CCR COMPLIANCE
GROUNDWATER MONITORING AND CORRECTIVE ACTION
ANNUAL REPORT
DUNKIRK LANDFILL

Prepared for:

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Dunkirk, New York

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January 2023

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Executive Summary

In response to the newly adopted Part A elements (effective September 28, 2020) of the Coal Combustion Residuals (CCR) Rule (or Rule), this Executive Summary has been incorporated into the annual report per the specific provisions as codified in Title 40 Code of Federal Regulations (CFR) §257.90(e)(6). These provisions require that an up-front overview of the current status (covering the immediately preceding calendar year) of groundwater monitoring and corrective action programs be provided in a concise and focused manner for each CCR unit at the facility. Accordingly, the following paragraphs document the respective groundwater monitoring status (for Calendar Year 2022) of the Dunkirk Landfill at the Dunkirk Generating Station, owned by Dunkirk Power LLC. Tables, figures and/or appendices referenced in the discussions below are included at the end of the report and further support the text (Section 2.0) in the main body of the report.

As shown on Figure 1, the Landfill maintains a CCR groundwater monitoring network comprised of five wells, including one upgradient location (Well BR-14-UG) and four downgradient locations (Wells BR-3-DG, BR-12-DG, BR-13-DG, and BR-20-DG). For Calendar Year 2022, the Landfill entered and ended the period in the Assessment Monitoring Program. The Landfill has remained in Assessment Monitoring since being transitioned in early-2018 following confirmed statistically significant increases (SSIs) for several CCR Appendix III constituents, including boron, calcium, chloride, fluoride, and total dissolved solids (TDS) in the downgradient wells (see Table 1).

Assessment Monitoring events for the current period were conducted in May and October 2022 (see Table 2). During the May 2022 event, lithium in downgradient Wells BR-13-DG and BR-20-DG was measured at an elevated concentration, and upgradient Well BR-14-UG also showed an elevated concentration. Each of these values represents a continued observation spanning back to the October 2021 sampling event, wherein downgradient wells BR-3-DG and BR-12-DG were additionally noted to have elevated lithium levels. The October 2022 event again yielded elevated lithium levels, now encompassing downgradient Wells BR-12-DG, BR-13-DG and BR-20-DG. Elevated lithium also persisted in upgradient Well BR-14-UG, marking the fourth consecutive event for this confounding observation.

In March 2022, notification was provided to the New York State Department of Environmental Conservation (NYSDEC) that the elevated lithium results from the October 2021 sampling event were being further investigated, and at that point, did not constitute a statistically significant level (SSL) above the corresponding groundwater protection standard (GWPS). In May 2022, repeat discovery of a beaver dam on the permitted discharge waterway from the landfill was encountered, along with a second dam located upgradient. Corrective actions were taken to breach the upgradient dam and to construct a piped bypass through the downgradient dam, with both actions intended to alleviate ponding of landfill effluent discharge in this area.

The further investigation noted in the NYSDEC correspondence led to the development and implementation of a study to characterize the geochemistry of the groundwater and leachate associated with the Dunkirk Landfill. This study was a collaboration between the University of Wisconsin-Madison and Vanderbilt University and concluded in late-October 2022. The findings from this body of work (included in Appendix A of this current report) provided sufficient evidence to refute the potential influence of Dunkirk Landfill leachate on the lithium concentrations in the downgradient groundwater wells. Historical disposal operations at a neighboring facility were also cited as possibly playing a role in the groundwater concentrations proximate to the western and northern boundaries of the Dunkirk Landfill. This body of work, when combined with the recurrent beaver dam obstructions, has given emphasis to the ongoing applicability of the previously completed Alternate Source Demonstration (December 2020), and the determination that recent lithium levels (from the 2021 and 2022 sampling events) are not recognized as an SSL.

Summarizing the above discussion with specific regard to the new criteria established in §257.90(e)(6), the following elements are noted:

- §257.90(e)(6)(i) – At the beginning of the current annual reporting period, the Dunkirk Landfill was operating under the CCR Assessment Monitoring Program.
- §257.90(e)(6)(ii) – At the conclusion of the current annual reporting period, the Dunkirk Landfill remained in the CCR Assessment Monitoring Program.
- §257.90(e)(6)(iii) – The following SSIs for Appendix III constituents were observed in the downgradient wells during the current annual reporting period:
  - Well BR-3-DG – calcium, chloride, sulfate, and TDS
  - Well BR-12-DG – calcium, chloride, fluoride, and TDS
  - Well BR-13-DG – boron and chloride
  - Well BR-20-DG – boron, chloride, and fluoride

  This same general subset of Appendix III constituents triggered the Dunkirk Landfill into the CCR Assessment Monitoring Program in early-2018, wherein it has since remained.
- §257.90(e)(6)(iv) – Lithium was measured above the GWPS in downgradient Wells BR-13-DG and BR-20-DG during the May 2022 monitoring event. Lithium was measured above the GWPS during the October 2021 monitoring event in downgradient Wells BR-12-DG, BR-13-DG, and BR-20-DG. These observations do not constitute an SSL for lithium as noted in the discussions above.

- §257.90(e)(6)(v) – The Dunkirk Landfill is not currently subject to corrective action or any associated remedy selection under §257.97.
- §257.90(e)(6)(vi) – The Dunkirk Landfill is not currently subject to corrective action or any associated remedy implementation under §257.98.

1.0 Introduction

Title 40 Code of Federal Regulations (CFR) §257.90 mandates that existing Coal Combustion Residuals (CCR) landfills and surface impoundments, also known as CCR units, be subject to groundwater monitoring and corrective action requirements as further detailed in §257.91 through §257.98. These requirements are part of the overall CCR Rule (or Rule) which was published in the Federal Register on April 17, 2015 and which became effective on October 19, 2015. Specific obligations for Owners and Operators of existing CCR units regarding the preparation of "Annual Groundwater Monitoring and Corrective Action Reports (Annual Report)" are outlined in §257.90(e)(1-5). The first Annual Report was completed on January 31, 2018, and provided information, per the Rule, to address the following aspects for the preceding calendar year:

- Document the status of the groundwater monitoring and corrective action program for the respective CCR units;
- Summarize key actions completed;
- Describe any problems encountered and actions taken to resolve the problems; and
- Offer a projection of key activities for the upcoming year.

At a minimum, the Annual Report must contain the following information to the extent applicable and available, and must also address the items contained in §257.90(e)(6) in the form of an Executive Summary:

- A map, aerial image, or diagram showing the CCR unit and all background/upgradient and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program;
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;
- In addition to all the monitoring data obtained under §257.90 through §257.98, a summary including the number of groundwater samples that were collected for analysis for each background/upgradient and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;
- A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and
- Any other information required to be included as specified in §257.90 through §257.98.

The Dunkirk Generating Station, owned by Dunkirk Power LLC, is a coal-fired power plant located in Dunkirk, New York. The facility was decommissioned and ceased electric generating operations in early-2016, subsequent to the effective date of the Rule. The Rule applies to this facility due to the continued management/disposal of CCR materials resulting from sustained operations and maintenance activities. Accordingly, the Station's captive disposal site, located in Pomfret, New York and identified as the Dunkirk Landfill, has been designated as an existing CCR unit. This unit has a dedicated groundwater monitoring well network that meets the requirements of §257.91 with regard to number and appropriate locations of wells (certification previously provided under separate cover).

In summary, this sixth Annual Report has been prepared to comply with the requirements of §257.90(e) with respect to documenting the groundwater monitoring and corrective actions undertaken during Calendar Year 2022 for the Dunkirk Landfill CCR unit. This Annual Report and all subsequent reports thereto will be placed in the Station's operating record per §257.105(h)(1), noticed to the State Director per §257.106(h)(1), and posted to the publicly accessible internet site per §257.107(h)(1).

The previously prepared fifth Annual Report (covering the 2021 Calendar Year reporting period) was completed on January 31, 2022 and placed into the facility operating record on this same date. Subsequent notification to the State Director and posting to the publicly accessible website was completed on March 1, 2022.

2.0 Dunkirk Landfill

2.1 Groundwater Monitoring Network

The CCR groundwater monitoring system for the Dunkirk Landfill is comprised of five wells, including Well BR-14-UG (upgradient), and Wells BR-3-DG, BR-12-DG, BR-13-DG, and BR-20-DG (downgradient). The locations of the wells are shown on the attached Figure 1, along with depiction of the generalized groundwater flow direction in the area of the landfill. Each of these wells was already existing, and no new wells were added nor were any existing wells abandoned/replaced during the 2022 reporting period.

2.2 2022 Data Collection

Following its transition in early-2018, the Dunkirk Landfill continued in the CCR Assessment Monitoring Program during the 2022 reporting period. Accordingly, samples were collected and analyzed for Appendix III and Appendix IV constituents as required, during the May and October monitoring events. Results from the 2022 sampling events are summarized in Tables 1 and 2, covering Appendix III and Appendix IV constituents, respectively. As shown in Table 2, lithium in downgradient Wells BR-13-DG and BR-20-DG was measured at elevated levels of 0.07 and 0.40 mg/L, respectively, during the May event. The October event showed similar results with elevated lithium concentrations reported in downgradient Wells BR-12-DG (0.07 mg/L), BR-13-DG (0.10 mg/L), and BR-20-DG (0.43 mg/L). Upgradient Well BR-14-UG also continued with suspect readings for lithium during each of the 2022 sampling events, marking the third and fourth consecutive measurable levels for this constituent spanning back to the May 2021 event.

Dating back to the October 2021 sampling event, lithium was detected in each of the downgradient Wells BR-3-DG (0.06 mg/L), BR-12-DG (0.07 mg/L), BR-13-DG (0.10 mg/L), and BR-20-DG (0.48 mg/L) at concentrations that could potentially represent a significantly significant level (SSL) above the Groundwater Protection Standard of 0.05 mg/L. Accordingly in March 2022, notification was made to the New York State Department of Environmental Conservation (NYSDEC) with indications that further investigation of these values would be conducted to more clearly determine their status as potential SSLs. This investigation took the form of a geochemistry study designed to characterize, compare, and contrast the composition and properties of groundwater and leachate associated with the Dunkirk Landfill. The study was implemented in April 2022, and was a joint collaboration involving resources from the University of Wisconsin-Madison and Vanderbilt University, and the Vanderbilt analytical laboratory facilities. The study concluded in late-October 2022, with the findings published in a summary document, a copy of which is included in Appendix A of this report. The findings from this body of work provided sufficient evidence to refute the potential influence of Dunkirk Landfill leachate on the lithium concentrations in the downgradient groundwater wells. Historical disposal operations at a neighboring facility were also cited as possibly playing a role in the groundwater concentrations proximate to the western and northern boundaries of the Dunkirk Landfill.

In tandem with the above, and during a May 2022 walkdown of the Dunkirk Landfill and surrounding environs, it was discovered that a beaver dam had been reconstructed along the waterway that serves as the permitted discharge pathway for the landfill effluent. Further reconnaissance revealed a second dam in an upgradient location on this same waterway. To alleviate the damming and ponding water effects caused by the obstructions, corrective actions were undertaken to breach the upgradient dam and install a piped bypass in the lower dam. Acknowledging the impacts that earlier discovered dams created in 2020, the previously completed Alternate Source Demonstration (December 2020) remains relevant and applicable for the observations during the 2022 sampling events, particularly in the area of Well BR-20-DG. The findings from the geochemistry study further serve to offer potential rationale for groundwater in the area of Well BR-20-DG and in reaches along the western and northern limits of the Dunkirk Landfill property (in the directions of Wells BR-12-DG and BR-13-DG). Collectively, the information provides convincing evidence that the elevated lithium concentrations do not constitute SSLs tied in any way to the Dunkirk Landfill.

2.3 2022 Monitoring Program Transitions

During 2022, there were no transitions between monitoring programs, with the Dunkirk Landfill remaining in the CCR Assessment Monitoring Program.

2.4 2022 Corrective Actions

During 2022, there were no corrective actions undertaken specific to the CCR Rule. However, measures were taken to alleviate ponding water created by the reconstructed beaver dams encountered on the permitted discharge waterway for the Dunkirk Landfill.

2.5 2023 Projected Activities

It is anticipated that Assessment Monitoring activities will continue for the Dunkirk Landfill during 2023, with continued review of Appendix III/Appendix IV constituent concentrations and comparison against calculated background and established groundwater protection standards.

Tables

Table 1
Dunkirk Power LLC
Dunkirk Landfill – Groundwater Analytical Data
CCR Appendix III Constituents

Monitoring Well	Date Sampled	Total Boron (mg/L)	Total Calcium (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	pH (S.U.)
		Calculated Background						
		0.270	135	5.1	0.22	699	254	5.79-8.38
BR-14-UG (Upgradient)	17-Nov-15	0.183	100	3.6	< 0.20	370	82	7.53
	9-Feb-16	0.200	89	3.4	< 0.20	435	78	6.56
	11-May-16	0.164	86	3.1	0.22	430	73	7.24
	30-Aug-16	0.185	87	3.6	< 0.20	470	87	6.98
	9-Nov-16	0.160	92	4.1	< 0.20	575	159	7.33
	14-Feb-17	0.175	108	4.3	< 0.20	480	133	7.17
	16-May-17	0.157	81	3.5	< 0.20	460	91	7.42
	15-Aug-17	0.228	111	3.4	0.21	505	128	6.42
	2-Oct-17	0.154	103	4.0	< 0.20	570	147	7.10
	9-May-18	0.121	80	2.5	< 0.20	385	51	7.29
	9-Oct-18	0.199	81	3.4	0.22	440	78	7.29
	11-Mar-19	0.254	97	3.0	< 0.20	465	62	7.37
	15-May-19	0.170	89	2.9	< 0.20	425	52	7.30
	1-Oct-19	0.190	91	3.5	0.23	500	95	7.31
	11-Feb-20	0.195	90	2.9	< 0.20	355	58	7.21
	13-May-20	0.164	92	2.8	< 0.20	420	67	7.38
	20-Oct-20	0.181	106	3.4	< 0.20	610	155	7.31
	11-May-21	0.158	100	3.2	0.39	565	78	7.02
	12-Oct-21	0.246	95	2.9	< 0.20	505	86	7.07
	10-May-22	0.168	100	3.1	< 0.20	445	70	6.99
	4-Oct-22	0.170	97	3.3	< 0.20	525	143	6.78
BR-3-DG (Downgradient)	17-Nov-15	0.098	141	45.9	< 0.20	545	159	7.23
	9-Feb-16	0.078	119	32.8	< 0.20	590	155	7.50
	11-May-16	0.098	111	23.0	< 0.20	560	137	7.16
	30-Aug-16	0.096	114	28.8	< 0.20	585	159	7.01
	9-Nov-16	0.088	115	84.9	< 0.20	705	152	7.13
	14-Feb-17	0.092	151	99.7	< 0.20	590	161	7.19
	16-May-17	0.062	113	58.1	< 0.20	580	150	6.55
	15-Aug-17	0.135	139	69.4	0.27	600	158	6.98
	2-Oct-17	0.095	134	77.4	0.38	700	165	7.32
	9-May-18	0.068	145	34.9	< 0.20	585	147	7.12
	8-Oct-18	0.109	106	33.5	0.22	565	155	7.24
	11-Mar-19	0.097	157	24.3	< 0.20	600	166	7.48
	15-May-19	0.125	125	19.0	< 0.20	500	153	7.03
	1-Oct-19	0.150	140	26.2	0.25	635	153	6.99
	11-Feb-20	0.137	129	19.9	< 0.20	520	163	6.93
	12-May-20	0.097	140	21.5	< 0.20	625	230	7.52
	20-Oct-20	0.091	132	25.5	< 0.20	665	191	7.32
	11-May-21	0.063	168	22.3	0.32	850	345	7.19
	12-Oct-21	0.115	155	19.9	0.48	745	275	7.31
	10-May-22	0.058	151	18.9	< 0.20	950	342	7.51
	4-Oct-22	0.087	129	47.9	< 0.20	795	272	7.11
BR-12-DG (Downgradient)	17-Nov-15	0.163	197	319	< 0.20	825	66	6.94
	9-Feb-16	0.104	177	263	< 0.20	920	151	7.00
	11-May-16	0.083	156	158	< 0.20	780	168	7.29
	30-Aug-16	0.173	166	329	< 0.20	1040	70	7.04
	9-Nov-16	0.179	222	375	< 0.20	1260	62	7.00
	14-Feb-17	0.117	241	422	< 0.20	1030	109	7.07
	16-May-17	0.068	160	299	< 0.20	1100	139	6.54
	15-Aug-17	0.181	174	299	< 0.20	1030	83	6.99
	2-Oct-17	0.163	196	421	1.04	1250	70	6.94
	9-May-18	0.061	205	260	< 0.20	950	147	6.69
	8-Oct-18	0.169	171	382	< 0.20	1120	71	6.91
	11-Mar-19	0.073	244	213	< 0.20	920	154	7.16
	15-May-19	0.066	175	188	< 0.20	945	156	6.91
	1-Oct-19	0.142	241	323	0.29	1340	85	6.91
	11-Feb-20	0.092	181	224	< 0.20	785	147	6.78
	12-May-20	0.079	179	183	< 0.20	815	194	7.05
	20-Oct-20	0.176	196	395	< 0.20	1470	67	7.09
	11-May-21	0.077	198	228	0.25	860	169	7.19
	12-Oct-21	0.165	181	285	< 0.20	855	91	6.95
	10-May-22	0.061	183	167	< 0.20	845	188	7.42
	4-Oct-22	0.144	173	491	< 0.20	1550	74	7.03

See notes at end of table.

Table 1 (cont'd)
Dunkirk Power LLC
Dunkirk Landfill – Groundwater Analytical Data
CCR Appendix III Constituents

Monitoring Well	Date Sampled	Total Boron (mg/L)	Total Calcium (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Dissolved Solids (mg/L)	Sulfate (mg/L)	pH (S.U.)
		Calculated Background						
		0.270	**135**	**5.1**	**0.22**	**699**	**254**	**5.79-8.38**
BR-13-DG (Downgradient)	17-Nov-15	0.223	109	8.8	< 0.20	495	67	7.23
	9-Feb-16	0.162	109	7.9	< 0.20	560	129	7.25
	11-May-16	0.151	115	7.1	< 0.20	620	161	7.23
	30-Aug-16	0.304	118	8.6	< 0.20	560	59	7.09
	9-Nov-16	0.164	85	7.3	< 0.20	560	127	7.20
	14-Feb-17	0.144	113	7.6	< 0.20	545	140	7.21
	16-May-17	0.103	97	7.1	< 0.20	585	142	6.79
	15-Aug-17	0.274	103	8.4	0.21	500	60	7.03
	2-Oct-17	0.240	96	8.4	< 0.20	565	41	7.19
	9-May-18	0.109	131	6.7	< 0.20	540	108	7.05
	8-Oct-18	0.252	89	8.9	< 0.20	555	72	7.09
	11-Mar-19	0.172	126	8.2	< 0.20	545	122	7.07
	15-May-19	0.134	123	7.8	< 0.20	585	137	7.11
	1-Oct-19	0.278	94	8.7	0.26	615	29	7.13
	11-Feb-20	0.173	115	8.5	< 0.20	470	99	6.78
	12-May-20	0.153	125	7.9	< 0.20	545	159	7.21
	20-Oct-20	0.322	102	9.0	0.27	500	32	7.56
	11-May-21	0.144	120	8.3	0.38	645	118	7.19
	12-Oct-21	0.269	103	9.0	0.63	375	54	7.09
	10-May-22	0.129	121	9.2	< 0.20	625	136	7.61
	4-Oct-22	0.280	83	9.1	0.20	480	43	7.25
BR-20-DG (Downgradient)	17-Nov-15	1.42	26	2.8	< 0.20	670	102	7.61
	9-Feb-16	1.40	24	12.2	0.35	725	< 2.0	7.74
	11-May-16	1.44	22	33.0	0.35	720	< 2.0	7.85
	30-Aug-16	1.39	24	25.4	0.36	685	< 4.0	6.97
	9-Nov-16	1.35	19	15.5	0.22	675	< 2.0	7.69
	14-Feb-17	1.56	25	16.5	0.39	635	< 2.0	7.69
	16-May-17	1.37	21	15.5	< 0.20	675	< 2.0	7.71
	15-Aug-17	1.42	25	38.3	0.41	655	< 2.0	7.58
	2-Oct-17	1.24	22	21.6	0.42	720	< 4.0	7.32
	9-May-18	1.09	21	21.3	0.40	650	< 4.0	7.49
	8-Oct-18	1.41	21	14.9	0.39	640	< 2.0	7.58
	12-Mar-19	1.35	22	19.8	0.42	725	< 4.0	7.54
	15-May-19	1.27	24	23.7	0.33	765	< 4.0	7.71
	1-Oct-19	1.45	22	17.7	0.42	575	< 4.0	7.73
	11-Feb-20	1.47	25	28.3	< 0.20	630	< 4.0	7.73
	12-May-20	1.47	26	18.1	0.31	635	< 4.0	7.52
	20-Oct-20	1.42	25	31.0	0.44	650	< 2.0	7.92
	11-May-21	1.26	24	59.6	0.54	865	< 2.0	7.80
	12-Oct-21	1.50	26	15.5	0.85	425	< 4.0	7.51
	10-May-22	1.29	29	23.2	0.36	690	< 2.0	7.89
	4-Oct-22	1.36	20	31.4	0.41	680	< 2.0	7.79

Notes:

1. Cells with "<" are represented as non-detects. Values shown correspond to the laboratory reporting limit.
2. Background values based on statistical evaluation of initial eight rounds (Nov. 2015 through Aug. 2017) of groundwater sampling data for Well BR-14-UG.

