



2010 Water Quality Monitoring Report

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APPENDICES

Appendix 1. 2010 MDA Pesticide List by Method and Analyte: Analyte Name; Chemical Abstracts Service (CAS) Registry Number; and Method Reporting Limit (MRL).

Appendix 2. Pesticide compounds detected in Minnesota water resources by Minnesota Department of Agriculture.

Appendix 3. Groundwater Monitoring Network Sample Results, 2010.

Appendix 4. Trend analysis of pesticide concentration and detection frequency in Minnesota groundwater documentation.

Appendix 5. MDA Tier 1 through 3 surface water monitoring site names and characteristics of locations sampled in 2010.

Appendix 6. Surface Water Quality Sample Results, 2010.

Appendix 7. MDA and STORET ID numbers for current and historic stream monitoring locations.

ABBREVIATIONS

MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
MCES	Metropolitan Council Environmental Services
USGS	United States Geological Survey
USEPA/OPP	United States Environmental Protection Agency/Office of Pesticide Programs
DNR	Department of Natural Resources
TCMA	Twin Cities Metropolitan Area
PMR	Pesticide Monitoring Region
EFI	Equal-Flow Increment
ETI	Equal-Time Increment
ppm	parts per million (equivalent to milligrams of chemical per liter of water sample or mg/L)
ppb	parts per billion (equivalent to micrograms chemical per liter of water sample or µg/L)
ppt	parts per trillion (equivalent to nanograms chemical per liter of water sample or ng/L)
HRL	Health Risk Limit
HBV	Health Based Value
MCL	Maximum Contaminant Level
MRL	Method Reporting Limit
ERL	Estimated Reporting Limit
MS	Maximum Standard Value

DEFINITIONS

Chronic Standard, Criterion or Advisory Value

The highest water concentration of a chemical to which organisms can be exposed without causing chronic toxicity to organisms in question. Established for individual chemicals based on toxicity to aquatic life (the “toxicity-based”) and based on toxicity to human life (the “human health-based”), when sufficient information exists to establish one or both of these numbers. The more stringent of the two numbers is used as the chronic standard, criterion or advisory value for purposes of implementation of Minnesota Rules Chapter 7050. The underlying exposure assumptions (e.g., timeframes for exposure comparisons) and applicability of any numbers are established by the MPCA and may vary depending on the state classification of the water body, the nature of the data comparisons being made, and the regulatory status of the number being used for comparison.

Enzyme-linked immunosorbent assays (ELISA)

ELISA is an alternative laboratory analysis method. The MAU used this methodology to screen water quality samples for both surface and groundwater for atrazine and acetochlor in 2009.

Estimated reporting Limit (ERL)

An estimate of the lowest concentration that a given method may be capable of reporting when final validation of the method is complete. Used for reporting mass estimates for analytes of interest before the analytical method is fully developed and validated. Analytes with an ERL may be reported as “present” when there is enough mass of the chemical to be measured although total mass is below the ERL.

Final Acute Value (FAV) and Maximum Standard (MS)

An estimate of the concentration of a pollutant corresponding to the cumulative probability of 0.05 in the distribution of all the acute toxicity values for the genera or species from the acceptable acute toxicity tests conducted on a chemical. The FAV is the value found to be toxic in 5% of all studies conducted. Ninety five percent of all tests conducted found toxicity values to be higher than the FAV chosen. One-half the value of the FAV is the Maximum Standard (MS), and is the highest concentration of a toxicant in water to which aquatic organisms can be exposed for a brief time with zero to slight mortality. The MS is often used as a remedial action cleanup goal to protect surface waters in some groundwater contamination situations.

Health Based Value (HBV)

Identical to an HRL except that the value is issued on an interim basis for specific situations and until such time that the basis of its derivation and calculation are reviewed and subject to rule-making.

Health Risk Limit (HRL)

The concentration of a substance or chemical (i.e., one that has been determined to be a potential private well drinking water contaminant) in drinking water that can produce a potential toxicological result due to systemic or carcinogenic effect in humans upon consumption. The underlying exposure assumptions (e.g., volume of water consumed and timeframes for exposure comparisons) and the general applicability of any HRL are established for Minnesota by the MDH and adopted by rule of the MDH Commissioner.

Maximum Contaminant Level (MCL)

A value set by the USEPA as the maximum amount of a chemical allowed in a federally regulated public water supply, considering health, economic or other factors including technological factors such as treatment cost and feasibility.

Method Reporting Limit (MRL)

Represents the minimum concentration of an analyte that can be reliably quantified and reported by the laboratory. Analytes may be positively identified via qualitative procedures and reported as “Present” below the MRL.

SECTION 1: INTRODUCTION

This annual report presents groundwater and surface water quality data collected by the Monitoring and Assessment Unit (MAU) of the Minnesota Department of Agriculture (MDA). Water quality results for 2010 as well as summaries of historical pesticide data are shown. In addition, the report presents monitoring results for select nutrients and sediments. The information presented in this report is used to characterize and assess the nature and general extent of pesticide impacts to Minnesota's water resources.

1.1. Program history

In 1985 the MDA and Minnesota Department of Health (MDH) undertook a cooperative survey of groundwater for pesticides and nitrate-nitrogen in areas of agricultural land use considered susceptible to contamination (outwash sands and karst bedrock areas). This survey found that pesticides commonly applied to fields in agricultural production (normal use) were showing up in groundwater in detectable concentrations. The most frequently detected pesticides were atrazine and alachlor (both herbicides) (Klaseus, Buzicky, and Schneider, 1988). A second survey by the MDH in 1986 targeted primarily toward private (farm) drinking water wells showed similar results (Klaseus and Hines, 1989).

In 1987 Minnesota Legislature amended the Minnesota Pesticide Control Law (Chapter 18B of Minnesota State Statutes). Minnesota Statute 18B.04 requires: "*The commissioner shall:*

- (1) determine the impact of pesticides on the environment, including the impacts on surface water and groundwater in this state;*
- (2) develop best management practices involving pesticide distribution, storage, handling, use, and disposal; and*
- (3) cooperate with and assist other state agencies and local governments to protect public health and the environment from harmful exposure to pesticides."*

In response to this charge the MDA initiated a groundwater monitoring program in 1987 and began monitoring surface water in 1991.

In 1989 the Minnesota Comprehensive Groundwater Protection Act (Chapter 103H of Minnesota State Statutes) expanded groundwater protection responsibilities of the MDA, including specific direction regarding monitoring for agricultural chemicals and the management of those chemicals when found to impact groundwater. The Groundwater Protection Act mandated development of a State Pesticide Management Plan with monitoring to act as the primary support to management decisions within that Plan.

In response to these mandates, MDA has developed regionally based water quality monitoring networks for the purpose of collecting and reporting groundwater and surface water monitoring data. These ten Pesticide Monitoring Regions (PMRs) are based on areas of similar agricultural practices and hydrologic/geologic characteristics and are identified as Region 1 through Region 10 (Figure 1). The PMR boundaries follow county boundaries, but also generally represent different hydrologic regions of Minnesota. These distinct hydrologic regions include parts of: PMR 1) the Red River of the North Basin, PMR 2) the Rainy River Basin, PMR 3) Lake

Superior Basin, PMR 4) the Upper Mississippi River Basin, PMR 5) the St. Croix River Basin, PMR 6) the Upper Minnesota River Basin, PMR 7) the Missouri and Des Moines River Basins, PMR 8) the Middle and Lower Minnesota River Basin, PMR 9) the Lower Mississippi River Basin, and PMR 10) the Twin Cities Metropolitan Region.

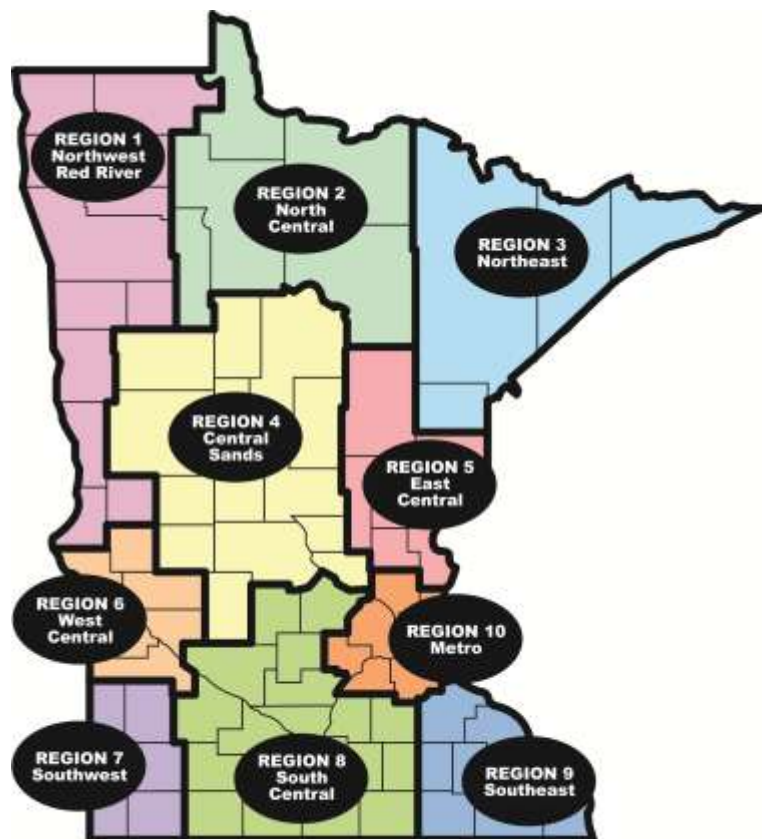


Figure 1. MDA’s Pesticide Monitoring Regions (PMRs).

1.2. Hydrologic information specific to 2010

Total annual precipitation and annual precipitation departure from normal for 2010, as reported by the State Climatology Office, are shown in Figures 2 and 3, respectively. Precipitation amounts were lowest in the northwestern corner of the state, with totals ranging from 20 to 24 inches. The southern portion of the state received the most precipitation, ranging from 36 inches to 52 inches in the most southeastern county (Houston). The precipitation departure map indicates that the majority of the state saw above normal precipitation, excluding the northeastern portion which was at or below normal levels. Annual precipitation summaries can provide useful information on general conditions that existed during the monitoring year and may also provide clues as to why pesticides may be detected in surface water or groundwater in a particular location during the given year.

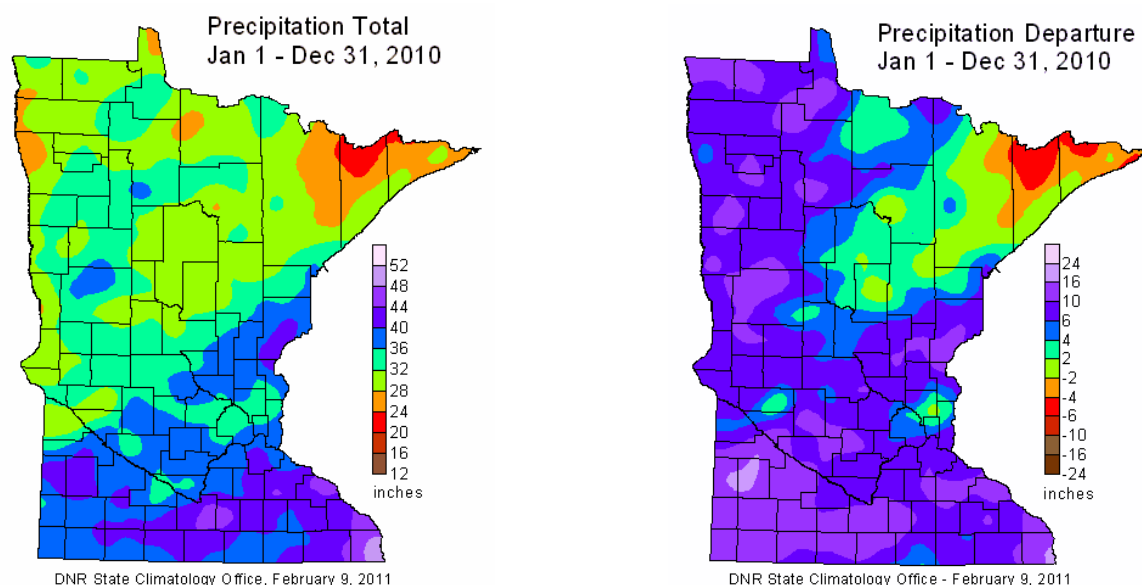


Figure 2 (left) and Figure 3 (right). 2010 statewide precipitation total and annual precipitation departure from normal.

1.3. Program elements

In general, the MDA monitors river and stream quality using a combination of sampling techniques (“grab sampling” to characterize water quality during typical, long-term base-flow conditions, and “composite sampling” to characterize water quality over short-term run-off events). Groundwater is monitored by collecting samples from networks of wells established by MDA to characterize long-term trends in specific aquifers. Both surface and groundwater samples are analyzed by well-established laboratory methods; however, occasionally there are departures from these monitoring and analytical approaches as the MDA explores new ways to implement its mandates and enhance its capabilities.

1.3.1. New in 2010

The MAU undertook several special projects in 2010. Special projects are selected based on opportunities for partnerships, the desire to know more about transport of pesticides to our water resources and availability of funds. Further information on each of these topics can be found in the sections indicated within the text.

New analytical instruments

Previous laboratory analyses consisted of separate analytical procedures for base neutral pesticides, chloroacetanilide degradates, and chlorophenoxy acid herbicides. To increase laboratory efficiency and capacity, the MDA used funds from the Minnesota Clean Water Legacy Fund and an Legislative Citizen Commission on Minnesota Resources (LCCMR) grant to purchase two sets of equipment and develop analytical methodology from 2008 - 2010. The liquid chromatography with tandem mass spectrometry (LC-MS/MS) analytical method is

capable of detecting a much broader suite of chemicals, and at lower concentrations for some chemicals. The MDA laboratory also continued to run a gas chromatography mass spectrometry (GC-MS) procedure for analytes not captured by the new LC-MS/MS.

New laboratory methods and their impacts

LC-MS/MS methods have been used for several years by the United States Geological Survey (USGS) analytical laboratories with detection limits similar to or lower than the MDA's, depending on the specific chemical in question. These methods were developed by the MDA to increase sensitivity in detecting compounds currently under analysis and to incorporate compounds into the program for which analytical methods were not previously available. A further goal of development of these methods was to bring MDA collected data into a more comparable position with that developed by nationwide projects conducted by the USGS.

With the new LC-MS/MS method, MDA has greatly increased the number of chemicals to 110 available for routine analysis. In addition to the LC-MS/MS method, the MDA has revised their previous GC-MS method to include several new chemicals.

The most significant component of the new methods is the ability to quantify concentrations for many of these chemicals at much lower levels. All of the pesticides now analyzed with the LC-MS/MS are being quantified at parts per trillion (ppt) or as nanograms/Liter (ng/L) levels. During this, the first year, compounds were added at various times during the year as validation of specific analytes was completed.

Data implications of new laboratory methods

The LC-MS/MS method lowered the MDA Laboratory's detection limits for several compounds. Most notably are for the breakdown products of the herbicides acetochlor, metolachlor, alachlor and dimethenamid. A consequence of lowered detection limits is the potential for significant increases in the frequency of detection. Changing detection limits may also cause issues when evaluating trends in the data and care must be taken to ensure the data is analyzed uniformly across time. In addition to lowered detection limits, the list of compounds available for analysis has expanded, and as a result several compounds are now being detected for the first time.

These additional capabilities have allowed MDA to better characterize statewide pesticide related water quality in both groundwater and surface water. They do give the MDA more information to aid in the pesticide management process and provide a better understanding of the presence of pesticides in the environment. MDA will continue to be proactive in assessing the presence and potential impacts of pesticides on the waters of the State of Minnesota. With these additional capabilities, Minnesota continues to be a national leader when it comes to assessing and characterizing the impacts of pesticide on water resources.

All pesticides analyzed by the MDA Laboratory Services are listed in Table 1. This table also indicates if the analyte was detected in either surface water or groundwater in 2010, along with the associated MRL. Compounds new in 2010 to routine monitoring by MDA are found in Table 2.

For additional details regarding MDA monitoring, as well as analytical and reporting methods, visit the MAU website (www.mda.state.mn.us/monitoring).

Public drinking water well reconnaissance sampling

In February 2010, the MDH collected raw water samples from a select set of community drinking water supplies. This one-time collection of water quality samples was coordinated with the MDA and was the first use of the MDA's new analytical methods. The MDH compiled the results and wrote up a brief report on the findings. The report is located on MDH's website: (www.health.state.mn.us/divs/eh/water/pesticide.pdf). Briefly, the survey found that results from water collected from the community public water supply wells showed no risk to public health. The detections that were found were all well below established health reference values.

ELISA

Throughout the monitoring season, the MDA conducted glyphosate monitoring utilizing two different laboratory methods. Methods included an immunoassay screen (ELISA) and an LC-MS/MS method. Samples were collected from both surface and groundwater from around the state. For further information on both methods, see Section 5.3.

In the spring of 2010, the MDA completed a second year of assessment on the use of an acetochlor ELISA for the analysis of acetochlor in surface water samples collected from within the Le Sueur River Watershed in south central Minnesota. Both composite and grab samples were collected from a network of existing stream gage locations. Results on this project can be found in Section 5.2.2.

MDA has conducted ELISA sampling for diaminochlorotriazine (DACT) (a degradate of the herbicide atrazine) since 2007. MDA's new analytical methodology is now capable of detecting DACT using the LC-MS/MS. MDA stopped analyzing for DACT using the ELISA method at the completion of the contract in June 2010. MDA laboratory started reporting the compound as DEDI atrazine in 2010.

Table 1. 2010 list for target and non-target GC-MS (gas chromatography mass spectrometry) and LC-MS/MS (liquid chromatography with tandem mass spectrometry) pesticide and pesticide degradates analyzed in both surface water and groundwater with associated method reporting limit (MRL).

Common Name	Type	2010 Detected Target or Non-Target Analyte in Surface Water	2010 Detected Target or Non-Target Analyte in Groundwater	GC-MS MRL (µg/L)	LC- MS/MS MRL (ng/L)
target analytes					
2,4,5-T	Herbicide				50
2,4,5-TP	Herbicide				50
2,4-D	Herbicide	x	x		8.3
2,4-DB	Herbicide				13.3
Acetamiprid	Insecticide				15
Acetochlor	Herbicide	x	x	0.05	
Acetochlor ESA	Degradate	x	x		30
Acetochlor OXA	Degradate	x	x		33.3
Alachlor	Herbicide	x	x	0.05	
Alachlor ESA	Degradate	x	x		41.6
Alachlor OXA	Degradate	x	x		33.3
Aldicarb Sulfone	Insecticide				15
Aldicarb Sulfoxide	Insecticide				50
Atrazine	Herbicide	x	x	0.05	
DEDI Atrazine	Degradate	x	x		50
Deisopropylatrazine	Degradate	x	x	0.20	
Desethylatrazine	Degradate	x	x	0.05	
Hydroxyatrazine	Degradate	x	x		6.7
Azoxystrobin	Fungicide	x			10
Bensulfuron-methyl	Herbicide				16.7
Bentazon	Herbicide	x	x		0.8
Boscalid	Fungicide	x		0.30	
Bromacil	Herbicide	x	x		20
Carbaryl	Insecticide				25
Carbofuran	Insecticide				13.3
Chlorimuron-ethyl	Herbicide				20
Chlorothalonil	Fungicide			0.12	
Chlorpyrifos	Insecticide	x		0.04	
Clomazone	Herbicide			0.10	
Clopyralid	Herbicide	x	x		41.6
Cyanazine	Herbicide			0.20	
Cyfluthrin	Insecticide			0.50	
Diazinon	Insecticide			0.12	

Table 1 continued. 2010 list for target and non-target GC-MS (gas chromatography mass spectrometry) and LC-MS/MS (liquid chromatography with tandem mass spectrometry) pesticide and pesticide degradates analyzed in both surface water and groundwater with associated method reporting limit (MRL).

Common Name	Type	2010 Detected Target or Non-Target Analyte in Surface Water	2010 Detected Target or Non-Target Analyte in Groundwater	GC-MS MRL (µg/L)	LC- MS/MS MRL (ng/L)
Dicamba	Herbicide	x	x		50
Dichlorprop	Herbicide				50
Dimethenamid	Herbicide	x	x	0.05	
Dimethenamid ESA	Degradate	x	x		6.7
Dimethenamid OXA	Degradate	x	x		10
Dimethoate	Insecticide	x		0.22	
Disulfoton	Insecticide			0.15	
Disulfoton Sulfone	Degradate				20
Diuron	Herbicide	x	x		13.3
EPTC	Herbicide	x		0.23	
Esfenvalerate	Insecticide			0.20	
Ethalfuralin	Herbicide	x		0.15	
Flufenacet OXA	Herbicide				8.3
Fonofos	Insecticide			0.10	
Halosulfuron-methyl	Herbicide				30
Hexazinone	Herbicide				10
Imazamethabenz-methyl	Herbicide				5
Imazamethabenz Acid	Degradate	x			10
Imazamox	Herbicide	x	x		13.3
Imazapic	Herbicide	x			10
Imazapyr	Herbicide	x	x		8.3
Imazaquin	Herbicide				16.7
Imazethapyr	Herbicide	x	x		6.7
Imidacloprid	Insecticide	x	x		20
Isoxaflutole	Herbicide				25
Isoxaflutole DKN	Degradate				50
lambda Cyhalothrin	Insecticide			0.20	
Linuron	Herbicide				20
Malathion	Insecticide			0.09	
MCPA	Herbicide	x			5
MCPB	Herbicide				10
MCPP	Herbicide	x	x		50

Table 1 continued. 2010 list for target and non-target GC-MS (gas chromatography mass spectrometry) and LC-MS/MS (liquid chromatography with tandem mass spectrometry) pesticide and pesticide degradates analyzed in both surface water and groundwater with associated method reporting limit (MRL).

Common Name	Type	2010 Detected Target or Non-Target Analyte in Surface Water	2010 Detected Target or Non-Target Analyte in Groundwater	GC-MS MRL (µg/L)	LC- MS/MS MRL (ng/L)
Mesotrione	Herbicide	x	x		50
Metalaxyl	Fungicide	x	x		8.3
Metolachlor	Herbicide	x	x	0.07	
Metolachlor ESA	Degradate	x	x		10
Metolachlor OXA	Degradate	x	x		10
Metribuzin	Herbicide	x	x	0.10	
Metribuzin DA	Degradate		x	1.00	
Metribuzin DADK	Degradate	x	x	1.00	
Metribuzin DK	Degradate		x	1.00	
Metsulfuron-methyl	Herbicide	x			23.3
Myclobutanil	Fungicide			0.20	
Neburon	Herbicide				10
Nicosulfuron	Herbicide		x		26.6
Norflurazon	Herbicide				20
Oxadiazon	Herbicide			0.05	
Parathion-methyl	Insecticide			0.12	
Pendimethalin	Herbicide			0.08	
Phorate	Insecticide			0.12	
Picloram	Herbicide	x	x		41.6
Prometon	Herbicide	x	x	0.10	
Prometryn	Herbicide				3.3
Propachlor	Herbicide			0.10	
Propachlor ESA	Degradate		x		30
Propachlor OXA	Degradate				10
Propazine	Herbicide	x		0.10	
Propiconazole	Fungicide	x		0.20	
Propoxur	Insecticide				10
Pyraclostrobin	Fungicide			0.23	
Saflufenacil	Herbicide	x	x		15
Siduron	Herbicide	x			6.7
Simazine	Herbicide	x	x	0.10	
Sulfometuron-methyl	Herbicide	x			8.3
Tebuconazole	Fungicide	x		0.20	

Table 1 continued. 2010 list for target and non-target GC-MS (gas chromatography mass spectrometry) and LC-MS/MS (liquid chromatography with tandem mass spectrometry) pesticide and pesticide degradates analyzed in both surface water and groundwater with associated method reporting limit (MRL).

Common Name	Type	2010 Detected Target or Non-Target Analyte in Surface Water	2010 Detected Target or Non-Target Analyte in Groundwater	GC-MS MRL (µg/L)	LC- MS/MS MRL (ng/L)
Tebupirimphos (phostebupirim) ¹	Insecticide	x		0.10	
Tembotrione	Herbicide	x			50
Terbufos	Insecticide			0.19	
Tetraconazole	Fungicide	x	x	0.15	
Thiamethoxam	Insecticide	x	x		25
Thifensulfuron-methyl	Herbicide				16.7
Thiobencarb	Herbicide				8.3
Triallate	Herbicide			0.10	
Triasulfuron	Herbicide				23.3
Triclopyr	Herbicide	x	x		50
Trifluralin	Herbicide			0.17	
zeta-Cypermethrin	Insecticide			0.50	
<i>non-target analytes</i>					
Dichlobenil	Herbicide	x		0.05	
Ethofumesate	Herbicide	x		0.50	

¹ Tebupirimphos and phostebupirim are synonyms for the same chemical. They share the same CAS number (96182-53-5). For the purpose of the 2010 Annual Water Quality Report, we will refer to this chemical as tebupirimphos.

Table 2. Detected and undetected pesticide and pesticide degradate analytes for both surface and groundwater as a result of new and expanded MDA laboratory methods in 2010.

Common Name	Type	2010 Detected Target Analyte in Surface Water	2010 Detected Target Analyte in Groundwater	GC-MS MRL (µg/L)	LC- MS/MS MRL (ng/L)
<i>target analytes</i>					
2,4,5-T	Herbicide				50
2,4,5-TP	Herbicide				50
2,4-DB	Herbicide				13.3
Acetamiprid	Insecticide				15
Aldicarb Sulfone	Insecticide				15
Aldicarb Sulfoxide	Insecticide				50
DEDI Atrazine	Degradate	x	x		50
Hydroxyatrazine	Degradate	x	x		6.7
Azoxystrobin	Fungicide	x			10
Bensulfuron-methyl	Herbicide				16.7
Bentazon	Herbicide	x	x		0.8
Bromacil	Herbicide	x	x		20
Carbaryl	Insecticide				25
Carbofuran	Insecticide				13.3
Chlorimuron-ethyl	Herbicide				20
Chlorothalonil	Fungicide			0.12	
Clomazone	Herbicide			0.10	
Clopyralid	Herbicide	x	x		41.6
Cyfluthrin	Insecticide			0.50	
Disulfoton	Insecticide			0.15	
Disulfoton Sulfone	Insecticide				20
Diuron	Herbicide	x	x		13.3
Esfenvalerate	Insecticide			0.20	
Ethalfuralin	Herbicide	x		0.15	
Flufenacet OXA	Herbicide				8.3
Halosulfuron-methyl	Herbicide				30
Hexazinone	Herbicide				10
Imazamethabenz-methyl	Herbicide				5
Imazamethabenz Acid	Degradate	x			10
Imazamox	Herbicide	x	x		13.3
Imazapic	Herbicide	x			10
Imazapyr	Herbicide	x	x		8.3
Imazaquin	Herbicide				16.7
Imazethapyr	Herbicide	x	x		6.7

Table 2 continued. Detected and undetected pesticide and pesticide degradate analytes for both surface and groundwater as a result of new and expanded MDA laboratory methods in 2010.

Common Name	Type	2010 Detected Target or Non-Target Analyte in Surface Water	2010 Detected Target or Non-Target Analyte in Groundwater	GC-MS MRL (µg/L)	LC- MS/MS MRL (ng/L)
Imidacloprid	Insecticide	x	x		20
Isoxaflutole	Herbicide				25
Isoxaflutole DKN	Degradate				50
lambda Cyhalothrin	Insecticide			0.20	
Linuron	Herbicide				20
MCPB	Herbicide				10
Mesotrione	Herbicide	x	x		50
Metalaxyl	Fungicide	x	x		8.3
Metsulfuron-methyl	Herbicide	x			23.3
Neburon	Herbicide				10
Nicosulfuron	Herbicide		x		26.6
Norflurazon	Herbicide				20
Oxadiazon	Herbicide			0.05	
Picloram	Herbicide	x	x		41.6
Prometon	Herbicide	x	x	0.10	
Prometryn	Herbicide				3.3
Propachlor	Herbicide			0.10	
Propachlor ESA	Degradate		x		30
Propachlor OXA	Degradate				10
Propazine	Herbicide	x		0.10	
Propoxur	Insecticide				10
Pyraclostrobin	Fungicide			0.23	
Saflufenacil	Herbicide	x	x		15
Siduron	Herbicide	x			6.7
Simazine	Herbicide	x	x	0.10	
Sulfometuron-methyl	Herbicide	x			8.3
Tebupirimphos	Insecticide	x		0.10	
Tembotrione	Herbicide	x			50
Thiamethoxam	Insecticide	x	x		25
Thifensulfuron-methyl	Herbicide				16.7
Thiobencarb	Herbicide				8.3
Triallate	Herbicide			0.10	

Table 2 continued. Detected and undetected pesticide and pesticide degradate analytes for both surface and groundwater as a result of new and expanded MDA laboratory methods in 2010.

Common Name	Type	2010 Detected Target or Non-Target Analyte in Surface Water	2010 Detected Target or Non-Target Analyte in Groundwater	GC-MS MRL (µg/L)	LC-MS/MS MRL (ng/L)
Triasulfuron	Herbicide				23.3
zeta-Cypermethrin	Insecticide			0.50	

1.3.2. Upcoming in 2011

Several new projects planned for 2011 are shown below.

Partnership with MPCA for database management

There is an ongoing need for secure storage of MDA's monitoring data. Working in partnership with the Minnesota Pollution Control Agency (MPCA), the MDA developed an interagency agreement which allows MPCA to house MDA's water quality results in a database using the Environmental Quality Information System (EQulS) Database Management System. This system replaces the STOrage and RETrieval (STORET) data warehouse as MPCA's primary water quality database. This is an excellent example of partnerships between state agencies that allow for easier data access while conserving limited state resources. The database has the capability for cross querying between MDA and MPCA data, graphical analysis and provides other database management tools.

Pesticide sampling with MPCA

With the continued increase in lab capacity, the MAU has more flexibility to partner with other agencies for additional pesticide sampling. In agreement with the MPCA, samples will be collected from lakes and surface water samples from both their Major Watershed Load Network and the Intensive Watershed Monitoring Streams programs. Additional samples are being allocated to complete the pesticide sampling effort on the MPCA's Environmental Monitoring and Assessment Program (EMAP) project from 2010.

Discovery Farms Minnesota

Modeled after the successful Wisconsin Discovery Farms program, Discovery Farms Minnesota is a producer-led effort organized by the Minnesota Agricultural Water Resources Coalition (MAWRC) to gather field-scale information regarding sediment and nutrient losses from a variety of farming systems in different settings across Minnesota. The mission of Discovery Farms Minnesota is to gather water quality information under real-world conditions.

Information from Discovery Farms Minnesota will provide practical, credible, site-specific information to help farmers and others make land use decisions for water quality improvement. MDA will partner in and support the program by overseeing the water monitoring efforts, managing data and providing technical assistance.

The 2011 monitoring season will kick off with five new sites and one existing special project (Table 3 and Figure 4). Over the next year, the program will target adding three to five additional sites with a focus on the south-central Minnesota region. Future site selection will be based on an application form for enrollment into the program and through a review process conducted by the program's Steering Committee.

Additional Discovery Farms Minnesota information is available at the following web address: (www.mda.state.mn.us/cleanwaterfund).

Objectives of Discovery Farms Minnesota

- Create an opportunity for producers to learn from each other about the relationship between agriculture and water quality;
- Improve communication among the agricultural community, consumers, researchers, and policy-makers to better identify and implement effective environmental management decisions that are compatible with profitable agriculture;
- Integrate outreach and research programs with environmental management and regulatory efforts;
- Fill the gap between plot level research and watershed-scale monitoring to improve the empirical understanding of farm-scale agricultural runoff.
- Provide research-based information on agricultural production and natural resource management to public policymakers;
- Promote the economic viability of Minnesota agriculture across the state's diverse livestock and cropping systems.



Table 3. Discovery Farm Minnesota site information.

Discovery Farm ID	County	Major Watershed	Major Basin	Nearest Town	Station Type
CH1	Chisago	Lower St. Croix	St. Croix	North Branch	Edge of Field
GO1	Goodhue	Mississippi River, Lake Pepin	Lower Mississippi	Goodhue	Edge of Field
ST1	Stearns	Sauk River	Upper Mississippi	Sauk Centre	Edge of Field & Subsurface Tile
BE1	Blue Earth	Le Sueur	Minnesota	Mankato	Edge of Field & Subsurface Tile
BE2	Blue Earth	Le Sueur	Minnesota	St. Clair	Edge of Field & Subsurface Tile
KA1	Kandiyohi	South Fork of the Crow River	Upper Mississippi	Willmar	Subsurface Tile

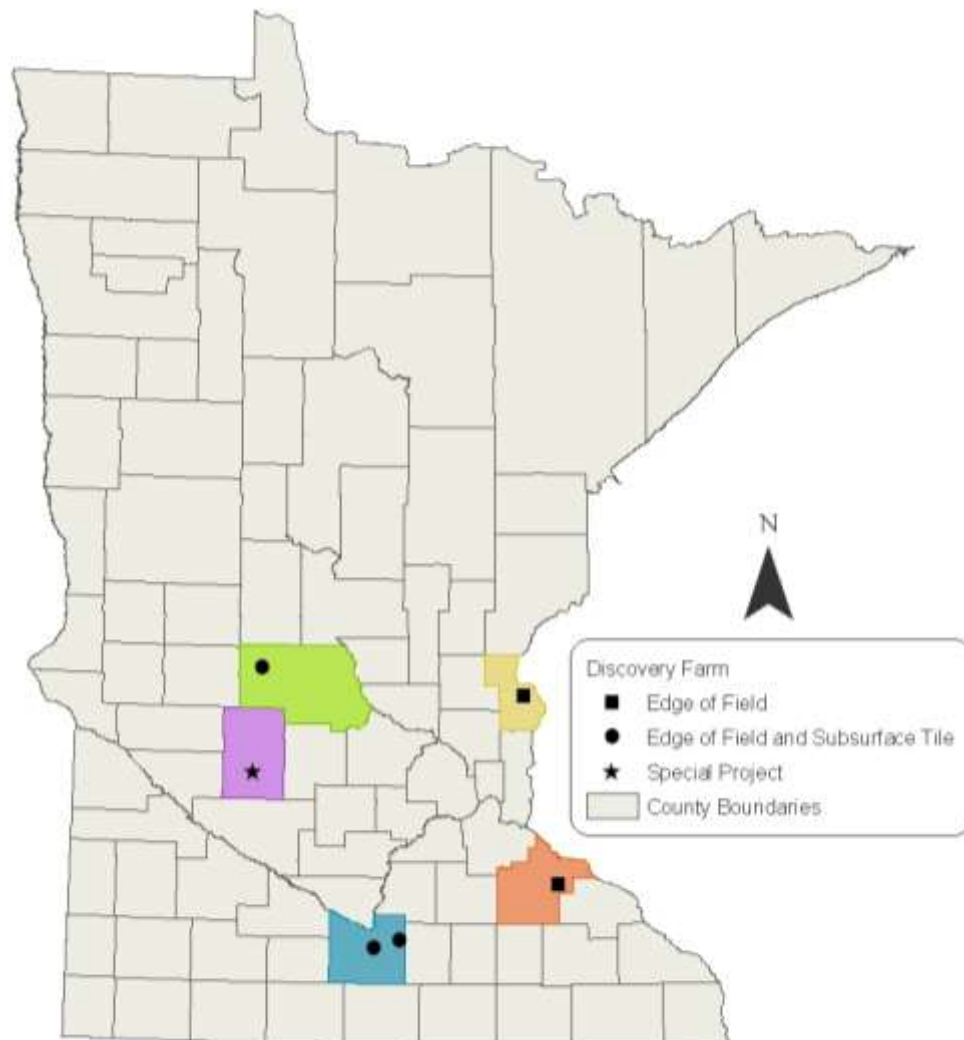


Figure 4. Discovery Farm Minnesota locations.

1.3.3. MDA's selection of pesticides analytes

Both ground and surface water samples are collected and analyzed for many commonly used agricultural chemicals. Analysis of water samples for pesticides is very expensive. As a result the MDA carefully selects which pesticides to include in its monitoring program. To be included, a pesticide must be used in the state, it must have environmental fate characteristics or use patterns that could result in water resource impacts, and it must have a laboratory analytical method that can achieve reasonable results given prevailing resource limitations. Availability of risk guidance for human health and aquatic life toxicity is also considered. More details about the selection methodology of pesticides can be found within the MAU's Ground and Surface Water Design Documents available through the MDA monitoring program website (www.mda.state.mn.us/monitoring), as well as in the following section.

1.3.4. Chemical analytes

Water samples are analyzed in the laboratory for pesticides and inorganic compounds. The pesticides and inorganic compounds being analyzed for are referred to as analytes throughout this report. A pesticide may be included in a "target analyte" list for a given water sample based on the relative expectation of detecting the pesticide. This expectation may depend on the mobility of the pesticide in soil or water, the general use of the pesticide in the monitoring area or other programmatic reasons or concerns.

A pesticide target analyte list helps MDA monitoring efforts focus limited resources on the chemicals of greatest concern to water resources. The target analyte list typically includes many of the most commonly used pesticide products or degradates; however, there may also be additional pesticides detected and identified that are "non-target" analytes. When this occurs, the "non-target" analytes are added to the data evaluation and are considered for further method development as target analytes.

In 2002, the MDA laboratory began analysis of groundwater samples for the primary ethanesulfonic acid (ESA) and secondary oxanilic acid (OXA) degradates of acetochlor, alachlor, dimethenamid and metolachlor. This analysis began during the second quarter of the 2002 calendar year. For that reporting period, these methods were limited to groundwater samples only. In late May 2004, six additional base neutral pesticide analytes and three degradates of metribuzin were added to the list of target analytes. Beginning in 2007, select surface water samples were also analyzed for the ESA and OXA degradates of acetochlor, alachlor, dimethenamid and metolachlor.

New methods and their impacts on detection levels

During early 2010 the MDA Laboratory Services completed the development of a new laboratory method using LC-MS/MS technology. This method was developed to incorporate compounds into the program which analytical methods were not previously available. As a consequence, the method also increased sensitivity in detecting compounds under analysis before method development. All pesticides analyzed by the MDA Laboratory Services are listed in Table 1. For further information pertaining to chemical abstracts service (CAS) registry number, refer to Appendix 1. Please refer to Section 1.3.1 for more information on the new laboratory methods.

The MDA contracted with an outside laboratory to conduct ELISA analysis of a selected number of ground and surface water samples for diaminochlorotriazine (DACT) (which is a degradate of atrazine), acetochlor and glyphosate (Table 4). A list of inorganic analytes is provided in Table 5. For a historic view of all pesticide analytes detected in either surface or groundwater, see Appendix 2. For additional details regarding MDA sampling, as well as analytical and reporting methods, visit the MAU website (www.mda.state.mn.us/monitoring).

Table 4. ELISA target analyte list.

Common Name	Type	2010 Detected Target or Non-Target Analyte in Surface Water	2010 Detected Target or Non-Target Analyte in Groundwater	MRL (µg/L)
Diaminochlorotriazine (DACT; as known as DEDI)	Atrazine Degradate	x	x	0.10
Acetochlor	Herbicide	x	na	0.10
Glyphosate	Herbicide	x	x	0.10

Table 5. Nutrient and sediment target analyte list.

Compound	Method	MRL (mg/L)
Ammonia	MDA Method # WC-230, Standard Method 4500-NH3	0.20
Nitrate/Nitrite-Nitrogen	#WC-105	0.40
Dissolved Orthophosphorus	MDA Method #260	0.005
Turbidity	EPA method # 180.1	0.20 NTU ¹
Total Phosphorus	MDA Method #250	0.01
Total Suspended Solids	Standard Method #2540D	0.10

¹ Nephelometric Turbidity Units (NTU)

1.4. Water quality reference values and standards

Water quality reference values and standards are used by the MDA's monitoring program to help guide water monitoring activities. These reference values come from several state and federal agency sources. The development of surface water and groundwater reference values is an ongoing process and new and revised values may become available over time. For this reason, each website shown on the following pages should be checked for the most current water quality reference values or standards.

1.4.1. Groundwater

The MDH develops drinking water guidance referred to as Health Based Values (HBVs) or Risk Assessment Advice (RAA) for chemicals detected or potentially detected in groundwater. During scheduled rule-making, HBVs are considered for adoption into rule, at which point they may become Health Risk Limits (HRLs). HRLs, HBVs and RAAs are values developed by MDH to evaluate the level at which a chemical detected in private well water or in groundwater used for drinking water presents a health risk.

In monitoring groundwater, the MDA detects pesticides and pesticide degradates for which a HRL, HBV, or RAA has not been developed by the MDH. In such instances, the MDA may

consult with MDH on the use of drinking water reference values, when available, as published by MDH for other purposes, or as published by the USEPA Office of Pesticide Programs, the USEPA Office of Water, the USGS, or other sources. In addition, the MDA formally requests that MDH develop HRLs, HBVs, or RAAs for these pesticides and their degradates.

It should be noted that values listed in the table are protective of chronic exposure durations (i.e., greater than 10 percent of a lifetime).

Table 6 provides a summary of human health-based drinking water guidance (reference values, standards, values or limits) used by state and federal agencies in risk evaluation for select registered and commonly used pesticides or their degradates.

For the most current MDH health-based guidance values for groundwater, go to (www.health.state.mn.us/divs/eh/risk/rules/hrlrule.html).

For the most current USEPA drinking water standards go to (www.epa.gov/safewater/index.html).

1.4.2. Surface water

The federal Clean Water Act, as administered by states, requires review and where necessary, revision of water quality rules every three years. The MPCA develops, through a rule-making process, toxicity-based (for aquatic life) and human health-based enforceable chronic standards for pollutants detected in surface water. The toxicity-based standard (protective for aquatic life exposure) is typically based on exposure duration of four days. The human health-based standard (protective for drinking water plus fish consumption) is based on exposure duration of 30 days. When the MDA detects pollutants in water resource samples for which a chronic standard has not been developed, a request is made to the MPCA for standards development. In the absence of sufficient toxicity data of specific quality, the MPCA may provide the MDA with unpromulgated risk advice. The MPCA should be contacted for specific information related to the development of these values. For the most current MPCA water quality rules see Chapter 7050: Standards for Protection of Waters of the State (www.revisor.leg.state.mn.us/rules/?id=7050).

The USEPA provides Aquatic Life Benchmarks for surface waters for individual pesticides. Aquatic Life Benchmarks (ALB) are based on toxicity values derived from data made available when pesticides are registered with the USEPA's Office of Pesticide Programs (OPP) supporting registration of the pesticide. These values are derived from risk assessments developed during pesticide registration. Toxicity values are adjusted by Levels-of-Concern established by OPP for different aquatic taxa or for specific pesticide exposure concerns for a pesticide (e.g., endangered species exposures). The methodology used by USEPA for pesticide risk assessments is outlined in detail in *"Overview of the Ecological Risk Assessment Process in the Office of Pesticide Programs (OPP), U.S. Environmental Protection Agency"* (www.epa.gov/espp/consultation/ecorisk-overview.pdf).

In general, MPCA water quality reference values supersede other reference values because they have been reviewed for their applicability to Minnesota's water resources and because of their potential use in making water body impairment decisions under the federal Clean Water Act. USEPA benchmarks can help direct MDA monitoring activities and can serve as screening tools

for evaluating potential risks of pesticides in the aquatic environment if an MPCA reference value is not available. The most current USEPA ALBs are located at their website: (www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm).

Table 7 provides a summary of applicable toxicity-based and human health-based chronic surface water standards and aquatic life benchmarks used by state and federal agencies in risk evaluation for pesticides detected in surface water and for select registered pesticides.

Table 6. Summary of available groundwater reference values associated with target and detected non-target pesticide analytes as of May 2011.

Pesticide Analyte	Value (µg/L)	Value Type
2,4,5-T	70	HRL ₉₃
2,4,5-TP	50	HRL-MCL
2,4-D	70	HRL ₉₃
2,4-DB	60	HBV ₉₅
Acetamiprid	-	-
Acetochlor	9	HRL ₀₈
Acetochlor ESA	300	HBV ₁₁
Acetochlor OXA	100	HBV ₁₁
Alachlor	5	HRL ₀₈
Alachlor ESA	70	RAA ₀₉
Alachlor OXA	70	RAA ₀₉
Aldicarb Sulfone	2	MCL
Aldicarb Sulfoxide	4	MCL
Atrazine	3	HRL-MCL
Deisopropylatrazine	3**	Parent HRL-MCL
Desethylatrazine	3**	Parent HRL-MCL
DEDI Atrazine	3**	Parent HRL-MCL
Hydroxyatrazine	20	HBV ₀₅
Azoxystrobin	-	-
Bensulfuron-methyl	-	-
Bentazon	200	HBV ₉₈
Boscalid	-	-
Bromacil	70	Reference _{HA}
Carbaryl	70	HBV ₀₃
Carbofuran	40	MCL
Chlorimuron-ethyl	100	HBV ₉₇
Chlorothalonil	30	HRL ₉₄
Chlorpyrifos	20	HBV ₉₅
Clomazone	300	HBV ₉₇
Clopyralid	4,900	Reference _{DWLOC}
Cyanazine	1	HRL ₀₈
Cyfluthrin	-	-
Diazinon	1	Reference _{HA}
Dicamba	200	HRL ₉₃
Dichlobenil	-	-
Dichlorprop	-	-
Dimethenamid	40	HBV ₉₉
Dimethenamid ESA	40**	Parent HBV ₉₉
Dimethenamid OXA	40**	Parent HBV ₉₉
Dimethoate	1	HBV ₉₆
Disulfoton	0.3	HRL ₉₄
Disulfoton Sulfone	0.3**	Parent HRL ₉₄
Diuron	200	Reference _{HA}
EPTC	200	HRL ₉₃
Esfenvalerate	-	-
Ethalfuralin	300	HBV ₉₉
Ethofumesate	-	-
Flufenacet OXA	-	-
Fonofos	10	HBV ₉₅
Glyphosate	700	MCL
Halosulfuron-methyl	-	-
Hexazinone	200	HBV ₉₅
Imazamethabenz Acid	-	-
Imazamethabenz-methyl	-	-
Imazamox	104,980	Reference _{DWLOC}
Imazapic	-	-
Imazapyr	6,000	Reference _{MDH}

Pesticide Analyte	Value (µg/L)	Value Type
Imazaquin	-	-
Imazethapyr	2,000	Reference _{HBSL}
Imidacloprid	400	Reference _{HBSL}
Isoxaflutole	10	HBV ₀₃
Isoxaflutole DKN	10**	Parent HBV ₀₃
lambda Cyhalothrin	-	-
Linuron	1	HRL ₉₃
Malathion	100	HBV ₉₆
MCPA	3	HRL ₉₃
MCPB	70	HBV ₉₇
MCPP	7	HBV ₉₆
Mesotrione	24	Reference _{DWLOC}
Metalaxyl	600	Reference _{HBSL}
Metolachlor	300	HRL ₁₁
Metolachlor ESA	800	HBV ₁₁
Metolachlor OXA	800	HBV ₁₁
Metribuzin	200/10**	HRL ₉₃ /HBV ₁₀
Metribuzin DA	200/10*	Parent HRL ₉₃ /HBV ₁₀
Metribuzin DADK	200/10*	Parent HRL ₉₃ /HBV ₁₀
Metribuzin DK	200/10*	Parent HRL ₉₃ /HBV ₁₀
Metsulfuron-methyl	2000	HBV ₉₇
Myclobutanil	-	-
Neburon	-	-
Nicosulfuron	9000	HBV ₉₇
Norflurazon	-	-
Oxadiazon	-	-
Parathion-methyl	2	HBV ₉₆
Pendimethalin	90	HBV ₉₅
Phorate	1	HBV ₉₅
Picloram	500	HRL ₉₃
Prometon	100	HRL ₉₃
Prometryn	-	-
Propachlor	90	HRL ₉₃
Propachlor ESA	90**	Parent HRL ₉₃
Propachlor OXA	90**	Parent HRL ₉₃
Propazine	10	HBV ₉₅
Propiconazole	90	HBV ₀₀
Propoxur	-	-
Pyraclostrobin	-	-
Saflufenacil	300	Reference _{HBSL Methodology}
Siduron	-	-
Simazine	4	HRL-MCL
Sulfometuron-methyl	-	-
Tebuconazole	-	-
Tebupirimphos	-	-
Tembotrione	-	-
Terbufos	0.2	HBV ₉₅
Tetraconazole	246	Reference _{DWLOC}
Thiamethoxam	20	Reference _{DWLOC}
Thifensulfuron-methyl	90	HBV ₉₇
Thiobencarb	-	-
Triallate	9	HBV ₉₅
Triasulfuron	70	HBV ₉₇
Triclopyr	300	HBV ₉₉
Trifluralin	5	HBV ₉₅
zeta-Cypermethrin	-	-

Table 6 continued. Summary of available groundwater reference values associated with target and detected non-target pesticide analytes as of May 2011.

Key to Value Types and Symbols in Groundwater Reference Values

Human health-based groundwater guidance values for private wells:

HRL – Health Risk Limit (chronic) promulgated by the Minnesota Department of Health (MDH) in the year indicated or set in 2007 to the Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) as required by state law.

HBV – Health Based Value (chronic), a non-promulgated value established by the MDH in the year indicated.

RAA – Risk Assessment Advice (chronic), a non-promulgated value established by the MDH in the year indicated.

MCL – Maximum Contaminant Level, established by the USEPA for the regulation of public water supplies. If available, used in the absence of an HRL, HBV or RAA.

Reference – In keeping with the Minnesota Pesticide Management Plan, the MDA seeks an available chronic reference value in the absence of an MCL, HRL, HBV or RAA. The lowest value was selected from among available published values and methods from the MDH (MDH Methodology), the USEPA Office of Pesticide Programs (DWLOC: Drinking Water Level of Comparison), the USEPA Office of Water (HA: Health Advisory), and the United States Geological Survey (HBSL: Health Based Screening Level, calculated according to EPA methods for Health Advisories). The values selected were discussed with MDH while preparing this report, and appropriate human health-based groundwater guidance may change pending MDH evaluation of underlying toxicity information.

****** – In the absence of compound-specific toxicological information for pesticide degradates, the MDH conservatively assumes by default that a pesticide degradate has the same toxicological effect as the pesticide parent compound and is as potent.

- – For some undetected analytes, reference values have not been identified or evaluated.

For an MCL or Reference HA, potential health effects information found at:

www.epa.gov/safewater/mcl.html

For all other Reference values, health effects information is available from the MDA or MDH. Guidance for evaluating concurrent exposures to multiple chemicals can be found at

www.health.state.mn.us/divs/eh/risk/guidance/gw/additivity.html

Table 7. Summary of available surface water reference values and standards associated with target and detected non-target pesticide analytes as of February 2011.

Pesticide Analyte ¹	Surface Water Reference Values as of February 2011 (µg/L)					
	MPCA				USEPA/OPP Aquatic Life Benchmark ²	
	Chronic Standards ³			Maximum Standard ⁴	Acute Value	Chronic Value
	Class 2A ⁵	Class 2Bd ⁶	Class 2B,C,D ⁷			
2,4,5-T	—	—	—	—	—	—
2,4,5-TP	50 H	50 H	—	—	—	—
2,4-D	70 H	70 H	—	—	299.2 (v)	14,200 (f)
2,4-DB	—	—	—	—	1,000 (f)	932 (n)
Acetamiprid	—	—	—	—	—	—
Acetochlor	3.6 T	3.6 T	3.6 T	86 T	na	na
Acetochlor ESA	—	—	—	—	> 62,500 (i)	9,900 (n)
Acetochlor OXA	—	—	—	—	—	—
Alachlor	3.8 H; 59 T	4.2 H; 59 T	59 T	800 T	na	na
Alachlor ESA	—	—	—	—	52,000 (f)(i)	—
Alachlor OXA	—	—	—	—	47,500 (i)	—
Aldicarb Sulfone	2 H	2 H	—	—	140 (i)	—
Aldicarb Sulfoxide	4H	4 H	—	—	21.5 (i)	—
Atrazine	3.4 H; 10 T	3.4 H; 10 T	10 T	323 T	na	na
Deisopropylatrazine	—	—	—	—	8,500 (f)	2,500 (n)
Desethylatrazine	—	—	—	—	—	1,000 (n)
DEDI Atrazine	—	—	—	—	> 50,000 (f)(i)	—
Hydroxyatrazine	—	—	—	—	> 1,500 (f)	> 10,000 (n)
Azoxystrobin	—	—	—	—	130 (i)	44 (i)
Bensulfuron-methyl	—	—	—	—	—	—
Bentazon	—	—	—	—	> 50,000 (f)(i)	4,500 (n)
Boscalid	—	—	—	—	1,350 (f)	116 (f)
Bromacil	—	—	—	—	18,000 (f)	6.8 (n)
Carbaryl	—	—	—	—	0.85 (i)	0.5 (i)
Carbofuran	40 H	40 H	—	—	1.12 (i)	0.75 (i)
Chlorimuron-ethyl	—	—	—	—	—	—
Chlorothalonil	—	—	—	—	1.8 (i)	0.6 (i)
Chlorpyrifos	0.041 T	0.041 T	0.041 T	0.083 T	na	na
Clomazone	—	—	—	—	1,450 (f)	167 (n)
Clopyralid	—	—	—	—	56,500 (i)	—
Cyanazine	—	—	—	—	—	—
Cyfluthrin	—	—	—	—	0.0125 (i)	0.007 (i)
Diazinon	—	—	—	—	0.11 (i)	0.17 (i)
Dicamba	—	—	—	—	14,000 (f)	61 (n)
Dichlobenil	—	—	—	—	1,850 (i)	30 (v)
Dichlorprop	—	—	—	—	—	—
Dimethenamid	—	—	—	—	3,150 (f)	5.1 (v)
Dimethenamid ESA	—	—	—	—	—	—
Dimethenamid OXA	—	—	—	—	—	—
Dimethoate	—	—	—	—	21.5 (i)	0.5 (i)
Disulfoton	—	—	—	—	1.95 (i)	0.01 (i)
Disulfoton Sulfone	—	—	—	—	17.5 (i)	0.14 (i)
Diuron	—	—	—	—	80 (i)	2.4 (n)
EPTC	—	—	—	—	3,245 (i)	810 (i)

Table 7 continued. Summary of available surface water reference values and standards associated with target and detected non-target pesticide analytes as of February 2011.

Pesticide Analyte ¹	Surface Water Reference Values as of February 2011 (µg/L)					
	MPCA				USEPA/OPP Aquatic Life Benchmark ²	
	Chronic Standards ³			Maximum Standard ⁴	Acute Value	Chronic Value
	Class 2A ⁵	Class 2Bd ⁶	Class 2B,C,D ⁷			
Esfenvalerate	—	—	—	—	0.025 (i)	0.017 (i)
Ethalfuralin	—	—	—	—	16 (f)	0.4 (f)
Ethofumesate	—	—	—	—	250 (f)	250 (i)
Flufenacet OXA	—	—	—	—	—	—
Fonfos	—	—	—	—	—	—
Glyphosate	700 H	700 H	—	—	21,500 (f)	1,800 (f)
Halosulfuron-methyl	—	—	—	—	—	—
Hexazinone	—	—	—	—	75,800 (i)	7 (n)
Imazamethabenz Acid	—	—	—	—	—	—
Imazamethabenz-methyl	—	—	—	—	—	—
Imazamox	—	—	—	—	> 59,500 (f)	11 (v)
Imazapic	—	—	—	—	> 49,350 (f)	4.23 (v)
Imazapyr	—	—	—	—	50,000 (i)	18 (v)
Imazaquin	—	—	—	—	—	—
Imazethapyr	—	—	—	—	> 55,000 (f)	8.10 (v)
Imidacloprid	—	—	—	—	35 (i)	1.05 (i)
Isoxaflutole	—	—	—	—	> 750 (i)	4.9 (v)
Isoxaflutole DKN	—	—	—	—	> 15,300 (f)	75 (v)
lambda-Cyhalothrin	—	—	—	—	0.0035 (i)	0.002 (i)
Linuron	—	—	—	—	60 (i)	0.09 (i)
Malathion	—	—	—	—	0.3 (i)	0.035 (i)
MCPA	—	—	—	—	90 (i)	130 (v)
MCPB	—	—	—	—	1,950 (v)	210 (v)
MCPP	—	—	—	—	45,500 (i)	14 (n)
Mesotrione	—	—	—	—	> 57,000 (f)	6.70 (v)
Metalaxyl	—	—	—	—	14,000 (i)	100 (i)
Metolachlor	23 T	23 T	23 T	271 T	na	na
Metolachlor ESA	—	—	—	—	24,000 (f)	> 95,100 (v)
Metolachlor OXA	—	—	—	—	7,700 (i)	57,100 (n)
Metribuzin	—	—	—	—	2,100 (i)	8.7 (n)
Metribuzin DA	—	—	—	—	—	—
Metribuzin DADK	—	—	—	—	—	—
Metribuzin DK	—	—	—	—	—	—
Metsulfuron-methyl	—	—	—	—	> 75,000 (f)(i)	0.36 (v)
Myclobutanil	—	—	—	—	1,200 (f)	830 (v)
Neburon	—	—	—	—	—	—
Nicosulfuron	—	—	—	—	—	—
Norflurazon	—	—	—	—	4,050 (f)	9.7 (v)
Oxadiazon	—	—	—	—	440 (f)	0.88 (f)
Parathion-methyl	—	—	—	—	0.49 (i)	0.25 (i)
Pendimethalin	—	—	—	—	69 (f)	5.2 (n)
Phorate	—	—	—	—	0.3 (i)	0.21 (i)
Picloram	500 H	500 H	—	—	6,500 (v)	550 (f)
Prometon	—	—	—	—	6,000 (f)	98 (n)
Prometryn	—	—	—	—	1,450 (f)	1 (v)
Propachlor	—	—	—	—	85 (f)	13.5 (v)

Table 7 continued. Summary of available surface water reference values and standards associated with target and detected non-target pesticide analytes as of February 2011.

Pesticide Analyte ¹	Surface Water Reference Values as of February 2011 (µg/L)					
	MPCA				USEPA/OPP Aquatic Life Benchmark ²	
	Chronic Standards ³			Maximum Standard ⁴	Acute Value	Chronic Value
	Class 2A ⁵	Class 2Bd ⁶	Class 2B,C,D ⁷			
Propachlor ESA	—	—	—	—	—	—
Propachlor OXA	—	—	—	—	—	—
Propazine	—	—	—	—	2,660 (i)	25 (n)
Propiconazole	—	—	—	—	425 (f)	93 (n)
Propoxur	—	—	—	—	5.5 (i)	—
Pyraclostrobin	—	—	—	—	—	—
Saflufenacil	—	—	—	—	> 49,000 (f)(i)	42 (n)
Siduron	—	—	—	—	4,050 (f)	6 (i)
Simazine	4 H	4 H	—	—	500 (i)	36 (n)
Sulfometuron-methyl	—	—	—	—	> 6,250 (f)(i)	0.48 (v)
Tebuconazole	—	—	—	—	1,440 (i)	12 (f)
Tebuprimiphos	—	—	—	—	0.039 (i)	0.011 (i)
Tembotrione	—	—	—	—	—	—
Terbufos	—	—	—	—	0.1 (i)	0.03 (i)
Tetraconazole	—	—	—	—	1,315 (i)	190 (i)
Thiamethoxam	—	—	—	—	> 50,000 (f)	20,000 (f)
Thifensulfuron-methyl	—	—	—	—	—	—
Thiobencarb	—	—	—	—	50 (i)	1 (i)
Triallate	—	—	—	—	45.5 (i)	13 (i)
Triasulfuron	—	—	—	—	> 50,000 (f)(i)	68,600 (f)
Triclopyr	—	—	—	—	180 (f)	100 (n)
Trifluralin	—	—	—	—	20.5 (f)	1.14 (f)
zeta-Cypermethrin	—	—	—	—	—	—

Table 7 continued. Summary of available surface water reference values and standards associated with target and detected non-target pesticide analytes as of February 2011.

Key to Value Types and Symbols in Surface Water Reference Values

- – no value currently available
- na – not applicable
- (f) – USEPA/OPP benchmark value for fish.
- (i) – USEPA/OPP benchmark value for invertebrates.
- (n) – USEPA/OPP benchmark value for nonvascular plants
- (v) – USEPA/OPP benchmark value for vascular plants.
- H – “H” Chronic Standard values are human health-based and protective for an exposure duration of 30 days.
- T – “T” Chronic Standard values are toxicity-based for aquatic organisms and protective for an exposure duration of 4 days.

¹ **Reference Values** are given for all target and detected non-target analytes for which there is a reference value. Other analytes have been analyzed for and/or detected, but have no associated reference value. For a complete list of all target analytes and detected non-target analytes, please refer to Table 2.

² **Aquatic Life Benchmarks** based on toxicity values derived from data available to the United States Environmental Protection Agency’s (USEPA’s) Office of Pesticide Programs (OPP) supporting registration of the pesticide and are provided only when an MPCA value is not available. Current values posted by the USEPA’s OPP may differ from those of previous reports. See USEPA’s web site for more detailed information and definitions. For the dimethenamid chronic value, the MPCA has calculated a non-promulgated criterion for aquatic plants using two point estimates of toxicity to the vascular plant duckweed.”

³ **Chronic Standard** as defined in Minn. Rule Chap. 7050. “H” value is human health-based and is protective for an exposure duration of 30 days. Human health-based values are shown only when they are less than toxicity-based values. “T” value is toxicity-based for aquatic organisms and is protective for an exposure duration of 4 days.

⁴ **Maximum Standard Value for Aquatic Life & Recreation** as defined on MPCA’s web site and Minn. Rule Chap. 7050. Values are the same for all classes of surface waters.

⁵ **State Water Classification for aquatic life (cold water streams) & all recreation.** Protected as drinking water sources.

⁶ **State Water Classification for aquatic life (cold and warm water streams) & all recreation.** Protected as drinking water sources.

⁷ **State Water Classification for aquatic life** (2B – sport and commercial; 2C – non-commercial; 2D – wetlands) & recreation (2B – all types; 2C,D – limited types). Not protected as drinking water sources.

SECTION 2: GROUNDWATER MONITORING RESULTS

MDA's groundwater monitoring network seeks to provide information on impacts to the state's groundwater from the routine use of agricultural chemicals. Information is made available so management decisions can be made to reduce, or eliminate, impacts to groundwater.

The MDA began monitoring groundwater in November 1985 and redesigned the program in 1998. New wells were installed in 1999, and the MDA began sampling the re-designed monitoring network in January 2000. The current program is established around the goal of providing the information necessary to manage pesticide use for water quality protection on a sub-state, regional basis. Each monitoring site is established to evaluate pesticide impacts to the most vulnerable groundwater conditions in their associated PMR. The first network was established in PMR 4 (central sands), which contains the majority of sites in the program. It was designed for the purpose of tracking trends over time. PMRs 1, 5, 6, 7 and 8 were started in 2004. PMR 9 groundwater has been sampled via naturally occurring springs since 1993. Monitoring of natural springs in PMR 9 is accompanied by sampling of domestic drinking water wells, which started in 2009. PMRs 2 and 3 are not currently monitored for groundwater due to very limited agricultural production in these heavily forested regions.

2.1. Groundwater sampling

Samples were collected from 174 groundwater monitoring sites in 2010 (Figure 5). Of the total sites, 148 are comprised of one or more specifically designed and installed monitoring or observation wells, 14 were private drinking water wells, and 12 consisted of naturally occurring springs emerging from bedrock formations of interest in the southeastern karst area of the state (PMR 9). All of the locations are considered sensitive to contamination from activities at the land surface. Network design and sampling protocols are available in the program's groundwater design document on the MDA website at: (www.mda.state.mn.us/monitoring).

A total of 259 samples were collected in 2010, although not all analytes were available for each sample collected. The complete list of analytes was not available until part way into the year due to ongoing development of laboratory analytical methods (See *New analytical instruments* on page 3). Table 8 lists all the pesticides that were detected in groundwater samples during 2010. Many analytes were detected in fewer than 10 samples. The most frequently detected analyte was a degradate of metolachlor (217 detections). Before 2010, detections of atrazine and its degradates were more common than any other pesticide or breakdown product. In 2010 however, metolachlor ESA was the most frequently detected single compound. Two atrazine breakdown products, hydroxyatrazine and DEDI atrazine which were not available analytes prior to 2010, were detected relatively frequently (22 percent and 21 percent, respectively). Bentazon is a newly available analyte in 2010 and was present in 14.8 percent of the samples analyzed. Bentazon occurred most frequently in PMR 4 although it did appear in other PMRs. Tables, graphics and discussion of detection trends over time for commonly detected pesticides in groundwater can be found in the following subsections of this report. Groundwater quality analytical results for each of the PMRs are located in Appendix 3.

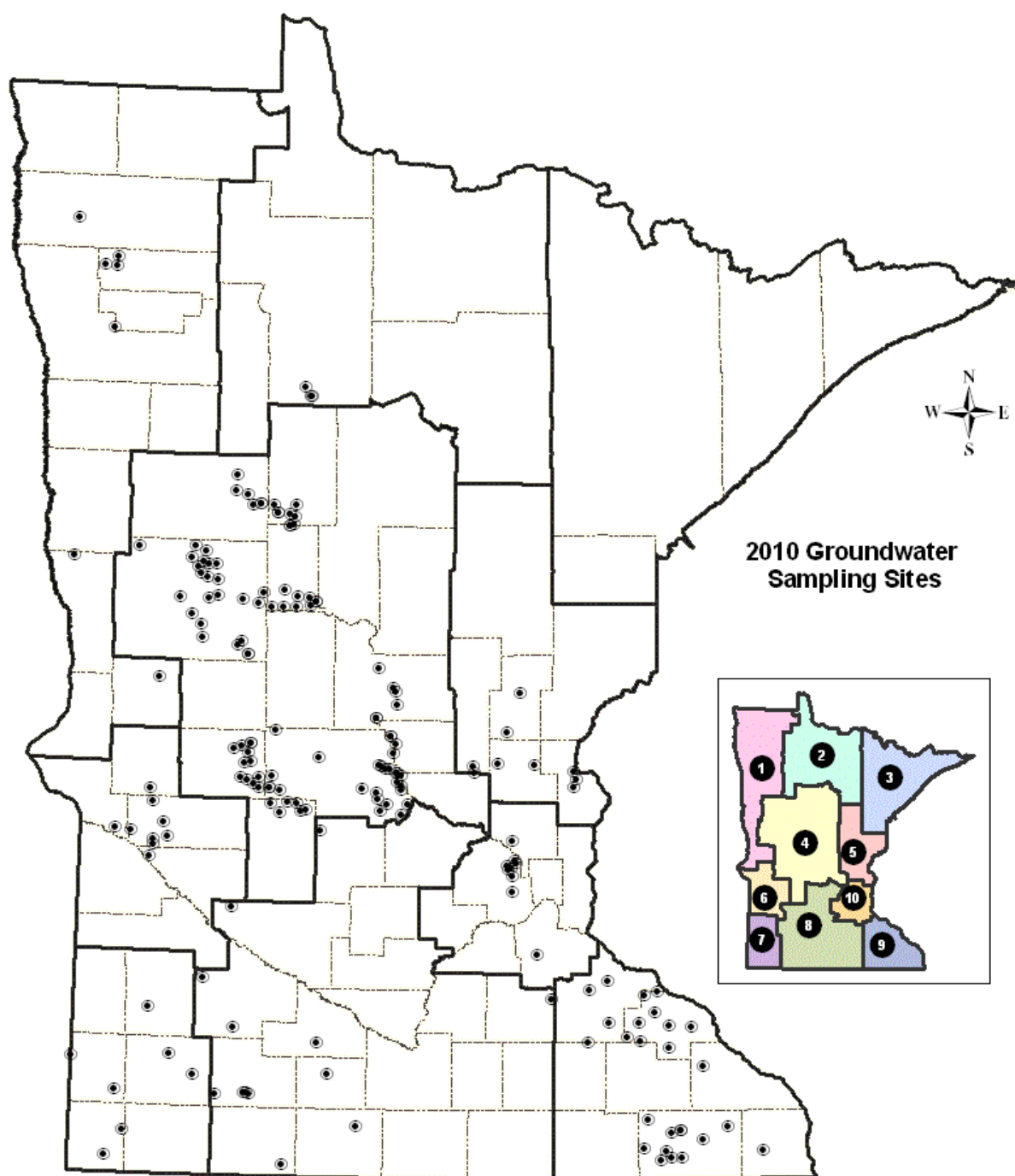


Figure 5. Location of groundwater monitoring sites sampled in 2010.

Table 8. Pesticides and degradates detected in groundwater monitoring samples collected by MDA during 2010.

Chemical detected in MDA groundwater samples during 2010	Samples Analyzed	Detections	Percent Detected (%)
2,4-D	259	7	2.7
Acetochlor	259	7	2.7
Acetochlor ESA	259	85	32.8
Acetochlor OXA	259	17	6.6
Alachlor	259	2	0.8
Alachlor ESA	259	120	46.3
Alachlor OXA	259	6	2.3
Atrazine	259	126	48.6
Bentazon	259	38	14.7
Bromacil	259	6	2.3
Clopyralid	259	2	0.8
DEDI atrazine (DACT)	259	54	20.8
Deisopropylatrazine	259	28	10.8
Desethylatrazine	259	160	61.8
Dicamba	229	2	0.9
Dimethenamid	259	8	3.1
Dimethenamid ESA	259	22	8.5
Dimethenamid OXA	259	12	4.6
Diuron	259	1	0.4
Hydroxyatrazine	259	58	22.4
Imazamox	259	14	5.4
Imazapyr	259	7	2.7
Imazethapyr	259	11	4.2
Imidacloprid	256	11	4.3
MCP	229	1	0.4
Mesotrione	229	2	0.9
Metalaxyl	259	13	5.0
Metolachlor	259	35	13.5
Metolachlor ESA	259	217	83.8
Metolachlor OXA	259	103	39.8
Metribuzin	259	17	6.6
Metribuzin DA	259	11	4.2
Metribuzin DADK	259	26	10.0
Metribuzin DK	259	19	7.3
Nicosulfuron	259	2	0.8
Picloram	259	2	0.8
Prometon	259	4	1.5
Propachlor ESA	229	1	0.4
Saflufenacil	256	4	1.6
Simazine	259	2	0.8
Tetraconazole	259	1	0.4
Thiamethoxam	256	10	3.9

To provide further context to the information above, information relating to the maximum detection of all chemicals from the 2010 analyte list (Table 1) for groundwater monitoring is shown in Table 9. **No groundwater pesticide sample exceeded any standard or human health-based groundwater standards, values or limits in 2010.**

Table 9. 2010 groundwater maximum detections for all analytes along with guidance values.

Common Name	Maximum Detection	Guidance Value (µg/L)	Value Type
2,4,5-T	nd	70	HRL ₉₃
2,4,5-TP	nd	50	HRL _{MCL}
2,4-D	0.1410	70	HRL ₉₃
2,4-DB	nd	60	HBV ₉₅
Acetamiprid	nd	-	-
Acetochlor	0.19	9	HRL ₀₈
Acetochlor ESA	10.1000	300	HBV ₁₁
Acetochlor OXA	1.3400	100	HBV ₁₁
Alachlor	P	5	HRL ₀₈
Alachlor ESA	10.3000	70	RAA ₀₉
Alachlor OXA	0.4430	70	RAA ₀₉
Aldicarb Sulfone	nd	2	MCL
Aldicarb Sulfoxide	nd	4	MCL
Atrazine	0.54	3	HRL _{MCL}
DEDI Atrazine	0.5050	3**	Parent HRL _{MCL}
Deisopropylatrazine	0.30	3**	Parent HRL _{MCL}
Desethylatrazine	1.54	3**	Parent HRL _{MCL}
Hydroxyatrazine	0.2220	20	HBV ₀₅
Azoxystrobin	nd	-	-
Bensulfuron-methyl	nd	-	-
Bentazon	15.5000	200	HBV ₉₈
Boscalid	nd	-	-
Bromacil	0.1250	70	Reference _{HA}
Carbaryl	nd	70	HBV ₀₃
Carbofuran	nd	40	MCL
Chlorimuron-ethyl	nd	100	HBV ₉₇
Chlorothalonil	nd	30	HRL ₉₄
Chlorpyrifos	nd	20	HBV ₉₅
Clomazone	nd	300	HBV ₉₇
Clopyralid	0.6430	4,900	Reference _{DWLOC}
Cyanazine	nd	1	HRL ₀₈
Cyfluthrin	nd	-	-
Diazinon	nd	1	Reference _{HA}
Dicamba	0.1350	200	HRL ₉₃
Dichlorprop	nd	-	-
Dimethenamid	0.10	40	HBV ₉₉
Dimethenamid ESA	3.6000	40**	Parent HBV ₉₉
Dimethenamid OXA	1.5900	40**	Parent HBV ₉₉
Dimethoate	nd	1	HBV ₉₆

Table 9 continued. 2010 groundwater maximum detections for all analytes along with guidance values.

Common Name	Maximum Detection	Guidance Value (µg/L)	Value Type
Disulfoton	nd	0.3	HRL ₉₄
Disulfoton Sulfone	nd	0.3**	Parent HRL ₉₄
Diuron	0.0596	200	Reference _{HA}
EPTC	nd	200	HRL ₉₃
Esfenvalerate	nd	-	-
Ethalfuralin	nd	300	HBV ₉₉
Ethofumesate	nd	-	-
Flufenacet OXA	nd	-	-
Fonofos	nd	10	HBV ₉₅
Halosulfuron-methyl	nd	-	-
Hexazinone	nd	200	HBV ₉₅
Imazamethabenz Acid	nd	-	-
Imazamethabenz-methyl	nd	-	-
Imazamox	0.3270	104,980	Reference _{DWLOC}
Imazapic	nd	-	-
Imazapyr	0.0402	6,000	Reference _{MDH}
Imazaquin	nd	-	-
Imazethapyr	0.2920	2,000	Reference _{HBSL}
Imidacloprid	1.3600	400	Reference _{HBSL}
Isoxaflutole	nd	10	HBV ₀₃
Isoxaflutole DKN	nd	10**	Parent HBV ₀₃
lambda Cyhalothrin	nd	-	-
Linuron	nd	1	HRL ₉₃
Malathion	nd	100	HBV ₉₆
MCPA	nd	3	HRL ₉₃
MCPB	nd	70	HBV ₉₇
MCPP	0.3880	7	HBV ₉₆
Mesotrione	0.1520	24	Reference _{DWLOC}
Metalaxyl	0.5580	600	Reference _{HBSL}
Metolachlor	4.25	300**	HRL ₁₁
Metolachlor ESA	24.3000	800	HBV ₁₁
Metolachlor OXA	12.6000	800	HBV ₁₁
Metribuzin	1.10	200/10*	HRL ₉₃ /HBV ₁₀
Metribuzin DA	P	200/10*	Parent HRL ₉₃ /HBV ₁₀
Metribuzin DADK	3.00	200/10*	Parent HRL ₉₃ /HBV ₁₀
Metribuzin DK	P	200/10*	Parent HRL ₉₃ /HBV ₁₀
Metsulfuron-methyl	nd	2000	HBV ₉₇
Myclobutanil	nd	-	-
Neburon	nd	-	-

Table 9 continued. 2010 groundwater maximum detections for all analytes along with guidance values.

Common Name	Maximum Detection	Guidance Value (µg/L)	Value Type
Nicosulfuron	0.0431	9000	HBV ₉₇
Norflurazon	nd	-	-
Oxadiazon	nd	-	-
Parathion-methyl	nd	2	HBV ₉₆
Parathion-methyl	nd	2	HBV ₉₆
Pendimethalin	nd	90	HBV ₉₅
Phorate	nd	1	HBV ₉₅
Picloram	0.2700	500	HRL ₉₃
Prometon	P	100	HRL ₉₃
Prometryn	nd	-	-
Propachlor	nd	90	HRL ₉₃
Propachlor ESA	0.0627	90**	Parent HRL ₉₃
Propachlor OXA	nd	90**	Parent HRL ₉₃
Propazine	nd	10	HBV ₉₅
Propiconazole	nd	90	HBV ₀₀
Propoxur	nd	-	-
Pyraclostrobin	nd	-	-
Saflufenacil	0.0644	300	Reference HBSL
Siduron	nd	-	-
Simazine	P	4	HRL _{MCL}
Sulfometuron-methyl	nd	-	-
Tebuconazole	nd	-	-
Tebupirimphos	nd	-	-
Tembotrione	nd	-	-
Terbufos	nd	0.2	HBV ₉₅
Tetraconazole	0.19	246	Reference DWLOC
Thiamethoxam	0.3790	20	Reference DWLOC
Thifensulfuron-methyl	nd	90	HBV ₉₇
Thiobencarb	nd	-	-
Triallate	nd	9	HBV ₉₅
Triasulfuron	nd	70	HBV ₉₇
Triclopyr	0.1820	300	HBV ₉₉
Trifluralin	nd	5	HBV ₉₅
zeta-Cypermethrin	nd	-	-

2.2. Analysis of the most frequently detected pesticides collected from MDA PMRs

Acetochlor, alachlor, atrazine, metolachlor, and metribuzin were designated as common detected pesticides in years previous to 2010. Figure 6 graphically displays the spatial relationship of these common detection chemical results in 2010.

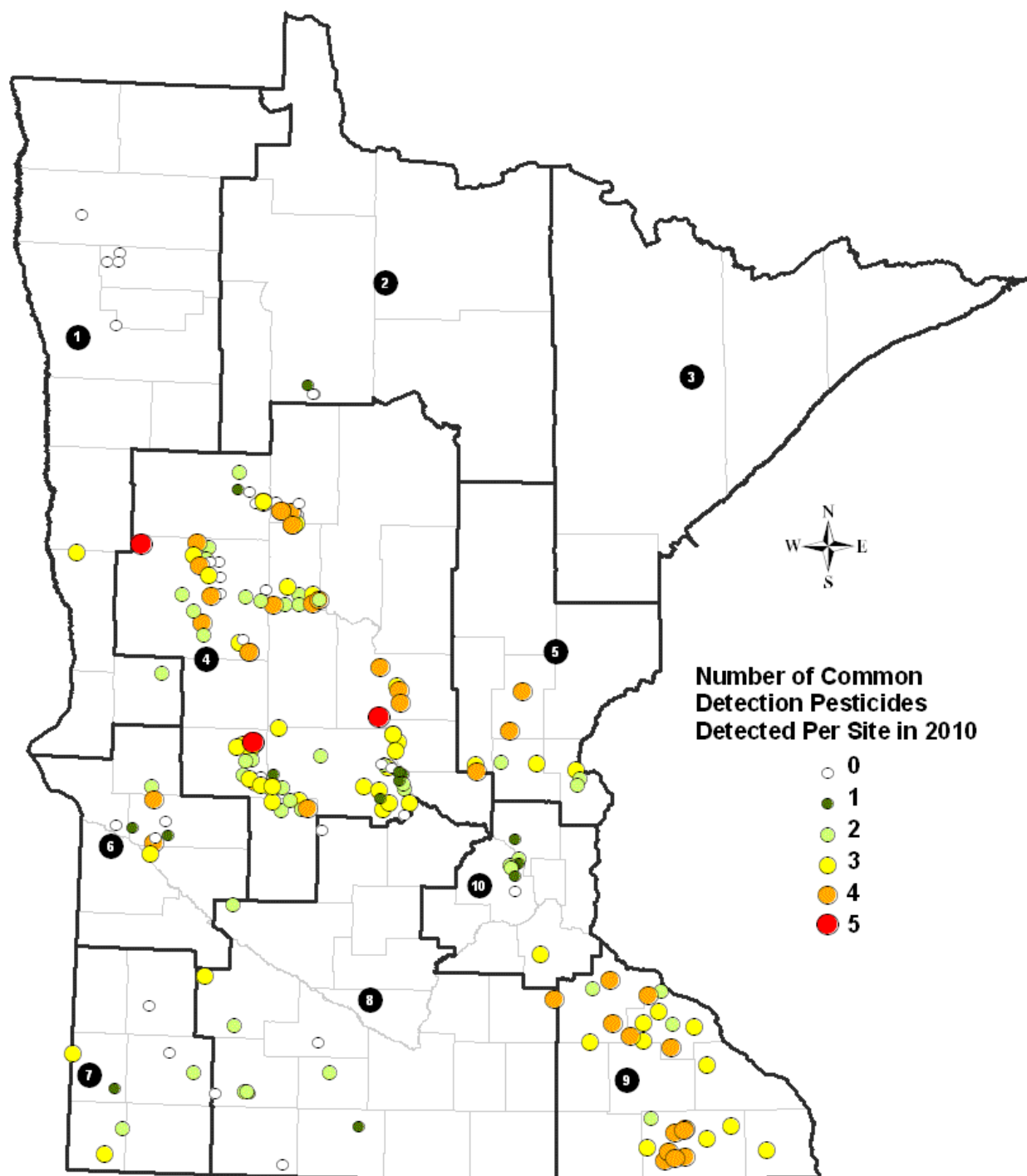


Figure 6. Number of common detection pesticides detected in groundwater samples per site in 2010.

As a result of their common detection status, these pesticides and their degradates receive heightened scrutiny from the MDA during reporting of monitoring results. Common detection is an official state designation made by the MDA Commissioner when a pesticide is detected in groundwater as a result of normal use. The process of designating common detection is described in the Minnesota Pesticide Management Plan (www.mda.state.mn.us/pesticides). Dimethenamid has been detected for several years and is included in this section, although it is not currently in common detection status. Bentazon is not included in this section because data is only available for 2010. Due to its relatively high detection frequency, bentazon will be watched in coming years for any trends that may become apparent or measurable. Bentazon parent is the only form of bentazon considered for analysis in groundwater due to the rapid conversion of breakdown products to other forms that are extremely short-lived in natural systems.

The MDA groundwater monitoring program is designed to determine the frequency of detections, the concentration of detections, and changes in detections and concentrations over space and time for pesticides. Various analyses were performed and summaries prepared for this report to meet these objectives, specifically for the commonly detected pesticides. Figures have been prepared to display the spatial variability in pesticide detections across Minnesota in 2010. Tables are utilized to present pesticide concentration data (median, 75th percentile, 90th percentile, and maximum). Concentration time-trend data is presented through the use of graphical displays of median, 75th percentile and 90th percentile concentration values with a separate graphical display of detection frequencies. Minimum and lower quartile values are not included because they are typically less than detectable concentrations. Maximum values are not included in time trend graphics because their magnitude can mask trends in the other more important statistics and because they are a single number that is not representative of general conditions and the wider sample population as a whole. The 90th percentile is used instead to give a more detailed look at the tendencies of the data at higher concentrations.

Included in each of these time-trend graphical displays are trend lines, which have been included as an aid in visual assessment of the data. These trend lines were generated for each of the data groups that are displayed in the graphs (median, 75th percentile and 90th percentile values) through the use of a method called Locally Weighted Scatter plot Smoothing (LOWESS). The LOWESS method is a robust and particularly useful method as it generates a line to track the central tendency of the data over time based upon the data itself rather than being constrained by assumptions associated with an equation that is attempted to be “fit” to the data. This is particularly useful for non-normal data, such as the pesticide data that the MAU generates. The drawback, however, is that the accuracy of the line estimate degrades at the tails of the line. This is due to the fact that the data near the midpoint of the line receives greater weight than the data located at the ends of the line during LOWESS generation. As such, caution should be exercised when evaluating the shape of the line at the tails and interpreting trends during more recent time periods. Similar to regression methods, extrapolating the line beyond the extent of the data is inappropriate.

Trend analyses on the MDA groundwater monitoring data are accomplished on the three graphically displayed statistics (median, 75th and 90th percentiles). Time-trend analysis on median values is the most widely accepted measure on which to base decisions. Trend analyses on 75th and 90th percentile concentrations may also be quite valuable in decision-making

processes. All trend analyses conducted on MDA groundwater monitoring data utilizes the nonparametric Mann-Kendall test for trend, coupled with the Thiel-Sen slope estimation procedure and calculation of Kendall's tau (a nonparametric correlation estimate). Tabulated results of trend analyses on concentrations and detections are located in Appendix 4.

The best data set currently available for assessing changes in groundwater impacts over time is from PMR 4. For all parent compounds, as well as atrazine and metribuzin degradates, data back to 2000 was utilized for looking at trends in pesticide levels in PMR 4 groundwater. Degradate data for the other four chemicals is available dating back to 2002, when degradate analysis began for these analytes. Because of a change in sampling strategy in June 2008, PMR 4 trend analysis uses only spring and fall quarter concentration data. It should be noted, though, that summary statistics presented in the tables use all sample results, regardless of which quarter samples were collected. For further information on this change in sampling strategy, please refer to the Groundwater Monitoring Design Document at (www.mda.state.mn.us/monitoring).

Data from PMR 9 was also included in trend testing work because this region has a long history of sample collection from three DNR fish hatchery springs. There is also data from the more recently monitored springs (nine total), which are not included for trend testing due to differences in sampling schedules and length of record. These most recently sampled springs have five or fewer years of data available and, as such, have a data record that is insufficient for providing statistically conclusive results from concentration trend testing. It should be noted, however, that data from the more recently sampled springs is the better source for tracking changes in the detection of pesticides in PMR 9 and is therefore utilized in this manner by combining the data from the two sources for analysis. The newer springs are the better source of data due to the facts that the DNR fish hatchery springs total only three locations, which can't be considered enough to adequately represent PMR 9 as a whole, and the land use around the DNR fish hatchery springs is not predominantly agriculture, like it is for the other springs. This should be taken into consideration when reviewing the PMR 9 trend testing results. Appendix 4.7 - 4.12 contains the results of trend analysis for all the common detection chemicals monitored in the DNR fish hatchery springs of PMR 9. Figures showing the sampling results from the PMR 9 springs over time have also been prepared in a manner identical to the associated time series graphics for PMR 4, but only for those analytes with sufficient detections to create a display for use in providing a meaningful discussion of the results. Alachlor ESA, atrazine, desethylatrazine, deisopropylatrazine, metolachlor, metolachlor ESA and metolachlor OXA are the only analytes with sufficient detections to accomplish this.

