December 18, 2017

ISSUED FOR USE
FILE: 704-ENW.VENW03140-01

School District 68 (Nanaimo-Ladysmith)
395 Wakesiah Road
Nanaimo, BC V9R 3K6

Via Email: BHackwood@sd68.bc.ca, Chris.Baker@sd68.bc.ca

Attention: Mr. Brian Hackwood, Maintenance Manager

Subject: Domestic Water Testing (Lead) Inventory – Ladysmith Secondary

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained School District 68 Nanaimo-Ladysmith (SD 68) to conduct a domestic water testing inventory at Ladysmith Secondary located in SD 68. Tetra Tech understands that the BC Ministry of Education has issued a directive to protect drinking water. The directive requires that a systematic investigation of public drinking water supplies at select schools in the District be undertaken. The investigation is based on procedures set forth by the Vancouver Island Health Authority (VIHA), modified per Health Canada guidelines, to ascertain risk and mitigation.

Tetra Tech understands that the sampling schedule, collection, testing and reporting of results needs to be completed by December 22, 2017 in order to allow sufficient time for SD 68 to implement mitigation measures prior to its deadline of March 31, 2018.

Carrie McVeigh, of SD 68, provided Tetra Tech with authorization to proceed with the inventory on October 24, 2017.

2.0 METHODOLOGY

Tetra Tech completed the domestic water testing inventory program at Ladysmith Secondary on November 6th and 27thth, 2017. The 2017 sampling program was conducted as per the protocols established during the 2016 program. The methodologies employed during the field program are detailed in the following subsections.

2.1 Sampling Locations

Tetra Tech reviewed plans for the facility prior to commencing the field work to identify potential sampling locations. The facility was then assessed in the field and sampling locations were selected based on the probability of human consumption at a location. The sampling locations included one point that was closest to the location where the water supply enters the building, one that is the furthest point from where the water supply enters the building and from points where human consumption of water occurred or was reasonably likely to occur. The sampling locations for Ladysmith Secondary are shown on the attached Figures 1 and 2.

Drinking fountains and kitchen sinks were all considered to have a high probability of human consumption of water and were always sampled. Sinks with visible evidence of human consumption of water, such as water bottles, cups, or electric kettles were also considered to have a high probability of human consumption of water and were sampled. Although classroom sinks were considered to have a moderate probability of human consumption of water, only

Tetra Tech Canada Inc.
#1 - 4376 Boban Drive
Nanaimo, BC V9T 6A7 CANADA
Tel 250.756.2256 Fax 250.756.2686

representative samples were collected as per the direction of SD 68 Maintenance Manager, Mr. Brian Hackwood. Classroom laboratory and art room sinks, where present, were considered to have a low probability of human consumption of water so only representative samples were collected. Finally, washrooms and utility sinks, unless there was other evidence of human consumption of water (such as an electric kettle) were considered to be a low probability of human consumption of water and only representative samples were collected.

2.2 Drinking Water Sampling

Sampling was conducted in the early hours of Monday, November 6th and 27th, 2017 in order collect water samples representative of an approximate worse-case scenario of water that had remained in contact with the school's plumbing over the course of a weekend. Two samples were collected at each sample location; the first collected immediately prior to any water line flushing (0 second sample); the second collected after thirty seconds of water line flushing (30 second sample).

The process for the sequence of analysis for a sample location is as follows:

- Only the pre-flush (0 second) sample is initially submitted for laboratory analysis;
- If the analytical result exceeds the *Guidelines for Canadian Drinking Water Quality* (GCDQG) Maximum Allowable Concentration (MAC), the 30 second sample would be submitted for further analysis; and
- If the 30 second sample analytical result exceeds the GCDQG MAC, additional samples would be collected after flushing with cold water for 2 minutes and 5 minutes at a subsequent sampling event and both samples submitted for analysis.

Water samples were collected directly from the sample point into clean, labeled, new laboratory-supplied containers pre-charged with preservative for total lead. Sampling personnel wore new nitrile gloves prior to collecting each sample. Samples were kept in a cooler with ice after collection until being brought back to Tetra Tech's Nanaimo office, where samples not immediately submitted to the laboratory were stored in refrigerated conditions.

2.3 Analytical Testing

Maxxam is a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory that is qualified to analyze the samples using British Columbia Ministry of Environment (MOE)-approved procedures. All water samples submitted were analyzed for total lead.

2.4 Quality Assurance / Quality Control

During the sampling program, Tetra Tech implemented a Quality Assurance/Quality Control (QA/QC) program to ensure the integrity of the sampling methodology and analytical testing. The QA/QC program adhered to Tetra Tech's in-house Quality Management System (QMS), which was designed to generate representative samples, minimize the potential for cross-contamination between sampling locations and samples, and reduce the potential for systematic bias.

The QA/QC program included the following tasks:

- Recording the results of field activities in the field concurrently with the activities;
- Use of clean, new sampling gloves at each sampling location;
- Placing samples into new, labeled laboratory-supplied containers;

- Transporting samples to Maxxam in chilled coolers using chain-of-custody procedures;
- Using a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory that is qualified to analyze the samples using MOE-approved procedures;
- Independently verifying the sample concentrations flagged by Maxxam as being greater than Health Canada guidelines; and
- Conducting a review of this report by a qualified senior Tetra Tech professional to ensure that the report meets Tetra Tech technical and reporting requirements.

