

Agenda Memorandum

Date 4 February 2020



**Memorandum to
Chairperson and Members
Policy and Planning Committee**

Subject: Pesticides in surface water in Taranaki

Approved by: G K Bedford, Director – Environment Quality

BG Chamberlain, Chief Executive

Document: 2392980

Purpose

The purpose of this memorandum is to present the results, together with a discussion of their significance, of a survey undertaken by Council officers in order to determine whether there is any consequent environmental or human health issue due to pesticides in surface waters in Taranaki.

Executive summary

The Council's *Regional Freshwater Plan for Taranaki* identifies the use of pesticides as an activity that needs to be appropriately managed in order to safeguard the ecological health of the region's waterways and the health of those who rely on them, including through municipal water supplies. Also, the *National Environmental Standard for Sources of Human Drinking Water* requires regional councils to take steps to ensure catchments used for municipal water supply do not become contaminated beyond the capability of treatment plants to provide safe water supplies. The Council's ongoing programme for monitoring for the presence of pesticides in groundwater, together with the responsibilities of the Ministry of Health and water supply authorities to ensure the wholesome quality of community water for human consumption, already provides some degree of assurance in this regard, but Council officers deemed it worthwhile to undertake a survey of surface waters around the region to ascertain whether pesticide residues were present and if so, whether concentrations might be significant from an environmental or human health perspective.

The findings of the survey are reported within this memorandum. Samples were collected from lower river reaches in catchments considered to have a relatively higher usage of pesticides due to land uses. Each sample was tested for around 200 different pesticide compounds, generating a total of around 1800 analytical results. Analytical methods had limits to detectability far below criteria for ecological or consumptive protection. From 1800 results, there were only two detections, at concentrations barely above the laboratory detection limit. These were for two organochlorine compounds, which are highly persistent and widely distributed in the environment. They were detected in a catchment where market gardening and plant nurseries have been long-established activities. Given the very low

concentrations and the fact that the compounds in question were banned from sale and withdrawn from use 3 decades ago, no follow-up action is practical or beneficial.

The survey included analyses for glyphosate (trade name Roundup), a very widely used and long-established herbicide that has more recently become controversial because of alleged and disputed adverse effects upon human and/or environmental health. Glyphosate is considered more likely to be transported via surface water rather than ground water. No glyphosate was detected in any survey sample, despite the extremely low limits of detection used in analysis.

This survey and its results provide some reassurance to the Council and the regional community that the provisions of the *RFWP* and the implementation of good practices around the usage of pesticides are proving effective for the protection of the region's waterways and their associated values and uses.

Recommendations

That the Taranaki Regional Council:

1. receives the memorandum *Pesticides in surface water in Taranaki*
2. notes the results of the survey, that pesticides are virtually undetectable in the surface waters of Taranaki, or when present, are far below levels of concern for either environmental or human health
3. notes that these findings will inform the provisions of the next *Regional Land and Water Plan for Taranaki*

Background

Pesticides, which include insecticides, fungicides, herbicides and plant growth regulators, are commonly used in New Zealand to control insects, diseases and weeds in primary industries such as horticulture, agricultural farming, and forestry. The horticultural sector is the most intensive user of pesticides on a land area basis, followed by arable, forestry and pastoral sectors. They are also used in urban areas eg domestic vegetable gardens and lawns, and roadside and recreational reserve spraying for weed control.

Pesticide contamination of water is a subject potentially of national importance because of the need to safeguard catchments used for municipal water supply (whether groundwater or surface water), to provide for safe recreational contact uses of water bodies, and more generally to recognise and mitigate against potential adverse effects of pesticides on aquatic ecosystems and their component communities.

Under the Resource Management Act (1991), regional councils have the responsibility to maintain and enhance the quality of regional water resources. The Council recognises that pesticide application to land is a potential point and diffuse source contaminant of freshwater. The *Regional Fresh Water Plan for Taranaki* (RFWP) identified as an issue for the region, adverse effects upon surface and ground water from the discharge of contaminants to land and water, if these discharges are not managed properly and with consideration of receiving water quality requirements. Objective 6.2.1 of the RFWP is '*to maintain and enhance the quality of the surface water resources of Taranaki by avoiding, remedying or mitigating adverse effects of contaminants discharged to land and water from point sources*', while Objective 6.3.1 applies in

similar vein to diffuse discharges. Policies 6.2.1-6.2.4, 6.2.7, and 6.3.1 provide a suite of considerations that the Council applies when assessing discharges to land or water, including the values of the water body and the extent to which these might be impacted. Policy 6.3.1 states explicitly that *'Land use practices which avoid, remedy or mitigate adverse effects on water quality will be encouraged and promoted including...the careful use of agrichemicals'*.

Groundwater is likewise addressed. Objective 6.5.2 is *'to promote the sustainable management of groundwater while avoiding, remedying or mitigating adverse effects on groundwater quality from the discharge of contaminants'*. Policy 6.5.3 is that *'The Taranaki Regional Council will manage the discharge of contaminants to land and water such that any actual or potential adverse effects on groundwater quality are avoided, remedied or mitigated'*.