Changing method reporting limits impacts on trend analysis

A difficulty in analyzing the current time series data is the existence of multiple detection limits (i.e. varying MRLs) over time for a single compound. This is the situation specifically for the degradate (ESA and OXA) forms of compounds. Additionally, several pesticides had concentrations reported as "peak present" when sufficient quantities of the chemical were present to be able to distinguish that it was there, without enough available to actually measure the amount present. There is no way to determine the concentration of the chemicals found below the MRLs, complicating the use of any of the values below the reporting limit. Use of analytical reports below historical measurable detection levels has the strong likelihood of significantly biasing the results over time. This necessitates the truncation of the entire data set at the highest available MRL. The limits for the five common detection pesticides and their associated

degradates under current laboratory methodology is located in Table 1. The MRL for the ESA and OXA degradates of the acetanilide pesticides was 0.07 µg/L for samples collected before 2010. All trend analysis discussions and graphics for these compounds were developed from a data set where all values below 0.07 µg/L were set to zero, which places all historical concentration data at an equal base level.

Summary tables (example Table 10 and Table 11 in Section 2.2.1) in the groundwater section include two columns for results from 2010. One column (10-new) presents 2010 summary statistics based on the 2010 MRLs with the second column (10) representing 2010 summary statistics based on the MRLs in use prior to 2010. MRLs for atrazine, desethylatrazine, deisopropylatrazine and all forms of metribuzin are unchanged negating the need to report results in two separate columns.

2.2.1. Acetochlor results

Figure 7 shows the distribution of sites where acetochlor and its degradates were detected in 2010 sampling. Summary information on groundwater monitoring results for acetochlor is located in Table 10 and Figure 8. Acetochlor ESA is the most common form of acetochlor detected (see Table 11 and Figure 10) and is the principal factor when analyzing acetochlor impacts to groundwater. Acetochlor was first registered for use in 1994, although it was unlikely to have been applied to crop land before April 1995. Acetochlor or its degradates have been found in every PMR tested, although the median concentration has remained at or near non-detectable levels through all the years represented in Table 10. In PMR 4, median, 75th percentile, and 90th percentile concentrations of acetochlor and its degradates have remained relatively constant over the time period of interest (Figure 8 - 10). The concentration of acetochlor and its degradate compounds was analyzed statistically using a Mann-Kendall test for trend which found no statistically significant trend overall.

Acetochlor or its degradates have been detected in over 35 percent of samples in a single year, although detection frequencies for each form of acetochlor shows a general decline from 2002 through 2010, except for acetochlor ESA (Figure 11). Upon graphical inspection of PMR 4 results for acetochlor ESA detection frequencies, there was an obvious downward trend through 2009 with an abrupt rise in detection frequencies at that point. Analysis of the apparent trend in acetochlor ESA detection frequencies over time reported a statistically significant decrease through 2009. Analysis of the data through 2010 shows trend analysis to no longer be statistically significant. This is an artifact of the upturn in the data which a monotonic trend test is incapable of recognizing. Short term changes in trends are not uncommon in environmental data and do not necessarily reflect a permanent condition. In this particular case the most recent detection frequencies are well within previous levels and may reflect normal fluctuations in the data which should be anticipated over time.

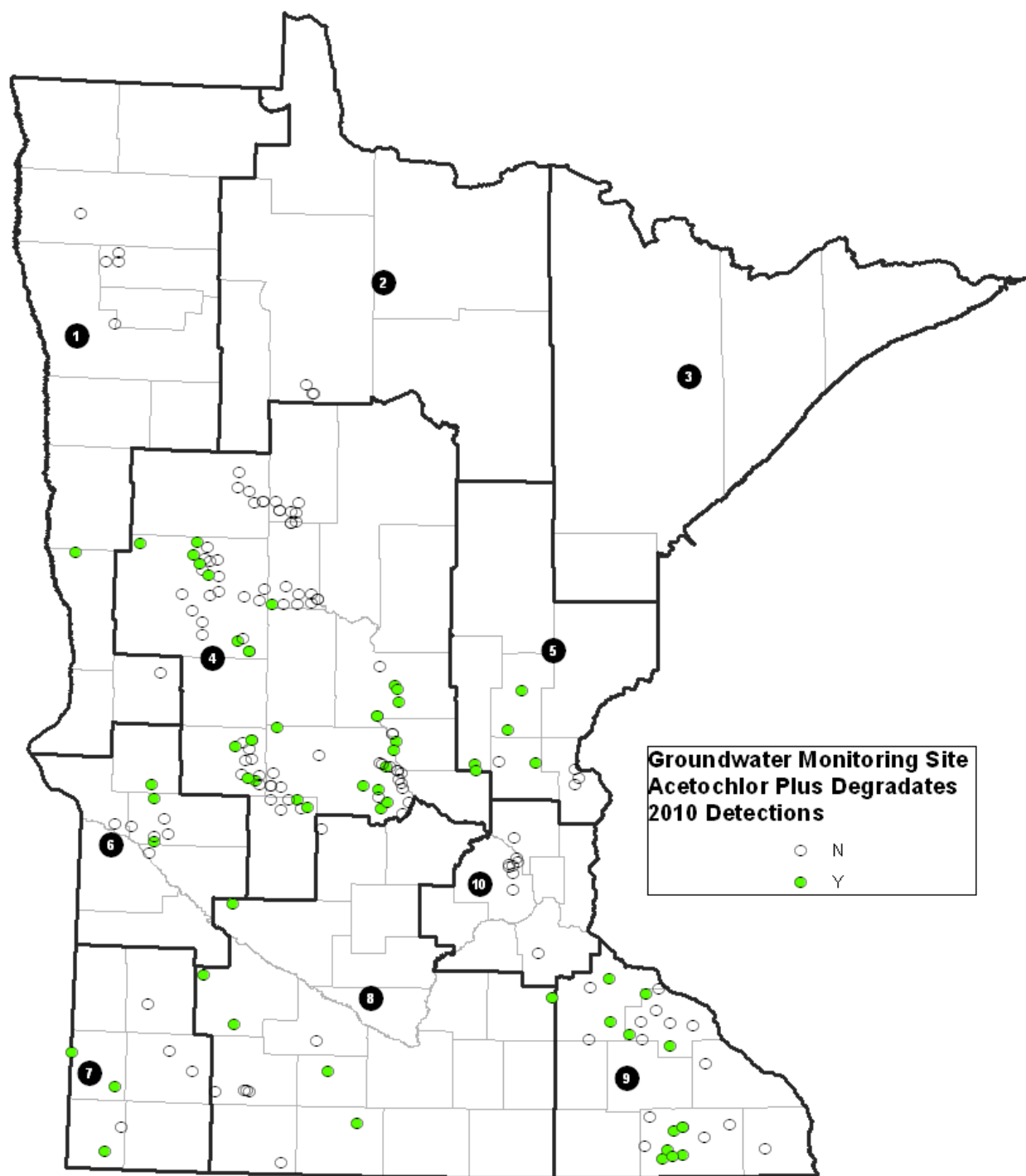


Figure 7. Pesticide Monitoring Regions and groundwater sites with acetochlor plus acetochlor degrade detections in 2010.

Table 10. MDA analytical results 2005 through 2010 in groundwater for acetochlor and its degradates.

PMR 1	Median (µg/L)							75th Percentile (µg/L)						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor ESA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Acetochlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 4														
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor ESA	nd	nd	nd	nd	nd	nd	nd	0.1	nd	nd	nd	nd	0.1165	0.1165
Acetochlor OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PMR 5														
Acetochlor	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Acetochlor ESA	-	-	0.08	nd	0.24	0.0816	0.0816	-	-	0.94	0.46	0.63	0.9657	0.9657
Acetochlor OXA	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
PMR 6														
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor ESA	nd	-	nd	nd	nd	nd	nd	0.08	-	nd	nd	0.02	nd	0.0384
Acetochlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 7														
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor ESA	nd	-	nd	nd	nd	nd	nd	0.05	-	0.07	0.05	nd	0.1550	0.1550
Acetochlor OXA	0.03	-	nd	nd	nd	nd	nd	0.08	-	nd	nd	nd	0.0836	0.0836
PMR 8														
Acetochlor	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd	nd
Acetochlor ESA	-	-	0.07	nd	nd	nd	nd	-	-	0.19	nd	0.12	0.1050	0.1199
Acetochlor OXA	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
PMR 9														
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor ESA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.07	0.07	nd	0.0678
Acetochlor OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Urban														
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor ESA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

***10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.**

Table 10 continued. MDA analytical results 2005 through 2010 in groundwater for acetochlor and its degradates.

PMR 1	90th Percentile (µg/L)							Maximum (µg/L)						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor ESA	nd	-	nd	nd	nd	nd	0.0042	nd	-	nd	nd	nd	nd	0.0423
Acetochlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 4														
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	0.14	nd	nd	nd	nd	nd
Acetochlor ESA	0.65	0.60	1.12	0.32	0.64	0.7501	0.7501	16.4	26.5	8.68	8.29	5.62	10.10	10.10
Acetochlor OXA	nd	nd	nd	nd	nd	nd	nd	7.89	2.21	2.23	0.28	1.24	1.340	1.340
PMR 5														
Acetochlor	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Acetochlor ESA	-	-	1.31	1.44	2.09	3.732	3.732	-	-	1.41	1.79	2.98	5.400	5.400
Acetochlor OXA	-	-	0.08	nd	nd	nd	nd	-	-	0.13	nd	nd	nd	nd
PMR 6														
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor ESA	0.16	-	0.05	nd	0.12	0.1009	0.1009	0.17	-	0.09	nd	0.15	0.2990	0.2990
Acetochlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	0.1770	0.1770
PMR 7														
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	P	P
Acetochlor ESA	0.11	-	0.15	0.09	nd	0.5157	0.5157	0.11	-	0.17	0.1	nd	0.6120	0.6120
Acetochlor OXA	0.09	-	0.07	nd	nd	0.3588	0.3588	0.09	-	0.09	nd	nd	0.3750	0.3750
PMR 8														
Acetochlor	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor ESA	-	-	0.29	0.08	0.30	0.2236	0.2236	nd	nd	0.39	0.09	0.31	0.2730	0.2730
Acetochlor OXA	-	-	0.07	nd	0.02	nd	0.0419	nd	nd	0.14	nd	0.08	0.2560	0.2560
PMR 9														
Acetochlor	nd	nd	nd	nd	P	nd	nd	nd	P	0.46	0.16	0.15	0.1900	0.1900
Acetochlor ESA	nd	0.10	0.1	0.11	0.16	0.1366	0.1366	nd	0.62	0.28	0.24	0.56	2.190	2.190
Acetochlor OXA	nd	nd	nd	nd	0.02	nd	nd	nd	0.66	0.71	0.14	0.31	1.010	1.010
Urban														
Acetochlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Acetochlor ESA	nd	nd	nd	nd	nd	nd	nd	nd	0.16	0.27	nd	0.36	nd	nd
Acetochlor OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

***10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.**

Table 11. Total number of detections and detection frequencies in groundwater samples for acetochlor and its degradates, 2005-2010 by PMR.

PMR 1	Detections							Percent Detections						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Acetochlor	0/17	0/9	0/8	0/8	0/7	0/14	0/14	0%	0%	0%	0%	0%	0%	0%
Acetochlor ESA	0/17	-	0/8	0/7	0/7	0/14	1/14	0%	-	0%	0%	0%	0%	7%
Acetochlor OXA	0/17	-	0/8	0/7	0/7	0/14	0/14	0%	-	0%	0%	0%	0%	0%
Acetochlor + Degradates	0/17	-	0/8	0/7	0/7	0/14	1/14	0%	-	0%	0%	0%	0%	7%
PMR 4														
Acetochlor	0/113	1/112	0/110	0/83	0/83	0/92	0/92	0%	1%	0%	0%	0%	0%	0%
Acetochlor ESA	33/113	24/113	25/111	14/84	18/83	26/92	29/92	29%	21%	23%	17%	22%	28%	32%
Acetochlor OXA	3/113	2/113	5/111	2/84	5/83	4/92	5/92	3%	2%	5%	2%	6%	4%	5%
Acetochlor + Degradates	34/113	25/112	25/110	14/83	18/82	26/92	29/92	30%	22%	23%	17%	22%	28%	32%
PMR 5														
Acetochlor	-	-	0/9	0/9	0/9	0/17	0/17	-	-	0%	0%	0%	0%	0%
Acetochlor ESA	-	-	5/9	4/9	5/9	9/17	9/17	-	-	56%	44%	56%	53%	53%
Acetochlor OXA	-	-	1/9	0/9	0/9	0/17	0/17	-	-	11%	0%	0%	0%	0%
Acetochlor + Degradates	-	-	5/9	4/9	5/9	9/17	9/17	-	-	56%	44%	56%	53%	53%
PMR 6														
Acetochlor	0/6	0/9	0/9	0/9	0/9	0/18	0/18	0%	0%	0%	0%	0%	0%	0%
Acetochlor ESA	2/6	-	1/9	0/9	2/9	3/18	5/18	33%	-	11%	0%	22%	17%	28%
Acetochlor OXA	0/6	-	0/9	0/9	0/9	1/18	1/18	0%	-	0%	0%	0%	6%	6%
Acetochlor + Degradates	2/6	-	1/9	0/9	2/9	3/18	5/18	33%	-	11%	0%	22%	17%	28%
PMR 7														
Acetochlor	0/4	0/7	0/7	0/7	0/7	1/14	1/14	0%	0%	0%	0%	0%	7%	7%
Acetochlor ESA	1/4	-	2/7	2/7	0/7	5/14	5/14	25%	-	29%	29%	0%	36%	36%
Acetochlor OXA	2/4	-	1/7	0/7	0/7	4/14	4/14	50%	-	14%	0%	0%	29%	29%
Acetochlor + Degradates	2/4	-	2/7	2/7	0/7	5/14	5/14	50%	-	29%	29%	0%	36%	36%
PMR 8														
Acetochlor	0/1	0/9	0/10	0/12	0/12	0/23	0/23	0%	0%	0%	0%	0%	0%	0%
Acetochlor ESA	0/1	0/1	5/10	2/12	5/12	6/23	9/23	0%	0%	50%	17%	42%	26%	39%
Acetochlor OXA	0/1	0/1	1/10	0/12	1/12	1/23	3/23	0%	0%	10%	0%	8%	4%	13%
Acetochlor + Degradates	0/1	0/1	5/10	2/12	5/12	6/23	9/23	0%	0%	50%	17%	42%	26%	39%
PMR 9														
Acetochlor	0/63	2/56	2/55	4/46	8/62	6/62	6/62	0%	4%	4%	9%	13%	10%	10%
Acetochlor ESA	0/64	7/56	9/55	12/46	17/62	15/62	27/62	0%	13%	16%	26%	27%	24%	44%
Acetochlor OXA	0/64	4/56	1/55	3/46	6/62	4/62	4/62	0%	7%	2%	7%	10%	7%	7%
Acetochlor + Degradates	0/62	7/56	10/55	12/46	19/62	16/62	28/62	0%	13%	18%	26%	31%	26%	45%
Urban														
Acetochlor	0/22	0/21	0/17	0/16	0/15	0/20	0/20	0%	0%	0%	0%	0%	0%	0%
Acetochlor ESA	0/22	1/21	1/17	0/16	1/15	0/20	0/20	0%	5%	6%	0%	7%	0%	0%
Acetochlor OXA	0/22	0/21	0/17	0/16	0/15	0/20	0/20	0%	0%	0%	0%	0%	0%	0%
Acetochlor + Degradates	0/22	1/21	1/17	0/16	1/15	0/20	0/20	0%	5%	6%	0%	7%	0%	0%

*10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.

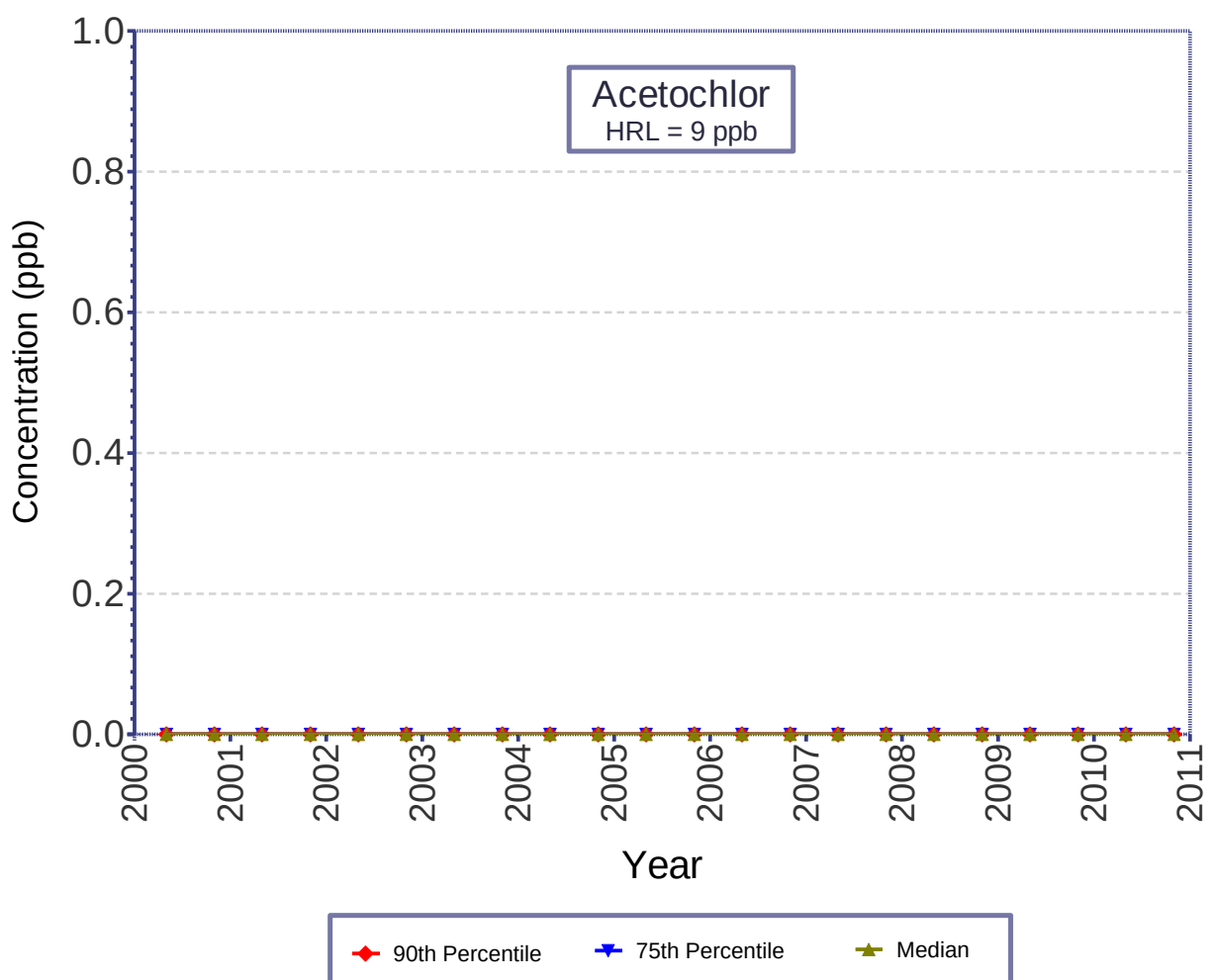


Figure 8. Acetochlor groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

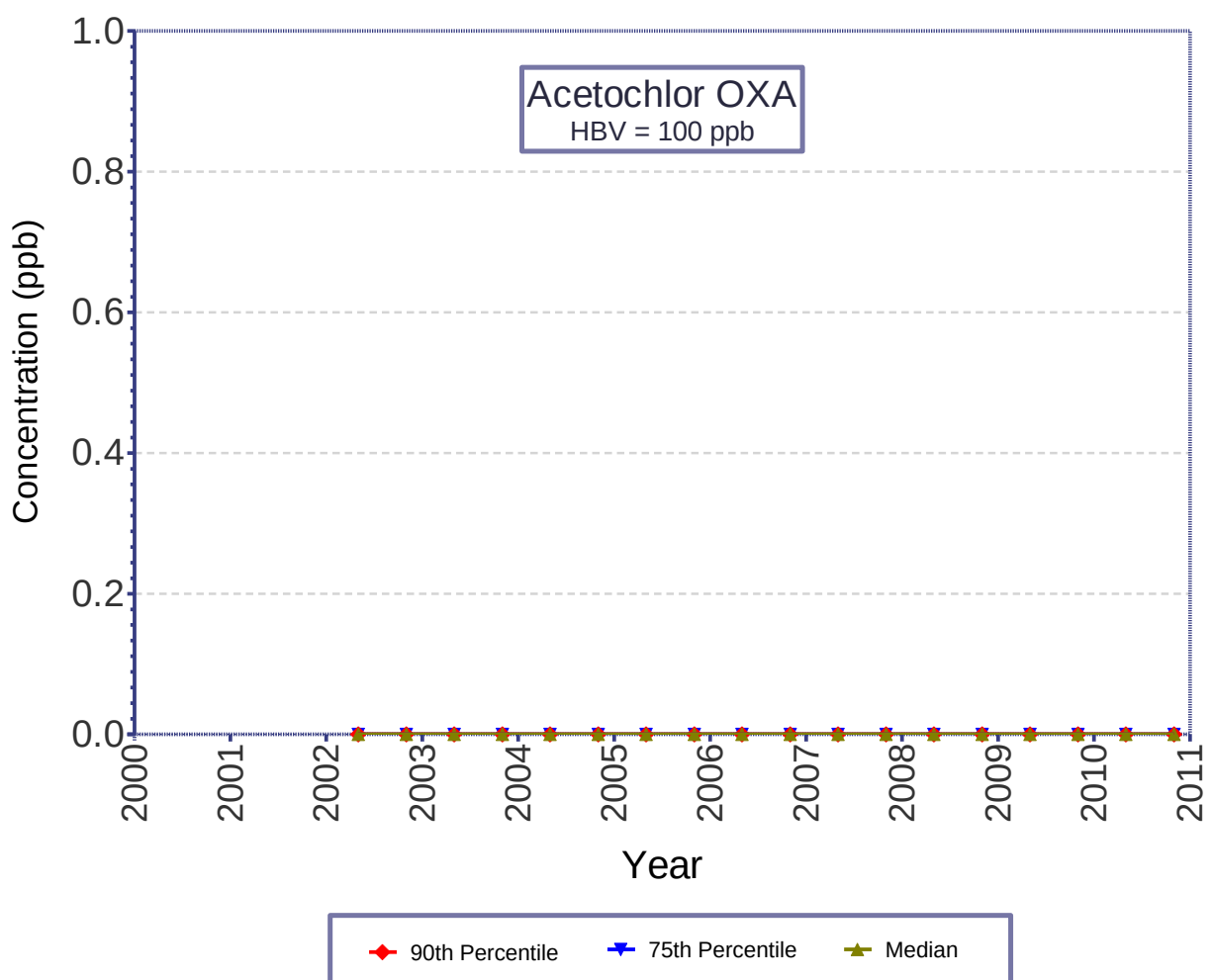


Figure 9. Acetochlor OXA groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

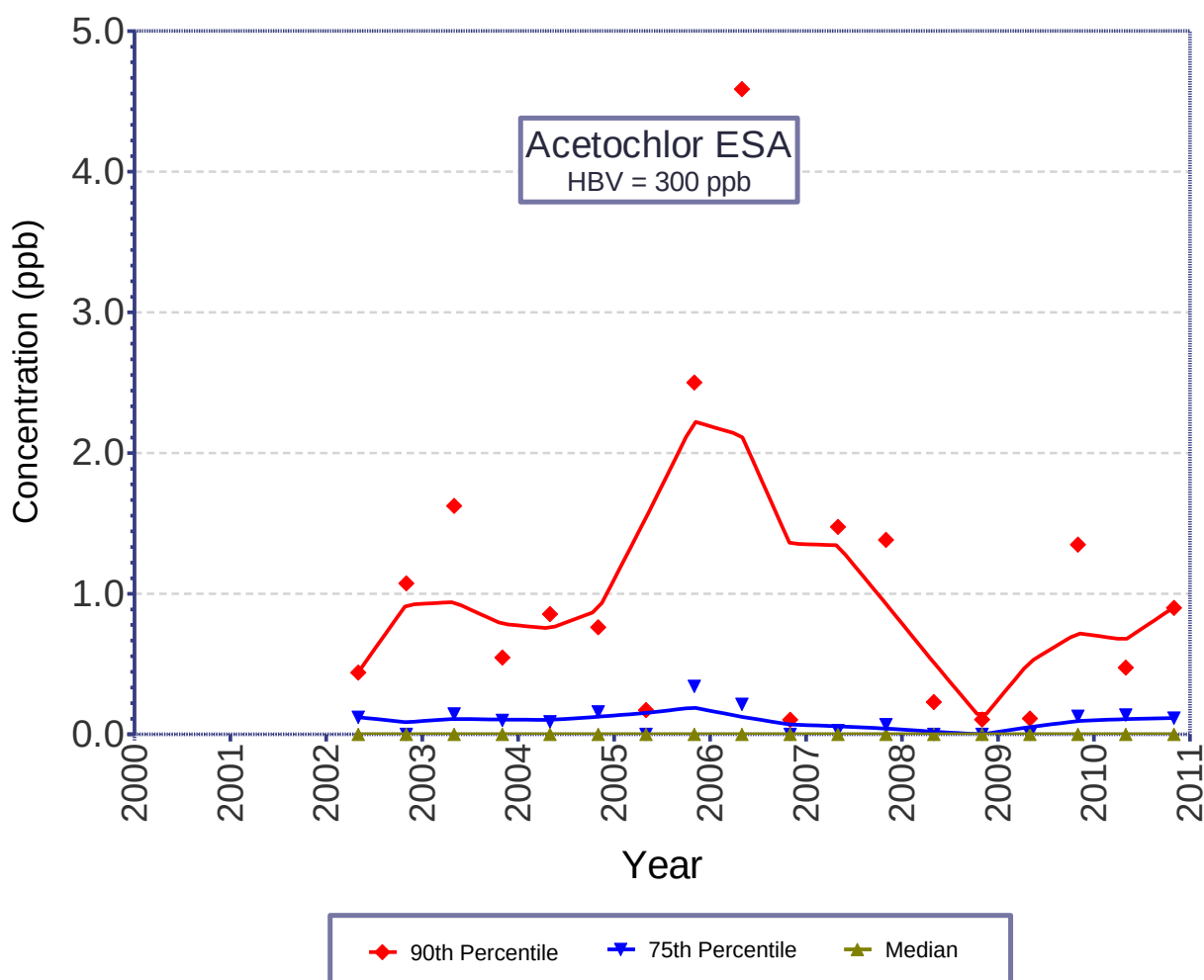


Figure 10. Acetochlor ESA groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

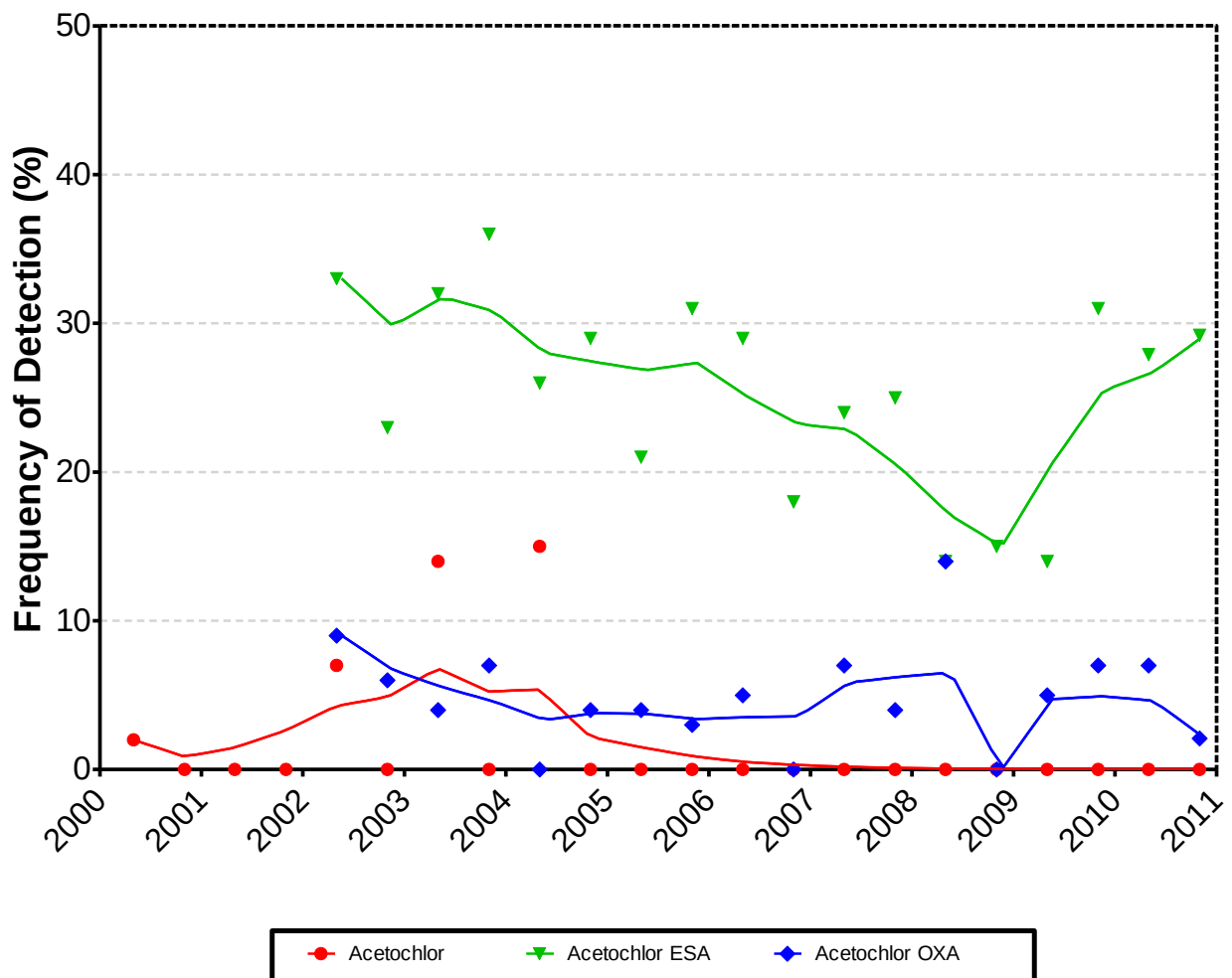


Figure 11. Acetochlor and acetochlor degradate detection frequency over time for MDA groundwater monitoring in PMR 4. NOTE: Graphics contain only spring and fall quarter results. Frequency of detection is based on pre 2010 Method Reporting Limits.

Detections of acetochlor in PMR 9 have been increasing since 2005 (Figure 12) although concentration trend analysis remains inconclusive due to few detections in the DNR fish hatchery springs. Analysis of the trends in detection of the various forms of acetochlor shows the trends to be significant for acetochlor and acetochlor ESA, although not for acetochlor OXA, the least frequently occurring form of acetochlor. Current trend test results for concentration and detection frequency can be found in Appendix A4-1.

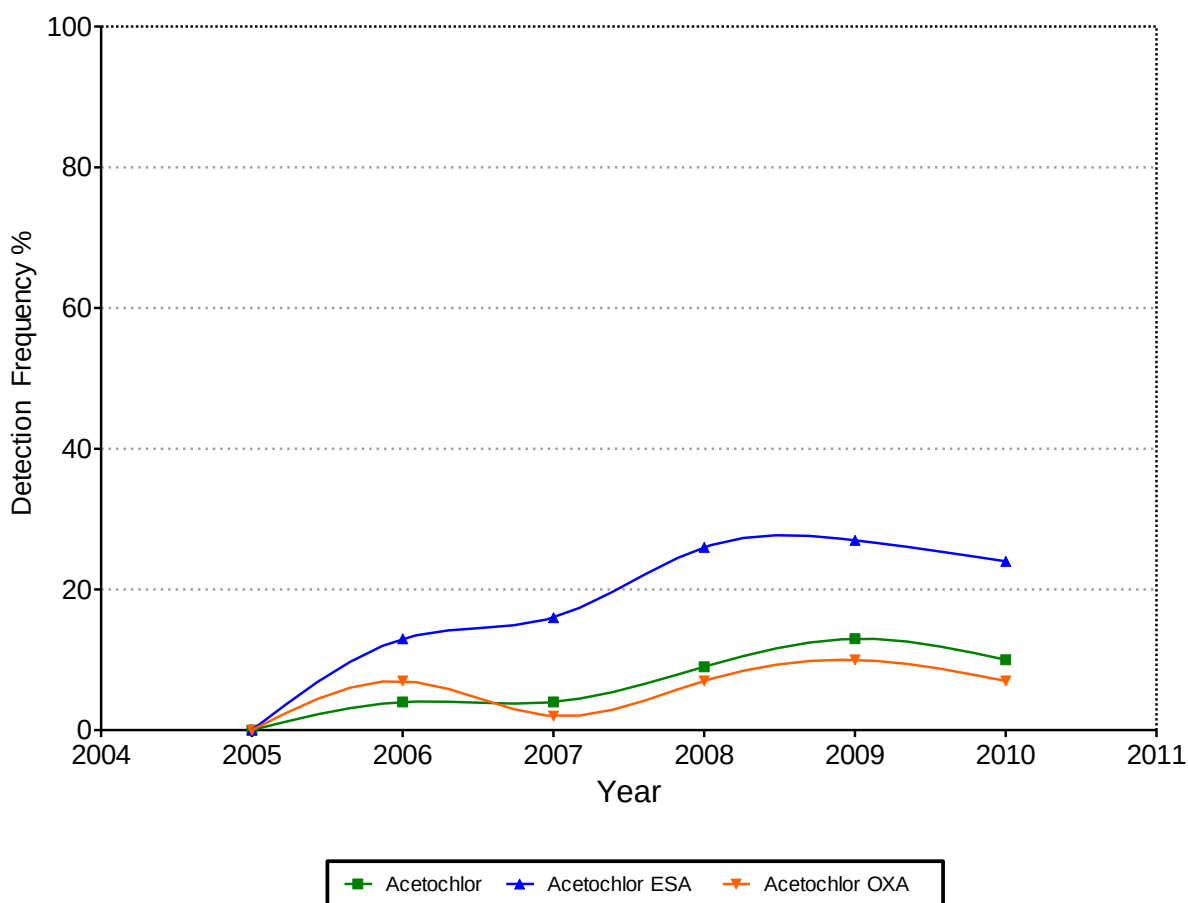


Figure 12. Acetochlor and acetochlor degradate annual detection frequency over time for MDA groundwater monitoring in PMR 9. Frequency of detection is based on pre 2010 Method Reporting Limits.

2.2.2. Alachlor results

Summary information for alachlor groundwater monitoring results is located in Tables 12 and 13 and Figure 13. Alachlor has been an included analyte in MDA monitoring since 1985. MDA laboratory analysis of degradates (breakdown products) of alachlor began in 2002. Alachlor or its degradates have been found in every sampled PMR except PMR 1, which is characterized by heavier, more clay rich soils than many other locations in the state. The median concentration of alachlor and degradates is normally near non-detectable levels, as evidenced in Table 12. As with acetochlor, the ESA degradate of alachlor is the most frequently occurring form, as found in Table 13, and drives all analyses and conclusions regarding alachlor. Figure 13 shows the distribution of sites where alachlor or its degradates were detected in 2010 sampling. In monitoring PMR 4, detectable levels for alachlor and its degradates have been generally declining in magnitude since 2002 (Figures 14 - 16). The decline in concentration for alachlor ESA was analyzed using the Mann-Kendall test for trend which found statistically significant downward trends for the 75th percentile and 90th percentile. Detection frequencies of alachlor or its degradates in PMR 4 have also shown a statistically significant decrease over time (Figure 17). Trend test results for concentration and detection frequency can be found in Appendix A4-2.

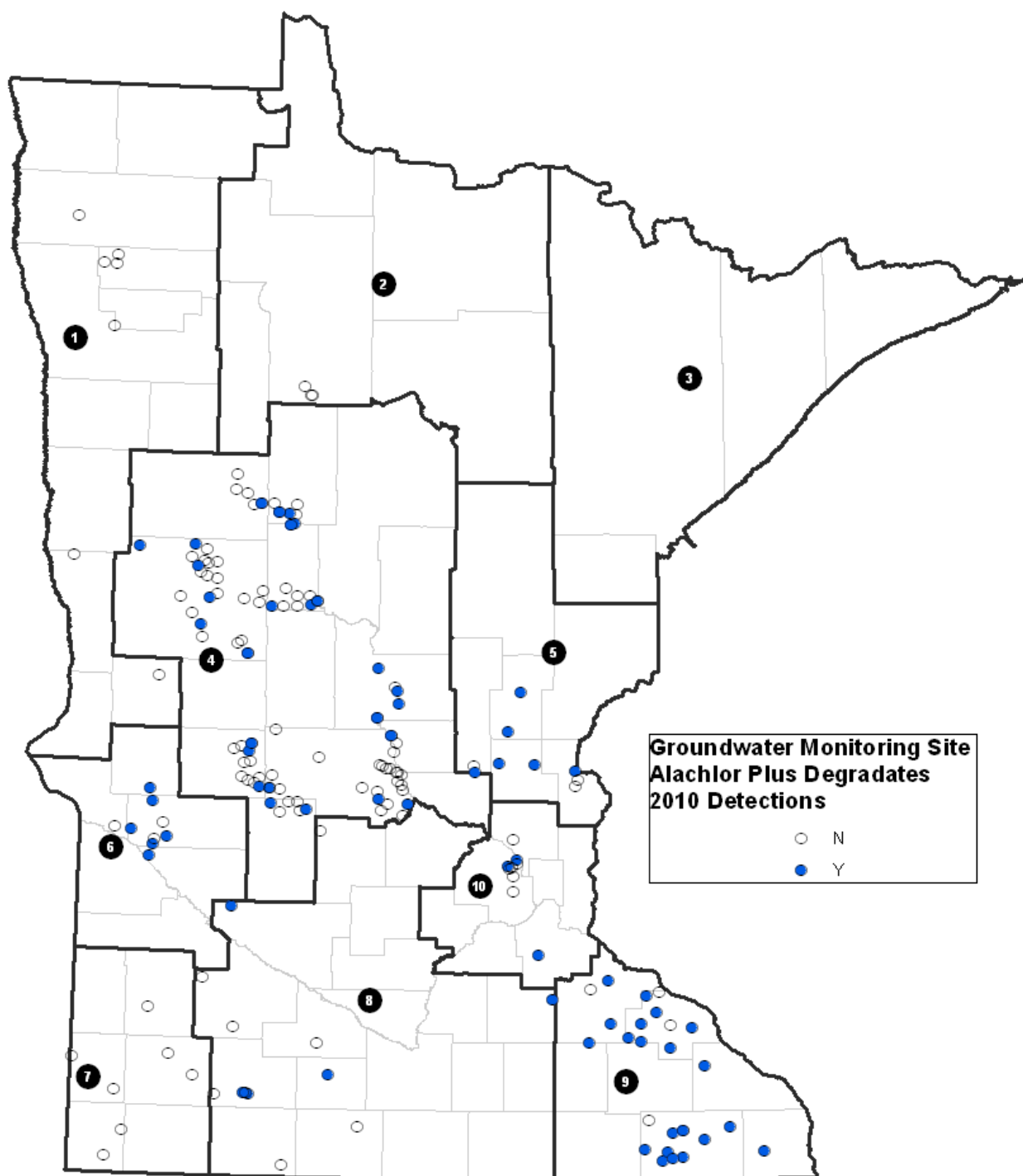


Figure 13. Pesticide Monitoring Regions and groundwater sites with alachlor plus alachlor degradate detections in 2010.

Table 12. MDA analytical results 2005 through 2010 in groundwater for alachlor and its degradates.

PMR 1	Median (µg/L)							75th Percentile (µg/L)						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Alachlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 4														
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	nd	nd	nd	nd	nd	nd	nd	0.27	0.20	0.20	0.15	0.05	0.1010	0.1010
Alachlor OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PMR 5														
Alachlor	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Alachlor ESA	-	-	0.13	nd	0.07	nd	0.0566	-	-	1.01	1.03	1.24	0.2632	0.2632
Alachlor OXA	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
PMR 6														
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	0.14	-	nd	nd	nd	nd	0.0474	0.75	-	0.26	0.16	0.16	0.0828	0.0828
Alachlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 7														
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	0.03	-	nd	nd	nd	nd	nd	0.08	-	nd	nd	nd	nd	nd
Alachlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 8														
Alachlor	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd	nd
Alachlor ESA	-	-	nd	nd	nd	nd	nd	-	-	0.10	0.14	0.11	0.0624	0.0772
Alachlor OXA	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
PMR 9														
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	0.10	0.14	0.20	0.24	0.19	0.1710	0.1710	0.14	0.42	0.43	0.45	0.42	0.2720	0.2720
Alachlor OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Urban														
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

***10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.**

Table 12 continued. MDA analytical results 2005 through 2010 in groundwater for alachlor and its degradates.

PMR 1	90th Percentile (µg/L)							Maximum (µg/L)						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Alachlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 4														
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	1.23	0.77	0.65	0.46	0.28	0.4686	0.4686	4.26	4.55	6.74	2.33	2.16	2.170	2.170
Alachlor OXA	nd	nd	nd	nd	nd	nd	nd	1.20	1.50	1.05	0.82	0.91	0.4430	0.4430
PMR 5														
Alachlor	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Alachlor ESA	-	-	7.44	7.25	6.97	3.052	3.052	-	-	10.4	10.2	9.24	10.30	10.30
Alachlor OXA	-	-	0.23	0.16	0.30	nd	nd	-	-	0.38	0.27	0.50	0.1490	0.1490
PMR 6														
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	0.88	-	1.46	0.92	1.23	0.9251	0.9251	0.90	-	1.97	1.31	1.79	1.260	1.260
Alachlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 7														
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	0.10	-	0.07	nd	nd	nd	nd	0.10	-	0.09	nd	nd	nd	nd
Alachlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 8														
Alachlor	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	-	-	0.85	0.55	0.78	0.4772	0.4772	0.38	nd	1.29	0.78	1.03	1.170	1.170
Alachlor OXA	-	-	0.05	nd	nd	nd	nd	nd	nd	0.10	nd	nd	nd	nd
PMR 9														
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	P	P
Alachlor ESA	0.17	0.60	0.62	0.55	0.69	0.6918	0.6918	0.24	0.78	0.77	0.71	1.93	2.400	2.400
Alachlor OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.73	nd	0.11	0.4260	0.4260
Urban														
Alachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alachlor ESA	nd	0.06	nd	0.32	nd	0.1296	0.1296	0.44	0.15	0.36	1.31	0.13	1.080	1.080
Alachlor OXA	nd	nd	nd	nd	nd	0.0580	0.0580	0.15	nd	nd	0.13	nd	0.1180	0.1180

***10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.**

Table 13. Total number of detections and detection frequencies in groundwater samples for alachlor and its degradates, 2005-2010 by PMR.

PMR 1	Detections							Percent Detections						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Alachlor	0/17	0/9	0/8	0/8	0/7	0/14	0/14	0%	0%	0%	0%	0%	0%	0%
Alachlor ESA	0/17	-	0/8	0/7	0/7	0/14	0/14	0%	-	0%	0%	0%	0%	0%
Alachlor OXA	0/17	-	0/8	0/7	0/7	0/14	0/14	0%	-	0%	0%	0%	0%	0%
Alachlor + Degradates	0/17	-	0/8	0/7	0/7	0/14	0/14	0%	-	0%	0%	0%	0%	0%
PMR 4														
Alachlor	0/113	0/112	0/110	0/83	0/83	0/92	0/92	0%	0%	0%	0%	0%	0%	0%
Alachlor ESA	50/113	47/113	44/111	26/84	21/83	26/92	33/92	44%	42%	40%	31%	25%	29%	36%
Alachlor OXA	7/113	6/113	7/111	3/84	3/83	2/92	2/92	6%	5%	6%	4%	4%	2%	2%
Alachlor + Degradates	50/113	47/112	44/110	25/83	21/82	26/92	33/92	44%	42%	40%	30%	26%	29%	36%
PMR 5														
Alachlor	-	-	0/9	0/9	0/9	0/17	0/17	-	-	0%	0%	0%	0%	0%
Alachlor ESA	-	-	5/9	4/9	5/9	6/17	9/17	-	-	56%	44%	56%	35%	53%
Alachlor OXA	-	-	1/9	1/9	1/9	1/17	1/17	-	-	11%	11%	11%	0%	6%
Alachlor + Degradates	-	-	5/9	4/9	5/9	6/17	9/17	-	-	56%	44%	56%	35%	53%
PMR 6														
Alachlor	0/6	0/9	0/9	0/9	0/9	0/18	0/18	0%	0%	0%	0%	0%	0%	0%
Alachlor ESA	6/6	-	4/9	3/9	4/9	6/18	10/18	100%	-	44%	33%	44%	33%	56%
Alachlor OXA	0/6	-	0/9	0/9	0/9	0/18	0/18	0%	-	0%	0%	0%	0%	0%
Alachlor + Degradates	6/6	-	4/9	3/9	4/9	6/18	10/18	100%	-	44%	33%	44%	33%	56%
PMR 7														
Alachlor	0/4	0/7	0/7	0/7	0/7	0/14	0/14	0%	0%	0%	0%	0%	0%	0%
Alachlor ESA	2/4	-	1/7	0/7	0/7	0/14	0/14	50%	-	14%	0%	0%	0%	0%
Alachlor OXA	0/4	-	0/7	0/7	0/7	0/14	0/14	0%	-	0%	0%	0%	0%	0%
Alachlor + Degradates	2/4	-	1/7	0/7	0/7	0/14	0/14	50%	-	14%	0%	0%	0%	0%
PMR 8														
Alachlor	0/1	0/9	0/10	0/12	0/12	0/23	0/23	0%	0%	0%	0%	0%	0%	0%
Alachlor ESA	1/1	0/1	4/10	3/12	3/12	6/23	8/23	100%	0%	40%	25%	25%	26%	35%
Alachlor OXA	0/1	0/1	1/10	0/12	0/12	0/23	0/23	0%	0%	10%	0%	0%	0%	0%
Alachlor + Degradates	1/1	0/1	4/10	3/12	3/12	6/23	8/23	100%	0%	40%	25%	25%	26%	35%
PMR 9														
Alachlor	0/63	0/56	0/55	0/46	0/62	2/62	2/62	0%	0%	0%	0%	0%	3%	3%
Alachlor ESA	52/64	42/56	46/55	45/46	56/62	53/62	56/62	81%	75%	84%	98%	90%	86%	90%
Alachlor OXA	0/64	0/56	1/55	0/46	1/62	1/62	1/62	0%	0%	2%	0%	2%	2%	2%
Alachlor + Degradates	50/62	42/56	46/55	45/46	56/62	54/62	57/62	81%	75%	84%	98%	90%	87%	92%
Urban														
Alachlor	0/22	0/21	0/17	0/16	0/15	0/20	0/20	0%	0%	0%	0%	0%	0%	0%
Alachlor ESA	1/22	2/21	1/17	2/16	1/15	3/20	4/20	5%	10%	6%	13%	7%	15%	20%
Alachlor OXA	1/22	0/21	1/17	1/16	0/15	2/20	2/20	5%	0%	0%	6%	0%	10%	10%
Alachlor + Degradates	1/22	2/21	1/17	2/16	1/15	3/20	4/20	5%	10%	6%	13%	7%	15%	20%

*10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.

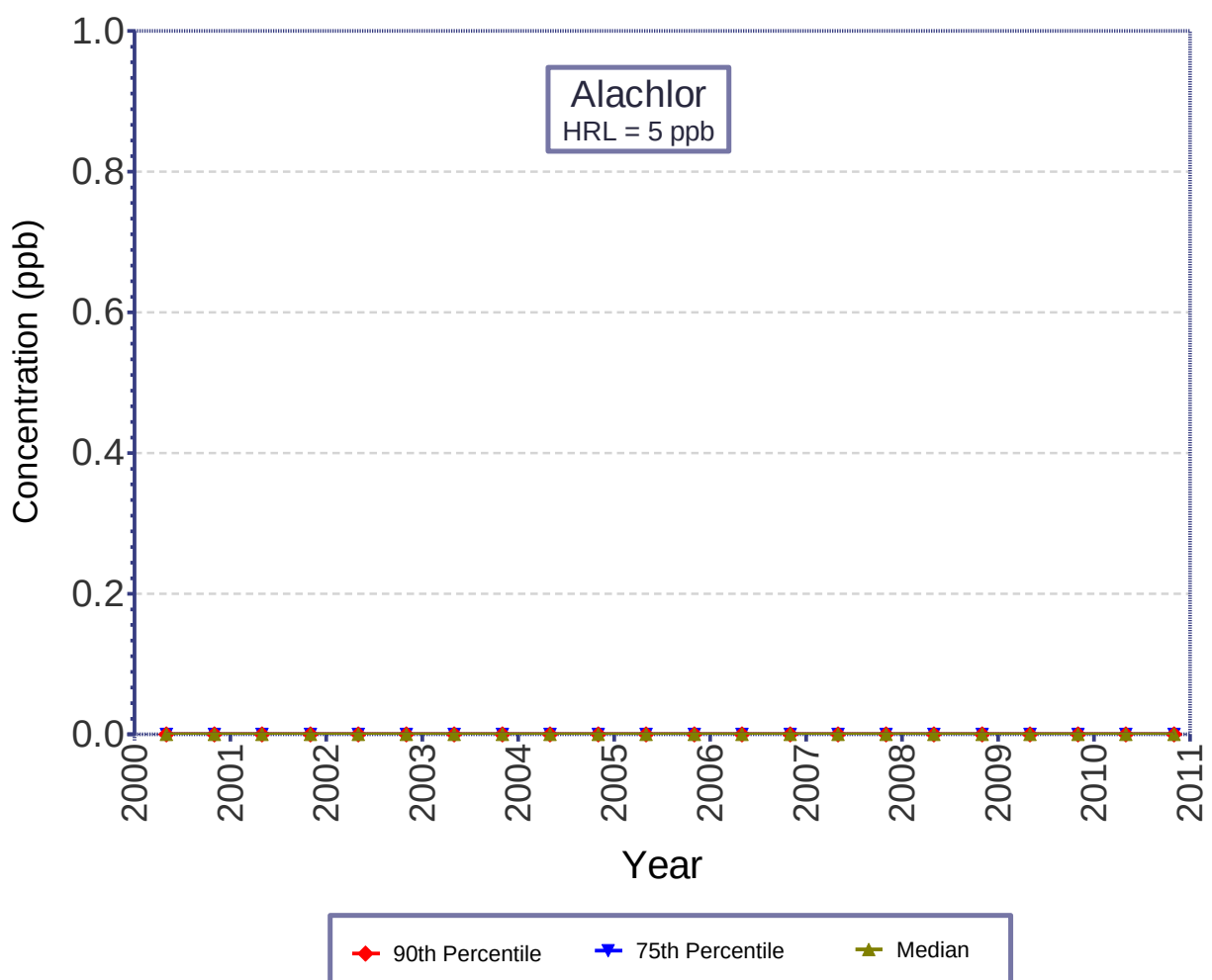


Figure 14. Alachlor groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

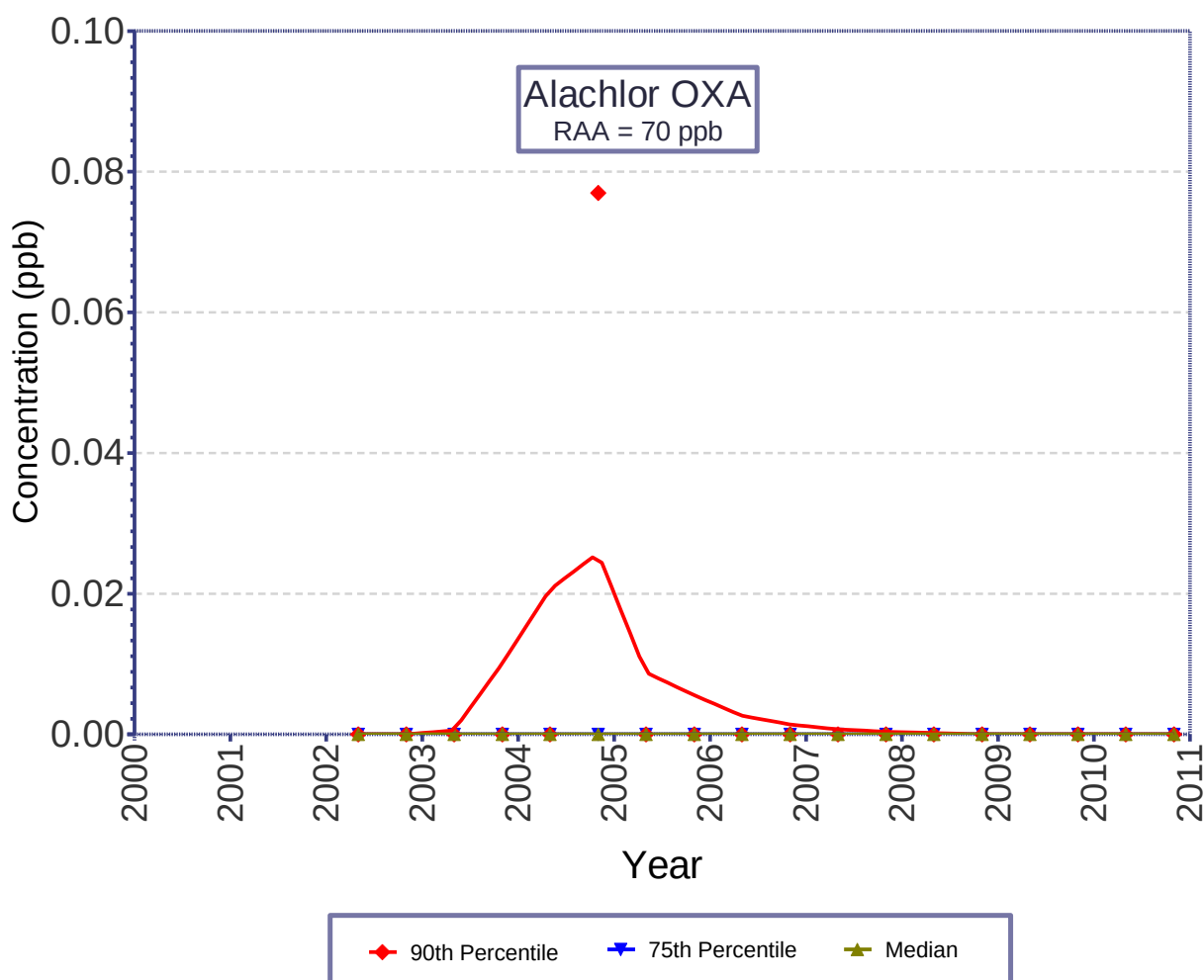


Figure 15. Alachlor OXA degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

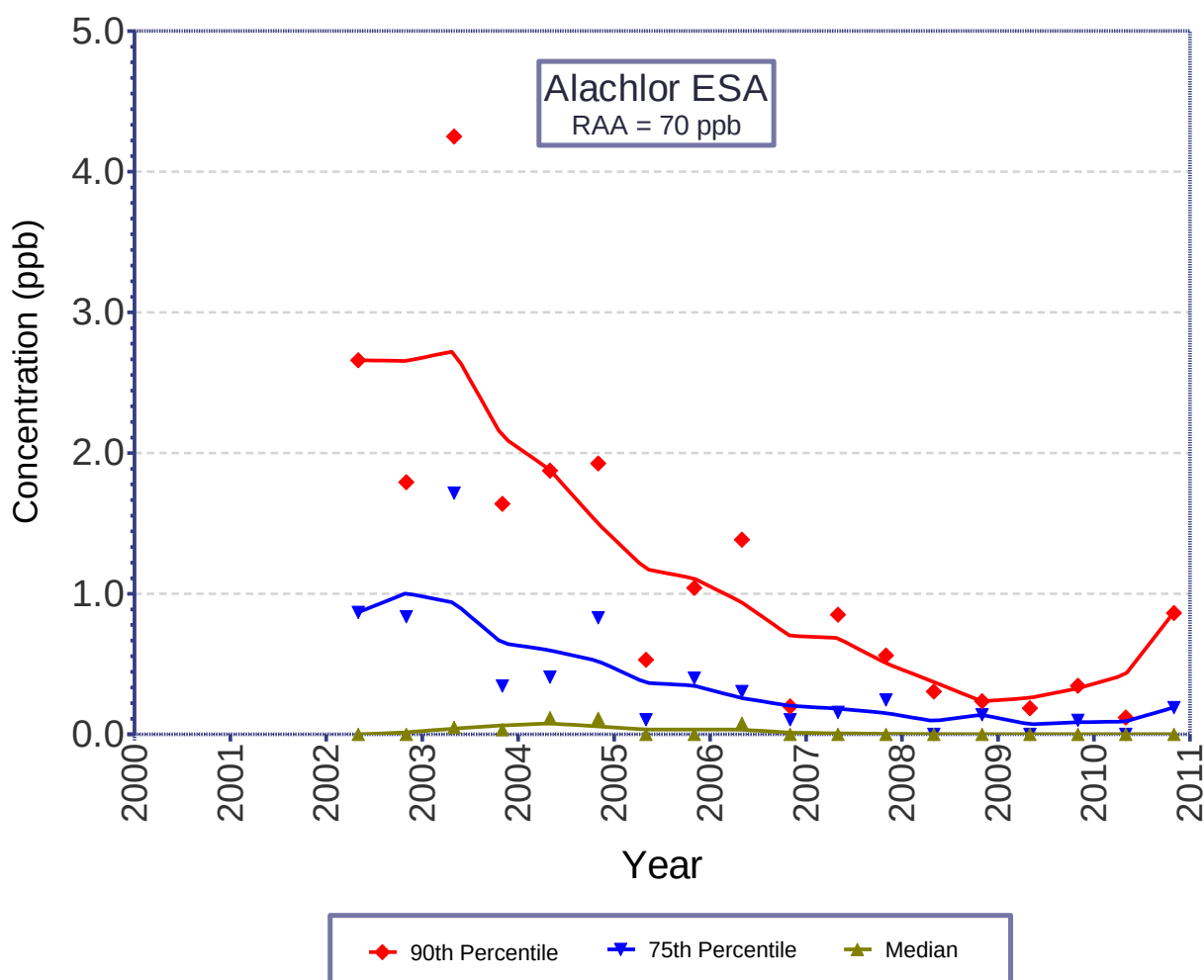


Figure 16. Alachlor ESA degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

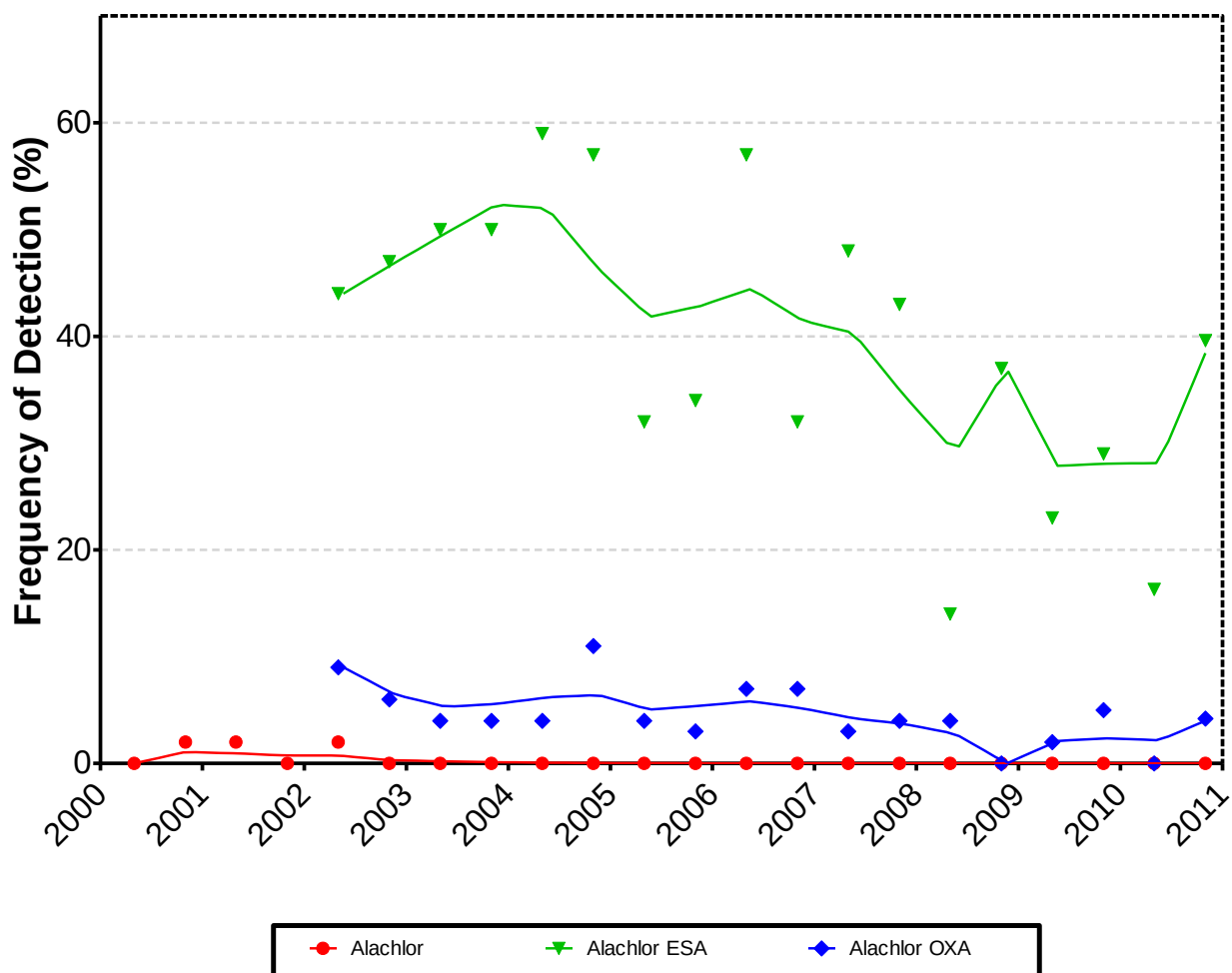


Figure 17. Alachlor and alachlor degradate detection frequency over time for MDA groundwater monitoring in PMR 4. NOTE: Graphics contain only spring and fall quarter results. Frequency of detection is based on pre 2010 Method Reporting Limits.

Alachlor concentration in the DNR fish hatchery springs has been relatively steady since 2007, which is similar to the other springs in the area (Figures 18 and 19). As in other PMRs, alachlor ESA is the most frequently detected form of alachlor in PMR 9 and drives all aspects of the evaluation of alachlor impacts. Detection of alachlor has been on the rise, though the trend is not statistically significant.

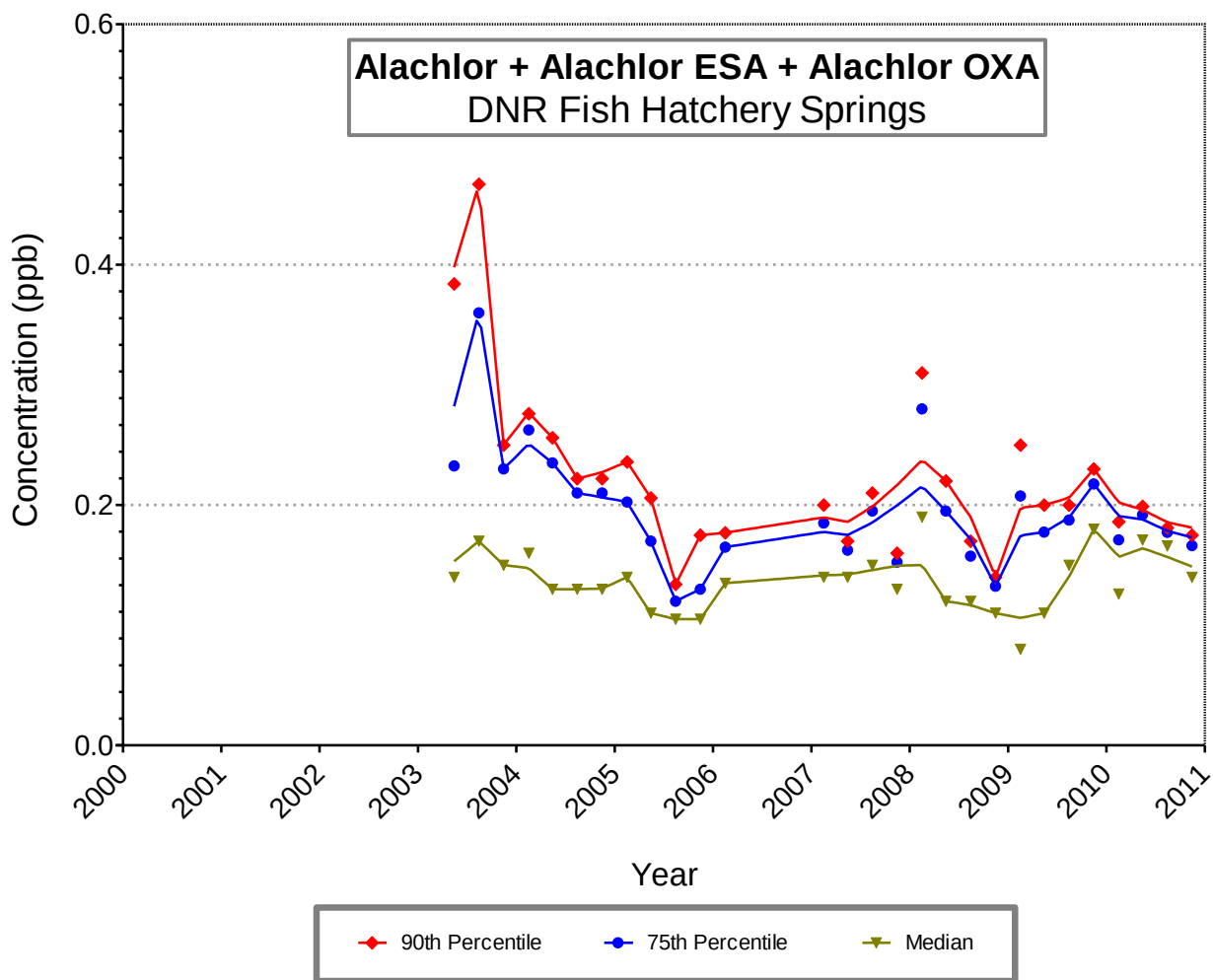


Figure 18. Alachlor and alachlor degradate groundwater sample analysis results over time for MDA PMR 9.

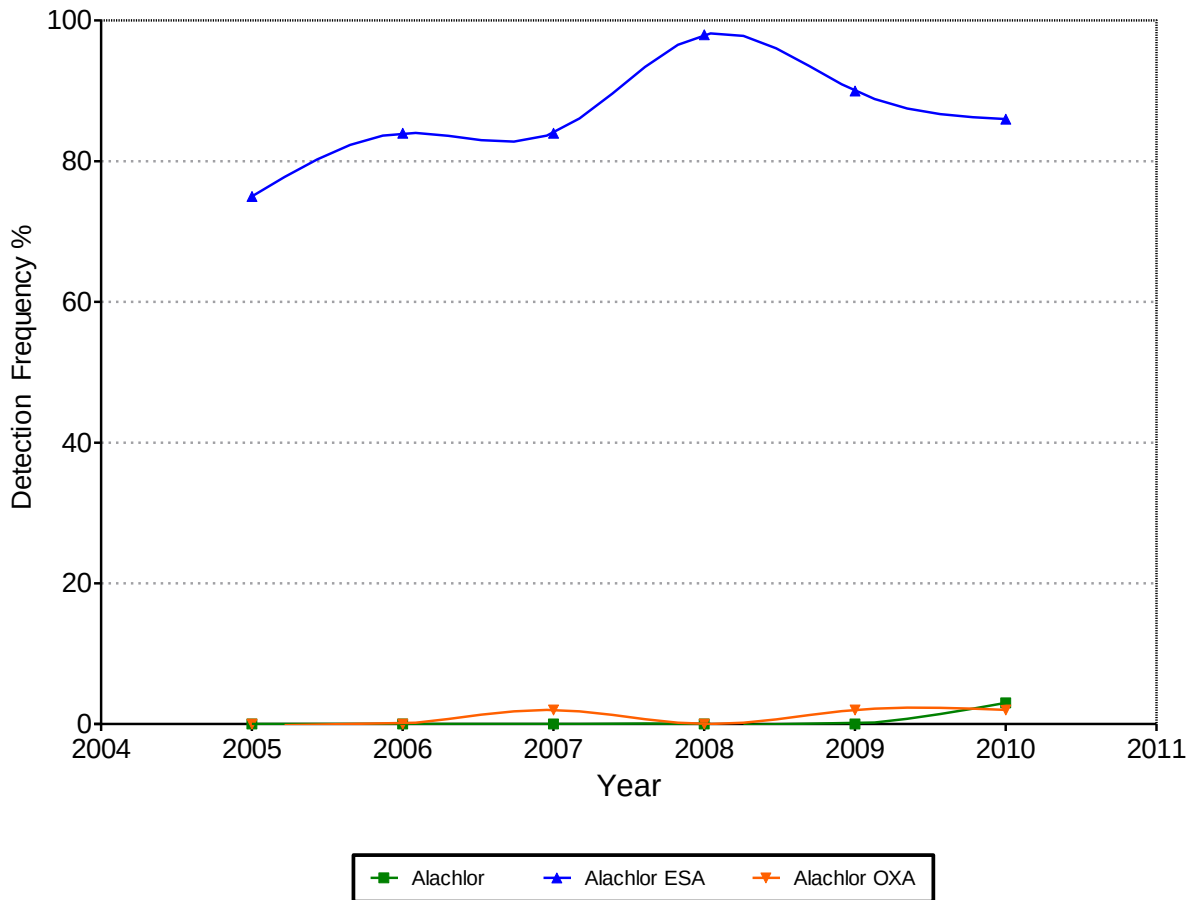


Figure 19. Alachlor and alachlor degradate annual detection frequency over time for MDA groundwater monitoring in PMR 9. Frequency of detection is based on pre 2010 Method Reporting Limits.

2.2.3. Atrazine results

Summary information for atrazine groundwater monitoring results is located in Tables 14 and 15 and Figure 20. Until 2010, atrazine had been detected more frequently over more years and across more locations, including differing land uses, than any other single pesticide (Table 15). In 2010, metolachlor ESA was detected more frequently than atrazine (see Table 8). Figure 20 illustrates the distribution of sites where atrazine or its degradates were detected in 2010 sampling. The desethylatrazine degradate is the most frequently occurring atrazine species (Table 15), although not to the same level as the ESA degradates of the acetanilide pesticides. As shown in Figures 21 - 23, the PMR 4 concentrations of atrazine and its degradates, at all percentiles, is declining. The decline in concentration for atrazine plus its degradate compounds was analyzed statistically using a Mann-Kendall test for trend which found a statistically significant downward trend. Detection frequencies for atrazine and desethylatrazine in PMR 4 (Figure 24) are relatively high and display a small, but statistically significant, increase over time, which is directly opposite of the trend in concentration over time. Deisopropylatrazine detection frequencies (Figure 24) show a slight, although statistically significant, decline over time, similar to the concentration trend.

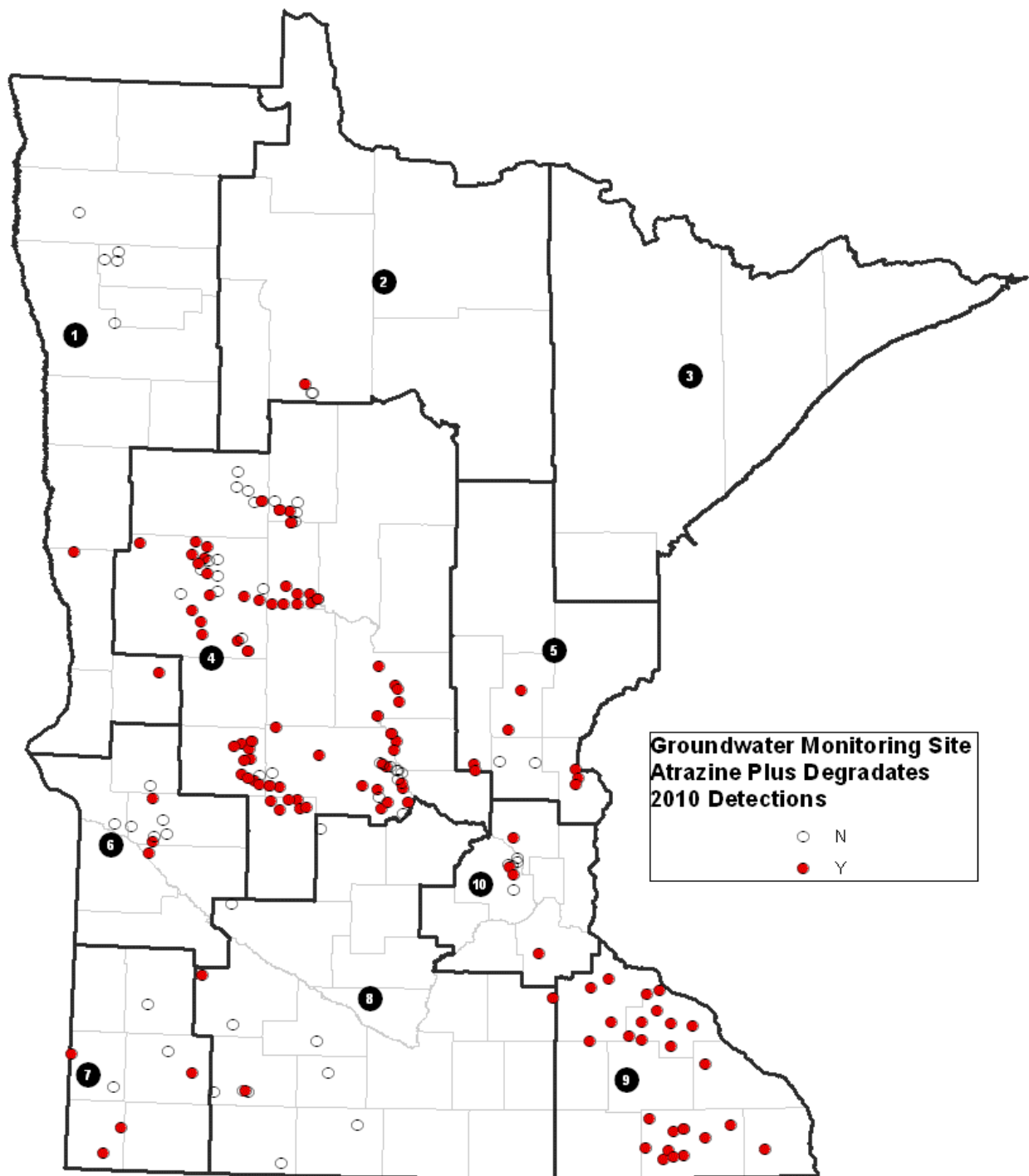


Figure 20. Pesticide Monitoring Regions and groundwater sites with atrazine plus atrazine degradate detections in 2010.

Table 14. MDA analytical results 2005 through 2010 in groundwater for atrazine and its degradates.

PMR 1	Median (µg/L)						75th Percentile (µg/L)					
	05	06	07	08	09	10	05	06	07	08	09	10
Atrazine	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	P	nd
Desethylatrazine	nd	nd	nd	nd	nd	nd	nd	nd	0.03	P	P	P
Deisopropylatrazine	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	nd	nd	nd	nd	nd	nd	nd	nd	0.03	P	P	P
PMR 4												
Atrazine	P	P	P	P	P	P	P	P	P	P	P	P
Desethylatrazine	0.06	P	0.05	P	P	P	0.09	0.08	0.08	0.06	0.05	0.0500
Deisopropylatrazine	nd	nd	nd	nd	nd	nd	P	nd	nd	P	nd	nd
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	0.06	P	0.05	P	P	P	0.10	0.09	0.08	0.06	0.05	0.0600
PMR 5												
Atrazine	-	-	nd	nd	nd	nd	-	-	0.05	0.01	0.01	P
Desethylatrazine	-	-	0.07	P	P	P	-	-	0.13	0.04	0.08	0.0175
Deisopropylatrazine	-	-	nd	nd	nd	nd	-	-	nd	nd	nd	nd
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	-	-	0.07	P	P	P	-	-	0.19	0.12	0.11	0.0725
PMR 6												
Atrazine	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Desethylatrazine	nd	nd	nd	nd	nd	nd	nd	0.02	0.05	P	P	nd
Deisopropylatrazine	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	nd	nd	nd	nd	nd	nd	nd	0.02	0.05	P	P	P
PMR 7												
Atrazine	nd	nd	nd	nd	nd	nd	nd	P	P	P	P	P
Desethylatrazine	nd	nd	nd	nd	nd	nd	nd	0.04	0.06	P	P	P
Deisopropylatrazine	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	nd	nd	nd	nd	nd	nd	nd	0.04	0.06	P	P	P
PMR 8												
Atrazine	-	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Desethylatrazine	-	nd	nd	nd	nd	nd	-	nd	0.06	nd	nd	nd
Deisopropylatrazine	-	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	-	nd	nd	nd	nd	nd	-	nd	0.06	nd	nd	nd

Table 14 continued. MDA analytical results 2005 through 2010 in groundwater for atrazine and its degradates.

	Median (µg/L)						75th Percentile (µg/L)					
PMR 9	05	06	07	08	09	10	05	06	07	08	09	10
Atrazine	0.05	0.05	0.05	0.05	0.05	0.0500	0.07	0.07	0.08	0.07	0.09	0.0800
Desethylatrazine	0.09	0.09	0.10	0.08	0.08	0.0800	0.10	0.12	0.12	0.09	0.10	0.1000
Deisopropylatrazine	nd	nd	P	nd	nd	nd	P	P	P	P	P	nd
DEDI-Atrazine	-	-	-	-	-	0.0642	-	-	-	-	-	0.1020
Atrazine + degs	0.13	0.12	0.15	0.11	0.11	0.1815	0.16	0.19	0.21	0.17	0.19	0.2800
Urban												
Atrazine	nd	nd	nd	nd	nd	nd	nd	nd	P	nd	nd	nd
Desethylatrazine	nd	nd	P	nd	P	nd	P	0.05	P	P	P	P
Deisopropylatrazine	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	nd	nd	P	nd	P	nd	P	0.05	P	P	P	P

Table 14 continued. MDA analytical results 2005 through 2010 in groundwater for atrazine and its degradates.

	90th Percentile (µg/L)						Maximum (µg/L)					
PMR 1	05	06	07	08	09	10	05	06	07	08	09	10
Atrazine	nd	nd	0.13	0.14	0.11	0.0510	nd	nd	0.18	0.20	0.14	0.0600
Desethylatrazine	P	nd	0.15	0.48	0.13	0.0740	0.06	nd	0.18	0.69	0.16	0.1100
Deisopropylatrazine	nd	nd	P	P	nd	nd	nd	nd	P	P	nd	nd
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	P	nd	0.27	0.62	0.24	0.1160	0.06	nd	0.36	0.89	0.30	0.1700
PMR 4												
Atrazine	0.05	0.05	0.05	P	P	P	0.32	0.20	0.17	0.18	0.20	0.1500
Desethylatrazine	0.15	0.12	0.11	0.08	0.07	0.0800	0.42	0.37	0.42	0.22	0.33	0.2100
Deisopropylatrazine	P	P	P	P	P	P	0.72	0.42	0.53	0.28	0.36	P
DEDI-Atrazine	-	-	-	-	-	0.0812	-	-	-	-	-	0.5050
Atrazine + degs	0.18	0.16	0.16	0.09	0.08	0.1623	1.17	0.91	1.11	0.65	0.89	0.8650
PMR 5												
Atrazine	-	-	0.11	0.07	0.05	0.0480	-	-	0.14	0.09	0.05	0.0800
Desethylatrazine	-	-	0.17	0.18	0.20	0.1780	-	-	0.17	0.20	0.26	0.1900
Deisopropylatrazine	-	-	P	P	P	nd	-	-	P	P	P	P
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	-	-	0.23	0.20	0.21	0.1900	-	-	0.23	0.20	0.26	0.1900
PMR 6												
Atrazine	nd	P	P	P	P	nd	nd	P	P	P	P	nd
Desethylatrazine	P	0.08	0.08	P	P	P	P	0.08	0.09	P	P	P
Deisopropylatrazine	nd	nd	nd	P	nd	nd	nd	nd	nd	P	nd	nd
DEDI-Atrazine	-	-	-	-	-	0.0416	-	-	-	-	-	0.0710
Atrazine + degs	P	0.08	0.08	P	P	0.0416	P	0.08	0.09	P	P	0.0710
PMR 7												
Atrazine	nd	P	0.05	0.24	0.04	0.0500	nd	P	0.06	0.30	0.05	0.0500
Desethylatrazine	P	0.10	0.12	0.07	0.06	0.0700	P	0.11	0.13	0.09	0.07	0.0700
Deisopropylatrazine	nd	nd	P	P	nd	nd	nd	nd	P	P	nd	nd
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	P	0.10	0.17	0.31	0.10	0.1200	P	0.11	0.19	0.39	0.12	0.1200
PMR 8												
Atrazine	-	P	P	nd	nd	P	nd	P	P	P	P	P
Desethylatrazine	-	0.04	0.06	P	0.02	0.0120	nd	0.06	0.06	P	0.08	0.0800
Deisopropylatrazine	-	nd	nd	nd	nd	nd	nd	nd	nd	P	nd	P
DEDI-Atrazine	-	-	-	-	-	0.0172	-	-	-	-	-	0.1080
Atrazine + degs	-	0.04	0.06	P	0.02	0.0292	nd	0.06	0.06	P	0.08	0.1880

Table 14 continued. MDA analytical results 2005 through 2010 in groundwater for atrazine and its degradates.

	90th Percentile (µg/L)						Maximum (µg/L)					
PMR 9	05	06	07	08	09	10	05	06	07	08	09	10
Atrazine	0.08	0.09	0.11	0.09	0.13	0.1100	0.10	0.26	0.13	0.19	1.10	0.5400
Desethylatrazine	0.11	0.14	0.13	0.11	0.13	0.1400	0.13	0.15	0.15	0.12	0.50	1.540
Deisopropylatrazine	P	P	P	P	P	P	P	P	P	P	P	0.3000
DEDI-Atrazine	-	-	-	-	-	0.1469	-	-	-	-	-	0.3050
Atrazine + degs	0.18	0.24	0.24	0.19	0.25	0.3513	0.21	0.40	0.26	0.28	1.24	2.285
Urban												
Atrazine	nd	P	P	P	P	P	P	0.08	0.06	P	0.05	P
Desethylatrazine	0.02	0.06	0.06	P	0.05	P	0.08	0.10	0.15	P	0.09	0.0700
Deisopropylatrazine	nd	nd	nd	nd	nd	nd	nd	P	P	P	nd	nd
DEDI-Atrazine	-	-	-	-	-	nd	-	-	-	-	-	nd
Atrazine + degs	0.02	0.06	0.10	P	0.05	P	0.08	0.18	0.15	P	0.14	0.0700

Table 15. Total number of detections and detection frequencies in groundwater samples for atrazine and its degradates, 2005-2010 by PMR.

PMR 1	Detections						Percent Detections					
	05	06	07	08	09	10	05	06	07	08	09	10
Atrazine	0/17	0/9	2/8	2/8	2/7	3/14	0%	0%	25%	25%	29%	21%
Desethylatrazine	2/17	0/9	2/8	3/8	2/7	4/14	12%	0%	25%	38%	29%	29%
Deisopropylatrazine	0/17	0/9	1/8	1/8	0/7	0/14	0%	0%	13%	13%	0%	0%
DEDI-Atrazine	-	-	-	-	-	0/14	-	-	-	-	-	0%
Atrazine + degradates	2/17	0/9	2/8	3/8	2/7	4/14	12%	0%	25%	38%	29%	29%
PMR 4												
Atrazine	58/113	62/112	66/110	44/83	45/83	51/92	51%	55%	60%	53%	54%	55%
Desethylatrazine	96/113	89/112	90/110	59/83	64/83	64/92	85%	80%	82%	71%	77%	70%
Deisopropylatrazine	32/113	28/112	21/110	24/83	13/83	16/92	28%	25%	19%	29%	16%	17%
DEDI-Atrazine	-	-	-	-	-	12/92	-	-	-	-	-	13%
Atrazine + degradates	97/113	91/112	90/110	63/83	64/83	66/92	86%	81%	82%	76%	77%	72%
PMR 5												
Atrazine	-	-	4/9	4/9	4/9	7/17	-	-	44%	44%	44%	41%
Desethylatrazine	-	-	7/9	6/9	7/9	10/17	-	-	78%	67%	78%	59%
Deisopropylatrazine	-	-	2/9	1/9	1/9	1/17	-	-	22%	11%	11%	6%
DEDI-Atrazine	-	-	-	-	-	0/17	-	-	-	-	-	0%
Atrazine + degradates	-	-	7/9	6/9	7/9	12/17	-	-	78%	67%	78%	71%
PMR 6												
Atrazine	0/6	2/9	1/9	2/9	1/9	0/18	0%	22%	11%	22%	11%	0%
Desethylatrazine	1/6	2/9	3/9	3/9	3/9	3/18	17%	22%	33%	33%	33%	17%
Deisopropylatrazine	0/6	0/9	0/9	1/9	0/9	0/18	0%	0%	0%	11%	0%	0%
DEDI-Atrazine	-	-	-	-	-	2/18	-	-	-	-	-	11%
Atrazine + degradates	1/6	2/9	3/9	4/9	3/9	5/18	17%	22%	33%	44%	33%	28%
PMR 7												
Atrazine	0/4	2/7	2/7	2/7	2/7	4/14	0%	29%	29%	29%	29%	29%
Desethylatrazine	1/4	2/7	3/7	2/7	2/7	7/14	25%	29%	43%	29%	29%	50%
Deisopropylatrazine	0/4	0/7	1/7	1/7	0/7	0/14	0%	0%	14%	14%	0%	0%
DEDI-Atrazine	-	-	-	-	-	0/14	-	-	-	-	-	0%
Atrazine + degradates	1/4	2/7	3/7	2/7	2/7	7/14	25%	29%	43%	29%	29%	50%
PMR 8												
Atrazine	0/1	1/9	1/10	1/12	1/12	3/23	0%	11%	10%	8%	8%	13%
Desethylatrazine	0/1	2/9	3/10	2/12	1/12	4/23	0%	22%	30%	17%	8%	17%
Deisopropylatrazine	0/1	0/9	0/10	1/12	0/12	1/23	0%	0%	0%	8%	0%	4%
DEDI-Atrazine	-	-	-	-	-	2/23	-	-	-	-	-	9%
Atrazine + degradates	0/1	2/9	3/10	2/12	1/12	4/23	0%	22%	30%	17%	8%	17%

Table 15 continued. Total number of detections and detection frequencies in groundwater samples for atrazine and its degradates, 2005-2010 by PMR.

