Minnesota Department of Agriculture

Groundwater Quality Monitoring 2016 Annual Work Plan

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MONITORING and ASSESSMENT UNIT
ENVIRONMENTAL SECTION
PESTICIDE & FERTILIZER MANAGEMENT DIVISION

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1. INTRODUCTION

The purpose of this document is to describe planned groundwater monitoring activities of the Minnesota Department of Agriculture (MDA) Monitoring and Assessment Unit (MAU) for 2016. Direction for groundwater monitoring by MDA is derived from the Minnesota Pesticide Control Law (M.S. 18B) and the Minnesota Groundwater Protection Act (M.S. 103H). Specific information describing goals, objectives and practices pursued in implementing the charge to monitor groundwater by the MAU are described in the MAU's Groundwater Monitoring Design Document and its supporting material (QAPP, SOPs, etc.). Planning and prioritization are essential to the practical implementation of monitoring to meet MDA goals and objectives related to groundwater. Projects implemented by the MAU are pursued to optimize outcomes from limited resources, thus the MAU is constantly evaluating projects and procedures to try to maximize benefits and minimize costs.

2. LABORATORY ANALYTICAL METHODS

During 2016 the MDA laboratory will utilize a variety of methods for analyzing water samples collected by the monitoring program. The methods for the pesticide analysis are: GC-MS/MS - gas chromatography with tandem mass spectrometry; LC-MS/MS - liquid chromatography with tandem mass spectrometry; and glyphosate. Nitrate-nitrogen will also be analyzed. The list of chemical analytes and associated methodology for 2016 is located in Appendix A.

Samples from all locations (monitoring wells, springs and domestic wells) unless specifically stated in the sections below, will be analyzed by GC-MS/MS, LC-MS/MS, glyphosate, and nitrate-nitrogen methods.

3. GROUNDWATER MONITORING FRAMEWORK

The MAU has divided the state into ten Pesticide Monitoring Regions (PMRs), as shown in Figure 1. PMRs are based on areas with similar cropping practices, soil characteristics, hydrogeologic conditions, climate, and agro-ecosystem classifications. PMRs are delineated on county lines to facilitate the evaluation of the results by farmers, the general public and others. Table 1 provides detailed descriptions and characteristics of each PMR.

