

## Cultivated Riparian Zone Estimates

### Overview

The Riparian Buffer Analysis is an effort to estimate the total area and miles where cultivated land is within a riparian zone along surface water features. It has been developed for Minnesota counties deemed to have an overall agricultural rate of more than 30%. The results are based on the USDA - National Agricultural Statistics Service's 2008 Cropland Data Layer (CDL), a 56 meter resolution raster layer of land uses and therefore results at larger scales will be subject to the coarseness of this data layer. Because of the resolution of the CDL, it is likely some existing non-cultivated buffers are not reflected in the results. Additionally, all buffers were derived from an overlay of vector streams, lakes and wetland data and the estimates reflect any under or over estimation of these features or misrepresentations of them.

Two iterations of the cultivated riparian zone estimates have been completed, each narrowing the focus of the surface waters being analyzed. The estimates are being provided for:

1. All Minnesota DNR 24k waters and National Wetland Inventory (NWI) open water wetlands
2. All Minnesota DNR Public Waters Inventory (PWI) watercourses and basins

### Methods

#### ***Surface Water Data Layer Selection – Vector Datatype***

Because of the two iterations of the analysis, there are two slightly varied vector data sources that represent the streams (*watercourses*) and the Lakes and Wetlands (*Basins*). The vector data sources for each iteration of the analysis are as follows:

1. All Minnesota DNR 24k waters and NWI open water wetlands (Tables 1 & 2)

Vector Data layers used in the analysis were:

- MN DNR 24K Rivers and Streams, including channelized streams and drainage ditches.
- MN DNR 24K Lakes
- U.S. Fish and Wildlife Service NWI

Vector data consideration for this analysis:

DNR 24K rivers and streams were filtered and only the following classes were used for the analysis: streams (perennial), streams (intermittent), streams (unknown), drainage ditch (perennial), drainage ditch (intermittent), drainage ditch (undifferentiated). All DNR 24K lakes were used. NWI data was filtered and only wetland types 3, 4 and 5 greater than 10 acres were used to represent open water wetlands. Other wetlands were not considered in the analysis.

2. All Minnesota DNR Public Waters Inventory (PWI) watercourses and basins (Tables 3 & 4)

Vector Data layer used in the analysis were:

- MN DNR PWI Watercourses
- MN DNR PWI Basins.

Vector data consideration for this analysis:

DNR PWI Watercourses contain natural watercourses and public ditch/altered natural watercourses as designated by the commissioner under Minnesota Statute 103G.201. All DNR PWI basins were used. This basin layer includes both lakes and wetlands.

### ***Land Use Data Layer Selection – Raster Datatype***

The land use used for these estimates was the USDA-NASS 2008 Cropland Data Layer (CDL). It was chosen because it is the most recent land use data available. The USDA Cropland Data Layer was classified using imagery taken by the Indian Remote Sensing satellite IRS-P6 (RESOURCESAT-1) using its Advanced Wide Field Sensor (AWiFS) which operates in three spectral bands in the Visible and Near Infrared Region (VNIR) and one band in Short Wave Infrared (SWIR). The AWiFS ground resolution is 56 meters squared. USGS Digital Elevation Models (DEM), USGS NLCD 2001 Imperviousness and Tree Canopy data sets, and MODIS 250 meter 16 days Normalized Difference Vegetation Index (NDVI) composites were utilized as ancillary inputs to the classification. The CDL is aggregated to a reduced number of standardized categories for display purposes with the emphasis being agricultural land cover.

In the process of determining what data to use, we considered the National Land Cover Database (NLCD) data because it is available at an improved 30 meter resolution but because its last update was 2001, the decision was to use more recent data.

### ***Riparian Zone Generation***

A 50 foot riparian zone was created for each surface water layer and subsequently merged into a single buffer layer. This was completed for each of the two iterations of this analysis. Counties with greater than 30% cultivated land were delineated from the Board of Water and Soil Resources Conservation Lands Summary<sup>1</sup>. The merged buffer was then clipped to only those counties that contain greater than 30% cultivated land. Total riparian buffer area was calculated from this layer.

To calculate linear miles of cropped riparian buffers, the 50 foot polygon buffer was converted to a line feature. Then, to remove the inside lines, the subsequent line feature was erased by the original water features themselves buffered to 25 feet. Total riparian miles were calculated using the resulting feature.

### ***Cropland Data Layer Preparations***

Because of the coarse resolution of the 2008 CDL raster layer, boundaries between water areas and land can be jagged and incorrectly classify land areas in the riparian zone as water, effectively underestimating the area cultivated when cropped pixels are adjacent to water pixels (Figure 1).