Laboratory Quality Assurance / Quality Control Program

Water samples were submitted to Maxxam, a CALA accredited laboratory. Laboratory testing was conducted using methods outlined in the British Columbia Environmental Laboratory Manual. Laboratory QA/QC reports are attached to the laboratory reports presented in Appendix B. Samples included in the QA/QC reports consist of laboratory batches and will include random samples from the lab report and potentially other projects to complete a batch.

The Laboratories will note any sample deficiencies, such as unacceptable headspace, broken jars or bottles, etc. As well, the laboratory will measure the temperature of samples received by the laboratory in Burnaby.

3.0 ASSESSMENT STANDARDS

As per the guidance from the Vancouver Island Health Authority (VIHA), Tetra Tech compared the sample analytical results to the *Guidelines for Canadian Drinking Water Quality* (GCDQG) published by Health Canada, February 2017. The guidelines list a Maximum Acceptable Concentration (MAC) for lead of 10 µg/L (0.010 mg/L). The MAC for lead is based on chronic effects and is intended to apply to average concentrations in water consumed for extended periods. No immediately toxic concentration for lead is listed, however exposure to lead should nevertheless be kept to a minimum.

4.0 ANALYTICAL RESULTS

Tetra Tech collected 0 second and 30 second water samples from Ladysmith Secondary on November 6th, 2017. A total of 20 sample locations were identified; two samples were collected at each location (i.e., 0 second sample and 30 second sample). 20 pre-flush (0 second) samples were submitted for laboratory analysis of total lead.

10 of the 0 second samples contained concentrations of total lead that were greater than the GCDQG MAC.

The 30 second samples from the 10 locations that exceeded lead concentrations in their 0 second samples were submitted for laboratory analysis.

Four of the 30 second samples contained concentrations of total lead that were greater than the GCDQG MAC.

Tetra Tech collected 2 minute and 5 minute flush samples from these four locations on November 27th and submitted them for laboratory analysis of total lead.

The 2 minute sample at LS12 as well as the 5 minute samples from LS08 and LS17 contained concentrations of total lead greater than the GCDQG MAC.

Sampling locations are shown on Figures 1 and 2. Laboratory testing results for Ladysmith Secondary are summarized in the table below. The complete laboratory certificates are provided as Appendix B.

Table 1: Laboratory Testing Results

Sample ID	Sample Date	MAC	Total Lead (µg/L)
0 Second Samples			
LS01-0s	11/06/2017	10 µg/L	**32.3**
LS02-0s	11/06/2017		9.42
LS03-0s	11/06/2017		1.17
LS04-0s	11/06/2017		4.68
LS05-0s	11/06/2017		**54.5**
LS06-0s	11/06/2017		3.37
LS07-0s	11/06/2017		**287**
LS08-0s	11/06/2017		**28.2**
LS09-0s	11/06/2017		**32.0**
LS10-0s	11/06/2017		0.92
LS11-0s	11/06/2017		**41.1**
LS12-0s	11/06/2017		**111**
LS13-0s	11/06/2017		3.23
LS14-0s	11/06/2017		0.59
LS15-0s	11/06/2017		1.06
LS16-0s	11/06/2017		**49.3**
LS17-0s	11/06/2017		**48.6**
LS18-0s	11/06/2017		3.28
LS19-0s	11/06/2017		**10.7**
LS20-0s	11/06/2017		3.19
30 Second Samples			
LS01-30s	11/06/2017	10 µg/L	4.46
LS05-30s	11/06/2017		5.59
LS07-30s	11/06/2017		6.13
LS08-30s	11/06/2017		**10.6**
LS09-30s	11/06/2017		1.44
LS11-30s	11/06/2017		4.81
LS12-30s	11/06/2017		**16.2**
LS16-30s	11/06/2017		**41.4**
LS17-30s	11/06/2017		**34.2**
LS19-30s	11/06/2017		1.38
2 Minute Samples			
LS08-2m	11/27/2017	10 µg/L	8.63
LS12-2m	11/27/2017		**17.5**
LS16-2m	11/27/2017		9.50
LS17-2m	11/27/2017		9.88
5 Minute Samples			
LS08-5m	11/27/2017	10 µg/L	**10.6**
LS12-5m	11/27/2017		9.85
LS16-5m	11/27/2017		9.76
LS17-5m	11/27/2017		**10.4**
Notes:	**Grey Fill**	Exceeds GCDQG MAC	

5.0 DISCUSSION AND RECOMMENDATIONS

Tetra Tech's sampling program was based upon guidance from the Ministry of Health, found in the document *Guidance on Controlling Corrosion in Drinking Water Distribution Systems* (2009). The rationale is that for each sampling point, if the pre-flush (0 second) sample (Tier 1) contained elevated lead concentrations, it could indicate that the faucet or fittings are the likely be the source of lead. If a subsequent 30 second flush sample (Tier 2) contained elevated lead concentrations, the source of the lead would likely be the piping (plumbing) leading to the faucet; whereas low lead concentrations in the 30 second sample would further indicate that the source was likely the faucet and fittings. Finally, 2 minute and 5 minute flush samples (if required) should be drawing water directly from the water supply piping within the building and would indicate if flushing is feasible for lowering the lead concentration in water within the building.