The application of agrichemicals in Taranaki is controlled in the current *RFWP* (eg Rules 32, 33, 34, 43) and *Regional Air Quality Plan* (Rules 56-58 and Appendices VI and VII). The Council promotes the careful use of such chemicals in accordance with these rules and the manufacturers' instructions, thus safeguarding off-target or secondary receiving environments.

Section 10.3 of the *RFWP* sets out the Council's commitment to undertake relevant monitoring, either on its own account or by participation in monitoring and research programmes conducted by other agencies. To ascertain the effectiveness of the controls discussed above, and to confirm the ongoing state of the environment of Taranaki, the Taranaki Regional Council routinely monitors the attaining of these objectives through its State of the Environment surface and groundwater monitoring programmes, which include sampling groundwater for pesticides in a collaborative nationwide programme administered by the Institute of Environmental and Scientific Research Ltd (ESR). This programme is undertaken on a cycle of about 4 years. Surveys have been undertaken in 1990, 1994, 1995 (Taranaki-specific), 1998, 2002, 2006, 2010, 2014 and 2018. Traces of pesticides have been occasionally found in a few individual monitoring wells in Taranaki during the earlier surveys. In the latest survey, a trace of one pesticide, at levels non-significant for human health, was found in one well in Taranaki; otherwise, the last detection of pesticides in groundwater in Taranaki was in 1998. The results of the latest ESR groundwater survey are reported more fully elsewhere in today's agenda.

There is no equivalent national programme surveying pesticides in surface water. Through New Zealand's Drinking Water Standards (2000), the Ministry for Health and municipal water supply authorities (usually district councils) are together responsible for ensuring that municipal water supplies are routinely analysed for pesticides, amongst a range of other potential contaminants that may affect public health or the aesthetic quality of water supplies.

The *National Environmental Standard for Sources of Human Drinking Water* (2008; currently under review) is a regulation made under the *Resource Management Act*. It imposes requirements for protecting sources of human drinking water from becoming contaminated. It does not apply to catchments not used for municipal supply, nor to waters used to supply other consumptive purposes (eg stock drinking supply), nor to ecological considerations. Specifically, it requires regional councils to be satisfied that activities permitted in regional plans will not pose unacceptable risks to the quality of community-scale drinking water supplies. The Government has noted that changes to the intensity or composition of land-use activities in a catchment can introduce new contaminants or increase the concentration of existing contaminants in the source waters. A review of regional council performance in implementing the NES undertaken by MfE last year found that this Council was one of 7, out of 16, that had a 'high' level of implementation of the drinking water NES when considering resource consent

applications, and as with almost all regional councils this Council had a 'medium' level of implementation of the NES provisions within its regional freshwater plan. MfE's ratings for implementation of the NES within regional plans focused on the extent to which plans had specific provisions applying to drinking water supply catchments. It should be noted that the shaping and publication of the Council's *RFWP* pre-dates the NES; the NES does not require councils to retrospectively amend existing plans; and in any case the Council is currently reviewing its plan and will incorporate the requirements of the NES as the latter stand at the time (given that the NES is now under review with a view to amendment).

Discussion

Programme design

There are 16 surface water catchments in Taranaki used for municipal or community water supply. Notwithstanding that MoH monitoring of water supply quality might therefore be considered to already offer a fair coverage of representative pesticide concentrations in surface water catchments in the region, and that the Council's participation in the ongoing national groundwater survey is a monitoring programme that offers by implication significant information on the (absence of any) presence and effects of pesticide usage, this Council deemed it worthwhile to undertake its own survey of agrichemical concentrations in surface waters by targeting sites in rivers that were likely to be the most impacted by pesticide usage, at a time of year when agrichemical usage (whether herbicide or pesticide) was relatively high.

It is noted that while it is expected there would be overall similar patterns in pesticides in groundwater and surface water respectively, there would also be differences- the different routes of transportation (horizontal overland flow vs infiltration) would mean different attenuation and degradation pathways due to the varying exposures to sunlight and temperature; different microbial communities and levels of metabolic activity; soil and vegetation adsorption; different times of travel to receptors; and extent of relative dilution and dispersion. Surface water systems are much more likely to show time-dependant variation in concentrations, due to the presence of peaks immediately following usage and run-off, or alternatively the flushing away and removal of any residues, compared to the persistent reservoirs of agrichemicals within long-retention groundwater systems.

