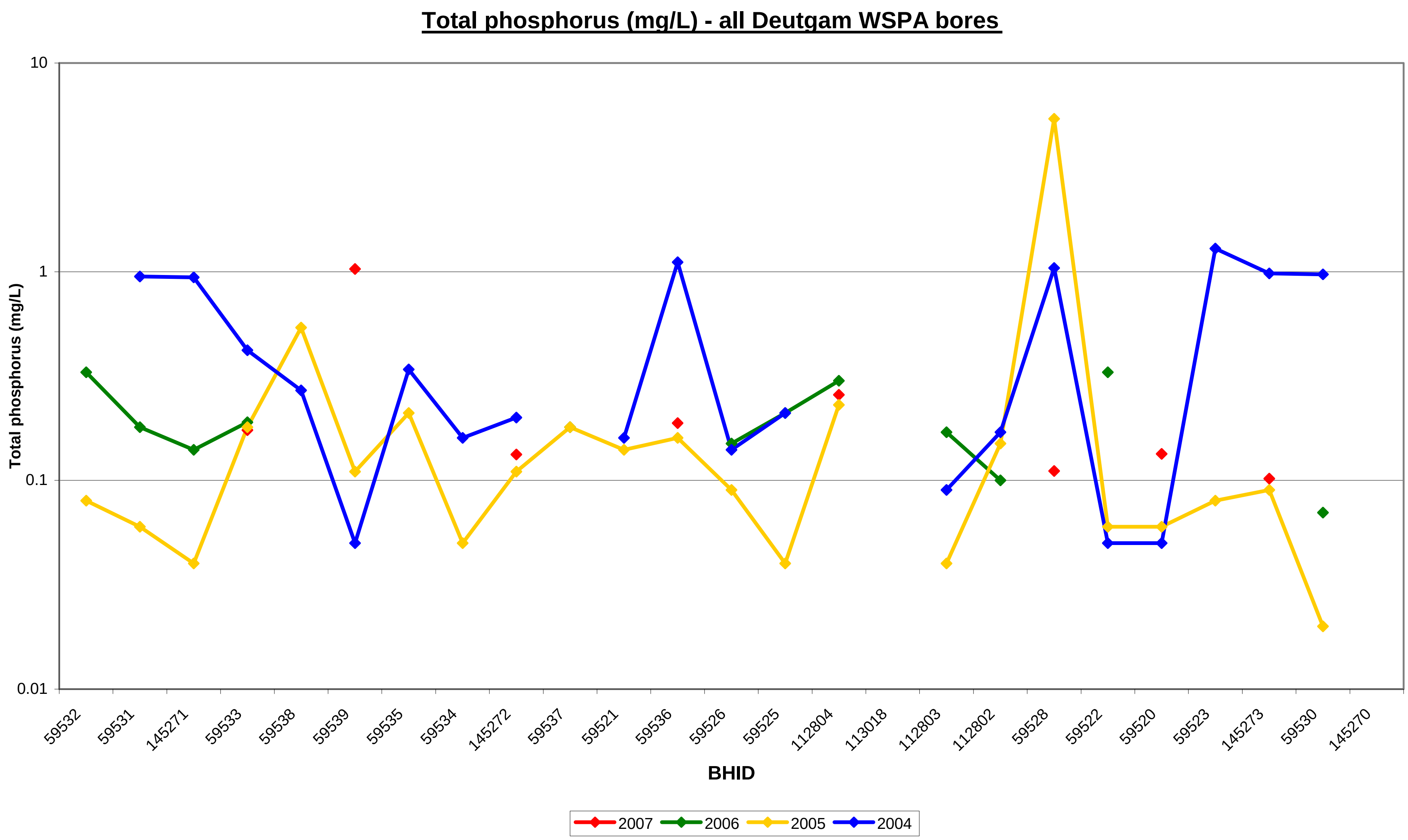
Bore ID	59532	59531	145271	59533	59538	59539	59535	59534	145272	59537	59521	59536
Date	11/02/08	11/02/08	11/02/08	11/02/08	11/02/08	11/02/08	12/02/08	12/02/08	12/02/08	12/02/08	12/02/08	13/02/08
EC (µS/cm)	3560	2810	1720	2200	1520	1780	13300	2860	2190	3390	27600	1970
Ammonia as N (mg/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
pH (pH)	7.2	7.5	7.7	7.7	7.9	7.2	7.5	7.6	7.8	7.7	6.9	7.9
Total P (µg/L)	<0.1	<0.1	<0.1	0.174	<0.1	1.03	<0.1	<0.1	0.133	<0.1	<0.1	0.188
TKN (mg/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nitrogen (mg/L)	<2	4	10	13	8	10	<2	28	21	66	<2	39
Nitrate as N (mg/L)	<0.5	4.1	10	13	7.6	10	0.7	28	21	66	1.3	39
Nitrite as N (mg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Antimony (µg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Boron (µg/L)	310	240	290	450	240	190	560	420	580	560	940	380
Cadmium (µg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Copper (µg/L)	<5	<5	<5	<5	<5	5.4	<5	<5	<5	<5	8.8	<5
Lead (µg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Manganese (µg/L)	510	130	44	19	<5	48	420	140	15	18	290	<5
Nickel (µg/L)	<5	<5	<5	<5	<5	9.3	8.2	<5	<5	<5	9.6	<5
Zinc (µg/L)	35	45	37	32	33	47	23	26	22	22	34	19

Bore ID	59526	59525	112804	113018	112803	112802	59528	59522	59520	59523	145273	59530	145270
Date	13/02/08	13/02/08	13/02/08	13/02/08	13/02/08	13/02/08	14/02/08	14/02/08	14/02/08	14/02/08	14/02/08	14/02/08	14/02/08
EC (µS/cm)	1770	1630	1930	2000	9760	1590	2360	5150	2870	2920	1720	5360	874
Ammonia as N (mg/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
pH (pH)	8.1	7.5	7.9	7.3	7.6	7.4	7.9	7.6	7.6	7.8	8	7.5	7.1
Total P (µg/L)	<0.1	<0.1	0.257	<0.1	<0.1	<0.1	0.111	<0.1	0.134	<0.1	0.102	<0.1	<0.1
TKN (mg/L)	2.6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nitrogen (mg/L)	16	7	12	<2	18	20	41	25	55	11	<2	<2	<2
Nitrate as N (mg/L)	13	7	12	1.8	18	20	41	24	55	11	1.5	<0.5	1.4
Nitrite as N (mg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Antimony (µg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Boron (µg/L)	330	140	370	320	830	230	1200	1200	690	1400	1300	640	290
Cadmium (µg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Copper (µg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Lead (µg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Manganese (µg/L)	5.3	<5	32	200	1300	<5	<5	43	25	<5	5	120	140
Nickel (µg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	160
Zinc (µg/L)	27	31	19	30	25	23	16	20	28	18	19	25	25

4.4 NUTRIENT CONCENTRATION ANALYSIS

Nutrient levels within the Deutgam WSPA groundwater resource are generally stable, and remain relatively consistent with concentrations observed prior to the commencement of recycled water supply into the district.



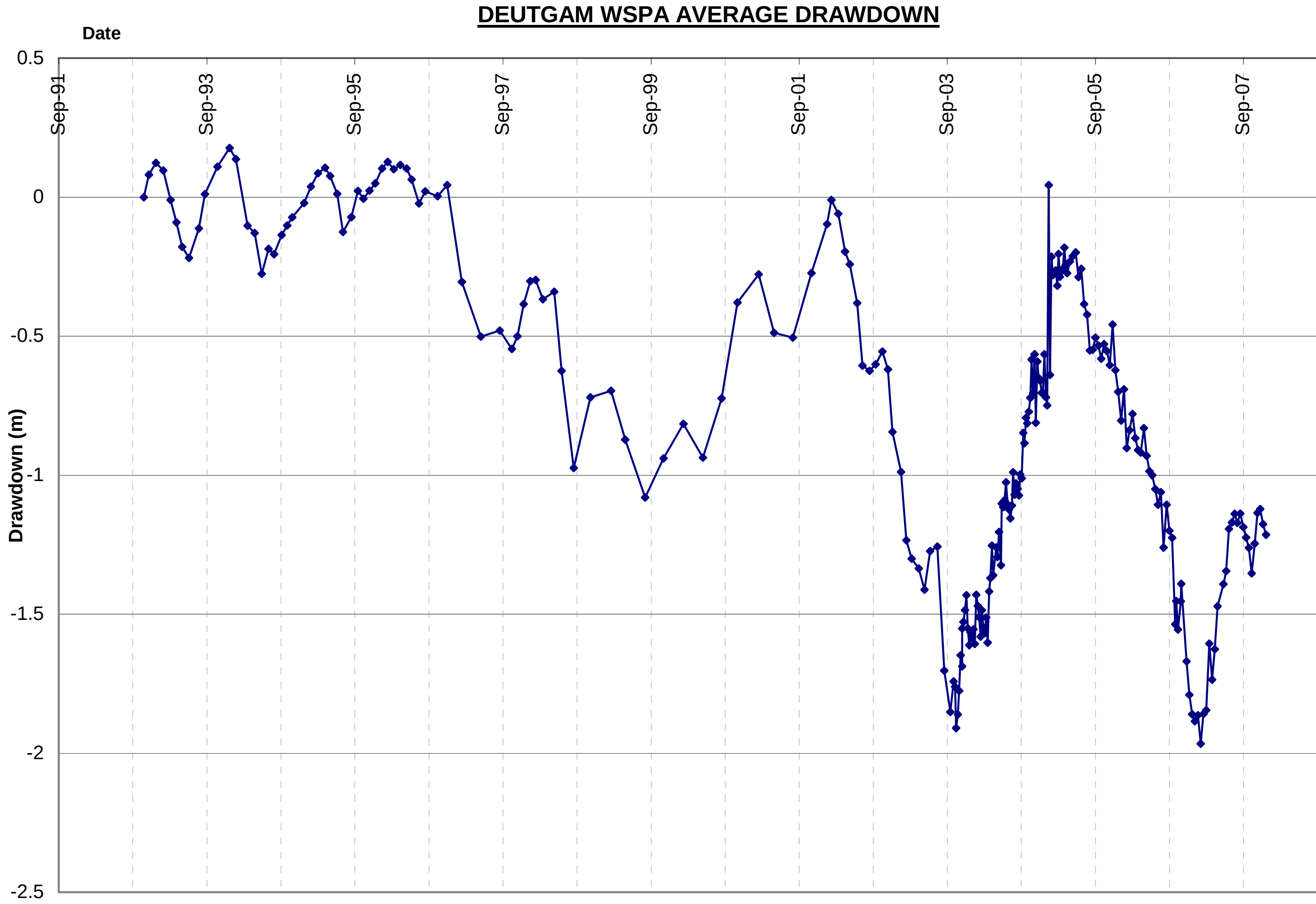

Total phosphorus (mg/L) - all Deutgam WSPA bores
Total phosphorus (mg/L)
10
1
0.1
0.01
59532
59531
145271
59533
59538
59539
59535
59534
145272
59537
59521
59536
59526
59525
112804
113018
112803
112802
59528
59522
59520
59523
145273
59530
145270
BHID
2007
2006
2005
2004

4.5 REDUCED GROUNDWATER WATER LEVEL DATA (MAHD)

Date	59520	59521	59522	59523	59525	59526	59528	59530	59531	59532	59533	59534	59535	59536	59537	59538	59539	112802	112803	112804	113018	145273	145272	145271	145270
5/1/07	0.09	0.15	5.31	3.27	4.61	4.44	6.22	5.51	0.57	0.79	0.18	0.64	0.44	1.26	0.11	7.11	7.42	2.34	0.28	0.38	0.38	3.3	0.78	0.54	6.65
19/1/07	0.17	0.05	5.26	3.11	4.48	4.29	6.2	5.51	0.6	0.82	0.23	0.72	0.45	1.02	0.17	7.08	7.36	2.21	0.03	0.29	0.29	3.13	0.83	0.56	6.56
2/2/07	0.06	0.18	5.37	3.26	4.78	4.62	6.16	5.48	0.47	0.7	0.19	0.66	0.39	1.19	0.06	7.15	7.39	2.18	0	0.41	0.42	3.28	0.77	0.47	6.55
16/2/07	0.13	0.08	5.28	3.08	4.33	4.07	6.05	5.49	0.46	0.69	0.18	0.72	0.52	0.76	0.16	6.82	7.01	2.06	0.01	0.34	0.345	3.09	0.84	0.42	6.42
2/3/07	0.25	0.05	5.51	3.11	4.66	4.52	6.17	5.51	0.57	0.78	0.23	0.61	0.37	0.92	0.1	7.07	7.3	2.1	0.27	0.3	0.31	3.07	0.74	0.52	6.63
16/3/07	0.27	0.08	5.56	3	4.49	4.37	6.24	5.51	0.6	0.81	0.25	0.61	0.27	1.03	0.31	6.9	7.11	2.14	0.43	0.31	0.32	2.99	0.72	0.57	6.71
30/3/07	0.59	0.36	5.52	3.24	4.82	4.63	6.32	5.5	0.74	0.94	0.39	0.12	0.19	1.41	0.62	7.08	7.29	2.22	0.63	0.38	0.38	3.26	0	0.71	6.56
13/4/07	0.34	0.12	5.39	3.29	4.85	4.76	6.2	5.46	0.55	0.77	0.23	0.25	0.03	1.42	0.35	6.99	7.14	2.18	0.56	0.32	0.32	3.29	0.38	0.54	6.52
27/4/07	0.24	0.04	5.55	3.32	5.02	4.97	6.3	5.47	0.54	0.76	0.19	0.49	0.5	1.84	0.27	7.17	7.33	2.28	0.7	0.41	0.41	3.36	0.38	0.54	6.54
11/5/07	0.43	0.22	5.57	3.44	5.24	5.07	6.3	5.44	0.65	0.9	0.36	0.71	0.72	2.07	0.43	7.24	7.34	2.44	0.8	0.56	0.56	3.48	0.6	0.68	6.55
8/6/07	0.46	0.26	5.74	3.43	5.37	5.24	6.43	5.48	0.55	0.78	0.34	1.1	1.01	2.35	0.46	7.33	7.46	2.53	0.85	0.7	0.7	3.44	0.98	0.58	6.59
22/6/07	0.47	0.25	5.75	3.44	5.48	5.43	6.55	5.48	0.64	0.86	0.35	1.31	1.22	2.51	0.48	7.2	7.24	2.65	0.94	0.72	0.71	3.46	1.19	0.64	6.66
6/7/07	0.77	0.55	5.86	3.54	5.5	5.46	6.66	5.52	0.77	1	0.55	1.52	1.43	2.66	0.77	7.22	7.29	2.75	1.06	0.8	0.79	3.57	1.4	0.8	7.89
20/7/07	0.65	0.44	5.83	4.11	5.53	5.5	6.65	5.47	0.62	0.85	0.42	1.72	1.6	2.79	0.67	7.19	7.23	2.81	1.06	0.89	0.88	4.18	1.6	0.65	7.32
3/8/07	0.71	0.44	6.1	3.93	5.65	5.57	6.73	5.53	0.77	0.98	0.52	1.69	1.64	2.76	0.7	7.25	7.29	2.87	1.11	0.86	0.86	3.96	1.58	0.79	6.88
16/8/07	0.44	0.16	6.12	3.74	5.93	5.78	6.77	5.52	0.65	0.88	0.36	1.76	1.64	2.84	0.41	7.49	7.58	2.89	1.02	1	0.99	3.76	1.65	0.67	6.9
31/8/07	0.49	0.24	6.15	3.68	6.14	5.84	6.74	5.52	0.67	0.9	0.38	1.55	1.48	2.9	0.5	7.75	7.99	2.97	0.98	0.88	0.88	3.7	1.45	0.72	6.91
14/9/07	0.47	0.21	6.14	3.61	6.09	5.86	6.71	5.53	0.77	0.98	0.4	1.47	1.41	2.7	0.47	7.63	7.73	2.95	0.9	0.83	0.83	3.63	1.35	0.78	6.87
28/9/07	0.46	0.1	6.18	3.58	5.91	5.6	6.66	5.545	0.73	0.91	0.425	1.23	1.32	2.76	0.415	7.7	7.89	2.865	0.995	0.79	0.8	3.58	1.165	0.71	6.8
12/10/07	0.4	0.15	6.05	3.53	5.91	5.63	6.58	5.54	0.68	0.9	0.41	0.91	1.07	2.73	0.37	7.72	7.91	2.84	0.88	0.84	0.84	3.55	0.8	0.7	6.82
26/10/07	0.25	0.02	6	3.41	5.7	5.51	6.47	5.52	0.63	0.84	0.29	0.91	0.96	2.45	0.27	7.77	8.06	2.8	0.78	0.76	0.76	3.44	0.8	0.65	6.67
9/11/07	0.32	0.03	6.09	3.91	5.82	5.72	6.56	5.5	0.47	0.71	0.27	1.53	1.42	2.76	0.32	7.73	7.81	2.74	0.92	0.96	0.96	3.94	1.41	0.51	7.03
23/11/07	0.48	0.2	6.16	3.94	6.16	5.93	6.62	5.51	0.8	0.97	0.4	1.46	1.4	2.9	0.49	8.71	7.67	2.82	0.99	0.96	0.95	3.98	1.35	0.76	6.88
7/12/07	0.46	0.19	6.22	3.83	6.02	5.95	6.58	5.53	0.75	0.96	0.46	1.5	1.43	2.79	0.49	8.12	8.22	2.76	1.02	0.97	0.97	3.88	1.39	0.74	6.79
21/12/07	0.45	0.17	6.21	3.76	6.21	6.05	6.51	5.52	0.76	0.97	0.38	1.1	1.08	2.68	0.42	8.21	8.38	2.72	0.82	0.88	0.88	3.82	0.97	0.74	6.69
4/1/08	0.29	0.07	6.29	3.95	6.11	5.98	6.54	5.54	0.64	0.95	0.37	0.85	1.01	2.53	0.25	8.41	8.85	2.72	0.76	0.89	0.92	3.99	0.72	0.74	6.96

4.6 GROUNDWATER LEVEL TRENDS AND CURRENT SITUATION

Groundwater levels across the WSPA are generally strongly declined, and currently at levels dramatically below historical levels. The aquifer is currently at direct risk of saline intrusion as a number of bores near the coast show groundwater levels at or near to sea level. A groundwater ban was introduced mid-2007 to substantially reduce extraction in order to mitigate the risk of saline intrusion.



5. OPERATION & MAINTENANCE

5.1 MAINTENANCE REVIEW

During the course of 2007 no noticeable changes have occurred to the maintenance programming or changes in maintenance work practices. Due to low river water volumes being distributed into the channel system we have yet again not experienced the filamentous algae problems that have occurred when river allocations were greater. The Werribee Weir is fed by the Werribee River and is the supply source of the algae affected water and the large volume percentage of recycled water distributed to customers has assisted in managing the overall algae problem again in 2007

The volume of silt in the channel system again remained low in 2007 in comparison to pre recycled water supply seasons as the Werribee River can contain high levels of turbidity which greatly contributes the problem.

5.2 OPERATIONS

The water right allocation remained at 10% for the 2006/2007 season. The start of the 2007/08 allocation was only 100% of stock and domestic supply with the water right allocation reaching 5% in September and increasing to 8% in late December 2007.

As a result of the extremely low river water allocation in the 2006/2007 season and for the commencement of the 2007/2008 season, the split running schedule has been modified to incorporate a 6 day a week supply of recycled water from Saturday to Thursday, with a River only supply day on the Friday for customers who have not signed on for the recycled water supply.

The introduction of Recycled water into the WID and the current low water right allocations has seen water supplied to customers on more days during the year, mainly due to the restricted volume available from the Western Treatment plant being 65 Mega litres per day. This small volume has forced us to modify our supply arrangement and split the district into 2 sections. Each section is supplied over a 2 day cycle that concentrates on supplying the top of the section for the first day, and then shifts to the lower reaches of the section on the second day before switching over to the next section and the same principles apply... This means a customer can only be supplied recycled water on farm on three occasion over a 2 week period (days).

The seven day roster has impacted on the operating regime of the working group and has changed the way we operate the system. Customers are now receiving volumes overnight when in the past this was not a common practice. We now flat line the supply from the treatment plant at 65 Mega litres per day and reschedule orders to follow on from one another to ensure maximum efficiency and volume being delivered to our customers.

Our operational working group required a restructure of the roster arrangements to incorporate weekend work when in previous years employees have rarely been required on weekends.

A total of 7,422 Mega litres of recycled water was delivered to customers during the 2006/07 irrigation season from a total volume delivered to customers of 8,465 Mega litres. The recycled volume represented 87.6% of the total volume delivered to customers during the 2006/07 season. A further 3,823 Mega litres of recycled water has been delivered to customers at end of December 2007.

At the start of January 2007, 160 customers had signed recycled water supply agreements and buy the end of the year (December 2007), 179 customers had signed on for the use of recycled water. The additional 17 new agreements meant that the volume required to be shared evenly out to customers applying a percentage rule against their water right to determine a volume that is able to be supplied as demand 90% of the time has exceeded the capacity of the recycled supply.

Appendix No 7 lists the recycled use of all recycled customers.

6. COMPLIANCE

6.1 SUMMARY OF INCIDENTS

No incidents or non-conformances were reported for the year. The definition of an incident includes

- Significant leaks or overflows from the shandied water storage dams
- Discharges of shandied water to rivers or creeks
- Contamination of potable water supply by shandied water
- Soil salinity, sodicity or acidity problems by use of shandied water.

There were no formal incidents or incidences leading to non-compliance (as defined by the Customer Site Management Plan) for the reporting period.

6.2 SUMMARY OF COMPLAINTS

We received one written (email) complaint received regarding recycled water during 2007.

- Customer expressed concern about the limited volume of recycled water and requested we lobby government for more. We explained our work with Melbourne Water to increase volumes, our Thomson contingency plans and also our Western Irrigation Futures project.

We received the following verbal complaints:

- On 2 and 5 February 2007 we received feedback from two customers regarding dead fish in their dams after a delivery of recycled water. This corresponded to a period where Melbourne Water were using Chloramine to treat the water and this process can cause fish deaths. Testing was undertaken for residual Chlorine in his dam and no significant levels were recorded.
- On 13 October 2007 we received a complaint from a customer that interest is payable on the recycled water sales account. Noting that an extension to the payable date had been provided but interest would still accrue for the amount that has not been paid by

the due date. The customer was advised he would not have to pay interest on the amount he pays by the due date. Customer was advised that it was SRW policy to charge interest on unpaid accounts. At this time, our approach was to bill for additional usage at the year end. This has subsequently been changed to bill progressively, on a quarterly basis for usage.

- A customer complained that he took on recycled water with an understanding that it would be supplied at 1800EC, or better with a shandy, and that he would have quality of 1000EC by 2009. Customer claims that it is doubtful that the lettuce he has planted after mid August will be marketable due to the recycled water being too salty. We explained the initiatives we were taking to assist growers including the Thomson water initiative which would reduce the salinity of water once delivered.
- Customer expressed concern about the limited volume on recycled water and requested we lobby government for more.

There was, in addition to the above, considerable concern expressed at Melbourne Waters decision not to proceed with salt reduction post 2009. Customers are concerned about how this decision will impact the district and individual viability and the EPA's attitude toward the continuation of the scheme post 2009.

6.3 SUMMARY OF AUDITS

Southern Rural Water has 25 planned audits for the 2007/2008 season to commence in March 2008. The audits are random and will focus on recycled customers who weren't inspected during the 2006 audit campaign. Improvement notices will be issued if non-compliance is detected.

Below is the audit form used to conduct the compliance assessments.

ENVIRONMENT IMPROVEMENT PLAN COMPLIANCE CHECK LIST

Date………………………………………………

Landowner Name………………………………………………

Lessee Name…………………………………………………….

Wheel Number/s………………………………

Service Number………………………………

	Items to Check:	Yes	No
1	Information in EIP correct – and signed by all parties	□	□
2	Taps carrying recycled water to be painted lilac and be located not within 300mm of potable supply*	□	□
3	Taps supplying recycled water to be signed "Do Not Drink" and contain the universal picture i.e. glass surrounded by circle with a line through it.	□	□
4	Provision of signage at all entrance points and boundary fences	□	□
5	Water supply and use in accordance with EIP	□	□
6	Map of property generated/updated correctly	□	□

*Requirement is for the tap and up to one meter of exposed plumbing to be painted.

Required Action
If a subsequent SRW visit is required, customer to notify SRW officer.

NAME OF SRW OFFICER…………………………………..
DATE OF APPROVAL………………………………………….

6.4 SALINITY (SOIL SODICITY) AND NUTIRENT MANAGEMENT

We recognise that the levels of sodicity and nutrients in the soil results trigger the requirements for action to address these issues. While the increase in soil sodicity is a district wide phenomena largely driver by the drought, the provision of recycled water has clearly been a contributing factor. The data shows that in many cases, soil salinity has declined from baseline levels indicating that on farm management practices are a significant contributing factor.

Our belief is that the most effective means of improving on farm practices is through the initiatives outlined below, which take a holistic approach to identifying and validating these best "on farm" practices and communicating them in a manner that are most likely to change behaviour.

6.5 IMPROVEMENT PROGRAMS

Southern Rural Water is continually monitoring the performance of all operations to identify and implement potential improvement actions. Refinements have been made to our operational implementation of the split running processes this season and we will continue to refine this over the coming twelve months. Some specific actions that are planned for the forthcoming period include:

6.5.1 Land and on farm management committee

The Land and on farm management committee operated during 2007, with three meetings conducted during the year. The committee identified a range of initiatives which it is pursuing to assist with the management of soils in the irrigation district. These are;

- Establish 6 key demonstration sites where "best practices" can be deployed and communicated
- Establish a newsletter promoting best practices in recycled water management
    - Salinity management
    - Leaching practices
    - Nitrate management
    - Phosphorous management
    - Gypsum application
- Committee to meet with fertiliser manufacturer to discuss recycled water fertiliser requirements (lower salts)
- Consultant assessment of those sites who have remained at baseline to determine common practices
- Monitoring of additional sites for common chemical properties as recycled water users
    - Non recycled water customers
    - Fallow land for last 3 years
- Exploration of small scale desalination
- Explore options with Melbourne Water for increased volumes of recycled water to increase leaching practices

Members of the committee (DPI and DSE) made two submissions for funding of the six demonstration sites which the committee believes is the best way of bringing about changes in on farm management in the irrigation district. A separate funding application is expected to be made for the establishment of a small scale desalination plant.

6.5.2 Provision of Thomson Water for shandying with recycled water

As part of our drought contingency plan, Southern Rural Water secured 1,000 ML of water from the Macalister Irrigation District for supply to the Werribee Irrigation District as part of a strategy to both reduce the salinity of the recycled water and increase the volume of water for increased production and improved leaching.

Considerable work was undertaken with DSE, Melbourne Water and City West water to develop and agree on the architecture of the system. On 21 December 2008, the Managing Director of Southern Rural Water signed a qualification of rights on the Werribee system to facilitate the supply of this water. An allocation process was undertaken and water delivery commenced on 7 January 2008, with steady flows of about 15ML per day being shandied with 60ML day of recycled water shortly thereafter.

6.5.3 Reduction in outfalls

During the 2007 calendar year we established a major effort toward reducing the level of outfalls from the irrigation district and into the bay. This has the dual benefit of increasing the water available for productive use, and reducing nutrient runoff into the bay. For the second half of the year, outfalls were reduced from a 2006 level of 36.4ML to 12.8ML.

6.5.4 One on one discussion between Ag-Challenge and customers on annual soil results

Under the REIP, each customer is required to undertake and annual soil sample and receive a report on the results of this work. While some customers are making use of this data, we believe a one on one conversation between Ag-Challenge and the farmer would vastly improve the understanding of the soil data results and the resulting actions that can be taken to address any issues.

We will be exploring that as part of the 2008 soil testing program.

6.5.5 New sampling and monitoring

To assist in the analysis of future crop incidents, river water samples are being retained to aid in the investigation of incidents where shandied or straight recycled water has been supplied.

Furthermore, Southern Rural Water installed two additional drainage flow and water quality monitoring sites within the district, to provide additional water quality data. The existing monitoring site on drain 5 has a drainage area of 20% of the district providing a good representation of the total area. The installation of two more monitoring sites within drain 6 and drain 11 catchments will represent a greater percentage of the district, thereby leading to a more accurate determination of overall water quality and flow characteristics. These sites have been operational since April 2007 with results to be used for 2008 load calculations.

6.5.6 Groundwater investigations

Given the interdependency of channel water, rainfall and groundwater resources within the district, a key step in increasing our management capability is to understand how water moves into, within, and out of the district. During 2007, the Department of Primary Industries and Southern Rural Water are conducting a detailed geochemical-isotopic analysis of the groundwater and surface waters in the Deutgam WSPA and Werribee Irrigation District. The proposal is an investigation into age of the water, and interactions between channel water, the river, the coast and the aquifer. Results of the study will become available during 2008.

6.5.6 Western Irrigation Futures

In both the Werribee and Bacchus Marsh Irrigation Districts there are powerful drivers to develop a detailed long-term strategic infrastructure investment plan for SRW's irrigation supply system. The Western Irrigation Futures Project will develop a strategy addressing these drivers commensurate with the financial capacity of current and prospective customers and third-party investors and the repayment period for which SRW can be confident.

The Western Irrigation Futures Strategy is expected to outline a plan for SRW's investment in water supply and distribution in BMID and WID.

In doing so, it is expected to explain:

- the context for the plan:
    - relevant characteristics of BMID and WID;
    - key drivers for change;
    - why particular choices are preferred; and
- to confirm how it:
    - is aligned with agreed expectations of major stakeholders;
    - can be afforded by customers and third-party investors;
    - has an implementation and funding horizon in which we have confidence;
    - will provide for sustainable environmental and production performance.

A full copy of the draft terms of reference is outlined in attachment 6.

6.4 <u>SPLIT RUNNING</u>

Several refinements were made to the split running schedule, which were issued to the customers in line with the REIP requirements – providing 21 days notice.

