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April 26, 2021

Bonnie Bergsma
Sahtu Land and Water Board
Regulatory Specialist
P.O. Box 1
Fort Good Hope, NT
X0E 0H0

**Re: Annual Aquatic Effects Monitoring Program Report
Type A Water Licence S13L1-007, Part 1, Item 3
Imperial Oil Resources N.W.T. Limited (Imperial)**

Dear Ms. Bergsma,

Part I, Item 3 of Type A Water Licence S13L1-007 requires the Licencee (Imperial) to submit an Aquatic Effects Monitoring Program (AEMP) Annual report to the Board for approval on or before April 30, 2017 and each year thereafter. The full 2020 Annual AEMP Report is included as Attachment B and a summary of the results are presented as Attachment A.

Following submission of the 2019 Annual AEMP Report (submitted to the Board in March 2020), Imperial received feedback and comments from stakeholders. Imperial responded to comments received (proponent responses submitted to the SLWB in August 2020). Changes to the report have been made to incorporate stakeholder feedback, where applicable. Notably, updated statistical analysis (considering spatial and temporal trends) has not been included in the report. It is known that water quality is highly correlated with seasonal patterns of discharge in the river, and that trend analysis in the absence of flow data is not an acceptable statistical method. Flow data is currently not readily available in the vicinity of Norman Wells. Accordingly, Imperial will be evaluating options for obtaining flow data. This data, along with an updated trend analysis (spatial and temporal) will be included in upcoming annual AEMP reports. Inclusion of flow data combined with an additional year of monitoring data will significantly increase Imperial's ability to perform a robust statistical analysis.

Key findings from the 2020 Annual AEMP Report (Attachment B) are summarized as follows.

- Measured hydrocarbon concentrations in water continue to be below laboratory detection limits and below applicable criteria.
- Statistical analysis was able to find a clear distinction in water chemistry between sampling locations at the Bosworth Creek, Bear Island, and the Mackenzie River.
- Some metals concentrations in water exceed applicable criteria at some locations. Analysis of the spatial distribution these exceedances showed that these results are not associated with the Norman Wells Operation.
- Data collected to date does not show an adverse impact from the Norman Wells Operation on the water quality in the Mackenzie River.

Based on the results described above, Imperial will continue to execute the AEMP surface water quality monitoring program on an annual basis and will look to obtain flow data for analysis in future reports.



Completion of this ongoing annual monitoring will improve the statistical power of the program. Ongoing monitoring will also help identify if any longer term spatial and temporal trends in water quality exist.

Imperial submitted AEMP Version 3.0 to the SLWB in December 2019. Stakeholder comments were received in the first half of 2020. Imperial responded to stakeholder comments in fall 2020. Currently, Imperial is awaiting a decision from the SLWB on AEMP Version 3.0. The additional monitoring activities outlined in AEMP Version 3.0 and in Imperial's response to stakeholder comments (namely, execution of a fish monitoring program and execution of targeted winter water quality sampling) will be scheduled accordingly following receipt of a decision from the SLWB on AEMP Version 3.0.

In conjunction with submission of this years' Annual AEMP Report, Imperial reached out directly to all Sahtu communities and scheduled meetings with those that expressed interest. Imperial provided an update on the AEMP, including an overview of the sampling results and discussed receiving input on the execution plan the proposed fish monitoring program (e.g. exact sampling locations), which will be a topic for future meetings. Imperial is looks forward to continued direct engagement with interested stakeholders on the AEMP.

If you require further information, please contact Christine Wickens at 587-476-5007 or christine.a.wickens@exxonmobil.com. Imperial looks forward to receiving a decision from the SLWB on AEMP Version 3.0 in the near term.

Sincerely,

A handwritten signature in blue ink that reads "C Wickens".

Christine Wickens
Environment and Regulatory Advisor
Imperial

Cc:

Jody Crawford, Conventional Operations Superintendent
Doug Ford, SSHE Manager
Pascale St-Germain, Environmental & Regulatory Advisor
Susan Scott, Socioeconomic Advisor

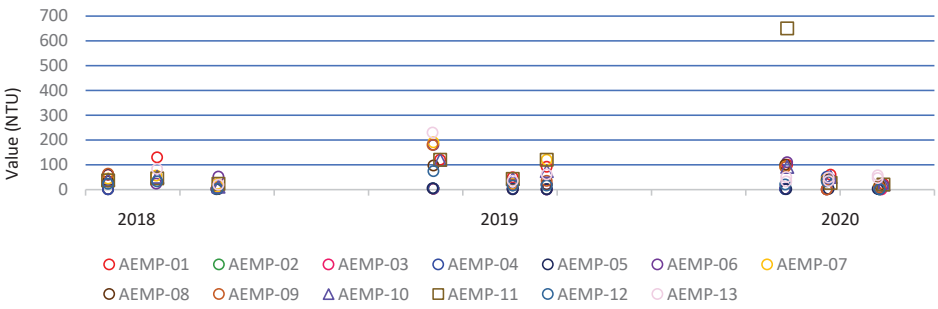
List of attachments:

Attachment A – 2020 AEMP Results Summary
Attachment B – 2020 Annual Aquatic Effects Monitoring Program Report

Attachment A

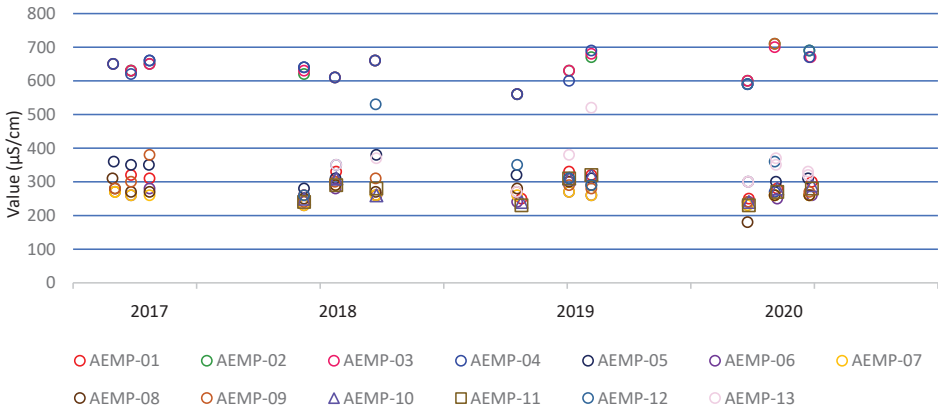
Turbidity

Turbidity is a measure of how cloudy the water is. It is affected by sediments and other solid materials in the water. There is no regulatory guideline for turbidity. The range of turbidity values remains constant over time.



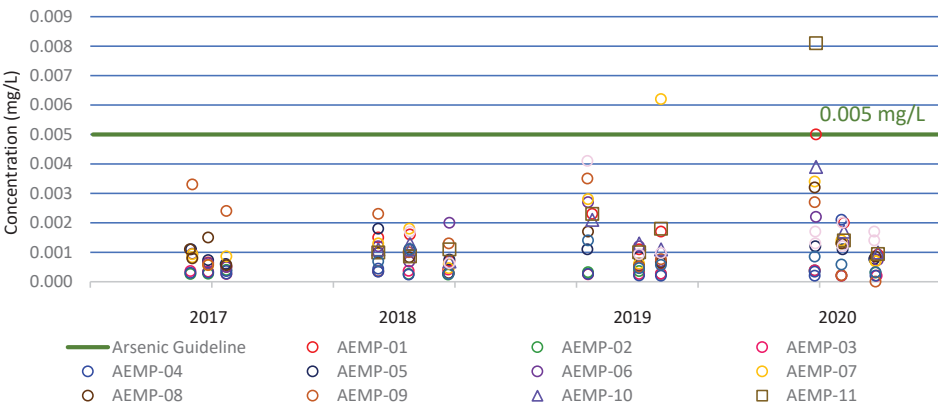
Electrical Conductivity

Conductivity is an indicator of how much salt may be dissolved in water. There is no regulatory guideline for conductivity. The range of electrical conductivity values remains constant over time.



Arsenic - Total

Arsenic is metal that is found naturally in the river but can also be increased through industrial activity. Increased concentrations of arsenic have been associated with increased suspended solids.



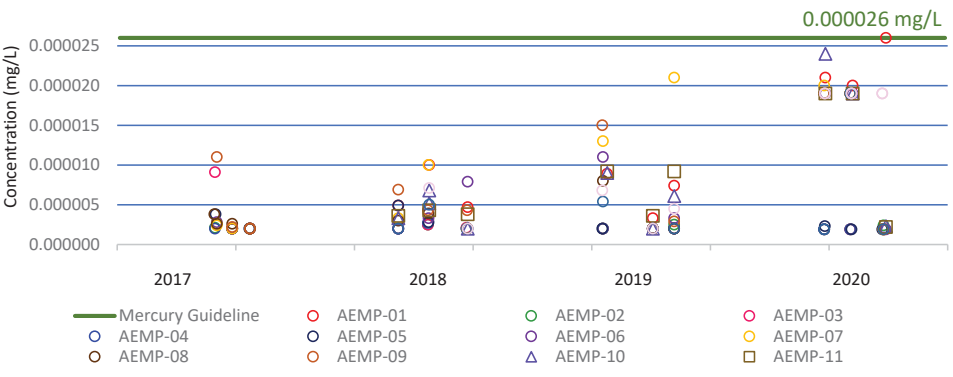
Aquatic Effects Monitoring Program

Data collected between 2017 and 2020 was analyzed for routine variables, hydrocarbons, and total and dissolved metals. All analyses of hydrocarbons were below detectable limits. In some cases, metals concentrations were found to exceed applicable guidelines. There is no current information indicating that these metals results are related to the operation. Data collected to date does not show an impact from the Norman Wells Operation on the water quality in the Mackenzie River. Ongoing annual monitoring and analysis will continue to help understand any long term trends and improve the statistical power of the analysis. Additional information can be found within the annual Aquatic Effects Monitoring Program Annual Report..

Where available, results have been compared to Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 2018).

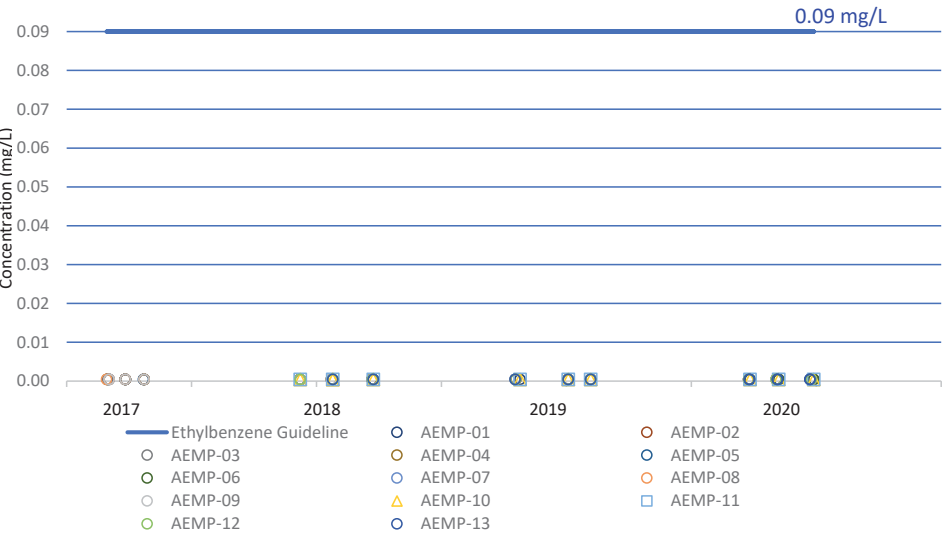
Mercury - Total

Mercury is metal that is found naturally in the river but can also be increased through industrial activity. Increased concentrations of mercury have been associated with increased suspended solids.



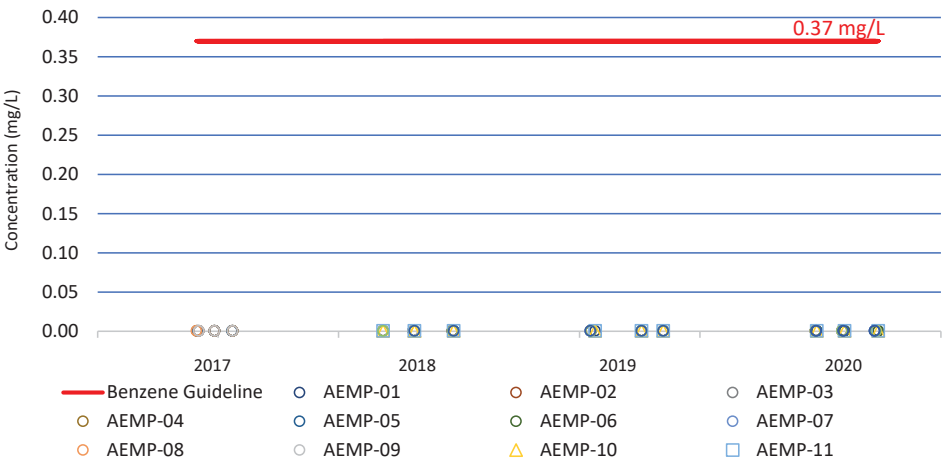
Ethylbenzene

Ethylbenzene is a component of hydrocarbons that can dissolve and move in water. All ethylbenzene results were below laboratory detection limits.



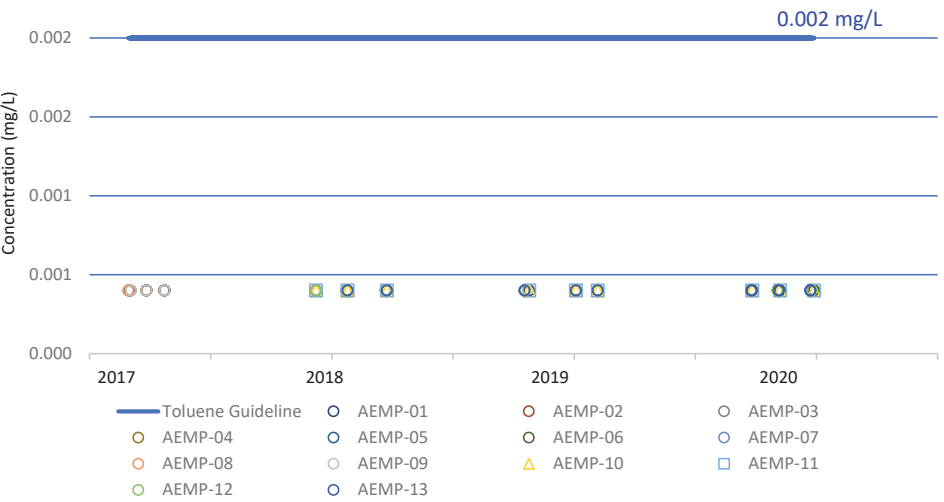
Benzene

Benzene is a component of hydrocarbons that can dissolve and move in water. All benzene results were below laboratory detection limits.



Toluene

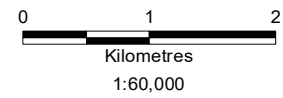
Toluene is a component of hydrocarbons that can dissolve and move in water. All toluene results were below laboratory detection limits.





Legend

● AQUATIC EFFECTS MONITORING PROGRAM LOCATION



Attachment B



Aquatic Effects Monitoring Program

Norman Wells Operations

Imperial

31 March 2021

417011-00068-20200

Advisian
Worley Group

advisian.com

THIS REPORT CONTAINS PROVISIONS LIMITING LIABILITY, THE SCOPE OF THE REPORT AND THIRD PARTY RELIANCE

These documents and the information contained therein are confidential, property of Imperial Oil and any disclosure of same is governed by the provisions of each of the applicable provincial and territorial freedom of information legislation, the Privacy Act (Canada) 1980-81-82-83, c.111, Sch.II"1", and the Access to Information Act (Canada) 1980-81-82-83, c.111, Sch.I"1", as such legislation may be amended from time to time.

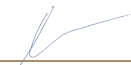
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PROJECT: 417011-00068-20200-WW-REP-0001: Aquatic Effects Monitoring Program – Norman Wells Operations

Rev	Description	Author	Review	Advisian Approval	Revision Date
0	Issued as final	 M. Vander Meulen	 C. Mushens	 A. Haigh	05-Mar-21
1	Re-issued as final	 M. Vander Meulen	 C. Mushens	 A. Haigh	16-Mar-21
2	Re-issued as final	 M. Vander Meulen	 C. Mushens	 A. Haigh	31-Mar-21

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Appendix B	Field Procedures
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Executive Summary

Water quality samples were collected in the Mackenzie River and Bosworth Creek between June and October in 2017-2020 to discern potential effects of ongoing Norman Wells operations and/or presence of legacy contaminants. This aquatic effects monitoring program (AEMP) is executed three times annually during spring, summer, and fall.

Many analytes quantified in water samples were below detection limits. All hydrocarbon analytes, including benzene, toluene, ethylbenzene, xylenes and petroleum hydrocarbon fractions 1 and 2, were below detection limits. There are no current indications to suggest that metals concentrations above guidelines are related to Imperial's operations given their spatial distribution.

Multivariate analysis was applied to a common set of variables not including those that had any analytical non-detections. Multivariate analysis found clear distinction between Bosworth Creek, Bear Island, and Mackenzie River sampling locations. At any sampling location there was no discernible and consistent long-term trend in water chemistry.

In summary:

- There are differences in water chemistry in Bosworth Creek, on Bear Island, and in the Mackenzie River;
- Multivariate analysis did not detect long-term trends in water chemistry;
- All hydrocarbons analyses were below detection limits;
- There are no current indications to suggest that metals concentrations above guidelines are related to Imperial's operations given their spatial distribution; and,
- Ongoing annual monitoring and analysis will continue to help understand any long-term trends and improve the statistical power of the analysis.

1 Introduction

Imperial Oil Resources (Imperial) requested that Worley Canada Services Ltd., operating as Advisian, prepare a report to summarize results of the 2020 Aquatic Effects Monitoring Program (AEMP) sampling in Norman Wells, NT (Figure 1).

2020 was the fourth year of AEMP sampling, and this report includes statistical analysis of spatial and temporal patterns in accumulated data.

1.1 Background

The AEMP (Imperial 2016, 2019) was developed as part of Imperial's 10-year Water License Renewal Application submitted to the Sahtu Land and Water Board (SLWB) in 2015. This approval permits Imperial to use water from the Mackenzie River, and stipulates that Imperial is to develop and execute a variety of monitoring, including an AEMP.

The Norman Wells Operations AEMP contributes to satisfying requirements in Imperial's Water Licence to monitor potential effects from Imperial's operation. This includes evaluating immediate or long-term significance of potential aquatic effects, measuring the effect activities may be having on water, and identifying if steps are needed to prevent serious or permanent damage to aquatic life.

The AEMP involves sampling at 13 monitoring locations three times per year (spring, summer, and fall). These locations were established to allow characterization of normal (background) water quality conditions, and to detect potential surface water quality issues across the area in which Norman Wells Operations maintains a presence.

1.2 Scope of Work

The scope of work for the 2020 AEMP included the following:

- Collect surface water samples at AEMP locations for laboratory analysis of general, indicator, and organic variables; nutrients; benzene, toluene, ethylbenzene and xylene [BTEX] compounds; petroleum hydrocarbon fractions F1 and F2; and metals and trace elements (total and dissolved); and
- Provide a summary report presenting the work completed since the first year of sampling (2017) and any highlights.

1.3 Environmental Assessment Guidelines

There are no specific water quality guidelines currently existing for Northwest Territories. Instead, tabulated surface water assessment variables in this report are compared with the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (CEQG) for the Protection of Freshwater Aquatic Life (FWAL; CCME 2014), as surface water bodies (e.g. Bosworth Creek and the Mackenzie River) are potential receptors of concern. Note that guidelines are presented in tables and not discussed further as the intent of the program is to detect changes over time and to detect differences among sampling locations.

1.4 AEMP Locations

The AEMP at Norman Wells consists of seasonal surface water sampling (spring, summer, and fall, which correspond to June, July/August, and September/October, respectively) as a first step to detect and quantify any possible changes in water quality near Imperial's operations. As outlined in the AEMP (Imperial 2016, 2019), if any anomalous chemistry, increasing trend or CCME FWAL exceedances that are not within the expected range are identified, the results are verified to understand whether further investigation is required.

Monitoring locations on Bosworth Creek and the Mackenzie River were selected to:

- Obtain data both upstream and downstream from potential points of inputs;
- Capture the longitudinal nature of these watercourses so that the potential effects attributable to position along channel can be quantified; and
- Support quantifying seasonal variability and trends.

The distribution of sampling locations is intended to allow comparison of water potentially influenced by operations with water that is unaffected. The AEMP document submitted to the SLWB (Imperial 2016, 2019) develops this rationale in relation to program design and resulted in the 13 sampling points listed in Table A below and illustrated in Figures 2-5.

Sampling locations include an upstream location (AEMP-10) to characterize background conditions in the Mackenzie River. There are three sampling locations on Bosworth Creek (AEMP-04 is the farthest upstream and characterizes background conditions) and one at the inflow of a creek into a small waterbody on Bear Island (AEMP-05), near where it drains into the Mackenzie River. Most of the remaining locations are along the right bank of the Mackenzie River, AEMP-13 is adjacent to Bear Island, and AEMP-11 is downstream and reflective of any net incremental change in water quality as indicated by effluent modeling. Sampling began in summer 2017 at some locations (AEMP-01 to -09), and in summer 2018 at others (AEMP-10 to -13) as the breadth of the program expanded.

Table A AEMP Monitoring Locations

Location	Name	Relation to Facility	Description	Stressors	Latitude	Longitude
Mackenzie River Locations						
AEMP-01	Man-made Islands	Within facility footprint	Most downstream island in Mackenzie River	Flowline, Island Maintenance	65°16'37.13"N	126°55'3.13"W
AEMP-06	Natural Seep	Upstream of facility influence – reference location	Near observed natural seep on Mackenzie River, near Town Dock	Seep	65°16'41.29"N	126°50'25.99"W
AEMP-07	Historical – Refinery	Within facility footprint	On Mackenzie River near refinery basin discharge	Fuel Storage, Historical, Surface Water Release, Waste Storage	65°16'46.39"N	126°50'59.46"W
AEMP-08	Imperial's Main dock on Mackenzie River	Within facility footprint	On downstream side of dock projecting into Mackenzie River channel	Boat Activity, Bunker, Surface Water Release, Water Use	65°16'46.01"N	126°52'27.93"W
AEMP-09	Downstream CPF Effluent Discharge	Within facility footprint	Where effluent enters the Mackenzie River	Water Return, Water Use	65°16'57.61"N	126°53'10.86"W
AEMP-10	Upstream from Imperial Site	Upstream of facility influence (approx., 10 km) – reference location	Upstream from Imperial's Norman Wells Operations		65°14'0.06"N	126°44'9.66"W
AEMP-11	Downstream from Imperial Site	Downstream of facility influence (approx. 10 km)	Downstream at Radar Island and downstream of Imperial's Norman Wells Operations	Net input from operations and natural contributions from seeps	65°18'11.70"N	127° 3'30.30"W

Location	Name	Relation to Facility	Description	Stressors	Latitude	Longitude
AEMP-12	Seep	Within facility footprint	Downstream from Bosworth Creek inflow, near natural seep	Natural input of hydrocarbons	65°16'51.10"N	126°52'27.04"W
AEMP-13	Bear Island	Within facility footprint	Edge of the Mackenzie River adjacent to island	Run off from nearby roads and facilities. Outflow of a creek and wetland.	65°15'43.21"N	126° 52'42.32"W
Bosworth Creek Locations						
AEMP-02	Downstream Bosworth Creek	Within facility footprint	Near mouth with the Mackenzie River	Fuel Storage, Historical, Surface Water Release, Waste Storage	65°16'58.66"N	126°51'55.83"W
AEMP-03	Midstream Bosworth Creek	Within facility footprint	Downgradient from SNP – GWP Well	Fuel Storage, Historical, Surface Water Release, Waste Storage	65°17'4.81"N	126°52'34.54"W
AEMP-04	Upstream Bosworth Creek	Upstream of facility influence – reference location	Upstream of Imperial Norman Wells Operations		65°17'24.50"N	126°52'29.39"W
Bear Island Surface Water						
AEMP-05	Bear Island	Within facility footprint	Surface water on island	Bunker, Flowline, Surface Water Release	65°15'37.76"N	126°52'36.48"W

2 Sampling and Methods

Advisian personnel sampled surface water for the AEMP between June and October of 2017-2020. Field procedures followed are summarized in Appendix B.

Surface water grab samples were collected by immersing containers provided by the analytical laboratory. All surface water samples were submitted for analysis at an accredited third-party laboratory in Edmonton (Bureau Veritas) in accordance with standard packaging, preservation, and chain-of-custody procedures. Water quality analyses included general (e.g. pH, alkalinity, conductivity, hardness, suspended solids), and indicator (including major anions and cations) variables; nutrients; benzene, toluene, ethylbenzene and xylene [BTEX] compounds; petroleum hydrocarbon fractions F1 and F2; and metals and trace elements (total and dissolved). For those sample bottles that contained a preservative, they were filled from another laboratory-provided bottle rather than by immersing in the water directly.

All analytical results have been compared to generic CCME Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 2014), where available. Analytical results are presented in Tables 1 through 5.

A principal components approach to multivariate statistical analysis has been implemented to investigate possible underlying trends common across the dataset. Further explanation of the methodology and results of statistical analysis is included in Section 3.1 .

It is known that water quality is highly correlated with seasonal patterns of discharge in the river, and that trend analysis in the absence of flow data is not an acceptable statistical method. Accordingly, based on the current lack of flow data in the vicinity of Norman Wells, limited trend analysis has been presented in this report.

3 Results

Water quality data for the duration of the AEMP (2017-2020) are presented in Tables 1-5. Many results are below respective detection limits, and notably this is the case for all instances where BTEX compounds and petroleum hydrocarbon fractions were analyzed. Lack of detections places some constraints on possibilities for statistical analysis of results; substitutions for results below analytical detection limit is not an acceptable alternative, so the suite of variables examined statistically was reduced where there were non-detections.

Exceedances of the applied CCME guidelines of several metals are observed in both the Mackenzie River and Bosworth Creek samples, as well as the Bear Island location AEMP-05.

Concentrations of dissolved aluminum and copper, and total aluminum, cadmium, copper, iron, lead, and zinc were above guideline in 2020 at most Mackenzie River locations on at least several sampling dates, including at the far upstream location, AEMP-10. Concentrations of total arsenic, chromium, manganese, and nickel also were above guideline in 2020 at several locations, but not consistently.

Similarly, concentrations of total aluminum, cadmium, copper, iron, and lead above guideline are observed at all three Bosworth Creek locations including at the upstream location, AEMP-04.

There are no current indications to suggest that metals concentrations above guidelines are related to Imperial's operations given their spatial distribution.

3.1 Multivariate Data Analysis

The AEMP involved sampling water at numerous locations seasonally for several years, which generated a large data set to be examined. The distribution of sampling locations is intended to capture points where water might reasonably be expected to show effects of the stressors identified in Table A. However, the numerous locations and water quality variables analyzed for each sample generated a large multi-dimensional data set (Tables 1-5). This means that for any location at any time there are data for the concentrations of numerous water chemistry variables. It is interesting to know how each of these variables responds over time and in the different monitoring locations, but this quickly results in a nearly overwhelming number of figures, trends, statistics, and so on. However, some of these variables are likely to show similar spatial and temporal patterns so that a single description might capture what is important about all of them. A tool is needed to sort through the wealth of data so that underlying trends common to monitoring variables become apparent. A simple program would monitor a variable over time, or compare a small number of variables and plot results on axes that are intuitively understandable; however, doing this for the current large number of variables, locations, and sampling occasions requires introducing common axes that are mathematical constructs, and this is done using multivariate statistics.

Multivariate analysis was used to explore the complexity of the monitoring data and, possibly, reduce it. Specifically, principal components analysis (PCA) was implemented using the `prcomp()` procedure in the R language for statistical computing (R Development Core Team 2008). Principal components analysis calculates orthogonal axes through multivariate data where variables may be correlated such that the first principal component (PC) explains as much of the total variability as possible. The second PC is orthogonal to the first (perpendicular so that there is no correlation) and rotated to explain as much of the remaining

variability as possible; the third PC is orthogonal to the first two, and subsequent PCs are mathematically orthogonal to the first ones.

Data were arranged for analysis by location and then by date. For each location or date, only the variables with no non-detections were included. This meant that the number and identity of the variables during initial exploratory multivariate data analyses was not necessarily the same for each location or date.

As an example of PCA results, the biplot in Figure A shows both loadings and PC scores for location AEMP-01. The `prcomp()` procedure labelled the axes as Dim1 and Dim2, rather than PC1 and PC2. The first of these principal components was oriented through the data to maximize the variation explained (Figure A), which is 45.3%, and the second perpendicular captures another 21.5% of the total variation. Loadings of each variable are projected on the axes, and the dates are positioned in the plane. Loadings convey how closely each variable is correlated with each component; an example is total strontium concentration (TSr) which extends vertically and is highly correlated with Dim2, but not at all with Dim1. The total variation in Figure A explained by the first two PCs shown is 66.8%, which is less than the 80-85% generally interpreted as adequate in such multivariate examination. This relates to the pattern of loadings in Figure A where numerous variables are correlated with each other (vectors closely parallel), but the vectors also head in all directions with angles between them indicative of lack of correlation, which reduces the explanatory power of the PCA.

The final set of data subjected to PCA consisted of those variables common to all locations and dates for which there were no non-detections (i.e. a set reduced from that shown in Figure A). Additionally, variables that were obviously and highly correlated (e.g. total organic carbon and dissolved organic carbon) were removed to improve clarity in biplots for each analysis. The final common set of 22 variables examined for each location and date was: bicarbonate, chloride, sulphate, calcium, magnesium, potassium, sodium, alkalinity, electrical conductivity (EC), total dissolved solids (TDS), total organic carbon (TOC), dissolved barium (DBa), dissolved molybdenum (DMo), dissolved silicon (DSi), dissolved strontium (DSr), total aluminum (Tal), total barium (TBa), total calcium (TCa), total potassium (TK), total silicon (TSi), total strontium (TSr), and total uranium (TU). Loadings for these variables all are visible in the revised biplot for AEMP-01 (Figure B). This set of monitoring variables did not consider possible correlations among them *a priori*, but only whether there were consistent detections for all locations and dates given the computational problems caused by non-detections; in fact the multivariate analysis looked for correlations and how these changed seasonally and by location.

Scores for sampling dates in the program incorporate the temporal aspect of monitoring. There is not a consistent trajectory in water chemistry at AEMP-01 during the program, and this illustrated by the connecting lines between sequential dates (Figure B). An ellipse encloses September and October 2017 which lie close together in the plane, as might be expected given the short time between sampling, and another ellipse encloses August and October 2019 similarly. However, there is no apparent trend among any other sampling dates, and this is not necessarily attributable to seasonality because spring, summer, and fall dates are not clustered.

Figure A Biplot with scores for sampling dates and loadings onto first and second principal components for PCA of all variables with no non-detections at AEMP-01

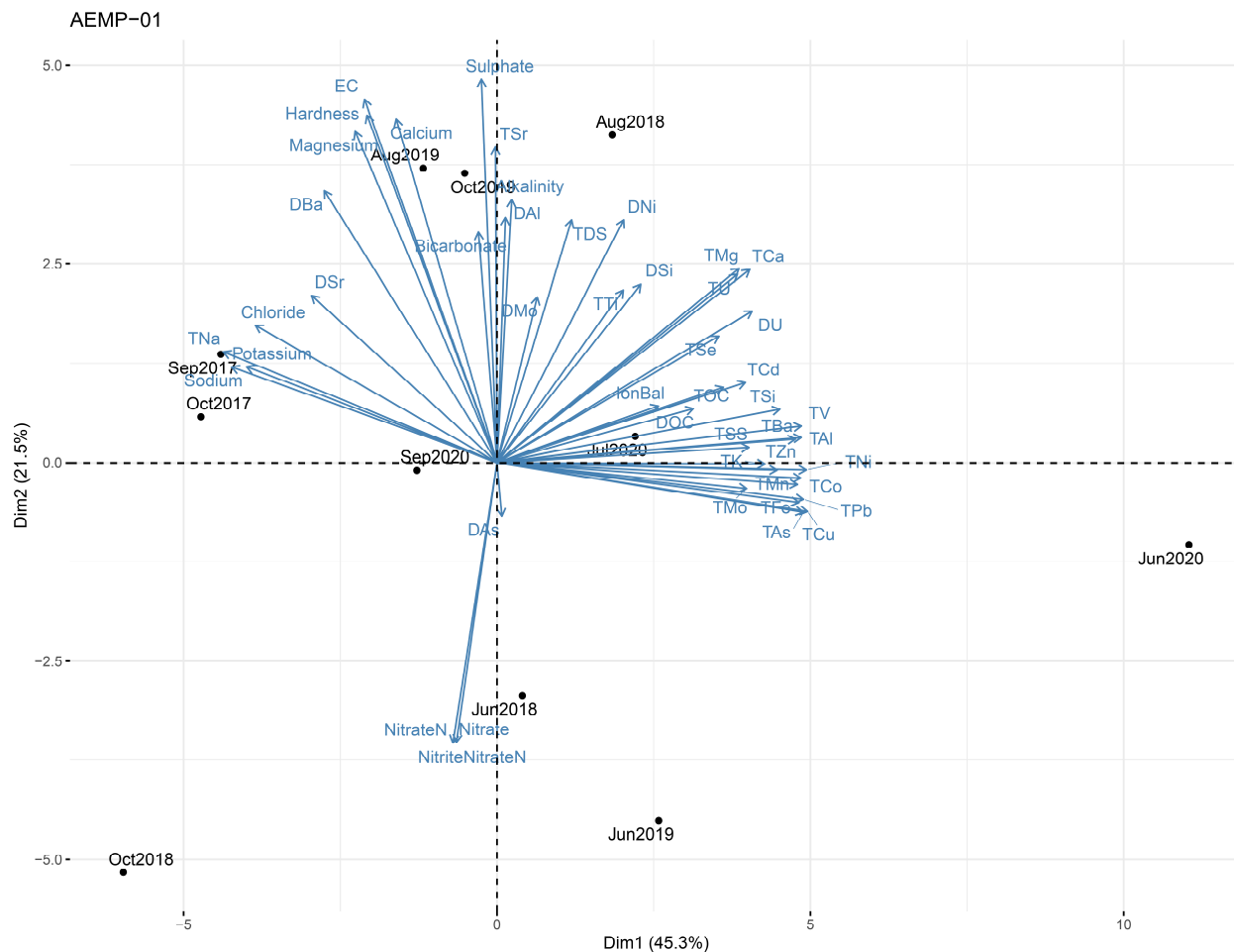
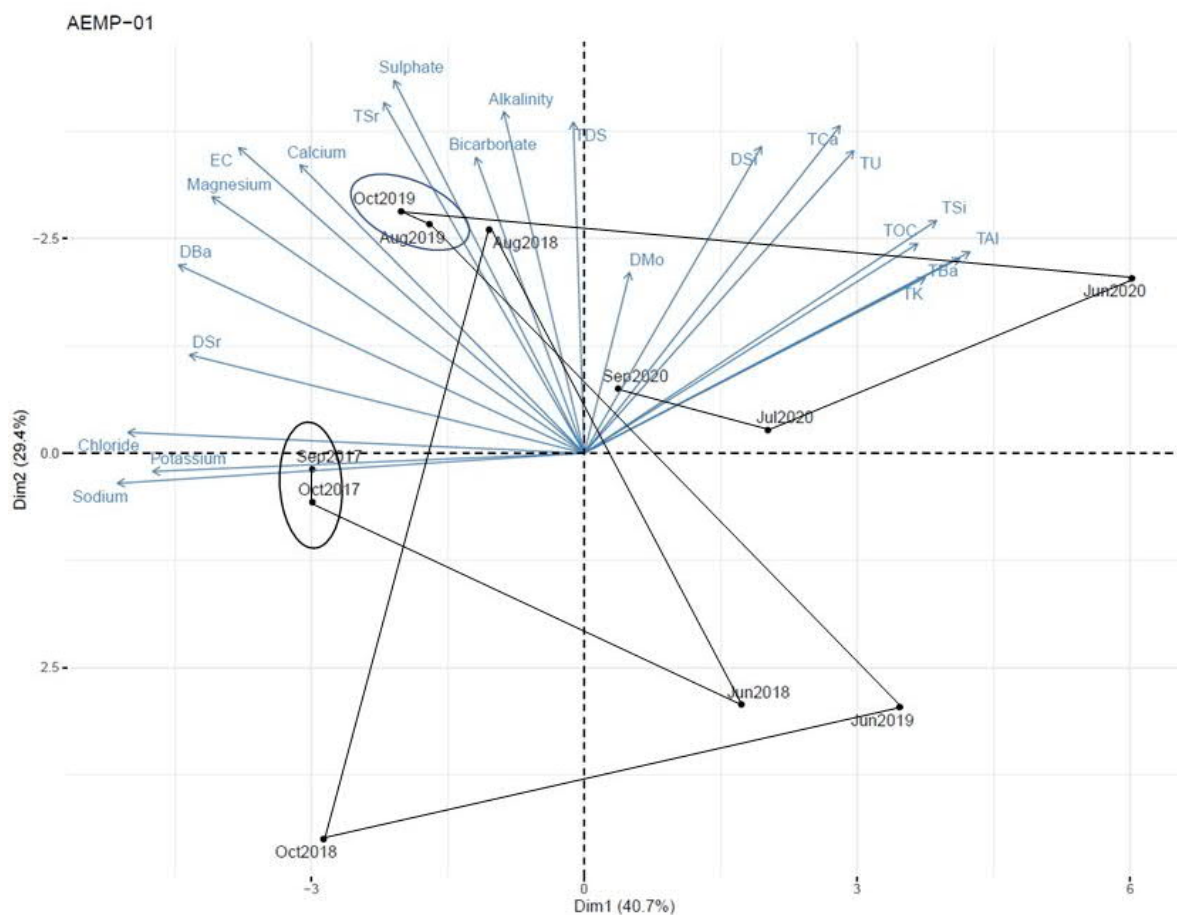


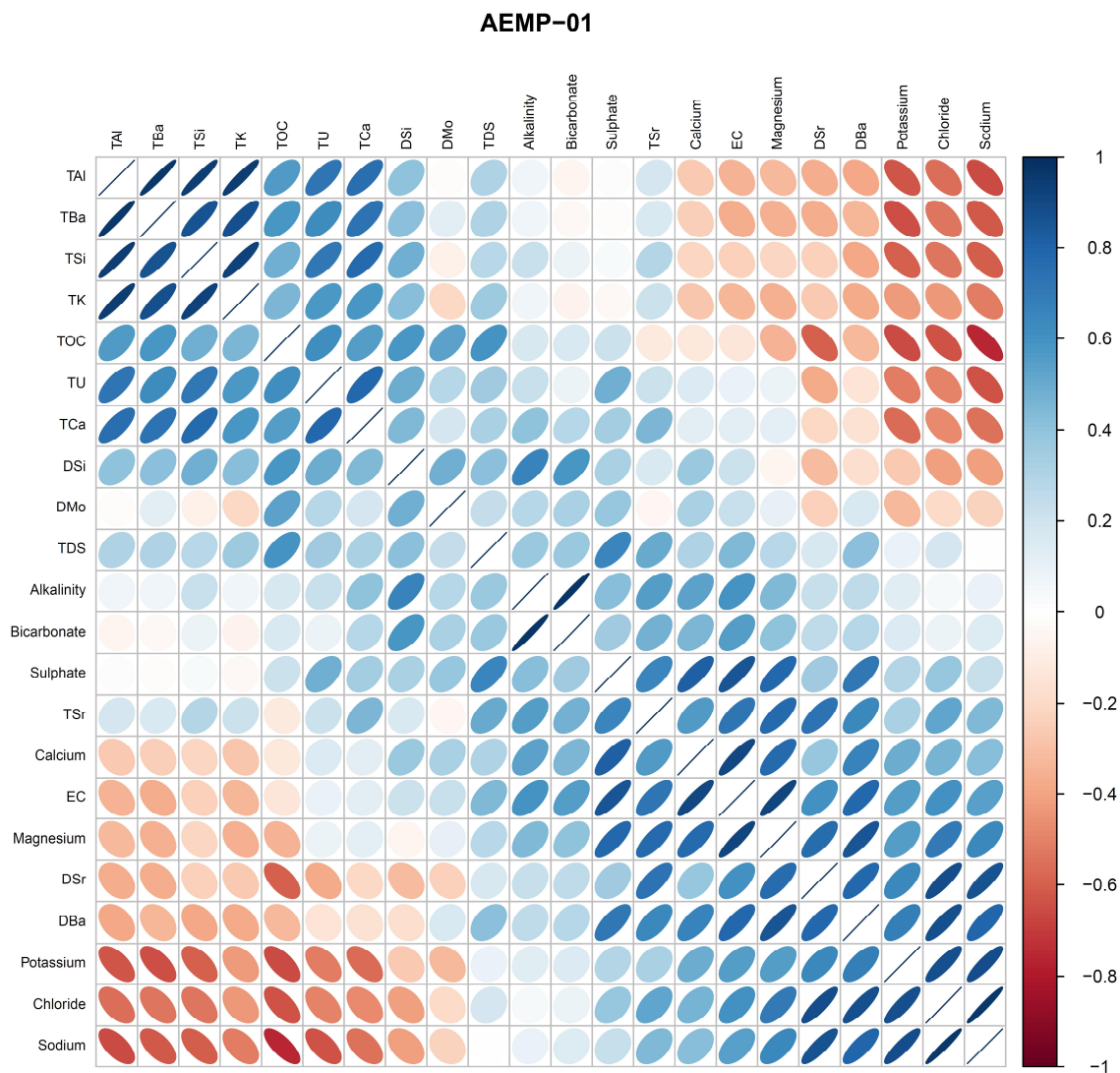
Figure B Biplot with scores for sampling dates and loadings onto first and second principal components for AEMP-01 with temporal trajectory during program



The proportion of total variation explained by the first two principal components on the reduced common data set for location AEMP-01 is 70.1% (Figure B), which is a marginal improvement over that shown in Figure A.

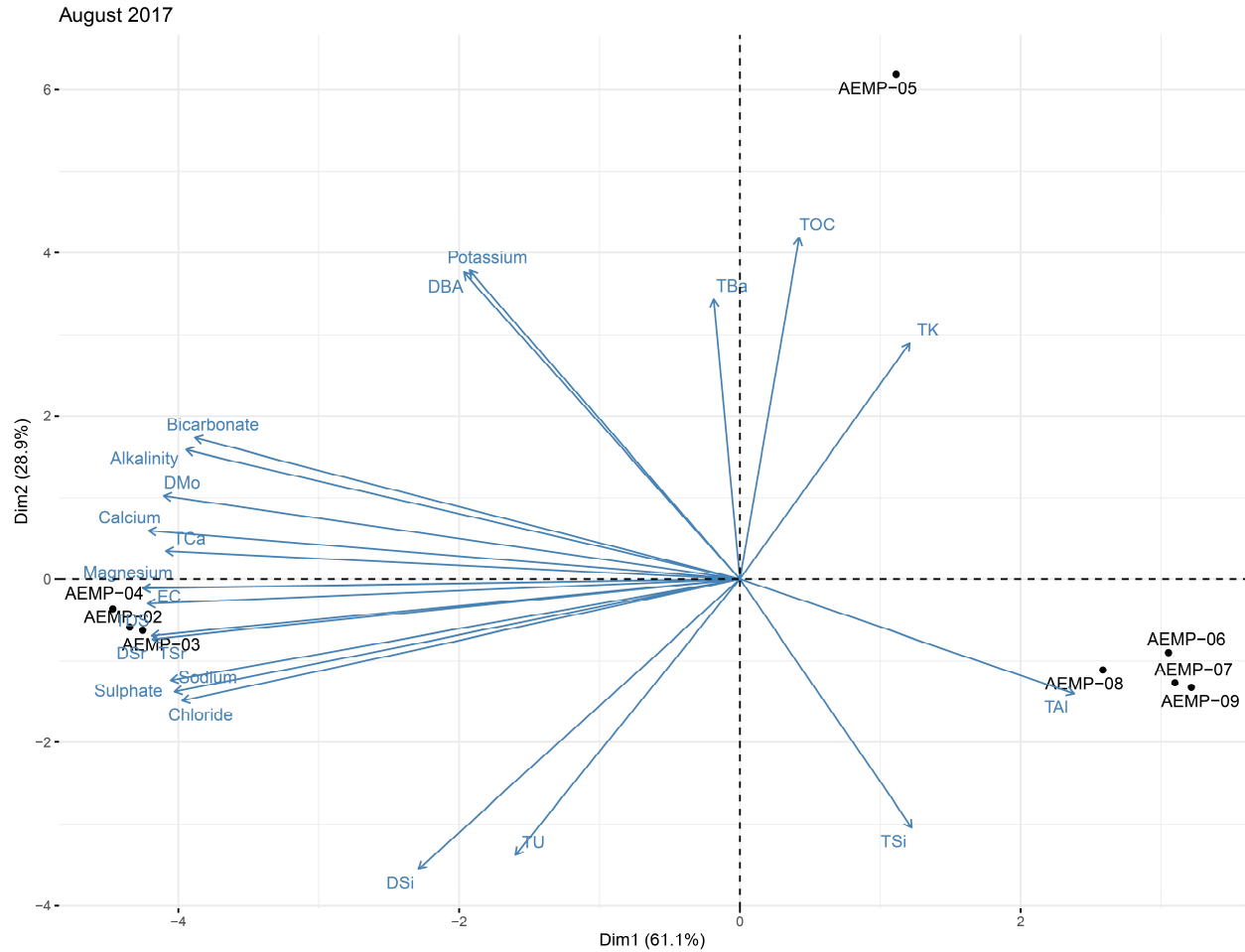
PCA results may be accompanied by a matrix of pairwise correlations between variables. Correlations between pairs of variables for AEMP-01 are shown in Figure C. Blue ellipses sloping up and to the right depict positive correlations, whereas red ones sloping down and to the right negative ones. Ellipses are narrower with increasing magnitude of the correlation, and this results in a line in cells on the main diagonal for the 100% correlation of each variable with itself. Perfect negative correlation would produce a negatively sloping red line when vectors for two variables are oriented 180° to each other. Vectors that are orthogonal to each other in the plane result in correlation near zero, which appears as a faint blue or red circle, such as for bicarbonate and TSi. The colour scale along the right-hand side also illustrates the degree or positive or negative correlation.

Figure C Correlations between monitoring variables at AEMP-01; order along axes relative to loading on first principal component



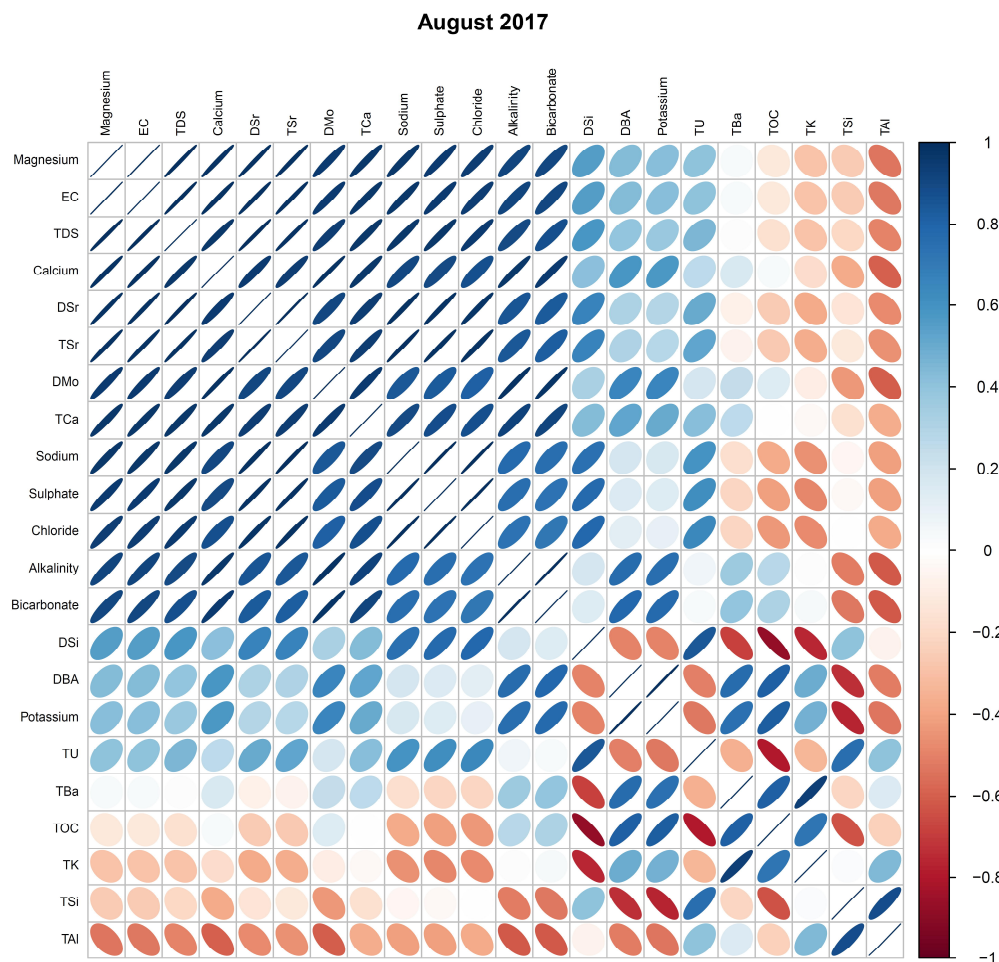
The procedure was applied to the same variables for data collected on August 2017, the first sampling event in the program. The biplot in Figure D shows the loadings and the scores of the sampling locations in the plane. It is clear that water chemistry in Bosworth Creek (AEMP-02,-03, and -04) differs from Bear Island (AEMP-05) and from the locations in the main channel of the Mackenzie River (AEMP-06, -07, -08, and -09; locations AEMP-10, -11, -12, and -13 appear in later sampling and generally cluster with these).