Table 2
Dunkirk Power LLC
Dunkirk Landfill – Groundwater Analytical Data
CCR Appendix IV Constituents

Monitoring Well	Date Sampled	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Cadmium (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/L)	Total Fluoride (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)	Total Selenium (mg/L)	Total Thallium (mg/L)	Total Radium-226 and 228 (pCi/L)
		Calculated Background														
		0.0025	0.009	0.68	0.004	0.005	0.005	0.05	0.22	0.005	0.05	0.000001	0.01	0.005	0.0007	1.25
		Groundwater Protection Standard														
		MCL	MCL	MCL	Background	MCL	MCL	Background	MCL	RSL	Background	MCL	RSL	MCL	MCL	MCL
		0.006	0.01	2	0.004	0.005	0.1	0.05	4.0	0.015	0.05	0.002	0.10	0.05	0.002	5
BR-14-UG (Upgradient)	17-Nov-15	< 0.060	0.009	0.21	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.23
	9-Feb-16	< 0.060	< 0.005	0.33	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.24
	11-May-16	< 0.060	< 0.005	0.20	< 0.005	< 0.005	< 0.005	< 0.050	0.22	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.18
	30-Aug-16	< 0.060	0.008	0.24	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	0.0000005	< 0.010	< 0.005	< 0.010	1.25
	9-Nov-16	< 0.060	< 0.005	0.05	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.23
	14-Feb-17	< 0.060	< 0.005	0.09	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.22
	16-May-17	0.0010	< 0.005	0.11	< 0.004	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0007	0.33
	15-Aug-17	0.0025	< 0.005	0.10	< 0.004	< 0.005	< 0.005	< 0.050	0.21	< 0.005	< 0.050	< 0.0000010	< 0.010	< 0.005	< 0.0007	< 1.22
	29-Mar-18	< 0.0004	< 0.005	0.13	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	0.00
	9-May-18	Not Analyzed	Not Analyzed	0.12	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	1.29
	9-Oct-18	Not Analyzed	Not Analyzed	0.14	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.22	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	1.29
	11-Mar-19	< 0.0004	0.005	0.20	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	0.63
	15-May-19	Not Analyzed	< 0.01	0.20	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	< 0.003	Not Analyzed	0.0000016	Not Analyzed	Not Analyzed	Not Analyzed	0.77
	1-Oct-19	Not Analyzed	< 0.005	0.12	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.23	< 0.005	Not Analyzed	0.0000007	Not Analyzed	Not Analyzed	Not Analyzed	0.43
	11-Feb-20	< 0.0004	< 0.005	0.17	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	0.87
	13-May-20	< 0.0004	Not Analyzed	0.18	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	< 0.050	0.0000008	Not Analyzed	Not Analyzed	Not Analyzed	1.23
	20-Oct-20	< 0.0004	Not Analyzed	0.12	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	< 0.050	0.0000006	Not Analyzed	Not Analyzed	Not Analyzed	0.76
	11-May-21	< 0.0004	< 0.005	0.18	< 0.0003	< 0.005	< 0.005	< 0.050	0.39	< 0.005	0.178	0.0000018	< 0.010	< 0.005	< 0.0003	0.11
	12-Oct-21	Not Analyzed	Not Analyzed	0.21	Not Analyzed	Not Analyzed	0.007	Not Analyzed	< 0.20	Not Analyzed	0.060	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	0.72
	10-May-22	< 0.0004	< 0.005	0.23	< 0.0005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	0.060	< 0.0000005	< 0.010	< 0.005	< 0.0005	0.24
	4-Oct-22	< 0.0004	Not Analyzed	0.08	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	0.060	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	0.27
BR-3-DG (Downgradient)	17-Nov-15	< 0.060	0.008	0.05	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	0.006	< 0.050	< 0.0000005	< 0.010	< 0.005	0.012	0.22
	9-Feb-16	< 0.060	< 0.005	0.04	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.22
	11-May-16	< 0.060	< 0.005	0.03	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.76
	30-Aug-16	< 0.060	0.008	0.04	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	1.23
	9-Nov-16	< 0.060	< 0.005	0.03	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.28
	14-Feb-17	< 0.060	0.006	0.04	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.31
	16-May-17	0.0016	< 0.005	0.03	< 0.004	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0007	1.28
	15-Aug-17	0.0040	< 0.005	0.05	< 0.004	< 0.005	< 0.005	< 0.050	0.27	< 0.005	< 0.050	< 0.0000010	< 0.010	< 0.005	< 0.0007	1.23
	29-Mar-18	< 0.0004	< 0.005	0.04	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	0.00
	9-May-18	Not Analyzed	Not Analyzed	0.03	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	1.20
	8-Oct-18	Not Analyzed	Not Analyzed	0.03	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.22	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	1.58
	11-Mar-19	< 0.0004	< 0.005	0.03	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	0.006	< 0.050	0.0000030	< 0.010	< 0.005	< 0.0003	0.54
	15-May-19	Not Analyzed	< 0.01	< 0.20	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	< 0.003	Not Analyzed	0.0000028	Not Analyzed	Not Analyzed	Not Analyzed	3.48
	1-Oct-19	Not Analyzed	< 0.005	0.04	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.25	< 0.005	Not Analyzed	0.0000016	Not Analyzed	Not Analyzed	Not Analyzed	0.81
	11-Feb-20	< 0.0004	< 0.005	0.03	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	0.0000014	< 0.010	< 0.005	< 0.0003	1.19
	12-May-20	< 0.0004	Not Analyzed	0.03	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	< 0.050	0.0000009	Not Analyzed	Not Analyzed	Not Analyzed	0.89
	20-Oct-20	0.0007	Not Analyzed	0.03	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	< 0.050	0.0000006	Not Analyzed	Not Analyzed	Not Analyzed	0.03
	11-May-21	< 0.0004	< 0.005	0.03	< 0.0003	< 0.005	< 0.005	< 0.050	0.32	< 0.005	0.119	0.0000016	< 0.010	< 0.005	< 0.0003	0.57/0.71
	12-Oct-21	Not Analyzed	Not Analyzed	0.04	Not Analyzed	Not Analyzed	0.019	Not Analyzed	0.48	Not Analyzed	0.060	0.0000011	Not Analyzed	Not Analyzed	Not Analyzed	0.55
	10-May-22	< 0.0004	< 0.005	0.02	< 0.0005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	0.050	0.0000010	< 0.010	< 0.005	< 0.0005	0.21
	4-Oct-22	< 0.0004	Not Analyzed	0.02	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	0.050	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	1.48
BR-12-DG (Downgradient)	17-Nov-15	< 0.060	0.006	0.07	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	0.014	0.35
	9-Feb-16	< 0.060	< 0.005	0.06	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.16
	11-May-16	< 0.060	< 0.005	0.04	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.31
	30-Aug-16	< 0.060	0.009	0.09	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	1.61
	9-Nov-16	< 0.060	< 0.005	0.08	< 0.005	< 0.005	0.045	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.45
	14-Feb-17	< 0.060	< 0.005	0.08	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	1.22
	16-May-17	0.0022	< 0.005	0.04	< 0.004	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0007	0.22
	15-Aug-17	0.0045	< 0.005	0.08	< 0.004	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000010	< 0.010	< 0.005	< 0.0007	0.32
	29-Mar-18	< 0.0004	< 0.005	0.05	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	0.00
	9-May-18	Not Analyzed	Not Analyzed	0.04	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.32
	8-Oct-18	Not Analyzed	Not Analyzed	0.07	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	1.67
	11-Mar-19	< 0.0004	< 0.005	0.03	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	1.16
	15-May-19	Not Analyzed	< 0.01	< 0.20	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	< 0.003	Not Analyzed	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	1.49
	1-Oct-19	Not Analyzed	< 0.005	0.06	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.29	< 0.005	Not Analyzed	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	0.89
	11-Feb-20	< 0.0004	< 0.005	0.05	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	1.34
	12-May-20	< 0.0004	Not Analyzed	0.04	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	< 0.050	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	0.47
	20-Oct-20	< 0.0004	Not Analyzed	0.09	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	< 0.050	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	1.77
	11-May-21	< 0.0004	< 0.005	0.05	< 0.0003	< 0.005	0.007	< 0.050	0.25	< 0.005	0.145	< 0.0000005	< 0.010	< 0.005	< 0.0003	0.79
	12-Oct-21	Not Analyzed	Not Analyzed	0.08	Not Analyzed	Not Analyzed	< 0.010	Not Analyzed	< 0.20	Not Analyzed	0.070	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	0.44
	10-May-22	< 0.0004	< 0.005	0.03	< 0.0005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	0.040	< 0.0000005	< 0.010	< 0.005	< 0.0005	0.74
	4-Oct-22	< 0.0004	Not Analyzed	0.07	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	0.070	0.0000007	Not Analyzed	Not Analyzed	Not Analyzed	1.64

See notes at end of table.

Table 2 (cont'd)
Dunkirk Power LLC
Dunkirk Landfill – Groundwater Analytical Data
CCR Appendix IV Constituents

Monitoring Well	Date Sampled	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Cadmium (mg/L)	Total Chromium (mg/L)	Total Cobalt (mg/L)	Total Fluoride (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)	Total Selenium (mg/L)	Total Thallium (mg/L)	Total Radium-226 and 228 (pCi/L)
		Calculated Background														
		0.0025	0.009	0.68	0.004	0.005	0.005	0.05	0.22	0.005	0.05	0.000001	0.01	0.005	0.0007	1.25
		Groundwater Protection Standard														
		MCL	MCL	MCL	Background	MCL	MCL	Background	MCL	RSL	Background	MCL	RSL	MCL	MCL	MCL
		0.006	0.01	2	0.004	0.005	0.1	0.05	4.0	0.015	0.05	0.002	0.10	0.05	0.002	5
BR-13-DG (Downgradient)	17-Nov-15	< 0.060	< 0.005	0.08	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	0.012	0.36
	9-Feb-16	< 0.060	< 0.005	0.08	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.45
	11-May-16	< 0.060	< 0.005	0.07	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.44
	30-Aug-16	< 0.060	0.008	0.11	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	1.39
	9-Nov-16	< 0.060	< 0.005	0.05	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.33
	14-Feb-17	< 0.060	< 0.005	0.06	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.17
	16-May-17	0.0015	< 0.005	0.05	< 0.004	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0007	0.24
	15-Aug-17	0.0030	< 0.005	0.09	< 0.004	< 0.005	< 0.005	< 0.050	0.21	< 0.005	< 0.050	< 0.0000010	< 0.010	< 0.005	< 0.0007	0.34
	29-Mar-18	< 0.0004	< 0.005	0.07	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	0.00
	9-May-18	Not Analyzed	Not Analyzed	0.06	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	1.37
	8-Oct-18	Not Analyzed	Not Analyzed	0.09	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	1.87
	11-Mar-19	< 0.0004	0.006	0.07	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	1.12
	15-May-19	Not Analyzed	< 0.01	< 0.20	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	< 0.003	Not Analyzed	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	1.09
	1-Oct-19	Not Analyzed	< 0.005	0.09	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.26	< 0.005	Not Analyzed	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	1.13
	11-Feb-20	< 0.0004	< 0.005	0.08	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	0.65
	12-May-20	< 0.0004	Not Analyzed	0.08	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	< 0.20	Not Analyzed	< 0.050	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	1.18
	20-Oct-20	< 0.0004	Not Analyzed	0.10	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.27	Not Analyzed	< 0.050	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	1.21
	11-May-21	< 0.0004	< 0.005	0.07	< 0.0003	< 0.005	0.007	< 0.050	0.38	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	0.34
	12-Oct-21	Not Analyzed	Not Analyzed	0.08	Not Analyzed	Not Analyzed	< 0.010	Not Analyzed	0.63	Not Analyzed	0.100	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	0.48
	10-May-22	< 0.0004	< 0.005	0.04	< 0.0005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	0.070	< 0.0000005	< 0.010	< 0.005	< 0.0005	1.29
	4-Oct-22	< 0.0004	Not Analyzed	0.07	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.20	Not Analyzed	0.100	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	0.74
BR-20-DG (Downgradient)	17-Nov-15	< 0.060	0.006	1.50	< 0.005	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	1.53
	9-Feb-16	< 0.060	< 0.005	1.83	< 0.005	< 0.005	< 0.005	< 0.050	0.35	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	1.71
	11-May-16	< 0.060	< 0.005	1.57	< 0.005	< 0.005	0.006	< 0.050	0.35	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	2.13
	30-Aug-16	< 0.060	0.006	1.93	< 0.005	< 0.005	< 0.005	< 0.050	0.36	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	2.04
	9-Nov-16	< 0.060	< 0.005	1.25	< 0.005	< 0.005	< 0.005	< 0.050	0.22	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	0.61
	14-Feb-17	< 0.060	< 0.005	1.88	< 0.005	< 0.005	< 0.005	< 0.050	0.39	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.010	2.20
	16-May-17	0.0014	< 0.005	1.53	< 0.004	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0007	0.99
	15-Aug-17	0.0016	< 0.005	1.84	< 0.004	< 0.005	< 0.005	< 0.050	0.41	< 0.005	< 0.050	< 0.0000010	< 0.010	< 0.005	< 0.0007	0.77
	29-Mar-18	< 0.0004	< 0.005	2.00	< 0.0003	< 0.005	< 0.005	< 0.050	0.36	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	2.01
	9-May-18	Not Analyzed	Not Analyzed	1.51	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.40	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	2.02
	8-Oct-18	Not Analyzed	Not Analyzed	1.58	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.39	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.87
	12-Mar-19	< 0.0004	< 0.005	1.51	< 0.0003	< 0.005	< 0.005	< 0.050	0.42	< 0.005	< 0.050	< 0.0000005	< 0.010	< 0.005	< 0.0003	1.24
	15-May-19	Not Analyzed	< 0.01	1.60	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.33	< 0.003	Not Analyzed	0.0000008	Not Analyzed	Not Analyzed	Not Analyzed	1.89
	1-Oct-19	Not Analyzed	< 0.005	1.38	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.42	< 0.005	Not Analyzed	0.0000008	Not Analyzed	Not Analyzed	Not Analyzed	1.22
	11-Feb-20	0.0004	< 0.005	1.84	< 0.0003	< 0.005	< 0.005	< 0.050	< 0.20	< 0.005	0.139	< 0.0000005	< 0.010	< 0.005	< 0.0003	1.43
	12-May-20	0.0005	Not Analyzed	1.95	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.31	Not Analyzed	0.266	0.0000024	Not Analyzed	Not Analyzed	Not Analyzed	1.07
	20-Oct-20	< 0.0004	Not Analyzed	1.99	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.44	Not Analyzed	< 0.050	< 0.0000005	Not Analyzed	Not Analyzed	Not Analyzed	2.33
	11-May-21	< 0.0004	< 0.005	1.66	< 0.0003	< 0.005	< 0.005	< 0.050	0.54	< 0.005	< 0.050	0.0000015	< 0.010	< 0.005	< 0.0003	1.80
	12-Oct-21	Not Analyzed	Not Analyzed	2.0	Not Analyzed	Not Analyzed	0.007	Not Analyzed	0.85	Not Analyzed	0.480	0.0000006	Not Analyzed	Not Analyzed	Not Analyzed	1.74
	10-May-22	0.0005	< 0.005	1.42	< 0.0005	< 0.005	< 0.005	< 0.050	0.36	< 0.005	0.400	< 0.0000005	< 0.010	< 0.005	< 0.0005	0.92
	4-Oct-22	0.0005	Not Analyzed	1.52	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	0.41	Not Analyzed	0.430	0.0000010	Not Analyzed	Not Analyzed	Not Analyzed	1.54

🟨 = Result from April 10, 2019 re-analysis; prior result from March 11, 2019 sample considered an atypical value (0.339 mg/L). April 2019 re-analysis result (< 0.050 mg/L) deemed representative and consistent with historical values for this well.

🟫 = Results from July 22, 2021 re-sampling and analysis of split samples; prior result from May 11, 2021 sample considered an atypical value (8.14 pCi/L). July 2021 re-sampling and split analysis results (0.57/0.71 pCi/L) deemed representative and consistent with historical values for this well.

🟨 = Results deemed invalid based on July 2021 re-sampling and split sample analysis. See Appendix A of the 2021 CCR Annual Groundwater Monitoring & Corrective Action Report (dated January 2022).

🟦 = Results addressed via peformance of Alternate Source Demonstration. See Appendix A of the 2020 CCR Annual Groundwater Monitoring & Corrective Action Report (dated January 2021).

🟥 = Results not deemed as SSL based on still relevant Alternate Source Demonstration (see Appendix A of 2020 Groundwater Monitoring Report [dated January 2021]) and findings from focused Geochemical Investigation (see Appendix A of this current Groundwater Monitoring Report [dated January 2023]).

🟧 = Samples from the May 10, 2022 event were lost by the laboratory. Values presented are associated with August 10, 2022 resampling.

Notes:

1. Cells with "<" are represented as non-detects. Values shown correspond to the laboratory reporting limit.
2. Background values based on statistical evaluation of initial eight rounds (Nov. 2015 through Aug. 2017) of groundwater sampling data for Well BR-14-UG.
3. As indicated, Groundwater Protection Standards are either published MCLs or risk-based Regional Screening Levels (RSLs). For constituents where calculated background exceeds either the MCL or RSL, the background value is used.

Figures

LEGEND:

BR-20-DG ⊕ (611.34)	CCR GROUNDWATER MONITORING WELL WITH GROUNDWATER ELEVATION MEASURED ON OCTOBER 4, 2022
▨	ACTIVE AREAS
←	GROUNDWATER GENERALIZED FLOW DIRECTION

REFERENCE:

GOOGLE AERIAL PHOTOGRAPH, DATED APRIL 2022.

SCALE
0 400 800 FEET

APTIM

500 Penn Center Boulevard,
Suite 1000
Pittsburgh, Pennsylvania 15235

DUNKIRK POWER LLC

FIGURE 1
CCR COMPLIANCE GROUNDWATER
MONITORING WELL LOCATION MAP
DUNKIRK LANDFILL
DUNKIRK GENERATING STATION
DUNKIRK, NEW YORK

DRAWING NUMBER	631016538-B4
APPROVED BY	--
CHECKED BY	D. Shott
DRAWN BY	E. Schlegel
DESIGNED BY	--
DATE	12/14/22
OFFICE	Pittsburgh, PA

File: O:\PROJECT\NRG DUNKIRK\631016538\631016538-B4.dwg
Plot Date/Time: Dec 14, 2022 - 11:29am
Plotted By: Evan.Schlegel
Xref:
Image

Appendix A

Groundwater and Leachate Geochemical Study

GEOCHEMISTRY OF LEACHATE FROM DUNKIRK FLY ASH LANDFILL AND GROUNDWATER AND SURFACE WATER IN THE ENVIRONS

by

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Report No. 22-36

22 December 2022
(FINAL)

This report was prepared under my direction in accordance with professional standards.

22 December 2022

Craig H. Benson, PhD, PE, DGE, BCEE, NAE

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BENSON
E-34108
VERONA
WI
PROFESSIONAL ENGINEER

1. INTRODUCTION

The primary objective of this study was to evaluate if isotopes of elements associated with leachate from coal combustion products (CCPs) can be used to identify sources of dissolved species in groundwater in the area surrounding Dunkirk Fly Ash Landfill in Pomfret, New York. Dunkirk Fly Ash Landfill was used for dry disposal of coal combustion products (CCPs) produced by the Dunkirk Generating Station, which ceased operating in 2016. A secondary objective was to evaluate whether concentrations of other elements in leachate can be used to identify sources of dissolved species in groundwater. Samples of leachate from the landfill, as well as surrounding groundwater and surface water bodies, were collected and analyzed for geochemical characteristics. These data are described and interpreted in this report.

Samples of the leachate, groundwater, and surface water were collected on 5 April 2022 by Frontier Technical Associates Inc. (see Appendix). The sampling locations are shown in Fig. 1, which is an aerial photograph of the Dunkirk Fly Ash Landfill and its environs superimposed with circular notations marking sampling locations. Groundwater samples were collected from six groundwater monitoring wells, three leachate manholes, and two surface water bodies. One monitoring well is located upgradient and east of Dunkirk Fly Ash Landfill (BR-14-UG). Three monitoring wells are downgradient and north (BR-3-DG, BR-13-DG) or northwest (BR-12-DG) of Dunkirk Fly Ash Landfill. Two monitoring wells are downgradient and west of Dunkirk Fly Ash Landfill. One of these westerly wells is along the western periphery of Dunkirk Fly Ash Landfill (BR-20-DG), whereas the other is appreciably west of Dunkirk Fly Ash Landfill (OB-5-DG) and directly adjacent to another landfill (Fig. 1). Herein this other landfill is referred to as the West Landfill. Surface water samples were collected south of the hydraulic basin (SW-BG), representing conditions believed to be outside the area of influence by the landfills, and at the Beaver Dam outflow (SW-BD) between the Dunkirk Fly Ash Landfill and the West Landfill. Leachate samples were collected from three manholes in the Dunkirk Fly Ash Landfill (MH2, MH16, and MH19).

The water samples were shipped to Vanderbilt University, where chemical analysis was conducted using inductively coupled plasma optical emission spectrometry (ICP-OES) or inductively coupled plasma mass spectrometry (ICP-MS). Results of the chemical analysis, and interpretation of the data, are described in this report.

2. METHODS

All water samples were analyzed for metals representing the major cations (Na, K, Ca, Mg), elements known to be present in CCP leachate with isotopes that can be unique to CCPs from specific coal sources (B with isotope ^{11}B, Li with isotopes ^{6}Li and ^{7}Li, and Se with isotopes ^{74}Se, ^{76}Se,and ^{80}Se), a suite of redox sensitive elements (Sb, As, Cr, Cu, Fe, Mn, Mo, V), and other elements encountered at CCP disposal facilities (Al, Ba, Ni, P, Sr, Zn). Metals representing the major cations as well as P were analyzed by ICP-OES. The isotopes and the “other” elements were analyzed by ICP-MS.

2.1 ICP-OES

An Agilent 5110 VDV was used for analysis by ICP-OES following EPA Method 6010d. A six-point calibration curve was generated for an analytical range of 25 µg/L (used as the lower limit of quantitation, LLOQ) to 500,000 µg/L from dilutions of a multi-element reference standard (AccuStandard catalog # AG-QCS27-ASL-1). Samples were analyzed as received. Analytical blanks and analytical check standards at approximately 0.5 mg/L were run after each sample set and required to be within 15% of the specified value and that blanks be below method detection limits (MDLs).

2.2 ICP-MS

Samples were analyzed by ICP-MS under quantitative mode using a Perkin-Elmer NexION 2000B in accordance with USEPA Method 6020b. A seven-point calibration curve was generated from dilutions of a multi-element reference standard (Fisher CLMS-SET, SPEX CertiPrep) for an analytical range of 0.50 µg/L to 500 µg/L under standard mode for the majority of the metals. The lower limit of the calibration curve was used as the lower limit of quantitation (LLOQ).

Arsenic, chromium, and selenium were analyzed under collision cell mode using helium as the non-reactive gas to remove matrix interferences. An internal yttrium standard (Fisher catalog CLY21AM, SPEX CertiPrep) was added at a final concentration of 50 µg/L to each sample before analysis. Concentrations for specific isotopes were also measured using quantitative mode. Individual standards were diluted to generate calibration curves for isotopes of boron (^{11}B), lithium (^{6}Li and ^{7}Li), and selenium (^{74}Se, ^{76}Se, ^{80}Se). Analysis of ^{10}B was not conducted due to the current unavailability of ^{10}B standards in the marketplace.

The isotope ratio method is used to determine the ratio between the intensity of the lesser abundant isotope to the intensity of the most abundant isotope. A one-point calibration was determined from the standard of the most abundant isotope.^{6}Li was compared to ^{7}Li and the isotopes of selenium ^{74}Se and ^{76}Se were compared to ^{80}Se. Samples were analyzed as received with no internal standard addition.

3. RESULTS

Concentrations of metals corresponding to the major cations are summarized in Table 1, concentrations of the isotopes are summarized in Table 2, concentrations of the redox sensitive elements are summarized in Table 3, and concentrations of the "other" elements are summarized in Table 4.

3.1 Indicator Parameters

pH, Eh, and specific conductance of the water samples reported by Frontier Technical Associates are shown in Figs. 2-4. All of the samples have circumneutral pH, with surface water slightly more alkaline than groundwater and leachate comparable to groundwater. Groundwater is strongly reducing, surface water is modestly oxidizing, and leachate varies from modestly oxidizing to modestly reducing. Specific conductance of the leachate is high, representing dissolved species released from the CCPs. Groundwater north, northwest, and directly west of Dunkirk Fly Ash Landfill has higher specific conductance than background, indicating a greater presence of dissolved species relative to background. Groundwater adjacent to the West Landfill (OB-5-DG) has very high specific conductance that is comparable to, but somewhat lower than in the leachates. This suggests that elevated dissolved species are present in groundwater at the sampling point adjacent to the West Landfill.

3.2 Major Cations

Concentrations of elements associated with the major cations (Na, K, Ca, Mg) are shown on the aerial photos in Figures 5-8. The data are summarized in Table 1

Na, K, and Ca are elevated in the leachate from Dunkirk Fly Ash Landfill relative to background concentrations in groundwater and surface water. Na concentrations are modestly elevated in groundwater north of Dunkirk Fly Ash Landfill (BR-13-DG), on the western periphery of Dunkirk Fly Ash Landfill (BR-20-DG), on the eastern periphery of West Landfill (OB-5-DG), and in the Beaver Dam outflow (SW-BD). K concentrations are elevated in leachate from Dunkirk Fly Ash Landfill and in groundwater on the periphery of West Landfill (OB-5-DG), but not at other locations. Ca is elevated in leachate from Dunkirk Fly Ash Landfill, and in groundwater to the north and northwest (BR-3-DG, BR-12-DG, BR-13-DG). Mg is elevated in leachate from Dunkirk Fly Ash Landfill, and at no other locations.

3.3 Isotopes

Concentrations of B, Li, and Se and their isotopes are shown in Figs. 9-17. The data are summarized in Table 2. Isotope concentrations in Figs. 9-17 are shown as a ratio of the total concentration (e.g., $^{11}B/B$) or as a ratio of the isotope concentrations (e.g., $^{6}Li/^{7}Li$).

Boron concentrations are very high in leachate from Dunkirk Fly Ash Landfill, in groundwater adjacent to West Landfill (OB-5-DG), and in the Beaver Dam outflow (SW-BD) (Fig. 9). All other concentrations are comparable to background. ^{11}B concentrations (shown as ratios) are slightly higher in groundwater to the north and northwest of Dunkirk Fly Ash Landfill and the West Landfill but are similar at all other locations.

Lithium concentrations are very high in leachate from Dunkirk Fly Ash Landfill, and in groundwater adjacent to West Landfill (OB-5-DG) (Fig. 11). The Li concentrations adjacent to West Landfill are substantially higher than at all other locations. Li in the Beaver Dam outflow (SW-BD) (Fig. 11) is appreciably higher than the Li concentration in the background location south of the hydraulic basin (SW-BG). All other concentrations are comparable to background. The ratios of concentrations of ^{6}Li and ^{7}Li to Li and to each other ($^{6}Li/^{7}Li$) are comparable at all locations (Figs. 12-14).

Selenium concentrations are elevated in leachate from Dunkirk Fly Ash Landfill, and in groundwater adjacent to West Landfill (OB-5-DG) (Fig. 15). Se concentrations to the north of

Dunkirk Fly Ash Landfill (BR-3-DG) and in the Beaver Dam outflow (SW-BD) are above background. All other locations have comparable concentrations, with many below the interpretation threshold. Ratios of the isotopes ^{74}Se, ^{74}Se, and ^{80}Se (Figs. 16-18) are also elevated in leachate from Dunkirk Fly Ash Landfill, in groundwater adjacent to West Landfill (OB-5-DG), and in groundwater directly west of Dunkirk Fly Ash Landfill (BR-20-DG) (Figs. 16-18). The relative concentration of ^{80}Se on the western periphery of Dunkirk Fly Ash Landfill (BR-20-DG) is more similar to that in groundwater on the eastern periphery of West Landfill (OB-5-DG) (Fig. 18).

The ^{74}Se/^{80}Se, ^{74}Se/^{80}Se, and ^{74}Se/^{80}Se isotope ratios are shown in Figs. 19-21. The ^{74}Se/^{80}Se ratios for leachate from manholes MH-16 and MH-19 and in groundwater adjacent to West Landfill (OB-5-DG) are comparable and are substantially greater than zero (Fig. 19). The ^{74}Se/^{80}Se ratios for leachate from manholes MH-2 and MH-16 and groundwater adjacent on the western periphery of Dunkirk Fly Ash Landfill (BR-20-DG) and the eastern periphery of West Landfill (OB-5-DG) are comparable (Fig. 20). The leachate in manhole MH-19 has lower, but non-zero ^{74}Se/^{80}Se ratio. Similarly, ^{74}Se/^{80}Se ratios for leachate from manholes MH-2 and MH-19 and groundwater adjacent the eastern periphery of West Landfill (OB-5-DG) are similar (Fig. 21). The leachate in manhole MH-16 has lower, but non-zero ^{74}Se/^{80}Se ratio. All other locations are below the interpretation limit.

