



**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

March 23, 2011

File: 17-210-100

Capital Regional District  
625 Fisgard Street  
Victoria, B.C.  
V8W 2S6

Attention: Richard Edwards, P.Eng.

**CEDARLANE WATER SYSTEM  
SALT SPRING ISLAND, B.C.  
REPORT ON REVIEW OF EXISTING WELL &  
GROUNDWATER INFORMATION**

Dear Richard;

Thurber Engineering Ltd. (Thurber) is pleased to present this letter responding to your request that we examine the historic information on groundwater investigations for the Cedarlane Water System (Utility) and provide an opinion on the feasibility of finding suitable groundwater supplies to augment the limited well supply that exists today. In addition, we were requested to comment on an alternate supply of water from the existing North Salt Spring Waterworks District (NSSWD) system.

The use of this report is subject to the attached *Statement of General Conditions* which is located following the text of this letter.

**DATA EXAMINED**

The primary source of information is provided in our 1980 "*Cedarlane Water System, Salt Spring Island, Groundwater Study*". This study reviewed all available well and water system information including work done by Associated Engineering Services Ltd, provided well logs, water quality data and system assessments reported in 1968, 1970 and 1973. We also reviewed a published report provided by the BC Ministry of Environment entitled "*A Preliminary Geohydrology Study of Salt Spring Island, March 1977*".

We also re-examined the geological mapping of the study area using "Muller J.E. Map 1553A, Geology; Victoria", British Columbia published in 1980.



## DATA ASSESSMENT

The results of the Thurber November 1980 report indicated that, of several wells drilled, only three (#1, 2 & 5) were in use. We understand wells #1 & #5 are producing a barely adequate groundwater supply, especially during the summer high water demand season. The aquifer penetrated by the wells consists primarily of tight, low permeability sandstone. The data also noted that some dry wells and others that produced salt water were drilled within the Utility. At that time, we recommended a detailed hydrogeological study be undertaken including geo-mapping of bedrock lineaments to see if any potential drilling sites existed within the Utility boundaries. No further work was undertaken by Thurber.

The examination of the geological mapping revealed that the Utility is situated in an elongated, bedrock controlled valley which is mapped along a synclinal axis geological boundary feature between the Geoffrey Formation (sandstone, conglomerate, siltstone and shale) and the Northumberland Formation (shale, siltstone and sandstone) of the Nanaimo Group of sedimentary rocks. Our experience in this geologic setting is that these bedrock features are generally not a satisfactory producer of a communal water supply, although single family home domestic well water supplies may be possible with conservative use of water. As noted above it is not uncommon for wells in this formation on Salt Spring Island to encounter saline water at shallow depths, even though the well may be inland from the coast.

A further examination of the Muller mapping indicated the presence of a major bedrock fault zone extending across the northwest portion of Salt Spring Island, entering the island from Burgoyne Bay, crosses the east end of Lake Maxwell and Booth Inlet, is present along the east shore of St. Mary Lake and exits the island at Fernwood Point. The closest access point to this fault zone (following existing roads), would be at the intersection of North End Road and Stark Road. A rough scaled distance from the Utility to this point along these roads would be 5 to 6 km. It is unknown at this time if there may be a bedrock lineament through the Bullocks Lake valley towards the Utility that might intersect the fault zone.

## CONCLUSIONS

It is our opinion, based on the information available, that the likelihood of intercepting a significant groundwater supply of non-saline water from one or more wells on the Utility site is low.

Should you wish to develop an expanded well water supply for the Utility, we would recommend exploring within the GSC fault zone in the area of North End Road and Stark Road or undertake a bedrock lineament air photo and field



reconnaissance mapping program along the Bullocks Lake valley and if successful, consider the feasibility of drilling closer to the Utility delivery point.

As mentioned, the possibility of connecting to the NSSWD is an option. We recommend you investigate the cost of connecting to a source of their water to the Utility. This approach has little risk. The geological mapping (if found promising) followed by locating an available, accessible drill site and drilling/testing one or more wells, plus piping the water to the Utility has challenges, with no guarantee of success at this time.

### ESTIMATED FUTURE WELL EXPLORATION & DEVELOPMENT COSTS

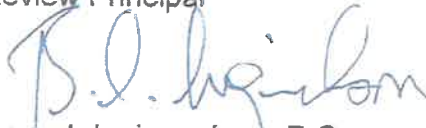
The cost of an air photo lineament study and field reconnaissance is approximately \$5,000. Further estimated costs would need to follow if we felt drilling in this area looked promising and the CRD determined this concept would be feasible from a delivery perspective.

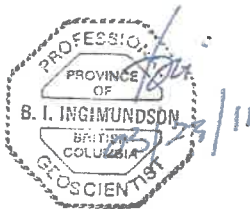
Based on the recent (2010) Cedars of Tuam Service single well program, we estimate the cost for hydrogeological consulting services, well drilling and test pumping to be approximately \$50,000/well. This does not include site access and preparation for the drilling/test pumping equipment, nor the cost of piping the water from the well(s) site to the Utility.

