

Golder Associates Inc.

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January 7, 2008

Our Ref.: 073-95024.005

CRW Engineering Group, LLC
3940 Arctic Boulevard, Suite 300
Anchorage, Alaska 99503

Attention: David Yanoshek

**RE: FINAL TEST WELL INSTALLATION REPORT
PROPOSED MERTARVIK TOWN SITE
NEWTOK, ALASKA**

Dear David:

1.0 INTRODUCTION

Golder Associates Inc. (Golder) is pleased to present CRW Engineering Group, LLC (CRW) with this report concerning the water supply test well installation at the proposed Mertarvik town site. Golder has been contracted by CRW to provide technical support for the well installation project. Our service is part of a larger effort to relocate the existing village in Newtok, Alaska. CRW is contracted by the Village Safe Water (VSW) office and the Newtok Tribal Council (NTC) (CRW project #81201.00, VSW project # 02EH74).

1.1 Background

A groundwater investigation was previously completed for the proposed Mertarvik town site¹. Mertarvik will be located on the north side of Nelson Island in the area shown in Figure 1. The regional geology information for Nelson Island indicates that a series of relatively level basalt flows underlies the area. The thickness and frequency of the sediment and basalt layers is unknown in the Mertarvik area. A local spring is located within the town site area at an approximate elevation of 30 ft above mean sea level (MSL) (Figure 2).

Based on the previous investigation results, three test well locations were recommended for the area directly up slope of the local spring (Figure 2). Proposed well location No. 2 was selected as the location for the first test well drilled at Mertarvik by VSW. This location is at an approximate elevation of about 125 ft MSL, (Figure 2). The test well was installed by Denali Drilling under contract with the State of Alaska Village Safe Water (VSW) Program.

¹ Report prepared by Golder Associates, Inc, Geophysical Investigation of Subsurface Hydrology and Groundwater Extraction at the Proposed Mertarvik Town Site, Newtok Alaska, dated August 14, 2007, Golder Project Number 073-95024

1.2 Purpose and Scope of Services

The purpose of our services was to provide technical support and on-site documentation during the well installation project. Our general scope of services included traveling to the site and documenting a 24-hour pump test, collecting a groundwater quality sample for analysis, and reporting the results.

The scope of services performed by Golder included:

- Coordination with the driller, laboratory, CRW Engineering Group and VSW.
- Mobilization with field equipment for pump test, water level measurement and water quality sample kit.
- Received the water quality sample collected by the drillers and submitted the sample to a State of Alaska Certified Drinking Water Quality Laboratory (Analytica Group Laboratories of Anchorage) for analysis per the "Initial Class A Drinking Water Suite" as specified by the laboratory. Total lead was added to the standard parameter list.
- Prepared this report presenting a summary of the field activities, results, conclusions and recommendations.

2.0 FIELD ACTIVITIES

2.1 Well Drilling & Installation

Well drilling and installation was performed using an air rotary drill rig operated by Ryan Ralston of Denali Drilling, Anchorage Alaska from October 11 to 26, 2007. A Golder representative traveled to the site to perform our scope of services. However, it was obvious that our services would not be needed for an unknown time due to unexpected well drilling delays. As a result the Golder person, mobilized off the site to avoid significant cost over-runs to the project. The well installation delays were caused by unexpected subsurface conditions and inclement weather. The water sampling kit and other equipment was left at the site for our return or use by Denali Drilling. It was later determined that Denali Drilling personnel would conduct a limited pump test and collect the groundwater sample from the test well.

Drilling progress was reportedly hampered by the unexpected thickness and frequency of unconsolidated sediments between relatively thin rock layers. These conditions required the drillers to case the borehole with 6-inch diameter steel casing to the maximum depth drilled of 110 ft below ground surface (bgs). The steel casing was then lined with 4-inch diameter PVC with a nominal 3-inch diameter, 6.7 ft long well screen and tailpipe. The stainless steel wire-wrap well screen is approximately 5 ft long with an inside diameter of 3.1-inches. The 6-inch steel casing was then pulled back to expose the well screen. A copy of the water well log and a generalized well construction drawing prepared by Denali Drilling is presented in Appendix A.

The well was disinfected with chlorine bleach following the completion and development of the well. Air lift methods were used to develop the well prior to the pump test. A 2-hr pump test was conducted rather than the planned 24 hr test because gasoline for the generator was limited and the weather and ice conditions in Baird Inlet hampered the delivery of addition supplies. The groundwater sample was collected by Denali Drilling personnel at the end of the pump test on

October 26, 2007. The water sample was picked up at the Denali Drilling office in Anchorage by Golder personnel on October 27, 2007 and delivered to the laboratory on October 29, 2007.

3.0 RESULTS

3.1 Stratigraphy

The stratigraphy encountered in the 110 ft deep borehole at the location of TW #1 included 21.5 ft of over burden consisting of organics and brown silt. These soils were underlain by a series of hard grey rock, probably basalt flows, interlayered with brown and grey silt to 104.5 ft bgs. To this depth, five layers of rock were encountered with thicknesses ranging from 2 ft to 20 ft. The silt layer thickness ranged from 4 ft to 20 ft with two layers of silt also containing rounded gravel. No groundwater was encountered until a fractured basalt aquifer was penetrated at a depth of 104 ft bgs. This depth is similar to the spring source area at 30 ft MSL (Figure 2). The basalt aquifer is only slightly confined because the static water level measured in the well at 98 ft bgs is only slightly above the top of the aquifer at 104 ft bgs.

3.2 Pump Test

The 2-hr pump test conducted by Denali Drilling resulted in no measurable drawdown in the well when pumped at a rate of 15 gallons per minute according to the information provided in the well log in Appendix A. This result suggests that the well can produce additional flow, however, the pump test was of short duration and the ability for the well to sustain 15 gpm or greater flow over a longer period can not be evaluated with the current data. In addition, groundwater level seasonal variation is of concern since the available drawdown from the static water level, at time of drilling, to the top of the screen is minimal at about 5.5 ft. Total available drawdown if a pump is installed within the screen is about 10 to 12 ft.

Note that a small diameter pump will be required to fit in the current well screen for future use. The pump would also need to be shrouded to direct water across the pump motor to prevent the motor from over heating. The 10-slot screen was telescoped in to the 4-inch diameter PVC liner. According to the Johnson Well Screen specifications available on their website, the screen installed is a model 3P/4T, W60 wire-wrap construction, with an open area of 19.9 square inches per ft of 10 slot screen. The total open area for a 5 ft long screen is approximately 99.5 sq in (0.69 sq ft). A 10-slot size screen with these specifications should be able to produce about 30 gallons per minute without significant well losses. This assumes an average groundwater entrance velocity across the screen of 0.1 ft per second, which is a common recommended entrance velocity to reduce chemical encrustation and corrosion in a variety of groundwater quality conditions².

3.3 Groundwater Quality

The analytical results indicate that the groundwater quality meets the primary and secondary drinking water quality standards presented in the State of Alaska Administrative Code 18 AAC 80, with one exception. Total iron, at a concentration of 0.357 milligrams per liter (mg/l) slightly exceeds the secondary standard of 0.3 mg/l. The analytical results are summarized in Table 1. A copy of the laboratory report is presented in Appendix B.