PMR 9	Detections						Percent Detections					
	05	06	07	08	09	10	05	06	07	08	09	10
Atrazine	61/63	52/56	53/55	46/46	61/62	57/62	97%	93%	96%	100%	98%	92%
Desethylatrazine	63/63	56/56	55/55	45/46	62/62	62/62	100%	100%	100%	98%	100%	100%
Deisopropylatrazine	16/63	19/56	29/55	21/46	29/62	11/62	25%	34%	53%	46%	47%	18%
DEDI-Atrazine	-	-	-	-	-	38/62	-	-	-	-	-	61%
Atrazine + degradates	63/63	56/56	55/55	46/46	62/62	62/62	100%	100%	100%	100%	100%	100%
Urban												
Atrazine	2/22	4/21	8/17	2/16	3/15	2/20	9%	19%	47%	13%	20%	10%
Desethylatrazine	7/22	9/21	12/17	6/16	8/15	7/20	32%	43%	71%	38%	53%	35%
Deisopropylatrazine	0/22	1/21	1/17	1/16	0/15	0/20	0%	5%	6%	6%	0%	0%
DEDI-Atrazine	-	-	-	-	-	0/20	-	-	-	-	-	0%
Atrazine + degradates	7/22	9/21	13/17	6/16	8/15	7/20	32%	43%	77%	38%	53%	35%

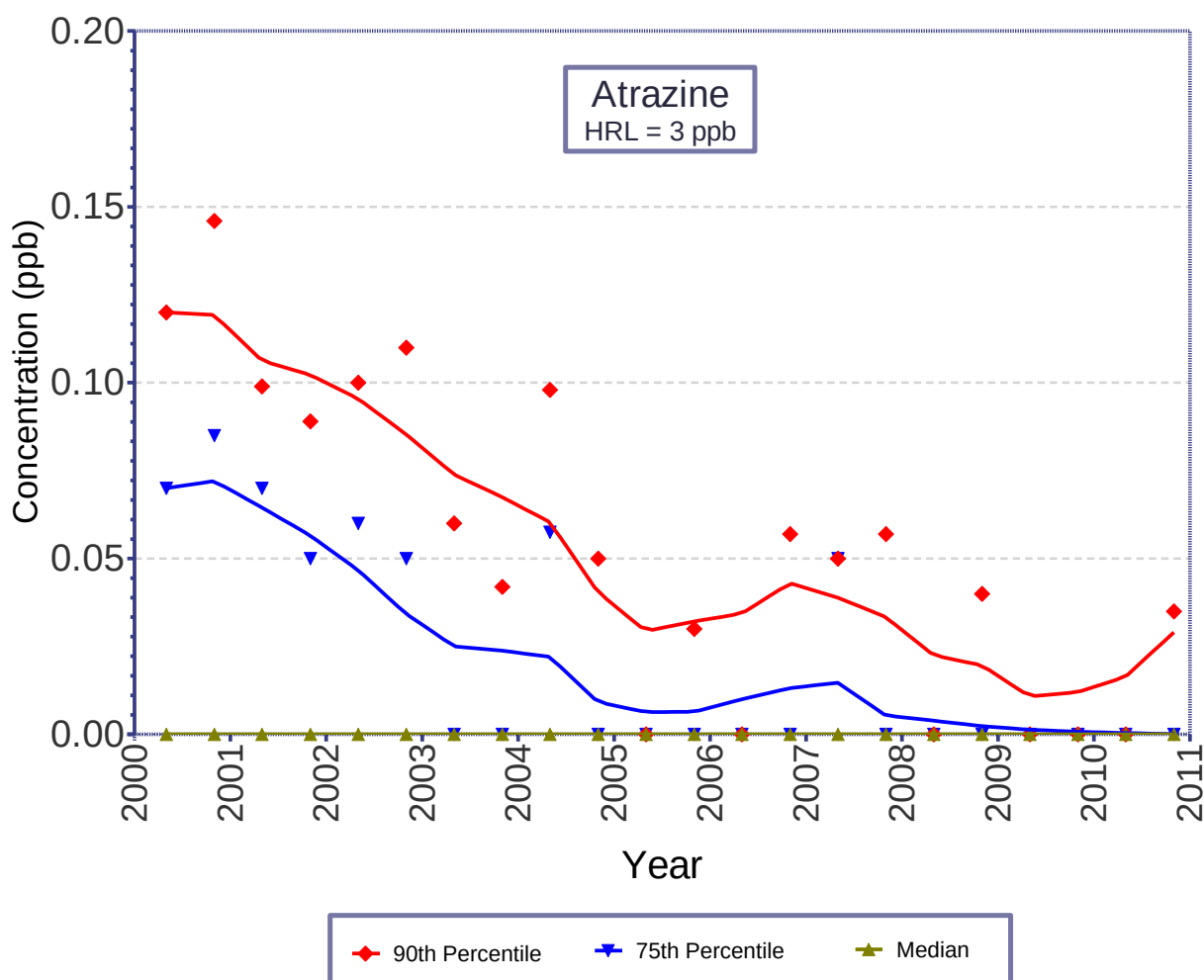


Figure 21. Atrazine groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

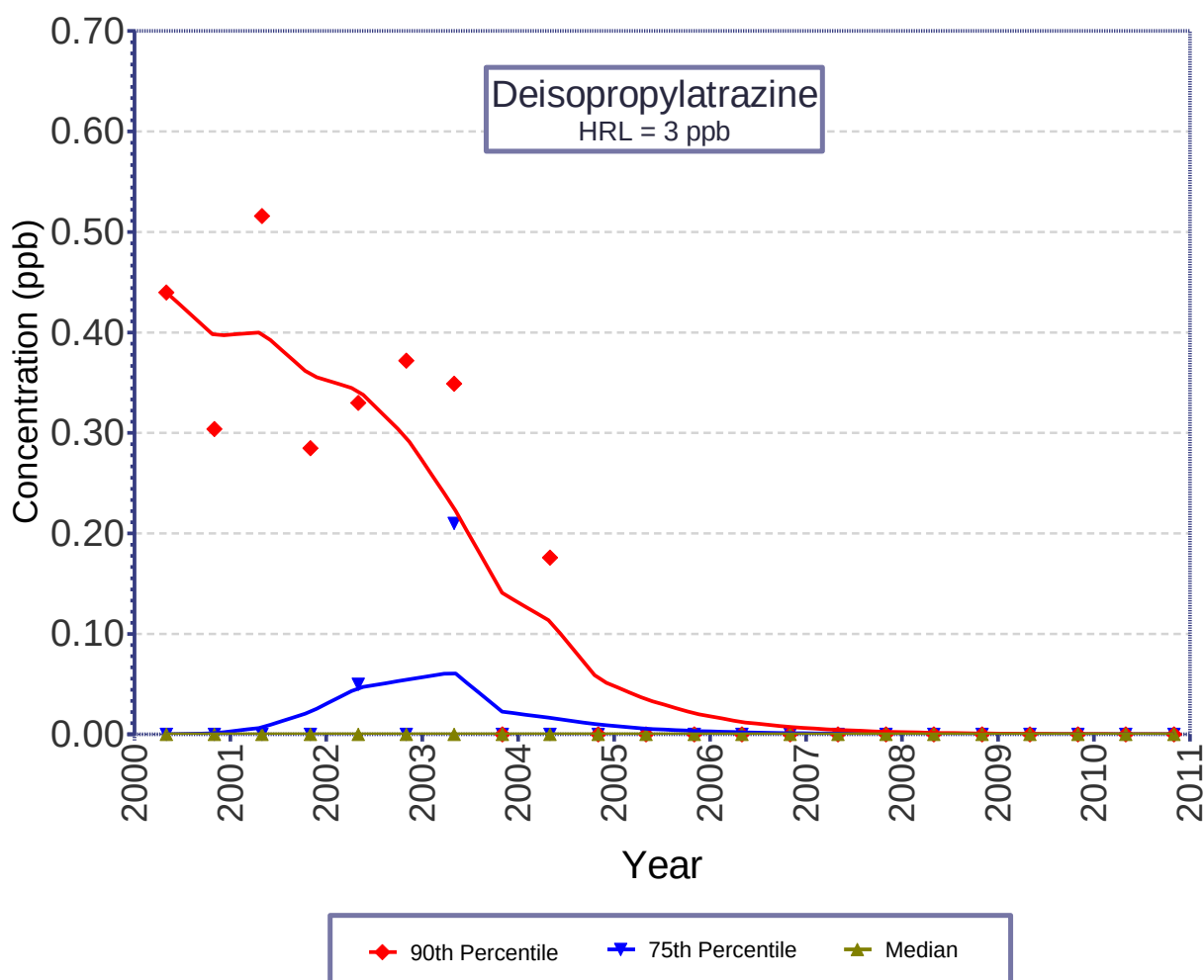


Figure 22. Deisopropylatrazine degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

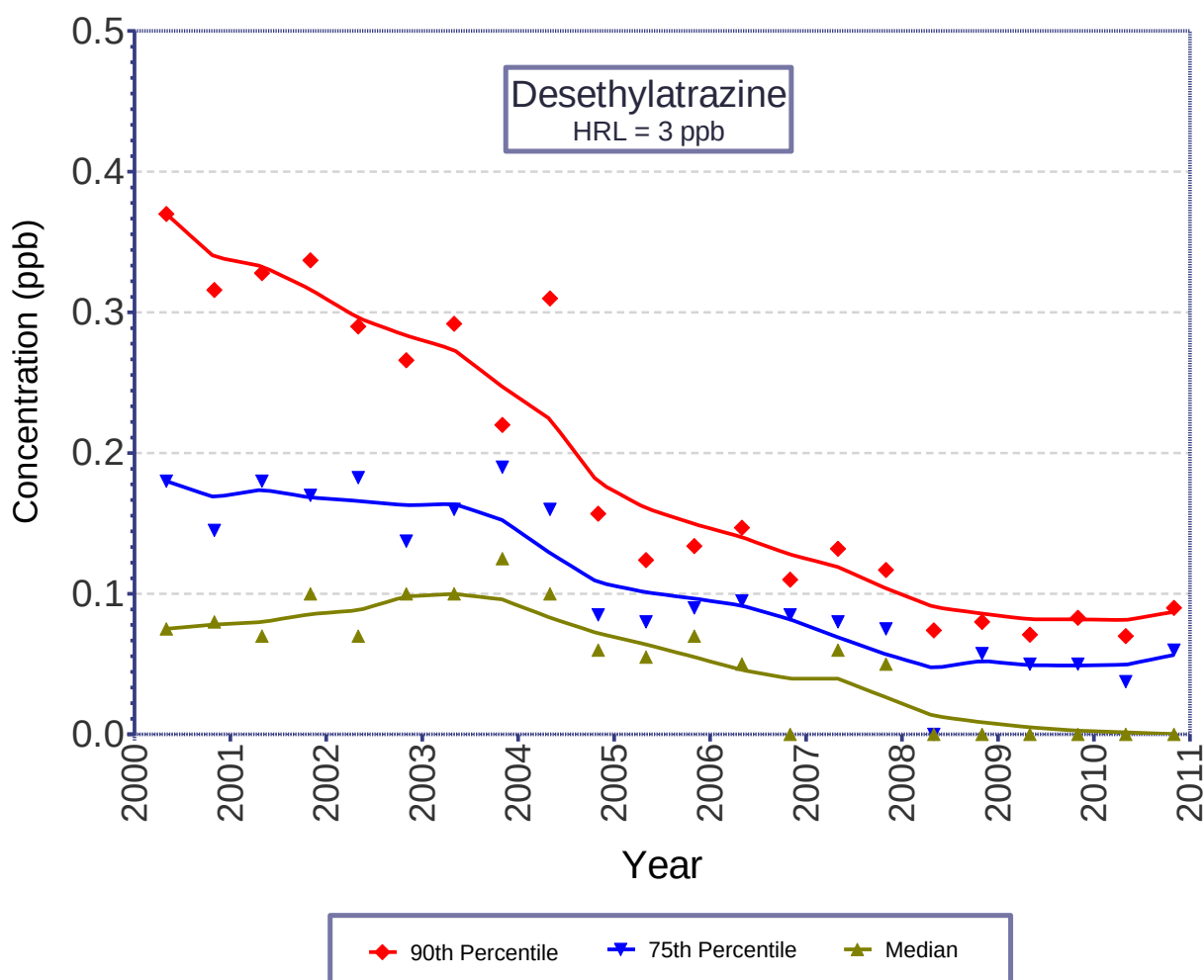


Figure 23. Desethylatrazine degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

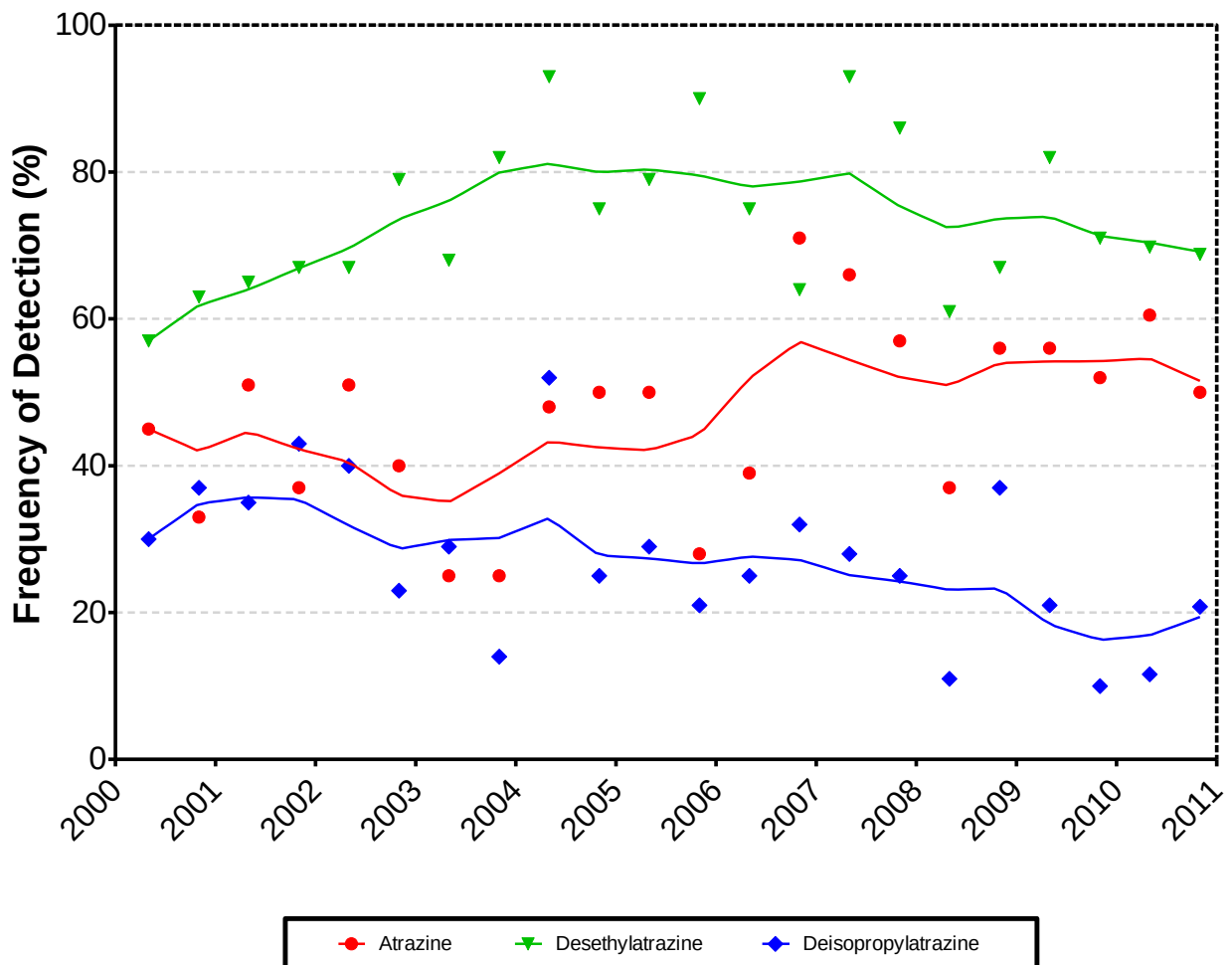


Figure 24. Atrazine and atrazine degradate detection frequency over time for MDA groundwater monitoring in PMR 4. NOTE: Graphics contain only spring and fall quarter results.

Atrazine data from sampled DNR fish hatchery sites in PMR 9 is of sufficient quantity to evaluate trends in the data collected (Figure 25). Extrapolating the available PMR 9 data to general conditions is problematic, however, due to the small number of sample locations. The available data for PMR 9 shows decreasing trends in detection frequency that are statistically significant for atrazine plus its degradates (Figure 26). Detection of atrazine and desethylatrazine in PMR 9 is so close to 100 percent that trend analysis returns inconclusive results. All trend test results for concentration and detection frequency can be found in Appendix A4-3.

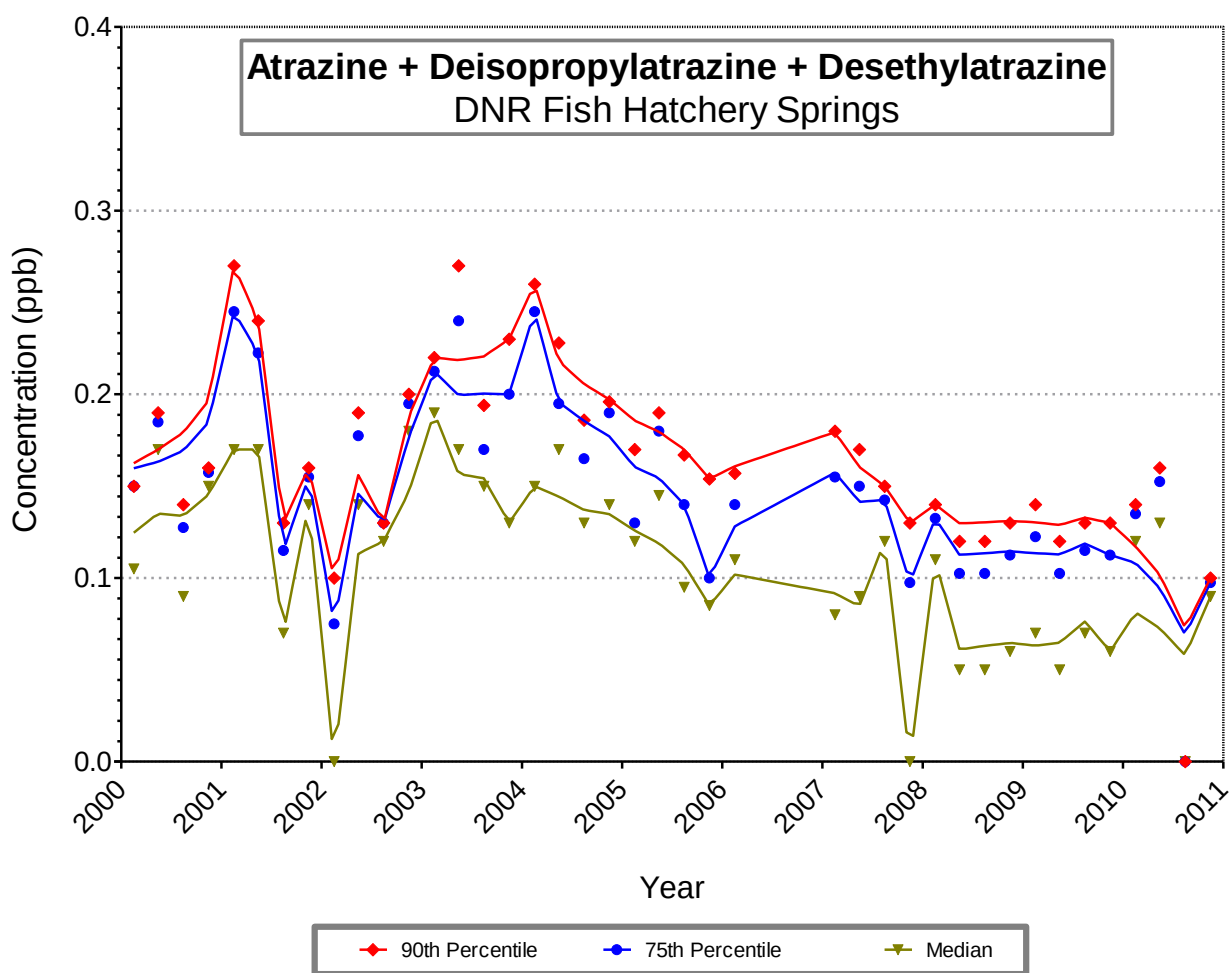


Figure 25. Atrazine and atrazine degradate groundwater sample analysis results over time for MDA PMR 9.

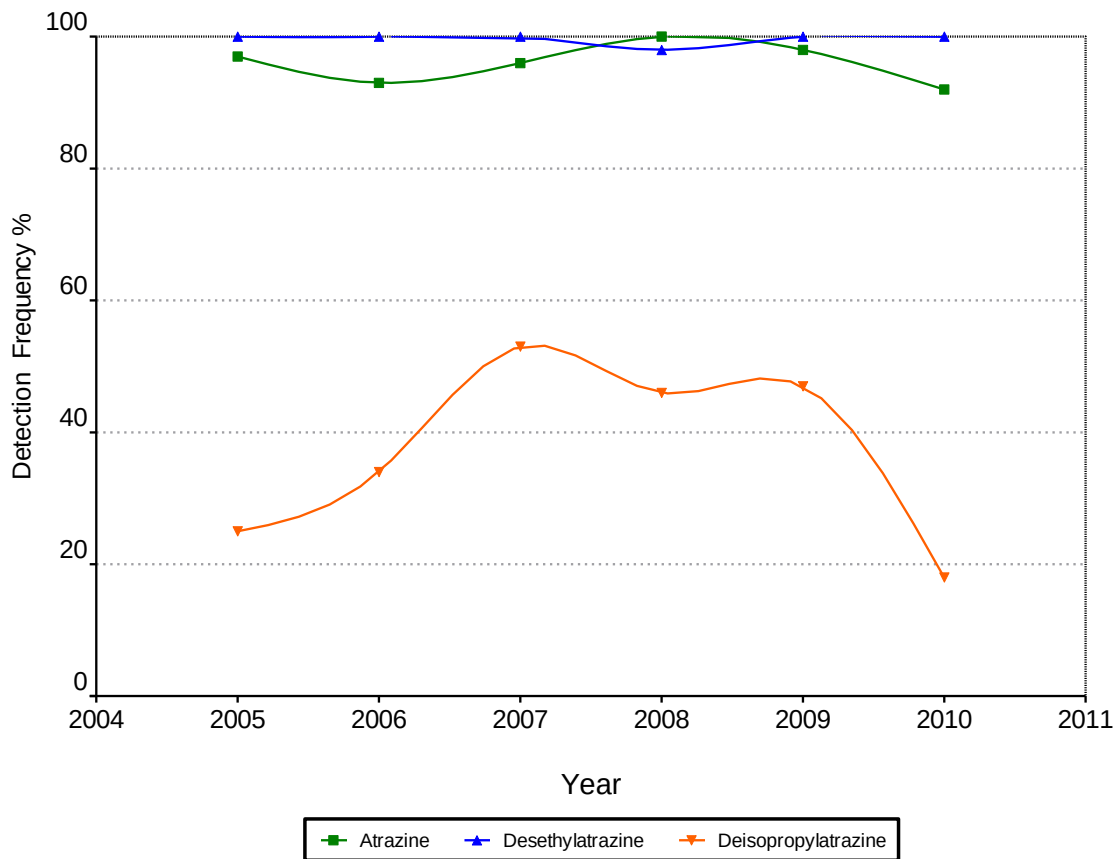


Figure 26. Atrazine and degradates annual detection frequency over time for MDA groundwater monitoring in PMR 9.

2.2.4. Dimethenamid results

Summary information for dimethenamid groundwater monitoring results is located in Tables 16 and 17 and Figure 27. Dimethenamid is normally detected in less than 10 percent of groundwater samples analyzed (Table 17). Accordingly, percentile concentrations are typically less than detectable levels. Maximum values of dimethenamid have all been less than 1.0 µg/L, with the ESA and OXA degradates showing maximum concentrations significantly higher than the parent compound (Table 16) in PMR 4. Figure 27 shows the distribution of sites where dimethenamid or its degradates were detected in 2010 sampling. Graphical representations of dimethenamid results (Figures 28 - 30) display no obvious trends in concentration, although detection frequency does seem to be increasing (Figure 31). Concentration trend analysis shows no sign of being statistically significant for the selected percentiles and forms of dimethenamid. This lack of statistically significant results for concentration trend analysis may be the result of the small number of detections. Trend test results for concentration and detection frequency can be found in Appendix A4-4.

Dimethenamid results in PMR 9 are insufficient for trend analysis.

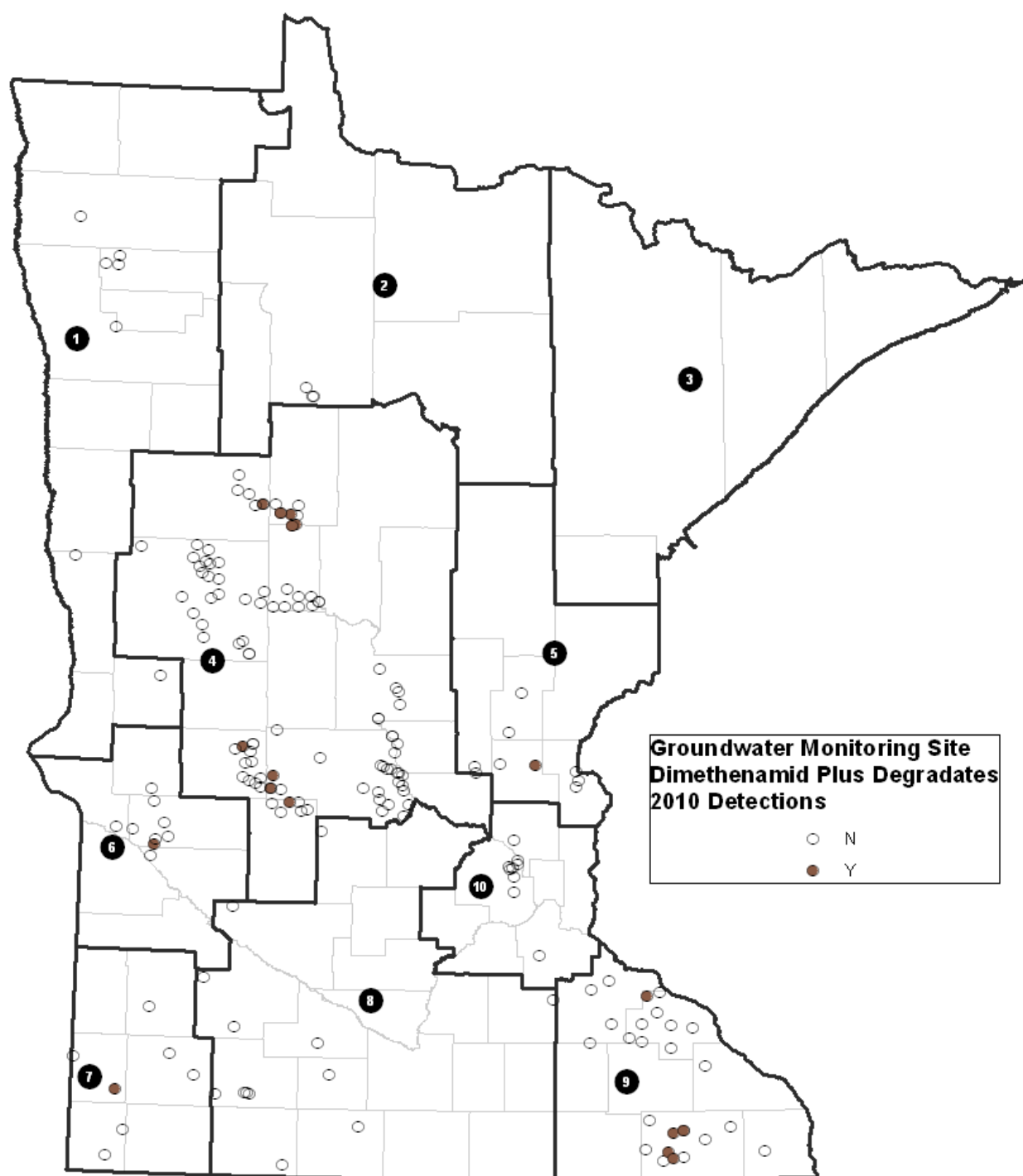


Figure 27. Pesticide Monitoring Regions and groundwater sites with dimethenamid plus dimethenamid degradate detections in 2010.

Table 16. MDA analytical results 2005 through 2010 in groundwater for dimethenamid and its degradates.

PMR 1	Median (µg/L)							75th Percentile (µg/L)						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Dimethenamid OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Dimethenamid + degs	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 4														
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid + degs	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PMR 5														
Dimethenamid	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Dimethenamid ESA	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Dimethenamid OXA	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Dimethenamid + degs	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
PMR 6														
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Dimethenamid OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Dimethenamid + degs	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 7														
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Dimethenamid OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Dimethenamid + degs	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 8														
Dimethenamid	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Dimethenamid OXA	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Dimethenamid + degs	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd

*10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.

Table 16 continued. MDA analytical results 2005 through 2010 in groundwater for dimethenamid and its degradates.

	Median (µg/L)							75th Percentile (µg/L)						
PMR 9	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid + degs	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Urban														
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid + degs	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

*10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.

Table 16 continued. MDA analytical results 2005 through 2010 in groundwater for dimethenamid and its degradates.

PMR 1	90th Percentile (µg/L)							Maximum (µg/L)						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Dimethenamid OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Dimethenamid + degs	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 4														
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	0.07	nd	nd	P	0.13	P	P
Dimethenamid ESA	0.10	nd	nd	nd	nd	nd	0.0556	7.06	2.06	4.70	4.20	10.10	3.600	3.600
Dimethenamid OXA	nd	nd	nd	nd	nd	nd	0.0059	3.01	0.65	3.19	2.49	5.11	1.590	1.590
Dimethenamid + degs	0.11	nd	nd	nd	nd	nd	0.0694	10.07	2.71	7.89	6.69	15.34	5.190	5.190
PMR 5														
Dimethenamid	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Dimethenamid ESA	-	-	0.06	0.08	0.05	nd	nd	-	-	0.10	0.13	0.09	nd	0.0544
Dimethenamid OXA	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Dimethenamid + degs	-	-	0.06	0.08	0.05	nd	nd	-	-	0.10	0.13	0.09	nd	0.0544
PMR 6														
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	0.0095
Dimethenamid OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Dimethenamid + degs	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	0.0095
PMR 7														
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	nd	-	nd	nd	nd	nd	0.0018	nd	-	nd	nd	nd	nd	0.0184
Dimethenamid OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Dimethenamid + degs	nd	-	nd	nd	nd	nd	0.0018	nd	-	nd	nd	nd	nd	0.0184
PMR 8														
Dimethenamid	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	-	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid OXA	-	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid + degs	-	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

*10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.

Table 16 continued. MDA analytical results 2005 through 2010 in groundwater for dimethenamid and its degradates.

	90th Percentile (µg/L)							Maximum (µg/L)						
PMR 9	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Dimethenamid	nd	nd	nd	P	nd	nd	nd	nd	0.07	0.51	0.35	0.12	0.1000	0.1000
Dimethenamid ESA	nd	nd	nd	nd	nd	nd	0.0134	nd	0.07	0.19	nd	nd	0.1240	0.1240
Dimethenamid OXA	nd	nd	nd	nd	nd	nd	nd	nd	0.10	0.38	nd	nd	nd	0.0575
Dimethenamid + degs	nd	nd	nd	P	nd	nd	0.0134	nd	0.24	1.08	0.35	0.12	0.2240	0.2815
Urban														
Dimethenamid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid ESA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Dimethenamid + degs	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

*10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.

Table 17. Total number of detections and detection frequencies in groundwater samples for dimethenamid and its degradates, 2005-2010 by PMR.

PMR 1	Detections							Percent Detections						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Dimethenamid	0/17	0/9	0/8	0/8	0/7	0/14	0/14	0%	0%	0%	0%	0%	0%	0%
Dimethenamid ESA	0/17	-	0/8	0/7	0/7	0/14	0/14	0%	-	0%	0%	0%	0%	0%
Dimethenamid OXA	0/17	-	0/8	0/7	0/7	0/14	0/14	0%	-	0%	0%	0%	0%	0%
Dimethenamid + degradates	0/17	-	0/8	0/7	0/7	0/14	0/14	0%	-	0%	0%	0%	0%	0%
PMR 4														
Dimethenamid	2/113	0/112	0/110	2/83	1/83	2/92	2/92	2%	0%	0%	2%	1%	2%	2%
Dimethenamid ESA	12/113	9/113	9/111	7/84	5/83	8/92	12/92	11%	8%	8%	8%	6%	9%	13%
Dimethenamid OXA	5/113	6/113	7/111	5/84	4/83	6/92	9/92	4%	5%	6%	6%	5%	7%	10%
Dimethenamid + degradates	12/113	9/112	9/110	7/83	5/82	8/92	12/92	11%	8%	8%	8%	6%	9%	13%
PMR 5														
Dimethenamid	-	-	0/9	0/9	0/9	0/17	0/17	-	-	0%	0%	0%	0%	0%
Dimethenamid ESA	-	-	1/9	1/9	1/9	0/17	1/17	-	-	11%	11%	11%	0%	6%
Dimethenamid OXA	-	-	0/9	0/9	0/9	0/17	0/17	-	-	0%	0%	0%	0%	0%
Dimethenamid + degradates	-	-	1/9	1/9	1/9	0/17	1/17	-	-	11%	11%	11%	0%	6%
PMR 6														
Dimethenamid	0/6	0/9	0/9	0/9	0/9	0/18	0/18	0%	0%	0%	0%	0%	0%	0%
Dimethenamid ESA	0/6	-	0/9	0/9	0/9	0/18	1/18	0%	-	0%	0%	0%	0%	6%
Dimethenamid OXA	0/6	-	0/9	0/9	0/9	0/18	0/18	0%	-	0%	0%	0%	0%	0%
Dimethenamid + degradates	0/6	-	0/9	0/9	0/9	0/18	1/18	0%	-	0%	0%	0%	0%	6%
PMR 7														
Dimethenamid	0/4	0/7	0/7	0/7	0/7	0/14	0/14	0%	0%	0%	0%	0%	0%	0%
Dimethenamid ESA	0/4	-	0/7	0/7	0/7	0/14	1/14	0%	-	0%	0%	0%	0%	7%
Dimethenamid OXA	0/4	-	0/7	0/7	0/7	0/14	0/14	0%	-	0%	0%	0%	0%	0%
Dimethenamid + degradates	0/4	-	0/7	0/7	0/7	0/14	1/14	0%	-	0%	0%	0%	0%	7%
PMR 8														
Dimethenamid	0/1	0/9	0/10	0/12	0/12	0/23	0/23	0%	0%	0%	0%	0%	0%	0%
Dimethenamid ESA	0/1	0/1	0/10	0/12	0/12	0/23	0/23	0%	0%	0%	0%	0%	0%	0%
Dimethenamid OXA	0/1	0/1	0/10	0/12	0/12	0/23	0/23	0%	0%	0%	0%	0%	0%	0%
Dimethenamid + degradates	0/1	0/1	0/10	0/12	0/12	0/23	0/23	0%	0%	0%	0%	0%	0%	0%
PMR 9														
Dimethenamid	0/63	4/56	4/55	5/46	1/62	6/62	6/62	0%	7%	7%	11%	2%	10%	10%
Dimethenamid ESA	0/64	2/56	1/55	0/46	0/62	1/62	7/62	0%	2%	2%	0%	0%	2%	11%
Dimethenamid OXA	0/64	1/56	1/55	0/46	0/62	0/62	3/62	0%	2%	2%	0%	0%	0%	5%
Dimethenamid + degradates	0/62	4/56	4/55	5/46	1/62	6/62	9/62	0%	7%	7%	11%	2%	10%	15%
Urban														
Dimethenamid	0/22	0/21	0/17	0/16	0/15	0/20	0/20	0%	0%	0%	0%	0%	0%	0%
Dimethenamid ESA	0/22	0/21	0/17	0/16	0/15	0/20	0/20	0%	0%	0%	0%	0%	0%	0%
Dimethenamid OXA	0/22	0/21	0/17	0/16	0/15	0/20	0/20	0%	0%	0%	0%	0%	0%	0%
Dimethenamid + degradates	0/22	0/21	0/17	0/16	0/15	0/20	0/20	0%	0%	0%	0%	0%	0%	0%

*10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.

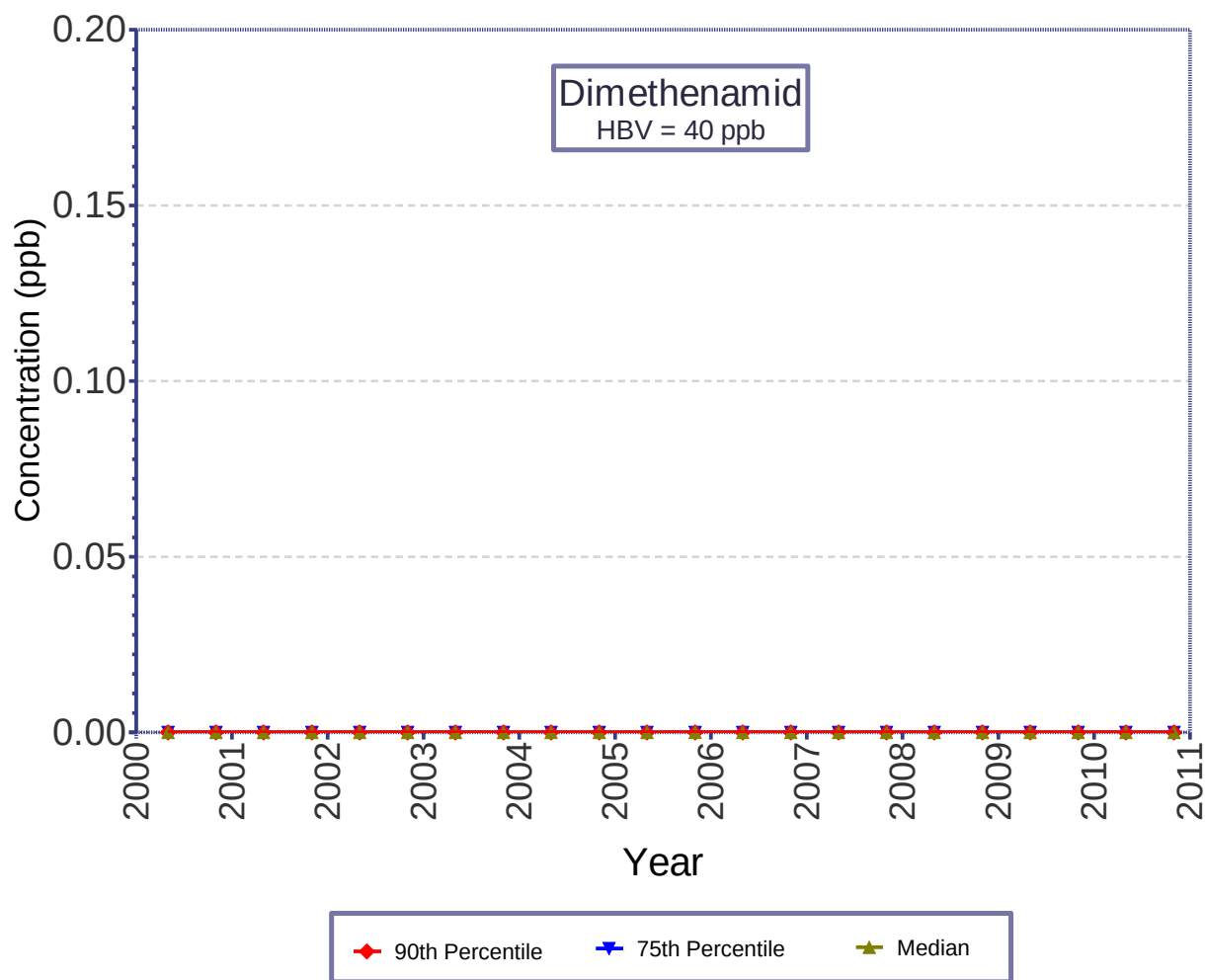


Figure 28. Dimethenamid groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y-axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

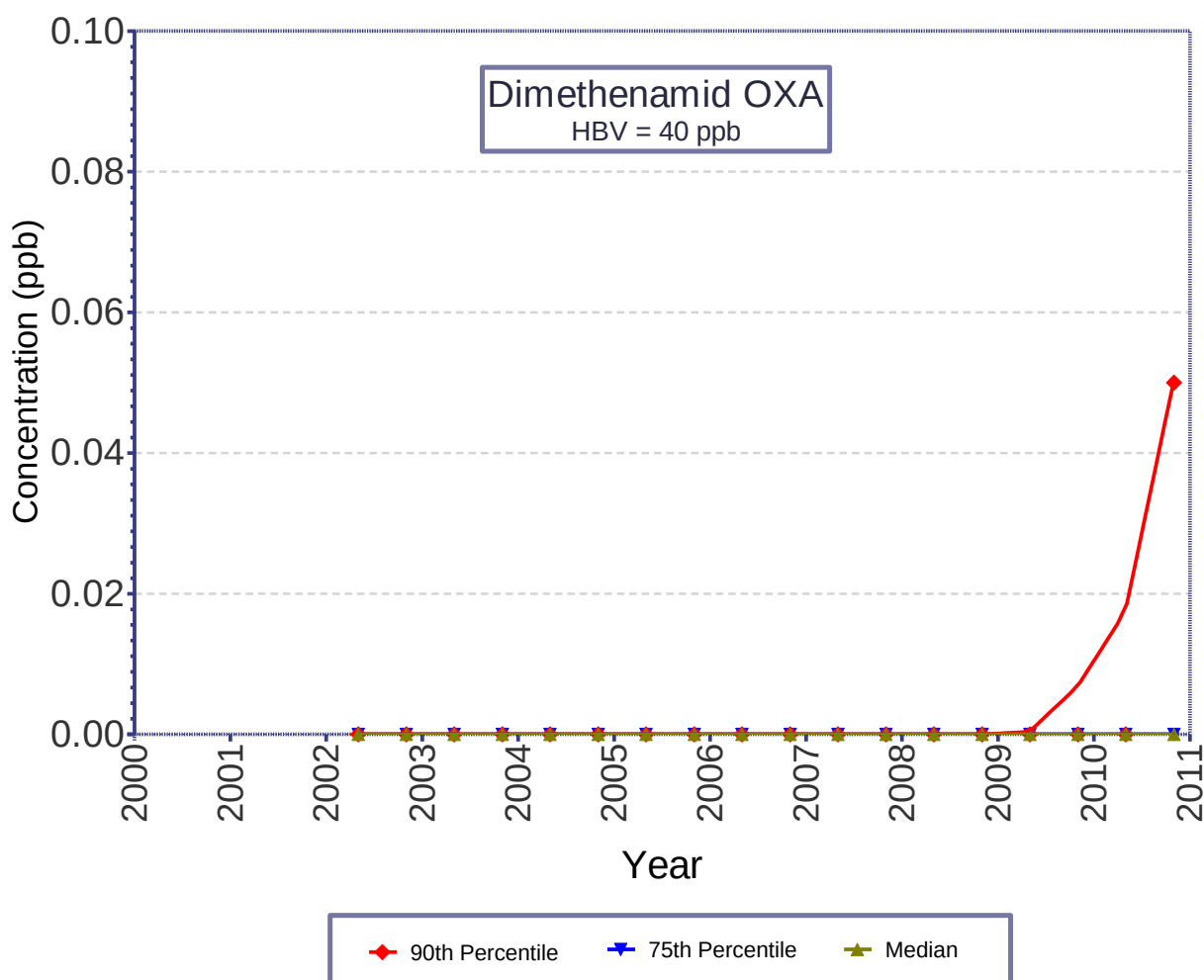


Figure 29. Dimethenamid OXA degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

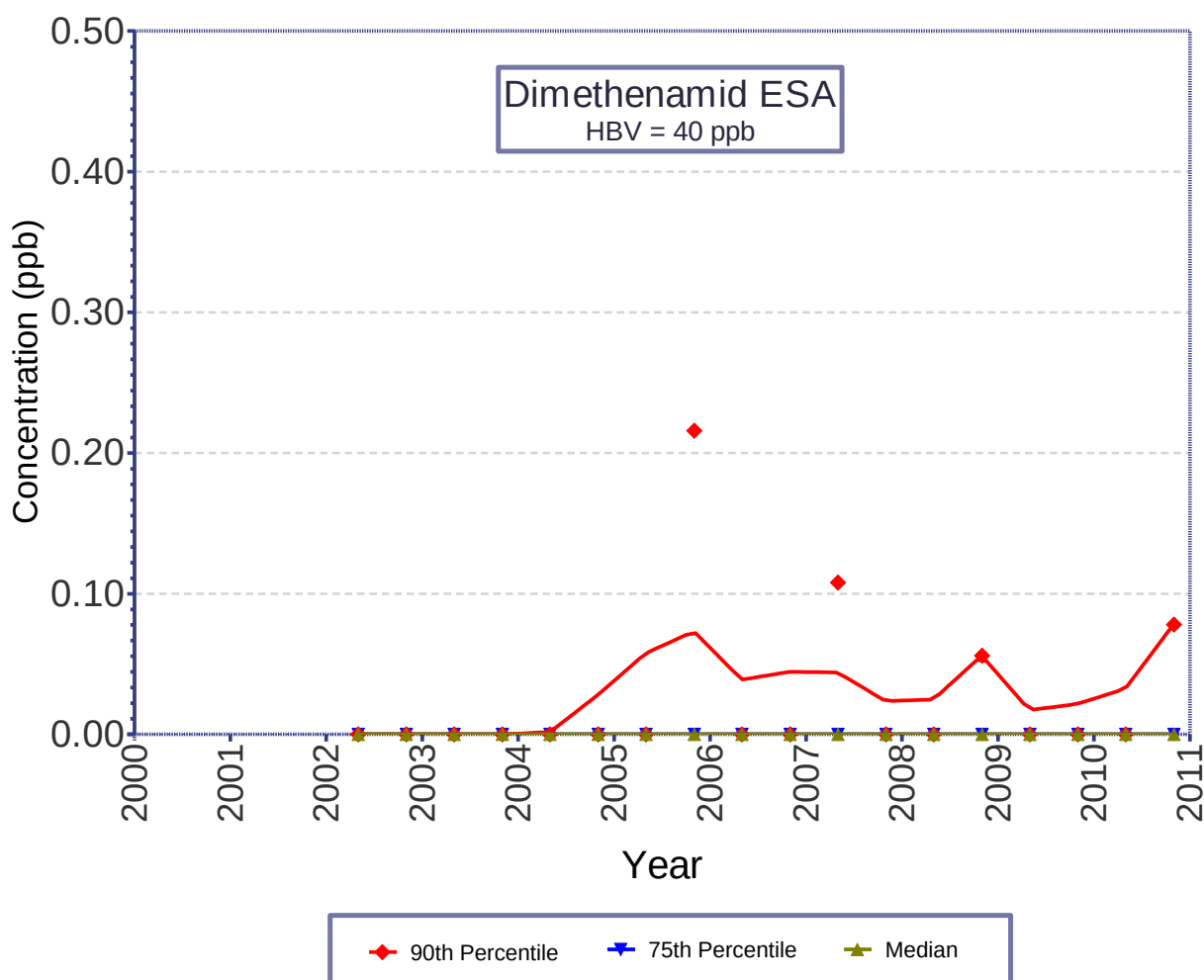


Figure 30. Dimethenamid ESA degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

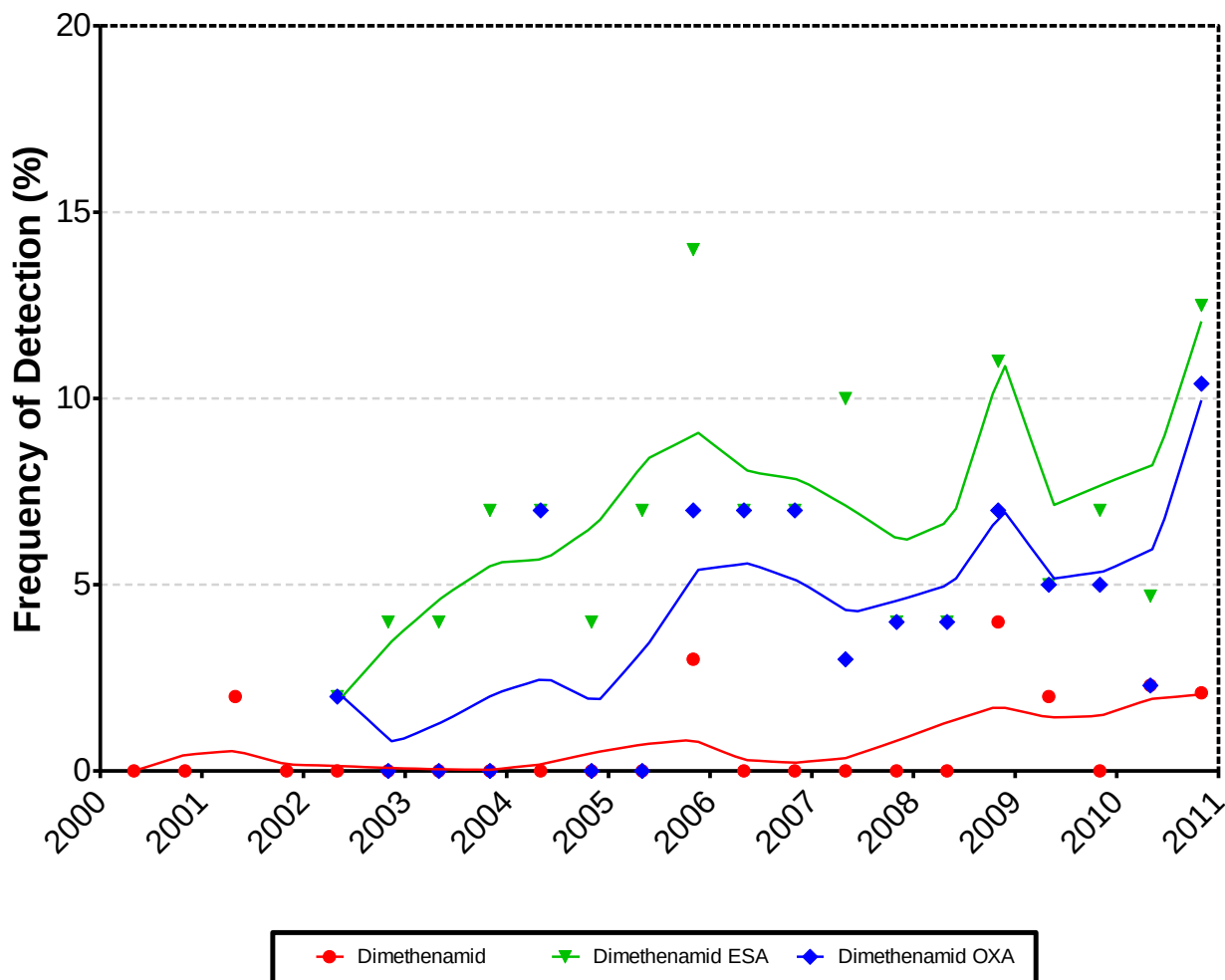


Figure 31. Dimethenamid and dimethenamid degradates detection frequency over time for MDA groundwater monitoring PMR 4. NOTE: Graphics contain only spring and fall quarter results. Frequency of detection is based on pre 2010 Method Reporting Limits.

2.2.5. Metolachlor results

Summary information for metolachlor groundwater monitoring results is located in Tables 18 and 19. Metolachlor has been an included analyte in MDA monitoring since 1985. MDA laboratory analysis of degradates of metolachlor began in 2002. Metolachlor or its degradates has been found in every PMR sampled. Figure 32 shows the distribution of sites where metolachlor and/or degradates were detected in 2010 sampling. As with the other acetanilide pesticides, metolachlor ESA is the most frequently detected form of metolachlor (Table 19) and typically is detected at the highest concentrations (Table 18). Data for 2010 indicate that metolachlor ESA has become the most commonly detected single chemical from analyzed groundwater samples. Overall, concentrations for metolachlor and its degradate compounds appear to be in a general decline over time (Figures 33 - 35). This general decline in concentration has been found to be statistically significant for many of the percentile values greater than the median for all three metolachlor species. This indicates that higher level concentrations are not as prevalent compared to earlier monitoring data. Detection frequency of

metolachlor parent material is declining at a statistically significant rate; however, the ESA and OXA degradates show no statistically significant trends (Figure 36). The lack of quantifiable trends for metolachlor degradate data may be an artifact of the high variability present in the data, the non-linear nature of the results over time, and the relatively short time period for which data is available. Trend test results for concentration and detection frequency can be found in Appendix A4-5.

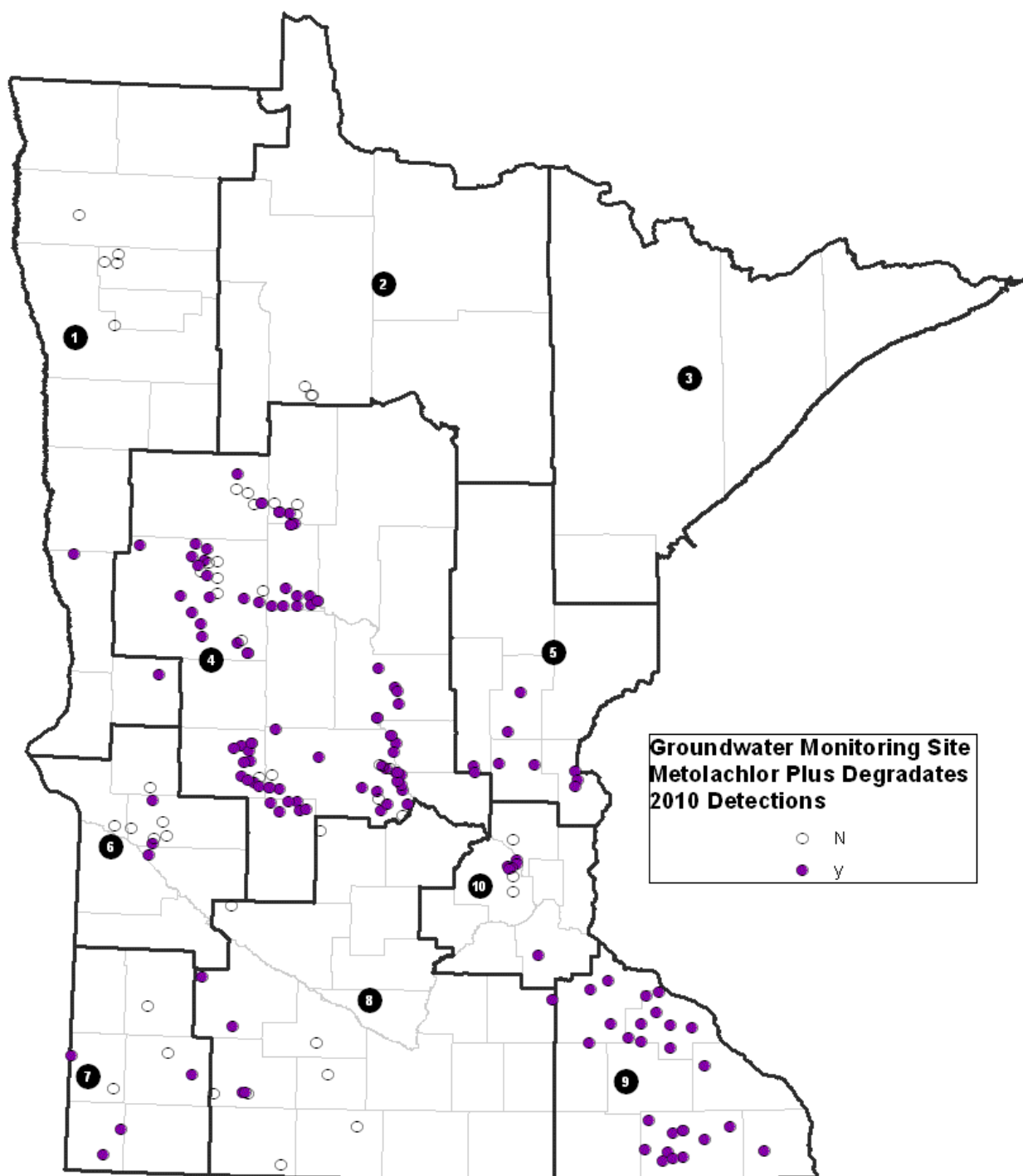


Figure 32. Pesticide Monitoring Regions and groundwater monitoring sites with metolachlor plus metolachlor degrade detections in 2010.

Table 18. MDA analytical results 2005 through 2010 in groundwater for metolachlor and its degradates.

PMR 1	Median (µg/L)							75th Percentile (µg/L)						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Metolachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metolachlor ESA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Metolachlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 4														
Metolachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metolachlor ESA	0.23	0.20	0.22	0.19	0.15	0.1720	0.1720	1.13	1.24	1.72	1.14	1.27	1.465	1.465
Metolachlor OXA	nd	nd	nd	nd	nd	nd	nd	0.11	0.12	0.19	0.11	0.18	0.1635	0.1667
PMR 5														
Metolachlor	-	-	nd	nd	nd	nd	nd	-	-	nd	nd	nd	nd	nd
Metolachlor ESA	-	-	0.60	0.29	0.54	0.3320	0.3320	-	-	1.85	2.71	1.80	1.172	1.172
Metolachlor OXA	-	-	nd	nd	0.09	nd	0.0284	-	-	0.37	0.49	0.17	nd	0.0490
PMR 6														
Metolachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metolachlor ESA	nd	-	nd	nd	0.07	nd	0.0536	0.75	-	0.05	0.16	0.30	0.1900	0.1900
Metolachlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
PMR 7														
Metolachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metolachlor ESA	1.09	-	0.12	0.08	0.09	0.1075	0.1075	1.21	-	0.65	0.39	0.56	0.3900	0.3900
Metolachlor OXA	0.05	-	nd	nd	nd	nd	nd	0.13	-	nd	nd	nd	nd	0.0103
PMR 8														
Metolachlor	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd	nd
Metolachlor ESA	-	-	nd	nd	0.22	0.2580	0.2580	-	-	nd	0.25	0.53	0.4597	0.4597
Metolachlor OXA	-	-	0.07	nd	nd	nd	nd	-	-	0.59	nd	nd	nd	nd
PMR 9														
Metolachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	P	P	P	P
Metolachlor ESA	0.13	0.24	0.27	0.53	0.52	0.4050	0.4050	0.26	0.84	0.81	1.21	0.79	0.8660	0.8660
Metolachlor OXA	nd	nd	nd	nd	nd	nd	0.0153	nd	nd	nd	0.07	nd	0.0441	0.0441
Urban														
Metolachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metolachlor ESA	nd	nd	nd	nd	nd	nd	0.0112	nd	nd	nd	nd	nd	nd	0.0222
Metolachlor OXA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.0054

*10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.

Table 18 continued. MDA analytical results 2005 through 2010 in groundwater for metolachlor and its degradates.

PMR 1	90th Percentile (µg/L)							Maximum (µg/L)						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10-1	10-new*
Metolachlor	nd	nd	nd	nd	0.17	0.0710	0.0710	nd	nd	nd	nd	0.21	0.0800	0.0800
Metolachlor ESA	nd	-	nd	1.75	1.74	0.2406	0.2406	nd	-	nd	2.19	2.18	1.020	1.020
Metolachlor OXA	nd	-	nd	0.32	0.98	0.0430	0.0613	nd	-	nd	0.40	1.23	0.4300	0.4300
PMR 4														
Metolachlor	nd	nd	P	nd	nd	P	P	1.87	0.76	0.24	0.75	1.79	0.3700	0.3700
Metolachlor ESA	2.68	3.33	4.10	2.39	2.98	4.903	4.903	10.20	12.70	34.20	12.30	20.70	24.30	24.30
Metolachlor OXA	0.66	0.64	0.64	0.49	0.71	1.082	1.082	6.75	4.90	8.03	5.41	13.00	12.60	12.60
PMR 5														
Metolachlor	-	-	nd	nd	P	nd	nd	-	-	nd	nd	P	P	P
Metolachlor ESA	-	-	4.63	3.61	4.82	3.272	3.272	-	-	4.66	4.00	4.89	5.140	5.140
Metolachlor OXA	-	-	1.89	2.98	2.15	0.5950	0.5950	-	-	2.86	4.15	3.47	3.810	3.810
PMR 6														
Metolachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metolachlor ESA	0.76	-	0.49	0.38	0.75	0.4436	0.4436	0.76	-	0.67	0.47	0.81	0.5300	0.5300
Metolachlor OXA	nd	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	0.0258
PMR 7														
Metolachlor	nd	nd	P	nd	nd	P	P	nd	nd	P	nd	nd	P	P
Metolachlor ESA	1.23	-	1.08	0.62	0.89	0.8717	0.8717	1.23	-	1.16	0.65	0.94	0.9320	0.9320
Metolachlor OXA	0.15	-	0.07	nd	nd	nd	0.0515	0.15	-	0.09	nd	nd	nd	0.0538
PMR 8														
Metolachlor	-	P	nd	nd	nd	nd	nd	nd	P	nd	nd	nd	P	P
Metolachlor ESA	-	-	nd	0.51	0.97	0.6508	0.6508	0.12	nd	nd	0.89	1.43	1.760	1.760
Metolachlor OXA	-	-	2.00	0.02	0.02	nd	0.0380	nd	nd	2.69	0.07	0.07	nd	0.0414
PMR 9														
Metolachlor	P	P	P	P	0.17	0.0360	0.0360	P	0.58	P	0.12	5.00	4.250	4.250
Metolachlor ESA	0.36	1.48	1.26	1.70	1.48	1.680	1.680	0.43	3.13	2.60	2.70	3.63	4.550	4.550
Metolachlor OXA	nd	0.11	nd	0.14	0.15	0.2015	0.2015	nd	0.61	0.16	0.22	0.59	1.570	1.570
Urban														
Metolachlor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metolachlor ESA	nd	0.11	0.61	0.40	0.26	0.1470	0.1470	nd	1.59	8.49	9.71	0.76	0.1470	0.1470
Metolachlor OXA	nd	nd	nd	nd	nd	nd	0.0235	0.07	nd	0.65	5.43	nd	nd	0.0356

*10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.

Table 19. Total number of detections and detection frequencies in groundwater samples for metolachlor and its degradates, 2005-2010 by PMR.

PMR 1	Detections							Percent Detections						
	05	06	07	08	09	10	10-new*	05	06	07	08	09	10	10-new*
Metolachlor	0/17	0/9	0/8	0/8	1/7	2/14	2/14	0%	0%	0%	0%	14%	14%	14%
Metolachlor ESA	0/17	-	0/8	1/7	1/7	2/14	3/14	0%	-	0%	14%	14%	14%	21%
Metolachlor OXA	0/17	-	0/8	1/7	1/7	1/14	2/14	0%	-	0%	14%	14%	7%	14%
Metolachlor + Degradates	0/17	-	0/8	1/8	1/7	2/14	3/14	0%	-	0%	13%	14%	14%	21%
PMR 4														
Metolachlor	9/113	11/112	14/110	6/83	6/83	12/92	12/92	8%	10%	13%	7%	7%	13%	13%
Metolachlor ESA	74/113	66/113	69/111	54/84	51/83	59/92	79/92	66%	58%	62%	64%	62%	64%	86%
Metolachlor OXA	30/113	30/113	37/111	26/84	26/83	34/92	43/92	27%	27%	33%	31%	31%	37%	47%
Metolachlor + Degradates	74/113	65/112	69/110	53/83	52/82	61/92	79/92	66%	58%	63%	64%	63%	66%	86%
PMR 5														
Metolachlor	-	-	0/9	0/9	1/9	1/17	1/17	-	-	0%	0%	11%	6%	6%
Metolachlor ESA	-	-	8/9	7/9	9/9	13/17	17/17	-	-	89%	78%	100%	77%	100%
Metolachlor OXA	-	-	3/9	3/9	6/9	3/17	11/17	-	-	33%	33%	67%	18%	65%
Metolachlor + Degradates	-	-	8/9	7/9	9/9	13/17	17/17	-	-	89%	78%	100%	77%	100%
PMR 6														
Metolachlor	0/6	0/9	0/9	0/9	0/9	0/18	0/18	0%	0%	0%	0%	0%	0%	0%
Metolachlor ESA	2/6	-	2/9	3/9	5/9	7/18	12/18	33%	-	22%	33%	56%	39%	67%
Metolachlor OXA	0/6	-	0/9	0/9	0/9	0/18	1/18	0%	-	0%	0%	0%	0%	6%
Metolachlor + Degradates	2/6	-	2/9	3/9	5/9	7/18	12/18	33%	-	22%	33%	56%	39%	67%
PMR 7														
Metolachlor	0/4	0/7	1/7	0/7	0/7	2/14	2/14	0%	0%	14%	0%	0%	14%	14%
Metolachlor ESA	4/4	-	4/7	5/7	4/7	8/14	12/14	100%	-	57%	71%	57%	57%	86%
Metolachlor OXA	2/4	-	1/7	0/7	0/7	0/14	4/14	50%	-	14%	0%	0%	0%	29%
Metolachlor + Degradates	4/4	-	4/7	5/7	4/7	8/14	12/14	100%	-	57%	71%	57%	57%	86%
PMR 8														
Metolachlor	0/1	1/9	0/10	0/12	0/12	1/23	1/23	0%	11%	0%	0%	0%	4%	4%
Metolachlor ESA	1/1	0/1	0/10	5/12	9/12	13/23	21/23	100%	0%	0%	42%	75%	57%	91%
Metolachlor OXA	0/1	0/1	5/10	1/12	1/12	0/23	4/23	0%	0%	50%	8%	8%	0%	17%
Metolachlor + Degradates	1/1	0/1	5/10	5/12	9/12	13/23	22/23	100%	0%	50%	42%	75%	57%	96%
PMR 9														
Metolachlor	8/63	10/56	13/55	14/46	18/62	17/62	17/62	13%	18%	24%	30%	29%	27%	27%
Metolachlor ESA	49/64	45/56	47/55	41/46	56/62	55/62	61/62	77%	80%	86%	89%	90%	89%	98%
Metolachlor OXA	0/64	7/56	5/55	12/46	12/62	10/62	33/62	0%	13%	9%	26%	19%	16%	53%
Metolachlor + Degradates	47/62	45/56	47/55	41/46	56/62	55/62	61/62	76%	80%	86%	89%	90%	89%	98%
Urban														
Metolachlor	0/22	0/21	0/17	0/16	0/15	0/20	0/20	0%	0%	0%	0%	0%	0%	0%
Metolachlor ESA	0/22	4/21	2/17	2/16	2/15	3/20	12/20	0%	19%	12%	13%	13%	15%	60%
Metolachlor OXA	1/22	0/21	1/17	1/16	0/15	0/20	5/20	5%	0%	6%	6%	0%	0%	25%
Metolachlor + Degradates	1/22	4/21	2/17	2/16	2/15	3/20	12/20	5%	19%	12%	13%	13%	15%	60%

*10-new is based on the lower detection limits of the new LC-MS/MS method. The change only affects the degradates.

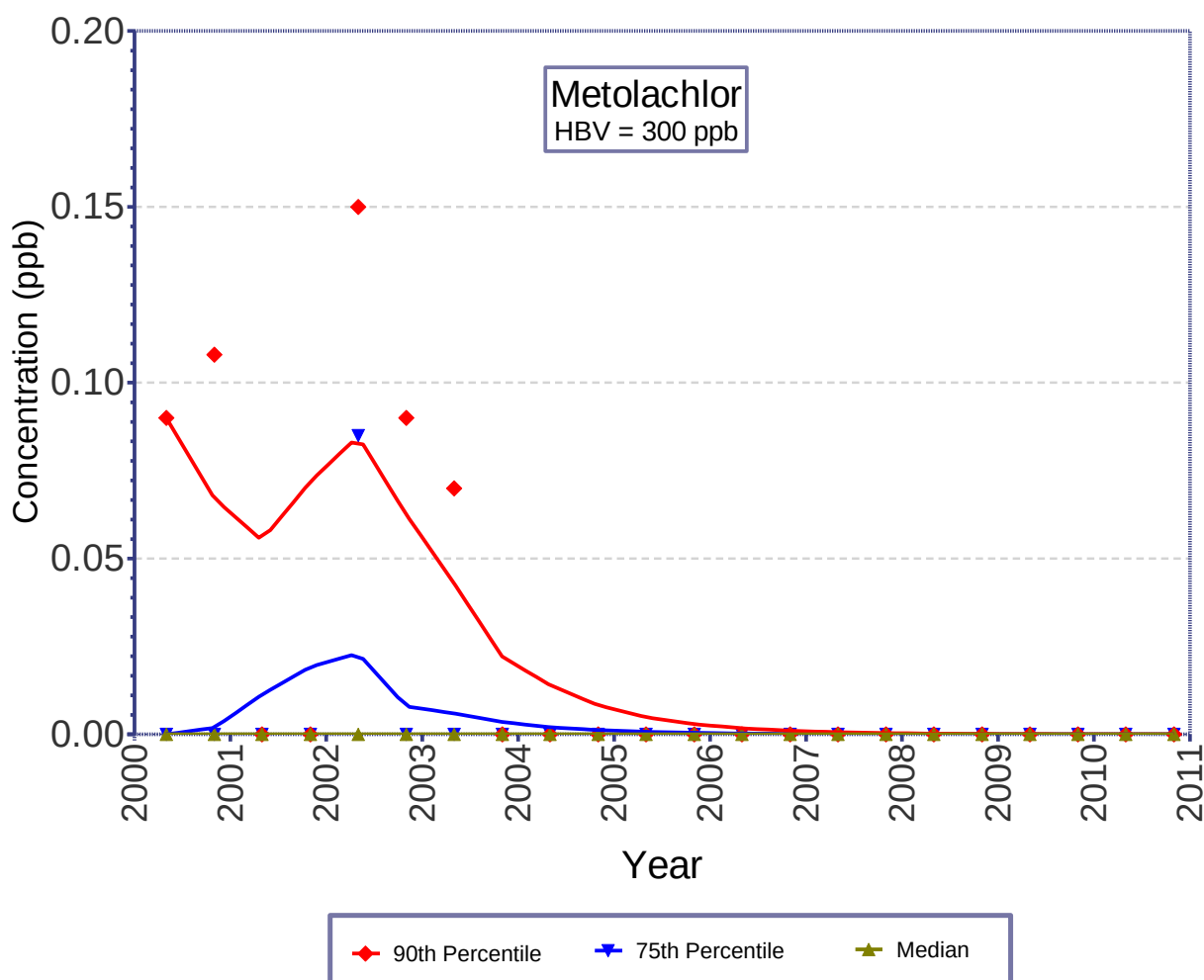


Figure 33. Metolachlor groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

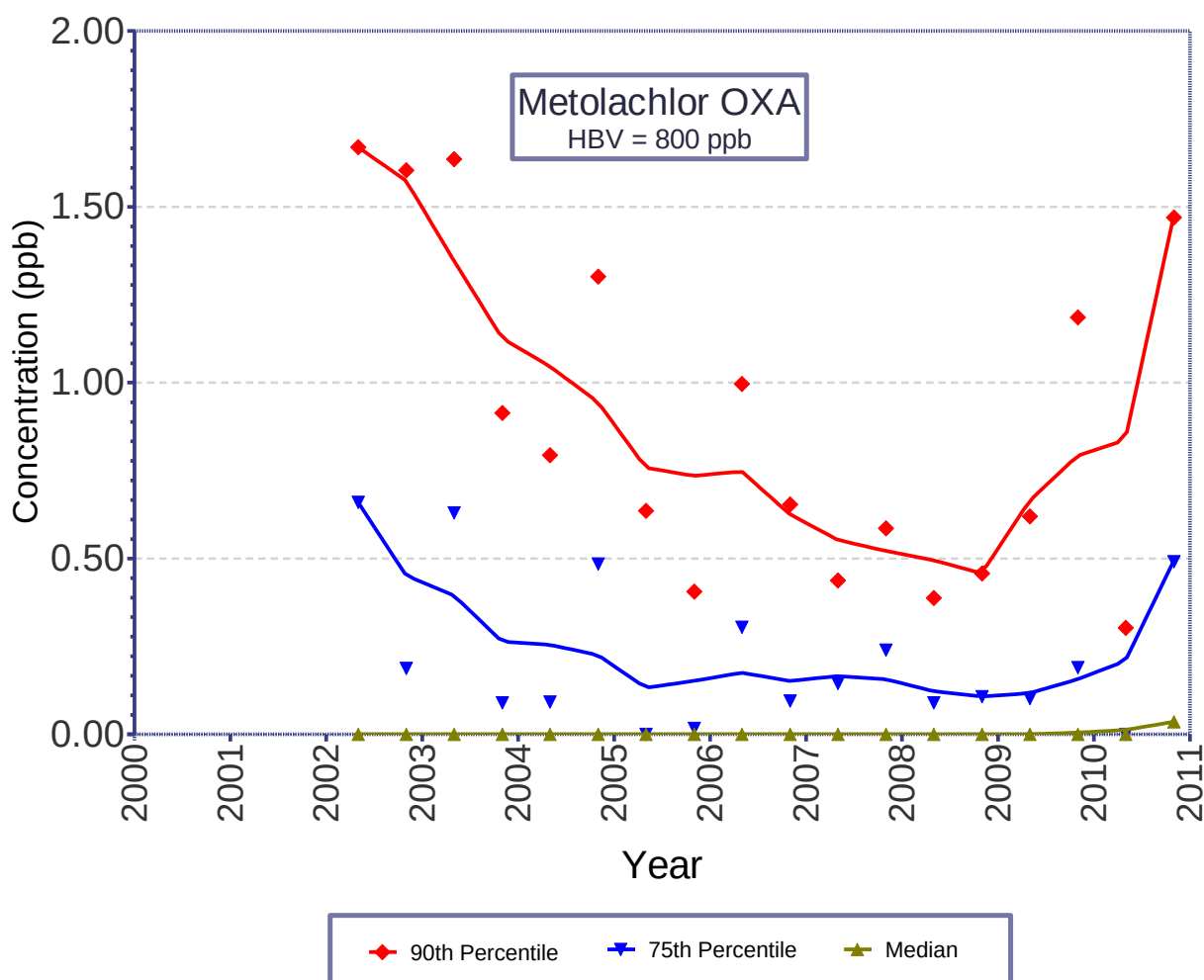


Figure 34. Metolachlor OXA degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

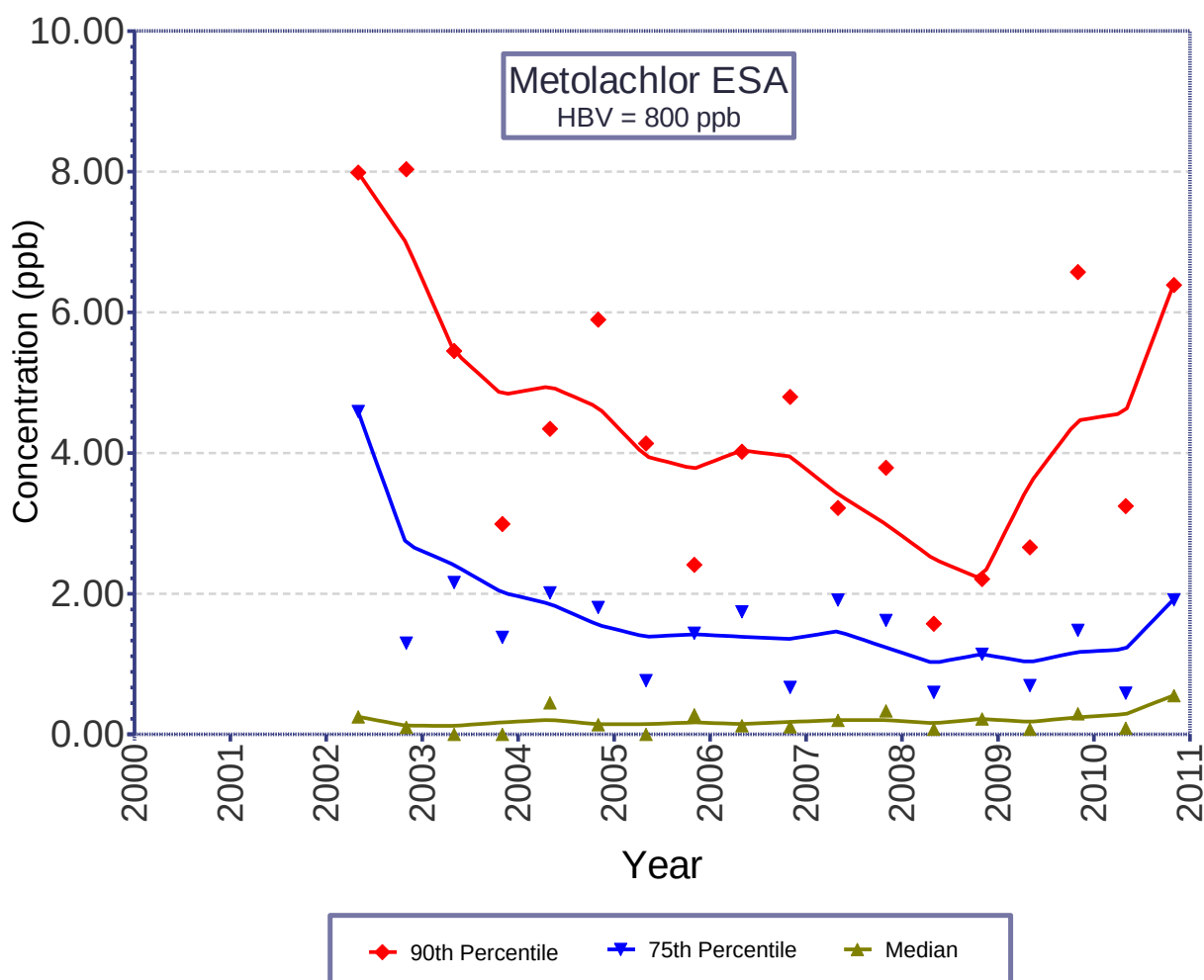


Figure 35. Metolachlor ESA degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

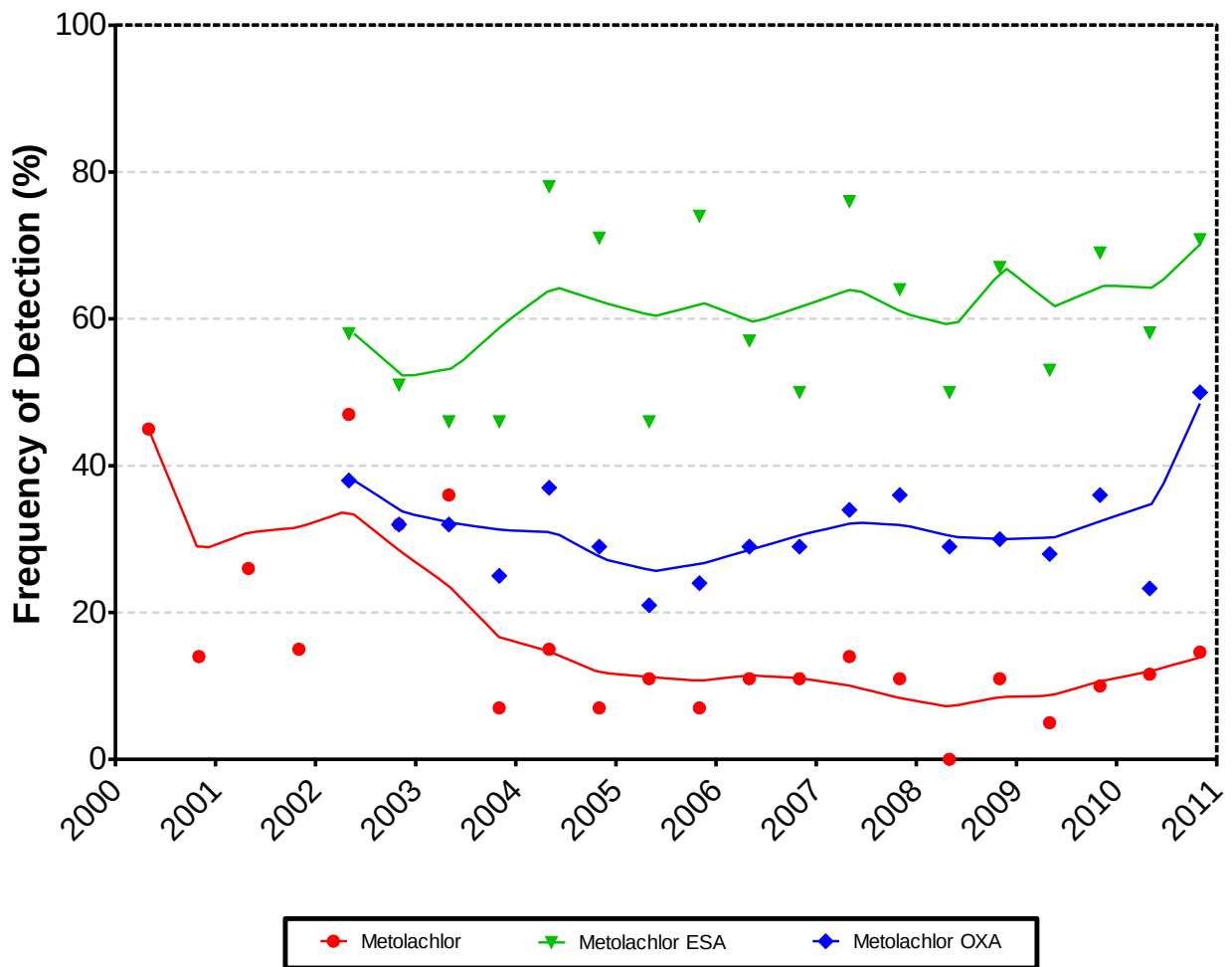


Figure 36. Metolachlor and metolachlor degradate detection frequency over time for MDA groundwater monitoring in PMR 4. NOTE: Graphics contain only spring and fall quarter results. Frequency of detection is based on pre 2010 Method Reporting Limits.

Metolachlor ESA results for PMR 9 show a statistically significant increasing trend in concentration and frequency of detection (Figure 37 and 38). Other forms of metolachlor are remaining relatively constant over time. Continued monitoring of more recently sampled springs supplemented with ongoing data from domestic drinking water wells will aid in understanding PMR 9 results in the future.

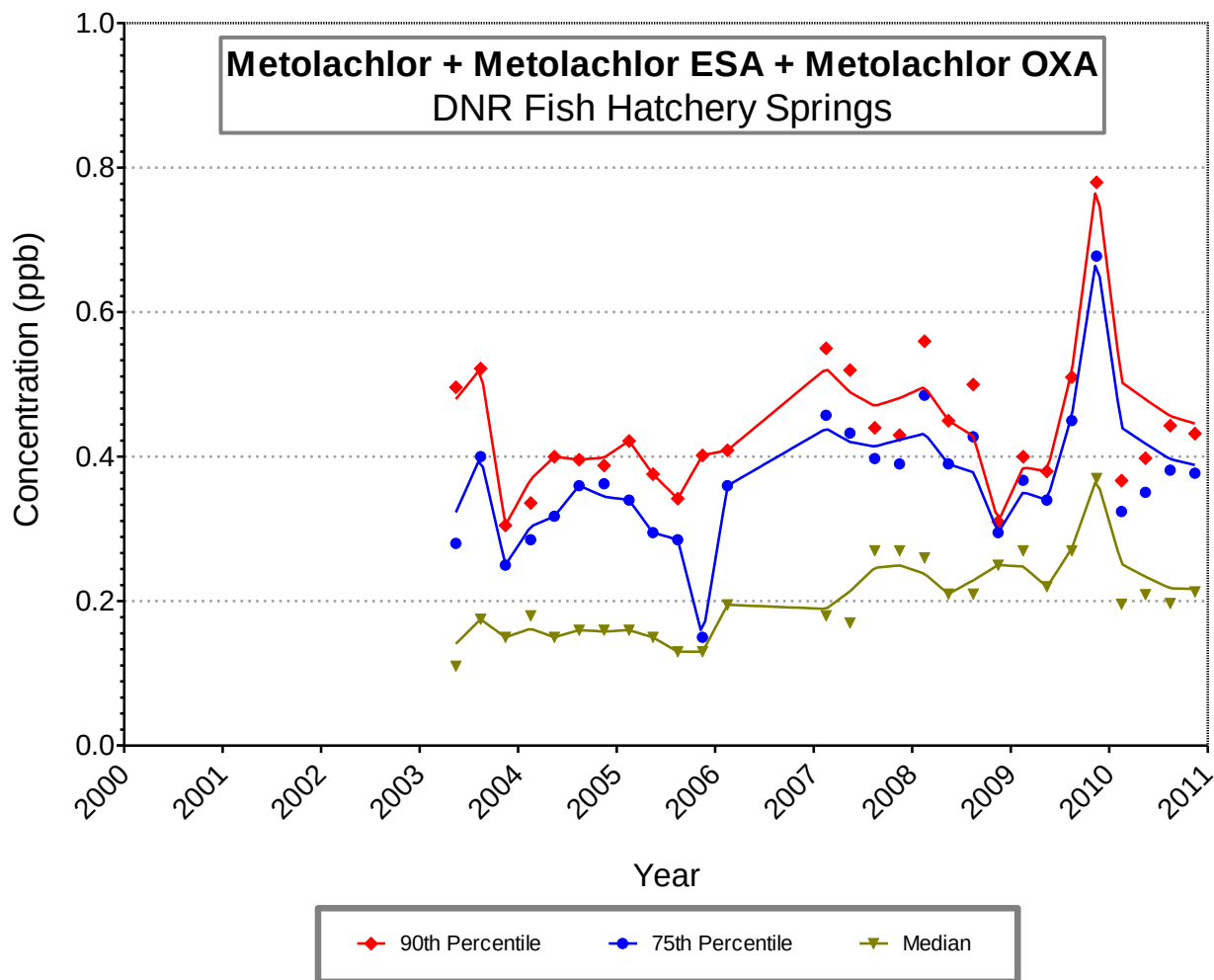


Figure 37. Metolachlor and metolachlor degradate groundwater sample analysis results over time for MDA PMR 9.