Council officers considered that in Taranaki, agrichemical contamination of surface water is most likely to occur in areas where there are commercial horticultural activities (plant nurseries, market gardens etc) or below areas of intensive urban and agricultural land use, including recreational areas where agrichemical usage might be high (eg golf courses). Advice from industry and supply representatives was that peak usage tends to be in spring-early summer. Nine regionally representative sites were selected, located in the lower reaches of the Waitara River, Waiongana River, Waiwhakaiho River, Te Henui Stream, Huatoki Stream, Oakura River, Waimoku Stream, Timaru River, and Waingongoro River. Sampling was undertaken in November 2019, with the sampling run timed to avoid wet weather and any consequent dilution of agrichemicals by high river flows, and to avoid or minimise any seawater mixing in estuarine sites that might likewise dilute pesticide concentrations if present.

Samples were analysed for comprehensive suites of acidic herbicides (22 compounds eg 2,4D, 2,4,5-T, MCPA, MCPB), organochlorine pesticides (24 compounds eg aldrin, DDT, dieldrin, heptachlor), organophosphorus and organonitrogen pesticides (89 compounds eg atrazine, captan, chlorpyrifos, diazinon, malathion, simazine), glyphosate/ AMPA herbicide (AMPA is a breakdown product from glyphosate), and a multi-residue analysis for 64 other

pesticides (eg bromophos-ethyl, methiocarb, phorate). A certificate of analysis for the Waitara River and Waiongana River sites is attached to this memorandum as an example. The full laboratory certificates for all sites are available from Council officers upon request.

