Wisconsin Department of Agriculture, Trade and Consumer Protection
Agricultural Resource Management Division
Environmental Quality Unit

Targeted Sampling Summary Report, 2018

Background

Wisconsin's groundwater law, chapter 160, Wis. Stats., requires agencies to sample and monitor groundwater for substances related to facilities, activities and practices under their jurisdiction, that have a reasonable probability of entering the groundwater resources of the state, and to determine whether preventive action limits or enforcement standards have been exceeded at points of standards application. The statute further specifies that agencies develop monitoring plans that include provisions for conducting four types of monitoring: problem assessment, regulatory, at-risk and management practice monitoring (§160.27; §160.05).

Purpose of Targeted Sampling

It is estimated that agriculture contributes $88-billion annually to Wisconsin's economy. Growers use millions of pounds of pesticides, and millions of tons of fertilizers annually, to grow a wide variety of crops. DATCP's Targeted Sampling Program (TSAMP) is one method of monitoring the agency performs to meet its statutory obligation to protect groundwater. The agency utilizes a targeted approach to select drinking water wells that are at an elevated risk of being impacted by agricultural chemicals. The program tests private wells located within or near agricultural areas for pesticides and nitrate-nitrogen (nitrate).

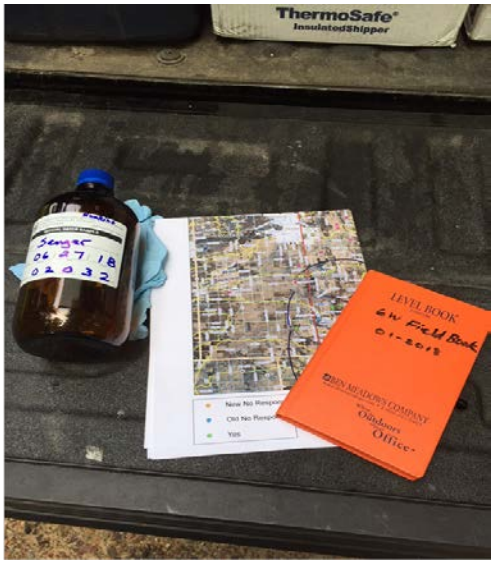
Program Approach and Selection Criteria

Many criteria are considered when selecting areas for TSAMP testing. Criteria are primarily based on geology, hydrogeology or environmental conditions, predominant crop types, and characteristics of the predominant pesticides used on crops within the study area. Criteria may vary from year to year. Criteria used for study area selection in the past are listed below.

- Areas that are susceptible to groundwater contamination (i.e. sandy soils with shallow groundwater, shallow depth to bedrock, or karst features).
- Areas where prior testing by others (county government, university, private owner, etc.) indicates elevated nitrate, pesticides or other unusual test results.
- Areas within or near an existing atrazine prohibition area (PA), or areas where other restrictions on pesticide use have been imposed over concerns of groundwater contamination.
- Areas with little variation in crop rotation (e.g. corn, cranberry, and ginseng grown year after year) increasing the likelihood of repetitive pesticide-use within the area.
- Areas where crops that require extensive chemical or fertilizer inputs and/or irrigation are grown.
- Areas where pesticides with characteristics of high mobility and resistance to degradation are used.

Program planning occurs early in the year with sampling occurring in summer. Planning starts with staff and management agreeing on a number of samples for the coming year. Generally, 50-percent of the wells sampled each year are new to the program, and the remaining wells are repeat samples from a prior year. Repeat testing usually occurs on wells sampled five or more years earlier. Permission to sample wells is typically obtained in advance, but staff may also go door-to-door requesting permission to collect samples within the study area. Using this approach, water quality observations can be made for an agricultural area, and trends in water quality can be observed over time for those same areas.

Another goal of the program is to select wells that have known well construction information. Well construction information such as well depth, casing depth, well age, geologic formation, or other construction characteristics can then be compared to water quality observations,. For example, in a given area, comparisons might be drawn between wells that are 80 to 100 feet deep, versus wells that are shallower. Likewise, wells that are cased to the bedrock surface may be compared to wells cased at greater depth into bedrock.



Samples are collected using standard protocols and hand delivered to the DATCP Bureau of Laboratory Services (BLS) for analysis of pesticides and nitrate. Testing is free of charge to homeowners and a copy of the analytical results are provided to homeowners within 10-days of receipt of the data from BLS.

2018 Program Specifics

During program planning for 2018, staff coordinated testing with BLS to analyze samples from 100 wells. Roughly half of the samples would come from wells in new areas (areas not sampled in prior years) and half would come from wells tested five years earlier. From June through August, staff collected a total of 101 samples from agricultural areas spanning 10 counties. Fifty-six samples were collected from wells that had been sampled in a prior year, while 45 were collected from wells sampled for the first time. Figure 1 shows private well locations sampled in 2018. Figure 2 shows all well locations sampled under the program since 2010. Table 1 lists the criteria used to select areas tested in 2018 and shows the number of samples collected from each area.

Analytical Testing and Groundwater Standards

BLS performed all groundwater analytical testing using GC/MS/MS and LC/MS/MS in accordance with ISO 17025 accreditation standards. All samples were tested for 100 pesticides and nitrate. The analytical parameter list is included in Appendix A along with established Preventive Action Limits (PALs) and Enforcement Standards (ESs) for each compound (ch. NR 140, Wis. Adm. Code).

Results

A total of 101 groundwater samples were collected from private drinking water wells as a part of the TSAMP effort in 2018. All well owners were mailed a copy of their test results upon receipt of the data from BLS. A summary of all detections of nitrate and pesticides is shown in Table 2.

Figure 1: 2018 TSAMP Well Locations

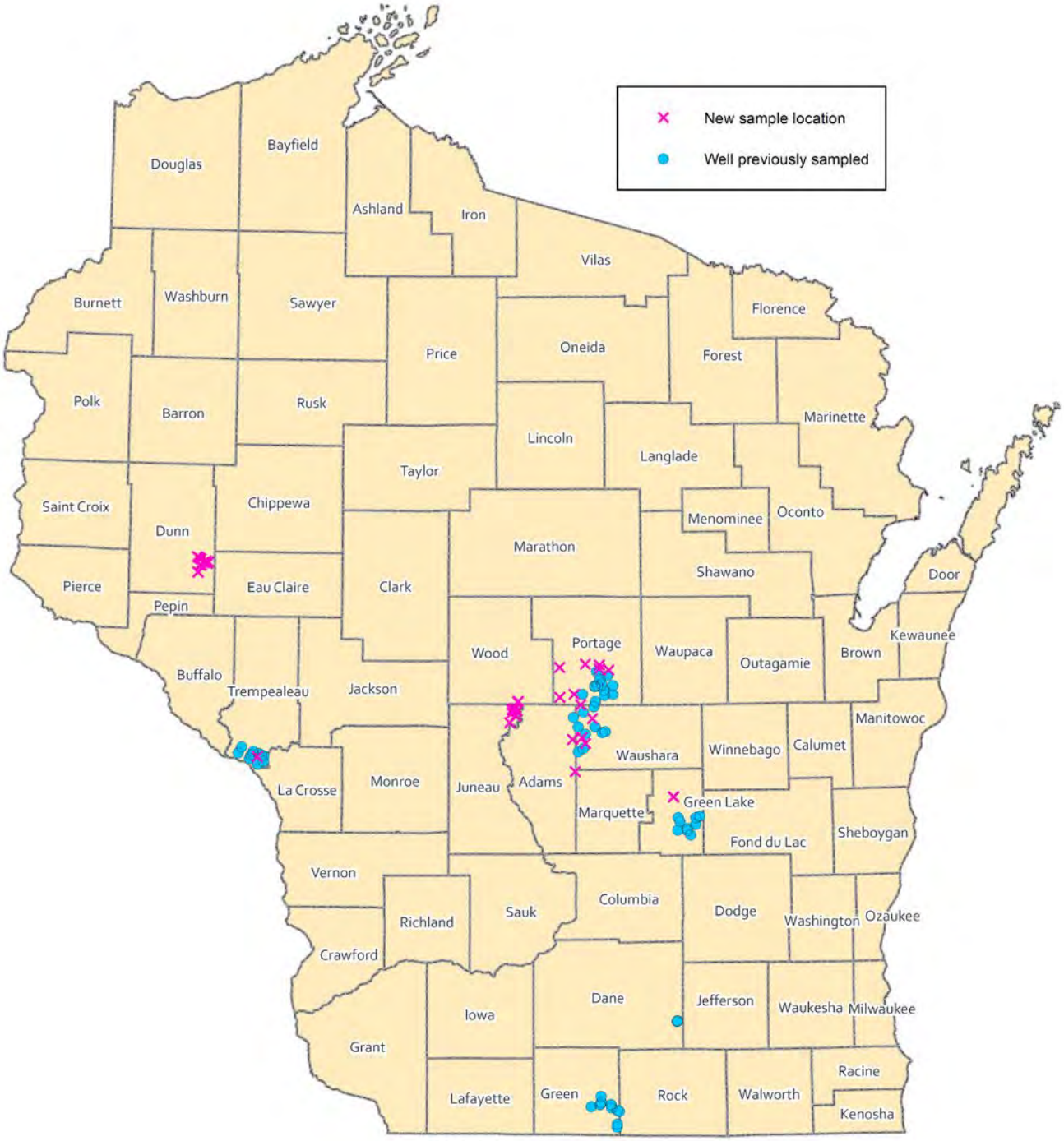


Figure 1 shows locations of 101 TSAMP wells tested in 2018. Forty-five wells (X) were newly sampled, while 56 wells (●) were initially sampled in 2013 and again in 2018.