Figure D Biplot with scores for sampling dates and loadings onto first and second principal components for August 2017



The associated correlation matrix (Figure E) shows many strong positive correlations, and order is different than in Figure C for AEMP-01 given the particular variable loadings on the first PC in each case.

Figure E Correlations between monitoring variables on August 2017; order along axes relative to loading on first principal component



Comparable biplots and correlation matrices for all other locations and sampling dates are appended (Appendix C). These are not discussed individually because there are no consistent trajectories through time, and no clustering by season relative to the PCs. However, the Bosworth Creek locations (AEMP-02, -03, and -04) cover a smaller area than those on the Mackenzie River and may be more readily interpretable because of fewer possible confounding influences on water chemistry. Variables in the biplots for AEMP-02, -03 and -04 load somewhat similarly on the PCs and dates trace somewhat similar trajectories in the plane defined by PC1 and PC2 except for July 2020 at AEMP-04, the most upstream location; the level of similarity among these trajectories has not been quantified, but it may suggest that there is little difference between the downstream (potentially affected) locations and the background one upstream. For all sampling dates, locations cluster similarly to that in Figure D (August 2017 sampling).

The proportion of total variation explained by implementation of PCA for each location and sampling date is presented in Table B; Figures B and D illustrate this for AEMP-01 and August 2017, respectively, and the rest are in Appendix C. On average, the first two PCs for locations explained 72.6% of the total variation, whereas this was 88.7% for sampling dates.

Table B Variation explained by first two PCs for AEMP monitoring locations and sampling dates

Location	PC1	PC2	Total	Date	PC1	PC2	Total
AEMP-01	40.7	29.4	70.1	Aug 2017	61.1	28.9	90
AEMP-02	43.4	16	59.4	Sep 2017	60.6	33	93.6
AEMP-03	43.3	14.7	58	Oct 2017	57.9	26.4	84.3
AEMP-04	71.6	10.9	82.5	Jun 2018	85	11.6	96.6
AEMP-05	52.7	20.7	73.4	Aug 2018	60	29.1	89.1
AEMP-06	52.7	20.7	73.4	Oct 2018	59.4	32	91.4
AEMP-07	41.3	27.4	68.7	Jun 2019	65.9	24.2	90.1
AEMP-08	57	15.1	72.1	Aug 2019	58.1	32.1	90.2
AEMP-09	65	17.9	82.9	Oct 2019	58	20.2	78.2
AEMP-10	42.7	29.3	72	Jun 2020	67.5	19.6	87.1
AEMP-11	37.5	28.3	65.8	Jul 2020	66.7	21.5	88.2
AEMP-12	77.7	13.2	90.9	Sep 2020	66.6	18.9	85.5
AEMP-13	48.4	25.6	74				

4 Summary

The AEMP monitors numerous water quality variables seasonally. The multi-dimensional nature of the data set lends itself to multivariate analysis, which aims to reduce the number of variables to make patterns or trends more apparent. For any given sampling location there was no consistent multivariate trajectory over time, but on any given sampling date there was clear separation of Bosworth Creek, Bear Island, and main channel locations.

AEMP water quality data are characterized by appreciable variability, which limits statistical power to detect trends in some instances. Power was examined *post hoc*, so it includes no information that was not contained in respective coefficients of determination and tests of significance, but the analysis does provide perspective as to the strength of any conclusions.

In summary:

- There are differences in water chemistry in Bosworth Creek, on Bear Island, and in the Mackenzie River;
- Multivariate analysis did not detect long-term trends in water chemistry;
- All hydrocarbons analyses were below detection limits;
- There are no current indications to suggest that metals concentrations above guidelines are related to Imperial's operations given their spatial distribution; and,
- Ongoing annual monitoring and analysis will increase the dataset allowing for further statistical analysis and investigation.

5 Closure

We trust that this report satisfies your current requirements and provides suitable documentation for your records. If you have any questions or require further details, please contact the undersigned at any time.

Report Prepared by



Michael Vander Meulen, Ph.D., P.Biol.
Senior Aquatic Ecologist

Senior Review by



Craig Mushens, M.Sc., P.Biol.
Senior Fish Biologist

6 References

Advisian 2020. Norman Well Operations Aquatic Effects Monitoring Program Report. Imperial Norman Wells Operations. Report prepared for Imperial Oil Resources. Project 407011-00770-1000. March 2020.

CCME (Canadian Council of Ministers for the Environment) 2014. Canadian Environmental Quality Guidelines Summary Table. Water Quality Guidelines for the Protection of Freshwater Aquatic Life. Available at: <http://st-ts.ccme.ca/?chems=all&chapters=1>.

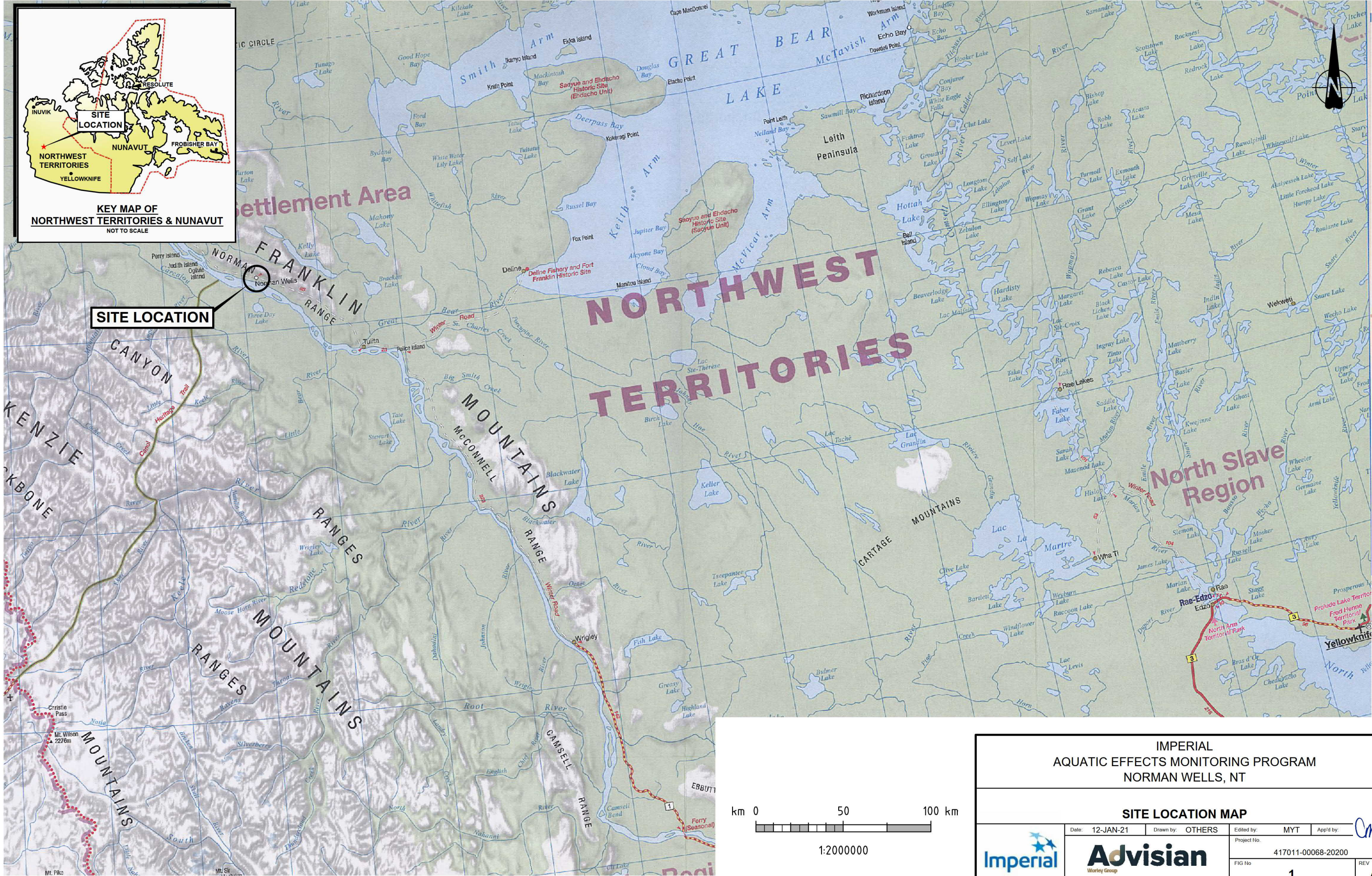
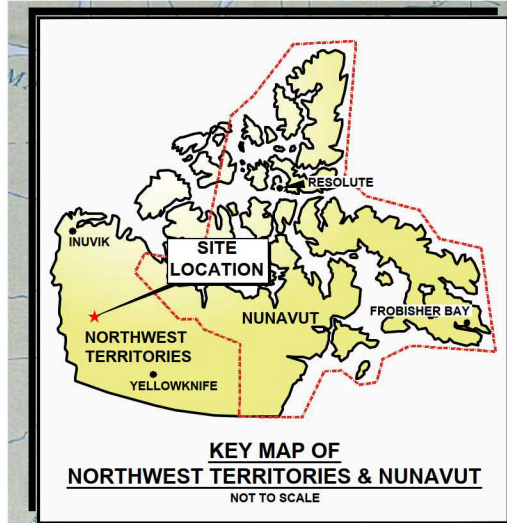
Imperial 2016. Norman Wells Operations Aquatic Effects Monitoring Plan. Imperial Oil Resources NWT Ltd. March 2016.

Imperial 2019. Norman Wells Operations Aquatic Effects Monitoring Plan. Imperial Oil Resources NWT Ltd. October 2019.

R Development Core Team 2008. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. Available at: <http://www.R-project.org>.



Figures



SCANNING SOURCE: MAPART PUBLISHING, 2002 EDITION

FILE LOCATION: U:\CAL\GBS\417011-00068\20200 - AEMP SURFACE WATER SAMPLING\11.0_FIGURES_ & MAPS\11.4_CAD_FILES\00068-20200-00-EN-DWG-ROADMAP.DWG

IMPERIAL
AQUATIC EFFECTS MONITORING PROGRAM
NORMAN WELLS, NT

SITE LOCATION MAP



Date: 12-JAN-21	Drawn by: OTHERS	Edited by: MYT	App'd by: Cm
Project No.	417011-00068-20200		
FIG No	1	REV	A

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USER NAME: mta.leford
PLOT DATE & TIME: 12/1/2021 2:02:54 PM
SAVE DATE & TIME: 12/1/2021 2:02:13 PM
ISSUING OFFICE: CALGARY



LEGEND

- SNP GROUNDWATER WELLS
- AEMP MONITORING LOCATIONS
- MOST ACTIVE NATURAL SEEPS
- X CULVERT GATE/PUMP LOCATION
- O END OF PIPE/CULVERT/PUMP DISCHARGE LOCATION
- CATEGORY A SURFACE WATER RUN-OFF COLLECTION LOCATIONS
- CATEGORY B SURFACE WATER RUN-OFF COLLECTION LOCATIONS
- UNDERWATER FLOW LINE

IMAGERY SOURCE:
1. MAIN PLAN - BING MAPS ©2020 MICROSOFT CORPORATION
EARTHSTAR GEOGRAPHICS SIQ.
2. INSET - PLANET LABS GEOMATICS CORPORATION, GEOTIFF
0.5m RESOLUTION, IMAGERY DATE AUGUST 6 AND 30, 2017.

NAD27 UTM ZONE 9N
m 0 1000 2000 3000 m
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IMPERIAL
AQUATIC EFFECTS MONITORING PROGRAM
NORMAN WELLS, NT

SITE PLAN WITH SURFACE WATER MONITORING LOCATIONS

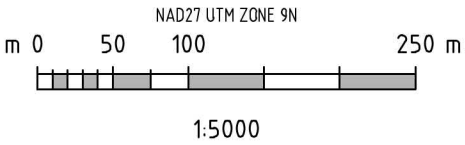
Imperial Worley Group	Date: 28-JAN-21	Drawn by: OTHERS	Edited by: MYT	App'd by: Cm
	Project No. 417011-00068-20200		FIG No. 2	
	REV B			

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LEGEND

- SNP GROUNDWATER WELLS
- AEMP MONITORING LOCATIONS
- MOST ACTIVE NATURAL SEEPS
- X CULVERT GATE/PUMP LOCATION
- O END OF PIPE/CULVERT/PUMP DISCHARGE LOCATION
- Category A Surface Water Run-off Collection Locations
- Category B Surface Water Run-off Collection Locations
- PIPELINE/UNDERWATER FLOW LINE



IMAGERY SOURCE:
1. PLANET LABS GEOMATICS CORPORATION, GEOTIFF 0.5m
RESOLUTION, IMAGERY DATE AUGUST 6 AND 30, 2017.

IMPERIAL
AQUATIC EFFECTS MONITORING PROGRAM
NORMAN WELLS, NT

MAINLAND EAST DETAILED SITE PLAN



Date: 28-JAN-21	Drawn by: OTHERS	Edited by: MYT	App'd by:
Project No. 417011-00068-20200		REV B	
FIG No. 3			

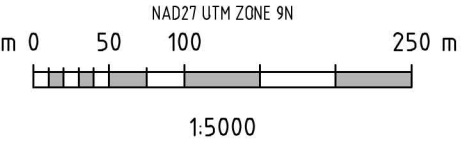
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LEGEND

- SNP GROUNDWATER WELLS
- AEMP MONITORING LOCATIONS
- MOST ACTIVE NATURAL SEEPS
- X CULVERT GATE/PUMP LOCATION
- END OF PIPE/CULVERT/PUMP DISCHARGE LOCATION
- CATEGORY A SURFACE WATER RUN-OFF COLLECTION LOCATIONS
- CATEGORY B SURFACE WATER RUN-OFF COLLECTION LOCATIONS
- PIPELINE/UNDERWATER FLOW LINE

IMAGERY SOURCE:
1. PLANET LABS GEOMATICS CORPORATION, GEOTIFF 0.5m
RESOLUTION, IMAGERY DATE AUGUST 6 AND 30, 2017.



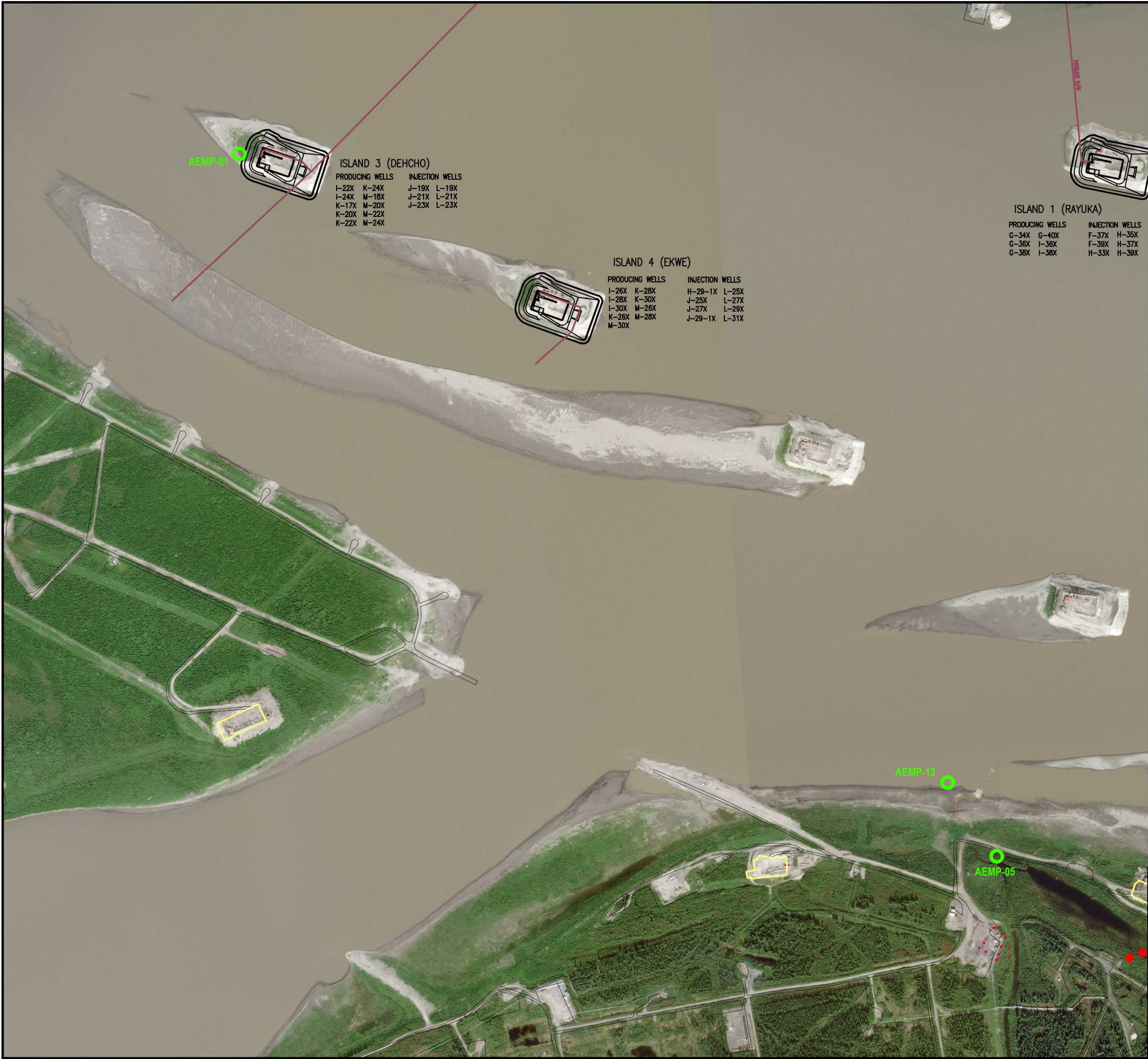
**IMPERIAL
AQUATIC EFFECTS MONITORING PROGRAM
NORMAN WELLS, NT**

MAINLAND WEST DETAILED SITE PLAN



Date: 28-JAN-21	Drawn by: OTHERS	Edited by: MYT	App'd by: Cm
Project No. 417011-00068-20200		REV B	
FIG No. 4			

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AEMP-11 DETAIL

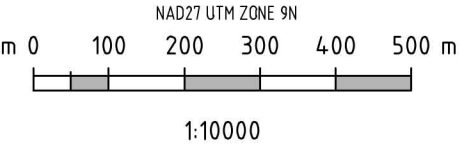


AEMP-10 DETAIL

LEGEND

- SNP GROUNDWATER WELLS
- AEMP MONITORING LOCATIONS
- MOST ACTIVE NATURAL SEEPS
- PIPELINE/UNDERWATER FLOW LINE

IMAGERY SOURCE:
1. DETAILS - BING MAPS ©2020 MICROSOFT CORPORATION EARTHSTAR GEOGRAPHICS SIO.
2. MAIN PLAN - PLANET LABS GEOMATICS CORPORATION, GEOTIFF 0.5m RESOLUTION, IMAGERY DATE AUGUST 6 AND 30, 2017.



IMPERIAL
AQUATIC EFFECTS MONITORING PROGRAM
NORMAN WELLS, NT

ISLANDS DETAILED SITE PLAN



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FIG No. 5			

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Tables

Surface Water Analytical Results: Field Measurements

PROJECT No.: 417011-00068							
Sampling Location	Date (dd-mmm-yyyy)	Dissolved Oxygen (mg/L)	Electrical Conductivity (µS/cm)	Oxidation/Reduction Potential (mV)	pH (pH Units)	Temperature (°C)	Turbidity (NTU)
CCME CEQG Freshwater Aquatic Life ^{#1}		5.5	---	---	(6.5 - 9)	---	---
AEMP							
AEMP-01	12-Jun-2020	12.84	179	-241	8.37	9.7	259
	28-Jul-2020	10.83	273.1	-116.3	8.11	16.3	211.7
	22-Sep-2020	10.88	219.7	62.4	8.22	9.6	81.02
AEMP-02	10-Jun-2020	10.87	446.1	-193	9.57 ^{#1}	11.7	2.89
	24-Jul-2020	---	557	---	7.0	16.0	---
	18-Sep-2020	12.18	444	73.8	8.35	7.1	0
AEMP-03	10-Jun-2020	11.82	438.8	156	8.57	11.2	3.05
	24-Jul-2020	---	545	---	6.5 ^{#1}	14.0	---
	18-Sep-2020	12.35	442	145	7.87	7.0	0
AEMP-04	10-Jun-2020	12.26	417.0	14.2	8.56	10.4	3.01
	24-Jul-2020	---	564	---	7.0	17.5	---
	18-Sep-2020	11.99	442	85.1	8.34	7.0	0
AEMP-05	11-Jun-2020	6.33	242	-201	7.82	14.1	1.62
	26-Jul-2020	---	214	---	6.5 ^{#1}	18.5	---
	26-Sep-2020	9.57	2265	-480	7.83	7.1	0.58
AEMP-06	12-Jun-2020	13.02	166	-234	8.36	9	159
	28-Jul-2020	11.16	235.4	-241.5	8.10	14.9	78.31
	22-Sep-2020	11.61	268.7	72	8.24	8.5	82.26
AEMP-07	10-Jun-2020	12.27	157	-225	8.36	8.2	166
	24-Jul-2020	---	227	---	6.0 ^{#1}	15.0	---
	18-Sep-2020	13.27	166	-225	8.15	9.0	367
AEMP-08	10-Jun-2020	12.95	162	-200	8.31	8.7	126
	24-Jul-2020	---	227	---	6.0 ^{#1}	15.5	---
	18-Sep-2020	12.61	168	-232	8.17	9.0	23.9
AEMP-09	10-Jun-2020	13.01	161	-216	8.33	8.7	154
	24-Jul-2020	---	235	---	6.0 ^{#1}	17	---
	18-Sep-2020	10.50	147	61.7	8.4	8.9	52.54
AEMP-10	12-Jun-2020	12.68	169.8	-221	8.30	9.2	2764
	28-Jul-2020	10.78	262.2	-71.9	8.14	16.4	99.5
	22-Sep-2020	10.99	213.0	70.2	8.29	9.6	62.80
AEMP-11	12-Jun-2020	12.70	169	-252	8.41	9.11	308
	28-Jul-2020	11.05	258.4	-33.7	8.10	16.2	83.28
	22-Sep-2020	11.06	203	663	7.94	9.4	63.71
AEMP-12	10-Jun-2020	11.16	480	-167	8.53	14.7	18.86
	24-Jul-2020	---	302	---	6.0 ^{#1}	15.5	---
	18-Sep-2020	10.56	451	71.5	8.36	7.5	1.09
AEMP-13	11-Jun-2020	931	219	-184	7.83	13.1	89.12
	26-Jul-2020	---	254	---	6.0 ^{#1}	19.0	---
	16-Sep-2020	11.04	226	78.0	8.2	9.4	23.23

NOTES:

1. --- in guideline row(s) denotes no criteria for that parameter.
2. --- in detail data row(s) denotes parameter not analyzed.
3. Highlighting indicates parameters above applied guideline/criteria.
4. Highlighting indicates non-detect parameters above applied guideline/criteria.
5. Highlighting indicates parameters at applied guideline/criteria.
6. Superscript ^{#1} denotes values exceeding

(CCME. 2014. Canadian Environmental Quality Guidelines Summary Table. Water Quality Guidelines for the Protection of Freshwater Aquatic Life.

<http://st-ts.ccme.ca/?chems=all&chapters=1> accessed Aug 22, 2014.)

Dissolved Oxygen:

Warm Water Biota:

Early life stages = 6 mg/L

Other life stages = 5.5 mg/L

Cold Water Biota:

Early life stages = 9.5 mg/L

Other life stages = 6.5 mg/L

Surface Water Analytical Results: General, Indicator and Nutrient Analysis Parameters

PROJECT No.: 417011-00068		Anions					Cations					General										Inorganic Nitrogen Compounds							Inorganic Sulphur Compounds	Ion Balance	Miscellaneous							
Sampling Location	Date	Bicarbonate	Carbonate	Chloride	Sulphate	Hydroxide	Calcium	Iron	Magnesium	Manganese	Potassium	Sodium	Alkalinity (Total; as CaCO ₃)	Alkalinity (PP; as CaCO ₃)	Colour	Electrical Conductivity	Hardness (Total; as CaCO ₃)	pH	Total Dissolved Solids	Total Suspended Solids	Turbidity	Ammonia (Total; as N)	Nitrate	Nitrate (as N)	Nitrite	Nitrite (as N)	Nitrite-plus-Nitrate (as N)	Total Kjeldahl Nitrogen	Sulphide (asH ₂ S)	Ion Balance % Difference	Biochemical Oxygen Demand	Chemical Oxygen Demand	Dissolved Organic Carbon	Total Organic Carbon				
(dd-mmm-yyyy)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(color unit)	(uS/cm)	(mg/L)	(pH Units)	(mg/L)	(mg/L)	(NTU)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(%)	(mg/L)	(mg/L)	(mg/L)	(mg/L)				
CCME CEQG Freshwater Aquatic Life ^{#1}		---	---	120	---	---	---	0.3	---	0.2	---	---	---	---	---	---	---	(6.5 - 9)	---	---	---	---	8.5	---	2.9	---	0.06	---	---	---	---	---	---	---	---			
AEMP																																						
AEMP-01	16-Sep-2017	120	< 0.50	9.4	48	< 0.50	42	< 0.060	11	< 0.0040	0.94	9.0	99	< 0.50	---	320	150	---	160	22	---	---	0.17	0.038	< 0.033	< 0.010	0.038	---	---	< 0.0020	2.5	< 2.0 ^{#2}	---	4.3	3.5			
	16-Oct-2017	120	< 1.0	10	47	< 1.0	37	< 0.060	11	< 0.0040	0.94	9.3	97	< 1.0	---	310	140	---	170	8.0	---	---	0.20	0.046	< 0.033	< 0.010	0.046	---	---	0.0020	0.42	< 2.0	---	3.6	4.2			
	23-Jun-2018	100	< 1.0	6.3	44	< 1.0	33	< 0.060	9.5	< 0.0040	0.82	6.1	82	< 1.0	---	260	120	---	160	71	60	0.024	0.16	0.035	< 0.033	< 0.010	0.035	0.28	---	< 0.0020	0.77	---	32	5.7	5.0			
	14-Aug-2018	120	< 1.0	8.7	57	< 1.0	38	< 0.060	12	< 0.0040	0.84	7.6	98	< 1.0	---	330	140	---	190	220	130	0.033	0.095	0.021	< 0.033	< 0.010	0.021	0.64	---	0.016	2.9	< 2.0	41	4.9	5.2			
	18-Oct-2018	110	< 1.0	11	32	< 1.0	30	< 0.060	10	0.0093	0.91	10	86	< 1.0	---	260	120	---	160	58	7.3	< 0.015	0.35	0.079	< 0.033	< 0.010	0.079	0.21	---	0.0050	1.4	2.1	22	2.8	3.1			
	10-Jun-2019	98	< 1.0	5.8	37	< 1.0	31	< 0.060	8.1	< 0.0040	0.78	5.7	80	< 1.0	19	250	110	8.00	180	150	120	< 0.015	0.23	0.052	< 0.033	< 0.010	0.052	0.44	---	0.0090	1.6	< 2.0 ^{#3}	45	6.8	5.8			
	26-Aug-2019	120	< 1.0	9.6	57	< 1.0	38	< 0.060	12	< 0.0040	0.86	8.2	99	< 1.0	9.8	330	150	8.20	190	55	49	0.027	0.17	0.038	< 0.033	< 0.010	0.038	0.30	---	2.3	< 2.0	21	5.2	4.7				
	27-Aug-2019	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.0050	---	---	---	---			
	01-Oct-2019	120	< 1.0	11	60	< 1.0	39	< 0.060	11	< 0.0040	0.93	8.9	96	< 1.0	21	320	140	8.07	220	76	92	0.020	0.15	0.033	< 0.033	< 0.010	0.033	0.37	---	0.011	3.2	2.2	45	6.7	5.9			
	12-Jun-2020	120	< 1.0	4.7	40	< 1.0	32	< 0.060	8.9	< 0.0040	0.74	5.2	100	< 1.0	29	250	120	6.69	180	190 ^{#4}	100	0.023	0.26	0.058	< 0.033	< 0.010	0.058	0.69 ^{#5}	---	< 0.0020	7.4	< 2.0	84	5.8	5.8 ^{#6}			
	28-Jul-2020	120	< 1.0	5.8	45	< 1.0	35	< 0.060	9.9	< 0.0040	0.70	6.1	95	< 1.0	22	280	130	7.66	170	130	60	< 0.015	0.088	0.020	< 0.033	< 0.010	0.020	0.50 ^{#5}	---	< 0.019	2.7	< 2.0	24	6.6	6.0			
	22-Sep-2020	140	< 1.0	6.4	44	< 1.0	35	< 0.060	9.8	< 0.0040	0.85	6.7	110	< 1.0	20	300	130	7.75	190 ^{#7}	39	22	< 0.015	0.22	0.049	< 0.033	< 0.010	0.049	0.32	---	0.012	8.5	< 2.0	20	6.0	5.9			
AEMP-02	18-Aug-2017	230	< 0.50	24	140	< 0.50	76	< 0.060	28	0.0077	1.1	23	190	< 0.50	---	650	310	---	400	4.0	---	---	0.054	0.012	< 0.033	< 0.010	< 0.014	---	---	---	1.5	< 2.0 ^{#8}	---	3.3	4.0			
	16-Sep-2017	220	< 0.50	19	130	< 0.50	80	< 0.060	29	0.0081	1.0	18	180	< 0.50	---	630	320	---	390	2.7	---	---	0.15	0.033	< 0.033	< 0.010	0.033	---	---	0.0030	2.7	< 2.0 ^{#2}	---	5.1	4.2			
(Duplicate)	16-Sep-2017	220	< 0.50	19	130	< 0.50	79	< 0.060	29	0.0078	0.96	18	180	< 0.50	---	630	320	---	380	1.3	---	---	0.15	0.033	< 0.033	< 0.010	0.033	---	---	0.0020	2.9	< 2.0 ^{#2}	---	4.3	3.7			
	16-Oct-2017	220	< 1.0	20	150	< 1.0	75	< 0.060	30	0.0091	0.97	19	180	< 1.0	---	650	310	---	420	21	---	---	0.26	0.059	< 0.033	< 0.010	0.059	---	---	< 0.0020	0.47	< 2.0	---	3.8	4.0			
23-Jun-2018	230	< 1.0	19	130	< 1.0	78	< 0.060	28	0.0058	1.1	17	180	< 1.0	---	620	310	---	400	2.0	1.3	0.019	0.17	0.038	< 0.033	< 0.010	0.038	0.21	---	< 0.0020	0.36	---	13	4.8	4.3				
12-Aug-2018	220	< 1.0	14	140	< 1.0	74	< 0.060	29	0.0079	1.0	16	180	< 1.0	---	610	300	---	400	3.3	---	---	0.018	0.068	0.015	< 0.033	< 0.010	0.015	0.23	---	0.0030	1.0	---	19	3.8	4.2			
15-Aug-2018	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.086	0.019	< 0.033	< 0.010	0.019	---	---	---	< 2.0	---	---	---	---			
16-Oct-2018	230	< 1.0	17	160	< 1.0	78	< 0.060	31	0.0046	1.0	18	190	< 1.0	---	660	320	---	410	19	1.5	< 0.015	0.17	0.038	< 0.033	< 0.010	0.038	0.17	---	< 0.0020	2.2	---	13	2.7	2.9				
17-Oct-2018	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.5 ^{#2}	---	---	---	---		
(Duplicate)	03-Jun-2019	190	< 1.0	17	120	< 1.0	65	< 0.060	24	0.0050	0.85	14	160	< 1.0	16	560	260	8.21	350	4.7	3.7	< 0.015	0.18	0.041	< 0.033	< 0.010	0.041	0.21	---	< 0.0020	2.9	< 2.0	15	5.2	4.7			
	03-Jun-2019	190	< 1.0	17	120	< 1.0	65	< 0.060	24	0.0049	0.84	14	160	< 1.0	18	560	260	8.18	360	4.0	4.1	< 0.015	0.19	0.042	< 0.033	< 0.010	0.042	0.21	---	< 0.0020	2.4	< 2.0	20	5.0	4.9			
28-Aug-2019	230	< 1.0	17	140	< 1.0	76	< 0.060	27	0.0069	0.96	16	190	< 1.0	15	630	300	8.29	400	3.3	2.0	0.028	0.18	0.040	< 0.033	< 0.010	0.040	0.24	---	< 0.0020	2.9	< 2.0	< 10	5.6	4.5				
02-Oct-2019	---	---	---	---	---	---	---	---	---	---	---	---</																										

Surface Water Analytical Results: General, Indicator and Nutrient Analysis Parameters

PROJECT No.: 417011-00068		Anions					Cations						General										Inorganic Nitrogen Compounds							Inorganic Sulphur Compounds	Ion Balance	Miscellaneous					
Sampling Location	Date (dd-mmm-yyyy)	Bicarbonate	Carbonate	Chloride	Sulphate	Hydroxide	Calcium	Iron	Magnesium	Manganese	Potassium	Sodium	Alkalinity (Total; as CaCO ₃)	Alkalinity (PP; as CaCO ₃)	Colour	Electrical Conductivity	Hardness (Total; as CaCO ₃)	pH	Total Dissolved Solids	Total Suspended Solids	Turbidity	Ammonia (Total; as N)	Nitrate	Nitrate (as N)	Nitrite	Nitrite (as N)	Nitrite-plus-Nitrate (as N)	Total Kjeldahl Nitrogen	Sulphide (asH ₂ S) (mg/L)	Ion Balance % Difference (%)	Biochemical Oxygen Demand	Chemical Oxygen Demand	Dissolved Organic Carbon	Total Organic Carbon			
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(color unit)	(uS/cm)	(mg/L)	(pH Units)	(mg/L)	(mg/L)	(NTU)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
CCME CEQG Freshwater Aquatic Life ^{#1}		---	---	120	---	---	---	0.3	---	0.2	---	---	---	---	---	---	---	(6.5 - 9)	---	---	---	---	8.5	---	2.9	---	0.06	---	---	---	---	---	---	---	---	---	---
(Duplicate)	10-Jun-2020	210	< 1.0	15	130	< 1.0	70	< 0.060	25	< 0.0040	0.92	12	170	< 1.0	14	590	280	8.23	400	9.5	1.4	< 0.015	0.21	0.047	< 0.033	< 0.010	0.047	0.27	< 0.0020	3.7	< 2.0 ^{#8}	16	5.2	4.3			
	10-Jun-2020	210	< 1.0	16	130	< 1.0	71	< 0.060	24	< 0.0040	0.99	13	170	< 1.0	13	590	280	8.24	380	9.1	2.3	0.020	0.21	0.048	< 0.033	< 0.010	0.048	0.25	< 0.0020	3.5	< 2.0 ^{#8}	13	4.5	4.0			
	24-Jul-2020	100	< 1.0	8.1	38	< 1.0	30	< 0.060	9.1	0.0043	0.81	8.1	85	< 1.0	23	270	110	7.95	160	140	51	0.032	0.25	0.056	< 0.033	< 0.010	0.056	0.35	< 0.010	1.9	< 2.0	13	4.9	4.6			
	18-Sep-2020	220	< 1.0	20	170	< 1.0	80	< 0.060	28	< 0.0040	0.76	17	180	< 1.0	5.5	670	320	8.20	490	< 1.0	0.41	< 0.015	0.14	0.031	< 0.033	< 0.010	0.031	0.18	0.0038	3.6	< 2.0	< 10	2.8	2.5			
AEMP-05	19-Aug-2017	210	< 0.50	4.5	19	< 0.50	52	0.073	14	0.0071	1.5	5.6	170	< 0.50	---	360	190	---	210	2.7	---	---	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	---	---	0.31	< 2.0	---	10	9.0			
	16-Sep-2017	200	< 0.50	4.7	18	< 0.50	53	< 0.060	13	< 0.0040	1.7	5.1	160	< 0.50	---	350	190	---	180	1.3	---	---	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	---	< 0.0020	3.9	2.0 ^{#2}	---	9.1	7.8			
	15-Oct-2017	200	< 0.50	5.6	18	< 0.50	48	< 0.060	14	0.0052	2.3	5.2	170	< 0.50	---	350	180	---	180	2.0	---	---	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	---	< 0.0020	0.35	< 2.0	---	10	10			
	23-Jun-2018	110	< 1.0	6.6	47	< 1.0	34	< 0.060	10	0.013	0.84	6.3	88	< 1.0	---	280	130	---	150	71	61	0.030	0.14	0.031	< 0.033	< 0.010	0.031	0.35	0.0030	1.3	---	35	5.6	5.4			
	13-Aug-2018	190	< 1.0	3.7	5.0	< 1.0	42	0.34 ^{#1}	14	0.028	1.4	3.9	160	< 1.0	---	310	160	---	200	3.3	---	0.028	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	0.55	0.0040	1.2	---	42	12	12			
	14-Aug-2018	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	---	---	< 2.0	---	---	---			
	18-Oct-2018	230	< 1.0	5.1	14	< 1.0	52	0.18	15	0.18	3.6	4.6	190	< 1.0	---	380	190	---	220	2.0	2.4	< 0.015	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	0.52	0.0040	0.87	2.9	32	12	12			
	02-Jun-2019	190	< 1.0	3.6	9.8	< 1.0	43	0.25	14	0.040	2.4	3.8	150	< 1.0	20	320	160	7.98	210	4.0	4.9	< 0.015	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	0.47	0.0030	2.3	< 2.0	35	12	12			
	27-Aug-2019	190	< 1.0	3.3	7.3	< 1.0	43	< 0.060	13	< 0.0040	2.0	3.3	160	< 1.0	15	310	160	8.21	190	1.3	0.90	0.034	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	0.51	< 0.0020	0.98	< 2.0 ^{#8}	26	13	11			
	01-Oct-2019	190	< 1.0	4.0	5.3	< 1.0	42	0.11	16	< 0.0040	1.7	3.1	160	< 1.0	18	310	170	8.16	200	6.7	1.1	0.015	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	0.51	0.0030	3.6	---	38	14	13			
	02-Oct-2019	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	< 2.0	---	---	---	---		
	11-Jun-2020	170	< 1.0	4.6	25	< 1.0	41	0.25	10	0.024	1.7	4.6	140	< 1.0	35	300	140	7.06	180	1.9	1.5	0.021	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	0.43	< 0.0020	4.6	< 2.0	32	9.7	9.2			
	26-Jul-2020	160	< 1.0	3.7	10	< 1.0	39	0.40 ^{#1}	12	0.022	1.1	4.2	130	< 1.0	41	300	150	8.13	120	13	2.6	< 0.015	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	0.47	< 0.0020	2.3	< 2.0 ^{#10}	28	12	11			
	16-Sep-2020	180	< 1.0	4.0	9.6	< 1.0	45	0.11	13	0.0061	1.3	4.0	140	< 1.0	21	310	170	7.91	230 ^{#7}	9.7	2.4	< 0.015	< 0.044	< 0.010	< 0.033	< 0.010	< 0.014	0.39	0.0053	4.8	< 2.0 ^{#8}	26	9.5	9.1			
AEMP-06	21-Aug-2017	110	< 0.50	9.0	41	< 0.50	31	< 0.060	9.7	< 0.0040	0.84	8.2	87	< 0.50	---	270	120	---	170	39	---	---	0.25	0.057	< 0.033	< 0.010	0.057	---	---	2.8	< 2.0 ^{#11}	---	4.4	4.5			
	16-Sep-2017	100	< 0.50	9.8	36	< 0.50	30	< 0.060	9.9	< 0.0040	0.91	8.6	85	< 0.50	---	260	120	---	140	19	---	---	0.31	0.070	< 0.033	< 0.010	0.070	---	< 0.0020	0.49	< 2.0 ^{#2}	---	4.6	4.3			
	16-Oct-2017	110	< 0.50	10	38	< 0.50	32	< 0.060	10	0.0068	0.90	9.2	90	< 0.50	---	280	120	---	190	13	---	---	0.36	0.082	< 0.033	< 0.010	0.082	---	< 0.0020	0.51	< 2.0	---	3.8	4.3			
	23-Jun-2018	92	< 1.0	7.5	34	< 1.0	28	< 0.060	8.5	< 0.0040	0.78	6.7	76	< 1.0	---	230	100	---	120	33	33	0.023	0.23	0.051	< 0.033	< 0.010	0.051	0.25	< 0.0020	1.0	---	21	5.1	4.5			
	13-Aug-2018	110	< 1.0	11	43	< 1.0	30	< 0.060	9.6	< 0.0040	0.77	8.5	89	< 1.0	---	280	110	---	180	19 ^{#4}	24	0.015	0.16	0.035	< 0.033	< 0.010	0.035	0.23	0.0050	5.2	---	23	4.4	4.8			
	15-Aug-2018	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.16	0.035	< 0.033	< 0.010	0.035	---	---	< 2.0	---					

Surface Water Analytical Results: General, Indicator and Nutrient Analysis Parameters

PROJECT No.: 417011-00068		Anions					Cations						General										Inorganic Nitrogen Compounds							Inorganic Sulphur Compounds	Ion Balance	Miscellaneous				
Sampling Location	Date (dd-mmm-yyyy)	Bicarbonate	Carbonate	Chloride	Sulphate	Hydroxide	Calcium	Iron	Magnesium	Manganese	Potassium	Sodium	Alkalinity (Total; as CaCO ₃)	Alkalinity (PP; as CaCO ₃)	Colour	Electrical Conductivity	Hardness (Total; as CaCO ₃)	pH	Total Dissolved Solids	Total Suspended Solids	Turbidity	Ammonia (Total; as N)	Nitrate	Nitrate (as N)	Nitrite	Nitrite (as N)	Nitrite-plus-Nitrate (as N)	Total Kjeldahl Nitrogen	Sulphide (asH ₂ S) (mg/L)	Ion Balance % Difference (%)	Biochemical Oxygen Demand	Chemical Oxygen Demand	Dissolved Organic Carbon	Total Organic Carbon		
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(color unit)	(uS/cm)	(mg/L)	(pH Units)	(mg/L)	(mg/L)	(NTU)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
CCME CEQG Freshwater Aquatic Life ^{#1}		---	---	120	---	---	---	0.3	---	0.2	---	---	---	---	---	---	---	(6.5 - 9)	---	---	---	---	8.5	---	2.9	---	0.06	---	---	---	---	---	---	---	---	---
AEMP-08	17-Aug-2017	120	< 0.50	7.1	54	< 0.50	40	< 0.060	12	< 0.0040	0.93	7.8	96	< 0.50	---	310	150	---	180	33	---	---	0.18	0.040	< 0.033	< 0.010	0.040	---	< 0.0020	0.87	< 2.0	---	4.8	4.1		
	21-Aug-2017	110	< 0.50	9.4	42	< 0.50	31	< 0.060	9.9	< 0.0040	0.83	8.4	88	< 0.50	---	280	120	---	160	31	---	---	0.25	0.057	< 0.033	< 0.010	0.057	---	---	2.8	< 2.0	---	3.7	3.6		
	16-Sep-2017	110	< 0.50	10	38	< 0.50	33	< 0.060	10	0.0041	0.83	8.8	86	< 0.50	---	270	130	---	150	110	---	---	0.30	0.068	< 0.033	< 0.010	0.068	---	0.0080	2.2	< 2.0 ^{#2}	---	4.7	4.0		
	16-Oct-2017	100	< 0.50	9.9	44	< 0.50	30	< 0.060	10	0.0049	0.89	8.8	82	< 0.50	---	270	120	---	130	29	---	---	0.38	0.086	< 0.033	< 0.010	0.086	---	< 0.0020	1.7	< 2.0	---	3.0	3.6		
	23-Jun-2018	97	< 1.0	8.9	36	< 1.0	26	0.20	8.1	0.011	0.72	6.3	79	< 1.0	---	250	99	---	140	51	33	0.037	0.23	0.052	< 0.033	< 0.010	0.052	0.27	< 0.0020	6.6	---	33	5.5	4.9		
	13-Aug-2018	110	< 1.0	11	45	< 1.0	33	< 0.060	11	< 0.0040	0.83	10	90	< 1.0	---	290	130	---	200	29	---	0.018	0.17	0.037	< 0.033	< 0.010	0.037	0.28	0.0030	0.80	---	25	4.8	4.8		
	15-Aug-2018	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.17	0.038	< 0.033	< 0.010	0.038	---	---	< 2.0	---	---	---	---	
	17-Oct-2018	100	< 1.0	11	40	< 1.0	31	< 0.060	11	< 0.0040	0.92	9.4	85	< 1.0	---	270	120	---	160	5.3	2.2	< 0.015	0.41	0.093	< 0.033	< 0.010	0.093	0.12	< 0.0020	0.39	---	7.2	3.0	2.8		
	18-Oct-2018	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.4 ^{#11}	---	---	---	---
	03-Jun-2019	110	< 1.0	8.7	39	< 1.0	31	< 0.060	10	0.0048	0.82	7.4	87	< 1.0	17	280	120	8.07	190	130	97	< 0.015	0.54	0.12	< 0.033	< 0.010	0.12	0.38	0.0070	1.9	< 2.0	52	6.7	5.1		
	28-Aug-2019	110	< 1.0	9.4	47	< 1.0	34	< 0.060	11	< 0.0040	0.84	8.5	94	< 1.0	14	300	130	8.17	180	22	17	0.026	0.31	0.069	< 0.033	< 0.010	0.069	0.23	0.0020	1.7	< 2.0	< 10	4.7	3.6		
	02-Oct-2019	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	< 2.0	---	---	---	---	
	03-Oct-2019	110	< 1.0	10	43	< 1.0	32	< 0.060	11	< 0.0040	0.81	8.5	89	< 1.0	8.9	290	120	---	150	18	20	0.015	0.34	0.077	< 0.033	< 0.010	0.077	0.19	0.0030	1.8	---	26	3.6	3.5		
	10-Jun-2020	69	< 1.0	5.9	24	< 1.0	26	< 0.060	7.4	< 0.0040	0.73	5.9	57	< 1.0	15	180	96	6.76	130	220 ^{#4}	100	< 0.015	0.25	0.057	< 0.033	< 0.010	0.057	0.62	< 0.0020	9.5	< 2.0	52	6.1	6.2 ^{#6}		
	24-Jul-2020	95	< 1.0	7.3	36	< 1.0	29	< 0.060	8.9	< 0.0040	0.77	6.9	78	< 1.0	19	260	110	8.03	150	74	39	< 0.015	0.22	0.051	< 0.033	< 0.010	0.051	0.40	< 0.010	0.25	< 2.0	14	5.1	4.4		
	18-Sep-2020	100	< 1.0	7.7	36	< 1.0	32	< 0.060	8.8	< 0.0040	0.54	6.9	82	< 1.0	15	260	120	7.91	160	25	17	< 0.015	0.24	0.055	< 0.033	< 0.010	0.055	0.26	0.013	0.44	< 2.0	12	4.9	4.8		
AEMP-09	21-Aug-2017	110	< 0.50	9.5	43	< 0.50	31	< 0.060	10	0.013	0.82	8.5	89	< 0.50	---	280	120	---	180	130	---	---	0.17	0.038	< 0.033	< 0.010	0.038	---	---	2.9	< 2.0	---	3.8	4.0		
	16-Sep-2017	110	< 0.50	11	44	< 0.50	38	< 0.060	11	0.019	0.86	9.7	90	< 0.50	---	300	140	---	170	16 ^{#4}	---	---	0.18	0.040	< 0.033	< 0.010	0.040	---	0.0070	3.9	< 2.0 ^{#2}	---	4.9	4.7		
	16-Oct-2017	160	< 0.50	16	45	< 0.50	36	< 0.060	12	0.092	1.0	26	130	< 0.50	---	380	140	---	200	290 ^{#4}	---	---	0.31	0.071	< 0.033	< 0.010	0.071	---	0.0030	1.2	< 2.0	---	6.2	7.5		
	23-Jun-2018	96	< 1.0	8.2	34	< 1.0	28	< 0.060	8.6	< 0.0040	0.81	7.3	78	< 1.0	---	240	110	---	140	200	64	0.032	0.22	0.050	< 0.033	< 0.010	0.050	0.40	< 0.0020	1.3	---	34	5.0	4.7		
	12-Aug-2018	110	< 1.0	12	44	< 1.0	35	0.20	11	0.020	0.93	11	94	< 1.0	---	300	130	---	190	45	---	0.024	0.093	0.021	< 0.033	< 0.010	0.021	0.30	0.0060	0.73	---	29	5.6	4.9		
	15-Aug-2018	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.080	0.018	< 0.033	< 0.010	0.018	---	---	< 2.0	---	---	---	---	
	17-Oct-2018	120	< 1.0	13	42	< 1.0	31	< 0.060	11	0.019	0.91	12	100	< 1.0	---	310	120	---	170	74	5.3	0.029	0.38	0.085	< 0.033	< 0.010	0.085	0.25	0.0060	4.3	---	12	3.5	2.9		
	18-Oct-2018	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.4 ^{#11}	---	---	---	---	
	02-Jun-2019	100	< 1.0	7.3	34	< 1.0	32	< 0.060	9.4	0.021	0.84	8.5	86	< 1.0	19	270	120	8.05	190	240 ^{#12}	180	0.018	0.33	0.074	< 0.033	< 0.010	0.074	0.57	0.013	2.8	< 2.0	64	6.6	6.9		
	28-Aug-2019																																			