Therefore, we interpolated the CDL to better reflect the land use in the buffered areas. To do this, we began by stripping any CDL raster cells out that were classed as water or wetlands (Figure 2). Then we resampled the raster to 28m<sup>2</sup> to allow a moderate expansion of cell values in the newly opened space. The interpolation was accomplished by expanding cells adjacent to the areas that were once classified as water. This expansion was only implemented into empty areas of the raster and therefore classification of land use other than water was not altered (Figure 3).

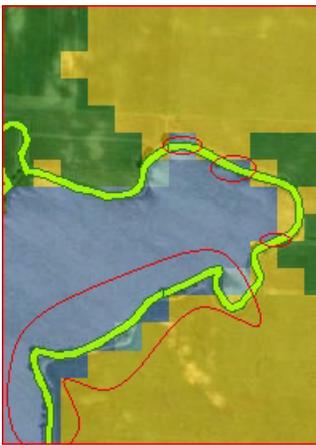


Figure 1.

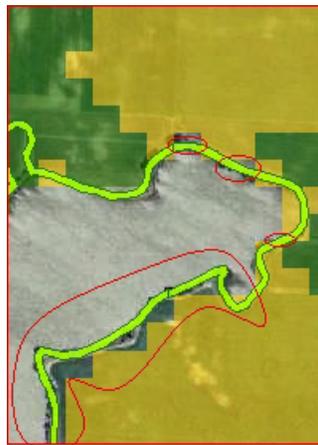


Figure 2.

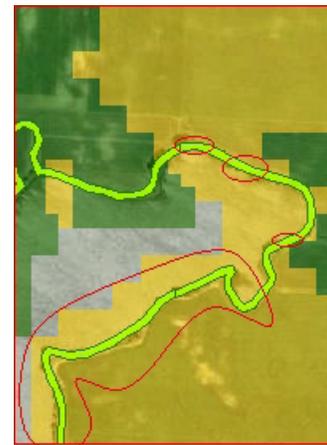


Figure 3.

The interpolated 2008 CDL raster layer was vectorized to better accommodate clipping. No generalization was applied in the vectorization.

***Riparian Zone / Interpolated CDL Intersect and Summary***

For each iteration, the CDL vector layer was clipped to the merged riparian zone area effectively creating a 50 foot riparian CDL layer. Also, the linear riparian layer was intersected with the CDL so the CDL classifications could be summarized for miles. All cultivated crop classes within the CDL except Christmas trees, clover/wildflowers, and apples were selected and total cultivated area was summarized for each county. For detailed information about the CDL, see the USDA cropland data layer metadata referenced at the end of this report.

As a general reference, Table 5 shows the acreage of Conservation Reserve Program (CRP)<sup>2</sup> parcels within the 50 foot riparian zone is included as well as total CRP acreages by county.

**Data Accuracy Considerations**

***Sources of Error***

The cropland land use data (CDL) is over three times the size of the 50 foot riparian zone being analyzed. This creates a significant possibility that actual land use in the riparian zone is misrepresented in the result. Because of the random nature of the CDL, there some balancing of the land use estimation, however, land use adjacent to the riparian zones is an influencing factor in the classification of the land use within the riparian zone. In general, it is not desirable to use datasets with differing scales, but given the lack of high resolution current statewide agricultural land use data, it was determined some basic large scale understanding was possible from doing this analysis.

Additionally, the data layers representing streams, lakes and wetlands can also create error if they do not precisely reflect surface waters on the ground.

Keep in mind that this analysis is designed to provide only an estimate of cultivated riparian area. Due to the coarse resolution of the CDL data, these results should not be interpreted as precise calculations. They are meant to be used for general planning purposes only and to approximate target acres for riparian easement programs.

***Comparison with Similar Studies***

Cannon River Watershed Partnership (CRWP) is currently working on a Shoreland Mapping Project (SMP) in ten southeastern Minnesota counties. This project is using aerial photography to manually delineate land use according to the Minnesota Land Cover Classification System(MLCCS) along watercourses with shoreland status. Because of the far higher accuracy, it makes good base data to compare with. At this time, four counties are complete and as a comparison, BWSR determined the acreage of cultivation within a 50 foot riparian zone for the same set of watercourses using both the CDL based cultivated acres and the CRWP cultivated acres. (Figure 4.)

Figure 4.

County	CDL Estimate (acres w/in 50ft)	CRWP SMP (acres w/in 50ft)
Goodhue	885	276
Mower	952	238
Rice	769	414
Winona	116	154

As evident in figure 4, in this small sample of counties, there is a significant over estimation in three of the counties. However, in Winona County, the CDL layer is underestimating cultivation relative to the manual determination of cultivation from the Shoreland Mapping Project. There are too many variables to fully understand what causes the CDL to classify higher or lower cultivated riparian estimates, but a comparison like this helps keep prospective on the level of emphasis to place on the estimates. In all instances where more precise efforts have been made to determine land use within a riparian zone, those numbers should be favored over the estimates of this analysis.

