ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

NATIONAL QUALITY MANUAL SUMMARY

ALS management is committed to good professional practice, and to providing a superior level of service and quality in its testing activities that exceeds the industry norm. The ALS management system is designed to comply with the requirements of ISO/IEC 17025:2005, the program requirements of all applicable accrediting bodies, ALS corporate goals, and to satisfy the needs of clients, regulatory authorities, and organizations providing recognition. All staff are required to be familiar with ALS quality system documentation and to implement its policies and procedures in their work. ALS management is committed to complying with these policies and to continually improving the effectiveness of the management system.

ALS Policies and Objectives:

ALS protects its customers' confidential information and proprietary rights. We require all employees to review and sign a Code of Conduct policy that communicates the ALS confidentiality policy. It is ALS practice to never disclose information about a client's analysis to a third party without prior consent of the client, or unless compelled to by law. If we are obligated by law to disclose such information, we will inform the client prior to doing so.

ALS employees avoid involvement in activities that would diminish confidence in their competence, impartiality, judgment or integrity by complying with the ALS Code of Conduct and Data Integrity Policy.

All new employees receive an orientation to ALS safety, quality system and technical policies as well as job-specific training. Training needs are reviewed to ensure appropriate training is provided. The effectiveness of training actions is evaluated where appropriate.

Appropriate personnel are involved with the provision of quotations and contracts to the degree necessary to understand our clients' needs, to determine if a location can manage projected workloads, to identify the correct test methods to be used, and to maintain appropriate communications with the client during testing. Records of client communications are maintained and all changes to work plans are communicated to those involved.

Suppliers of goods and services are pre-approved using national protocols where they could have an affect on the quality of tests. The national purchasing system ensures control over selection and purchasing, while systems for reception, storage and handling of supplies ensure we receive what was ordered, that appropriate storage is provided, and that records of verification are maintained where needed.

All complaints, whether received by direct communication or during survey activities, are managed and resolved. Records are maintained of the complaint, discussions with the client about the complaint, and its resolution.

When any of our services fail to conform to ALS policies or procedures or to the requirements of our customer, a nonconformance is recorded. A national procedure defines the responsibilities and authorities for handling non-conformances, including documentation, work stoppage, work resumption, and for evaluating the significance of the non-conformance. Correction, evaluation and customer notification are initiated where applicable.

When nonconforming work is identified, root cause analysis and selection and implementation of corrective action that will prevent recurrence are initiated, and are documented in the LIMS CAR System. Monitoring is performed both locally and nationally, and additional audits are performed as needed.

Internal audits are performed at each facility following pre-determined schedules and procedures to ensure operations comply with the requirements of the management system, the program requirements of all applicable

accrediting and recognition bodies, and ISO/IEC 17025:2005. Audits are managed by Quality representatives for each location, and are performed by individuals who are trained in internal auditing techniques and who are independent of the activity being audited.

All ALS locations have appropriate facilities to securely maintain sample integrity, both before testing and where archiving for future testing is required. Traceability and monitoring of critical temperatures is maintained.

Customers rely on ALS to select test methods that are appropriate to meet their needs. Wherever possible, ALS uses the latest versions of published standard methods developed by organizations such as American Public Health Association, United States Environmental Protection Agency, NIOSH, Environment Canada, and other international, regional or regulatory organizations, or equipment manufacturers. Test method and support procedure instructions are kept current and accessible. Deviations from test methods occur only if the deviation has been documented, technically justified, authorized, and accepted by the customer where applicable.

Method validations are conducted to confirm that our test methods are fit for their intended use. The validations are as extensive as necessary to meet the needs of the given application. The extent depends on the source of the method. Test methods are revalidated periodically to ensure continued suitability and fitness for purpose.

ALS Limits of Reporting (LORs) are established using rigorous experimental and statistical procedures that begin with the determination of the Method Detection Limit (MDL) at 99% confidence. The MDL takes into account several factors, like long term Method Blanks, low level Sample Duplicates, and low level Spiked Samples. But the MDL is based on “typical” sample types in the absence of sample-specific problems, and it doesn’t apply in all circumstances.

ALS takes a conservative approach to detection limits. Our goal is to minimize false positives, because we recognize that any false positive results can be damaging for our clients. Where possible, we establish LORs at levels well-above the statistical MDL. This improves the accuracy and precision of results near the detection limit, and reduces the chance of false positives due to sample-specific issues.

ALS procedures for calculating measurement uncertainty are based on accepted practices of identifying components contributing to uncertainty, compiling data that represents or includes these components, evaluating the data using appropriate statistical calculations, and reporting in a manner that prevents misunderstanding of the result. In those cases where the nature of the test precludes calculation of uncertainty, ALS will at minimum identify the components of uncertainty and make a reasonable estimation where needed. This estimation will be based on available validation data and other sources of information about the test method’s performance.

Measuring and testing equipment used by ALS laboratories that can have a significant effect on the accuracy or validity of test results is calibrated using established procedures. The procedures ensure traceability through an unbroken chain of calibrations or comparisons to national measurement standards. Where traceability of measurements to SI units is not possible and/or not relevant, traceability is provided by the use of certified reference materials and/or consensus standards.

ALS has established quality control (QC) procedures for monitoring the validity of tests performed by its laboratories. Individual test methods specify quality control requirements, frequency of use and data quality objectives (DQOs).

