

Sand and gravel aquifers (glaciated regions)  
Glacial Surficial Sand and/or Gravel

Douglas County, MN

LOCATION.--Lat 45°59'27.43", long 95°12'24.64" referenced to North American Datum of 1983, in NW ¼ NW ¼ NW ¼ sec.15, T.129 N., R.36 W., Douglas County, MN, Hydrologic Unit 07010108, 11.5 miles NNW of Osakis, Minnesota, 1.1 mile east of Belle River, Minnesota. Located just south of ditch on the west end of shrub line, on the NW corner of barn.

### GROUNDWATER RECORDS

WELL CHARACTERISTICS.--Depth 20 ft. Upper casing diameter 2 in; top of first opening 10 ft, bottom of last opening 20 ft. The hole for well WLN03 was drilled with an 8.25-inch-diameter power auger on Nov. 4, 2004 to a depth of 20 feet. The well is constructed of a 10-foot-long, 2.04-inch-diameter, schedule-40 PVC, 0.010-inch slotted, flush-threaded screen attached to about 11 feet of 2.04-inch-diameter, schedule-40 PVC casing. This casing stick-up was 1.33 feet above land surface on Feb. 11, 2005.

DATUM.--Land-surface datum is 1,347.56 ft above North American Vertical Datum of 1988. Measuring point: MP is top of casing, not protection post., 1.33 ft above land-surface datum, Nov. 04, 2004, to present. Water levels are in depth below land surface and feet above sea level. Water levels are accurate to within 0.01 feet below land surface. Water-level elevations are accurate to plus-or-minus 0.03 feet, based on the elevation of the land surface from a differential GPS survey. Water-level differences are accurate to plus-or-minus 0.001 feet.

PERIOD OF RECORD.--Water level at nearby DNR ob. well #21001 (0.1 miles WSW) were measured manually with a steel or calibrated electric tape, about monthly from Apr. 1972 through Sep. 2005. Water levels were recorded hourly during Nov. 30, 2004 at 21:00 CST to the present, except during the following periods:

Feb. 10, 2005 at 22:00 CST - Feb. 11, 2005 at 07:00 CST: due poor telemetry, lost data.  
Feb. 13, 2005 at 20:00 CST - Feb. 14, 2005 at 19:00 CST: due to poor telemetry, lost data.  
Apr. 19, 2010 at 16:00 CDT - Apr. 20, 2010 at 11:00 CDT: due to poor telemetry, lost data.  
Intermittent gaps: May 06, 2010 at 12:00 - May 26, 2010 at 23:00: poor telemetry, lost data.  
Intermittent gaps: Jul. 22, 2010 at 12:00 - Aug. 05, 2010 at 15:00: poor cell telemetry.  
Oct. 08, 2010 at 12:00 CDT - Nov. 03, 2010 at 08:00 CDT: due to station failure after visit.  
Dec. 08, 2010 at 16:00 CST - Dec. 10, 2010 at 23:00 CST: due to poor telemetry, lost data.  
Feb. 06, 2011 at 00:00 CST - Feb. 10, 2011 at 19:00 CST: due to poor telemetry, lost data.  
Mar. 26, 2011 at 04:00 CDT - Mar. 28, 2011 at 07:00 CDT: due to poor telemetry, lost data.

GAGE.--Water level and water temperature were measured with a KPSI 500 submersible pressure transducer accurate to 0.01 feet and 0.1°C respectively. The pressure transducer was replaced with a Design Analysis H-310 submersible pressure transducer of equal accuracy on Oct. 25, 2006. The data logger was changed to a Campbell Scientific, Inc. CR206 and cell phone telemetry via an AirLink Comm., Inc. Raven EDGE E3214 modem was added on Jun. 17, 2009 at 19:00 CDT. The data logger was changed to a Campbell Scientific, Inc. CR10PB on Aug. 17, 2009 to allow radio communications with site WLN03-1. The data logger is housed in a shelter attached to the well casing, is solar powered, and data are telemetered by a cell phone modem.

An unheated Texas Electronics, Inc. TR-5251 tipping-bucket rain gage was added to the station on Jun. 21, 2007 at 21:00 CDT which measures and records precipitation total hourly.

COOPERATION.--The gage at well WLN03 is operated as part of the U.S. Geological Survey's Collection-of-Basic-Record program. These data are provided to the Minnesota Department of Natural Resources for their Observation Well Network.