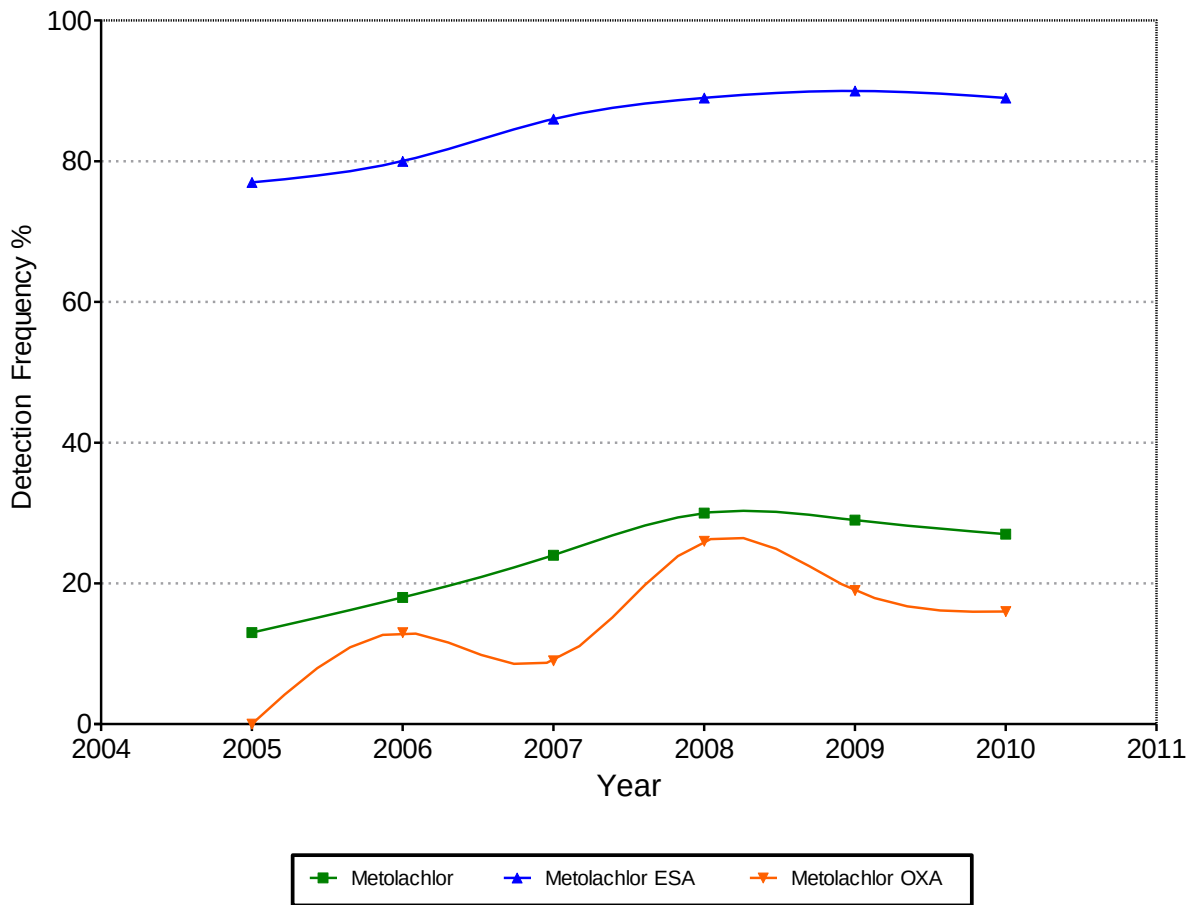


Figure 38. Metolachlor and metolachlor degradate annual detection frequency over time for MDA groundwater monitoring in PMR 9. Frequency of detection is based on pre 2010 Method Reporting Limits.

2.2.6. Metribuzin results

Summary information for metribuzin groundwater monitoring results is located in Tables 20 and 21. Metribuzin has been an included analyte in MDA monitoring since 1985. MDA laboratory analysis of degradates of metribuzin has been included in analyses, but with an Estimated Reporting Limit (ERL) rather than a MRL. ERLs are used when there has not been a statistical study done to verify the laboratory's confidence in quantifying low-level concentrations.

Figure 39 shows the distribution of sites where metribuzin and its degradates were detected in 2010 sampling. Metribuzin and/or degradates of metribuzin have been found primarily in PMR 4, which is characterized by glacial outwash sand plains. Much of the cropped land in this region is irrigated and includes potatoes in the cropping rotation. There is an apparent trend in higher metribuzin and degrade concentrations over time (Figures 40 - 43). Graphical inspection of the detection frequency data (Figure 44) shows an apparent increasing trend, although statistical analysis does not indicate that it is statistically significant except for metribuzin DADK. It is not unusual to have difficulty analyzing for trends in environmental data due to high variability and extreme values data. As a consequence, trends in water quality data frequently become graphically apparent before statistical analysis provides supporting evidence. As discussed in previous sections, statistical methods to account for the high variability of the data need to be incorporated into future analyses. Trend test results for concentration and detection frequency can be found in Appendix A4-6.

Metribuzin has not been detected in PMR 9.

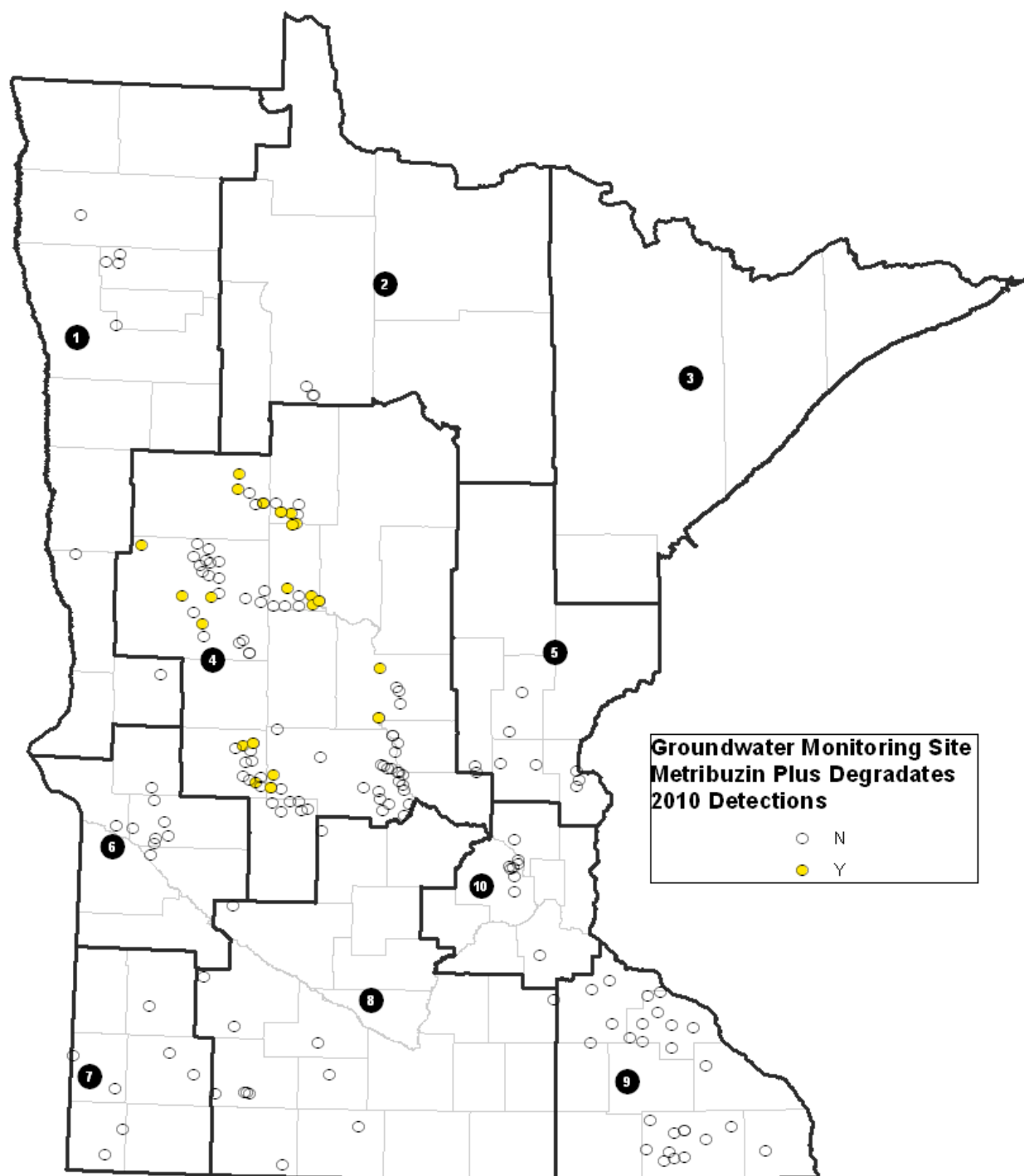


Figure 39. Pesticide Monitoring Regions and groundwater sites with metribuzin plus metribuzin degradate detections in 2010.

Table 20. MDA analytical results 2005 through 2010 in groundwater for metribuzin and its degradates.

PMR 1	Median (µg/L)						75th Percentile (µg/L)					
	05	06	07	08	09	10	05	06	07	08	09	10
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PMR 4												
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	nd	nd	nd	nd	nd	P	nd	P	P
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	nd	nd	nd	nd	nd	P	nd	P	P
PMR 5												
Metribuzin	-	-	nd	nd	nd	nd	-	-	nd	nd	nd	nd
Metribuzin DADK	-	-	nd	nd	nd	nd	-	-	nd	nd	nd	nd
Metribuzin DK	-	-	nd	nd	nd	nd	-	-	nd	nd	nd	nd
Metribuzin DA	-	-	nd	nd	nd	nd	-	-	nd	nd	nd	nd
Metribuzin + degradates	-	-	nd	nd	nd	nd	-	-	nd	nd	nd	nd
PMR 6												
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PMR 7												
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PMR 8												
Metribuzin	-	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Metribuzin DADK	-	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Metribuzin DK	-	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Metribuzin DA	-	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd
Metribuzin + degradates	-	nd	nd	nd	nd	nd	-	nd	nd	nd	nd	nd

Table 20 continued. MDA analytical results 2005 through 2010 in groundwater for metribuzin and its degradates.

PMR 9	Median (µg/L)						75 th Percentile (µg/L)					
	05	06	07	08	09	10	05	06	07	08	09	10
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Urban												
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table 20 continued. MDA analytical results 2005 through 2010 in groundwater for metribuzin and its degradates.

PMR 1	90th Percentile(µg/L)						Maximum (µg/L)					
	05	06	07	08	09	10	05	06	07	08	09	10
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PMR 4												
Metribuzin	P	P	P	P	P	P	1.24	1.06	0.72	0.13	1.89	1.10
Metribuzin DADK	1.07	1.49	1.31	1.29	1.26	1.06	5.60	9.28	5.76	2.23	5.15	3.00
Metribuzin DK	nd	P	P	P	P	P	1.20	1.49	P	P	1.51	P
Metribuzin DA	nd	nd	nd	nd	nd	P	P	P	P	P	P	P
Metribuzin + degradates	1.07	1.49	1.34	1.29	1.42	1.12	7.34	9.52	6.32	2.23	7.04	3.31
PMR 5												
Metribuzin	-	-	nd	0.09	nd	nd	-	-	nd	0.15	nd	nd
Metribuzin DADK	-	-	nd	nd	nd	nd	-	-	nd	nd	nd	nd
Metribuzin DK	-	-	nd	nd	nd	nd	-	-	nd	nd	nd	nd
Metribuzin DA	-	-	nd	nd	nd	nd	-	-	nd	nd	nd	nd
Metribuzin + degradates	-	-	nd	0.09	nd	nd	-	-	nd	0.15	nd	nd
PMR 6												
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	P	nd	nd	nd	nd	nd	P	nd	nd
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	P	nd	nd	nd	nd	nd	P	nd	nd
PMR 7												
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
PMR 8												
Metribuzin	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DK	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table 20 continued. MDA analytical results 2005 through 2010 in groundwater for metribuzin and its degradates.

PMR 9	90 th Percentile(µg/L)						Maximum (µg/L)					
	05	06	07	08	09	10	05	06	07	08	09	10
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Urban												
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DADK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DK	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin DA	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin + degradates	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table 21. Total number of detections and detection frequencies in groundwater samples for metribuzin and its degradates, 2005-2010 by PMR.

PMR 1	Detections						Percent Detections					
	05	06	07	08	09	10	05	06	07	08	09	10
Metribuzin	0/17	0/17	0/17	0/17	0/17	0/17	0%	0%	0%	0%	0%	0%
Metribuzin DADK	0/17	0/17	0/17	0/17	0/17	0/17	0%	0%	0%	0%	0%	0%
Metribuzin DK	0/17	0/17	0/17	0/17	0/17	0/17	0%	0%	0%	0%	0%	0%
Metribuzin DA	0/17	0/17	0/17	0/17	0/17	0/17	0%	0%	0%	0%	0%	0%
Metribuzin + degradates	0/17	0/17	0/17	0/17	0/17	0/17	0%	0%	0%	0%	0%	0%
PMR 4												
Metribuzin	14/113	14/113	14/113	14/113	14/113	14/113	12%	12%	14%	12%	13%	19%
Metribuzin DADK	23/113	23/113	23/113	23/113	23/113	23/113	20%	21%	26%	23%	25%	28%
Metribuzin DK	8/113	8/113	8/113	8/113	8/113	8/113	7%	15%	20%	17%	16%	21%
Metribuzin DA	4/113	4/113	4/113	4/113	4/113	4/113	4%	7%	6%	1%	8%	12%
Metribuzin + degradates	25/113	25/113	25/113	25/113	25/113	25/113	22%	22%	29%	23%	25%	30%
PMR 5												
Metribuzin	-	-	-	-	-	-	-	-	0%	11%	0%	0%
Metribuzin DADK	-	-	-	-	-	-	-	-	0%	0%	0%	0%
Metribuzin DK	-	-	-	-	-	-	-	-	0%	0%	0%	0%
Metribuzin DA	-	-	-	-	-	-	-	-	0%	0%	0%	0%
Metribuzin + degradates	-	-	-	-	-	-	-	-	0%	11%	0%	0%
PMR 6												
Metribuzin	0/6	0/6	0/6	0/6	0/6	0/6	0%	0%	0%	0%	0%	0%
Metribuzin DADK	0/6	0/6	0/6	0/6	0/6	0/6	0%	0%	0%	11%	0%	0%
Metribuzin DK	0/6	0/6	0/6	0/6	0/6	0/6	0%	0%	0%	0%	0%	0%
Metribuzin DA	0/6	0/6	0/6	0/6	0/6	0/6	0%	0%	0%	0%	0%	0%
Metribuzin + degradates	0/6	0/6	0/6	0/6	0/6	0/6	0%	0%	0%	11%	0%	0%
PMR 7												
Metribuzin	0/4	0/4	0/4	0/4	0/4	0/4	0%	0%	0%	0%	0%	0%
Metribuzin DADK	0/4	0/4	0/4	0/4	0/4	0/4	0%	0%	0%	0%	0%	0%
Metribuzin DK	0/4	0/4	0/4	0/4	0/4	0/4	0%	0%	0%	0%	0%	0%
Metribuzin DA	0/4	0/4	0/4	0/4	0/4	0/4	0%	0%	0%	0%	0%	0%
Metribuzin + degradates	0/4	0/4	0/4	0/4	0/4	0/4	0%	0%	0%	0%	0%	0%
PMR 8												
Metribuzin	0/1	0/1	0/1	0/1	0/1	0/1	0%	0%	0%	0%	0%	0%
Metribuzin DADK	0/1	0/1	0/1	0/1	0/1	0/1	0%	0%	0%	0%	0%	0%
Metribuzin DK	0/1	0/1	0/1	0/1	0/1	0/1	0%	0%	0%	0%	0%	0%
Metribuzin DA	0/1	0/1	0/1	0/1	0/1	0/1	0%	0%	0%	0%	0%	0%
Metribuzin + degradates	0/1	0/1	0/1	0/1	0/1	0/1	0%	0%	0%	0%	0%	0%
PMR 9												
Metribuzin	0/63	0/63	0/63	0/63	0/63	0/63	0%	0%	0%	0%	0%	0%
Metribuzin DADK	0/63	0/63	0/63	0/63	0/63	0/63	0%	0%	0%	0%	0%	0%
Metribuzin DK	0/63	0/63	0/63	0/63	0/63	0/63	0%	0%	0%	0%	0%	0%
Metribuzin DA	0/63	0/63	0/63	0/63	0/63	0/63	0%	0%	0%	0%	0%	0%
Metribuzin + degradates	0/63	0/63	0/63	0/63	0/63	0/63	0%	0%	0%	0%	0%	0%

Table 21 continued. Total number of detections and detection frequencies in groundwater samples for metribuzin and its degradates, 2005-2010 by PMR.

	Detections						Percent Detections					
Urban	05	06	07	08	09	10	05	06	07	08	09	10
Metribuzin	0/22	0/22	0/22	0/22	0/22	0/22	0/22	0%	5%	6%	0%	0%
Metribuzin DADK	0/22	0/22	0/22	0/22	0/22	0/22	0/22	0%	5%	6%	0%	0%
Metribuzin DK	0/21	0/21	0/21	0/21	0/21	0/21	0/21	0%	5%	6%	0%	0%
Metribuzin DA	0/22	0/22	0/22	0/22	0/22	0/22	0/22	0%	5%	0%	0%	0%
Metribuzin + degradates	0/22	0/22	0/22	0/22	0/22	0/22	0/22	0%	5%	6%	0%	0%

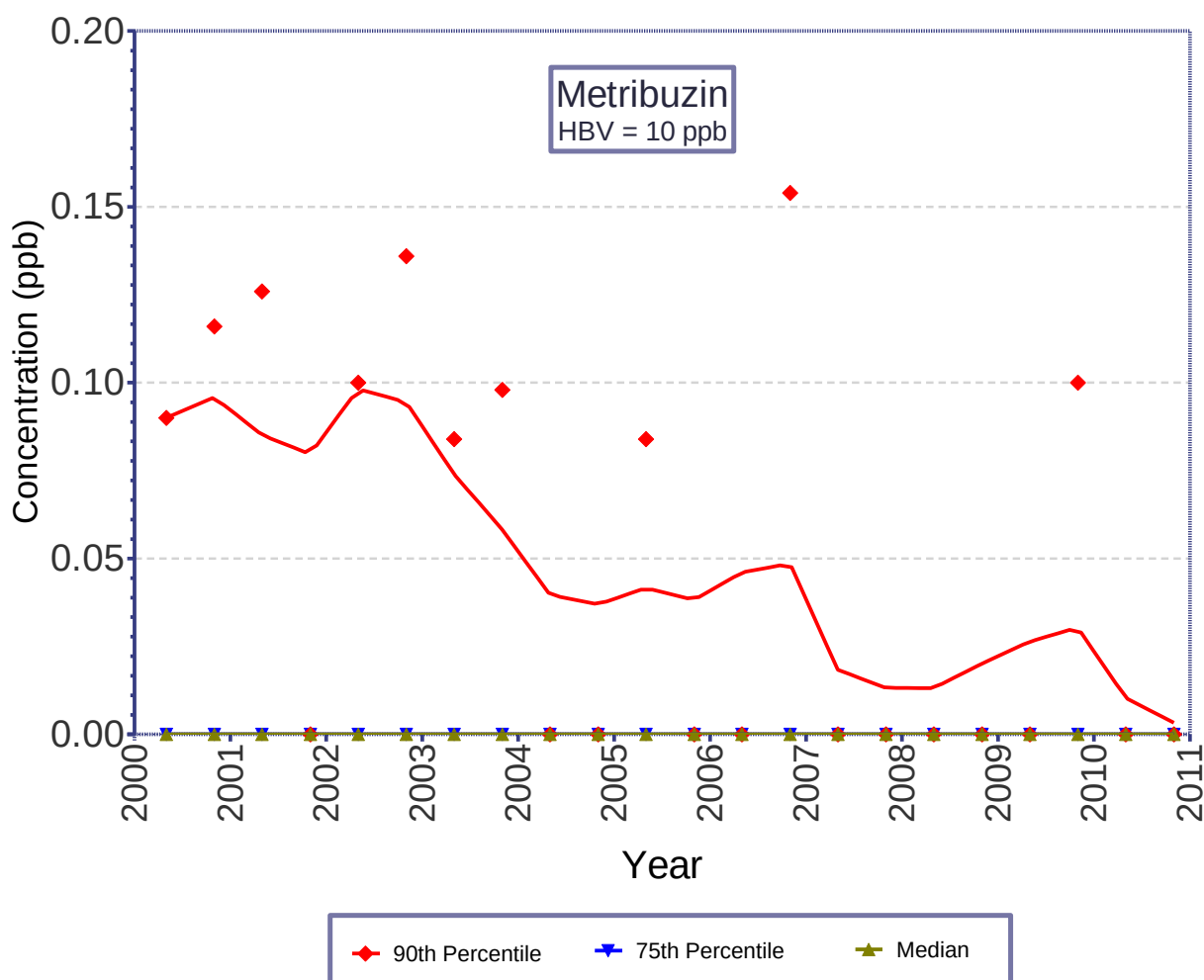


Figure 40. Metribuzin groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

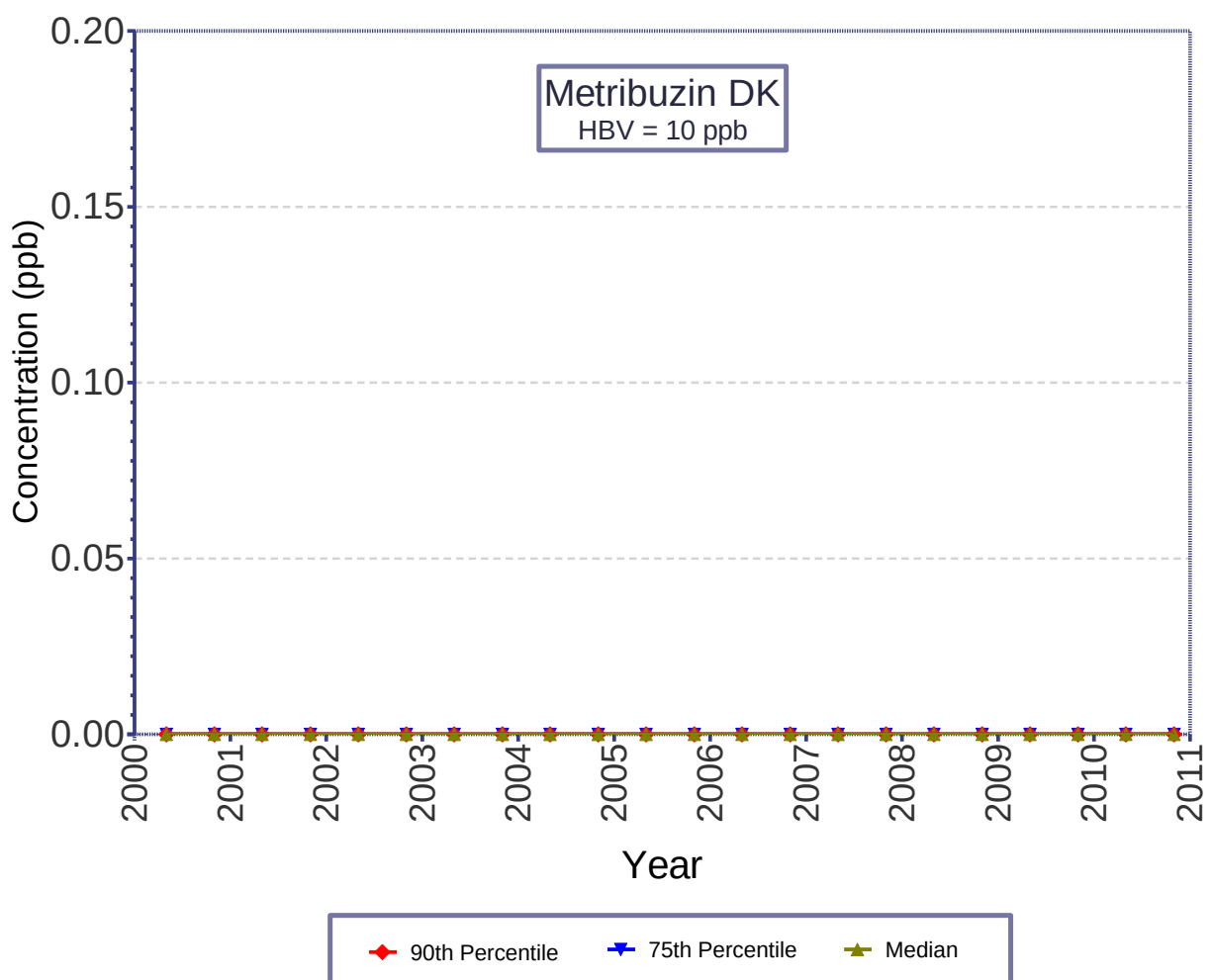


Figure 41. Metribuzin DK degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

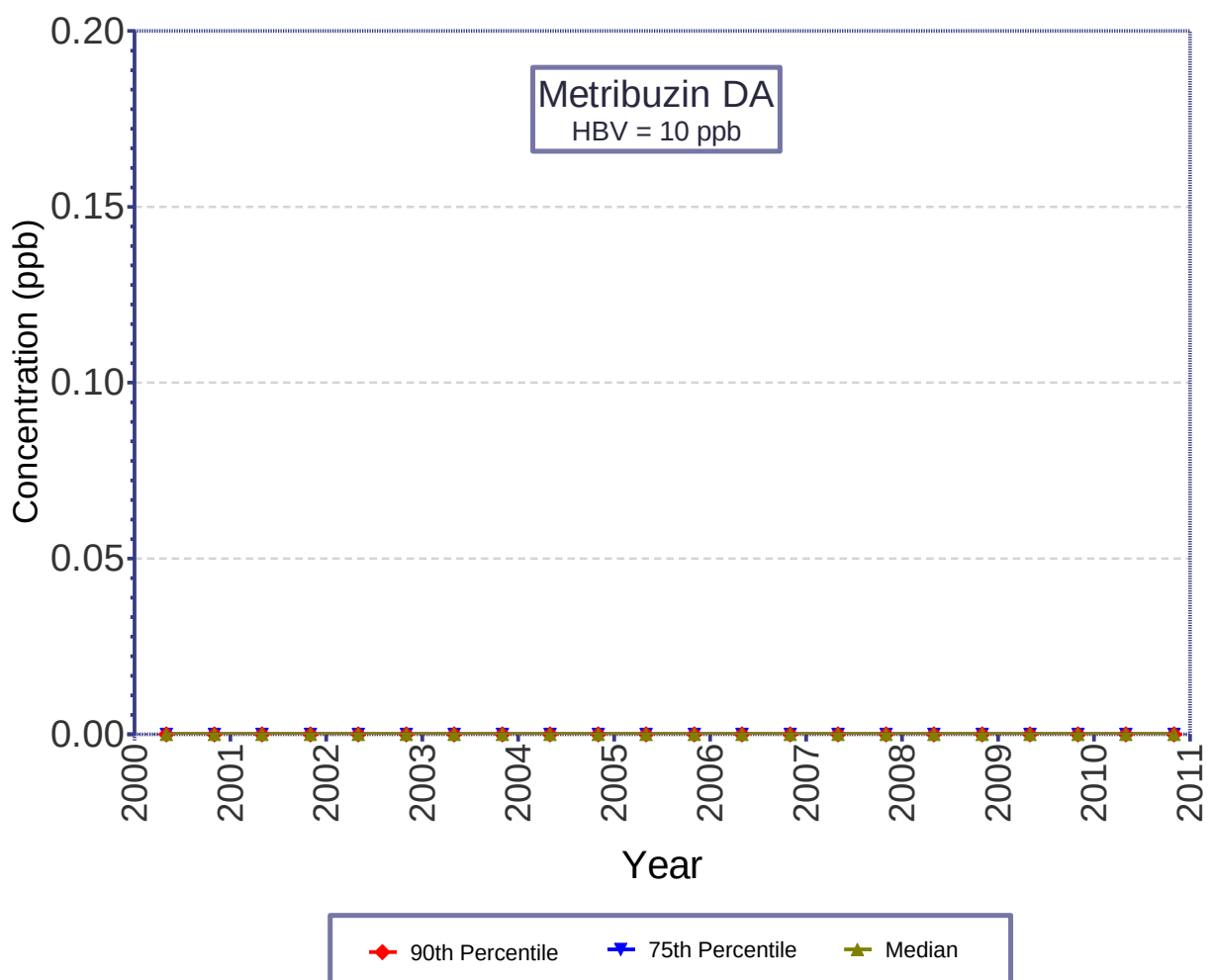


Figure 42. Metribuzin DA degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

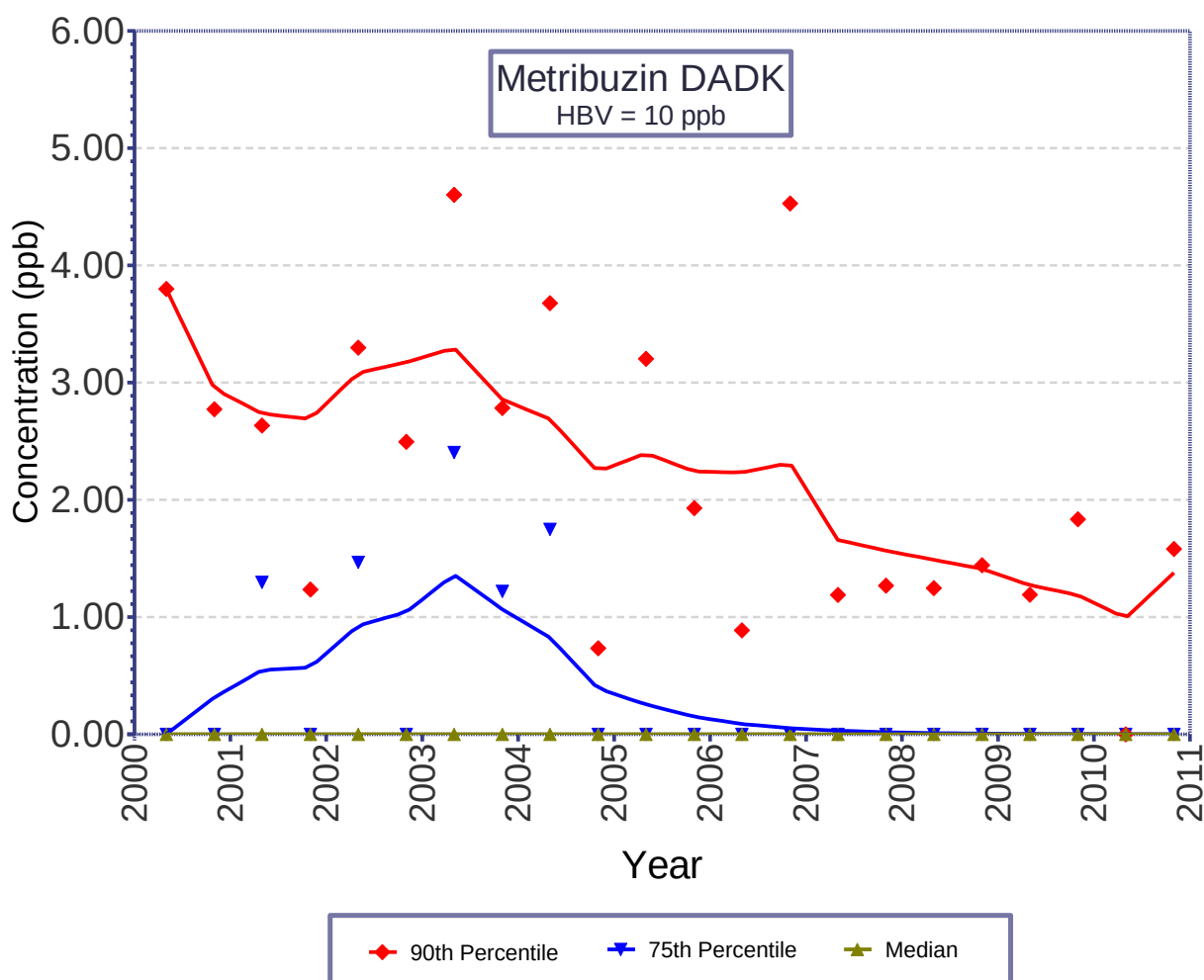


Figure 43. Metribuzin DADK degradate groundwater sample analysis results over time for MDA PMR 4 (please note scale difference on Y- axis between analytes). NOTE: Graphics contain only spring and fall quarter results.

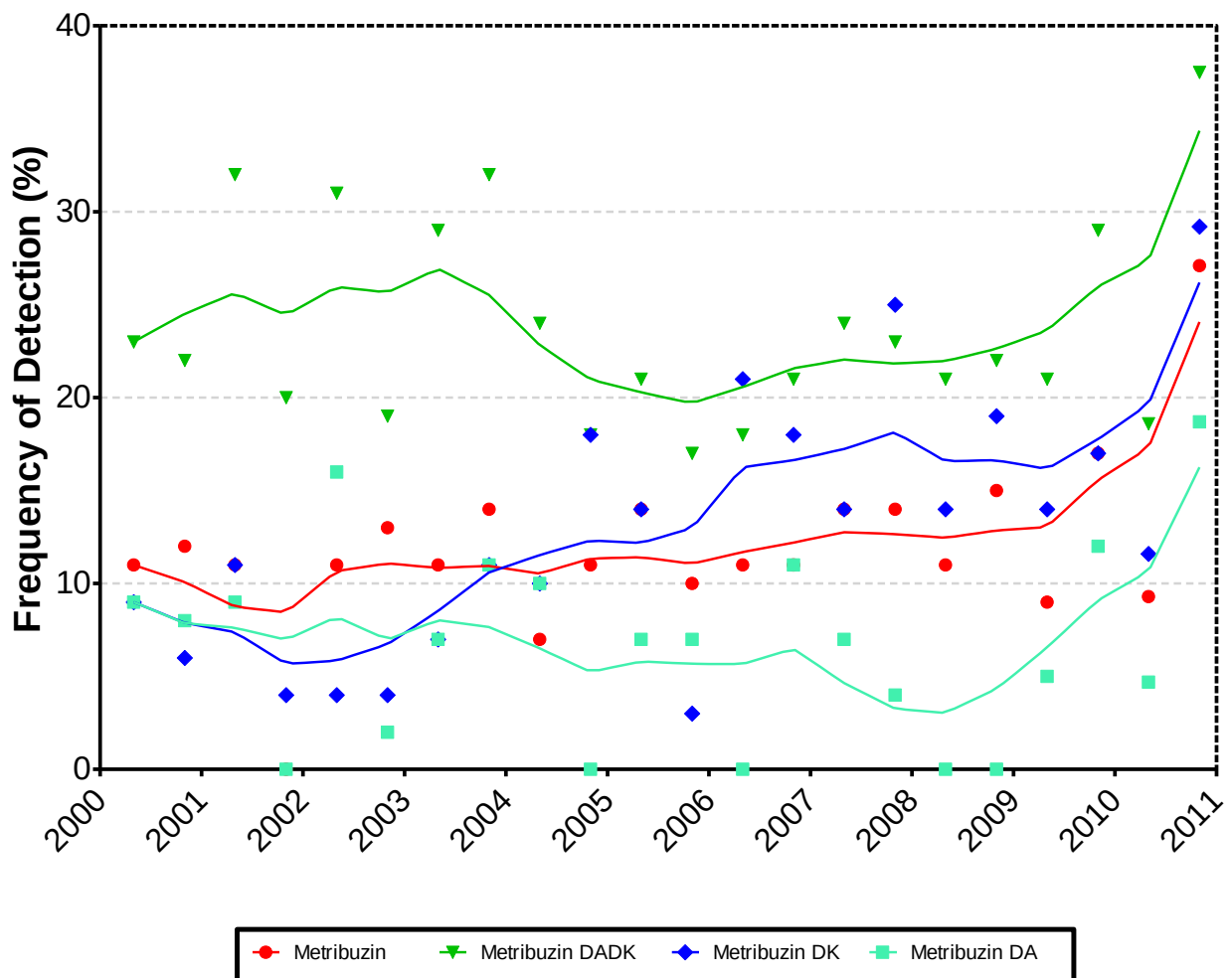


Figure 44. Metribuzin and metribuzin degradate detection frequency over time for MDA groundwater monitoring in PMR 4. NOTE: Graphics contain only spring and fall quarter results.

2.3. Southeast Minnesota residential monitoring

Fourteen wells were selected as part of a long-term effort to monitor residential wells in southeastern Minnesota in 2009. A target group of wells from Fillmore, Goodhue, and Wabasha counties were identified through the use of selection criteria. The selection criteria were as follows:

1. Be completed in the aquifer of interest (first aquifer below the land surface).
2. Have a well owner willing to participate.
3. Lie outside of flood prone areas (so water cannot pond around the well head).
4. Be up-gradient of point sources of agricultural chemicals, or be at least ¼ mile from such sources if the well is down-gradient.
5. Have a readily available and accessible location (not inside a building of any kind) from which to collect the water sample.
6. Have a well log or other construction information available (such as owner reported depth).
7. Be located in areas where the majority land use is agricultural and where row crop agriculture is present on approximately 25 percent or more of the land area.

Sampling was conducted in September of 2010 for nitrate and pesticides analysis. In 2010, another well was sampled in Wabasha County as a reconnaissance effort to see if it should be included in the long-term effort to increase the network to 15. It was discovered that a well log could not be found for the well and further, the owner believed the well to be completed in an aquifer that was deeper than the MDA was interested in. No nitrate or pesticides were detected in this well. Based on this information, it was determined that this well will not be included in future long-term monitoring efforts and, thus, will not be included in the project results summary.

A summary of 2009 and 2010 results from the residential well sampling effort for detected pesticide compounds and nitrate can be found in Table 22. An expanded listing of results can be found in Appendix 3. Of the 14 water samples analyzed in 2010, none were found to have concentrations of compounds above the listed health-based guidance values for pesticides; four samples had nitrate concentrations that were above the listed health-based guidance value. Only desethylatrazine and nitrate were detected in all 14 samples, with median values of 0.03 µg/L and 7.98 mg/L, respectively. These results are nearly identical to what was found in 2009.

Table 22. Nutrient and pesticide data summary from Southeast Minnesota residential sampling in 2009 and 2010.

County	Aquifer	2009 Nitrate-nitrogen (mg/L)	2010 Nitrate-nitrogen (mg/L)	2009 Acetochlor (µg/L)	2010 Acetochlor (µg/L)	2009 Acetochlor ESA (µg/L)	2010 Acetochlor ESA (µg/L)	2009 Acetochlor OXA (µg/L)	2010 Acetochlor OXA (µg/L)	2009 Alachlor (µg/L)	2010 Alachlor (µg/L)	2009 Alachlor ESA (µg/L)	2010 Alachlor ESA (µg/L)	2009 Alachlor OXA (µg/L)	2010 Alachlor OXA (µg/L)
Fillmore	Wapsipinicon	2.35	2.11	nd	nd	0.14	0.1780	nd	nd	nd	nd	0.56	0.6670	nd	nd
Fillmore	Wapsipinicon	7.55	3.83	nd	nd	nd	nd	nd	nd	nd	nd	1.68	0.2210	nd	nd
Fillmore	Galena	10.40	14.10	nd	nd	0.24	0.1100	nd	nd	nd	nd	0.38	0.1930	nd	nd
Fillmore	Galena	5.99	8.48	nd	nd	nd	nd	nd	nd	nd	nd	0.26	nd	nd	nd
Goodhue	Platteville- Glenwood	7.13	8.56	nd	nd	nd	nd	nd	nd	nd	nd	0.82	0.0462	nd	nd
Goodhue	Prairie du Chien	7.39	7.48	nd	nd	0.09	0.1020	nd	nd	nd	nd	1.03	1.050	nd	nd
Goodhue	Prairie du Chien	3.77	3.90	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Wabasha	Eau Claire	3.05	3.26	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Wabasha	Prairie du Chien	9.42	9.36	nd	nd	nd	nd	nd	nd	nd	nd	0.67	0.6700	nd	nd
Wabasha	Prairie du Chien	11.50	12.10	P	P	0.25	0.2000	nd	nd	nd	nd	1.930	2.400	nd	nd
Wabasha	Prairie du Chien	10.80	11.10	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Wabasha	Prairie du Chien- Jordan	4.81	5.61	nd	nd	nd	0.0456	nd	nd	nd	nd	0.16	0.1940	nd	nd
Wabasha	Prairie du Chien- Jordan	6.99	6.68	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.0666	nd	nd
Wabasha	Prairie du Chien- Jordan	11.70	26.10	P	0.19	0.48	2.190	0.12	1.010	nd	P	0.92	1.790	0.11	0.4260
# of detections		14/14	14/14	2/14	2/14	5/14	6/14	1/14	1/14	0/14	1/14	10/14	10/14	1/14	1/14
median value		7.26	7.98	nd	nd	nd	nd	nd	nd	nd	nd	0.47	0.1935	nd	nd

Table 22 continued. Nutrient and pesticide data summary from Southeast Minnesota residential sampling in 2009 and 2010.

County	Aquifer	2009 Atrazine (µg/L)	2010 Atrazine (µg/L)	2009 Deisopropylatrazine (µg/L)	2010 Deisopropylatrazine (µg/L)	2009 Desethylatrazine (µg/L)	2010 Desethylatrazine (µg/L)	2009 DEDI Atrazine (µg/L)	2010 DEDI Atrazine (µg/L)	2009 Hydroxyatrazine (µg/L)	2010 Hydroxyatrazine (µg/L)	2009 Dimethenamid ESA (µg/L)	2010 Dimethenamid ESA (µg/L)
Fillmore	Wapsipinicon	P	nd	nd	nd	P	P	-	nd	-	nd	nd	nd
Fillmore	Wapsipinicon	0.07	nd	nd	nd	0.14	P	-	nd	-	nd	nd	nd
Fillmore	Galena	0.06	0.06	nd	nd	0.12	0.14	-	nd	-	0.0241	nd	0.0133
Fillmore	Galena	P	nd	nd	nd	P	P	-	nd	-	nd	nd	nd
Goodhue	Platteville- Glenwood	P	P	nd	nd	P	0.05	-	nd	-	nd	nd	nd
Goodhue	Prairie du Chien	P	P	P	nd	0.11	0.11	-	0.0650	-	0.0121	nd	nd
Goodhue	Prairie du Chien	P	P	nd	nd	0.05	P	-	nd	-	0.0134	nd	nd
Wabasha	Eau Claire	nd	nd	nd	nd	P	P	-	nd	-	nd	nd	nd
Wabasha	Prairie du Chien	P	P	nd	nd	P	P	-	nd	-	nd	nd	nd
Wabasha	Prairie du Chien	0.07	0.08	P	nd	0.10	0.13	-	0.0650	-	0.0074	nd	nd
Wabasha	Prairie du Chien	P	nd	nd	nd	P	P	-	nd	-	nd	nd	nd
Wabasha	Prairie du Chien- Jordan	0.12	0.1	P	nd	0.18	0.18	-	0.1400	-	0.0087	nd	nd
Wabasha	Prairie du Chien- Jordan	0.14	0.1	nd	P	0.15	0.16	-	0.0650	-	0.0147	nd	nd
Wabasha	Prairie du Chien- Jordan	0.14	0.14	P	0.3	0.50	1.54	-	0.3050	-	0.0436	nd	0.0232
# of detections		13/14	9/14	4/14	2/14	14/14	14/14	-	5/14	-	7/14	0/14	2/14
median value		P	P	nd	nd	0.08	0.03	-	nd	-	0.0037	nd	nd

Table 22 continued. Nutrient and pesticide data summary from Southeast Minnesota residential sampling in 2009 and 2010.

County	Aquifer	2009 Metolachlor (µg/L)	2010 Metolachlor (µg/L)	2009 Metolachlor ESA (µg/L)	2010 Metolachlor ESA (µg/L)	2009 Metolachlor OXA (µg/L)	2010 Metolachlor OXA (µg/L)	2009 Bentazon (µg/L)	2010 Bentazon (µg/L)	2009 Propachlor ESA (µg/L)	2010 Propachlor ESA (µg/L)	2009 Imazethapyr (µg/L)	2010 Imazethapyr (µg/L)
Fillmore	Wapsipinicon	nd	nd	0.13	0.1590	nd	nd	-	0.0043	-	nd	-	nd
Fillmore	Wapsipinicon	nd	nd	1.47	0.2270	nd	0.0161	-	nd	-	0.0627	-	nd
Fillmore	Galena	nd	P	3.63	4.550	0.59	1.070	-	nd	-	nd	-	0.0697
Fillmore	Galena	nd	nd	0.69	0.3560	nd	nd	-	nd	-	nd	-	nd
Goodhue	Platteville- Glenwood	nd	nd	0.47	0.1500	nd	nd	-	nd	-	nd	-	nd
Goodhue	Prairie du Chien	nd	nd	0.64	0.5400	nd	nd	-	0.0109	-	nd	-	nd
Goodhue	Prairie du Chien	nd	nd	nd	0.0165	nd	nd	-	nd	-	nd	-	nd
Wabasha	Eau Claire	nd	nd	nd	0.0390	nd	nd	-	nd	-	nd	-	nd
Wabasha	Prairie du Chien	nd	nd	0.39	0.4120	nd	0.0516	-	nd	-	nd	-	nd
Wabasha	Prairie du Chien	nd	nd	1.53	1.750	0.15	0.0891	-	0.0070	-	nd	-	nd
Wabasha	Prairie du Chien	nd	nd	nd	nd	nd	nd	-	nd	-	nd	-	nd
Wabasha	Prairie du Chien- Jordan	nd	nd	0.56	0.4240	nd	nd	-	nd	-	nd	-	nd
Wabasha	Prairie du Chien- Jordan	nd	nd	0.45	0.3670	nd	nd	-	nd	-	nd	-	nd
Wabasha	Prairie du Chien- Jordan	P	P	0.70	1.040	0.15	0.3980	-	2.840	-	nd	-	nd
# of detections		1/14	2/14	11/14	13/14	3/14	5/14	-	4/14	-	1/14	-	1/14
median value		nd	nd	0.52	0.3615	nd	nd	-	nd	-	nd	-	nd

2.4. Installation and monitoring of deeper wells

The MDA groundwater monitoring program installed eight new wells in PMR 4 in 2010 (Figure 45). New PMR 4 wells were installed at existing sites, at depths between 10 and 15 feet deeper into the aquifer than previously installed wells at the sites. The shallowest wells at each site are screened across the water table, while the screens of the deeper wells should be below the water table. The new, deeper wells were distributed across PMR 4 at sites that had previously shown higher pesticide levels. The purpose of monitoring the new, deeper wells is to determine whether pesticides are impacting a larger portion of the aquifer than wells completed at the water table would indicate. These sites will be sampled twice each year during the normal sampling rounds, which are in May and November. One sample from the shallowest well and one from the deepest well are to be collected during each sample visit. The installation of the new, deeper wells was completed in May and June 2010 with the first samples being collected during the November 2010 sampling round.

Results from this first round of sampling are located in Table 23. The initial hypothesis of the investigation was that the deeper wells would have significantly lower pesticide concentrations than the shallowest well at each site. As can be seen in Figures 46 and 47, this is not always the case. In some instances pesticide levels were higher in the deeper well than in the shallowest well. Overall, however, the general tendency was for concentrations in the deeper wells to be less than in the shallower wells. MDA will continue to monitor the deep wells in an effort to assess the long-term fate of pesticides in these aquifers.

In an effort to provide additional data to help understand the water quality results from these deep well/shallow well sites, the program has installed automatic water level recorders into the deeper wells. There was not enough water level data collected in 2010 to be reported. This is expected to change in future years as more data becomes available.

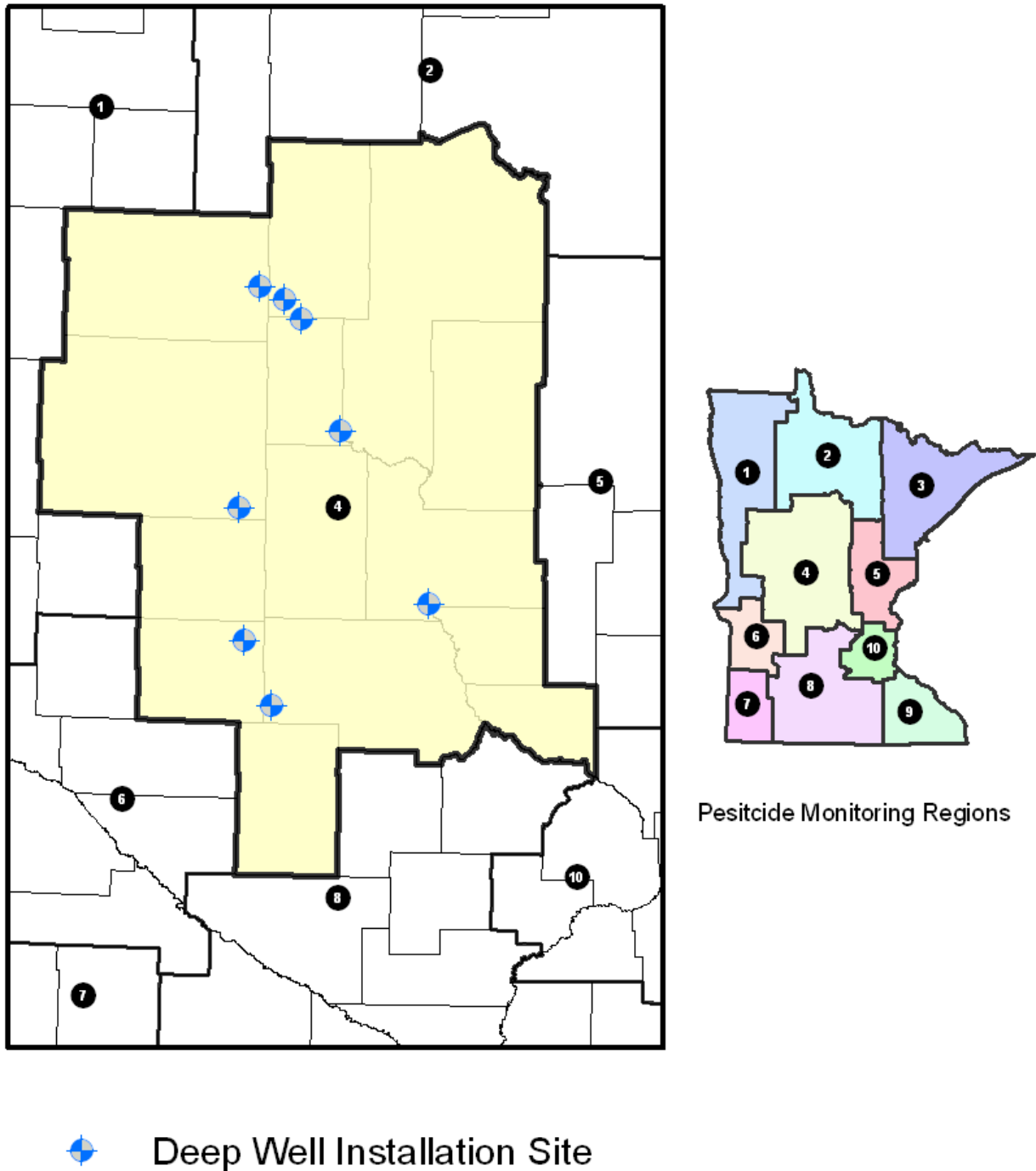


Figure 45. Location of deeper wells within MDA's groundwater monitoring network.

Table 23. Pesticide results summary from wells at the shallow and deep well nests in MDA PMR 4 (Results in parts per billion).

Site	Well Type	Acetochlor ESA	Alachlor ESA	Alachlor OXA	Atrazine	Bentazon	Deisopropylatrazine	Desethylatrazine	Dimethenamid ESA	Dimethenamid OXA	Imazamox	Imidacloprid	Metaxyl	Metolachlor	Metolachlor ESA	Metolachlor OXA	Metribuzin	Metribuzin DA	Metribuzin DADK	Metribuzin DK	Thiamethoxam
03K4	Deep	0	0.0903	0	0.05	0.302	0	0.08	0.0715	0.0296	0.0391	0.0252	0.0208	0	0.283	0.0872	P	P	1.04	P	0
	Shallow	0	0.104	0	0	0.0263	0	P	0	0	0	0	0	0	0.144	0.0301	0	0	0	0	0
29A8	Deep	0	0.409	0	P	0.988	0	0.06	0.0809	0.0874	0.0515	0	0.054	P	4.56	1.59	P	P	2.33	P	0
	Shallow	0	0.0566	0	P	0.144	0	0.05	0.102	0.112	0	0.0326	0.0236	P	0.884	0.461	P	0	1.54	P	0.0322
80B1	Deep	0	0.95	0.443	0	15.5	0	P	3.6	1.59	0.327	0.202	0	0	1.66	0.948	P	0	1.43	P	0
	Shallow	0	0.839	0.321	0.12	0.228	0	0.1	0.873	1.13	0.0227	1.36	0.558	P	1.57	1.19	1.1	P	2.21	P	0
80E8	Deep	0	0.0428	0	0	0	0	P	0	0	0	0.167	0	0.37	24.3	12.6	0.45	P	2.68	P	0.379
	Shallow	0	0	0	0	0	0	0	0	0	0	0	0	0	1.71	0.884	0	P	1.1	0	0
73A6	Deep	0	0.874	0	P	0.0134	0	0.08	0.0558	0	0	0	0	0	5.78	0.522	0	P	P	0	0
	Shallow	0	0	0	0	0	0	0.05	0	0	0	0	0	0	0.818	0.0107	0	0	P	0	0
61G2	Deep	0.127	0.0636	0	P	0	P	0.09	0	0	0	0	0	0	4.68	0.0715	P	0	P	P	0
	Shallow	0.164	0.214	0	P	0	P	0.08	0	0	0	0	0	0	6.65	0.191	P	0	P	P	0
56J10	Deep	0.86	0.459	0	P	0	0	0.09	0	0	0.0452	0	0	0	16	3.15	0	0	0	0	0
	Shallow	2.53	1.12	0	P	0	0	0.1	0	0	0.0192	0	0	0	10.6	2.01	0	0	0	0	0
49D9	Deep	0.703	0.347	0	0.07	0.0023	0	0.1	0	0	0.0168	0.0234	0.0212	P	1.14	0.021	P	P	P	0	0
	Shallow	0.251	1.66	0	0	0	0	0	0	0	0	0	0.185	0	5.4	1.11	0	0	0	0	0.0278

Figure 46. Difference in concentration between deep and shallow wells for degradates of the chloroacetanilide pesticides.

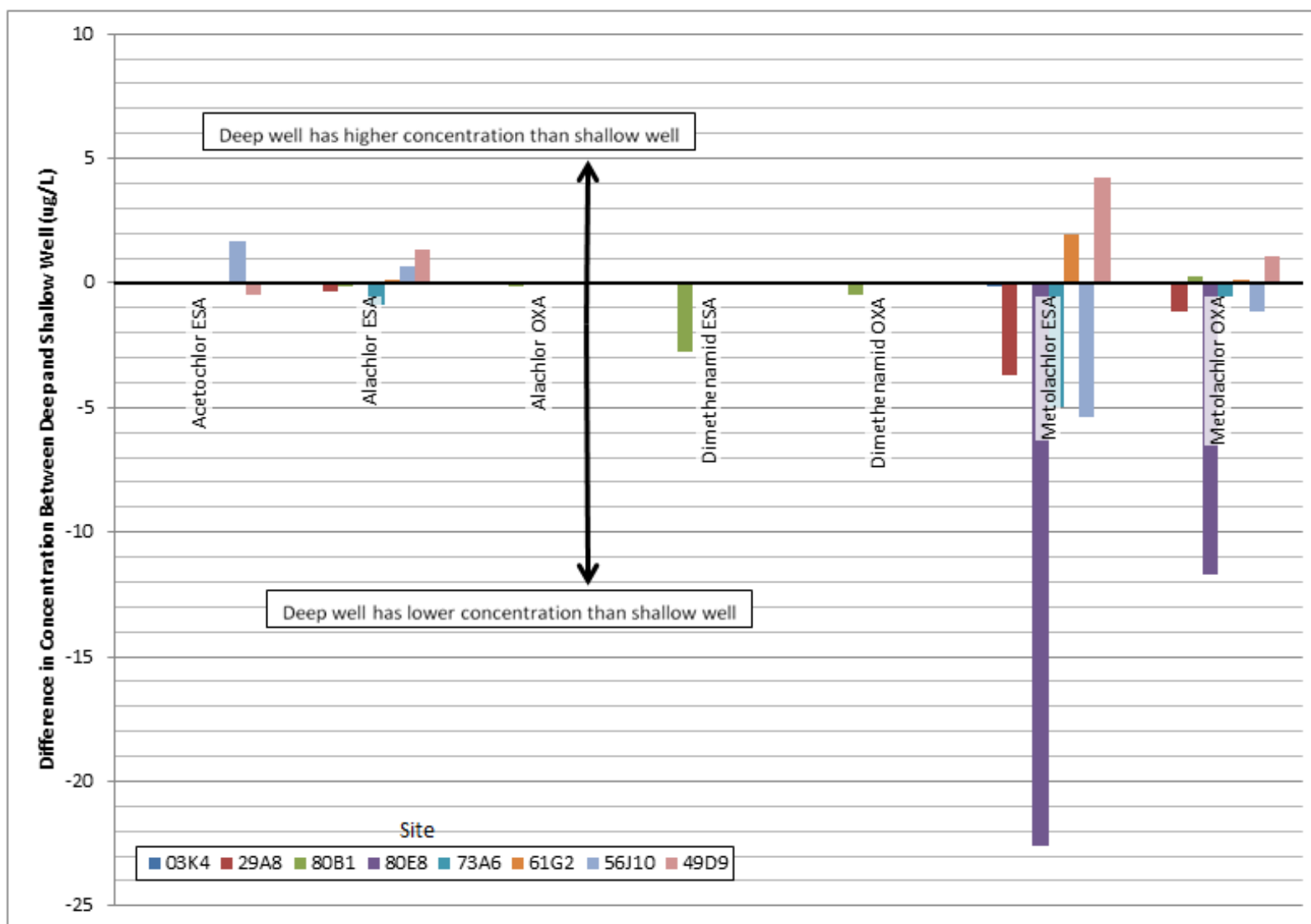
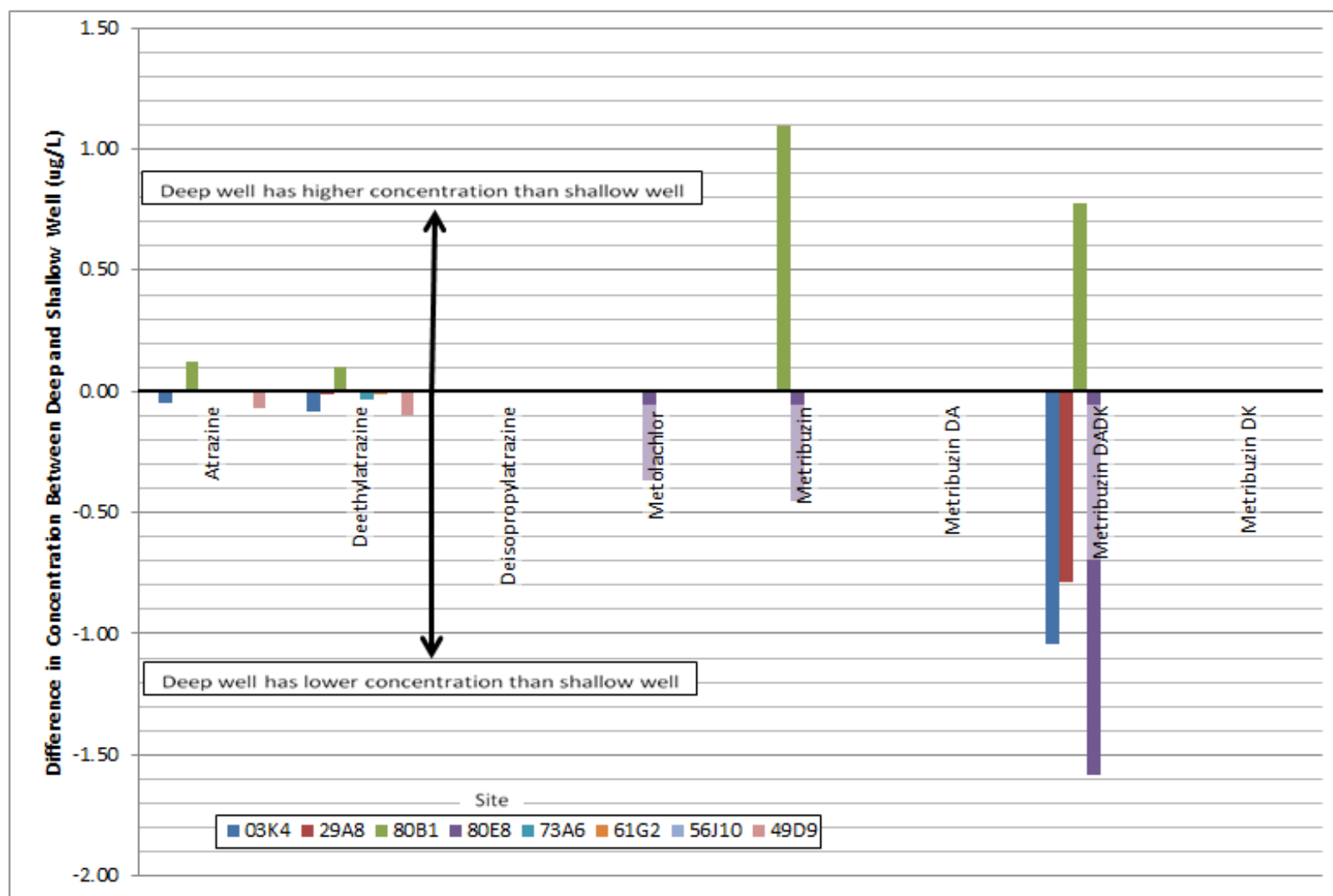


Figure 47. Difference in concentration between deep and shallow wells for several pesticide analytes.



SECTION 3: SURFACE WATER MONITORING RESULTS

3.1. 2010 sampling season summary

In 2006, the MDA began monitoring surface water utilizing the tiered structure defined and described in the MDA Surface Water Monitoring Design Document (www.mda.state.mn.us/monitoring). Within the tiered structure, there are three different levels (tiers) of monitoring intensity. Tier 1 site locations are distributed throughout most of the agricultural areas of the state and are sampled four times during an eight week period from May 1st through June 30th. The objective is to provide a general assessment of water quality during peak pesticide detection periods from watersheds throughout the state. At Tier 2 and 3 site locations, the frequency of sampling increases to provide better information for duration assessment or the length of time pesticide concentrations remain at a particular level. For purposes of discussion in the following sections, a pesticide sample is defined as the collection of either a GC-MS or a LC-MS/MS sample which together include analysis for up to 110 pesticide related chemicals. In some instances, both GC-MS and LC-MS/MS samples are collected during a visit to a site. This would result in the collection of two pesticide samples.

Change in methods

As indicated previously in the report (Section 1.3.1 and Section 2.2), there has been a change in analytical method reporting units. This can cause confusion about the analytical results unless these are properly noted. Unlike in Section 2, where all results are shown in micrograms per Liter (µg/L) or parts per billion, Section 3 presents chemicals analyzed by the LC-MS/MS method as they are reported from the laboratory in nanograms per Liter (ng/L) or parts per trillion. Each table with results from the LC-MS/MS indicates the appropriate units. All surface water data presented for multiple years or trend type analysis is presented in consistent micrograms per Liter (µg/L) or parts per billion.

To provide better context to the results from the new method, a new table has been created in both the groundwater (Table 9) and the surface water section (Table 24). These tables indicate the maximum concentration of all compounds analyzed by GC-MS, LC-MS/MS or ELISA during the 2010 season along with the appropriate units. Surface water reference values are also indicated. Please refer back to Table 7 for complete reference information for surface water.

Table 24. 2010 surface water maximum detections for all pesticide analytes along with reference values.

		Surface Water Reference Values as of February 2011 (µg/L)					
		MPCA				USEPA/OPP Aquatic Life Benchmark ²	
		Chronic Standards ³				Acute Value	Chronic Value
Pesticide Analyte	Maximum detection (µg/L)	Class 2A ⁵	Class 2Bd ⁶	Class 2B,C,D ⁷	Maximum Standard ⁴		
2,4,5-T	nd	—	—	—	—	—	—
2,4,5-TP	nd	50 H	50 H	—	—	—	—
2,4-D	5.27	70 H	70 H	—	—	299.2 (v)	14,200 (f)
2,4-DB	nd	—	—	—	—	1,000 (f)	932 (n)
Acetamiprid	nd	—	—	—	—	—	—
Acetochlor	2.8	3.6 T	3.6 T	3.6 T	86 T	na	na
Acetochlor ESA	4.41	—	—	—	—	> 62,500 (i)	9,900 (n)
Acetochlor OXA	4.63	—	—	—	—	—	—
Alachlor	P	3.8 H; 59 T	4.2 H; 59 T	59 T	800 T	na	na
Alachlor ESA	1.34	—	—	—	—	52,000 (f)(i)	—
Alachlor OXA	0.208	—	—	—	—	47,500 (i)	—
Aldicarb Sulfone	nd	2 H	2 H	—	—	140 (i)	—
Aldicarb Sulfoxide	nd	4H	4 H	—	—	21.5 (i)	—
Atrazine	2.18	3.4 H; 10 T	3.4 H; 10 T	10 T	323 T	na	na
Deisopropylatrazine	P	—	—	—	—	8,500 (f)	2,500 (n)
Desethylatrazine	0.21	—	—	—	—	—	1,000 (n)
DEDI Atrazine	0.18	—	—	—	—	> 50,000 (f)(i)	—
Hydroxyatrazine	0.636	—	—	—	—	> 1,500 (f)	> 10,000 (n)
Azoxystrobin	0.347	—	—	—	—	130 (i)	44 (i)
Bensulfuron-methyl	nd	—	—	—	—	—	—
Bentazon	1.22	—	—	—	—	> 50,000 (f)(i)	4,500 (n)
Boscalid	P	—	—	—	—	1,350(f)	116 (f)
Bromacil	14	—	—	—	—	18,000 (f)	6.8 (n)
Carbaryl	nd	—	—	—	—	0.85 (i)	0.5 (i)
Carbofuran	nd	40 H	40 H	—	—	1.12 (i)	0.75 (i)
Chlorimuron-ethyl	nd	—	—	—	—	—	—
Chlorothalonil	nd	—	—	—	—	1.8 (i)	0.6 (i)
Chlorpyrifos	0.24	0.041 T	0.041 T	0.041 T	0.083 T	na	na
Clomazone	nd	—	—	—	—	1,450 (f)	167 (n)
Clopyralid	0.15	—	—	—	—	56,000 (i)	—
Cyanazine	nd	—	—	—	—	—	—
Cyfluthrin	nd	—	—	—	—	0.0125 (i)	0.007 (i)
Diazinon	nd	—	—	—	—	0.11 (i)	0.17 (i)
Dicamba	0.467	—	—	—	—	14,000 (f)	61 (n)
Dichlorprop	nd	—	—	—	—	—	—

Table 24 continued. 2010 surface water maximum detections for all pesticide analytes along with reference values.

		Surface Water Reference Values as of February 2011 (µg/L)					
		MPCA				USEPA/OPP Aquatic Life Benchmark ²	
		Chronic Standards ³				Acute Value	Chronic Value
Pesticide Analyte	Maximum detection (µg/L)	Class 2A ⁵	Class 2Bd ⁶	Class 2B,C,D ⁷	Maximum Standard ⁴		
Dimethenamid	1.46	—	—	—	—	3,150 (f)	5.1 (v)
Dimethenamid ESA	0.236	—	—	—	—	—	—
Dimethenamid OXA	0.246	—	—	—	—	—	—
Dimethoate	P	—	—	—	—	21.5 (i)	0.5 (i)
Disulfoton	nd	—	—	—	—	1.95 (i)	0.01 (i)
Disulfoton Sulfone	nd	—	—	—	—	17.5 (i)	0.14 (i)
Diuron	1.22	—	—	—	—	80 (i)	2.4 (n)
EPTC	P	—	—	—	—	3,245 (i)	810 (i)
Esfenvalerate	nd	—	—	—	—	0.025 (i)	0.017 (i)
Ethalfuralin	P	—	—	—	—	16 (f)	0.4 (f)
Flufenacet OXA	nd	—	—	—	—	—	—
Fonofos	nd	—	—	—	—	—	—
Halosulfuron-methyl	nd	—	—	—	—	—	—
Hexazinone	nd	—	—	—	—	75,800 (i)	7 (n)
Imazamethabenz-methyl	nd	—	—	—	—	—	—
Imazamethabenz Acid	0.0175	—	—	—	—	>50,000 (f)(i)	—
Imazamox	0.0463	—	—	—	—	> 59,500 (f)	11 (v)
Imazapic	0.301	—	—	—	—	> 49,350 (f)	4.23 (v)
Imazapyr	0.1	—	—	—	—	50,000 (i)	18 (v)
Imazaquin	nd	—	—	—	—	—	—
Imazethapyr	0.169	—	—	—	—	> 55,000 (f)	8.10 (v)
Imidacloprid	0.0957	—	—	—	—	35 (i)	1.05 (i)
Isoxaflutole	nd	—	—	—	—	> 750 (i)	4.9 (v)
Isoxaflutole DKN	nd	—	—	—	—	> 15,300 (f)	75 (v)
lambda Cyhalothrin	nd	—	—	—	—	0.0035 (i)	0.002 (i)
Linuron	nd	—	—	—	—	60 (i)	0.09 (i)
Malathion	nd	—	—	—	—	0.3 (i)	0.035 (i)
MCPA	0.488	—	—	—	—	90 (i)	130 (v)
MCPB	nd	—	—	—	—	1,950 (v)	210 (v)
MCPP	0.571	—	—	—	—	45,500 (i)	14 (n)
Mesotrione	0.165	—	—	—	—	> 57,000 (f)	6.70 (v)
Metalaxyl	0.0158	—	—	—	—	14,000 (i)	100 (i)
Metolachlor	3.96	23 T	23 T	23 T	271 T	na	na
Metolachlor ESA	4.15	—	—	—	—	24,000 (f)	> 95,100 (v)
Metolachlor OXA	1.34	—	—	—	—	7,700 (i)	57,100 (n)
Metribuzin	P	—	—	—	—	2,100 (i)	8.7 (n)
Metribuzin DA	nd	—	—	—	—	—	—

Table 24 continued. 2010 surface water maximum detections for all pesticide analytes along with reference values.

		Surface Water Reference Values as of February 2011 (µg/L)					
		MPCA				USEPA/OPP Aquatic Life Benchmark ²	
		Chronic Standards ³				Acute Value	Chronic Value
Pesticide Analyte	Maximum detection (µg/L)	Class 2A ⁵	Class 2Bd ⁶	Class 2B,C,D ⁷	Maximum Standard ⁴		
Metribuzin DADK	P	—	—	—	—	—	—
Metribuzin DK	nd	—	—	—	—	—	—
Metsulfuron-methyl	1.02	—	—	—	—	> 75,000 (f)(i)	0.36 (v)
Myclobutanil	nd	—	—	—	—	1,200 (f)	830 (v)
Neburon	nd	—	—	—	—	—	—
Nicosulfuron	nd	—	—	—	—	—	—
Norflurazon	nd	—	—	—	—	4,050 (f)	9.7 (v)
Oxadiazon	nd	—	—	—	—	440 (f)	0.88 (f)
Parathion-methyl	nd	—	—	—	—	0.49 (i)	0.25 (i)
Pendimethalin	nd	—	—	—	—	69 (f)	5.2 (n)
Phorate	nd	—	—	—	—	0.3 (i)	0.21 (i)
Picloram	3.14	500 H	500 H	—	—	6,500 (v)	550 (f)
Prometon	3.35	—	—	—	—	6,000 (f)	98 (n)
Prometryn	nd	—	—	—	—	1,450 (f)	1 (v)
Propachlor	nd	—	—	—	—	85 (f)	13.5 (v)
Propachlor ESA	nd	—	—	—	—	—	—
Propachlor OXA	nd	—	—	—	—	—	—
Propazine	P	—	—	—	—	2,660 (i)	25 (n)
Propiconazole	0.22	—	—	—	—	425 (f)	93 (n)
Propoxur	nd	—	—	—	—	5.5 (i)	—
Pyraclostrobin	nd	—	—	—	—	—	—
Saflufenacil	0.0321	—	—	—	—	> 49,000 (f)(i)	42 (n)
Siduron	0.0265	—	—	—	—	4,050 (f)	6 (i)
Simazine	0.37	4 H	4 H	—	—	500 (i)	36 (n)
Sulfometuron-methyl	3.4	—	—	—	—	> 6,250 (f)(i)	0.48 (v)
Tebuconazole	1.78	—	—	—	—	1,440 (i)	12 (f)
Tebupirimphos	0.1	—	—	—	—	0.039 (i)	0.011 (i)
Tembotrione	0.0775	—	—	—	—	915 (f)	310 (n)
Terbufos	nd	—	—	—	—	0.1 (i)	0.03 (i)
Tetraconazole	0.31	—	—	—	—	1,440 (i)	12 (f)
Thiamethoxam	0.13	—	—	—	—	> 50,000 (f)	20,000 (f)
Thifensulfuron-methyl	nd	—	—	—	—	—	—
Thiobencarb	nd	—	—	—	—	50 (i)	1 (i)
Triallate	nd	—	—	—	—	45.5 (i)	13 (i)
Triasulfuron	nd	—	—	—	—	> 50,000 (f)(i)	68,600 (f)
Triclopyr	0.828	—	—	—	—	180 (f)	100 (n)
Trifluralin	nd	—	—	—	—	20.5 (f)	1.14 (f)

Table 24 continued. 2010 surface water maximum detections for all pesticide analytes along with reference values.

		Surface Water Reference Values as of February 2011 (µg/L)					
		MPCA				USEPA/OPP Aquatic Life Benchmark ²	
		Chronic Standards ³				Acute Value	Chronic Value
Pesticide Analyte	Maximum detection (µg/L)	Class 2A ⁵	Class 2Bd ⁶	Class 2B,C,D ⁷	Maximum Standard ⁴		
zeta-Cypermethrin	nd	—	—	—	—	—	—
Non target analytes							
Dichlobenil	0.1	—	—	—	—	1,850 (i)	30 (v)
Ethofumesate	1.54	—	—	—	—	250 (f)	250 (i)
Non MDA Laboratory Analytes							
Acetochlor ELISA	2.45	3.6 T	3.6 T	3.6 T	86 T	na	na
DACT ELISA	0.17	—	—	—	—	> 50,000 (f)(i)	—
Glyphosate MON	15.04	700 H	700 H	—	—	21,500 (f)	1,800 (f)
Glyphosate ELISA	5.50	700 H	700 H	—	—	21,500 (f)	1,800 (f)

During the 2010 monitoring season 252 pesticide samples were collected at the Tier 1 level, 88 samples collected at the Tier 2 level and 268 samples collected at the Tier 3 level. With the exception of two locations in northern Minnesota, all of the “Tiered” sampling occurred in either urban or agricultural watersheds. MDA also coordinated the collection of 21 pesticide samples from three urban streams as a special project to begin monitoring for the presence of insecticides that may be related to the control of emerald ash borer (EAB). In a cooperative effort with the MPCA, Environmental Monitoring and Assessment Program (EMAP) pesticide samples were collected from a randomly selected group of approximately 100 streams from the agricultural areas of the state. This sampling occurred somewhat later in the year and generally at lower flow conditions. The MPCA also collected pesticide samples from other streams that had identified biological impairments as part of a stressor identification effort (STID). Between the EMAP and STID efforts, approximately 296 additional pesticide samples were collected from across the state. Pesticide samples were also collected by MPCA from 21 different lakes across the state totaling 44 pesticide samples. Precipitation monitoring also occurred at two different locations in the state resulting in 20 pesticide samples collected.

None of the 616 pesticide samples collected from rivers, streams and lakes in 2010 were measured at concentrations greater than the established aquatic life standards for acetochlor, atrazine and metolachlor. Acetochlor and atrazine are the two pesticides that have been identified by the MDA Commissioner as “pesticides of concern” for surface water. Only one sample exceeded 50 percent of the acetochlor aquatic life standard (3.6 µg/L). It occurred in a grab sample collected from Seven Mile Creek, a Tier 3 site, on June 1, 2010, with a measured concentration of 2.8 µg/L.

Chlorpyrifos (an organophosphate insecticide), however, was detected at five stream locations in 2010 at concentration levels above the MPCA’s chronic aquatic life standard (0.041 µg/L).

Three of these chlorpyrifos detections occurred in PMR 1 in tributaries to the Red River of the North. Of the chlorpyrifos detections that occurred in 2010, two were above the maximum standard (0.083 µg/L). One of these locations was an EMAP site located on the Black River in PMR 1 with a measured grab sample concentration of 0.11 µg/L. The other was a Tier 3 site in PMR 8 (Seven Mile Creek) with a measured grab sample concentration of 0.24 µg/L. Chlorpyrifos detections prior to 2010 were listed only as “present,” indicating concentrations below the method reporting limit (MRL) of 0.04 µg/L and therefore below the chronic standard.

Chlorpyrifos was not detected in precipitation samples in 2010, after being detected for two consecutive years at the Little Cobb River precipitation site. Chlorpyrifos was also not detected at the Buffalo River Tier 3 (PMR 1) site after being detected at low levels for the previous four years. The Buffalo River was elevated to a Tier 3 site in 2009 in response to continued low level chlorpyrifos detections.

In addition to the detections mentioned above, there were also detections of another organophosphate insecticide (tebupirimphos) in Seven Mile Creek above chronic and acute reference values. There were also three herbicide compounds (bromacil, metsulfuron-methyl and sulfometuron-methyl) detected at concentrations above reference values in Hidden Falls Creek, an urban stream in St. Paul.

A summary of all MDA Tier 1 and Tier 2 surface water monitoring site names and physical characteristics are provided in Appendix 5. A summary of the water quality results can be found in Appendix 6, which is available on the MAU’s website (www.mda.state.mn.us/monitoring). MDA and STORET ID numbers for current and historic stream monitoring locations are found in Appendix 7.

3.2. Surface water Tier 1 and 2 sampling

From May through June 2010 (mid-May through mid-August for Urban Tier locations), the MDA coordinated sampling from 55 surface water sites. The goal of this effort was to evaluate the presence of commonly used pesticides in the rivers and streams draining agricultural and urban areas of the state. The sampling protocol was generally consistent with the historic sampling conducted by MDA (2006 – 2009). At least four sites were sampled from each PMR at the Tier 1 and Tier 2 levels, except PMRs 2 and 3 which had limited pesticide samples collected from rivers and streams due to the low amount of overall pesticide use in those areas. Many of the sites sampled at the Tier 1 and Tier 2 level were sampled by cooperators and have been sampled over several years. Returning to the same location allows for the expression of climatic and pesticide use variability that may not be apparent in single year. Additional information regarding specific locations can be found in the MDA 2010 Surface Water Quality Monitoring Work Plan (www.mda.state.mn.us/monitoring).

3.2.1. 2010 Tier 1 and 2 results

Samples were collected at the Tier 1 and Tier 2 level from the 55 locations shown on Figures 48 and 49. During the 2010 season, 252 samples were collected from the Tier 1 sites and 88 samples were collected from the Tier 2 sites. The main objective was to collect grab samples from each stream during major storm events once in each of the four two-week periods beginning on May 1 and ending on June 30. If no storm events were anticipated during a given

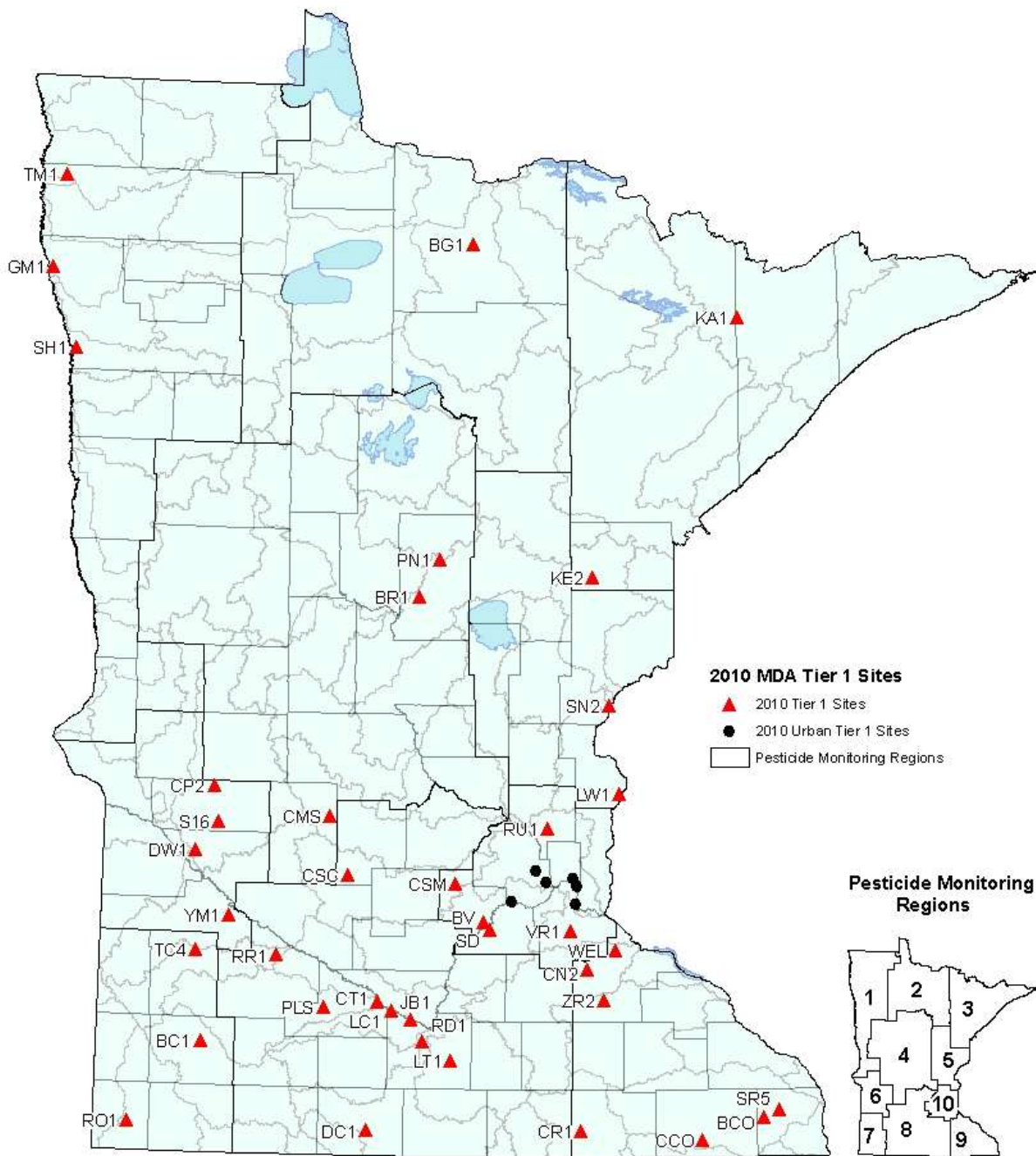


Figure 48. Tier 1 2010 surface water sampling locations.