The type of quality control elements used for process monitoring is dependant on the test performed, but typically includes (as appropriate): Calibration Verification Standards, Continuing Calibration Verifications, Instrument and Method Blanks, Laboratory Control Samples, Reference Materials, Matrix Spikes, Surrogate Spikes and Internal Standards.

DQOs are set for each QC sample, based on a combination of reference method objectives, customer requirements and historical test method performance. Where applicable, prescriptive elements of reference methods take precedence over internal DQOs.

Control charts are used to provide a graphical representation of QC results and test method performance over time. Control charts graphically display the mean, together with “Warning Limits” and “Control Limits”, plotted at ± 2 and 3 standard deviations (“sigma”) around the mean, calculated from recent historical QC results. ALS applies advanced trend monitoring algorithms to identify outliers and non-random data distributions (trends) that may indicate undesirable changes in test method performance. The trend monitoring process has been automated within our LIMS. Upon data entry, each QC result is checked against programmed limits and trends. If a trend is identified, a notification is e-mailed to the analyst and their supervisor, so that it can be investigated and corrected.

ALS analytical data proceeds through several reviews prior to the release of final reports. The ALS data validation process includes test result validation, inter-parameter validation and report validation. Test result validation involves an independent peer review of raw and calculated test results. Inter-parameter validation occurs when all department specific parameters for a sample are completed, and involves an overall review of test results within each sample for consistency among any related test parameters. Report validation occurs when all the requested test results for a work order are completed, and involves a review of the final report before it is sent to the customer.

ALS provides test reports that are designed to include all information necessary for the interpretation of test results. Formats are customized to meet our clients’ needs and include customized electronic reports.

Protection of electronic information is managed by the ALS North America IT Group. Security for the computer systems and electronic database is achieved through a combination of passwords, permissions, firewalls and Virtual Private Network (VPN) systems.

Management’s commitment to continuously improving the effectiveness of the management system is demonstrated by the use of various management system tools to identify areas of needed improvement. Regular evaluations of the following contribute to the ALS continuous improvement process: internal and external audits, corrective and preventive action reports, management reviews, various management reports and meetings, client feedback, proficiency test results, test method performance and data quality objective reviews, client surveys, and input from personnel.

Management conducts a review at least annually to ensure the management system is effective, and continues to be suitable for its operations, and to identify necessary changes or improvements. Senior management is included in the review process for all locations.

DATA QUALITY OBJECTIVES – WATER SAMPLES

INORGANICS	ACCURACY [1] DQO	MATRIX SPIKE [2] DQO	PRECISION [3] DQO
Acidity	85-115%	70-130%	20%
Alkalinity	85-115%	70-130%	20%
Ammonia	85-115%	75-125%	20%
Biochemical Oxygen Demand - BOD, Soluble BOD, CBOD - Chemical Oxygen Demand (COD)	 85-115% 85-115%	 n/a n/a	 20% 20%
Carbons (TOC/TIC/DIC/DOC)	80-120%	70-130%	20%
Chlorine (Free & Total)	75-125%	n/a	15%
Chrome VI	80-120%	75-125%	15%
Colour	85-115%	n/a	20%
Common Anions (Cl, Br, F, NO2, NO3, SO4)	85-115%	75-125%	20%
Conductivity	90-110%	85-115%	10%
Cyanate	85-115%	75-125%	20%
Cyanides (Total and WAD)	80-120%	70-130%	20%
Dissolved Oxygen	85-115%	75-125%	20%
Hardness (as CaCO3)	75-125%	65-135%	25%
Metals	80-120%	70-130%	20%
Oxidation - Reduction Potential	80-120%	n/a	15%
Oxyhalides (Chlorate, Chlorite, Bromate)	85-115%	75-125%	20%
pH	± 0.10 pH units	n/a	± 0.20 pH units
Phenols, Total (4AAP)	85-115%	75-125%	15%
Phosphates - all forms	80-120%	70-130%	20%
Salinity	85-115%	n/a	20%
Solids (TDS / TSS)	85-115%	75-125%	20%
Sulfide	75-125%	65-135%	20%
Tannins & Lignins	85-115%	n/a	20%
Thiocyanate	85-115%	75-125%	20%
Total Kjedahl Nitrogen / Total Nitrogen	75-125%	70-130%	20%
Turbidity	85-115%	n/a	15%
ORGANICS - HYDROCARBONS	**ACCURACY [1] DQO**	**MATRIX SPIKE [2] DQO**	**PRECISION [3] DQO**
Extractable Hydrocarbons - CWS F2-F4, EPH/LEPH/HEPH, RBCA, SK	 65-135%	 50-150%	 n/a [4]
Oil & Grease / Mineral Oil & Grease	70-130%	50-150%	n/a [4]
Volatile Hydrocarbons (F1, VH/VPH)	70-130%	50-150%	30%
ORGANICS – SEMI-VOLATILES	**ACCURACY [1] DQO**	**MATRIX SPIKE [2] DQO**	**PRECISION [3] DQO**
Acid Extractable Herbicides, except listed - Dinoseb, Clopyralid - Picloram	65-135% 30-150% 25-150%	50-150% 30-150% 25-150%	n/a [4] n/a [4] n/a [4]
Chlorinated Hydrocarbons	40-130%	40-150%	n/a [4]
Chlorophenols, except listed - 5,6- Dichlorovanillin, Tetrachlorocatechol - Tetrachloroveratrole - 2,6-Dichlorosyringaldehyde	65-130% 40-130% 40-130% 20-130%	n/a [4] n/a [4] n/a [4] n/a [4]	n/a [4] n/a [4] n/a [4] n/a [4]
Formaldehyde	70-130%	50-150%	30%
Glycols	70-130%	50-150%	30%