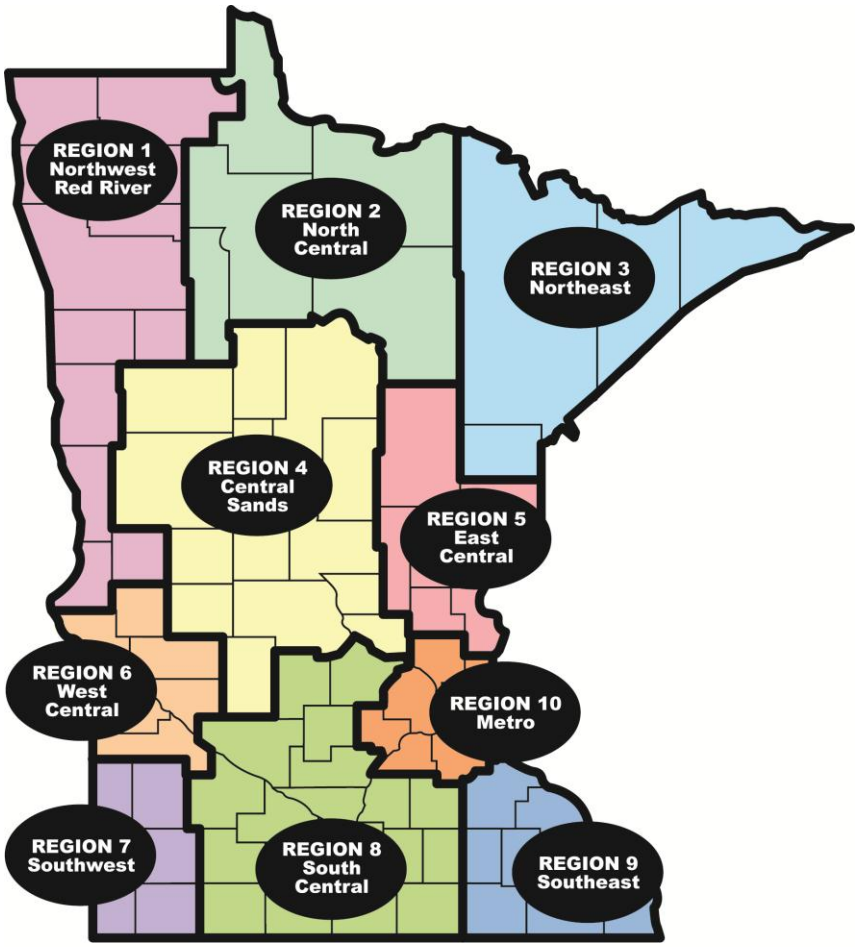

Figure 1. Pesticide Monitoring Region (PMRs).

Table 1. MDA's Pesticide Monitoring Region (PMR) descriptions and characteristics.

PMR	Region	Counties Included	Physical Characteristics
1	Northwest Red River	Kittson, Roseau, Marshall, Pennington, Red Lake, Polk, Norman, Mahnomen, Clay, Wilkin, Traverse, Grant	Glacial lake bed w/ high clay content soils 150 to 250 ft thick; gravel aquifers buried under clay; beach ridge deposits of sand and gravel; high value agriculture of sugar beets and small grains
2	North Central	Lake of the Woods, Koochiching, Beltrami, Clearwater, Itasca	Mostly forested and bog; little agriculture in discontinuous areas; groundwater resources quite variable
3	Northeast	St. Louis, Lake, Cook, Carlton	Forested with shallow bedrock; agriculture nearly nonexistent
4	Central Sands	Becker, Hubbard, Cass, Crow Wing, Morrison, Wadena, Otter Tail, Todd, Douglas, Pope, Stearns, Benton, Sherburne, Kandiyohi	Large glacial outwash sand plains that are highly sensitive to surface activities; high value potatoes and other crops; irrigated fields are common
5	East Central	Aitkin, Pine, Mille Lacs, Kanabec, Chisago, Isanti	Glacial outwash and lacustrine sands; low pH soils; generally poor cropping conditions; some irrigation; some potato production
6	West Central	Stevens, Big Stone, Swift, Chippewa, Lac Qui Parle, Yellow Medicine	Some areas of glacial outwash sand; thin and narrow alluvial aquifers; many buried sand aquifers; mix of corn and soybeans; thick glacial tills in some areas
7	Southwest	Lincoln, Lyon, Pipestone, Murray, Rock, Nobles	Aquifers consist of highly sensitive alluvial river valley deposits; fractured quartzite formations and well protected deep cretaceous sediments; sufficient water supply is hard to come by; rural water systems are large and growing
8	South Central	Wright, Meeker, Renville, McLeod, Sibley, Nicollet, Le Sueur, Rice, Steele, Waseca, Blue Earth, Brown, Redwood, Cottonwood, Watonwan, Jackson, Martin, Faribault, Freeborn	A mix of glacial outwash sands; deep glacial tills, glacial lacustrine deposits; windblown silts, river valley deposits; and deep bedrock aquifers; sensitivity varies accordingly; corn and soybeans; intensive ag production; most productive land in the state
9	Southeast Karst	Goodhue, Wabasha, Winona, Olmsted, Dodge, Mower, Fillmore, Houston	Karst geology that is highly sensitive to surface activities; shallow windblown silt and glacial till soils; springs, sinkholes and disappearing streams; high value trout streams; extremely shallow to very deep bedrock aquifers; some river valley alluvial deposits
10	Metro	Anoka, Ramsey, Washington, Dakota, Scott, Carver, Hennepin	Urban, suburban and transitional areas; some irrigated farming; hobby farms; much farming conducted on leased land by relatively large farm operations; outwash sand and gravel to deep bedrock aquifers

Specific monitoring designs for each region are based on the characteristics of the specific region. Water quality samples are collected and analyzed to facilitate evaluation of conditions within, and between, each region. Five PMRs (1, 5, 6, 7, and 8) are included in a common design. Two PMRs (4 and 9) have unique monitoring designs based on their distinctive land use, hydrogeology, or other important characteristics. PMR 10 is monitoring urban land use settings. PMRs 2 and 3 are not included in the monitoring program due to very small amounts of agricultural production in these heavily forested areas.