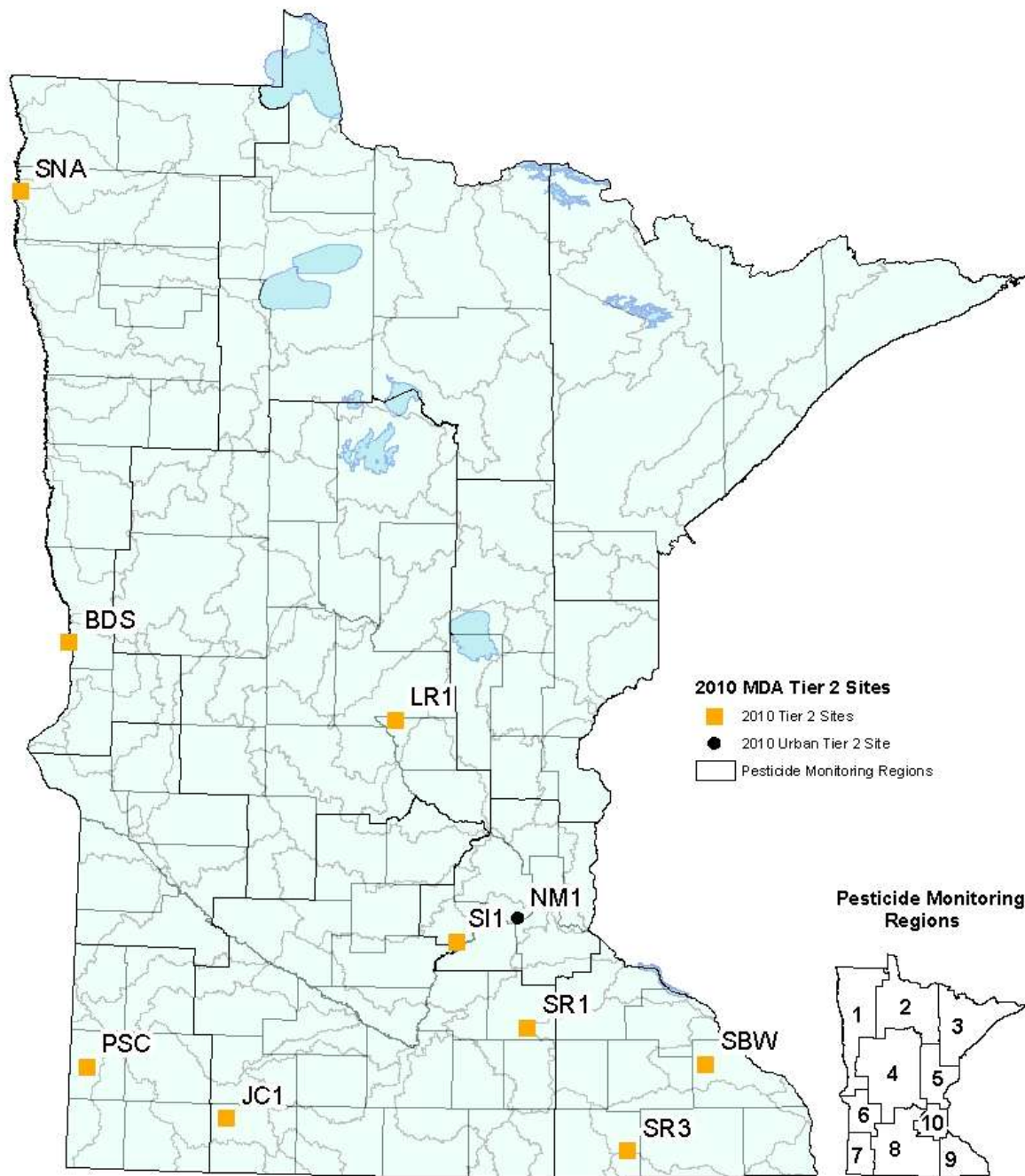


Figure 49. Tier 2 2010 surface water sampling locations.

period, a base flow grab sample was collected near the end of the two-week period. Analysis was generally limited to the GC-MS pesticide list in non-urban areas. Additionally, some non-target analytes were reported by the laboratory if they were detected in the routine analysis of samples. All analyses were conducted by the MDA Laboratory in St. Paul. Inorganic samples were collected for analysis at most locations as well. Inorganic analytes include the nutrients nitrate-nitrogen, dissolved orthophosphorus and total phosphorus.

A small number of samples for total suspended solids were also collected at some sites. All analyses were conducted by the MDA Laboratory Services in St. Paul. Inorganic samples were collected for analysis at most locations as well. Inorganic analytes include the nutrients nitrate-nitrogen, dissolved orthophosphorus and total phosphorus. A small number of samples for total suspended solids were also collected at some sites. Results for inorganic analyses will be discussed in Section 6.

Urban tiered sampling has a slightly longer season, from mid-May through mid-August. Urban locations are identified in Figure 61. The objective is the same, to collect grab samples from each stream during major storm events once in each two-week period through that time frame. If no storm events were anticipated during a period, a base flow grab sample was taken near, or at the end of the two week period. Along with GC-MS analysis, LC-MS/MS analysis was conducted only for urban tiered locations. All analysis was completed by the MDA Laboratory Services in St. Paul.

Table 25 and 27 present the GC-MS results for 2010. These tables also present results comparing flow conditions during sample collection (base flow vs. storm flow periods). Pesticide samples collected during storm flow events generally had a greater frequency and magnitude of detection when compared to samples collected during base flow periods. Atrazine was the most frequently detected pesticide at Tier 1 sites, and metolachlor was the most frequently detected pesticide at the Tier 2 sites in 2010. Acetochlor, atrazine, dimethenamid and metolachlor were detected routinely in both base and storm flow. A breakdown product of atrazine, desethylatrazine, was a frequently detected compound at both Tier 1 and 2 sites. Chlorpyrifos was detected twice at both the Tier 1 and 2 level. Detections of chlorpyrifos are notable due to the low aquatic life standard of 0.041 µg/L. All other GC-MS pesticide detections at Tier 1 and 2 locations were below applicable water quality standards.

Table 26 and 28 present LC-MS/MS results for 2010. All data presented in these tables were collected at the Urban Tier 1 and Urban Tier 2 locations. For more information about these detections, refer to the Urban Tier 1 and Urban Tier 2 sampling (Section 4).

Table 29 presents statistics for the four most frequently detected GC-MS pesticides by PMR. In 2010, there were no samples collected that exceeded 50 percent of the aquatic life standard for acetochlor (3.6 µg/L), atrazine (10.0 µg/L) and metolachlor (23.0 µg/L) at any of the Tier 1 or Tier 2 sites. In addition there were no exceedences of the dimethenamid reference value of (8.9 µg/L). None of these four compounds were detected in PMR 2 and PMR 3 in 2010. Statewide detection frequencies ranged from 32 percent for dimethenamid to 76 percent for atrazine. Many of the detections in 2010 were reported as “present”, being below measureable concentrations.

Table 25. 2010 Tier 1 GC-MS surface water results.

Tier 1 2010 GC-MS Detected Analytes	Total Detects (total n = 200)	Total % Detects	Total Max (µg/L)	Total Median (µg/L)	Base flow n = 57				Storm flow n = 143			
					Base flow Detects	Base flow % Detects	Base flow Max (µg/L)	Base flow Median (µg/L)	Storm flow Detects	Storm flow % Detects	Storm flow Max (µg/L)	Storm flow Median (µg/L)
Acetochlor	101	51%	0.99	P	23	40%	0.99	nd	78	55%	0.99	P
Atrazine	141	71%	2.18	P	36	63%	0.42	P	105	78%	2.18	P
Deisopropylatrazine	2	1%	P	nd	0	--	--	--	2	1%	P	nd
Desethylatrazine	117	59%	0.21	P	33	58%	0.10	P	84	59%	0.21	P
Boscalid	4	2%	P	nd	0	--	--	--	4	3%	P	nd
Chlorpyrifos	2	1%	0.06	nd	0	--	--	--	2	1%	0.06	nd
Dichlobenil (not a target analyte)	3	2%	0.10	nd	0	--	--	--	3	2%	0.10	nd
Dimethenamid	65	33%	0.23	nd	10	18%	0.17	nd	55	38%	0.23	nd
EPTC	2	1%	P	nd	0	--	--	--	2	1%	P	nd
Ethafluralin	2	1%	P	nd	0	--	--	--	2	1%	P	nd
Metolachlor	134	67%	3.7	P	34	60%	3.7	P	100	70%	1.36	P
Prometon	7	4%	0.36	nd	1	2%	0.36	nd	6	4%	P	nd
Propazine	1	1%	P	nd	0	--	--	--	1	1%	P	nd
Propiconazole	5	3%	P	nd	0	--	--	--	5	3%	P	nd
Simazine	1	1%	P	nd	1	2%	P	nd	0	--	--	--
Tebuconazole	4	2%	0.74	nd	1	2%	P	nd	3	2%	0.74	nd
Tetraconazole	4	2%	P	nd	1	2%	P	nd	3	2%	P	nd

Table 26. 2010 Urban Tier 1 LC-MS/MS surface water results. PLEASE NOTE results in ng/L. 1 µg/L = 1000 ng/L

Tier 1 2010 LC-MS/MS Detected Analytes	Total Detects (total n = 52)	Total % Detects	Total Max (ng/L)	Total Median (ng/L)	Base flow n = 8				Storm flow n = 44			
					Base flow Detects	Base flow % Detects	Base flow Max (ng/L)	Base flow Median (ng/L)	Storm flow Detects	Storm flow % Detects	Storm flow Max (ng/L)	Storm flow Median (ng/L)
2,4-D	50	96%	1380	190	8	100%	1300	55.3	42	95%	1380	201
Acetochlor ESA	9	17%	735	nd	6	75%	526	129	3	7%	735	nd
Acetochlor OXA	8	15%	470	nd	5	63%	325	51.1	3	7%	470	nd
Alachlor ESA	13	25%	109	nd	6	75%	109	73	7	16%	104	nd
Azoxystrobin	4	8%	33.2	nd	0	--	--	--	4	9%	33.2	nd
Bentazon	4	8%	6.54	nd	2	25%	6.54	nd	2	5%	2.14	nd
Bromacil	6	12%	262	nd	1	13%	20.2	nd	5	11%	262	nd
Dimethenamid ESA	7	13%	44.5	nd	3	38%	38.5	nd	4	9%	44.5	nd
Dimethenamid OXA	5	10%	22.2	nd	3	38%	14.7	nd	2	5%	22.2	nd
Diuron	23	44%	330	nd	2	25%	22.6	nd	21	48%	330	nd
Hydroxyatrazine	51	98%	129	22.5	8	100%	51.6	34.5	43	98%	129	19.9
Imazapic	3	6%	85.6	nd	0	--	--	--	3	7%	85.6	nd
Imazapyr	10	19%	28.7	nd	0	--	--	--	10	23%	28.7	nd
Imazethapyr	1	2%	11	nd	0	--	--	--	1	2%	11	nd
Imidacloprid	2	4%	45.4	nd	0	--	--	--	2	5%	45.4	nd
MCPA	27	52%	105	5.05	3	38%	8.35	nd	24	55%	105	5.68
MCPP	10	19%	281	nd	0	--	--	--	10	23%	281	nd
Metolachlor ESA	28	54%	903	11.6	7	88%	525	338	21	48%	903	nd
Metolachlor OXA	23	44%	243	nd	7	88%	115	37	16	36%	243	nd
Siduron	3	6%	26.5	nd	1	13%	12.1	nd	2	5%	26.5	nd
Sulfometuron-methyl	3	6%	13.5	nd	0	--	--	--	3	7%	13.5	nd
Triclopyr	3	6%	828	nd	0	--	--	--	3	7%	828	nd

Table 27. 2010 Tier 2 GC-MS surface water results.

Tier 2 2010 GC-MS Detected Analytes	Total Detects (total n = 75)	Total % Detects	Total Max (µg/L)	Total Median (µg/L)	Base flow n = 33				Storm flow n = 42			
					Base flow Detects	Base flow % Detects	Base flow Max (µg/L)	Base flow Median (µg/L)	Storm flow Detects	Storm flow % Detects	Storm flow Max (µg/L)	Storm flow Median (µg/L)
Acetochlor	49	65%	0.84	P	19	57%	0.17	P	30	71%	0.84	0.05
Atrazine	63	84%	0.62	P	26	79%	0.28	P	37	88%	0.62	0.06
Deisopropylatrazine	2	3%	P	nd	0	--	--	--	2	5%	P	nd
Desethylatrazine	61	81%	0.15	P	24	73%	0.12	P	37	88%	0.15	P
Chlorpyrifos	2	3%	0.04	nd	0	--	--	--	2	5%	0.04	nd
Dimethenamid	22	29%	0.64	nd	5	15%	P	nd	17	40%	0.64	nd
Dimethoate	1	1%	P	nd	1	3%	P	nd	0	--	--	--
EPTC	2	3%	P	nd	1	3%	P	nd	1	2%	P	nd
Metolachlor	69	92%	3.96	P	30	91%	0.43	P	39	93%	3.96	P
Metribuzin	1	1%	P	nd	0	--	--	--	1	2%	P	nd
Metribuzin DADK	2	3%	P	nd	2	6%	P	nd	0	--	--	--
Prometon	2	3%	P	nd	0	--	--	--	2	5%	P	nd
Propiconazole	5	7%	0.22	nd	0	--	--	--	5	12%	0.22	nd
Simazine	1	1%	0.37	nd	0	--	--	--	1	2%	0.37	nd
Tebuconazole	4	5%	1.78	nd	0	--	--	--	4	10%	1.78	nd
Tetraconazole	2	3%	P	nd	0	--	--	--	2	5%	P	nd

Table 28. 2010 Urban Tier 2 LC-MS/MS surface water results. PLEASE NOTE results in ng/L. 1 µg/L = 1000 ng/L

Tier 2 2010 LC-MS/MS Detected Analytes	Total Detects (total n = 12)	Total % Detects	Total Max (ng/L)	Total Median (ng/L)	Base flow n = 8				Storm flow n = 4			
					Base flow Detects	Base flow % Detects	Base flow Max (ng/L)	Base flow Median (ng/L)	Storm flow Detects	Storm flow % Detects	Storm flow Max (ng/L)	Storm flow Median (ng/L)
2,4-D	12	100%	1990	207	8	100%	1990	155	4	100%	328	237
Bromacil	1	8%	36.8	nd	1	13%	36.8	nd	0	--	--	--
Diuron	12	100^	145	19.3	8	100%	134	19.7	4	100%	145	19.3
Hydroxyatrazine	10	83%	21.2	17.8	8	100%	21.2	17.8	2	50%	10.6	nd
Imazapic	6	50%	32.9	nd	5	63%	32.9	21.3	1	25%	10.2	nd
Imazapyr	3	25%	17.9	nd	3	38%	17.9	nd	0	--	--	--
MCPA	9	75%	152	11.4	5	63%	26	10.9	4	100%	152	18.9
MCPP	3	25%	131	nd	2	25%	131	nd	1	25%	56.5	nd
Metolachlor ESA	4	33%	13.4	nd	2	25%	13.4	nd	2	50%	11.2	nd
Metolachlor OXA	6	50%	19.4	nd	3	38%	19.4	nd	3	75%	16.7	13.2
Siduron	1	8%	6.97	nd	1	13%	6.97	nd	0	--	--	--

Table 29. 2010 Tier 1 and Tier 2 acetochlor, atrazine, dimethenamid and metolachlor surface water results by PMR.

	Positive Samples/Total Samples (and %) for Pesticide	Maximum Value Detected (µg/L)	90 th percentile (µg/L)	75 th percentile (µg/L)	Median Value of Samples (µg/L)	Samples, Exceeding 50% of Reference Value (%)	Positive Samples/Total Samples (and %) for Pesticide	Maximum Value Detected (µg/L)	90 th percentile (µg/L)	75 th percentile (µg/L)	Median Value of Samples (µg/L)	Samples Exceeding 50% of a Reference Value (%)
	Acetochlor						Atrazine					
PMR 1	12/24 (50%)	0.81	0.09	0.05	P	0 (0%)	18/24 (75%)	2.18	0.11	0.08	P	0 (0%)
PMR 2	0/4 (0%)	nd	nd	nd	nd	0 (0%)	0/4 (0%)	nd	nd	nd	nd	0 (0%)
PMR 3	0/4 (0%)	nd	nd	nd	nd	0 (0%)	0/4 (0%)	nd	nd	nd	nd	0 (0%)
PMR 4	4/19 (21%)	0.07	P	nd	nd	0 (0%)	9/19 (47%)	0.08	0.06	P	nd	0 (0%)
PMR 5	1/12 (8%)	P	nd	nd	nd	0 (0%)	6/12 (50%)	P	P	P	nd	0 (0%)
PMR 6	10/16 (63%)	0.99	0.37	P	P	0 (0%)	10/16 (63%)	0.38	P	P	P	0 (0%)
PMR 7	17/21 (81%)	0.86	0.55	0.2	P	0 (0%)	18/21 (86%)	0.36	0.13	0.09	0.06	0 (0%)
PMR 8	46/54 (85%)	0.34	0.22	0.17	0.07	0 (0%)	46/54 (85%)	0.28	0.14	0.1	P	0 (0%)
PMR 9	27/42 (64%)	0.99	0.5	0.08	P	0 (0%)	42/42 (100%)	0.72	0.38	0.12	0.07	0 (0%)
PMR 10	33/79 (42%)	0.84	0.092	P	nd	0 (0%)	55/79 (70%)	0.44	0.092	0.05	P	0 (0%)
Statewide Total	150/275 (54%)	0.99	0.20	0.06	P	0 (0%)	210/275 (76%)	2.18	0.13	0.07	P	0 (0%)
	Dimethenamid						Metolachlor					
PMR 1	7/24 (29%)	0.64	0.09	P	nd	0 (0%)	13/24 (54%)	0.8	P	P	P	0 (0%)
PMR 2	0/4 (0%)	nd	nd	nd	nd	0 (0%)	0/4 (0%)	nd	nd	nd	nd	0 (0%)
PMR 3	0/4 (0%)	nd	nd	nd	nd	0 (0%)	0/4 (0%)	nd	nd	nd	nd	0 (0%)
PMR 4	1/19 (5%)	P	nd	nd	nd	0 (0%)	7/19 (37%)	P	P	P	nd	0 (0%)
PMR 5	0/12 (0%)	nd	nd	nd	nd	0 (0%)	3/12 (25%)	P	P	nd	nd	0 (0%)
PMR 6	7/16 (44%)	0.06	P	P	nd	0 (0%)	9/16 (56%)	0.74	P	P	P	0 (0%)
PMR 7	6/21 (29%)	0.06	P	P	nd	0 (0%)	18/21 (86%)	0.42	0.12	0.09	P	0 (0%)
PMR 8	30/54 (56%)	0.14	P	P	P	0 (0%)	54/54 (100%)	0.66	0.50	0.19	P	0 (0%)
PMR 9	17/42 (40%)	0.25	0.08	P	nd	0 (0%)	37/42 (88%)	3.96	0.48	0.23	0.1	0 (0%)
PMR 10	19/79 (24%)	0.23	P	nd	nd	0 (0%)	62/79 (78%)	1.96	0.27	0.09	P	0 (0%)
Statewide Total	87/275 (32%)	0.64	P	P	nd	0 (0%)	203/275 (74%)	3.96	0.29	0.09	P	0 (0%)

3.3. Surface water Tier 3 sampling

Minnesota Department of Agriculture's long-term intensive surface water monitoring efforts (known as Tier 3) have historically focused on two primary areas of the state: southeastern Minnesota and the Minnesota River Basin. In 2010, there were seven MDA Tier 3 monitoring sites in operation, three of which are located in the Minnesota River Basin, three in southeastern Minnesota and one in the Red River Basin. Surface water monitoring at most of the intensively monitored sites includes both equal-flow increment (EFI) and equal-time increment (ETI) composite sample collection during storm flow periods using stage activated automated samplers. Since 2006, the MDA has made an effort to collect storm flow samples on an ETI basis at Tier 3 sites to generate data that was more readily comparable to duration based standards or reference values. Base flow periods are typically characterized by grab samples collected between storm events. In some instances, when presenting data, MDA staff has elected to present EFI and ETI composite sample concentrations collected before and after 2006 in the same table or graph. In these instances, the contrasting data is typically foot-noted to highlight the different nature of the collection method.

Monitoring data for long-term sites sampled prior to this report can be found in previously published MDA reports, as well as in the datasets used to prepare these reports. A summary of MDA Tier 3 surface water monitoring site names and physical characteristics are provided in Appendix 5, Appendix 6 has water quality results, which are available online only (www.mda.state.mn.us/monitoring) and MDA and STORET ID numbers appear in Appendix 7.

3.3.1. 2010 Tier 3 results

The 2010 Tier 3 sites included the Beauford Ditch, Le Sueur River and Seven Mile Creek in the Minnesota River Basin (south central); the Middle Branch of the Whitewater, the North Branch of the Root River and South Branch of the Root River in southeastern Minnesota; and the Buffalo River near Georgetown in northwestern Minnesota (Figure 50). Associated land use for the state is shown in Figure 51. Agriculture is the dominant land use in all of these watersheds.

The 2010 monitoring season began with a large snowmelt event and associated flooding in all of the Tier 3 monitoring watersheds. It was followed by an exceptionally wet June and September period over large portions of Minnesota collectively representing one of the wettest seasons since pesticide monitoring began in the early 1990's. This stands in sharp contrast to the 2009 monitoring season which was much drier. A storm in late September 2010 resulted in flood level flows in most of the rivers of south central Minnesota including Beauford Ditch, Seven Mile Creek and the Le Sueur River at Highway 66 (Figures 52 – 54). The high water inundated all three of the monitoring enclosures at these sites and resulted in equipment damage at Seven Mile Creek and a complete loss of the monitoring station at the Le Sueur site which was moved by the river downstream about 150 ft. An alternate location about one mile upstream of the historic location is being sought for reinstalling the Le Sueur site at a higher elevation. The site will be moved in the spring of 2011, and will be co-located with the United States Geological Survey (USGS).

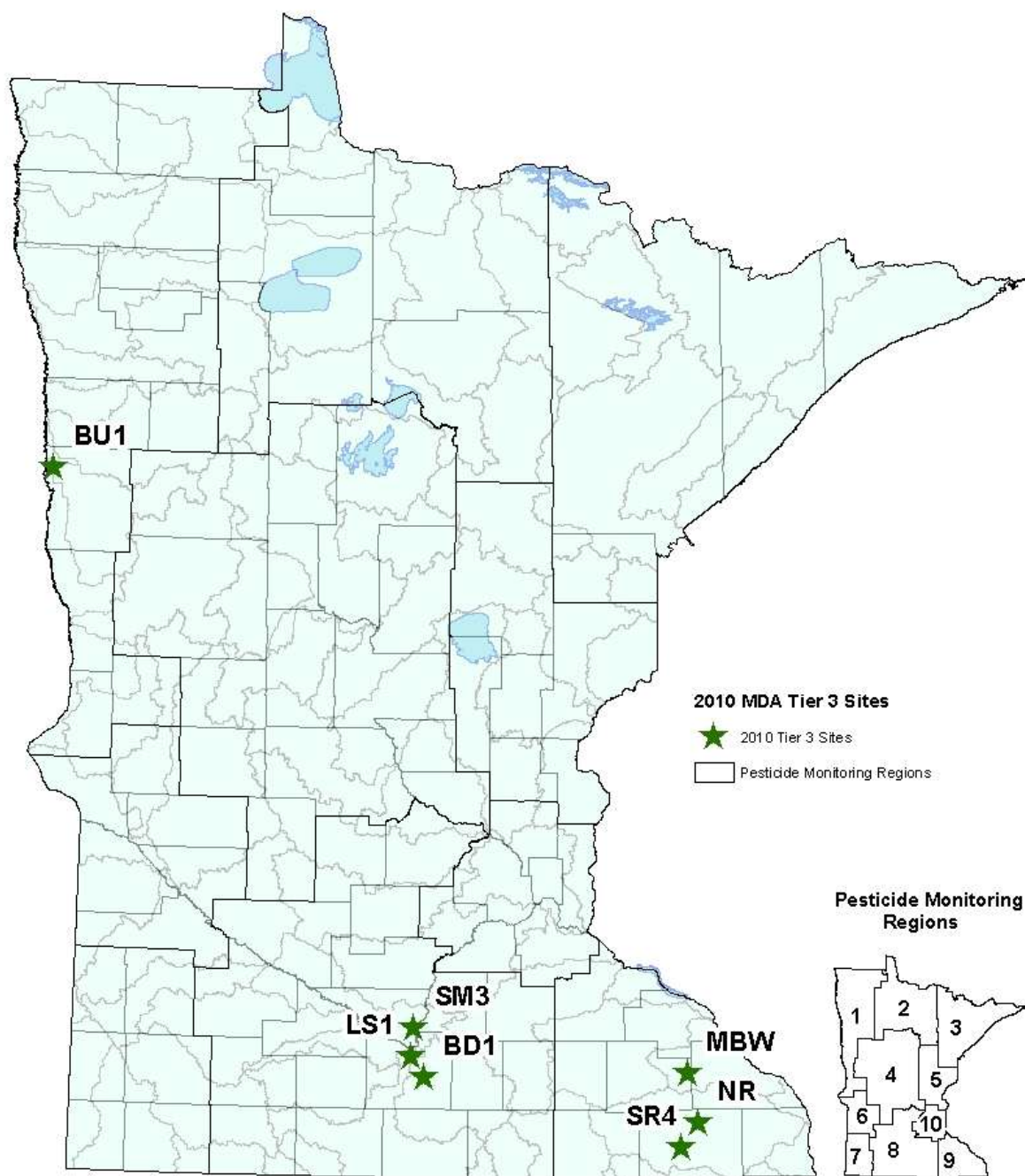


Figure 50. Tier 3 2010 surface water sampling locations.

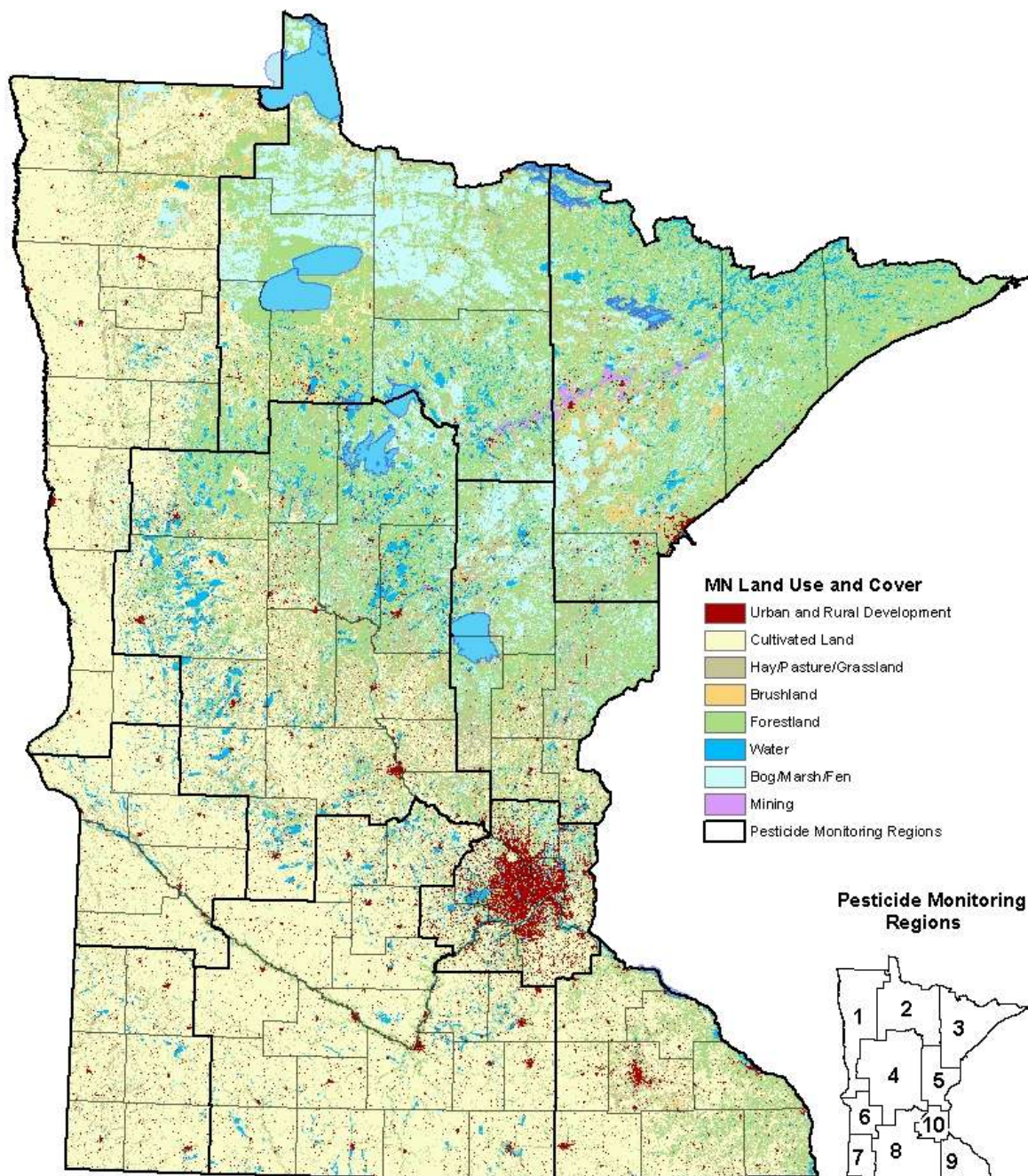


Figure 51. 2010 Statewide land use.



Figure 52. Beauford Ditch monitoring station, September 2010.



Figure 53. Le Sueur River monitoring station, September 2010.



Figure 54. Le Sueur River monitoring station, September 2010.

During the 2010 monitoring season, 168 GC-MS and 100 LC-MS/MS samples were collected from these seven Tier 3 sites primarily during April, May, June and July. Table 30 presents pesticide information related to the frequency of detections, as well as information on the general flow condition of the river or stream as it relates to pesticide detection. The maximum acetochlor and atrazine concentrations measured at any of the Tier 3 sites in 2010 were detected at Seven Mile Creek. The grab sample was collected on June 1, 2010, following a small but intense rainfall that resulted in a small storm event. The concentration of acetochlor and atrazine in the sample was 2.80 µg/L and 1.53 µg/L, respectively. Both of these concentrations are below the respective standards of 3.6 µg/L for acetochlor (4-day chronic aquatic life) and 3.4 µg/L for atrazine (30-day human health).

Of the 268 samples collected from Tier 3 sites in 2010, there was only two samples collected with a pesticide concentration detected at a level above the reference values (Table 7). Chlorpyrifos, an organophosphate insecticide, was detected in a grab sample from Seven Mile Creek at the monitoring station near the confluence with the Minnesota River on September 2, 2010. The concentration of chlorpyrifos in that grab samples was 0.24 µg/L, which is above the chronic aquatic life standard of 0.041 µg/L. This value is also above the maximum aquatic life standard of 0.083 µg/L. This detection occurred as a result of a small but intense storm event (0.78 inches of rain) that occurred the morning of September 2, 2010. Figure 55 presents the hydrograph for September as well as a photograph that was taken at the time of collection.

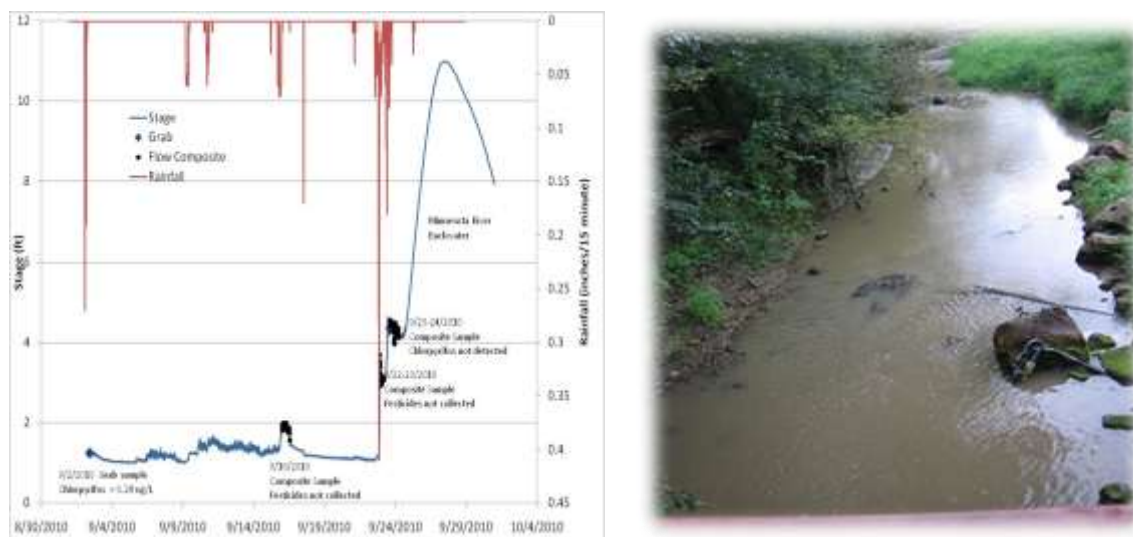


Figure 55. Hydrograph for Seven Mile Creek from September 2010. The photograph was taken on September 2, 2010, the same day as the elevated chlorpyrifos detection.

This was the only detection of chlorpyrifos at any of the Tier 3 sites in 2010. However, there were detections of chlorpyrifos at lower concentrations at several other river surface water monitoring sites in 2010 as discussed earlier in this report. As with all data presented in this report, these data will be provided to MPCA for further assessment. Additional assessment of these detections is presented in the MDA 2011 Surface Water Work Plan.

Table 30. 2010 Tier 3 GC-MS surface water results.

Tier 3 2010 GC-MS Detected Analytes	Total Detects (total n = 168)	Total % Detects	Total Max (µg/L)	Total Median (µg/L)	Base flow n = 46				Storm flow n = 122			
					Base flow Detects	Base flow % Detects	Base flow Max (µg/L)	Base flow Median (µg/L)	Storm flow Detects	Storm flow % Detects	Storm flow Max (µg/L)	Storm flow Median (µg/L)
Acetochlor	72	43%	2.8	nd	10	22%	0.28	nd	62	51%	2.8	P
Atrazine	120	71%	1.53	P	38	83%	0.33	P	82	67%	1.53	P
Deisopropylatrazine	2	1%	P	nd	1	2%	P	nd	1	1%	P	nd
Desethylatrazine	119	71%	0.18	P	37	80%	0.14	0.06	82	67%	0.18	P
Chlorpyrifos	1	1%	0.24	nd	0	--	--	--	1	1%	0.24	nd
Dimethenamid	57	34%	1.46	nd	4	9%	0.16	nd	53	43%	1.46	nd
Metolachlor	141	84%	3.56	P	28	61%	0.76	P	113	93%	3.56	0.1
Prometon	1	1%	P	nd	0	--	--	--	1	1%	P	nd
Propazine	1	1%	P	nd	0	--	--	--	1	1%	P	nd
Propiconazole	3	2%	P	nd	1	2%	P	nd	2	2%	P	nd
Tebuconazole	2	1%	P	nd	1	2%	P	nd	1	1%	P	nd
Tebuprimiphos	1	1%	0.1	nd	0	--	--	--	1	1%	0.1	nd
Tetraconazole	3	2%	P	nd	0	--	--	--	3	2%	P	nd

Table 30 also presents a summary of the 2010 Tier 3 monitoring results for the compounds detected in the GC-MS analysis method. As indicated in Table 24 and Table 30, tebupirimphos was detected in a grab sample from Seven Mile Creek on June 1, 2010. This organophosphate insecticide was detected at a concentration (0.10 µg/L) which is above the USEPA OPP surface water reference value of 0.011 µg/L (chronic) and above the 0.039 µg/L acute value.

In 2010 there were 46 samples collected during base flow conditions and 122 samples collected during storm flow periods. The high number of storm flow samples is indicative of the large number of storm events that occurred in 2010. For most pesticide compounds, samples collected during storm flow events have a higher detection frequency than samples collected during base flow periods. Many of the maximum concentrations observed in 2010 were collected during storm flow events. Atrazine and two associated degradates, deisopropylatrazine and desethylatrazine, had higher detection frequencies in base flow samples. There were a number of pesticide compounds that were only detected in samples collected during storm flow events.

Table 31 presents all MDA monitoring program chlorpyrifos detections in surface water since 2005. Prior to 2010, chlorpyrifos had never been detected at concentrations above the MRL. However, there had been several detections qualified by the laboratory as “present” as indicated in Table 31. Historically these detections most frequently occurred in the Red River tributaries (Buffalo and Snake rivers) and one detection each in the Le Sueur River and Beauford Ditch. The Buffalo River had detection in each of the four years prior to 2010. Despite increased monitoring in 2010, including the collection of automated time-based composite samples, chlorpyrifos was not detected in the Buffalo River in 2010. Table 31 below presents all of the chlorpyrifos detections in surface waters of Minnesota since 2005 as well as the aquatic life standards. The reference values are 0.041 µg/L (4-day aquatic toxicity) and 0.083 µg/L (1-day acute aquatic toxicity).

In response to the increase in detections of chlorpyrifos in 2010, the MDA is increasing monitoring at several locations. For additional information please refer to the MDA 2011 Surface Water Quality Monitoring Annual Work Plan (www.mda.state.mn.us/monitoring).

Table 31. Detections of chlorpyrifos in Minnesota surface waters since 2005.

Site	PMR	Date	Chlorpyrifos (µg/L)	MRL through 2007 (µg/L)	Current MRL (µg/L)
Beauford Ditch	8	5/13/2005	P	0.10	
Snake River	1	7/5/2005	P	0.10	
Buffalo River- Georgetown	1	7/17/2006	P	0.10	
Snake River	1	7/18/2006	P	0.10	
Buffalo River- Georgetown	1	5/23/2007	P	0.10	
Le Sueur River- Hwy 66	8	8/2/2007	P	0.10	
Buffalo River- Georgetown	1	6/9/2008	P		0.04
Buffalo River- Georgetown	1	9/3/2009	P		0.04
Snake River	1	6/28/2010	0.04		0.04
Snake River	1	6/30/2010	P		0.04
Grand Marais Creek	1	5/25/2010	0.05		0.04
Tamarac River	1	6/23/2010	0.06		0.04
Unnamed Ditch-Tamarac River (EMAP)	1	6/30/2010	P		0.04
Black River near Thief River Falls (EMAP)	1	6/30/2010	0.11		0.04
Unnamed Ditch-South Fork Crow River (EMAP)	4	8/5/2010	0.05		0.04
Seven Mile Creek	8	9/2/2010	0.24		0.04

Table 32 presents a summary of the 2010 Tier 3 monitoring results for the compounds detected within the LC-MS/MS analytical method. Note that the LC-MS/MS analysis results in Table 32 are reported in parts per trillion (ppt) whereas the GC-MS analysis results (Table 30) are presented in parts per billion (ppb). The pesticide data is presented in the format that it is provided by the laboratory. Because of the very low detection level for many of the LC-MS/MS analytes, the laboratory prefers to report those results in parts per trillion. There were 100 pesticide samples analyzed for LC-MS/MS from Tier 3 sites in 2010, of which 74 were storm flow samples and 26 were base flow samples. Many of the 23 different pesticide and degradate compounds detected in 2010 had not been routinely analyzed by MDA in the past. Two degradates of atrazine, DEDI and hydroxyatrazine were detected in 11 and 99 percent of the samples, respectively. None of the compound detected exceeded the reference values listed in Table 7; however, several of the detected compounds do not have established reference values.

Degradate monitoring assists in the assessment of the long-term fate of pesticides applied to the landscape. The 2010 surface water monitoring data for the primary (ESA) and secondary (OXA) chloroacetanilide degradates of acetochlor, alachlor, dimethenamid and metolachlor is presented in Table 32. Detection frequency and magnitude of detection for many of the degradate concentrations were higher than for the parent compounds found in Table 30. In 2010, as was the case in 2007 – 2009, the parent chemical alachlor was not detected in any surface water samples but alachlor ESA was found 75 percent of the time. Aquatic life standards are currently available for some degradates in surface water (Table 7). There is a general indication from the

available literature that the chloroacetanilide degradates are less toxic than the parent compounds.

Table 33 and 34 present the detected compounds by location for the Tier 3 sites for 2010. Acetochlor and metolachlor were detected in greater frequency in the sites located in south central Minnesota (Beauford Ditch, Le Sueur River and Seven Mile Creek). Atrazine on the other hand, was detected more frequently in the sites located in southeastern Minnesota. The detection frequency in these watersheds was likely a function of product usage and climatic conditions in the days and weeks following application.

Table 32. 2010 Tier 3 LC-MS/MS surface water results. PLEASE NOTE results in ng/L. 1 µg/L = 1000 ng/L

Tier 3 2010 LC-MS/MS Detected Analytes	Total Detects (total n = 100)	Total % Detects	Total Max (ng/L)	Total Median (ng/L)	Base flow n = 26				Storm flow n = 74			
					Base flow Detects	Base flow % Detects	Base flow Max (ng/L)	Base flow Median (ng/L)	Storm flow Detects	Storm flow % Detects	Storm flow Max (ng/L)	Storm flow Median (ng/L)
2,4-D	58	58%	2640	11.3	3	12%	2640	nd	55	74%	888	18.1
Acetochlor ESA	90	90%	4410	220	24	92%	1230	103	66	89%	4410	229
Acetochlor OXA	64	64%	4630	57.4	11	42%	734	nd	53	72%	4630	86.2
Alachlor ESA	75	75%	297	105	22	85%	297	143	53	72%	275	89.6
Alachlor OXA	6	6%	55.9	nd	1	4%	33.3	nd	5	7%	55.9	nd
Azoxystrobin	5	5%	54.5	nd	0	--	--	--	5	7%	54.5	nd
Bentazon	18	18%	3.53	nd	9	35%	2.3	nd	9	12%	3.53	nd
DEDI Atrazine	11	11%	150	nd	7	27%	150	nd	4	5%	104	nd
Dicamba	2	2%	106	nd	0	--	--	--	2	3%	106	nd
Dimethenamid ESA	68	68%	236	12.3	13	50%	181	P	55	74%	236	14.7
Dimethenamid OXA	26	26%	246	nd	3	12%	47.7	nd	23	31%	246	nd
Hydroxyatrazine	99	99%	636	35.4	25	96%	70	22.9	74	100%	636	40.4
Imazapyr	2	2%	18.5	nd	0	--	--	--	2	3%	18.5	nd
Imazethapyr	31	31%	169	nd	3	12%	15	nd	28	38%	169	nd
Imidacloprid	3	3%	52.2	nd	0	--	--	--	3	4%	52.2	nd
MCPA	5	5%	116	nd	1	4%	7.6	nd	4	5%	116	nd
MCPP	1	1%	57	nd	0	--	--	--	1	1%	57	nd
Mesotrione	1	1%	165	nd	0	--	--	--	1	1%	165	nd
Metalaxyl	2	2%	15.8	nd	0	--	--	--	2	3%	15.8	nd
Metolachlor ESA	100	100%	2380	851	26	100%	1300	808	74	100%	2380	864
Metolachlor OXA	97	97%	1340	86.2	25	96%	862	53	72	97%	1340	95.2
Saflufenacil	4	4%	32.1	nd	0	--	--	--	4	5%	32.1	nd
Thiamethoxam	15	15%	130	nd	2	8%	55.5	nd	13	8%	130	nd

Table 33. GC-MS pesticide analyte detections in storm event and base flow samples for MDA Tier 3 surface water monitoring sites, 2010.

2010		Storm Event Samples (µg/L)					Base Flow Samples (µg/L)				
GC-MS Pesticide Analyte	Tier 3 Surface Water Monitoring Site	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration
Acetochlor	Beauford Ditch	23	65%	0.51	May 14	P	6	33%	P	multiple	nd
	Buffalo River-Georgetown	17	35%	0.15	June 21	nd	4	0%	nd	--	nd
	Le Sueur River-Hwy66	15	93%	0.4	Mar 17	0.12	5	40%	0.28	June 21	nd
	Root River-North Branch	15	20%	0.11	June 20	nd	8	25%	0.11	May 11	nd
	Root River-South Branch-Carimona	19	47%	0.22	June 16	nd	7	14%	P	May 17	nd
	Seven Mile Creek #3	19	63%	2.8	June 1	0.06	4	50%	0.05	May 7	nd
	Whitewater River-Middle Branch	14	21%	0.06	June 23	nd	12	8%	P	May 13	nd
Atrazine	Beauford Ditch	23	48%	0.05	June 26	nd	6	17%	P	May 7	nd
	Buffalo River-Georgetown	17	41%	0.22	June 21	nd	4	50%	0.07	Aug 13	nd
	Le Sueur River-Hwy66	15	67%	0.26	June 22	P	5	100%	0.33	June 21	P
	Root River-North Branch	15	73%	0.35	June 20	0.05	8	100%	0.06	May 11	P
	Root River-South Branch-Carimona	19	100%	0.51	June 16	0.06	7	100%	0.05	multiple	P
	Seven Mile Creek #3	19	68%	1.53	June 1	P	4	75%	P	multiple	P
	Whitewater River-Middle Branch	14	79%	0.25	June 22	P	12	100%	0.1	June 15	0.07
Deisopropylatrazine	Whitewater River-Middle Branch	14	7%	P	June 22	nd	12	8%	P	Jan 20	nd
Desethylatrazine	Beauford Ditch	23	30%	0.05	June 26	nd	6	33%	P	multiple	nd
	Buffalo River-Georgetown	17	47%	0.06	June 17	nd	4	25%	0.06	Aug 13	nd
	Le Sueur River-Hwy66	15	60%	0.05	June 22	P	5	60%	0.07	June 21	P
	Root River-North Branch	15	87%	0.14	June 20	0.06	8	100%	0.1	May 27	P
	Root River-South Branch-Carimona	19	100%	0.18	June 16	0.08	7	100%	0.09	multiple	0.07
	Seven Mile Creek #3	19	74%	0.09	June 1	P	4	100%	P	multiple	P
	Whitewater River-Middle Branch	14	86%	0.15	June 22	0.06	12	100%	0.14	May 27	0.09
Chlorpyrifos	Seven Mile Creek #3	19	5%	0.24	Sept 2	nd	4	0%	nd	--	nd

Table 33 continued. GC-MS pesticide analyte detections in storm event and base flow samples for MDA Tier 3 surface water monitoring sites, 2010.

2010		Storm Event Samples (µg/L)					Base Flow Samples (µg/L)				
GC-MS Pesticide Analyte	Tier 3 Surface Water Monitoring Site	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration
Dimethenamid	Beauford Ditch	23	61%	0.08	multiple	P	6	0%	nd	--	nd
	Buffalo River-Georgetown	17	29%	0.9	June 17	nd	4	25%	P	Aug 13	nd
	Le Sueur River-Hwy66	15	73%	0.12	June 22	P	5	20%	0.16	June 21	nd
	Root River-North Branch	15	27%	P	multiple	nd	8	13%	P	Aug 16	nd
	Root River-South Branch-Carimona	19	26%	0.05	June 16	nd	7	0%	nd	--	nd
	Seven Mile Creek #3	19	32%	1.46	June 1	nd	4	0%	nd	--	nd
	Whitewater River-Middle Branch	14	57%	0.42	June 22	P	12	8%	P	June 29	nd
Metolachlor	Beauford Ditch	23	100%	3.04	Mar 15	0.14	6	100%	0.07	Apr 23	P
	Buffalo River-Georgetown	17	71%	0.37	June 21	P	4	75%	0.18	Aug 13	P
	Le Sueur River-Hwy66	15	100%	1.56	Mar 15	0.15	5	100%	0.76	June 21	P
	Root River-North Branch	15	87%	0.39	June 20	0.1	8	50%	0.09	May 11	nd
	Root River-South Branch-Carimona	19	95%	1.59	June 16	P	7	71%	P	multiple	P
	Seven Mile Creek #3	19	100%	3.56	Mar 17	0.28	4	75%	0.08	Apr 22	P
	Whitewater River-Middle Branch	14	93%	0.31	June 25	P	12	17%	P	multiple	nd
Prometon	Beauford Ditch	23	4%	P	July 24	nd	6	0%	nd	--	nd
Propazine	Seven Mile Creek #3	19	5%	P	June 1	nd	4	0%	nd	--	nd
Propiconazole	Buffalo River-Georgetown	17	12%	P	multiple	nd	4	25%	P	Aug 13	nd
Tebuconazole	Buffalo River-Georgetown	17	6%	P	July 6	nd	4	25%	P	Aug 13	nd
Tebuprimiphos	Seven Mile Creek #3	19	5%	0.10	June 1	nd	4	0%	nd	--	nd
Tetraconazole	Buffalo River-Georgetown	17	18%	P	multiple	nd	4	0%	nd	--	nd

Table 34. LC-MS/MS pesticide analyte detections in storm event and base flow samples for MDA Tier 3 surface water monitoring sites, 2010.
PLEASE NOTE results in ng/L. 1 µg/L = 1000 ng/L

2010		Storm Event Samples (ng/L)					Base Flow Samples (ng/L)				
LC-MS/MS Pesticide Analyte	Tier 3 Surface Water Monitoring Site	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration
2,4-D	Beauford Ditch	10	70%	276	July 22	12.8	5	20%	104	Sept 2	1
	Buffalo River-Georgetown	17	76%	852	Sept 29	17.8	4	25%	2640	Aug 13	nd
	Le Sueur River-Hwy66	10	80%	536	May 21	46	4	25%	22.6	Sept 2	nd
	Root River-North Branch	7	86%	95.4	June 14	39.7	3	0%	nd	--	nd
	Root River-South Branch-Carimona	11	73%	42.8	June 25	11	3	0%	nd	--	nd
	Seven Mile Creek #3	9	78%	888	June 1	70	4	0%	nd	--	nd
	Whitewater River-Middle Branch	10	60%	78.8	June 25	12.5	3	0%	nd	--	nd
Acetochlor ESA	Beauford Ditch	10	100%	4410	June 18	1615	5	100%	1230	Sept 2	295
	Buffalo River-Georgetown	17	53%	82.5	Aug 4	30.3	4	50%	39.6	Sept 7	P
	Le Sueur River-Hwy66	10	100%	1800	June 28	586	4	100%	328	Nov 9	274
	Root River-North Branch	7	100%	426	June 25	222	3	100%	82.2	Nov 9	64.5
	Root River-South Branch-Carimona	11	100%	1050	June 16	217	3	100%	79.8	Apr 21	76.5
	Seven Mile Creek #3	9	100%	1310	June 27	342	4	100%	254	Apr 22	237
	Whitewater River-Middle Branch	10	100%	549	June 25	120	3	100%	120	Nov 10	85.2
Acetochlor OXA	Beauford Ditch	10	100%	4630	June 18	888	5	100%	734	Sept 2	61.9
	Buffalo River-Georgetown	17	35%	56.1	June 21	nd	4	0%	nd	--	nd
	Le Sueur River-Hwy66	10	100%	1320	June 28	271	4	100%	167	Sept 2	104
	Root River-North Branch	7	57%	213	Sept 24	98.2	3	0%	nd	--	nd
	Root River-South Branch-Carimona	11	73%	721	June 16	62.9	3	0%	nd	--	nd
	Seven Mile Creek #3	9	100%	689	June 27	133	4	50%	84.6	Apr 22	29.3
	Whitewater River-Middle Branch	10	60%	311	June 25	34.5	3	0%	nd	--	nd

Table 34 continued. LC-MS/MS pesticide analyte detections in storm event and base flow samples for MDA Tier 3 surface water monitoring sites, 2010. PLEASE NOTE results in ng/L. 1 µg/L = 1000 ng/L

2010		Storm Event Samples (ng/L)					Base Flow Samples (ng/L)				
LC-MS/MS Pesticide Analyte	Tier 3 Surface Water Monitoring Site	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration
Alachlor ESA	Beauford Ditch	10	80%	243	July 24	162	5	100%	229	Nov 9	128
	Buffalo River-Georgetown	17	0%	nd	--	nd	4	0%	nd	--	nd
	Le Sueur River-Hwy66	10	100%	149	Sept 17	93.4	4	100%	122	Sept 2	107
	Root River-North Branch	7	100%	198	June 14	109	3	100%	212	Nov 9	178
	Root River-South Branch-Carimona	11	100%	275	July 26	163	3	100%	297	multiple	297
	Seven Mile Creek #3	9	100%	177	June 19	116	4	100%	237	Jan 20	159
	Whitewater River-Middle Branch	10	80%	212	June 25	68	3	100%	296	Nov 10	291
Alachlor OXA	Beauford Ditch	10	50%	55.9	July 22	20.5	5	20%	33.3	Sept 2	nd
Azoxystrobin	Le Sueur River-Hwy66	10	20%	15	Sept 17	nd	4	0%	nd	--	nd
	Seven Mile Creek #3	9	11%	31.7	June 1	nd	4	0%	nd	--	nd
	Whitewater River-Middle Branch	10	20%	54.5	Aug 15	nd	3	0%	nd	--	nd
Bentazon	Beauford Ditch	10	0%	nd	--	nd	5	40%	1.67	Nov 9	nd
	Buffalo River-Georgetown	17	35%	2.18	July 28	nd	4	75%	2.3	Mar 2	1.34
	Le Sueur River-Hwy66	10	10%	0.82	May 21	nd	4	50%	2.1	Nov 9	P
	Root River-North Branch	7	14%	2.7	June 25	nd	3	33%	1.06	Nov 9	nd
	Root River-South Branch-Carimona	11	9%	3.53	July 26	nd	3	3%	0.9	Nov 9	nd
DEDI Atrazine	Root River-North Branch	7	14%	69	June 25	nd	3	33%	59.5	Nov 9	nd
	Root River-South Branch-Carimona	11	18%	104	June 25	nd	3	100%	94.5	Nov 9	76
	Whitewater River-Middle Branch	10	10%	104	June 25	nd	3	100%	150	Jan 20	134
Dicamba	Buffalo River-Georgetown	17	6%	76.5	June 17	nd	4	0%	nd	--	nd
	Whitewater River-Middle Branch	10	10%	106	June 23	nd	3	0%	nd	--	nd

Table 34 continued. LC-MS/MS pesticide analyte detections in storm event and base flow samples for MDA Tier 3 surface water monitoring sites, 2010. PLEASE NOTE results in ng/L. 1 µg/L = 1000 ng/L

2010		Storm Event Samples (ng/L)					Base Flow Samples (ng/L)				
LC-MS/MS Pesticide Analyte	Tier 3 Surface Water Monitoring Site	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration
Dimethenamid ESA	Beauford Ditch	10	100%	236	June 11	82	5	100%	181	Sept 2	13.3
	Buffalo River-Georgetown	17	47%	14.3	July 28	nd	4	25%	14.7	Aug 13	nd
	Le Sueur River-Hwy66	10	100%	98.5	June 28	18.9	4	100%	21.8	Nov 9	13.2
	Root River-North Branch	7	57%	23.3	June 25	10.7	3	0%	nd	--	nd
	Root River-South Branch-Carimona	11	73%	135	June 16	8.31	3	0%	nd	--	nd
	Seven Mile Creek #3	9	100%	117	June 1	19	4	75%	36.4	Nov 10	14.1
	Whitewater River-Middle Branch	10	60%	85.1	June 25	24.4	3	0%	nd	--	nd
Dimethenamid OXA	Beauford Ditch	10	90%	246	June 11	32	5	20%	47.7	Sept 2	nd
	Buffalo River-Georgetown	17	6%	15	July 28	nd	4	25%	11.8	Aug 13	nd
	Le Sueur River-Hwy66	10	40%	67	June 28	nd	4	0%	nd	--	nd
	Root River-South Branch-Carimona	11	18%	65.5	June 16	nd	3	0%	nd	--	nd
	Seven Mile Creek #3	9	33%	64.5	June 1	nd	4	25%	11.6	Nov 10	nd
	Whitewater River-Middle Branch	10	40%	51.5	June 23	nd	3	0%	nd	--	nd
Hydroxyatrazine	Beauford Ditch	10	100%	79.3	June 28	44.8	5	100%	70	Sept 2	25
	Buffalo River-Georgetown	17	100%	61.9	June 17	25.5	4	100%	49.2	Aug 13	30.5
	Le Sueur River-Hwy66	10	100%	106	June 28	39.6	4	100%	54.6	Sept 2	36.7
	Root River-North Branch	7	100%	62.3	Sept 24	43.3	3	100%	23.6	Apr 21	19.4
	Root River-South Branch-Carimona	11	100%	93.8	June 16	36.6	3	100%	23.6	Apr 21	21.8
	Seven Mile Creek #3	9	100%	636	June 1	39.7	4	75%	23	May 7	18.1
	Whitewater River-Middle Branch	10	100%	120	June 23	50.6	3	100%	22.8	Apr 21	22.4
Imazapyr	Buffalo River-Georgetown	17	6%	18.5	Sept 12	nd	4	0%	nd	--	nd
	Root River-South Branch-Carimona	11	9%	8.04	June 14	nd	3	0%	nd	--	nd

Table 34 continued. LC-MS/MS pesticide analyte detections in storm event and base flow samples for MDA Tier 3 surface water monitoring sites, 2010. PLEASE NOTE results in ng/L. 1 µg/L = 1000 ng/L

2010		Storm Event Samples (ng/L)					Base Flow Samples (ng/L)				
LC-MS/MS Pesticide Analyte	Tier 3 Surface Water Monitoring Site	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration
Imazethapyr	Beauford Ditch	10	100%	169	June 18	50	5	60%	15	Sept 2	6.9
	Buffalo River-Georgetown	17	6%	7.3	Aug 4	nd	4	0%	nd	--	nd
	Le Sueur River-Hwy66	10	90%	51.6	June 28	9.66	4	0%	nd	--	nd
	Root River-South Branch-Carimona	11	18%	20	June 16	nd	3	0%	nd	--	nd
	Whitewater River-Middle Branch	10	60%	8.11	June 23	7.37	3	0%	nd	--	nd
Imidacloprid	Beauford Ditch	10	30%	52.2	July 22	nd	5	0%	nd	--	nd
MCPA	Buffalo River-Georgetown	17	24%	116	June 17	nd	4	25%	7.6	June 16	nd
MCPP	Seven Mile Creek #3	9	11%	57	June 1	nd	4	0%	nd	--	nd
Mesotrione	Root River-South Branch-Carimona	11	9%	165	June 16	nd	3	0%	nd	--	nd
Metalaxyl	Buffalo River-Georgetown	17	12%	15.8	June 17	nd	4	0%	nd	--	nd
Metolachlor ESA	Beauford Ditch	10	100%	2380	June 11	1520	5	100%	1210	Sept 2	1050
	Buffalo River-Georgetown	17	100%	195	Oct 3	86.7	4	100%	232	Aug 13	100
	Le Sueur River-Hwy66	10	100%	1500	Sept 17	907	4	100%	756	Nov 9	657
	Root River-North Branch	7	100%	1600	June 25	1210	3	100%	990	Jan 20	855
	Root River-South Branch-Carimona	11	100%	1810	June 16	826	3	100%	769	Nov 9	621
	Seven Mile Creek #3	9	100%	2060	June 27	1250	4	100%	1300	Nov 10	1124
	Whitewater River-Middle Branch	10	100%	1490	Aug 15	627	3	100%	1020	Nov 10	898

Table 34 continued. LC-MS/MS pesticide analyte detections in storm event and base flow samples for MDA Tier 3 surface water monitoring sites, 2010. PLEASE NOTE results in ng/L. 1 µg/L = 1000 ng/L

2010		Storm Event Samples (ng/L)					Base Flow Samples (ng/L)				
LC-MS/MS Pesticide Analyte	Tier 3 Surface Water Monitoring Site	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration	No. of samples	% Detection	Max. Concentration	Date of Max.	Median Concentration
Metolachlor OXA	Beauford Ditch	10	100%	1340	June 11	481	5	100%	862	Sept 2	119
	Buffalo River-Georgetown	17	94%	81.4	July 28	29.9	4	75%	190	Aug 13	94.3
	Le Sueur River-Hwy66	10	100%	589	June 28	294	4	100%	125	Nov 9	82.4
	Root River-North Branch	7	100%	326	Sept 24	111	3	100%	27.5	Apr 21	24
	Root River-South Branch-Carimona	11	100%	468	June 16	85.6	3	100%	18	Nov 9	16.2
	Seven Mile Creek #3	9	100%	711	Sept 2	211	4	100%	114	Nov 10	87.6
	Whitewater River-Middle Branch	10	90%	377	June 25	70.6	3	100%	18.1	Nov 10	12
Saflufenacil	Beauford Ditch	10	10%	20.3	June 11	nd	5	0%	nd	--	nd
	Buffalo River-Georgetown	17	6%	18	Sept 29	nd	4	0%	nd	--	nd
	Le Sueur River-Hwy66	10	20%	32.1	June 28	nd	4	0%	nd	--	nd
Thiamethoxam	Beauford Ditch	10	60%	88.2	June 11	27.2	5	20%	55.5	Sept 2	nd
	Buffalo River-Georgetown	17	0%	nd	--	nd	4	25%	27	Aug 13	nd
	Le Sueur River-Hwy66	10	20%	91.8	June 28	nd	4	0%	nd	--	nd
	Root River-South Branch-Carimona	11	27%	92.2	June 16	nd	3	0%	nd	--	nd
	Seven Mile Creek #3	9	11%	53.3	June 27	nd	4	0%	nd	--	nd
	Whitewater River-Middle Branch	10	10%	130	June 23	nd	3	0%	nd	--	nd

3.4. Long-term analysis of pesticides in surface water

This section presents a review of MDA's long-term data from surface water sites located throughout the state. In most years, acetochlor, atrazine and metolachlor are detected more often in streams and rivers around the state than any other pesticide. Two of these three chemicals (acetochlor and atrazine) have been identified as "surface water pesticides of concern" by the MN Commissioner of Agriculture. This section of the report will focus on long-term results for these three chemicals at Tier 1, Tier 2 and Tier 3 locations. Reference values for these chemicals can be found in Table 7 as well as in Table 35.

Table 35. Surface water reference values for acetochlor, atrazine and metolachlor.

Pesticide	Surface Water Reference Value (human health-based value shown if lower than aquatic toxicity value)
Acetochlor	3.6 µg/L (4-day aquatic toxicity)
Atrazine	10 µg/L (4-day aquatic toxicity) 3.4 µg/L (30-day human health based; applicable only to class 2A and 2Bd waters designated by Minn. R. ch. 7050)
Metolachlor	23 µg/L (4-day aquatic toxicity)

3.4.1. Long-term results for Tier 1 and Tier 2 from 2005 through 2010

Table 37 contains the following four values of interest to the MDA for evaluating pesticide water quality results:

Median – the middle value of the data when ranked from high to low;

75th Percentile – 75 percent of the data is less than this value;

90th Percentile – 90 percent of the data is less than this value;

Maximum – the largest value.

Although MDA has elected to present maximum values in several of the tables in this report, often times maximum values are unusual occurrences, frequently much higher than the associated data set statistics. However, maximums can be useful for assessing "worst case" scenarios and comparing with water quality standards to assess the potential for impacts. It is worth noting that a maximum concentration may never be repeated, and annual maximum values are often times impossible to accurately predict.

Tier 1 and Tier 2 samples were collected from all PMRs during May, June and/or July. Data presented in this section from PMR 10 is comparable to other statewide Tier 1 and Tier 2 locations because the Urban Tier 1/Tier 2 sites data have been removed for this specific analysis. The urban locations have a longer sampling season (May through August) to better align with pesticide applications in urban settings and therefore are not comparable to these data. Data from these sites are presented in Section 4 of this report. The locations for all of the Tier 1 and Tier 2 sites presented in this section of the report are presented in Figure 56.

Further information on sampling guidelines can be found in the 2010 Tier 1 and Tier 2 sampling section of this report or the MDA Surface Water Monitoring Design Document (www.mda.state.mn.us/monitoring).

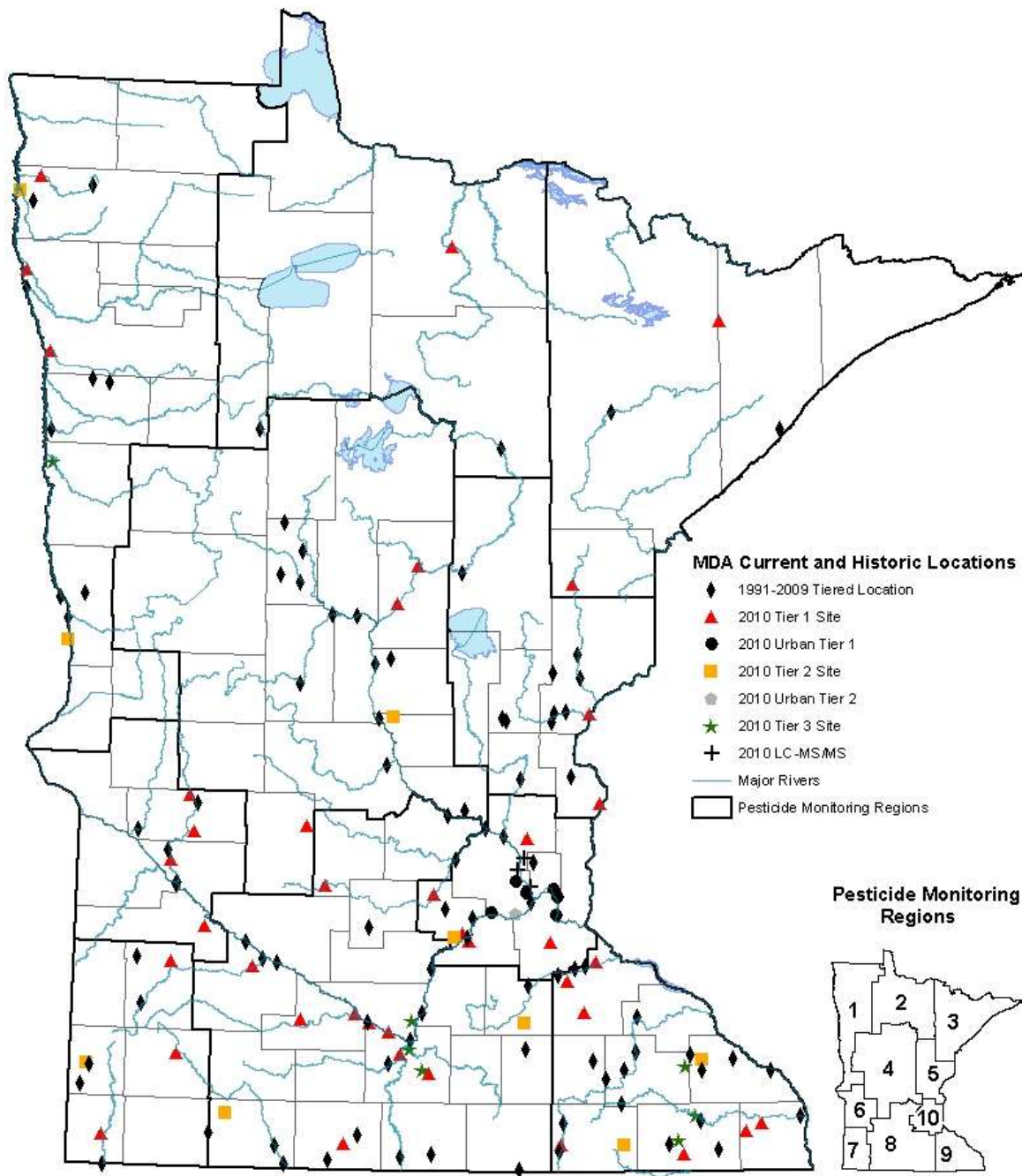


Figure 56. Current and historic surface water sampling locations.

Acetochlor

Information on the frequency of surface water detection of acetochlor in each PMR from 2005 through 2010 can be found in Table 36. Acetochlor is detected in streams around the state (with the exception of PMRs 2 and 3); however, the detection frequency is generally highest in PMR 8.

Historically, the highest single concentration of acetochlor was 12.3 µg/L and was detected at the Lower South Branch of the Root River (PMR 9) on June 8, 2009 (Table 37). Prior to the 2009 detection, the maximum acetochlor concentration measured at a Tier 1 or Tier 2 site was 4.88 µg/L from Pipestone Creek (PMR 7) on June 6, 2008.

In 2010, the highest concentration of acetochlor measured was 0.99 µg/L detected in the Chippewa River at West Branch (PMR 6) on May 26, 2010 and in the Little Cannon River (PMR 9) on May 26, 2010. Maximum concentrations across the PMR's ranged from non-detect to 0.99 µg/L in 2010.

PMRs 7, 8 and 9 usually have higher acetochlor concentrations at the 75th percentile and 90th percentile levels than the other PMRs. In general, percentile concentrations were comparable to concentrations in the last few years for each PMR.

Table 36. Total number of detections and frequency of surface water detections for acetochlor at Tier 1 and Tier 2 locations, 2005 through 2010.

Detections							Percent Detections (%)					
PMR	05	06	07	08	09	10	05	06	07	08	09	10
1	3/19	3/18	13/28	16/26	6/23	12/24	16	17	46	62	26	50
2	--	--	--	--	0/4	0/4	--	--	--	--	0	0
3	--	--	--	--	0/4	0/4	--	--	--	--	0	0
4	16/28	7/25	10/29	9/18	3/13	4/19	57	28	34	50	23	21
5	5/12	--	3/16	6/16	4/26	1/12	42	--	19	38	15	8
6	8/12	2/12	4/9	13/16	10/16	10/16	67	17	44	81	63	63
7	13/20	8/22	10/24	13/17	11/16	17/21	65	36	42	76	69	81
8	41/51	46/67	45/64	48/51	50/57	46/54	80	69	70	94	88	85
9	18/42	13/47	18/44	28/31	23/31	27/42	43	28	41	90	74	64
10	9/25	7/22	7/25	17/22	15/25	21/27	36	32	28	77	60	78
Statewide	113/ 209	86/ 213	110/ 239	150/ 197	122/ 215	138/ 223	54	40	46	76	57	62

Table 37. Tier 1 and Tier 2 acetochlor, atrazine and metolachlor surface water concentration results 2005 through 2010.

	Acetochlor						Atrazine								Metolachlor							
Maximum (µg/L)							Maximum (µg/L)							Maximum (µg/L)								
PMR	2005	2006	2007	2008	2009	2010	PMR	2005	2006	2007	2008	2009	2010	PMR	2005	2006	2007	2008	2009	2010		
1	0.44	0.09	0.18	3.08	0.06	0.81	1	0.83	0.16	0.71	0.97	0.06	2.18	1	0.18	0.11	0.58	1.00	P	0.8		
2	--	--	--	--	nd	nd	2	--	--	--	--	P	nd	2	--	--	--	--	nd	nd		
3	--	--	--	--	nd	nd	3	--	--	--	--	nd	nd	3	--	--	--	--	nd	nd		
4	0.23	P	0.42	0.09	0.07	0.07	4	1.87	0.35	0.73	0.77	P	0.08	4	1.45	P	0.15	0.11	P	P		
5	0.06	--	0.36	0.85	P	P	5	0.16	--	0.96	0.96	P	P	5	P	--	0.62	0.20	P	P		
6	0.48	P	0.17	0.50	0.06	0.99	6	3.20	0.10	1.05	0.96	0.09	0.38	6	0.53	P	0.09	0.20	P	0.74		
7	1.16	0.20	0.14	4.88	0.57	0.86	7	5.70	1.26	2.11	0.78	0.26	0.36	7	0.98	0.50	0.09	0.31	0.78	0.42		
8	1.43	0.75	1.28	1.82	0.60	0.34	8	1.10	1.73	1.80	0.68	0.90	0.28	8	0.87	0.99	3.36	0.91	1.43	0.66		
9	1.35	0.23	1.39	1.62	12.3	0.99	9	5.70	1.59	1.46	3.52	9.40	0.72	9	3.10	1.04	0.56	9.84	4.45	3.96		
10	0.92	0.07	0.58	2.17	0.08	0.84	10	13.2	0.54	1.26	1.45	0.50	0.41	10	2.74	0.36	3.44	1.78	0.72	1.36		
90th Percentile (µg/L)							90th Percentile (µg/L)							90th Percentile (µg/L)								
PMR	2005	2006	2007	2008	2009	2010	PMR	2005	2006	2007	2008	2009	2010	PMR	2005	2006	2007	2008	2009	2010		
1	0.12	0.15	0.13	0.33	P	0.09	1	0.70	0.08	0.47	0.50	P	0.11	1	0.13	0.07	0.14	0.24	nd	P		
2	--	--	--	--	nd	nd	2	--	--	--	--	P	nd	2	--	--	--	--	nd	nd		
3	--	--	--	--	nd	nd	3	--	--	--	--	nd	nd	3	--	--	--	--	nd	nd		
4	0.12	0.16	0.05	0.20	P	P	4	0.73	P	0.21	0.15	P	0.06	4	0.18	P	P	P	P	P		
5	0.03	--	0.26	0.14	P	nd	5	0.09	--	0.34	0.28	P	P	5	P	--	P	P	nd	P		
6	0.30	0.09	0.09	0.29	P	0.37	6	1.73	P	0.48	0.09	P	P	6	0.39	P	0.08	0.12	P	P		
7	0.28	0.13	0.05	0.67	0.20	0.55	7	1.53	0.15	0.37	0.46	0.20	0.13	7	0.40	0.07	0.07	0.20	0.10	0.12		
8	0.27	0.40	0.34	0.58	0.12	0.22	8	0.61	0.17	0.43	P	0.08	0.14	8	0.24	0.15	0.20	0.33	0.12	0.5		
9	0.22	0.22	0.24	0.39	0.69	0.5	9	0.89	0.12	0.42	0.81	0.58	0.38	9	0.45	0.13	0.27	0.79	1.01	0.48		
10	0.57	0.23	0.07	0.14	P	0.20	10	1.36	P	0.16	0.26	0.09	0.09	10	1.25	0.07	0.09	0.21	0.17	0.28		

Table 37 continued. Tier 1 and Tier 2 acetochlor, atrazine and metolachlor surface water concentration results 2005 through 2010.

	Acetochlor						Atrazine								Metolachlor							
75th Percentile (µg/L)							75th Percentile (µg/L)							75th Percentile (µg/L)								
PMR	2005	2006	2007	2008	2009	2010	PMR	2005	2006	2007	2008	2009	2010	PMR	2005	2006	2007	2008	2009	2010		
1	nd	0.07	P	P	nd	0.05	1	0.13	nd	0.33	P	nd	0.06	1	0.08	P	P	P	nd	P		
2	--	--	--	--	nd	nd	2	--	--	--	--	P	nd	2	--	--	--	--	nd	nd		
3	--	--	--	--	nd	nd	3	--	--	--	--	nd	nd	3	--	--	--	--	nd	nd		
4	P	0.06	P	0.06	nd	nd	4	0.25	P	0.10	0.08	P	P	4	P	P	P	P	P	P		
5	P	--	nd	P	nd	nd	5	0.06	--	0.07	0.07	P	P	5	P	--	nd	P	nd	nd		
6	0.06	0.07	P	0.11	P	P	6	0.57	nd	0.35	0.05	P	P	6	0.11	P	0.05	P	nd	P		
7	0.13	0.10	P	0.11	P	0.2	7	0.71	P	0.15	P	0.10	0.09	7	0.09	P	P	P	P	0.09		
8	0.11	0.17	0.12	0.26	0.05	0.17	8	0.29	0.06	0.16	0.12	P	0.1	8	0.14	0.08	0.11	0.13	0.07	0.19		
9	0.05	0.10	P	0.13	0.13	0.08	9	0.35	P	0.20	0.31	0.19	0.12	9	0.22	0.07	0.17	0.26	0.22	0.23		
10	0.09	0.11	nd	P	P	0.10	10	0.71	nd	0.12	0.06	0.07	P	10	0.28	P	P	P	0.08	P		
Median (µg/L)							Median (µg/L)							Median (µg/L)								
PMR	2005	2006	2007	2008	2009	2010	PMR	2005	2006	2007	2008	2009	2010	PMR	2005	2006	2007	2008	2009	2010		
1	nd	nd	nd	nd	nd	nd	1	P	P	0.16	P	nd	P	1	nd	nd	P	nd	nd	P		
2	--	--	--	--	nd	nd	2	--	--	--	--	nd	nd	2	--	--	--	--	nd	nd		
3	--	--	--	--	nd	nd	3	--	--	--	--	nd	nd	3	--	--	--	--	nd	nd		
4	P	nd	nd	P	nd	nd	4	0.08	P	0.06	P	P	nd	4	P	nd	P	P	nd	nd		
5	nd	--	nd	nd	nd	nd	5	P	--	0.06	P	P	nd	5	nd	--	nd	P	nd	nd		
6	P	nd	nd	P	P	P	6	0.26	P	0.14	P	P	P	6	P	nd	P	P	nd	P		
7	P	nd	nd	P	P	P	7	0.17	0.05	0.09	P	P	0.06	7	P	P	P	P	P	P		
8	0.05	P	P	0.06	P	0.07	8	0.12	0.07	0.08	P	P	P	8	0.07	P	P	P	P	P		
9	nd	nd	nd	P	P	P	9	0.08	0.07	0.14	0.14	0.07	0.07	9	P	P	P	0.10	0.07	0.10		
10	nd	nd	nd	nd	P	P	10	0.14	0.05	0.08	P	0.05	P	10	0.05	nd	P	P	P	P		

Atrazine

The maximum atrazine surface water concentration detected at a Tier 1 or Tier 2 location was 13.2 µg/L from Silver Creek (PMR 10) on June 8, 2005 (Table 37). In 2010, the maximum concentration was 2.18 µg/L measured at Tamarac River near Stephen (PMR 1). This was the highest detection of atrazine in PMR 1 from 2005 - 2010. Excluding this sample, the next highest concentration measured in 2010 from a Tier 1 or Tier 2 site was 0.72 µg/L detected in PMR 9.

PMRs 7, 8 and 9 usually have higher atrazine concentrations at the 75th percentile and 90th percentile levels than the other PMRs. In general, percentile concentrations were comparable to concentrations in the last few years for each PMR. Atrazine concentration median values in each PMR ranged from non-detect to 0.07 µg/L in 2010.

Additional information on the frequency of atrazine surface water detection in each PMR from 2005 through 2010 can be found in Table 38. Atrazine is often detected in streams around the state, frequently at levels greater than 80 percent, however in 2010 the overall state wide detection frequency fell to 74 percent. The lowest frequency of detection recorded for PMR 5 occurred in 2010 at 47 percent. PMR 9 had a consistent detection frequency of 100 percent. Tier 1 monitoring began in PMR 2 and PMR 3 in 2009. PMR 2 had a 50 percent frequency of detection (four samples collected), while atrazine was not detected in PMR 3 (four samples collected) in 2009. In 2010, atrazine was not detected in either PMR 2 or PMR 3 (eight total samples collected).

Table 38. Total number of detections and frequency surface water of detections for atrazine at Tier 1 and Tier 2 locations, 2005 through 2010.

Detections							Percent Detections (%)					
PMR	05	06	07	08	09	10	05	06	07	08	09	10
1	18/19	28/28	28/28	20/26	15/23	18/24	95	61	100	77	65	75
2	--	--	--	--	2/4	0/4	--	--	--	--	50	0
3	--	--	--	--	0/4	0/4	--	--	--	--	0	0
4	26/28	24/25	28/29	18/18	7/13	9/19	93	96	97	100	54	47
5	12/12	--	14/16	13/16	21/26	6/12	100	--	88	81	81	50
6	12/12	12/12	9/9	16/16	13/16	10/16	100	100	100	100	81	63
7	20/20	22/22	24/24	16/17	16/16	18/21	100	100	100	94	100	86
8	50/51	52/67	62/64	49/51	56/57	46/54	98	92	97	96	98	85
9	42/42	45/47	44/44	31/31	31/31	42/42	100	96	100	100	100	100
10	25/25	21/22	23/25	21/22	25/25	17/27	100	95	92	95	100	63
Statewide	205/ 209	197/ 213	232/ 239	184/ 197	186/ 215	166/ 223	98	92	97	93	87	74

Metolachlor

The overall maximum metolachlor surface water concentration at a Tier 1 or Tier 2 site of 14.0 µg/L was detected in the Cannon River near Welch, MN (PMR 9) on June 2, 2004 (Table 37). In 2010, the maximum concentration of 3.96 µg/L was measured at the Lower South Branch of the Root River on June 15 (PMR 9). The maximum concentration of metolachlor has

occurred in PMR 9 for five of the six years presented, including 2010. The median metolachlor concentration for each PMR in 2010 ranged from non-detect to 0.10 µg/L.

Information on the frequency of surface water detection of metolachlor in each PMR from 2005 through 2010 can be found in Table 39. With the exception of PMR 2 and PMR 3, metolachlor was detected in streams around the state. In 2010, every sample collected from PMR 8 had metolachlor detected. With the exception of PMR 10, metolachlor was detected more frequently in each PMR in 2010 than in 2009.

Table 39. Total number of detections and frequency of surface water detections for metolachlor at Tier 1 and Tier 2 locations, 2005 through 2010.

Detections							Percent Detections (%)					
PMR	05	06	07	08	09	10	05	06	07	08	09	10
1	8/19	8/18	20/28	12/26	3/23	13/24	42	44	71	46	13	54
2	--	--	--	--	0/4	0/4	--	--	--	--	0	0
3	--	--	--	--	0/4	0/4	--	--	--	--	0	0
4	20/28	8/25	17/29	12/18	4/13	7/19	71	32	59	67	31	37
5	4/12	--	3/16	9/16	2/26	3/12	33	--	19	56	8	25
6	12/12	6/12	5/9	13/16	4/16	9/16	100	50	56	81	25	56
7	18/20	16/22	19/24	14/17	9/16	18/21	90	73	79	82	56	86
8	48/51	61/67	61/64	46/51	48/57	54/54	94	91	95	90	84	100
9	30/42	31/47	40/44	31/31	27/31	37/42	71	66	91	100	87	88
10	20/25	16/22	19/25	21/22	21/25	20/27	80	73	76	95	84	74
Statewide	160/ 209	146/ 213	184/ 239	158/ 197	121/ 215	161/ 223	77	69	77	80	56	72

3.4.2. Number of sample concentrations above 10 percent or 50 percent of surface water standards at Tier 3 locations from 1992 to 2010

Sample concentrations occurring at either greater than 10 percent or 50 percent of the surface water aquatic life standard for atrazine, acetochlor and metolachlor are shown in Tables 40 through 47 (except Tables 44 and 45 for atrazine, which use the human health based standard). All current and historic Tier 3 locations are included in this analysis. All results are compared against the current standards, which may or may not have been the standard in place at the time of sampling. Further information on sampling guidelines for Tier 3 stations can be found in the 2010 Tier 3 sampling section of this report or the MDA Surface Water Monitoring Design Document (www.mda.state.mn.us/monitoring).

MDA uses the thresholds of 10 percent and 50 percent of applicable water quality standards for analyzing water quality data in accordance with the Minnesota Pesticide Management Plan (PMP). These thresholds provide context to historical data and in some instances, trigger specific actions by MDA, such as initiating the development of pesticide specific best management practices or increased monitoring. It should be noted that the following tables do not consider the duration component of these standards. These tables simply note whether a concentration was detected at levels above 10 or 50 percent of the standard.

Acetochlor

Acetochlor results for the seven active Tier 3 locations from 1995 through 2010 are shown in Table 40. Acetochlor results from the ten former Tier 3 locations from 1995 through 2004 are presented in Table 41. For every year that acetochlor has been analyzed, it has been detected, though not necessarily at greater than 10 percent of the aquatic life standard (3.6 µg/L). The Middle Branch of the Whitewater River has had the most detections above both 10 percent of the aquatic life standard (15 in 2000) and above 50 percent of the aquatic life standard (7 in 2002). The Le Sueur River also had seven detections above the 50 percent of the aquatic life standard in 2001. The greatest number of occurrences above 10 or 50 percent of the aquatic life standard occurred between 1999 and 2004. The number of occurrences above 10 or 50 percent of the aquatic life standard decreased in 2010 compared to 2009 at five of seven locations. Of the 168 samples collected from the Tier 3 sites in 2010 there was only one sample (Seven Mile Creek) that was above 50 percent of the acetochlor aquatic life standard. Acetochlor was present at detectable levels in 72 of 168 samples (42 percent) collected at Tier 3 locations in 2010.

Atrazine

Atrazine results for seven current Tier 3 sites are presented in Table 42 (1993 – 2010). Atrazine results from historic sites are presented in Table 43 (1992 – 2004). The Middle Branch of the Whitewater River has the longest record of atrazine results, ranging from 1993 through 2010. The number of occurrences above 10 percent of the aquatic life standard (10.0 µg/L) in this stream has varied from none (1997, 2006, 2007, 2009 and 2010) to 24 (2004). The majority of occurrences above 10 percent of the standard occurred between 2000 and 2004 at the Middle Branch of the Whitewater River. In the Buffalo River, atrazine has been detected but never above 10 percent of the standard. In 2010, there was only one occurrence of atrazine above 10 percent of the standard at any of the Tier 3 sites (Seven Mile Creek). Atrazine was present at detectable levels in 120 of 168 samples (71 percent) collected at Tier 3 locations in 2010.

Atrazine has two applicable standards for streams that are designated by Minnesota Rules chapter 7050 as class 2A. In addition to the 10 µg/L aquatic life standard (4-day duration aquatic

toxicity based), there is a 3.4 µg/L human health standard (30 day-human health based) applicable to Class 2A streams. Tables 44 and 45 present data from current and former Tier 3 sites designated as class 2A streams relative to the 3.4 µg/L human health standard. The Middle Branch of the Whitewater River has the longest period of record for atrazine results, from 1993 through 2010. The number of occurrences above 10 percent of the human health standard (6.5 µg/L) has varied from none in 2006 and 2010 to 31 in 2004 for this stream. The majority of occurrences above 50 percent of the human health standard occurred between 2000 and 2004 at the Middle Branch of the Whitewater River. Atrazine was present at detectable levels in 65 of 75 samples (87 percent) collected at Tier 3 locations located on Class 2A streams in 2010; however, only two samples were measured above 10 percent (one from Seven Mile Creek and one from South Branch of the Root River), and none above 50 percent, of the human health standard.

Metolachlor

Metolachlor results from the seven current Tier 3 sites are presented in Table 46 (1993 – 2010). Metolachlor results for historic Tier 3 sites are in Table 47 (1992 – 2004). Of the three compounds listed in this section, metolachlor has had the fewest occurrences of detection above 10 percent of the aquatic life standard (23 µg/L). The highest number of incidences occurred in 2000, with 10 samples above 10 percent of the aquatic life standard at the Middle Branch of the Whitewater River. In the Buffalo River, metolachlor has never been detected above 10 percent of the aquatic life standard. Measured metolachlor levels at several historic Tier 3 locations, (Bent Creek, Bevens Creek and Chaska Creek) also never went above 10 percent of the standard. In both 2006 and 2007, metolachlor was not detected above 10 percent of the aquatic life standard at any of the Tier 3 locations. In 2010, there were only three samples that were measured above 10 percent of the aquatic life standard (two from Beauford Ditch and one from Seven Mile Creek). Metolachlor was more frequently detected than acetochlor and atrazine in 2010 and was present at detectable levels in 141 of 168 samples (83 percent) collected at Tier 3 locations.

Table 40. Number of sample concentrations above 10% or 50% of the acetochlor standard from 1995 - 2010 for current Tier 3 sites.