² Fletcher G. Driscoll, Ph.D., Groundwater and Wells, Published by Johnson Division, St Paul Minnesota 55112, Appendix 13.1, Discussion of Appropriate Screen Entrance Velocities

4.0 CONCLUSIONS

The conclusions based on the test well installation and groundwater quality sampling results are as follows:

- The first deep borehole drilled to 110 ft bgs in Mertarvik encountered interlayered basalt and sediments. Groundwater was encountered in a slightly confined fractured basalt aquifer at about the elevation of the spring at 30 ft above MSL.
- A test well was successfully installed that appears to yield at least 15 gpm. The well screen design should be able to yield approximately 30 gpm without significant well loss if the aquifer can meet the demand. This well may meet the needs of Mertarvik in its present state, however, there are some concerns about the long-term use of the well and well design as noted below:
 - Even though the pump test indicates that the well yielded at least 15 gpm with no measureable drawdown over a 2 hr period, the available drawdown in the well is minimal at about 10 ft to 12 ft. If the groundwater levels become lower during periods of less recharge (i.e. winter) the yield of the well could be impacted by these seasonal fluctuations. A groundwater level monitoring program would be needed to verify the ability of the well to maintain flow through periods of seasonal groundwater level fluctuations.
 - A long-term pump test is required to evaluate if this well can sustain a suitable yield for Mertarvik. A typical pump test duration in unconfined to moderately confined aquifers is 48 hrs to 72 hrs, or potentially longer, depending on the response to pumping.
 - Well pumps are not typically installed inside a well screen in order to avoid cooling and sediment problems, and to reduce the distance the water has to be lifted to the surface to reduce electrical costs. In this case, the available drawdown is minimal so a pump may need to be installed in the screen. A small diameter pump will be required to fit in the existing well screen to maximize the available drawdown in the well and reduce the risk of the lower seasonal groundwater levels from impacting the well yield. This pump should be shrouded to cool the pump motor. During a telephone conversation with an employee at Alaska Pump, a shrouded pump in the 3.1-inch diameter screen is available that can produce 20 + gpm, but it may not fit inside the screen³ or the shroud will reduce the flow into the screen because of the tight fit. If the existing well construction is used, a suitable well pump needs further investigation to verify fit and performance.
- Groundwater quality meets the primary and secondary drinking water quality standards, with the exception that iron is slightly above the secondary standard. There is no evidence to suggest this water quality may change with long-term use of the well, but if another pump test of longer duration is conducted in the future additional water quality analysis would be recommended.

³ Telephone conversation on December 5, 2007 between Jan Deick of Golder Associates, Inc. and Dave Masters, Alaska Pump in Anchorage (907) 562-5449.

5.0 RECOMMENDATIONS

The long-term use or yield of TW#1 can be evaluated by implementing a groundwater level monitoring program and a longer pump test on the existing well. The period of water level monitoring should extend through the winter and into the summer season at a minimum. The water level monitoring could be performed manually by having a local from Newtok visit the site once a month to measure the water level and provide the data to VSW. However, a pressure transducer and data logger could also be installed and retrieved when the monitoring period is concluded.

If the groundwater monitoring indicates that seasonal variation is of concern, or if installation of a second water supply well is considered, then deepening the existing TW#1 borehole and reinstalling a larger diameter well screen is recommended. The PVC liner will not be needed in the 6-inch steel casing so a 6-inch telescoping screen could then be installed. This should provide the following benefits of increasing the aquifer thickness, available drawdown, and allow for the installation of a longer and larger diameter screen that will allow installation of a more typical pump size. According to Ron Pichler (Denali Drilling), deepening the existing well is possible since the drill shoe was not removed from the steel casing. There are some risks according to Pichler in that the PVC liner and well screen may be damaged during its removal, but these items may not be needed for the new well, or that the 6-inch steel casing cannot be advanced after being left idle for a long period.

If the groundwater level monitoring results indicate that seasonal variation will not impact well yield, then a 72-hr or longer pump test is recommended considering that the aquifer is only moderately confined and the drawdown is limited. The test should be conducted using the small diameter well pump installed in the screen to verify it will not over heat and that it will meet the needs of the new town site.

6.0 LIMITATIONS

This report was prepared for the exclusive use of CRW. Golder services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the professional community currently practicing under similar conditions subject to the time limits and financial and physical constraints applicable to the services. No warranty expressed or implied is made. This report is not meant to represent a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, please note that regulatory statutes and the interpretation of regulatory statutes are subject to change over time and should be discussed with legal council.

The report is based on data and information collected during the investigation conducted by Golder personnel and is based solely on the conditions at the time of the site work as described in this report. Golder has relied in good faith on information provided by others noted in the report. We accept no responsibility for any deficiency, misstatements, or inaccuracy contained in this report as a result of omissions, misstatements or fraudulent acts of others.

Any use which a third party makes of this report, any reliance on or decisions to be made based on it, are the responsibility 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 based on this report.

If new information is discovered in the future or if additional subsurface investigations or testing are conducted by others, Golder should be requested to re-evaluate the conclusions of this report and to provide amendments as required prior to any reliance upon the information presented herein.

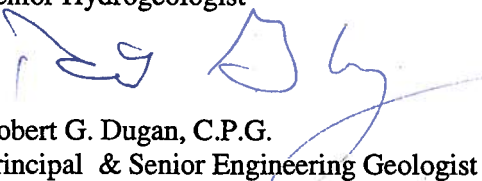
7.0 CLOSING

We appreciate the opportunity to work on this project. If you have questions or require additional information, please contact us at (907) 344-6001.

GOLDER ASSOCIATES



Jan F. Deick, P.G.
Senior Hydrogeologist



Robert G. Dugan, C.P.G.
Principal & Senior Engineering Geologist

Attachments: Table 1 Water Quality Summary

Figures:

Figure 1 – Project Location
Figure 2 – Well Location – TW#1

Appendix A Water Well Log

Appendix B Copy of Laboratory Report

CC: Jon Menough, Village Safe Water

JFD/RGD/mlm

TABLE 1
WATER QUALITY SUMMARY
TEST WELL #1
MERTARVIK, ALASKA

Parameters	Units	Drinking Water Standard ⁽¹⁾	Well No., Date Sampled & Result
Primary Inorganic Chemical Contaminant - by EPA Method 200.8 or as specified			TW#1 10/26/2007
Antimony	mg/l	0.006	<0.0001
Arsenic	mg/l	0.01	<0.00015
Barium	mg/l	2	0.00187
Beryllium	mg/l	0.004	<0.00015
Cadmium	mg/l	0.005	<0.00020
Chromium	mg/l	0.1	0.00543
Nickel	mg/l	0.1	0.000853
Selenium	mg/l	0.05	<0.0005
Thallium	mg/l	0.002	<0.00005
Cyanide - SM4500	mg/l	0.2	<0.0040
Nitrate - SM 4500-NO3E	mg/l	10	<0.10
Nitrite - 4500-NO2-B	mg/l	1	<0.020
Mercury - CVAA 245.1	mg/l	0.002	<0.00020
Secondary Chemical Contaminants - by EPA Method 200.7			
Aluminum	mg/l	0.05-0.2	0.125
Calcium	mg/l	Not Established	6.21
Iron	mg/l	0.3	0.357
Manganese	mg/l	0.05	<0.0100
Sodium	mg/l	250	5.60
Secondary Chemical Contaminants - by EPA Method 200.8			
Copper	mg/l	1.3 ⁽²⁾	0.00314
Lead	mg/l	15 ⁽²⁾	0.00767
Silver	mg/l	0.1	0.000455
Zinc	mg/l	5	0.0149
Secondary Chemical Contaminants - by EPA Method 300 or as specified			
Chloride	mg/l	250	5.45
Flouride	mg/l	4.0 / 2.0	<0.20
Sulfate	mg/l	250	0.800
pH - EPA 150.1	pH	6.5 - 8.5	7.2
Color - 2120B	mg/l	15 color units	< 5.0
Odor - 2150B	T.O.N	1	No Odor
Alkalinity- Total -SM2320	mg/l CaCO3	Not Established	36.1
Corrosivity Langlier Index - SM2330	Lang Units	Noncorrosive	0.0
Total Dissolved Solids - SM2540	mg/l	500	76.3
MBAS Foaming Agents - 5540C	mg/l	0.5	<0.10
Coliform Bacteria - 9223B-PA Aqueous			
E. Coli	Pass/Fail	1	Pass
Total Coliform	Pass/Fail	1	Pass
Volatile Organic Compounds - "None Detected by EPA Method 524.2 Aqueous"			