ORGANICS – SEMI-VOLATILES – Cont'd	ACCURACY [1] DQO	MATRIX SPIKE [2] DQO	PRECISION [3] DQO
Haloacetic Acids	50-130%	50-150%	40%
Naphthenic Acids	70-130%	50-150%	n/a [4]
Nitrogen Heterocyclics (e.g. Acridine, Quinoline)	60-130%	50-150%	n/a [4]
Pesticides, Organochlorine	50-150%	50-150%	n/a [4]
Pesticides, Organophosphate, except listed - Acephate, Dimethoate, Phorate	60-130% 30-140%	50-150% 30-150%	n/a [4] n/a [4]
Pesticides, Carbamate	50-140%	50-150%	n/a [4]
Phenolics, Chlorinated - Mono, Di, and Trichlorophenols - Tetra and Pentrachlorophenols	 50-130% 60-130%	 50-150% 50-150%	 50% 50%
Phenolics, Non-chlorinated, except listed - Dimethylphenol, Phenol, Phenol-d5 - Nitrophenols - 2-Fluorophenol (surrogate)	50-130% 30-130% 40-140% 20-130%	50-150% 30-150% 40-150% n/a	50% 50% 50% n/a
Polychlorinated Biphenyls (Arochlors)	65-130%	50-150%	n/a [4]
Polycyclic Aromatic Hydrocarbons, except listed - Naphthalene, 3-Methylcholanthrene - 7,12-Dimethylbenz(a)anthracene - Misc surrogates: 2-Fluorobiphenyl, 2,4,6-Tribromophenol, Nitrobenzene-d5	60-130% 50-130% 40-130% 40-130%	50-150% 50-150% 40-150% n/a	n/a [4] n/a [4] n/a [4] n/a
Resin and Fatty Acids, except listed - Abietic and Palustric Acids - Levopimaric and Neoabietic Acids	60-140% 40-130% 15-130%	50-150% 40-150% 15-150%	50% 50% 50%
ORGANICS – VOLATILES	**ACCURACY [1] DQO**	**MATRIX SPIKE [2] DQO**	**PRECISION [3] DQO**
VOCs, Non-Gaseous	70-130%	n/a	30%
VOCs, Gaseous (e.g. Vinyl Chloride, Chloromethane)	60-140%	n/a	50%
Volatile Fatty Acids	70-130%	70-130%	30%
MICROBIOLOGICAL TESTS	**ACCURACY [1] DQO**	**MATRIX SPIKE [2] DQO**	**PRECISION [3] DQO**
Coliform - Total & Fecal, by MF or Colilert	n/a [5]	n/a [5]	50% [5]
Coliform - Total and Fecal, by MPN	n/a [5]	n/a [5]	100% [5]
Heterotrophic Plate Count	n/a [5]	n/a [5]	50% [5]

METHOD BLANK DQO (All Tests): < Limit of Reporting (LOR)

Footnotes and Explanations:

1) Accuracy is measured as Percent Difference from True Value or Certified Target for Reference Materials and/or Method Analyte Spikes and Surrogates where applicable. For Matrix Spikes, accuracy is measured as the measured amount minus the sample background amount divided by the spiked amount.

   For low level results the accuracy objective is for the measured result to lie within +/- 1 times the LOR from the target.

2) Matrix Spike (MS) recovery, expressed as a percentage is defined as:
   100 * {[(Measured Concentration) - (Background Analyte Concentration in Sample)] ÷ (Spike Concentration)}

   High analyte background may prevent accurate determination of MS recovery. MS recoveries are not calculated or evaluated when the spiked amount is less than 0.3 times the background analyte concentration in the sample.

3) Precision is measured as the absolute value of Relative Percent Difference (RPD) for Laboratory Duplicate Samples. RPD = |(Result2 - Result1) / Mean| * 100. For low level results, the precision objective is for the difference of the two results to be less than 2 times the LOR.

4) Precision DQO is not applicable where whole samples are analyzed (lab duplicates not possible).

5) Spikes or Reference Materials unavailable for Microbiological tests. Duplicates are only possible when sufficient sample has been submitted to allow multiple tests.

DQOs are in the process of being standardized at the ALS Environmental locations in Canada. ALS DQOs represent the minimum criteria for acceptance of QC data without qualification. Where DQOs are not met, analysis will be repeated or affected result(s) will be qualified. DQOs are subject to periodic change. Please contact your Account Manager for current DQOs, or to receive an update.

