Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Regional Groundwater Assessment Studies

— Workbook —

Working with the CD-ROM Programs and Data

June 2001

Canada

PFRA ARAP

Prairie Farm Rehabilitation Administration

Administration du rétablissement agricole des Prairies

TABLE OF CONTENTS

1. Workbook Format

The intention of this workbook is to provide information on the “hows” and “whys”of the regional groundwater assessment study CD-ROMs:

- What data and programs are on the CD-ROM Disk?
- How was the information on the MD/County CD-ROM Disk created?
- How can I start and run the various programs or view the reports, maps or completion reports (water well logs)?

This workbook is intended as a guide. Exercises are also available, or can be prepared for selected MDs or Counties, that allow the user to work directly with the CD-ROM data and programs. Many people learn better by doing. Contact your local Prairie Farm Rehabilitation Administration (PFRA) office to see if exercises are available in your area.

2. Acknowledgments

This workbook is based on, and intended to provide additional support to, regional groundwater assessment studies completed by **Hydrogeological Consultants Ltd.** These studies were also dependent on assistance from **MOW-TECH LTD.** and **AltaLis Ltd.** Funding for these studies was provided by **Agriculture and Agri-Food Canada** and local municipalities.

Questions?

Contact your local PFRA District Office

Hanna 403-854-4448
Red Deer 403-340-4290
Lethbridge 403-327-4340
Medicine Hat 403-526-2429
Vegreville 780-632-2150
Westlock 780-349-3963
Peace River 780-624-3386

or

Terry Dash - PFRA Calgary
Phone 403-292-5719 FAX 403-292-5659
email: dasht@em.agr.ca

Tony Cowen - PFRA Edmonton
Phone 780-495-4911 FAX 780-495-4504
email: cowent@em.agr.ca

3. What is a Regional Groundwater Assessment Study?

3.1. Why were these studies done?

In the late 1960s and early 1970s, the Groundwater Division of the Research Council of Alberta published a set of hydrogeological reconnaissance maps that covered all of the agricultural area of Alberta. These maps showed potential water well yields and the general quality of water that could be anticipated in rural Alberta.

About twenty-five to thirty years have passed since these maps were published and since then a lot of test holes and water wells have been completed. PFRA and many Municipalities have recognized that an updated assessment of their local groundwater resources is desirable and, as a result, have combined to fund regional groundwater assessment studies that contain updated “digital” maps showing the groundwater-development potential of potable water aquifers that underlie the Municipality.

This information allows the Municipality to better understand and protect the underlying groundwater resource, and the studies provide important information that can help with planning or project-siting type studies.

The study also includes completion reports (water well logs) and a groundwater query program that answers typical questions from water well owners: *How deep can I expect to drill to complete a water well? What quantity of water can be expected? What chemical quality of water can be expected?*

3.1.1. Why is PFRA supporting these studies?

Groundwater in Alberta is a very important resource, it needs to be protected and conserved. The regional groundwater assessments provide updated information to help users determine the status of the groundwater resource in an area and what steps should be taken to best manage the resource. They also can be used to help identify constraints to, and opportunities for, rural economic development.

3.1.2. What is the accuracy of these studies?

The groundwater assessment is based on a regional-scale review of water well and other data. Accordingly, the maps and the groundwater query program are intended ONLY AS A GUIDE. Geological conditions can vary over very short distances (especially where most groundwater flow to a water well is provided by fractures) and there are **NO GUARANTEES** that the predicted yield and water quality will occur in every or any water well. In some cases, several test holes may be required to achieve a water well with the desired yield and water quality. In other areas, local geological conditions may be such that the groundwater-development potential is better or worse than that predicted in the study.

The intention is to give the landowner an estimate of:

- **The quantity (sustainable yield) and quality of water** that can be obtained
- **How deep a water well driller may have to drill** to successfully complete a water well, and also guidance as to the depth at which to stop drilling and maybe try again at another location.

When purchasing a new parcel of land, considering herd expansion, or opening a new type of business that is dependent on groundwater (e.g. aquaculture), **the landowner MUST always first confirm by drilling and testing that the quantity and quality of groundwater is suitable and sustainable, even in drought years.** Consultation with a professional geologist and/or engineer who specializes in groundwater assessments is recommended where substantial investment is involved.

3.2. What data were used in these studies?

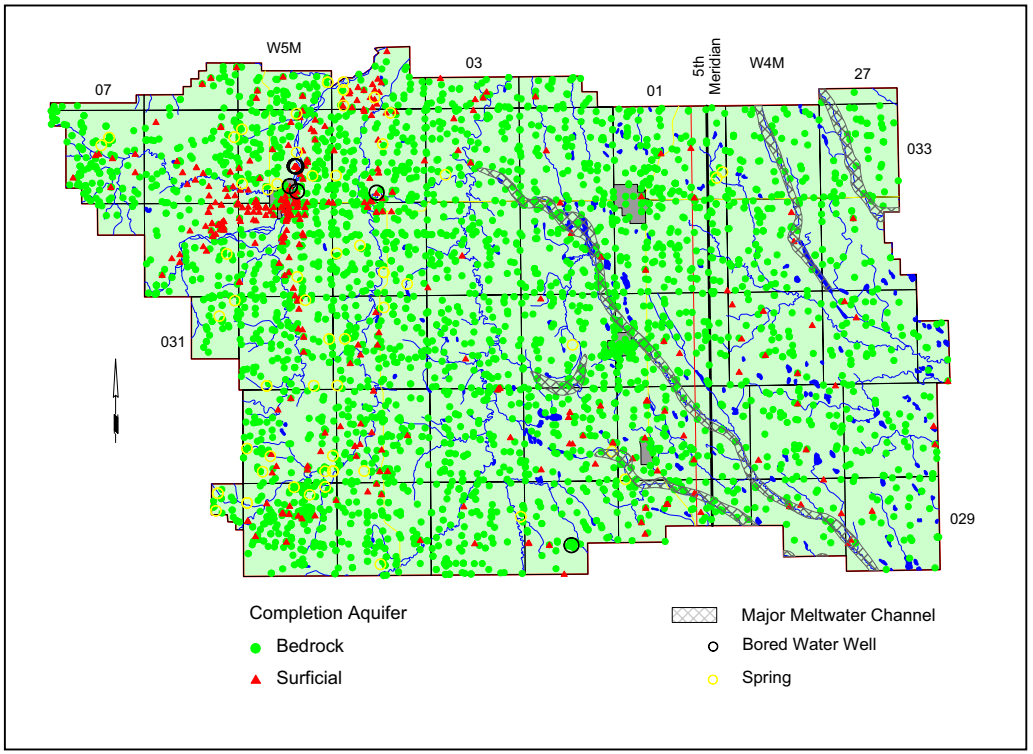
The Alberta Environment Groundwater Information Centre provided water well data. Cultural detail (roads, streams, community locations, township fabric) was provided by Altalis. Ltd. Other groundwater-related data were provided by the Consultant carrying out the work.

4. What Groundwater Data are Contained on the CD-ROM?

4.1. Water well completion reports (water well logs)

Only those water well reports on file (electronically) with Alberta Environment at the time the regional groundwater assessment study was done are available. Recent completion reports (water well logs) may not be available. For some water wells, completion reports may never have been submitted to Alberta Environment and are not available.

TIP - *For both recent and historical water well completion reports (water well logs), check with the Alberta Environment Groundwater Information Centre. Phone toll-free 310-0000 and ask for the Groundwater Information Centre. Other phone numbers that aren't toll free are 780-944-0313 or 780-427-2770 or email env.infocent@gov.ab.ca* ***or*** *check with your local water well driller. Water well information is also available online from the Groundwater Centre http://www.groundwatercentre.com/.*



4.2. MOW-TECH LTD. Groundwater Query

A quick assessment of the groundwater development potential beneath a specific land location. Again, this is only a **GUIDE**.

4.3. Paper reports and maps showing groundwater-related information

See sample map on right from Mountain View County.

4.4. GIS (Geographic Information System) ready maps

These maps show aquifer development potential and water quality and are intended to be used by County/MD planners and others to identify areas where groundwater supplies may be available.

5. Let's Start the Engine and Kick the Tires

5.1. Autorun

This screen will appear once the CD-ROM is inserted into your CD-ROM drive.

5.2. Copyright information

When the CD-ROM is placed in a CD-ROM drive, the autorun.exe program will start and the copyright screen will appear.

If you click on the three central icons (MOW-TECH LTD., AltaLIS, hydrogeological consultants ltd.), a text file will open stating the copyright information of the data and reports on this CD-ROM.

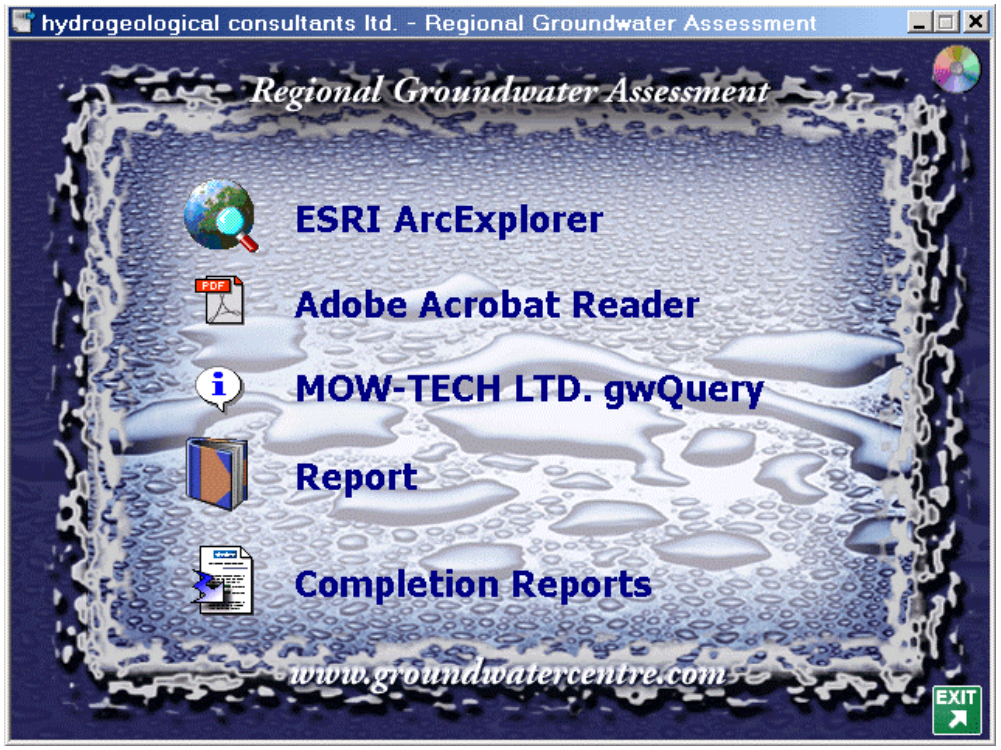
Double-clicking on the **Agriculture and Agri-Food Canada** icon will send you to the PFRA Internet site containing the regional groundwater study assessment reports.

Clicking on ***next >*** in lower right corner will bring up installation options for the data and reports on the CD-ROM.

Copyright information

5.3. Auto-install and quick access

This screen will install and/or allow you to access the contents of the CD-ROM in a user-friendly manner by simply clicking on any of the items listed below:



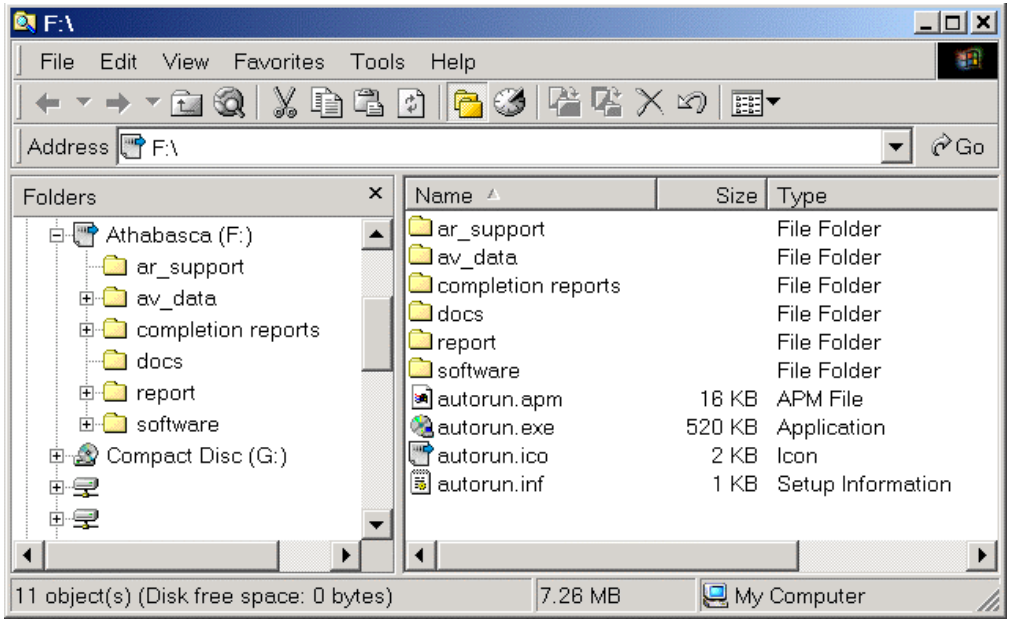
Auto install and quick access

- **ESRI ArcExplorer** - will install a free version of ArcExplorer (a GIS viewer program) onto your computer. This is needed to access the GIS projects stored on the CD-ROM (county.aep).
- **Adobe Acrobat Reader** installs a free version of Adobe Acrobat Reader. This program is needed to view the report and the groundwater well completion reports (water well logs).
- **MOW-TECH LTD. gwQuery** installs this program onto your computer. This program allows the user to get an estimate of the groundwater resources underlying land locations within the County or MD.
- **Report** will allow you to view the consultant's report and maps. Adobe Acrobat Reader must be installed (see above).
- **Completion Reports** will allow you to view the completion reports within the study area (County or MD). Adobe Acrobat Reader must be installed (see above).
- **EXIT** (lower right) will close the Autorun menu system to close menu screen.
- **CD-ROM Icon** (upper right) will allow you to explore the contents of the CD-ROM.