REMARKS.--Measured groundwater levels are precise to two decimal places, not the 3 decimal places reported. Differences between subsequent groundwater levels are precise to 3 decimal places, however. Three-decimal place precision is useful at this site for hydrologic analyses such as estimation of groundwater recharge and evapotranspiration.

EXTREMES FOR PERIOD OF RECORD.--Highest hourly water level: 4.487 feet below land surface datum (1343.072 feet NAVD88) on Jun. 03, 2011 at 06:00 CDT; lowest hourly water level: 8.278 feet below land surface datum (1338.412 feet NAVD88) on Mar. 05, 2007 at 02:00 CST.

Highest daily-average water level: 4.510 feet below land surface datum (1343.049 feet NAVD88) on Jun. 02 & 03, 2010; lowest daily-average water level: 8.269 feet below land surface datum (1338.421 feet NAVD88) on Mar. 10, 2007.

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EXTREMES FOR CURRENT YEAR.--Highest hourly water level: 4.487 feet below land surface datum (1343.072 feet NAVD88) on Jun. 03, 2011 at 6:00 CDT; lowest hourly water level, 6.827 feet below land surface datum (1340.732 feet NAVD88) on Mar. 13, 2011 at 14:00 CDT.

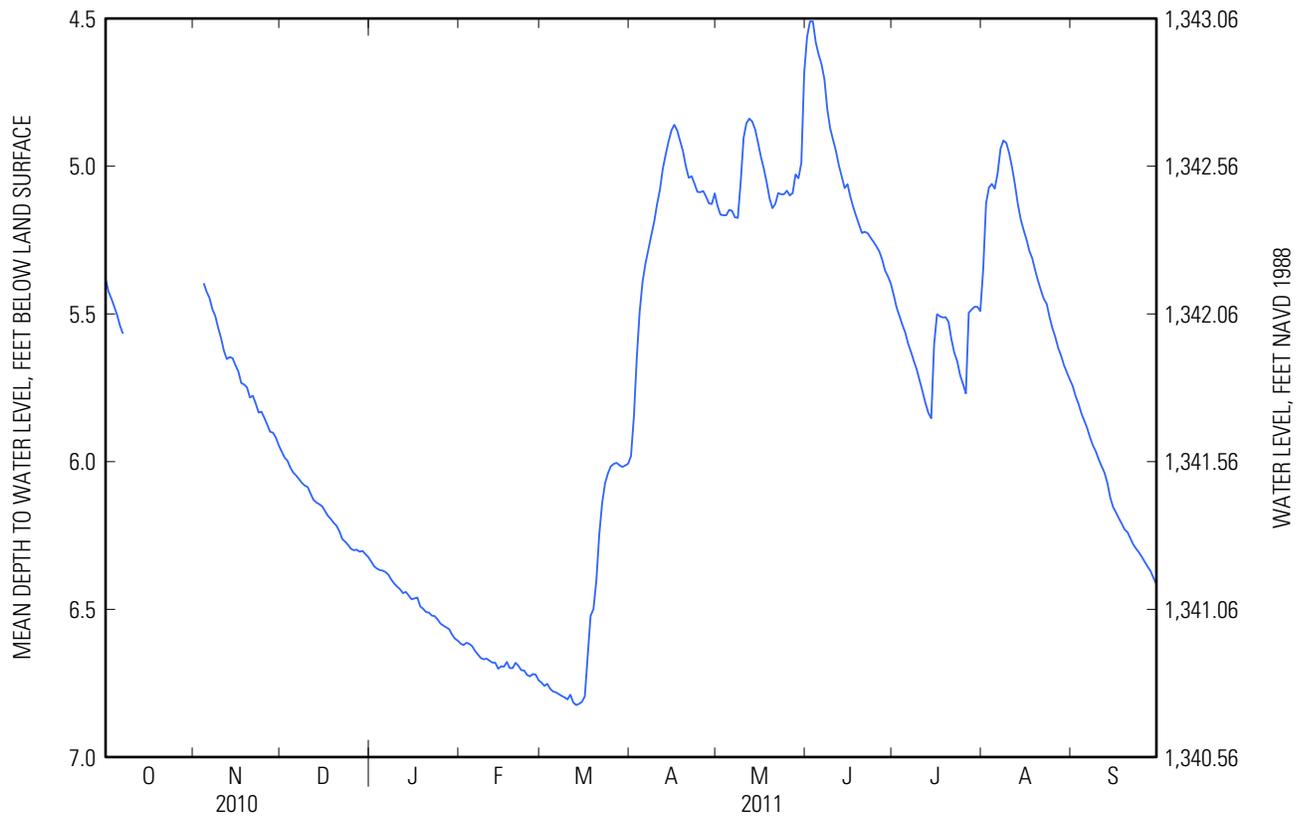
Highest daily-average water level: 4.510 feet below land surface datum (1343.049 feet NAVD88) on Jun. 02 & 03, 2011; lowest daily-average water level: 6.824 feet below land surface datum (1340.735 feet NAVD88) on Mar. 13, 2011.