### CLOSURE

We trust that this letter meets your immediate requirements. Should you have any questions, please contact Bruce Ingimundson at your convenience.

Yours truly,  
Thurber Engineering Ltd.  
Kevin B. Sterne, P.Eng.  
Review Principal

  
Bruce I. Ingimundson, P.Geo.  
Senior Hydrogeologist



Attachment: Geological Map portion (GSC Map 1553A)



## STATEMENT OF GENERAL CONDITIONS

### 1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

### 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

### 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this Report expressly addresses proposed development, design objectives and purposes, and then only to the extent there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation or to consider such representations, information and instructions.

### 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS WE MAY EXPRESSLY APPROVE. The contents of the Report remain our copyright property. The Client may not give, lend or, sell the Report, or otherwise make the Report, or any portion thereof, available to any person without our prior written permission. Any use which a third party makes of the Report are the sole responsibility of such third parties. Unless expressly permitted by us, no person other than the Client is entitled to rely on this Report. We accept no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without our express written permission.

### 5. INTERPRETATION OF THE REPORT

- a) **Nature and Exactness of Soil and Contaminant Description:** Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and this report is delivered on the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) **Reliance on Provided Information:** The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.



## INTERPRETATION OF THE REPORT *(continued . . .)*

- c) Design Services: The Report may form part of the design and construction documents for information purposes even though it may have been issued prior to the final design being completed. We should be retained to review the final design, project plans and documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the report recommendations and the final design detailed in the contract documents should be reported to us immediately so that we can address potential conflicts.
- d) Construction Services: During construction we must be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

## 6. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

## 7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

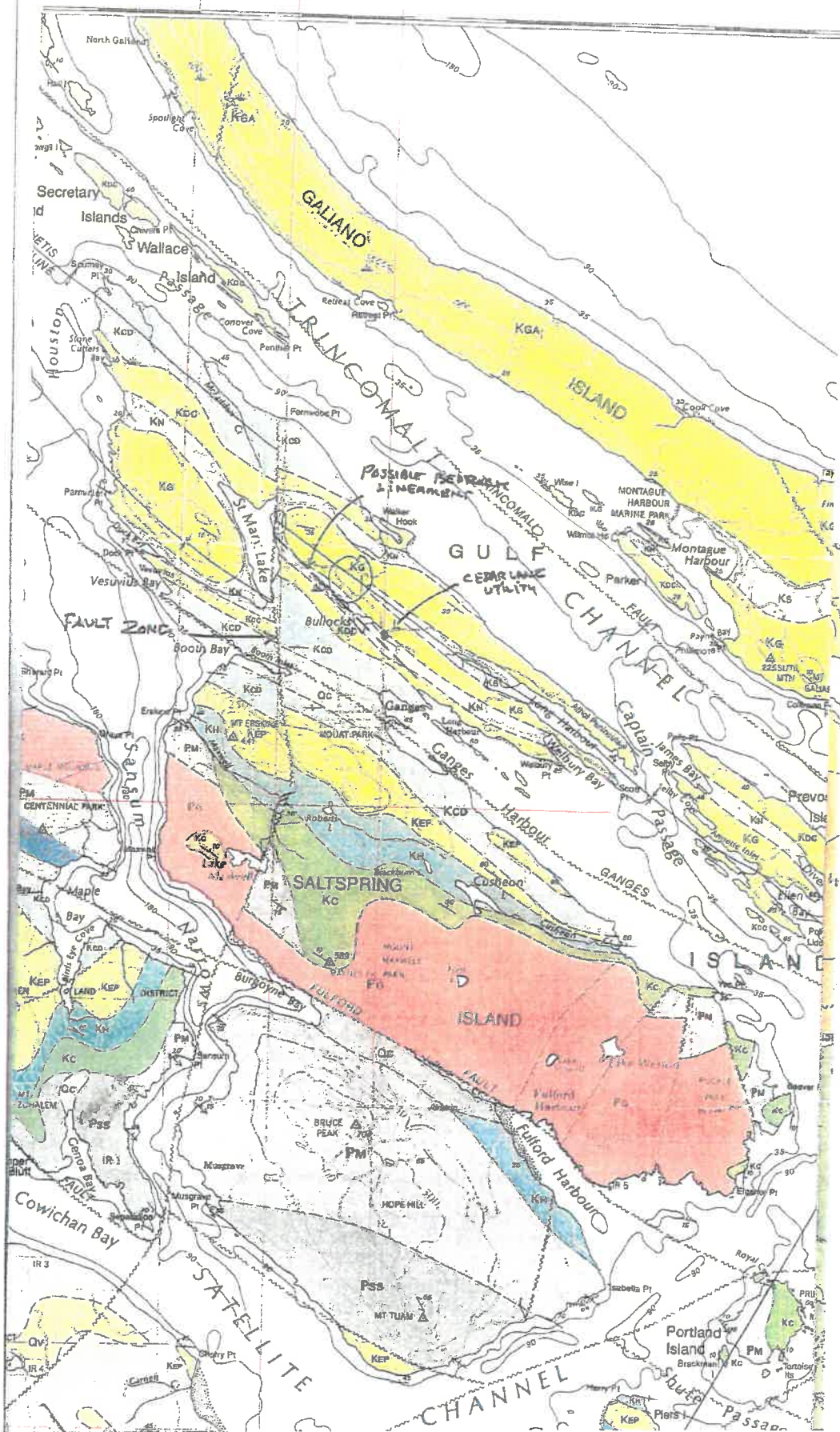
The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Client's benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular these conditions apply to the use of drilling, excavation and laboratory testing services.