The Health Canada guidance recommend that Tier 2 sampling (30 second samples) take place when Tier 1 sampling identifies more than 10% of sites with lead concentrations above the MAC, and then only at the 10% of sampling sites with the highest lead concentration. Rather, Tetra Tech ran every 30 second sample for locations where the 0 second sample was above the MAC to show that flushing was adequate to lower the lead concentration in the drinking water at each point of concern.

The guidance from the Ministry of Health recommended that samples be collected after the sampling points had been stagnant for a minimum of 8 hours but not longer than 24 hours in order to simulate the worst case daily scenario for lead in drinking water consumption. Based on guidance from VIHA, SD 68 directed Tetra Tech to collect samples Monday mornings prior to any staff or students arriving at the facilities in order to simulate a worst-case scenario for stagnant water. As such, lead concentrations reported represent what could be expected following a weekend and would likely be lower on subsequent weekday mornings.

Ten of the 20 pre-flush (0 second) samples collected at Ladysmith Secondary contained concentrations of lead exceeding the GCDQG MAC. Four of the 30 second samples exceeded the GCDQG MAC: LS08, LS12, LS16 and LS17. Samples LS12-2m (2 minute), LS08-5m and LS17-5m (5 minute samples) exceeded the GCDQG MAC. Because the majority of the locations (16 of the 20) had concentrations of lead that were below the MAC at either the 0 second or 30 second timeframe, the main water distribution infrastructure at Ladysmith Secondary is not likely the source of the lead. Rather, the faucets/fittings and/or plumbing leading to LS08, LS12, LS16 and LS17 are the likely sources at these locations.

During sample collection, Tetra Tech noted signage throughout the facility stating "Water Quality – First thing in the morning… Run the water for two minutes before drinking. Throughout the day… Let the water run until it is cold before drinking." Tetra Tech recommends that this signage be maintained at each point where drinking water could be consumed and that this procedure continues to be followed as it promotes drinking water safety awareness. In most sample locations the flushing process recommended in the signage is adequate to lower any initial lead concentrations.

Recommendations for the four sample locations with 30 second samples exceeding the MAC are provided in Table 2.

Table 2: Summary of Sample Locations with 30 second Exceedances

Sample (Location)	0 second sample	30 second sample	2 minute sample	5 minute sample	Recommendation/Discussion
LS08 (Science Lab)	***28.2 µg/L***	***10.6 µg/L***	8.63 µg/L	**10.6 *µg/L***	Tetra Tech notes that the lead concentration in the 5 minute sample was greater than the 2 minute sample. This could be the result of a slug of water within the distribution system with a high concentration of lead flushing at 5 minutes (indicating that water was not yet being drawn directly from the water main and a problem further up in the distribution system); or a onetime release of lead resulting from flushing/agitating a potentially long time stagnant piping system. Tetra Tech recommends re-testing (time 0, 30 seconds, 2 minutes, and 5 minutes) following prolonged flushing at this location to evaluate if the flush was successful at lowering the concentrations. Tetra Tech further recommends that signage be placed in the lab indicating water not for human consumption.
LS12 (Second Floor Staff Prep Area, Rm 211)	***111 µg/L***	***16.2 µg/L***	**17.5 *µg/L***	9.85 µg/L	Sink in a laboratory prep area, evidence of water consumption (kettles, mugs etc.). Tetra Tech recommends re-testing (time 0, 30 seconds, 2 minutes, and 5 minutes) following prolonged flushing at this location to evaluate if the flush was successful at lowering the concentrations. Tetra Tech further recommends that signage be placed in the staff prep area indicating water not for human consumption.
LS16 (Drinking Fountain near Classroom 606)	***49.3 µg/L***	***41.4 µg/L***	9.50 µg/L	9.76 µg/L	Maintain current signage indicating recommended 2 minute flush time. Replace fixture, if possible.
LS17 (Water Closet near Bandroom 701)	***48.6 µg/L***	***34.2 µg/L***	9.88 µg/L	**10.4 *µg/L***	Tetra Tech notes that the lead concentration in the 5 minute sample was marginally greater than the 2 minute sample. This could be the result of a slug of water within the distribution system with a high concentration of lead flushing at 5 minutes (indicating that water was not yet being drawn directly from the water main and a problem further up in the distribution system); or a onetime release of lead resulting from flushing/agitating a potentially long time stagnant piping system. Tetra Tech recommends re-testing (time 0, 30 seconds, 2 minutes, and 5 minutes) following prolonged flushing at this location to evaluate if the flush was successful at lowering the concentrations. Tetra Tech further recommends that signage be placed in the water closet indicating water not for human consumption.

