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REPORT ON

TEST WELL DRILLING AND GROUNDWATER DEVELOPMENT POTENTIAL EVALUATION CRYSTAL MOUNTAIN RESORT WESTBANK, BRITISH COLUMBIA

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EXECUTIVE SUMMARY

INTRODUCTION

Golder Associates Ltd. (Golder) is pleased to provide this report, summarizing the results of the construction and testing of a test well and assessment of groundwater development potential for Crystal Mountain Resort (the Resort), located approximately 14.5 km northwest of Westbank, BC. The test well (TW2) is located approximately 7.5 km to the north of the Resort, directly north of Power Creek, with the area surrounding the test well referred to as the “Study Area".

It is understood that Crystal Mountain Resort, in partnership with BMR Golf Construction Inc. (BMR Golf) is proposing to expand the current ski hill operation to include year-round resort activities, including a golf course and various accommodations (single family and multi family homes). The purpose of the construction and testing of a test well was to collect hydrogeological information to aid in the assessment of whether groundwater within the area could provide a sufficient quantity and quality of potable water to support the initial stages (Phase 1) of a proposed development within the Crystal Mountain Resort area. A preliminary estimate of the required well yield by McElhanney Consulting Services Ltd. indicated that the total water demand for Phase 1 of the development, including the golf course, is approximately 142,809 m^3 annually.

The scope of work for this investigation included the construction of a test well, and a 72-hour pumping test, during which time water levels were monitored within the test well and nearby observation well.

REGIONAL GEOLOGY AND HYDROGEOLOGY

Based on our experience and available information, the regional surficial geology in the area of Crystal Mountain Resort consists primarily of glacial till and shallow bedrock.

TW2 is located within the northern reaches of the Powers Creek watershed, which contains numerous lakes and creeks.

RESULTS

Based on the results of the hydrogeologic investigation and test well drilling program completed for the Study Area, the following conclusions are presented:

1. A 4 to 7 m thick, confined silty, sand and gravel aquifer has been identified in the area where TW2 has been completed, at a depth between approximately 32 and 35 m below ground surface (mbgs). The aquifer was overlain with a thick (24 m thick) clay deposit and underlain with bedrock.

2. Based on drawdown and recovery data collected during a 72-hour constant-rate pumping test, the transmissivity of the confined aquifer in which the test well is completed is approximately 8 m^2/day. The hydraulic conductivity of the aquifer is estimated to be about 2 m/day.

3. The 100-day specific capacity of the well is 0.13 L/sec/m (0.6 US gpm/ft). Based on an available drawdown of 21 m (applying a 70% factor of safety), the theoretical capacity of this well is approximately 2.6 L/s (41 USgpm), the approximate rate at which the well was tested.

4. A drawdown of approximately 11 m was observed within an observation well located approximately 15 m from the pumping well. As such, it can be inferred that there will be some mutual well interference between TW2 and other potential water wells located within a 1 km radius of TW2.

5. Based on the results of the constant rate pumping test, it can be inferred that an additional pumping well located approximately 1 km from TW2 could yield an additional 2.5 L/sec (40 USgpm), with little effect of the water levels at TW2. Similarly,

   - two pumping wells located within 500 m of each other could theoretically yield approximately 2.4 L/sec (38 USgpm) each or 4.8 L/sec (76 USgpm) total; or

   - two pumping wells located within 50 m of each other in the area of TW2 could theoretically yield approximately 1.4 L/sec (23 USgpm) each, or 2.8 L/sec (46 USgpm) total.

   This assumes that TW2 is one of the two wells and that the pumping rate at TW2 has been reduced to 2.4 L/sec or 1.4 L/sec, respectively.

6. Groundwater from the test well does not appear to be under the direct influence of surface water from Powers Creek at a discharge of 2.5 L/sec (40 USgpm). however, once the well is put into production and water samples collected over a suitable length of time then the water analyses should be reviewed to determine if water from the well should receive chemically assisted filtration and disinfection (or equivalent) treatment processes. .

7. Water quality testing at TW2 indicated that all analyzed parameters were below the applicable guidelines for Canadian drinking water quality (GCDWQ, CCME 1996). Hardness concentrations were reported at 196 mg/L.

8. The proposed withdrawal of approximately 2.5 L/sec (40 USgpm) is not anticipated to adversely impact surface water flows within Powers Creek or groundwater users located approximately 11 km to the southeast and hydraulically downgradient of the Study Area.

RECOMMENDATIONS

Based on the results of this investigation, the following recommendations are provided regarding TW2:

1. Test well TW2 is a valuable long-term asset, which should be preserved. Although the primary purpose for this test well was for identifying production and water quality options for the proposed development, the completed TW2 test well should be preserved for: a) use as a backup water supply well, capable of producing up to 2.5 L/sec (40 USgpm), b) long-term monitoring of water-levels, and c) as an observation well to monitor the aquifer and derive aquifer coefficients during hydraulic testing of potential planned production well.

2. Should the test well be used as either a backup well or an observation well, dedicated measuring tubes for housing pressure transducers and/or for manual measurement of water levels should be permanently installed in the well. A permanent pressure transducer/data logger sensor should be installed in the test well, so that an accurate and up-to-date record of water levels in the test well can be maintained by the well operator.

3. Access to the site where the test well and presumably any production wells will be located should be restricted, to discourage vandalism and animal grazing. Measures should be taken to ensure that drainage of surface water and run-off is away from the wellhead. No toxic liquids should be stored temporarily or permanently on the well lot and, preferentially, storage of these types of materials (if absolutely necessary) should be in excess of 100 m from any well head. Any wells should be enclosed in well houses, with grading sloping away from the wellheads. The well house structures should be designed to be removable so that the wells can be accessed by a drilling rig, for regular well maintenance. The wells should be secured and locked at all times to restrict access.

4. Because lateral and vertical changes in lithology can occur over very short distances, any final production well design and well screen slot sizing will be determined after the borehole of the production well is drilled. Grain size analyses of cuttings obtained from the proposed production well borehole will be necessary in order to accurately determine the final specifications of the well screen assembly. Furthermore, final recommendations on pump selection and setting depth will be made after the results of a pumping test of the production well have been evaluated.

5. Once up and running, any monitoring data from both the test well and/or proposed production wells should be periodically reviewed by a qualified professional. Typically, if the specific capacity of the well decreases by 20-to-25 percent, this is indication that a well rehabilitation program may be needed.

6. Should TW2 be used as a potable water source, consideration can be given to treating the water for hardness, if required.

The effect of pumping water from TW2 on downgradient water well users (approximately 11 km to the southeast) is considered to be negligible. However, should it be necessary, a groundwater level monitoring program could be developed for those users, such that water levels within private wells are monitored on a regular frequency. Should a monitoring program for downgradient water well users be developed, it is recommended that it be initiated as soon as possible, in order to establish some baseline data prior to the potential operation of TW2 or any other water well within the Study Area.

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) is pleased to provide this report, summarizing the results of the construction and testing of a test well and assessment of groundwater development potential for Crystal Mountain Resort (the Resort), located approximately 14.5 km northwest of Westbank, BC (Figure 1). The test well location is located approximately 7.5 km to the north of the Resort, directly north of Power Creek, and is referred to as the “Study Area".

It is understood that Crystal Mountain Resort, in partnership with BMR Golf Construction Inc. (BMR Golf) is proposing to expand the current ski hill operation to include year-round resort activities, including a golf course and various accommodations (single family and multi family homes).

1.1 Purpose and Objective

The purpose of the construction and testing of a test well was to collect hydrogeological information to aid in the assessment of whether groundwater within the area could provide a sufficient quantity and quality of potable water to support the initial stages (Phase 1) of a proposed development within the Crystal Mountain Resort area. The well yield required to support the initial stages of the proposed development is not known; however, a preliminary estimate by McElhanney Consulting Services Ltd., as outlined within their April 19, 2006 letter, indicated that the total water demand for Phase 1 of the development, including the golf course, is approximately 142,809 m^3 annually.

1.2 Scope of Work

The scope of work for this assignment included the following:

- monitor drilling and well construction;
- collect samples of aquifer sediments and design a well screen assembly;
- design and monitor step-drawdown and constant-rate pumping tests;
- analyze pumping test data;
- collect groundwater quality sample and review results for potability; and
- prepare a hydrogeologic report, summarizing the field investigations and analyses, with conclusions and recommendations.

The structure of this report is based on the 2004 Land and Water BC (LWBC) Inc. companion document to the *Water Utility Act* and the *Utilities Commission Act* entitled “*Guide to Applying for a Certificate of Public Convenience and Necessity (CPCN*)”.

1.3 Selection of Test Well Location

The test well location was chosen based on

i) the results of our August 27, 2002 letter entitled "Groundwater Availability Assessment, Proposed Crystal Mountain Resort Development, Westbank, BC", which identified four potential well drilling locations within the Powers Creek Watershed area (Figure 2), based on precipitation recharge estimates to the areas; and

ii) a reconnaissance of two of the four areas on October 31, 2002, which identified Area 3 as the most favourable of the four areas to construct a test well.

Two wells were drilled as part of this assignment. The first well (TW1) was drilled in December 2004, and is located approximately 60 m north of Powers Creek, and 15 m to the southeast of TW2 (Figure 3). Although this well intersected favourable subsurface soil and groundwater conditions, a subsequent break in the welded seal between casing lengths resulted in that this well could not be used to provide a potable water supply. A second test well, TW2, was drilled in close proximity to TW1, on the premise that subsurface conditions would be similar. TW2 was drilled in December 2005, and was successfully completed at a location approximately 15 m northwest of TW1 and 60 m to the north of Powers Creek (Figure 3).

2.0 REGIONAL GEOLOGY AND HYDROGEOLOGY

Based on our experience and available information, the regional surficial geology in the area of Crystal Mountain Resort consists primarily of glacial till and shallow bedrock.

TW1 and TW2 are located within the northern reaches of the Powers Creek watershed, which contains numerous lakes and creeks, amongst which are Paynter Lake (located approximately 6.2 km to the northwest of the Study Area), Jackpine Lake (located approximately 5.2 km to the southwest of the Study Area), and Lambley (Bear) Lake (located approximately 1.7 km to the east of the Study Area), and Powers Creek and North Powers Creek (Figure 1). Powers Creek is located approximately 60 m to the south of the Study Area and flows in a southerly direction from Paynter Lake, eventually discharging into Okanagan Lake approximately 17.2 km to the southeast.

According to the Geological Survey of Canada, bedrock in the Study Area consists of the Cache Creek Group, which contains greenstone, quartzite, argillite and limestone.

The inferred regional direction of groundwater flow (based on topography) is southeast towards the valley bottom.

3.0 METHODOLOGY

3.1 Test Well Drilling

A new well source construction permit (No. OK-157) was issued by the Interior Health Authority ("IHA") prior to the commencement of the drilling activities (Appendix I). For the purposes of long-term monitoring and to assess the quantity and quality of groundwater, two exploratory boreholes were drilled and completed as test wells within Area 3 as described below:

TW1

TW1 was drilled by Cascade Drilling Ltd. Of Kelowna, BC in December 2004, at which time a 150 mm (6 inch) steel well casing was advanced to a total depth of 38.8 m below ground surface (mbgs), and later pulled back to a depth of approximately 32 mbgs to expose the well screen. A surface casing was not placed around this well, as this well was not useable as a water well (discussed in Section 3.2) and will likely be decommissioned.

Golder field personnel were available to monitor the first day of drilling, collecting soil samples from uniform depth intervals or at changes in the stratigraphy. Subsequent to the first day of drilling, the driller collected soil samples during drilling. The following two soil samples were selected by Golder and submitted to our in-house laboratory for grain-size analyses, to aid in the selection of an appropriate well screen.

- Sample depth – 32 mbgs

- Sample depth – 33.5 – 35 mbgs

The screen intake area (a function of well screen slot size) was chosen based on a slot size equivalent to grain size with 50% to 60% of the aquifer material being retained, as plotted on the grain size distribution plot for each sample. A conservative percent retained (50-60%) was applied during screen selection as the integrity and reliability of the samples collected were in question. Results of the grain size analyses are provided in Appendix II.

The screen assembly was installed in January 2005 and consists of two 1.2 m in length, 150 mm (6 inch) diameter, stainless steel telescopic screens. The initial screen is installed between 32 m and 33.2 m and consists of a 50 slot screen, while the second screen is installed between 33.2 m and 34.4 mbgs and consists of a 60 slot screen.

Following installation of the well screen assembly within TW1, the well was developed using the air lifting capabilities of the drilling rig. Developing of the well occurred for a period of 6.5 hours in January 2005.

TW2

TW2 was drilled by Cyclone Drilling Ltd. of Westbank, BC, between December 19 and 20, 2005. It was drilled using a truck mounted air rotary drilling rig with a casing hammer attachment. Drilling activities for TW2 were monitored by Golder field personnel.

A 200 mm (8 inch) diameter, steel surface casing was installed to a depth of 5.5 mbgs to allow the placement of an annular bentonite grout surface seal around the outside of a 150 mm (6 inch) diameter steel casing. The 150 mm diameter steel casing was advanced through the 200 mm surface casing to a total depth of 35 mbgs. Drill cuttings returned to the surface were sampled by a Golder representative every 1.5 m (5 ft), or at noticeable changes in lithology (whichever was less). Although two soil samples were selected for grain size analyses, they did not play a role in selecting the slot size of the screens, as the screens were placed within fractured bedrock. The purpose of the screens in this instance was to prevent the sloughing of fractured rock into the borehole. The following two soil samples were selected by Golder and submitted to our in-house laboratory for grain-size analyses, the results of which are provided in Appendix II.

- Sample depth – 34.1 m – 34.7 mbgs
- Sample depth – 34.7 m – 35.4 mbgs

The screen assembly was installed on December 20, 2005, and consists of two 1.2 m in length, 150 mm (6 inch) diameter, stainless steel telescopic screens. The initial screen is installed between 34.7 m and 36.1 m and consists of a 100 slot screen, while the second screen is installed between 36.1 m and 37.5 m and consists of a 60 slot screen.

Following installation of the well screen assembly within TW2, the well was developed using the air lifting capabilities of the drilling rig. Developing of the well occurred for a period of approximately 4 hours on January 21, 2006. The well screen was developed until the water discharge was clear and relatively free of sediment.

3.2 Pumping Tests

A pumping test was attempted on TW1 in January 2005 by Aqua Tech Services of Kelowna, BC. However, due to increasing silt content within the water, the test was terminated. A subsequent camera inspection within the well identified that the casing weld had broken at a depth of approximately 20 m below ground surface, allowing silt and/or clay sediment to enter into the well. As this problem could not be corrected, the well was no longer considered suitable as a water well, and was used for water level monitoring purposes during the pumping test conducted at TW2.

A pumping test was conducted on TW2 between December 27 and 31, 2005, by Aqua Tech Services Ltd. The testing consisted of a step-drawdown test to assess the specific capacity and efficiency of TW2 and to determine the optimum pumping rate to be used during the constant rate pumping test. The step drawdown test was followed by a 72-hour constant rate pumping test, and measurement of water level recovery following the cessation of pumping.