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**Disclaimer**

BWSR conducted this analysis using available public data layers, but does not assume responsibility for how the data is used or any products or conclusions derived from it by others.

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***Metadata links:***

- DNR 24K Rivers and Streams: [http://jmaps.dnr.state.mn.us/mdreporter/dp\\_brief\\_record.jsp?mpid=26000007&ptid=21&fcid=02](http://jmaps.dnr.state.mn.us/mdreporter/dp_brief_record.jsp?mpid=26000007&ptid=21&fcid=02)
- DNR 24K Lakes: [http://jmaps.dnr.state.mn.us/mdreporter/dp\\_brief\\_record.jsp?mpid=26000006&ptid=21&fcid=01](http://jmaps.dnr.state.mn.us/mdreporter/dp_brief_record.jsp?mpid=26000006&ptid=21&fcid=01)
- NWI: [http://jmaps.dnr.state.mn.us/mdreporter/dp\\_brief\\_record.jsp?mpid=26000016&ptid=21&fcid=01](http://jmaps.dnr.state.mn.us/mdreporter/dp_brief_record.jsp?mpid=26000016&ptid=21&fcid=01)
- PWI Watercourses: [http://jmaps.dnr.state.mn.us/mdreporter/dp\\_full\\_record.jsp?mpid=39000659&ptid=02&fcid=02&dsid=null](http://jmaps.dnr.state.mn.us/mdreporter/dp_full_record.jsp?mpid=39000659&ptid=02&fcid=02&dsid=null)
- PWI Basins: [http://jmaps.dnr.state.mn.us/mdreporter/dp\\_full\\_record.jsp?mpid=39000660&ptid=02&fcid=01&dsid=null](http://jmaps.dnr.state.mn.us/mdreporter/dp_full_record.jsp?mpid=39000660&ptid=02&fcid=01&dsid=null)
- USDA 2008 Cropland Data Layer: [http://www.nass.usda.gov/research/Cropland/metadata/metadata\\_mn08.htm](http://www.nass.usda.gov/research/Cropland/metadata/metadata_mn08.htm)

***Cited Web Resources:***

1. Conservation Lands Summary: <http://www.bwsr.state.mn.us/easements/COENROL.XLS>
2. Conservation Reserve Program: <http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp>
3. Cannon River Watershed Partnership Shoreland Mapping Project: <http://www.crowp.net/shorelandmap.html>

**Counties with More than 30% Cultivated Land**  
**Cultivated Acres within 50 Ft Riparian Zone Adjacent to Surface Waters**  
 Reporting Perennial & Intermittent Streams, Rivers, Lakes and Open Water Wetlands \*