At LS16, flushing lowered the lead concentrations to marginally below the MAC at both 2 and 5 minutes. However, because the 0 and 30 second samples were both approximately 4 times greater than the guideline, the fixture is likely a significant source of lead. Since this location is specifically intended for drinking, and flushing only resulted in a lowering of the lead concentration to marginally below the MAC, Tetra Tech recommends that the fixture at this location be replaced and the flushing signage maintained.

All sample locations where 2 and 5 minute flushing did not result in lowering the lead concentration below the MAC occurred in bathroom, laboratory or laboratory prep room sinks. These sample locations may not be regularly utilized and the elevated lead concentrations are likely the results of infrequent flushing. The replacement of the supply and distribution water lines to the three noted locations (LS8, LS12 and LS17) is likely impractical; therefore, Tetra Tech recommends that one or both of following two actions be implemented:

1. The sinks and lines to the sample locations identified be flushed for a prolonged period and re-tested, then flushed on a regular schedule (as determined by further testing); or

2. Placing signage at each sink stating that the water is not for human consumption. A bulletin should be provided to staff summarizing the drinking water quality results and instructing them that the sinks are not fit for human consumption of water. Staff should then instruct students and visitors in the drinking water procedure.

6.0 SUMMARY AND CONCLUSIONS

Half of the 20 pre-flush (0 second) samples collected at Ladysmith Secondary contained concentrations of total lead exceeding the GCDQG MAC of 10µg/L (0.010 mg/L). Four of those 10 locations exceeded the MAC in the 30 second samples.

Concentrations of lead in the 2 and 5 minute samples from location LS16, a drinking water fountain at the northwest end of the facility, were marginally below the MAC. This suggests that the lead source is likely in the fixture. If possible, the fixture at this location should be replaced.

Three locations (LS8, LS12 and LS17) exceeded either the 2 minute or 5 minute sample. These locations include laboratory, laboratory prep and bathroom sinks that may be used infrequently. Further investigation at these sample locations is recommended, including confirming frequency of use, prolonged flushing and re-testing.

Tetra Tech recommends that SD 68 continue with its ongoing procedure of conducting a 2 minute flush at each drinking water consumption point each morning; and running taps/faucets until cold prior to consuming water. Tetra Tech noted signage at most drinking water consumption points stating “Water Quality – First thing in the morning… Run the water for two minutes before drinking. Throughout the day… Let the water run until it is cold before drinking.”

Tetra Tech recommends that the facility be inspected on a routine basis to ensure that the above noted signage is present and in good condition at each point where drinking water could be consumed. Tetra Tech further recommends that a bulletin be provided to staff summarizing the drinking water quality results at the facility and reminding them of the above procedure. Staff should then instruct students and visitors in the drinking water procedure.

7.0 CLOSURE

This report has been prepared based on the scope of work and for the use of School District 68, which includes distribution as required for the purposes for which this assessment was commissioned. The assessment has been carried out in accordance with generally accepted professional practice. No other warranty is made, either express or implied. Professional judgment has been applied in developing the recommendations in this report.

This report was prepared by personnel with professional experience in investigations of this nature and who specifically conducted the investigations at this Site. Reference should be made to the 'Geoenvironmental Report – Limitations on the Use of this Report' attached in Appendix A that forms a part of this report.

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

Shawneen Walker, B.Sc., R.P.Bio., P.Biol.
Biologist
Environment Practice
Direct Line: 250.756.3966 x245
Shawneen.Walker@tetratech.com

Nigel Cavanagh, M.Sc., R.P.Bio., P.Biol.
Senior Aquatic Biologist
Environment Practice
Direct Line: 250.756.3966 x240
Nigel.Cavanagh@tetratech.com

/dr

Attachments: Figure 1 - Ladysmith Secondary Sample Locations, Main Floor
Figure 2 – Ladysmith Secondary Sample Locations, Upper Floor
Appendix A - Limitations on the Use of this Document
Appendix B - Laboratory Report

FIGURES

ENCLOSED SPACES

Floor Hatches

1 – In Custodian Room #
2 – Gym Sliding Door Access Hatch
3 – Boiler Room (Tunnel)
4 – Boiler Room (Locked Access)
5 – Storage Room # 607
7 – GYM – Hatch To Folding Doors
9 – In Room #
3 – Pipe Chase B109A
5 – Stairwell A101
6 – Pipe Chase A111B
8 – W.C. Skills 4 Life A107B
9 – In Alt. Room #
10 – In Science Room # 115
11 – In Skills For Life Rm #120
13 – In Server Rm #
14 – In Work Rm #
15 – In Storage Rm #
16 – In Medical W.C.
17 – Hatch To Fan Unit – Roof
18 – Hatch To Fan Unit – Roof