Surface Water Analytical Results: General, Indicator and Nutrient Analysis Parameters

PROJECT No.: 417011-00068		Anions					Cations					General										Inorganic Nitrogen Compounds							Inorganic Sulphur Compounds		Ion Balance	Miscellaneous				
Sampling Location	Date (dd-mmm-yyyy)	Bicarbonate	Carbonate	Chloride	Sulphate	Hydroxide	Calcium	Iron	Magnesium	Manganese	Potassium	Sodium	Alkalinity (Total; as CaCO ₃)	Alkalinity (PP; as CaCO ₃)	Colour	Electrical Conductivity	Hardness (Total; as CaCO ₃)	pH	Total Dissolved Solids	Total Suspended Solids	Turbidity	Ammonia (Total; as N)	Nitrate	Nitrate (as N)	Nitrite	Nitrite (as N)	Nitrite-plus-Nitrate (as N)	Total Kjeldahl Nitrogen	Sulphide (asH ₂ S) (mg/L)	Ion Balance % Difference (%)	Biochemical Oxygen Demand	Chemical Oxygen Demand	Dissolved Organic Carbon	Total Organic Carbon		
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(color unit)	(uS/cm)	(mg/L)	(pH Units)	(mg/L)	(mg/L)	(NTU)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
CCME CEQG Freshwater Aquatic Life #1		---	---	120	---	---	---	0.3	---	0.2	---	---	---	---	---	---	---	(6.5 - 9)	---	---	---	---	8.5	---	2.9	---	0.06	---	---	---	---	---	---	---	---	---
(Duplicate)	03-Jun-2019	130	< 1.0	10	57	< 1.0	38	< 0.060	13	0.0071	0.81	9.1	100	< 1.0	18	350	150	8.10	230	93	74	< 0.015	0.28	0.064	< 0.033	< 0.010	0.064	0.32	0.0040	2.0	< 2.0	36	5.6	4.7		
	28-Aug-2019	120	< 1.0	10	46	< 1.0	34	< 0.060	12	< 0.0040	0.84	9.1	95	< 1.0	12	310	130	8.18	190	16	16	0.026	0.36	0.081	< 0.033	< 0.010	0.081	0.21	< 0.0020	0.45	< 2.0	< 10	3.9	4.1		
	28-Aug-2019	110	< 1.0	10	48	< 1.0	34	< 0.060	12	0.0072	0.84	9.1	94	< 1.0	62	300	140	8.19	180	13	17	0.027	0.30	0.067	< 0.033	< 0.010	0.067	0.21	< 0.0020	1.1	< 2.0	< 10	5.5	3.7		
AEMP-13	02-Oct-2019	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	03-Oct-2019	110	< 1.0	11	45	< 1.0	32	< 0.060	11	0.0042	0.80	8.7	92	< 1.0	9.9	290	130	8.19	140	13	16	0.017	0.33	0.074	< 0.033	< 0.010	0.074	0.21	0.0030	2.8	---	30	3.4	3.6		
	10-Jun-2020	210	< 1.0	16	130	< 1.0	69	< 0.060	24	0.012	0.95	13	170	< 1.0	15	590	270	8.18	310	64	20	0.032	0.29	0.066	< 0.033	< 0.010	0.066	0.34	< 0.0020	5.1	< 2.0	25	5.1	4.4		
	24-Jul-2020	130	< 1.0	11	60	< 1.0	40	< 0.060	13	0.0083	0.86	11	100	< 1.0	19	360	160	8.14	200	49	33	< 0.015	0.21	0.047	< 0.033	< 0.010	0.047	0.32	0.015	0.45	< 2.0	20	4.4	4.5		
	18-Sep-2020	220	< 1.0	22	160	< 1.0	78	< 0.060	29	0.019	1.1	21	180	< 1.0	7.6	690	320	8.27	450	4.2	1.5	< 0.015	< 0.22	< 0.050	< 0.033	< 0.010	< 0.050 ^{#13}	0.17	0.0053	1.8	< 2.0	11	2.7	2.9		
	14-Aug-2018	120	< 1.0	10	60	< 1.0	41	0.32 ^{#1}	12	0.042	0.92	8.5	100	< 1.0	---	350	150	---	200	220	83	0.039	0.098	0.022	< 0.033	< 0.010	0.022	0.42	0.020	1.3	< 2.0	28	5.1	5.2		
	18-Oct-2018	150	< 1.0	14	51	< 1.0	43	< 0.060	12	0.040	1.1	11	120	< 1.0	---	370	160	---	210	23	19	0.022	0.17	0.038	< 0.033	< 0.010	0.038	0.20	0.0020	2.0	< 2.0	11	4.4	4.5		
	02-Jun-2019	100	< 1.0	6.5	41	< 1.0	35	< 0.060	9.4	0.0065	0.91	6.6	84	< 1.0	20	270	130	8.09	180	330 ^{#12}	230	0.021	0.26	0.058	< 0.033	< 0.010	0.058	0.62	0.0070	2.2	< 2.0	73	5.9	6.2		
	27-Aug-2019	150	< 1.0	9.6	62	< 1.0	43	< 0.060	13	0.022	0.96	8.8	130	< 1.0	14	380	160	8.15	240	10	35	0.064	0.14	0.031	< 0.033	< 0.010	0.031	0.31	0.0050	6.3	< 2.0 ^{#8}	14	6.2	5.4		
	02-Oct-2019	250	< 1.0	9.7	72	< 1.0	79	< 0.060	22	0.68 ^{#1}	1.6	8.7	210	< 1.0	18	520	290	8.03	350	16	61	0.32 ^{#13}	0.099	0.022	< 0.033	< 0.010	0.022	0.68	0.0070	2.2	< 2.0	32	8.1	7.6		
(Duplicate)	11-Jun-2020	160	< 1.0	4.9	34	< 1.0	38	0.13	9.4	0.035	1.3	4.4	130	< 1.0	30	300	130	7.09	200	87	50	0.026	0.23	0.052	< 0.033	< 0.010	0.052	0.43	0.0070	7.9	< 2.0	40	7.6	8.8 ^{#6}		
	11-Jun-2020	160	< 1.0	4.8	33	< 1.0	38	0.13	9.5	0.035	1.3	4.6	130	< 1.0	28	300	140	7.06	170	74	33	0.023	0.10	0.023	< 0.033	< 0.010	0.023	0.40	0.029	6.9	< 2.0	29	7.9	7.6		
	26-Jul-2020	140	< 1.0	5.4	50	< 1.0	47	0.25	13	0.12	1.0	5.5	120	< 1.0	23	350	170	8.21	170	61	48	< 0.015	0.20	0.046	< 0.033	< 0.010	0.046	0.45	< 0.010	2.2	< 2.0 ^{#10}	30	6.5	7.6		
(Duplicate)	26-Jul-2020	170	< 1.0	5.0	40	< 1.0	46	0.16	13	0.10	1.0	5.6	140	< 1.0	26	370	170	8.20	140	78	34	< 0.015	0.14	0.032	< 0.033	< 0.010	0.032	0.48	< 0.010	2.2	< 2.0 ^{#10}	31	7.4	7.7		
	16-Sep-2020	130	< 1.0	6.9	64	< 1.0	44	< 0.060	12	0.025	0.87	7.1	110	< 1.0	30	320	160	7.97	210	150	57	0.017	0.17	0.039	< 0.033	< 0.010	0.039	0.39	0.014	2.6	< 2.0 ^{#8}	27	6.7	6.4		
(Duplicate)	16-Sep-2020	140	< 1.0	6.9	59	< 1.0	44	< 0.060	12	0.021	0.89	7.0	110	< 1.0	95 ^{#9}	330	160	7.86	210	100	46	0.016	0.17	0.039	< 0.033	< 0.010	0.039	0.38	0.012	2.0	< 2.0 ^{#8}	27	7.0	6.4		

Relative Percent Difference (RPD) Report																																						
AEMP-02 (Duplicate)	16-Sep-2017	220	< 0.50	19	130	< 0.50	80	< 0.060	29	0.0081	1.0	18	180	< 0.50	---	630	320	---	390	2.7	---	---	0.15	0.033	< 0.033	< 0.010	0.033	---	0.0030	2.7	< 2.0 ^{#2}	---	5.1	4.2				
	16-Sep-2017	220	< 0.50	19	130	< 0.50	79	< 0.060	29	0.0078	0.96	18	180	< 0.50	---	630	320	---	380	1.3	---	---	0.15	0.033	< 0.033	< 0.010	0.033	---	0.0020	2.9	< 2.0 ^{#2}	---	4.3	3.7				
	RPD(%)	0.0%	---	0.0%	0.0%	---	1.3%	---	0.0%	3.8%	4.1%	0.0%	0.0%	---	---	0.0%	0.0%	---	2.6%	70.0%	---	---	0.0%	0.0%	---	---	0.0%	---	40.0%	7.1%	---	---	17.0%	12.7%				
AEMP-02 (Duplicate)	03-Jun-2019	190	< 1.0	17	120	< 1.0	65	< 0.060	24	0.0050	0.85	14	160	< 1.0	16	560	260	8.21	350	4.7	3.7	< 0.015	0.18	0.041	< 0.033	< 0.010	0.041	0.21	< 0.0020	2.9	< 2.0	15	5.2	4.7				
	03-Jun-2019	190	< 1.0	17	120	< 1.0	65	< 0.060	24	0.0049	0.84	14	160	< 1.0	18	560	260	8.18	360	4.0	4.1	< 0.015	0.19	0.042	< 0.033	< 0.010	0.042	0.21	< 0.0020	2.4	< 2.0	20	5.0	4.9				
	RPD(%)	0.0%	---	0.0%	0.0%	---	0.0%	---	0.0%	2.0%	1.2%	0.0%	0.0%	---	11.8%	0.0%	0.0%	0.4%	2.8%	16.1%	10.3%	---	5.4%	2.4%	---	---	2.4%	0.0%	---	18.9%	---	28.6%	3.9%	4.2%				
AEMP-04 (Duplicate)	16-Oct-2017	210	< 1.0	21	150	< 1.0	75	< 0.060	30	0.0050	0.98	19	170	< 1.0	---	660	310	---	420	6.0	---	---	0.26	0.059	< 0.033	< 0.010	0.059	---	< 0.0020	1.2	< 2.0	---	3.0	3.5				
	16-Oct-2017	220	< 1.0	21	150	< 1.0	75	< 0.060	30	0.0051	0.97	19	180	< 1.0	---	660	310	---	440	6.7	---	---	0.26	0.059	< 0.033	< 0.010	0.059	---	< 0.0020	1.4	< 2.0	---	2.9	3.4				
	RPD(%)	4.7%	---	0.0%	0.0%	---	0.0%	---	0.0%	2.0%	1.0%	0.0%	5.7%	---	---	0.0%	0.0%	---	4.7%	11.0%	---	---	0.0%	0.0%	---	---	0.0%	---	15.4%	---	---	3.4%	2.9%					
AEMP-04 (Duplicate)	23-Jun-2018	230	< 1.0	20	140	< 1.0	76	< 0.060	28	0.0070	1.1	18	180	< 1.0	---	640	300	---	380	4.7	1.4	0.039	0.18	0.041	< 0.033	< 0.010	0.041	0.20	< 0.0020	1.5	---	15	4.9	3.9				
	23-Jun-2018	230	< 1.0	19	140	< 1.0	71	< 0.060	26	0.0066	1.0	17	190	< 1.0	---	640	280	---	390	4.7	1.1	0.037	0.18	0.040	< 0.033	< 0.010	0.040	0.21	< 0.0020	5.1	---	22	4.7	4.1				
	RPD(%)	0.0%	---	5.1%	0.0%	---	6.8%	---	7.4%	5.9%	9.5%	5.7%	5.4%	---	---	0.0%	6.9%	---	2.6%	0.0%	24.0%	5.3%	0.0%	2.5%	---	---	2.5%	4.9%	---	109.1%	---	37.8%	4.2%	5.0%				
AEMP-04 (Duplicate)	10-Jun-2020	210	< 1.0	15	130	< 1.0	70	< 0.060	25	< 0.0040	0.92	12	170	< 1.0	14	590	280	8.23	400	9.5	1.4	< 0.015	0.21	0.047	< 0.033	< 0.010	0.047	0.27	< 0.0020	3.7	< 2.0 ^{#8}	16	5.2	4.3				
	10-Jun-2020	210	< 1.0	16	130	< 1.0	71	< 0.060	24	< 0.0040	0.99	13	170	< 1.0	13	590	280	8.24	380	9.1	2.3	0.020	0.21	0.048	< 0.033	< 0.010	0.048	0.25	< 0.0020	3.5	< 2.0 ^{#8}	13	4.5	4.0				
	RPD(%)	0.0%	---	6.5%	0.0%	---	1.4%	---	4.1%	---	7.3%	8.0%	0.0%	---	7.4%	0.0%	0.0%	0.1%	5.1%	4.3%	48.6%	---	0.0%	2.1%	---	---	2.1%	7.7%	---	5.6%	---	20.7%	14.4%	7.2%				
AEMP-06 (Duplicate)	02-Oct-2019	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---				
	02-Oct-2019	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---				
	(Duplicate)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---				
	(Duplicate)	02-Oct-2019	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---				
AEMP-07 (Duplicate)	21-Aug-2017	110	< 0.50	9.1	41	< 0.50	31	< 0.060	9.7	< 0.0040	0.79	8.1	88	< 0.50	---	270	120	---	170	35	---	---	0.25	0.056	<													

Surface Water Analytical Results: General, Indicator and Nutrient Analysis Parameters

PROJECT No.: 417011-00068		Anions					Cations					General									Inorganic Nitrogen Compounds							Inorganic Sulphur Compounds	Ion Balance	Miscellaneous							
Sampling Location	Date	Bicarbonate (mg/L)	Carbonate (mg/L)	Chloride (mg/L)	Sulphate (mg/L)	Hydroxide (mg/L)	Calcium (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Alkalinity (Total; as CaCO ₃) (mg/L)	Alkalinity (PP; as CaCO ₃) (mg/L)	Colour (color unit)	Electrical Conductivity (uS/cm)	Hardness (Total; as CaCO ₃) (mg/L)	pH (pH Units)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Ammonia (Total; as N) (mg/L)	Nitrate (mg/L)	Nitrate (as N) (mg/L)	Nitrite (mg/L)	Nitrite (as N) (mg/L)	Nitrite-plus-Nitrate (as N) (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Sulphide (asH2S) (mg/L)	Ion Balance % Difference (%)	Biochemical Oxygen Demand (mg/L)	Chemical Oxygen Demand (mg/L)	Dissolved Organic Carbon (mg/L)	Total Organic Carbon (mg/L)			
CCME CEQG Freshwater Aquatic Life ^{#1}		---	---	120	---	---	---	0.3	---	0.2	---	---	---	---	---	---	---	---	(6.5 - 9)	---	---	---	8.5	---	2.9	---	0.06	---	---	---	---	---	---	---	---	---	---
AEMP-07 (Duplicate)	18-Sep-2020	100	< 1.0	7.4	34	< 1.0	33	< 0.060	9.1	< 0.0040	0.73	7.0	82	< 1.0	16	260	120	8.09	200	36	19	< 0.015	0.27	0.061	< 0.033	< 0.010	0.061	0.34	0.011	2.7	< 2.0	17	5.4	4.7			
	18-Sep-2020	110	< 1.0	7.2	34	< 1.0	30	< 0.060	8.8	< 0.0040	0.84	7.1	88	< 1.0	15	260	110	8.07	120	36	17	< 0.015	0.28	0.063	< 0.033	< 0.010	0.063	0.27	0.0086	2.3	< 2.0	20	6.0	4.8			
	RPD(%)	9.5%	---	2.7%	0.0%	---	9.5%	---	3.4%	---	14.0%	1.4%	7.1%	---	6.5%	0.0%	8.7%	0.2%	50.0%	0.0%	11.1%	---	3.6%	3.2%	---	---	3.2%	23.0%	24.5%	16.0%	---	16.2%	10.5%	2.1%			
AEMP-10 (Duplicate)	14-Aug-2018	120	< 1.0	8.6	49	< 1.0	36	< 0.060	11	< 0.0040	0.83	7.7	97	< 1.0	---	310	130	---	180	59	51	0.016	0.093	0.021	< 0.033	< 0.010	0.021	0.30	0.0040	3.0	< 2.0	25	4.5	4.8			
	14-Aug-2018	120	< 1.0	8.6	49	< 1.0	37	0.28	11	0.018	0.93	7.7	96	< 1.0	---	310	140	---	170	66	51	0.023	0.085	0.019	< 0.033	< 0.010	0.019	0.32	0.0030	0.69	< 2.0	26	5.3	4.9			
	RPD(%)	0.0%	---	0.0%	0.0%	---	2.7%	---	0.0%	---	11.4%	0.0%	1.0%	---	---	0.0%	7.4%	---	5.7%	11.2%	0.0%	35.9%	9.0%	10.0%	---	---	10.0%	6.5%	28.6%	125.2%	---	3.9%	16.3%	2.1%			
AEMP-12 (Duplicate)	28-Aug-2019	120	< 1.0	10	46	< 1.0	34	< 0.060	12	< 0.0040	0.84	9.1	95	< 1.0	12	310	130	8.18	190	16	16	0.026	0.36	0.081	< 0.033	< 0.010	0.081	0.21	< 0.0020	0.45	< 2.0	< 10	3.9	4.1			
	28-Aug-2019	110	< 1.0	10	48	< 1.0	34	< 0.060	12	0.0072	0.84	9.1	94	< 1.0	62	300	140	8.19	180	13	17	0.027	0.30	0.067	< 0.033	< 0.010	0.067	0.21	< 0.0020	1.1	< 2.0	< 10	5.5	3.7			
	RPD(%)	8.7%	---	0.0%	4.3%	---	0.0%	---	0.0%	---	0.0%	0.0%	1.1%	---	135.1%	3.3%	7.4%	0.1%	5.4%	20.7%	6.1%	3.8%	18.2%	18.9%	---	---	18.9%	0.0%	---	83.9%	---	---	34.0%	10.3%			
AEMP-13 (Duplicate)	11-Jun-2020	160	< 1.0	4.9	34	< 1.0	38	0.13	9.4	0.035	1.3	4.4	130	< 1.0	30	300	130	7.09	200	87	50	0.026	0.23	0.052	< 0.033	< 0.010	0.052	0.43	0.0070	7.9	< 2.0	40	7.6	8.8 ^{#6}			
	11-Jun-2020	160	< 1.0	4.8	33	< 1.0	38	0.13	9.5	0.035	1.3	4.6	130	< 1.0	28	300	140	7.06	170	74	33	0.023	0.10	0.023	< 0.033	< 0.010	0.023	0.40	0.029	6.9	< 2.0	29	7.9	7.6			
	RPD(%)	0.0%	---	2.1%	3.0%	---	0.0%	0.0%	1.1%	0.0%	0.0%	4.4%	0.0%	---	6.9%	0.0%	7.4%	0.4%	16.2%	16.1%	41.0%	12.2%	78.8%	77.3%	---	---	77.3%	7.2%	122.2%	13.5%	---	31.9%	3.9%	14.6%			
AEMP-13 (Duplicate)	26-Jul-2020	140	< 1.0	5.4	50	< 1.0	47	0.25	13	0.12	1.0	5.5	120	< 1.0	23	350	170	8.21	170	61	48	< 0.015	0.20	0.046	< 0.033	< 0.010	0.046	0.45	< 0.010	2.2	< 2.0 ^{#10}	30	6.5	7.6			
	26-Jul-2020	170	< 1.0	5.0	40	< 1.0	46	0.16	13	0.10	1.0	5.6	140	< 1.0	26	370	170	8.20	140	78	34	< 0.015	0.14	0.032	< 0.033	< 0.010	0.032	0.48	< 0.010	2.2	< 2.0 ^{#10}	31	7.4	7.7			
	RPD(%)	19.4%	---	7.7%	22.2%	---	2.2%	43.9%	0.0%	18.2%	0.0%	1.8%	15.4%	---	12.2%	5.6%	0.0%	0.1%	19.4%	24.5%	34.1%	---	35.3%	35.9%	---	---	35.9%	6.5%	---	0.0%	---	3.3%	12.9%	1.3%			
AEMP-13 (Duplicate)	16-Sep-2020	130	< 1.0	6.9	64	< 1.0	44	< 0.060	12	0.025	0.87	7.1	110	< 1.0	30	320	160	7.97	210	150	57	0.017	0.17	0.039	< 0.033	< 0.010	0.039	0.39	0.014	2.6	< 2.0 ^{#8}	27	6.7	6.4			
	16-Sep-2020	140	< 1.0	6.9	59	< 1.0	44	< 0.060	12	0.021	0.89	7.0	110	< 1.0	95 ^{#9}	330	160	7.86	210	100	46	0.016	0.17	0.039	< 0.033	< 0.010	0.039	0.38	0.012	2.0	< 2.0 ^{#8}	27	7.0	6.4			
	RPD(%)	7.4%	---	0.0%	8.1%	---	0.0%	---	0.0%	17.4%	2.3%	1.4%	0.0%	---	104.0%	3.1%	0.0%	1.4%	0.0%	40.0%	21.4%	6.1%	0.0%	0.0%	---	---	0.0%	2.6%	15.4%	26.1%	---	0.0%	4.4%	0.0%			

NOTES:

1. --- in guideline row(s) denotes no criteria for that parameter.
 2. --- in detail data row(s) denotes parameter not analyzed.
 3. Highlighting indicates parameters above applied guideline/criteria.
 4. Highlighting indicates non-detect parameters above applied guideline/criteria.
 5. Highlighting indicates parameters at applied guideline/criteria.
 6. Superscript ^{†1} denotes values exceeding
(CCME. 2014. Canadian Environmental Quality Guidelines Summary Table. Water Quality Guidelines for the Protection of Freshwater Aquatic Life.
<http://st-ts.ccme.ca/?chems=all&chapters=1> accessed Aug 22, 2014.)
- Chloride:**
Guideline based on chronic exposure
- Ammonia (Total; as N):**
Guideline for total ammonia is dependent on pH and temperature of surface water. Guideline based on Temperature of 10oC and pH of 7
- Nitrate (as N):**
Guideline based on long term exposure
- Nitrite (as N):**
Standard is for NO₂ as N, equivalent standard for NO₂ is 0.197 mg/L.

Surface Water Analytical Results: Petroleum Hydrocarbons

PROJECT No.: 417011-00068

Sampling Location	Date (dd-mmm-yyyy)	Benzene (mg/L)	Ethylbenzene (mg/L)	Oil and Grease (mg/L)	PHC F1 (C6-C10) (mg/L)	PHC F1 (C6-C10) - BTEX (mg/L)	PHC F2 (C10-C16) (mg/L)	Toluene (mg/L)	Xylenes-Total (mg/L)
CCME CEQG Freshwater Aquatic Life ^{#1}		0.37	0.09	---	---	---	---	0.002	---
AEMP									
AEMP-01	16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	21-Sep-2017	---	---	< 2.0	---	---	---	---	---
	16-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	23-Jun-2018	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	14-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Oct-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	10-Jun-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	26-Aug-2019	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	27-Aug-2019	---	---	< 2.0	---	---	---	---	---
	01-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	12-Jun-2020	< 0.00040	< 0.00040	4.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	28-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	22-Sep-2020	< 0.00040	< 0.00040	4.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
AEMP-02	18-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	21-Sep-2017	---	---	< 2.0	---	---	---	---	---
	16-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	23-Jun-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	12-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	16-Oct-2018	< 0.00040	< 0.00040	2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Jun-2019	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	28-Aug-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Oct-2019	< 0.00040	< 0.00040	2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	10-Jun-2020	< 0.00040	< 0.00040	6.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	24-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Sep-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
AEMP-03	18-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	21-Sep-2017	---	---	< 2.0	---	---	---	---	---
	16-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	23-Jun-2018	< 0.00040	< 0.00040	4.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	12-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	16-Oct-2018	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Jun-2019	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	28-Aug-2019	< 0.00040	< 0.00040	2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	02-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	10-Jun-2020	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	24-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	20-Sep-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
AEMP-04	18-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	21-Sep-2017	---	---	< 2.0	---	---	---	---	---
	16-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	23-Jun-2018	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	12-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	16-Oct-2018	< 0.00040	< 0.00040	2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Jun-2019	< 0.00040	< 0.00040	5.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	25-Aug-2019	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	27-Aug-2019	---	---	3.0	---	---	---	---	---
	02-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	10-Jun-2020	< 0.00040	< 0.00040	5.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	24-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Sep-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089

Surface Water Analytical Results: Petroleum Hydrocarbons

PROJECT No.: 417011-00068

Sampling Location	Date (dd-mmm-yyyy)	Benzene (mg/L)	Ethylbenzene (mg/L)	Oil and Grease (mg/L)	PHC F1 (C6-C10) (mg/L)	PHC F1 (C6-C10) - BTEX (mg/L)	PHC F2 (C10-C16) (mg/L)	Toluene (mg/L)	Xylenes-Total (mg/L)
CCME CEQG Freshwater Aquatic Life #1		0.37	0.09	---	---	---	---	0.002	---
AEMP-05	19-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	21-Sep-2017	---	---	< 2.0	---	---	---	---	---
	15-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	23-Jun-2018	< 0.00040	< 0.00040	7.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	13-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Oct-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	02-Jun-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	27-Aug-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	01-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	11-Jun-2020	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	26-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	16-Sep-2020	< 0.00040	< 0.00040	9.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
AEMP-06	21-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	21-Sep-2017	---	---	< 2.0	---	---	---	---	---
	16-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	23-Jun-2018	< 0.00040	< 0.00040	10	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	13-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Oct-2018	< 0.00040	< 0.00040	2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Jun-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	25-Aug-2019	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	27-Aug-2019	---	---	< 2.0	---	---	---	---	---
	03-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	12-Jun-2020	< 0.00040	< 0.00040	8.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	28-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	22-Sep-2020	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
AEMP-07	21-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	21-Sep-2017	---	---	< 2.0	---	---	---	---	---
	16-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	23-Jun-2018	< 0.00040	< 0.00040	10	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	13-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	17-Oct-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Jun-2019	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	25-Aug-2019	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	27-Aug-2019	---	---	< 2.0	---	---	---	---	---
	03-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	10-Jun-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	24-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Sep-2020	< 0.00040	< 0.00040	4.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
AEMP-08	17-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	21-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	21-Sep-2017	---	---	< 2.0	---	---	---	---	---
	16-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	23-Jun-2018	< 0.00040	< 0.00040	6.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	13-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	17-Oct-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Jun-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	28-Aug-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Oct-2019	< 0.00040	< 0.00040	12	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	10-Jun-2020	< 0.00040	< 0.00040	4.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	24-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Sep-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089

Surface Water Analytical Results: Petroleum Hydrocarbons

PROJECT No.: 417011-00068

Sampling Location	Date (dd-mmm-yyyy)	Benzene (mg/L)	Ethylbenzene (mg/L)	Oil and Grease (mg/L)	PHC F1 (C6-C10) (mg/L)	PHC F1 (C6-C10) - BTEX (mg/L)	PHC F2 (C10-C16) (mg/L)	Toluene (mg/L)	Xylenes-Total (mg/L)
CCME CEQG Freshwater Aquatic Life #1		0.37	0.09	---	---	---	---	0.002	---
AEMP-09	21-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	21-Sep-2017	---	---	< 2.0	---	---	---	---	---
	16-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	23-Jun-2018	< 0.00040	< 0.00040	6.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	12-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	17-Oct-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	02-Jun-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	28-Aug-2019	0.00043	< 0.00040	2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	10-Jun-2020	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	24-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Sep-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
AEMP-10	23-Jun-2018	< 0.00040	< 0.00040	9.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	14-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Oct-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	10-Jun-2019	< 0.00040	< 0.00040	4.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	26-Aug-2019	< 0.00040	< 0.00040	< 3.6	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	01-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	12-Jun-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	28-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	22-Sep-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
AEMP-11	23-Jun-2018	< 0.00040	< 0.00040	8.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	14-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Oct-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	10-Jun-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	26-Aug-2019	< 0.00040	< 0.00040	< 3.8	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	01-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	12-Jun-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	28-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	22-Sep-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
AEMP-12	23-Jun-2018	< 0.00040	< 0.00040	12	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	14-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	17-Oct-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Jun-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	28-Aug-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	03-Oct-2019	< 0.00040	< 0.00040	2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	10-Jun-2020	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	24-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Sep-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
AEMP-13	14-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	18-Oct-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	02-Jun-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	27-Aug-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	02-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	11-Jun-2020	< 0.00040	< 0.00040	4.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	26-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	16-Sep-2020	< 0.00040	< 0.00040	10	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089

Surface Water Analytical Results: Petroleum Hydrocarbons

PROJECT No.: 417011-00068

Sampling Location		Date (dd-mmm-yyyy)	Benzene (mg/L)	Ethylbenzene (mg/L)	Oil and Grease (mg/L)	PHC F1 (C6-C10) (mg/L)	PHC F1 (C6-C10) - BTEX (mg/L)	PHC F2 (C10-C16) (mg/L)	Toluene (mg/L)	Xylenes-Total (mg/L)
CCME CEQG Freshwater Aquatic Life ^{#1}			0.37	0.09	---	---	---	---	0.002	---
Relative Percent Difference (RPD) Report										
AEMP-02		16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
(Duplicate)		16-Sep-2017	< 0.00040	< 0.00040	---	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-02		03-Jun-2019	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		03-Jun-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-04		16-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
(Duplicate)		16-Oct-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-04		23-Jun-2018	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		23-Jun-2018	< 0.00040	< 0.00040	11	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	114.3%	---	---	---	---	---
AEMP-04		10-Jun-2020	< 0.00040	< 0.00040	5.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		10-Jun-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-06		27-Aug-2019	---	---	< 2.0	---	---	---	---	---
(Duplicate)		02-Oct-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-07		21-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
(Duplicate)		21-Aug-2017	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00080
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-07		17-Oct-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		17-Oct-2018	< 0.00040	< 0.00040	3.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-07		24-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		24-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-07		18-Sep-2020	< 0.00040	< 0.00040	4.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		18-Sep-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-10		14-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		14-Aug-2018	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-12		28-Aug-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		28-Aug-2019	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-13		11-Jun-2020	< 0.00040	< 0.00040	4.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		11-Jun-2020	< 0.00040	< 0.00040	7.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	54.5%	---	---	---	---	---
AEMP-13		26-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		26-Jul-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	---	---	---	---	---	---
AEMP-13		16-Sep-2020	< 0.00040	< 0.00040	10	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
(Duplicate)		16-Sep-2020	< 0.00040	< 0.00040	< 2.0	< 0.10	< 0.10	< 0.10	< 0.00040	< 0.00089
	RPD(%)		---	---	---	---	---	---	---	---

NOTES:

1. --- in guideline row(s) denotes no criteria for that parameter.
2. --- in detail data row(s) denotes parameter not analyzed.
3. Highlighting indicates parameters above applied guideline/criteria.
4. Highlighting indicates non-detect parameters above applied guideline/criteria.
5. Highlighting indicates parameters at applied guideline/criteria.
6. Superscript ^{#1} denotes values exceeding

(CCME. 2014. Canadian Environmental Quality Guidelines Summary Table. Water Quality Guidelines for the Protection of Freshwater Aquatic Life. <http://st-ts.ccme.ca/?chems=all&chapters=1> accessed Aug 22, 2014.)

Surface Water Analytical Results: Dissolved Metals and Trace Elements

PROJECT No.: 417011-00068																														
Sampling Location	Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium (Total)	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Selenium	Silicon	Silver	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	
(dd-mmm-yyyy)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
CCME CEQG Freshwater Aquatic Life ^{#1}		0.005	---	0.005	---	---	1.5	0.00009	0.0089	---	0.002	0.3	0.001	---	0.2	0.000026	0.073	0.025	---	0.001	---	0.00025	---	0.0008	---	---	0.015	---	0.03	
AEMP																														
AEMP-01	16-Sep-2017	0.051 ^{#1}	< 0.00060	0.00025	0.047	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0010	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00092	0.0014	< 0.10	0.00035	1.8	< 0.00010	0.23	< 0.00020	< 0.0010	< 0.0010	0.00072	< 0.0010	< 0.0030	
	16-Oct-2017	0.024 ^{#1}	< 0.00060	0.00028	0.047	< 0.0010	< 0.020	0.000022	< 0.0010	< 0.00030	0.0011	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.0010	0.0017	< 0.10	0.00034	1.7	< 0.00010	0.24	< 0.00020	< 0.0010	< 0.0010	0.00076	< 0.0010	< 0.0030	
	23-Jun-2018	0.047 ^{#1}	< 0.00060	0.00036	0.044	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0013	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00097	0.0011	< 0.10	0.00029	1.6	< 0.00010	0.17	< 0.00020	< 0.0010	< 0.0010	0.00065	< 0.0010	< 0.0030	
	14-Aug-2018	0.090 ^{#1}	< 0.00060	0.00028	0.048	< 0.0010	< 0.020	0.000023	< 0.0010	< 0.00030	0.0015	< 0.060	< 0.00020	< 0.020	< 0.0040	0.0000031	0.00090	0.0015	< 0.10	0.00034	1.6	< 0.00010	0.24	< 0.00020	< 0.0010	< 0.0010	0.00083	< 0.0010	< 0.0030	
	18-Oct-2018	0.0060 ^{#1}	< 0.00060	0.00031	0.047	< 0.0010	0.020	< 0.000020	< 0.0010	< 0.00030	0.00088	< 0.060	< 0.00020	< 0.020	0.0093	< 0.0000020	0.00075	0.00092	< 0.10	< 0.00020	1.4	< 0.00010	0.27	< 0.00020	< 0.0010	< 0.0010	0.00056	< 0.0010	< 0.0030	
	10-Jun-2019	0.020 ^{#1}	< 0.00060	0.00021	0.041	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0017	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00085	0.0014	< 0.10	0.00026	1.7	< 0.00010	0.18	< 0.00020	< 0.0010	< 0.0010	0.00066	< 0.0010	< 0.0030	
	26-Aug-2019	0.047 ^{#1}	< 0.00060	0.00020	0.048	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0012	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00094	0.0014	< 0.10	0.00036	1.8	< 0.00010	0.27	< 0.00020	< 0.0010	< 0.0010	0.00084	< 0.0010	< 0.0030	
	01-Oct-2019	0.032 ^{#1}	< 0.00060	0.00033	0.051	< 0.0010	< 0.020	0.000021	< 0.0010	< 0.00030	0.0015	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.0011	0.0017	< 0.10	0.00057	1.8	< 0.00010	0.24	< 0.00020	< 0.0010	0.0011	0.00078	< 0.0010	0.0057	
	12-Jun-2020	0.023 ^{#1}	< 0.00060	0.00030	0.042	< 0.0010	< 0.020	0.000022	< 0.0010	< 0.00030	0.0019	< 0.060	< 0.00020	< 0.020	< 0.0040	0.0000038	0.00090	0.0017	< 0.10	0.00034	1.9	< 0.00010	0.19	< 0.00020	< 0.0010	< 0.0010	0.0012	< 0.0010	< 0.0030	
	28-Jul-2020	0.0084 ^{#1}	< 0.00060	0.00032	0.045	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	< 0.00020	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000019	0.0013	0.0014	< 0.10	0.00047	1.8	< 0.00010	0.20	< 0.00020	< 0.0010	< 0.0010	0.00083	0.0020	0.0084	
	22-Sep-2020	0.026 ^{#1}	< 0.00060	0.00039	0.044	< 0.0010	< 0.020	0.000026	< 0.0010	< 0.00030	0.0023 ^{#1}	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000019	0.0010	0.0015	< 0.10	0.00032	1.9	< 0.00010	0.20	< 0.00020	< 0.0010	< 0.0010	0.00074	< 0.0010	< 0.0030	
AEMP-02	18-Aug-2017	< 0.0030	< 0.00060	< 0.00020	0.087	< 0.0010	0.027	< 0.000020	< 0.0010	< 0.00030	0.00086	< 0.060	< 0.00020	< 0.020	0.0077	< 0.0000020	0.0019	0.00088	< 0.10	< 0.00020	2.1	< 0.00010	1.3	< 0.00020	< 0.0010	< 0.0010	0.00099	< 0.0010	< 0.0030	
	16-Sep-2017	0.0054 ^{#1}	< 0.00060	0.00020	0.077	< 0.0010	0.026	< 0.000020	< 0.0010	< 0.00030	0.00042	< 0.060	< 0.00020	< 0.020	0.0081	0.0000023	0.0017	0.00069	< 0.10	< 0.00020	2.0	< 0.00010	1.3	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0030	
	(Duplicate)	16-Sep-2017	0.0051 ^{#1}	< 0.00060	< 0.00020	0.076	< 0.0010	0.026	< 0.000020	< 0.0010	< 0.00030	0.00037	< 0.060	< 0.00020	< 0.020	0.0078	0.0000021	0.0017	0.00074	< 0.10	< 0.00020	2.0	< 0.00010	1.3	< 0.00020	< 0.0010	< 0.0010	0.0010	< 0.0010	< 0.0030
	16-Oct-2017	0.0033	< 0.00060	0.00021	0.072	< 0.0010	0.024	< 0.000020	< 0.0010	< 0.00030	0.00042	< 0.060	< 0.00020	< 0.020	0.0091	< 0.0000020	0.0018	0.00077	< 0.10	< 0.00020	2.1	< 0.00010	1.4	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0030	
	23-Jun-2018	< 0.0030	< 0.00060	0.00023	0.085	< 0.0010	0.028	< 0.000020	< 0.0010	< 0.00030	0.00045	< 0.060	< 0.00020	< 0.020	0.0058	< 0.0000020	0.0019	0.00074	< 0.10	< 0.00020	2.0	< 0.00010	1.3	< 0.00020	< 0.0010	< 0.0010	0.0010	< 0.0010	< 0.0030	
	12-Aug-2018	< 0.0030	< 0.00060	< 0.00020	0.078	< 0.0010	0.029	< 0.000020	< 0.0010	< 0.00030	0.00062	< 0.060	< 0.00020	< 0.020	0.0079	0.0000020	0.0017	0.00078	< 0.10	0.00024	2.1	< 0.00010	1.4	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0030	
	16-Oct-2018	0.0060 ^{#1}	< 0.00060	< 0.00020	0.068	< 0.0010	0.027	< 0.000020	< 0.0010	< 0.00030	0.00092	< 0.060	< 0.00020	< 0.020	0.0046	< 0.0000020	0.0019	< 0.00050	< 0.10	< 0.00020	2.0	< 0.00010	1.5	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0030	
	03-Jun-2019	0.0033	< 0.00060	0.00023	0.072	< 0.0010	0.021	< 0.000020	< 0.0010	< 0.00030	0.00086	< 0.060	< 0.00020	< 0.020	0.0050	< 0.0000020	0.0017	0.00060	< 0.10	< 0.00020	1.6	< 0.00010	1.1	< 0.00020	< 0.0010	< 0.0010	0.00098	< 0.0010	< 0.0030	
	03-Jun-2019	0.0035	< 0.00060	0.00020	0.071	< 0.0010	0.021	< 0.000020	< 0.0010	< 0.00030	0.00047	< 0.060	< 0.00020	< 0.020	0.0049	< 0.0000020	0.0016	0.00058	< 0.10	< 0.00020	1.6	< 0.00010	1.1	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0030	
	28-Aug-2019	< 0.0030	< 0.00060	< 0.00020	0.076	< 0.0010	0.024	< 0.000020	< 0.0010	< 0.00030	0.0014	< 0.060	< 0.00020	< 0.020	0.0069	< 0.0000020	0.00													

Surface Water Analytical Results: Dissolved Metals and Trace Elements

PROJECT No.: 417011-00068																													
Sampling Location	Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium (Total)	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Selenium	Silicon	Silver	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
(dd-mmm-yyyy)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
CCME CEQG Freshwater Aquatic Life ^{#1}		0.005	---	0.005	---	---	1.5	0.00009	0.0089	---	0.002	0.3	0.001	---	0.2	0.000026	0.073	0.025	---	0.001	---	0.00025	---	0.0008	---	---	0.015	---	0.03
AEMP-05	19-Aug-2017	0.0030	< 0.00060	0.00089	0.15	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	< 0.00020	0.073	< 0.00020	< 0.020	0.0071	< 0.0000020	0.0015	0.00099	< 0.10	< 0.00020	0.21	< 0.00010	0.25	< 0.00020	< 0.0010	< 0.0010	0.00034	< 0.0010	< 0.0030
	16-Sep-2017	0.0043	< 0.00060	0.00049	0.14	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	< 0.00020	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.0016	0.0010	< 0.10	< 0.00020	0.25	< 0.00010	0.21	< 0.00020	< 0.0010	< 0.0010	0.00033	< 0.0010	< 0.0030
	15-Oct-2017	< 0.0030	< 0.00060	0.00064	0.13	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00042	< 0.060	< 0.00020	< 0.020	0.0052	< 0.0000020	0.0013	0.0012	< 0.10	< 0.00020	0.39	< 0.00010	0.20	< 0.00020	< 0.0010	< 0.0010	0.00029	< 0.0010	< 0.0030
	23-Jun-2018	0.040 ^{#1}	< 0.00060	0.00030	0.052	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0014	< 0.060	< 0.00020	< 0.020	0.013	0.0000025	0.0010	0.0011	< 0.10	0.00033	1.5	< 0.00010	0.17	< 0.00020	< 0.0010	< 0.0010	0.00066	< 0.0010	< 0.0030
	13-Aug-2018	< 0.0030	< 0.00060	0.0011	0.15	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00055	0.34 ^{#1}	< 0.00020	< 0.020	0.028	< 0.0000020	0.0017	0.0013	< 0.10	< 0.00020	0.44	< 0.00010	0.17	< 0.00020	< 0.0010	< 0.0010	0.00018	< 0.0010	< 0.0030
	18-Oct-2018	0.015 ^{#1}	< 0.00060	0.00081	0.17	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0012	0.18	< 0.00020	< 0.020	0.18	< 0.0000020	0.0015	0.0017	< 0.10	< 0.00020	0.34	< 0.00010	0.19	< 0.00020	< 0.0010	< 0.0010	0.00032	< 0.0010	0.0032
	02-Jun-2019	0.0051 ^{#1}	< 0.00060	0.00090	0.13	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00024	0.25	< 0.00020	< 0.020	0.040	< 0.0000020	0.00093	0.0011	< 0.10	< 0.00020	1.1	< 0.00010	0.16	< 0.00020	< 0.0010	< 0.0010	0.00022	< 0.0010	< 0.0030
	27-Aug-2019	< 0.0030	< 0.00060	0.00062	0.15	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	< 0.00020	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.0014	0.00068	< 0.10	< 0.00020	0.17	< 0.00010	0.17	< 0.00020	0.0018	< 0.0010	0.00018	< 0.0010	< 0.0030
	01-Oct-2019	< 0.0030	< 0.00060	0.00047	0.15	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00031	0.11	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.0011	0.00080	< 0.10	< 0.00020	0.25	< 0.00010	0.15	< 0.00020	< 0.0010	< 0.0010	0.00018	< 0.0010	< 0.0030
	11-Jun-2020	0.0092 ^{#1}	< 0.00060	0.00087	0.11	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0013	0.25	< 0.00020	< 0.020	0.024	0.0000054	0.0015	0.0018	< 0.10	< 0.00020	1.2	< 0.00010	0.17	< 0.00020	< 0.0010	< 0.0010	0.00061	< 0.0010	< 0.0030
	26-Jul-2020	< 0.0030	< 0.00060	0.00087	0.13	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00036	0.40 ^{#1}	< 0.00020	< 0.020	0.022	< 0.0000019	0.0013	0.0011	< 0.10	< 0.00020	0.41	< 0.00010	0.17	< 0.00020	< 0.0010	< 0.0010	0.00017	< 0.0010	< 0.0030
16-Sep-2020	< 0.0030	< 0.00060	0.00057	0.13	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0039 ^{#1}	0.11	< 0.00020	< 0.020	0.0061	< 0.0000019	0.0012	0.0011	< 0.10	< 0.00020	0.29	< 0.00010	0.18	< 0.00020	< 0.0010	< 0.0010	0.00018	< 0.0010	< 0.0030	
AEMP-06	21-Aug-2017	0.032 ^{#1}	< 0.00060	0.00038	0.043	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0011	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00087	0.0010	< 0.10	0.00033	1.5	< 0.00010	0.22	< 0.00020	< 0.0010	< 0.0010	0.00062	< 0.0010	< 0.0030
	16-Sep-2017	0.027 ^{#1}	< 0.00060	0.00024	0.040	< 0.0010	< 0.020	0.000021	< 0.0010	< 0.00030	0.00091	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00079	0.0011	< 0.10	< 0.00020	1.4	< 0.00010	0.22	< 0.00020	< 0.0010	< 0.0010	0.00054	< 0.0010	0.010
	16-Oct-2017	0.013 ^{#1}	< 0.00060	0.00030	0.040	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00083	< 0.060	< 0.00020	< 0.020	0.0068	< 0.0000020	0.0014	0.0013	< 0.10	0.00022	1.5	< 0.00010	0.22	< 0.00020	< 0.0010	< 0.0010	0.00080	< 0.0010	< 0.0030
	23-Jun-2018	0.027 ^{#1}	< 0.00060	0.00032	0.038	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0011	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00086	0.00096	< 0.10	0.00021	1.4	< 0.00010	0.16	< 0.00020	< 0.0010	< 0.0010	0.00054	< 0.0010	< 0.0030
	13-Aug-2018	0.048 ^{#1}	< 0.00060	0.00029	0.043	< 0.0010	< 0.020	0.000020	< 0.0010	< 0.00030	0.0017	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00085	0.0017	< 0.10	0.00031	1.4	< 0.00010	0.21	< 0.00020	< 0.0010	< 0.0010	0.00064	< 0.0010	0.0034
	18-Oct-2018	0.0069 ^{#1}	< 0.00060	0.00049	0.047	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00079	< 0.060	< 0.00020	< 0.020	0.018	< 0.0000020	0.00077	0.00092	< 0.10	0.00027	1.4	< 0.00010	0.22	< 0.00020	0.0023	< 0.0010	0.00048	< 0.0010	< 0.0030
	03-Jun-2019	0.015 ^{#1}	< 0.00060	0.00029	0.035	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0011	< 0.060	< 0.00020	< 0.020	< 0.0040	0.0000021	0.00074	0.00096	< 0.10	< 0.00020	1.4	< 0.00010	0.18	< 0.00020	< 0.0010	< 0.0010	0.00058	< 0.0010	< 0.0030
	25-Aug-2019	0.024 ^{#1}	< 0.00060	0.00023	0.038	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00091	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.													