7. APPENDIX 1: RECYCLED WATER DELIVERY AND QUALITY

Mixed Water Supply Period

Start date	End Date	Operating Mode	Actual River Volume	Actual Recycled Volume	Seasonal allocation %	Shandy Limit EC	Max EC Main Channel	Max EC Spur 4/1	River EC
06.01.2007 07:00:01	12.01.2007 07:00	MIXED	40	331.600	10	1800+	1970	1850	2288
13.01.2007 0700:01	19.01.2007 07:00:00	MIXED	38	330.3	10	1800+	2430	1780	2255
20.01.2007 07:00:01	26.01.2007 07:00:00	MIXED	10	319	10	1800+	2000	1820	2346
27.01.2007 07:00:01	02.02.2007 07:00:00	MIXED	9	329.7	10	1800+	2010	1850	2380
03.02.2007 07:00:01	09.02.2007 07:00:00	MIXED	35	330.1	10	1800+	2030	1800	2550
10.02.2007 07:00:01	16.02.2007 07:00:00	MIXED	16	322.4	10	1800+	2000	1860	2312
17.02.2007 07:00:01	23.02.2007 07:00:00	MIXED	24	328.1	10	1800+	1980	1900	2400
24.02.2007 07:00:01	2.03.2007 07:00:00	MIXED	0	321.8	10	1800+	2060	2370	2435
03.03.2007 07:00:01	09.03.2007 07:00:00	MIXED	51	295	10	1800+	1960	2400	2425
10.03.2007 07:00:01	16.03.2007 07:00:00	MIXED	13.8	327.8	10	1800+	1970	2370	2220
17.03.2007 07:00:01	23.03.2007 07:00:00	MIXED	0	330.3	10	1800+	1980	2190	2225
24.03.2007 07:00:01	30.03.2007 07:00:00	MIXED	76	257.5	10	1800+	1990	2350	2380

Start date	End Date	Operating Mode	Actual River Volume	Actual Recycled Volume	Seasonal allocation %	Shandy Limit EC	Max EC Main Channel	Max EC Spur 4/1	River EC
31.03.2007 07:00:01	06.04.2007 07:00:00	MIXED	4	303.9	10	1800+	1990	2470	2245
07.04.2007 07:00:01	13.04.2007 07:00:00	MIXED	5	345.9	10	1800+	1970	2500	2517
14.04.2007 07:00:01	20.04.20007 07:00:00	MIXED	10.5	332.6	10	1800+	1950	2500	2400
21.04.2007 07:00:01	27.04.2007 07:00:00	MIXED	0	300.1	10	1800+	1930	2000	2539
28.04.2007 07:00:01	04.05.2007 07:00:00	MIXED	6	152.5	10	1800+	1950	2200	2438
05.05.2007 07:00:01	11.05.2007 07:00:00	MIXED	10	127.2	10	1800+	2700	2460	2419
12.05.2007 07:00:01	18.05.2007 07:00:00	MIXED	12	182	10	1800+	1900	2640	2660
26.05.2007 07:00:01	01.065.2007 07:00:00	MIXED	24.5	188	10	1800+	1870	2600	2582
02.06.2007 07:00:01	08.06.2007 07:00:00	MIXED	4	115.6	10	1800+	2800	2500	2580
09.06.2007 07:00:01	15.06.2007 07:00:00	MIXED	10	110	10	1800+	1820	2760	2600
16.06.2007 07:00:01	22.06.2007 07:00:00	MIXED	0	16	10	1800+	2010	2780	1950
23.06.2007 07:00:01	29.06.2007 07:00:00	MIXED	0	65.9	10	1800+	2630	2750	2700
07.07.2007 07:00:01	13.07.2007 07:00:00	MIXED	0	50.3	5	1800+	2920	3010	2134
21.07.2007 07:00:01	27.07.2007 07:00:00	MIXED	0	58.2	5	1800+	2830	3030	2880

Start date	End Date	Operating Mode	Actual River Volume	Actual Recycled Volume	Seasonal allocation %	Shandy Limit EC	Max EC Main Channel	Max EC Spur 4/1	River EC
28.07.2007 07:00:01	03.08.2007 07:00:00	MIXED	0	55.6	5	1800+	1900	2780	2840
04.08.2007 07:00:01	10.08.2007 07:00:00	MIXED	5.8	178.4	5	1800+	1750	2830	2855
11.08.2007 07:00:01	17.08.2007 07:00:00	MIXED	0	174.9	5	1800+	1710	1900	2730
18.08.2007 07:00:01	24.08.2007 07:00:00	MIXED	5.4	186.7	5	1800+	2850	2640	2650
25.08.2007 07:00:01	31.08.2007 07:00:00	MIXED	10.2	210.5	5	1800+	1660	2410	2600
01.09.2007 07:00:01	07.09.2007 07:00:00	MIXED	10.5	207.8	5	1800+	1840	2500	2435
08.09.2007 07:00:01	14.09.2007 07:00:00	MIXED	0	214	5	1800+	2400	2000	2360
15.09.2007 07:00:01	21.09.2007 07:00:00	MIXED	15.7	203.1	5	1800+	1890	2400	2500
22.09.2007 07:00:01	28.09.2007 07:00:00	MIXED	15	207.1	5	1800+	1930	2460	2400
29.09.2007 07:00:01	05.10.2007 07:00:00	MIXED	0	319.8	5	1800+	1960	2150	2460
06.10.2007 07:00:01	12.10.2007 07:00:00	MIXED	2	319.4	5	1800+	1970	2210	2460
13.10.2007 07:00:01	19.10.2007 07:00:00	MIXED	0	321	5	1800+	2000	2100	2454
20.10.2007 07:00:01	26.10.2007 07:00:00	MIXED	9	333	5	1800+	2020	2160	2470
27.10.2007 07:00:01	02.11.2007 07:00:00	MIXED	0	330.6	5	1800+	2030	2250	2580

Start date	End Date	Operating Mode	Actual River Volume	Actual Recycled Volume	Seasonal allocation %	Shandy Limit EC	Max EC Main Channel	Max EC Spur 4/1	River EC
03.11.2007 07:00:01	09.11.2007 07:00:00	MIXED	0	220.5	5	1800+	1970	2410	2450
10.11.2007 07:00:01	16.11.2007 07:00:00	MIXED	20	328.2	5	1800+	1970	2600	2602
17.11.2007 07:00:01	23.11.2007 07:00:00	MIXED	4	329	5	1800+	1960	2350	2710
24.11.2007 07:00:01	30.11.2007 07:00:00	MIXED	0	332	5	1800+	1940	2240	2505
01.12.2007 07:00:01	07.12.2007 07:00:00	MIXED	0	319.2	5	1800+	2120	2090	2770
08.12.2007 07:00:01	14.12.2007 07:00:00	MIXED	3	338.7	5	1800+	1960	1940	2740
14.12.2007 07:00:01	21.12.2007 07:00:00	MIXED	0	366.2	5	1800+	1900	2800	2600
21.12.2007 07:00:01	28.12.2007 07:00:00	MIXED	0	191.3	5	1800+	1930	2210	2793
28.12.2007 07:00:01	04.01.2008 07:00:00	MIXED	257	100.6	5	1800+	2750	3200	3100

8. APPENDIX 2: BASELINE SOIL DATA

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Light Clay	8.0	7.5	40	560	1.7	11	3.0	2.0	140	0.48	6.3	17.7	3.7	1.8	3.6	11	180	2	Partial	<0.2
Light Clay	8.0	7.5	39	160	1.6	9	3.4	3.1	240	0.59	4.6	17.1	2.6	2.1	4.4	18	140	7	considerable	<0.2
Light Clay	7.9	7.3	42	30	1.2	7	3.9	2.8	300	0.55	3.0	14.9	1.8	3.3	4.1	19	97	3	considerable	<0.2
Clay Loam	9.1	8.2	16	550	1.5	11	5.9	3.7	270	0.51	5.9	22.1	1.9	3.9	4.1	17	220	9	considerable	0.4
Light Clay	8.4	7.6	17	150	1.9	8	6.3	5.7	360	0.58	5.6	21.9	1.3	3.3	4.3	26	230	13	considerable	0.3
Light Clay	8.9	8.2	28	15	0.5	8	4.0	3.7	320	0.53	1.8	16.2	2	7.5	3.9	23	60	8	considerable	<0.2
Clay Loam	8.5	7.7	5.4	430	1.2	11	1.9	0.5	18	0.15	4.4	14.6	5.8	1.6	1.2	3.6	150	5	considerable	<0.2
Light Clay	8.0	7.3	6.8	110	2.3	15	4.3	1.7	100	0.32	4.4	23.3	3.5	1.9	2.4	7.3	300	11	considerable	0.3
Light Clay	8.3	7.9	37	7	0.7	12	6.7	1.7	140	0.59	5.0	21.1	1.8	9.2	4.4	8.1	160	0	partial	<0.2
Clay Loam	8.0	7.6	33	470	1.6	13	2.7	0.9	63	0.49	4.1	18.2	4.8	1.7	3.9	5	150	0	Partial	<0.2
Clay Loam	8.0	7.5	28	320	1.2	12	2.8	1.6	75	0.52	3.9	17.6	4.3	2.3	4.2	9.1	150	1	Partial	0.4
Clay Loam	8.2	7.8	40	22	1.0	16	6.3	2.2	160	0.63	3.9	25.5	2.5	6.3	5.0	8.6	150	0	Partial	<0.2
Clay Loam	7.1	6.8	260	500	1.7	9	2.2	0.7	60	0.74	4.8	13.6	4.1	1.3	5.9	5.1	110	0	Partial	0.2
Clay Loam	7.8	7.2	48	190	0.9	6	1.8	1.5	64	0.31	3.3	10.2	3.3	2.1	2.5	15	83	6	Partial	<0.2
Clay Loam	7.7	7.2	54	26	0.9	9.5	7.1	2.7	180	0.58	6.1	20.2	1.3	8.4	4.6	13	140	0	Partial	<0.2
Sandy Clay Loam	7.5	7.3	120	530	1.2	12	1.7	1.1	210	1.15	3.4	16.0	7.1	1.4	10.2	6.9	110	0	considerable	<0.2
Light Clay	7.8	7.5	54	230	1.8	8.5	2.6	2.0	280	0.91	5.2	14.9	3.3	1.4	6.7	13	120	0	considerable	<0.2
Light Clay	7.9	7.6	51	12	0.8	11	5.8	2.2	270	0.73	4.0	19.8	1.9	7.7	5.4	11	95	2	considerable	<0.2
Light Clay	7.9	7.5	19	420	1.2	10	2.0	0.7	50	0.44	3.8	13.9	5	1.7	3.3	5	140	0	considerable	0.2
Light Clay	7.7	7.1	7.7	310	1.1	9.5	2.4	1.3	62	0.29	3.9	14.3	4	2.2	2.1	9.1	150	40	Partial	<0.2
Light Clay	7.5	7.1	15	23	0.8	10	5.7	1.7	100	0.45	5.0	18.2	1.8	7.4	3.3	9.3	130	0	considerable	<0.2
Clay Loam	7.8	7.4	13	480	1.2	11	1.9	0.4	51	0.40	4.6	14.5	5.8	1.6	3.2	3	130	0	Partial	0.5
Clay Loam	7.7	7.2	16	150	1.3	8	2.2	1.0	77	0.28	4.0	12.5	3.6	1.7	2.2	7.7	100	5	Partial	<0.2
Medium Clay	8.0	7.6	36	7.5	1.1	11	8.2	1.8	160	0.59	5.4	22.1	1.3	7.5	3.7	8.1	100	0	considerable	0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Medium Clay	7.8	7.3	23	630	2.1	16	3.2	0.7	36	0.30	7.5	22.0	5	1.5	1.9	3	200	2	Partial	0.3
Medium Clay	7.9	7.4	44	23	1.8	15	5.4	2.5	130	0.53	6.2	24.7	2.8	3.0	3.3	10	210	7	considerable	0.3
Medium Clay	8.5	8.1	44	7.7	1.0	23	9.9	2.0	200	0.65	4.8	35.9	2.3	9.9	4.0	5.6	85	0	Partial	<0.2
Clay Loam	8.1	7.5	5.3	460	1.1	11	2.4	0.4	12	0.16	3.7	14.9	4.6	2.2	1.3	2.9	120	5	Partial	0.4
Light Clay	8.3	7.5	6.9	25	1.4	13	4.9	2.6	82	0.30	5.4	21.9	2.7	3.5	2.2	12	240	14	Partial	0.4
Light Clay	8.6	8.2	32	6	0.7	22	8.2	2.5	140	0.56	6.3	33.1	2.7	12.6	4.1	7.5	120	0	Partial	<0.2
Medium Clay	7.9	7.4	7.7	78	1.7	13	9.9	2.7	190	0.44	4.9	27.3	1.3	5.8	2.7	9.9	200	9	partial	<0.2
Medium Clay	8.1	7.4	9.7	37	1.9	10	13.0	6.1	340	0.65	9.7	31.0	0.77	6.8	4.0	20	220	14	Partial	<0.2
Medium Clay	8.8	8.3	2.7	<5	1.8	4.4	16.0	11.0	120	0.80	12.0	33.2	0.28	8.9	5.0	33	140	14	considerable	<0.2
Light Clay	7.4	6.9	74	120	1.1	11	4.9	1.2	120	0.32	2.8	18.2	2.2	4.5	2.4	6.6	96	2	Partial	<0.2
Light Clay	6.9	6.4	58	21	0.8	7.5	6.2	1.9	150	0.40	2.6	16.4	1.2	7.8	3.0	12	190	5	considerable	0.4
Medium Clay	7.9	7.5	130	5.8	1.6	6.5	21.0	5.2	590	1.05	11.0	34.3	0.31	13.1	6.5	15	180	0	Water Stable	<0.2
Clay Loam	8.6	7.9	38	460	1.1	12	3.6	2.2	190	0.38	3.0	18.9	3.3	3.3	3.0	12	120	4	Partial	<0.2
Clay Loam	8.6	8.0	10	99	0.8	9	3.4	2.3	210	0.39	2.4	15.5	2.6	4.2	3.1	15	110	7	Partial	<0.2
Medium Clay	8.2	7.7	28	8.3	1.4	7.5	12.0	4.1	440	0.62	7.4	25.0	0.63	8.6	3.8	16	140	4	Partial	<0.2
Light Clay	8.3	7.7	58	500	2.4	17	5.8	2.2	120	0.45	3.7	27.4	2.9	2.4	3.3	8	190	2	Partial	<0.2
Light Clay	8.3	7.7	40	110	1.9	14	5.9	3.3	220	0.51	2.3	25.1	2.4	3.1	3.8	13	220	7	Partial	0.2
Medium Clay	7.6	7.2	29	10	1.7	10	14.0	4.4	630	0.91	5.2	30.1	0.71	8.2	5.6	15	320	0	Partial	<0.2
Clay Loam	8.3	7.8	68	170	1.2	16	4.3	1.4	120	0.40	3.5	22.9	3.7	3.6	3.2	6.1	130	2	Partial	0.3
Light Clay	8.6	7.7	5.2	21	0.7	9	3.6	1.9	56	0.20	2.1	15.2	2.5	5.0	1.5	13	150	15	Partial	<0.2
Light Clay	7.9	7.3	17	13	0.6	8	6.7	2.3	230	0.45	1.8	17.6	1.2	10.8	3.3	13	160	6	Partial	<0.2
Clay Loam	8.0	7.6	30	480	1.1	14	3.4	1.4	120	0.48	3.0	19.9	4.1	3.1	3.8	7	160	2	Partial	<0.2
Clay Loam	8.6	7.9	9.6	91	0.6	8.5	3.8	3.0	110	0.44	2.0	15.9	2.2	6.8	3.5	19	160	13	considerable	0.2
Clay Loam	8.5	8.0	26	27	0.4	19	5.2	3.1	390	0.71	2.0	27.7	3.7	14.4	5.7	11	91	4	considerable	<0.2
Clay Loam	8.4	7.7	64	980	2.0	15	4.8	3.2	350	0.65	3.3	25.0	3.1	2.4	5.2	13	270	6	considerable	<0.2
Clay Loam	8.3	7.8	79	470	2.5	14	6.1	5.2	630	0.92	2.9	27.8	2.3	2.4	7.4	19	290	10	considerable	<0.2
Light Clay	8.4	8.0	81	41	0.7	17	4.7	4.0	680	0.93	2.2	26.4	3.6	6.6	6.9	15	100	2	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Clay Loam	8.3	7.7	66	840	2.3	14	5.9	3.2	220	0.62	6.4	25.4	2.4	2.6	5.0	13	270	10	considerable	<0.2
Light Clay	8.3	7.6	51	63	1.2	7	4.5	3.1	210	0.52	3.8	15.8	1.6	3.8	3.8	20	110	12	considerable	<0.2
Light Clay	8.6	8.1	56	15	0.7	21	7.9	3.5	380	0.71	4.9	33.0	2.7	12.2	5.3	11	120	2	Partial	<0.2
Light Clay	8.4	7.7	36	800	1.9	16	4.5	1.4	57	0.31	3.1	23.8	3.6	2.4	2.3	5.9	210	5	considerable	0.3
Light Clay	8.4	7.8	46	270	1.6	12	5.5	2.9	230	0.54	2.5	22.0	2.2	3.4	4.0	13	260	7	considerable	<0.2
Light Clay	8.1	7.6	52	21	0.5	7	4.5	2.4	420	0.59	2.0	14.4	1.6	8.7	4.4	17	73	2	considerable	<0.2
Clay Loam	8.0	7.4	31	760	1.7	14	3.3	1.2	81	0.33	4.1	20.2	4.2	1.9	2.6	5.9	210	1	considerable	0.2
Light Clay	8.0	7.4	35	210	1.5	13	4.9	3.7	200	0.64	4.1	23.1	2.7	3.3	4.7	16	240	6	considerable	<0.2
Light Clay	8.0	7.6	25	21	0.6	11	4.8	2.5	400	0.71	3.1	18.9	2.3	8.0	5.3	13	82	2	considerable	<0.2
Light Clay	7.9	7.2	14	640	1.2	9	2.6	0.7	44	0.21	2.9	13.4	3.5	2.2	1.6	4.9	140	3	Water stable	0.2
Light Clay	7.9	6.9	25	380	1.1	8	3.7	2.3	47	0.25	3.0	15.1	2.2	3.4	1.9	15	160	5	considerable	<0.2
Clay Loam	7.6	6.9	29	13	0.3	6.5	2.6	1.6	170	0.32	1.5	11.0	2.5	8.1	2.6	15	57	0	Water stable	<0.2
Clay Loam	8.1	7.4	7	470	1.4	8.5	2.1	0.9	58	0.22	3.0	12.9	4	1.5	1.8	6.7	110	5	considerable	<0.2
Light Clay	8.0	7.3	34	140	1.1	8	3.0	2.3	150	0.39	2.4	14.4	2.7	2.7	2.9	16	120	6	considerable	<0.2
Medium Clay	8.2	7.8	49	35	0.6	16	5.3	2.2	280	0.61	2.7	24.1	3	9.5	3.8	9.1	110	0	Partial	<0.2
Silty Loam	7.9	7.4	34	850	1.2	12	2.3	0.7	69	0.39	2.8	16.2	5.2	1.9	3.5	4.6	190	0	considerable	<0.2
Silty Loam	8.4	7.7	13	600	0.6	7.5	2.1	1.2	71	0.28	1.9	11.4	3.6	3.3	2.5	11	140	2	Partial	0.3
Light Clay	7.0	6.6	25	200	1.3	7	3.5	2.7	380	0.72	2.5	14.5	2	2.7	5.3	19	97	1	considerable	<0.2
Light Clay	8.3	7.7	20	570	1.3	13	3.2	0.8	41	0.25	2.7	18.3	4.1	2.5	1.9	4.5	170	2	considerable	<0.2
Light Clay	7.9	7.3	15	50	1.7	10	6.3	2.7	89	0.42	3.0	20.7	1.6	3.7	3.1	13	310	2	Partial	<0.2
Light Clay	8.3	7.9	36	13	0.8	12	4.7	1.7	210	0.50	2.7	19.2	2.6	5.8	3.7	8.9	120	0	considerable	<0.2
Light Clay	8.3	7.7	9.4	750	1.4	15	3.5	1.0	38	0.26	2.7	20.9	4.3	2.5	1.9	4.6	190	2	considerable	0.5
Light Clay	8.3	7.7	31	280	1.1	11	5.4	2.5	130	0.49	2.1	20.0	2	4.9	3.6	13	200	0	Partial	<0.2
Light Clay	7.9	7.5	55	13	0.4	8	3.4	1.7	280	0.50	1.6	13.5	2.4	8.1	3.7	13	67	3	considerable	<0.2
Light Clay	8.4	7.8	58	470	1.3	12	4.4	2.5	190	0.44	3.3	20.2	2.7	3.4	3.3	12	220	5	Partial	<0.2
Light Clay	7.8	7.1	40	32	0.7	9	4.9	3.7	240	0.54	3.0	18.3	1.8	7.3	4.0	20	150	9	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Light Clay	8.6	8.1	54	22	0.4	12	3.9	2.5	380	0.56	1.3	18.8	3.1	11.1	4.1	13	68	2	considerable	<0.2
Light Clay	7.9	7.1	16	600	1.7	10	3.7	2.3	97	0.32	5.0	17.7	2.7	2.2	2.4	13	180	8	Partial	0.3
Light Clay	7.8	6.9	8.8	160	1.7	10	4.5	3.1	130	0.34	4.5	19.3	2.2	2.6	2.5	16	180	13	Partial	<0.2
Clay Loam	8.6	8.0	26	22	0.4	17	4.0	2.1	190	0.44	1.6	23.5	4.3	9.3	3.5	8.9	82	1	Partial	0.2
Light Clay	7.9	7.5	15	240	1.6	15	4.0	0.8	48	0.29	3.3	21.4	3.8	2.5	2.1	3.9	210	0	partial	<0.2
Medium Clay	7.2	6.9	18	69	1.9	14	6.7	1.7	210	0.57	3.7	24.3	2.12	3.5	3.5	7	360	0	partial	<0.2
Medium Clay	8.3	7.8	16	6.8	1.8	7.5	17.0	4.2	310	0.70	12.0	30.5	0.44	9.4	4.3	14	160	10	Partial	<0.2
Medium Clay	8.2	7.5	26	370	1.3	13	4.2	1.6	73	0.27	3.4	20.1	3.1	3.2	1.7	8	170	7	Partial	0.2
Medium Clay	8.2	7.5	27	84	0.7	12	5.3	2.7	70	0.30	3.5	20.7	2.3	7.9	1.9	13	180	14	considerable	<0.2
Light Clay	8.6	8.1	19	19	0.5	19	7.1	2.3	280	0.58	2.3	28.9	2.7	13.4	4.3	8	88	0	considerable	<0.2
Clay Loam	8.0	7.4	42	410	1.2	11	3.4	1.1	79	0.27	3.1	16.7	3.2	2.8	2.2	6.6	140	4	Partial	0.2
Medium Clay	8.1	7.3	31	150	0.7	11	4.6	2.7	82	0.28	3.7	19.0	2.4	6.3	1.7	14	210	14	Partial	0.5
Light Clay	8.6	8.1	10	11	0.6	19	6.9	2.3	270	0.52	2.5	28.8	2.8	12.1	3.8	8	83	0	Partial	<0.2
Clay Loam	7.6	7.2	83	710	1.7	19	2.6	1.0	120	0.85	3.8	24.3	7.3	1.5	6.8	4.1	180	0	partial	<0.2
Clay Loam	7.5	7.1	39	190	1.4	11	2.6	1.3	100	0.58	2.5	16.3	4.2	1.9	4.6	8	130	2	considerable	<0.2
Silty Loam	8.3	7.9	46	16	0.5	16	3.4	1.2	100	0.51	1.2	21.1	4.7	6.3	4.5	5.7	51	2	considerable	0.4
Clay Loam	7.7	7.4	9.3	440	1.3	17	2.2	0.7	100	0.77	3.0	21.2	7.7	1.7	6.2	3.5	110	0	considerable	<0.2
Silty Loam	7.8	7.3	12	120	0.8	6.5	1.4	0.6	85	0.44	1.6	9.3	4.6	1.8	3.9	6.6	61	0	considerable	<0.2
Clay Loam	8.4	8.0	90	23	0.6	23	8.2	2.4	160	0.81	2.7	34.2	2.8	14.9	6.5	7	160	2	considerable	<0.2
Light Clay	8.8	8.3	21	450	1.3	10	4.4	5.2	900	1.00	4.0	20.9	2.3	3.4	7.4	25	150	4	considerable	0.3
Light Clay	8.4	7.8	31	280	1.4	8	4.6	4.8	710	0.87	3.5	18.8	1.7	3.3	6.4	26	130	6	considerable	0.2
Light Clay	7.8	7.3	38	13	0.5	5.5	6.8	5.7	690	0.86	2.2	18.5	0.81	14.2	6.4	31	140	2	considerable	<0.2
Light Clay	7.4	6.7	31	270	0.5	7.5	2.9	2.4	250	0.41	2.5	13.3	2.6	5.6	3.0	18	130	8	considerable	<0.2
Light Clay	7.6	7.0	42	400	0.7	7.5	2.4	1.6	150	0.32	2.3	12.2	3.1	3.3	2.4	13	110	6	considerable	<0.2
Light Clay	8.0	7.4	31	9.7	0.5	4.8	6.4	2.8	340	0.50	6.5	14.5	0.75	12.1	3.7	19	120	7	considerable	<0.2
Light Clay	8.0	7.2	19	270	1.0	7.5	3.5	2.6	160	0.37	3.0	14.6	2.1	3.5	2.7	18	140	8	considerable	0.3

