



2019 Groundwater Monitoring Report

Halls Glen Landfill Site
(PC of A A341004)
Township of Douro-Dummer
County of Peterborough

GHD | 347 Pido Road Unit 29, Peterborough, Ontario, K9J 6X7 Canada
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Table of Contents

1.	Introduction.....	1
2.	Background	1
3.	Site Conditions	2
3.1	General Geology	2
3.2	Existing Groundwater Monitors.....	2
3.3	Pattern of Groundwater Movement.....	3
3.4	Horizontal Hydraulic Gradient.....	5
3.5	Hydraulic Conductivity	6
4.	Monitoring Program.....	7
5.	Water Quality Data	7
5.1	General	7
5.2	Overburden Monitors	8
5.3	Bedrock Monitors	12
5.4	Reasonable Use Concept	15
5.5	Historical Chemical Comparison.....	16
5.6	Residential Wells	17
5.7	Surface Water Monitoring	19
5.8	Groundwater Trigger Mechanism	20
6.	Conclusions and Recommendations.....	22
6.1	Signatures.....	24



Table Index

Table 3.1	Monitoring Well Locations and Installation Dates.....	3
Table 3.2	2018 Water Level Summary	4
Table 3.3	Hydraulic Gradient – Overburden Wells.....	5
Table 3.4	Hydraulic Gradient – Bedrock Wells.....	6
Table 3.5	Hydraulic Gradient – Bedrock Wells.....	6
Table 5.1	May 2019 Overburden Monitors	10
Table 5.2	October 2019 Overburden Monitors.....	11
Table 5.3	May 2019 Bedrock Monitors.....	13
Table 5.4	October 2019 Bedrock Monitors	14
Table 5.5	2019 Residential Well Water Quality Summary	18
Table 5.6	2019 Surface Water Field Measurements.....	19
Table 5.7	2019 Surface Water Data	20

Appendix Index

Appendix A	MECP PROVISIONAL CERTIFICATES OF APPROVAL AND MECP CORRESPONDENCE FROM 2015
Appendix B	MONITORING WELL DETAILS AND BOREHOLE DATA
Appendix C	ESTABLISHED MONITORING PROGRAM AND SAMPLING PROTOCOL
Appendix D	CERTIFICATES OF ANALYSIS
Appendix E	WATER LEVEL ELEVATIONS AND HYDRAULIC CONDUCTIVITY GRAPHS
Appendix F	CHEMICAL COMPARISON GRAPHS
Appendix G	MECP MONITORING AND SCREENING CHECKLIST

Enclosures

Plate 1	Geologic Plan
Plate 2	Property Plan
Plate 3	Property Boundary Plan
Plate 4	2019 Field Monitoring Summary
Plate 5	2019 Water Level Monitoring Summary
Plate 6	RUC Plates A



1. Introduction

The following report presents the results of the 2019 groundwater monitoring program that was completed for the Halls Glen Landfill Site in the Township of Douro-Dummer (formerly Township of Dummer) of the County of Peterborough. The monitoring program was conducted in accordance with the scope of work as presented by our proposal dated October 24, 2013 as well as additional requirements outlined in various Ministry of the Environment, Conservation and Parks (MECP) Memorandums.

2. Background

The Halls Glen Landfill Site is situated along the south side of County Road No. 6, 10km north of the community of Warsaw. The Geologic Plan, Plate 1, illustrates the location of the landfill with respect to nearby roads and watercourses. The location of the property is described as part of Lot 25, Concession 4 in the Township of Douro-Dummer.

Details regarding the operation of the landfill are outlined in the Provisional Certificate of Approval (PC of A) No. A 341004 dated October 8, 1980. The site also operates as a transfer station according to PC of A No. A 341007 dated October 25, 1991, and the amended Certificate of Approval (C of A) dated February 1, 2006 (see Appendix A). Two Memorandums were issued by MECP personnel in 2014 in response to reviewing the 2013 Groundwater Monitoring Report (see Appendix A).

A Memorandum dated June 23, 2014 provides commentary on the groundwater aspects of the 2013 monitoring program. A Memorandum dated August 7, 2014 presented comments relating to surface water. The MOE recommendations were implemented in the monitoring program in 2016. In general, the background data consisted of the following documents:

1. Current PC's of A issued by the MECP (Appendix A);
2. Excerpts from a report prepared by Hydroterra Limited regarding details of the monitoring well construction and borehole records (Appendix B);
3. MECP well record for monitor MW-7 that was installed in March, 1997 (Appendix B), MECP well records for monitors MW-8, 9, 10, 11 and 12 that were installed in the Fall of 2001 (Appendix B), MECP well record for monitor MW-13 (TW1-02) that was installed in October, 2002 (Appendix B)
4. Monitoring program and sampling protocol established for the landfill site by the former Township of Dummer (Appendix C); and
5. Reports prepared by Geo-Logic Inc./ GHD dated 1994, 1996 to 2006, 2009 to 2019 and AECOM Canada Ltd. dated 2007-2008 presenting the results of previous monitoring programs.



3. Site Conditions

3.1 General Geology

The site is situated in an area within the physiographic region known as the Dummer Moraine (Chapman and Putnam, 1984). This region is characterized by relatively flat, stoney ground covered with shallow deposits of glacial drift (till). Based on previous investigations, this material is covered locally by a layer of glaciolacustrine sand. Bedrock underlying the site consists of limestone belonging to the Lindsay Formation. The bedrock is part of the Trenton-Black River Group and is of Middle Ordovician age. Based on previous subsurface data, bedrock underlies the site at an average depth of 3.25m below the ground surface.

3.2 Existing Groundwater Monitors

In total, thirteen (13) groundwater monitoring stations were included during both monitoring circuits (spring and fall). The location of the monitors with respect to the property limits is illustrated on the Site Plan, Plate 2. Monitors MW 1, 2, 3, 4, 5, 6 and 7 consist of a 38mm diameter standpipe and a 50mm diameter piezometer, which have been constructed within a common borehole. Monitors MW 8, 9, 10, 11 and 13 consist of two (2) 50mm diameter piezometers with MW 12 having three (3) 50mm diameter piezometers that have been constructed within a common borehole. The monitoring stations are protected by a 150mm diameter steel locked well casing. In general, each monitor consists of a bedrock monitor and an overburden monitor with the exception of MW12 which has one (1) overburden monitor and two (2) bedrock monitors at different depths. Details pertaining to the construction of the monitoring wells are presented in Appendix B. A description of the monitoring station locations is summarized in Table 3.1.

During the summer of 2003, the landfill refuse area was prepared for closure. The landfill area was mounded and capped. It is our understanding that further work was conducted in 2004 and the work continued in 2005. Monitors MW-2 and MW-6 casing were extended to allow for the mounding of the landfill. Elevation data for these two (2) monitors have been calculated using past measurements of well depth compared to the 2004 recorded values.



Table 3.1 Monitoring Well Locations and Installation Dates

Monitor	Descriptive Location
MW 1-91 MW 13-02	up-gradient to existing landfill area
MW 2-91	within the central area of the refuse landfill
MW 3-91 MW 4-91 MW 5-91 MW 6-91 MW 7-97 MW 8-01 MW 9-01 MW 10-01 MW 11-01 MW 12-01	down-gradient of existing landfill

Note: See Site Plan for precise location of monitoring stations.

3.3 Pattern of Groundwater Movement

Groundwater monitoring was conducted during two sampling circuits in 2019. The water level data was acquired on May 30th and October 29th, 2019. The measurements are presented on Plate 5 and summarized in Table 3.2. Elevation data was not available for the monitor installed in October 2002 (MW-13). The ground water elevations for MW-2 and MW-6 for the monitoring circuits were adjusted to compensate for the extended casings using field measurements.

As is past monitoring events, monitors MW1-II, MW 2-I and MW2-II were dry during both sampling circuits while MW 5-II was dry for the fall circuit. The overburden groundwater monitoring data for May 2019 is presented on the Site Plan, Plate 2. Based on the data, the pattern of overburden and the deeper groundwater movement appears to be in a southeasterly direction.



Table 3.2 2018 Water Level Summary

Monitor Number	Elevation Top of Casing	Water Level Elevation	
		May 30, 2019	Oct. 29 2019
Overburden Monitors			
MW 1-II	271.24	dry	dry
MW 2-II	282.49	dry	dry
MW 3-II	269.23	268.47	268.02
MW 4-II	268.28	266.73	266.39
MW 5-II	271.35	268.52	267.19
MW 6-II	271.01	268.46	267.37
MW 7-II	269.03	267.00	266.63
MW 8-II	270.74	266.46	264.93
MW 9-II	267.25	266.27	265.72
MW 10-II	267.97	265.96	265.76
MW 11-II	268.50	265.94	265.75
MW 12-I	268.00	266.40	266.24
MW 13-II	na	na	na
Bedrock Monitors			
MW 1-I	271.24	268.54	268.42
MW 2-I	282.53	dry	dry
MW 3-I	269.23	268.02	267.41
MW 4-I	268.28	266.36	266.21
MW 5-I	271.35	266.83	266.78
MW 6-I	271.01	266.49	266.31
MW 7-I	269.03	266.33	265.77
MW 8-I	270.74	266.35	265.69
MW 9-I	267.25	266.59	266.31
MW 10-I	267.97	266.09	265.77
MW 11-I	268.50	266.11	265.92
MW 12-II	268.00	266.48	266.30
MW 12-III	268.00	266.59	266.35
MW 13-I	na	na	na

Notes: All measurements are presented in metres. Monitor top of casing elevations provided by TSH.
(na) indicates information not available.



3.4 Horizontal Hydraulic Gradient

Horizontal hydraulic gradient is simply the slope of the water table or potentiometric surface. It is the change in hydraulic head over the change in distance between the two monitoring wells or dh/dl . In mathematical terms, horizontal gradient is rise over run.

$$dh/dl = \text{difference in head} / \text{horizontal distance between wells} = (h_2 - h_1) / L$$

All well locations were recorded using the Ministry of Natural Resources (MNR) Topographical mapping and plotted on the Site Plan, Plate 2. The distances between the wells were measured after plotting well locations on the MNR mapping for the site. Water level elevation was obtained from Table 3.2.

Overburden wells for the site are divided into shallow and deeper wells. Two gradients per monitoring period were calculated for each level of overburden wells for the spring monitoring period as most were dry during the fall. The average horizontal gradient for the shallow overburden wells was 9.7 m/km. The average horizontal gradient for the deeper overburden wells was 4.3 m/km. The results are summarized on Table 3.3.

Three gradients of bedrock wells were calculated for each monitoring period. The average horizontal gradient within the bedrock is calculated at 3.3 m/km. The results of the bedrock gradient analysis are summarized on Table 3.4.

Table 3.3 Hydraulic Gradient – Overburden Wells

Monitoring Wells	Shallow / Deep Spring / Fall 2019	Groundwater Elevation (m)	Distance Between Wells (km)	Hydraulic Gradient (m/km)
MW 3-II MW 4-II	Shallow / Spring	268.47 266.73	0.095	18.3
MW 3-II MW 7-II	Shallow / Spring	268.47 267.00	0.87	1.69
MW 6-II MW 11-II	Deep / Spring	268.46 265.94	0.28	9.0
MW 12-I MW 9-II	Deep / Spring	266.32 266.15	0.23	0.17
MW 3-II MW 4-II	Shallow / Fall	268.02 266.39	0.095	17.1
MW 3-II MW 7-II	Shallow / Fall	268.02 266.63	0.87	1.60
MW 6-II MW 11-II	Deep / Fall	267.37 265.75	0.28	5.79
MW 12-I MW 9-II	Deep / Fall	266.24 265.72	0.23	2.26
Average	Shallow		0.48	9.67
Average	Deep		0.26	4.31



Table 3.4 Hydraulic Gradient – Bedrock Wells

Monitoring Wells	Spring/Fall 2019	Groundwater Elevation (m)	Distance Between Wells (km)	Hydraulic Gradient (m/km)
MW 1-I MW 5-I	Spring	268.45 266.83	0.22	7.4
MW 7-I MW 8-I	Spring	266.33 266.35	0.38	0.1
MW 12-II MW 10-I	Spring	266.59 266.09	0.25	2.0
MW 1-I MW 5-I	Fall	268.48 266.78	0.22	7.7
MW 7-I MW 8-I	Fall	265.77 265.69	0.38	0.2
MW 12-II MW 10-I	Fall	266.35 265.77	0.25	2.3
Average	Spring		0.28	3.2
Average	Fall		0.28	3.4
Yearly Average				3.3

3.5 Hydraulic Conductivity

The hydraulic conductivity of a soil is described as a measure of the soil's ability to transmit water. Slug tests were performed in 2009 on two overburden and two bedrock wells in order to assess the permeability of the two layers present at the site. The results of the testing indicate that the overburden soils to be silty sand with a relatively high hydraulic conductivity. The bedrock results indicate this layer to be fractured limestone. Table 3.5 summarizes the results of slug tests performed at the site. The graphs of the hydraulic conductivity testing are presented in Appendix E.

Table 3.5 Hydraulic Gradient – Bedrock Wells

Location	Test Type	Hydraulic Conductivity (cm/s)	Geometric Mean K (cm/s)	Representative Aquifer
MW-3-1 MW-3-1	Falling Head Rising Head	6E-03 3E-03	10E-03	Fractured limestone Fractured limestone
MW-7-2 MW-7-2	Falling Head Rising Head	3E -02 2E-02	10E-02	Silty sand, clean sand Silty sand, clean sand
MW-8-2 MW-8-2	Falling Head Rising Head	2E-02 4E-02	10E-02	Silty sand Silty sand, clean sand
MW-8-1 MW-8-1	Falling Head Rising Head	4E-03 2E-03	10E-03	Fractured limestone Fractured limestone



4. Monitoring Program

GHD followed the established sampling and monitoring protocol for the Halls Glen landfill site during the 2019 season. Details of this protocol are summarized in Appendix C. An overview of the protocol is outlined below.

1. Field work to be carried out at all thirteen (13) monitoring stations during the spring and fall seasons.
2. Field work and sampling to be completed at four (4) residential wells during the spring and fall sampling period. Two (2) surface water stations to be sampled during both monitoring circuit.
3. Methane gas hydrogen sulphide generation was measured at each well using a portable multi-gas indicator.
4. Water levels were then recorded for each monitor prior to well purging.
5. Three to five measured casing volumes were then removed from each monitor in order to ensure that representative groundwater samples were obtained.
6. In-situ chemical testing was conducted during the purging operation in order to determine a stabilized water quality condition. The in-situ testing included parameters such as temperature, conductivity, pH, Orp and DO.
7. After the purging operation, representative samples of groundwater were collected in proper containers with appropriate preservatives where needed.
8. The water samples were delivered to SGS Laboratories in Lakefield. Sampling was carried out as per previous sampling circuits.
9. Reviewed slug testing on wells to determine hydraulic conductivity values as requested by MECP review (dated September 2, 2009) of the Halls Glen 2008 Monitoring Report prepared by AECOM Canada Ltd. Hydraulic Gradients were calculated using well locations and groundwater elevations.

5. Water Quality Data

5.1 General

Representative groundwater samples from each of the monitors were subjected to chemical testing for specified parameters. The parameters tested included those listed in Column 1 of Schedule 5 (Comprehensive List) in the spring and Column 2 (Indicator List) in the fall, of the Landfill Standards: A Guideline on Regulatory and Approval Requirements for New or Expanding Sites for the deeper wells. All metals were analyzed for the parameters listed in Schedule 5 Column 1 for all wells. In addition, selected samples were analyzed for volatile organic compounds (VOCs) to evaluate any trends that may develop. The surface water stations and shallow monitors that discharge to surface water were analyzed for the parameters listed in Column 3 of Schedule 5 of the Landfill Standards Guideline (Comprehensive List for Surface Water). The certificates of analysis are included in Appendix D.



5.2 Overburden Monitors

As in the past, monitor MW 1-II and MW 2-II were measured dry during the spring and fall 2019 sampling period. MW 5-II which usually has had insufficient water for sampling did generate enough water for sampling in the spring but not in the fall sampling circuit. Monitoring Well 3-II was also dry in the fall sampling period. In general, the groundwater levels in the monitors were found to be at normal elevation in the spring but lower in the fall. The chemical results from the shallow wells (where samples were obtained) have been summarized in Tables 5.1 and 5.2.

The data is presented with the Ontario Drinking Water Standards (ODWS) and Provincial Water Quality (PWQO) for comparison purposes. As in past reports, the monitors located closest to the former landfill area (MW-3, MW-5-II, MW- 6-II and MW-7-II) had the highest number of the parameters exceeding the PWQO and ODWS during both sampling circuits. Iron was elevated in down-gradient monitor MW 10-II during both sampling circuits. Although Iron has been historically elevated for the area and is interpreted to be naturally elevated this should be closely monitored for any upwards trends. Elevated levels of total dissolved solids (TDS) were reported in some wells during both sampling periods. MW-4-II that has in the past had exceedances for some parameters, met all analyzed parameters in 2019.

Although there were still exceedances of the ODWS and PWQO for some parameters there are no upward trends in the remaining monitors or in the parameters indicating exceedances. Future monitoring programs should continue to monitor these parameters to evaluate potential environmental concerns.

As in past reports, the monitoring data indicates that the monitoring stations located near the landfill area are being impacted by the landfill. The following overburden wells had parameters that exceeded the ODWS in 2019.

Spring Circuit Exceedances of ODWS

Alkalinity	MW 3-II, 5-II, 6-II
Iron	MW 5-II, 6-II 10-II, 11-II
TDS	MW-3-II, 5-II, 6-II
Manganese	MW 3-II, 5-II, 6-II, 7-II, 10-II

Fall Circuit Exceedances of ODWS

Alkalinity	MW 3-II, 6-II
Iron	MW 6-II, 10-II
TDS	MW 3-II, 6-II
Manganese	MW 6-II

The MECP in their 2014 memorandum indicated that all shallow wells that possibly discharge to the wetland located southeast of the landfill, be analyzed for the same parameters as surface water and must be compared to the PWQO standards. It was once again noted that the majority of exceedances were from monitoring wells MW 3-II, 5-II and 6-II that are located next to the landfill. These wells had the most exceedances while monitors further down gradient showed very few exceedances. The following overburden wells had parameters that exceeded the PWQO in 2019.



Spring Circuit Exceedances of PWQO

Iron	MW-5-II, 6-II, 10-II, 11-II
Boron	MW-3-II, 5-II, 6-II
Ammonia	MW-5-II, 6-II

Fall Circuit Exceedances of PWQO

Iron	MW 6-II, 10-II,
Ammonia	MW 6-II
Boron	MW 3-II, 6-II
Phenolics	MW 6-II
Copper	MW 6-II

In addition to the aforementioned parameters, monitors MW-3-II, MW-4-II, MW-5-II, MW-6-II, MW-7-II and MW-11-II were sampled for VOCs during the spring and fall sampling circuits. The monitors did not yield detectable levels of VOCs in either the spring or fall sampling circuits. As such all levels are within the ODWS and PWQO. The results of the chemical testing are presented in Appendix D.



Table 5.1 May 2019 Overburden Monitors

Parameters	Overburden Monitors											ODWS	PWQO
	MW 3-II	MW 4-II	MW 5-II	MW 6-II	MW 7-II	MW 8-II	MW 9-II	MW 10-II	MW 11-II	MW 12-1	MW 13-II		
May 30, 2019													
BOD	< 4	< 4	6	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	---	---
TSS	713	653	124	228	148	23	66	50	5	42	28	---	---
Alkalinity	536	218	806	792	191	235	241	243	224	284	230	30-500	---
pH	7.42	7.77	6.86	6.98	7.84	7.66	8.00	7.54	8.09	7.42	7.51	6.5-8.5	6.5-8.5
Conductivity	1110	320	1600	1640	331	429	653	599	465	675	569	---	---
TDS	677	186	934	1010	209	257	214	334	274	403	329	500	---
COD	11	< 8	47	70	< 8	< 8	< 8	< 8	< 8	< 8	10	---	---
Phosphorus	0.52	0.24	0.15	0.06	0.05	< 0.03	< 0.03	0.09	< 0.03	< 0.03	0.05	---	---
TKN	0.6	< 0.5	11.8	22.5	< 0.5	< 0.5	< 0.5	0.7	< 0.5	< 0.5	0.8	---	---
Ammonia	0.7	< 0.1	11.0	22.1	< 0.1	< 0.1	< 0.1	0.8	0.5	0.1	0.4	---	**3.3
Phenolics	< 0.001	< 0.001	0.005	0.006	< 0.001	0.002	0.003	< 0.001	< 0.001	< 0.001	0.002	---	0.005
Sulphate	70	< 2	9	170	11	7	16	8	6	22	18	500	--
Chloride	37	2	93	80	6	3	66	48	14	51	51	250	---
Nitrite	0.33	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.07	< 0.03	< 0.03	< 0.03	1.0	---
Nitrate	1.01	< 0.06	0.23	< 0.06	0.08	< 0.06	< 0.06	0.08	< 0.06	< 0.06	0.65	10	---
Mercury	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		
Arsenic	0.0002	<0.0002	0.0007	0.0016	< 0.0002	<0.0002	0.0003	0.0002	<0.0002	< 0.0002	<0.0002	0.002	0.05
Barium	0.175	0.0877	0.667	0.685	0.0876	0.0531	0.158	0.626	0.381	0.713	0.137	200	---
Boron	0.563	0.034	0.401	0.831	0.055	0.014	0.026	0.118	0.085	0.104	0.051	1.0	0.2
Calcium	246	92.9	281	372	72.1	103	105	117	96.6	126	139	---	---
Cadmium	0.000018	0.000003	0.000012	0.000012	0.000003	.000003	.000003	.000003	.000003	0.000003	0.000004	0.005	0.0002
Chromium	0.00019	0.00013	0.00072	0.00118	0.00017	0.00027	0.00015	0.00014	0.00059	0.00016	0.00015	0.05	---
Cooper	0.0011	0.0002	0.0016	0.0054	0.0007	0.0003	0.0008	0.0003	<0.0002	< 0.0002	0.0007	1.0	0.005
Iron	0.132	< 0.007	13.3	15.6	0.008	0.007	0.293	6.91	1.55	0.010	0.027	0.3	0.3
Potassium	16.9	0.729	24.4	40.3	1.33	0.472	2.16	2.42	1.99	3.28	3.48	---	---
Magnesium	22.0	2.20	27.8	48.0	3.71	2.82	3.89	11.2	7.40	11.5	4.42	---	---
Manganese	3.24	0.00041	6.61	8.40	0.00092	0.00074	0.0291	0.171	0.0245	0.00352	0.00144	0.05	---
Sodium	38.3	5.32	63.6	109	17.3	3.74	42.9	7.47	6.30	13.7	30.0	200	---
Lead	0.00002	<0.00001	0.00014	0.00020	0.00002	0.00002	0.00002	0.00012	0.00001	<0.00001	0.00003	0.01	0.005
Zinc	0.003	< 0.002	0.004	0.005	0.002	0.002	0.003	0.005	0.004	0.003	0.003	5.0	0.03

Notes: All results in mg/L with the exception of Conductivity (uS/cm) and pH, (---) indicates no data, (np) indicates not performed. Highlighted values exceed ODWS or PWQO.



Table 5.2 October 2019 Overburden Monitors

Parameters	Overburden Monitors										ODWS	PWQO
	MW 3-II	MW 4-II	MW 6-II	MW 7-II	MW 8-II	MW 9-II	MW 10-II	MW 11-II	MW 12-I	MW 13-II		
Oct. 29, 2019												
BOD	< 4	< 4	21	< 4	< 4	< 4	< 4	< 4	< 4	< 4	---	---
TSS	183	1130	110	178	37	2	55	6	38	69	---	---
Alkalinity	559	287	951	322	272	260	245	242	265	331	30-500	---
pH	7.58	7.93	7.60	7.92	8.12	8.11	8.03	8.10	7.92	7.82	6.5-8.5	6.5-8.5
Conductivity	1630	705	2010	691	748	737	621	584	649	833	---	---
TDS	1120	374	1240	451	434	414	354	320	403	474	500	---
COD	20	< 8	68	< 8	< 8	< 8	< 8	< 8	< 8	< 8	---	---
Phosphorus	0.11	0.39	0.06	0.06	0.03	< 0.03	0.06	0.04	< 0.03	0.10	---	---
TKN	< 0.5	< 0.5	25.4	< 0.5	< 0.5	< 0.5	1.1	1.0	< 0.5	< 0.5	---	---
Ammonia	0.1	< 0.1	23.3	< 0.1	< 0.1	< 0.1	1.1	0.9	< 0.1	< 0.1	---	**3.3
Phenolics	0.002	< 0.001	0.006	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	---	0.005
Sulphate	210	6	61	15	12	11	7	10	28	26	500	--
Chloride	100	34	110	35	69	73	48	33	44	58	250	---
Nitrite	0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03	1.0	---
Nitrate	5.39	0.45	3.72	1.36	0.66	0.93	0.08	0.18	< 0.06	2.36	10	---
Mercury	<0.01	< 0.01	0.02	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		
Arsenic	0.0003	< 0.0002	0.0012	0.0004	< 0.0002	< 0.0002	< 0.0002	0.0007	0.0008	0.0003	0.002	0.05
Barium	0.237	0.156	0.467	0.211	0.158	0.184	0.580	0.0408	0.230	0.155	200	---
Boron	0.827	0.036	0.753	0.138	0.050	0.065	0.145	0.176	0.099	0.046	1.0	0.2
Calcium	325	120	322	130	127	121	129	147	117	144	---	---
Cadmium	0.000030	0.000004	0.000016	0.000003	0.000005	0.000003	0.000003	0.000005	0.000003	0.000007	0.005	0.0002
Chromium	0.00030	0.00018	0.00080	0.00030	0.00025	0.00016	0.00012	0.00020	0.00013	0.00022	0.05	---
Cooper	0.0031	0.0014	0.0087	0.0031	0.0008	0.0014	< 0.0002	0.0011	0.0005	0.0020	1.0	0.005
Iron	0.020	< 0.007	3.86	< 0.007	0.010	0.038	4.03	0.124	0.019	0.019	0.3	0.3
Potassium	21.1	1.56	33.9	5.41	1.40	2.57	2.69	7.59	2.25	3.64	---	---
Magnesium	24.4	3.75	30.8	10.1	3.82	3.82	10.9	221	7.58	4.68	---	---
Sodium	43.3	24.4	101	29.8	36.8	46.5	5.54	76.7	12.0	36.5	200	---
Manganese	0.0520	0.00099	5.34	0.00029	0.00433	0.00464	0.0544	0.0147	0.0201	0.00227	0.05	---
Lead	0.00003	0.00002	0.00001	0.00003	0.00003	0.00002	0.00001	0.00002	0.00001	0.00004	0.01	0.005
Zinc	0.004	0.002	< 0.002	< 0.002	0.003	0.003	< 0.002	0.004	0.003	0.004	5.0	0.03

Notes: All results in mg/L with the exception of Conductivity (uS/cm) and pH, (---) indicates no data, (np) indicates not performed. Highlighted values exceed ODWS or PWQO



5.3 Bedrock Monitors

All of the bedrock monitors were sampled during the 2019 sampling circuits with the exception of MW 2-I, which was dry during both circuits. MW 2-I has been historically dry. The results of the testing are compared in Tables 5.3 and 5.4 against the ODWS. In general, the results are similar to past years with MW 5-I and MW 6-I yielding the most exceedances. MW 3-I and 4-I that yielded exceedances in the past had very few in 2019. All of these wells are directly adjacent to the landfill. As in past years, iron and manganese are elevated in other monitors. TDS that is generally elevated in other monitors was not this year. It is interpreted that these parameters are naturally elevated since the background monitors MW 1-I exceeded the criteria for TDS. Future monitoring programs should continue to monitor these parameters to evaluate potential environmental concerns. The results of the chemical testing are presented in Appendix D.

The following deeper bedrock wells had parameters that exceeded the ODWS in 2019.

Spring Circuit Exceedances of ODWS

Alkalinity	MW 5-I
TDS	MW 1-I (background) 5-I, 6-I
Iron	MW 5-I, 6-I
Manganese	MW 4-I, 5-I, 6-I, 9-I, 10-I, 11-I, 12-II

Fall Circuit Exceedances of ODWS

Alkalinity	MW 5-I
DOC	MW 5-I, 6-I
Iron	MW 5-I, 6-I
TDS	MW 1-I (background) 3-I, 4-I, 5-I, 6-I
Manganese	MW 4-I, 5-I, 6-I, 8-I, 9-I, 10-I 11-I, 12-II

In addition to the aforementioned parameters, monitors MW-3-I, MW-4-I, MW-5-I, MW-6-I, MW-7-I and MW-11-I were sampled for VOCs during the spring and fall sampling circuits. All other wells were sampled for the VOC parameters listed in Schedule 5 Column 1 during the spring circuit. The monitors yielded results below the detectable levels of VOCs in both the spring or fall sampling circuits with the exception of Benzene and Monochlorobenzene in Monitor MW 5-I in the fall sampling period which reported levels just above the detection limit. Generally monitors close to the landfill have yielded detectable VOC levels for a some parameters but only MW 5-I reported detectable levels this year. Duplicate sample 14-I (MW7-I) also indicated no detectable VOC's. The results of the chemical testing are presented in Appendix D.



Table 5.3 May 2019 Bedrock Monitors

Parameters	Bedrock Monitors													ODWS
	MW 1-I	MW 3-I	MW 4-I	MW 5-I	MW 6-I	MW 7-I	MW 8-I	MW 9-I	MW 10-I	MW 11-I	MW 12-II	MW 12-III	MW 13-I	
May 30, 2019														
Alkalinity	272	248	291	536	468	370	284	271	245	260	294	290	249	30-500
pH	7.53	7.34	8.08	7.44	7.21	7.92	7.53	7.41	7.74	7.78	7.62	8.06	8.10	6.5-8.5
Conductivity	1150	526	713	980	1260	808	795	605	616	643	740	711	628	---
TDS	711	294	434	574	749	474	489	391	400	400	463	443	394	500
COD	< 8	< 8	< 8	17	25	65	< 8	34	< 8	9	8	< 8	< 8	---
Phosphorus	0.04	< 0.03	< 0.03	0.04	0.14	0.04	< 0.03	< 0.03	< 0.03	< 0.03	0.03	< 0.03	< 0.03	---
TKN	< 0.5	< 0.5	1.1	6.2	6.6	< 0.5	< 0.5	0.5	< 0.5	0.5	< 0.5	< 0.5	< 0.5	---
Ammonia	< 0.1	< 0.1	1.2	5.8	6.6	< 0.1	< 0.1	0.7	0.2	0.7	0.3	< 0.1	< 0.1	---
Phenolics	0.006	< 0.001	0.002	0.002	0.006	0.002	0.001	< 0.001	0.002	< 0.001	0.001	0.001	0.003	---
Sulphate	79	9	22	12	44	34	18	41	25	37	72	26	10	500
Chloride	180	24	51	29	130	47	83	16	51	29	38	55	57	250
Nitrite	< 0.03	< 0.03	< 0.03	< 0.03	0.28	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	1.0
Nitrate	2.29	1.41	1.19	0.71	0.65	0.13	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	2.42	10
Mercury	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
Arsenic	<0.0002	<0.0002	<0.0002	0.0011	0.0002	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002
Barium	0.282	0.0836	0.115	0.434	0.402	0.136	0.106	0.688	0.839	0.460	0.252	0.0399	0.118	200
Boron	0.093	0.025	0.069	0.213	0.246	0.516	0.114	0.590	0.260	0.362	0.609	0.090	0.021	1.0
Calcium	175	106	118	203	198	34.0	125	58.7	103	101	111	162	132	---
Cadmium	<0.00003	<0.00003	0.000006	<0.00003	<0.00003	0.000003	<0.00003	<0.00003	<0.00003	<0.00003	<0.00003	<0.00003	<0.00003	0.005
Chromium	0.00017	0.00018	0.00013	0.00033	0.00031	0.00013	0.00012	0.00015	0.00013	0.00018	0.00035	0.00026	0.00016	0.05
Cooper	0.0009	0.0004	0.0005	0.0003	0.0003	<0.0002	0.0009	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	1.0
Iron	< 0.007	< 0.007	0.012	11.1	0.684	0.007	0.016	< 0.007	0.085	0.042	0.143	0.054	< 0.007	0.3
Potassium	5.56	2.86	5.64	16.1	18.3	2.25	3.77	6.17	4.69	4.26	3.75	1.94	1.88	---
Magnesium	15.0	2.96	4.94	15.5	13.8	7.59	11.7	22.7	20.7	19.4	24.7	6.18	3.11	---
Manganese	0.00003	0.00024	0.168	1.17	1.53	0.00076	0.00523	0.0820	0.173	0.0629	0.139	0.0145	0.00015	0.05
Sodium	73.0	21.1	37.0	36.5	71.4	151	48.4	51.7	13.2	12.6	41.4	15.7	38.2	200
Lead	0.00001	0.00001	0.00001	0.00002	0.00020	0.00003	0.00001	0.00001	0.00001	0.00003	0.00046	0.00026	0.00004	0.01
Zinc	< 0.002	0.007	0.003	0.002	0.003	0.002	0.003	< 0.002	0.004	0.003	0.004	0.008	0.002	5.0

Notes: All results in mg/L with the exception of Conductivity (uS/cm) and pH, (---) indicates no data, (np) indicates not performed. Highlighted values exceed ODWS.



Table 5.4 October 2019 Bedrock Monitors

Parameters	Bedrock Monitors													ODWS
	MW 1-I	MW 3-I	MW 4-I	MW 5-I	MW 6-I	MW 7-I	MW 8-I	MW 9-I	MW 10-I	MW 11-I	MW 12-II	MW 12-III	MW 13-I	
Oct. 29, 2019														
Alkalinity	261	330	378	653	429	328	274	241	232	248	285	272	250	30-500
pH	7.98	7.90	7.57	7.21	7.94	8.12	7.94	8.23	8.16	8.22	7.95	7.75	7.89	6.5-8.5
Conductivity	1150	920	1050	1510	1210	844	801	561	608	598	730	694	534	---
TDS	666	534	597	874	671	469	454	323	334	334	417	391	286	500
COD	< 8	< 8	< 8	47	11	< 8	< 8	24	< 8	11	18	< 8	< 8	---
Ammonia	< 0.1	< 0.1	0.4	14.5	9.0	0.1	0.2	0.7	0.2	0.9	0.4	< 0.1	< 0.1	---
Sulphate	74	20	42	7	43	33	19	42	23	29	78	24	8	500
Chloride	170	56	90	120	120	45	78	18	49	35	37	51	21	250
Nitrate	2.40	2.51	2.14	0.24	0.50	0.25	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.26	10
DOC	< 1	2	3	14	6	2	< 1	< 1	< 1	< 1	< 1	1	1	5
Barium	0.278	0.118	0.193	0.664	0.337	0.128	0.106	0.570	0.803	0.446	0.204	0.0664	0.0824	200
Boron	0.105	0.050	0.079	0.340	0.227	0.445	0.102	0.491	0.273	0.396	0.548	0.143	0.019	1.0
Calcium	178	137	214	249	217	40.1	121	55.7	91.9	90.6	115	140	96.5	---
Iron	< 0.007	< 0.007	0.125	32.6	1.34	0.009	0.018	0.008	0.014	0.019	0.007	0.099	< 0.007	0.3
Magnesium	14.2	3.35	7.48	22.9	11.0	7.52	11.3	18.9	20.5	20.7	26.8	8.91	2.59	---
Sodium	69.4	43.0	49.2	80.2	60.9	152	45.9	42.6	13.0	12.3	45.7	18.8	28.4	200
Arsenic	<0.0002	<0.0002	0.0002	0.0035	0.0004	0.0008	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002
Cadmium	0.000003	0.000012	0.000045	0.000003	0.000005	0.000016	0.000009	<0.000003	<0.000003	<0.000003	<0.000003	<0.000003	0.000003	0.005
Chromium	0.00017	0.00019	0.00013	0.00090	0.00029	0.00017	0.00016	0.00016	0.00014	0.00018	0.00023	0.00015	0.00023	0.05
Cooper	0.0014	0.0016	0.0009	0.0011	0.0014	0.0005	0.0009	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0005	1.0
Potassium	5.45	3.59	5.67	32.2	16.4	2.55	3.64	5.32	4.59	4.23	4.16	2.06	2.24	---
Manganese	0.00185	0.00620	0.0694	2.68	1.46	0.00831	0.0837	0.0700	0.136	0.0853	0.148	0.05023	0.00013	0.05
Sodium	69.4	43.0	49.2	80.2	60.9	152	45.9	42.6	13.0	12.3	45.7	18.8	28.4	200
Lead	0.00014	0.00005	0.00002	0.00005	0.00026	0.00003	0.00014	0.00001	0.00001	0.00008	0.00010	0.00003	0.00002	0.01
Zinc	< 0.002	0.004	< 0.002	0.002	0.004	< 0.002	0.003	< 0.002	< 0.002	< 0.002	0.003	< 0.002	0.003	5.0

Notes: All results in mg/L with the exception of Conductivity (uS/cm) and pH, (---) indicates no data, (np) indicates not performed. Highlighted values exceed ODWS.



5.4 Reasonable Use Concept

Reference is made to previous monitoring reports that presented estimated criteria for significant contaminant indicators. The Reasonable Use Concept evaluation was developed from MECP Guideline B-7 and Guideline B-7-1 Determination of Contaminant Limits and Attenuation Zones. The criterion is based on the following equation.

$$X = B + F(W - B)$$

Where:

X = maximum acceptable concentration at property boundary

B = background concentration of parameter

F = factor of 0.5 for aesthetic parameter and 0.25 for health related parameter

W = ODWS value for each particular parameter

The MECP (in their June 23, 2014 Memorandum) indicated that RUC should be applied to the parameters of Schedule 5 Column 2 indicator list for groundwater leachate for parameters that had ODWS. The RUC was applied to samples from both the overburden and bedrock monitors. Background water quality for the overburden monitors utilized the chemical results from monitor MW 13 while background water quality for the bedrock monitors utilized the chemical results from the bedrock monitor at stations MW 1 and MW 13. The results for the shallow monitors RUC are illustrated on Plates 6A and 6C. The results for the bedrock monitors RUC are illustrated on plates 6B and 6D with the RUC exceedances for the shallow wells summarized below.

Spring 2019 Overburden Monitors Exceedances of RUC

Alkalinity	MW 3-II, 5-II, 6-II
TDS	MW 3-II, 5-II, 6-II
Iron	MW 5-II, 6-II, 9-II, 10-II, 11-II
Manganese	MW-3-II, 5-II, 6-II, 7-II
Barium	MW-5-II **, 6-II **

Fall 2019 Overburden Monitors Exceedances of RUC

Alkalinity	MW 3-II, 6-II
TDS	MW 3-II, 6-II
Iron	MW 6-II, MW-9-II*, 10-II, 11-II
Manganese	MW 3-II, 6-II, 10-II

** indicates value within ODWS.



Exceedances for the bedrock monitors are listed below.

Spring 2019 Bedrock Monitors Exceedances of RUC

Alkalinity	MW-5-I, MW-6-I**
TDS	MW 4-1, MW-5-I, MW-7-I
Barium	MW 3-I, MW 9-I, MW 10-I
Iron	MW-5-I, MW-6-I, MW-8-1
Manganese	MW MW-4-I, 5-I, MW-6-I, MW-9-I, MW-10-I, MW-11-I, MW 12-II
Sodium	MW-7-I

Fall 2019 Bedrock Monitors Exceedances of RUC

Alkalinity	MW5-I, MW 6-I
TDS	MW 3-I, MW 4-I, MW-5-I, MW-6-I
DOC	MW 5-1 MW 6-I
Barium	MW 5-1
Iron	MW-5-I, MW-6-I, MW-8-I
Manganese	MW-4-I, 5-I, MW-6-I, MW-8-I, MW-9-I, MW-10-I, MW-11-I, MW 12-II, MW-12-III

**indicates value within ODWS.

A historical review of past monitoring programs indicates elevated levels of parameters within the monitors immediately down-gradient of the refuse area. The 2019 monitoring indicated less shallow monitors exceeded RUC MAC while similar monitors exceeded the RUC MAC's as historically in the fall. Based on the data off site significant impact has not been observed and it is anticipated that the potential for impact will decrease over time due to closure of the landfill site.

5.5 Historical Chemical Comparison

The MECP in their June 23, 2014 Memorandum indicated that a historical comparison be conducted for the chemical results for all parameters in the MECP Schedule 5 Column 2 Indicator List for Groundwater and Leachate for all monitors. For monitors MW-1 to MW-7 the data dates back to 1993 while in the newer monitors MW-8 to MW-12 well the data is from 2001 to present. Background Monitor MW-13 data ranges from installation in 2006 to 2019. No data is available for this well for 2007-2008 as TSH could not locate it for sampling.

The review of the historical chemical data indicates that monitors within the landfill or near the mound experience more elevated parameters compared to those down gradient. For the most part the values for each parameter in each well either remain constant or show seasonal fluctuations with the occasionally spike that generally returns to normal.



The exception to this appears to be at Monitoring Location 6, which is located within the south-eastern portion of the landfill. The shallow groundwater monitor MW-6-II and the deeper monitor 6-I are both showing an increasing trend for Ammonia.

Although there appears to be an upwards trend at monitoring location MW-6, the down-gradient monitors at locations MW-4 and MW-7, are not showing increasing trends for the Schedule 5 Column 2 parameters. Although there does appear to be a plume around MW-6 at this time it does not appear to be spreading to the south or east. The chemical comparison graphs are presented in Appendix F.

5.6 Residential Wells

Four (4) residential wells were sampled during the fall of 2019 but only three in the spring. Residential Well R-1 was observed during the spring circuit to be compromised to the point it was unable to be sampled. The well was abandoned in the summer of 2019 and a new monitoring well was established adjacent to the former well at a depth similar to the former dug well. The remaining three wells are deeper drilled wells (R2, R3 and R4). R1 and R2 are situated down-gradient of the landfill site and R3 and R4 are situated up-gradient. The wells were sampled and analyzed for the same parameters as the monitoring wells. The results of the 2019 residential well monitoring circuits are presented on Table 5.5 with the locations of the residential wells and the surface water stations presented on Plate 2.

As in past monitoring programs, the majority of the parameters tested are within the ODWS with respect to the residential wells. TDS (total dissolved solids) in R4 exceeded the criteria during the fall sampling circuit. TDS is considered an aesthetic objective under the ODWS and has been historically elevated in some of the residential wells. R1 and R3 exceeded for iron and manganese in the fall sample obtained. Iron levels in R-2 that have in the past exceeded the ODWS were within the criteria during both sampling circuits. The results of the sampling are presented in Appendix D. The 2019 sampling program did not yield any detectable concentrations of VOCs in the residential wells.

The results of the analyses indicate that the landfill appears to have had no impact on the surrounding residential wells. It should be noted that R-1 is located down-gradient of the landfill. This property is now part of the landfill property. Because of its location, it is our opinion that R-1 intercepts the shallow groundwater regime that represents the on-site conditions. In addition, the former well has been used for several years as a groundwater monitoring station that has resulted in a long history of chemical data. For these reasons, it is our opinion that R-1 should be used as a trigger point (RUC exceedance would trigger action) when evaluating the potential for off-site impacts from the former landfill operation. R3 showed no indication of contamination during the spring sampling but had iron and manganese levels that exceeded the ODWS in the fall sampling period. R1 could not be sampled in the spring. This should be closely monitored in the future monitoring events to see if a trend is developing. The results for the R-1 monitor are summarized on Table 5.5 while the RUC summary for this well is illustrated on Plate 5E.



Table 5.5 2019 Residential Well Water Quality Summary

Parameters	Residential Monitors								ODWS
	R-1 May / 19	R-1 Oct. / 19	R-2 May / 19	R-2 Oct. / 19	R-3 May / 19	R-3 Oct. / 19	R-4 May / 19	R4 Oct. / 19	
Alkalinity	Unable to Sample	273	272	291	243	257	288	336	30-500
pH		7.93	7.54	7.79	7.95	7.72	8.01	7.75	6.5-8.5
Conductivity		721	695	777	552	825	743	1290	---
TDS		423	403	454	343	480	411	726	500
COD		< 8	< 8	< 8	< 8	< 8	25	< 8	---
Phosphorus		0.074	< 0.03	< 0.003	< 0.03	0.005	< 0.03	0.023	---
TKN			< 0.5		< 0.5		< 0.5		---
Ammonia		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	---
Phenolics			< 0.002		< 0.002		< 0.002		---
Sulphate		18	17	11	< 2	19	13	17	500
Chloride		55	62	70	32	92	52	210	250
Nitrite			< 0.03		< 0.03		< 0.03		1
Nitrate (as N)		1.43	3.97	1.14	0.62	3.56	3.15	1.59	10
DOC		1	1	< 1	3	2	5	1	5.0
Mercury			< 0.01		< 0.01		< 0.01		
Arsenic		0.0005	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0003	< 0.0002	0.025
Barium		0.262	0.0953	0.0983	0.0377	0.0495	0.117	0.141	1.0
Boron		0.100	0.009	0.025	0.010	0.048	0.016	0.029	5.0
Calcium		111	126	125	56.2	56.9	128	120	---
Cadmium		0.000131	0.000008	0.000013	0.000006	0.000019	0.000004	0.000011	0.005
Chromium		0.00159	0.00023	0.00040	0.00033	0.00019	0.00025	0.00058	0.05
Copper		0.0044	0.154	2.29	0.210	0.0546	0.109	0.0862	5.0
Iron		0.664	< 0.007	0.010	< 0.007	0.591	< 0.007	0.014	0.3
Potassium		4.30	1.34	1.14	1.42	0.793	3.26	3.22	---
Magnesium		7.54	3.24	3.32	1.58	1.84	3.29	3.29	---
Manganese		3.27	0.00022	0.00032	0.00056	0.263	0.00010	0.00061	0.05
Sodium		31.0	21.3	38.3	70.4	123	34.6	153	200
Lead		0.00134	< 0.003	0.00128	0.00237	0.00132	0.009	0.00143	0.01
Zinc		0.010	0.00064	0.106	0.019	0.029	0.00229	0.037	5.0

Notes: All results in mg/L with the exception of Conductivity (uS/cm) and pH, (---) indicates no data, (np) indicates not performed. **Highlighted** values exceed ODWS.



5.7 Surface Water Monitoring

Two surface water sampling station were also utilized during the May and October 2019 sampling period. The surface water station (S-1) is located down-gradient from the landfill site and is adjacent to R1. Surface Water location S-2 is a background surface water monitor that was added in the fall of 2014. The samples obtained were analyzed for the parameters listed in Column 3 of Schedule 5 of the Landfill Standards Guideline (Comprehensive List for Surface Water). In-field measurements were taken at the surface water stations as presented in Table 5.6. The results of the analyses are summarized in Table 5.7. The results of the analysis are included in Appendix D. All of the parameters tested are within their respective current Provincial Water Quality Objective (PWQO), Canadian Water Quality Objective (CWQO) and Aquatic Protection Value (APV) with the exception of phenolics for PWQO in both fall and spring samples for both the background sample and the down-gradient sample and Nitrates and Nitrites in the background sample in the fall. It should be noted that the water samples obtained from S-1 and S-2 in the fall were stagnant with very little water for sampling. It is our opinion that this is not representative of the flowing conditions. It is recommended that should this condition arise in the future, an additional location be found in the general area of S-1.

Table 5.6 2019 Surface Water Field Measurements

Parameter	Field Measurement			
	S-1	S-2	S-1	S-2
	May, 2019	May, 2019	Oct. 2019	Oct. 2019
Temperature (°C)	13.8	14.9	12.2	13.9
pH	7.75	7.52	7.92	7.74
Conductivity (us/cm)	505	555	441	648
Dissolved Oxygen (mg/L)	5.90	7.30	5.71	5.06
ORP	---	---	180	190
Flow	Pond – Continuous Flow	Pond – Continuous Flow	Pond - Stagnant	Pond - Stagnant



Table 5.7 2019 Surface Water Data

Parameters	Sample Locations				APV	CWQG	PWQO
	S-1 May 2019	S-2 May 2019	S-1 Oct. 2019	S-2 Oct. 2019			
BOD	< 4	< 4	16	23			
TSS	5	< 2	2	28			
Alkalinity (mg/L)	240	235	245	168			
pH	8.09	7.70	7.85	7.72		6.0-9.0	6.5-8.5
Conductivity	603	638	587	675			
TDS	366	363	354	489			
COD	< 8	11	16	60			
TKN	< 0.5	< 0.5	< 0.5	1.1			
Ammonia	< 0.1	< 0.1	< 0.1	0.3			
Phenolics	0.004	0.003	0.010	0.011	0.04**	0.004	0.001
Sulphate	4	7	17	89			
Chloride (mg/L)	56	67	33	36	180	128	
Nitrite	< 0.03	< 0.03	< 0.03	1.16		0.06	
Nitrate	0.18	< 0.06	1.00	10.3		2.9	
Mercury	< 0.01	< 0.01	< 0.01	< 0.01			
Arsenic	< 0.0002	< 0.0002	0.0003	0.0005	0.150		
Barium	0.0764	0.0593	0.115	0.115	2.30		
Boron	0.017	0.013	0.025	0.030	3.55	1.50	0.2
Calcium	96.7	89.5	98.7	106			
Cadmium	0.000005	0.000003	0.000030	0.000071	0.00021	0.000017	0.0005
Chromium	0.00016	0.00012	0.00016	0.00032	0.064		
Copper	0.0007	0.0007	0.0039	0.0044	0.0069		0.005
Iron (mg/L)	0.010	0.020	0.042	0.025	1.00*		0.3
Potassium	1.51	1.07	2.29	6.10			
Magnesium	3.27	2.90	3.85	4.67			
Manganese	0.00306	0.0143	0.0299	0.0286			0.05
Sodium	35.3	42.8	22.2	20.3			
Phosphorus	0.006	0.008	0.048	0.404			3.3***
Lead	<0.00001	<0.00001	0.00029	0.00017	0.02		0.005
Zinc	0.003	0.003	0.012	0.009	0.089	0.03	0.02

Notes: Highlighted values exceed standard, * USA EPA Criterion, ** Lowest observed effect criterion

*** Based on 10° Celcius at 8pH, All results in mg/L with the exception of Conductivity (uS/cm) and pH,

PWQO=Provincial Water Quality Objective, CWQO=Canadian Water Quality Objective, APV=Aquatic Protection Value

5.8 Groundwater Trigger Mechanism

Groundwater trigger mechanisms and contingency planning have been developed with respect to VOCs parameters due to detected levels in down gradient wells in past monitoring events. For the down-gradient wells (MW-8, MW-9, MW-10 and MW-11), parameters that have maximum acceptable concentrations (MACs) should consider a trigger of 0.5 of the MAC. The VOC parameters that have interim MACs (IMACs) should consider a trigger of 0.75 of the IMAC. If concentrations of parameters exceed the trigger values, then the contingency plan(s) should be implemented.



For example, consider benzene with an MAC in the ODWS of 5 µg/L. If a groundwater sample is greater than 2.5 µg/L, the contingency plan is triggered. The groundwater trigger mechanism was not exceeded for VOCs for any monitoring well during the 2019 monitoring period.

In addition, to address the MECP concern for a trigger mechanism for the RUC parameters prior to reaching the property boundary, R-1 was selected to be representative of the shallow groundwater on-site. At this location, the potential for off-site impact of the RUC parameters in the shallow groundwater was evaluated as an early warning sign (see Plate 6-E for 2018 results). R-1 was found to be unable to be sampled in the spring. A new shallow monitor was installed in the late fall to replace this well. This monitor was sampled in the fall. Exceedances of the RUC for iron and manganese were recorded for R-1 in the fall. The contingency plan indicates that if a second exceedance is recorded, then the down-gradient wells should be sampled. R-2 is the only well within two (2) kilometers down-gradient of R-1. The results of the iron and manganese testing for R-2 showed non-recordable levels of iron and negligible levels of manganese in both the spring and fall samples. Both were within the ODWS.

Contingency planning may be broken into the following steps when a trigger value is exceeded:

1. Immediately re-sample the well where an exceedance of the trigger value was observed;
2. If a second exceedance is reported, sample down-gradient wells to confirm that off-site migration has not occurred (re-sample if exceedance of trigger value at down-gradient wells);
3. If down-gradient wells at the Site boundary are impacted above trigger value, notify private well owners down-gradient of the Site and sample private wells on a monthly basis for parameter(s) of concern;
4. If private wells are impacted above the trigger values as outlined above, the Township of Douro-Dummer will need to provide an alternative water supply to the home owner (i.e. bottled water, temporary water supply, new well, etc.) until the exceedance of the trigger value subsides; and
5. If impacted, groundwater is migrating off-site (greater than Guideline B-7 values, MECP Table 2 Standards or exceeds ODWS), remediation will need to be implemented or greater attenuation areas established.



6. Conclusions and Recommendations

This report presents the results of the 2019 groundwater-monitoring program carried out at the Halls Glen Landfill Site in the Township of Douro-Dummer. It is our professional opinion that the groundwater level and chemical data do not indicate a significant anomaly from the results of the previous years.

The majority of the parameters are within their acceptable limits with a few exceedances in the shallow monitors located adjacent to the refuse area as determined by MECP Guideline B-7. The well trends should be monitored during future monitoring programs to evaluate if the exceedances are increasing.

Initiated during the 2002-monitoring program, monitors MW 3, MW 4, MW 5, MW 6 and MW 7, the bedrock monitor at MW 11 and the residential monitors have been sampled for VOCs annually during both sampling periods. Monitors MW5 and MW6, located within the former landfill, have historically detected low concentrations of some VOC parameters during all of the sampling periods. In 2019 only MW 5-I had recordable values for monochlorobenzene and benzene in the fall sample. The remainder of the monitors have indicated sporadic trace levels of VOCs with no trends or duplication of results. MW 11-I (bedrock), had been yielding relatively low levels of toluene, ethylbenzene and xylenes that were trending downwards towards non-detectable or trace levels of in past years. The 2016-2019 results have indicated non-detectable levels for all VOCs in MW-11-I and MW-11-II in both sampling events. Toluene levels (that meet ODWS) have been measured in MW 3-I and MW 4-I in the past but not for the last 8 monitoring periods. No VOC levels were recorded in any of the other monitoring wells or residential wells during either sampling period in 2019. Future monitoring programs should continue to evaluate the data collected to evaluate the VOC monitoring program. No VOC trigger mechanism values were met during the 2019 monitoring program.

Landfill gas was not detected during the 2019 sampling circuits. The water quality at the residential wells is not interpreted to be affected by the landfill.

Historical trends for BOD, TSS, Alkalinity, pH, Conductivity, COD, Ammonia, Sulphate, Chloride, Nitrate, Barium, Boron, Calcium, Iron, Magnesium, Sodium and Manganese have been tracked annually. All monitors have either been staying stable or decreasing for all parameters with very few exceptions. Monitor M 6-I and MW 6-II have been showing increases in Ammonia for the last few years although Monitors MW 4 and MW 12 that are immediately down gradient of MW 6 do not show increases for ammonia. Iron levels in monitor MW 5-1 has remained higher than other wells. Iron levels at 6-II (landfill shallow monitor) which appeared to be increasing in the past few years showed fluctuations this year but no longer appears to be increasing.

Alkalinity, TDS, Iron and Manganese levels generally exceed the ODWS and the RUC for shallow monitors MW 3-II, MW-5-II and MW 6-II. These wells are located within the landfill area. Shallow monitors immediately down gradient of these monitors (MW-4-II and MW-12-I) generally don't show exceedances of the ODWS or RUC indicating that the impacted shallow groundwater is not impacting the down-gradient shallow ground-water. In the deeper aquifer, landfill monitors MW-5 and OW-6 also have many exceedances of the ODWS and RUC.



Although there are occasional exceedances at down-gradient monitors MW-12-II and MW-12-III, there are rarely exceedances at the monitors further down gradient with the exception of manganese in MW-11-I. Manganese levels in MW-11-I should be monitored in future sampling events to see if the levels increase.

It is our professional opinion that even though the ground water within the landfill area may be impacted, it does not appear to be impacting the down-gradient, shallow or deep groundwater. Surface water samples taken at the site do not show any impact related to the landfill. Down-gradient residential wells show no impact from the landfill.

Exceedance of the RUC for R-1 were noted for iron and manganese in the fall. Down-gradient well R-2 did not show any elevated levels for each parameter. R-1 was formerly a dug well that became unusable and has been replaced by a monitoring station. This monitor was sampled for the first time in the fall and should be closely watched to see if a trend is developing.

Future monitoring programs should consider the following recommendations.

1. At the recommendation of the MECP, the chemical parameter list for monitoring and residential wells should include the parameters in Column 1 (Groundwater) in the spring and Column 2 in the fall. Shallow wells that may discharge to surface water along with surface water samples should be analyzed for Column 3 of Schedule 5 in the Landfill Standards, A Guideline on Regulatory and Approval Requirements for New or Expanding Sites. The surface water monitoring should include the new background station (S-2) that was established in 2014.
2. Sampling should continue VOCs for wells that surround the landfill (MW 3-7) as well as the residential wells. Monitors MW-11-I and MW-11-II had shown detectable levels of VOC's in the past but have not for nine straight monitoring events. It is recommended that VOC monitoring be discontinued at these monitoring wells.
3. The monitoring program should continue to utilize the monitor installed in the fall of 2002 (MW-13) to evaluate the background water quality in the shallow overburden.
4. The use of S-1(surface Water) as a future predictor of potential RUC impacts offsite should continue for future monitoring periods. If S-1 is stagnant or dry it is recommended that a suitable surface water location be found in the general area of S-1.
5. The monitors should continue to be monitored for any trend increases.



6.1 Signatures

We trust that this report meets with your immediate requirements. Should you have any questions, please contact our office.

Sincerely,

GHD

A handwritten signature in black ink, appearing to read "Steven Gagne".

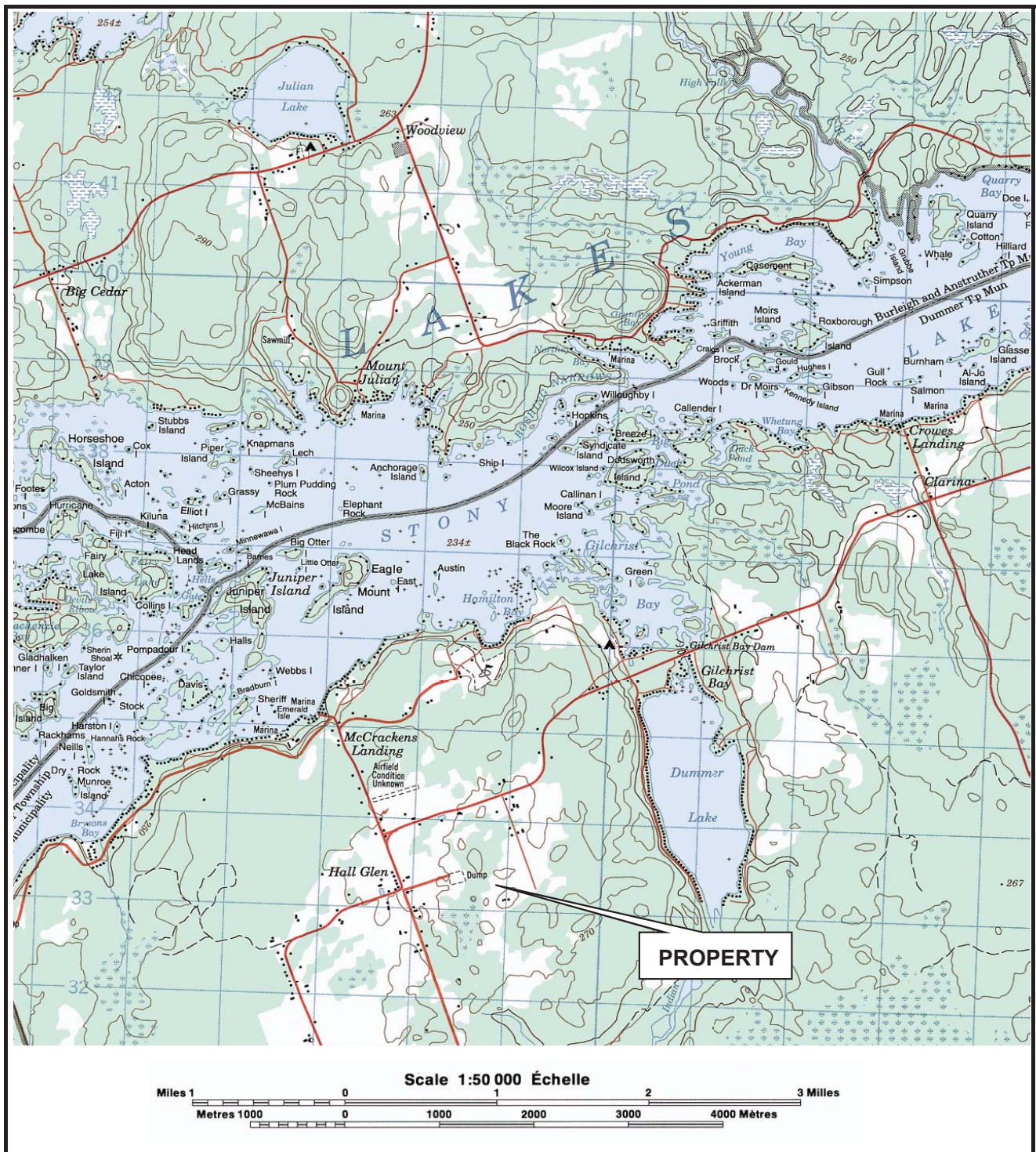
Steven Gagne, H.B.Sc.

A handwritten signature in black ink, appearing to read "Nyle McIlveen".

Nyle McIlveen, P.Eng.



Enclosures



Base map compiled from Energy, Mines and Resources Canada Map 31 D/9 dated 1996. Air photography 1999.

Scale:
1:50000
Coordinate System
NAD 1983 UTM

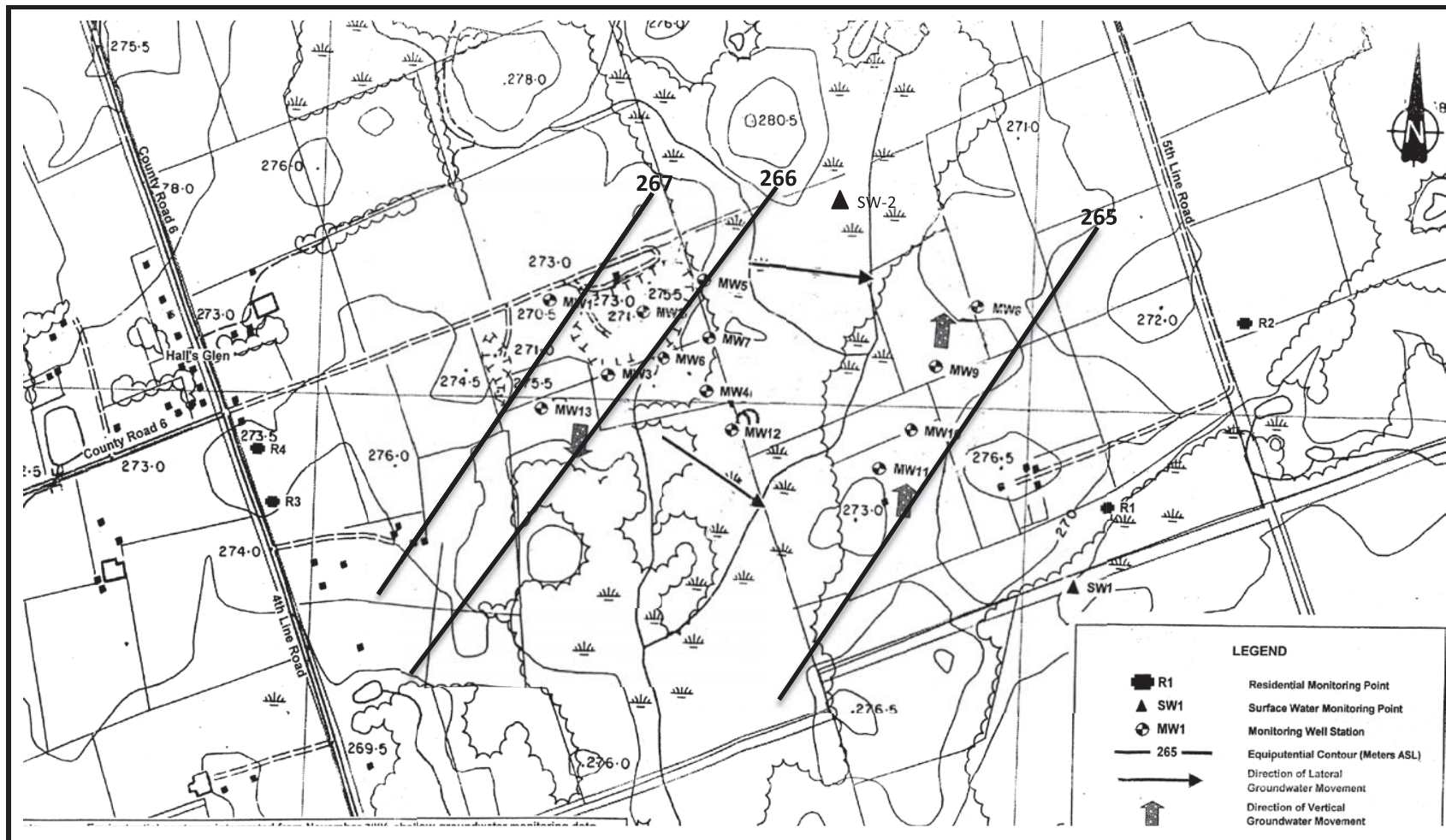


Halls Glenn Landfill
Douro-Dummer Township
Peterborough County

11193337-01
January, 2019

Vicinity Plan

Plate 1



Source: Ministry of Natural Resources Base Map Series 10 17 7250 49300 dated 1990, Air Photo 1984

Scale:
1: 18000
Coordinate System:
NAD 1983 UTM Zone 17



Halls Glenn Landfill
Douro Dummer Township
Peterborough County

Property Plan

11156057-01
January, 2019

Plate 2



Source: Ministry of Natural Resources Base Map Series10 17 7250 49300 dated 1990, Air Photo 1984

Scale:
1: 18000
Coordinate System:
NAD 1983 UTM Zone 17



Halls Glenn Landfill
Douro Dummer Township
Peterborough County

11156057-01
January, 2019

Property Boundary Plan

Plate 3

2018 FIELD DATA SUMMARY

Hall's Glen Landfill Site
Township of Douro-Dummer, County of Peterborough
Project No. 11156057-01

	June 6, 2018						October 11, 2017					
Monitoring Well	TEMP (°C)	EC (uS/cm)	DO (ppm)	ORP mV	METHANE (% CH ₄) / H ₂ S (ppm)	pH	TEMP (°C)	EC (uS/cm)	DO (ppm)	ORP mV	METHANE (% CH ₄) / H ₂ S (ppm)	pH
MW 1-I	8.9	767	6.4	164	0/0	7.7	10.8	9	6.6	75	0/0	6.5
MW 1-II					0/0						0/0	
MW 2-I					0/0						0/0	
MW 2-II					0/0						0/0	
MW 3-I	11.7	729	3.7	29	0/0	7.4	10.9	621	9.5	49	0/0	6.7
MW 3-II	11.3	490	3.7	86	0/0	7.0					0/0	
MW 4-I	8.5	477	4.1	-9	0/0	7.6	10.0	723	7.5	138	0/0	7.9
MW 4-II	10.3	295	8.6	-23	0/0	7.8	10.3	565	10.5	134	0/0	8.1
MW 5-I	10.2	958	7.2	-72	0/0	7.1	11.3	1124	9.0	44	0/0	6.1
MW 5-II	12.1	1236	9.6	101	0/0	7.0					0/0	
MW 6-I	11.2	918	4.2	-60	0/0	7.2	10.8	919	10.1		0/0	6.9
MW 6-II	11.7	1953	3.3	-88	0/0	6.9	10.9	832	11.8	55	0/0	6.7
MW 7-I	10.1	590	6.0	56	0/0	8.0	10.3	597	10.6	51	0/0	7.3
MW 7-II	11.3	370	9.8	63	0/0	7.7	11.1	1662	9.8	86	0/0	6.7
MW8-I	9.2	570	4.8	198	0/0	7.7	12.2	695	3.7	21	0/0	6.4
MW8-II	8.5	419	3.4	196	0/0	7.7	13.4	803	8.8	79	0/0	6.1
MW9-I	10.5	420	3.7	-195	0/0	7.9	13.2	533	2.8	-220	0/0	7.6
MW9-II	10.3	404	3.6	-125	0/0	7.7	14.1	655	4.1	-86	0/0	7.4
MW10-I	10.2	447	4.0	-70	0/0	7.8	13.2	556	3.6	-126	0/0	7.5
MW10-II	10.6	442	3.6	-109	0/0	7.6	13.8	518	4.0	-115	0/0	7.6
MW11-I	9.5	435	3.8	-95	0/0	7.8	12.9	589	4.4	-125	0/0	7.7
MW11-II	9.1	345	4.0	-93	0/0	7.8	12.5	528	5.7	-122	0/0	7.7
MW12-I	8.5	457	3.0	-92	0/0	7.6	9.9	477	5.9	-149	0/0	7.6
MW12-II	9.1	501	4.1	-55	0/0	7.7	9.2	576	6.5	-106	0/0	7.5
MW12-III	10.1	510	5.7	147	0/0	7.7	9.5	572	10.8	-51	0/0	7.7
MW 13-I	9.1	385	9.9	158	0/0	7.9	9.6	652	10.3	13	0/0	7.8
MW 13-II	8.9	292	7.1	129	0/0	7.9	10.8	502	8.7	10	0/0	7.6

Notes:
(---) indicates no data

2018 WATER LEVEL MONITORING SUMMARY

Hall's Glen Landfill Site

Township of Douro-Dummer, County of Peterborough

Project No. 11156057-01

MONITORING WELL	TOP OF CASING ELEVATION	June 6, 2018		October 14, 2018	
		WATER LEVEL FROM TOP OF CASING	WATER LEVEL ELEVATION	WATER LEVEL FROM TOP OF CASING	WATER LEVEL ELEVATION
	(M)	(M)	(M)	(M)	(M)
MW1-I	271.24	2.70	268.54	3.52	267.72
MW1-II	271.24	dry	---	dry	---
MW2-I	282.49	dry	---	dry	---
MW2-II	282.53	dry	---	dry	---
MW3-I	269.23	1.10	268.13	2.30	266.93
MW3-II	269.23	1.18	268.05	dry	---
MW4-I	268.28	2.05	266.23	2.50	265.78
MW4-II	268.28	1.86	266.42	2.31	---
MW5-I	271.35	4.92	266.43	5.13	266.22
MW5-II	271.35	3.30	268.05	dry	---
MW6-I	271.01	4.73	266.28	5.16	265.85
MW6-II	271.01	3.08	267.93	3.98	267.03
MW7-I	269.03	2.97	266.06	3.15	265.88
MW7-II	269.03	2.31	266.72	2.96	266.07
MW8-I	270.74	4.48	266.26	5.55	265.19
MW8-II	270.74	4.46	266.28	6.59	264.15
MW9-I	267.25	0.78	266.47	1.30	265.95
MW9-II	267.25	1.10	266.15	2.11	265.14
MW10-I	267.97	2.09	265.88	2.55	265.42
MW10-II	267.97	2.22	265.75	2.51	265.46
MW11-I	268.50	2.52	265.98	2.89	265.61
MW11-II	268.50	2.48	266.02	3.04	265.46
MW12-I	268.00	1.68	266.32	2.16	265.84
MW12-II	268.00	1.61	266.39	2.11	265.89
MW12-III	268.00	1.52	266.48	2.11	265.89
MW13-I	na	1.55	---	2.27	---
MW13-II	na	1.65	---	2.37	---

Notes:

All measurements presented in metres.

MP refers to measuring point (top of protective casing) above surrounding ground surface.

(na) - indicates not available

EVALUATION OF REASONABLE USE CRITERIA - OVERBURDEN WELLS, JUNE 2018
Hall's Glen Landfill Site

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	OVERBURDEN MONITORS						BACKGROUND WELL
				MW 2-II	MW 3-II	MW 4-II	MW 5-II	MW 6-II	MW 7-II	MW 13-II
Alkalinity	500	221	360.50		609	305	819	929	609	221
pH	8.5	7.89	8.20		7.66	7.94	7.18	7.41	7.66	7.89
Conductivity		503			1300	356	1480	2060	1300	503
TDS	500	269	384.50		794	220	969	1310	794	269
COD		8			11	< 8	51	87	11	8
Ammonia		0.9			2.1	< 0.1	11.1	19.7	2.1	0.9
Sulphate	500	18	259.00		78	3	9	180	78	18
Chloride	250	44	147.00		26	4	91	99	26	44
Nitrate	10	0.7	5.36		7.6	0.07	1.02	< 0.06	7.6	0.71
Barium	1	0.16	0.58		0.173	0.0955	0.689	0.701	0.173	0.16
Boron	5	0.074	2.54		0.435	0.045	0.362	0.817	0.435	0.074
Calcium		130			231	107	273	438	231	130
Iron	0.3	0.02	0.16		1.4	< 0.007	29.9	21.4	1.4	0.024
Manganese	0.05	0.00378	0.03		3.15	0.0678	6.76	11.7	3.15	0.00378
Sodium	200	29.3	114.65		58.5	11.4	64	121	58.5	29.3

All results are represented in mg/L, unless otherwise stated

ODWS - Ontario Drinking Water Standards, 2000

RUP - Reasonable Use Policy (Policy B-7) Bolded values exceed RUP.

Background Well MW1-I was reported at less than detection limit for Nitrate (<0.05).

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	OVERBURDEN MONITORS						BACKGROUND WELL
				MW 8-II	MW 9-II	MW 10-II	MW 11-II	MW 12-II		MW 13-II
Alkalinity	500	221	360.50	235	247	251	238	267		221
pH	8.5	7.89	8.20	7.82	7.99	7.82	8.04	7.93		7.89
Conductivity		503		639	616	610	509	690		503
TDS	500	269	384.50	349	317	380	294	414		269
COD		8		11	8	< 8	< 8	< 8		8
Ammonia		0.9		< 0.1	< 0.1	0.6	0.6	0.2		0.9
Sulphate	500	18	259.00	8	10	11	10	24		18
Chloride	250	44	147.00	72	44	52	13	51		44
Nitrate	10	0.7	5.36	0.2	< 0.06	0.4	< 0.06	< 0.06		0.71
Barium	1	0.16	0.58	0.107	0.16	0.566	0.361	0.62		0.16
Boron	5	0.074	2.54	0.043	0.039	0.128	0.164	0.117		0.074
Calcium		130		106	106	128	99.9	135		130
Iron	0.3	0.02	0.16	0.016	0.372	4.28	1.52	< 0.007		0.024
Manganese	0.05	0.00378	0.03	0.0052	0.0159	0.0931	0.0268	0.00515		0.00378
Sodium	200	29.3	114.65	37.4	34.6	6.56	8.7	13.9		29.3

EVALUATION OF REASONABLE USE CRITERIA - BEDROCK WELLS, JUNE 2018
Hall's Glen Landfill Site

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	BEDROCK MONITORS						BACKGROUND WELL	
				MW2-I	MW3-I	MW4-I	MW5-I	MW6-I	MW7-I	MW1-I	MW13-I
Alkalinity	500	259	379.50		272	310	640	469	301	291	227
pH	8.5	8.09	8.30		8.01	8.01	7.52	7.84	7.76	8.07	8.11
Conductivity		880			643	743	1340	1270	435	1170	590
TDS	500	544	522.00		354	397	774	686	254	774	314
COD		10.5			< 8	< 8	38	25	10	8	13
Ammonia		0.1			0.1	0.4	10.2	6.2	< 0.1	0.1	0.1
Sulphate	500	45.5	272.75		61	350	15	43	12	76	15
Chloride	250	130	190.00		40	65	130	110	14	160	100
Nitrate	10	1.2			1.41	0.88	2.74	0.61	< 0.06	1.48	0.94
DOC	5	2	3.50		4	5	20	9	3	2	2
Barium	1	0.15415	0.58		0.0998	0.115	0.484	0.313	0.123	0.238	0.0703
Boron	5	0.0665	2.53		0.065	0.092	0.295	0.241	0.539	0.111	0.022
Calcium		135.2			135	135	259	194	35.7	174	96.4
Iron	0.3	0.01	0.15		< 0.007	< 0.007	21.8	1.24	< 0.007	0.007	0.007
Manganese	0.05	0.0001	0.03		0.00437	0.234	2.03	1.42	0.00052	0.00012	0.00008
Sodium	200	48.7	124.35		17.8	27.7	54.6	64.1	143	65.8	31.6

All results are represented in mg/L unless otherwise stated

ODWS - Ontario Drinking Water Standards, 2000

RUP - Reasonable Use Policy (Policy B-7)

Bolded values exceed RUP.

Background Well MW1-I was reported at less than detection limit for Nitrate (<0.05).

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	BEDROCK MONITORS						BACKGROUND WELL	
				MW8-I	MW9-I	MW10-I	MW11-I	MW12-II	MW12-III	MW1-I	MW13-I
Alkalinity	500	259	379.50	291	275	241	265	284	281	291	227
pH	8.5	8.09	8.30	7.89	8.15	8.03	8.11	8.11	8.01	8.07	8.11
Conductivity		880		816	633	638	669	767	747	1170	590
TDS	500	544	522.00	457	386	389	391	429	463	774	314
COD		10.5		< 8	19	9	< 8	< 8	< 8	8	13
Ammonia		0.1		< 0.1	0.6	< 0.1	0.8	0.2	< 0.1	0.1	0.1
Sulphate	500	45.5	272.75	16	68	28	53	71	25	76	15
Chloride	250	130	190.00	82	15	51	32	39	60	160	100
Nitrate	10	1.2	5.61	< 0.06	0.14	0.27	< 0.06	< 0.06	< 0.06	1.48	0.94
DOC	5	2	3.50	1	1	3	2	2	< 1	2	2
Barium	1	0.15415	0.58	0.096	0.416	0.702	0.377	0.18	0.0735	0.238	0.0703
Boron	5	0.0665	2.53	0.108	0.385	0.242	0.492	0.533	0.115	0.111	0.022
Calcium		135.2		125	77.2	112	118	119	153	174	96.4
Iron	0.3	0.01	0.15	0.031	0.096	0.481	0.028	0.033	0.04	0.007	0.007
Manganese	0.05	0.0001	0.03	0.00156	0.0526	0.191	0.0814	0.156	0.0161	0.00012	0.00008
Sodium	200	48.7	124.35	47.1	41.8	12	14.8	38.5	14.5	65.8	31.6

EVALUATION OF REASONABLE USE CRITERIA - OVERBURDEN WELLS, NOVEMBER 2018
Hall's Glen Landfill Site

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	OVERBURDEN MONITORS						BACKGROUND WELL
				MW 2-II	MW 3-II	MW 4-II	MW 5-II	MW 6-II	MW 7-II	MW 13-II
Alkalinity	500	282	391.00			315		505	1080	282
pH	8.5	7.91	8.21			7.87		7.74	7.58	7.91
Conductivity		610				701		1080	2200	610
TDS	500	371	435.50			417		686	1470	371
COD		< 8				< 8		17	95	< 8
Ammonia		< 0.1				< 0.1		< 0.1	23.2	< 0.1
Sulphate	500	15	257.50			11		43	60	15
Chloride	250	30	140.00			50		65	140	30
Nitrate	10	1.4	5.69			0.77		4.76	0.12	1.37
Barium	1	0.106	0.55			0.143		0.304	0.432	0.106
Boron	5	0.027	2.51			0.044		0.269	0.673	0.027
Calcium		109				116		145	308	109
Iron	0.3	0.01	0.16			0.017		0.111	0.178	0.013
Manganese	0.05	0.0096	0.03			0.00114		0.00925	7.44	0.0096
Sodium	200	31.8	115.90			20.6		55.6	128	31.8

All results are represented in mg/L unless otherwise stated

ODWS - Ontario Drinking Water Standards, 2000

RUP - Reasonable Use Policy (Policy B-7) Bolded values exceed RUP.