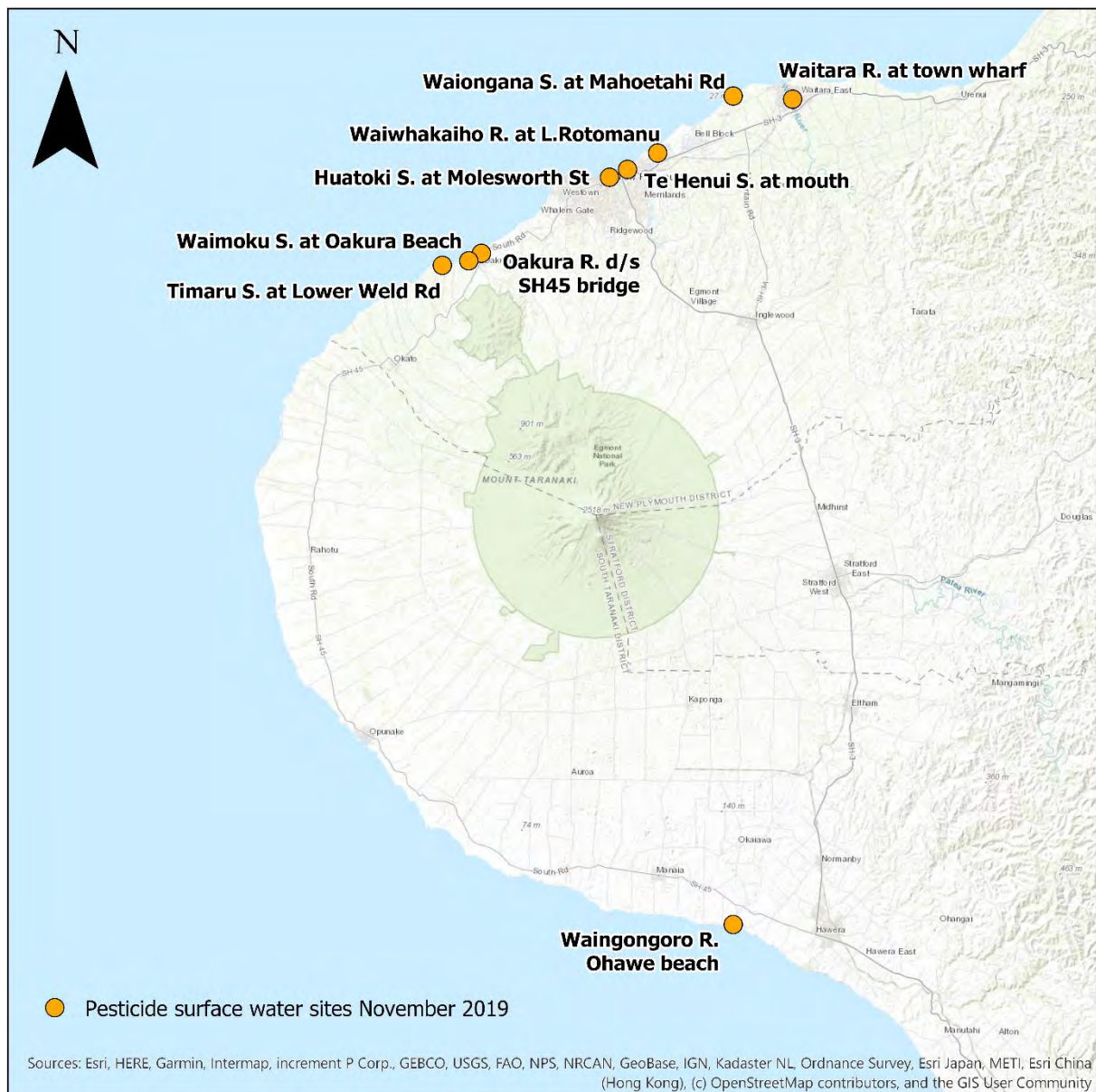


Figure 1: sampling sites for survey of pesticides in surface water

Limits of detection achieved by the laboratories were far below (by many orders of magnitude) the standards (human health standards) or guideline values (aesthetic quality) for drinking water. The limits of detection were also generally at least about the trigger values used by the Australian and New Zealand Environment and Conservation Council (ANZECC) to ensure protection of at least 95% of all freshwater species, and for some groups of pesticides the limits of laboratory detection were lower than even the trigger levels for 99% protection. The suites of pesticide residues analysed on behalf of the Council were similar to and in some cases broader than those used by ESR in the latter's national groundwater surveys.

Results

Out of some 200 individual analytical results available for each of 9 sites- about 1800 results altogether- there were only two detections of individual pesticides. That is, there was a detection rate of 0.1%. No pesticides were detected in 99.9% of all analyses.

Both aldrin and heptachlor were detected in the sample collected from the Waiongana River. These chemicals are part of the family of organochlorines that were banned several decades ago. Both compounds were present at a concentration of 0.000 006 g/m³, or 6 parts of a millionth of a millionth. Both results were barely above the detection threshold of 0.000 005 g/m³. To put these results into perspective, the New Zealand Drinking Water Standard for aldrin and dieldrin combined is 0.000 03 g/m³, so the aldrin concentration in the Waiongana River sample is 5 times lower than the drinking water standard; the drinking water standard for heptachlor and heptachlor epoxide combined is 0.000 04 g/m³, so the heptachlor result in the Waiongana River sample is 7 times lower than the drinking water standard. (Note that neither dieldrin nor heptachlor epoxide were detected in the sample, even at limits of detection 30 times below the relevant drinking water standards).

The ANZECC aquatic ecological guidelines do not provide a trigger value for further investigation for aldrin, as there was insufficient data available to derive defensible trigger values. For heptachlor, the trigger value for protection of 99% of species (the most stringent ecological protection value provided within the ANZECC guidelines) is 0.000 01 g/m³, so the result for the Waiongana River is half that which is to be applied for the most stringent level of protection; the trigger value for protection of 95% of species (the recommended level of protection for communities desiring a good level of ecological health in slightly modified freshwater systems) is 0.000 09 g/m³, so the result for the Waiongana River is 15 times lower than the level of protection most relevant for waterways in a developed landscape.

Organochlorines were historically used as insecticides. They are highly persistent within the environment, and widely dispersed, typically through adsorption onto particles of soil which subsequently become mobilised. While their use was banned more than 30 years ago, it is not surprising, given the power of modern analytical techniques, that residues can still be detected in some environments. In the case of the Waiongana River, it is noted that market gardening is a historical activity within the catchment, along with very large plant nurseries. Such activities might well have used organochlorine insecticides while they were legal for application. During the 1990s and the first decade of the current millennium, this Council undertook a number of collections of hazardous substances throughout the region. Over 40 tonnes of substances were gathered and appropriately disposed of, including over 5 tonnes of organochlorine pesticides. Given the number and success of collection programmes the Council has delivered, with associated intensive publicity campaigns, the Council is confident that at most there are only very small stockpiles or holdings of organochlorines left in the region, and thus negligible potential for ongoing fresh releases of organochlorines into the environment.

Conclusions

The survey of the presence and concentrations of pesticides in surface waters in Taranaki is in response to the commitments and obligations of the Council as set out in its *RFWP* and various statutes and regulations. It provides robust data for any discussion around the effect of pesticide usage in the region and the appropriateness of current controls, and thus can inform the shaping of the next *Regional Land and Water Plan for Taranaki* (in development). The survey's findings, that pesticide residues in surface waters are negligible, provide some

reassurance to the Council and the regional community that the provisions of the *RFWP* and the implementation of good practices around the usage of pesticides are proving effective for the protection of the region's waterways and their associated values and uses.

Decision-making considerations

Part 6 (Planning, decision-making and accountability) of the *Local Government Act 2002* has been considered and documented in the preparation of this agenda item. The recommendations made in this item comply with the decision-making obligations of the *Act*.

Financial considerations—LTP/Annual Plan

This memorandum and the associated recommendations are consistent with the Council's adopted Long-Term Plan and estimates. Any financial information included in this memorandum has been prepared in accordance with generally accepted accounting practice.

Policy considerations

This memorandum and the associated recommendations are consistent with the policy documents and positions adopted by this Council under various legislative frameworks including, but not restricted to, the *Local Government Act 2002*, the *Resource Management Act 1991* and the *Local Government Official Information and Meetings Act 1987*.

Iwi considerations

This memorandum and the associated recommendations are consistent with the Council's policy for the development of Māori capacity to contribute to decision-making processes (schedule 10 of the *Local Government Act 2002*) as outlined in the adopted long-term plan and/or annual plan. Similarly, iwi involvement in adopted work programmes has been recognised in the preparation of this memorandum.