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Light Clay	7.5	6.8	28	28	0.6	6	3.7	3.2	260	0.55	1.7	13.5	1.6	6.6	4.1	24	130	7	considerable	<0.2
Light Clay	7.4	6.8	39	39	0.6	6	5.7	3.7	420	0.71	2.4	16.0	1.1	9.0	5.3	23	110	3	considerable	<0.2
Clay Loam	7.9	7.1	8.1	440	0.9	6	2.5	1.6	59	0.27	3.0	11.0	2.4	2.9	2.2	15	120	7	considerable	0.3
Light Clay	7.3	6.5	23	130	0.9	6.5	3.5	3.6	230	0.58	3.6	14.5	1.9	3.9	4.3	25	160	9	considerable	<0.2
Light Clay	8.4	7.9	36	11	0.9	16	8.2	3.6	380	0.76	6.0	28.7	2	9.5	5.6	13	130	2	considerable	<0.2
Light Clay	8.5	8.0	7.8	450	1.4	14	2.8	1.2	170	0.41	4.0	19.4	5	2.0	3.0	6.2	200	8	considerable	0.3
Light Clay	8.5	7.8	6.5	53	1.6	11	4.6	3.0	140	0.52	2.3	20.2	2.4	2.9	3.8	15	260	7	considerable	<0.2
Light Clay	8.7	8.2	13	43	0.8	19	6.3	3.5	340	0.69	2.9	29.6	3	8.1	5.1	12	100	2	considerable	<,0.2
Clay Loam	8.1	7.7	55	800	1.2	14	3.3	1.1	280	0.47	2.5	19.6	4.2	2.8	3.8	5.6	180	2	considerable	0.4
Clay Loam	8.4	8.0	18	490	0.7	11	2.9	1.3	280	0.43	1.8	15.9	3.8	4.1	3.4	8.2	130	4	considerable	0.4
Clay Loam	8.3	7.9	18	87	1.6	10	5.8	2.0	410	0.61	6.2	19.4	1.7	3.6	4.9	10	140	2	considerable	<0.2
Light Clay	7.9	7.4	40	620	2.1	18	4.4	1.0	100	0.37	3.0	25.5	4.1	2.1	2.7	3.9	220	2	partial	0.4
Light Clay	7.8	7.4	25	23	2.1	17	7.5	2.3	120	0.56	3.7	28.9	2.3	3.6	4.1	8	380	2	considerable	<0.2
Light Clay	8.1	7.8	33	12	1.3	12	16.0	2.8	520	1.00	9.0	32.1	0.75	12.3	7.4	8.7	160	0	partial	<0.2
Light Clay	8.5	7.7	13	260	1.5	10	4.1	1.8	130	0.30	2.6	17.4	2.4	2.7	2.2	10	140	6	considerable	0.3
Light Clay	7.9	7.3	24	44	1.9	8	4.6	3.0	370	0.55	1.5	17.5	1.7	2.4	4.4	17	330	9	considerable	<0.2
Light Clay	7.4	7.0	40	7.4	1.1	6	12.0	2.7	570	0.68	2.8	21.8	0.5	10.9	5.0	12	210	0	partial	<0.2
Silty Loam	8.1	7.5	15	390	1.3	11	5.1	1.5	200	0.33	2.8	18.9	2.2	3.9	2.9	7.9	150	2	partial	<0.2
Clay Loam	8.5	7.6	6	30	0.5	7.5	3.8	2.1	140	0.26	1.6	13.9	2	7.5	2.1	15	170	10	considerable	0.4
Light Clay	7.8	7.2	15	24	0.8	7.5	6.5	2.9	320	0.41	1.4	17.7	1.2	8.2	3.0	16	210	9	considerable	<0.2
Silty Loam	7.7	7.5	89	330	1.9	14	4.6	1.7	280	1.12	3.0	22.2	3	2.4	10.0	7.7	140	0	considerable	0.5
Light Clay	8.0	7.6	49	70	1.6	9.5	5.0	2.0	250	0.67	2.4	18.1	1.9	3.1	5.0	11	260	0	considerable	<0.2
Light Clay	7.6	7.2	68	11	2.2	7	12.0	3.8	580	0.92	3.8	25.0	0.58	5.5	6.8	15	280	0	n/a	<0.2
Clay Loam	8.0	7.8	11	420	1.0	14	3.5	1.5	99	0.68	2.7	20.0	4	3.5	5.4	7.5	150	0	considerable	0.3
Light Clay	8.8	7.9	5.3	42	0.5	7	3.6	2.6	80	0.34	1.8	13.7	1.9	7.7	2.5	19	120	12	considerable	0.3
Clay Loam	8.8	8.3	13	5.7	0.3	7.5	3.9	2.5	290	0.54	1.4	14.2	1.9	11.8	4.3	18	54	2	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
	8.0	7.6	8.1	480	0.9	11	2.7	1.5	160	0.65	2.4	16.1	4.1	3.1	5.8	9.3	130	0	considerable	<0.2
Silty Loam	8.5	7.8	9.9	140	0.7	7.5	2.6	2.4	130	0.41	1.9	13.2	2.9	3.6	3.6	18	110	10	considerable	0.2
Clay Loam	8.5	8.0	30	12	0.4	18	3.5	2.9	290	0.60	1.8	24.8	5.1	8.5	4.8	12	94	0	considerable	0.3
Light Clay	7.7	7.3	21	510	1.3	9.5	3.1	1.0	110	0.58	3.1	14.9	3.1	2.4	4.3	6.7	130	0	considerable	0.4
Light Clay	8.4	7.5	11	200	0.9	6	3.8	2.3	90	0.29	3.2	12.0	2.1	4.2	2.1	19	130	12	considerable	<0.2
Light Clay	7.8	7.0	19	17	0.8	5.5	3.2	2.8	360	0.46	2.1	12.3	1.7	4.1	3.4	23	61	8	Partial	<0.2
Clay Loam	8.0	7.5	42	490	0.7	5.5	1.9	1.7	240	0.49	2.8	9.8	2.9	2.6	3.9	17	100	2	considerable	<0.2
Sandy Loam	7.6	7.0	25	98	0.4	1.9	1.1	1.6	260	0.36	1.3	5.0	1.7	2.8	3.7	32	33	8	considerable	<0.2
Sandy Loam	8.5	8.1	37	12	1.4	11	9.1	3.7	460	0.75	5.8	25.2	1.2	6.5	7.7	15	94	2	Partial	<0.2
Light Clay	8.0	7.4	47	430	1.3	9	2.7	1.7	180	0.40	2.7	14.7	3.3	2.1	3.0	12	130	6	considerable	<0.2
Light Clay	7.6	6.9	18	43	1.5	9.5	4.6	3.6	210	0.53	2.8	19.2	2.1	3.1	4.2	19	260	14	considerable	<0.2
Light Clay	8.2	7.9	18	16	0.9	16	9.1	2.7	360	0.67	5.9	28.7	1.8	10.2	5.0	9.4	150	2	considerable	0.2
Clay Loam	8.2	7.7	62	460	1.0	10	2.2	1.0	130	0.37	3.5	14.2	4.5	2.2	3.0	7	120	3	considerable	<0.2
Clay Loam	8.0	7.6	55	55	1.4	10	7.2	4.8	230	0.85	3.8	23.4	1.4	5.1	6.8	21	270	6	considerable	<0.2
Clay Loam	8.6	8.2	44	15	0.6	11	8.2	3.3	420	0.71	5.0	23.1	1.3	14.1	5.7	14	100	0	considerable	<0.2
Light Clay	7.4	6.9	35	240	1.0	8	3.5	1.2	110	0.28	2.8	13.7	2.3	3.6	2.1	8.8	97	5	Partial	0.7
Light Clay	7.4	6.7	31	96	0.8	9	5.0	2.0	160	0.33	3.7	16.8	1.8	6.0	2.4	12	150	11	Partial	0.2
Clay Loam	8.4	8.0	14	21	0.5	14	8.1	2.5	440	0.63	3.1	25.1	1.7	15.6	5.0	10	190	1	considerable	<0.2
Clay Loam	7.6	7.1	120	230	1.2	7	2.3	1.0	95	0.35	4.0	11.5	3	1.9	2.8	8.3	97	4	Partial	<0.2
Light Clay	8.0	7.2	25	110	0.9	8.5	2.4	2.3	120	0.30	4.4	14.1	3.5	2.6	2.2	16	130	11	Partial	<0.2
Clay Loam	8.3	7.9	6.6	34	0.8	16	3.5	2.1	370	0.56	2.2	22.4	4.6	4.5	4.5	9.4	63	2	considerable	<0.2
Light Clay	7.7	7.1	21	230	0.8	8	3.1	1.3	86	0.25	2.0	13.2	2.6	3.7	1.9	9.8	86	5	considerable	0.2
Light Clay	7.2	6.6	13	29	0.9	9.5	5.3	2.4	250	0.37	2.8	18.1	1.8	6.2	2.7	13	160	9	considerable	<0.2
Light Clay	8.5	8.1	7.6	14	0.6	23	8.1	2.7	430	0.69	2.7	34.4	2.8	14.0	5.1	7.8	220	0	considerable	<0.2
Light Clay	8.7	8.0	48	280	1.6	19	7.2	3.5	180	0.51	4.8	31.3	2.6	4.5	3.8	11	130	9	Partial	<0.2
Light Clay	9.0	8.3	19	83	0.6	19	8.2	5.2	390	0.67	3.4	33.0	2.3	13.0	5.0	16	140	6	considerable	<0.2
Light Clay	7.8	7.1	39	11	0.5	6	5.8	3.5	350	0.50	4.4	15.8	1	12.3	4.0	22	110	11	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Silty Loam	8.2	7.5	51	220	0.8	8	3.5	2.0	130	0.36	3.3	14.3	2.3	4.4	3.2	14	67	6	Partial	<0.2
Clay Loam	8.2	7.5	52	34	0.2	5	2.7	2.6	270	0.45	2.1	10.5	1.9	12.9	3.6	25	56	6	considerable	<0.2
Clay Loam	8.7	8.2	33	60	0.5	8.5	8.2	4.0	590	0.70	2.3	21.2	1	17.4	5.6	19	80	1	Partial	<0.2
Light Clay	8.4	7.8	16	360	1.5	12	2.3	1.1	110	0.28	4.2	16.9	5.2	1.5	2.1	6.5	160	2	partial	0.3
Medium Clay	8.3	7.5	15	61	1.6	12	4.2	2.7	100	0.33	4.2	20.5	2.9	2.6	2.0	13	310	12	partial	0.2
Light Clay	7.9	7.1	7.5	12	0.7	6.5	4.1	2.3	88	0.32	2.3	13.6	1.6	5.8	2.4	17	95	10	considerable	<0.2
Medium Clay	7.8	7.3	40	390	1.2	9	3.5	2.3	130	0.55	2.8	16.0	2.6	2.9	3.4	14	140	6	Partial	<0.2
Light Clay	7.6	6.8	14	63	0.8	7.5	4.8	5.2	190	0.51	3.1	18.3	1.6	5.9	3.8	28	330	16	considerable	<0.2
Medium Clay	7.6	7.0	4.2	26	0.8	6.5	7.4	2.9	330	0.47	5.2	17.6	0.88	9.1	2.9	16	120	9	considerable	<0.2
Light Clay	8.4	7.9	12	320	1.0	17	3.0	1.1	49	0.32	4.2	22.1	5.7	3.0	2.4	5	140	2	Partial	0.2
Light Clay	8.6	8.0	4	120	0.8	14	4.5	3.7	130	0.54	3.6	23.0	3.1	5.6	4.0	16	300	9	considerable	<0.2
Light Clay	8.1	7.2	6.3	9.4	0.6	6.5	4.9	3.4	230	0.39	4.4	15.4	1.3	8.8	2.9	22	120	12	considerable	<0.2
Clay Loam	8.3	7.9	55	360	1.5	15	2.6	1.6	190	0.75	2.7	20.7	5.8	1.7	6.0	7.7	150	0	considerable	0.6
Clay Loam	8.8	7.9	30	65	1.4	9	3.0	3.3	70	0.37	2.3	16.7	3	2.1	3.0	20	220	12	considerable	0.2
Clay Loam	8.1	7.4	16	6.4	0.5	4.9	2.9	2.6	230	0.43	2.0	10.8	1.7	6.4	3.4	24	62	10	considerable	<0.2
Clay Loam	8.2	7.8	66	400	1.9	18	3.5	1.8	190	0.85	4.2	25.2	5.1	1.8	6.8	7.1	220	0	partial	<0.2
Medium Clay	8.6	7.7	29	17	1.7	11	4.1	4.2	90	0.43	2.5	21.0	2.7	2.4	2.7	20	450	14	considerable	0.6
Medium Clay	8.5	7.7	12	11	0.4	6	3.0	2.2	210	0.30	2.1	11.6	2	7.7	1.9	19	62	10	considerable	<0.2
Clay Loam	8.0	7.4	6.4	480	0.7	8	3.3	1.2	140	0.26	2.8	13.2	2.4	5.0	2.1	9.1	130	4	considerable	0.3
Light Clay	8.1	7.2	4.8	330	0.7	7.5	3.8	2.1	110	0.26	3.5	14.1	2	5.2	1.9	15	140	12	considerable	<0.2
Light Clay	7.7	6.7	14	10	0.8	6.5	5.3	2.5	140	0.27	3.0	15.1	1.2	7.0	2.0	17	130	12	considerable	<0.2
Clay Loam	8.4	7.7	16	510	0.6	10	3.0	1.0	80	0.22	2.4	14.6	3.3	4.7	1.8	6.6	140	4	Partial	0.4
Clay Loam	8.3	7.5	10	340	0.4	7	2.9	1.4	82	0.23	2.4	11.7	2.4	6.9	1.8	12	110	10	considerable	0.2
Light Clay	8.4	7.6	12	10	0.5	8	4.5	2.5	210	0.36	2.2	15.5	1.8	8.7	2.7	16	95	9	considerable	<0.2
Light Clay	7.7	7.2	74	800	2.0	16	4.4	0.8	170	0.47	2.8	23.2	3.6	2.2	3.5	3.6	230	0	Partial	<0.2
Light Clay	7.9	7.3	52	220	1.2	13	5.8	1.5	67	0.36	3.1	21.5	2.2	4.8	2.7	7	220	2	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Medium Clay	8.3	7.9	45	15	1.2	22	11.0	2.4	360	0.72	8.6	36.6	2	9.2	4.5	6.6	280	0	Partial	0.3
Silty Loam	8.4	7.9	11	220	0.3	9.5	2.3	0.7	67	0.22	1.5	12.8	4.1	8.2	2.0	5.8	77	8	Partial	0.2
Clay Loam	8.2	7.6	21	20	0.5	9.5	6.8	2.5	200	0.50	3.3	19.3	1.4	13.1	4.0	13	300	10	considerable	<0.2
Light Clay	8.8	8.2	14	<.5	0.6	6	7.9	1.9	240	0.42	4.6	16.4	0.76	14.1	3.1	12	79.6	1	water stable	<0.2
Clay Loam	8.4	7.8	9.7	490	1.6	13	3.4	1.7	260	0.43	3.2	19.7	3.8	2.1	3.4	8.6	170	3	considerable	<0.2
Clay Loam	8.3	7.8	33	420	1.0	12	3.0	2.0	340	0.60	2.2	18.0	4	3.0	4.8	11	130	1	considerable	<0.2
Light Clay	8.0	7.5	51	16	0.6	8.5	7.2	2.8	340	0.65	3.9	19.1	1.2	12.2	4.8	15	140	1	considerable	<0.2
Light Clay	7.7	7.2	44	610	1.5	11	2.2	0.4	42	0.29	2.9	15.1	5	1.5	2.1	2.5	130	1	Partial	0.3
Silty Loam	8.1	7.6	67	200	0.3	5.5	1.6	0.8	37	0.26	1.4	8.3	3.4	5.0	2.3	10	62	0	Partial	<0.2
Light Clay	8.2	7.8	43	25	0.8	14	7.2	2.1	250	0.56	3.3	24.1	1.9	9.2	4.1	8.7	130	0	Partial	<0.2
Light Clay	8.2	7.7	31	290	0.9	13	3.0	1.4	110	0.38	3.5	18.3	4.3	3.3	2.8	7.7	120	4	Partial	<0.2
Light Clay	8.1	7.6	44	85	0.3	7	2.3	1.6	130	0.35	2.0	11.2	3	7.9	2.6	14	71	6	considerable	<0.2
Light Clay	7.8	7.3	61	10	0.5	5.5	6.5	2.6	260	0.56	5.8	15.1	0.85	12.3	4.1	17	140	4	considerable	<0.2
Clay Loam	8.0	7.5	39	420	1.1	11	2.8	0.7	75	0.27	2.6	15.6	3.9	2.5	2.2	4.5	110	2	Partial	0.3
Clay Loam	8.2	7.6	16	75	0.9	8.5	3.4	1.3	150	0.29	3.2	14.1	2.5	3.8	2.3	9.2	130	6	Partial	<0.2
Light Clay	8.6	8.1	4.4	5.6	0.6	18	9.1	1.7	280	0.49	4.5	29.4	2	14.4	3.6	5.8	110	0	considerable	<0.2
Clay Loam	7.4	6.6	9	350	0.3	6.5	2.6	1.7	120	0.25	1.8	11.1	2.5	9.0	2.0	15	100	6	considerable	<0.2
Light Clay	7.2	6.4	9.2	53	0.5	7	3.9	2.4	240	0.32	3.4	13.8	1.8	8.7	2.4	17	120	11	partial	<0.2
Clay Loam	8.5	8.0	35	13	0.9	21	9.1	2.5	370	0.59	5.9	33.5	2.3	9.9	4.4	7.5	130	2	considerable	0.3
Silty Loam	8.1	7.3	11	480	1.1	6.5	1.8	0.7	<10	0.16	2.0	10.1	3.6	1.6	1.4	6.9	110	6	considerable	0.5
Light Clay	7.6	6.8	24	160	1.8	9.5	4.0	2.2	110	0.30	3.2	17.5	2.4	2.2	2.2	13	190	11	considerable	<0.2
Clay Loam	8.3	7.9	86	12	0.9	11	4.1	1.4	340	0.58	1.6	17.4	2.7	4.8	4.6	8	50	0	considerable	<0.2
Light Clay	8.3	7.6	40	590	1.9	12	3.9	1.7	150	0.34	3.0	19.5	3.1	2.1	2.5	8.7	200	6	considerable	0.5
Clay Loam	7.3	6.7	53	420	0.7	6	1.9	1.1	170	0.31	1.0	9.7	3.2	2.6	2.5	11	88	2	considerable	0.4
Light Clay	7.2	6.7	47	55	1.0	6.5	3.5	1.2	150	0.29	1.5	12.2	1.9	3.5	2.1	9.8	73	4	considerable	<0.2
Clay Loam	8.4	7.8	20	140	0.9	9.5	2.6	0.5	31	0.18	1.9	13.5	3.7	3.0	1.4	3.9	85	2	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Clay Loam	7.7	7.0	30	6.4	0.6	9	5.7	1.8	97	0.27	2.9	17.0	1.6	10.4	2.2	11	190	12	considerable	<0.2
Clay Loam	8.4	8.0	60	8.3	0.8	13	9.9	1.7	260	0.53	5.6	25.4	1.3	12.7	4.2	6.7	110	2	considerable	<0.2
Light Clay	8.0	7.5	54	430	1.5	12	3.0	0.7	55	0.30	2.3	17.2	4	2.0	2.2	4.1	110	2	considerable	0.2
Light Clay	8.1	7.7	41	160	0.8	8.5	2.3	1.1	160	0.52	1.4	12.7	3.7	2.7	3.8	8.7	74	2	considerable	<,0.2
Light Clay	7.6	7.2	44	18	0.6	5	6.7	2.1	370	0.66	4.1	14.4	0.75	10.6	4.9	15	110	2	considerable	0.3
Light Clay	8.7	8.0	10	320	1.0	11	3.6	2.1	140	0.32	2.4	17.7	3.1	3.6	2.4	12	110	4	considerable	0.3
Light Clay	8.4	7.8	5.9	83	0.7	7.5	3.4	2.5	260	0.39	1.7	14.1	2.2	5.1	2.9	18	130	9	considerable	<0.2
Light Clay	8.0	7.5	31	7.6	0.6	5.5	7.8	4.0	600	0.69	4.3	17.9	0.71	13.7	5.1	22	120	4	considerable	0.4
Light Clay	8.5	7.7	18	240	1.4	10	3.5	1.5	27	0.23	2.7	16.4	2.9	2.5	1.7	9.1	110	9	considerable	0.2
Light Clay	8.0	7.2	4.2	12	1.5	9	6.9	3.0	75	0.33	2.6	20.4	1.3	4.6	2.4	15	280	16	considerable	<0.2
Light Clay	8.5	8.1	14	6.5	1.7	11	17.0	4.8	720	1.04	6.7	34.5	0.65	10.0	7.7	14	130	1	partial	<0.2
Clay Loam	7.9	7.4	23	640	0.9	9	2.9	0.7	100	0.29	2.9	13.6	3.1	3.1	2.3	5.4	140	0	considerable	0.3
Medium Clay	8.1	7.2	12	290	1.2	10	4.1	2.3	77	0.26	4.3	17.6	2.4	3.4	1.6	13	170	7	considerable	<0.2
Medium Clay	8.6	8.0	15	13	0.6	13	6.7	2.5	150	0.46	4.3	22.8	1.9	10.8	2.9	11	120	0	considerable	<0.2
Clay Loam	8.3	7.7	29	300	0.8	12	4.0	1.5	130	0.31	4.2	18.3	3	4.8	2.5	8.2	150	2	considerable	<0.2
Medium Clay	8.2	7.3	15	95	1.0	11	5.8	3.0	98	0.29	4.5	20.8	1.9	5.8	1.8	14	280	13	partial	<0.2
Light Clay	8.7	8.1	24	6.2	0.7	22	9.9	2.8	200	0.56	4.8	35.4	2.2	13.8	4.1	7.9	150	0	considerable	<0.2
Clay Loam	8.8	8.1	2.9	370	0.8	11	2.9	1.1	70	0.24	3.0	15.8	3.8	3.8	1.9	7	110	6	considerable	<0.2
Medium Clay	8.7	7.8	9.3	48	1.1	9	6.4	3.9	180	0.41	4.5	20.4	1.4	5.8	2.5	19	220	10	considerable	<0.2
Light Clay	8.7	8.3	35	9	0.7	21	9.1	3.0	450	0.69	5.9	33.8	2.3	13.6	5.1	8.9	150	0	considerable	<0.2
Clay Loam	8.0	7.4	9.9	610	0.7	9.5	2.3	0.8	57	0.23	2.9	13.3	4.1	3.3	1.8	5.9	140	0	considerable	0.2
Medium Clay	8.0	7.2	9.3	410	0.8	11	3.9	2.2	82	0.27	4.0	17.9	2.8	4.8	1.7	12	200	9	considerable	0.3
Light Clay	8.5	8.0	12	34	0.5	16	5.2	2.3	160	0.48	3.2	24.0	3.1	10.2	3.6	9.6	96	0	considerable	<0.2
Sandy Loam	8.2	7.6	11	570	0.7	6.5	2.0	0.8	140	0.27	2.2	10.0	3.3	2.9	2.8	8.3	120	2	considerable	<0.2
Sandy Clay Loam	8.1	7.4	27	360	0.6	4	2.0	1.3	150	0.30	2.3	7.9	2	3.3	2.7	16	90	4	considerable	<0.2
Light Clay	8.6	8.1	55	8.1	0.8	15	6.4	3.3	390	0.70	5.7	25.4	2.3	8.5	5.2	13	110	3	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Light Clay	8.5	8.0	29	320	1.0	14	3.3	1.4	85	0.33	3.8	19.7	4.2	3.3	2.4	7.1	160	1	considerable	0.4
Light Clay	8.5	7.7	6.3	35	0.7	9	4.3	2.9	110	0.34	3.9	16.9	2.1	6.4	2.5	17	180	7	considerable	<0.2
Light Clay	8.4	7.9	32	31	0.7	8.5	7.8	2.7	320	0.56	5.1	19.7	1.1	10.5	4.3	14	100	2	considerable	<0.2
Clay Loam	8.3	7.6	23	470	0.7	13	2.8	1.2	95	0.28	2.4	17.7	4.6	4.0	2.2	6.8	150	2	considerable	0.3
Clay Loam	8.2	7.4	8.1	370	0.4	7	2.7	1.7	110	0.27	1.7	11.8	2.6	6.3	2.2	14	120	10	considerable	0.2
Light Clay	7.4	6.8	7.6	29	0.9	10	5.9	2.9	170	0.53	2.6	19.7	1.7	6.6	3.9	15	160	5	considerable	<,0.2
Clay Loam	8.3	7.7	44	390	1.5	18	4.4	1.5	83	0.35	3.1	25.4	4.1	2.9	2.8	5.9	210	4	partial	0.3
Light Clay	8.5	7.6	20	96	1.2	12	5.2	2.7	66	0.33	2.4	21.1	2.3	4.3	2.4	13	270	10	considerable	0.2
Clay Loam	8.5	7.9	6.1	7.9	0.6	7	4.0	1.3	92	0.30	1.5	12.9	1.8	6.5	2.4	10	67	40	considerable	<0.2
Clay Loam	8.3	7.7	10	480	1.0	15	3.6	1.2	96	0.28	2.5	20.8	4.2	3.6	2.2	5.8	170	5	considerable	0.3
Light Clay	8.2	7.2	6.9	110	1.3	10	5.3	2.8	170	0.37	2.6	19.4	1.9	4.1	2.7	14	230	8	considerable	0.2
Clay Loam	8.5	8.0	12	17	0.7	19	5.8	1.9	190	0.45	1.8	27.4	3.3	8.8	3.6	6.9	110	2	Partial	<0.2
Light Clay	7.8	7.4	30	460	1.6	13	3.0	1.4	170	0.58	3.6	19.0	4.3	1.9	4.3	7.4	160	1	considerable	<0.2
Light Clay	7.9	7.5	15	300	1.4	14	4.0	2.4	180	0.68	3.6	21.8	3.5	2.9	5.0	11	210	1	considerable	<0.2
Light Clay	8.2	7.9	40	65	0.8	19	6.2	2.4	360	0.79	3.3	28.4	3.1	8.2	5.8	8.5	110	1	considerable	<0.2
Light Clay	7.2	6.9	85	250	1.2	10	3.0	1.9	280	0.89	2.3	16.1	3.3	2.5	6.6	12	92	0	partial	<0.2
Light Clay	7.1	6.8	57	49	1.0	7	3.5	2.1	330	0.73	1.6	13.6	2	3.5	5.4	15	110	1	considerable	<0.2
Light Clay	7.2	6.9	81	24	0.7	6	9.1	2.4	470	0.76	2.8	18.2	0.66	13.0	5.6	13	170	1	considerable	<0.2
Light Clay	7.5	7.2	26	740	1.8	15	3.0	1.5	200	0.74	3.2	21.3	5	1.7	5.5	7	210	2	partial	<0.2
Light Clay	7.5	7.2	39	370	1.8	13	4.0	2.0	250	0.73	3.1	20.8	3.3	2.2	5.8	9.6	210	5	partial	<0.2
Light Clay	8.2	7.9	46	40	1.0	12	6.7	2.2	300	0.69	4.2	21.8	1.8	7.1	5.1	10	180	1	considerable	<0.2
Silty Loam	8.2	7.7	38	550	1.0	14	3.4	1.9	200	0.54	3.5	20.3	4.1	3.5	4.8	9.4	160	4	partial	<0.2
Medium Clay	8.0	7.4	28	190	1.0	8.5	4.9	3.4	170	0.50	3.8	17.8	1.7	4.9	3.1	19	170	14	partial	<0.2
Medium Clay	8.7	8.1	33	26	0.6	22	5.8	3.5	290	0.61	3.5	31.8	3.8	10.5	3.8	11	120	5	partial	<0.2
Light Clay	7.8	7.5	72	380	1.5	17	3.0	2.0	220	0.93	4.6	23.5	5.7	2.0	6.9	8.5	150	0	partial	0.3
Light Clay	8.1	7.7	24	230	1.1	16	3.5	2.2	120	0.64	4.2	22.8	4.6	3.2	4.7	9.6	180	2	partial	0.3
Light Clay	8.5	8.0	24	26	0.8	147	6.5	3.6	150	0.67	2.5	27.8	2.6	8.7	5.0	13	120	2	partial	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Silty Loam	8.4	7.6	8.6	270	1.2	8.5	4.4	4.0	450	0.53	4.1	18.1	1.9	3.7	4.7	22	120	8	partial	<0.2
Clay Loam	8.3	7.5	3.9	70	1.0	7	5.4	5.2	480	0.57	4.2	18.6	1.3	5.4	4.6	28	120	12	considerable	<0.2
Clay Loam	8.0	7.4	6.1	11	0.8	4.1	5.6	5.2	900	0.91	4.3	15.7	0.73	6.7	7.3	33	46	11	considerable	<0.2
Sandy Loam	8.3	7.6	13	290	0.8	8.5	1.7	0.6	19	0.18	2.2	11.5	5	2.2	1.9	5	57	5	Partial	0.3
Sandy Loam	8.5	7.8	17	100	0.7	5.5	2.1	1.2	58	0.23	2.3	9.5	2.6	3.1	2.4	13	62	7	considerable	<0.2
Light Clay	8.7	8.1	30	12	0.7	14	8.2	4.8	300	0.67	3.6	27.6	1.7	12.6	5.0	17	75	7	considerable	<0.2
Light Clay	8.5	7.9	60	370	1.3	19	5.1	3.1	140	0.50	4.4	28.5	3.7	3.9	3.7	11	210	3	Partial	0.2
Clay Loam	8.8	8.2	16	110	0.6	18	4.8	3.5	170	0.55	2.3	26.9	3.8	8.0	4.4	13	120	6	considerable	<0.2
Clay Loam	8.5	8.0	6.4	32	0.3	7	4.9	2.8	410	0.58	1.1	15.0	1.4	18.8	4.6	19	76	0	considerable	<0.2
Light Clay	8.2	7.6	20	330	1.1	11	3.5	1.2	11	0.24	3.1	16.8	3.1	3.2	1.8	7.1	120	5	considerable	0.4
Medium Clay	8.2	7.5	26	33	0.6	9.5	4.6	3.3	120	0.43	2.3	18.0	2.1	7.8	2.7	18	280	11	considerable	<0.2
Light Clay	7.5	6.9	24	9.4	0.7	6	6.8	3.1	390	0.57	3.8	16.6	0.88	10.1	4.2	19	120	8	considerable	<0.2
Light Clay	7.9	7.5	160	280	0.9	7.5	5.2	3.5	370	0.82	3.9	17.1	1.4	5.7	6.1	20	91	2	considerable	<0.2
Light Clay	8.1	7.3	50	79	0.4	4.7	3.4	3.0	310	0.46	2.4	11.5	1.4	8.7	3.4	26	72	7	considerable	<0.2
Light Clay	7.7	6.8	41	19	0.5	5	4.7	3.9	300	0.45	1.7	14.1	1.1	9.4	3.3	28	140	11	considerable	<0.2
Clay Loam	8.9	8.1	20	300	1.1	8.5	3.1	1.0	14	0.19	3.0	13.7	2.7	2.8	1.5	7	130	5	considerable	<0.2
Medium Clay	8.4	7.4	36	85	1.1	6.5	4.0	5.2	240	0.48	3.2	16.8	1.6	3.6	3.0	31	220	15	considerable	0.2
Light Clay	8.7	7.8	33	<5	0.5	5.5	3.4	3.4	290	0.45	2.0	12.8	1.6	6.5	3.3	27	73.4	13	considerable	<0.2
Clay Loam	8.9	8.1	28	290	1.2	11	3.6	1.5	32	0.23	3.8	17.3	3.1	3.0	1.8	8.7	170	8	considerable	0.5
Medium Clay	7.9	7.0	34	23	1.2	9.5	5.8	4.8	280	0.50	3.4	21.3	1.6	4.8	3.1	23	300	13	considerable	<0.2
Light Clay	8.7	8.1	34	29	0.6	11	6.5	3.4	280	0.54	2.0	21.4	1.7	11.8	4.0	16	100	8	considerable	0.2
Clay Loam	9.0	8.1	12	390	2.2	9	4.9	1.7	21	0.26	4.7	16.8	1.8	2.2	2.1	10	180	10	considerable	0.3
Medium Clay	8.4	7.5	25	36	0.8	10	7.3	5.7	250	0.49	5.2	23.8	1.4	8.8	3.0	24	300	15	considerable	<0.2
Light Clay	9.0	8.3	31	12	0.5	14	6.3	4.4	240	0.58	1.8	25.2	2.2	12.1	4.3	17	140	9	considerable	<0.2
Clay Loam	7.8	7.2	28	730	1.5	16	3.7	1.7	140	0.39	3.9	22.9	4.3	2.5	3.1	7.4	210	2	considerable	0.4
Clay Loam	7.6	7.1	22	340	1.2	12	3.3	1.7	110	0.47	3.0	18.2	3.6	2.8	3.8	9.3	170	5	partial	0.4