Current Tier 3 Locations	Standard of 3.6 µg/L	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beauford Ditch	Total Detections	--	--	--	--	--	--	--	--	--	--	26/34	7/11	8/14	13/20	10/13	17/29
	# > 10% Standard	--	--	--	--	--	--	--	--	--	--	9	1	0	3	1	3
	# > 50% Standard	--	--	--	--	--	--	--	--	--	--	5	0	0	0	0	0
Buffalo River	Total Detections	--	--	--	--	--	--	--	2/2	--	1/4	0/4	0/4	4/6	3/5	12/26	6/21
	# > 10% Standard	--	--	--	--	--	--	--	0	--	0	0	0	0	2	1	0
	# > 50% Standard	--	--	--	--	--	--	--	0	--	0	0	0	0	0	0	0
Le Sueur River	Total Detections	--	--	--	--	19/26	22/33	27/37	18/26	17/28	26/34	14/27	11/15	17/24	15/23	16/20	16/20
	# > 10% Standard	--	--	--	--	5	9	10	5	5	10	3	3	4	3	5	1
	# > 50% Standard	--	--	--	--	2	4	7	1	1	0	2	0	0	1	0	0
Seven Mile Creek	Total Detections	--	--	--	--	--	--	--	2/2	14/19	12/20	10/21	10/11	5/12	9/15	4/13	14/23
	# > 10% Standard	--	--	--	--	--	--	--	1	3	5	3	3	0	0	0	2
	# > 50% Standard	--	--	--	--	--	--	--	0	1	1	0	0	0	0	0	1
North Branch of the Root River	Total Detections	--	--	--	--	--	--	--	3/3	3/4	15/33	6/15	5/14	5/19	8/20	10/23	5/23
	# > 10% Standard	--	--	--	--	--	--	--	2	2	7	0	1	2	2	3	0
	# > 50% Standard	--	--	--	--	--	--	--	1	0	1	0	0	1	0	0	0
South Branch of the Root River	Total Detections	--	--	--	--	--	--	--	3/3	2/4	4/5	2/5	0/5	3/15	4/14	13/23	10/26
	# > 10% Standard	--	--	--	--	--	--	--	2	1	2	0	0	0	0	6	0
	# > 50% Standard	--	--	--	--	--	--	--	1	0	0	0	0	0	0	0	0
Middle Branch of the Whitewater	Total Detections	6/42	12/68	5/54	20/50	26/61	29/56	16/62	19/38	9/25	34/68	8/31	2/11	3/21	8/22	3/13	4/26
	# > 10% Standard	2	3	0	4	8	15	7	14	3	10	2	0	0	2	3	0
	# > 50% Standard	1	0	0	1	4	4	4	7	0	1	1	0	0	0	1	0

Gray shading indicates change in sampling beginning in 2006 from equal-flow increment composite sampling to equal-time increment based composite sampling. For further discussion, refer to the MDA's Surface Water Design Document.

Table 41. Number of sample concentrations above 10% or 50% of the acetochlor standard from 1995 - 2004 for former Tier 3 sites.

Former Tier 3 Locations	Standard of 3.6 µg/L	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Bent Creek	Total Detections	--	--	1/13	0/20	7/20	4/24	5/39	2/17	--	--
	# > 10% Standard	--	--	0	0	1	0	0	0	--	--
	# > 50% Standard	--	--	0	0	0	0	0	0	--	--
Bevens Creek	Total Detections	9/29	8/19	15/30	17/28	7/25	3/7	7/17	11/20	--	--
	# > 10% Standard	4	2	2	6	1	1	3	5	--	--
	# > 50% Standard	0	2	0	2	0	0	1	0	--	--
Blue Earth River – Frost	Total Detections	11/23	12/27	9/30	--	--	--	--	--	--	--
	# > 10% Standard	5	0	1	--	--	--	--	--	--	--
	# > 50% Standard	1	0	0	--	--	--	--	--	--	--
Blue Earth River – Rapidan	Total Detections	--	--	--	--	16/24	19/29	25/34	17/24	17/26	17/25
	# > 10% Standard	--	--	--	--	4	4	10	4	3	5
	# > 50% Standard	--	--	--	--	0	2	3	0	0	0
Cascade Creek	Total Detections	--	--	--	20/31	30/39	0/6	--	--	--	--
	# > 10% Standard	--	--	--	2	8	0	--	--	--	--
	# > 50% Standard	--	--	--	0	3	0	--	--	--	--
Chaska Creek	Total Detections	--	--	--	--	0/9	3/19	12/36	5/22	--	--
	# > 10% Standard	--	--	--	--	0	0	0	0	--	--
	# > 50% Standard	--	--	--	--	0	0	0	0	--	--
MN River at Judson	Total Detections	--	--	--	--	15/29	10/24	26/39	14/26	5/20	15/23
	# > 10% Standard	--	--	--	--	0	4	1	3	1	6
	# > 50% Standard	--	--	--	--	0	0	0	0	0	0
MN River at Jordan	Total Detections	--	9/25	21/44	10/19	16/26	8/12	--	--	--	--
	# > 10% Standard	--	3	1	2	2	6	--	--	--	--
	# > 50% Standard	--	0	0	0	0	1	--	--	--	--
Sand Creek	Total Detections	8/38	7/17	10/33	17/33	4/26	9/19	7/17	9/20	--	--
	# > 10% Standard	0	1	0	4	1	1	1	2	--	--
	# > 50% Standard	0	0	0	1	0	0	0	0	--	--
Whitewater River – South Branch	Total Detections	18/45	--	--	--	5/15	6/14	--	--	--	--
	# > 10% Standard	9	--	--	--	4	1	--	--	--	--
	# > 50% Standard	3	--	--	--	0	0	--	--	--	--

Table 42. Number of sample concentrations above 10% or 50% of the atrazine standard from 1993 - 2010 for current Tier 3 sites.

Current Tier 3 Locations	<i>Standard of 10.0 µg/L</i>	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beauford Ditch	Total Detections	--	--	--	--	--	--	--	--	--	--	--	--	32/34	5/11	12/14	13/20	9/13	12/29
	# > 10% Standard	--	--	--	--	--	--	--	--	--	--	--	--	3	0	0	0	0	0
	# > 50% Standard	--	--	--	--	--	--	--	--	--	--	--	--	0	0	0	0	0	0
Buffalo River	Total Detections	--	--	--	--	--	--	--	--	--	2/2	--	4/4	4/4	3/4	6/6	4/5	20/26	9/21
	# > 10% Standard	--	--	--	--	--	--	--	--	--	0	--	0	0	0	0	0	0	0
	# > 50% Standard	--	--	--	--	--	--	--	--	--	0	--	0	0	0	0	0	0	0
Le Sueur River	Total Detections	--	--	--	--	--	--	15/26	28/33	29/37	19/26	19/28	32/34	27/27	14/15	24/24	20/23	16/20	15/20
	# > 10% Standard	--	--	--	--	--	--	2	8	4	8	0	3	0	0	0	0	0	0
	# > 50% Standard	--	--	--	--	--	--	0	0	0	0	0	0	0	0	0	0	0	0
Seven Mile Creek	Total Detections	--	--	--	--	--	--	--	--	--	2/2	15/19	20/20	21/21	10/11	11/12	14/15	10/13	16/23
	# > 10% Standard	--	--	--	--	--	--	--	--	--	2	3	3	2	3	0	0	0	1
	# > 50% Standard	--	--	--	--	--	--	--	--	--	0	0	0	1	0	0	0	0	0
North Branch of the Root River	Total Detections	--	--	--	--	--	--	--	--	--	3/3	4/4	30/33	15/15	14/14	19/19	20/20	23/23	19/23
	# > 10% Standard	--	--	--	--	--	--	--	--	--	2	0	7	2	0	1	1	5	0
	# > 50% Standard	--	--	--	--	--	--	--	--	--	1	0	2	0	0	0	0	0	0
South Branch of the Root River	Total Detections	--	--	--	--	--	--	--	--	--	3/3	4/4	5/5	5/5	5/5	14/15	13/14	23/23	26/26
	# > 10% Standard	--	--	--	--	--	--	--	--	--	2	3	4	0	0	0	0	8	0
	# > 50% Standard	--	--	--	--	--	--	--	--	--	1	1	2	0	0	0	0	0	0
Middle Branch of the Whitewater	Total Detections	43/56	41/41	37/42	68/68	52/54	45/50	49/61	54/56	60/62	34/38	23/25	67/68	30/31	11/11	21/21	22/22	13/13	23/26
	# > 10% Standard	9	5	2	5	0	4	2	21	6	16	7	24	1	0	0	3	0	0
	# > 50% Standard	1	1	1	0	0	0	0	11	4	8	2	8	0	0	0	0	0	0

Gray shading indicates change in sampling beginning in 2006 from equal-flow increment composite sampling to equal-time increment based composite sampling. For further discussion, refer to the MDA's Surface Water Design Document.

Table 43. Number of sample concentrations above 10% or 50% of the atrazine standard from 1992 - 2004 for former Tier 3 sites.

Former Tier 3 Locations	<i>Standard of 10.0 µg/L</i>	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Bent Creek	Total Detections	--	--	--	--	--	10/13	2/20	9/20	7/24	15/39	13/17	--	--
	# > 10% Standard	--	--	--	--	--	0	0	0	0	0	0	--	--
	# > 50% Standard	--	--	--	--	--	0	0	0	0	0	0	--	--
Bevens Creek	Total Detections	16/19	22/29	44/47	28/29	16/19	29/30	21/28	7/25	4/7	9/17	16/20	--	--
	# > 10% Standard	5	11	7	2	1	3	4	3	2	1	4	--	--
	# > 50% Standard	0	1	0	0	0	0	1	0	0	0	1	--	--
Blue Earth River – Frost	Total Detections	17/40	16/26	18/18	22/23	24/27	24/30	--	--	--	--	--	--	--
	# > 10% Standard	0	5	0	3	0	0	--	--	--	--	--	--	--
	# > 50% Standard	0	0	0	0	0	0	--	--	--	--	--	--	--
Blue Earth River – Rapidan	Total Detections	--	--	--	--	--	--	--	13/24	23/29	24/34	17/24	17/26	23/25
	# > 10% Standard	--	--	--	--	--	--	--	1	4	3	5	0	3
	# > 50% Standard	--	--	--	--	--	--	--	0	0	0	0	0	0
Cascade Creek	Total Detections	--	--	--	--	--	--	26/31	32/39	4/6	--	--	--	--
	# > 10% Standard	--	--	--	--	--	--	2	5	0	--	--	--	--
	# > 50% Standard	--	--	--	--	--	--	0	0	0	--	--	--	--
Chaska Creek	Total Detections	--	--	--	--	--	--	--	6/9	6/19	13/36	16/22	--	--
	# > 10% Standard	--	--	--	--	--	--	--	0	1	0	3	--	--
	# > 50% Standard	--	--	--	--	--	--	--	0	0	0	1	--	--
MN River at Judson	Total Detections	--	--	--	--	--	--	--	12/29	18/24	24/39	14/26	16/20	23/23
	# > 10% Standard	--	--	--	--	--	--	--	0	0	0	4	0	3
	# > 50% Standard	--	--	--	--	--	--	--	0	0	0	0	0	0
MN River at Jordan	Total Detections	--	--	--	--	25/25	42/44	17/19	13/26	10/12	--	--	--	--
	# > 10% Standard	--	--	--	--	2	1	1	3	4	--	--	--	--
	# > 50% Standard	--	--	--	--	0	0	0	0	0	--	--	--	--
Sand Creek	Total Detections	19/24	21/33	36/36	32/38	12/17	31/33	17/33	9/26	5/19	10/17	17/20	--	--
	# > 10% Standard	10	6	4	2	1	0	6	1	4	0	3	--	--
	# > 50% Standard	0	0	0	0	0	0	1	0	0	0	2	--	--
Whitewater River – South Branch	Total Detections	16/38	46/65	42/45	42/45	--	--	--	8/15	8/14	--	--	--	--
	# > 10% Standard	2	11	2	3	--	--	--	0	0	--	--	--	--
	# > 50% Standard	1	0	0	2	--	--	--	0	0	--	--	--	--

Table 44. Number of sample concentrations above 10% or 50% of the atrazine standard from 1993 - 2010 for current Tier 3 sites located on class 2A waters.

Current Tier 3 Locations	Standard of 3.4 µg/L	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Seven Mile Creek	Total Detections	--	--	--	--	--	--	--	--	--	2/2	15/19	20/20	21/21	10/11	11/12	14/15	10/13	16/23
	# > 10% Standard	--	--	--	--	--	--	--	--	--	2	4	8	3	3	0	0	0	1
	# > 50% Standard	--	--	--	--	--	--	--	--	--	2	1	0	2	3	0	0	0	0
South Branch of the Root River	Total Detections	--	--	--	--	--	--	--	--	--	3/3	4/4	5/5	5/5	5/5	14/15	13/14	23/23	26/26
	# > 10% Standard	--	--	--	--	--	--	--	--	--	3	3	4	1	0	1	2	11	1
	# > 50% Standard	--	--	--	--	--	--	--	--	--	3	3	4	0	0	0	0	6	0
Middle Branch of the Whitewater	Total Detections	43/56	41/41	37/42	68/68	52/54	45/50	49/61	54/56	60/62	34/38	23/25	67/68	30/31	11/11	21/21	22/22	13/13	23/26
	# > 10% Standard	17	14	4	8	3	6	5	28	8	18	9	31	3	0	1	4	2	0
	# > 50% Standard	4	3	2	2	0	4	0	13	5	15	6	20	1	0	0	2	0	0

Gray shading indicates change in sampling beginning in 2006 from equal-flow increment composite sampling to equal-time increment based composite sampling. For further discussion, refer to the MDA's Surface Water Design Document.

Table 45. Number of sample concentrations above 10% or 50% of the atrazine standard from 1992 - 2004 for a former Tier 3 site located on a class 2A waters.

Former Tier 3 Location	Standard of 3.4 µg/L	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Whitewater River – South Branch	Total Detections	16/38	46/65	42/45	42/45	--	--	--	8/15	8/14	--	--	--	--
	# > 10% Standard	6	29	13	7	--	--	--	5	0	--	--	--	--
	# > 50% Standard	1	8	2	2	--	--	--	0	0	--	--	--	--

Table 46. Number of sample concentrations above 10% or 50% of the metolachlor standard from 1993 - 2009 for current Tier 3 sites.

Current Tier 3 Locations	Standard of 23.0 µg/L*	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beauford Ditch	Total Detections	--	--	--	--	--	--	--	--	--	--	--	--	30/34	7/11	14/14	18/20	13/13	29/29
	# > 10% Standard	--	--	--	--	--	--	--	--	--	--	--	--	1	0	0	0	1	2
	# > 50% Standard	--	--	--	--	--	--	--	--	--	--	--	--	0	0	0	0	1	0
Buffalo River	Total Detections	--	--	--	--	--	--	--	--	--	2/2	--	3/4	2/4	1/4	6/6	3/5	15/26	15/21
	# > 10% Standard	--	--	--	--	--	--	--	--	--	0	--	0	0	0	0	0	0	0
	# > 50% Standard	--	--	--	--	--	--	--	--	--	0	--	0	0	0	0	0	0	0
Le Sueur River	Total Detections	--	--	--	--	--	--	24/26	26/33	36/37	25/26	20/28	32/34	27/27	15/15	23/24	21/23	20/20	20/20
	# > 10% Standard	--	--	--	--	--	--	0	0	0	0	0	0	0	0	0	0	1	0
	# > 50% Standard	--	--	--	--	--	--	0	0	0	0	0	0	0	0	0	0	0	0
Seven Mile Creek	Total Detections	--	--	--	--	--	--	--	--	--	2/2	17/19	17/20	18/21	10/11	8/12	12/15	8/13	22/23
	# > 10% Standard	--	--	--	--	--	--	--	--	--	0	0	1	0	0	0	0	0	1
	# > 50% Standard	--	--	--	--	--	--	--	--	--	0	0	0	0	0	0	0	0	0
North Branch of the Root River	Total Detections	--	--	--	--	--	--	--	--	--	3/3	3/4	30/33	8/15	13/14	18/19	15/20	20/23	17/23
	# > 10% Standard	--	--	--	--	--	--	--	--	--	0	0	2	0	0	0	0	2	0
	# > 50% Standard	--	--	--	--	--	--	--	--	--	0	0	0	0	0	0	0	0	0
South Branch of the Root River	Total Detections	--	--	--	--	--	--	--	--	--	3/3	4/4	5/5	4/5	5/5	12/15	11/14	20/23	23/26
	# > 10% Standard	--	--	--	--	--	--	--	--	--	1	0	0	0	0	0	0	4	0
	# > 50% Standard	--	--	--	--	--	--	--	--	--	0	0	0	0	0	0	0	0	0
Middle Branch of the Whitewater	Total Detections	23/56	15/41	12/42	31/68	15/54	36/50	36/61	36/56	39/62	20/38	12/25	52/68	16/31	6/11	12/21	12/22	2/13	15/26
	# > 10% Standard	3	0	0	0	0	0	0	10	0	6	1	0	1	0	0	2	0	0
	# > 50% Standard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Gray shading indicates change in sampling beginning in 2006 from equal-flow increment composite sampling to equal-time increment based composite sampling. For further discussion, refer to the MDA's Surface Water Design Document.

*Method Report Limit for metolachlor was changed from 0.10 µg/L from 1993 – 1999 to 0.07 µg/L starting in 2000.

Table 47. Number of sample concentrations above 10% or 50% of the metolachlor standard from 1992 – 2004 for former Tier 3 sites.

Former Tier 3 Locations	<i>Standard of 23.0 µg/L*</i>	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Bent Creek	Total Detections	--	--	--	--	--	0/13	1/20	2/20	1/24	0/39	1/17	--	--
	# > 10% Standard	--	--	--	--	--	0	0	0	0	0	0	--	--
	# > 50% Standard	--	--	--	--	--	0	0	0	0	0	0	--	--
Bevens Creek	Total Detections	5/19	13/29	4/47	9/29	7/19	22/30	6/28	1/25	2/7	8/17	10/20	--	--
	# > 10% Standard	0	0	0	0	0	0	0	0	0	0	0	--	--
	# > 50% Standard	0	0	0	0	0	0	0	0	0	0	0	--	--
Blue Earth River – Frost	Total Detections	13/40	15/26	14/18	18/23	25/27	12/30	--	--	--	--	--	--	--
	# > 10% Standard	0	3	0	0	0	0	--	--	--	--	--	--	--
	# > 50% Standard	0	0	0	0	0	0	--	--	--	--	--	--	--
Blue Earth River – Rapidan	Total Detections	--	--	--	--	--	--	--	23/24	25/29	33/34	21/24	22/26	24/25
	# > 10% Standard	--	--	--	--	--	--	--	0	0	1	0	0	0
	# > 50% Standard	--	--	--	--	--	--	--	0	0	0	0	0	0
Cascade Creek	Total Detections	--	--	--	--	--	--	27/31	34/39	4/6	--	--	--	--
	# > 10% Standard	--	--	--	--	--	--	0	2	2	--	--	--	--
	# > 50% Standard	--	--	--	--	--	--	0	0	1	--	--	--	--
Chaska Creek	Total Detections	--	--	--	--	--	--	--	0/9	1/19	2/36	6/22	--	--
	# > 10% Standard	--	--	--	--	--	--	--	0	0	0	0	--	--
	# > 50% Standard	--	--	--	--	--	--	--	0	0	0	0	--	--
MN River at Judson	Total Detections	--	--	--	--	--	--	--	25/29	15/24	33/39	16/26	9/20	22/23
	# > 10% Standard	--	--	--	--	--	--	--	0	1	3	0	0	1
	# > 50% Standard	--	--	--	--	--	--	--	0	0	0	0	0	0
MN River at Jordan	Total Detections	--	--	--	--	25/25	41/42	19/19	25/26	10/12	--	--	--	--
	# > 10% Standard	--	--	--	--	0	0	1	0	0	--	--	--	--
	# > 50% Standard	--	--	--	--	0	0	0	0	0	--	--	--	--
Sand Creek	Total Detections	15/24	20/33	13/36	21/38	10/17	26/33	25/33	4/26	15/19	10/17	14/20	--	--
	# > 10% Standard	3	2	0	0	0	0	0	0	0	0	0	--	--
	# > 50% Standard	0	0	0	0	0	0	0	0	0	0	0	--	--
Whitewater R. South Branch	Total Detections	9/38	38/65	19/45	24/45	--	--	--	3/15	6/14	--	--	--	--
	# > 10% Standard	1	3	0	0	--	--	--	0	0	--	--	--	--
	# > 50% Standard	0	0	0	0	--	--	--	0	0	--	--	--	--

*Method Report Limit for metolachlor was changed from 0.10 µg/L from 1993 – 1999 to 0.07 µg/L starting in 2000.

3.4.3. Period of record data at current Tier 3 locations

Since 2006, the MDA has made an effort to collect storm flow samples on an ETI basis at Tier 3 sites to generate data that was more readily comparable to duration based standards or reference values. Surface water monitoring at most of the Tier 3 sites has included both equal-flow increment (EFI) and equal-time increment (ETI) composite sample collection during storm flow periods using stage activated automated samplers. Grab samples are also collected during and between storm events. In the following tables, composite sample concentrations collected before 2006 (generally EFI) and starting in 2006 (generally ETI) are presented together with grab concentration data.

Table 48 summarizes results for the period of record at each of the current Tier 3 locations. The Tier 3 period of record ranges from 18 years at the Middle Branch of the Whitewater River to two years at the Buffalo River near Georgetown. The number of samples per year varies, though on average it generally consists of 20 to 30 samples per Tier 3 site.

Acetochlor

Acetochlor results are available from 1995 through 2010. The maximum measured acetochlor surface water concentration occurred at Beauford Ditch in 2005 with a result of 12.1 µg/L. Maximum acetochlor concentrations were lower than or consistent with previous measured values for six of seven sites in 2010. Seven Mile Creek recorded its highest maximum concentration since monitoring began (2003) in 2010. Median values varied from non-detect to 0.10 µg/L in 2010 for these Tier 3 sites. During the period of record, the median range was from non-detect to 0.13 µg/L. Median values at the North Branch of the Root River, South Branch of the Root River and the Middle Branch of the Whitewater River have been at non-detect or “present” levels since monitoring began at these locations. The 90th percentile increased at only two locations in 2010 compared to 2009; Beauford Ditch and Seven Mile Creek.

Atrazine

Maximum atrazine surface water concentrations have ranged from “present” at Beauford Ditch in 2006 and 2008 to 32.0 µg/L at the Middle Branch of the Whitewater River in 2004. This wide variation in results over time makes further statistical work on the data impossible. The Middle Branch of the Whitewater River experienced several years of high maximum values from 2000 to 2004. Since then, maximum atrazine concentrations have declined substantially at the Middle Branch of the Whitewater River, with the exception being in 2008 when a value of 3.64 µg/L was measured. The Beauford Ditch and Buffalo River – Georgetown had median atrazine values of non-detect in 2010. Prior to 2010, there was only one non-detect median value for atrazine (2006 in Beauford Ditch). In 2000, the highest median concentrations of 0.48 µg/L and 0.34 µg/L occurred in the Le Sueur and Middle Branch of the Whitewater rivers, respectively. Median values have generally declined at these stations since 2000. In 2010, the 90th percentile atrazine surface water concentrations ranged from “present” to 0.23 µg/L.

Metolachlor

The highest metolachlor surface water concentration in the period of record for MDA’s surface water program was a result of 76.0 µg/L from a sample collected during snowmelt in Beauford Ditch in 2009. During that same event, the second highest metolachlor concentration

(9.44 µg/L) from a Tier 3 site was measured on the Le Sueur River. In 2010, the maximum concentration for Beauford Ditch was 3.04 µg/L and 1.56 µg/L for the Le Sueur River. The only site that saw an increase in maximum concentration compared to 2009 was Seven Mile Creek. During the period of record, median metolachlor concentrations ranged from non-detect to 0.32 µg/L. Median metolachlor concentrations ranged from “present” to 0.12 µg/L in 2010. The 90th percentile increased at four of seven sites in 2010 compared to the previous year.

Table 48. Period of record surface water concentration results at current Tier 3 locations for acetochlor, atrazine and metolachlor.

	Acetochlor (µg/L)			Atrazine (µg/L)			Metolachlor (µg/L)		
Beauford Ditch	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum
2005	P	3.88	12.1	P	0.43	2.85	P	0.74	3.70
2006	0.06	0.21	1.58	nd	P	P	P	0.14	0.17
2007	0.04	0.14	0.19	0.04	0.20	0.22	P	0.15	0.42
2008	P	0.70	1.46	P	P	P	P	0.28	1.99
2009	P	0.16	0.43	P	P	0.08	0.12	0.34	76.0
2010	P	0.31	0.51	nd	P	0.05	0.11	2.01	3.04
Buffalo River - Georgetown	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum
2009	nd	0.29	0.44	0.06	0.35	0.88	P	0.27	1.47
2010	nd	P	0.15	nd	0.07	0.22	P	0.08	0.37
Le Sueur River	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum
1999	0.09	1.08	3.63	0.04	0.77	2.04	0.13	0.36	0.70
2000	0.11	1.90	3.55	0.48	1.55	2.80	0.21	0.73	1.41
2001	0.13	2.67	9.00	0.10	1.38	3.80	0.22	0.90	1.44
2002	0.08	0.91	7.10	0.24	1.83	2.97	0.10	0.31	0.65
2003	0.09	1.42	2.38	0.07	0.30	0.43	0.08	0.52	0.68
2004	0.06	0.82	1.52	0.22	0.82	1.95	0.11	0.37	1.30
2005	P	0.42	5.30	0.07	0.28	0.72	0.07	0.37	0.98
2006	0.13	0.58	1.24	0.05	0.17	0.29	P	0.08	0.24
2007	P	1.74	1.50	0.08	0.27	0.47	P	1.60	0.57
2008	P	0.91	2.05	P	0.16	0.66	0.10	0.29	1.54
2009	0.06	0.40	0.47	P	0.20	0.29	0.08	0.28	9.44
2010	0.10	0.24	0.40	P	0.22	0.33	0.12	0.80	1.56
Seven Mile Creek	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum
2003	0.07	0.58	2.19	0.09	1.26	2.59	0.11	0.60	1.65
2004	0.09	1.17	2.45	0.16	1.21	1.35	0.32	1.45	3.20
2005	nd	0.45	1.18	0.05	1.00	10.0	0.05	0.32	0.90
2006	0.06	0.43	0.48	0.06	1.03	1.06	P	0.33	0.40
2007	nd	P	0.21	0.04	0.11	0.22	P	P	P
2008	P	0.08	0.12	P	P	0.09	P	0.20	0.30
2009	nd	nd	0.07	P	P	0.11	P	P	0.10
2010	0.05	0.24	2.80	P	0.08	1.53	0.12	1.61	3.56
N. Branch Root River	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum
2004	nd	0.81	1.83	0.24	4.06	7.40	0.12	1.60	5.80
2005	nd	P	0.06	0.07	0.88	1.27	P	0.15	1.59
2006	nd	0.12	1.71	0.15	0.55	0.72	0.05	0.40	1.55
2007	nd	0.10	2.16	0.08	0.23	1.06	P	0.61	2.01
2008	nd	0.18	0.69	P	0.25	1.02	P	0.36	1.57
2009	nd	0.18	0.69	P	0.25	1.02	P	0.36	1.57
2010	nd	nd	P	0.11	0.05	0.11	0.35	P	0.17
S. Branch Root River	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum
2008	nd	0.12	0.60	P	0.40	0.96	P	0.30	1.08
2009	P	0.69	1.23	0.08	3.27	4.70	P	3.42	5.00
2010	nd	0.15	0.22	0.05	0.23	0.51	P	0.39	1.59

Table 48 continued. Period of record surface water concentration results at current Tier 3 locations for acetochlor, atrazine and metolachlor.

Middle Branch Whitewater River	Acetochlor (µg/L)			Atrazine (µg/L)			Metolachlor (µg/L)		
	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum	Median	90th %-tile	Maximum
1993	--	--	--	0.23	1.26	5.14	nd	1.57	6.15
1994	--	--	--	0.25	1.15	5.01	nd	0.18	1.41
1995	nd	0.11	2.53	0.18	0.25	5.58	nd	0.24	0.98
1996	nd	0.08	1.50	0.20	0.43	3.42	nd	0.20	1.85
1997	nd	nd	0.22	0.14	0.27	0.64	nd	0.12	0.37
1998	nd	0.12	2.55	0.12	0.62	3.75	P	0.46	1.27
1999	nd	0.26	6.35	0.12	0.56	1.55	P	0.18	1.58
2000	P	1.48	4.89	0.34	6.98	16.5	0.19	3.49	7.79
2001	nd	0.55	7.80	0.13	0.43	17.4	P	0.14	0.69
2002	nd	2.38	9.60	0.17	11.8	29.4	P	2.57	4.30
2003	nd	0.37	1.19	0.16	3.61	7.15	nd	1.09	3.90
2004	P	0.53	2.17	0.18	6.24	32.0	0.13	0.37	1.62
2005	nd	P	2.20	0.09	0.33	2.00	P	0.28	3.70
2006	nd	P	P	0.08	0.14	0.16	P	P	P
2007	nd	P	P	0.07	0.11	0.35	P	0.08	0.39
2008	nd	0.10	0.53	0.07	1.14	3.64	P	1.53	3.32
2009	nd	0.74	1.88	0.08	0.34	0.69	nd	P	0.45
2010	nd	P	0.06	0.06	0.20	0.25	P	0.12	0.31

3.5. Lake sampling

In 2010, twenty-one total lakes were sampled for pesticides (Figure 57). Twenty lakes were sampled for pesticides from watersheds selected for 2010 MPCA's 10 Year Intensive Watershed Monitoring cycle. In addition, as part of an endocrine disruption study led by MPCA, one lake had four samples collected during the same trip from various shoreline points. At least one lake was sampled from all ten PMR's in 2010. This sampling follows cooperative efforts with MPCA and USGS that occurred from 2007 through 2009. The 2007 sampling was part of the National Lakes Assessment Program sponsored by EPA where 53 randomly selected lakes were sampled across the state. A report was produced by MDA in 2008 titled "Pesticides in Minnesota Lakes" which summarizes the results from the 2007 study. The report is available at: (www.mda.state.mn.us/monitoring).

Table 49 shows summary statistics for GC-MS pesticide compounds detected in 2010 lake sampling efforts. All pesticide detections in lakes in 2010 were well below applicable water quality standards. Atrazine was detected in 48 percent of the lake samples with a maximum concentration of 0.08 µg/L, metolachlor was detected in 26 percent of the lake samples with a maximum concentration of 0.59 µg/L, and acetochlor was detected in 9 percent of the lake samples with a maximum detected concentration of "present". Desethylatrazine was detected in 26 percent of the lake samples.

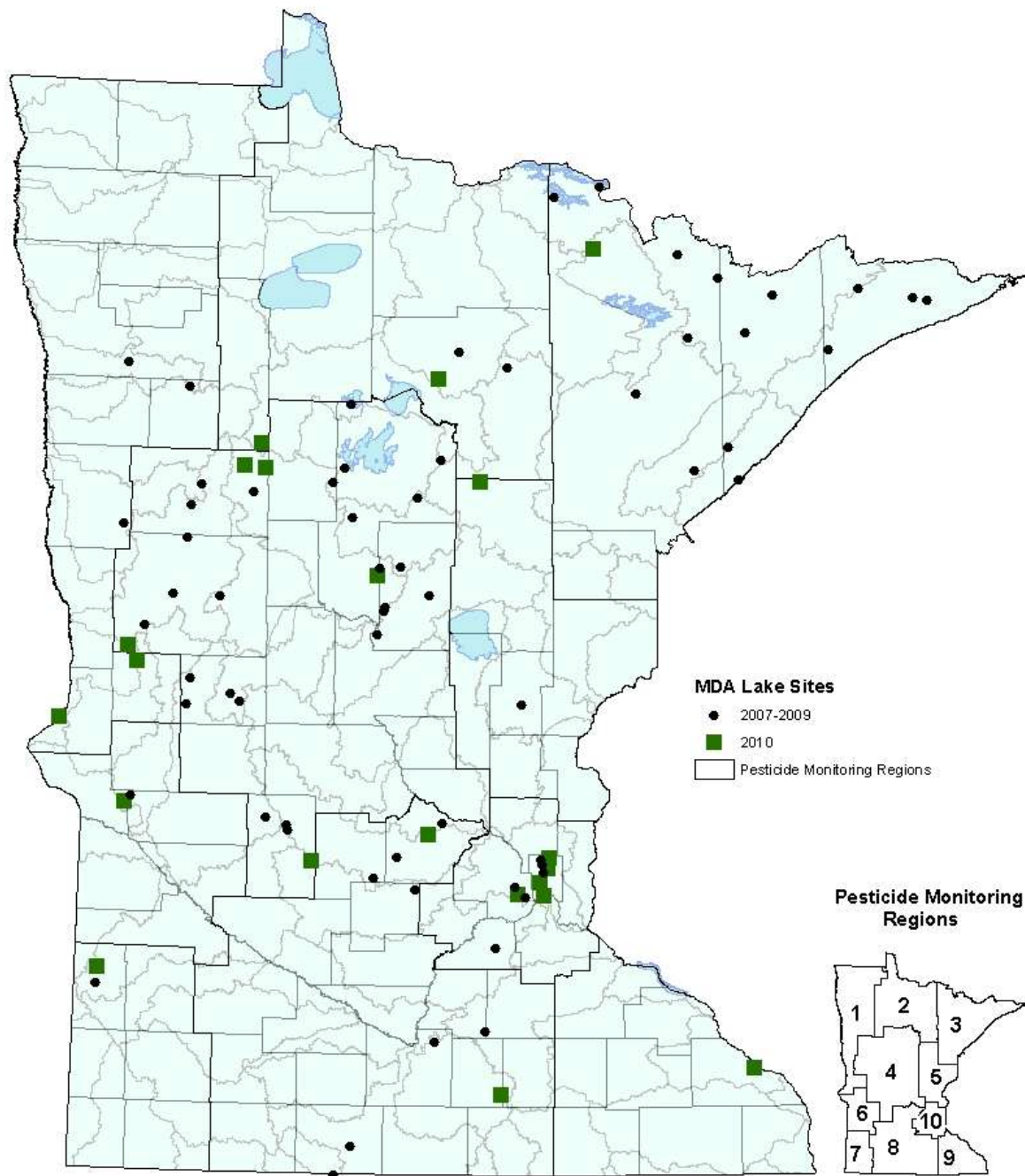


Figure 57. 2010 MDA lake sampling locations.

Table 49. Summary statistics for GC-MS pesticide compounds detected in lake sampling, 2010.

GC-MS Detected Analyte	Median (µg/L)	Maximum (µg/L)	Detections (23 samples)	Detection Frequency
Acetochlor	nd	P	2	9%
Atrazine	nd	0.08	11	48%
Desethylatrazine	nd	0.06	6	26%
Metolachlor	nd	0.59	6	26%

Table 50 shows summary statistics for LC-MS/MS pesticide compounds detected in 2010 lake sampling efforts. As with previous sampling, the degradate compounds of acetochlor, alachlor, dimethenamid, and metolachlor were detected more frequently than their parent compound. The new LC-MS/MS laboratory capabilities allowed for additional pesticide compounds to be analyzed. Among the new analytes that were detected in lakes in 2010 include: 2,4-D, bentazon, dicamba, diuron, hydroxyatrazine, and MCPA. 2,4-D and hydroxyatrazine were the most commonly detected pesticide compounds in lakes in 2010 among both GC-MS and LC-MS/MS analytes.

Table 50. Summary statistics for LC-MS/MS pesticide compounds detected in lake sampling, 2010. PLEASE NOTE results in ng/L. 1 µg/L = 1000 ng/L

LC-MS/MS Detected Analyte	Median (ng/L)	Maximum (ng/L)	Detections (24 samples)	Detection Frequency
2,4-D	38.6	190	19	79%
Acetochlor ESA	48.8	498	13	54%
Acetochlor OXA	19.2	470	12	50%
Alachlor ESA	nd	371	7	29%
Bentazon	nd	1.5	3	13%
Dicamba	nd	71.5	2	8%
Dimethenamid ESA	nd	9.3	2	8%
Diuron	nd	49.5	1	4%
Hydroxyatrazine	24.1	214	19	79%
MCPA	nd	30	5	21%
Metolachlor ESA	18.6	393	14	58%
Metolachlor OXA	nd	124	9	38%

Limited glyphosate sampling was completed on six lakes in 2010. These six lakes include Artichoke, Carrie, Elephant, Elk, Hill, and St. Olaf. Sampling methodology and results are discussed further in Section 5.3, however all glyphosate lake samples results were non-detect.

3.6. Precipitation sampling

Precipitation monitoring for selected pesticides and nutrients began in south central Minnesota in 2008 at the Little Cobb River (LTP) near Beauford and in southeastern Minnesota in 2009 at the MDA office (ZRP) in Rochester. Little Cobb precipitation site is located in an agriculturally dominated area, while the Rochester precipitation site is located within the City of Rochester. Differences in detection frequency and concentrations between the sites may be related to their relative location and associated pesticide applications within close proximity of the collectors. Samples were collected via wet precipitation collectors for rainfall sampling from May through early October. These collectors automatically open a collection vessel at the onset of rainfall. The sampler collects composite rainfall samples over the event, or over a series of events. Samples were transferred to a refrigerator on-site at the time of collection for temporary storage until sufficient volume was available for pesticide analysis. Nutrient samples were collected when sufficient volume was available. The 2010 nutrient data are presented in Table 51.

Table 51. Nutrient data summary from rainfall precipitation sampling in 2010.

Analyte	Location	PMR	Detections/ Total Samples	Detection Frequency (%)	Median (mg/L)	Maximum (mg/L)	Date of Maximum (2010)
Nitrate/Nitrogen	Little Cobb	8	3/3	100	0.98	0.99	June 8
	Rochester	9	1/6	17	nd	0.48	April 26
Total Phosphorus	Little Cobb	8	2/3	67	0.40	0.46	May 28
	Rochester	9	5/5	100	0.03	0.05	April 26
Dissolved Orthophosphorus	Little Cobb	8	3/3	100	0.29	0.41	May 28
	Rochester	9	5/5	100	0.01	0.04	April 26

Nitrate-nitrogen was detected in all three samples at Little Cobb site and in one of six samples from the Rochester site. Total phosphorous was frequently detected at both stations (only one sample between the two sites did not have a detection), and dissolved orthophosphorus was detected in all samples in 2010. The Little Cobb site had higher median and maximum values for all analytes including a maximum total phosphorus concentration of 0.46 mg/L. It is worth noting that the precipitation collector at the Little Cobb site was stuck in the open position for part of the season which may explain the elevated phosphorus concentration. Once it became apparent that the collector was not operating correctly in early June, nutrient analysis was discontinued. Additional monitoring in 2011 will be completed to further evaluate atmospheric nitrate and phosphorous contributions in southern Minnesota.

Acetochlor, atrazine, and metolachlor were the most commonly detected pesticides at both sites in 2010 (Table 52). The Little Cobb site had higher maximums for all compounds, including a maximum acetochlor concentration of 2.52 µg/L. Desethylatrazine was detected in nine of seventeen samples at both the Little Cobb and Rochester sites at low concentrations. Alachlor, deisopropylatrazine, dimethenamid, and propiconazole were also detected at lower frequencies and concentrations. All maximum pesticide concentrations in rainfall occurred in May and June, except the fungicide propiconazole (which was detected in July). Most detections occurred during, or shortly after, the presumed application period for the various pesticides. Figures 58 and 59 displays the seasonal aspect of the pesticide detections in 2010 at the precipitation stations.

Table 52. GC-MS pesticide data summary from rainfall precipitation sampling in 2010.

GC-MS Detected Analyte	Location	PMR	Detections/ Total Samples	Detection Frequency (%)	Median (µg/L)	Maximum (µg/L)	Date of Maximum (2010)
Acetochlor	Little Cobb	8	5/10	50	nd	2.52	May 6
	Rochester	9	7/7	100	0.07	0.34	May 10
Alachlor	Little Cobb	8	1/10	10	nd	P	May 6
	Rochester	9	0/7	--	--	--	--
Atrazine	Little Cobb	8	7/10	70	0.26	0.37	May 6
	Rochester	9	7/7	100	0.12	0.23	May 10
Deisopropylatrazine	Little Cobb	8	0/10	--	--	--	--
	Rochester	9	1/7	14	nd	P	June 6
Desethylatrazine	Little Cobb	8	5/10	50	nd	0.09	May 6
	Rochester	9	4/7	57	P	0.06	May 10 May 27
Dimethenamid	Little Cobb	8	2/10	20	nd	0.05	May 6
	Rochester	9	2/7	28	nd	P	May 10 May 27
Metolachlor	Little Cobb	8	6/10	60	nd	0.34	May 6
	Rochester	9	6/7	86	0.09	0.18	May 13
Propiconazole	Little Cobb	8	2/10	20	nd	P	July 22 July 30
	Rochester	9	0/7	--	--	--	--

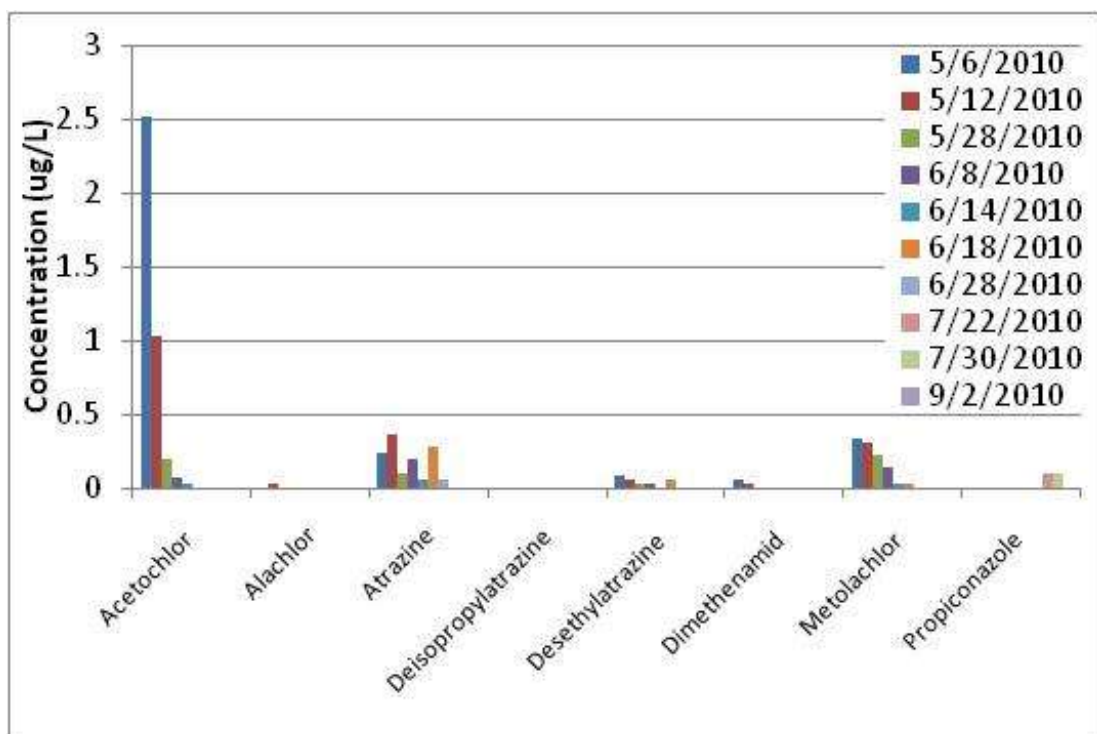


Figure 58. Concentration pesticide results from rainfall precipitation collected at Little Cobb River.

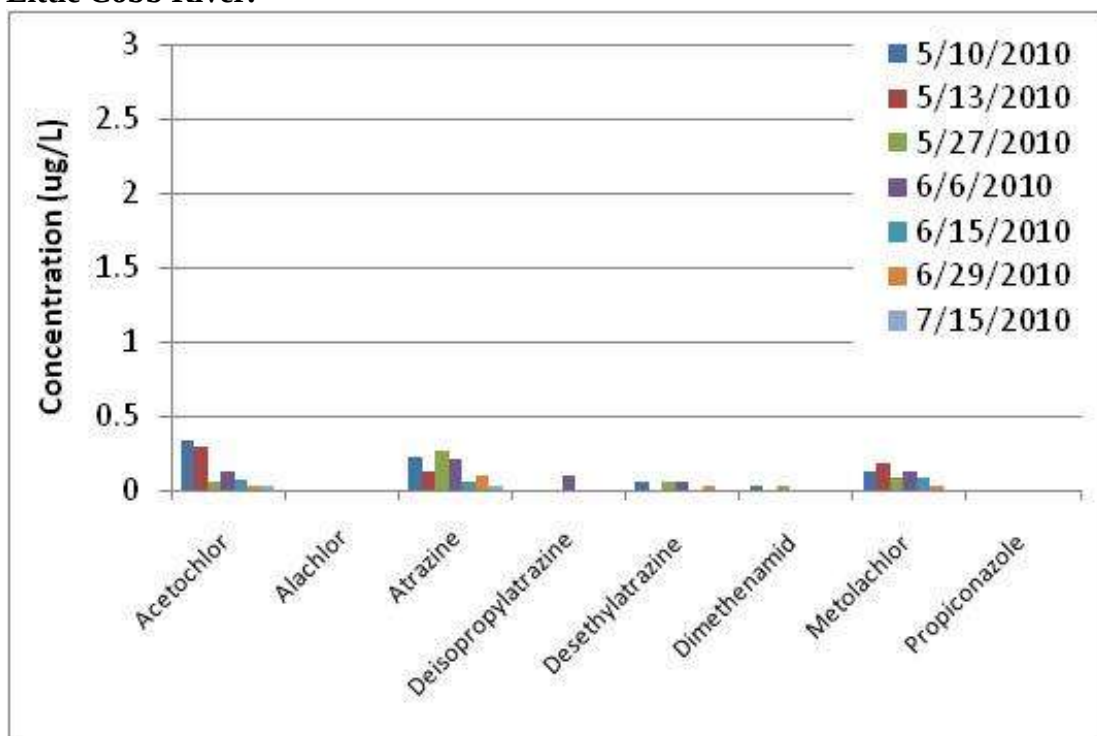


Figure 59. Concentration pesticide results from rainfall precipitation collected in Rochester.

Limited LC-MS/MS pesticide monitoring occurred at each of the precipitation monitoring locations. Sample volume constraints limited the overall LC-MS/MS monitoring. A total of three LC-MS/MS samples were submitted in 2010, one from the Little Cobb location and two from the Rochester site. The chemicals 2,4-D, bentazon, DEDI atrazine, and imazapyr were detected at low concentrations. Table 53 presents 2010 LC-MS/MS precipitation pesticide results.

Table 53. LC-MS/MS pesticide data summary from rainfall precipitation sampling in 2010. PLEASE NOTE results in ng/L. 1 µg/L = 1000 ng/L

LC-MS/MS Detected Analyte	Location	PM R	Detections/ Total Samples	Detection Frequency (%)	Median (ng/L)	Maximum (ng/L)	Date of Maximum (2010)
2,4-D	Little Cobb	8	1/1	100	--	79.9	June 8
	Rochester	9	1/2	50	nd	61.2	June 6
Bentazon	Little Cobb	8	0/1	--	--	--	--
	Rochester	9	1/2	50	nd	1.28	June 6
DEDI Atrazine	Little Cobb	8	0/1	--	--	--	--
	Rochester	9	1/2	50	nd	141	June 6
Imazapyr	Little Cobb	8	1/1	100	--	8.38	June 8
	Rochester	9	0/2	--	--	--	--

Precipitation monitoring for pesticides began in 2008 for the Little Cobb site and in 2009 for the Rochester site. Table 54 presents all detected GC-MS pesticides from the Little Cobb site and the Rochester site since precipitation site establishment. In 2010, the highest maximum detection of acetochlor in precipitation was measured at the Little Cobb site; however, the lowest median acetochlor concentration also occurred in 2010 at the Little Cobb site. Acetochlor was detected 100% (7/7 samples) at the Rochester location. Alachlor was detected at the “present” level in a single sample for the second consecutive year at the Little Cobb site only. Atrazine and metolachlor were detected relatively frequently at both locations in 2010. Desethylatrazine is detected more frequently, and at higher concentrations, than deisopropylatrazine at both locations. Chlorpyrifos has been detected two out of three years (2008 and 2009), in a single sample each year, at the Little Cobb location only. For the second consecutive year propiconazole was detected at “present” levels at the Little Cobb site only.

Limited glyphosate monitoring was conducted at each of the precipitation monitoring locations in 2010. Sampling methodology and results are discussed further in Section 5.3.

Table 54. 2008-2010 GC-MS pesticide data summary from rainfall precipitation sampling.

GC-MS Detected Analyte	Location	PMR	2008			2009			2010		
			Detections/ Total Samples	Median (µg/L)	Maximum (µg/L)	Detections/ Total Samples	Median (µg/L)	Maximum (µg/L)	Detections/ Total Samples	Median (µg/L)	Maximum (µg/L)
Acetochlor	Little Cobb	8	6/9	P	0.28	5/7	0.07	0.57	5/10	nd	2.52
	Rochester	9	--	--	--	2/10	nd	0.09	7/7	0.07	0.34
Alachlor	Little Cobb	8	0/9	--	--	1/7	nd	P	1/10	nd	P
	Rochester	9	--	--	--	0/10	--	--	0/7	--	--
Atrazine	Little Cobb	8	6/9	P	0.16	5/7	0.07	0.48	7/10	0.26	0.37
	Rochester	9	--	--	--	2/10	nd	0.09	7/7	0.12	0.23
Deisopropylatrazine	Little Cobb	8	0/9	--	--	2/7	nd	P	0/10	--	--
	Rochester	9	--	--	--	0/10	--	--	1/7	nd	P
Desethylatrazine	Little Cobb	8	4/9	nd	0.06	5/7	P	0.11	5/10	nd	0.09
	Rochester	9	--	--	--	2/10	nd	0.09	4/7	P	0.06
Chlorpyrifos	Little Cobb	8	1/9	nd	0.10	1/7	nd	0.26	0/10	--	--
	Rochester	9	--	--	--	0/10	--	--	0/7	--	--
Dimethenamid	Little Cobb	8	1/9	nd	P	1/7	nd	P	2/10	nd	0.05
	Rochester	9	--	--	--	0/10	--	--	2/7	nd	P
Metolachlor	Little Cobb	8	6/9	P	0.10	4/7	P	0.19	6/10	nd	0.34
	Rochester	9	--	--	--	2/10	nd	0.07	6/7	0.09	0.18
Propiconazole	Little Cobb	8	--	--	--	1/7	nd	P	2/10	nd	P
	Rochester	9	--	--	--	0/10	--	--	0/7	--	--

SECTION 4: URBAN SAMPLING

4.1. Urban groundwater sampling

In 2004, the MDA began a cooperative effort with the MPCA to sample wells within urban/suburban or developing urban settings where there is a high likelihood that turf management pesticide products are used. In this effort, samples were collected by MPCA staff for pesticide analysis from a select number of sites among those sampled as part of ongoing MPCA monitoring. Each year since 2004, MPCA sends MDA information regarding approximately 20 candidate sites for MDA's review and concurrence for planned sampling for pesticides. Sites from previous years' sampling efforts that had detectable levels of pesticides are given preference for inclusion in sampling for following years, to allow for determination of trend in these wells over time. These urban sampling wells may occur in urban settings throughout Minnesota, not just PMR 10 which includes the Twin Cities metro area.

Table 55 shows results for all samples collected in 2010; Figure 60 depicts the locations. Detection frequencies and concentrations tend to be quite low for most compounds. Interestingly, the compounds detected are also detected in rural agricultural settings, although rural settings show significantly more compounds detected than does urban monitoring. The reasons for the detection of agricultural pesticides in urban settings are unknown, but is suggestive of atmospheric transport, deposition and/or historic application under different land use.

Table 55. Summary of pesticides detected in 2010 urban groundwater samples.

Pesticide or Pesticide Degradate	Detections/Total Samples		
	Detections/ Total Samples	Detection Frequency (%)	Maximum (µg/L)
Alachlor ESA	4/20	20	1.08
Alachlor OXA	2/20	10	0.12
Atrazine	2/20	10	P
Desethylatrazine	7/20	35	0.07
Hydroxyatrazine	1/20	5	0.0086
Bentazon	1/20	5	0.0010
Bromacil	1/20	5	0.047
Imazapyr	2/20	10	0.0402
Imazethapyr	1/20	5	0.096
MCPP	1/20	5	0.39
Metolachlor ESA	12/20	60	0.46
Metolachlor OXA	5/20	25	0.036
Prometon	2/20	10	P
Simazine	1/20	5	P
2,4-D	2/20	10	0.027

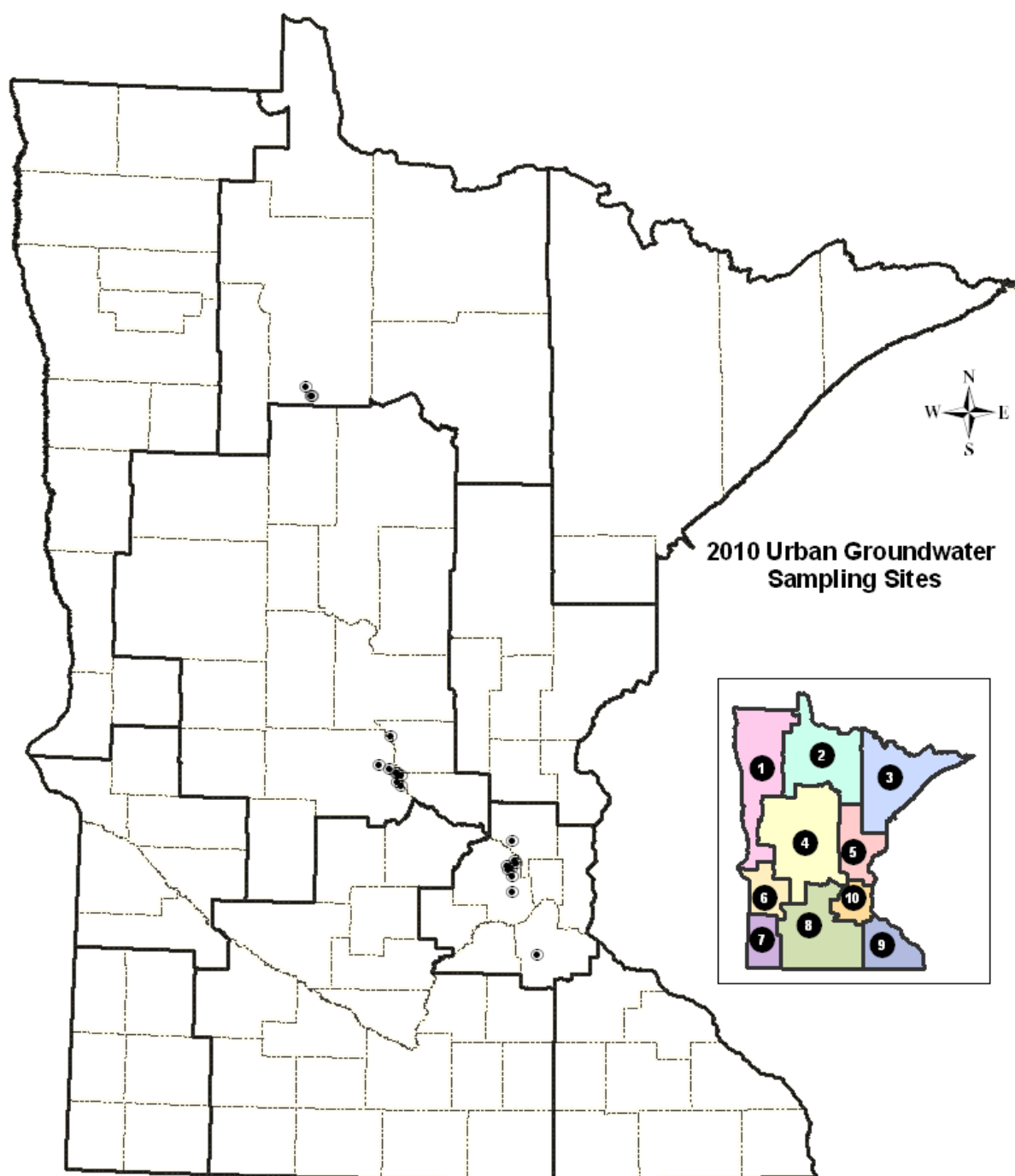


Figure 60. 2010 MDA urban groundwater monitoring wells by Pesticide Monitoring Region.

4.2. Urban Tier 1 and Tier 2 surface water sampling

Urban watershed sampling is conducted to evaluate the concentration of pesticides in runoff from urban watersheds. These sites are sampled in essentially the same manner as the Tier 1 and Tier 2 sites, except that the monitoring season is slightly longer (mid-May through mid-August). This time frame was selected to capture the main application period for turf management pesticide products in urban locations.

Figure 61 shows the location of urban surface water monitoring sites in the Twin Cities Metropolitan area (PMR 10). In 2010, six sites were sampled using the Urban Tier 1 protocol and one site was sampled using the Urban Tier 2 protocol. Additional information regarding sampling protocols can be found in the MDA 2010 Surface Water Quality Monitoring Work Plan. Samples were collected for both GC-MS and LC-MS/MS pesticide analyses at these seven monitoring sites. Three sites, as shown in Figure 58, were monitored for LC-MS/MS pesticides only.

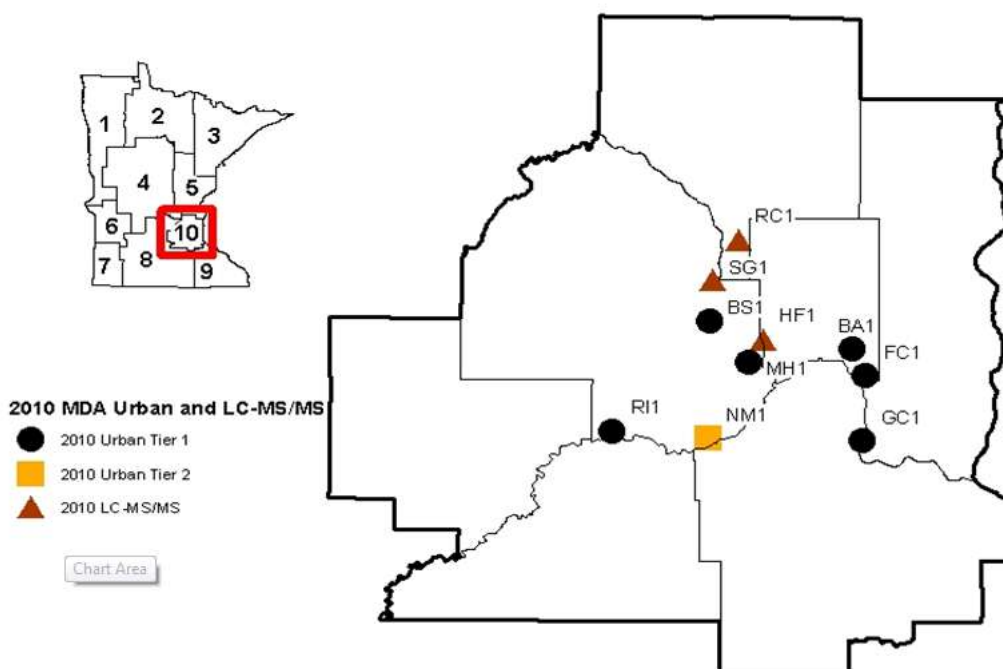


Figure 61. 2010 surface water urban monitoring locations.

Table 56 and 57 shows pesticide results for the seven Urban Tier 1 and Urban Tier 2 sites sampled in 2010. Ten GC-MS samples and 12 LC-MS/MS samples were collected from the Urban Tier 2 site. At the Urban Tier 1 sites, a total of 42 GC-MS samples and 52 LC-MS/MS samples were collected. The results in the tables below show that 33 different pesticide compounds and breakdown products were detected in the urban streams. Of the 116 pesticide samples collected from the seven urban tiered streams in 2010, none of the samples indicated pesticide concentrations above 50 percent of the reference values listed in Table 7.

Table 56. Summary of GC-MS pesticide detections in Urban Tier 1 and Tier 2 surface water monitoring samples, 2010.

Urban Tier 1 and Urban Tier 2 GC-MS Detected Analyte Total n = 52	Number of Detections and Detection %	Maximum (µg/L)	Date of Maximum	90th Percentile (µg/L)	Median (µg/L)	Of Total Samples, Number Exceeding 50% of a Surface Water Reference Value (and %)
Acetochlor	12 (23%)	0.1	multiple	.05	nd	0 (0%)
Atrazine	32 (62%)	0.44	June 8	.09	P	0 (0%)
Desethylatrazine	12 (23%)	0.05	multiple	P	nd	0 (0%)
Boscalid	4 (8%)	P	multiple	nd	nd	0 (0%)
Dichlobenil (not a target analyte)	3 (6%)	0.1	May 26	nd	nd	0 (0%)
Dimethenamid	10 (19%)	0.23	June 8	P	nd	0 (0%)
Metolachlor	36 (69%)	0.8	July 14	0.26	P	0 (0%)
Metribuzin DADK	1 (2%)	P	May 27	nd	nd	NA*
Prometon	1 (2%)	P	July 14	nd	nd	0 (0%)
Propiconazole	1 (2%)	P	Aug 11	nd	nd	0 (0%)

*There is no surface water reference value available the analyte.

Sample collection for LC-MS/MS pesticide analysis began in mid-April at all 10 sites. This sampling began earlier than the urban monitoring season protocol in response to Emerald Ash Borer infestations in the area. The three LC-MS/MS sites (Hidden Falls Creek, Rice Creek and Shingle Creek), shown in Figure 61, had a total of 21 samples collected from which three pesticide were measured at levels above the reference values presented in Table 24.

At Hidden Falls Creek (an urban stream located in St. Paul), there were three herbicide compounds detected that exceeded the USEPA OPP reference values. A sample collected on June 28th had a bromacil (LC-MS/MS method) concentration of 14.0 µg/L, which is above the chronic reference value for bromacil (6.8 µg/L). Bromacil also exceeded 50 percent of the reference value on two different occasions with concentrations of 4.7 µg/L and 5.6 µg/L. Metsulfuron-methyl (LC-MS/MS method) was detected six times in Hidden Falls with two detects (1.020 and 0.467 µg/L) over the chronic reference value (0.36 µg/L) and another at over 50 percent of the chronic reference value. Sulfometuron-methyl was also detected over the chronic reference value (0.48 µg/L) on three different occasions (3.4, 1.46 and 1.11 µg/L). In addition to these detections the herbicide diuron was detected at a concentration (1.22 µg/L) that exceeds 50 percent of the chronic reference value (2.4 µg/L). In response to these detections Hidden Falls will be monitored for pesticides as a Tier 1 site in 2011.

Table 57. Summary of LC-MS/MS pesticide detections in Urban Tier 1 and Tier 2 surface water monitoring samples, 2010. PLEASE NOTE: Results in ng/L. 1 µg/L = 1000 ng/L

Urban Tier 1 and Urban Tier 2 LC-MS/MS Detected Analyte Total n = 85	Number of Detections and Detection %	Maximum (ng/L)	Date of Maximum	90th Percentile (ng/L)	Median (ng/L)	Of Total Samples, Number Exceeding 50% of a Surface Water Reference Value (and %)
2,4-D	82 (96%)	4120	April 26	608.4	167	0 (0%)
Acetochlor ESA	14 (16%)	735	June 30	82.2	nd	0 (0%)
Acetochlor OXA	10 (12%)	470	June 30	38.14	nd	0 (0%)
Alachlor ESA	15 (18%)	109	July 27	63.2	nd	0 (0%)
Azoxystrobin	5 (6%)	33.2	May 26	nd	nd	0 (0%)
Bentazon	4 (5%)	6.54	July 14	nd	nd	0 (0%)
Bromacil	18 (21%)	14000	June 28	96.88	nd	3 (4%)
DEDI Atrazine	1 (1%)	81.5	June 8	nd	nd	0 (0%)
Dicamba	4 (5%)	467	May 25	nd	nd	0 (0%)
Dimethenamid ESA	7 (8%)	44.5	June 30	nd	nd	NA*
Dimethenamid OXA	5 (6%)	22.2	June 30	nd	nd	NA*
Diuron	48 (56%)	1220	May 25	86.22	14.9	1 (1%)
Hydroxyatrazine	79 (93%)	129	May 11	46.06	19.4	0 (0%)
Imazapic	16 (19%)	301	June 28	25.12	nd	0 (0%)
Imazapyr	17 (20%)	100	June 11	16.54	nd	0 (0%)
Imazethapyr	1 (1%)	11	June 30	nd	nd	0 (0%)
Imidacloprid	2 (2%)	45.4	Aug 11	nd	nd	0 (0%)
MCPA	45 (53%)	154	April 26	28.64	5.35	0 (0%)
MCPP	19 (22%)	571	June 8	80.1	nd	0 (0%)
Metolachlor ESA	44 (52%)	903	June 30	153.4	10.5	0 (0%)
Metolachlor OXA	38 (45%)	243	June 30	33.08	nd	0 (0%)
Metsulfuron-methyl	5 (6%)	1020	May 25	nd	nd	3 (4%)
Picloram	4 (5%)	3140	May 25	nd	nd	0 (0%)
Siduron	6 (7%)	26.5	April 15	nd	nd	0 (0%)
Sulfometuron-methyl	10 (12%)	3400	May 25	11.56	nd	3 (4%)
Thiamethoxam	1 (1%)	33.2	April 30	nd	nd	0 (0%)
Triclopyr	4 (5%)	828	July 14	nd	nd	0 (0%)

*There is no surface water reference value available the analyte.

SECTION 5: SPECIAL MONITORING STUDIES IN 2010

5.1. Plot and field scale evaluation of Best Management Practices

From 2007 through 2010 the MDA coordinated nutrient and pesticide monitoring studies at three agricultural drainage tile locations in southern Minnesota. This was a collaborative effort with the Acetochlor Registration Partnership, Minnesota State University Mankato, and the University of Minnesota (UM) Southern Research and Outreach Center (SROC). Although subsurface tile drainage water was analyzed, these studies are focused on surface water quality since tile drainage water is discharged directly to surface water.

The focus of the pesticide portion of the studies was acetochlor, a common corn herbicide in Minnesota. Acetochlor has been detected in surface water at concentrations of concern by MDA. Two south central Minnesota water bodies, the Le Sueur River and the Little Beauford Ditch (both current Tier 3 stations), have been included on the Minnesota 2008 303(d) Total Maximum Daily Load (TMDL) list of impaired waters due to violations of the four-day aquatic toxicity standard of acetochlor (3.6 µg/L). The violations occurred in 2001 in the Le Sueur River and 2005 in both the Little Beauford Ditch and the Le Sueur River. Subsurface agricultural drainage systems are dominant hydrologic features in the Le Sueur River and Little Beauford Ditch watersheds. These studies were initiated to evaluate the potential for acetochlor movement to subsurface drainage systems.

MDA has developed Best Management Practices (BMPs) designed to minimize water quality impacts associated with acetochlor use. One of the BMPs, reduced application rate, was evaluated in these studies. Additional information related to the results of this study can be found in the report: *“Evaluation of Reduced Application Rates of Acetochlor to Reduce Concentration in Tile Drainage Water”* available from MDA staff.

5.2. Enzyme Linked Immunosorbent Assay (ELISA) sampling

During 2010, the MDA completed three different projects using the ELISA method of analysis. The lab work was contracted to the Water and Environmental Analysis Laboratory (WEAL) at the University of Wisconsin-Stevens Point (UW-SP). The work included analyses for a degradate of atrazine (DACT), glyphosate and acetochlor. The three different projects and results are discussed below.

5.2.1. DACT Monitoring

Groundwater

MDA sampled for DACT in 2007, 2008 and 2009, and those results can be found in earlier annual reports. In 2010, sampling for DACT was only conducted through June 30th due to contract and laboratory limitations. Furthermore, the MDA laboratory developed a new analytical method that was implemented in 2010, which included this atrazine degradate.

Table 58 includes a summary of DACT results utilizing the ELISA method. There were 105 groundwater samples analyzed in 2010. Detection frequency ranged from zero percent in PMR 1 and to 94 percent in PMR 9, and averaged 25 percent for all samples. PMR 9 had the highest detection frequency and median values. PMR 4 had the highest maximum value (1.01 µg/L).

Table 58. 2010 groundwater DACT ELISA results.

PMR	Detections	Total % Detects	Median (µg /L)	75 th percentile (µg/L)	90 th percentile (µg/L)	Maximum (µg/L)
1	0/7	0%	nd	nd	nd	nd
4	5/43	12%	nd	nd	0.15	1.01
5	2/9	22%	nd	0.03	0.14	0.15
6	1/9	11%	nd	nd	0.22	0.36
7	0/7	0%	nd	nd	nd	nd
8	1/12	8%	nd	nd	0.07	0.24
9	17/18	94%	0.14	0.17	0.31	0.37
All Samples	26/105	25%	nd	0.03	0.16	1.01

Surface water

Table 59 presents summary results for DACT samples collected from Tier 3 sites in 2010. DACT was detected in 40 percent of the surface water samples collected in 2010 (as compared to 65 percent in 2009 and 66 percent in 2008). It should be noted that surface water sampling for DACT has only occurred in PMRs 8 and 9. Further, sampling in 2010 only occurred in January through mid-June and was dominated with snowmelt sampling in March. The maximum concentration (0.17 µg/L) was detected twice and came from base flow samples collected from the Middle Branch of the Whitewater River.

Table 59. 2010 surface water DACT ELISA results.

PMR	Detections	Total % Detects	Median (µg/L)	75 th percentile (µg/L)	90 th percentile (µg/L)	Maximum (µg/L)
8	0/1	0%	NA	NA	NA	NA
9	8/19	42%	nd	nd	nd	0.17
Both 8 and 9	8/20	40%	nd	nd	nd	0.17

Continuation of DACT monitoring after 2010

MDA has utilized the ELISA method to analyze for DACT from 2007 through 2010. In 2010, the MDA laboratory developed an analytical method that included many new pesticide compounds, including, the atrazine degradate reported through ELISA methodology as DACT. This atrazine degradate will be reported as DEDI atrazine on all routine LC-MS/MS samples. The difference in nomenclature is related to laboratory preference; *DACT and DEDI atrazine are the same compound.*

Before the ELISA contract was completed, duplicate surface water and groundwater samples were analyzed for both DACT (ELISA (UW-SP laboratory)) and DEDI atrazine (LC-MS/MS (MDA laboratory)) to compare the methods. There was a slight difference in method reporting limits for the two analyses: ELISA was 0.10 µg/L and LC-MS/MS was 0.05 µg/L. Figure 62 presents results of samples where duplicate analysis of DEDI atrazine was completed using the ELISA and a 1:1 line is presented for general comparison. Statistical analysis was completed

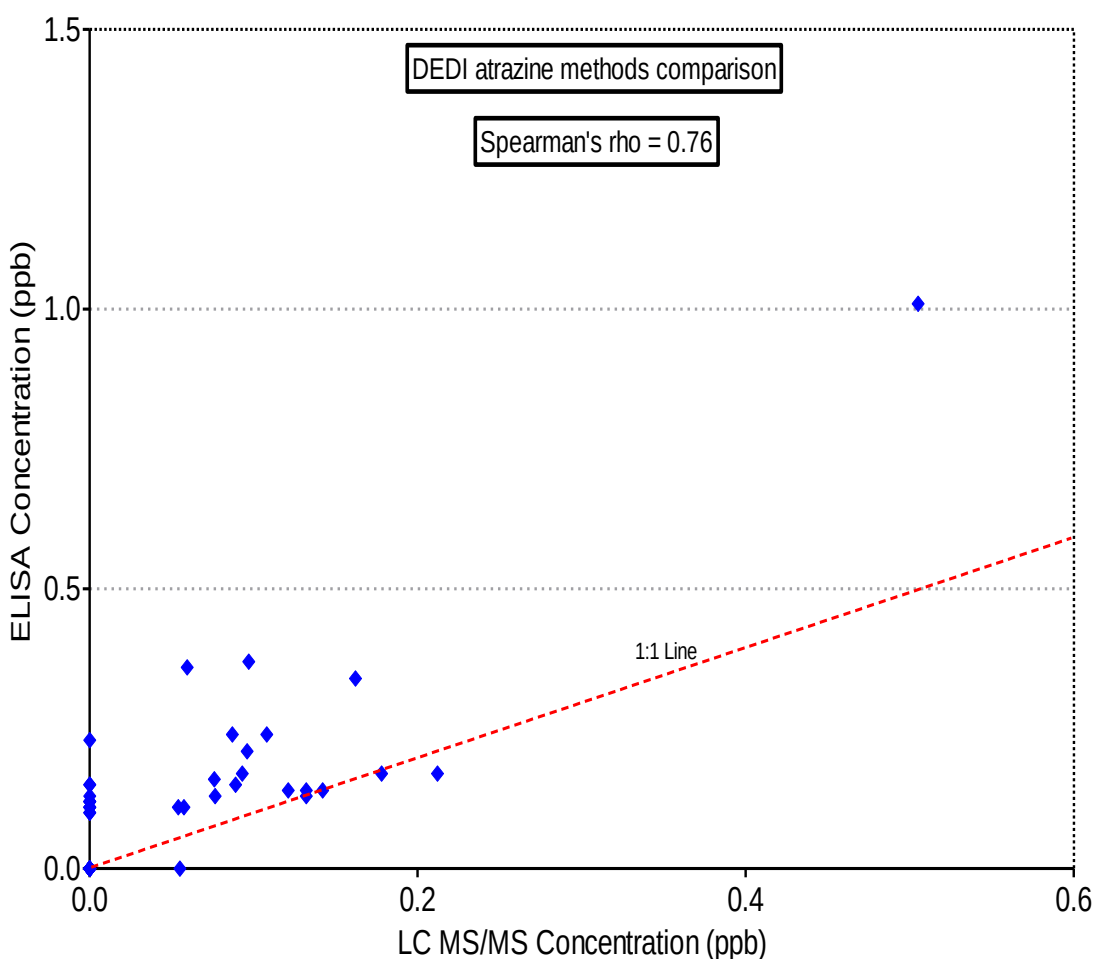


Figure 62. Comparison of ELISA and LC-MS/MS DEDI atrazine results collected as duplicates from both groundwater and surface water.

using Spearman's rank-order correlation method and spearman's rho was found to be 0.76 between the methods. In general, it appears the ELISA method reported slightly higher values than the LC-MS/MS method for DEDI atrazine, but there appears to be a good correlation between results reported from the two methodologies.

5.2.2. Acetochlor evaluation in the Le Sueur River Watershed and tributaries

In 2009 and 2010, the MDA conducted an evaluation of the use of ELISA for the analysis of acetochlor in surface water samples collected from within the Le Sueur River Watershed in south central Minnesota (Figure 63 and Table 60). Both composite and grab samples were collected from a network of existing stream gage locations and submitted to the UW-SP Laboratory for ELISA analysis.

Table 60. Sampling locations for acetochlor ELISA analysis.

Site Name	Site Code	Project	Drainage Acres
Le Sueur River Outlet	LS1	MDA	710,041
Upper Le Sueur River	LS2	MSU	285,189
Le Sueur River near St. Clair	LS3	MSU	225,078
Little Cobb River	LT1	MDA/MSU	82,868
Maple River Outlet	MR1	Maple River CWP	216,879
Upper Maple River	MR2	Maple River CWP	197,362
Beauford Ditch @ Hwy 22	BD1	MDA/MSU	5,111
Big Cobb Outlet	BCR	MSU	195,145

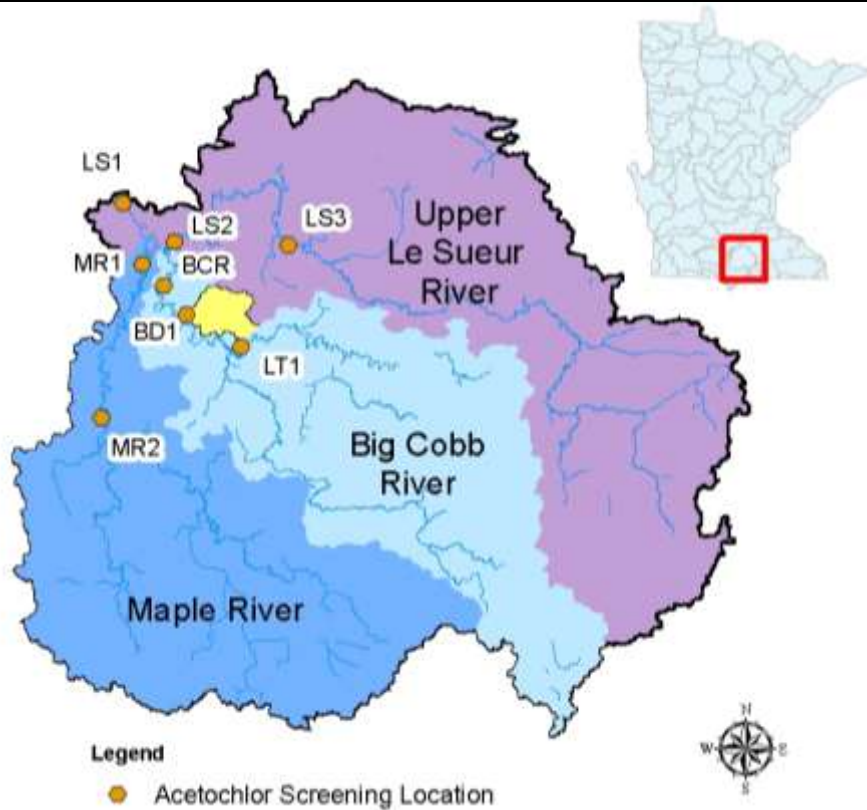


Figure 63. Le Sueur River Watershed with the three major sub-watersheds and the Beauford Ditch Watershed identified along with the sampling locations.

Of the 139 samples submitted for ELISA analysis, 27 were also submitted for base neutral pesticide analysis, which includes acetochlor, using GC-MS at the MDA Laboratory. ELISA results indicated that 22 percent of the samples exceeded an acetochlor concentration of 1 µg/L; however, none of the 27 GC-MS samples submitted for acetochlor analysis exceeded 1 µg/L. No samples analyzed by either method exceeded the current Minnesota aquatic life standard for acetochlor of 3.6 µg/L. As was the case in 2009, the ELISA method tended to over predict the amount of acetochlor present in the sample when compared to GC-MS results. The ELISA analysis appears to be sensitive to the presence of metolachlor in the sample, which causes cross-reactivity and indicates an elevated concentration of acetochlor. In spite of the cross-reactivity with metolachlor, the ELISA analysis still provides a reasonable tool for screening large numbers of samples for the presence of elevated concentrations of acetochlor, when combined with GC-MS analysis for confirmation. In 2011, additional QC samples will be submitted to better evaluate the effect of metolachlor. Summary results for the 2009 and 2010 ELISA sampling are presented in Table 61.

Table 61. Acetochlor ELISA results for 2009 and 2010.

	LS1	LS2	LS3	BCR	LT1	BD1	MR1	MR2
Watershed Acres	710,041	285,189	225,078	195,145	82,868	5,111	216,879	197,362
2009 Sample #	14	8	10	9	9	10	11	9
2010 Sample #	16	16	16	17	16	14	22	22
2009 Median (µg/L)	0.29	0.19	0.18	0.23	0.23	0.24	0.18	0.21
2010 Median (µg/L)	0.35	0.21	0.23	0.23	0.23	0.24	0.43	0.37
2009 Maximum (µg/L)	1.13	0.74	1.56	1.38	1.07	0.89	1.89	2.28
2010 Maximum (µg/L)	1.61	1.34	2.45	1.36	1.82	1.88	2.02	1.78
2009 Minimum (µg/L)	0.13	0.12	0.17	0.16	0.13	0.13	0.15	<0.10
2010 Minimum (µg/L)	0.1	0.1	<0.10	0.11	0.11	0.15	<0.10	<0.10

Local cooperators and MDA staff will continue to monitor the three major sub-watersheds of the Le Sueur River including the Upper Le Sueur, Big Cobb and the Maple River systems for acetochlor, nutrients, sediment and flow. Data collected from this project will continue to test the reliability of the ELISA method for future sampling and aid in determining where additional sampling might be needed in the watershed to better characterize the acetochlor impairment. The eight sites proposed for sampling are identified in Table 61 and in Figure 63. The 2011 project will be similar in scope to the 2010 efforts and is part of the Acetochlor Impairment Response Action Plan being conducted in the Le Sueur River Watershed in cooperation with the MPCA.

5.3. Glyphosate monitoring in Minnesota

In 2010, the MDA conducted statewide glyphosate monitoring. Samples were collected from agriculture drainage tile, groundwater, lakes, precipitation, and rivers/streams. Locations are presented in Figure 64.

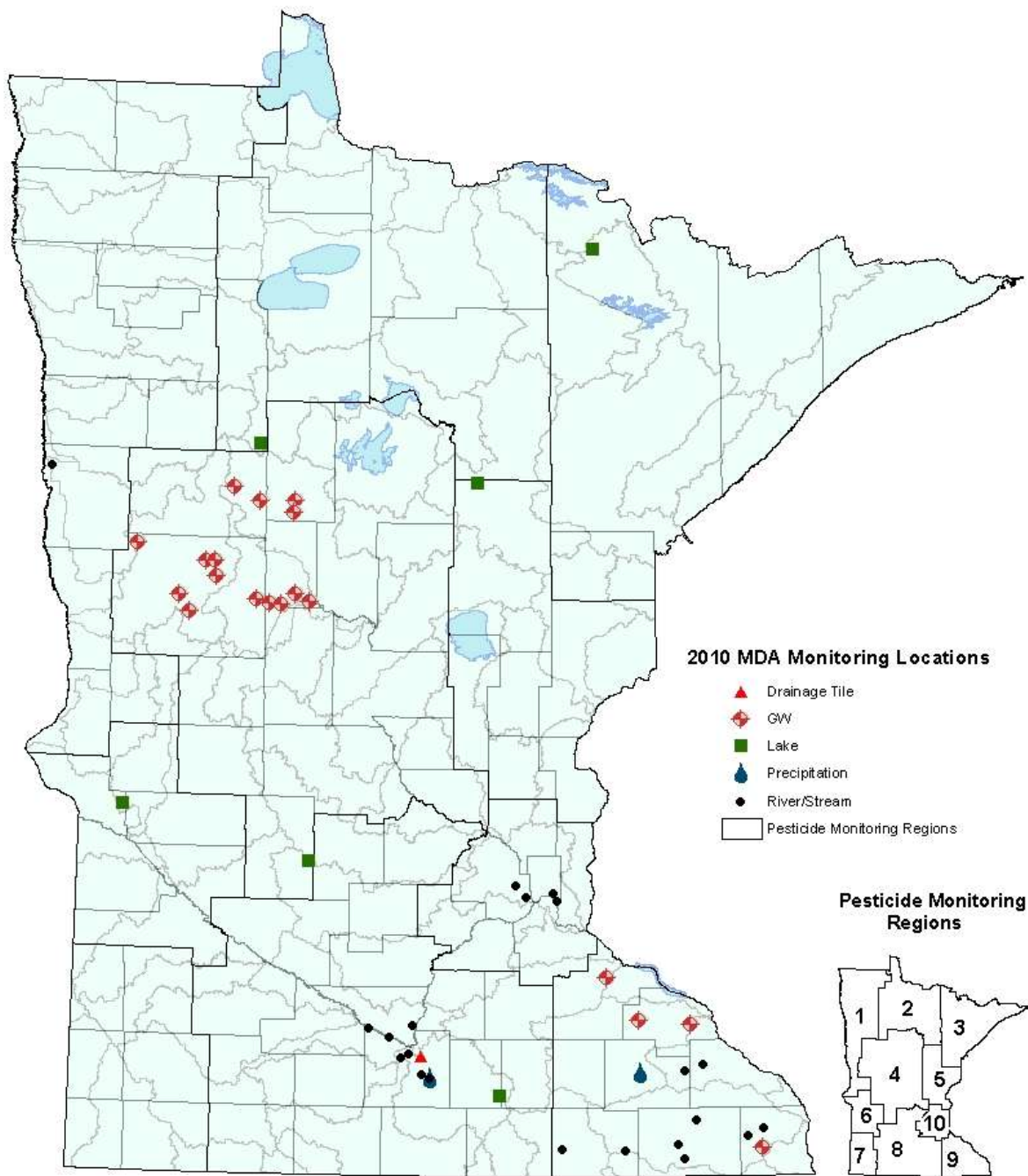


Figure 64. 2010 MDA glyphosate monitoring locations.

Two glyphosate laboratory methods were used in 2010. One utilized an immunoassay method (GLY-ELISA), and the other was a LC-MS/MS method (GLY-MON). To assess and validate the methods, field duplicates were collected and submitted for each method; however, there was a large difference in MRLs between the two methods. The estimated MRL for GLY-ELISA was 0.10 µg/L, while the MRL was 1.5 µg/L for GLY-MON. Due to the differences in MRL for each method and some method uncertainty, a complete method validation was not possible in 2010. Additional sampling in 2011 will provide further validation for both methods.

Results will be presented for each method independently. Although the same water body types were sampled and some method field duplicates were collected, there was great variability among actual site locations and timing of sampling. As such, the data presented in Tables 62 and 63 should not be compared to evaluate methods; each table represents a different data set.

5.3.1. Glyphosate ELISA results

GLY-ELISA analysis was completed on 126 samples in 2010. These samples were collected from groundwater, lakes, precipitation, and rivers/stream. No samples were collected from drainage tile for GLY-ELISA. There were no detections in lake samples. Groundwater had three detections, out of twenty-three samples, and had a maximum value of 0.34 µg/L. Two wet precipitation samples were collected, and both had glyphosate detected. The majority of samples were collected in rivers and streams. Fifty-nine out of 96 river and stream samples had glyphosate detected. The maximum concentration was 4.83 µg/L and was collected at MDA's Tier 3 Buffalo River near Georgetown location on July 28, 2010. All samples were well below applicable water quality standards for glyphosate presented in Tables 6 and 7.

Table 62. 2010 GLY-ELISA monitoring results.

Site Description	Total Detects	Total Samples	Total % Detects	Total Median (µg/L)	75 th Percentile (µg/L)	90 th Percentile (µg/L)	Total Max (µg/L)
Drainage Tile	--	--	--	--	--	--	--
Groundwater	3	23	13%	<0.10	<0.10	<0.10	0.34
Lakes	0	5	0%	<0.10	<0.10	<0.10	<0.10
Precipitation	2	2	100%	0.29	0.37	0.41	0.44
Rivers/Streams	59	96	61%	0.12	0.91	1.9	4.83

5.3.2. Glyphosate LC-MS/MS results

GLY-MON analysis was completed on 182 samples in 2010. There were no detections in agricultural drainage tile, groundwater, lakes, and precipitation through this method. The majority of samples were collected from rivers and streams. Thirty out of 149 river and stream samples had glyphosate detected. The maximum concentration was 15.04 µg/L and was collected at MDA's Tier 1 Crystal Creek Outlet location on June 21, 2010. All samples were well below applicable water quality standards for glyphosate presented in Tables 6 and 7.