Legal considerations

This memorandum and the associated recommendations comply with the appropriate statutory requirements imposed upon the Council.

Appendices/Attachments

Document 2386582: Certificate of analysis for survey of agrichemicals in surface waters: Waitara and Waiongana river sites



Certificate of Analysis

Client:	Taranaki Regional Council	Lab No:	2280407	POPv1
Contact:	J Kitto C/- Taranaki Regional Council Private Bag 713 Stratford 4352	Date Received:	23-Nov-2019	
		Date Reported:	02-Dec-2019	
		Quote No:	100151	
		Order No:	72831	
		Client Reference:	#5498 - Bacto A: NORTH	
		Submitted By:	Jonti Owen	

Sample Type: Saline

Sample Name:	TRC194165 (WTR000922) 22-Nov-2019 11:25 am				
Lab Number:	2280407.1				
OrganoNitrogen & Phosphorus pesticides, trace, liq/liq GCMS					
Analytes Detected:	None				
Acid Herbicides Screen in Water by LCMSMS					
Analytes Detected:	None				
Multiresidue Extra Pesticides Trace in Water samples by Liq/liq					
Analytes Detected:	None				
Organochlorine Pesticides Trace in water, By Liq/Liq					
Analytes Detected:	None				
Individual Tests					
Glyphosate	See attached report	-	-	-	-

Please refer to the detection limits table for the list of analytes screened and their detection limits.

Sample Type: Aqueous

Sample Name:	TRC194167 (WGA000495) 22-Nov-2019 12:40 pm				
Lab Number:	2280407.2				
OrganoNitrogen & Phosphorus pesticides, trace, liq/liq GCMS					
Analytes Detected:	None				
Acid Herbicides Screen in Water by LCMSMS					
Analytes Detected:	None				
Multiresidue Extra Pesticides Trace in Water samples by Liq/liq					
Analytes Detected:	None				
Organochlorine Pesticides Trace in water, By Liq/Liq					
Analytes Detected:	2				
Aldrin	g/m ³	0.000006			
Heptachlor	g/m ³	0.000006			
Individual Tests					
Glyphosate	See attached report	-	-	-	-

Please refer to the detection limits table for the list of analytes screened and their detection limits.



Analyst's Comments

2280407.1 was spiked with target compounds as part of the in-house QC procedure for Acidic Herbicides analysis. It showed lower than expected recoveries for bentazone and clopyralid (51% and 56% respectively). The corresponding sample result was accepted because the Laboratory Control Sample (LCS) spike recovery was within the expected ranges (91% and 92% respectively). This indicates that the low sample spike recovery was due to the matrix of the samples that were spiked. The detection limits reported for these compounds have been raised for this reason.

Appendix No.1 - AsureQuality Report

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Saline			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Glyphosate (Sub AQ)	Subcontracted to AsureQuality, Lower Hutt.	-	1-2
Acid Herbicides Screen in Water by LCMSMS	Direct injection LCMSMS	0.0003 - 0.0006 g/m ³	1-2
Multiresidue Pesticides Trace in Water by Liq/liq GCMS	Liquid/liquid extraction, GPC (if required), GC-MS analysis	-	1-2
Multiresidue Extra Pesticides Trace in Water samples by Liq/liq			
Bendiocarb*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Benodanil*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00008 g/m ³	1-2
Bifenthrin*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00002 g/m ³	1-2
Bromophos-ethyl*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Bupirimate*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Buprofezin*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Captafol*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.0002 g/m ³	1-2
Carboxin*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Chlorfenvinphos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Chlorpropham*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00008 g/m ³	1-2
Chlozolinate*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Coumaphos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00008 g/m ³	1-2
Cyproconazole*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Cyprodinil*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Demeton-S-methyl*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00008 g/m ³	1-2
Dichlobenil*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Dichlofenthion*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Dicofol*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.0002 g/m ³	1-2
Dicrotophos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Dinocap*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.0003 g/m ³	1-2
Disulfoton*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
EPN*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Esfenvalerate*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2

Sample Type: Saline			
Test	Method Description	Default Detection Limit	Sample No
Ethion*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Etrifos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Famphur*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Fenamiphos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Fenarimol*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Fenitrothion*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Fenpropathrin*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Fensulfothion*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Fenthion*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Fenvalerate*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Folpet*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00008 g/m ³	1-2
Hexythiazox*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.0002 g/m ³	1-2
Imazalil*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.0002 g/m ³	1-2
Indoxacarb*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Iodofenphos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Isazophos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Isofenphos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00002 g/m ³	1-2
Leptophos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Methacrifos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Methidathion*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Methiocarb*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Mevinphos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00008 g/m ³	1-2
Nitrofen*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00008 g/m ³	1-2
Nitrothal-isopropyl*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Oxychlorane*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00002 g/m ³	1-2
Penconazole*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Phorate*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00008 g/m ³	1-2
Phosmet*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Phosphamidon*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Propetamphos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00006 g/m ³	1-2
Propham*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Prothiofos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Pyrazophos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Pyrifeno*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2