Background Well MW1-I was reported at less than detection limit for Nitrate (<0.05).

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	OVERBURDEN MONITORS						BACKGROUND WELL
				MW 8-II	MW 9-II	MW 10-II	MW 11-II	MW 12-I		MW 13-II
Alkalinity	500	282	391.00	272	272	244	247	251		282
pH	8.5	7.91	8.21	8.15	8.14	7.9	7.65	7.95		7.91
Conductivity		610		984	801	619	603	593		610
TDS	500	371	435.50	583	423	360	354	346		371
COD		< 8		9	8	10	9	13		< 8
Ammonia		< 0.1		0.1	0.2	0.6	0.9	0.1		< 0.1
Sulphate	500	15	257.50	14	16	7	13	22		15
Chloride	250	30	140.00	120	85	47	29	45		30
Nitrate	10	1.4	5.69	0.94	0.62	0.23	< 0.06	< 0.06		1.37
Barium	1	0.106	0.55	0.19	0.203	0.472	0.477	0.667		0.106
Boron	5	0.027	2.51	0.023	0.091	0.113	0.129	0.12		0.027
Calcium		109		139	97.6	90.8	102	96.7		109
Iron	0.3	0.01	0.15	1.32	0.526	9.96	3.35	< 0.007		0.013
Manganese	0.05	0.0096	0.03	0.0389	0.0211	0.0751	0.0313	0.00269		0.0096
Sodium	200	31.8	115.90	46	48.3	8.17	5.56	10.4		31.8

PLATE 6C

EVALUATION OF REASONABLE USE CRITERIA - BEDROCK WELLS, NOVEMBER 2018
Hall's Glen Landfill Site

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	BEDROCK MONITORS						BACKGROUND WELL	
				MW2-I	MW3-I	MW4-I	MW5-I	MW6-I	MW7-I	MW1-I	MW13-I
Alkalinity	500	282.5	391		354	376	677	469	342	292	273
pH	8.5	7.975	8.2		7.82	7.76	7.56	7.75	8.26	7.96	7.99
Conductivity		966			815	904	1520	1190	787	1110	822
TDS	500	564	532.00		471	537	877	703	454	671	457
COD		8			< 8	8	41	15	< 8	8	8
Ammonia		0.1			< 0.1	0.2	13.3	6.5	< 0.1	0.1	0.1
Sulphate	500	43	271.50		16	27	10	42	30	73	13
Chloride	250	126.5	188.25		52	67	120	100	45	160	93
Nitrate	10	2.0	5.98		2.26	1.58	0.54	0.14	0.25	2.7	1.21
DOC	5	2.5	3.75		2	3	14	6	1	2	3
Barium	1	0.1537	0.58		0.112	0.151	0.587	0.285	0.131	0.229	0.0784
Boron	5	0.062	2.53		0.045	0.11	0.45	0.213	0.54	0.104	0.02
Calcium		114.4			129	155	230	163	40.6	157	71.8
Iron	0.3	0.01	0.15		0.013	0.061	28.4	2.24	< 0.007	0.008	0.007
Manganese	0.05	0.003585	0.03		0.102	0.0535	2.12	1.37	0.00568	0.00682	0.00035
Sodium	200	70.55	135.28		30.7	34.2	81.9	63.7	148	70.5	70.6

All results are represented in mg/L, unless otherwise stated

ODWS - Ontario Drinking Water Standards, 2000

RUP - Reasonable Use Policy (Policy B-7).

Bolded values exceed RUP.

Background Well MW1-I was reported at less than detection limit for Nitrate (<0.05).

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	BEDROCK MONITORS						BACKGROUND WELL	
				MW8-I	MW9-I	MW10-I	MW11-I	MW12-II	MW12-III	MW1-I	MW13-I
Alkalinity	500	282.5	391	292	279	240	256	287	294	292	273
pH	8.5	7.975	8.24	7.85	8.41	8.26	8.19	8	7.83	7.96	7.99
Conductivity		966		818	606	649	647	732	708	1110	822
TDS	500	564	532.00	434	280	374	380	449	426	671	457
COD		8		12	37	< 8	15	15	< 8	8	8
Ammonia		0.1		< 0.1	0.6	0.2	0.7	0.2	< 0.1	0.1	0.1
Sulphate	500	43	271.50	17	31	23	52	66	23	73	13
Chloride	250	126.5	188.25	81	18	50	30	43	56	160	93
Nitrate	10	2.0	5.98	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.08	2.7	1.21
DOC	5	2.5	3.75	< 1	1	< 1	2	2	1	2	3
Barium	1	0.1132	0.56	0.102	0.769	0.747	0.37	0.168	0.0347	0.148	0.0784
Boron	5	0.0495	2.52	0.104	0.612	0.253	0.478	0.501	0.08	0.079	0.02
Calcium		112.4		117	59	98.5	103	97.7	136	153	71.8
Iron	0.3	0.01	0.15	0.031	< 0.007	0.043	0.148	0.024	0.2	0.008	0.007
Manganese	0.05	0.003585	0.03	0.0452	0.0706	0.133	0.0835	0.149	0.0493	0.00682	0.00035
Sodium	200	70.55	135.28	49.7	52.4	14.7	15.7	40.4	15.2	70.5	70.6

EVALUATION OF REASONABLE USE CRITERIA - OVERBURDEN WELLS, 2018
Hall's Glen Landfill Site

PARAMETER	ODWS MAC	BACKGROUND AVERAGE	RUP MAC'S	OVERBURDEN MONITORS		BACKGROUND WELL	
				R-1 Spring	R-1 Fall	MW 13-II Spring	MW 13-II Fall
Alkalinity	500	251.5	375.75	228	267	221	282
pH	8.5	7.9	8.20	7.98	7.93	7.89	7.91
Conductivity		556.5		623	667	503	610
TDS	500	320	410.00	320	357	269	371
COD		8		8	11	8	8
Ammonia		0.5		0.1	0.3	0.9	0.1
Sulphate	500	16.5	258.25	4	10	18	15
Chloride	250	37	143.50	56	51	44	30
Nitrate	10	1.0	5.52	0.12	0.24	0.71	1.37
Barium	1	0.133	0.57	0.0663	0.0946	0.16	0.106
Boron	5	0.0505	2.53	0.037	0.017	0.074	0.027
Calcium		119.5		101	111	130	109
Iron	0.3	0.02	0.16	0.3	0.371	0.024	0.013
Manganese	0.05	0.01	0.03	0.00241	0.308	0.00378	0.0096
Sodium	200	30.55	115.28	38.8	33.5	29.3	31.8

All results are represented in mg/L unless otherwise stated

ODWS - Ontario Drinking Water Standards, 2000

RUP - Reasonable Use Policy (Policy B-7)

Bolded values exceed RUP.

Background Well MW1-I was reported at less than detection limit for Nitrate (<0.05).

PLATE 6E

Appendix A

MOECC C of A and Correspondence



M E M O R A N D U M

September 8, 2016

TO: C. Johnston
Senior Environmental Officer
Peterborough District Office
Eastern Region

FROM: B. W. Metcalfe
Senior Environmental Officer
Water Resources Unit – Surface Water Group
Technical Support Section
Eastern Region

RE: 2015 Groundwater Monitoring Report – Hall's Glen Landfill Site
Lot 25, Concession 4, Geographic Township of Dummer
Township of Douro-Dummer, County of Peterborough
Environmental Compliance Approval (ECA) No. 341007

I have reviewed the noted report dated March 2016, prepared by GHD, for the Township of Douro-Dummer, the landfill site Owner. The following comments are offered relative to surface water impact concerns:

Background Information

The Hall's Glen landfill Site is situated along the south side of County Road no. 6 approximately 10 km north of the community of Warsaw. The site operates per the provisional Certificate of Approval No. 341004 dated October 8, 1980. The site also operates as a transfer site according to ECA No. A341007. It was reported that during the summer of 2003 the landfill site was prepared for closure. The landfill area has been mounded and capped and it was understood that that further work was conducted in 2004 and 2005. The landfill operates as a natural attenuating site.

Surface Water Regime

The landfill site is situated within the Trent River Basin. The major surface water features in the landfill site area include Stony Lake located north of the Site and Dummer Lake located to the east of the Site.

Based on overburden groundwater monitoring data GEO-LOGIC determined that the pattern of overburden groundwater movement within the Site area appears to be in a southeasterly direction. There is possible groundwater discharge from the Site area to the wetland located southeast of the landfill.

2015 Surface Water Sampling Program

Surface water samples were collected on two occasions during May and November of 2015. Surface water sample station S-1 is located downgradient from the landfill site and sample station S-2 is the background surface water monitor that was added in 2014. The collected samples were analyzed for the parameters listed in Column 3 of Schedule 5 of the Landfill Standards Guidelines (Comprehensive List for Surface Water). In-field measurements of water temperature, pH, conductivity and dissolved oxygen were taken for each sampling event.

2015 Surface Water Sampling Results

Upstream Background (S-2):

Surface water sample station, newly established in 2014, is located north, upgradient of the landfill site. Sampling was conducted on two occasions in 2015 during May (spring) and November (fall).

The water quality general chemistry was characterized having BOD (<4 mg/L), COD (9 – 18 mg/L), field Dissolved Oxygen (8.18 mg/L, Nov. 19/15), field Conductivity (109 µS/cm, Nov. 19/15), field pH (7.82, Nov. 19/15), Alkalinity (251 - 269 mg/L), Chlorides (34 - 84 mg/L), Total Ammonia (<0.1 mg/L), Un-ionized Ammonia (n.a.), Nitrate (<0.06 – 0.13 mg/L), Total Phosphorus (0.021 - <0.03 mg/L), Total Suspended Solids (< 2 – 3 mg/L) and Phenols (0.001 – 0.002 mg/L).

- Provincial Water Quality Objectives (PWQO) exceedance was observed only for Phenols (0.002 mg/L slightly exceeded 0.001 mg/L, Nov. 91/15).

Downstream Impact (S-1):

Surface water sample station is located approximately 0.75 km southeast downgradient of the landfill site waste mound. Sampling was conducted on two occasions during May and November 2015.

The water quality general chemistry was characterized having BOD (< 4 mg/L), COD (9 - 10 mg/L), field Dissolved Oxygen (6.05 mg/L, Nov. 4/15), field Conductivity (546 µS/cm, Nov. 4/15), field pH (7.2, Nov. 4/15), Alkalinity (253 - 273 mg/L), Chlorides (59 – 84 mg/L), Total Ammonia (<0.1 mg/L), Un-ionized Ammonia (n.a.), Nitrate (<0.03 mg/L), Total Phosphorus (0.012 – <0.03 mg/L), Total Suspended Solids (< 2 – 4 mg/L) and Phenols (<0.001 – 0.001 mg/L).

- There were no PWQO exceedances observed for the relevant parameters analyzed for.

Surface Water Quality Impact Assessment

- The reviewer is in agreement with the landfill site Owner's assessment that all of the water quality parameters tested for are within their respective current PWQO, the Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines, and APV concentrations with the exception of a minor exceedance for Phenols of the PWQO in the background 2015 November (fall) sample.
- The monitoring results for the 2015 sampling events indicated the landfill site was not having an adverse impact to the water quality of the down-gradient surface water monitored at sample location S-2.
- Relative to surface water impact concerns the reviewer is in agreement with the conclusions and recommendations presented in the 2015 Annual Monitoring Report for the Hall's Glen Landfill Site.

"Original Signed By"

Bruce Metcalfe
BWM/dv

ec: G. Faaren
P. Taylor
C. Redmond

c: S. Trimper
B. Metcalfe (Aba2016\aba4161.mem) 6151-AAFLMZ \ X-ref. 6700-AAFLBU
File SW PB DD C4 03 06, Hall's Glen Landfill Site, Township of Douro-Dummer
File SW 11 02 07 02, Unnamed Tributary, Stony Lake, Trent River Basin



MEMORANDUM

07 August 2014

TO: C. Johnston
Senior Environmental Officer
Peterborough District Office
Eastern Region

FROM: B. W. Metcalfe
Senior Environmental Officer
Water Resources Unit, Surface Water Group
Technical Support Section
Eastern Region

RE: 2013 Annual Monitoring Report - Hall's Glen Landfill Site
Lot 25, Concession 4, Dummer Ward, Geographic Township of Dummer
Township of Duoro-Dummer, County of Peterborough
Environmental Compliance Approval (ECA) No. A341004

I have reviewed the document entitled, "2013 Groundwater Monitoring Report, Hall's Glen Landfill Site (C of A A341004)", dated March 2014, prepared by Geo-Logic Inc. (Geo-Logic) for the Township of Duoro- Dummer. The following comments are offered relative to surface water impact concerns.

Background Information

The Hall's Glen landfill Site is situated along the south side of County Road No. 6 approximately 10 km north of the community of Warsaw. The site operates per the provisional Certificate of Approval No. 341004 dated October 8, 1980. The site also operates as transfer site according to Provisional Certificate of Approval No. A341007. It was reported that during the summer of 2003 the landfill site was prepared for closure. The landfill area has been mounded and capped and it was understood that further work was conducted in 2004 and 2005. The landfill operates as a natural attenuating site.

Surface Water Regime

The landfill site is situated within the Trent River Basin. The major surface water features in the landfill site area include Stony Lake located north of the site and Dummer Lake located to the east of the site.

Based on overburden groundwater monitoring data Geo-Logic determined that the pattern of overburden groundwater movement appears to be in an easterly direction.

Surface Water Monitoring Program

The groundwater monitoring report includes a limited surface water sampling component for the site. The surface water monitoring program is limited to one surface water sampling station (identified as SW1 on the Site Plan) which is located southeast downgradient of the site. The surface water feature monitored was not identified, but appears to be a drainage ditch or ponded wetland. The landfill site Owner did not include a reference background upstream surface water quality sampling station.

Sample station SW1 was sampled on two occasions, June 10 and November 5, 2013. The collected surface water samples were analyzed for the limited parameter suite specified in Column 4 of Schedule 5 of the Landfill Standards Guideline (Indicator List for Surface Waters).

The analyses of the June 10 and November 5, 2013 collected surface water samples (referenced as sample station S-1) were presented in the SGS Certificate of Analysis Reports dated June 17 and November 13, 2013 respectively.

Surface Water Impact Assessment

SGS summarized the surface water quality data with the assessment that all of the parameters tested are within their respective current PWQO (the PWQO parameters analyzed for were limited only to pH, total phosphorus, phenols, and iron).

A review of the 2013 analytical results showed a total phosphorus concentration of 0.08 mg/L for the June 10/13 sample which exceeded the PWQO of 0.03 mg/L.

- The reviewer would note that there is no upstream background surface water sampling station incorporated in the surface water monitoring program for the landfill site.

Summary and Recommendations

Relative to surface water quality impact assessment purposes the reviewer considers the 2013 Annual Monitoring Report for the Hall's Glen Landfill Site provided by the landfill site Owner to be deficient.

The reviewer provided previous surface water technical comment on the 2012 Annual Monitoring Report for the Hall's Glen Landfill Site (Geo-Logic, 2012) which was presented in the memorandum dated January 20, 2014, from B. Metcalfe, Senior Environmental Officer, Water Resources Unit, Technical Support Section, Eastern Region to D. Johnston, Senior Environmental Officer, Peterborough District Office. The reviewer's recommendations presented in the noted January 20, 2014 memorandum and those provided in this memorandum remain essentially the same. Additional detail regarding the nature and degree of the surface water quality impact associated with the landfill site is required from the landfill site Owner. The reviewer recommends the following:

- In addition to the existing downstream surface water sampling station SW1 a reference upstream background surface water sampling station is required for the surface water monitoring program for the landfill site.

- The chemical parameter suite per Column 4 of Schedule 5 of the Landfill Standards Guideline (Indicator List for Surface Waters) is considered to be inadequate for the purposes of surface water quality impact assessment for this landfill site. The collected surface water samples should be analyzed for the Schedule 5 – Column 3 Comprehensive List for Surface Water (which includes the metals analyses suite) per the MOE Landfill Standards Guideline.
- A surface water quality impact assessment section is required to be provided by the landfill site Owner and this should be included in all future Annual Monitoring Reports for the Hall's Glen Landfill Site.



Bruce Metcalfe
BWM/gl

- c: G. Faaren
B. Metcalfe (Aba2014\aba414.mem) 2441-9KKLGX \ X-ref. 2387-9KHRP6
File SW PB DD C4 03 06, Hall's Glen Landfill Site, Township of Duoro-Dummer
File SW 11 02 07 02, Unnamed Tributary, Stony Lake, Trent River Basin
- ec: G. Dagg-Foster
P. Taylor
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M E M O R A N D U M

23 June 2014

TO: Chris Johnston
Senior Environmental Officer
Peterborough District Office
Eastern Region

FROM: Greg Faaren
Hydrogeologist
Technical Support Section
Eastern Region

RE: Hall's Glen Waste Disposal Site, 2013 Annual Monitoring Report
Lot 25, Concession IV, Geographic Region of Dummer
Township of Duoro-Dummer, County of Peterborough, A341004

Purpose

I have reviewed the hydrogeologically pertinent sections of the document entitled "2013 Groundwater Monitoring Report, Hall's Glen Landfill Site (A341004), Township of Douro-Dummer, County of Peterborough" dated March 2014 and prepared by GEO-LOGIC Inc. (GLI). This report was provided on behalf of Township of Douro-Dummer to fulfill the requirements of the Provisional Environmental Compliance Approval (ECA) for the site. I offer the following comments for your consideration.

Summary

- The primary pathway for leachate migration at the site is within the overburden and shallow bedrock to the southeast of the waste mound. Leachate impacted groundwater is present to the south and southeast of the waste mound.
- GLI completed a Guideline B-7 Reasonable Use (RU) assessment as part of the 2013 annual monitoring report. However, the RU assessment only included four (4) parameters (iron, chloride, sulphate and nitrate). The data provided by GLI shows RU exceedances for iron in several downgradient wells. GLI states that the iron concentrations observed in the downgradient wells at locations MW8, MW10 and MW11 may be naturally occurring. Continued monitoring is recommended. Future RU assessments must also include all leachate indicator parameters for the site.
- Leachate impacted groundwater flows to the south and southeast from the waste mound, and may discharge to the wetland in this portion of the site. It is recommended that any monitoring wells that are thought to intercept groundwater that discharges to surface water be analyzed for the same suite of parameters as the surface water samples. The samples should also be analyzed with detection limits commensurate with

the Provincial Water Quality Objectives (PWQO). The samples from these monitoring wells must be compared to the PWQO and the Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWSOG).

- The fall sample from residential well R2 exceeded the ODWSOG for iron. The spring and fall samples from well R4 also exceeded the ODWSOG for TDS. These impacts do not appear to be landfill related as well R4 is located upgradient of the waste disposal site and well R2 is located downgradient of the site across a wetland. Continued monitoring is recommended.
- Trend analysis information was provided for select monitoring wells at the site, but the supporting data (i.e. numerical data tables) was not provided. It is recommended that the historical sampling data as well as background water quality ranges be included as part of each annual report. The supporting data should be provided in both hard copy and electronic format (i.e. MS Excel) as well. Evaluation of trends in groundwater concentrations should continue to be completed for all leachate indicator parameters at all monitoring wells at the site.
- GLI has provided groundwater trigger mechanisms based on only health related volatile organic compound (VOC) parameters. These parameters alone do not comprise an appropriate trigger mechanism for the site. It is recommended that trigger mechanisms and contingency plans based Guideline B-7, Reasonable Use and surface water issues be developed for the site and provided in the next annual monitoring report. The trigger parameters should include all leachate indicator parameters.
- It is noted that the waste disposal site boundaries are not shown clearly on the figures attached in the report. This issue should be addressed.
- GLI recommends that groundwater samples be analyzed for the list of parameters in Column 2 of Schedule 5 of the Landfill Standards Guideline. The reporting frequency is to be every year. I recommend that the semi-annual groundwater monitoring sampling program continue at this site. The list of parameters should include those listed in Column 1 (spring) and Column 2 (fall) of Schedule 5 of the Landfill Standards Guideline (including manganese).
- As per the MOE's November 2010 Monitoring and Reporting for Waste Disposal Sites Technical Guidance Document, a Monitoring and Screening checklist is to be submitted with all annual monitoring reports, commencing in 2011. In reviewing the Hall's Glen waste disposal site report, it is noted that the checklist was not included. It is recommended that the 2014 report, and all subsequent future reports include a completed and signed checklist.

Environmental Compliance Approval (ECA)

The Hall's Glen waste disposal site previously operated under Provisional ECA A341004. The site stopped accepting waste in 2003 and began closure activities at that time. Final capping of the landfill was completed in 2005. The site is located in Lot 25, Concession IV, Geographic Region of Dummer, Township of Douro-Dummer. Originally, the licensed waste footprint was 1.0 hectare within a total property of 2.0 ha. However in 2005, additional buffer lands were

purchased by the Township to bring the site's total area to 48.5 ha. These additional lands were added in an amendment to the site's ECA issued on February 1, 2006. A groundwater monitoring program was implemented for the site as part of the post closure plan. It is noted that the waste disposal site boundaries are not shown clearly on the figures attached in the report.

According to MOE's November 2010 Monitoring and Reporting for Waste Disposal Sites Technical Guidance Document, and as communicated by the ministry (through webinars and information distributed in coordination with the Ontario Waste Management Association both last year and earlier this year), a Monitoring and Screening checklist is to be submitted with all annual monitoring reports, commencing in 2011. In reviewing the 2013 Hall's Glen waste disposal site report, it is noted that the checklist was not included.

Geology

The consultants previously described the geology of the site as:

- A glacial drift/till unit;
- A glaciolacustrine sand unit; and,
- A limestone bedrock unit (Lindsay Formation).

GLI reports that the typical overburden thickness at the site is approximately 3.25 m.

Hydrogeology

The consultants previously determined the physical hydrogeological characteristics of the site as:

- Groundwater flow within the overburden on-site is to the southeast towards an unnamed wetland. Groundwater flow within the bedrock is towards the south.
- The hydraulic conductivities at the site range from 10^{-2} to 10^{-3} cm/second.
- GLI reported that the average horizontal gradient for the shallow overburden wells was 1.6×10^{-2} m/m, deep overburden wells was 4.6×10^{-3} m/m and 3.8×10^{-3} m/m in bedrock. Vertical hydraulic gradients are variable with downward gradients observed in wells near the waste mound and upward gradients in wells near the wetland.

GLI reports that monitoring wells MW1-II, MW2-I, MW2-II and MW5-II were not able to be sampled in 2013.

Background Water Quality

GLI has used monitoring wells MW1-I, MW1-II, MW13-I and MW13-II to represent background water quality conditions for the site. These monitoring wells are located hydraulically upgradient to the existing landfill area. Water samples were unable to be collected from well MW1-II during the 2013 sampling program. The groundwater sampling results show that only dissolved organic carbon (DOC) and total dissolved solids (TDS) from well MW1-I exceeded the ODWSOG in analyzed background groundwater samples in 2013.

Leachate

Groundwater monitoring wells MW2-I and MW2-II are located within the waste area and are expected to be representative of leachate quality. However, monitoring wells MW2-I and MW2-II were not able to be sampled in 2013. It is noted that both the shallow and deep monitoring wells at locations MW3, MW5 and MW6 were sampled in 2013 and (as in previous years) the groundwater quality in these wells was notably impacted. Elevated concentrations of iron, alkalinity, DOC, sulphate and TDS were noted in these wells. These wells would appear to most represent leachate quality at the landfill.

Downgradient Water Quality

The primary pathway for leachate migration is inferred to be within the overburden and shallow bedrock in a south to southeasterly direction. Leachate impacts to groundwater as measured in the downgradient locations at this site are summarized as follows:

- The highest levels of leachate indicator parameters were seen in the overburden monitoring wells at locations MW3, MW5 and MW6. Levels of one (1) or more of iron, alkalinity, DOC and TDS exceeded the ODWSOG in each of these wells.
- It is noted that concentrations of most leachate indicator parameters were lower in the spring sampling event (June) than in the fall sampling event (November). GLI also notes that groundwater quality showed less impact in 2013 as compared to previous years. Further monitoring is required to study this trend.
- Exceedances of the ODWSOG for iron were noted in the furthest downgradient monitoring wells (i.e. MW10 and MW11).

GLI reports that the elevated concentrations of iron observed in wells MW8-I, MW10-II and MW11-II may be naturally occurring. The concentrations of iron observed in these monitoring wells are significantly higher than those observed in wells closer to the waste mound, particularly in the shallow zone wells. There may be other factors contributing to the elevated iron concentrations in these wells. However it is noted that elevated concentrations of landfill related iron are evident in some monitoring wells closer to the waste mound.

The results of the VOC analyses conducted showed no exceedances of the ODWSOG for VOC parameters.

It is noted that the groundwater samples from the Hall's Glen waste disposal site were not submitted for analysis of manganese. Manganese is a common leachate indicator parameter at waste disposal sites. The reason for not including manganese in the sampling suite was not provided.

Groundwater/Surface Water Interaction

The site plans provided by GLI indicate that there are wetlands located off-site to the southeast of the waste mound. GLI reports that vertical hydraulic gradients near the wetland are upward, indicating groundwater discharge conditions. Therefore there is the potential that shallow groundwater discharges to the surface water to the southeast of the site. GLI has not compared the results of the groundwater analyses conducted to the PWQO criteria.

Potable Groundwater Sampling

GLI reports that groundwater samples were collected from nearby potable water supply wells R1, R2, R3 and R4 in the spring and fall of 2013. Wells R1 and R2 are located downgradient of the landfill site and across a wetland. Wells R3 and R4 are located upgradient of the landfill near the intersection of 4th Line Road and County Road 6.

A review of the sampling results indicates that the spring and fall 2013 water samples from well R4 exceeded the ODWSOG for TDS. However, the samples from well R4 showed low levels of barium, calcium and magnesium, but elevated levels of chloride, sodium, TDS and conductivity. Well R4 is located hydraulically upgradient of the waste disposal site and therefore the impacts in this well are not likely related to the landfill. This well may be showing signs of road salt impacts.

The fall sample from well R2 exceeded the ODWSOG for iron. These impacts do not appear to be landfill related as well R2 is located significantly downgradient of the site across a wetland.

Guideline B-7 Reasonable Use

Guideline B-7 applies to operating waste disposal sites and to sites closed post 1986. GLI conducted a Guideline B-7 Reasonable Use for the site as part of the 2013 monitoring program report. However, GLI only used four (4) parameters as part of the Reasonable Use assessment, namely chloride, sulphate, nitrate and iron. Other leachate indicator parameters including TDS, alkalinity and DOC were not included.

GLI reports Reasonable Use (RU) exceedances for iron in several downgradient wells on at least one (1) occasion in 2013. GLI states that the iron concentrations observed in the downgradient wells may be naturally occurring. Iron is not elevated in any of the background groundwater monitoring wells and wells located closer to the waste mound show elevated concentrations of iron likely related to leachate impacts. However, iron concentrations observed in wells MW8-I, MW10-II and MW11-II are significantly higher than those observed in wells closer to the waste mound, particularly in the shallow zone wells. There may be other factors contributing to the elevated iron concentrations in these wells. It is noted that concentrations of leachate indicators in the downgradient wells has decreased from previous years.

The landfill site boundaries are not well illustrated on the site plan. Therefore it is difficult to ascertain where the Guideline B-7 conformance boundary is located.

Trigger Mechanisms/Contingency Plans

Information regarding trigger mechanisms or contingency plans was provided in the 2013 report. However, the trigger mechanisms specified were based only on health related parameters from the ODWSOG for VOCs. Trigger mechanisms based on non-health related groundwater parameters or surface water issues were not provided.

Groundwater Monitoring

GLI recommends that groundwater samples be analyzed for the list of parameters in Column 2 of Schedule 5 of the Landfill Standards Guideline. GLI also recommends that additional QA/QC samples be analyzed for VOCs during both sampling events in 2014. The reporting frequency is to be annual.



Greg Faaren, P.Geo.
GF/sh

ec: Peter Taylor
Gillian Dagg-Foster
David Bradley
Victor Castro

c: File GW PB DD C4 01 03 (A341004)
GF/IDS #2417-8VLL4E

FEB 08 2006



Ontario

Ministry
of the
Environment

Ministère
de
l'Environnement

AMENDMENT TO PROVISIONAL CERTIFICATE OF APPROVAL
WASTE DISPOSAL SITE
NUMBER A341004

Issue Date: February 1, 2006

The Corporation of the Township of Douro-Dummer
PO Box 92
Warsaw, Ontario
K0L 3A0

Site Location: Hall's Glen Landfill Site
Lot 25, Concession 4, Dummer Ward
Douro-Dummer Township, County of Peterborough

You are hereby notified that I have amended Provisional Certificate of Approval No. A341004 issued on October 8, 1980 and amended on April 6, 2001, November 29, 2001, August 29, 2002, July 18, 2003, July 23, 2004 and June 23, 2005 for a Waste Disposal Site (Landfill/Transfer), as follows:

- I. The total area of the closed Hall's Glen landfill site is hereby increased from 8 hectares to 48.5 hectares in accordance with the letter dated August 30, 2005 to James O' Mara, Director, Environmental Assessment and Approvals Branch, Ministry of the Environment. See Part IV for Registration on Title requirements.
- II. The following definitions are hereby added:
 - (1) (g) "Competent" means knowledgeable, through instruction and practice, and able to carry out any necessary duties in the following:
 - (i) relevant waste management legislation, regulations and guidelines;
 - (ii) major environmental concerns pertaining to the waste to be handled;
 - (iii) emergency response procedures for the waste to be handled;
 - (iv) use and operation of the equipment to be used at the Site;
 - (v) emergency response procedure and alerting;
 - (vi) Site specific written procedures for the control of conditions that may cause an adverse effect; and
 - (vii) requirements of this Certificate.

III. HOUSEHOLD HAZARDOUS WASTE ("HHW") DEPOT

The Township is hereby approved to establish and operate a household hazardous waste depot at the site, in accordance with the following added conditions and with the items listed in Schedule "B" of this Certificate:

- (34) (a) The HHW depot shall not receive more than 20 cubic metres of HHW per day; and
(b) The HHW depot shall not store in excess of 50 cubic metres of HHW on site.
- (35) HHW shall not be stored at the Site for longer than one hundred eighty (180) days, unless the consent of the District Manager has been obtained, with the exception of waste oil which shall be stored on site in accordance with Condition 31(b).
- (36) All household hazardous waste received and stored must be managed in accordance with Ontario Regulation 347, R.R.O. 1990, as amended, and with the Ministry of Environment document entitled "Household Hazardous Waste Collection and Facility Guidelines" dated May 1993.
- (37) All storage of liquid wastes shall be in accordance with this Ministry's publication "Guidelines of Environmental Protection Measures at Chemical Storage Facilities", dated October 1978 as amended.
- (38) All HHW shall be stored in secondary containment that is adequate to contain any spills or leaks. Segregated secondary containment shall be provided for incompatible types of waste.
- (39) Incoming HHW shall be inspected by Competent personnel, prior to being accepted at the Site, to ensure that the Site is approved to accept that type of waste.
- (40) All containers shall be clearly labeled indicating the type and nature of the hazardous waste stored as required by regulation. All points of access to the Site shall be posted to warn that the area contains hazardous materials.
- (41) No radioactive wastes shall be accepted at this Site.
- (42) Oil and oil-based paints which have been manufactured prior to 1972; or whose manufacturing date cannot be determined, may contain PCBs and shall be handled as follows:
 - (a) The oil and oil-based paints shall not be mixed (bulked) with other paints prior to testing. Paints which are lab-packed are not considered to be mixed under this Certificate;
 - (b) The oil and oil-based paints shall be tested by a certified laboratory for PCB content and shall be handled in the manner outlined in Condition 42(c) if found to contain PCBs;

- (c) If the oil and oil-based paints are found to have PCBs at or above levels identified in Condition 42(d), it shall be forthwith reported to the District Manager and shall be managed in accordance with Regulation 362 and stored or removed from the Site to an approved PCB storage site, in accordance with written instructions from the District Manager; and
 - (d) The oil and oil-based paints shall not be distributed for reuse if they have any measurable PCB content. The oil and oil-based paint is considered to be a PCB waste, if measured levels are equal to or greater than 50 parts per million.
- (43) Except for oil based paints that become classified as PCB Waste, paints may be offered for reuse to the public. Records shall be kept of the type, volume and recipient of paint returned to the public.
- (44) The Township shall maintain, at the Site, a log book which records daily, the following information:
- (a) date of record;
 - (b) types, quantities and source of HHW received;
 - (c) quantities of HHW stored at the Site;
 - (d) quantities and destination of HHW shipped from the Site; and
 - (e) quantities of waste returned to the public as noted in Condition (42).

IV. The following Conditions are hereby added:

CERTIFICATE OF REQUIREMENT

- (45) The Owner shall:
- (a) within sixty (60) calendar days of the date of this Certificate, submit to the Director, for Director's signature, two copies of a completed Certificate of Requirement containing a registerable description of the newly acquired property, in accordance with the attached form; and
 - (b) within twenty (20) calendar days of receiving the Certificate of Requirement signed by the Director, register the Certificate of Requirement in the appropriate Land Registry Office on title to the Property and submit to the Director the duplicate registered copy immediately following registration.
- (46) Pursuant to Section 197 of the *EPA*, neither the *Owner* nor any person having an interest in the Property shall deal with the Property in any way without first giving a copy of this Certificate to each person acquiring an interest in the Property as a result of the dealing.

V. The following items are hereby added to Schedule "B":

- (8) Application for a Provisional Certificate of Approval for a Waste Disposal Site dated September 1, 2005 and signed by Mr. David Clifford, CAO, The Corporation of the Township of Douro-Dummer including all attached supporting information and documentation.
- (9) Document entitled "*County of Peterborough: Household Hazardous Waste (HHW) Facility Operations Manual*" dated August 10, 2005.
- (10) Letter dated August 30, 2005 to Mr. James O'Mara, Director, Environmental Assessment and Approvals Branch, Ministry of Environment from Mr. Michael Cant, Manager, Solid Waste, Totten Sims Hubicki Associates. Re: Amendment for Certificate of Approval No. A341004 including all attachments.
- (11) Letter dated October 11, 2005 to Mr. Matthew Chisholm, Application Processor, Ministry of Environment, from Mr. Michael Cant, Manager, Solid Waste, Totten Sims Hubicki Associates. Re: Application for Approval of a Waste Disposal Site, MOE Reference No. 2960-6FTPZG.
- (12) Letter dated January 24, 2006 to Mr. David Lee, Waste Evaluator, Ministry of Environment, from Mr. Michael Cant, TSH Associates, Re: Draft Notice of Amendment for Certificate of Approval No. A341004.

The reasons for this amendment to the Certificate of Approval are as follows:

The reason for section I is to recognize the new total site area of the waste disposal site.

The reason for section II is to define the specific meaning of the term "competent" as used in this Notice of Amendment.

The reason for the conditions imposed in section III is to approve the establishment and operation of a household hazardous waste transfer station and to ensure that the wastes are managed in a manner that protects the environment and the health and safety of the public.

The reason for the conditions imposed in section IV is to ensure that any persons having an interest in the lands are aware that the land has been used for waste disposal operations.

This Notice shall constitute part of the approval issued under Provisional Certificate of Approval No. A341004 dated October 8, 1980

In accordance with Section 139 of the Environmental Protection Act, R.S.O. 1990, Chapter E-19, as amended, you may by written notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the waste disposal site is located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., 12th Floor
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Director
Section 39, *Environmental Protection Act*
Ministry of Environment and Energy
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the

Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca

The above noted waste disposal site is approved under Section 39 of the Environmental Protection Act.

DATED AT TORONTO this 1st day of February, 2006



Greg Washuta, P.Eng.

Director

Section 39, *Environmental Protection Act*

DL/

c: District Manager, MOE Peterborough
Michael Cant, Totten Sims Hubicki Associates (1997) Limited

Appendix B

Monitoring Well Details and Borehole Data

TOWNSHIP OF DUMMER
HALL'S GLEN LANDFILL STUDY

BOREHOLE LOGS

June 27 - July 9, 1991

<u>BOREHOLE</u>	<u>DEPTH INTERVAL (metres below ground)</u>	<u>DRILLER'S DESCRIPTION</u>
1-91	0 - 0.61	Brown CLAY, GRAVEL, hard
	0.61 - 1.98	Grey GRAVEL, dry
	1.98 - 6.10	Grey LIMESTONE
	6.10 - 6.71	Brown SHALE
	Water-bearing zone reported at 6.10 metres	
2-91	0 - 1.22	Brown FILL
	1.22 - 3.05	REFUSE
	3.05 - 4.88	Brown SAND, COBBLES
	4.88 - 5.49	Grey GRAVEL
	5.49 - 6.71	Brown SHALE, wet
	6.71 - 8.53	Grey LIMESTONE
	8.53 - 9.14	Brown SHALE
	Water-bearing zone reported at 8.53 metres	
3-91	0 - 0.91	Brown SAND, CLAY
	0.91 - 1.52	Brown GRAVEL, COBBLES, CLAY, hard
	1.52 - 4.27	Grey LIMESTONE
	Water-bearing zone reported at 3.66 metres	
4-91	0 - 2.74	Grey GRAVEL, BOULDERS
	2.74 - 3.66	Grey LIMESTONE
	3.66 - 4.88	Brown SHALE
	Water-bearing zone reported at 3.66 metres	
5-91	0 - 1.83	Brown SAND, CLAY
	1.83 - 3.20	Brown SAND, GRAVEL
	3.20 - 3.66	Brown SAND, CLAY
	3.66 - 7.01	Grey LIMESTONE
	Water-bearing zone reported at 6.40 metres	

TOWNSHIP OF DUMMER
HALL'S GLEN LANDFILL STUDY

BOREHOLE LOGS

June 27 - July 9, 1991

<u>BOREHOLE</u>	<u>DEPTH INTERVAL (metres below ground)</u>	<u>DRILLER'S DESCRIPTION</u>
6-91	0 - 0.61	Brown SAND
	0.61 - 2.74	Brown SAND, GRAVEL
	2.74 - 5.18	Grey LIMESTONE
	5.18 - 5.79	Brown SHALE

Water-bearing zone reported at 5.18 metres

MONITOR DETAILS

BOREHOLE		MONITOR					SCREENED INTERVAL (mbgl)	SAND FILTER PACK (mbgl)	BENTONITE SEAL (mbgl)	STEEL CASING (mbgl)
NO	Diameter (mm)	NO	Type	Diameter (mm)	Stick-up (m)	Elevation (top m.)				
1-91	150	I	P	50	0.98	271.27	6.71 - 5.18	6.71 - 5.33	5.33 - 4.72	0.91 - +0.88
1-91		II	S	38			1.98 - 0.46	1.98 - 0.46	0.46 - 0.00	
2-91	150	I	P	50	1.07	275.79	9.14 - 7.62	9.14 - 6.70	6.70 - 5.79	0.91 - +1.07
2-91		II	S	38			5.49 - 3.96	5.49 - 0.61	0.61 - 0.00	
3-91	150	I	P	50	1.11	269.23	4.27 - 2.74	4.27 - 2.13	2.13 - 1.52	0.91 - +1.11
3-91		II	S	38			1.52 - 0.00	1.52 - 0.31	0.31 - 0.00	
4-91	150	I	P	50	1.04	268.28	4.88 - 3.35	4.88 - 3.66	3.66 - 3.05	0.91 - +1.04
4-91		II	S	38			3.05 - 1.52	3.05 - 0.61	0.61 - 0.00	
5-91	150	I	P	50	1.00	271.32	7.01 - 5.49	7.01 - 4.27	4.27 - 3.66	0.91 - +1.00
5-91		II	S	38			3.66 - 2.13	3.66 - 0.16	0.61 - 0.00	
6-91	150	I	P	50	1.02	269.83	5.79 - 4.26	5.79 - 3.35	3.35 - 2.74	0.91 - +1.02
6-91		II	S	38			2.74 - 1.22	2.74 - 0.61	0.61 - 0.00	



Print only in spaces provided.
Mark correct box with a checkmark, where applicable

County or District	Township/Borough/City/Town/Village		Can block tract survey etc. (see
Peterborough	Dummer Twp., Hall Glen Landfill		Con.4 26
Owner's surname	First name	Address	Date completed
Township of Dummer		C/O Totten Sims Hubicki Assoc. 300 Water St., Whitchy, Ont. L1N 9J2	18 OCT 97

[illegible]

WATER RECORD		
Water found at - feet	Kind of water	
9	☐ Fresh	☐ Sulphur Minerals
10	☐ Salty	☐ Gas
18	☐ Fresh	☐ Sulphur Minerals
19	☐ Salty	☐ Gas
	☐ Fresh	☐ Sulphur Minerals
	☐ Salty	☐ Gas
	☐ Fresh	☐ Sulphur Minerals
	☐ Salty	☐ Gas
	☐ Fresh	☐ Sulphur Minerals
	☐ Salty	☐ Gas

CASING & OPEN HOLE RECORD				
Hole depth - inches	Material	Wall thickness - inches	Depth - feet	
			From	To
6 1/2	☒ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	.188	+ 2	3
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	Piso	+ 2	16
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	Piso	+ 2	4

Size of casing (Std. No.)	Diameter	Length
Material and type		
PVC		
Depth at toe of casing		
4 816 feet		

PLUGGING & SEALING RECORD		
Annular space		Abandonment
Depth set at - feet		
From	To	Material and type Cement, grout, bentonite, etc.
4	11	Mud Slurry
11	12	Bentonite
12	13	Gravel
13	14	Bentonite
14	15	Gravel

PUMPING TEST	Pumping test method ☐ Pump ☒ Sinker		Pumping rate 10 GPM		Duration of pumping Hours 30, mins	
	Static level and water level and of pumping		Water levels during pumping		☒ Pumping ☐ Recovery	
	15 minutes		30 minutes		45 minutes	
	6 feet		11 feet		11 feet	
	11 feet		11 feet		11 feet	
Flowing cone rate		Pump intake level		Water at end of test		
GPM		feet		☐ Clear ☒ Cloudy		
Recommended pump type ☐ Shallow ☐ Deep		Recommended pump setting		Recommended pump rate		
		feet		GPM		

FINAL STATUS OF WELL		
☐ Water supply	☐ Abandoned, inefficient supply	☐ Unfinished
☐ Observation well	☐ Abandoned, poor quality	☐ Replacement well
☐ Test hole	☐ Abandoned (Other)	
☐ Radon gas well	☐ Drilling	

WATER USE

☐ Domestic	☐ Commercial	☐ Not used
☐ Stock	☐ Municipal	☒ Other <u>Pesticides</u>
☐ Irrigation	☐ Public supply	
☐ Industrial	☐ Cooling & air conditioning	

METHOD OF CONSTRUCTION

☒ Cable tool	☐ Air percussion	☐ Driving
☐ Rotary (conventional)	☐ Boring	☐ Digging
☐ Rotary (reverse)	☐ Diamond	☐ Other
☐ Rotary (air)	☐ Jeting	

LOCATION OF WELL

In diagram below show distances of well from road and lot line.
Indicate north by arrow.

174284

Name of Well Contractor	Well Contractor's Licence No.
C.Hart & Sons Well Drilling Ltd.	2662
Address	
Box 850, Fenelon Falls, Ontario	
Name of Well Technician	Well Technician's Licence No.
Greg Bullock	T-2108
Signature of Technician/Contractor	Submission date
	day month year

MINISTRY USE ONLY				

3 - OWNER'S COPY

OSOE 107/943 Final Form 8

M.O.E. WATER WELL RECORD

MW-7

Geo-
Logic Inc.
Plate B-4

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

County or District Peterborough	Township or Village (BH-8) Dummer Twp., Halls Glen-Landfill	Con. block test survey, etc. Con. 4	Lot 26
Owner's name Township of Dummer	First Name 300 Water St., Whitby, ON L1N 9J2	Date completed 1 11 01	Day month year

Zone

Location

Number

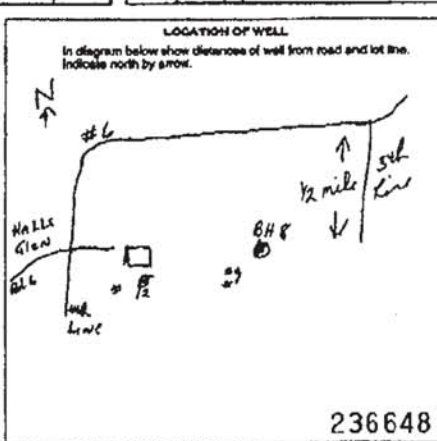
LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Major common materials	Other materials	General description	Depth - feet	
				from	to
Black	Topsoil			0	1
Brown	Gravel	sand		1	9
Brown	Gravel	stones		9	15
Brown	Rock		broken	15	17
Gray	Limestone			17	35

WATER RECORD Water found at - feet Kind of water 19 ☐ Fresh ☐ Saline ☐ Sulphur ☐ Mineral 26 ☐ Fresh ☐ Saline ☐ Sulphur ☐ Mineral ☐ Fresh ☐ Saline ☐ Sulphur ☐ Mineral ☐ Fresh ☐ Saline ☐ Sulphur ☐ Mineral ☐ Fresh ☐ Saline ☐ Sulphur ☐ Mineral ☐ Fresh ☐ Saline ☐ Sulphur ☐ Mineral		CASING & OPEN HOLE RECORD Inside diam. inches Material Depth - feet From To 6 1/2 ☐ Steel ☐ Cast-iron ☐ Concrete ☐ Open hole ☐ Plastic 188 +2 17 2 ☐ Steel ☐ Cast-iron ☐ Concrete ☐ Open hole ☐ Plastic Piezo +2 30 2 ☐ Steel ☐ Cast-iron ☐ Concrete ☐ Open hole ☐ Plastic Piezo +2 17 1/2		Base of casing (Box No.) 10 Material and type PVC Depth at top of screen 30, 17 1/2 feet	
---	--	--	--	--	--

PUMPING TEST Pumping rate 8-10 gpm Duration of pumping 30 min Photo level Water level and end of pumping 15 feet Pumping rate 15 minutes 30 minutes 45 minutes 60 minutes Water level at end of test 15 feet Pumping rate 15 minutes 30 minutes 45 minutes 60 minutes Water level at end of test 15 feet		FINAL STATUS OF WELL ☐ Water supply ☐ Abandoned, insufficient supply ☐ Unfinished ☐ Observation well ☐ Abandoned, poor quality ☐ Plugged/cement well ☐ Test hole ☐ Abandoned (Other) ☐ Plugged/cement well ☐ Potable well ☐ Casing only	
--	--	---	--

WATER USE ☐ Domestic ☐ Commercial ☐ Industrial ☐ Irrigation ☐ Municipal ☐ Other (specify) ☐ Potable ☐ Public supply ☐ Cooling & air conditioning		METHOD OF CONSTRUCTION ☐ Casing test ☐ Air percussion ☐ Driving ☐ Rotary (conventional) ☐ Boring ☐ Digging ☐ Rotary (special) ☐ Diamond ☐ Other ☐ Rotary (jet) ☐ Jetting	
---	--	--	--



NAME OF WELL CONTRACTOR C. Hart & Sons Well Drilling Ltd. Address Box 850, Fenelon Falls, Ontario		WELL CONTRACTOR'S LICENSE NO. 2662	
NAME OF WELL TECHNICIAN Jim Leach Signature of Technician/Contractor		WELL TECHNICIAN'S LICENSE NO. T-0546 Expiration date	

1 - CONTRACTOR'S COPY

0608 (07/00) Form 5000

M.O.E. WATER WELL RECORD

MW-8

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

County or District Peterborough	Township Borough City Town Village (BH-9) Dummer Twp., Hall's Glen-Landfill	Can block tract survey, etc. Con.4	Lot 26
Owner's Name Township of Dummer	Final Name Address c/o Totten Sims Hubicki Assoc. 300 Water St., Whitby, Ont. L1N 9J2	Date completed 30 day	10 month 01 year

[illegible]

WATER RECORD		
Water found at - foot	Kind of water	
12	☐ Fresh ☐ Salty	☐ Sulphur ☐ Moderate ☐ Good
26	☐ Fresh ☐ Salty	☐ Sulphur ☐ Moderate ☐ Good
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Moderate ☐ Good
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Moderate ☐ Good
	☐ Fresh ☐ Salty	☐ Sulphur ☐ Moderate ☐ Good

CHANGES IN OPEN-POLE RECORD				
Insulator about to retire	Material	Insulator thickness inches	Depth - feet	
			From	To
6 1/2	☒ Steel ☒ Galvanized ☒ Concrete ☒ Open hole ☒ Plastic	.188	+2 1/2	12
2	☒ Steel ☒ Galvanized ☒ Concrete ☒ Open hole ☒ Plastic	Pleco	+2 1/2	25
2	☒ Steel ☒ Galvanized ☒ Concrete ☒ Open hole ☒ Plastic	Pleco	+2 1/2	13

SECTION	Base of stratum (Box No.)	Diastem	Length
	10	2 inches	2 x 5 ft
	Material and type	Depth at top of stratum	
	PVC	25, 6' 13 in	

PLASTERING & SEALING RECORD			
Plaster made by ☐ American square ☒ Abundant			
Plaster made by ☐ A. S. S. ☐ B. S. S.			
Plaster	to	Material and type (Cement grad, sand, etc.)	
0	12	Bentonite	

PUMP TEST	Pumping test method ☒ In situ ☐ Bucket	Pumping rate 8-10 GPM	Duration of pumping 1 hour 30 min
	Static level Water level and of pumping	Water losses during 15 minutes 30 minutes	☐ Pumping ☐ Recovery 15 minutes 30 minutes
	8 feet feet	feet feet	feet feet
	If flowing give rate GPM	Pump stops and if feet	Shuts off and test ☐ Clear ☐ Cloudy
	Recommended pump type 1) Siphon 1) Check	Recommended pump rating feet	Recommended pump rate GPM

POOL STATUS OF WELL ☒ Observation well ☐ Test hole ☐ Discharge well		☐ Abandoned, insubstantial supply ☐ Abandoned, inner quality ☐ Abandoned (Water) ☐ Dewatering	☐ Unfinished ☐ Replacement well	
WATER USE ☐ Domestic ☐ Stock ☐ Irrigation ☐ Industrial		☐ Commercial ☐ Municipal ☐ Private supply ☐ Cooling & air conditioning	☒ Hot water ☐ Other <i>Process tank</i>	
METHOD OF CONSTRUCTION ☒ Caisson well ☐ Rotary (unventilated) ☐ Rotary (ventilated) ☐ Rotary (air) ☐ Air percussion ☐ Boring ☐ Diamond ☐ Jetting				☐ Driving ☐ Digging ☐ Other

LOCATION OF WELL.

In diagram below show distances of well from road and lot line. Indicate north by arrow.

WELL 6

Rd. 6

Lot Line

Side Line

1/2 mile

1/2 mile

N

Name of Well Contractor G.Hart & Sons Well Drilling Ltd	Well Contractor's Licence No. 2662
Address Box 850, Fenelon Falls, Ontario	
Name of Well Technician Jim Lean	Well Technician's Licence No. T-0546
Signature of Technician/Contractor 	Submission date day mo yr

INDUSTRY USE ONLY			

1 - CONTRACTOR'S COPY

0004-1270/03/0001-0000\$05.00/0

M.O.E. WATER WELL RECORD

MW-9

Geo-
Logic Inc.
PLATE B-6

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

County or District Peterborough	Town or Burgh or Village (DH-IV) Dummer Twp., Halls Glen-Landfill	Can block tract survey, etc. Con. 4	Lot 26
Owner's surname Township of Dummer	First Name Address c/o Totten Sims Hubicki Assoc. 300 Water St., Whiteby, ON L1N 9J2	Date completed 2 11 01 day month year	

[illegible][illegible]

Interval Start-End Feet	Mud-Ad Type Gravelized Concrete Open hole Plastic	Well Reference Notes	Depth - Feet	To
6 1/2	Gravelized Concrete Open hole Plastic	-188	+2 1/2	13
2	Shelf Gravelized Concrete Open hole Plastic	Pieso	+2 1/2	25
2	Shelf Gravelized Concrete Open hole Plastic	Pieso	+2 1/2	14.3

SCREEN	Size of opening (flat film)	Diameter	Length
	10	2 inches	2x 5 feet
	Substrate and type		Depth of top of screen
	PVC		25, 14, 3 feet

PLUGGING & SEALING RECORD		
④ Ammeter reading		⑤ Abnormalities
Depth used is: Feet	Time	Material and type (Cement grout, bentonite, etc.)
0	13	Holeplug (outside 6")
13	20 1/2	Sand
20 1/2	22	Holeplug
22	30	Sand

15241 Observations	Pumping test name ☐ Pump ☐ Back		Pumping rate → 6 gpm	Duration of pumping hours 30 mins		
	Static level	Water level and at pumping	Water levels during		☐ Pumping ☐ Recovery	
			15 minutes	30 minutes	45 minutes	90 minutes
	8.50 feet		feet	feet	feet	feet
	Is flowing after test	Pump intake sat at		Water at end of test		
		gpm		feet	☐ Clear ☐ Cloudy	
	Recommended pump type	Recommended pump rating		Recommended pump use		
	☐ Shallow ☐ Deep	feet		gpm		

FINAL STATUS OF WELL

☒ Water supply	☐ Abandoned, insufficient supply	☐ Unfinished
☒ Observation well	☐ Abandoned, poor quality	☐ Replacement well
☒ Test hole	☐ Abandoned (Other)	
☒ Production well	☐ Dewatering	

WATER USE

☐ Domestic	☐ Commercial	☐ Air use
☐ Stock	☐ Municipal	☒ Other <i>Industrial</i>
☐ Irrigation	☐ Public supply	
☐ Industrial	☐ Cooling & air conditioning	

METHOD OF CONSTRUCTION

☒ Cable tool	☐ Air percussion	☐ Drilling
☐ Flotary (unassisted)	☐ Boring	☐ Chipping
☐ Flotary (remote)	☐ Diamond	☐ Other _____
☐ Flotary jet	☐ Jetting	

LOCATION OF WELL

In diagram below show distance of well from road and lot line. Indicate north by arrow.

Diagram illustrating the location of a well relative to a road (RR. 6) and a lot line. The diagram shows a road (RR. 6) running horizontally, and a lot line running vertically. A well is marked with a circle containing a cross. A distance of 1/2 mile is indicated between the road and the well. Other labels include "Halls Glen", "H.L. Line", and "B.M. 10".

Name of Well Contractor G.Hart & Sons Well Drilling Ltd	Well Contractor's Licence No. 2662
Address Box 850, Feneelon Falls, Ontario	
Name of Well Technician Jim Lean	Well Technician's Licence No. T-0546
Signature of Technician/Contractor 	Date day 10 mo 10 year 1988

MINISTRY USE ONLY			

1 - CONTRACTOR'S COPY

M.O.E. WATER WELL RECORD

MW-10

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

County or District Peterborough	Township/Borough/Village/Town/Village (B.H.-11) Dummer Twp., Hall's Glen-Tandfill	Con. back sheet survey, etc. Con. 4	Lot 26
Owner's name Township of Dummer	Address c/o Totten Sims Hubicki Assoc. 300 Water St., Whitby, ON L1N 9J2	Date completed 5 11 01 day month year	

General colour	Most common material	Other materials	General description	Depth - feet	
				From	To
Black	Topsoil			0	1
Brown	Gravel			1	5
Brown	Gravel	boulder		5	10
Brown	Broken Rock			10	12
Gray	Limestone			12	30

Water level at - feet	Kind of water
19	☒ Fresh ☐ Salty ☐ Brackish ☐ Mineral ☐ Gas
29	☒ Fresh ☐ Salty ☐ Brackish ☐ Mineral ☐ Gas
	☐ Fresh ☐ Salty ☐ Brackish ☐ Mineral ☐ Gas
	☐ Fresh ☐ Salty ☐ Brackish ☐ Mineral ☐ Gas
	☐ Fresh ☐ Salty ☐ Brackish ☐ Mineral ☐ Gas

Casing start depth	Material	Wall thickness	Depth - feet	
			From	To
61	☒ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	-188	+21	12
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	Pieno	+21	25
2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	Pieno	+21	15

Depth of plug - feet		Material and type (Concrete, grout, bentonite, etc.)
From	To	
0	12	Holeplug (outside steel)
11	20	Sand
20	22	Holeplug
22	30	Sand

Pumping test method	Pumping rate	Duration of pumping
☐ Pump ☐ Bailer	2-3 GPM	Hour 30
Steady level	Water level during	Pumping ☐ Recovery
9 feet	15 minutes 30 minutes 45 minutes 60 minutes	
if rising give rate	Pump motor set at	Water at end of test
Recommended pump type	Recommended pump setting	Recommended pump rate
☐ Shallow ☐ Deep		

☐ Water supply	☐ Abandoned, insufficient supply	☐ Unfinished
☐ Observation well	☐ Abandoned, poor quality	☐ Replacement well
☐ Test hole	☐ Abandoned (Clear)	
☐ Piezometer well	☐ Dewatering	

☐ Domestic	☐ Commercial	☐ Hot water
☐ Stock	☐ Municipal	☐ Other
☐ Irrigation	☐ Public supply	
☐ Industrial	☐ Cooling & air conditioning	

☒ Cable tool	☐ Air percussion	☐ Drilling
☐ Rotary (conventional)	☐ Boring	☐ Digging
☐ Rotary (downhole)	☐ Diamond	☐ Other
☐ Rotary (sh)	☐ Jetting	



Name of Well Contractor G. HART & Sons Well Drilling Ltd	Well Contractor's License No. 2062
Address Box 850, Fenelon Falls, Ontario	
Name of Well Technician Jim Lean	Well Technician's License No. T-0546
Signature of Technician/Contractor <i>Jim Lean</i>	Submission date day month year

1 - CONTRACTOR'S COPY

0008 (07/00) Print Form B

M.O.E. WATER WELL RECORD

MW-11

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

County or District Peterborough	Township/Borough/City/Town/Village (RH-12) Dummer Twp., Halls Glen - Landfill	Con block first survey, etc. Con. 4	Lot 26
Owner's surname Township of Dummer	First Name Address c/o Totten Sims Hubicki Assoc. 300 Water St., Whitby, ON L1N 9J2	Date completed 7 11 01 day month year	
	Zone None	Rating Nothing	

[illegible]

WATER RECORD		
Water found at _____	Kind of water	
13	☒ Fresh ☒ Salty ☒ Brackish	☐ Sulphur ☐ Minerals ☐ Gas
29	☐ Fresh ☐ Salty ☐ Brackish	☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty ☐ Brackish	☐ Sulphur ☐ Minerals ☐ Gas
	☐ Fresh ☐ Salty ☐ Brackish	☐ Sulphur ☐ Minerals ☐ Gas

CANNING & OPEN-HOLE RECORD						
Inches dipm Feet	Material	Inch Increase Per Foot	Days - feet		T _h	
			From	To		
6½	☐ Sand ☒ Gravelized ☐ Graveline ☐ Open hole ☐ Plugged	.188	+3	13		
2	☐ Sand ☒ Gravelized ☐ Graveline ☐ Open hole ☐ Plugged	Pleco	+3	35		
2	☐ Sand ☒ Gravelized ☐ Graveline ☐ Open hole ☐ Plugged	Pleco	+3	25½		
2	☐ Sand ☒ Gravelized ☐ Graveline ☐ Open hole ☐ Plugged	Pleco	+3	16½		

NEEDLES	Size of opening (Not less)	Diameter	Length
	10	2 inches	3x 5
	Material and type	Depth of test in feet 35, 25.3 14.5 feet	
PVC			

FLUDDING & SEALING RECORD			
☐ Annular space		☐ Abutment	
Depth and test	Material and type (Cement grout, bentonite, etc.)		
Feet	Ts		
0	13	Bentonite (outside)	
40	30	Sand (inside)	
31	30	Holeplug, * Cont'd	

PUMPING TEST DATA SHEET	Pumping test method ☐ Pump ☒ Bailer		Pumping rate 10 = 150 gpm		Duration of pumping _____ hours _____ minutes _____ seconds	
	Water level _____		Water levels during ☐ Pumping ☐ Recovery			
	Water level at end of pumping _____		15 minutes 30 minutes		At intervals 60 minutes	
	4 _____ feet		_____ feet		_____ feet	
	If leveling gage rate		Pump started at _____ feet		Water at end of test ☐ Clear ☐ Cloudy	
Recommended pump type ☐ Whirlpool ☐ Deep		Recommended pump setting _____ feet		Recommended pump rate _____ gpm		

FINAL STATUS OF WELL

☐ Water supply	☐ Abandoned, insufficient supply	☐ Undrilled
☐ Clean water	☐ Abandoned, poor quality	☐ Replacement well
☐ Test hole	☐ Abandoned (Other)	
☐ Recapture well	☐ Dewatering	

WATER USE

☐ Domestic	☐ Commercial	☐ Not used
☐ Stock	☐ Municipal	☒ Other DWNTS
☐ Irrigation	☐ Public supply	
☐ Industrial	☐ Cooling & air conditioning	

METHOD OF CONSTRUCTION

☐ Casing installed	☐ Air percussion	☐ Driving
☐ Rotary (conventional)	☐ Drilling	☐ Digging
☐ Rotary (reverse)	☐ Casedram	☐ Other
☐ Rotary (air)	☐ Jetting	

LOCATION OF WELL.

In diagram below show distances of well from road and lot line. Indicate north by arrow.

* 30 - 21 Sand
 21 - 19 1/2 Holeplug
 19 1/2 - 9 Sand

236641

Name of Well Contractor G.Hart & Sons Well Drilling Ltd.	Well Permitting Licence No. 2662
Address Box 850, Fenelon Falls, Ontario	
Name of Well Technician Jim Lenn	Well Technician's Licence No. T-0346
Signature of Technician/Contractor 	Submission date

ADMINISTRATIVE USE ONLY			

1 - CONTRACTOR'S COPY

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M.O.E. WATER WELL RECORD

MW-12

Geo-
Logic Inc.
PLATE B-9

[illegible]

WATER RECORD		CANNING & OPENING RECORD						SCHEDULE		
Water found at - feet	Kind of water	Inches down from top	Material	Wall thickness in inch	Depth - feet		Score of opening (Bolt No)	Diameter	Length	
	☐ Fresh ☐ Salty ☐ Clear		☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic		From	To	10	2 inches	3'x5'	
15.5	☐ Fresh ☐ Salty ☐ Clear	6	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	.188	+3	6				
	☐ Fresh ☐ Salty ☐ Clear	2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	.180	+3	6				
	☐ Fresh ☐ Salty ☐ Clear	2	☐ Steel ☐ Galvanized ☐ Concrete ☐ Open hole ☐ Plastic	.180	+3	12				

PULLING & SEALING RECORD

☐ AVAILABLE space ☐ MISCELLANEOUS

Depth and at - feet		Material and type (Concrete grade, concrete, etc.)
From	To	
17	11	sand
11	9	holeplug
9	5	sand

PUMPING TEST	Pumping test method ☐ Plumb ☐ Sealer		Pumping rate GPM		Location of pumping Hwy Sub	
	Static level	Water level and of pumping	Water levels during	☐ Pumping	☐ Recovery	
	7		1st interval 2nd interval	4th interval 6th interval		
	feet	feet	feet	feet	feet	
	If flowing give rate		Pump lifting test at		Water is end of test	
	GPM		feet		☐ Clear ☐ Cloudy	
	Pneumatically pumped pump type ☐ Shallow ☐ Deep		Pneumatically pump setting		Pneumatically pump rate GPM	

FINAL STATUS OF WELL		
☐ Water supply	☐ Abandoned, insufficient supply	☐ Unfilled
☒ Observation well	☐ Abandoned, poor quality	☐ Replacement well
☐ Test hole	☐ Abandoned (Other)	
☐ Production well	☐ Damaged	

WATER USE

☐ Domestic	☐ Commercial	☐ Hot use
☐ Bath	☐ Irrigation	☒ Other <i>domestic</i>
☐ Industrial	☐ Public supply	
☐ Inst. water	☐ Cooling & air conditioning	

METHOD OF CONSTRUCTION

☐ Cellular form	☐ Air penetration	☐ Driving
☐ Rotary (conventional)	☐ Boring	☐ Digging
☐ Rotary (vertical)	☐ Diamond	☐ Other _____
☐ Shallow (slab)	☐ Jetting	

LOCATION OF WELL.

In diagram below show distances of well from road and lot line. Indicate north by arrow.

Diagram showing the location of a well relative to a road and a lot line. The well is located 16 feet from the road and 16 feet from the lot line. The road is 16 feet wide. A landfill area is indicated.

Name of Well Contractor G. Hart & Sons Well Drilling Ltd.	Well Contractor's License No. 2662
Address Box 850, Fenelon Falls, ON K0M 1N0	
Name of Well Driller Jim Leann	Well Driller's License No. T-0546
Signature of Well Contractor 	Submitter's Dist. 20-1

1. CONTRACTOR'S COPY

M.O.E. WELL RECORD

MW-13

Appendix C

Chemical Comparison Tables and Certificates of Analysis



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2H0
Phone: 705-652-2000 FAX: 705-652-6365

GHD

Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Schedule 5 Column 1 with VOC short list

29-June-2018

Date Rec. : 06 June 2018
LR Report: CA14178-JUN18
Reference: PO# 11156057-01

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW8-1	6: MW9-1	7: MW10-1	8: MW11-II	9: R-1	10: R-2	11: R-3	12: R-4
Sample Date & Time					06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18
Temperature Upon Receipt [°C]	---	---	--	---	13.0	13.0	13.0	13.0	---	---	---	---
Alkalinity [mg/L as CaCO ₃]	07-Jun-18	18:18	12-Jun-18	21:33	291	275	241	265	228	251	240	272
pH [no unit]	07-Jun-18	18:18	12-Jun-18	21:33	7.89	8.15	8.03	8.11	7.98	7.94	8.01	7.96
Conductivity [µS/cm]	07-Jun-18	18:18	12-Jun-18	21:33	816	633	638	669	623	667	559	743
Total Dissolved Solids [mg/L]	07-Jun-18	21:02	17-Jun-18	22:35	457	386	389	391	320	383	300	409
Chemical Oxygen Demand [mg/L]	08-Jun-18	07:26	14-Jun-18	19:39	< 8	19	9	< 8	8	< 8	27	< 8
Phosphorus (total) [mg/L]	08-Jun-18	18:00	21-Jun-18	16:03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.04
Total Kjeldahl Nitrogen [as N mg/L]	11-Jun-18	20:42	23-Jun-18	09:50	< 0.5	0.7	< 0.5	0.9	< 0.5	< 0.5	< 0.5	< 0.5
Ammonia+Ammonium (N) [mg/L]	08-Jun-18	20:14	21-Jun-18	14:31	< 0.1	0.6	< 0.1	0.8	< 0.1	< 0.1	< 0.1	0.1
4AAP-Phenolics [mg/L]	13-Jun-18	10:00	15-Jun-18	11:46	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.007	< 0.002
Sulphate [mg/L]	15-Jun-18	11:21	19-Jun-18	13:58	16	68	28	53	4	9	< 2	10
Chloride [mg/L]	15-Jun-18	11:27	19-Jun-18	13:58	82	15	51	32	56	58	35	71
Nitrite (as N) [mg/L]	13-Jun-18	12:58	13-Jun-18	17:44	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Nitrate (as N) [mg/L]	13-Jun-18	12:58	13-Jun-18	17:44	< 0.06	0.14	0.27	< 0.06	0.12	1.60	0.78	1.34
Dissolved Organic Carbon [mg/L]	08-Jun-18	06:00	13-Jun-18	10:53	1	1	3	2	6	< 1	1	2
Mercury (total) [ug/L]	08-Jun-18	11:00	11-Jun-18	10:28	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Arsenic (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.0018	0.0010	0.0007	0.0004	0.0005	0.0004	0.0003	0.0003
Barium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.0960	0.416	0.702	0.377	0.0663	0.0853	0.0663	0.105
Boron (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.108	0.385	0.242	0.492	0.037	0.021	0.018	0.024
Calcium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	125	77.2	112	118	101	127	102	125

OnLine LIMS

0001425795



SGS Canada Inc.