**Table 1.**

County Name	Total Acres	Riparian and Cultivated Riparian Acres Adjacent to Surface Waters					
		All Surface Waters			Perennial Surface Waters		
		Riparian Acres	Cultivated Riparian Acres	Cultivated Percent	Riparian Acres	Cultivated Riparian Acres	Cultivated Percent
Becker	925,073	29,843	5,162	17%	23,604	1,733	7%
Benton	264,221	10,929	1,740	16%	6,030	679	11%
Big Stone	338,286	9,688	5,391	56%	5,338	2,406	45%
Blue Earth	489,731	12,763	4,860	38%	7,904	2,355	30%
Brown	395,607	11,274	5,882	52%	5,707	2,065	36%
Carver	240,450	9,473	1,849	20%	7,768	1,298	17%
Chippewa	376,406	11,234	6,858	61%	3,850	1,276	33%
Chisago	283,030	9,053	590	7%	5,433	127	2%
Clay	674,378	18,449	7,961	43%	8,730	2,343	27%
Cottonwood	415,044	13,922	8,009	58%	4,887	1,678	34%
Dakota	374,981	10,906	2,765	25%	6,015	520	9%
Dodge	281,164	10,538	5,739	54%	2,905	585	20%
Douglas	460,946	17,591	2,837	16%	14,085	1,684	12%
Faribault	461,631	9,505	5,353	56%	6,670	3,226	48%
Fillmore	551,460	23,194	4,172	18%	7,171	481	7%
Freeborn	461,960	10,221	5,426	53%	6,529	2,927	45%
Goodhue	499,093	19,953	5,583	28%	6,137	756	12%
Grant	368,568	10,945	5,002	46%	5,413	1,394	26%
Houston	363,942	17,529	1,077	6%	6,223	412	7%
Isanti	288,733	10,049	799	8%	8,208	554	7%
Jackson	460,267	11,309	6,076	54%	4,678	1,611	34%
Kandiyohi	551,880	19,169	7,094	37%	11,831	2,159	18%
Kittson	707,261	15,770	4,928	31%	6,201	1,068	17%
Lac Qui Parle	498,329	17,283	9,161	53%	7,266	2,373	33%
Le Sueur	303,022	10,960	3,571	33%	6,573	1,446	22%
Lincoln	351,298	13,594	5,345	39%	4,334	1,108	26%
Lyon	462,086	15,843	8,057	51%	5,812	2,222	38%
Mahnomen	373,535	14,151	4,262	30%	8,825	1,306	15%
Marshall	1,161,080	31,979	10,329	32%	10,507	1,694	16%
Martin	466,613	9,341	5,087	54%	6,007	2,525	42%
McLeod	323,361	9,892	4,461	45%	7,156	2,629	37%
Meeker	412,484	15,314	5,155	34%	11,349	2,777	24%
Morrison	737,783	28,714	1,780	6%	22,518	1,218	5%
Mower	455,010	15,595	8,703	56%	5,602	1,395	25%
Murray	460,673	14,341	6,751	47%	5,582	1,713	31%
Nicollet	298,537	8,399	4,495	54%	5,234	2,665	51%
Nobles	462,647	15,636	9,359	60%	3,881	1,320	34%
Norman	561,592	16,789	8,817	53%	4,915	1,535	31%
Olmsted	418,743	18,351	4,394	24%	5,308	466	9%
Otter Tail	1,423,970	43,263	4,474	10%	36,216	2,120	6%
Pennington	395,641	9,224	2,322	25%	3,104	590	19%
Pipestone	298,526	13,351	5,192	39%	3,155	478	15%
Polk	1,279,480	38,527	15,269	40%	14,731	3,254	22%
Pope	458,955	15,407	3,758	24%	11,632	1,894	16%
Red Lake	277,195	8,879	2,830	32%	3,727	578	16%
Redwood	564,194	13,424	8,238	61%	6,605	3,071	46%
Renville	631,739	13,860	8,415	61%	7,811	4,057	52%
Rice	329,914	12,439	3,445	28%	5,492	618	11%
Rock	309,155	13,133	7,234	55%	2,868	615	21%
Roseau	1,074,190	28,833	4,819	17%	10,419	607	6%
Scott	235,508	9,341	1,156	12%	6,807	582	9%
Sherburne	288,266	10,636	460	4%	9,607	385	4%
Sibley	384,139	11,677	7,045	60%	6,730	3,603	54%
Stearns	889,283	37,925	7,654	20%	26,617	3,104	12%
Steele	276,476	6,815	3,176	47%	3,174	904	28%
Stevens	368,359	11,031	6,738	61%	3,858	1,567	41%
Swift	481,455	13,857	7,066	51%	5,947	1,914	32%
Todd	626,774	26,037	1,506	6%	19,868	824	4%
Traverse	375,292	10,135	6,456	64%	2,478	1,251	50%
Wabasha	351,374	16,154	2,675	17%	4,630	279	6%
Wadena	347,609	13,162	183	1%	10,823	118	1%
Waseca	276,947	7,485	3,745	50%	3,586	1,094	31%
Watonwan	281,255	7,212	4,649	64%	3,616	1,701	47%
Wilkin	481,192	15,084	9,153	61%	3,617	1,505	42%
Winona	410,324	18,291	1,561	9%	6,097	184	3%
Wright	457,189	16,982	2,225	13%	14,250	1,600	11%
Yellow Medicine	488,667	16,853	8,848	53%	6,129	2,256	37%
<b>Counties with &gt; 30% Ag.</b>	<b>32,043,972</b>	<b>1,038,505</b>	<b>345,170</b>	<b>33%</b>	<b>535,781</b>	<b>102,482</b>	<b>19%</b>

\*Accuracy of Analysis Limited by 56 Meter Resolution Crop Data Layer and any inaccuracies of the 24k Lakes, 24k Streams and NWI Wetlands > than 10 Acres.

**Counties with More than 30% Cultivated Land**  
**Cultivated Miles within 50 Ft Riparian Zone Adjacent to Surface Waters**  
 Reporting Perennial & Intermittent Streams, Rivers, Lakes and Open Water Wetlands\*