5.4. Folders and files

If you want to look at the files, click on the CD-ROM icon in the upper right of the Auto install and quick access screen or open Windows Explorer (Start|Programs|Windows|Explorer). A description of the folders and files is listed below:

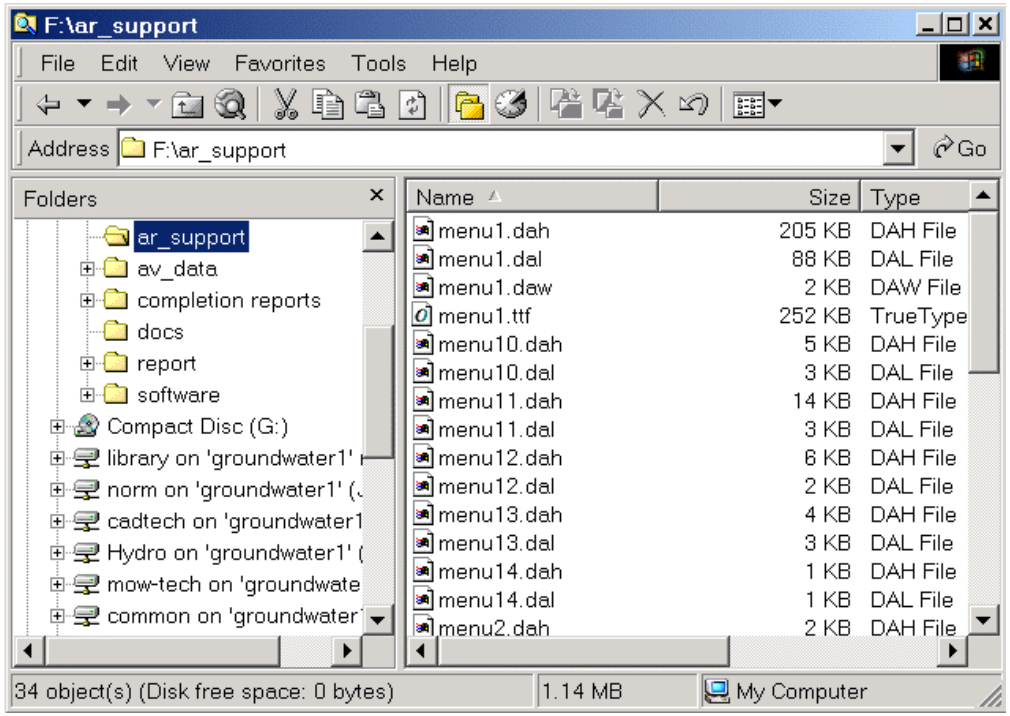
- **ar_support** - files for autorun program
- **av_data** - GIS data for ArcExplorer or ESRI ArcView (shape files, databases, ArcExplorer project files (*.aep), ESRI ArcView project file (*.apr).
- **completion reports** - (water well log files) in Adobe Acrobat PDF format.
- **docs** - copyright text files for AltaLIS, Ltd. Hydrogeological Consultants Ltd., and MOW-TECH LTD.
- **report** – Regional Groundwater Assessment report in Adobe Acrobat PDF format.
- **software** - used to work with the data on this CD-ROM (ArcExplorer, Adobe Acrobat Reader, MOW-TECH LTD. gwQuery).
- **autorun.*** - files support the autorun menus.



Folders and files

5.4.1. \ar_support folder

This folder contains the system files for the Autorun menu system and is of no use to the end user.



\ar_supprt folder

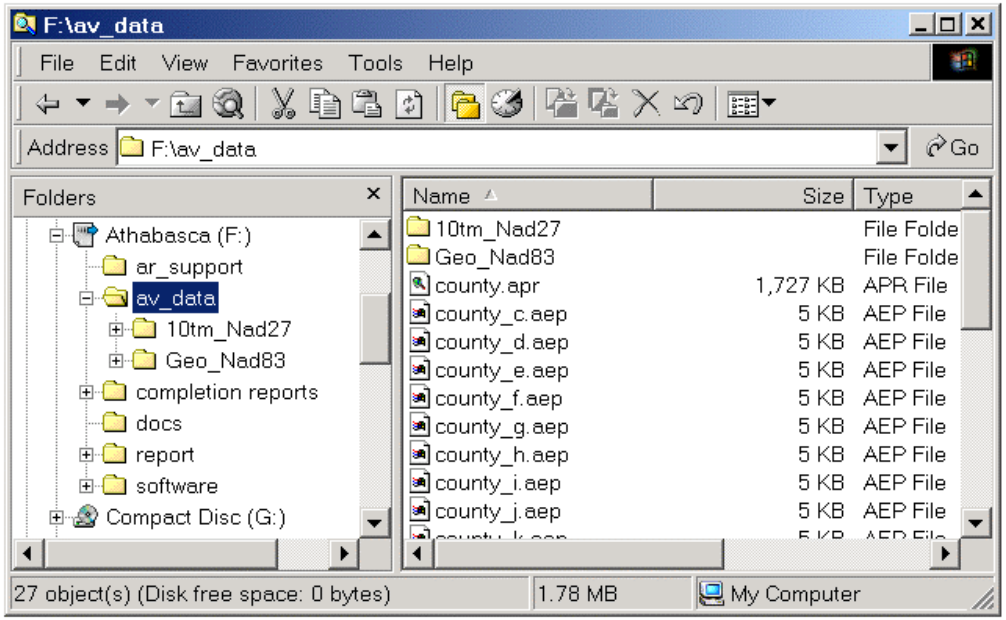
5.4.2. \av_data folder

The two 10tm_Nad27 and Geo_Nad83 folders contain the same data but in different geographic projections:

- 10tm_Nad27 - projected data. These data are used by ArcExplorer (as it has no capability to change the projection once the GIS data are loaded).
- Geo-Nad83 - non-projected data (PFRA standard). These data are used by ESRI ArcView (which can change the projection to 10tm once the data are loaded).

Double-clicking on *county.apr* file will open this project file in ESRI ArcView (GIS program), but only if you have ESRI ArcView on your computer.

Double-clicking on *county_c.aep* will open ArcExplorer and then open this project file. The letter before the .aep is to designate the letter of your CD-ROM drive. Example, if your CD-ROM drive was designated as drive F, you would open the *county_f.aep* file.



\av_data folder

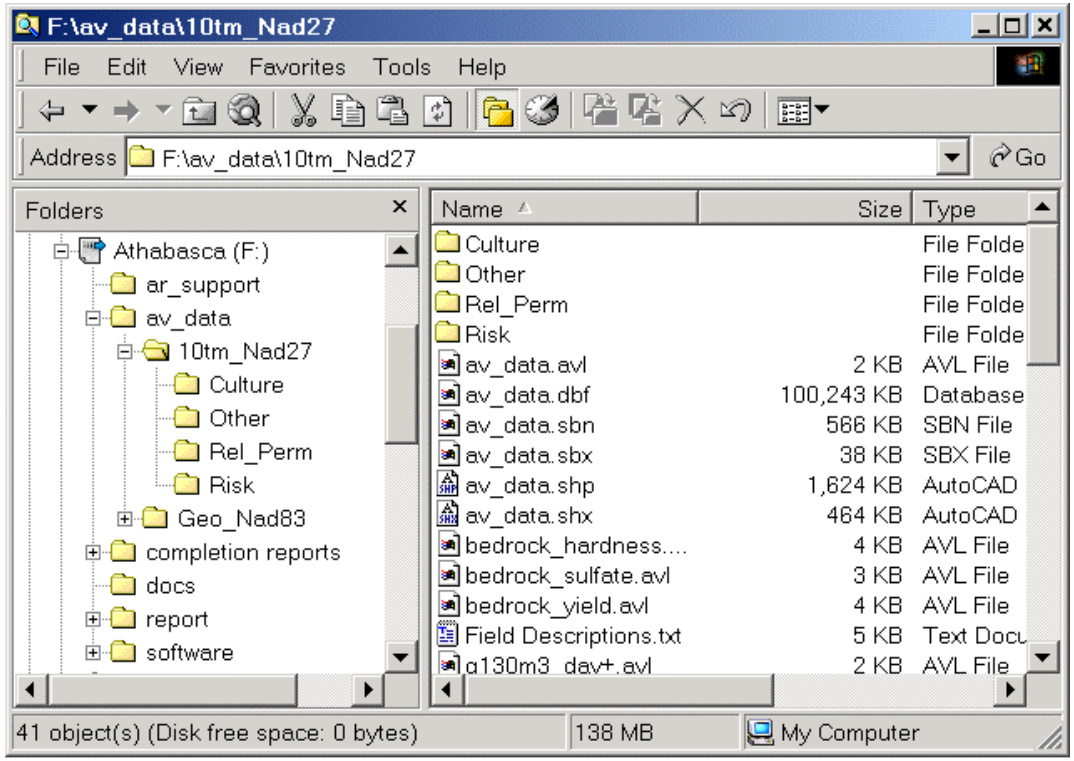
5.4.3. \av_data\10tm_Nad27 (Geo_Nad83) folder

In either the Geo_Nad83 or 10TM_Nad27 folders, or in some cases directly inside the av_data folder, you will find a series of folders and files.

Below is a description of the folders and files contained in these directories:

- *.sbn or *.sbx or *.shp or *.shx - are ESRI-compatible GIS "shape" files that can only be viewed in either ArcView or ArcExplorer. Note: these are already added to the ESRI ArcView or ArcExplorer project files (*.apr or *.aep) in most cases.
- *.avl – ESRI legend files which instruct ESRI ArcView how to display the shape file within ArcView.
- *.dbf - database companion file to the shape files. These are xbase compatible table files, which can be opened with Microsoft Excel or a similar spreadsheet program.

  NOTE: Microsoft Excel (97/2000) has row/record limit of 65,536; therefore, any dbf file which has more than 65,536 will not properly open in Microsoft Excel. Ideally, a database program should be used when viewing dbf files. Microsoft Access or Microsoft Fox Pro are two examples of database programs.



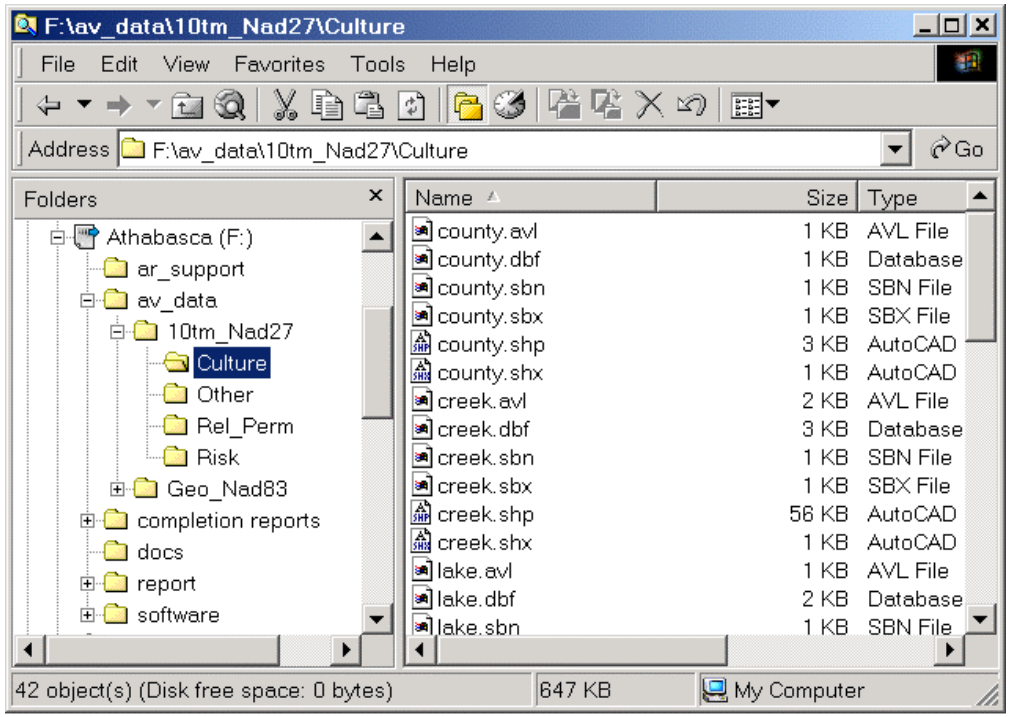
\av_data projection folders

The "Field Descriptions.txt" and "Field Descriptions.xls" files describe the fields included in the av_data or gw_data.dbf files. For a sample see Appendix B. "Field Descriptions.txt" is a text file and can be opened using wordpad or textpad. "Field Descriptions.xls" is a Microsoft Excel spreadsheet which can be opened using Microsoft Excel or other spreadsheet or database programs.