P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - K0L 2H0
Phone: 705-652-2000 FAX: 705-652-6365

Schedule 5 Column 1 with VOC short list

LR Report : CA14178-JUN18

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW8-1	6: MW9-1	7: MW10-1	8: MW11-II	9: R-1	10: R-2	11: R-3	12: R-4
Cadmium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.000005	< 0.000003	< 0.000003	< 0.000003	0.000053	0.000004	< 0.000003	0.000022
Chromium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.00014	0.00011	0.00013	0.00015	0.00019	0.00020	0.00026	0.00020
Copper (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.00116	0.00010	0.00011	0.00012	0.00123	0.394	0.163	0.288
Iron (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.031	0.096	0.481	0.028	0.030	< 0.007	< 0.007	< 0.007
Potassium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	3.97	4.51	4.40	5.11	0.890	0.952	0.856	6.01
Magnesium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	11.9	14.7	19.6	25.3	3.00	2.97	2.76	3.47
Manganese (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.00156	0.0526	0.191	0.0814	0.00241	0.00011	0.00016	0.00029
Sodium (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	47.1	41.8	12.0	14.8	38.8	29.0	26.8	43.6
Lead (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.00002	< 0.00001	< 0.00001	< 0.00001	0.00139	0.00088	0.00095	0.00447
Zinc (dissolved) [mg/L]	12-Jun-18	14:50	13-Jun-18	13:31	0.003	0.002	< 0.002	< 0.002	0.008	0.037	0.008	0.127
Benzene [µg/L]	08-Jun-18	16:13	12-Jun-18	15:49	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,4-Dichlorobenzene [µg/L]	08-Jun-18	16:13	12-Jun-18	15:49	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Dichloromethane [µg/L]	08-Jun-18	16:13	12-Jun-18	15:49	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Toluene [µg/L]	08-Jun-18	16:13	12-Jun-18	15:49	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Vinyl Chloride [µg/L]	08-Jun-18	16:13	12-Jun-18	15:49	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Bromodichloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bromoform [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Bromomethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carbon tetrachloride [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 5	< 5	< 5	< 5	< 5
Chloroform [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 5	< 5	< 5	< 5	< 5
Dibromochloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,3-Dichlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloropropane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
trans-1,2-Dichloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
cis-1,2-Dichloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
cis-1,3-Dichloropropene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
trans-1,3-Dichloropropene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ethylbenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ethylenedibromide [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Monochlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Styrene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

OnLine LIMS

0001425795

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW8-1	6: MW9-1	7: MW10-1	8: MW11-II	9: R-1	10: R-2	11: R-3	12: R-4
1,1,2,2-Tetrachloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Tetrachloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Trichloroethylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Trichlorofluoromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 5	< 5	< 5	< 5	< 5
1,1,1-Trichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Xylene (total) [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
o-xylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
m/p-xylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:49	---	---	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5



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Schedule 5 Column 3

29-June-2018

Date Rec. : 06 June 2018
LR Report: CA14186-JUN18
Reference: 11153057-01

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-2	6: MW-9-2	7: MW-10-2	8: MW-11-2	9: S-1	10: S-2
Sample Date & Time			06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18	06-Jun-18
Temperature Upon Receipt [°C]	--	---	13.0	13.0	13.0	13.0	13.0	13.0
Biochemical Oxygen Demand (BOD5) [mg/L]	14-Jun-18	10:09	< 4	< 4	10	< 4	< 4	< 4
Total Suspended Solids [mg/L]	14-Jun-18	15:35	19	2	34	11	8	5
Alkalinity [mg/L as CaCO3]	12-Jun-18	21:55	235	247	251	238	238	230
pH [no unit]	12-Jun-18	21:55	7.82	7.99	7.82	8.04	7.96	8.01
Conductivity [µS/cm]	12-Jun-18	21:55	639	616	610	509	588	652
Total Dissolved Solids [mg/L]	13-Jun-18	10:45	349	317	380	294	326	360
Chemical Oxygen Demand [mg/L]	19-Jun-18	11:58	11	8	< 8	< 8	10	22
Phosphorus (total) [mg/L]	12-Jun-18	13:22	< 0.03	< 0.03	0.04	< 0.03	< 0.03	< 0.03
Total Kjeldahl Nitrogen [as N mg/L]	13-Jun-18	14:59	< 0.5	< 0.5	0.7	0.7	< 0.5	< 0.5
Ammonia+Ammonium (N) [mg/L]	12-Jun-18	09:02	< 0.1	< 0.1	0.6	0.6	< 0.1	< 0.1
4AAP-Phenolics [mg/L]	14-Jun-18	11:38	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001
Sulphate [mg/L]	19-Jun-18	14:00	8	10	11	10	< 2	< 2
Chloride [mg/L]	19-Jun-18	14:00	72	44	52	13	48	73
Nitrite (as N) [mg/L]	17-Jun-18	12:20	< 0.03	< 0.03	0.19	0.05	< 0.03	< 0.03
Nitrate (as N) [mg/L]	17-Jun-18	12:20	0.20	< 0.06	0.40	< 0.06	0.23	< 0.06
Mercury (total) [ug/L]	11-Jun-18	10:29	< 0.01	0.02	< 0.01	< 0.01	< 0.01	0.02



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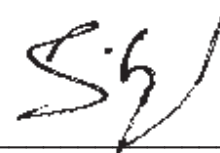
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Schedule 5 Column 3

LR Report : CA14186-JUN18

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-2	6: MW-9-2	7: MW-10-2	8: MW-11-2	9: S-1	10: S-2
Arsenic (total) [mg/L]	11-Jun-18	14:46	< 0.0002	0.0004	< 0.0002	< 0.0002	< 0.0002	0.0003
Barium (total) [mg/L]	11-Jun-18	14:46	0.107	0.160	0.566	0.361	0.08721	0.06474
Boron (total) [mg/L]	11-Jun-18	14:46	0.043	0.039	0.128	0.164	0.020	0.015
Cadmium (total) [mg/L]	11-Jun-18	14:46	0.000006	< 0.000003	0.000003	0.000003	0.000007	0.000004
Calcium (total) [mg/L]	11-Jun-18	14:46	106	106	128	99.9	103	103
Chromium (total) [mg/L]	11-Jun-18	14:46	0.00013	0.00012	0.00011	0.00011	0.00394	0.00014
Copper (total) [mg/L]	11-Jun-18	14:46	0.00084	0.00098	0.00041	0.00042	0.00047	0.00035
Iron (total) [mg/L]	11-Jun-18	14:46	0.016	0.372	4.28	1.52	0.014	0.080
Potassium (total) [mg/L]	11-Jun-18	14:46	1.31	2.16	2.60	3.19	1.35	1.47
Magnesium (total) [mg/L]	11-Jun-18	14:46	3.64	3.67	11.1	10.3	2.97	2.82
Manganese (total) [mg/L]	11-Jun-18	14:46	0.0052	0.0159	0.0931	0.0268	0.0014	0.0409
Sodium (total) [mg/L]	11-Jun-18	14:46	37.4	34.6	6.56	8.70	28.1	43.9
Lead (total) [mg/L]	11-Jun-18	14:46	0.00004	0.00003	0.00002	0.00002	0.00004	0.00004
Zinc (total) [mg/L]	11-Jun-18	14:46	< 0.002	< 0.002	< 0.002	< 0.002	0.004	< 0.002
Benzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,4-Dichlorobenzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Dichloromethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Toluene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Vinyl Chloride [ug/L]	11-Jun-18	15:54	---	---	---	< 0.2	---	---
Bromodichloromethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Bromoform [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Bromomethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Carbon tetrachloride [ug/L]	11-Jun-18	15:54	---	---	---	< 0.2	---	---
Chloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 5	---	---
Chloroform [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Chloromethane [ug/L]	11-Jun-18	15:54	---	---	---	< 5	---	---
Dibromochloromethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,2-Dichlorobenzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,3-Dichlorobenzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,1-Dichloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,2-Dichloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,1-Dichloroethylene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-2	6: MW-9-2	7: MW-10-2	8: MW-11-2	9: S-1	10: S-2
1,2-Dichloropropane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
trans-1,2-Dichloroethene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
cis-1,2-Dichloroethene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
cis-1,3-Dichloropropene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
trans-1,3-Dichloropropene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Ethylbenzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Ethylenedibromide [ug/L]	11-Jun-18	15:54	---	---	---	< 0.2	---	---
Monochlorobenzene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Styrene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,1,2,2-Tetrachloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Tetrachloroethene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Trichloroethylene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Trichlorofluoromethane [ug/L]	11-Jun-18	15:54	---	---	---	< 5	---	---
1,1,1-Trichloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
1,1,2-Trichloroethane [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
Xylene (total) [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
o-xylene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---
m/p-xylene [ug/L]	11-Jun-18	15:54	---	---	---	< 0.5	---	---



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Schedule 5 Column 1 with full VOC scan

29-June-2018

Date Rec. : 07 June 2018
LR Report: CA14224-JUN18
Reference: Project #: 11148416-01 PO#
73507633

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1	10: MW-7-1	11: MW-12-2	12: MW-12-3
Sample Date & Time					07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18
Temperature Upon Receipt [°C]					13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
Alkalinity [mg/L as CaCO ₃]	07-Jun-18	18:18	12-Jun-18	21:34	291	272	310	640	469	334	284	281
pH [no unit]	07-Jun-18	18:18	12-Jun-18	21:34	8.07	8.01	8.01	7.52	7.84	8.32	8.11	8.01
Conductivity [uS/cm]	07-Jun-18	18:18	12-Jun-18	21:34	1170	643	743	1340	1270	817	767	747
Total Dissolved Solids [mg/L]	08-Jun-18	15:23	17-Jun-18	22:35	774	354	397	774	686	474	429	463
Chemical Oxygen Demand [mg/L]	08-Jun-18	07:26	13-Jun-18	11:09	< 8	< 8	< 8	38	25	14	< 8	< 8
Phosphorus (total) [mg/L]	11-Jun-18	18:00	12-Jun-18	12:37	< 0.03	< 0.03	0.04	0.08	0.08	0.10	< 0.03	< 0.03
Total Kjeldahl Nitrogen [as N mg/L]	11-Jun-18	16:00	15-Jun-18	10:12	< 0.5	< 0.5	0.5	11.2	7.0	2.3	< 0.5	< 0.5
Ammonia+Ammonium (N) [mg/L]	11-Jun-18	18:00	14-Jun-18	09:06	< 0.1	0.1	0.4	10.2	6.2	< 0.1	0.2	< 0.1
4AAP-Phenolics [mg/L]	15-Jun-18	08:00	16-Jun-18	08:53	0.004	< 0.002	< 0.002	0.005	0.003	< 0.002	< 0.002	< 0.002
Sulphate [mg/L]	18-Jun-18	09:12	19-Jun-18	12:56	76	61	350	15	43	33	71	25
Chloride [mg/L]	18-Jun-18	09:03	19-Jun-18	12:56	160	40	65	130	110	46	39	60
Nitrite (as N) [mg/L]	14-Jun-18	11:53	19-Jun-18	16:46	0.03	0.05	< 0.03	0.05	0.14	< 0.03	< 0.03	< 0.03
Nitrate (as N) [mg/L]	14-Jun-18	11:53	19-Jun-18	16:46	1.48	1.41	0.88	2.74	0.61	< 0.06	< 0.06	< 0.06
Dissolved Organic Carbon [mg/L]	08-Jun-18	06:00	13-Jun-18	10:49	2	4	5	20	9	3	2	< 1
Mercury (total) [mg/L]	08-Jun-18	11:00	11-Jun-18	10:29	0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Arsenic (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	< 0.0002	< 0.0002	< 0.0002	0.0027	0.0004	0.0006	< 0.0002	< 0.0002
Barium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.238	0.0998	0.115	0.484	0.313	0.123	0.180	0.0735

OnLine LIMS

0001426174



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Schedule 5 Column 1 with full VOC scan

LR Report : CA14224-JUN18

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1	10: MW-7-1	11: MW-12-2	12: MW-12-3
Boron (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.111	0.065	0.092	0.295	0.241	0.539	0.533	0.115
Calcium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	174	135	135	259	194	35.7	119	153
Cadmium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.000035	0.000006	0.000017	< 0.000003	0.000008	0.000006	< 0.000003	< 0.000003
Chromium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.00015	0.00015	0.00016	0.00059	0.00032	0.00016	0.00013	0.00013
Copper (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.00187	0.00061	0.00079	0.00033	0.00059	0.00035	0.00040	0.00030
Iron (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	< 0.007	< 0.007	< 0.007	21.8	1.24	< 0.007	0.033	0.040
Potassium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	4.97	4.14	5.31	19.1	15.3	2.05	3.40	1.66
Magnesium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	13.2	4.10	4.95	17.8	11.2	7.00	20.0	5.59
Manganese (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.00012	0.00437	0.234	2.03	1.42	0.00052	0.156	0.0161
Sodium (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	65.8	17.8	27.7	54.6	64.1	143	38.5	14.5
Lead (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	< 0.00001	< 0.00001	< 0.00001	< 0.00001	0.00019	< 0.00001	< 0.00001	< 0.00001
Zinc (dissolved) [mg/L]	13-Jun-18	14:55	14-Jun-18	11:13	0.003	0.002	0.002	0.002	0.004	0.002	< 0.002	< 0.002
Benzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromodichloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromoform [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromomethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Carbon tetrachloride [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Chloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 5	< 5	< 5	< 5	< 5	---	---
Chloroform [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Chloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 5	< 5	< 5	< 5	< 5	---	---
Dibromochloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,3-Dichlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,4-Dichlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1-Dichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1-Dichloroethylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichloropropane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
trans-1,2-Dichloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
cis-1,2-Dichloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
cis-1,3-Dichloropropene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
trans-1,3-Dichloropropene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Ethylbenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Ethylenedibromide [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Dichloromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Monochlorobenzene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	0.6	< 0.5	< 0.5	---	---

OnLine LIMS

0001426174



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Schedule 5 Column 1 with full VOC scan

LR Report : CA14224-JUN18

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1	10: MW-7-1	11: MW-12-2	12: MW-12-3
Styrene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,2,2-Tetrachloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Tetrachloroethene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Toluene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Trichloroethylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Vinyl Chloride [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Trichlorofluoromethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 5	< 5	< 5	< 5	< 5	---	---
1,1,1-Trichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,2-Trichloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Xylene (total) [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
o-xylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
m/p-xylene [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,1,2-Tetrachloroethane [ug/L]	08-Jun-18	16:13	12-Jun-18	15:50	---	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---

Analysis	13: MW-13-1
Sample Date & Time	07-Jun-18
Temperature Upon Receipt [°C]	13.0
Alkalinity [mg/L as CaCO3]	227
pH [no unit]	8.11
Conductivity [uS/cm]	590
Total Dissolved Solids [mg/L]	314
Chemical Oxygen Demand [mg/L]	13
Phosphorus (total) [mg/L]	0.04
Total Kjeldahl Nitrogen [as N mg/L]	< 0.5
Ammonia+Ammonium (N) [mg/L]	< 0.1
4AAP-Phenolics [mg/L]	< 0.002
Sulphate [mg/L]	15
Chloride [mg/L]	100
Nitrite (as N) [mg/L]	< 0.03
Nitrate (as N) [mg/L]	0.94
Dissolved Organic Carbon [mg/L]	2
Mercury (total) [mg/L]	0.00001
Arsenic (dissolved) [mg/L]	< 0.0002



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Schedule 5 Column 1 with full VOC scan

LR Report : CA14224-JUN18

Analysis	13: MW-13-1
Barium (dissolved) [mg/L]	0.0703
Boron (dissolved) [mg/L]	0.022
Calcium (dissolved) [mg/L]	96.4
Cadmium (dissolved) [mg/L]	0.000012
Chromium (dissolved) [mg/L]	0.00023
Copper (dissolved) [mg/L]	0.00068
Iron (dissolved) [mg/L]	< 0.007
Potassium (dissolved) [mg/L]	1.91
Magnesium (dissolved) [mg/L]	2.31
Manganese (dissolved) [mg/L]	0.00008
Sodium (dissolved) [mg/L]	31.6
Lead (dissolved) [mg/L]	0.00002
Zinc (dissolved) [mg/L]	0.013
Benzene [ug/L]	---
Bromodichloromethane [ug/L]	---
Bromoform [ug/L]	---
Bromomethane [ug/L]	---
Carbon tetrachloride [ug/L]	---
Chloroethane [ug/L]	---
Chloroform [ug/L]	---
Chloromethane [ug/L]	---
Dibromochloromethane [ug/L]	---
1,2-Dichlorobenzene [ug/L]	---
1,3-Dichlorobenzene [ug/L]	---
1,4-Dichlorobenzene [ug/L]	---
1,1-Dichloroethane [ug/L]	---
1,2-Dichloroethane [ug/L]	---
1,1-Dichloroethylene [ug/L]	---
1,2-Dichloropropane [ug/L]	---
trans-1,2-Dichloroethene [ug/L]	---
cis-1,2-Dichloroethene [ug/L]	---
cis-1,3-Dichloropropene [ug/L]	---
trans-1,3-Dichloropropene [ug/L]	---
Ethylbenzene [ug/L]	---
Ethylenedibromide [ug/L]	---
Dichloromethane [ug/L]	---



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Schedule 5 Column 1 with full VOC scan

LR Report : CA14224-JUN18

Analysis	13: MW-13-1
Monochlorobenzene [ug/L]	---
Styrene [ug/L]	---
1,1,2,2-Tetrachloroethane [ug/L]	---
Tetrachloroethene [ug/L]	---
Toluene [ug/L]	---
Trichloroethylene [ug/L]	---
Vinyl Chloride [ug/L]	---
Trichlorofluoromethane [ug/L]	---
1,1,1-Trichloroethane [ug/L]	---
1,1,2-Trichloroethane [ug/L]	---
Xylene (total) [ug/L]	---
o-xylene [ug/L]	---
m/p-xylene [ug/L]	---
1,1,1,2-Tetrachloroethane [ug/L]	---

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Schedule 5 Column 3

29-June-2018

Date Rec. : 07 June 2018
LR Report: CA14225-JUN18
Reference: PO# 73510995 Project #:
111562057-1

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-3-2	6: MW-4-2	7: MW-5-2	8: MW-6-II	9: MW-7-2	10: MW-12-1	11: MW-13-2
Sample Date & Time			07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18	07-Jun-18
Temperature Upon Receipt [°C]			13.0	13.0	13.0	13.0	13.0	13.0	13.0
Biochemical Oxygen Demand (BOD5) [mg/L]	14-Jun-18	15:23	7	< 4	< 4	< 4	< 4	< 4	< 4
Total Suspended Solids [mg/L]	13-Jun-18	14:36	392	1340	1610	188	259	19	46
Alkalinity [mg/L as CaCO3]	12-Jun-18	21:55	609	305	819	929	286	267	221
pH [no unit]	12-Jun-18	21:55	7.66	7.94	7.18	7.41	7.97	7.93	7.89
Conductivity [uS/cm]	12-Jun-18	21:55	1300	356	1480	2060	650	690	503
Total Dissolved Solids [mg/L]	13-Jun-18	11:20	794	220	969	1310	380	414	269
Chemical Oxygen Demand [mg/L]	13-Jun-18	11:09	11	< 8	51	87	< 8	< 8	< 8
Phosphorus (total) [mg/L]	12-Jun-18	12:37	0.13	0.23	0.18	0.05	0.06	< 0.03	0.04
Total Kjeldahl Nitrogen [as N mg/L]	15-Jun-18	10:12	2.6	< 0.5	14.3	23.4	< 0.5	< 0.5	1.7
Ammonia+Ammonium (N) [mg/L]	14-Jun-18	15:14	2.1	< 0.1	11.1	19.7	0.2	0.2	0.9
4AAP-Phenolics [mg/L]	15-Jun-18	11:46	0.001	< 0.001	0.006	0.010	< 0.001	< 0.001	< 0.001
Sulphate [mg/L]	21-Jun-18	15:55	78	3	9	180	16	24	18
Chloride [mg/L]	20-Jun-18	14:05	26	4	91	99	7	51	44
Nitrite (as N) [mg/L]	19-Jun-18	16:47	0.90	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.10
Nitrate (as N) [mg/L]	19-Jun-18	16:47	7.60	0.07	1.02	< 0.06	< 0.06	< 0.06	0.71
Mercury (total) [ug/L]	11-Jun-18	10:29	< 0.01	0.03	< 0.01	0.01	< 0.01	< 0.01	< 0.01
Arsenic (total) [mg/L]	12-Jun-18	09:31	0.0003	< 0.0002	0.0020	0.0028	< 0.0002	< 0.0002	< 0.0002



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Schedule 5 Column 3

LR Report : CA14225-JUN18

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-3-2	6: MW-4-2	7: MW-5-2	8: MW-6-II	9: MW-7-2	10: MW-12-1	11: MW-13-2
Barium (total) [mg/L]	12-Jun-18	09:31	0.173	0.0955	0.689	0.701	0.144	0.620	0.160
Boron (total) [mg/L]	12-Jun-18	09:31	0.435	0.045	0.362	0.817	0.076	0.117	0.074
Calcium (total) [mg/L]	12-Jun-18	09:31	231	107	273	438	110	135	130
Cadmium (total) [mg/L]	12-Jun-18	09:31	0.000012	0.000004	0.000006	0.000014	< 0.000003	0.000021	0.000004
Chromium (total) [mg/L]	12-Jun-18	09:31	0.00020	0.00015	0.00075	0.00163	0.00024	0.00011	0.00017
Copper (total) [mg/L]	12-Jun-18	09:31	0.00178	0.00057	0.00058	0.00430	0.00154	0.00017	0.00080
Iron (total) [mg/L]	12-Jun-18	09:31	1.40	< 0.007	29.9	21.4	< 0.007	< 0.007	0.024
Potassium (total) [mg/L]	12-Jun-18	09:31	18.1	1.81	23.3	44.0	1.87	3.40	4.47
Magnesium (total) [mg/L]	12-Jun-18	09:31	22.6	2.92	24.7	50.4	5.07	11.0	4.43
Manganese (total) [mg/L]	13-Jun-18	13:32	3.15	0.0678	6.76	11.7	0.00208	0.00515	0.00378
Sodium (total) [mg/L]	12-Jun-18	09:31	58.5	11.4	64.0	121	19.9	13.9	29.3
Lead (total) [mg/L]	12-Jun-18	09:31	0.00003	< 0.00001	0.00005	0.00005	0.00003	0.00002	0.00002
Zinc (total) [mg/L]	12-Jun-18	09:31	< 0.002	0.002	0.004	0.002	0.004	0.002	0.003
Benzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromodichloromethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromoform [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Bromomethane [ug/L]	14-Jun-18	15:00	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Carbon tetrachloride [ug/L]	12-Jun-18	15:41	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Chloroethane [ug/L]	12-Jun-18	15:41	< 5	< 5	< 5	< 5	< 5	---	---
Chloroform [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Chloromethane [ug/L]	12-Jun-18	15:41	< 5	< 5	< 5	< 5	< 5	---	---
Dibromochloromethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichlorobenzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,3-Dichlorobenzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,4-Dichlorobenzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1-Dichloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1-Dichloroethylene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,2-Dichloropropane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
trans-1,2-Dichloroethene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
cis-1,2-Dichloroethene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
cis-1,3-Dichloropropene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
trans-1,3-Dichloropropene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Ethylbenzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Ethylenedibromide [ug/L]	12-Jun-18	15:41	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Dichloromethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: MW-3-2	6: MW-4-2	7: MW-5-2	8: MW-6-II	9: MW-7-2	10: MW-12-1	11: MW-13-2
Monochlorobenzene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Styrene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,2,2-Tetrachloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Tetrachloroethene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Toluene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Trichloroethylene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Vinyl Chloride [ug/L]	12-Jun-18	15:41	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	---	---
Trichlorofluoromethane [ug/L]	12-Jun-18	15:41	< 5	< 5	< 5	< 5	< 5	---	---
1,1,1-Trichloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,2-Trichloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
Xylene (total) [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
o-xylene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
m/p-xylene [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---
1,1,1,2-Tetrachloroethane [ug/L]	12-Jun-18	15:41	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	---

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Schedule 5 Column 2

21-October-2018

Date Rec. : 11 October 2018
LR Report: CA14226-OCT18
Reference: PO#73510995 11156055-01

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-1	6: MW-9-1	7: MW-10-1	8: MW-11-1
Sample Date & Time					11-Oct-18	11-Oct-18	11-Oct-18	11-Oct-18
Temp Upon Receipt [°C]	---	---	--	---	17.0	17.0	17.0	17.0
Alkalinity [mg/L as CaCO ₃]	11-Oct-18	13:13	14-Oct-18	21:26	292	279	240	256
pH [no unit]	11-Oct-18	13:13	14-Oct-18	21:26	7.85	8.41	8.26	8.19
Conductivity [uS/cm]	11-Oct-18	13:13	14-Oct-18	21:26	818	606	649	647
TDS [mg/L]	11-Oct-18	14:59	14-Oct-18	15:49	434	280	374	380
COD [mg/L]	12-Oct-18	08:16	14-Oct-18	22:16	12	37	< 8	15
NH ₃ +NH ₄ [as N mg/L]	18-Oct-18	17:50	18-Oct-18	14:53	< 0.1	0.6	0.2	0.7
SO ₄ [mg/L]	16-Oct-18	15:48	18-Oct-18	15:31	17	31	23	52
Cl [mg/L]	16-Oct-18	15:53	18-Oct-18	15:31	81	18	50	30
NO ₃ [as N mg/L]	16-Oct-18	21:10	18-Oct-18	15:06	< 0.06	< 0.06	< 0.06	< 0.06
DOC [mg/L]	15-Oct-18	18:00	17-Oct-18	09:36	< 1	1	< 1	2
Ba (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	0.102	0.769	0.747	0.370
B (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	0.104	0.612	0.253	0.478
Ca (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	117	59.0	98.5	103
Fe (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	0.031	< 0.007	0.043	0.148



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Schedule 5 Column 2

LR Report : CA14226-OCT18

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-1	6: MW-9-1	7: MW-10-1	8: MW-11-1
Mg (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	12.3	22.9	22.0	26.9
Na (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	49.7	52.4	14.7	15.7
As (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Cd (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:25	< 0.000003	< 0.000003	< 0.000003	< 0.000003
Cr (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	0.00014	0.00011	0.00011	0.00016
Cu (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	0.00143	0.00044	0.00013	0.00031
K (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	3.58	5.38	4.29	4.52
Mn (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	0.0452	0.0706	0.133	0.0835
Pb (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	0.00003	0.00001	0.00002	0.00001
Zn (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	09:26	0.003	0.004	0.005	0.004
Benzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Bromodichloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Bromoform [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Bromomethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Carbon tetrachloride [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.2
Chloroethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 5
Chloroform [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Chloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 5
Dibromochloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,2-Dichlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,3-Dichlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,4-Dichlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,1-Dichloroethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,2-Dichloroethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,1-Dichloroethylene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,2-Dichloropropane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
trans-1,2-Dichloroet [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
cis-1,2-Dichloroethe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
cis-1,3-Dichloroprop [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-1	6: MW-9-1	7: MW-10-1	8: MW-11-1
trans-1,3-Dichloropr [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Ethylbenzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Ethylenedibromide [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.2
Dichloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Monochlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Styrene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,1,2,2-Tetrachloroe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Tetrachloroethene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Toluene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Trichloroethylene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Vinyl Chloride [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.2
Trichlorofluorometha [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 5
1,1,1-Trichloroethan [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,1,2-Trichloroethan [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
Xylene (total) [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
o-xylene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
m-p-xylene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5
1,1,1,2-Tetrachloroe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	---	---	---	< 0.5



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Schedule 5 Column 3, Column 1 metals

Project : PO#735108995 11156057-01

13-November-2018

GHD

Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Date Rec. : 11 October 2018
LR Report: CA14227-OCT18
Reference: PO#735108995
11156057-01Gus Bolin

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-2	6: MW-9-2	7: MW-10-2	8: MW-11-2
Sample Date & Time			11-Oct-18	11-Oct-18	11-Oct-18	11-Oct-18
Temperature Upon Receipt [°C]	--	---	17.0	17.0	17.0	17.0
Biochemical Oxygen Demand (BOD5) [mg/L]	16-Oct-18	14:02	6	< 4	6	< 4
Total Suspended Solids [mg/L]	16-Oct-18	16:06	17	8	29	8
Alkalinity [mg/L as CaCO ₃]	14-Oct-18	21:27	272	272	244	247
pH [no unit]	14-Oct-18	21:27	8.15	8.14	7.90	7.65
Conductivity [uS/cm]	14-Oct-18	21:27	984	801	619	603
Total Dissolved Solids [mg/L]	14-Oct-18	15:49	583	423	360	354
Chemical Oxygen Demand [mg/L]	16-Oct-18	14:02	9	8	10	9
Phosphorus (total) [mg/L]	17-Oct-18	11:21	0.04	0.04	0.06	0.05
Total Kjeldahl Nitrogen [as N mg/L]	18-Oct-18	10:40	0.7	< 0.5	1.3	1.4
Ammonia+Ammonium (N) [as N mg/L]	16-Oct-18	12:27	0.1	0.2	0.6	0.9
4AAP-Phenolics [mg/L]	15-Oct-18	15:32	0.005	0.004	0.004	0.004
Sulphate [mg/L]	18-Oct-18	15:31	14	16	7	13
Chloride [mg/L]	18-Oct-18	15:31	120	85	47	29
Nitrite (as N) [mg/L]	18-Oct-18	15:06	< 0.03	< 0.03	0.18	< 0.03
Nitrate (as N) [mg/L]	18-Oct-18	15:06	0.94	0.62	0.23	< 0.06
Mercury (total) [ug/L]	16-Oct-18	14:18	0.03	0.02	0.01	< 0.01
Arsenic (dissolved) [mg/L]	19-Oct-18	14:54	0.0003	0.0004	0.0003	< 0.0002
Barium (dissolved) [mg/L]	19-Oct-18	14:58	0.190	0.203	0.472	0.477
Boron (dissolved) [mg/L]	19-Oct-18	14:58	0.023	0.091	0.113	0.129
Calcium (dissolved) [mg/L]	19-Oct-18	14:58	139	97.6	90.8	102
Cadmium (dissolved) [mg/L]	19-Oct-18	14:58	0.000010	0.000008	0.000008	0.000008
Chromium (dissolved) [mg/L]	19-Oct-18	14:58	0.00026	0.00070	0.00100	0.00016
Copper (dissolved) [mg/L]	19-Oct-18	14:58	0.00063	0.00189	0.00039	< 0.00002
Iron (dissolved) [mg/L]	19-Oct-18	14:58	1.32	0.526	9.96	3.35
Potassium (dissolved) [mg/L]	19-Oct-18	14:58	1.31	4.86	3.54	2.57
Magnesium (dissolved) [mg/L]	19-Oct-18	14:58	4.98	5.78	10.3	10.4
Manganese (dissolved) [mg/L]	19-Oct-18	14:58	0.0389	0.0211	0.0751	0.0313
Sodium (dissolved) [mg/L]	19-Oct-18	14:58	46.0	48.3	8.17	5.56

**SGS Canada Inc.**

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Schedule 5 Column 3, Column 1 metals**Project :** PO#735108995 11156057-01**LR Report :** CA14227-OCT18

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-8-2	6: MW-9-2	7: MW-10-2	8: MW-11-2
Lead (dissolved) [mg/L]	19-Oct-18	14:58	0.00058	0.00031	0.00028	0.00013
Zinc (total) [mg/L]	19-Oct-18	14:58	< 0.002	0.005	< 0.002	< 0.002
Benzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Bromodichloromethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Bromoform [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Bromomethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Carbon tetrachloride [ug/L]	17-Oct-18	13:58	---	---	---	< 0.2
Chloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 5
Chloroform [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Chloromethane [ug/L]	17-Oct-18	13:58	---	---	---	< 5
Dibromochloromethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,2-Dichlorobenzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,3-Dichlorobenzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,4-Dichlorobenzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,1-Dichloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,2-Dichloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,1-Dichloroethylene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,2-Dichloropropane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
trans-1,2-Dichloroethene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
cis-1,2-Dichloroethene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
cis-1,3-Dichloropropene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
trans-1,3-Dichloropropene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Ethylbenzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Ethylenedibromide [ug/L]	17-Oct-18	13:58	---	---	---	< 0.2
Dichloromethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Monochlorobenzene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Styrene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,1,2,2-Tetrachloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Tetrachloroethene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Toluene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Trichloroethylene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Vinyl Chloride [ug/L]	17-Oct-18	13:58	---	---	---	< 0.2
Trichlorofluoromethane [ug/L]	17-Oct-18	13:58	---	---	---	< 5
1,1,1-Trichloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,1,2-Trichloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
Xylene (total) [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
o-xylene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
m/p-xylene [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5
1,1,1,2-Tetrachloroethane [ug/L]	17-Oct-18	13:58	---	---	---	< 0.5



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Schedule 5 Column 3, Column 1 metals

Project : PO#735108995 11156057-01

LR Report : CA14227-OCT18

Chris Sullivan



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Schedule 5 Column 2

Project : 11156055-01

01-November-2018

Date Rec. : 13 October 2018
LR Report: **CA14289-OCT18**
Reference: PO#73510995 11156055-01 Gus Bolin

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CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-12-2	6: MW-12-3	7: MW-13-1	8: MW-7-1
Sample Date & Time					12-Oct-18	12-Oct-18	12-Oct-18	12-Oct-18
Temp Upon Receipt [°C]	---	---	--	---	10.0	10.0	10.0	10.0
Alkalinity [mg/L as CaCO ₃]	15-Oct-18	14:46	16-Oct-18	14:33	287	294	273	342
pH [no unit]	15-Oct-18	14:46	16-Oct-18	14:33	8.00	7.83	7.99	8.26
Conductivity [uS/cm]	15-Oct-18	14:46	16-Oct-18	14:33	732	708	822	787
TDS [mg/L]	15-Oct-18	14:21	17-Oct-18	13:06	449	426	457	454
COD [mg/L]	17-Oct-18	07:43	17-Oct-18	16:25	15	< 8	< 8	< 8
NH ₃ +NH ₄ [as N mg/L]	18-Oct-18	17:50	18-Oct-18	14:54	0.2	< 0.1	< 0.1	< 0.1
SO ₄ [mg/L]	18-Oct-18	13:55	19-Oct-18	13:27	66	23	13	30
Cl [mg/L]	18-Oct-18	13:49	19-Oct-18	13:27	43	56	93	45
NO ₃ [as N mg/L]	16-Oct-18	23:21	18-Oct-18	15:58	< 0.06	0.08	1.21	0.25
DOC [mg/L]	23-Oct-18	14:00	30-Oct-18	13:41	2	1	3	1
Ba (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.168	0.0347	0.0784	0.131
B (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.501	0.080	0.020	0.540



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Schedule 5 Column 2

Project : 11156055-01

LR Report : CA14289-OCT18

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-12-2	6: MW-12-3	7: MW-13-1	8: MW-7-1
Ca (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	97.7	136	71.8	40.6
Fe (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.024	0.200	< 0.007	< 0.007
Mg (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	22.2	5.99	2.31	8.26
Na (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	40.4	15.2	70.6	148
As (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	< 0.0002	< 0.0002	< 0.0002	0.0006
Cd (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	< 0.000003	< 0.000003	< 0.000003	0.000007
Cr (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00012	0.00013	0.00015	0.00016
Cu (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00024	0.00022	0.00077	0.00048
K (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	3.11	1.67	2.64	2.45
Mn (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.149	0.0493	0.00035	0.00568
Pb (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	< 0.00001	0.00002	0.00003	0.00002
Zn (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	< 0.002	0.002	< 0.002	< 0.002
Benzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Bromodichloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Bromoform [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Bromomethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Carbon tetrachloride [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.2
Chloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 5
Chloroform [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Chloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 5
Dibromochloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,2-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,3-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,4-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,1-Dichloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,2-Dichloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,1-Dichloroethylene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5



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Schedule 5 Column 2

Project : 11156055-01

LR Report : CA14289-OCT18

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-12-2	6: MW-12-3	7: MW-13-1	8: MW-7-1
1,2-Dichloropropane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
trans-1,2-Dichloroet [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
cis-1,2-Dichloroethe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
cis-1,3-Dichloroprop [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
trans-1,3-Dichloropr [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Ethylbenzene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Ethylenedibromide [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.2
Dichloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Monochlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Styrene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,1,2,2-Tetrachloroe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Tetrachloroethene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Toluene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Trichloroethylene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Vinyl Chloride [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.2
Trichlorofluorometha [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 5
1,1,1-Trichloroethan [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,1,2-Trichloroethan [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
Xylene (total) [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
o-xylene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
m-p-xylene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5
1,1,1,2-Tetrachloroe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:15	---	---	---	< 0.5



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Schedule 5 Column 2

Project : 11156055-01

LR Report : CA14289-OCT18



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Lakefield - Ontario - K0L 2H0
Phone: 705-652-2000 FAX: 705-652-6365

GHD

Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
Canada, K9J 6Z8
Phone: 705-749-3317, Fax:

Schedule 5 Column 2

01-November-2018

Date Rec. : 15 October 2018
LR Report: CA14290-OCT18
Reference: PO#73510995 11156055-01
Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1
Sample Date & Time					12-Oct-18	12-Oct-18	12-Oct-18	12-Oct-18	12-Oct-18
Temp Upon Receipt [°C]	---	---	--	---	8.0	8.0	8.0	8.0	8.0
Alkalinity [mg/L as CaCO ₃]	15-Oct-18	14:46	16-Oct-18	14:33	292	354	376	677	469
pH [no unit]	15-Oct-18	14:46	16-Oct-18	14:33	7.96	7.82	7.76	7.56	7.75
Conductivity [uS/cm]	15-Oct-18	14:46	16-Oct-18	14:33	1110	815	904	1520	1190
TDS [mg/L]	15-Oct-18	14:21	17-Oct-18	13:06	671	471	537	877	703
COD [mg/L]	17-Oct-18	07:43	17-Oct-18	16:25	< 8	< 8	8	41	15
Total P [mg/L]	18-Oct-18	19:10	22-Oct-18	10:48	0.04	< 0.03	< 0.03	< 0.03	0.06
NH ₃ +NH ₄ [as N mg/L]	18-Oct-18	17:50	23-Oct-18	12:01	< 0.1	< 0.1	0.2	13.3	6.5
SO ₄ [mg/L]	18-Oct-18	13:55	19-Oct-18	13:27	73	16	27	10	42
Cl [mg/L]	18-Oct-18	13:49	19-Oct-18	15:23	160	52	67	120	100
NO ₃ [as N mg/L]	17-Oct-18	04:00	22-Oct-18	14:29	2.70	2.26	1.58	0.54	0.14
DOC [mg/L]	23-Oct-18	14:00	24-Oct-18	12:48	2	2	3	14	6
Ba (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.229	0.112	0.151	0.587	0.285
B (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.104	0.045	0.110	0.450	0.213
Ca (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	157	129	155	230	163



SGS Canada Inc.

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Schedule 5 Column 2

LR Report : CA14290-OCT18

Analysis	1: Analysis Start Date	2: Analysis Start Time Completed	3: Analysis Date Completed	4: Analysis Time Completed	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1
Fe (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.008	0.013	0.061	28.4	2.24
Mg (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	14.9	4.46	7.42	22.5	11.6
Na (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	70.5	30.7	34.2	81.9	63.7
As (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	< 0.0002	< 0.0002	< 0.0002	0.0026	0.0005
Cd (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.000007	0.000022	0.000014	< 0.000003	0.000003
Cr (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00012	0.00011	0.00018	0.00077	0.00032
Cu (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00330	0.00281	0.00177	0.00111	0.00086
K (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	4.84	3.69	4.46	25.1	13.3
Mn (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00682	0.102	0.0535	2.12	1.37
Pb (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.00015	0.00016	0.00009	0.00007	0.00021
Zn (diss) [mg/L]	19-Oct-18	09:57	23-Oct-18	10:05	0.004	0.005	0.003	0.003	0.004
Benzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Bromodichloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Bromoform [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Bromomethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Carbon tetrachloride [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.2	< 0.2	< 0.2	< 0.2
Chloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 5	< 5	< 5	< 5
Chloroform [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Chloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 5	< 5	< 5	< 5
Dibromochloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,3-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,4-Dichlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloroethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethylene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloropropane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
trans-1,2-Dichloroet [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
cis-1,2-Dichloroethe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Date Completed	4: Analysis Time Completed	5: MW-1-1	6: MW-3-1	7: MW-4-1	8: MW-5-1	9: MW-6-1
cis-1,3-Dichloroprop [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
trans-1,3-Dichloropr [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Ethylbenzene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Ethylenedibromide [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.2	< 0.2	< 0.2	< 0.2
Dichloromethane [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Monochlorobenzene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Styrene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2,2-Tetrachloroe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Tetrachloroethene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Toluene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Trichloroethylene [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Vinyl Chloride [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.2	< 0.2	< 0.2	< 0.2
Trichlorofluorometha [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 5	< 5	< 5	< 5
1,1,1-Trichloroethan [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichloroethan [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
Xylene (total) [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
o-xylene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
m-p-xylene [ug/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5
1,1,1,2-Tetrachloroe [µg/L]	16-Oct-18	16:02	18-Oct-18	16:16	---	< 0.5	< 0.5	< 0.5	< 0.5



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13-November-2018

GHD

Attn : Gus Bolin

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Date Rec. : 13 October 2018
LR Report: CA14303-OCT18
Reference: PO#735108995
11156057-01Gus Bolin

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-12-1	6: MW-13-2	7: MW-7-2	8: MW-14-1
Sample Date & Time			12-Oct-18	12-Oct-18	12-Oct-18	12-Oct-18
Temperature Upon Receipt [°C]	--	---	10.0	10.0	10.0	10.0
Biochemical Oxygen Demand (BOD5) [mg/L]	22-Oct-18	13:36	9	< 4	< 4	---
Total Suspended Solids [mg/L]	19-Oct-18	11:53	2	< 2	100	---
Alkalinity [mg/L as CaCO ₃]	16-Oct-18	14:33	251	282	1080	---
pH [no unit]	16-Oct-18	14:33	7.95	7.91	7.58	---
Conductivity [uS/cm]	16-Oct-18	14:33	593	610	2200	---
Total Dissolved Solids [mg/L]	17-Oct-18	13:22	346	371	1470	---
Chemical Oxygen Demand [mg/L]	22-Oct-18	13:36	13	< 8	95	---
Phosphorus (total) [mg/L]	17-Oct-18	13:50	< 0.03	0.06	< 0.03	---
Total Kjeldahl Nitrogen [as N mg/L]	06-Nov-18	12:51	< 0.5	< 0.5	31.9	---
Ammonia+Ammonium (N) [as N mg/L]	24-Oct-18	09:15	0.1	< 0.1	23.2	---
4AAP-Phenolics [mg/L]	25-Oct-18	09:04	< 0.001	< 0.001	0.003	---
Sulphate [mg/L]	19-Oct-18	13:27	22	15	60	---
Chloride [mg/L]	19-Oct-18	15:23	45	30	140	---
Nitrite (as N) [mg/L]	17-Oct-18	12:29	< 0.03	< 0.03	< 0.03	---
Nitrate (as N) [mg/L]	17-Oct-18	12:29	< 0.06	1.37	0.12	---
Mercury (total) [ug/L]	17-Oct-18	14:33	< 0.01	< 0.01	0.01	---
Mercury (dissolved) [mg/L]	17-Oct-18	14:33	< 0.00001	< 0.00001	0.00001	---
Arsenic (dissolved) [mg/L]	30-Oct-18	15:22	< 0.0002	< 0.0002	0.0009	---
Barium (dissolved) [mg/L]	30-Oct-18	15:22	0.667	0.106	0.432	---
Boron (dissolved) [mg/L]	30-Oct-18	15:22	0.120	0.027	0.673	---
Calcium (dissolved) [mg/L]	30-Oct-18	15:22	96.7	109	308	---
Cadmium (dissolved) [mg/L]	30-Oct-18	15:22	< 0.000003	0.000004	0.000008	---
Chromium (dissolved) [mg/L]	30-Oct-18	15:22	0.00003	0.00007	0.00093	---
Copper (dissolved) [mg/L]	30-Oct-18	15:22	0.00030	0.00071	0.00318	---
Iron (dissolved) [mg/L]	30-Oct-18	15:22	< 0.007	0.013	0.178	---
Potassium (dissolved) [mg/L]	30-Oct-18	15:22	3.30	3.17	39.4	---
Magnesium (dissolved) [mg/L]	30-Oct-18	15:22	12.1	2.82	37.6	---
Manganese (dissolved) [mg/L]	30-Oct-18	15:22	0.00269	0.00960	7.44	---



Schedule 5 Column 3, Column 1 metals

SGS Canada Inc.

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LR Report : CA14303-OCT18

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-12-1	6: MW-13-2	7: MW-7-2	8: MW-14-1
Sodium (dissolved) [mg/L]	30-Oct-18	15:22	10.4	31.8	128	---
Lead (dissolved) [mg/L]	30-Oct-18	15:22	< 0.00001	< 0.00001	< 0.00001	---
Zinc (dissolved) [mg/L]	30-Oct-18	15:22	< 0.002	< 0.002	< 0.002	---
Benzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Bromodichloromethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Bromoform [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Bromomethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Carbon tetrachloride [ug/L]	18-Oct-18	16:17	---	---	< 0.2	< 0.2
Chloroethane [ug/L]	18-Oct-18	16:17	---	---	< 5	< 5
Chloroform [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Chloromethane [ug/L]	18-Oct-18	16:17	---	---	< 5	< 5
Dibromochloromethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,2-Dichlorobenzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,3-Dichlorobenzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,4-Dichlorobenzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,1-Dichloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,2-Dichloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,1-Dichloroethylene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,2-Dichloropropane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
trans-1,2-Dichloroethene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
cis-1,2-Dichloroethene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
cis-1,3-Dichloropropene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
trans-1,3-Dichloropropene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Ethylbenzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Ethylenedibromide [ug/L]	18-Oct-18	16:17	---	---	< 0.2	< 0.2
Dichloromethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Monochlorobenzene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Styrene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,1,2,2-Tetrachloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Tetrachloroethene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Toluene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Trichloroethylene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Vinyl Chloride [ug/L]	18-Oct-18	16:17	---	---	< 0.2	< 0.2
Trichlorofluoromethane [ug/L]	18-Oct-18	16:17	---	---	< 5	< 5
1,1,1-Trichloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,1,2-Trichloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
Xylene (total) [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
o-xylene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
m/p-xylene [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5
1,1,1,2-Tetrachloroethane [ug/L]	18-Oct-18	16:17	---	---	< 0.5	< 0.5



SGS Canada Inc.

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Schedule 5 Column 3, Column 1 metals

LR Report : CA14303-OCT18

Chris Sullivan



Chris Sullivan, B.Sc., C.Chem
Project Specialist
Environmental Services, Analytical

**SGS Canada Inc.**

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GHD

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Schedule 5 Column 3, Column 1 metals

Project : PO#735108995 11156057-01

13-November-2018

Date Rec. : 13 October 2018

LR Report: CA14304-OCT18

Reference: PO#735108995
11156057-01 Gus Bolin

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-4-2	6: MW-6-2
Sample Date & Time			12-Oct-18	12-Oct-18
Temperature Upon Receipt [°C]	--	---	8.0	8.0
Biochemical Oxygen Demand (BOD5) [mg/L]	22-Oct-18	13:35	< 4	< 4
Total Suspended Solids [mg/L]	18-Oct-18	13:47	2520	704
Alkalinity [mg/L as CaCO3]	16-Oct-18	14:33	315	505
pH [no unit]	16-Oct-18	14:33	7.87	7.74
Conductivity [uS/cm]	16-Oct-18	14:33	701	1080
Total Dissolved Solids [mg/L]	17-Oct-18	13:06	417	686
Chemical Oxygen Demand [mg/L]	17-Oct-18	16:26	< 8	17
Phosphorus (total) [mg/L]	17-Oct-18	13:50	< 0.03	0.05
Total Kjeldahl Nitrogen [as N mg/L]	18-Oct-18	09:49	< 0.5	< 0.5
Ammonia+Ammonium (N) [as N mg/L]	24-Oct-18	09:15	< 0.1	< 0.1
4AAP-Phenolics [mg/L]	25-Oct-18	09:04	< 0.001	0.002
Sulphate [mg/L]	19-Oct-18	13:27	11	43
Chloride [mg/L]	19-Oct-18	13:27	50	65
Nitrite (as N) [mg/L]	19-Oct-18	14:42	< 0.03	< 0.03
Nitrate (as N) [mg/L]	19-Oct-18	14:42	0.77	4.76
Mercury (total) [ug/L]	17-Oct-18	14:33	< 0.01	0.02
Mercury (dissolved) [mg/L]	03-Nov-18	07:09	0.00001	0.00001
Arsenic (dissolved) [mg/L]	30-Oct-18	15:25	< 0.0002	< 0.0002
Barium (dissolved) [mg/L]	30-Oct-18	15:25	0.143	0.304
Boron (dissolved) [mg/L]	30-Oct-18	15:25	0.044	0.269
Calcium (dissolved) [mg/L]	30-Oct-18	15:25	116	145
Cadmium (total) [mg/L]	30-Oct-18	15:25	0.000004	0.000005
Chromium (dissolved) [mg/L]	30-Oct-18	15:25	0.00014	0.00039
Copper (dissolved) [mg/L]	30-Oct-18	15:25	0.00071	0.00358
Iron (dissolved) [mg/L]	30-Oct-18	15:25	0.017	0.111
Potassium (dissolved) [mg/L]	30-Oct-18	15:25	1.80	9.57
Magnesium (dissolved) [mg/L]	30-Oct-18	15:25	3.82	16.5
Manganese (dissolved) [mg/L]	30-Oct-18	15:25	0.00114	0.00925

**SGS Canada Inc.**

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Schedule 5 Column 3, Column 1 metals**Project :** PO#735108995 11156057-01**LR Report :** CA14304-OCT18

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-4-2	6: MW-6-2
Sodium (dissolved) [mg/L]	30-Oct-18	15:25	20.6	55.6
Lead (dissolved) [mg/L]	30-Oct-18	15:25	0.00004	0.00019
Zinc (dissolved) [mg/L]	30-Oct-18	15:25	< 0.002	< 0.002
Benzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Bromodichloromethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Bromoform [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Bromomethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Carbon tetrachloride [ug/L]	18-Oct-18	16:16	< 0.2	< 0.2
Chloroethane [ug/L]	18-Oct-18	16:16	< 5	< 5
Chloroform [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Chloromethane [ug/L]	18-Oct-18	16:16	< 5	< 5
Dibromochloromethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,2-Dichlorobenzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,3-Dichlorobenzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,4-Dichlorobenzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,1-Dichloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,2-Dichloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,1-Dichloroethylene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,2-Dichloropropane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
trans-1,2-Dichloroethene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
cis-1,2-Dichloroethene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
cis-1,3-Dichloropropene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
trans-1,3-Dichloropropene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Ethylbenzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Ethylenedibromide [ug/L]	18-Oct-18	16:16	< 0.2	< 0.2
Dichloromethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Monochlorobenzene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Styrene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,1,2,2-Tetrachloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Tetrachloroethene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Toluene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Trichloroethylene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Vinyl Chloride [ug/L]	18-Oct-18	16:16	< 0.2	< 0.2
Trichlorofluoromethane [ug/L]	18-Oct-18	16:16	< 5	< 5
1,1,1-Trichloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,1,2-Trichloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
Xylene (total) [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
o-xylene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
m/p-xylene [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5
1,1,1,2-Tetrachloroethane [ug/L]	18-Oct-18	16:16	< 0.5	< 0.5



SGS Canada Inc.

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Schedule 5 Column 3, Column 1 metals

Project : PO#735108995 11156057-01

LR Report : CA14304-OCT18

Chris Sullivan



Chris Sullivan, B.Sc., C.Chem
Project Specialist
Environmental Services, Analytical



SGS Canada Inc.

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GHD

Attn : Gus Bolin

347 Pido Rd., Unit #29, Peterborough
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Phone: 705-749-3317, Fax:

Schedule 5 Column 2

21-October-2018

Date Rec. : 11 October 2018
LR Report: CA15200-OCT18
Reference: PO#73510995 11156055-01
Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time Completed	3: Analysis Date Completed	4: Analysis Time Completed	5: R-1	6: R-2	7: R-3	8: R-4
Sample Date & Time					11-Oct-18	11-Oct-18	11-Oct-18	11-Oct-18
Temp Upon Receipt [°C]	---	---	--	---	17.0	17.0	17.0	17.0
Alkalinity [mg/L as CaCO ₃]	11-Oct-18	13:13	14-Oct-18	21:27	267	286	255	374
pH [no unit]	11-Oct-18	13:13	14-Oct-18	21:27	7.93	8.12	8.28	8.17
Conductivity [uS/cm]	11-Oct-18	13:13	14-Oct-18	21:27	667	894	792	1610
TDS [mg/L]	11-Oct-18	14:59	14-Oct-18	20:54	357	509	434	843
COD [mg/L]	12-Oct-18	08:52	14-Oct-18	22:17	11	< 8	22	10
NH ₃ +NH ₄ [as N mg/L]	18-Oct-18	17:50	18-Oct-18	15:00	0.3	< 0.1	< 0.1	< 0.1
SO ₄ [mg/L]	16-Oct-18	15:48	18-Oct-18	15:31	10	13	< 2	18
Cl [mg/L]	16-Oct-18	15:53	18-Oct-18	15:31	51	110	84	280
NO ₃ [as N mg/L]	16-Oct-18	21:10	18-Oct-18	15:06	0.24	0.59	1.78	2.49
DOC [mg/L]	15-Oct-18	18:00	17-Oct-18	09:39	3	2	3	5
Ba (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.0946	0.106	0.00061	0.145
B (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.017	0.023	0.033	0.037
Ca (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	111	138	0.32	137
Fe (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.371	< 0.007	< 0.007	< 0.007

OnLine LIMS

0001549239



SGS Canada Inc.

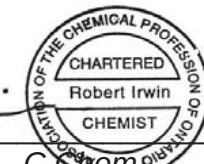
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - K0L 2H0
Phone: 705-652-2000 FAX: 705-652-6365

Schedule 5 Column 2

LR Report : CA15200-OCT18

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Date Completed	4: Analysis Time Completed	5: R-1	6: R-2	7: R-3	8: R-4
Mg (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	3.99	4.63	0.025	4.04
Na (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	33.5	49.0	193	154
As (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.0003	< 0.0002	< 0.0002	0.0002
Cd (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.000031	< 0.000003	< 0.000003	0.000004
Cr (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.00017	0.00017	0.00016	0.00029
Cu (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.00185	0.144	0.0600	0.0845
K (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	1.68	1.37	0.273	3.76
Mn (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.308	0.00025	0.00013	0.00029
Pb (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:08	0.00288	0.00057	0.00032	0.00217
Zn (diss) [mg/L]	18-Oct-18	03:46	19-Oct-18	10:09	0.013	0.009	0.009	0.036
Benzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Bromodichloromethane [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Bromoform [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Bromomethane [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Carbon tetrachloride [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.2	< 0.2	< 0.2	< 0.2
Chloroethane [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 5	< 5	< 5	< 5
Chloroform [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Chloromethane [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 5	< 5	< 5	< 5
Dibromochloromethane [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichlorobenzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,3-Dichlorobenzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,4-Dichlorobenzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethane [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloroethane [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,1-Dichloroethylene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,2-Dichloropropane [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
trans-1,2-Dichloroet [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
cis-1,2-Dichloroethe [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
cis-1,3-Dichloroprop [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: R-1	6: R-2	7: R-3	8: R-4
trans-1,3-Dichloropr [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Ethylbenzene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Ethylenedibromide [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.2	< 0.2	< 0.2	< 0.2
Dichloromethane [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Monochlorobenzene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Styrene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2,2-Tetrachloroe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Tetrachloroethene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Toluene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Trichloroethylene [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Vinyl Chloride [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.2	< 0.2	< 0.2	< 0.2
Trichlorofluorometha [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 5	< 5	< 5	< 5
1,1,1-Trichloroethan [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,1,2-Trichloroethan [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
Xylene (total) [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
o-xylene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
m-p-xylene [ug/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5
1,1,1,2-Tetrachloroe [µg/L]	15-Oct-18	16:49	17-Oct-18	13:59	< 0.5	< 0.5	< 0.5	< 0.5



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**SGS Canada Inc.**

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GHD

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Schedule 5 Column 3, Column 1 metals

Project : PO#73510995 11156057-01

21-October-2018

Date Rec. : 11 October 2018

LR Report: CA15199-OCT18

Reference: PO#73510995
11156057-01

Copy: 1

CERTIFICATE OF ANALYSIS

Final Report

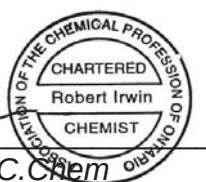
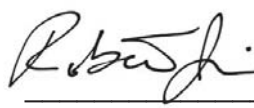
Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: S-1
Sample Date & Time			11-Oct-18
Temperature Upon Receipt [°C]	--	---	17.0
Biochemical Oxygen Demand (BOD5) [mg/L]	16-Oct-18	14:02	18
Total Suspended Solids [mg/L]	16-Oct-18	16:06	27
Alkalinity [mg/L as CaCO ₃]	14-Oct-18	21:27	278
pH [no unit]	14-Oct-18	21:27	7.87
Conductivity [uS/cm]	14-Oct-18	21:27	613
Total Dissolved Solids [mg/L]	14-Oct-18	20:54	371
Chemical Oxygen Demand [mg/L]	16-Oct-18	14:02	58
Total Kjeldahl Nitrogen [as N mg/L]	18-Oct-18	10:41	1.1
Ammonia+Ammonium (N) [as N mg/L]	16-Oct-18	13:27	0.1
4AAP-Phenolics [mg/L]	15-Oct-18	15:32	0.032
Sulphate [mg/L]	18-Oct-18	15:31	25
Chloride [mg/L]	18-Oct-18	15:31	25
Nitrite (as N) [mg/L]	18-Oct-18	14:34	< 0.03
Nitrate (as N) [mg/L]	18-Oct-18	14:34	< 0.06
Mercury (total) [ug/L]	16-Oct-18	14:25	0.01
Arsenic (total) [mg/L]	16-Oct-18	11:35	0.0013
Barium (total) [mg/L]	16-Oct-18	11:35	0.145
Boron (total) [mg/L]	16-Oct-18	11:35	0.037
Calcium (total) [mg/L]	16-Oct-18	11:35	128
Cadmium (total) [mg/L]	16-Oct-18	11:35	0.000056
Chromium (total) [mg/L]	16-Oct-18	11:35	0.00093
Copper (total) [mg/L]	16-Oct-18	11:35	0.00172
Iron (total) [mg/L]	16-Oct-18	11:35	0.528
Potassium (total) [mg/L]	16-Oct-18	11:35	5.49
Magnesium (total) [mg/L]	16-Oct-18	11:35	4.48
Manganese (total) [mg/L]	16-Oct-18	11:35	0.197
Sodium (total) [mg/L]	16-Oct-18	11:35	18.9
Phosphorus (total) [mg/L]	16-Oct-18	11:35	0.342

**SGS Canada Inc.**

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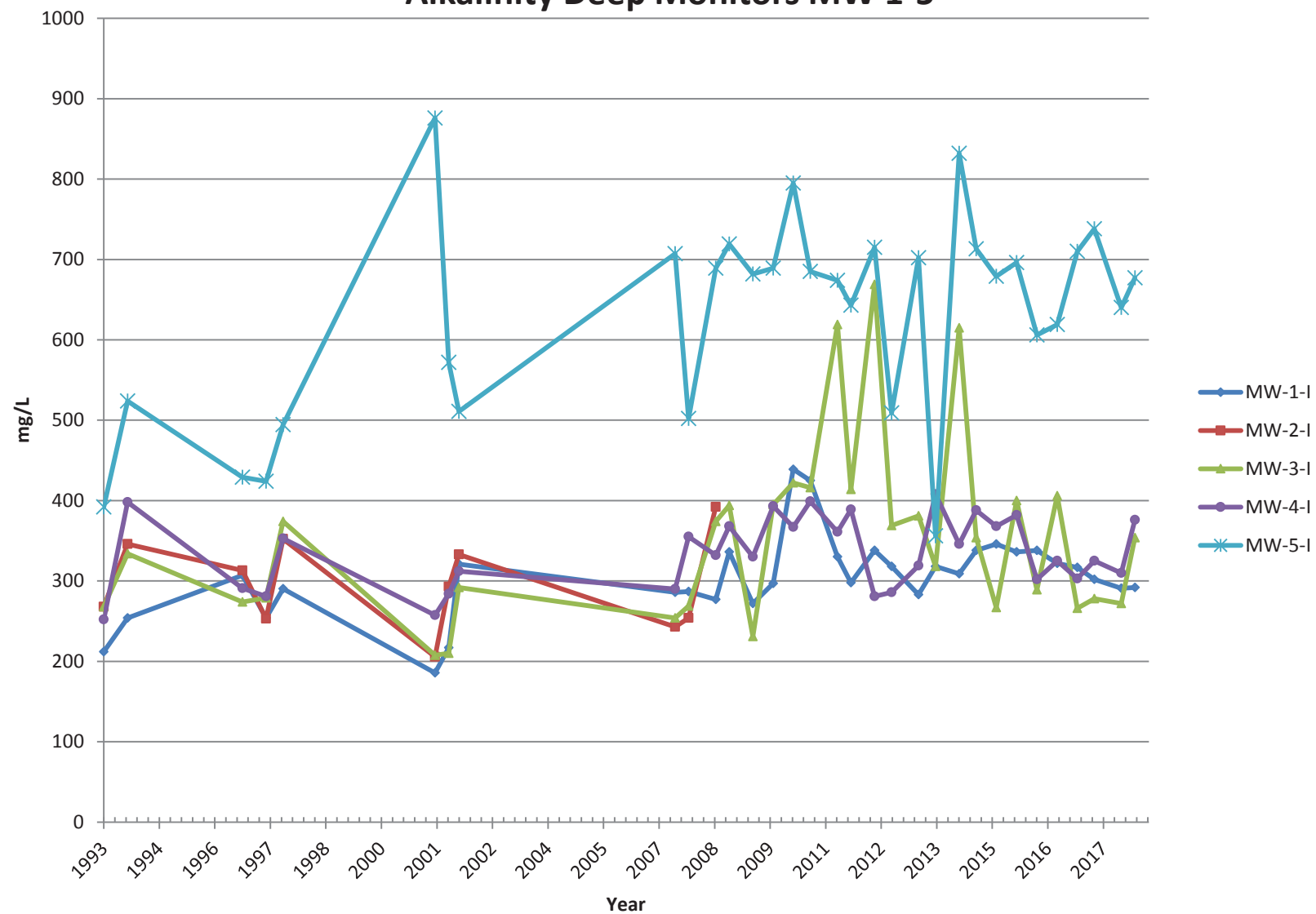
Schedule 5 Column 3, Column 1 metals**Project :** PO#73510995 11156057-01**LR Report :** CA15199-OCT18

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: S-1
Lead (total) [mg/L]	16-Oct-18	11:35	0.00033
Zinc (total) [mg/L]	16-Oct-18	11:35	0.006

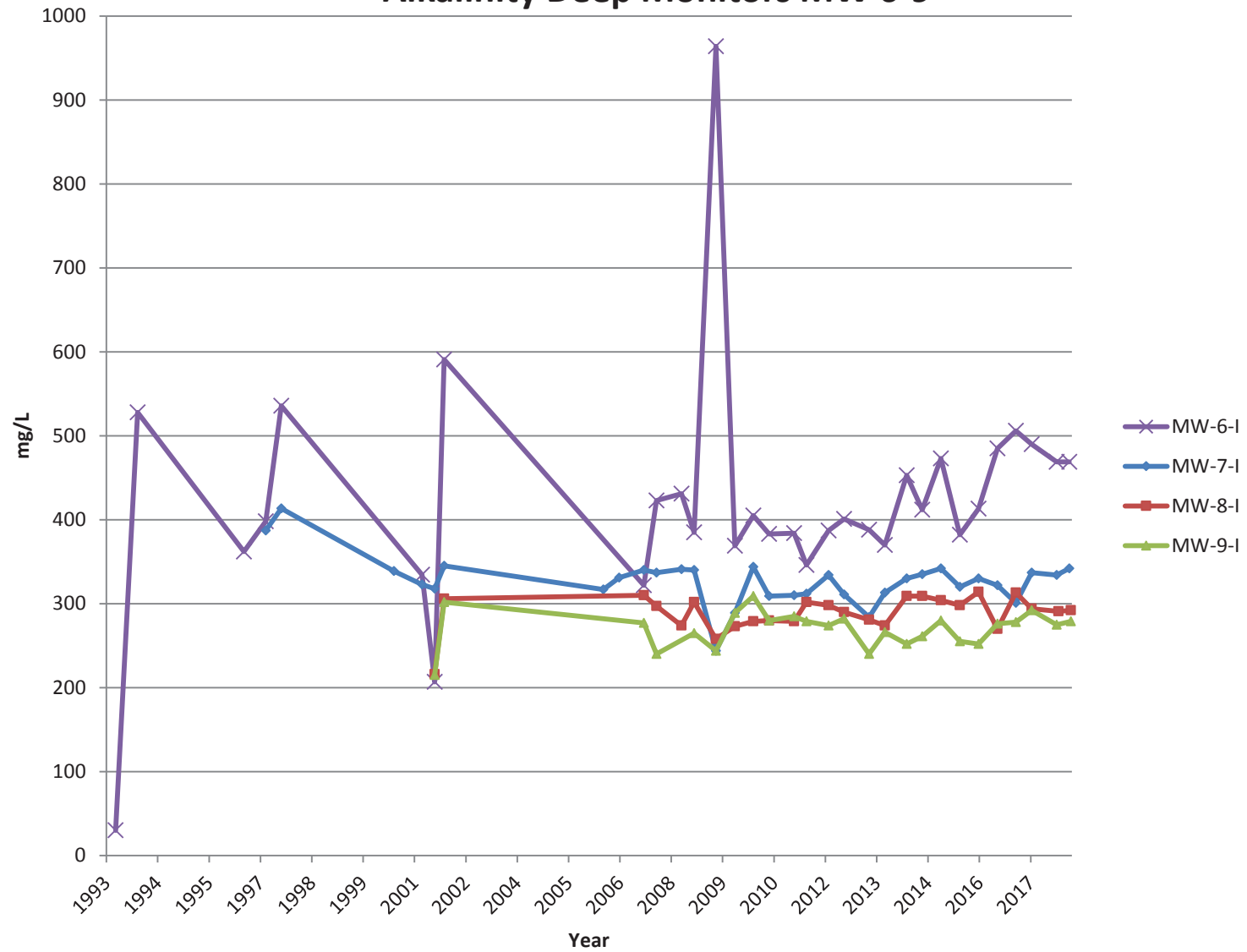


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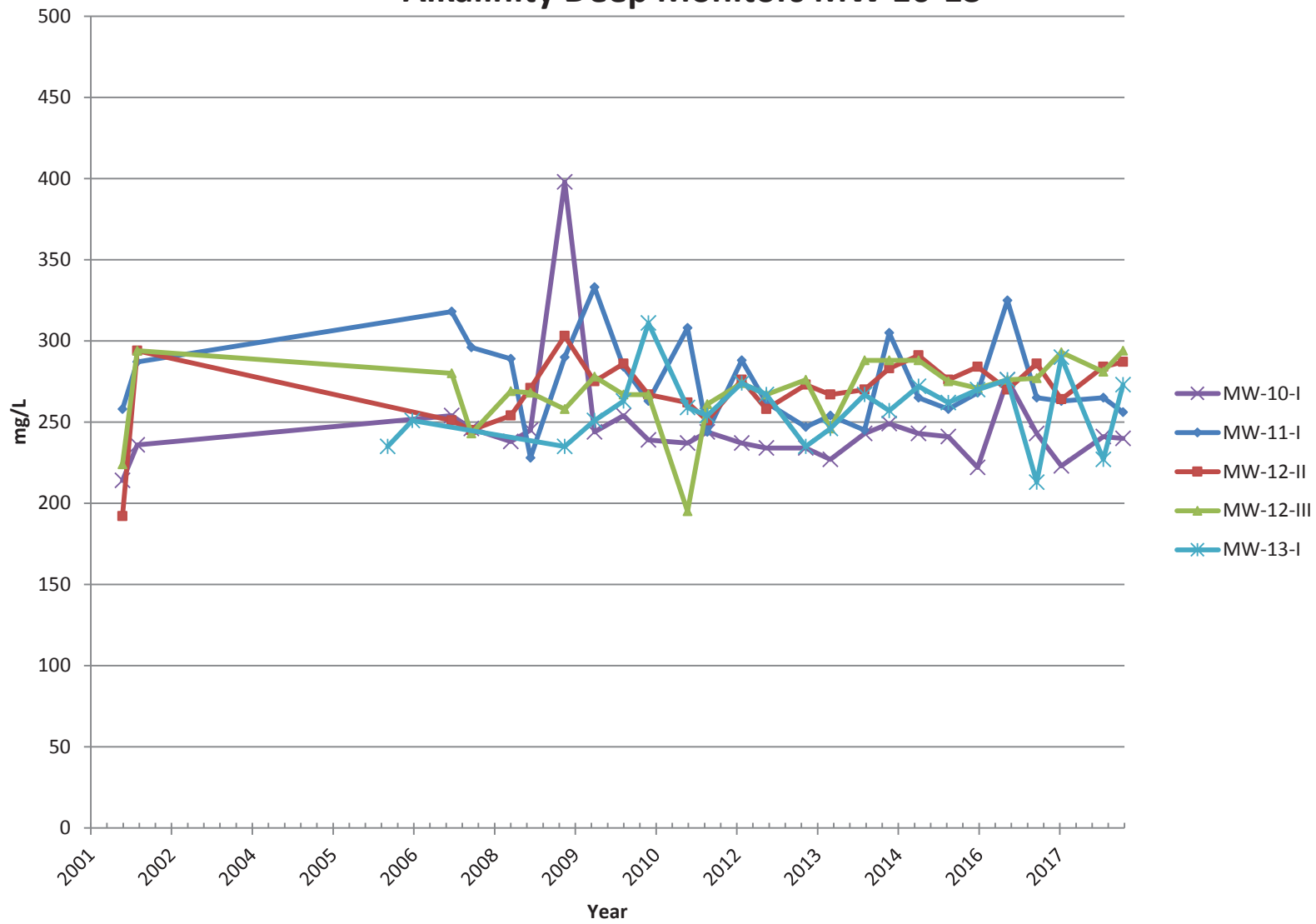
Alkalinity Deep Monitors MW 1-5