3.4 Redox Sensitive Elements

Concentrations of the redox sensitive elements As, Cr, Fe, Mn, Mo, and V are shown on the aerial photos in Figs. 22-27. The data are summarized in Table 3. Se is also redox sensitive and was discussed in Section 3.3 with the isotopes.

All of the redox sensitive elements have concentrations in leachate that are elevated relative to background, which reflects dissolution from the CCPs in Dunkirk Fly Ash Landfill. Concentrations of As and Mn are elevated above background in groundwater directly adjacent to West Landfill (OB-5-DG) (Figs. 22 and 25). As is also above upgradient concentrations in groundwater northwest of Dunkirk Fly Ash Landfill and north of West Landfill (BR-12-DG), and in surface water at the Beaver Dam outflow (SW-BD) (Fig. 22). Mo is elevated above background in groundwater directly adjacent to West Landfill (OB-5-DG) and on the western periphery of the Dunkirk Fly Ash Landfill (BR-20-DG), and in surface water at the Beaver Dam outflow (SW-BD) (Fig. 26).

Fe concentrations are highly elevated in groundwater directly adjacent to West Landfill (OB-5-DG), in the background surface water south of the hydraulic basin (SW-BG), and in Beaver Dam outflow (SW-BD) (Fig. 24). Fe concentrations at all three of these locations are above the maximum Fe concentration in the leachate samples from the Dunkirk Fly Ash Landfill. Elevated Fe concentration most often is associated with reducing conditions.

V concentrations in leachate are very high at MH-2 and are elevated in the other manholes. V is also elevated at the Beaver Dam outflow (SW-BD) (Fig. 27).

3.5 Other Elements

Concentrations of the other elements that were analyzed (Al, Ba, Ni, Cr, P, Sr, Zn) are shown in Figs. 28-33. The data are summarized in Table 4.

Al concentrations in the leachate are elevated above background, especially in leachate from manhole MH-19 (Fig. 28). Al concentrations are elevated in groundwater directly adjacent to West Landfill (OB-5-DG), but at no other locations. Al concentrations in the surface water at the hydraulic basin (SW-BG) and in the Beaver Dam outflow (SW-BD) are comparable to the background concentration in surface water south the hydraulic basin (SWBG). These surface water concentrations are above all groundwater concentrations, except the concentration in groundwater directly adjacent to West Landfill (OB-5-DG),

Ba concentrations are highly variable (Fig. 29). The highest concentration is in groundwater directly west of Dunkirk Fly Ash Landfill, which is much higher than at any other location. The next highest concentration is in the upgradient groundwater at BR-14-UG, followed by the leachate in manhole MH-2 and the background concentration in surface water south of the hydraulic basin (SW-BG). All other locations have lower Ba concentration.

Ni concentrations are elevated in leachate from Dunkirk Fly Ash Landfill and in groundwater directly adjacent to West Landfill (OB-5-DG) (Fig. 30). Ni concentrations were below the interpretation threshold at all other locations.

P concentrations are elevated in leachate in two manholes (MH-2 and MH-19) and in two of the groundwater wells north and northwest of Dunkirk Fly Ash Landfill (BR-3-DG, BR-13-DG) (Fig. 31). All other locations have P concentrations comparable to background.

Sr concentrations are elevated in two manholes (MH-2 ad MH-16) and in groundwater directly adjacent to West Landfill (OB-5-DG) (Fig. 32). All other locations are comparable to background concentrations in groundwater.

Zn concentrations are shown in Fig. 33. Zn is modestly elevated in leachate and is above background in groundwater directly adjacent to the West Landfill (OB-5-DG) and north of the Dunkirk Fly Ash Landfill and West Landfill (BR-13-DG). Zn is also elevated modestly in the Beaver Dam outflow (SW-BD). The highest Zn concentration is in groundwater directly adjacent to the West Landfill (OB-5-DG).

4. SUMMARY AND IMPLICATIONS

Dissolved species observed in leachate are present in groundwater between and north of the Dunkirk Fly Ash Landfill and the West Landfill at concentrations elevated relative to upgradient groundwater. Identifying the source of these dissolved species is not possible with the data that have been collected. Analysis of isotopes of B, Li, and Se was not useful in identifying the source of dissolved species in groundwater between and north of the landfills.

Leakage from the Dunkirk Fly Ash Landfill liner is an unlikely source of constituents in groundwater at BR-20-DG that are also in leachate. If liner leakage was a source, redox sensitive elements that are mobile under oxidizing conditions (Cr, Mn, Mo, Se, and V) and have elevated concentrations in leachate would have highly elevated concentrations in groundwater at BR-20-DG, which is in mildly oxidizing state. None of these elements have highly elevated concentrations in groundwater at BR-20-DG.

The geochemical data collected from a monitoring well adjacent to West Landfill suggests that West Landfill may be impacting surface water and groundwater between the two landfills, and in proximity to the Dunkirk Fly Ash Landfill. However, the magnitude of this impact cannot be identified from the data.

TABLES

Table 1. Concentrations of elements for major cations.

Quantity or Location	**Sodium Na**	**Potassium K**	**Calcium Ca**	**Magnesium Mg**
Units	mg/L	mg/L	mg/L	mg/L
MDL	0.0059	0.0036	0.0065	0.0029
LLOQ	0.025	0.025	0.025	0.025
Blank	0.0096	-	0.166	0.0007
BR-3-DG	14.9	2.43	150	47.6
BR-12-DG	17.3	2.89	152	52.1
BR-13-DG	42.0	2.53	101	33.3
BR-14-UG	23.2	3.05	79.3	31.2
BR-20-DG	189	4.34	20.7	6.36
MH-2	72.1	49.4	355	130
MH-16	355	84.2	380	33.6
MH-19	953	21.4	13.9	7.32
OB5-DG	62.6	34.8	220	56.5
SW-BG	12.1	1.66	28.8	5.88
SW-BD	39.6	3.90	44.5	8.15

Note: “-” indicates sample below MDL and not quantifiable.

Table 2. Concentrations of boron, lithium and selenium and their isotopes.

Quantity or Location	**Boron B**	**Boron-11 ^{11}B**	**Lithium Li**	**Lithium-6 ^{6}Li**	**Lithium-7 ^{7}Li**	**Selenium Se**	**Selenium-74 ^{74}Se**	**Selenium-76 ^{76}Se**	**Selenium-80 ^{80}Se**
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MDL	0.04	0.01	0.02	0.07	0.04	0.03	0.10	0.05	0.73
LLOQ	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.0
Field Blank	-	-	0.0	0.02	0.0	0.0	0.00	0.00	0.0
BR-3-DG	73.97	73.28	62.88	3.40	58.57	4.07	0.00	0.79	0.92
BR-12-DG	67.03	66.65	55.42	3.15	51.48	1.74	0.03	0.00	0.52
BR-13-DG	140.1	139.8	84.65	5.23	78.63	0.92	0.01	0.07	0.48
BR-14-UG	151.8	146.7	70.76	4.45	65.64	0.36	0.03	-	0.24
BR-20-DG	1580	1420	388.2	29.87	360.3	36.09	21.09	0.01	13.12
MH-2	14,450	12,920	1140	85.02	997.0	133.1	34.27	36.93	19.06
MH-16	17,340	15,660	3040	178.3	2800	30.14	0.71	2.43	15.17
MH-19	10,700	9430	229	12.36	216.0	1240	172.1	184.80	243.4
OB5-DG	1160	1040	5090	350.4	4820	163.8	99.16	3.28	53.19
SW-BG	25.92	23.48	5.84	0.38	4.75	1.47	0.0	0.04	1.24
SW-BD	468.3	392.2	30.65	1.69	26.95	2.96	0.0	0.01	2.79

Note: “-” indicates sample below MDL and not quantifiable.

Table 3. Concentrations of redox sensitive elements.

Quantity or Location	**Antimony Sb**	**Arsenic As**	**Chromium Cr**	**Copper Cu**	**Iron Fe**	**Manganese Mn**	**Molybdenum Mo**	**Vanadium V**
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MDL	0.01	0.04	0.05	0.04	0.73	0.03	0.03	0.03
LLOQ	0.50	0.50	0.50	0.50	1.00	0.50	0.50	0.50
Field Blank	0.09	0.00	0.03	0.15	0.01	0.00	0.00	0.01
BR-3-DG	0.20	1.06	0.01	0.06	1.45	133.1	0.01	0.04
BR-12-DG	0.16	1.86	0.01	0.07	0.84	237.8	0.02	1.85
BR-13-DG	0.04	0.02	0.02	0.15	0.27	100.1	0.01	0.07
BR-14-UG	0.04	0.03	0.01	0.17	12.3	29.2	0.01	0.03
BR-20-DG	0.09	0.65	0.03	0.61	37.3	21.8	0.02	0.08
MH-2	35.09	243.6	0.01	0.29	36.3	278.2	2200	9,030
MH-16	0.02	3.13	56.58	6.90	1.54	5.12	2510	50.0
MH-19	0.47	64.98	7.87	17.06	46.24	8.89	1080	482.7
OB5-DG	0.02	4.05	0.02	0.26	593.9	859.1	48.1	1.62
SW-BG	0.02	0.93	0.03	0.25	327.8	124.1	0.03	0.04
SW-BD	1.05	2.37	0.51	0.30	89.43	37.9	39.82	23.4

Note: “-” indicates sample below MDL and not quantifiable.

Table 4. Concentrations of other elements.

Quantity or Location	**Aluminum Al**	**Barium Ba**	**Nickel Ni**	**Phosphorus P**	**Strontium Sr**	**Zinc Zn**
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MDL	0.39	0.07	0.03	5.40	3.60	0.05
LLOQ	1.00	0.50	0.50	25.0	25.0	0.50
Field Blank	0.25	0.01	0.00	-	-	0.76
BR-3-DG	32.68	36.39	2.38	108	749	2.27
BR-12-DG	26.11	40.33	2.14	170	580	2.95
BR-13-DG	21.39	69.54	1.26	15.5	564	0.74
BR-14-UG	18.76	220.5	0.82	23.4	744	1.19
BR-20-DG	32.71	1740	0.97	14.1	571	3.74
MH-2	67.31	66.19	12.68	261.	7190	3.72
MH-16	70.26	30.75	23.28	10.9	7750	1.86
MH-19	1450	36.76	3.85	491.	249	2.71
OB5-DG	56.37	28.26	9.84	8.40	2440	6.80
SW-BG	46.90	73.21	1.89	7.80	52.3	0.52
SW-BD	49.70	67.62	1.32	8.30	191	2.86

Note: “-” indicates sample below MDL and not quantifiable.

FIGURES

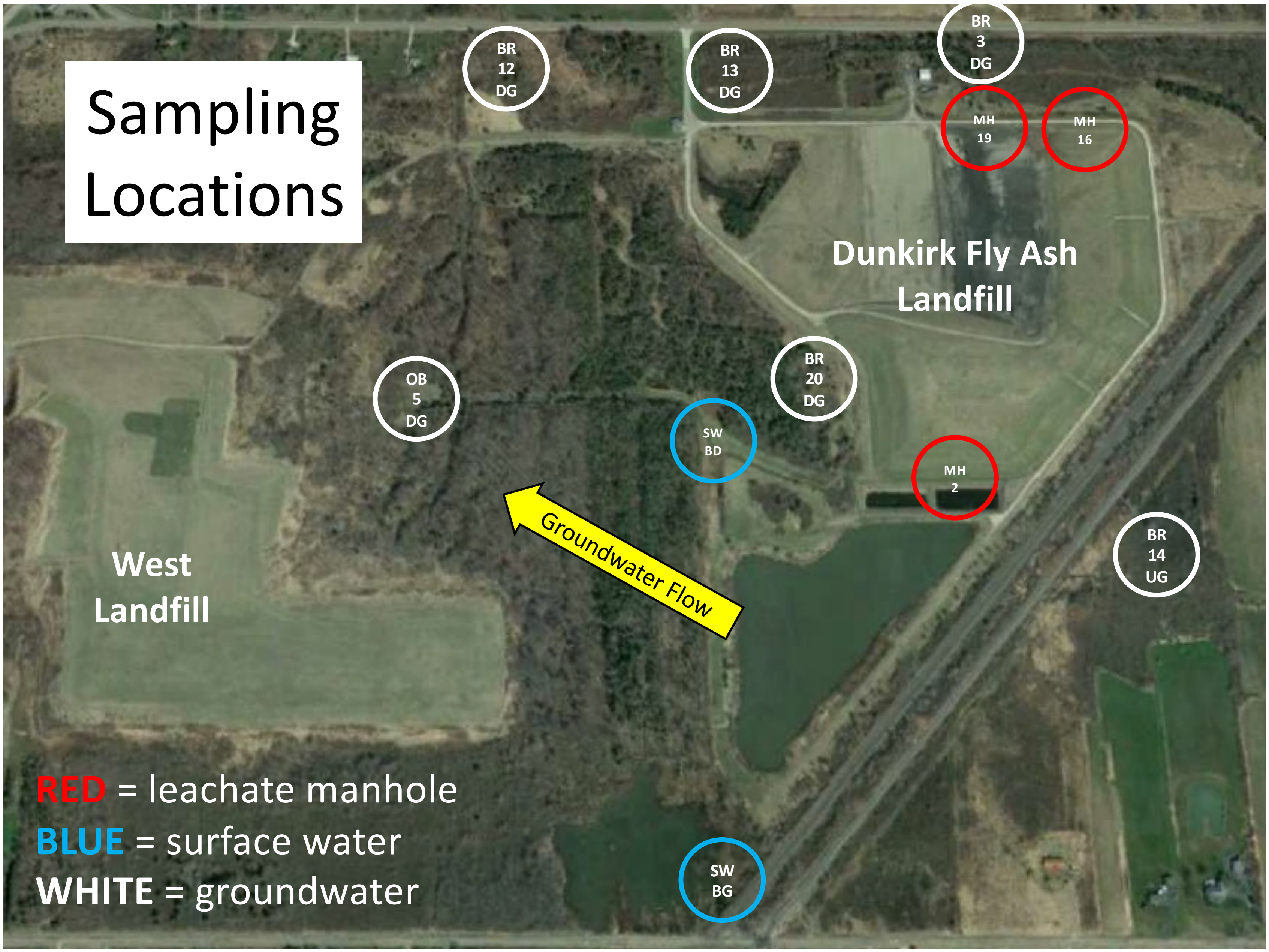

Fig. 1. Sampling locations and location of Dunkirk Fly Ash and West Fly Ash Landfills.

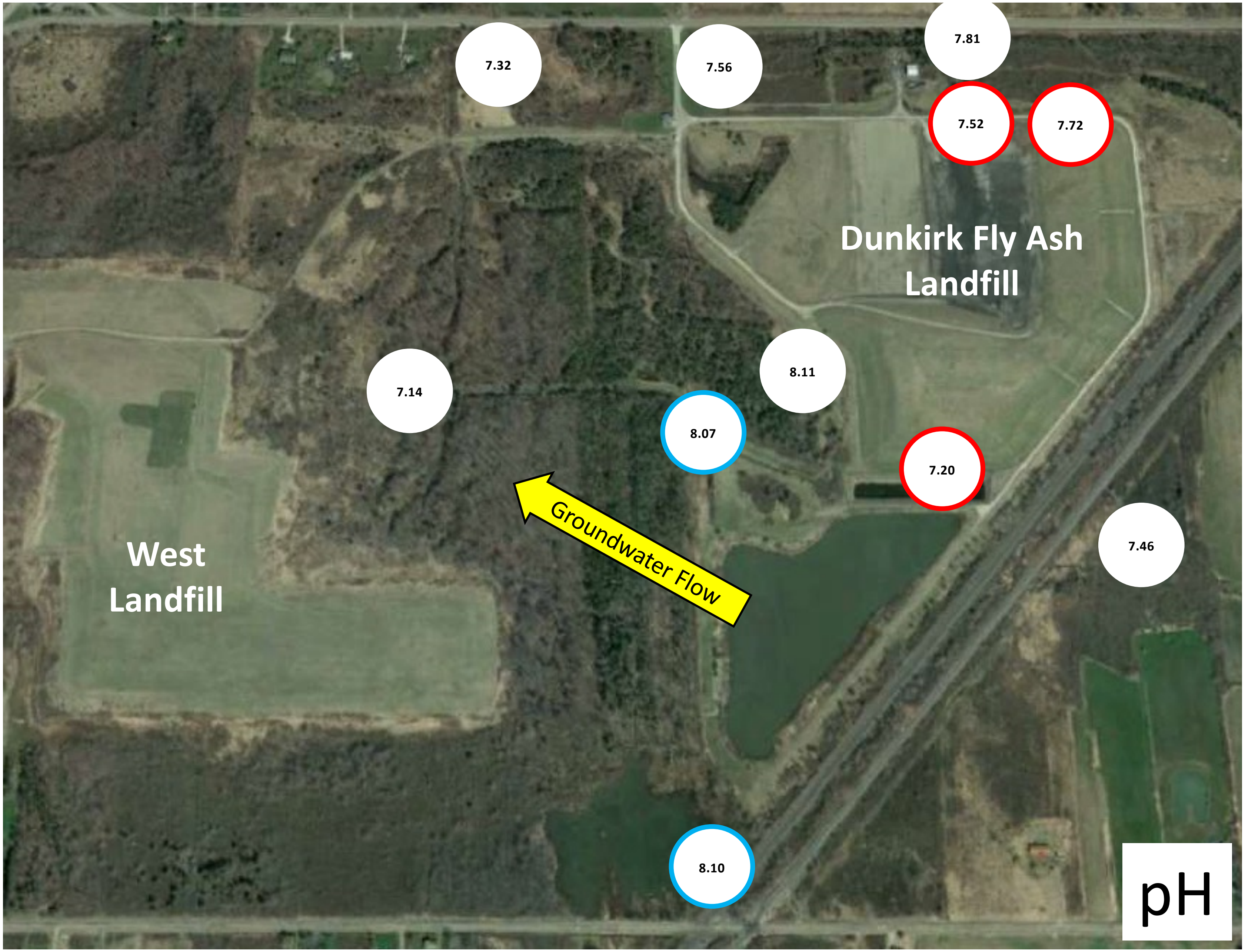

Fig. 2. pH of leachate, surface water, and groundwater samples.

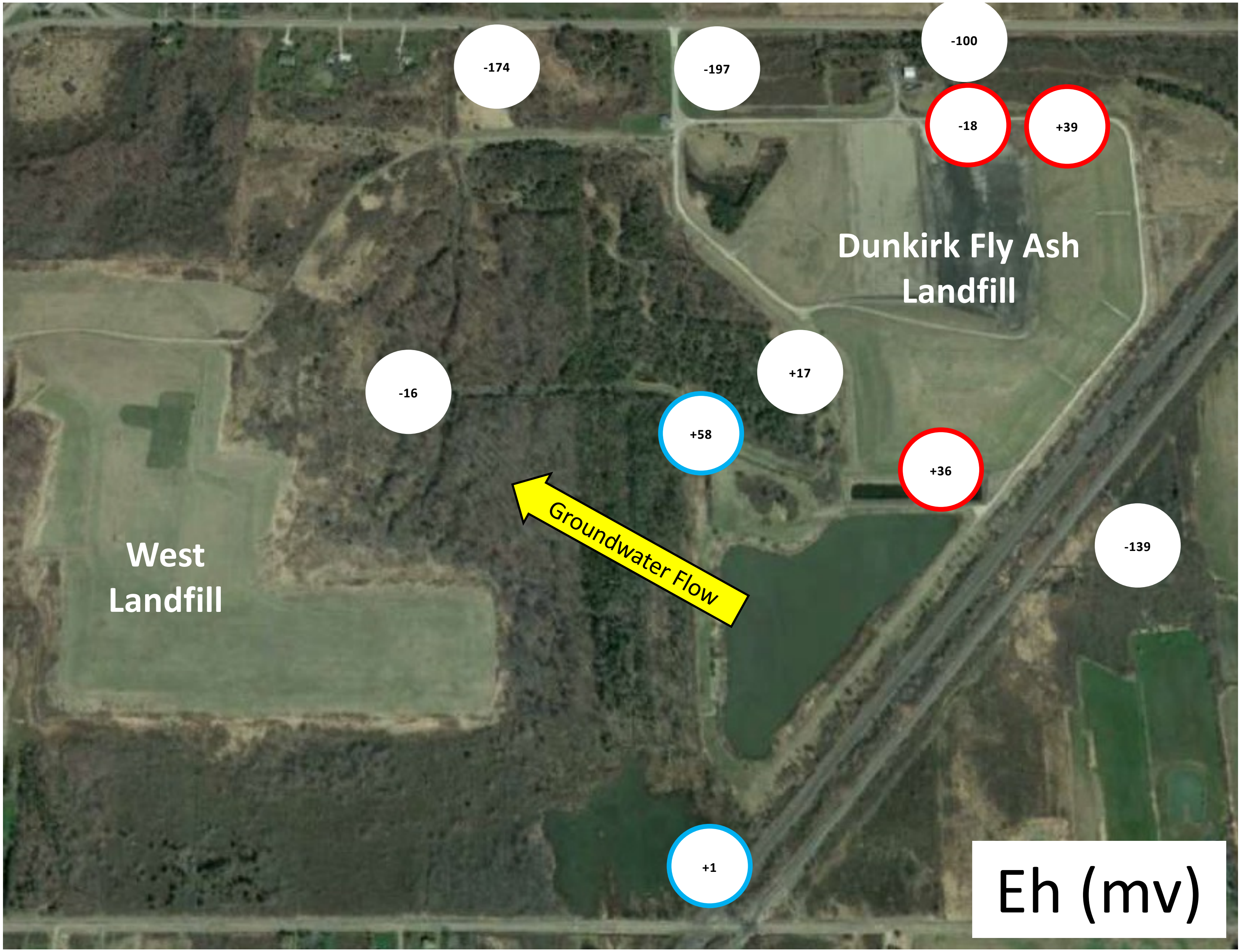

Fig. 3. Eh of leachate, surface water, and groundwater samples.

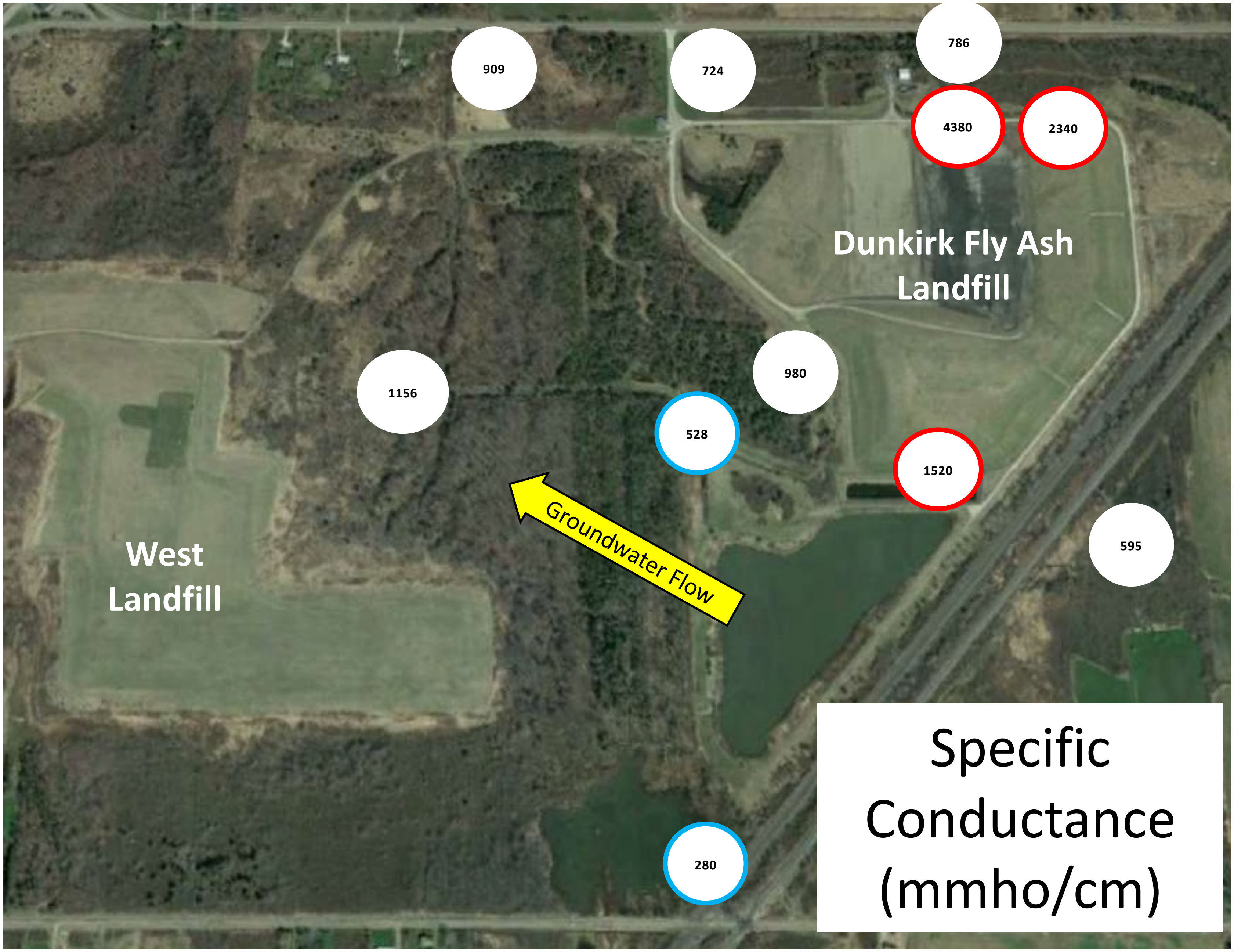

Fig. 4. Specific conductance of leachate, surface water, and groundwater samples.