**DEPTH TO WATER LEVEL, FEET BELOW LAND SURFACE  
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011  
DAILY MEAN VALUES**

[e, estimated]

<b>Day</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>
<b>1</b>	5.381	---	5.966	6.338	6.616	6.748	5.981	5.135	4.562	5.436	5.349	5.744
<b>2</b>	5.424	---	5.986	6.354	6.621	6.759	5.848	5.164	4.510	5.478	5.125	5.778
<b>3</b>	5.448	---	5.997	6.362	6.613	6.752	5.649	5.166	4.510	5.507	5.072	5.804
<b>4</b>	5.475	5.396	6.020	6.367	6.617	6.769	5.493	5.166	4.581	5.537	5.060	5.836
<b>5</b>	5.504	5.425	6.037	6.369	e6.625	6.778	5.392	5.148	4.622	5.563	5.076	5.861
<b>6</b>	5.540	5.446	6.047	6.374	e6.641	6.781	5.330	5.151	4.655	5.601	5.024	5.886
<b>7</b>	5.567	5.484	6.059	6.383	e6.653	6.787	5.283	5.173	4.706	5.629	4.941	5.918
<b>8</b>	---	5.507	e6.072	6.400	e6.665	6.793	5.235	5.175	4.808	5.660	4.913	5.945
<b>9</b>	---	5.547	e6.081	6.413	e6.669	6.798	5.190	5.054	4.872	5.689	4.921	5.965
<b>10</b>	---	5.582	e6.086	6.423	e6.667	6.805	5.130	4.904	4.911	5.726	4.956	5.992
<b>11</b>	---	5.625	6.108	6.432	6.674	6.789	5.081	4.854	4.949	5.763	5.004	6.015
<b>12</b>	---	5.653	6.129	6.445	6.680	6.815	5.010	4.839	4.997	5.802	5.062	6.037
<b>13</b>	---	5.646	6.138	6.441	6.681	6.824	4.961	4.849	5.035	5.835	5.128	6.071
<b>14</b>	---	5.650	6.144	6.453	6.701	6.820	4.917	4.875	5.074	5.853	5.180	6.121
<b>15</b>	---	5.674	6.151	6.466	6.693	6.813	4.879	4.920	5.061	5.603	5.216	6.154
<b>16</b>	---	5.695	6.167	6.463	6.694	e6.795	4.860	4.968	5.104	5.501	5.248	6.172
<b>17</b>	---	5.734	6.183	6.460	6.678	e6.658	4.879	5.008	5.139	5.508	5.287	6.192
<b>18</b>	---	5.739	6.194	6.490	6.699	6.522	4.914	5.055	5.169	5.512	5.312	6.210
<b>19</b>	---	5.749	6.207	6.498	6.699	6.499	4.949	5.109	5.198	5.511	5.352	6.230
<b>20</b>	---	5.783	6.217	6.509	6.681	6.402	5.000	5.142	5.226	5.527	5.388	6.239
<b>21</b>	---	5.777	6.236	e6.511	6.691	6.247	5.039	5.127	5.222	5.586	5.420	6.260
<b>22</b>	---	5.803	6.262	e6.521	6.706	e6.141	5.034	5.091	5.227	5.632	5.449	6.281
<b>23</b>	---	5.834	6.271	6.523	6.707	e6.074	5.059	5.095	5.242	5.660	5.466	6.295
<b>24</b>	---	5.831	6.282	6.534	6.722	6.040	5.087	5.095	5.256	5.707	5.511	6.308
<b>25</b>	---	5.852	6.295	6.548	6.727	6.016	5.088	5.083	5.271	5.737	5.549	6.323
<b>26</b>	---	e5.875	6.300	6.555	6.719	e6.008	5.084	5.099	5.288	5.769	5.579	6.340
<b>27</b>	---	e5.899	6.298	6.561	6.721	e6.004	5.103	5.091	5.316	5.496	5.616	6.356
<b>28</b>	---	5.902	6.305	6.567	6.740	e6.012	5.126	5.028	5.353	5.485	5.642	6.371
<b>29</b>	---	5.919	e6.302	6.585	---	6.018	5.128	5.041	5.373	5.476	5.674	6.394
<b>30</b>	---	5.945	e6.313	6.599	---	6.013	5.092	4.989	5.397	5.476	5.698	6.415
<b>31</b>	---	---	6.323	6.606	---	6.007	---	4.683	---	5.490	5.722	---
<b>Mean</b>	---	---	6.167	6.469	6.679	6.493	5.161	5.041	5.021	5.605	5.288	6.117
<b>Max</b>	---	---	6.323	6.606	6.740	6.824	5.981	5.175	5.397	5.853	5.722	6.415
<b>Min</b>	---	---	5.966	6.338	6.613	6.004	4.860	4.683	4.510	5.436	4.913	5.744
<b>Med</b>	---	---	6.167	6.463	6.681	6.748	5.088	5.091	5.089	5.586	5.287	6.163