Sample Type: Saline			
Test	Method Description	Default Detection Limit	Sample No
Pyrimethanil*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Quintozene*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00008 g/m ³	1-2
Sulfotep*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Tebufenpyrad*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00002 g/m ³	1-2
Tetrachlorvinphos*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2
Thiometon*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00008 g/m ³	1-2
Triadimefon*	Liquid / liquid extraction, GPC (if required), GC-MS SIM analysis. Roos et al (modified).	0.00004 g/m ³	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

Detection Limits

Analytes	Detection Limit	Analytes	Detection Limit	Analytes	Detection Limit
OrganoNitrogen & Phosphorus pesticides, trace, liq/liq GCMS		Norflurazon*	0.00008 g/m ³	Mecoprop	0.0004 g/m ³
Sample Number(s): 1-2		Oxadiazon*	0.00004 g/m ³	Oryzalin	0.0011 g/m ³
Acetochlor*	0.00004 g/m ³	Oxyfluorfen*	0.00002 g/m ³	2,3,4,6-Tetrachlorophenol (TCP)	0.0004 g/m ³
Alachlor*	0.00004 g/m ³	Paclobutrazol*	0.00004 g/m ³	2,4,5-trichlorophenoxypropionic acid (245TP,Fenoprop, Silvex)	0.0004 g/m ³
Atrazine*	0.00004 g/m ³	Parathion-ethyl*	0.00004 g/m ³	2,4,5-Trichlorophenoxyacetic acid (245T)	0.0004 g/m ³
Atrazine-desethyl*	0.00004 g/m ³	Parathion-methyl*	0.00004 g/m ³	Pentachlorophenol (PCP)	0.0004 g/m ³
Atrazine-desisopropyl*	0.00008 g/m ³	Pendimethalin*	0.00004 g/m ³	Picloram	0.0004 g/m ³
Azaconazole*	0.00002 g/m ³	Permethrin*	0.00002 g/m ³	Quizalofop	0.0004 g/m ³
Azinphos-methyl*	0.00008 g/m ³	Pirimicarb*	0.00004 g/m ³	Triclopyr	0.0004 g/m ³
Benalaxyl*	0.00002 g/m ³	Pirimiphos-methyl*	0.00004 g/m ³	Sample Number(s): 2	
Bitertanol*	0.00008 g/m ³	Prochloraz*	0.0002 g/m ³	Bentazone	0.0004 g/m ³
Bromacil*	0.00004 g/m ³	Procymidone*	0.00004 g/m ³	Clopyralid	0.0004 g/m ³
Bromopropylate*	0.00004 g/m ³	Prometryn*	0.00002 g/m ³	Multiresidue Extra Pesticides Trace in Water samples by Liq/liq	
Butachlor*	0.00004 g/m ³	Propachlor*	0.00004 g/m ³	Sample Number(s): 1-2	
Captan*	0.00008 g/m ³	Propanil*	0.0002 g/m ³	Bendiocarb*	0.00004 g/m ³
Carbaryl*	0.00004 g/m ³	Propazine*	0.00002 g/m ³	Benodanil*	0.00008 g/m ³
Carbofenthion*	0.00004 g/m ³	Propiconazole*	0.00004 g/m ³	Bifenthrin*	0.00002 g/m ³
Carbofuran*	0.00004 g/m ³	Pyriproxyfen*	0.00004 g/m ³	Bromophos-ethyl*	0.00004 g/m ³
Chlorfluzuron*	0.00004 g/m ³	Quizalofop-ethyl*	0.00004 g/m ³	Bupirimate*	0.00004 g/m ³
Chlorothalonil*	0.00004 g/m ³	Simazine*	0.00004 g/m ³	Buprofezin*	0.00004 g/m ³
Chlorpyrifos*	0.00004 g/m ³	Simetryn*	0.00004 g/m ³	Captafol*	0.0002 g/m ³
Chlorpyrifos-methyl*	0.00004 g/m ³	Sulfentrazone*	0.0002 g/m ³	Carbofenthion*	0.00004 g/m ³