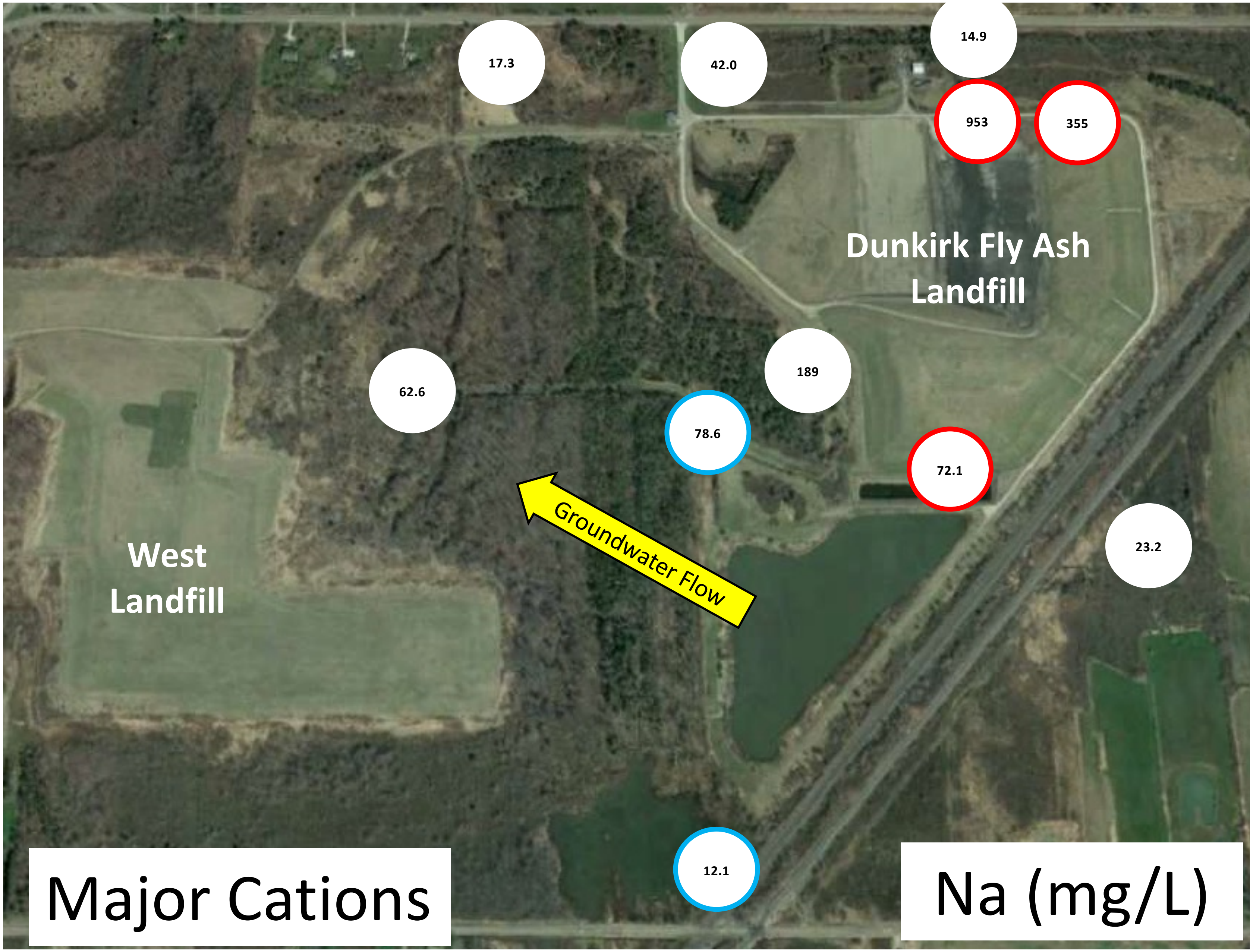

Fig. 5. Concentration of Na in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

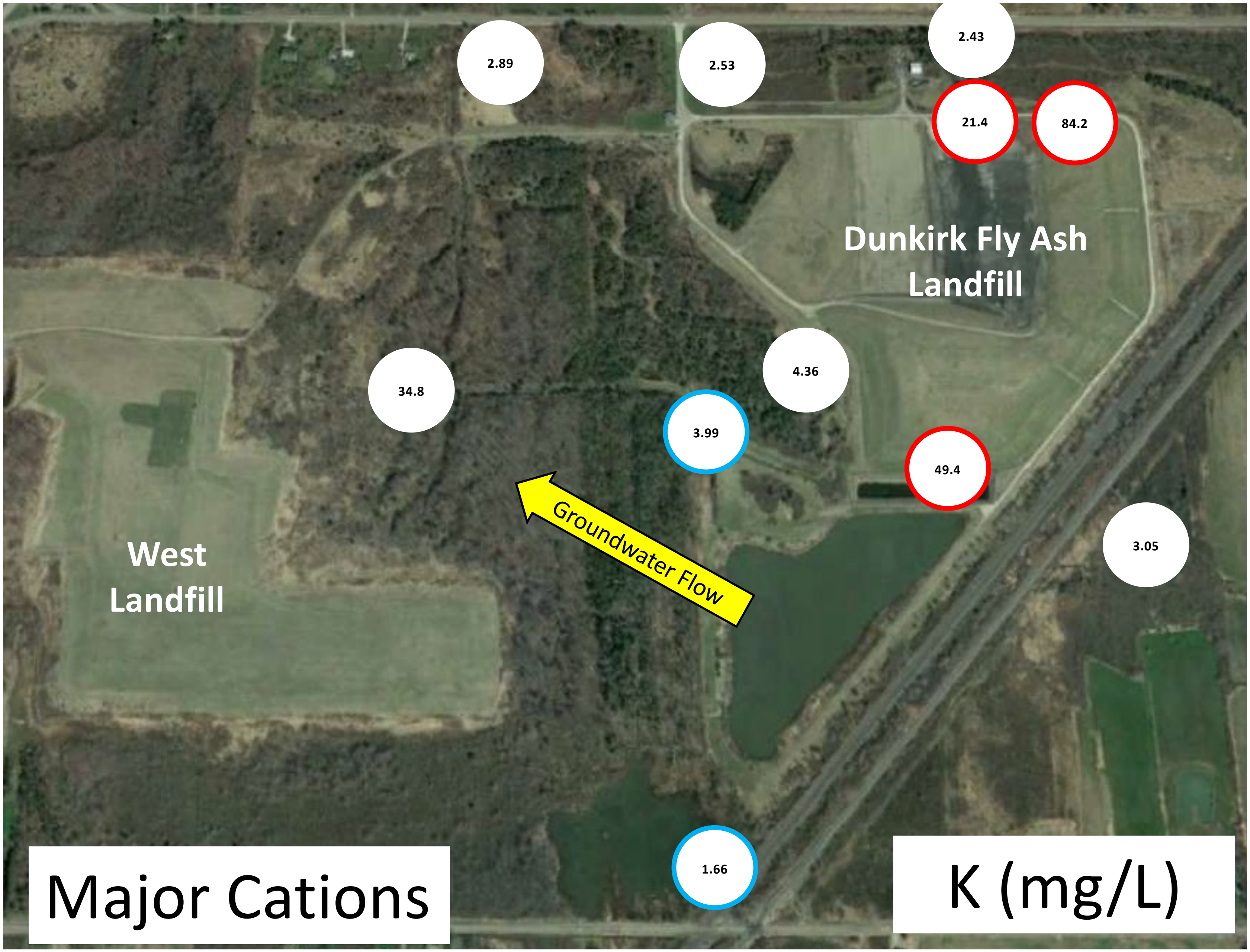

Fig. 6. Concentration of K in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

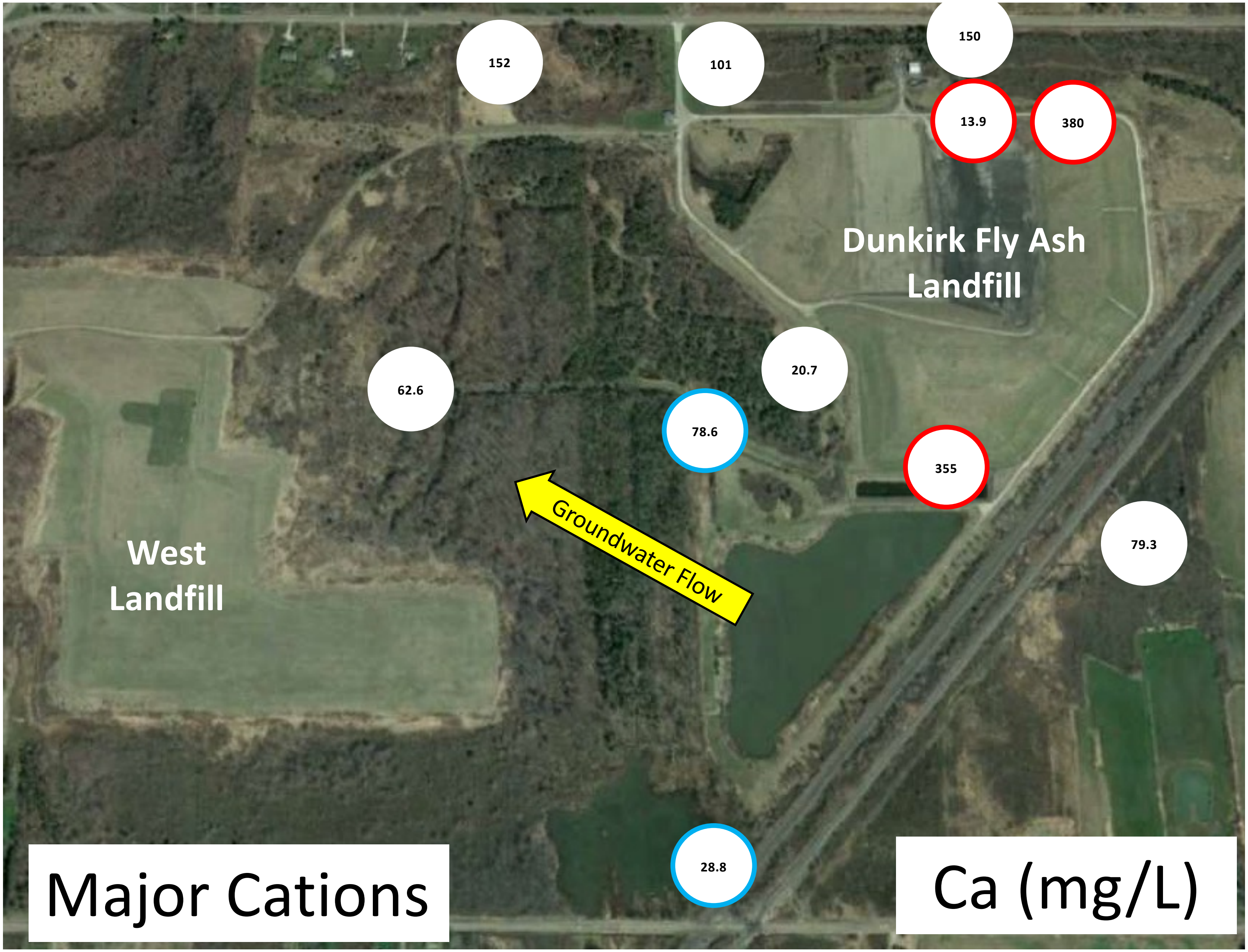

Fig. 7. Concentration of Ca in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

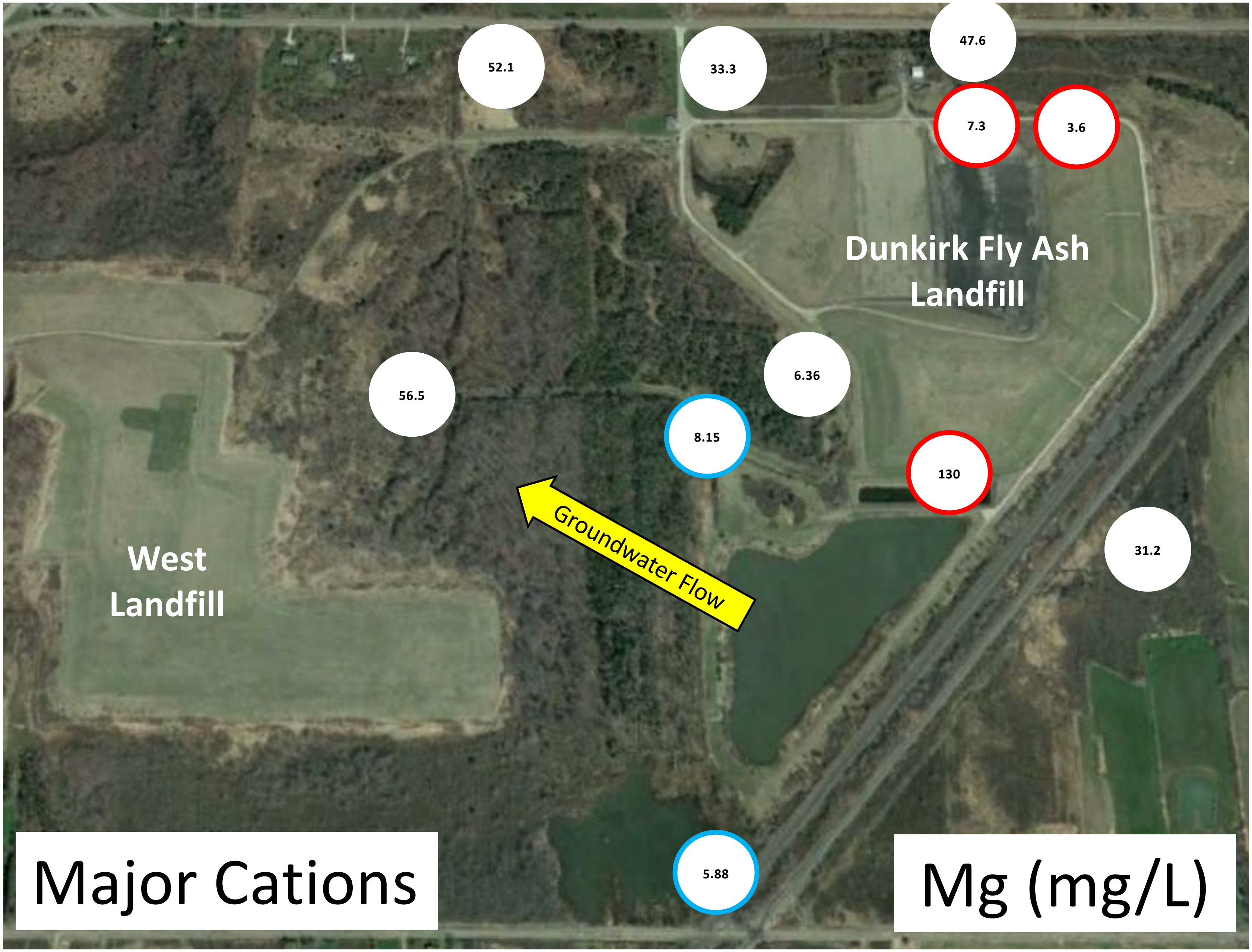

Fig. 8. Concentration of Mg in leachate, surface water, and groundwater samples.
"<" indicates below interpretation threshold.

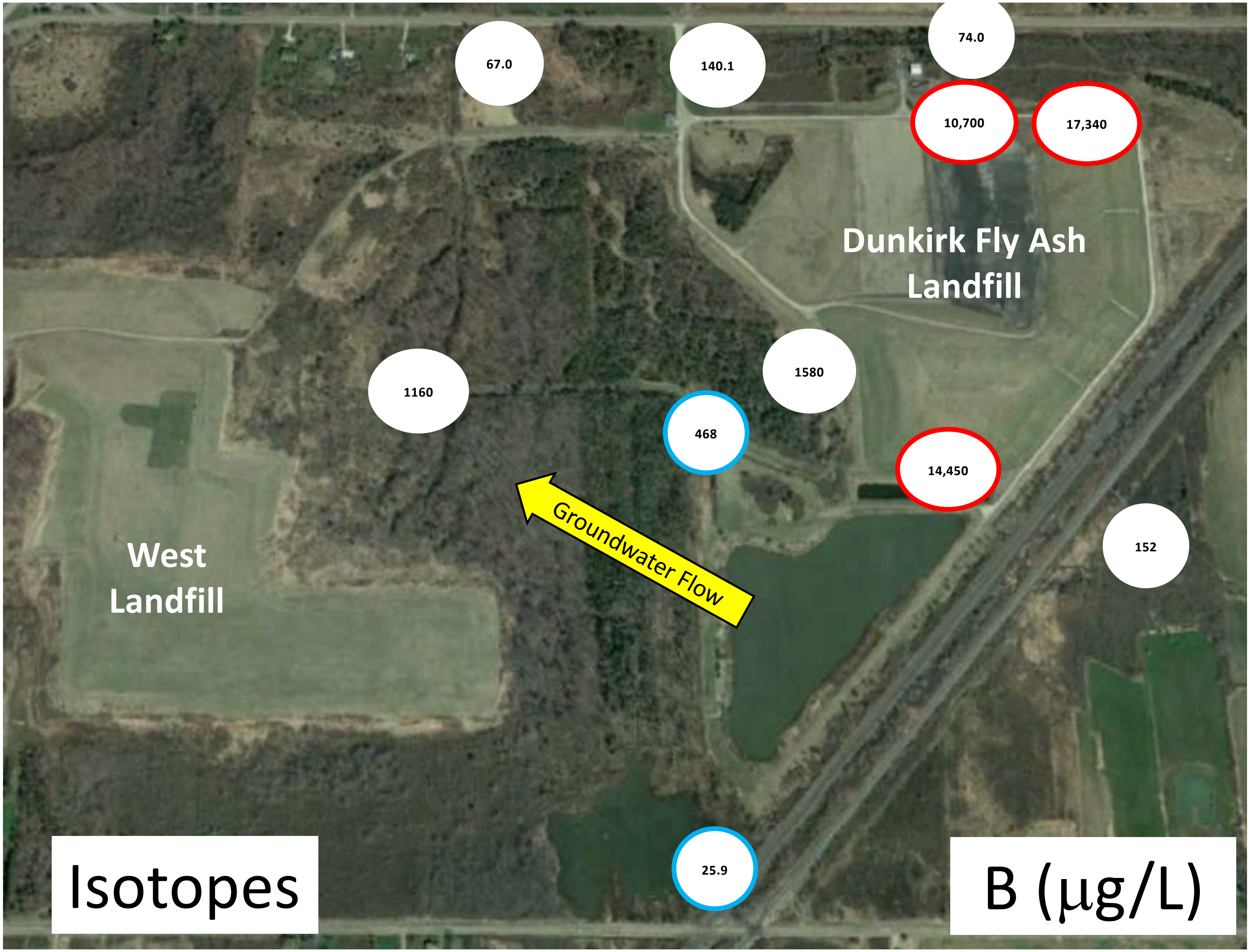

Fig. 9. Concentration of B in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

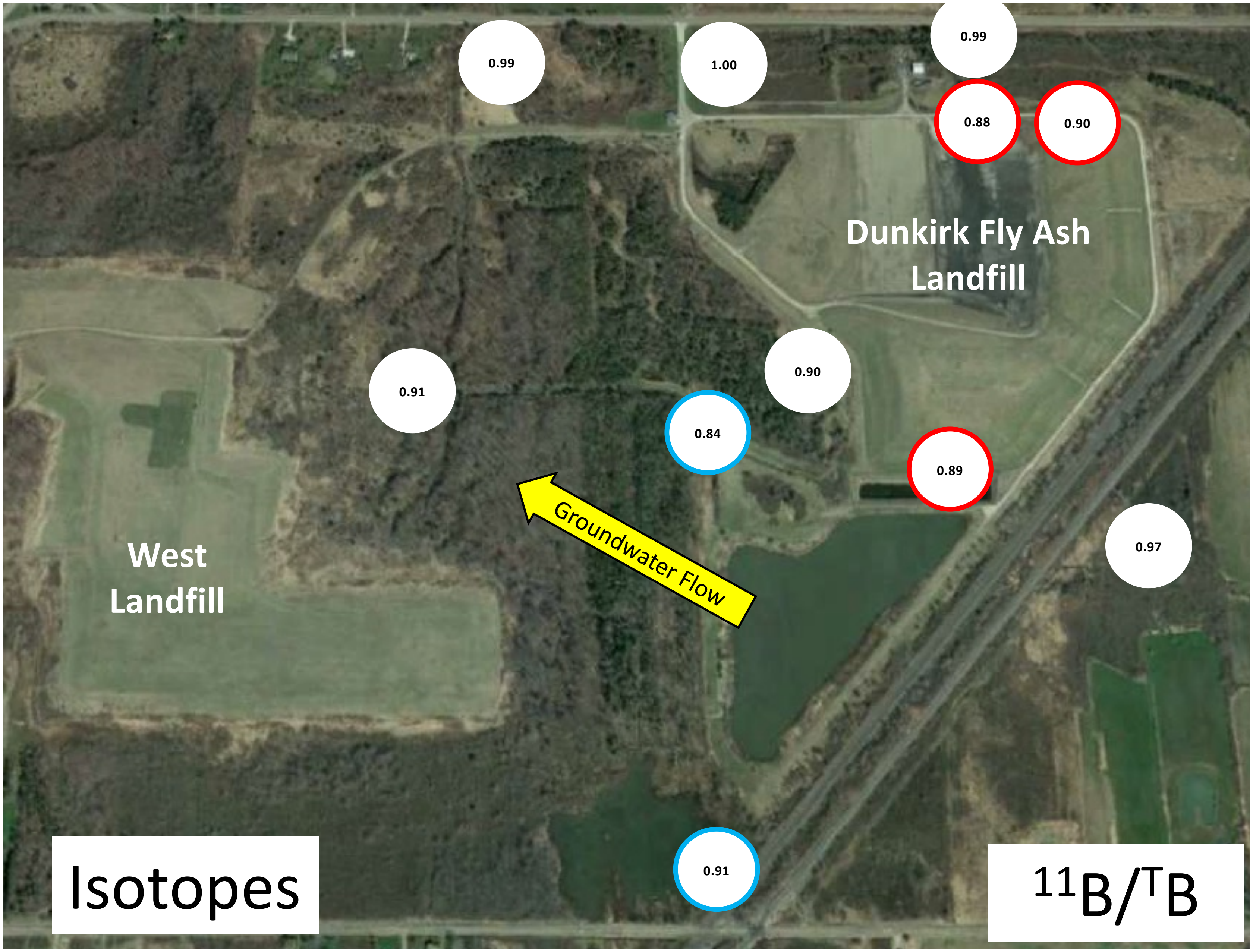

Fig. 10. Concentration ratios for ^{11}B relative to total B in leachate, surface water, and groundwater samples. "<" indicates below interpretation threshold.