**Table 2.**

County Name	Total Acres	Riparian and Riparian Cultivated Miles Adjacent to Surface Waters					
		All Surface Waters			Perennial Surface Waters		
		Riparian Miles	Cultivated Riparian Miles	Cultivated Percent	Riparian Miles	Cultivated Riparian Miles	Cultivated Percent
Becker	925,073	4,889	868	18%	3,874	302	8%
Benton	264,221	1,787	298	17%	998	124	12%
Big Stone	338,286	1,613	908	56%	904	416	46%
Blue Earth	489,731	2,089	811	39%	1,297	396	31%
Brown	395,607	1,849	981	53%	936	347	37%
Carver	240,450	1,546	312	20%	1,275	223	17%
Chippewa	376,406	1,839	1,136	62%	629	214	34%
Chisago	283,030	1,496	100	7%	904	23	3%
Clay	674,378	3,045	1,331	44%	1,454	404	28%
Cottonwood	415,044	2,276	1,328	58%	800	282	35%
Dakota	374,981	1,798	463	26%	1,001	93	9%
Dodge	281,164	1,726	955	55%	476	101	21%
Douglas	460,946	2,900	498	17%	2,336	306	13%
Faribault	461,631	1,559	891	57%	1,094	539	49%
Fillmore	551,460	3,821	707	18%	1,207	90	7%
Freeborn	461,960	1,680	904	54%	1,075	490	46%
Goodhue	499,093	3,257	934	29%	1,004	132	13%
Grant	368,568	1,800	841	47%	894	244	27%
Houston	363,942	2,885	181	6%	1,045	71	7%
Isanti	288,733	1,668	140	8%	1,373	99	7%
Jackson	460,267	1,845	1,013	55%	763	273	36%
Kandiyohi	551,880	3,144	1,185	38%	1,948	372	19%
Kittson	707,261	2,622	829	32%	1,055	183	17%
Lac Qui Parle	498,329	2,832	1,524	54%	1,200	403	34%
Le Sueur	303,022	1,782	600	34%	1,073	249	23%
Lincoln	351,298	2,229	895	40%	732	195	27%
Lyon	462,086	2,601	1,342	52%	966	377	39%
Mahnomen	373,535	2,320	715	31%	1,453	228	16%
Marshall	1,161,080	5,237	1,720	33%	1,725	289	17%
Martin	466,613	1,524	846	56%	979	423	43%
McLeod	323,361	1,620	749	46%	1,179	450	38%
Meeker	412,484	2,495	874	35%	1,860	484	26%
Morrison	737,783	4,685	314	7%	3,713	222	6%
Mower	455,010	2,552	1,450	57%	913	238	26%
Murray	460,673	2,339	1,129	48%	923	296	32%
Nicollet	298,537	1,375	745	54%	857	442	52%
Nobles	462,647	2,560	1,558	61%	644	228	35%
Norman	561,592	2,762	1,472	53%	813	262	32%
Olmsted	418,743	2,998	735	25%	870	81	9%
Otter Tail	1,423,970	7,131	777	11%	5,995	389	6%
Pennington	395,641	1,537	404	26%	533	107	20%
Pipestone	298,526	2,185	872	40%	531	87	16%
Polk	1,279,480	6,353	2,555	40%	2,454	560	23%
Pope	458,955	2,514	644	26%	1,902	335	18%
Red Lake	277,195	1,468	481	33%	622	105	17%
Redwood	564,194	2,211	1,368	62%	1,095	516	47%
Renville	631,739	2,275	1,399	61%	1,286	679	53%
Rice	329,914	2,026	577	28%	900	108	12%
Rock	309,155	2,152	1,207	56%	483	112	23%
Roseau	1,074,190	4,745	816	17%	1,734	109	6%
Scott	235,508	1,533	196	13%	1,123	101	9%
Sherburne	288,266	1,737	80	5%	1,574	68	4%
Sibley	384,139	1,913	1,168	61%	1,108	604	54%
Stearns	889,283	6,189	1,304	21%	4,368	553	13%
Steele	276,476	1,115	531	48%	519	153	30%
Stevens	368,359	1,813	1,123	62%	640	269	42%
Swift	481,455	2,276	1,180	52%	981	327	33%
Todd	626,774	4,249	270	6%	3,267	156	5%
Traverse	375,292	1,664	1,070	64%	410	212	52%
Wabasha	351,374	2,641	449	17%	761	51	7%
Wadena	347,609	2,125	33	2%	1,754	22	1%
Waseca	276,947	1,219	624	51%	584	187	32%
Watonwan	281,255	1,177	767	65%	590	283	48%
Wilkin	481,192	2,479	1,527	62%	596	256	43%
Winona	410,324	2,994	262	9%	1,009	34	3%
Wright	457,189	2,810	386	14%	2,378	283	12%
Yellow Medicine	488,667	2,761	1,474	53%	1,016	382	38%
<b>Counties with &gt; 30% Ag.</b>	<b>32,043,972</b>	<b>170,338</b>	<b>57,828</b>	<b>34%</b>	<b>88,455</b>	<b>17,638</b>	<b>20%</b>

\*Accuracy of Analysis Limited by 56 Meter Resolution Crop Data Layer and any inaccuracies of the 24k Lakes, 24k Streams and NWI Wetlands > than 10 Acres.