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Light Clay	8.3	7.9	7.9	77	0.6	18	6.5	3.0	330	0.83	2.4	28.1	2.8	11.0	6.1	11	160	2	considerable	<0.2
Clay Loam	8.0	7.4	38	420	1.3	13	2.7	1.7	180	0.46	3.5	18.7	4.8	2.1	3.7	9.1	150	1	considerable	0.2
Clay Loam	8.0	7.5	17	280	1.2	13	2.8	1.9	190	0.52	3.2	18.9	4.6	2.3	4.2	10	160	1	considerable	0.3
Light Clay	7.9	7.3	28	28	1.5	7	6.7	3.2	200	0.56	4.3	18.4	1	4.5	4.1	17	130	5	considerable	<0.2
Light Clay	8.1	7.8	72	150	0.9	15	2.6	0.9	200	0.68	2.1	19.4	5.8	2.9	5.0	4.7	120	0	partial	0.2
Light Clay	7.5	7.2	20	30	0.6	12	3.4	1.4	140	0.63	2.0	17.4	3.5	6.1	4.7	8	180	2	considerable	<0.2
Light Clay	8.1	7.8	37	26	1.2	10	13.0	2.3	320	0.91	10.0	26.5	0.77	10.8	6.7	8.7	230	0	partial	<0.2
Light Clay	8.0	7.5	39	97	1.0	17	5.6	1.3	130	0.47	1.9	24.9	3	5.6	3.5	5.2	220	0	partial	<0.2
Light Clay	6.8	6.3	19	8.8	0.6	14	7.4	2.0	120	0.44	1.8	24.0	1.9	12.5	3.3	8.3	430	2	partial	<,0.2
Medium Clay	8.2	7.8	25	5.9	1.3	11	20.0	3.7	270	0.83	7.5	36.0	0.55	15.4	5.1	10	170	0	partial	<0.2
Clay Loam	7.8	7.3	10	620	0.8	10	2.5	1.3	140	0.40	3.0	14.6	4	3.1	3.2	8.9	160	4	considerable	,0.2
Light Clay	7.6	7.1	6	520	0.9	11	3.6	2.5	130	0.55	3.8	18.0	3.1	4.0	4.1	14	190	8	considerable	<0.2
Clay Loam	8.2	7.8	18	32	0.7	21	6.0	2.7	290	0.67	5.9	30.4	3.5	9.1	5.4	8.9	160	0	Partial	<0.2
Clay Loam	8.1	7.7	30	550	0.8	11	2.2	1.4	170	0.51	3.4	15.4	5	2.8	4.1	9.1	140	3	considerable	<0.2
Silty Loam	8.2	7.8	14	140	0.9	9.5	4.0	3.0	310	0.61	4.9	17.4	2.4	4.4	5.4	17	150	7	considerable	0.2
Clay Loam	8.4	8.0	18	14	0.7	9	5.4	2.3	340	0.60	4.5	17.4	1.7	8.1	4.8	13	86	2	considerable	<0.2
Clay Loam	7.6	7.1	140	390	1.5	9	2.6	1.4	180	0.51	3.3	14.5	3.5	1.7	4.1	9.7	98	0	considerable	<0.2
Clay Loam	8.2	7.6	46	220	1.0	8	2.2	1.7	160	0.37	3.1	12.9	3.6	2.3	3.0	13	98	3	partial	<0.2
Clay Loam	8.7	8.2	49	34	1.0	18	6.4	2.7	350	0.67	3.9	28.1	2.8	6.4	5.4	9.6	120	2	partial	<0.2
Clay Loam	8.0	7.4	83	440	1.8	10	3.4	1.9	160	0.47	2.8	17.1	2.9	1.9	3.8	11	130	4	partial	<0.2
Medium Clay	8.1	7.4	18	26	2.4	10	5.8	3.2	170	0.39	3.0	21.4	1.7	2.4	2.4	15	270	15	considerable	0.2
Clay Loam	8.6	8.2	59	24	0.9	14	6.9	2.5	280	0.66	2.7	24.3	2	7.3	5.3	10	91	1	partial	0.2
Light Clay	8.1	7.7	17	490	1.4	18	5.9	3.0	190	0.70	4.0	28.3	3.1	4.2	5.2	11	240	3	partial	0.4
Light Clay	8.6	8.1	27	17	0.6	22	6.4	3.0	230	0.59	3.2	32.0	3.4	10.2	4.4	9.4	130	2	partial	0.4
Light Clay	8.5	8.1	51	29	0.6	10	7.7	2.5	310	0.66	2.6	20.8	1.3	12.8	4.9	12	98	1	partial	<0.2
Silty Clay	8.2	7.5	21	520	1.0	8.5	3.2	1.0	65	0.22	2.0	13.6	2.7	3.2	2.0	7.1	110	6	Partial	0.3
Light Clay	8.3	7.5	7	450	0.8	7	4.0	2.0	91	0.27	2.1	13.8	1.8	5.3	2.0	14	120	14	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Clay Loam	7.6	6.7	1.8	17	0.3	4.9	3.1	2.2	160	0.25	1.2	10.5	1.6	11.1	2.0	21	57	14	considerable	<0.2
Medium Clay	7.9	7.3	24	600	1.6	11	4.9	1.5	93	0.29	2.9	19.0	2.2	3.1	1.8	7.9	190	8	Partial	0.4
Medium Clay	7.9	7.1	12	230	1.2	11	5.8	3.0	72	0.27	2.9	21.0	1.9	4.8	1.7	14	220	15	Partial	0.3
Clay Loam	8.8	8.1	3.9	31	0.5	17	5.5	2.2	130	0.31	1.8	25.2	3.1	11.7	2.5	8.7	72	7	considerable	<0.2
Clay Loam	8.2	7.6	10	460	1.2	14	2.3	0.7	37	0.28	3.1	18.2	6.1	1.9	2.2	4.1	150	2	Partial	<0.2
Clay Loam	8.1	7.6	15	330	1.1	11	2.4	0.9	100	0.43	2.6	15.4	4.6	2.2	3.4	5.6	110	2	considerable	0.4
Light Clay	8.0	7.4	22	14	1.2	8	5.5	2.2	88	0.37	1.8	16.9	1.5	4.6	2.7	13	72	4	considerable	<0.2
Clay Loam	7.8	7.2	89	330	0.8	11	4.0	2.9	240	0.48	2.7	18.7	2.8	4.9	3.8	16	100	6	Partial	0.5
Clay Loam	7.3	6.4	31	150	0.4	8.5	3.0	2.8	170	0.35	1.7	14.7	2.8	7.7	2.8	19	73	7	Partial	0.3
Medium Clay	6.8	6.4	9.8	24	1.2	8.5	5.9	2.6	440	0.66	2.1	18.2	1.4	4.9	4.1	14	140	0	considerable	<0.2
Clay Loam	7.9	7.5	5.5	440	0.9	11	3.5	1.8	160	0.56	3.6	17.2	3.1	3.9	4.5	10	120	1	Partial	0.2
Light Clay	8.1	7.4	4.1	230	0.6	8	3.0	2.6	140	0.41	2.8	14.2	2.7	5.4	3.0	18	110	11	considerable	<0.2
Medium Clay	7.7	7.3	35	58	1.2	12	7.8	4.0	480	0.77	9.7	25.0	1.5	6.5	4.8	16	240	4	considerable	<0.2
Silty Loam	8.0	7.4	27	480	0.6	7.5	2.3	1.7	210	0.39	2.5	12.1	3.3	4.0	3.5	14	110	2	considerable	<0.2
Clay Loam	8.1	7.5	27	260	0.6	7.5	4.0	3.2	220	0.53	3.6	15.3	1.9	6.7	4.2	21	150	12	considerable	0.3
Light Clay	8.2	7.9	85	31	0.6	21	8.2	3.5	540	0.86	5.9	33.3	2.6	14.1	6.4	11	140	0	Partial	<0.2
Clay Loam	8.4	7.8	45	350	1.4	15	4.2	2.0	130	0.36	3.6	22.6	3.6	3.0	2.9	8.8	130	6	Partial	0.3
Light Clay	8.4	7.5	6.6	26	1.5	7.5	3.5	2.4	83	0.28	2.5	14.9	2.1	2.3	2.1	16	180	15	considerable	<0.2
Medium Clay	8.2	7.7	52	21	2.2	6	15.0	5.2	580	0.90	14.0	28.4	0.4	6.8	5.6	18	170	4	Partial	<0.2
Clay Loam	8.3	7.8	66	170	0.6	9.5	3.0	1.4	140	0.42	2.6	14.5	3.2	5.0	3.4	9.7	55	2	Partial	<0.2
Clay Loam	8.7	8.0	7	37	0.2	4.8	1.9	1.3	81	0.23	1.4	8.2	2.5	7.9	1.8	16	41	5	Partial	<0.2
Light Clay	7.9	7.1	19	10	0.4	4.8	6.0	3.6	200	0.45	2.0	14.8	0.8	15.8	3.3	24	100	12	considerable	<0.2
Clay Loam	8.3	8.0	120	240	1.4	21	5.6	2.3	320	0.81	4.5	30.3	3.8	4.0	6.5	7.6	160	0	Partial	<0.2
Clay Loam	8.3	7.9	31	73	0.5	14	3.8	2.0	380	0.59	2.3	20.3	3.7	7.2	4.7	9.9	93	2	Partial	0.2
Light Clay	7.8	7.5	55	6.5	1.4	7.5	16.0	3.5	550	0.85	13.0	28.4	0.47	11.4	6.3	12	300	0	considerable	<0.2
Clay Loam	8.2	7.8	81	330	1.2	19	5.3	3.5	310	0.75	3.7	29.0	3.6	4.4	6.0	12	160	4	Partial	0.3
Light Clay	8.0	7.5	30	29	0.5	14	5.6	5.2	320	0.73	2.4	25.3	2.5	10.4	5.4	21	210	9	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Light Clay	7.3	7.0	56	11	0.8	10	9.9	4.1	700	0.98	4.3	24.8	1	12.7	7.3	17	160	0	Partial	<0.2
Clay Loam	8.5	7.9	3.6	420	1.1	13	3.6	2.3	250	0.45	3.9	20.0	3.6	3.3	3.6	12	140	5	Partial	<0.2
Light Clay	8.2	7.6	17	160	0.9	12	4.7	4.2	310	0.65	3.5	21.8	2.6	5.5	4.8	19	160	9	Partial	<0.2
Light Clay	8.1	7.7	41	120	0.8	13	7.5	3.2	460	0.81	5.2	24.5	1.7	9.0	6.0	13	120	1	Partial	<0.2
Clay Loam	8.2	7.6	31	320	0.9	12	3.2	0.6	38	0.23	1.9	16.7	3.8	3.5	1.8	3.7	82	0	Partial	<0.2
Medium Clay	8.8	8.0	27	97	0.7	9	4.3	2.1	63	0.26	2.1	16.1	2.1	6.5	1.6	13	110	4	considerable	<0.2
Light Clay	8.7	8.2	11	14	0.7	15	6.8	1.9	300	0.44	2.0	24.4	2.2	9.4	3.3	7.8	61	2	Water stable	<0.2
Light Clay	8.5	8.0	20	170	1.2	15	4.4	1.7	140	0.39	3.0	22.3	3.4	3.7	2.9	7.6	160	3	Partial	<0.2
Light Clay	8.3	7.8	5.2	66	1.2	11	4.4	2.6	210	0.61	2.0	19.2	2.5	3.7	4.5	14	150	11	considerable	<0.2
Light Clay	7.7	7.4	18	8.4	2.3	5.5	12.0	4.4	710	1.00	6.6	24.2	0.46	5.2	7.4	18	230	5	considerable	<0.2
Clay Loam	8.3	7.6	4.6	470	0.9	10	2.6	0.6	28	0.16	3.3	14.1	3.8	2.8	1.3	4.3	120	3	considerable	<0.2
Light Clay	8.1	7.4	9.7	260	0.5	8	4.3	2.1	140	0.30	2.4	14.9	1.9	8.3	2.2	14	190	8	considerable	0.2
Light Clay	8.4	8.0	27	11	0.7	19	7.7	2.2	340	0.60	4.9	29.6	2.5	10.7	4.4	7.4	110	2	considerable	<0.2
Clay Loam	8.9	8.1	17	370	0.8	7	3.0	1.4	90	0.25	3.7	12.2	2.3	3.8	2.0	11	120	3	Partial	<0.2
Clay Loam	8.9	7.9	5.9	220	0.5	3.6	2.1	2.0	150	0.30	2.7	8.2	1.7	4.3	2.4	24	82	3	considerable	<0.2
Light Clay	8.6	8.0	25	42	0.9	10	6.7	4.8	310	0.63	5.2	22.4	1.5	7.9	4.7	21	110	4	considerable	<0.2
Light Clay	8.7	8.0	27	200	1.0	19	6.3	3.4	110	0.37	4.2	29.7	3	6.5	2.7	11	170	1	Partial	0.2
Light Clay	9.0	8.2	11	63	0.4	13	5.0	3.4	180	0.37	2.5	21.8	2.6	11.4	2.7	16	100	0	Partial	<0.2
Light Clay	8.7	8.0	2.4	35	1.3	6	4.1	3.0	400	0.47	1.2	13.4	1.5	3.2	3.5	22	53	0	Partial	<0.2
Light Clay	8.2	7.4	8.6	270	1.1	13	4.4	2.0	110	0.26	4.5	20.5	3	4.0	1.9	9.8	190	1	Partial	0.5
Light Clay	8.5	7.9	2.5	21	0.6	24	5.8	2.7	160	0.38	4.6	33.0	4.1	10.5	2.8	8.2	210	0	Partial	<0.2
Silty Loam	8.3	7.7	2.8	40	0.4	10	6.6	2.5	360	0.46	1.9	19.5	1.5	17.4	4.1	13	100	0	Partial	<0.2
Light Clay	8.5	7.8	24	490	1.2	12	4.6	1.3	62	0.25	3.5	19.1	2.6	3.8	1.9	6.8	150	0	Partial	0.4
Light Clay	8.1	7.4	39	160	0.8	8.5	6.3	2.9	190	0.37	3.7	18.5	1.3	7.6	2.7	16	130	4	Partial	<0.2
Light Clay	8.1	7.2	30	12	0.5	5	5.0	2.2	200	0.30	3.1	12.7	1	9.8	2.2	17	93	3	Partial	<0.2
Light Clay	8.4	7.9	73	380	2.1	15	3.5	1.5	290	0.51	4.2	22.1	4.3	1.7	3.8	6.8	180	1	Partial	0.4

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Medium Clay	8.3	7.6	11	110	2.2	15	4.8	3.4	170	0.51	3.6	25.4	3.1	2.2	3.2	13	330	12	considerable	<0.2
Light Clay	8.5	8.1	17	8.9	0.9	15	6.1	2.2	430	0.68	3.8	24.2	2.5	6.7	5.0	9.1	100	2	considerable	<0.2
Light Clay	8.7	8.0	12	390	1.7	11	3.0	1.0	170	0.30	3.6	16.7	3.7	1.8	2.2	6	150	4	considerable	0.3
Light Clay	8.5	7.8	4.7	59	1.6	10	4.9	2.7	160	0.38	2.1	19.2	2	3.1	2.8	14	320	9	considerable	<0.2
Light Clay	7.5	7.0	13	7.8	0.4	6	3.8	1.7	290	0.41	1.5	11.9	1.6	9.3	3.0	14	77	2	considerable	<0.2
Clay Loam	8.4	7.7	12	430	1.2	9.5	3.7	2.0	150	0.30	2.2	16.4	2.6	3.1	2.4	12	140	7	considerable	0.3
Light Clay	8.3	7.4	22	71	1.3	8.5	5.8	3.9	150	0.35	2.1	19.5	1.5	4.5	2.6	20	220	15	considerable	<0.2
	8.0	7.3	26	29	1.1	6.5	5.9	3.3	340	0.47	3.9	16.8	1.1	5.4	3.5	20	120	4	considerable	<0.2
Clay Loam	8.0	7.3	40	490	1.1	12	4.9	3.1	290	0.51	2.0	21.1	2.4	4.5	4.1	15	130	8	considerable	0.3
Clay Loam	7.8	7.1	39	150	0.5	10	5.2	3.7	400	0.54	1.5	19.4	1.9	11.3	4.3	19	69	5	considerable	<0.2
Clay Loam	7.7	7.1	28	77	0.6	10	8.2	3.6	550	0.63	1.9	22.4	1.2	12.8	5.0	16	67	5	Partial	<0.2
Light Clay	8.5	7.8	63	430	1.8	16	4.4	2.7	140	0.46	3.7	24.9	3.6	2.4	3.4	11	160	7	considerable	0.3
Clay Loam	8.6	7.9	66	140	0.9	11	4.9	4.3	380	0.65	3.0	21.1	2.2	5.3	5.2	20	89	8	considerable	<0.2
Clay Loam	8.5	8.0	18	20	0.4	5.5	3.3	2.7	540	0.72	1.6	11.9	1.7	8.7	5.8	23	19	1	considerable	
Light Clay	8.1	7.5	27	710	2.8	19	6.6	3.4	210	0.53	3.5	31.8	2.9	2.4	3.9	11	200	2	considerable	<0.2
Light Clay	8.1	7.5	34	210	1.5	15	7.2	4.8	450	0.70	3.0	28.5	2.1	4.8	5.2	17	150	4	considerable	<0.2
Clay Loam	8.0	7.6	36	94	1.0	11	11.0	6.1	800	1.07	1.9	29.1	1	11.0	8.6	21	110	0	considerable	0.2
Light Clay	8.1	7.7	35	190	1.3	17	5.8	1.7	180	0.38	5.2	25.8	2.9	4.5	2.8	6.6	160	1	Partial	<0.2
Medium Clay	8.8	8.2	54	16	1.6	7.5	17.0	9.6	500	0.87	12.0	35.7	0.44	10.6	5.4	27	130	12	Partial	<0.2
Medium Clay	7.6	7.2	120	19	1.2	11	13.0	4.4	490	0.90	5.7	29.6	0.85	10.8	5.6	15	380	2	Partial	<0.2
Medium Clay	8.2	7.7	54	150	0.8	13	4.1	1.1	110	0.32	4.0	19.0	3.2	5.1	2.0	5.8	110	4	considerable	<0.2
Medium Clay	7.5	7.1	140	25	0.7	10	7.9	2.9	420	0.71	2.7	21.5	1.3	11.4	4.4	13	340	1	considerable	<0.2
Medium Clay	7.9	7.5	39	18	1.2	9	12.0	2.7	410	0.66	5.4	24.9	0.75	10.0	4.1	11	150	2	considerable	<0.2
Clay Loam	8.6	7.9	5.9	760	0.9	15	3.9	1.1	120	0.26	3.3	20.9	3.8	4.1	2.1	5.3	200	2	considerable	0.3
Clay Loam	8.5	7.8	8	200	1.3	7	3.3	1.4	120	0.28	3.6	13.0	2.1	2.5	2.2	11	130	9	considerable	<0.2
Light Clay	8.8	8.1	31	<5	1.0	23	6.6	3.4	220	0.60	5.8	34.0	3.5	6.8	4.4	10	155	2	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Light Clay	7.8	7.3	10	360	2.0	14	3.0	0.6	17	0.27	6.9	19.6	4.7	1.5	2.0	3.1	150	5	Partial	0.2
Light Clay	7.7	7.2	27	260	1.8	14	3.5	1.0	40	0.34	7.3	20.3	4	1.9	2.5	4.9	160	3	Partial	0.4
Light Clay	7.8	7.4	41	18	0.9	10	8.2	2.0	130	0.56	6.9	21.1	1.2	9.5	4.1	9.5	160	0	considerable	<0.2
Light Clay	7.8	7.2	29	720	2.1	13	3.5	0.6	15	0.23	4.8	19.2	3.7	1.7	1.7	3.2	200	2	considerable	<0.2
Clay Loam	7.6	6.9	22	24	1.0	12	4.4	2.2	100	0.30	4.2	19.6	2.7	4.6	2.4	11	220	10	considerable	0.4
Clay Loam	8.4	8.0	44	29	0.6	17	5.4	1.7	170	0.46	2.2	24.7	3.1	9.6	3.7	6.9	94	0	considerable	<0.2
Clay Loam	7.9	7.6	33	600	1.5	21	3.7	1.1	99	0.56	5.8	27.3	5.7	2.5	4.5	4	270	0	Partial	0.4
Clay Loam	7.9	7.5	32	230	0.6	13	3.0	1.6	86	0.48	3.5	18.2	4.3	5.5	3.8	8.8	160	0	Partial	<0.2
Clay Loam	8.3	8.0	65	18	0.5	27	5.9	2.6	250	0.68	2.1	36.0	4.6	13.1	5.4	7.2	160	0	Partial	<0.2
Clay Loam	8.1	7.6	9.7	440	1.0	15	3.9	1.2	190	0.33	4.8	21.1	3.8	3.9	2.6	5.7	190	0	Partial	<0.2
Clay Loam	8.1	7.6	6.4	310	1.0	13	4.0	1.5	160	0.35	3.4	19.5	3.3	4.0	2.8	7.7	180	7	Partial	<0.2
Light Clay	7.6	7.0	13	11	0.7	8	6.4	1.9	180	0.30	5.0	17.0	1.3	9.8	2.2	11	140	2	considerable	<0.2
Light Clay	8.0	7.6	44	410	1.7	16	4.2	1.7	110	0.58	6.2	23.6	3.8	2.5	4.3	7.2	190	0	Partial	<0.2
Light Clay	8.3	7.8	21	220	1.3	16	5.2	2.9	160	0.50	6.0	25.4	3.1	4.0	3.7	11	230	0	considerable	0.4
Light Clay	8.4	8.0	19	18	0.6	24	6.4	2.1	230	0.50	4.4	33.1	3.8	10.3	3.7	6.3	140	1	considerable	<0.2
Clay Loam	8.1	7.7	67	140	1.1	10	3.5	1.0	110	0.46	2.0	15.6	2.9	3.2	3.7	6.4	120	4	considerable	<0.2
Light Clay	8.1	7.5	43	8.2	1.1	10	6.3	2.4	130	0.44	2.3	19.8	1.6	5.7	3.3	12	310	5	partial	<0.2
Light Clay	8.5	8.0	38	13	1.4	11	13.0	2.5	320	0.54	5.3	27.9	0.85	9.3	4.0	9	180	2	considerable	<0.2
Clay Loam	7.8	7.4	67	250	1.0	10	4.5	1.3	220	0.52	2.1	16.8	2.2	4.5	4.2	7.7	100	2	considerable	0.2
Light Clay	7.8	7.0	33	33	0.9	6	4.7	1.6	110	0.28	1.8	13.2	1.3	5.2	2.1	10	160	12	considerable	<0.2
Light Clay	7.3	6.6	50	9.4	1.4	4.5	6.6	1.4	150	0.32	2.5	13.9	0.68	4.7	2.4	3.6	90	4	considerable	<0.2
Silty Loam	8.2	7.6	20	480	0.8	10	2.8	0.9	140	0.26	3.2	14.5	3.6	3.5	2.3	6	140	1	considerable	0.4
Light Clay	8.7	8.1	36	24	0.2	20	3.0	1.3	110	0.33	0.9	24.5	6.7	13.0	2.4	5.3	75	0	considerable	<0.2
Light Clay	8.4	7.6	7.4	39	0.4	8	3.3	1.3	75	0.20	2.8	13.0	2.4	8.5	1.5	10	160	12	considerable	<0.2
Clay Loam	7.8	7.4	160	760	1.5	17	4.9	1.6	200	0.72	5.1	25.0	3.5	3.3	5.8	6.4	240	0	Partial	0.5
Light Clay	8.0	7.6	55	340	0.9	17	4.7	2.2	190	0.59	4.3	24.8	3.6	5.1	4.4	4.4	220	2	considerable	0.3
Light Clay	7.8	7.2	31	24	0.4	6.5	2.1	1.3	120	0.29	2.1	10.2	3.1	6.0	2.1	2.1	110	2	considerable	<0.2

Texture	pH	pH)	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect.Cond	Boron	C. Ex.Cap	Ca/Mg	Mg/K	E.C.E	(ESP)	Phos Index	disp	slaking	cadmium
Light Clay	8.4	7.6	25	490	1.7	10	3.5	2.0	68	0.31	2.7	17.2	2.9	2.1	2.3	12	160	11	considerable	0.2
Light Clay	7.9	7.0	20	26	1.8	10	6.3	4.4	140	0.43	3.4	22.5	1.6	3.5	3.2	20	280	15	considerable	0.2
Light Clay	8.7	8.1	25	25	0.7	10	7.7	3.3	260	0.55	2.7	21.7	1.3	11.2	4.1	15	110	6	considerable	<0.2
Light Clay	8.5	7.8	41	450	1.2	7.5	2.7	1.2	79	0.28	4.4	12.6	2.8	2.3	2.1	9.5	130	9	considerable	0.3
Light Clay	8.3	7.5	43	150	1.5	7	3.9	3.7	200	0.47	4.8	16.1	1.8	2.6	3.5	23	210	13	considerable	0.4
Light Clay	8.4	7.9	33	15	0.6	9	4.7	2.9	280	0.54	3.3	17.2	1.9	7.7	4.0	17	74	6	considerable	<0.2
Clay Loam	8.9	8.1	25	240	0.6	8.5	2.2	1.3	76	0.26	3.3	12.6	3.9	3.8	2.1	10	96	7	considerable	0.2
Light Clay	8.3	7.5	68	92	0.6	9	3.9	4.0	260	0.63	4.6	17.5	2.3	6.7	4.7	23	210	12	considerable	<0.2
Light Clay	8.7	8.0	45	9	0.4	7.5	3.5	2.5	240	0.49	2.3	13.9	2.1	8.5	3.6	18	59	6	considerable	<0.2
Light Clay	8.9	8.1	6.2	170	0.8	9	2.1	1.9	130	0.32	3.9	13.8	4.3	2.8	2.4	14	120	11	considerable	0.4
Light Clay	8.4	7.7	6.3	81	0.6	11	3.0	3.8	350	0.61	4.6	18.4	3.7	5.3	4.5	21	210	12	considerable	0.2
Light Clay	7.9	7.4	48	6.4	0.7	8.5	4.7	2.8	290	0.61	3.8	16.7	1.8	7.0	4.5	17	85	5	considerable	<0.2
Light Clay	8.1	7.4	13	380	0.8	8	3.7	1.1	76	0.20	2.4	13.6	2.2	4.9	1.5	8.1	130	6	Partial	0.3
Medium Clay	7.8	7.0	9.7	170	1.2	10	5.0	2.0	59	0.21	3.3	18.2	2	4.2	1.3	11	240	12	Partial	<0.2
Light Clay	8.4	7.8	11	17	1.1	12	4.4	1.6	80	0.28	2.8	19.1	2.7	4.0	2.1	8.4	96	7	Partial	<0.2
Medium Clay	8.2	7.6	24	390	1.2	13	4.1	2.3	140	0.35	3.8	20.6	3.2	3.4	2.2	11	200	3	Partial	<0.2
Medium Clay	8.1	7.3	19	49	0.7	13	5.1	4.0	140	0.39	2.4	22.8	2.5	7.0	2.4	18	340	13	Partial	<0.2
Light Clay	8.4	8.0	33	24	0.6	24	8.2	3.3	290	0.62	2.9	36.1	2.9	14.1	4.6	9.1	190	1	Partial	<0.2
Light Clay	8.4	7.8	9.7	250	0.7	10	3.0	1.3	120	0.33	3.0	15.0	3.3	4.3	2.4	8.7	100	3	considerable	0.3
Light Clay	8.5	7.8	14	91	0.6	9	4.5	2.3	110	0.34	3.2	16.4	2	8.0	2.5	14	190	5	considerable	<0.2
Light Clay	8.1	7.0	9.9	5.4	0.5	4.6	3.9	3.1	87	0.27	1.7	12.1	1.2	8.3	2.0	26	97	15	considerable	<0.2

9. APPENDIX 3: 2007 SOIL MONITORING RESULTS (0-30CM)

texture	pH in water	pH in CaCl2	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect Cond	Boron	C Ex Cap	Ca Mg ratio	Mg K ratio	E C E	ESP	Phos Index	Dispersion	Slaking	Cadmium
light clay	8	7.5	40	560	1.7	11.0	3.0	2.0	140	0.48	6.3	17.7	3.7	1.8	3.6	11	180	2	Partial	<0.2
Clay loam	9.1	8.2	16	550	1.5	11.0	5.9	3.7	270	0.51	5.9	22.1	1.9	3.9	4.1	17	220	9	considerable	0.4
Light Clay	8	7.2	19	270	1.0	7.5	3.5	2.6	160	0.37	3.0	14.6	2.1	3.5	2.7	18	140	8	considerable	0.3
Clay Loam	8.5	7.7	5.4	430	1.2	11.0	1.9	0.5	18	0.15	4.4	14.6	5.8	1.6	1.2	3.6	150	5	considerable	<0.2
Clay Loam	7.1	6.8	260	500	1.7	9.0	2.2	0.7	60	0.74	4.8	13.6	4.1	1.3	5.9	5.1	110	0	Partial	0.2
light clay	7.9	7.5	19	420	1.2	10.0	2.0	0.7	50	0.44	3.8	13.9	5.0	1.7	3.3	5	140	0	considerable	0.2
Clay Loam	7.8	7.4	13	480	1.2	11.0	1.9	0.4	51	0.40	4.6	14.5	5.8	1.6	3.2	3	130	0	Partial	0.5
Clay Loam	8.1	7.5	5.3	460	1.1	11.0	2.4	0.4	12	0.16	3.7	14.9	4.6	2.2	1.3	2.9	120	5	Partial	0.4
Clay Loam	8.1	7.7	33	390	1.3	15.0	3.7	2.3	230	0.70	4.5	22.3	4.1	2.8	5.6	10	170	2	Partial	0.3
Light Clay	8.2	7.4	6.6	350	1.3	7.5	2.9	1.2	56	0.22	2.7	12.9	2.6	2.2	1.6	9.3	110	5	Considerable	<0.2
Clay Loam	8.1	7.5	56	900	1.6	13.0	4.0	2.7	260	0.54	3.0	21.3	3.3	2.5	4.3	13	190	5	Partial	0.4
Clay Loam	8.4	7.9	32	550	0.7	13.0	2.4	2.0	290	0.55	2.1	18.1	5.4	3.3	4.4	11	150	1	Partial	<0.2
Light Clay	7.6	7	15	22	0.6	7.0	7.7	2.1	260	0.40	2.7	17.4	0.9	14.0	3.0	12	120	3	Considerable	<0.
Clay Loam	8.6	7.9	38	460	1.1	12.0	3.6	2.2	190	0.38	3.0	18.9	3.3	3.3	3.0	12	120	4	Partial	<0.2
Light clay	8.7	8	10	320	1.0	11.0	3.6	2.1	140	0.32	2.4	17.7	3.1	3.6	2.4	12	110	4	considerable	0.3
Clay Loam	8	7.6	30	480	1.1	14.0	3.4	1.4	120	0.48	3.0	19.9	4.1	3.1	3.8	7	160	2	Partial	<0.2
Clay Loam	8.4	7.7	64	980	2.0	15.0	4.8	3.2	350	0.65	3.3	25.0	3.1	2.4	5.2	13	270	6	considerable	<0.2
Clay Loam	8.3	7.7	66	840	2.3	14.0	5.9	3.2	220	0.62	6.4	25.4	2.4	2.6	5.0	13	270	10	considerable	<0.2
light clay	8.4	7.7	36	800	1.9	16.0	4.5	1.4	57	0.31	3.1	23.8	3.6	2.4	2.3	5.9	210	5	considerable	0.3
light clay	8.3	7.7	9.4	750	1.4	15.0	3.5	1.0	38	0.26	2.7	20.9	4.3	2.5	1.9	4.6	190	2	considerable	0.5
light clay	7.9	7.2	14	640	1.2	9.0	2.6	0.7	44	0.21	2.9	13.4	3.5	2.2	1.6	4.9	140	3	Water stable	0.2
Silty loam	7.9	7.4	34	850	1.2	12.0	2.3	0.7	69	0.39	2.8	16.2	5.2	1.9	3.5	4.6	190	0	considerable	<0.2
Light Clay	8.4	7.8	58	470	1.3	12.0	4.4	2.5	190	0.44	3.3	20.2	2.7	3.4	3.3	12	220	5	Partial	<0.2
Light Clay	7.9	7.5	15	240	1.6	15.0	4.0	0.8	48	0.29	3.3	21.4	3.8	2.5	2.1	3.9	210	0	partial	<0.2
Medium Clay	8.2	7.5	26	370	1.3	13.0	4.2	1.6	73	0.27	3.4	20.1	3.1	3.2	1.7	8	170	7	Partial	0.2
Clay Loam	7.6	7.2	83	710	1.7	19.0	2.6	1.0	120	0.85	3.8	24.3	7.3	1.5	6.8	4.1	180	0	partial	<0.2
Clay Loam	7.7	7.4	9.3	440	1.3	17.0	2.2	0.7	100	0.77	3.0	21.2	7.7	1.7	6.2	3.5	110	0	considerable	<0.2
Clay loam	8.1	7.9	130	260	1.5	15.0	5.8	7.4	###	1.97	3.3	29.7	2.6	3.9	15.8	25	140	0	Partial	0.2
Light Clay	8.8	8.3	21	450	1.3	10.0	4.4	5.2	900	1.00	4.0	20.9	2.3	3.4	7.4	25	150	4	considerable	0.3
Light Clay	7.4	6.7	31	270	0.5	7.5	2.9	2.4	250	0.41	2.5	13.3	2.6	5.6	3.0	18	130	8	considerable	<0.2