Notes: (1) Water quality standards in 18 Alaska Administrative Code 80.300

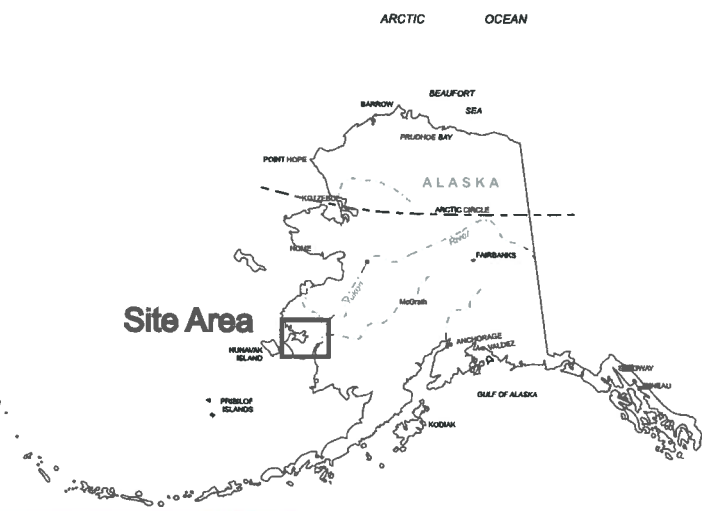
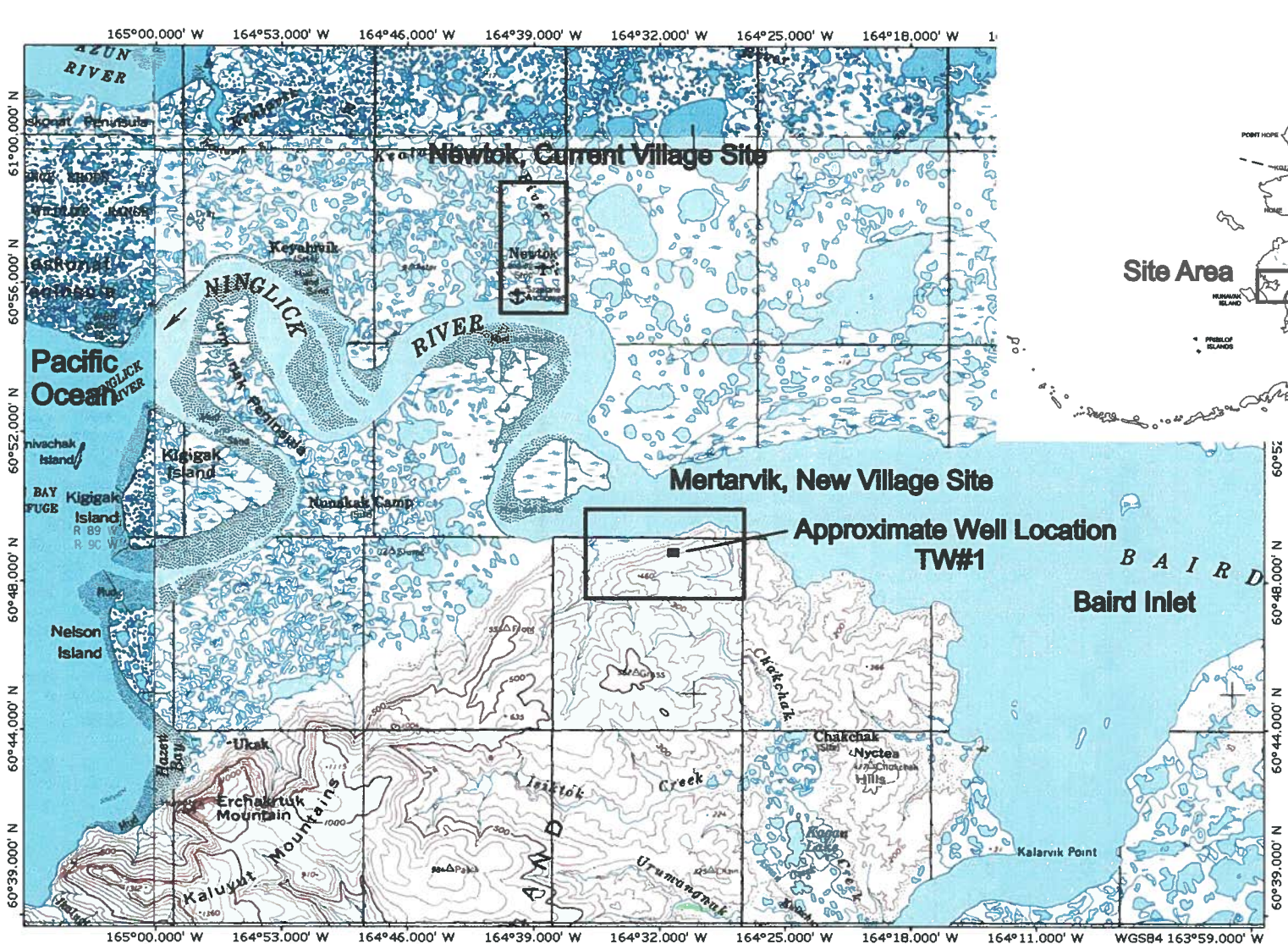
(2) Copper and Lead are regulated by Treatment Technique action levels that requires systems to control the corrosiveness of their water.