**Counties with More than 30% Cultivated Land**  
**Cultivated Acres within 50 Ft Riparian Zone Adjacent to All Public Waters**  
**Reporting Rivers, Streams, Lakes and Wetlands \***



**Table 3.**

County Name	Total Acres	Riparian and Cultivated Riparian Acres Adjacent to Public Surface Waters					
		All Public Surface Waters			Perennial Public Surface Waters		
		Riparian Acres	Cultivated Riparian Acres	Cultivated Percent	Riparian Acres	Cultivated Riparian Acres	Cultivated Percent
Becker	925,073	17,597	1,436	8%	16,407	1,154	7%
Benton	264,221	3,107	189	6%	2,235	86	4%
Big Stone	338,286	5,850	2,952	50%	4,098	1,811	44%
Blue Earth	489,731	8,510	2,801	33%	6,728	1,741	26%
Brown	395,607	5,397	1,891	35%	3,916	987	25%
Carver	240,450	5,432	765	14%	4,271	410	10%
Chippewa	376,406	5,474	2,894	53%	2,724	965	35%
Chisago	283,030	5,474	161	3%	4,273	61	1%
Clay	674,378	7,415	2,202	30%	5,592	1,480	26%
Cottonwood	415,044	6,698	2,746	41%	4,072	1,323	32%
Dakota	374,981	5,392	405	8%	4,156	166	4%
Dodge	281,164	3,066	685	22%	2,220	274	12%
Douglas	460,946	9,428	1,042	11%	8,194	854	10%
Faribault	461,631	7,072	3,637	51%	5,915	2,755	47%
Fillmore	551,460	10,946	748	7%	5,753	191	3%
Freeborn	461,960	4,087	1,810	44%	3,379	1,343	40%
Goodhue	499,093	7,876	933	12%	4,490	359	8%
Grant	368,568	6,005	1,786	30%	4,539	1,111	24%
Houston	363,942	7,988	384	5%	5,201	303	6%
Isanti	288,733	4,579	231	5%	4,282	204	5%
Jackson	460,267	6,466	3,097	48%	3,547	1,199	34%
Kandiyohi	551,880	7,777	1,507	19%	6,932	1,030	15%
Kittson	707,261	6,606	1,664	25%	3,726	442	12%
Lac Qui Parle	498,329	7,949	3,071	39%	5,150	1,586	31%
Le Sueur	303,022	5,715	1,199	21%	4,394	760	17%
Lincoln	351,298	6,635	1,729	26%	2,645	511	19%
Lyon	462,086	5,801	2,026	35%	3,932	1,265	32%
Mahnomen	373,535	7,881	1,309	17%	6,608	790	12%
Marshall	1,161,080	10,302	1,788	17%	9,058	1,242	14%
Martin	466,613	6,876	3,298	48%	5,157	2,107	41%
McLeod	323,361	4,735	1,531	32%	2,893	605	21%
Meeker	412,484	7,073	1,524	22%	6,271	1,184	19%
Morrison	737,783	8,672	219	3%	6,992	155	2%
Mower	455,010	5,247	1,060	20%	4,469	781	17%
Murray	460,673	7,456	2,496	33%	3,905	1,013	26%
Nicollet	298,537	3,159	921	29%	2,709	742	27%
Nobles	462,647	7,742	3,394	44%	2,849	850	30%
Norman	561,592	6,010	2,229	37%	3,637	1,103	30%
Olmsted	418,743	5,823	436	7%	4,121	287	7%
Otter Tail	1,423,970	24,732	1,716	7%	22,260	1,314	6%
Pennington	395,641	2,436	405	17%	1,815	243	13%
Pipestone	298,526	5,146	725	14%	2,190	251	11%
Polk	1,279,480	13,803	3,502	25%	10,516	2,102	20%
Pope	458,955	9,248	1,428	15%	8,235	1,110	13%
Red Lake	277,195	3,163	441	14%	2,559	264	10%
Redwood	564,194	7,052	3,522	50%	4,935	2,120	43%
Renville	631,739	5,362	2,369	44%	4,088	1,588	39%
Rice	329,914	5,186	941	18%	2,917	276	9%
Rock	309,155	4,759	1,344	28%	1,978	310	16%
Roseau	1,074,190	7,995	480	6%	6,241	256	4%
Scott	235,508	5,735	433	8%	4,709	199	4%
Sherburne	288,266	5,226	134	3%	5,046	132	3%
Sibley	384,139	4,285	1,963	46%	3,569	1,514	42%
Stearns	889,283	13,967	1,508	11%	11,620	836	7%
Steele	276,476	1,703	291	17%	1,634	279	17%
Stevens	368,359	5,021	2,298	46%	3,136	1,158	37%
Swift	481,455	5,632	2,011	36%	4,293	1,250	29%
Todd	626,774	8,947	222	2%	7,577	188	2%
Traverse	375,292	4,050	2,406	59%	1,504	760	51%
Wabasha	351,374	6,426	330	5%	3,901	169	4%
Wadena	347,609	4,179	25	1%	4,031	11	0%
Waseca	276,947	4,481	1,819	41%	2,517	669	27%
Watonwan	281,255	4,856	2,769	57%	3,074	1,366	44%
Wilkin	481,192	2,980	1,253	42%	2,402	1,018	42%
Winona	410,324	9,935	197	2%	5,553	111	2%
Wright	457,189	8,757	643	7%	7,832	477	6%
Yellow Medicine	488,667	9,316	3,917	42%	4,883	1,742	36%
<b>Counties with &gt; 30% Ag.</b>	<b>32,043,972</b>	<b>459,697</b>	<b>103,288</b>	<b>22%</b>	<b>336,452</b>	<b>56,941</b>	<b>17%</b>