DATA QUALITY OBJECTIVES – SEDIMENT / SOIL SAMPLES

INORGANICS	ACCURACY [1] DQO	MATRIX SPIKE [2] DQO	PRECISION [3] DQO
Acid Volatile Sulfide	70-130%	n/a	45%
Ammonia	80-120%	70-130%	20%
Anions, extractable (Cl, Br, F, NO2, NO3, SO4)	70-130%	60-140%	30%
Carbons (TOC)	80-120%	70-130%	30%
Conductivity	80-120%	70-130%	20%
Cyanide (Total and WAD)	80-120%	70-130%	20%
Hexavalent Chromium	80-120%	70-130%	20%
Metals, Extractable - Hot Water Soluble Boron - Major Cations (Sat Paste, Fixed Ratio Extracts) - Soluble Barium ($CaCl_2$ extractable)	 70-130% [4] 70-130% [4] 70-130% [4]	 n/a n/a n/a	 30% 30% 30%
Metals, Strong Acid Digested, except listed - Ag,Al,Ba,Hg,K,Mo,Na,Pb,Sn,Sr,Ti	70-130% [4] 70-130% [4]	n/a n/a	30% 40%
Methyl Mercury	70-130%	60-140%	40%
Phenols, Total	80-120%	70-130%	30%
Phosphates - all forms	80-120%	70-130%	30%
Total Kjedahl Nitrogen	80-120%	70-130%	20%
Total Solids	80-120%	n/a	20%
ORGANICS - HYDROCARBONS	**ACCURACY [1] DQO**	**MATRIX SPIKE [2] DQO**	**PRECISION [3] DQO**
Oil and Grease / Mineral Oil and Grease (Gravimetric) Oil and Grease (IR)	70-130% 60-140%	50-150% 50-150%	40% 40%
Extractable Hydrocarbons - CCME / CWS Parameters (F2-F4G) - BC, RBCA, SK Parameters (EPH/LEPH/HEPH, SK TPH)	 80-120% 70-130%	 50-150% 50-150%	 40% 40%
Volatile Hydrocarbons - CCME / CWS Parameters (F1, F1-BTEX) - BC, RBCA Parameters (VH, VPH)	 80-120% 70-130%	 50-150% 50-150%	 40% 40%
ORGANICS – SEMI-VOLATILES	**ACCURACY [1] DQO**	**MATRIX SPIKE [2] DQO**	**PRECISION [3] DQO**
Acid Extractable Herbicides, except listed - Clopyralid, Dinoseb, Picloram	60-140% 30-150%	50-150% 30-150%	50% 50%
Chlorinated Hydrocarbons	40-130%	40-150%	50%
Glycols	70-130%	60-140%	40%
Nitrogen Heterocyclics (e.g. Acridine, Quinoline)	50-140%	50-150%	50%
Pesticides, Carbamate	50-140%	50-150%	50%
Pesticides, Organochlorine, except listed - Endosulfan I / II, Endosulfan Sulfate	50-140% 40-140%	50-150% 40-150%	50% 50%
Pesticides, Organophosphate, except listed - Acephate, Dimethoate, Phorate	60-140% 30-140%	50-150% 30-150%	50% 50%
Phenolics, Chlorinated - Mono & Dichlorophenols - Tri, Tetra, and Pentrachlorophenols	 60-130% 60-130%	 50-150% 50-150%	 50% 50%
Phenolics, Non-chlorinated, except listed - Dimethylphenol - Nitrophenols - 2-Fluorophenol (Surrogate)	50-130% 30-130% 40-130% 20-130%	50-150% 30-150% 40-150% n/a	50% 50% 50% n/a
Phthalate Esters	50-150%	50-150%	50%

ORGANICS – SEMI-VOLATILES – Cont'd	ACCURACY [1] DQO	MATRIX SPIKE [2] DQO	PRECISION [3] DQO
Polychlorinated Biphenyls (Arochlors)	65-130%	50-150%	50%
Polycyclic Aromatic Hydrocarbons, except listed - Naphthalene, 3-Methylcholanthrene - 7,12-Dimethylbenz(a)anthracene Misc surrogates: - 2-Fluorobiphenyl, 2,4,6-Tribromophenol, Nitrobenzene-d5	60-130% 50-130% 40-130% 50-130%	50-150% 50-150% 40-150% n/a	50% 50% 50% n/a
Resin Acids and Fatty Acids, except listed - Levopimaric acid, Neoabietic acid	50-130% 40-130%	50-150% 50-150%	50% 50%
ORGANICS – VOLATILES	**ACCURACY [1] DQO**	**MATRIX SPIKE [2] DQO**	**PRECISION [3] DQO**
Volatile Organic Compounds, except listed - Gaseous VOCs (e.g. Vinyl Chloride) - Dichloromethane	70-130% 60-140% 60-140%	60-140% 50-150% 50-150%	50% 50% 50%
Volatile Fatty Acids	70-130%	70-130%	30%
PHYSICAL TESTS	**ACCURACY [1] DQO**	**MATRIX SPIKE [2] DQO**	**PRECISION [3] DQO**
Moisture	90-110%	n/a	20%
Particle Size Analysis (Hydrometer)	LTM +/- 5% [5]	n/a	Diff < 5%
pH	+/- 0.3 pH units	n/a	+/- 0.3 pH units
Loss on ignition	n/a	n/a	20%
WASTE CHARACTERIZATION	**ACCURACY [1] DQO**	**MATRIX SPIKE [2] DQO**	**PRECISION [3] DQO**
Flashpoint	+/- 3°C	n/a	+/- 5°C
Microtox (Drilling Waste)	as certified	n/a	20%

METHOD BLANK DQO (All Tests): < Limit of Reporting (LOR)

Footnotes and Explanations:

1) Accuracy is measured as Percent Difference from True Value or Certified Target for Reference Materials and/or Method Analyte Spikes and Surrogates where applicable. For Matrix Spikes, accuracy is measured as the measured amount minus the sample background amount divided by the spiked amount.