mg/l - Concentration in milligrams per liter


T.O.N. - Threshold odor number

Shaded result exceeds the referenced water quality standard

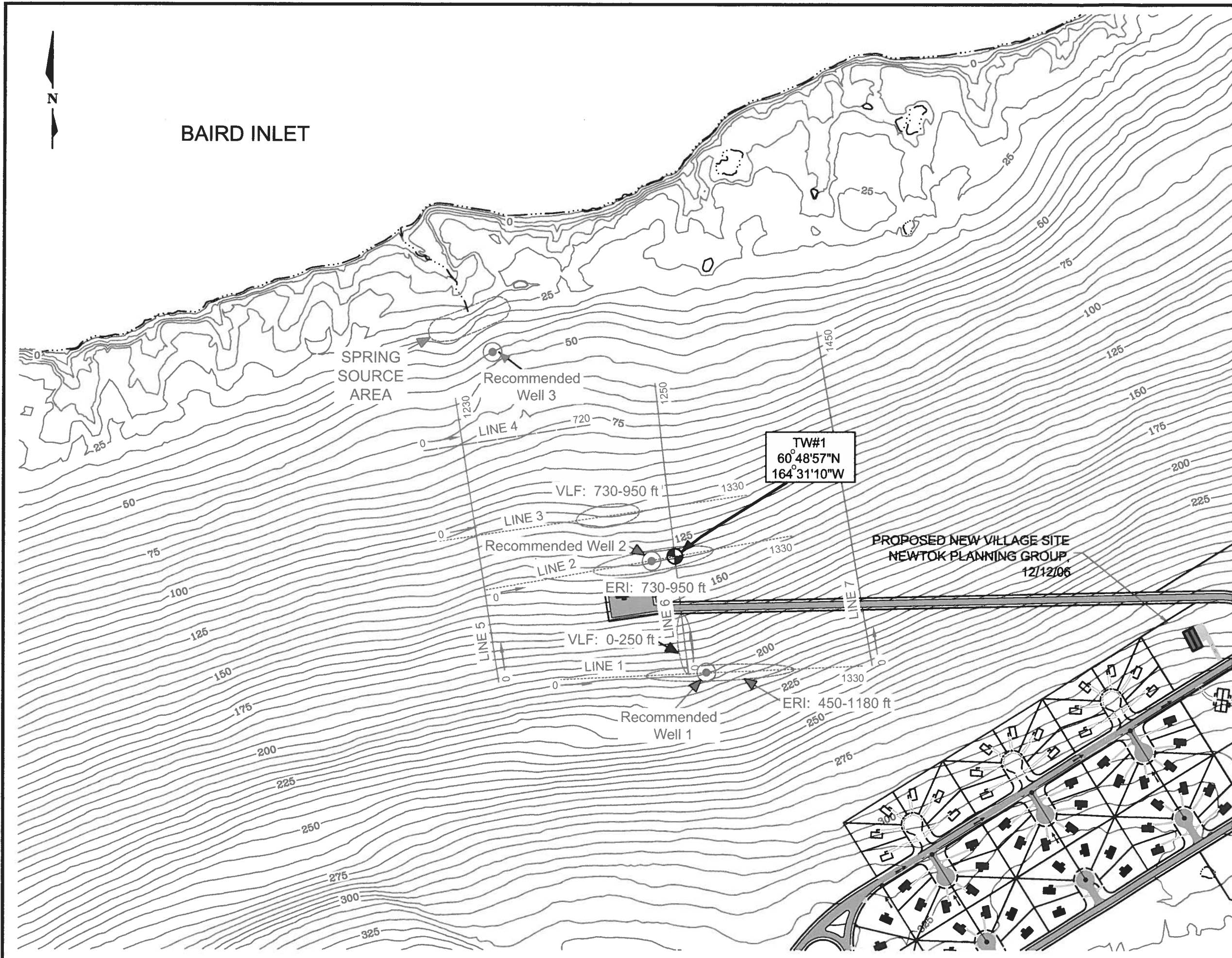
FIGURES



Map created with TOPOI® © 2003 National Geographic (www.nationalgeographic.com/topo)

	SCALE AS SHOWN	TITLE
	CADD BBS	<h2 style="text-align: center;">PROJECT LOCATION NEWTOK GROUNDWATER INVESTIGATION</h2>
DATE 12/4/07	FIGURE 1	
CHECK JFD	DATE 12/5/07	
PROJECT No. 073-95024.005	REV. 0	CRW/NEWTOK 073-95024 / WESTERN AK

FILE No. J:\2007\073-95024 CRW Newtok Water Investigation\Reports\Appendices\Figures\Fig_1_NewtokLocation
 PROJECT No. 073-95024.005



LEGEND

- MINOR CONTOUR @ 5ft
- MAJOR CONTOUR @ 25ft
- VLF LINE ONLY
- ERI LINE ONLY
- VLF & ERI LINE

ERI: 450-1180 ft VLF & ERI ANOMALIES (DISTANCE RANGE ALONG PROFILE IN FT)

APPROXIMATE SCALE IN FEET

NOTES

- ABEN WADI VLF System
- IRIS Electrical Resistivity Eystem

GEODETTIC PARAMETERS

VERT. DATUM: - NAVD 88
 HORIZ. DATUM: - Alaska State Plane, Zone 8, Feet
 PROJECTION: -

Golder Associates
 GOLDER ASSOCIATES INC.
 1750 ABBOTT ROAD, SUITE 200
 ANCHORAGE, AK USA 99507
 TEL: (907) 344-8001
 FAX: (907) 344-8011

SUBMITTED TO:
 CRW ENGINEERING GROUP, LLC
 3940 ARCTIC BLVD, SUITE 300
 ANCHORAGE, AK 99503

PROJECT:
 CRW / NEWTOK GROUNDWATER INVESTIGATION / AK

TITLE:
WELL LOCATION - TW#1


PROJECT	073-85024.005	DESIGN	DH	7/10/07
FILE No.	07385024000F02	CADD	BBS	12/4/07
REV.	0	CHECK	JFD	12/5/07
SCALE	AS SHOWN REVIEW			

FIGURE 2

APPENDIX A

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINING, LAND & WATER
WATER WELL LOG

Drilling Started: 10 / 11 / 2007, Completed: 10 / 26 / 2007

City/Borough:	Subdivision:	BLOCK	LOT	Property Owner Name & Address:
Mertarvik	N/A	N/A	N/A	Village Safe Water, 555 Cordova Street, Anchorage, AK 99501
Meridian Seward		Township 18N Range 86W		Section 3, NE 1/4 of SW 1/4 of NW 1/4 of - 1/4
BOREHOLE DATA: (from ground surface) Depth				Drilling method: <input checked="" type="checkbox"/> Air rotary, <input type="checkbox"/> Cable tool <input type="checkbox"/> Other _____
Material: Type, Color & wetness				Well use: <input type="checkbox"/> Public supply, <input type="checkbox"/> Domestic, <input checked="" type="checkbox"/> Other Test Well
		From	To	
Organics & brown silt		0'	21.5'	Depth of hole: <u>110</u> ft, Casing stickup: <u>3</u> ft
Hard grey rock		21.5'	42'	Casing type: <u>Steel</u> Thickness <u>.250</u> inches
Brown moist silt		42'	62'	Casing diameter: <u>6</u> inches Casing depth <u>104.5</u> ft
Hard grey rock		62'	65'	Liner type: <u>PVC</u> Diameter: <u>4</u> inches Depth: <u>103.5</u> ft
Brown silt w/pea size round gravel		65'	69'	Note: <u>PVC stick up 1.5 ft</u>
Hard grey rock		69'	70'	Static water (from top of casing): <u>101</u> ft on <u>10 / 26 / 2007</u>
Brown silt rounded gravel		70'	80'	Pumping level & yield: <u>101</u> feet after <u>4</u> hours at <u>15</u> gpm
Hard grey rock		80'	82'	Recovery rate: <u>15</u> gpm, Method of testing: <u>Pumping</u>
Red/brown silt, no gravel		82'	85'	Development method: <u>Air</u> Duration: <u>2</u> hours
Grey silt		85'	90'	Well intake opening type: <input checked="" type="checkbox"/> Open end <input type="checkbox"/> Open hole, Other <input type="checkbox"/>
Hard grey rock		90'	100'	<input checked="" type="checkbox"/> Screened; Start: <u>103.5</u> ft, Stopped <u>108.5</u> ft
Black fractured rock - water		104'	110'	Screen type: <u>Stainless</u> Slot/mesh size <u>10</u>
				<input type="checkbox"/> Perforated; Start: _____ ft, Stopped _____ ft
				Start: _____ ft, Stopped _____ ft
				Gravel packed <input type="checkbox"/> Yes <input type="checkbox"/> No From _____ ft to _____ ft
				Note: <u>Screen and tailpipe 6' 7"</u>
				Grout type: <u>Bentonite</u> Volume <u>12</u> Cu. Ft.
				Depth, from <u>0</u> ft, to <u>20</u> ft
				Pump intake depth: <u>N/A</u> ft
				Pump size _____ hp Brand name _____
				Was well disinfected upon completion? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
				Method of disinfection: _____
				Driller comments/ disclaimers: <u>Installed heat trace to bottom of hole</u>
				<u>Installed well seal in top of well.</u>
				Well driller name: <u>Ryan Ralston</u>
				Company name: <u>Denali Drilling, Inc.</u>
				Mailing address: <u>8240 Petersburg Street</u>
				City: <u>Anchorage</u> State: <u>AK</u> Zip: <u>AK 99507</u>
				Phone number: (<u>907</u>) <u>562</u> - <u>2312</u>
				Drillers signature: 
				Date: <u>11 / 28 / 2007</u>