Surface Water Analytical Results: Dissolved Metals and Trace Elements

PROJECT No.: 417011-00068																													
Sampling Location	Date																												
		Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium (Total)	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Selenium	Silicon	Silver	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
(dd-mmm-yyyy)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
CCME CEQG Freshwater Aquatic Life ^{#1}		0.005	---	0.005	---	---	1.5	0.00009	0.0089	---	0.002	0.3	0.001	---	0.2	0.000026	0.073	0.025	---	0.001	---	0.00025	---	0.0008	---	---	0.015	---	0.03
AEMP-09	21-Aug-2017	0.031 ^{#1}	< 0.00060	0.00039	0.045	< 0.0010	< 0.020	0.000027	< 0.0010	< 0.00030	0.0013	< 0.060	< 0.00020	< 0.020	0.013	< 0.0000020	0.00088	0.00098	< 0.10	0.00032	1.5	< 0.00010	0.24	< 0.00020	< 0.0010	< 0.0010	0.00064	< 0.0010	< 0.0030
	16-Sep-2017	0.029 ^{#1}	< 0.00060	0.00026	0.045	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0012	< 0.060	< 0.00020	< 0.020	0.019	< 0.0000020	0.0010	0.0013	< 0.10	0.00028	1.4	< 0.00010	0.24	< 0.00020	< 0.0010	< 0.0010	0.00080	< 0.0010	< 0.0030
	16-Oct-2017	0.0076 ^{#1}	< 0.00060	0.00053	0.071	< 0.0010	0.050	< 0.000020	< 0.0010	< 0.00030	0.0013	< 0.060	< 0.00020	< 0.020	0.092	< 0.0000020	0.00084	0.0012	< 0.10	0.00023	1.7	< 0.00010	0.26	< 0.00020	< 0.0010	< 0.0010	0.00060	< 0.0010	< 0.0030
	23-Jun-2018	0.026 ^{#1}	< 0.00060	0.00036	0.039	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0013	< 0.060	< 0.00020	< 0.020	< 0.0040	0.0000023	0.00091	0.00095	< 0.10	< 0.00020	1.4	< 0.00010	0.18	< 0.00020	< 0.0010	< 0.0010	0.00051	< 0.0010	< 0.0030
	12-Aug-2018	0.13 ^{#1}	< 0.00060	0.00038	0.053	< 0.0010	< 0.020	0.000025	< 0.0010	< 0.00030	0.0014	0.20	0.00023	< 0.020	0.020	0.0000027	0.00083	0.0016	< 0.10	0.00023	1.6	< 0.00010	0.27	< 0.00020	< 0.0010	0.0011	0.00070	< 0.0010	< 0.0030
	17-Oct-2018	0.0099 ^{#1}	< 0.00060	0.00050	0.067	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0020 ^{#1}	< 0.060	< 0.00020	< 0.020	0.019	< 0.0000020	0.0010	0.0010	< 0.10	0.00020	1.4	< 0.00010	0.27	< 0.00020	< 0.0010	< 0.0010	0.00062	< 0.0010	< 0.0030
	02-Jun-2019	0.017 ^{#1}	< 0.00060	0.00039	0.049	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0014	< 0.060	< 0.00020	< 0.020	0.021	0.0000021	0.0011	0.0012	< 0.10	0.00021	1.5	< 0.00010	0.19	< 0.00020	< 0.0010	< 0.0010	0.00067	< 0.0010	< 0.0030
	28-Aug-2019	0.027 ^{#1}	< 0.00060	0.00035	0.052	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0023 ^{#1}	< 0.060	< 0.00020	< 0.020	0.0078	< 0.0000020	0.0010	0.00094	< 0.10	0.00025	1.6	< 0.00010	0.26	< 0.00020	0.0014	< 0.0010	0.00064	< 0.0010	< 0.0030
	03-Oct-2019	0.020 ^{#1}	< 0.00060	0.00034	0.045	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0011	< 0.060	< 0.00020	< 0.020	0.0071	< 0.0000020	0.00084	0.00094	< 0.10	0.00021	1.4	< 0.00010	0.23	< 0.00020	< 0.0010	< 0.0010	0.00059	< 0.0010	0.0039
	10-Jun-2020	0.017 ^{#1}	< 0.00060	0.00027	0.036	< 0.0010	< 0.020	0.000028	0.0035	< 0.00030	0.0016	< 0.060	< 0.00020	< 0.020	0.0041	< 0.0000019	0.00074	0.0032	< 0.10	0.00030	1.5	< 0.00010	0.17	< 0.00020	< 0.0010	< 0.0010	0.00054	< 0.0010	< 0.0030
24-Jul-2020	< 0.0030	< 0.00060	< 0.00020	0.086	< 0.0010	0.033	< 0.000020	< 0.0010	< 0.00030	0.00040	< 0.060	< 0.00020	< 0.020	0.0054	< 0.0000019	0.0020	< 0.00050	< 0.10	< 0.00020	1.8	< 0.00010	1.4	< 0.00020	< 0.0010	< 0.0010	0.0013	< 0.0010	< 0.0030	
18-Sep-2020	0.013 ^{#1}	< 0.00060	< 0.00020	0.040	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0014	< 0.060	< 0.00020	< 0.020	0.0093	< 0.0000019	0.00072	0.0014	< 0.10	0.00025	1.7	< 0.00010	0.19	< 0.00020	< 0.0010	< 0.0010	0.00055	< 0.0010	< 0.0030	
AEMP-10	23-Jun-2018	0.045 ^{#1}	< 0.00060	0.00025	0.044	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0013	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00094	0.0012	< 0.10	0.00029	1.5	< 0.00010	0.16	< 0.00020	< 0.0010	< 0.0010	0.00062	< 0.0010	< 0.0030
	14-Aug-2018	0.074 ^{#1}	< 0.00060	< 0.00020	0.047	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0015	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00097	0.0017	< 0.10	0.00036	1.6	< 0.00010	0.22	< 0.00020	< 0.0010	< 0.0010	0.00076	< 0.0010	< 0.0030
	(Duplicate)	0.24 ^{#1}	< 0.00060	0.00050	0.054	< 0.0010	< 0.020	0.000065	< 0.0010	0.00050	0.0019	0.28	0.00034	< 0.020	0.018	0.0000021	0.00090	0.0024	< 0.10	0.00037	2.0	< 0.00010	0.22	< 0.00020	< 0.0010	0.0027	0.00077	< 0.0010	0.0079
	18-Oct-2018	0.0061 ^{#1}	< 0.00060	0.00030	0.048	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00081	< 0.060	< 0.00020	< 0.020	0.0099	< 0.0000020	0.00077	0.00079	< 0.10	< 0.00020	1.4	< 0.00010	0.22	< 0.00020	< 0.0010	< 0.0010	0.00050	< 0.0010	< 0.0030
	10-Jun-2019	0.017 ^{#1}	< 0.00060	0.00021	0.040	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0022 ^{#1}	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00090	0.0013	< 0.10	0.00026	1.6	< 0.00010	0.17	< 0.00020	< 0.0010	< 0.0010	0.00065	< 0.0010	< 0.0030
	26-Aug-2019	0.039 ^{#1}	< 0.00060	< 0.00020	0.047	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0012	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00077	0.0012	< 0.10	0.00038	1.8	< 0.00010	0.25	< 0.00020	0.0019	< 0.0010	0.00078	< 0.0010	< 0.0030
	01-Oct-2019	0.026 ^{#1}	< 0.00060	0.00028	0.048	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0014	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.0011	0.0018	< 0.10	0.00048	1.8	< 0.00010	0.24	< 0.00020	< 0.0010	< 0.0010	0.00082	< 0.0010	< 0.0030
	12-Jun-2020	0.017 ^{#1}	< 0.00060	0.00023	0.040	< 0.0010	< 0.020	0.000021	< 0.0010	< 0.00030	0.0019	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000019	0.00089	0.0015	< 0.10	0.00042	1.7	< 0.00010	0.17						

Surface Water Analytical Results: Dissolved Metals and Trace Elements

PROJECT No.: 417011-00068																													
Sampling Location	Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium (Total)	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Selenium	Silicon	Silver	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
(dd-mmm-yyyy)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
CCME CEQG Freshwater Aquatic Life ^{#1}		0.005	---	0.005	---	---	1.5	0.00009	0.0089	---	0.002	0.3	0.001	---	0.2	0.000026	0.073	0.025	---	0.001	---	0.00025	---	0.0008	---	---	0.015	---	0.03
Relative Percent Difference (RPD) Report																													
AEMP-02 (Duplicate)	16-Sep-2017	0.0054 ^{#1}	< 0.00060	0.00020	0.077	< 0.0010	0.026	< 0.000020	< 0.0010	< 0.00030	0.00042	< 0.060	< 0.00020	< 0.020	0.0081	0.0000023	0.0017	0.00069	< 0.10	< 0.00020	2.0	< 0.00010	1.3	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0030
	16-Sep-2017	0.0051 ^{#1}	< 0.00060	< 0.00020	0.076	< 0.0010	0.026	< 0.000020	< 0.0010	< 0.00030	0.00037	< 0.060	< 0.00020	< 0.020	0.0078	0.0000021	0.0017	0.00074	< 0.10	< 0.00020	2.0	< 0.00010	1.3	< 0.00020	< 0.0010	< 0.0010	0.0010	< 0.0010	< 0.0030
	RPD(%)	5.7%	---	---	1.3%	---	0.0%	---	---	---	12.7%	---	---	---	3.8%	9.1%	0.0%	7.0%	---	---	0.0%	---	0.0%	---	---	---	---	9.5%	---
AEMP-02 (Duplicate)	03-Jun-2019	0.0033	< 0.00060	0.00023	0.072	< 0.0010	0.021	< 0.000020	< 0.0010	< 0.00030	0.00086	< 0.060	< 0.00020	< 0.020	0.0050	< 0.0000020	0.0017	0.00060	< 0.10	< 0.00020	1.6	< 0.00010	1.1	< 0.00020	< 0.0010	< 0.0010	0.00098	< 0.0010	< 0.0030
	03-Jun-2019	0.0035	< 0.00060	0.00020	0.071	< 0.0010	0.021	< 0.000020	< 0.0010	< 0.00030	0.00047	< 0.060	< 0.00020	< 0.020	0.0049	< 0.0000020	0.0016	0.00058	< 0.10	< 0.00020	1.6	< 0.00010	1.1	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0030
	RPD(%)	5.9%	---	14.0%	1.4%	---	0.0%	---	---	---	58.6%	---	---	---	2.0%	---	6.1%	3.4%	---	---	0.0%	---	0.0%	---	---	---	---	11.5%	---
AEMP-04 (Duplicate)	16-Oct-2017	< 0.0030	< 0.00060	< 0.00020	0.070	< 0.0010	0.022	< 0.000020	< 0.0010	< 0.00030	0.00031	< 0.060	< 0.00020	< 0.020	0.0050	< 0.0000020	0.0018	0.00051	< 0.10	0.00022	2.1	< 0.00010	1.4	< 0.00020	< 0.0010	< 0.0010	0.0012	< 0.0010	< 0.0030
	16-Oct-2017	0.0041	< 0.00060	< 0.00020	0.070	< 0.0010	0.022	< 0.000020	< 0.0010	< 0.00030	0.00035	< 0.060	< 0.00020	< 0.020	0.0051	< 0.0000020	0.0017	0.00064	< 0.10	< 0.00020	2.1	< 0.00010	1.4	< 0.00020	< 0.0010	< 0.0010	0.0012	< 0.0010	< 0.0030
	RPD(%)	---	---	---	0.0%	---	0.0%	---	---	---	12.1%	---	---	---	2.0%	---	5.7%	22.6%	---	---	0.0%	---	0.0%	---	---	---	---	0.0%	---
AEMP-04 (Duplicate)	23-Jun-2018	0.0032	< 0.00060	0.00029	0.084	< 0.0010	0.029	< 0.000020	< 0.0010	< 0.00030	0.00055	< 0.060	< 0.00020	< 0.020	0.0070	< 0.0000020	0.0019	0.00059	< 0.10	< 0.00020	2.0	< 0.00010	1.3	< 0.00020	< 0.0010	< 0.0010	0.0010	< 0.0010	< 0.0030
	23-Jun-2018	0.0034	< 0.00060	0.00029	0.083	< 0.0010	0.026	< 0.000020	< 0.0010	< 0.00030	0.0010	< 0.060	< 0.00020	< 0.020	0.0066	< 0.0000020	0.0018	0.00063	< 0.10	< 0.00020	1.8	< 0.00010	1.2	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	0.019
	RPD(%)	6.1%	---	0.0%	1.2%	---	10.9%	---	---	---	58.1%	---	---	---	5.9%	---	5.4%	6.6%	---	---	10.5%	---	8.0%	---	---	---	---	9.5%	---
AEMP-04 (Duplicate)	10-Jun-2020	< 0.0030	< 0.00060	< 0.00020	0.076	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00044	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000019	0.0017	0.00064	< 0.10	< 0.00020	1.9	< 0.00010	1.2	< 0.00020	< 0.0010	< 0.0010	0.0012	< 0.0010	< 0.0030
	10-Jun-2020	< 0.0030	< 0.00060	0.00030	0.076	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00036	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000019	0.0020	< 0.00050	< 0.10	< 0.00020	1.9	< 0.00010	1.2	< 0.00020	< 0.0010	< 0.0010	0.0012	< 0.0010	< 0.0030
	RPD(%)	---	---	---	0.0%	---	---	---	---	---	20.0%	---	---	---	---	---	16.2%	---	---	---	0.0%	---	0.0%	---	---	---	---	0.0%	---
AEMP-06 (Duplicate)	25-Aug-2019	0.024 ^{#1}	< 0.00060	0.00023	0.038	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00091	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00068	0.00068	< 0.10	0.00022	1.5	< 0.00010	0.23	< 0.00020	< 0.0010	< 0.0010	0.00062	< 0.0010	< 0.0030
	02-Oct-2019	0.015 ^{#1}	< 0.00060	0.00024	0.036	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00078	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00077	0.00098	< 0.10	0.00021	1.4	< 0.00010	0.21	< 0.00020	< 0.0010	< 0.0010	0.00054	< 0.0010	< 0.0030
	RPD(%)	46.2%	---	4.3%	5.4%	---	---	---	---	---	15.4%	---	---	---	---	---	12.4%	36.1%	---	4.7%	6.9%	---	9.1%	---	---	---	---	13.8%	---
AEMP-07 (Duplicate)	21-Aug-2017	0.033 ^{#1}	< 0.00060	0.00034	0.043	< 0.0010	< 0.020	0.000028	< 0.0010	< 0.00030	0.0012	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00084	0.0011	< 0.10	0.00032	1.5	< 0.00010	0.22	< 0.00020	0.0010	< 0.0010	0.00065	< 0.0010	< 0.0030
	21-Aug-2017	0.030 ^{#1}	< 0.00060	0.00036	0.042	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0014	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000020	0.00083	0.00089	< 0.10	0.00032	1.5	< 0.00010	0.22	< 0.00020	< 0.0010	< 0.0010	0.00059	< 0.0010	< 0.0030
	RPD(%)	9.5%	---	5.7%	2.4%	---	---	---	---	---	15.4%	---	---	---	---	---	1.2%	21.1%	---	0.0%	0.0%	---	0.0%	---	---	---	---	9.7%	---
AEMP-07 (Duplicate)	17-Oct-2018	0.0077 ^{#1}	< 0.00060	0.00044	0.046	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00092	< 0.060	< 0.00020	< 0.020	0.013	< 0.0000020	0.00081	0.00086	< 0.10	0.00025	1.3	< 0.00010	0.23	< 0.00020	< 0.0010	< 0.0010	0.00050	< 0.0010	< 0.0030
	17-Oct-2018	0.0088 ^{#1}	< 0.00060	0.00046	0.048	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.00081	< 0.060	< 0.00020	< 0.020	0.018	< 0.0000020	0.00087	0.00091	< 0.10	0.00024	1.4	< 0.00010	0.22	< 0.00020	< 0.0010	< 0.0010	0.00048	< 0.0010	< 0.0030
	RPD(%)	13.3%	---	4.4%	4.3%	---	---	---	---	---	12.7%	---	---	---	32.3%	---	7.1%	5.6%	---	4.1%	7.4%	---	4.4%	---	---	---	---	4.1%	---
AEMP-07 (Duplicate)	24-Jul-2020	0.018 ^{#1}	< 0.00060	0.00026	0.041	< 0.0010	< 0.020	< 0.000020	< 0.0010	< 0.00030	0.0017	< 0.060	< 0.00020	< 0.020	< 0.0040	< 0.0000019	0.00097	0.0013	< 0.10	< 0.00020	1.5	< 0.00010	0.19	<					

Surface Water Analytical Results: Dissolved Metals and Trace Elements

PROJECT No.: 417011-00068																													
Sampling Location	Date (dd-mmm-yyyy)	Aluminum (mg/L)	Antimony (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Beryllium (mg/L)	Boron (mg/L)	Cadmium (mg/L)	Chromium (Total) (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Lithium (mg/L)	Manganese (mg/L)	Mercury (mg/L)	Molybdenum (mg/L)	Nickel (mg/L)	Phosphorus (mg/L)	Selenium (mg/L)	Silicon (mg/L)	Silver (mg/L)	Strontium (mg/L)	Thallium (mg/L)	Tin (mg/L)	Titanium (mg/L)	Uranium (mg/L)	Vanadium (mg/L)	Zinc (mg/L)
CCME CEQG Freshwater Aquatic Life #1		0.005	---	0.005	---	---	1.5	0.00009	0.0089	---	0.002	0.3	0.001	---	0.2	0.000026	0.073	0.025	---	0.001	---	0.00025	---	0.0008	---	---	0.015	---	0.03

6. Superscript ^{#1}denotes values exceeding
(CCME. 2014. Canadian Environmental Quality Guidelines Summary Table. Water Quality Guidelines for the Protection of Freshwater Aquatic Life.
<http://st-ts.ccme.ca/?chems=all&chapters=1> accessed Aug 22, 2014.)

Aluminum:
Standard varies with pH.
pH < 6.5 = 0.005 mg/L
pH >= 6.5 = 0.1 mg/L

Boron:
Guideline based on long term exposure

Cadmium:
Guideline based on long term exposure

Chromium (Total):
Limit is for Chromium(III).

Copper:
Guideline is hardness dependent. Presented guideline set to lower limit.

Lead:
Guideline is hardness dependent. Presented guideline set to lower limit.

Mercury:
Guideline for Inorganic mercury

Nickel:
Guideline is hardness dependent. Presented guideline set to lower limit.

Silver:
Guideline based on long term exposure

Uranium:
Guideline based on long term exposure

Surface Water Analytical Results: Total Metals and Trace Elements

PROJECT No.: 417011-00068																																	
Sampling Location	Date (dd-mmm-yyyy)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium (Total)	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
CCME CEQG Freshwater Aquatic Life ^{#1}		0.005	---	0.005	---	---	1.5	0.00009	---	0.0089	---	0.002	0.3	0.001	---	---	0.2	0.000026	0.073	0.025	---	---	0.001	---	0.00025	---	---	0.0008	---	---	0.015	---	0.03
AEMP																																	
AEMP-01	16-Sep-2017	0.52 ^{#1}	< 0.00060	0.00065	0.061	< 0.0010	< 0.020	0.000040	38	0.0010	0.00054	0.0020 ^{#1}	0.88 ^{#1}	0.00048	< 0.020	11	0.022	< 0.0000020	0.0011	0.0029	< 0.10	1.1	0.00034	2.4	< 0.00010	9.4	0.23	< 0.00020	< 0.0010	0.0082	0.00083	0.0026	0.023
	16-Oct-2017	0.33 ^{#1}	< 0.00060	0.00050	0.053	< 0.0010	< 0.020	0.000050	37	< 0.0010	0.00034	0.0017	0.50 ^{#1}	0.00034	< 0.020	11	0.015	< 0.0000020	0.0011	0.0026	< 0.10	1.1	0.00039	2.1	< 0.00010	9.1	0.24	< 0.00020	< 0.0010	0.0083	0.00080	0.0020	0.0045
	23-Jun-2018	1.5 ^{#1}	< 0.00060	0.0015	0.073	< 0.0010	< 0.020	0.00015 ^{#1}	37	0.0028	0.0025	0.0055 ^{#1}	2.3 ^{#1}	0.0016 ^{#1}	< 0.020	11	0.054	0.0000049	0.0016	0.0086	< 0.10	1.2	0.00060	2.9	< 0.00010	6.4	0.17	< 0.00020	< 0.0010	0.018	0.0011	0.0040	0.026
	14-Aug-2018	2.1 ^{#1}	< 0.00060	0.0016	0.099	< 0.0010	< 0.020	0.000042 ^{#1}	51	0.0022	0.0033	0.0064 ^{#1}	3.3 ^{#1}	0.0023 ^{#1}	< 0.020	15	0.13	0.0000010	0.0010	0.011	0.17	1.3	0.00048	4.3	< 0.00010	7.5	0.27	< 0.00020	< 0.0010	0.024	0.0011	0.0054	0.056 ^{#1}
	18-Oct-2018	0.45 ^{#1}	< 0.00060	0.00070	0.059	< 0.0010	< 0.020	0.000065	32	< 0.0010	0.00053	0.0021 ^{#1}	1.0 ^{#1}	0.00063	< 0.020	10	0.028	0.0000047	0.00076	0.0025	< 0.10	1.1	0.00030	2.1	< 0.00010	9.4	0.22	< 0.00020	< 0.0010	0.0079	0.00057	0.0016	0.0070
	10-Jun-2019	2.1 ^{#1}	0.00094	0.0023	0.10	< 0.0010	< 0.020	0.000015 ^{#1}	39	0.0038	0.0024	0.0078 ^{#1}	5.0 ^{#1}	0.0026 ^{#1}	< 0.020	11	0.11	0.0000089	0.0013	0.0087	0.11	1.6	0.00045	4.2	< 0.00010	6.3	0.19	< 0.00020	< 0.0010	0.028	0.00086	0.0059	0.045 ^{#1}
	26-Aug-2019	1.9 ^{#1}	< 0.00060	0.0011	0.077	< 0.0010	< 0.020	0.000084	42	0.0028	0.0012	0.0034 ^{#1}	2.2 ^{#1}	0.0010 ^{#1}	< 0.020	12	0.04	0.0000033	0.0011	0.0049	< 0.10	1.5	0.00062	5.5	< 0.00010	8.3	0.27	< 0.00020	< 0.0010	0.086	0.0011	0.0055	0.013
	01-Oct-2019	2.0 ^{#1}	< 0.00060	0.0017	0.11	< 0.0010	< 0.020	0.000012 ^{#1}	39	0.0037	0.0015	0.0050 ^{#1}	3.4 ^{#1}	0.0018 ^{#1}	< 0.020	12	0.047	0.0000074	0.0014	0.0066	< 0.10	1.5	0.00061	3.3	< 0.00010	9.2	0.25	< 0.00020	< 0.0010	0.037	0.00097	0.0060	0.017
	12-Jun-2020	5.3 ^{#1}	< 0.00060	0.0050 ^{#1}	0.19	< 0.0010	< 0.020	0.000036 ^{#1}	51	0.0089 ^{#1}	0.0060	0.013 ^{#1}	12 ^{#1}	0.0061 ^{#1}	< 0.020	15	0.22 ^{#1}	0.000021	0.0018	0.020	0.24	2.3	0.00066	8.8	< 0.00010	5.2	0.24	< 0.00020	< 0.0010	0.045	0.0012	0.014	0.078 ^{#1}
	28-Jul-2020	1.7 ^{#1}	< 0.00060	0.0020	0.11	< 0.0010	< 0.020	0.000020 ^{#1}	44	0.0074	0.0021	0.0060 ^{#1}	3.6 ^{#1}	0.0021 ^{#1}	< 0.020	12	0.086	0.000020	0.0013	0.0079	< 0.10	1.1	0.00062	3.7	< 0.00010	6.0	0.21	< 0.00020	< 0.0010	0.029	0.00098	0.0056	0.025
	22-Sep-2020	0.86 ^{#1}	0.0019	0.00092	0.061	< 0.0010	< 0.020	0.000074	40	0.0012	0.00065	0.0026 ^{#1}	1.3 ^{#1}	0.00066	< 0.020	11	0.029	0.0000026 ^{#1}	0.0011	0.0044	< 0.10	1.2	0.00036	3.3	< 0.00010	7.3	0.21	< 0.00020	< 0.0010	0.019	0.00090	0.0042	0.0076
AEMP-02	18-Aug-2017	0.039 ^{#1}	< 0.00060	0.00026	0.085	< 0.0010	0.031	0.000020	74	< 0.0010	< 0.00030	0.00092	0.11	< 0.00020	< 0.020	27	0.0098	0.0000021	0.0018	0.00079	< 0.10	1.1	0.00021	2.1	< 0.00010	22	1.3	< 0.00020	< 0.0010	0.0032	0.0010	0.0014	< 0.0030
	16-Sep-2017	0.031 ^{#1}	< 0.00060	0.00032	0.082	< 0.0010	0.024	< 0.000020	73	< 0.0010	< 0.00030	0.00064	0.096	< 0.00020	< 0.020	29	0.0087	< 0.0000020	0.0017	0.00077	< 0.10	1.0	< 0.00020	2.1	< 0.00010	19	1.3	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0030
(Duplicate)	16-Sep-2017	0.032 ^{#1}	< 0.00060	0.00027	0.080	< 0.0010	0.023	< 0.000020	72	< 0.0010	< 0.00030	0.00035	0.10	< 0.00020	< 0.020	28	0.0084	< 0.0000020	0.0018	0.00078	< 0.10	0.98	< 0.00020	2.1	< 0.00010	19	1.2	< 0.00020	< 0.0010	< 0.0010	0.0011	0.0013	< 0.0030
	16-Oct-2017	0.23 ^{#1}	< 0.00060	0.00040	0.079	< 0.0010	0.022	0.000027	75	< 0.0010	< 0.00030	0.00074	0.57 ^{#1}	0.00030	< 0.020	31	0.02	< 0.0000020	0.0019	0.0014	< 0.10	1.1	0.00025	2.3	< 0.00010	20	1.4	< 0.00020	< 0.0010	0.0039	0.0012	0.0020	< 0.0030
	23-Jun-2018	0.047 ^{#1}	< 0.00060	0.00036	0.086	< 0.0010	0.029	< 0.000020	76	< 0.0010	< 0.00030	0.00073	0.12	< 0.00020	< 0.020	27	0.0085	< 0.0000020	0.0027	0.0012	< 0.10	1.1	0.00031	2.0	< 0.00010	18	1.3	< 0.00020	< 0.0010	< 0.0010	0.0016	< 0.0010	< 0.0030
	12-Aug-2018	0.030 ^{#1}	< 0.00060	0.00026	0.073	< 0.0010	0.023	< 0.000020	72	< 0.0010	< 0.00030	0.00033	0.11	< 0.00020	< 0.020	28	0.0091	0.0000025	0.0018	0.0010	< 0.10	0.93	< 0.00020	2.1	< 0.00010	14	1.3	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0030
	16-Oct-2018	0.20 ^{#1}	< 0.00060	0.00024	0.074	< 0.0010	0.027	0.000031	78	< 0.0010	< 0.00030	0.00071	0.50 ^{#1}	0.00026	< 0.020	31	0.017	0.0000020	0.0019	0.0013	< 0.10	1.1	0.00031	2.3	< 0.00010	18	1.5	< 0.00020	< 0.0010	0.0038	0.0013	< 0.0010	< 0.0030
	03-Jun-2019	0.081 ^{#1}	< 0.00060	0.00032	0.076	< 0.0010	0.022	< 0.000020	67	< 0.0010	< 0.00030	0.00076	0.18	< 0.00020	< 0.020	25	0.0078	< 0.0000020	0.0016	0.00089	< 0.10	1.1	< 0.00020	1.8	< 0.00010	15	1.1	< 0.00020	< 0.0010	0.0012</			

Surface Water Analytical Results: Total Metals and Trace Elements

PROJECT No.: 417011-00068																																	
Sampling Location	Date (dd-mmm-yyyy)																																
		Aluminum (mg/L)	Antimony (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Beryllium (mg/L)	Boron (mg/L)	Cadmium (mg/L)	Calcium (mg/L)	Chromium (Total) (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Lithium (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Mercury (mg/L)	Molybdenum (mg/L)	Nickel (mg/L)	Phosphorus (mg/L)	Potassium (mg/L)	Selenium (mg/L)	Silicon (mg/L)	Silver (mg/L)	Sodium (mg/L)	Strontium (mg/L)	Thallium (mg/L)	Tin (mg/L)	Titanium (mg/L)	Uranium (mg/L)	Vanadium (mg/L)	Zinc (mg/L)
CCME CEQG Freshwater Aquatic Life ^{#1}		0.005	---	0.005	---	---	1.5	0.00009	---	0.0089	---	0.002	0.3	0.001	---	---	0.2	0.000026	0.073	0.025	---	---	0.001	---	0.00025	---	---	0.0008	---	---	0.015	---	0.03
AEMP-05	19-Aug-2017	0.015 ^{#1}	< 0.00060	0.0011	0.16	< 0.0010	< 0.020	< 0.000020	52	< 0.0010	< 0.00030	0.00034	0.17	< 0.00020	< 0.020	14	0.013	0.0000038	0.0017	0.0011	< 0.10	1.7	< 0.00020	0.27	< 0.00010	5.7	0.25	< 0.00020	< 0.0010	< 0.0010	0.00041	0.0024	< 0.0030
	16-Sep-2017	0.012 ^{#1}	< 0.00060	0.00073	0.15	< 0.0010	< 0.020	< 0.000020	48	< 0.0010	< 0.00030	0.00032	0.078	< 0.00020	< 0.020	13	0.0051	< 0.0000020	0.0016	0.0013	< 0.10	1.7	< 0.00020	0.27	< 0.00010	5.4	0.20	< 0.00020	< 0.0010	< 0.0010	0.00036	0.0011	< 0.0030
	15-Oct-2017	0.025 ^{#1}	< 0.00060	0.00060	0.15	< 0.0010	< 0.020	< 0.000020	51	< 0.0010	< 0.00030	0.00030	0.11	< 0.00020	< 0.020	14	0.006	< 0.0000020	0.0016	0.0011	< 0.10	2.3	0.00027	0.41	< 0.00010	5.4	0.20	< 0.00020	< 0.0010	< 0.0010	0.00034	0.0015	< 0.0030
	23-Jun-2018	1.4 ^{#1}	< 0.00060	0.0018	0.089	< 0.0010	< 0.020	0.00017 ^{#1}	39	0.0025	0.0022	0.0058 ^{#1}	2.4 ^{#1}	0.0018 ^{#1}	< 0.020	11	0.075	0.0000049	0.0016	0.0081	< 0.10	1.2	0.00054	2.8	< 0.00010	6.4	0.19	< 0.00020	< 0.0010	0.022	0.0011	0.0044	0.024
	13-Aug-2018	0.033 ^{#1}	< 0.00060	0.0011	0.14	< 0.0010	< 0.020	< 0.000020	42	< 0.0010	< 0.00030	0.00029	0.50 ^{#1}	< 0.00020	< 0.020	14	0.031	0.0000028	0.0017	0.0011	< 0.10	1.4	< 0.00020	0.50	< 0.00010	3.6	0.16	< 0.00020	< 0.0010	0.0011	0.00017	< 0.0010	< 0.0030
	18-Oct-2018	0.033 ^{#1}	< 0.00060	0.00075	0.17	< 0.0010	< 0.020	< 0.000020	50	< 0.0010	< 0.00030	0.00042	0.34 ^{#1}	< 0.00020	< 0.020	15	0.18	< 0.0000020	0.0016	0.0016	< 0.10	3.5	< 0.00020	0.36	< 0.00010	4.2	0.20	< 0.00020	< 0.0010	0.0014	0.00035	< 0.0010	< 0.0030
	02-Jun-2019	0.067 ^{#1}	< 0.00060	0.0011	0.14	< 0.0010	< 0.020	< 0.000020	44	< 0.0010	< 0.00030	0.00038	0.56 ^{#1}	< 0.00020	< 0.020	13	0.041	< 0.0000020	0.0010	0.0014	< 0.10	2.3	< 0.00020	1.1	< 0.00010	3.8	0.14	< 0.00020	< 0.0010	0.0011	0.00028	< 0.0010	0.0071
	27-Aug-2019	0.016 ^{#1}	< 0.00060	0.00085	0.16	< 0.0010	< 0.020	< 0.000020	44	< 0.0010	< 0.00030	0.00027	0.12	< 0.00020	< 0.020	13	0.0056	< 0.0000020	0.0014	0.00078	< 0.10	2.0	< 0.00020	0.25	< 0.00010	3.4	0.16	< 0.00020	< 0.0010	< 0.0010	0.00020	< 0.0010	< 0.0030
	01-Oct-2019	0.042 ^{#1}	< 0.00060	0.00069	0.16	< 0.0010	< 0.020	< 0.000020	42	< 0.0010	< 0.00030	0.00038	0.41 ^{#1}	< 0.00020	< 0.020	16	0.0094	< 0.0000020	0.0013	0.0011	< 0.10	1.8	< 0.00020	0.33	< 0.00010	3.3	0.15	< 0.00020	< 0.0010	0.0012	0.00017	< 0.0010	< 0.0030
	11-Jun-2020	0.036 ^{#1}	< 0.00060	0.0012	0.10	< 0.0010	< 0.020	0.000041	40	< 0.0010	< 0.00030	0.0012	0.46 ^{#1}	< 0.00020	< 0.020	10	0.033	0.0000023	0.0018	0.0022	< 0.10	1.5	< 0.00020	1.3	< 0.00010	4.3	0.16	< 0.00020	< 0.0010	0.0011	0.00048	< 0.0010	< 0.0030
	26-Jul-2020	0.021 ^{#1}	< 0.00060	0.0011	0.16	< 0.0010	< 0.020	< 0.000020	57	0.0013	< 0.00030	0.00084	0.38 ^{#1}	< 0.00020	< 0.020	14	0.013	< 0.0000019	0.0015	0.00084	< 0.10	1.4	< 0.00020	0.35	< 0.00010	4.9	0.24	< 0.00020	< 0.0010	< 0.0010	0.00032	< 0.0010	< 0.0030
	16-Sep-2020	0.0062 ^{#1}	< 0.00060	0.00077	0.13	< 0.0010	< 0.020	< 0.000020	43	< 0.0010	< 0.00030	0.00086	0.43 ^{#1}	< 0.00020	< 0.020	13	0.0065	< 0.0000019	0.0014	0.0010	< 0.10	1.4	< 0.00020	0.37	< 0.00010	4.0	0.17	< 0.00020	< 0.0010	< 0.0010	0.00016	< 0.0010	< 0.0030
AEMP-06	21-Aug-2017	0.66 ^{#1}	< 0.00060	0.00095	0.061	< 0.0010	< 0.020	0.000055	34	0.0011	0.00079	0.0023 ^{#1}	1.3 ^{#1}	0.00071	< 0.020	11	0.031	0.0000028	0.0010	0.0031	< 0.10	1.1	0.00035	2.4	< 0.00010	8.3	0.23	< 0.00020	< 0.0010	0.0087	0.00075	0.0023	0.0074
	16-Sep-2017	0.36 ^{#1}	< 0.00060	0.00063	0.049	< 0.0010	< 0.020	0.000032	31	< 0.0010	0.00042	0.0014	0.68 ^{#1}	0.00043	< 0.020	10	0.019	< 0.0000020	0.00086	0.0021	< 0.10	0.96	0.00022	2.0	< 0.00010	9.4	0.21	< 0.00020	< 0.0010	0.0061	0.00062	0.0020	0.0065
	16-Oct-2017	0.24 ^{#1}	< 0.00060	0.00050	0.044	< 0.0010	< 0.020	0.000023	31	< 0.0010	< 0.00030	0.0013	0.36 ^{#1}	0.00025	< 0.020	11	0.016	< 0.0000020	0.0013	0.0018	< 0.10	1.0	0.00024	1.8	< 0.00010	9.1	0.22	< 0.00020	< 0.0010	0.0069	0.00080	0.0019	0.0036
	23-Jun-2018	0.90 ^{#1}	< 0.00060	0.0012	0.055	< 0.0010	< 0.020	0.000087	29	0.0017	0.0012	0.0038 ^{#1}	1.2 ^{#1}	0.0010 ^{#1}	< 0.020	8.8	0.029	< 0.0000020	0.0014	0.0051	< 0.10	0.98	0.00043	2.1	< 0.00010	6.8	0.17	< 0.00020	< 0.0010	0.010	0.00092	0.0030	0.012
	13-Aug-2018	0.56 ^{#1}	< 0.00060	0.00068	0.049	< 0.0010	< 0.020	0.000061	33	< 0.0010	0.00054	0.0018	0.70 ^{#1}	0.00045	< 0.020	10	0.021	0.0000033	0.00085	0.0028	< 0.10	0.92	0.00030	2.2	< 0.00010	8.7	0.22	< 0.00020	< 0.0010	0.0071	0.00066	0.0016	0.0094
	18-Oct-2018	1.7 ^{#1}	0.00098	0.0020	0.10	< 0.0010	< 0.020	0.000015 ^{#1}	35	0.0033	0.0024	0.0075 ^{#1}	4.5 ^{#1}	0.0027 ^{#1}	< 0.020	11	0.099	0.0000079	0.0012	0.0086	0.12	1.5	0.00031	5.0	< 0.00010	9.1	0.23	< 0.00020	< 0.0010	0.019	0.00076	0.0	

Surface Water Analytical Results: Total Metals and Trace Elements

PROJECT No.: 417011-00068																																	
Sampling Location	Date (dd-mmm-yyyy)																																
		Aluminum (mg/L)	Antimony (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Beryllium (mg/L)	Boron (mg/L)	Cadmium (mg/L)	Calcium (mg/L)	Chromium (Total) (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Lithium (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Mercury (mg/L)	Molybdenum (mg/L)	Nickel (mg/L)	Phosphorus (mg/L)	Potassium (mg/L)	Selenium (mg/L)	Silicon (mg/L)	Silver (mg/L)	Sodium (mg/L)	Strontium (mg/L)	Thallium (mg/L)	Tin (mg/L)	Titanium (mg/L)	Uranium (mg/L)	Vanadium (mg/L)	Zinc (mg/L)
CCME CEQG Freshwater Aquatic Life ^{#1}		0.005	---	0.005	---	---	1.5	0.00009	---	0.0089	---	0.002	0.3	0.001	---	---	0.2	0.000026	0.073	0.025	---	---	0.001	---	0.00025	---	---	0.0008	---	---	0.015	---	0.03
AEMP-09	21-Aug-2017	3.2 ^{#1}	< 0.00060	0.0033	0.12	< 0.0010	0.021	0.000021 ^{#1}	48	0.0067	0.0040	0.0092 ^{#1}	7.1 ^{#1}	0.0040 ^{#1}	< 0.020	16	0.16	0.000011	0.0015	0.013	0.18	1.6	0.00051	5.0	< 0.00010	8.8	0.28	< 0.00020	< 0.0010	0.030	0.0011	0.0087	0.034 ^{#1}
	16-Sep-2017	0.24 ^{#1}	< 0.00060	0.00057	0.052	< 0.0010	< 0.020	0.000033	34	< 0.0010	0.00032	0.0014	0.40 ^{#1}	0.00038	< 0.020	11	0.028	0.0000022	0.00094	0.0017	< 0.10	0.94	0.00024	1.8	< 0.00010	10	0.24	< 0.00020	< 0.0010	0.0054	0.00076	0.0014	0.0032
	16-Oct-2017	2.5 ^{#1}	< 0.00060	0.0024	0.14	< 0.0010	0.052	0.000020 ^{#1}	45	0.0041	0.0029	0.0073 ^{#1}	6.2 ^{#1}	0.0031 ^{#1}	< 0.020	15	0.21 ^{#1}	< 0.0000020	0.0011	0.0090	0.11	1.8	0.00043	5.3	< 0.00010	28	0.26	< 0.00020	< 0.0010	0.028	0.00081	0.0081	0.026
	23-Jun-2018	1.8 ^{#1}	< 0.00060	0.0023	0.083	< 0.0010	< 0.020	0.00012 ^{#1}	34	0.0037	0.0025	0.0061 ^{#1}	3.4 ^{#1}	0.0024 ^{#1}	< 0.020	11	0.082	0.0000069	0.0012	0.0083	< 0.10	1.2	0.00042	3.0	< 0.00010	7.5	0.18	< 0.00020	< 0.0010	0.019	0.00095	0.0059	0.024
	12-Aug-2018	0.74 ^{#1}	< 0.00060	0.0010	0.062	< 0.0010	< 0.020	0.000073	36	0.0011	0.00079	0.0023 ^{#1}	1.3 ^{#1}	0.00076	< 0.020	11	0.038	0.0000043	0.0010	0.0034	< 0.10	1.1	0.00036	2.4	< 0.00010	10	0.26	< 0.00020	< 0.0010	0.019	0.00071	0.0024	0.010
	17-Oct-2018	0.87 ^{#1}	< 0.00060	0.0013	0.087	< 0.0010	0.020	0.000091 ^{#1}	32	0.0016	0.0011	0.0057 ^{#1}	1.9 ^{#1}	0.0012 ^{#1}	< 0.020	11	0.058	0.0000043	0.0011	0.0039	< 0.10	1.2	0.00031	2.6	< 0.00010	12	0.27	< 0.00020	< 0.0010	0.061	0.00070	0.0025	0.011
	02-Jun-2019	3.7 ^{#1}	0.0028	0.0035	0.13	< 0.0010	< 0.020	0.000020 ^{#1}	43	0.0067	0.0045	0.011 ^{#1}	8.9 ^{#1}	0.0043 ^{#1}	< 0.020	13	0.18	0.000015	0.0017	0.015	0.18	1.8	0.00048	5.7	< 0.00010	9.1	0.21	< 0.00020	< 0.0010	0.035	0.0010	0.011	0.074 ^{#1}
	28-Aug-2019	0.72 ^{#1}	< 0.00060	0.00050	0.062	< 0.0010	< 0.020	0.000032	34	< 0.0010	0.00046	0.0024 ^{#1}	0.89 ^{#1}	0.00049	< 0.020	11	0.022	< 0.0000020	0.0011	0.0018	< 0.10	1.1	0.00032	2.9	< 0.00010	9.4	0.24	< 0.00020	< 0.0010	0.016	0.00069	0.0027	0.0038
	03-Oct-2019	0.57 ^{#1}	< 0.00060	0.00076	0.067	< 0.0010	< 0.020	0.000047	33	0.0011	0.00058	0.0028 ^{#1}	1.4 ^{#1}	0.00076	< 0.020	10	0.031	0.0000029	0.0011	0.0055	< 0.10	1.2	0.00033	2.9	< 0.00010	10	0.24	< 0.00020	< 0.0010	0.010	0.00062	0.0024	0.0086
	10-Jun-2020	2.3 ^{#1}	< 0.00060	0.0027	0.13	< 0.0010	0.022	0.000018 ^{#1}	33	0.0036	0.0024	0.0062 ^{#1}	5.8 ^{#1}	0.0029 ^{#1}	< 0.020	9.8	0.11	< 0.000019	0.0013	0.0081	0.12	2.3	0.00037	12	< 0.00010	8.0	0.20	< 0.00020	< 0.0010	0.027	0.00083	0.0068	0.045 ^{#1}
24-Jul-2020	0.019 ^{#1}	< 0.00060	0.00022	0.080	< 0.0010	0.033	< 0.000020	82	< 0.0010	< 0.00030	0.00067	0.088	< 0.00020	< 0.020	28	0.0052	< 0.000019	0.0021	0.0016	< 0.10	0.85	0.00024	1.9	0.00014	22	1.4	< 0.00020	< 0.0010	< 0.0010	0.0013	< 0.0010	< 0.0030	
18-Sep-2020	1.0 ^{#1}	0.0022	0.0013	0.076	< 0.0010	< 0.020	0.000066	37	0.0024	0.0010	0.0041 ^{#1}	1.9 ^{#1}	0.0010 ^{#1}	< 0.020	10	0.051	< 0.0000019	0.0010	0.0041	< 0.10	1.3	0.00039	3.3	< 0.00010	10	0.20	< 0.00020	0.0017	0.053	0.00085	0.0035	0.011	
AEMP-10 (Duplicate)	23-Jun-2018	0.93 ^{#1}	< 0.00060	0.0011	0.061	< 0.0010	< 0.020	0.000080	32	0.0018	0.0012	0.0036 ^{#1}	1.5 ^{#1}	0.00093	< 0.020	8.7	0.031	0.0000033	0.0011	0.0050	< 0.10	1.1	0.00041	2.5	< 0.00010	6.1	0.15	< 0.00020	< 0.0010	0.024	0.00085	0.0027	0.011
	14-Aug-2018	1.6 ^{#1}	< 0.00060	0.0013	0.077	< 0.0010	< 0.020	0.00015 ^{#1}	40	0.0014	0.0016	0.0037 ^{#1}	2.0 ^{#1}	0.0012 ^{#1}	< 0.020	12	0.052	0.0000068	0.0011	0.0057	< 0.10	1.3	0.00047	4.1	< 0.00010	7.8	0.24	< 0.00020	< 0.0010	0.029	0.00084	0.0035	0.021
	14-Aug-2018	1.4 ^{#1}	< 0.00060	0.0011	0.076	< 0.0010	< 0.020	0.00015 ^{#1}	40	0.0016	0.0015	0.0036 ^{#1}	2.1 ^{#1}	0.0011 ^{#1}	< 0.020	12	0.052	0.0000052	0.0011	0.0054	< 0.10	1.3	0.00042	3.8	< 0.00010	7.7	0.23	< 0.00020	< 0.0010	0.068	0.00086	0.0037	0.020
	18-Oct-2018	0.44 ^{#1}	< 0.00060	0.00069	0.057	< 0.0010	< 0.020	0.000053	28	< 0.0010	0.00047	0.0016	0.89 ^{#1}	0.00057	< 0.020	9.6	0.028	< 0.0000020	0.00079	0.0031	< 0.10	0.98	< 0.00020	1.9	< 0.00010	9.5	0.22	< 0.00020	< 0.0010	0.014	0.00057	0.0016	0.0055
	10-Jun-2019	2.0 ^{#1}	0.00096	0.0021	0.098	< 0.0010	< 0.020	0.00015 ^{#1}	38	0.0033	0.0024	0.0074 ^{#1}	4.8 ^{#1}	0.0026 ^{#1}	< 0.020	10	0.11	0.0000090	0.0012	0.0081	0.11	1.5	0.00038	4.0	< 0.00010	6.2	0.18	< 0.00020	< 0.0010	0.028	0.00087	0.0056	0.042 ^{#1}
	26-Aug-2019	1.7 ^{#1}	< 0.00060	0.0013	0.076	< 0.0010	< 0.020	0.000083	40	0.0026	0.0010	0.0031 ^{#1}	2.2 ^{#1}	0.0011 ^{#1}	< 0.020	11	0.042	< 0.0000020	0.0011	0.0043	< 0.10	1.5	0.00053	5.2	< 0.00010	8.1	0.24	< 0.00020	< 0.0010	0.028	0.00097	0.0048	0.013
	01-Oct-2019	1.6 ^{#1}	< 0.00060	0.0011	0.085	< 0.0010	< 0.020	0.000086	37	0.0026	0.0010	0.0043 ^{#1}	2.3 ^{#1}	0.0014 ^{#1}	< 0.020	11	0.028	0.0000061	0.001														