texture	pH in water	pH in CaCl2	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect Cond	Boron	C Ex Cap	Ca Mg ratio	Mg K ratio	E C E	ESP	Phos Index	Dispersion	Slaking	Cadmium
Light clay	8.5	8	7.8	450	1.4	14.0	2.8	1.2	170	0.41	4.0	19.4	5.0	2.0	3.0	6.2	200	8	considerable	0.3
Clay loam	8.1	7.7	55	800	1.2	14.0	3.3	1.1	280	0.47	2.5	19.6	4.2	2.8	3.8	5.6	180	2	considerable	0.4
Light Clay	7.7	7.3	21	510	1.3	9.5	3.1	1.0	110	0.58	3.1	14.9	3.1	2.4	4.3	6.7	130	0	considerable	0.4
Silty Loam	8.1	7.5	15	390	1.3	11.0	5.1	1.5	200	0.33	2.8	18.9	2.2	3.9	2.9	7.9	150	2	partial	<0.2
Silty Loam	7.7	7.5	89	330	1.9	14.0	4.6	1.7	280	1.12	3.0	22.2	3.0	2.4	10.0	7.7	140	0	considerable	0.5
Light Clay	8.5	7.7	13	260	1.5	10.0	4.1	1.8	130	0.30	2.6	17.4	2.4	2.7	2.2	10	140	6	considerable	0.3
Clay Loam	8.1	7.5	21	420	1.4	11.0	4.3	0.7	47	0.22	2.4	17.4	2.6	3.1	1.8	4	110	5	Considerable	0.3
Clay Loam	8.1	7.6	14	350	1.7	15.0	5.9	1.2	58	0.25	2.6	23.8	2.5	3.5	2.0	5	190	9	Partial	0.3
Clay Loam	8	7.5	42	490	0.7	5.5	1.9	1.7	240	0.49	2.8	9.8	2.9	2.6	3.9	17	100	2	considerable	<0.2
Clay Loam	8.2	7.7	62	460	1.0	10.0	2.2	1.0	130	0.37	3.5	14.2	4.5	2.2	3.0	7	120	3	considerable	<0.2
Light Clay	8	7.4	47	430	1.3	9.0	2.7	1.7	180	0.40	2.7	14.7	3.3	2.1	3.0	12	130	6	considerable	<0.2
Clay Loam	8.1	7.4	10	200	0.5	5.5	1.3	1.6	210	0.33	1.7	8.9	4.2	2.9	2.6	18	79	4	Considerable	<0.2
Light Clay	7.4	6.9	35	240	1.0	8.0	3.5	1.2	110	0.28	2.8	13.7	2.3	3.6	2.1	8.8	97	5	Partial	0.7
Clay Loam	7.6	7.1	120	230	1.2	7.0	2.3	1.0	95	0.35	4.0	11.5	3.0	1.9	2.8	8.3	97	4	Partial	<0.2
Light Clay	8.1	7.6	60	170	1.0	9.0	4.1	1.3	270	0.42	2.3	15.4	2.2	4.3	3.1	8.4	89	2	Partial	<0.2
Light Clay	8.7	8	48	280	1.6	19.0	7.2	3.5	180	0.51	4.8	31.3	2.6	4.5	3.8	11	130	9	Partial	<0.2
Clay Loam	7.9	7.1	8.1	440	0.9	6.0	2.5	1.6	59	0.27	3.0	11.0	2.4	2.9	2.2	15	120	7	considerable	0.3
Light Clay	8.1	7.7	37	290	1.1	13.0	2.8	1.3	230	0.55	2.7	18.2	4.6	2.5	4.1	7.1	170	2	Considerable	<0.2
Light clay	8.4	7.8	16	360	1.5	12.0	2.3	1.1	110	0.28	4.2	16.9	5.2	1.5	2.1	6.5	160	2	partial	0.3
Medium Clay	8.1	7.5	60	780	1.7	15.0	4.2	1.7	260	0.48	2.4	22.6	3.6	2.5	3.0	7.5	210	4	Considerable	0.3
Medium Clay	8.3	7.6	3.8	470	1.1	12.0	4.0	2.7	350	0.49	2.2	19.8	3.0	3.6	3.0	14	180	4	Partial	<0.2
Medium Clay	7.8	7.3	40	390	1.2	9.0	3.5	2.3	130	0.55	2.8	16.0	2.6	2.9	3.4	14	140	6	Partial	<0.2
Light Clay	8.4	7.9	12	320	1.0	17.0	3.0	1.1	49	0.32	4.2	22.1	5.7	3.0	2.4	5	140	2	Partial	0.2
Clay Loam	8.2	7.8	66	400	1.9	18.0	3.5	1.8	190	0.85	4.2	25.2	5.1	1.8	6.8	7.1	220	0	partial	<0.2
Silty Loam	7.9	7.4	56	390	0.9	7.0	3.0	1.0	140	0.32	2.1	11.9	2.3	3.4	2.8	8.4	91	2	Considerable	0.3
Clay Loam	8	7.4	6.4	480	0.7	8.0	3.3	1.2	140	0.26	2.8	13.2	2.4	5.0	2.1	9.1	130	4	considerable	0.3
Clay Loam	8.4	7.7	16	510	0.6	10.0	3.0	1.0	80	0.22	2.4	14.6	3.3	4.7	1.8	6.6	140	4	Partial	0.4
Light Clay	7.7	7.2	74	800	2.0	16.0	4.4	0.8	170	0.47	2.8	23.2	3.6	2.2	3.5	3.6	230	0	Partial	<0.2
Silty Loam	8.4	7.9	11	220	0.3	9.5	2.3	0.7	67	0.22	1.5	12.8	4.1	8.2	2.0	5.8	77	8	Partial	0.2
Clay Loam	8.4	7.8	9.7	490	1.6	13.0	3.4	1.7	260	0.43	3.2	19.7	3.8	2.1	3.4	8.6	170	3	considerable	<0.2
Medium Clay	8.1	7.6	54	430	0.7	11.0	2.8	1.3	160	0.50	2.6	15.8	3.9	4.2	3.1	8.2	120	1	Partial	0.3

texture	pH in water	pH in CaCl2	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect Cond	Boron	C Ex Cap	Ca Mg ratio	Mg K ratio	E C E	ESP	Phos Index	Dispersion	Slaking	Cadmium
light clay	7.7	7.2	44	610	1.5	11.0	2.2	0.4	42	0.29	2.9	15.1	5.0	1.5	2.1	2.5	130	1	Partial	0.3
Light Clay	8.2	7.7	31	290	0.9	13.0	3.0	1.4	110	0.38	3.5	18.3	4.3	3.3	2.8	7.7	120	4	Partial	<0.2
Light Clay	8.6	7.9	65	430	1.5	16.0	4.5	1.9	87	0.39	3.8	23.9	3.6	3.0	2.9	7.9	170	6	Partial	0.3
Clay Loam	8	7.5	39	420	1.1	11.0	2.8	0.7	75	0.27	2.6	15.6	3.9	2.5	2.2	4.5	110	2	Partial	0.3
Medium Clay	8.1	7.5	44	450	1.2	10.0	2.6	1.5	180	0.43	3.4	15.3	3.8	2.2	2.7	9.8	140	5	Partial	0.3
Medium Clay	8.9	8.2	57	140	1.0	19.0	5.0	3.0	280	0.48	3.0	28.0	3.8	5.0	3.0	11	120	7	Considerable	<0.2
Light Clay	8.3	7.7	61	510	1.3	10.0	2.2	2.9	400	0.62	3.1	16.4	4.5	1.7	4.6	18	140	3	Considerable	0.3
Light Clay	8.2	7.7	93	390	1.8	12.0	3.8	2.9	350	0.69	4.3	20.5	3.2	2.1	5.1	14	150	3	Considerable	<0.2
Clay Loam	7.9	7.5	99	580	1.1	13.0	1.7	2.0	310	0.76	2.5	17.8	7.6	1.5	6.1	11	150	2	Considerable	0.2
Clay Loam	7.4	6.6	9	350	0.3	6.5	2.6	1.7	120	0.25	1.8	11.1	2.5	9.0	2.0	15	100	6	considerable	<0.2
Medium Clay	8.4	7.7	29	300	0.8	9.0	2.8	1.3	120	0.29	1.7	13.9	3.2	3.3	1.8	9.4	120	5	Considerable	<0.2
Light Clay	8.2	7.5	9.6	280	0.6	9.0	2.4	1.4	86	0.25	3.0	13.4	3.8	3.8	1.9	10	93	7	Considerable	0.3
Medium Clay	8.7	8	26	450	1.1	15.0	4.0	1.8	150	0.31	3.1	21.9	3.8	3.6	1.9	8.2	190	2	Partial	0.3
Light Clay	8.1	7.6	61	680	1.5	19.0	4.5	1.3	300	0.48	2.0	26.3	4.2	3.0	3.6	4.9	290	4	Considerable	0.5
Sandy Clay Loam	7.6	7	32	840	0.6	6.0	2.2	1.3	220	0.33	2.0	10.1	2.7	3.9	2.9	13	160	3	Partial	0.4
clay loam	8.3	7.7	29	300	0.8	12.0	4.0	1.5	130	0.31	4.2	18.3	3.0	4.8	2.5	8.2	150	2	considerable	<0.2
clay loam	8.8	8.1	2.9	370	0.8	11.0	2.9	1.1	70	0.24	3.0	15.8	3.8	3.8	1.9	7	110	6	considerable	<0.2
clay loam	8	7.4	9.9	610	0.7	9.5	2.3	0.8	57	0.23	2.9	13.3	4.1	3.3	1.8	5.9	140	0	considerable	0.2
Light Clay	8.4	7.7	22	390	1.1	12.0	4.2	1.7	140	0.31	2.4	19.0	2.9	3.8	2.3	8.9	150	6	Considerable	<0.2
Clay Loam	7.9	7.5	38	370	0.9	7.5	1.6	1.0	300	0.55	2.1	11.0	4.7	1.8	4.4	9.1	95	4	Considerable	0.2
Clay Loam	8.4	7.8	20	140	0.9	9.5	2.6	0.5	31	0.18	1.9	13.5	3.7	3.0	1.4	3.9	85	2	considerable	<0.2
Light Clay	7.8	7.4	30	460	1.6	13.0	3.0	1.4	170	0.58	3.6	19.0	4.3	1.9	4.3	7.4	160	1	considerable	<0.2
Light Clay	7.2	6.9	85	250	1.2	10.0	3.0	1.9	280	0.89	2.3	16.1	3.3	2.5	6.6	12	92	0	partial	<0.2
Light Clay	7.9	7.6	68	350	1.2	21.0	5.3	3.0	400	0.96	2.5	30.5	4.0	4.4	7.1	9.8	130	0	Partial	0.2
Light Clay	7.5	7.2	26	740	1.8	15.0	3.0	1.5	200	0.74	3.2	21.3	5.0	1.7	5.5	7	210	2	partial	<0.2
Silty loam	8.2	7.7	38	550	1.0	14.0	3.4	1.9	200	0.54	3.5	20.3	4.1	3.5	4.8	9.4	160	4	partial	<0.2
Light clay	7.8	7.5	72	380	1.5	17.0	3.0	2.0	220	0.93	4.6	23.5	5.7	2.0	6.9	8.5	150	0	partial	0.3
Medium clay	7.8	7.4	21	590	1.9	18.0	5.0	4.0	420	1.06	3.6	28.9	3.6	2.6	6.6	14	200	1	Partial	0.3
Light Clay	8.3	7.7	39	440	1.5	10.0	3.5	2.5	240	0.48	2.9	17.5	2.9	2.3	3.6	14	170	6	Partial	<0.2
Medium Clay	8.3	7.7	52	370	1.3	10.0	3.5	2.3	210	0.48	3.5	17.1	2.9	2.7	3.0	13	160	6	Partial	<0.2
Silty Loam	8.4	7.6	8.6	270	1.2	8.5	4.4	4.0	450	0.53	4.1	18.1	1.9	3.7	4.7	22	120	8	partial	<0.2

texture	pH in water	pH in CaCl2	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect Cond	Boron	C Ex Cap	Ca Mg ratio	Mg K ratio	E C E	ESP	Phos Index	Dispersion	Slaking	Cadmium
Medium Clay	8.1	7.7	110	250	1.9	20.0	5.3	1.8	320	0.64	2.5	29.0	3.8	2.8	4.0	6.2	230	1	Partial	<0.2
Clay Loam	8.2	7.6	18	500	2.3	14.0	5.9	1.6	210	0.37	3.5	23.8	2.4	2.6	3.0	6.7	160	4	Partial	0.3
Sandy Loam	8.3	7.6	13	290	0.8	8.5	1.7	0.6	19	0.18	2.2	11.5	5.0	2.2	1.9	5	57	5	Partial	0.3
light clay	8.5	7.9	60	370	1.3	19.0	5.1	3.1	140	0.50	4.4	28.5	3.7	3.9	3.7	11	210	3	Partial	0.2
Medium Clay	8.5	7.9	30	250	1.2	17.0	5.1	1.9	250	0.42	3.1	25.2	3.3	4.3	2.6	7.5	200	4	Partial	<0.2
light clay	8.2	7.6	20	330	1.1	11.0	3.5	1.2	11	0.24	3.1	16.8	3.1	3.2	1.8	7.1	120	5	considerable	0.4
Clay Loam	6.8	6.2	9.7	270	1.1	7.0	4.4	1.3	93	0.21	2.5	13.8	1.6	4.0	1.7	9.4	130	10	Considerable	0.2
Clay Loam	7.8	7.2	28	730	1.5	16.0	3.7	1.7	140	0.39	3.9	22.9	4.3	2.5	3.1	7.4	210	2	considerable	0.4
Light Clay	7.7	7.1	15	620	1.8	11.0	3.8	1.9	350	0.50	3.3	18.5	2.9	2.1	3.7	10	170	3	Water Stable	<0.2
Clay Loam	8	7.4	38	420	1.3	13.0	2.7	1.7	180	0.46	3.5	18.7	4.8	2.1	3.7	9.1	150	1	considerable	0.2
Light clay	8	7.5	39	97	1.0	17.0	5.6	1.3	130	0.47	1.9	24.9	3.0	5.6	3.5	5.2	220	0	partial	<0.2
Clay Loam	7.8	7.3	10	620	0.8	10.0	2.5	1.3	140	0.40	3.0	14.6	4.0	3.1	3.2	8.9	160	4	considerable	,0.2
Clay Loam	8.1	7.7	30	550	0.8	11.0	2.2	1.4	170	0.51	3.4	15.4	5.0	2.8	4.1	9.1	140	3	considerable	<0.2
Light Clay	8.1	7.6	13	530	0.9	8.0	2.6	1.4	330	0.40	1.8	12.9	3.1	2.8	3.0	11	140	4	Partial	0.5
Light Clay	8.2	7.7	11	290	0.9	11.0	3.9	1.2	250	0.38	2.4	17.0	2.8	4.1	2.8	7.1	150	2	Partial	<0.2
Light Brown	8.3	7.7	37	410	0.8	8.5	3.5	2.3	400	0.56	2.0	15.1	2.4	4.2	4.1	15	120	5	Considerable	<0.2
Clay Loam	8	7.4	83	440	1.8	10.0	3.4	1.9	160	0.47	2.8	17.1	2.9	1.9	3.8	11	130	4	partial	<0.2
Light clay	8.1	7.7	17	490	1.4	18.0	5.9	3.0	190	0.70	4.0	28.3	3.1	4.2	5.2	11	240	3	partial	0.4
Clay Loam	8	7.8	11	420	1.0	14.0	3.5	1.5	99	0.68	2.7	20.0	4.0	3.5	5.4	7.5	150	0	considerable	0.3
Clay Loam	8.4	7.8	35	420	2.3	16.0	5.0	1.7	79	0.34	3.8	25.0	3.2	2.2	2.7	6.8	200	4	Partial	0.4
Clay Loam	7.9	7.5	5.5	440	0.9	11.0	3.5	1.8	160	0.56	3.6	17.2	3.1	3.9	4.5	10	120	1	Partial	0.2
Silty Loam	8	7.4	27	480	0.6	7.5	2.3	1.7	210	0.39	2.5	12.1	3.3	4.0	3.5	14	110	2	considerable	<0.2
Light Clay	8.2	7.8	68	180	0.6	11.0	4.0	1.9	340	0.56	2.2	17.5	2.8	7.0	4.1	11	93	1	Partial	<0.2
Clay Loam	8.3	7.8	66	170	0.6	9.5	3.0	1.4	140	0.42	2.6	14.5	3.2	5.0	3.4	9.7	55	2	Partial	<0.2
Clay Loam	7.8	7.2	89	330	0.8	11.0	4.0	2.9	240	0.48	2.7	18.7	2.8	4.9	3.8	16	100	6	Partial	0.5
Clay Loam	8.3	8	120	240	1.4	21.0	5.6	2.3	320	0.81	4.5	30.3	3.8	4.0	6.5	7.6	160	0	Partial	<0.2
Clay Loam	8.2	7.8	81	330	1.2	19.0	5.3	3.5	310	0.75	3.7	29.0	3.6	4.4	6.0	12	160	4	Partial	0.3
clay loam	8.2	7.6	31	320	0.9	12.0	3.2	0.6	38	0.23	1.9	16.7	3.8	3.5	1.8	3.7	82	0	Partial	<0.2
Clay Loam	8.3	7.6	4.6	470	0.9	10.0	2.6	0.6	28	0.16	3.3	14.1	3.8	2.8	1.3	4.3	120	3	considerable	<0.2
Clay Loam	8.9	8.1	17	370	0.8	7.0	3.0	1.4	90	0.25	3.7	12.2	2.3	3.8	2.0	11	120	3	Partial	<0.2
Clay Loam	8	7.5	31	790	1.6	12.0	3.2	1.0	210	0.39	1.8	17.8	3.8	2.0	3.1	5.4	220	4	Partial	0.4
light clay	8.7	8	27	200	1.0	19.0	6.3	3.4	110	0.37	4.2	29.7	3.0	6.5	2.7	11	170	1	Partial	0.2

texture	pH in water	pH in CaCl2	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect Cond	Boron	C Ex Cap	Ca Mg ratio	Mg K ratio	E C E	ESP	Phos Index	Dispersion	Slaking	Cadmium
light clay	8.2	7.4	8.6	270	1.1	13.0	4.4	2.0	110	0.26	4.5	20.5	3.0	4.0	1.9	9.8	190	1	Partial	0.5
light clay	8.5	7.8	24	490	1.2	12.0	4.6	1.3	62	0.25	3.5	19.1	2.6	3.8	1.9	6.8	150	0	Partial	0.4
Light Clay	8.4	7.9	73	380	2.1	15.0	3.5	1.5	290	0.51	4.2	22.1	4.3	1.7	3.8	6.8	180	1	Partial	0.4
Light Clay	8.7	8	12	390	1.7	11.0	3.0	1.0	170	0.30	3.6	16.7	3.7	1.8	2.2	6	150	4	considerable	0.3
Clay Loam	8.7	8.2	27	280	0.6	10.0	2.7	2.2	290	0.59	2.1	15.5	3.7	4.8	4.7	14	100	2	Considerable	<0.2
Clay Loam	8	7.4	5.9	420	0.6	9.0	2.5	1.3	160	0.30	3.8	13.4	3.6	4.2	2.4	9.7	130	6	Partial	0.3
Light Clay	8.4	7.9	24	370	2.1	18.0	5.2	1.2	180	0.36	3.8	26.5	3.5	2.5	2.7	4.5	200	1	Partial	0.3
Clay loam	8.4	7.7	12	430	1.2	9.5	3.7	2.0	150	0.30	2.2	16.4	2.6	3.1	2.4	12	140	7	considerable	0.3
Clay loam	8	7.3	40	490	1.1	12.0	4.9	3.1	290	0.51	2.0	21.1	2.4	4.5	4.1	15	130	8	considerable	0.3
Light Clay	7.9	7.5	160	280	0.9	7.5	5.2	3.5	370	0.82	3.9	17.1	1.4	5.7	6.1	20	91	2	considerable	<0.2
Light Clay	8.1	7.5	27	710	2.8	19.0	6.6	3.4	210	0.53	3.5	31.8	2.9	2.4	3.9	11	200	2	considerable	<0.2
Light Clay	8.1	7.7	35	190	1.3	17.0	5.8	1.7	180	0.38	5.2	25.8	2.9	4.5	2.8	6.6	160	1	Partial	<0.2
Medium Clay	8.2	7.7	54	150	0.8	13.0	4.1	1.1	110	0.32	4.0	19.0	3.2	5.1	2.0	5.8	110	4	considerable	<0.2
Light Clay	7.8	7.2	37	710	1.0	13.0	4.0	2.6	300	0.53	4.0	20.6	3.3	4.2	3.9	13	230	2	Considerable	0.5
clay loam	8.6	7.9	5.9	760	0.9	15.0	3.9	1.1	120	0.26	3.3	20.9	3.8	4.1	2.1	5.3	200	2	considerable	0.3
Light Clay	7.3	6.9	220	740	2.8	12.0	5.0	3.9	530	1.09	4.2	23.7	2.4	1.8	8.1	16	190	1	Partial	0.3
Light Clay	7.8	7.3	10	360	2.0	14.0	3.0	0.6	17	0.27	6.9	19.6	4.7	1.5	2.0	3.1	150	5	Partial	0.2
light clay	7.8	7.2	29	720	2.1	13.0	3.5	0.6	15	0.23	4.8	19.2	3.7	1.7	1.7	3.2	200	2	considerable	<0.2
Medium Clay	7.8	7.5	170	480	1.6	16.0	3.8	1.4	160	0.68	3.8	22.8	4.2	2.4	4.2	6.1	190	0	Partial	0.3
clay loam	7.9	7.6	33	600	1.5	21.0	3.7	1.1	99	0.56	5.8	27.3	5.7	2.5	4.5	4	270	0	Partial	0.4
clay loam	8.1	7.6	9.7	440	1.0	15.0	3.9	1.2	190	0.33	4.8	21.1	3.8	3.9	2.6	5.7	190	0	Partial	<0.2
Clay Loam	8.1	7.7	67	140	1.1	10.0	3.5	1.0	110	0.46	2.0	15.6	2.9	3.2	3.7	6.4	120	4	considerable	<0.2
Silty Loam	8.2	7.6	20	480	0.8	10.0	2.8	0.9	140	0.26	3.2	14.5	3.6	3.5	2.3	6	140	1	considerable	0.4
Light Clay	8.5	7.8	41	450	1.2	7.5	2.7	1.2	79	0.28	4.4	12.6	2.8	2.3	2.1	9.5	130	9	considerable	0.3
Clay Loam	8.2	7.7	51	200	1.0	10.0	2.7	1.1	220	0.41	2.0	14.8	3.7	2.7	3.3	7.4	79	2	Considerable	<0.2
Clay Loam	8.9	8.1	25	240	0.6	8.5	2.2	1.3	76	0.26	3.3	12.6	3.9	3.8	2.1	10	96	7	considerable	0.2
Light Clay	8.1	7.4	13	380	0.8	8.0	3.7	1.1	76	0.20	2.4	13.6	2.2	4.9	1.5	8.1	130	6	Partial	0.3
Medium Clay	8.2	7.6	24	390	1.2	13.0	4.1	2.3	140	0.35	3.8	20.6	3.2	3.4	2.2	11	200	3	Partial	<0.2
Light Clay	8.4	7.8	9.7	250	0.7	10.0	3.0	1.3	120	0.33	3.0	15.0	3.3	4.3	2.4	8.7	100	3	considerable	0.3
Light Brown	8.4	7.8	54	490	1.4	16.0	4.5	2.7	310	0.57	2.8	24.6	3.6	3.2	4.2	11	210	4	Water Stable	0.2
Mean	8.1	7.6	39.6	###	1.2	12.2	3.6	1.7	###	0.46	3.2	18.8	3.6	3.3	3.5	9.3	###	3		
Standard Deviation	0.4	0.3	38.1	###	0.5	3.6	1.2	1.0	###	0.23	1.0	5.1	1.1	1.5	1.8	4.3	44.9	3		

texture	pH in water	pH in CaCl2	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect Cond	Boron	C Ex Cap	Ca Mg ratio	Mg K ratio	E C E	ESP	Phos Index	Dispersion	Slaking	Cadmium
Medium Clay	8.4	7.9	85	500	1.4	11.0	3.0	3.2	420	0.90	5.8	18.6	3.7	2.1	5.6	17	200	3	considerable	0.3
Medium Clay	8.8	8.2	68	690	1.5	12.0	5.8	4.4	540	0.97	6.2	23.7	2.1	3.9	6.0	19	280	5	partial	0.2
Medium Clay	8.6	7.8	21	460	1.2	8.0	3.5	2.4	220	0.51	3.8	15.1	2.3	2.9	3.2	16	170	8	considerable	0.3
Clay Loam	8.4	7.7	14	410	1.3	9.5	2.0	1.7	200	0.36	4.0	14.5	4.8	1.5	2.7	12	150	8	partial	0.5
Light Clay	7.5	7.1	94	430	1.6	8.5	2.1	1.1	230	0.67	3.8	13.3	4.0	1.3	5.0	8.3	110	1	partial	0.9
Medium Clay	8.3	7.5	20	300	1.3	7.5	2.2	1.8	300	0.40	3.8	12.8	3.4	1.7	2.5	14	130	8	partial	0.3
Medium Clay	8.2	7.6	25	650	1.8	14.0	3.2	2.0	210	0.45	5.1	21.0	4.4	1.8	2.8	9.5	250	7	partial	0.3
Clay Loam	8	7.3	54	470	1.6	9.0	2.4	1.2	110	0.35	4.3	14.2	3.8	1.5	2.6	8.5	140	6	partial	0.2
Medium Clay	8.1	7.7	41	470	1.2	13.0	3.5	2.0	200	0.77	3.7	19.7	3.7	2.9	4.8	10	200	2	partial	0.2
Light Clay	8	7.3	26	370	1.2	7.0	3.0	1.2	97	0.27	2.3	12.4	2.3	2.5	2.0	9.7	110	5	partial	<0.21
Light Clay	8.2	7.5	62	800	1.3	11.0	3.6	3.0	370	0.63	2.7	18.9	3.1	2.8	4.7	16	190	6	partial	0.4
Light Clay	8.6	7.9	44	590	0.8	12.0	2.2	2.3	300	0.57	2.1	17.3	5.5	2.7	4.2	13	180	4	partial	0.3
Light Clay	8.5	7.9	32	310	0.9	10.0	4.1	2.5	240	0.50	3.3	17.5	2.4	4.8	3.1	14	160	5	considerable	0.3
Medium Clay	8.5	7.9	54	220	1.2	13.0	3.8	2.1	280	0.50	2.6	20.1	3.4	3.2	3.1	10	150	5	partial	<0.2
Medium Clay	8.3	7.7	80	440	1.3	12.0	4.0	1.9	220	0.56	2.5	19.2	3.0	3.1	3.5	9.9	130	4	partial	0.3
Medium Clay	8.4	7.9	25	450	1.5	15.0	4.2	2.2	300	0.61	2.9	22.9	3.6	2.8	3.8	9.6	190	4	considerable	<0.2
Medium Clay	8.1	7.7	120	960	2.1	16.0	4.9	3.9	670	1.18	3.4	26.9	3.3	2.3	7.3	14	270	4	partial	0.4
Medium Clay	8.1	7.7	93	110	2.1	13.0	5.6	3.8	490	1.02	5.5	24.5	2.3	2.7	6.3	16	290	4	partial	0.2
Medium Clay	8.1	7.6	59	840	1.9	15.0	4.4	2.6	460	0.85	2.7	23.9	3.4	2.3	5.3	11	240	2	partial	0.3
Clay Loam	8.2	7.6	95	700	1.4	13.0	3.4	2.0	320	0.66	2.7	19.8	3.8	2.4	5.3	10	180	5	considerable	0.5
Clay Loam	7.7	7.1	120	640	1.5	8.0	2.7	1.8	210	0.61	2.9	14.0	3.0	1.8	4.9	13	130	5	partial	0.5
Clay Loam	8	7.5	98	780	1.3	10.0	2.3	1.7	360	0.70	2.6	15.3	4.3	1.8	5.6	11	170	4	partial	0.4
Medium Clay	8.7	7.9	26	410	1.1	12.0	4.3	2.6	190	0.42	3.3	20.0	2.8	3.9	2.6	13	250	11	considerable	0.2
Medium Clay	8.1	7.3	14	120	1.1	11.0	4.4	2.3	240	0.36	2.7	18.8	2.5	4.0	2.2	12	120	7	partial	0.2
Medium Clay	8.3	7.9	54	420	1.1	17.0	5.2	2.1	390	0.68	2.4	25.4	3.3	4.7	4.2	8.3	260	1	partial	0.3
Light Clay	7.8	7.5	62	770	1.5	17.0	2.4	2.0	200	0.90	3.9	22.9	7.1	1.6	6.7	8.7	200	0	water stable	<0.2
Light Clay	7.7	7.4	82	430	1.2	14.0	2.1	2.0	280	0.98	3.0	19.3	6.7	1.8	7.3	10	110	0	partial	<0.2
Medium Clay	8.3	7.9	51	340	1.3	12.0	4.3	3.5	480	1.02	3.7	21.1	2.8	1.2	6.3	17	180	2	water stable	0.2
Medium Clay	9	8.3	27	470	1.0	9.5	4.6	4.1	550	0.83	4.0	19.2	2.1	1.1	5.1	21	190	6	partial	0.2
Light Clay	7.5	7.1	120	380	0.7	8.5	2.7	2.9	530	0.87	1.9	14.8	3.1	3.6	6.4	20	130	3	considerable	0.2
Medium Clay	8.7	8.1	50	410	1.2	14.0	2.9	2.0	310	0.55	3.4	20.1	4.8	2.4	3.4	10	190	4	partial	0.4
Medium Clay	8.1	7.7	98	900	1.2	17.0	3.6	2.2	780	1.13	2.1	24.0	4.7	3.0	7.0	9.2	230	0	partial	0.4