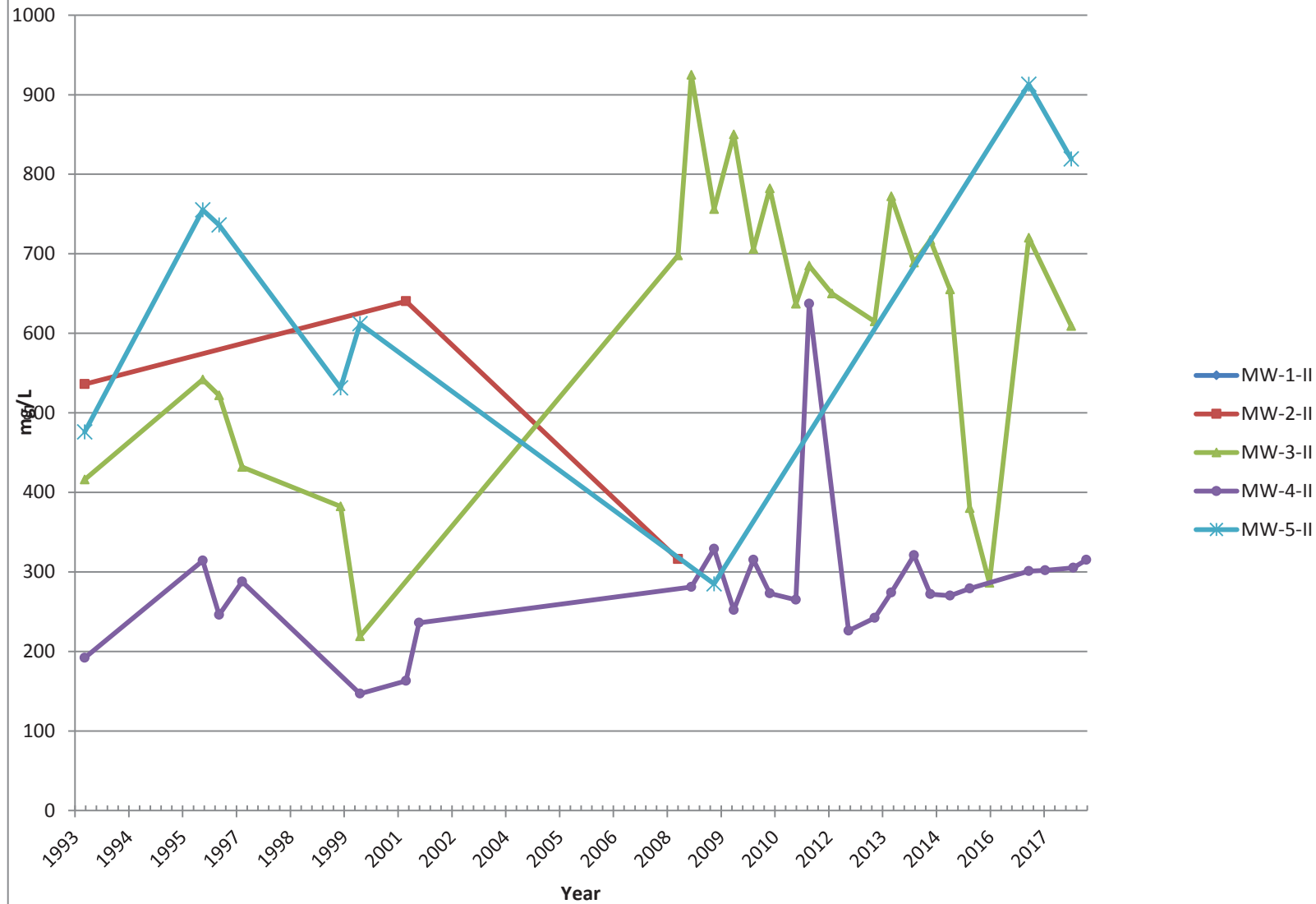
Alkalinity Deep Monitors MW 6-9



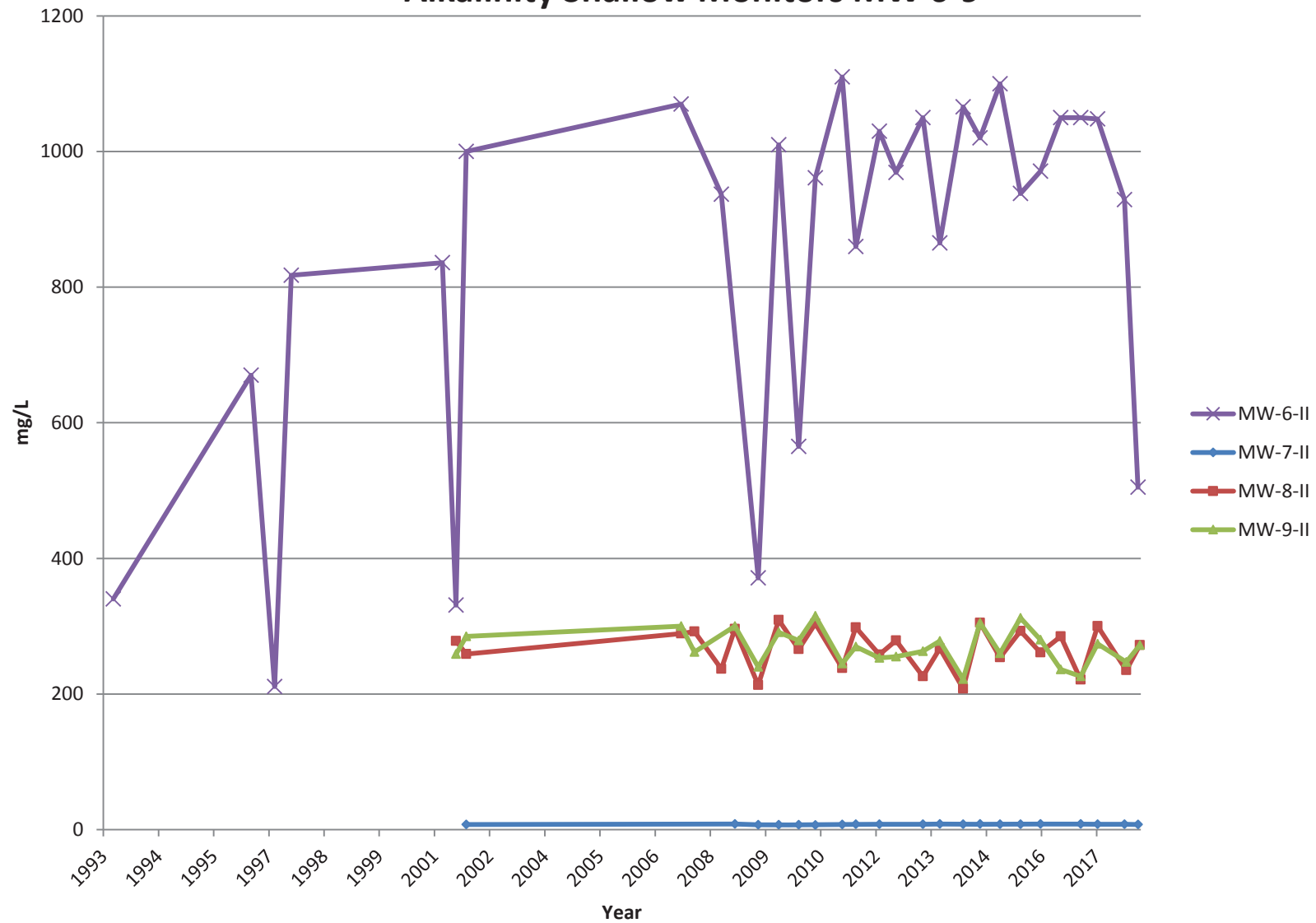
Alkalinity Deep Monitors MW 10-13



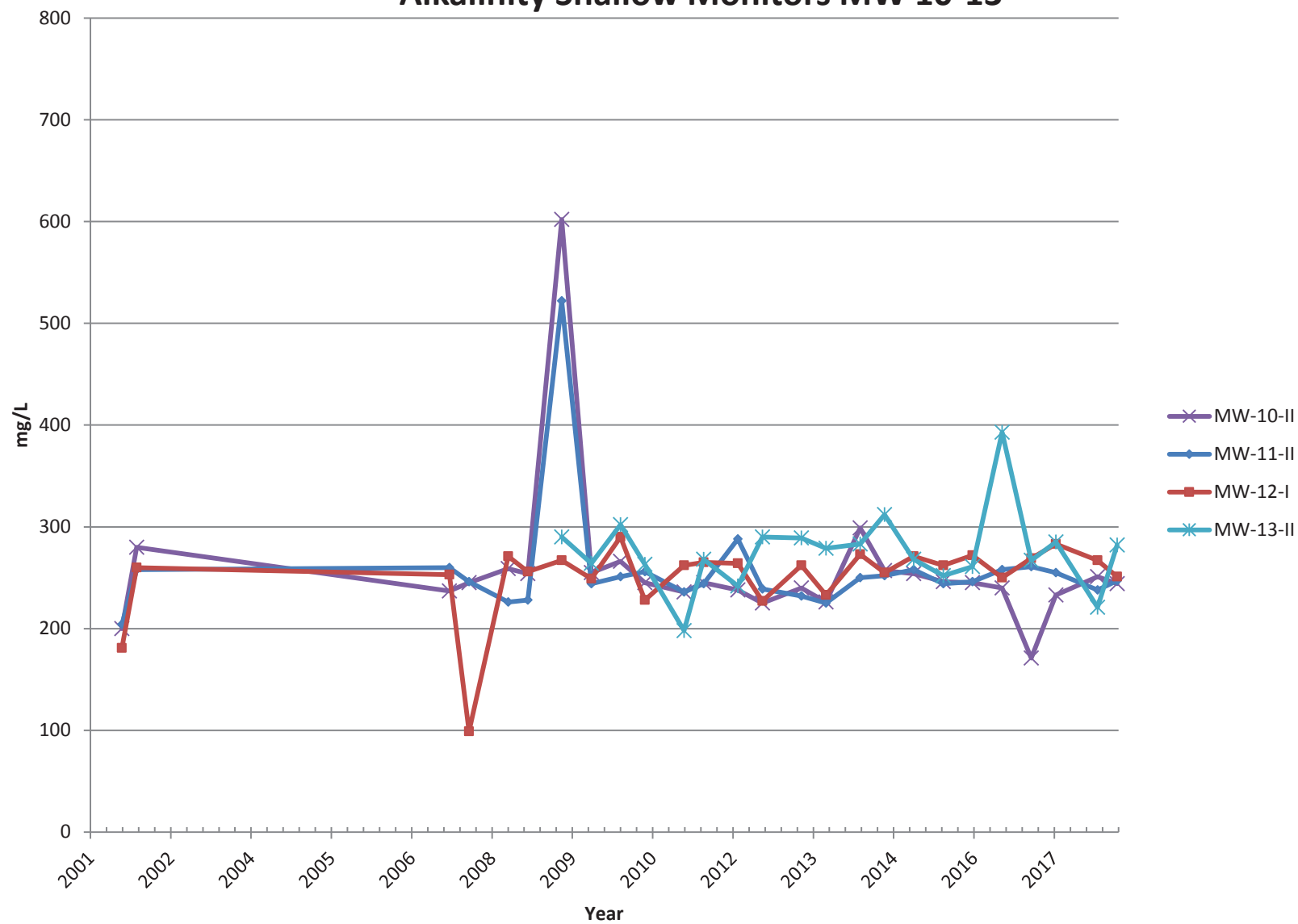
Alkalinity Shallow Monitors MW 1-5



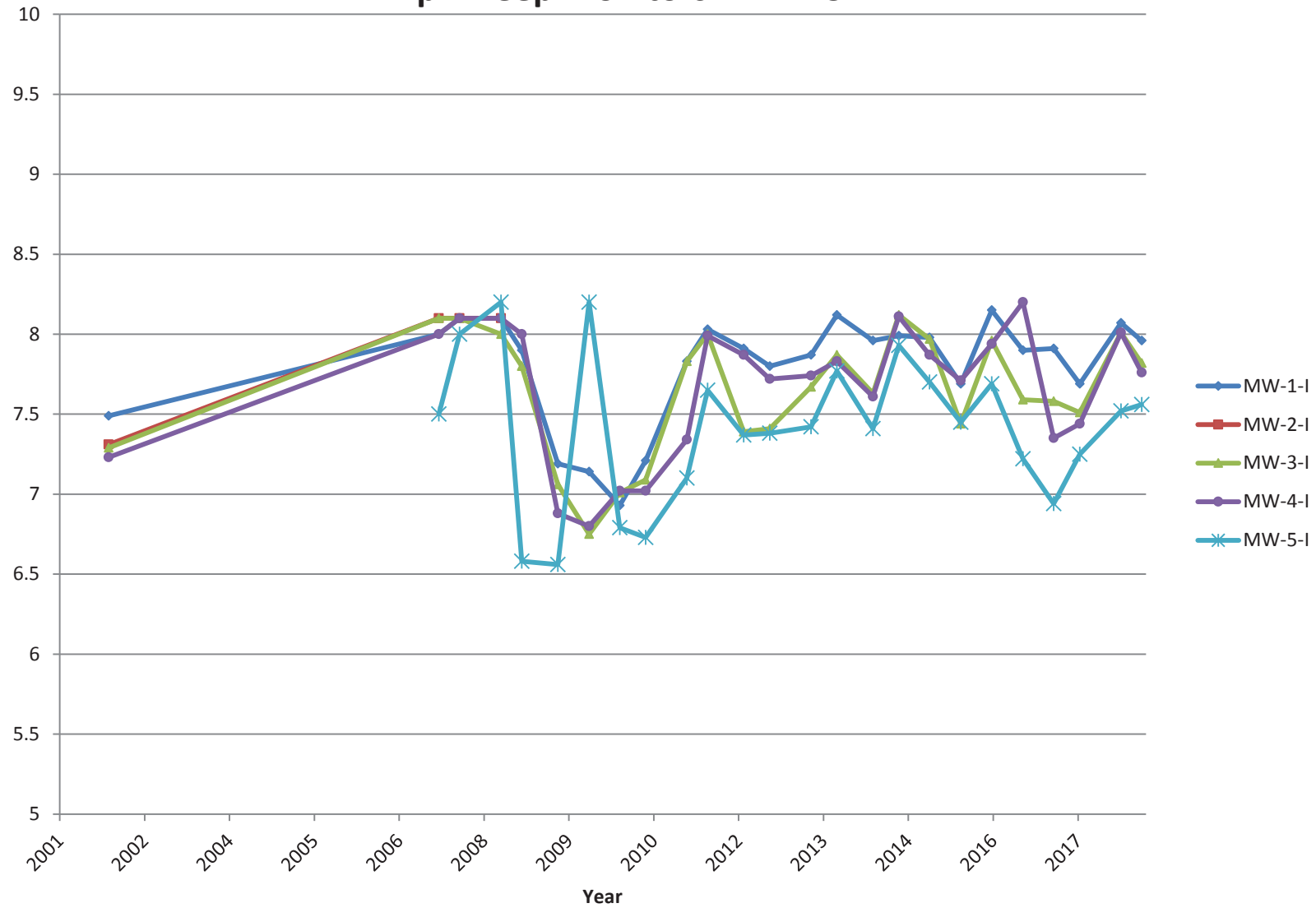
Alkalinity Shallow Monitors MW 6-9



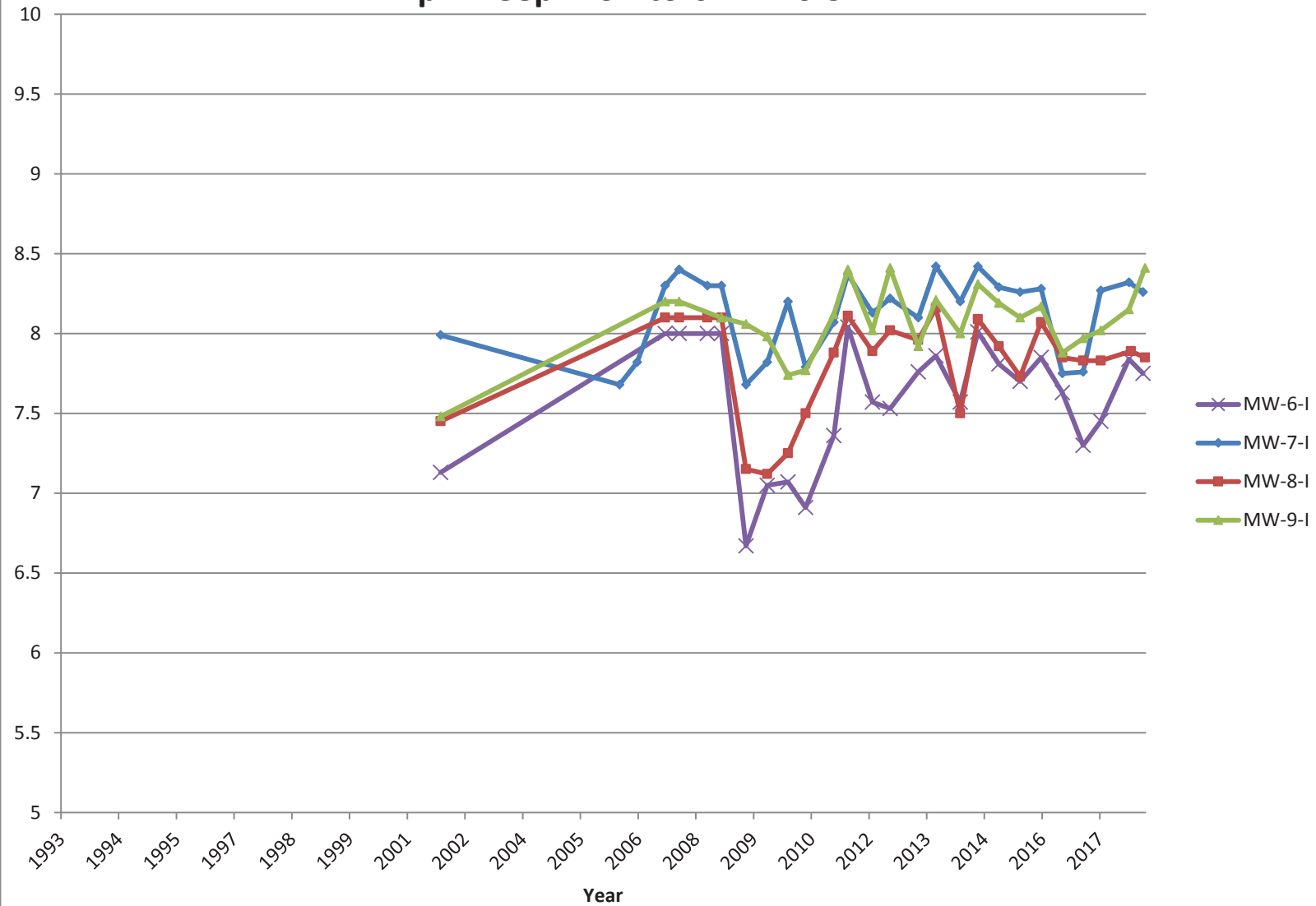
Alkalinity Shallow Monitors MW 10-13



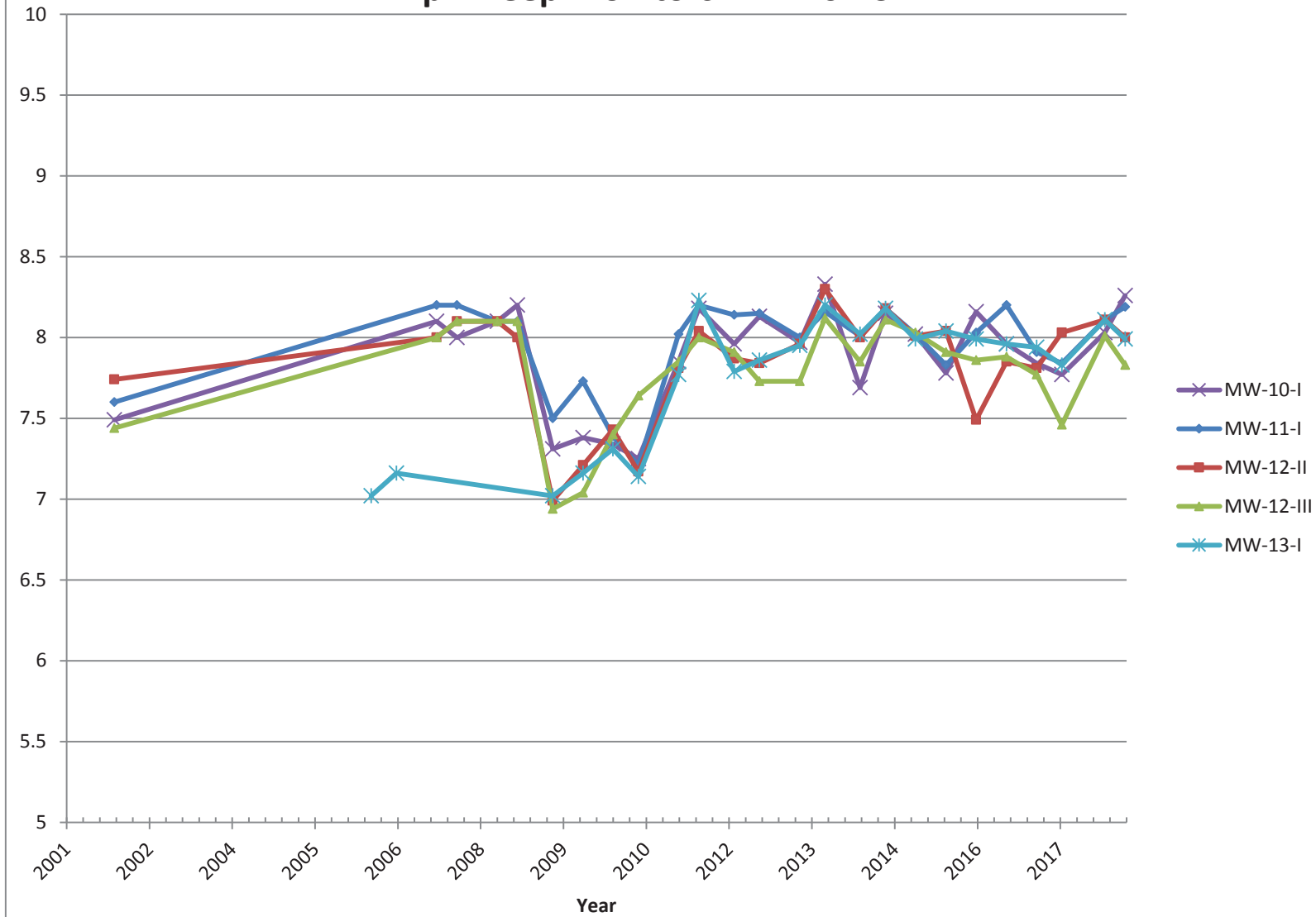
pH Deep Monitors MW 1-5



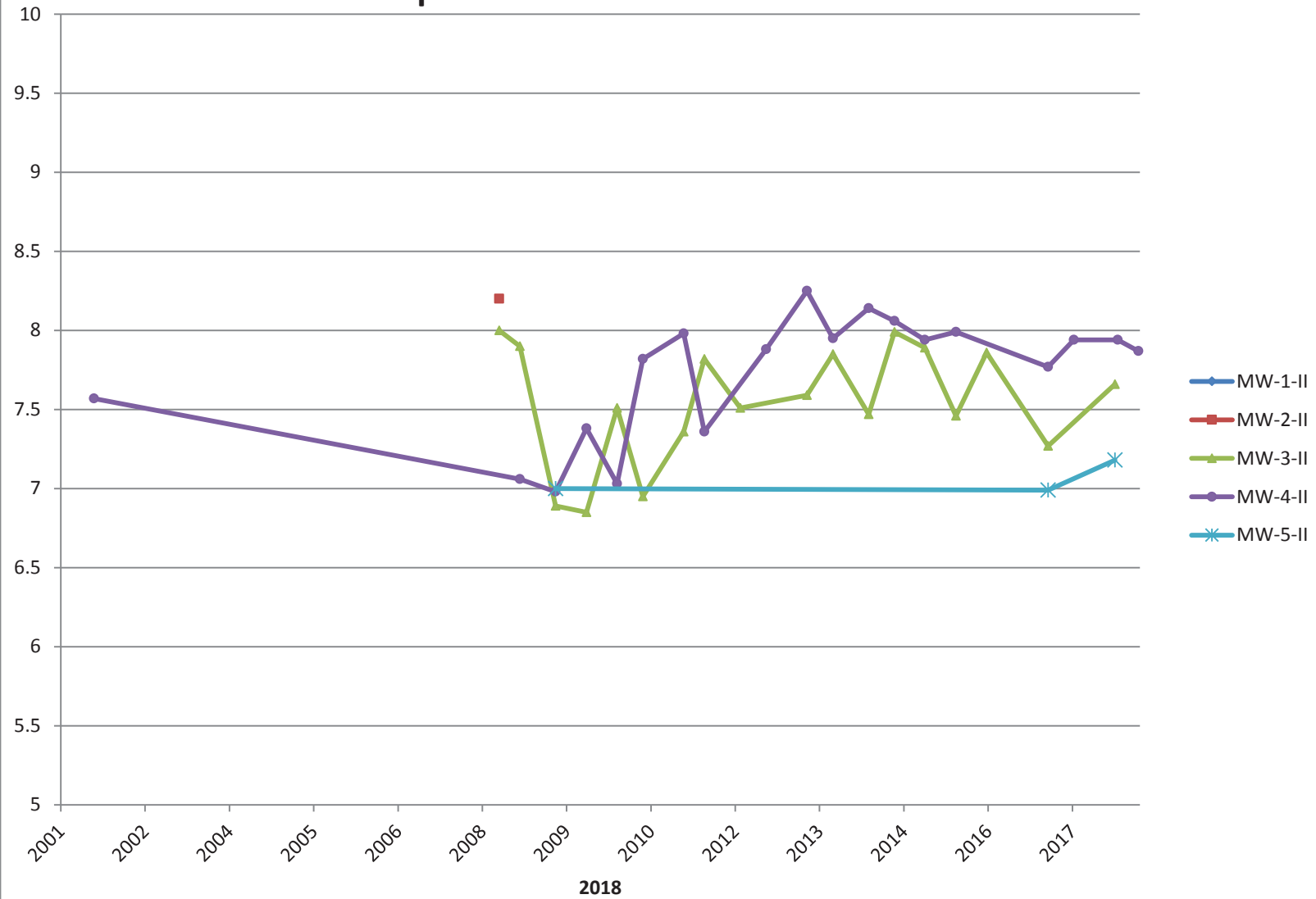
pH Deep Monitors MW 6-9



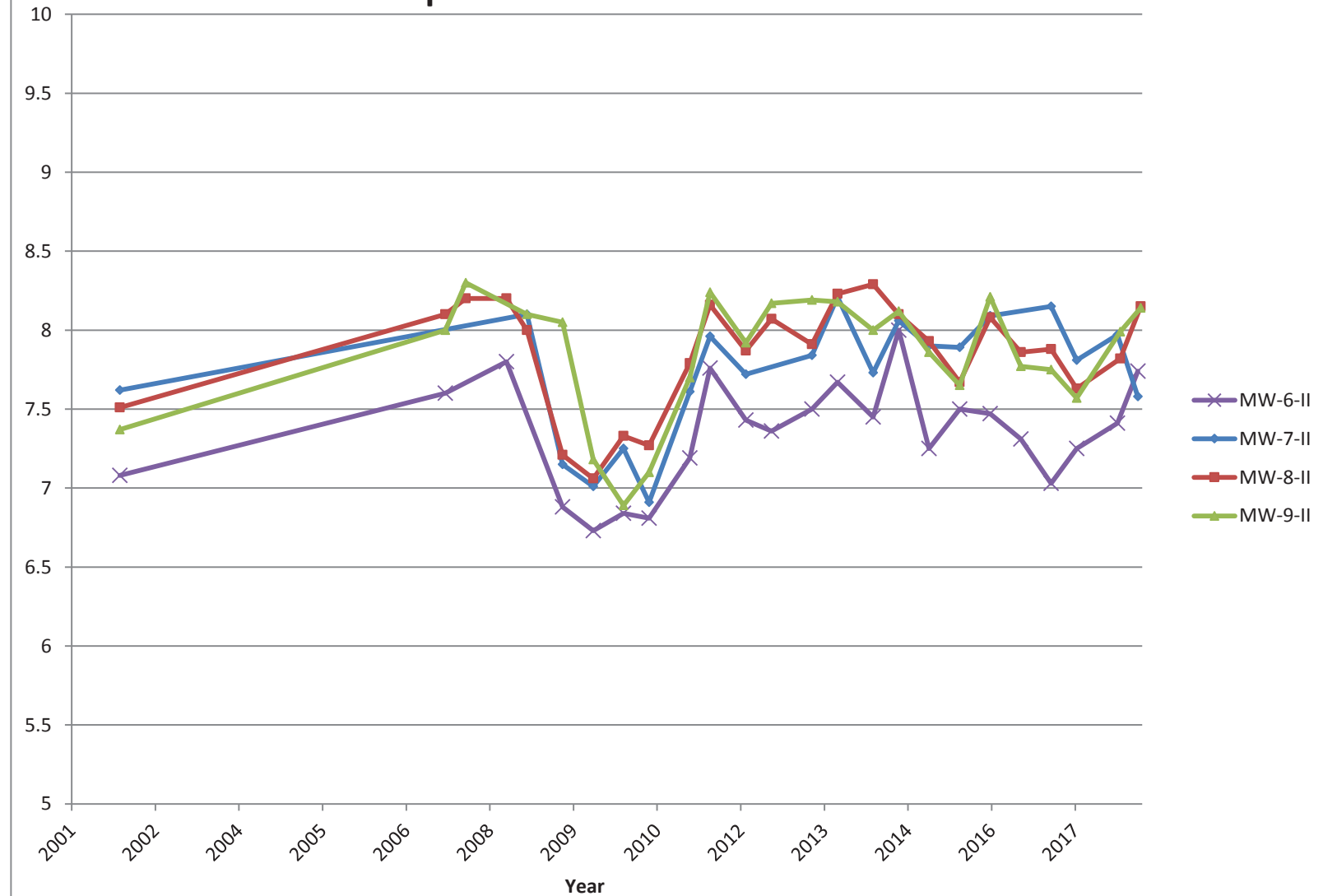
pH Deep Monitors MW 10-13



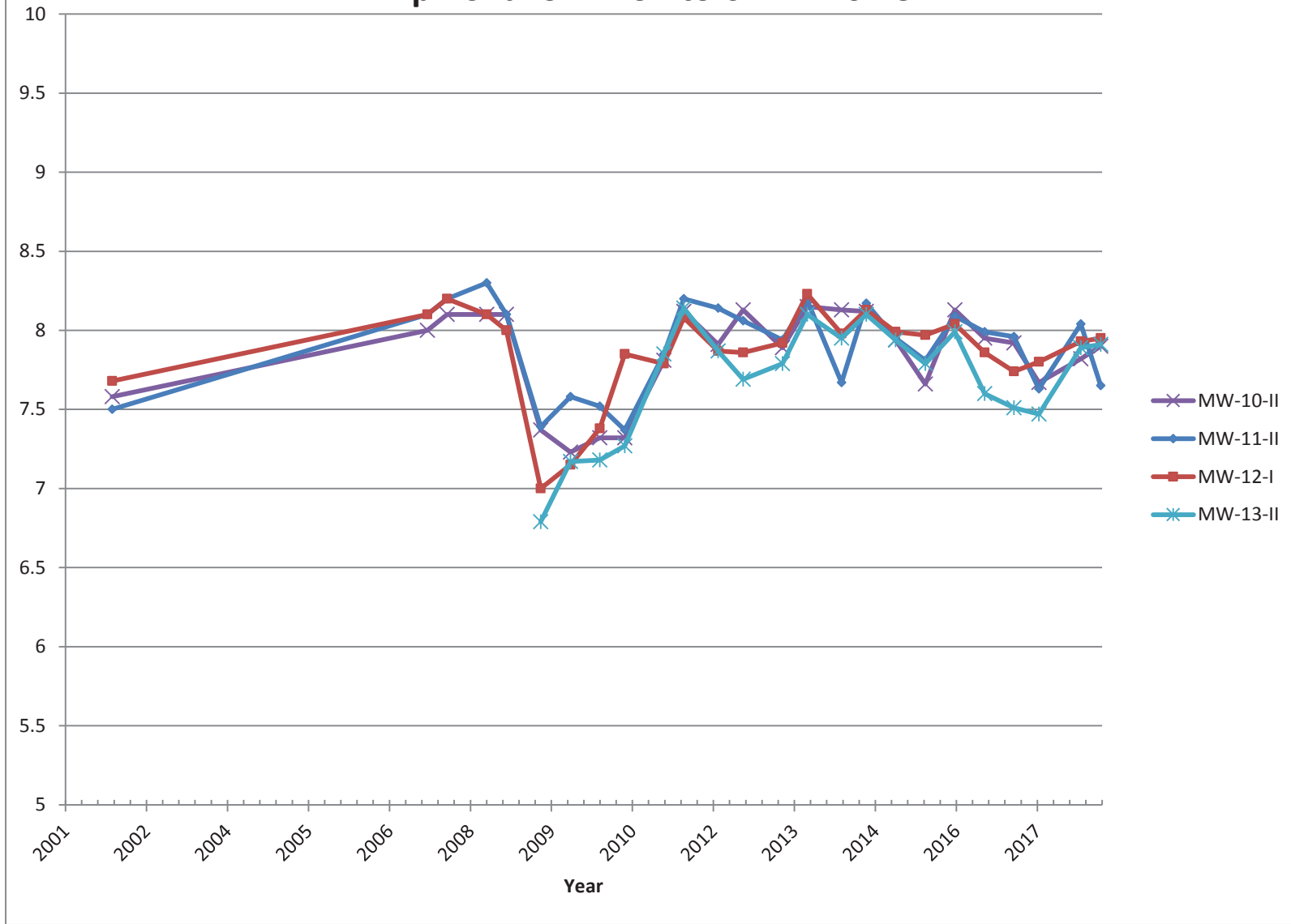
pH Shallow Monitors MW 1-5



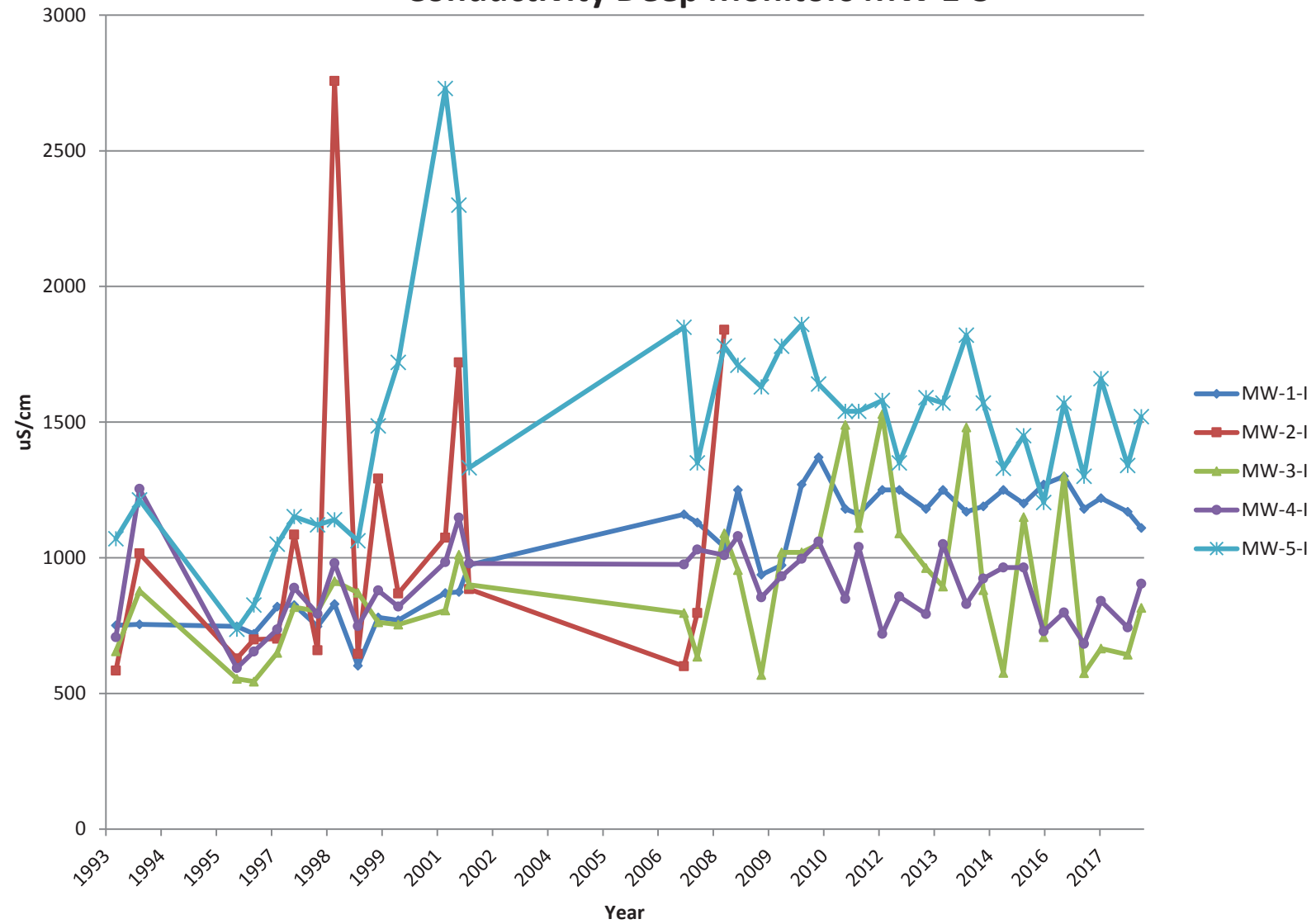
pH Shallow Monitors MW 6-9



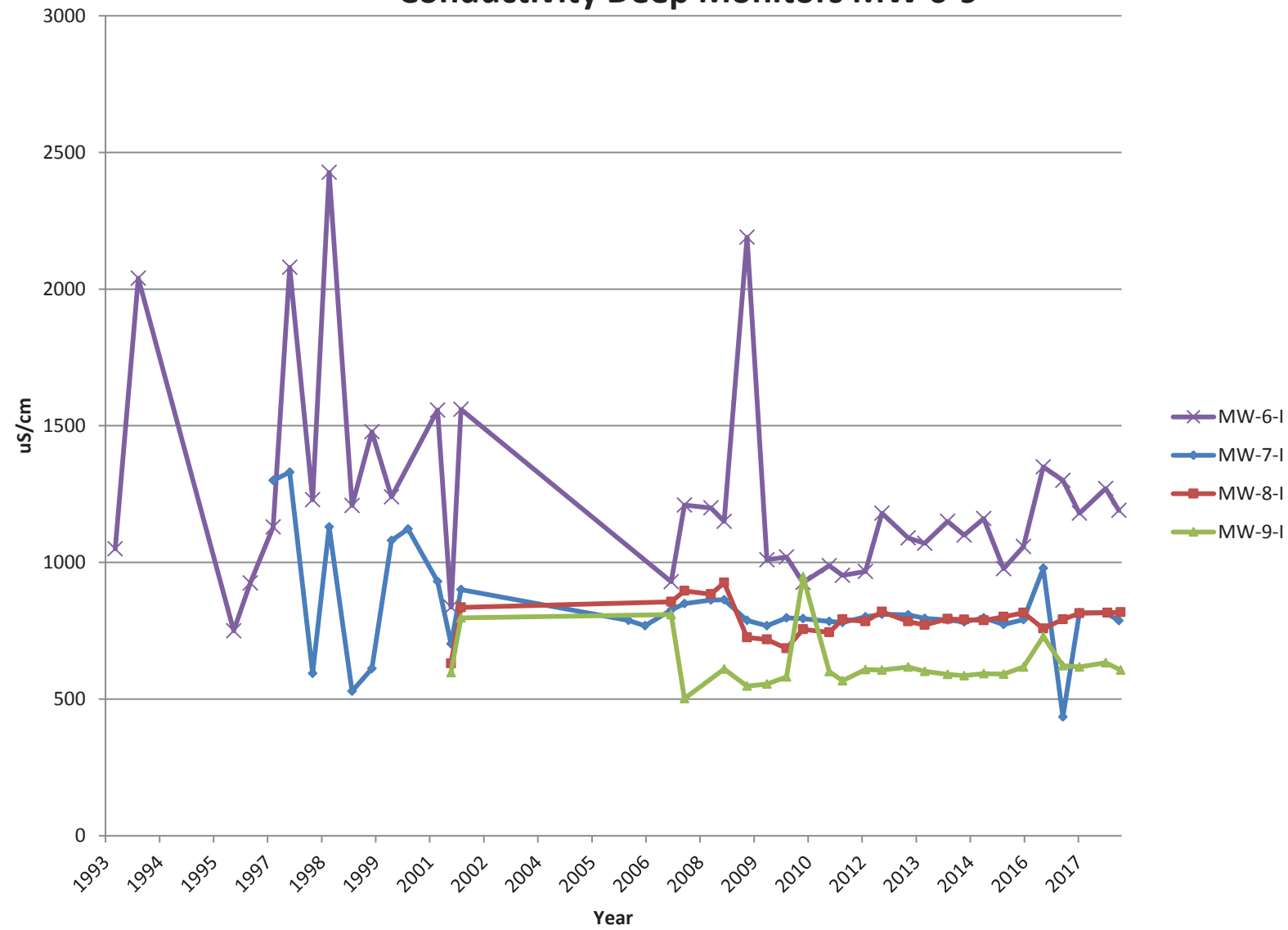
pH Shallow Monitors MW 10-13



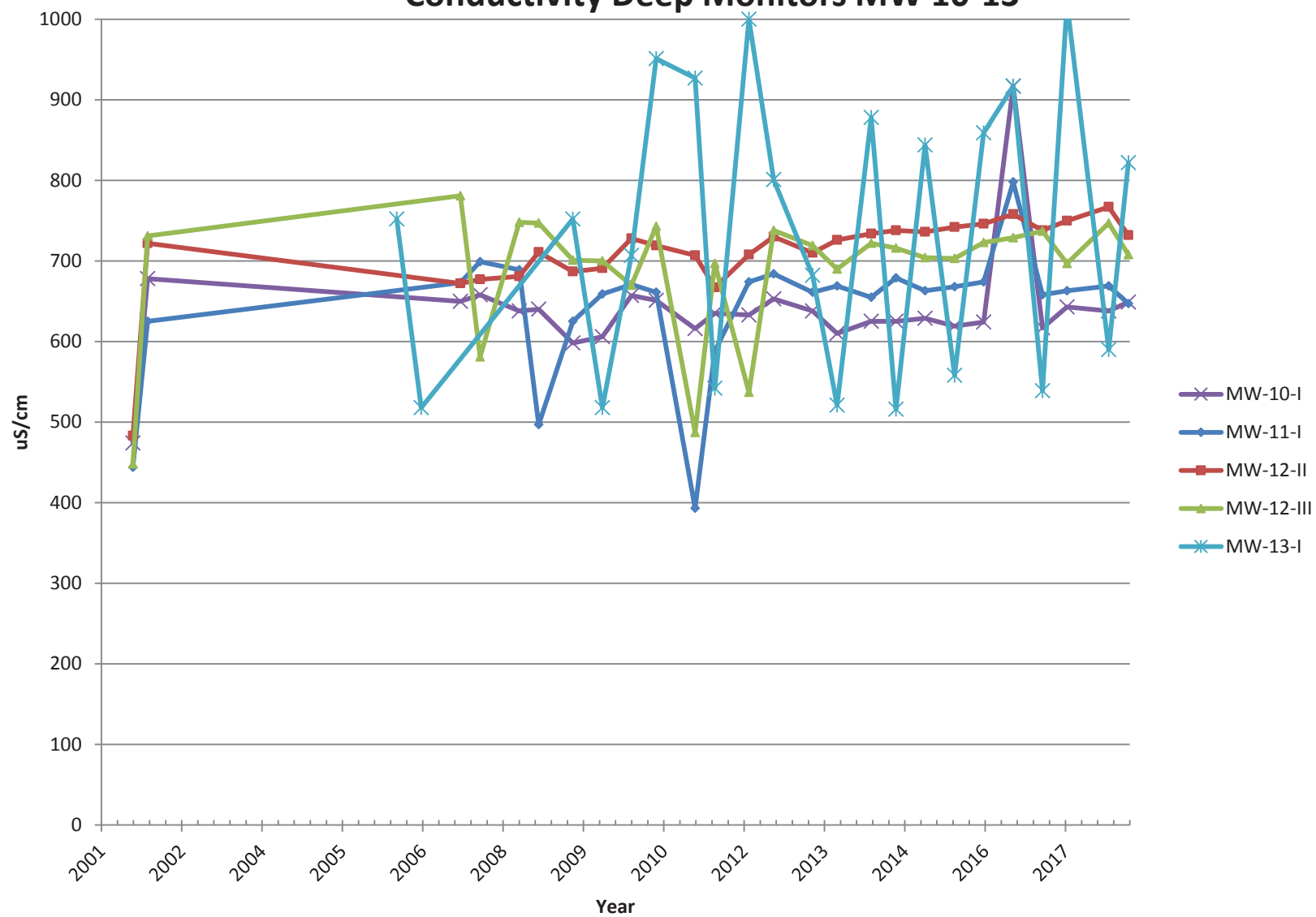
Conductivity Deep Monitors MW 1-5



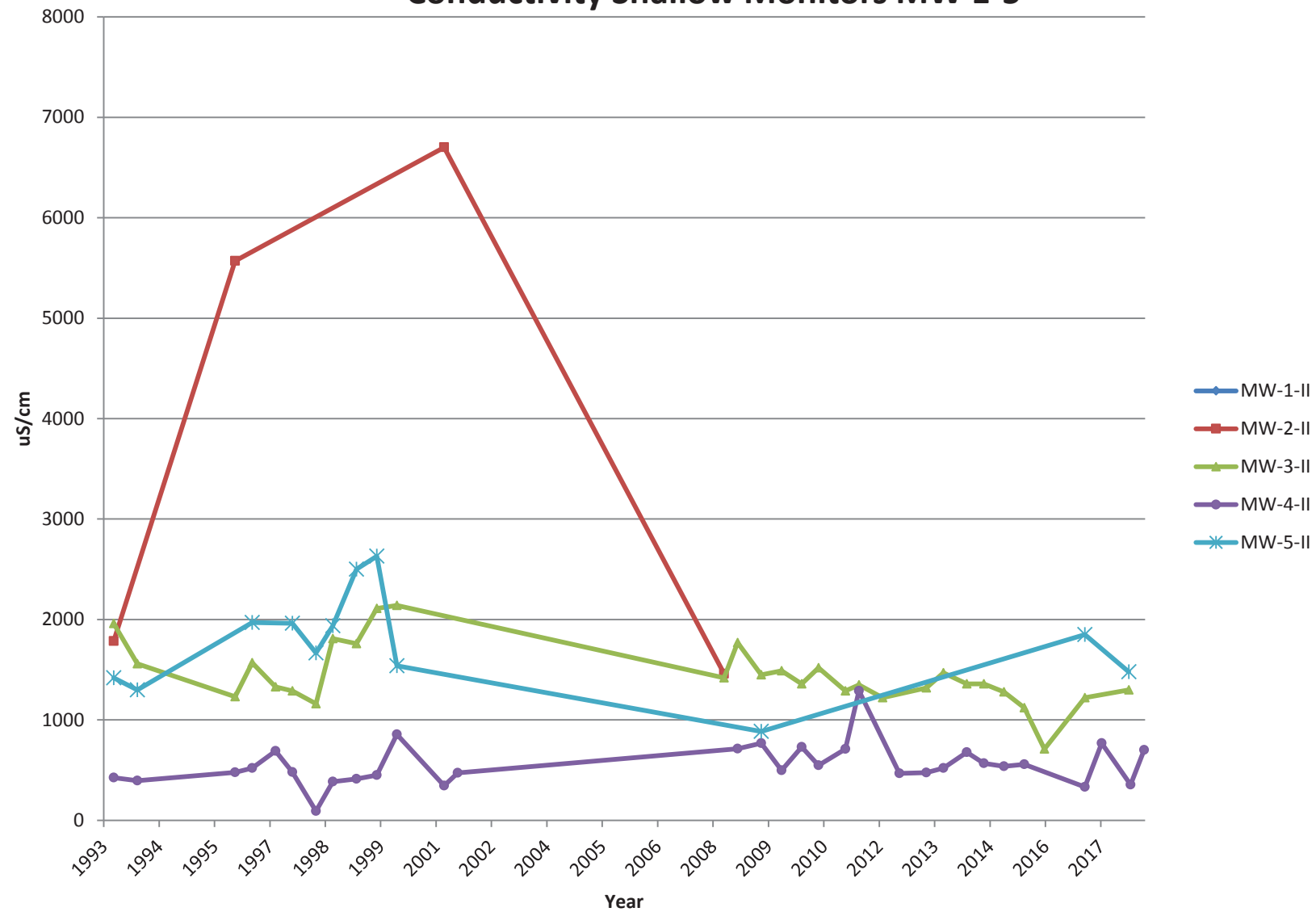
Conductivity Deep Monitors MW 6-9



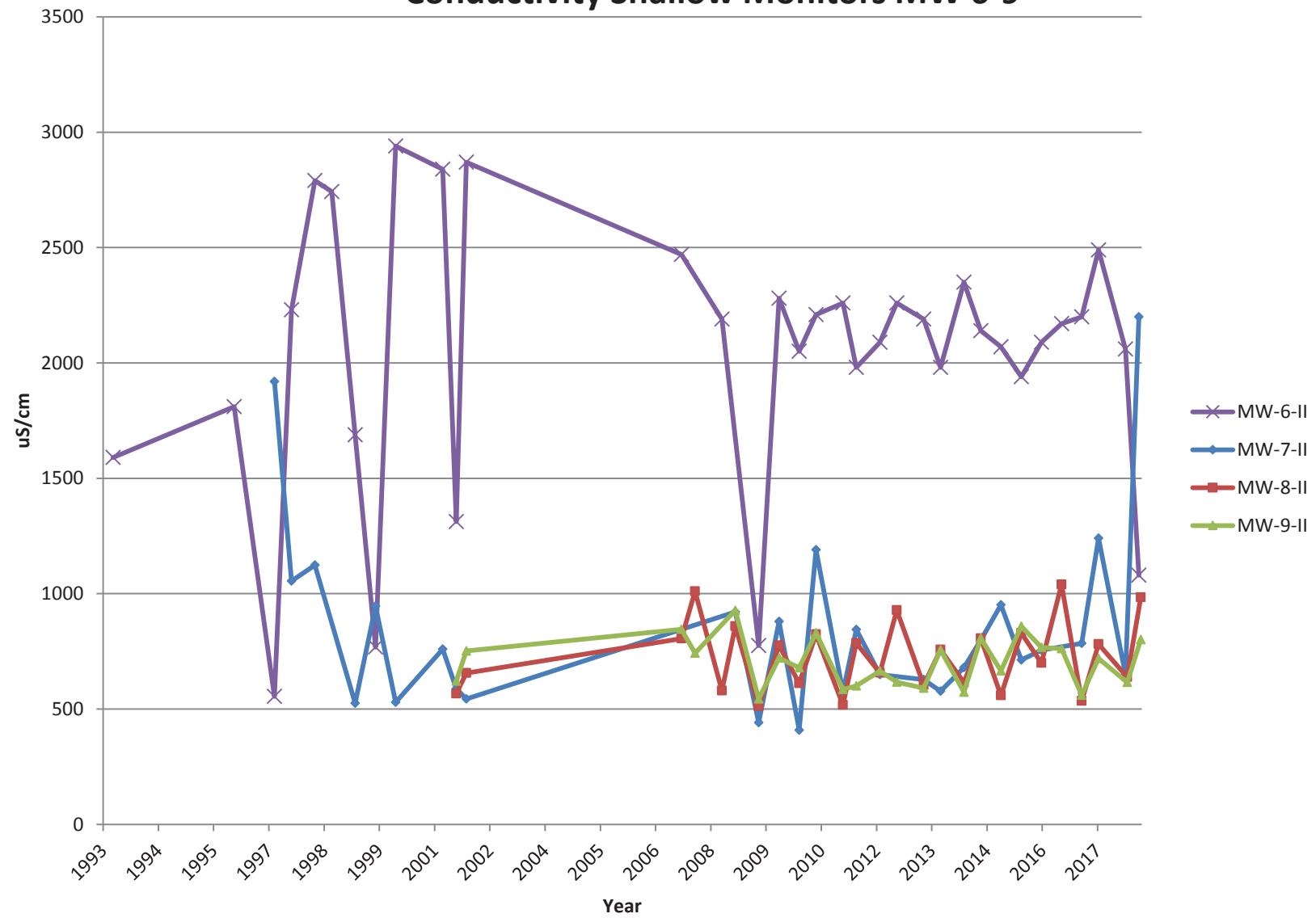
Conductivity Deep Monitors MW 10-13



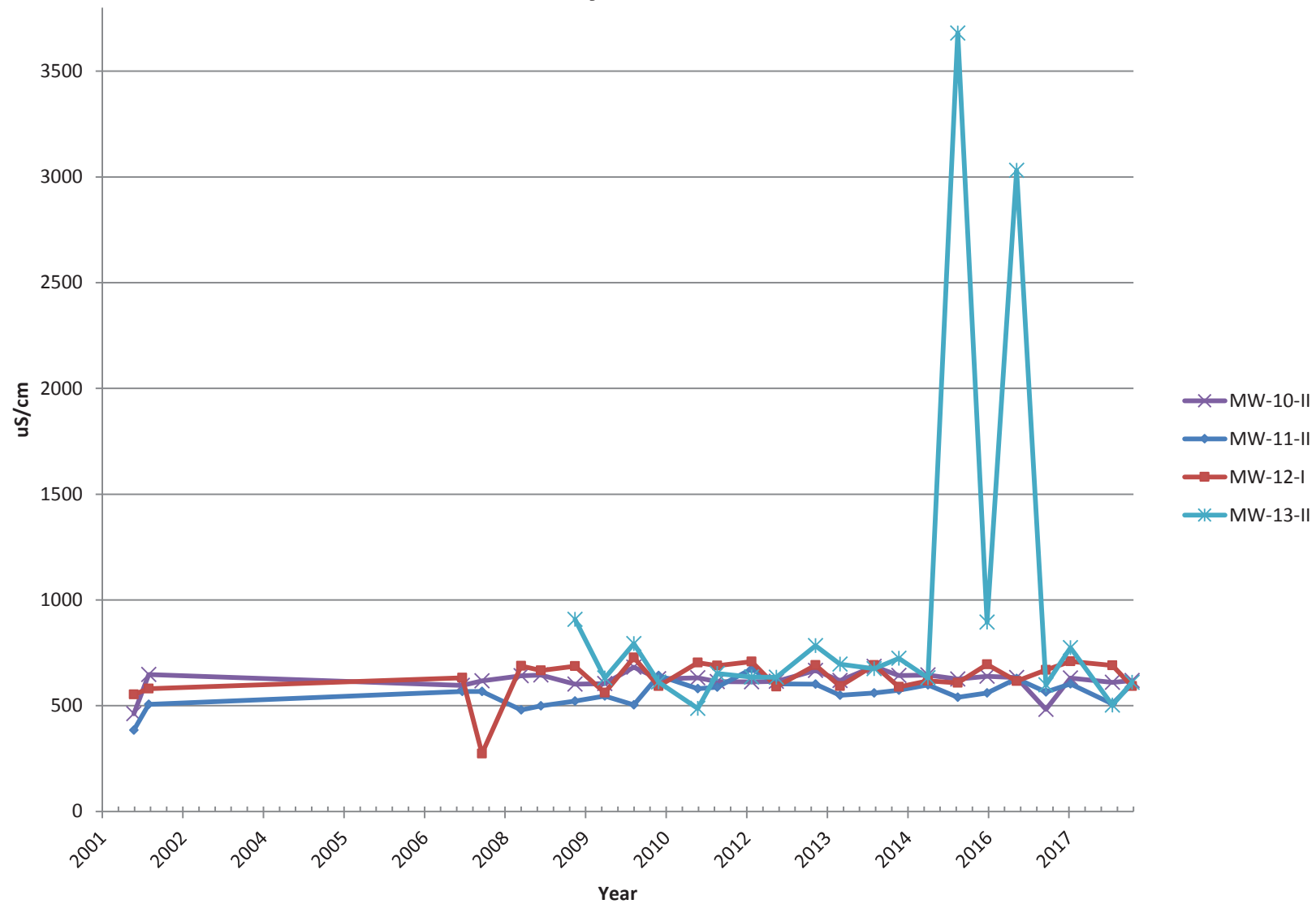
Conductivity Shallow Monitors MW 1-5



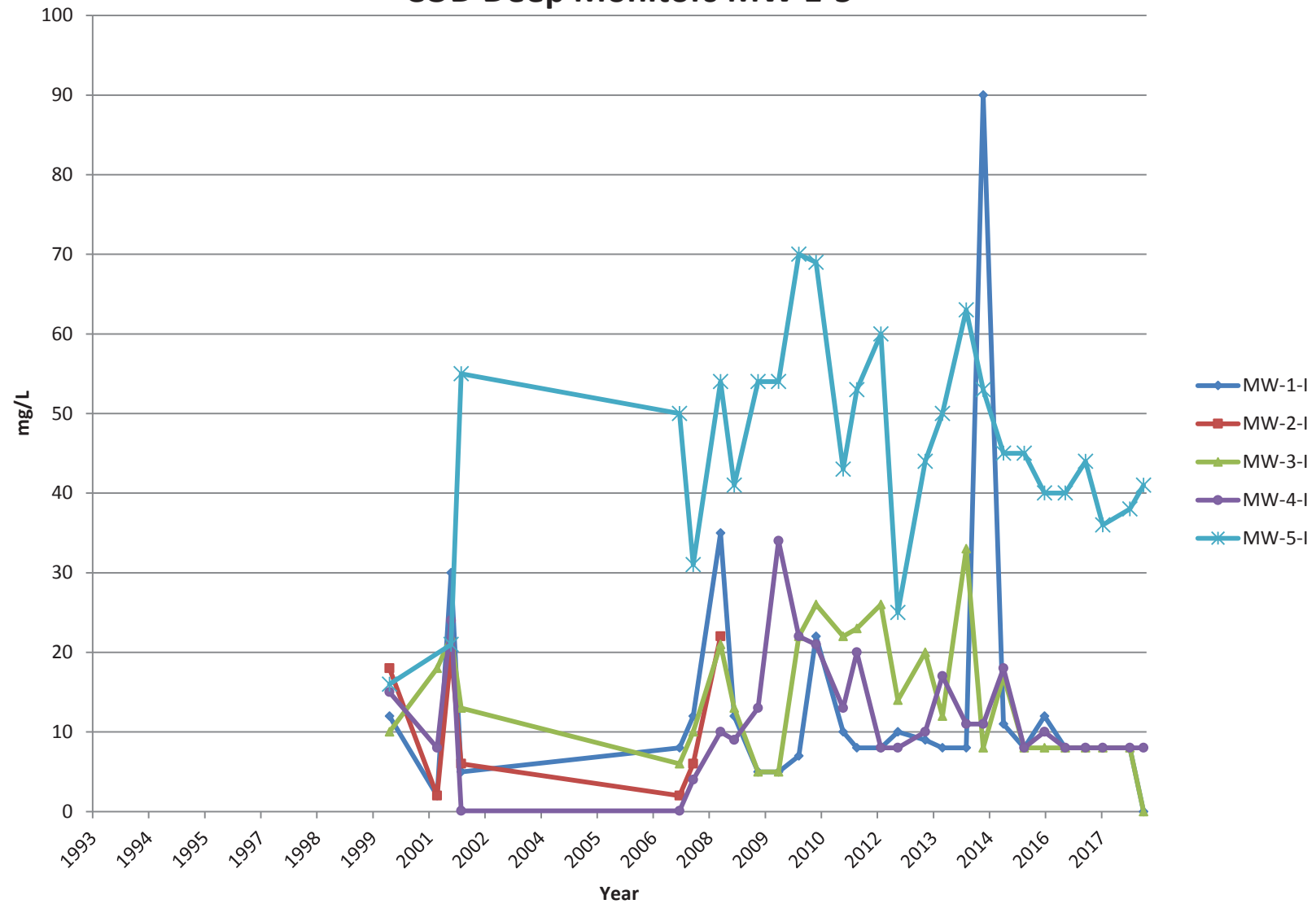
Conductivity Shallow Monitors MW 6-9



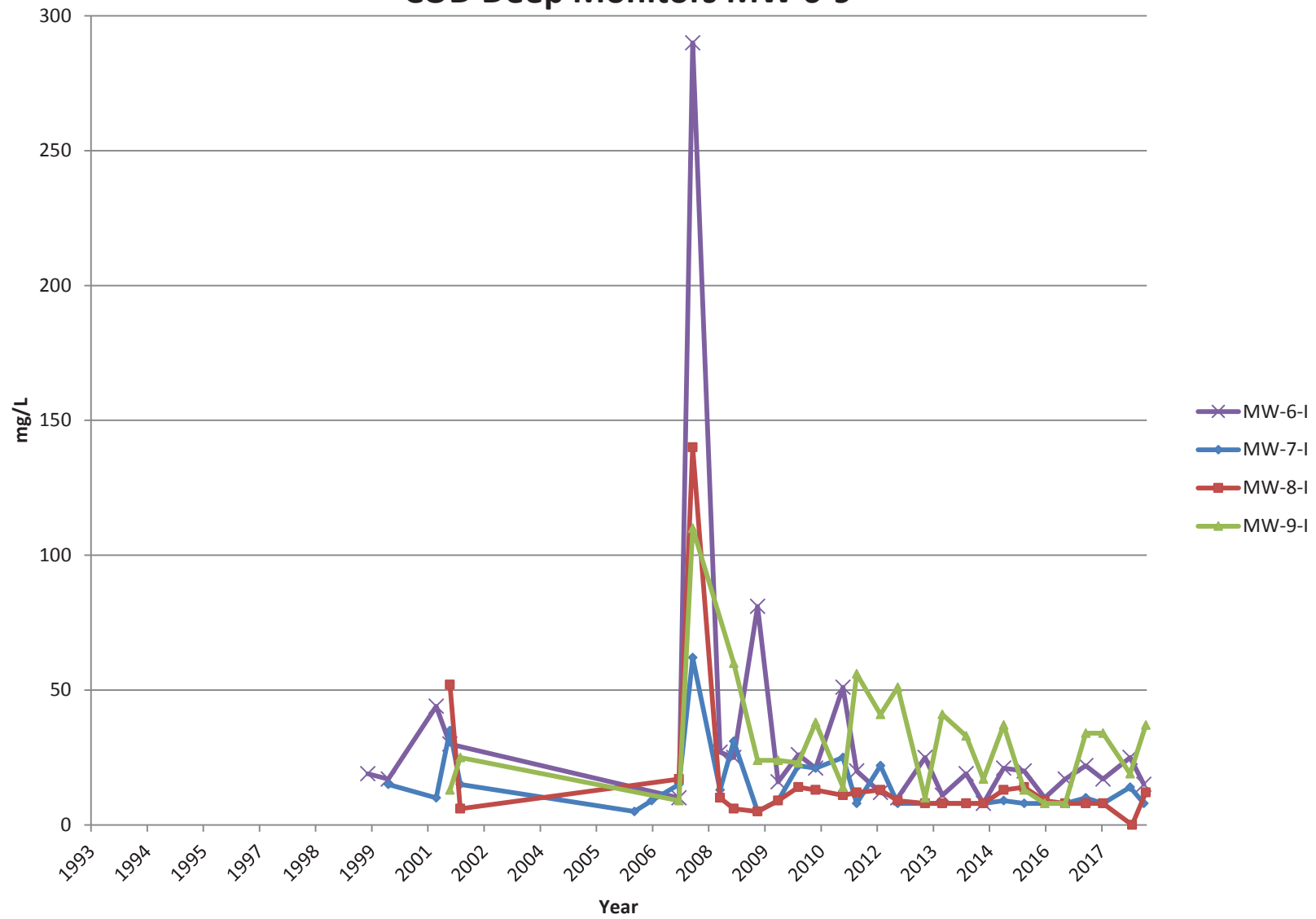
Conductivity Shallow Monitors MW 10-13



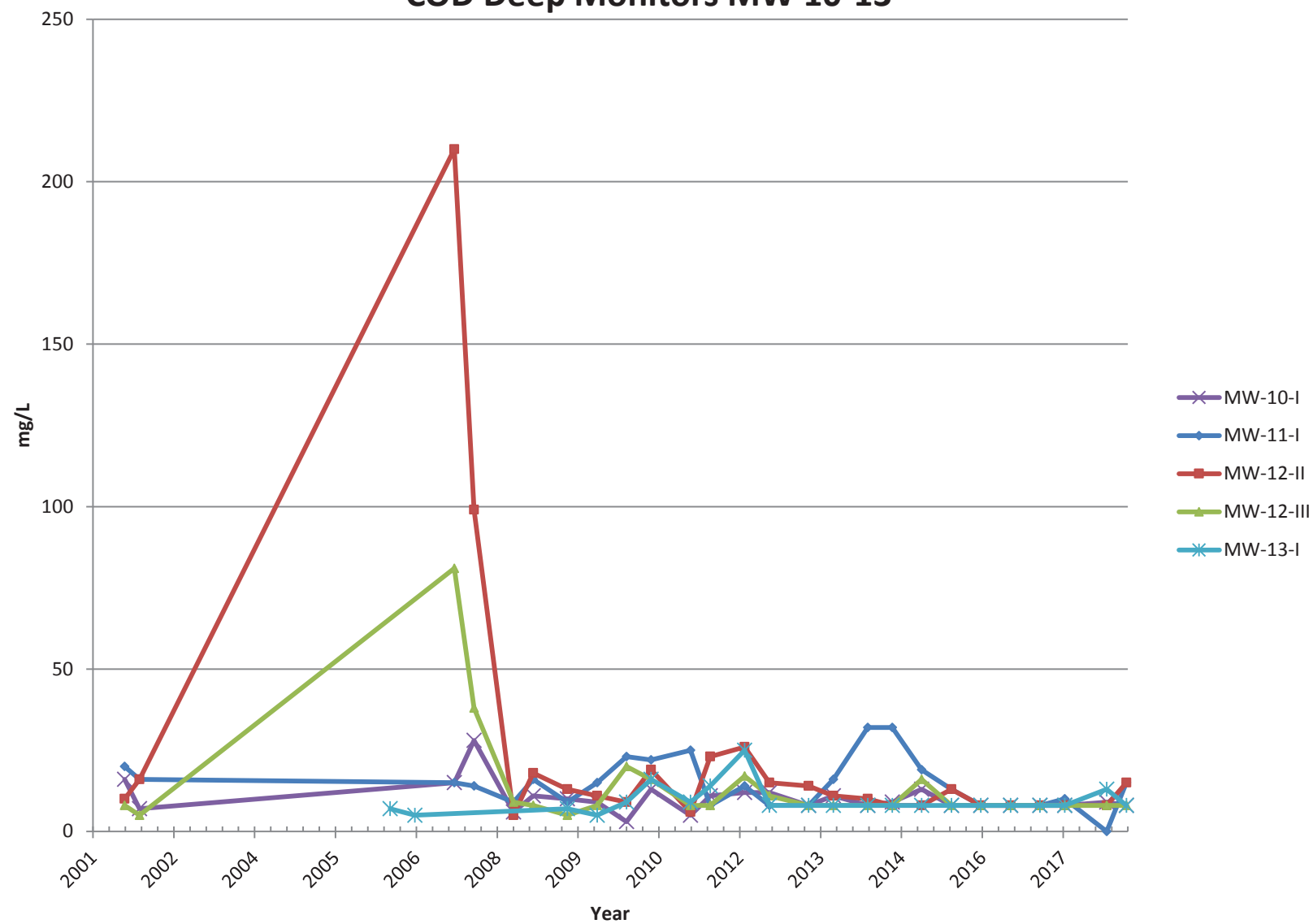
COD Deep Monitors MW 1-5



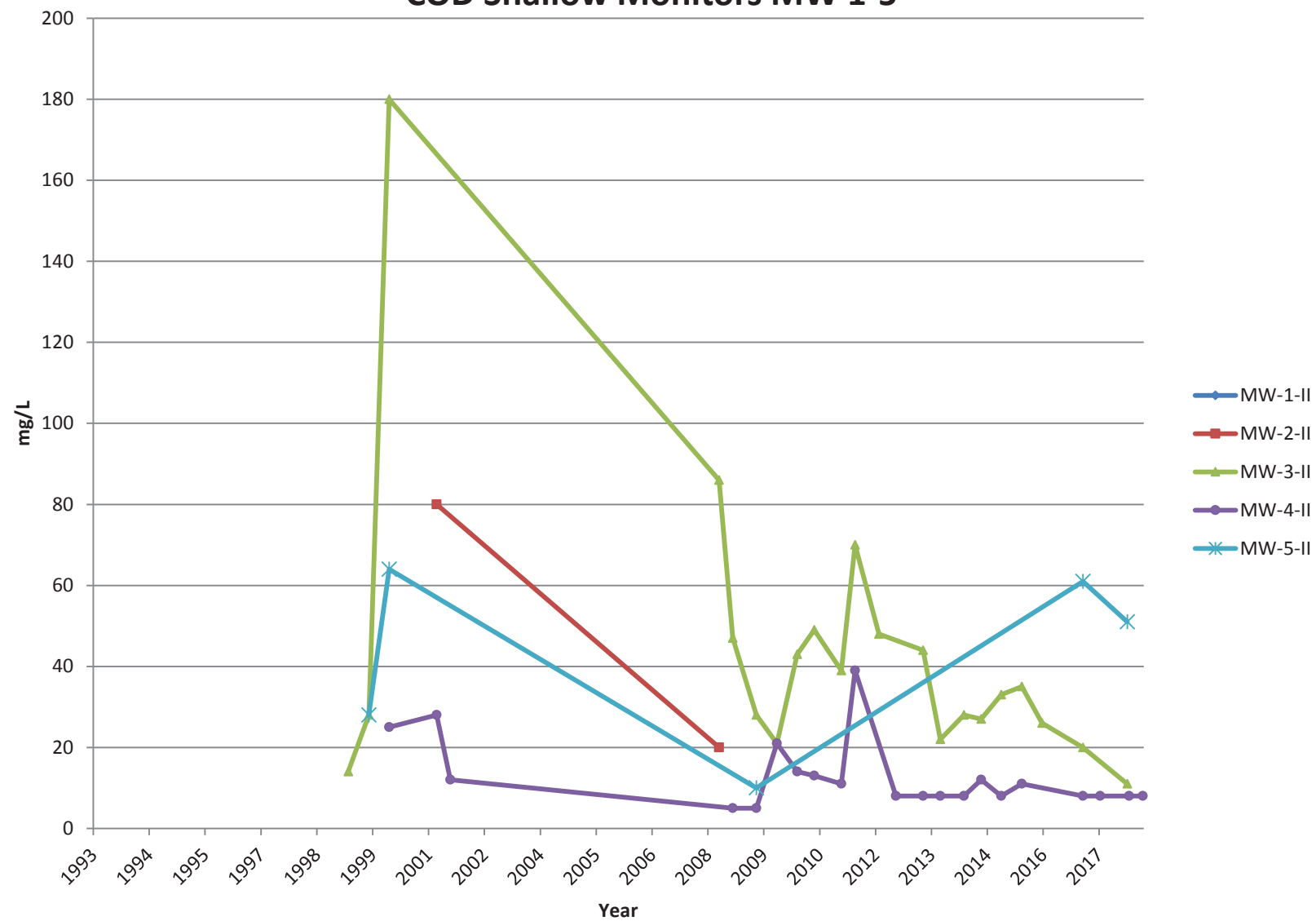
COD Deep Monitors MW 6-9



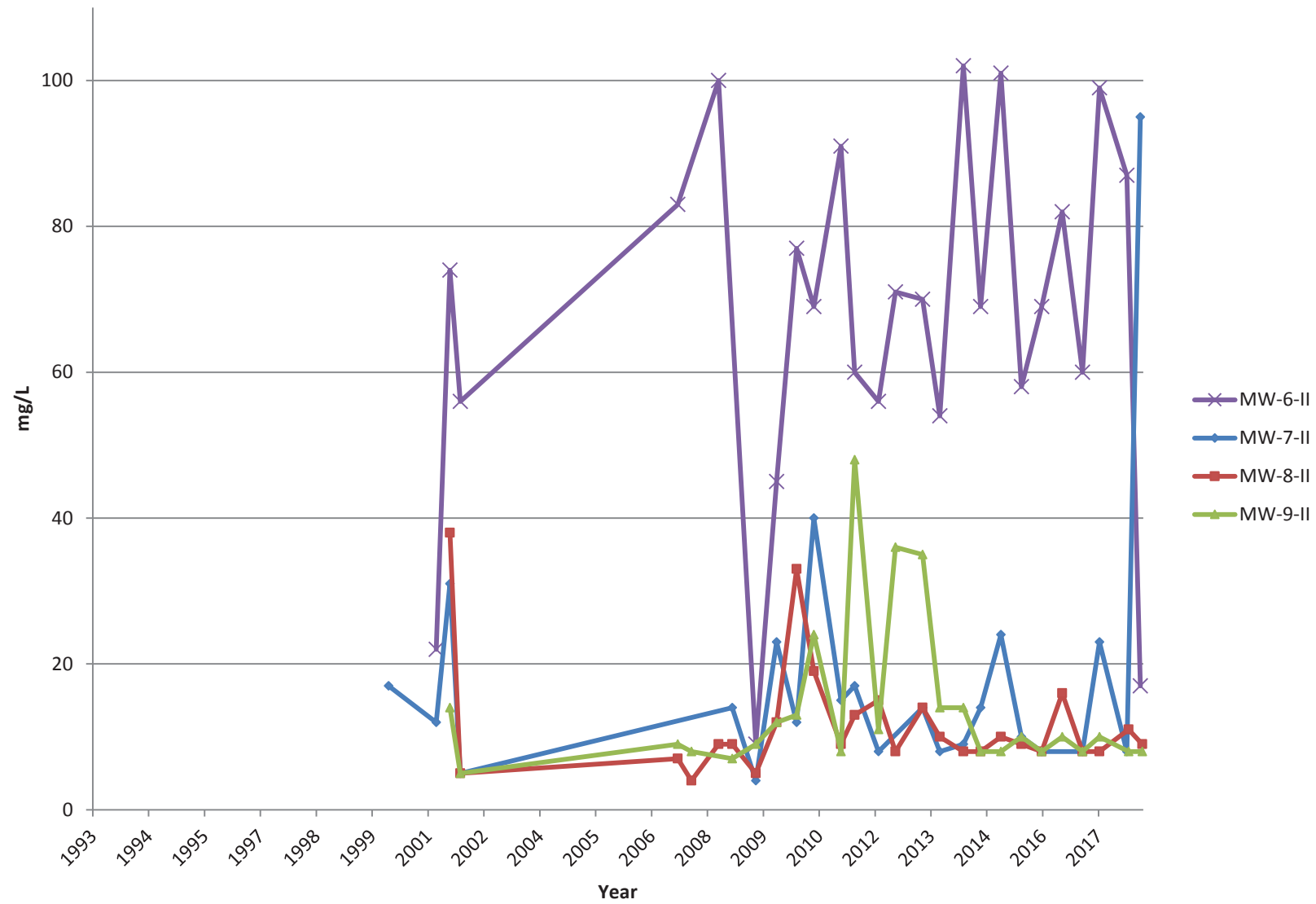
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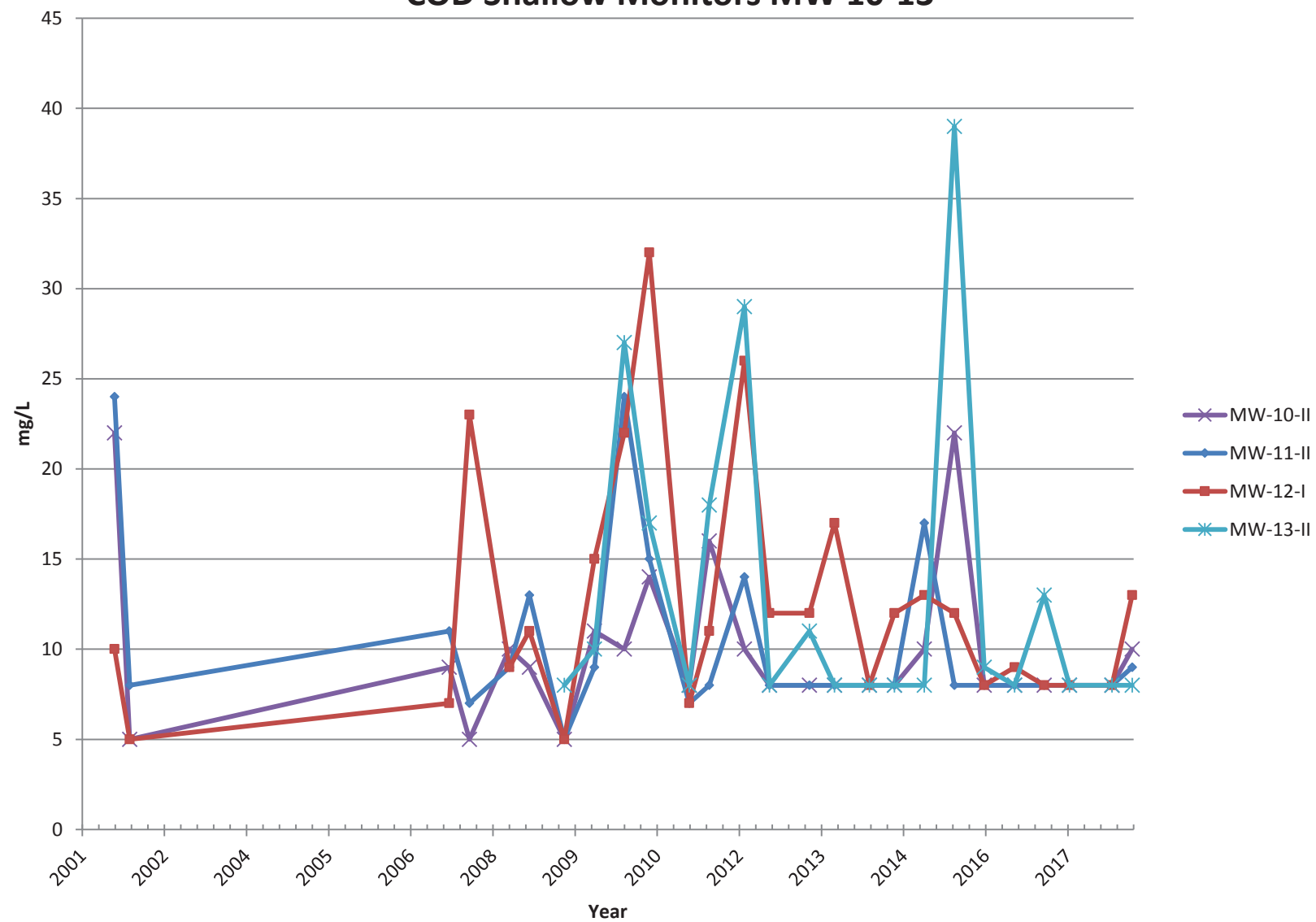
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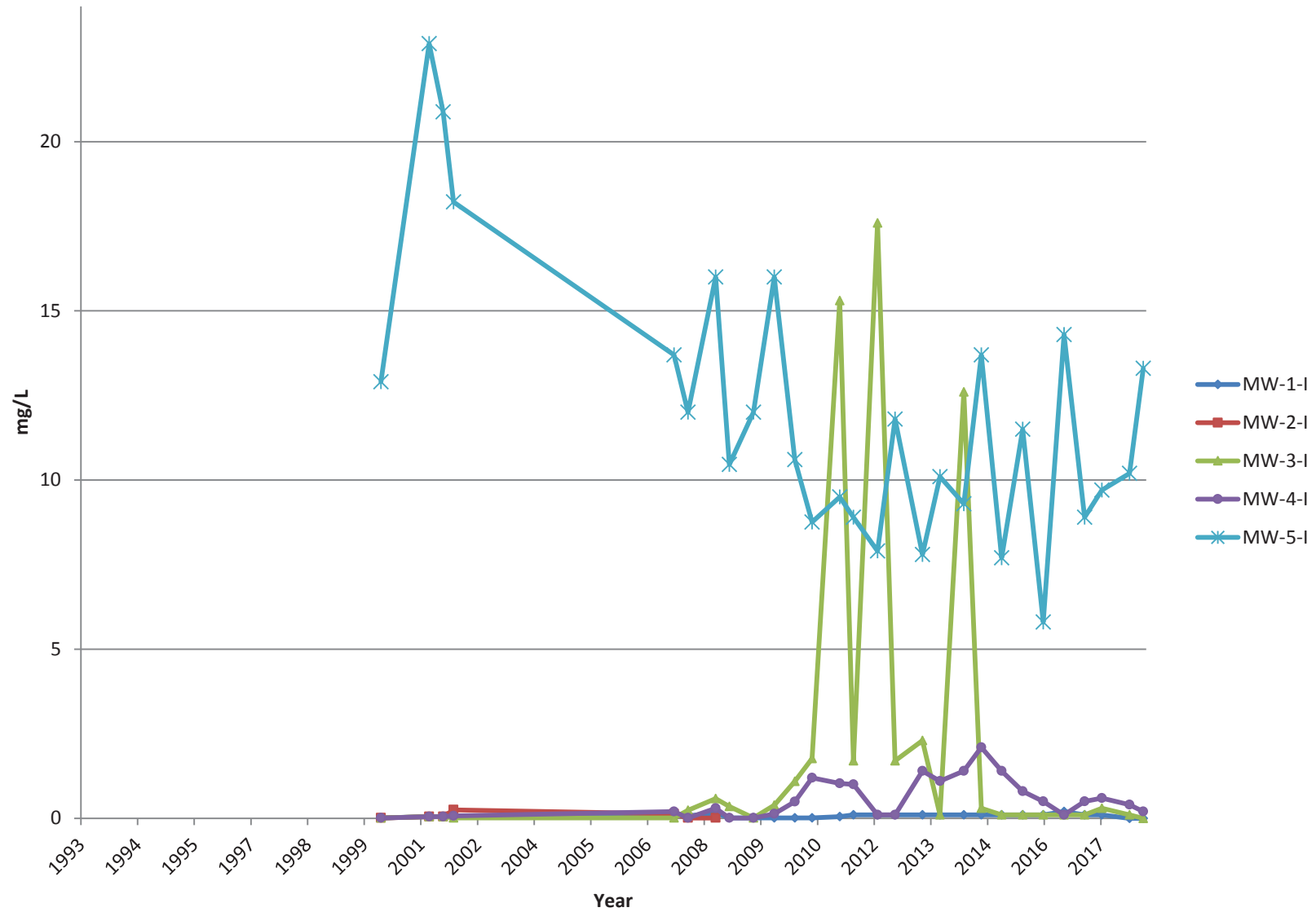
COD Shallow Monitors MW 6-9