Figure 2 presents the location of the 2016 proposed sampling locations except for the urban wells. The locations of the urban wells are determined in collaboration with the MPCA (see Section 3.1.4) and the exact locations will be presented in the annual report after sampling has been completed.

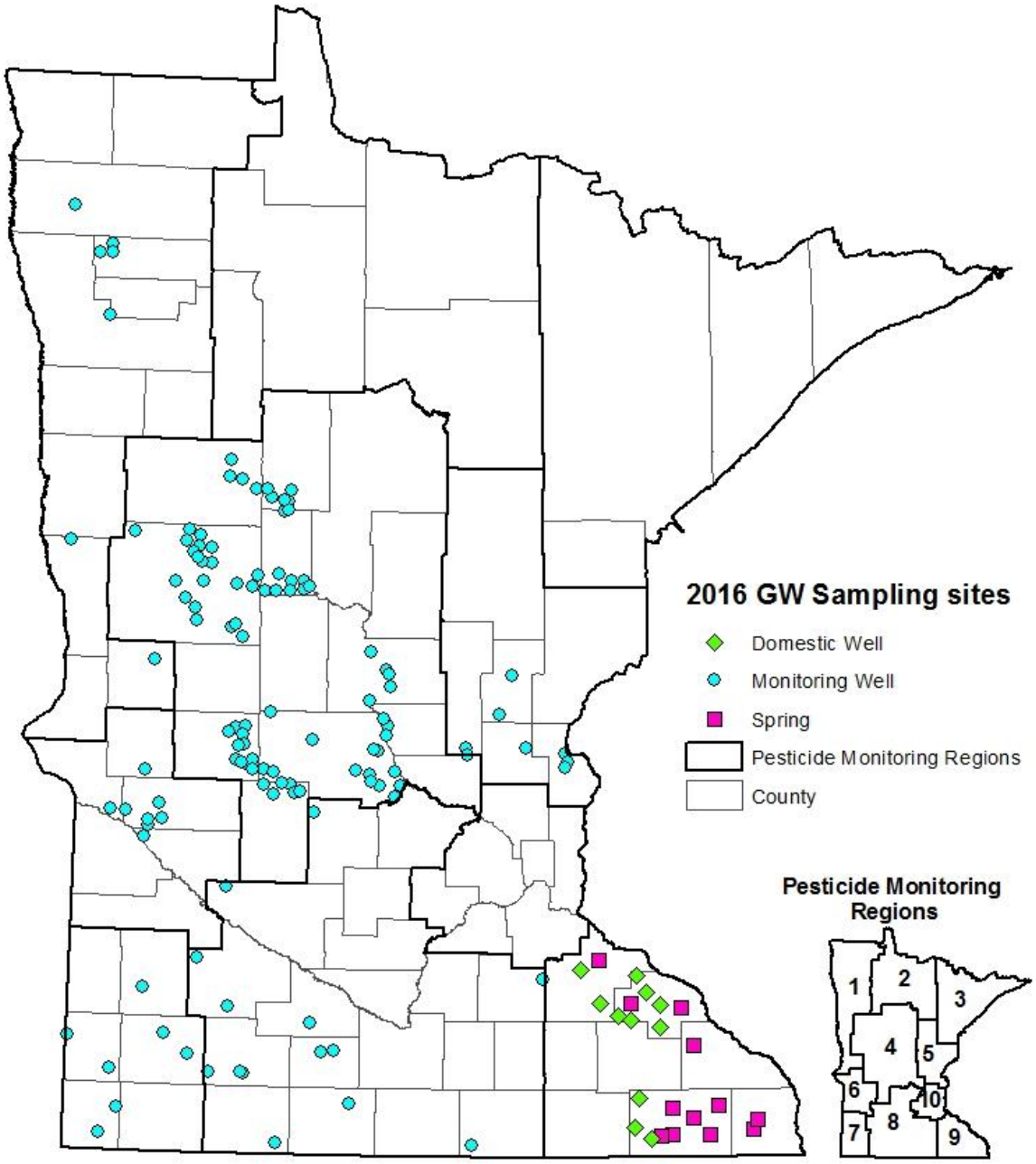

Figure 2 Groundwater Sampling Locations for 2016

3.1. PMR-specific Monitoring

The wells and springs to be sampled are detailed in tables in Appendix B. The number of expected samples by analytical method and PMR is presented in Appendix C. It has happened that not all locations can be sampled during the season. This could be due to but not limited to; well condition, low water in the wells due to drought, weather and access limitations. All efforts are made to sample all of the listed locations during the sampling season.