Alaska state law requires that a copy of this well log be forwarded to the Department of Natural Resources within 45 days (AK statutes 38.05.020, 38.05.035, 41.08.020, 46.15.020 and AK regulations 11 AAC 93.140). Faxes are acceptable.

Alaska DNR, Division of Mining, Land and Water,
 560 W 7th Avenue, Suite 1020
 Anchorage, AK 99501-3562

Phone (907)269-8839 and fax (907)269-8947

If the well is within city limits, the City of Anchorage requires that a copy of this well log be forwarded to the city within 60 days and another copy of this log be forwarded to the owner of the property, on which the well is located, within 30 days.

City Permit Number: _____
 Date of Issue: _____

Parcel Identification Number: _____

Is well located at approved permit location? Yes or No

NOT DRAWN TO SCALE

Top of casing 3' stick up from ground surface

Top of PVC 18" stick up from ground surface

Top of ground surface

107.5' of 6" x .250 wall steel casing installed to 104.5'

105' of 4" PVC installed to 103.5'

Heat trace installed to bottom of hole.

Static water level 101' from top of casing - 98' below ground surface while pumped at 15 GPM

5.5' of water in 4" PVC

PVC installed to 103.5'

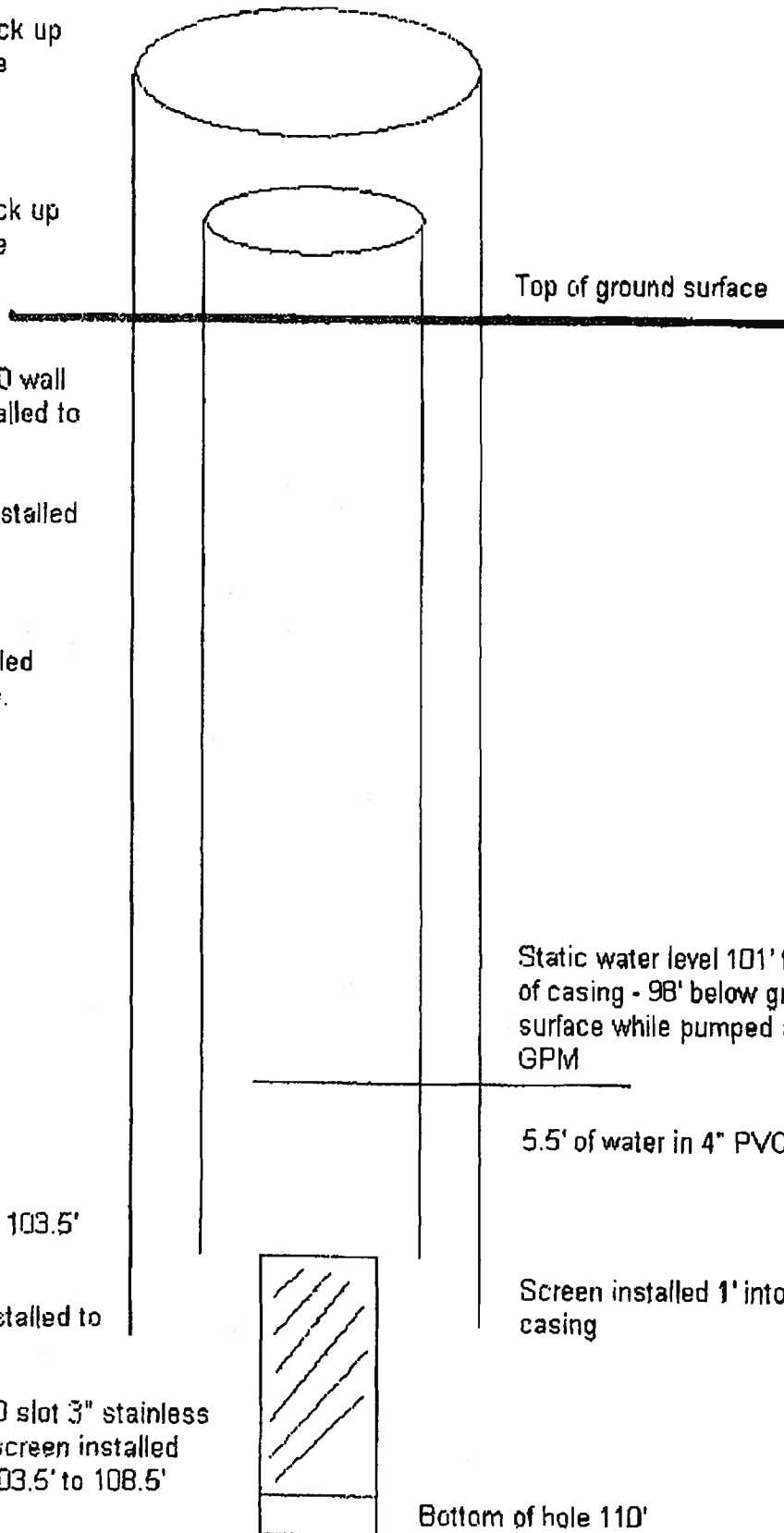
6" steel casing installed to 104.5'

Screen installed 1' into casing

5' of 10 slot 3" stainless steel screen installed from 103.5' to 108.5'

Bottom of hole 110'

Mertanik Water Well drilled October 1007 by Denali Drilling, Inc., Ryan Raiston, drillr



APPENDIX B



Analytica International, Inc.
 4307 Arctic Blvd.
 Anchorage, AK 99503
 Phone: 907-258-2155
 Fax: 907-258-6634

Golder Assoc., Inc.
 Attn: Mr. Jan Deick
 1750 Abbott Road
 Suite #200
 Anchorage, AK 99507-3443
 907.341.6107
 Fax: 907-344-6011

Report Date: 12/3/2007
 Receipt Date: 10/29/2007
 Sample Date: 10/26/2007
 Sample Time: 1:00:00PM
 Collected By: R/T