Cyclone Drilling suggested that the production well would be capable of sustaining a pumping rate of approximately 2.8 L/s (45 USgpm) to 3.2 L/s (50 USgpm). As such, the step drawdown testing was designed to consist of 4 steps, each step 90 minutes in duration, starting at 1.3 L/s (20 USgpm) for the first step, 1.9 L/s (30 USgpm) for the second step, 2.8 L/s (45 USgpm) for the third step, and 3.9 L/s (62 USgpm) for the fourth step. Based on the results of this testing, the 72-hour constant-rate pumping test was conducted at a pumping rate of 2.5 L/s (40 USgpm).

During testing, discharged water was routed away from the wellhead through 50 m of 100-mm-diameter (4-inch) PVC pipe into a forested area located approximately 50 m to the northeast of the wellhead. This area was chosen so that it would not affect the drawdown observed near TW2 during the pumping test. Precautions were taken during testing to minimize any ground erosion or flooding and to ensure there were no leaks in the discharge pipe.

Flow rates during testing were measured using an in-line digital flow meter, placed in a straight-running section of the discharge pipe at the wellhead.

Water levels within TW1 and TW2 were monitored during the testing of TW2 using data loggers installed within the wells and by collecting and recording water level measurements by hand.

Following shut down of the pump at the end of the constant-rate pumping test, the recovery to static water level was monitored in TW2 until January 1, 2006.

Water level measurement data and other observations collected during the step-drawdown and constant rate test are presented in Appendix III. A plot of the observed drawdown is shown as Figure 4.

3.3 Water Sample Collection and Chemical Analyses

A water sample was collected by Golder's technician from TW2 on December 29, 2005, after approximately 48 hours of pumping, to assess the potability of the groundwater adjacent to the screened portion of the aquifer. The water sample was submitted to Cantest Ltd. in Burnaby, BC for enhanced potability analyses and for radiological (Gross Alpha and Gross Beta) analyses. Analytical results are provided on Table 1 and in Appendix IV.

3.4 Well Location Surveying

TW1, TW2 and Powers Creek were surveyed on January 5, 2006 by Golder staff, using a total station surveying equipment, such that groundwater elevations can be compared to creek elevations.

4.0 RESULTS OF FIELD INVESTIGATIONS

4.1 Test Drilling and Well Construction

4.1.1 TW1

The soil profile encountered during the drilling of TW1 is summarized in the following table. A copy of the driller's report for this well is provided in Appendix V.

Table 2: Soil Profile at TW1

Soil Type	Depth (mbgs)	Inferred Aquifer/Confining Unit	Comments
Sand and Gravel	0 – 1.5	Top Soil	Dry
Sand and Gravel	1.5 – 4.4	Unconfined Aquifer	Water bearing
Till	4.4 – 15.2	Confining Unit	Dry
Black Clay	15.2 – 28.3		Sticky
Coarse Gravel	28.3 – 35	Confined Aquifer	Water bearing
Bedrock	35 – 38.7	--	--

The depth to the static water level at the time of drilling was approximately 1.5 mbgs.

4.1.2 TW2

Figure 5 shows the well completion details for TW2 and a copy of the driller's report is provided in Appendix V. The soil profile encountered during the drilling of TW2 is summarized in the following table.

Table 3: Soil Profile at TW2

Soil Type	Depth (mbgs)	Inferred Aquifer/Confining Unit	Comments
Brown sandy clay with boulder and gravel	0 – 1.8	Topsoil	Dry
Reddish brown, coarse sand with gravel and trace clay	1.8 – 4.6	Unconfined Aquifer	Wet
Reddish brown sandy clay with gravel	4.6 - 10.7	Confining Unit	Moist to wet
Sandy grey clay with trace gravel	10.7 – 13.4		
Silty grey clay, trace gravel at depth	13.4 – 31.7		Moist to wet
Sand and gravel with silty sand	31.7 – 34.1	Confined Aquifer	Wet
Brown sand and gravel	34.1 – 35.1		Wet
Soft, fractured weathered bedrock	35.1 – 36.9	--	--
Solid brown weathered bedrock	36.9 – 37.5	--	--

The maximum transmitting capacity of the screen assembly (based on recommendations of an entrance velocity of 0.03 m/s) was estimated to be 18 L/s (286 USgpm).

The available drawdown in TW2 is estimated to be 30.2 m, and is based on the difference between the static water level (1.5 mbgs) and the base of the confining layer overlying the aquifer (31.7 mbgs) in which the well screen was set.

4.2 Hydraulic Testing

4.2.1 Step-Drawdown Testing

Water level measurements that were taken during the step-drawdown testing are presented in Appendix III and a plot of drawdown versus time for the four steps is presented in Figure 4. The plot shows that the individual drawdowns resulting from each step are as follows: 5.6 m after the first step, followed by 3.9 m after the second step, 6 m after the third step and the final drawdown after the fourth step was 7.3 m. Based on the results of the step-drawdown test, a rate of 2.5 L/s (40 USgpm) was selected for the 72-hour constant rate pumping test.

4.2.2 Constant Rate Testing

The constant-rate pumping test was conducted at 2.5 L/s (40 USgpm) for a 72-hour period. Water level measurements were recorded at TW1 and TW2 during the constant-rate pumping test, the results of which are presented in Appendix III and in Figure 6. The total drawdown observed within TW2 during the pumping test was 16.8 m after 72 hours of pumping, while the total drawdown noted at TW1 was approximately 11.8 m.

Upon cessation of pumping, water levels at TW1 and TW2 recovered to within 90% of the pre-test static water level within 24 hours.

5.0 INTERPRETATION OF RESULTS

5.1 Hydrogeological Setting

Based on the results of the test well drilling program, a shallow, unconfined sand and gravel aquifer is present in the area of TW1 and TW2, between approximately 1.5 m and 4.6 mbgs. This is underlain with a 24 m to 27 m thick confining deposit of clay. A confined sand and gravel aquifer appears to be present below the confining deposit to a depth of approximately 35 mbgs, and is underlain with bedrock. The lateral extent of the aquifer is unknown, as information in the area is limited. However, the saturated thickness of the confined aquifer is approximately 4 m to 7 m, and is based on the distance between the bedrock surface and the base of the confining deposit.

The results of the well and creek elevation survey indicated that groundwater elevations at TW1 and TW2 are approximately 4 m higher than the creek elevation in the area, thus implying there is an upward hydraulic gradient within the confined aquifer. However, there is insufficient information to assess the direction of groundwater flow within the deeper, confined aquifer. Based on the topography of the area, it can be inferred that the groundwater flow in the area of TW2 is towards the southeast.

5.2 Well Capacity

Well capacity was estimated using the methodology outlined in the guidance document published by the BCMoE entitled "*Evaluating Long-Term Well Capacity for a Certificate of Public Convenience and Necessity (CPCN)*" (1999). The recommended methodology for estimating the well capacity typically calls for a minimum 72-hour duration pumping test during low water level periods (late fall-winter for the interior of B.C). The MoE recommends that the following four criteria be considered when evaluating well capacity:

1. adequate pumping test procedures;
2. estimated drawdown in pumping well extended to a minimum of 100 day period;
3. total available drawdown in the pumping well; and,
4. other factors, such as well design limitations, well interference and water quality.

The theoretical well capacity (Q) for a specific well, using information from the well log and the pumping test, is calculated as follows:

Q = 0.7 (70% of the available drawdown) x 100 day specific capacity x total available drawdown in the pumping well

The 100 day specific capacity is estimated by projecting the drawdown of the 72-hour pumping test to 100 days. The 100 day projection period is utilized as it extends the pumping period from the mid-winter period (Dec/Jan) when the lowest static water levels typically exist to April/May when recharge typically occurs to an aquifer from spring snowmelt/runoff. This time period is intended to represent the period when the recharge to the aquifer is the lowest and hence reasonable worst case conditions.

As shown on Figure 6, the extrapolated drawdown after 100 days of pumping at a discharge of approximately 2.5 L/sec (40 USgpm) is approximately 20.5 m. This is slightly less than the total available drawdown at TW2 of 21 m, applying a 70% factor of safety.

The 100-day specific capacity of the well is 0.13 L/sec/m (0.6 US gpm/ft). Based on an available drawdown of 21 m (applying a 70% factor of safety), the theoretical capacity of this well is approximately 2.7 L/s (43 USgpm), the approximate rate at which the well was tested.

The characteristics of the confined aquifer were estimated using the results of the constant rate pumping test and AQTESOLV™, a commercial software package for pumping test analysis. The transmissivity of the aquifer was estimated using the Leaky Hantush solution method, a type curve solution for a pumping/recovery test in a leaky, confined aquifer. Transmissivity is the rate at which groundwater is transmitted through a unit width of an aquifer under a unit hydraulic gradient. The transmissivity was estimated to be approximately 8 m^2/day. Copies of the output file and a plot of the solution generated using the AQTESOLV™ program are included in Appendix VI.

The hydraulic conductivity of the aquifer was estimated to be in the order of approximately 2 m/day, based on the calculated transmissivity of 8 m^2/day and the approximate 4 m saturated thickness of the aquifer encountered in the immediate area of the test well. For comparative purposes, the hydraulic conductivity of sediments also can be estimated from grain size distribution curves, providing the uniformity coefficient and density of the material are known (Driscoll, 1986). Without the benefit of blow counts or laboratory analysis to determine density, the density of the aquifer sediments was estimated to be “medium-dense”, based on the effort of driving the steel casing through the aquifer section. The uniformity coefficient is determined by dividing the “90% passing” grain size by the “40% passing” grain size, obtained from the grain size distribution curves of the drilled aquifer sediments (Appendix II). Using a uniformity coefficient of 10 for medium-dense sediments, the hydraulic conductivity of the aquifer sediments (represented by the 50% passing grain size), is approximately 26 m/day, which is one order of magnitude greater than the hydraulic conductivity based on the transmissivity value.

Specific storage for the aquifer was also estimated using AQTESOLV™, and was estimated to be approximately 0.00006. This specific storage value is typical of confined aquifers (Driscoll, 1986).

5.3 Groundwater Quality

Results of laboratory analysis indicate the water samples collected from TW2 near the end of the constant-rate pumping test meet the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) for all analyzed parameters. The water quality results are summarized in Table 1, along with the maximum acceptable concentrations (MACs), interim maximum acceptable concentrations (IMACs), and aesthetic objectives (AOs) guidelines, where applicable. While MACs and IMACs are health-based standards, AOs are based on aesthetic water quality and typically are not a health concern. Note that hardness is an aesthetic objective, with public acceptance of hardness varying considerably. Generally hardness levels between 80 mg/L and 100 mg/L are considered acceptable, with levels greater than 200 mg/L considered poor, and levels greater than 500 mg/L considered unacceptable. Hardness concentrations at TW2 were reported to be 196 mg/L. With the exception of the water being slightly hard, groundwater from TW2 is of good, potable quality for drinking water and other needs.

The water sample collected from TW2 was also submitted for the analyses of radiological parameters. The results of the analyses for gross alpha and gross beta were reported to be 0.11 (+/- 0.06) Becquerel/litre (Bq/L) and 0.38 (+/- 0.06) Bq/L, respectively. According to the GCDWQ, compliance with the guidelines can be inferred provided that gross alpha measurements are less than 0.1 Bq/L and that gross beta concentrations are below 1 Bq/L, as these MACs represent the most conservative MACs for the listed radio nuclides.

However, it is possible for the gross alpha and/or gross beta results to exceed the 0.1 and1 Bq/L guideline, and still be below the GCDWQ for the individual radionuclide parameters.

The gross beta results for TW2 are well below the guidelines, however, the gross alpha results were slightly greater than the most conservative guideline for gross alpha parameters. As such, Golder requested that the two specific radionuclide parameters (Lead -210 and Thorium-232) be analyzed, as the MAC for these radio nuclides are 0.1 Bq/L. The next highest MAC is for Thorium-230 at a MAC of 0.4 Bq/L. The results of this analyses indicated that Lead-210 and Thorium-232 concentrations were 0.02 and 0.01, respectively (Appendix IV). As such, it can be inferred that all gross alpha concentrations are below the MACs listed in the GCDWQ.

5.4 Preliminary GUDI Assessment

The Province of British Columbia does not have a formal regulation with respect to evaluating if groundwater is considered to be under the direct influence of surface water ("GUDI"). As such, the Ontario Ministry of Environment (MOE) protocols were followed as outlined in the Ministry document entitled "Terms of Reference for Hydrogeological Study to Examine Groundwater Sources Potentially Under Direct Influence of Surface Water" dated October 2001. The document states that community wells are "flagged" as potentially under the direct influence of surface water if they satisfy the following criteria:

- The wells regularly contain Total Coliforms and/or periodically contain E. coli; or

- The wells are located within approximately 50 days horizontal saturated travel time from surface water, or are within 100 m (overburden wells) or 500 m (bedrock wells) of surface water (whichever is greater) **<u>and</u>** meet one or more of the following criteria:

    - Wells may be drawing water from an unconfined aquifer;

    - Wells may be drawing water from formations within approximately 15 m of surface;

    - Wells are part of an enhanced recharge/infiltration project;

    - When the well is pumped, water levels in surface water rapidly change or hydraulic gradients beside the surface water significantly increase in a downward direction;

- Chemical water quality parameters are more consistent with nearby surface water than local groundwater and/or if they fluctuate significantly and rapidly in response to climatological or surface water conditions.

A GUDI designation would require that the water from the well receive chemically assisted filtration and disinfection (or equivalent treatment processes).

There is insufficient water quality information to assess whether TW2 can be "flagged" as GUDI; however, based on the presently available physical and chemical information it is our opinion that the well would not be flagged as GUDI. The following provides comments on the presently available physical and chemical information:

1. There is insufficient chemical monitoring data to assess if the well *regularly* contains total coliforms and/or periodically contains E. Coli. However, the initial chemical analyses of a water sample collected from TW2 indicated that total and fecal coliform concentrations were below the laboratory detection limit of 1 colony per 100 mL.

2. TW2 is located within 100 m of surface water (overburden well).

3. TW2 does not appear to be collecting water from an unconfined aquifer or from within 15 m of the surface.

4. Water level measurements of Powers Creek during the pumping test did not appear to be impacted as a result of the 72-hour pumping test. In addition, groundwater levels within TW2 during the test did not indicate the presence of a positive boundary condition (Powers Creek).

5. The quality of the surface water within Powers Creek was not evaluated.

Not withstanding the above, once the well is placed in production and water samples are collected over a sufficient period of time, then a full evaluation of whether the well should be "flagged" as GUDI should be made.

5.5 Assessment of Well Interference

As previously stated, water levels were monitored in an observation well (TW1) during the constant rate pumping test of TW2. TW1 is located approximately 15 m to the southeast of TW2. As shown on Figure 6, the rate at which water levels were lowered during the pumping test was similar within TW1 as TW2. The total drawdown within TW1 was approximately 11.8 m after approximately 72 hours of pumping at a rate of approximately 2.5 L/sec (40 USgpm). Extrapolating the drawdown to 100 days, the anticipated drawdown at TW1 was approximately 16 mbgs.