Table 63. 2010 GLY-MON monitoring results.

Site Description	Total Detects	Total Samples	Total % Detects	Total Median (µg/L)	75th Percentile (µg/L)	90th Percentile (µg/L)	Total Max (µg/L)
Drainage Tile	0	2	0%	<1.5	<1.5	<1.5	<1.5
Groundwater	0	23	0%	<1.5	<1.5	<1.5	<1.5
Lakes	0	6	0%	<1.5	<1.5	<1.5	<1.5
Precipitation	0	2	0%	<1.5	<1.5	<1.5	<1.5
Rivers/Streams	30	149	20%	<1.5	<1.5	2.69	15.04

5.4. Clean Water Legacy project sites

Two surface water monitoring sites were installed on small ditches in the upper portion of the South Branch of the Root River in 2007. The two sites (SR2 and SR3) are on parallel ditch systems that drain the flatter upland portions of the South Branch of the Root River Watershed in Mower County. These small watersheds are extensively drained with subsurface tile. The monitoring sites have automatic sampling systems and continuous turbidity monitoring. 2010 marked the fourth year of intensive nutrient and sediment monitoring, along with Tier 2 pesticide sampling at SR3.

SR2 and SR3 differ from most other automated monitoring stations in the state because they utilize a turbidity-based threshold methodology to trigger sampling. This is possible because there are in-stream probes that continuously record the turbidity concentration. Turbidity-based sampling, or turbidity threshold sampling (TTS), was developed to provide better sample collection during dynamic sediment concentration periods. TTS is also appealing to install at new monitoring locations that do not have a well established rating curve. TTS uses storm turbidity as a surrogate for flow to initiate intensive sampling that covers the rising and falling limbs of the hydrograph. Grab sampling during base flow periods are used to characterize water quality between events. Evaluating the dynamic nature of turbidity will also help better predict when to sample for other pollutants, like pesticides, that may be transported with surface runoff and behave similar to TSS in some systems.

These two systems are also being monitored over time for use in paired watershed study for calibration purposes. Since 2007, these sites have been used to calibrate and validate Soil and Water Assessment Tool (SWAT) modeling being conducted by University of Minnesota researchers. Further, the watersheds are part of a study being conducted by the University of Minnesota in evaluating alternative ditch designs.

In 2010, SR2 and SR3 were sampled very intensively. Table 64 presents combined summary statistics for SR2 and SR3 partitioned into base and storm flow collection periods. A total of 133 samples were collected for nitrate-nitrogen, total phosphorus, and dissolved orthophosphorus, and 121 total suspended solid samples were collected. Sampling was heavily biased to storm flow sampling. Total phosphorus, dissolved orthophosphorus, and total suspended solids had higher detection frequencies, as well as median and maximum concentrations, during storm flow periods. Nitrate-nitrogen was less variable when comparing summary statistics between base and storm flow. Nitrate-nitrogen concentrations tended to be lower during periods of high surface run-off and higher during periods of increased flow through subsurface tile (often following

Table 64. Sampling results from SR2 and SR3 in 2010.

2010	Base Flow Samples					Storm Flow Samples				
Inorganic Analyte	No. of samples	% Detection	Median Value of Samples (mg/L)	90th percentile (mg/L)	Maximum Value Detected (mg/L)	No. of samples	% Detection	Median Value of Samples (mg/L)	90th percentile (mg/L)	Maximum Value Detected (mg/L)
Nitrate-Nitrogen	42	100	11.3	17.2	18.9	91	100	9.63	15.8	20.4
Total Phosphorus	42	86	0.020	0.048	0.110	91	100	0.240	0.724	2.04
Dissolved Orthophosphorus	42	50	0.003	0.014	0.039	91	96	0.072	0.216	0.368
Total Suspended Solids	31	100	4.8	19.2	32.4	90	100	67.9	537.6	1710

surface run-off periods). Future monitoring work in the SR3 watershed through the Root River Field to Stream Partnership will allow for better interpretation of data.

Prior to August 2010, SR2 was a ditch system that was cleaned in 2007, and SR3 was a ditch system without channel modification for decades. The close proximity of the ditch systems, along with the variation in the maintenance record, made both of these watersheds enticing to monitor. In August 2010, SR3 was cleaned out and the channel dimensions were dramatically changed. Subsequently, SR2 and SR3 now have similar channel characteristics. Also in 2010, SR3 was incorporated into the Root River Field to Stream Partnership as primary watershed that will be monitored intensively, including at the edge-of-field and subsurface drainage tile scale. In addition, SR3 had been monitored for pesticides since 2007, and based on 2009 results, will be a Tier 2 pesticide sampling location at least through 2014. SR2 has only been monitored for nutrients and sediment since 2007. In 2011, MDA will stop monitoring the SR2 ditch system, and will be focusing its efforts on the SR3 watershed.

5.5. Expanded Sampling with MPCA

In 2010, MDA worked cooperatively with MPCA on two new projects. These projects were possible due to expanded MDA laboratory capacity created by funds provided to MDA through the Clean Water Fund and an LCCMR grant. The projects included the Environmental Monitoring and Assessment Program (EMAP) and Biological Stressor Identification (STID) project. Approximately 150 paired GC-MS and LC-MS/MS samples were collected from locations statewide for the projects.

5.5.1. Environmental Monitoring and Assessment Program (EMAP)

EMAP sampling was conducted by MPCA in 2010. EMAP is a United States Environmental Protection Agency (USEPA) program. EMAP's program goal is to *"Monitor the condition of the Nation's ecological resources to evaluate the cumulative success of current policies and programs and to identify emerging problems before they become widespread or irreversible."* MPCA's 2010 EMAP effort included sampling of 150 sites from a total of three different eco-regions within Minnesota. The site selection process was facilitated by MPCA, and was randomized to include all stretches of streams and rivers in Minnesota. MDA worked with MPCA to sample up to 100 sites from the two eco-regions with dominant agricultural land use. Sites ranged from small drainage ditches to large river systems (Figure 65). Pesticide sampling was completed in conjunction with other chemical, physical, and biological sampling, all performed by the MPCA. Due to the elevated stream flows in 2010 which limited access, some sampling will be conducted in 2011 to complete the study. EMAP sampling was biased toward

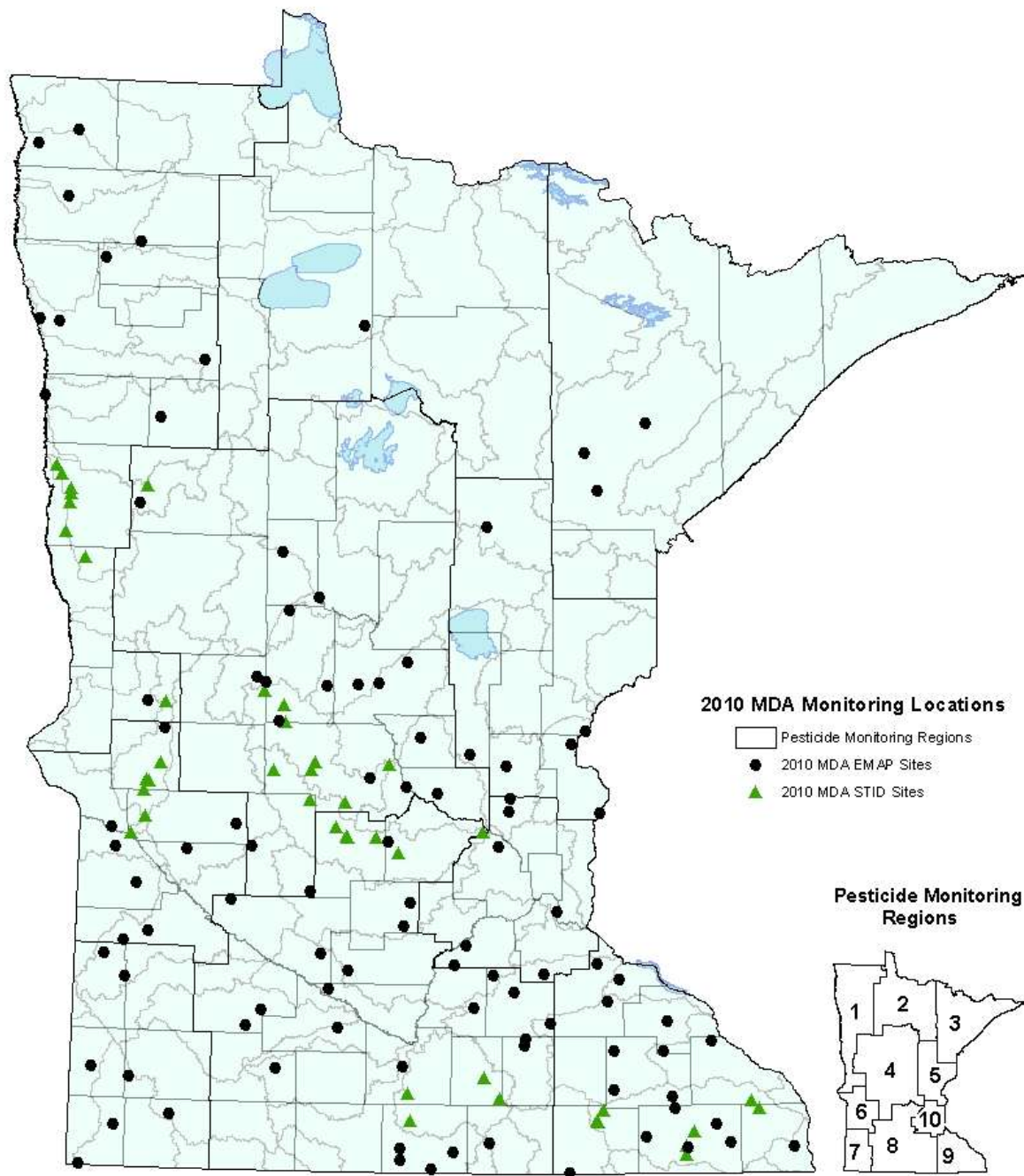


Figure 65. 2010 EMAP and STID locations.

base flow conditions because wading access in the stream was required. Sampling was completed from June 7, 2010 to September 14, 2010. An EMAP pesticide report will be developed and published by the MDA in cooperation with the MPCA when the effort is completed. For more information on EMAP, visit (www.epa.gov/emap).

5.5.2. Biological Stressor Identification (STID)

STID pesticide sampling was conducted by MPCA in 2010. STID is completed yearly in conjunction with MPCA's Intensive Watershed Investigation efforts. STID occurs in years three and four of the Intensive Watershed Investigation. STID sampling in 2010 occurred in the following major watersheds: Buffalo, Crow, Le Sueur, Pomme de Terre, and Root. Locations are presented in Figure 62.

STID sampling included both storm and base flow conditions. Sampling was completed from June 24, 2010 to September 3, 2010.

5.5.3. EMAP and STID Sampling

Prior to the EMAP and STID projects in 2010, MDA has not conducted a statewide stream survey effort of this magnitude that included streams of varying orders with many ungaged locations. Stream gaging allows for flow characterization during water quality assessment periods. Most of the locations sampled in EMAP and STID were only sampled once, and limited emphasis was placed on targeting storm flow periods. Also, the sampling periods ranged from June through September, which is later in the year than the period the MDA Tier 1 and Tier 2 typically target. Along with the expanded laboratory capacity in 2010, came additional pesticide analytes that had never been monitored for in Minnesota waters. All EMAP and STID samples included both a GC-MS and LC-MS/MS sample.

MDA implemented a tiered structure in 2006 to guide surface water sampling. This structure was developed to target routine herbicide application periods (May through June) with Tier 1 and Tier 2 sites. All locations are gaged to allow for flow characterization and are sampled a minimum of four times. Emphasis is placed on capturing storm flow during and shortly after the application of herbicides. Statewide Tier 1 and Tier 2 samples typically only include GC-MS analysis. This method is well proven for assessing herbicides in Minnesota streams and rivers including: atrazine, acetochlor, and metolachlor among many other. However, the application of fungicides and insecticides can and do occur after July 1. Within the tiered structure, there are also Tier 3 sites that are fully automated and operate year-round. These sites serve as indicators for statewide monitoring efforts, providing information on when particular pesticides may be present in the rivers. This information is then used to help develop and tune the Tier 1 and Tier 2 monitoring efforts. Figure 66 shows MDA's monthly sample event distribution for its statewide tiered network, EMAP, and STID for 2010. A sample event is defined as any GC-MS or LC-MS/MS pesticide sample collection for any project.

The EMAP and STID pesticide results provided an opportunity to evaluate MDA's current tiered structure by offering a statewide snapshot of pesticide presence later in the summer. In addition, the sample collection period for EMAP and STID will be evaluated using the current Tier 1 and Tier 2 sample collection periods which occur during the spraying of pre-plant and pre-emergence herbicides. To aide this effort, MDA decided to present the summary statistics of the EMAP and

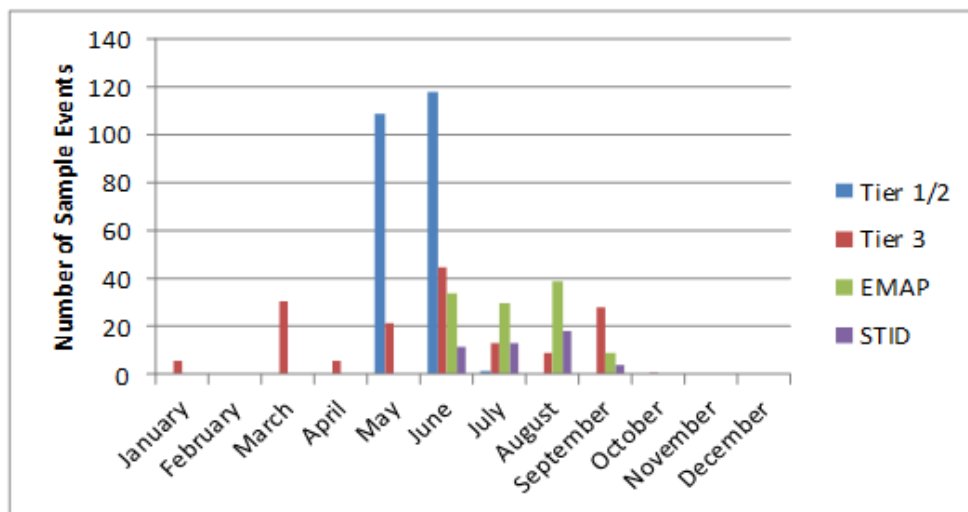


Figure 66. 2010 MDA monthly sample distribution among its statewide tiered network, EMAP, and STID projects.

STID projects together, and results will be used to help inform future sampling decisions.

Table 65 present the GC-MS results for 2010 EMAP and STID. Atrazine was the most frequently detected pesticide (62 percent of samples), followed by desethylatrazine (53 percent of samples), metolachlor (48 percent of samples), dimethenamid (10 percent of samples), and acetochlor (9 percent of samples). Seven additional pesticides were detected in the GC-MS analysis; however, each was detected in less than 5 percent of samples. Concentrations were below applicable water quality standards for all compounds, except chlorpyrifos. A sample from the Black River, west of Thief River Falls, had a chlorpyrifos concentration of 0.11 µg/L. This concentration is above the numeric 0.083 µg/L maximum standard developed by the MPCA and is the second highest concentration of chlorpyrifos ever measured by MDA in surface water. A sample collected in an unnamed ditch southwest of Cosmos, had a chlorpyrifos concentration of 0.05 µg/L. This concentration is above the 4-day chronic standard 0.041 µg/L developed by MPCA. A sample collected in an unnamed ditch northeast of Argyle, had a chlorpyrifos concentration of “present”. This concentration may be near the 0.041 µg/L chronic MPCA standard; however, the current laboratory GC-MS method has a chlorpyrifos MRL of 0.04 µg/L. MDA will be implementing additional monitoring at the Tier 2 level near all of the locations where chlorpyrifos was detected during the 2011 monitoring season. This monitoring will include an expanded Tier 2 monitoring season that will extend through the end of August.

The GC-MS results for EMAP and STID can be compared to the statewide Tier 1 results presented in Table 25. In general, acetochlor, atrazine, dimethenamid, and metolachlor were detected at a lower detection frequency, and the maximum concentrations observed in EMAP and STID were less than the Tier 1 results. This was expected as Tier 1 sampling targets storm flow periods during and shortly after the application of these pesticides. Insecticides and fungicides including chlorpyrifos, propiconazole, tebuconazole, and tetraconazole, were detected

Table 65. 2010 EMAP and STID GC-MS surface water result.

EMAP and STID 2010 GC-MS Detected Analytes	Total Detects (total n – 149)	Total Samples	Total % Detects	Total Median (µg/L)	75th Percentile (µg/L)	90th Percentile (µg/L)	Total Max (µg/L)
Acetochlor	14	149	9	nd	nd	nd	0.87
Atrazine	93	149	62	P	P	0.07	0.36
Desethylatrazine	79	149	53	P	P	0.06	0.15
Chlorpyrifos	3	149	2	nd	nd	nd	0.11
Dimethenamid	15	149	10	nd	nd	P	0.08
Ethofumesate (not a target analyte)	1	149	-	-	-	-	P
Metolachlor	72	149	48	nd	P	P	0.29
Metribuzin	1	149	1	nd	nd	nd	P
Prometon	2	149	1	nd	nd	nd	3.35
Propiconazole	7	149	5	nd	nd	nd	P
Tebuconazole	6	149	4	nd	nd	nd	1.46
Tetraconazole	4	149	3	nd	nd	nd	0.31

in a limited number of samples in both the Tier 1 samples and EMAP and STID, although the maximum concentrations tended to be higher with the EMAP and STID samples. As expected for the GC-MS analytical suite, higher pesticide detection frequency and maximum values generally align with sampling that occurred during or shortly after the various pesticide application periods.

Table 66 presents LC-MS/MS results for 2010 EMAP and STID in parts per trillion. LC-MS/MS results were dominated by the degradates of acetochlor, alachlor, atrazine, dimethenamid, and metolachlor. The herbicide 2,4-D was the most frequently detected parent pesticide compound (51 percent of samples), followed by bentazon (45 percent of samples). There were fifteen additional pesticide compounds detected by the LC-MS/MS method; all of these compounds were detected in less than 10 percent of the samples. None of these compounds were detected above applicable water quality standards. The aforementioned degradates tended to be detected at higher concentrations than other compounds in either the GC-MS or LC-MS/MS method.

The LC-MS/MS results for EMAP and STID cannot be compared to statewide Tier 1 or Tier 2 results since LC-MS/MS samples are not generally collected at Tier 1 or Tier 2 sites. As stated previously, the Tier 1 and Tier 2 locations primarily target herbicides contained in the GC-MS method. MDA does do extensive LC-MS/MS sampling at its Urban Tier 1 and Urban Tier 2 locations; however, it is not appropriate to compare the urban results with the statewide sampling completed through the EMAP and STID projects.

**Table 66. 2010 EMAP and STID LC-MS/MS surface water results. PLEASE NOTE:
Results in ng/L. 1 µg/L = 1000 ng/L**

EMAP and STID 2010 LC-MS/MS Detected Analytes	Total Detects (total n = 150)	Total Samples	Total % Detects	Median (ng/L)	75th Percentile (ng/L)	90th Percentile (ng/L)	Max (ng/L)
2,4-D	75	147	51	8.72	22.8	82.9	5270
Acetochlor ESA	110	147	75	150	331	593	2280
Acetochlor OXA	79	147	54	42	119	223	1350
Alachlor ESA	98	147	67	73.2	155	271	1340
Alachlor OXA	7	147	5	nd	nd	nd	208
Azoxystrobin	8	150	5	nd	nd	nd	347
Bentazon	66	147	45	nd	2.16	4.32	1220
Bromacil	2	150	1	nd	nd	nd	46.6
Clopyralid	4	147	3	nd	nd	nd	150
Dicamba	1	147	1	nd	nd	nd	53
DEDI Atrazine	17	150	11	nd	nd	56.5	180
Dimethenamid ESA	68	147	46	nd	15.7	33.6	198
Dimethenamid OXA	23	147	16	nd	nd	12.5	93.5
Diuron	6	150	4	nd	nd	nd	286
Hydroxyatrazine	138	150	92	33.4	59.9	100	292
Imazamethabenz Acid	2	150	1	nd	nd	nd	17.5
Imazamox	2	150	1	nd	nd	nd	46.3
Imazapyr	4	150	3	nd	nd	nd	14
Imazethapyr	13	150	9	nd	nd	nd	36.3
Imidacloprid	2	150	1	nd	nd	nd	95.7
MCPA	11	147	7	nd	nd	nd	488
Metolachlor ESA	136	147	93	235	835	1502	4150
Metolachlor OXA	114	147	78	35.7	85.2	189	480
Saflufenacil	10	150	7	nd	nd	nd	30.3
Tembotrione	1	147	1	nd	nd	nd	77.5
Thiamethoxam	3	150	2	nd	nd	nd	75.5
Triclopyr	1	147	1	nd	nd	nd	415

5.6. Flow and chemistry monitoring at a large spring

In 2006, the MDA expanded groundwater monitoring in the karst region of the state (PMR 9) to include sampling at the emergence point of several perennial springs. There were notable changes in flow and turbidity at several of the springs during the year, related strongly to climatic conditions. In 2008, the MDA installed flow monitoring equipment at one of the larger springs in Fillmore County to assess variability in flow and rainfall response and to allow for evaluation of groundwater-surface water interaction. The spring is instrumented to continuously measure water level and velocity near the emergence point. Estimated daily discharge is determined from recorded velocity, and calculated stream cross-sectional area (from recorded water level). Estimated 2010 mean daily discharge and daily rainfall is presented in Figure 67.

There was great variability in mean daily discharge, and values ranged from under five cubic feet per second (cfs) to an estimated 459 cfs. There were increases in flow related to snowmelt in early March, elevated flow from rainfall events throughout the summer, and the maximum discharge rate for 2010 occurred on September 24, due to a large rainfall event. Presented rainfall data was collected in a nearby state park and totaled 38.1 inches in 2010, which is nearly seven inches more than the 30 year (1971-2000) normal amount for Rochester, MN (31.40 inches as

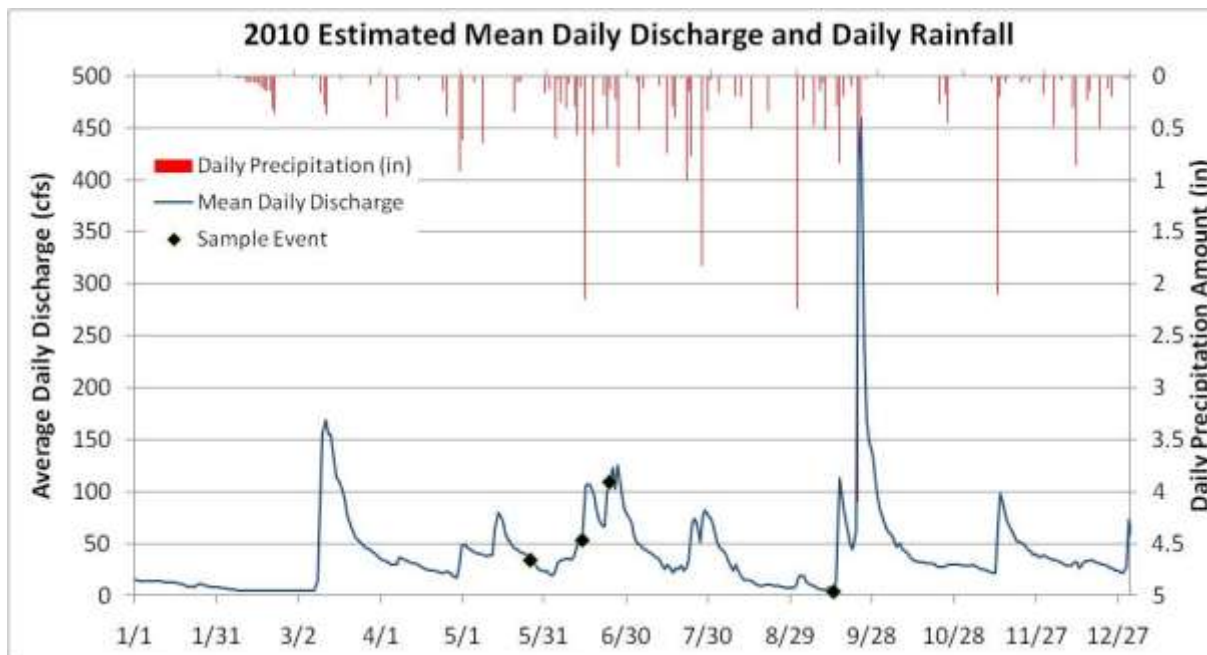


Figure 67. Estimated mean daily discharge and daily rainfall at a large spring in PMR 9.

calculated by the National Climatic Data Center). The spring is less responsive to rainfall following extended dry periods and rainfall observed during weeks of high plant water uptake.

Pesticide and nutrient monitoring at this spring began in 2009, and was continued through 2010. Samples were collected as part of the MDA's PMR 9 regional groundwater program. Samples were collected once in late May, twice in June, and once in September, and are indicated in Figure 67. Monitoring results from this location are included within the PMR 9 data analysis located in Section 2 of this report.

SECTION 6: NUTRIENTS AND TOTAL SUSPENDED SOLIDS

Although the primary focus of the MDA's surface water monitoring efforts are towards the collection of pesticide data, nutrients (including nitrate-N, dissolved orthophosphorus, and total phosphorus), sediment data (total suspended solids) and, in limited locations, turbidity, have also been collected along with the pesticide data. Nutrient and sediment samples are collected along with pesticide samples to provide additional information about the possible transport mechanisms and pathways (overland flow, sub-surface tile, groundwater, etc.) that the pesticides may have followed to enter the water body. These additional analytes also provide information associated with the potential impact of non-pesticide related agricultural chemical application, such as fertilizers and manure.

6.1. Groundwater

6.1.1. Statewide nitrate

Samples for nitrate-nitrogen were collected from 240 groundwater sampling events in 2010. Table 67 is a summary of results for the samples collected in 2010. In total, 208 samples, or 87 percent of all samples analyzed, had detectable levels of nitrate-nitrogen, with 36 percent exceeding the MDH health risk limit of 10.0 mg/L. The highest value of 61.9 mg/L was recorded in PMR 4. Every PMR had at least 50 percent of the samples with detectable levels of nitrate-nitrogen. PMRs 4 and 5, both areas of irrigated agriculture and sandy soils, displayed the highest median values of 11.3 and 10.2 mg/L, respectively.

Generally, groundwater nitrate-nitrogen concentrations are divided into four categories when assessing sample results. Samples with no measurable levels are considered unimpacted by any source; levels between the MDL and 3.0 mg/L are considered background; levels greater than 3.0 to 10.0 mg/L are considered impacted; concentrations greater than 10.0 mg/L exceed the state's health risk limit. As evidenced in Table 68, it is fairly common throughout Minnesota to have shallow groundwater exceed MDH health risk limit for nitrate-nitrogen. PMRs 4 and 5, which had the highest median nitrate concentrations as pointed out earlier, also had the highest percent detections at levels exceeding the MDH health risk limit, at 53 percent.

Further, the present groundwater monitoring network was not designed to determine the quality of the state's groundwater with respect to nitrate-nitrogen, making extrapolation of the information presented here inappropriate.

Table 67. Summary of nitrate-nitrogen results in groundwater samples for 2010.

PMR	Detections/Total Samples	% detections	Median (mg/L)	75% (mg/L)	90% (mg/L)	Maximum (mg/L)	% Exceeding 10 mg/L Standard
1	10/14	71%	0.85	1.09	16.4	26.2	21%
4	87/92	95%	11.3	24.8	36.0	61.9	53%
5	15/17	88%	10.2	14.2	22.9	33.6	53%
6	10/18	56%	1.04	2.77	23.8	40.3	11%
7	8/14	57%	4.36	8.02	17.9	27.7	21%
8	16/23	70%	1.85	9.26	14.8	27.6	22%
9	62/62	100%	6.97	9.61	12.8	26.1	24%
All samples	208/240	87%	7.05	14.1	26.3	61.9	36%

Table 68. Summary of nitrate-nitrogen results in groundwater samples for 2010 compared against MDH health risk limits.

PMR	% < MDL	% MDL to 3.0 mg/L	% 3.01 to 10.0 mg/L	% > 10.0 mg/L
1	29%	50%	0%	21%
4	5%	18%	23%	53%
5	12%	24%	12%	53%
6	44%	33%	11%	11%
7	43%	0%	36%	21%
8	30%	26%	22%	22%
9	0%	3%	73%	24%
Total	13%	18%	33%	36%

6.1.2. PMR 4 shallow-versus deep-well nitrate

The MDA monitoring well network was designed primarily for assessing pesticide concentration near the water table. A nitrate sample was collected during each visit to also assess nitrate concentration at the water table. To get a sense for pesticide and nitrate concentration with depth, the MDA groundwater monitoring program installed nine new wells in PMR 4 during 2010. Although intended to determine whether pesticides are impacting a larger portion of the aquifer than wells completed at the water table would indicate, the new deeper wells can be also be used to assess nitrate concentrations at slightly deeper depths in the aquifer. New PMR 4 wells were installed at existing well sites at depths between 10 and 15 feet deeper into the aquifer than previously installed wells, which are screened across the water table. The installation of the new deeper wells was completed in May and June 2010. The first samples were collected during

the November 2010 sampling round, from both the shallow and deeper wells (although a sample was unable to be collected from one of the deep wells).

Table 69 provides a summary of the nitrate results from the eight shallow and eight deep wells from the November 8th to November 19th in PMR 4. The shallow wells had higher nitrate concentrations than the deeper wells, with median concentrations of 23.1 and 11.3 mg/L, respectively. This is not surprising because reducing conditions (lower dissolved oxygen concentrations) typically increase with depth below ground. Reducing conditions facilitate the decomposition of nitrate by anaerobic bacteria. Shallower, water-table wells are typically more connected to “fresher” water that has been recently infiltrated and thus has a higher dissolved oxygen content and associated nitrate concentration. The results obtained from the shallow and deep wells tend to support these assumptions.

Table 69. Summary of nitrate-nitrogen results in paired shallow and deep wells in PMR 4.

Depth Type	Detections	% detections	Median (mg/L)	75% (mg/L)	90% (mg/L)	Maximum (mg/L)	% Exceeding 10 mg/L Standard
Shallow	8/8	100%	23.1	28.6	39.8	44.5	100
Deep	8/8	100%	11.3	18.9	26.6	28.0	62

6.1.3. PMR 9 springs inorganic analysis summary from 2009-2010.

The MDA began collecting samples for expanded inorganic analysis (more than just nitrate) from the nine non-DNR springs in PMR 9 during the 2009 sampling season. These additional analytes included total and dissolved orthophosphorus, total suspended solids, and turbidity. Sampling occurred at these springs four times during each year (three times in the spring and once in later summer). The three DNR springs in PMR 9 were also sampled four times during each year (once during each quarter), but only for nitrate. The intent of this expanded sampling was to help the MDA characterize the hydrology of the springs being sampled in the groundwater monitoring program. PMR 9 encompasses the state’s karst geology, which is an area characterized as containing near-surface carbonate bedrock that is fractured and relatively soluble. Features of karst areas include sinkholes, caves, disappearing streams, springs, and deeply incised valleys. This all makes the shallow groundwater in the area not only complex in nature, but highly susceptible to contamination from activities at the ground surface. It is important to note however that not all the aquifers in this region are affected by the karst geology.

Table 70 provides a summary of the inorganic analysis results from the 12 springs in PMR 9 that the MDA has monitored during the last two years. The table separates the data by county where sampling occurred (Fillmore, Houston, Winona, Wabasha, and Goodhue counties). As observed in Table 70, data from Fillmore County displayed the highest variability in and maximums of inorganic analyte concentrations. The springs in the other counties displayed relatively more stable conditions with respect to the inorganic analytes. What this indicates is that the springsheds of the Fillmore County springs tend to be more intimately connected to surface activities. This is likely due to the large number of sinkholes that are found in Fillmore County, which are directly connected to spring outlets through conduits in the shallow bedrock.

Table 70. Summary of inorganic analysis from 12 springs.

Inorganic Analyte	County	# of Samples	Minimum (mg/L)	Median (mg/L)	75% (mg/L)	90% (mg/L)	Maximum (mg/L)
Nitrate/Nitrite-nitrogen (mg/L)	Fillmore	56	2.95	9.46	11.50	13.17	16.00
	Houston	8	6.38	6.73	6.97	7.07	7.08
	Winona	8	3.22	4.02	4.07	4.11	4.12
	Wabasha	16	4.26	4.58	4.79	4.93	5.01
	Goodhue	8	5.75	6.62	7.68	7.85	7.90
Dissolved Orthophosphorus (mg/L)	Fillmore	40	0.009	0.028	0.047	0.058	0.112
	Houston	8	0.008	0.018	0.023	0.025	0.025
	Winona	0	-	-	-	-	-
	Wabasha	16	0.010	0.021	0.030	0.035	0.036
	Goodhue	8	0.009	0.019	0.023	0.026	0.027
Total Phosphorus (mg/L)	Fillmore	40	0.036	0.061	0.078	0.251	9.45
	Houston	8	0.024	0.031	0.033	0.036	0.037
	Winona	0	-	-	-	-	-
	Wabasha	16	0.024	0.036	0.043	0.047	0.050
	Goodhue	8	0.023	0.031	0.033	0.035	0.035
Total Suspended Solids (mg/L)	Fillmore	40	nd	0.75	9.70	210	16,000
	Houston	8	nd	nd	0.20	0.27	0.30
	Winona	0	-	-	-	-	-
	Wabasha	16	nd	nd	0.30	0.89	3.00
	Goodhue	8	nd	0.55	3.80	4.91	5.30
Turbidity (NTU)	Fillmore	40	0.276	0.909	8.04	166.9	4,640
	Houston	8	nd	0.149	0.323	0.399	0.405
	Winona	0	-	-	-	-	-
	Wabasha	16	nd	nd	0.150	0.650	0.662
	Goodhue	8	nd	0.381	0.615	0.960	1.03

6.2. Surface water Tier 1 and Tier 2

Summary statistics for inorganic results are shown for Tier 1, Urban Tier 1, and Tier 2 in Table 71. With the exception of PMR 1, inorganic sampling was conducted more during storm flow than base flow periods. Nitrate-nitrogen (NO₃-N), total phosphorus (TP) and dissolved orthophosphorus (DOP) samples were collected with each pesticide sample collected at all tiered locations. In 2010, a total of 250 samples each of NO₃-N, TP, and DOP were collected. Limited

total suspended solids (TSS) samples were collected in PMR 8 and PMR 9. TSS storm flow samples had much higher concentrations than base flow samples.

Limited sampling in PMR 2 and 3 resulted in non-detection of NO₃-N during both base and storm flow periods. NO₃-N results were highest in PMR's 7, 8, 9, and 10 in 2010. Nitrate-nitrogen collected from Urban Tier 1 locations were generally low. Total phosphorus was detected in 249 of 250 samples collected in 2010. Dissolved orthophosphorus was detected more in storm than base flow samples. Median concentrations for TP ranged from 0.014 mg/L (base flow) in PMR 3 to 0.331 mg/L (storm flow in PMR 1). Median concentrations for DOP ranged from 0.011 mg/L (base flow) in PMRs 4 and 5 to 0.192 mg/L (storm flow) in PMR 1.

Table 71. Tier 1 and Tier 2 inorganic results for surface water samples by PMR, 2010.

2010		Base Flow Samples					Storm Event Samples				
Inorganic Analyte	Tier 1 and Tier 2 Surface Water Monitoring Site	No. of samples	% Detection	Maximum Value Detected (mg/L)	90th percentile (mg/L)	Median Value of Samples (mg/L)	No. of samples	% Detection	Maximum Value Detected (mg/L)	90th percentile (mg/L)	Median Value of Samples (mg/L)
Nitrate/Nitrite-Nitrogen	PMR 1	13	8%	1.14	nd	nd	11	55%	9.8	4.32	0.43
	PMR 2	1	0%	nd	nd	nd	3	0%	nd	nd	nd
	PMR 3	2	0%	nd	nd	nd	2	0%	nd	nd	nd
	PMR 4	5	80%	4.88	3.33	nd	14	43%	4.34	3.76	nd
	PMR 5	4	75%	1.43	1.36	1.17	8	13%	1.21	0.36	nd
	PMR 6	5	80%	5.45	4.97	3.97	11	100%	9.77	9.58	3.62
	PMR 7	3	100%	11.0	10.5	8.52	19	100%	16.5	16.3	11.8
	PMR 8	16	100%	14.3	13.8	8.61	37	100%	18.3	15.1	10.1
	PMR 9	19	100%	18.9	14.3	9.79	25	100%	16.2	14.3	3.71
	PMR 10	6	67%	11.6	11.5	10.8	13	85%	13.9	13.1	5.33
	Urban Tier 1	0	--	--	--	--	33	18%	1.56	0.88	nd
Total Suspended Solids	PMR 1	0	--	--	--	--	0	--	--	--	--
	PMR 2	0	--	--	--	--	0	--	--	--	--
	PMR 3	0	--	--	--	--	0	--	--	--	--
	PMR 4	0	--	--	--	--	0	--	--	--	--
	PMR 5	0	--	--	--	--	0	--	--	--	--
	PMR 6	0	--	--	--	--	0	--	--	--	--
	PMR 7	0	--	--	--	--	0	--	--	--	--
	PMR 8	0	--	--	--	--	1	100%	77.2	77.2	77.2
	PMR 9	4	100%	6.6	6.6	5.4	7	100%	868	585	62
	PMR 10	0	--	--	--	--	0	--	--	--	--
	Urban Tier 1	0	--	--	--	--	0	--	--	--	--

Table 71 continued. Tier 1 and Tier 2 inorganic results for surface water samples by PMR, 2010.

2010		Base Flow Samples					Storm Event Samples				
Inorganic Analyte	Tier 1 and Tier 2 Surface Water Monitoring Site	No. of samples	% Detection	Maximum Value Detected (mg/L)	90th percentile (mg/L)	Median Value of Samples (mg/L)	No. of samples	% Detection	Maximum Value Detected (mg/L)	90th percentile (mg/L)	Median Value of Samples (mg/L)
Total Phosphorus	PMR 1	13	100%	0.494	0.4	0.215	11	100%	2.11	1.82	0.331
	PMR 2	1	100%	0.065	0.065	0.065	3	100%	0.055	0.054	0.048
	PMR 3	2	100%	0.016	0.016	0.014	2	100%	0.015	0.015	0.014
	PMR 4	5	100%	0.092	0.076	0.029	14	100%	0.188	0.071	0.052
	PMR 5	4	100%	0.056	0.051	0.028	8	100%	0.146	0.101	0.045
	PMR 6	5	100%	0.151	0.135	0.081	11	100%	0.246	0.199	0.1
	PMR 7	3	100%	0.065	0.061	0.043	19	100%	0.343	0.263	0.052
	PMR 8	16	100%	0.215	0.188	0.108	37	100%	0.358	0.278	0.147
	PMR 9	19	92%	0.375	0.184	0.082	25	100%	5.71	1.98	0.212
	PMR 10	6	100%	0.173	0.167	0.14	13	100%	0.48	0.243	0.157
	Urban Tier 1	0	--	--	--	--	33	100%	0.232	0.153	0.084
Dissolved Orthophosphorus	PMR 1	13	100%	0.389	0.296	0.081	11	100%	0.261	0.249	0.192
	PMR 2	1	100%	0.021	0.021	0.021	3	100%	0.016	0.015	0.012
	PMR 3	2	0%	nd	nd	nd	2	100%	0.006	0.006	0.006
	PMR 4	5	60%	0.023	0.022	0.011	14	79%	0.056	0.028	0.013
	PMR 5	4	75%	0.018	0.017	0.011	8	88%	0.046	0.033	0.014
	PMR 6	5	100%	0.039	0.034	0.014	11	91%	0.142	0.079	0.026
	PMR 7	3	67%	0.015	0.014	0.009	19	84%	0.256	0.139	0.012
	PMR 8	16	100%	0.172	0.122	0.019	37	100%	0.244	0.165	0.052
	PMR 9	19	70%	0.233	0.099	0.024	25	95%	1.09	0.508	0.062
	PMR 10	6	100%	0.126	0.105	0.050	13	100%	0.272	0.144	0.04
	Urban Tier 1	0	--	--	--	--	33	100%	0.068	0.054	0.029

6.3. Surface water Tier 3

Tier 3 nutrient and total suspended solid results from 2010 are shown in Table 72. Nutrient and sediment samples are not always collected. Field personnel determine whether or not a collection should take place based on a variety of factors, including current field conditions and volume of water available if collecting from composite samplers.

6.3.1. Nitrate-nitrogen

The maximum NO₃-N concentration in 2010 was detected at Seven Mile Creek at a concentration of 25.1 mg/L. In southeast Minnesota, base flow NO₃-N levels in streams are heavily influenced by the source aquifer that discharges to the stream. There are a number of streams that have annual maximum NO₃-N levels measured during base flow periods. In 2010, the Middle Branch of the Whitewater River had a median NO₃-N concentration of 9.68 mg/L during base flow and 4.45 mg/L during storm flow. The newest Tier 3 location, the Buffalo River at Georgetown, exhibited the lowest NO₃-N concentrations of all the Tier 3 stations. The median values during base flow periods ranged from 0.42 mg/L at the Buffalo River at Georgetown to 9.68 mg/L at the Middle Branch of the Whitewater River.

6.3.2. Total phosphorus/dissolved orthophosphorus

Out of the 175 samples collected, there was a 100 percent detection frequency for TP at all Tier 3 sites. DOP was detected in 100 percent of storm flow samples collected at Tier 3 sites.

The maximum TP concentration detected during storm flow periods (7.14 mg/L) occurred at the Seven Mile Creek station. Median TP concentrations for storm event samples ranged from 0.204 mg/L to 0.517 mg/L and from 0.034 mg/L to 0.254 mg/L for base flow samples. Median DOP concentrations for storm event samples were between 0.038 mg/L and 0.287 mg/L and 0.009 mg/L to 0.033 mg/L for base flow samples.

6.3.3. Total suspended solids and turbidity

There were 144 TSS samples collected from Tier 3 locations in 2010. Median TSS concentrations during storm events ranged from 48 mg/L to 632 mg/L. The median TSS concentration during base flow events ranged from 3.9 mg/L to 100 mg/L.

Table 72. Inorganic analyte detections in storm event and base flow samples for MDA Tier 3 surface water monitoring sites, 2010.

2010		Base Flow Samples					Storm Event Samples				
Inorganic Analyte	Tier 3 Surface Water Monitoring Site	No. of samples	% Detection	Maximum Value Detected (mg/L)	90th percentile (mg/L)	Median Value of Samples (mg/L)	No. of samples	% Detection	Maximum Value Detected (mg/L)	90th percentile (mg/L)	Median Value of Samples (mg/L)
Nitrate/Nitrite	Beauford Ditch	5	100%	11.6	10.8	9.15	11	100%	14.5	13.3	8.64
	Buffalo River-Georgetown	3	67%	0.42	0.42	0.42	17	59%	2.37	1.38	0.51
	Le Sueur River-Hwy66	4	100%	13.3	11.2	6.15	9	100%	10.1	9.28	6.48
	Root River-North Branch	9	100%	8.09	6.62	5.38	18	100%	9.33	9.22	5.18
	Root River-South Branch-Carimona	7	100%	8.87	8.83	8.47	22	100%	11.7	10.6	7.64
	Seven Mile Creek #3	5	100%	12.9	12.4	6.15	25	100%	25.1	24.6	16.7
	Whitewater River-Middle Branch	16	100%	11.3	11	9.68	22	100%	8.9	8.45	4.45
Total Phosphorus	Beauford Ditch	5	100%	0.772	0.507	0.042	11	100%	0.609	0.606	0.415
	Buffalo River-Georgetown	3	100%	0.338	0.321	0.254	17	100%	1	0.339	0.266
	Le Sueur River-Hwy66	5	100%	0.238	0.186	0.087	10	100%	1.23	1.09	0.517
	Root River-North Branch	9	100%	0.128	0.099	0.034	18	100%	0.814	0.713	0.447
	Root River-South Branch-Carimona	7	100%	0.066	0.066	0.039	22	100%	0.657	0.482	0.204
	Seven Mile Creek #3	5	100%	0.261	0.202	0.099	25	100%	7.14	2.12	0.301
	Whitewater River-Middle Branch	16	100%	0.167	0.147	0.058	22	100%	4.22	2.79	0.507
Dissolved Orthophosphorus	Beauford Ditch	5	100%	0.505	0.321	0.016	11	100%	0.466	0.458	0.287
	Buffalo River-Georgetown	3	100%	0.184	0.165	0.09	17	100%	0.303	0.207	0.096
	Le Sueur River-Hwy66	5	100%	0.044	0.044	0.027	10	100%	0.299	0.266	0.125
	Root River-North Branch	9	89%	0.044	0.026	0.009	18	100%	0.252	0.202	0.069
	Root River-South Branch-Carimona	7	86%	0.016	0.015	0.012	22	100%	0.291	0.097	0.038
	Seven Mile Creek #3	5	100%	0.166	0.12	0.033	25	100%	0.324	0.262	0.099
	Whitewater River-Middle Branch	16	88%	0.074	0.04	0.016	22	100%	0.334	0.281	0.169

Table 72 cont. 2010 Inorganic analyte detections in storm event and base flow samples for MDA Tier 3 surface water monitoring sites, 2010.

2010		Base Flow Samples					Storm Event Samples				
Inorganic Analyte	Tier 3 Surface Water Monitoring Site	No. of samples	% Detection	Maximum Value Detected (mg/L)	90th percentile (mg/L)	Median Value of Samples (mg/L)	No. of samples	% Detection	Maximum Value Detected (mg/L)	90th percentile (mg/L)	Median Value of Samples (mg/L)
Total Suspended Solids	Beauford Ditch	3	100%	90	73.1	5.5	9	100%	131	127	48
	Buffalo River-Georgetown	3	100%	128	122	100	16	100%	896	157	81.6
	Le Sueur River-Hwy66	3	100%	303	247	20.6	9	100%	1740	1300	632
	Root River-North Branch	4	100%	36.8	33.8	14.7	14	100%	800	630	260
	Root River-South Branch-Carimona	4	100%	7.6	6.6	3.9	22	100%	598	276	109
	Seven Mile Creek #3	2	100%	10.6	9.7	6.2	23	100%	11300	3062	564
	Whitewater River-Middle Branch	10	100%	81.6	64.7	14.4	22	100%	4750	1959	306

SECTION 7: REFERENCES

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MDA 2010, Groundwater Design Document.

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Appendix 1

2010 MDA Pesticide List by Method and Analyte: Analyte Name; Chemical Abstracts Service (CAS) Registry Number; and Method Reporting Limit (MRL).

2010 MDA Pesticide List by Method and Analyte: Analyte Name; Chemical Abstracts Service (CAS) Registry Number; and Method Reporting Limit (MRL).

MDA GC-MS Analytes	CAS Number	MRL (ppb)
Acetochlor	34256-82-1	0.05
Alachlor	15972-60-8	0.05
Atrazine	1912-24-9	0.05
Boscalid	188425-85-6	0.30
Chlorothalonil	1897-45-6	0.12
Chlorpyrifos	2921-88-2	0.04
Clomazone	81777-89-1	0.10
Cyanazine	21725-46-2	0.20
Cyfluthrin	68359-37-5	0.50
Deisopropylatrazine	1007-28-9	0.20
Desethylatrazine	6190-65-4	0.05
Diazinon	333-41-5	0.12
Dimethenamid	87674-68-8	0.05
Dimethoate	60-51-5	0.22
Disulfoton	298-04-4	0.15
EPTC	759-94-4	0.23
Esfenvalerate	66230-04-4	0.20
Ethalfuralin	5523-68-6	0.15
Fonofos	944-22-9	0.10
Lambda Cyhalothrin	91465-08-6	0.20
Malathion	121-75-5	0.09
Metolachlor	51218-45-2	0.07
Metribuzin	21087-64-9	0.10
Metribuzin DA (ERL)	35045-02-4	1.00
Metribuzin DADK (ERL)	52236-30-3	1.00
Metribuzin DK (ERL)	56507-35-0	1.00
Myclobutanil	88671-89-0	0.20
Oxadiazon	19666-30-9	0.05
Parathion-methyl	298-00-0	0.12
Pendimethalin	40487-42-1	0.08
Phorate	298-02-2	0.12
Prometon	1610-18-0	0.10
Propachlor	1918-16-7	0.10
Propazine	139-40-2	0.10
Propiconazole	60207-90-1	0.20
Pyraclostrobin	175013-18-0	0.23
Simazine	122-34-9	0.10
Tebuconazole	107534-96-3	0.20
Tebupirimphos	96182-53-5	0.10
Terbufos	13071-79-9	0.19
Tetraconazole	112281-77-3	0.15
Triallate	2303-17-5	0.10
Trifluralin	1582-09-8	0.17
zeta-Cypermethrin	52315-07-8	0.50

MDA LC-MS/MS (+) Analytes	CAS Number	MRL (ppt)
Acetamiprid	160430-64-8	15
Aldicarb Sulfone	1646-88-4	15
Aldicarb Sulfoxide	1646-87-3	50
Azoxystrobin	131860-33-8	10
Bensulfuron-methyl	83055-99-6	16.7
Bromacil	314-40-9	20
Carbaryl	63-25-2	25
Carbofuran	1553-66-2	13.3
Chlorimuron-ethyl	90982-32-4	20
DEDI Atrazine	3397-62-4	50
Disulfoton Sulfone	2497-06-5	20
Diuron	330-54-1	13.3
Halosulfuron-methyl	100784-20-1	30
Hexazinone	51235-04-2	10
Hydroxyatrazine	2163-68-0	6.7
Imazamethabenz Acid	Not Available	10
Imazamethabenz-methyl	81405-85-8	5
Imazamox	114311-32-9	13.3
Imazapic	104098-48-8	10
Imazapyr	81334-34-1	8.3
Imazaquin	81335-37-7	16.7
Imazethapyr	81335-77-5	6.7
Imidacloprid	138261-41-3	20
Isoxaflutole	141112-29-0	25
Linuron	330-55-2	20
Metalaxyl	57837-19-1	8.3
Metsulfuron-methyl	74223-64-6	23.3
Neburon	555-37-3	10
Nicosulfuron	111991-09-4	26.6
Norflurazon	27314-13-2	20
Prometryn	7287-19-6	3.3
Propoxur	114-26-1	10
Saflufenacil	372137-35-4	15
Siduron	1982-49-6	6.7
Sulfometuron-methyl	74222-97-2	8.3
Thiamethoxam	153719-23-4	25
Thifensulfuron-methyl	79277-27-3	16.7
Thiobencarb	28249-77-6	8.3
Triasulfuron	82097-50-5	23.3

MDA LC-MS/MS (-) Analytes	CAS Number	MRL (ppt)
2,4,5-T	93-76-5	50
2,4,5-TP	93-72-1	50
2,4-D	94-75-7	8.3
2,4-DB	94-82-6	13.3
Acetochlor ESA	187022-11-3	30
Acetochlor OXA	184992-44-4	33.3
Alachlor ESA	142363-53-9	41.6
Alachlor OXA	171262-17-2	33.3
Bentazon	25057-89-0	0.8
Clopyralid	1702-17-6	41.6
Dicamba	1918-00-9	50
Dichlorprop	120-36-5	50
Dimethenamid ESA	205939-58-8	6.7
Dimethenamid OXA	Not Available	10
Flufenacet OXA	201668-31-7	8.3
Isoxaflutole DKN	143701-75-1	50
MCPA*	94-74-6	5
MCPB	94-81-5	10
MCP**	93-65-2	50
Mesotrione	104206-82-8	50
Metolachlor ESA	171118-09-5	10
Metolachlor OXA	152019-73-3	10
Picloram	1918-02-1	41.6
Propachlor ESA	947601-88-9	30
Propachlor OXA	Not Available	10
Tembotrione	335104-82-2	50
Triclopyr	55335-06-3	50

(ERL) : Estimated Reporting Limit

* MCPA EHE CAS Number: 29450-45-1. MCPA DMAS CAS Number: 2039-46-5.

** MCPP-p acid CAS Number: 16484-77-8. MCPP-p DMAS CAS Number: 66423-9-4.

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Appendix 2

***Pesticide compounds detected in Minnesota water resources by
Minnesota Department of Agriculture.***

Pesticide Compounds Detected in Minnesota Water Resources by Minnesota Department of Agriculture

Pesticide Compound*	Groundwater Analyte	Detection in Minnesota Groundwater (1985-2010)**	Surface Water*** Analyte	Detection in Minnesota Surface Water (1991-2010)**
2,4,5-T	x		x	
2,4,5-TP	x		x	
2,4-D	x	x	x	x
2,4-DB	x		x	
2,6-Dichlorobenzamide			x	x
3-hydroxycarbofuran	x		x	
Acetamiprid	x		x	
Acetochlor	x	x	x	x
Acetochlor ESA	x	x	x	x
Acetochlor OXA	x	x	x	x
Alachlor	x	x	x	x
Alachlor ESA	x	x	x	x
Alachlor OXA	x	x	x	x
Aldicarb	x	x	x	
Aldicarb Sulfone	x		x	x
Aldicarb Sulfoxide	x		x	x
AMPA			x	x
Atrazine	x	x	x	x
Azoxystrobin	x		x	x
Bensulfuron-methyl	x		x	
Bentazon	x	x	x	x
Boscalid	x		x	x
Bromacil	x	x	x	x
Butylate	x		x	
Carbaryl	x		x	
Carbofuran	x		x	
Chloramben	x		x	
Chlorimuron-ethyl	x		x	
Chlorothalonil	x	x	x	x
Chlorpyrifos	x		x	x
Chlorsulfuron****			x	
Clomazone	x	x	x	x
Clopyralid	x	x	x	x
Cyanazine	x	x	x	x
Cyanazine Acid	x	x		
Cyanazine Amide	x	x		
Cyfluthrin	x		x	
Di-dealkyl atrazine (DACT)	x	x	x	x
Diaminochlorotriazine (DACT)	x	x	x	x
Deisopropylatrazine	x	x	x	x
Desethylatrazine	x	x	x	x
De-ethylcyanazine Acid	x	x		
De-ethylcyanazine Amide	x			
Diazinon	x		x	x
Dicamba	x	x	x	x
Dichlobenil			x	x
Dichlorprop	x		x	x
Dimethenamid	x	x	x	x
Dimethenamid ESA	x	x	x	x
Dimethenamid OXA	x	x	x	x
Dimethoate	x	x	x	x
Disulfoton	x		x	
Disulfoton Sulfone	x		x	
Diuron	x	x	x	x
EPTC	x		x	x
Esfenvalerate	x		x	
Ethalfuralin	x		x	
Ethofumesate			x	x
Fenoprop****			x	x*****
Flufenacet OXA	x			
Flumetsulam****			x	
Fonofos	x		x	
Glyphosate			x	x
Halosulfuron-methyl	x		x	
Hexazinone	x		x	
Hydroxyatrazine	x	x	x	x
Imazamethabenz Acid	x		x	x
Imazamethabenz-methyl	x		x	

Imazamox	x	x	x	x
Imazapic	x		x	x
Imazapyr	x	x	x	x
Imazaquin	x		x	
Imazethapyr	x	x	x	x
Imidacloprid	x	x	x	x
Isoxaflutole	x		x	
Isoxaflutole DKN	x			
Lambda Cyhalothrin	x		x	
Linuron	x		x	
Malathion	x		x	
MCPA	x	x	x	x
MCPB	x		x	
MCPP	x	x	x	x
Mesotrione	x	x	x	
Metalaxyl	x	x	x	x
Metolachlor	x	x	x	x
Metolachlor ESA	x	x	x	x
Metolachlor OXA	x	x	x	x
Metribuzin	x	x	x	x
Metribuzin DA	x	x	x	x
Metribuzin DADK	x	x	x	x
Metribuzin DK	x	x	x	x
Metsulfuron-methyl	x		x	x
Myclobutinol	x		x	
Neburon	x		x	
Nicosulfuron	x	x	x	
Norflurazon	x		x	
Oxadiazon	x		x	x
Parathion-methyl	x		x	
Pendamethalin	x		x	
Pentachlorophenol (PCP)	x	x	x	x
Phorate	x		x	x****
Phosphamidon	x		x	
Picloram	x	x	x	x
Primisulfuron methyl****			x	x****
Prometon	x	x	x	x
Prometryn	x		x	
Propachlor	x		x	x
Propachlor ESA	x	x	x	
Propachlor OXA	x		x	
Propazine	x	x	x	x
Propiconazole	x		x	x
Propoxur	x		x	
Prosulfuron****			x	
Pyraclostrobin	x		x	
Rimisulfuron****			x	
Saflufenacil	x	x	x	x
Siduron	x		x	x
Simazine	x	x	x	x
Sulfometuron-methyl	x		x	x
Tebuconazole	x		x	x
Tebuprimiphos	x		x	x
Tebuthiuron****			x	
Tembotrione	x		x	x
Terbufos	x		x	x
Tetraconazole	x	x	x	x
Thiamethoxam	x	x	x	x
Thifensulfuron-methyl	x		x	
Thiobencarb	x		x	
Triallate	x		x	
Triasulfuron	x		x	
Tribenuron methyl****			x	
Triclopyr	x	x	x	x
Trifluralin	x		x	x
Triflurosulfuron methyl****			x	
zeta-Cypermethrin	x		x	

*Laboratory analytes have changed during years presented. All target and detected non-target analytes (1985-2010) are presented.

**Detection is defined as compound occurring in water sample at concentration of "present" or higher

***Surface water sites include lakes, precipitation, streams, rivers, and tile demonstration sites

****Analysis of pesticide compound only completed at tile demonstration sites.

*****Analyte only detected in tile demonstration site

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Appendix 3

Groundwater Monitoring Network Sample Results, 2010.

PMR 1 Groundwater Monitoring Network Sample Results

County	Site ID	Date	nitrate nitrogen (mg/l)	Pesticide Concentrations in µg/L																																								
				Acetochlor	Alachlor	Atrazine	Boscalid	Chlorothalonil	Chlorpyrifos	Clomazone	Cyanazine	Cyfluthrin	Deisopropylatrazine	Desethylatrazine	Diazinon	Dimethenamid	Dimethoate	Disulfoton	EPTC	Estenvalerate	Ethionfuralin	Fenofos	Lambda Cyhalothrin	Malathion	Metolachlor	Meribuzin	Metribuzin DA	Metribuzin DADK	Metribuzin DK	Myclobutanil	Oxadiazon	Parathion-methyl	Pendimethalin	Phorate	Prometon	Propachlor	Propazine	Propiconazole	Pyraclostrobin	Simazine				
Grant	26101	4/23/2010	26.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Grant	26101	10/6/2010	12.80	ND	ND	P	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	
Marshall	45006	4/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	
Marshall	45006	10/7/2010	15.30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	
Pennington	57003	4/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	
Pennington	57003	10/7/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	
Pennington	57005	4/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	
Pennington	57005	10/7/2010	0.54	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	
Pennington	57008	4/28/2010	0.43	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	
Pennington	57008	10/7/2010	0.95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	
Polk	60201	4/28/2010	0.91	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND
Polk	60201	10/7/2010	0.95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND
Wilkin	84101	4/23/2010	1.09	ND	ND	0.05	ND	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND
Wilkin	84101	10/6/2010	0.78	ND	ND	0.06	ND	ND	ND	ND	ND	ND	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND

NOTE: ND = non-detect; P = present; = detection

PMR 1 Groundwater Monitoring Network Sample Results

[illegible]

NOTE: ND = non-detect; P = present; = detection

PMR 1 Groundwater Monitoring Network Sample Results

			Pesticide Concentrations in µg/L																																						
County	Site ID	Date	Propoxur	Saflufenacil	Siduron	Sulfometuron-methyl	Thiamethoxam	Thifensulfuron-methyl	Thiobencarb	Triasulfuron	2,4,5-T	2,4,5-TP	2,4-D	2,4-DB	Acetochlor ESA	Acetochlor OXA	Alachlor ESA	Alachlor OXA	Bentazon	Clpyralid	Dicamba	Dichlorprop	Dimethenamid ESA	Dimethenamid OXA	Flufenacet OXA	Isoxaflutole DKN	MCPA	MCPB	MCPP	Mesotrione	Metolachlor ESA	Metolachlor OXA	Picloram	Propachlor ESA	Propachlor OXA	Tembotrione	Triclopyr	DACT ELISA			
Grant	26101	4/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Grant	26101	10/6/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0139	ND	ND	ND	ND	ND	ND	ND	na	
Marshall	45006	4/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Marshall	45006	10/7/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	
Pennington	57003	4/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pennington	57003	10/7/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	
Pennington	57005	4/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pennington	57005	10/7/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	
Pennington	57008	4/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pennington	57008	10/7/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	
Polk	60201	4/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Polk	60201	10/7/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	
Wilkin	84101	4/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0423	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1540	0.0203	ND	ND	ND	ND	ND	ND	ND	
Wilkin	84101	10/6/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0200	0.4300	ND	ND	ND	ND	ND	na		

NOTE: ND = non-detect; P = present;  = detection

PMR 4 Groundwater Monitoring Network Sample Results

County	Site ID	Date	nitrate nitrogen (mg/l)	Pesticide Concentrations in µg/L																																												
				Acetochlor	Alachlor	Atrazine	Boscalid	Chlorothalonil	Chlorpyrifos	Clomazone	Cyanazine	Cyfluthrin	Deisopropylatrazine	Desethylatrazine	Diazinon	Dimethenamid	Dimethoate	Disulfoton	EPTC	Esfenvalerate	Ethalfuralin	Fonofos	Lambda Cyhalothrin	Malathion	Metolachlor	Metribuzin	Metribuzin DA	Metribuzin DADK	Metribuzin DK	Nyctotanol	Oxadiazon	Parathion-methyl	Pendimethalin	Phorate	Prometon	Propachlor	Propazine	Propiconazole	Pyraclostrobin	Simazine								
Becker	03-I2	11/8/2010	7.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	0.11	P	1.05	P		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Becker	03-I3	5/12/2010	9.68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Becker	03-J3	11/8/2010	10.60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Becker	03-J4	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Becker	03-K4	5/12/2010	12.80	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Becker	03-K4	11/8/2010	14.30	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	P	1.04	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Becker	03-K4	11/8/2010	0.68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Benton	05-B2	11/18/2010	14.40	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Benton	05-C3	5/19/2010	7.88	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hubbard	29-A7	11/8/2010	6.79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hubbard	29-A8	11/9/2010	28.70	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	P	ND	1.54	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hubbard	29-A8	11/9/2010	9.59	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	P	P	P	2.33	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hubbard	29-B8	11/9/2010	28.00	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	1.60	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hubbard	29-C7	5/12/2010	2.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hubbard	29-C8	5/12/2010	2.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hubbard	29-C9	11/9/2010	8.63	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Kandiyo	34-C1	5/25/2010	20.30	ND	ND	0.15	ND	ND	ND	ND	ND	na	P	0.21	ND	ND	ND	ND	ND	na	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	
Kandiyo	34-D1	5/25/2010	37.30	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	P	ND	ND	ND	ND	ND	na	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	
Kandiyo	34-D2	11/19/2010	6.85	ND	ND	P	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Kandiyo	34-E1	5/25/2010	7.31	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	na	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	
Kandiyo	34-E2	11/19/2010	19.80	ND	ND	P	ND	ND	ND	ND	ND	ND	P	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Kandiyo	34-F2	11/19/2010	34.60	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Morrison	49-D5	5/20/2010	9.51	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	P	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Morrison	49-D9	11/18/2010	28.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND		
Morrison	49-D9	11/18/2010	11.40	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	P	P	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	
Morrison	49-F6	5/20/2010	61.90	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Morrison	49-F7	11/18/2010	26.40	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Morrison	49-F8	5/20/2010	28.70	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-A1	5/20/2010	13.70	ND	ND	P	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	0.25	P	P	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Otter Tail	56-D6	5/20/2010	47.80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-E1	11/24/2010	40.80	ND	ND	P	ND	ND	ND	ND	ND	ND	P	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-E2	11/24/2010	23.70	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-E3	11/23/2010	24.70	ND	ND	P	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-E7	5/20/2010	0.82	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Otter Tail	56-F1	11/23/2010	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F2	11/23/2010	8.62	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F3-1	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F3-2	5/21/2010	1.72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F4	11/23/2010	1.16	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F6	11/24/2010	37.60	ND	ND	ND																																										

NOTE: ND = non-detect; P = present;  = detection

PMR 4 Groundwater Monitoring Network Sample Results

County	Site ID	Date	Pesticide Concentrations in µg/L																																												
			Tebuconazole	Tebupirimphos	Terbufos	Tetraconazole	Triallate	Trifluralin	zeta-Cypermethrin	Acetamiprid	Aldicarb Sulfone	Aldicarb Sulfoxide	Azoxystrobin	Bensulfuron-methyl	Bromacil	Carbaryl	Carbofuran	Chlorimuron-ethyl	DEDI Atrazine	Disulfoton Sulfone	Diuron	Halosulfuron-methyl	Hexazinone	Hydroxyatrazine	Imazamethabenz Acid	Imaz amethabenz-methyl	Imazamox	Imazapic	Imazapyr	Imazaquin	Imazethapyr	Imidacloprid	Isoxaflutole	Linuron	Metolaxyl	Metsulfuron-methyl	Neburon	Nicosulfuron	Norfurazon	Prometyn							
Becker	03-I2	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0278	ND	ND	ND	ND	ND	ND	ND	ND	0.0085	ND	ND	ND	ND	ND	ND					
Becker	03-I3	5/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND						
Becker	03-J3	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0849	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Becker	03-J4	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Becker	03-K4	5/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0732	ND	ND	ND	ND	0.0230	ND	ND	0.0414	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Becker	03-K4	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0391	ND	ND	ND	ND	0.0252	ND	ND	0.0208	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Becker	03-K4	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Benton	05-B2	11/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Benton	05-C3	5/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Hubbard	29-A7	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Hubbard	29-A8	11/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0515	ND	ND	ND	ND	ND	ND	ND	0.0540	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Hubbard	29-A8	11/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0326	ND	ND	0.0236	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Hubbard	29-B8	11/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0245	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Hubbard	29-C7	5/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Hubbard	29-C8	5/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Hubbard	29-C9	11/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0086	ND	ND	ND	ND	ND	ND	ND			
Kandiyo	34-C1	5/25/2010	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	0.5050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Kandiyo	34-D1	5/25/2010	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0541	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Kandiyo	34-D2	11/19/2010	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Kandiyo	34-E1	5/25/2010	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0267	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Kandiyo	34-E2	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1540	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Kandiyo	34-F2	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0620	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Morrison	49-D5	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3480	ND	ND	0.0554	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Morrison	49-D9	11/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0168	ND	ND	ND	ND	0.0234	ND	ND	0.0212	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Morrison	49-D9	11/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1850	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Morrison	49-F6	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Morrison	49-F7	11/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Morrison	49-F8	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-A1	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3060	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Otter Tail	56-D6	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-E1	11/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-E2	11/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0103	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-E3	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-E7	5/20/2010	ND	ND	ND	0.19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0147	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F1	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1360	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F2	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F3-1	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F3-2	5/21/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F4	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-F6	11/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0258	ND	ND	ND	ND	0.1840	ND	ND	0.0124	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Otter Tail	56-F8	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																			

NOTE: ND = non-detect; P = present; = detection

PMR 4 Groundwater Monitoring Network Sample Results

			Pesticide Concentrations in µg/L																																						
County	Site ID	Date	Propoxur	Safinlufenil	Siduron	Sulfometuron-methyl	Thiamethoxam	Thifensulfuron-methyl	Thiobencarb	Triasulfuron	2,4,5-T	2,4,5-TP	2,4-D	2,4-DB	Acetochlor ESA	Acetochlor OXA	Alachlor ESA	Alachlor OXA	Bentazon	Clopyralid	Dicamba	Dichlorprop	Dimethenamid ESA	Dimethenamid OXA	Flufenacet OXA	Isoxaflutole DKN	MCPA	MCPB	MCPP	Mesotrione	Metolachlor ESA	Metolachlor OXA	Picloram	Propachlor ESA	Propachlor OXA	Tembotrione	Triclopyr	DACT ELISA	Glyphosate MON	Glyphosate ELISA	
Becker	03-02	11/8/2010	ND	ND	ND	ND	0.0310	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0271	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2300	0.2210	ND	ND	ND	ND	ND	ND	na	na	na
Becker	03-03	5/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.12	
Becker	03-J3	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.3200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na
Becker	03-34	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0554	ND	ND	ND	ND	ND	ND	na	na	na	
Becker	03-K4	5/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1250	ND	0.7780	ND	ND	ND	0.1650	0.0197	ND	ND	ND	ND	ND	ND	0.3630	0.0849	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Becker	03-K4	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0903	ND	0.3020	ND	0.3020	ND	ND	0.0715	0.0296	ND	ND	ND	ND	ND	0.2830	0.0872	ND	ND	ND	ND	ND	ND	na	na	na	
Becker	03-K4	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1040	ND	0.0263	ND	0.0263	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1440	0.0301	ND	ND	ND	ND	ND	na	na	na	
Benton	05-B2	11/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0803	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3440	ND	ND	ND	ND	ND	ND	na	na	na	
Benton	05-C3	5/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0603	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2200	0.1150	ND	ND	ND	ND	ND	ND	na	na	
Hubbard	29-A7	11/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0049	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na	
Hubbard	29-A8	11/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4090	ND	0.9880	ND	0.9880	ND	ND	0.0809	0.0874	ND	ND	ND	ND	ND	ND	4.5600	1.5900	ND	ND	ND	ND	ND	na	na	na	
Hubbard	29-A8	11/9/2010	ND	ND	ND	ND	0.6322	ND	ND	ND	ND	ND	ND	ND	ND	0.0566	ND	0.1440	ND	0.1440	ND	ND	0.1020	0.1120	ND	ND	ND	ND	ND	ND	0.8840	0.4610	ND	ND	ND	ND	ND	na	na	na	
Hubbard	29-B8	11/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1020	ND	0.2590	ND	0.2590	ND	ND	0.3960	0.0775	ND	ND	ND	ND	ND	0.3400	0.0903	ND	ND	ND	ND	ND	na	na	na		
Hubbard	29-C7	5/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0360	ND	ND	ND	ND	ND	ND	na	na	0.34	
Hubbard	29-C8	5/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0125	ND	ND	ND	ND	ND	ND	na	na	ND		
Hubbard	29-C9	11/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0620	ND	0.0158	ND	0.0158	ND	ND	0.0555	0.0576	ND	ND	ND	ND	ND	0.2140	0.0850	ND	ND	ND	ND	ND	na	na	na		
Kandiyohi	34-C1	5/25/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1160	ND	0.5260	ND	0.5260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1090	ND	ND	ND	ND	ND	ND	1.01	na	na	
Kandiyohi	34-D1	5/25/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0021	ND	0.0021	ND	ND	0.0100	ND	ND	ND	ND	ND	ND	0.2000	ND	ND	ND	ND	ND	ND	na	na	na		
Kandiyohi	34-D2	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na			
Kandiyohi	34-E1	5/25/2010	ND	ND	ND	ND	0.0252	ND	ND	ND	ND	ND	ND	ND	0.4620	ND	ND	ND	ND	0.1630	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1030	ND	ND	ND	ND	ND	ND	na	na	na	
Kandiyohi	34-E2	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0102	ND	ND	ND	ND	ND	na	na	na		
Kandiyohi	34-F2	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5700	ND	0.2800	ND	0.2800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3600	0.0838	ND	ND	ND	ND	ND	na	na	na	
Morrison	49-D5	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4910	ND	0.0032	ND	0.0032	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4600	0.6920	ND	ND	ND	ND	ND	na	na	na	
Morrison	49-D9	11/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7030	ND	0.3470	ND	0.0023	ND	0.0023	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1400	0.0210	ND	ND	ND	ND	na	na	na		
Morrison	49-D9	11/18/2010	ND	ND	ND	ND	0.0278	ND	ND	ND	ND	ND	ND	ND	0.2510	ND	1.6600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.4000	1.1100	ND	ND	ND	ND	ND	na	na	na	
Morrison	49-F6	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3300	0.0480	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1070	0.0235	ND	ND	ND	ND	ND	na	na	na	
Morrison	49-F7	11/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10.1000	ND	1.3500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.6900	0.5720	ND	ND	ND	ND	ND	na	na	na	
Morrison	49-F8	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5280	ND	0.6516	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.6000	ND	ND	ND	ND	ND	ND	na	na	na	
Otter Tail	56-A1	5/20/2010	ND	ND	ND	ND	0.1740	ND	ND	ND	ND	ND	ND	ND	2.7700	0.3130	0.1090	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.2200	1.1500	ND	ND	ND	ND	ND	ND	ND	ND	
Otter Tail	56-D6	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6140	0.3880	ND	ND	ND	ND	ND	ND	na	na	
Otter Tail	56-E1	11/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.8500	ND	0.1130	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0202	ND	ND	ND	ND	ND	na	na	na		
Otter Tail	56-E2	11/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0864	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4360	ND	ND	ND	ND	ND	na	na	na		
Otter Tail	56-E3	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9180	1.3400	0.0495	ND	0.0023	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na			
Otter Tail	56-E7	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0481	0.0339	ND	ND	ND	ND	ND	na	na	na	
Otter Tail	56-F1	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na			
Otter Tail	56-F2	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1040	0.0838	ND	ND	ND	ND	ND	na	na	na	
Otter Tail	56-F3-1	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1400	ND	ND	ND	ND	ND	na	na	na		
Otter Tail	56-F3-2	5/21/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na		
Otter Tail	56-F4	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0339	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1110	ND	ND	ND	ND	ND	na	na	na		
Otter Tail	56-F6	11/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2350	ND	0.0011	ND	0.0011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.2300	2.0200	ND	ND	ND	ND	na	na	na		
Otter Tail	56-F8	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1700	ND	0.0689	ND	0.0689	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.1400	0.2820	ND	ND	ND	ND	ND	na	na	na	
Otter Tail	56-F9	11/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na			
Otter Tail	56-G3	5/21/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0425	ND	ND	ND	ND	ND	na	na	na		

NOTE: ND = non-detect; P = present; = detection

PMR 4 Groundwater Monitoring Network Sample Results

[illegible]

NOTE: ND = non-detect; P = present;  = detection

PMR 4 Groundwater Monitoring Network Sample Results

[illegible]

NOTE: ND = non-detect; P = present; = detection

PMR 4 Groundwater Monitoring Network Sample Results

			Pesticide Concentrations in µg/L																																							
County	Site ID	Date	Propoxur	Safinacil	Siduron	Sulfometuron-methyl	Thiamethoxam	Thifensulfuron-methyl	Thiobencarb	Triasulfuron	2,4,5-T	2,4,5-TP	2,4-D	2,4-DB	Acetochlor ESA	Acetochlor OXA	Alachlor ESA	Alachlor OXA	Bentazon	Clopyralid	Dicamba	Dichlorprop	Dimethenamid ESA	Dimethenamid OXA	Flufenacet OXA	Isoxaflutole DKN	MCPA	MCPB	MCPP	Mesotrione	Metolachlor ESA	Metolachlor OXA	Picloram	Propachlor ESA	Propachlor OXA	Tembotrione	Triclopyr	DACT ELISA	Glyphosate MON	Glyphosate ELISA		
Outer Tail	56-G4	5/21/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0327	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND
Outer Tail	56-G5	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0420	ND	ND	ND	0.0066	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1000	0.0820	ND	ND	ND	ND	ND	na	na	na	na	
Outer Tail	56-I6	5/21/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2780	0.1570	ND	ND	ND	ND	ND	na	na	na	na	
Outer Tail	56-J9	5/20/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0201	ND	0.1390	ND	ND	ND	ND	ND	na	na	na	na
Outer Tail	56-J10	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8600	ND	0.4590	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	16.0000	3.1500	ND	ND	ND	ND	ND	na	na	na	na	
Outer Tail	56-J10	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5300	ND	1.1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10.6000	2.0100	ND	ND	ND	ND	ND	na	na	na	na	
Outer Tail	56-K5	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na	na		
Outer Tail	56-K6	5/21/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6140	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND
Pope	61-F2	5/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1980	0.2330	ND	ND	ND	ND	ND	ND	0.0311	ND	ND	ND	ND	ND	ND	ND	na	na	na	na
Pope	61-F3	5/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7560	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0346	ND	ND	ND	ND	ND	ND	na	na	na	na
Pope	61-F4	5/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0564	ND	ND	ND	ND	ND	ND	na	na	na	na	
Pope	61-F5	5/6/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5130	ND	ND	ND	ND	ND	ND	na	na	na	na	
Pope	61-G2	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1270	ND	0.0636	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.6800	0.0715	ND	ND	ND	ND	ND	na	na	na	na	
Pope	61-G2	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1640	ND	0.2140	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.6500	0.1910	ND	ND	ND	ND	ND	na	na	na	na	
Pope	61-G3	11/17/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1680	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9100	0.1700	ND	ND	ND	ND	ND	na	na	na	na	
Pope	61-G4	5/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0706	ND	ND	ND	ND	ND	ND	na	na	na	na	
Pope	61-G5	5/6/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1530	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na	na		
Pope	61-G6	6/2/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2810	0.0716	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0989	ND	ND	ND	ND	ND	ND	na	na	na	na	
Pope	61-H5	11/17/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0188	ND	ND	ND	ND	ND	na	na	na	na		
Pope	61-H6	6/2/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1190	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9490	0.0236	ND	ND	ND	ND	ND	0.23	na	na	na	na
Stearns	73-A1	5/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1910	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0208	ND	ND	ND	ND	ND	ND	na	na	na	na	
Stearns	73-A5	5/25/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0232	ND	ND	ND	ND	ND	ND	ND	0.0180	ND	ND	ND	ND	ND	na	na	na	na		
Stearns	73-A6	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8180	0.0107	ND	ND	ND	ND	ND	na	na	na	na	
Stearns	73-A6	11/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8740	ND	0.0134	ND	ND	ND	0.0558	ND	ND	ND	ND	ND	ND	ND	ND	5.7800	0.5226	ND	ND	ND	ND	ND	na	na	na	na	
Stearns	73-B6	11/17/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0009	ND	ND	ND	ND	ND	ND	ND	0.0641	ND	ND	ND	ND	ND	na	na	na	na		
Stearns	73-E3	5/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12.2000	3.0200	ND	ND	ND	ND	0.21	na	na	na	na	
Stearns	73-I6	6/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2910	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0105	ND	ND	ND	ND	ND	ND	na	na	na	na	
Stearns	73-J4	5/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0797	ND	ND	ND	ND	ND	0.15	na	na	na	na	
Stearns	73-J6	6/3/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0874	ND	ND	ND	ND	ND	0.15	na	na	na	na	
Stearns	73-J7	11/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1190	ND	ND	ND	ND	ND	na	na	na	na		
Stearns	73-J8	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3960	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9330	ND	ND	ND	ND	ND	na	na	na	na		
Stearns	73-K3	5/18/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0441	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0904	ND	ND	ND	ND	ND	na	na	na	na		
Stearns	73-K4	5/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2960	0.0746	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3880	0.0232	ND	ND	ND	ND	na	na	na	na		
Stearns	73-K7	11/23/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1060	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0202	ND	ND	ND	ND	ND	na	na	na	na		
Stearns	73-L6	6/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7280	0.0840	ND	ND	ND	ND	ND	na	na	na	na	
Stearns	73-L8	6/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na	na			
Stearns	73-M7	11/16/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9200	ND	ND	ND	ND	ND	na	na	na	na	
Wadena	80-A8	5/26/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0942	ND	2.1600	ND	0.7440	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.6800	0.0239	ND	ND	ND	ND	ND	na	na	na	na	
Wadena	80-B1	11/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9500	0.4430	15.5000	ND	ND	ND	3.6000	1.5900	ND	ND	ND	ND	ND	ND	ND	1.6600	0.9480	ND	ND	ND	ND	na	na	na	na		
Wadena	80-B1	11/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8390	0.3210	0.2280	ND	ND	ND	0.8730	1.1300	ND	ND	ND	ND	ND	ND	ND	1.5700	1.1900	ND	ND	ND	ND	na	na	na	na		
Wadena	80-B7	11/23/2010	ND	ND	ND	ND	0.0350	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6710	ND	ND	ND	ND	ND	na	na	na	na	
Wadena	80-B8	5/26/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0181	ND	0.2700	ND	ND	ND	ND	na	na	na	na	
Wadena	80-C7	5/26/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0534	0.0252	ND									

NOTE: ND = non-detect; P = present; = detection

PMR 5 Groundwater Monitoring Network Sample Results

County	Site ID	Date	nitrate nitrogen (mg/l)	Pesticide Concentrations in µg/L																																								
				Acetochlor	Alachlor	Atrazine	Boscalid	Chlorothalonil	Chlorpyrifos	Clomazone	Cyanazine	Cyfluthrin	Deisopropylatrazine	Desethylatrazine	Diazinon	Dimethenamid	Dimethoate	Disulfoton	EPTC	Esfenvalerate	Ethalfuralin	Fonofos	Lambda Cyhalothrin	Malathion	Metolachlor	Metribuzin	Metribuzin DA	Metribuzin DADK	Metribuzin DK	Myclobutanil	Oxadiazon	Parathion-methyl	Pendimethalin	Phorate	Prometon	Propachlor	Propazine	Propiconazole	Pyraclostrobin	Simazine				
Chisago	13101	4/22/2010	2.12	ND	ND	0.08	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	
Chisago	13101	10/22/2010	1.49	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	
Chisago	13102	4/20/2010	10.20	ND	ND	P	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND
Chisago	13102	10/22/2010	3.86	ND	ND	P	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	
Chisago	13103	4/20/2010	1.45	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	
Chisago	13103	10/22/2010	2.53	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	
Isanti	30005	4/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	
Isanti	30005	10/25/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	
Isanti	30008	4/22/2010	11.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Kanabec	33006	4/26/2010	15.30	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	
Kanabec	33006	10/29/2010	13.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND
Kanabec	33101	4/27/2010	4.95	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND
Kanabec	33101	10/29/2010	33.60	ND	ND	0.06	ND	ND	ND	ND	ND	ND	P	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND
Mille Lacs	48101	4/27/2010	22.70	ND	ND	P	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND
Mille Lacs	48101	10/25/2010	22.90	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.19	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND
Mille Lacs	48102	4/27/2010	11.40	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND
Mille Lacs	48102	10/25/2010	13.80	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND

NOTE: ND = non-detect; P = present;  = detection

PMR 5 Groundwater Monitoring Network Sample Results

[illegible]

NOTE: ND = non-detect; P = present;  = detection

PMR 5 Groundwater Monitoring Network Sample Results

[illegible]

NOTE: ND = non-detect; P = present;  = detection

PMR 6 Groundwater Monitoring Network Sample Results

			Pesticide Concentrations in µg/L																																										
County	Site ID	Date	nitrate nitrogen (mg/L)	Acetochlor	Alachlor	Atrazine	Boscalid	Chlorothalonil	Chlorpyrifos	Clomazone	Cyanazine	Cyfluthrin	Deisopropylatrazine	Desethylatrazine	Diazinon	Dimethenamid	Dimethoate	Disulfoton	EPTC	Esfenvalerate	Ethalfuralin	Fonofos	Lambda Cyhalothrin	Malathion	Metolachlor	Metribuzin	Metribuzin DA	Metribuzin DADK	Metribuzin DK	Myclobutanil	Oxadiazon	Parathion-methyl	Pendimethalin	Phorate	Prometon	Propachlor	Propazine	Propiconazole	Pyraclostrobin	Simazine					
Big Stone	6101	4/8/2010	2.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Big Stone	6101	10/5/2010	3.26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND		
Chippewa	12101	4/9/2010	30.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Chippewa	12101	10/5/2010	40.30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND		
Stevens	75002	4/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Stevens	75002	10/6/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	
Swift	76042	4/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Swift	76042	10/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	
Swift	76045	4/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	
Swift	76045	10/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND		
Swift	76101	4/9/2010	2.31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Swift	76101	10/5/2010	2.77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	
Swift	76102	4/8/2010	0.49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Swift	76102	10/6/2010	1.58	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	
Swift	76103	4/8/2010	1.86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Swift	76103	10/6/2010	8.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	
Swift	76104	4/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Swift	76104	10/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND

NOTE: ND = non-detect; P = present;  = detection

PMR 6 Groundwater Monitoring Network Sample Results

[illegible]

NOTE: ND = non-detect; P = present;  = detection

PMR 6 Groundwater Monitoring Network Sample Results

			Pesticide Concentrations in µg/L																																					
County	Site ID	Date	Propoxur	Saflufenacil	Siduron	Sulfometuron-methyl	Thiamethoxam	Thifensulfuron-methyl	Thiobencarb	Triasulfuron	2,4,5-T	2,4,5-TP	2,4-D	2,4-DB	Acetochlor ESA	Acetochlor OXA	Alachlor ESA	Alachlor OXA	Bentazon	Clpyralid	Dicamba	Dichlorprop	Dimethenamid ESA	Dimethenamid OXA	Flufenacet OXA	Isoxaflutole DKN	MCPA	MCPB	MCPP	Mesotrione	Metolachlor ESA	Metolachlor OXA	Picloram	Propachlor ESA	Propachlor OXA	Tembotrione	Triclopyr	DACT ELISA		
Big Stone	6101	4/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	ND	ND	ND	ND	ND	na	ND	na	na	ND
Big Stone	6101	10/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na
Chippewa	12101	4/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	0.0661	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.1900	ND	ND	na	ND	na	na	na	0.36	
Chippewa	12101	10/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0828	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	0.2840	ND	ND	ND	ND	ND	ND	na	na	
Stevens	75002	4/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	0.1130	ND	0.2080	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.5300	ND	ND	na	ND	na	na	na	ND	
Stevens	75002	10/6/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0726	ND	0.2370	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5120	ND	ND	ND	ND	ND	ND	na	na	
Swift	76042	4/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	0.0524	ND	0.0092	ND	na	na	ND	ND	ND	na	ND	ND	na	na	ND	ND	ND	na	ND	na	na	na	ND	
Swift	76042	10/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0724	ND	0.0220	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	
Swift	76045	4/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	0.0384	ND	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.0436	ND	ND	na	ND	na	na	na	ND	
Swift	76045	10/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0489	ND	0.0562	ND	ND	ND	ND	ND	0.0095	ND	ND	ND	ND	ND	ND	ND	0.0656	ND	ND	ND	ND	ND	ND	na	na	
Swift	76101	4/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	na	ND	ND	na	na	0.0211	ND	ND	na	ND	na	na	na	ND	
Swift	76101	10/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0997	ND	ND	ND	ND	ND	ND	na	na	
Swift	76102	4/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	1.2600	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.0636	ND	ND	na	ND	na	na	na	ND	
Swift	76102	10/6/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2200	ND	0.0015	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	0.1000	ND	ND	ND	ND	ND	ND	na	na	
Swift	76103	4/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	0.2990	0.1770	0.0424	ND	0.0027	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.0331	ND	ND	na	ND	na	na	na	ND	
Swift	76103	10/6/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0082	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2470	0.0258	ND	ND	ND	ND	ND	na	na	
Swift	76104	4/8/2010	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	ND	ND	ND	na	ND	na	na	na	ND	
Swift	76104	10/5/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	