3.1.1. PMRs 1, 5, 6, 7 and 8

The 2016 sampling plan for PMRs 1, 5, 6, 7 and 8 consists of seven to fourteen wells per PMR. Each well is sampled twice a year, once during the spring (April or May) and once during the fall (October or November). Well locations are presented in Figure 2.

3.1.2. PMR 4

The 2016 sampling plan for PMR 4 consists of 78 sites containing nested wells. The majority of samples in PMR 4 will be collected from the shallowest well in the nest that intersects the water table and is able to produce enough water for a sample. Each site will be sampled once during 2016, either in the spring (April or May) or in the fall (October or November).

There are eight sites with a co-located deep well and these sites will have samples collected from the shallow well and from the deep well twice during 2016, once in the spring and once in the fall. Automated water level monitoring will continue at the eight deep well sites within PMR 4 during 2016.

With exception of the deep well sites, all wells are distributed to each sampling period by a randomization procedure. Well locations are presented in Figure 2.

3.1.3. PMR 9

The 2016 sampling plan for PMR 9 includes 13 springs and 12 domestic wells.

3.1.3.1. Springs

Each spring will be sampled two times during the year. The Minnesota Department of Natural Resources (DNR) fish hatchery springs will be sampled in February and in August; the remaining ten springs will be sampled in June and September. The sampling of springs is intended to target base flow (groundwater) periods instead of storm flow (rain event) periods. Spring locations are presented on Figure 2.

MDA staff will collect samples from the DNR hatcheries per the MDA Pesticide and Fertilizer Management Division - DNR Division of Fish and Wildlife, Section of Fisheries Spring Sampling Agreement. MDA staff will notify DNR hatchery staff when MDA staff will be on site to sample the springs so that DNR staff can observe/assist if necessary.

3.1.3.2. Domestic Wells

The domestic wells will be sampled in September to coincide with the September sampling from the springs.

3.1.4. Urban

Wells in urban settings are sampled to evaluate for the presence of pesticides, some of which maybe different than those used in agricultural areas. In addition, some of the urban areas sampled contain significant amounts of agricultural land that are in the process of conversion to suburban development. Samples are typically collected from urban areas within PMRs 2, 4, 9 and 10. In 2016, approximately 20 wells will be sampled in PMRs 2 and 10.

The wells in the MDA's urban region are sampled by the Minnesota Pollution Control Agency (MPCA) as part of their groundwater monitoring program. Based on MDA established criteria, the MPCA selects a subset of the wells (in collaboration with MDA staff) that the MPCA is sampling for their program. These selected wells are also sampled for pesticides. The pesticide samples are collected by MPCA staff at the same time as their regular samples and submitted to the MDA laboratory for pesticide analysis. The samples will be collected during the summer months of July and August, if possible, but may be collected as late as October. The samples will be analyzed using GC-MS/MS, LC-MS/MS, and glyphosate methods. Nitrate-nitrogen will not be analyzed by the MDA laboratory for these samples because the MPCA includes it in their analytical suite

These sample sites are best considered mixed-use, although summary statistics will be prepared for all urban sites together. All sampling work by the MPCA is conducted as outlined in the MDA/ MPCA groundwater monitoring Memorandum of Agreement (MOA) (see MDA website).

4. MAINTENANCE OF NETWORK WELLS AND SITES

4.1. Changes to the Groundwater Monitoring Well Network in 2015

Continuing a process that began in 2010, the condition of the wells in the monitoring well network was evaluated in 2015. Based on data review, site visits, and (where appropriate) tests to determine the condition of the well, the MDA identified wells that need to be repaired, replaced or sealed.

Based on the assessment, a number of wells were determined to either not function properly, were in locations no longer suitable for the requirements of the MDA network, or had been requested to be removed by the land owner. Work was conducted in 2015 to seal or replace some of the wells on the list. The wells selected were no longer being monitored or had been damaged in such a way that the integrity of the well was in question. Table 2 lists the wells that were sealed or replaced in 2015 and the reason that the work was conducted. The work was conducted in partnership with the DNR, whose licensed well driller conducted the work under the direction of an MDA hydrologist.