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**455927095123101 Local number WLN03 129N36W15BBBB02 Belle River 0000708358—Continued**

### **WATER-QUALITY RECORDS**

PERIOD OF RECORD.--Water temperatures were recorded hourly during Nov. 30, 2004 at 21:00 CST to the present, except during the following periods:

Feb. 10, 2005 at 22:00 CST - Feb. 11, 2005 at 07:00 CST: due poor telemetry, lost data.  
Feb. 13, 2005 at 20:00 CST - Feb. 14, 2005 at 19:00 CST: due to poor telemetry, lost data.  
Apr. 19, 2010 at 16:00 CDT - Apr. 20, 2010 at 11:00 CDT: due to poor telemetry, lost data.  
Intermittent gaps: May 06, 2010 at 12:00 - May 26, 2010 at 23:00: poor telemetry, lost data.  
Intermittent gaps: Jul. 22, 2010 at 12:00 - Aug. 05, 2010 at 15:00: poor telemetry, lost data.  
Oct. 08, 2010 at 12:00 CDT - Nov. 03, 2010 at 08:00 CDT: due to station failure after visit.  
Dec. 08, 2010 at 16:00 CST - Dec. 10, 2010 at 23:00 CST: due to poor telemetry, lost data.  
Feb. 06, 2011 at 00:00 CST - Feb. 10, 2011 at 19:00 CST: due to poor telemetry, lost data.  
Mar. 26, 2011 at 04:00 CDT - Mar. 28, 2011 at 07:00 CDT: due to poor telemetry, lost data.

INSTRUMENTATION.--Water temperature was measured with a KPSI submersible pressure transducer accurate to 0.1°C. The pressure transducer was replaced with a Design Analysis H-310 transducer of equal accuracy on Oct. 25, 2006. Record is currently uncalibrated while sufficient calibration data is being collected.

COOPERATION.--The gage at well WLN03 is operated as part of the U.S. Geological Survey's Collection-of-Basic-Record program. These data are provided to the Minnesota Department of Natural Resources for their Observation Well Network.

EXTREMES FOR PERIOD OF RECORD.--

WATER TEMPERATURE: Maximum, 9.9°C on Oct. 25, 2006 at 16:00 CDT, and many hours during Nov. & Dec., 2010; minimum, 5.9°C on many hours during Apr. & May, 2005.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURE: Maximum, 9.9°C on many days during Nov. & Dec., 2010; minimum, 6.0°C on many days during Apr. & May, 2005, May & Jun., 2007.