NOTE: ND = non-detect; P = present;  = detection

PMR 7 Groundwater Monitoring Network Sample Results

County	Site ID	Date	Nitrate nitrogen (mg/l)	Pesticide Concentrations in µg/L																																							
				Acetochlor	Alachlor	Atrazine	Boscalid	Chlorothalonil	Chlorpyrifos	Clomazone	Cyanazine	Cyfluthrin	Deisopropylatrazine	Desethylatrazine	Diazinon	Dimethenamid	Dimethoate	Disulfoton	EPTC	Esfenvalerate	Ethalfuralin	Fonofos	Lambda Cyhalothrin	Malathion	Metolachlor	Metribuzin	Metribuzin DA	Metribuzin DADK	Metribuzin DK	Myclobutanil	Oxadiazon	Parathion-methyl	Pendimethalin	Phorate	Prometon	Propachlor	Propazine	Propiconazole	Pyraclostrobin	Simazine			
Lyon	42101	4/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Lyon	42101	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	
Murray	51008	4/12/2010	8.02	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Murray	51008	10/28/2010	7.52	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	
Murray	51101	4/11/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Murray	51101	10/31/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	
Pipestone	59101	4/11/2010	4.97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pipestone	59101	10/29/2010	3.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	
Pipestone	59102	4/11/2010	7.49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pipestone	59102	10/29/2010	27.70	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	
Rock	67006	4/11/2010	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Rock	67006	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	
Rock	67102	4/11/2010	16.80	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Rock	67102	10/29/2010	14.10	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	

NOTE: ND = non-detect; P = present;  = detection

PMR 7 Groundwater Monitoring Network Sample Results

County	Site ID	Date	Pesticide Concentrations in µg/L																																										
			Tebuconazole	Tebupirimphos	Terbufos	Tetraconazole	Triallate	Trifluralin	zeta-Cypermethrin	Acetamiprid	Aldicarb Sulfone	Aldicarb Sulfoxide	Azoxystrobin	Bensulfuron-methyl	Bromacil	Carbaryl	Carbofuran	Chlorimuron-ethyl	DEDI Atrazine	Disulfoton Sulfone	Diuron	Halosulfuron-methyl	Hexazinone	Hydroxyatrazine	Imazamethabenz Acid	Imazamethabenz-methyl	Imazamox	Imazapic	Imazapyr	Imazaquin	Imazethapyr	Imidacloprid	Isoxaflutole	Linuron	Metaxyl	Metsulfuron-methyl	Neburon	Nicosulfuron	Norflurazon	Prometryn					
Lyon	42101	4/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Lyon	42101	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Murray	51008	4/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Murray	51008	10/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Murray	51101	4/11/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Murray	51101	10/31/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pipestone	59101	4/11/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pipestone	59101	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pipestone	59102	4/11/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pipestone	59102	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Rock	67006	4/11/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0077	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Rock	67006	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0076	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Rock	67102	4/11/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0451	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Rock	67102	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0561	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTE: ND = non-detect; P = present;  = detection

PMR 7 Groundwater Monitoring Network Sample Results

County	Site ID	Date	Pesticide Concentrations in µg/L																																			
			Propoxur	Saflufenacil	Siduron	Sulfometuron-methyl	Thiamethoxam	Thifensulfuron-methyl	Thiobencarb	Triasulfuron	2,4,5-T	2,4,5-TP	2,4-D	2,4-DB	Acetochlor ESA	Acetochlor OXA	Alachlor ESA	Alachlor OXA	Bentazon	Clpyralid	Dicamba	Dichlorprop	Dimethenamid ESA	Dimethenamid OXA	Flufenacet OXA	Isoxaflutole DKN	MCPA	MCPB	MCPP	Mesotrione	Metolachlor ESA	Metolachlor OXA	Picloram	Propachlor ESA	Propachlor OXA	Tembotrione	Triclopyr	DACT ELISA
Lyon	42101	4/9/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	na	ND	ND	na	na	ND	ND	ND	na	ND	na	na	ND
Lyon	42101	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na
Murray	51008	4/12/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	na	ND	ND	na	na	0.9320	ND	ND	na	ND	na	na	ND
Murray	51008	10/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8650	0.0302	ND	ND	ND	ND	na	ND
Murray	51101	4/11/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	na	ND	ND	na	na	0.0114	ND	ND	na	ND	na	na	ND
Murray	51101	10/31/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0165	ND	ND	ND	ND	ND	na	ND
Pipestone	59101	4/11/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	na	ND	ND	na	na	0.1010	ND	ND	na	ND	na	na	ND
Pipestone	59101	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4090	ND	ND	ND	ND	ND	ND	ND	na	na	0.0184	ND	ND	ND	ND	ND	ND	ND	0.1170	ND	ND	ND	ND	ND	ND	na
Pipestone	59102	4/11/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	0.6120	0.3570	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	na	ND	ND	na	na	0.0358	0.0103	ND	na	ND	na	na	ND
Pipestone	59102	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5050	0.3750	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3590	ND	ND	ND	ND	ND	ND	na	
Rock	67006	4/11/2010	ND	ND	ND	ND	ND	ND	ND	na	na	0.0279	ND	0.1530	0.1020	ND	ND	ND	ND	na	na	ND	ND	ND	ND	na	ND	ND	na	na	0.4670	0.0538	ND	na	ND	na	na	ND
Rock	67006	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1550	0.0836	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3900	0.0513	ND	ND	ND	ND	ND	na	ND
Rock	67102	4/11/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.0554	ND	ND	na	ND	na	na	na	ND
Rock	67102	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1140	ND	ND	ND	ND	ND	ND	na	ND

NOTE: ND = non-detect; P = present;  = detection

PMR 8 Groundwater Monitoring Network Sample Results

[illegible]

NOTE: ND = non-detect; P = present;  = detection

PMR 8 Groundwater Monitoring Network Sample Results

County	Site ID	Date	Pesticide Concentrations in µg/L																						
			Tebuconazole	Tebupirimphos	Terbufos	Tetraconazole	Triallate	Trifluralin	zeta-Cypermethrin	Acetamiprid	Aldicarb Sulfone	Aldicarb Sulfoxide	Azoxystrobin	Bensulfuron-methyl	Bromacil	Carbaryl	Carbofuran	Chlorimuron-ethyl	DEDI Atrazine	Disulfoton Sulfone	Diuron	Halosulfuron-methyl	Hexazinone	Hydroxyatrazine	Imazamethabenz Acid
Brown	8101	4/7/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Brown	8101	10/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cottonwood	17007	4/13/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cottonwood	17007	10/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cottonwood	17101	4/13/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cottonwood	17101	10/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cottonwood	17102	4/13/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cottonwood	17102	10/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cottonwood	17103	4/13/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Jackson	32101	4/14/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Jackson	32101	10/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Martin	46101	4/14/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Martin	46101	10/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Meeker	47101	4/1/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Meeker	47101	11/16/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Redwood	64016	10/31/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Redwood	64103	4/6/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0276	ND	ND
Redwood	64103	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0384	ND	ND
Renville	65101	4/6/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Rice	66101	4/21/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1090	ND	ND	ND	ND	ND	ND
Rice	66101	10/21/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0860	ND	ND	ND	ND	ND	ND
Watowan	83101	4/14/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Watowan	83101	10/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTE: ND = non-detect; P = present;  = detection

PMR 8 Groundwater Monitoring Network Sample Results

County	Site ID	Date	Pesticide Concentrations in µg/L																																		
			Propoxur	Saflufenacil	Siduron	Sulfometuron-methyl	Thiamethoxam	Thifensulfuron-methyl	Thiobencarb	Triasulfuron	2,4,5-T	2,4,5-TP	2,4-D	2,4-DB	Acetochlor ESA	Acetochlor OXA	Alachlor ESA	Alachlor OXA	Bentazon	Clopyralid	Dicamba	Dichlorprop	Dimethenamid ESA	Dimethenamid OXA	Flufenacet OXA	Isoxaflutole DKN	MCPA	MCPB	MCPP	Mesotrione	Metolachlor ESA	Metolachlor OXA	Picloram	Propachlor ESA	Propachlor OXA	Tembotrione	Triclopyr
Brown	8101	4/7/2010	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.5400	ND	ND	na	ND	na	na	ND
Brown	8101	10/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7600	ND	ND	ND	ND	ND	ND	na
Cottonwood	17007	4/13/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	0.0832	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.3560	ND	ND	na	ND	na	na	ND
Cottonwood	17007	10/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1850	ND	ND	ND	ND	ND	ND	na
Cottonwood	17101	4/13/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.0372	ND	ND	na	ND	na	na	ND
Cottonwood	17101	10/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0410	ND	ND	ND	ND	ND	ND	na
Cottonwood	17102	4/13/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.0140	ND	ND	na	ND	na	na	ND
Cottonwood	17102	10/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0250	ND	ND	ND	ND	ND	ND	na
Cottonwood	17103	4/13/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	0.3190	ND	0.0032	ND	na	na	ND	ND	ND	na	ND	ND	na	na	ND	0.0414	ND	na	ND	na	na	ND
Jackson	32101	4/14/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.4730	ND	ND	na	ND	na	na	ND
Jackson	32101	10/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	ND	ND	ND	ND	0.4200	ND	ND	ND	ND	ND	ND	na
Martin	46101	4/14/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	0.0528	ND	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.2580	ND	ND	na	ND	na	na	ND
Martin	46101	10/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3770	ND	ND	ND	ND	ND	ND	na
Meeker	47101	4/1/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.0134	ND	ND	na	ND	na	na	ND
Meeker	47101	11/16/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0113	ND	ND	ND	ND	ND	ND	na
Redwood	64016	10/31/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0489	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6700	0.0241	ND	ND	ND	ND	ND	na
Redwood	64103	4/6/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	0.1800	0.0629	ND	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	0.2660	0.0379	ND	na	ND	na	na	ND
Redwood	64103	10/29/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2460	0.0366	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3800	0.0385	ND	ND	ND	ND	ND	na
Renville	65101	4/6/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	0.2730	0.2560	0.1410	ND	ND	ND	na	na	ND	ND	ND	na	ND	ND	na	na	ND	ND	ND	na	ND	na	na	ND
Rice	66101	4/21/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0416	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6460	ND	ND	ND	ND	ND	ND	0.24
Rice	66101	10/21/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0597	ND	0.0591	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4780	ND	ND	ND	ND	ND	ND	na
Watsonwan	83101	4/14/2010	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	0.2180	ND	1.1100	ND	ND	ND	na	na	ND	ND	ND	na	ND	na	na	na	0.0135	ND	ND	na	ND	na	na	ND
Watsonwan	83101	10/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1810	ND	1.1700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0127	ND	ND	ND	ND	ND	ND	na

NOTE: ND = non-detect; P = present;  = detection

PMR 9 Groundwater Monitoring Network Sample Results

County	Site ID	Date	Nitrate Nitrogen (mg/l)	Ortho Phosphorus (mg/l)	Total Phosphorus (mg/l)	Total Suspended Solids (mg/l)	Turbidity (NTU)	Pesticide Concentrations in µg/L																																				
								Acetochlor	Alachlor	Atrazine	Boscalid	Chlorothalonil	Chlorpyrifos	Clomazone	Cyanazine	Cyfluthrin	Deisopropylatrazine	Desethylatrazine	Diazinon	Dimethenamid	Dimethoate	Disulfoton	EPTC	Esfenvalerate	Ethalfuralin	Fenofos	Lambda Cyhalothrin	Malathion	Metolachlor	Metribuzin	Metribuzin DA	Metribuzin DAOK	Metribuzin DK	Myclobutanil	Oxadiazon	Parathion-methyl	Pendimethalin	Phorate	Prometon	Propachlor	Propazine			
Fillmore	BURR	5/19/2010	12.20	0.012	0.054	0.20	0.633	ND	ND	P	ND	ND	ND	ND	ND	ND	P	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Fillmore	BURR	6/15/2010	11.00	0.063	0.201	61.00	90.900	ND	ND	0.05	ND	ND	ND	ND	ND	ND	P	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	BURR	6/23/2010	11.20	0.031	0.234	110.00	83.000	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	ND	na	ND	ND	ND	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fillmore	BURR	9/8/2010	13.70	0.016	0.060	0.80	0.939	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	D	9/24/2010	2.11	na	na	na	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	D	9/24/2010	3.83	na	na	na	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	D	9/24/2010	14.10	na	na	na	na	ND	ND	0.06	ND	ND	ND	ND	ND	ND	P	0.14	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	D	9/24/2010	8.48	na	na	na	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNE	5/19/2010	7.35	0.014	0.053	1.70	0.674	ND	ND	P	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNE	6/14/2010	10.80	0.033	0.055	0.30	0.481	ND	ND	P	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNE	6/21/2010	3.08	0.077	9.450	14,100.00	3,620.000	P	ND	0.54	ND	ND	ND	ND	ND	ND	P	0.07	ND	0.10	ND	ND	ND	na	ND	ND	ND	1.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNE	9/10/2010	10.60	0.015	0.058	0.70	0.515	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNW	5/19/2010	9.18	0.009	0.047	0.80	1.490	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fillmore	FNTNW	6/14/2010	9.61	0.039	0.067	0.60	0.918	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNW	6/21/2010	3.63	0.052	6.710	16,000.00	4,640.000	P	P	0.15	ND	ND	ND	ND	ND	ND	P	0.14	ND	P	ND	ND	na	ND	ND	ND	4.25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNW	9/10/2010	9.33	0.012	0.051	0.30	0.618	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.08	ND	ND	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	LNSBR2	2/10/2010	6.51	na	na	na	na	ND	ND	0.06	ND	ND	ND	ND	ND	ND	P	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	LNSBR2	5/13/2010	6.15	na	na	na	na	ND	ND	0.06	ND	ND	ND	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	LNSBR2	8/17/2010	6.53	na	na	na	na	ND	ND	P	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	LNSBR2	11/10/2010	6.68	na	na	na	na	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	MOTH	5/26/2010	8.80	0.011	0.038	0.50	0.504	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	MOTH	6/14/2010	11.70	0.025	0.046	3.90	2.040	P	ND	0.08	ND	ND	ND	ND	ND	ND	ND	0.09	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	MOTH	6/24/2010	9.61	0.033	0.112	11.80	12.700	P	ND	0.11	ND	ND	ND	ND	ND	ND	ND	0.10	ND	P	ND	ND	na	ND	ND	ND	0.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	MOTH	9/14/2010	8.77	0.016	0.036	1.10	0.900	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	PTRSN1	2/10/2010	3.99	na	na	na	na	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	PTRSN1	5/12/2010	3.86	na	na	na	na	ND	ND	0.05	ND	ND	ND	ND	ND	ND	ND	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	PTRSN1	8/17/2010	2.95	na	na	na	na	ND	ND	P	ND	ND	ND	ND	ND	ND	P	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	PTRSN1	11/10/2010	3.15	na	na	na	na	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	RAINY	5/19/2010	12.40	0.019	0.063	0.30	1.250	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.09	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	RAINY	6/14/2010	15.40	0.038	0.064	ND	0.520	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.06	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	RAINY	6/24/2010	13.70	0.018	0.102	12.20	8.980	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.07	ND	P	ND	ND	na	ND	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	RAINY	9/10/2010	16.00	0.019	0.063	0.30	0.856	ND	ND	P	ND	ND	ND	ND	ND	ND	ND	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	

NOTE: ND = non-detect; P = present; = detection

PMR 9 Groundwater Monitoring Network Sample Results

County	Site ID	Date	Pesticide Concentrations in µg/L																																														
			Propiconazole	Pyraclostrobin	Simazine	Tebuconazole	Tebuipirphos	Terbufos	Tetraconazole	Triallate	Trifluralin	zeta-Cypermethrin	Acetamiprid	Aldicarb Sulfone	Aldicarb Sulfioxide	Azoxystrobin	Bensulfuron-methyl	Bromacil	Carbaryl	Carbofuran	Chlorimuron-ethyl	DEDI Atrazine	Disulfoton Sulfone	Diuron	Halosulfuron-methyl	Hexazinone	Hydroxyatrazine	mazamehthabenz Acid	mazamehthabenz-methyl	mazanox	mazapic	mazapyr	mazaquin	mazethapyr	imidacloprid	isoxaflutole	Linuron	Metolaxyl	Metsulfuron-methyl	Neburon	Nicosulfuron								
Fillmore	BURR	5/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0970	ND	ND	ND	ND	0.0100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Fillmore	BURR	6/15/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0760	ND	ND	ND	ND	0.0338	ND	ND	ND	ND	ND	ND	ND	0.2020	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Fillmore	BURR	6/23/2010	ND	na	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0770	ND	ND	ND	ND	0.0336	ND	ND	ND	ND	ND	ND	ND	0.1090	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Fillmore	BURR	9/8/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1020	ND	ND	ND	ND	0.0091	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Fillmore	D	9/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Fillmore	D	9/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Fillmore	D	9/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0241	ND	ND	ND	ND	ND	ND	ND	0.0697	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	D	9/24/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Fillmore	FNTNE	5/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0174	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNE	6/14/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0198	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNE	6/21/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0246	ND	ND	ND	ND	ND	ND	ND	0.1460	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNE	9/10/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNW	5/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0242	ND	ND	ND	ND	ND	ND	ND	ND	0.0175	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNW	6/14/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0374	ND	ND	ND	ND	ND	ND	ND	ND	0.0167	ND	ND	ND	ND	ND	ND	ND	0.0374	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNW	6/21/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1250	ND	ND	ND	ND	0.0610	ND	0.0596	ND	ND	0.2220	ND	ND	ND	ND	ND	0.0151	ND	0.0177	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	FNTNW	9/10/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0566	ND	ND	ND	ND	ND	ND	ND	ND	0.0201	ND	ND	ND	ND	ND	0.0123	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fillmore	LNSBR2	2/10/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na	na	ND	ND	ND	ND	ND	0.1560	ND	ND	na	0.0100	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND		
Fillmore	LNSBR2	5/13/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0635	ND	ND	ND	0.0115	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	LNSBR2	8/17/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0650	ND	ND	ND	0.0117	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	LNSBR2	11/10/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1430	ND	ND	ND	0.0082	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	MOTH	5/26/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0575	ND	ND	ND	0.0305	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	MOTH	6/14/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0432	ND	ND	ND	ND	ND	ND	ND	ND	0.0109	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	MOTH	6/24/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0598	ND	ND	ND	ND	ND	ND	ND	ND	0.0636	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	MOTH	9/14/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0520	ND	ND	ND	0.0290	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	PTRSN1	2/10/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na	na	ND	ND	ND	ND	ND	0.0660	ND	ND	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	PTRSN1	5/12/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	PTRSN1	8/17/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Fillmore	PTRSN1	11/10/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0725	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fillmore	RAINY	5/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0870	ND	ND	ND	0.0133	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fillmore	RAINY	6/14/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1620	ND	ND	ND	0.0093	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fillmore	RAINY	6/24/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0785	ND	ND	ND	0.0173	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		

NOTE: ND = non-detect; P = present;  = detection

PMR 9 Groundwater Monitoring Network Sample Results

[illegible]

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PMR 9 Groundwater Monitoring Network Sample Results

County	Site ID	Date	Pesticide Concentrations in µg/L																																																
			Propiconazole	Pyraclostrobin	Simazine	Tebuconazole	Tebuiprimphos	Terbufos	Tetraconazole	Triallate	Trifluralin	zeta-Cypermethrin	Acetamiprid	Aldicarb Sulfone	Aldicarb Sulfoxide	Azoxystrobin	Bensulfuron-methyl	Bromacil	Carbaryl	Carbofuran	Chlorimuron-ethyl	DEDI Atrazine	Disulfoton Sulfone	Diuron	Halosulfuron-methyl	Hexazinone	Hydroxyatrazine	Imazamethabenz-Acid	Imazamethabenz-methyl	Imazamox	Imazapic	Imazapyr	Imazaquin	Imazethapyr	Imidacloprid	Isafluotole	Linuron	Metolaxyl	Metsulfuron-methyl	Neburon	Nicosulfuron										
Goodhue	D	9/30/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0650	ND	ND	ND	ND	ND	0.0121	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND							
Goodhue	D	9/30/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0134	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Goodhue	SPRCRK	5/27/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1780	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Goodhue	SPRCRK	6/9/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2120	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Goodhue	SPRCRK	6/28/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Goodhue	SPRCRK	9/30/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Houston	BCVSP	5/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Houston	BCVSP	6/15/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0765	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Houston	BCVSP	6/28/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1180	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Houston	BCVSP	9/13/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0830	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Wabasha	CNFLD	5/27/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1420	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Wabasha	CNFLD	6/9/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1320	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Wabasha	CNFLD	6/28/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0585	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Wabasha	CNFLD	9/28/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Wabasha	COLDS	5/27/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1320	ND	ND	ND	ND	0.0102	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Wabasha	COLDS	6/9/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1210	ND	ND	ND	ND	0.0107	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Wabasha	COLDS	6/28/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0580	ND	ND	ND	ND	0.0099	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Wabasha	COLDS	9/30/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0600	ND	ND	ND	ND	0.0100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Wabasha	D	9/28/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Wabasha	D	9/28/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0650	ND	ND	ND	ND	0.0074	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Wabasha	D	9/28/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Wabasha	D	9/28/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0650	ND	ND	ND	ND	0.0147	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Wabasha	D	9/28/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3050	ND	ND	ND	ND	0.0436	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Wabasha	D	9/30/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Wabasha	D	9/30/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1400	ND	ND	ND	ND	0.0087	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Winona	CRYSTL1	2/10/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na	na	ND	ND	ND	ND	ND	ND	0.0985	ND	ND	ND	na	0.0142	ND	ND	ND	ND	ND	ND	ND	ND	na	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Winona	CRYSTL1	5/13/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0190	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Winona	CRYSTL1	8/17/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0163	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Winona	CRYSTL1	11/10/2010	ND	na	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0925	ND	ND	ND	ND	0.0123	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTE: ND = non-detect; P = present;  = detection

PMR 9 Groundwater Monitoring Network Sample Results

County	Site ID	Date	Pesticide Concentrations in µg/L																																								
			Norflurazon	Prometryn	Propoxur	Saflufenacil	Siduron	Sulfometuron-methyl	Thiamethoxam	Thifensulfuron-methyl	Thiobencarb	Triasulfuron	2,4,5-T	2,4,5-TP	2,4-D	2,4-DB	Acetochlor ESA	Acetochlor OXA	Alachlor ESA	Alachlor OXA	Bentazon	Clopyralid	Dicamba	Dichlorprop	Dimethenamid ESA	Dimethenamid OXA	Flufenacet OXA	Isoxaflutole DKN	MCPA	MCPB	MCPP	Mesotrione	Metolachlor ESA	Metolachlor OXA	Picloram	Propachlor ESA	Propachlor OXA	Tembotrione	Triclopyr	DACT ELISA	Glyphosate MON	Glyphosate ELISA	
Goodhue	D	9/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1020	ND	1.0500	ND	0.0109	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5400	ND	ND	ND	ND	ND	ND	na	na	na	
Goodhue	D	9/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0462	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1500	ND	ND	ND	ND	ND	ND	na	na	na
Goodhue	SPRCRK	5/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0678	ND	0.6780	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6800	0.0374	ND	ND	ND	ND	ND	na	na	na
Goodhue	SPRCRK	6/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0990	ND	0.7570	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8160	0.0431	ND	ND	ND	ND	ND	na	na	na
Goodhue	SPRCRK	6/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0885	ND	0.6450	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7260	0.0410	ND	ND	ND	ND	ND	na	na	na
Goodhue	SPRCRK	9/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1030	ND	0.7340	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8270	0.0441	ND	ND	ND	ND	ND	na	na	na
Houston	BCVSP	5/19/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6320	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3600	0.0142	ND	ND	ND	ND	ND	na	na	na
Houston	BCVSP	6/15/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6610	ND	0.0008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3810	0.0170	ND	ND	ND	ND	ND	na	na	na
Houston	BCVSP	6/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6410	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3640	0.0160	ND	ND	ND	ND	ND	na	na	na
Houston	BCVSP	9/13/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7240	ND	0.0015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3940	0.0154	ND	ND	ND	ND	ND	na	na	na
Wabasha	CNFLD	5/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1790	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0586	ND	ND	ND	ND	ND	ND	0.14	na	na
Wabasha	CNFLD	6/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1780	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0602	ND	ND	ND	ND	ND	ND	na	na	na
Wabasha	CNFLD	6/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2040	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0640	ND	ND	ND	ND	ND	ND	na	na	na
Wabasha	CNFLD	9/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0419	ND	ND	ND	ND	ND	0.1820	na	na	na
Wabasha	COLDS	5/27/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1190	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1020	ND	ND	ND	ND	ND	ND	0.13	na	na
Wabasha	COLDS	6/9/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1350	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1070	ND	ND	ND	ND	ND	ND	0.14	ND	ND
Wabasha	COLDS	6/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1120	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1160	ND	ND	ND	ND	ND	ND	na	na	0.28
Wabasha	COLDS	9/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0948	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1030	ND	ND	ND	ND	ND	ND	na	na	na
Wabasha	D	9/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0390	ND	ND	ND	ND	ND	ND	na	na	na
Wabasha	D	9/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2000	ND	2.4000	ND	0.0070	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7500	0.0891	ND	ND	ND	ND	ND	na	na	na
Wabasha	D	9/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	na	na	na	
Wabasha	D	9/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0666	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3670	ND	ND	ND	ND	ND	ND	na	na	na
Wabasha	D	9/28/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1900	1.0100	1.7900	0.4260	2.8400	ND	ND	ND	0.0232	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0400	0.3980	ND	ND	ND	ND	ND	na	na	na
Wabasha	D	9/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4120	0.0516	ND	ND	ND	ND	ND	na	na	na
Wabasha	D	9/30/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0456	ND	0.1940	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4240	ND	ND	ND	ND	ND	ND	na	na	na
Winona	CRYSTL1	2/10/2010	na	ND	na	na	na	na	ND	na	ND	ND	na	na	ND	ND	0.1260	ND	ND	ND	na	na	ND	ND	ND	ND	na	ND	ND	na	na	na	0.1650	ND	ND	na	ND	na	na	na	na	na	
Winona	CRYSTL1	5/13/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1710	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1980	ND	ND	ND	ND	ND	ND	na	na	na
Winona	CRYSTL1	8/17/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1660	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1800	ND	ND	ND	ND	ND	ND	na	na	na
Winona	CRYSTL1	11/10/2010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1900	ND	ND	ND	ND	ND	ND	na	na	na

NOTE: ND = non-detect; P = present;  = detection

Urban Groundwater Monitoring Network Sample Results

[illegible]

NOTE: ND = non-detect; P = present; = detection

Urban Groundwater Monitoring Network Sample Results

County	Site ID	Date	PMR	Pesticide Concentrations in µg/L																																								
				Simazine	Tebuconazole	Tebupirimphos	Terbufos	Tetraconazole	Triallate	Trifluralin	zeta-Cypermethrin	Acetamiprid	Aldicarb Sulfone	Aldicarb Sulfoxide	Azoxystrobin	Bensulfuron-methyl	Bromacil	Carbaryl	Carboturan	Chlorimuron-ethyl	DEDI Atrazine	Disulfoton Sulfone	Diuron	Halosulfuron-methyl	Hexazinone	Hydroxyatrazine	Imazamethabenz Acid	Imazamethabenz-methyl	Imazamox	Imazapic	Imazapyr	Imazaquin	Imazethapyr	Imidacloprid	Isosafllutole	Linuron	Metaxyl	Metsulfuron-methyl	Neburon	Nicosulfuron				
Beltrami	PCA	8/26/2010	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Beltrami	PCA	8/26/2010	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Beltrami	PCA	8/26/2010	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benton	PCA	8/18/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Stearns	PCA	8/12/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Stearns	PCA	8/12/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Stearns	PCA	8/12/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Stearns	PCA	8/16/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Stearns	PCA	8/16/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0096	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Stearns	PCA	8/16/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0096	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Stearns	PCA	8/16/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anoka	PCA	8/11/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dakota	PCA	8/13/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0096	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hennepin	PCA	8/11/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hennepin	PCA	8/19/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hennepin	PCA	8/19/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hennepin	PCA	8/19/2010	10	P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hennepin	PCA	8/20/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hennepin	PCA	8/20/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hennepin	PCA	8/20/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0470	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTE: ND = non-detect; P = present; = detection

Urban Groundwater Monitoring Network Sample Results

County	Site ID	Date	PMR	Pesticide Concentrations in µg/L																																											
				Norflurazon	Prometryn	Propoxur	Saflufenacil	Siduron	Sulfometuron-methyl	Thiamethoxam	Thifensulfuron-methyl	Thiobencarb	Triasulfuron	2,4,5-T	2,4,5-TP	2,4-D	2,4-DB	Acetochlor ESA	Acetochlor OXA	Alachlor ESA	Alachlor OXA	Bentazon	Clopyralid	Dicamba	Dichlorprop	Dimethenamid ESA	Dimethenamid OXA	Flufenacet OXA	Isoxaflutole DKN	MCPA	MCPB	MCPP	Mesotrione	Metolachlor ESA	Metolachlor OXA	Picloram	Propachlor ESA	Propachlor OXA	Tembotrione	Triclopyr							
Beltrami	PCA	8/26/2010	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
Beltrami	PCA	8/26/2010	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Beltrami	PCA	8/26/2010	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Benton	PCA	8/18/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0782	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4610	0.0140	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Stearns	PCA	8/12/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Stearns	PCA	8/12/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1370	0.0356	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Stearns	PCA	8/12/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Stearns	PCA	8/16/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0272	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3880	ND	0.0113	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Stearns	PCA	8/16/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0168	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Stearns	PCA	8/16/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0131	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Stearns	PCA	8/16/2010	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0126	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Anoka	PCA	8/11/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Dakota	PCA	8/13/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1810	0.1180	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1570	0.0330	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Hennepin	PCA	8/11/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0800	0.1160	0.0010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0103	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hennepin	PCA	8/19/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0194	0.0108	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hennepin	PCA	8/19/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0251	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hennepin	PCA	8/19/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hennepin	PCA	8/20/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0111	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hennepin	PCA	8/20/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0524	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0281	0.0137	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Hennepin	PCA	8/20/2010	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTE: ND = non-detect; P = present;  = detection

2010 Water Quality Monitoring Report

January – December 2010

Appendix 4

Trend analysis of pesticide concentration and detection frequency in Minnesota groundwater documentation.

Comments to accompany trend analysis of pesticide concentration and detection frequency in Minnesota groundwater.

The Minnesota Department of Agriculture utilizes nonparametric trend analysis procedures on its groundwater monitoring data. Nonparametric procedures are necessary because of the nature of the MDA data set. First, MDA groundwater quality data is censored meaning that concentrations below the method reporting limit are reported as not detected; second, there are values reported as detected although unable to be quantified and are entered into the data base as 0.000001 parts-per-billion; third, the data contains missing values; and fourth, the distribution of the measured data is highly skewed, negating the validity of parametric statistical procedures.

Trend analysis procedures utilized by the MDA measure linear (straight line), monotonic (one direction) trends only. Mann-Kendall test results give a measure of the general direction of the up or down trend over time in a data set and cannot account for non-seasonal random time-series fluctuations. Inconclusive results may be due to data that is non-linear over time or contains multiple maximums and minimums. Rates of change can be over or under estimated in situations where the data does not follow a straight line. Results from MDA trend analysis should only be viewed together with the associated time series graphics to help interpret impacts due to the serial structure of the data.

A4-1. Results of acetochlor concentration and detection frequency trend analysis for common detection pesticides in PMR 4 groundwater.

Parameter	M-K stat	p Value	Statistically Significant at $\alpha = 0.05$	Kendall Tau	slope estimate
Acetochlor Median	0	1.0	No	0	0
Acetochlor 75 th %-ile	0	1.0	No	0	0
Acetochlor 90 th %-ile	-14	0.46	No	-0.06	0
Acetochlor Detection Frequency	-42	0.08	Yes	-0.18	0
Acetochlor ESA Median	0	1.0	No	0	0
Acetochlor ESA 75 th %-ile	-12	0.67	No	-0.08	0
Acetochlor ESA 90 th %-ile	-7	0.82	No	-0.05	-0.005
Acetochlor ESA Detection Frequency	-42	0.12	No	-0.27	-1.0
Acetochlor OXA Median	0	1.0	No	0	0
Acetochlor OXA 75 th %-ile	0	1.0	No	0	0
Acetochlor OXA 90 th %-ile	0	1.0	No	0	0
Acetochlor OXA Detection Frequency	-5	0.88	No	-0.03	0

A4-2. Results of alachlor concentration and detection frequency trend analysis for common detection pesticides in PMR 4 groundwater.

Parameter	M-K stat	p Value	Statistically Significant at $\alpha = 0.05$	Kendall Tau	slope estimate
Alachlor Median	0	1.0	No	0	0
Alachlor 75 th %-ile	0	1.0	No	0	0
Alachlor 90 th %-ile	0	1.0	No	0	0
Alachlor Detection Frequency	-49	0.02	Yes	-0.21	0
Alachlor ESA Median	-27	0.24	No	-0.18	0
Alachlor ESA 75 th %-ile	-97	0.00	Yes	-0.63	-0.02
Alachlor ESA 90 th %-ile	-89	0.00	Yes	-0.58	-0.07
Alachlor ESA Detection Frequency	-62	0.02	Yes	-0.41	-3.14
Alachlor OXA Median	0	1.0	No	0	0
Alachlor OXA 75 th %-ile	0	1.0	No	0	0
Alachlor OXA 90 th %-ile	-7	0.56	No	-0.05	0
Alachlor OXA Detection Frequency	-49	0.06	Yes	-0.03	-0.5

A4-3. Results of atrazine concentration and detection frequency trend analysis for common detection pesticides in PMR 4 groundwater.

Parameter	M-K stat	p Value	Statistically Significant at $\alpha = 0.05$	Kendall Tau	Sen slope estimate
Atrazine Median	76	0.01	Yes	0.33	0
Atrazine 75 th %-ile	-110	0.00	Yes	-0.48	-0.001
Atrazine 90 th %-ile	-137	0.00	Yes	-0.59	-0.003
Atrazine Detection Frequency	72	0.04	Yes	0.31	1.55
Deethylatrazine Median	-134	0.00	Yes	-0.58	-0.002
Deethylatrazine 75 th %-ile	-162	0.00	Yes	-0.70	-0.004
Deethylatrazine 90 th %-ile	-183	0.00	Yes	-0.79	-0.007
Deethylatrazine Detection Frequency	48	0.18	No	0.21	0.75
Deisopropylatrazine Median	-5	0.75	No	-0.02	0
Deisopropylatrazine 75 th %-ile	-73	0.02	Yes	-0.32	0
Deisopropylatrazine 90 th %-ile	-130	0.00	Yes	-0.56	-0.009
Deisopropylatrazine Detection Frequency	-99	0.01	Yes	-0.43	-1.84
Atrazine+Degradates Median	-136	0.00	Yes	-0.59	-0.006
Atrazine+Degradates 75 th %-ile	-181	0.00	Yes	-0.78	-0.01
Atrazine+Degradates 90 th %-ile	-189	0.00	Yes	-0.82	-0.02
Atrazine+Degradates Detection Frequency	13	0.73	No	0.06	0.36

A4-4. Results of dimethenamid concentration and detection frequency trend analysis for common detection pesticides in PMR 4 groundwater.

Parameter	M-K stat	p Value	Statistically Significant at $\alpha = 0.05$	Kendall Tau	slope estimate
Dimethenamid Median	0	1.0	No	0	0
Dimethenamid 75 th %-ile	0	1.0	No	0	0
Dimethenamid 90 th %-ile	0	1.0	No	0	0
Dimethenamid Detection Frequency	52	0.06	Yes	0.23	0
Dimethenamid ESA Median	0	1.0	No	0	0
Dimethenamid ESA 75 th %-ile	0	1.0	No	0	0
Dimethenamid ESA 90 th %-ile	35	0.10	Yes	0.23	0
Dimethenamid ESA Detection Frequency	44	0.09	Yes	0.29	0.35
Dimethenamid OXA Median	0	1.0	No	0	0
Dimethenamid OXA 75 th %-ile	0	1.0	No	0	0
Dimethenamid OXA 90 th %-ile	0	1.0	No	0	0
Dimethenamid OXA Detection Frequency	53	0.04	Yes	0.35	0.68
Dimethenamid + Degradates Median	0	1.0	No	0	0
Dimethenamid + Degradates 75 th %-ile	0	1.0	No	0	0
Dimethenamid + Degradates 90 th %-ile	30	0.13	No	0.20	0
Dimethenamid + Degradates Detection Frequency	52	0.05	Yes	0.34	0.5

A4-5. Results of metolachlor concentration and detection frequency trend analysis for common detection pesticides in PMR 4 groundwater.

Parameter	M-K stat	p Value	Statistically Significant at $\alpha = 0.05$	Kendall Tau	slope estimate
Metolachlor Median	0	1.0	No	0	0
Metolachlor 75 th %-ile	-71	0.01	Yes	-0.31	0
Metolachlor 90 th %-ile	-80	0.02	Yes	-0.35	0
Metolachlor Detection Frequency	-82	0.02	Yes	-0.35	-1.33
Metolachlor ESA Median	27	0.32	No	0.18	0.004
Metolachlor ESA 75 th %-ile	-49	0.07	Yes	-0.32	-0.03
Metolachlor ESA 90 th %-ile	-43	0.11	No	-0.28	-0.08
Metolachlor ESA Detection Frequency	27	0.32	No	0.18	1.33
Metolachlor OXA Median	17	0.12	No	0.11	0
Metolachlor OXA 75 th %-ile	-14	0.62	No	-0.09	-0.004
Metolachlor OXA 90 th %-ile	-63	0.02	Yes	-0.41	-0.02
Metolachlor OXA Detection Frequency	-3	0.94	No	-0.02	0

A4-6. Results of metribuzin concentration and detection frequency trend analysis for common detection pesticides in PMR 4 groundwater.

Parameter	M-K stat	Two-sided p Value	Statistically Significant at $\alpha = 0.10$	Kendall Tau	slope estimate
Metribuzin Median	0	1.0	No	0	0
Metribuzin 75 th %-ile	21	0.11	No	0.09	0
Metribuzin 90 th %-ile	-71	0.04	Yes	-0.31	-0.0003
Metribuzin Detection Frequency	51	0.15	No	0.22	0.37
Metribuzin DADK Median	0	1.0	No	0	0
Metribuzin DADK 75 th %-ile	-27	0.37	No	-0.12	0
Metribuzin DADK 90 th %-ile	-79	0.03	Yes	-0.34	-0.05
Metribuzin DADK Detection Frequency	-15	0.69	No	-0.06	-0.12
Metribuzin DK Median	0	1.0	No	0	0
Metribuzin DK 75 th %-ile	21	0.11	No	0.09	0
Metribuzin DK 90 th %-ile	87	0.00	Yes	0.38	0
Metribuzin DK Detection Frequency	108	0	Yes	0.47	1.43
Metribuzin DA Median	0	1.0	No	0	0
Metribuzin DA 75 th %-ile	0	1.0	No	0	0
Metribuzin DA 90 th %-ile	18	0.53	No	0.08	0
Metribuzin DA Detection Frequency	-17	0.65	No	-0.07	0
Metribuzin+Degradates Median	0	1.0	No	0	0
Metribuzin+Degradates 75 th %-ile	-43	0.09	Yes	-0.28	0
Metribuzin+Degradates 90 th %-ile	-49	0.07	Yes	-0.32	-0.07
Metribuzin+Degradates Detection Frequency	1	1.0	No	0.004	0

A4-7. Results of acetochlor concentration and detection frequency trend analysis for common detection pesticides in PMR 9 groundwater.

Parameter	M-K stat	p Value	Statistically Significant at $\alpha = 0.05$	Kendall Tau	slope estimate
Acetochlor Median	0	1.0	No	0	0
Acetochlor 75 th %-ile	0	1.0	No	0	0
Acetochlor 90 th %-ile	0	1.0	No	0	0
Acetochlor Detection Frequency	12	0.03	Yes	0.8	2.5
Acetochlor ESA Median	0	1.0	No	0	0
Acetochlor ESA 75 th %-ile	0	1.0	No	0	0
Acetochlor ESA 90 th %-ile	0	1.0	No	0	0
Acetochlor ESA Detection Frequency	11	0.05	Yes	0.73	4.8
Acetochlor OXA Median	0	1.0	No	0	0
Acetochlor OXA 75 th %-ile	0	1.0	No	0	0
Acetochlor OXA 90 th %-ile	-23	0.17	No	-0.07	0
Acetochlor OXA Detection Frequency	8	0.19	No	0.53	1.4

A4-8. Results of alachlor concentration and detection frequency trend analysis for common detection pesticides in PMR 9 groundwater.

Parameter	M-K stat	p Value	Statistically Significant at $\alpha = 0.05$	Kendall Tau	slope estimate
Alachlor Median	0	1.0	No	0	0
Alachlor 75 th %-ile	-22	0.37	No	-0.03	0
Alachlor 90 th %-ile	-22	0.39	No	-0.03	0
Alachlor Detection Frequency	5	0.41	No	0.33	0
Alachlor ESA Median	-2	0.98	No	-0.005	0
Alachlor ESA 75 th %-ile	-102	0.05	Yes	-0.27	-0.002
Alachlor ESA 90 th %-ile	-143	0.005	Yes	-0.38	-0.003
Alachlor ESA Detection Frequency	8	0.19	No	0.53	2.2
Alachlor OXA Median	0	1.0	No	0	0
Alachlor OXA 75 th %-ile	0	1.0	No	0	0
Alachlor OXA 90 th %-ile	0	1.0	No	0	0
Alachlor OXA Detection Frequency	7	0.24	No	0.47	0.4

A4-9. Results of atrazine concentration and detection frequency trend analysis for common detection pesticides in PMR 9 groundwater.

Parameter	M-K stat	p Value	Statistically Significant at $\alpha = 0.05$	Kendall Tau	Sen slope estimate
Atrazine Median	-163	0.06	Yes	-0.20	0
Atrazine 75 th %-ile	-211	0.02	Yes	-0.26	-0.0007
Atrazine 90 th %-ile	-254	0.00	Yes	-0.31	-0.0006
Atrazine Detection Frequency	-1	0.91	No	-0.07	-0.25
Deethylatrazine Median	-323	0.00	Yes	-0.39	-0.001
Deethylatrazine 75 th %-ile	-328	0.00	Yes	-0.40	-0.002
Deethylatrazine 90 th %-ile	-330	0.00	Yes	-0.40	-0.002
Deethylatrazine Detection Frequency	-1	0.91	No	-0.07	0
Deisopropylatrazine Median	-1	1.0	No	-0.001	0
Deisopropylatrazine 75 th %-ile	59	0.45	No	0.07	0
Deisopropylatrazine 90 th %-ile	63	0.44	No	0.08	0
Deisopropylatrazine Detection Frequency	1	0.91	No	0.07	1.0
Atrazine+Degradates Median	-338	0.00	Yes	-0.41	-0.002
Atrazine+Degradates 75 th %-ile	-317	0.00	Yes	-0.39	-0.002
Atrazine+Degradates 90 th %-ile	-317	0.00	Yes	-0.39	-0.002
Atrazine+Degradates Detection Frequency	0	1.0	No	0	0

A4-10. Results of dimethenamid concentration and detection frequency trend analysis for common detection pesticides in PMR 9 groundwater.

Parameter	M-K stat	p Value	Statistically Significant at $\alpha = 0.05$	Kendall Tau	slope estimate
Dimethenamid Median	0	1.0	No	0	0
Dimethenamid 75 th %-ile	0	1.0	No	0	0
Dimethenamid 90 th %-ile	0	1.0	No	0	0
Dimethenamid Detection Frequency	6	0.35	No	0.4	1.0
Dimethenamid ESA Median	0	1.0	No	0	0
Dimethenamid ESA 75 th %-ile	0	1.0	No	0	0
Dimethenamid ESA 90 th %-ile	0	1.0	No	0	0
Dimethenamid ESA Detection Frequency	1	0.91	No	0.07	0
Dimethenamid OXA Median	0	1.0	No	0	0
Dimethenamid OXA 75 th %-ile	0	1.0	No	0	0
Dimethenamid OXA 90 th %-ile	0	1.0	No	0	0
Dimethenamid OXA Detection Frequency	-4	0.56	No	-0.27	0
Dimethenamid + Degradates Median	0	1.0	No	0	0
Dimethenamid + Degradates 75 th %-ile	0	1.0	No	0	0
Dimethenamid + Degradates 90 th %-ile	0	1.0	No	0	0
Dimethenamid + Degradates Detection Frequency	-5	0.77	No	-0.08	0

A4-11. Results of metolachlor concentration and detection frequency trend analysis for common detection pesticides in PMR 9 groundwater.

Parameter	M-K stat	p Value	Statistically Significant at $\alpha = 0.05$	Kendall Tau	slope estimate
Metolachlor Median	0	1.0	No	0	0
Metolachlor 75 th %-ile	-25	0.55	No	-0.03	0
Metolachlor 90 th %-ile	-22	0.64	No	-0.03	0
Metolachlor Detection Frequency	9	0.12	No	0.6	3.67
					0.003
Metolachlor ESA Median	182	0.00	Yes	0.48	0.003
Metolachlor ESA 75 th %-ile	109	0.03	Yes	0.29	0.003
Metolachlor ESA 90 th %-ile	59	0.25	No	0.16	0.002
Metolachlor ESA Detection Frequency	12	0.03	Yes	0.80	3.0
Metolachlor OXA Median	0	1.0	No	0	0
Metolachlor OXA 75 th %-ile	0	1.0	No	0	0
Metolachlor OXA 90 th %-ile	0	1.0	No	0	0
Metolachlor OXA Detection Frequency	7	0.24	No	0.47	3.2

A4-12. Results of metribuzin concentration and detection frequency trend analysis for common detection pesticides in PMR 9 groundwater.

Parameter	M-K stat	Two-sided p Value	Statistically Significant at $\alpha = 0.10$	Kendall Tau	slope estimate
Metribuzin Median					
Metribuzin 75 th %-ile					
Metribuzin 90 th %-ile					
Metribuzin Detection Frequency					
Metribuzin DADK Median					
Metribuzin DADK 75 th %-ile					
Metribuzin DADK 90 th %-ile					
Metribuzin DADK Detection Frequency					
Metribuzin DK Median					
Metribuzin DK 75 th %-ile					
Metribuzin DK 90 th %-ile					
Metribuzin DK Detection Frequency					
Metribuzin DA Median					
Metribuzin DA 75 th %-ile					
Metribuzin DA 90 th %-ile					
Metribuzin DA Detection Frequency					
Metribuzin+Degradates Median					
Metribuzin+Degradates 75 th %-ile					
Metribuzin+Degradates 90 th %-ile					
Metribuzin+Degradates Detection Frequency					

No Detections

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Appendix 5

***MDA Tier 1 through 3 surface water monitoring site names
and characteristics of locations sampled in 2010.***

APPENDIX 6 – MDA Tier 1 through 3 surface water monitoring site names and characteristics of locations sampled in 2010.

2010 Tier^a	PMR^b	Site Code	Site Name	County	State Water Use Classification Rule 7050^c	Associated Major River Basin	Associated Major Watershed Name	Acres Represented^d	MDA Sampling History (Prior to 2010)
2	1	BDS	Bois de Sioux River	Wilkin	2C	Red River of the North	Bois de Souix River	1,180,000	Tier 1: 2005-2008.Tier 2: 2009
3	1	BU1	Buffalo River-Georgetown	Clay	2B	Red River of the North	Buffalo River	625,000	Tier 1: 2002; 2004-2006. Tier 2: 2007-2008. Tier 3: 2009.
1	1	GM1	Grand Marais Creek	Polk	2B	Red River of the North	Grand Marais Creek	111,000	Tier 1: 2004-2009.
1	1	SH1	Sand Hill River nr Climax	Polk	2B	Red River of the North	Red River of the North	268,800	--
2	1	SNA	Snake River	Marshall	2B	Red River of the North	Snake River	736,000	Tier 1: 2005-2006. Tier 2: 2007-2009.
1	1	TM1	Tamarac River nr Stephen	Marshall	2B	Red River of the North	Red River of the North	222,942	--
1	2	BG1	Big Fork River @ Big Falls	Koochiching	2B	Rainy River	Big Fork River	947,200	Tier 1: 2009.
1	3	KA1	Kawishiwi River near Winton	Lake	1B, 2Bd, 3C	Rainy River	Rainy River	787,200	Tier 1: 1991-1993, 2009.
2	4	LR1	Little Rock Creek-Rice	Benton	1B/2A/3B	Upper Mississippi	Mississippi River-Sartell	12,800	Tier 1: 2005. Tier 2: 2006-2009.
1	4	BR1	Mississippi River at Brainerd	Crow Wing	2B	Upper Mississippi	Mississippi River-Brainerd	4,684,800	--
1	4	PN1	Pine River near Mission	Crow Wing	2B	Upper Mississippi	Pine River	498,772	Tier 1: 2009.
1	4	CMS	Crow River-Middle Fork	Kandiyohi	2B	Upper Mississippi	Crow River- North Fork	106,767	Tier 1: 2009.

2010 Tier ^a	PMR ^b	Site Code	Site Name	County	State Water Use Classification Rule 7050 ^c	Associated Major River Basin	Associated Major Watershed Name	Acres Represented ^d	MDA Sampling History (Prior to 2010)
1	5	KE2	Kettle River at Kettle River	Carlton	2B	St. Croix	Kettle River	102,279	--
1	5	LW1	Lawrence Creek	Chisago	1B/2B/3B	St. Croix	St. Croix River-Stillwater	--	Tier 1: 2007-2008.
1	5	SN2	Snake River nr Pine City	Pine	2B	St. Croix	Snake River	623,360	--
1	6	CP9	Chippewa River-West Branch	Swift	2B	Minnesota	Chippewa River	485,095	Tier 1: 2009.
1	6	CP1	Dry Weather Creek	Chippewa	2B	Minnesota	Chippewa River	67,200	Tier 1: 2009.
1	6	S16	Shakopee Creek	Swift	2C	Minnesota	Chippewa River	197,000	Tier 1: 2005-2009
1	6	YM1	Yellow Medicine River	Yellow Medicine	2B	Minnesota	Minnesota River-Granite Falls	424,960	Tier 1: 1991-1993, 2009.
1	7	BC1	Beaver Creek	Murray	2B	Des Moines River	West Fork Des Moines-Head	113,465	Tier 1: 2007-2009.
2	7	PSC	Pipestone Creek	Pipestone	2C	Missouri	Big Souix River-Pipestone	96,600	Tier 1: 2005, 2008. Tier 2: 2006-2007, 2009.
1	7	RO1	Rock River	Rock	2B	Missouri	Rock River	262,000	Tier 1: 1991, 2006-2009.
1	7	TC4	Three Mile Creek-Green Valley	Lyon	2B	Minnesota	Redwood River	67,200	Tier 1: 2005-2009.

2010 Tier^a	PMR^b	Site Code	Site Name	County	State Water Use Classification Rule 7050^c	Associated Major River Basin	Associated Major Watershed Name	Acres Represented^d	MDA Sampling History (Prior to 2010)
3	8	BD1	Beauford Ditch	Blue Earth	2B	Minnesota	Le Sueur River	4,500	Tier 3: 2005-2009.
1	8	RD1	Blue Earth River-Rapidan Dam	Blue Earth	2B	Minnesota	Blue Earth River	1,560,000	Tier 3: 1999-2004. Tier 2: 2006-2007. Tier 1: 2008-2009.
1	8	CT1	Cottonwood River-New Ulm	Brown	2B	Minnesota	Cottonwood River	838,000	Tier 1: 1991-1993; 2002; 2005-2009.
1	8	CSC	Crow River-South Fork-Cosmos	Meeker	2B	Upper Mississippi	South Fork Crow River	153,000	Tier 1: 2005-2009.
1	8	DC1	Dutch Creek	Martin	2B	Minnesota	Blue Earth River	8,650	Tier 1: 2003-2005. Tier 2: 2006-2009.
2	8	JC1	Jack Creek	Jackson	2B	Des Moines River	West Fork Des Moines-Head	130,637	Tier 1: 2007-2009.
3	8	LS1	Le Sueur River-Hwy 66	Blue Earth	2B	Minnesota	Le Sueur River	710,000	Tier 3: 1999-2009.
1	8	LT1	Little Cobb River	Blue Earth	2B	Minnesota	Le Sueur River	83,200	Tier 1: 2003-2005; 2008-2009.. Tier 2: 2006-2007.
1	8	LC1	Little Cottonwood River	Blue Earth	2B	Minnesota	Middle MN River-Mankato	109,000	Tier 1: 2002; 2005-2009.
1	8	JB1	Minnesota River-Judson Bridge	Nicollet	2B	Minnesota	Middle MN River-Mankato	7,170,000	Tier 3: 1999-2004. Tier 1: 2005; 2008-2009. .. Tier 2: 2006-2007.
1	8	RR1	Redwood River-Redwood Falls	Redwood	2B	Minnesota	Redwood River	403,000	Tier 1: 2002; 2005-2009.

2010 Tier ^a	PMR ^b	Site Code	Site Name	County	State Water Use Classification Rule 7050 ^c	Associated Major River Basin	Associated Major Watershed Name	Acres Represented ^d	MDA Sampling History (Prior to 2010)
3	8	SM3	Seven Mile Creek #3	Nicollet	1B/2A/3B	Minnesota	Middle MN River-Mankato	23,600	Tier 1:2002. Tier 3: 2003- 2009.
1	8	PLS	Sleepy Eye Creek-Leavenworth	Brown	2B	Minnesota	Cottonwood River	173,000	Tier 1: 2005, 2009. Tier 2: 2006-2008.
2	8	SR1	Straight River-Fairbault	Rice	2B	Lower Mississippi	Cannon River	276,000	Tier 1: 2002; 2006-2009.
1	9	BCO	Bridge Creek Outlet	Houston	1B/2A/3B	Lower Mississippi	Root River		--
1	9	WEL	Cannon River-Welch	Goodhue	2B/3B	Lower Mississippi	Cannon River	838,000	Tier 1: 1991-1993; 2002; 2004-2005; 2008-2009.. Tier 2: 2006-2007.
1	9	CCO	Crystal Creek Outlet	Fillmore	1B/2A/3B	Lower Mississippi	Root River		--
1	9	CR1	Cedar River-Austin	Mower	2B	Lower Mississippi	Cedar River	249,000	Tier 1: 2002; 2005-2009.
1	9	CN2	Little Cannon River	Goodhue	1B/2A/3B	Lower Mississippi	Cannon River	54,159	Tier 1: 2009.
2	9	SR3	Root River-Lower South Branch	Mower	2B	Lower Mississippi	Root River	3,260	Tier 1: 2007-2009.
3	9	NR	Root River-North Branch	Fillmore	2B	Lower Mississippi	Root River	362,000	Tier: 2003-2003. Tier 3: 2004-2009.
3	9	SR4	Root River-South Branch-Carimona	Fillmore	1B/2A/3B	Lower Mississippi	Root River	91,445	Tier 1: 2002-2006. Tier 3: 2007-2009.
1	9	SFR	Root River-South Fork	Fillmore	1B/2A/3B	Lower Mississippi	Root River	176,000	Tier 1: 2003-2005, 2009. Tier 2: 2006-2008.

2010 Tier ^a	PMR ^b	Site Code	Site Name	County	State Water Use Classification Rule 7050 ^c	Associated Major River Basin	Associated Major Watershed Name	Acres Represented ^d	MDA Sampling History (Prior to 2010)
3	9	MBW	Whitewater River-Middle Branch	Olmstead	1B/2A/3B	Lower Mississippi	Mississippi River-Winona	16,100	Tier 3: 1993-2009.
2	9	SBW	Whitewater River-South Branch	Winona	1B/2A/3B	Lower Mississippi	Mississippi River-Winona	49,200	Tier 3: 1992-2000. Tier 1: 2005. Tier 2: 2006-2009.
1	9	ZR2	Zumbro River-North Fork nr Wanamingo	Goodhue	2B	Lower Mississippi	Zumbro River	67,801	--
1 Urban	10	BS1	Basset Creek	Hennepin	2B	Upper Mississippi	Mississippi River	27,500	Tier 1: 2006-2009.
1 Urban	10	BA1	Battle Creek	Ramsey	2B	Upper Mississippi	Mississippi River	7,200	Tier 1: 2006-2009.
1	10	BV	Bevens Creek	Carver	2B	Minnesota	Lower MN River-Shakopee	83,800	Tier 3: 1995-2001. Tier 1: 2003-2005; 2008-2009. Tier 2: 2006-2007.
1	10	CSM	Crow River-South Fork-Mayer	Carver	2B	Upper Mississippi	South Fork Crow River	710,000	Tier 1: 2005-2009.
1 Urban	10	FC1	Fish Creek	Ramsey	2C	Upper Mississippi	Mississippi River	3,260	Tier 1: 2006-2009.
1 Urban	10	MH1	Minnehaha Creek	Hennepin	2B	Upper Mississippi	Mississippi River	116,000	Tier 1: 2006-2008.
2 Urban	10	NM1	Nine Mile Creek	Hennepin	2B	Minnesota	Lower MN River-Shakopee	24,500	Tier 1: 2006. Tier 2: 2007-2009.
1 Urban	10	RI1	Riley Creek	Hennepin	2B	Minnesota	Lower MN River-Shakopee	8,320	Tier 1: 2006-2009.

2010 Tier^a	PMR^b	Site Code	Site Name	County	State Water Use Classification Rule 7050^c	Associated Major River Basin	Associated Major Watershed Name	Acres Represented^d	MDA Sampling History (Prior to 2010)
1	10	RU2	Rum River nr St. Francis	Anoka	2B	Upper Mississippi	Mississippi River	870,400	--
1	10	SD	Sand Creek	Scott	2B	Minnesota	Lower MN River-Shakopee	163,000	Tier 3: 1995-2002. Tier 1: 2003 – 2009.
2	10	SI1	Silver Creek-CR41	Carver	2B	Minnesota	Lower MN River-Shakopee	21,900	Tier 1: 2005. Tier 2: 2006-2009.
1	10	VR1	Vermillion River-Farmington	Dakota	2B	Lower Mississippi	Mississippi River&Lake Pepin [Red Wing]	82,600	Tier 1: 1991-1993; 2002; 2005-2009.

^a See description of Tier Levels in appropriate Surface Water Monitoring Sections of this report.

^d Approximate acreage of watershed area represented by surface water sampling location.

^b Pesticide Monitoring Region (PMR)

^c Class 2A: for aquatic life (cold) & all recreation. Protected as a drinking water sources. Class 2Bd: for aquatic life (cool/warm) & all recreation. Protected as a drinking water source. Class 2B, C, D: For aquatic life (2B – sport and commercial; 2C – non-commercial; 2D – wetlands & recreation 2B – all types; 2C,D – limited types). Not protected as a drinking water source.

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Appendix 6

Surface Water Quality Sample Results, 2010.

These results are only available online due to the expanded analyte list. Please visit:

www.mda.state.mn.us/monitoring

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Appendix 7

*MDA and STORET ID numbers for current and historic
stream monitoring locations*

Appendix 7. MDA and STORET ID numbers for current and historic stream monitoring locations.¹

MDA Site ID	STORET ID	Site Name
STID10003	S004-625	Ashley Creek@CSAH11-Sauk Centre
BS1	S005-017	Bassett Creek
10EM196		Battle Brook Downstream of 136th St, 4 mi. SW of Princeton
STID10016	S006-443	Battle Creek@620th Ave-Forest City
BA1	S005-395	Battle Creek
BD1	S001-210	Beauford Ditch
BC1	S002-005	Beaver Creek
BV4	S000-252	Beaver River S of CSAH-3 1.5 MI NW of Beaver Bay
BNA	S002-504	Bent Creek
BV1	S005-360	Bevens Creek
BCR	S003-446	Big Cobb River Outlet (CR 16)
BG1	S004-000	Big Fork River at Big Falls
10EM176		Black River Adjacent to Unnamed St., 11 mi. W of Thief River Falls
10EM051		Blue Earth River Adjacent to 542nd Ln, 2.5 mi. NW of Good Thunder
10EM163		Blue Earth River Upstream of CSAH 6, 0.5 mi. SW of Blue Earth
10EM028		Blue Earth River, West Branch 0.5 mi. E of 370th Ave, 4 mi. NW of Elmore
	S000-135	Blue Earth River at CSAH-4, 4 MI S of Blue Earth
	S000-134	Blue Earth River in Sibley Park at Mankato
BE1	S005-358	Blue Earth River-East Branch
RD1	S005-379	Blue Earth River-Rapidan Dam
BDS	S000-553	Bois de Sioux River
BCO		Bridge Creek Outlet
BF1	S000-461	Buffalo Creek-Brownton
STID10023	S002-700	Buffalo River@CR68-Glyndon
BU1	S002-125	Buffalo River-Georgetown
STID10019	S005-608	Buffalo River-South Branch@CR60-Baker
STID10022	S004-148	Buffalo River-South Branch@CR79-Glyndon
10EM112		Burnham Creek Upstream of 170th Ave. SW, 7.5 mi. W of Crookston
STID10030	S006-317	Campbell Creek@CSAH26-Money Creek
10EM175		Cannon River Downstream of CSAH 7, 8 mi. NE of Cannon Falls
10EM027		Cannon River Downstream of Hwy 13, 6 mi. SW of Montgomery
WEL	S000-003	Cannon River-Welch
CC	S005-361	Cascade Creek
	S000-137	Cedar River at CSAH-2, 0.5 MI E of Lansing
	S000-136	Cedar River at CSAH-4, 3 MI S of Austin
CR1	S000-001	Cedar River-Austin
CVC	S004-245	Cedar Valley Creek
	S000-291	Center Creek between S34/35, 1 MI NE of Fairmont
10EM014		Champepadan Creek Upstream of CSAH 9, 5 mi. NE of Luverne
10EM142		Chanarambie Creek, North Branch Upstream of CSAH 5, 4 mi. NW of Chandler
CHA	S002-548	Chaska Creek
10EM046		Chetomba Creek Downstream of CSAH 9, 5 mi. N of Sacred Heart
	S000-175	Chippewa River at bridge on MN-7 at Montevideo
CP9	S005-364	Chippewa River-East Branch
CP1	S000-292	Chippewa River-Milan
CP2	S002-193	Chippewa River- West Branch
10EM087		Chub Creek Upstream of Arkansas Ave, 4 mi. NE of Northfield
STID10018	S005-610	Clay County Ditch 10-Kragnes
STID10017	S005-609	Clay County Ditch 2@90th St. N-Glyndon
STID10020	S005-605	Clay County Ditch 39-Kragnes
STID10028	S004-287	Corey Creek@CSAH17-Money Creek

MDA Site ID	STORET ID	Site Name
10EM094		Cottonwood River Downstream of CR 61, 2 mi. E of Lamberton
CT1	S001-918	Cottonwood River-New Ulm
10EM099		County Ditch 13A Upstream of 611th Ave, 1.5 mi. E of Gibbon
10EM064		County Ditch 27 Downstream of CR 13, 3.5 mi. NW of Kennedy
10EM007		County Ditch 38 Downstream of Nature Ave, 5 mi. SW of Clements
10EM183		County Ditch 66 Upstream of Co. Hwy. 46, 5 mi. W of Albert Lea
STID10005	S003-303	Crooked Lake Ditch@CR73-Osakis
STID10013	S000-004	Crow River at bridge on CSAH-36 at Dayton
CO1	S000-050	Crow River Hwy 55 Rockford
CMS	S004-463	Crow River- Middle Fork
10EM131		Crow River, North Fork 0.3 mi. W of 20th St NW, 8 mi. SE of Annandale
STID10010	S006-295	Crow River-North Fork@182nd St. NE-Paynesville
STID10012	S002-024	Crow River-North Fork@CSAH19-Kingston
CSC	S002-015	Crow River-South Fork-Cosmos
CSM	S000-165	Crow River-South Fork-Mayer
10EM195		Crow River, South Fork Downstream of CR 63, 1.5 mi W of Lester Prairie
CW1	S001-326	Crow Wing River-Nimrod
CW2	S000-176	Crow Wing River-Pillager
CCO		Crystal Creek Outlet
STID10024	S003-151	Deer horn Creek@CR211-Barnesville
DM1	S004-359	Des Moines River-West Fork
	S000-156	Des Moines River- West Fork at bridge at CSAH-23 S of Petersburg
DW1	S002-204	Dry Weather Creek
STID10034	S004-413	Drywood Creek@520th St-Fairfield
DC1	S003-000	Dutch Creek
	S000-141	East Fork Des Moines River at MN-263, 2 MI NE of Ceylon
STID10007	S000-916	Eden Lake Outlet@MN22-Eden Valley
EB1	S000-278	Elk River-Big Lake
10EM138		Elk River Downstream of Little Rock Rd. NE, 5.5 mi. NW of Foley
10EM084		Elk River Upstream of CR 23, 2 mi. N of Becker
10EM167		Elm Creek 0.5 mi. upstream of Elm Creek Rd, 2 mi. NW of Osseo
FC1	S005-376	Fish Creek
GAB	S000-828	Garvin Brook
STID10002	S000-498	Getchell Creek@CSAH12-New Munich
GM1	S002-083	Grand Marais Creek
GS1	S001-263	Grindstone River-South Branch
GH1	S001-097	Groundhouse River-Headwaters
GH2	S003-532	Groundhouse River-S Fork
STID10011	S000-897	Grove Creek@CSAH3-Grove City
10EM111		Hay Creek Upstream of 320th St, 6 mi. SW of Red Wing
HF1		Hidden Falls Creek
JC1	S001-590	Jack Creek
10EM078		Jack Creek Upstream of Lais Ave, 4 mi. E of Wilmont
STID10015	S000-294	Jewetts Creek-btwnS13/24-Litchfield
10EM156		Judicial Ditch 13 Downstream of CR 219, 4.5 mi. SW of Bricelyn
10EM035		Judicial Ditch 8 Downstream of 90th St, 2 mi. SE of Glencoe
KA1	S000-108	Kawishiwi River at bridge on MN-1 at dam 8 MI SE of Ely
	S000-121	Kettle River at bridge on MN-48, 4.5 MI E of Hinckley
KE1	S001-437	Kettle River Hwy 123 in Sandstone
KE2		Kettle River at Kettle River
10EM003		Lac qui Parle River Downstream of Hwy 212, 1 mi. NE of Dawson
LW1	S004-034	Lawrence Creek
LE1	S001-153	Leaf River-Aldrich
STID10045	S006-324	Le Sueur River@120th St-Otisco

MDA Site ID	STORET ID	Site Name
STID10047	S006-330	Le Sueur River@1CR58-New Richland
LS1	S000-340	Le Sueur River-Hwy 66
LS2	S003-860	Le Sueur River- Upper (CR8)
LS3	S003-448	Le Sueur River –St. Clair (CR28)
CN2	S004-512	Little Cannon River
LT1	S003-574	Little Cobb River
LC1	S001-377	Little Cottonwood River
LR1	S005-384	Little Rock Creek-Rice
10EM150		Little Partridge River Downstream of CR 77, 5.5 mi. E of Hewitt
10EM118		Little Swan River E of CR 105, 7 mi. W of Flensburg
10EM042		Long Prairie River Adjacent to Unnamed St., 7 mi. E of Carlos
10EM070		Long Prairie River Downstream of Hauer Lane, 5 mi. NE of Carlos
LP1	S000-282	Long Prairie River
LP2	S002-904	Long Prairie River-Long Prairie
MR1	S002-427	Maple River (Lower) Outlet (CR 35)
MR2	S004-101	Maple River – Upper (CR18)
10EM075		Medford Creek Downstream of Cedar Ave N, 1 mi. NE of Medford
MID5	S000-697	Middle River
MH1	S003-742	Minnehaha Creek
10EM058		Minnesota River Adjacent to CR 59, 6 mi. SE of Odessa
	S000-054	Minnesota River at CSAH-24 bridge, 1 MI S of Courtland
	S000-310	Minnesota River under Landing Lights at Fort Snelling Park
	S000-040	Minnesota River at MN-19 Bridge at Henderson
DE1	S000-780	Minnesota River-Delhi
JO1	S000-039	Minnesota River-Jordan
JB1	S001-759	Minnesota River-Judson Bridge
MN1	S000-740	Minnesota River-Montevideo
MO1	S000-145	Minnesota River-Morton
SP1	S000-041	Minnesota River-St. Peter
MC1	S003-531	Mission Creek
10EM135		Mississippi River Adjacent to Doane Tr, 0.5 mi. SE of Inver Grove Heights
	S000-105	Mississippi River at MN-200 Bridge 0.5 MI W of Lake Itasca
	S000-151	Mississippi River at bridge on MN-115 at Camp Ripley
AT1	S002-010	Mississippi River at Aitkin
AN1	S000-024	Mississippi River-Anoka
	S000-220	Mississippi River Bridge on CR-441, 1 MI SW of Blackberry
LF1	S005-385	Mississippi River-Little Falls
MT1	S000-221	Mississippi River-Monticello
10EM090		Mississippi River Upstream of 77th St., 4 mi. NW of Clearwater
STID10031	S004-824	Money Creek@Hwy76-Houston
10EM126		Mud Creek Downstream of CR D7, 3 mi. NE of Porter
NM1	S005-377	Nine Mile Creek
	S000-240	Okabena Creek at CSAH-14, 2 MI SE of Brewster
10EM092		Otter Creek 0.5 mi. downstream of 105th St, 1 mi. E of Lyle
OT1	S000-006	Ottertail River
10EM026		Pike Creek Upstream of 95th Ave., 3.5 mi. W of Little Falls
PIN	S001-941	Pine Creek
PN1	S000-181	Pine River near Mission
PSC	S000-646	Pipestone Creek
	S000-099	Pipestone Creek bridge on N Line of S24
PL1	S001-930	Platte River-Rice
10EM102		Platte River Upstream of Hwy 25, 3. mi. SW of Harding
STID10036	S002-058	Pomme de Terre River@CR38-Barrett
STID10040	S004-580	Pomme de Terre River@CR51-Appleton

MDA Site ID	STORET ID	Site Name
STID10038	S005-650	Pomme de Terre River@CR58-Alberta
STID10039	S004-576	Pomme de Terre River@HWY12-Appleton
STID10037	S004-411	Pomme de Terre River@HWY9-Morris
PT1	S000-195	Pomme de Terre River-Appleton
10EM106		Pomme de Terre River West of 440th Ave, 7 mi. SW of Hoffman
	S001-186	Prairie Creek at 310 th St, 2 MI upstream of Lake Byllesby
	S000-013	Red Lake River downstream of MN-220 bridge in East Grand Forks
RL1	S002-080	Red Lake River-Crookston
RL2	S005-403	Red Lake River-Fischer
	S000-012	Red River at bridge on CSAH-18, 0.5 MI W of Brushvale
RE1	S000-011	Red River Hwy 10 Moorhead
10EM032		Red River of the North Adjacent to CR 102, 3 mi. N of Halstad
10EM022		Redeye River N of Hwy 227, 2.5 mi. E of Sebeka
	S000-299	Redwood River at bridge on CSAH-101 at North Redwood
RR1	S001-679	Redwood River-Redwood Falls
RR2	S000-696	Redwood River-Russell
STID10043	S002-431	Rice Creek@CR151-Sterling Center
STID10041	S006-365	Rice Creek@Hwy109-Delavan
RC1		Rice Creek
RI1	S005-380	Riley Creek
	S001-138	Robinson Creek bridge at Dead End Rd, NW High Forest
RO1	S000-097	Rock River
10EM079		Root River Adjacent to Hwy 16, 2 mi. NE of Whalan
	S000-097	Rock River at bridge on Stateline RD 10 MI S of Luverne
	S000-065	Root River at bridge on MN-26, 3 MI E of Hokah
NR1	S005-405	Root River- Eagle Bluff
SR3	S001-539	Root River-Lower South Branch
NR	S004-842	Root River-North Branch
STID10027	S006-308	Root River-North Branch@680th Ave-Hayfield
STID10026	S006-310	Root River-North Branch@CSAH7-Dexter
10EM123		Root River, North Branch Downstream of CSAH 2, 1 mi. S of Chatfield
SR	S001-320	Root River-South Branch
SR4	S004-839	Root River-South Branch-Carimona
SFR	S004-123	Root River-South Fork
SR5	S004-860	Root River- South Fork near Houston
10EM146		Root River, South Fork Upstream of Hwy 43, 9 mi. N of Mabel
SR2	S001-340	Root River-Upper South Branch
RU1/RU2	S005-386	Rum River
10EM164		Rum River 0.5 mi. W of Rum River Blvd, 1 mi. N of Saint Francis
10EM036		Rum River Adjacent to 329th Ave NW, 7 mi. W of Cambridge
10EM100		Rum River Adjacent to Vintage Dr, 5 mi. W of East Bethel
	S000-016	Rum River at bridge on Pleasant Street in Anoka
	S000-043	Rum River at bridge on CSAH-5, 0.5 MI W of Isanti
10EM148		Rush Creek 0.3 mi. upstream of CSAH 5, 2 mi. E of Rush City
10EM068		Saint Croix River Adjacent to Nature Rd, 8 mi. NE of Rush City
	S000-119	St. Louis River at bridge at CSAH-7, 0.5 MI S of Forbes
10EM132		St Croix River Upstream of Hwy 243, 0.5 mi. W of Osceola, WI
	S001-191	Salem Creek at Unnamed Creek 4 MI SW of Salem Corners
SD	S004-898	Sand Creek
SHI	S002-099	Sand Hill River near Climax
SK1	S004-621	Sauk River-St. Cloud
STID10006	S000-503	Sauk River@CSAH4-St. Cloud
STID10009	S002-384	Sedan Brook@Ironsides Rd-Brooten
SM3	S003-706	Seven Mile Creek #3

MDA Site ID	STORET ID	Site Name
S16	S002-201	Shakopee Creek
SHE	S002-962	Shell River-Menahga
	S000-084	Shell Rock River at bridge on CSAH-1, 1 MI W of Gordonsville
SG1	S001-946	Shingle Creek
SI1	S000-843	Silver Creek-CR41
10EM054		Silver Creek Upstream of Unnamed St., 5 mi. NW of Sauk Centre
PLS	S005-378	Sleepy Eye Creek-Leavenworth
	S000-198	Snake River at bridge at CSAH-9, 2 MI NE of Pine City
SNA	S000-185	Snake River
SN1	S002-587	Snake River-Pokegema
SN2	S000-128	Snake River near Pine City
10EM053		South Cormorant River 2 mi. E of CR 41, 1 mi. W of Funkley
SRC	S005-382	Split Rock Creek
SPR		Spring Brook
10EM190		Spring Creek Upstream and downstream of CR D3, 5 mi. E of St Leo
10EM015		Spring Valley Creek Upstream of Hwy 63, in Spring Valley
STID10004	S000-497	Stony Creek-Spring Hill
10EM011		Straight River Downstream of CSAH 45, 2 mi. S of Medford
	S000-047	Straight River near CSAH-1, 1 MI SE of Clinton Falls
SR1	S003-557	Straight River-Faribault
ST1	S002-960	Straight River-Park Rapids
SU1	S004-033	Sunrise River-North Branch
STID10014	S005-561	Sucker Creek@40th St SW-Cokato
10EM086		Swan Creek E of CR 32, 4 mi. NE of Staples
TM1	S005-788	Tamarac River near Stephen
10EM197		Thief River Downstream of CR 31, 4 mi. N of Thief River Falls
TC4	S002-313	Three Mile Creek-Green Valley
10EM083		Tributary to Little Rock Creek Adjacent to CSAH 5, 7 mi SE of Fairfax
STID10025	S006-311	Tributary to Root River-North Branch@CSAH7-Dexter
10EM018		Tributary to Sand Creek Adjacent to Dry Rd., 7mi. NW of Meadowlands
10EM047		Tributary to Trout Brook Upstream of CSAH 6, 2 mi. SW of Goodhue
TRO	S001-936	Trout Brook
10EM171		Trout Creek Upstream of Trout Dr, 11.5 mi. E of Plainview
TR1	S005-387	Two Rivers-Hallock
10EM192		Two Rivers, South Branch Downstream of CR 175, 0.5 mi. W of Lake Bronson
10EM187		Unnamed creek 1 mi. upstream of Hwy 52, 3 mi. N of Chatfield
10EM162		Unnamed Creek Adjacent to Meadowbrook Rd, 5 mi. SW of Brownsville
10EM170		Unnamed Creek Downstream of CR 34, 6 mi. SW of Barrett
10EM166		Unnamed Creek Upstream of 153rd St., 2 mi. E of Little Falls
10EM021		Unnamed Creek Upstream of 285th St. SE, 5 mi. E of Fosston
10EM169		Unnamed Creek Upstream of Swan Lake Rd., 7 mi. S of Meadowlands
10EM115		Unnamed Ditch 0.5 mi. W of Grandview Rd, 6.5 mi. SW of New Ulm
10EM128		Unnamed Ditch Adjacent to 320th Ave. NW, 6 mi. NE of Argyle
10EM174		Unnamed Ditch Adjacent to 70th St, 11 mi. NE of Montevideo
10EM067		Unnamed Ditch Adjacent to CSAH 32, 3 mi. SW of Louisberg
10EM151		Unnamed Ditch Adjacent to Jackson Ave, 2.5 mi. NW of Lonsdale
10EM103		Unnamed Ditch Adjacent to Old Hwy 169 Blvd, 2 mi. SW of Jordan
10EM186		Unnamed Ditch Downstream of 150th Ave. SE, 4 mi. N of Kerkhoven
10EM039		Unnamed Ditch Downstream of 273rd St W, 4 mi. SE of Belle Plaine
10EM001		Unnamed Ditch Upstream of 11th St, 1.5 mi. S of Hills
10EM110		Unnamed Ditch Upstream of 120th St NW, 1.5 mi. E of Pennock
10EM116		Unnamed ditch Upstream of CR 149, 4 mi. NW of Princeton
10EM119		Unnamed Ditch Upstream of CSAH 25, 3.5 mi. W of Walters
10EM187		Unnamed creek 1 mi. upstream of Hwy 52, 3 mi. N of Chatfield

MDA Site ID	STORET ID	Site Name
STID10035	S005-651	Unnamed Stream to Pomme de Terre River at CSAH-7, 5 MI N of Fairfield
10EM069		Unnamed Tributary To Hay Creek Upstream of 140th Ave., 1 mi. S of Lake Park
10EM160		Unnamed Tributary to Red Lake River Downstream of Hwy 220, 5 mi. SW of Fisher
STID10008	S006-155	Unnamed Tributary to Little Sauk Lake
VR1	S000-896	Vermillion River-Farmington
10EM121		Water Hen Creek Downstream to Long Lake Rd., 14 mi. SE of Eveleth
WA1	S000-163	Watonwan River-Garden City
10EM071		Watonwan River, Trib to N Fork Downstream of CSAH 9, 6 mi.NW of Mountain Lake
STID10050	S003-338	Watson Creek@CSAH17-Preston
	S000-288	Whitewater River South Fork N of CR-115 3.5 MI NW of Utica
MBW	S001-831	Whitewater River-Middle Branch
NBW	S000-451	Whitewater River-North Branch
10EM059		Whitewater River, North Fork At CSAH 2, 1 mi. S of Elgin
SBW	S000-321	Whitewater River-South Branch
WR1	S002-102	Wild Rice River
10EM005		Wild Rice River Downstream of 140th Ave., S of Mahnommen
10EM143		Willow Creek Upstream of CSAH 15, 3 mi. SW of Preston
STID10033	S004-287	Willow Creek@CSAH12-Preston
STID10049	S006-301	Willow Creek@Jumper Rd-Harmony
10EM023		Wolf Creek Upstream and downstream of Canby Ave, 6 mi. SW of Lonsdale
YM1	S000-159	Yellow Medicine River at MN-67 bridge, 7 MI SE of Granite Falls
10EM016		Yellow Medicine River, North Branch Downstream of CR 109, 5 mi. SW of Porter
	S001-156	Yellow Medicine River-South Branch at CSAH-10 at Minneota
10EM062		Yellow Medicine River, S Branch Downstream of 280th St, 7.5 mi. SW of Minneota
ZR1	S000-819	Zumbro River
10EM107		Zumbro River Adjacent to CSAH 11, 3 mi. NE of Millville
MFZ	S001-729	Zumbro River-Middle Fork
10EM095		Zumbro River, Middle Fork, S Branch Adjacent to 90 St NW, 6 mi. NW of Rochester
10EM139		Zumbro River, North Fork Upstream of Larson Ave, 3.5 mi. W of Kenyon
ZR2	S004-383	Zumbro River- North Fork near Wanamingo
	S000-268	Zumbro River South Fork at CSAH-14, 3 MI N of Rochester
10EM155		Zumbro River, South Fork Upstream of CR 126 SW, 7.5 mi. SW of Rochester

¹ STORET ID numbers can be used to locate water monitoring data for a site in MPCA's Environmental Data Access (EDA) System, which can be accessed on their website at <http://www.pca.state.mn.us/data/eda/index.cfm>.

Appendix 7b - MDA and STORET IDs for current and historic lake monitoring locations.¹

MDA Site ID	STORET ID	Site Name
1ALL	44-0157	Allen Lake
1ALR	69-0005	Alruss Lake
1ATC	06-0002	Artichoke Lake
1ART	69-0154	Arthur Lake
1AGU	38-0691	August Lake
1BEC	38-0472	Becoosin Lake
1BOW	31-0813	Bowstring Lake
1BUD	46-0030	Budd Lake
1CAR	34-0032	Carrie Lake
1CAS	04-0030	Cass Lake
1CED	27-0039	Cedar Lake
1COK	86-0263	Cokato Lake
1COM	62-0055	Como Lake
1CRO	18-0155	Crow Wing Lake
1DAR	21-0080	Darling Lake
1EAG	07-0060-01	Eagle (North) Lake
1ELE	69-0810	Elephant Lake
1ELK	15-0010	Elk Lake
1EVA	62-0038-01	East Vadnais Lake
1FAI	56-0356	Fairy Lake
1FAN	21-0336	Fanny Lake
1FIS	70-0069	Fish Lake
1FLA	03-0242	Flat Lake
1HAR	27-0016	Harriet Lake
1HIL	01-0142-02	Hill Lake (South Basin)
1HUN	03-0029	Hungryman Lake
1ISL	11-0102	Island Lake
1JEN	47-0015	Jennie Lake
1KAB	69-0845	Kabetogama Lake
1LAM	69-0341	Lamb Lake
1LIG	26-0282	Lightning Lake
1LON	31-0266-01	Long (Main Bay) Lake
3LON	86-0069	Long Lake
2LON	11-0480	Long Lake (45)
1LOO	18-0123	Lookout Lake
1LOS	69-0611	Lost Lake
1LW1	85-0011-01	Lake Winona (South Bay)
1MAI	56-0476	Maine (Round) Lake
1MYO	18-0408	Mayo Lake
1MUS	16-0104	Musquash Lake
1NES	34-0154	Nest Lake
1NOK	27-0019	Nokomis Lake
1NAS	41-0055	North Ash Lake
1NDR	76-0169	North Drywood Lake
1NMA	14-0029	North Mayfield Lake
1NLL	16-0089	Northern Light Lake
1NOR	34-0251	Norway Lake

MDA Site ID	STORET ID	Site Name
1OKA	46-0051	Okamanpeedan Lake
1OWA	62-0056	Owasso Lake
1PEB	56-0829	Pebble Lake
1PEL	18-0308	Pelican Lake
1PER	41-0067	Perch Lake
1PIC	03-0287	Pickerel Lake
2PIC	44-9175	Pickerel Lake
1PIN	11-0411	Pine Mountain Lake
1PLE	62-0046	Pleasant Lake
1UNN	21-0291	Red Rock Lake
1RSA	18-0386	Red Sand Lake
1RIC	16-0643	Richey Lake
1SAS	41-0057	South Ash Lake
1SHI	29-0043	Shingobee Lake
1SNA	62--0073	Snail Lake
1SOU	43-0014	South Lake
1SPR	33-0027	Spring Lake
2SPR	69-0129	Spring Lake
3SPR	11-0022	Spring Lake
1STO	81-0003	St. Olaf Lake
1STE	38-0744	Stewart Lake
1STR	3-0010	Straight Lake
1SUL	86-0119	Sullivan Lake
1TRA	78-0025	Traverse Lake
1TUR	62-0061	Turtle Lake
1THA	16-0001	Two Harbors Lake
1UGU	11-0218	Upper Gull Lake
1UHA	31-0770	Upper Hatch Lake
1ULI	56-0957	Upper Lightning Lake
2UNN	60-0307	Unnamed Lake
1USA	40-0002	Upper Sakatah Lake
1VES	16-0414	Vesper Lake
1VIC	21-0054	Victoria Lake
1WLE	56-0114	West Leaf Lake
1WSA	18-0379	White Sand Lake
1WOO	34-0141	Woodcock Lake

¹ STORET ID numbers can be used to locate water monitoring data for a site in MPCA's Environmental Data Access (EDA) System, which can be accessed on their website at <http://www.pca.state.mn.us/data/eda/index.cfm>.