Table 2. Changes to MDA network wells in 2015

Well Unique Number	County	Activity	Reason for work	Date completed
623601 and 623602	Otter Tail	Sealed	Next to a feedlot, farmer requested wells be removed.	11/3/2015
623629 and 623638	Otter Tail	Sealed	Replaced by 792533 in November 2012	11/3/2015
639558 and 639559	Becker	Sealed	Wells upgradient of fields, not measuring possible effects of agriculture	11/3/2015
669812	Hubbard	Sealed	Installed with County to monitor nitrates. MDA has wells nearby, so this well duplicated those.	11/3/2015
676380	Morrison	Sealed	No longer in agricultural area as there was urban development around the well.	11/2/2015
733711	Watonwan	Sealed	Well replaced because casing was damaged and integrity was questionable.	11/23/2015
809300	Watonwan	Installed	Replaces 733711	11/24/2015

4.2. Replacement wells

Occasionally wells in the network may need to be replaced, closed or discontinued for various reasons. When necessary, replacement wells will be located as close to the existing well as possible. If a replacement well cannot be installed near the existing well, a new site, based on site selection criteria in the program design document, will be selected. Wells will also need major maintenance or repair on an unknown frequency. In 2015, the MDA contracted with the DNR to provide well drilling, sealing, and maintenance services. This agreement extends into 2016 and is expected to be continued into 2017. Currently 45 well or well nests have been identified as possible candidates for replacement within the existing MDA network. The exact number of wells to be replaced in 2016 is uncertain at this time and is dependent upon funding and the driller's schedule.

4.3. Installation of wells at new locations

Additional wells at previously unmonitored locations may be installed as resources allow. At the time of the publication of this document, potential new sites in PMRs 1, 4, 9, and 10 are being investigated. The installation of any new wells in 2016 will depend upon the availability of funds, well siting, cooperation with landowners, and personnel scheduling.

4.4. Evaluation of existing wells

Existing monitoring wells installed by other state or federal agencies remain the most cost effective means of collecting groundwater samples. The program will continue to assess existing wells of which it becomes aware. When a suitable, functioning well is discovered, it may or may not be immediately added to the program based on the Monitoring Unit resources or laboratory sample load constraints. All such wells will be added to a list the program will maintain for future reference when expansion of the network becomes possible or necessary.

5. SPECIAL PROJECTS FOR 2016

5.1. Private Well Pesticide Sampling Project

At the direction of the Minnesota Legislature (HF1183 Article 2, Sec. 2), the MDA will continue evaluating pesticide presence and magnitude in select private residential drinking water wells for the Private Well Pesticide Sampling (PWPS) project. Selections will come from a population of wells in sensitive geologic areas that were previously sampled by homeowners for nitrate-nitrogen as part of the MDA Groundwater Nitrate-Nitrogen Township Sampling project.

The primary goal of the PWPS is to provide information to homeowners and the general public on the presence of pesticides in private drinking water wells in geologically sensitive areas of Minnesota. This will be achieved by hiring a contract laboratory to analyze water samples at low level concentrations for a suite of pesticides and pesticide degradates. Nitrate-nitrogen samples will also be collected from the wells sampled and redox parameters (total dissolved manganese, total dissolved iron and sulfate) may also be analyzed from several townships.

The MDA plans to sample approximately 1,600 wells in Morrison, Ottertail, Sherburne and Pope Counties during the 2016 sampling season.

5.2. Coordination with DNR, MPCA and MDH

It is anticipated that coordination on projects with the DNR, MPCA, and MDH will occur in 2016. Projects with the DNR relate to installing new wells or sharing existing monitoring wells around the state. Cooperative sampling projects with the MPCA and the MDH occur on an as-needed basis and is anticipated to continue in 2016.

5.3. Coordination with Bayer Crop Science

Bayer Crop Science (BCS) is working to register isoxaflutole in Minnesota. As part of the registration process, BCS will install and sample up to eight monitoring wells in 2016 – 2017 in areas of the state where isoxaflutole could be used. The MDA will coordinate with BCS on the location and installation of these wells. BCS will sample the wells for isoxaflutole and it's degradate isoxaflutole DKN. The results will be provided to the MDA for review and comment. This data will be used as part of the registration review process for isoxaflutole in Minnesota.