Ceiling Hatches

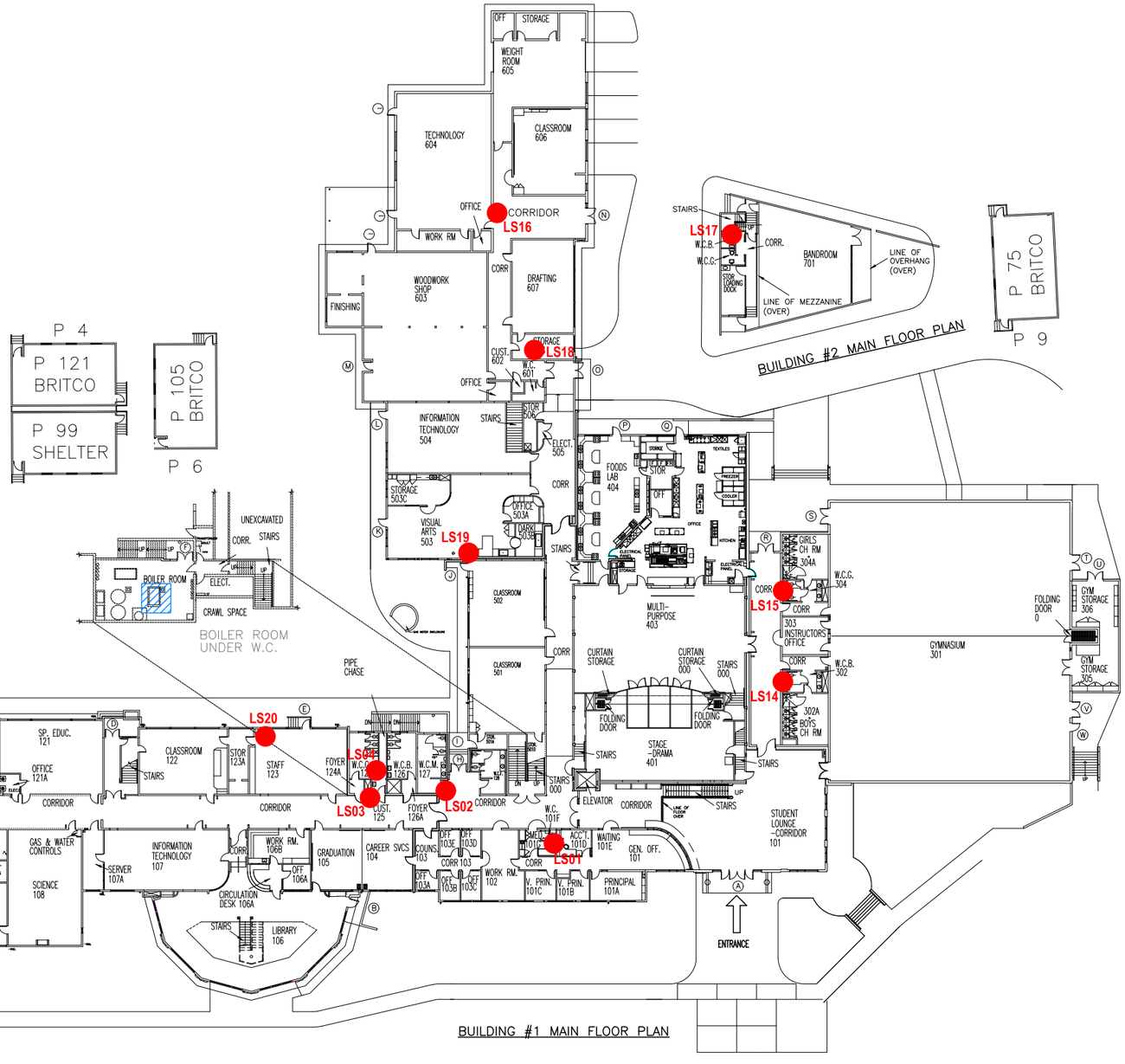
6 – In Corridor Outside Rm # 120
6A – In Corridor Outside Rm # 101
12 – In Custodian Rm #

PIPE CHASE

8 – Custodian Room # 227

Roof Access

Ladder To Roof – Inside Storage Rm #
Ladder To Roof – In Mech. Rm. By Gym
Ladder To Roof – In Mech. Rm. #



NOTES:

1) BASE DRAWING IS PROVIDED BY CLIENT
2) DRAWING NOT TO SCALE

LEGEND:

- WATER ENTRY POINT
- SAMPLE LOCATION

CLIENT

School District 68

DOMESTIC WATER TESTING (LEAD) INVENTORY
LADYSMITH SECONDARY SCHOOL
710 SIXTH AVENUE, LADYSMITH, BC

LADYSMITH SECONDARY SCHOOL
SAMPLE LOCATIONS (MAIN FLOOR)

TETRA TECH

PROJECT NO.	DWN	CKD	REV
ENW.VENW03140-01	DBD	SW	0
OFFICE: EDM	DATE: December 2017		

Figure 1

ENCLOSED SPACES

Floor Hatches

1 – In Custodian Room #
2 – Gym Sliding Door Access Hatch
3 – Boiler Room (Tunnel)
4 – Boiler Room (Locked Access)
5 – Storage Room # 607
7 – GYM – Hatch To Folding Doors
9 – In Room #
3 – Pipe Chase B109A
5 – Stairwell A101
6 – Pipe Chase A111B
8 – W.C. Skills 4 Life A107B
9 – In Alt. Room #
10 – In Science Room # 115
11 – In Skills For Life Rm #120
13 – In Server Rm #
14 – In Work Rm #
15 – In Storage Rm #
16 – In Medical W.C.
17 – Hatch To Fan Unit – Roof
18 – Hatch To Fan Unit – Roof