Client Sample ID:
 Sampling Location: TW #1
 Client Project: CRW - Mertarvik New Well
 Sample Matrix: Aqueous
 COC #: 61206
 PWS#:
 Residual Chlorine:
 Comments:

Flag Definitions:
 MRL = Method Reporting Limit
 MCL = Maximum Contaminant Limit
 B = Present also in Method Blank
 H = Exceeds Regulatory Limit
 M = Matrix Interference
 J = Estimated Value
 D = Lost to Dilution
 ** = RL higher than MCL; target not detected
 TNC = Too Numerous to Count - result rejected
 CF = Confluent Growth - result rejected
 TCNG = Turbid Culture No Growth - rejected

Lab#: A0710448-01A

Sample Comment: Mertarvik Well

Analysis Method					Prep	Prep	Analysis		
Parameter	Result	Units	Flags	MRL	MCL	Method	Date	Date	Analyst
9223B-PA (Aqueous) - Coliforms in DW					<i>Test was conducted by: Analytica - Anchorage</i>				
E. Coli	Pass	PASS/FAI L		1.0	1		10/29/2007	10/29/2007	PL
Total Coliform	Pass	PASS/FAI L		1.0	1		10/29/2007	10/29/2007	PL

Lab#: A0710448-01B

Sample Comment: Mertarvik Well

Analysis Method					Prep	Prep	Analysis		
Parameter	Result	Units	Flags	MRL	MCL	Method	Date	Date	Analyst
245.1 (Aqueous) - Total Hg					<i>Test was conducted by: Analytica - Thornton</i>				
Mercury	<MRL	mg/L		0.00020	0.002		11/1/2007	11/1/2007	DL
200.7/200.7 (Aqueous) - Secondary Metals					<i>Test was conducted by: Analytica - Thornton</i>				
Aluminum	0.125	mg/L		0.050	0.2	200.7	11/1/2007	11/1/2007	RM
Calcium	6.21	mg/L		0.10	200.7		11/1/2007	11/1/2007	RM

Reported by: Steve Gaither,
 Laboratory Project Manager



Analytica International, Inc.
 4307 Arctic Blvd.
 Anchorage, AK 99503
 Phone: 907-258-2155
 Fax: 907-258-6634

Golder Assoc., Inc.
 Attn: Mr. Jan Deick
 1750 Abbott Road
 Suite #200
 Anchorage, AK 99507-3443
 907.341.6107
 Fax: 907-344-6011

Report Date: 12/3/2007
 Receipt Date: 10/29/2007
 Sample Date: 10/26/2007
 Sample Time: 1:00:00PM
 Collected By: R/T

Client Sample ID:
 Sampling Location: TW #1
 Client Project: CRW - Mertarvik New Well
 Sample Matrix: Aqueous
 COC #: 61206
 PWS#:
 Residual Chlorine:
 Comments:

Flag Definitions:
 MRL = Method Reporting Limit
 MCL = Maximum Contaminant Limit
 B = Present also in Method Blank
 H = Exceeds Regulatory Limit
 M = Matrix Interference
 J = Estimated Value
 D = Lost to Dilution
 ** = RL higher than MCL; target not detected
 TNC = Too Numerous to Count - result rejected
 CF = Confluent Growth - result rejected
 TCNG = Turbid Culture No Growth - rejected

Analysis Method									
Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
200.7/200.7 (Aqueous) - Secondary Metals					<i>Test was conducted by: Analytica - Thornton</i>				
Iron	0.357	mg/L	H	0.050	0.3	200.7	11/1/2007	11/1/2007	RM
Manganese	<MRL	mg/L		0.0100	0.05	200.7	11/1/2007	11/1/2007	RM
Sodium	5.60	mg/L		3.0		200.7	11/1/2007	11/1/2007	RM
200.8/200.8 (Aqueous) - Primary and Secondary					<i>Test was conducted by: Analytica - Thornton</i>				
Antimony	<MRL	ug/L		0.10	6.0	200.8	11/8/2007	11/8/2007	KS
Arsenic	<MRL	ug/L		0.15	10	200.8	11/8/2007	11/8/2007	KS
Barium	1.87	ug/L		0.25	2000	200.8	11/8/2007	11/8/2007	KS
Beryllium	<MRL	ug/L		0.15	4.0	200.8	11/8/2007	11/8/2007	KS
Cadmium	<MRL	ug/L		0.20	5.0	200.8	11/8/2007	11/8/2007	KS
Chromium	5.43	ug/L		0.15	100	200.8	11/8/2007	11/8/2007	KS
Copper	3.14	ug/L		0.10	1300	200.8	11/8/2007	11/8/2007	KS
Lead	0.767	ug/L		0.10	15	200.8	11/8/2007	11/9/2007	KS
Nickel	0.853	ug/L		0.15	100	200.8	11/8/2007	11/8/2007	KS
Selenium	<MRL	ug/L		0.50	50	200.8	11/8/2007	11/8/2007	KS
Silver	0.455	ug/L		0.10	100	200.8	11/8/2007	11/9/2007	KS
Thallium	<MRL	ug/L		0.050	2.0	200.8	11/8/2007	11/9/2007	KS
Zinc	14.9	ug/L		0.25	5000	200.8	11/8/2007	11/8/2007	KS

Reported by: Steve Gaither,
 Laboratory Project Manager



Analytica International, Inc.
 4307 Arctic Blvd.
 Anchorage, AK 99503
 Phone: 907-258-2155
 Fax: 907-258-6634

Golder Assoc., Inc.
 Attn: Mr. Jan Deick
 1750 Abbott Road
 Suite #200
 Anchorage, AK 99507-3443
 907.341.6107
 Fax: 907-344-6011

Report Date: 12/3/2007
 Receipt Date: 10/29/2007
 Sample Date: 10/26/2007
 Sample Time: 1:00:00PM
 Collected By: R/T

Client Sample ID:
 Sampling Location: TW #1
 Client Project: CRW - Mertarvik New Well
 Sample Matrix: Aqueous
 COC #: 61206
 PWS#:
 Residual Chlorine:
 Comments:

Flag Definitions:
 MRL = Method Reporting Limit
 MCL = Maximum Contaminant Limit
 B = Present also in Method Blank
 H = Exceeds Regulatory Limit
 M = Matrix Interference
 J = Estimated Value
 D = Lost to Dilution
 ** = RL higher than MCL; target not detected
 TNC = Too Numerous to Count - result rejected
 CF = Confluent Growth - result rejected
 TCNG = Turbid Culture No Growth - rejected

Lab#: A0710448-01C

Sample Comment: Mertarvik Well

Analysis Method					Prep	Prep	Analysis	
Parameter	Result	Units	Flags	MRL	MCL	Method	Date	Analyst
4500-CNE/4500-CNB (Aqueous) - Total CN					Test was conducted by: Analytica - Thornton			
Cyanide	<MRL	mg/L		0.0040		4500-CN	11/5/2007	11/5/2007 KL

Lab#: A0710448-01D

Sample Comment: Mertarvik Well

Analysis Method					Prep	Prep	Analysis	
Parameter	Result	Units	Flags	MRL	MCL	Method	Date	Analyst
300.0/300.0 (Aqueous) - Secondary					Test was conducted by: Analytica - Fairbanks			
Chloride	5.45	mg/L		0.50	250	300.0	10/30/2007	10/30/2007 KAH
Fluoride	<MRL	mg/L		0.20	4.0	300.0	10/30/2007	10/30/2007 KAH
Sulfate	0.800	mg/L		0.75	250	300.0	10/30/2007	10/30/2007 KAH