While not considered groundwater, BCS will also conduct sampling of water at tile drain locations to evaluate the presence of isoxaflutole in the water. The site(s) for this study are being evaluated by BCS in early 2016. This data will be used as part of the registration process for isoxaflutole in Minnesota.

5.4 Deep well evaluation

In 2010, the MDA installed deep wells in eight locations within PMR 4. These wells (32 to 52 feet deep) were paired with shallower wells (12 to 20 feet deep) in areas which had previously shown higher pesticide concentrations at the water table. The data from the deep wells is being used to determine if pesticides are impacting deeper portions of the aquifer.

In 2016, the data from the wells in each well nest will be evaluated to determine if pesticides are impacting the deeper portions of the aquifers. It is expected that the study will provide a recommendation on maintaining, modifying, or discontinuing the deep wells within the MDA network.

6 DATA ANALYSIS AND REPORT

During 2016, analysis of data for the 2015 annual MAU monitoring report began in January with a report completion goal of April 30, 2016. Goals and objectives of the annual report are largely established by the information needs of the MDA pesticide management programs.

Additional reports covering specific components of the groundwater program may be completed during the year. Although no specific reports have yet been established, the program is considering detailed reports on various aspects of the monitoring program.

7 QUALITY ASSURANCE SAMPLING

The groundwater monitoring program collects additional samples used to ensure the quality of the program's results. Samples to be collected in 2016 include field blanks, replicates, field equipment blanks, and field equipment post-lab cleaning blanks, all of which are submitted to the laboratory as regular samples. Replicates will be collected at a rate of 1 in 20 regular samples (5%), while field blanks will be collected at a rate of 1 in 40 regular samples (2.5%). Field equipment blanks (collected in the field between sites) and field equipment lab cleaning blanks (collected in the lab following cleaning of the equipment and prior to sampling occurs) are collected by field staff that utilize equipment (such as peristaltic pumps) and will each be collected at a rate of 1 in 80 regular samples (1.25%). Approximately 12 sets of replicates, 6 sets of field blanks, 3 sets of field equipment blanks, and 3 sets of field equipment post-lab cleaning blanks will be collected during 2016. Data from the quality assurance samples will be checked against regular sample results as they become available. Results will additionally be shared with the analytical laboratory for the purposes of their internal quality control process.

Appendix A
Laboratory Analysis

List of target pesticide and pesticide degradate detection status in groundwater with associated method reporting limits (MRLs).

*** New analyte for 2016**
**** Added in summer 2015**

Common Name	Type	GC-MS/MS MRL (ng/L)	LC-MS/MS MRL (ng/L)
2,4,5-T	Herbicide		50
2,4,5-TP	Herbicide		50
2,4-D	Herbicide		8.3
2,4-DB	Herbicide		20
Acetamiprid	Insecticide		25
Acetochlor	Herbicide	30	
Acetochlor ESA	Herbicide Degradate		30
Acetochlor OXA	Herbicide Degradate		33.3
Alachlor	Herbicide	30	
Alachlor ESA	Herbicide Degradate		41.6
Alachlor OXA	Herbicide Degradate		33.3
Aldicarb Sulfone	Insecticide Degradate		15
Aldicarb Sulfoxide	Insecticide Degradate		50
Aminopyralid*	Herbicide		25
Atrazine	Herbicide	30	
DEDI Atrazine	Herbicide Degradate		50
Deisopropylatrazine	Herbicide Degradate	150	
Desethylatrazine	Herbicide Degradate	50	
Hydroxyatrazine	Herbicide Degradate		6.7
Azoxystrobin	Fungicide		10
Benfluralin	Herbicide	25	
Bensulfuron-methyl	Herbicide		16.7
Bensulide	Herbicide		250
Bentazon	Herbicide		5
Benzovindiflupyr*	Fungicide		50
Bicyclopyrone*	Herbicide		10
Bicyclopyrone SYN503870*	Herbicide		100
Bifenthrin	Insecticide	20	
Boscalid	Fungicide		50
Bromacil	Herbicide		30
Bromoxynil	Herbicide		25
Carbaryl	Insecticide		25
Carbendazim	Fungicide Degradate		10