\*Accuracy of Analysis Limited by 56 Meter Resolution Crop Data Layer and any inaccuracies of the Public Waters Inventory

**Counties with More than 30% Cultivated Land  
Cultivated Linear Miles within 50 Ft Riparian Zone Adjacent to All Public Waters  
Reporting Rivers, Streams, Lakes and Wetlands \***



**Table 4.**

County Name	Total Acres	Riparian and Cultivated Riparian Miles Adjacent to Public Surface Waters					
		All Public Surface Waters			Perennial Public Surface Waters		
		Riparian Miles	Cultivated Riparian Miles	Cultivated Percent	Riparian Miles	Cultivated Riparian Miles	Cultivated Percent
Becker	925,073	2,810	246	9%	2,628	199	8%
Benton	264,221	486	33	7%	350	15	4%
Big Stone	338,286	945	497	53%	666	308	46%
Blue Earth	489,731	1,338	466	35%	1,062	291	27%
Brown	395,607	856	316	37%	624	166	27%
Carver	240,450	864	129	15%	681	71	10%
Chippewa	376,406	870	480	55%	432	161	37%
Chisago	283,030	844	27	3%	657	11	2%
Clay	674,378	1,174	370	32%	887	250	28%
Cottonwood	415,044	1,049	455	43%	632	220	35%
Dakota	374,981	844	68	8%	649	29	4%
Dodge	281,164	480	116	24%	346	47	13%
Douglas	460,946	1,521	183	12%	1,331	151	11%
Faribault	461,631	1,132	606	54%	948	460	49%
Fillmore	551,460	1,677	127	8%	874	34	4%
Freeborn	461,960	654	302	46%	542	224	41%
Goodhue	499,093	1,220	158	13%	695	61	9%
Grant	368,568	973	304	31%	741	193	26%
Houston	363,942	1,220	64	5%	791	51	6%
Isanti	288,733	739	40	5%	694	36	5%
Jackson	460,267	1,022	517	51%	557	202	36%
Kandiyohi	551,880	1,247	257	21%	1,113	178	16%
Kittson	707,261	1,030	276	27%	580	72	12%
Lac Qui Parle	498,329	1,259	512	41%	819	266	32%
Le Sueur	303,022	880	203	23%	673	130	19%
Lincoln	351,298	1,048	290	28%	417	87	21%
Lyon	462,086	930	338	36%	633	212	33%
Mahnomen	373,535	1,268	219	17%	1,069	134	13%
Marshall	1,161,080	1,619	294	18%	1,424	204	14%
Martin	466,613	1,096	549	50%	827	353	43%
McLeod	323,361	759	259	34%	465	105	22%
Meeker	412,484	1,130	263	23%	1,005	206	21%
Morrison	737,783	1,370	38	3%	1,113	27	2%
Mower	455,010	814	180	22%	695	133	19%
Murray	460,673	1,181	418	35%	624	172	28%
Nicollet	298,537	499	154	31%	429	124	29%
Nobles	462,647	1,216	566	47%	448	143	32%
Norman	561,592	931	364	39%	554	177	32%
Olmsted	418,743	894	74	8%	636	48	8%
Otter Tail	1,423,970	3,982	302	8%	3,596	235	7%
Pennington	395,641	391	68	17%	293	41	14%
Pipestone	298,526	791	124	16%	344	43	12%
Polk	1,279,480	2,207	590	27%	1,690	356	21%
Pope	458,955	1,487	247	17%	1,330	194	15%
Red Lake	277,195	497	76	15%	403	46	11%
Redwood	564,194	1,128	585	52%	792	354	45%
Renville	631,739	851	394	46%	649	265	41%
Rice	329,914	821	158	19%	465	48	10%
Rock	309,155	736	226	31%	308	53	17%
Roseau	1,074,190	1,260	82	6%	987	43	4%
Scott	235,508	901	75	8%	739	36	5%
Sherburne	288,266	826	24	3%	800	24	3%
Sibley	384,139	686	328	48%	572	253	44%
Stearns	889,283	2,215	260	12%	1,851	148	8%
Steele	276,476	267	50	19%	257	47	18%
Stevens	368,359	808	385	48%	510	197	39%
Swift	481,455	900	338	38%	687	212	31%
Todd	626,774	1,422	40	3%	1,211	34	3%
Traverse	375,292	646	399	62%	241	127	52%
Wabasha	351,374	980	55	6%	590	28	5%
Wadena	347,609	653	4	1%	633	2	0%
Waseca	276,947	705	303	43%	401	114	29%
Watsonwan	281,255	771	456	59%	489	226	46%
Wilkin	481,192	458	207	45%	367	167	45%
Winona	410,324	1,491	33	2%	826	19	2%
Wright	457,189	1,416	114	8%	1,273	86	7%
Yellow Medicine	488,667	1,479	654	44%	781	291	37%
<b>Counties with &gt; 30% Ag.</b>	<b>32,043,972</b>	<b>72,667</b>	<b>17,337</b>	<b>24%</b>	<b>53,396</b>	<b>9,637</b>	<b>18%</b>