Ceiling Hatches

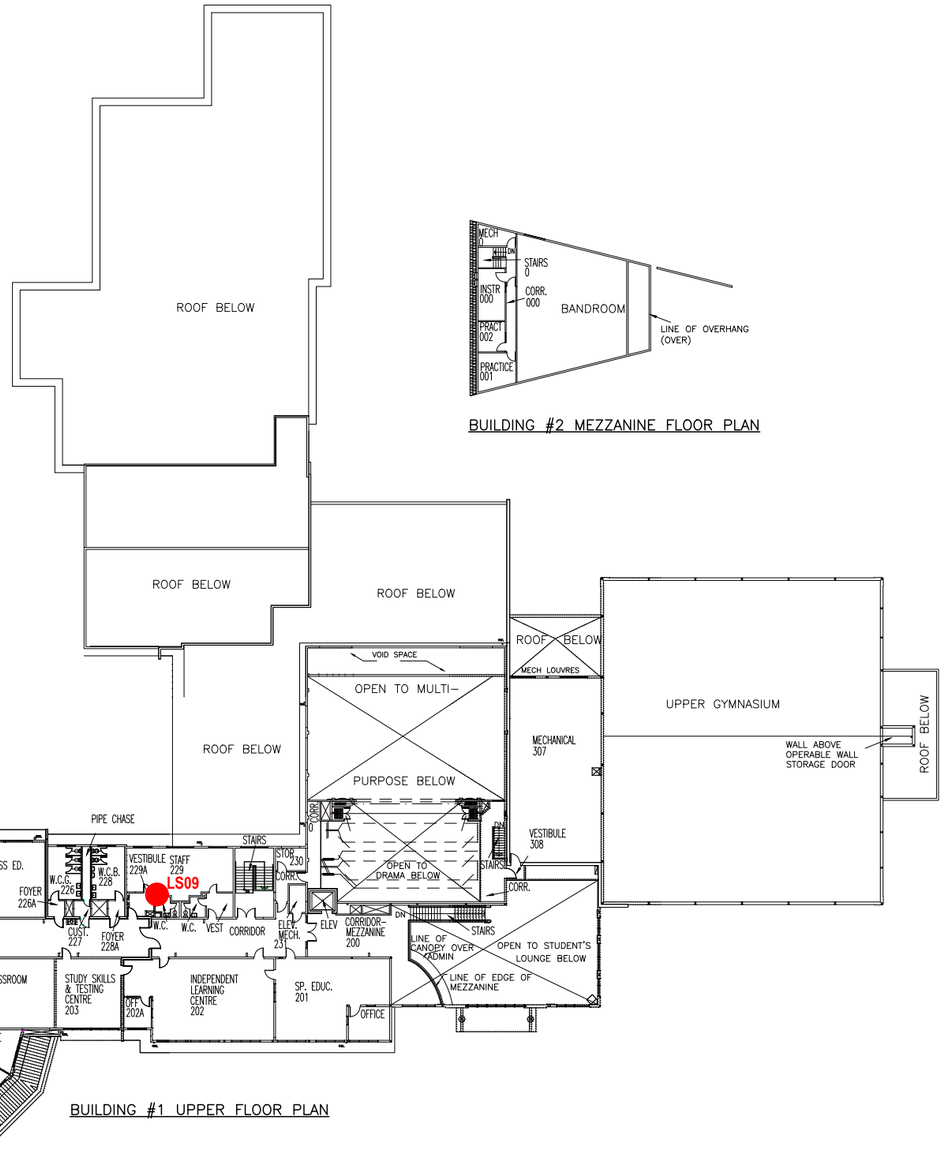
6 – In Corridor Outside Rm # 120
6A – In Corridor Outside Rm # 101
12 – In Custodian Rm #

PIPE CHASE

8 – Custodian Room # 227

Roof Access

Ladder To Roof – Inside Storage Rm #
Ladder To Roof _ In Mech. Rm. By Gym
Ladder To Roof – In Mech. Rm. #



BUILDING #1 UPPER FLOOR PLAN

BUILDING #2 MEZZANINE FLOOR PLAN

NOTES:

1) BASE DRAWING IS PROVIDED BY CLIENT
2) DRAWING NOT TO SCALE

LEGEND:

● - SAMPLE LOCATION

CLIENT

School District 68

DOMESTIC WATER TESTING (LEAD) INVENTORY
LADYSMITH SECONDARY SCHOOL
710 SIXTH AVENUE, LADYSMITH, BC

LADYSMITH SECONDARY SCHOOL
SAMPLE LOCATIONS (UPPER FLOOR)