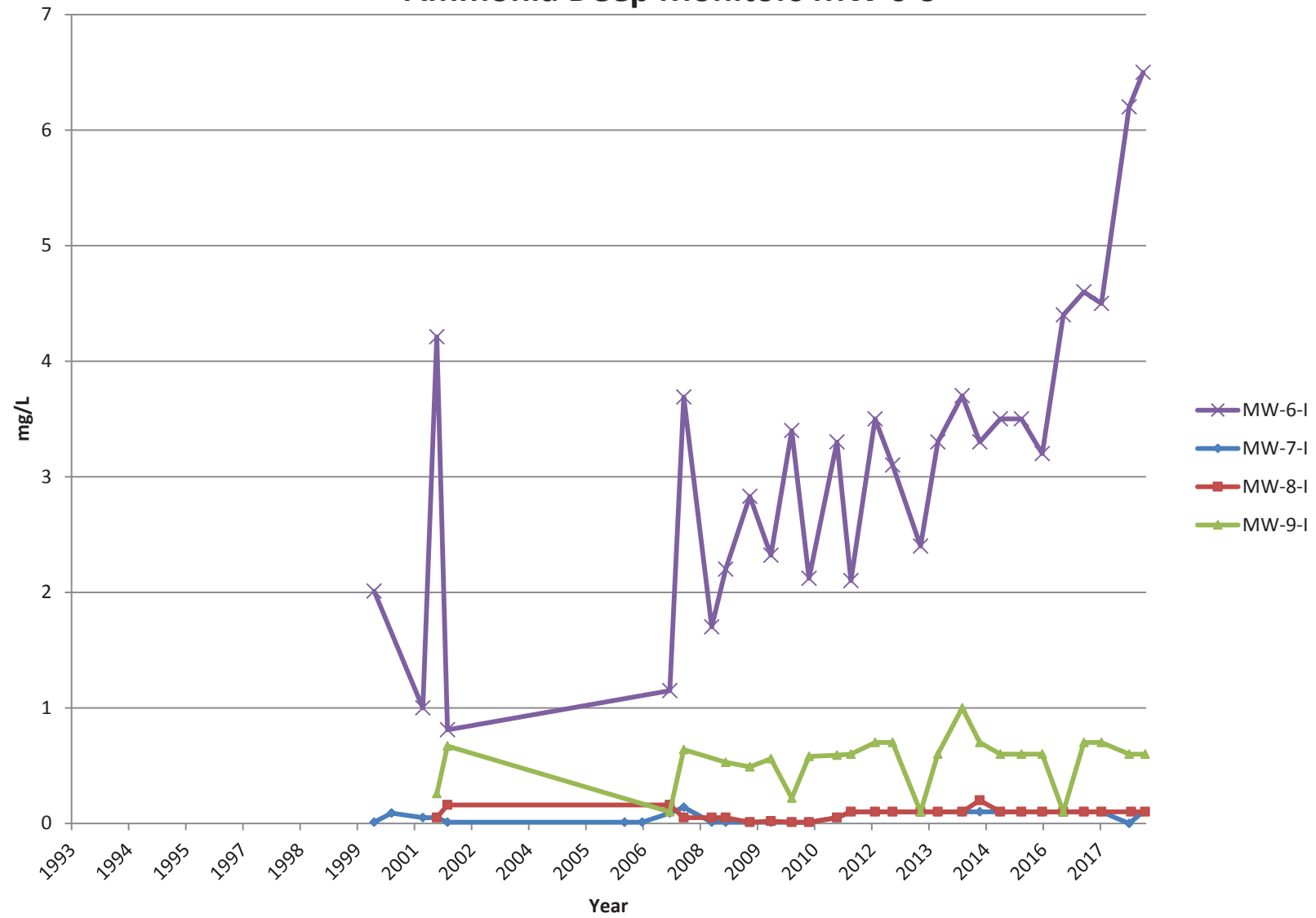
COD Shallow Monitors MW 10-13



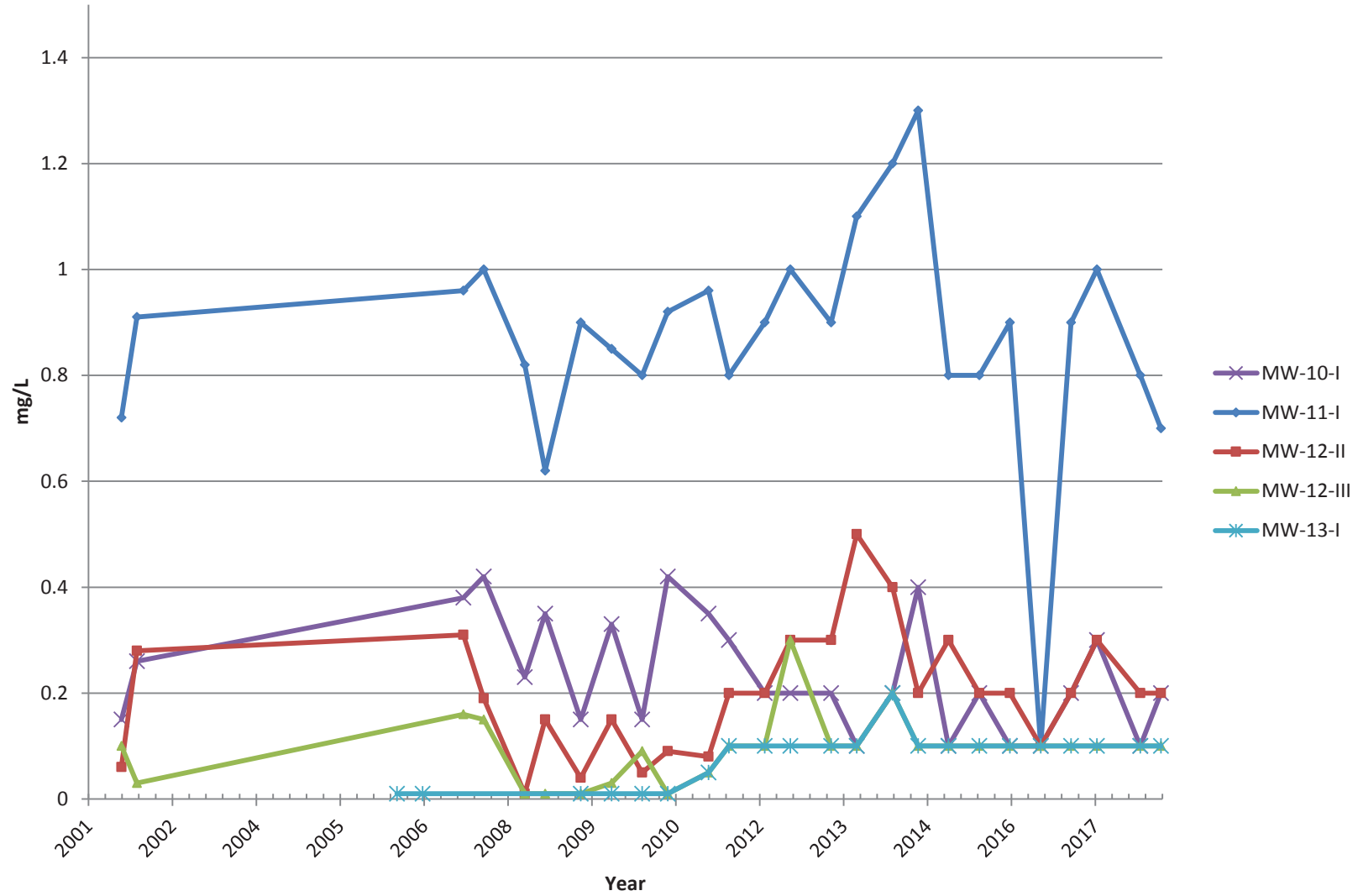
Ammonia Deep Monitors MW 1-5



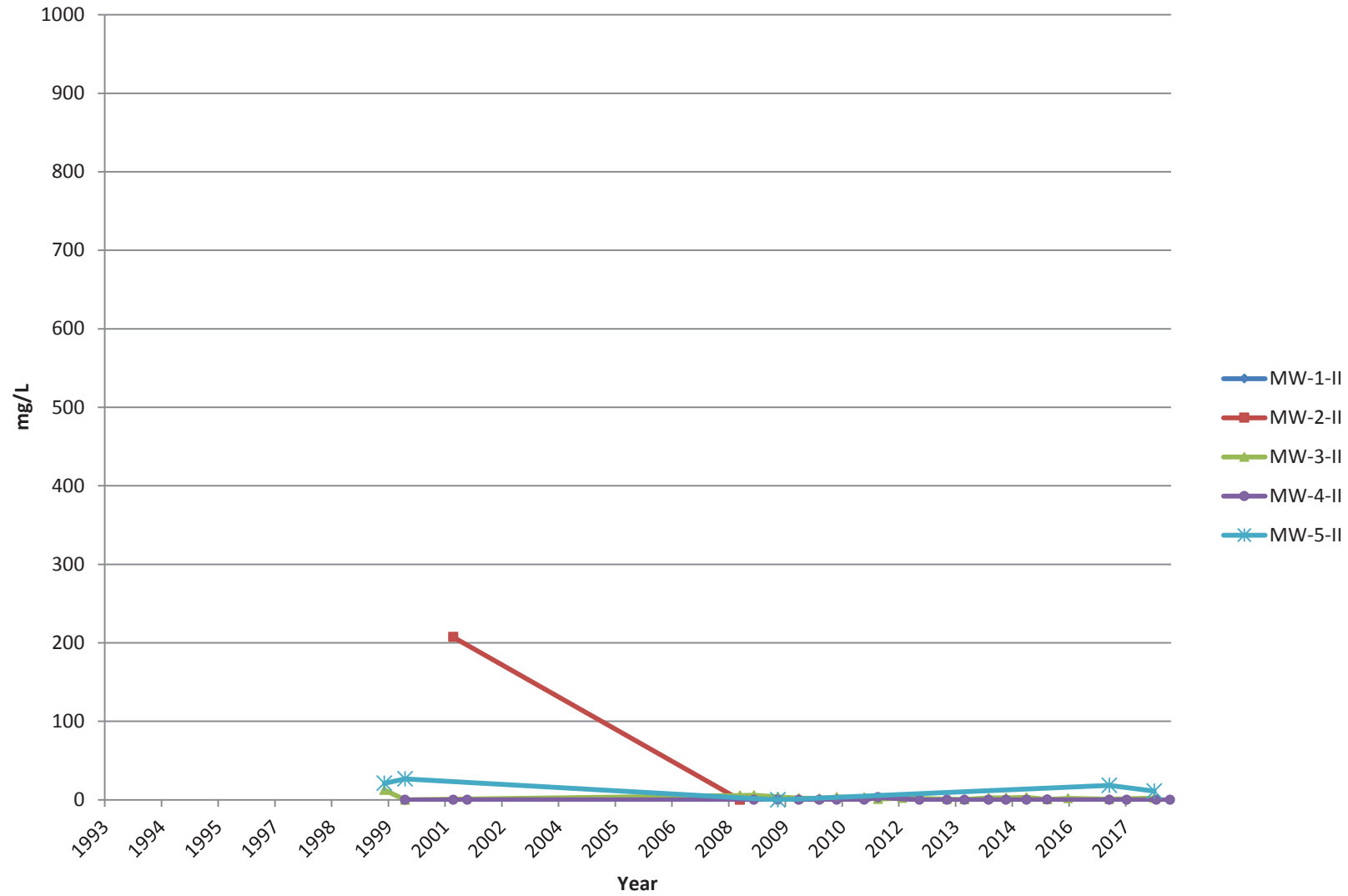
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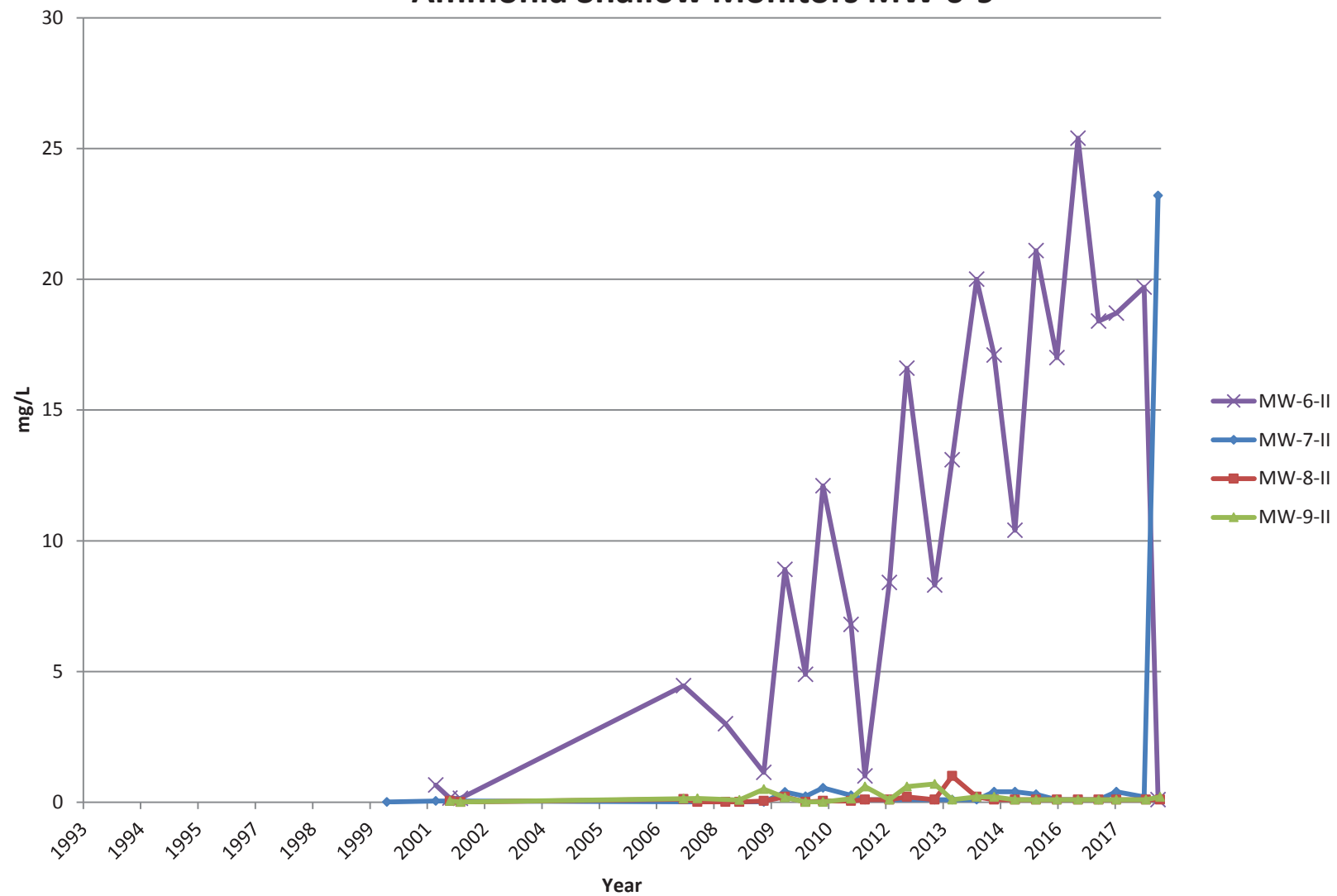
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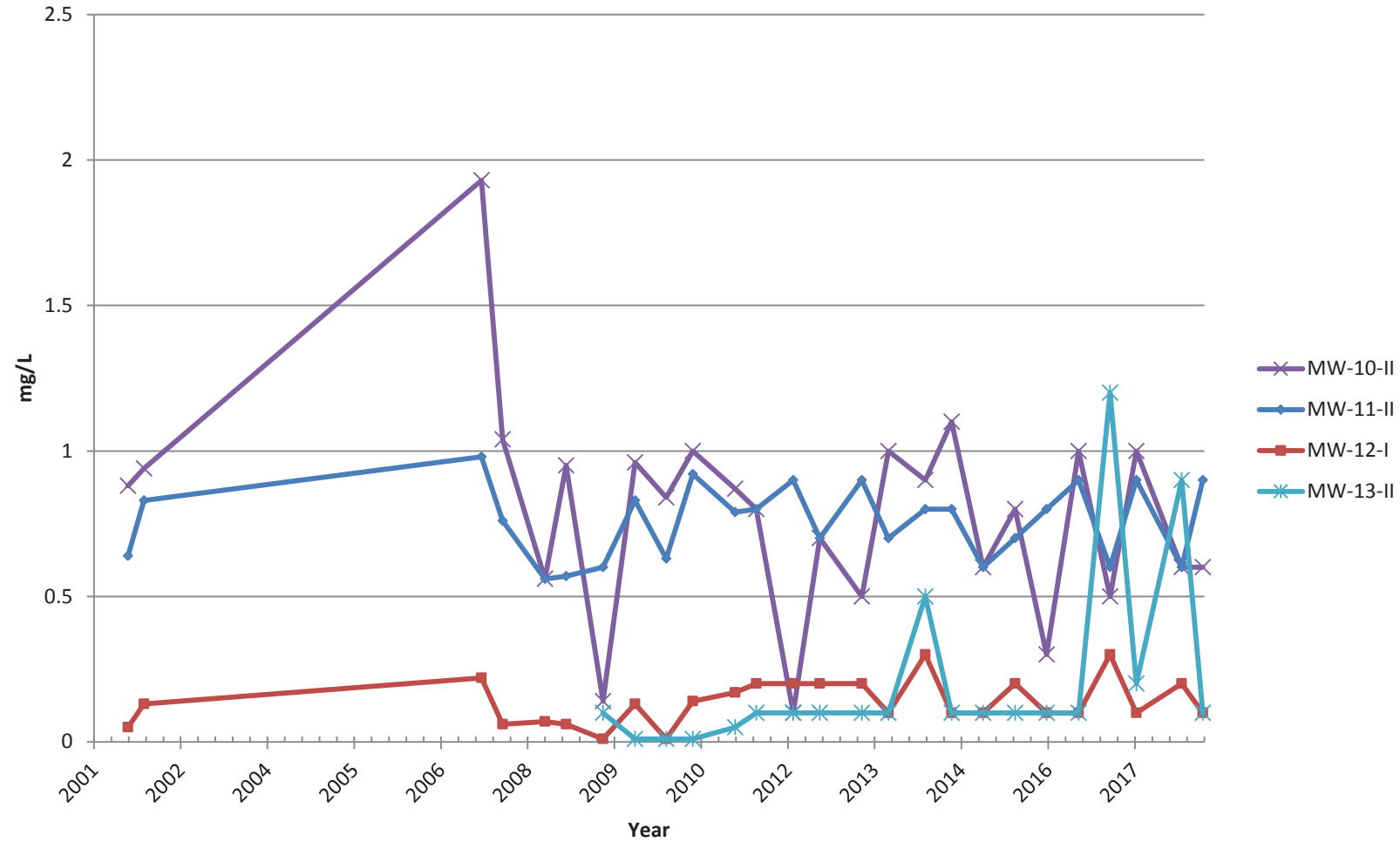
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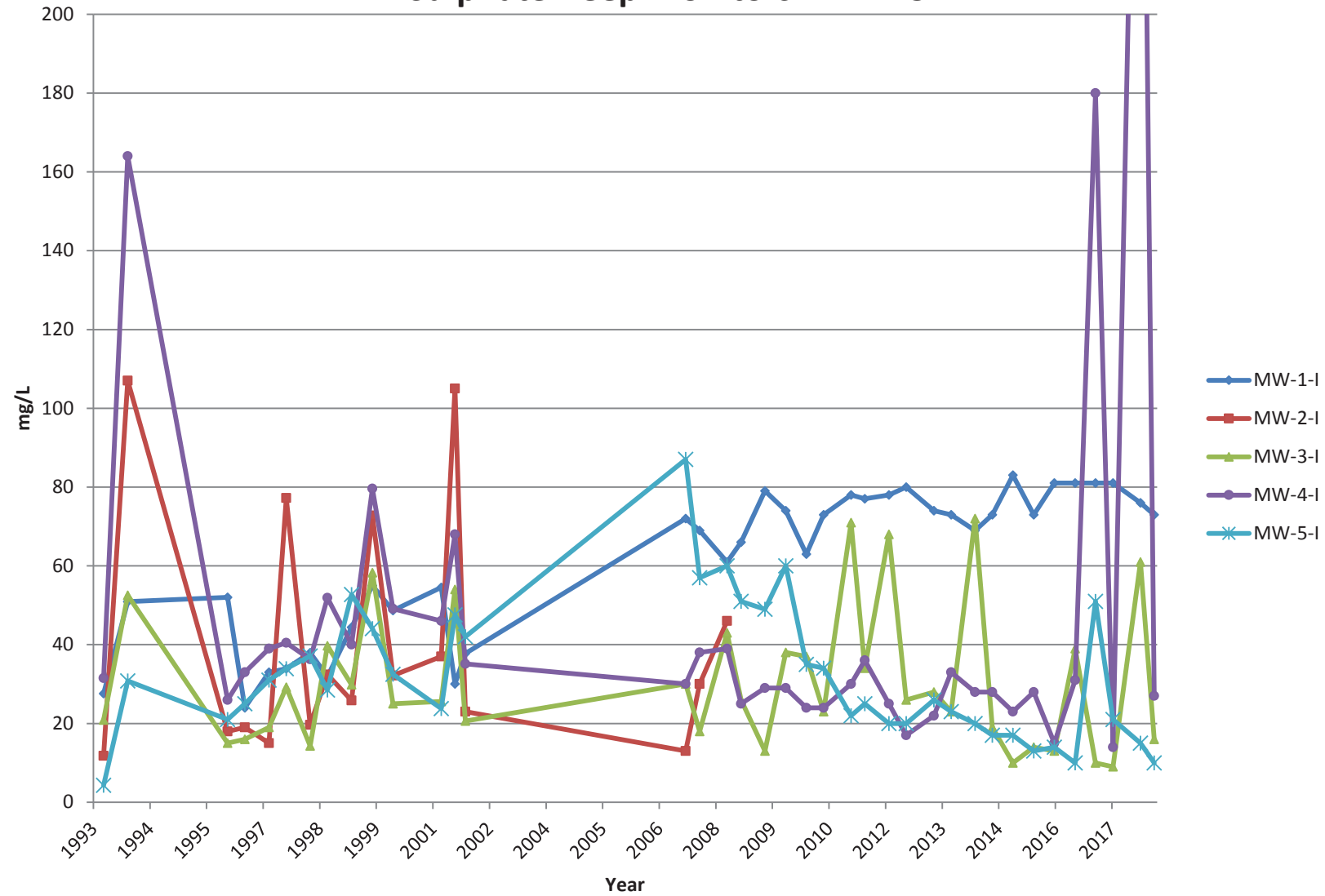
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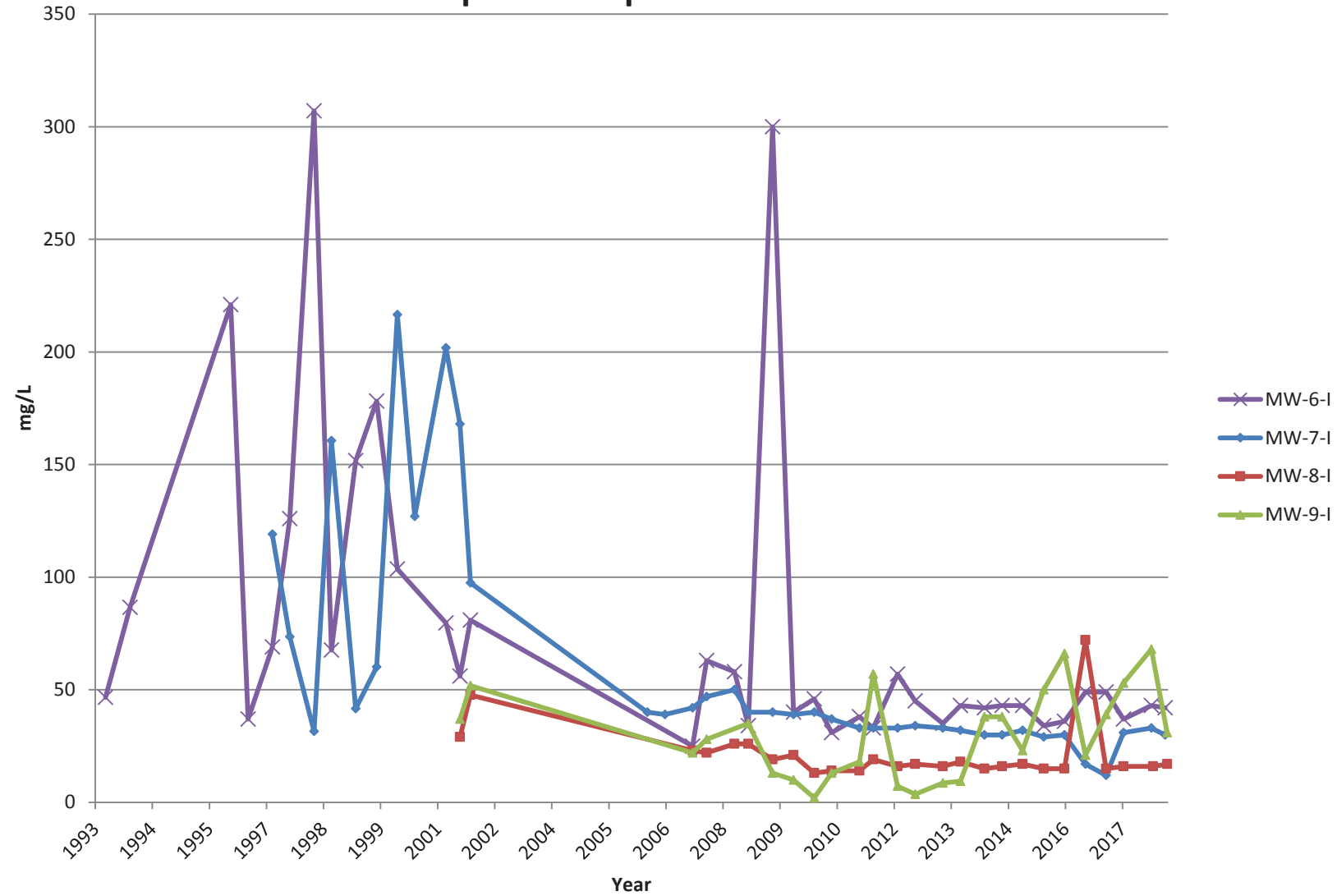
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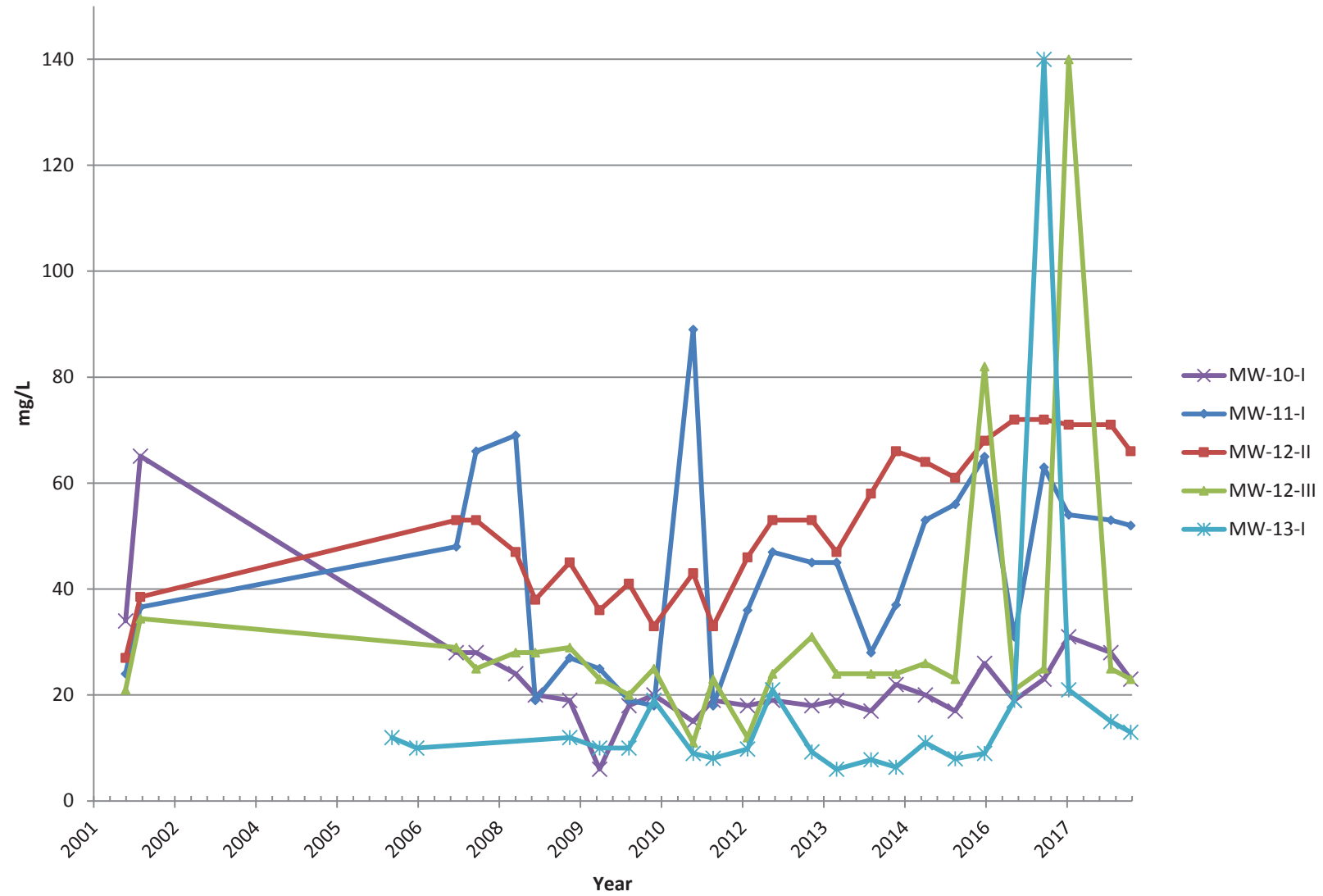
Sulphate Deep Monitors MW 1-5



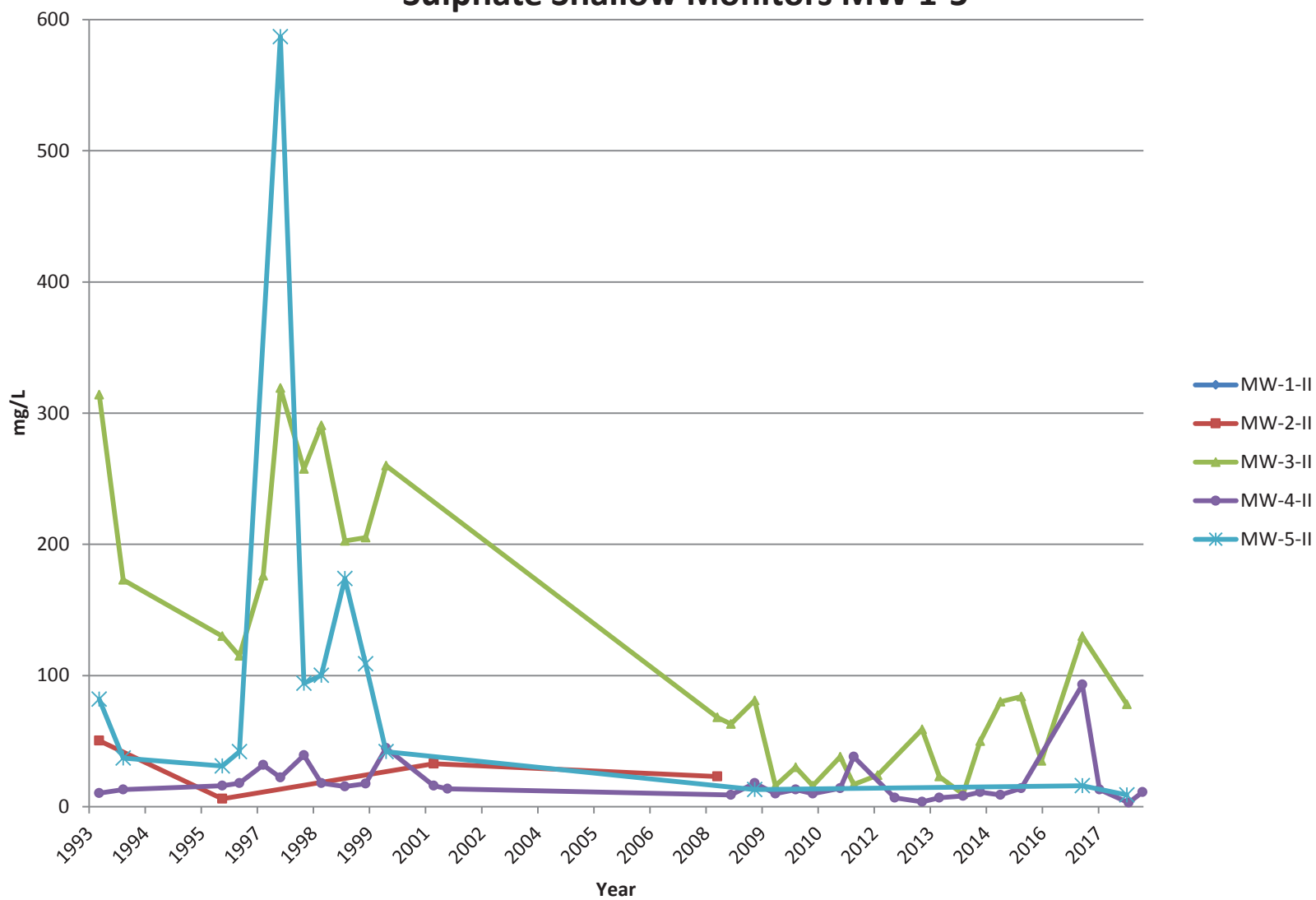
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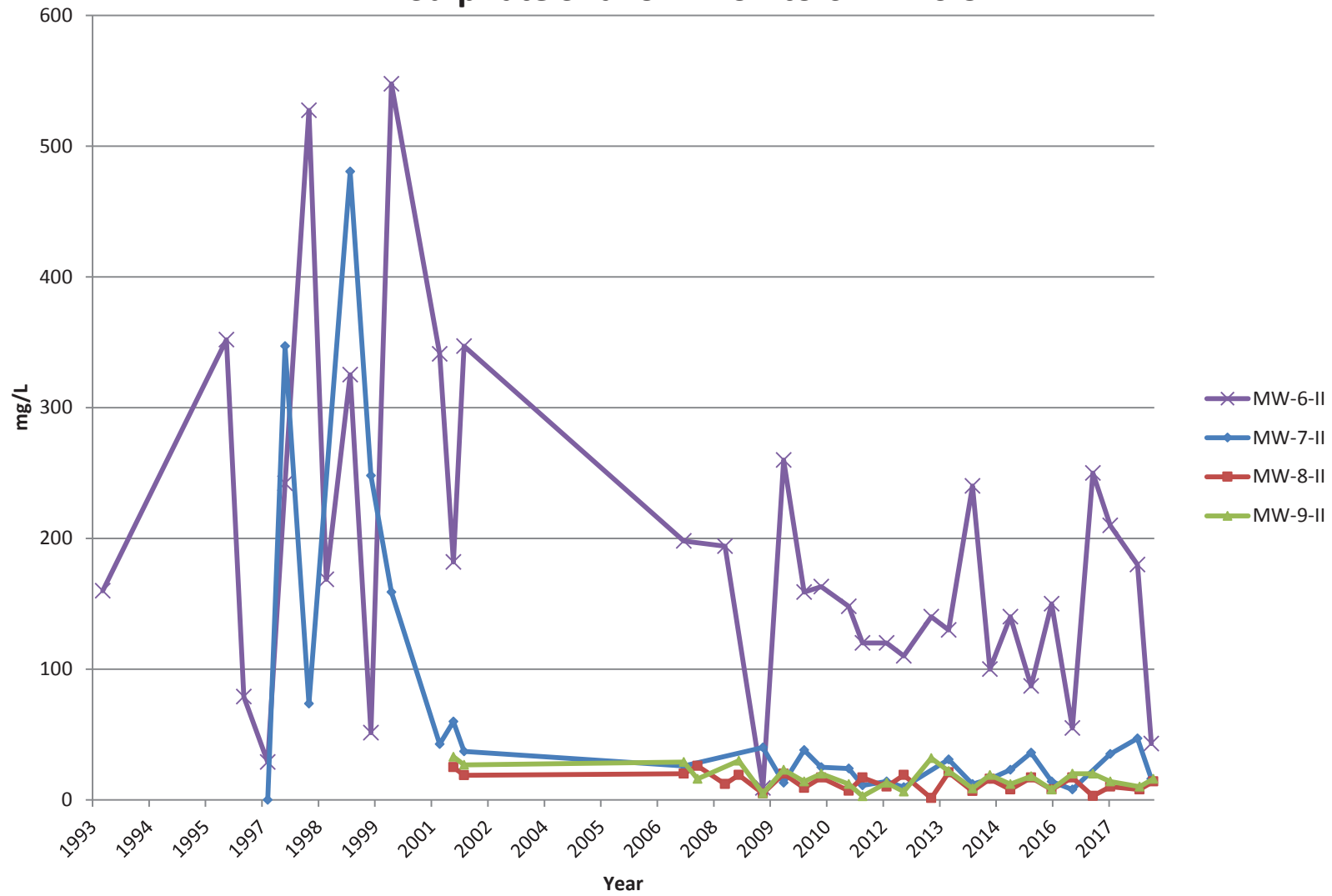
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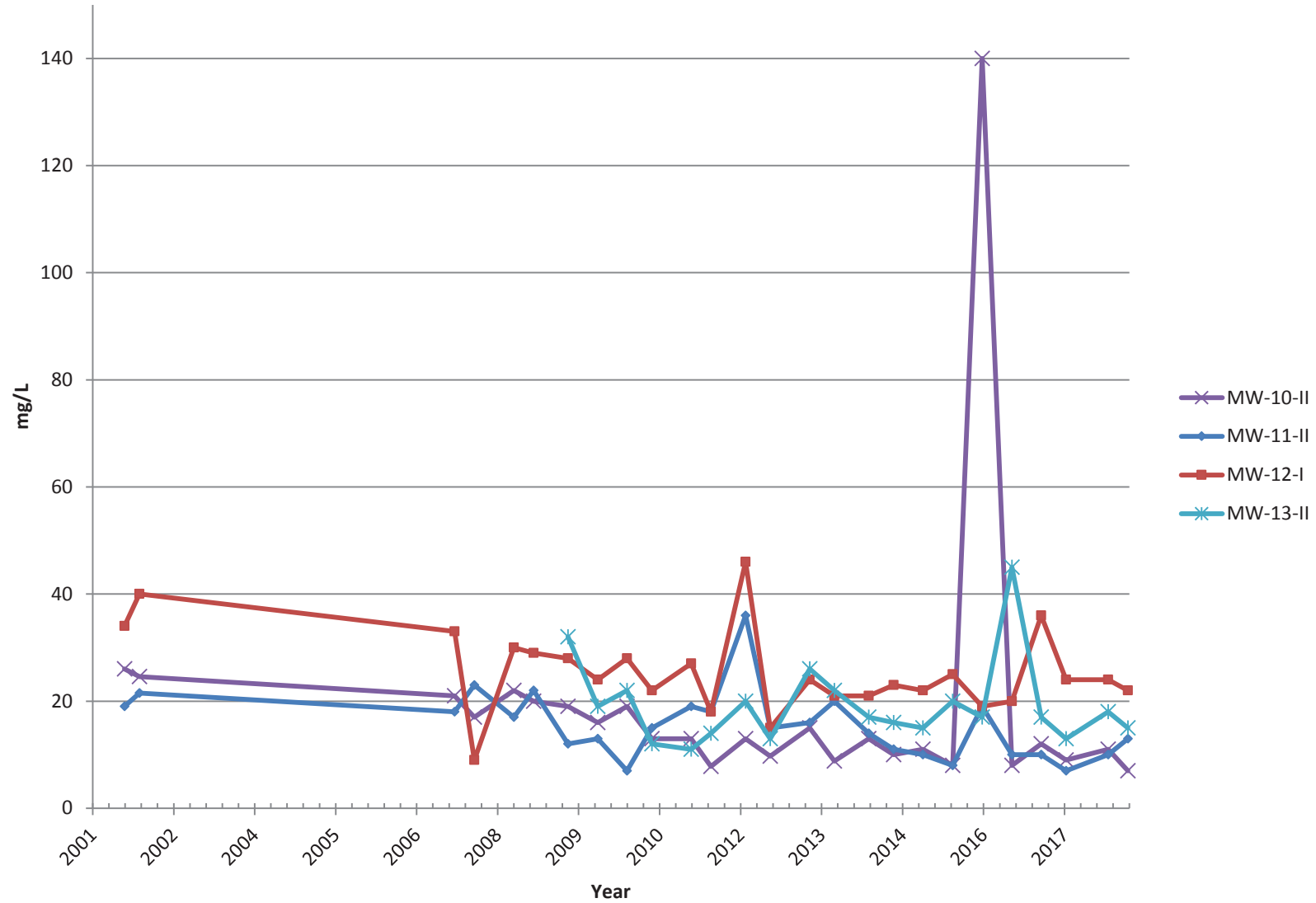
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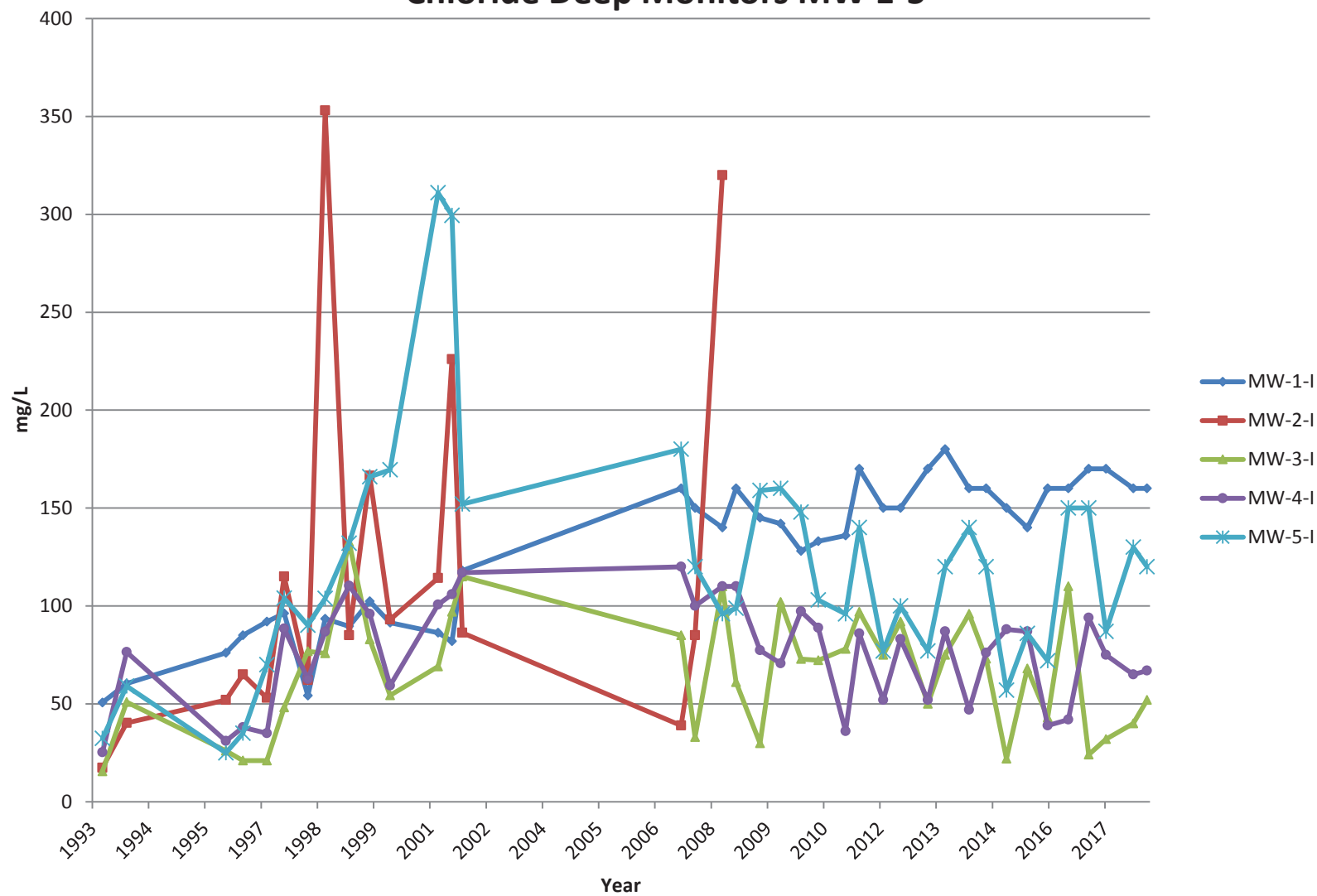
Sulphate Shallow Monitors MW 6-9



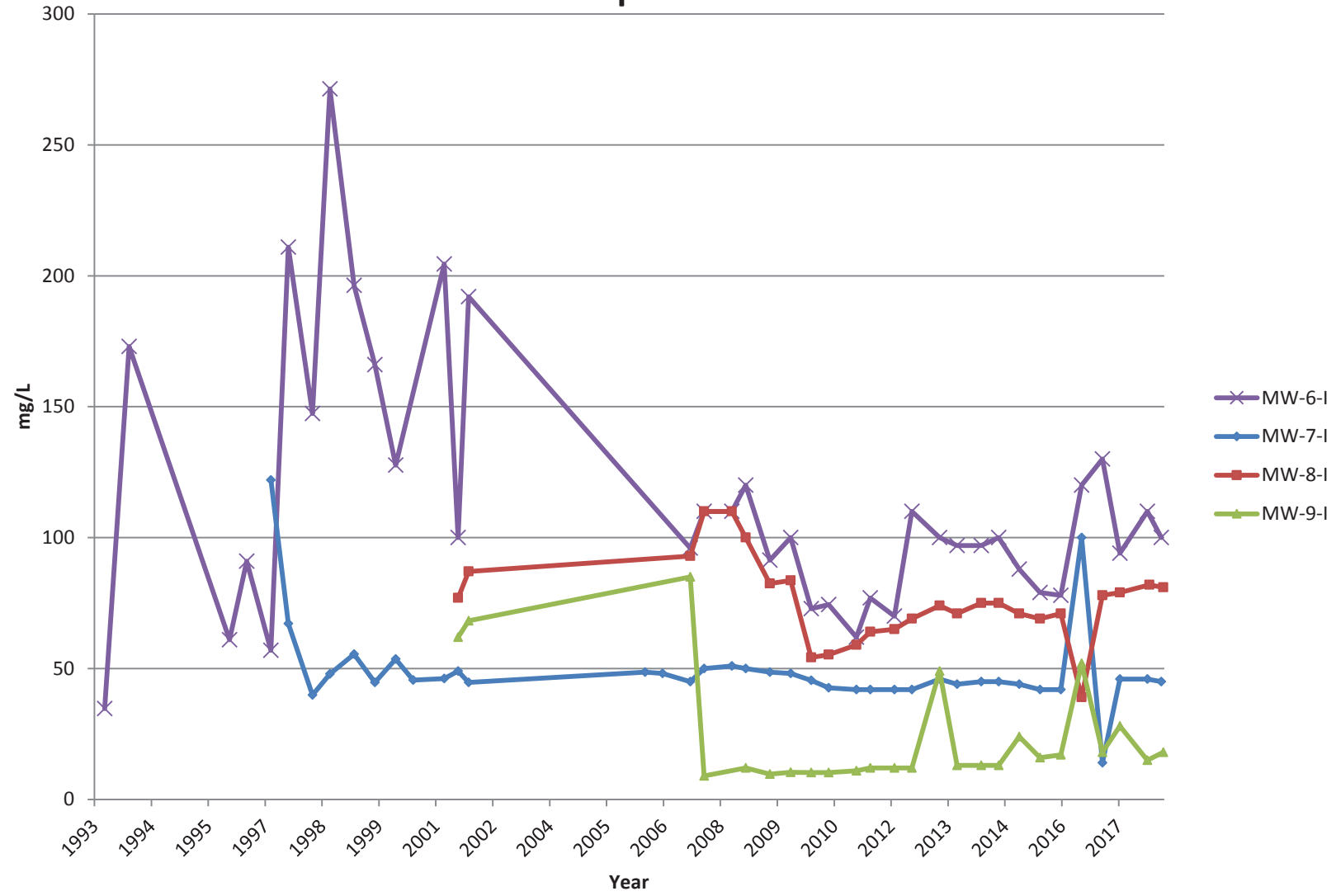
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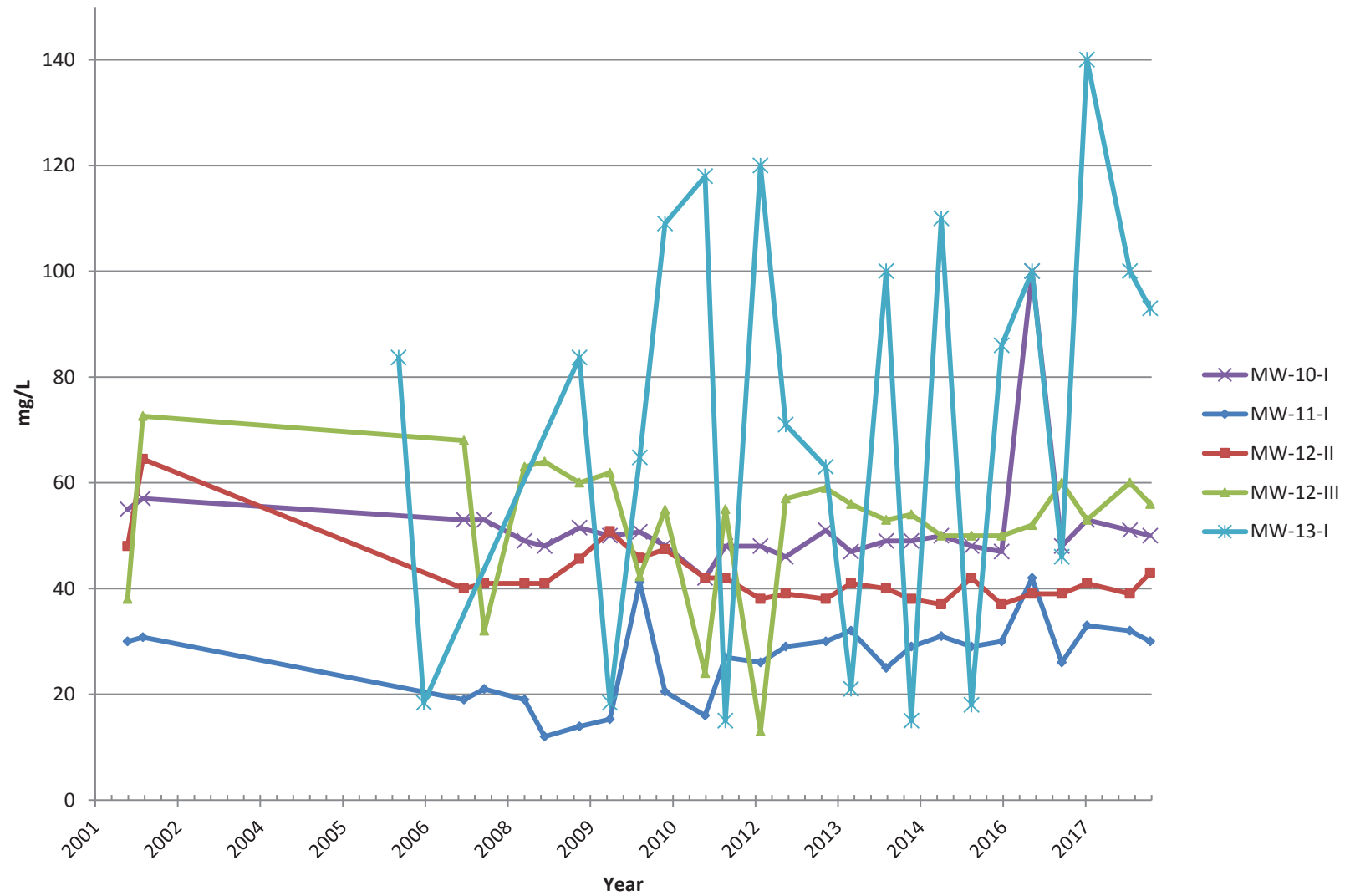
Chloride Deep Monitors MW 1-5



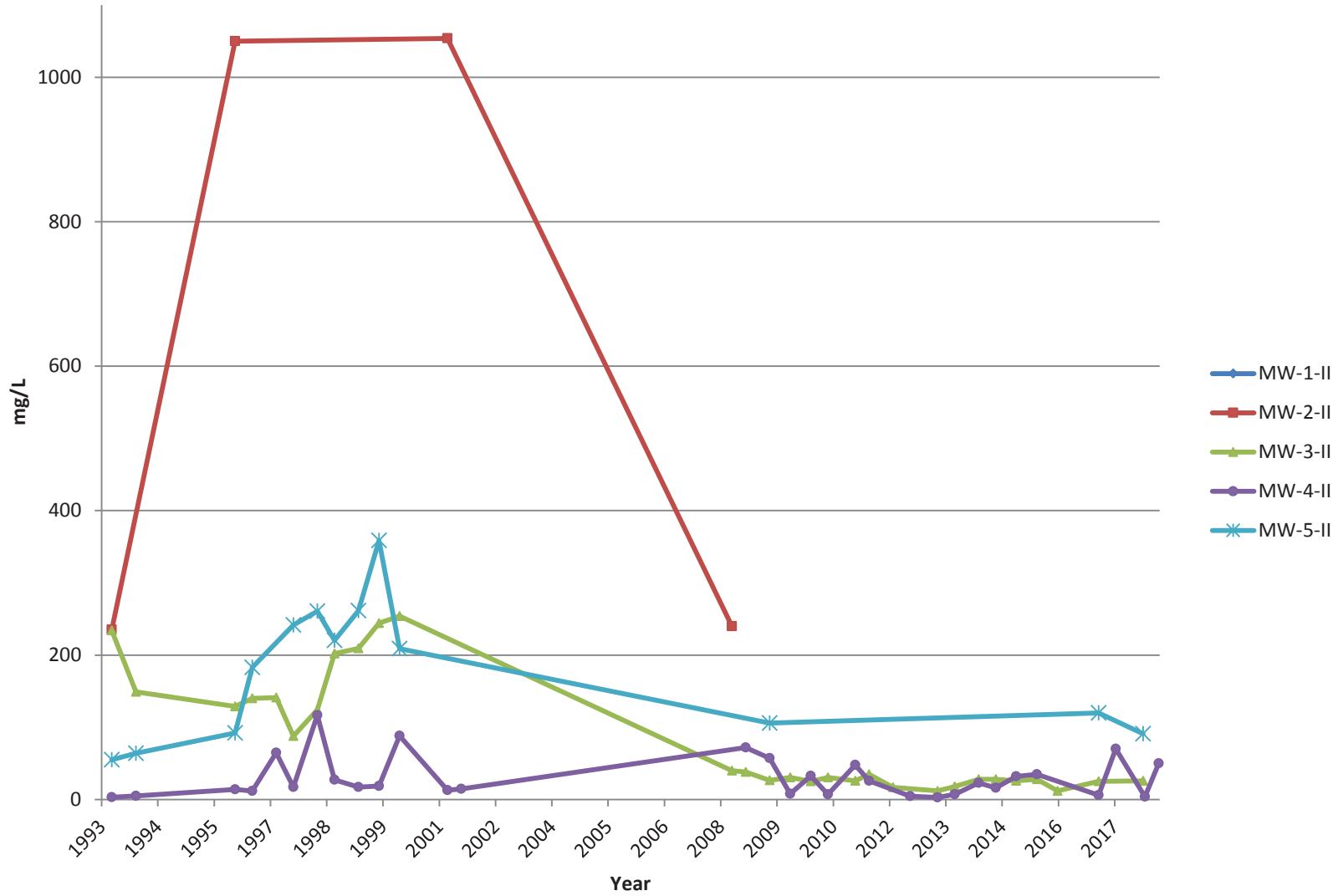
Chloride Deep Monitors MW 6-9



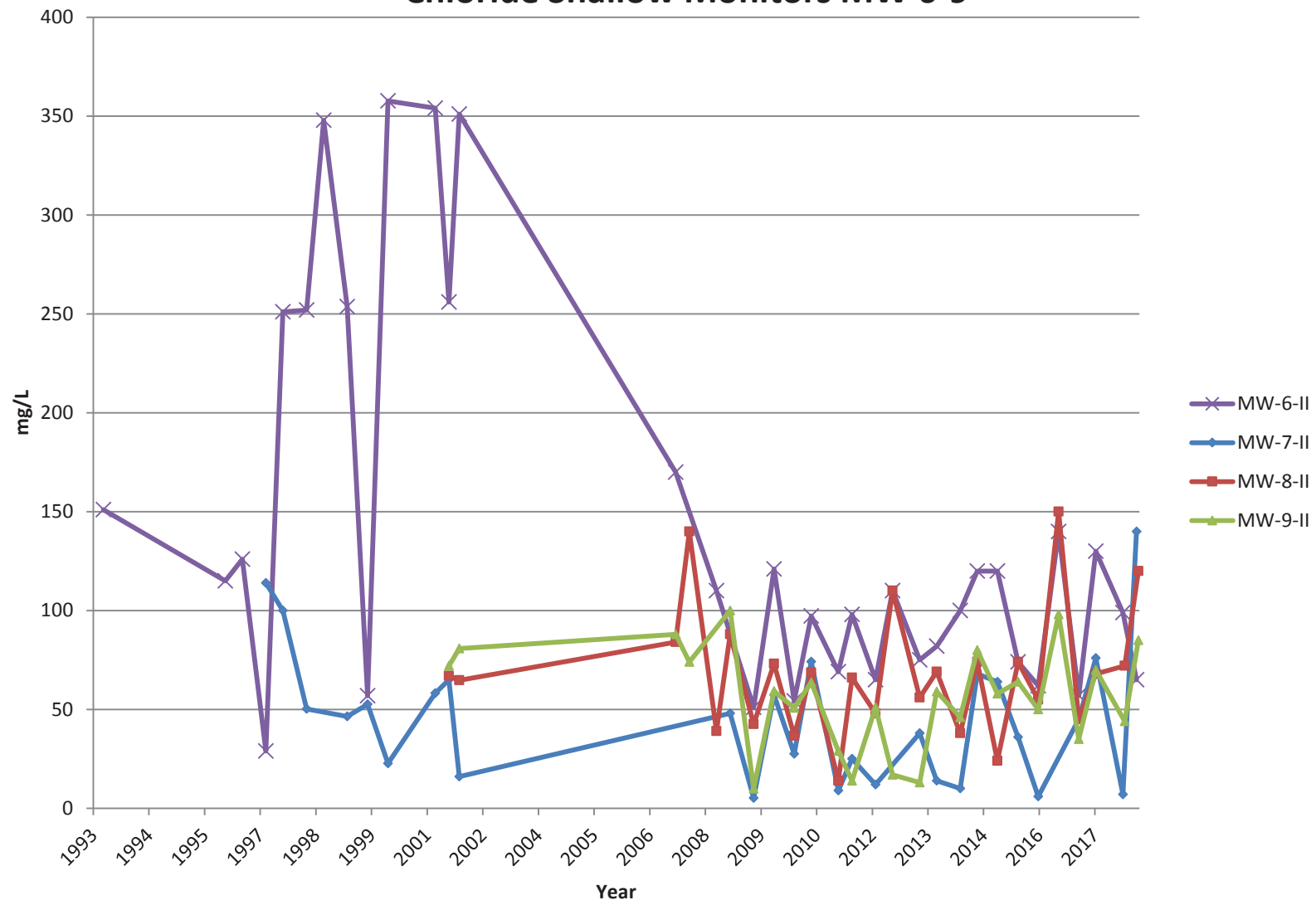
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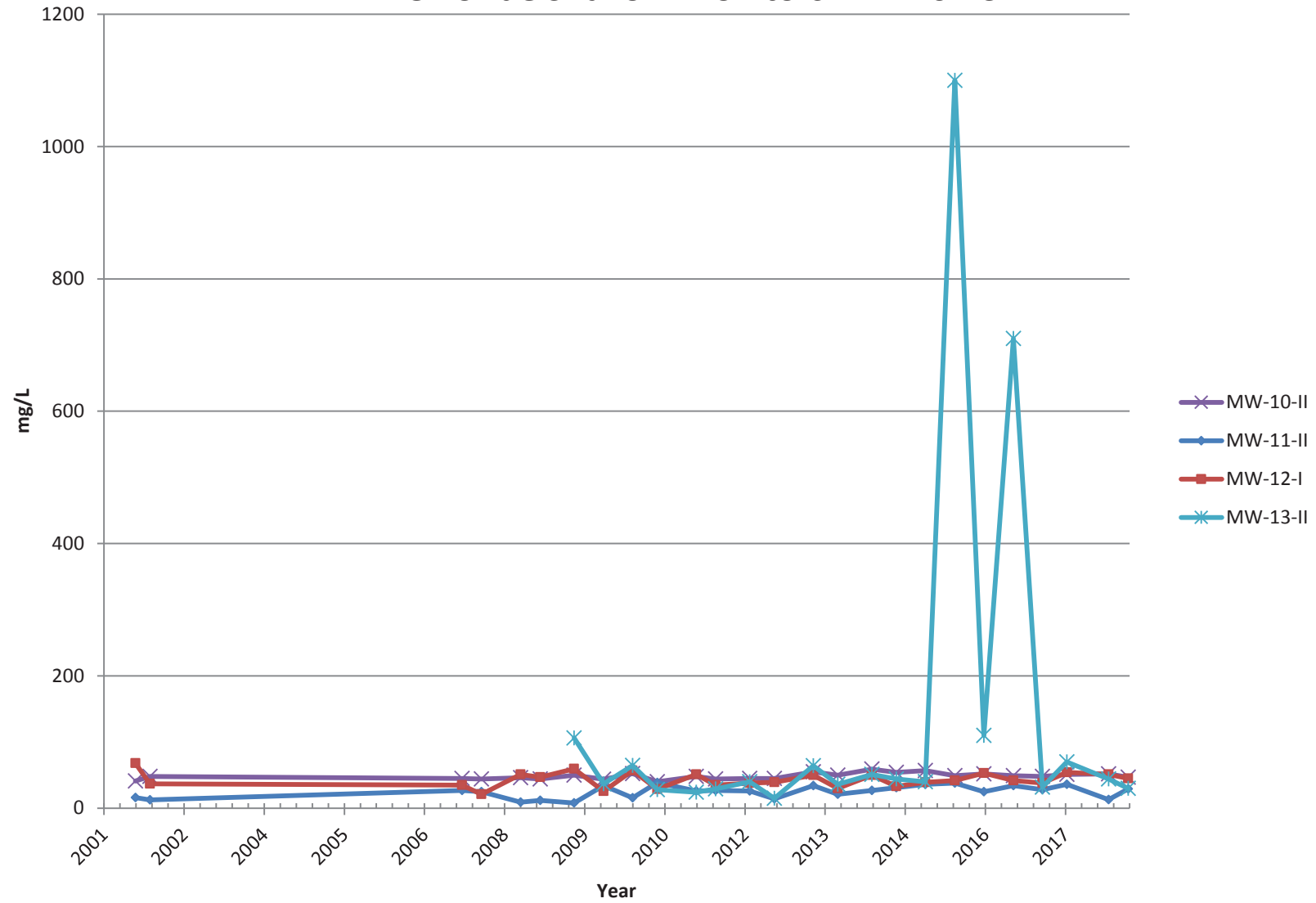
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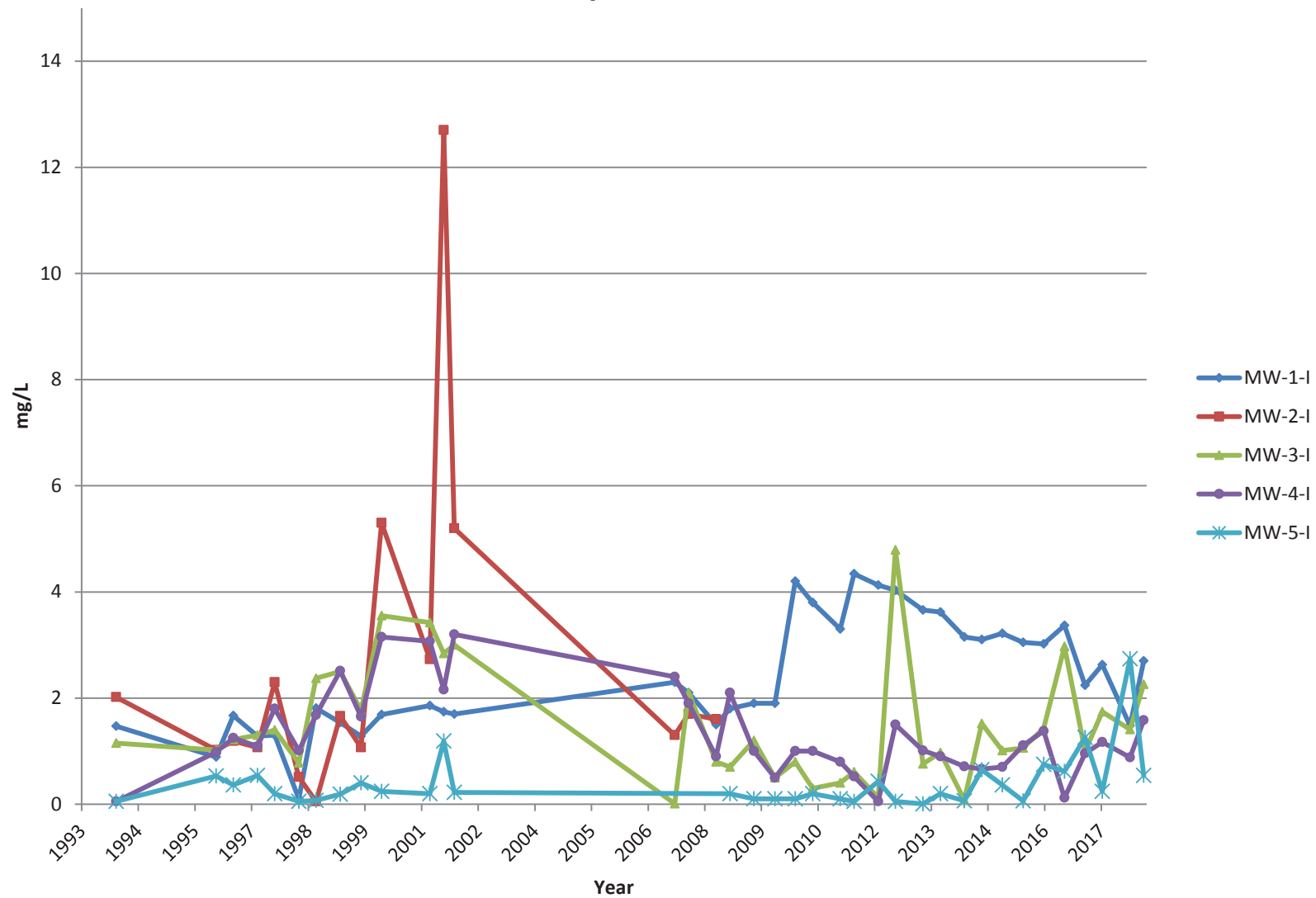
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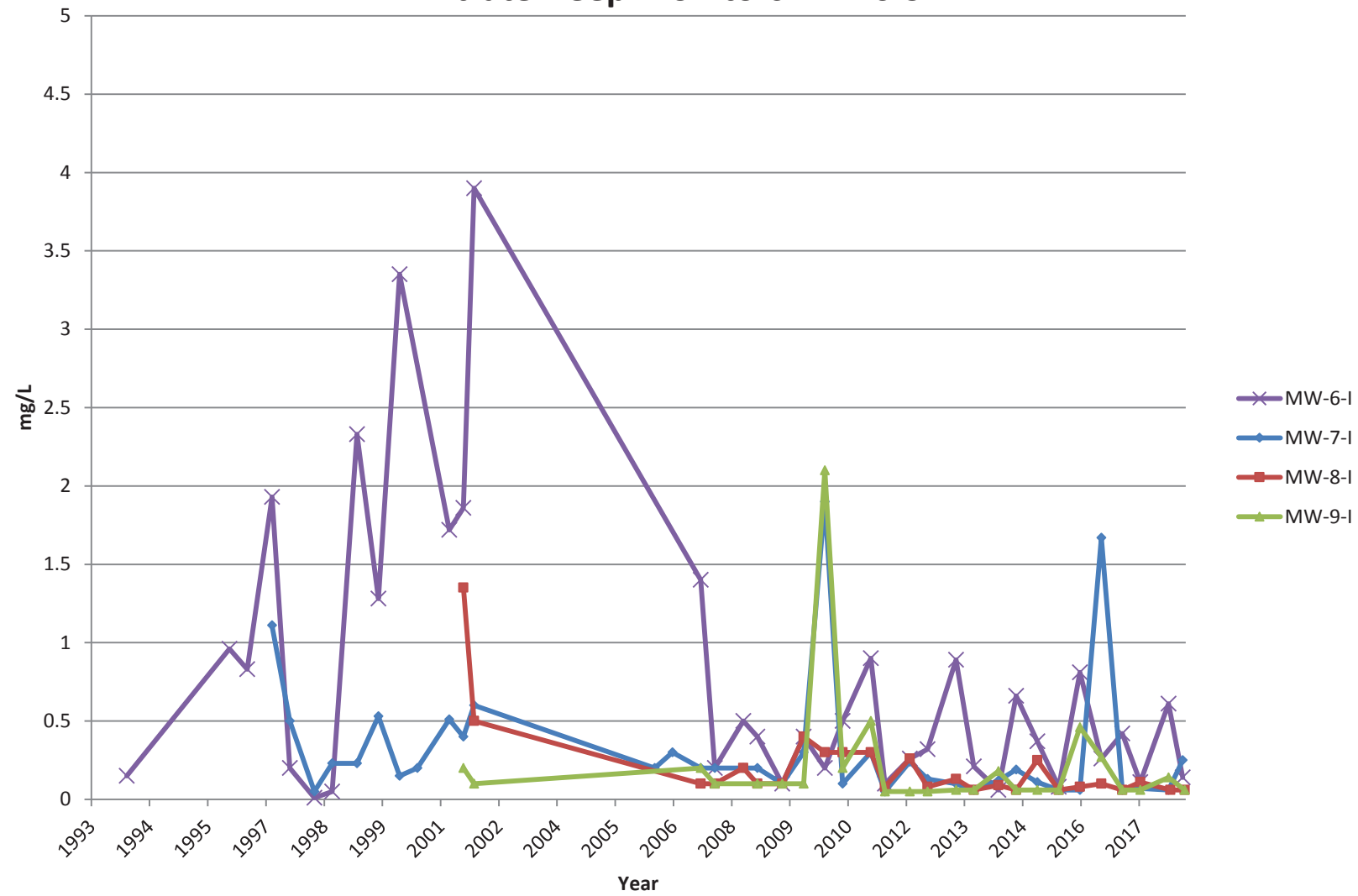
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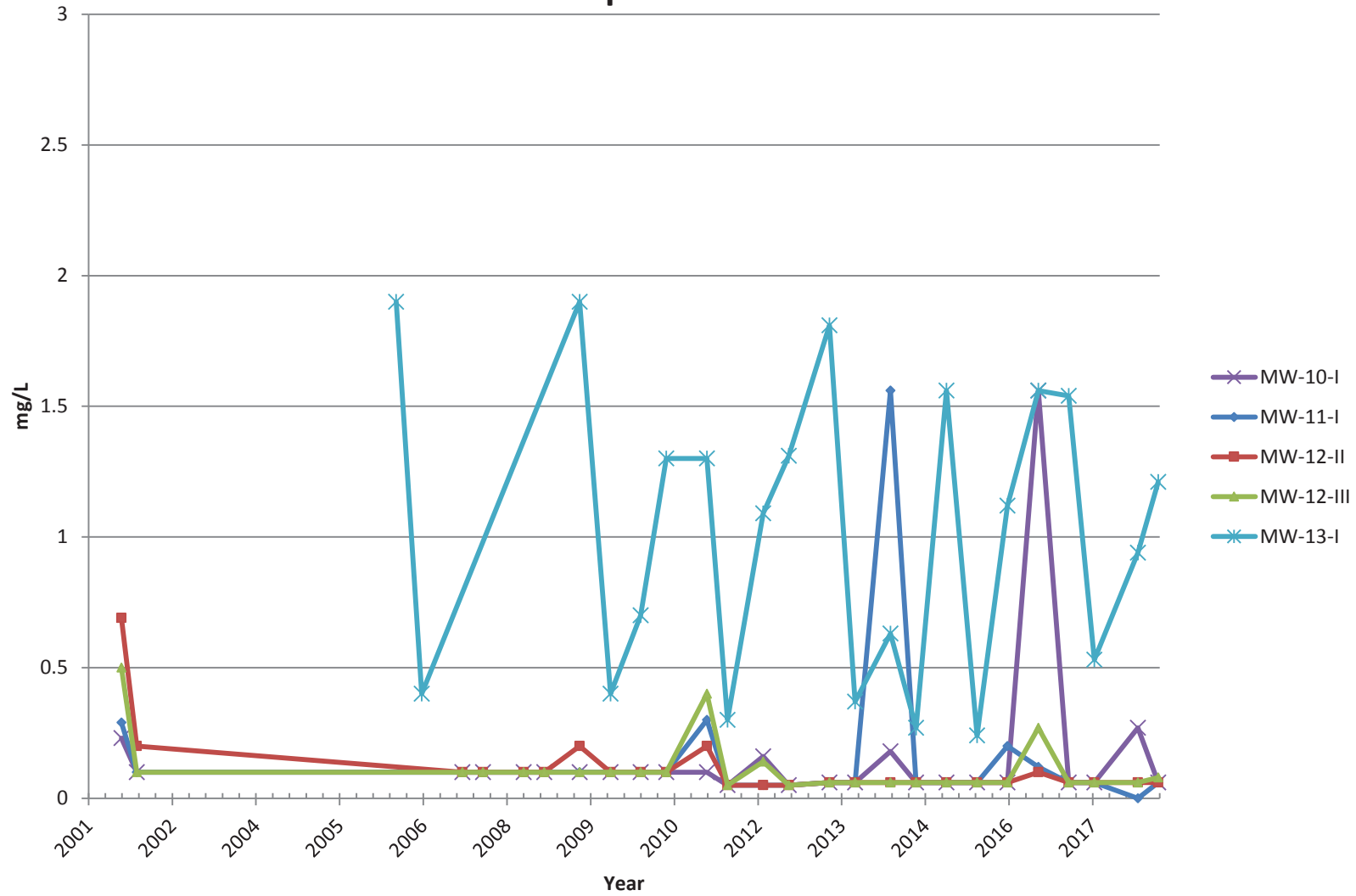
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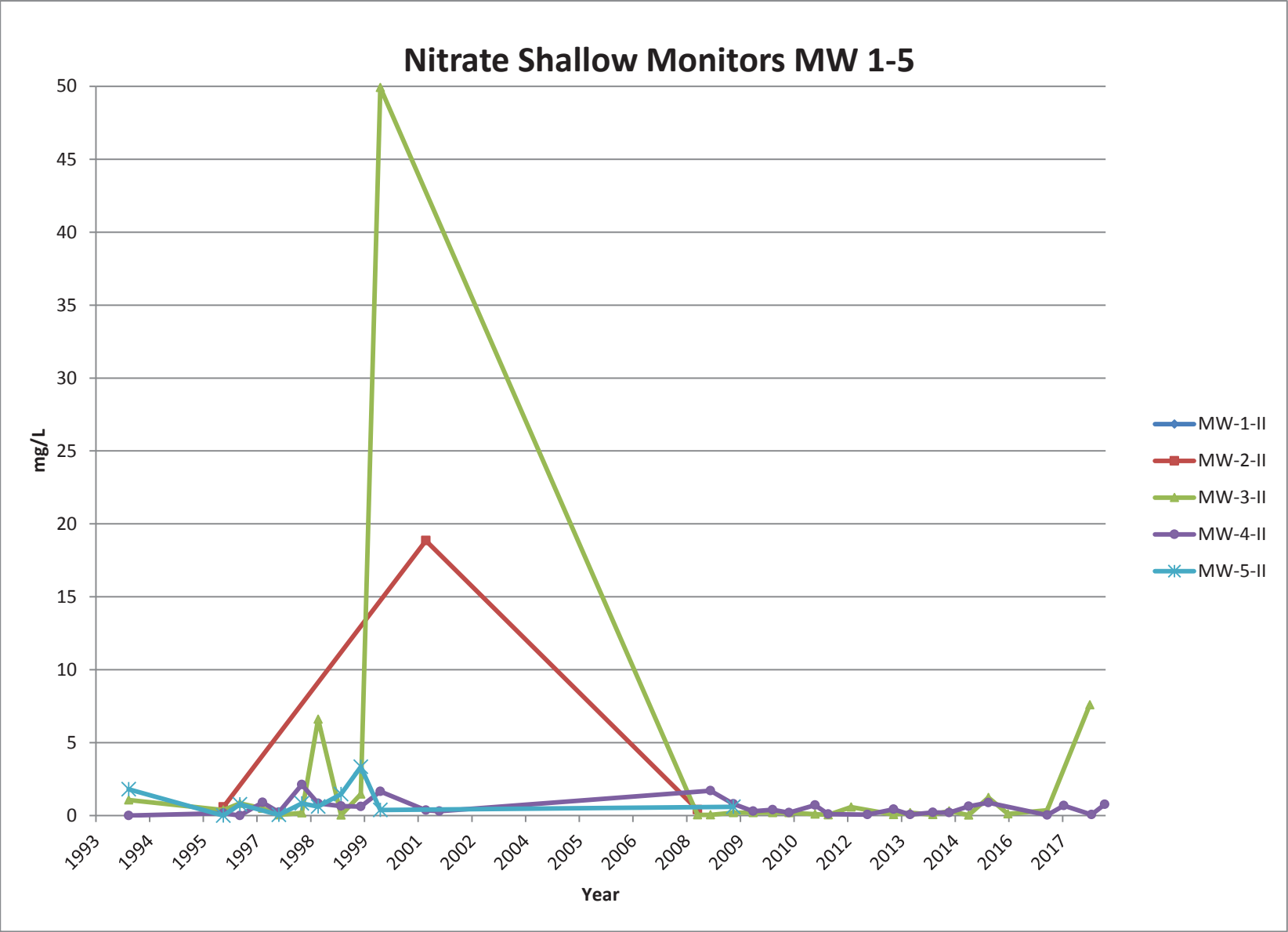


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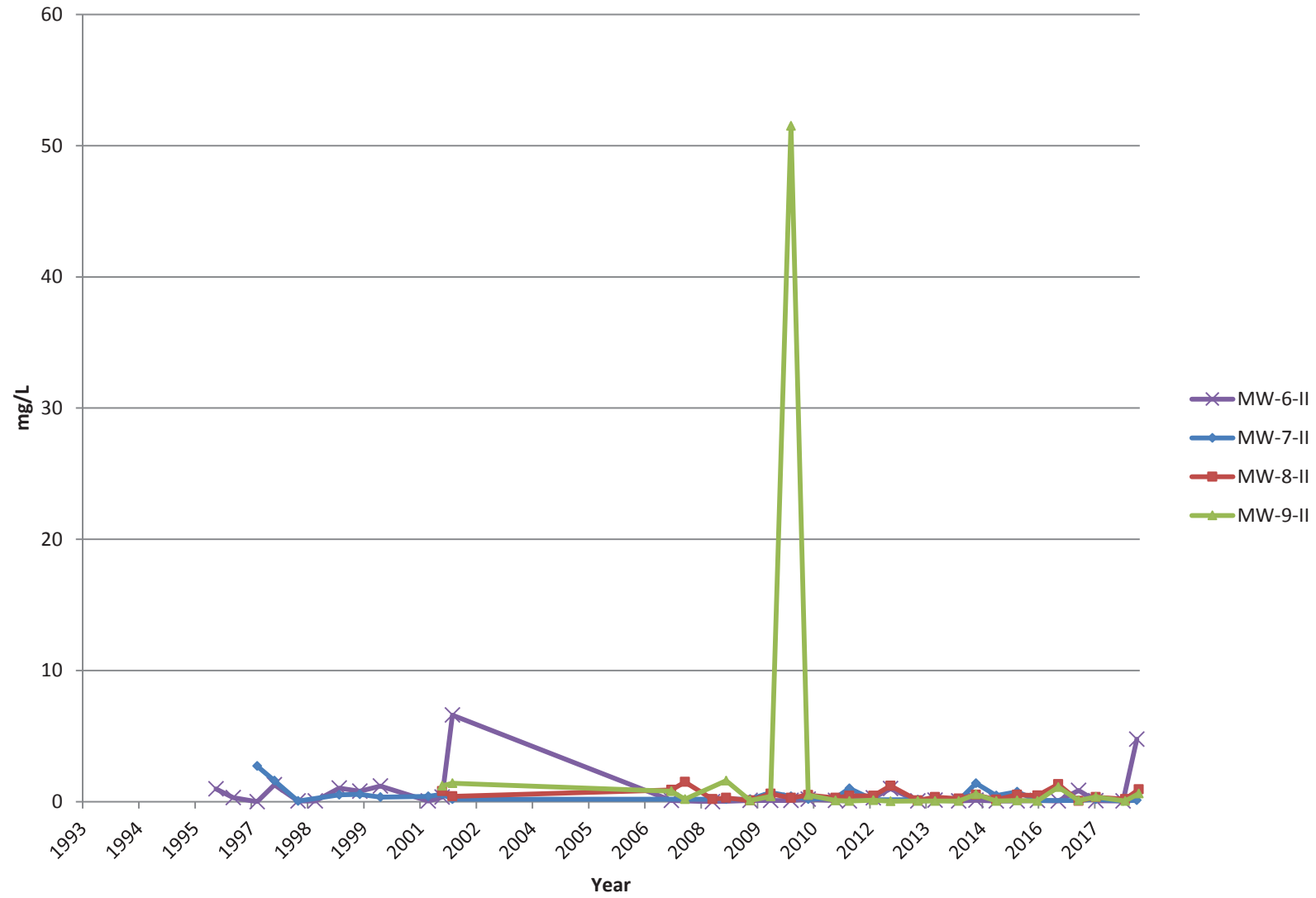


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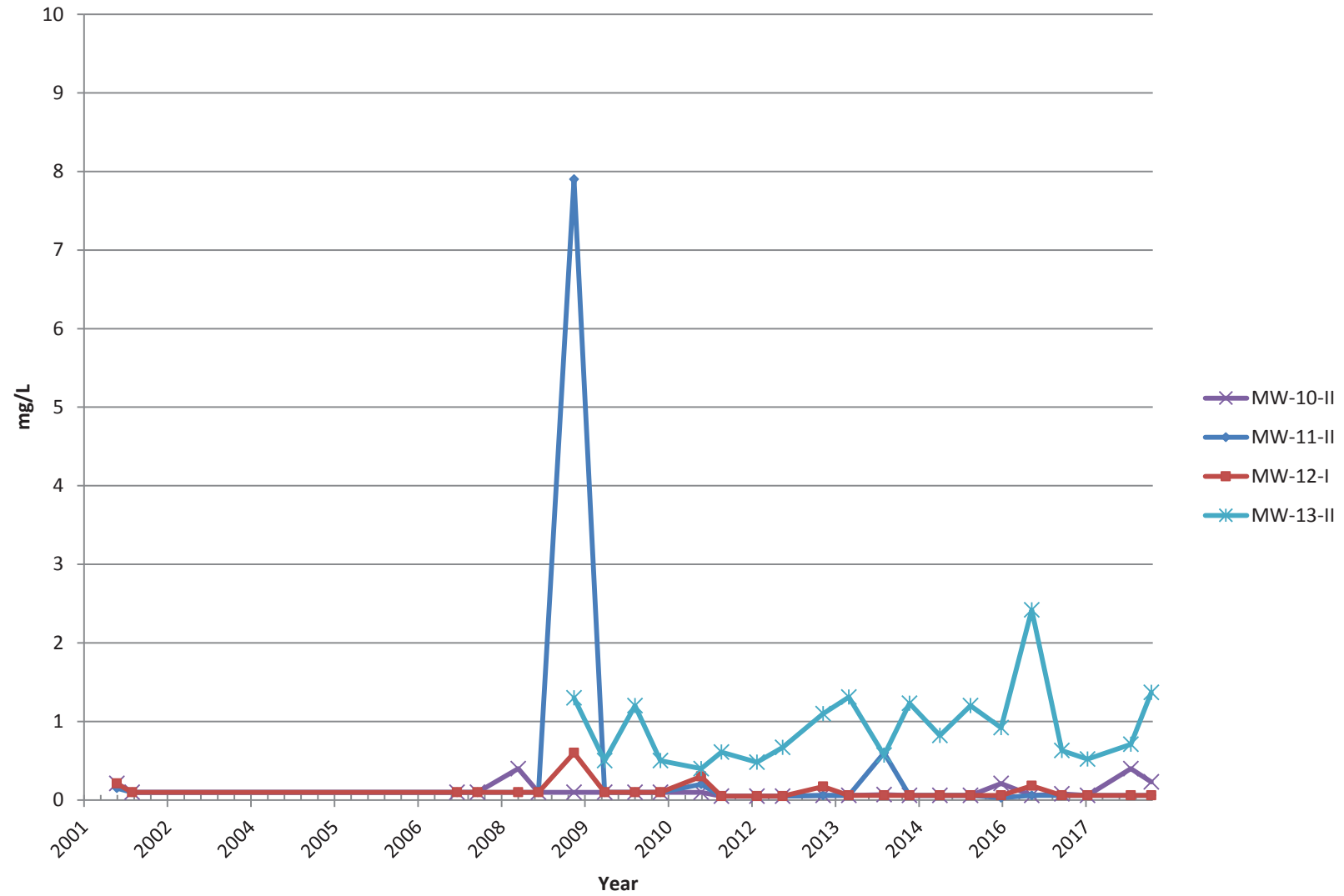