5.4.4. \av_data\10tm_Nad27\Culture folder

This is all proprietary AltaLIS Ltd. base mapping GIS data provided as ESRI-compatible shape files.

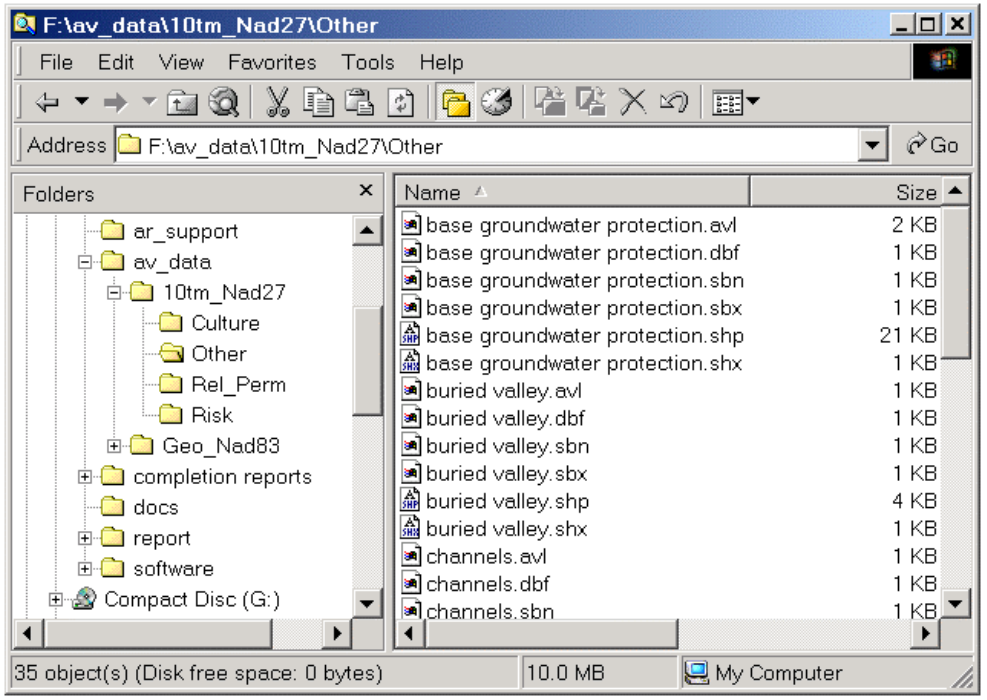
- county.* - county outline
- lake.* - lakes
- creek.* - creeks
- river.* - rivers
- road.* - major roads
- town.* - towns
- section.* - section boundaries (Copyright MOW-TECH LTD.)
- township.* - township boundaries (Copyright MOW-TECH LTD.)



\av_data\10tm_Nad27\Culutre folder

5.4.5. \av_data\10tm_Nad27\Other folder

Other shape files and databases created by the Consultant. (Note: files may differ on your CD-ROM):



\av_data\ av_data\10tm_Nad27\Other folder

- hc_well.*/oil_well.* - hydrocarbon (hc) or oil/gas industry well logs with lat-long location and elevation data (used by consultant to check elevation data in provincial Digital Elevation Model data - DEM data).
- wwells.* - **important file** that contains the list of water wells in the County/MD available to the time of the study, with "value added" data created by the Consultant (aquifer name, completion zone top & bottom, etc.). For a more detailed view of the fields in this type of database file, see next page.

  Note: *These files may also be named as one of the following wwell.* or water_wells.* or w_wells.**
- base groundwater protection.* - the Base of Groundwater Protection, the depth of potable water (TDS<=4000 mg/l) as defined by Alberta Environment)
- buried valley.* - the location of buried valleys: valleys created in preglacial time and now infilled with glacial deposits. These valleys can be important regional aquifers.
- channels.* - the location of meltwater channels created by water flowing from melting glaciers

5.4.6. \av_data\10tm_Nad27\other\wwells.dbf / wwell.dbf / water_well.dbf (key database table)

This file contains the list of water wells in the County/MD available to the time of the study, with "value added" data created by the Consultant (aquifer name, completion zone top & bottom, etc.). Below is a partial list of the fields in this file. For a complete list, please refer to Appendix A.

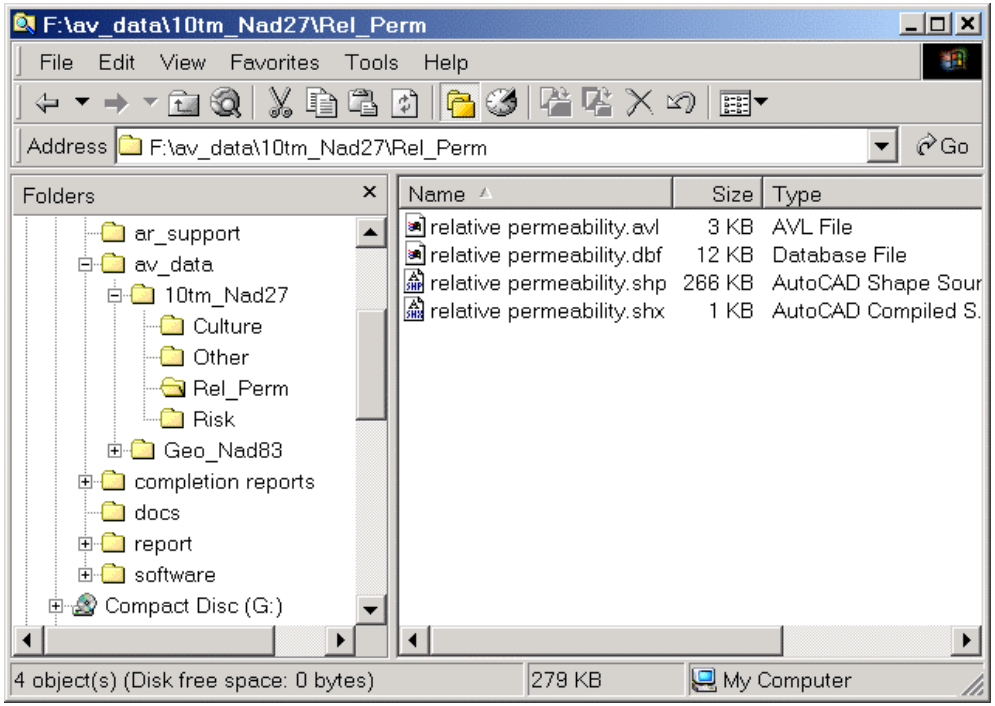
UID	OWNER	AEP_NO	ELEVATION	LOCATION	DATE	DRILLER	CI_TOP	CI_BOT	DEPTH	NPWL	YIELD_M3_D	T_APP	T_AQUIFER	T_EFF	AQUIFER	BDR_TOP	SGTHC_TOT
M35377.049390	Bluda, Dave	260887	551.6	SE-20-068-18 W4M	14-Jul-95	Comfort, Grant Enterprises Ltd.	12.5	18.6	18.6	3.8	40.91	4.24	3.20	15.10	Upper Surficial	-1	10.98
M35377.054951	Land & Forest Service	263495	707.0	SE-01-065-25 W4M	27-Jul-95	Whispering Hills Drilling Ltd.	46.0	47.6	47.6	16.6	31.82	3.71	0.60	3.10	Upper Surficial	-1	7.93
M35377.054962	Lang, Mel	263506	582.4	NW-01-067-24 W4M	01-Jul-95	Whispering Hills Drilling Ltd.	27.1	40.8	40.8	8.7	18.18	1.49		0.40	Victoria	25.91	7.92
M35377.056913	Hunt, Gordon	265457	686.2	NW-29-062-23 W4M	18-May-95	Whispering Hills Drilling Ltd.	43.0	44.5	44.5	13.4	54.55	7.94	2.10	35.15	Upper Surficial	44.5	2.14
M35377.056922	Helms, Detter	265466	623.7	SE-12-064-23 W4M	11-Aug-95	Town & Country Water Well Boring Ltd.	10.7	15.2	15.2	10.4	27.28	3.42		0.35	Upper Surficial	-1	2.13
M35377.056925	Gordon, Dave	265471	584.1	SE-30-065-21 W4M	16-May-95	Whispering Hills Drilling Ltd.	43.6	45.1	45.1	10.4	27.28	2.27	0.40	1.20	Upper Surficial	-1	8.54
M35377.056932	228468 Alberta Ltd (Evans)	265476	563.0	NE-21-065-22 W4M	07-Jul-95	Whispering Hills Drilling Ltd.	22.9	24.4	24.4	13.4	36.37	5.49		7.70	Upper Surficial	-1	8.84
M35377.056934	Chamzuk, Michael	265479	592.4	SE-22-067-19 W4M	14-Nov-95	Lakeland Drilling Ltd.	40.2	41.8	41.8	26.5	45.46	4.26		6.40	Upper Surficial	48.77	2.75
M35377.056937	Meave, Mark	265482	583.8	NW-01-067-24 W4M	17-Aug-95	Whispering Hills Drilling Ltd.	25.9	26.5	26.5	7.3	45.46	4.92		4.00	Upper Surficial	26.52	4.56
M35377.056940	Homa, Mike	265486	589.5	SW-09-068-19 W4M	08-May-95	Whispering Hills Drilling Ltd.	28.4	29.9	29.9	14.7	45.46	5.48			Upper Surficial	-1	2.13
M35377.056943	Deren, Margaret	265488	636.6	NW-33-068-22 W4M	28-Oct-94	Town & Country Water Well Boring Ltd.	10.1	17.4	17.4	9.5	68.19	12.92		0.90	Upper Surficial	-1	5.79
M35377.056946	Morin, Ron	265490	629.5	NE-36-069-21 W4M	03-Jun-95	Whispering Hills Drilling Ltd.	73.2	74.7	74.7	15.9	22.73	0.75		0.20	Upper Surficial	-1	
M35377.056956	Hebert, Jeannette	265500	573.5	···12-071-17 W4M	08-Nov-95	Lakeland Drilling Ltd.	21.6	23.2	23.2	15.9	45.46	9.37			Upper Surficial	-1	7.62
M35377.058270	Dorman, Jim/Clawdette/Prbm Rpt	266816	634.1	NE-20-065-17 W4M	07-Aug-95	Chorney Water Well Drilling Ltd.	23.5	24.1	24.1	7.1					Upper Surficial	-1	3.66
M35377.058280	Dych, Bert	266825	634.1	NE-20-065-17 W4M	14-Aug-95	Chorney Water Well Drilling Ltd.	47.2	48.5	48.5	17.2	45.46	3.74	0.70	3.90	Upper Surficial	-1	3.36

- assigns water wells to aquifers or formations.
- estimates completion zone - the top and bottom depth in ***Metres***, between which water may be entering the water well.
- shows NPWL = Non-pumping Water Level (often referred to as "Static" water level) in ***Metres*** in the water well.
- shows YIELD in cubic metres per day (m^3/day).
- also contains some water-quality parameters - TDS, sulfate, chloride (NOT ALL....more is available from Alberta Environment or maybe from the water well record data).
- there is also a field, not shown in the graphic, that contains the Alberta Environment "wellid" number.
- the LAST and FIRST names given are the owners at the time the water well was installed (see DATE field) and the current water well owner may be different. These fields often contain typos.

Note: In the most recent studies, this file is also linked to the Alberta Environment licensed water well file (licensed under the Water Act).

5.4.7. \av_data\10tm_Nad27\Rel_Perm folder

This folder contains the Consultant's Relative Permeability shape file based on review of surficial geology and/or soils maps.