TETRA TECH

PROJECT NO.	DWN	CKD	REV
ENW.VENW03140-01	DBD	SW	0

OFFICE: EDM
DATE: December 2017

Figure 2

APPENDIX A

LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

APPENDIX B

LABORATORY REPORT

Your Project #: ENW.VENW03140-01

Attention:Shawneen Walker

TETRA TECH CANADA INC.
#1 - 4376 BOBAN DRIVE
NANAIMO, BC
Canada V9T 6A7

Your C.O.C. #: 540307-12-01, 540307-13-01, 540307-14-01, 540307-15-01

Report Date: 2017/12/05
Report #: R2486780
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7A6044
Received: 2017/11/28, 08:55

Sample Matrix: DRINKING WATER
Samples Received: 39

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Elements by CRC ICPMS (total)	23	N/A	2017/12/02	BBY7SOP-00003,	BCLM2005,EPA6020bR2m
Elements by CRC ICPMS (total)	15	N/A	2017/12/04	BBY7SOP-00003,	BCLM2005,EPA6020bR2m
Elements by CRC ICPMS (total)	1	2017/12/01	2017/12/03	BBY7SOP-00003,	BCLM2005,EPA6020bR2m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Your Project #: ENW.VENW03140-01

Attention:Shawneen Walker

TETRA TECH CANADA INC.
#1 - 4376 BOBAN DRIVE
NANAIMO, BC
Canada V9T 6A7

Your C.O.C. #: 540307-12-01, 540307-13-01, 540307-14-01, 540307-15-01

Report Date: 2017/12/05
Report #: R2486780
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7A6044
Received: 2017/11/28, 08:55

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Letitia Prefontaine, B.Sc., Senior Project Manager
Email: LPrefontaine@maxxam.ca
Phone# (604)639-2616

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B7A6044
Report Date: 2017/12/05

TETRA TECH CANADA INC.
Client Project #: ENW.VENW03140-01
Sampler Initials: SW

ELEMENTS BY ATOMIC SPECTROSCOPY (DRINKING WATER)

Maxxam ID			SO7104	SO7105	SO7106	SO7107	SO7108	SO7109		
Sampling Date			2017/11/27	2017/11/27	2017/11/27	2017/11/27	2017/11/27	2017/11/27		
COC Number			540307-12-01	540307-12-01	540307-12-01	540307-12-01	540307-12-01	540307-12-01		
	UNITS	MAC	QW01-OS	QW02-OS	QW03-OS	QW04-OS	QW05-OS	QW06-OS	RDL	QC Batch
Total Metals by ICPMS										
Total Lead (Pb)	ug/L	10	3.23	1.92	2.69	1.48	2.13	0.80	0.20	8849248

No Fill — No Exceedance
Grey — Exceeds 1 criteria policy/level
Black — Exceeds both criteria/levels
RDL = Reportable Detection Limit

Maxxam ID			SO7110	SO7111		SO7112	SO7113	SO7121		
Sampling Date			2017/11/27	2017/11/27		2017/11/27	2017/11/27	2017/11/27		
COC Number			540307-12-01	540307-12-01		540307-12-01	540307-12-01	540307-13-01		
	UNITS	MAC	QW07-OS	QW08-OS	QC Batch	QW09-OS	QW10-OS	QW11-OS	RDL	QC Batch
Total Metals by ICPMS										
Total Lead (Pb)	ug/L	10	0.76	0.41	8849248	<0.20	7.73	**47.9**	0.20	8850028

No Fill — No Exceedance
Grey — Exceeds 1 criteria policy/level
Black — Exceeds both criteria/levels
RDL = Reportable Detection Limit

Maxxam ID			SO7122	SO7123	SO7124	SO7125	SO7126	SO7127		
Sampling Date			2017/11/27	2017/11/27	2017/11/27	2017/11/27	2017/11/27	2017/11/27		
COC Number			540307-13-01	540307-13-01	540307-13-01	540307-13-01	540307-13-01	540307-13-01		
	UNITS	MAC	QW12-OS	QW13-OS	QWDUP-OS	SD01-OS	SD02-OS	SD03-OS	RDL	QC Batch
Total Metals by ICPMS										
Total Lead (Pb)	ug/L	10	1.47	1.93	<0.20	2.78	9.83	7.09	0.20	8849248

No Fill — No Exceedance
Grey — Exceeds 1 criteria policy/level
Black — Exceeds both criteria/levels
RDL = Reportable Detection Limit

Maxxam ID			SO7128	SO7129		SO7130		SO7131		
Sampling Date			2017/11/27	2017/11/27		2017/11/27		2017/11/27		
COC Number			540307-13-01	540307-13-01		540307-13-01		540307-14-01		
	UNITS	MAC	SD04-OS	SD05-OS	QC Batch	SD06-OS	QC Batch	SD07-OS	RDL	QC Batch
Total Metals by ICPMS										
Total Lead (Pb)	ug/L	10	3.24	7.87	8849248	**46.6**	8848999	**22.2**	0.20	8848411

No Fill — No Exceedance
Grey — Exceeds 1 criteria policy/level
Black — Exceeds both criteria/levels
RDL = Reportable Detection Limit

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B7A6044
Report Date: 2017/12/05