Based on observations at TW1, and using AQTESOLV™ Golder was able to assess the potential for well interference should another pumping well be constructed within the area. As a preliminary assessment, AQTESOLV's leaky Hantush solution for confined aquifers was used to predict the extent of the drawdown at a potential well location 500 m and 1000 m away from TW2. Based on a transmissivity of 8 m^2/day and a specific storage value of approximately 0.00006, the following table summarizes the estimated drawdowns approximately 100 days after pumping, at various distances from the pumping well.

Table 4: Estimated Drawdowns at Various Distances from Pumping Well at 100 Days

Drawdown at TW2 (pumping well)	Drawdown at 15 m away (TW1)	Drawdown at 50 m away	Drawdown at 500 m away	Drawdown at 1000 m away
20.5 m	15.5 m	10 m	2 m	0.5 m

This prediction involved several basic assumptions about the hydraulic conditions in the aquifer. Among them are the following:

- The aquifer is bounded above and below by top and bottom by a confining layers;
- All geologic formations are horizontal and of relatively large horizontal extent; and
- The aquifer is relatively homogeneous and isotropic; and

Based on our knowledge of the hydrogeologic conditions at the site, these assumptions appear to be reasonable.

Based on the above, the estimated theoretical drawdown approximately 1 km away from TW2 is approximately 0.5 m. Alternatively, it can be inferred that a well located approximately 1 km away from TW2 would induce approximately 0.5 m of drawdown at TW2, assuming similar aquifer conditions and pumping rates as TW2. This would potentially result in the water level at TW2 dropping to approximately 21 mbgs (the total available drawdown at a period of 100 days).

Drawdown from mutual well interference at any subsequent wells drilled in the area should not exceed 70 % of the available drawdown at that well. Based on the above Table 4, an additional pumping well located approximately 1 km from TW2 could yield an additional 2.5 L/sec (40 USgpm) without dropping water levels within TW2 below 70% of the available drawdown. Similarly, an additional pumping well located approximately 500 m away from TW2 would potentially result in an additional 2 m drop in water levels within TW2. To ensure that the water level at TW2 would not fall below 21 m (70% of the available drawdown), the yield at TW2 would be required to be reduced to approximately 2.4 L/sec (38 USgpm). Thus combined yields with TW2 pumping and an additional well pumping approximately 500 m away would be in the order of 4.8 L/sec (76 USgpm). Similarly, an additional pumping well be constructed approximately 50 m away from TW2, this would potentially result in an additional 10 m drop in water levels within TW2. As this would result in the water level falling below the 70% of available drawdown, the pumping rate at TW2 would be required to be reduced to 1.4 L/sec (23 USgpm), to accommodate the resulting drop in water levels. Two wells pumping within 50 m of each other could theoretically yield approximately 1.4 L/sec (23 USgpm) each, or 2.8 L/sec (46 USgpm) total.

5.6 Potential Impacts to Powers Creek and Downgradient Groundwater Users

It is understood that the Westbank Irrigation District ("WID") has expressed some concern regarding the proposed use of groundwater collected from the area of Powers Creek, as Powers Creek provides potable and irrigation water for the WID. WID is concerned that the close location of TW2 to Powers Creek would result in reduced flows to the creek and removal of potentially licensed surface water.

According to the WID's Capital Works Plan (Agua Consulting Inc., 2005), the average annual runoff flows within Powers Creek are estimated to be approximately 920 L/sec, with projected flows under drought conditions estimated to be approximately 410 L/sec. The withdrawal of approximately 2.5 L/sec of *groundwater* for the proposed development only accounts for approximately 0.3% of the total average annual runoff flows, and 0.6% of runoff flows during drought conditions within Powers Creek.

Based on the following, it is our opinion that i) flows within Powers Creek will not be adversely affected by the proposed withdrawal of approximately 2.5 L/sec (40 USgpm) of groundwater for the proposed development and ii) groundwater collected from the area of TW2 does not represent licensed surface water:

- Based on the location of Powers Creek approximately 60 m to the south of TW2, it can be inferred that the 24 m thick confining deposits encountered at TW1 and TW2 extend beneath Powers Creek. The upper portion of the confining deposit was identified as unsaturated in the drillers' logs. The presence of these confining deposits substantially reduces the infiltration of creek water to the local groundwater regime, thus inferring that Powers Creek and groundwater from the deeper confined aquifer are not likely hydraulically connected in the area of TW2.

- The results of the well and creek elevation survey indicated that groundwater elevations at TW1 and TW2 are approximately 4 m higher than the creek elevation in the area, thus implying there is an upward hydraulic gradient within the confined aquifer.

- Based on the results of the pumping test, no positive boundary condition, indicating the presence of a hydraulic connection with a water body, was identified during the constant rate pumping test, as water levels within TW2 did not stabilize, nor did the rate at which the water levels were dropping decrease. Thus, it can be inferred that Powers Creek is not recharging groundwater within the area of TW2.

In addition, there has also been some concern from residents in the Westbank area who collect their water from springs and groundwater wells, that the water requirements of the proposed development would reduce the water yields within their wells/springs. The nearest private water wells to the Study Area are located approximately 11 km to the southeast. As shown in the above analyses the interference effects in these wells would be negligible.

6.0 CONCLUSIONS

Based on the results of the hydrogeologic investigation and test well drilling program completed for the Study Area, the following conclusions are presented:

1. A 4 to 7 m thick, confined silty, sand and gravel aquifer has been identified in the area where TW2 has been completed, at a depth between approximately 32 and 35 mbgs. The aquifer was overlain with a thick (24 m thick) clay deposit and underlain with bedrock.

2. Based on drawdown and recovery data collected during a 72-hour constant-rate pumping test, the transmissivity of the confined aquifer in which the test well is completed is approximately 8 m^2/day. The hydraulic conductivity of the aquifer is estimated to be about 2 m/day.

3. The 100-day specific capacity of the well is 0.13 L/sec/m (0.6 US gpm/ft). Based on an available drawdown of 21 m (applying a 70% factor of safety), the theoretical capacity of this well is approximately 2.6 L/s (41 USgpm), the approximate rate at which the well was tested.

4. A drawdown of approximately 11 m was observed within an observation well located approximately 15 m from the pumping well. As such, it can be inferred that there will be some mutual well interference between TW2 and other potential water wells located within a 1 km radius of TW2.

5. Based on the results of the constant rate pumping test, it can be inferred that an additional pumping well located approximately 1 km from TW2 could yield an additional 2.5 L/sec (40 USgpm), with little effect of the water levels at TW2. Similarly,

   - two pumping wells located within 500 m of each other could theoretically yield approximately 2.4 L/sec (38 USgpm) each or 4.8 L/sec (76 USgpm) total; or

   - two pumping wells located within 50 m of each other in the area of TW2 could theoretically yield approximately 1.4 L/sec (23 USgpm) each, or 2.8 L/sec (46 USgpm) total.

   This assumes that TW2 is one of the two wells and that the pumping rate at TW2 has been reduced to 2.4 L/sec or 1.4 L/sec, respectively.

6. Groundwater from the test well does not appear to be under the direct influence of surface water from Powers Creek at a discharge of 2.5 L/sec (40 USgpm). however, once the well is put into production and water samples collected over a suitable length of time then the water analyses should be reviewed to determine if water from the well should receive chemically assisted filtration and disinfection (or equivalent) treatment processes. .

7. Water quality testing at TW2 indicated that all analyzed parameters were below the applicable guidelines for Canadian drinking water quality (GCDWQ, CCME 1996). Hardness concentrations were reported at 196 mg/L.

8. The proposed withdrawal of approximately 2.5 L/sec (40 USgpm) is not anticipated to adversely impact surface water flows within Powers Creek or groundwater users located approximately 11 km to the southeast and hydraulically downgradient of the Study Area.

7.0 RECOMMENDATIONS

Based on the results of this investigation, the following recommendations are provided regarding TW2:

1. Test well TW2 is a valuable long-term asset, which should be preserved. Although the primary purpose for this test well was for identifying production and water quality options for the proposed development, the completed TW2 test well should be preserved for: a) use as a backup water supply well, capable of producing up to 2.5 L/sec (40 USgpm), b) long-term monitoring of water-levels, and c) as an observation well to monitor the aquifer and derive aquifer coefficients during hydraulic testing of potential planned production well.

2. Should the test well be used as either a backup well or an observation well, dedicated measuring tubes for housing pressure transducers and/or for manual measurement of water levels should be permanently installed in the well. A permanent pressure transducer/data logger sensor should be installed in the test well, so that an accurate, and up-to-date record of water levels in the test well can be maintained by the well operator.

3. Access to the site where the test well and presumably any production wells will be located should be restricted, to discourage vandalism and animal grazing. Measures should be taken to ensure that drainage of surface water and run-off is away from the wellhead. No toxic liquids should be stored temporarily or permanently on the well lot and, preferentially, storage of these types of materials (if absolutely necessary) should be in excess of 100 m from any well head. Any wells should be enclosed in well houses, with grading sloping away from the wellheads. The well house structures should be designed to be removable so that the wells can be accessed by a drilling rig, for regular well maintenance. The wells should be secured and locked at all times to restrict access.

4. Because lateral and vertical changes in lithology can occur over very short distances, any final production well design and well screen slot sizing will be determined after the borehole of the production well is drilled. Grain size analyses of cuttings obtained from the proposed production well borehole will be necessary in order to accurately determine the final specifications of the well screen assembly. Furthermore, final recommendations on pump selection and setting depth will be made after the results of a pumping test of the production well have been evaluated.

5. Once up and running, any monitoring data from both the test well and/or proposed production wells should be periodically reviewed by a qualified professional. Typically, if the specific capacity of the well decreases by 20-to-25 percent, this is indication that a well rehabilitation program may be needed.

6. Should TW2 be used as a potable water source, consideration can be given to treating the water for hardness, if required.

The effect of pumping water from TW2 on downgradient water well users (approximately 11 km to the southeast) is considered to be negligible. However, should it be necessary, a groundwater level monitoring program could be developed for those users, such that water levels within private wells are monitored on a regular frequency. Should a monitoring program for downgradient water well users be developed, it is recommended that it be initiated as soon as possible, in order to establish some baseline data prior to the potential operation of TW2 or any other water well within the Study Area.

8.0 LIMITATIONS AND USE OF THIS REPORT

This report was prepared for the exclusive use of Pheidias Development Management Corporation, BMR Construction Inc. and their representatives and is intended to provide documentation of the test well drilling program and a preliminary assessment of groundwater production potential from a proposed production well to be completed at this location. This report is not meant to represent a legal opinion regarding compliance with applicable laws. Any use which a third party makes of this letter report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this letter report.

The assessment of groundwater conditions presented has been made using historical and technical data collected and information from sources noted in the report. The methodologies used to conduct field investigation, to analyze information and for the preparation of a technical report were performed according to current professional standards and practices in the groundwater field.

Calculations of long-term well capacity have been made based on well conditions at the time when pumping tests have been completed. Typically, for public water supply wells in British Columbia, pumping tests are completed for a minimum duration of 72 hours in accordance with the guidance document entitled "*Evaluating Long-Term Well Capacity for a Certificate of Public Convenience and Necessity (CPCN)*". For other well types, including those for domestic, agricultural and industrial use, the duration of testing is a function of aquifer type and hydrogeological setting, as well as observed response during testing and hydrogeological judgment.

The actual drawdown measured in a well will depend on well design, pumping rate, and well efficiency in addition to aquifer hydraulics. It is typical for wells to realize decreasing efficiency over time due to precipitation of dissolved chemicals or sedimentation in the well. Periodic maintenance of wells may alleviate these problems. Golder makes no prediction concerning the effect of decreasing well efficiency on well yields. Furthermore, any chemical analysis, based on either sampling completed as part of field investigations on this assignment, or on water quality information provided by others, is intended to provide a snapshot only of the existing water quality available from the aquifer and only at the locations specified. The spatial and temporal water quality within the aquifer may vary as the aquifer is stressed or impacts occur due to other influences.

Predictions regarding potential impacts are based on a reasonably good understanding of the current conditions at the Site. However because of the limited available data, in particular information on fundamental aquifer characteristics including aquifer transmissivity, width and thickness, some uncertainty exists with respect to predictions

Golder has relied in good faith on information provided by third parties noted in this report. We accept no responsibility for any deficiency, misstatements or inaccuracies contained in this report as a result of omissions, misinterpretations or fraudulent acts of others. Furthermore, if new information is discovered during future work, including excavations, borings or other studies, Golder should be requested to provide amendments as required.

9.0 CLOSURE

We trust the foregoing provides the information you need at this time. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Yours truly,

GOLDER ASSOCIATES LTD.

Jacqueline Foley, M.Sc.
Hydrogeologist

Don Chorley, M.Sc., P.Eng.
Senior Hydrogeologist, Associate

Attachments
JF/WZ/DC/jc
N:\Active\2004\1440 - Kelowna\04-1440-116 Crystal Mountain Phase 1 PSI\Task 2000 New Water Supply\Final\GW Eval letter April 24-06.doc

REFERENCES

AQTESOLV® for Windows® 95/98/NT/2000/XP version 3.50 Professional. Developed by Glenn Duffield, HydroSOLVE, Inc. © ARCADIS Geraghty & Miller, Inc. 1996-2003.

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Geological Survey of Canada (1970) Department of Energy Mines and Resources. "*Structure and Petrology of the Grand Forks Group, British Columbia*". Page 69-22.

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FIGURES AND TABLES

0 5

SCALE (km)

REFERENCE

NTS 1:50,000 Map 82E13, "Peachland" Dated,

PROJECT

CRYSTAL MOUNTAIN RESORT,
BMR GOLF CONSTRUCTION INC,
PHEIDIAS DEVELOPMENT MANAGEMENT CORP.
GROUDWATER EVALUATION, WESTBANK, B.C.