texture	pH in water	pH in CaCl2	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect Cond	Boron	C Ex Cap	Ca Mg ratio	Mg K ratio	E C E	ESP	Phos Index	Dispersion	Slaking	Cadmium
Light Clay	8.2	7.5	45	460	1.2	8.0	2.7	1.9	240	0.48	2.7	13.8	3.0	2.3	3.6	14	140	5	partial	0.4
Medium Clay	7.9	7.4	58	420	1.3	11.0	4.6	2.1	280	0.61	2.7	19.0	2.4	3.5	3.8	11	160	4	partial	0.3
Medium Clay	8.1	7.6	66	330	1.6	11.0	3.9	2.1	290	0.61	3.0	18.6	2.8	2.4	3.8	11	150	4	partial	<0.2
Light Clay	8.1	7.6	46	310	1.5	12.0	3.8	2.0	330	0.65	2.4	19.3	3.2	2.5	4.0	10	140	2	partial	<0.2
Light Clay	8.5	7.8	50	460	1.6	12.0	4.5	1.9	180	0.48	2.5	20.0	2.7	2.8	3.4	9.5	160	7	partial	0.4
Light Clay	8.6	7.8	25	230	1.4	8.5	3.3	1.3	64	0.26	2.4	14.5	2.6	2.4	1.9	9	120	10	partial	0.4
Clay Loam	8.8	8.1	52	550	0.9	7.5	2.2	2.2	330	0.57	2.7	12.8	2.9	2.5	5.1	17	130	4	partial	<0.2
Clay Loam	9.1	8.2	27	500	0.8	10.0	2.4	1.5	140	0.34	3.7	14.7	4.2	3.0	2.7	10	150	5	considerable	<0.2
Light Clay	8.2	7.6	83	480	1.3	9.0	3.0	1.9	230	0.54	2.7	15.2	3.0	2.3	4.0	13	130	3	considerable	0.2
Light Clay	7.4	7	58	200	0.8	7.5	2.5	2.0	350	0.64	2.2	12.8	3.0	3.2	4.7	16	93	3	considerable	0.2
Medium Clay	7.9	7.4	110	230	0.9	9.5	3.8	1.5	320	0.59	2.0	15.7	2.5	4.4	3.7	9.6	110	1	partial	0.2
Medium Clay	8.5	7.9	36	190	0.9	8.0	2.6	1.1	190	0.36	2.8	12.6	3.1	3.0	2.2	8.7	110	4	considerable	0.2
Clay Loam	8.2	7.6	60	190	0.8	6.5	3.2	1.4	250	0.43	2.1	11.9	2.0	4.0	3.4	12	84	5	considerable	0.2
Clay loam	8.4	7.9	66	310	1.5	17.0	7.0	4.1	530	0.86	4.1	29.6	2.4	4.7	6.4	14	160	5	partial	<0.2
Light Clay	7.7	7.2	100	510	1.2	6.0	2.4	1.6	150	0.55	3.2	11.2	2.5	2.0	4.1	14	120	4	partial	0.3
Medium Clay	8.1	7.7	9.2	360	1.4	11.0	2.1	1.2	150	0.59	2.7	15.7	5.2	1.5	3.7	7.6	160	2	partial	<0.2
Medium Clay	8.7	8	48	340	1.6	10.0	2.6	1.7	140	0.37	4.0	15.9	3.8	1.6	2.3	11	180	8	considerable	0.3
Medium Clay	8	7.6	46	680	1.5	17.0	4.0	1.5	190	0.79	2.2	24.0	4.3	2.7	4.9	6.3	200	1	partial	1.5
Medium Clay	8.3	7.7	14	420	1.1	10.0	3.6	2.8	560	0.62	1.9	17.5	2.8	3.3	3.8	16	160	5	partial	0.3
Light Clay	8.2	7.5	63	420	1.4	7.5	3.6	2.5	310	0.55	2.4	15.0	2.1	1.4	4.1	17	150	6	partial	0.2
Light Clay	8.8	8.1	42	340	1.0	13.0	3.5	3.0	310	0.56	3.1	20.5	3.7	1.2	4.1	15	160	6	partial	0.3
Medium Clay	8.7	8.1	81	320	1.3	12.0	2.6	2.7	300	0.62	2.9	18.6	4.6	1.0	3.8	15	150	5	partial	0.4
Light Clay	8.3	7.7	49	360	0.7	6.5	2.5	1.4	190	0.45	1.8	11.1	2.6	3.6	3.3	13	110	6	partial	<0.2
Light Clay	8.6	7.8	22	420	0.7	7.5	3.1	1.8	170	0.37	2.6	13.1	2.4	4.6	2.7	14	140	8	partial	0.4
Light Clay	8.6	7.8	3.8	500	0.6	8.5	2.4	1.3	130	0.31	2.4	12.8	3.5	3.9	2.3	10	130	6	partial	0.4
Medium Clay	8	7.5	110	730	1.7	15.0	4.6	1.8	220	0.58	2.7	23.1	3.3	2.7	3.6	7.8	250	3	considerable	<0.2
Light Clay	8.3	7.6	23	260	0.4	7.5	2.0	0.9	85	0.24	1.9	10.8	3.8	4.5	1.8	8.4	86	4	partial	<0.2
Light Clay	8.6	7.9	43	510	1.2	13.0	3.2	1.6	140	0.38	3.2	19.0	4.1	2.7	2.8	8.4	180	6	partial	0.2
Light Clay	8.2	7.7	29	420	0.5	8.5	2.0	1.3	160	0.40	2.7	12.3	4.3	3.7	3.0	11	120	4	partial	0.3

texture	pH in water	pH in CaCl2	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect Cond	Boron	C Ex Cap	Ca Mg ratio	Mg K ratio	E C E	ESP	Phos Index	Dispersion	Slaking	Cadmium
Light Clay	7.9	7.6	94	320	0.8	9.5	4.0	2.0	330	0.93	2.3	16.3	2.4	4.9	6.9	12	140	0	partial	<0.2
Medium Clay	8.3	7.9	110	300	1.0	13.0	3.4	2.4	450	0.74	2.7	19.8	3.8	3.5	4.6	12	130	3	considerable	0.2
Medium Clay	8.5	7.9	54	460	1.3	12.0	3.7	1.9	140	0.47	3.8	18.9	3.2	2.8	2.9	10	170	7	partial	0.3
Light Clay	7.9	7.4	67	430	0.9	9.0	2.3	1.5	330	0.57	2.6	13.7	3.9	2.6	4.2	11	110	1	considerable	<0.2
Medium Clay	8.3	7.6	23	460	1.0	9.0	2.3	1.5	190	0.37	3.2	13.8	3.9	2.4	2.3	11	150	6	partial	0.2
Light Clay	9	8.2	10	170	0.8	18.0	4.9	2.3	110	0.31	2.7	26.0	3.7	2.1	2.3	8.8	140	8	water stable	<0.2
Light Clay	8.5	7.8	17	480	1.1	8.5	2.1	2.3	350	0.55	2.8	14.0	4.0	0.9	4.1	16	150	7	considerable	<0.2
Light Clay	8.2	7.6	63	410	1.6	10.0	3.5	2.6	310	0.61	3.8	17.7	2.9	2.2	4.5	15	150	5	partial	<0.2
Clay Loam	8.1	7.6	51	530	0.9	10.0	1.5	1.2	90	0.39	2.2	13.6	6.7	1.8	2.9	8.8	160	3	partial	0.3
Light Clay	7.7	7.2	30	380	0.4	7.0	3.0	2.1	440	0.54	1.5	12.4	2.3	1.4	4.0	17	120	4	partial	0.4
Medium Clay	8.4	7.7	40	290	0.8	8.0	2.8	1.5	110	0.35	1.8	13.1	2.9	1.9	2.2	11	110	6	partial	<0.2
Light Clay	8.3	7.6	25	290	0.9	8.5	2.9	1.5	110	0.31	2.5	13.8	2.9	1.9	2.3	11	110	7	partial	<0.2
Light Clay	8.5	8	84	450	1.3	12.0	3.8	2.2	290	0.60	2.9	19.3	3.2	2.9	4.4	11	190	4	partial	0.2
Medium Clay	8.2	7.7	50	770	1.3	15.0	3.8	1.6	180	0.47	2.0	21.7	3.9	2.4	2.9	7.4	310	3	considerable	0.4
Sandy Clay Loam	7.5	7.1	100	690	0.6	4.9	2.1	1.8	450	0.70	2.0	9.4	2.3	1.2	6.2	19	130	4	partial	0.6
Light Clay	8.4	7.9	25	330	0.9	11.0	3.5	1.7	150	0.40	3.2	17.1	3.1	2.1	3.0	9.9	170	4	partial	0.2
Clay Loam	8.8	8.1	17	350	0.8	11.0	2.9	1.4	180	0.35	2.5	16.1	3.8	2.1	2.8	8.7	130	7	partial	<0.2
Clay Loam	8.2	7.6	40	490	0.7	7.5	2.1	1.0	120	0.33	1.8	11.3	3.6	2.1	2.6	8.8	110	5	considerable	0.4
Light Clay	8.4	7.7	7.6	380	0.9	9.5	3.1	1.2	100	0.27	2.1	14.7	3.1	2.6	2.0	8.2	130	10	partial	<0.2
Clay Loam	8.1	7.6	61	350	0.8	6.5	1.5	0.9	210	0.47	1.8	9.7	4.3	1.7	3.8	9	88	2	partial	0.4
Medium Clay	8.5	7.9	17	160	0.8	9.0	2.8	1.7	220	0.43	1.5	14.2	3.2	1.6	2.7	12	98	6	partial	<0.2
Medium Clay	7.8	7.5	160	460	1.6	15.0	3.1	2.0	320	0.97	3.2	21.7	4.8	1.6	6.0	9.2	170	0	water stable	<0.2
Medium Clay	7.6	7.4	65	370	1.4	14.0	3.0	2.7	710	1.26	2.4	21.1	4.7	1.1	7.8	13	130	1	water stable	<0.2
Medium Clay	7.7	7.4	190	430	1.2	18.0	4.7	3.7	560	1.31	2.6	27.6	3.8	1.3	8.1	13	170	0	water stable	<0.2
Light Clay	7.6	7.3	120	720	1.8	15.0	3.1	1.8	270	0.88	2.8	21.7	4.8	1.7	6.5	8.3	200	1	water stable	<0.2
Medium Clay	8	7.6	62	540	0.9	14.0	2.6	1.7	310	0.61	3.0	19.2	5.4	1.5	3.8	8.9	150	2	partial	<0.2
Medium Clay	7.8	7.5	130	400	1.3	17.0	3.0	3.2	440	1.30	4.8	24.5	5.7	0.9	8.1	13	180	0	water stable	<0.2
Light Clay	7.7	7.5	120	640	2.4	22.0	4.8	4.4	630	1.75	5.3	33.6	4.6	1.1	13.0	13	230	0	water stable	0.2
Light Clay	8.5	7.8	30	410	1.2	9.0	3.4	2.3	210	0.48	2.4	15.9	2.6	1.5	3.6	14	200	7	partial	<0.2
Light Clay	8.4	7.7	45	390	1.0	8.5	2.8	2.0	230	0.49	2.4	14.3	3.0	1.4	3.6	14	150	5	considerable	<0.2

texture	pH in water	pH in CaCl2	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect Cond	Boron	C Ex Cap	Ca Mg ratio	Mg K ratio	E C E	ESP	Phos Index	Dispersion	Slaking	Cadmium
Light Clay	8.1	7.6	72	310	1.3	9.0	4.4	4.8	960	1.20	3.2	19.5	2.0	0.9	8.9	25	130	3	partial	<0.2
Medium Clay	8.3	7.8	93	250	1.9	17.0	4.6	2.4	410	0.67	2.4	25.9	3.7	1.9	4.2	9.3	220	0	water stable	<0.2
Light Clay	8.5	7.9	11	450	2.1	14.0	4.3	2.3	240	0.54	2.8	22.7	3.3	1.9	4.0	10	180	5	partial	<0.2
Sandy Clay loam	8.3	7.8	45	340	0.8	8.0	1.7	2.7	660	0.88	2.2	13.2	4.7	0.6	7.8	20	85	0	partial	<0.2
Medium Clay	8.2	7.8	51	470	1.6	15.0	5.0	4.4	610	1.08	4.6	26.0	3.0	1.1	6.7	17	230	0	water stable	<0.2
Medium Clay	8.3	7.9	64	290	1.2	15.0	5.2	2.8	590	0.78	3.0	24.2	2.9	1.9	4.8	12	220	0	partial	<0.2
Medium Clay	8	7.6	60	390	1.1	11.0	3.4	3.4	560	0.98	3.1	18.9	3.2	1.0	6.1	18	150	2	water stable	0.2
Light Clay	6.9	6.3	63	280	1.7	6.0	4.0	2.1	280	0.48	2.2	13.8	1.5	1.9	3.6	15	130	8	partial	<0.2
Medium Clay	8.2	7.5	51	730	1.3	14.0	3.8	2.8	310	0.54	3.8	21.9	3.7	1.4	3.3	13	230	6	partial	0.3
Medium Clay	7.8	7.2	46	690	1.5	9.5	3.4	1.9	260	0.48	3.2	16.3	2.8	1.8	3.0	12	190	7	partial	0.3
Light Clay	8.3	7.7	73	420	1.1	10.0	2.7	2.8	350	0.63	3.2	16.6	3.7	1.0	4.7	17	160	6	water stable	0.2
Medium Clay	8.2	7.6	45	230	1.3	15.0	4.9	2.2	180	0.51	2.0	23.4	3.1	2.2	3.2	9.4	220	2	water stable	<0.2
Medium Clay	7.3	7	130	730	1.4	13.0	2.7	2.3	350	1.10	3.2	19.4	4.8	1.2	6.8	12	190	1	partial	0.4
Clay Loam	8.3	7.9	56	520	0.8	10.0	2.2	2.1	370	0.72	3.0	15.1	4.5	1.0	5.8	14	150	2	water stable	0.3
Clay Loam	8.3	7.6	6.9	530	0.8	7.0	2.4	1.0	170	0.27	1.5	11.2	2.9	2.4	2.2	8.9	130	6	Considerable	0.4
Light Clay	8.6	8	24	370	1.0	10.0	3.0	1.2	89	0.28	2.2	15.2	3.3	2.5	2.1	7.9	140	6	partial	0.2
Medium Clay	8.5	7.8	25	460	0.9	8.0	3.5	1.8	250	0.41	1.6	14.2	2.3	1.9	2.5	13	130	9	water stable	0.2
Light Clay	7.7	7.2	170	420	1.5	8.5	2.6	2.8	470	0.74	3.4	15.4	3.3	0.9	5.5	18	110	3	partial	<0.2
Medium Clay	8	7.6	48	640	1.6	19.0	5.1	4.4	430	1.05	3.7	30.1	3.7	1.2	6.5	15	280	2	partial	0.9
Light Clay	8.1	7.7	25	480	0.9	11.0	3.2	2.0	340	0.79	2.2	17.1	3.4	1.6	5.8	12	150	1	water stable	0.2
Medium Clay	8.1	7.6	140	510	1.9	13.0	6.0	4.3	600	0.95	3.7	25.2	2.2	1.4	5.9	17	170	5	water stable	<0.2
Light Clay	8	7.6	69	440	0.6	9.5	3.2	3.0	470	0.84	3.0	16.3	3.0	1.1	6.2	18	140	2	partial	0.3
Clay Loam	8.7	7.9	18	580	0.5	8.5	2.3	1.3	150	0.28	2.3	12.6	3.7	1.8	2.2	10	140	5	considerable	0.3
Light Clay	8	7.6	94	220	0.8	10.0	3.8	2.1	410	0.70	2.0	16.7	2.6	1.8	5.2	13	97	2	partial	<0.2
Light Clay	8.7	8.1	33	220	0.5	7.5	2.6	2.4	490	0.56	2.2	13.0	2.9	1.1	4.1	18	79	3	partial	0.3
Light Clay	8.2	7.6	32	430	0.8	10.0	4.7	3.4	480	0.67	2.7	18.9	2.1	1.4	5.0	18	150	7	partial	<0.2
Light Clay	8.3	8	66	320	1.2	20.0	4.6	3.7	770	1.51	3.5	29.5	4.3	1.2	11.2	13	210	0	water stable	0.2
Light Clay	8.3	7.9	60	490	1.0	12.0	3.3	3.0	490	0.89	3.5	19.3	3.6	1.1	6.6	16	180	1	water stable	0.3
Medium Clay	8.2	7.6	31	520	1.6	13.0	4.3	3.4	490	0.75	2.4	22.3	3.0	1.3	4.7	15	170	6	partial	0.2
Clay Loam	8.4	7.7	25	440	1.0	9.0	2.7	1.7	190	0.38	2.1	14.4	3.3	1.6	3.0	12	130	6	partial	0.3
Clay Loam	8.9	8	42	420	0.9	6.5	3.0	2.1	190	0.43	2.8	12.5	2.2	1.4	3.4	17	120	6	partial	0.2

texture	pH in water	pH in CaCl2	Nitrate	Phos	Potas	Ca	Mg	Na	Chloride	Elect Cond	Boron	C Ex Cap	Ca Mg ratio	Mg K ratio	E C E	ESP	Phos Index	Dispersion	Slaking	Cadmium
Light Clay	7.8	7.3	33	650	1.1	10.0	3.5	1.5	340	0.53	1.7	16.1	2.9	2.3	3.9	9.3	170	2	considerable	0.4
Medium Clay	8.3	7.9	76	300	1.3	16.0	6.3	3.9	580	0.84	3.9	27.5	2.5	1.6	5.2	14	190	0	water stable	<0.2
Medium Clay	8.2	7.5	13	330	1.2	11.0	4.0	2.0	170	0.32	2.9	18.2	2.8	2.0	2.0	11	170	10	considerable	0.2
Light Clay	8.9	8.1	27	440	0.9	9.0	4.0	1.7	150	0.29	2.9	15.6	2.3	2.4	2.1	11	140	9	partial	0.2
Light Clay	8.1	7.8	66	390	1.6	17.0	3.3	1.9	280	1.08	4.0	23.6	5.2	1.7	8.0	8	200	1	water stable	0.2
Light Clay	8	7.8	47	380	1.3	14.0	3.0	1.7	270	1.33	3.6	20.0	4.7	1.8	9.8	8.5	160	0	partial	0.3
Clay Loam	8.8	8.2	69	330	0.5	9.5	2.7	2.4	290	0.63	2.9	15.1	3.5	1.1	5.0	16	110	3	partial	<0.2
Light Clay	7.7	7.4	27	460	0.5	9.5	2.0	1.4	190	0.75	2.9	13.4	4.8	1.4	5.6	10	120	1	considerable	0.2
Medium Clay	8.4	8	73	400	1.8	19.0	5.8	2.3	360	0.75	3.7	28.9	3.3	2.5	4.7	8	240	1	considerable	0.2
Light Clay	8.3	7.7	50	490	1.2	9.5	4.5	3.2	610	0.72	2.2	18.4	2.1	1.4	5.3	17	160	6	water stable	<0.2
Light Clay	8.2	7.5	40	550	1.3	10.0	5.4	4.0	690	0.74	2.2	20.7	1.9	1.4	5.5	19	160	8	partial	0.3
Medium Clay	8.1	7.4	55	260	0.8	6.5	4.4	2.4	290	0.55	3.4	14.1	1.5	1.8	3.4	17	98	7	partial	0.2
Medium Clay	7.9	7.4	170	770	2.5	17.0	7.2	5.2	830	1.24	4.1	31.9	2.4	1.4	7.7	16	220	5	water stable	<0.2
Medium Clay	8.2	7.8	120	230	1.5	16.0	5.4	3.0	630	0.88	3.8	25.9	3.0	1.8	5.5	12	150	2	partial	0.2
Light Clay	8.1	7.7	120	180	0.8	12.0	4.0	2.7	760	0.92	3.6	19.5	3.0	1.5	6.8	14	99	0	partial	<0.2
Medium Clay	7.9	7.3	52	790	1.0	11.0	3.7	2.4	240	0.57	4.1	18.1	3.0	1.5	3.5	13	230	3	partial	0.5
Clay Loam	8.8	8.2	26	730	0.8	11.0	3.2	1.7	350	0.48	2.8	16.7	3.4	1.9	3.8	10	190	5	considerable	0.3
Medium Clay	7.8	7.1	26	760	2.2	9.5	3.8	3.5	400	0.71	3.3	19.0	2.5	1.1	4.4	18	190	7	water stable	0.3
Clay Loam	7.5	7.2	150	470	2.3	14.0	3.2	1.8	320	0.84	4.4	21.3	4.4	1.8	6.7	8.5	170	2	partial	0.2
Medium Clay	7.8	7.3	49	830	2.2	12.0	3.6	1.8	250	0.56	3.4	19.6	3.3	2.0	3.5	9.2	220	5	water stable	0.4
Light Clay	8.1	7.6	38	570	2.0	14.0	3.3	1.6	260	0.53	3.5	20.9	4.2	2.1	3.9	7.7	200	5	water stable	0.3
Medium Clay	7.9	7.6	150	580	1.4	18.0	3.6	2.4	330	1.11	4.6	25.4	5.0	1.5	6.9	9.4	270	0	water stable	0.4
Medium Clay	7.9	7.6	83	370	1.4	15.0	4.2	2.5	450	0.96	5.1	23.1	3.6	1.7	6.0	11	220	0	partial	<0.2
Light Clay	8.1	7.6	73	170	1.3	9.5	3.3	1.9	210	0.61	2.4	16.0	2.9	1.7	4.5	12	140	4	water stable	<0.2
Clay Loam	7.8	7.3	65	580	0.9	9.5	2.6	1.3	180	0.45	2.6	14.3	3.7	2.0	3.6	9.1	140	2	water stable	0.3
Clay Loam	8.8	8.1	45	400	1.1	7.0	2.6	2.1	220	0.51	3.4	12.8	2.7	1.2	4.1	16	140	7	partial	0.5
Clay Loam	8.8	8.1	13	210	1.0	10.0	2.6	1.0	100	0.26	1.6	14.6	3.9	2.6	2.1	6.8	92	6	considerable	<0.2
Clay Loam	8.8	8.1	75	310	0.9	7.5	2.6	1.6	140	0.43	3.1	12.6	2.9	1.6	3.4	13	110	4	water stable	0.3
Light Clay	8	7.3	29	390	0.8	6.0	3.5	1.4	120	0.29	2.1	11.7	1.7	2.5	2.1	12	130	6	water stable	0.4
Medium Clay	8.3	7.7	56	360	0.8	10.0	3.8	2.6	240	0.54	2.8	17.2	2.6	1.5	3.3	15	190	5	partial	0.3
Light Clay	8.6	7.8	29	290	0.8	9.5	2.9	1.3	86	0.27	2.8	14.5	3.3	2.2	2.0	9	100	8	partial	<0.2
Light Clay	8.2	7.7	92	500	1.4	14.0	4.9	2.6	200	0.67	3.0	22.9	2.9	1.9	5.0	11	220	4	partial	0.3

10. APPENDIX 4: Listing Of Recycled Customers And Usage To June 30 2007

Service	Cumulative Volume of River Usage for previous meter reading	Cumulative Volume of Recycled Usage for previous meter reading	Cumulative Volume of River Usage for current meter reading	Cumulative Volume of Recycled Usage for current meter reading	Cumulative Volume YTD of River Usage	Cumulative Volume YTD of Recycled Usage
185620	0	0	0	0	0	0
163953	0.4	1.2	0	0	1.3	5.4
316377	0	0.3	0	0	0.5	6.7
320455	4.5	0	0	0	63.5	0
310638	0	0	0	0	5.6	71.4
168041	0	0	0	0	0.5	7.9
383651	0	0	0	0	12	18.1
343803	0.1	0.8	0	0	14	26.9
352543	1.1	1.7	0	0	5.9	44.3
237647	0	0	0	0	8	102.6
251321	0.9	0.4	0	0	4.8	31
250589	0.4	4.8	0	0	16	105.9
379867	0	0	0	0	10.7	50.9
224812	0	0	0	0	0	0.7
314587	0.1	1.1	0	0	13.8	33.8
155217	0	0.6	0	0	0.9	12.2
310018	0	0	0	0	5.9	31.8
135070	0.1	0.6	0	0	8.8	58.7
159433	0.1	1.1	0	0	2.6	1.1
353884	0.3	0.9	0	0	0.9	5
262676	2.7	0	0	0	5.3	27.9
324116	3.1	4.7	0	0	10.5	50.6
964220	0.2	2.1	0	0	1.9	20.5
190098	0.2	2.6	0	0	4.4	59.1
323209	1.7	8.3	0	0	23.7	221.1
104086	10.1	0	0	0	37.7	212.1
276294	0.1	0.6	0	0	3.8	46.4
380652	1.6	1.7	0	0	3.8	35.8
104124	0.6	8.4	0	0	24.3	309.1
250546	0.2	3.2	0	0	6.6	70
241490	0.2	3.1	0	0	8.5	114.5
306541	1.6	0.7	0	0	9.7	79
293865	0	0	0	0	12.6	132.4
239674	0.1	1.3	0	0	6.5	38.2
156620	0	0	0	0	0	0
314595	0	0	0	0	2.2	24.8
238481	2.5	2.7	0	0	8.1	67.1
103136	0	0.6	0	0	1.1	14.9
1098403	0	0	0	0	0	0
146145	0	0	0	0	1.6	11.4
171433	0.5	6.8	0	0	24.1	121

Service	Cumulative Volume of River Usage for previous meter reading	Cumulative Volume of Recycled Usage for previous meter reading	Cumulative Volume of River Usage for current meter reading	Cumulative Volume of Recycled Usage for current meter reading	Cumulative Volume YTD of River Usage	Cumulative Volume YTD of Recycled Usage
221562	0.1	0.9	0	0	3.7	28.5
321648	0.3	3.2	0	0	5.9	66.5
210218	0.1	0.7	0	0	2.5	33.7
209074	0	0.5	0	0	1.1	14.5
4000609	1.2	0	0	0	2.9	23.8
240540	0.3	3.3	0	0	8.6	106.7
318108	0.1	1	0	0	0.1	2.1
319694	0.5	6.7	0	0	9.8	126.5
183245	2.3	1	0	0	9.1	52.1
144436	0.1	0.9	0	0	2.8	35.8
124443	4.4	11.7	0	0	21	247.6
294268	0	0.4	0	0	1	13.9
350850	0.1	1.8	0	0	2.7	34.8
344486	1.4	18	0	0	41.9	543.2
270636	0	0	0	0	2.7	12.1
202940	0.5	6.6	0	0	3.4	49.7
4003403	0	0	0	0	0.5	2.3
262498	0.2	2.9	0	0	3.5	42.7
277355	0.7	0	0	0	2.1	8
201618	0.1	0.6	0	0	1.9	28.6
321591	0.2	2.5	0	0	3	3
240257	1.2	2.7	0	0	5.8	25.3
102148	3.7	0	0	0	12.4	123
375683	3.1	2.4	0	0	17.4	149.6
218111	0.2	2.3	0	0	7.8	40.7
247367	0.2	2	0	0	6.3	68
288241	0.1	1.7	0	0	6.8	34.3
363774	0.2	3	0	0	6.1	72.8
216488	0.1	0.8	0	0	6.2	61.4
239836	0.1	1.3	0	0	1.7	23.7
149934	3.4	16.6	0	0	34	233.9
307947	0.2	2.2	0	0	3.2	41
152501	0.2	2.3	0	0	4.2	52.4
122483	0.1	1.7	0	0	2.8	35.8
122408	0	0	0	0	4	26.8
194654	0.1	1.5	0	0	2.2	19.2
282987	0.1	0.9	0	0	2.8	41.4
141283	0.1	1.4	0	0	2.1	29.8
129100	0	0	0	0	1.8	23.3
158992	0	0	0	0	0.7	8.8
284378	0	0	0	0	1.7	20.4
216798	0.1	0.6	0	0	1.9	25.7
275441	0.2	2.8	0	0	5.6	72.9
114189	0	0	0	0	10.2	12.8

Service	Cumulative Volume of River Usage for previous meter reading	Cumulative Volume of Recycled Usage for previous meter reading	Cumulative Volume of River Usage for current meter reading	Cumulative Volume of Recycled Usage for current meter reading	Cumulative Volume YTD of River Usage	Cumulative Volume YTD of Recycled Usage
262919	0	0	0	0	3.3	6.6
347655	0	0.6	0	0	1.4	18.9
131164	0.1	0.9	0	0	3.7	28
300519	0	0.4	0	0	3.3	22.3
179027	4.4	0	0	0	7	35.5
196533	0.3	4.2	0	0	12.9	140.8
251224	0.1	1.9	0	0	4.2	57.8
183385	0.1	1.2	0	0	0.9	13.8
202681	0.2	2.4	0	0	6.6	72
382701	0.2	3.2	0	0	5.8	71.3
341428	1	0	0	0	2.4	7.2
281360	0.2	2.7	0	0	5.6	5.5
278017	0.1	1.3	0	0	1.2	14.5
310514	0.1	1.1	0	0	7.8	71.4
390127	0.2	2	0	0	6	77.7
256234	0	0	0	0	13.1	21.5
231169	0	0.3	0	0	1.6	23.8
165654	0	0	0	0	6.1	14
204684	0.1	1.2	0	0	4.7	43.4
107360	1.3	0	0	0	3.4	20.2
150347	0.8	10.6	0	0	51.7	329
317500	0	0	0	0	3.2	39.2
171069	0	0.1	0	0	0.7	10.4
300144	0	0	0	0	3.9	5.2
106860	0.1	1.4	0	0	3.6	34.6
109835	0.4	4.5	0	0	22.1	121.2
283991	0	0	0	0	2.9	41
254533	0.2	1.9	0	0	4.8	29.3
161012	1.7	0	0	0	3.8	3.5
152803	4.5	0.9	0	0	5.4	15.4
305588	0.1	0.6	0	0	1.2	18.1
202061	0.4	4.9	0	0	4.1	55.4
183059	0	0	0	0	0.1	1.2
223190	0	0.5	0	0	5.5	26.5
311170	0	0.5	0	0	1.7	9.7
366935	0	0.2	0	0	2.7	12.6
170291	0	0.3	0	0	4	20
358150	0	0.6	0	0	0.8	10.8
388858	0.1	0.7	0	0	0.8	12.1
389250	2.5	0	0	0	11.6	58.6
198218	0	0.3	0	0	1.2	15.3
4003306	0.7	8.9	0	0	76.3	26.6
4005511	0.1	0.8	0	0	1.8	23.1
4008650	0	0	0	0	3.6	47.7

Service	Cumulative Volume of River Usage for previous meter reading	Cumulative Volume of Recycled Usage for previous meter reading	Cumulative Volume of River Usage for current meter reading	Cumulative Volume of Recycled Usage for current meter reading	Cumulative Volume YTD of River Usage	Cumulative Volume YTD of Recycled Usage
4008960	0.7	9.3	0	0	38.3	241.3
4011686	0.4	4.5	0	0	4	50.3
9016187	0.1	1.7	0	0	4	56.8
9016497	0.2	3	0	0	5.3	60.9
9016498	0.5	5.8	0	0	10.2	145
9016915	0	0	0	0	3.8	48.7
9020445	0	0.5	0	0	1.6	20.6
9020446	0.3	4.4	0	0	2.9	39.3
9026341	0	0	0	0	0.5	5.2
9027234	0	0	0	0	1.1	9.8
9029105	0.1	1	0	0	1.8	22.7
	81.5	**260.6**	**0**	**0**	**1042.4**	**7422.3**