Lab#: A0710448-01E

Sample Comment: Mertarvik Well

Reported by: Steve Gaither,
 Laboratory Project Manager



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 907.341.6107
 Fax: 907-344-6011

Report Date: 12/3/2007
 Receipt Date: 10/29/2007
 Sample Date: 10/26/2007
 Sample Time: 1:00:00PM
 Collected By: R/T

Client Sample ID:
 Sampling Location: TW #1
 Client Project: CRW - Mertarvik New Well
 Sample Matrix: Aqueous
 COC #: 61206
 PWS#:
 Residual Chlorine:
 Comments:

Flag Definitions:
 MRL = Method Reporting Limit
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Analysis Method	Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO2-B (Aqueous) - Nitrite	Nitrite as N	<MRL	mg/L		0.020	1		10/29/2007	10/29/2007	AJ

Lab#: A0710448-01F

Sample Comment: Mertarvik Well

Analysis Method	Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
4500-NO3E (Aqueous) - Nitrate	Nitrate as N	<MRL	mg/L		0.10	10		10/30/2007	10/30/2007	AJ

Lab#: A0710448-01G

Sample Comment: Mertarvik Well

Analysis Method	Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
150.1/150.1 (Aqueous) - pH	pH	7.2	pH		0.0		150.1	10/29/2007	10/29/2007	AJ
2330B (Aqueous) - Langelier Index	Langelier Index/Corrosivity	0.0	N/A					11/1/2007	11/1/2007	SG

Reported by: Steve Gaither,
 Laboratory Project Manager



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Golder Assoc., Inc.
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 1750 Abbott Road
 Suite #200
 Anchorage, AK 99507-3443
 907.341.6107
 Fax: 907-344-6011

Report Date: 12/3/2007
 Receipt Date: 10/29/2007
 Sample Date: 10/26/2007
 Sample Time: 1:00:00PM
 Collected By: R/T

Client Sample ID:
 Sampling Location: TW #1
 Client Project: CRW - Mertarvik New Well
 Sample Matrix: Aqueous
 COC #: 61206
 PWS#:
 Residual Chlorine:
 Comments:

Flag Definitions:

MRL = Method Reporting Limit
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Analysis Method					Prep	Prep	Analysis		
Parameter	Result	Units	Flags	MRL	MCL	Method	Date	Date	Analyst
2320B/2320B (Aqueous) - Total Alkalinity					<i>Test was conducted by: Analytica - Anchorage</i>				
Alkalinity, Total	36.1	mg/L CaCO3		4.0		2320B	10/30/2007	10/30/2007	AJ
2540C/2540C (Aqueous) - TDS					<i>Test was conducted by: Analytica - Anchorage</i>				
Total Dissolved Solids	76.3	mg/L		20	500	2540C	10/31/2007	10/31/2007	AJ
2120B/2120B (Aqueous) - Color in DW					<i>Test was conducted by: Analytica - Anchorage</i>				
Color, apparent	<MRL	Color Unit		5.0		2120B	10/29/2007	10/29/2007	PL

Lab#: A0710448-01H

Sample Comment: Mertarvik Well

Analysis Method					Prep	Prep	Analysis		
Parameter	Result	Units	Flags	MRL	MCL	Method	Date	Date	Analyst
2150B (Aqueous) - Odor @ 60C					<i>Test was conducted by: Analytica - Anchorage</i>				
Odor	NO ODO	T.O.N.		1.0			10/29/2007	10/29/2007	PL
5540C (Aqueous) - Surfactants as MBAS					<i>Test was conducted by: Analytica - Anchorage</i>				
MBAS Foaming Agents	<MRL	mg/L		0.10			10/29/2007	10/29/2007	AJ

Reported by: Steve Gaither,
 Laboratory Project Manager



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 1750 Abbott Road
 Suite #200
 Anchorage, AK 99507-3443
 907.341.6107
 Fax: 907-344-6011

Report Date: 11/12/2007
 Receipt Date: 10/29/2007
 Sample Date: 10/26/2007
 Sample Time: 1:00:00PM
 Collected By: R/T

Client Sample ID:
 Sampling Location: TW #1
 Client Project: CRW - Mertarvik New Well
 Sample Matrix: Aqueous
 COC #: 61206
 PWS#:
 Residual Chlorine:
 Comments:

Flag Definitions:
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 MCL = Maximum Contaminant Limit
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 H = Exceeds Regulatory Limit
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 J = Estimated Value
 D = Lost to Dilution
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 TCNG = Turbid Culture No Growth - rejected

Lab#: A0710449-01A

Sample Comment: Mertarvik Well

Analysis Method	Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
524.2 (Aqueous) - Ak DW VOCs MWH						<i>Test was conducted by: MWH Laboratories</i>				
	1,1,1-Trichloroethane	<MRL	ug/L		0.50	200			11/2/2007	KCP
	1,1,2-Trichloroethane	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
	1,1-Dichloroethene	<MRL	ug/L		0.50	7.0			11/2/2007	KCP
	1,2,4-Trichlorobenzene	<MRL	ug/L		0.50	70			11/2/2007	KCP
	1,2-Dichlorobenzene	<MRL	ug/L		0.50	600			11/2/2007	KCP
	1,2-Dichloroethane	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
	1,2-Dichloropropane	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
	1,4-Dichlorobenzene	<MRL	ug/L		0.50	75			11/2/2007	KCP
	Benzene	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
	Carbon Tetrachloride	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
	Chlorobenzene	<MRL	ug/L		0.50	100			11/2/2007	KCP
	Cis-1,2-Dichloroethene	<MRL	ug/L		0.50	70			11/2/2007	KCP
	Ethylbenzene	<MRL	ug/L		0.50	700			11/2/2007	KCP

Reported by: Steve Gaither,
 Laboratory Project Manager



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Golder Assoc., Inc.
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 1750 Abbott Road
 Suite #200
 Anchorage, AK 99507-3443
 907.341.6107
 Fax: 907-344-6011

Report Date: 11/12/2007
 Receipt Date: 10/29/2007
 Sample Date: 10/26/2007
 Sample Time: 1:00:00PM
 Collected By: R/T

Client Sample ID:
 Sampling Location: TW #1
 Client Project: CRW - Mertarvik New Well
 Sample Matrix: Aqueous
 COC #: 61206
 PWS#:
 Residual Chlorine:
 Comments:

Flag Definitions:
 MRL = Method Reporting Limit
 MCL = Maximum Contaminant Limit
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 TCNG = Turbid Culture No Growth - rejected

Analysis Method	Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
524.2 (Aqueous) - Ak DW VOCs MWH						<i>Test was conducted by: MWH Laboratories</i>				
	Methylene Chloride	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
	Styrene	<MRL	ug/L		0.50	100			11/2/2007	KCP
	Tetrachloroethene	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
	Toluene	<MRL	ug/L		0.50	1000			11/2/2007	KCP
	trans-1,2-Dichloroethene	<MRL	ug/L		0.50	100			11/2/2007	KCP
	Trichloroethene	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
	Vinyl Chloride	<MRL	ug/L		0.30	2.0			11/2/2007	KCP
	Xylenes, Total	<MRL	ug/L		1.5	10000			11/2/2007	KCP