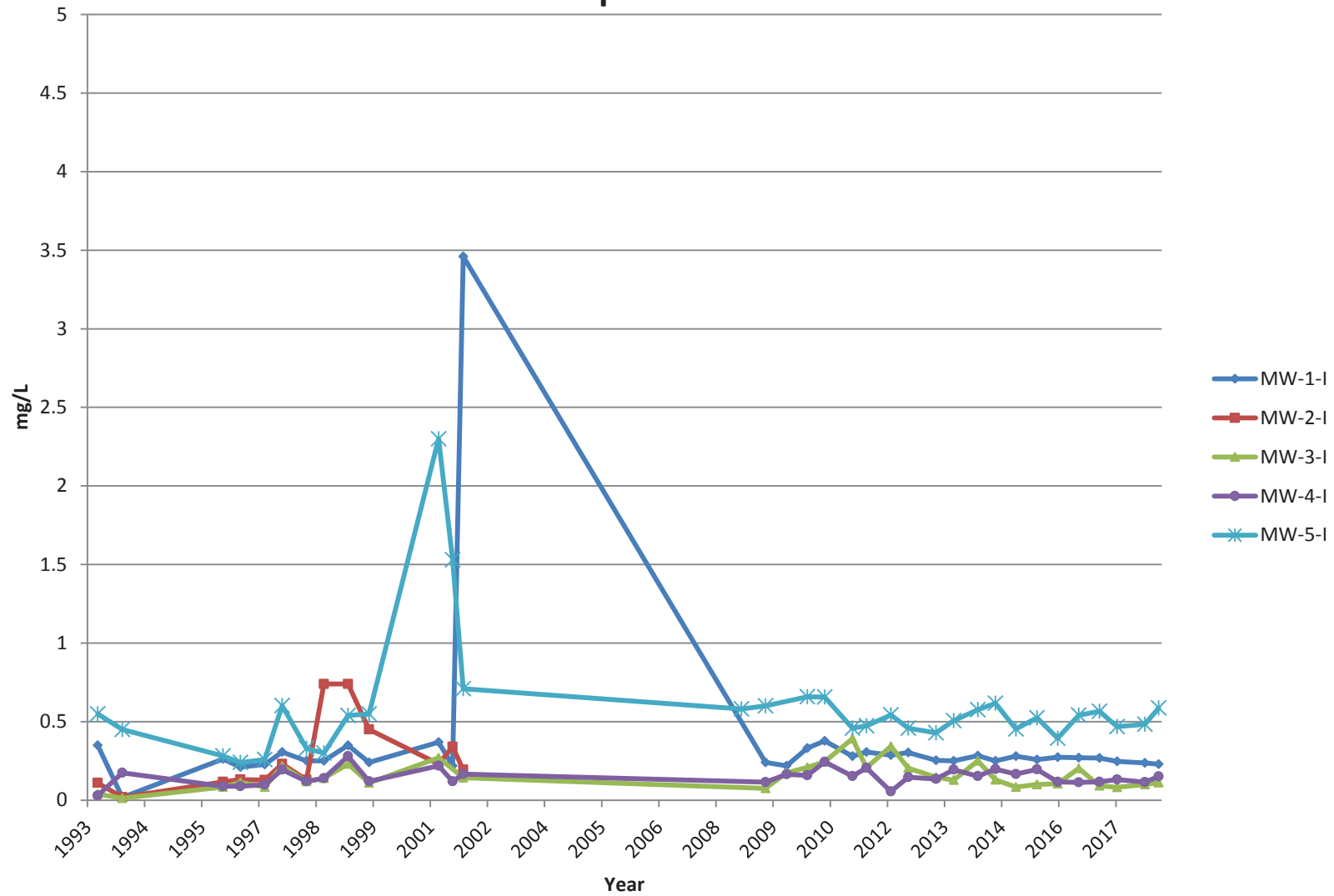
Nitrate Shallow Monitors MW 6-9



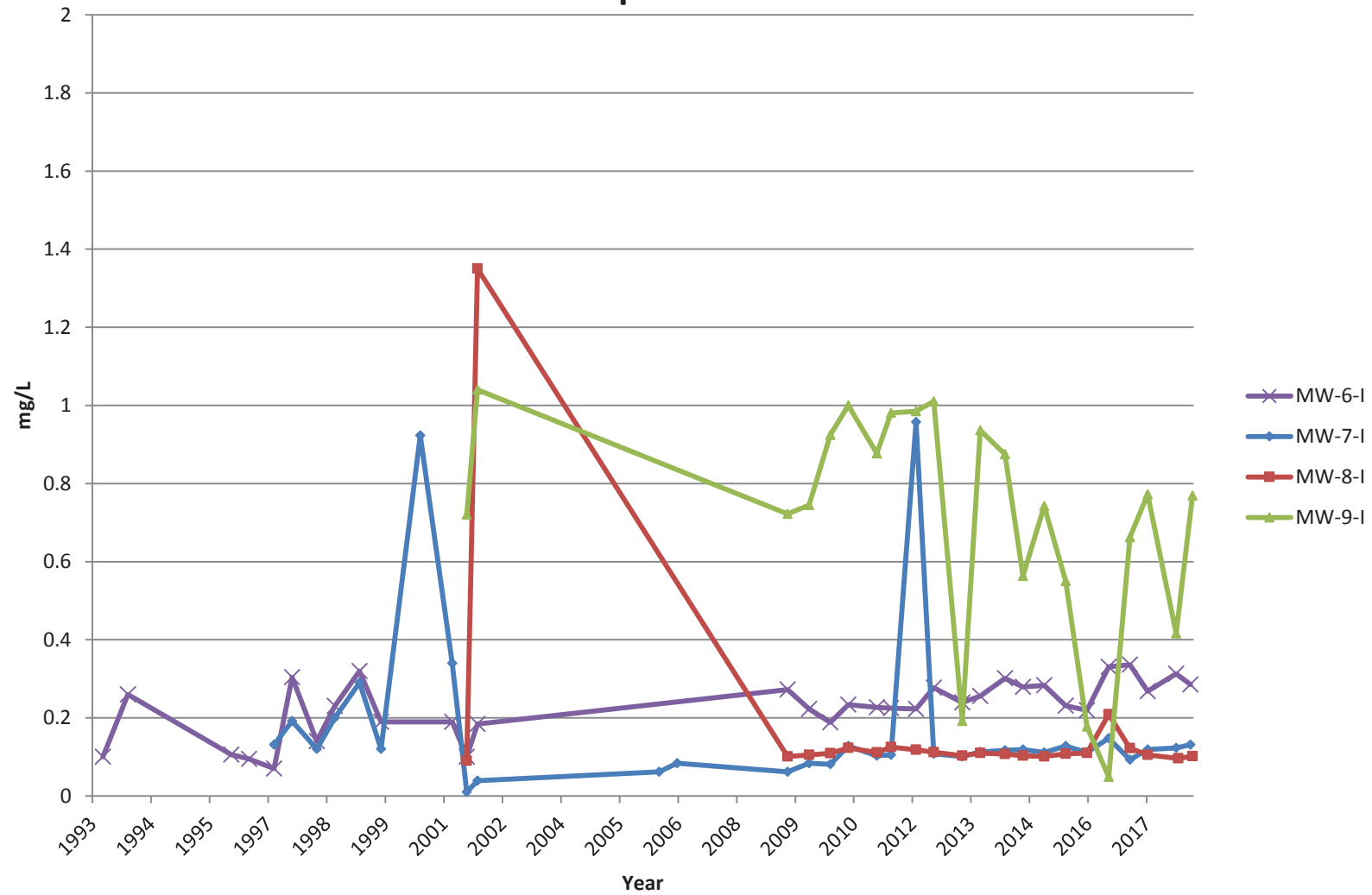
Nitrate Shallow Monitors MW 10-13



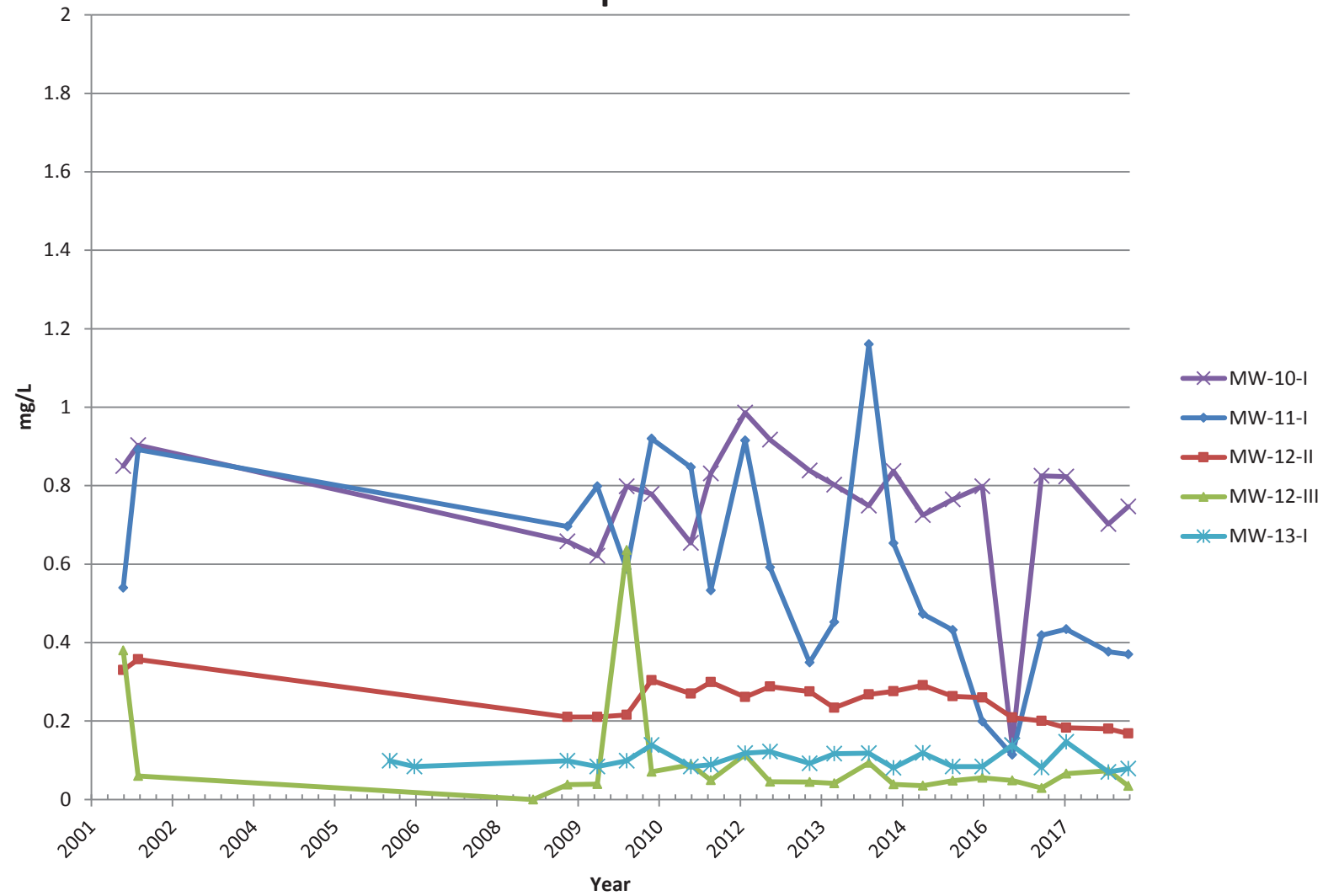
Barium Deep Monitors MW 1-5



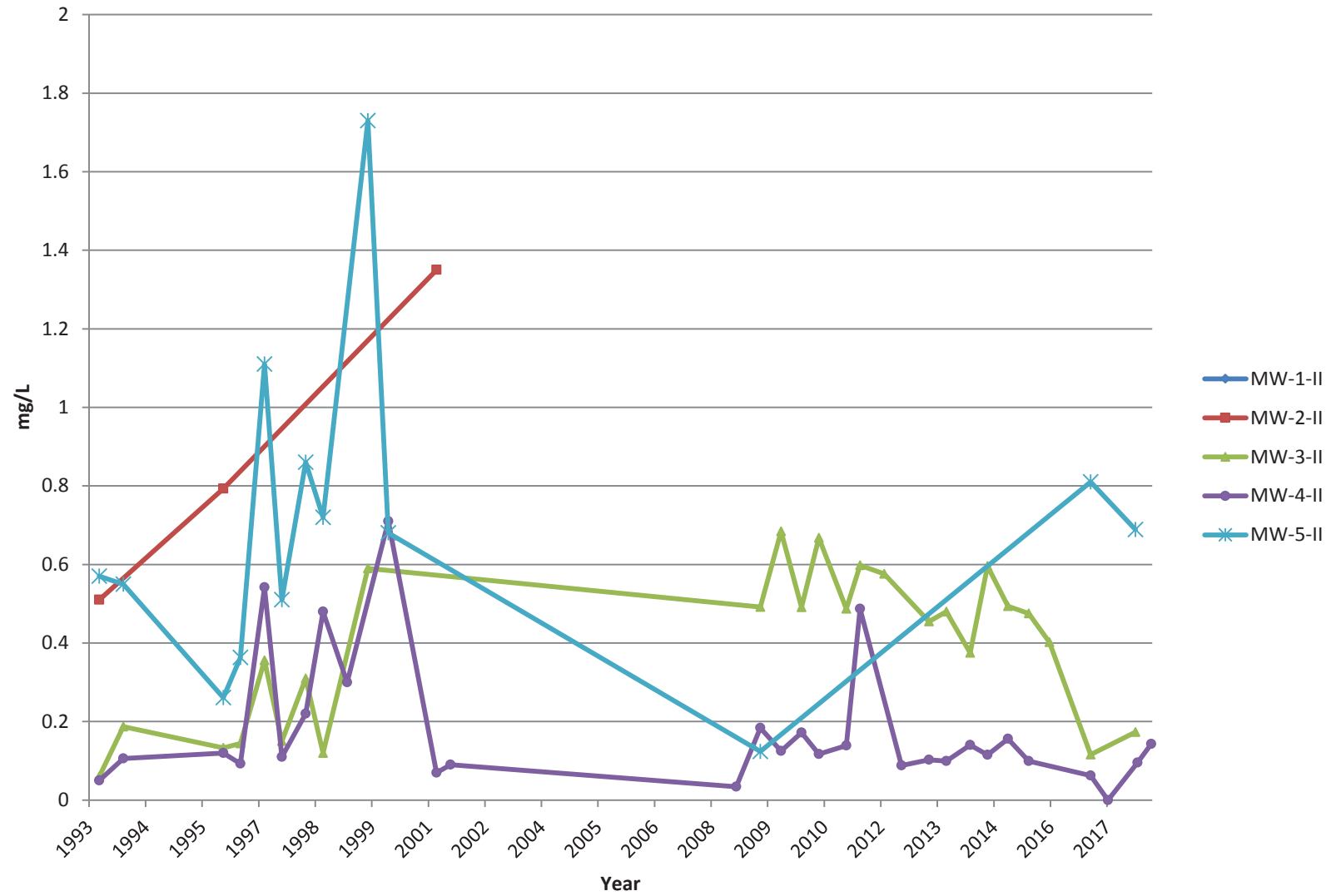
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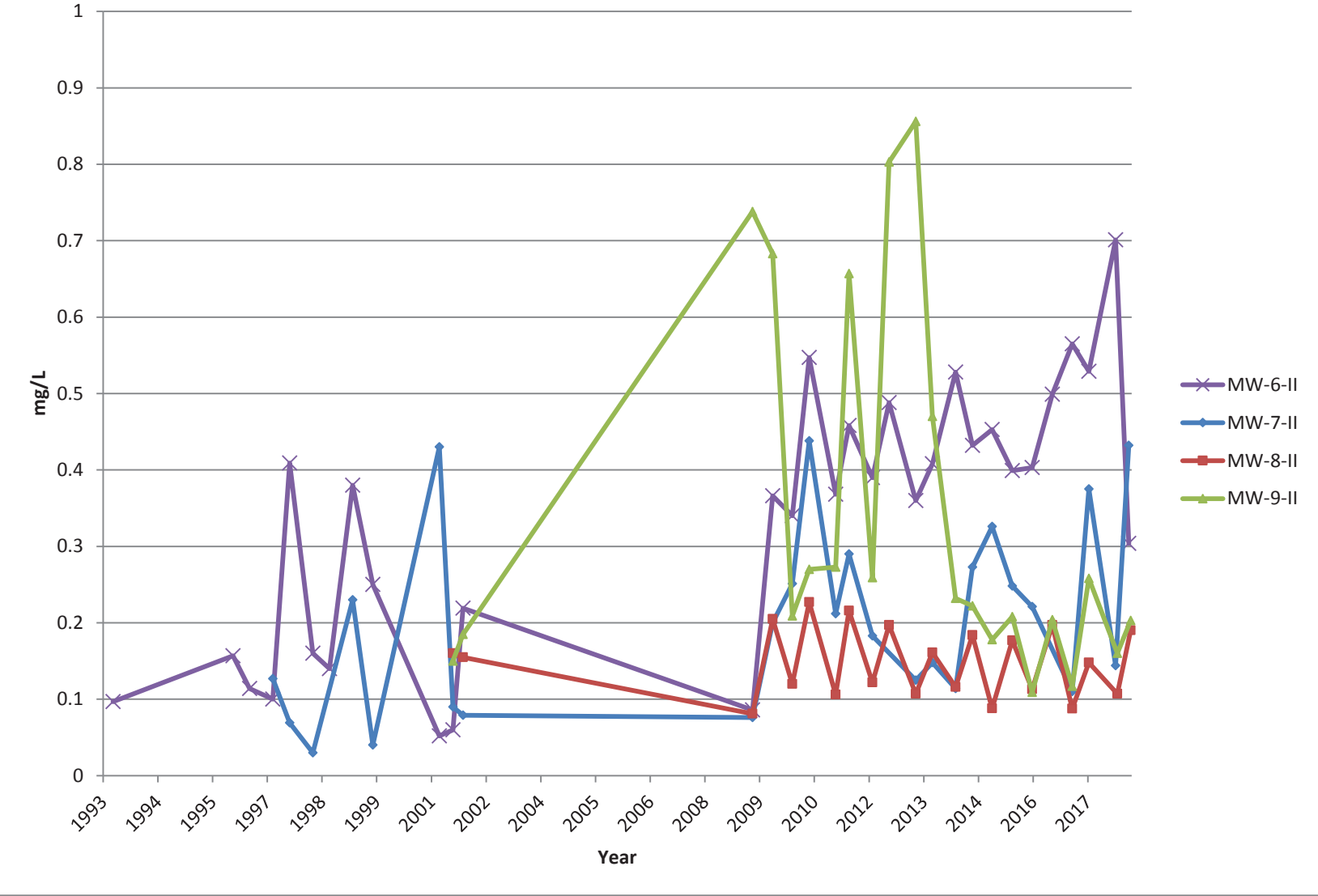
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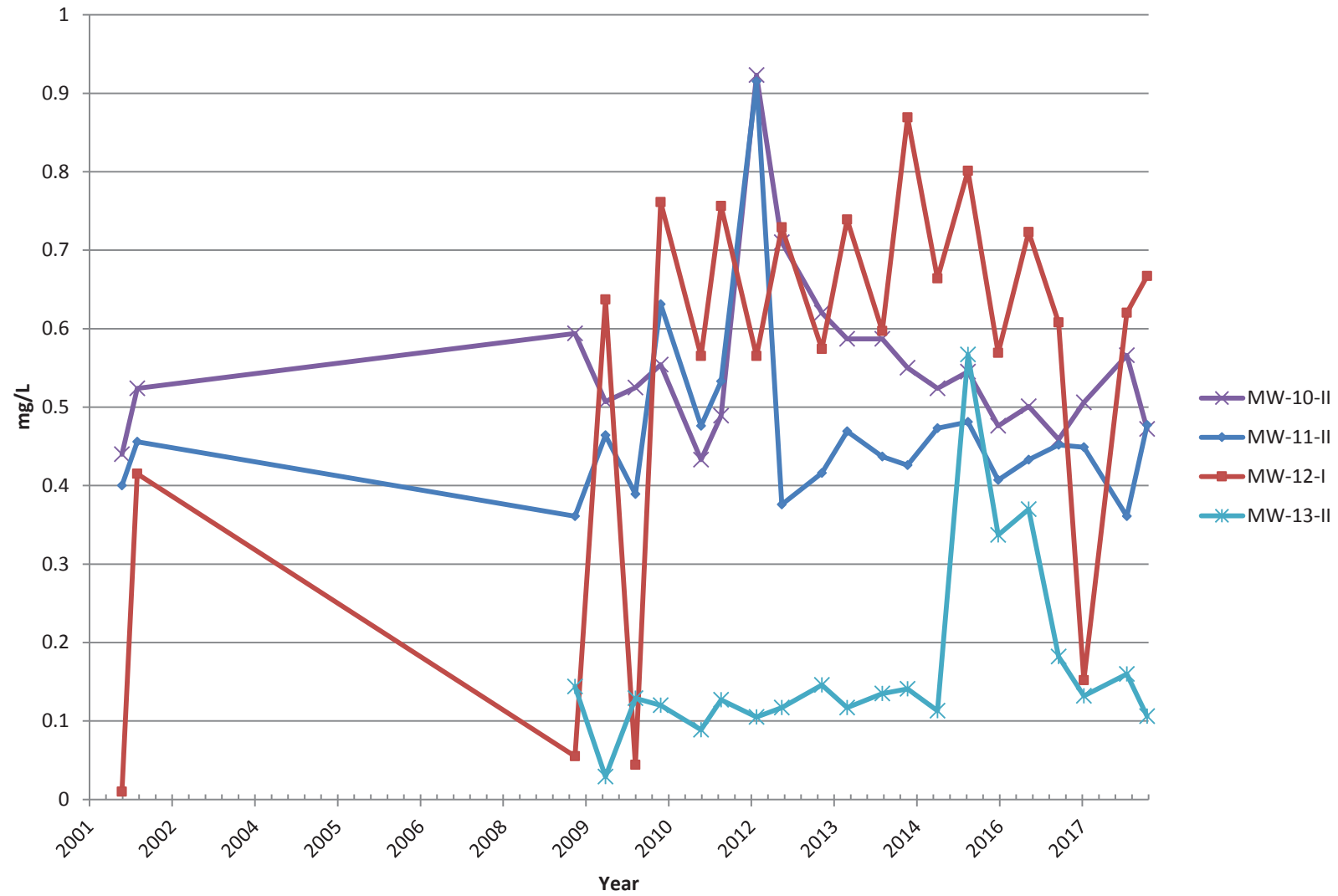
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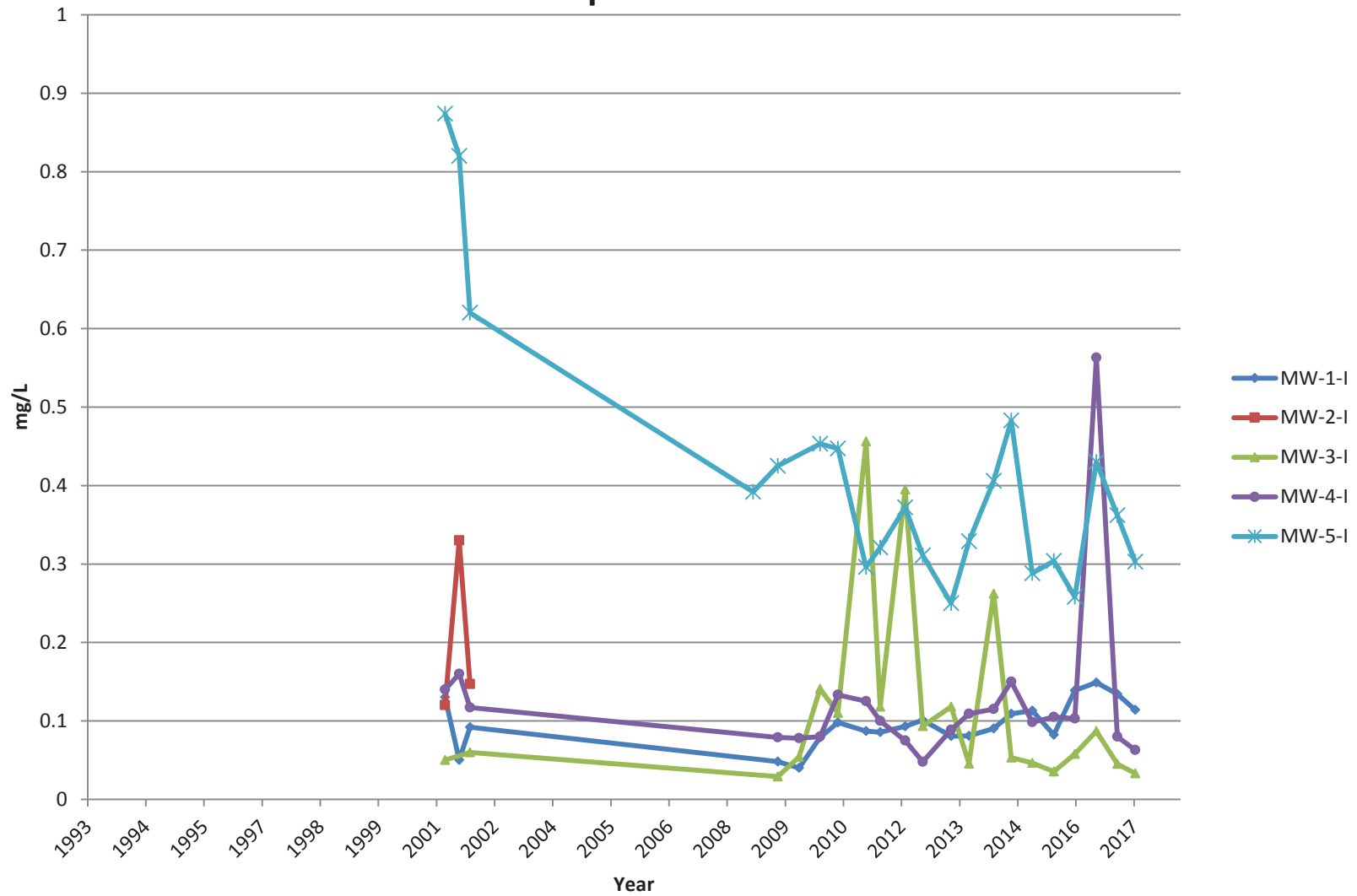
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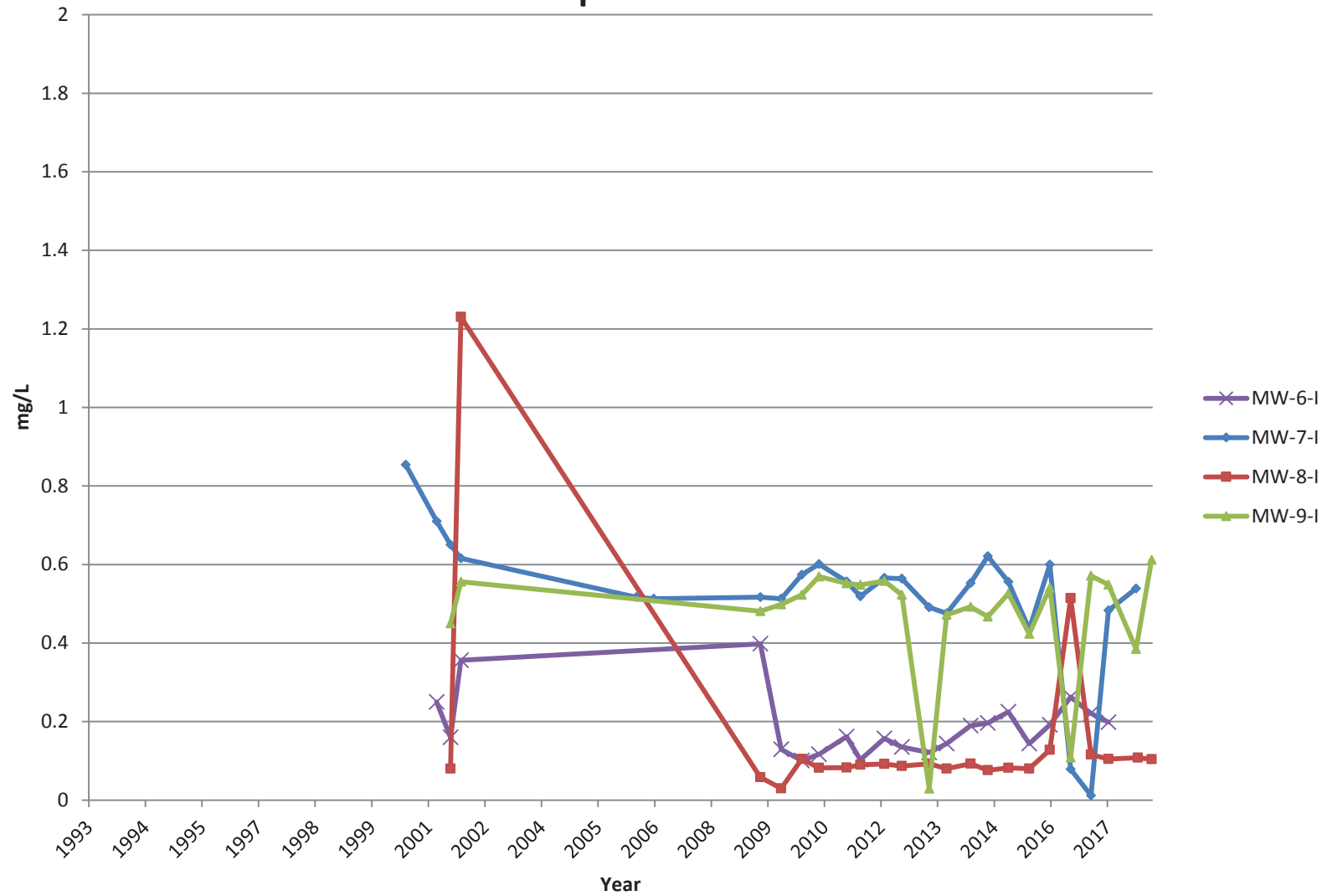
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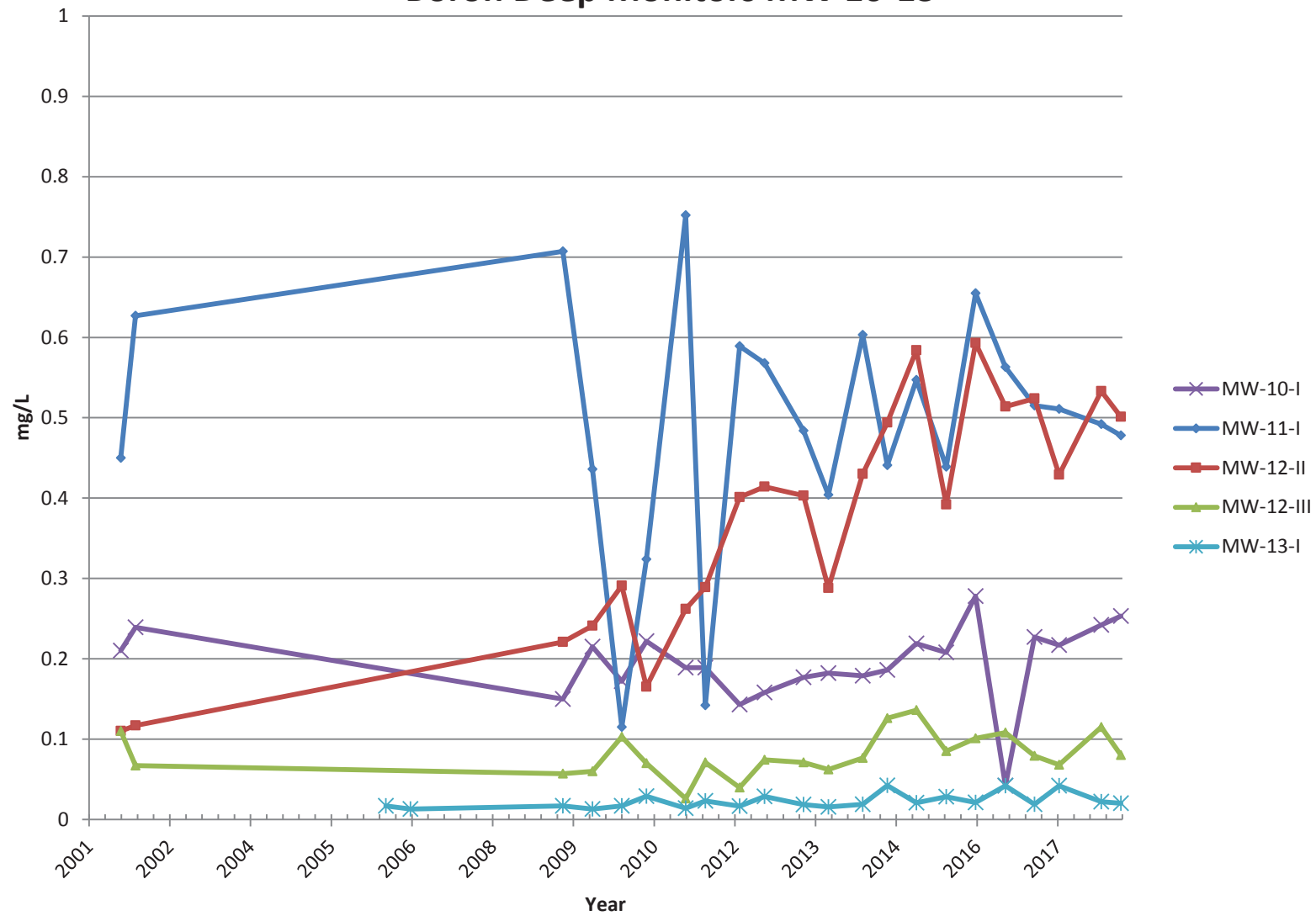
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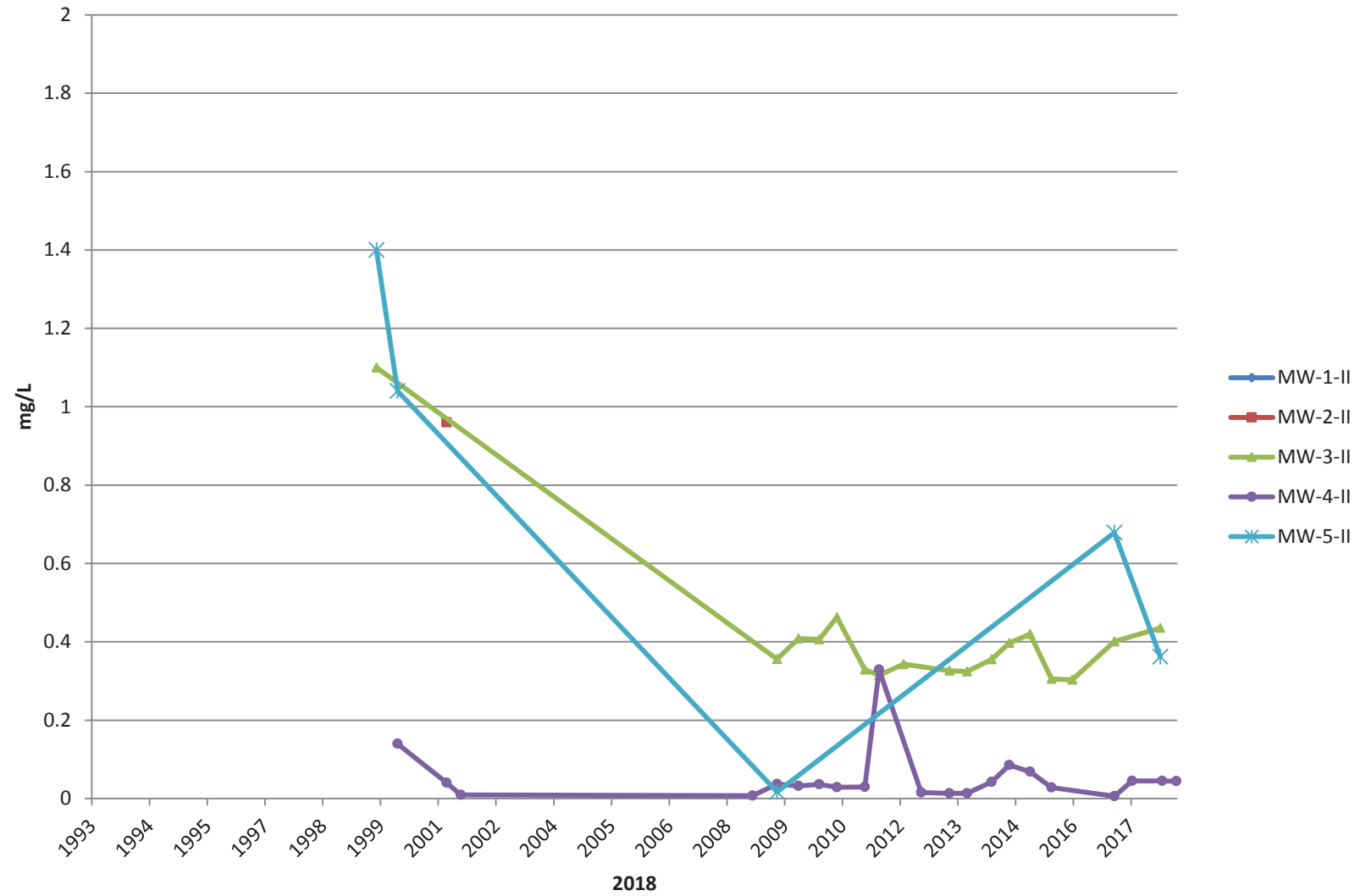
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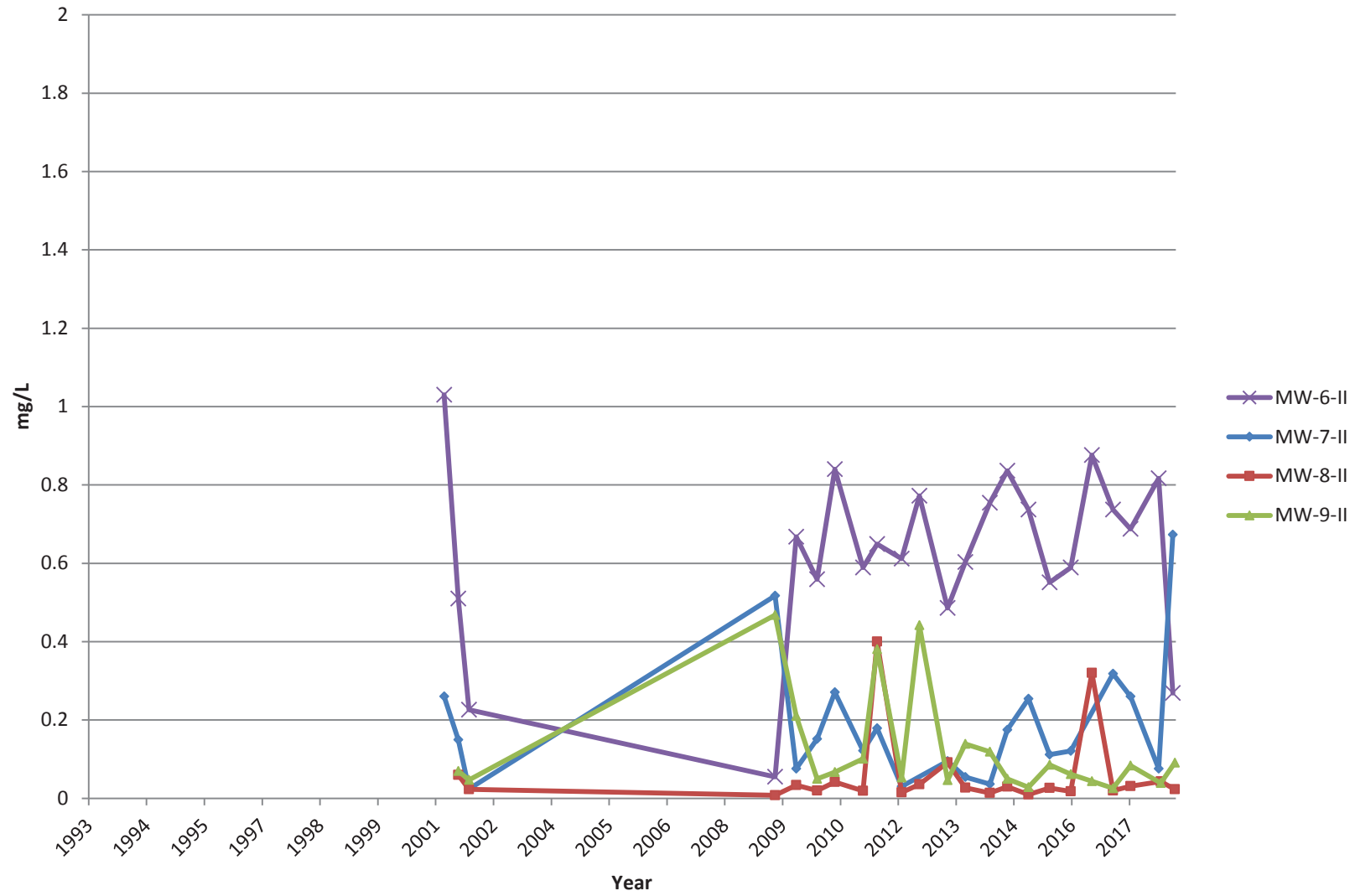
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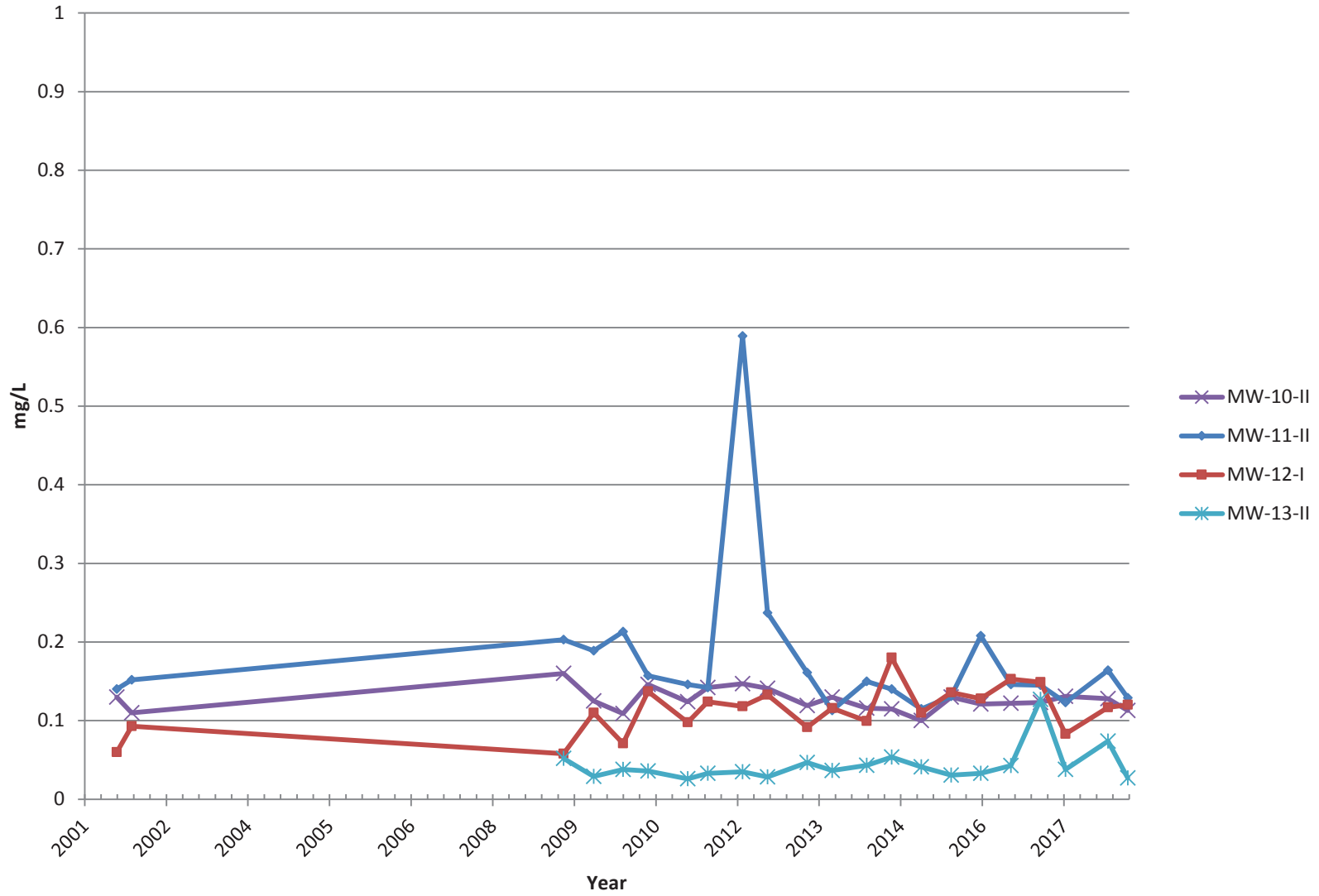
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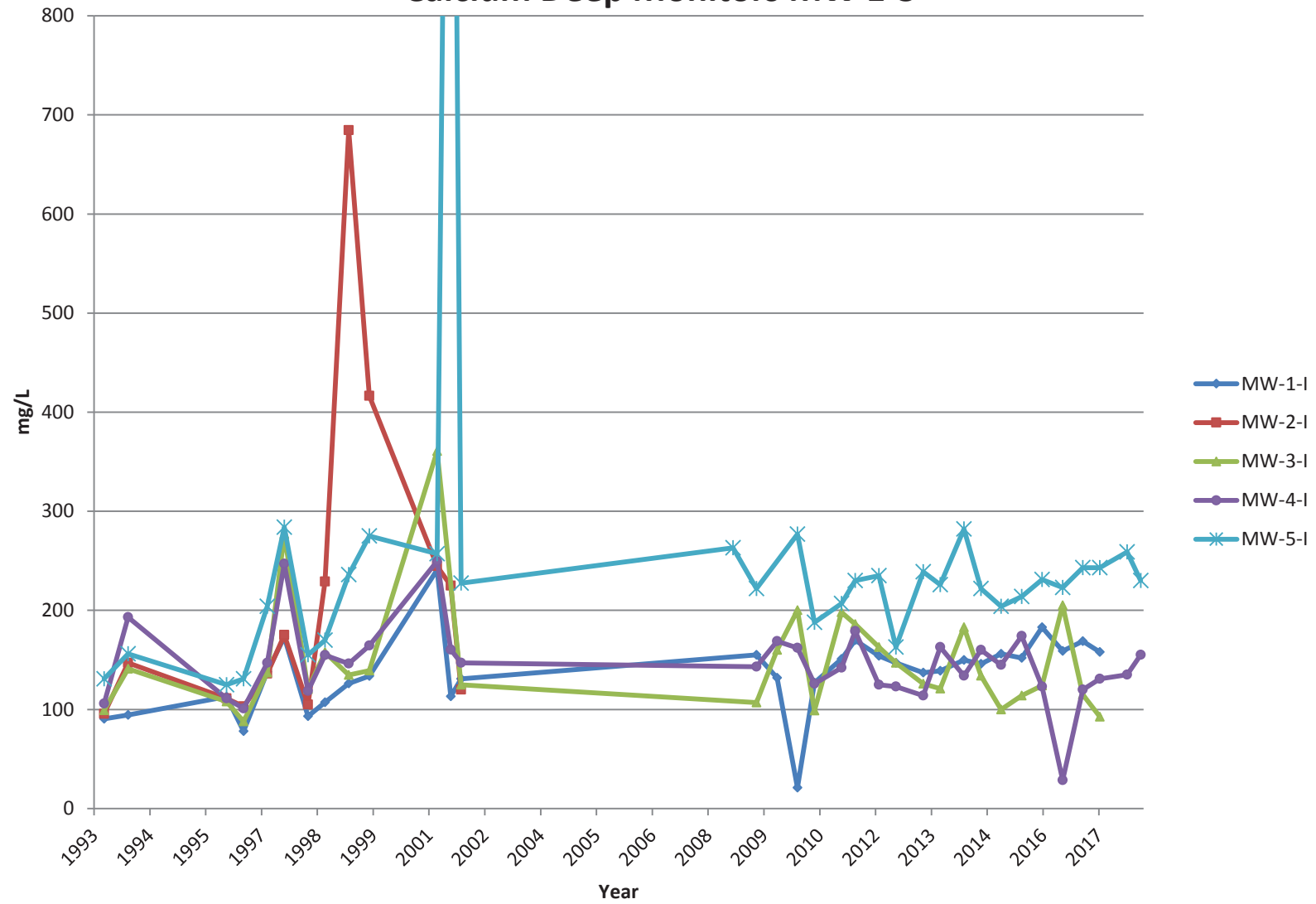
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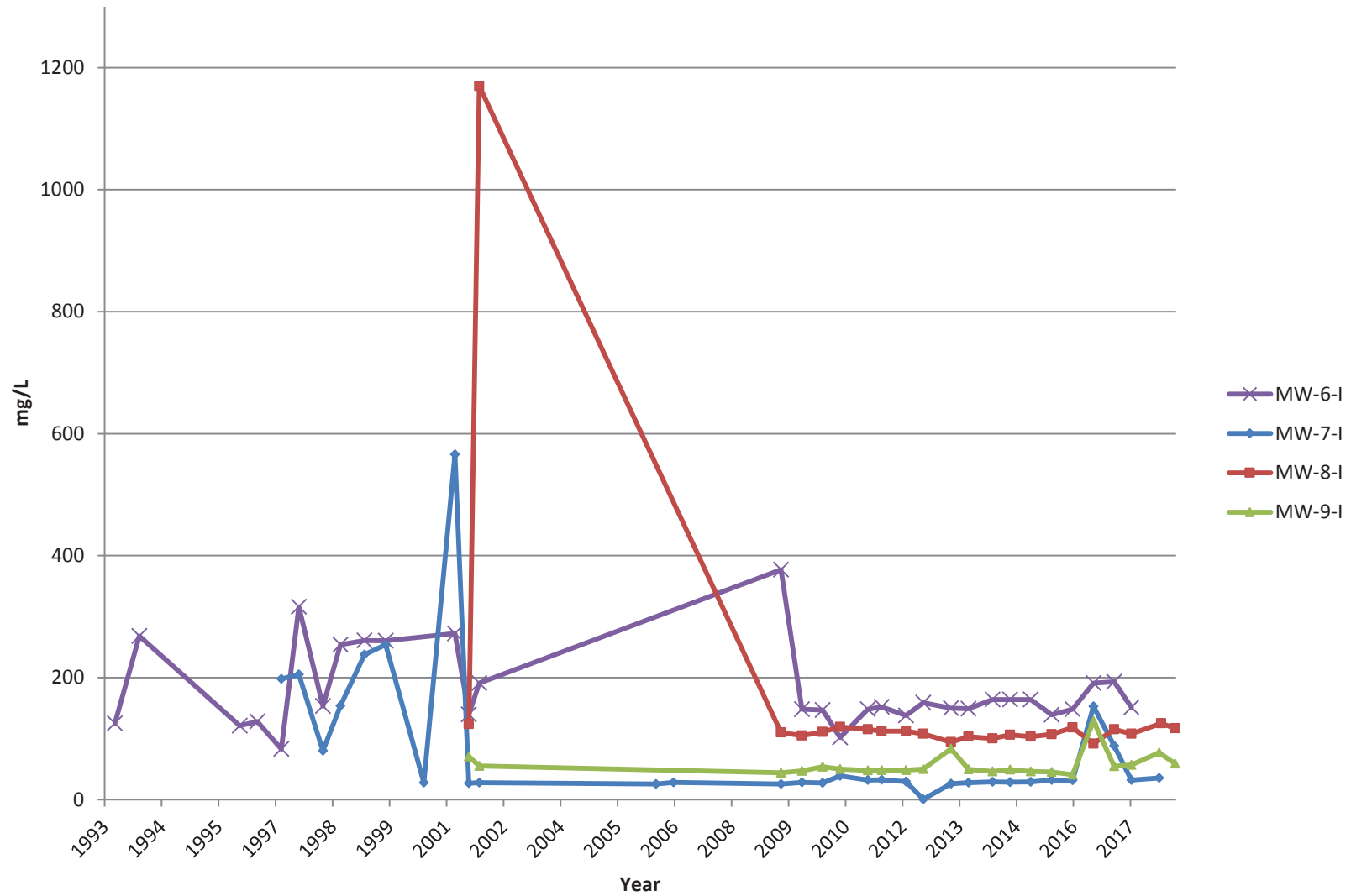
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Calcium Deep Monitors MW 1-5



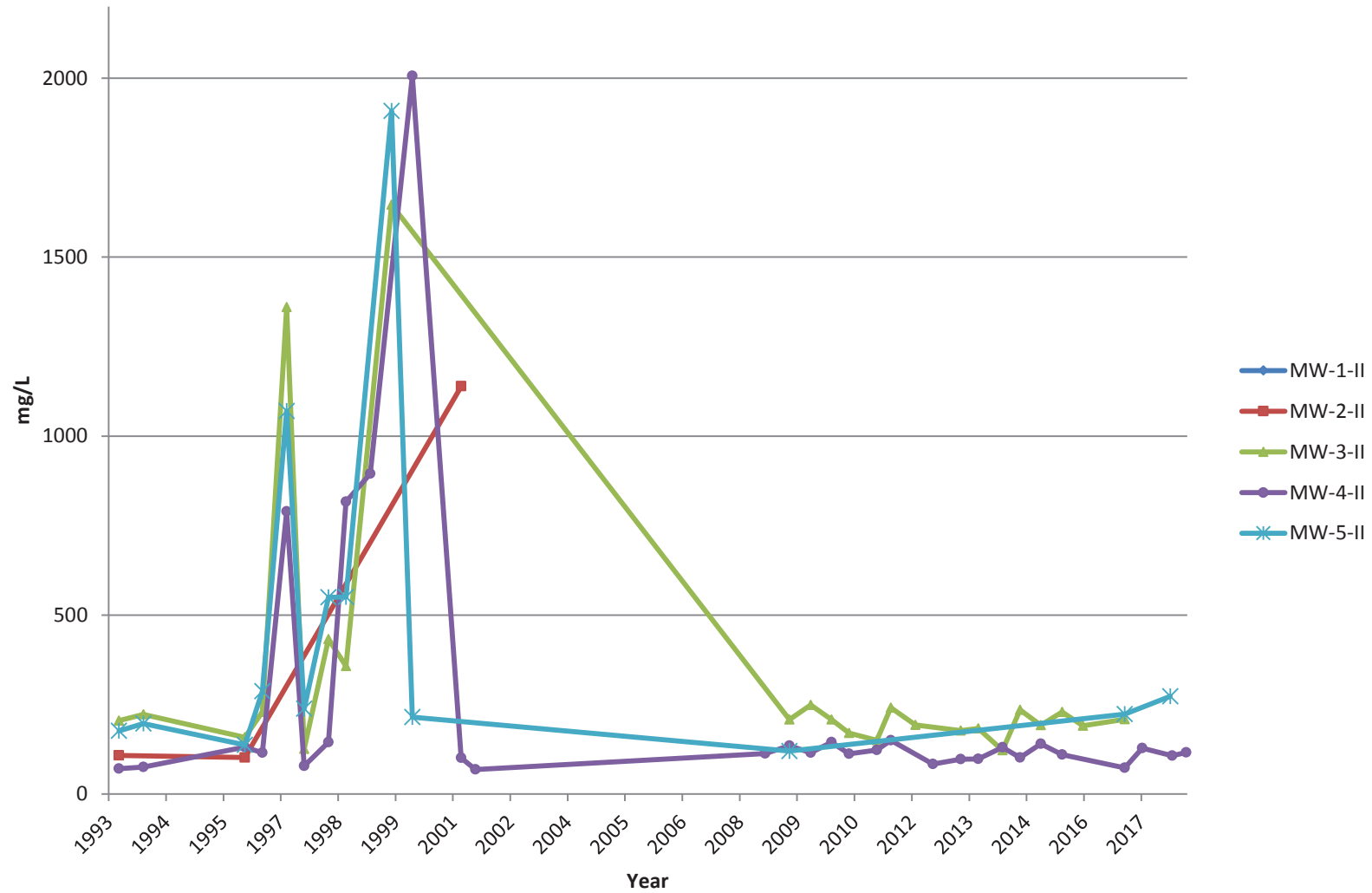
Calcium Deep Monitors MW 6-9



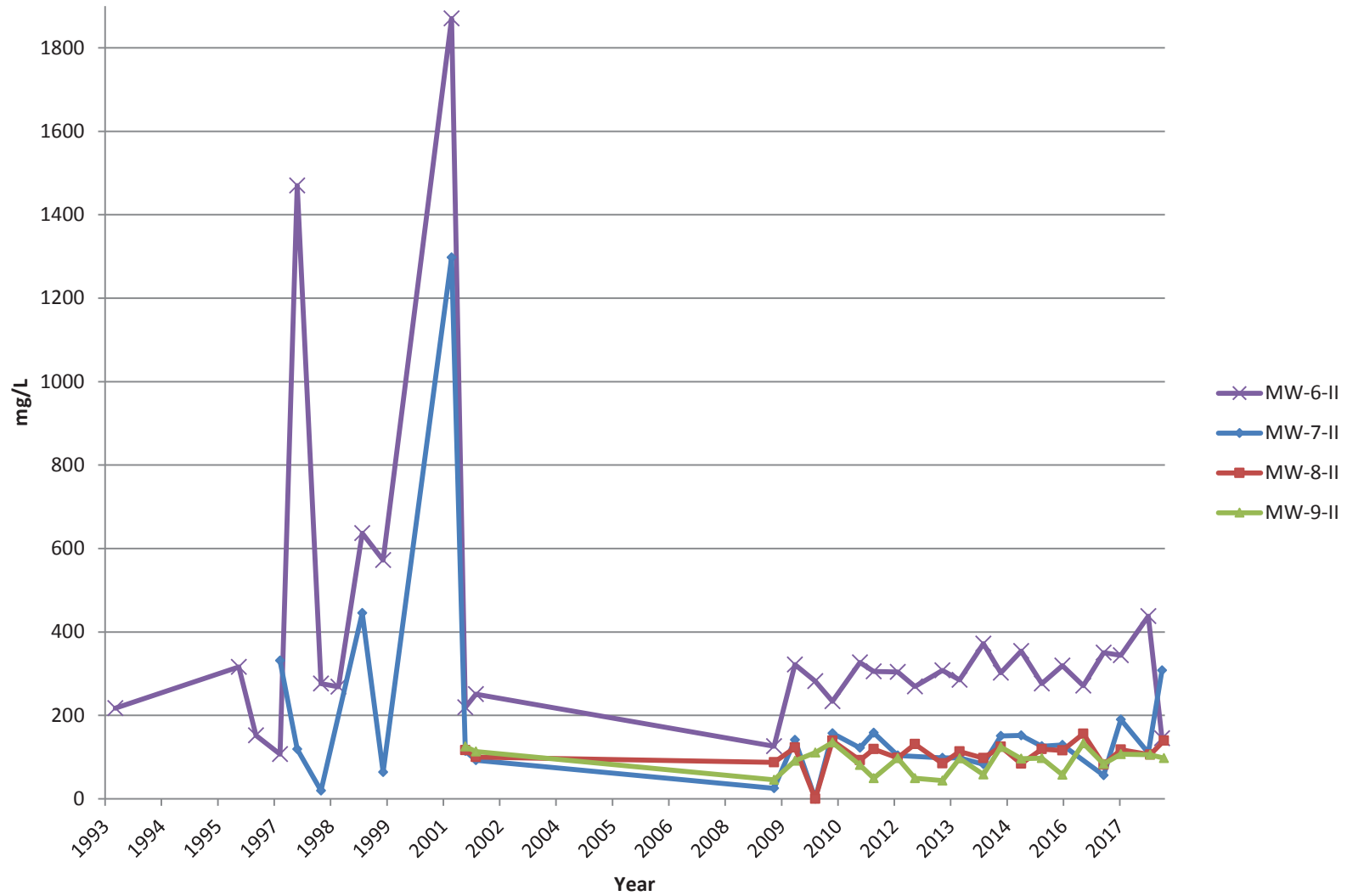
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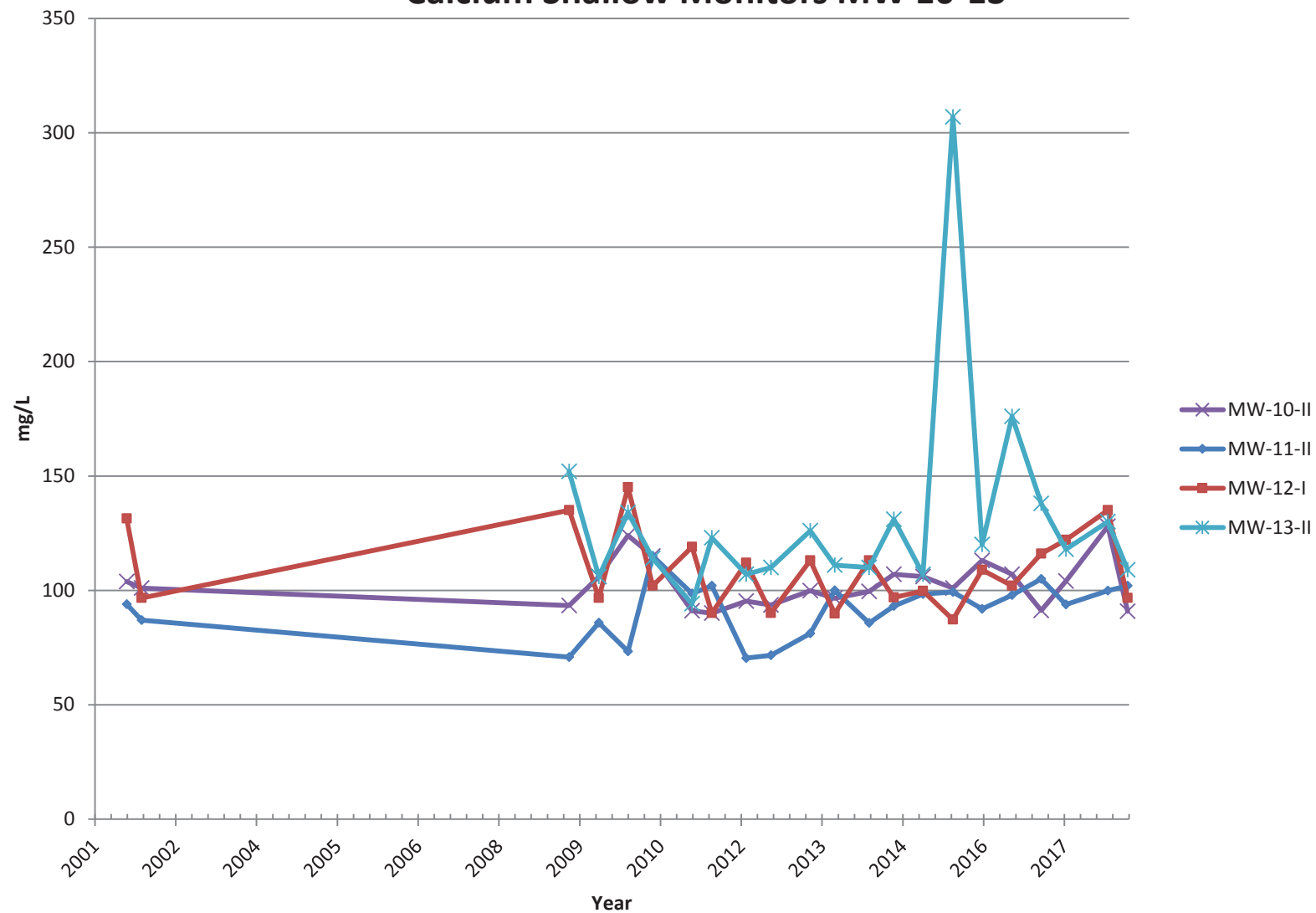
Calcium Shallow Monitors MW 1-5



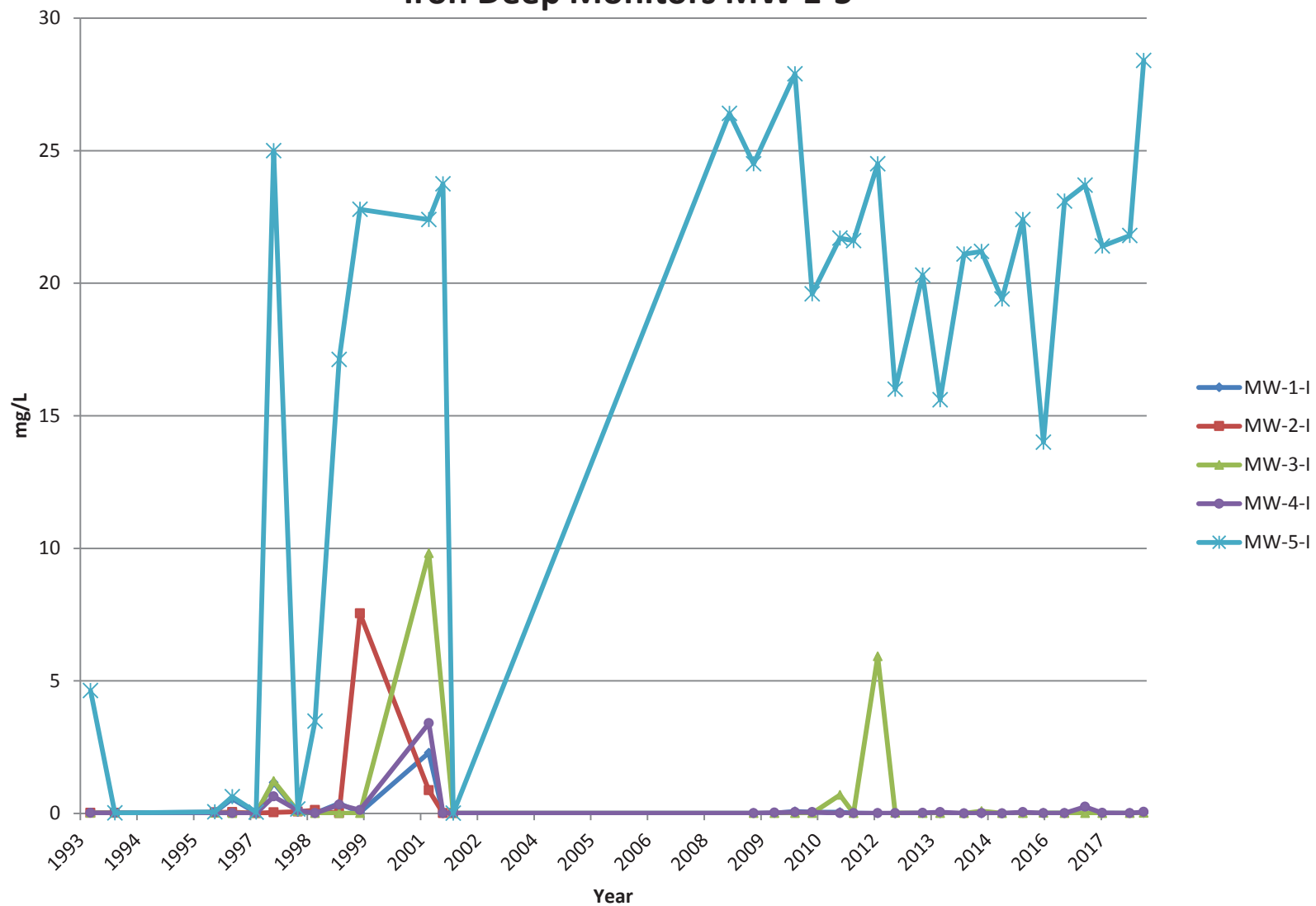
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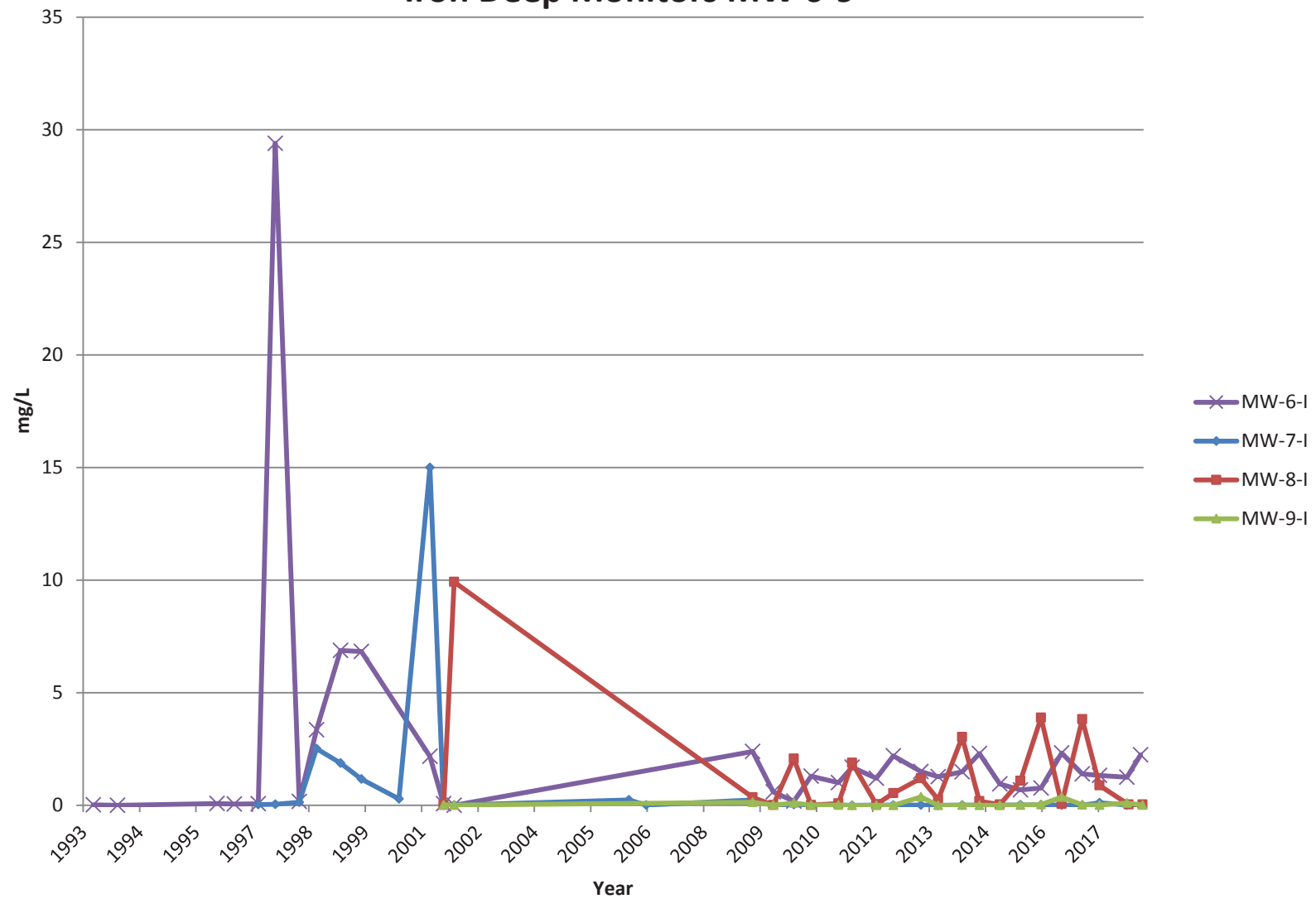
Calcium Shallow Monitors MW 10-13