Common Name	Type	GC-MS/MS MRL (ng/L)	LC-MS/MS MRL (ng/L)
Carbofuran	Insecticide		13.3
Chlorantraniliprole	Insecticide		50
Chlorimuron-ethyl	Herbicide		20
Chlorothalonil	Fungicide	50	
Chlorpyrifos	Insecticide	40	
Chlorpyrifos Oxon	Insecticide Degradate		40
Clomazone	Herbicide	15	
Clopyralid	Herbicide		41.6
Clothianidin	Insecticide		25
Cyanazine	Herbicide		25
Cyantraniliprole	Insecticide		100
Cyfluthrin	Insecticide	100	
Diazinon	Insecticide	30	
Diazinon Oxon	Insecticide Degradate	75	
Dicamba	Herbicide		50
Dichlobenil	Herbicide	5	
Dichlorprop	Herbicide		50
Dichlorvos	Insecticide	15	
Dicrotophos	Insecticide		25
Difenoconazole	Fungicide		25
Dimethenamid	Herbicide	15	
Dimethenamid ESA	Herbicide Degradate		6.7
Dimethenamid OXA	Herbicide Degradate		10
Dimethoate	Insecticide	100	
Dinotefuran	Insecticide		25
Disulfoton	Insecticide	60	
Disulfoton Sulfone	Insecticide		20
Diuron	Herbicide		13.3
EPTC	Herbicide	10	
Esfenvalerate	Insecticide	150	
Ethalfluralin	Herbicide	50	
Ethofumesate	Herbicide	50	
Flufenacet OXA	Herbicide Degradate		8.3
Flumetsulam	Herbicide		50
Flupyradifurone*	Insecticide		10
Flutriafol	Fungicide		10
Fluxapyroxad**	Fungicide		10 (estimated)
Fonofos	Insecticide	15	

Common Name	Type	GC-MS/MS MRL (ng/L)	LC-MS/MS MRL (ng/L)
Glyphosate	Herbicide		3100
AMPA	Herbicide Degradate		5160
Halosulfuron-methyl	Herbicide		30
Hexazinone	Herbicide		10
Imazamethabenz-methyl	Herbicide		5
Imazamethabenz Acid	Herbicide Degradate		10
Imazamox	Herbicide		13.3
Imazapic	Herbicide		10
Imazapyr	Herbicide		8.3
Imazaquin	Herbicide		16.7
Imazethapyr	Herbicide		6.7
Imidacloprid	Insecticide		20
Isoxaflutole	Herbicide		40
Isoxaflutole DKN	Herbicide Degradate		50
lambda-Cyhalothrin	Insecticide	75	
Linuron	Herbicide		20
Malathion	Insecticide	50	
MCPA	Herbicide		5
MCPB	Herbicide		20
MCPP	Herbicide		50
Mesotrione	Herbicide		50
Metalaxyl	Fungicide		8.3
Methoxychlor	Insecticide	50	
Metolachlor	Herbicide	25	
Metolachlor ESA	Herbicide Degradate		10
Metolachlor OXA	Herbicide Degradate		10
Metribuzin	Herbicide	75	
Metribuzin DA	Herbicide Degradate	500 (estimated)	
Metribuzin DADK	Herbicide Degradate	500 (estimated)	
Metribuzin DK	Herbicide Degradate	500 (estimated)	
Metsulfuron-methyl	Herbicide		23.3
Myclobutanil	Fungicide		10
Nicosulfuron	Herbicide		26.6
Norflurazon	Herbicide		20
Norflurazon-desmethyl	Herbicide Degradate		50
Oxadiazon	Herbicide	75	
Oxydemeton-methyl	Insecticide		20
Parathion-methyl	Insecticide	100	

Common Name	Type	GC-MS/MS MRL (ng/L)	LC-MS/MS MRL (ng/L)
Parathion-methyl Oxon	Insecticide Degradate		25
Pendimethalin	Herbicide	75	
Phorate	Insecticide	25	
Picloram	Herbicide		41.6
Picoxystrobin	Fungicide		50
Prometon	Herbicide	100	
Prometryn	Herbicide		3.3
Propachlor	Herbicide	30	
Propachlor ESA	Herbicide Degradate		30
Propachlor OXA	Herbicide Degradate		10
Propazine	Herbicide	25	
Propiconazole	Fungicide		10
Pyraclostrobin	Fungicide		25
Pyroxasulfone	Herbicide		50
Saflufenacil	Herbicide		15
Sedaxane	Fungicide		75
Siduron	Herbicide		6.7
Simazine	Herbicide	75	
Sulfometuron-methyl	Herbicide		8.3
Tebuconazole	Fungicide		10
Tebuprimiphos	Fungicide	30	
Tembotrione	Herbicide		50
Terbufos	Insecticide	30	
Tetraconazole	Fungicide		10
Thiacloprid	Insecticide		50
Thiamethoxam	Insecticide		25
Thifensulfuron-methyl	Herbicide		16.7
Thiobencarb	Herbicide		8.3
Tolfenpyrad	Insecticide	100	
Triallate	Herbicide	50	
Triasulfuron	Herbicide		23.3
Triclopyr	Herbicide		50
Trifluralin	Herbicide	50	
zeta-Cypermethrin	Insecticide	500	