EXTREMES FOR CURRENT YEAR.--

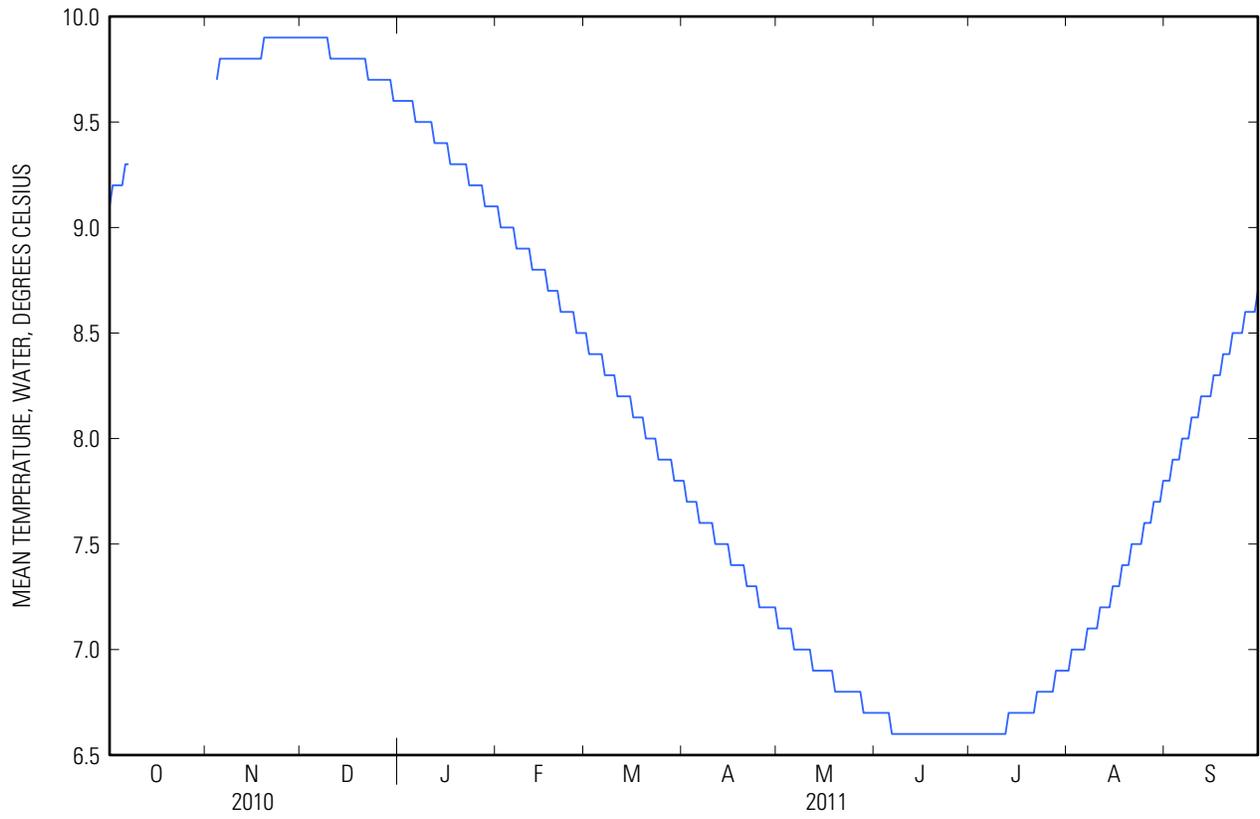
WATER TEMPERATURE: Maximum hourly, 9.9°C on many hours during Nov. & Dec., 2010; minimum hourly, 6.6°C on many hours during Jun. & Jul., 2011.

Maximum daily, 9.9°C on many days during Nov. & Dec., 2010; minimum daily, 6.6°C on many days during Jun. & Jul., 2011.

**TEMPERATURE, WATER, DEGREES CELSIUS**  
**WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011**  
**DAILY MEAN VALUES**  
[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	9.1	---	9.9	9.6	9.1	8.5	e7.8	7.1	6.7	6.6	6.9	e7.8
2	9.2	---	9.9	9.6	9.0	8.4	e7.7	7.1	6.7	6.6	7.0	7.8
3	9.2	---	9.9	9.6	9.0	8.4	e7.7	7.1	6.7	6.6	7.0	7.9
4	9.2	9.7	9.9	9.6	e9.0	8.4	e7.7	7.1	6.7	6.6	7.0	7.9
5	9.2	9.8	9.9	9.6	e9.0	8.4	e7.7	7.1	6.7	6.6	7.0	7.9
6	9.3	9.8	9.9	9.5	e9.0	8.4	e7.6	7.0	6.6	6.6	7.0	8.0
7	9.3	9.8	e9.9	9.5	e8.9	8.3	e7.6	7.0	6.6	6.6	7.1	8.0
8	---	9.8	e9.9	9.5	e8.9	8.3	7.6	7.0	6.6	6.6	7.1	8.0
9	---	9.8	e9.9	9.5	e8.9	8.3	7.6	7.0	6.6	6.6	7.1	8.1
10	---	9.8	e9.8	9.5	e8.9	8.3	7.6	7.0	6.6	6.6	7.1	8.1
11	---	9.8	9.8	9.5	8.9	8.2	7.5	7.0	6.6	6.6	7.2	8.1
12	---	9.8	9.8	9.4	8.8	8.2	7.5	6.9	6.6	6.6	7.2	8.2
13	---	9.8	9.8	9.4	8.8	8.2	7.5	6.9	6.6	6.7	7.2	8.2
14	---	9.8	9.8	9.4	8.8	8.2	e7.5	6.9	6.6	6.7	7.2	e8.2
15	---	9.8	9.8	9.4	8.8	8.2	e7.5	6.9	6.6	e6.7	7.3	8.2
16	---	9.8	9.8	9.4	8.8	e8.1	e7.4	6.9	6.6	e6.7	7.3	e8.3
17	---	9.8	9.8	9.3	8.7	e8.1	e7.4	6.9	6.6	6.7	7.3	8.3
18	---	9.8	9.8	9.3	8.7	8.1	e7.4	6.9	6.6	6.7	7.4	8.3
19	---	9.9	9.8	9.3	8.7	8.1	e7.4	6.8	6.6	6.7	7.4	8.4
20	---	9.9	9.8	9.3	8.7	8.0	e7.4	6.8	6.6	6.7	7.4	8.4
21	---	9.9	9.8	e9.3	8.6	e8.0	7.3	6.8	6.6	6.7	7.5	8.4
22	---	9.9	9.7	e9.3	8.6	e8.0	7.3	6.8	6.6	6.8	7.5	8.5
23	---	9.9	9.7	9.2	8.6	e8.0	7.3	6.8	6.6	6.8	7.5	e8.5
24	---	9.9	9.7	9.2	8.6	7.9	7.3	6.8	6.6	6.8	7.5	8.5
25	---	9.9	9.7	9.2	8.6	e7.9	7.2	6.8	6.6	6.8	7.6	8.5
26	---	e9.9	9.7	9.2	8.5	e7.9	7.2	6.8	6.6	6.8	7.6	8.6
27	---	e9.9	9.7	9.2	8.5	e7.9	7.2	6.8	6.6	6.8	7.6	8.6
28	---	9.9	9.7	9.1	8.5	e7.9	7.2	6.7	6.6	6.9	7.7	8.6
29	---	9.9	e9.7	9.1	---	7.8	7.2	6.7	6.6	6.9	7.7	e8.6
30	---	9.9	e9.6	9.1	---	7.8	7.2	6.7	6.6	6.9	7.7	8.7
31	---	---	9.6	9.1	---	e7.8	---	6.7	---	6.9	7.8	---
<b>Mean</b>	---	---	9.8	9.4	8.8	8.1	7.5	6.9	6.6	6.7	7.3	8.3
<b>Max</b>	---	---	9.9	9.6	9.1	8.5	7.8	7.1	6.7	6.9	7.8	8.7
<b>Min</b>	---	---	9.6	9.1	8.5	7.8	7.2	6.7	6.6	6.6	6.9	7.8
<b>Med</b>	---	---	9.8	9.4	8.8	8.1	7.5	6.9	6.6	6.7	7.3	8.3

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**455927095123101 Local number WLN03 129N36W15BBBB02 Belle River 0000708358—Continued**

**CLIMATOLOGICAL RECORDS**

PERIOD OF RECORD.--Precipitation were recorded hourly during Jun. 21, 2007 at 21:00 CDT - to the present, except during the following periods:

Apr. 19, 2010 at 16:00 CDT - Apr. 20, 2010 at 11:00 CDT: due to poor telemetry, lost data.  
Intermittent gaps: May 06, 2010 at 12:00 - May 26, 2010 at 23:00: poor telemetry, lost data.  
Intermittent gaps: Jul. 22, 2010 at 12:00 - Aug. 05, 2010 at 15:00: poor telemetry.  
Oct. 08, 2010 at 12:00 CDT - Nov. 03, 2010 at 08:00 CDT: due to station failure after visit.  
Dec. 08, 2010 at 16:00 CST - Dec. 10, 2010 at 23:00 CST: due to poor telemetry, lost data.  
Feb. 06, 2011 at 00:00 CST - Feb. 10, 2011 at 19:00 CST: due to poor telemetry, lost data.  
Mar. 26, 2011 at 04:00 CDT - Mar. 28, 2011 at 07:00 CDT: due to poor telemetry, lost data.