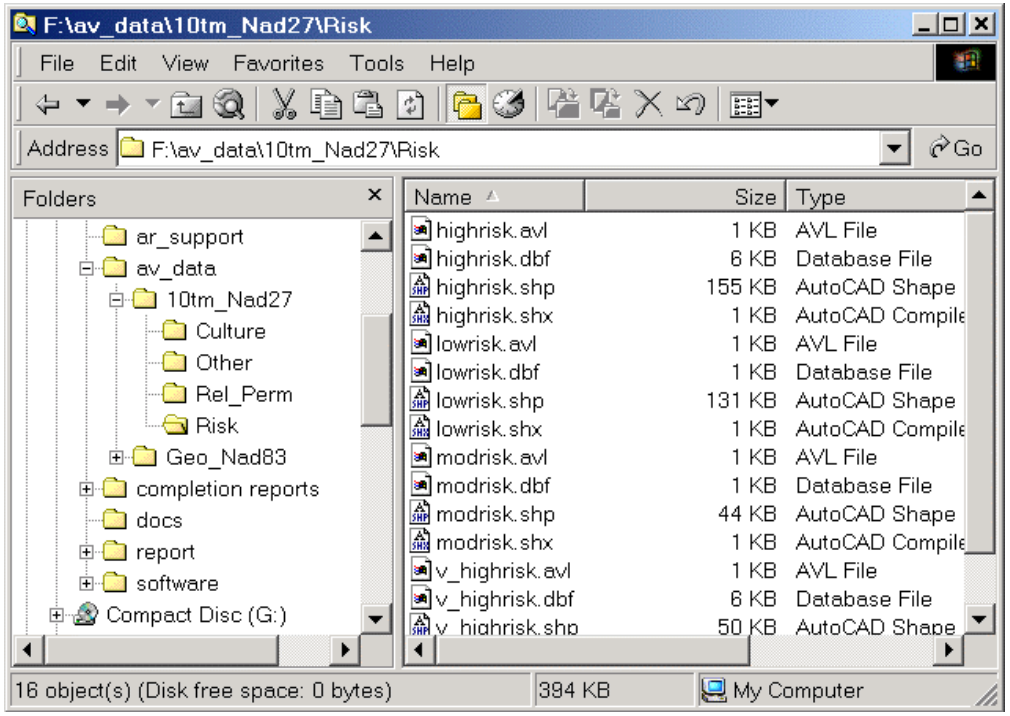


\av_data\ av_data\10tm_Nad27\Rel_Perm folder

5.4.8. \av_data\10tm_Nad27\Risk folder

This folder contains the Consultant's Risk of Contamination shape files, and is based on relative permeability above, combined with consideration of where sands or gravels are present within one metre of the ground surface.

Note: *this is not being included in later studies as similar type mapping has been completed by PFRA and Alberta Agriculture, Food and Rural Development for most agricultural areas in Alberta.*



\av_data\ av_data\10tm_Nad27\Risk folder

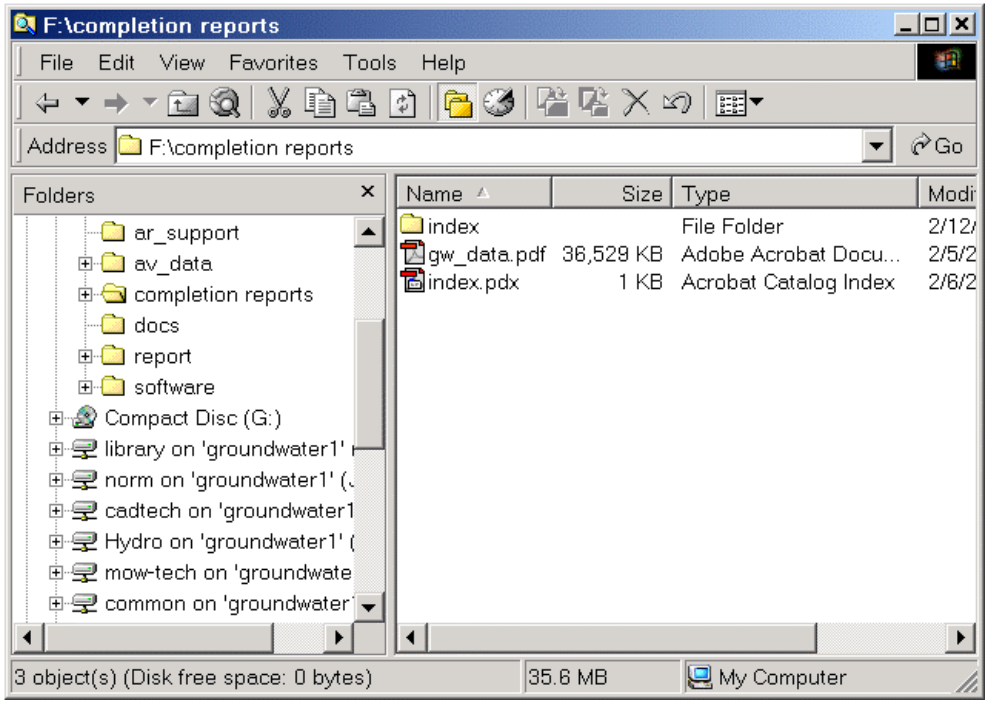
5.4.9. \completion reports folder

This folder contains the completion reports (water well logs) for the groundwater wells within the County/MD study area.

- gw_data.pdf is the completion reports (water well logs) document in Adobe Acrobat format (PDF).
- Index.pdx is an index file for the data

Double-clicking on ***gw_data.pdf*** will open the completion reports document in Adobe Acrobat Reader. Adobe Acrobat Reader must be installed (see above). This document can also be opened using the Autorun Menu system.

Note: *All completion reports are included in this document; each completion report is on a separate page.*

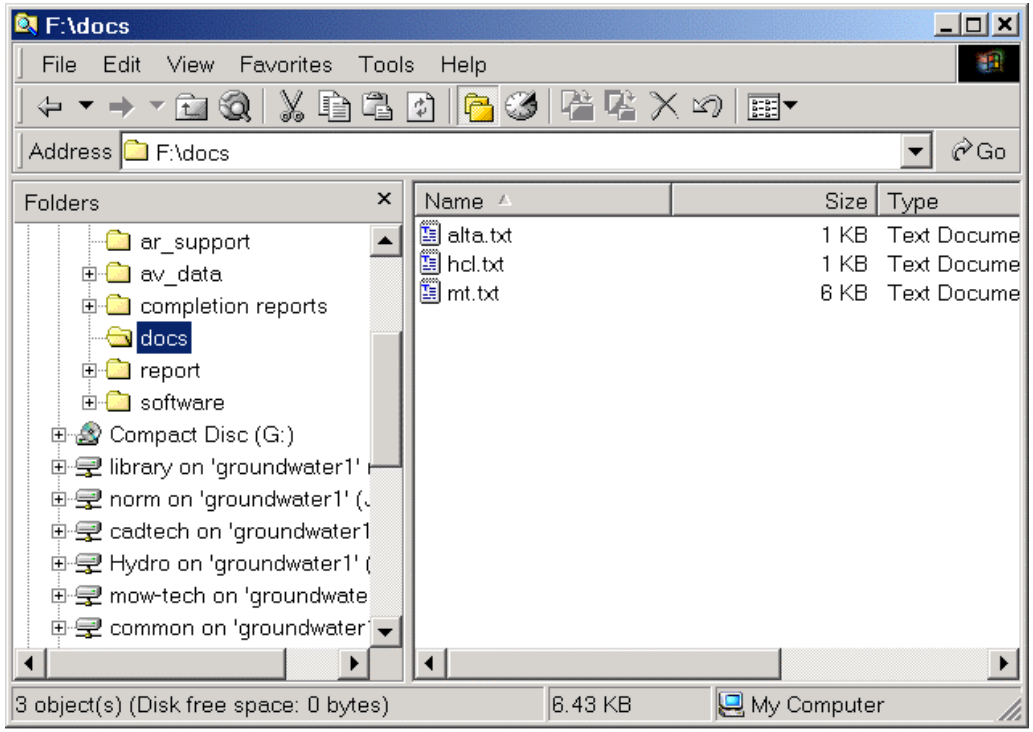


\completion reports folder

5.4.10. \docs folder

This folder contains the copyright documents stating the copyright information of the data and reports on this CD-ROM.

- alta.txt - AltaLis Ltd. copyright details
- hcl.txt - hydrogeological consultants ltd. copyright details.
- mt.txt - MOW-TECH LTD. Copyright details.
- county.txt - County or MD copyright details (later studies).

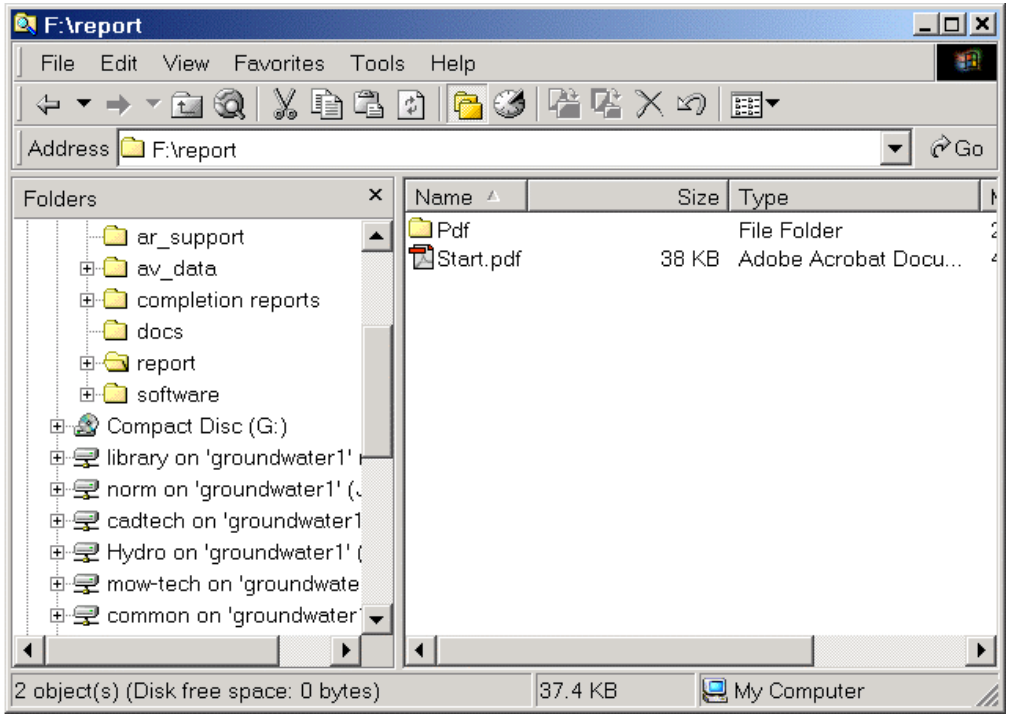


\docs Folder

5.4.11. \report folder

This folder contains the graphic report menu system. Using this menu system you can view the report and all the related maps.

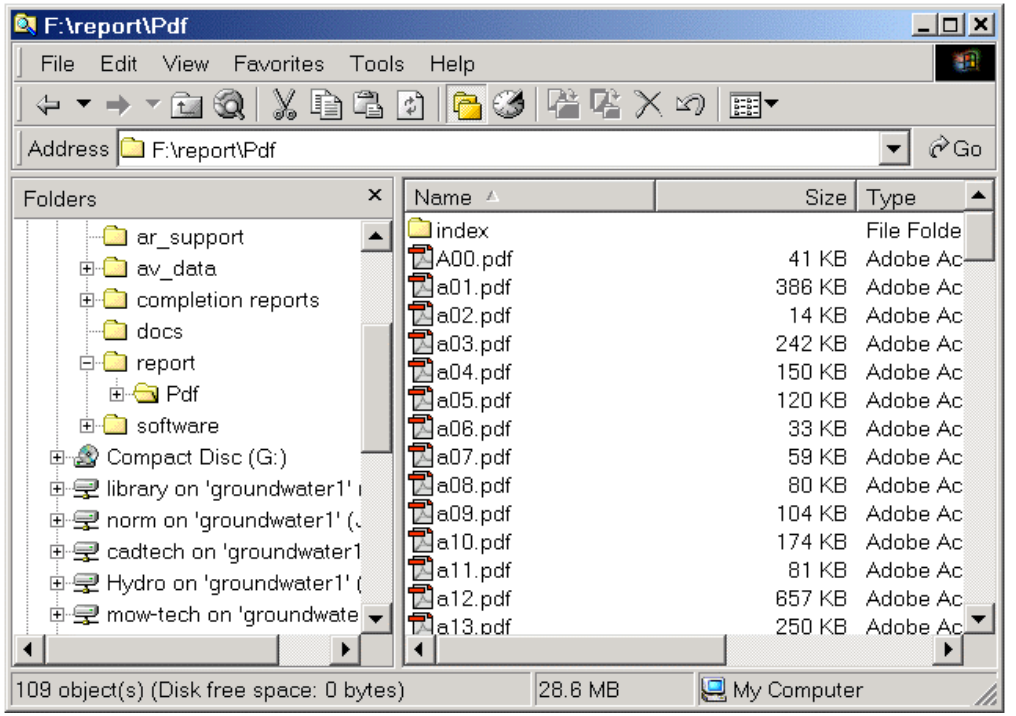
- **Pdf** folder contains all the supporting PDF files for the graphical menu system.
- **start.pdf** - is the starting page for the graphical menu system.



\report folder

5.4.12. \report\Pdf folder

This folder contains the support files for the graphic report menu system.



\report\Pdf folder

- index folder contains supporting index files for the full-text searching of the Regional Groundwater Assessment Report (report.pdf). *Note: these are system files and are of no use to the end user.*
- A??.pdf files are for the general map and figures component of the graphical menu system. *Note: Internal numbering system with no reference to other files on CD-ROM.*
- B??.pdf files are for the Surficial Aquifer maps of the graphical menu system. *Note: Internal numbering system with no reference to other files on CD-ROM.*
- C??.pdf files are for the Bedrock Aquifers maps of the graphical menu system. *Note: Internal numbering system with no reference to other files on CD-ROM.*
- D??.pdf files are for the Observation Water Well Hydrographs of the graphical menu system (newer studies only). *Note: Internal numbering system with no reference to other files on CD-ROM.*

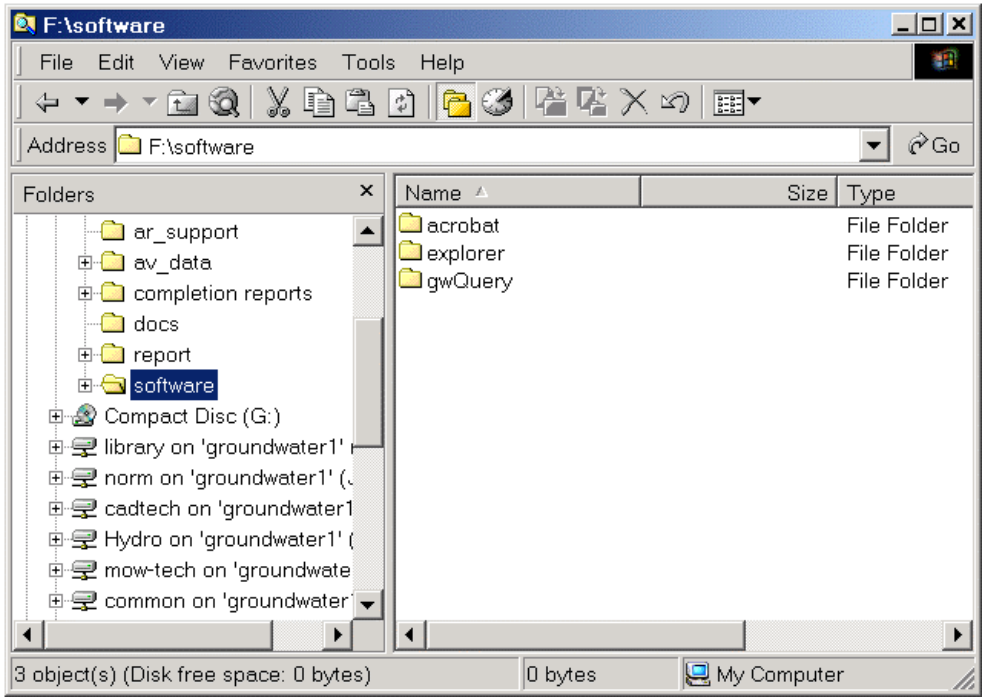
These files (A??.pdf, B??.pdf, C??.pdf, D??.pdf) are generally in the same order as listed in Appendix B of the RGA study report. These files are good to use if you want to email someone a specific map presented in the report or on the CD-ROM.

5.4.13. \software folder

These folders contain software for installing the various programs required to use the information contained on the CD-ROM.

- acrobat – this folder contains setup.exe which will install Adobe Acrobat Reader on your computer.
- explorer – this folder contains aeclient.exe which will install ESRI ArcExplorer software on your computer.
- gwQuery – this folder contains setup.exe which will install MOW-TECH LTD. gwQuery software on your computer.

Note: *You may be prompted to reboot your computer after each program is installed.*



\software folder

Adobe and ESRI software programs are constantly being improved and updated. Current versions of Adobe Acrobat Reader and ESRI ArcExplorer software can be downloaded from the following Internet sites:

Adobe Acrobat Reader –
http://www.adobe.com/products/acrobat/readermain.html

ESRI ArcExplorer –
http://www.esri.com/software/arcexplorer/index.html

6. MOW-TECH LTD. gwQuery Program

6.1. Limitations and Accuracy

1.1.1.What are the limitations of the MOW-TECH LTD. gwQuery program?

- It is based on a regional review of water well log data...site-specific conditions may be different.
- It is only as reliable as the original data collected and is constrained by how the original aquifer test was done (how long an aquifer test, at what pumping rate and how accurately it was measured, how accurately water levels were taken, etc.).
- It's based on values picked from "mathematical contour surfaces" which "average" data, so local differences will occur. Contour surfaces may also extrapolate beyond the available water well data. Data density should be considered for these areas (see ArcExplorer).
- Accordingly, the Mow-Tech Ltd. gwQuery program ***should only be used as a guide*** to estimate potential yields and water quality that may be available at that location. Its intent is to give the individual an idea of likely key zones to investigate during drilling.

6.1.1. What is the accuracy of these studies?

The groundwater assessment is based on a regional-scale review of water well and other data. Accordingly, the maps and the groundwater query program are intended only as a *GUIDE*. No land purchase or other activity should be undertaken without site-specific testing to confirm groundwater conditions and actual long-term water well yields and groundwater quality. Contact a professional geologist or engineer specializing in groundwater for more guidance.

6.1.2. Costs to drill a water well?

On the enclosed groundwater query program, estimated costs to drill water wells to a variety of depths are not provided. It is recommended that interested landowners contact at least three licensed water well drillers to get estimates of drilling and water well completion costs in their area. They should also consult the "Water Wells that Last for Generations" booklet published by Alberta Agriculture, Food and Rural Development for advice on hiring a driller, and for a checklist of items that the landowner should discuss with the driller and agree to before starting any actual work.

6.2. *Using the MOW-TECH LTD. gwQuery*

6.2.1. Installing the MOW-TECH LTD. gwQuery program

- Put CD in CD-ROM drive.
- Install gwQuery software at auto-install screen by clicking on **gwQuery** icon.
- Follow instructions, re-booting your computer as necessary.

6.2.2. Running the MOW-TECH LTD. gwQuery program

The steps outlined below will assist you in running the MOW-TECH LTD. gwQuery program.

Step 1: Start program by either: double clicking on the installed **gwQuery** icon on your desktop or go to **Start | Programs | MowTech-gwQuery**

Step 2: Using the drop-down menu (down arrow), select the area of interest. Select your County, MD or Special Area.

Step 3: Enter password from back of CD jewel case and then click the Accept button

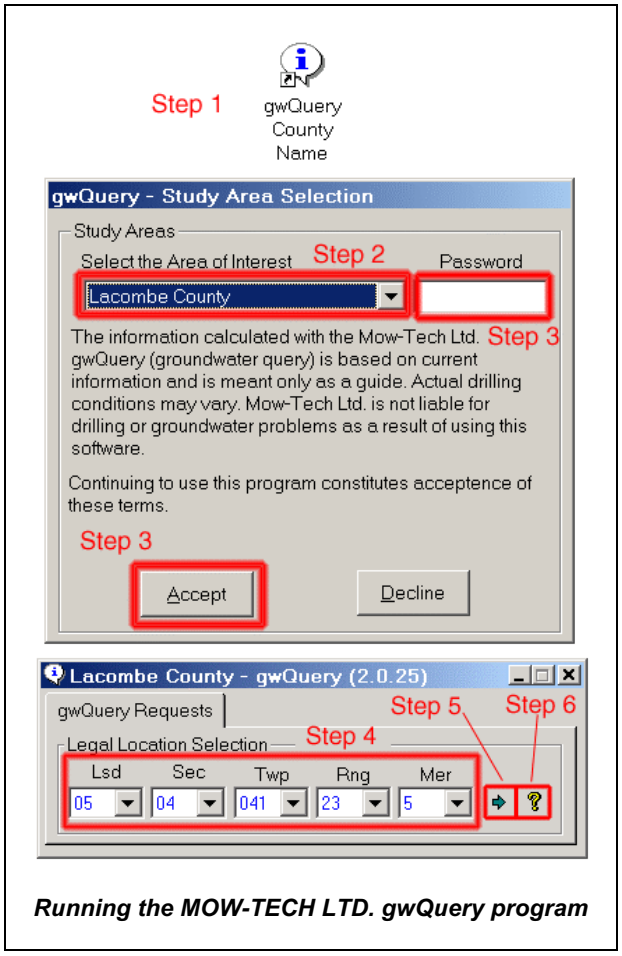
Step 4: Using drop-down menus, specify the land location of interest.

For LSD, you can choose any of

- LSD number 01 (Legal SubDivision 1) to 16 or Quarter SW (southwest), SE, NE, NW Half SH (southhalf), EH, WH, NH

Step 5: Click the result arrow to view the General Results

Step 6: Display the on-line help.



Running the MOW-TECH LTD. gwQuery program

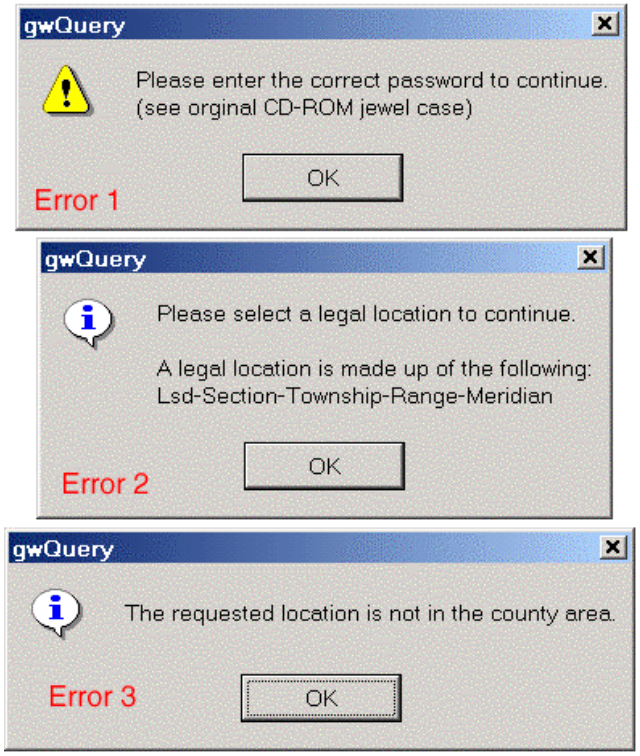
6.2.3. Possible Error Messages While Using MOW-TECH LTD. gwQuery

In a user enters/performs an invalid operation, one of the messages below will be displayed:

Error 1: You've entered an incorrect password for the study area selected. Check that you've selected the correct study area and re-enter the password. *Resolution: Try again.*

Error 2: If you don't pick a complete Lsd-Sec-Twp-Rng-Mer combination, you will get a reminder that a land location requires ALL of these. If you wanted to get the results for just a Section, pick one of the halfs (SH,EH,WH,NH). *Resolution: Try again.*

Error 3: You've picked a location outside the County/MD boundary. Check the land location you've specified. *Resolution: Try again.*



MOW-TECH LTD. gwQuery Error Messages

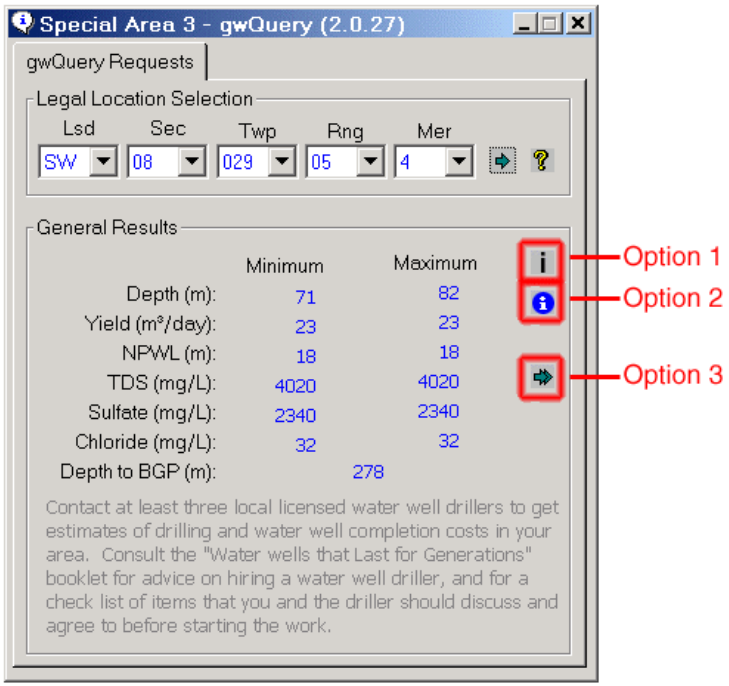
7. What do the MOW-TECH LTD. gwQuery results mean?

7.1. Interpreting the MOW-TECH LTD. gwQuery General Results

For the general area, water wells are generally between 71 and 82 m deep (note that the units are given and on this screen all are in METRIC) which, as they are similar depths, might imply that water wells in this area appear to be completed in a similar aquifer zone.

Yield could be expected to be ***about*** 23 m³/day, NPWL = non-pumping water level should rise to about 18 m below ground in the water well, water quality would be expected to be about 4020 mg/L TDS (Total Dissolved Solids), 2340 mg/L sulfate, 32 mg/l chloride.

The Base of Groundwater Protection (BGP) is estimated to be at about 278 m in this area. That would be the assumed maximum depth to which potable groundwater MIGHT be found and represents a reasonable maximum depth of drilling in most areas. Drilling below that depth would encounter very poor quality water (>4000 mg/L TDS groundwater).



MOW-TECH LTD. gwQuery General Results

7.2. Options for the MOW-TECH LTD. gwQuery General Results

Option 1: Toggle units from Imperial to Metric

Option 2: Display copyright and version information.

Option 3: Display the MOW-TECH LTD. gwQuery Detailed Results

7.3. Interpreting the MOW-TECH LTD. gwQuery Detailed Results

7.3.1. General Results (Imperial):

Same as given in the previous General Results screen. Most water wells in general area are likely completed between 233 and 270 ft and yield *about* 4 igpm. Non-pumping water level is about 59 ft below ground and water quality is *estimated* to be *about* 4020 mg/L TDS, 2340 mg/L sulfate, 32 mg/L chloride.

7.3.2. Detailed Results (Imperial):

Upper surficial deposits extend from 0 to 62 ft, yield expected to be about 4 igpm. *Estimated* water level and quality as shown.

Bedrock surface (grey bar) is *estimated* to be at about 62 ft.

Bearpaw Formation extends from 62 ft (TOP) to 364 ft. Estimated yield is 4 igpm, NPWL 59 ft, and quality as shown. Existing water wells in area are obviously in this formation as they are typically 233 to 270 ft deep.

Special Area 3

Mow-Tech Ltd. gwQuery Results (imperial)

SW 05-024-06 W4M

General Results	Depth	Yield	NPWL	TDS	Sulfate	Chloride
Depth (s)	feet	igpm	feet	mg/L	mg/L	mg/L
Minimum	27	4	79	2439	1524	19
Maximum	30	4	79	2439	1524	19

Detailed Results	Top	Yield	NPWL	TDS	Sulfate	Chloride
Formation Name	feet	igpm	feet	mg/L	mg/L	mg/L
Upper Surficial Deposits	--	4	79	2439	1524	19
Lower Surficial Deposits	348	--	--	2439	1524	19
Bedrock Surface	358					
Oldman Formation	358	37	331	1729	121	665
Birch Lake Member	653	30	325	1525	503	94
Ribstone Creek Member	942	--	--	--	--	--
Victoria Member	1056	--	--	--	--	--

Miscellaneous

Parameter	feet
Base of Groundwater Protection (Depth)	791
Ground Elevation (AMSL)	2595

Legend/Notes

'--' indicates information not available

Base of Groundwater Protection (BGP) {groundwater > 4000 mg/L TDS}

Results are based on a regional groundwater study by hydrogeological consultants ltd.

Contact at least three local licensed water well drillers to get estimates of drilling and water well completion costs in your area. Consult the 'Water wells that Last for Generations' booklet for advice on hiring a water well driller, and for a check list of items that you and the driller should discuss and agree to before starting the work.

MOW-TECH LTD. gwQuery Detailed Results (Interpreting)

7.3.3. Two other possible groundwater options in this area:

- Oldman Formation - extends from about 364 to 732 ft below ground. Estimated yield could be 10 igpm, NPWL at 210 ft below ground, quality 1946 mg/L TDS, 604 mg/L sulfate, 259 mg/L chloride.
- Birch Lake Member - extends from about 732 to 846 ft below ground. Estimated yield could be 112 igpm, NPWL at 295 ft below ground, quality 1517 mg/L TDS, 84 mg/L sulfate, 381 mg/L chloride.

7.3.4. Base of Groundwater Protection

The Base of Groundwater Protection is at about 912 ft. This is the maximum depth that should be considered for drilling for potable water (TDS < 4000 mg/L). Ground elevation in the centre of this Quarter (where this information is from) is about 2602 ft AMSL.

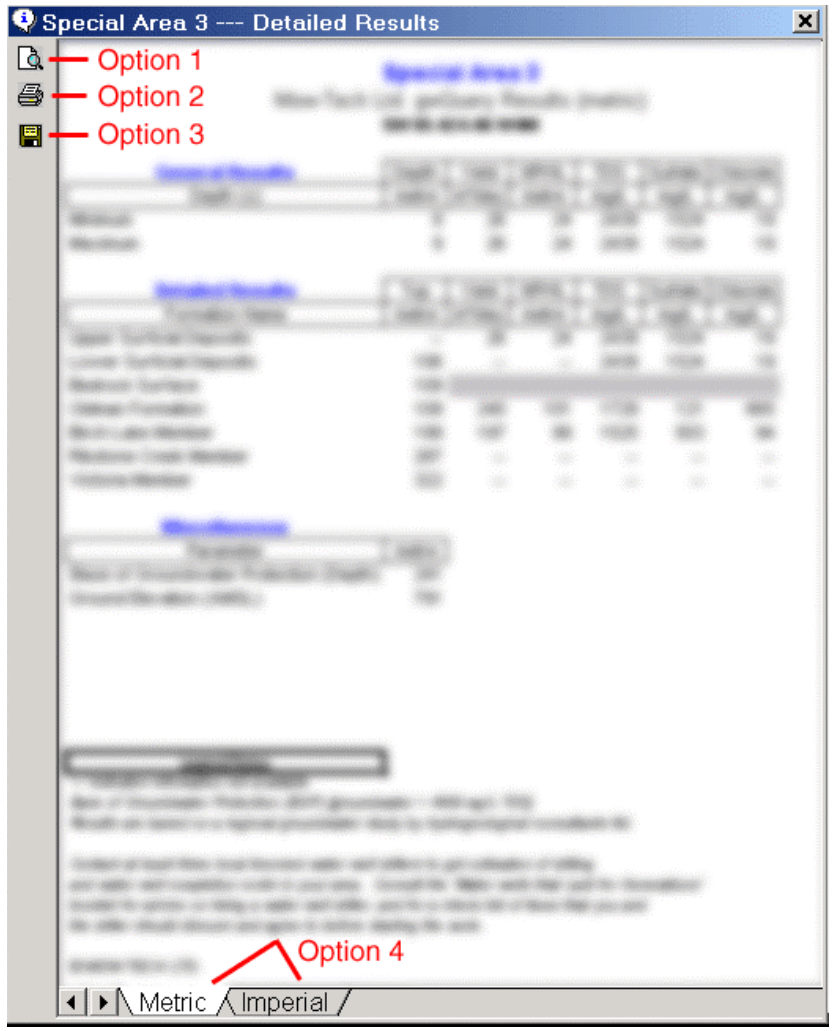
7.4. Options for the MOW-TECH LTD. gwQuery Detailed Results

Option 1: Print Preview, preview the current detailed results before printing, you can then either print to your default printer or select another printer. The active sheet (metric/imperial) will be printed.

Option 2: Printer, prints the current detailed results to your default printer. The active sheet (metric/imperial) will be printed.

Option 3: Diskette, saves the current detailed results to a Microsoft Excel spreadsheet, both metric and imperial results are saved.

Option 4: Units, selecting the imperial tab will display the detailed results in imperial units. Conversely, selecting the metric tab will display the detailed results in metric units.



MOW-TECH LTD. gwQuery Detailed Results (Navigation)

8. How should the MOW-TECH LTD. gwQuery results be used?

- As one piece in the puzzle.
- The MOW-TECH LTD. gwQuery should be used only as a GUIDE, in conjunction with the steps given below.

Why ?

- Because it's based on a regional assessment.

The MOW-TECH LTD. gwQuery General or Detailed Results screens say *nothing* about:

- whether or not there is even a water well in this LSD or quarter (or even if there were, how many water wells).
- how close it is to the nearest water well completed in each of the aquifers.
- the *reliability* of the assessments made in each aquifer; the assessment could be based on several water wells located in this LSD or Quarter or it could be based on a couple of water wells that are both located over ten kilometres away. Less RELIABILITY means more RISK (less certainty of outcome).

The following steps are recommended to develop a groundwater supply:

1) **Evaluate all water sourcing options: surface and groundwater.** Water wells that last For Generations (Alberta Environment, Allberta Agriculture, Food and Rural Development, and PFRA Publication) gives readers a good description of water system planning and help on choosing a water well site and a water well driller. This publication is available at no cost from your local PFRA, Alberta Environment, or Alberta Agriculture, Food and Rural Development office. It is also on the Internet at: http://www.agric.gov.ab.ca/water/wells

2) **Collect information on past water wells or test holes drilled in your area.** Landowners may access drilling records for studies completed on their property or surrounding lands. These records are available at your local County, MD, or PFRA offices. At the same time, the results of the Mow-Tech Ltd. gwQuery program can be obtained and may provide some guidance on possible groundwater options.

3) **Locate recent groundwater records for water wells drilled in your area.** Contact the Alberta Environment Groundwater Information Centre for information regarding recent records for water wells drilled in your area. Phone 1-780-427-2770 or call the RITE toll-free operator at 310-0000 and ask for the Groundwater Information Centre. Groundwater drilling reports are also available from the Groundwater Centre (http://www.groundwatercentre.com).

4) **Review the collected water well records.** Talk with your neighbours about their water wells and investigate any problems that they may be experiencing, including water well yield, water quality, or maintenance problems. Information regarding who drilled the water well is also important.

5) **Talk to your local water well driller(s).** Landowners are encouraged to talk with the drilling companies that drilled their water well and others in the area. These companies can supply information regarding the success of local water wells in the area, while providing suggestions and cost estimates for groundwater exploration or the installation of a new water well.

9. How did they do that? How does the query work?

The query program is the last in a series of steps.

1. The consultant reviews the geological and water well data and identifies key data (e.g. top and bottom of formations).
2. The consultant creates mathematical contour surfaces of the key data. (e.g. surfaces are created of minimum water well depth, maximum water well depth, top and bottom of each aquifer or formation, yield estimate for each aquifer or formation, TDS for each aquifer, sulfate for each aquifer, chloride for each aquifer and so on).
3. For every potential location in the County (every LSD, every Quarter, every Half, and the centre of the section), the values are picked from each of the surfaces and stored in a database (the file size will be quite large as it contains 16 + 4 + 4 +1 = 25 points per section in your County and for each point, up to about ten entries, one for each surface). This works out to 900 points per township or for a County covering say 20 townships, 18,000 points.
4. When you enter the land location desired, the matching location is found in the database file and the results are displayed on screen.

Questions and Notes on MOW-TECH LTD. gwQuery:

_____

_____

_____

_____

_____

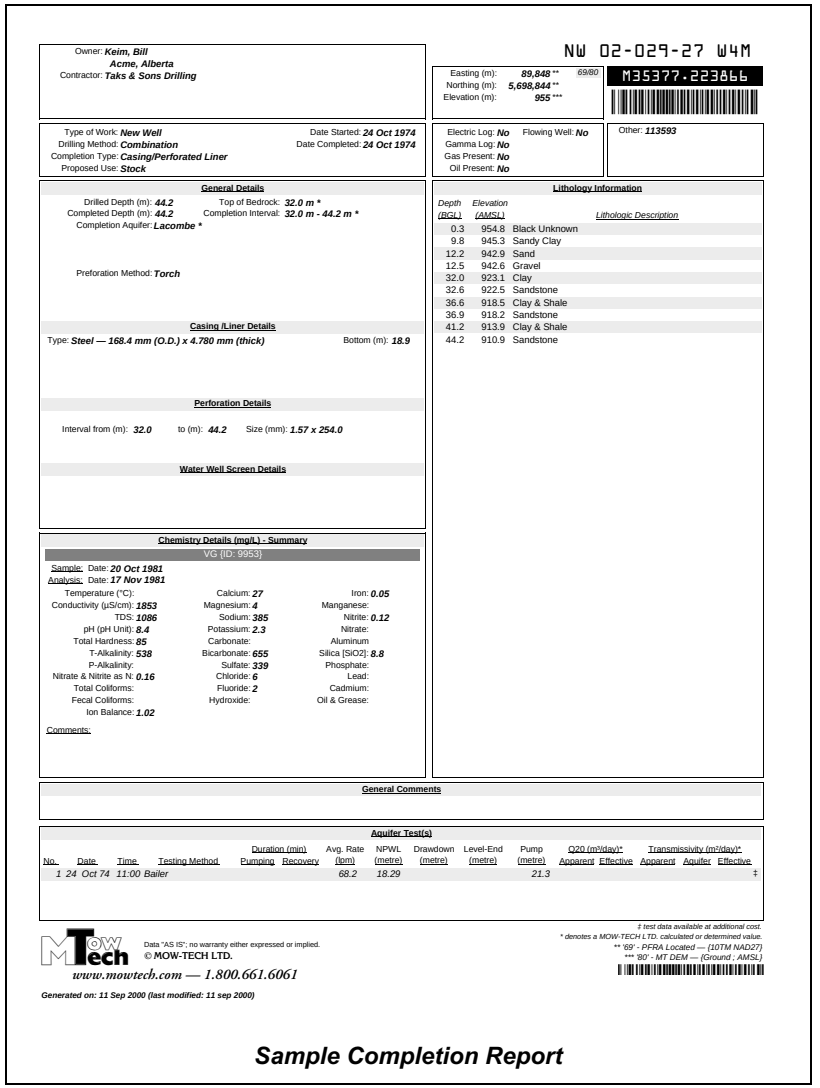
_____

10. Completion Reports

10.1. What information is on the completion reports (water well log)?

Most of it is from the Alberta Environment water well file and is entered by the water well driller at the time the work is done.

Some “added value” information is added by the Consultant and is based on a review of the groundwater well data.