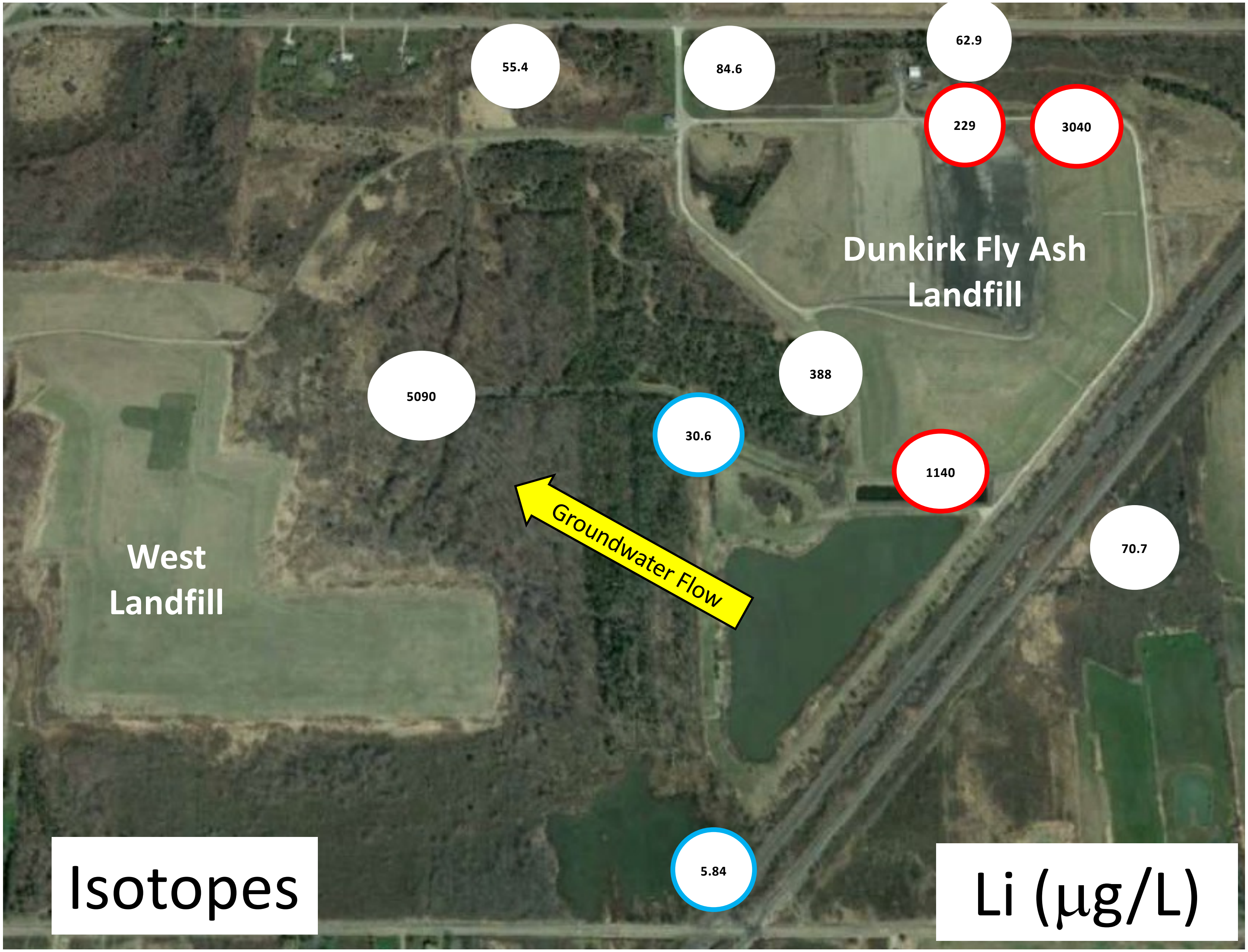

Fig. 11. Concentration of Li in leachate, surface water, and groundwater samples.
"<" indicates below interpretation threshold.

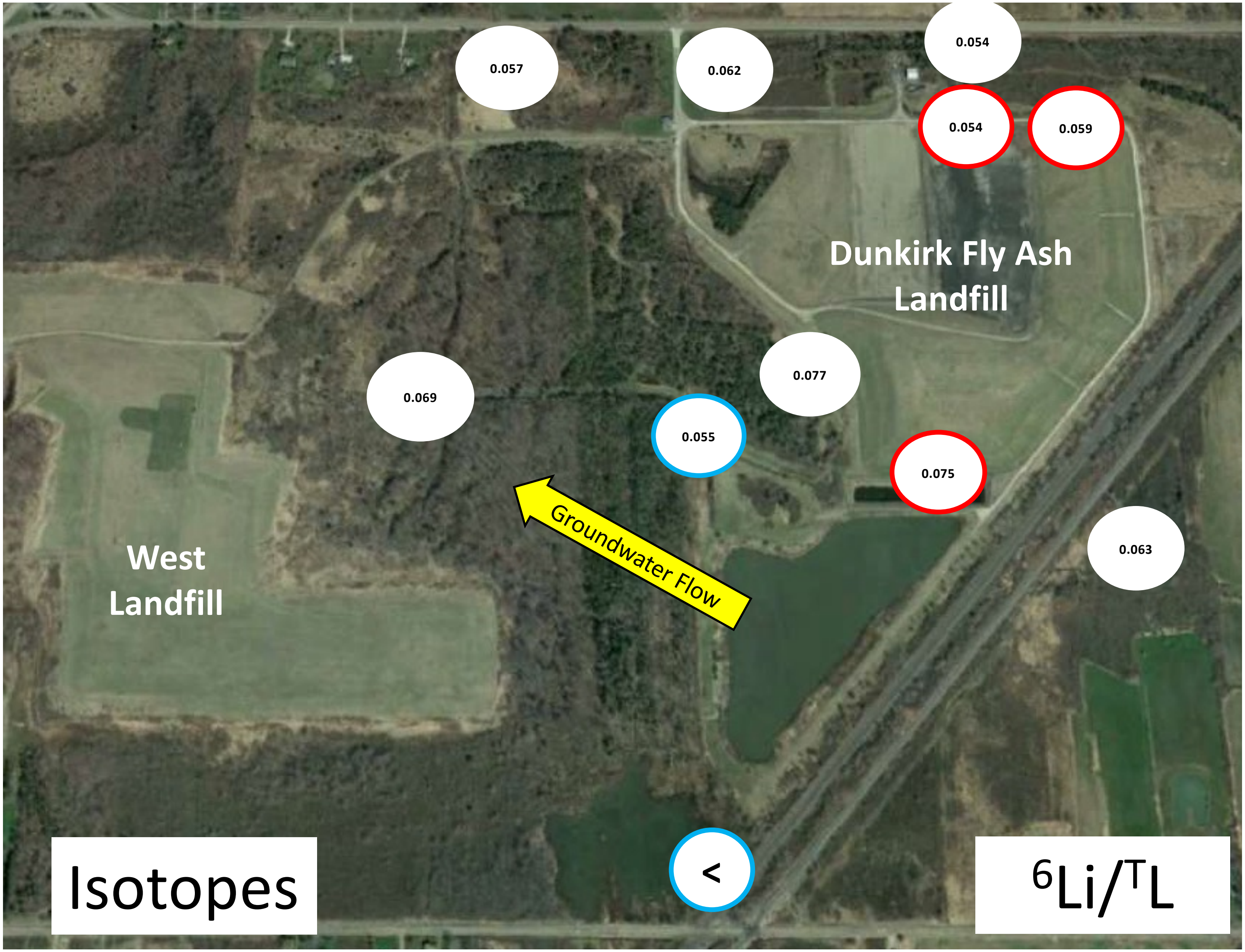

Fig. 12. Concentration ratios for ^{6}Li relative to total Li in leachate, surface water, and groundwater samples. "<" indicates below interpretation threshold.

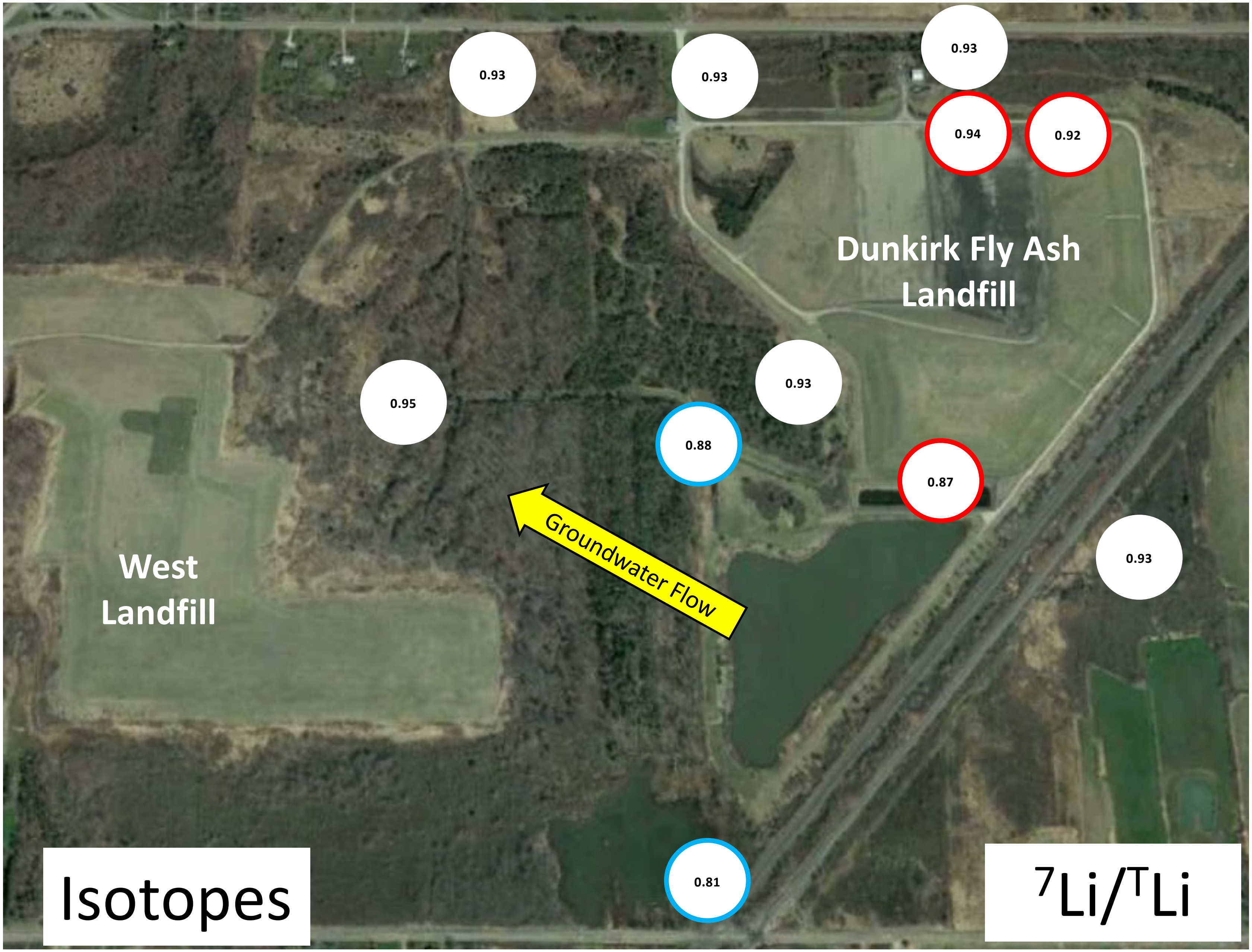

Fig. 13. Concentration ratios for ^{7}Li relative to total Li in leachate, surface water, and groundwater samples. “<” indicates below interpretation threshold.

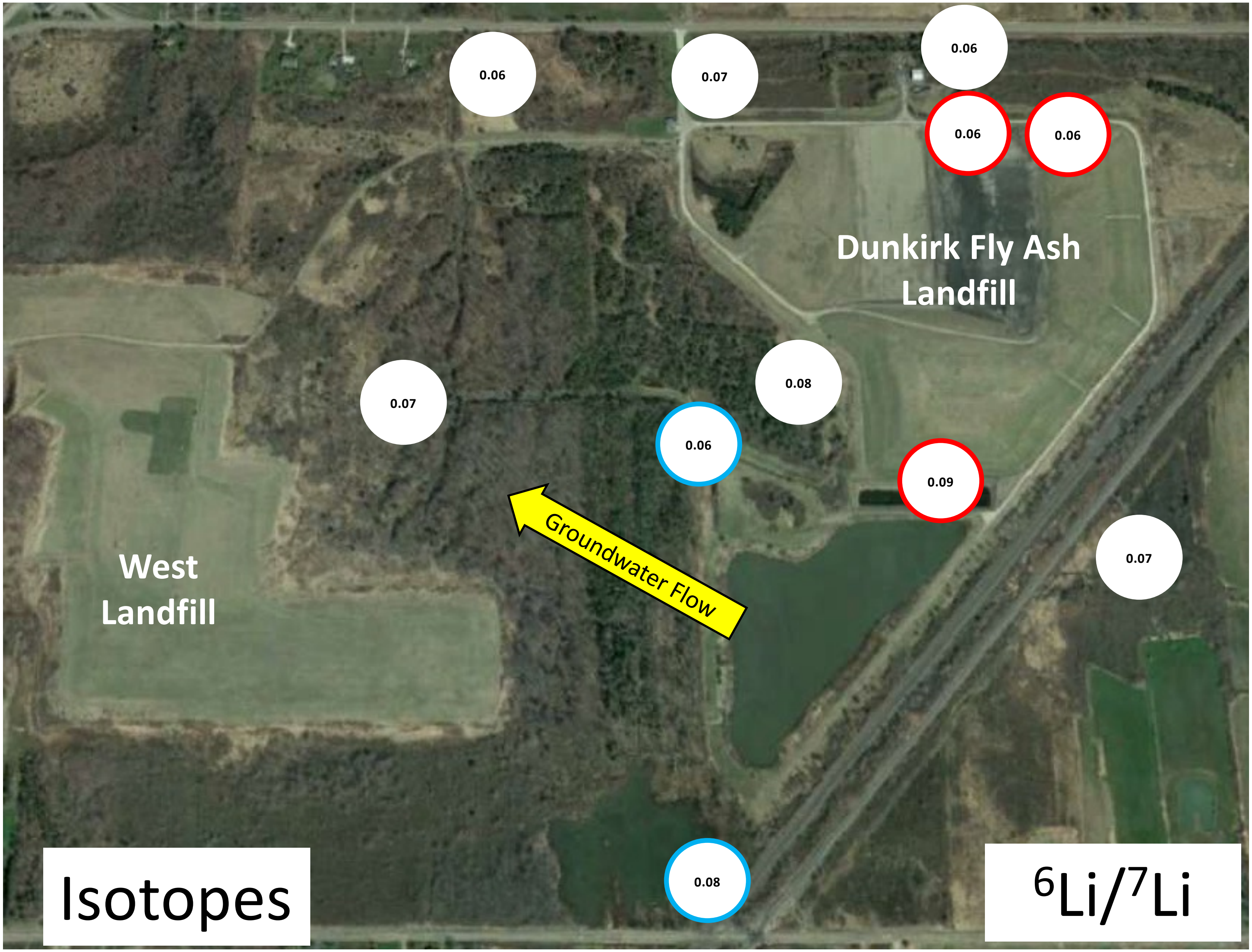

Fig. 14. Ratios of concentrations ^{6}Li/^{7}Li in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

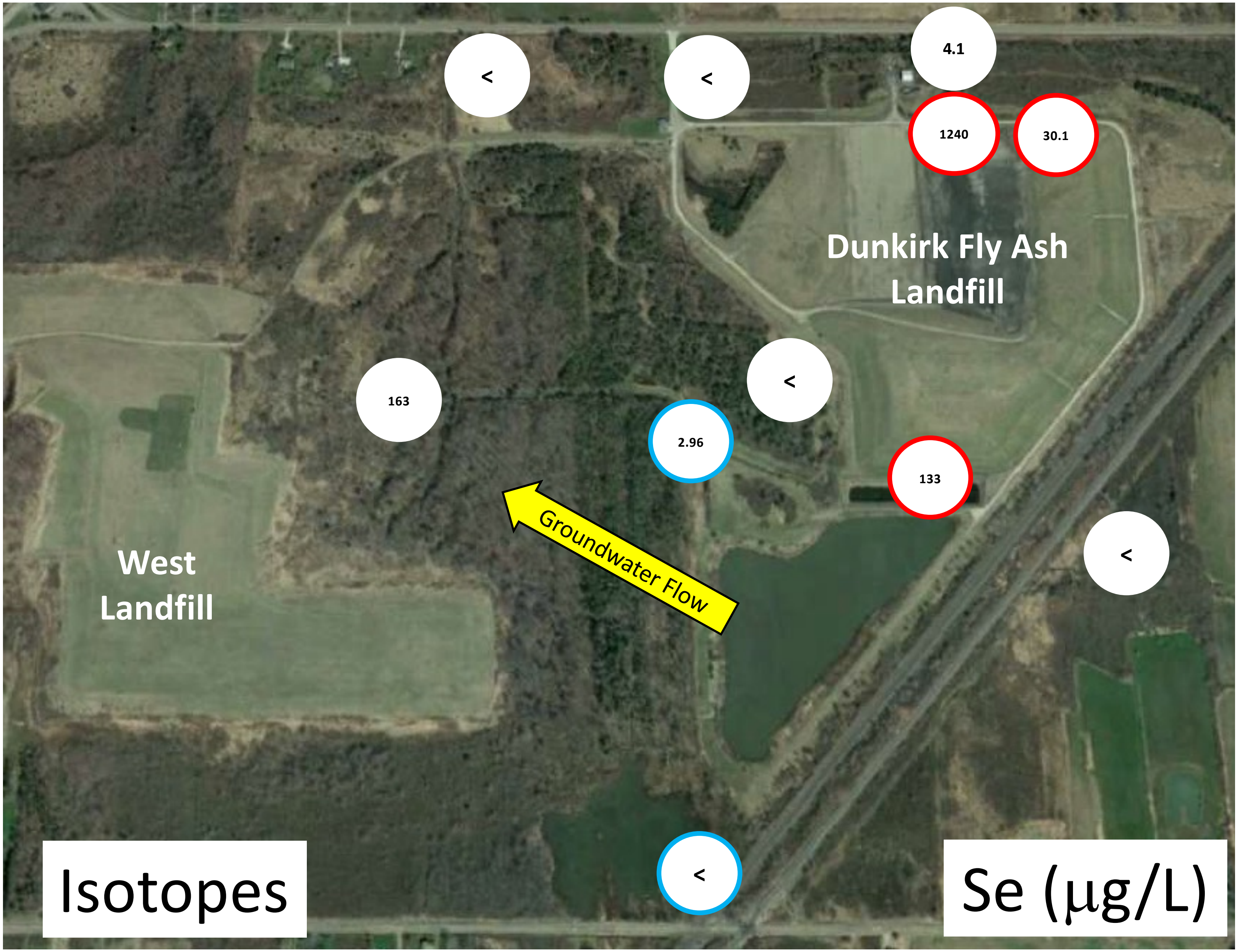

Fig. 15. Concentration of Se in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

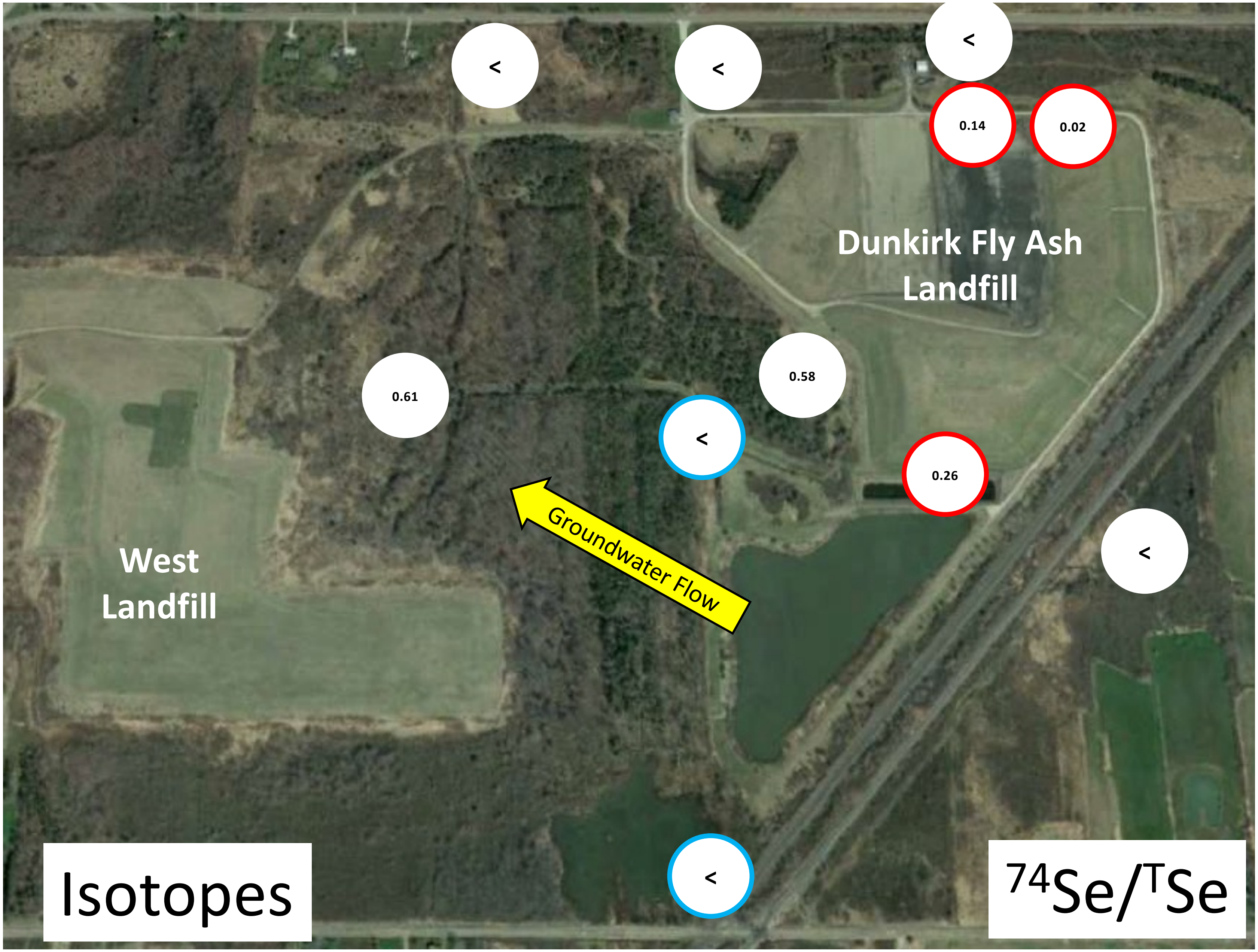

Fig. 16. Concentration ratios for ^{74}Se relative to total Se in leachate, surface water, and groundwater samples. "<" indicates below interpretation threshold.

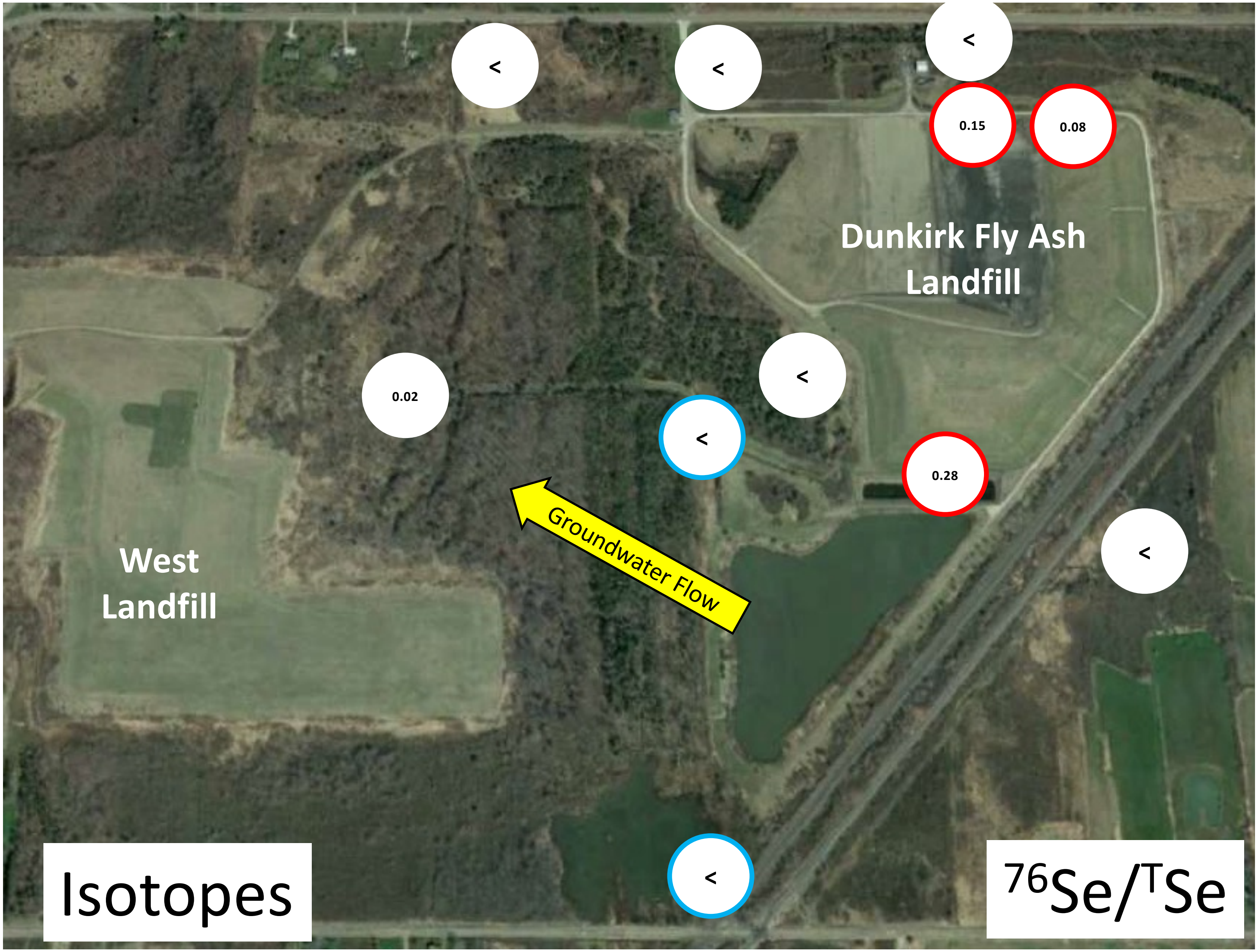

Fig. 17. Concentration ratios for ^{76}Se relative to total Se in leachate, surface water, and groundwater samples. “<” indicates below interpretation threshold.