TITLE

KEY PLAN

Golder Associates
Abbotsford, BC

PROJECT No.	04-1440-116		FILE No.	K440116-01
DESIGN	J.F.	09/03/06	SCALE AS SHOWN	REV. 0
CADD	S.S.S.	09/03/06		
CHECK			**FIGURE 1**	
REVIEW				

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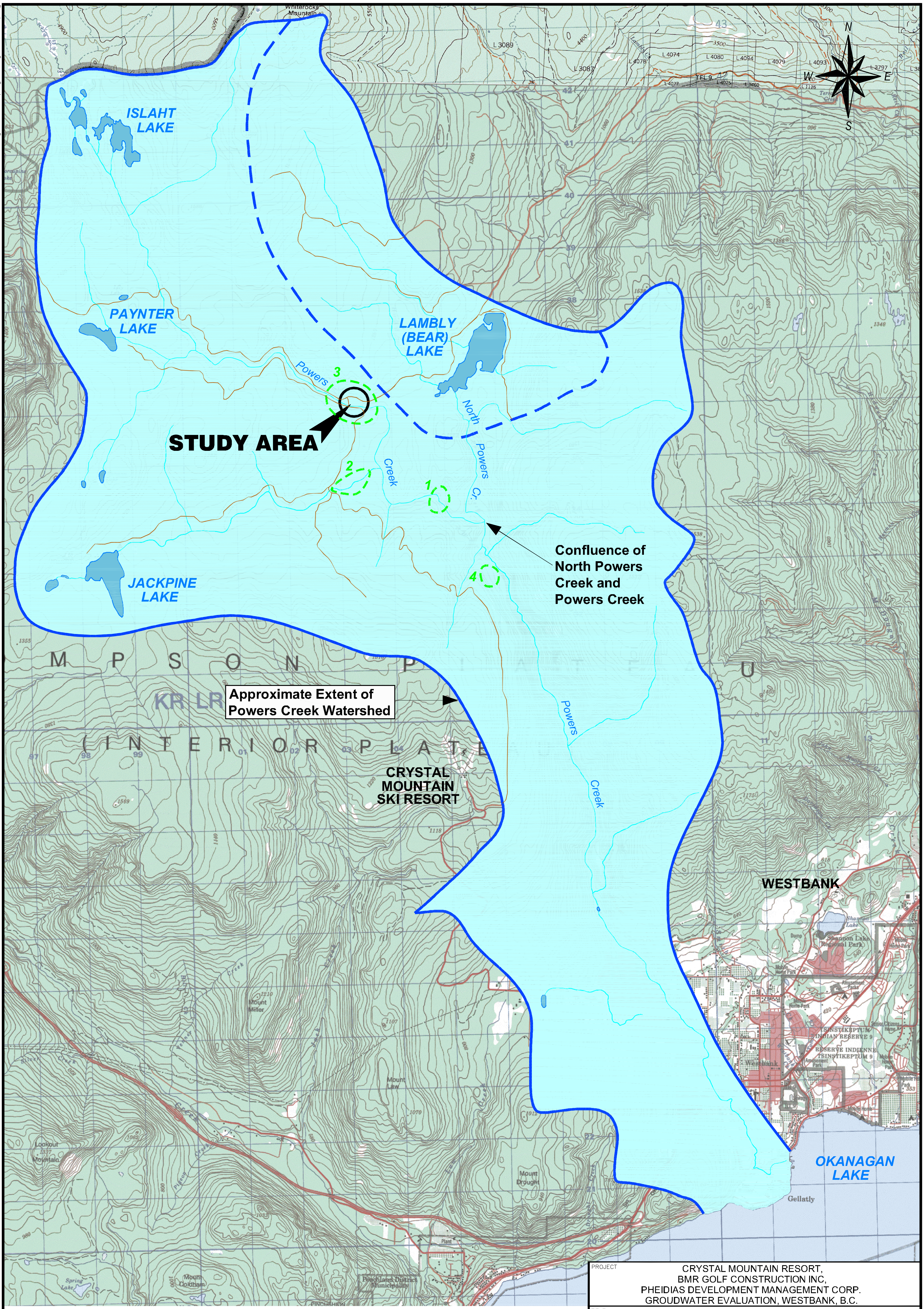


LEGEND

Potential Well Drilling Locations from 2002 Investigation

REFERENCE

NTS 1:50,000 Map 82E13, "Peachland" Dated,

0 3
SCALE (km)

PROJECT

CRYSTAL MOUNTAIN RESORT,
BMR GOLF CONSTRUCTION INC,
PHEIDIAS DEVELOPMENT MANAGEMENT CORP.
GROUDWATER EVALUATION, WESTBANK, B.C.

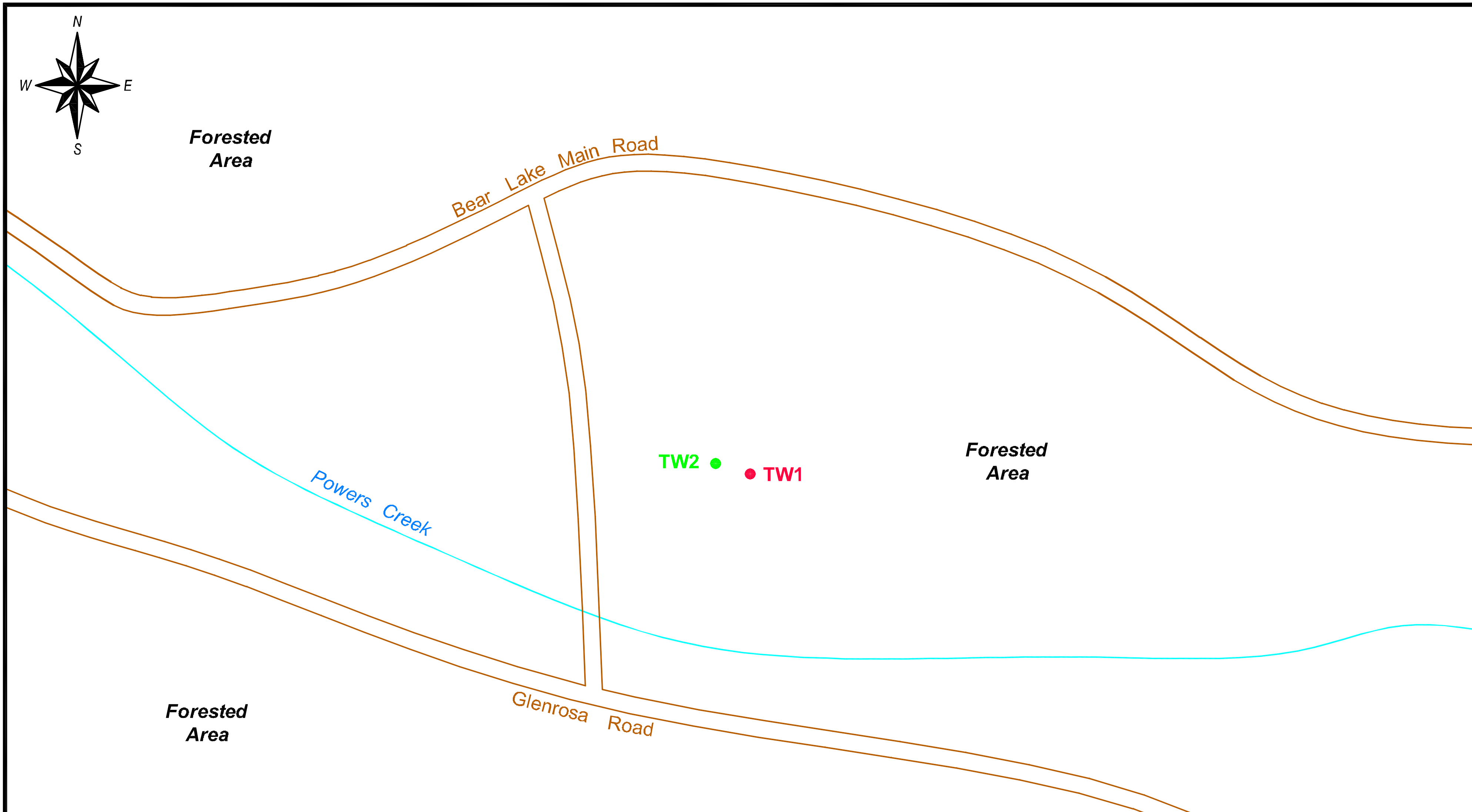
TITLE

POWERS CREEK WATERSHED AREA

PROJECT No.	04-1440-116		FILE No.	P440116-02.DWG
DESIGN	J.F.	10/03/06	SCALE AS SHOWN	REV. 0
CADD	S.S.S.	10/03/06		
CHECK				
REVIEW				

Golder Associates
Abbotsford, BC

FIGURE 2



LEGEND

- TW1
- TW2

REFERENCES

1.) NTS 1:50,000 Map 82E13, "Peachland".
2.) CAD file: CRYSTAL.CR5, and CRYSTAL.RW5, Dated, January 5, 2006.

0 50
SCALE (m)

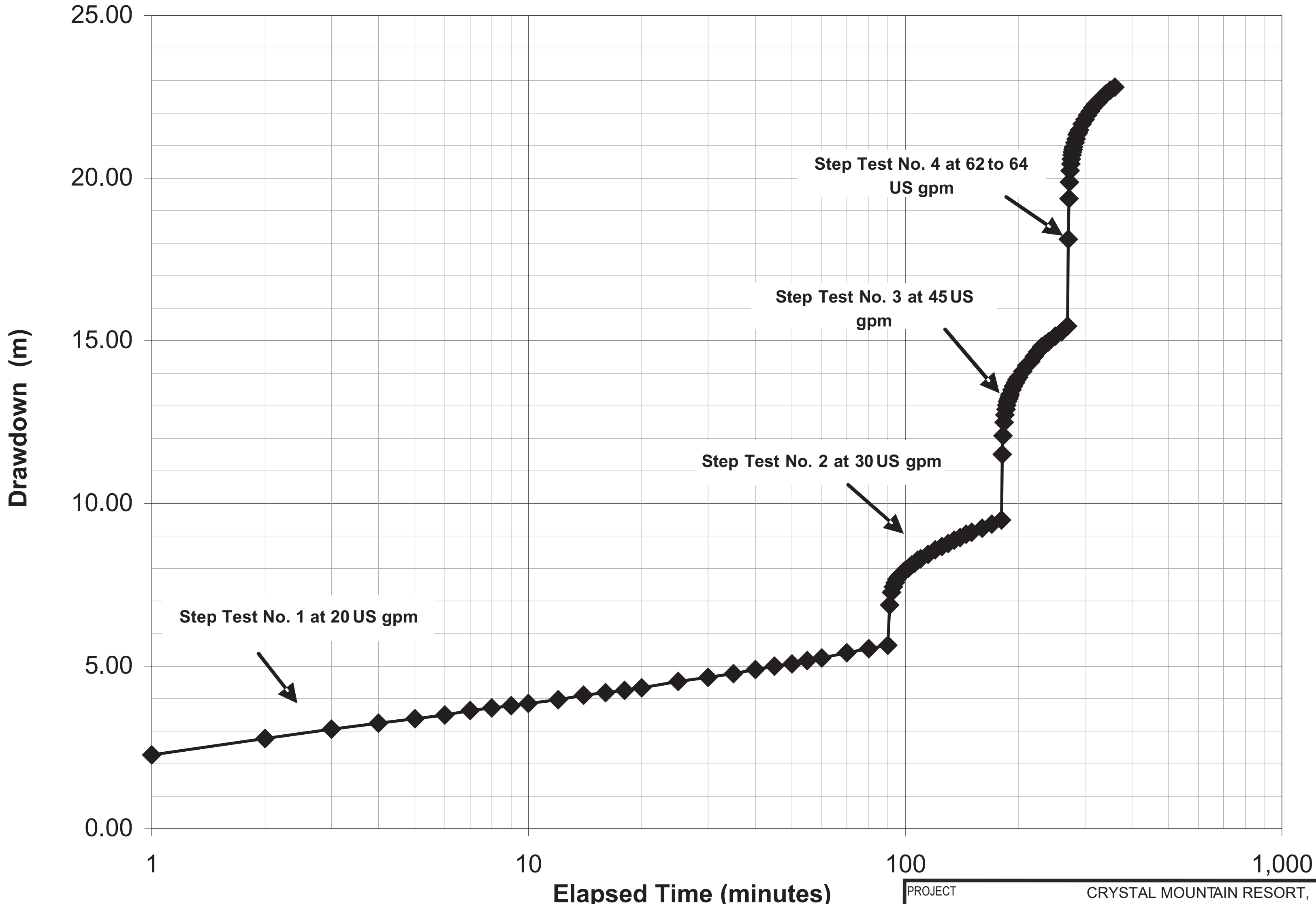
PROJECT
CRYSTAL MOUNTAIN RESORT,
BMR GOLF CONSTRUCTION INC,
PHEIDIAS DEVELOPMENT MANAGEMENT CORP.
GROUDWATER EVALUATION, WESTBANK, B.C.

TITLE
STUDY AREA AND TEST WELL LOCATIONS

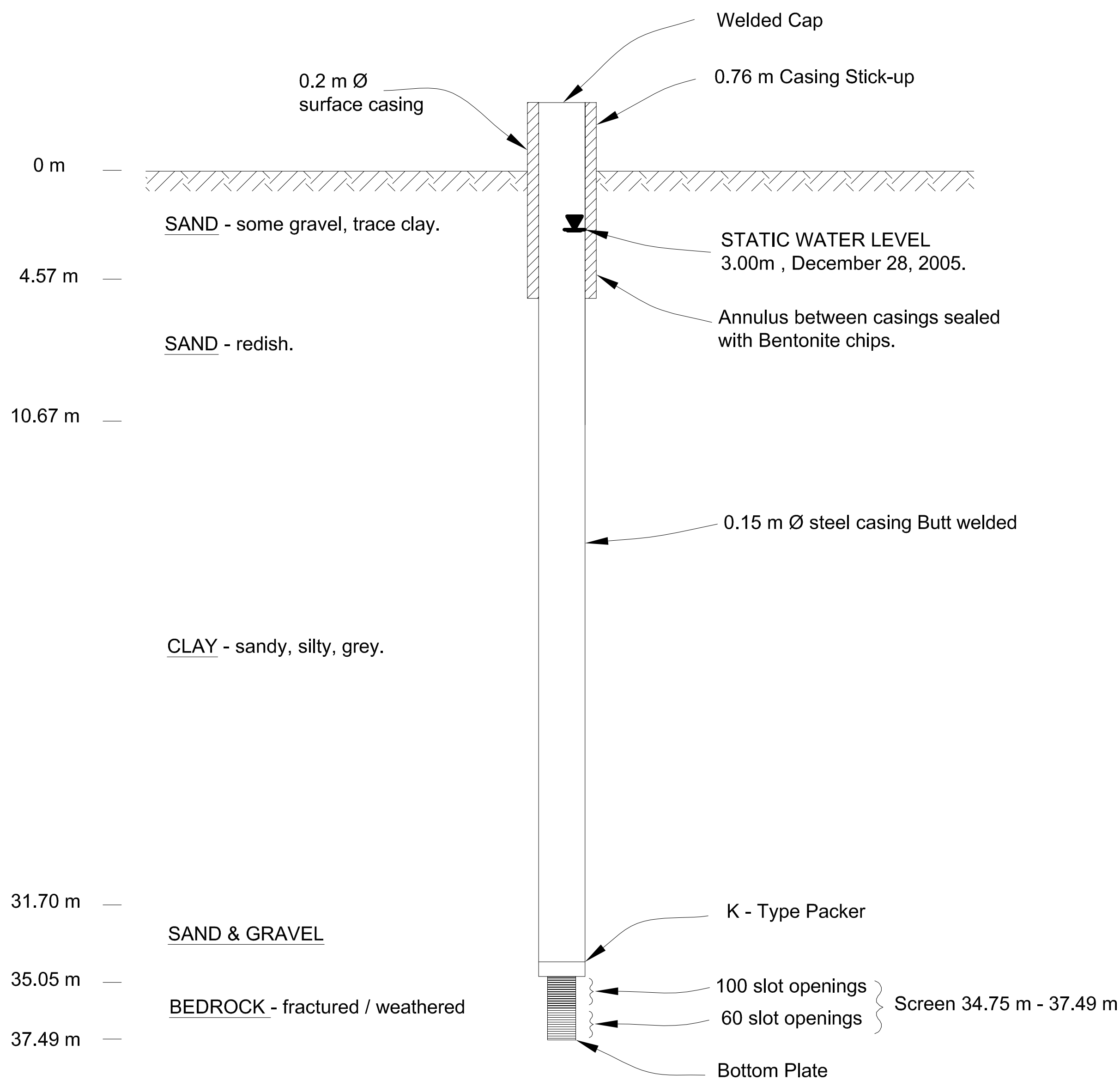
Golder Associates
Abbotsford, BC

PROJECT No. 041−440−116			FILE No. P440116−3.dwg		
DESIGN	J.F.	MAR22−06	SCALE AS SHOWN	REV. 0	
CADD	K.D.J.	MAR−22−06			
CHECK			**FIGURE 3**		
REVIEW					

PROJECT NO. 04-1440-065 DRAWN BY: S.S.S REVIEWED BY: J.F. DATE: 13MAR06 FILE LOCATION:\\ABB1-S-FILESRV1\Data\Active\2005\04-1440-065\Drafting\Corel\TW2 Step Test.cdr



PROJECT	CRYSTAL MOUNTAIN RESORT, BMR GOLF CONSTRUCTION INC, PHEIDIAS DEVELOPMENT MANAGEMENT CORP. GROUNDWATER EVALUATION, WESTBANK, B.C.			
TITLE	**STEP TEST AT TW2**			
Golder Associates	PROJECT No.	04-1440-065		FILE No. Tw2 Step Test.cdr
	DESIGN	J.F.	13/03/06	SCALE AS SHOWN REV.
	CADD	S.S.S.	13/03/06	**FIGURE 4**
	CHECK			
	REVIEW			



NOTE: (1) All measurements taken from top of casing

Golder Associates
Kelowna, British Columbia

SCALE	NTS
DATE	24/APR/06
DESIGN	JF
CADD	JG
CHECK	
REVIEW	
FILE No.	041440116_2000_5.dwg
PROJECT No.	04-1440-116(2000)
REV.	0

TITLE

WELL COMPLETION DETAIL FOR TW#2

CRYSTAL MT. RESORT

FIGURE 5

Drawing: N:\Active\2004\1440 - Kelowna\04-1440-116 Crystal Mountain Phase I PSI\Task 2000 New Water Supply\Figures\041440116_2000_5.dwg Plotted: Apr 24, 2006 - 1:01pm By: JGoodier

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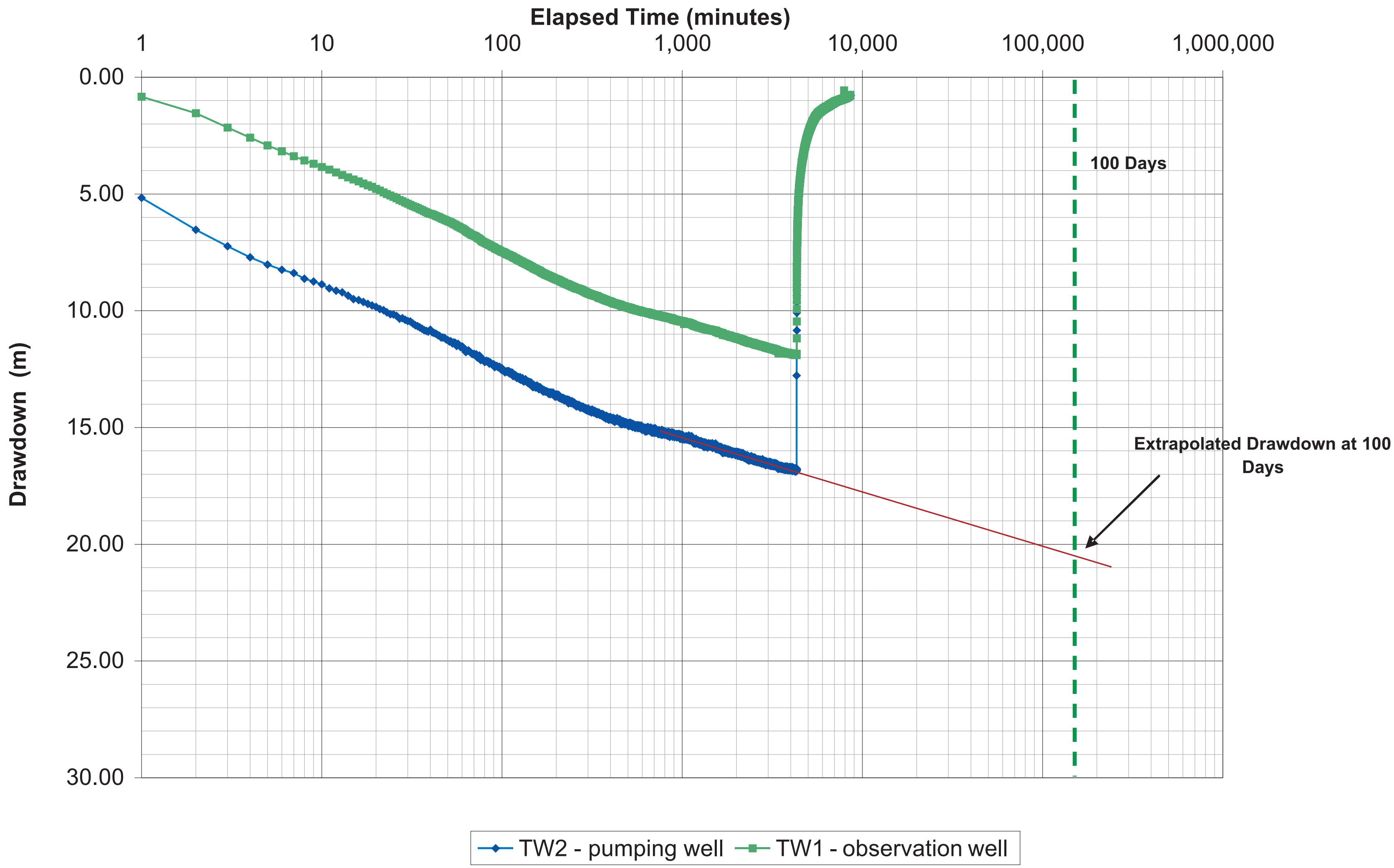


PROJECT
CRYSTAL MOUNTAIN RESORT,
BMR GOLF CONSTRUCTION INC,
PHEIDIAS DEVELOPMENT MANAGEMENT CORP.
GROUNDWATER EVALUATION, WESTBANK, B.C.

TITLE

CONSTANT RATE TEST AT TW2

Golder Associates

PROJECT No.	04-1440-065	
DESIGN	J.F.	13/03/06
CADD	S.S.S.	13/03/06
CHECK		
REVIEW		

FILE No. Constant.cdr
SCALE AS SHOWN REV.

FIGURE 6

Table 1 - Drinking Water Analytical Results
TW2, Crystal Mt. Resort, Westbank, B.C.

Parameter	Units	TW2	CDWQ[1] AO	CDWQ[1] MAC/ IMAC
Sample ID / Date Sampled		30-Dec-05		
Conventional Parameters				
pH	(-)	7.61	6.5 - 8.5	-
Conductivity	uS/cm	373	-	-
True Color	CU	<5	15	-
Turbidity	NTU	0.26	5	1
Hardness CaCO3	mg/L	196	- [2]	-
Total Dissolved Solids	mg/L	240	500	-
Bicarbonate Alkalinity HCO3	mg/L	205	-	-
Carbonate Alkalinity CO3	mg/L	<0.5	-	-
Hydroxide Alkalinity OH	mg/L	<0.5	-	-
Dissolved Fluoride F	mg/L	0.11	-	1.5
Dissolved Chloride Cl	mg/L	0.66	250	-
Nitrate and Nitrite N	mg/L	0.27	-	10
Dissolved Nitrate N	mg/L	0.27	-	45
Nitrite N	mg/L	<0.002	-	3.2
Dissolved Sulphate SO4	mg/L	21.4	500	-
Total Metals				
Aluminum Al	mg/L	0.014	-	0.1
Antimony Sb	mg/L	<0.001	-	0.006
Arsenic As	mg/L	<0.001	-	0.005[3]
Barium Ba	mg/L	0.029	-	1
Boron B	mg/L	<0.05	-	5
Cadmium Cd	mg/L	0.0004	-	0.005
Chromium Cr	mg/L	<0.001	-	0.05
Copper Cu	mg/L	0.006	1.0	-
Iron Fe	mg/L	<0.05	0.3	-
Lead Pb	mg/L	0.002	-	0.010
Magnesium Mg	mg/L	4.8	-	-
Manganese Mn	mg/L	0.002	0.05	-
Mercury	mg/L	<0.00002		0.001
Selenium Se	mg/L	0.001	-	0.01
Uranium U	mg/L	0.0009	-	0.02
Zinc Zn	mg/L	0.01	5	-
Dissolved Metals				
Calcium Ca	mg/L	70.4	-	-
Iron Fe	mg/L	<0.05	0.3	-
Magnesium Mg	mg/L	4.92	-	-
Manganese Mn	mg/L	0.002	0.05	-
Potassium K	mg/L	2.8	-	-
Silicon SiO2	mg/L	9.3	-	-
Sodium Na	mg/L	3.68	200	-
Microbiological Analysis				
Total Coliform (Confirmed)	Col./100 mL	<1	-	not detected
Fecal Coliform	Col./100 mL	<1	-	not detected
Radionuclides				
Gross Alpha	Bq/L [6,7]	$\boxed{\textbf{0.11+-0.05}}$	**-**	0.1
Gross Beta	Bq/L	0.38+-0.06	-	1

1. Health Canada. 1996 (and all amendments as posted on the internet at time of report). Guidelines for Canadian Drinking Water Quality (CDWQ). (April 2004)
   AO = Aesthetic Objective
   MAC = Maximum Acceptable Concentration
   IMAC = Interim Maximum Acceptable Concentration
2. Hardness is an aesthetic objective, with public acceptance of hardness varying considerably. Generally, hardness levels between 80 and 100 mg/L are considered acceptable, with levels greater than 200 mg/L considered poor and level greater than 500 mg/L considered unacceptable.
3. Value is a proposed CDWQ guideline and is more conservative than the current MAC guideline of 0.025 mg/L.
4. Boxed and bold values indicates concentration exceeds the CDWQ guideline, i.e., $\boxed{\textbf{100}}$
5. Boxed value indicates concentration approaching the CDWQ guideline, i.e., $\boxed{100}$
6. Bq/L = Bequerels per litre
7. Subsequent analyses indicated that Gross Alpha concentrations were below MAC, as individual radionuclide parameters with MAC less than 0.4 Bq/L resulted in concentrations below 0.1 Bq/L (Appendix IV).

Appendix I

New Well Source Construction Permit

Interior Health
Community Health Programs
Public Health Engineering
Okanagan Region

Penticton Health Centre
740 Carmi Avenue
Penticton, British Columbia
V2A 8P9
Telephone: (250) 770-3523
Facsimile: (250) 770-3470

December 19, 2005

W – Crystal Mountain Resorts

Crystal Mountain Resorts Ltd.
PO Box 26044
Westbank, BC V4T 2G3

FAXED Dec. 19/05

RECEIVED
DEC 21 2005

Dear Sir:

Re: Attached Construction Permit No. OK-157 Crystal Mountain Resorts

Enclosed is a Construction Permit issued under Section 7 of the *Drinking Water Protection Act* authorizing your new well source construction. This Permit is valid for one year only and is non-transferable. Any changes to the approved well must receive pre-construction authorization in writing from the undersigned.

The well must be completed according to the *Ground Water Protection Regulation* http://www.qp.gov.bc.ca/statreg/reg/W/Water/Water299_2004/299_2004.htm
and Part 5 of the *Water Act*
http://www.qp.gov.bc.ca/statreg/stat/W/96483_01.htm. A letter of Certification from the hydrogeologist stating that the production well was constructed in accordance with the *Ground Water Protection Regulation* and Part 5 of the *Water Act* should be submitted.

Once the production well has been drilled and pump tested, please provide this office with the driller's log, bacteriological and chemical analysis of a water sample, letter of certification and hydrogeologist report, so that the well may be approved as a community water source.

A separate construction permit will be required to complete the production well and connect it to the water supply system. (See attached "Guidelines for the Approval of Waterworks")

Should the well prove insufficient or inadequate and require that the well be closed, the closure of the well must be done in accordance with Section 6, Appendix A of the *Ground Water Protection Regulation.*

Yours truly,

Wayne Radomske

Wayne Radomske, E.I.T.
Public Health Engineering
Okanagan Service Delivery Area

WAR:hl
Encl.

c.c. PHI, IHA, 2nd Floor, 1340 Ellis Street, Kelowna, BC V1Y 9N1
Water Use Planning & Utilities Branch, Ministry Of Environment, Water Stewardship Division
Management Standards Branch, Po Box 9340 Stn Prov Govt, Victoria Bc V8W 9M1
Golder Associates, Suite 220 - 1755 Springfield Road, Kelowna, BC V1Y 5V5

c.c. PHI, IHA, Kelowna
MOE Utilities Branch
Golder Associates

W – Crystal Mountain Resorts

Interior Health

Waterworks
Construction Permit

NO. OK – 157

TO CRYSTAL MOUNTAIN RESORTS

THIS IS TO CERTIFY THAT the application form dated December 8, 2005 and the site plan Figure 1 portraying Project No. 012-4063 prepared by Golder Associates, showing the proposed location of the well at Crystal Mountain Resorts, Westbank, B.C., and submitted in accordance with Section 7 of the *Drinking Water Protection Act* have been reviewed and the proposed work on the construction, alteration or extension may be commenced in accordance with the approved plan.

This document certifies that the plans and specifications for the proposed works have been reviewed pursuant to the current "Waterworks System Guidelines" issued by Interior Health and that the plans and specifications meet the health protection requirements outlined in the Guidelines.

The Standards of structural adequacy and safety of the works have not been considered and are not the subject of this Permit.

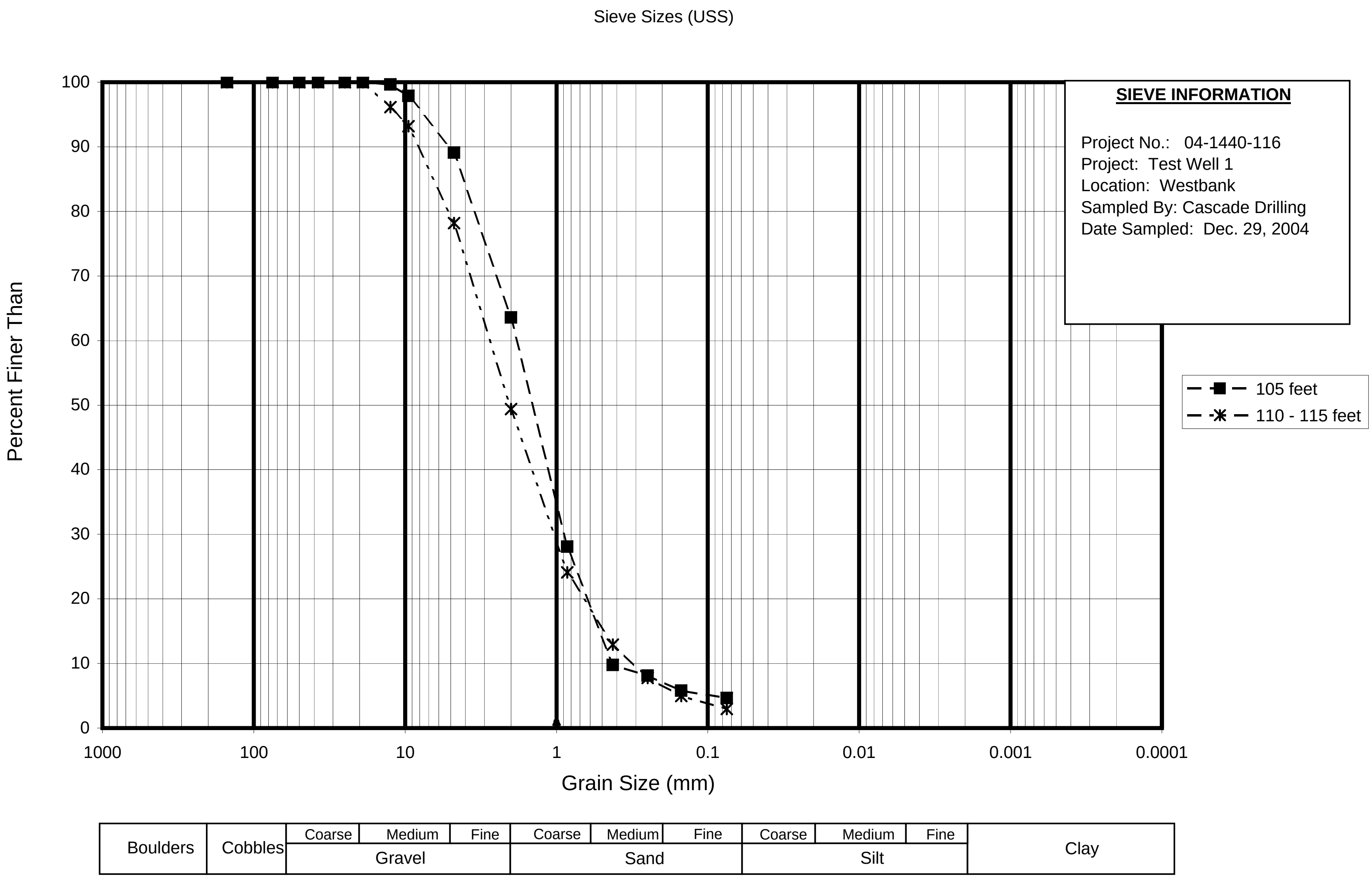
December 19, 2005
DATE ISSUED

Wayne Radomske
ISSUING OFFICIAL

Appendix II

Grain Size Distribution Curves

Grain Size Analysis



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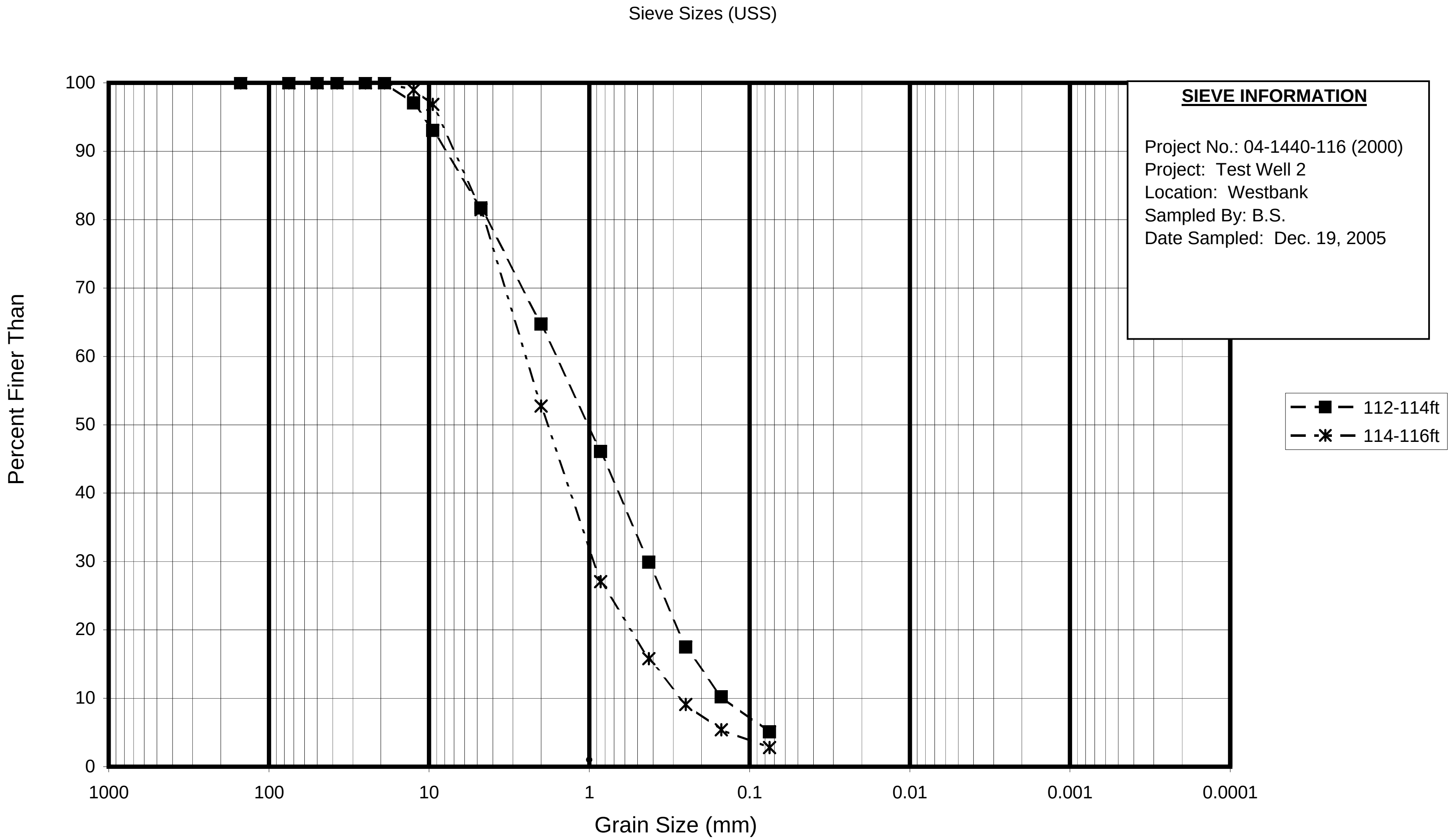
Grain Size Analysis



SIEVE INFORMATION

Project No.: 04-1440-116 (2000)
Project: Test Well 2
Location: Westbank
Sampled By: B.S.
Date Sampled: Dec. 19, 2005

Boulders	Cobbles	Gravel			Sand			Silt			Clay
		Coarse	Medium	Fine	Coarse	Medium	Fine	Coarse	Medium	Fine	

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Appendix III

Stepped-Discharge and Constant-Rate Pumping Test Data

Step-Discharge Test

Step-Drawdown Test	Date	Time	Time since pump started, t (minutes)	Time since pump stopped, t' (minutes)	Step-Drawdown Test of Production Well TW2					
					t/t'	Water level measurment (btoc) (m)	Water level change, s (m)	Drawdown (m)	Residual Drawdown (s' in m)	Pumping Rate (USgpm)
Step-Drawdown Test No. 1	27/12/2005	12:00:00	0	--	--	2.03	-	0.00	--	20
		12:01:00	1	--	--	4.30	2.27	2.27	--	
		12:02:00	2	--	--	4.80	0.50	2.77	--	
		12:03:00	3	--	--	5.09	0.29	3.07	--	
		12:04:00	4	--	--	5.27	0.18	3.25	--	
		12:05:00	5	--	--	5.41	0.13	3.38	--	
		12:06:00	6	--	--	5.53	0.12	3.50	--	
		12:07:00	7	--	--	5.66	0.13	3.64	--	
		12:08:00	8	--	--	5.74	0.08	3.71	--	
		12:09:00	9	--	--	5.81	0.07	3.78	--	
		12:10:00	10	--	--	5.88	0.08	3.86	--	
		12:12:00	12	--	--	5.99	0.11	3.96	--	
		12:14:00	14	--	--	6.13	0.14	4.10	--	
		12:16:00	16	--	--	6.21	0.08	4.18	--	
		12:18:00	18	--	--	6.28	0.08	4.25	--	
		12:20:00	20	--	--	6.36	0.07	4.33	--	
		12:25:00	25	--	--	6.55	0.20	4.52	--	
		12:30:00	30	--	--	6.68	0.13	4.65	--	
		12:35:00	35	--	--	6.80	0.12	4.77	--	
		12:40:00	40	--	--	6.92	0.12	4.89	--	
		12:45:00	45	--	--	7.02	0.10	5.00	--	
		12:50:00	50	--	--	7.10	0.08	5.07	--	
		12:55:00	55	--	--	7.20	0.10	5.17	--	
		13:00:00	60	--	--	7.28	0.08	5.25	--	
		13:10:00	70	--	--	7.44	0.16	5.41	--	
		13:20:00	80	--	--	7.56	0.12	5.53	--	
		13:30:00	90	--	--	7.67	0.11	5.64	--	
Step-Drawdown Test No. 2	27/12/2005	13:31:00	91	--	--	8.90	1.23	6.87	--	30
		13:32:00	92	--	--	9.30	0.40	7.27	--	
		13:33:00	93	--	--	9.47	0.17	7.44	--	
		13:34:00	94	--	--	9.60	0.13	7.57	--	
		13:35:00	95	--	--	9.70	0.10	7.67	--	
		13:36:00	96	--	--	9.77	0.07	7.74	--	
		13:37:00	97	--	--	9.83	0.06	7.80	--	
		13:38:00	98	--	--	9.88	0.05	7.85	--	
		13:39:00	99	--	--	9.93	0.05	7.90	--	
		13:40:00	100	--	--	9.98	0.05	7.95	--	
		13:42:00	102	--	--	10.05	0.07	8.02	--	
		13:44:00	104	--	--	10.14	0.09	8.11	--	
		13:46:00	106	--	--	10.19	0.05	8.16	--	
		13:48:00	108	--	--	10.28	0.09	8.25	--	
		13:50:00	110	--	--	10.33	0.05	8.30	--	
		13:55:00	115	--	--	10.47	0.13	8.44	--	
		14:00:00	120	--	--	10.61	0.14	8.58	--	
		14:05:00	125	--	--	10.71	0.10	8.68	--	
		14:10:00	130	--	--	10.80	0.09	8.77	--	
		14:15:00	135	--	--	10.90	0.09	8.87	--	
		14:20:00	140	--	--	10.98	0.09	8.96	--	
		14:25:00	145	--	--	11.08	0.09	9.05	--	
		14:30:00	150	--	--	11.15	0.07	9.12	--	
		14:40:00	160	--	--	11.27	0.12	9.24	--	
		14:50:00	170	--	--	11.40	0.13	9.37	--	
		15:00:00	180	--	--	11.52	0.12	9.49	--	
Step-Drawdown Test No. 3	27/12/2005	15:01:00	181	--	--	13.54	2.02	11.51	--	45
		15:02:00	182	--	--	14.11	0.57	12.08	--	
		15:03:00	183	--	--	14.52	0.41	12.49	--	
		15:04:00	184	--	--	14.75	0.23	12.72	--	
		15:05:00	185	--	--	14.92	0.17	12.89	--	
		15:06:00	186	--	--	15.05	0.12	13.02	--	
		15:07:00	187	--	--	15.16	0.12	13.14	--	
		15:08:00	188	--	--	15.24	0.08	13.21	--	
		15:09:00	189	--	--	15.31	0.07	13.29	--	
		15:10:00	190	--	--	15.39	0.07	13.36	--	
		15:12:00	192	--	--	15.52	0.14	13.50	--	
		15:14:00	194	--	--	15.64	0.11	13.61	--	
		15:16:00	196	--	--	15.73	0.10	13.71	--	
		15:18:00	198	--	--	15.83	0.09	13.80	--	
		15:20:00	200	--	--	15.91	0.08	13.88	--	
		15:25:00	205	--	--	16.09	0.19	14.06	--	
		15:30:00	210	--	--	16.27	0.17	14.24	--	
		15:35:00	215	--	--	16.39	0.13	14.36	--	
		15:40:00	220	--	--	16.55	0.16	14.53	--	
		15:45:00	225	--	--	16.70	0.14	14.67	--	
		15:50:00	230	--	--	16.84	0.14	14.81	--	
		15:55:00	235	--	--	16.91	0.08	14.89	--	
		16:00:00	240	--	--	16.99	0.08	14.96	--	
		16:10:00	250	--	--	17.17	0.18	15.14	--	
		16:20:00	260	--	--	17.31	0.14	15.28	--	
		16:30:00	270	--	--	17.48	0.17	15.45	--	
Step-Drawdown Test No. 4	27/12/2005	16:31:00	271	--	--	20.15	2.68	18.12	--	62 to 64
		16:32:00	272	--	--	21.41	1.25	19.38	--	
		16:33:00	273	--	--	21.91	0.50	19.88	--	
		16:34:00	274	--	--	22.26	0.35	20.23	--	
		16:35:00	275	--	--	22.46	0.21	20.43	--	
		16:36:00	276	--	--	22.61	0.15	20.58	--	
		16:37:00	277	--	--	22.74	0.13	20.71	--	
		16:38:00	278	--	--	22.84	0.10	20.81	--	
		16:39:00	279	--	--	22.91	0.08	20.89	--	
		16:40:00	280	--	--	22.99	0.07	20.96	--	
		16:42:00	282	--	--	23.12	0.13	21.09	--	
		16:44:00	284	--	--	23.24	0.12	21.21	--	
		16:46:00	286	--	--	23.38	0.14	21.35	--	
		16:48:00	288	--	--	23.43	0.05	21.40	--	
		16:50:00	290	--	--	23.51	0.09	21.48	--	
		16:55:00	295	--	--	23.69	0.18	21.66	--	
		17:00:00	300	--	--	23.84	0.15	21.81	--	
		17:05:00	305	--	--	23.97	0.14	21.94	--	
		17:10:00	310	--	--	24.09	0.11	22.06	--	
		17:15:00	315	--	--	24.19	0.11	22.16	--	
		17:20:00	320	--	--	24.30	0.10	22.27	--	
		17:25:00	325	--	--	24.37	0.07	22.34	--	
		17:30:00	330	--	--	24.46	0.09	22.43	--	
		17:40:00	340	--	--	24.61	0.15	22.58	--	
		17:50:00	350	--	--	24.72	0.11	22.69	--	
		18:00:00	360	--	--	24.83	0.11	22.80	--	
End of Step Test (Recovery)	27/12/2005	18:00:30	360.5	0.5	721	19.73	-5.10	17.70	0.00	--
		18:01:00	361	1	361	16.11	-3.61	14.08	3.61	
		18:02:00	362	2	181	13.52	-2.60	11.49	6.21	
		18:03:00	363	3	121	12.35	-1.17	10.32	7.38	
		18:04:00	364	4	91	11.65	-0.70	9.62	8.08	

Constant Rate Pumping Test

Appendix IV

Analytical Laboratory Results

Cantest Results

Analysis Report

CANTEST LTD.

Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Water Samples

REPORTED TO: Golder Associates Ltd.
220-1755 Springfield Rd
Kelowna, BC
V1Y 5V5

Att'n: J. Foley

CHAIN OF CUSTODY: 186308
PROJECT NAME: Crystal Mtn.
PROJECT NUMBER: 04-1440-116

NUMBER OF SAMPLES: 1

REPORT DATE: February 22, 2006

DATE SUBMITTED: December 30, 2005

GROUP NUMBER: 61230016

SAMPLE TYPE: Water

NOTE: Results contained in this report refer only to the testing of samples as submitted. Other information is available on request.

TEST METHODS:

Anions in Water by Ion Chromatography - was determined based on Method 4110 in Standard Methods (20th Edition) and EPA Method 300.0 (Revision 2.1).

Alkalinity in Water - was performed based on Method 2320 in Standard Methods (20th Edition).

Alkalinity in Water - was performed based on Method 2320 in Standard Methods (20th Edition).

Colour (True) in Water - was determined based on Method 2120 in Standard Methods (20th Edition) and Method X321 in the BC Laboratory Manual (1994 Edition).

Conductivity in Water - was performed based on Method 2510 in Standard Methods and Method X322 in the BC Laboratory Manual (1994 Edition).

Hardness in Water - was calculated based on Method 2340 B in Standard Methods for the Examination of Water and Wastewater (20th Edition, 1998).

Nitrite in Water - was determined based on Method 4500-NO3 B in Standard Methods for the examination of Water and Wastewater (20th Edition) and from the BC Laboratory Methods Manual (2003 Edition).

pH in Water - was determined based on Method 4500-H in Standard Methods (20th Edition) and Method X330 in the BC Laboratory Manual (1994 Edition).

(Continued)

CANTEST LTD.

Tim Matsushita
Coordinator, Water Laboratory

REPORTED TO: Golder Associates Ltd.

REPORT DATE: February 22, 2006

GROUP NUMBER: 61230016

Total Dissolved Solids in Water - was determined based on Method 2540 C in Standard Methods (20th Edition).

Turbidity in Water - was performed based on Method 2130 in Standard Methods (20th Edition) and Method X164 in the BC Laboratory Manual (1994 Edition).

Conventional Parameters - analyses were performed using procedures based on those described in "British Columbia Environmental Laboratory Manual For the Analysis of Water, Wastewater, Sediment and Biological Materials" (1994 Edition), Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" 20th Edition, (1998), published by the American Public Health Association.

Mercury in Water - analysis was performed using procedures based on U. S. EPA Method 1631, oxidative digestion using bromination, and analysis using Cold Vapour Atomic Fluorescence Spectroscopy.

Metals in Water - analysis was performed using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP), Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS).

Field Filtered Metals in Water - Samples were filtered in the field (e.g. at the time of sampling) and quantitatively determined using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP) and/or Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS).

Microbiological Parameters - analyses were performed using procedures based on those described in "B. C. Environmental Laboratory Manual For the Analysis of Water, Wastewater, Sediment and Biological Materials" (1994 Edition) and "Standard Methods for the Examination of Water and Wastewater", 20th Edition (1998). Analysis was performed using Membrane Filtration (MF) Method (reported as "Colonies or CFU per unit volume").

Gross Alpha and Gross Beta - analysis was performed using a Tennelec LB5100 Analyzer. This test was performed by a subcontractor.

COMMENTS:

Amended Report-This report supercedes the original hard copy dated January 25, 2006. The Canadian Drinking Water Guidelines have been removed as per Jacque Foley of Golder Associates (Kelowna).

TEST RESULTS:

(See following pages)

REPORTED TO: Golder Associates Ltd.

REPORT DATE: February 22, 2006

GROUP NUMBER: 61230016

Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:		Crystal Mtn TW2		
DATE SAMPLED:		Dec 29/05		
CANTEST ID:		512300033	DETECTION LIMIT	UNITS
pH, Laboratory		7.61	-	pH units
Conductivity		373	1	µS/cm
True Color		<	5	CU
Turbidity		0.26	0.1	NTU
Hardness	$CaCO_3$	196	1	mg/L
Total Dissolved Solids		240	10	mg/L
Total Alkalinity	$CaCO_3$	168	0.5	mg/L
Bicarbonate Alkalinity	HCO_3	205	0.5	mg/L
Carbonate Alkalinity	CO_3	<	0.5	mg/L
Hydroxide Alkalinity	OH	<	0.5	mg/L
Dissolved Fluoride	F	0.11	0.05	mg/L
Dissolved Chloride	Cl	0.66	0.2	mg/L
Nitrate and Nitrite	N	0.27	0.05	mg/L
Dissolved Nitrate	N	0.27	0.05	mg/L
Nitrite	N	<	0.002	mg/L
Dissolved Sulphate	SO_4	21.4	0.5	mg/L

µS/cm = microsiemens per centimeter
NTU = nephelometric turbidity units
< = Less than detection limit

CU = color units
mg/L = milligrams per liter

REPORTED TO: Golder Associates Ltd.

REPORT DATE: February 22, 2006

GROUP NUMBER: 61230016

CANTEST®

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		**Crystal Mtn TW2**	**Crystal Mtn TW2**		
SAMPLE PREPARATION:		TOTAL	DISSOLVED		
DATE SAMPLED:		Dec 29/05	Dec 29/05		
CANTEST ID:		512300033	512300033	DETECTION LIMIT	UNITS
Aluminum	Al	0.014	-	0.005	mg/L
Antimony	Sb	<	-	0.001	mg/L
Arsenic	As	<	-	0.001	mg/L
Barium	Ba	0.029	-	0.001	mg/L
Boron	B	<	-	0.05	mg/L
Cadmium	Cd	0.0004	-	0.0002	mg/L
Calcium	Ca	-	70.4	0.05	mg/L
Chromium	Cr	<	-	0.001	mg/L
Copper	Cu	0.006	-	0.001	mg/L
Iron	Fe	<	<	0.05	mg/L
Lead	Pb	0.002	-	0.001	mg/L
Magnesium	Mg	4.80	4.92	0.05	mg/L
Manganese	Mn	0.002	0.002	0.001	mg/L
Mercury	Hg	<	-	0.02	µg/L
Potassium	K	-	2.8	0.1	mg/L
Selenium	Se	0.001	-	0.001	mg/L
Silicon	Si	-	9.3	0.25	mg/L
Sodium	Na	-	3.68	0.05	mg/L
Uranium	U	0.0009	-	0.0005	mg/L
Zinc	Zn	0.010	-	0.005	mg/L

mg/L = milligrams per liter

µg/L = micrograms per liter

< = Less than detection limit

REPORTED TO: Golder Associates Ltd.

REPORT DATE: February 22, 2006

GROUP NUMBER: 61230016

Radionuclides in Water

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Gross Alpha	Gross Beta
Crystal Mtn TW2	Dec 29/05	512300033	0.11 + -0.05	0.38 + -0.06
DETECTION LIMIT UNITS			0.04 Bq/L	0.05 Bq/L

Bq/L = Bequerels per liter

REPORTED TO: Golder Associates Ltd.

REPORT DATE: February 22, 2006

GROUP NUMBER: 61230016

CANTEST®

Microbiological Analysis in Water

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Total Coliforms (Confirmed)	Fecal Coliform
Crystal Mtn TW2	Dec 29/05	512300033	<	<
DETECTION LIMIT UNITS			1 Col./100 mL	1 Col./100 mL

Col./100 mL = Colonies per 100 mL
< = Less than detection limit

REPORTED TO: Golder Associates Ltd.

REPORT DATE: February 22, 2006

GROUP NUMBER: 61230016

Batch Quality Control for Conventional Parameters in Water

Parameter		QC Type	QC Result	Units	Lower Limit	Upper Limit
pH, Laboratory		pH Calibration Verification	98.1	% Recovery	98	102
		Duplicate	0.1	R.P.D.	0	3
		Duplicate	0.3	R.P.D.	0	3
Conductivity		Blank	1	uS/cm	0	1
		Conductivity Calibration Ver.	102.0	% Recovery	96	104
		Duplicate	0.5	R.P.D.	0	5
		Duplicate	0.9	R.P.D.	0	5
True Color		Blank	< 5	CU	0	5
		Calibration Verification	87.5	% Recovery	75	105
		Duplicate	0.0	R.P.D.	0	10
Turbidity		Blank	< 0.1	NTU	0	0.1
		Duplicate	0.0	R.P.D.	0	15
		Duplicate	0.0	R.P.D.	0	15
		Duplicate	1.2	R.P.D.	0	15
Total Dissolved Solids		Duplicate	5.6	R.P.D.	0	18
Total Alkalinity	CaCO3	Blank	2.9	mg/L	0	4
		Alkalinity Calibration Ver.	87.2	% Recovery	85	115
		Duplicate	0.0	R.P.D.	0	9
		Duplicate	0.6	R.P.D.	0	9
Bicarbonate Alkalinity	HCO3	Duplicate	0.0	R.P.D.	0	9
		Duplicate	0.5	R.P.D.	0	9
Carbonate Alkalinity	CO3	Duplicate	NC	R.P.D.	0	9
Hydroxide Alkalinity	OH	Duplicate	NC	R.P.D.	0	9
Dissolved Fluoride	F	Blank	< 0.05	mg/L	0	0.05
		Dionex Certified Standard	103.9	% Recovery	90	110
		Duplicate	0.0	R.P.D.	0	10
		Duplicate	PASS	R.P.D.	0	10

(Continued on next page)

REPORTED TO: Golder Associates Ltd.

REPORT DATE: February 22, 2006

GROUP NUMBER: 61230016

CANTEST®

Batch Quality Control for Conventional Parameters in Water

Parameter		QC Type	QC Result	Units	Lower Limit	Upper Limit
Dissolved Chloride	Cl	Blank	< 0.2	mg/L	0	0.2
		Dionex Certified Standard	95.7	% Recovery	90	110
		Duplicate	2.8	R.P.D.	0	12
		Duplicate	PASS	R.P.D.	0	12
Dissolved Nitrate	N	Blank	< 0.05	mg/L	0	0.05
		Dionex Certified Standard	96.9	% Recovery	90	110
		Duplicate	3.8	R.P.D.	0	10
		Duplicate	NC	R.P.D.	0	10
Nitrite	N	Blank	< 0.002	mg/L	0	0.002
		Spike	102.0	% Recovery	86	112
		Calibration Verification	102.5	% Recovery	93	107
		Duplicate	NC	R.P.D.	0	12
Dissolved Sulphate	SO4	Blank	< 0.5	mg/L	0	0.5
		Dionex Certified Standard	92.7	% Recovery	90	110
		Duplicate	0.4	R.P.D.	0	10
		Duplicate	0.5	R.P.D.	0	10

uS/cm = microsiemens per centimeter
NTU = nephelometric turbidity units
< = Less than detection limit
R.P.D. = Relative Percent Difference
PASS = Duplicate sample results were in the range of one to five times the detection limit. R.P.D. calculation is not applicable in this range. Acceptance criteria is a maximum difference between the duplicates equivalent to the value of the detection limit.
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

CU = color units
mg/L = milligrams per liter

REPORTED TO: Golder Associates Ltd.

REPORT DATE: February 22, 2006

GROUP NUMBER: 61230016

Batch Quality Control for Total Metals Analysis in Water (QC# 74861)

Parameter		Duplicate (R.P.D.) 512230301	Duplicate Limits	Duplicate (R.P.D.) 512230324	Duplicate Limits	Spike (% Recovery) 512230301	Spike Limits
Mercury	Hg	NC	20	NC	20	105	70 - 128

ug/L = micrograms per liter
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: Golder Associates Ltd.

REPORT DATE: February 22, 2006

GROUP NUMBER: 61230016

Batch Quality Control for Total Metals Analysis in Water (QC# 74861)

Parameter		Spike (% Recovery) 512230324	Spike Limits
Mercury	Hg	105	70 - 128

ug/L = micrograms per liter

REPORTED TO: Golder Associates Ltd.

REPORT DATE: February 22, 2006

GROUP NUMBER: 61230016

CANTEST®

Batch Quality Control for Total Metals Analysis in Water (QC# 74869)

Parameter		ICPMS Spike (% Recovery) 512210235	ICPMS Spike Limits	ICPMS Lab Fortified Blank (% Recovery)	ICPMS Lab Fortified Blank Limits	Total Blank (mg/L)	Total Blank Limits
Aluminum	Al	-	-	-	-	0.009	0.015
Antimony	Sb	89	78 - 118	85	75 - 117	< 0.0002	0.001
Arsenic	As	89	80 - 118	85	72 - 114	< 0.0002	0.001
Barium	Ba	-	-	95	81 - 119	< 0.0002	0.001
Boron	B	-	-	100	92 - 110	-	-
Cadmium	Cd	87	74 - 124	87	78 - 116	< 0.00004	0.001
Chromium	Cr	91	70 - 130	95	83 - 119	< 0.0002	0.001
Copper	Cu	83	77 - 125	90	85 - 120	< 0.0002	0.001
Lead	Pb	90	77 - 124	85	80 - 116	< 0.0002	0.001
Manganese	Mn	70	69 - 131	95	82 - 120	< 0.0002	0.001
Selenium	Se	-	-	75	58 - 120	-	-
Uranium	U	97	65 - 133	85	75 - 121	< 0.0001	0.0005
Zinc	Zn	-	-	100	64 - 126	< 0.001	0.01

mg/L = milligrams per liter

CANTEST

Instrument Quality Control for the PSA Mercury Analyzer-AF (QC# 149408)

QC Type: Calibration Verification

Parameter		% Recovery	Limits
Mercury	Hg	106	90 - 110

Batch Quality Control Frequency Summary

Auto-Titrator Analysis (Batch# 74843)

QC Type	No. Samples
Blank	1
Duplicate	2

Mercury Water Bromination Prep (Batch# 74861)

QC Type	No. Samples
Duplicate	4
Spike	4

Turbidity Analysis (Batch# 74864)

QC Type	No. Samples
Blank	1
Duplicate	3

Colour Analysis (Batch# 74866)

QC Type	No. Samples
Blank	1
Duplicate	3

Total Metals Preparation (Batch# 74869)

QC Type	No. Samples
ICPMS Spike	1
ICP Spike Vista ICAP	1
ICPMS Lab Fortified Blank	1
Total Blank	1
Duplicate	2

(Continued on next page)

Batch Quality Control Frequency Summary

Water Lab Ion Chromatography (Batch# 74962)

QC Type	No. Samples
Blank	2
Duplicate	2

Coliform MF Method in Water (Batch# 74853)

QC Type	No. Samples
Blank	1
Duplicate	1

Auto-Titrator Analysis (Batch# 74843)

QC Type	No. Samples
Batch Size	25

Coliform MF Method in Water (Batch# 74853)

QC Type	No. Samples
Batch Size	6

Mercury Water Bromination Prep (Batch# 74861)

QC Type	No. Samples
Batch Size	37

(Continued on next page)

Batch Quality Control Frequency Summary

Turbidity Analysis (Batch# 74864)

QC Type	No. Samples
Batch Size	31

Colour Analysis (Batch# 74866)

QC Type	No. Samples
Batch Size	28

Total Metals Preparation (Batch# 74869)

QC Type	No. Samples
Batch Size	32

Water Lab Ion Chromatography (Batch# 74962)

QC Type	No. Samples
Batch Size	22

SRC RESULTS

Foley, Jacqueline

From: SRC Analytical Laboratories [analytical@src.sk.ca]
Sent: February 6, 2006 1:45 PM
To: Foley, Jacqueline
Subject: SRC Analytical Results for Group 2006-501

Attachments: 200600501.txt

200600501.txt
(529 B)

Results for the following SRC Analytical Groups are included in the enclosed file:

2006-501

If you have any problems with your enclosed file, feel free to give me a call.