Surface Water Analytical Results: Total Metals and Trace Elements

PROJECT No.: 417011-00068																																	
Sampling Location	Date (dd-mmm-yyyy)																																
		Aluminum (mg/L)	Antimony (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Beryllium (mg/L)	Boron (mg/L)	Cadmium (mg/L)	Calcium (mg/L)	Chromium (Total) (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Lithium (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Mercury (mg/L)	Molybdenum (mg/L)	Nickel (mg/L)	Phosphorus (mg/L)	Potassium (mg/L)	Selenium (mg/L)	Silicon (mg/L)	Silver (mg/L)	Sodium (mg/L)	Strontium (mg/L)	Thallium (mg/L)	Tin (mg/L)	Titanium (mg/L)	Uranium (mg/L)	Vanadium (mg/L)	Zinc (mg/L)
CCME CEQG Freshwater Aquatic Life ^{#1}		0.005	---	0.005	---	---	1.5	0.00009	---	0.0089	---	0.002	0.3	0.001	---	---	0.2	0.000026	0.073	0.025	---	---	0.001	---	0.00025	---	---	0.0008	---	---	0.015	---	0.03
Relative Percent Difference (RPD) Report																																	
AEMP-02 (Duplicate)	16-Sep-2017	0.031 ^{#1}	< 0.00060	0.00032	0.082	< 0.0010	0.024	< 0.000020	73	< 0.0010	< 0.00030	0.00064	0.096	< 0.00020	< 0.020	29	0.0087	< 0.0000020	0.0017	0.00077	< 0.10	1.0	< 0.00020	2.1	< 0.00010	19	1.3	< 0.00020	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0030
	16-Sep-2017	0.032 ^{#1}	< 0.00060	0.00027	0.080	< 0.0010	0.023	< 0.000020	72	< 0.0010	< 0.00030	0.00035	0.10	< 0.00020	< 0.020	28	0.0084	< 0.0000020	0.0018	0.00078	< 0.10	0.98	< 0.00020	2.1	< 0.00010	19	1.2	< 0.00020	< 0.0010	< 0.0010	0.0011	0.0013	< 0.0030
	RPD(%)	3.2%	---	16.9%	2.5%	---	4.3%	---	1.4%	---	---	58.6%	4.1%	---	---	3.5%	3.5%	---	5.7%	1.3%	---	2.0%	---	0.0%	---	0.0%	8.0%	---	---	---	0.0%	---	---
AEMP-02 (Duplicate)	03-Jun-2019	0.081 ^{#1}	< 0.00060	0.00032	0.076	< 0.0010	0.022	< 0.000020	67	< 0.0010	< 0.00030	0.00076	0.18	< 0.00020	< 0.020	25	0.0078	< 0.0000020	0.0016	0.00089	< 0.10	1.1	< 0.00020	1.8	< 0.00010	15	1.1	< 0.00020	< 0.0010	0.0012	0.0011	< 0.0010	< 0.0030
	03-Jun-2019	0.078 ^{#1}	< 0.00060	0.00027	0.077	< 0.0010	0.022	< 0.000020	68	< 0.0010	< 0.00030	0.00061	0.19	< 0.00020	< 0.020	25	0.0081	< 0.0000020	0.0017	0.00079	< 0.10	1.0	< 0.00020	1.8	< 0.00010	15	1.1	< 0.00020	< 0.0010	0.0022	0.0011	< 0.0010	< 0.0030
	RPD(%)	3.8%	---	16.9%	1.3%	---	0.0%	---	1.5%	---	---	21.9%	5.4%	---	---	0.0%	3.8%	---	6.1%	11.9%	---	9.5%	---	0.0%	---	0.0%	0.0%	---	---	58.8%	0.0%	---	---
AEMP-04 (Duplicate)	16-Oct-2017	0.087 ^{#1}	< 0.00060	0.00027	0.072	< 0.0010	< 0.020	< 0.000020	74	< 0.0010	< 0.00030	0.00041	0.21	< 0.00020	< 0.020	31	0.010	< 0.0000020	0.0020	0.00088	< 0.10	1.0	0.00025	2.1	< 0.00010	19	1.4	< 0.00020	< 0.0010	0.0015	0.0013	0.0015	< 0.0030
	16-Oct-2017	0.084 ^{#1}	< 0.00060	0.00036	0.072	< 0.0010	0.021	< 0.000020	74	< 0.0010	< 0.00030	0.00046	0.20	< 0.00020	< 0.020	31	0.010	< 0.0000020	0.0020	0.00084	< 0.10	1.0	0.00026	2.1	< 0.00010	19	1.4	< 0.00020	< 0.0010	0.0022	0.0013	0.0014	< 0.0030
	RPD(%)	3.5%	---	28.6%	0.0%	---	---	---	0.0%	---	---	11.5%	4.9%	---	---	0.0%	0.0%	---	0.0%	4.7%	---	0.0%	3.9%	0.0%	0.0%	---	---	---	37.8%	0.0%	6.9%	---	
AEMP-04 (Duplicate)	23-Jun-2018	0.090 ^{#1}	< 0.00060	0.00044	0.086	< 0.0010	0.029	< 0.000020	76	< 0.0010	< 0.00030	0.00083	0.14	< 0.00020	< 0.020	27	0.0098	< 0.0000020	0.0028	0.0012	< 0.10	1.1	0.00028	2.0	< 0.00010	19	1.3	< 0.00020	< 0.0010	0.0014	0.0015	< 0.0010	< 0.0030
	23-Jun-2018	0.057 ^{#1}	< 0.00060	0.00034	0.089	< 0.0010	0.031	< 0.000020	78	< 0.0010	< 0.00030	0.00077	0.15	< 0.00020	< 0.020	28	0.010	< 0.0000020	0.0023	0.00087	< 0.10	1.2	0.00023	2.1	< 0.00010	19	1.3	< 0.00020	< 0.0010	0.0015	0.0013	< 0.0010	< 0.0030
	RPD(%)	44.9%	---	25.6%	3.4%	---	6.7%	---	2.6%	---	---	7.5%	6.9%	---	---	3.6%	2.0%	---	19.6%	31.9%	---	8.7%	19.6%	4.9%	---	0.0%	0.0%	---	---	6.9%	14.3%	---	---
AEMP-04 (Duplicate)	10-Jun-2020	0.086 ^{#1}	< 0.00060	0.00034	0.078	< 0.0010	0.020	< 0.000020	70	< 0.0010	< 0.00030	0.00049	0.21	< 0.00020	< 0.020	26	0.0054	< 0.0000019	0.0021	0.00095	< 0.10	0.87	0.00025	2.2	< 0.00010	12	1.3	< 0.00020	< 0.0010	0.0023	0.0013	< 0.0010	< 0.0030
	10-Jun-2020	0.087 ^{#1}	< 0.00060	< 0.00020	0.079	< 0.0010	0.020	< 0.000020	70	< 0.0010	< 0.00030	0.00049	0.23	< 0.00020	< 0.020	27	0.0059	< 0.0000019	0.0020	0.00096	< 0.10	0.90	0.00025	2.3	< 0.00010	12	1.3	< 0.00020	< 0.0010	0.0031	0.0013	< 0.0010	< 0.0030
	RPD(%)	1.2%	---	---	1.3%	---	0.0%	---	0.0%	---	---	0.0%	9.1%	---	---	3.8%	8.8%	---	4.9%	1.0%	---	3.4%	0.0%	4.4%	---	0.0%	0.0%	---	---	29.6%	0.0%	---	---
AEMP-06 (Duplicate)	25-Aug-2019	0.78 ^{#1}	< 0.00060	0.00072	0.054	< 0.0010	< 0.020	0.000047	32	0.0013	0.00054	0.0017	1.1 ^{#1}	0.00059	< 0.020	10	0.021	0.0000021	0.00085	0.0025	< 0.10	1.1	0.00039	3.2	< 0.00010	8.4	0.22	< 0.00020	< 0.0010	0.020	0.00065	0.0024	0.0073
	02-Oct-2019	0.66 ^{#1}	< 0.00060	0.00061	0.053	< 0.0010	< 0.020	0.000037	29	0.0011	0.00039	0.0017	0.88 ^{#1}	0.00043	< 0.020	9.5	0.015	< 0.0000020	0.00084	0.0024	< 0.10	1.1	0.00027	3.0	< 0.00010	8.2	0.21	< 0.00020	< 0.0010	0.014	0.00062	0.0024	0.0052
	RPD(%)	16.7%	---	16.5%	1.9%	---	---	23.8%	9.8%	16.7%	32.3%	0.0%	22.2%	31.4%	---	5.1%	33.3%	---	1.2%	4.1%	---	0.0%	36.4%	6.5%	---	2.4%	4.7%	---	---	35.3%	4.7%	0.0%	33.6%
AEMP-07 (Duplicate)	21-Aug-2017	0.62 ^{#1}	< 0.00060	0.00083	0.058	< 0.0010	< 0.020	0.000060	33	0.0011	0.00069	0.0023 ^{#1}	1.2 ^{#1}	0.00063	< 0.020	10	0.029	0.0000024	0.00097	0.0030	< 0.10	1.1	0.00034	2.4	< 0.00010	8.1	0.23	< 0.00020	< 0.0010	0.0089	0.00074	0.0022	0.0082
	21-Aug-2017	0.67 ^{#1}	< 0.00060	0.00093	0.059	< 0.0010	< 0.020	0.000053	33	0.0013	0.00077	0.0025 ^{#1}	1.3 ^{#1}	0.00074	< 0.020	11	0.031	0.0000026	0.0010	0.0032	< 0.10	1.1	0.00038	2.4	< 0.00010	8.2	0.23	< 0.00020	< 0.0010	0.011	0.00079	0.0024	0.0078
	RPD(%)	7.8%	---	11.4%	1.7%	---	---	12.4%	0.0%	16.7%	11.0%	8.3%	8.0%	16.1%	---	9.5%	6.7%	8.0%	3.0%	6.5%	---	0.0%	11.1%	0.0%	---	1.2%	0.0%	---	---	21.1%	6.5%	8.7%	5.0%
AEMP-07 (Duplicate)	17-Oct-2018	0.34 ^{#1}	< 0.00060	0.00060	0.052	< 0.0010	< 0.020	0.000040	28	< 0.0010	0.00042	0.0018	0.66 ^{#1}	0.00047	< 0.020	9.1	0.024	< 0.0000020	0.00091	0.0020	< 0.10	1.0	< 0.00020	2.1	< 0.00010	9.5	0.21	< 0.00020	< 0.0010	0.013	0.00059	< 0.0010	0.0039
	17-Oct-2018	0.34 ^{#1}	< 0.00060	0.00046	0.053	< 0.0010	< 0.020	0.000038	28	< 0.0010	0.00040	0.0015	0.72 ^{#1}	0.00047																			

Surface Water Analytical Results: Total Metals and Trace Elements

PROJECT No.: 417011-00068																																	
Sampling Location	Date (dd-mmm-yyyy)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium (Total)	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
CCME CEQG Freshwater Aquatic Life ^{#1}		0.005	---	0.005	---	---	1.5	0.00009	---	0.0089	---	0.002	0.3	0.001	---	---	0.2	0.000026	0.073	0.025	---	---	0.001	---	0.00025	---	---	0.0008	---	---	0.015	---	0.03

6. Superscript ^{#1}denotes values exceeding
(CCME, 2014. Canadian Environmental Quality Guidelines Summary Table. Water Quality Guidelines for the Protection of Freshwater Aquatic Life.
<http://st-ts.ccme.ca/?chems=all&chapters=1> accessed Aug 22, 2014.)

Aluminum:
Standard varies with pH.
pH < 6.5 = 0.005 mg/L
pH >= 6.5 = 0.1 mg/L

Boron:
Guideline based on long term exposure

Cadmium:
Guideline based on long term exposure

Chromium (Total):
Limit is for Chromium(III).

Copper:
Guideline is hardness dependent. Presented guideline set to lower limit.

Lead:
Guideline is hardness dependent. Presented guideline set to lower limit.

Mercury:
Guideline for Inorganic mercury

Nickel:
Guideline is hardness dependent. Presented guideline set to lower limit.

Silver:
Guideline based on long term exposure

Uranium:
Guideline based on long term exposure



Appendix A

Limitation of Liability, Scope of Report, and Third-Party Reliance

Limitation of Liability, Scope of Report, and Third-Party Reliance

This report has been prepared and the work referred to in this report has been undertaken by Worley Canada Services Ltd., operating as Advisian (Advisian) for Imperial Oil Limited. It is intended for the sole and exclusive use of Imperial Oil Limited, its affiliated companies and partners and their respective [insurers], agents, employees, and advisors (collectively, "Imperial Oil"). Any use, reliance on or decision made by any person other than Imperial Oil based on this report is the sole responsibility of such other person. Imperial Oil and Advisian make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

The investigation undertaken by Advisian with respect to this report and any conclusions or recommendations made in this report reflect Advisian's judgment based on the site conditions observed at the time of the site inspection on the date(s) set out in this report and on information available at the time of preparation of this report. This report has been prepared for the specific application to this site and it is based, in part, upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site, substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken.

If site conditions or applicable standards change or if any additional information becomes available at a future date, modifications to the findings, conclusions, and recommendations in this report may be necessary.

Other than by Imperial Oil, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of Advisian. Nothing in this report is intended to constitute or provide a legal opinion.



Appendix B
Field Procedures



Scope The following procedure is applicable for field filtration of surface water quality samples.

1. SAFETY CONSIDERATIONS

This Preferred Operating Procedure (POP) does not address all of the safety issues associated with this task or with other activities that may be undertaken in conjunction with this task. Refer to the WorleyParsons safety management system and the site-specific hazard assessment to identify the potential hazards, mitigations, and controls.

2. MATERIALS AND EQUIPMENT

The following equipment is needed to complete this task:

- Disposable nitrile gloves.
- Sample containers.

Syringe Filtering

- Disposable filter disk (0.45 µm pore size).
- Disposable syringe compatible with filter disk.

Disposable Bailer Filtering

- Disposable capsule filters (0.45 µm pore size).
- Disposable bailer and spigot.
- Clean flexible tubing which fits inside the outlet of bailer or funnel.
- Waterra cutters.

3. PROCEDURES

Syringe Filtering

- 1) Put on clean nitrile gloves before handling sampling equipment.
- 2) Remove the syringe from packaging and rinse the barrel of the syringe three times with ambient surface water.
- 3) Fill the barrel of the syringe with sample water, and then screw the disposal filter disk firmly to the syringe tip.
- 4) Using the plunger of the syringe, force the sample water through the filter disk and into the sample container. Ensure that the sample container is filled to approximately 20% of capacity and the lid tightened securely. Shake the filtered sample water so that it comes in contact with the entire inside surface of the sample container. Discard filtered sample water rinsate downstream if in flowing waters, or on the opposite side of the boat/canoe in lakes or wetlands. Repeat three times.
- 5) Remove the filter disk and plunger, fill the barrel of the syringe with sample water, and use the plunger of the syringe to force sample water through the filter disk into the rinsed sample container. Repeat as needed until the sample container is filled. Ensure that the sample container lid is secured tightly, and that the container is labelled.
- 6) If required, preserve samples using laboratory-supplied preservatives according to laboratory instructions.

Disposable Bailer Filtering

- 1) Put on clean nitrile gloves before handling sampling equipment.
- 2) Use Waterra cutters to cut the top half (approximately 50 cm) from the bailer to create a device that can be used as a funnel. Ensure that the portion with the ball, which prevents water from leaking from the bailer, is intact.
- 3) Rinse the bailer three times with sample water and discard rinsate downstream in flowing waters, or on the opposite side of the boat/canoe in lakes or wetlands.
- 4) Use Waterra cutters to cut an appropriate length (5-10 cm) of clean PVC tubing. Attach one end of the PVC tubing to the extrusion on the curved end of the capsule filter. Place the other end firmly inside the spigot that accompanies the bailer. The open end of the spigot will be placed inside the outlet from the bailer.
- 5) Fill the bailer with sample water and run through filter apparatus once to rinse and ensure proper filter function. Water should be run through the filter apparatus for approximately 20 seconds.
- 6) Ensure that water discharging from the flat end of the capsule filter is used to fill the sample container.



- 7) Rinse the sample container three times with filtered sample water. Each time, ensure that the sample container is filled to approximately 20% capacity and the lid is tightened securely. Shake the filtered sample water so that it comes in contact with the entire inside surface of the sample container. Discard filtered sample water rinsate downstream if in flowing waters, or on the opposite side of the boat/canoe in lakes or wetlands.
- 8) Fill the bailer with sample water as many times as needed to fill the sample container using the surface water grab sampling POP. Ensure that the sample container lid is secured tightly and that the container is labelled.
- 9) If required, preserve samples using laboratory-supplied preservatives according to laboratory instructions.

4. TECHNICAL CONSIDERATIONS

- Ensure new clean equipment (e.g. bailer, tubing, and filter) is used for each new station. Keep PVC tubing in clean Ziploc bags.
- To avoid sample contamination, designate one crew member to handle and prepare the filter apparatus and bottles, and the other to collect the surface water samples and filter them.
- If using filter disks, ensure that plenty are available as several (i.e. more than five) may be required when filtering highly turbid samples.

5. ADDITIONAL REFERENCES

CCME (Canadian Council of Ministers of the Environment). 2011. Protocols Manual for Water Quality Sampling in Canada. PN 1461, ISBN 978-1-896997- 7-0. Section 5.0, pp 36–37.

6. CONTROL

This POP has been prepared and reviewed for use in the WorleyParsons Infrastructure & Environment Division. Any inquiries regarding this POP should be directed to the undersigned.

Prepared By:

Reviewed By:

Patrick Chahil, M.E.S.

Michael Vander Meulen, Ph.D. P.Biol.

Lucie Sliva, M.Sc. P.Biol.



Scope The following procedure is applicable for surface water grab sampling.

1. SAFETY CONSIDERATIONS

This Preferred Operating Procedure (POP) does not address all of the safety issues associated with this task or with other activities that may be undertaken in conjunction with this task. Refer to the WorleyParsons safety management system and the site-specific hazard assessment to identify the potential hazards, mitigations, and controls.

2. MATERIALS AND EQUIPMENT

The following equipment is required for the completion of this task:

- Labels, pen, and Sharpie® permanent marker.
 - Analytical schedule.
 - Sample and QA/QC bottles (provided by the accredited laboratory).
 - Field data sheets or log books.
 - Meters for in situ measurement of field parameters.
 - GPS unit.
 - Disposable nitrile gloves.
 - Coolers.
 - Zip-lock bags.
 - Ice in zip-lock bags/ice packs (for sampling at outside temperatures above freezing).
 - Tinfoil.
 - Bubble wrap.
-

3. PROCEDURES

- 1) Label sample bottles before sampling. At a minimum, include the site identifier. The date is also useful to include on the label, but not necessary.
- 2) Grab samples should be collected in a particular order. Preferably start with field blanks. These should be followed by ultra-clean samples (mercury or bacteria). For ultra-clean protocols (e.g. "clean-hands dirty-hands") follow instructions provided by laboratory. Any remaining samples (nutrients, metals, PAHs, BTEX, etc.) and associated replicates can be sampled in any order.
- 3) It is best to have one person collect the grab samples, and the other person handing the bottles to the sampler. Both should wear clean gloves which need to be changed between stations. The person handing the bottles can ensure that the contents on the sample bottle label are correct, add the preservative to the sample, if applicable, and ensure that the lid is tightened securely on the sample container.
- 4) For watercourses (flowing water), the sampler will wade in and choose a suitable sampling location, preferably near the middle of the watercourse. Ensure that the sample location is away from any obstacles, such as rocks, debris, and sediment deposits. Once at the sampling location, minimize movement to prevent the agitation of substrate sediments. For waterbodies (standing water), carefully wade to the sample location, if possible. If sampling from a boat or canoe, lower the anchors and ensure that the boat does not drift. Sample on one side of the boat, away from the anchors, as that area was disturbed. Ensure that the other person is on the other side boat/canoe to provide balance.
- 5) Lower the sampling bottle to a depth of 30 cm, or mid-column if the depth is less than 30 cm, until it is completely submerged. For watercourses, ensure that the sample is taken upstream from the sampler to avoid sampling water that may have been disturbed while wading to the sampling location.
- 6) Triple rinse all plastic sample containers. Ensure that the sample container is filled to approximately 20% of capacity, the lid is tightened securely, and the water is shaken inside such that it comes in contact with the entire inside surface

of the sample container. Discard rinsate downstream if in flowing waters, or on the opposite side of the boat/canoe in lakes or wetlands. Repeat three times. Amber glass bottles do not need to be rinsed.

- 7) Lower the sample bottle to a depth of 30 cm, or mid-column if the depth is less than 30 cm, until it is completely submerged. Allow the bottle to fill with water sample until there are no air bubbles remaining. Samples requiring preservation must have some head space and do not need to be filled completely. Some sample bottles come pre-charged with a preservative capsule; ensure that the preservative is still in the sample bottle after sampling.
- 8) If a preservative is required, add it to the sample and tighten the cap securely. Otherwise, samples bottles can be capped underwater. Filter and/or add preservatives to appropriate bottles, immediately, or as soon as possible after sample collection. If samples are to be laboratory-filtered, ship them as soon as possible and ensure they arrive in the laboratory well within the specified hold time for un-filtered and un-preserved samples. Unfiltered chlorophyll a samples should be stored in dark amber bottles or plastic bottles wrapped in tinfoil to minimize light exposure.
- 9) Hold sample bottle caps lid-down while filling sample bottle and cap bottles immediately before and after filling and preserving. Avoid touching lids and mouths of bottles.
- 10) Place sampling bottles upright in cooler for transport. Ensure that glass bottles are wrapped in bubble wrap and do not contact each other directly.
- 11) During warmer seasons (e.g. summer), place ice bags in the cooler or shipping container immediately. As general guideline, the volume of sealed ice in a cooler should be equivalent to the volume of sampled water and greater during hot summer days or samples which require longer transport distances. In the winter, use bubble wrap to surround the samples bottles. The bubble wrap will act as an insulator and keep the temperature inside the cooler, warmer than the ambient air temperature.

4. TECHNICAL CONSIDERATIONS

- 1) BTEX and PAH samples require no head space. This can be achieved by capping the sample bottles under water.
- 2) Grab water samples can be taken by wading into the water, from a boat, bridge or dock, and from the floats on an airplane/helicopter during the open-water season. During the winter, samples may be taken through the ice.
- 3) Stream and ditch samples should be collected at mid-stream, unless otherwise specified in the study design. Specific sampling locations will be determined from site reconnaissance.
- 4) For multi-year/season programs, samples should be taken from the same location. GPS unit or marker can be used to identify the sampling location. If it is not possible for a sample to be taken at the original sampling location, document the change in location and the reason for the change.
- 5) Samples must arrive at the laboratory as close to 4°C as possible and within 48 hours of sampling.
- 6) It is a sampler's responsibility to collect samples as directed in the program/study design, note any unusual conditions at a site, and minimize field error by adhering to relevant POPs.

5. ADDITIONAL REFERENCES

- AENV (Alberta Environment). 2006. Aquatic Ecosystems Field Sampling Protocols. Prepared by Alberta Environment. March 2006. W0605
- CCME (Canadian Council of Ministers of the Environment). 2011. Protocols Manual for Water Quality Sampling in Canada. PN 1461, ISBN 978-1-896997- 7-0. 186 pp.



6. CONTROL

This POP has been prepared and reviewed for use in the WorleyParsons Infrastructure & Environment Division. Any inquiries regarding this POP should be directed to the undersigned.

Prepared By:

Reviewed By:

Patrick Chahil, M.E.S.

Michael B. Vander Meulen, Ph.D. P.Biol.

Lucie Sliva, M.Sc. P.Biol.



Scope The following procedure is applicable for low-level mercury sampling in surface waters.

1. SAFETY CONSIDERATIONS

This Preferred Operating Procedure (POP) does not address all of the safety issues associated with this task or with other activities that may be undertaken in conjunction with this task. Refer to the WorleyParsons safety management system and the site-specific hazard assessment to identify the potential hazards, mitigations, and controls.

2. MATERIALS AND EQUIPMENT

The following equipment is required for the completion of this task:

- Disposable nitrile gloves (powder less) or non-talc gloves.
- Sample bottles provided by the accredited laboratory; should be glass or Teflon (confirm with laboratory).
- Syringe (used when dissolved mercury analysis is required).
- Syringe filter disks (used when dissolved mercury analysis is required).
- Preservative (provided by the laboratory).
- Mercury-free de-ionized water (provided by the laboratory).

3. PROCEDURES

- 1) Pre-label the outer bag, at a minimum identifying the sampling site; additional information can be added later.
- 2) Designate one individual as 'dirty hands' and the other individual as 'clean hands'. Both individuals must wear nitrile or non-talc gloves. 'Clean hands' touches only the inner bag and the sample bottle from this point on. If dissolved low-level mercury is required, 'clean hands' will also touch the syringe and filter (see steps 8 to 11).
- 3) 'Dirty hands' opens the sample cooler, removes a doubly-bagged sample container, and opens the outer re-sealable plastic bag. 'Clean hands' reaches into the outer bag, opens the inner Ziploc bag, removes the sample container, and folds down the inner bag. 'Dirty hands' then re-seals the outer bag to prevent entry of any contaminant before inner bag is replaced with sample.
- 4) 'Clean hands' removes the lid from the sample container and holds the lid in one hand. With the other hand 'clean hands' obtains the sample by submerging the sample container approximately 30 cm, or mid-column, of the water. Care should be taken to ensure hands are downstream from the inlet of the sample container. The sample container should be filled to capacity, leaving only a small headspace. 'Clean hands' will secure the lid tightly. If the sample is to be persevered in the field, 'dirty hands' will pour the preservative into the sample container, which is held by 'clean hands', being careful not to touch the sample container with any part of the vial holding the preservative; 'clean hands' will secure the lid tightly and mix the sample by inverting the sample container several times.
- 5) 'Dirty hands' retrieves the Ziploc bags and opens the outer bag.
- 6) 'Clean hands' reaches inside and places the sample container inside the inner bag. The inner bag is sealed.
- 7) 'Dirty hands' seals the outer bags and places the bagged sample into the shipping cooler.
- 8) Repeat steps 2 to 8 for each sample site.
- 9) If dissolved low-level mercury concentration is required, follow the syringe procedure as outlined in the Field Filtration POP.
- 10) 'Dirty hands' opens the package containing the syringe and filter disk. 'Clean hands' removes the syringe and filter disk. The filter disk is twisted onto the syringe tip.
- 11) Fill syringe with sample water and push volume through syringe filter to rinse.
- 12) 'Clean hands' opens sample bottle, fills the syringe with sample, and filters into sample container. Replace lid on bottle after each syringe is filtered. Repeat until sample container is full or filter becomes clogged. If filter becomes clogged, replace the filter with a clean filter and repeat. 'Clean hands' will secure the lid tightly. If the sample is to be persevered in the field, 'dirty hands' will pour the preservative into the sample container, which is held by 'clean



hands', being careful not to touch the sample container with any part of the vial holding the preservative; 'clean hands' will secure the lid tightly and mix the sample by inverting the sample container several times.

4. TECHNICAL CONSIDERATIONS

- Two individuals are required to collect low-level mercury samples. One individual will be considered the 'dirty hands', and the second individual will be the 'clean hands'. The "clean hands" individual will be responsible for handling the sample container and filling the sample container from the sample source (river, ditch, lake, wetland, spigot, pump outlet, scooper, etc.). The "dirty hands" individual will be responsible for handling equipment and any other activities which do not involve direct contact with the sample or sample container.
- All sampling equipment and sample containers must be non-metallic and free of any material which might contain trace metals. Low-level mercury sample containers often are made of glass or Teflon. Other plastic bottles (other than Teflon or other fluoropolymers) are unacceptable as mercury may diffuse through, adhere to, or leach from the plastic surfaces.
- Sampling personnel will wear nitrile or non-talc disposable gloves. Gloves will be worn at all times when handling sample bottles or sampling equipment. Gloves will be removed when sample collection is complete, and new gloves will be used when a sample is collected from next the site.
- To prepare the field blank, the mercury-free water (which is provided by the laboratory) should contact all of the sampling equipment to be used for collecting normal samples (e.g. syringe barrel and plunger).
- Low-level mercury samples can be preserved at the laboratory or in the field. If preservation is to occur in the field, the laboratory will provide the proper preservatives.
- If samples are not field preserved, they must be express shipped to the laboratory so that they are received within 24 hours of sampling. If samples are field preserved, express shipping is not required.
- At least 200 ml of sample must be collected. Samples must be placed into double Ziploc bags immediately after collection following the 'Clean hands-Dirty hands' procedure, and only the outside bag should be labelled.
- Be careful not to breathe onto samples as detectable amounts of mercury can be emitted from certain tooth fillings.

5. ADDITIONAL REFERENCES

U.S. EPA., 1996. Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. 42 pp.

6. CONTROL

This POP has been prepared and reviewed for use in the WorleyParsons Infrastructure & Environment Division. Any inquiries regarding this POP should be directed to the undersigned.

Prepared By:

Reviewed By:

Patrick Chahil, M.E.S.

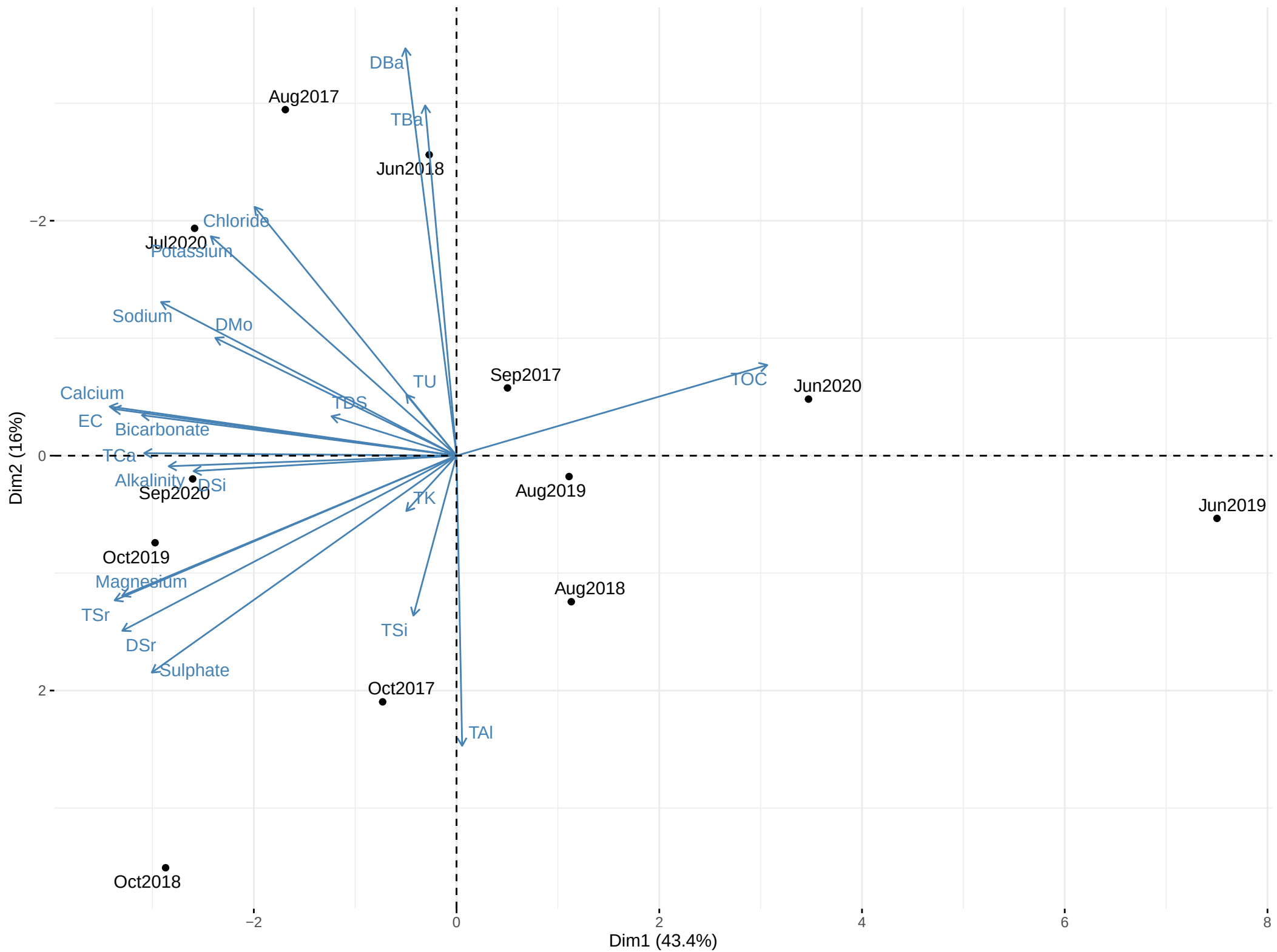
Michael Vander Meulen, Ph.D. P.Biol.

Lucie Sliva, M.Sc. P.Biol.