Reported by: Steve Gaither,
 Laboratory Project Manager



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 Fax: 907-344-6011

Report Date: 11/12/2007
 Receipt Date: 10/29/2007
 Sample Date: 10/26/2007
 Sample Time: 1:00:00PM
 Collected By: R/T

Client Sample ID:
 Sampling Location: **Trip Blank**
 Client Project: CRW - Mertarvik New Well
 Sample Matrix: Aqueous
 COC #: 61206
 PWS#:
 Residual Chlorine:
 Comments:

Flag Definitions:
 MRL = Method Reporting Limit
 MCL = Maximum Contaminant Limit
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 J = Estimated Value
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Lab#: A0710449-02A

Analysis Method

Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
524.2 (Aqueous) - Ak DW VOCs MWH					<i>Test was conducted by: MWH Laboratories</i>				
1,1,1-Trichloroethane	<MRL	ug/L		0.50	200			11/2/2007	KCP
1,1,2-Trichloroethane	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
1,1-Dichloroethene	<MRL	ug/L		0.50	7.0			11/2/2007	KCP
1,2,4-Trichlorobenzene	<MRL	ug/L		0.50	70			11/2/2007	KCP
1,2-Dichlorobenzene	<MRL	ug/L		0.50	600			11/2/2007	KCP
1,2-Dichloroethane	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
1,2-Dichloropropane	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
1,4-Dichlorobenzene	<MRL	ug/L		0.50	75			11/2/2007	KCP
Benzene	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
Carbon Tetrachloride	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
Chlorobenzene	<MRL	ug/L		0.50	100			11/2/2007	KCP
Cis-1,2-Dichloroethene	<MRL	ug/L		0.50	70			11/2/2007	KCP
Ethylbenzene	<MRL	ug/L		0.50	700			11/2/2007	KCP
Methylene Chloride	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
Styrene	<MRL	ug/L		0.50	100			11/2/2007	KCP

Reported by: Steve Gaither,
 Laboratory Project Manager



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 Anchorage, AK 99507-3443
 907.341.6107
 Fax: 907-344-6011

Report Date: 11/12/2007
 Receipt Date: 10/29/2007
 Sample Date: 10/26/2007
 Sample Time: 1:00:00PM
 Collected By: R/T

Client Sample ID:
 Sampling Location: **Trip Blank**
 Client Project: CRW - Mertarvik New Well
 Sample Matrix: Aqueous
 COC #: 61206
 PWS#:
 Residual Chlorine:
 Comments:

Flag Definitions:
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Analysis Method	Parameter	Result	Units	Flags	MRL	MCL	Prep Method	Prep Date	Analysis Date	Analyst
524.2 (Aqueous) - Ak DW VOCs MWH	<i>Test was conducted by: MWH Laboratories</i>									
	Tetrachloroethene	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
	Toluene	<MRL	ug/L		0.50	1000			11/2/2007	KCP
	trans-1,2-Dichloroethene	<MRL	ug/L		0.50	100			11/2/2007	KCP
	Trichloroethene	<MRL	ug/L		0.50	5.0			11/2/2007	KCP
	Vinyl Chloride	<MRL	ug/L		0.30	2.0			11/2/2007	KCP
	Xylenes, Total	<MRL	ug/L		1.5	10000			11/2/2007	KCP

Reported by: Steve Gaither,
 Laboratory Project Manager



Analytica Chain of Custody Form

12189 Pennsylvania St.
Thornton, CO 80241
(303) 469-8868
(303) 469-5254 fax

4307 Arctic Boulevard
Anchorage, AK 99503
(907) 258-2155
(907) 258-6634 fax

475 Hall St.
Fairbanks, AK 99701
(907) 456-3116
(907) 456-3125 Fax

5438 Shaune Drive
Juneau, AK 99801
(907) 780-6668
(907) 780-8670 fax

Chain of Custody No: 61206

Client Name & Address: Golden Associates Inc - 1750 Abbott Rd, Ste 200 Anchorage, AK 99516-01		Public Water System (PWS) ID#:		Section To be Completed by Analytica	
Report to: JAN DEICK		Project Name: CAW / MERTUOK - new well		A0165003-1 A0710449	
Phone No: 907-344-6001		Turnaround Time for Results (TAT)		Invoice to Name & Address:	
Fax No: 907-344-6011		<input checked="" type="checkbox"/> Standard <input type="checkbox"/> Expedited (< 10 days, prior authorization required) <small>(please specify due date below; add'l charges may apply)</small>		SAME	
E-mail: jdeick@golden.com		Requested Due Date for Results:		Client ID 009720	
Special Instructions/Comments: Samples collected by Denali Drilling Personnel (Ryan/Trevor) on 10/26/07 Received by Golden (Jan Deick) on 10/27/07 at 11 AM				P.O. or Contract No: 073-95024.005	

Kit Prep/Shipping Charge: \$	Client Sample Identification / Location	Date Sampled	Time Sampled	Matrix (S-DW-WW-Other)	No. of Containers	Requested Analysis/Method															
						Lot # Pres:	Lot # Pres:	Lot # Pres:	Lot # Pres:	Lot # Pres:	Lot # Pres:	Lot # Pres:	Lot # Pres:	Field Preserved	Field Filtered	MS/MSD ?					
	PW #1																				
	TW #1	10/26/07	08:20	W	15																
	Trip Blank		1:00pm																		
	⊗ Performed by Anchorage and Thornton on LGN A0710448																				

Relinquished by: Jan Deick	Date: 10/29/07	Time: 08:20	Received by: [Signature]	Date: 10/28/07	Time: 8:20	Section To Be Completed by Analytica				
Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Condition of Custody Seal?:	INITIALS	ANALYST	DATE	TIME
Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Initiated By:				
Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Temp/Loc:				
Name of Sampler: (printed)						Thermo ID#:				
						Shipped Via:				

N/A
 3.4 TB
 I.R. 1.
 Client



Cooler Receipt Form

Client: Golder Assoc., Inc.
Project: CRW - Mertarvik New Well

Client Code: 009720

Order #: A0710449

Cooler ID: 1

A. Preliminary Examination Phase:

Date cooler opened: 10/29/2007
Cooler opened by: dc

Signature:

1. Was airbill Attached? N/A

Airbill #:

Carrier Name: Client

2. Custody Seals? N/A

How many? 0

Location:

Seal Name:

3. Seals intact? N/A

4. COC Attached? Yes

Properly Completed? Yes

Signed by AEL employee? Yes

5. Project Identification from custody paper: CRW Mertarvik New Well

6. Preservative: BlueGel

Temperature: 3.4 deg. C

Designated person initial here to acknowledge receipt:

Date: 10/29/07

COMMENTS:

B. Log-In Phase: Samples Log-in Date: 10/29/2007 Log-in By: dc

1. Packing Type: Bubblewrap

2. Were samples in separate bags? Yes

3. Were containers intact? Yes

Labels agree with COC? Yes

4. Number of bottles received: 6

Number of samples received: 2

5. Correct containers used? Yes

Correct preservatives added? Yes

6. Sufficient sample volume? Yes

7. Bubbles in VOA samples? No

8. Was Project manager called and status discussed? No

9. Was anyone called? No Who was called? _____ By whom? _____ Date: _____

COMMENTS: