

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

Red Lake County, MN

LOCATION.--Lat 47°47'20.04", long 96°16'34.05" referenced to North American Datum of 1983, in NW ¼ NW ¼ NE ¼ sec.27, T.150 N., R.44 W., Red Lake County, MN, Hydrologic Unit 09020303, 2 mile north and ½ mile west of the intersection of MN Highway 32 and US Highway 2, along fenceline north of road.

GROUNDWATER RECORDS

WELL CHARACTERISTICS.--Depth 18.06 ft. Upper casing diameter 2.12 in; top of first opening 12.7 ft, bottom of last opening 17.7 ft. The hole for well E05 was drilled with a hydraulic rotary drill-rig to a depth of 22 feet. The well is constructed of a 5-foot-long, 2-inch-diameter, wire-wound stainless steel screen threaded to about 14 feet of 2-inch-diameter, galvanized steel casing. This casing was 1.16 feet above land surface on July 18, 2002.

DATUM.--Land-surface datum is 1,083.53 ft above North American Vertical Datum of 1988. Measuring point: Black mark on N side of locking cap ring, 1.09 ft above land-surface datum, May 14, 2009, 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 0.08 feet, based on a differential GPS survey on Jun. 12, 2003. Water-level differences are accurate to plus-or-minus 0.001 feet.

PERIOD OF RECORD.--Hourly water levels were recorded hourly during Aug. 06, 2003 at 11:00 CDT to the present, except during the following periods:

Oct. 24, 2004 at 16:00 CDT - Oct. 25, 2004 at 08:00 CDT: due to station failure.
Oct. 31, 2004 at 19:00 CDT - Nov. 01, 2004 at 10:00 CDT: due to station failure.
Dec. 07, 2004 at 20:00 CST - Dec. 13, 2004 at 09:00 CST: due to station failure.
Dec. 29, 2004 at 18:00 CST - Dec. 31, 2004 at 10:00 CST: due to station failure.
Apr. 24, 2008 at 05:00 CDT - Aug. 27, 2008 at 11:00 CDT: due to transducer thermistor failure.
Oct. 29, 2009 at 19:00 CDT - Nov. 17, 2010 at 02:00 CST: due to poor telemetry.
Nov. 24, 2009 at 02:00 CST - Jan. 15, 2010 at 09:00 CST: due to poor telemetry.

GAGE.--Water level and water temperature were measured with a Design Analysis H-310 submersible pressure transducer accurate to 0.01 feet and 0.1°C respectively. Data are recorded hourly by a Campbell Scientific, Inc. CR205 data logger. The data logger is housed in a shelter attached to the well casing, is solar powered, and data are telemetered by radio and telephone.

An unheated Weather Measure Corp. P-501 tipping-bucket raingage was added to the station on Oct. 01, 2005 which measures and records precipitation total hourly. However, the raingage was discovered to not be functioning after its installation until it was repaired on Aug. 27, 2008. Hourly rainfall total began recording for the first time at this site on Aug. 27, 2008 at 12:00 CDT. On Apr. 15, 2011, precipitation total began being recorded quarter-hourly.

COOPERATION.--This station is operated as part of a study to understand hydrologic changes resulting from wetland and prairie restoration and climate change. The station is operated by the U.S. Geological Survey in cooperation with the Red Lake Watershed District, the U.S. Fish and Wildlife Service, and The Nature Conservancy.

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 water level: 8.125 feet below land surface datum (1075.405 feet NAVD88) on Nov. 02, 2010 at 14:00 CDT; lowest water level: 15.648 feet below land surface datum (1067.882 feet NAVD88) on Mar. 13, 2007 at 10:00 CDT.

Highest daily-average water level: 8.149 feet below land surface datum (1074.865 feet NAVD88) on Nov. 05, 2010; lowest daily-average water level: 15.629 feet below land surface datum (1067.901 feet NAVD88) on Mar. 13, 2007.

EXTREMES FOR CURRENT YEAR.--Highest water level: 8.125 feet below land surface datum (1075.405 feet NAVD88) on Nov. 02, 2010 at 14:00 CDT; lowest water level: 13.308 feet below land surface datum (1070.222 feet NAVD88) on Sept. 30, 2011 at 23:00 CDT.

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Highest daily-average water level: 8.149 feet below land surface datum (1074.865 feet NAVD88) on Nov. 05, 2010; lowest daily-average water level: 13.298 feet below land surface datum (1067.901 feet NAVD88) on Sept. 30, 2011.

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

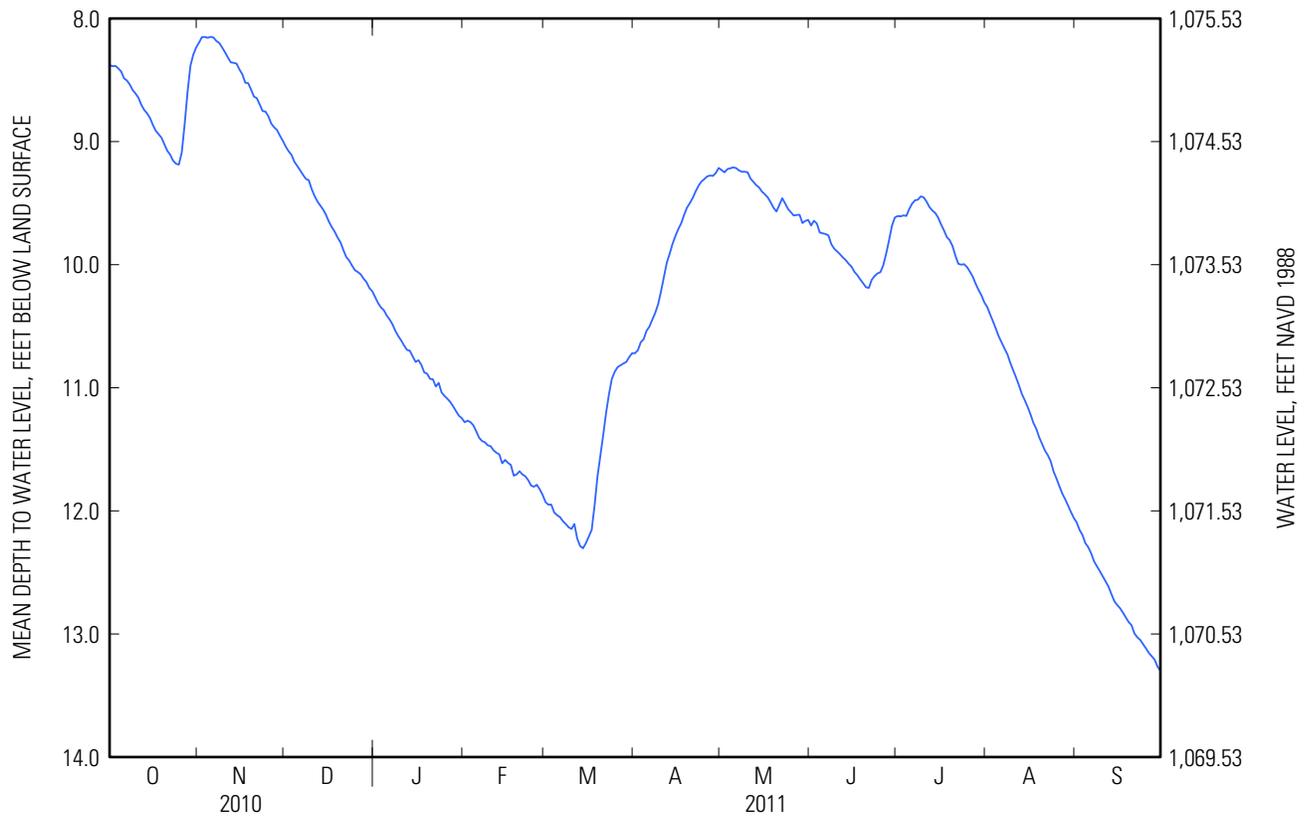
[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	8.378	8.195	9.040	10.264	11.280	11.928	10.719	9.232	9.682	9.605	10.343	12.094
2	8.388	8.151	9.078	10.312	11.267	11.950	10.695	9.250	9.643	9.607	10.403	12.155
3	8.385	8.150	9.107	10.347	11.279	11.949	10.630	9.224	9.666	9.600	10.460	12.196
4	8.405	8.157	9.163	10.370	11.305	12.012	10.605	9.217	9.739	9.604	10.520	12.262
5	8.430	8.149	9.198	10.413	11.353	12.035	10.537	9.210	9.745	9.548	10.583	12.295
6	8.486	8.155	9.233	10.445	11.406	12.050	10.503	9.215	9.751	9.504	10.632	12.344
7	8.504	8.183	9.270	10.485	11.432	12.083	10.446	9.234	9.762	9.477	10.681	12.409
8	8.537	8.199	9.303	10.538	11.443	12.106	10.392	9.245	9.833	9.472	10.728	12.450
9	8.582	8.236	9.314	10.580	11.467	12.133	10.322	9.245	9.870	9.445	10.797	12.489
10	8.610	8.275	9.386	10.615	11.475	12.147	10.218	9.249	9.892	9.453	10.858	12.531
11	8.644	8.318	9.442	10.656	11.508	12.107	10.102	9.300	9.915	9.488	10.917	12.572
12	8.702	8.357	9.487	10.692	11.528	12.226	9.985	9.327	9.941	9.532	10.980	12.615
13	8.743	8.360	9.520	10.699	11.541	e12.286	9.912	9.354	9.963	9.560	11.050	12.674
14	8.771	8.367	9.553	10.745	11.614	e12.304	9.831	9.373	9.992	9.580	11.100	12.732
15	8.808	8.415	9.597	10.790	11.586	e12.262	9.767	9.407	10.016	9.617	11.155	12.764
16	8.865	8.454	9.652	10.776	11.610	12.209	9.711	9.429	10.058	9.672	11.216	12.790
17	8.912	8.522	9.696	10.814	11.627	12.154	9.664	9.454	10.085	9.720	11.285	12.826
18	8.941	8.525	9.733	10.875	11.714	11.956	9.596	9.494	10.119	9.775	11.333	12.865
19	8.969	8.577	9.780	10.886	11.704	11.721	9.537	9.538	10.150	9.801	11.402	12.903
20	9.023	8.634	9.819	10.928	11.678	11.552	9.500	9.568	10.183	9.849	11.455	12.929
21	9.075	8.648	9.882	10.931	11.704	11.382	9.458	9.515	10.189	9.928	11.510	12.996
22	9.107	8.698	9.939	10.990	11.719	e11.202	9.405	9.460	10.123	9.993	11.548	13.027
23	9.155	8.752	9.966	10.960	11.750	e11.050	9.359	9.502	10.092	10.000	11.597	13.048
24	9.180	8.756	10.008	11.038	11.794	10.926	9.325	9.547	10.071	9.996	11.681	13.083
25	9.187	8.794	10.045	e11.066	11.804	10.869	9.305	9.574	10.061	10.019	11.737	13.117
26	9.088	8.854	10.060	e11.089	11.788	e10.832	9.283	9.601	10.005	10.056	11.799	13.154
27	8.860	8.884	10.079	11.115	11.825	e10.817	9.276	9.596	9.911	10.097	11.859	13.181
28	8.599	8.906	10.114	e11.150	11.870	e10.803	e9.279	9.594	9.802	10.155	11.905	13.209
29	8.385	8.952	10.142	e11.190	---	10.790	9.255	9.662	9.685	10.205	11.956	13.265
30	8.293	8.993	10.190	11.227	---	10.750	9.214	9.644	9.617	10.248	12.009	13.298
31	8.235	---	10.216	11.247	---	10.719	---	9.637	---	10.306	12.057	---
Mean	8.718	8.487	9.646	10.782	11.574	11.655	9.861	9.416	9.919	9.771	11.211	12.742
Max	9.187	8.993	10.216	11.247	11.870	12.304	10.719	9.662	10.189	10.306	12.057	13.298
Min	8.235	8.149	9.040	10.264	11.267	10.719	9.214	9.210	9.617	9.445	10.343	12.094

Water Year 2011

Mean	10.306
High	8.149
Low	13.298

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WATER-QUALITY RECORDS

PERIOD OF RECORD.--Hourly water temperatures were recorded hourly during Aug. 06, 2003 at 11:00 CDT to the present, except during the following periods:

Oct. 24, 2004 at 16:00 CDT - Oct. 25, 2004 at 08:00 CDT: due to station failure.
Oct. 31, 2004 at 19:00 CDT - Nov. 01, 2004 at 10:00 CDT: due to station failure.
Dec. 07, 2004 at 20:00 CST - Dec. 13, 2004 at 09:00 CST: due to station failure.
Dec. 29, 2004 at 18:00 CST - Dec. 31, 2004 at 10:00 CST: due to station failure.
Apr. 24, 2008 at 05:00 CDT - Aug. 27, 2008 at 11:00 CDT: due to transducer thermistor failure.
Oct. 29, 2009 at 19:00 CDT - Nov. 17, 2010 at 02:00 CST: due to poor telemetry.
Nov. 24, 2009 at 02:00 CST - Jan. 15, 2010 at 09:00 CST: due to poor telemetry.

INSTRUMENTATION.--Water temperature is measured with a Design Analysis H-310 submersible pressure transducer accurate to 0.1°C. Record is currently uncalibrated while sufficient calibration data is being collected.

COOPERATION.--Well E05 is operated as part of a study to understand hydrologic changes resulting from wetland and prairie restoration and climate change. The station is operated by the U.S. Geological Survey in cooperation with the Red Lake Watershed District, the U.S. Fish and Wildlife Service, and The Nature Conservancy.

EXTREMES FOR PERIOD OF RECORD.--

WATER TEMPERATURE: Maximum hourly, 10.1°C on many hours during Oct. & Nov., 2010; minimum hourly: 5.3°C on many hours during May & Jun., 2009.

EXTREMES FOR PERIOD OF DAILY RECORD.--

WATER TEMPERATURE: 10.1°C on many days during Oct. & Nov., 2010; minimum daily-average: 5.3°C on many days during May & Jun., 2009.

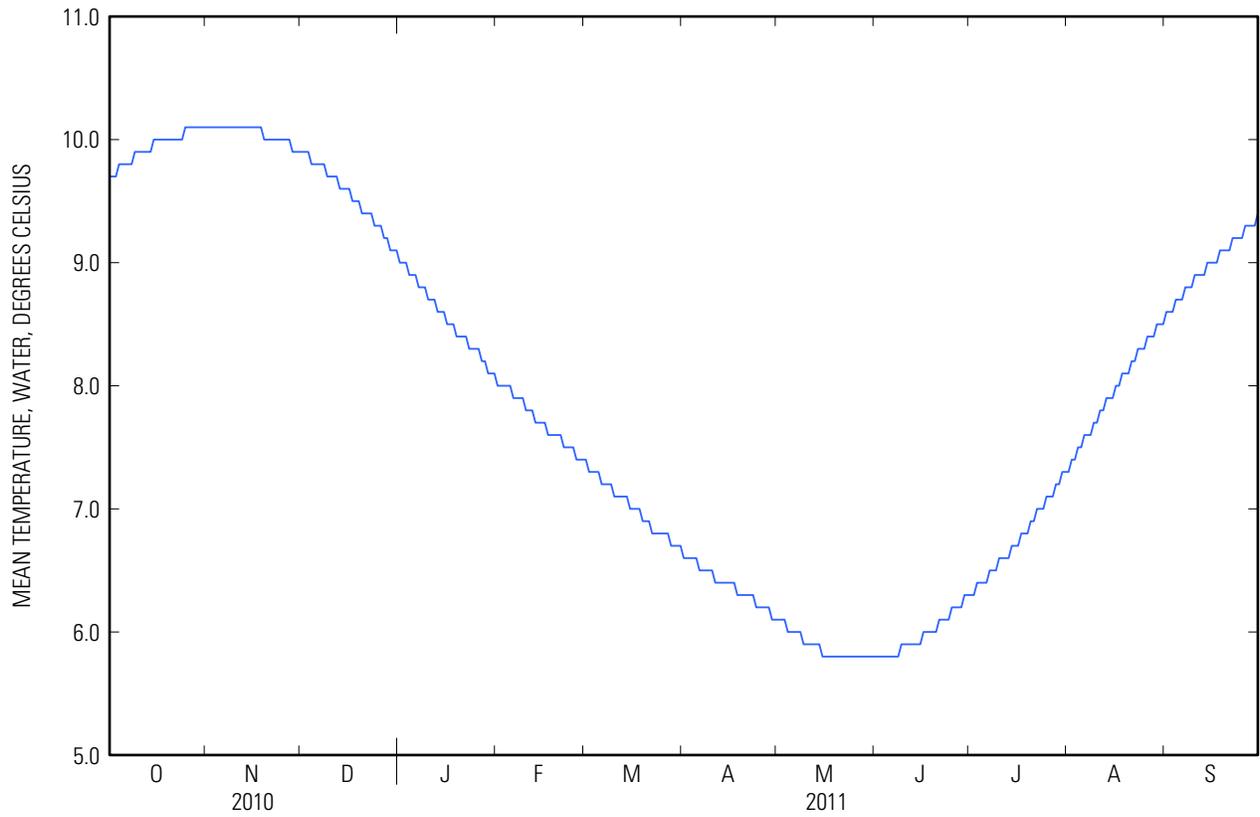
EXTREMES FOR CURRENT YEAR.--

WATER TEMPERATURE: Maximum hourly, 10.1°C on many hours during Oct. & Nov., 2010; minimum hourly, 5.8°C on many hours during May & Jun., 2011.

Maximum daily-average, 10.1°C on many days during Oct. & Nov., 2010; minimum daily-average, 5.8°C on many days during May & Jun., 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	9.7	10.1	9.9	9.0	e8.0	7.4	6.6	6.1	5.8	6.3	7.3	8.6
2	9.7	10.1	9.9	9.0	8.0	7.3	e6.6	6.1	5.8	6.3	7.4	8.6
3	9.7	10.1	9.9	9.0	8.0	e7.3	e6.6	6.1	5.8	6.4	7.4	8.6
4	9.8	10.1	9.8	8.9	8.0	7.3	e6.6	6.0	5.8	6.4	7.5	8.7
5	9.8	10.1	9.8	8.9	8.0	7.3	6.6	6.0	5.8	6.4	7.5	8.7
6	9.8	10.1	9.8	8.9	7.9	7.2	e6.5	6.0	5.8	6.4	7.6	8.7
7	9.8	10.1	9.8	8.8	7.9	7.2	e6.5	6.0	5.8	6.5	7.6	8.8
8	9.8	10.1	9.8	8.8	e7.9	7.2	6.5	6.0	5.8	6.5	7.6	8.8
9	9.9	10.1	9.7	8.8	7.9	7.2	6.5	5.9	5.9	6.5	7.7	8.8
10	9.9	10.1	9.7	8.7	7.8	7.1	e6.5	5.9	5.9	6.6	7.7	8.9
11	9.9	10.1	9.7	8.7	7.8	7.1	e6.4	5.9	5.9	6.6	7.8	8.9
12	9.9	10.1	9.7	8.7	7.8	7.1	6.4	5.9	5.9	6.6	7.8	8.9
13	9.9	10.1	9.6	8.6	7.7	e7.1	6.4	5.9	5.9	6.6	7.9	8.9
14	9.9	10.1	9.6	8.6	7.7	e7.1	6.4	5.9	5.9	6.7	7.9	9.0
15	10	10.1	9.6	8.6	7.7	e7.0	6.4	5.8	5.9	6.7	7.9	9.0
16	10.0	10.1	9.6	8.5	7.7	7.0	6.4	5.8	6.0	6.7	8.0	9.0
17	10.0	10.1	9.5	8.5	7.6	7.0	6.4	5.8	6.0	6.8	8.0	9.0
18	10.0	10.1	9.5	8.5	e7.6	7.0	6.3	5.8	6.0	6.8	8.1	9.1
19	10.0	10.0	9.5	8.4	7.6	6.9	6.3	5.8	6.0	6.8	8.1	9.1
20	10.0	10.0	9.4	8.4	7.6	6.9	6.3	5.8	6.0	6.9	8.1	9.1
21	10.0	10.0	9.4	8.4	7.6	e6.9	6.3	5.8	6.1	6.9	8.2	9.1
22	10.0	10.0	9.4	8.4	7.5	e6.8	6.3	5.8	6.1	7.0	8.2	9.2
23	10.0	10.0	9.4	8.3	e7.5	e6.8	6.3	5.8	6.1	7.0	8.3	9.2
24	10.0	10.0	9.3	8.3	e7.5	6.8	6.2	5.8	6.1	7.0	8.3	9.2
25	10.1	10.0	9.3	e8.3	7.5	6.8	6.2	5.8	6.2	7.1	8.3	9.2
26	10.1	10.0	9.3	e8.3	e7.4	e6.8	6.2	5.8	6.2	7.1	8.4	9.3
27	10.1	10.0	9.2	8.2	7.4	e6.8	6.2	5.8	6.2	7.1	8.4	9.3
28	10.1	9.9	9.2	e8.2	7.4	e6.7	6.2	5.8	6.2	7.2	8.4	9.3
29	10.1	9.9	9.1	e8.1	---	6.7	6.1	5.8	6.3	7.2	8.5	9.3
30	10.1	9.9	9.1	8.1	---	6.7	6.1	5.8	6.3	7.3	8.5	9.4
31	10.1	---	9.1	e8.1	---	6.7	---	5.8	---	7.3	8.5	---



CLIMATOLOGICAL RECORDS

PERIOD OF RECORD.--Precipitation were recorded hourly during Aug. 27, 2008 at 12:00 CDT - to the present, except during the following periods:

Oct. 01, 2005 - Aug. 27, 2008: Rain gage installed at site, but not functioning properly.

Oct. 29, 2009 at 19:00 CDT - Nov. 17, 2010 at 02:00 CST: due to poor telemetry.

Nov. 24, 2009 at 02:00 CST - Jan. 15, 2010 at 09:00 CST: due to poor telemetry.

Precipitation was recorded quarter-hourly from Apr. 15, 2011 at 09:00 CDT to the present.

INSTRUMENTATION.--Precipitation is measured with an unheated Weather Measure Corp. 7.875-inch TR-6118-1L tipping-bucket raingage accurate to 0.01 inch, except during freezing periods (about Dec. through early Apr.). The rain gage is unheated and uncovered. The precipitation data during freezing periods result from melting of snow (accumulated in the rain gage) during warm periods and do NOT represent actual precipitation.

Precipitation totals during freezing periods may underestimate actual totals because the rain gage funnel may be full of snow (preventing further accumulation) or because snow in the funnel may sublimate instead of melt.

EXTREMES FOR PERIOD OF RECORD.--

PRECIPITATION: Maximum hourly, 1.49 inches on May 24, 2010 at 19:00 CDT; maximum daily, 4.55 inches on Apr. 13, 2010.

EXTREMES FOR CURRENT YEAR.--

PRECIPITATION: Maximum hourly, 0.84 inches on Jul. 04, 2011 at 21:00 CDT; maximum daily, 0.92 inches on Jun. 21, 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	0.00	0.00	0.02	0.00	0.00	0.10	0.23
2	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.00	0.01	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.01
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.87	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.11	0.00	0.14	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	---	0.05	0.22	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	---	0.01	0.00	0.08	0.00	0.02
9	0.01	0.00	0.00	0.00	0.00	0.12	0.00	0.06	0.00	0.35	0.00	0.00
10	0.01	0.29	0.00	0.00	0.00	0.00	---	0.01	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.05	0.14
13	0.00	0.00	0.00	0.00	0.00	---	0.00	0.02	0.01	0.00	0.00	0.20
14	0.02	0.00	0.00	0.00	0.00	---	0.14	0.03	0.00	0.00	0.00	0.01
15	0.00	0.00	0.00	0.00	0.00	---	0.00	0.00	0.10	0.06	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.06	0.03
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.02	0.01
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.03
19	0.03	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.05	0.28	0.00
20	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.09	0.04	0.40
21	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.55	0.92	0.02	0.00	0.12
22	0.00	0.00	0.00	0.00	0.00	---	0.01	0.00	0.10	0.00	0.00	0.05
23	0.00	0.01	0.00	0.00	0.00	---	0.00	0.00	0.00	0.86	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.12	0.00
25	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
26	0.08	0.00	0.00	---	0.00	---	0.00	0.00	0.82	0.04	0.00	0.00
27	0.02	0.00	0.00	0.00	0.00	---	0.00	0.19	0.25	0.00	0.00	0.01
28	0.89	0.02	0.00	---	0.00	---	0.00	0.03	0.00	0.00	0.00	0.00
29	0.35	0.00	0.00	---	---	0.00	0.18	0.00	0.02	0.00	0.00	0.18
30	0.10	0.00	0.00	0.00	---	0.00	0.24	0.35	0.00	0.02	0.13	0.00
31	0.00	---	0.00	0.00	---	0.00	---	0.52	---	0.00	0.00	---
Total	2.23	0.32	0.00	---	0.00	---	---	2.04	2.67	2.61	1.18	1.44