Mr. Loran Chrusch
Computer Operations
SRC Analytical Laboratories
422 Downey Road
Saskatoon, Saskatchewan
S7N 4N1

Phone: (306) 933-7872
Fax: (306) 933-7922
email: chrusch@src.sk.ca

"SRC provides Smart Science Solutions"

200600501

SRC Group #	Sample #	Description	Analyte Name	<	Result	Units	Method	Sample Type	DL
2006-501	1998	512300033 (PREV SRC GR# 85 LAB# 296)	Lead-210	1	0.02	Bq/L	Pb 210, total	WATER	0.02
2006-501	1998	512300033 (PREV SRC GR# 85 LAB# 296)	Thorium-232	1	0.01	Bq/L	Th 232, total	WATER	0.01

Appendix V

Drillers Well Logs

BRITISH COLUMBIA

Ministry of Water, Land and Air Protection
Water, Air & Climate Change Branch

WATER WELL RECORD

Date 05 12 21 (YR MO DY)

BCGS MAP | WELL No. | ELEV | Location Accuracy
UTM Z | E | N | UTM Date 20__ | Well Type | Well ID Plate #

Owners Name & Address: Crystal Mtn, Resort c/o Golder Associates Ltd.

Legal Description & Address: GPS 49° 56.699 N 119° 44.553 W Elevation 3783 ft.

Descriptive Location: Km 12 Jackpine Road Westbank B.C.

1. TYPE OF WORK: ☑ 1 New Well ☐ 2 Reconditioned ☐ 3 Deepened ☐ 4 Abandoned

2. WORK METHOD: ☐ 1 Cable tool ☐ 2 Bored ☐ 3 Jetted ☑ 4 Rotary ☐ a mud ☑ b air ☐ c reverse ☐ Other: with Casing Hammer

3. WATER WELL USE: ☑ 1 Domestic ☐ 2 Municipal ☐ 3 Irrigation ☐ 4 Comm. & Ind. ☐ Other: ski hill

4. DRILLING ADDITIVES: Rock oil

5. MEASUREMENTS from ☑ 1 ground level ☐ 2 top of casing; casing height above ground level 2 ½ ft.

FROM ft	TO ft	6. WELL LOG DESCRIPTION	SWL ft
0	6 ft	Brown Sandy Clay w Bolders + Gravel	
6 ft	15 ft	wet Redish Brown Coarse sand with Gravel + trace of Brown clay	
15 ft	35'	Dryer Redish Brown Sandy Clay with Gravel	
35'	44'	Sandy Grey Clay w trace of Gravel	
44'	77'	moist to wet silty Grey Clay	
77'	101'	water Bearing Silty Grey clay	
101'	104	wet silty Grey clay w trace of Gravel	
104'	112'	water Bearing Dirty sand + Gravel w silty sand	
112'	115	Tighter Brown Sand + Gravel with less water	
115'	121	Brown weathered Bedrock soft + fractured	
121	123	more soild Brown weathered Bedrock	
123'		stopped Drilling	
		most of water Coming in at 116 ft.	

7. CONSULTANT
Address

8. WELL LOCATION SKETCH

9. CASING: Materials ☑ 1 Steel ☐ 2 Galvanized ☐ 3 Wood ☐ 4 Plastic ☐ 5 Concrete ☐ Other

		units
Hole Diameter	Steel	ins
Diameter	6 5/8	ins
from	0	ft
to	115 ft	ft
Thickness	.219	ins
Weight	16 lbs ft.	lb/ft

Pitless unit ____ ft ☐ 1 above ☐ 2 below ground level
☑ 1 Welded ☐ 2 Cemented ☐ 3 Threaded | ☑ 1 New ☐ 2 Used
Perforations:
Shoe(s): Yes, weld on Driven with Casing Hammer
Open hole, from 115' to 123' ft Diameter 6" ins
Grout: Bentonite Chips into 18 ft x 8" surface hole

10. SCREEN: ☑ 1 Nominal (Telescope) ☐ 2 Pipe Size
Type ☑ 1 Continuous Slot ☐ 2 Perforated ☐ 3 Louvre ☐ Other: Tate + Endale
Material ☑ 1 Stainless Steel ☐ 2 Plastic ☐ Other
Set from 114' to 123' ft below ground level

RISER, SCREEN & BLANKS			units
Length	4 ½ ft	4 ½ ft	ft
Diam. I D	6"	6"	ins
Slot Size	.100	.060	ins
from	114'	118 ½'	ft
to	118 ½	123'	ft

Fittings, top K Packer bottom Threaded Bott.
Gravel Pack Top of K Packer at 114 ft.

11. DEVELOPED BY: ☑ 1 Surging ☐ 2 Jetting ☑ 3 Air ☐ 4 Bailing ☐ 5 Pumping ☐ Other

12. TEST ☐ 1 Pump ☐ 2 Bail ☑ 3 Air Date 05 12 21
Rate 45 to 50 USgpm Temp ___ °C SWL before test ___ ft
Water Level 11' ft after test of 2 hrs Dev

DRAWDOWN in ft				RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL

13.

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
Sub.	100' to 110' ft	45 to 50 USgpm

14. WATER TYPE: ☑ 1 fresh ☐ 2 salty ☑ 3 clear ☐ 4 cloudy
colour ___ smell ___ ; gas ☐ 1 yes ☑ 2 no

15. WATER ANALYSIS: 1 Hardness ___ mg/L; 2 Iron ___ mg/L; 3 Chloride ___ mg/L; 4 pH ___
Field Date 05 12 21
Lab Date

EMS SITE No.

16. FINAL WELL COMPLETION DATA
Well Depth 123 ft
Well Yield ___ US gpm 45 to 50 est only
Static Water Level 11 ft hr ft; Artesian Flow ___ US gpm; Pressure Head ___ ft
Back filled 5 ft in 13 hrs
Well Head Completion: Steel Cap welded to Casing

Reg. NO. W.D. 05062302

17. DRILLER (PLEASE PRINT) SURNAME GENEREUX FIRST NAME JIM
Signature

18. CONTRACTOR, Address: Cyclone Drilling Ltd, Kelowna B.C. V1Y 6V3

Member, B C G W A ☐ yes ☑ no

Jackie

WELL LOG

CASCADE DRILLING LTD.

DOMESTIC IRRIGATION EXPLORATION

TW 1

BOX 306, STN. A
KELOWNA, B.C.
V1Y 7N8

PHONE / FAX (250) 769-3408
MOBILE (250) 762-1362
317-2238

№ 2591

Be 'WELL' Satisfied

Name: Crystal Mountain Resort
Address: Km 12 Jackpine Road
Address: Westbank, B.C.

DATE: Spudded Dec 24/04 Completed Feb 22/05
Rig # 3 Other Equip.

WELL LOCATION: Lot ______ PL ______ DL ______
TW 1

DEPTH:
Overburden 115 ft. Tool Push
Bedrock 12 ft. Driller John Watts
Total 127 ft. Roughneck Patrick Walsh

PROPOSED USE: Domestic ____ Industrial ____ Municipal ____
Irrigation ____ Test Well ____ Other resort

TYPE OF WORK: Owner's number of well. (if more than one) ______
New Well ✓ Air Rotary ✓
Deepened ____ Rotary ____
Reconditioned ____ Jetted ____
Liner Installed ____ Pressure Fractured ____

FORMATION:

DEPTH:

FROM	TO	
GROUND LEVEL	5	sand & gravel
5	14 1/2	wet sand & gravel
14	50	dry till
50	93	sticky black clay
93	115	coarse gravel
115	127	bedrock.

DIMENSIONS: Diameter of well 6 inches
Drilled 127 ft. Depth of completed well 113 ft.

CONSTRUCTION DETAILS:
CASING INSTALLED: ____ " Diam. from ____ ft. to ____ ft.
Threaded 6" " Diam. from ____ ft. to ____ ft.
Welded 6" " Diam. from 0 ft. to 107 ft.

PERFORATIONS: Yes ☐ No ☑
Type of perforator used ______
SIZE of perforations ____ in. by ____ in.
perforations from ____ ft. to ____ ft.
perforations from ____ ft. to ____ ft.

SCREENS: Yes ☑ No ☐
Manufacturer Tate Andale Screen Co
Type ____ Model No. ____
Diam. 6 Slot Size 50 from 105 ft. to 109 ft.
Diam. 6 Slot Size 60 from 109 ft. to 113 ft.

GRAVEL PACKED: Yes ☑ No ☐ Size of Gravel Jet sand & drain rock
Gravel placed from 115 ft. to 127 ft.

SURFACE SEAL: Yes ☑ No ☐ Depth 107 ft.
Material Used In Seal Welded steel casing
Method of Sealing strata off CSG hammer & drive shoe

PRODUCTION DATA AT TIME OF DRILLING:
Static Level 5 ft.
Measured from 0 ft. With tape
Pumping level ____ ft. at 45 GPM
Recommended Pump Setting 100 ft.
If Flowing Well ____ GPM
Recommended Max. Pump Output ____ GPH
Water Clear ____ Coloured ____ Silty ✓ Sandy ____
Duration of test 6 1/2 Hrs.

WELL OWNER:
I ______ Hereby Agree work has been completed in accordance with the contact and all material used has been of top quality.

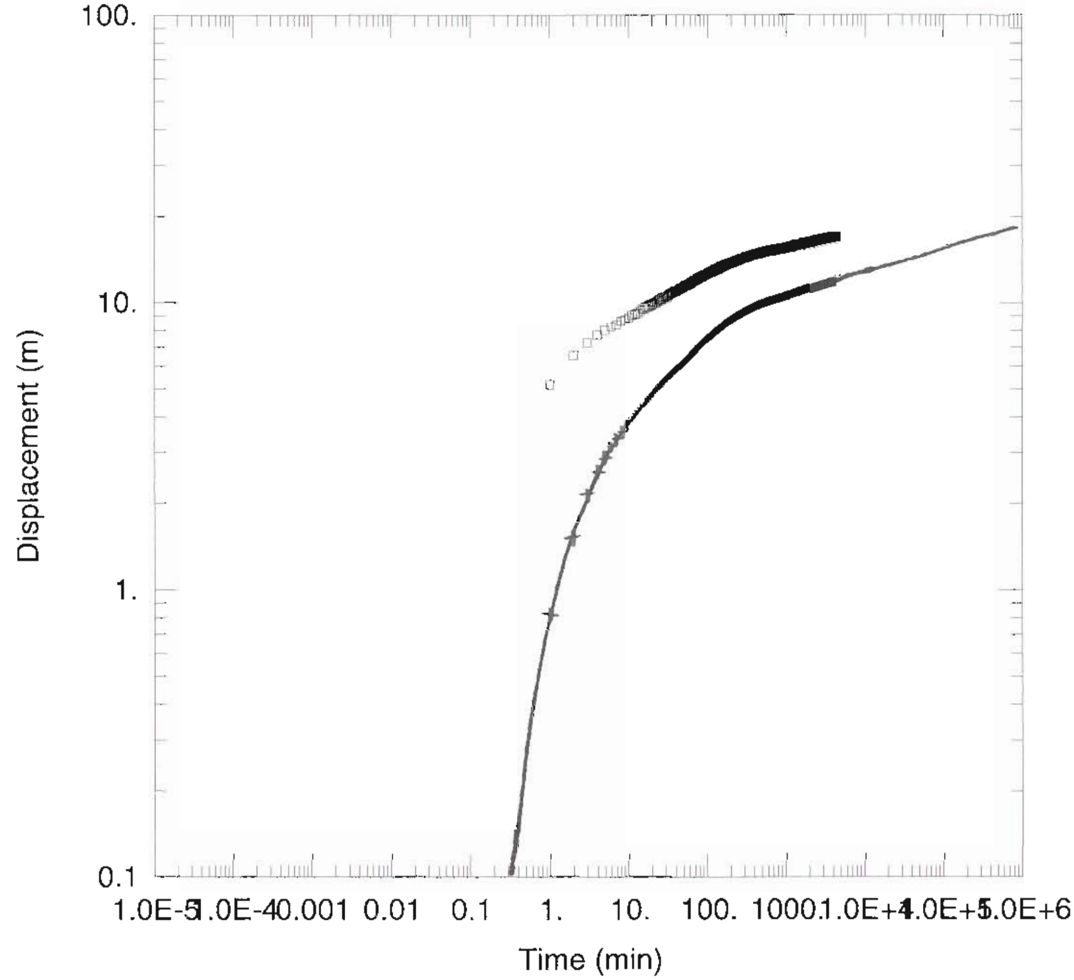
CASCADE DRILLING LTD. J. Watts

GENERAL REMARKS
Upon completion of drilling, well yield meet requirements of CORD Bylaw 176

317 2238

Appendix VI

AQTESLOV



WELL TEST ANALYSIS

Data Set: N:\...\Report TW2 LH.aqt
Date: 04/24/06 Time: 12:44:06

PROJECT INFORMATION

Company: Golder Associates
Client: Crystal Mt. Resort
Project: 04-1440-116-2000
Test Well: TW2
Test Date: December 2005

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
TW 2	0	0

Observation Wells

Well Name	X (m)	Y (m)
□ TW2	0.1	0
+ TW1	0	15

SOLUTION

Aquifer Model: Leaky

Solution Method: Hantush

T = 8.02 m^2/day

ß/r = 0.0045 m^{-1}

b = 3.66 m

S = 6.398E-5

Kz/Kr = 1.