Nutrient target analyte list.

Compound	Method	MRL (mg/L)
Nitrate/Nitrite-Nitrogen	LAB-MTH-0041	0.40

Appendix B
Sampling Locations

Wells scheduled for sampling in PMRs 1, 5, 6, 7 and 8 during spring and fall 2016.

PMR	MDA#
1	26101
1	45006
1	57003
1	57005
1	57008
1	60201
1	84101
5	13101
5	13102
5	13103
5	30014
5	33102
5	33101
5	48101
5	48102
6	6101
6	12101
6	75002
6	76047
6	76045
6	76101
6	76102
6	76104
7	42101
7	51008
7	51101
7	59101
7	59102
7	67006
7	67102
8	8101
8	17007
8	17101
8	17102
8	24101
8	32101
8	46101
8	47101
8	64103
8	64016
8	65101
8	66101
8	83102
8	83103

Wells scheduled for sampling in PMR 4 during spring and fall 2016.

*= sites with deep wells

2nd quarter (spring 2016)	2nd quarter (spring 2016)	4th quarter (fall 2016)	4th quarter (fall 2016)
03-I2	56-J10*	03-J3	56-J10*
03-I3	56-K6	03-K4*	56-K5
03-K4*	61-F2	05-B2	61-F3
29-A8*	61-G2*	05-C3	61-F4
29-B8	61-G4	29-A7	61-F5
29-C7	61-H5	29-A8*	61-G2*
29-C8	61-H6	29-C9	61-G3
34-D2	73-A1	34-C1	61-G5
34-F2	73-A6*	34-D1	61-G6
49-D5	73-B6	34-E1	73-A6*
49-D9*	73-E3	34-E2	73-J7
49-F6	73-I6	49-D9*	73-L6
56-D6	73-J4	49-F7	73-L8
56-F1	73-J6	49-F8	73-M7
56-F2	73-K3	56-A1	80-A8
56-F3-3	73-K4	56-E1	80-B1*
56-F6	73-K7	56-E2	80-B7
56-F8	80-B1*	56-E3	80-C7
56-G3	80-B8	56-E7	80-C8
56-G4	80-D8	56-F4	80-D7
56-I10	80-E8*	56-F9	80-E8*
56-I9		56-I6	

Springs scheduled for sampling in PMR 9 during spring and fall 2016.

Spring Name	County	Schedule
Big BCVSP	Houston	June & September
Canfield	Wabasha	June & September
Cold South	Wabasha	June & September
Fountain E	Fillmore	June & September
Fountain W	Fillmore	June & September
Burr Oak	Fillmore	June & September
Rainy	Fillmore	June & September
Spring Creek	Goodhue	June & September
Hvoslef	Fillmore	June & September
Highway 76	Houston	June & September
Crystal Springs	Winona	Winter (February) & summer (August) quarters
Lanesboro	Fillmore	Winter (February) & summer (August) quarters
Peterson	Fillmore	Winter (February) & summer (August) quarters

Appendix C
Analysis Goals by PMR

2016 Analysis Goals by PMR.

Setting	PMR #	GC-MS/MS	LC-MS/MS	Nitrate-N	Glyphosate
Ag	1	14	14	14	14
Ag	2	0	0	0	0
Ag	3	0	0	0	0
Ag	4	102	102	102	102
Ag	5	16	16	16	16
Ag	6	16	16	16	16
Ag	7	14	14	14	14
Ag	8	28	28	28	28
Ag	9	38	38	38	38
Urban	Urban (multiple PMRs)	20	20	0	20
Total	**All**	**248**	**248**	**228**	**248**