JAN 10 2007

GREEN HAVEN ESTATES – AREA STRUCTURE PLAN - SE 27-20-29 W4

BYLAW 36/2006

Bylaw 36/2006 was reintroduced into the meeting to authorize the adoption of the Green Haven Estates Area Structure Plan located within SE 27-20-29 W4 under three separate titles described as follows:

1. *SE 27-20-29 W4 (lying North of the Southerly 1650 ft.) containing 49.5 acres;*
2. *SE 27-20-29 W4 (the South 1650 ft.) containing 89.39 acres;*
3. *Plan 9912116 Lot 2 containing 10.5 acres*

Mr. Mills moved second reading.

THE BYLAW WAS PASSED FOR TWO READINGS

Mr. Mills moved third reading.

THE BYLAW WAS PASSED

BYLAW 36/2006

BEING A BYLAW OF THE MUNICIPAL DISTRICT OF FOOTHILLS NO. 31 TO ADOPT AN AREA STRUCTURE PLAN

WHEREAS the Council of the Municipal District of Foothills No. 31 (hereinafter called the "Council") is empowered by Section 633(1) of the Municipal Government Act, being Chapter M-26.1, to adopt an Area Structure Plan which provides a framework for subsequent subdivision and development of an area of land within the Municipality's boundaries; and

WHEREAS the Council did direct the preparation of an Area Structure Plan for the lands legally described as Plan 04128975 Plan 041003905 and Plan 021098304 in SE 27-20-29 W4 (consisting of 127.87 acres).

WHEREAS the Area Structure Plan has been prepared under the direction of Council;

NOW THEREFORE the Council of the Municipal District of Foothills No. 31 in the Province of Alberta, hereby enacts as follows:

1. This Bylaw may be cited as the *"Green Haven Area Structure Plan"*.

2. The Green Haven Area Structure Plan being Schedule "A" attached hereto and forming part of this Bylaw.

3. That the *Green Haven Area Structure Plan* may be amended by Bylaw from time to time in accordance with the Municipal Government Act, by the Municipal District of Foothills No. 31.

4. This Bylaw comes into full force and effect upon the third and final reading.

FIRST READING: March 23, 2006

Roy R. McLean
Reeve

Municipal Manager

SECOND READING: January 18, 2007

Roy R. McLean
Reeve

Municipal Manager

THIRD READING: January 18, 2007

Roy R. McLean
Reeve

Municipal Manager

PASSED IN OPEN COUNCIL assembled at the Town of High River in the Province of Alberta this 18 day of January 2007.

Green Haven
ESTATES

Area Structure Plan

Final

Submitted to: The MD of Foothills No. 31

October 2006

DILLON CONSULTING

The Green Haven Estates
Area Structure Plan

Prepared for
The Municipal District of Foothills No. 31

Prepared by

Kristi Beunder, ACP, MCIP
Dillon Consulting Ltd.

October 2006

TABLE OF CONTENTS

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Purpose of the Plan

Development Concept

Green Haven Estates is a residential and recreational development project that will develop as a built green community. All of the homes will utilize eco-architectural design components (i.e. geothermal heating, solar energy, high efficiently heating and cooling, waste reduction and recycling, non-toxic/earth friendly materials). "Built Green" is intended to add value to new home construction by promoting and recognizing the use of practices and products that represents resource-efficient and environmentally friendly construction[i]. Each lot will have a Restrictive Covenant and Architectural Controls registered against it to ensure the promotion and enhancement of the green built design for every developed unit.

Legal Framework

The Green Haven Estates Area Structure Plan (A.S.P.) has been prepared pursuant to provincial legislation, in order to provide for the orderly development of the Plan Area. The Plan is more detailed than the M.D. of Foothills Municipal Development Plan, and is intended to provide a framework for continued subdivision and development within the Plan Area.

The subject property has been identified in the Municipal District of Foothills/Town of Okotoks Intermunicipal Development Plan as part of the Town of Okotoks future urban growth corridor. The landowner and adjacent landowners have requested that the property be removed for the urban growth area as the Town has identified it as future industrial in their Municipal Development plan.

In accordance with Part 17 of the Municipal Government Act (MGA), the Council of a Municipality may, by by-law, adopt the Plan as a statutory document.

The Green Haven Estates Area Structure Plan has been prepared pursuant to Section 633(1) of the Municipal Government Act (MGA) *(RSA 2000, c. M-26)*.

> *633(1) For the purpose of providing a framework for subsequent subdivision and development of an area of land, a council may, by bylaw, adopt an area structure plan.*
>
> *(2) An area structure plan*

[i] Built Green ™ – Alberta – History, www.builtgreenalberta.com

(a) must describe
(i) the sequence of development proposed for the area,
(ii) the land uses proposed for the area, either generally or with respect to specific parts of the area,
(iii) the density of population proposed for the area either generally or with respect to specific parts of the area, and
(iv) the general location of major transportation routes and public utilities,
and
(b) may contain any other matters the council considers necessary.

In addition, this ASP was prepared in accordance with the Municipal District of Foothills No. 31 Municipal Development Plan and Land Use Bylaw and complies with the municipal guidelines for the preparation of Area Structure Plans. Technical information required to complete this Area Structure Plan was obtained in consultation with the Municipal District of Foothills Staff.

Direction for the Plan was provided by the Municipal Development Plan, and examines and addresses the following issues:

a) the proposed land use
b) the sequence of development
c) the location of proposed and existing roads and public utilities
d) the location of reserves
e) water supply and public sewage provisions
f) the developability of the land
g) impacts on surrounding land uses

1.2 Background to the ASP

The objectives of the Plan are as follows:

A. To ensure that the review of any subdivision and/or development proposal is conducted on the basis of approved policies and guidelines for the Plan area;

B. To define a land use strategy, which is in conformity with the overall principles of the Municipal Development Plan.

C. To conform to the provisions of the Municipal Government Act, and applicable provincial standards and regulations.

1.3 The Approval Process

The Municipal District of Foothills No. 31 requires the preparation of an Area Structure Plan to provide a framework for subsequent subdivision and development within the Plan area.

Following circulation and subsequent reviews, the Plan was presented to M.D. Council and Bylaw 36/2006 was adopted as the Green Haven Estates Area Structure Plan. Community and municipal input had been received at various stages in the planning process. In addition, the Developers have circulated adjacent property owners, and held a non-statutory Open House in advance of the public hearing, to gain feedback.

A statutory Public Hearing was held on March 23, 2006. First reading of Bylaw 36/2006 was given March 23, 2006.

Second and third reading was obtained _____, 2006 and Bylaw 36/2006 was adopted.

The Green Haven Estates Area Structure Plan does not supersede, repeal, replace or regulate or otherwise diminish any Statutory Plan in effect in the Plan Area.

1.4 Plan Review and Amendment

Periodic review and occasional amendment of The Green Haven Estates Area Structure Plan may be required in accordance with the *Municipal Government Act*.

1.5 Interpretation

In this Plan:

a) "**Concept Plan**" means a land use concept prepared for the Plan Area.
b) "**Council**" means the Council of the Municipal District of Foothills No. 31
c) "**Developers**" means the landowner and joint venture partners.
d) "**Plan**" means Green Haven Estates Area Structure Plan
e) "**Subdivision Approving Authority**" means the Council of the Municipal District of Foothills No. 31.
f) "**Plan of Subdivision**" means a detailed proposal for development of the land and forms the basis for an application for subdivision.
g) "**Residual Lands**" means all lands within the Plan Area which are not identified for residential, reserve, roadway or utility uses by the Plan

NOT INCLUDED

MR

PHASE 2 ER

0 40 200m

LEGEND

PHASE 1: LOTS 1-27

PHASE 2: LOTS 53-72

PHASE 3 LOTS 28-52

EXISTING RESIDENCE

EXISTING GROUNDWATER WELL

DILLON CONSULTING	PROJECT: GREEN HAVEN ESTATES		PROJECT NO.: 06-6302
DATE: OCTOBER 2006	TITLE: PHASES		FIGURE NO.: 4

FileName: g:\cad\06302\asp\06302-asp.dwg

2.0 THE PLAN AREA

2.1 Regional/Municipal Location

The Plan Area is located immediately adjacent to the east and south of the Town of Okotoks current municipal boundary and is three kilometres west of the intersection of Highway 2 and 370th Avenue. The land gains access from 48th Street East and is north of a residential and campground area. Refer to **Figure 1** for a map of the general Plan Area location.

2.2 Definition of the Plan Area

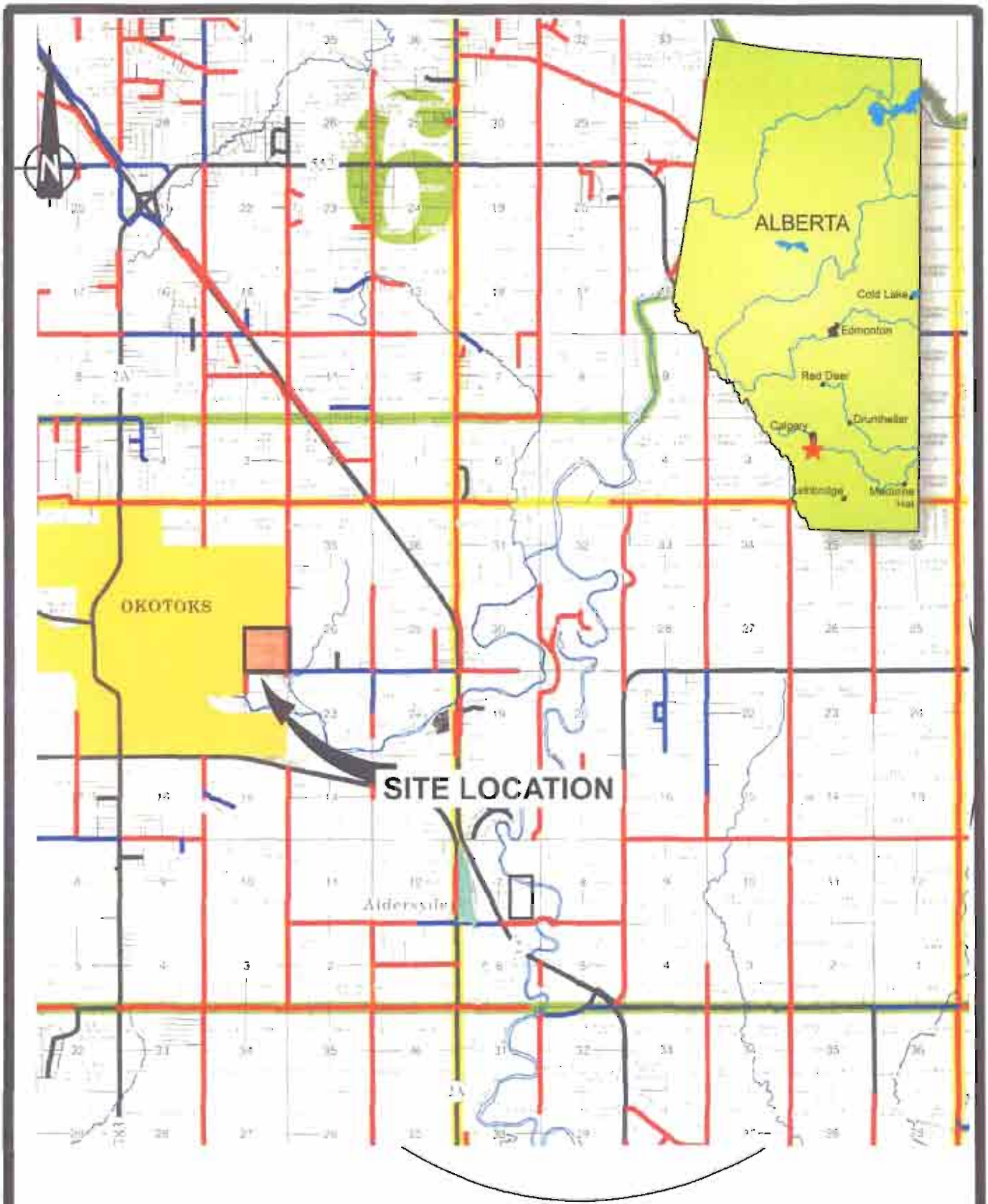
2.2.1 Boundaries of the Plan Area (Figure 2)

The Plan Area is described as those portions of the South East of Section 27; Township 20; Range 29; West of the 4th Meridian which lie west of the road plan for 48th Street East. The Plan Area contains a total area of +/- 127.57 acres (51.62 ha) more or less.

There are three titles in the Plan Area which are presented as follows for clarification.

Title No.	Description	Owner	Acres (*)	Ha
014 289 751	That portion of the south east quarter which lies north of the southerly 1650 feet of the said quarter section	Shelley Lynn Kapeller	38.53	15.59
041 003 905	The south 1650 feet of the south east quarter section	Shelley Lynn Kapeller	78.84	31.9
021 098 304	Plan 9912116, Lot 2	Shelley Lynn Kapeller	10.5	4.249 ha
			127.87	51.739

(*) Areas are given less the registered right of way plan acreage.



DILLON CONSULTING

KJKB

2006.10.23

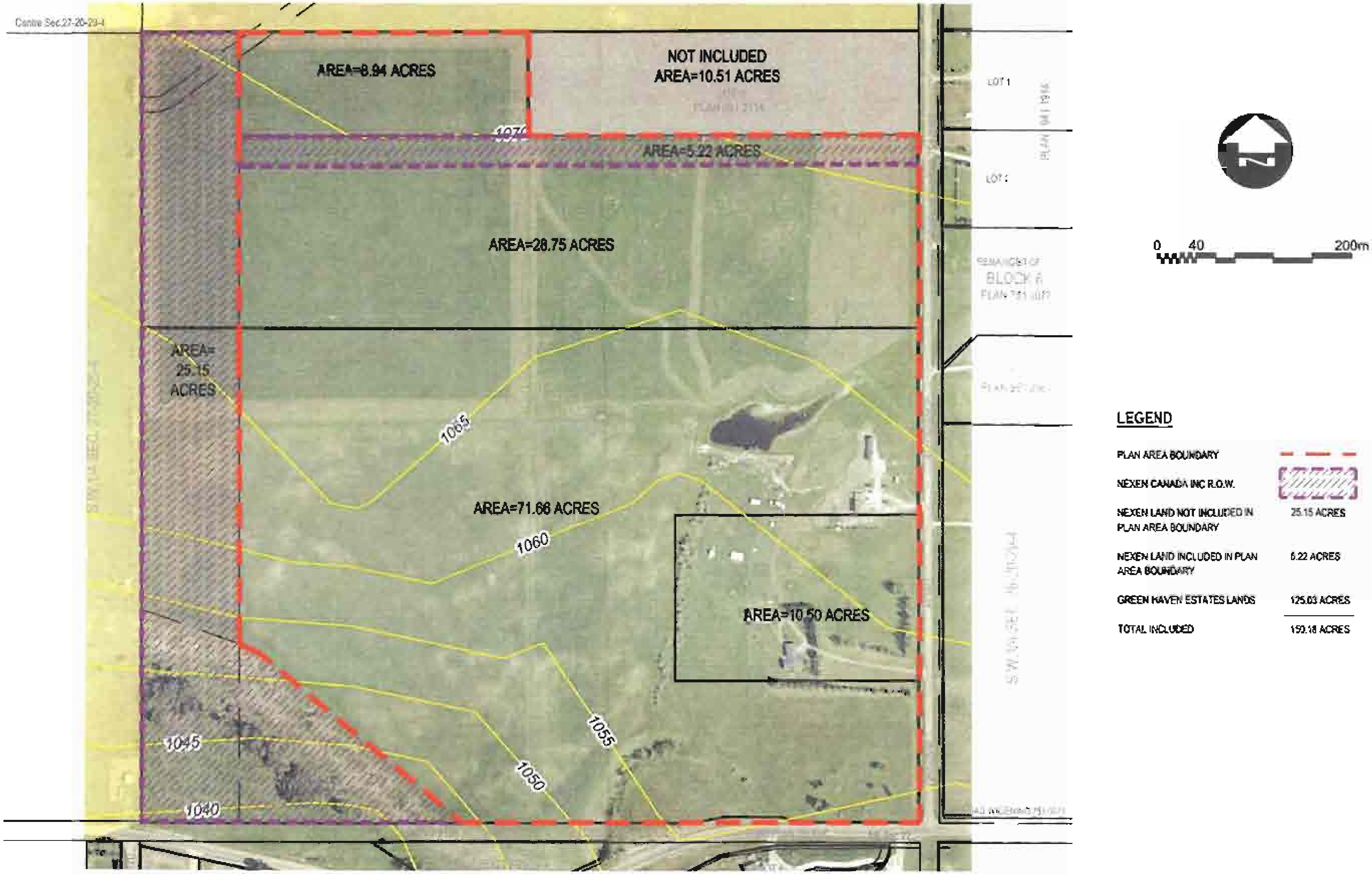
NTS

Site Location Plan

Green Haven Estates
Area Structure Plan

SE 27-21-29 W4M

FIG 1



LEGEND

PLAN AREA BOUNDARY	
NEXEN CANADA INC R.O.W.	
NEXEN LAND NOT INCLUDED IN PLAN AREA BOUNDARY	25.15 ACRES
NEXEN LAND INCLUDED IN PLAN AREA BOUNDARY	5.22 ACRES
GREEN HAVEN ESTATES LANDS	125.03 ACRES
TOTAL INCLUDED	150.18 ACRES

DILLON CONSULTING

PROJECT	GREEN HAVEN ESTATES	PROJECT NO.	06-6302
TITLE	PLAN AREA BOUNDARY	FIGURE NO.	2
DATE	OCTOBER 2006		

For the purpose of this Plan, the boundaries of the various titled areas contained within the Plan Area shall be considered approximate only, and minor variations thereto shall not require an amendment to the Plan.

2.2.2 General Physical Description

The Plan Area lies upon a high plateau overlooking the Town of Okotoks to the west. The south side of the property contains part of a lager escarpment that runs in an east/west direction. Most of these escarpment lands and a 100m strip along the west side are to proposed to be acquired and protected as open space by Nexen Canada Ltd. The upper portion of the property can be described as flat to rolling terrain with extensive native grass and hay cover. The vegetation is characteristic of the general area. The property contains a mix of Canada Land Inventory 5 and 3T soils, which have limited agricultural productive capacity.

3.0 PLAN GOALS AND OBJECTIVES

3.1 Goals and Objectives of the Plan

- To plan a residential development achieving the highest design, aesthetic and environmental standards and in conformance with existing provincial, regional and municipal policy documents.
- To act as a guide under which the Municipal District can review and evaluate specific development proposals.
- To provide a framework for subsequent subdivision and development proposals.
- To establish policies which will direct proposed land use, open space, population density, location of transportation routes, location and methods of utility servicing, phasing of development, site specific issues such as escarpment and highway setbacks and such other matters as Council deems necessary.

3.2 Principles of Development

The major objectives of development are as follows:

a. to ensure all development is in accordance with current statutory policy, provincial, and municipal standards.

b. to provide for built green development in a manner which is sensitive to the rural surroundings and natural environment.
c. to provide a high quality of eco-architectural design and development for all components of the project including residential, and recreational uses and method of servicing.
d. to provide a variety of dwelling units in a medium density range.
e. to facilitate the acquisition of open space as part of Nexen Canada Ltd.'s mitigation of the Wascana business park.
f. to encourage recreational development that is compatible with the surrounding development and takes advantage of natural physical features and large areas of land.
g. to provide, where appropriate, passive and active recreational uses within the Plan Area.
h. to accommodate a water collection and re-use strategy that encourages water conservation and habitat restoration.
i. to address any significant historic sites in the Plan Area.
j. to ensure the provision of municipal reserve.
k. to establish future road requirements that will provide for the safe and efficient movement of traffic in accordance with the long term goals of the Municipality and/or Alberta Infrastructure and Transportation.
l. to provide a high level of services which will not detrimentally affect adjacent and downstream communities.
m. to develop an efficient internal roadway system.
n. to phase development in a logical and efficient manner.
o. to ensure that environmental reserve dedication is provided on lands that qualify in accordance with the Municipal District of Foothills No. 31.
p. to allow the utilization of such environmental areas for public and private outdoor recreational activities such as walking, hiking, wildlife viewing and scenic view appreciation.

4.0 PLAN POLICIES

4.1 The Plan Concept

This section outlines the implementation of the Area Structure Plan objectives and principles of development identified in Section 3.0 as applied to Green Haven Estates Plan Area and reflected in the Land Use Concept Plan ***(Figure 3)***. Green Haven Estates is proposed to contain seventy-two (72) lots to accommodate a mixture of family oriented residential and recreational uses. Lots are divided into sub-categories as follows:

Type of Lot	Number of lots (total)	Number of dwelling units (total)
Residential - Single Family	56	56
Residential - Duplex	13	26
Residential - Triplex	3	9
TOTAL	72	91

This residential community is unique in that it offers a variety of housing types in a country residential setting. Bordering the Town of Okotoks, this community will act as a transition area from an urban setting to country residential and agricultural uses that lay south and east of this development. By providing the option for a variety of housing types in the form of single detached, duplex, and triplex there is an opportunity for families that have varying needs such as empty nesters or young professionals, to live in a country residential community. Extended families can live, congregate, and recreate in the same community. As the lot sizes are proportionate to the number of units, the lot coverage will also be similar.

The Direct Control zoning provides options that include duplex or triplex dwelling alternatives to the homeowner. The Direct Control Guidelines (***Appendix A***) apply to the multi-family sites and will follow all of the land use bylaw general land use regulations and provisions, as well as the minimum requirements, maximum limits, and special requirements of the Residential District. The Direct Control Bylaw adds definitions for duplex, and triplex, along with a minimum site area for each form of development. This will ensure that the requirements of residential land use including front, side, and rear yards, along with height of buildings, are consistent within Direct Control.

All lots are to be developed to Built Green standards and introduced in phases as market forces and development timing dictates. The Plan Area will be centrally serviced from a groundwater source with a central water distribution system (***Appendix B***). Individual package treatment plants (MICRO Fast) with grey water irrigation capabilities will be utilized for wastewater treatment (***Appendix C***). The Plan Area is adjacent to a passive recreational use (park),

0 40 200m

HOUSING TYPE	LOTS	UNITS
SINGLE	56	56
DUPLEX UNITS	13	26
TRIPLEX UNITS	3	9
TOTAL	72	91

LEGEND

- RESIDENTIAL
- DUPLEX UNITS
- TRIPLEX UNITS
- MUNICIPAL RESERVE
- PRIVATE AREA (DC/PUL) HOME OWNERS ASSOCIATION
- WETLAND
- NEXEN ACQUISITION

DILLON CONSULTING	PROJECT: GREEN HAVEN ESTATES		PROJECT NO. 06-6302
DATE: OCTOBER 2006	TITLE: PROPOSED LOT LAYOUT		FIGURE NO. 3

DILLON CONSULTING	PROJECT: GREEN HAVEN ESTATES	PROJECT NO. 06-6302
DATE: OCTOBER 2006	TITLE: PROPOSED LOT LAYOUT	FIGURE NO. 3A

and contains a private area for the Homeowners Association, and a constructed wetland to promote Best Management Practices for stormwater management. The Plan area also contains Municipal Reserve parcels.

What is Built Green?

Built Green homes are designed to provide homeowners with comfortable, durable, environmentally friendly homes that are cost-effective to own and operate. These resource-efficient homes are crafted to exceed building codes and provide homeowners with years of healthy, quality living, while protecting the environment.

The built green mission is to promote environmentally friendly home building methods and practices, and to enhance communities through leadership in sustainable development. Building and development projects are qualified using Built Green checklists, depending on the type of project, organized into environmentally friendly action categories. Builders, remodelers, architects and developers use the checklists prior to construction to determine which features to include in the home.

Goal:

To *comprehensively plan* a *built green recreational and residential development achieving the highest design, aesthetic and environmental standards and in conformance with existing provincial, regional and municipal policy documents*.

Planning Framework

The Plan provides the Municipal District of Foothills with a framework on which to evaluate future redesignation and subdivision applications within the Plan Area. It also allows for but is not limited to:

i. the provision of a common water supply and distribution system;
ii. the provision of a recreation facility in the form of a pathway system to open space areas;
iii. the utilization of sustainable technologies in both the built form and method of servicing, utilizing communal systems whenever possible;
iv. economic viability of the amenities and infrastructure both in terms of built green homes, and common utility servicing;
v. comprehensively planning and developing the entire area, and;
vi. review and resolution of external transportation issues prior to development.

Principle: *To ensure all development is in accordance with current statutory policy and municipal standards.*

Figure 3 conceptually illustrates a proposed land use plan for the Plan Area. The Plan provides for the Nexen Canada Ltd. land acquisition, integrates recreational and residential land uses, and provides Municipal Reserve (MR) and Environmental Reserve (ER) dedications.

The key land use elements are the residential lands with the required communal water system, which form the basis for the built green development economics.

The proposed development layout is aimed at maximizing the site potential, topography, and views, while minimizing any impact on adjacent lands or uses.

The overall theme of the concept provides a comprehensively designed community in a park like setting, in harmony with the natural features of the site and has no adverse impact on surrounding land uses.

4.2 Land Use Component

4.2.1 Residential Land Use

Principle:

To provide for residential land use in a manner which will permit the development of a built green community in a manner that is comprehensive, appropriately phased and is sensitive to the rural surroundings, the environment and existing development in the area.

Policies:

4.2.1.1 The single-family residential development shall conform to provisions of the Foothills Land Use Bylaw including the general and specific setback requirements from highways, property lines and internal roads.

4.2.1.2 The residential lots shall not exceed seventy two (72) in number and dwelling units shall not exceed ninety one (91). Lots shall be a variety of sizes ranging from 0.81 acres (0.33 ha) to 2.54 acres (1.03 ha.).

4.2.1.3 The multi-family residential development may contain a variety of dwelling units in a density range that compliment single-family residential dwelling units and shall conform to the provisions of the Direct Control bylaw. The multi-family sites may be either fee simple

Policy:

4.3.1 The Homeowners Association shall be responsible for the operation and maintenance of a potential private amenity parcel(s), public utility lots, and the constructed wetland and the Municipality shall bear no responsibility for maintenance or operation of these sites.

4.4 Constructed Wetland

A constructed wetland is a water treatment facility. Duplicating the processes occurring in natural wetlands, constructed wetlands are complex, integrated systems in which water, plants, animals, microorganisms and the environment--sun, soil, air--interact to improve water quality.

To the extent that what is human-made is artificial--while what is formed by nature is said to be natural--constructed wetlands are artificial wetlands. Whereas geology, hydrology and biology create natural wetlands, constructed wetlands are the result of human skill and technology. Humans design, build and operate constructed wetlands to treat wastewater.

Yet to refer to constructed wetlands as purely artificial, human-made or engineered is not entirely accurate and slights their most significant feature. By utilizing, and even attempting to optimize the physical, chemical and biological processes of the natural wetland ecosystem, constructed wetlands also are, to various extents, natural environments.

If properly built, maintained and operated, constructed wetlands can effectively remove many pollutants associated with municipal and industrial wastewater and stormwater. Such systems are especially efficient at removing contaminants such as BOD, suspended solids, nitrogen, phosphorus, hydrocarbons, and even metals. They are used to treat municipal effluent, industrial and commercial wastewater, agricultural runoff, stormwater runoff, animal wastes, acid mine drainage and landfill leachates.

Although a primary purpose of constructed wetlands is to treat various kinds of wastewater, the facilities usually serve other purposes as well. Research might be conducted, to study and evaluate the workings of the wetland process. A wetland also can serve as a wildlife site, to attract various animals and provide habitat. Also a wetland can be a public attraction welcoming visitors to explore its environmental and educational possibilities[ii]

[ii] http://ag.arizona.edu/AZWATER/arroyo/094wet.html

Elbow Valley Constructed Wetland[iii]

Policy:

4.4.1 The Constructed Wetland / Stormwater facility shall be utilized primarily for stormwater management and treatment and for educational purposes it shall be constructed by the Developer and maintained and operated by the Homeowner's Association.

4.5 Environmental Considerations

4.5.1 Environmentally Sensitive Areas

Principles:

To allow the utilization of such areas for public and private outdoor recreational activities such as walking, hiking, wildlife viewing and scenic appreciation.

To ensure that areas that qualify as Environmental Reserve are identified and dedicated at the discretion of the Municipality.

There are areas within the Plan Area Boundary that contain slopes in excess of 15% and they have been identified as Environmental Reserve.

Policies:

4.5.1.1 The Municipality may require that the developers, in support of a proposal for redesignation, subdivision or development, and at their sole expense, prepare and submit the following in a form and content satisfactory to the Municipality, and in accordance with all pertinent Alberta Environmental Protection guidelines or

[iii] http://www.riparia.ca/projects/elbow_valley.htm

requirements of the appropriate Provincial or Municipal Departments:

i. A Geotechnical report pursuant to the provisions of the *Municipal Development Plan*;

ii. An Archaeological and/or Historical Resources Impact Assessment pursuant to the provisions of the *Municipal Development Plan* and to the satisfaction of the provincial department of Alberta Culture.

iii. Any additional environmental testing or study deemed necessary by the Municipality (i.e. slope stability testing, percolation testing, high water table testing).

iv. Any additional soil and/or groundwater study as deemed necessary by the Municipality and/or Alberta Environment.

4.6 Reserve Lands

4.6.1 Environmental Reserve

Principle:

To ensure that lands qualifying for dedication are protected through the provision of Environmental Reserve or Environmental Reserve Easement.

Where there are significant slopes identified on the site, these lands shall be protected from development through the dedication of Environmental Reserve or Environmental Reserve Easement, and/or identification outside the building envelope via Restrictive Covenant where appropriate and at the discretion of the Municipality.

Policy:

4.6.1.1 The dedication of environmental reserve (ER) and/or environmental reserve easement (ERE) in the Plan Area shall be considered by the Municipal District at the time of subdivision approval.

4.6.2 Municipal Reserve

Principle:

To ensure the dedication of public land consisting largely of Municipal Reserve (MR) or Environmental Reserve (ER) land that has been dedicated to the Municipality upon development approval.

Policies:

4.6.2.1 Dedication of Municipal Reserve, either by cash-in-lieu of land, deferred reserve caveat, or by physical dedication of land, or combination of same, in the Plan Area shall be determined by the Municipality in accordance with the Policies in this Plan.

4.6.2.2 Lands dedicated for Municipal Reserve should be of similar quality as lands being utilized for development. .

The Land Use Concept Plan (Figure 3) identifies proposed Municipal Reserve parcels within the Plan Area.

4.7 Transportation

Principles:

To establish future highway requirements that will provide for the safe and efficient movement of traffic in accordance with the long-term goals of the Municipality.

The Municipal Road Network

The plan area gains access directly from 48th Street E, a surfaced Municipal road. The developer/landowner will be required to upgrade 48th Street E as a part of the Green Haven Development.

4.7.1 In accordance with municipal policy, the developer may be subject to the Municipal Road Levy and/or be required to improve external roads at the discretion of Council.

The Internal Road Network

Internal roadways will be developed to ac ceptable Municipal Standards, complete with a paved surface.

Policies:

4.7.2 Road access to the residential lots shall be provided by way of internal roads, with ingress/egress directed to 48th Street East. Only two lots shall have direct access to 48 th Street East.

4.7.3 Internal access, roadways required to service the development area shall be designed in accordance with Municipal Standards and constructed at the Developers expense.

4.7.4 Internal subdivision roads shall be constructed to an acceptable Municipal standard at the sole cost of the Developer. The Municipality shall take ownership of roads after issuance of Final Acceptance Certificate.

4.8 Phasing and Density

Principle:

To phase development in a logical and efficient manner.

Given the size and scope of the project a logical phasing plan which considers such factors as servicing, access capacity and potential market absorption is contemplated.

The residential sites are broken into phases which address both market absorption and the servicing considerations. The actual phasing may be varied as a result of detailed utility design and development plans without the need to amend this Plan.

There may be opportunities where phases are applied for concurrently (i.e. – phases 2 & 3 were applied for concurrently) without need to amend this Plan.

Proposed plan for phasing is identified on ***Figure 4***.

Proposed Phasing Table

Phase #	Location	Number of Dwelling Units/Phase
One	Lots #1-27	27
Two	Lots #53-72	32
Three	Lots# 28 - 52	32
TOTAL		91

4.8.1 The overall density of the Plan area shall not exceed a total of 72 residential units and 91 dwelling units.

4.9 Servicing

Principle:

To provide a high level of services which will not detrimentally affect adjacent and downstream communities.

The Plan Area is to have quality development standards in all areas including, the communal water and sewer systems, roadways, landscaping, signage and architectural guidelines/restrictive covenants, aimed a creating a quality recreational and residential environment.

Water Supply (Appendix B)

Of primary importance in a development of this nature is the development of a long term water supply capable of meeting the average and peak daily needs of the development without negatively impacting the existing water supplies in the immediate area. A Preliminary Groundwater Feasibility Assessment was prepared is attached in ***Appendix B***. The Groundwater Feasibility Assessment utilized 100 lots as the base line assessment number for factoring aquifer yield and ability of groundwater sources to service the subject property. This is a higher lot number than is proposed for Green Haven Estates and this was intentional, in order to ensure beyond a doubt that the assessment was accurate.

The Preliminary Groundwater Feasibility Assessment concludes that based upon existing water well flow test information there is a minimum cumulative groundwater potential of 24.9 x 10^6 m^3/year within the upper 90m of the geological section in the region. The additional water requirements for the proposed one hundred lots are much less than the cumulative groundwater potential in the adjacent regions. Therefore, the indication is that there are sufficient groundwater reserves to serve the proposed additional 100 lots in SE ¼ 27-20-29 based upon existing information.

Waste Water Treatment & Disposal (Appendix C)

A package treatment plant is proposed to service this plan area. These plants are currently operating in the Municipal District of Foothills in the ***Pinehurst*** subdivision (NE 1-22-1 W5M) and can be designed for single and multi-family users by addition and expansion of chambers. The FAST plant (Fixed Activated Sludge Treatment) can treat flows of up to 28, 000 imp gal/day of residential or high strength sewage. The ASCO2R treatment plant extends capabilities for on site sewage treatment to 750,000 imp gal/day. The FAST treatment plant is NSF Certified. Each lot owner will treat wastewater in an individual basis. Safe, reliable and affordable, FAST(R) treatment systems work using only naturally occurring biochemical processes. The FAST(R) systems clean wastewater more efficiently and more thoroughly than any practical system available today, including multiple compartment septic tanks and filters.

The FAST(R) process actually transforms biodegradable waste matter into simple carbon dioxide and water useful for flora and fauna. The advanced technology behind FAST(R) was originally developed by Smith & Loveless, a world leader in the design and manufacture of wastewater and sewage treatment systems. The FAST(R) process has been used successfully since 1946 in municipal, industrial, marine, commercial and residential applications. FAST(R) is proven technology that thoroughly cleans wastewater in an environmentally safe and responsible manner before it is released into drain fields, dispersal sites and the environment.

Options for treated wastewater distribution on this site include either year-round trickle irrigation on the lots or treating the wastewater to a recreational standard for discharge to the wetland / storm water facility.

Policies:

4.9.1 Water and Wastewater Systems

4.9.1.1 The water system, inclusive of possibly a water reservoir and distribution system if required, and the wastewater system(s) shall be constructed by the Developers at their sole cost to the design standards of Alberta Environment and the Municipal District of Foothills.

4.9.1.2 The design, operation and maintenance of the water and wastewater treatment facilities shall comply with Alberta Environment guidelines and regulations.

4.9.1.3 Operation and maintenance of the water and wastewater systems shall be undertaken by the Developers until an adequate percentage of the development is occupied.

Ownership, operation and maintenance of the water supply and distribution system shall subsequently be transferred to the Homeowner's Association and be incorporated under the Rural Utilities Act of Alberta at the expiration of the maintenance period or the percentage occupancy as required under the Development Agreement. The Rural Services Coop shall include as members, all homeowners within the proposed development.

4.9.1.4 All capital costs associated with the provision of the facilities will be the sole responsibility of the Developers.

4.9.1.5 The design, operation and maintenance of the proposed communal wastewater treatment system shall comply with Alberta Environment guidelines and regulations and shall be owned and operated by the Homeowner's Association (refer to Appendix C for more information). Should a communal system not be feasible, the developer may install individual systems to the satisfaction of the Municipality.

4.9.3 Storm Water Management

4.9.3.1 The developer shall submit a Storm Water Management Plan, prepared by a Professional Engineer licensed to practice in the Province of Alberta, to the satisfaction of the Municipal District of Foothills No. 31.

4.9.3.2 In accordance with Municipal Storm Water policies, the internal road design shall address storm water management and ensure that all existing drainage patterns are retained. Post-development flows shall not exceed pre-development flows.

4.9.4 Shallow Utilities

4.9.4.1 Extension of shallow utilities shall be the responsibility of the Developers. The right of way and final servicing requirements for electrical, natural gas and telephone shall be determined at the plan of subdivision preparation stage.

APPENDIX A Proposed Direct Control Bylaw

DIRECT CONTROL DISTRICT # XX

PURPOSE AND INTENT

The purpose and intent of this District is to allow for the direct control of Council over multi-family residential development within the Green Haven Estates Plan area legally described as a portion of the South East of Section 27; Township 20; Range 29; West of the 4th Meridian which lie west of the road plan for 48th Street East.

This District will provide for a variety of dwelling units in a low density range that compliment Country Residential while accommodating smaller, affordable, units that are consistent with the policies outlined in the Municipal Development Plan.

LIST OF PERMITTED AND DISCRETIONARY USES

PERMITTED USES GENERAL

Accessory Buildings not requiring a Development Permit – Section 4.2.0(n)
Accessory Uses
Dwellings – Detached Single Family
Signs not requiring a development permit

DISCRETIONARY USES

Accessory Buildings requiring a Development Permit – Section 10.6.0
Dwelling Temporary
Dwelling – Duplex
Dwelling - Triplex
Home Based Business, Minor
Moved Houses on a parcel of land under 80 acres in size
Public Works
Signs requiring a development permit

DEFINITIONS

Notwithstanding Section 3.0.0 Definitions, the following additional Definitions shall apply to this District:

Dwelling – Duplex means a single building comprising of two dwelling units side-by-side, separated from each other by a party-wall extending from foundation to roof, each unit having a separate direct entrance from grade, and of which each unit contains the rooms and amenities included in a detached single family dwelling.

Dwelling - Triplex means a single building comprised of three dwelling units, each unit having a separate direct entrance from grade and of which each unit contains the rooms and amenities included in a detached single family dwelling.

GENERAL REQUIREMENTS

Refer to Section 4.2.0 in the Land Use Bylaw for uses not requiring a development permit and to Section 10.0.0 for the general land use regulations and provisions that apply to this District.

As well, the Minimum Requirements, Maximum Limits, and Special Requirements of Section 13.0.0 Country Residential District shall apply unless otherwise noted below.

MINIMUM REQUIREMENTS
Site Area

Semi–detached	A minimum of 3240 square metres (.80 ac)
Triplex	A minimum of 4450 square metres (1.1 ac)

PROCEEDURE
Notwithstanding the procedure established for development permit applications in Section 3.0.0, an application for a development permit in respect of the lands referred to in Section 18.1.1 shall be referred by the Development Officer to the Council for its approval or refusal.

Notwithstanding the procedure established for the issuance of development permits in Section 4.0.0, the Council shall decide on all applications for development permits for lands referred to in this District. The Council may approve a development permit application with or without conditions, or may refuse an application for development permit.

There is no appeal to the Development Appeal Board from a decision of the Council on an application for a development permit in respect of the lands referred to in this district.

APPENDIX B Groundwater Feasibility Assessment

Shelley Kapeller
Okotoks, Alberta

GROUNDWATER SUPPLY EVALUATION
SE ¼ 27-020-29 W4M
NEAR OKOTOKS, ALBERTA

5340192.003

March 2006

EBA Engineering Consultants Ltd.
p. 403.203.3355 • f. 403.203.3301
Riverbend Atrium One • 115, 200 Rivercrest Drive SE • Calgary, Alberta T2C 2X5 • CANADA

EXECUTIVE SUMMARY

EBA Engineering Consultants Ltd. (EBA) was retained by Ms. Shelley Kapeller to conduct the groundwater supply evaluation for a proposed 100 lot subdivision development at SE ¼ 27-20-29 W4M. The objectives of the groundwater supply evaluation were:

- to investigate the potential of providing enough water from groundwater wells drilled in the proposed subdivision development based on the results of the testing at the exploration well pumping well test (PWT);
- to assess potential interference on nearby water users; and
- to evaluate water quality for domestic use.

The proposed 100 lot subdivision and two existing users at SE ¼ 27-20-29 W4M located near Okotoks, Alberta requires 127,500 m^3/year [i.e., 349.3 m^3/day, 92,289 imperial gallons per day (igpd), 64 imperial gallons per minute (igpm)]. The PWT exploration well was tested to investigate the groundwater yield potential in the proposed development area. The PWT well is completed over a continuous confined aquifer, which extends from 48.5 m to 57.9 m below ground.

The average transmissivity and storativity of the aquifer (29.16 m^2/day and 6.3 x 10^{-3}, respectively) were obtained from pumping test data analysis. Based on these values, a conservative estimate of the sustainable yield of the well PWT is 243.75 m^3/day (37 igpm).

Of the 45 wells located within 1.6 km of the PWT, only 6 wells are screened within the sandstone aquifer located greater than 48 m below grade (mbg). This aquifer is likely a continuous aquifer as it extends across the entire ¼ Section SE 27-20-29 W4M. The remaining wells are completed in the surficial tills or partially screened in the groundwater-bearing sandstone-shale aquifers less than 48 mbg.

The pump test conducted at PWT resulted in a computed long-term safe yield of 245.75 m^3/d (37 igpm) which is slightly less than the required 349.32 m^3/d (64 igpm) required for the proposed 100 users and two existing users. Based on the apparent limited use of the aquifer by other users and the continuous extent of the aquifer, it is likely that one ot more additional wells could be installed within the quarter section to provide a cumulative yield of 349.32 m^3/d (64 igpm). The projected drawdown with distance from PWT demonstrates that the drawdown effects at wells in excess of 1,000 m from PWT will not be significant. Therefore, it is concluded that the aquifer is likely capable of supplying the needs of the existing users and that of the proposed development. In order to obtain a licensed water supply this will need to be confirmed by installing additional wells in the quarter section and conducting pump tests on all these wells.

The results of the analysis of groundwater indicates that watet transmitted by the aquifer meets Canadian Drinking Watet Standards with the exception of total dissolved solids (TDS), which is an aesthetic objective.

Based on the results of the investigation carried out, there is likely sufficient groundwater potential at SE ¼ 27-20-29 W4M for the proposed 100 lot subdivision development and existing users.

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

EBA Engineering Consultants Ltd. (EBA) was retained by Shelley Kapeller to conduct the groundwater supply evaluation for a proposed subdivision at SE ¼ 27-020-29 W4M (Figure 1). The objectives of the groundwater supply evaluation were:

- to investigate the potential of providing sufficient water from groundwater wells drilled at the proposed subdivision based upon the results of testing at the exploration well pumping well test (PWT);
- to assess potential interference on nearby water users; and
- to evaluate water quality for domestic use.

This report summarizes the results of exploration for groundwater between the depths of 0 m and 61 m (0 ft to 200 ft) at SE ¼ 27-020-29 W4M to investigate the feasibility of obtaining 127,500 m^3/year [i.e., 349.3 m^3/day, 92,289 imperial gallons per day (igpd), 64 imperial gallons per minute (igpm)] for a proposed country residential subdivision development and two existing users located near Okotoks, Alberta.

The developer has proposed a subdivision consisting of 100 residential lots within the subject area. The location of the pumping well PWT is shown on Figure 2. This investigation was conducted in accordance with the requirements outlined in the Alberta Environment's (AENV) 2003 publication "Groundwater Evaluation Guideline: Information Required When Submitting Application Under the Water Act". EBA's Environmental Report – General Conditions for conducting environmental work are presented in Appendix A.

1.1 INVESTIGATION METHODOLOGY

The groundwater exploration program described in this report was conducted from October 2005 to March 2006. The groundwater exploration consisted of the following two tasks:

Task 1 – Long-term Pump Test and Field Verified Survey

During this task, a 24 hour pump test followed by a recovery test was conducted. A groundwater sample was collected from the pumped well following the pump test in November 2005. In addition, a field survey to verify existing water wells, springs and dugouts was also conducted. The long-term pump test and data collection was conducted by Peter Niemans Water Well Drilling (Niemans).

Task 2 – Data Analysis and Report Preparation

During this task, the results of the pumping test were analyzed and this report was prepared for submission to Ms. Kapeller. All pump test data for this groundwater supply evaluation was supplied to EBA by Niemans.

2.0 FIELD INVESTIGATION

The field investigation methods used for the aquifer testing, water sampling and well, dugout and spring survey are described in Section 2.1 to Section 2.3.

2.1 AQUIFER TESTING

Aquifer testing was conducted by Niemans using PWT as the pumping well. The pump testing began on November 9, 2005 at 6:47 pm. The pump test involved 24 hours of pumping at a constant rate of approximately 50.74 m^3/day (9.31 igpm). Following this, the pump was turned off and recovery data was collected. Raw data collected during the course of the constant rate pumping and recovery tests are presented in Appendix C.

2.2 WATER SAMPLING

Water samples were collected on November 10, 2005 for submission to Enviro-Test Laboratories (ETL) in Calgary for detailed analysis. The samples submitted to ETL were analyzed for determination of routine parameters [pH, electrical conductivity (EC), Ca, Mg, Na, K, Fe, Mn, Cl, fluoride, phosphate, nitrite, nitrate, sulphate, carbonate, bicarbonate, T-alkalinity, total hardness and total dissolved solids (TDS)], ammonia, ortho-phosphate, sulphide, total kjeldahl nitrogen (TKN), dissolved metals and bacteriological parameters (total and fecal coliforms). The water analyses reports are provided in Appendix D.

2.3 WELL, DUGOUT AND SPRING SURVEY

A search of all Water Well Drilling Reports filed with the Groundwater Information Centre of AENV identified 45 wells drilled within (or close to) 1.6 km (1 mile) of the PWT water well. The AENV records indicate that water in the area is primarily used for domestic purposes. The Water Well Drillers Reports for these wells are contained in Appendix E for reference. Table 1 contains a list of all the above-referenced wells. Included in this table are construction details such as well depth, static water level, screen intervals and completion date. In addition, the legal subdivision location, well owner and water use are identified. Figure 2 shows the approximate location of these wells in addition to PWT. A field survey to identify well users in the area was conducted by EBA personnel.

A review of the immediate area revealed there are no dugouts or springs in the vicinity of the PWT well.

3.0 EXPLORATION PROGRAM RESULTS

3.1 GEOLOGICAL SETTING AND STRATIGRAPHY

The geology in the area has been characterized based upon information gathered from Water Well Drillers Reports and a literature review. In addition, cross-sections were used to aid in defining the site geology. Regional geology and local stratigraphy are presented in Section 3.1 and Seetion 3.2, respectively.

3.1.1 Regional Geology

The site lies within the Interior Plains physiographic regions. Topography is a result of differential erosion and glacial deposition (Ceroici, 1978). Geological and hydrogeological reports and water well lithologs were reviewed for the development area. Surficial deposits in the area consist of unconsolidated Quaternary deposits that typically extend to a depth of 20 m to 30 m and may provide a moderate groundwater resource having well yields on the order of 1 igpm to 5 ipgm. Groundwater wells in the area are typically completed in the bedrock of the Paleocene Porcupine Hills Formation and the upper Cretaceous Willow Creek Formation.

Below the surficial sediments is the bedrock composed of the Paleocene Porcupine Hills Formation. The Porcupine Hills Formation consists of pale grey, thick bedded cherty calcareous sandstone and mudstone to a depth of 60 m (Ozoray and Lytviak, 1974). The Porcupine Hills Formation is underlain by the Paleocene and upper Cretaceous Willow Creek Formation to a depth of approximately 610 m. It consists of pale grey fine grained calcareous sandstone and grey, green and pink bentonitic mudstone with abundant white weathering calcareous concretions (Ozoray and Lytviak, 1974).

3.1.2 Local Stratigraphy

Water Well Drillers Reports from wells in the area similarly identify two stratigraphic units, which dominate rhe area. The upper unit is identified as unconsolidated glacial deposits, which vary in thickness. Generally, the uuconsolidated material consists of sands and gravel mixed with clay deposits. Underlying the glacial deposits is the Porcupine Hills Formation followed by the Willow Creek Formation. The Porcupine Hills Formation is described as a pale grey, thick bedded cherty calcareous sandstone and mudstone. The Porcupine Hills Formation extends up to approximately 61 m near the site. The Willow Creek Formation underlies the Porcupine Hills Formation. The Willow Creek Formation consists of pale grey fine-grained calcareous sandstone and mudstone. At the pumping well there is a sandstone layer from 48.5 m to 57 m below grade (mbg), which is a source of groundwater. Well PWT is screened over this sandstone from 48.5 mbg to 57.9 mbg. Geological cross-section A-B (Figure 4) illustrates the geology in the area of PWT.

3.2 HYDROGEOLOGY

The hydrogeology in the area has heen charactetized based upon information gathered from Water Well Drillers Reports and a literature review. In addition, cross-sections were used to aid in defining the site hydrogeology. Regional and local hydrogeology are presented in Section 3.2.1 and Section 3.2.2, respectively.

3.2.1 Regional Hydrogeology

Groundwater wells in the area are completed in the sandstone and shale intervals of the Porcupine Hills and Willow Creek Formations. Groundwater is generally not produced from the surficial sediments located above the bedrock. The main aquifers are bedrock zones ranging in depth from 24 m to 76 m. Well yields of 5 igpm to 25 igpm are attainable

from the Willow Creek bedrock in fine- to medium-grain sandstones (Ozoray and Litviak, 1974). There were four springs identified in the surrounding area, normally resulting from shallow local flow systems or topographic lows. It should be noted that there are local pockets of sandy gravel deposits scattered throughout the regional area which are capable of high groundwater yields of 100 ipgm or greater (Ozoray and Litviak, 1974).

3.2.2 Local Hydrogeology

As mentioned previously, a search of all Water Well Drilling Reports filed with the Groundwater Information Centre of AENV identified a total of 45 wells (32 domestic well users, five domestic/stock, one domestic/industrial, two municipal, two industrial and three unknown) use within a 1.6 km radius of PWT well (see Figure 3 and Appendix F). Many of these wells are completed in the Porcupine Hills and Willow Creek Formations. Details regarding wells (where available) are provided in Table 1. Figure 2 depicts the well locations within 1.6 km of the PWT well. The 20 year safe yields for these wells ranges from 22.35 m^3/day to 2,667 m^3/day (8,157 m^3/year to 973,610 m^3/year).

A review of the Water Well Drillers Reports confirms that sandstones within the Porcupine Hills and Willow Creek Formations are the dominant aquifers throughout the area. Structural Section A-B (see Figure 4) depicts proven aquifer zones in the vicinity of PWT well. As shown on this figure, the dominant sandstone zones are the main aquifers identified in the vicinity of the PWT well.

Based upon Water Well Drillers Reports, the inferred lateral extent of the sandstone aquifer screened at PWT appears to be quite extensive, on the order of 1 km or more.

3.3 AQUIFER TEST RESULTS AND AQUIFER PARAMETERS

A constant rate pump test was conducted to determine aquifer parameters and the long term yield. The data collected is summarized in Appendix C. Pumping was conducted at 50.74 m^3/day (9.31 igpm) for a period of 24 hours. Following the pump test, recovery was monitored for a period of 24 hours. Water levels were recorded at PWT.

The pump test data has provided a good source of data for aquifer characterization. The pumping test drawdown data was analyzed using the Cooper-Jacob Straight Line Method (refer to Appendix C for details). In addition, aquifer parameters were computed using the results of the recovery data using the Cooper-Jacob Calculated Recovery Method. Aquifer parameters were computed based upon data collected at monitoring well PWT.

TABLE 1: DATA COLLECTED AT MONITORING WELL PWT

Wells	Transmissivity (m^2/day)	Storativity
PWT Cooper-Jacob (Drawdown)	23.81	4.46E-03 (computed)
PWT Cooper Jacob (Recovery)	35.72	8.90E-03 (computed)
Average/Geometric Mean	**29.16**	**6.30×10^{-3}**

The Cooper Jacob semi-log plot of drawdown vs. time for the pumping well did not indicate the presence of recharge or limiting boundaries. The slope of the line did decrease slightly after 100 minutes which is likely the result of developing the well, thereby increasing the well efficiency during pumping (Appendix C). The purpose of this report is to determine the maximum long-term aquifer yield. The aquifer transmissiviry determined by resting has been used to determine the maximum long-term aquifer yield.

3.4 AQUIFER YIELD

The susrainable well yield is a measure the quantity of water a well will provide on a long-term basis. The 20 year well yield (Q_{20}) represents the continuous pumping rate for which the water level in the well is projected to be drawndown to the top of the aquifer. The maximum long-term well yield (Q_{20}) been computed per AENV requirements using the Farvolden formula (1959) as follows:

Q_{20} = (0.68 x T x H x 0.7) (1)

Where Q_{20} = 20 year safe yield (m^3/day)

0.7 = safety factor

0.68 = "heuristic parameter" neglecting radius, srorativity and 8 log cycles of time (20 years, as described by Parks and Bentley)

H = available head = Top of screen – static water level

= 48.78 – 31.21 = 17.56 m

T = transmissivity = 29.16 m^2/day

$\therefore Q_{20}$ = 0.68 (29.16 m^2/day) (17.56 m) (0.7) = 243.74 m^3/day (37 igpm)

It sbould be noted that the proposed 100 lor development and existing two users would require 349.32 m^3/day (64 igpm). Additional wells could be drilled into the aquifer to obtain the required amount of water. If the developer wishes to form a water co-operative then the water supply wells would be required to be licensed. As a component of the license application it would be required to demonstrate to AENV that there is sufficient water availability.

3.5 PROJECTED DRAWDOWN

The drawdown at any distance from the PWT well may be predicted for any time using Theis (Kruseman and de Ridder, 1992). Assuming an average transmissitivity of the aquifer of 29.16 m^2/day, a storativity of 6.3 x 10^{-3} and water production at 243.74 m^3/day (37 igpm) at PWT, the drawdown has been computed for 1 year, 5 years and 20 years. Table 2 provides a summary of predicted drawdown at various distances from the PWT well for wells completed in the same aquifer. Appendix C provides computation details.

Calculations using Theis predict that drawdown effects will be evident at 1,000 m from the pumping well (at 20 years of continuous pumping). It is our experience that significant drawdown effects will not be observed at distances in excess of 1,000 m based upon the transmissitvity of the aquifer. As such, wells that may be affected by pumping are within 1 km of PWT. Table 2 presents the projected drawdown with distance from the pumping well. As shown, the predicted drawdown after 20 years remains significantly less than the available head in the water wells.

TABLE 2: PROJECTED DRAWDOWN DUE TO PRODUCTION AT PWT

Radius(m)	Well ID, AENV Well ID/ Available Head (m)	Drawdown (m) Pumping at 243.74 m^3/day		
		1 Years	5 Years	20 Years
540	AENV 289566/12.5	0.88	1.93	2.81
1100	AENV 249764/14.9	0.85	1.86	2.75
1100	AENV 249765/14.6	0.85	1.86	2.75
1100	AENV 249766/13.1	0.85	1.86	2.75
1100	AENV 249767/18.3	0.85	1.86	2.75
1100	AENV 249768/16.8	0.85	1.86	2.75

3.6 PROJECTED INTERFERENCE

As previously noted, there are 45 existing wells located within 1.6 km of the PWT well (Figure 2). It should be noted that a majority of these wells are used for domestic supply for homes. Of these 45 wells, only 6 wells are screened within the sandstone aquifer located greater than 48 mbg. This aquifer is likely a continuous aquifer as it extends across the entire ¼ Section SE 27-20-29 W4M (Figure 3). The remaining wells are completed in the surficial tills or screened in groundwater-bearing sandstone-shale aquifers less than 48 mbg.

The pump test conducted at PWT resulted in a computed long-term safe yield of 245.75 m^3/d (37 igpm) which is less than the required 349.32 m^3/d (64 igpm). Based on the apparent limited use of the aquifer by other users and the continuous extent of the aquifer, it is likely that one or more additional wells could be installed within the quarter section to provide a cumulative yield of 349.32 m^3/d (64 igpm) or more. The projected drawdown with distance from PWT demonstrates that the drawdown effects at wells in exeess of 1,000 m from PWT will not be significant.

Table 2 provides a representative listing of wells within the area that may be effected by the pumping at PWT. On this table, the available head at each well is compared to the predicted drawdown due to pumping at PWT. As can be seen on this table, the drawdown due to pumping at the PWT well does not exceed the available head of the wells in the area

after 20 years. It should be noted that the calculated cumulative drawdown is conservative because it assumes no recharge and assumes continuous pumping for 20 years and therefore represents a worse case estimate. Actual observed drawdown in the nearby wells will likely be considerably less than shown.

3.7 WATER QUALITY

Water samples collected at the end of the pump test were sent to ETL for analysis (Appendix D). The results of the analyses were compared to Canadian Council of the Ministers of the Environment (CCME, 2004) Drinking Water Guidelines and are summarized in Table 3.

Chemical analysis results show that the water is sodium-bicarbonate type. TDS concentrations exceeded the CCME Guidelines for drinking water (aesthetic objective). Previous studies indicate that sodium-bicarbonate type groundwater and TDS ranging from 500 mg/L to 2,500 mg/L is typical from wells completed in the bedrock (Ceroici, 1978). While sodium concentrations are greater than the CDWQ aesthetic objectives, it is not necessarily a health risk (CCME, 2004).

The acceptable range for TDS in drinking water is based on minimizing corrosion and encrustation and therefore, does not present a health concern (CCME, 2004). In addition, toxic levels of TDS is not defined by CCME; however, AENV considers an aquifer having TDS concentrations less than 4,000 mg/L as a domestic use aquifer (AENV, 2003).

Based on previous studies and the available guidelines, it can be concluded that the TDS concentrations are within the range typically observed in this aquifer in the surrounding area. All the remaining parameter concentrations were found to be within acceptable concentrations defined by the CCME Guidelines. The chemistry of the water produced from the well PWT is considered typical of groundwater in the area.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The production well installed as part of this program (PWT) is completed in a sandstone aquifer. Average transmissivity and srorativity values of 29.16 m^2/day and 6.3 $x10^{-3}$, respectively, were obtained from pumping test data analysis. These values were used to calculate the well yield (Q_{20}), radius of influence and long-term drawdown in the well. Based on these values, a conservative estimate of the sustainable yield of the well is 243.75 m^3/day (37 igpm).

Of the 45 wells located within 1.6 km of the PWT, only 6 wells are screened within the sandstone aquifer located greater than 48 mbg. This aquifer is likely a continuous aquifer as it extends across the entire ¼ section SE 27-20-29 W4M. The remaining wells are completed in the surficial tills or screened in groundwater-bearing sandstone-shale aquifers less than 48 mbg.

The pump test conducted at PWT resulted in a computed long-term safe yield of 245.75 m^3/d (37 igpm) which is slightly less than the required 349.32 m^3/d (64 igpm)

required for the proposed 100 users and two existing users. Based on the apparent limited use of the aquifer by other users and the continuous extent of the aquifer, it is likely that one or more additional wells could be installed within the quarter section to provide a cumulative yield of 349.32 m^3/d (64 igpm). The projected drawdown with distance from PWT demonstrates that the drawdown effects at wells in excess of 1,000 m from PWT will not be significant. Therefore, it is concluded that the aquifer is likely capable of supplying the needs of the existing users and that of the proposed development. In order to obtain a licensed water supply this will need to be confirmed by installing additional wells in the quarter section and conducting pump tests on all these wells.

The results of the analysis of groundwater indicates that water transmitted by the aquifer meets Canadian Drinking Water Standards with the exception of TDS, which is an aesthetic objective.

Based on the results of the investigation carried out, there is likely sufficient groundwater potential at SE ¼ 27-20-29 W4M for the proposed 100 lot subdivision development and existing users.

5.0 DISCLAIMER

It should be noted that this assessment of potential groundwater availability is not a guarantee, but rather an indication of the probability of securing a sustainable groundwater supply from water wells drilled at the proposed subdivision.

6.0 LIMITATIONS OF LIABILITY

The conclusions presented herein are based on the work scope as described in Section 1.0. This report has been prepared for the use of Ms. Kapeller and her agents for the specific application described above in accordance with generally accepted environmental engineering practices. No further warranty is made, either express or implied.

For further limitations, references should be made to EBA's Environmental Report – General Conditions, Appendix A.

7.0 CLOSURE

We trust the information provided satisfies your present requirements. Should you have any questions, please contact Ms. Kelly or Mr. Mailath at our Calgary Riverbend office.

Best Regards,

EBA Engineering Consultants Ltd.

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PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature _____
Date _____
PERMIT NUMBER: P245
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

/ccw

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TABLES

TABLE 1: SUMMARY OF WATER WELLS WITHIN 1.6 KM RADIUS OF THE PROPOSED DEVELOPMENT AT SE 27-020-25 W4M

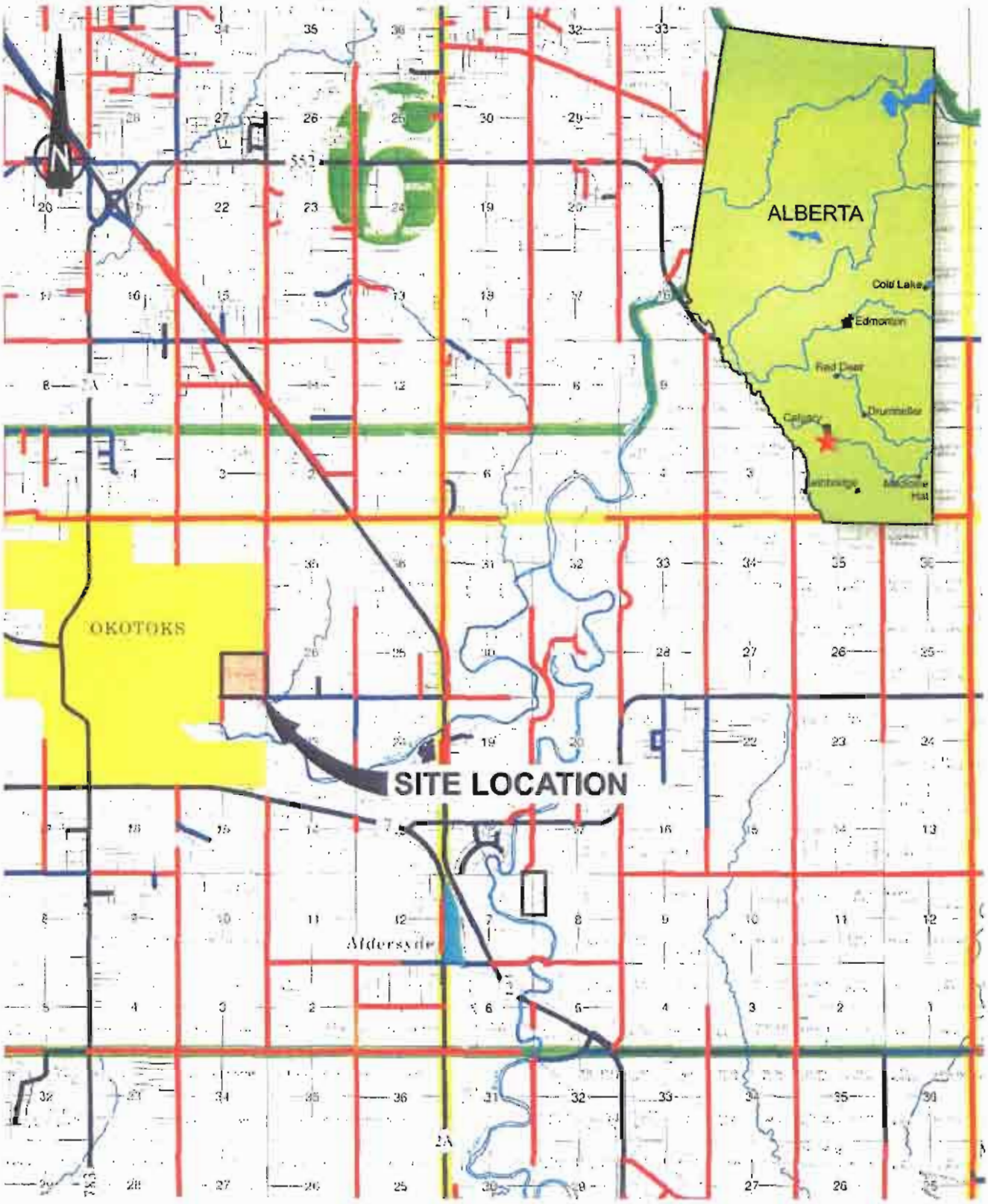
Map Well ID	AENV Well ID	Location	Well Owner	Use	Water Well Elevation (ft)	Date Abandoned	Date Completed	SWL (ft)	PWL (ft)	Pumping Rate (gpm)	Duration of Test (hrs)
NE 22-20-29 W4M											
1	239165	EH 22-20-29 W4M	WRIGHT, J.W.	Unknown	3609		11/20/1967				
2	282140	NE 22-20-29 W4M	CAMP OKOTOKS SOC	Domestic							
3	289566	NE 22-20-29 W4M	WIEBE, HENRY	Domestic			6/3/1998	87	94	6.5	2
NW 22-20-29 W4M											
4	147439	NW 22-20-29 W4M	VIRTUE, GORDON	Domestic & Stock			6/28/1985	10		5	2
5	258326	NW 22-20-29 W4M	OKOTOKS, TOWN OF #1	Municipal							
6	258327	NW 22-20-29 W4M	OKOTOKS, TOWN OF #2	Municipal			5/10/1978				
7	258328	NW 22-20-29 W4M	HENDERSON, R	Domestic			4/17/1979				
8	258329	NW 22-20-29 W4M	CAMP OKOTOKS SOCIETY	Domestic							
9	258330	NW 22-20-29 W4M	STUMPF, HARLEY	Domestic							
NW 23-20-29 W4M											
10	133762	NW 23-20-29 W4M	HERMAN, J	Domestic	3460		4/27/1976	75	80	5	2
11	133763	NW 23-20-29 W4M	RIVER BEND CAMPGROUND	Domestic							
12	150739	NW 23-20-29 W4M	BLOOMIE, M. #1356	Domestic			5/19/1980	70		8	2
SE 26-20-29 W4M											
13	294764	2-26-20-29 W4M	KHAN, A.R.	Domestic			8/9/2000	121	140	3	9
14	294765	2-26-20-29 W4M	KHAN, A.R.	Domestic			8/4/2000	112	117	8	3.5
15	294766	2-26-20-29 W4M	KHAN, R	Domestic			7/26/2000	112	138.8	6.8	2
16	294767	2-26-20-29 W4M	KHAN, A.R	Domestic			8/1/2000	110	140	8.1	2
17	294768	2-26-20-29 W4M	KHAN, A.R	Domestic			7/28/2000	115	139.6	4	2
NW 26-20-29 W4M											
19	133794	NW 26-20-29 W4M	SHARPE, J.G.	Domestic & Stock	3535		1/21/1976	108		16	2
20	133795	NW 26-20-29 W4M	MACKENIE, TONY	Domestic			1/25/1974	50		10	2
21	133796	NW 26-20-29 W4M	MILLEN, LYNDA	Domestic							
22	147570	NW 26-20-29 W4M	ADKINS, J/I #267	Domestic			5/15/1995	101.5	101.9	8	4
23	147661	NW 26-20-29 W4M	HYLAND, KITTH#3131	Domestic			2/27/1997	44		4	2
24	160703	NW 26-20-29 W4M	STONEY, C/G	Domestic							
SW 26-20-29 W4M											
18	288346	3-26-20-29 W4M	CHANUT, D.	Domestic			7/18/1999	107	111	4.1	4
25	125876	SW 26-20-29 W4M	MOORE, RON	Domestic	3475			100			
26	125877	SW 26-20-29 W4M	STIRLING, I.M.	Domestic	3470						
27	133791	SW 26-20-29 W4M	LANE UNT LTD	Domestic			4/1/1975	111		10	2
28	133792	SW 26-20-29 W4M	LANE, MILT	Domestic			4/3/1975	113	120	10	2
29	133793	SW 26-20-29 W4M	BLOOMIE, J.	Domestic	3480		5/9/1978	115		10	2
30	241038	SW 26-20-29 W4M	KIVEA, BERRY	Domestic			7/4/1994	117.19	117.31	7.5	2
SE 27-20-29 W4M											
31	288347	8-27-20-29 W4M	RENARD, RON	Domestic			4/26/1999	102	106	4.1	2
39	133804	SE-27-20-29 W4M	RENARD, R	Domestic & Stock			12/1/1973	26		4	2
NE 27-20-29 W4M											
32	133812	15-27-20-29 W4M	JONES, TOM	Unknown	3530						
NW-27-20-29 W4M											
33	133805	NW-27-20-29 W4M	KUNKHOLM, M.	Domestic				20			
34	133808	NW-27-20-29 W4M	ROWLAND FARMS	Domestic & Stock			8/19/1975	55		12	2
35	133809	NW-27-20-29 W4M	ROWLAND FARMS	Domestic & Stock			8/10/1973				
36	133810	NW-27-20-29 W4M	ROWLAND, O. FARMS	Domestic	3555		6/17/1977	45		50	2
37	133811	NW-27-20-29 W4M	ROWLAND, O. FARMS	Domestic	3555		6/20/1977	38		28	2
38	169297	NW-27-20-29 W4M	ROLLO, COLIN	Domestic							
SW-27-20-29 W4M											
40	133803	SW-27-20-29 W4M	TEXAS GULF #WELL 2	Industrial	3420		7/1/1958	13	15	107	2
41	133806	SW-27-20-29 W4M	TEXAS GULF #WELL 1	Industrial	3415		6/1/1958	11.8	14	107	2
42	155392	SW-27-20-29 W4M	CAN OIL GAS SUP#3B	Domestic							
43	157439	SW-27-20-29 W4M	CAN OIL GAS PLANT	Domestic							
SE-28-20-29 W4M											
44	133823	8-28-20-29 W4M	ALTA ENV #2	Unknown	3425.5		7/31/1975	18.6	21.9	114	2
45	229646	8-28-20-29 W4M	MILLER, BRYINE	Domestic/Industrial			11/4/1993	9	9.13	10	2

Notes:
SWL - Static water level
PWL - Pumping water level

TABLE 2: SUMARY OF WATER ANALYSES

Parameters	Units	Canadian Drinking Water Criteria Concentrations	PWT SE 1/4-020-29 W4
Routine			
pH		6.5 to 8.5	8
Conductivity		--	898
Bicarbonate		--	384
Carbonate		--	<5
Hydroxide		--	<5
Alkalinity, Total		--	315
Hardness		--	61
TDS Calculated		500	581
Sulphide		--	0.011
Nutrients			
Nitrate+Nitrite-N		--	<0.05
Nitrate-N		10	<0.05
Nitrite-N		1	<0.05
Ammonia-N		--	0.38
Sulphate		--	170
Phenols			
Phenols		--	<0.001
Ortho phosphate		--	<0.05
Bacteriological			
Total Coliform		--	53
Fecal Coliform		--	<1
Dissolved Metals			
Aluminum	mg/L	0.1	0.01
Antimony	mg/L	0.006	
Arsenic	mg/L	0.025	
Barium	mg/L	1.0	0.015
Beryllium	mg/L	--	<0.001
Bismuth	mg/L	--	
Boron	mg/L	5	0.09
Cadmium	mg/L	0.005	<0.001
Calcium	mg/L	--	16.7
Chromium	mg/L	0.05	<0.005
Cobalt	mg/L	--	<0.002
Copper	mg/L	1.0	<0.001
Iron	mg/L	0.3	<0.005
Lead	mg/L	0.010	<0.005
Lithium	mg/L	--	
Magnesium	mg/L	--	4.8
Manganese	mg/L	0.05	0.031
Mercury	mg/L	0.001	
Molybdenum	mg/L	--	<0.005
Nickel	mg/L	--	<0.002
Phosphorous	mg/L	--	
Potassium	mg/L	--	1.7
Selenium	mg/L	0.01	
Silicon	mg/L	--	
Silver	mg/L	--	<0.005
Sodium	mg/L	200	194
Strontium	mg/L	--	0.329
Thallium	mg/L	--	
Tin	mg/L	--	
Titanium	mg/L	--	<0.001
Vanadium	mg/L	--	0.001
Zinc	mg/L	5.0	0.002

FIGURES



CLIENT/PROJECT DESCRIPTION

SHELLEY KAPELLER - GERMANN

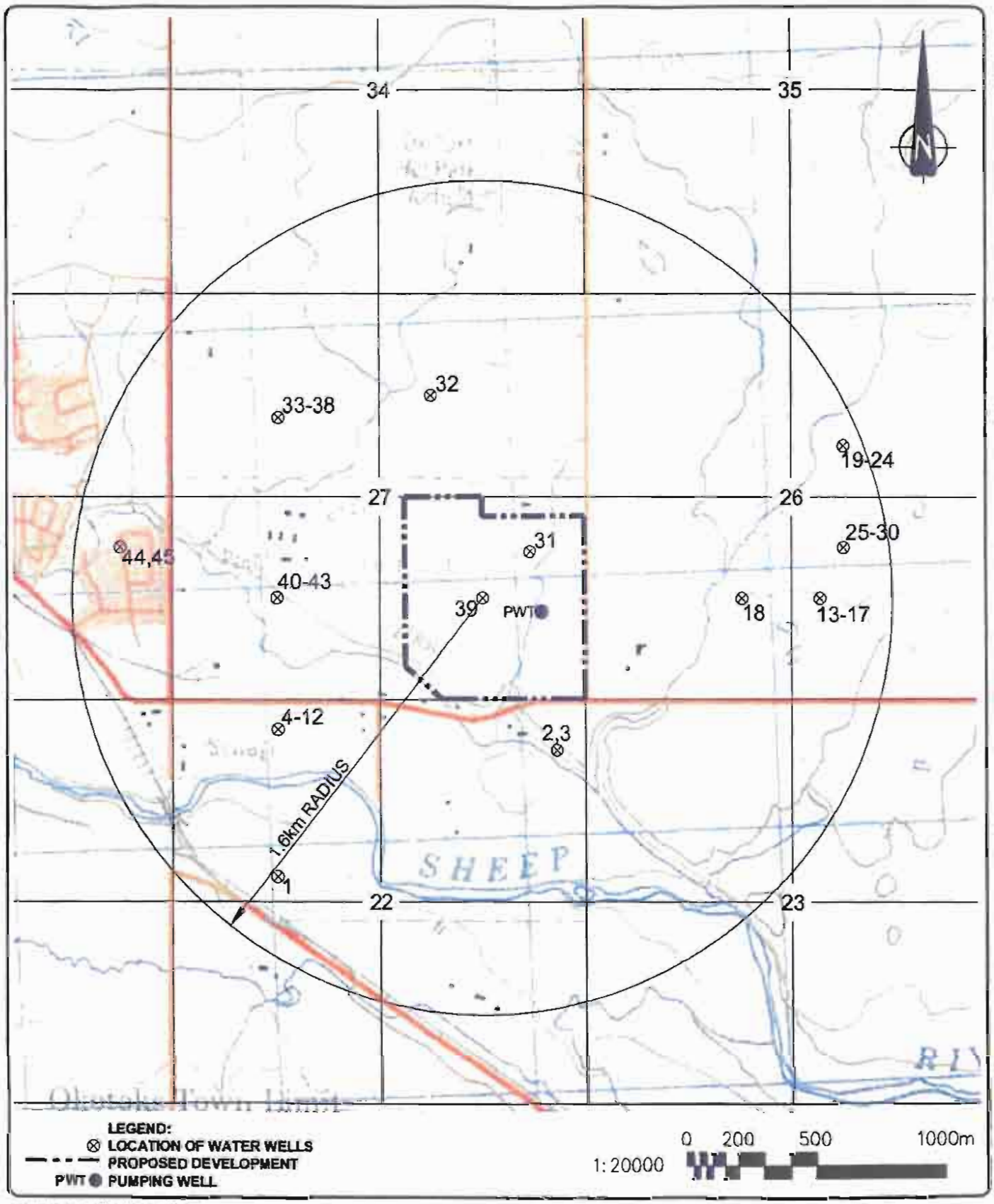
PRELIMINARY GROUNDWATER SUPPLY EVALUATION

SE 27-20-29 W4M

EBA Engineering Consultants Ltd.

SCALE/EBA PROJECT NO.	DATE/DRAWN BY:	TITLE/EBA DRAWING NO.
1:100,000 5340192-003	05/03/15 ANS/KJKB	SITE LOCATION PLAN FIGURE 1

G:\0345\5340192\003\cdr\5340192-003 fg1.cdr



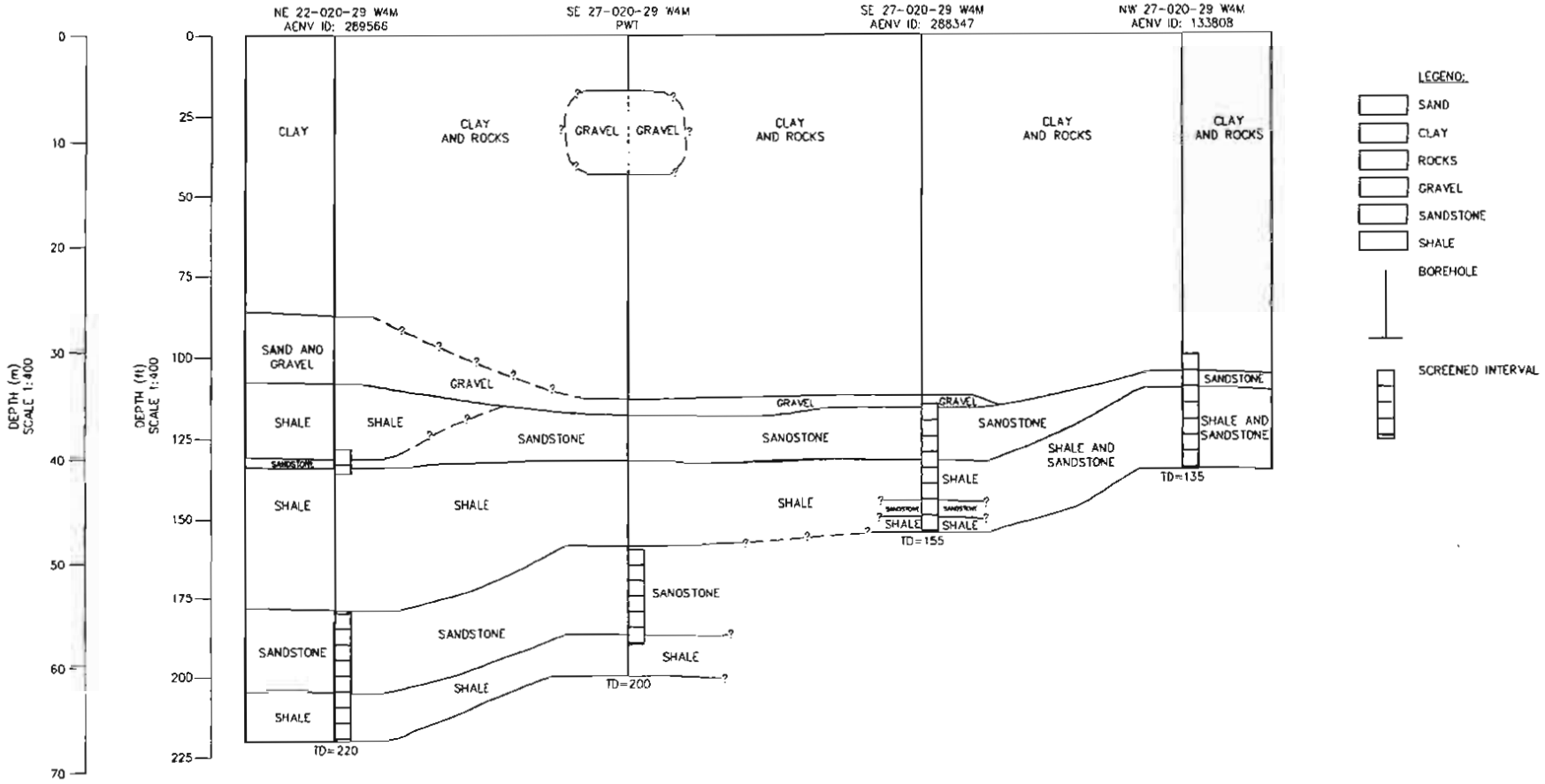
CLIENT/PROJECT DESCRIPTION
SHELLY KAPELLAR – GERMAN
PRELIMINARY GROUNDWATER SUPPLY EVALUATION
SE 1/4-27-020-29 W4M

EBA Engineering Consultants Ltd.

SCALE/EBA PROJECT NO.
AS SHOWN
5340192-003

DATE/DRAWN BY:
06/03/17
DCH/JK

TITLE/EBA DRAWING NO.
PROPOSED DEVELOPMENT SHOWING PUMPING WELL (PWT) AND WATER WELLS WITHIN 1.6km
FIGURE 2



SHEET TITLE

SHELLEY KAPELLER – GERMANN

PRELIMINARY GROUNDWATER SUPPLY ELEVATION

SE 27-020-29 W4M

OKOTOKS, ALBERTA

NOTES

THE GEOLOGIC AND STRATIGRAPHIC SECTIONS SHOWN ON THIS DRAWING ARE INTERPRETED FROM BOREHOLE LOGS. STRATIGRAPHY IS KNOWN WITH CERTAINTY ONLY AT THE BOREHOLE LOCATIONS. ACTUAL STRATIGRAPHY AND GEOLOGIC CONDITIONS BETWEEN BOREHOLES MAY VARY FROM THAT INDICATED ON THIS DRAWING.

DRAWN/CHECKED BY: DCH/JK

DATE/EBA PROJECT NO.: 06/03/17 5340192-003

EBA Engineering Consultants Ltd.

SCALE: AS SHOWN

TITLE/EBA DRAWING NO.: CROSS-SECTION FIGURE 3

APPENDIX

APPENDIX A ENVIRONMENTAL REPORT – GENERAL CONDITIONS

ENVIRONMENTAL REPORT – GENERAL CONDITIONS

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of EBA's client. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 LIMITATIONS OF REPORT

This report is based solely on the conditions which existed on site at the time of EBA's investigation. The client, and any other parties using this report with the express written consent of the client and EBA, acknowledge that conditions affecting the environmental assessment of the site can vary with time and that the conclusions and recommendations set out in this report are time sensitive.

The client, and any other party using this report with the express written consent of the client and EBA, also acknowledge that the conclusions and recommendations set out in this report are based on limited observations and testing on the subject site and that conditions may vary across the site which, in turn, could affect the conclusions and recommendations made.

The client acknowledges that EBA is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the client.

2.1 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of this report, EBA may have relied on information provided by persons other than the client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

3.0 LIMITATION OF LIABILITY

The client recognizes that property containing contaminants and hazardous wastes creates a high risk of claims brought by third parties arising out of the presence of those materials. In consideration of these risks, and in consideration of EBA providing the services requested, the client agrees that EBA's liability to the client, with respect to any issues relating to contaminants or other hazardous wastes located on the subject site shall be limited as follows:

1. With respect to any claims brought against EBA by the client arising out of the provision or failure to provide services hereunder shall be limited to the amount of fees paid by the client to EBA under this Agreement, whether the action is based on breach of contract or tort;
2. With respect to claims brought by third parties arising out of the presence of contaminants or hazardous wastes on the subject site, the client agrees to indemnify, defend and hold harmless EBA from and against any and all claim or claims, action or actions, demands, damages, penalties, fines, losses, costs and expenses of every nature and kind whatsoever, including solicitor-client costs, arising or alleged to arise either in whole or part out of services provided by EBA, whether the claim be brought against EBA for breach of contract or tort.

4.0 JOB SITE SAFETY

EBA is only responsible for the activities of its employees on the job site and is not responsible for the supervision of any other persons whatsoever. The presence of EBA personnel on site shall not be construed in any way to relieve the client or any other persons on site from their responsibility for job site safety.

5.0 DISCLOSURE OF INFORMATION BY CLIENT

The client agrees to fully cooperate with EBA with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The client acknowledges that in order for EBA to properly provide the service, EBA is relying upon the full disclosure and accuracy of any such information.

6.0 STANDARD OF CARE

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

7.0 EMERGENCY PROCEDURES

The client undertakes to inform EBA of all hazardous conditions, or possible hazardous conditions which are known to it. The client recognizes that the activities of EBA may uncover previously unknown hazardous materials or conditions and that such discovery may result in the necessity to undertake emergency procedures to protect EBA employees, other persons and the environment. These procedures may involve additional costs outside of any budgets previously agreed upon. The client agrees to pay EBA for any expenses incurred as a result of such discoveries and to compensate EBA through payment of additional fees and expenses for time spent by EBA to deal with the consequences of such discoveries.

8.0 NOTIFICATION OF AUTHORITIES

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

9.0 OWNERSHIP OF INSTRUMENTS OF SERVICE

The client acknowledges that all reports, plans, and data generated by EBA during the performance of the work and other documents prepared by EBA are considered its professional work product and shall remain the copyright property of EBA.

10.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by EBA shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancies, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by EBA shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. The Client warrants that EBA's instruments of professional service will be used only and exactly as submitted by EBA.

The Client recognizes and agrees that electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

APPENDIX

APPENDIX B WATER WELL DRILLING REPORT FOR PUMPING WELL (PWT)

ENVIRONMENT

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy. All information on this report will be retained in a public database.

Date reported: | Date report received:

1 Contractor & Well Owner Information

Company Name: PEE WEE DRILLING (2004) LTD Approval No.: 00205191-00-00

Mailing Address: RR 1 City or Town: AIRDRIE Postal Code: T4B 2A3

Well Owner's Name: SHELLEY KAPELLER Well Owner has a copy of this report: ☒ Yes ☐ No

Mailing Address: BOX 1315 City or Town: OKOTOKS. Postal Code: T1S 1B3

2 Well Location NORTH WELL

¼ or LSD	Sec	Twp	Rge	West of Meridian
8	27	20	29	4

Location in Quarter: m/ft from ☐ N ☐ S; m/ft from ☐ E ☐ W

Lot / Block / Plan

3 Drilling Information

Type of Work: ☐ Testhole ☒ New Well ☐ Reconditioned ☐ Deepened ☐ Reclaimed well Date reclaimed:

Materials Used: ☐ Owners ☐ Bentonite Product ☐ Other

Proposed well use: ☒ Household (up to 1250 m³ per year with a residence on the property) ☐ Other Specify:

Method of Drilling: ☐ Auger ☐ Boring ☐ Cable tool ☒ Rotary ☐ Combination ☐ Backhoe ☐ Other

4 Formation Log

Depth from ground level ☐ metres ☐ feet — Lithology Description

Depth	Lithology Description
17	Cl & Rks
43	GRAVEL
113	Cl & Rks.
118	GRAVEL.
132	SS
159	Sh
187	SS - H2O
200	Sh.

GPS: N 50.72382 W113.92888

Geophysical Log taken: ☐ Electric ☐ Gamma

Did you encounter: ☐ Mineralized water more than 4000 ppm TDS ☐ Gas

At what depth:

Remedial action taken:

5 Well Yield

Test Date: Start time:

Test method: ☒ Pump ☐ Bailer ☐ Air

Are measurements in metric or (imperial)?

Non pumping static water level: 102.4 Ft. FROM GROUND.

Rate of water removal: 8-11 GPM

Depth of pump intake if pump tested: 195'

Depth bailed or air tested from:

Distance from top of casing to ground level: 8"

Depth to water level

Pumping	Elapsed Time minutes	Recovery
	0	
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	12	
	14	
	16	
	20	
	25	
	30	
	35	
	40	
	50	
	60	
	75	
	90	
	105	
	120	

Total Drawdown:

If water removal was less than 2 hr. duration, reason why:

Recommended pumping rate:

Recommended pump intake:

Pump installed ☐ Yes Depth:

Type:

Any further pumptest information? ☐ Yes ☐ No

6 Well Completion

Date Started (Yr Mo Day): 04 6 1 Date Completed: 04 6 04

Are measurements in metric or (imperial)?

Well Depth: 200 Borehole diameter: 8 3/4 + 5"

Casing type: STEEL ~~PE~~ Liner type: PVC

Size OD: 5.56" ~~6.62~~ Size OD: 4.5

Wall thickness: 0.188 ~~0.2??~~ Wall thickness: 0.214

Bottom at: 121 Top: 40 Bottom: 200

Perforations: from: 160 to: 190

from: to:

Perforation size: 0.01 x 5"

Perforated by: ☒ Saw ☐ Torch ☐ Machine ☐ Other

Seal: ☒ Bentonite product ☒ Driven ☐ Cement / Grout ☐ Other

Sealed interval: from: 0 to: 121

Screen type: Size OD:

Intervals: from: to: slot size:

from: to: slot size:

Installation: ☐ Attached to casing ☐ Telescoped

Fittings: Top ☐ Packer ☐ Coupler Bottom ☐ Wash-down ☐ Bail ☐ Plug

Pack: ☐ Artificial/Mechanical ☐ Natural

Grain size: Amount:

7 Contractor Certification

Driller's Name: DWAYNE KONDRAT

Certification No.: 9985A

This well was constructed in accordance with the Water (Ministerial) Regulation of the Water Act. All information in this report is true.

Signature: [signature] 04 6 12 (Yr Mo Day)

APPENDIX

APPENDIX C RAW PUMPING TEST DATA AND ANALYSIS

Raw Pumping Test Data (PWT)
Pumping Well PWT

		Elapsed time (hrs)	Elapsed time (mins)	Water level (m below casing)	Water level (m below ground)	Drawdown (m)
Time from start of pumping (mins)		0	0	32.02	31.82	0.00
			1	33.26	33.06	1.24
			2	33.41	33.21	1.39
			3	33.54	33.34	1.52
			4	33.65	33.45	1.63
			5	33.75	33.55	1.73
			6	33.80	33.60	1.78
			7	33.89	33.69	1.87
			8	33.95	33.75	1.93
			9	34.00	33.80	1.98
			10	34.06	33.86	2.04
			12	34.16	33.96	2.14
			14	34.25	34.05	2.23
			16	34.32	34.12	2.30
			18	34.39	34.19	2.37
			20	34.44	34.24	2.42
			25	34.56	34.36	2.54
			30	34.62	34.42	2.60
			35	34.74	34.54	2.72
			40	34.77	34.57	2.75
			50	34.90	34.70	2.88
		1	60	34.95	34.75	2.93
		1.5	90	35.14	34.94	3.12
		2	120	35.22	35.02	3.20
		3	180	35.34	35.14	3.32
		4	240	35.41	35.21	3.39
		5	300	35.46	35.26	3.44
		6	360	35.48	35.28	3.46
		7	420	35.51	35.31	3.49
		8	480	35.52	35.32	3.50
		9	540	35.56	35.36	3.54
		10	600	35.58	35.38	3.56
		11	660	35.57	35.37	3.55
		12	720	35.59	35.39	3.57
		13	780	35.60	35.40	3.58
		14	840	35.61	35.41	3.59
		15	900	35.64	35.44	3.62
		16	960	35.65	35.45	3.63
		17	1020	35.65	35.45	3.63
		18	1080	35.69	35.49	3.67
		19	1140	35.70	35.50	3.68
		20	1200	35.72	35.52	3.70
		21	1260	35.70	35.50	3.68
		22	1320	35.70	35.50	3.68
		23	1380	35.72	35.52	3.70
		24	1440	35.71	35.51	3.69
		24.85	1491	35.72	35.52	3.70

Raw Recovery Test Data
Pumping Well PWT
All observations at PWT

		Time from Shutdown (hrs)	Time from Shutdown (mins)	Elapsed time (mins)	Water level (m below casing)	Water level (m below ground)	s-s' (m)	t' (min)
Time since pump turned off (mins)			1	1492.00	34.28	34.08	1.44	1.00
			2	1493.00	34.51	34.31	1.21	2
			3	1494.00	34.40	34.20	1.32	3
			4	1495.00	34.32	34.12	1.40	4
			5	1496.00	34.23	34.03	1.49	5
			6	1497.00	34.16	33.96	1.56	6
			7	1498.00	34.07	33.87	1.65	7
			8	1499.00	34.04	33.84	1.68	8
			9	1500.00	33.98	33.78	1.74	9
			10	1501.00	33.92	33.72	1.80	10
			12	1503.00	33.84	33.64	1.88	12
			14	1505.00	33.77	33.57	1.95	14
			16	1507.00	33.71	33.51	2.01	16
			18	1509.00	33.64	33.44	2.08	18
			20	1511.00	33.59	33.39	2.13	20
			25	1516.00	33.48	33.28	2.24	25
			30	1521.00	33.38	33.18	2.34	30
			35	1526.00	33.31	33.11	2.41	35
			40	1531.00	33.25	33.05	2.47	40
			50	1541.00	33.14	32.94	2.58	50
		1	60	1551.00	33.06	32.86	2.66	60
		1.5	90	1581.00	32.88	32.68	2.84	90
		2	120	1611.00	32.79	32.59	2.93	120
		3	180	1671.00	32.64	32.44	3.08	180
		4	240	1731.00	32.57	32.37	3.15	240
		5	300	1791.00	32.48	32.28	3.24	300
		6	360	1851.00	32.44	32.24	3.28	360
		7	420	1911.00	32.40	32.20	3.32	420
		8	480	1971.00	32.38	32.18	3.34	480
		9	540	2031.00	32.36	32.16	3.36	540
		10	600	2091.00	32.33	32.13	3.39	600
		11	660	2151.00	32.30	32.10	3.42	660
		12	720	2211.00	32.30	32.10	3.42	720
		13	780	2271.00	32.29	32.09	3.43	780
		14	840	2331.00	32.28	32.08	3.44	840
		15	900	2391.00	32.26	32.06	3.46	900
		16	960	2451.00	32.26	32.06	3.46	960
		17	1020	2511.00	32.25	32.05	3.47	1020
		18	1080	2571.00	32.24	32.04	3.48	1080

Notes:
1) Drawdown at equilibrium = s = 35.52m
2) Residual drawdown = s'
3) Time since pump turned off = t'
4) Time since pumping started = t

Pumping Test Analysis

A pumping and recovery test was conducted at PWT well. The test was performed in order to quantify the hydraulic characteristics of the aquifer. The pumping test drawdown data was used to determine aquifer parameters. The pumping and recovery test data was also processed and is presented. No constant head boundary is evident on the late time data at the pumping well.

The raw data derived from the pumping and recovery tests, relevant semi-log plots and computation details for the are presented in the following pages.

Computational Details

Pumping Test

The Cooper-Jacob straight line method (Kruseman and de Ridder, 1992) was used to analyze the late time pumping test data for aquifer parameters. Early drawdown data has a steep slope, likely due to water produced from wellbore storage, and thus cannot be used to compute aquifer parameters using the Cooper-Jacob method. Following the early time period, drawdown data at time greater than approximately 10 minutes, falls approximately on a straight line and represents a confined response.

The assumptions and conditions underlying this method are as follows:

1. Aquifer is effectively infinite (i.e. stretches beyond the zone of influence of the well).
2. Aquifer is confined
3. Aquifer is uniform in thickness
4. Aquifer is homogenous and isotropic
5. Initial piezometric surface is horizontal
6. Pumping rate is constant. Flow to the well in unsteady state.
7. Horizontal flow in the aquifer
8. Negligible storage volume in borehole
9. Well efficiency is 100% (i.e. no hydraulic head losses in pumping hole).
10. The pumped borehole penetrates entire aquifer thickness
11. Water released from storage instantly when head declines

The following is an example of how aquifer parameters (T and S) were calculated from the drawdown pumping test data for the pumping well and the observation wells.

Transmissivity of PWC for drawdown data:

$T = (2.3 \times Q)/(4 \times \pi \times \Delta s)$

Where Q = pumping rate = 50.74 m^3/day

Δs = 0.39 m

$T = 23.81\ m^2/day$

Storativity of PWC for drawdown data:

$S = (2.25 \times T \times t_o)/(r^2)$

Where T = transmissivity = 23.81 m^2/day

t_o = t intercept at s = 0 = 3.0×10^{-7} min

r = well radius = 0.06 m

$S = 4.46 \times 10^{-3}$

Storativity (S) is within typical range for a confined aquifer. It should also be noted that the sandstone aquifer of the Porcupine Hills Formations occurs below unconsolidated clay till deposits. It is therefore felt that the aquifer is very likely confined.

Recovery Test

The Copper-Jacob Calculated Recovery plot of s-s' vs t' is presented for comparative purposes. This method of analysis requires use of late time data to determine Δs-s'. The following is an example of how aquifer parameters (T and S) were calculated from the recovery pumping test data for the pumping well and the observation wells.

$T = (2.3 \times Q)/(4 \times \pi \times \Delta s\text{-}s')$

Where Q = pumping rate = 50.74 m^3/day

Δs -s' = 0.26 m

$T = 35.72\ m^2/day$

Storativity of PWC for drawdown data:

$S = (2.25 \times T \times t')/(r^2)$

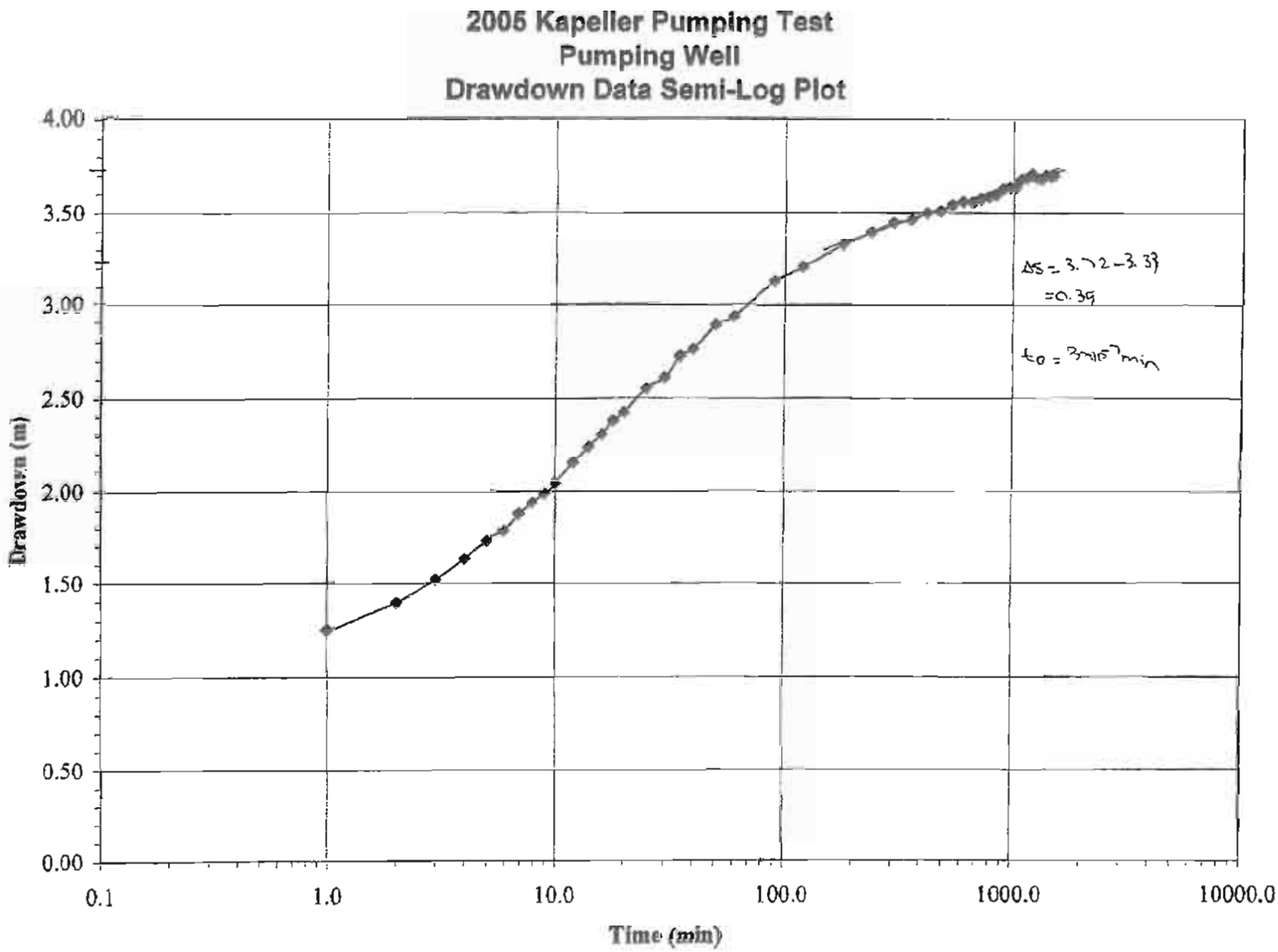
Where T = transmissivity = 35.72 m^2/day

t = t intercept at Δs -s' = 0 = 7.0×10^{-7} min

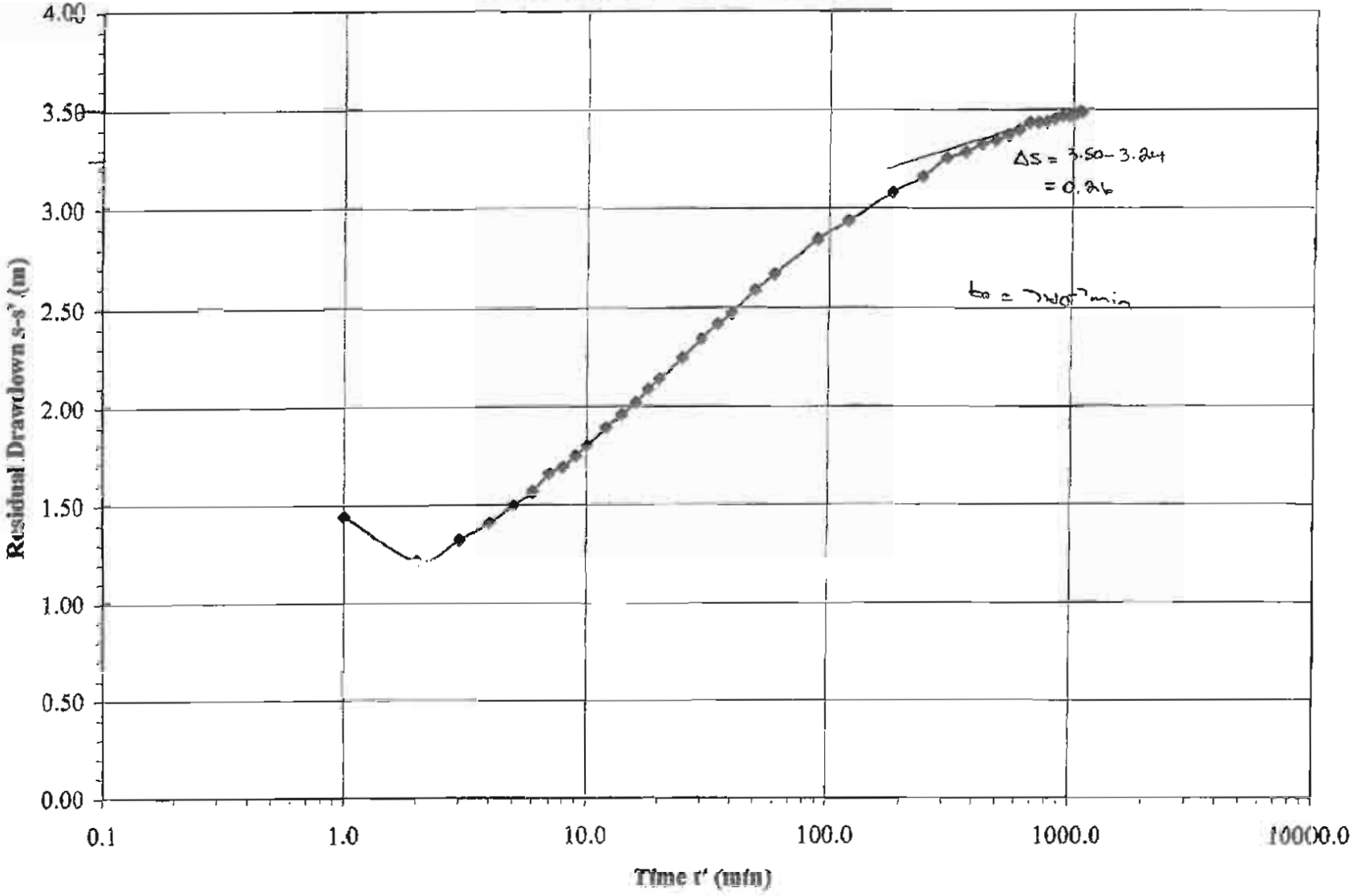
r = well radius = 0.06 m

$S = 8.9 \times 10^{-3}$

Storativity (S) is within typical range for a confined aquifer


2005 Kapeller Pumping Test
Pumping Well
Drawdown Data Semi-Log Plot
Drawdown (m)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (min)
Δs = 3.72 − 3.33
= 0.39
t0 = 3×10^7 min

2005 Kapeller Pumping Test
Pumping Well
Recovery Data Semi-Log Plot



APPENDIX

APPENDIX D ANALYTICAL RESULTS

ENVIRO-TEST ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L339763-1 SE 1/4 27-020-29 W4								
Sampled By: JAMES on 10-NOV-05 @ 13:00								
Matrix: WATER								
Ammonia-N	0.38		0.05	mg/L		15-NOV-05	APH	R346589
Ortho Phosphate as P	<0.05		0.05	mg/L	13-NOV-05	13-NOV-05	HSC	R346205
Phenols (4AAP)	<0.001		0.001	mg/L		14-NOV-05	APH	R346220
Sulphide	0.011		0.003	mg/L		16-NOV-05	SHC	R346978
Total Kjeldahl Nitrogen	0.4		0.2	mg/L	16-NOV-05	16-NOV-05	KMY	R347134
Special Request HydroQual								
Total Coliforms	53			CFU/100mL		12-NOV-05	HQ	R346432
Fecal Coliforms	<1			CFU/100mL		12-NOV-05	HQ	R346432
Major Ions & Dissolved Metals								
Iron (Fe)-Dissolved	<0.005		0.005	mg/L		15-NOV-05	HAS	R346727
Manganese (Mn)-Dissolved	0.031		0.001	mg/L		15-NOV-05	HAS	R346727
Chloride (Cl)	4.7		0.1	mg/L	13-NOV-05	13-NOV-05	HSC	R346205
Nitrate+Nitrite-N	<0.05		0.05	mg/L	13-NOV-05	13-NOV-05	HSC	R346205
Nitrate-N	<0.05		0.05	mg/L	13-NOV-05	13-NOV-05	HSC	R346205
Nitrite-N	<0.05		0.05	mg/L	13-NOV-05	13-NOV-05	HSC	R346205
Sulphate (SO4)	170		0.5	mg/L	13-NOV-05	13-NOV-05	HSC	R346205
pH, Conductivity and Total Alkalinity								
pH	8.0		0.1	pH		14-NOV-05	LHH	R346373
Conductivity (EC)	898		3	uS/cm		14-NOV-05	LHH	R346373
Bicarbonate (HCO3)	384		5	mg/L		14-NOV-05	LHH	R346373
Carbonate (CO3)	<5		5	mg/L		14-NOV-05	LHH	R346373
Hydroxide (OH)	<5		5	mg/L		14-NOV-05	LHH	R346373
Alkalinity, Total (as CaCO3)	315		5	mg/L		14-NOV-05	LHH	R346373
Ion Balance Calculation								
Ion Balance	97.4			%		15-NOV-05		
TDS (Calculated)	581			mg/L		15-NOV-05		
Hardness (as CaCO3)	61			mg/L		15-NOV-05		
ICP metals for routine water								
Calcium (Ca)	16.7		0.5	mg/L		14-NOV-05	KG	R346081
Potassium (K)	1.7		0.1	mg/L		14-NOV-05	KG	R346081
Magnesium (Mg)	4.8		0.1	mg/L		14-NOV-05	KG	R346081
Sodium (Na)	194		1	mg/L		14-NOV-05	KG	R346081
Dissolved Trace Metals								
Silver (Ag)	<0.005		0.005	mg/L		15-NOV-05	CLL	R347138
Aluminum (Al)	0.01		0.01	mg/L		15-NOV-05	CLL	R347138
Boron (B)	0.09		0.05	mg/L		15-NOV-05	CLL	R347138
Barium (Ba)	0.015		0.003	mg/L		15-NOV-05	CLL	R347138
Beryllium (Be)	<0.001		0.001	mg/L		15-NOV-05	CLL	R347138
Cadmium (Cd)	<0.001		0.001	mg/L		15-NOV-05	CLL	R347138
Cobalt (Co)	<0.002		0.002	mg/L		15-NOV-05	CLL	R347138
Chromium (Cr)	<0.005		0.005	mg/L		15-NOV-05	CLL	R347138
Copper (Cu)	<0.001		0.001	mg/L		15-NOV-05	CLL	R347138
Molybdenum (Mo)	<0.005		0.005	mg/L		15-NOV-05	CLL	R347138
Nickel (Ni)	<0.002		0.002	mg/L		15-NOV-05	CLL	R347138
Lead (Pb)	<0.005		0.005	mg/L		15-NOV-05	CLL	R347138
Tin (Sn)	<0.05		0.05	mg/L		15-NOV-05	CLL	R347138
Strontium (Sr)	0.329		0.005	mg/L		15-NOV-05	CLL	R347138
Titanium (Ti)	<0.001		0.001	mg/L		15-NOV-05	CLL	R347138
Thallium (Tl)	<0.05		0.05	mg/L		15-NOV-05	CLL	R347138
Vanadium (V)	<0.001		0.001	mg/L		15-NOV-05	CLL	R347138

ENVIRO-TEST ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By	Batch
L339763-1 SE 1/4 27-020-29 W4								
Sampled By: JAMES on 10-NOV-05 @ 13:00								
Matrix: WATER								
Major Ions & Dissolved Metals								
Dissolved Trace Metals								
Zinc (Zn)	0.002		0.001	mg/L		15-NOV-05	CLL	R347138

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Methods Listed (if applicable):

ETL Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
CL-CL	Water	Chloride (Cl)		APHA 4110 B-Ion Chromatography
ETL-ROUTINE-ICP-CL	Water	ICP metals for routine water		APHA 3120 B-ICP-OES
FE-DIS-ED	Water	Iron (Fe)-Dissolved		EPA 200.7
IONBALANCE-CL	Water	Ion Balance Calculation		APHA 1030E
MET1-DIS-ED	Water	Dissolved Trace Metals		EPA 6020
MN-DIS-ED	Water	Manganese (Mn)-Dissolved		EPA 200.7
N-TOTKJ-ED	Water	Total Kjeldahl Nitrogen		APHA 4500N-C -Dig.-Auto-Colorimetry
N2N3-CL	Water	Nitrate+Nitrite-N		APHA 4110 B-Ion Chromatography
NH4-CL	Water	Ammonia-N		APHA 4500 NH3F-Colorimetry
NO2-CL	Water	Nitrite-N		APHA 4110 B-Ion Chromatography
NO3-IC-CL	Water	Nitrate-N		APHA 4110 B-Ion Chromatography
PH/EC/ALK-CL	Water	pH, Conductivity and Total Alkalinity		APHA 4500H,2510,2320
PHENOLS-CL	Water	Phenols (4AAP)		EPA 9066-Colorimetric
PO4-IC-CL	Water	Ortho-Phosphate		APHA 4110 B - IC
SO4-CL	Water	Sulfate (SO4)		APHA 4110 B-Ion Chromatography
SULPHIDE-ED	Water	Sulphide		APHA 4500 -S E-Auto-Colorimetry

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

213442

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
CL	Enviro-Test Laboratories - Calgary, Alberta, Canada	ED	Enviro-Test Laboratories - Edmonton, Alberta, Canada

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds. The reported surrogate recovery value provides a measure of method efficiency. The Laboratory warning units are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million
mg/L (units) - unit of concentration based on volume, parts per million
< - Less than
D.L. - Detection Limit
N/A - Result not available. Refer to qualifier code and definition for explanation

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

Enviro-Test Laboratories has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, Enviro-Test Laboratories assumes no liability for the use or interpretation of the results.

Enviro-Test Quality Control Report

Workorder: L339763

Client: EBA ENG CONSULTANTS LTD
115, 200 RIVERCREST DR SE
CALGARY AB T2C 2X5

Contact: JAMES ROSS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-CL	Water							
Batch R346205								
WG378216-2 DUP		L339763-1						
Chloride (Cl)		4.7	4.6		mg/L	1.9	10	13-NOV-05
WG378216-4 DUP		L339827-3						
Chloride (Cl)		3.4	3.5		mg/L	3.2	10	13-NOV-05
WG378216-5 DUP		L339827-21						
Chloride (Cl)		1.7	1.7		mg/L	4.5	10	13-NOV-05
WG378216-1 LCS								
Chloride (Cl)			105		%		93-108	13-NOV-05
WG378216-3 MS		L339763-1						
Chloride (Cl)			97		%		88-104	13-NOV-05
ETL-ROUTINE-ICP-CL	Water							
Batch R346081								
WG378099-10 DUP		L339827-30						
Calcium (Ca)		57.4	57.4		mg/L	0.11	10	14-NOV-05
Magnesium (Mg)		44.0	43.9		mg/L	0.24	10	14-NOV-05
Potassium (K)		0.9	0.9	J	mg/L	0.0	0.31	14-NOV-05
Sodium (Na)		6	6	J	mg/L	0	3.1	14-NOV-05
WG378099-11 DUP		L339828-10						
Calcium (Ca)		60.3	60.2		mg/L	0.19	10	14-NOV-05
Magnesium (Mg)		76.8	76.1		mg/L	1.0	10	14-NOV-05
Potassium (K)		36.5	35.2		mg/L	3.8	10	14-NOV-05
Sodium (Na)		36	36		mg/L	0.54	10	14-NOV-05
WG378099-12 DUP		L340254-1						
Calcium (Ca)		123	122		mg/L	0.52	10	14-NOV-05
Magnesium (Mg)		5.7	5.7		mg/L	0.0091	10	14-NOV-05
Potassium (K)		3.1	3.1		mg/L	0.33	10	14-NOV-05
Sodium (Na)		46	46		mg/L	1.6	10	14-NOV-05
WG378099-2 DUP		L339653-4						
Calcium (Ca)		66.5	66.1		mg/L	0.55	10	14-NOV-05
Magnesium (Mg)		39.9	39.5		mg/L	0.94	10	14-NOV-05
Potassium (K)		3.7	3.7		mg/L	1.2	10	14-NOV-05
Sodium (Na)		57	57		mg/L	0.10	10	14-NOV-05
WG378099-4 DUP		L339701-1						
Calcium (Ca)		52.7	53.8		mg/L	2.1	10	14-NOV-05
Magnesium (Mg)		14.5	14.5		mg/L	0.16	10	14-NOV-05

Enviro-Test Quality Control Report

Workorder: L339763

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ETL-ROUTINE-ICP-CL	Water							
Batch R346081								
WG378099-4 DUP		L339701-1						
Potassium (K)		0.8	0.7	J	mg/L	0.1	0.31	14-NOV-05
Sodium (Na)		4	3	J	mg/L	0	3.1	14-NOV-05
WG378099-5 DUP		L339731-10						
Calcium (Ca)		251	238		mg/L	5.2	10	14-NOV-05
Magnesium (Mg)		72.0	67.4		mg/L	6.6	10	14-NOV-05
Potassium (K)		1.2	1.2		mg/L	0.81	10	14-NOV-05
Sodium (Na)		15	14		mg/L	3.6	10	14-NOV-05
WG378099-6 DUP		L339731-19						
Calcium (Ca)		80.6	79.0		mg/L	0.22	10	14-NOV-05
Magnesium (Mg)		34.3	30.8		mg/L	0.97	10	14-NOV-05
Potassium (K)		1.3	1.1		mg/L	2.6	10	14-NOV-05
Sodium (Na)		17	15		mg/L	0.13	10	14-NOV-05
WG378099-7 DUP		L339762-3						
Calcium (Ca)		414	415		mg/L	0.29	10	14-NOV-05
Magnesium (Mg)		127	128		mg/L	0.21	10	14-NOV-05
Potassium (K)		19.7	19.5		mg/L	1.0	10	14-NOV-05
Sodium (Na)		193	189		mg/L	2.1	10	14-NOV-05
WG378099-8 DUP		L339827-10						
Calcium (Ca)		75.6	75.0		mg/L	0.81	10	14-NOV-05
Magnesium (Mg)		35.1	35.5		mg/L	1.1	10	14-NOV-05
Potassium (K)		1.8	1.9		mg/L	5.4	10	14-NOV-05
Sodium (Na)		19	19		mg/L	0.36	10	14-NOV-05
WG378099-9 DUP		L339827-20						
Calcium (Ca)		87.9	88.2		mg/L	0.31	10	14-NOV-05
Magnesium (Mg)		35.2	35.6		mg/L	1.3	10	14-NOV-05
Potassium (K)		2.9	3.0		mg/L	4.6	10	14-NOV-05
Sodium (Na)		9	10	J	mg/L	0	3.1	14-NOV-05
WG378099-1 LCS								
Calcium (Ca)			105		%		99-111	14-NOV-05
Magnesium (Mg)			100		%		94-106	14-NOV-05
Potassium (K)			99		%		95-107	14-NOV-05
Sodium (Na)			105		%		95-107	14-NOV-05
WG378099-3 MS		L339653-4						
Calcium (Ca)			113		%		90-114	14-NOV-05
Magnesium (Mg)			107	H	%		89-107	14-NOV-05
Potassium (K)			106	H	%		90-104	14-NOV-05
Sodium (Na)			108		%		87-113	14-NOV-05
FE-DIS-ED	Water							

Enviro-Test Quality Control Report

Workorder: L339763

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
FE-DIS-ED	Water							
Batch R346727								
WG378606-10 DUP		L340247-5						
Iron (Fe)-Dissolved		<0.005	<0.005	RPD-NA	mg/L	N/A	20	15-NOV-05
WG378606-12 DUP		L340247-15						
Iron (Fe)-Dissolved		<0.005	<0.005	RPD-NA	mg/L	N/A	20	15-NOV-05
WG378606-8 DUP		L339828-12						
Iron (Fe)-Dissolved		0.012	0.011	J	mg/L	0.001	0.015	15-NOV-05
WG378606-1 MB								
Iron (Fe)-Dissolved			<0.005		mg/L		0.005	15-NOV-05
WG378606-11 MS		L340247-5						
Iron (Fe)-Dissolved			100		%		75-125	15-NOV-05
WG378606-13 MS		L340247-15						
Iron (Fe)-Dissolved			99		%		75-125	15-NOV-05
WG378606-9 MS		L339828-12						
Iron (Fe)-Dissolved			98		%		75-125	15-NOV-05
MET1-DIS-ED	Water							
Batch R347138								
WG378669-2 CRM		1643E_WATER						
Aluminum (Al)			110		%		95-115	15-NOV-05
Barium (Ba)			97		%		92-105	15-NOV-05
Beryllium (Be)			88		%		85-108	15-NOV-05
Boron (B)			90		%		89-109	15-NOV-05
Cadmium (Cd)			96		%		93-106	15-NOV-05
Chromium (Cr)			102		%		94-110	15-NOV-05
Cobalt (Co)			99		%		92-105	15-NOV-05
Copper (Cu)			100		%		94-107	15-NOV-05
Lead (Pb)			101		%		94-106	15-NOV-05
Molybdenum (Mo)			97		%		93-106	15-NOV-05
Nickel (Ni)			97		%		91-105	15-NOV-05
Strontium (Sr)			93		%		91-105	15-NOV-05
Vanadium (V)			96		%		92-109	15-NOV-05
Zinc (Zn)			97		%		84-114	15-NOV-05
WG378669-1 MB								
Aluminum (Al)			<0.01		mg/L		0.05	15-NOV-05
Barium (Ba)			<0.003		mg/L		0.015	15-NOV-05
Beryllium (Be)			<0.001		mg/L		0.005	15-NOV-05
Boron (B)			<0.05		mg/L		0.25	15-NOV-05
Cadmium (Cd)			<0.001		mg/L		0.005	15-NOV-05
Chromium (Cr)			<0.005		mg/L		0.025	15-NOV-05
Cobalt (Co)			<0.002		mg/L		0.01	15-NOV-05
Copper (Cu)			<0.001		mg/L		0.005	15-NOV-05

Enviro-Test Quality Control Report

Workorder: L339763

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET1-DIS-ED	Water							
Batch R347138								
WG378669-1 MB								
Lead (Pb)			<0.005		mg/L		0.025	15-NOV-05
Molybdenum (Mo)			<0.005		mg/L		0.025	15-NOV-05
Nickel (Ni)			<0.002		mg/L		0.01	15-NOV-05
Phosphorus (P)			<0.1		mg/L		0.1	15-NOV-05
Silver (Ag)			<0.005		mg/L		0.025	15-NOV-05
Strontium (Sr)			<0.005		mg/L		0.025	15-NOV-05
Thallium (Tl)			<0.05		mg/L		0.25	15-NOV-05
Tin (Sn)			<0.05		mg/L		0.25	15-NOV-05
Titanium (Ti)			<0.001		mg/L		0.005	15-NOV-05
Vanadium (V)			<0.001		mg/L		0.005	15-NOV-05
Zinc (Zn)			<0.001		mg/L		0.005	15-NOV-05
MN-DIS-ED	Water							
Batch R346727								
WG378606-10 DUP		L340247-5						
Manganese (Mn)-Dissolved		0.016	0.016		mg/L	0.0	20	15-NOV-05
WG378606-12 DUP		L340247-15						
Manganese (Mn)-Dissolved		0.073	0.073		mg/L	0.0	20	15-NOV-05
WG378606-8 DUP		L339828-12						
Manganese (Mn)-Dissolved		0.006	0.006	J	mg/L	0.000	0.0031	15-NOV-05
WG378606-1 MB								
Manganese (Mn)-Dissolved			<0.001		mg/L		0.001	15-NOV-05
WG378606-11 MS		L340247-6						
Manganese (Mn)-Dissolved			98		%		75-125	15-NOV-05
WG378606-13 MS		L340247-15						
Manganese (Mn)-Dissolved			99		%		75-125	15-NOV-05
WG378606-9 MS		L339828-12						
Manganese (Mn)-Dissolved			98		%		75-125	15-NOV-05
N-TOTKJ-ED	Water							
Batch R347134								
WG379082-6 DUP		L340450-1						
Total Kjeldahl Nitrogen		1.4	1.6	J	mg/L	0.2	0.61	16-NOV-05
WG379082-2 LCS								
Total Kjeldahl Nitrogen			98		%		66-113	16-NOV-05
WG379082-3 LCS								
Total Kjeldahl Nitrogen			107		%		66-124	16-NOV-05
WG379082-4 LCS								
Total Kjeldahl Nitrogen			99		%		87-112	16-NOV-05
WG379082-1 MB								
Total Kjeldahl Nitrogen			<0.2		mg/L		0.2	16-NOV-05
WG379082-5 MS		L337926-2						

Enviro-Test Quality Control Report

Workorder: L339763

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
N-TOTKJ-ED	Water							
Batch R347134								
WG378082-6 MS		L337926-2						
Total Kjeldahl Nitrogen			106		%		69-124	16-NOV-05
N2N3-CL	Water							
Batch R346206								
WG378216-2 DUP		L339763-1						
Nitrate+Nitrite-N		<0.05	<0.05	RPD-NA	mg/L	N/A	13	13-NOV-05
WG378216-4 DUP		L339827-3						
Nitrate+Nitrite-N		<0.05	<0.05	RPD-NA	mg/L	N/A	13	13-NOV-05
WG378216-5 DUP		L339827-21						
Nitrate+Nitrite-N		14.1	14.5		mg/L	3.2	13	13-NOV-05
WG378216-1 LCS								
Nitrate+Nitrite-N			104		%		94-105	13-NOV-05
WG378216-3 MS		L339763-1						
Nitrate+Nitrite-N			102		%		91-106	13-NOV-05
NH4-CL	Water							
Batch R346589								
WG378717-3 DUP		L339763-1						
Ammonia-N		0.38	0.36	J	mg/L	0.02	0.15	15-NOV-05
WG378717-1 LCS								
Ammonia-N			98		%		91-112	15-NOV-05
WG378717-2 MB								
Ammonia-N			<0.05		mg/L		0.05	15-NOV-05
WG378717-4 MS		L339763-1						
Ammonia-N			98		%		84-113	15-NOV-05
NO2-CL	Water							
Batch R346205								
WG378216-2 DUP		L339763-1						
Nitrite-N		<0.05	<0.05	RPD-NA	mg/L	N/A	13	13-NOV-05
WG378216-4 DUP		L339827-3						
Nitrite-N		<0.05	<0.05	RPD-NA	mg/L	N/A	13	13-NOV-05
WG378216-5 DUP		L339827-21						
Nitrite-N		<0.05	0.07	RPD-NA	mg/L	N/A	13	13-NOV-05
WG378216-1 LCS								
Nitrite-N			98		%		93-107	13-NOV-05
WG378216-3 MS		L339763-1						
Nitrite-N			102		%		95-108	13-NOV-05
NO3-IC-CL	Water							
Batch R346206								
WG378216-2 DUP		L339763-1						
Nitrate-N		<0.05	<0.05	RPD-NA	mg/L	N/A	13	13-NOV-05
WG378216-4 DUP		L339827-3						

Enviro-Test Quality Control Report

Workorder: L339763

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-CL	Water							
Batch R346205								
WG378216-4 DUP		L339827-3						
Nitrate-N		<0.05	<0.05	RPD-NA	mg/L	N/A	13	13-NOV-05
WG378216-5 DUP		L339827-21						
Nitrate-N		14.1	14.5		mg/L	2.8	13	13-NOV-05
WG378216-1 LCS								
Nitrate-N			104		%		92-106	13-NOV-05
WG378216-3 MS		L339763-1						
Nitrate-N			99		%		91-102	13-NOV-05
PH/EC/ALK-CL	Water							
Batch R346373								
WG378441-10 DUP		L339827-30						
Alkalinity, Total (as CaCO3)		304	293		mg/L	3.6	5	14-NOV-05
Bicarbonate (HCO3)		370	357		mg/L	3.6	4.9	14-NOV-05
Carbonate (CO3)		<5	<5	RPD-NA	mg/L	N/A	8.9	14-NOV-05
Conductivity (EC)		610	629		uS/cm	3.1	7.5	14-NOV-05
Hydroxide (OH)		<5	<5	RPD-NA	mg/L	N/A	5	14-NOV-05
pH		7.6	7.6	J	pH	0.0	0.1	14-NOV-05
WG378441-11 DUP		L339828-10						
Alkalinity, Total (as CaCO3)		274	266		mg/L	2.7	5	14-NOV-05
Bicarbonate (HCO3)		334	325		mg/L	2.7	4.9	14-NOV-05
Carbonate (CO3)		<5	<5	RPD-NA	mg/L	N/A	8.9	14-NOV-05
Conductivity (EC)		1190	1190		uS/cm	0.0	7.5	14-NOV-05
Hydroxide (OH)		<5	<5	RPD-NA	mg/L	N/A	5	14-NOV-05
pH		7.6	7.6	J	pH	0.0	0.1	14-NOV-05
WG378441-2 DUP		L339663-10						
Alkalinity, Total (as CaCO3)		422	414		mg/L	1.9	5	14-NOV-05
Bicarbonate (HCO3)		515	505		mg/L	1.9	4.9	14-NOV-05
Carbonate (CO3)		<5	<5	RPD-NA	mg/L	N/A	8.9	14-NOV-05
Conductivity (EC)		2840	2830		uS/cm	0.35	7.5	14-NOV-05
Hydroxide (OH)		<5	<5	RPD-NA	mg/L	N/A	5	14-NOV-05
pH		7.3	7.3	J	pH	0.0	0.1	14-NOV-05
WG378441-3 DUP		L339731-1						
Alkalinity, Total (as CaCO3)		346	348		mg/L	0.58	5	14-NOV-05
Bicarbonate (HCO3)		423	425		mg/L	0.58	4.9	14-NOV-05
Carbonate (CO3)		<5	<5	RPD-NA	mg/L	N/A	8.9	14-NOV-05
Conductivity (EC)		611	608		uS/cm	0.49	7.5	14-NOV-05
Hydroxide (OH)		<5	<5	RPD-NA	mg/L	N/A	5	14-NOV-05
pH		7.3	7.3	J	pH	0.0	0.1	14-NOV-05
WG378441-4 DUP		L339731-9						
Alkalinity, Total (as CaCO3)		439	436		mg/L	0.64	5	14-NOV-05

Enviro-Test Quality Control Report

Workorder: L339763

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-CL	Water							
Batch R346373								
WG378441-4 DUP		L339731-9						
Bicarbonate (HCO3)		536	532		mg/L	0.64	4.9	14-NOV-05
Carbonate (CO3)		<5	<5	RPD-NA	mg/L	N/A	8.9	14-NOV-05
Conductivity (EC)		890	898		uS/cm	0.89	7.5	14-NOV-05
Hydroxide (OH)		<5	<5	RPD-NA	mg/L	N/A	5	14-NOV-05
pH		7.0	7.1	J	pH	0.1	0.1	14-NOV-05
WG378441-5 DUP		L339731-20						
Alkalinity, Total (as CaCO3)		311	313		mg/L	0.56	5	14-NOV-05
Bicarbonate (HCO3)		380	382		mg/L	0.56	4.9	14-NOV-05
Carbonate (CO3)		<5	<5	RPD-NA	mg/L	N/A	8.9	14-NOV-05
Conductivity (EC)		553	550		uS/cm	0.54	7.5	14-NOV-05
Hydroxide (OH)		<5	<5	RPD-NA	mg/L	N/A	5	14-NOV-05
pH		7.8	7.7	J	pH	0.0	0.1	14-NOV-05
WG378441-6 DUP		L339736-30						
Alkalinity, Total (as CaCO3)		254	244		mg/L	4.2	5	14-NOV-05
Bicarbonate (HCO3)		310	297		mg/L	4.2	4.9	14-NOV-05
Carbonate (CO3)		<5	<5	RPD-NA	mg/L	N/A	8.9	14-NOV-05
Conductivity (EC)		878	862		uS/cm	1.8	7.5	14-NOV-05
Hydroxide (OH)		<5	<5	RPD-NA	mg/L	N/A	5	14-NOV-05
pH		7.2	7.1	J	pH	0.1	0.1	14-NOV-05
WG378441-7 DUP		L339827-1						
Alkalinity, Total (as CaCO3)		490	485		mg/L	0.92	5	14-NOV-05
Bicarbonate (HCO3)		597	592		mg/L	0.92	4.9	14-NOV-05
Carbonate (CO3)		<5	<5	RPD-NA	mg/L	N/A	8.9	14-NOV-05
Conductivity (EC)		901	893		uS/cm	0.89	7.5	14-NOV-05
Hydroxide (OH)		<5	<5	RPD-NA	mg/L	N/A	5	14-NOV-05
pH		7.6	7.6	J	pH	0.0	0.1	14-NOV-05
WG378441-8 DUP		L339827-10						
Alkalinity, Total (as CaCO3)		329	315		mg/L	4.3	5	14-NOV-05
Bicarbonate (HCO3)		402	385		mg/L	4.3	4.9	14-NOV-05
Carbonate (CO3)		<5	<5	RPD-NA	mg/L	N/A	8.9	14-NOV-05
Conductivity (EC)		672	671		uS/cm	0.15	7.5	14-NOV-05
Hydroxide (OH)		<5	<5	RPD-NA	mg/L	N/A	5	14-NOV-05
pH		7.3	7.3	J	pH	0.0	0.1	14-NOV-05
WG378441-9 DUP		L339827-20						
Alkalinity, Total (as CaCO3)		346	347		mg/L	0.52	5	14-NOV-05
Bicarbonate (HCO3)		422	424		mg/L	0.52	4.9	14-NOV-05
Carbonate (CO3)		<5	<5	RPD-NA	mg/L	N/A	8.9	14-NOV-05
Conductivity (EC)		705	706		uS/cm	0.14	7.5	14-NOV-05

Enviro-Test Quality Control Report

Workorder: L339763

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-CL	Water							
Batch R346373								
WG378441-8 DUP		L339827-20						
Hydroxide (OH)		<5	<5	RPD-NA	mg/L	N/A	5	14-NOV-05
pH		7.3	7.3	J	pH	0.0	0.1	14-NOV-05
WG378441-1 LCS								
Alkalinity, Total (as CaCO3)			100		%		93-105	14-NOV-05
Carbonate (CO3)			95		%		89-102	14-NOV-05
Conductivity (EC)			99		%		93-105	14-NOV-05
pH			7.0		pH		6.9-7.1	14-NOV-05
PHENOLS-CL	Water							
Batch R346220								
WG378153-3 DUP		L339653-8						
Phenols (4AAP)		<0.001	<0.001	RPD-NA	mg/L	N/A	13	14-NOV-05
WG378153-5 DUP		L339818-2						
Phenols (4AAP)		<0.001	<0.001	RPD-NA	mg/L	N/A	13	14-NOV-05
WG378153-1 LCS								
Phenols (4AAP)			92		%		81-103	14-NOV-05
WG378153-2 MB								
Phenols (4AAP)			<0.001		mg/L		0.001	14-NOV-05
WG378153-4 MS		L339653-8						
Phenols (4AAP)			97		%		83-111	14-NOV-05
PO4-IC-CL	Water							
Batch R346205								
WG378216-2 DUP		L339763-1						
Ortho Phosphate as P		<0.05	<0.05	RPD-NA	mg/L	N/A	25	13-NOV-05
WG378216-1 LCS								
Ortho Phosphate as P			101		%		91-116	13-NOV-05
WG378216-3 MS		L339763-1						
Ortho Phosphate as P			84		%		79-105	13-NOV-05
SO4-CL	Water							
Batch R346205								
WG378216-2 DUP		L339763-1						
Sulphate (SO4)		170	169		mg/L	0.52	10	13-NOV-05
WG378216-4 DUP		L339827-3						
Sulphate (SO4)		36.8	37.3		mg/L	1.4	10	13-NOV-05
WG378216-5 DUP		L339827-21						
Sulphate (SO4)		33.7	34.6		mg/L	2.7	10	13-NOV-05
WG378216-1 LCS								
Sulphate (SO4)			103		%		94-107	13-NOV-05
WG378216-3 MS		L339763-1						
Sulphate (SO4)			100		%		92-110	13-NOV-05
SULPHIDE-ED	Water							

Enviro-Test Quality Control Report

Workorder: L339763

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SULPHIDE-ED	Water							
Batch R346978								
WG379114-4 DUP		L340664-1						
Sulphide		0.080	0.084		mg/L	5.0	12	16-NOV-05
WG379114-2 LCS								
Sulphide			102		%		54-107	16-NOV-05
WG379114-3 LCS								
Sulphide			95		%		71-112	16-NOV-05
WG379114-1 MB								
Sulphide			<0.003		mg/L		0.003	16-NOV-05
WG379114-5 MS		L339555-1						
Sulphide			93		%		51-133	16-NOV-05

ENVIRO-TEST QC REPORT

Workorder # L339763

Legend:

Limit	95% Confidence Interval (Laboratory Warning Limits)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Qualifier:

RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.
A	Method blank exceeds acceptance limit. Blank correction not applied, unless the qualifier "RAMB" (result adjusted for method blank) appears in the Analytical Report.
B	Method blank result exceeds acceptance limit, however, it is less than 5% of sample concentration. Blank correction not applied.
E	Matrix spike recovery may fall outside the acceptance limits due to high sample background.
F	Silver recovery low, likely due to elevated chloride levels in sample.
G	Outlier - No assignable cause for nonconformity has been determined.
H	Result falls within the 99% Confidence Interval (Laboratory Control Limits)
J	Duplicate results and limit(s) are expressed in terms of absolute difference.
K	The sample referenced above is of a non-standard matrix type; standard QC acceptance criteria may not be achievable.

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Alberta Environment

Well I.D.:	0125877
Map Verified:	Map
Date Report Received:	1979/01/22
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER
Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN
City or Town: UNKNOWN AB CA
Postal Code:
WellOwner's Name: STIRLING, J.M.
Well Location Identifier:
P.O. Box Number: 44
Mailing Address: OKOTOKS
Postal Code:
City:
Province:
Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
SW	26	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary
Lot Block Plan
Well Elev: 3170 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: Chemistry
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Drilled
Flowing Well: No
Rate: Gallons
Gas Present: No
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

6. Well Yield

Test Date (yyyy/mm/dd):
Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet) Drawdown	Elapsed Time Minutes:Sec	Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):
Date Completed (yyyy/mm/dd):
Well Depth: 100 FT
Borehole Diameter: 0 Inches
Casing Type:
Liner Type:
Size OD: 0 Inches
Size OD: 0 Inches
Wall Thickness: 0 Inches
Wall Thickness: 0 Inches
Bottom at: 0 FT
Top: 0 FT Bottom: 0 FT

Perforations	Perforations Size:
from: 0 FT to: 0 FT	0 Inches x 0 Inches
from: 0 FT to: 0 FT	0 Inches x 0 Inches
from: 0 FT to: 0 FT	0 Inches x 0 Inches

Perforated by:
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT
Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT
Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:
Fittings
Top: Bottom:
Pack:
Grain Size: Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 1 Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: Diameter:
Comments:

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0133791
Map Verified:	Map
Date Report Received:	1976/04/29
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: GOODISON WATER WELL DRILLING		Drilling Company Approval No.:
Mailing Address:	City or Town:	Postal Code:
WellOwner's Name: LANE ENT LTD	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 5203 MARLBOROUGH NE, CALGARY	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
SW	26	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot	Block	Plan
	6	

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Proposed well use: Domestic
Method of Drilling: Rotary
Anticipated Water Requirements/day 0 Gallons
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No

4. Formation Log

Depth from ground level (feet)	Lithology Description
110	Clay & Boulders
125	Gravel
130	Gray Shale

5. Well Completion

Date Started(yyyy/mm/dd):
Date Completed (yyyy/mm/dd): 1975/04/01
Well Depth: 130 FT
Borehole Diameter: 0 Inches
Casing Type:
Liner Type: Steel
Size OD: 0 Inches
Size OD: 5 Inches
Wall Thickness: 0 Inches
Wall Thickness: 0 Inches
Bottom at: 0 FT
Top: 0 FT Bottom: 130 FT
Perforations
from: 120 FT to: 130 FT
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
Perforations Size:
0 Inches x 0 Inches
0 Inches x 0 Inches
0 Inches x 0 Inches
Perforated by: Unknown
Seal: Driven
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Screen Type:
from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Type:
from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Installation Method:
Fittings
Top:
Bottom:
Pack:
Grain Size:
Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 3
Documents Held: 4
Pitless Adapter Type:
Drop Pipe Type:
Length: FT
Diameter: Inches
Comments:

6. Well Yield

Test Date (yyyy/mm/dd): 1977/08/26
Start Time: 11:00 AM
Test Method:
Non pumping static level: 110 FT
Rate of water removal: Gallons/Min
Depth of pump intake: 0 FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches
Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0133792
Map Verified:	Not Verified
Date Report Received:	1975/04/25
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: GOODISON WATER WELL DRILLING		Drilling Company Approval No.:
Mailing Address:	City or Town:	Postal Code:
WellOwner's Name: LANE, MILT	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 5203 MARLBOROUGH DR NE, CALGARY	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
SW	26	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot | Block: 5 | Plan

Well Elev: FT | How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: | Materials Used:
Method of Drilling: Rotary
Flowing Well: No | Rate: Gallons
Gas Present: No | Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
115	Clay & Boulders
130	Sand & Gravel
143	Gray Shale

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd): 1975/04/01
Well Depth: 143 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type: Steel
Size OD: 0 Inches	Size OD: 4 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 143 FT

Perforations | Perforations Size:
from: 125 FT to: 135 FT | 0 Inches x 0 Inches
from: 0 FT to: 0 FT | 0 Inches x 0 Inches
from: 0 FT to: 0 FT | 0 Inches x 0 Inches

Perforated by: Unknown

Seal: Cement/Grout from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT

Screen Type: | Screen ID: 0 Inches
from: 0 FT to: 0 FT | Slot Size: 0 Inches
Screen Type: | Screen ID: 0 Inches
from: 0 FT to: 0 FT | Slot Size: 0 Inches

Screen Installation Method:

Fittings
Top: | Bottom:

Pack:
Grain Size: | Amount:

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0 | Documents Held: 1

Pitless Adapter Type:
Drop Pipe Type:
Length: FT | Diameter: Inches

Comments:

6. Well Yield

Test Date (yyyy/mm/dd): 1975/04/01	Start Time: 11:00 AM
Test Method: Unknown	
Non pumping static level:	113 FT
Rate of water removal:	10 Gallons/Min
Depth of pump intake:	0 FT
Water level at end of pumping:	120 FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 7 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0125876
Map Verified:	Not Verified
Date Report Received:	1976/12/20
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: MOORE, RON	Well Location Identifier:	
P.O. Box Number: 657	Mailing Address: OKOTOKS	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
SW	26	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot | Block | Plan

Well Elev: 3475 FT | How Obtain: Estimated

3. Drilling Information

Type of Work: Chemistry Reclaimed Well
Date Reclaimed: | Materials Used:
Method of Drilling: Drilled
Flowing Well: | Rate: Gallons
Gas Present: No | Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

6. Well Yield

Test Date (yyyy/mm/dd): 1976/12/17	Start Time: 11:00 AM
Test Method:	
Non pumping static level:	100 FT
Rate of water removal:	Gallons/Min
Depth of pump intake:	0 FT
Water level at end of pumping:	FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
Well Depth: 110 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches
Comments:	

7. Contractor Certification

Driller's Name:	UNKNOWN DRILLER
Certification No.:	

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0288346
Map Verified:	Map
Date Report Received:	1997/06/18
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: BLACKWOOD DRILLING LTD.		Drilling Company Approval No.: 118435
Mailing Address: BOX 53	City or Town: DE WINTON ALBERTA CANADA	Postal Code: T0L 0X0
WellOwner's Name: CHANUT, D.	Well Location Identifier:	
P.O. Box Number: 704	Mailing Address: OKOTOKS	Postal Code: T0L 1T0
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	W estof M
03	26	020	29	4

Location in Quarter
350 FT from S Boundary
325 FT from E Boundary
Lot Block Plan
Well Elev: FT How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 280 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
100	Clay & Rocks
118	Gravel
126	Sandstone
131	Shale
150	Sandstone
155	Shale

5. Well Completion

Date Started(yyyy/mm/dd): 1996/12/02
Date Completed (yyyy/mm/dd): 1997/01/18
Well Depth: 155 FT
Borehole Diameter: 0 Inches
Casing Type: Steel
Liner Type: Plastic
Size OD: 6.62 Inches
Size OD: 5 Inches
Wall Thickness: 0.188 Inches
Wall Thickness: 0.25 Inches
Bottom at: 119 FT
Top: 115 FT Bottom: 155 FT
Perforations from: 115 FT to: 155 FT
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
Perforations Size: 0 Inches x 0.02 Inches
0 Inches x 0 Inches
0 Inches x 0 Inches
Perforated by: Machine
Seal: Driven from: 154 FT to: 155 FT
Seal: from: 0 FT to: 0 FT
Seal; from: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Installation Method:
Fittings Top: Bottom:
Pack: Grain Size: Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0
Documents Held: 2
Pitless Adapter Type:
Drop Pipe Type:
Length: FT
Diameter: Inches
Comments:

6. Well Yield

Test Date (yyyy/mm/dd): 1997/01/18
Start Time: 11:00 AM
Test Method: Pump
Non pumping static level: 107 FT
Rate of water removal: 4.1 Gallons/Min
Depth of pump intake: 150 FT
Water level at end of pumping: 101 FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)	Elapsed Time Drawdown Minutes:Sec	Recovery
107	0:00	
109.33	1:00	112.58
111.08	2:00	110.67
111.25	3:00	109.58
111.42	4:00	108.67
111.42	5:00	108.17
113.75	10:00	107.25
115.17	16:00	107.18
115.17	20:00	
115.25	60:00	
115.25	120:00	
115.25	150:00	
115.33	240:00	

Total Drawdown: 5 FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 4 Gallons/Min
Recommended pump intake: 150 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.: 11020

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0160703
Map Verified:	Not Verified
Date Report Received:	1991/08/14
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: STONEY, CHERYL/GARY	Well Location Identifier:	
P.O. Box Number: 336	Mailing Address: OKOTOKS	Postal Code: T0L 1T0
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
NW	26	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry
Reclaimed Well
Date Reclaimed: Materials Used:

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

Method of Drilling: Not Applicable

Flowing Well: No
Gas Present:
Rate: Gallons
Oil Present:

6. Well Yield

Test Date (yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
Well Depth: 0 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount: 0
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

7. Contractor Certification

Driller's Name:	UNKNOWN DRILLER
Certification No.:	

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0147661
Map Verified:	Field
Date Report Received:	1997/06/10
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: AARON DRILLING INC.		Drilling Company Approval No.: 11590
Mailing Address: BOX 28, SITE 9, RR1	City or Town: DE WINTON ALBERTA CANADA	Postal Code: T0L 0X0
WellOwner's Name: HYLAND, KEITH#3131	Well Location Identifier:	
P.O. Box Number: 186	Mailing Address: OKOTOKS	Postal Code: T0L 1T0
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
NW	26	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Survey-Air

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Cable Tool
Flowing Well: Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 500 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
2	Topsoil
3	Brown Clay
11	Brown Clay & Silt
18	Brown Clay & Boulders
37	Brown Clay & Rocks
48	Gray Clay & Rocks
50	Brown Fractured Shale
58	Brownish Gray Soft Shale
78	Gray Shale
80	Brown Fractured Shale
82	Gray Water Bearing Sandstone
86	Brown Water Bearing Sandstone
88	Gray Water Bearing Sandstone
91	Brown Fractured Shale
93	Brown Sandstone
105	Gray Hard Shale

5. Well Completion

Date Started(yyyy/mm/dd): 1997/02/25	Date Completed (yyyy/mm/dd): 1997/02/27
Well Depth: 105 FT	Borehole Diameter: 0 Inches
Casing Type: Steel	Liner Type: Plastic
Size OD: 6.62 Inches	Size OD: 5 Inches
Wall Thickness: 0.188 Inches	Wall Thickness: 0.209 Inches
Bottom at: 61 FT	Top: 55 FT Bottom: 105 FT
Perforations from: 70 FT to: 100 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0.125 Inches x 7 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by: Saw	
Seal: Driven from: 0 FT	to: 61 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches
Comments: WATER ANALYSIS TDS 500 IRON 0.5 HARD 12	

6. Well Yield

Test Date (yyyy/mm/dd): 1997/02/28
Start Time: 3:00 AM
Test Method: Pump
Non pumping static level: 44 FT
Rate of water removal: 4 Gallons/Min
Depth of pump intake: 0 FT
Water level at end of pumping: 40 FT
Distance from top of casing to ground level: Inches

Depth To water level (feet) Elapsed Time Drawdown Minutes:Sec Recovery

44.29	0:01	44.38
44.29	0:05	44.35
44.19	0:10	44.32
44.22	0:15	44.29
44.23	0:20	44.29
44.25	0:30	44.29
44.29	0:40	44.29
44.35	0:50	44.29
44.35	1:00	44.29
44.38	1:15	44.29
44.38	1:30	44.29
44.47	1:45	44.29
44.45	2:00	44.29
44.48	2:15	44.29
44.52	2:30	44.29
44.55	3:00	44.29
44.58	4:00	44.29

Total Drawdown: 0 FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 3 Gallons/Min
Recommended pump intake: 100 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.: YA4006

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0147570
Map Verified:	Field
Date Report Received:	
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: AARON DRILLING INC.		Drilling Company Approval No.: 11590
Mailing Address: BOX 28, SITE 9, RR1	City or Town: DE WINTON ALBERTA CANADA	Postal Code: T0L 0X0
WellOwner's Name: ADKINS, JOHN/JUDY #2677	Well Location Identifier:	
P.O. Box Number: 633	Mailing Address: OKOTOKS	Postal Code: T0L 1T0
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
NW	26	020	29	4

Location In Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Survey-Air

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Rotary
Flowing Well:
Gas Present: No
Rate: Gallons
Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
1	Topsoil
30	Brown Clay & Rocks
105	Gray Clay & Rocks
124	Yellow Fractured Sandstone
131	Gray Shale
134	Gray Sandstone
142	Gray Shale
149	Gray Water Bearing Sandstone
152	Gray Shale

5. Well Completion

Date Started(yyyy/mm/dd): 1995/05/15	Date Completed (yyyy/mm/dd): 1995/05/15
Well Depth: 152 FT	Borehole Diameter: 0 Inches
Casing Type: Steel	Liner Type: Plastic
Size OD: 6.62 Inches	Size OD: 5 Inches
Wall Thickness: 0.188 Inches	Wall Thickness: 0.25 Inches
Bottom at: 118 FT	Top: 112 FT Bottom: 152 FT
Perforations from: 112 FT to: 152 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0.125 Inches x 12 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches

Perforated by: Saw

Seal: Driven from: 118 FT to: 118 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT

Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches

Screen Installation Method:
Fittings Top: Bottom:
Pack: Grain Size: Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0 Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: FT Diameter: Inches

Comments:
WATER ANALYSIS TDS: 700 Mg/L IRON: 0.5 Mg/L HARDNESS: 13 GRAINS

6. Well Yield

Test Date (yyyy/mm/dd): 1995/05/05
Start Time: 9:30 AM
Test Method: Pump
Non pumping static level: 101.5 FT
Rate of water removal: 8 Gallons/Min
Depth of pump intake: 145 FT
Water level at end of pumping: 101.9 FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)	Elapsed Time Drawdown Minutes:Sec	Recovery
102.032	1:00	101.539
102.031	2:00	
102.031	5:00	
102.031	10:00	
102.064	12:00	
102.097	15:00	
102.031	20:00	
102.031	60:00	
102.031	90:00	
102.031	120:00	
101.998	150:00	
101.998	210:00	
101.998	240:00	

Total Drawdown: 0 FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 8 Gallons/Min
Recommended pump intake: 145 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.: YA 4006

Enviro·Test LABORATORIES

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

CANADA TOLL FREE 1-800-668-9878

COC # 213442

WWW.ENVIROTEST.COM

Pg.___of___.

REPORT TO:
COMPANY: EBA Eng
CONTACT: JAMES ROSS
ADDRESS: 115, 200 Rivercrest Dr. SE Calgary T2C 2X5
PHONE: 203 3305 X330 FAX: 203 3301
CELLPHONE: 899 2441

INVOICE TO: SAME (Y) / N
COMPANY:
CONTACT:
ADDRESS:
PHONE: FAX:

DATE: 2005-11-10
REPORT DISTRIBUTION ALL FINAL RESULTS WILL BE MAILED
EMAIL X FAX___
EMAIL 1: JROSS @ EBA.CA
EMAIL 2:
DIGITAL EMAIL:
SELECT: pdf___ digital___ both X
INDICATE BOTTLES: FILTERED/PRESERVED (F/P) ▶
JOB # 960167-003
PO/AFE:
LSD: SE 1/4 27-020-29 W4M
QUOTE #

LAB WORK ORDER # L339762

- [X] REGULAR SERVICE (DEFAULT)
- [ ] PRIORITY SERVICE (50% SURCHARGE)
- [ ] EMERGENCY SERVICE (100% SURCHARGE)

ANALYSIS REQUEST

SAMPLE ID	SAMPLING LOCATION	SAMPLED BY / DATE / TIME	SAMPLING METHOD	SAMPLE TYPE	ROUTINE	DIS METALS (F/P)	NUTRIENTS (P)	SULPHIDE (P)	PHENOLS	T&F COLIFORM (P)	HAZARDOUS ? NO	NUMBER OF CONTAINERS	HIGHLY CONTAMINATED ?	LAB SAMPLE #
SE 1/4 27-020-29 W4		James / 05-11-10 / 1500	PUMP	H2O	X	X	X	X	X	X		6		1

GUIDELINES REQUIREMENTS: Subdivision/potability

SPECIAL INSTRUCTIONS / NATURE OF HAZARDOUS MATERIAL: Metals: needs to be filtered & acidified. Phenols: needs acid

SAMPLE CONDITION: FROZEN / COLD / AMBIENT — MEAN TEMPERATURE 1 °C

Failure to complete all portions of this form may delay analysis. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the reverse of the white report copy.

RELINQUISHED BY:	DATE & TIME:	RECEIVED BY:	DATE & TIME:	SAMPLE CONDITION ACCEPTABLE UPON RECEIPT ? (Y/N)
Ross	Nov 10 1715	[signature]	Nov 10/05	Y
RELINQUISHED BY:	DATE & TIME:	RECEIVED BY:	DATE & TIME: 17:17	

REFER TO BACK PAGE FOR SAMPLING INFORMATION & REGIONAL LOCATIONS WHITE - REPORT COPY, PINK - FILE COPY, YELLOW - CLIENT COPY GEN .01

22.9

APPENDIX

APPENDIX E WATER WELL REPORTS

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0147459
Map Verified:	Phone
Date Report Received:	
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: AARON DRILLING INC.		Drilling Company Approval No.: 11590
Mailing Address: BOX 28, SITE 9, RR1	City or Town: DE WINTON ALBERTA CANADA	Postal Code: T0L 0X0
WellOwner's Name: VIRTUE, GORDON	Well Location Identifier:	
P.O. Box Number: 193	Mailing Address: OKOTOKS	Postal Code: T0L 1T0
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof
NW	22	020	29	M 4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot | Block | Plan

Well Elev: FT | How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: | Materials Used:
Method of Drilling: Cable Tool
Flowing Well: No | Rate: Gallons
Gas Present: No | Oil Present: No

Proposed well use: Domestic & Stock
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
2	Topsoil
35	Gravel

5. Well Completion

Date Started(yyyy/mm/dd): 1985/06/28	Date Completed (yyyy/mm/dd): 1985/06/28
Well Depth: 35 FT	Borehole Diameter: 0 Inches
Casing Type: Steel	Liner Type:
Size OD: 6.62 Inches	Size OD: 0 Inches
Wall Thickness: 0.188 Inches	Wall Thickness: 0 Inches
Bottom at: 35 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: Driven from: 2 FT	to: 35 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches

Comments:
ORIGINALLY LOCATED @ NE22-029-29W4M.

6. Well Yield

Test Date (yyyy/mm/dd): 1985/06/28	Start Time: 3:00 AM
Test Method: Bailer	
Non pumping static level:	10 FT
Rate of water removal:	5 Gallons/Min
Depth of pump intake:	10 FT
Water level at end of pumping:	FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.: VA4096

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0258326
Map Verified:	Not Verified
Date Report Received:	1978/05/03
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: OKOTOKS, TOWN OF #1	Well Location Identifier:	
P.O. Box Number:	Mailing Address: OKOTOKS	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
NW	22	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry
Redaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Hand Dug
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Municipal
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
Well Depth: 16 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

6. Well Yield

Test Date (yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0258327
Map Verified:	Not Verified
Date Report Received:	
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: OKOTOKS, TOWN OF #2	Well Location Identifier:	
P.O. Box Number:	Mailing Address: OKOTOKS	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of
NW	22	020	29	M 4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Hand Dug
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Municipal
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd): 1978/05/10
Well Depth: 16 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

6. Well Yield

Test Date (yyyy/mm/dd):
Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min

Recommended pump intake: FT

Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name:	UNKNOWN DRILLER
Certification No.:	

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0258328
Map Verified:	Not Verified
Date Report Received:	
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: HENDERSON, R	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 13 MOUNTAIN PLACE, OKOTOKS	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
NW	22	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Unknown
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

6. Well Yield

Test Date (yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd): 1979/04/17
Well Depth: 0 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

7. Contractor Certification

Driller's Name:	UNKNOWN DRILLER
Certification No.:	

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0258329
Map Verified:	Not Verified
Date Report Received:	1982/07/13
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: CAMP OKOTOKS SOCIETY	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 2323 OSBORNE CRES SW, CALGARY	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
NW	22	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Unknown
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
Well Depth: 15 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

6. Well Yield

Test Date (yyyy/mm/dd):
Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT

Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0239165
Map Verified: Not Verified
Date Report Received:
Measurements: Imperial

1. Contractor & Well Owner Information

Company Name: ADAIR D
Drilling Company Approval No.:
Mailing Address:
City or Town:
Postal Code:
WellOwner's Name: WRIGHT, J.W.
Well Location Identifier:
P.O. Box Number:
Mailing Address: RR1, DE WINTON
Postal Code:
City:
Province:
Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
EH	22	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary
Lot Block Plan
Well Elev: 3609 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: Dry Hole
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Unknown
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Unknown
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
15	Clay
16	Gravel
26	Clay
32	Gray Shale
36	Blue Sandstone
41	Shale
43	Sandstone
157	Shale
167	Black Shale

5. Well Completion

Date Started(yyyy/mm/dd):
Date Completed (yyyy/mm/dd): 1967/11/20
Well Depth: 167 FT
Borehole Diameter: 0 Inches
Casing Type:
Liner Type:
Size OD: 0 Inches
Size OD: 0 Inches
Wall Thickness: 0 Inches
Wall Thickness: 0 Inches
Bottom at: 0 FT
Top: 0 FT Bottom: 0 FT
Perforations
Perforations Size:
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
Perforated by:
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Screen Type:
Screen ID: 0 Inches
from: 0 FT to: 0 FT
Slot Size: 0 Inches
Screen Type:
Screen ID: 0 Inches
from: 0 FT to: 0 FT
Slot Size: 0 Inches
Screen Installation Method:
Fittings
Top:
Bottom:
Pack:
Grain Size:
Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0
Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length:
Diameter:
Comments:
SEEPAGE ONLY CONSIDERED TO BE A DRY HOLE.

6. Well Yield

Test Date (yyyy/mm/dd):
Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches
Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0282140
Map Verified:	Phone
Date Report Received:	1987/08/17
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: CAMP OKOTOKS SOCIETY	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 3333 RICHARDSON WAY, CALGARY	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
NE	22	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Hand Dug
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):
Date Completed (yyyy/mm/dd):

Well Depth: 16 FT
Borehole Diameter: 0 Inches

Casing Type: Culvert	Liner Type:
Size OD: 42 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches

Bottom at: 0 FT
Top: 0 FT Bottom: 0 FT

Perforations	Perforations Size:
from: 0 FT to: 0 FT	0 Inches x 0 Inches
from: 0 FT to: 0 FT	0 Inches x 0 Inches
from: 0 FT to: 0 FT	0 Inches x 0 Inches

Perforated by:

Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT

Screen Type:	Screen ID: 0 Inches
from: 0 FT to: 0 FT	Slot Size: 0 Inches
Screen Type:	Screen ID: 0 Inches
from: 0 FT to: 0 FT	Slot Size: 0 Inches

Screen Installation Method:

Fittings
Top: Bottom:

Pack:
Grain Size: Amount:

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 3 Documents Held: 3

Pitless Adapter Type:
Drop Pipe Type:
Length: Diameter:

Comments:

6. Well Yield

Test Date (yyyy/mm/dd): Start Time:

Test Method:

Non pumping static level: FT

Rate of water removal: Gallons/Min

Depth of pump intake: FT

Water level at end of pumping: FT

Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min

Recommended pump intake: FT

Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0258330
Map Verified:	Not Verified
Date Report Received:	1976/12/08
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: STUMPE, HARLEY	Well Location Identifier:	
P.O. Box Number:	Mailing Address: OKOTOKS	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
NW	22	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Unknown
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd): Date Completed (yyyy/mm/dd):

Well Depth: 0 FT Borehole Diameter: 0 Inches

Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT

Perforations: from: 0 FT to: 0 FT; from: 0 FT to: 0 FT; from: 0 FT to: 0 FT
Perforations Size: 0 Inches x 0 Inches; 0 Inches x 0 Inches; 0 Inches x 0 Inches

Perforated by:

Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT

Screen Type: from: 0 FT to: 0 FT — Screen ID: 0 Inches, Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT — Screen ID: 0 Inches, Slot Size: 0 Inches

Screen Installation Method:

Fittings Top: Bottom:

Pack: Grain Size: Amount:

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 1 Documents Held: 1

Pitless Adapter Type:
Drop Pipe Type:
Length: Diameter:

Comments:

6. Well Yield

Test Date (yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0133762
Map Verified:	Map
Date Report Received:	1976/05/10
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: NELSON, C.H. DRILLING LTD.		Drilling Company Approval No.:
Mailing Address:	City or Town:	Postal Code:
WellOwner's Name: HERMAN, J.	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 1103 LAKE CHRISTINE PL SE, CALGARY	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
NW	23	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 3460 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
25	Yellow Clay & Rocks
35	Gray Clay
80	Blue Clay & Rocks
95	Clay & Rocks
98	Blue Shale

5. Well Completion

Date Started(yyyy/mm/dd): 1976/04/27	Date Completed (yyyy/mm/dd): 1976/04/27
Well Depth: 98 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type: Steel
Size OD: 0 Inches	Size OD: 4.5 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 98 FT

Perforations
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT

Perforations Size:
0 Inches x 0 Inches
0 Inches x 0 Inches
0 Inches x 0 Inches

Perforated by: Unknown

Seal: Loose
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT

Screen Type:
from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches

Screen Type:
from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches

Screen Installation Method:

Fittings
Top: Bottom:

Pack:
Grain Size: Amount:

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0 Documents Held: 1

Pitless Adapter Type:
Drop Pipe Type:
Length: FT Diameter: Inches

Comments:

6. Well Yield

Test Date (yyyy/mm/dd):	Start Time:
1976/04/27	11:00 AM

Test Method: Bailer

Non pumping static level:	75 FT
Rate of water removal:	5 Gallons/Min
Depth of pump intake:	80 FT
Water level at end of pumping:	80 FT

Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 5 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 0 Gallons/Min

Recommended pump intake: 0 FT

Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0133763
Map Verified:	Not Verified
Date Report Received:	1988/02/09
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: RIVER BEND CAMPGROUND	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 1103 LAKE CHRISTINA PL SE, CALGARY	Postal Code: T2S 2R7
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
NW	23	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Unknown
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):
Date Completed (yyyy/mm/dd):

Well Depth: 16 FT
Borehole Diameter: 0 Inches

Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT

Perforations
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
Perforations Size:
0 Inches x 0 Inches
0 Inches x 0 Inches
0 Inches x 0 Inches

Perforated by:

Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT

Screen Type:	Screen ID: 0 Inches
from: 0 FT to: 0 FT	Slot Size: 0 Inches
Screen Type:	Screen ID: 0 Inches
from: 0 FT to: 0 FT	Slot Size: 0 Inches

Screen Installation Method:

Fittings
Top: Bottom:

Pack:
Grain Size: Amount:

Geophysical Log Taken:
Retained on Files:

Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 1 Documents Held: 1

Pitless Adapter Type:
Drop Pipe Type:
Length: Diameter:

Comments:
SEE VG CHEM SAMPLE #881280

6. Well Yield

Test Date (yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0150739
Map Verified:	Surveyed GPS <1m
Date Report Received:	1990/05/18
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: AARON DRILLING INC.		Drilling Company Approval No.: 11590
Mailing Address: BOX 28, SITE 9, RR1	City or Town: DE WINTON ALBERTA CANADA	Postal Code: T0L 0X0
WellOwner's Name: BLOMME, AL #1336	Well Location Identifier:	
P.O. Box Number:	Mailing Address: GEN DEL, OKOTOKS	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
NW	23	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 0 FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Cable Tool
Flowing Well: No
Gas Present:
Rate: Gallons
Oil Present:
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
2	Topsoil
45	Clayey Gravel
84	Gray Sandy Gravel
93	Water Bearing Gravel
105	Clayey Gravel
120	Gray Water Bearing Sandstone

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd): 1990/03/19
Well Depth: 120 FT	Borehole Diameter: 0 Inches
Casing Type: Steel	Liner Type: Steel
Size OD: 6.62 Inches	Size OD: 5.56 Inches
Wall Thickness: 0.219 Inches	Wall Thickness: 0.156 Inches
Bottom at: 106 FT	Top: 100 FT Bottom: 120 FT
Perforations from: 100 FT to: 120 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0.25 Inches x 12 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by: Torch	
Seal: Driven from: 106 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount: 0
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches
Comments: TDS 100 PPM, IRON .5 PPM, HARDNESS 10 GPG	

6. Well Yield

Test Date (yyyy/mm/dd): 1990/05/18	Start Time: 11:00 AM
Test Method: Bailer	
Non pumping static level:	70 FT
Rate of water removal:	8 Gallons/Min
Depth of pump intake:	0 FT
Water level at end of pumping:	0 FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 6 Gallons/Min

Recommended pump intake: 0 FT

Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0294764
Map Verified:	Map
Date Report Received:	2000/09/21
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: PETER NIEMANS WATER WELL DRILLING		Drilling Company Approval No.: 119926
Mailing Address: BOX 6024	City or Town: HIGH RIVER AB CA	Postal Code: T1V 1M3
WellOwner's Name: KHAN, A.R.	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 1207 100 PARKWAY FOREST DR, N YORK, ONT	Postal Code: M2J 1L6
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
02	26	020	29	4

Location in Quarter
970 FT from S Boundary
710 FT from W Boundary

Lot	Block	Plan
3		

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 400 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
20	Brown Sandy Clay & Rocks
38	Brown Gravelly Clay & Rocks
88	Gray Clay & Rocks
93	Gravel
98	Clay & Rocks
120	Gravel
126	Gray Clay
138	Gray Shale
141	Gray Sandstone
150	Gray Shale
152	Gray Sandstone
159	Gray Shale
162	Gray Sandstone
165	Gray Shale
166	Gray Sandstone
199	Gray Shale
203	Gray Sandstone
231	Gray Shale
233	Gray Sandstone
248	Gray Shale
249	Gray Sandstone
260	Gray Shale

5. Well Completion

Date Started(yyyy/mm/dd): 2000/08/08	Date Completed (yyyy/mm/dd): 2000/08/09
Well Depth: 260 FT	Borehole Diameter: 0 Inches
Casing Type: Plastic	Liner Type: Plastic
Size OD: 5.56 Inches	Size OD: 4.5 Inches
Wall Thickness: 0.265 Inches	Wall Thickness: 0.237 Inches
Bottom at: 129 FT	Top: 120 FT Bottom: 260 FT
Perforations from: 170 FT to: 250 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0.125 Inches x 7 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by: Saw	
Seal: Driven & Bentonite from: 75 FT	to: 129 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 3
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches

Comments:
DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 0.45 M.

6. Well Yield

Test Date (yyyy/mm/dd): 2000/08/10	Start Time: 9:30 AM
Test Method: Pump	
Non pumping static level:	121 FT
Rate of water removal:	3 Gallons/Min
Depth of pump intake:	250 FT
Water level at end of pumping:	140 FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet) Drawdown	Elapsed Time Minutes:Sec	Recovery
121.194	0:00	140.255
125.623	1:00	134.383
128.805	2:00	130.839
131.233	3:00	129.101
133.333	4:00	129.822
134.58	5:00	128.608
135.4	6:00	128.412
135.662	7:00	128.248
135.826	8:00	128.083
135.925	9:00	127.952
135.99	10:00	127.821
136.154	12:00	127.657
136.318	14:00	127.46
136.45	16:00	127.296
136.712	20:00	127.001
137.237	30:00	126.377
137.565	40:00	125.984
137.926	60:00	125.328
138.254	90:00	124.704
138.451	120:00	124.245
138.812	180:00	123.786
139.14	240:00	123.556
139.632	360:00	123.228
139.927	480:00	
140.026	540:00	

Total Drawdown: 19 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 3 Gallons/Min

Recommended pump intake: 250 FT

Type Pump Installed

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0294765
Map Verified:	Map
Date Report Received:	2000/09/21
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: PETER NIEMANS WATER WELL DRILLING		Drilling Company Approval No.: 119926
Mailing Address: BOX 5024	City or Town: HIGH RIVER AB CA	Postal Code: T1V 1M3
WellOwner's Name: KHAN, A.R.	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 1207 100 PARKWAY FOREST DR, N YORK, ONT	Postal Code: M2J 1L6
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
02	26	020	29	4

Location in Quarter
575 FT from S Boundary
225 FT from W Boundary

Lot	Block	Plan
5		

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 400 Gallons

6. Well Yield

Test Date (yyyy/mm/dd): 2000/08/09
Start Time: 8:30 AM
Test Method: Pump
Non pumping static level: 112 FT
Rate of water removal: 8 Gallons/Min
Depth of pump intake: 210 FT
Water level at end of pumping: 117 FT
Distance from top of casing to ground level: Inches

Depth To water level (feet) Drawdown	Elapsed Time Minutes:Sec	Recovery
112.204	0:00	117.027
116.076	1:00	113.451
116.076	2:00	113.353
116.076	3:00	113.32
116.076	4:00	113.287
116.076	5:00	113.287
116.108	7:00	113.221
116.174	9:00	113.188
116.207	10:00	113.123
116.24	12:00	113.123
116.272	14:00	113.09
116.305	16:00	113.057
116.371	20:00	113.024
116.437	30:00	112.959
116.469	35:00	112.959
116.502	40:00	112.926
116.535	50:00	112.893
116.568	60:00	112.86
116.633	75:00	112.828
116.666	90:00	112.795
116.699	105:00	112.762
116.732	120:00	112.762
116.765	150:00	112.729
116.83	180:00	112.696
116.863	210:00	112.664

Total Drawdown: 5 FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 10 Gallons/Min
Recommended pump intake: 200 FT
Type Pump Installed

4. Formation Log

Depth from ground level (feet)	Lithology Description
86	Clay & Boulders
91	Gravel
107	Clay & Rocks
118	Gravel
121	Clay
132	Gray Shale
133	Gray Sandstone
146	Gray Shale
150	Gray Sandstone
163	Gray Shale
166	Gray Sandstone
177	Gray Shale
179	Gray Sandstone
183	Gray Shale
184	Gray Sandstone
198	Gray Shale
203	Gray Sandstone
211	Gray Shale
212	Gray Sandstone
218	Gray Shale

5. Well Completion

Date Started(yyyy/mm/dd): 2000/08/03	Date Completed (yyyy/mm/dd): 2000/08/04
Well Depth: 218 FT	Borehole Diameter: 0 Inches
Casing Type: Plastic	Liner Type: Plastic
Size OD: 5.56 Inches	Size OD: 4.5 Inches
Wall Thickness: 0.265 Inches	Wall Thickness: 0.237 Inches
Bottom at: 123 FT	Top: 118 FT Bottom: 218 FT
Perforations from: 160 FT to: 210 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0.125 Inches x 7 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by: Saw	
Seal: Driven & Bentonite from: 60 FT	to: 123 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 4
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches

Comments:
DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GRDUND LEVEL: 0.5 M.

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0294766
Map Verified:	Map
Date Report Received:	2000/09/21
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: PETER NIEMANS WATER WELL DRILLING		Drilling Company Approval No.: 119926
Mailing Address: BOX 5024	City or Town: HIGH RIVER AB CA	Postal Code: T1V 1M3
WellOwner's Name: KHAN, R.	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 1207 100 PARKWAY FOREST DR, N YORK, ONT	Postal Code: M2J 1L6
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
02	26	020	29	4

Location in Quarter
130 FT from S Boundary
530 FT from W Boundary

Lot	Block	Plan
1		

Well Elev: FT — How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Rotary
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 400 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
25	Brown Sandy Clay & Sand
42	Gray Clay & Rocks
58	Gray Sandy Clay & Sand
105	Gray Clay & Boulders
124	Dry Gravel
126	Gray Clay
146	Gray Shale
148	Gray Sandstone
170	Gray Shale
187	Sandstone
202	Gray Shale & Sandstone Ledges

5. Well Completion

Date Started(yyyy/mm/dd): 2000/07/24	Date Completed (yyyy/mm/dd): 2000/07/26
Well Depth: 202 FT	Borehole Diameter: 0 Inches
Casing Type: Plastic	Liner Type: Plastic
Size OD: 5.56 Inches	Size OD: 4.5 Inches
Wall Thickness: 0.265 Inches	Wall Thickness: 0.237 Inches
Bottom at: 128 FT	Top: 122 FT Bottom: 202 FT
Perforations from: 155 FT to: 195 FT	Perforations Size: 0.125 Inches x 7 Inches
from: 0 FT to: 0 FT	0 Inches x 0 Inches
from: 0 FT to: 0 FT	0 Inches x 0 Inches
Perforated by: Saw	
Seal: Driven & Bentonite from: 75 FT	to: 128 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 4
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches

Comments:
DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 0.4 M.

6. Well Yield

Test Date (yyyy/mm/dd): 2000/08/02	Start Time: 7:00 AM
Test Method: Pump	
Non pumping static level:	112 FT
Rate of water removal:	6.8 Gallons/Min
Depth of pump intake:	190 FT
Water level at end of pumping:	138.8 FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)	Elapsed Time Drawdown Minutes:Sec	Recovery
112.467	0:00	138.845
120.57	1:00	134.744
121.161	2:00	132.283
121.423	3:00	131.364
121.686	4:00	130.774
121.916	5:00	130.413
122.145	6:00	129.921
122.375	7:00	129.593
122.572	8:00	129.297
122.769	9:00	129.035
122.965	10:00	128.805
123.359	12:00	128.412
123.72	14:00	128.051
124.081	16:00	127.723
124.737	20:00	126.968
125.459	25:00	126.312
126.148	30:00	125.721
126.706	35:00	125.164
127.198	40:00	124.671
127.985	50:00	123.753
128.871	60:00	122.9
129.888	75:00	121.751
130.675	90:00	120.734
131.397	105:00	119.816
131.955	120:00	118.996

Total Drawdown: 26 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 6 Gallons/Min

Recommended pump intake: 180 FT

Type Pump Installed

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0294767
Map Verified:	Map
Date Report Received:	2000/09/21
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: PETER NIEMANS WATER WELL DRILLING		Drilling Company Approval No.: 119926
Mailing Address: BOX 5024	City or Town: HIGH RIVER AB CA	Postal Code: T1V 1M3
WellOwner's Name: KHAN, A.R.	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 1207 100 PARKWAY FOREST DR, N YORK, ONT	Postal Code: M2J 1L6
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
02	26	020	29	4

Location in Quarter
125 FT from S Boundary
155 FT from W Boundary

Lot	Block	Plan
6		

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 400 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
91	Clay & Boulders
95	Gravel
102	Clay & Rocks
121	Gravel
124	Clay
173	Gray Shale & Sandstone Ledges
179	Gray Sandstone
220	Gray Shale & Sandstone Ledges

5. Well Completion

Date Started(yyyy/mm/dd): 2000/07/31	Date Completed (yyyy/mm/dd): 2000/08/01
Well Depth: 220 FT	Borehole Diameter: 0 Inches
Casing Type: Plastic	Liner Type: Plastic
Size OD: 5.56 Inches	Size OD: 4.5 Inches
Wall Thickness: 0.265 Inches	Wall Thickness: 0.237 Inches
Bottom at: 126 FT	Top: 120 FT Bottom: 220 FT
Perforations from: 170 FT to: 210 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0.125 Inches x 7 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by: Saw	
Seal: Driven & Bentonite from: 75 FT	to: 126 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 3
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches

Comments:
DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 0.45 M.

6. Well Yield

Test Date (yyyy/mm/dd): 2000/08/08	Start Time: 7:00 AM
Test Method: Pump	
Non pumping static level:	110 FT
Rate of water removal:	8.1 Gallons/Min
Depth of pump intake:	207 FT
Water level at end of pumping:	140 FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet) Drawdown	Elapsed Time Minutes:Sec	Recovery
110.4	0:00	140.551
113.09	1:00	137.696
115.452	2:00	136.45
117.388	3:00	135.728
119.028	4:00	135.17
120.209	5:00	134.711
121.161	6:00	134.317
121.981	7:00	133.956
122.703	8:00	133.628
123.359	9:00	133.333
123.95	10:00	133.038
124.934	12:00	132.48
125.787	14:00	131.988
126.509	16:00	131.528
127.69	20:00	130.675
128.969	25:00	129.724
130.118	30:00	128.772
131.069	35:00	127.887
131.856	40:00	127.066
133.005	50:00	125.59
133.858	60:00	124.179
134.809	75:00	122.244
135.433	90:00	120.439
135.826	105:00	118.864
136.154	120:00	117.552

Total Drawdown: 30 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 10 Gallons/Min

Recommended pump intake: 200 FT

Type Pump Installed

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0294768
Map Verified:	Map
Date Report Received:	2000/09/21
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: PETER NIEMANS WATER WELL DRILLING		Drilling Company Approval No.: 119926
Mailing Address: BOX 5024	City or Town: HIGH RIVER AB CA	Postal Code: T1V 1M3
WellOwner's Name: KHAN, A.R.	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 1207 100 PARKWAY FOREST DR, N YORK, ONT	Postal Code: M2J 1L6
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
02	26	020	29	4

Location in Quarter
580 FT from S Boundary
705 FT from W Boundary

Lot	Block	Plan
2		

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Rotary
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 400 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
28	Brown Sandy Clay & Rocks
106	Gray Clay & Boulders
118	Sand & Gravel
126	Gray Clay & Rocks
138	Gray Shale
174	Gray Shale & Sandstone Ledges
178	Sandstone
240	Gray Shale & Sandstone Ledges

5. Well Completion

Date Started(yyyy/mm/dd): 2000/07/27	Date Completed (yyyy/mm/dd): 2000/07/28
Well Depth: 240 FT	Borehole Diameter: 0 Inches
Casing Type: Plastic	Liner Type: Plastic
Size OD: 5.56 Inches	Size OD: 4.5 Inches
Wall Thickness: 0.265 Inches	Wall Thickness: 0.237 Inches
Bottom at: 128 FT	Top: 120 FT Bottom: 240 FT
Perforations from: 170 FT to: 180 FT from: 210 FT to: 230 FT from: 0 FT to: 0 FT	Perforations Size: 0.125 Inches x 7 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by: Saw	
Seal: Driven & Bentonite from: 75 FT Seal: from: 0 FT Seal: from: 0 FT	lo: 128 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 2	Documents Held: 5
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches

Comments:
DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 0.45 M.

6. Well Yield

Test Date (yyyy/mm/dd): 2000/08/03	Start Time: 8:00 AM
Test Method: Pump	
Non pumping static level:	115 FT
Rate of water removal:	4 Gallons/Min
Depth of pump intake:	230 FT
Water level at end of pumping:	134.6 FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)	Elapsed Time Drawdown Minutes:Sec	Recovery
115.091	0:00	134.678
127.296	1:00	132.545
128.576	2:00	130.774
129.133	3:00	129.265
129.56	4:00	127.919
129.921	5:00	126.706
130.249	6:00	125.328
130.511	7:00	124.737
130.741	8:00	123.982
130.938	9:00	123.359
131.102	10:00	122.867
131.43	12:00	122.08
131.692	14:00	121.423
131.922	16:00	120.866
132.25	20:00	119.914
132.644	25:00	118.897
133.005	30:00	118.044
133.3	35:00	117.388
133.562	40:00	116.994
133.792	50:00	116.765
133.989	60:00	116.633
134.153	75:00	116.469
134.284	90:00	116.338
134.383	105:00	116.207
134.448	120:00	116.108

Total Drawdown: 19 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 4 Gallons/Min

Recommended pump intake: 230 FT

Type Pump Installed

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0133794
Map Verified:	Not Verified
Date Report Received:	1976/02/17
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: NORTHERN WATER SUPP
Drilling Company Approval No.:
Mailing Address: City or Town: Postal Code:
WellOwner's Name: SHARPE, J.G.
Well Location Identifier:
P.O. Box Number:
Mailing Address: 12560 LAKE GENEUA RD. CALGARY
Postal Code:
City: Province: Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
NW	26	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary
Lot Block Plan
Well Elev: 3535 FT How Obtain: Estimated

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Cable Tool
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No
Proposed well use: Domestic & Stock
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
1	Topsoil
41	Yellow Clay & Boulders
90	Blue Clay & Boulders
114	Yellow Hard Sandstone
120	Gray Sandstone
128	Fractured Sandstone
130	Yellow Sandstone
135	Blue Shale

5. Well Completion

Date Started(yyyy/mm/dd): Date Completed (yyyy/mm/dd): 1976/01/21
Well Depth: 135 FT Borehole Diameter: 0 Inches
Casing Type: Steel Liner Type: Steel
Size OD: 5.5 Inches Size OD: 4.5 Inches
Wall Thickness: 0.258 Inches Wall Thickness: 0 Inches
Bottom at: 92 FT Top: 91 FT Bottom: 135 FT
Perforations
from: 118 FT to: 132 FT
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
Perforations Size:
0.188 Inches x 10 Inches
0 Inches x 0 Inches
0 Inches x 0 Inches
Perforated by: Torch
Seal: Driven
from: 0 FT to: 92 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Screen Type: Screen ID: 0 Inches
from: 0 FT to: 0 FT Slot Size: 0 Inches
Screen Type: Screen ID: 0 Inches
from: 0 FT to: 0 FT Slot Size: 0 Inches
Screen Installation Method:
Fittings
Top: Bottom:
Pack:
Grain Size: Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: Yes
Held: 0 Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: FT Diameter: Inches
Comments:
DRILLER REPORTS HARD WATER

6. Well Yield

Test Date (yyyy/mm/dd): 1976/01/21 Start Time: 11:00 AM
Test Method: Bailer
Non pumping static level: 108 FT
Rate of water removal: 16 Gallons/Min
Depth of pump intake: 115 FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches
Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0133795
Map Verified:	Not Verified
Date Report Received:	1974/03/06
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: INTERPROVINCIAL DRLG		Drilling Company Approval No.:
Mailing Address:	City or Town:	Postal Code:
WellOwner's Name: MACKEVIC, TONY	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 1808 BRAESIDE PLACE SW, CALGARY	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
NW	26	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Cable Tool
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
2	Topsoil
36	Brown Till & Rocks
65	Blue Gray Till & Rocks
68	Brown Shale
72	Gray Shale
78	Brown Shale
84	Water Bearing Sandstone
90	Gray Hard Shale

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd): 1974/01/25
Well Depth: 90 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type: Steel
Size OD: 0 Inches	Size OD: 5 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 90 FT
Perforations from: 78 FT to: 84 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0.25 Inches x 12 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches

Perforated by: Torch

Seal: Driven from: 0 FT to: 68 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT

Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches

Screen Installation Method:
Fittings Top: Bottom:
Pack: Grain Size: Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data Chemistries taken By Driller: Yes
Held: 0 Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: FT Diameter: Inches
Comments:
DRILLER REPORTS MED HARD WATER

6. Well Yield

Test Date (yyyy/mm/dd): 1974/01/25
Start Time: 11:00 AM
Test Method: Bailer
Non pumping static level: 50 FT
Rate of water removal: 10 Gallons/Min
Depth of pump intake: 50 FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches
Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0133796
Map Verified:	Not Verified
Date Report Received:	1984/02/09
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: ALLEN, LYNDA	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 1575-7 ST SW, CALGARY	Postal Code: T2R 1N5
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
NW	26	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Unknown
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
Well Depth: 0 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

6. Well Yield

Test Date (yyyy/mm/dd):	Start Time:
Test Method:	
Non pumping static level:	FT
Rate of water removal:	Gallons/Min
Depth of pump intake:	FT
Water level at end of pumping:	FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min

Recommended pump intake: FT

Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0133807
Map Verified:	Map
Date Report Received:	1960/02/05
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: NUNKHOLM, M.	Well Location Identifier:	
P.O. Box Number: 63	Mailing Address: OKOTOKS	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westo'M
NW	27	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Drilled
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

6. Well Yield

Test Date (yyyy/mm/dd): 1960/02/01	Start Time: 11:00 AM
Test Method:	
Non pumping static level:	20 FT
Rate of water removal:	Gallons/Min
Depth of pump intake:	0 FT
Water level at end of pumping:	FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT

Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
Well Depth: 137 FT	Borehole Diameter: 0 Inches
Casing Type: Unknown	Liner Type:
Size OD: 5 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 2
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches
Comments:	

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0133808
Map Verified: Not Verified
Date Report Received: 1975/09/30
Measurements: Imperial

1. Contractor & Well Owner Information

Company Name: GEOSERVE DRLG
Drilling Company Approval No.:
Mailing Address: City or Town: Postal Code:
WellOwner's Name: ROWLAND FARMS
Well Location Identifier:
P.O. Box Number: Mailing Address: HIGH RIVER Postal Code:
City: Province: Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
NW	27	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary
Lot Block Plan
Well Elev: FT How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Rotary
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No
Proposed well use: Domestic & Stock
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
25	Blue Clay & Rocks
105	Brown Clay & Rocks
110	Hard Sandstone
135	Blue Shale & Sandstone Ledges

5. Well Completion

Date Started(yyyy/mm/dd): 1975/08/18
Date Completed (yyyy/mm/dd): 1975/08/19
Well Depth: 135 FT
Borehole Diameter: 0 Inches
Casing Type: Steel
Liner Type: Steel
Size OD: 6.63 Inches
Size OD: 4.5 Inches
Wall Thickness: 0.188 Inches
Wall Thickness: 0.25 Inches
Bottom at: 27 FT
Top: 27 FT Bottom: 135 FT
Perforations
from: 100 FT to: 135 FT
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
Perforations Size:
0.125 Inches x 10 Inches
0 Inches x 0 Inches
0 Inches x 0 Inches
Perforated by: Torch
Seal: Driven
from: 0 FT to: 27 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Screen Type:
from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Type:
from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Installation Method:
Fittings
Top: Bottom:
Pack:
Grain Size: Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: Yes
Held: 0 Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: FT Diameter: Inches
Comments:
DRILLER REPORTS SOFT WATER

6. Well Yield

Test Date (yyyy/mm/dd): 1975/08/19
Start Time: 11:00 AM
Test Method: Air
Non pumping static level: 57 FT
Rate of water removal: 12 Gallons/Min
Depth of pump intake: 120 FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches
Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0133809
Map Verified: Not Verified
Date Report Received:
Measurements: Imperial

1. Contractor & Well Owner Information

Company Name: GEOSERVE DRLG
Drilling Company Approval No.:
Mailing Address:
City or Town:
Postal Code:
WellOwner's Name: ROWLAND FARMS
Well Location Identifier:
P.O. Box Number:
Mailing Address: HIGH RIVER
Postal Code:
City:
Province:
Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
NW	27	020	29	4

Location In Quarter
0 FT from Boundary
0 FT from Boundary
Lot Block Plan
Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well-Abandoned Reclaimed Well
Date Reclaimed:
Materials Used: Unknown
Method of Drilling: Rotary
Flowing Well: No
Rate: Gallons
Gas Present: No
Oil Present: No
Proposed well use: Domestic & Stock
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
2	Gravel & Boulders
115	Clay & Boulders
250	Shale & Sandstone

5. Well Completion

Date Started(yyyy/mm/dd): 1975/08/18
Date Completed (yyyy/mm/dd): 1975/08/19
Well Depth: 250 FT
Borehole Diameter: 0 Inches
Casing Type:
Liner Type:
Size OD: 0 Inches
Size OD: 0 Inches
Wall Thickness: 0 Inches
Wall Thickness: 0 Inches
Bottom at: 0 FT
Top: 0 FT Bottom: 0 FT
Perforations
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
from: 0 FT to: 0 FT
Perforations Size:
0 Inches x 0 Inches
0 Inches x 0 Inches
0 Inches x 0 Inches
Perforated by:
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Seal:
from: 0 FT to: 0 FT
Screen Type:
from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Type:
from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Installation Method:
Fittings
Top:
Bottom:
Pack:
Grain Size:
Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0
Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length:
Diameter:
Comments:

6. Well Yield

Test Date (yyyy/mm/dd):
Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches
Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0133810
Map Verified: Not Verified
Date Report Received:
Measurements: Imperial

1. Contractor & Well Owner Information

Company Name: NIEMANS DRILLING (1980) LTD.		Drilling Company Approval No.: 119079
Mailing Address: BOX 5564	City or Town: HIGH RIVER AB CA	Postal Code: T0E 1M6
WellOwner's Name: ORVILLE ROWLAND FARMS	Well Location Identifier:	
P.O. Box Number:	Mailing Address: RR3, HIGH RIVER	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
NW	27	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 3555 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Rotary
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day: 0 Gallons

6. Well Yield

Test Date (yyyy/mm/dd): 1977/06/17
Start Time: 11:00 AM
Test Method: Pump & Air
Non pumping static level: 45 FT
Rate of water removal: 50 Gallons/Min
Depth of pump intake: 0 FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 75 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description
21	Sandy Clay & Rocks
76	Shale
102	Sandstone
110	Shale & Sandstone
120	Shale

5. Well Completion

Date Started(yyyy/mm/dd): 1977/06/15	Date Completed (yyyy/mm/dd): 1977/06/17
Well Depth: 120 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type: Steel
Size OD: 0 Inches	Size OD: 5.5 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0.156 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 100 FT
Perforations from: 76 FT to: 100 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0.125 Inches x 10 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by: Torch	
Seal: Welded Ring from: 0 FT	to: 73 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length: FT	Diameter: Inches
Comments:	

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0133811
Map Verified: Not Verified
Date Report Received:
Measurements: Imperial

1. Contractor & Well Owner Information

Company Name: NIELSEN DRILLING COMPANY (1984) LTD.
Drilling Company Approval No.:
Mailing Address:
City or Town:
Postal Code:
Well Owner's Name: ROWLAND, O. FARMS
Well Location Identifier:
P.O. Box Number:
Mailing Address: RR3, HIGH RIVER
Postal Code:
City:
Province:
Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
NW	27	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary
Lot Block Plan
Well Elev: 3555 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Rotary
Flowing Well: No
Rate: Gallons
Gas Present: No
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
69	Brown Sandy Clay & Rocks
71	Water Bearing Sand
119	Sandstone & Shale Ledges
140	Gray Shale

5. Well Completion

Date Started(yyyy/mm/dd): 1977/06/17
Date Completed (yyyy/mm/dd): 1977/06/20
Well Depth: 140 FT
Borehole Diameter: 0 Inches
Casing Type: Steel
Liner Type: Steel
Size OD: 5.5 Inches
Size OD: 4.5 Inches
Wall Thickness: 0.156 Inches
Wall Thickness: 0.25 Inches
Bottom at: 102 FT
Top: 0 FT Bottom: 140 FT
Perforations from: 85 FT to: 135 FT
Perforations Size: 0.125 Inches x 10 Inches
from: 0 FT to: 0 FT
0 Inches x 0 Inches
from: 0 FT to: 0 FT
0 Inches x 0 Inches
Perforated by: Torch
Seal: Driven & Welded Ring from: 0 FT to: 71 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Installation Method:
Fittings Top: Bottom:
Pack: Grain Size: Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0
Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: FT
Diameter: Inches
Comments:

6. Well Yield

Test Date (yyyy/mm/dd): 1977/06/20
Start Time: 11:00 AM
Test Method: Pump & Air
Non pumping static level: 38 FT
Rate of water removal: 28 Gallons/Min
Depth of pump intake: 125 FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches
Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 98 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0169297
Map Verified:	Not Verified
Date Report Received:	1992/10/21
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: ROLLO, COLIN	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 5 CRYSTAL RIDGE POINT, OKOTOKS	Postal Code: T0L 1T2
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
NW	27	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Unknown
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
Well Depth: 0 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

6. Well Yield

Test Date (yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0133804
Map Verified:	Map
Date Report Received:	1974/09/20
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: ALLAN BROS		Drilling Company Approval No.:
Mailing Address:	City or Town:	Postal Code:
WellOwner's Name: RENARD, R.	Well Location Identifier:	
P.O. Box Number:	Mailing Address: 824 ROYAL AVE, CALGARY	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
SE	27	020	29	4

Location In Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: FT How Obtain: Not Obtain

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Combination
Flowing Well: No Rate: Gallons
Gas Present: No Oil Present: No

Proposed well use: Domestic & Stock
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
42	Light Clay
71	Blue Clay
74	Light Sandy Clay & Gravel
112	Water Bearing Gravel

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd): 1973/12/01
Well Depth: 112 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type: Steel
Size OD: 0 Inches	Size OD: 4.5 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0.156 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 112 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by: Unknown	
Seal: Driven from: 0 FT Seal: from: 0 FT Seal: from: 0 FT	to: 0 FT to: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount:
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: GALV Length: FT	Diameter: 1 Inches
Comments:	

6. Well Yield

Test Date (yyyy/mm/dd): 1973/12/01	Start Time: 11:00 AM
Test Method: Pump	
Non pumping static level:	26 FT
Rate of water removal:	4 Gallons/Min
Depth of pump intake:	0 FT
Water level at end of pumping:	FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 0 FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 0 Gallons/Min

Recommended pump intake: 72 FT

Type Pump Installed
Pump Type: SUB
Pump Model: JACUZZI
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0133805
Map Verified: Map
Date Report Received:
Measurements: Imperial

1. Contractor & Well Owner Information

Company Name: BIG INDIAN DRLG
Drilling Company Approval No.:
Mailing Address:
City or Town:
Postal Code:
WellOwner's Name: TEXAS GULF #WELL 2
Well Location Identifier:
P.O. Box Number:
Mailing Address: OKOTOKS
Postal Code:
City:
Province:
Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
SW	27	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary
Lot Block Plan
Well Elev: 3420 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Drilled
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description
22	Gravel & Boulders
33	Coarse Grained Sand & Gravel
40	Pea Gravel
52	Clay

5. Well Completion

Date Started(yyyy/mm/dd):
Date Completed (yyyy/mm/dd): 1958/07/01
Well Depth: 52 FT
Borehole Diameter: 0 Inches
Casing Type: Steel
Liner Type:
Size OD: 6.63 Inches
Size OD: 0 Inches
Wall Thickness: 0 Inches
Wall Thickness: 0 Inches
Bottom at: 22 FT
Top: 0 FT Bottom: 0 FT

Perforations / Perforations Size:
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
Perforated by:

Seal: Cement/Grout from: 0 FT to: 5 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT

Screen Type: from: 0 FT to: 0 FT — Screen ID: 0 Inches, Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT — Screen ID: 0 Inches, Slot Size: 0 Inches
Screen Installation Method:
Fittings
Top: Bottom:
Pack:
Grain Size: Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0 Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: FT Diameter: Inches
Comments:

6. Well Yield

Test Date (yyyy/mm/dd): 1958/07/01
Start Time: 11:00 AM
Test Method: Pump
Non pumping static level: 13 FT
Rate of water removal: 107 Gallons/Min
Depth of pump intake: 0 FT
Water level at end of pumping: 15 FT
Distance from top of casing to ground level: Inches
Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 2 FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0133806
Map Verified: Map
Date Report Received:
Measurements: Imperial

1. Contractor & Well Owner Information

Company Name: BIG INDIAN DRLG
Drilling Company Approval No.:
Mailing Address:
City or Town:
Postal Code:
WellOwner's Name: TEXAS GULF #WELL 1
Well Location Identifier:
P.O. Box Number:
Mailing Address: OKOTOKS
Postal Code:
City:
Province:
Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
SW	27	020	29	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary
Lot Block Plan
Well Elev: 3415 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: New Well
Reclaimed Well
Date Reclaimed:
Materials Used:
Method of Drilling: Drilled
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Industrial
Anticipated Water Requirements/day 0 Gallons

6. Well Yield

Test Date (yyyy/mm/dd): 1958/06/01
Start Time: 11:00 AM
Test Method: Pump
Non pumping static level: 11.8 FT
Rate of water removal: 107 Gallons/Min
Depth of pump intake: 0 FT
Water level at end of pumping: 14 FT
Distance from top of casing to ground level: Inches
Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery
Total Drawdown: 2 FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pumptest information?

4. Formation Log

Depth from ground level (feet)	Lithology Description
15	Coarse Grained Gravel & Boulders
24	Coarse Grained Gravel
30	Loose Sand & Gravel
38	Fine Grained Gravel
46	Blue Clay & Rocks
50	Blue Clay

5. Well Completion

Date Started(yyyy/mm/dd):
Date Completed (yyyy/mm/dd): 1958/06/01
Well Depth: 50 FT
Borehole Diameter: 0 Inches
Casing Type:
Liner Type: Steel
Size OD: 0 Inches
Size OD: 6.63 Inches
Wall Thickness: 0 Inches
Wall Thickness: 0 Inches
Bottom at: 0 FT
Top: 0 FT Bottom: 29 FT
Perforations
Perforations Size:
from: 14 FT to: 29 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
from: 0 FT to: 0 FT — 0 Inches x 0 Inches
Perforated by: Unknown
Seal: Cement/Grout from: 0 FT to: 5 FT
Seal: from: 0 FT to: 0 FT
Seal: from: 0 FT to: 0 FT
Screen Type: from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT
Screen ID: 0 Inches
Slot Size: 0 Inches
Screen Installation Method:
Fittings
Top:
Bottom:
Pack:
Grain Size:
Amount:
Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0
Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: FT
Diameter: Inches
Comments:

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Water Well Drilling Report

Alberta Environment

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0155392
Map Verified:	Not Verified
Date Report Received:	1990/06/08
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: CAN OCCIDENTAL GAS PLANT#UP198	Well Location Identifier:	
P.O. Box Number: 400	Mailing Address: OKOTOKS	Postal Code: T0L 1T0
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westor M
SW	27	020	29	4

Location In Quarter
0 FT from Boundary
0 FT from Boundary
Lot Block Plan

Well Elev: FT
How Obtain: Not Obtain

3. Drilling Information

Type of Work: Chemistry Reclaimed Well
Date Reclaimed: Materials Used:
Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons
Method of Drilling: Not Applicable
Flowing Well: No Rate: Gallons
Gas Present: Oil Present:

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
Well Depth: 52 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount: 0
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 3	Documents Held: 3
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

6. Well Yield

Test Date (yyyy/mm/dd):	Start Time:
Test Method:	
Non pumping static level:	FT
Rate of water removal:	Gallons/Min
Depth of pump intake:	FT
Water level at end of pumping:	FT
Distance from top of casing to ground level:	Inches

Depth To water level (feet) Elapsed Time Drawdown Minutes:Sec Recovery

Total Drawdown: FT

If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min

Recommended pump intake: FT

Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER

Alberta Environment

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0155439
Map Verified:	Field
Date Report Received:	1990/06/08
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: UNKNOWN DRILLER		Drilling Company Approval No.: 99999
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:
WellOwner's Name: ANDERSON, H. JAY	Well Location Identifier:	
P.O. Box Number: 147	Mailing Address: CLUNY	Postal Code: T0J 0S0
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	West of M
NW	24	022	21	4

Location in Quarter
0 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 3088 FT
How Obtain: Estimated

3. Drilling Information

Type of Work: Chemistry
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Not Applicable
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No

Proposed well use: Domestic
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
Well Depth: 0 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type:
Size OD: 0 Inches	Size OD: 0 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by:	
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top:	Bottom:
Pack: Grain Size:	Amount: 0
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1	Documents Held: 1
Pitless Adapter Type: Drop Pipe Type: Length:	Diameter:
Comments:	

6. Well Yield

Test Date (yyyy/mm/dd): Start Time:
Test Method:
Non pumping static level: FT
Rate of water removal: Gallons/Min
Depth of pump intake: FT
Water level at end of pumping: FT
Distance from top of casing to ground level: Inches

Depth To water level (feet)
Elapsed Time
Drawdown Minutes:Sec Recovery

Total Drawdown: FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: Gallons/Min
Recommended pump intake: FT
Type pump installed
Pump type:
Pump model:
H.P.:
Any further pumptest information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0133823
Map Verified:	Field
Date Report Received:	
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: WEBSTER DRILLING		Drilling Company Approval No.: 120170
Mailing Address: BOX 956	City or Town: TURNER VALLEY AB CA	Postal Code: T0L 2A0
WellOwner's Name: ALTA ENV #2	Well Location Identifier:	
P.O. Box Number:	Mailing Address:	Postal Code:
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof M
08	28	020	29	4

Location in Quarter
3 FT from Boundary
0 FT from Boundary

Lot Block Plan

Well Elev: 3425.5 FT
How Obtain: Survey-Tra

3. Drilling Information

Type of Work: Test Hole
Reclaimed Well
Date Reclaimed: Materials Used:
Method of Drilling: Drilled
Flowing Well: No
Gas Present: No
Rate: Gallons
Oil Present: No
Proposed well use: Unknown
Anticipated Water Requirements/day 0 Gallons

4. Formation Log

Depth from ground level (feet)	Lithology Description

5. Well Completion

Date Started(yyyy/mm/dd): 1975/07/30	Date Completed (yyyy/mm/dd): 1975/07/31
Well Depth: 35 FT	Borehole Diameter: 0 Inches
Casing Type:	Liner Type: Steel
Size OD: 0 Inches	Size OD: 7 Inches
Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
Bottom at: 0 FT	Top: 0 FT Bottom: 35 FT

Perforations	Perforations Size:
from: 20 FT to: 35 FT	0 Inches x 0 Inches
from: 0 FT to: 0 FT	0 Inches x 0 Inches
from: 0 FT to: 0 FT	0 Inches x 0 Inches

Perforated by: Unknown

Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Seal: from: 0 FT	to: 0 FT
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches

Screen Installation Method:

Fittings Top:	Bottom:
Pack: Grain Size:	Amount:

Geophysical Log Taken:
Retained on Files:
Additional Test and/or Pump Data
Chemistries taken By Driller: No
Held: 0 Documents Held: 1
Pitless Adapter Type:
Drop Pipe Type:
Length: FT Diameter: Inches
Comments:

6. Well Yield

Test Date (yyyy/mm/dd): 1975/07/31
Start Time: 11:00 AM
Test Method: Pump
Non pumping static level: 18.6 FT
Rate of water removal: 114 Gallons/Min
Depth of pump intake: 28 FT
Water level at end of pumping: 23.15 FT
Distance from top of casing to ground level: Inches

Depth To water level (feet) Drawdown	Elapsed Time Minutes:Sec	Recovery
18.6	0:00	
	1:00	19.22
	2:00	19.18
22.08	3:00	19.15
	4:00	19.13
	5:00	19.11
21.66	6:00	
	7:00	19.1
21.69	8:00	
	9:00	19.1
21.7	10:00	
21.7	12:00	
21.69	16:00	
21.73	20:00	
21.72	25:00	
21.77	30:00	
20	35:00	
21.75	40:00	
21.78	50:00	
21.8	60:00	
21.85	75:00	
21.87	90:00	
21.92	105:00	
21.9	120:00	
22.98	121:00	

Total Drawdown: 5 FT
If water removal was less than 2 hr duration, reason why:
Recommended pumping rate: 0 Gallons/Min
Recommended pump intake: 0 FT
Type Pump Installed
Pump Type:

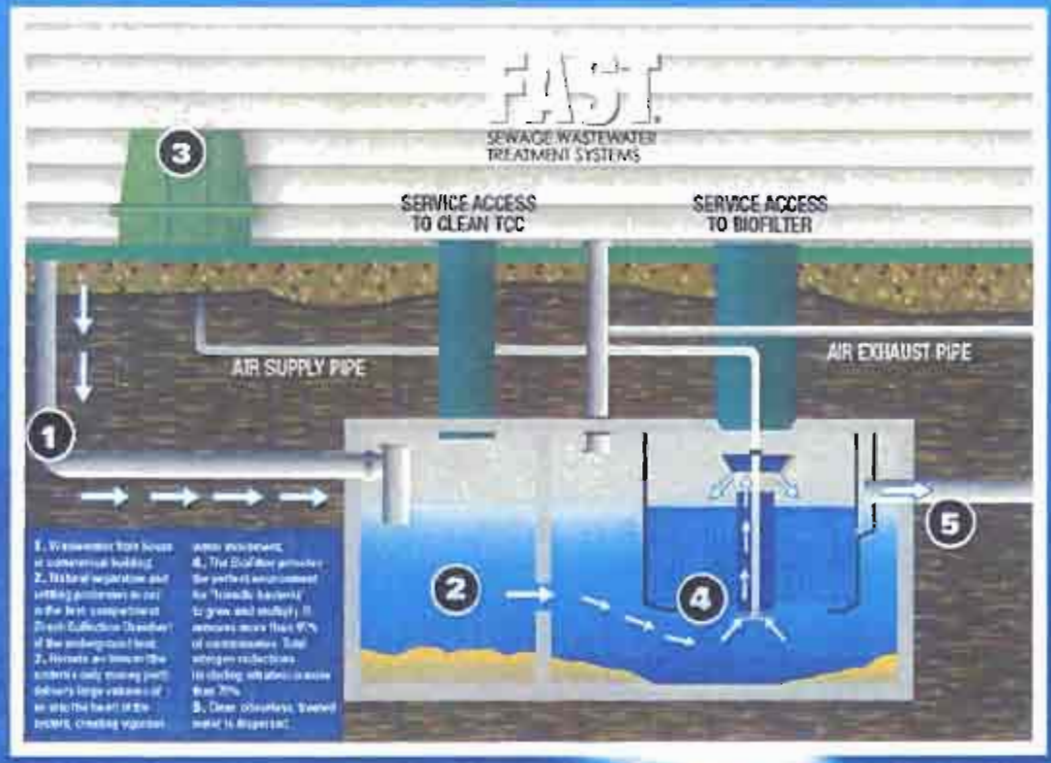
7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
Certification No.:

APPENDIX C MicroFAST System Information

EFFLUENT QUALITY

In domestic sewage wastewater, the two (2) main characteristics often mentioned are Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS), and are expressed as being 250 mg/l respectively. The graph shows the treatment levels of BOD and TSS from a septic tank, a secondary treatment device or a **FAST®** sewage wastewater treatment plant. The **FAST®** has the capabilities of achieving a tertiary treatment level of BOD – less then 10/mg/l, TSS – less than 10 mg/l, total Nitrogen – 70% reduction with Nitrate – less than 5 mg/l.



INSTALLATION

The **FAST®** system may be installed domestically, commercially or into existing septic systems.
The **FAST®** is delivered to the site completely factory pre-assembled into the tank. The installer connects building drain, air blower and discharge pipe to the system.
The system is simple, quiet and efficient.

MAINTENANCE

There is no part in the **FAST®** system to be removed, replaced or cleaned. Typically, the liquids and sewage solids in suspension will need to be removed once every 3 years.

- **Secondary and tertiary levels**
- **Total Nitrogen reduction 70%**

APPROVALS

- STANDARDS COUNCIL OF CANADA
- NSF STANDARD 40, CLASS 1
- CANADIAN GREAT LAKES
- INTERNATIONAL MARITIME ORGANIZATION (IMO)
- INDIVIDUAL PROVINCIAL CERTIFICATIONS

MICRO FAST

Advanced treatment systems for homes, sub-divisions, small communities, parks, mobile home parks and campgrounds.

HIGH-STRENGTH FAST

System for restaurants, pubs, lounges, golf and country clubs, service stations, commercial operations and permanent or mobile work camps.

RETRO FAST

- Upgrade on existing septic tank systems.
- Places **FAST®** BioFilter into existing tank
- or places **FAST®** BioFilter after existing tank.

peti@canada.com

The **FAST®** system is available from any one of Pinnacle's dealers throughout Canada

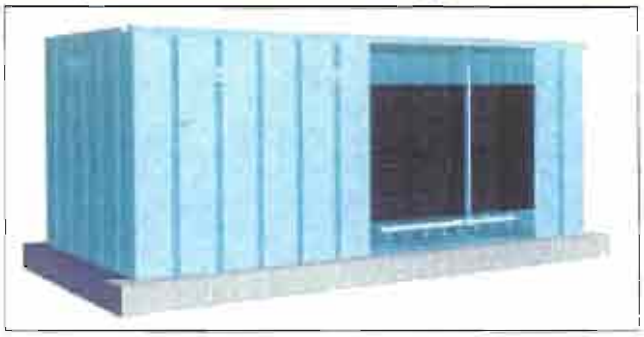
www.peti.ca

SMITH & LOVELESS INC.

www.smithandloveless.com

Fixed Activated Sludge Treatment (FAST®) Process Technology Overview

Biological treatment systems for small communities and even single-family dwellings have been available in the general water pollution control market for many years. These systems are basically scaled-down versions of the activated sludge process, utilizing suspended growth systems. Historically, the main operational problem associated with these systems has been the management of the sludge solids. In very small plants, flow rate variations can be extremely large and cause unintentional wasting or loss of the biological solids from the suspended growth reactor.



The FAST® (Fixed Activated Sludge Treatment) system eliminates many of the operational problems inherent with conventional suspended growth systems. It utilizes fixed media submerged in the aeration tank upon which the bacteria grow. Hence, the term "Fixed Activated Sludge Treatment."

The **FAST®** treatment system consists of a vessel packed with a media that provides a high surface area to volume ratio. The media is fully submerged in the liquid. Air diffusers below the media provide circulation of the waste to be treated through the media, and provide oxygenation to the liquid. The bacteria, unlike conventional activated sludge suspended growth systems, grow on the media while the liquor circulating through the bacteria-laden media is essentially clear and free of suspended solids. As the system operates, bacteria grow and flourish on the media and reach a point where they sluff from the media. The solids that are removed by this sluffing action are not overly gelatinous and slimy but tend to be very large and settle very rapidly.

In larger systems, these sluffed solids can easily be removed by a clarifier. Once removed from the effluent, these solids can be thrown away or returned to the aeration basin. Even without the return of the solids, the effective sludge age for this system is quite long, generally 40 to 100 days, depending upon loading rates, etc. The effective mixed liquid suspended solids levels are in the range of 4000 to 8000 mg/L. The concentration of bacteria is dependent on the concentration of the waste. The system is self-regulating.

The type of media is similar to media used in trickling filter towers. It has discreet channel flow paths, which cause self-cleaning action. The flow through the stacked-type media completely eliminates the need for any media maintenance.

The **FAST®** system offers numerous advantages:

1. **The system handles peak shock and toxic loads, along with low loadings as a biological system.**

   Conceptually, what occurs in the system is a bit different in theory than a conventional suspended growth system. The bacteria, unlike conventional activated sludge suspended growth systems, grow on the media and the liquor circulating through the bacteria-laden media.

   This growth pattern results in subsurface anaerobic microbes and surface aerobic microbes, both attached to the media. In case of a peak shock or toxic load, only the surface aerobic microbes would die and sluff off. The subsurface anaerobic microbes once exposed to air will quickly convert to aerobic microbes and degrade the incoming organics.

   If the loading conditions to the **FAST®** system varies, the microbial mass will adjust to these conditions but, unlike a conventional active sludge system, the excess mass is not lost in the effluent, but rather remains in the system attached to the media.

2. **The system can handle a very high biomass population.**

   In a conventional activated sludge system, the Sludge Volume Index (SVI) is a key factor in the system design. Indirectly it limits the reactor basin MLSS concentration and, in turn, the MLVSS that can be achieved because it controls the settling tank underflow concentration. Thus, for a given (SVI) and return sludge rate, the maximum MLSS and MLVSS is fixed with narrow limits.

   Because of the conceptual difference of the **FAST®** process, the system does not depend on the return sludge rate and,

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therefore, not on a given SVI value. No sludge has to be returned to the **FAST®** system once normal operation has been established.

3. **The media is submerged one hundred percent (100%) of the time.**

   Because the media is submerged one hundred percent of the time, an intimate contact between the organics and the biomass on the media is provided at all times and, hence, increases the rate of reduction, whereas in a Rotating Biological Contactor (RBC) for example, only part of the media is submerged in the wastewater; therefore, only part of the biomass comes in contact with the organics in the wastewater, resulting in a lower reduction efficiency.

4. **There are no moving parts for maintenance.**

   Again, a comparison with the RBC process shows the **FAST®** system advantage. The RBC process consists of a series of closely-spaced discs mounted on a horizontal shaft and rotated through the wastewater, resulting in a number of operational and maintenance problems. In the **FAST®** system, the media and the air distribution system are fixed in place. The only moving part of the system is the wastewater flowing through.

5. **The system saves space because of its unique design and biological loading characteristics.**

   The **FAST®** system consists of a vessel packed with a media which provides a high surface area to volume ratio. Since the biomass is fixed on the media rather than suspended in the vessel, like in a conventional activated sludge system, the design criteria is lbs. BOD/1000cf (kg BOD / cm) of media rather than lbs. BOD/1000cf of aeration volume. This results in a smaller aeration volume needed; therefore, in smaller vessel dimensions.

6. **The system maintains sludge ages of 40 to 100 days, allowing for sludge stability because of the long period of time.**

   In a conventional activated sludge system, both the Food-To-Mass (F/M) ratio and the solids retention time (SRT) are controlled by wasting of organisms; they are interrelated. A high F/M ratio corresponds to a short SRT, and a low F/M ratio corresponds to a long SRT. A typical SRT value for a conventional activated sludge system is 30 days. Also, a long SRT means a larger and more costly aeration tank. It means a higher requirement for oxygen and subsequent higher power costs. Problems with poor sludge settleability in the final clarifier may be encountered if the SRT is too long.

   Because of the independence of the **FAST®** system regarding the SVI, a higher sludge age can be achieved. As the surface aerobes grow and increase in thickness, the film strength of the bacteria growth weakens, and a sluffing of surface solids occurs. The anaerobic action of the microbes results in continuing reduction in cell mass and a reduced excess biological sludge accumulation without larger and more costly aeration tanks.

7. **If properly operated, the system should achieve BOD and suspended solids removal in excess of 90%.**

   In comparison with a conventional activated sludge system or an RBC system, less operation attention will be needed for the **FAST®** system but still a better than 90% reduction can be achieved.

8. **No control is necessary for this type of system.**

   Whereas, in a conventional activated sludge system having highly varying influent condition, the return and waste sludge rates, i.e., the MLSS (MLVSS) have to be controlled, no control is necessary with the FAST system for the reasons mentioned in Comments #2 and #6.

   Then employing the RBC process, the RPM of the rotating shaft is a means of control to enhance treatment efficiencies. With the **FAST®** system, the fixed biomass is the controlling factor and self-regulating.

Conclusion

The **FAST®** design produces a biological treatment system that is a hybrid of activated sludge, trickling filter, SBR and RBC technologies. The advantages of each of the technologies are maintained, and the disadvantages are eliminated. The aeration tank is completely mixed and a high concentration of bacteria is in intimate contact with the waste. The system, however, is not dependent on return sludge from a clarifier. The bacteria are self-regulating, manpower is kept to a minimum and low effluent concentrations are produced. For more information, please consult Smith & Loveless.

SMITH & LOVELESS INC.
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REPORT

COMPARING THE

FAST®

SEWAGE WASTEWATER

TREATMENT PLANT

TO

COMPETITORS' PRODUCTS

PREAMBLE

This Report on Comparing the FAST® Sewage Wastewater Treatment Plant to competitors' units is designed to provide the reader with a better understanding of the wide range of sewage treatment plants available in the market.

Each treatment plant manufacturer provides a product that serves a need to users and ensures a healthy competitive market for the benefit of the buyers.

Some treatment plants have been certified by the internationally recognized testing agency, **National Sanitation Foundation, International (a.k.a. NSF)**. Some have not. The reader should inquire with the supplier if their unit is NSF certified and, if not, why not.

We at Pinnacle Environmental Technologies Inc. are the authorized Canadian Distributor for the NSF certified FAST® Sewage Wastewater System. This report is to outline the differences and benefits of our system over that of the other systems.

The technical terms used to describe the various types of sewage treatment have been altered in some cases to assist the reader in a better understanding. This report compares the FAST® Sewage Wastewater Treatment System with these following types:

- Suspended Growth (a.k.a. Direct Air Injection Systems)
- Rotating Biological Contactor (RBC)
- Sequencing Batch Reactors (SBR)
- Specialized Mechanical Aerobic Plants
- Intermittent Sand Filter
- Peat Filters
- Foam Filters
- Fabric Filters

The reader is invited to question us or to comment on any matter or item of concern in regards to our system.

The FAST® System is the best unit available in the marketplace today and here is why.

SUSPENDED GROWTH (a.k.a. Direct Air Injection Systems)

Operation

1. These systems typically introduce atmospheric air into the wastewater by means of an external air pump. The air is usually injected into the wastewater in such a manner in order to keep the solids, paper and food particles in suspension in the liquid.

   Going through at least two (2) chambers, these systems rely solely on the mixing of the air with liquid, organic matter and solids in suspension to create the conditions for the aerobic organisms to digest the sewage material.

   One of the key functions of these types of plants is to match the amount of air to the amount of both liquid and organic matter (hydraulic and biological loading) coming into the system.

2. The two key methods of air injection are through fine bubble diffusion or through coarse bubble diffusion. Each of these methods has benefits and disadvantages that we will not discuss in this paper. The reader is welcome to discuss these with the suppliers of those types of systems.

   Regardless of the method of diffusion, it is the amount of air being delivered to the amount of hydraulic and biological loading that is of interest. These systems have a steady supply of a predetermined amount of air. They do not adjust the amount of air being delivered into the liquid and organic matter (a.k.a. biomass) when there are either daily, weekly, monthly or seasonally changes in either of the amount of liquid and/or organic matter loading rates.

   It is generally accepted that suspended growth systems using the principles of extended aeration through direct air injection suffer with the problem of over-aeration (too much air for the loading). This over-aeration causes the microorganisms to become too thin and light and therefore causes them not to settle out in the final clarification stage. This results in bursts of biological matter being intermittently released into the dispersal site that can lead to progressive failure of the drain field over time.

   At times of higher biological and hydraulic loadings, these systems can become under-aerated and insufficient organic digestion occurs, and, the excessive hydraulic loading can "flush" out the system releasing higher levels and amounts of under-treated biological mass to the dispersal site.

3. In an attempt to address these problems of over-aeration and under-aeration, suspended growth equipment suppliers may include the need for a filter to placed just prior to the liquid leaving the plant to hold back as much of the biological material as possible.

4. Several competitors' units **must** have and are **required** by National Sanitation Foundation to have a septic or pre-treatment tank ahead of the main treatment plant.

SUSPENDED GROWTH (a.k.a. Direct Air Injection Systems) cont'd

Operation

5. One of the manufacturers of suspended growth systems provides for the air pump to be housed directly on top of the tank. This may be satisfactory in the lower USA where it is warmer and lower potential for snow exists. During the winter months in colder climates, such as in Canada and the northern USA, there is a potential of snow covering the unit and the colder air temperature being drawn into the system. The air being drawn in could become restricted, or wet with snow, or too cold. Any of these conditions may cause equipment failure, poor treatment and low performance during the winter months. Also, deep bury requirements are more difficult to address with the air pump housing being directly on top of the tank.

6. While the coarse bubble diffusion based systems do not typically require the diffuser to be serviced, the fine bubble diffusion systems will require periodic removal, servicing or replacement.

   One of the competitor brands has located the airline drop tubes that feed air into the plant to one side of the unit in order to make removal and replacement of the fine bubble air diffusers more convenient.

7. Suspended growth systems are generally known as having limited capabilities to de-nitrify. While the aeration chamber may nitrify some amounts of ammonia-nitrogen to nitrate, they often have high residual amounts of ammonia-nitrogen and nitrite. These residual amounts may convert to nitrate in the soil.

   Thus, suspended growth systems may announce low nitrate values (values less than 5 mg/l), but it is important to note that the residual nitrogen in the form of ammonia and nitrite will contaminate the soil and place at risk the safety of drinking water in the groundwater and any aquifers when they convert naturally into nitrate after the plant.

Service / Maintenance

1. The suspended growth units typically recommend:
   - quarterly changing of air pump filter
   - annual checking and servicing of fine bubble diffusers inside the tank
   - annual checking and servicing of effluent filter inside the tank
   - pumping out and emptying the system every 1 - 3 years
   - by-annual check of scum baffle and effluent weir level

2. FAST® recommends
   - semi-annual cleaning of air pump's intake filter.
   - pump out system contents every 3 years

Summary

1. Suspended growth systems are highly likely to either under-aerate causing for under-treatment, over-aerate causing lightweight microorganisms (pin point floc) not settle-out in the final clarifier, or allow solids in suspension to be "flushed-out" of the plant as they build up or during periods of surge loadings.

2. Higher levels of maintenance to either clean, service or replace diffusers and/or effluent filters.

3. Suspended growth systems are typically unable to reduce Total Nitrogen to acceptable levels in order to better protect public health the environment from the harmful affects of nitrate.

The FAST® uses a fixed attached growth material in combination with extended aeration and trickling bio-filter principles to affect a greater ability to reduce Total Nitrogen by over 70%. The fixed attached growth media acts as a buffer to manage the matching of the amount of air to hydraulic and biological loading by permitting the media to act as both a biological filter and a holding area for the bacterial microorganism to attach to rather than exiting the system.

For more details, refer to the Technical Brief on the FAST® unit available.

ROTATING BIOLOGICAL CONTACTOR (RBC)

Operation

These plants have typically three (3) chambers to the plants. One chamber is called "primary clarifier", the second one called "biozone", and the third called "final clarifier".

The "primary clarifier" acts as a pre-treatment tank, the "biozone" holds the rotating plastic discs or tubes, and, the "final clarifier" acts a final settling tank.

Initially the sewage flows into the "primary clarifier", then through the "biozone", and finally through the "final clarifier". These discs or tubes in the biozone turn slowly allowing aerobic bacteria to attach to and grow on them. As they come up out of the liquid in the biozone the bacteria receive the air contact and when they are submerged they pick up the sewage for digestion.

There is a central shaft that holds the discs or tubes and is attached either directly to a motor and sprocket or to a sprocket chain drive and motor.

ROTATING BIOLOGICAL CONTACTOR (RBC) (cont'd)

Operation

These plant have the following problems:

1. The standard RBC has historically produced a BOD/TSS effluent quality of 45/60 mg/l, and, it does not reduce nitrates alone. The RBC's must have additional discs or tubes beyond the normal and then they reduce nitrates only moderately.

2. Often the shaft breaks or the bearings deteriorate or the sprocket drive and motor go out of alignment causing a major failure and/or expensive replacement.

3. The pumping out and emptying of the system is usually every 3 months (quarterly) to annually

4. To assure sufficient air exposure for the rotating discs or tubes, the treatment unit is installed at ground level with a large exposed lid to protect people or foreign objects from falling into it

5. The inlet into the biozone is submerged into the top portion of the primary clarifier. This inlet can often clog with debris restricting the flow into the biozone. If this persists for several days the biozone is starved and treatment reduced. Also the primary clarifier can become anaerobic and foul odours can occur.

6. Even without the biozone inlet being clogged, the primary clarifier often creates an offensive odour because it turns anaerobic (septic) as there is no air introduced into it. Only the biozone does not typically go anaerobic (septic).

Warranty

Each manufacturer warrants its product for five (5) years.

Service / Maintenance

1. pump out and empty system completely either every 3 months (quarterly) or annually.
2. Grease/oil shaft bearings and/or chain annually.
3. Check and clean drive motor electrical contacts as motors are installed inside the treatment plants humid conditions.

The FAST® unit has a 20" or 24" diameter access cover at grade and a 6" diameter PVC port for venting and pump-out.

AERATION AND FILTRATION

Operation

These plants are extended aeration plants combining the **introduction of air** with either of a **fabric filter** or a **Bio-Kinetic Filter** to treat sewage and remove solids. The fabric filters may be either a screen or sock-shaped type. The Bio-Kinetic filter is typically plastic.

1. Several pumps submerged in the sewage are subject to more frequent failure and difficulty in replacing as there is direct contact with crude, untreated, and suspect sewage.

2. The screen or sock-shaped type filters are usually of fabric based materials that last a long time but are subject to periodic clogging, causing sewage to rise out of the plant onto the surface.

3. The effluent quality is historically not consistent due to the frequency of the filter clogging.

4. Removal and cleaning of the screen or sock-shaped type fabric filters require individuals to directly handle potentially dangerous and hazardous waste water. The Bio-Kinetic filter typically requires a specialized sealed mobile cart / tank to move the filter to a service location to be properly cleaned.

   The Bio-Kinetic filter also has some history of breaking off from its moorings inside the systems due to increasing weight of the biomass building up on the filter.

Warranty

Each manufacturer warrants the plants for five (5) years.

Service/ Maintenance

1. Every 3 months for pumping out and emptying system
2. Every 3 months screen or sock-shaped filters must be removed and cleaned
3. Some require a monthly service agent maintenance schedule that often is not followed

SEQUENCING BATCH REACTOR

Operation

These units general handle a particular volume of wastewater (a.k.a. a batch) through a series of treatment processes and have the following general similarities:

1. More than one mechanical pump inside the sewage chamber.
2. Have aspirators and screen filters
3. Have an electronic system to handle the batch of material from one chamber to another

Warranty

Warranty period is generally five (5) years.

Service / Maintenance

1. More pumps require more frequent servicing and lead to increased potential for system failure
2. Typically require quarterly servicing and may have electronic failure of batch control system.

SPECIALIZED MECHANICAL AEROBIC PLANTS

Operation

These units have different operation characteristics, but, have the following general similarities:

1. More than one mechanical pump inside the sewage chamber.
2. Require either a full sized septic tank or chemical additive to work.
3. Some may use ozone created onsite for treatment that can be costly to operate and maintain.

Warranty

Warranties will vary from two (2) to five (5) years.

Service / Maintenance

1. More pumps require more frequent servicing and lead to increased potential for system failure
2. Check with manufacturer, but typically require monthly or quarterly servicing.

PEAT & FOAM & FABRIC FILTERS

Operation

Typically the raw sewage flows from the building to a septic tank which may or may not have a septic tank effluent filter. The septic tank effluent may flow by gravity or be pumped to be sprayed over the filter material.

In the case where the effluent is gravity flowed over the filter material, the filter material then spreads the effluent through-out the surface area by means of a tipping tray.

In the case where the effluent is pumped and sprayed over the filter media, there are spray nozzles that spray the septic tank effluent over the filter material.

In either case, the filter media allows the septic tank effluent to flow down and through permitting atmospheric air to penetrate the filter material. This may allow some conversion of the anaerobic septic affluent to some level of aerobic.

Once the liquid has passed through the filter media, it may be pumped around again for recycling back to the septic tank or be discharged into the disposal site by gravity or pump pressure.

Using the anaerobic septic tank effluent, the filter material becomes progressively clogged to the point where it needs to be replaced, and, the effluent being given to the drain field may still be anaerobic as there would be very low if any dissolved oxygen (DO) levels over time.

As the drain field is designed to be aerobic, the lack of DO in the effluent from the peat or foam filter systems do not assist the drain field from remaining healthy over the long term. However, the FAST® maintains a high DO level to assist the drain field to remain healthier longer.

Warranty

A seven (7) year guarantee that the filter material would not need to be removed and replaced subject to the septic tank being pumped out as required. Sewage effluent pumps are warranted by their respective pump manufacturers. Tankage may be warranted separately by the tank manufacturer or up to five (5) years.

PEAT & FOAM & FABRIC FILTERS

Warranty (cont'd)

One of the peat moss filter company's warranty states that the filter bed will function properly for two (2) years and cancels the warranty completely on the occurrence of any one of:

- system not used in accordance with the instructions for use contained in the manual.
- new owners do not advise the manufacturer in writing that they are new owners, that they are aware of the warranty, and that they accept its terms & conditions.

FAST's warranty is transferred automatically without notice being required and, as there is no filter material that could be damaged permanently. Any misbehaviour that the system could not recover from in the short term would simply mean that the unit would have to have the contents removed like a septic tank and start again as new. Therefore there would not be any sudden major expense.

There is some question whether the natural peat moss material will be readily available in the future at a reasonable cost. This may be due to restricted or reduced access to the peat moss at the discretion of the peat moss supplier as approved by the peat moss technology supplier.

Service & Maintenance

The filter system that utilizes septic tank effluent being pumped and sprayed over the filter material typically requires that the spray nozzles be checked and serviced to ensure that they do not clog. The frequency of nozzle cleaning and/or replacement will vary given the behaviour patterns of the user.

Each of the filter types rely on septic tank effluent and the septic tank requires the usual pumping out frequency of every two (2) to three (3) years.

Both types of filter (peat moss or foam block) require that the filter material be removed and replaced as required which may be as long as every seven (7) years.

In summary, the serviceable parts would typically be:

- septic tank being pumped out every 2 to 3 years
- filter material being replaced every 7 years
- spray nozzles being checked, cleaned or replaced
- the septic tank effluent pump and screen filter,
- the post filter recirculating pump (which may also be used to discharge)

The FAST® unit requires that it be pumped out every three (3) years similar to the peat moss and foam filter's septic tank. The FAST® is totally aerobic ensuring no foul odours and a high level of DO in the effluent to assist the drain field in maintaining an aerobic condition.

The FAST® does not have any internal serviceable part whereby there could be human contact with either sewage or effluent at any time such as septic tank pumps, recirculating pumps, spray nozzles, and filter material. The FAST® uses readily available free air and the peat and foam filters use costly filter material that may not be readily available.

INTERMITTENT SAND FILTER

Operation

Typically, the raw crude sewage flows from the facility, such as a residence, through to a septic tank. This septic tank requires a filter to hold back solids. Then the anaerobic filtered septic tank effluent flows into a holding chamber that contains a pump or pumps to pressurize the anaerobic effluent through small diameter pipes.

These small diameter pipes are pre-drilled with holes of a particular diameter in order to achieve a particular squirt height and velocity. Then the under pressure anaerobic filtered septic tank effluent is forced into the intermittent sand filter.

The intermittent sand filter itself consists of several layers of sand and/or gravel that must contain specific sieve characteristics and cleanliness. Once the pressurized anaerobic filter septic tank effluent has passed through the intermittent sand filter it travels to the disposal site.

The filtered anaerobic septic tank effluent is treated and filtered as it passes through the intermittent sand filter by the microorganism attached to the sand, by the aerobic condition of the intermittent sand filter (ISF), and by the sands ability to hold onto suspended solids.

To keep the intermittent sand filter small diameter pipes clean in larger commercial flows situations there often are recirculating tanks and pump systems to hold some of the ISF's effluent to be used to backwash the pipes.

Over months and years of service the sand bed has the potential to become saturated with suspended solids held by the sand. This condition, if not addressed, may cause the sand bed to go anaerobic or septic. To keep this from occurring, there may be installed a system of an air pump to air feed lines to force atmospheric air into the bottom of the sand bed.

Mechanical & Serviceable Equipment Required to Operate Intermittent Sand Filter

According to Triad Engineering Corp. in California, the service and maintenance of one the popular sand filter designs for a single family residence is as follows:

- every six (6) months servicing for Sand Filter required as follows:
- pressurizing the lateral pipe lines
- utilizing a bottle brush each lateral pipe line should be cleaned
- annual checking for pumping out of septic tank
- annually checking of pump screen and cleaned as needed

This appears to be a common requirement for all intermittent sand filter designs. However, some intermittent sand filter component suppliers have attempted to use the introduction of forced air through the bottom of the sand filter to remediate the sand bed of the solid biomass build up. This process involves another mechanical device and some protocol for activation and determination of actual success.

INTERMITTENT SAND FILTER (cont'd)

Mechanical & Serviceable Equipment Required to Operate Intermittent Sand Filter

1. The following are the typical intermittent sand filter's (ISF) components that require a level of servicing, maintenance, repair and/or replacement:

    - Septic Tank
    - Septic Tank Effluent Filter
    - Pressurizing Pump System
    - pressure distribution lateral pipes at top of sand bed to be cleaned
    - Air Pump, if any
    - sand bed may need to be removed, transported to sanitary land fill, and replaced in the event of the system's failure or systems abuse by user.

2. The use of submersible pumps and some type of screen filter in the septic tank adds to the service and maintenance requirements and potential system failure.

3. The amount **land area** required for the sand filter may be fairly large compared to a treatment plant.

4. In the State of Oregon, where the largest number and older Sand Filters are located, the **frequency of the sands removal and replacement** varies according to usage. The question of transporting toxic contaminated waste sand filter sand materials is NOT fully resolved in either Oregon or in B.C. at the time of this report.

Current Oregon State practice is to not enforce those State laws and dump the waste in sanitary landfills. The Canadian situation is unclear at this time.

Warranty

The **Warranty period** is variable subject to who has designed the system and who installs the system. Intermittent sand filters have not under gone independent testing by the National Sanitation Foundation. Typically, test results are provided by the sand filter designer only.

The installer warrants typically that the installation is in compliance to the design. The ISF designer warrants only that the parts are free from defect in workmanship and that the component suppliers offer their own warranty.

As a result there is no single point warranty centre and the user may be caught in arguments between the installer and the designer with neither accepting responsibility or warranty.

It is our understanding that recent performance review of the sand filter systems in Washington and Oregon States reveal up to 30% failure rate within the first 2 years and up to 80% in 7 years.

SUMMARY

The FAST® sewage package treatment plant has been designed to offer a high level of sewage treatment with the minimum of servicing and maintenance to provide protection to the health of the general public and the environment.

FAST® specifically offers the following capabilities:

Tertiary Effluent Quality

BOD5	= less than 10 mg/l
SS	= less than 10 mg/l
Nitrate	= less than 5 mg/l
Total Kjeldahl Nitrogen	= less than 10 mg/l
Total Nitrogen	= 70% reduction

Least Amount of Operation & Maintenance

- No mechanical moving part or filter inside the plant to be serviced at any time.
- Airlift system for air delivery assures no clogging and no servicing.
- No need for any individual to ever directly handle any item which has been in direct contact with potentially hazardous or dangerous wastewater.
- No septic tank effluent filter to clean or service.
- Pumpout and emptying system every 3 years.
- No submersible pumps and filters to service, wear out and/or be replaced.
- No bottlebrush cleaning required.
- No filter material (peat, foam, fabric or sand) to be cleaned or replaced
- No spray nozzles to be cleaned or replaced
- Lowest cost to operate and maintain

Other Considerations

- Single Point Warranty Centre
- Warranty period of 2 years on the external air pump.
- Tankage warranty by tank manufacturer.
- Quick, simple and easy installation ensuring long term operation.
- National Sanitation Foundation International certified.
- Least obtrusive to the aesthetics of the property as there is no large box or lid to try to conceal with shrubs, flowers, or trees.
- Typically smaller land area required than intermittent sand filter.
- Local factory trained Service Agent available for any support required.
- When the FAST® has had a problem for whatever cause, you simple pump out the contents and start again.