Owner: **Keim, Bill**
Acme, Alberta
Contractor: **Taks & Sons Drilling**

NW 02-029-27 W4M

Easting (m): **89,848** ** 69/80
Northing (m): **5,698,844** **
Elevation (m): **955** ***

M35377.223866

Type of Work: **New Well**
Drilling Method: **Combination**
Completion Type: **Casing/Perforated Liner**
Proposed Use: **Stock**
Date Started: **24 Oct 1974**
Date Completed: **24 Oct 1974**

Electric Log: **No** Flowing Well: **No**
Gamma Log: **No**
Gas Present: **No**
Oil Present: **No**

Other: **113593**

General Details

Drilled Depth (m): **44.2**
Completed Depth (m): **44.2**
Completion Aquifer: **Lacombe ***
Top of Bedrock: **32.0 m ***
Completion Interval: **32.0 m - 44.2 m ***
Preforation Method: **Torch**

Casing /Liner Details

Type: **Steel — 168.4 mm (O.D.) x 4.780 mm (thick)** Bottom (m): **18.9**

Perforation Details

Interval from (m): **32.0** to (m): **44.2** Size (mm): **1.57 x 254.0**

Water Well Screen Details

Lithology Information

Depth (BGL)	Elevation (AMSL)	Lithologic Description
0.3	954.8	Black Unknown
9.8	945.3	Sandy Clay
12.2	942.9	Sand
12.5	942.6	Gravel
32.0	923.1	Clay
32.6	922.5	Sandstone
36.6	918.5	Clay & Shale
36.9	918.2	Sandstone
41.2	913.9	Clay & Shale
44.2	910.9	Sandstone

Chemistry Details (mg/L) - Summary

VG (ID: 9953)

Sample: Date: **20 Oct 1981**
Analysis: Date: **17 Nov 1981**

Temperature (°C):
Conductivity (µS/cm): **1853**
TDS: **1086**
pH (pH Unit): **8.4**
Total Hardness: **85**
T-Alkalinity: **538**
P-Alkalinity:
Nitrate & Nitrite as N: **0.16**
Total Coliforms:
Fecal Coliforms:
Ion Balance: **1.02**

Calcium: **27**
Magnesium: **4**
Sodium: **385**
Potassium: **2.3**
Carbonate:
Bicarbonate: **655**
Sulfate: **339**
Chloride: **6**
Fluoride: **2**
Hydroxide:

Iron: **0.05**
Manganese:
Nitrite: **0.12**
Nitrate:
Aluminum
Silica [SiO2]: **8.8**
Phosphate:
Lead:
Cadmium:
Oil & Grease:

Comments:

General Comments

Aquifer Test(s)

No.	Date	Time	Testing Method	Duration (min) Pumping	Duration (min) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m²/day)* Apparent	Q20 (m²/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	24 Oct 74	11:00	Bailer			68.2	18.29			21.3					‡

‡ test data available at additional cost.
* denotes a MOW-TECH LTD. calculated or determined value.
** '69' - PFRA Located — {10TM NAD27}
*** '80' - MT DEM — {Ground ; AMSL}

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www.mowtech.com — 1.800.661.6061

Generated on: 11 Sep 2000 (last modified: 11 sep 2000)

Sample Completion Report

10.2. How are these completion reports (water well logs) created?

10.2.1. These reports are created as follows:

Step 1. Original driller's water well record. (Created by water well driller. See Appendix C for the original completion report for the same sample log as shown on the previous page.)

- hand written on Alberta Environment form. data quality is highly variable.
- may contain a sketch showing the location of water well relative to the LSD or Quarter or buildings or roads.
- may contain a sketch of water well completion details.
- many fields may not be filled in.
- can be typos or difficult to read writing.
- record has no "wellid" at that time.
- no chemistry data are usually contained on the completion report (water well log).

Step 2. Information from the original report is entered into a groundwater information database (done by students under contract to and under the direction of Alberta Environment).

- students entered the data from the original logs into databases (for interest, PFRA paid for a substantial portion of this effort).
- although some effort is made to correct data entry errors, there can be typos in the entered water well record data. Some data may be missed and not entered. Sketch figures are not re-created.
- much of the data are entered and stored in the database using codes, and look-up tables are given to understand the codes.
- Alberta Environment makes some effort to try to identify typos.
- lithologic descriptions by water well driller may be changed to fit into the set format.

Step 3. Consultant creates modified digital groundwater data.

- based on the Step 2. computer-generated log with all its *warts*.
- filtering and data checking is done to eliminate obvious typos or water wells wrongly located by either the original water well driller (e.g. entered W4 instead of W5) or entered incorrectly into the database by the students hired by Alberta Environment.
- most original data are in IMPERIAL. All data are converted to metric units
- removal of duplicate records

Step 4. Key information is added by the consultant.

- completion interval and completion aquifer
- top of bedrock depth.
- effective Transmissivity and effective Q20 (m^3/day) based on professional review of aquifer test data.
- approximate x and y location (latitude, longitude) and elevation data for most water well records. In earlier studies, water wells were assumed to be at the centre of the LSD or Quarter. In later studies, water wells are shifted to near the locations of buildings using air photos and then elevation is calculated from the Digital Elevation Model. In either case, *these are still only estimates*. In some areas, accurate GPS (Global Positioning System) generated data are available for water wells visited in the field as part of specific projects. These data are much more reliable.
- consultant adds their own unique identifier (GCID) but note that the water well record also contains the original water "wellid" given by Alberta Environment when the data were entered into the groundwater information database.
- chemical data from the database are added and can be output along with the other water well data.

10.2.2. Things to remember:

- The completion reports may contain typos.
- Completion reports (water well logs) that became available after the County/MD study was done would not be included.
- Updated completion reports are available from Alberta Environment Groundwater Information Centre or from the Consultant at http://www.groundwatercenter.com/pfra/task1.asp

10.2.3. How do I start using the completion reports (water well logs)?

1) Put CD in CD-ROM drive.
2) Install Adobe Acrobat Reader at the auto-install screen by clicking on Adobe Acrobat icon.
3) Follow instructions, re-booting your computer as necessary.
4) Put CD in CD-ROM drive, click **next >** to get past copyright screen, then at the auto-install screen, click on ***Completion Reports*** icon.

   TIP *- The groundwater well completion report file can also be started from My Computer or Windows Explorer by getting to CD-ROMDrive:\completion reports and double clicking on gw_data.pdf.*

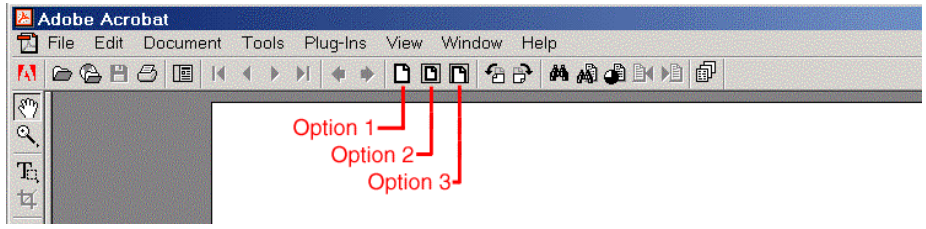
10.3. How to search and view completion reports (water well logs)?

10.3.1. Viewing completion report.

Option 1: View page at actual size.

Option 2: View whole page (Fit in Window).

Option 3: View page fitting it to the available screen width (Fit Width).



Adobe Acrobat PDF Viewing Options

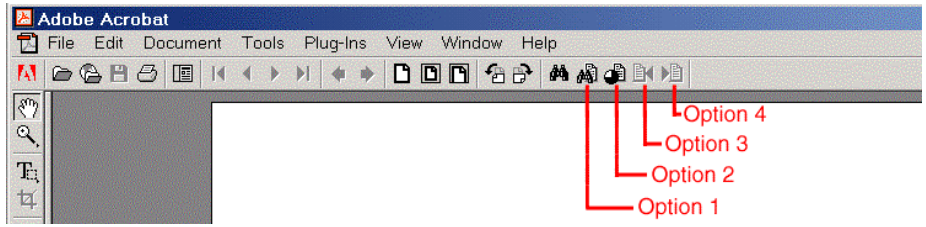
10.3.2. Adobe Acrobat Search options.

Option 1: Adobe Index Search.

Option 2: Adobe Index Search results.

Option 3: View next Search result.

Option 4: View previous Search result.

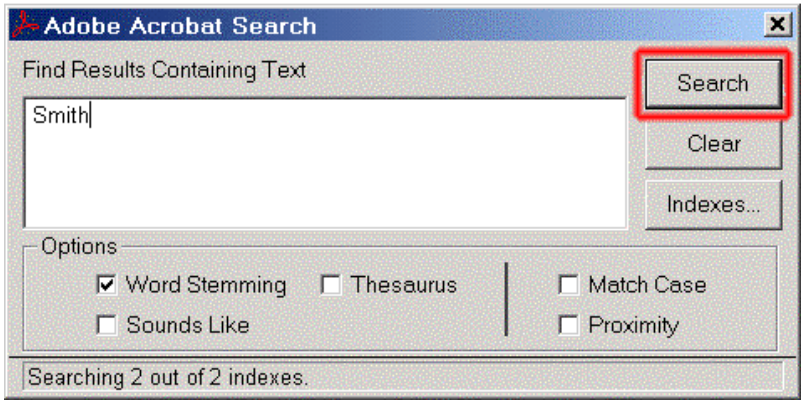


Adobe Acrobat PDF Index Search Options

10.3.3. Searching for a specific water well completion report (Search Criteria Entry)

Using the Adobe Index Search option (option 1 above), enter the text you are looking for. Once you have entered the search criteria, click on the "Search" button. *NOTE: When searching for legal location, it must be entered **exactly** as it would appear on the completion report. (e.g. NW 02-029-27 not NW 02-29-27). Also, searching for "Smith" will locate all owners and drilling contractors with the name Smith.*

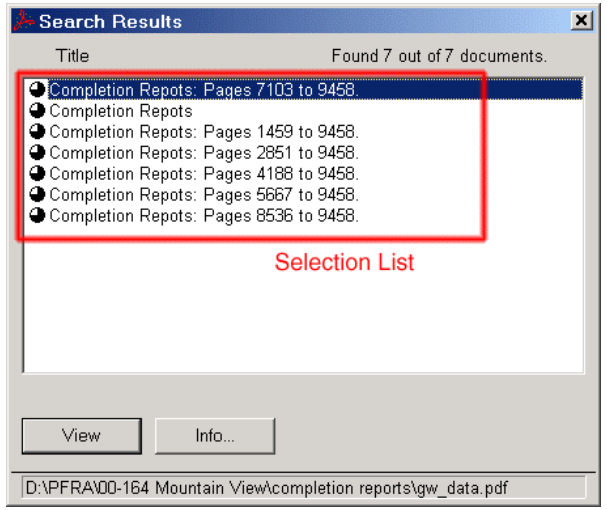
*You can also search for the completion report corresponding to a known Alberta Environment "wellid". Again, enter the wellid **exactly** as shown on the completion report (e.g. 089345 not 89345)*



Adobe Acrobat PDF Search Criteria Entry

10.3.4. Search Criteria Selection

Once a search has been completed, a search results dialog box will appear, listing all the completion reports that meet the search criteria. Double-clicking on any of the items in the "Selection List" will make that completion report the active page. To quickly navigate through the Selection List, you use the "View next Search result" or the "View previous Search result".



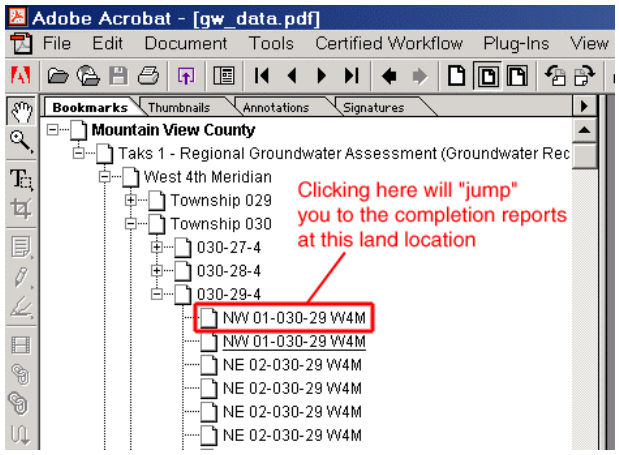
Adobe Acrobat PDF Search Criteria Selection

10.4. Using Bookmarks and Thumbnails

10.4.1. Bookmarks

On more recent studies, bookmarks are provided. You can use the bookmarks to go directly to the location of a completion report by simply clicking on the appropriate bookmark.

If there are multiple reports, it will go to the first report with the same land location and then, by paging down, you can see the other reports at that location.