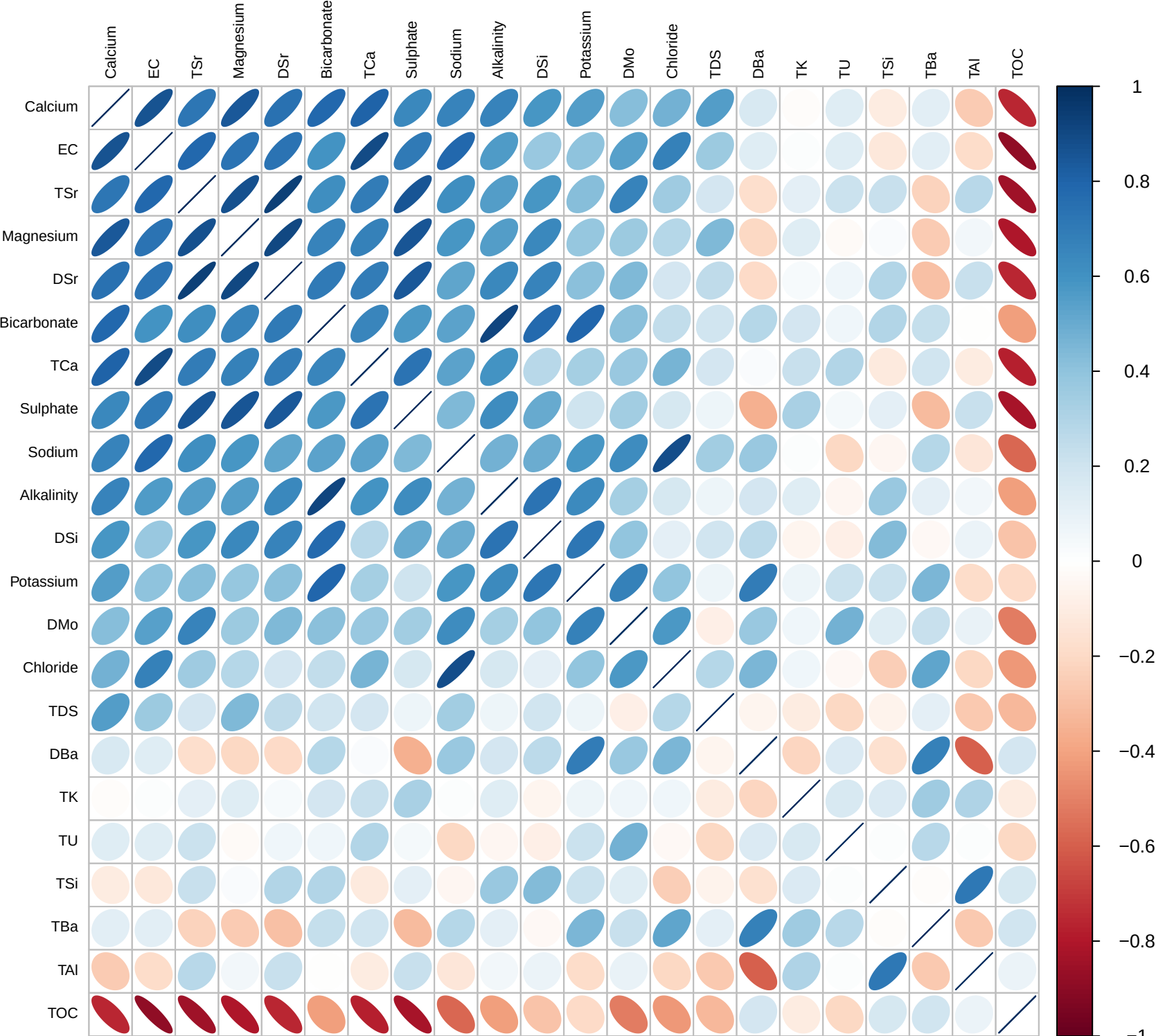


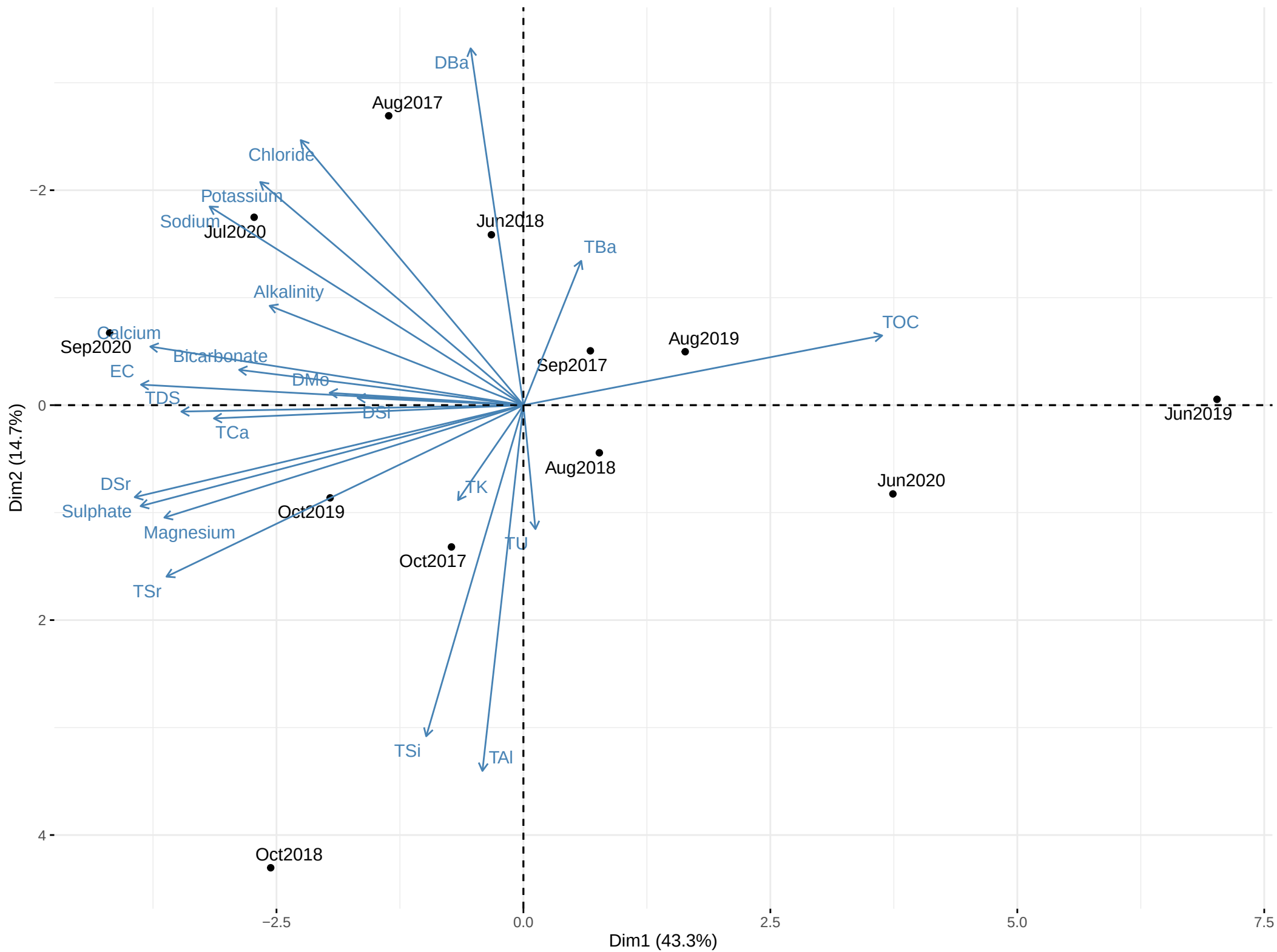
Appendix C

Multivariate Analyses

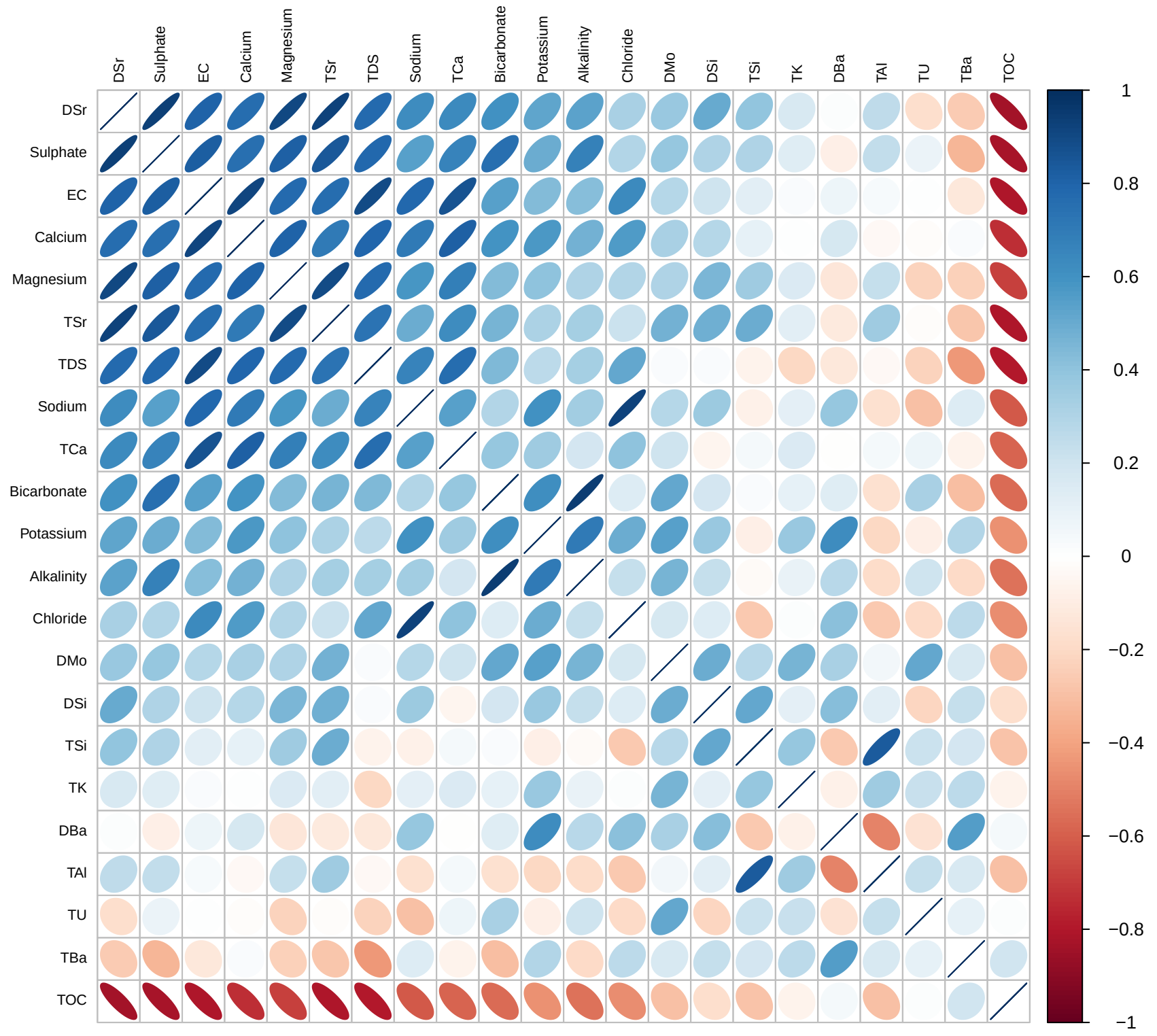


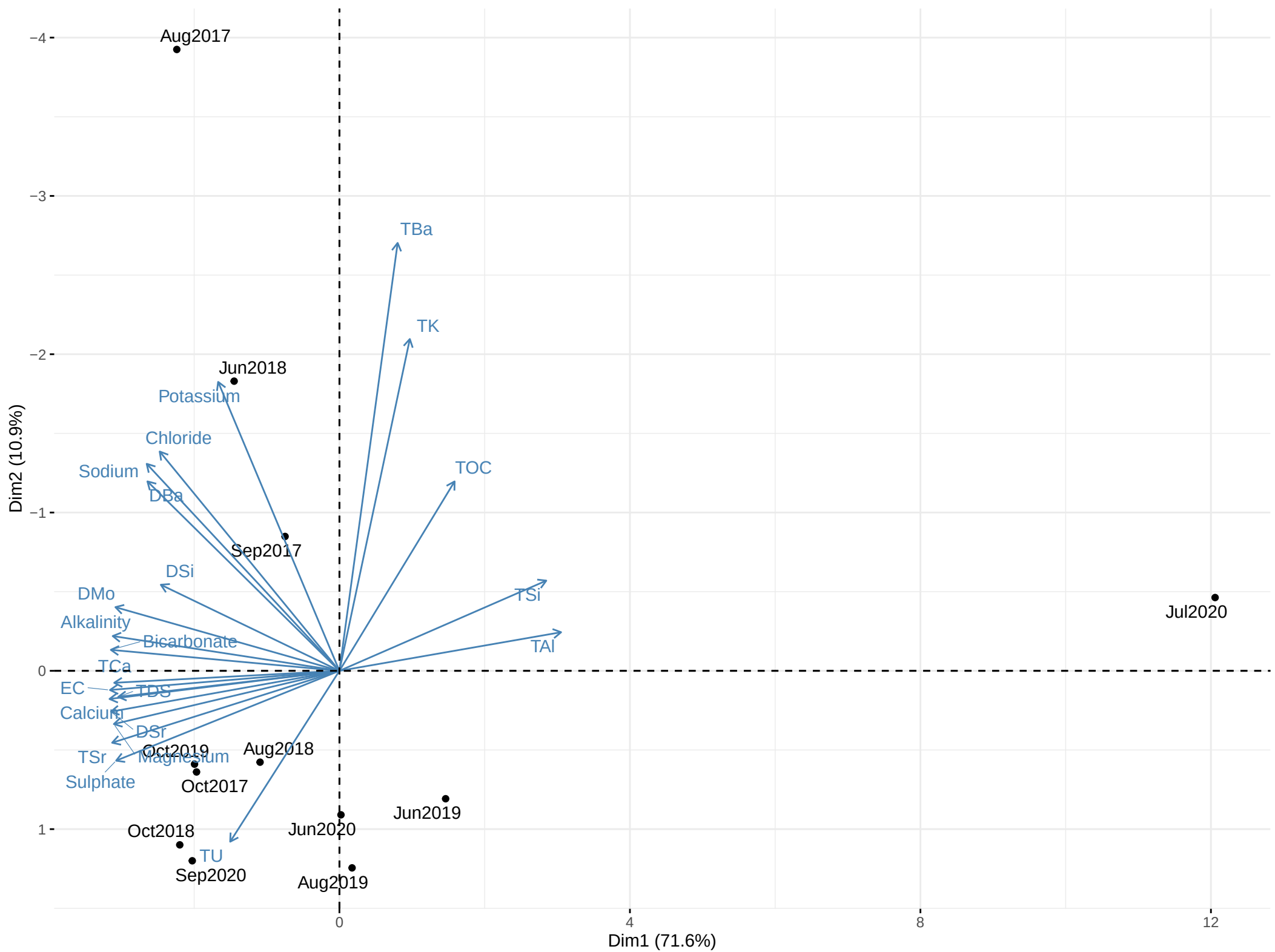
AEMP-02



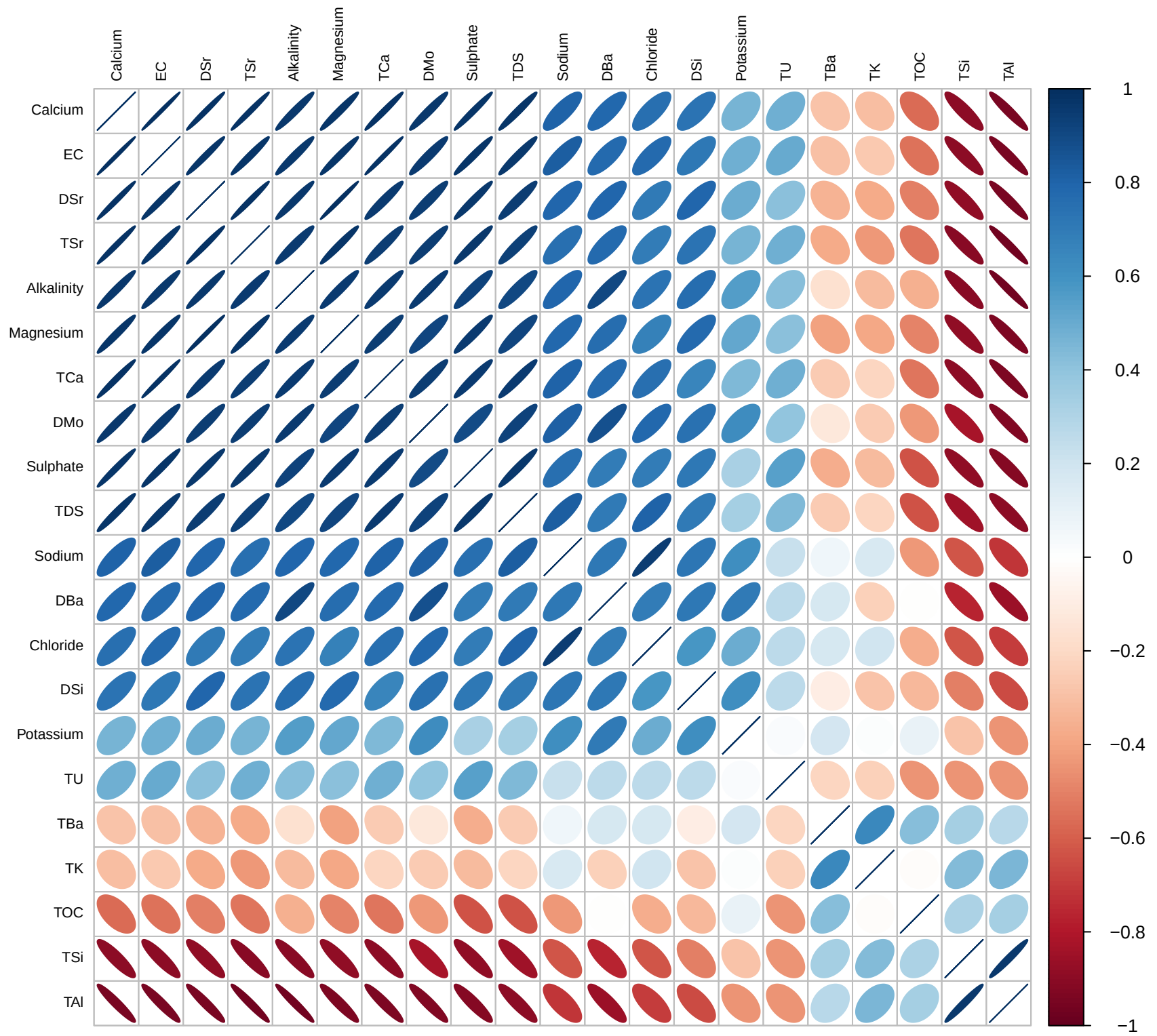


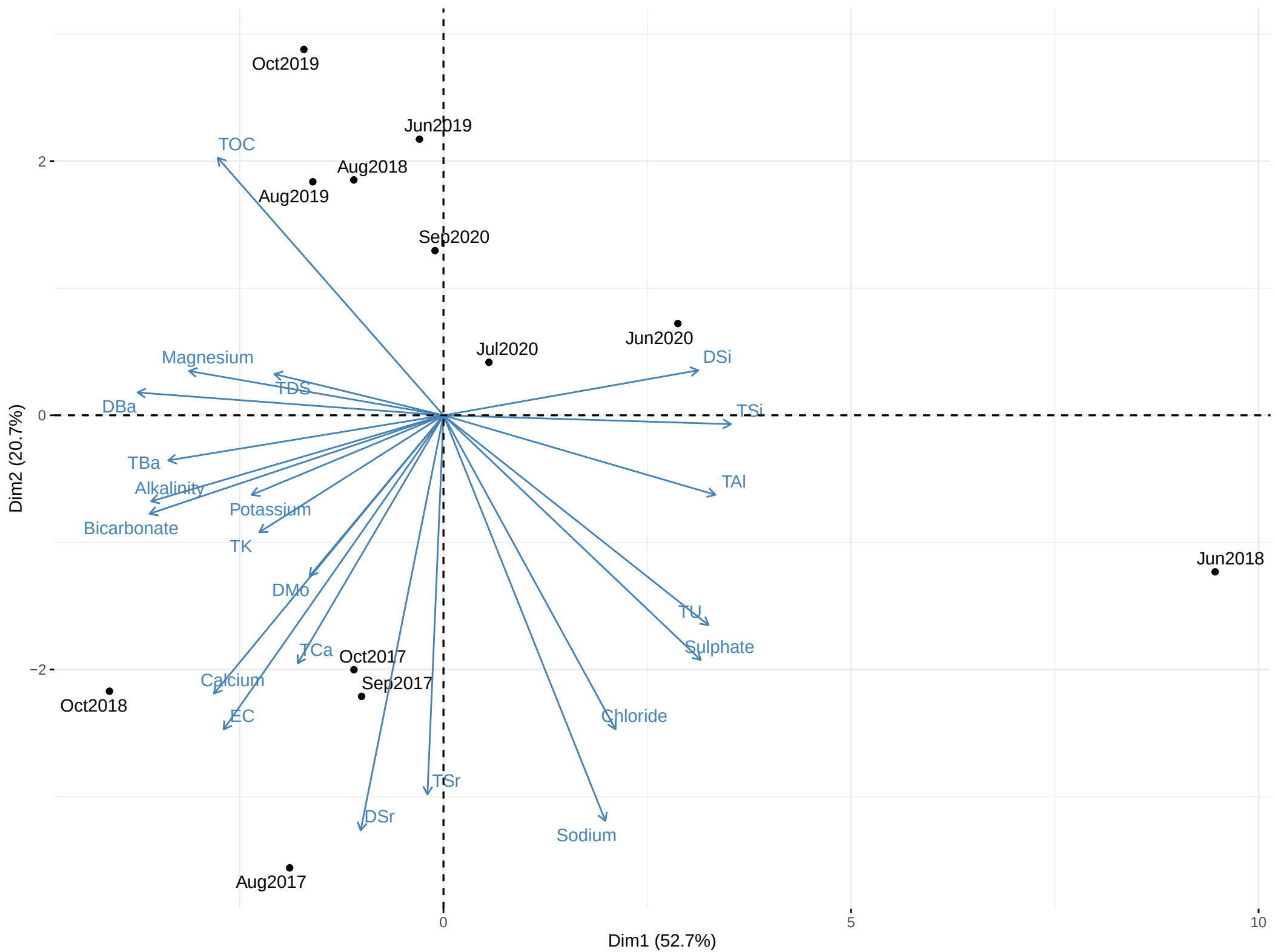
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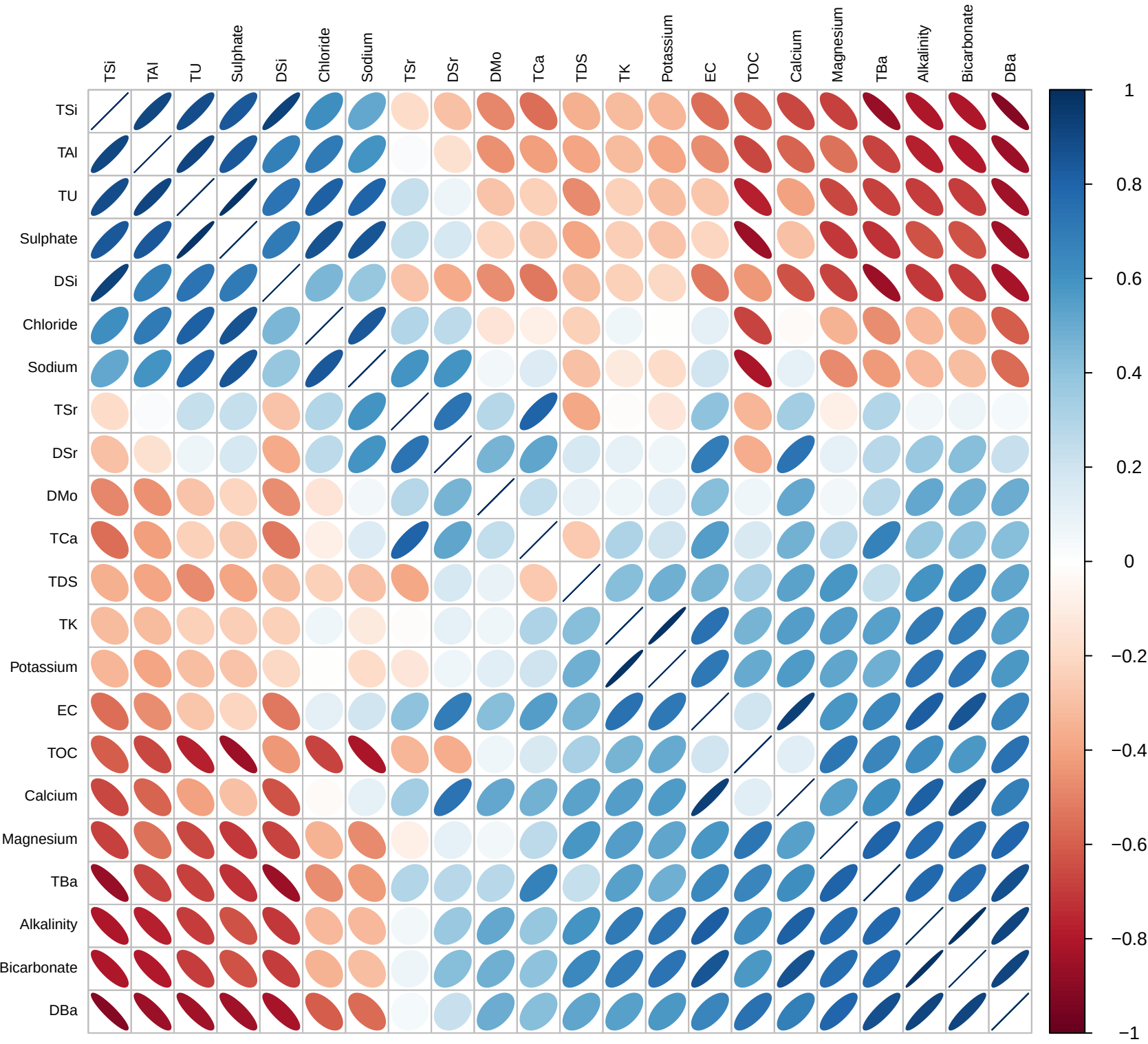


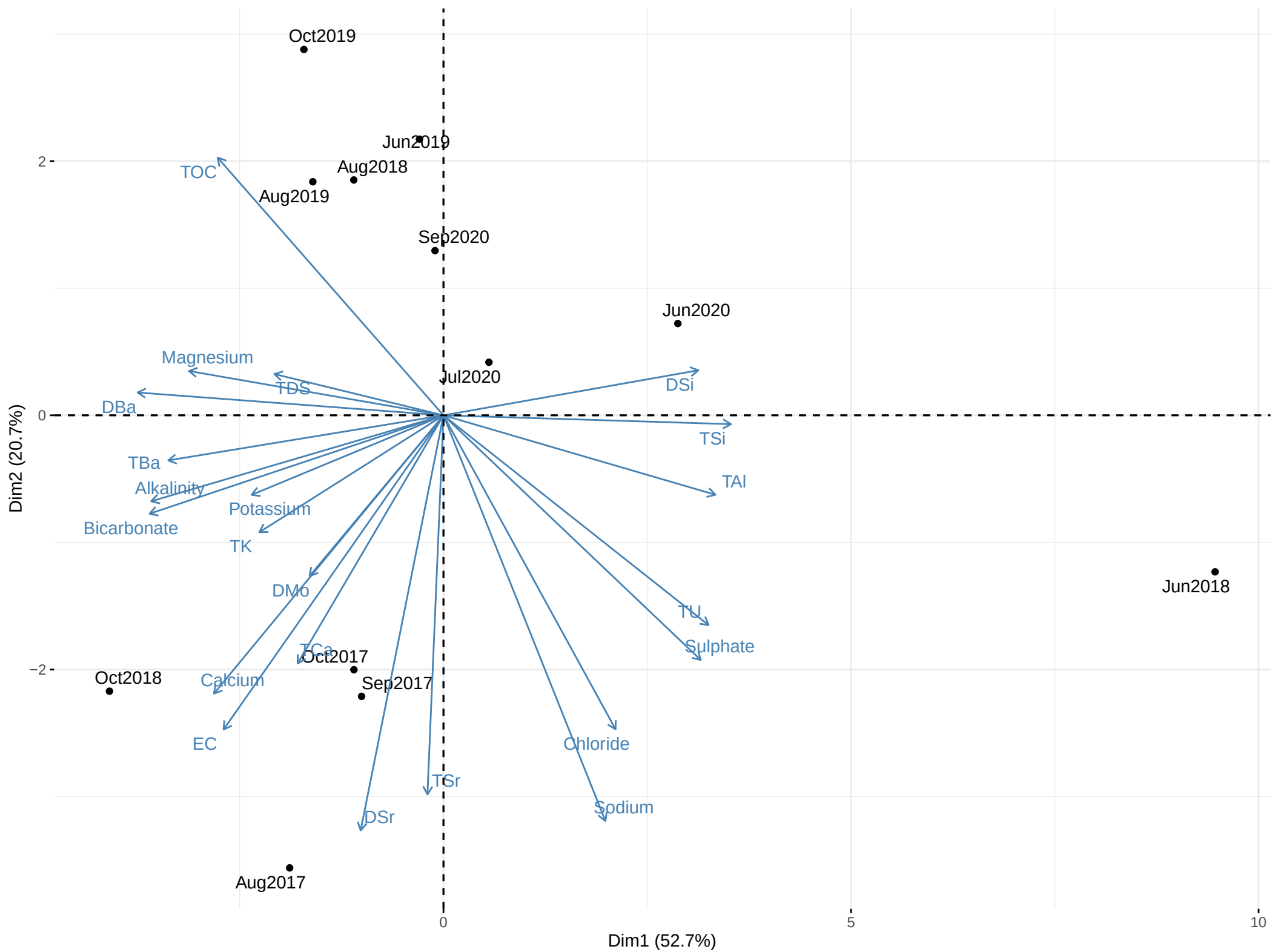
AEMP-04



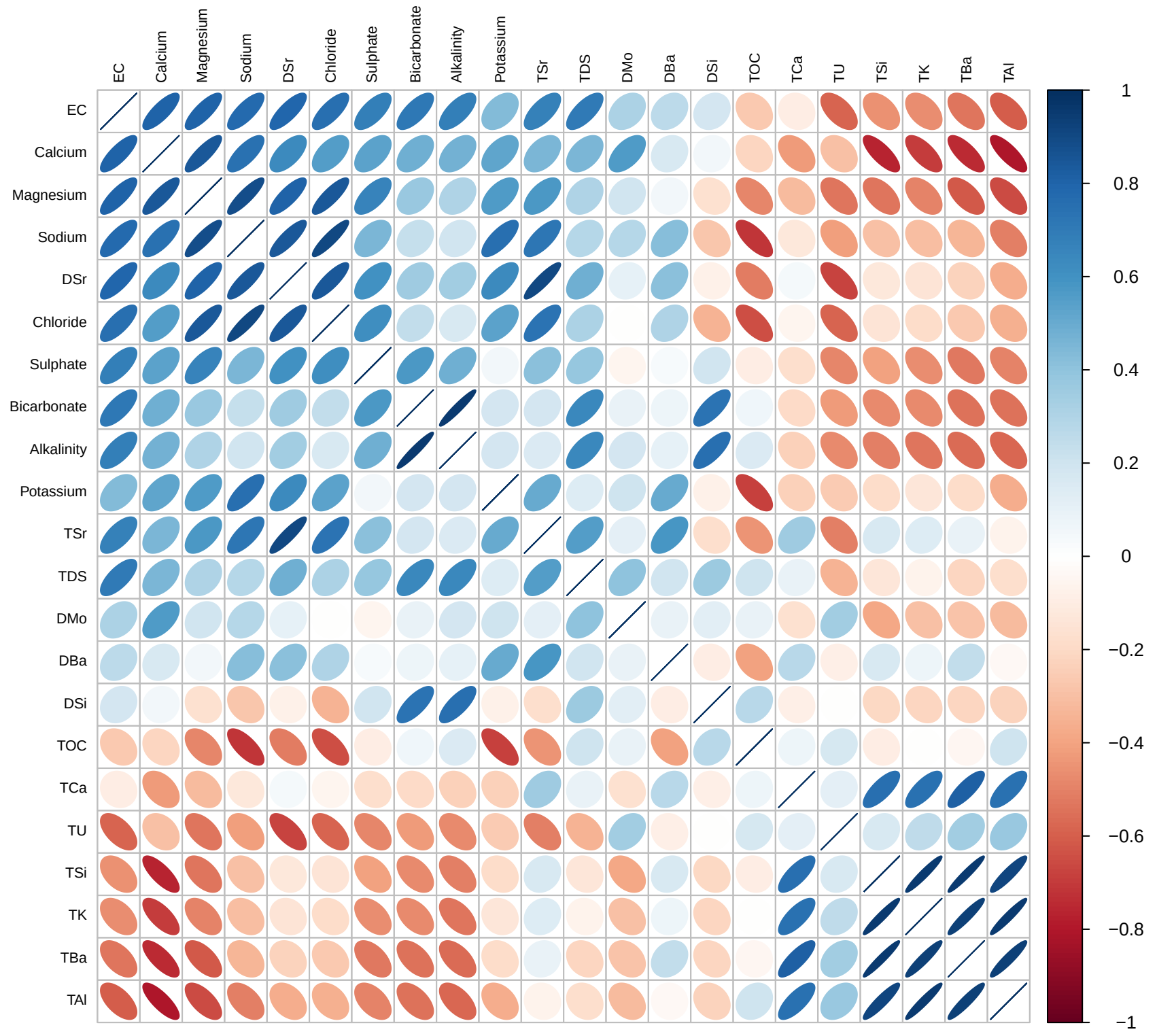


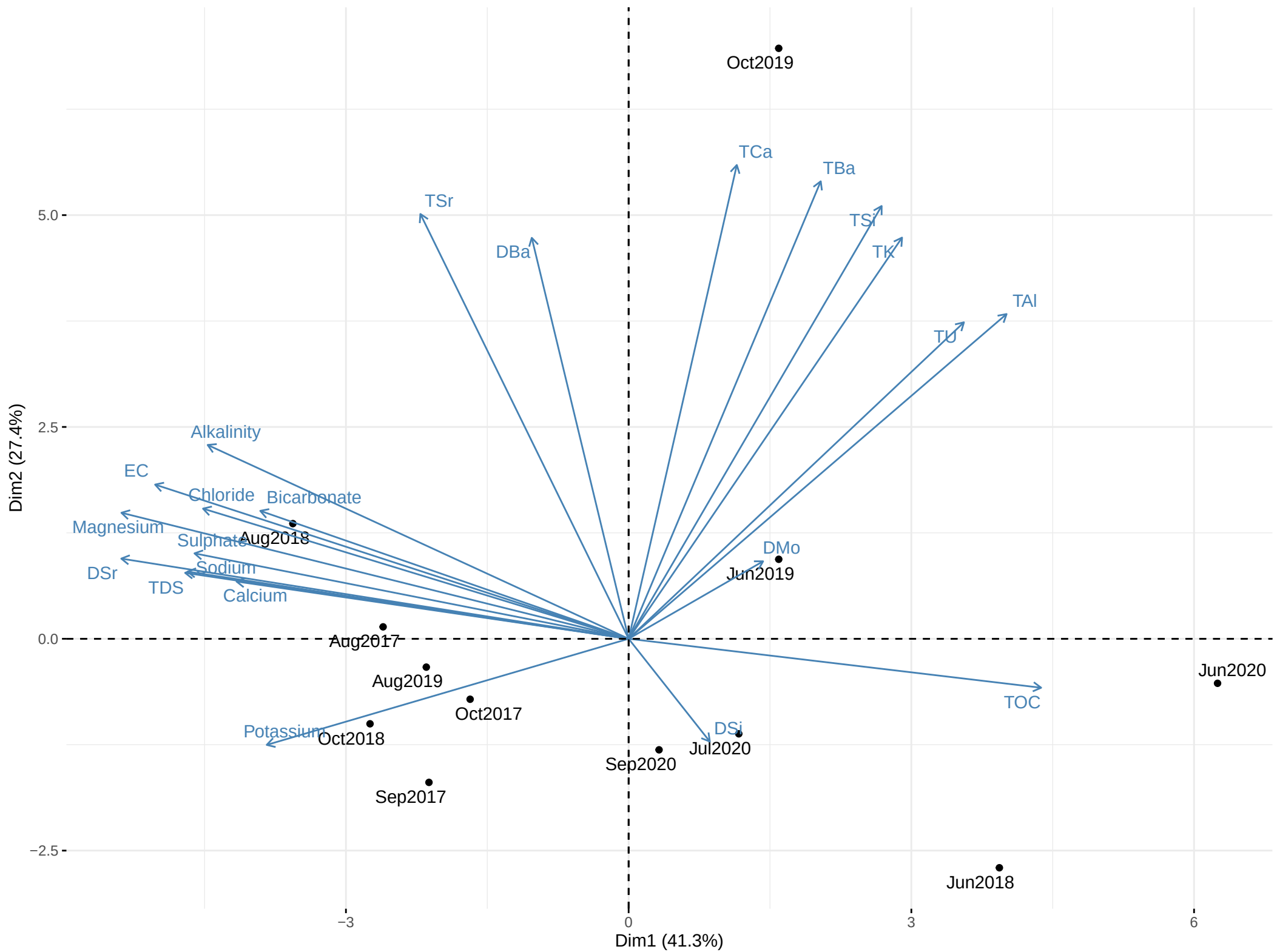
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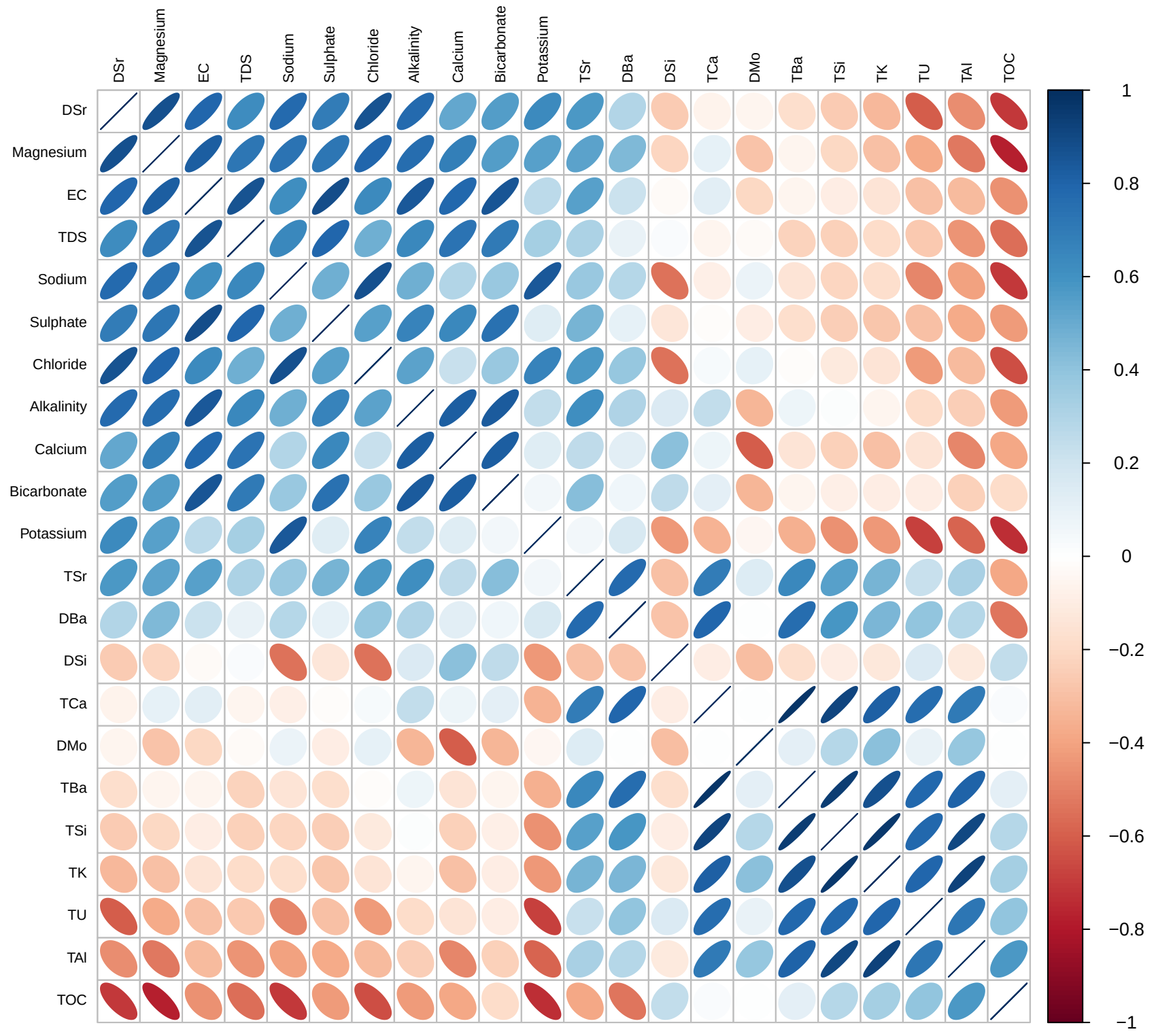


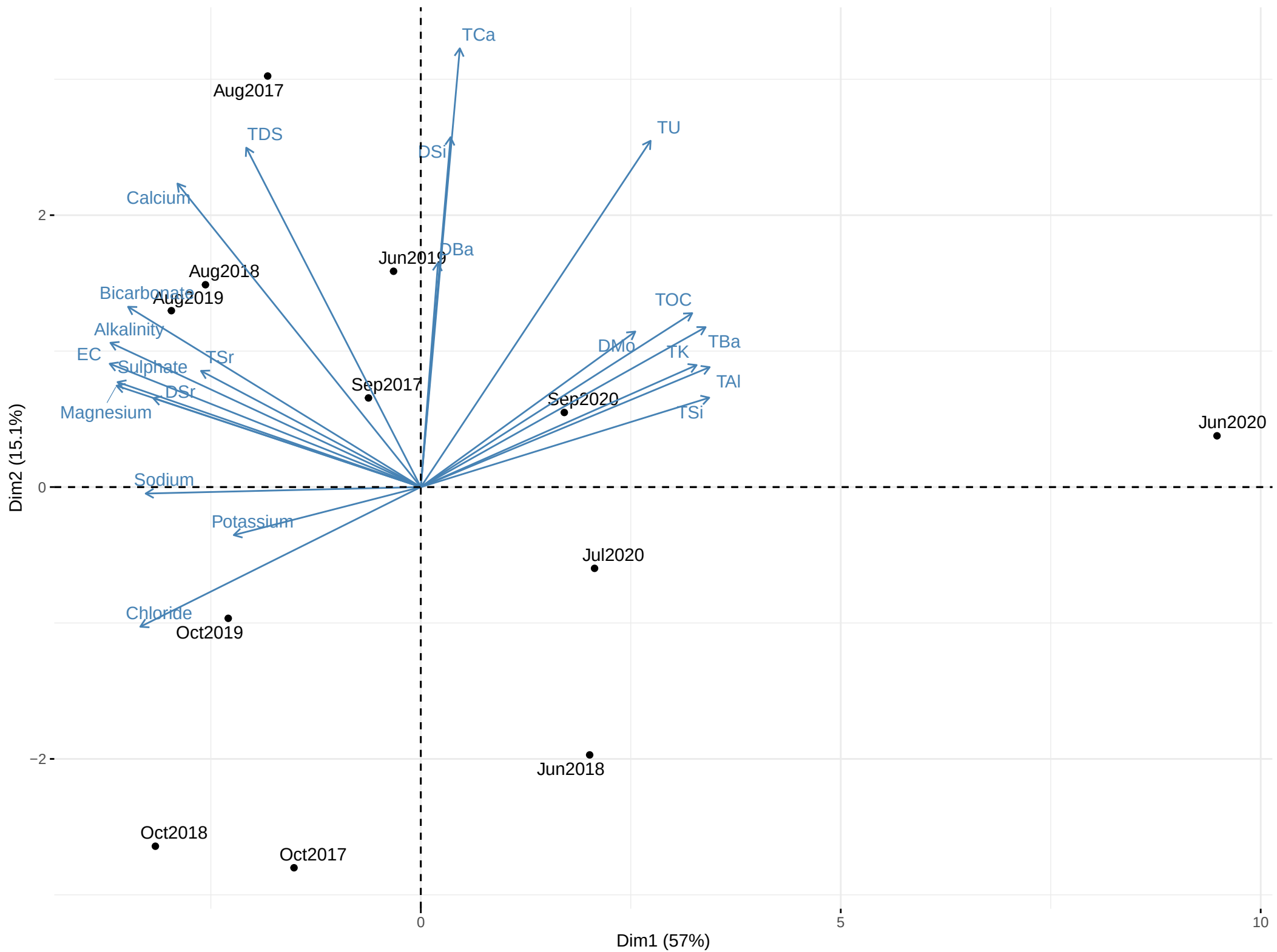
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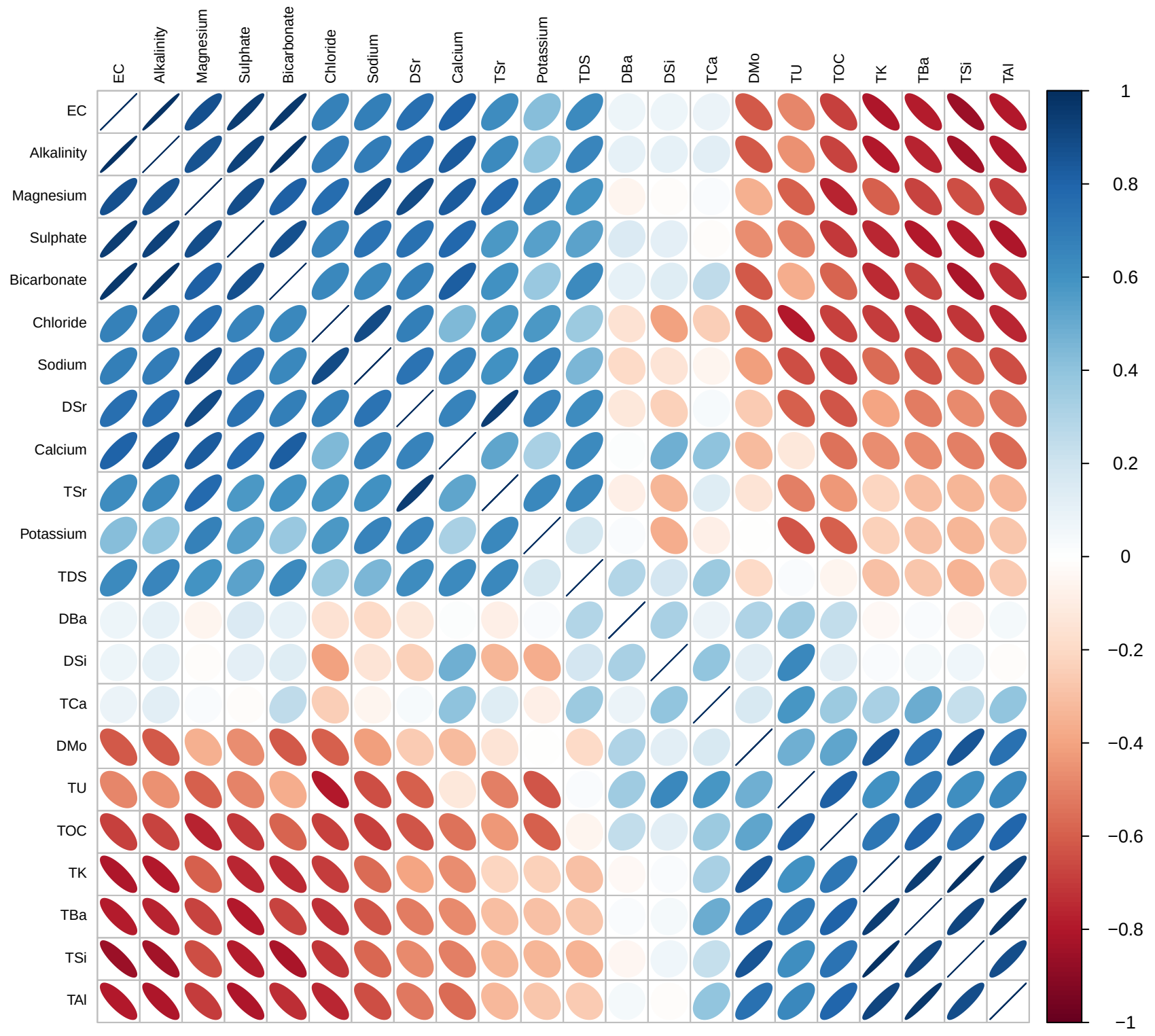


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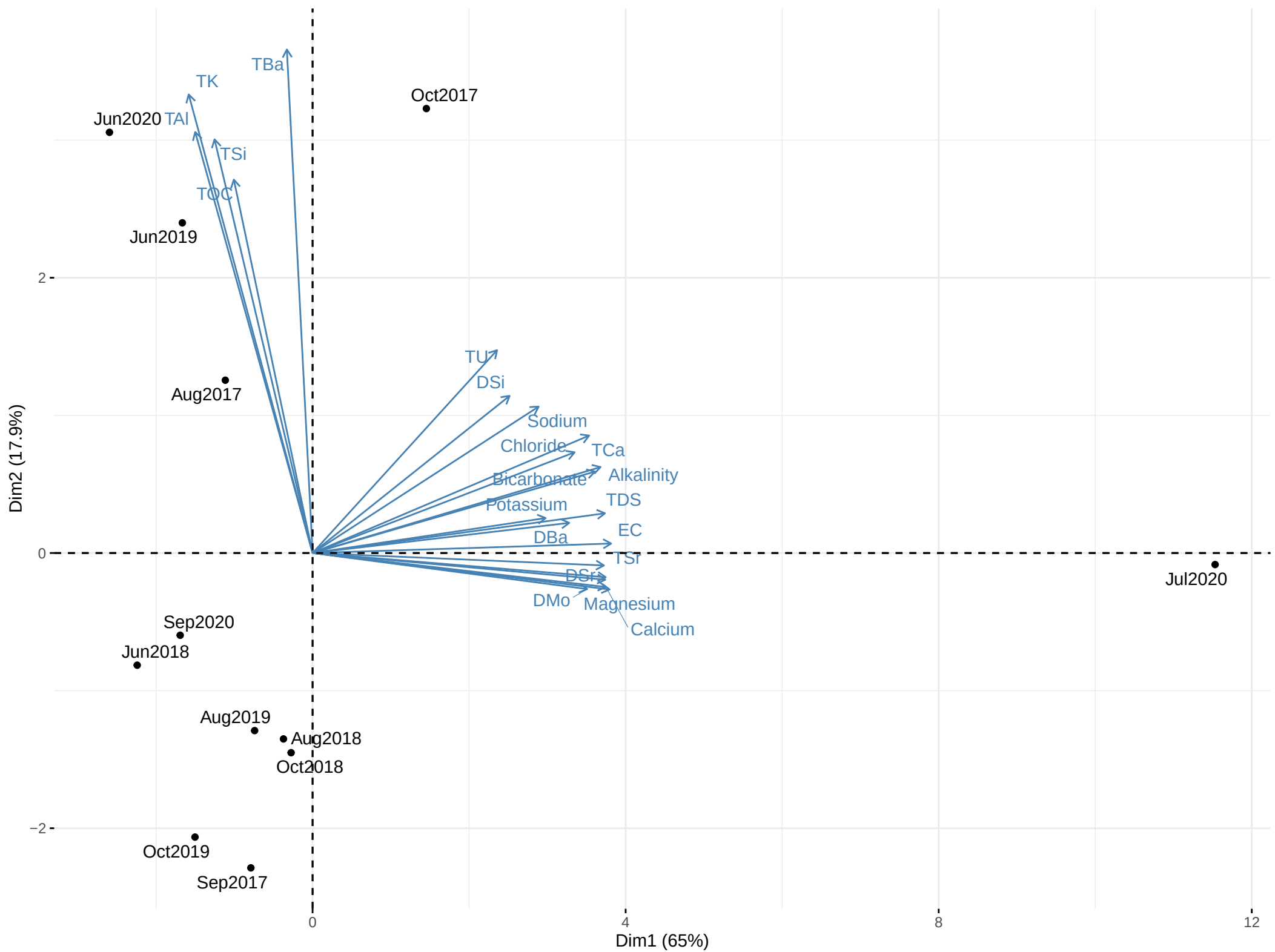




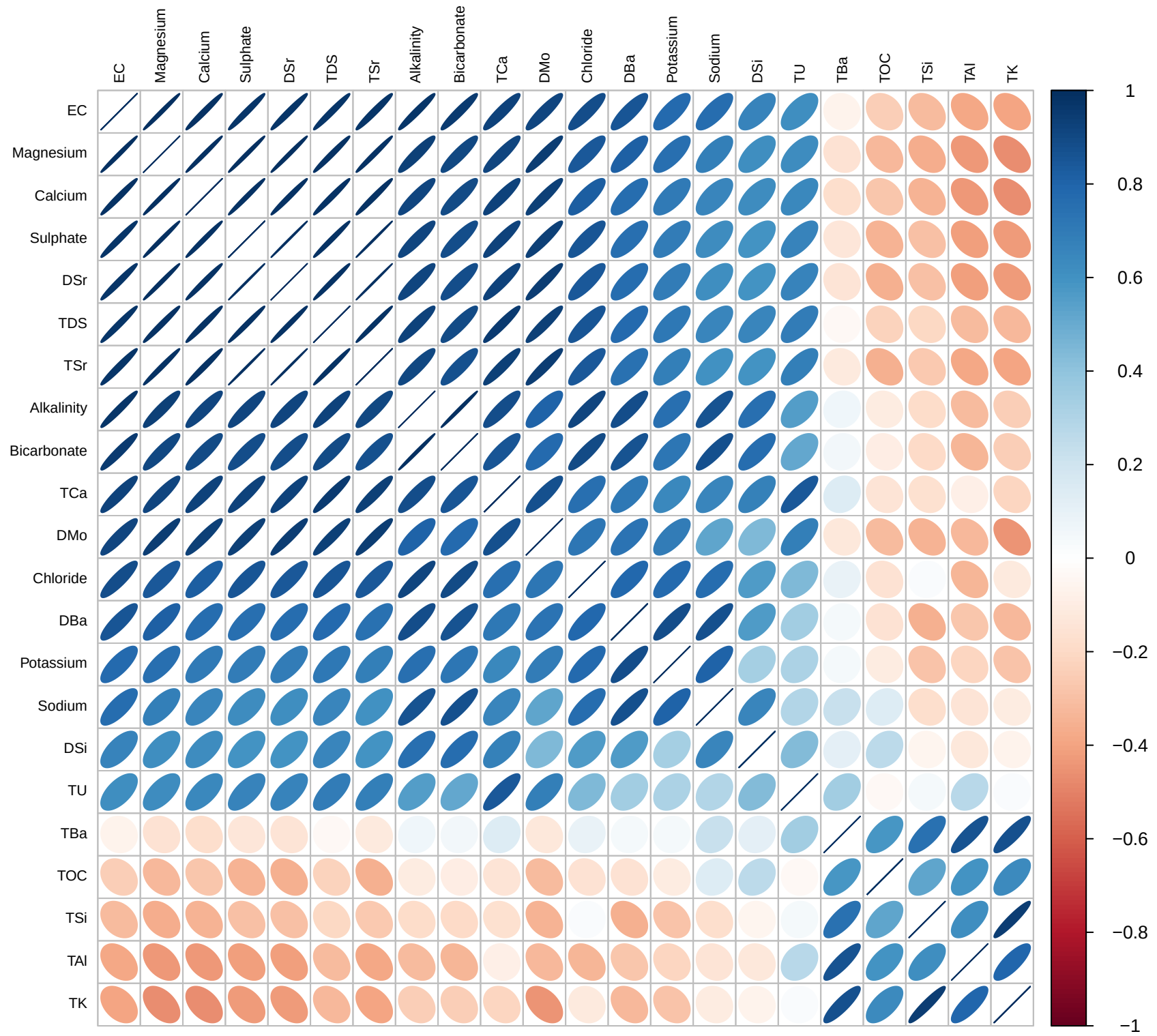
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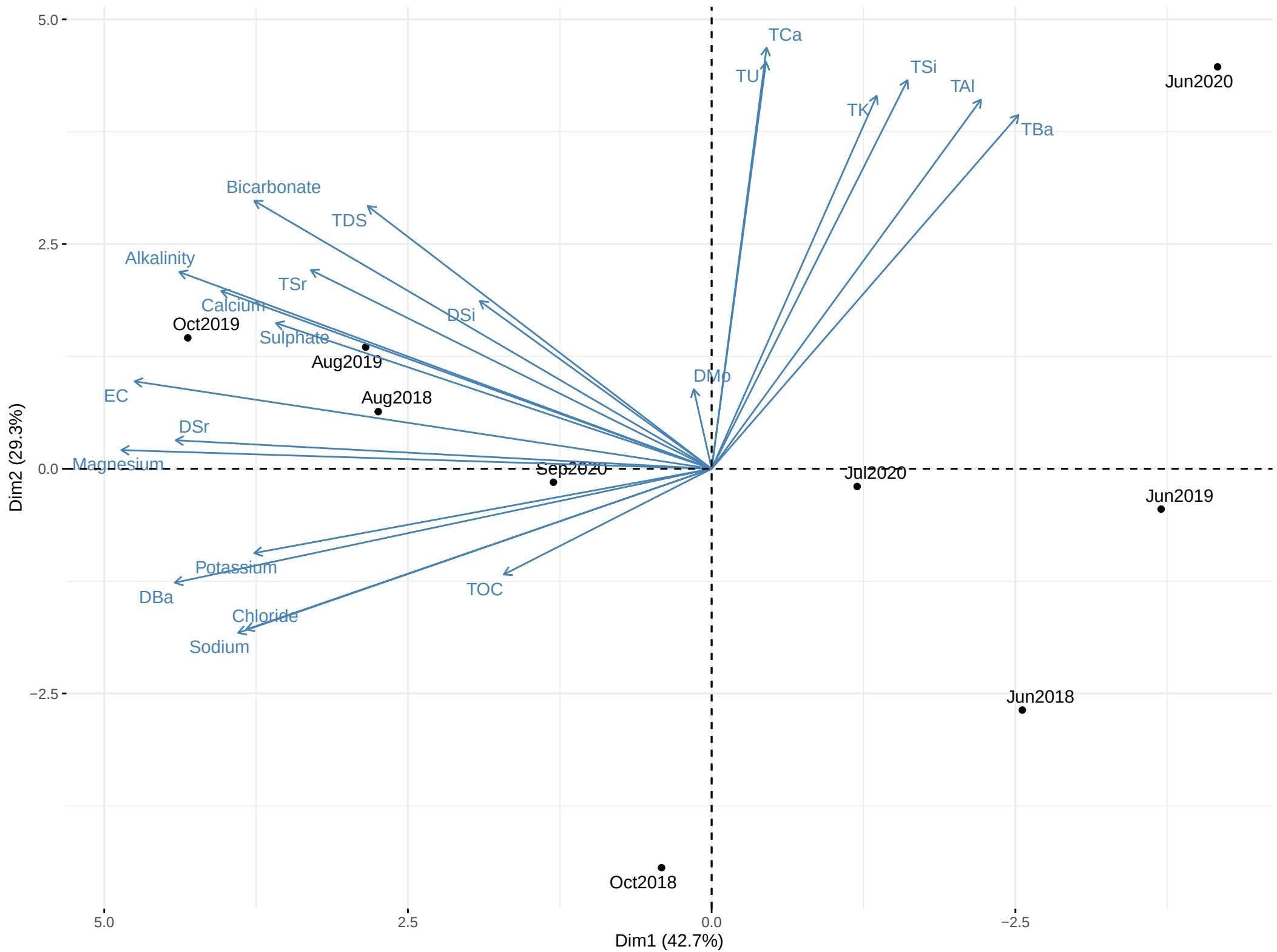
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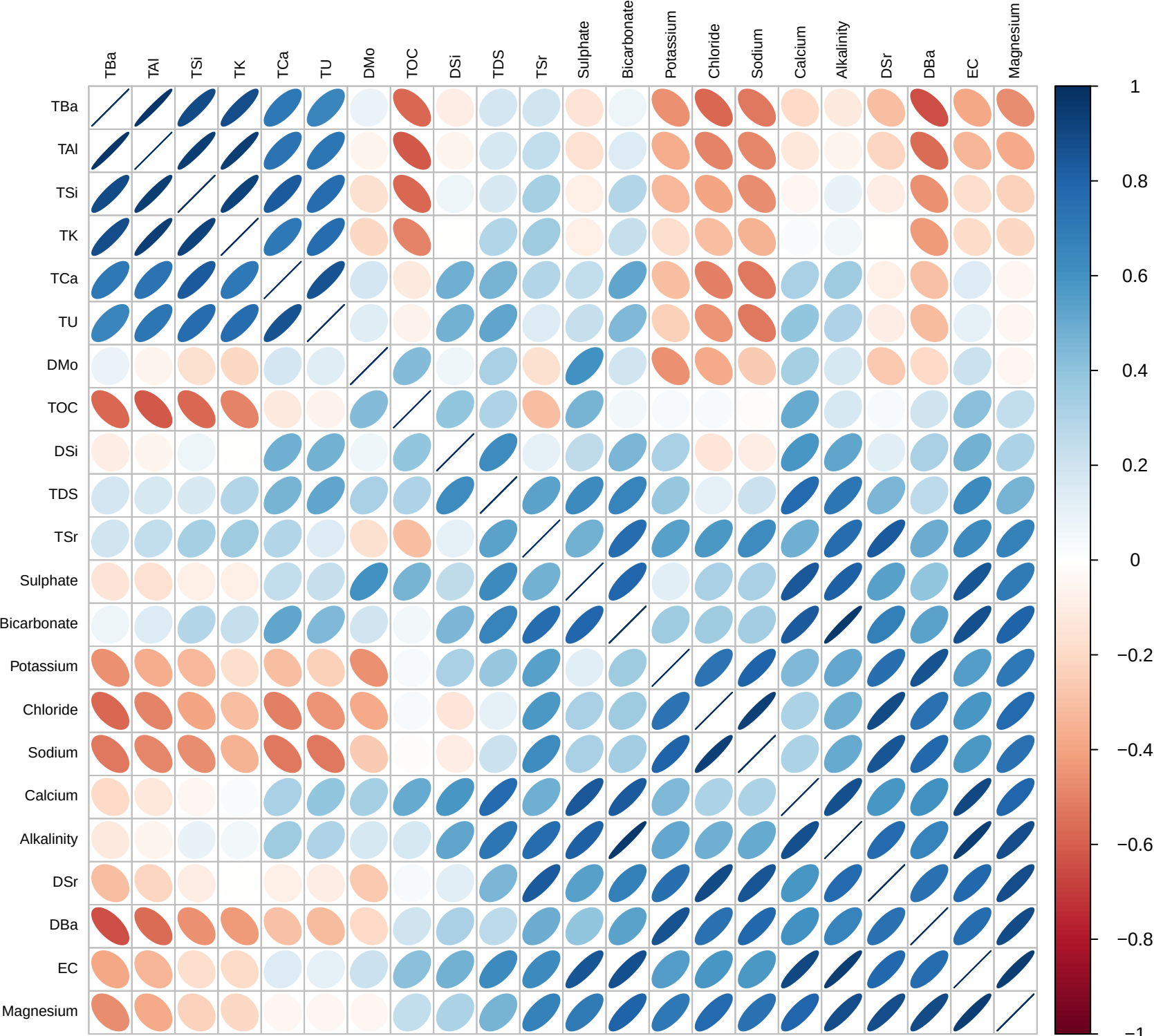
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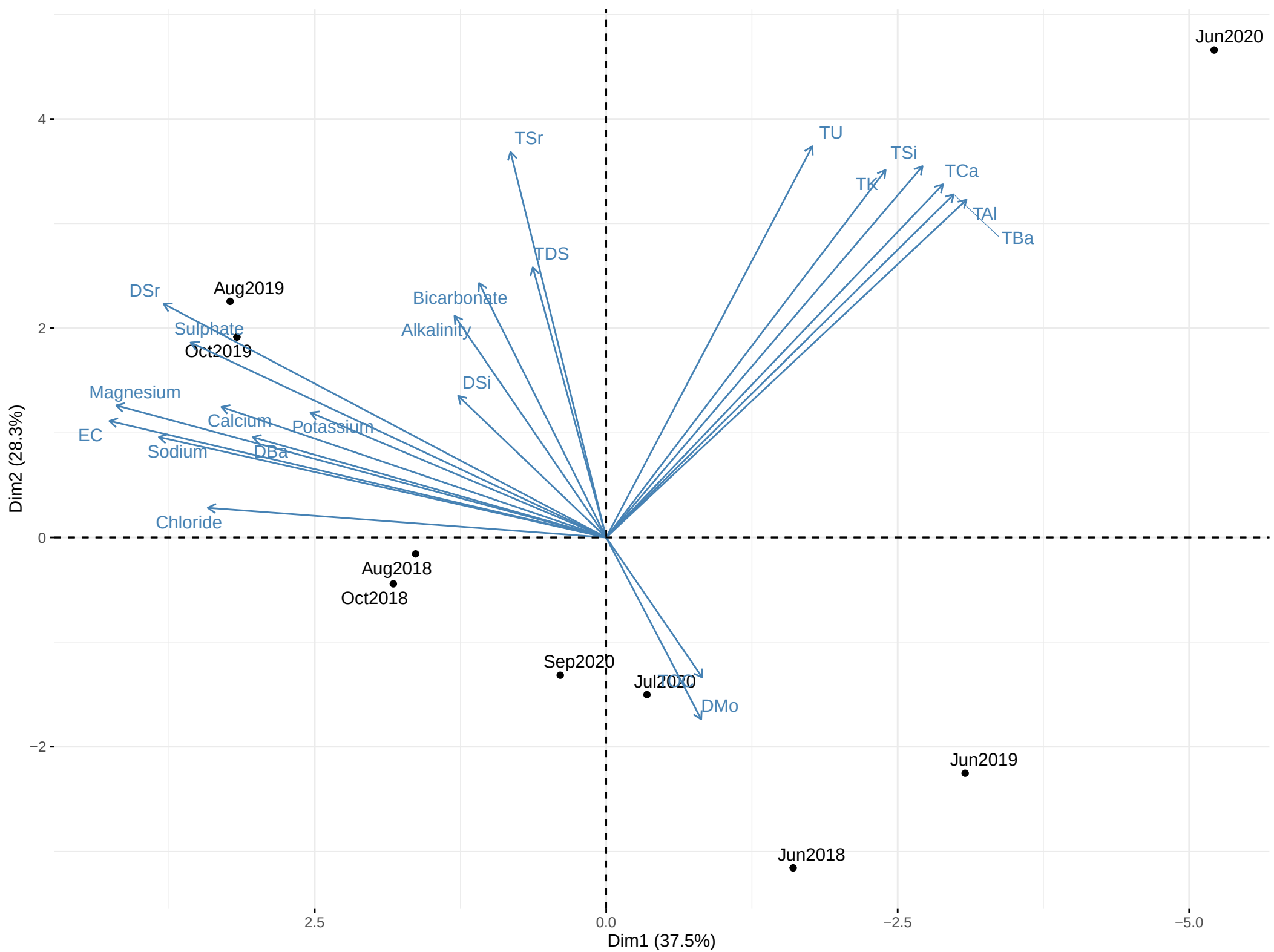


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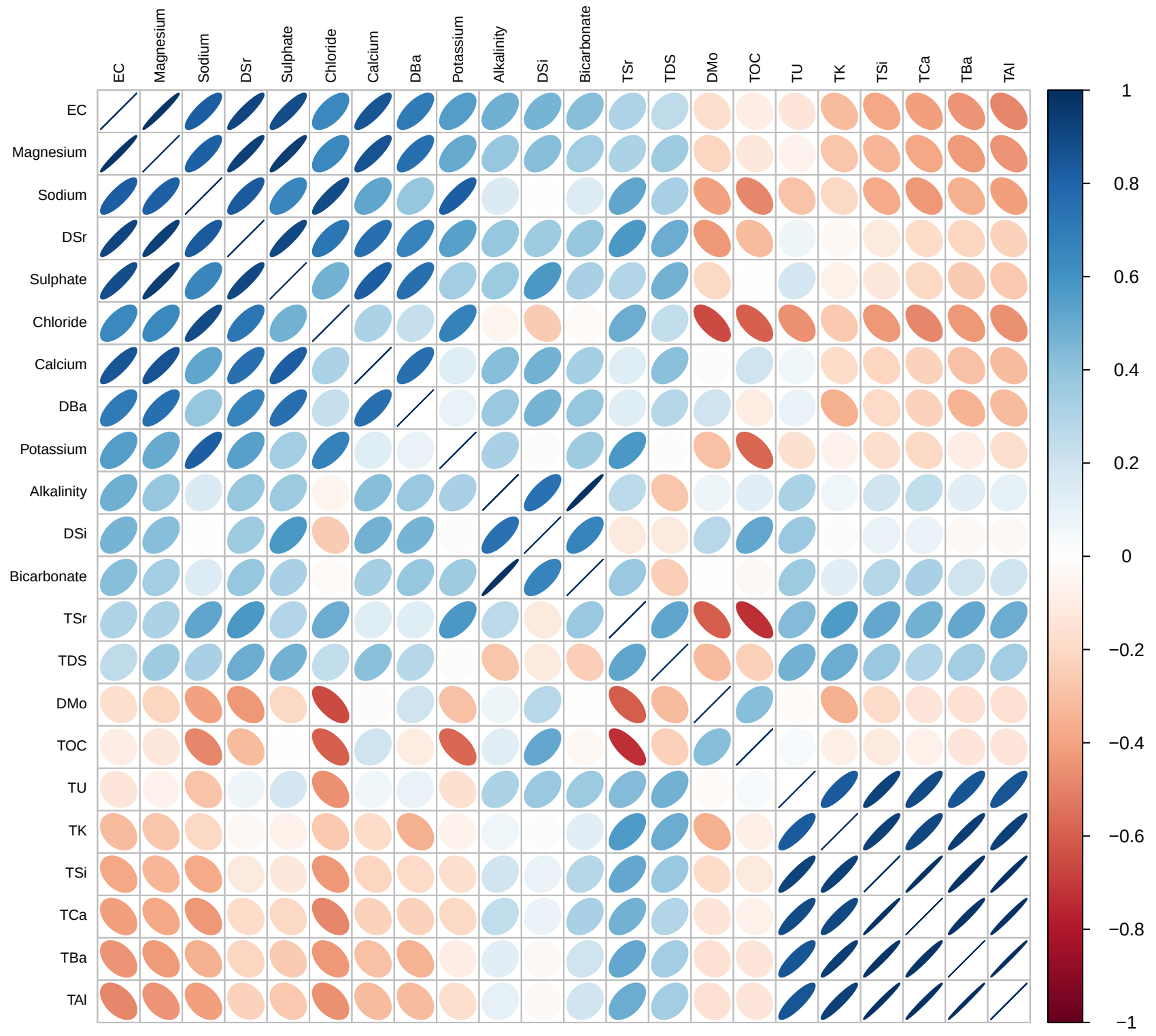


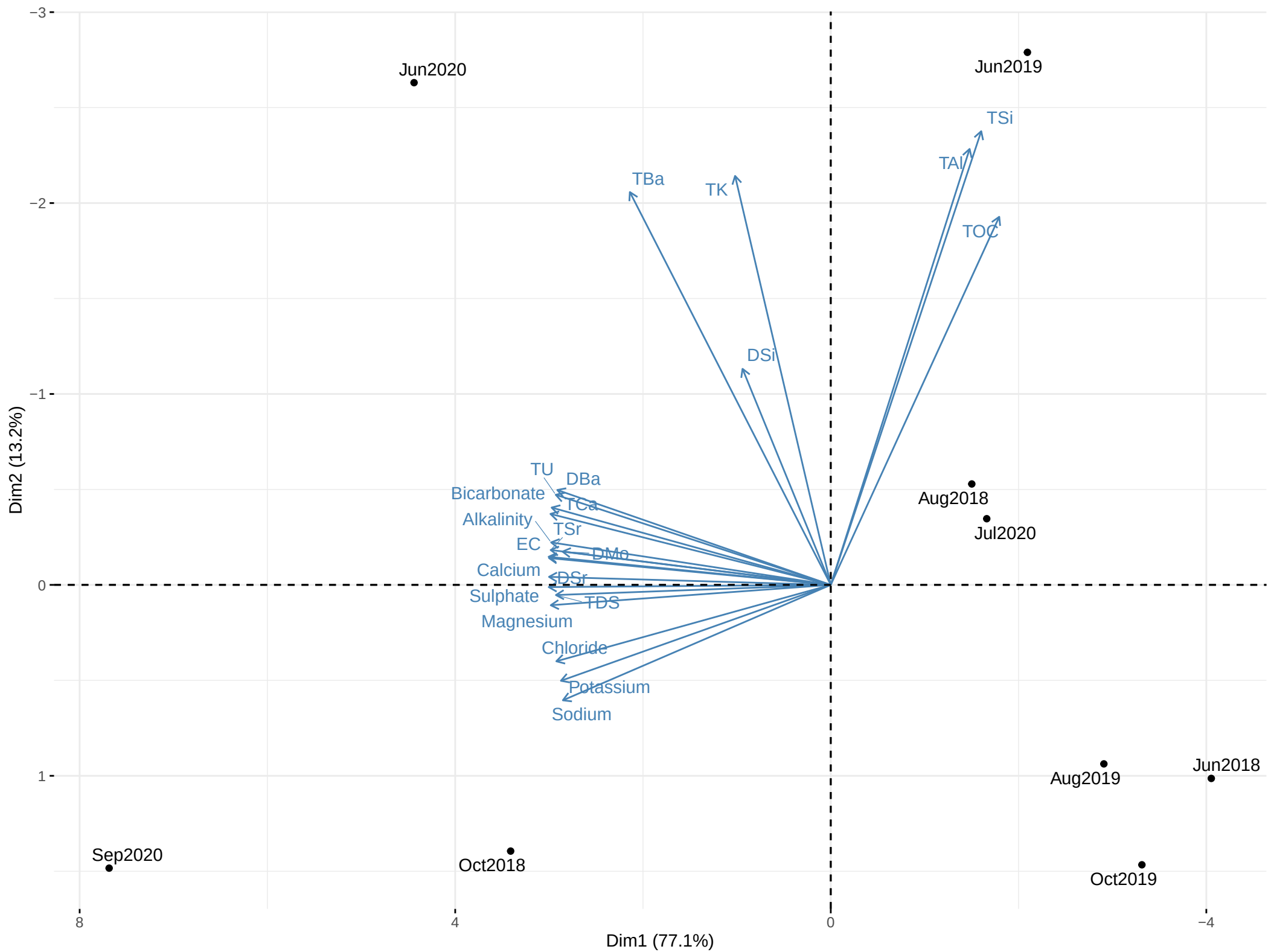
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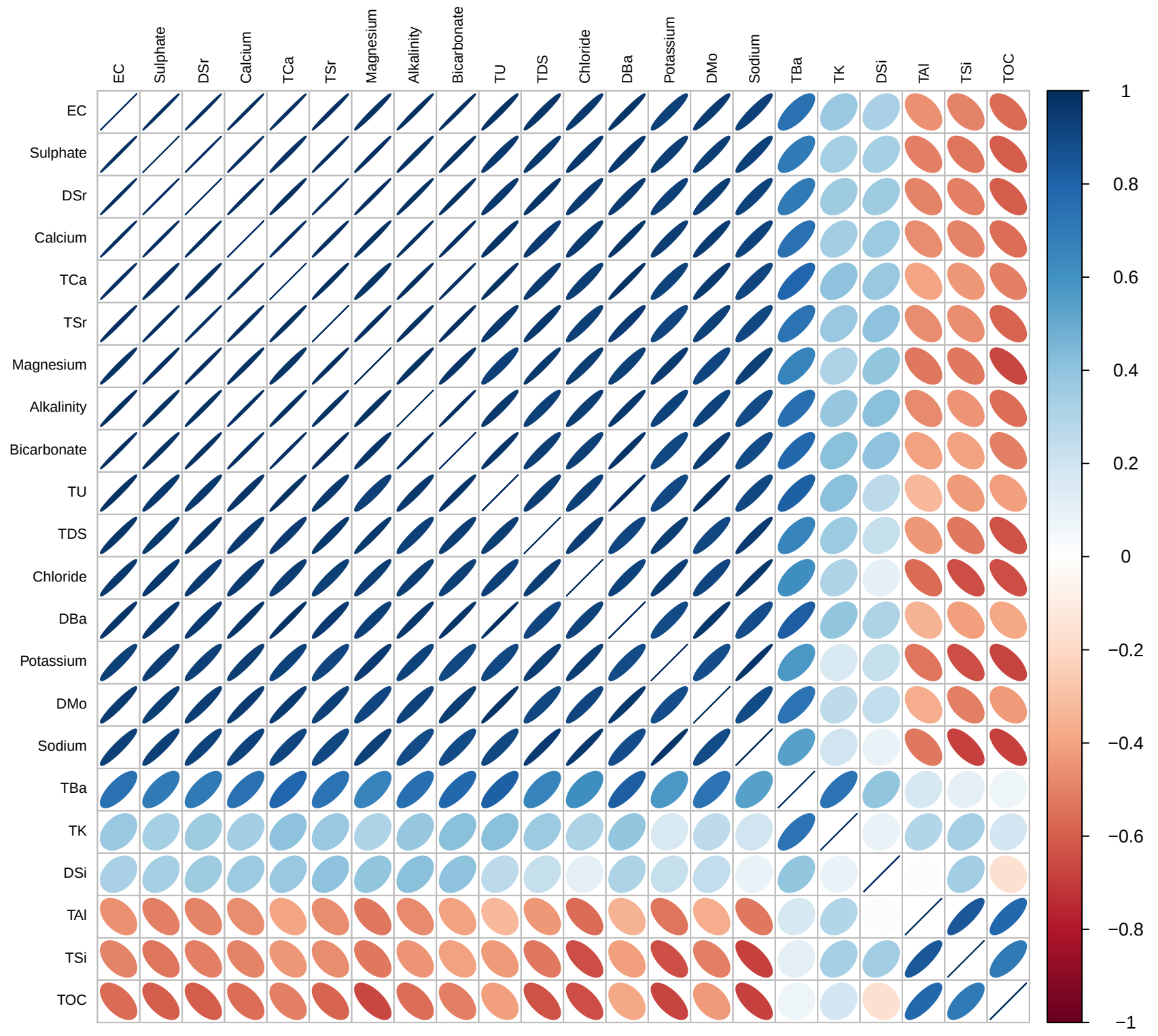


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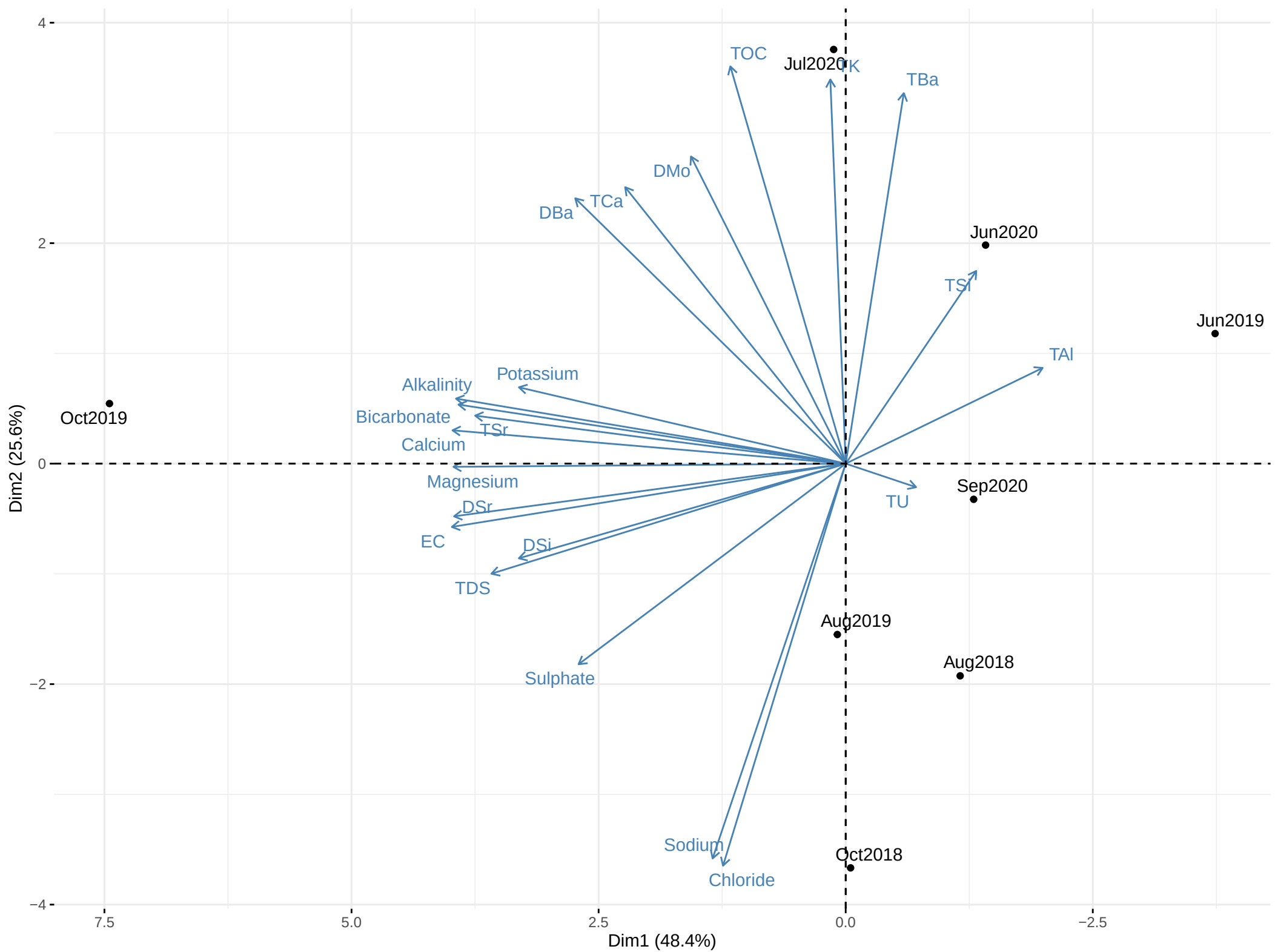




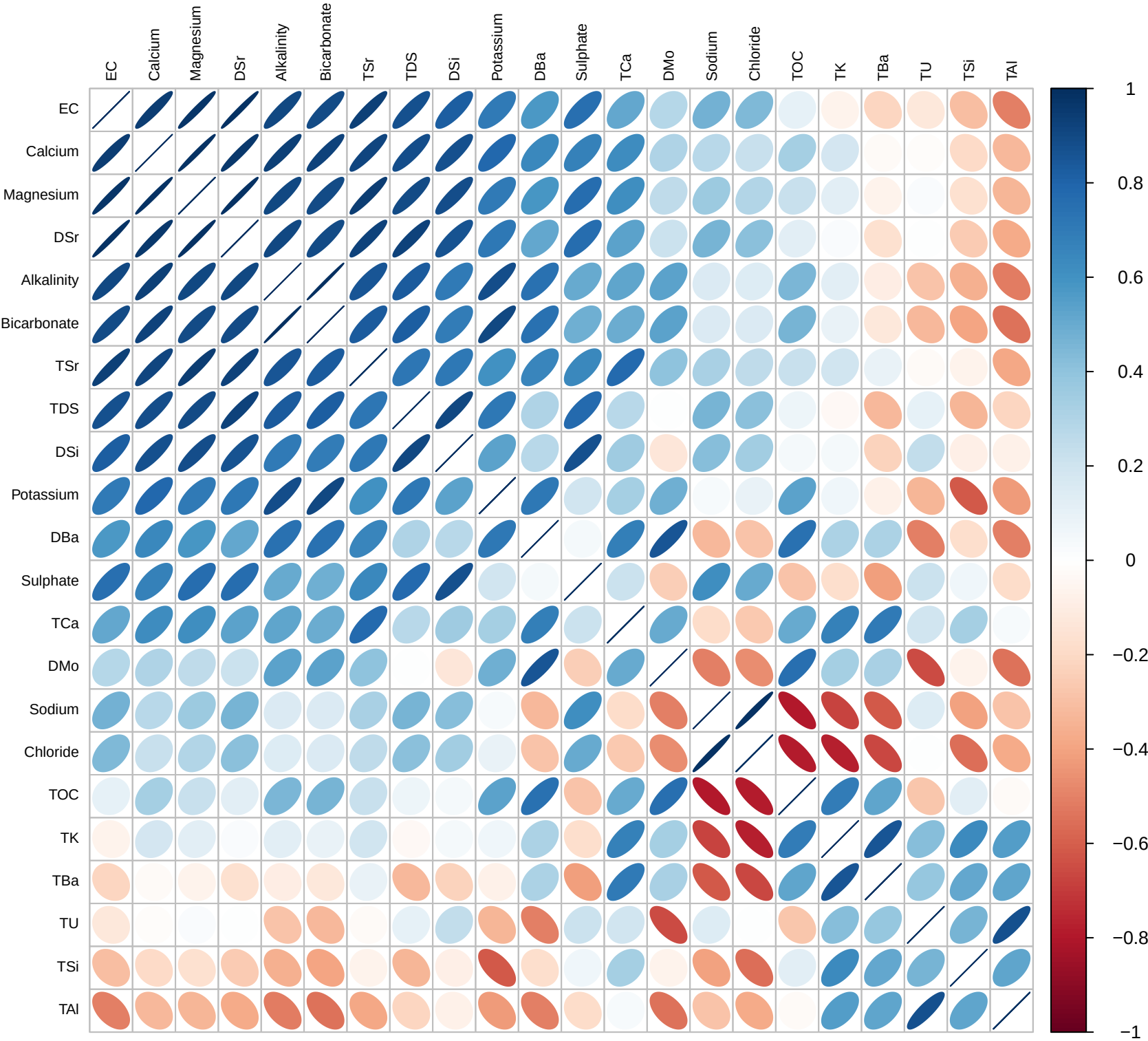
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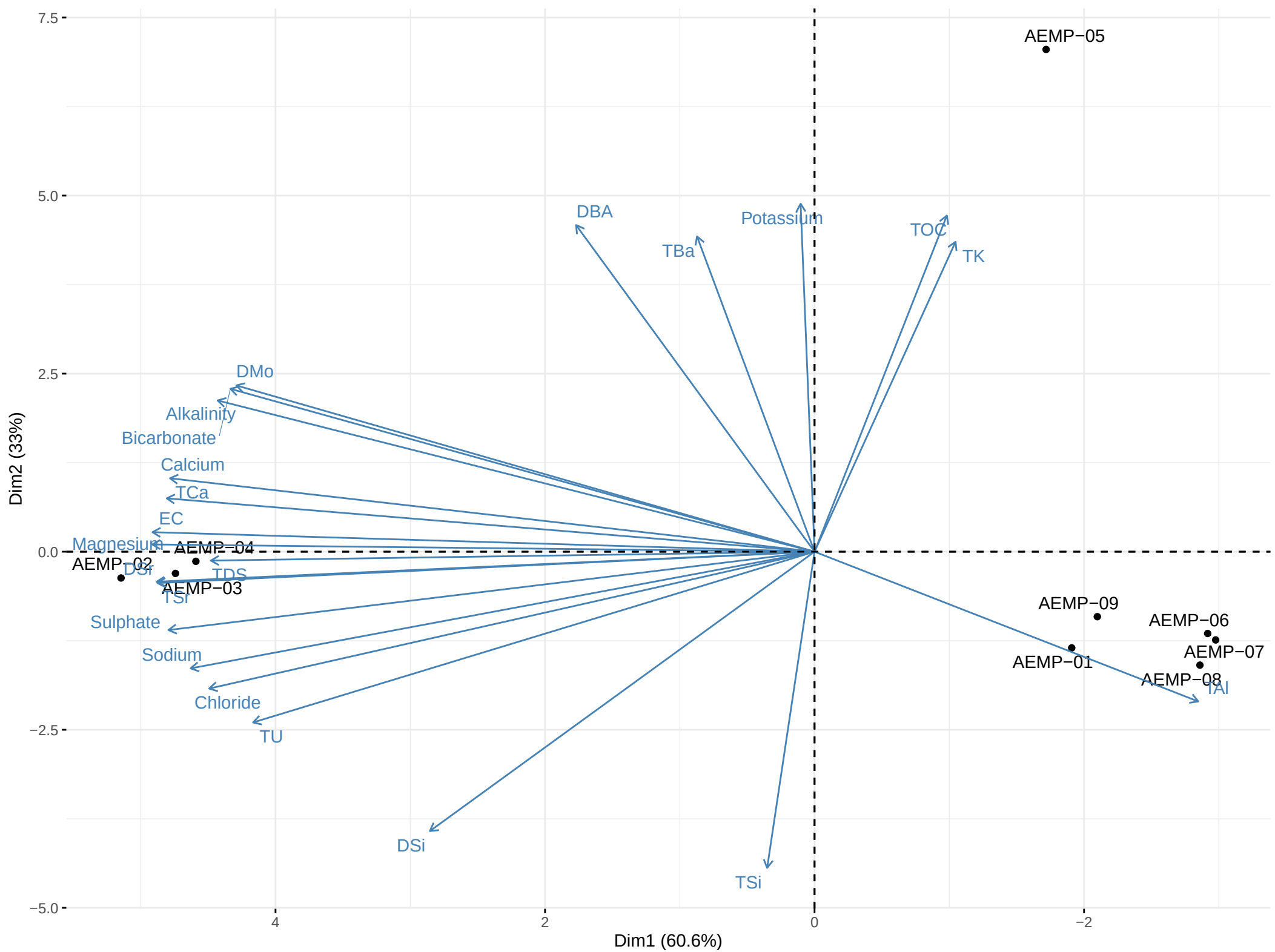
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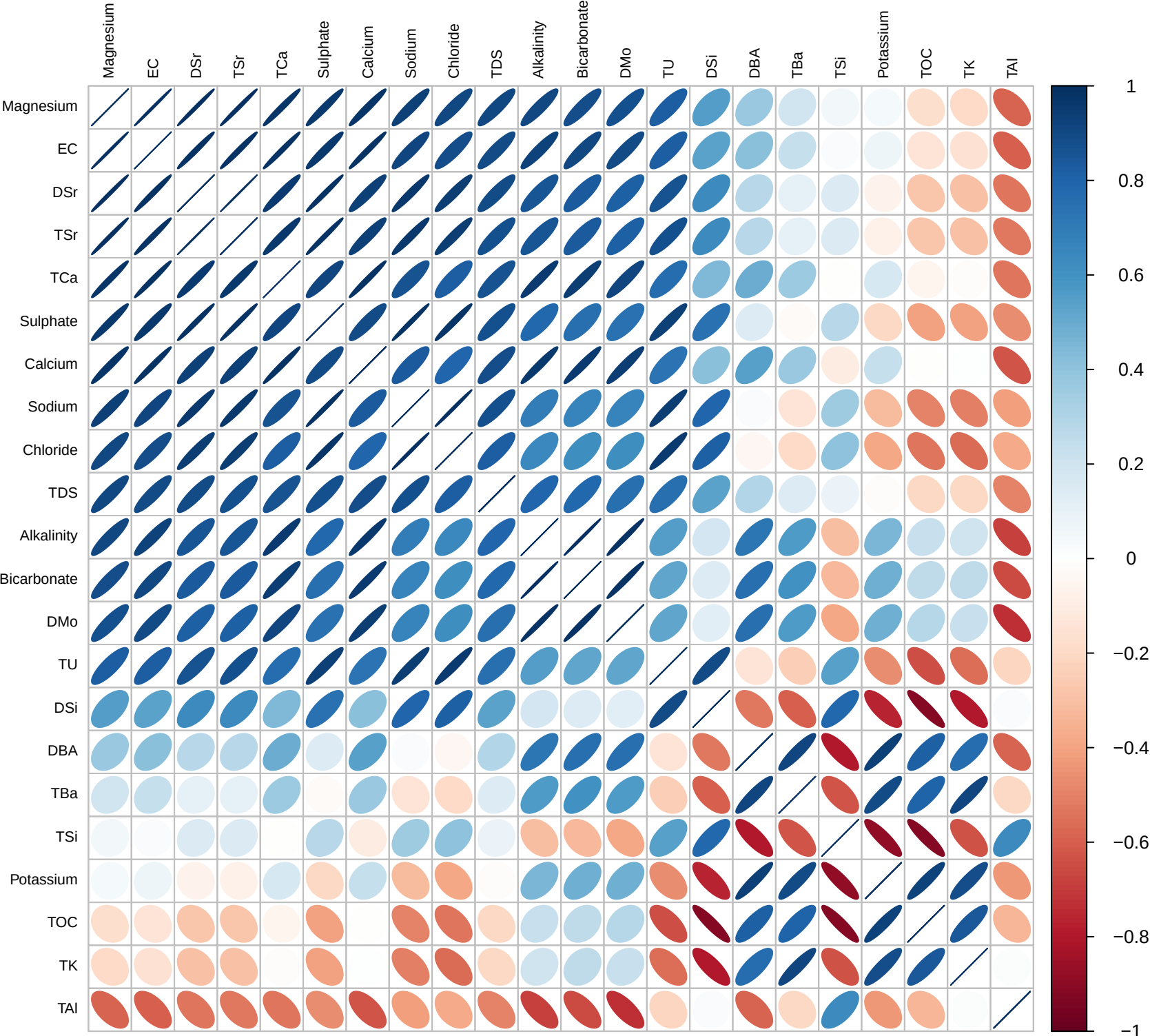
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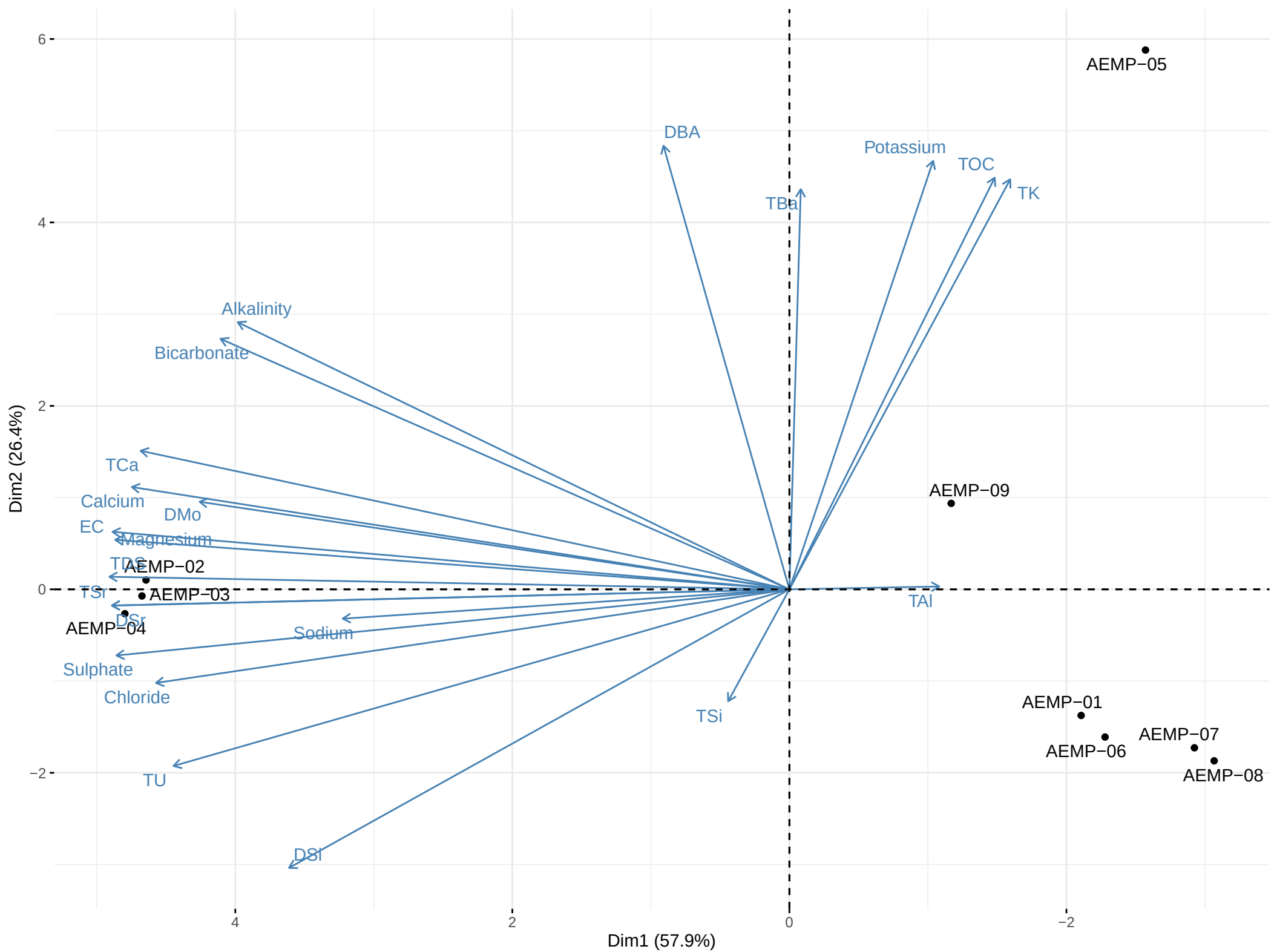
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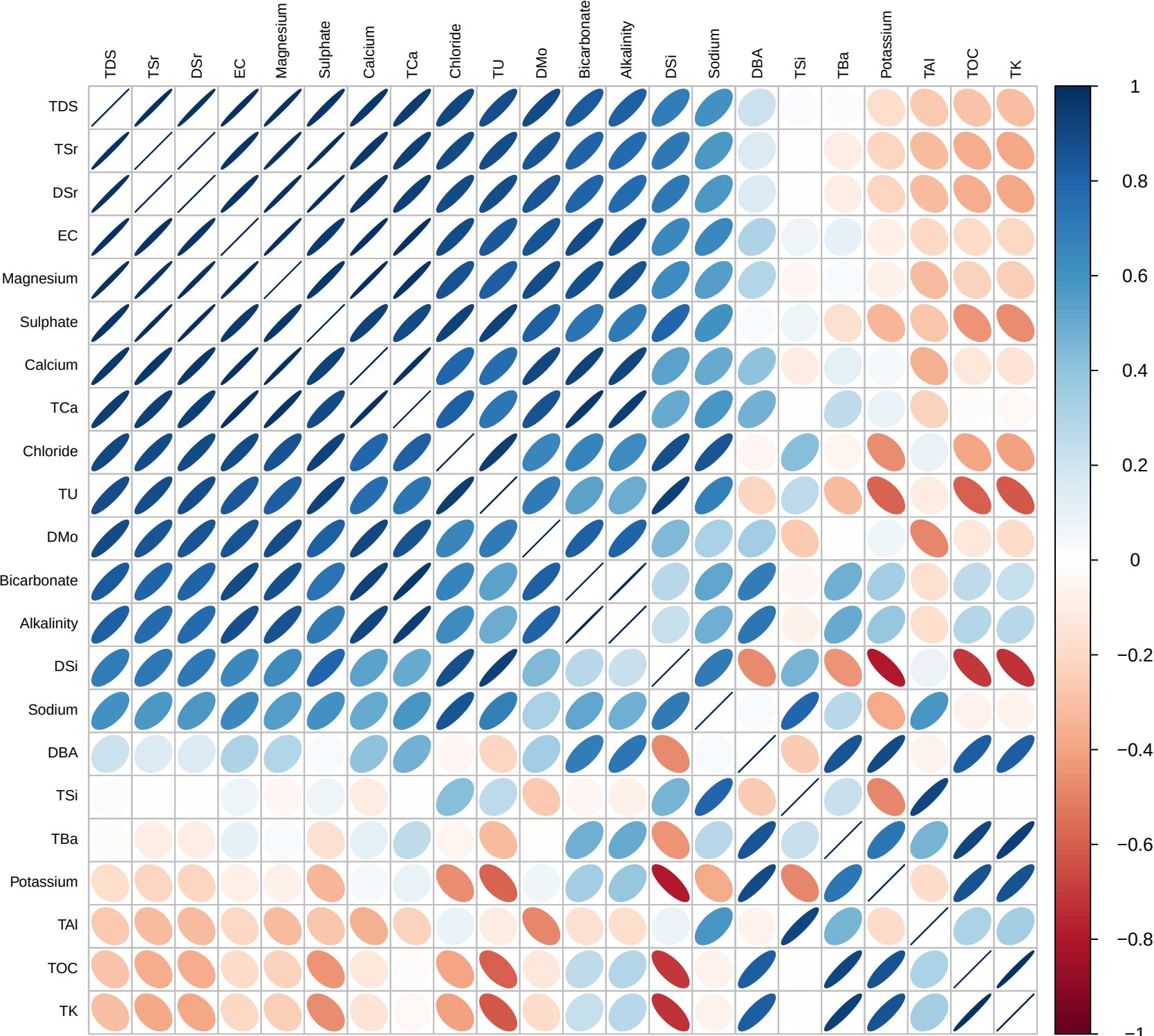
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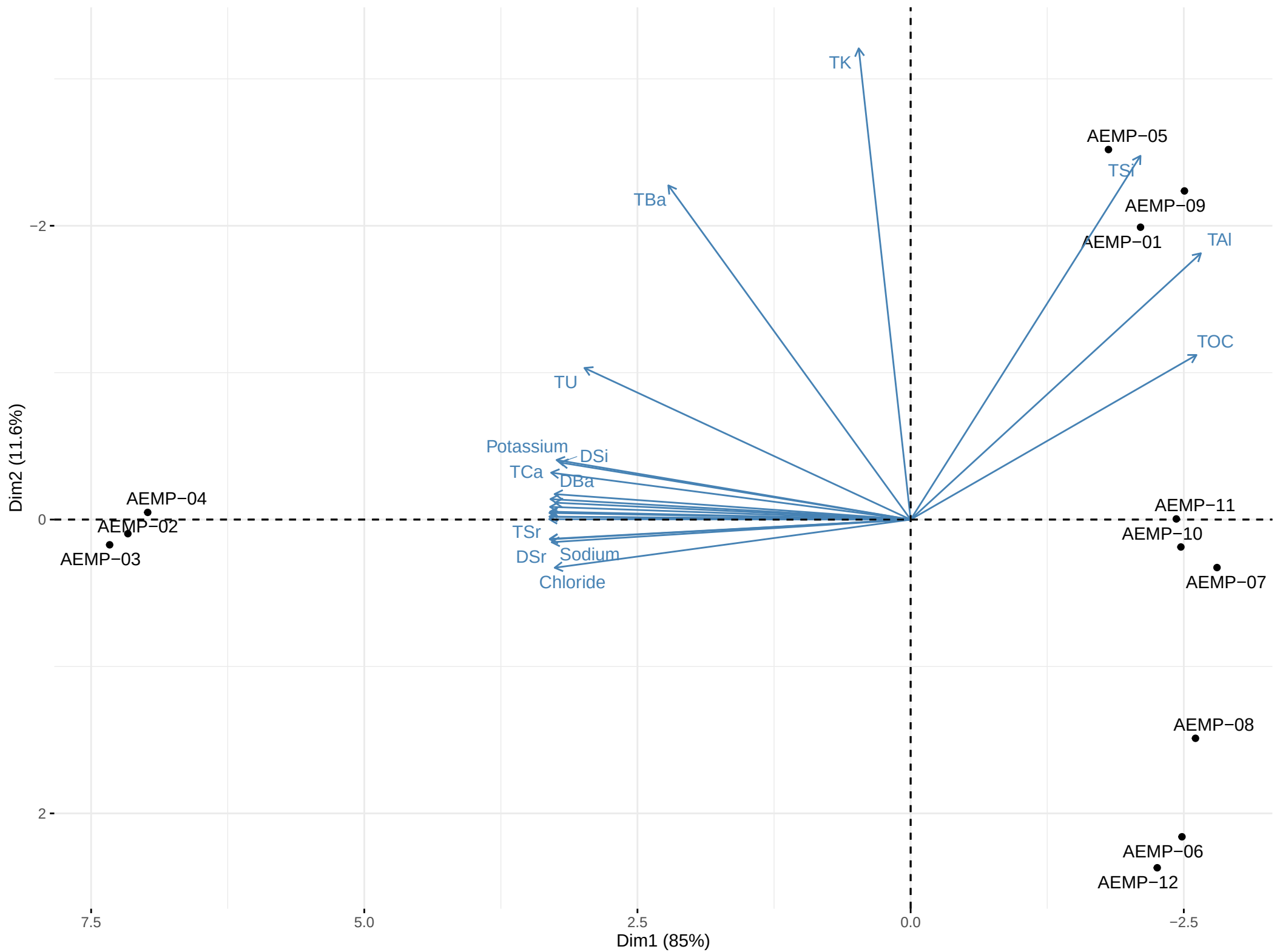
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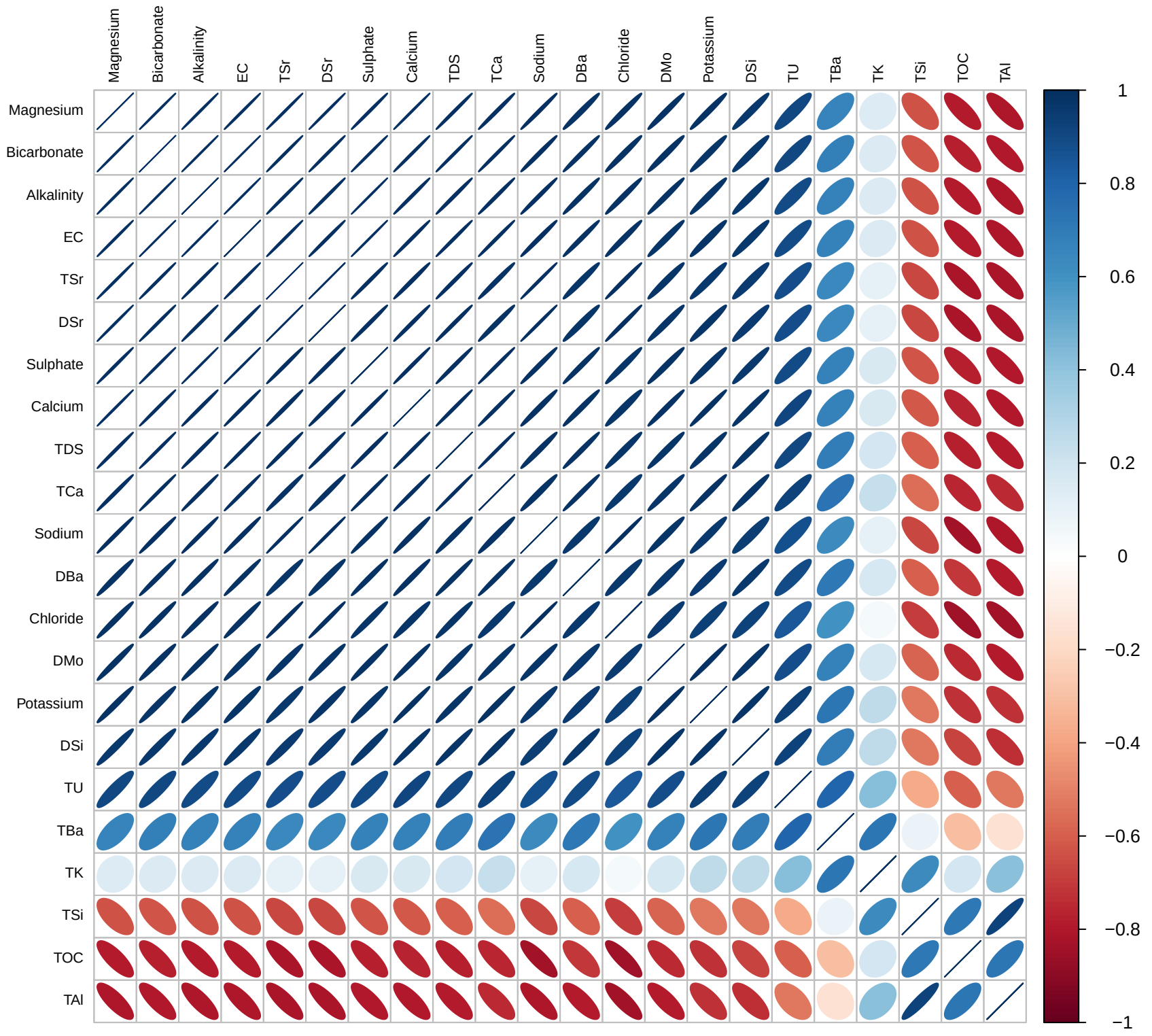
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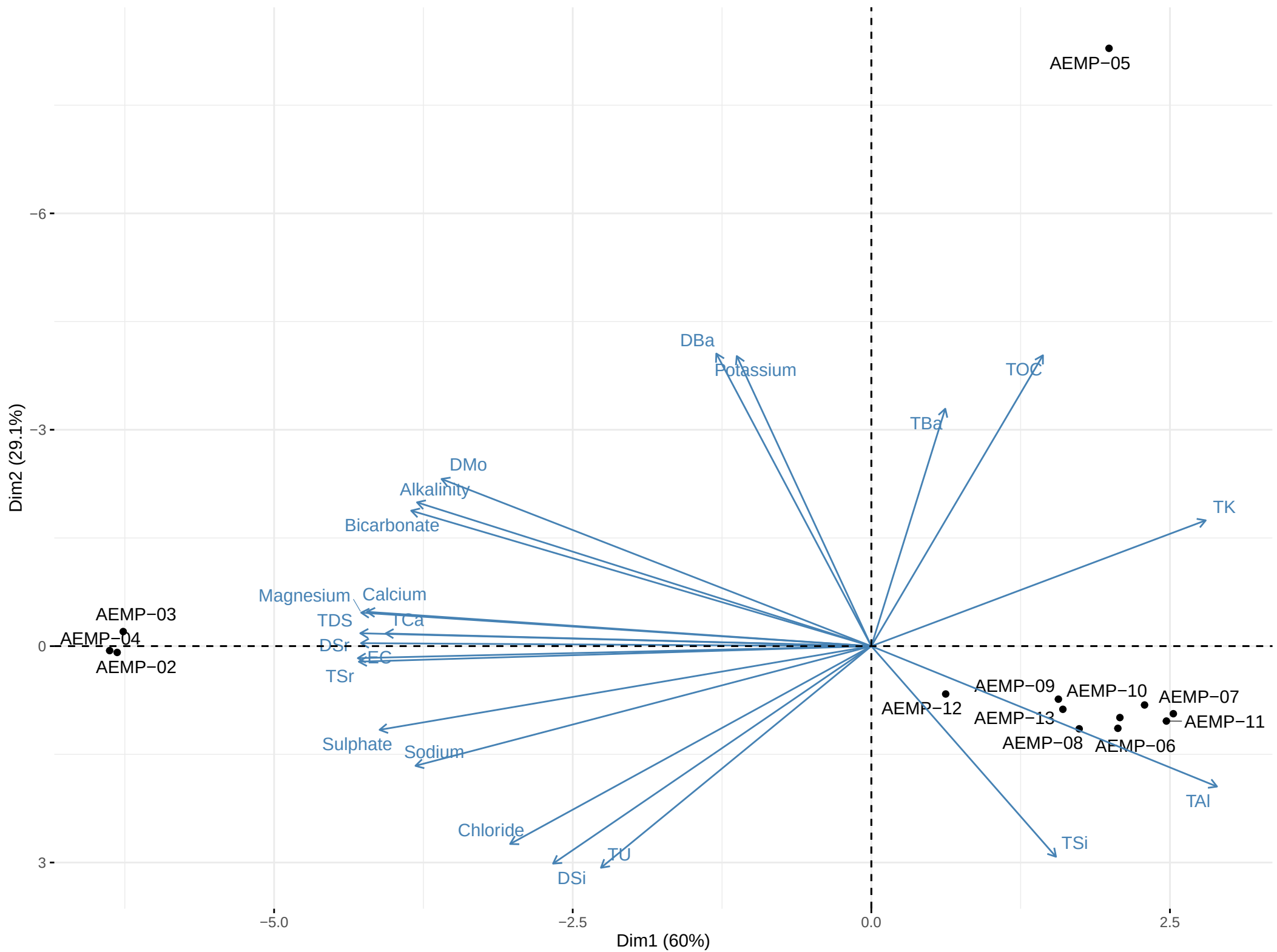
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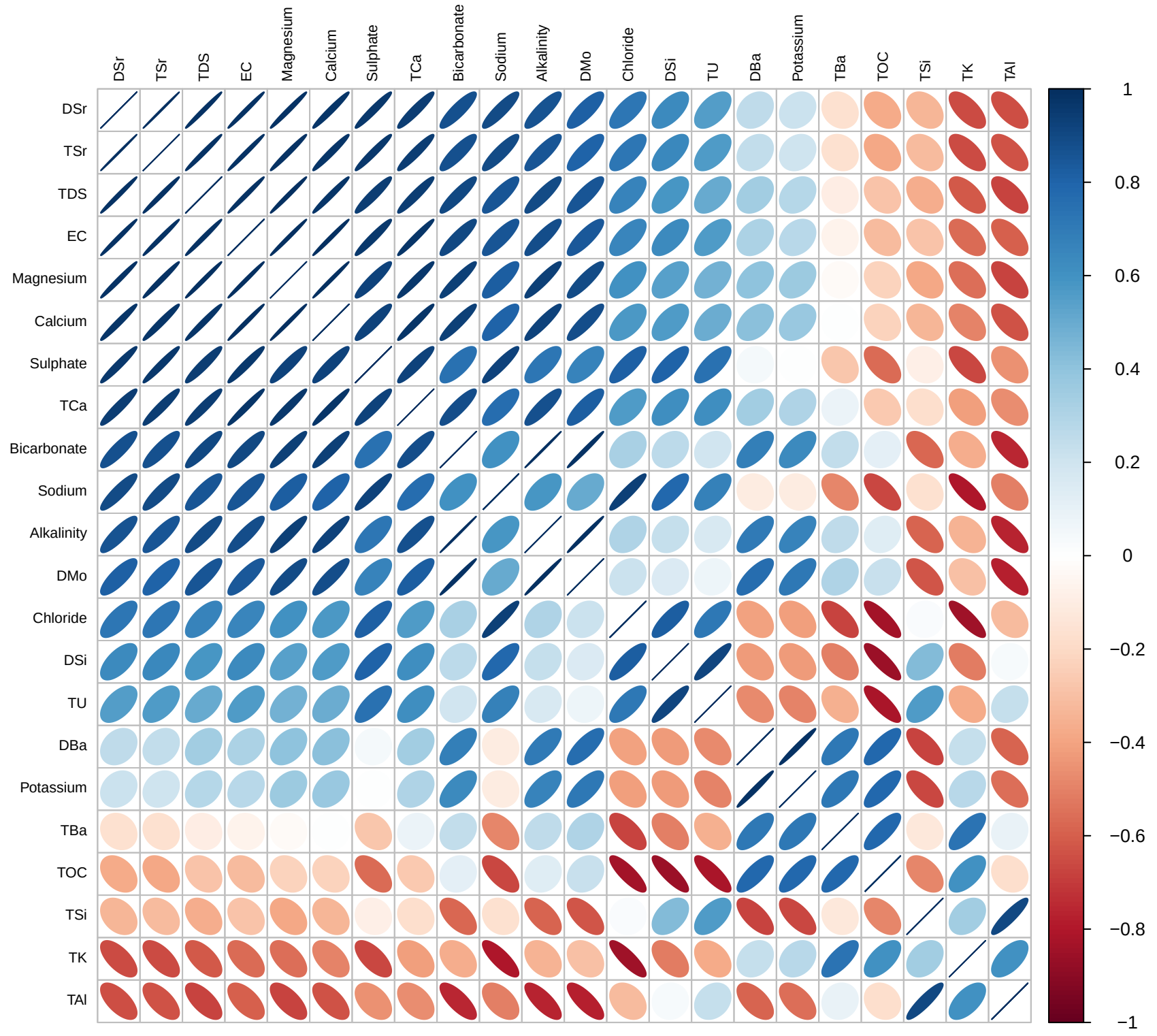
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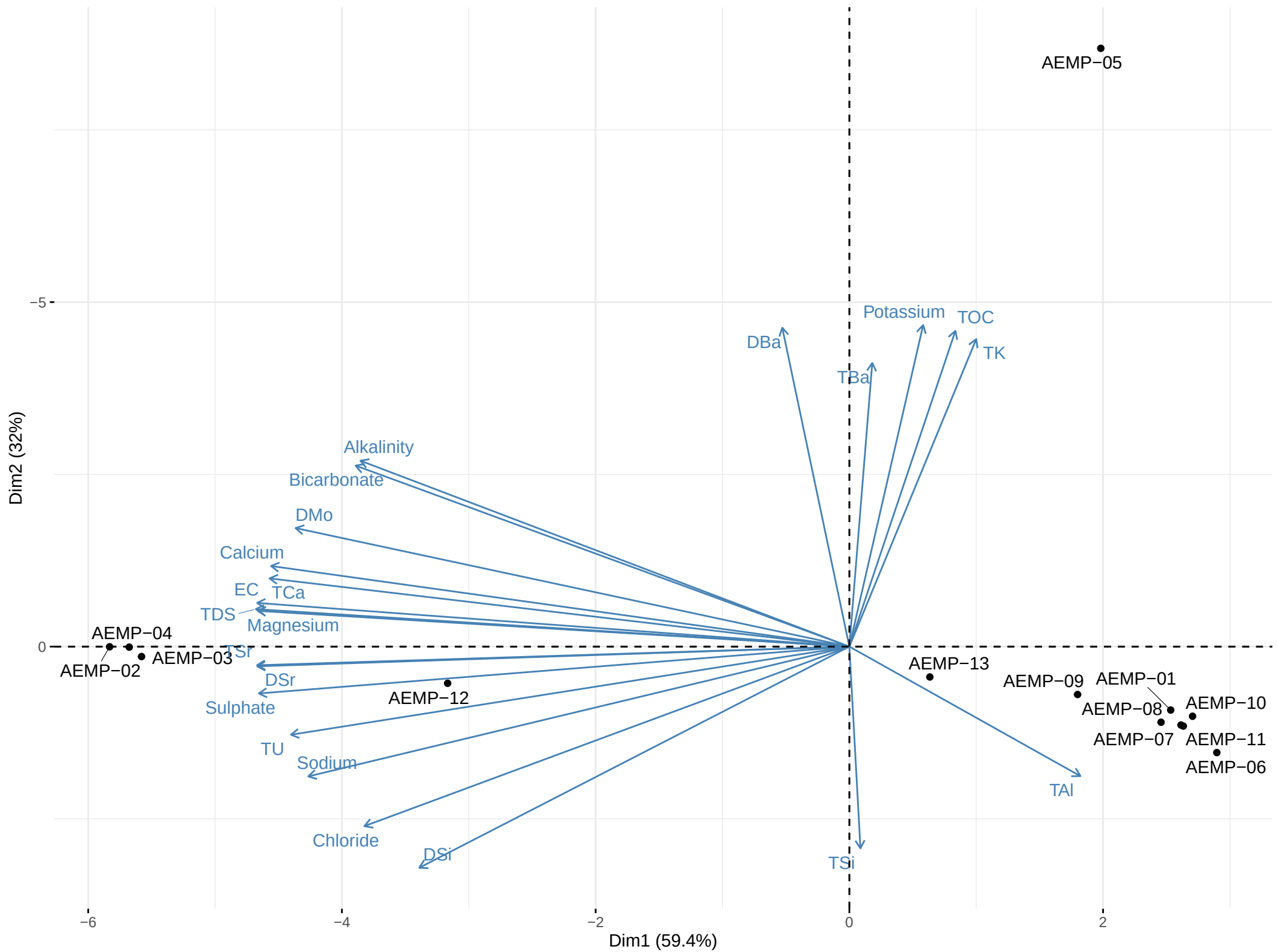
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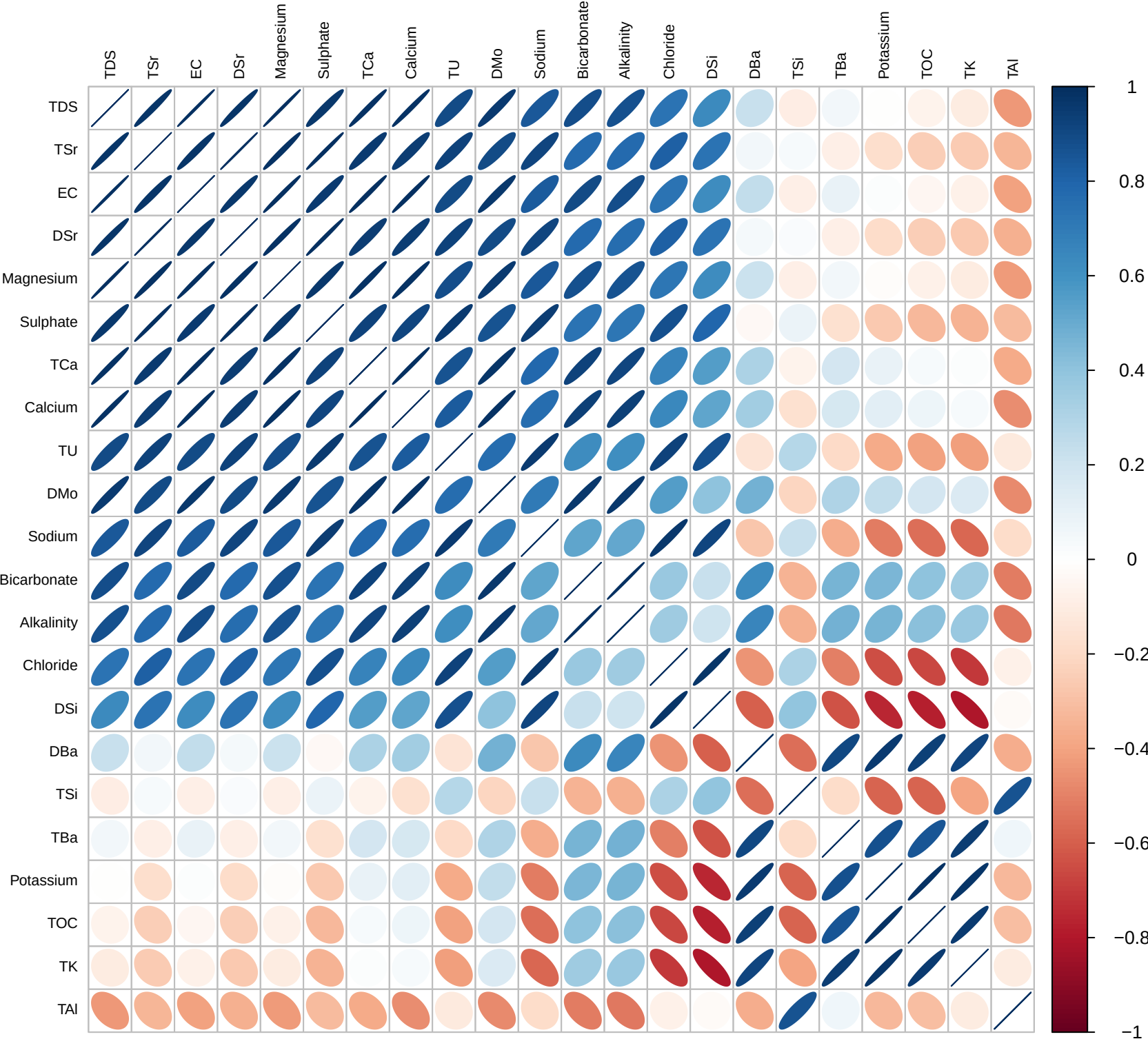
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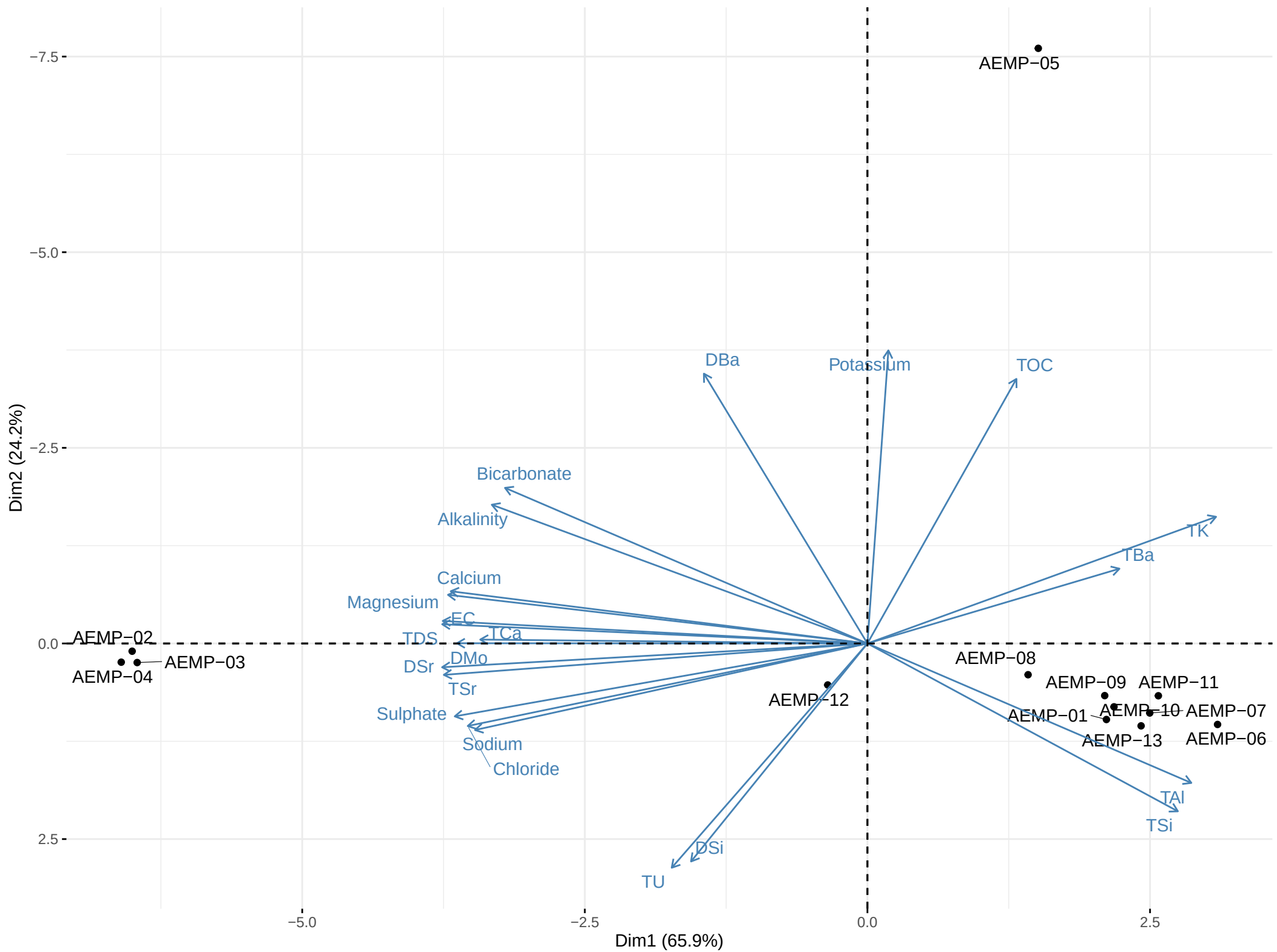
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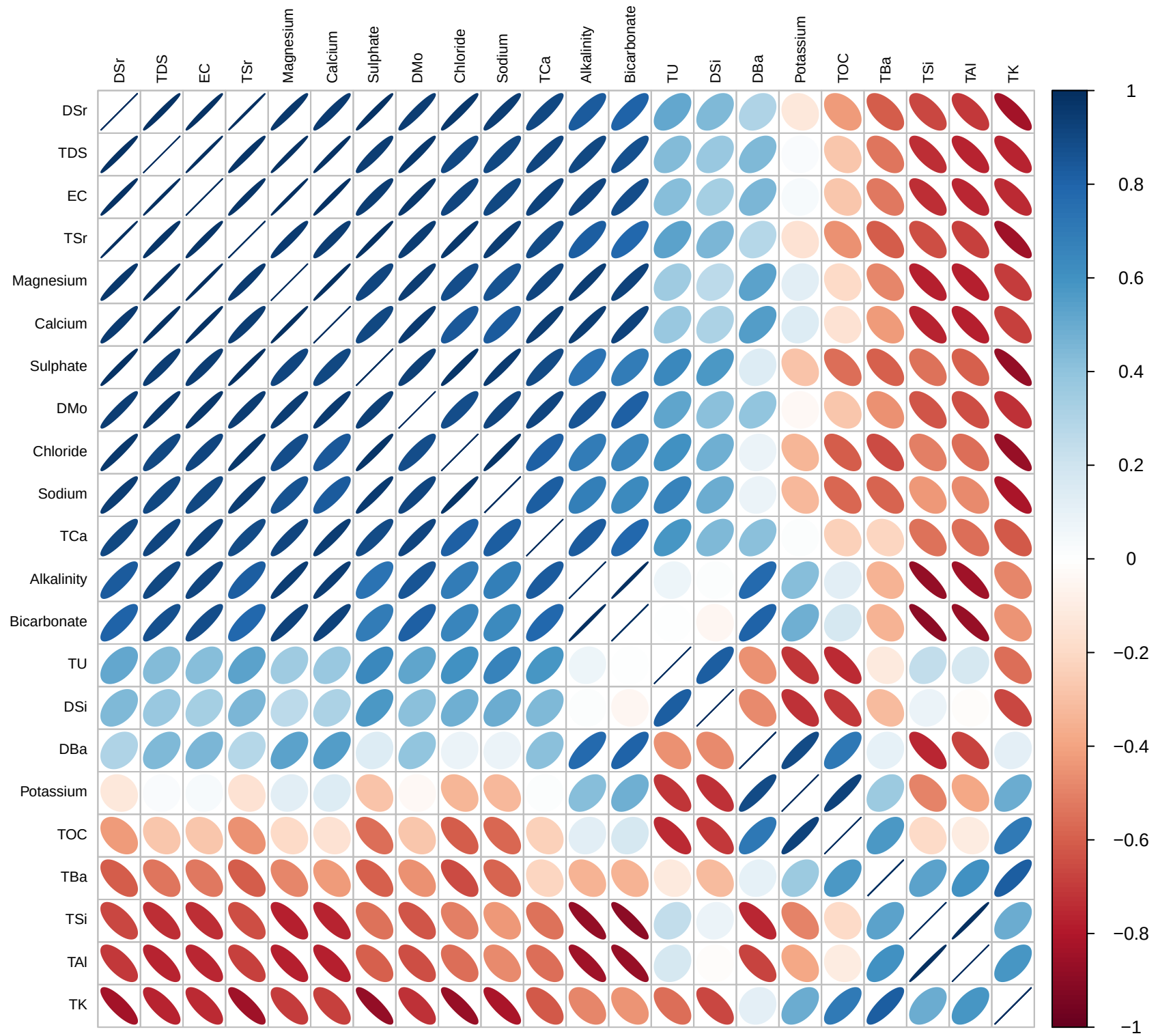
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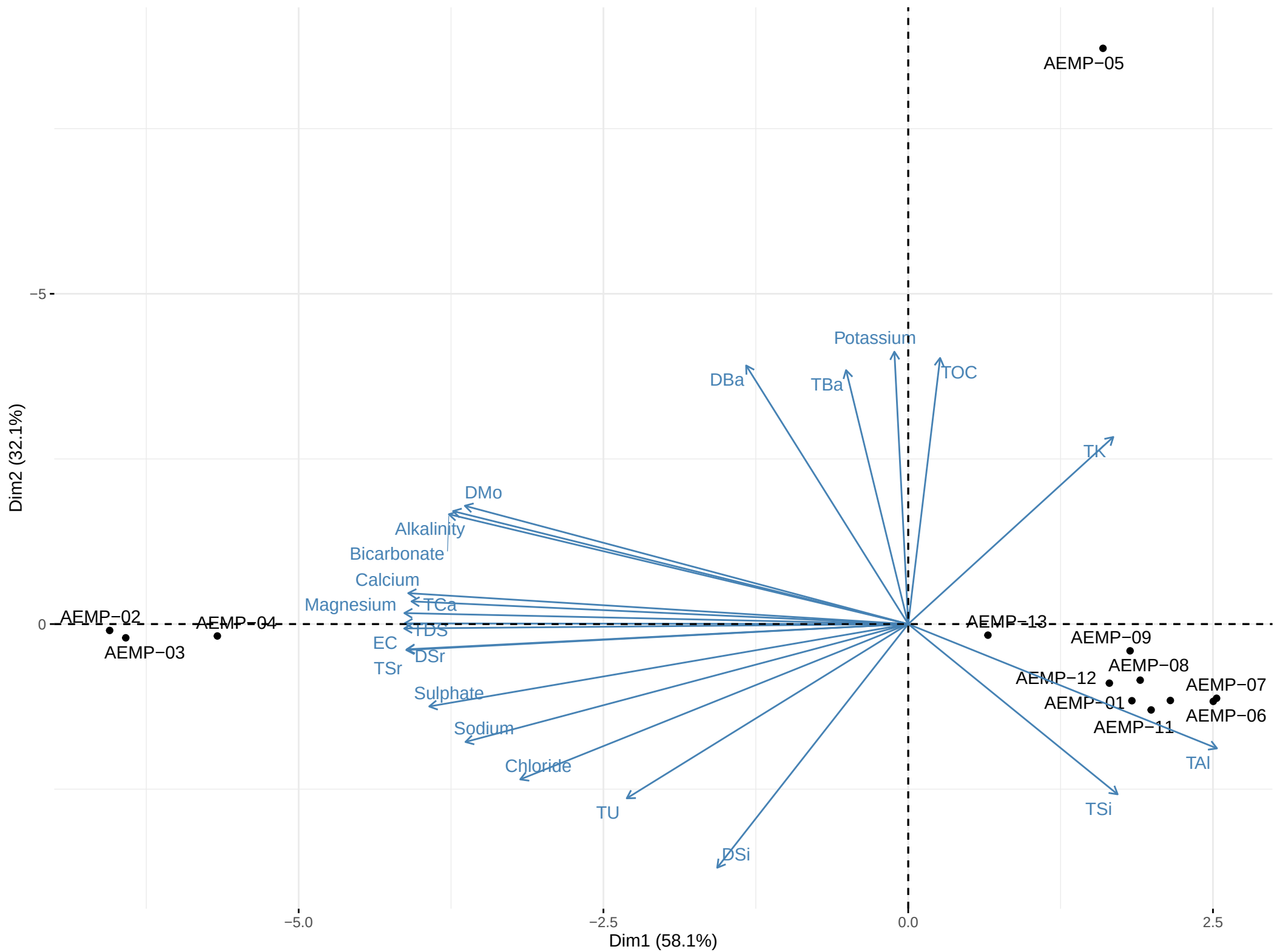
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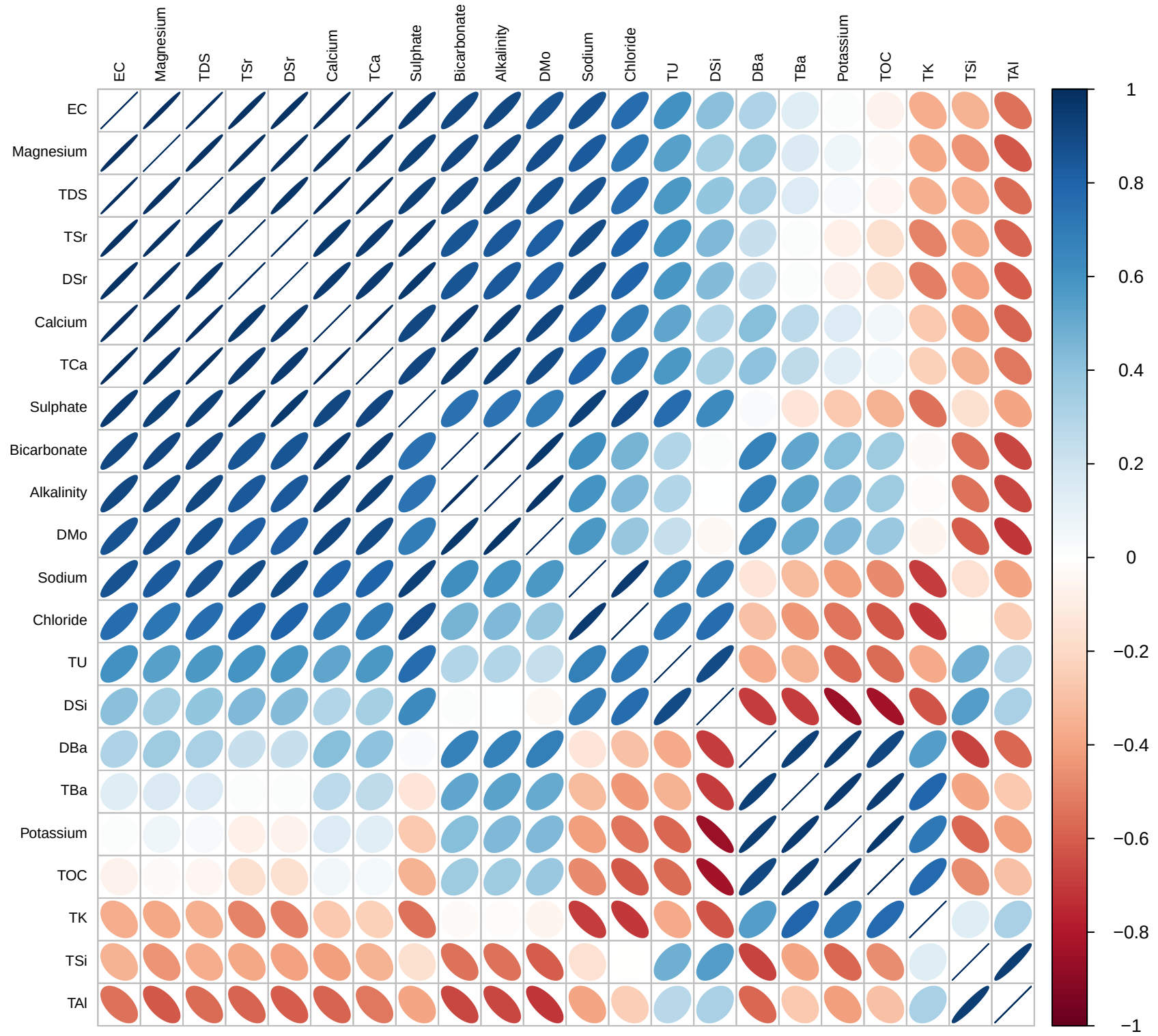
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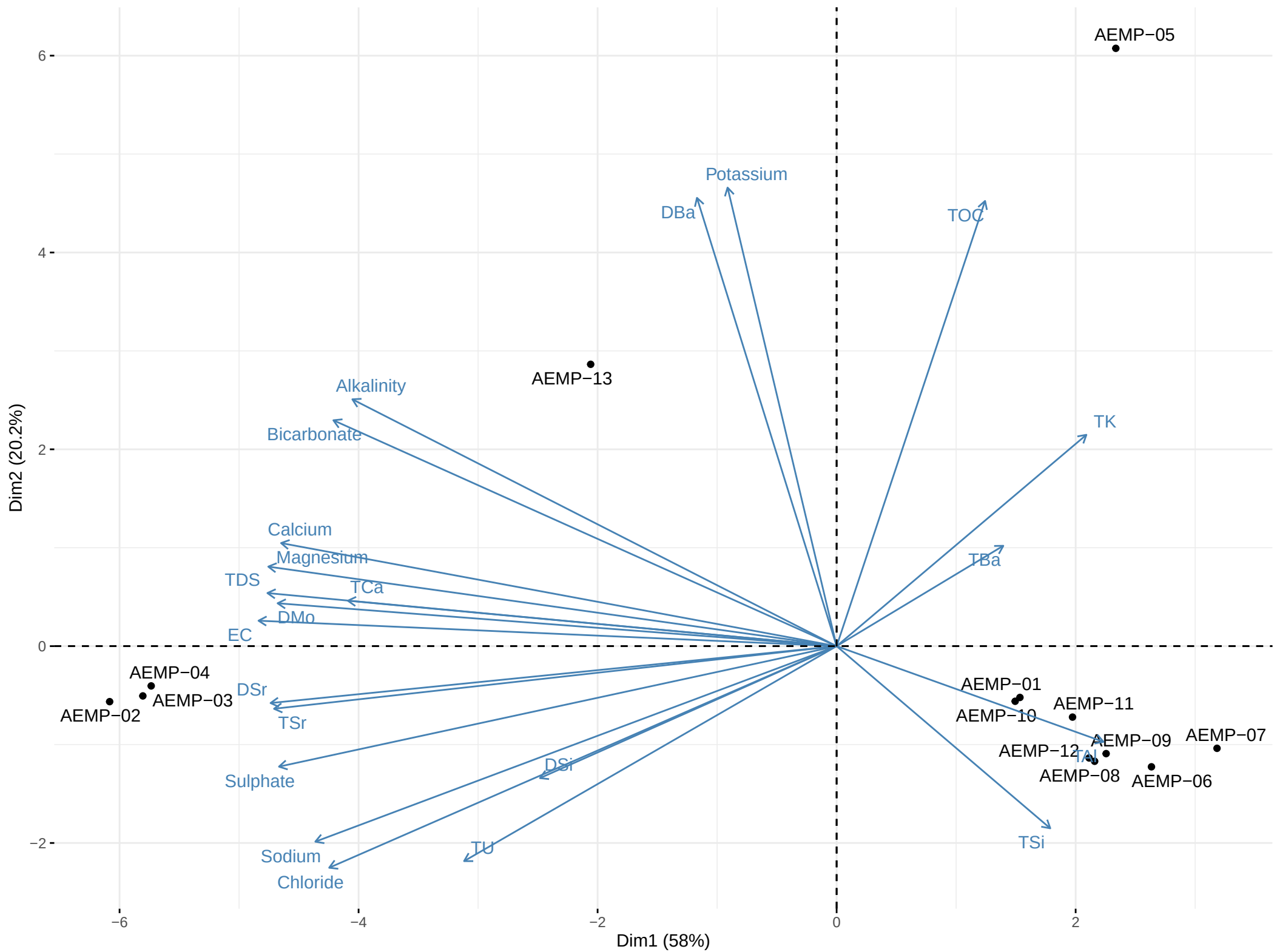
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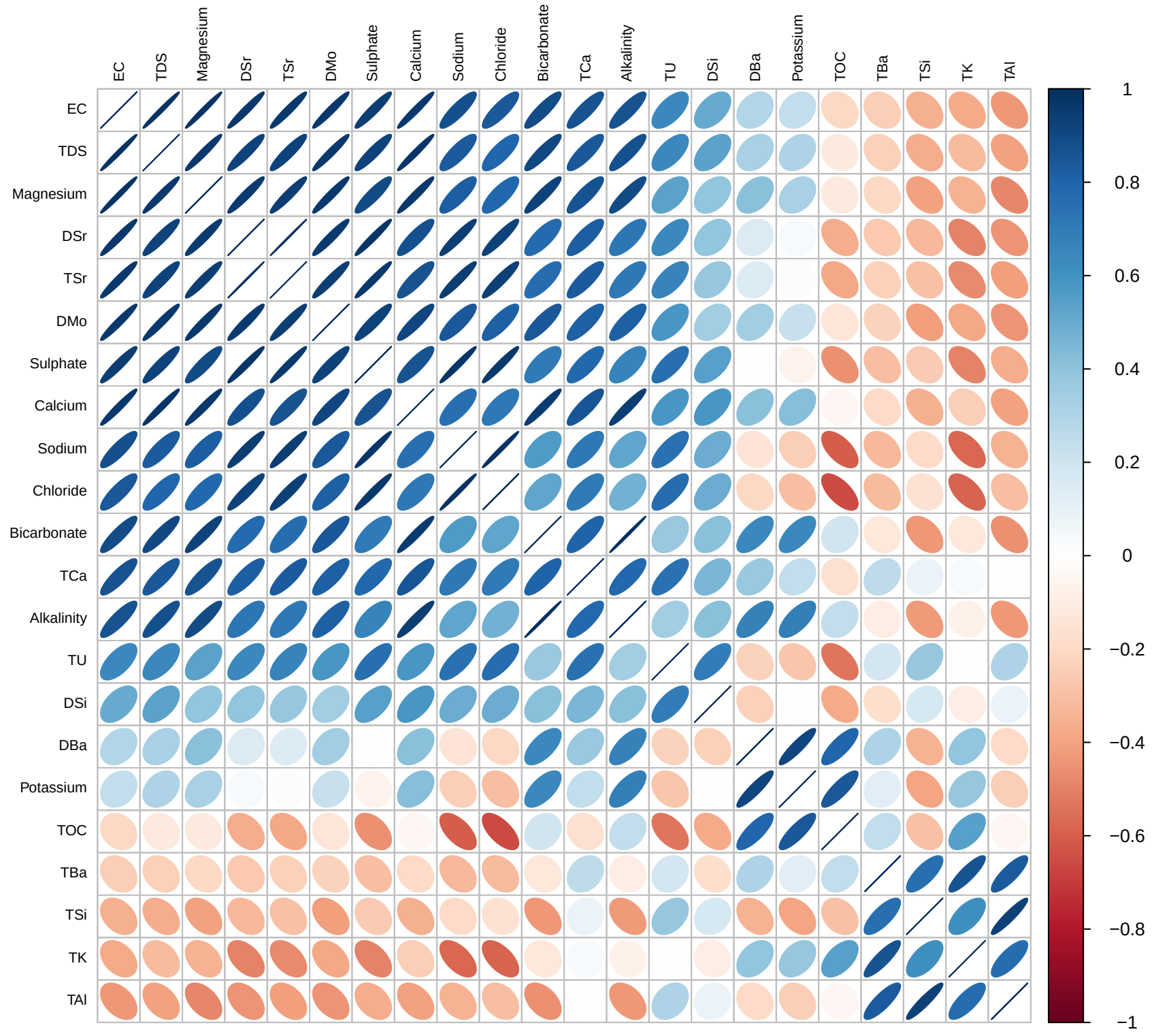
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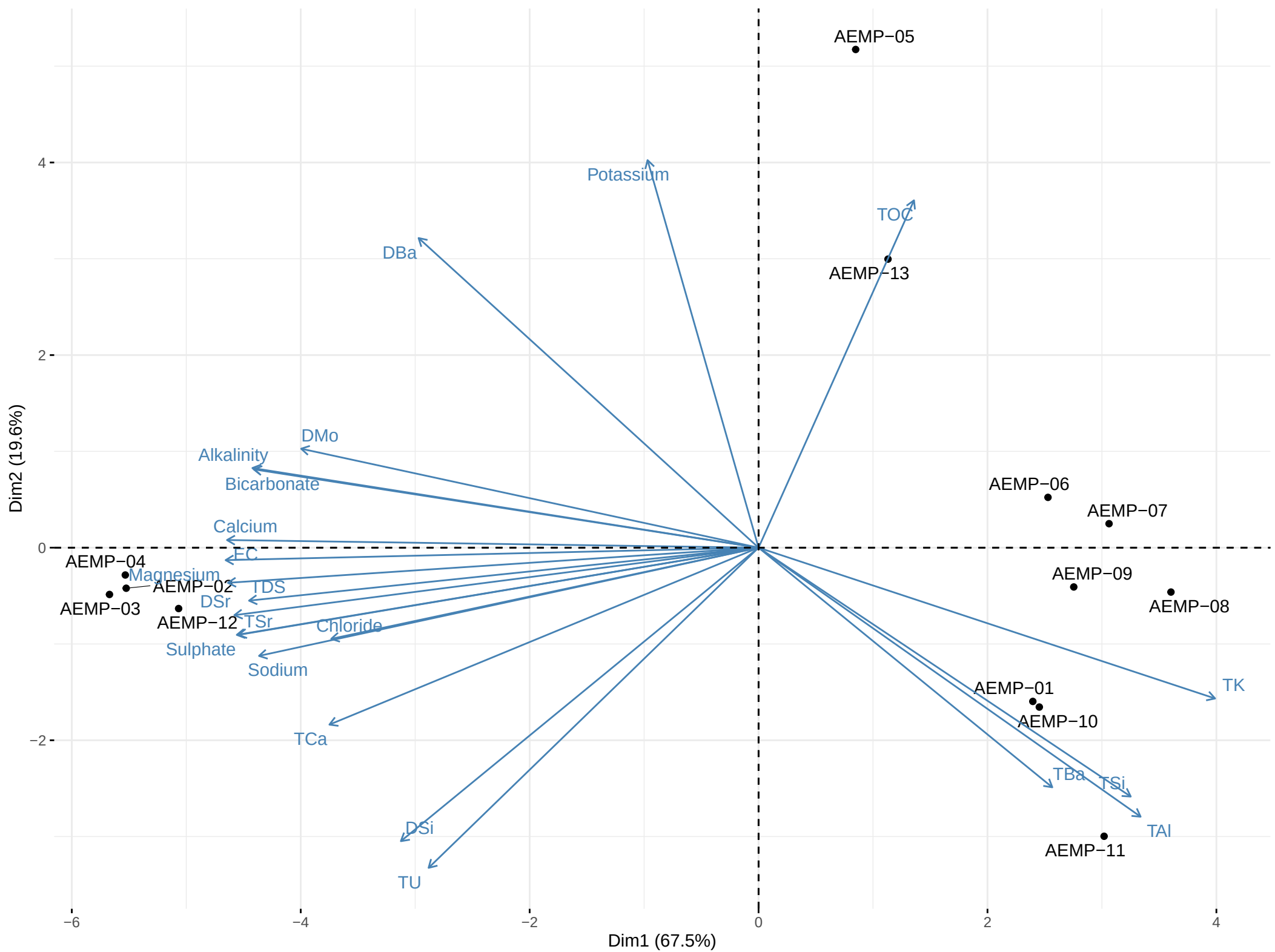
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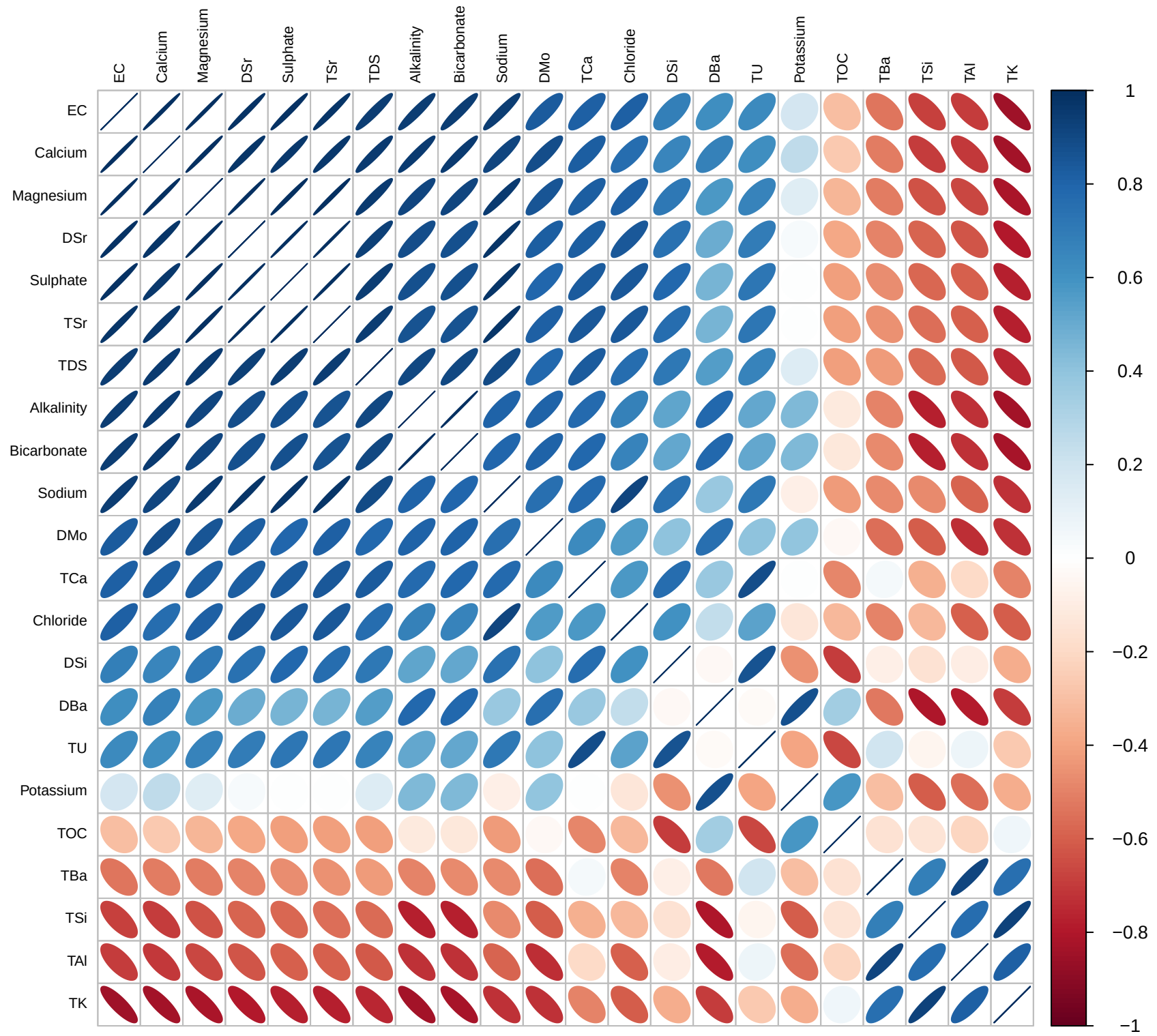
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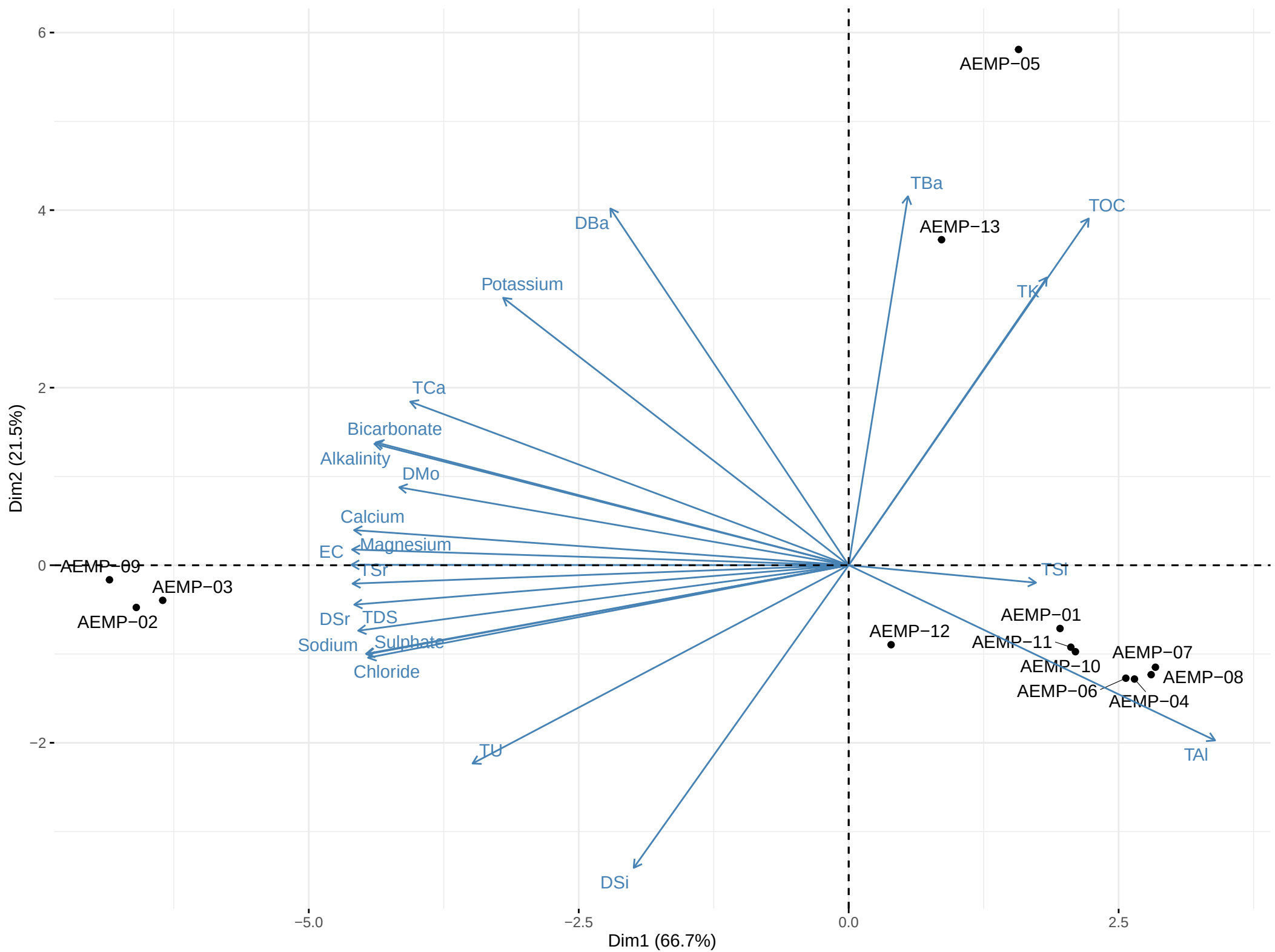
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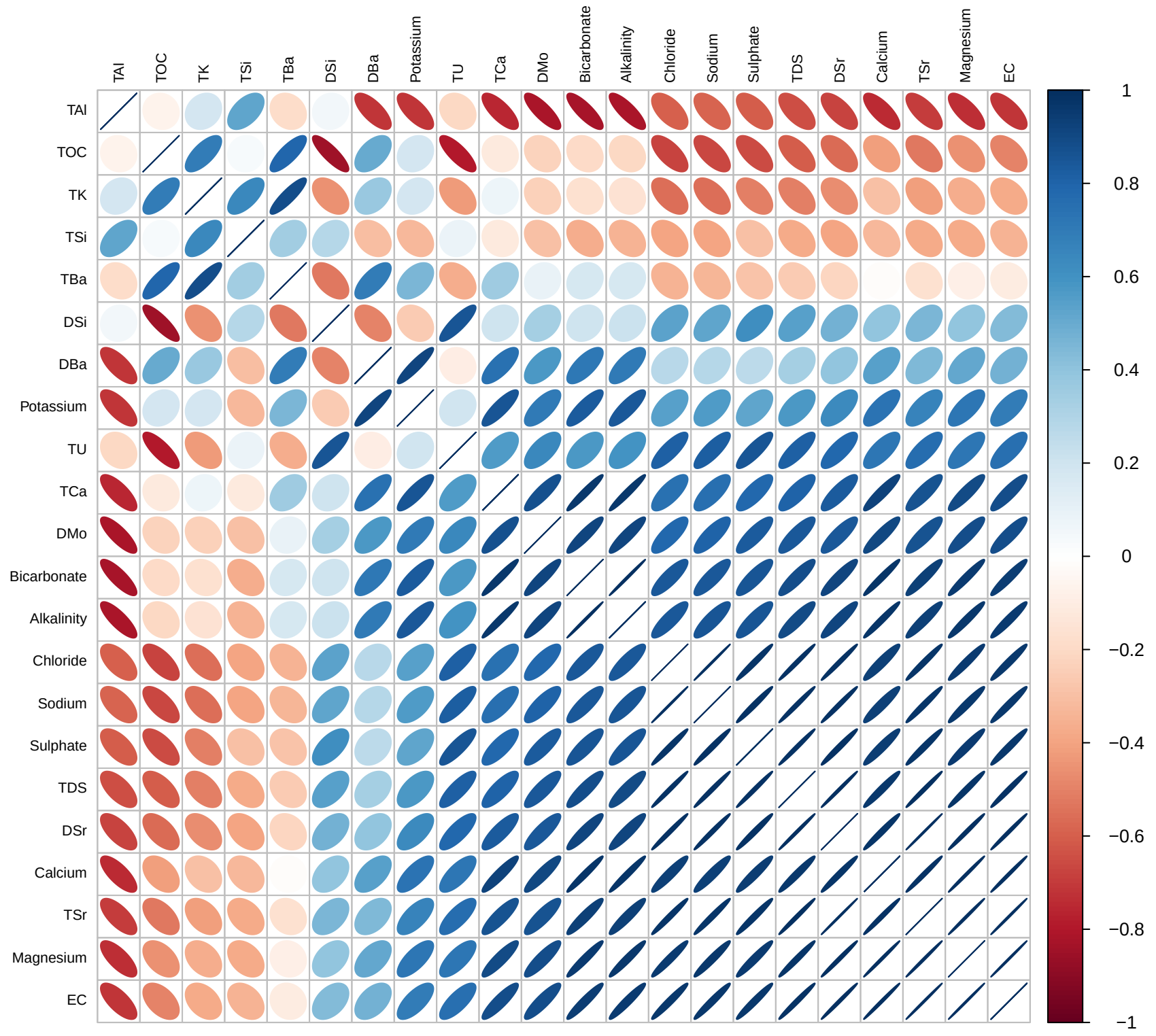
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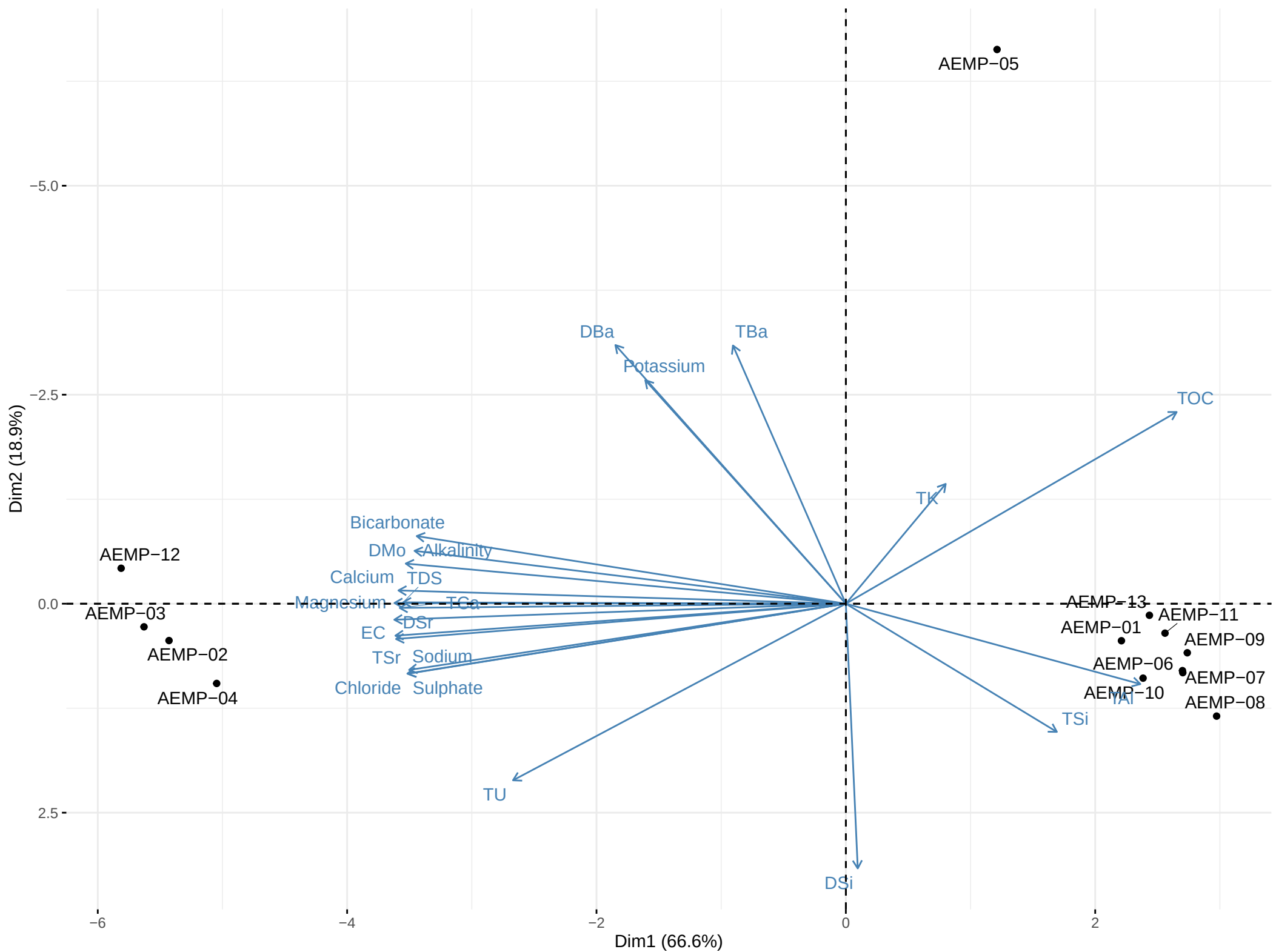
July 2020



July 2020



September 2020



September 2020