\*Accuracy of Analysis Limited by 56 Meter Resolution Crop Data Layer and any inaccuracies of the Public Waters Inventory

**Counties with More than 30% Cultivated Land**  
**CRP Acres within 50 Ft Riparian Zone Adjacent to Surface Waters and Public Waters**  
Reporting Rivers, Streams, Lakes and Wetlands

County Name	Total Acres	Total CRP Acres**	CRP Acres in 50 Ft. Riparian Zones*	
			All Surface Waters	Public Waters
Becker	925,073	13,664	373	165
Benton	264,221	2,254	335	228
Big Stone	338,286	6,786	300	169
Blue Earth	489,731	11,812	519	307
Brown	395,607	15,287	653	237
Carver	240,450	3,047	182	101
Chippewa	376,406	15,284	854	351
Chisago	283,030	731	14	9
Clay	674,378	36,695	581	210
Cottonwood	415,044	14,116	812	446
Dakota	374,981	2,952	221	84
Dodge	281,164	2,913	359	158
Douglas	460,946	17,847	511	174
Faribault	461,631	5,630	379	270
Fillmore	551,460	19,211	469	172
Freeborn	461,960	11,445	935	351
Goodhue	499,093	8,036	296	113
Grant	368,568	21,944	1,386	522
Houston	363,942	16,563	333	125
Isanti	288,733	664	19	7
Jackson	460,267	8,689	487	279
Kandiyohi	551,880	25,576	963	314
Kittson	707,261	96,299	1,317	268
Lac Qui Parle	498,329	32,356	1,619	555
Le Sueur	303,022	13,135	744	306
Lincoln	351,298	26,276	1,428	814
Lyon	462,086	15,445	646	225
Mahnomen	373,535	16,165	477	133
Marshall	1,161,080	134,600	3,191	179
Martin	466,613	6,575	331	229
McLeod	323,361	5,922	424	201
Meeker	412,484	17,025	738	284
Morrison	737,783	6,034	382	154
Mower	455,010	5,168	692	185
Murray	460,673	21,285	1,241	737
Nicollet	298,537	4,751	255	77
Nobles	462,647	7,982	1,010	671
Norman	561,592	31,226	1,031	292
Olmsted	418,743	8,843	190	31
Otter Tail	1,423,970	74,163	1,262	471
Pennington	395,641	62,146	1,175	85
Pipestone	298,526	9,646	571	193
Polk	1,279,480	135,997	2,373	411
Pope	458,955	38,532	996	540
Red Lake	277,195	41,588	929	54
Redwood	564,194	16,719	992	559
Renville	631,739	12,574	614	171
Rice	329,914	13,039	478	150
Rock	309,155	2,151	313	140
Roseau	1,074,190	128,572	2,962	267
Scott	235,508	2,753	145	64
Sherburne	288,266	1,494	55	27
Sibley	384,139	4,485	351	115
Stearns	889,283	31,838	1,353	416
Steele	276,476	10,923	409	55
Stevens	368,359	12,477	776	262
Swift	481,455	35,042	1,241	284
Todd	626,774	14,790	350	56
Traverse	375,292	14,045	1,502	714
Wabasha	351,374	8,132	144	20
Wadena	347,609	3,237	175	50
Waseca	276,947	7,531	568	339
Watonwan	281,255	6,190	350	226
Wilkin	481,192	15,949	711	98
Winona	410,324	9,284	217	141
Wright	457,189	6,331	159	74
Yellow Medicine	488,667	22,406	1,607	893
<b>Counties with &gt; 30% Ag.</b>	<b>32,043,972</b>	<b>1,452,268</b>	<b>49,470</b>	<b>17,006</b>

\*Accuracy Limited by any inaccuracies of the DNR 24K Surface Waters and Public Waters Inventory.

\*\*2007 CRP