   For low level results, the accuracy objective is for the measured result to lie within +/- 1 times the LOR from the target.

2) Matrix Spike (MS) recovery, expressed as a percentage is defined as:
   100 * {[(Measured Concentration) - (Background Analyte Concentration in Sample)] ÷ (Spike Concentration)}

   High analyte background may prevent accurate determination of MS recovery. MS recoveries are not calculated or evaluated when the spiked amount is less than 0.3 times the background analyte concentration in the sample.

3) Precision is measured as the absolute value of Relative Percent Difference (RPD) for Laboratory Duplicate Samples. RPD = |(Result2 - Result1) / Mean| * 100.

   For low level results, the precision objective is for the difference of the two results to be less than 2 times the LOR.

4) Accuracy targets for metals in soils are expressed relative to the ALS long term mean for each method where certified method-specific reference material targets are unavailable. Full recovery of matrix-bound elements is not expected or intended for environmental acid digestion methods.

5) Long Term Mean +/- 5% sand, silt, clay.

DQOs are in the process of being standardized at the ALS Environmental locations in Canada. ALS DQOs represent the minimum criteria for acceptance of QC data without qualification. Where DQOs are not met, analysis will be repeated or affected result(s) will be qualified. DQOs are subject to periodic change. Please contact your Account Manager for current DQOs, or to receive an update.

Annual Report 2011
Table A.1
QA/QC Field Replicate Comparison

TOTAL METALS

Al-T
DL = 0.001

Date	Site	Sample	Duplicate Sample	RPD	Criteria Exceeded
02-FEB-11	W7	0.0744	0.0860	n/a	n/a
07-MAR-11	W4	0.0114	0.0237	-70.1%	TRUE
05-APR-11	E5	0.0243	0.0198	20.4%	TRUE
04-MAY-11	W4	1.41	1.20	16.1%	FALSE
12-MAY-11	E8	0.0809	0.0863	-6.5%	FALSE
09-JUN-11	W4	0.205	0.195	5.0%	FALSE
04-AUG-11	W11	0.0762	0.0832	-8.8%	FALSE
25-AUG-11	W7	0.0430	0.0436	-1.4%	FALSE
08-SEP-11	W10	0.0298	0.0104	96.5%	TRUE
06-OCT-11	W7	0.0158	0.0142	10.7%	FALSE
01-NOV-11	E1	1.97	1.95	1.0%	FALSE

As-T
DL = 0.0001

Sample	Duplicate Sample	RPD	Criteria Exceeded
0.00052	0.00051	1.9%	FALSE
0.00034	0.00036	-5.7%	FALSE
0.00161	0.00157	2.5%	FALSE
0.00072	0.00067	7.2%	FALSE
0.00181	0.00178	1.7%	FALSE
0.00034	0.00035	-2.9%	FALSE
0.00067	0.00071	-5.8%	FALSE
0.00051	0.00053	-3.8%	FALSE
0.00131	0.00137	-4.5%	FALSE
0.00045	0.00044	2.2%	FALSE
0.00259	0.00257	0.8%	FALSE

Cr-T
DL = 0.0005

Sample	Duplicate Sample	RPD	Criteria Exceeded
0.00116	0.00132	-12.9%	FALSE
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
0.00216	0.00185	15.5%	FALSE
<0.0010	<0.0010	n/a	n/a
0.00058	0.00057	1.7%	FALSE
0.00064	0.00068	-6.1%	FALSE
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
0.00209	0.00203	2.9%	FALSE

Cd-T
DL = 0.000017

Date		Sample	Duplicate Sample	RPD	Criteria Exceeded
02-FEB-11	W7	<0.000010	<0.000010	n/a	n/a
07-MAR-11	W4	<0.000010	<0.000010	n/a	n/a
05-APR-11	E5	<0.00035	0.00013	n/a	n/a
04-MAY-11	W4	0.000025	0.000022	12.8%	FALSE
12-MAY-11	E8	<0.00018	<0.00016	n/a	n/a
09-JUN-11	W4	0.000011	<0.000010	n/a	n/a
04-AUG-11	W11	<0.000010	<0.000010	n/a	n/a
25-AUG-11	W7	<0.000010	<0.000010	n/a	n/a
08-SEP-11	W10	<0.000010	<0.000010	n/a	n/a
06-OCT-11	W7	<0.000010	<0.000010	n/a	n/a
01-NOV-11	E1	0.000050	<0.000060	n/a	n/a

Cu-T
DL = 0.0001

Sample	Duplicate Sample	RPD	Criteria Exceeded
0.00528	0.00627	-0.17143	FALSE
0.00242	0.00281	-0.14914	FALSE
0.05200	0.02860	0.580645	TRUE
0.01590	0.01500	0.058252	FALSE
0.03410	0.03240	5.1%	FALSE
0.00825	0.00850	-0.02985	FALSE
0.00267	0.00265	0.007519	FALSE
0.00162	0.00164	-0.01227	FALSE
0.00158	0.00139	0.127946	FALSE
0.00126	0.00129	-0.02353	FALSE
0.0275	0.02700	1.8%	FALSE