11. APPENDIX 5: Listing Of Recycled Customers And Usage From July-Dec 2007

Service	Cumulative Volume of River Usage for previous meter reading	Cumulative Volume of Recycled Usage for previous meter reading	Cumulative Volume of River Usage for current meter reading	Cumulative Volume of Recycled Usage for current meter reading	Cumulative Volume YTD of River Usage	Cumulative Volume YTD of Recycled Usage
185620	0	0	0	0	0	0
163953	0.1	0.3	0	0	0.1	2.1
316377	0.1	0.4	0	0	0.2	5.5
320455	1.5	3.5	0	0	6.9	18.8
168041	0	0	0	0	0	0.6
383651	0.6	3.9	0	0	2.1	20.4
343803	0.9	6.1	0	0	1.4	30.9
237647	0.4	2.7	0	0	1.2	47.7
251321	0.7	4.3	0	0	2	16.9
250589	1.5	9.5	0	0	3.5	57.4
215244	0	0	0	0	0	0.3
379867	0.3	1.9	0	0	1.1	35.4
224812	0	0	0	0	0	0
314587	2.3	3.5	0	0	2.4	9.5
155217	0.4	2.3	0	0	0.4	4.4
310018	0.2	1.3	0	0	0.5	9.4
135070	0.3	6.3	0	0	1.1	17.7
353884	0.1	0.4	0	0	0.1	2.1
262676	0.7	4.6	0	0	1	22.2
324116	1	6.2	0	0	1.5	33.6
964220	0.2	1.4	0	0	0.3	9.5
190098	0.9	6	0	0	1.3	26.4
323209	8.8	13.3	0	0	13.7	81.1
104086	5.6	18.8	0	0	6.6	68.6
276294	2.4	5.7	0	0	2.9	30.9
380652	1.7	2.8	0	0	1.9	14.4
104124	7.4	25.2	0	0	9.6	139.3
250546	0.9	6.6	0	0	1.3	29.8
241490	5.2	15.6	0	0	7.4	79.6
1110136	1	7.3	0	0	1.3	23.2
306541	0.6	4.4	0	0	1.9	12
293865	3.6	15.6	0	0	9	71.8
239674	0.6	3.5	0	0	1.3	11.9
187690	2.1	13.4	0	0	3.4	53.6
115576	0.4	3.1	0	0	1.7	16.2
351768	0.4	2.3	0	0	0.7	22.5
314595	0.9	6.5	0	0	2.5	13.2
103136	0.2	1.1	0	0	0.3	7.7
1098403	0	0	0	0	0	0
146145	0.2	1.1	0	0	0.2	3

Service	Cumulative Volume of River Usage for previous meter reading	Cumulative Volume of Recycled Usage for previous meter reading	Cumulative Volume of River Usage for current meter reading	Cumulative Volume of Recycled Usage for current meter reading	Cumulative Volume YTD of River Usage	Cumulative Volume YTD of Recycled Usage
171433	1.4	8.9	0	0	4.2	48.5
221562	1	6.1	0	0	1.2	20.4
321648	1	6.5	0	0	1.4	27.1
210218	0.7	4.2	0	0	0.9	14.5
209074	0.4	2.3	0	0	0.4	7
4000609	0.9	5.7	0	0	1.1	20.3
240540	1.9	14.5	0	0	3	69.2
318108	0.7	4.3	0	0	0.9	13.1
319694	4.6	17.8	0	0	6.6	103.9
144436	0.4	0.8	0	0	0.8	19.2
124443	2.5	15.7	0	0	6	76.1
294268	0.1	0.5	0	0	0.2	7.6
350850	1.9	2.7	0	0	2.6	41.9
344486	8.1	52	0	0	12.4	286
270636	0.1	0.7	0	0	0.1	1.3
4003403	0.1	0.8	0	0	0.2	2.4
262498	1.2	7.6	0	0	2.9	27.6
277355	0.2	1.1	0	0	0.2	3.4
201618	0.2	1.4	0	0	0.5	14.7
321591	0.4	2.6	0	0	0.7	17.3
240257	0.8	5.4	0	0	2.9	22.1
102148	0.7	4.6	0	0	1.1	19.4
375683	1.8	11.8	0	0	9.1	67.7
218111	0.9	5.8	0	0	3.5	23.4
288241	0.5	3.4	0	0	1.7	15.3
363774	2.6	5.8	0	0	3.2	38.3
216488	2.5	3.7	0	0	3.2	38
100099	0.1	1	0	0	1.3	7.4
239836	1.6	4	0	0	1.9	18.4
149934	8.2	24.6	0	0	11	131.7
232602	0.1	0.9	0	0	0.2	3.2
307947	0.5	3.1	0	0	1	24.2
152501	0.4	2.9	0	0	0.9	24.8
122483	0.6	3.8	0	0	2.3	18
194654	0.7	4.6	0	0	0.8	13.9
282987	1.8	4.5	0	0	2.3	27.1
124214	0	0	0	0	0	0
168599	0	0	0	0	0	0
141283	1.4	9.1	0	0	2	38.4
129100	0.3	1.7	0	0	0.4	8.8
158992	0.2	1	0	0	0.2	1
284378	0	0	0	0	0.2	9.5
216798	0.2	1.3	0	0	0.4	9.7
225118	0.8	5.4	0	0	2.2	18.5

Service	Cumulative Volume of River Usage for previous meter reading	Cumulative Volume of Recycled Usage for previous meter reading	Cumulative Volume of River Usage for current meter reading	Cumulative Volume of Recycled Usage for current meter reading	Cumulative Volume YTD of River Usage	Cumulative Volume YTD of Recycled Usage
275441	0	0	0	0	0.4	20.2
114189	1	6.3	0	0	1.3	25.9
262919	0.1	0.6	0	0	0.2	3.8
131164	0.8	5	0	0	1.2	25
300519	0.4	2.6	0	0	0.6	14.3
179027	2.3	14.6	0	0	2.7	36.6
196533	3.2	13.7	0	0	4.2	65.9
251224	1.7	5	0	0	2.2	25.5
301809	0.2	1	0	0	0.3	6.3
183385	0	0	0	0	0.1	2.5
202681	1.2	7.7	0	0	1.8	40.8
382701	1.2	7.4	0	0	1.6	30.4
341428	0.2	1.2	0	0	0.3	5.9
281360	1.2	7.8	0	0	1.8	34.9
278017	0.2	1.6	0	0	0.4	10.5
310514	1.4	9.2	0	0	1.7	26.2
390127	0.6	4.2	0	0	1.1	27.9
256234	0.4	2.8	0	0	0.7	13.3
231169	0.5	3.3	0	0	0.6	6.8
165654	0.4	2.3	0	0	0.5	9.3
204684	0.5	3.3	0	0	0.9	21.7
107360	0.2	1.3	0	0	0.4	9.3
150347	7.6	23.7	0	0	12	152.4
317500	0.5	3.2	0	0	0.7	15.2
171069	0.2	1.5	0	0	0.3	2.8
300144	0	0	0	0	0	0
106860	0.6	4.1	0	0	1.5	22.8
109835	2.2	14.1	0	0	2.8	50.8
209112	1.4	8.1	0	0	2	41.2
283991	0	0	0	0	0	0
254533	0.4	2.7	0	0	2.8	13.9
161012	0.1	0.5	0	0	0.1	3.4
152803	0.1	0.9	0	0	0.3	6.5
202061	1.1	7.3	0	0	1.7	33.1
183059	0	0	0	0	0	0
223190	0.3	2.2	0	0	0.6	15.4
311170	0.4	2.6	0	0	0.5	9.4
366935	0.5	3.2	0	0	0.6	11.1
170291	0.4	2.2	0	0	0.6	13.5
358150	0.3	1.6	0	0	0.5	13.4
388858	0.6	4	0	0	0.8	11.6
389250	1.1	6.8	0	0	2.9	35.8
359009	0.1	0.4	0	0	0.1	1.1
4003292	0	0	0	0	1	0

Service	Cumulative Volume of River Usage for previous meter reading	Cumulative Volume of Recycled Usage for previous meter reading	Cumulative Volume of River Usage for current meter reading	Cumulative Volume of Recycled Usage for current meter reading	Cumulative Volume YTD of River Usage	Cumulative Volume YTD of Recycled Usage
4003306	3.4	9.2	0	0	4.9	38
4005511	0.3	1.9	0	0	0.5	15.3
4008650	0.4	2.5	0	0	0.9	25.1
4008960	2.3	18.3	0	0	3.6	81.6
4011686	1.8	11.4	0	0	2.3	37.1
9016187	0.7	4.8	0	0	0.9	19.1
9016497	6.8	30.8	0	0	9.6	151.2
9016915	0.2	1.6	0	0	0.6	18.6
9020445	0.2	1.5	0	0	0.3	4
9020446	0.9	5.9	0	0	1.3	27.3
9022630	0.1	0.6	0	0	0.9	9.3
9027234	0.4	2.8	0	0	0.5	5.4
9029105	0.9	5.7	0	0	1.3	25.2
	162.8	**762.4**	**0**	**0**	**275.5**	**3823.3**

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12. APPENDIX 6: WESTERN IRRIGATION FUTURES

SOUTHERN RURAL WATER
WESTERN IRRIGATION FUTURES PROJECT

PROJECT SCOPE

PURPOSE

In both the Werribee and Bacchus Marsh Irrigation Districts there are powerful drivers to develop a detailed long-term strategic infrastructure investment plan for SRW's irrigation supply system. The Western Irrigation Futures Project will develop a strategy addressing these drivers commensurate with the financial capacity of current and prospective customers and third-party investors and the repayment period for which SRW can be confident.

THE WERRIBEE AND BACCHUS MARSH IRRIGATION DISTRICTS

The Werribee and Bacchus Marsh Irrigation Districts lie in Melbourne's rapidly-developing western fringe. The vegetable-growing WID abuts both the Werribee River and Port Phillip Bay, and uses some 10,000 ML each year from SRW's system of concrete-lined channels and pipelines. This water is sourced from the Werribee and Lerderderg Rivers, via the Melton, Merrimu and Pykes Creek Reservoirs.

Irrigators also pump groundwater from the underlying Deutgam Groundwater Management Area and, more recently, many have chosen to take Class A recycled water from Melbourne Water's nearby Western Treatment Plant.

The smaller BMID lies in the valley of the Werribee and Lerderderg Rivers at Bacchus Marsh, and uses some 4,000 ML each year from SRW's system (again, pipelines and concrete-lined channels) for vegetable growing, orchards and mixed uses. This water is sourced from the Werribee River, via Pykes Creek Reservoir. Some irrigators have limited access to groundwater; recycled water is not available.

SRW manages the available river water on a system-wide basis; in all but extreme years there is a common seasonal allocation for BMID, WID and the 1,100 ML of river diverters.

As the drought has deepened in recent years, seasonal allocations have plunged – and in 2006/7 reached a previously unimagined low of 10%. Drought conditions in 2003/4 prompted the WID Recycled Water Scheme, which was designed to augment river supplies in WID, but in 2006/7 became the principal supply for WID. Under the Scheme the salinity of this recycled water was to be reduced from around 1,800 EC to 1,000 EC by 2009; with desalination not now proceeding, the sustainable management of recycled water is an important challenge for WID.

At the same time, the drought has seen salinity in the lower Werribee River climb, from an average 870 EC in 1997-2002 to an average 1,460 EC in the last five years. At these levels salinity needs to be carefully managed on WID farms. Whilst BMID has seen some increase in overall salinity levels they are not at levels where they affect growers.

Werribee Irrigation District

A reliable and sustainable, fit for purpose water supply is the headline issue. River water has been increasingly unreliable in the last decade, the supplementary supply of Class A recycled water from the Western Treatment Plant has elevated salinity, and the availability of groundwater is expected to diminish with reduced infiltration as irrigation becomes more efficient and channel leakage is lessened.

Substantial water loss from ageing concrete-lined channels is a secondary question – although reduction of losses may provide an opportunity for improving water reliability. In contrast to many other irrigation areas, service levels in the WID are not a major driver – as on-farm systems are less dependent on the nature of deliveries from the channel system due to extensive on-farm investment in irrigation systems, including storage dams.

Factors potentially affecting investment certainty include the adaptability of agricultural production, the impact of elevated salinity in all sources of irrigation water, and pressures for urbanisation. Notwithstanding Werribee South's status as a green wedge, the attractiveness of the coastal fringe is expected to create urban pressures, rather than the general demand for urban land which is well catered for in existing growth areas. Modest reductions in the area of the WID may be sustainable if offset by intensification elsewhere, but a substantial reduction in area could render the irrigation system unviable.

Importantly, the impact of these factors would build over many years, rather than suddenly – so transition is expected to be a feature of both the WID's future and the investment strategy.

Ultimately, the matter of investment will turn on the capacity of a relatively small customer group to afford the necessary solutions – and the attractiveness of complementary benefits to other investors.

Bacchus Marsh Irrigation District

Likewise, water reliability is the headline issue for BMID. Unlike WID, however, recycled water is not currently available and groundwater is limited.

Again, the nature and state of BMID's pipelines and concrete-lined channels is the secondary question – with losses considerable and open channels backing onto residential areas a risk. As in the WID, on-farm systems mean that service levels are not a major driver.

In planning terms, the BMID is considered an important element of Bacchus Marsh's character – and is protected both by zoning and, in many areas, by its location within designated flood zones. Whether this will lead to long-term protection of a sufficient area to be viable, or instead restrict inevitable structural change, is one of the questions influencing investment certainty. A small customer group, with production biased to a small number of large producers, is another.

Whether the necessary solutions, even if complementary benefits are attractive to other investors, are affordable for this small customer group remains a fundamental question.

OBJECTIVES

The principal objective of Western Irrigation Futures is to develop a plan for SRW's investment in water supply and distribution in BMID and WID that:

- is aligned with agreed expectations of major stakeholders;
- can be afforded by customers and third-party investors;
- has an implementation and funding horizon in which we have confidence;
- has a path forward beyond the planning horizon;
- will provide for sustainable environmental and production performance.

The secondary objective is that, in developing this plan, all parties develop a deeper and shared understanding of the important characteristics of BMID and WID, the pressures on them and the drivers for change, the nature of the choices and trade-offs available and key considerations in each party's investment decisions.

PROCESS

Western Irrigation Futures will be one project, with two streams for selected activities. It will be built on strong customer, community and stakeholder engagement – and a staging involving an Atlas describing the system and providing a common starting point for all players, a Discussion Paper drawing out key issues and choices, and a Strategy Report explaining proposed investments.

The Atlas and Discussion Paper will cover both BMID and WID, although consultation with customers and the community is intended to be separate (with separate brochures and fact sheets). The extent of separate and joint consultation on the Strategy Report will be considered in the light of the emerging investment strategy.

The Western Irrigation Futures Atlas

The Atlas is expected to include a range of basic information about the Werribee basin, BMID and WID, including:

- **land use and industry profiles**
- **soil characteristics**
- **irrigation methods and practices**
- **water quality**
- **recycled water**
- **groundwater**
- **nutrients**
- **environmental flows**
- **system storages and bulk water movements**
- **water deliveries and usage history and patterns**
- **water distribution and drainage systems**
- **Wyndham and Moorabool growth plans**
- **statutory planning zoning and objectives**
- **flood levels used for planning**
- **climate**
- **watertable depth**

Much of the information in the Western Irrigation Futures Atlas will be drawn from existing resources and re-presented for a general readership. However, limited new analysis may be required, for example to incorporate recent years into surface water availability estimates. This initial phase will identify interest and concerns of customers and stakeholders and lead to developing assessment criteria for use in evaluating options in the Discussion Paper. This phase will largely shape the options investigated in the next phase.

The Western Irrigation Futures Discussion Paper

The Discussion Paper is expected to cover:

- future river water availability and quality
- future recycled water availability and quality (WID existing, BMID possible)
- future groundwater availability and quality
- on farm practices for sustainable irrigation
- management of public safety questions arising from SRW channels and infrastructure
- options for reducing water loss from SRW channels and infrastructure
- investment affordability for customer groups, and attractiveness for other investors
- urbanisation, managing transition, and viability thresholds for both districts

With its emphasis on the future, the Western Irrigation Futures Discussion Paper is expected to require further analysis in a number of areas – particularly to interpret and extrapolate currently available information.

The Western Irrigation Futures Strategy

The Western Irrigation Futures Strategy is expected to outline a plan for SRW's investment in water supply and distribution in BMID and WID.

In doing so, it is expected to explain:

- the context for the plan:
    - relevant characteristics of BMID and WID;
    - key drivers for change;
    - why particular choices are preferred; and
- to confirm how it:
    - is aligned with agreed expectations of major stakeholders;
    - can be afforded by customers and third-party investors;
    - has an implementation and funding horizon in which we have confidence;
    - will provide for sustainable environmental and production performance.

Consultation, engagement and communication

Western Irrigation Futures will canvass several areas of importance to Government – including water supply, agricultural production, land use and change, protection of soil and water quality, and the effectiveness of community and government investment. Alignment of Government priorities and agencies will be facilitated through an Agency Working Group.

The principal reference body for Western Irrigation Futures will be a Stakeholder Reference Group, comprising the members of the Agency Working Group and representatives of relevant stakeholder, community and customer bodies – including SRW's Werribee Bacchus Marsh Customer Consultative Committee.

There will also be regular engagement with the WBMCCC, reflecting its role in providing a customer perspective into SRW's Western Irrigation Business.

In each consultation phase there will be direct consultation with customers at large, the wider community, and relevant stakeholder bodies. This will utilise project documents, brochures summarising the project overall and/or for specific areas, and discussions with members of the project team.

Timetable

Project initiation and preparation of project plan	October 2007
Preparation of Western Irrigation Futures Atlas	November 2007 – February 2008
Formation of Stakeholder Reference Group	November 2007 – December 2007
Community response to Western Irrigation Futures Atlas	March 2008 – April 2008
Preparation of Western Irrigation Futures Discussion Paper	April 2008 – August 2008
Community consultation on Western Irrigation Futures Discussion Paper	September 2008 – October 2008
Preparation of draft Western Irrigation Futures Strategy	November 2008 – February 2009
Community consultation on draft Western Irrigation Futures Strategy	March 2009 – April 2009
Preparation of final Western Irrigation Futures Strategy	May 2009 – June 2009
Formal adoption of Western Irrigation Futures Strategy	July 2009 – August 2009

Project Management

SRW will appoint a senior Project Manager for Western Irrigation Futures.

A Project Board will provide oversight of progress. There will be regular reporting to the SRW Board.

13. APPENDIX 7: GROUNDWATER SAMPLING LABORATORY CERTFICATES

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Accreditation Number: 1645

Certificate of Analysis

Sinclair Knight Merz
590 Orrong Rd
Armadale VIC 3143
Australia

Attention: Heather Walker

Project	08ENME0003856
Client Reference	VW03716
	WERRIBEE PUMP SAMPLING
Received Date	14/02/2008 04:15:00 PM

Customer Sample ID			59628	59622	59620	59623	146273
Amdel Sample Number			847416	847417	847418	847419	847420
Date Sampled			14/02/2008	14/02/2008	14/02/2008	14/02/2008	14/02/2008
Metals							
Test/Reference	PQL	Unit					
3200 Total Metals in Water by ICP/AES							
Phosphorus *	100	µg/L	111	<100	134	<100	102
3100 Dissolved Metals in Water By ICP/MS							
Antimony	5	µg/L	<5	<5	<5	<5	<5
Boron	5	µg/L	1200	1200	690	1400	1300
Cadmium	5	µg/L	<5	<5	<5	<5	<5
Copper	5	µg/L	<5	<5	<5	<5	<5
Lead	5	µg/L	<5	<5	<5	<5	<5
Manganese	5	µg/L	<5	43	25	<5	5.0
Nickel	5	µg/L	<5	<5	<5	<5	<5
Zinc	5	µg/L	16	20	28	18	19
Inorganics							
Test/Reference	PQL	Unit					
4010 Conductivity in Water							
Electrical Conductivity	20	µS/cm	2360	5150	2870	2920	1720
4520 Ammonia in Water by Titration							
Ammonia as N	1	mg N/L	<1	<1	<1	<1	<1
4000 pH in Water							
pH	0.1	pH	7.9	7.6	7.6	7.8	8.0
4540 TKN in Water by Titration							
TKN	1	mg/L	<1	<1	<1	<1	<1
4941 Total Nitrogen in Water by Calc							
Total Nitrogen	2	mg N/L	41	25	55	11	<2
4300 Anions in Water by IC							
Nitrate as N	0.5	mg N/L	41	24	55	11	1.5
Nitrite as N	0.5	mg N/L	<0.5	<0.5	<0.5	<0.5	<0.5

Customer Sample ID			59630	146270
Amdel Sample Number			847421	847422
Date Sampled			14/02/2008	14/02/2008
Metals				
Test/Reference	PQL	Unit		
3200 Total Metals in Water by ICP/AES				
Phosphorus *	100	µg/L	<100	<100
3100 Dissolved Metals in Water By ICP/MS				
Antimony	5	µg/L	<5	<5

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Customer Sample ID			69630	145270
Amdel Sample Number			847421	847422
Date Sampled			14/02/2008	14/02/2008
Metals				
Test/Reference	PQL	Unit		
Boron	5	µg/L	640	290
Cadmium	5	µg/L	<5	<5
Copper	5	µg/L	<5	<5
Lead	5	µg/L	<5	<5
Manganese	5	µg/L	120	140
Nickel	5	µg/L	<5	160
Zinc	5	µg/L	25	25
Inorganics				
Test/Reference	PQL	Unit		
4010 Conductivity in Water				
Electrical Conductivity	20	µS/cm	5360	874
4520 Ammonia in Water by Titration				
Ammonia as N	1	mg N/L	<1	<1
4000 pH in Water				
pH	0.1	pH	7.5	7.1
4540 TKN in Water by Titration				
TKN	1	mg/L	<1	<1
4941 Total Nitrogen in Water by Calc				
Total Nitrogen	2	mg N/L	<2	<2
4300 Anions in Water by IC				
Nitrate as N	0.5	mg N/L	<0.5	1.4
Nitrite as N	0.5	mg N/L	<0.5	<0.5

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

Description	Extracted	Analysed
3100 Dissolved Metals in Water By ICP/MS	19/02/2008	20/02/2008
3200 Total Metals in Water by ICP/AES	20/02/2008	21/02/2008
4000 pH in Water	20/02/2008	19/02/2008
4010 Conductivity in Water	20/02/2008	19/02/2008
4300 Anions in Water by IC	21/02/2008	21/02/2008
4520 Ammonia in Water by Titration	19/02/2008	19/02/2008
4540 TKN in Water by Titration	19/02/2008	20/02/2008
4941 Total Nitrogen in Water by Calc		21/02/2008

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Amdel Internal Quality Control Review

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. Amdel QC Acceptance/Rejection criteria are available on request.
3. Proficiency trial results are available on request.
4. Actual PQLs are matrix dependant. Quotes PQLs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spike or surrogate recoveries.
6. Test samples duplicated or spiked, are for this job only and are identified in the following QC report.
7. SVOC analyses on waters are performed on homogenized, unfiltered sample, unless noted otherwise.
8. When individual results are qualified in the body of a report, refer to the qualifier descriptions that follow.

Holding Times

Please refer to 'Sampling and Preservation Chart for Soils & Waters' for holding times. (Amdel form AD-FOR_ADM-020)

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgement.
If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitablity qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

Quality Control Results

Laboratory: EN_METALS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
852664 [Method Blank]							
3100 Dissolved Metals in Water By ICP/MS							
Antimony	µg/L	<5			< 5	T	
Boron	µg/L	<5			< 5	T	
Cadmium	µg/L	<5			< 5	T	
Copper	µg/L	<5			< 5	T	
Lead	µg/L	<5			< 5	T	
Manganese	µg/L	<5			< 5	T	
Nickel	µg/L	<5			< 5	T	
Zinc	µg/L	<5			< 5	T	
852665 [Laboratory Control Sample]							
3100 Dissolved Metals in Water By ICP/MS			Expected Value	Percent Recovery			
Antimony	µg/L	95	100.0	95	80-120 %	T	
Cadmium	µg/L	98	100.0	98	80-120 %	T	
Copper	µg/L	110	100.0	107	80-120 %	T	
Lead	µg/L	95	100.0	95	80-120 %	T	
Manganese	µg/L	110	100.0	106	80-120 %	T	
Nickel	µg/L	110	100.0	108	80-120 %	T	
Zinc	µg/L	100	100.0	101	80-120 %	T	
848709 [Duplicate of 847416]							
3200 Total Metals in Water by ICP/AES			Result 2	RPD			
Phosphorus *	µg/L	113	111	2	0-30 %	T	
848710 [Duplicate of 847416]							
3100 Dissolved Metals in Water By ICP/MS			Result 2	RPD			
Antimony	µg/L	<5	<5	<1	0-10 %	T	
Boron	µg/L	1200	1200	4	0-10 %	T	
Cadmium	µg/L	<5	<5	<1	0-10 %	T	
Copper	µg/L	<5	<5	<1	0-10 %	T	
Lead	µg/L	<5	<5	<1	0-10 %	T	
Manganese	µg/L	<5	<5	<1	0-10 %	T	
Nickel	µg/L	<5	<5	<1	0-10 %	T	
Zinc	µg/L	18	18	4	0-10 %	T	

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Laboratory: EN_WATERS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
848560 [Method Blank]							
4300 Anions in Water by IC							
Bromide	mg/L	<0.5			< 0.5	T	
Chloride	mg/L	<0.5			< 0.5	T	
Fluoride	mg/L	<0.5			< 0.5	T	
Nitrate	mg/L	<0.5			< 0.5	T	
Nitrite	mg/L	<0.5			< 0.5	T	
Orthophosphate as P	mg/L	<0.5			< 0.5	T	
Sulphate	mg/L	<0.5			< 0.5	T	
850588 [Method Blank]							
4520 Ammonia in Water by Titration							
Ammonia as N	mg N/L	<1			< 1	T	
850614 [Method Blank]							
4540 TKN in Water by Titration							
TKN	mg/L	<1			< 1	T	
851080 [Method Blank]							
4300 Anions in Water by IC							
Bromide	mg/L	<0.5			< 0.5	T	
Chloride	mg/L	<0.5			< 0.5	T	
Fluoride	mg/L	<0.5			< 0.5	T	
Nitrate	mg/L	<0.5			< 0.5	T	
Nitrite	mg/L	<0.5			< 0.5	T	
Orthophosphate as P	mg/L	<0.5			< 0.5	T	
Sulphate	mg/L	<0.5			< 0.5	T	
848562 [Laboratory Control Sample]							
4300 Anions in Water by IC			Expected Value	Percent Recovery			
Bromide	mg/L	97	100.0	97	80-120 %	T	
Chloride	mg/L	99	100.0	99	80-120 %	T	
Fluoride	mg/L	98	100.0	98	80-120 %	T	
Nitrate	mg/L	120	100.0	115	80-120 %	T	
Nitrite	mg/L	84	100.0	84	80-120 %	T	
Orthophosphate as P	mg/L	90	100.0	90	80-120 %	T	
Sulphate	mg/L	98	100.0	98	80-120 %	T	
850590 [Laboratory Control Sample]							
4520 Ammonia in Water by Titration			Expected Value	Percent Recovery			
Ammonia as N	mg N/L	9.8	10.0	98	80-120 %	T	
850616 [Laboratory Control Sample]							
4540 TKN in Water by Titration			Expected Value	Percent Recovery			
TKN	mg/L	89	100.0	89	80-120 %	T	
851082 [Laboratory Control Sample]							
4300 Anions in Water by IC			Expected Value	Percent Recovery			
Bromide	mg/L	92	100.0	92	80-120 %	T	
Chloride	mg/L	98	100.0	98	80-120 %	T	
Fluoride	mg/L	94	100.0	94	80-120 %	T	
Nitrate	mg/L	110	100.0	111	80-120 %	T	
Nitrite	mg/L	82	100.0	82	80-120 %	T	
Orthophosphate as P	mg/L	95	100.0	95	80-120 %	T	
Sulphate	mg/L	94	100.0	94	80-120 %	T	
852061 [Laboratory Control Sample]							
4010 Conductivity in Water			Expected Value	Percent Recovery			
Electrical Conductivity	µS/cm	1420	N/A	N/A	N/A	N/A	
848707 [Duplicate of 847416]							
4300 Anions in Water by IC			Result 2	RPD			
Nitrate as N	mg N/L	41	41	1	0-10 %	T	
Nitrite as N	mg N/L	0.5	<0.5	5	0-10 %	T	
848708 [Duplicate of 847416]							
4010 Conductivity in Water			Result 2	RPD			
Electrical Conductivity	µS/cm	2350	2360	<1	0-10 %	T	

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Laboratory: EN_WATERS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
848711 [Duplicate of 847416]							
4520 Ammonia in Water by Titration			Result 2	RPD			
Ammonia as N	mg N/L	<1	<1	<1	0-20 %	T	
848712 [Duplicate of 847416]							
4000 pH in Water			Result 2	RPD			
pH	pH	7.9	7.9	0.0	0-0.2 pH	T	
848713 [Duplicate of 847416]							
4540 TKN in Water by Titration			Result 2	RPD			
TKN	mg/L	<1	<1	<1	0-20 %	T	
848714 [Spike of 847417]							
4300 Anions in Water by IC			Spike Value	Percent Recovery			
Nitrate as N	mg N/L	54	N/A	N/A	N/A	N/A	
Nitrite as N	mg N/L	25	N/A	N/A	N/A	N/A	
848716 [Spike of 847417]							
4520 Ammonia in Water by Titration			Spike Value	Percent Recovery			
Ammonia as N	mg N/L	10	10.0	102	80-120 %	T	
848717 [Spike of 847417]							
4540 TKN in Water by Titration			Spike Value	Percent Recovery			
TKN	mg/L	90	100.0	89	80-120 -	T	

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Samples correctly preserved	Yes
Organic samples had Teflon liners	Yes
Samples received with Zero Headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Vanda Dabkowski	Customer Service Leader	
Mark Herbstreit	Senior Analyst - Metals	Accreditation Number: 1645
Helen Lei	Senior Analyst - Waters	Accreditation Number: 1645

Laboratory Manager

Anthony Crane — Operations Manager

Final Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

The samples were not collected by Amdel staff.