Chlortoluron*	0.00008 g/m ³	TCMTB [2-(thiocyanomethylthio) benzothiazole, Busan]*	0.00008 g/m ³	Carboxin*	0.00004 g/m ³
Cyanazine*	0.00004 g/m ³	Tebuconazole*	0.00004 g/m ³	Chlorfenvinphos*	0.00004 g/m ³
Cyfluthrin*	0.00004 g/m ³	Terbacil*	0.00004 g/m ³	Chlorpropham*	0.00008 g/m ³
Cyhalothrin*	0.00004 g/m ³	Terbufos*	0.00004 g/m ³	Chlozolate*	0.00004 g/m ³
Cypermethrin*	0.00008 g/m ³	Terbumeton*	0.00004 g/m ³	Coumaphos*	0.00008 g/m ³
Deltamethrin (including Tralomethrin)*	0.00006 g/m ³	Terbutylazine*	0.00002 g/m ³	Cyproconazole*	0.00004 g/m ³
Diazinon*	0.00002 g/m ³	Terbutylazine-desethyl*	0.00004 g/m ³	Cyprodinil*	0.00004 g/m ³
Dichlofluanid*	0.00004 g/m ³	Terbutryn*	0.00004 g/m ³	Demeton-S-methyl*	0.00008 g/m ³
Dichloran*	0.0002 g/m ³	Thiabendazole*	0.0002 g/m ³	Dichlobenil*	0.00004 g/m ³
Dichlorvos*	0.00008 g/m ³	Thiobencarb*	0.00004 g/m ³	Dichlofenthion*	0.00004 g/m ³
Difenoconazole*	0.00008 g/m ³	Tolyfluanid*	0.00002 g/m ³	Dicofol*	0.0002 g/m ³
Dimethoate*	0.00008 g/m ³	Triazophos*	0.00004 g/m ³	Dicrotophos*	0.00004 g/m ³
Diphenylamine*	0.00008 g/m ³	Trifluralin*	0.00004 g/m ³	Dinocap*	0.0003 g/m ³
Diuron*	0.00004 g/m ³	Vinclozolin*	0.00004 g/m ³	Disulfoton*	0.00004 g/m ³
Fenpropimorph*	0.00004 g/m ³	Acid Herbicides Screen in Water by LCMSMS		EPN*	0.00004 g/m ³
Fluazifop-butyl*	0.00004 g/m ³	Sample Number(s): 1		Esfenvalerate*	0.00004 g/m ³
Fluometuron*	0.00004 g/m ³	Bentazone	0.0008 g/m ³	Ethion*	0.00004 g/m ³
Flusilazole*	0.00004 g/m ³	Clopyralid	0.0008 g/m ³	Etrifos*	0.00004 g/m ³
Fluvalinate*	0.00004 g/m ³	Sample Number(s): 1-2		Famphur*	0.00004 g/m ³
Furalaxyl*	0.00002 g/m ³	Acifluorfen	0.0004 g/m ³	Fenamiphos*	0.00004 g/m ³
Haloxifop-methyl*	0.00004 g/m ³	Bromoxynil	0.0004 g/m ³	Fenarimol*	0.00004 g/m ³
Hexaconazole*	0.00004 g/m ³	2,4-Dichlorophenoxyacetic acid (24D)	0.0004 g/m ³	Fenitrothion*	0.00004 g/m ³
Hexazinone*	0.00002 g/m ³	2,4-Dichlorophenoxybutyric acid (24DB)	0.0006 g/m ³	Fenpropathrin*	0.00004 g/m ³
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)*	0.0002 g/m ³	Dicamba	0.0006 g/m ³	Fensulfothion*	0.00004 g/m ³
Kresoxim-methyl*	0.00002 g/m ³	Dichlorprop	0.0004 g/m ³	Fenthion*	0.00004 g/m ³
Linuron*	0.00005 g/m ³	Fluazifop	0.0004 g/m ³	Fenvalerate*	0.00004 g/m ³
Malathion*	0.00004 g/m ³	Fluroxypyr	0.0004 g/m ³	Folpet*	0.00008 g/m ³
Metalaxyl*	0.00004 g/m ³	Haloxifop	0.0004 g/m ³	Hexythiazox*	0.0002 g/m ³
Metolachlor*	0.00004 g/m ³	2-methyl-4-chlorophenoxyacetic acid (MCPA)	0.0004 g/m ³	Imazalil*	0.0002 g/m ³
Metribuzin*	0.00004 g/m ³	2-methyl-4-chlorophenoxybutanoic acid (MCPB)	0.0004 g/m ³	Indoxacarb*	0.00004 g/m ³
Molinate*	0.00008 g/m ³			Iodofenphos*	0.00004 g/m ³
Myclobutanil*	0.00004 g/m ³			Isazophos*	0.00004 g/m ³
Naled*	0.0002 g/m ³				