Fe-T
DL = 0.03

Sample	Duplicate Sample	RPD	Criteria Exceeded
0.10600	0.11600	-9.0%	FALSE
<0.030	<0.030	n/a	n/a
0.19300	0.13000	39.0%	TRUE
1.12000	0.89500	22.3%	TRUE
0.06800	0.06500	4.5%	FALSE
0.15800	0.15400	2.6%	FALSE
0.20000	0.20200	-1.0%	FALSE
0.07000	0.07000	0.0%	FALSE
0.04600	<0.030	n/a	n/a
0.07300	0.07000	4.2%	FALSE
1.6900	1.7300	-2.3%	FALSE

Mn-T
DL = 0.00005

Date		Sample	Duplicate Sample	RPD	Criteria Exceeded
02-FEB-11	W7	0.00820	0.00944	-14.1%	FALSE
07-MAR-11	W4	0.000968	0.00241	-85.4%	TRUE
05-APR-11	E5	0.368	0.421	-13.4%	FALSE
04-MAY-11	W4	0.0316	0.0239	27.7%	TRUE
12-MAY-11	E8	0.0623	0.0693	-10.6%	FALSE
09-JUN-11	W4	0.00493	0.00439	11.6%	FALSE
04-AUG-11	W11	0.0177	0.0178	-0.6%	FALSE
25-AUG-11	W7	0.0233	0.0240	-3.0%	FALSE
08-SEP-11	W10	0.00447	0.00246	58.0%	TRUE
06-OCT-11	W7	0.0159	0.0157	1.3%	FALSE
01-NOV-11	E1	0.0598	0.0577	3.6%	FALSE

Se-T
DL = 0.0005

Sample	Duplicate Sample	RPD	Criteria Exceeded
<0.0010	<0.0010	n/a	n/a
0.00411	0.00401	2.5%	FALSE
0.0131	0.0163	-21.8%	TRUE
0.00095	0.00103	-8.1%	FALSE
0.0217	0.0161	29.6%	TRUE
0.00110	0.00111	-0.9%	FALSE
<0.00050	<0.00050	n/a	n/a
0.00062	0.00066	-6.3%	FALSE
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
0.0216	0.0213	1.4%	FALSE

Mo-T
DL = 0.001

Sample	Duplicate Sample	RPD	Criteria Exceeded
0.00204	0.00229	-11.5%	FALSE
0.0136	0.0136	0.0%	FALSE
0.187	0.232	-21.5%	TRUE
0.00401	0.00454	-12.4%	FALSE
0.182	0.191	-4.8%	FALSE
0.00653	0.00668	-2.3%	FALSE
0.00109	0.00110	-0.9%	FALSE
0.00218	0.00223	-2.3%	FALSE
0.00150	0.00152	-1.3%	FALSE
0.00186	0.00192	-3.2%	FALSE
0.204	0.201	1.5%	FALSE

Zn-T
DL = 0.001

Date		Sample	Duplicate Sample	RPD	Criteria Exceeded
02-FEB-11	W7	<0.0030	<0.0030	n/a	n/a
07-MAR-11	W4	<0.0030	<0.0030	n/a	n/a
05-APR-11	E5	<0.0030	<0.0030	n/a	n/a
04-MAY-11	W4	0.0052	0.0046	12.2%	FALSE
12-MAY-11	E8	<0.0060	<0.0060	n/a	n/a
09-JUN-11	W4	<0.0030	<0.0030	n/a	n/a
04-AUG-11	W11	0.0039	0.0037	5.3%	FALSE
25-AUG-11	W7	<0.0030	<0.0030	n/a	n/a
08-SEP-11	W10	<0.0030	<0.0030	n/a	n/a
06-OCT-11	W7	<0.0030	<0.0030	n/a	n/a
01-NOV-11	E1	0.0062	0.0063	-1.6%	FALSE

Pb-T
DL = 0.00005

Sample	Duplicate Sample	RPD	Criteria Exceeded
0.000155	0.000187	-18.7%	FALSE
<0.000050	<0.000050	n/a	n/a
0.000229	0.000076	100.3%	TRUE
0.000389	0.000356	8.9%	FALSE
<0.00010	<0.00010	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a
0.000560	0.000538	4.0%	FALSE

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Table A.1
QA/QC Field Replicate Comparison

DISSOLVED METALS

Al-D
DL = 0.001

Date	Site	Sample	Duplicate Sample	RPD	Criteria Exceeded
02-FEB-11	W7	0.0050	0.0045	10.5%	FALSE
07-MAR-11	W4	<0.0030	<0.0030	n/a	n/a
05-APR-11	E5	<0.0030	<0.0030	n/a	n/a
04-MAY-11	W4	0.143	0.257	-57.0%	TRUE
12-MAY-11	E8	<0.0060	<0.0060	n/a	n/a
09-JUN-11	W4	0.0345	0.0338	2.0%	FALSE
04-AUG-11	W11	0.0305	0.0304	0.3%	FALSE
25-AUG-11	W7	0.0098	0.0098	0.0%	FALSE
08-SEP-11	W10	0.0061	0.0058	5.0%	FALSE
06-OCT-11	W7	<0.0030	<0.0030	n/a	n/a
01-NOV-11	E1	0.0145	0.0155	n/a	n/a