First Reported: 21 February 2008
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Amended Certificate of Analysis

Sinclair Knight Merz
590 Orrong Rd
Armadale VIC 3143
Australia

Attention: Heather Walker

Project	08ENME0003506
Client Reference	VW03716
	WERRIBEE PUMP SAMPLING
Received Date	12/02/2008 09:00:00 AM

Customer Sample ID			69632	69631	146271	69633	69638
Amdel Sample Number			841641	841642	841643	841644	841645
Date Sampled			11/02/2008	11/02/2008	11/02/2008	11/02/2008	11/02/2008
Metals							
Test/Reference	PQL	Unit					
3200 Total Metals in Water by ICP/AES							
Phosphorus *	100	µg/L	<100	<100	<100	174	<100
3100 Dissolved Metals in Water By ICP/MS							
Antimony	5	µg/L	<5	<5	<5	<5	<5
Boron	5	µg/L	310	240	290	450	240
Cadmium	5	µg/L	<5	<5	<5	<5	<5
Copper	5	µg/L	<5	<5	<5	<5	<5
Lead	5	µg/L	<5	<5	<5	<5	<5
Manganese	5	µg/L	510	130	44	19	<5
Nickel	5	µg/L	<5	<5	<5	<5	<5
Zinc	5	µg/L	35	45	37	32	33
Inorganics							
Test/Reference	PQL	Unit					
4010 Conductivity in Water							
Electrical Conductivity	20	µS/cm	3560	2810	1720	2200	1520
4520 Ammonia in Water by Titration							
Ammonia as N	1	mg N/L	<1	<1	<1	<1	<1
4000 pH in Water							
pH	0.1	pH	7.2	7.5	7.7	7.7	7.9
4540 TKN in Water by Titration							
TKN	1	mg/L	<1	<1	<1	<1	<1
4941 Total Nitrogen in Water by Calc							
Total Nitrogen	2	mg N/L	<2	4	10	13	8
4300 Anions in Water by IC							
Nitrate as N	0.5	mg N/L	<0.5	4.1	10	13	7.6
Nitrite as N	0.5	mg N/L	<0.5	<0.5	<0.5	<0.5	<0.5

Customer Sample ID			69639
Amdel Sample Number			841646
Date Sampled			11/02/2008
Metals			
Test/Reference	PQL	Unit	
3200 Total Metals in Water by ICP/AES			
Phosphorus *	100	µg/L	1030
3100 Dissolved Metals in Water By ICP/MS			
Antimony	5	µg/L	<5

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Customer Sample ID			**59539**
Amdel Sample Number			**841648**
Date Sampled			**11/02/2008**

Metals

Test/Reference	PQL	Unit	
Boron	5	µg/L	190
Cadmium	5	µg/L	<5
Copper	5	µg/L	5.4
Lead	5	µg/L	<5
Manganese	5	µg/L	48
Nickel	5	µg/L	9.3
Zinc	5	µg/L	47

Inorganics

Test/Reference	PQL	Unit	
4010 Conductivity in Water			
Electrical Conductivity	20	µS/cm	1780
4520 Ammonia in Water by Titration			
Ammonia as N	1	mg N/L	<1
4000 pH in Water			
pH	0.1	pH	7.2
4540 TKN in Water by Titration			
TKN	1	mg/L	<1
4941 Total Nitrogen in Water by Calc			
Total Nitrogen	2	mg N/L	10
4300 Anions in Water by IC			
Nitrate as N	0.5	mg N/L	10
Nitrite as N	0.5	mg N/L	<0.5

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

Description	Extracted	Analysed
3100 Dissolved Metals in Water By ICP/MS	14/02/2008	15/02/2008
3200 Total Metals in Water by ICP/AES	14/02/2008	15/02/2008
4000 pH in Water	17/02/2008	14/02/2008
4010 Conductivity in Water	17/02/2008	14/02/2008
4300 Anions in Water by IC	19/02/2008	15/02/2008
4520 Ammonia in Water by Titration	14/02/2008	14/02/2008
4540 TKN in Water by Titration	14/02/2008	18/02/2008
4941 Total Nitrogen in Water by Calc		18/02/2008

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Amended Report Number : 282401

Amdel Internal Quality Control Review

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. Amdel QC Acceptance/Rejection criteria are available on request.
3. Proficiency trial results are available on request.
4. Actual PQLs are matrix dependant. Quotes PQLs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spike or surrogate recoveries.
6. Test samples duplicated or spiked, are for this job only and are identified in the following QC report.
7. SVOC analyses on waters are performed on homogenized, unfiltered sample, unless noted otherwise.
8. When individual results are qualified in the body of a report, refer to the qualifier descriptions that follow.

Holding Times

Please refer to 'Sampling and Preservation Chart for Soils & Waters' for holding times. (Amdel form AD-FOR_ADM-020)

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgement.
If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitablity qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

Quality Control Results

Laboratory: EN_METALS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
845346 [Method Blank]							
3100 Dissolved Metals in Water By ICP/MS							
Antimony	µg/L	<5			< 5	T	
Boron	µg/L	<5			< 5	T	
Cadmium	µg/L	<5			< 5	T	
Copper	µg/L	<5			< 5	T	
Lead	µg/L	<5			< 5	T	
Manganese	µg/L	<5			< 5	T	
Nickel	µg/L	<5			< 5	T	
Zinc	µg/L	<5			< 5	T	
845347 [Laboratory Control Sample]							
3100 Dissolved Metals in Water By ICP/MS			Expected Value	Percent Recovery			
Antimony	µg/L	94	100.0	94	80-120 %	T	
Boron	µg/L	97	100.0	97	80-120 %	T	
Cadmium	µg/L	98	100.0	98	80-120 %	T	
Copper	µg/L	100	100.0	103	80-120 %	T	
Lead	µg/L	87	100.0	87	80-120 %	T	
Manganese	µg/L	99	100.0	99	80-120 %	T	
Nickel	µg/L	100	100.0	102	80-120 %	T	
Zinc	µg/L	100	100.0	104	80-120 %	T	
841966 [Duplicate of 841641]							
3200 Total Metals in Water by ICP/AES			Result 2	RPD			
Phosphorus *	µg/L	<100	<100	<1	0-30 %	T	

Laboratory: EN_METALS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
841967 [Duplicate of 841641]							
3100 Dissolved Metals in Water By ICP/MS			Result 2	RPD			
Antimony	µg/L	<5	<5	<1	0-10 %	T	
Boron	µg/L	310	310	<1	0-10 %	T	
Cadmium	µg/L	<5	<5	<1	0-10 %	T	
Copper	µg/L	<5	<5	<1	0-10 %	T	
Lead	µg/L	<5	<5	<1	0-10 %	T	
Manganese	µg/L	510	510	<1	0-10 %	T	
Nickel	µg/L	<5	<5	<1	0-10 %	T	
Zinc	µg/L	39	35	10	0-10 %	T	

Laboratory: EN_WATERS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
842427 [Method Blank]							
4300 Anions in Water by IC							
Bromide	mg/L	<0.5			< 0.5	T	
Chloride	mg/L	<0.5			< 0.5	T	
Fluoride	mg/L	<0.5			< 0.5	T	
Nitrate	mg/L	<0.5			< 0.5	T	
Nitrite	mg/L	<0.5			< 0.5	T	
Orthophosphate as P	mg/L	<0.5			< 0.5	T	
Sulphate	mg/L	<0.5			< 0.5	T	
843204 [Method Blank]							
4520 Ammonia in Water by Titration							
Ammonia as N	mg N/L	<1			< 1	T	
843224 [Method Blank]							
4540 TKN in Water by Titration							
TKN	mg/L	<1			< 1	T	
842430 [Laboratory Control Sample]							
4300 Anions in Water by IC			Expected Value	Percent Recovery			
Bromide	mg/L	95	100.0	95	80-120 %	T	
Chloride	mg/L	98	100.0	98	80-120 %	T	
Fluoride	mg/L	94	100.0	94	80-120 %	T	
Nitrate	mg/L	110	100.0	113	80-120 %	T	
Nitrite	mg/L	83	100.0	83	80-120 %	T	
Orthophosphate as P	mg/L	98	100.0	98	80-120 %	T	
Sulphate	mg/L	98	100.0	98	80-120 %	T	
843206 [Laboratory Control Sample]							
4520 Ammonia in Water by Titration			Expected Value	Percent Recovery			
Ammonia as N	mg N/L	9.8	10.0	98	80-120 %	T	
843226 [Laboratory Control Sample]							
4540 TKN in Water by Titration			Expected Value	Percent Recovery			
TKN	mg/L	91	100.0	91	80-120 %	T	
843557 [Laboratory Control Sample]							
4010 Conductivity in Water			Expected Value	Percent Recovery			
Electrical Conductivity	µS/cm	1410	N/A	N/A	N/A	N/A	
Electrical Conductivity	µS/cm	1410	1413.0	100	95-105 %	T	
841964 [Duplicate of 841641]							
4300 Anions in Water by IC			Result 2	RPD			
Nitrate	mg/L	<0.5	<0.5	<1	0-10 %	T	
Nitrate as N	mg N/L	<0.5	<0.5	<1	0-10 %	T	
Nitrite as N	mg N/L	<0.5	<0.5	<1	0-10 %	T	
841965 [Duplicate of 841641]							
4010 Conductivity in Water			Result 2	RPD			
Electrical Conductivity	µS/cm	3620	3560	2	0-10 %	T	
841969 [Duplicate of 841641]							
4520 Ammonia in Water by Titration			Result 2	RPD			
Ammonia as N	mg N/L	<1	<1	<1	0-20 %	T	

First Reported: 18 February 2008
Date Printed: 19 February 2008

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Laboratory: EN_WATERS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
841970 [Duplicate of 841641]							
4000 pH in Water			Result 2	RPD			
pH	pH	7.2	7.2	0.0	0-0.2 pH	T	
841972 [Duplicate of 841641]							
4540 TKN in Water by Titration			Result 2	RPD			
TKN	mg/L	<1	<1	<1	0-20 %	T	
841973 [Spike of 841642]							
4300 Anions in Water by IC			Spike Value	Percent Recovery			
Nitrate	mg/L	130	100.0	110	80-120 %	T	
Nitrite	mg/L	110	100.0	108	80-120 %	T	
841975 [Spike of 841642]							
4520 Ammonia in Water by Titration			Spike Value	Percent Recovery			
Ammonia as N	mg N/L	10	10.0	104	80-120 %	T	
841976 [Spike of 841642]							
4540 TKN in Water by Titration			Spike Value	Percent Recovery			
TKN	mg/L	89	100.0	88	80-120 -	T	

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Samples correctly preserved	Yes
Organic samples had Teflon liners	Yes
Samples received with Zero Headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Ruth Callander	Client Services Officer	
Mark Herbstreit	Senior Analyst - Metals	Accreditation Number: 1645
Helen Lei	Senior Analyst - Waters	Accreditation Number: 1645

Laboratory Manager

Anthony Crane Operations Manager

Amended Report: QC report amended. This report replaces report number 282501

- Indicates Not Requested * Indicates NATA accreditation does not cover the performance of this service

The samples were not collected by Amdel staff.

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

NATA

Accreditation Number: 1645

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Certificate of Analysis

Sinclair Knight Merz
590 Orrong Rd
Armadale VIC 3143
Australia

Attention: Heather Walker

Project	08ENME0003550
Client Reference	VW03716
	WERRIBEE PUMP SAMPLING
Received Date	12/02/2008 04:31:00 PM

Customer Sample ID			69636	69634	146272	69637	69621
Amdel Sample Number			842223	842224	842226	842228	842227
Date Sampled			12/02/2008	12/02/2008	12/02/2008	12/02/2008	12/02/2008
Metals							
Test/Reference	PQL	Unit					
3200 Total Metals in Water by ICP/AES							
Phosphorus *	100	µg/L	<100	<100	133	<100	<100
3100 Dissolved Metals in Water By ICP/MS							
Antimony	5	µg/L	<5	<5	<5	<5	<5
Boron	5	µg/L	560	420	580	560	940
Cadmium	5	µg/L	<5	<5	<5	<5	<5
Copper	5	µg/L	<5	<5	<5	<5	8.8
Lead	5	µg/L	<5	<5	<5	<5	<5
Manganese	5	µg/L	420	140	15	18	290
Nickel	5	µg/L	8.2	<5	<5	<5	9.6
Zinc	5	µg/L	23	26	22	22	34
Inorganics							
Test/Reference	PQL	Unit					
4010 Conductivity in Water							
Electrical Conductivity	20	µS/cm	13300	2860	2190	3390	27600
4520 Ammonia in Water by Titration							
Ammonia as N	1	mg N/L	<1	<1	<1	<1	<1
4000 pH in Water							
pH	0.1	pH	7.5	7.6	7.8	7.7	6.9
4540 TKN in Water by Titration							
TKN	1	mg/L	<1	<1	<1	<1	<1
4941 Total Nitrogen in Water by Calc							
Total Nitrogen	2	mg N/L	<2	28	21	66	<2
4300 Anions in Water by IC							
Nitrate as N	0.5	mg N/L	0.7	28	21	66	1.3
Nitrite as N	0.5	mg N/L	<0.5	<0.5	<0.5	<0.5	<0.5

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

Description	Extracted	Analysed
3100 Dissolved Metals in Water By ICP/MS	14/02/2008	15/02/2008
3200 Total Metals in Water by ICP/AES	14/02/2008	15/02/2008
4000 pH in Water	17/02/2008	14/02/2008
4010 Conductivity in Water	17/02/2008	14/02/2008
4300 Anions in Water by IC	19/02/2008	19/02/2008
4520 Ammonia in Water by Titration	14/02/2008	14/02/2008
4540 TKN in Water by Titration	14/02/2008	18/02/2008
4941 Total Nitrogen in Water by Calc		19/02/2008

First Reported: 19 February 2008
Date Printed: 19 February 2008

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Amdel Internal Quality Control Review

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. Amdel QC Acceptance/Rejection criteria are available on request.
3. Proficiency trial results are available on request.
4. Actual PQLs are matrix dependant. Quotes PQLs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spike or surrogate recoveries.
6. Test samples duplicated or spiked, are for this job only and are identified in the following QC report.
7. SVOC analyses on waters are performed on homogenized, unfiltered sample, unless noted otherwise.
8. When individual results are qualified in the body of a report, refer to the qualifier descriptions that follow.

Holding Times

Please refer to 'Sampling and Preservation Chart for Soils & Waters' for holding times. (Amdel form AD-FOR_ADM-020)

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgement.
If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitablity qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

Quality Control Results

Laboratory: EN_METALS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
845336 [Method Blank]							
3100 Dissolved Metals in Water By ICP/MS							
Antimony	µg/L	<5			< 5	T	
Boron	µg/L	<5			< 5	T	
Cadmium	µg/L	<5			< 5	T	
Copper	µg/L	<5			< 5	T	
Lead	µg/L	<5			< 5	T	
Manganese	µg/L	<5			< 5	T	
Nickel	µg/L	<5			< 5	T	
Zinc	µg/L	<5			< 5	T	
845337 [Laboratory Control Sample]							
3100 Dissolved Metals in Water By ICP/MS			Expected Value	Percent Recovery			
Antimony	µg/L	95	100.0	95	80-120 %	T	
Boron	µg/L	100	100.0	101	80-120 %	T	
Cadmium	µg/L	100	100.0	101	80-120 %	T	
Copper	µg/L	100	100.0	104	80-120 %	T	
Lead	µg/L	89	100.0	89	80-120 %	T	
Manganese	µg/L	99	100.0	99	80-120 %	T	
Nickel	µg/L	100	100.0	103	80-120 %	T	
Zinc	µg/L	110	100.0	111	80-120 %	T	
842277 [Duplicate of 842223]							
3200 Total Metals in Water by ICP/AES			Result 2	RPD			
Phosphorus *	µg/L	<100	<100	<1	0-30 %	T	
842278 [Duplicate of 842223]							
3100 Dissolved Metals in Water By ICP/MS			Result 2	RPD			
Antimony	µg/L	<5	<5	<1	0-10 %	T	
Boron	µg/L	600	580	6	0-10 %	T	
Cadmium	µg/L	<5	<5	<1	0-10 %	T	
Copper	µg/L	<5	<5	<1	0-10 %	T	
Lead	µg/L	<5	<5	<1	0-10 %	T	
Manganese	µg/L	420	420	1	0-10 %	T	
Nickel	µg/L	7.9	8.2	3	0-10 %	T	

Laboratory: EN_WATERS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
842427 [Method Blank]							
4300 Anions in Water by IC							
Bromide	mg/L	<0.5			< 0.5	T	
Chloride	mg/L	<0.5			< 0.5	T	
Fluoride	mg/L	<0.5			< 0.5	T	
Nitrate	mg/L	<0.5			< 0.5	T	
Nitrite	mg/L	<0.5			< 0.5	T	
Orthophosphate as P	mg/L	<0.5			< 0.5	T	
Sulphate	mg/L	<0.5			< 0.5	T	
843204 [Method Blank]							
4520 Ammonia in Water by Titration							
Ammonia as N	mg N/L	<1			< 1	T	
843224 [Method Blank]							
4540 TKN in Water by Titration							
TKN	mg/L	<1			< 1	T	
842430 [Laboratory Control Sample]							
4300 Anions in Water by IC			Expected Value	Percent Recovery			
Bromide	mg/L	95	100.0	95	80-120 %	T	
Chloride	mg/L	98	100.0	98	80-120 %	T	
Fluoride	mg/L	94	100.0	94	80-120 %	T	
Nitrate	mg/L	110	100.0	113	80-120 %	T	
Nitrite	mg/L	83	100.0	83	80-120 %	T	
Orthophosphate as P	mg/L	98	100.0	98	80-120 %	T	
Sulphate	mg/L	98	100.0	98	80-120 %	T	
843206 [Laboratory Control Sample]							
4520 Ammonia in Water by Titration			Expected Value	Percent Recovery			
Ammonia as N	mg N/L	9.8	10.0	98	80-120 %	T	
843226 [Laboratory Control Sample]							
4540 TKN in Water by Titration			Expected Value	Percent Recovery			
TKN	mg/L	91	100.0	91	80-120 %	T	
843558 [Laboratory Control Sample]							
4010 Conductivity in Water			Expected Value	Percent Recovery			
Electrical Conductivity	µS/cm	1410	N/A	N/A	N/A	N/A	
Electrical Conductivity	µS/cm	1410	1413.0	100	95-105 %	T	
842275 [Duplicate of 842223]							
4300 Anions in Water by IC			Result 2	RPD			
Nitrate as N	mg N/L	0.7	0.7	2	0-10 %	T	
Nitrite as N	mg N/L	<0.5	<0.5	<1	0-10 %	T	
842276 [Duplicate of 842223]							
4010 Conductivity in Water			Result 2	RPD			
Electrical Conductivity	µS/cm	13500	13300	1	0-10 %	T	
842279 [Duplicate of 842223]							
4520 Ammonia in Water by Titration			Result 2	RPD			
Ammonia as N	mg N/L	<1	<1	<1	0-20 %	T	
842280 [Duplicate of 842223]							
4000 pH in Water			Result 2	RPD			
pH	pH	7.5	7.5	0.0	0-0.2 pH	T	
842281 [Duplicate of 842223]							
4540 TKN in Water by Titration			Result 2	RPD			
TKN	mg/L	<1	<1	<1	0-20 %	T	
842282 [Spike of 842224]							
4300 Anions in Water by IC			Spike Value	Percent Recovery			
Nitrate as N	mg N/L	49	N/A	N/A	N/A	N/A	
Nitrite as N	mg N/L	33	N/A	N/A	N/A	N/A	
842284 [Spike of 842224]							
4520 Ammonia in Water by Titration			Spike Value	Percent Recovery			
Ammonia as N	mg N/L	9.8	10.0	98	80-120 %	T	

First Reported: 19 February 2008
Date Printed: 19 February 2008

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Laboratory: EN_WATERS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
842285 [Spike of 842224]							
4540 TKN in Water by Titration			Spike Value	Percent Recovery			
TKN	mg/L	85	100.0	85	80-120 -	T	

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Samples correctly preserved	Yes
Organic samples had Teflon liners	Yes
Samples received with Zero Headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Ruth Callander	Client Services Officer	
Mark Herbstreit	Senior Analyst - Metals	Accreditation Number: 1645
Helen Lei	Senior Analyst - Waters	Accreditation Number: 1645

Laboratory Manager

Anthony Crane — Operations Manager

Final Report

- Indicates Not Requested * Indicates NATA accreditation does not cover the performance of this service

The samples were not collected by Amdel staff.

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Accreditation Number: 1645

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Certificate of Analysis

Sinclair Knight Merz
590 Orrong Rd
Armadale VIC 3143
Australia

Attention: Heather Walker

Project	08ENME0003702
Client Reference	VW03716
	WERRIBEE PUMP SAMPLING
Received Date	13/02/2008 04:31:00 PM

Customer Sample ID			69636	69628	69626	112804	113018
Amdel Sample Number			844179	844180	844181	844182	844183
Date Sampled			13/02/2008	13/02/2008	13/02/2008	13/02/2008	13/02/2008
Metals							
Test/Reference	PQL	Unit					
3200 Total Metals In Water by ICP/AES							
Phosphorus *	100	µg/L	188	<100	<100	257	<100
3100 Dissolved Metals In Water By ICP/MS							
Antimony	5	µg/L	<5	<5	<5	<5	<5
Boron	5	µg/L	380	330	140	370	320
Cadmium	5	µg/L	<5	<5	<5	<5	<5
Copper	5	µg/L	<5	<5	<5	<5	<5
Lead	5	µg/L	<5	<5	<5	<5	<5
Manganese	5	µg/L	<5	5.3	<5	32	200
Nickel	5	µg/L	<5	<5	<5	<5	<5
Zinc	5	µg/L	19	27	31	19	30
Inorganics							
Test/Reference	PQL	Unit					
4010 Conductivity In Water							
Electrical Conductivity	20	µS/cm	1970	1770	1630	1930	2000
4520 Ammonia In Water by Titration							
Ammonia as N	1	mg N/L	<1	<1	<1	<1	<1
4000 pH In Water							
pH	0.1	pH	7.9	8.1	7.5	7.9	7.3
4540 TKN In Water by Titration							
TKN	1	mg/L	<1	2.6	<1	<1	<1
4941 Total Nitrogen In Water by Calc							
Total Nitrogen	2	mg N/L	39	16	7	12	<2
4300 Anions In Water by IC							
Nitrate as N	0.5	mg N/L	39	13	7.0	12	1.8
Nitrite as N	0.5	mg N/L	<0.5	<0.5	<0.5	<0.5	<0.5

Customer Sample ID			112803	112802
Amdel Sample Number			844184	844185
Date Sampled			13/02/2008	13/02/2008
Metals				
Test/Reference	PQL	Unit		
3200 Total Metals In Water by ICP/AES				
Phosphorus *	100	µg/L	<100	<100
3100 Dissolved Metals In Water By ICP/MS				
Antimony	5	µg/L	<5	<5

First Reported: 19 February 2008
Date Printed: 19 February 2008

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Customer Sample ID			112803	112802
Amdel Sample Number			844184	844186
Date Sampled			13/02/2008	13/02/2008
Metals				
Test/Reference	PQL	Unit		
Boron	5	µg/L	830	230
Cadmium	5	µg/L	<5	<5
Copper	5	µg/L	<5	<5
Lead	5	µg/L	<5	<5
Manganese	5	µg/L	1300	<5
Nickel	5	µg/L	<5	<5
Zinc	5	µg/L	25	23
Inorganics				
Test/Reference	PQL	Unit		
4010 Conductivity in Water				
Electrical Conductivity	20	µS/cm	9760	1590
4520 Ammonia in Water by Titration				
Ammonia as N	1	mg N/L	<1	<1
4000 pH in Water				
pH	0.1	pH	7.6	7.4
4540 TKN in Water by Titration				
TKN	1	mg/L	<1	<1
4941 Total Nitrogen in Water by Calc				
Total Nitrogen	2	mg N/L	18	20
4300 Anions in Water by IC				
Nitrate as N	0.5	mg N/L	18	20
Nitrite as N	0.5	mg N/L	<0.5	<0.5

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

Description	Extracted	Analysed
3100 Dissolved Metals in Water By ICP/MS	18/02/2008	19/02/2008
3200 Total Metals in Water by ICP/AES	19/02/2008	19/02/2008
4000 pH in Water	18/02/2008	18/02/2008
4010 Conductivity in Water	18/02/2008	18/02/2008
4300 Anions in Water by IC	19/02/2008	19/02/2008
4520 Ammonia in Water by Titration	15/02/2008	15/02/2008
4540 TKN in Water by Titration	15/02/2008	18/02/2008
4941 Total Nitrogen in Water by Calc		19/02/2008

First Reported: 19 February 2008
Date Printed: 19 February 2008

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Page 2 of 5
Final Report Number : 262587

Amdel Internal Quality Control Review

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. Amdel QC Acceptance/Rejection criteria are available on request.
3. Proficiency trial results are available on request.
4. Actual PQLs are matrix dependant. Quotes PQLs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spike or surrogate recoveries.
6. Test samples duplicated or spiked, are for this job only and are identified in the following QC report.
7. SVOC analyses on waters are performed on homogenized, unfiltered sample, unless noted otherwise.
8. When individual results are qualified in the body of a report, refer to the qualifier descriptions that follow.

Holding Times

Please refer to 'Sampling and Preservation Chart for Soils & Waters' for holding times. (Amdel form AD-FOR_ADM-020)

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgement.
If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitablity qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

Quality Control Results

Laboratory: EN_METALS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
851201 [Method Blank]							
3100 Dissolved Metals in Water By ICP/MS							
Antimony	µg/L	<5			< 5	T	
Boron	µg/L	<5			< 5	T	
Cadmium	µg/L	<5			< 5	T	
Copper	µg/L	<5			< 5	T	
Lead	µg/L	<5			< 5	T	
Manganese	µg/L	<5			< 5	T	
Nickel	µg/L	<5			< 5	T	
Zinc	µg/L	<5			< 5	T	
851202 [Laboratory Control Sample]							
3100 Dissolved Metals in Water By ICP/MS			Expected Value	Percent Recovery			
Antimony	µg/L	99	100.0	99	80-120 %	T	
Boron	µg/L	100	100.0	104	80-120 %	T	
Cadmium	µg/L	100	100.0	102	80-120 %	T	
Copper	µg/L	97	100.0	97	80-120 %	T	
Lead	µg/L	100	100.0	103	80-120 %	T	
Manganese	µg/L	98	100.0	98	80-120 %	T	
Nickel	µg/L	98	100.0	98	80-120 %	T	
Zinc	µg/L	98	100.0	98	80-120 %	T	
844674 [Duplicate of 844179]							
3200 Total Metals in Water by ICP/AES			Result 2	RPD			
Phosphorus *	µg/L	174	188	8	0-30 %	T	

Laboratory: EN_METALS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
844675 [Duplicate of 844179]							
3100 Dissolved Metals in Water By ICP/MS			Result 2	RPD			
Antimony	µg/L	<5	<5	<1	0-10 %	T	
Boron	µg/L	380	380	4	0-10 %	T	
Cadmium	µg/L	<5	<5	<1	0-10 %	T	
Copper	µg/L	<5	<5	<1	0-10 %	T	
Lead	µg/L	<5	<5	<1	0-10 %	T	
Manganese	µg/L	<5	<5	<1	0-10 %	T	
Nickel	µg/L	<5	<5	<1	0-10 %	T	
Zinc	µg/L	19	19	2	0-10 %	T	

Laboratory: EN_WATERS

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
844632 [Method Blank]							
4300 Anions in Water by IC							
Bromide	mg/L	<0.5			< 0.5	T	
Chloride	mg/L	<0.5			< 0.5	T	
Fluoride	mg/L	<0.5			< 0.5	T	
Nitrate	mg/L	<0.5			< 0.5	T	
Nitrite	mg/L	<0.5			< 0.5	T	
Orthophosphate as P	mg/L	<0.5			< 0.5	T	
Sulphate	mg/L	<0.5			< 0.5	T	
845617 [Method Blank]							
4520 Ammonia in Water by Titration							
Ammonia as N	mg N/L	<1			< 1	T	
845637 [Method Blank]							
4540 TKN in Water by Titration							
TKN	mg/L	<1			< 1	T	
844634 [Laboratory Control Sample]							
4300 Anions in Water by IC			Expected Value	Percent Recovery			
Bromide	mg/L	98	100.0	98	80-120 %	T	
Chloride	mg/L	100	100.0	100	80-120 %	T	
Fluoride	mg/L	99	100.0	99	80-120 %	T	
Nitrate	mg/L	120	100.0	120	80-120 %	T	
Nitrite	mg/L	84	100.0	84	80-120 %	T	
Orthophosphate as P	mg/L	100	100.0	102	80-120 %	T	
Sulphate	mg/L	100	100.0	104	80-120 %	T	
845619 [Laboratory Control Sample]							
4520 Ammonia in Water by Titration			Expected Value	Percent Recovery			
Ammonia as N	mg N/L	9.7	10.0	97	80-120 %	T	
845639 [Laboratory Control Sample]							
4540 TKN in Water by Titration			Expected Value	Percent Recovery			
TKN	mg/L	97	100.0	97	80-120 %	T	
847181 [Laboratory Control Sample]							
4010 Conductivity in Water			Expected Value	Percent Recovery			
Electrical Conductivity	µS/cm	1410	N/A	N/A	N/A	N/A	
Electrical Conductivity	µS/cm	1410	N/A	N/A	N/A	N/A	
844672 [Duplicate of 844179]							
4300 Anions in Water by IC			Result 2	RPD			
Nitrate as N	mg N/L	39	39	1	0-10 %	T	
Nitrite as N	mg N/L	<0.5	<0.5	<1	0-10 %	T	
844673 [Duplicate of 844179]							
4010 Conductivity in Water			Result 2	RPD			
Electrical Conductivity	µS/cm	1990	1970	1	0-10 %	T	
844676 [Duplicate of 844179]							
4520 Ammonia in Water by Titration			Result 2	RPD			
Ammonia as N	mg N/L	<1	<1	<1	0-20 %	T	

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Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
844677 [Duplicate of 844179]							
4000 pH in Water			Result 2	RPD			
pH	pH	7.9	7.9	0.0	0-0.2 pH	T	
844678 [Duplicate of 844179]							
4540 TKN in Water by Titration			Result 2	RPD			
TKN	mg/L	<1	<1	<1	0-20 %	T	
844679 [Spike of 844180]							
4300 Anions in Water by IC			Spike Value	Percent Recovery			
Nitrate as N	mg N/L	39	N/A	N/A	N/A	N/A	
Nitrite as N	mg N/L	28	N/A	N/A	N/A	N/A	
844681 [Spike of 844180]							
4520 Ammonia in Water by Titration			Spike Value	Percent Recovery			
Ammonia as N	mg N/L	9.3	10.0	93	80-120 %	T	
844683 [Spike of 844180]							
4540 TKN in Water by Titration			Spike Value	Percent Recovery			
TKN	mg/L	95	100.0	92	80-120 -	T	

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Samples correctly preserved	Yes
Organic samples had Teflon liners	Yes
Samples received with Zero Headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Vanda Dabkowski	Customer Service Leader	
Mark Herbstreit	Senior Analyst - Metals	Accreditation Number: 1645
Helen Lei	Senior Analyst - Waters	Accreditation Number: 1645

Laboratory Manager

Anthony Crane Operations Manager

Final Report

- Indicates Not Requested * Indicates NATA accreditation does not cover the performance of this service

The samples were not collected by Amdel staff.