INSTRUMENTATION.--A tipping-bucket rain gage was added to the station on Oct. 25 2006, which measures and records precipitation total hourly. The rain gage is unheated and uncovered during the winter. Thus, precipitation data during freezing periods (about December through early April) result from melting of snow during warm periods and do NOT represent actual precipitation.

EXTREMES FOR PERIOD OF RECORD.--

PRECIPITATION: Maximum hourly, 1.71 inches on Aug. 11, 2007 at 3:00 CDT, maximum daily, 2.26 inches on Aug. 11, 2007.

EXTREMES FOR CURRENT YEAR.--

PRECIPITATION: Maximum hourly, 0.86 inches on May 30, 2011 at 23:00 CDT, maximum daily, 1.10 inches on May 30, 2011.

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**PRECIPITATION, TOTAL, INCHES**  
**WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011**  
**DAILY SUM VALUES**

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	0.00	---	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.17	0.00	0.01
2	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
3	---	---	---	0.00	---	0.00	0.05	0.00	0.09	0.00	0.00	0.00
4	---	---	0.00	0.00	---	---	0.00	0.00	0.00	0.00	0.01	0.00
5	0.00	---	0.00	0.00	---	---	0.00	0.41	0.00	0.46	0.00	0.00
6	---	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.01	0.00
7	---	0.00	---	0.00	---	---	0.00	0.13	0.00	0.00	0.01	0.00
8	---	0.00	---	0.00	---	---	0.00	0.33	0.00	0.00	0.01	0.00
9	---	0.00	---	0.00	---	0.00	0.00	0.44	0.00	0.11	0.00	0.00
10	---	---	---	---	---	0.00	0.23	0.00	0.30	0.19	0.00	0.00
11	---	0.00	0.00	---	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
12	---	0.00	0.00	0.00	---	0.00	0.01	0.00	0.00	0.00	0.01	0.00
13	---	0.00	---	---	---	0.00	0.00	0.02	0.01	0.00	0.00	0.00
14	---	0.00	---	---	---	0.00	0.00	0.00	0.33	0.14	0.00	0.00
15	---	0.00	---	0.00	---	---	0.00	0.00	0.50	0.05	0.00	0.00
16	---	---	---	0.00	---	---	0.03	0.00	0.00	0.03	0.05	0.00
17	---	---	0.00	0.00	0.00	---	0.00	0.00	0.18	0.04	0.00	0.00
18	---	0.00	---	---	---	---	0.00	0.00	0.03	0.03	0.00	0.23
19	---	0.00	0.00	---	---	---	0.00	0.00	0.00	0.01	0.00	0.01
20	---	0.00	0.00	0.00	---	---	0.03	0.17	0.00	0.01	0.00	0.16
21	---	---	0.00	---	---	---	0.02	0.39	0.11	0.00	0.00	0.38
22	---	---	---	---	0.00	---	0.34	0.39	0.08	0.01	0.00	0.00
23	---	---	0.00	---	0.05	---	0.02	0.04	0.00	0.00	0.32	0.00
24	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	---	0.00	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
26	---	---	---	0.01	0.00	---	0.06	0.00	0.00	0.00	0.00	0.00
27	---	---	---	0.12	0.00	---	0.06	0.91	0.00	0.00	0.00	0.00
28	---	0.01	---	0.01	---	---	0.00	0.00	0.00	0.01	0.00	0.00
29	---	0.05	---	---	---	---	0.02	0.00	0.00	0.00	0.00	0.06
30	---	0.00	---	---	---	0.00	0.36	1.10	0.00	0.00	0.09	0.00
31	---	---	0.00	---	---	---	---	0.17	---	0.00	0.10	---
<b>Total</b>	---	---	---	---	---	---	1.24	4.50	1.64	1.26	0.62	0.85
<b>Mean</b>	---	---	---	---	---	---	0.04	0.15	0.05	0.04	0.02	0.03
<b>Max</b>	---	---	---	---	---	---	0.36	1.10	0.50	0.46	0.32	0.38
<b>Min</b>	---	---	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00
<b>Med</b>	---	---	---	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00