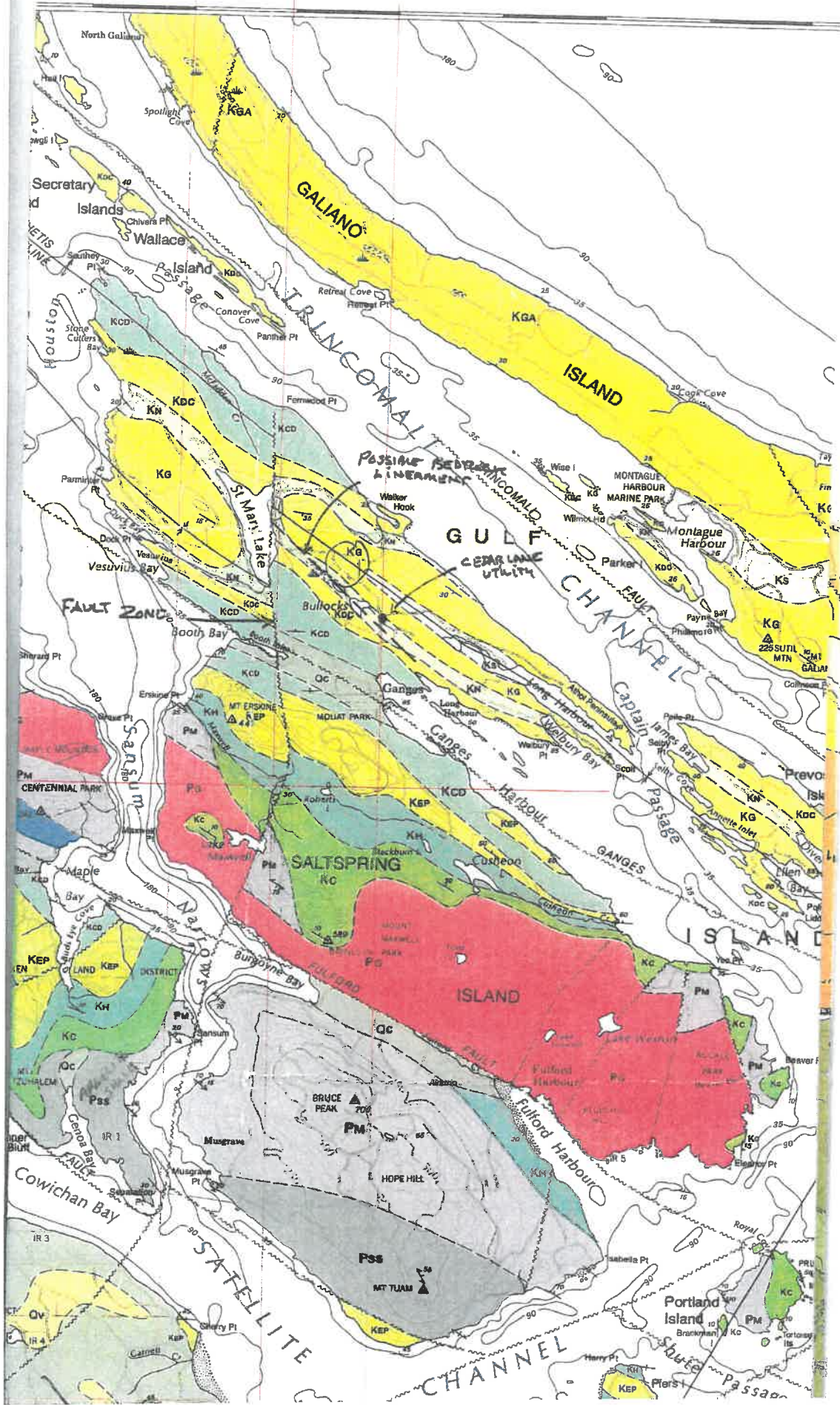
## 8. CONTROL OF WORK AND JOBSITE SAFETY

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

## 9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.







**Important**

This map is for general information purposes only. The Capital Regional District (CRD) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. The CRD is not responsible for any damage, loss or injury resulting from the use of the map or any information on the map and the map may be changed by the CRD at any time.

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**Cedarlane**

**Faultlines**

Intramap 2.0

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