As-D
DL = 0.0001

Sample	Duplicate Sample	RPD	Criteria Exceeded
0.00044	0.00044	0.0%	FALSE
0.00032	0.00033	-3.1%	FALSE
0.00146	0.00133	9.3%	FALSE
0.00036	0.00040	-10.5%	FALSE
0.00169	0.00173	-2.3%	FALSE
0.00029	0.00033	-12.9%	FALSE
0.00069	0.00067	2.9%	FALSE
0.00049	0.00050	-2.0%	FALSE
0.00146	0.00138	5.6%	FALSE
0.00046	0.00044	4.4%	FALSE
0.00201	0.00197	2.0%	FALSE

Cr-D
DL = 0.0005

Sample	Duplicate Sample	RPD	Criteria Exceeded
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
<0.00050	0.00061	n/a	n/a
<0.0010	<0.0010	n/a	n/a
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a

Cd-D
DL = 0.00016 to 0.00001

Date	Site	Sample	Duplicate Sample	RPD	Criteria Exceeded
02-FEB-11	W7	<0.000010	<0.000010	n/a	n/a
07-MAR-11	W4	<0.000010	<0.000010	n/a	n/a
05-APR-11	E5	<0.00030	0.000113	n/a	n/a
04-MAY-11	W4	<0.000010	0.000010	n/a	n/a
12-MAY-11	E8	<0.00018	<0.00016	n/a	n/a
09-JUN-11	W4	<0.000010	<0.000010	n/a	n/a
04-AUG-11	W11	<0.000010	<0.000010	n/a	n/a
25-AUG-11	W7	<0.000010	<0.000010	n/a	n/a
08-SEP-11	W10	<0.000010	<0.000010	n/a	n/a
06-OCT-11	W7	<0.000010	<0.000010	n/a	n/a
01-NOV-11	E1	<0.000050	<0.000050	n/a	n/a

Cu-D
DL = 0.0001

Sample	Duplicate Sample	RPD	Criteria Exceeded
0.00215	0.00223	-3.7%	FALSE
0.00190	0.00209	-9.5%	FALSE
0.00615	0.00353	54.1%	TRUE
0.00794	0.00878	-10.0%	FALSE
0.0238	0.0230	3.4%	FALSE
0.00670	0.00671	-0.1%	FALSE
0.00246	0.00234	5.0%	FALSE
0.00136	0.00137	-0.7%	FALSE
0.00128	0.00126	1.6%	FALSE
0.00111	0.00107	3.7%	FALSE
0.00092	0.00154	-50.4%	TRUE

Fe-D
DL = 0.03

Sample	Duplicate Sample	RPD	Criteria Exceeded
<0.030	<0.030	n/a	n/a
<0.030	<0.030	n/a	n/a
<0.030	<0.030	n/a	n/a
0.123	0.218	-55.7%	TRUE
<0.030	<0.030	n/a	n/a
<0.030	<0.030	n/a	n/a
0.122	0.120	1.7%	FALSE
<0.030	<0.030	n/a	n/a
<0.030	<0.030	n/a	n/a
<0.030	<0.030	n/a	n/a
<0.030	<0.030	n/a	n/a

Mn-D
DL = 0.00005

Date	Site	Sample	Duplicate Sample	RPD	Criteria Exceeded
02-FEB-11	W7	0.00321	0.00343	-6.6%	FALSE
07-MAR-11	W4	0.000284	0.000551	-64.0%	TRUE
05-APR-11	E5	0.388	0.398	-2.5%	FALSE
04-MAY-11	W4	0.00246	0.00369	-40.0%	TRUE
12-MAY-11	E8	0.0535	0.0635	-17.1%	FALSE
09-JUN-11	W4	0.00139	0.00134	3.7%	FALSE
04-AUG-11	W11	0.00877	0.00861	1.8%	FALSE
25-AUG-11	W7	0.000337	0.000373	-10.1%	FALSE
08-SEP-11	W10	0.000117	0.000118	-0.9%	FALSE
06-OCT-11	W7	0.00210	0.00178	16.5%	FALSE
01-NOV-11	E1	0.0166	0.0165	0.6%	FALSE

Se-D
DL = 0.0005

Sample	Duplicate Sample	RPD	Criteria Exceeded
<0.0010	<0.0010	n/a	n/a
0.00439	0.00393	11.1%	FALSE
0.0136	0.0158	-15.0%	FALSE
0.00102	0.00101	1.0%	FALSE
0.0223	0.0163	31.1%	TRUE
0.00119	0.00120	-0.8%	FALSE
<0.00050	<0.00050	n/a	n/a
0.00067	0.00070	-4.4%	FALSE
<0.00050	<0.00050	n/a	n/a
<0.00050	<0.00050	n/a	n/a
0.0217	0.0215	0.9%	FALSE

Mo-D
DL = 0.00005

Sample	Duplicate Sample	RPD	Criteria Exceeded
0.00201	0.00192	4.6%	FALSE
0.0130	0.0130	0.0%	FALSE
0.201	0.216	-7.2%	FALSE
0.00436	0.00442	-1.4%	FALSE
0.165	0.187	-12.5%	FALSE
0.00616	0.00603	2.1%	FALSE
0.00100	0.00103	-3.0%	FALSE
0.00218	0.00220	-0.9%	FALSE
0.00150	0.00144	4.1%	FALSE
0.00186	0.00186	0.0%	FALSE
0.198	0.198	0.0%	FALSE

Zn-D
DL = 0.001

Date	Site	Sample	Duplicate Sample	RPD	Criteria Exceeded
02-FEB-11	W7	<0.0030	<0.0030	n/a	n/a
07-MAR-11	W4	<0.0030	<0.0030	n/a	n/a
05-APR-11	E5	<0.0030	<0.0030	n/a	n/a
04-MAY-11	W4	<0.0030	<0.0030	n/a	n/a
12-MAY-11	E8	<0.0060	<0.0060	n/a	n/a
09-JUN-11	W4	<0.0030	<0.0030	n/a	n/a
04-AUG-11	W11	<0.0030	<0.0030	n/a	n/a
25-AUG-11	W7	<0.0030	<0.0030	n/a	n/a
08-SEP-11	W10	<0.0030	<0.0030	n/a	n/a
06-OCT-11	W7	<0.0030	<0.0030	n/a	n/a
01-NOV-11	E1	<0.0030	<0.0030	n/a	n/a

Pb-D
DL = 0.00005

Sample	Duplicate Sample	RPD	Criteria Exceeded
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	0.000068	n/a	n/a
<0.00010	<0.00010	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a
<0.000050	<0.000050	n/a	n/a

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Table A.1
QA/QC Field Replicate Comparison

GENERAL PARAMETERS

Amm
DL = 0.020

Date	Site	Sample	Duplicate Sample	RPD	Criteria Exceeded
02-FEB-11	W7	<0.005	<0.005	n/a	n/a
07-MAR-11	W4	<0.0050	<0.0050	n/a	n/a
05-APR-11	E5	0.0694	0.0635	8.9%	FALSE
04-MAY-11	W4	<0.0050	<0.0050	n/a	n/a
12-MAY-11	E8	<0.0050	<0.0050	n/a	n/a
09-JUN-11	W4	<0.0050	<0.0050	n/a	n/a
04-AUG-11	W11	0.0104	0.0117	-11.8%	FALSE
25-AUG-11	W7	0.0116	0.0117	-0.9%	FALSE
08-SEP-11	W10	<0.0050	0.0052	n/a	n/a
06-OCT-11	W7	0.0067	0.0063	6.2%	FALSE
01-NOV-11	E1	0.179	0.172	4.0%	FALSE

Nitrate
DL = 0.005

Sample	Duplicate Sample	RPD	Criteria Exceeded
0.108	0.109	-0.9%	FALSE
3.76	3.75	0.3%	FALSE
3.71	4.10	-10.0%	FALSE
0.156	0.148	5.3%	FALSE
5.65	5.84	-3.3%	FALSE
0.0746	0.0759	-1.7%	FALSE
0.0341	0.0352	-3.2%	FALSE
0.0269	0.0283	-5.1%	FALSE
0.0200	0.0233	-15.2%	FALSE
0.0486	0.0470	3.3%	FALSE
6.02	5.98	0.7%	FALSE

Nitrite
DL = 0.0010

Sample	Duplicate Sample	RPD	Criteria Exceeded
<0.001	<0.001	n/a	n/a
<0.0010	<0.0010	n/a	n/a
0.070	0.066	5.9%	FALSE
<0.0010	<0.0010	n/a	n/a
<0.010	0.011	n/a	n/a
<0.0010	<0.0010	n/a	n/a
<0.0010	<0.0010	n/a	n/a
<0.0010	<0.0010	n/a	n/a
<0.0010	<0.0010	n/a	n/a
0.0028	0.0026	7.4%	FALSE
0.097	0.097	0.0%	FALSE

Sulphate
DL = 0.5

Date	Site	Sample	Duplicate Sample	RPD	Criteria Exceeded
02-FEB-11	W7	33.0	32.6	1.2%	FALSE
07-MAR-11	W4	79.4	79.5	-0.1%	FALSE
05-APR-11	E5	577	587	-1.7%	FALSE
04-MAY-11	W4	29.1	28.7	1.4%	FALSE
12-MAY-11	E8	663	682	-2.8%	FALSE
09-JUN-11	W4	32.7	32.9	-0.6%	FALSE
04-AUG-11	W11	9.70	9.83	-1.3%	FALSE
25-AUG-11	W7	27.2	27.2	0.0%	FALSE
08-SEP-11	W10	8.35	8.36	-0.1%	FALSE
06-OCT-11	W7	26.6	26.7	-0.4%	FALSE
01-NOV-11	E1	596	592	0.7%	FALSE

TSS
DL = 3

Sample	Duplicate Sample	RPD	Criteria Exceeded
<3.0	3.0	n/a	n/a
<3.0	<3.0	n/a	n/a
<3.0	<3.0	n/a	n/a
37.5	44.5	-17.1%	FALSE
3.0	5.8	-63.6%	TRUE
<3.0	<3.0	n/a	n/a
<3.0	3.3	n/a	n/a
3.0	4.3	-35.6%	TRUE
<3.0	<3.0	n/a	n/a
<3.0	<3.0	n/a	n/a
16.9	15.6	n/a	n/a