Analytes	Detection Limit	Analytes	Detection Limit
Multiresidue Extra Pesticides Trace in Water samples by Liq/liq		Endosulfan II*	0.000010 g/m ³
Sample Number(s):	1-2	Endosulfan sulfate*	0.000010 g/m ³
Isofenphos*	0.00002 g/m ³	Endrin*	0.000005 g/m ³
Leptophos*	0.00004 g/m ³	Endrin aldehyde*	0.000005 g/m ³
Methacrifos*	0.00004 g/m ³	Endrin ketone*	0.000010 g/m ³
Methidathion*	0.00004 g/m ³	Heptachlor*	0.000005 g/m ³
Methiocarb*	0.00004 g/m ³	Heptachlor epoxide*	0.000005 g/m ³
Mevinphos*	0.00008 g/m ³	Hexachlorobenzene*	0.00004 g/m ³
Nitrofen*	0.00008 g/m ³	Methoxychlor*	0.000005 g/m ³
Nitrothal-Isopropyl*	0.00004 g/m ³	Total Chlordane [(cis+trans)* 100/42]*	0.00002 g/m ³
Oxychlordane*	0.00002 g/m ³		
Penconazole*	0.00004 g/m ³		
Phorate*	0.00008 g/m ³		
Phosmet*	0.00004 g/m ³		
Phosphamidon*	0.00004 g/m ³		
Propetamphos*	0.00006 g/m ³		
Propham*	0.00004 g/m ³		
Prothiofos*	0.00004 g/m ³		
Pyrazophos*	0.00004 g/m ³		
Pyrifenox*	0.00004 g/m ³		
Pyrimethanil*	0.00004 g/m ³		
Quintozene*	0.00008 g/m ³		
Sulfotep*	0.00004 g/m ³		
Tebufenpyrad*	0.00002 g/m ³		
Tetrachlorvinphos*	0.00004 g/m ³		
Thiometon*	0.00008 g/m ³		
Triadimefon*	0.00004 g/m ³		

Organochlorine Pesticides Trace in water, By Liq/Liq	
Sample Number(s):	1-2
Aldrin*	0.000005 g/m ³
alpha-BHC*	0.000010 g/m ³
beta-BHC*	0.000010 g/m ³
delta-BHC*	0.000010 g/m ³
gamma-BHC (Lindane)*	0.000010 g/m ³
cis-Chlordane*	0.000005 g/m ³
trans-Chlordane*	0.000005 g/m ³
2,4'-DDD*	0.000010 g/m ³
4,4'-DDD*	0.000010 g/m ³
2,4'-DDE*	0.000010 g/m ³
4,4'-DDE*	0.000010 g/m ³
2,4'-DDT*	0.000010 g/m ³
4,4'-DDT*	0.000010 g/m ³
Total DDT Isomers*	0.00006 g/m ³
Dieldrin*	0.000005 g/m ³
Endosulfan I*	0.000010 g/m ³



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Global Experts in Food Assurance

Certificate of Analysis

Submission Reference: EnvSubAQ_LH 249
Final Report

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Hamilton 3240
New Zealand

PO Number: 152895

Report Issued: 29-Nov-2019

AsureQuality Reference: **19-271948**

Sample(s) Received: 26-Nov-2019 07:30

Testing Period: 26-Nov-2019 to 29-Nov-2019

Results

The tests were performed on the samples as received.

Customer Sample Name: 2280407.1 **Lab ID:** 19-271948-1

Sample Description: Saline

Sample Condition: Acceptable

Sampled Date: 23-Nov-2019

Test	Result	Unit	Method Reference
Glyphosate and AMPA in Potable and Non-Potable Water			
AMPA	<0.0010	mg/kg	AsureQuality Method (LC-MS/MS)
Glyphosate	<0.0010	mg/kg	AsureQuality Method (LC-MS/MS)

Customer Sample Name: 2280407.2 **Lab ID:** 19-271948-2

Sample Condition: Acceptable

Sampled Date: 23-Nov-2019

Test	Result	Unit	Method Reference
Glyphosate and AMPA in Potable and Non-Potable Water			
AMPA	<0.0010	mg/kg	AsureQuality Method (LC-MS/MS)
Glyphosate	<0.0010	mg/kg	AsureQuality Method (LC-MS/MS)

Analysis Summary

Wellington Laboratory

Analysis	Method	Accreditation	Authorised by
Glyphosate and AMPA in Potable and Non-Potable Water			
DX-GLYP01, 01-DEFAULT	AsureQuality Method (LC-MS/MS)	IANZ	Joanne Fry

Results that are prefixed with '<' indicate the lowest level at which the analyte can be reported, and that in this case the analyte was not observed above this limit.

Joanne Fry
Scientist

AsureQuality has used reasonable skill, care, and effort to provide an accurate analysis of the sample(s) which form(s) the subject of this report. However, the accuracy of this analysis is reliant on, and subject to, the sample(s) provided by you and your responsibility as to transportation of the sample(s). AsureQuality's standard terms of business apply to the analysis set out in this report.

Accreditation



Appendix

Analyte LOR Summary

Glyphosate and AMPA in Potable and Non-Potable Water - AsureQuality Method (LC-MS/MS)

Analyte	LOR
AMPA	0.0010 mg/kg
Glyphosate	0.0010 mg/kg

Analyte Definitions

Glyphosate and AMPA in Potable and Non-Potable Water - AsureQuality Method (LC-MS/MS)

Analyte	Full Name
AMPA	Aminomethylphosphonic acid

LOR = Limit of Reporting

LOD = Limit of Detection

NR = Not Reportable