TETRA TECH CANADA INC.
Client Project #: ENW.VENW03140-01
Sampler Initials: SW

ELEMENTS BY ATOMIC SPECTROSCOPY (DRINKING WATER)

Maxxam ID			SO7132	SO7133	SO7134		SO7135	SO7136		
Sampling Date			2017/11/27	2017/11/27	2017/11/27		2017/11/27	2017/11/27		
COC Number			540307-14-01	540307-14-01	540307-14-01		540307-14-01	540307-14-01		
	UNITS	MAC	SD08-OS	SD09-OS	SD10-OS	QC Batch	SD11-OS	SD13-OS	RDL	QC Batch
Total Metals by ICPMS										
Total Lead (Pb)	ug/L	10	**183**	**38.4**	**23.7**	8848411	**177**	1.56	0.20	8848944

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B7A6044
Report Date: 2017/12/05

TETRA TECH CANADA INC.
Client Project #: ENW.VENW03140-01
Sampler Initials: SW

ELEMENTS BY ATOMIC SPECTROSCOPY (DRINKING WATER)

Maxxam ID			SO7137	SO7138	SO7139		SO7140	SO7141		
Sampling Date			2017/11/27	2017/11/27	2017/11/27		2017/11/22	2017/11/22		
COC Number			540307-14-01	540307-14-01	540307-14-01		540307-15-01	540307-15-01		
	UNITS	MAC	SD14-OS	SD15-OS	SDDUP-OS	QC Batch	QG01-2M	QG01-5M	RDL	QC Batch
Total Metals by ICPMS										
Total Lead (Pb)	ug/L	10	4.48	6.72	**344**	8848944	0.91	2.33	0.20	8849248

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

Maxxam ID			SO7142		SO7143	SO7144	SO7145	SO7146		
Sampling Date			2017/11/22		2017/11/22	2017/11/22	2017/11/22	2017/11/22		
COC Number			540307-15-01		540307-15-01	540307-15-01	540307-15-01	540307-15-01		
	UNITS	MAC	LS08-2M	QC Batch	LS08-5M	LS12-2M	LS12-5M	LS16-2M	RDL	QC Batch
Total Metals by ICPMS										
Total Lead (Pb)	ug/L	10	8.63	8849248	**10.6**	**17.5**	9.85	9.50	0.20	8848944

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

Maxxam ID			SO7147	SO7148	SO7149		
Sampling Date			2017/11/22	2017/11/22	2017/11/22		
COC Number			540307-15-01	540307-15-01	540307-15-01		
	UNITS	MAC	LS16-5M	LS17-2M	LS17-5M	RDL	QC Batch
Total Metals by ICPMS							
Total Lead (Pb)	ug/L	10	9.76	9.88	**10.4**	0.20	8848944

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B7A6044
Report Date: 2017/12/05

TETRA TECH CANADA INC.
Client Project #: ENW.VENW03140-01
Sampler Initials: SW

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	8.7°C
Package 2	10.3°C

MAC: The guidelines that have been included in this report have been taken from the Canadian Drinking Water Quality Summary Table, February 2017.

Criteria A = Maximum Acceptable Concentration (MAC) / Criteria B = Aesthetic Objectives (AO) / Criteria C = Operational Guidance Values (OG)
It is recommended to consult these guidelines when interpreting your data since there are non-numerical guidelines that are not included on this report.

Turbidity Guidelines:
1. Chemically assisted filtration: less than or equal to 0.3 NTU in 95% of the measurements or 95% of the time each month. Shall not exceed 1.0 NTU at any time.
2. Slow sand / diatomaceous earth filtration: less than or equal to 1.0 NTU in 95% of the measurements or 95% of the time each month. Shall not exceed 3.0 NTU at any time.
3. Membrane filtration: less than or equal to 0.1 NTU in 99% of the measurements made or at least 99% of the time each calendar month. Shall not exceed 0.3 NTU at any time.

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B7A6044
Report Date: 2017/12/05

QUALITY ASSURANCE REPORT

TETRA TECH CANADA INC.
Client Project #: ENW.VENW03140-01
Sampler Initials: SW

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8848411	Total Lead (Pb)	2017/12/02	98	80 - 120	100	80 - 120	<0.20	ug/L	0.76	20
8848944	Total Lead (Pb)	2017/12/04	NC	80 - 120	98	80 - 120	<0.20	ug/L	3.2	20
8848999	Total Lead (Pb)	2017/12/03	NC	80 - 120	98	80 - 120	<0.20	ug/L	1.6	20
8849248	Total Lead (Pb)	2017/12/02	99	80 - 120	104	80 - 120	<0.20	ug/L	18	20
8850028	Total Lead (Pb)	2017/12/04	NC	80 - 120	101	80 - 120	<0.20	ug/L	0.88	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

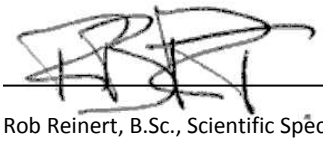
Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B7A6044
Report Date: 2017/12/05

TETRA TECH CANADA INC.
Client Project #: ENW.VENW03140-01
Sampler Initials: SW

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Rob Reinert, B.Sc., Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386