Figure 2: TSAMP Well Locations since 2010

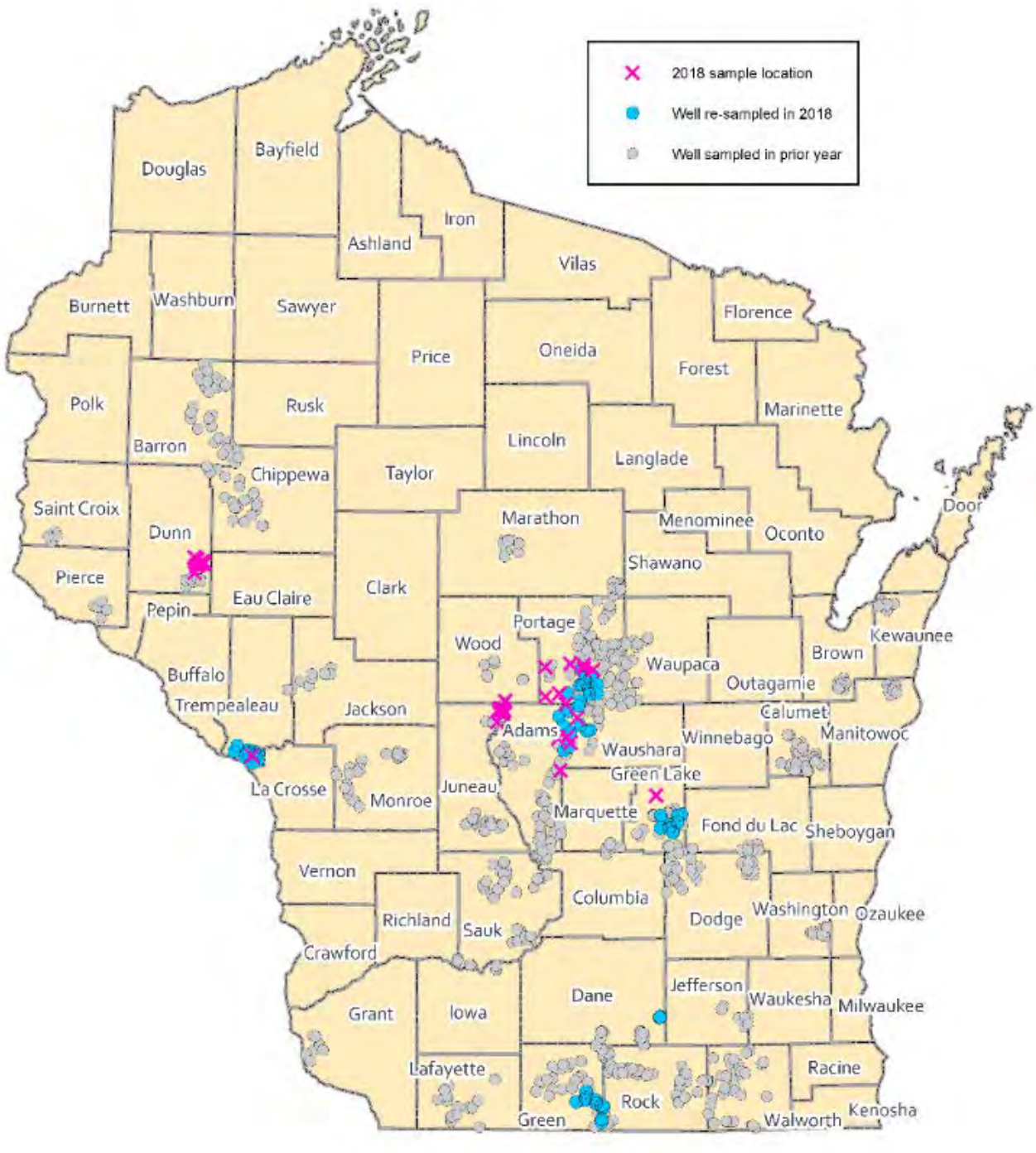


Figure 2 shows locations of wells sampled for the first time in 2018 (red X) and wells sampled a second time in 2018 after five years (●). Grey dots (●) show historic TSAMP locations from prior years dating back to 2010 and show where repeat sampling will occur in future years.

Table 1: TSAMP Criteria for 2018

Targeted Area	Counties	TSAMP Well Selection Summary and Study Area Conditions	Number of Samples
Coloma, Hancock, Plainfield, Almond, Bancroft, Plover	Adams, Portage, Waushara	13 new wells and 26 repeats from 2013. Sandy soils, repeated cropping patterns, vegetable crops, irrigation, shallow groundwater.	36
Nekoosa	Juneau, Wood	All new wells. Counties requested pesticide testing after EPA testing identified nitrate concentrations. Sandy soils, repeated cropping patterns, vegetable crops, irrigation, shallow groundwater.	15
Elk Mound	Dunn	All new wells. Sandy soils and shallow bedrock, repeat cropping patterns (vegetables/corn, beans) with irrigation.	13
Brodhead, Cambridge, Juda	Dane, Green and Rock	Repeats from 2013. Nearby PA, repeated cropping patterns (corn).	13
Green Lake, Markesan, Ripon	Green Lake	Three new wells and nine repeats from 2013. Shallow bedrock, susceptible to groundwater contamination, and repeated cropping patterns (corn).	12
Galesville, Trempealeau	Trempealeau	One new and 11 repeats from 2013. Sandy soils susceptible to groundwater contamination, repeated cropping patterns (corn) with irrigation.	12

Nitrate

In 2018, nitrate nitrogen was quantified above the detection limit in 91-percent of samples collected in agricultural areas. Nitrate exceeded the 10 mg/L ES in 79-percent of those wells sampled. This number contrasts sharply with results from the 2017 statewide random sampling survey, which estimated just 8-percent of wells exceeds the ES for nitrate statewide (Wisconsin DATCP, 2017).

Of the 56 wells sampled in both 2013 and 2018, nitrate (NO3-) was not detected in samples from just six wells in 2013. In 2018, five of those same six wells sampled remained non-detect for nitrate. The sample from the sixth well detected nitrate at 0.543 mg/l. All six of these wells are in either Green or Green Lake Counties. Table 3 provides a brief summary of changes in nitrate concentrations observed in wells sampled in 2013 and 2018.

Table 2: Summary of compounds detected in 101 samples in 2018, relative to PAL and ES

Compound Detected	Range Detected*	Detections			NR 140 PAL / ES
		Total	>=PAL	>=ES	
NITROGEN (NO3+NO2 as N)	0.543 – 52.2 mg/l	92	89	80	2 / 10 mg/l
ATRAZINE	0.0514 – 0.514 *	34	**	**	**
DE-ETHYL ATRAZINE	0.051 – 2.25	64	**	**	**
DEISOPROPYL ATRAZINE	0.495 – 0.0504	19	**	**	**
DIAMINO ATRAZINE	0.202 – 2.92	28	**	**	**
ATRAZINE (TOTAL)	0.051 – 6.179	64	34	1	0.3 / 3.0
ACETOCHLOR	ND	0	0	0	0.7 / 7
ACETOCHLOR ESA	0.055 – 2.31	21	***	***	***
ACETOCHLOR OA	0.553 – 0.692	2	0	0	46 / 230
ALACHLOR	ND	0	0	0	0.2 / 2
ALACHLOR ESA	0.0812 – 9.08	80	8	0	4 / 20
ALACHLOR OA	0.279 – 4.56	14			Not Established
BENTAZON	0.0524 – 6.64	17	0	0	60 / 300
CHLORANTRANILIPROLE	0.0653 - 0.778	17			Not Established
CLOPYRALID	0.161	1			Not Established
CLOTHIANIDIN	0.056 – 2.04	33			Not Established
DIMETHENAMID	0.0875	1	0	0	5 / 50****
DIMETHENAMID ESA	0.0571 – 1.47	16			Not Established
DIMETHENAMID OA	0.0517 – 1.21	8			Not Established
FLUMETSULAM	0.0502 – 0.237	5			Not Established
FOMESAFEN	0.0769 – 0.819	5			Not Established
HEXAZINONE	0.013 – 0.605	2			Not Established
IMIDACLOPRID	0.0556 – 2.19	33			Not Established
METALAXYL	0.0527 – 0.749	31			Not Established
METOLACHLOR	0.0601 – 5.61	27	0	0	10 / 100
METOLACHLOR ESA	0.053 – 20	88	*****	*****	*****
METOLACHLOR OA	0.28 – 18.3	53	0	0	260 / 1300
METRIBUZIN	0.086 - 0.0785	34	0	0	14 / 70
METRIBUZIN DA	0.106 – 0.871	24			Not Established
METRIBUZIN DADK	0.13 – 5.58	47			Not Established
NORFLURAZON	4.35	1			Not Established
SAFLUFENACIL	0.586	1			Not Established
SULFENTRAZONE	0.288	1			Not Established
THIAMETHOXAM	0.057 – 2.78	31			Not Established

* Units: Nitrate = mg/l (milligrams per liter, equivalent to parts per million) while pesticide = µg/l (micrograms per liter, equivalent to parts per billion)
** The NR 140 PAL and ES for the sum of parent atrazine and three breakdown products is 0.3 and 3 µg/l
*** The NR 140 PAL and ES for the sum of acetochlor ESA + OA is 46 and 230 µg/l
**** The NR 140 PAL and ES is listed for dimethenamid / dimethenamid-P
***** The NR 140 PAL and ES for the sum of metolachlor ESA + OA is 260 and 1,300 µg/l

Table 3: Number of samples showing an increase, no change, or a decrease in nitrate concentration

Observations for 56 wells sampled in 2013 and again in 2018		
Increasing	**No Change**	**Decreasing**
29 had a higher NO3- result 18 increased 2 mg/l or more 13 increased 5 mg/l or more 7 increased 10 mg/l or more	**Five did not change** …all were non-detect in both sample events	**22 had a lower NO3- result** 13 decreased 2 mg/l or more 8 decreased 5 mg/l or more 4 decreased 10 mg/l or more

More testing is needed before trend analyses can be performed on these 56 wells. The program intends to sample all wells again in 2024. Some observations have been identified in the pages and tables that follow.

A breakdown of nitrate occurrence data for samples collected in 2018 is provided below in Tables 4A through 4D, below. The data in each table is for a specific set of wells and presents the results relative to the NR 140 PAL (2 mg/l) and the NR 140 ES (10 mg/l). Table 4A provides nitrate occurrence data for all 101 wells sampled; Table 4B breaks out nitrate occurrence data for the 45 newly sampled wells; Table 4C provides a summary of results for the 56 wells sampled a second time in 2018; and Table 4D summarizes data for the same wells as Table 4C, except that 4D presents the results from five years earlier (2013).

Table 4A: 2018 Nitrate summary--all samples from all agricultural areas

Table 4A: Nitrate Occurrence Data for All 101 Wells Sampled in 2018			
12	wells sampled had from 0 to <=2 mg/L	12%	
3	wells sampled had from >2 to <=5 mg/L	3%	
6	wells sampled had from >5 to <=10 mg/L	6%	20.8% <= 10 ppm
31	wells sampled had from >10 to <= 20 mg/L	31%	
49	wells sampled had > 20 mg/L	49%	79.2% > 10 ppm

Table 4A shows that 12-percent of samples collected in 2018 detected nitrate at 2 mg/l nitrate or less, while an additional nine percent detected nitrate between two to 10 mg/l. Seventy-nine percent of samples (80) from wells tested within agricultural areas in 2018 exceeded 10 mg/l nitrate. Almost half of all wells tested in 2018 (49) exceeded 20 mg/l.

Table 4B (below) provides a summary of results for the 45 new samples collected in 2018, while Table 4C (also below) shows results for the 56 wells tested in 2018 and in 2013. Differences in the nitrate occurrence data can be seen between these data sets. Perhaps the most apparent difference is that the 45 new wells sampled in 2018 detected nitrate above 10 mg/l in 84-percent of the samples, while the 56 wells that were sampled a second time in 2018 detected nitrate above 10 mg/l in 75-percent of the samples (nine percent fewer wells exceeded 10 mg/l). Differences in soil types and agricultural practices near these wells are likely causes for differences in the occurrence of nitrate reflected in these data sets. As shown on Figure 1, a large number of the new wells sampled in 2018 (Table 4B) are located in Juneau, Adams, Portage and Waushara Counties and in Dunn County: areas having sandy

soil, extensive irrigation and crop rotations that include vegetables or other specialty crops. In contrast, many of the wells sampled a second time (Table 4C) are located in Green and Green Lake Counties: areas with (generally) greater variability in soil type, topography and groundwater depth. These localized differences in areas sampled are likely significant reasons for the differences in nitrate exceedance rates seen across Tables 4B and 4C.

Table 4B: 2018 Nitrate summary—45 results from newly sampled wells

Table 4B: Nitrate Occurrence Data for 45 Newly Sampled Wells in 2018			
5	wells sampled ranged from 0 to <=2 mg/L	11.11%	
2	wells sampled ranged from >2 to <=5 mg/L	4.44%	
0	wells sampled ranged from >5 to <=10 mg/L	0.00%	15.6% <= 10 ppm
9	wells sampled ranged from >10 to <= 20 mg/L	20.00%	
29	wells sampled exceeded 20 mg/L	64.44%	84.4% > 10 ppm

Table 4C: 2018 Nitrate summary—56 results from wells sampled a second time

Table 4C: Nitrate Occurrence in 56 Wells Sampled in 2013 and 2018			
7	wells sampled ranged from 0 to <=2 mg/L	12.50%	
1	wells sampled ranged from >2 to <=5 mg/L	1.79%	
6	wells sampled ranged from >5 to <=10 mg/L	10.71%	25% <= 10 ppm
22	wells sampled ranged from >10 to <= 20 mg/L	39.29%	
20	wells sampled exceeded 20 mg/L	35.71%	75% > 10 ppm

Tables 4C and 4D (below) compares nitrate occurrence data for 56 wells sampled twice, first in 2013 and again in 2018. The results suggest nitrate concentrations increased in those wells that had the greatest initial concentrations of nitrate in 2013. Important observations include the following:

1) The occurrence of nitrate below 2 mg/l remained the same (12.5-percent);
2) The occurrence of nitrate less than 10 mg/l decreased from 28.6 to 25-percent, and
3) The occurrence of nitrate exceeding 10 mg/l increased from 71.4 to 75-percent.

Tables 4C and 4D: Nitrate Occurrence Comparison—Results for 56 Wells in 2018 vs 2013

Table 4C: Nitrate Occurrence in 2018			
7	wells sampled ranged from 0 to <=2 mg/L	12.50%	
1	wells sampled ranged from >2 to <=5 mg/L	1.79%	
6	wells sampled ranged from >5 to <=10 mg/L	10.71%	25% <= 10 ppm
22	wells sampled ranged from >10 to <= 20 mg/L	39.29%	
20	wells sampled exceeded 20 mg/L	35.71%	75% > 10 ppm
Table 4D: Nitrate Occurrence in 2013			
7	wells sampled ranged from 0 to <=2 mg/L	12.50%	
5	wells sampled ranged from >2 to <=5 mg/L	8.93%	
4	wells sampled ranged from >5 to <=10 mg/L	7.14%	28.6% <= 10 ppm
23	wells sampled ranged from >10 to <= 20 mg/L	41.07%	
17	wells sampled exceeded 20 mg/L	30.36%	71.4% > 10 ppm

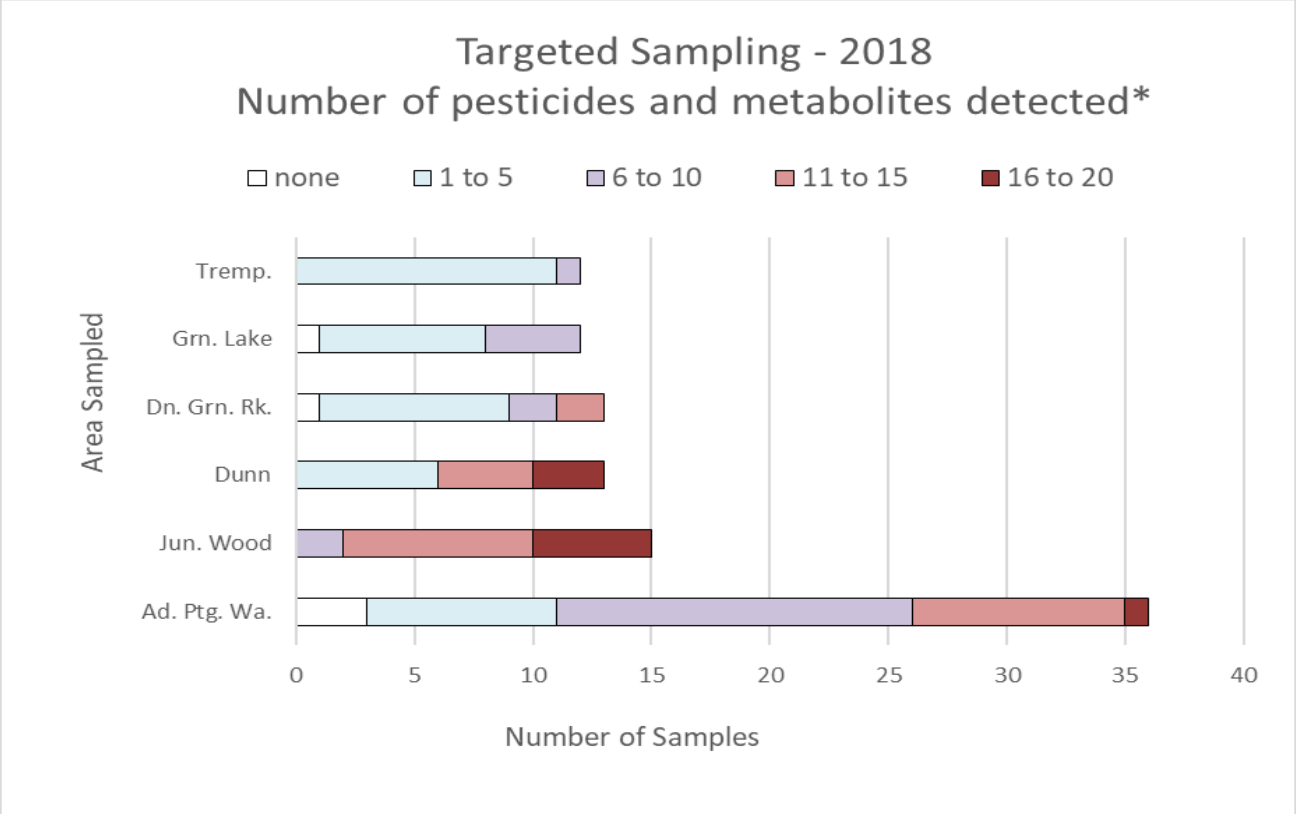
Pesticides

Detections: Table 2 (above) shows that a total of 30 different pesticide and pesticide metabolites were detected in one or more of the 101 wells sampled in 2018. The four most frequently detected compounds are metolachlor ESA (n=88); alachlor ESA (n=80); de-ethyl atrazine (n=64); and metolachlor OA (n=53); these compounds are metabolites of metolachlor, alachlor and atrazine. The four most frequently detected parent compounds include atrazine and metribuzin (each at n=34), followed by clothianidin and imidacloprid (each n=33), metalaxyl and thiamethoxam (each n=31); and metolachlor (n=27).

Standards Comparison: Total chlorinated residues of atrazine (atrazine TCR) includes the sum of atrazine plus its metabolites de-ethyl atrazine, deisopropyl atrazine, and diamino atrazine. Atrazine TCR exceeded its NR 140 ES in one well sample collected in Green Lake County. The ES exceedance (6.179 µg/l) was confirmed with a second test, and a groundwater investigation was initiated in November (DATCP Case 18727073120). It is anticipated that this investigation will be completed in 2019. PALs for atrazine TCR (0.2 µg/l) were exceeded in 34 samples, and for alachlor ESA (4 µg/l) in another eight samples. As Table 2 shows, many compounds detected have no NR 140 water quality standard established at this time.

Numbers of pesticides detected: Chart 1 shows the number of parent pesticide and pesticide metabolites (pesticides) that were detected in samples collected from each area in 2018. The chart shows that, in

Chart 1: Number of pesticides and pesticide metabolites detected in areas sampled in 2018



*Atrazine TCR was not counted in order to avoid duplication of metabolite counts for atrazine.

Trempealeau County, out of 12 samples collected, 11 had between one and five pesticides detected and one sample had six to 10 pesticides detected. In Juneau and Wood Counties, 15 samples were collected with two having detections of six to 10 pesticides, eight having detections of 11 to 15 pesticides, and five having detections of 16 to 20 pesticides.

The mixture of pesticide compounds is significant in many wells tested. Regardless, little can be said about the potential for health effects because many of the compounds detected do not have established drinking water standards. Further, studies do not generally include combinations of multiple pesticides and elevated nitrate like those identified here. With respect to the total number of pesticides detected per sample, the data from 2013 is not compared to the 2018 data because of analytical testing improvements made by BLS that allowed for a larger number of compounds to be detected in 2018 than in 2013.

Neonicotinoids: Interest in the neonicotinoid class of insecticides has increased greatly in recent years due to concerns over their potential to effect beneficial insects and pollinators. DATCP began testing for the neonicotinoid, thiamethoxam in 2008. Due to early detections of thiamethoxam, BLS expanded its capacity to test for neonicotinoids, and since about 2012, BLS analyzes for six compounds in the neonicotinoid class. Three compounds, clothianidin, imidacloprid and thiamethoxam (CIT) were detected in 2018 samples. The compounds acetamiprid, dinotefuran and thiacloprid were not detected in any samples. The detection of CIT is not unexpected, as these compounds are known to leach in sandy soils. They are also present in insecticide products that are labeled for use on most crops grown in the state including corn, soybeans, potatoes, many other vegetables, as well as fruit crops, and most small grains. CIT compounds have been detected in all DATCP water sampling programs.

One significant observation for the 2018 data is the *increased incidents of detection* for CIT compounds. Out of all 101 wells sampled in 2018, one or more neonicotinoid compounds were detected in 33-percent of samples. In some areas sampled, one or more CIT compounds were detected in 100-percent of wells sampled. This is in sharp contrast to just 5-percent of samples collected during 2017 TSAMP testing (n=107). The observed detection frequency increases greatly in sandy, irrigated agricultural areas where vegetable crops are grown in rotation with other crops like corn and soybeans. The greatest frequency of detection occurred in Juneau and Wood County wells (n=15), where 100-percent of samples tested positive for one or more neonicotinoids. Imidacloprid was present in all 15 samples, and all three CIT compounds were present in 93.3-percent of samples tested. For the Portage, Waushara, and Adams County wells sampled (n=36) the detection frequency of one or more CIT compounds was 50-percent. In Dunn County (n=13) the detection frequency was 38-percent.

Sandy soil also prevails in the Trempealeau County TSAMP area. However, of 12 Trempealeau County wells sampled, no neonicotinoids were detected. Fundamental differences between the Trempealeau area and the Central Sands and Dunn County areas appear to be less irrigation, greater depth to groundwater, and little to no vegetable crops. Corn, soybeans, small grains and forage crops were observed in Trempealeau during sampling. Neonicotinoid use on these crops is likely to occur in the form of seed treatments, but is less likely to include in-furrow and foliar treatments that are more common on vegetable crops.

Greater detail is provided in the Area Data Summaries below.

Area Data Summaries

1. Summary: Adams, Waushara and Portage Counties

Wells sampled in Adams, Portage and Waushara Counties lie within the Central Sands (CS) vegetable growing region. The CS is known for deep sandy soils with low organic matter content, abundant shallow groundwater and mostly level topography. Large agricultural fields and center-pivot irrigation dominate the landscape. Groundwater flow is generally southwest or westerly. Agricultural crops vary somewhat, but most cropping is dedicated to high-value vegetable crops for processing (potatoes, sweetcorn, carrots, snap beans, peas, etc.) with rotations to corn or other crops. Several large cranberry growing operations also exist in lowland areas. A total of 36 wells were sampled in this area in 2018, and 23 of the 36 were also sampled in 2013 (2013 data in shown in shaded rows).

Adams, Waushara and Portage County Results

WUWN	County	InstallationDate	WellDepth	CasingDepth	StaticWaterDepth	Description	Sample Date	ACETOCHLESA	ACETOCHLOA	ALACHLOR ESA	ALACHLOR OA	ATRAZINE	ATRAZINE TCR	BENTAZON	CHLRNTRA-N-PRL	CLOTHIANIDIN	DIMETH ESA	FLUMETSULAM	HEXAZINONE	IMIDACLOPRID	METALAXYL	METOLACHLOR	METOL ESA	METOL OA	METRIBUZIN	METRIB DA	METRIB DADK	NORFLURZN	THIAMETHOX	NITRATE
VR861	ADAMS						6/5/2018	0	0	0.304	0	0	0.594	0	0	0	0	0	0	0	0	0	0.615	0	0	0	0	0	0	33.1
VR862	ADAMS						6/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.58
XU972	ADAMS	Mar-16	85	81	38	Sand	6/5/2018	0	0	0.92	0	0.321	0.657	0.331	0	0	0	0	0	0.374	0.152	0	13.4	8.7	0.287	0.185	3.59	0	0	35.7
TW314	ADAMS	Oct-06	46	42	11	Sand	6/5/2018	0	0	0.842	0	0	0	0	0	0.155	0	0	0	0	0.17	0	11.6	8.2	0	0	0.3	0	0	21.5
TW314	ADAMS	Oct-06	46	42	11	Sand	6/10/2013	0	0	3.61	0.281	0	0			0				0		0	0.96	0.942	0				0	3.72
PX215	WAUSHARA						6/5/2018	0	0	0.0812	0	0	0.0596	0.196	0	0.513	0	0	0	0.269	0	0	9.98	2.31	0.25	0.118	1.15	0	0.428	25.9
PX215	WAUSHARA						5/14/2013	0	0	0	0	0	0			0				0		0	7.9	2.66	0.497				0	28.4
KU696	WAUSHARA	Feb-98	109	105	69	Sand	6/5/2018	0	0	9.08	2.13	0.141	0.556	0.165	0	0.423	0	0	0	1.14	0.37	0.312	12.6	9.38	0.944	0.248	3.29	0	0.584	46.3
KU696	WAUSHARA	Feb-98	109	105	69	Sand	5/14/2013	0	0	15.7	4.67	0	0			0				1.38		0	8.41	8.38	0.942				0.597	48.9
BN039	WAUSHARA		30				6/5/2018	0	0	0.111	0	0.127	0.895	0.0563	0.692	0.802	0	0	0	2.01	0.0795	5.61	20	18.3	0.93	0.26	1.27	0	0.45	26.6
BN039	WAUSHARA		30				5/14/2013	0	0	0.36	0.347	0.181	0.559			3.88				0.964		3.6	32.9	31.7	3.67				0.681	38.7
PX220	WAUSHARA						6/5/2018	0	0	0.751	0	0.0553	0.7023	0	0	0	0	0	0	0	0	0	0.207	0	0	0	0.36	0	0	17.1
PX220	WAUSHARA						6/10/2013	0	0	0.786	0	0	0.435			0				0		0	0	0	0				0	16.8
PX271	WAUSHARA		256	252	110		6/5/2018	0	0	0.663	0	0.152	1.408	0	0	0	0	0	0	0	0	0	0.482	0	0	0	0.36	0	0	12.5
PX271	WAUSHARA		256	252	110		6/10/2013	0	0	0.177	0	0	0.679			0				0		0	0	0	0				0	11.8
BN090	WAUSHARA		30				6/5/2018	0	0	2.27	0	0	0.493	0	0	0.358	0	0	0	0.0917	0.0587	0	10.5	5.49	0.938	0.21	1.5	0	0.069	27.4
BN090	WAUSHARA		30				5/14/2013	0	0	10.3	2.77	0	1.037			0.291				0		0	5.35	2.12	0.216				0	21.6
PX272	WAUSHARA						6/5/2018	0	0	0.133	0	0	0.192	0	0.074	0.71	0	0	0	0.101	0.0949	0	7.1	5.15	2.1	0.298	0.66	0	0.345	48
PX272	WAUSHARA						6/10/2013	0	0	0	0	0	0.317			0				0		0	7.31	3.01	0				0	20.9
PX275	WAUSHARA						6/19/2018	0	0	1.88	0.579	0.056	0.056	0	0.131	0.833	0	0	0	0.436	0.749	0.094	11.1	8.68	3.47	0.624	2.27	0	2.6	40
PX275	WAUSHARA						6/10/2013	0	0	2.7	1.83	0.261	0.635			0				1.53		0.272	6.41	5.76	4				0.334	6.76
PX274	WAUSHARA		34	31.2	15	Sand	6/19/2018	0	0	0	0	0	0	0	0	0	0	0	0	0.0556	0	0	1.34	0.532	0.0817	0	0.23	0	0.078	6.79
PX274	WAUSHARA		34	31.2	15	Sand	6/10/2013	0	0	0.381	0	0	0			0				0		0	0.318	0.131	0				0	3.93
VF730	WAUSHARA	Jul-10	82	79	55	Sand	6/5/2018	0	0	6.31	1.2	0.233	0.988	6.64	0	0	0	0	0	0.728	0.0901	0	2.46	1.3	0.165	0	1.01	0	0	22.8
VR860	WAUSHARA						6/19/2018	0	0	4.38	0.424	0.113	0.468	0	0	0.154	0	0	0	0.0827	0	0	5.03	1.83	0.342	0	1.02	0	0	15.6

(continued on next page)

Adams, Waushara and Portage Counties (page 2 of 3)

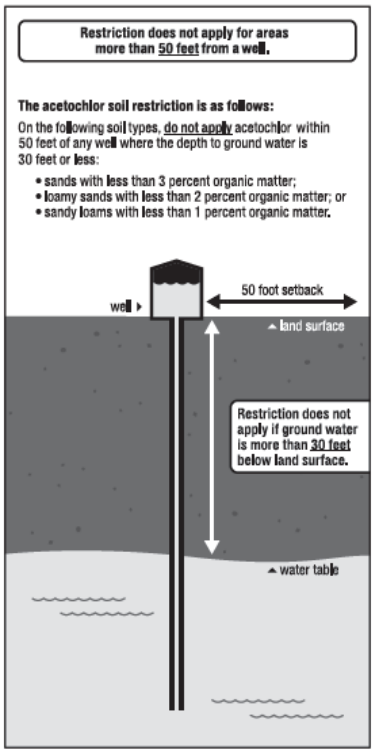
WUWN	County	Installation Date	Well Depth	Casing Depth	Static Water Depth	Description	Sample Date	ACETOCHLESA	ACETOCHLOA	ALACHLOR ESA	ALACHLOR OA	ATRAZINE	ATRAZINE TCR	BENTAZON	CHLRNTRA-N-PRL	CLOTHIANIDIN	DIMETH ESA	FLUMETSULAM	HEXAZINONE	IMIDACLOPRID	METALAXYL	METOLACHLOR	METOL ESA	METOL OA	METR BUZIN	METR BDA	METR BDADK	NORFLURZN	THIAMETHOX	NITRATE
PX681	PORTAGE						6/19/2018	0	0	0	0	0	0	0	0	0.888	0	0	0	0	0	0.145	12.3	6.35	3.63	0.429	1.47	0	0.167	28.1
PX681	PORTAGE						8/20/2013	0	0	0	0	0	0			0				0		0	2.09	0	0				0	14.9
TU100	PORTAGE	Jan-05	140	137	43	Sand	6/19/2018	0	0	3.23	0	0	0.44	0	0	0	0	0	0.6	0	0	0	0.747	0	0	0	0.46	0	0	17
TU100	PORTAGE	Jan-05	140	137	43	Sand	7/30/2013	0	0	0.654	0	0	0			0				0		0	0	0	0				0	11.1
BL745	PORTAGE				94		6/19/2018	0	0	1.7	0	0	0.075	0	0	0	0	0	0	0	0	0	5.5	2.07	0	0	0.31	0	0.057	12.6
BL745	PORTAGE				94		7/30/2013	0	0	1.7	0.305	0	0			0				0		0	2.36	0.545	0				0	13.3
GT316	PORTAGE	Jan-80	25		10	Sand	6/19/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	5.23
GT316	PORTAGE	Jan-80	25		10	Sand	8/20/2013	0	0	0.477	0	0	0			0				0		0	0.975	0.37	0				0	10.7
PX672	PORTAGE						6/19/2018	0	0	4.62	0	0.0607	0.5527	0	0	0	0	0	0	0	0	0	0.071	0	0	0	0	0	0	13.9
PX672	PORTAGE						7/30/2013	0	0	6.83	0	0	0.645			0				0		0	0	0	0				0	20.9
VA678	PORTAGE	Oct-09	81	77	49	Sand	6/19/2018	0	0	1.15	0	0	0.073	0	0	0	0	0	0	0	0	0	3.92	0.481	0	0	0.34	0	0	15.4
VA678	PORTAGE	Oct 09	81	77	49	Sand	8/23/2013	0	0	0.164	0	0	0			0				0		0	4.15	0.954	0				0	14.7
MM637	PORTAGE	Jul 99	75	70	40	Sand	6/19/2018	0	0	0.879	0	0.101	0.228	0	0	0	0	0	0	0	0	0	2.18	0.321	0	0	0.22	0	0	13.7
MM637	PORTAGE	Jul-99	75	70	40	Sand	8/23/2013	0	0	0.327	0	0	0			0				0		0	2.74	0.729	0				0	12.2
GS477	PORTAGE	Jan-89	138		90		6/19/2018	0	0	0.0953	0	0.0745	0.4725	0	0	0.144	0	0	0	0	0	0	3.46	0	0	0	0	0	0	15.3
GS477	PORTAGE	Jan-89	138		90		7/30/2013	0	0	0.865	0	0.207	0.763			0				0		0	2.34	0.64	0				0	25.5
ST873	PORTAGE	Apr-05	81	77	47	Sand	6/19/2018	0	0	0.437	0	0	0.092	0	0	2.04	0	0	0	0.194	0.144	0.122	14	7.5	0.304	0.111	1.57	0	0.676	36.8
ST873	PORTAGE	Apr-05	81	77	47	Sand	8/20/2013	0	0	1.92	0	0	0			0.273				0.336		0	5.75	3.78	0.179				0.807	31.7
PX669	PORTAGE						6/27/2018	0	0	7.74	4.56	0.0514	0.2474	0.139	0	0	0	0	0	0	0.578	0	0.317	0.28	0.426	0.426	5.58	0	0	33.1
PX669	PORTAGE						7/30/2013	0	0	1.23	0.836	0	0			0				0		0	0.717	0.716	0.353				0	26.3
PX670	PORTAGE						6/27/2018	1.25	0.69	1.35	0	0	0.136	0	0	0	0	0.1	0	0	0	0	10.4	6.43	0	0	0	0	0	52.2
PX670	PORTAGE						7/30/2013	0.99	0.76	2.78	0.359	0	0.307			0				0		0	0	0.325	0				0	45.7
GV207	PORTAGE				90		6/27/2018	0	0	1.85	0	0	0.215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16.7
GV207	PORTAGE				90		7/30/2013	0	0	3.4	0	0	0.344			0				0		0	0	0	0				0	14.3
PX668	PORTAGE						6/27/2018	0	0	0.213	0	0.0641	0.1851	0	0	0	0	0	0	0	0	0	6.63	2.09	0	0	0.27	0	0	21.3
PX668	PORTAGE						8/20/2013	0	0	0.596	0	0.158	0.158			0				0		0	2.98	1.52	0.0557				0	22.2
VR863	PORTAGE	Jun-72	53	49	18	Sand	6/27/2018	0	0	0.669	0	0	0.181	0	0	0	0	0	0	0	0	0	4.1	1.53	0	0	0.17	0	0	23.1
VR864	PORTAGE						6/27/2018	0	0	0.144	0	0	0.051	0	0.379	0.221	0	0	0	2.19	0.0527	0	19.2	10.1	0	0	0.21	0	0.409	23.9
VR865	PORTAGE						6/27/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VR866	PORTAGE		30			Sand	6/27/2018	0	0	0.495	0	0	0	0	0	0	0.1	0	0	0	0	0	1.07	0.405	0	0	0.41	0	0	0
VR867	PORTAGE	Feb-18	28		8	Sand	6/27/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MC070	PORTAGE	Apr-98	44	40	7	Sand	6/27/2018	0	0	2.37	0.288	0	0	0	0	0	0	0	0	0	0	0	1.43	0.68	0	0	0	4.35	0	0
DI773	PORTAGE	Jan-78	80	80	30	Sand	6/27/2018	0	0	0.46	0	0	0.157	0	0	0.092	0	0	0	0	0	0.116	15.3	9.25	0.091	0	0.47	0	0.141	33.5
XX074	PORTAGE	Jul-16	46	43	7	Sand	6/27/2018	0	0	1.34	0	0	0	0	0	0.102	0	0	0	0.267	0.161	0	11.7	5.84	0.0785	0	3.05	0	0.447	25.6

Notes: WUWN = Wisconsin Unique Well Number. Shaded rows are data for the same well as the unshaded row above, but from a prior date. Depths shown in feet. Pesticide results in micrograms per liter (µg/l). Nitrate data in milligrams per liter (mg/l). Where compound names are abbreviated, see Table 2 (page 6) for complete names. Zero (0) = tested, but not detected. Blank = not tested.

- Well depth is known for 30 wells and varied from 25 to 256 feet deep. All wells are likely to be screened in the underlying sand aquifer.
- Age of well does not correlate with contaminant presence.
- 78-percent of samples contained nitrate above 10 mg/l. Concentrations ranged from non-detect (5 wells) to 52.2 mg/l nitrate (at PX670). The average nitrate concentration for 2018 results is 21.2 mg/l.
- Wells screened at unknown depths (16) averaged 22.4 mg/l nitrate. Wells screened at a known depth of 35-feet or less (6) averaged 16.9 mg/l nitrate. Wells screened at a known depth greater than 35-feet (13) averaged 23.4 mg/l nitrate.
- 94-percent of samples collected in 2018 contained at least one pesticide or pesticide metabolite.

Adams, Waushara and Portage Counties (page 3 of 3)

- In 2018, a total of 19 pesticide or metabolites were detected.
- Metolachlor ESA was detected in 32 samples (89-percent).
- Detection frequencies for CIT are 39-percent for clothianidin, 36-percent for imidacloprid and 36-percent for thiamethoxam.
- It is clear that depth and location of shallow wells located within wooded/natural areas is an important factor in determining the potential for contamination. Portage County wells VR866 and VR867 showed minimal pesticide and no nitrate impacts. Each well is separated from the nearest agricultural field by natural and wooded areas (at least 0.25-mile). Both wells are shallow wells installed by their owners at depths of 30 and 28-feet deep, respectively. It is likely that these wells obtain water from the uppermost potion of the sand aquifer, and that recharge is from the nearby wooded areas.
- Of the 23 wells sampled in both 2018 and 2013 (shaded rows):
  - Nitrate fluctuated by 10 mg/l or more in six samples as follows: increased by 17.1 mg/l at PX272, increased by 17.8 mg/l at TW314, increased by 33.2 mg/l at PX275, and; increased by 13.2 mg/l PX681. Nitrate decreased by 12.1 mg/l at BN039 and by 10.2 mg/l at GS477.
  - Clothianidin was detected in three samples collected in 2013. In 2018, it was detected in samples from the same three wells, plus seven more.
  - Imidacloprid was detected in six samples collected in 2013. In 2018, it was detected at four of those same wells, plus four more.
  - Thiamethoxam was detected in four samples collected in 2013. In 2018, it was detected at three of those same wells, and at six more.
  - The PAL for Alachlor ESA was exceeded in four samples. Alachlor ESA and alachlor OA concentrations generally declined between 2013 and 2018. This is expected because alachlor use was systematically diminished over the past several years and is no longer labelled for use.
  - The corn herbicide acetochlor was detected at well PX670. The concentration increased between 2013 and 2018, but was still below the PAL. The label prevents acetochlor use within 50 feet of wells on certain soils when the depth to water is 30-feet or less (see graphic at right). The distance from PX670 to the nearest cropped field is more than 150 feet.
- Well PX670 had the highest concentration of nitrate detected at 52.2 mg/l, up from 45.7 mg/l in 2013.
- The compound norflurazon was detected in one sample at 4.35 ug/l. The sample was collected from a well (MC070) located near a very large cranberry operation. Norflurazon is the active ingredient in Evital 5G (EPA reg. 5481-506), a granular herbicide labeled exclusively for use on cranberries. The label contains language related to use in areas of shallow groundwater and limits use timing on cranberry bogs to help protect shallow groundwater. One other product containing norflurazon is registered, Solicam DF Herbicide (EPA reg. 61842-41). Solicam DF is NOT labeled for cranberries, but has numerous other agricultural uses including blueberries, barnyards and agricultural waterway maintenance.
- The insecticide chlorantraniliprole was present in one sample (VR864).



Acetochlor limitation: Degree Herbicide, EPA Reg. 524-496

2. Summary: Juneau and Wood Counties

The area sampled in Juneau and Wood Counties (outlined in blue on the photo to the right) is located south of Nekoosa (Wood County), and north of New Miner (Juneau County). In this area, numerous homes exist on a sandy terrace west of Petenwell Lake, a reservoir on the Wisconsin River. Agricultural fields dominate large areas west of these homes. Groundwater flows east or southeasterly, toward the Wisconsin River. The area has similar soil types, textures, and depth to groundwater, and supports agricultural crops and practices similar to those in the CS sample area east of the river (outlined in yellow).

Approximate sample areas in Juneau/Wood County are outlined in blue, and areas in Adams/Portage/Waushara are outlined in yellow.

Juneau (13) and Wood County (2) Results

WUWN	County	InstallationDate	WellDepth	CasingDepth	StaticWaterDepth	Description	Sample Date	ALACHLOR ESA	ALACHLOR OA	ATRAZINE	ATRAZINE TCR	BENTAZON	CHLRNTRA-N-PRL	CLOTHIANIDIN	DIMETH ESA	DIMETH OA	HEXAZINONE	IMIDACLOPRID	METALAXYL	METOLACHLOR	METOL ESA	METOL OA	METRIBUZIN	METRIB DA	METRIB DADK	THIAMETHOX	NITRATE
SZ549	JUNEAU	Jul-05	49	46	25	Sand	7/11/2018	1.5	0.287	0.178	0.267	0.106	0.778	0.313	0	0	0	1.65	0.124	0.214	16.6	14.3	3.36	0.404	1.5	2.44	52
UU105	JUNEAU	Sep-08	62	59	29	Sand	7/11/2018	1.24	0	0	0	0	0.0982	0.424	0	0	0	0.163	0.324	0.257	19.8	14.8	2.72	0.417	1.57	0.333	46.2
SI589	JUNEAU	Apr-06	57	53	29	Sand	7/11/2018	1.77	0.341	0.0806	0.1826	0	0.0865	0.371	0	0	0	0.134	0.371	0.266	14.9	10.6	2.31	0.364	1.5	0.202	45
NR728	JUNEAU	Nov-99	42	39	21	Sand	7/11/2018	2.69	0.585	0	0.1338	0.0543	0.0653	0.0908	0.22	0.05	0.13	0.365	0.378	0.362	10.8	7.76	2.3	0.367	1.49	0.618	28.5
SI175	JUNEAU	Jun-04	45	42	31	Sand	7/11/2018	0.769	0	0.0531	0.1136	0	0.129	0.16	0	0	0	0.419	0.0679	0.265	15.4	10.3	0.199	0	0.382	0.421	25.6
VR884	JUNEAU						7/11/2018	3.6	0.385	0.0657	0.2217	0	0.0733	0.0912	0	0	0	0.38	0.155	0.224	14	10.4	0.803	0.239	1.22	0.0579	27.6
VR883	JUNEAU						7/11/2018	0.896	0	0	0	0	0.107	0.125	0	0	0	0.465	0.14	0.108	15.9	11.4	0.452	0.117	0.627	0.441	31
VR882	JUNEAU		30				7/11/2018	0.929	0	0	0	0	0.111	0.122	0	0	0	0.446	0.134	0.101	14.2	10.2	0.476	0.107	0.591	0.585	27.9
SR544	JUNEAU	May-05	46	42	24	Sand	7/11/2018	0.806	0	0	0.0531	0	0.431	0.343	0	0	0	0.21	0.17	0.161	21.2	16.8	0.385	0.106	1.05	2.78	34.8
VR869	JUNEAU						7/11/2018	0.566	0	0.326	0.4969	0.151	0.236	0.156	0	0	0	0.602	0.209	0.119	14.8	11.8	0.926	0.106	0.666	1.64	25.7
VR881	JUNEAU						7/11/2018	1.19	0.32	0.0517	0.0517	0.138	0.105	0.056	0.07	0	0	0.802	0.43	0.217	15.4	16.3	1.98	0.372	1.28	0.55	44.2
VR880	JUNEAU						7/11/2018	1.3	0.316	0.174	0.2355	0.362	0.135	0.0831	0.08	0	0	0.831	0.179	0.748	16.1	15	0.456	0.871	2.2	0.79	39.5
VS427	JUNEAU						7/11/2018	2.1	0.601	0.347	0.463	0.134	0	0	0.17	0.09	0	0.81	0.13	1.12	12.3	10.9	3.2	0.542	1.53	0	36.8
UT743	WOOD	Sep-08	64	60	45	Sand	7/11/2018	0.155	0	0	0	0	0	0.142	0	0	0	0.226	0.154	0.123	4.4	2.94	0	0	0	0.151	15.3
VR868	WOOD		81		48		7/11/2018	0.356	0	0	0	0	0	0.209	0	0	0	0.426	0.214	0.229	10.4	7.36	0.128	0	0.195	0.0721	34.7

Notes: WUWN means Wisconsin Unique Well Number. Depths shown are in feet. Pesticide compound concentrations are in micrograms per liter (µg/l). Nitrate data is in milligrams per liter (mg/l). Where compound names are abbreviated, see Table 2 (page 6) for complete names. Zero (0) = not detected.

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Juneau and Wood Counties (page 2 of 2)

- A total of 15 new wells were sampled in this area in 2018.
- Well depth is known for 9 wells, and depths range from 30 to 81 feet. All of these wells draw from the underlying sand aquifer.
- Nitrate exceeded 10 mg/l in all 15 samples, ranging from 15.3 to 52 mg/l at well SZ549. The average nitrate concentration is 34.3 mg/l.
- All samples included detections of multiple pesticides and pesticide metabolites.
- Pesticide contaminants were very similar to those observed in the CS east of the river.
- 19 pesticides or pesticide metabolites were detected.
- The pesticide metabolite metolachlor ESA was detected at the greatest concentration, 21.2 µg/l at well SR544.
- Imidacloprid was detected in 100-percent of samples, while clothianidin and thiamethoxam were each detected in 93-percent of samples.
- The insecticide chlorantraniliprole was detected in 12 samples (80%): the same samples also had detections of three neonicotinoid insecticides clothianidin, imidacloprid and thiamethoxam.
- The fungicide metalaxyl was detected in 100-percent of samples.
- Age of well and well depth do not appear to correlate with contaminant presence.

3. Summary: Dunn County

The Dunn County sample area is an agricultural area in the Town of Springbrook. The area extends from CTH E to the north, and to the Chippewa River in the south. It is bordered by Elk Creek to the east and by Muddy Creek to the west. Groundwater flow is south towards the Chippewa River (WGNHS, 1988). Soils are sandy, and well records indicate a static water table at about 70 feet. Numerous fields are irrigated. Crops observed include bean crops and other specialty crops along with corn, forage and cover crops. Thirteen private wells were sampled in this area in 2018 (see inset at right).

Dunn County Results (13)

WUWN	County	InstallationDate	WellDepth	CasingDepth	StaticWaterDepth	Description	Sample Date	ACETOCHL ESA	ALACHLOR ESA	ALACHLOR OA	ATRAZINE	ATRAZINE TCR	BENTAZON	CHLRNTRA-N-PRL	CLOTHIANIDIN	DIMETH ESA	DIMETH OA	FOMESAFEN	IMIDACLOPRID	METALAXYL	METOLACHLOR	METOL ESA	METOL OA	METRIBUZIN	METRIB DA	METRIB DADK	SAFLUFENACIL	THIAMETHOX	NITRATE
OH513	DUNN	Oct-00	141	138	117	Sand & Gr	8/14/2018	0	0.722	0	0	0.1314	0.0867	0	0	0.61	0.244	0.602	0.0787	0	0.182	5.4	3.09	0.227	0	0.185	0.059	0.326	21.9
MG110	DUNN	Nov-01	150	150		Sand & Gr	8/14/2018	0.0914	0.644	0	0.099	0.7145	0	0	0	0.314	0	0	0	0	0.0633	1.43	0.355	0	0	0	0	0	23
AW042	DUNN	Aug-88	93	90	72	Sand & Gr	8/14/2018	0	0.95	0	0	0.642	0	0	0	0.203	0.0626	0	0	0	0	4.02	2.04	0	0	0.379	0	0	17.8
VR874	DUNN						8/14/2018	0	1.27	0.279	0	0.654	0.0524	0	0.079	1.38	0.858	0	0.0874	0.336	0	10.4	4.77	0.109	0	0.624	0	0	22.4
VR871	DUNN						8/14/2018	0	0.315	0	0	0.0856	0	0	0	0	0	0	0	0	0	1.04	0	0	0	0	0	0	14.1
VR875	DUNN						8/14/2018	0.164	0.31	0	0.053	0.1397	0.0956	0.117	0.198	0.96	0.369	0.077	0.128	0.0955	0.0601	4.82	2.48	0.0881	0	0.163	0	0.404	21
VR872	DUNN						8/14/2018	0.0593	0.647	0	0.146	0.2243	0.6	0	0.075	1.32	1.21	0.763	0.465	0.184	0.411	4.78	3.71	0.151	0.219	0.765	0	0.474	21.2
VR873	DUNN						8/14/2018	0.0579	0.444	0	0.065	0.1285	1.15	0	0	1.47	1.05	0.819	0.142	0.124	1.07	6.07	3.77	0.179	0.17	0.837	0	0.341	26.1
SB806	DUNN	May-04	102	99	84	Sand & Gr	8/14/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0909	0	0	0	0	0	0	3.31
YM771	DUNN	Jun-15	123	120	73	Sand & Gr	8/14/2018	0.0953	0.694	0	0	0.14	0	0	0	0	0	0	0	0	0	1.08	0.579	0	0	0	0	0	16.6
FD962	DUNN						8/14/2018	0.0793	0.121	0	0	0	0	0	0	0	0	0	0	0	0	0.314	0	0	0	0	0	0	0
VR870	DUNN						8/14/2018	0	0.213	0	0	0	0	0	0	0	0	0	0	0	0	0.344	0	0	0	0	0	0	10.2
VR889	DUNN						8/14/2018	0.0942	0.149	0	0	0	0	0	0	1.14	0	0	0	0	0	0.26	0	0	0	0	0	0	14

Notes: Notes: WUWN = Wisconsin Unique Well Number. Shaded rows are data for the same well as the unshaded row above, but from a prior date. Depths shown in feet. Pesticide results in micrograms per liter (µg/l). Nitrate data in milligrams per liter (mg/l). Where compound names are abbreviated, see Table 2 (page 6) for complete names. Zero (0) = tested, but not detected. Blank = not tested.

- Nitrate exceeded 10 mg/l in 11 of 13 samples (85%). Results ranged from not-detected to 26 mg/l, with an average of 16.3 mg/l.
- 21 pesticides or pesticide metabolites were detected, the most common compounds detected are metolachlor ESA and alachlor ESA.
- The highest concentration of metolachlor ESA was detected at well VR874 at 10.4 µg/l.
- The most frequently detected insecticides includes the neonicotinoids imidacloprid (n=5) followed by thiamethoxam (n=4) and clothianidin (n=3), and the compound chlorantraniliprole (n=1).
- One sample (VR875) contained all four insecticides (clothianidin, imidacloprid, thiamethoxam and chlorantraniliprole).
- The fungicide metalaxyl was detected in four of 13 samples (30.7%).

4. Summary: Dane, Green and Rock Counties

The Dane, Green and Rock County samples included testing of 13 private wells, all of which were first sampled in 2013. Results are shown below. The 2013 data is shaded in the row below the corresponding 2018 result. Nine private wells are from residences in Green County, three are in Dane, and one is just over the Rock County line (see inset at right). The three county area is in the glaciated area of southern Wisconsin, so topography, soils and groundwater depths vary. The primary reasons for sampling homes in this area is based on coarse soils in nearby fields and repeated cropping patterns for corn.

Results for Dane (3), Green (9) and Rock (1) Counties

WUWN	County	InstallationDate	WellDepth	BedrockDepth	CasingDepth	StaticWaterDepth	Description	Sample Date	ACETOCHL ESA	ACETOCHL OA	ALACHLOR ESA	ATRAZINE	ATRAZINE TCR	CLOPYRALID	CLOTHIANIDIN	DIMETH	DIMETH ESA	FLUMETSULAM	FOMESAFEN	METOL ESA	METOL OA	METRIB DADK	SULFENTRZNE	NITRATE
PX676	DANE							7/18/2018	0	0	0.321	0.152	0.9753	0	0	0	0	0.05	0	8.06	0	0	0	18.2
PX676	DANE							10/15/2013	0	0	0.465	0.208	0.8		0					10.9	1.1			36.9
PX675	DANE		145		47	45	Carbonate	7/18/2018	0.095	0	0.135	0.148	0.8224	0	0	0.088	0.076	0.099	0.373	6.88	0	0	0	17.4
PX675	DANE		145		47	45	Carbonate	10/15/2013	0	0	0.486	0	0		0					8.15	0.406			18.1
PX677	DANE							7/18/2018	1.06	0	0.262	0.073	0.971	0	0	0	0.065	0.108	0	12.3	1.73	0	0.288	47.4
PX677	DANE							10/15/2013	0	0	1.1	0	0.967		0					5.32	0.687			56.5
KB744	GREEN	Jul-97	240	25	115	48	Carbonate	7/18/2018	0	0	0	0	0	0	0	0	0	0	0	0.07	0	0	0	0
KB744	GREEN	Jul-97	240	25	115	48	Carbonate	7/2/2013	0	0	0	0	0		0					0	0			0
PX705	GREEN							7/18/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.9
PX705	GREEN							7/2/2013	0	0	0	0	0		0					0	0			17.1
PX703	GREEN							7/18/2018	0	0	0.254	0	0	0	0	0	0	0	0	0.487	0	0	0	1.38
PX703	GREEN							7/2/2013	0	0	0.15	0	0		0					0	0			1
FW322	GREEN	Nov-94	170	142	145	46	Carbonate	7/18/2018	0	0	0	0	0	0	0	0	0	0	0	0.067	0	0	0	1.35
FW322	GREEN	Nov-94	170	142	145	46	Carbonate	7/2/2013	0	0	0	0	0		0					0	0			1.26
PX704	GREEN							7/18/2018	0	0	0	0	0.0859	0	0	0	0	0	0	0	0	0	0	15.6
PX704	GREEN							7/2/2013	0	0	0	0	0		0					0	0			4.69
PX706	GREEN		188		107	25	Carbonate	7/18/2018	0	0	0.272	0	0	0	0	0	0	0	0	0.374	0	0	0	0
PX706	GREEN		188		107	25	Carbonate	7/2/2013	0	0	0	0	0		0					0	0			0
OK256	GREEN	Nov-01	54		50	19	Sand & Gr.	7/18/2018	0	0	0	0	0.052	0	0.146	0	0	0	0	8.97	3.96	0	0	15.5
OK256	GREEN	Nov-01	54		50	19	Sand & Gr.	6/19/2013	0	0	0.174	0	0		0					12.4	5.35			13.5
PX702	ROCK							7/18/2018	0	0	0	0	0.0898	0	0.359	0	0	0	0	30.1	14.7	0	0	33.7
PX702	ROCK							6/18/2013	0	0	0	0	0		0					13.9	5.75			16.9
PX279	GREEN							7/18/2018	2.31	0.553	0.836	0	0	0.161	0	0	0.131	0.237	0	7.24	0.956	0.13	0	10.4
PX279	GREEN							6/19/2013	0.21	0.151	0.425	0	0		0					3	0.332			2.09
PX278	GREEN							7/18/2018	0	0	0.122	0	0.5141	0	0	0	0	0	0	0	0	0	0	5.52
PX278	GREEN							6/19/2013	0	0	0.166	0	0		0					0	0			5.75

Notes: WUWN = Wisconsin Unique Well Number. Shaded rows are data for the same well as the unshaded row above, but from a prior date. Depths shown in feet. Pesticide results in micrograms per liter (µg/l). Nitrate data in milligrams per liter (mg/l). Where compound names are abbreviated, see Table 2 (page 6) for complete names. Zero (0) = tested, but not detected. Blank = not tested.

- Well construction information was available for five of 13 wells (38%).
- Nitrate exceeded 10 mg/l in 8 samples in 2018 (61.5%) and 6 samples in 2013 (46%).

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Dane, Green and Rock Counties (page 2 of 2)

- In 2018, nitrate concentrations ranged from non-detect to 47.4 mg/l (well PX677), with an average of 13.6 mg/l. In 2013, nitrate ranged from non-detect to 56.5 (well PX677) with an average of 13.4 mg/l.
- Nitrate was detected at concentrations below 2 mg/l was at four wells sampled in both 2013 and 2018.
- 15 pesticides or pesticide metabolites were detected in 2018 samples, the most common being metolachlor ESA and alachlor ESA; the highest pesticide concentration is metolachlor ESA, which was detected at 30.1 µg/l at PX702.
- The neonicotinoid, clothianidin was detected in two wells (15%) south of Brodhead (OK256 and PX702): this compound was not detected in either well in 2013.

Summary: Green Lake County

Most samples in Green Lake County were repeat samples of wells that were first sampled in 2013 (9 blue dots, right inset). Three additional new wells were sampled in 2018 (see X on inset). The three new wells (TP723, UO594 and VR885) were included due to a high test result for total chlorinated residues of atrazine (TCRAT) by homeowners through private testing. The results are shown below with the 2013 results shaded. Most samples were collected from an agricultural area south of Green Lake and north of Markesan. Shallow bedrock and sandy soils are common, and field crops include corn/soy rotations along with areas of continuous corn.

Green Lake County (14) Results

WUWN	County	InstallationDate	WellDepth	BedrockDepth	CasingDepth	StaticWaterDepth	Description	Sample Date	ACETOCHL ESA	ALACHLOR ESA	ATRAZINE	ATRAZINE TCR	METOLACHLOR	METOL ESA	METOL OA	NITRATE
PX710	GREEN LAKE							7/31/2018	0	0.418	0	0.255	0	1.17	0	7.24
PX710	GREEN LAKE							7/23/2013	0	0.618	0	0	0	0.51	0	10.3
PX707	GREEN LAKE							7/31/2018	0	0	0	0	0	0	0	0
PX707	GREEN LAKE							7/23/2013	0	0	0	0	0	0	0	0
CN224	GREEN LAKE	Oct-90	219	64	173	110	Sandstone	7/31/2018	0	0.632	0	0.4626	0	0.574	0	8.09
CN224	GREEN LAKE	Oct-90	219	64	173	110	Sandstone	7/23/2013	0	0.701	0	0	0	0	0	8.51
PX709	GREEN LAKE							7/31/2018	0	4.57	0.0781	1.7201	0	0.807	0	11.3
PX709	GREEN LAKE							7/23/2013	0	4.03	0	0	0	0	0	15.5
EL788	GREEN LAKE	Jan-92	244	25	62	104	Sandstone	7/31/2018	0	0	0	0	0	0	0	0
EL788	GREEN LAKE	Jan-92	244	25	62	104	Sandstone	7/16/2013	0	0	0	0	0	0	0	0
KW330	GREEN LAKE	Jun-96	168	19	83	71	Sandstone	7/31/2018	0	0.259	0	0.569	0	2.94	0	15.4
KW330	GREEN LAKE	Jun-96	168	19	83	71	Sandstone	7/16/2013	0	0.229	0	0	0	1.87	0.116	13.5
PX665	GREEN LAKE							7/31/2018	0	0.108	0	0	0	4.74	0	3.28
PX665	GREEN LAKE							7/16/2013	0	0.187	0	0	0	4.25	0	2.98
PX662	GREEN LAKE							7/31/2018	0	0.22	0	0.646	0	0.659	0	7.51
PX662	GREEN LAKE							7/16/2013	0	0.353	0	0	0	0	0	7.58
UG436	GREEN LAKE	Aug-07	353	17	103	130	Carbonate	7/31/2018	0	0.566	0	0	0	1.67	0	0.54
UG436	GREEN LAKE	Aug-07	353	17	103	130	Carbonate	7/16/2013	0	0.795	0	0	0	2.02	0.315	0
TP723	GREEN LAKE	Oct-03	104	13	61	42	Sandstone	7/31/2018	0.126	0.326	0.117	1.0254	0	4.75	0	14.5
UO594	GREEN LAKE	Jul-08	128	16	62	18	Sandstone	7/31/2018	0	4.58	0.514	6.179	0	3.03	0	26.3
VR885	GREEN LAKE							7/31/2018	0	0	0.0759	0.3349	0.438	2.42	0	12.6

Notes: WUWN = Wisconsin Unique Well Number. Shaded rows are data for the same well as the unshaded row above, but from a prior date. Depths shown in feet. Pesticide results in micrograms per liter (µg/l). Nitrate data in milligrams per liter (mg/l). Where compound names are abbreviated, see Table 2 (page 6) for complete names. Zero (0) = tested, but not detected. Blank = not tested.

- Well construction information was available for six of the 14 wells (43%). Where identified, sandstone or carbonate bedrock is reported at depths of 13 to 64 feet, and casing depths vary from 61 to 173 feet. Total well depths ranged from 104 to 353 feet deep.

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Green Lake County (page 2 of 2)

- Nitrate exceeded 10 mg/l in 5 of 13 samples collected in 2018 (36%). Little changed was observed from 2013 to 2018; the average nitrate concentration for both years is approximately 13 mg/l.
- Seven pesticides or pesticide metabolites were detected, and these compounds are corn herbicides.
- The pesticide metabolites metolachlor and alachlor were the most frequently detected.
- Atrazine TCR was detected at 6.179 µg/l at well UO594. This exceeds the 3 µg/l ES. Two neighboring wells (TP723 and VR885) had atrazine TCR detections below the standard.
- No insecticides or fungicides were detected.
- Age of well and well depth do not appear to correlate with contaminant presence.

5. Summary: Trempealeau County

The area sampled in Trempealeau County lies between Galesville to the northeast, and the Village of Trempealeau to the southwest. It is a large sandy terrace between the Mississippi River to the south and Hwy. 54 to the north. Soil is sandy and groundwater is about 70 feet deep. Many fields are large and irrigation is common. Field crops observed were mainly corn and soybeans, with other small grains and some forage crops.

Trempealeau County Results (12)

WUWN	County	InstallationDate	WellDepth	CasingDepth	StaticWaterDepth	Description	Sample Date	ACETOCHL ESA	ALACHLOR ESA	ATRAZINE	ATRAZINE TCR	METOL ESA	METOL OA	NITRATE
BM573	TREMPEALEAU						8/7/2018	0.102	0	0	0.483	0.168	0	19.6
BM573	TREMPEALEAU						8/22/2013	0.181	0	0	0.306	0	0	20.4
DT842	TREMPEALEAU	Aug-91	110	107	75	Sand & Gr	8/7/2018	0.224	1.01	0	0.0605	0.365	0	28.9
DT842	TREMPEALEAU	Aug-91	110	107	75	Sand & Gr	8/22/2013	0.446	2.16	0	0	0	0	28.4
EP316	TREMPEALEAU	Jun-93	109	104	77	Sand & Gr	8/7/2018	0.056	4.1	0	0.0736	1.89	0	18.1
EP316	TREMPEALEAU	Jun-93	109	104	77	Sand & Gr	10/9/2013	0	4.19	0	0	0.827	0	17.3
JF421	TREMPEALEAU						8/7/2018	0.139	0	0.13	1.383	0	0	21.7
JF421	TREMPEALEAU						10/9/2013	0	0	0	0.416	0	0	23.4
PX684	TREMPEALEAU						8/7/2018	0.119	0	0	0.5727	0	0	23.7
PX684	TREMPEALEAU						10/9/2013	0.198	0	0	0	0	0	19.5
PX685	TREMPEALEAU						8/7/2018	0.16	0	0	0.9	0.775	0	20.1
PX685	TREMPEALEAU						10/9/2013	0.388	0.217	0	0	1.48	0	17.6
QT270	TREMPEALEAU	Nov-02	87	84	39	Sand & Gr	8/7/2018	0	0.282	0	0.09	0.349	0	14.6
QT270	TREMPEALEAU	Nov-02	87	84	39	Sand & Gr	10/9/2013	0	0.582	0	0	0.882	0	15.1
RL040	TREMPEALEAU	Jun-04	90	86	70	Sand & Gr	8/7/2018	0.108	1.38	0	0	0.134	0	19
RL040	TREMPEALEAU	Jun-04	90	86	70	Sand & Gr	8/22/2013	0	1.63	0	0	0	0	18.7
RM838	TREMPEALEAU	Aug-03	91	87	70	Sand & Gr	8/7/2018	0.055	0	0	0	0	0	20.7
RM838	TREMPEALEAU	Aug-03	91	87	70	Sand & Gr	10/9/2013	0.227	0	0	0	0	0	44.7
SK852	TREMPEALEAU	Dec-04	103	100	73	Sand & Gr	8/7/2018	0	0.182	0	0	0	0	30
SK852	TREMPEALEAU	Dec-04	103	100	73	Sand & Gr	8/22/2013	0	0	0	0	0	0	17.6
TY365	TREMPEALEAU	Jun-07	108	104	67	Sand & Gr	8/7/2018	0	1.26	0	0.5474	0.127	0	13.8
TY365	TREMPEALEAU	Jun-07	108	104	67	Sand & Gr	8/22/2013	0	0.83	0	0	0.343	0	16.3
EP313	TREMPEALEAU	May-93	122	119	75	Sand & Gr	8/7/2018	0.224	0.874	0.27	1.548	3.22	0.312	21.8

Notes: WUWN = Wisconsin Unique Well Number. Shaded rows are data for the same well as the unshaded row above, but from a prior date. Depths shown in feet. Pesticide results in micrograms per liter (µg/l). Nitrate data in milligrams per liter (mg/l). Where compound names are abbreviated, see Table 2 (page 6) for complete names. Zero (0) = tested, but not detected. Blank = not tested.

- Well construction information was available for eight of 12 wells (67%).
- Known well depths are reported to vary from 87 to 122 feet, and draw from sand and gravel.
- In 2018, nitrate exceeded 10 mg/l in all 12 samples (100%). Nitrate ranged from 13.8 to 28.9 mg/l (well DT842), and averaged 21 mg/l.
- In 2013, nitrate also exceeded 10 mg/l in all 11 samples collected (100%). Nitrate ranged from 15.1 to 44.7 mg/l (well RM838), and averaged 21.7 mg/l.

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Trempealeau County (page 2 of 2)

- Six pesticides and pesticide metabolites were detected.
- In 2018, acetochlor ESA was the most frequently detected metabolite; it was detected in 9 of 12 samples (75%).
- The highest pesticide concentration detected is alachlor ESA (4.1 µg/l at well EP316).
- No insecticides or fungicides were detected.

Recommendations

- Repeat testing of all area wells in five years (2023) to evaluate trends in water quality.
- Continue to evaluate data for key pesticides in area wells, including the insecticides clothianidin, imidacloprid, thiamethoxam and chlorantranilaprole.
- Conduct a groundwater investigation for elevated atrazine in Green Lake County for exceedances at well UO594, and detections at two neighboring wells (TP723 and VR885) to evaluate atrazine use restrictions for this area.
- Share monitoring data and 2018 summary report with health departments and land conservation departments in the counties where sampling occurred.
- Share monitoring data and report findings with EPA and Groundwater Coordinating Council (GCC) member agencies.

Appendix A

2018 Sample Analytes and Applicable ESs and PALs (ch. NR 140, Wis. Adm. Code)

Analyte Description	PAL (µg/l)	ES (µg/l)
2,4,5-T		
2,4,5-TP	5	50
2,4-D	7	70
2,4-DB		
2,4-DP		
ACETAMIPRID		
ACETOCHLOR	0.7	7
ACETOCHLOR ESA	46	230
ACETOCHLOR OA	46	230
ACIFLUORFEN		
ALACHLOR	0.2	2
ALACHLOR ESA	4	20
ALACHLOR OA		
ALDICARB SULFONE		
ALDICARB SULFOXIDE		
AMINOPYRALID		
ATRAZINE	0.3	3
DE-ETHYL ATRAZINE	0.3	3
DEISOPROPYL ATRAZINE	0.3	3
DIAMINO ATRAZINE	0.3	3
ATRAZINE TCR	0.3	3
AZOXYSTROBIN		
BENFLURALIN		
BENTAZON	60	300
BICYCLOPYRONE		
BROMACIL		
CARBARYL	4	40
CARBOFURAN	8	40
CHLORAMBEN	30	150
CHLORANTRANILIPROLE		
CHLOROTHALONIL		
CHLORPYRIFOS	0.4	2
CHLORPYRIFOS OXYGEN ANALOG		
CLOMAZONE		
CLOPYRALID		
CLOTHIANIDIN		
CYCLANILIPROLE		
CYFLUTHRIN		
CYPERMETHRIN		
CYPROSULFAMIDE		
DACTHAL	14	70
DIAZINON		
DIAZINON OXYGEN ANALOG		
DICAMBA	60	300
DICHLOBENIL		
DIMETHENAMID	5	50
DIMETHENAMID ESA		
DIMETHENAMID OA		
DIMETHOATE	0.4	2
DINOTEFURAN		
DIURON		

Analyte Description	PAL (µg/l)	ES (µg/l)
EPTC	50	250
ESFENVALERATE		
ETHALFLURALIN		
ETHOFUMESATE		
FLUMETSULAM		
FLUPYRADIFURONE		
FLUROXYPYR		
FOMESAFEN		
HALOSULFURON METHYL		
HEXAZINONE		
IMAZAPYR		
IMAZETHAPYR		
IMIDACLOPRID		
ISOXAFLUTOLE		
ISOXAFLUTOLE RPA202248 (DKN)		
LAMBDA-CYHALOTHRIN		
LINURON		
MALATHION		
MCPA		
MCPB		
MCPP		
MESOTRIONE		
METALAXYL		
METHYL PARATHION		
METOLACHLOR	10	100
METOLACHLOR ESA	260	1300
METOLACHLOR OA	260	1300
METRIBUZIN	14	70
METRIBUZIN DA		
METRIBUZIN DADK		
METSULFURON-METHYL		
NICOSULFURON		
NORFLURAZON		
OXADIAZON		
PENDIMETHALIN		
PICLORAM	100	500
PROMETONE	20	100
PROMETRYN		
PROPICONAZOLE		
SAFLUFENACIL		
SIMAZINE	0.4	4
SULFENTRAZONE		
SULFOMETURON-METHYL		
TEBUPIRIMPHOS		
TEMBOTRIONE		
THIACLOPRID		
THIAMETHOXAM		
THIENCARBAZONE-METHYL		
TRICLOPYR		
TRIFLURALIN	0.75	7.5
NITROGEN-NITRATE/NITRITE (mg/l)	2	10