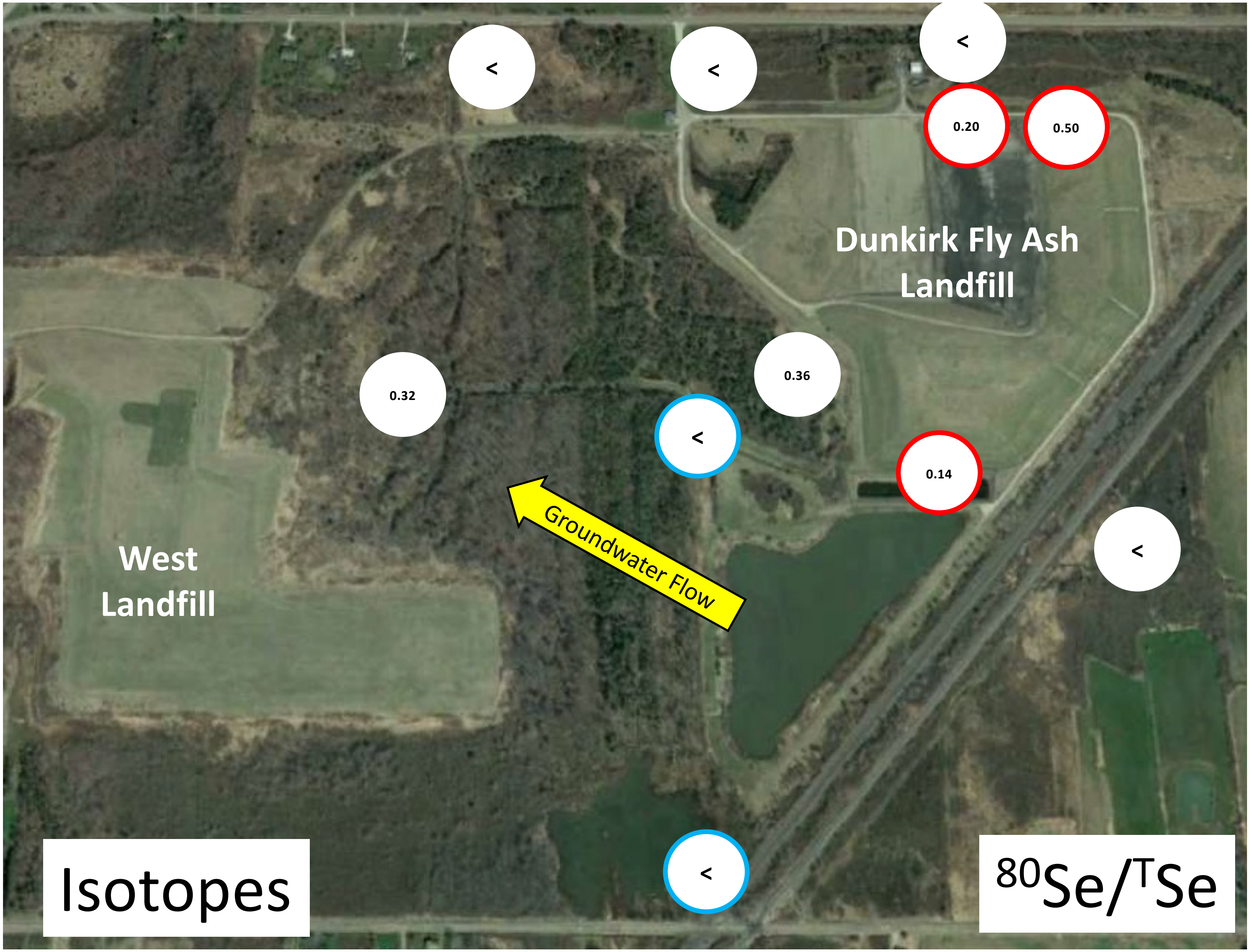

Fig. 18. Concentration ratios for ^{80}Se relative to total Se in leachate, surface water, and groundwater samples. “<” indicates below interpretation threshold.

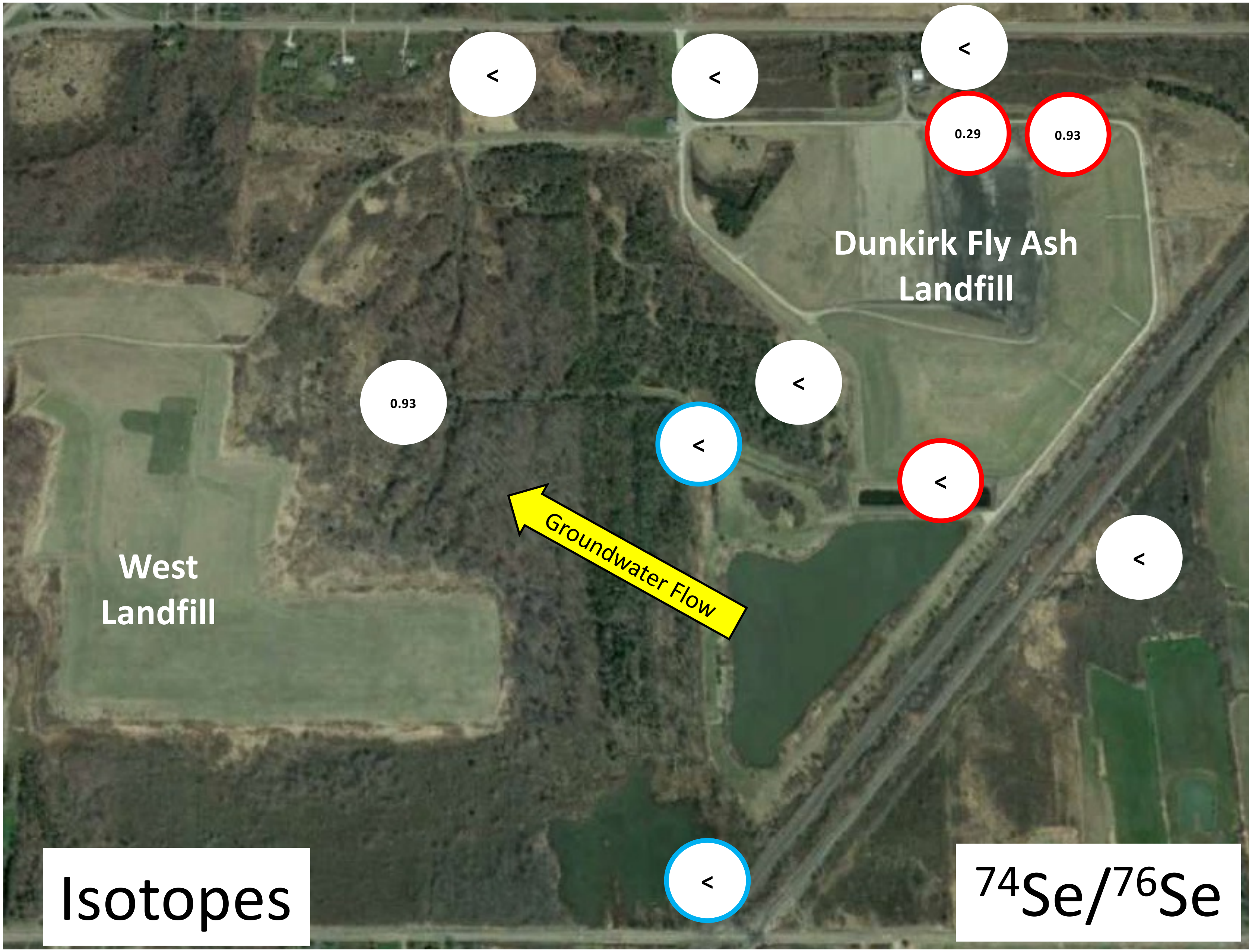

Fig. 19. Ratios of concentrations $^{6}Li/^{7}Li$ in leachate, surface water, and groundwater samples.
"<" indicates below interpretation threshold.

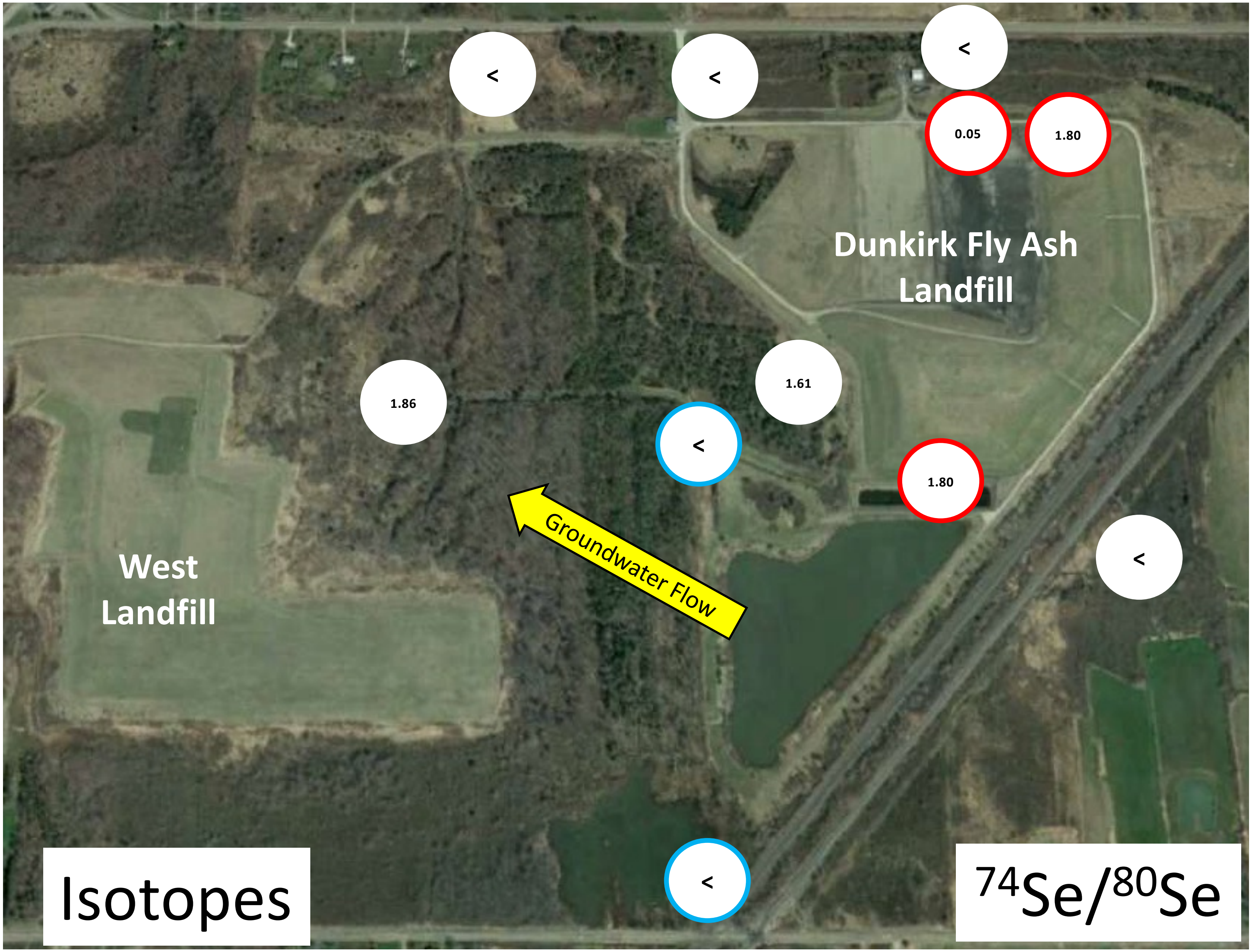

Fig. 20. Ratios of concentrations $^6Li/^7Li$ in leachate, surface water, and groundwater samples.
"<" indicates below interpretation threshold.

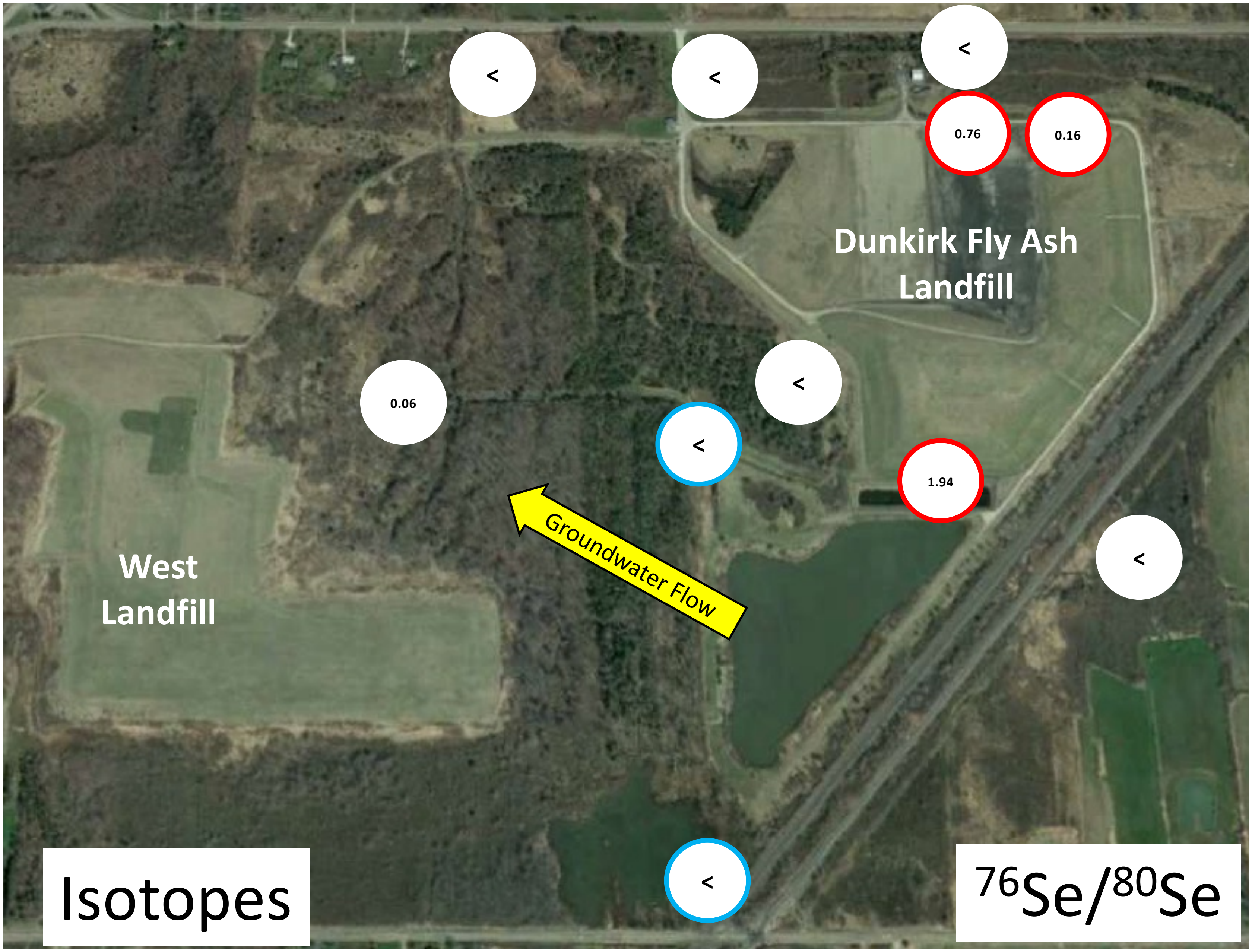

Fig. 21. Ratios of concentrations $^{6}Li/^{7}Li$ in leachate, surface water, and groundwater samples. “<” indicates below interpretation threshold.

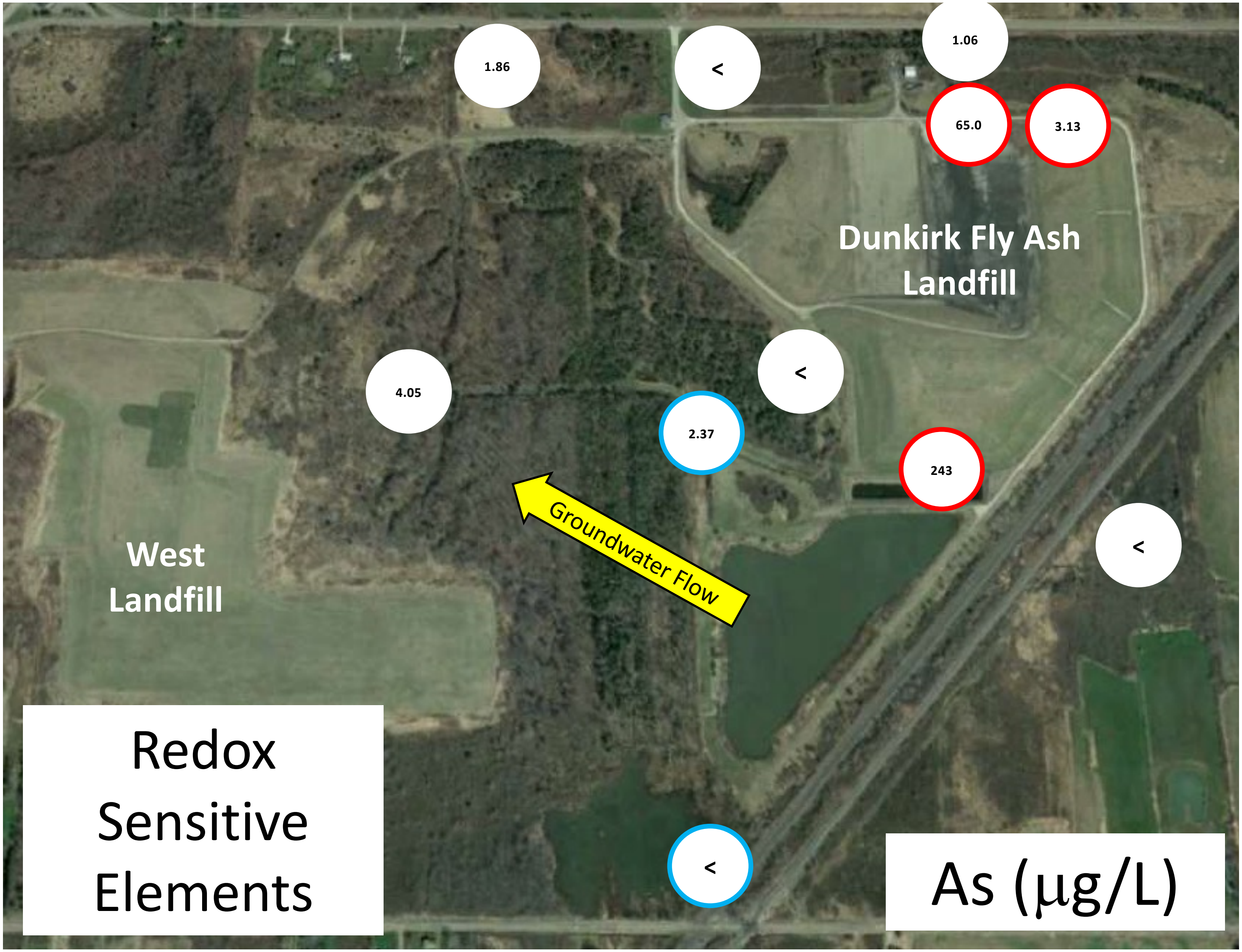

Fig. 22. Concentration of As in leachate, surface water, and groundwater samples. "<" indicates below interpretation threshold.

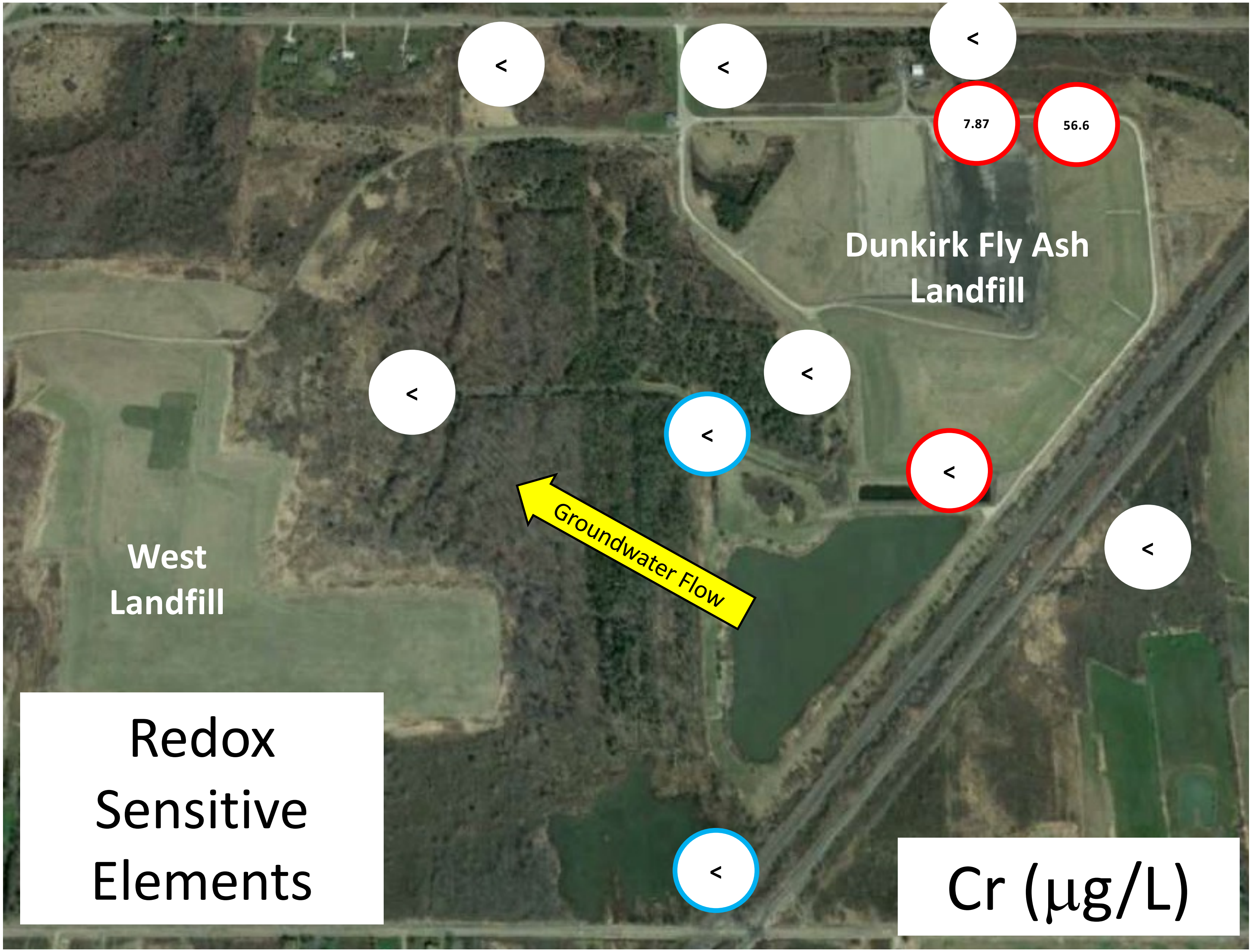

Fig. 23. Concentration of Cr in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

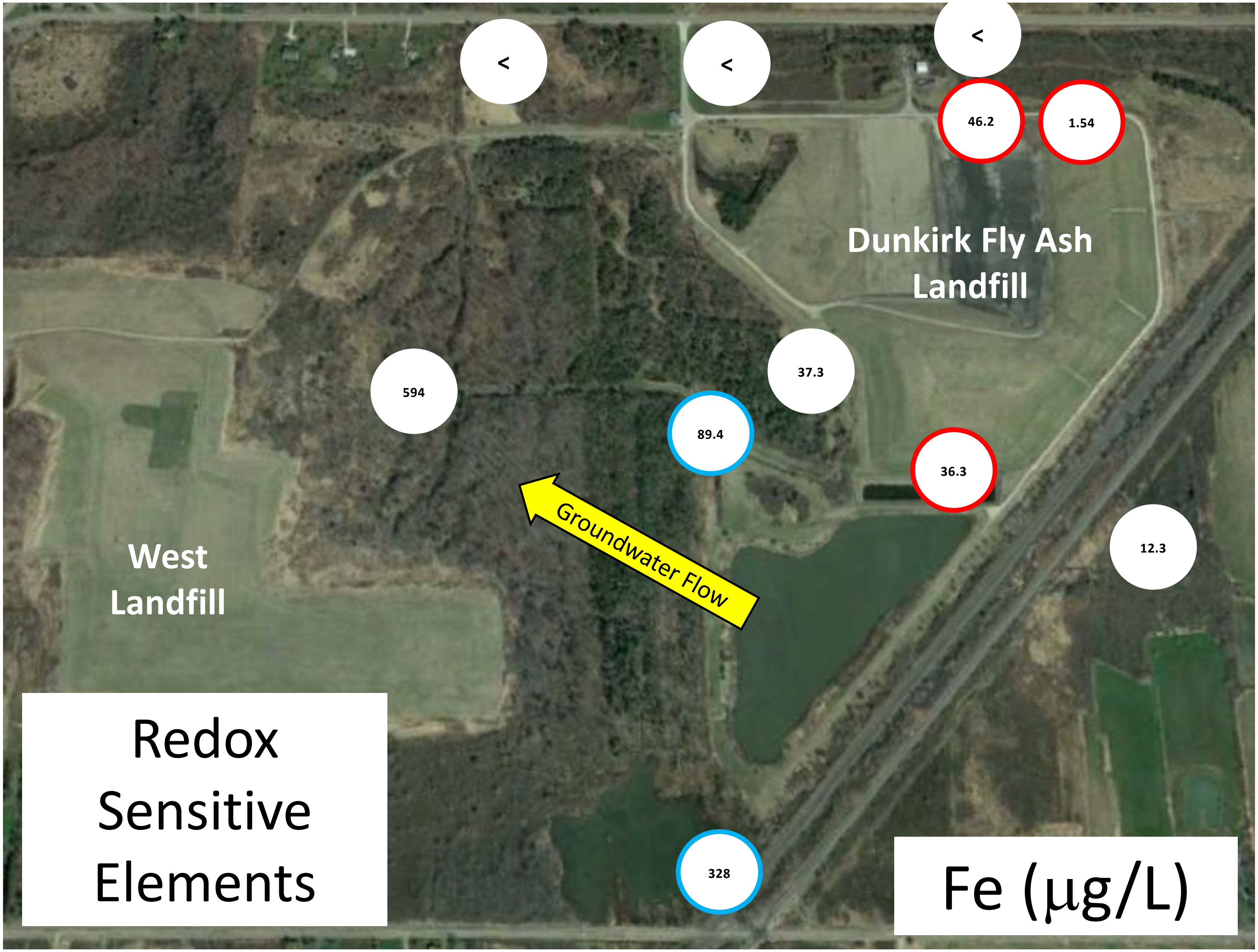

Fig. 24. Concentration of Fe in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