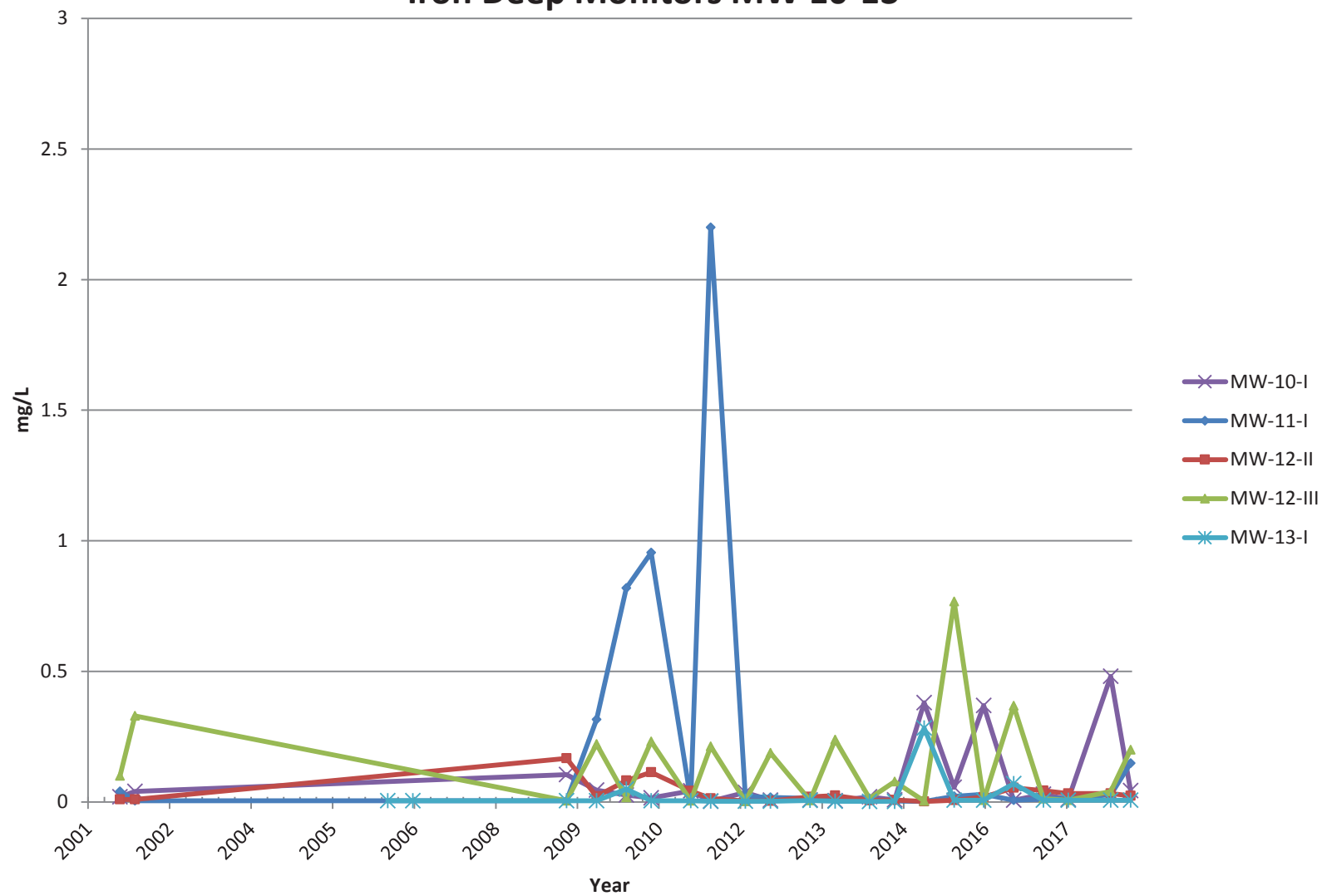
Iron Deep Monitors MW 1-5



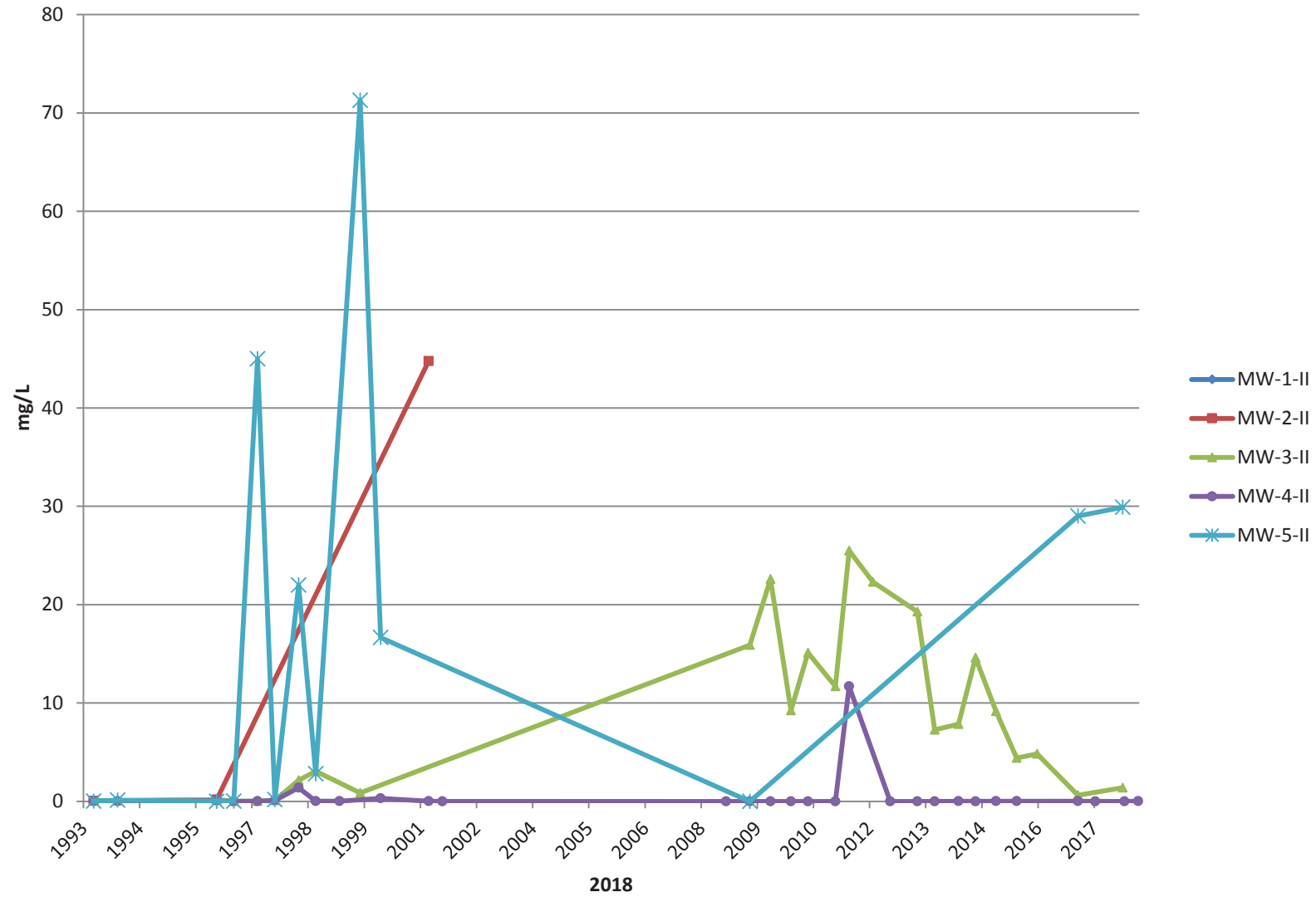
Iron Deep Monitors MW 6-9



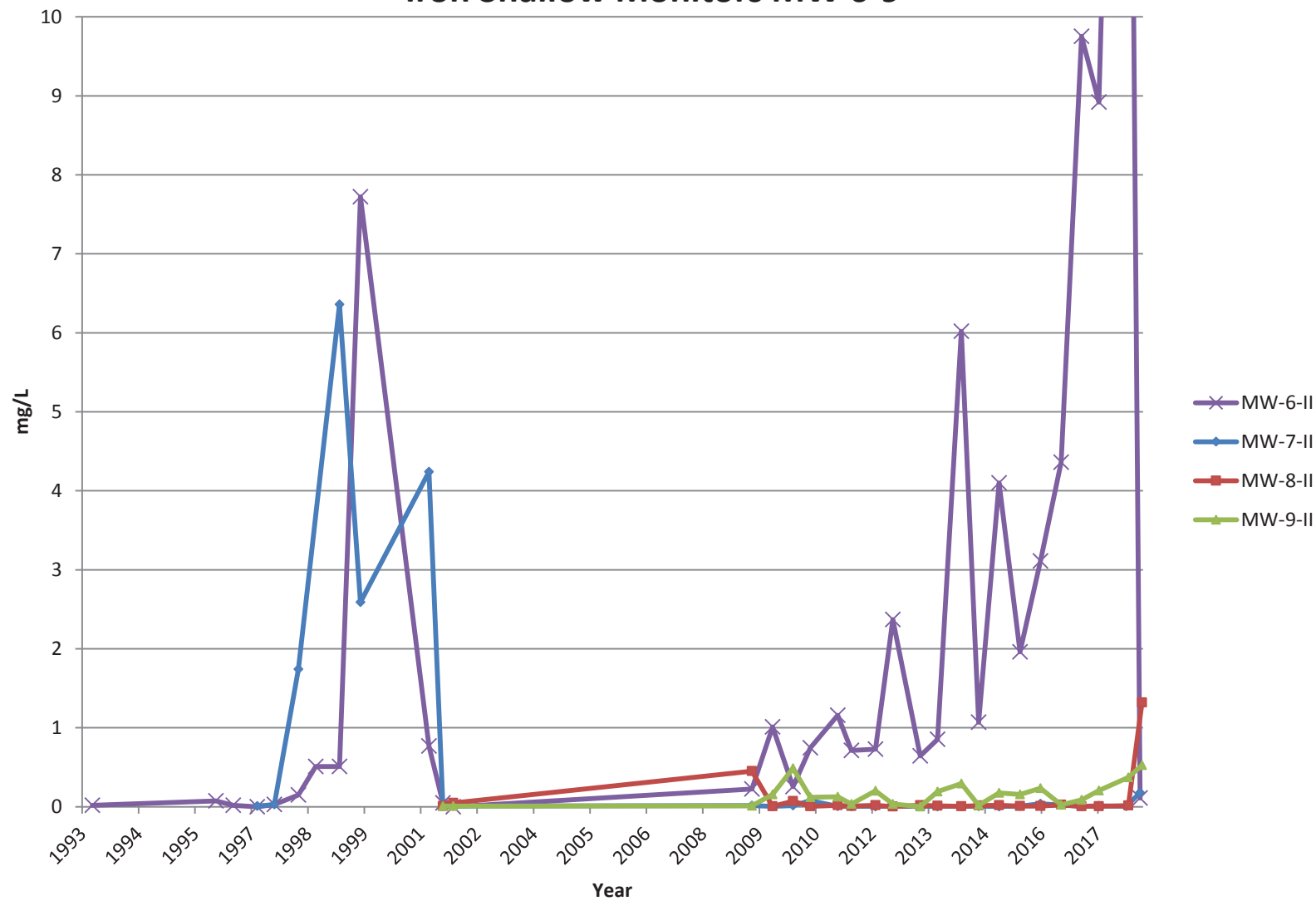
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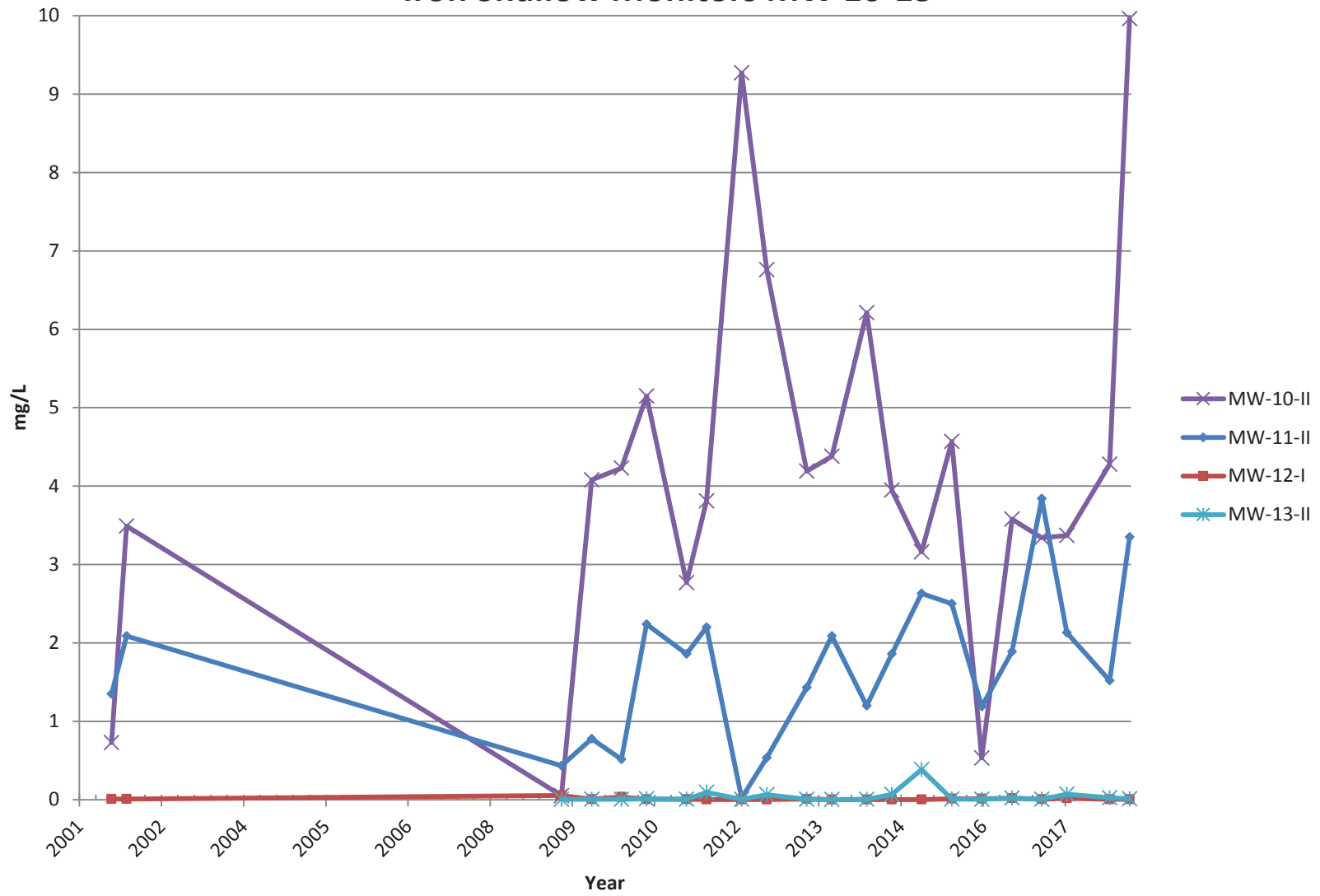
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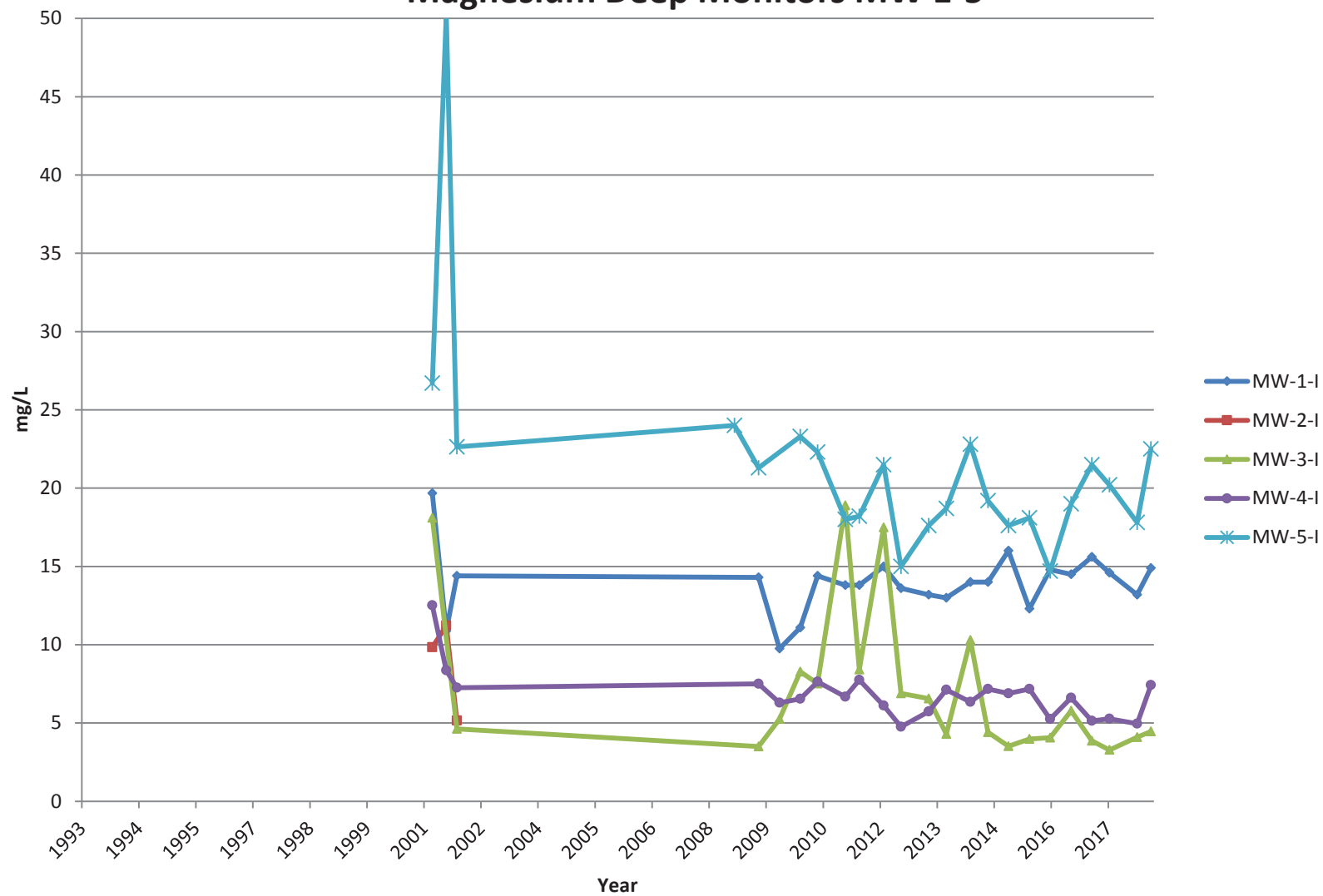
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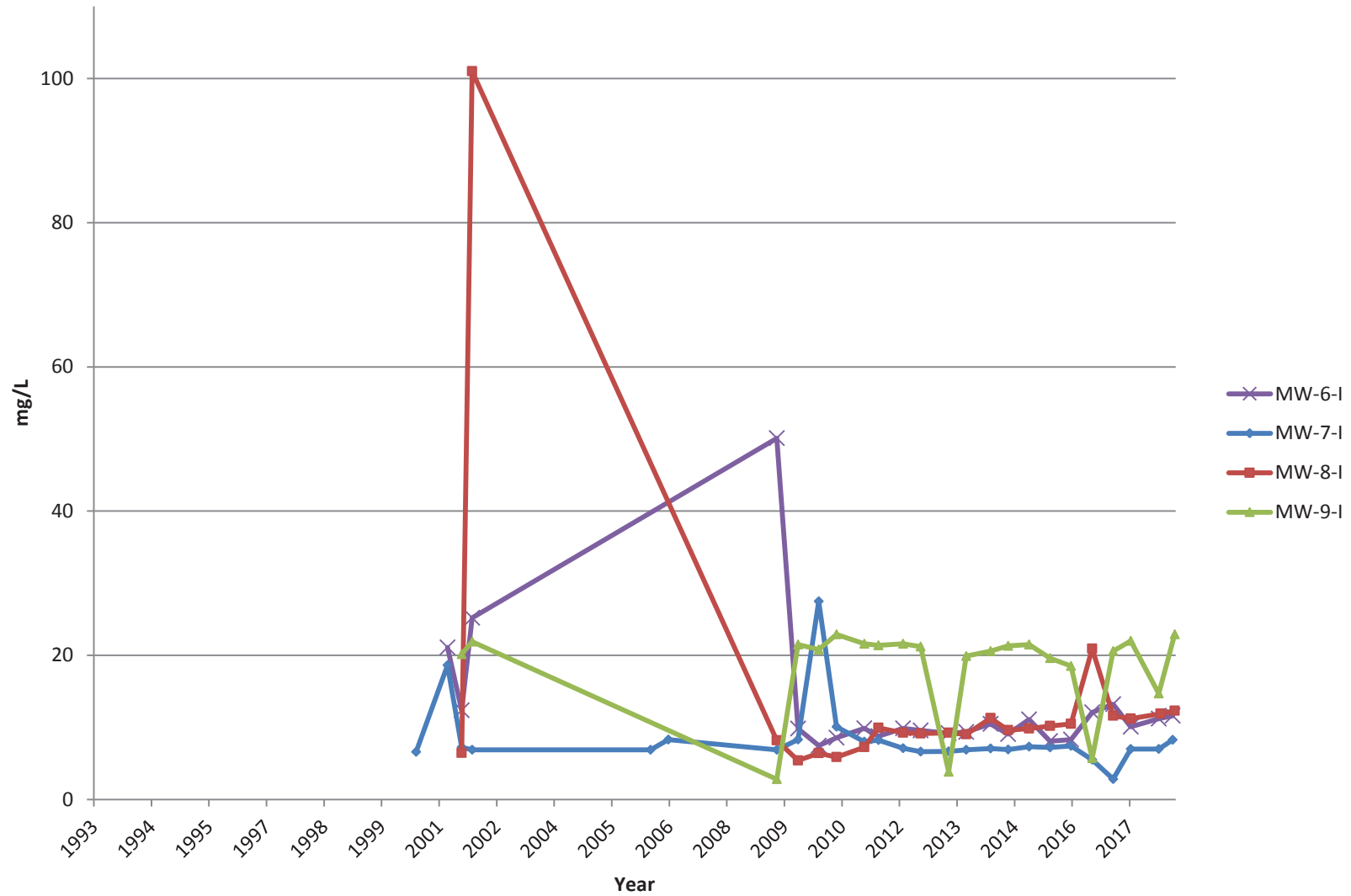
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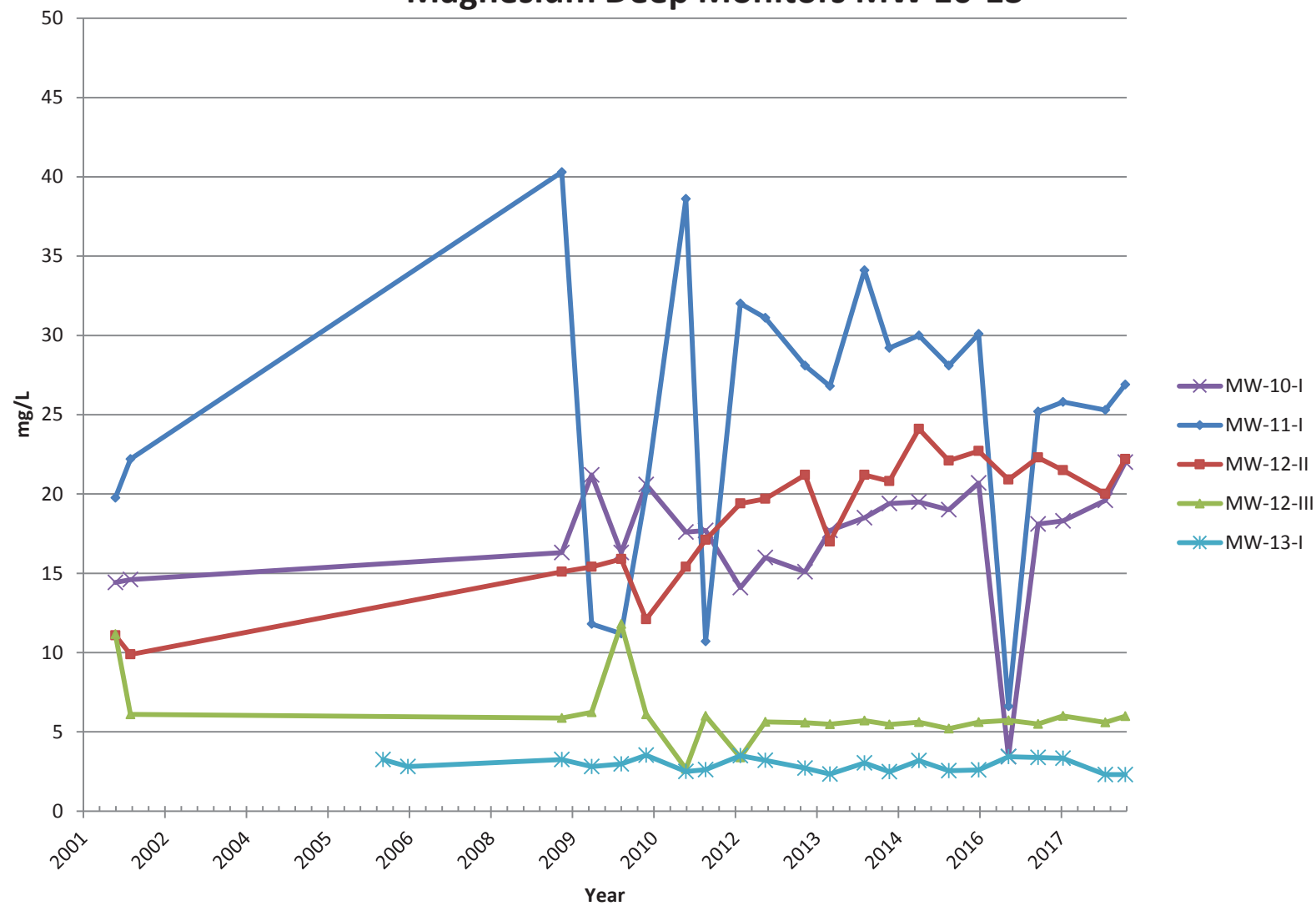
Magnesium Deep Monitors MW 1-5



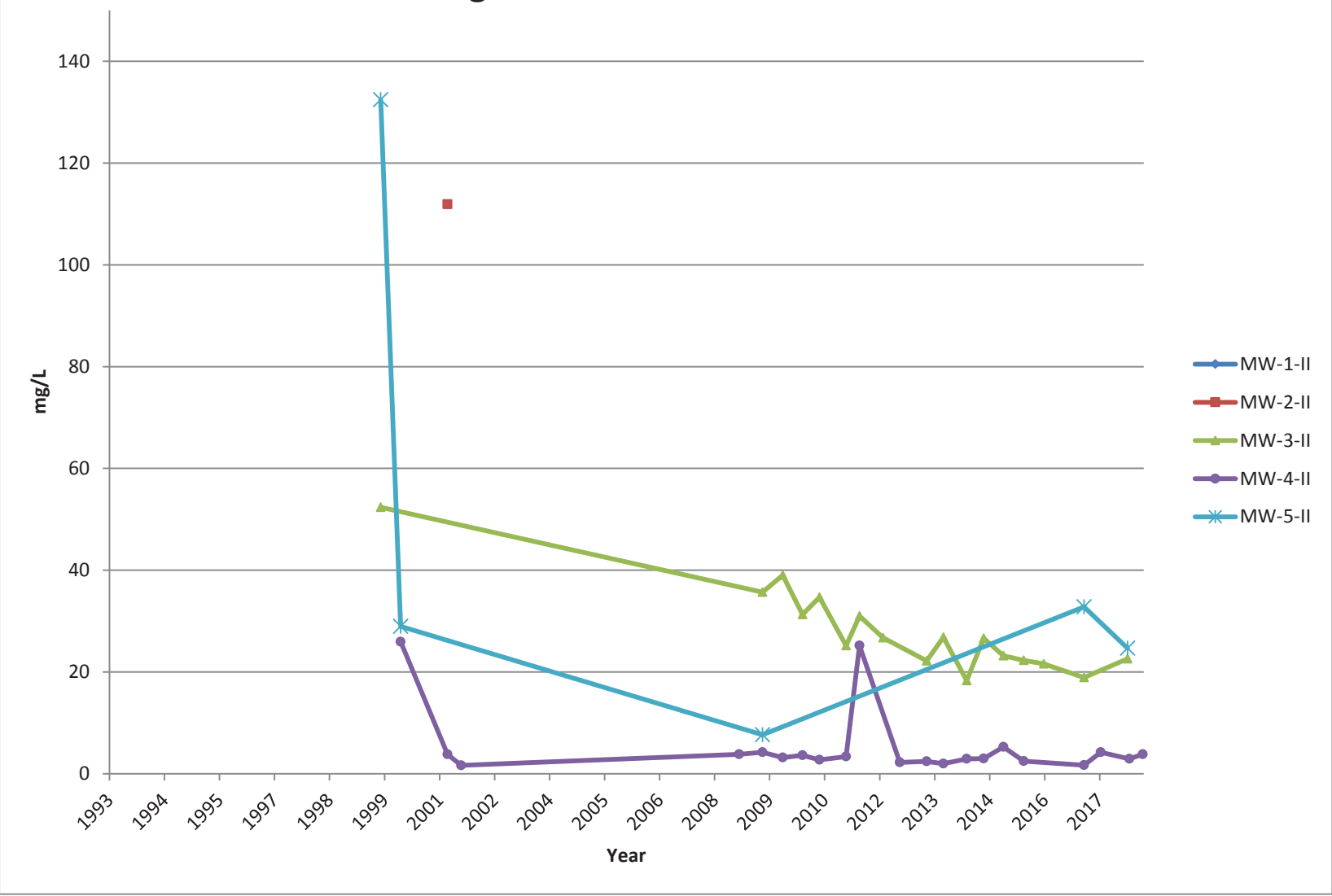
Magnesium Deep Monitors MW 6-9



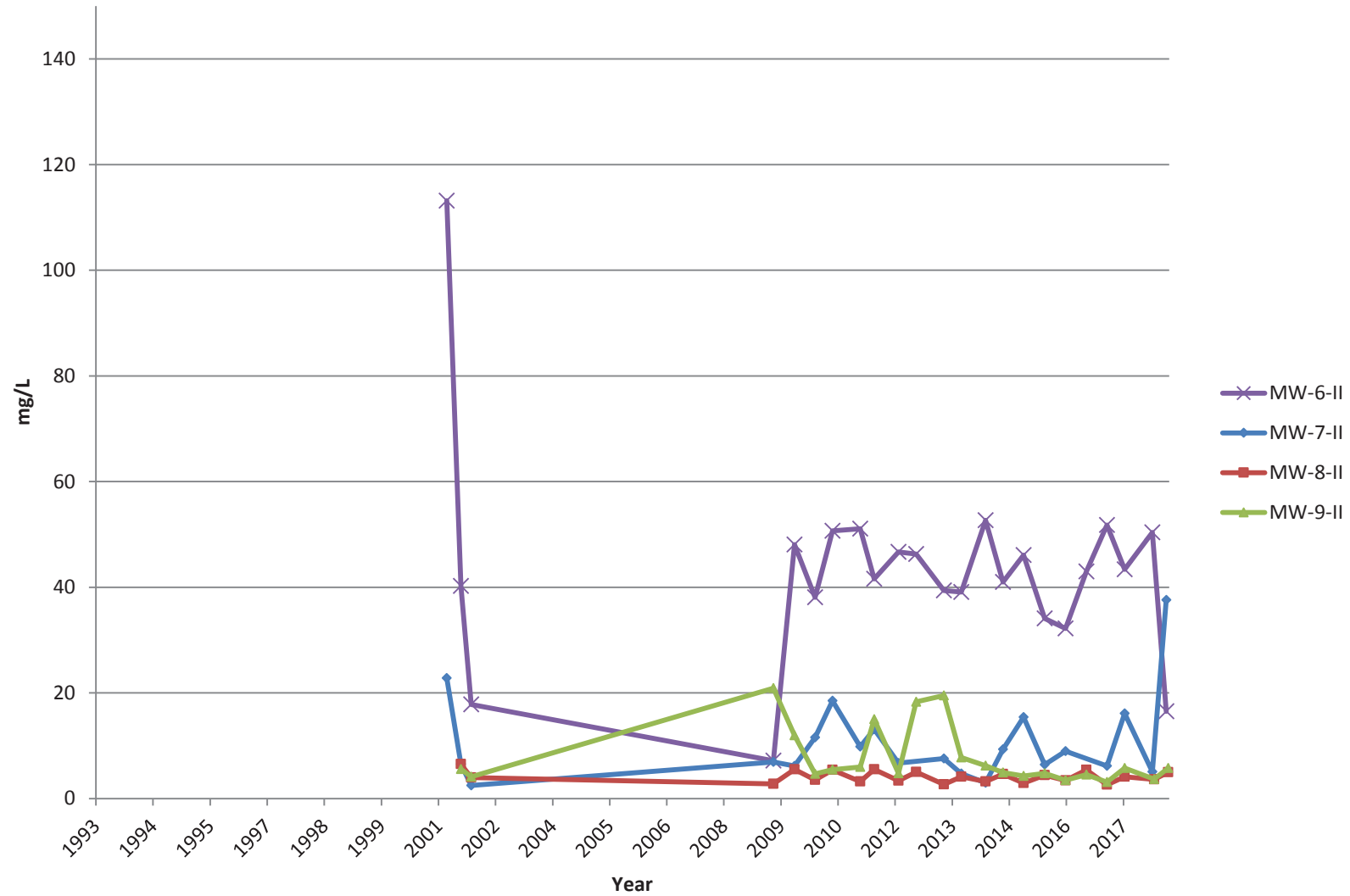
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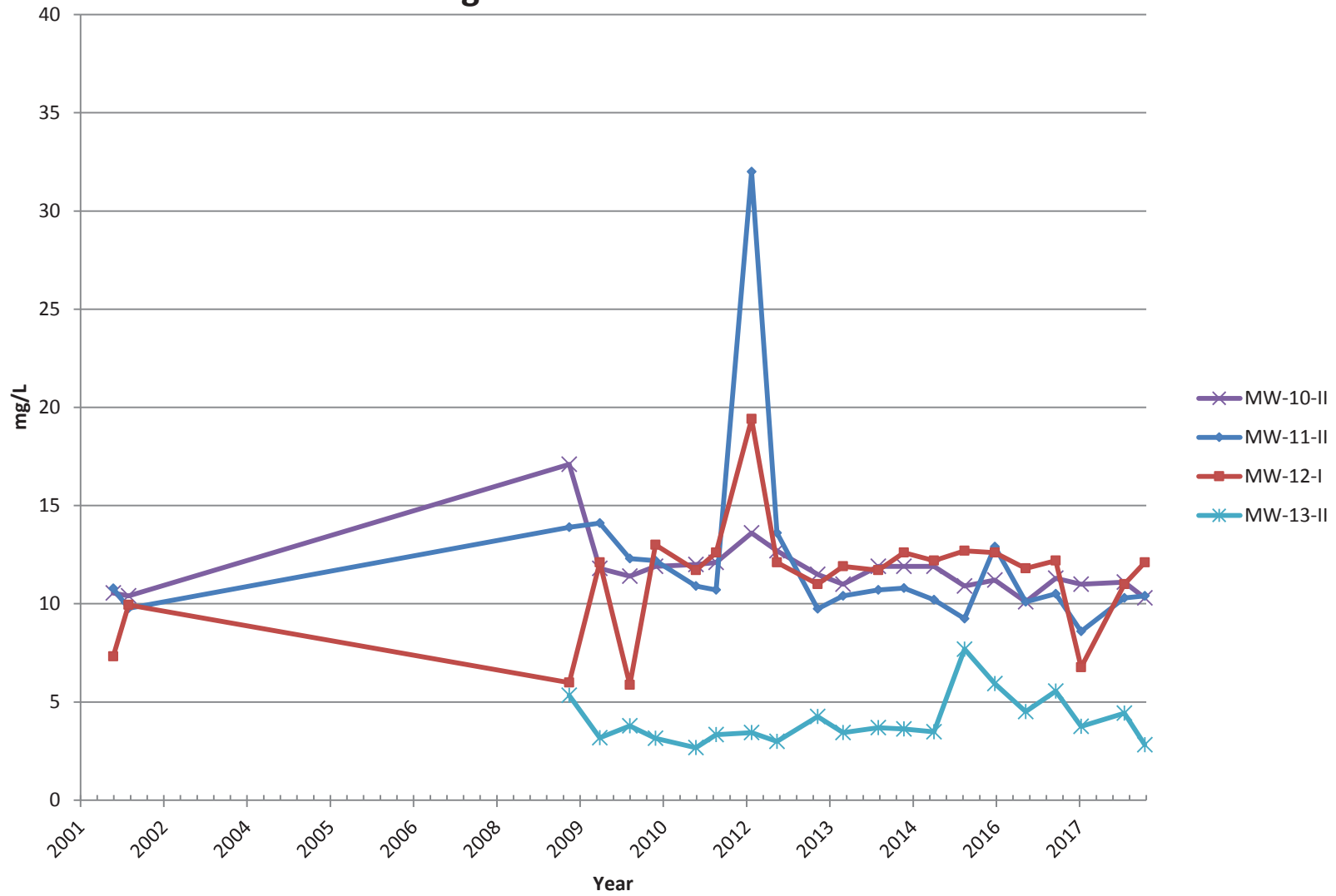
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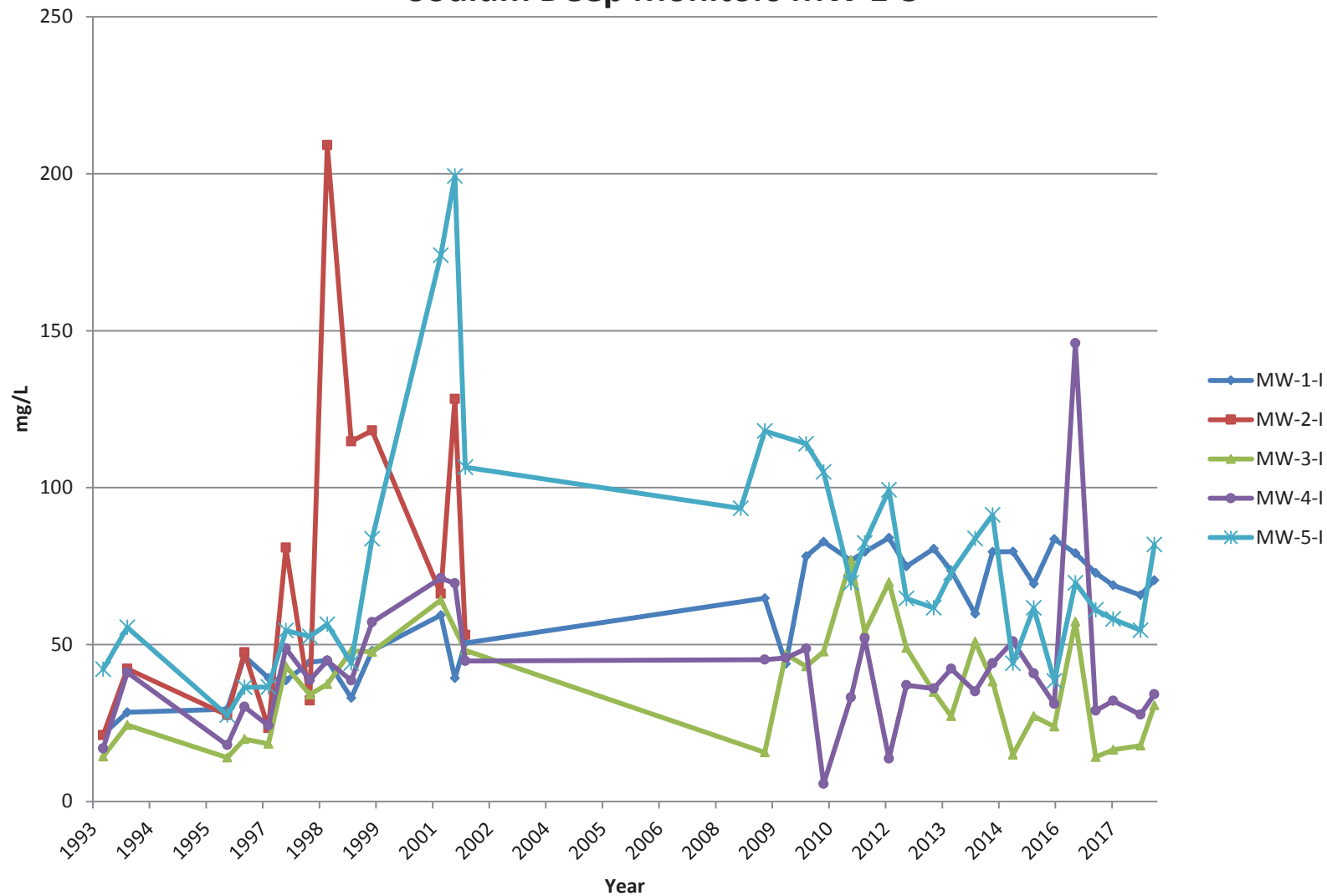
Magnesium Shallow Monitors MW 6-9



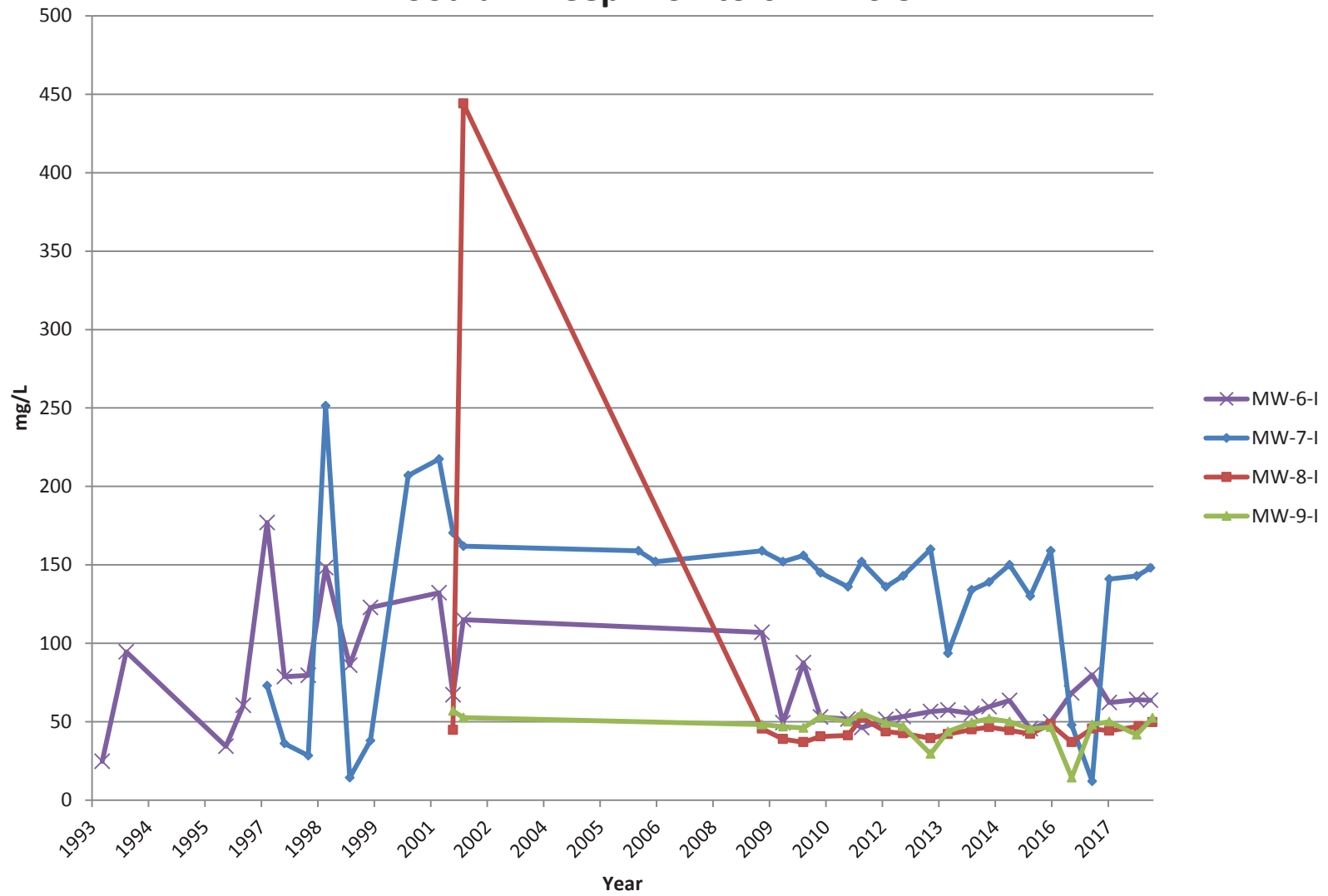
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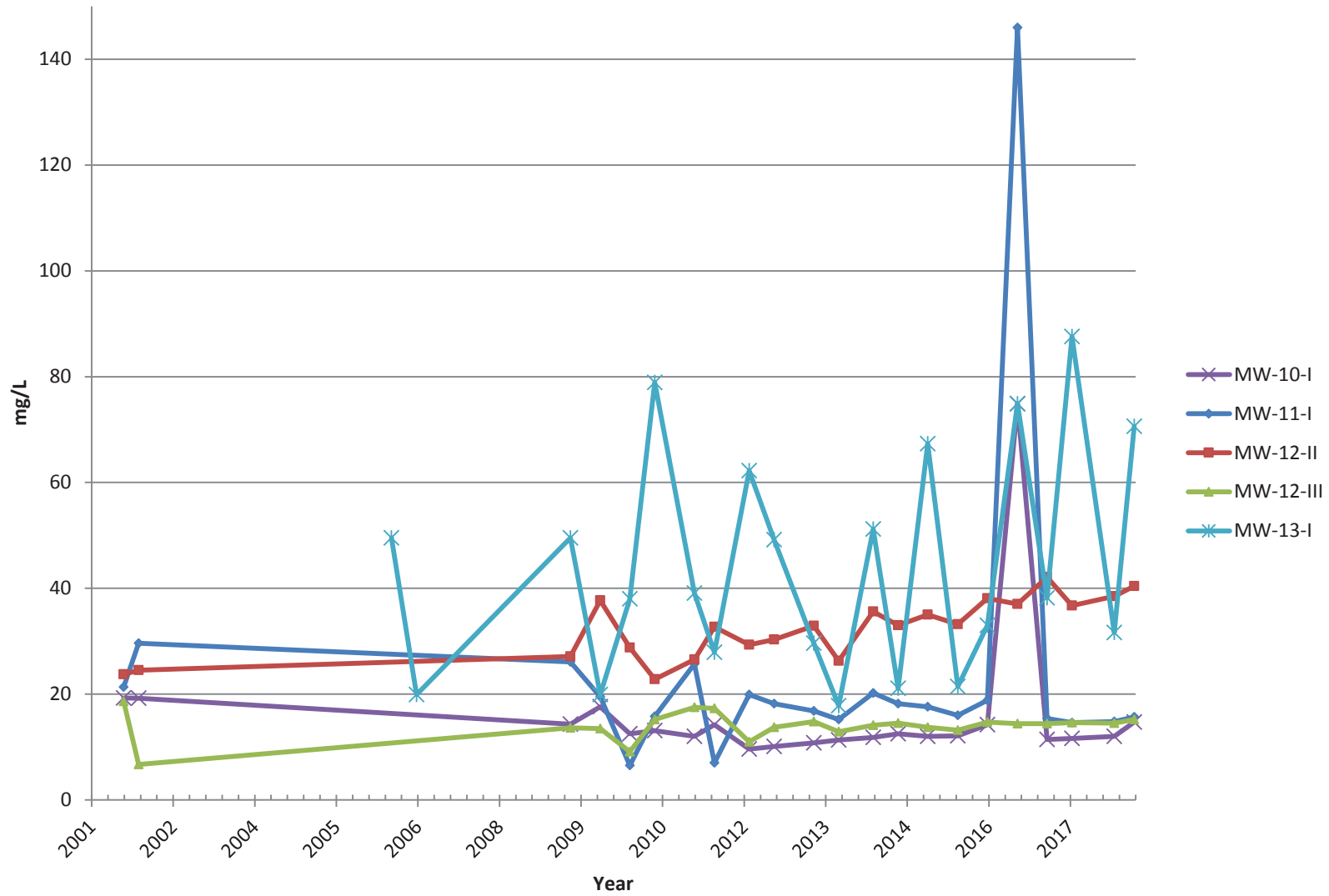
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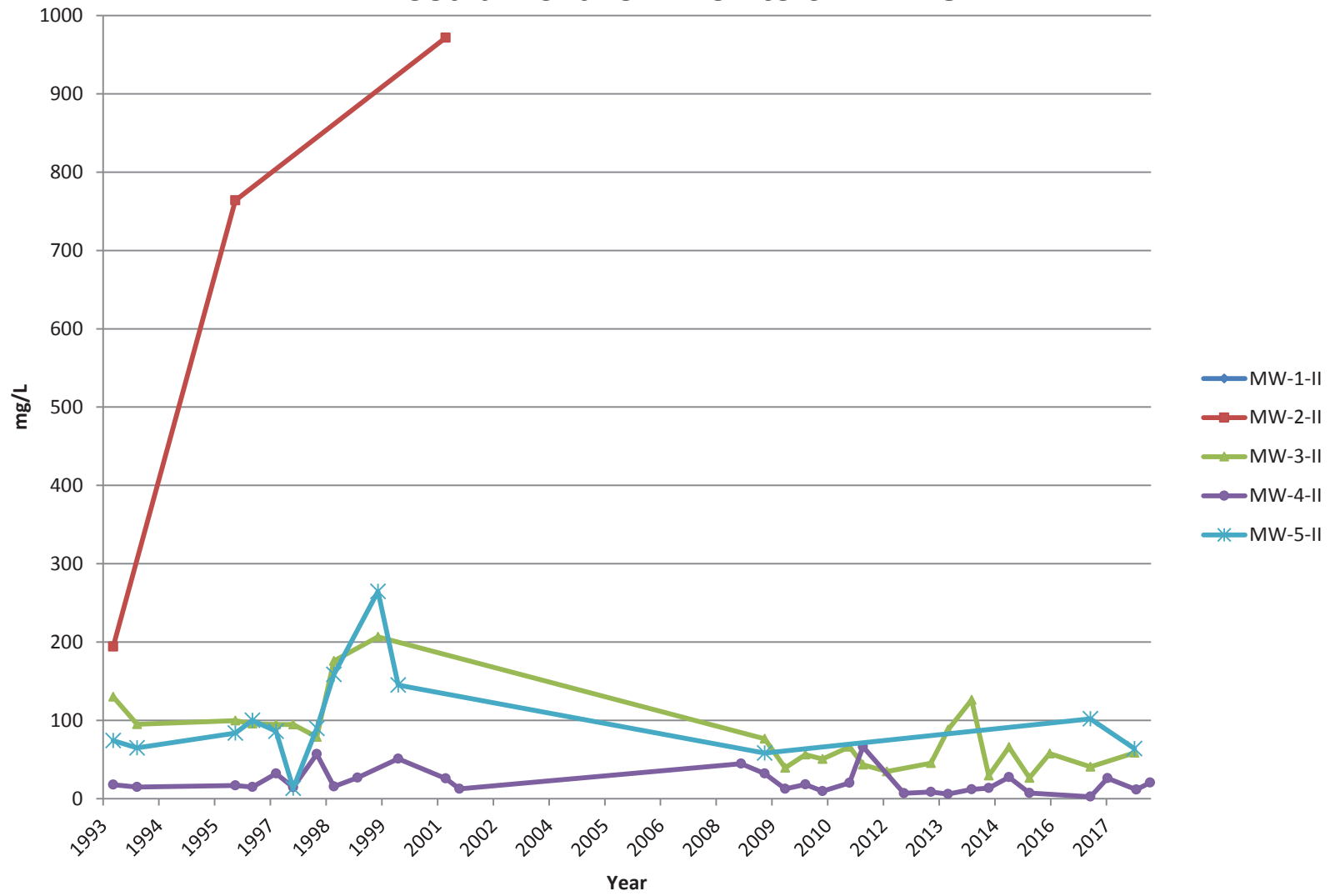
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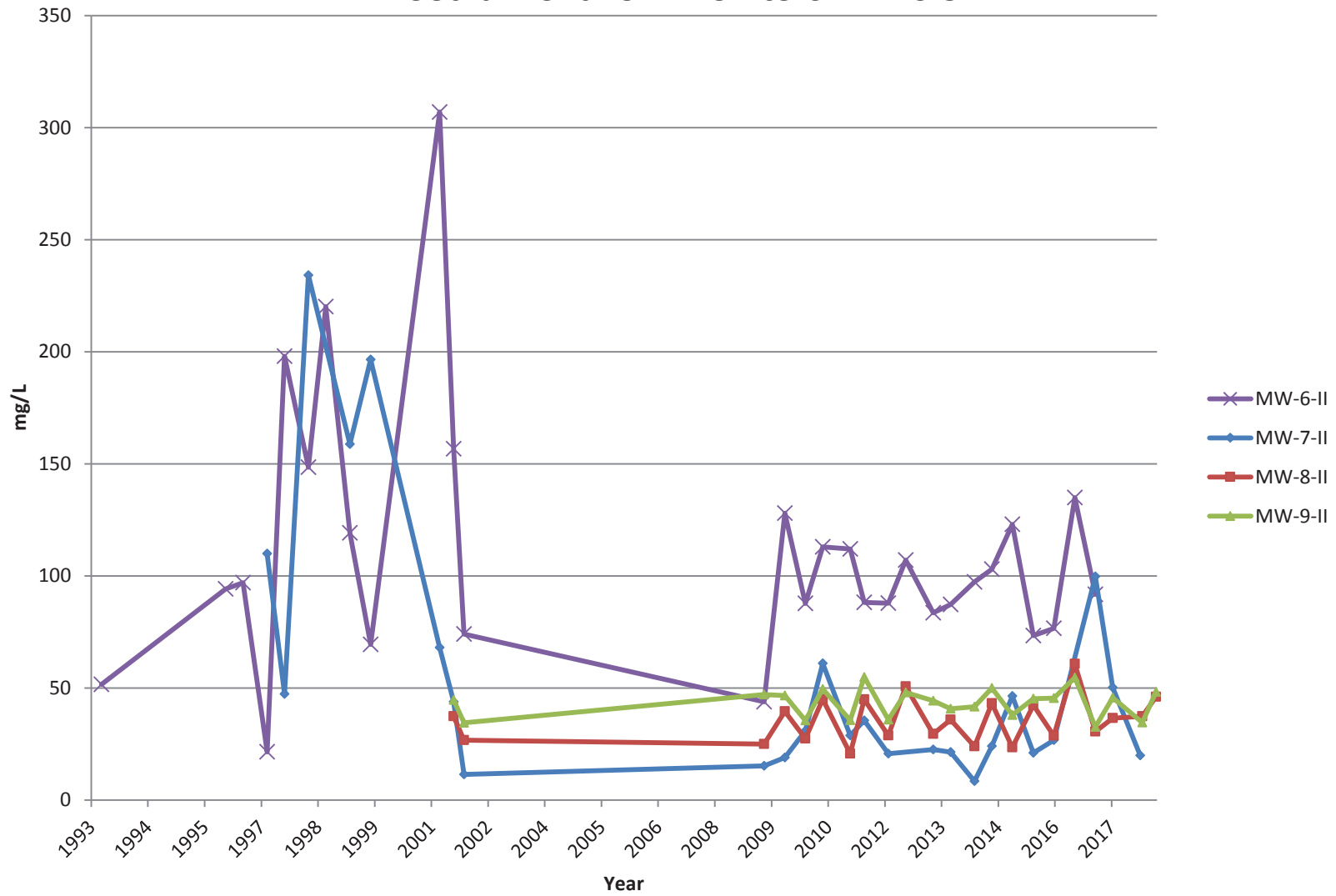
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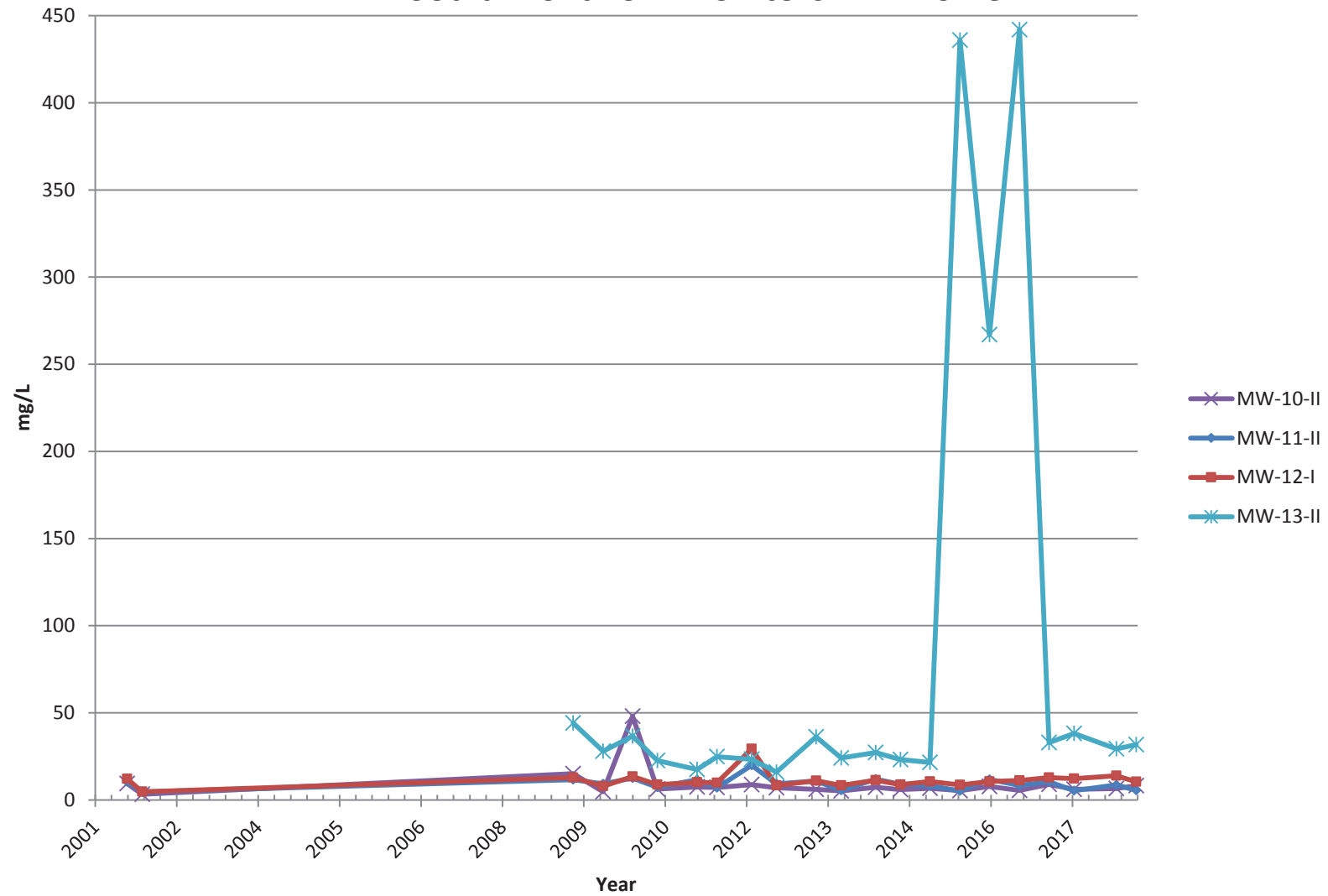
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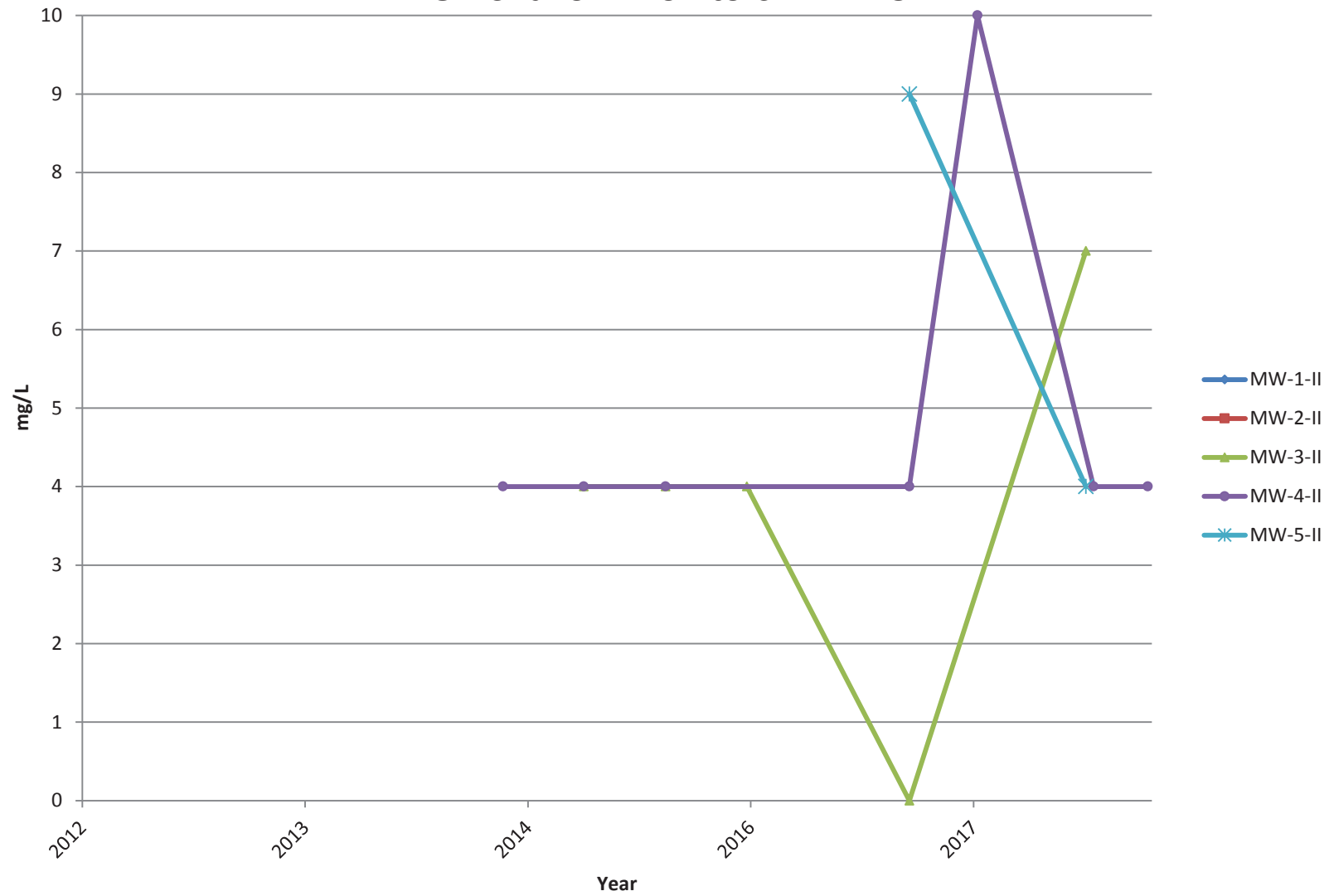
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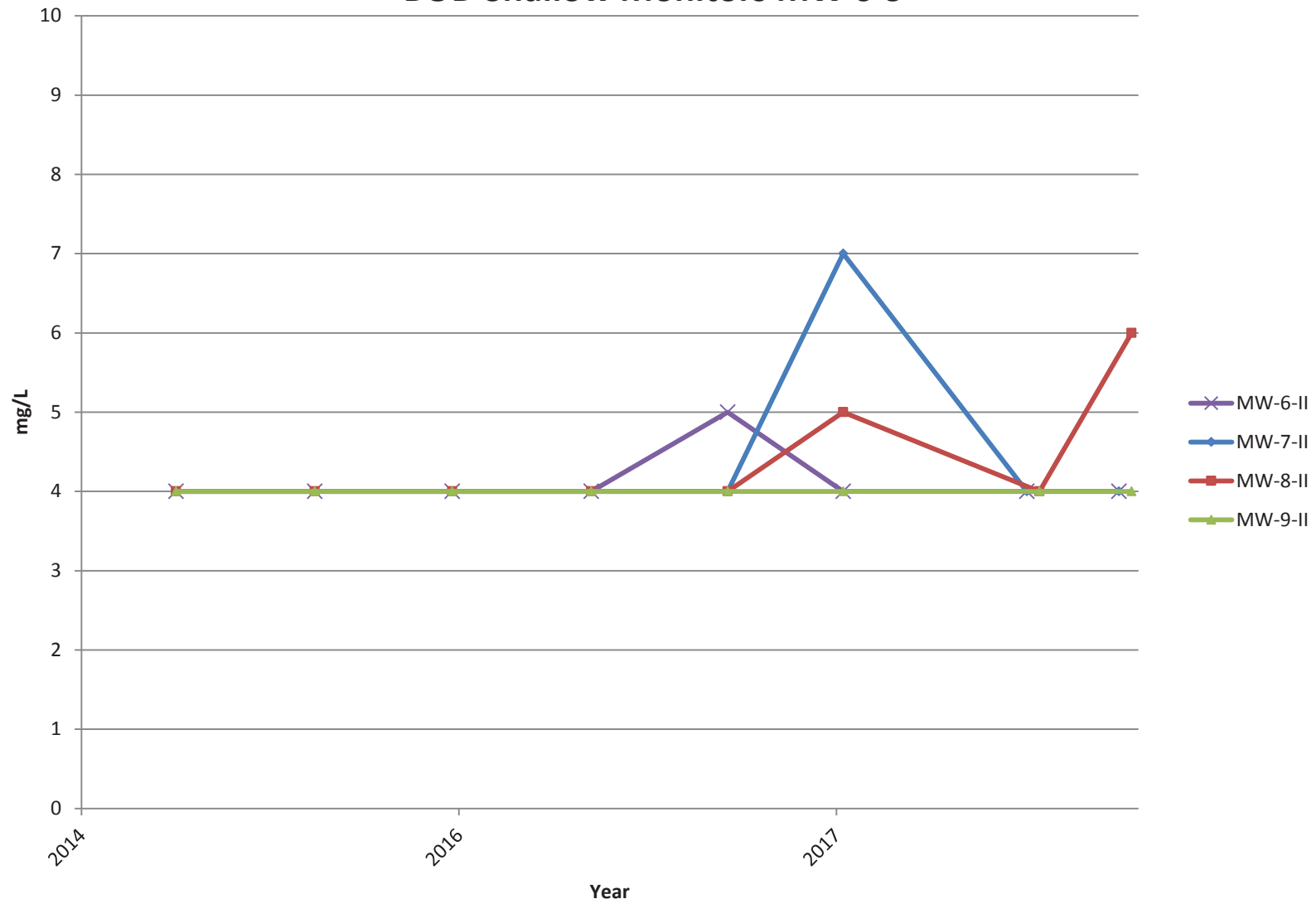
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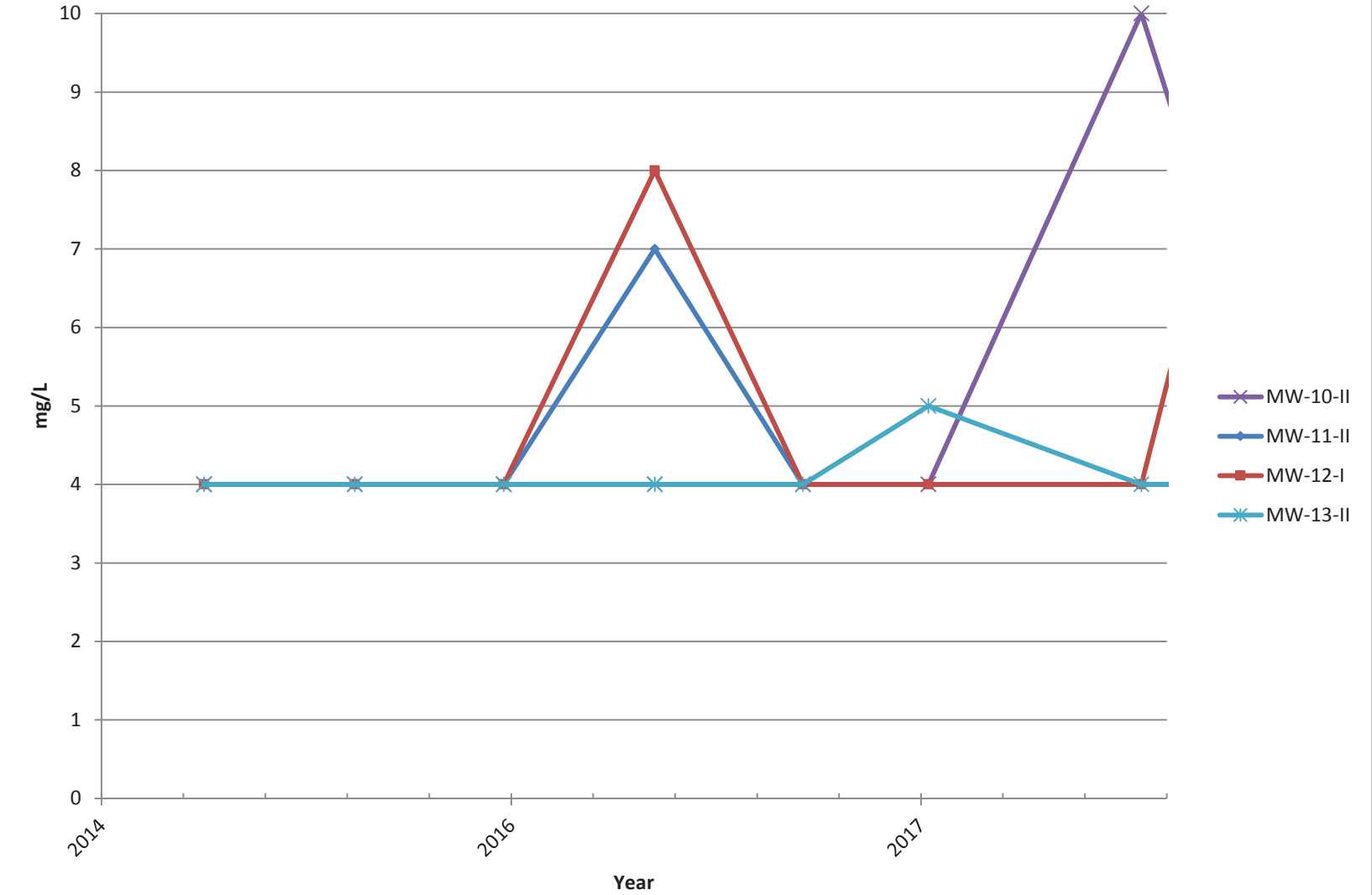
BOD Shallow Monitors MW 1-5



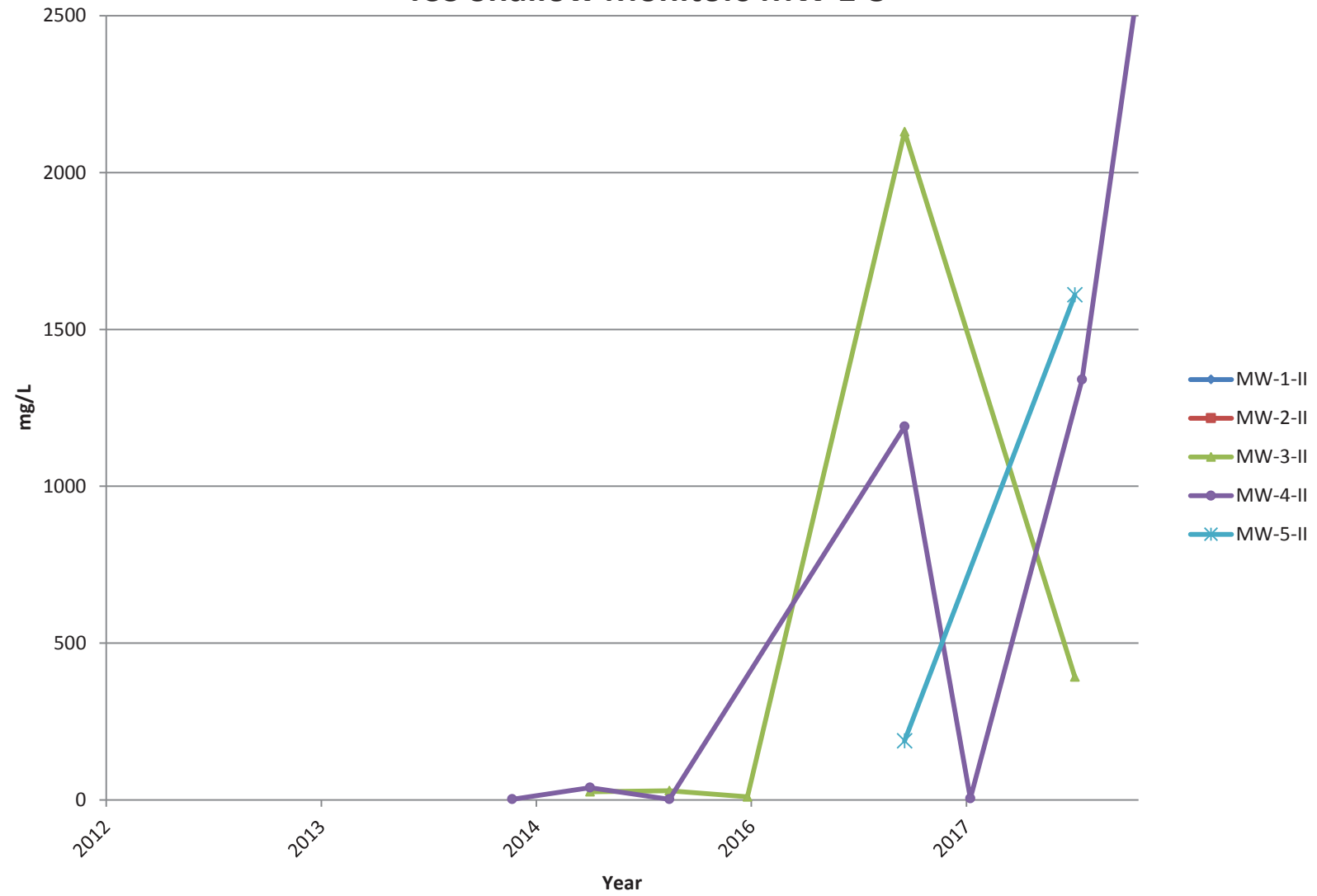
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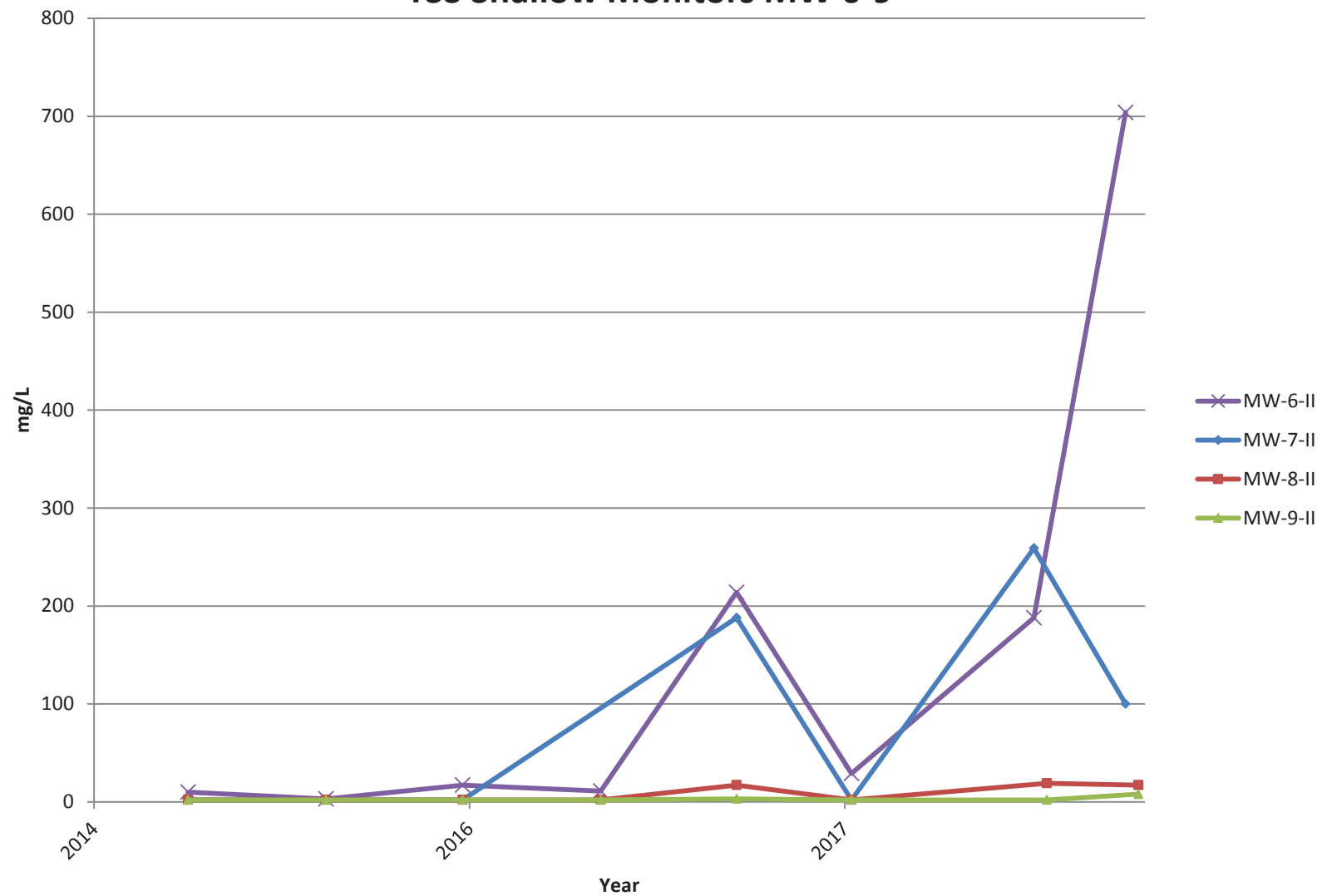
BOD Shallow Monitors MW 10-13



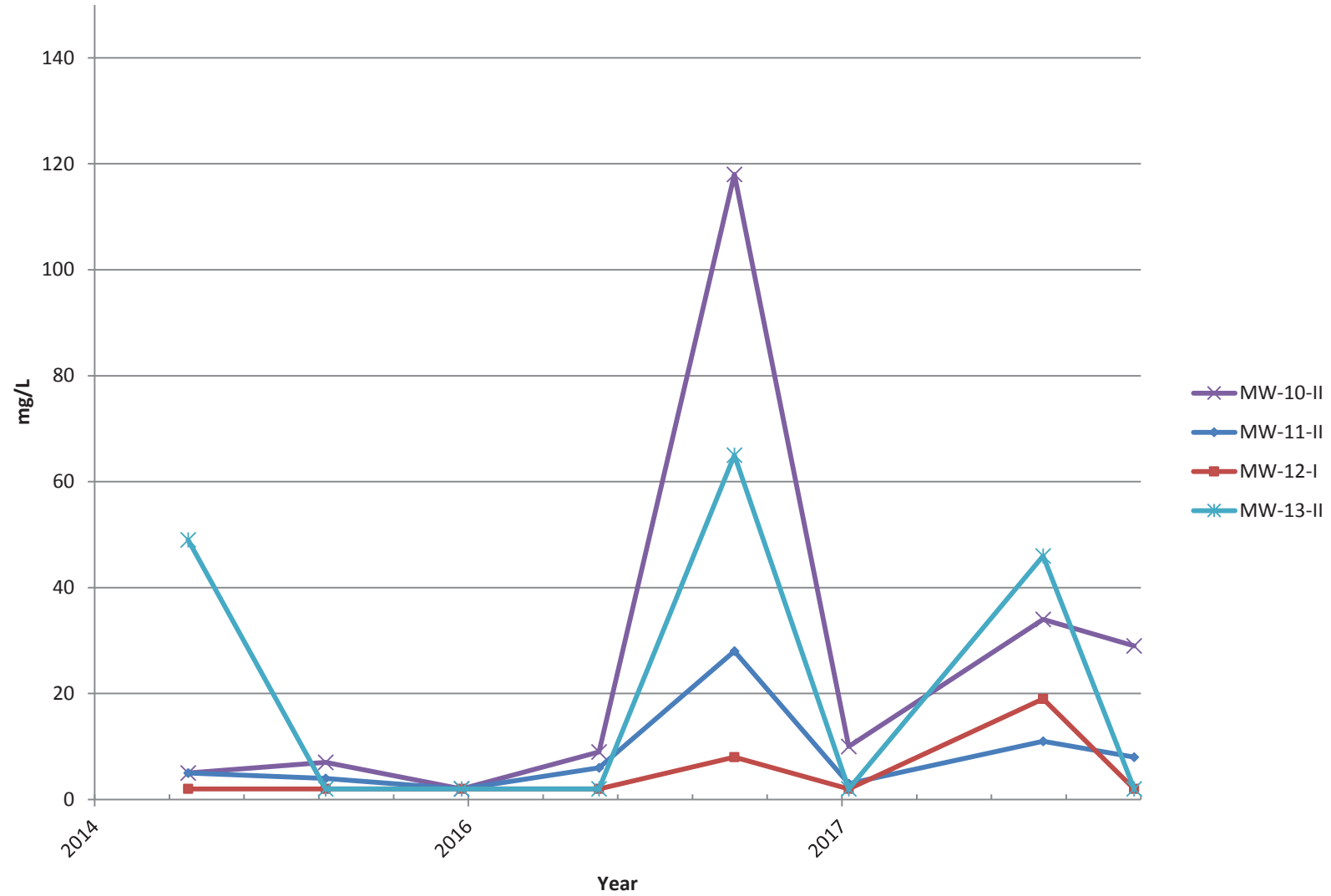
TSS Shallow Monitors MW 1-5



TSS Shallow Monitors MW 6-9



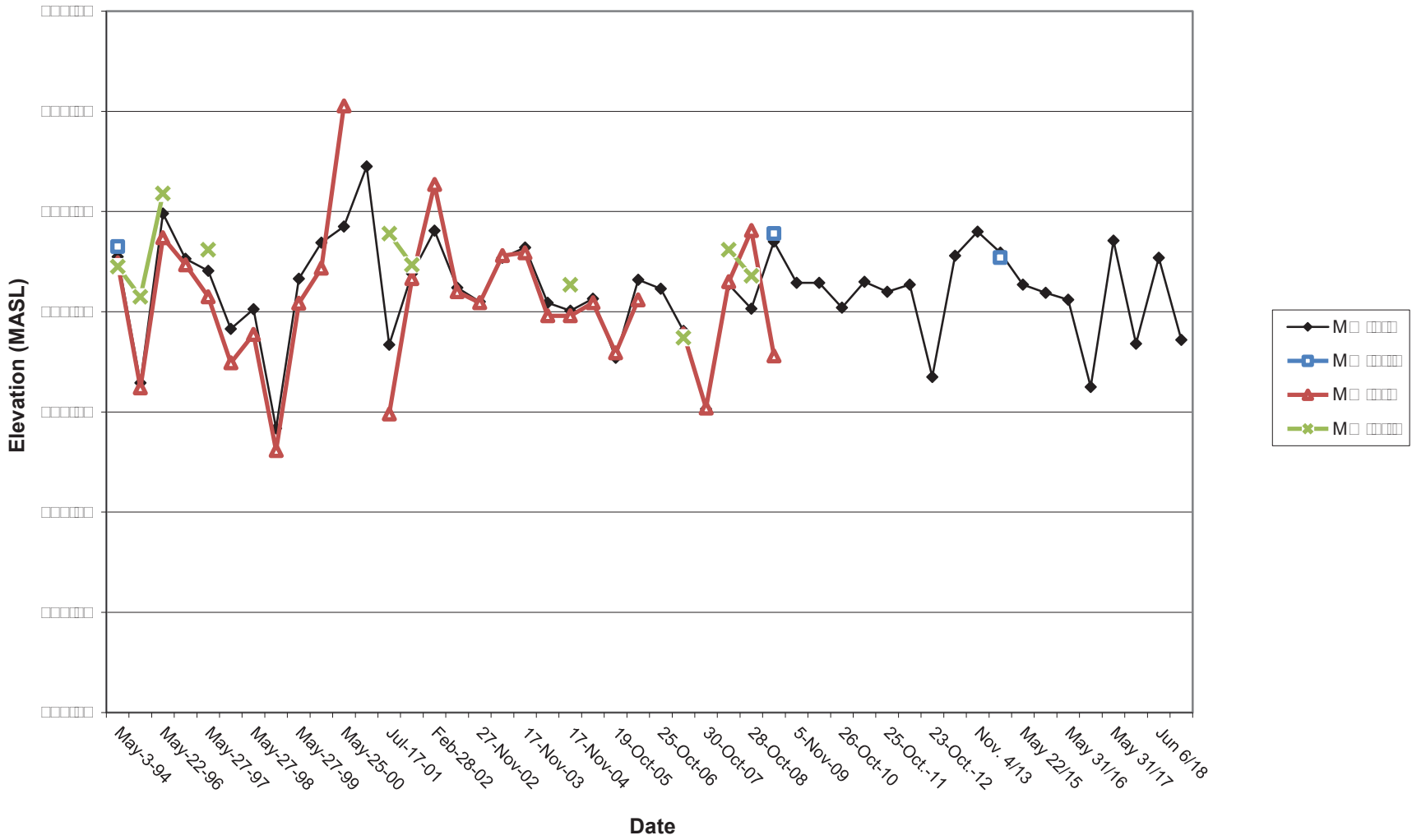
TSS Shallow Monitors MW 10-13



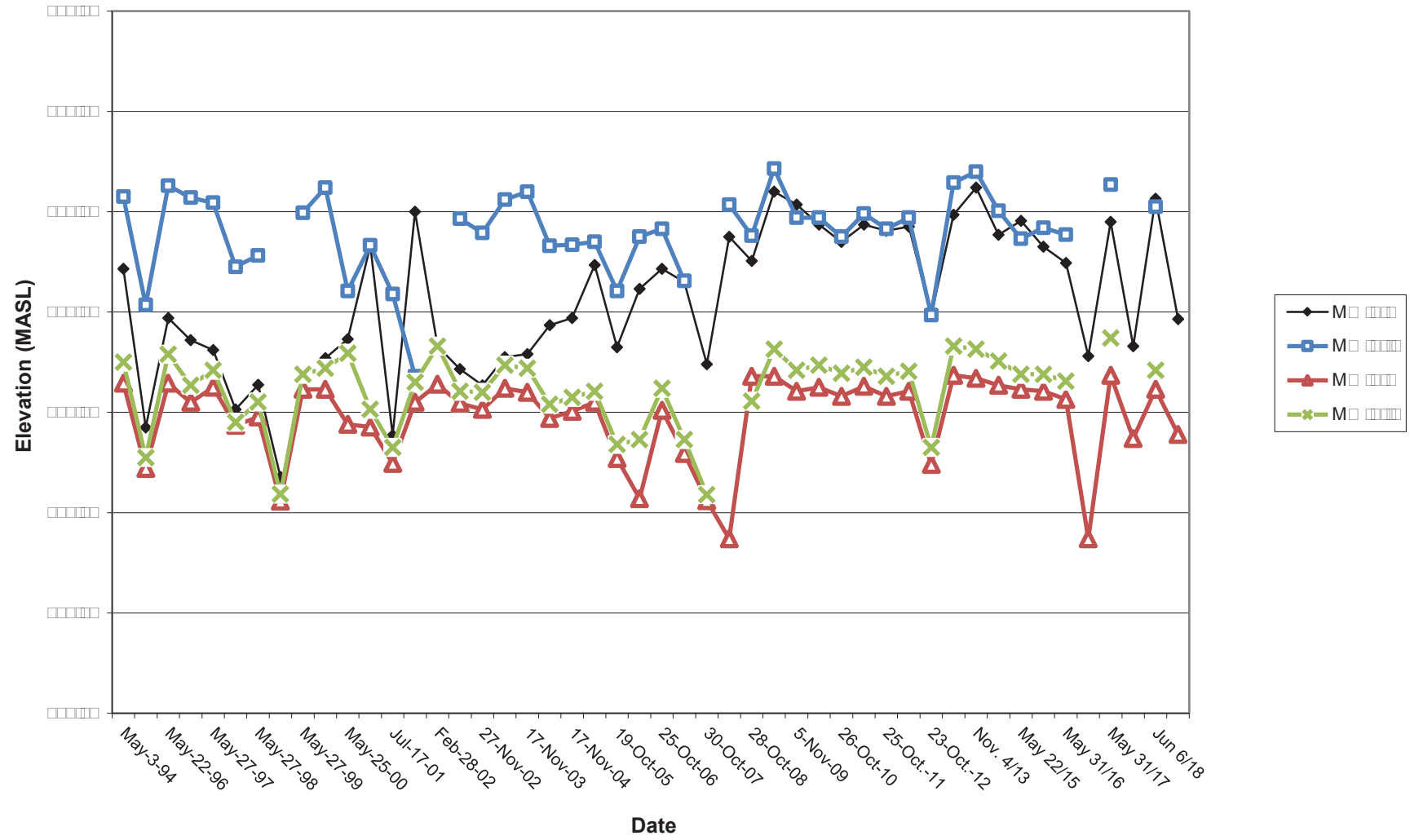
Appendix D

Water Level Elevations and Hydraulic Gradient Graphs

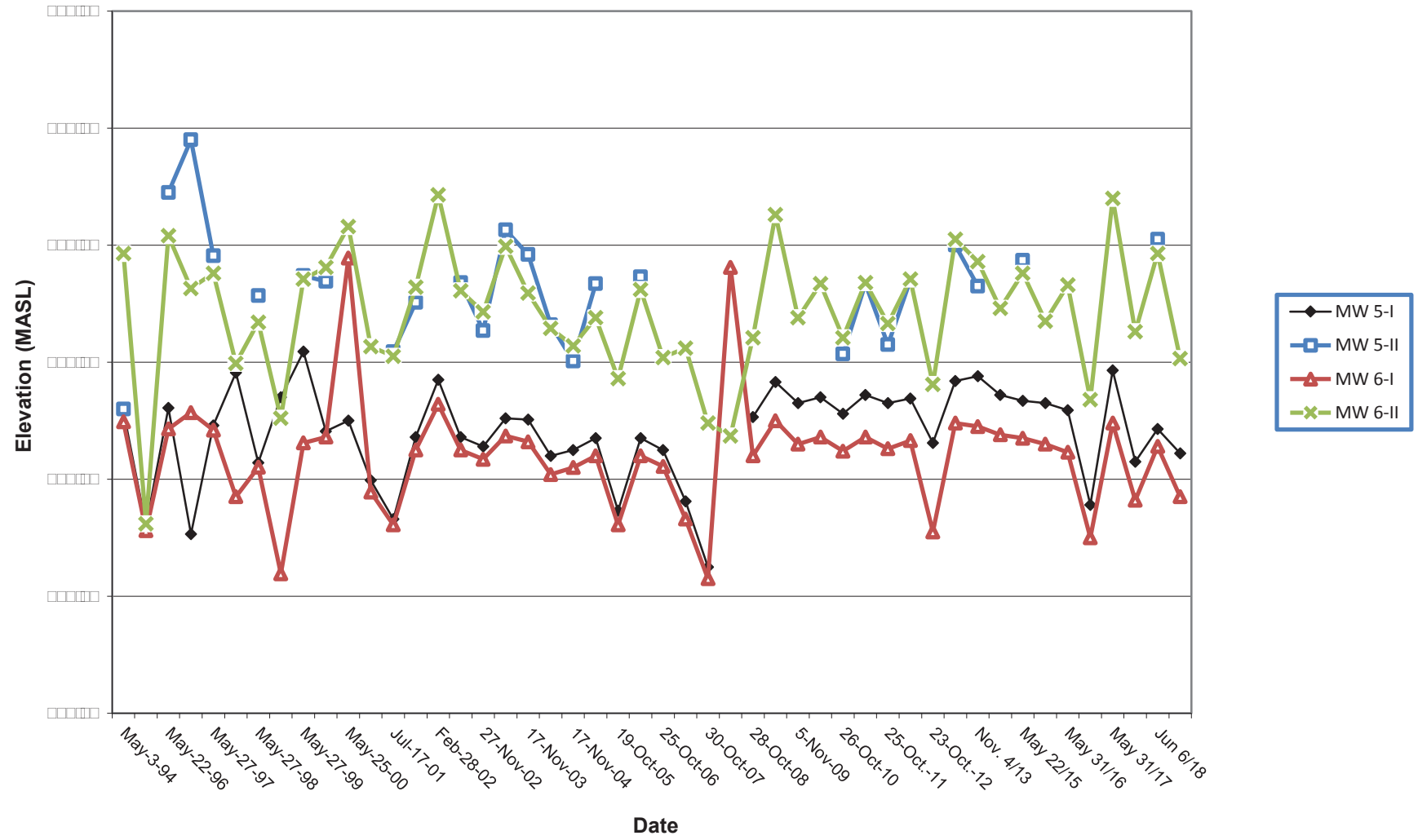
WATERLEVEL ELEVATION



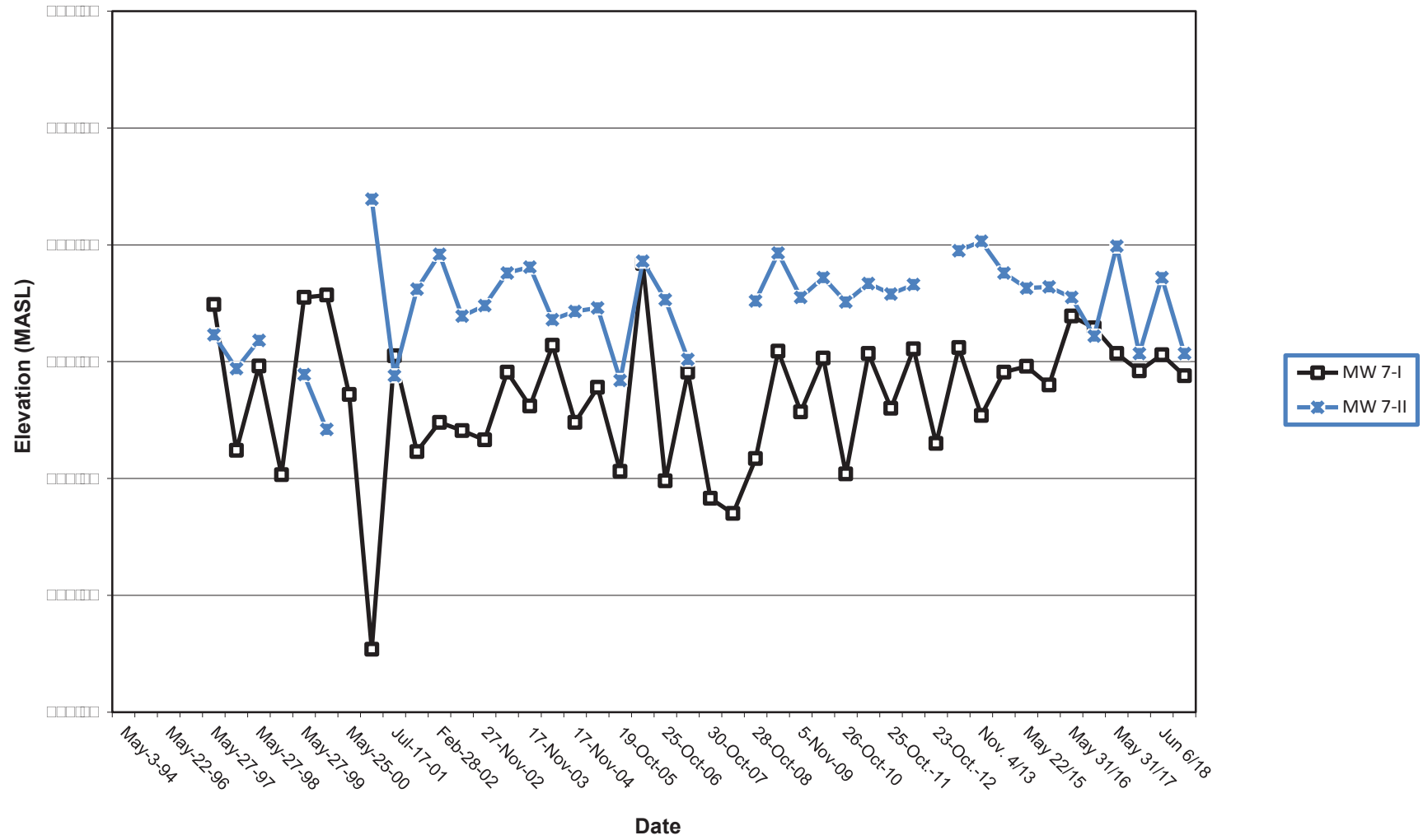
WATERLEVEL ELEVATIONS



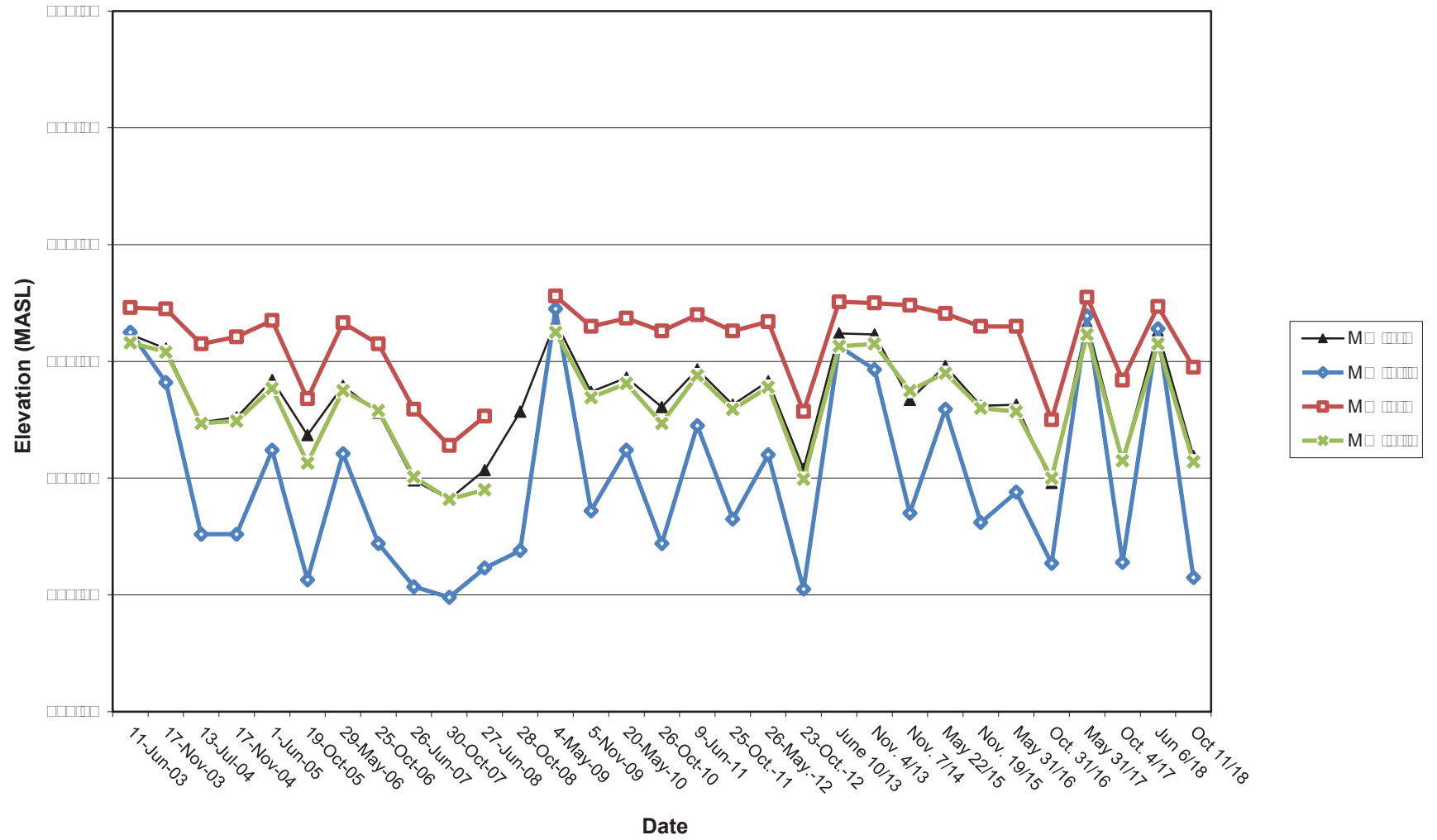
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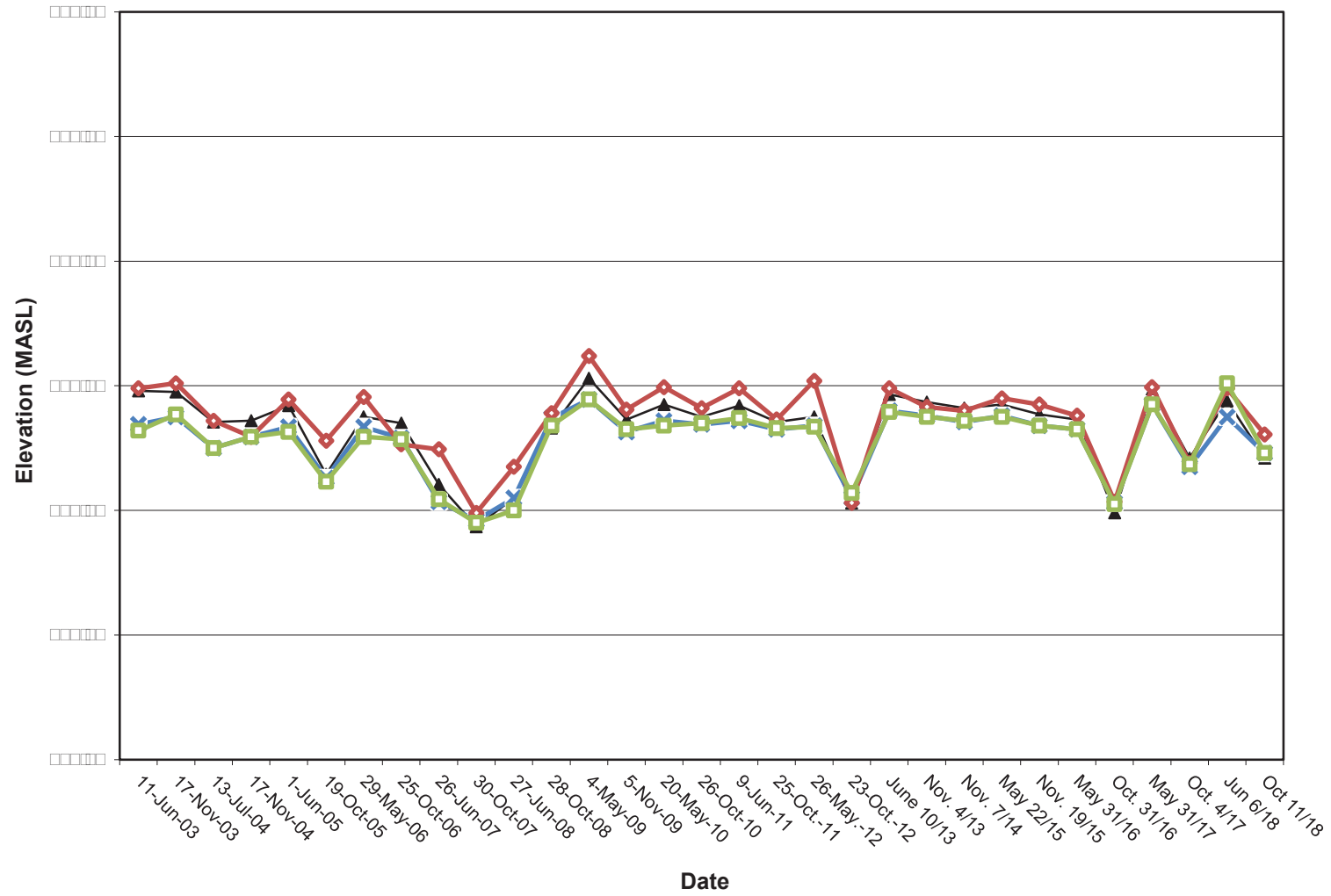
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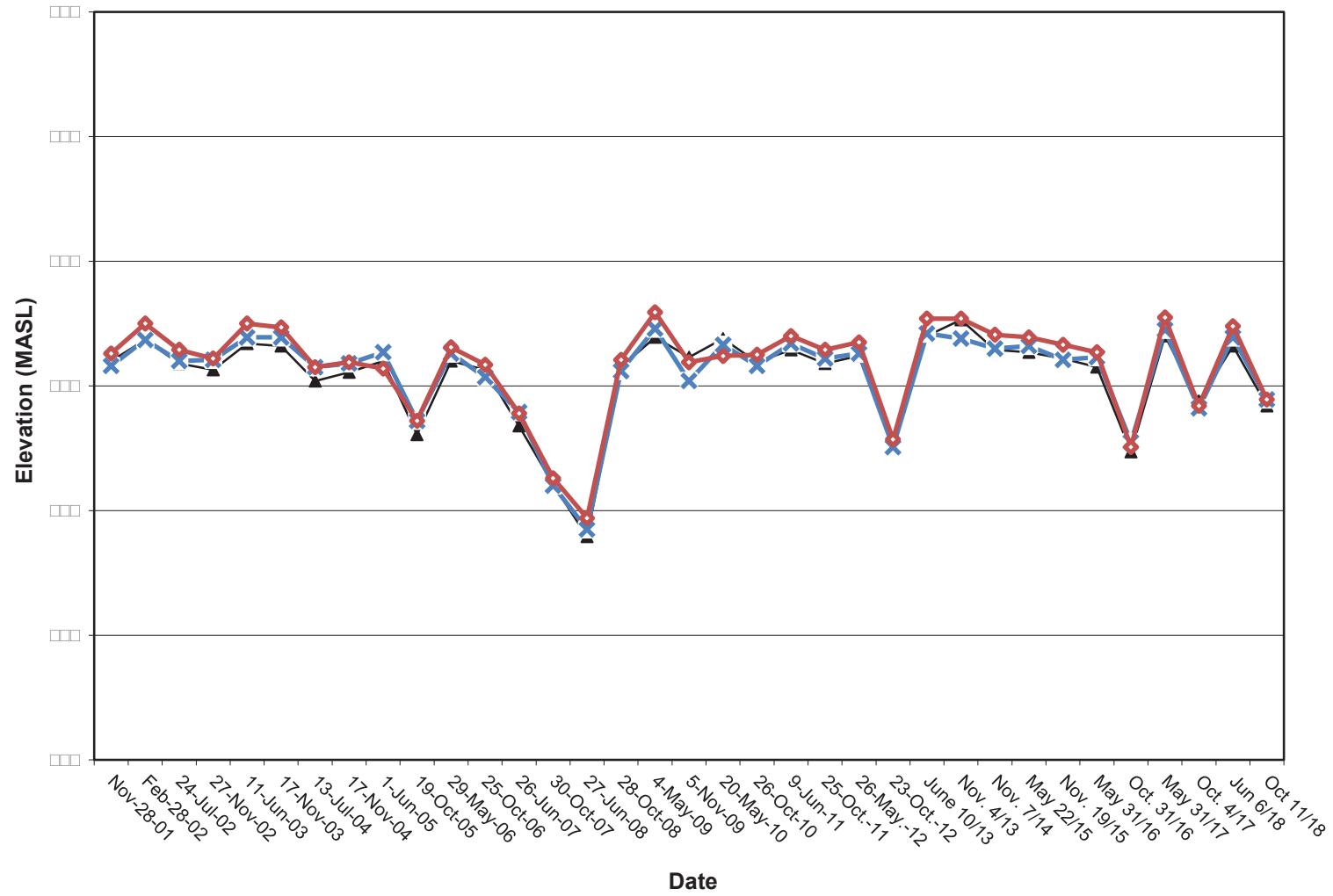
WATERLEVEL ELEVATIONS



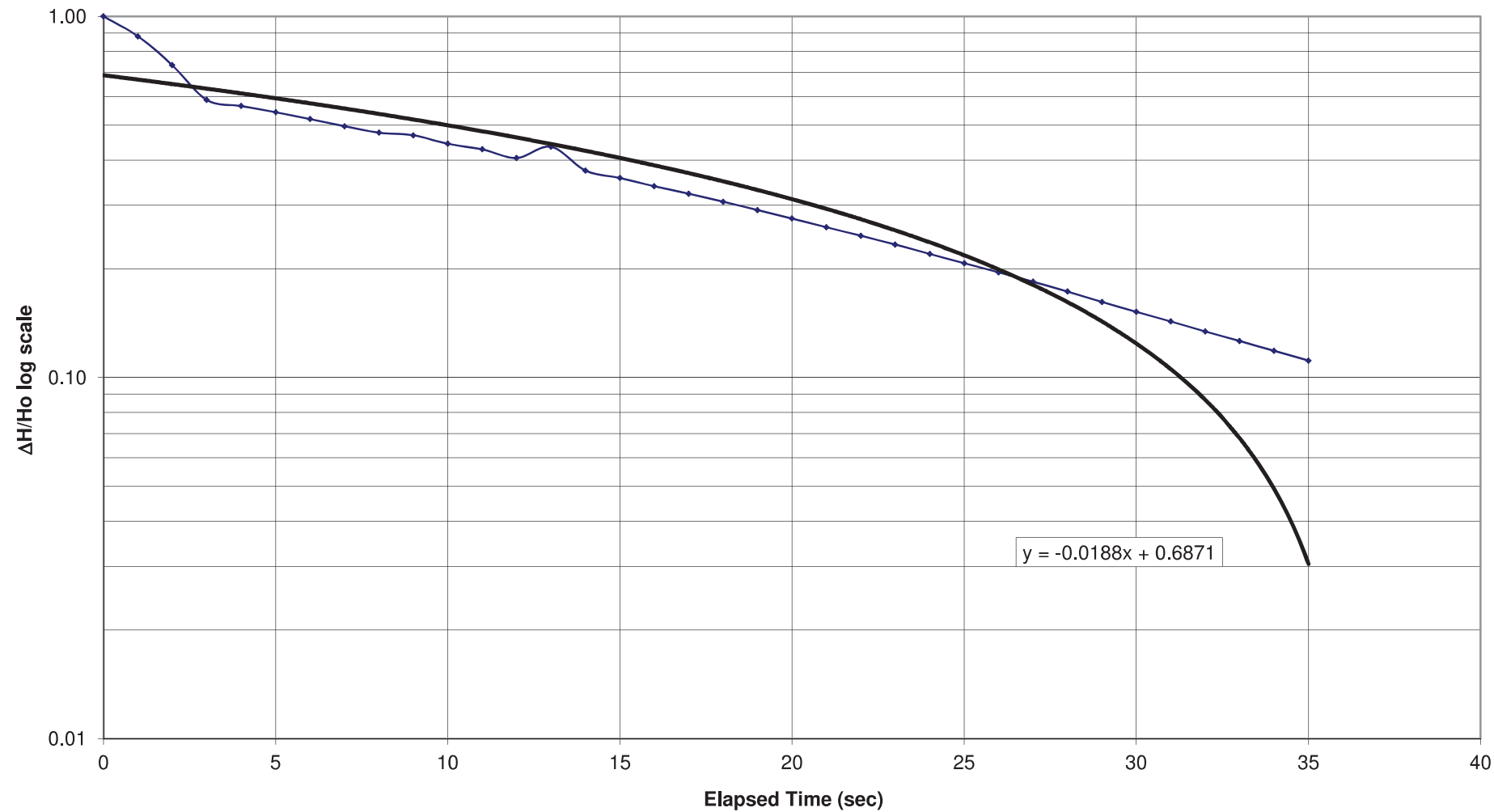
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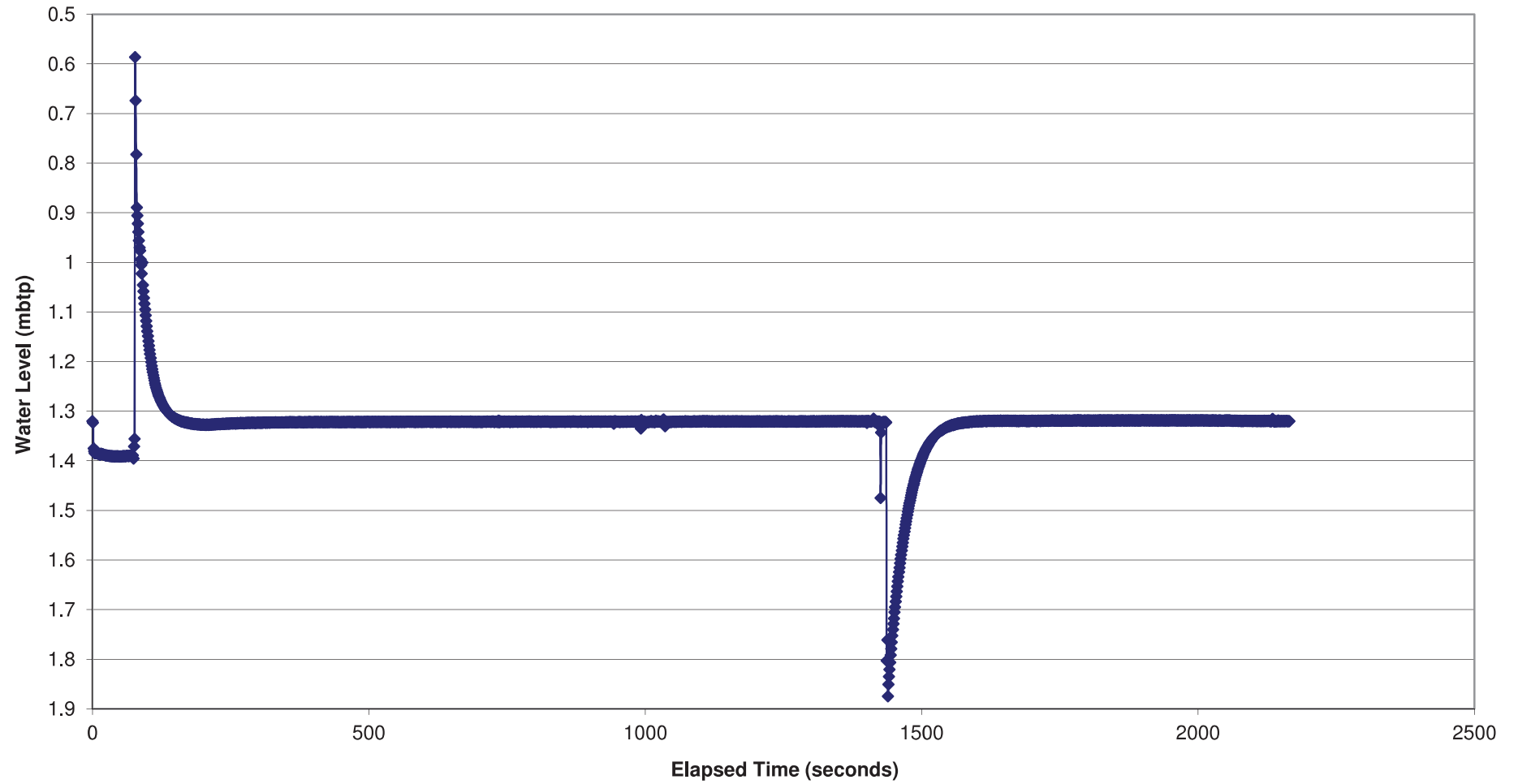
WATERLEVEL ELEVATIONS



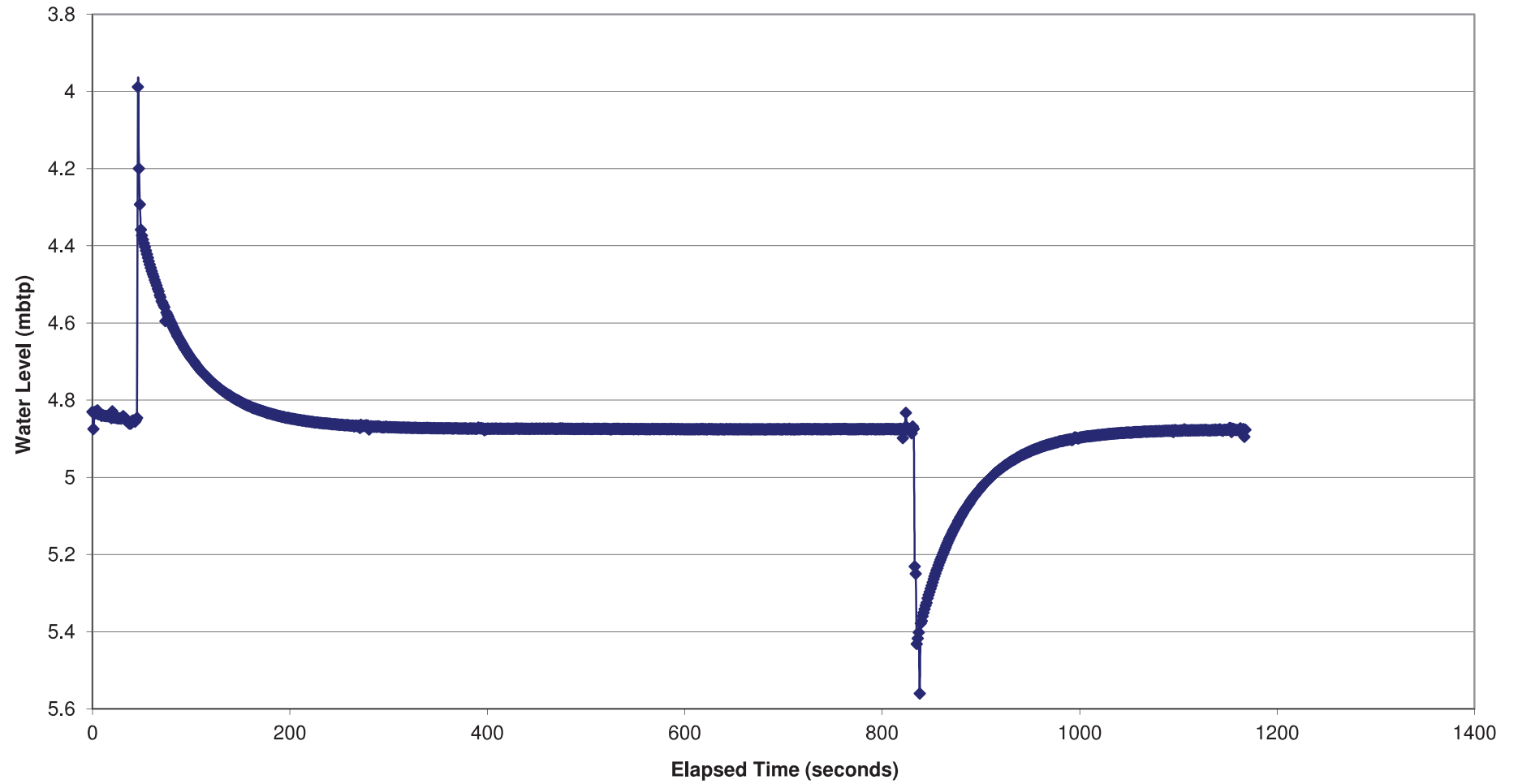
Falling Head Hydraulic Conductivity Analysis at MW-3-1



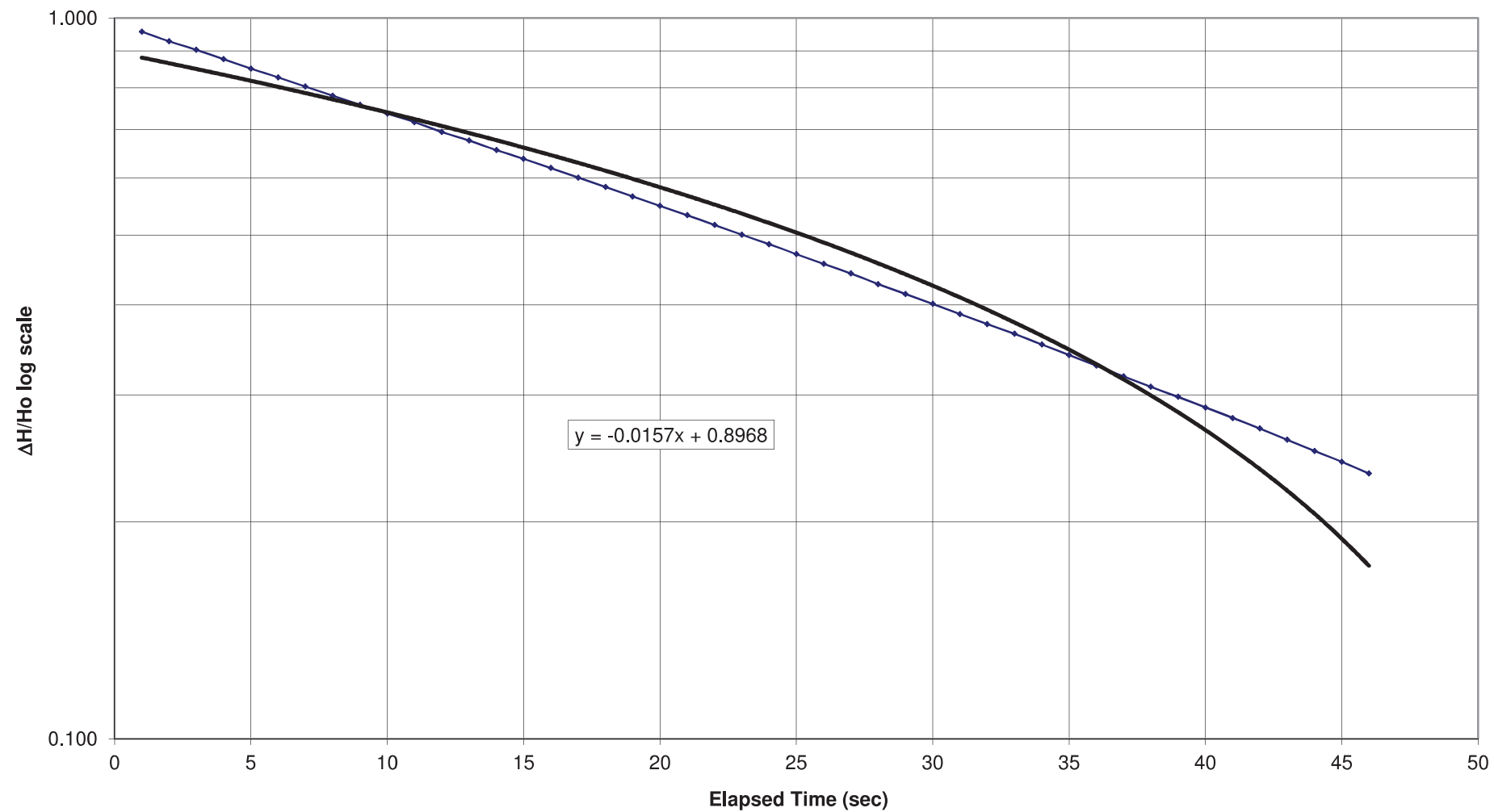
Hydraulic Conductivity Testing at MW-3-1
Hall's Glenn Landfill



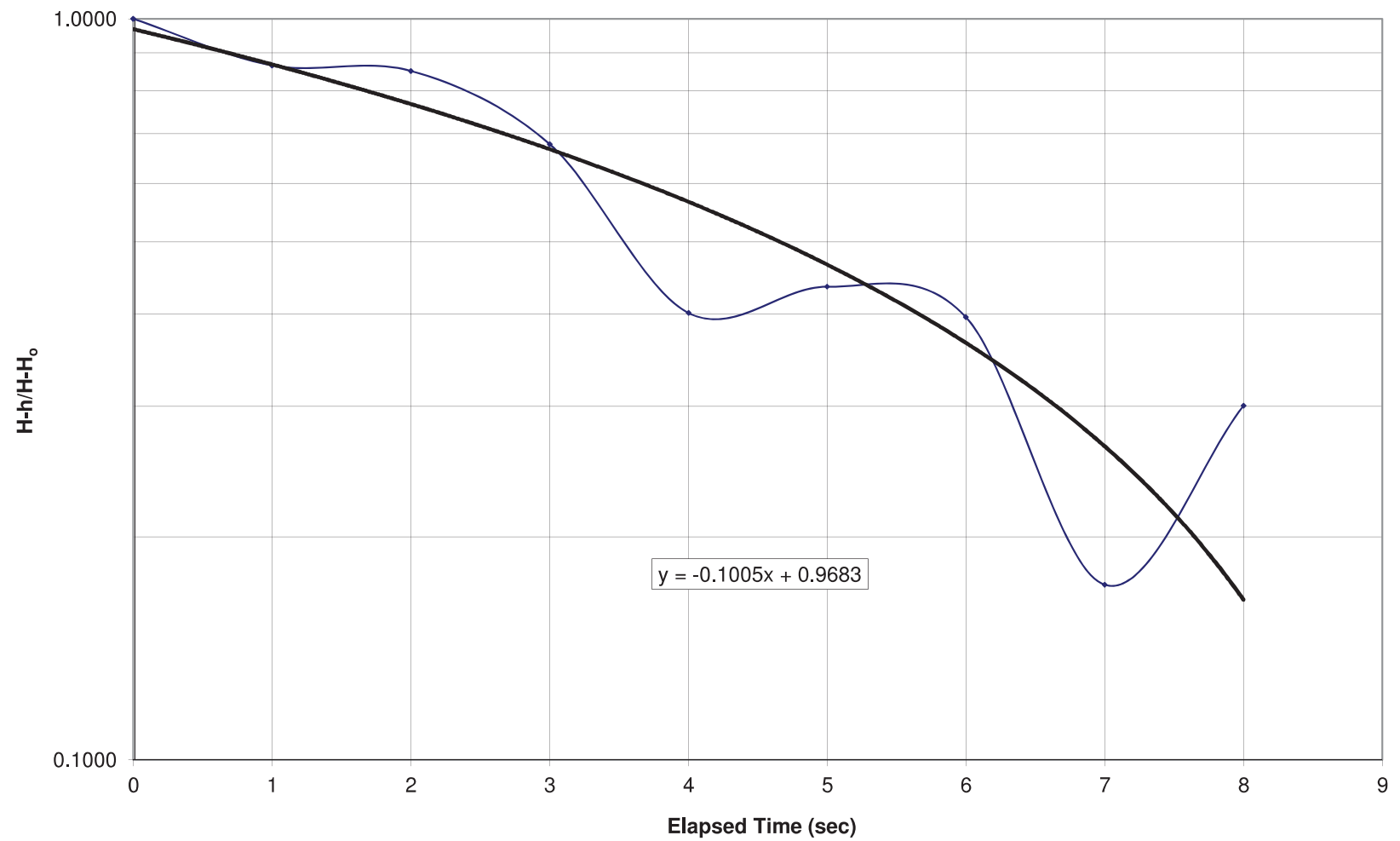
Hydraulic Conductivity Testing at MW-8-1 Hall's Glenn Landfill



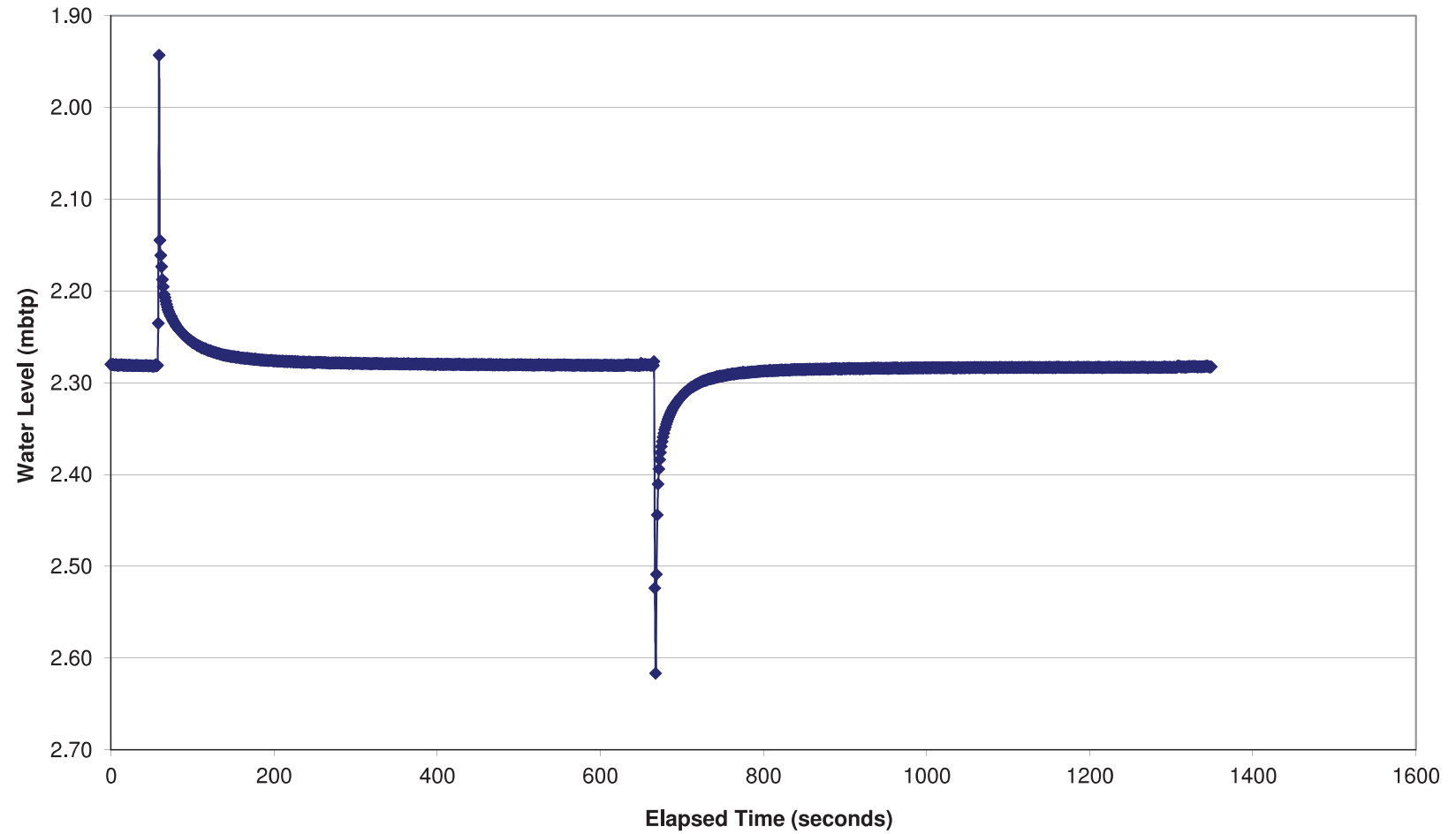
Rising Head Hydraulic Conductivity Analysis at MW-3-1



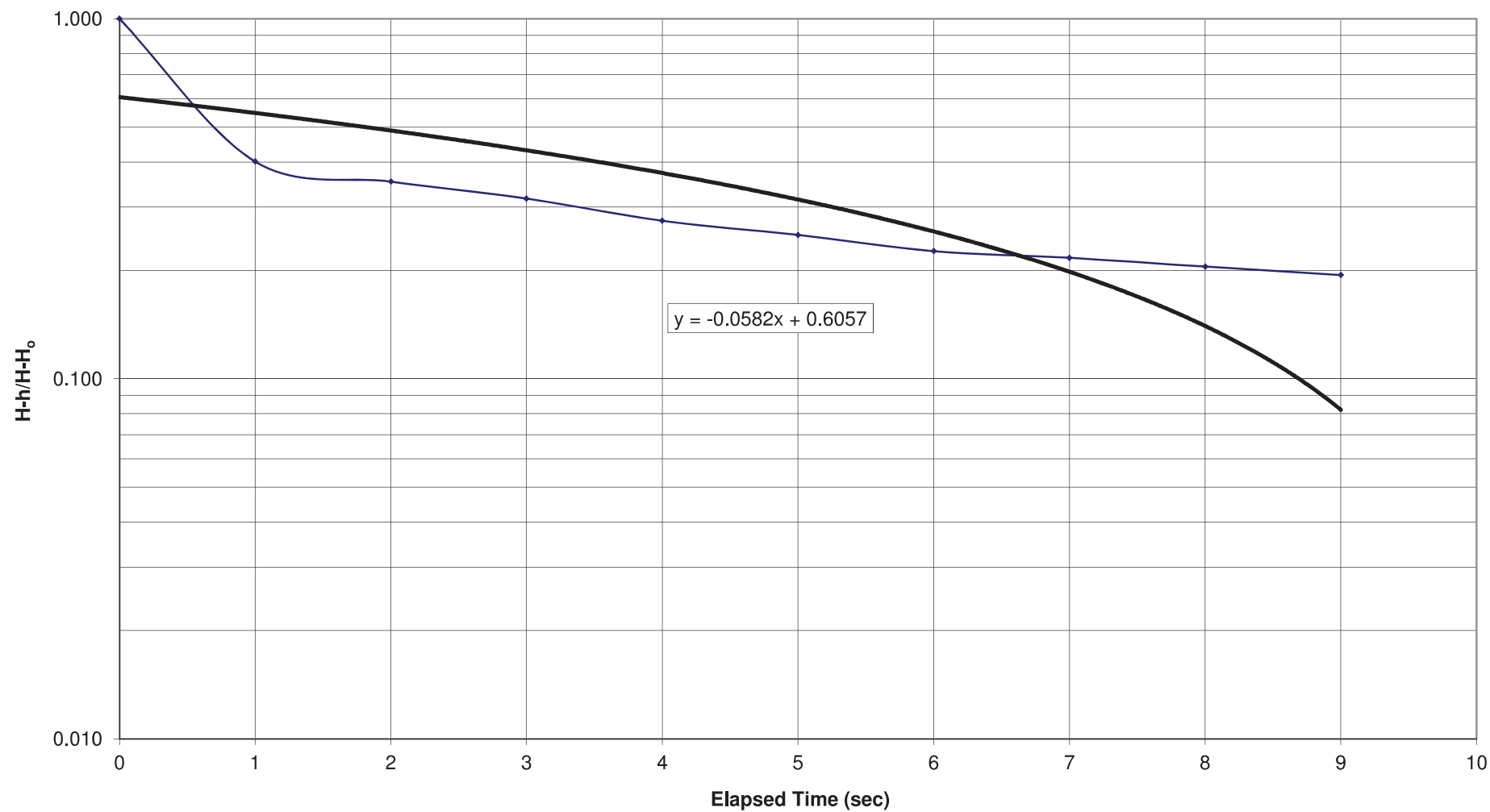
Falling Head Hydraulic Conductivity Analysis at MW-8-2



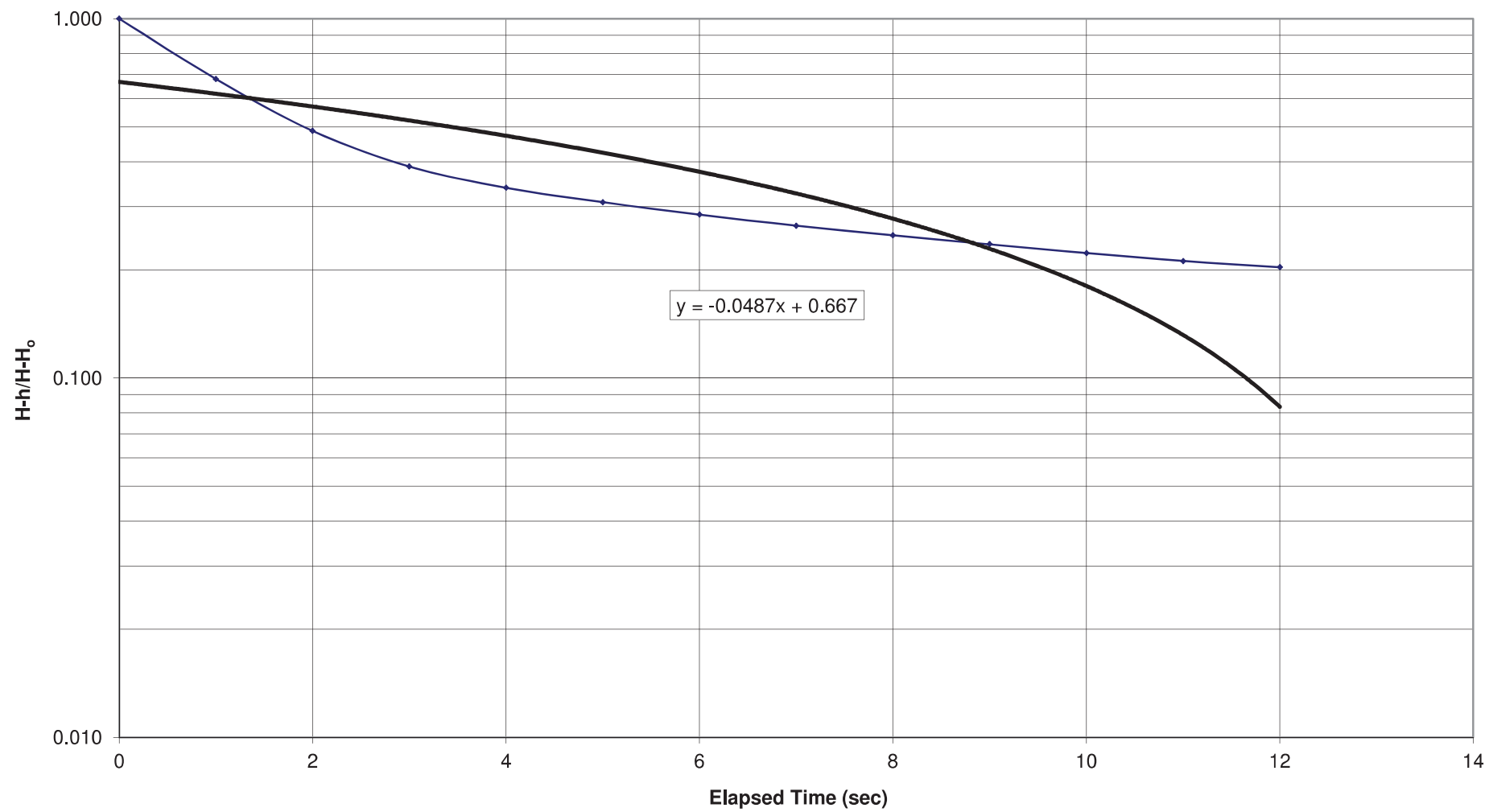
Hydraulic Conductivity Testing at MW-7-2
Hall's Glenn Landfill



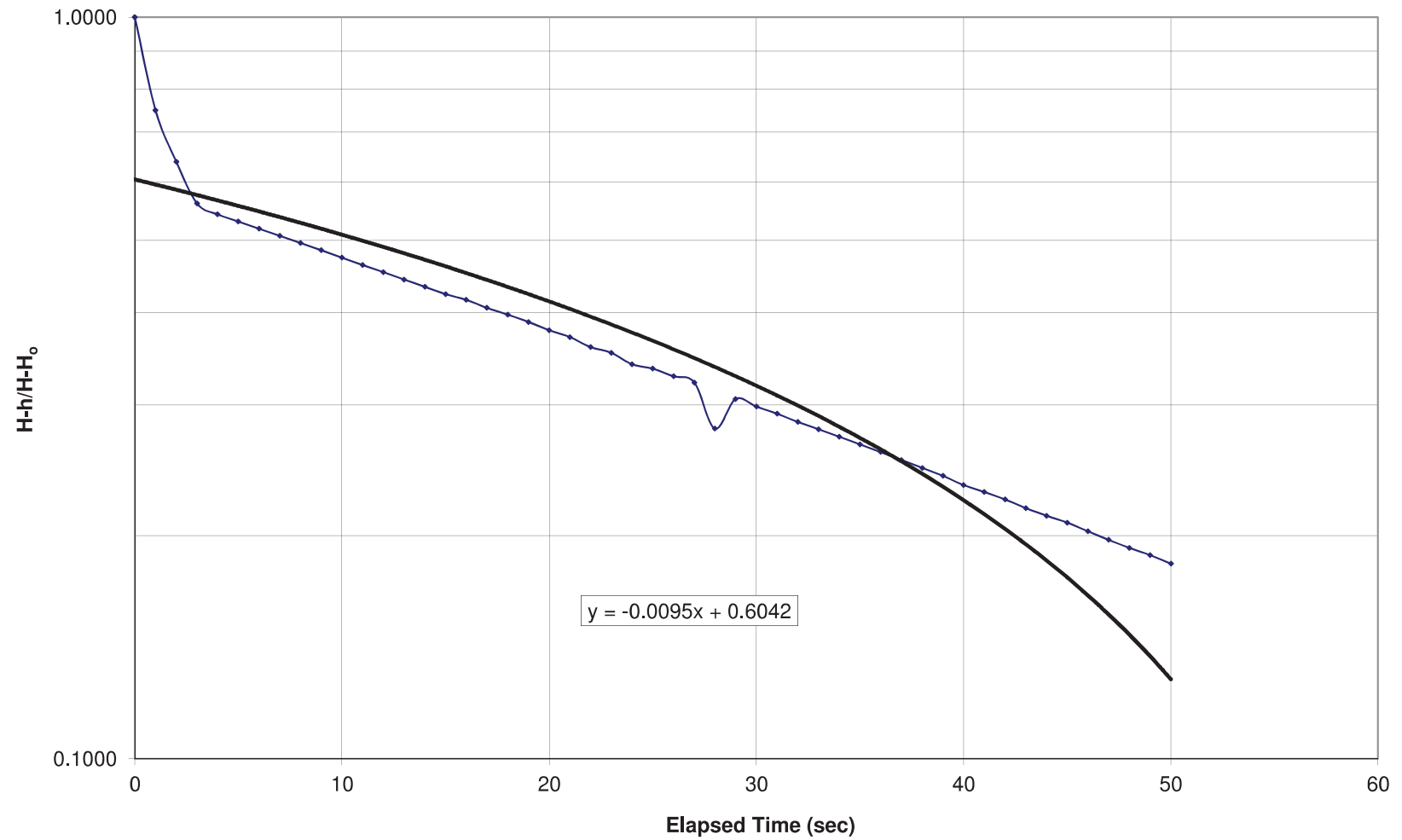
Falling Head Hydraulic Conductivity Analysis at MW-7-2



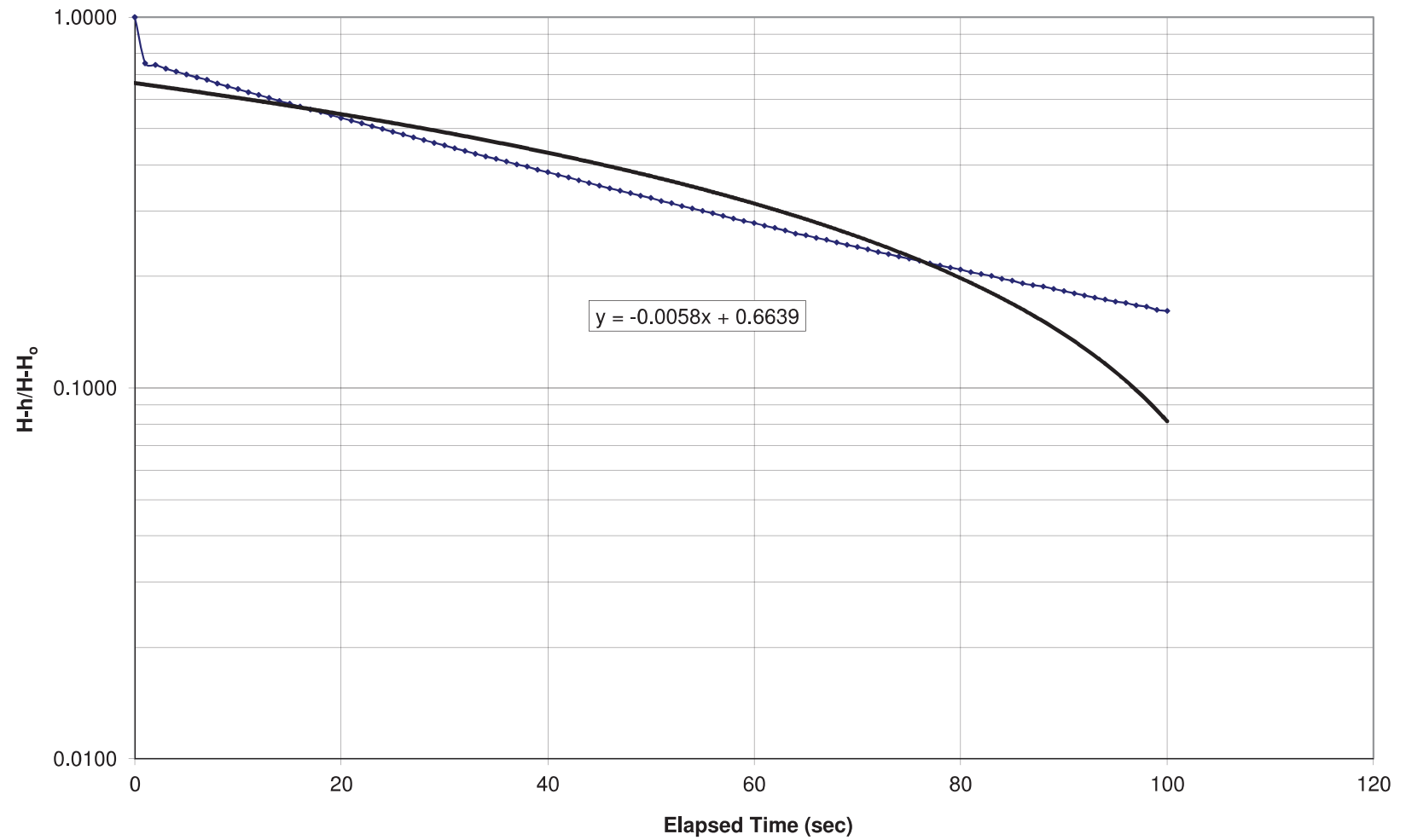
Rising Head Hydraulic Conductivity Analysis at MW-7-2



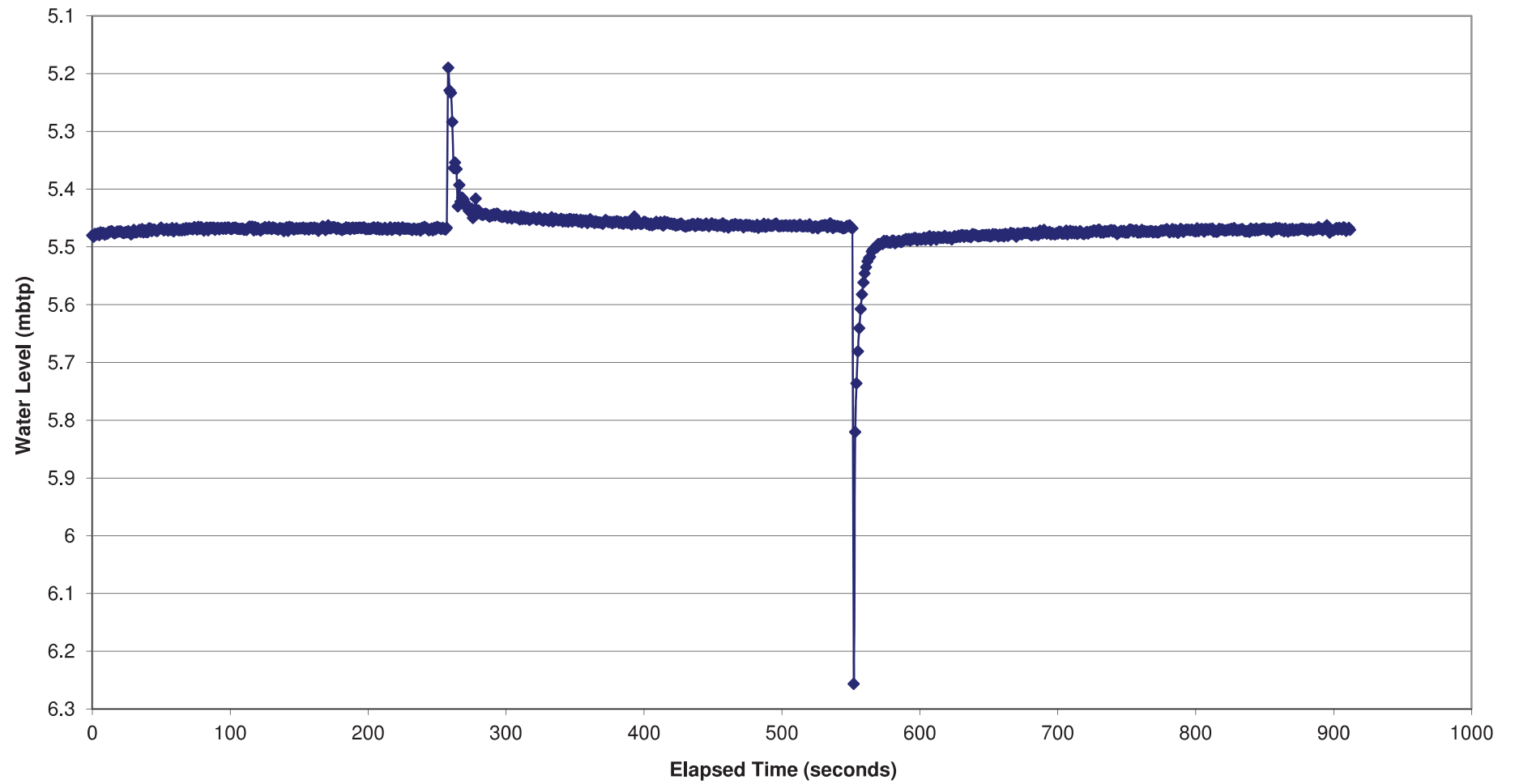
Falling Head Hydraulic Conductivity Analysis at MW-8-1



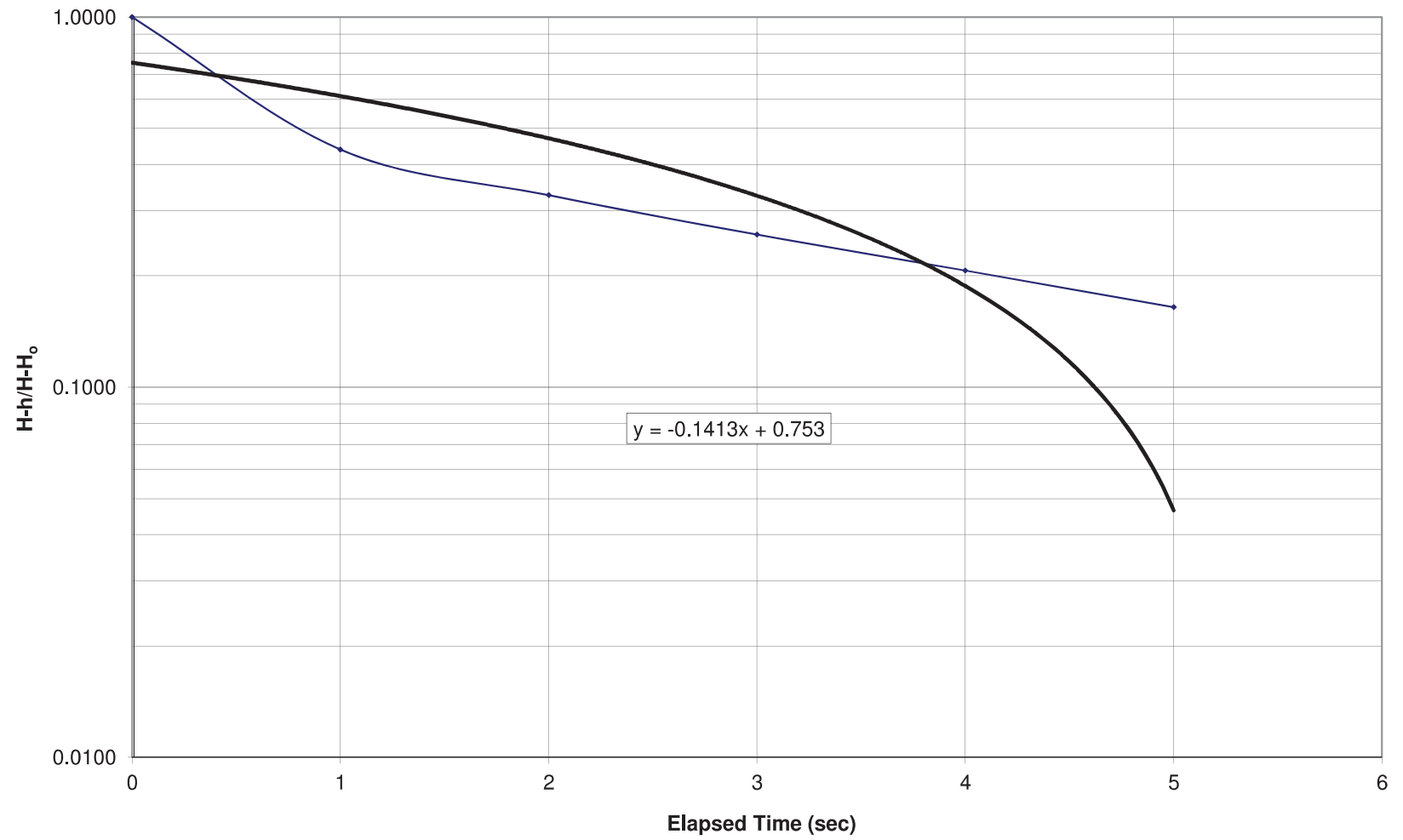
Rising Head Hydraulic Conductivity Analysis at MW-8-1



Hydraulic Conductivity Testing at MW-8-2
Hall's Glenn Landfill



Rising Head Hydraulic Conductivity Analysis at MW-8-2



Appendix E

MOECC Monitoring and Screening Checklist

Appendix D-Monitoring and Screening Checklist

General Information and Instructions

General Information: The checklist is to be completed, and submitted with the Monitoring Report.

Instructions: A complete checklist consists of:

- (a) a completed and signed checklist, including any additional pages of information which can be attached as needed to provide further details where indicated.
- (b) completed contact information for the Competent Environmental Practitioner (CEP)
- (c) self-declaration that CEP(s) meet(s) the qualifications as set out below and in Section 1.2 of the Technical Guidance Document.

Definition of Groundwater CEP:

For groundwater, the CEP must have expertise in hydrogeology and meet one of the following:

- (a) the person holds a licence, limited licence or temporary licence under the *Professional Engineers Act*; or
- (b) the person holds a certificate of registration under the *Professional Geoscientists Act, 2000* and is a practicing member, temporary, member or limited member of the Association of Professional Geoscientists of Ontario. O. Reg. 66/08, s. 2..

Definition of Surface water CEP:

A CEP for surface water assessments is a scientist, professional engineer or professional geoscientist as described in (a) and (b) above with demonstrated experience and post-secondary education, either a diploma or degree, in hydrology, aquatic ecology, limnology, aquatic biology, physical geography with specialization in surface water, and/or water resource management.

The type of scientific work that a CEP performs must be consistent with that person's education and experience. If an individual has appropriate training and credentials in both groundwater and surface water and is responsible for both areas of expertise, the CEP may then complete and validate both sections of the checklist.

Monitoring Report and Site Information	
Waste Disposal Site Name	Hall's Glenn Landfill Site
Location (e.g. street address, lot, concession)	1951 County Road 6, Part Lot 5, Concession 4, Township of Douro-Dummer (Douro), County of Peterborough
GPS Location (taken within the property boundary at front gate/ front entry)	17 781275E 445174N
Municipality	Township of Douro-Dummer
Client and/or Site Owner	Corporation of the Township of Douro-Dummer
Monitoring Period (Year)	2019
This Monitoring Report is being submitted under the following:	
Environmental Compliance Approval Number:	Provisional Certificate of Approval A341004
Director's Order No.:	N/A
Provincial Officer's Order No.:	N/A
Other:	N/A

Report Submission Frequency	☒ Annual ☐ Other	Specify (Type Here):	
The site is: (Operation Status)	☐ Open ☐ Inactive ☒ Closed		
Does your Site have a Total Approved Capacity?	☐ Yes ☒ No		
If yes, please specify Total Approved Capacity		Units	
Does your Site have a Maximum Approved Fill Rate?	☐ Yes ☒ No		
If yes, please specify Maximum Approved Fill Rate		Units	
Total Waste Received within Monitoring Period (Year)		Units	
Total Waste Received within Monitoring Period (Year) <i>Methodology</i>			
Estimated Remaining Capacity		Units	
Estimated Remaining Capacity <i>Methodology</i>			
Estimated Remaining Capacity <i>Date Last Determined</i>	Select Date		
Non-Hazardous Approved Waste Types	☐ Domestic ☐ Industrial, Commercial & Institutional (IC&I) ☐ Source Separated Organics (Green Bin) ☐ Tires	☐ Contaminated Soil ☐ Wood Waste ☐ Blue Box Material ☐ Processed Organics ☐ Leaf and Yard Waste	☐ Food Processing/Preparation Operations Waste ☐ Hauled Sewage Other: Provide any other approved waste types not listed here
Subject Waste Approved Waste Classes: Hazardous & Liquid Industrial (separate waste classes by comma)			
Year Site Opened (enter the Calendar Year <u>only</u>)	1977	Current ECA Issue Date	5-Mar-13
Is your Site required to submit Financial Assurance?	☐ Yes ☒ No		
Describe how your Landfill is designed.	☒ Natural Attenuation only ☐ Fully engineered Facility ☐ Partially engineered Facility		
Does your Site have an approved Contaminant Attenuation Zone?	☐ Yes ☒ No		

If closed, specify C of A, control or authorizing document closure date:	22-May-96
Has the nature of the operations at the site changed during this monitoring period?	☐ Yes ☒ No
If yes, provide details:	Type Here
Have any measurements been taken since the last reporting period that indicate landfill gas volumes have exceeded the MOE limits for subsurface or adjacent buildings? (i.e. exceeded the LEL for methane)	☐ Yes ☒ No

Groundwater WDS Verification:

Based on all available information about the site and site knowledge, it is my opinion that:

Sampling and Monitoring Program Status:

1) The monitoring program continues to effectively characterize site conditions and any groundwater discharges from the site. All monitoring wells are confirmed to be in good condition and are secure:

☐ Yes

☒ No

Monitor R-1

2) All groundwater, leachate and WDS gas sampling and monitoring for the monitoring period being reported on was successfully completed as required by Certificate(s) of Approval or other relevant authorizing/control document (s):

☒ Yes

☐ No

☐ Not Applicable

If no, list exceptions below or attach information.

Groundwater Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)	Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date

3) a) Is landfill gas being monitored or controlled at the site?		☒ Yes ☐ No
If yes to 3(a), please answer the next two questions below.		
b) Have any measurements been taken since the last reporting period that indicate landfill gas is present in the subsurface at levels exceeding criteria established for the site?		☐ Yes ☒ No
c) Has the sampling and monitoring identified under 3(a) for the monitoring period being reported on was successfully completed in accordance with established protocols, frequencies, locations, and parameters developed as per the Technical Guidance Document:		☒ Yes ☐ No ☐ Not Applicable
If no, list exceptions below or attach additional information.		
Groundwater Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)	Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
4) All field work for groundwater investigations was done in accordance with standard operating procedures as established/outlined per the Technical Guidance Document (including internal/external QA/QC requirements) (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):		
☒ Yes ☐ No	If no, specify (Type Here):	

Sampling and Monitoring Program Results/WDS Conditions and Assessment:

5) The site has an adequate buffer, Contaminant Attenuation Zone (CAZ) and/or contingency plan in place. Design and operational measures, including the size and configuration of any CAZ, are adequate to prevent potential human health impacts and impairment of the environment.	☒ Yes ☐ No	If no, the potential design and operational concerns/exceptions are as follows (Type Here):	
6) The site meets compliance and assessment criteria.	☒ Yes ☐ No	If no, list and explain exceptions (Type Here):	
7) The site continues to perform as anticipated. There have been no unusual trends/changes in measured leachate and groundwater levels or concentrations.	☒ Yes ☐ No	If no, list exceptions and explain reason for increase/change (Type Here):	
1) Is one or more of the following risk reduction practices in place at the site: (a) There is minimal reliance on natural attenuation of leachate due to the presence of an effective waste liner and active leachate collection/treatment; or (b) There is a predictive monitoring program in-place (modeled indicator concentrations projected over time for key locations); or (c) The site meets the following two conditions (typically achieved after 15 years or longer of site operation): i. The site has developed stable leachate mound(s) and stable leachate plume geometry/concentrations; and ii. Seasonal and annual water levels and water quality fluctuations are well understood.	☒ Yes ☐ No	Note which practice(s):	☐ (a) ☐ (b) ☒ (c)
9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):	☒ Yes ☐ No ☐ Not Applicable	Monitor R-1 exceeded for Iron. This well is an old dug residential well that has been severely compromised. It has been recommended that the well be abandoned and that a new monitor be constructed in the same area.	

Groundwater CEP Declaration:

I am a licensed professional Engineer or a registered professional geoscientist in Ontario with expertise in hydrogeology, as defined in Appendix D under Instructions. Where additional expertise was needed to evaluate the site monitoring data, I have relied on individuals who I believe to be experts in the relevant discipline, who have co-signed the compliance monitoring report or monitoring program status report, and who have provided evidence to me of their credentials.

I have examined the applicable Certificate of Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended), and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to *ISO/IEC 17025:2005 (E)- General requirements for the competence of testing and calibration laboratories*, or as amended from time to time by the ministry.

If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature and will be rectified for the next monitoring/reporting period. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

1-Mar-19

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

☐ No changes to the monitoring program are recommended ☒ The following change(s) to the monitoring program is/are recommended:	It is recommended that the R-1 monitor be abandoned and a new monitor installed at the same general location.
☒ No Changes to site design and operation are recommended ☐ The following change(s) to the site design and operation is/are recommended:	Type Here

Name:	Nyle McIlveen, P.Eng.		
Seal:	Add Image 		
Signature:		Date:	22-Mar-20
CEP Contact Information:	Nyle McIlveen, P./Eng.		
Company:	GHD		
Address:	347 Pido Road, Unit 29, Peterborough, Ontario K9J 6X7		
Telephone No.:	(705) 749-3317	Fax No. :	(705) 749-9248
E-mail Address:	nyle.mcilveen@ghd.com		
Co-signers for additional expertise provided:			
Signature:		Date:	
Signature:		Date:	Select Date

Surface Water WDS Verification:		
Provide the name of surface water body/bodies potentially receiving the WDS effluent and the approximate distance to the waterbody (including the nearest surface water body/bodies to the site):		
Name (s)	Dummer Lake	
Distance(s)	2.5 Km	
Based on all available information and site knowledge, it is my opinion that:		
Sampling and Monitoring Program Status:		
1) The current surface water monitoring program continues to effectively characterize the surface water conditions, and includes data that relates upstream/background and downstream receiving water conditions:	☒ Yes ☐ No	If no, identify issues (Type Here):
2) All surface water sampling for the monitoring period being reported was successfully completed in accordance with the Certificate(s) of Approval or relevant authorizing/control document(s) (if applicable):	☒ Yes ☐ No ☐ Not applicable (No C of A, authorizing / control document applies)	If no, specify below or provide details in an attachment.
Surface Water Sampling Location	Description/Explanation for change (change in name or location, additions, deletions)	Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date
Type Here	Type Here	Select Date

3) a) Some or all surface water sampling and monitoring program requirements for the monitoring period have been established outside of a ministry C of A or authorizing/control document.		☒ Yes ☐ No ☐ Not Applicable
b) If yes, all surface water sampling and monitoring identified under 3 (a) was successfully completed in accordance with the established program from the site, including sampling protocols, frequencies, locations and parameters) as developed per the Technical Guidance Document:		☒ Yes ☐ No ☐ Not Applicable
Surface Water Sampling Location		Description/Explanation for change (change in name or location, additions, deletions)
Date		
S-2		S-2 is a background surface water location that was established in 2014.
7-May-14		
Type Here		Type Here
Select Date		
Type Here		Type Here
Select Date		
Type Here		Type Here
Select Date		
4) All field work for surface water investigations was done in accordance with standard operating procedures, including internal/external QA/QC requirements, as established/outlined as per the Technical Guidance Document, MOE 2010, or as amended. (Note: A SOP can be from a published source, developed internally by the site owner's consultant, or adopted by the consultant from another organization):		☒ Yes ☐ No
If no, specify (Type Here):		

Sampling and Monitoring Program Results/WDS Conditions and Assessment:

5) The receiving water body meets surface water-related compliance criteria and assessment criteria: i.e., there are no exceedances of criteria, based on MOE legislation, regulations, Water Management Policies, Guidelines and Provincial Water Quality Objectives and other assessment criteria (e.g., CWQGs, APVs), as noted in Table A or Table B in the Technical Guidance Document (Section 4.6):

☒ Yes

☐ No

If no, list parameters that exceed criteria outlined above and the amount/percentage of the exceedance as per the table below or provide details in an attachment:

Parameter	Compliance or Assessment Criteria or Background	Amount by which Compliance or Assessment Criteria or Background Exceeded
e.g. Nickel	e.g. C of A limit, PWQO, background	e.g. X% above PWQO
Type Here	Type Here	Type Here
Type Here	Type Here	Type Here
Type Here	Type Here	Type Here
Type Here	Type Here	Type Here
Type Here	Type Here	Type Here
6) In my opinion, any exceedances listed in Question 5 are the result of non-WDS related influences (such as background, road salting, sampling site conditions)?	☐ Yes ☐ No	If yes, specify (Type Here)

7) All monitoring program surface water parameter concentrations fall within a stable or decreasing trend. The site is not characterized by historical ranges of concentrations above assessment and compliance criteria.	☐ Yes ☒ No	Surface Monitor S-1 exceeded for iron and manganese in the fall sampling. There was very minimal water for sampling at this location. In the past when the surface water at this location at this location was stagnant and / or very minimal (generally in the fall), there have been exceedances similar to this year. We
8) For the monitoring program parameters, does the water quality in the groundwater zones adjacent to surface water receivers exceed assessment or compliance criteria (e.g., PWQOs, CWQGs, or toxicity values for aquatic biota (APVs)):	☐ Yes ☒ No ☐ Not Known ☐ Not Applicable	Monitor R-1 exceeded for Iron. This well is an old dug residential well that has been severely compromised. It has been recommended that the well be abandoned and that a new monitor be constructed in the same area.
9) Have trigger values for contingency plans or site remedial actions been exceeded (where they exist):	☐ Yes ☒ No ☐ Not Applicable	If yes, list value(s) that are/have been exceeded and follow-up action taken (Type Here)

Surface Water CEP Declaration:

I, the undersigned hereby declare that I am a Competent Environmental Practitioner as defined in Appendix D under Instructions, holding the necessary level of experience and education to design surface water monitoring and sampling programs, conduct appropriate surface water investigations and interpret the related data as it pertains to the site for this monitoring period.

I have examined the applicable Certificate of Approval and any other environmental authorizing or control documents that apply to the site. I have read and followed the Monitoring and Reporting for Waste Disposal Sites Groundwater and Surface Water Technical Guidance Document (MOE, 2010, or as amended) and associated monitoring and sampling guidance documents, as amended from time to time. I have reviewed all of the data collected for the above-referenced site for the monitoring period(s) identified in this checklist. Except as otherwise agreed with the ministry for certain parameters, all of the analytical work has been undertaken by a laboratory which is accredited for the parameters analysed to *ISO/IEC 17025:2005 (E)- General requirements for the competence of testing and calibration laboratories*, or as amended from time to time by the ministry.

If any exceptions or potential concerns have been noted in the questions in the checklist attached to this declaration, it is my opinion that these exceptions and concerns are minor in nature or will be rectified for future monitoring events. Where this is not the case, the circumstances concerning the exception or potential concern and my client's proposed action have been documented in writing to the Ministry of the Environment District Manager in a letter from me dated:

Select Date

Recommendations:

Based on my technical review of the monitoring results for the waste disposal site:

☒ No Changes to the monitoring program are recommended

Type Here

☐ The following change(s) to the monitoring program is/are recommended:

☐ No changes to the site design and operation are recommended

Monitor R-2 should be decommissioned and a new monitor be installed in the same area.

☒ The following change(s) to the site design and operation is/are recommended:

CEP Signature		
Relevant Discipline	Civil engineering, hydrogeology	
Date:	22-Mar-20	
CEP Contact Information:	Nyle McIlveen, P.Eng.	
Company:	GHD	
Address:	347 Pido Road, Unit 29, Peterborough, Ontario K9J 6X7	
Telephone No.:	(705) 749-3317	
Fax No. :	(705) 749-9248	
E-mail Address:	nyle.mcilveen@ghd.com	
Save As		Print Form