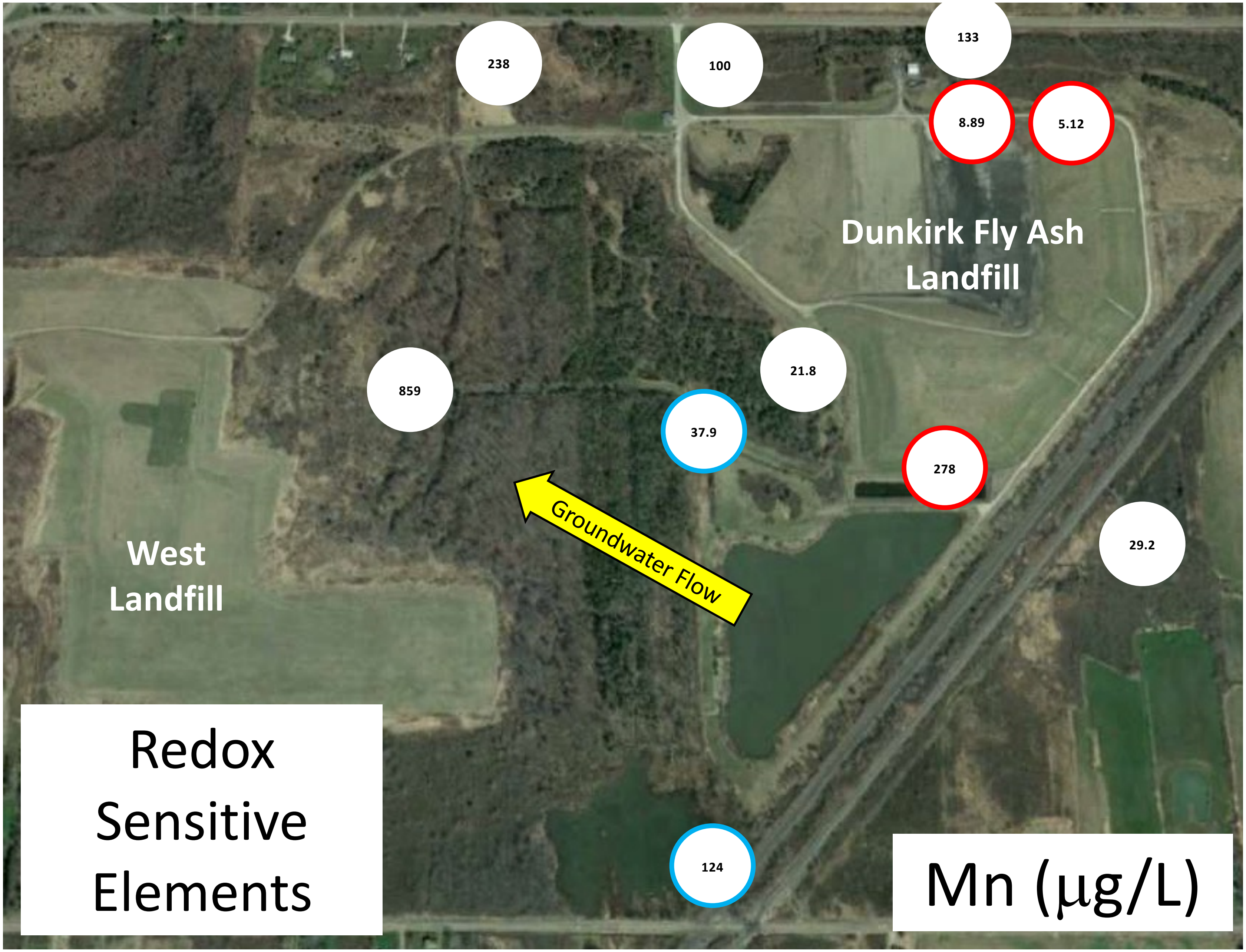

Fig. 25. Concentration of Mn in leachate, surface water, and groundwater samples.
"<" indicates below interpretation threshold.

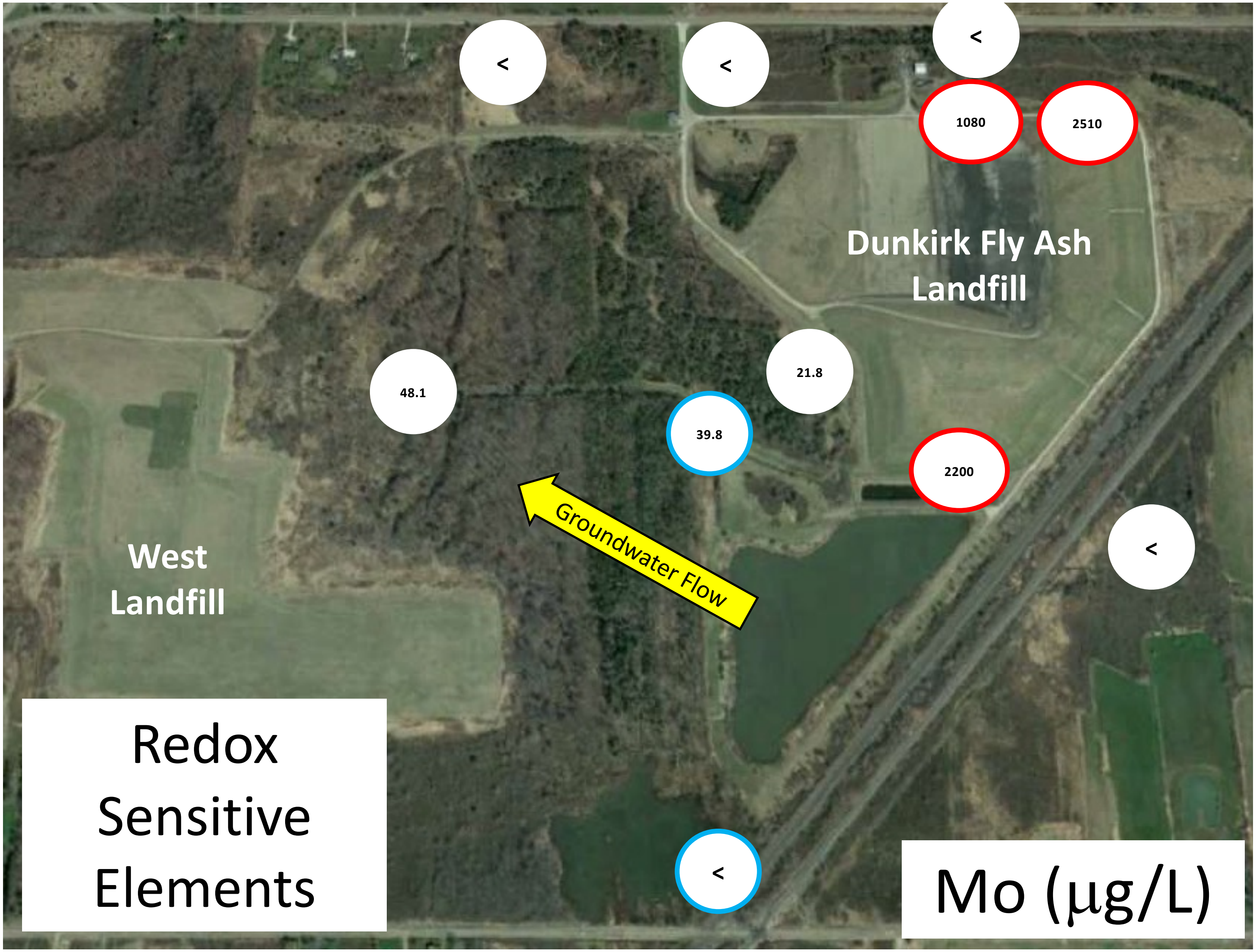

Fig. 26. Concentration of Mo in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

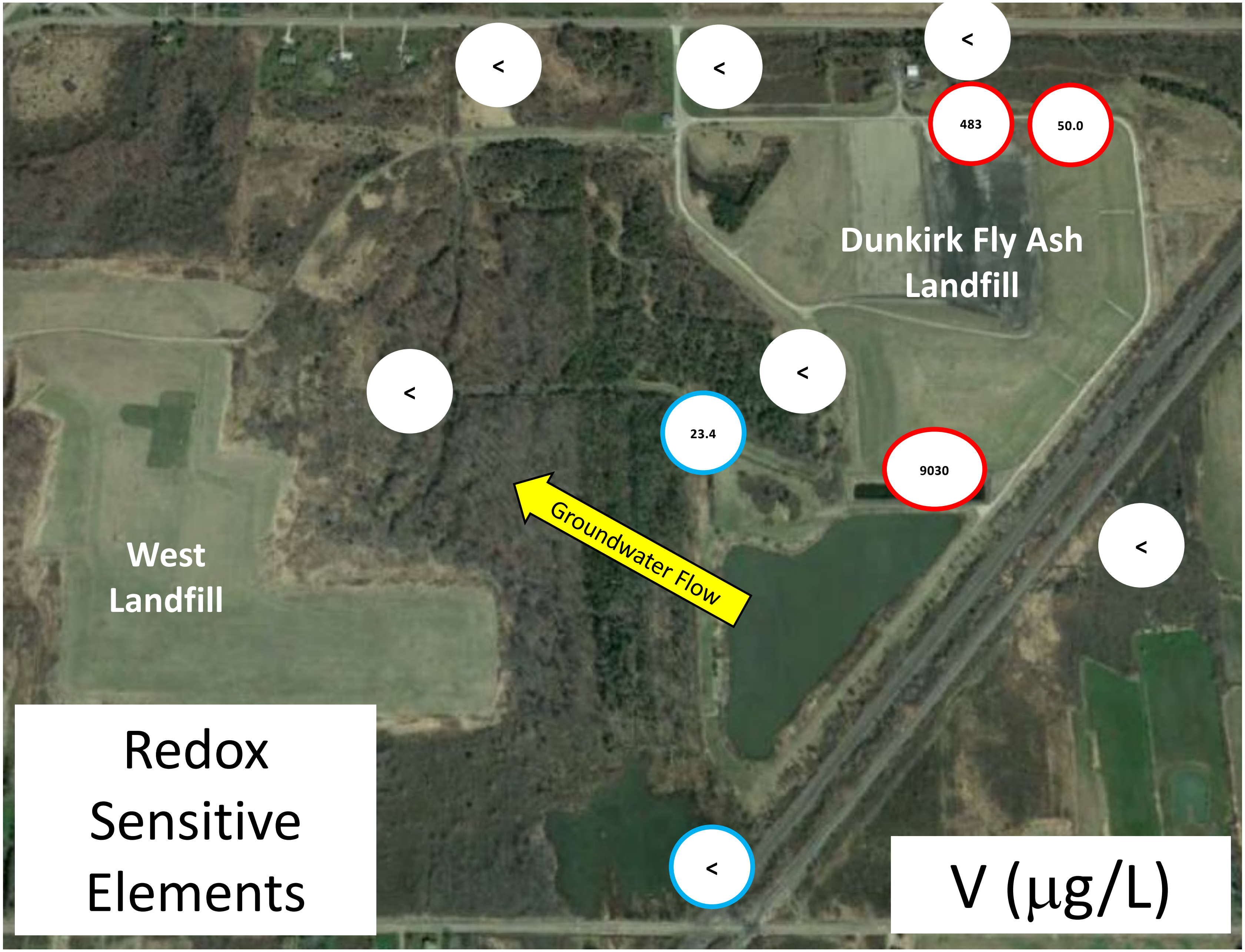

Fig. 27. Concentration of V in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

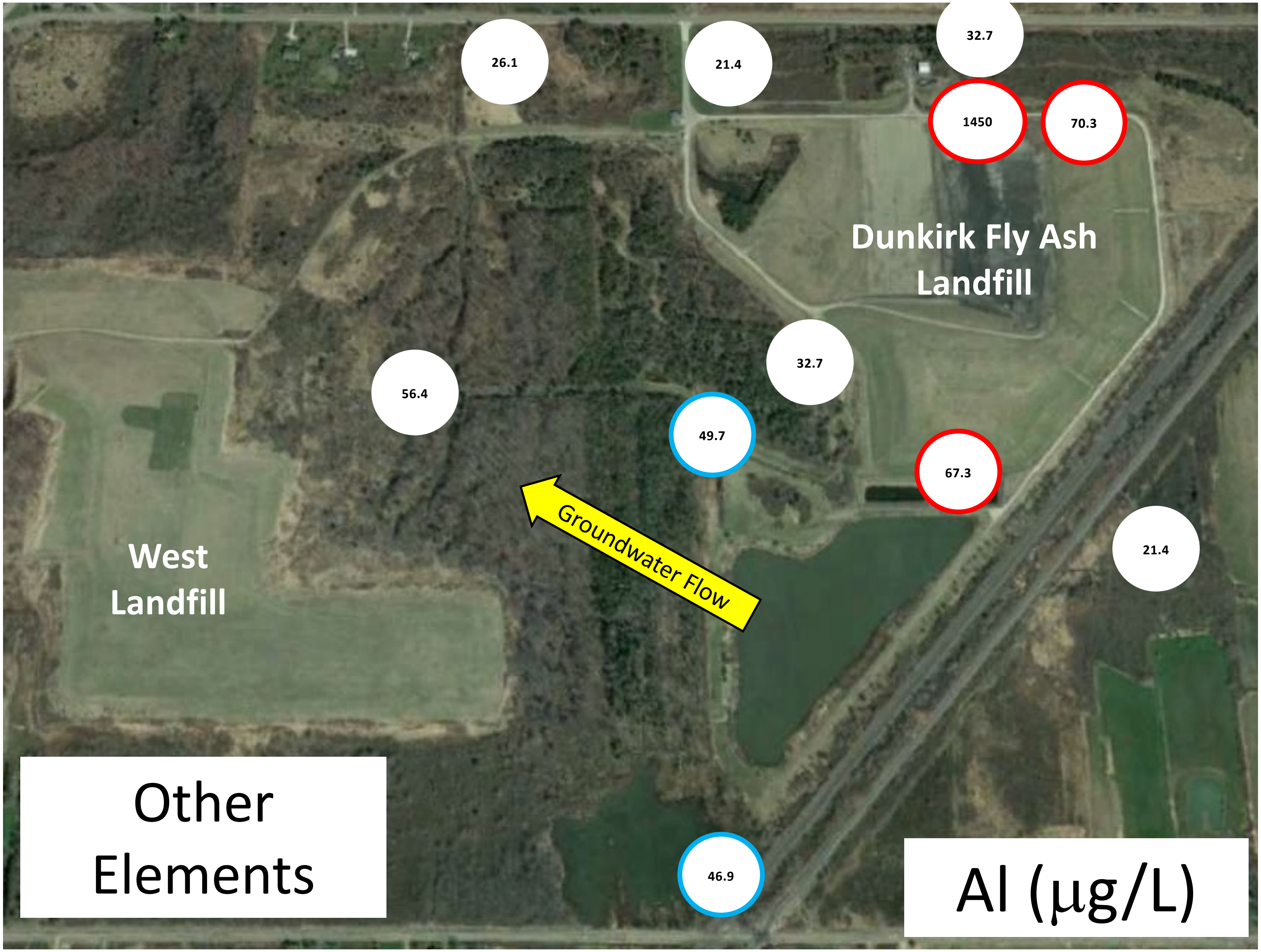

Fig. 28. Concentration of Al in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

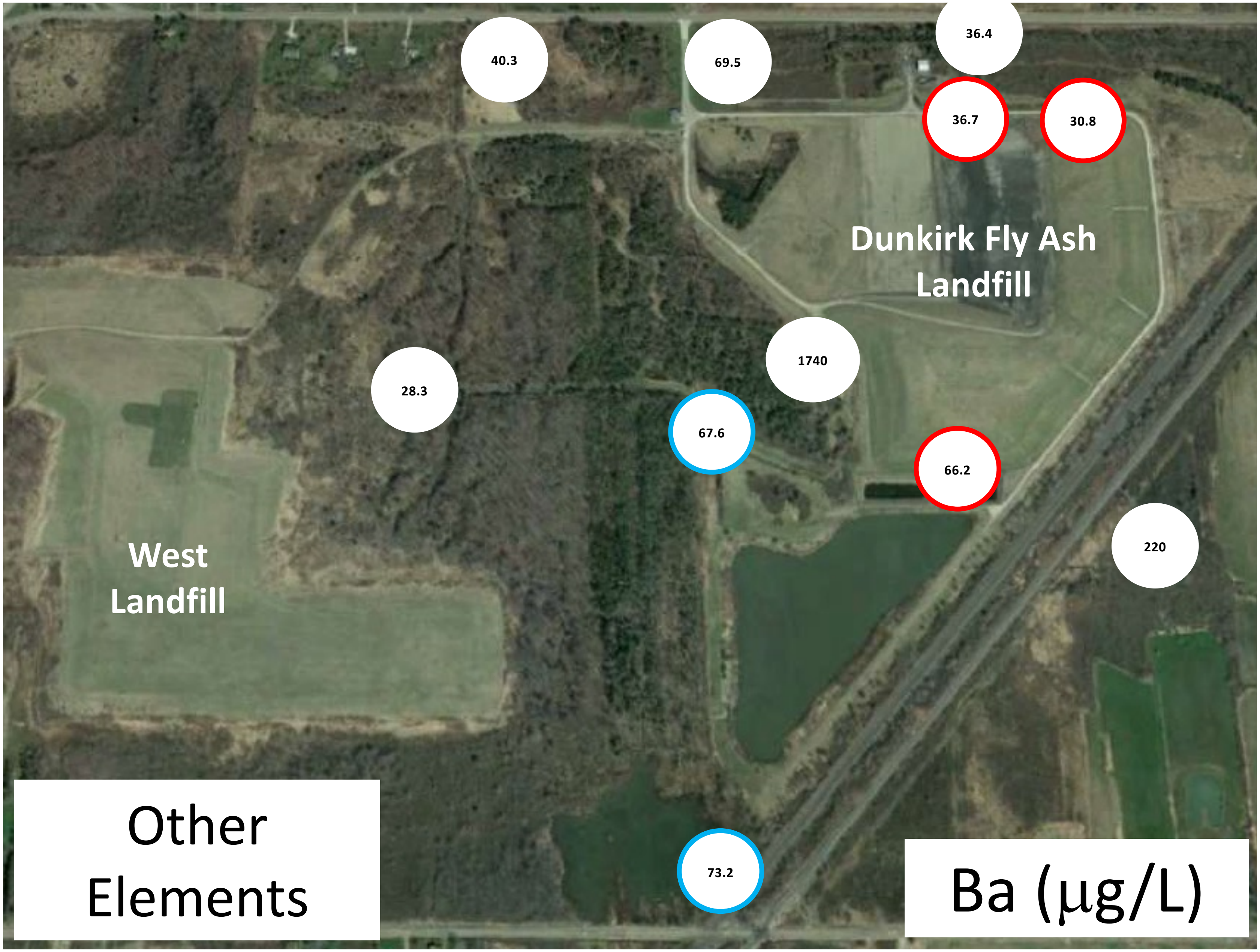

Fig. 29. Concentration of Ba in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

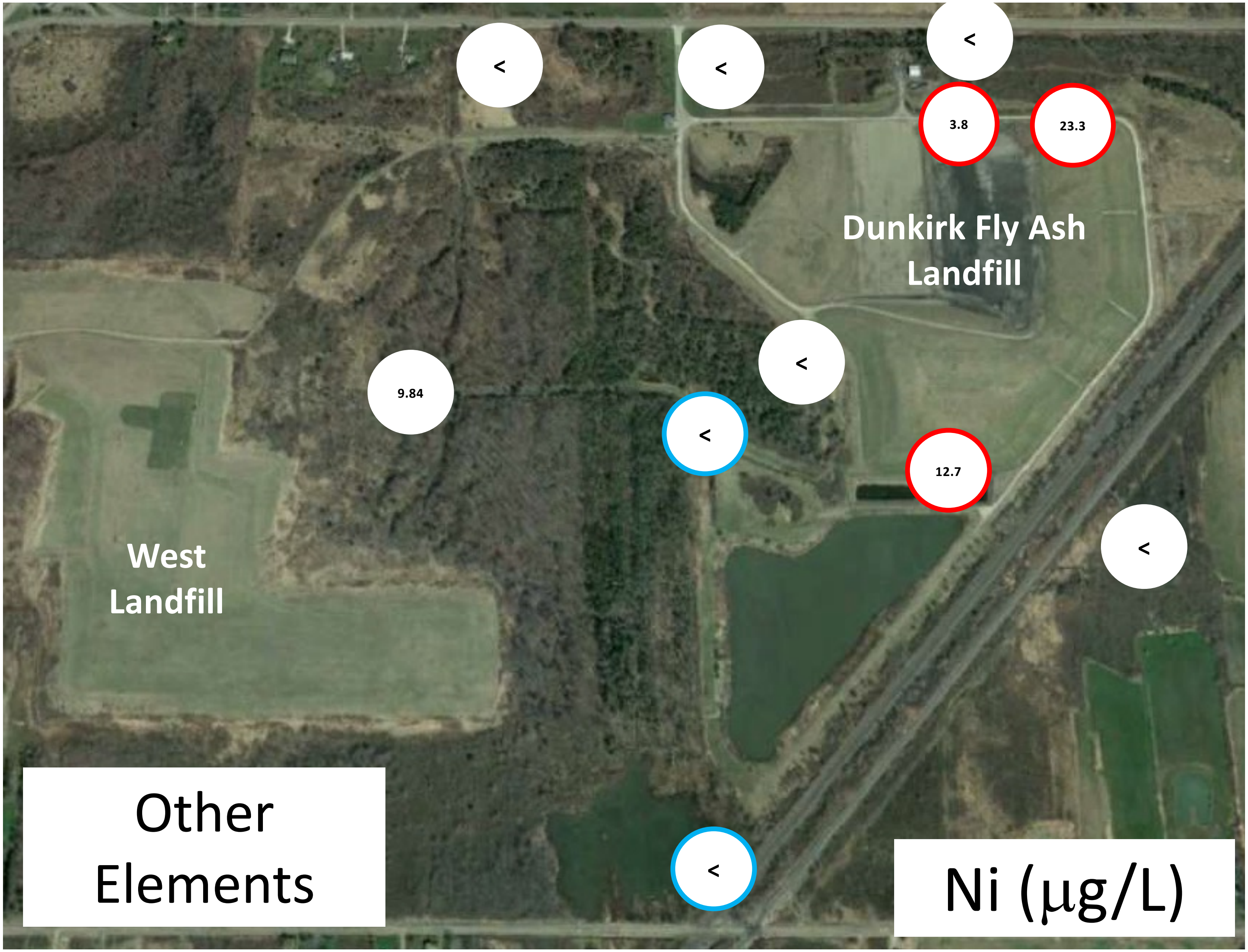

Fig. 30. Concentration of Ni in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

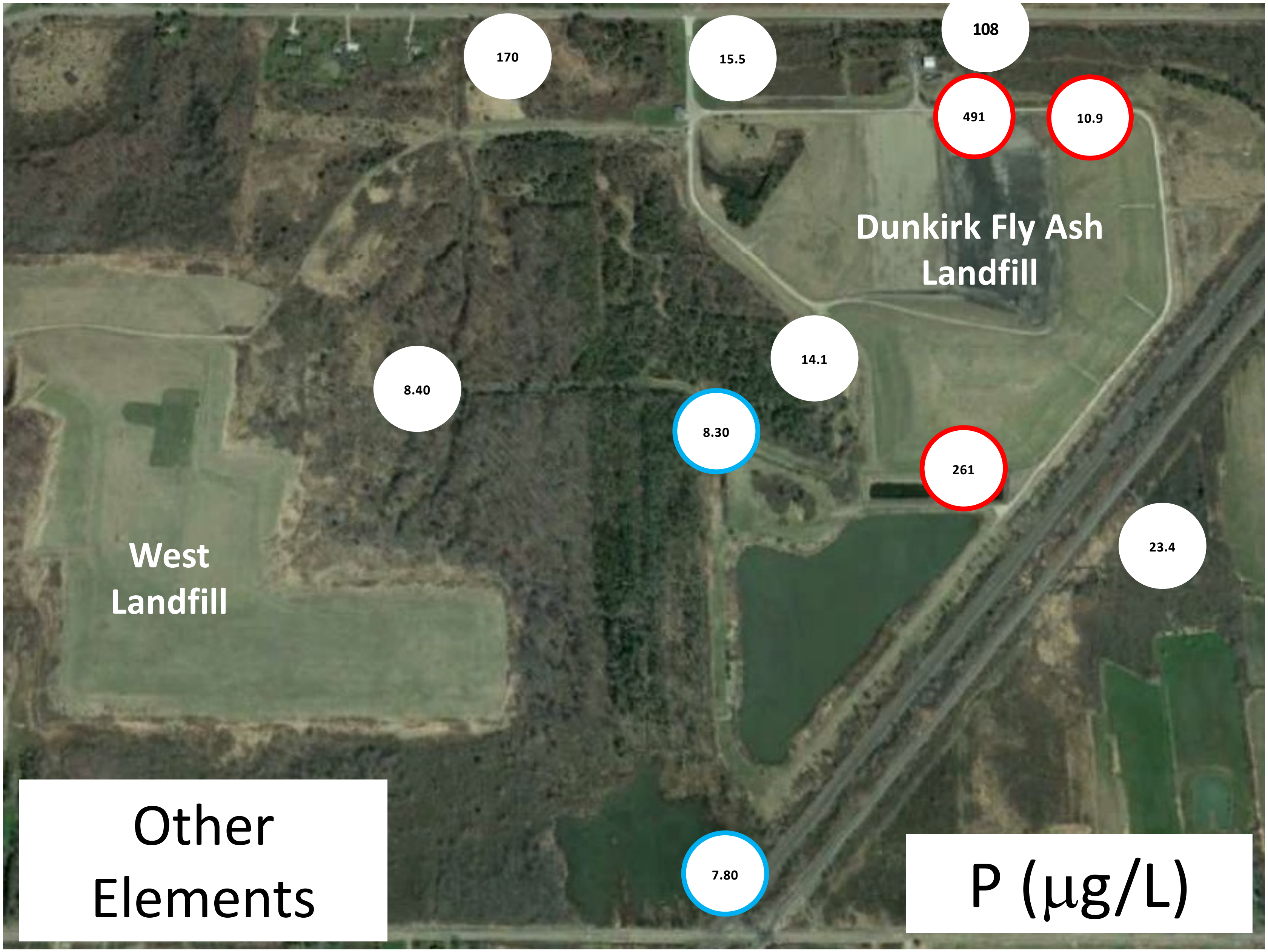

Fig. 31. Concentration of P in leachate, surface water, and groundwater samples.
"<" indicates below interpretation threshold.

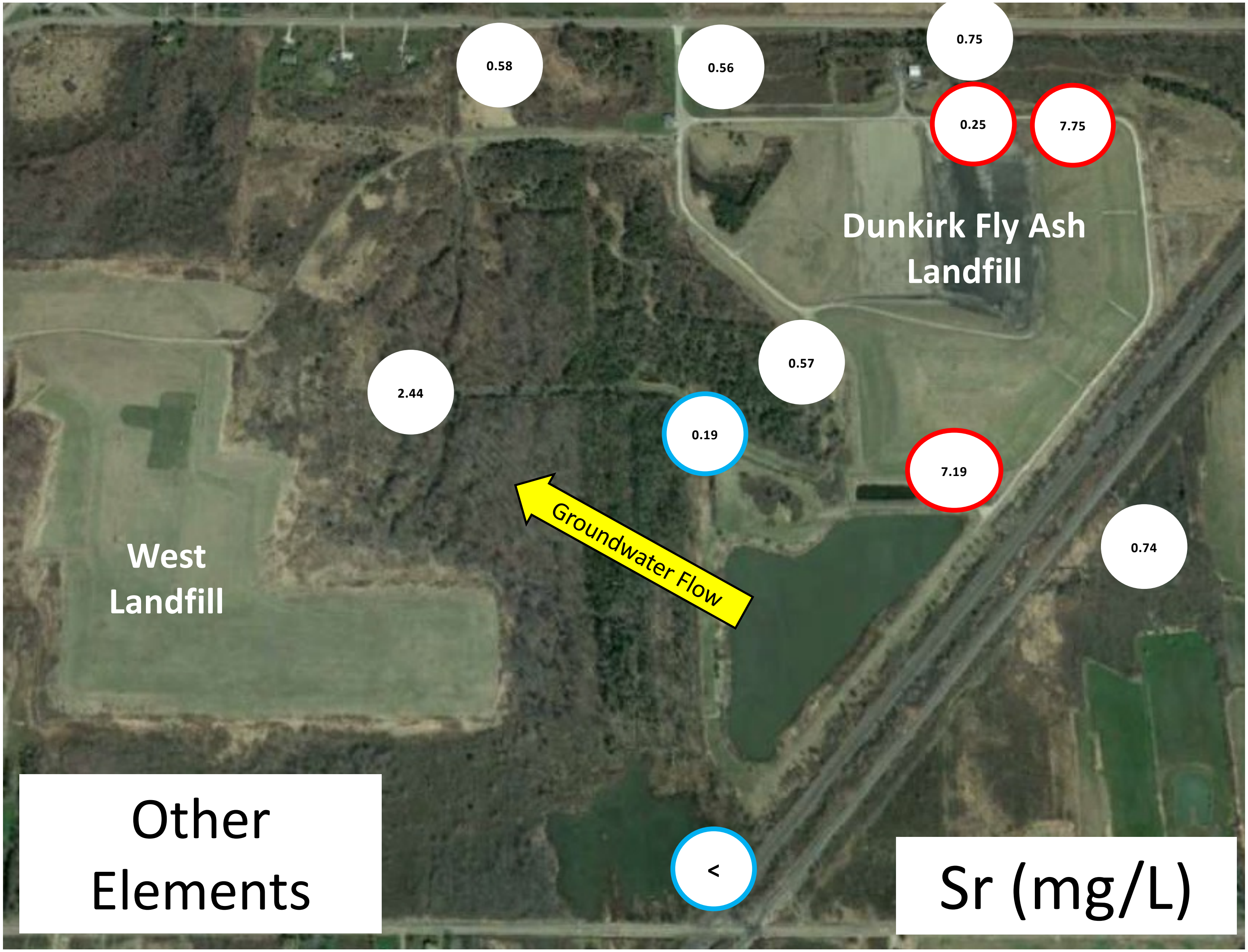

Fig. 32. Concentration of Sr in leachate, surface water, and groundwater samples.
"<" indicates below interpretation threshold.

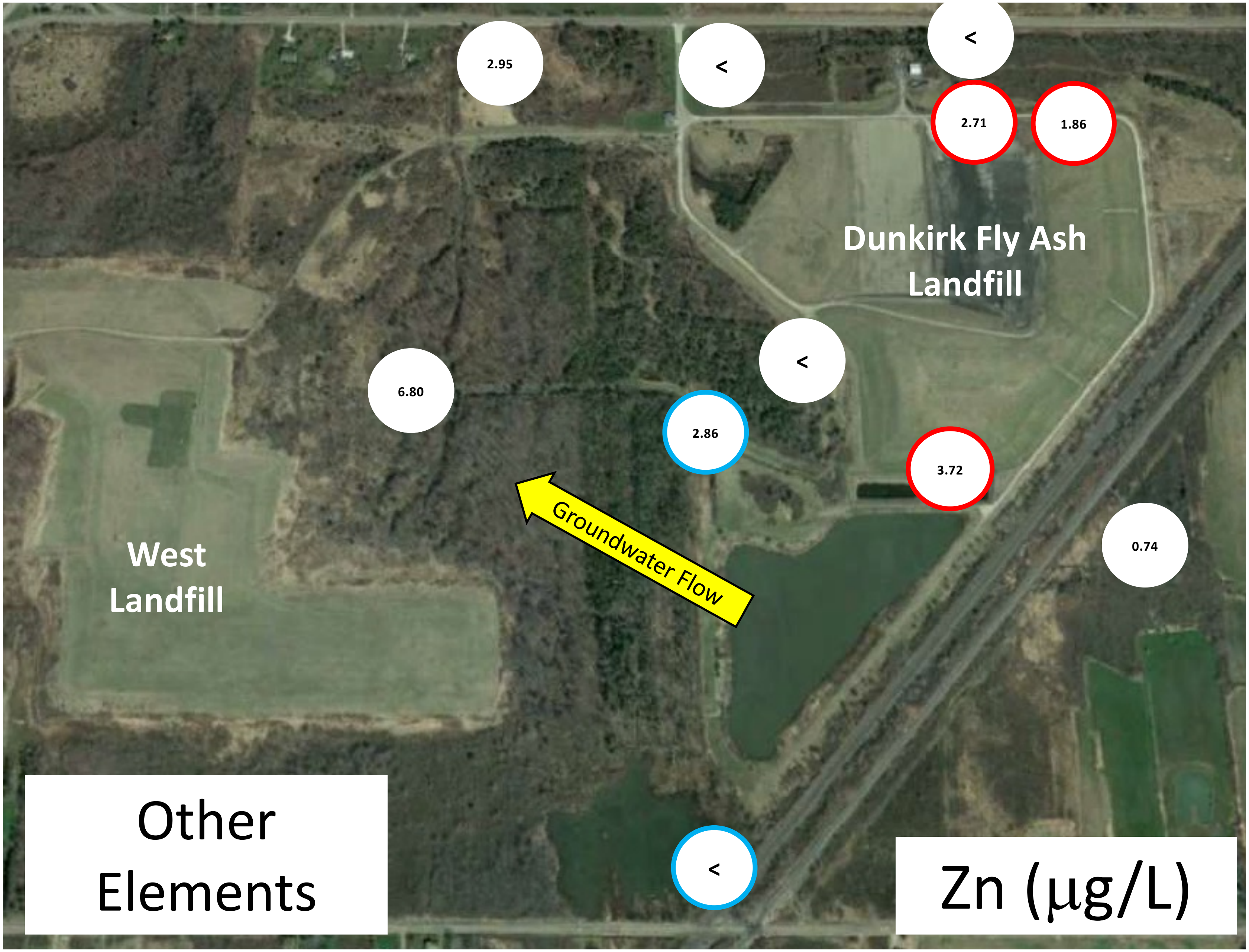

Fig. 33. Concentration of Zn in leachate, surface water, and groundwater samples.
“<” indicates below interpretation threshold.

APPENDIX

SAMPLE COLLECTION FORMS – FRONTIER TECHNICAL ASSOCIATES INC.

FRONTIER TECHNICAL ASSOCIATES INC.

8675 Main Street, Williamsville, N.Y. 14221 (716) 634-2293, Fax (716) 634-2344

WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Phase I & II Well Project No.: ET-1066

Sample Point I.D.: BR-14-UG Date: 4/5/27

Purge Information Purge Method: Bailer, [✓ Peristaltic Pump]

Depth to Bottom of Well: 26.25 ft

Depth to Water Surface: 4.10 ft 4" well = 0.66 gallons per foot

Depth of Water Column: 22.15 ft Elevation of Casing: '629.01

Volume of Standing Water in Well: 14.6 gallons

Start of Purge – Time: 8:43

End of Purge – Time: 10:38

Total Volume Purged: 43.8 gallons Well Purged Dry: Yes [✓ No]

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
					15		30		43.8
Time	--	--	9:45		9:17		9:55		10:38
pH	Oakton pH 300	SM 23rd 4500HB	7.13		7.43		7.64		7.46
Spec. Conductance	Oakton CON 5	EPA 120.1	913		594		581		595
Temperature	Oakton CON 5	SM 23rd 2550B	48		48		50		50
Eh	ORP tester	ASTM D1498	-20		-97		-132		-139
Turbidity	Hach 2100P	EPA 180.1	4.02		3.63		2.29		4.07
Appearance	--	--	clear		Clear		Clear.		Clear

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water:________ ft. Sample Method: Bailer [✓ Peristaltic Pump]

Meters Calibrated: [✓ Yes] Dedicated Sample Equipment [✓ Yes]

Notes/Weather: Sunny 50's

Sampling Personnel: David Harty

Sampling Personnel Signature:

FTA FRONTIER TECHNICAL ASSOCIATES INC.
8675 Main Street, Williamsville, N.Y. 14221 (716) 634-2293, Fax (716) 634-2344

WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Phase II Well Project No.: ET-1066
Sample Point I.D.: BR-12-DG Date: 4/5/22

Purge Information Purge Method: Bailer, [✓ Peristaltic Pump]

Depth to Bottom of Well: 17.37 ft 2" well = 0.17 gallons per foot
Depth to Water Surface: 4.66 ft
Depth of Water Column: 12.74 ft Elevation of Casing:'600.65
Volume of Standing Water in Well: 2.2 gallons
Start of Purge – Time: 1:50
End of Purge – Time: 2:11
Total Volume Purged: 6.6 gallons Well Purged Dry: Yes [✓ No]

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
					2.2		4.4		6.6
Time	--	--	1:50		1:56		2:05		2:11
pH	Oakton pH 300	SM 23rd 4500HB	7.40		7.30		7.23		7.32
Spec. Conductance	Oakton CON 5	EPA 120.1	931		926		925		909
Temperature	Oakton CON 5	SM 23rd 2550B	47		46		46		47
Eh	ORP tester	ASTM D1498	-181		-169		-177		-174
Turbidity	Hach 2100P	EPA 180.1	19.0		3.58		4.44		1.48
Appearance	--	--	Clear		clear		Clear		Clear

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water: 7.05 ft. Sample Method: Bailer [✓ Peristaltic Pump]

Meters Calibrated: Yes Dedicated Sample Equipment: Yes

Notes/Weather:

Sampling Personnel: David Harty

Sampling Personnel Signature: DMH

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8675 Main Street, Williamsville, N.Y. 14221 (716) 634-2293, Fax (716) 634-2344

WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Sed. Basin No. 2 Well Project No.: ET-1066

Sample Point I.D.: BR-13-DG Date: 4/5/22

Purge Information Purge Method: Bailer, [✓ Peristaltic Pump]

11

Depth to Bottom of Well: 19.21 ft

Depth to Water Surface: 3.86 ft 4" well = 0.66 gallons per foot

Depth of Water Column: 15.35 ft Elevation of Casing: '607.42

Volume of Standing Water in Well: 10.1 gallons

Start of Purge – Time: 12:10

End of Purge – Time: 1:40

Total Volume Purged: 30.3 gallons Well Purged Dry: Yes [✓ No]

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
					10.1		20.2		30.3
Time	--	--	12:10		12:32		1:07		
pH	Oakton pH 300	SM 23rd 4500HB	7.73		7.59		7.43		7.56
Spec. Conductance	Oakton CON 5	EPA 120.1	724		731		729		724
Temperature	Oakton CON 5	SM 23rd 2550B	46		.47		48		49
Eh	ORP tester	ASTM D1498	-119		-147		-160		-197
Turbidity	Hach 2100P	EPA 180.1	10.4		5.18		4.93		2.84
Appearance	--	--	clear		clear w/ white growth		clear		clear

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water: 9.20 ft. Sample Method: Bailer [✓ Peristaltic Pump]

Meters Calibrated: Yes Dedicated Sample Equipment: [✓ Yes]

Notes/Weather:

Sampling Personnel: David Hardy

Sampling Personnel Signature:

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WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Phase II Well Project No.: ET-1066

Sample Point I.D.: BR-3-DG Date: 4/5/22

Purge Information Purge Method: Bailer, [✓ Peristaltic Pump]

Depth to Bottom of Well: 18.75 ft

Depth to Water Surface: 4.20 ft 4" well = 0.66 gallons per foot

Depth of Water Column: 14.55 ft Elevation of Casing:'618.15

Volume of Standing Water in Well: 9.6 gallons

Start of Purge – Time: 10:50

End of Purge – Time: 12:03

Total Volume Purged: 28.4 gallons Well Purged Dry: Yes No

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
					9.6		19.2		28.8
Time	--	--	10:52		11:15		11:33		11:52
pH	Oakton pH 300	SM 18-20 4500HB	7.46		7.51		7.32		7.81
Spec. Conductance	Oakton COM 5	EPA 120.1	814		803		798		786
Temperature	Oakton COM 5	SM 18-20 2550B	46		47		47		48
Eh	ORP tester	ASTM D1498	-135		-101		-93		-100
Turbidity	Hach 2100P	EPA 180.1	78.9		514		953		Over Range
Appearance	--	--	Turbid.		Turbid.		Turbid		Turbid.

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water: 11.76 ft. Sample Method: Bailer [✓ Peristaltic Pump]

Meters Calibrated: Yes Dedicated Sample Equipment: Yes

Notes/Weather:

Sampling Personnel: David [illegible]

Sampling Personnel Signature:

FRONTIER TECHNICAL ASSOCIATES INC.
8675 Main Street, Williamsville, N.Y. 14221 (716) 634-2293, Fax (716) 634-2344

WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Project No.: ET-1066

Sample Point I.D.: OB- 5- DG Date: 4/6/22

Purge Information Purge Method: Bailer, [✓ Peristaltic Pump]

Depth to Bottom of Well: 8.200 ft

Depth to Water Surface: 2.90 ft 4" well = 0.66 gallons per foot

Depth of Water Column: 5.30 ft Elevation of Casing: 619.92

Volume of Standing Water in Well: 3.5 gallons

Start of Purge – Time: 10:25

End of Purge – Time: 10:54

Total Volume Purged: 11 gallons Well Purged Dry: Yes [✓ No]

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
					6.0				
Time	--	--	10:25		10:35				10:54
pH	Oakton pH 300	SM 18-20 4500HB	7.15		7.28				7.14
Spec. Conductance	Oakton CON 5	EPA 120.1	1112		1135				1156
Temperature	Oakton CON 5	SM 18-20 2550B	46		46				47
Eh	ORP tester	ASTM D1498	53		-18				-16
Turbidity	Hach 2100P	EPA 180.1	12.1		6.56				135
Appearance	--	--	Clear		Clear.				Clear

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water: 5.21 ft. Sample Method: Bailer [✓ Peristaltic Pump]

Meters Calibrated: Yes Dedicated Sample Equipment: Yes

Notes/Weather:

Sampling Personnel:

Sampling Personnel Signature:

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WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Phase I Cell A Project No.: ET-1066

Sample Point I.D.: MH-19 Leachate Date:

Purge Information Purge Method: None

Depth to Bottom of Well: NA ft

Depth to Water Surface: NA ft

Depth of Water Column: NA ft

Volume of Standing Water in Well: NA gallons

Start of Purge – Time: NA

End of Purge – Time: NA

Total Volume Purged: NA gallons Well Purged Dry: Yes No

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
Time	--	--							11:20
pH	Oakton pH 300	SM 23rd 4500HB							7.52
Spec. Conductance	Oakton CON 5	EPA 120.1							4380
Temperature	Oakton CON 5	SM 23rd 2550B							54
Eh	ORP tester	ASTM D1498							-14
Turbidity	HACH 2100P	EPA 180.1							6.43
Appearance	--	--							Beer color

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water: NA ft. Sample Method: Grab

Meters Calibrated: Yes Dedicated Sample Equipment: Yes

Notes/Weather:

Sampling Personnel:

Sampling Personnel Signature:

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WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Phase II Cell A Project No.: ET-1066

Sample Point I.D.: MH-16 Primary Leachate Date: 4/6/22

Purge Information Purge Method: None

Depth to Bottom of Well: NA ft

Depth to Water Surface: NA ft

Depth of Water Column: NA ft

Volume of Standing Water in Well: NA gallons

Start of Purge – Time: NA

End of Purge – Time: NA

Total Volume Purged: NA gallons Well Purged Dry: Yes No

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
Time	--	--							11:35
pH	Oakton pH 300	SM 23rd 4500HB							7.72(7.72)
Spec. Conductance	Oakton CON 5	EPA 120.1							2340(2300)
Temperature	Oakton CON 5	SM 23rd 2550B							53
Eh	ORP tester	ASTM D1498							41(39)
Turbidity	HACH 2100P	EPA 180.1							1.32(1.83)
Appearance	--	--							Clear

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water: NA ft. Sample Method: Grab

Meters Calibrated: Yes Dedicated Sample Equipment: Yes

Notes/Weather:

Sampling Personnel:

Sampling Personnel Signature:

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8675 Main Street, Williamsville, N.Y. 14221 (716) 634-2293, Fax (716) 634-2344

WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Phase I Well Project No.: ET-1066

Sample Point I.D.: BR-20-DG Date: 4/6/27

Purge Information Purge Method: [✓ Bailer], Peristaltic Pump

Depth to Bottom of Well: 35.99 ft 2" well = 0.17 gallons per foot

Depth to Water Surface: 10.88 ft

Depth of Water Column: 25.11 ft Elevation of Casing: '625.43

Volume of Standing Water in Well: 4.3 gallons

Start of Purge – Time: 9:20

End of Purge – Time:

Total Volume Purged: 4.3 gallons Well Purged Dry: [✓ Yes] No

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
					4.3				
Time	--	--	9:20		9:37				11:45
pH	Oakton pH 300	SM 23rd 4500HB	7.26		7.53				8.11
Spec. Conductance	Oakton CON 5	EPA 120.1	1010		936				980
Temperature	Oakton CON 5	SM 23rd 2550B	52		53				55
Eh	ORP tester	ASTM D1498	66		42				17
Turbidity	Hach 2100P	EPA 180.1	11.6		22.1				16.5
Appearance	--	--	clear		clear				clear

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water: 20.11 ft. Sample Method: [✓ Bailer] Peristaltic Pump

Meters Calibrated: Yes Dedicated Sample Equipment: Yes

Notes/Weather:

Sampling Personnel:

Sampling Personnel Signature:

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8675 Main Street, Williamsville, N.Y. 14221 (716) 634-2293, Fax (716) 634-2344

WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Project No.: ET-1066

Sample Point I.D.: Hydraulic Basin @ Road Date: 4/6/20

Purge Information Purge Method: None

Depth to Bottom of Well: NA ft

Depth to Water Surface: NA ft

Depth of Water Column: NA ft

Volume of Standing Water in Well: NA gallons

Start of Purge – Time: NA

End of Purge – Time: NA

Total Volume Purged: NA gallons Well Purged Dry: Yes No

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
Time	--	--							12:08
pH	Oakton pH 300	SM 23rd 4500HB							8.10
Spec. Conductance	Oakton CON 5	EPA 120.1							280
Temperature	Oakton CON 5	SM 23rd 2550B							53
Eh	ORP tester	ASTM D1498							1
Turbidity	HACH 2100P	EPA 180.1							5.58
Appearance	--	--							Clear

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water: NA ft. Sample Method: Grab

Meters Calibrated: Yes Dedicated Sample Equipment: Yes

Notes/Weather:

Sampling Personnel:

Sampling Personnel Signature:

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WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Project No.: ET-1066

Sample Point I.D.: Overflow Beaver Dam Date: 4/6/22

Purge Information Purge Method: None

Depth to Bottom of Well: NA ft

Depth to Water Surface: NA ft

Depth of Water Column: NA ft

Volume of Standing Water in Well: NA gallons

Start of Purge – Time: NA

End of Purge – Time: NA

Total Volume Purged: NA gallons Well Purged Dry: Yes No

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
Time	--	--							10:10
pH	Oakton pH 300	SM 23rd 4500HB							8.07
Spec. Conductance	Oakton CON 5	EPA 120.1							528
Temperature	Oakton CON 5	SM 23rd 2550B							52
Eh	ORP tester	ASTM D1498							58
Turbidity	HACH 2100P	EPA 180.1							43.5
Appearance	--	--							slightly Turbd

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water: NA ft. Sample Method: Grab

Meters Calibrated: Yes Dedicated Sample Equipment: Yes

Notes/Weather:

Sampling Personnel:

Sampling Personnel Signature:

FTA **FRONTIER TECHNICAL ASSOCIATES INC.**
8675 Main Street, Williamsville, N.Y. 14221 (716) 634-2293, Fax (716) 634-2344

WELL PURGING AND SAMPLING LOG

Site Location: Dunkirk Landfill Phase I Cell A Project No.: ET-1066

Sample Point I.D.: MH-2 Leachate Date: 4/6/22

Purge Information Purge Method: None

Depth to Bottom of Well: NA ft

Depth to Water Surface: NA ft

Depth of Water Column: NA ft

Volume of Standing Water in Well: NA gallons

Start of Purge – Time: NA

End of Purge – Time: NA

Total Volume Purged: NA gallons Well Purged Dry: Yes No

Parameters	Meter	Method	Initial Sample	Accumulated Volume Purged (gallons)					Sample
Time	--	--							9:48
pH	Oakton pH 300	SM 23rd 4500HB							7.20
Spec. Conductance	Oakton CON 5	EPA 120.1							1520
Temperature	Oakton CON 5	SM 23rd 2550B							53
Eh	ORP tester	ASTM D1498							36
Turbidity	HACH 2100P	EPA 180.1							4.98
Appearance	--	--							Clear

NYSDOH ELAP No. 10475, Values in parenthesis are duplicate values

Depth to Water: NA ft. Sample Method: [✓ Grab]

Meters Calibrated: Yes Dedicated Sample Equipment: Yes

Notes/Weather: ______

Sampling Personnel: ______

Sampling Personnel Signature: ______