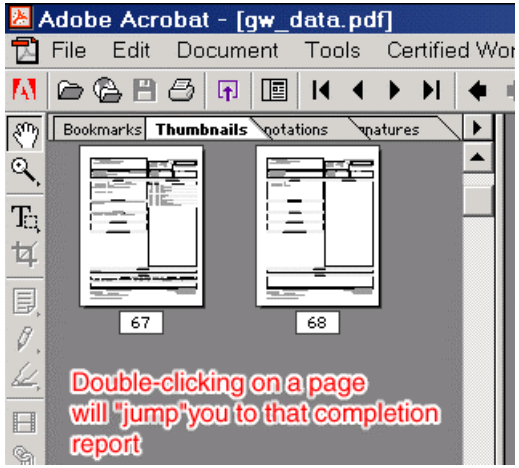
Adobe Acrobat Bookmarks

10.4.2. Thumbnails

Thumbnails are used to display a graphical representation of the completion report. However, they are not as easy to use for searching.

10.4.3. Help

For additional help, please use the on-line help under the Help menu.



Adobe Acrobat Thumbnails

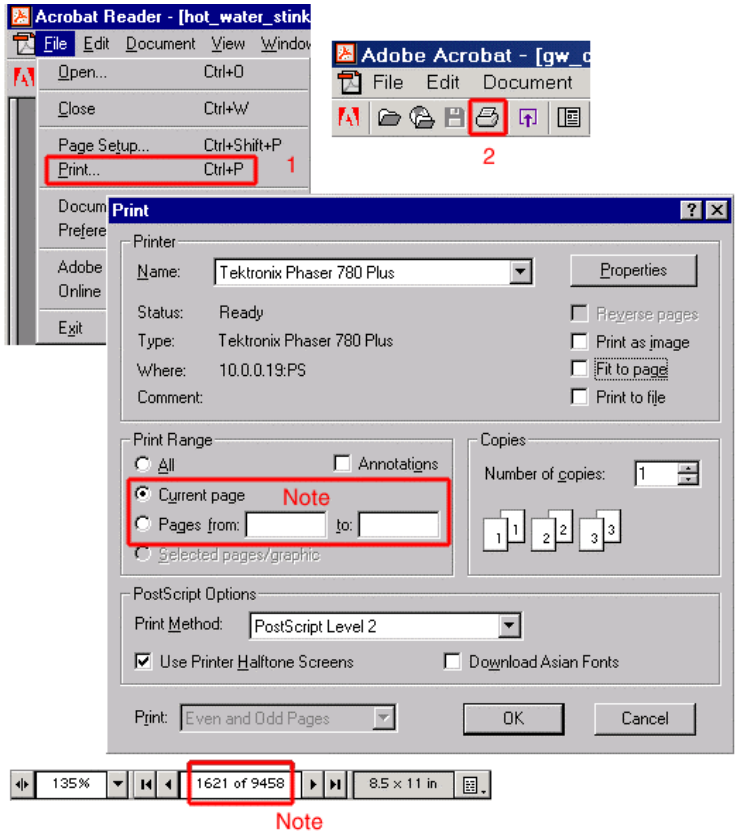
10.5. Printing Water Well Completion Reports

Before you print anything, you should always know how to delete or cancel print jobs. You can print completion reports in one of two ways, which are outlined below:

Option 1: Select print from the file menu.

Option 2: Use the Printer icon on the main toolbar.

Note: *Whenever you print specify, "Current page" or choose the page range you wish to print. Otherwise, by default Adobe Acrobat Reader will print all pages, which can be many thousand pages.*



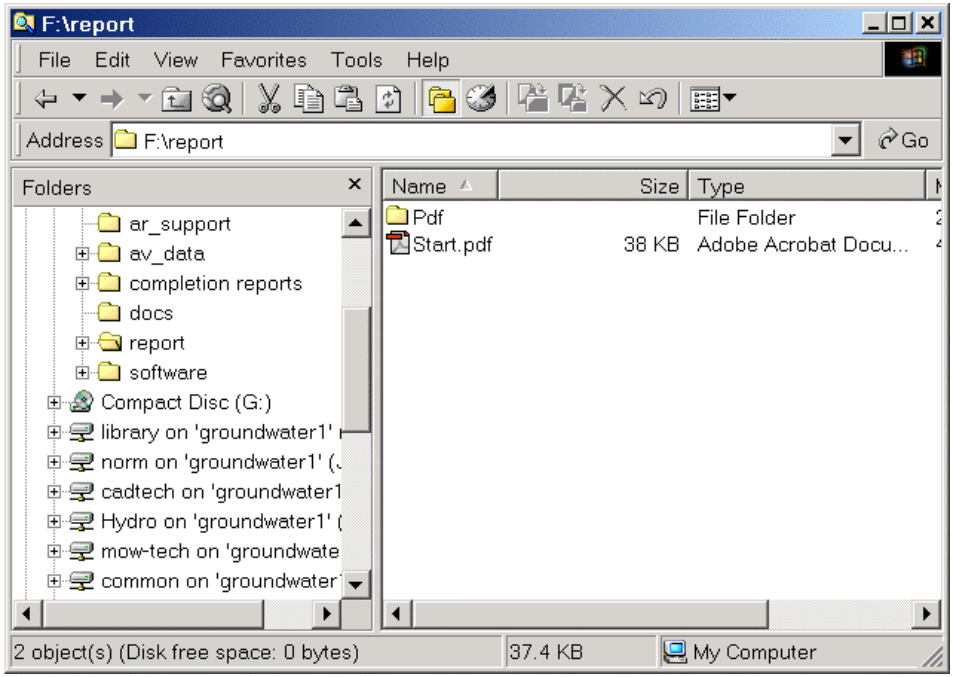
Adobe Acrobat Print Options

11. Consultant's Report and Maps

Key maps are contained in the paper copy of the report, and in the Adobe Acrobat report file (your CD-ROM drive letter:\report\pdf\report.pdf), which is accessed from start.pdf (your CD-ROM drive letter:\report\start.pdf) on the CD-ROM.

Same maps plus others are in Appendix A of the paper report and in the ***report.pdf*** file

All maps, including many not in the report, are on the CD-ROM.



report Folder

12. Consultant's Report and Maps on the CD-ROM

12.1. Accessing Consultant's Report

To view the report, you can use one of two methods to access the report:

Option 1: Insert CD-ROM into your CD-ROM drive, and select next (lower right) from the licence details screen, then select Report.

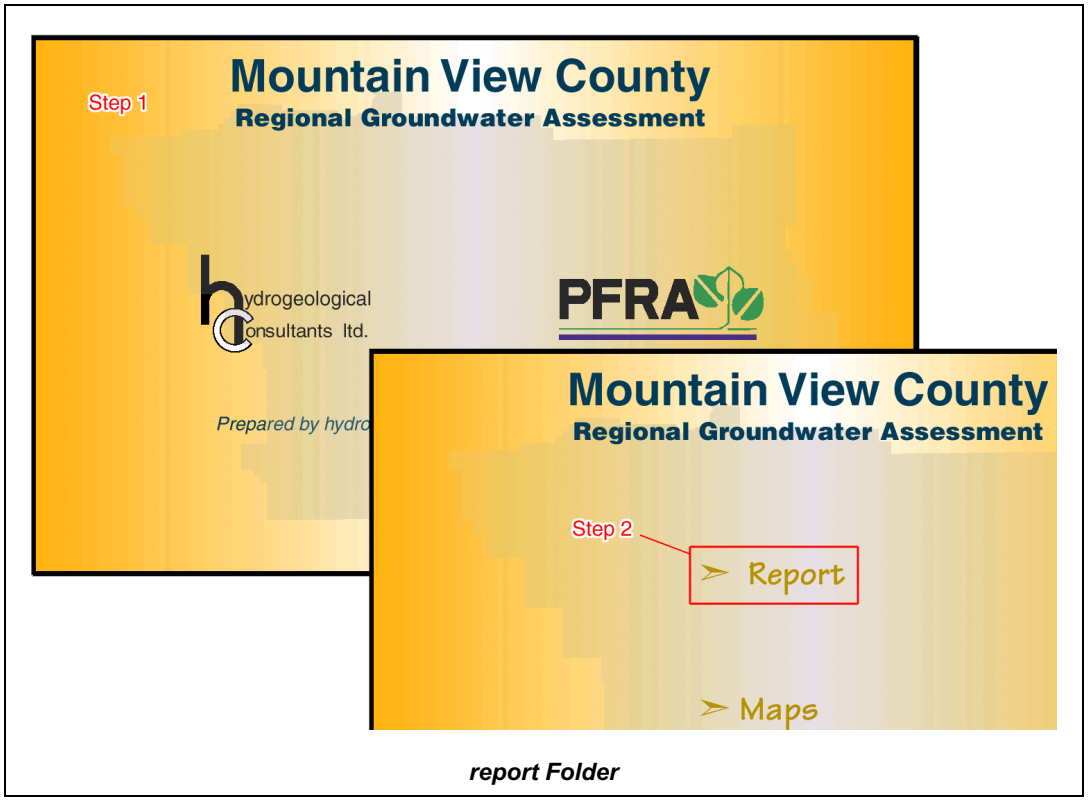
Option 2: Open Windows Explorer and navigate to your CD-ROM drive and then open the "Report" folder and double-click on the "Start.pdf" file.

NOTE: In either case, Adobe Acrobat Reader must be installed on your computer.

Once you have opened the "Start.pdf" using either method discussed above, please follow the steps listed below:

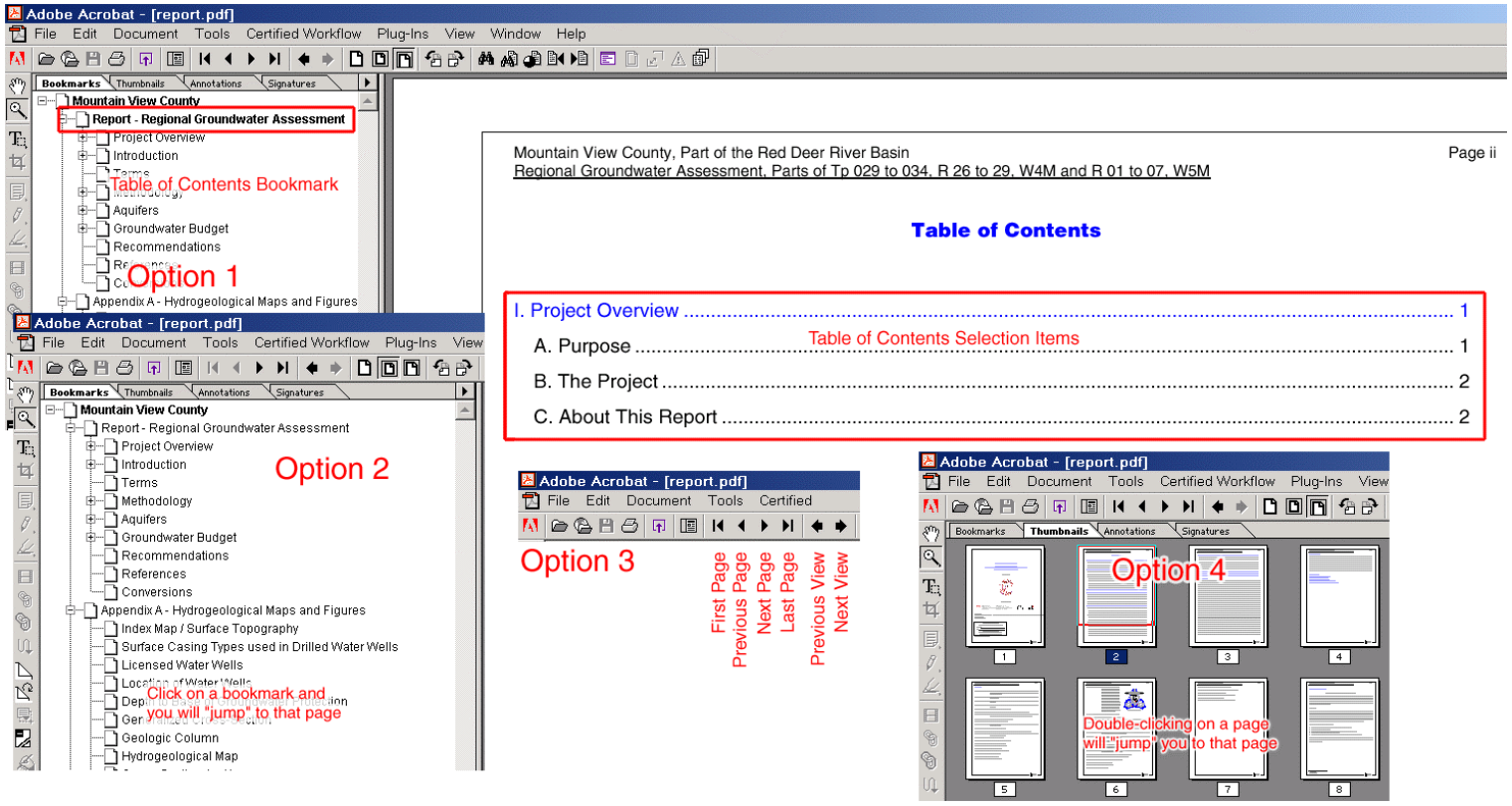
Step 1: Click anywhere on the screen to continue.

Step 2: Then select Report from the following menu.



report Folder

NOTE: Whenever you print pages from the report, specify, "Current page" or choose the page range you wish to print. Otherwise, by default Adobe Acrobat Reader will print all pages in the report.



Navigating Consultant's Report

Once the Consultant's report is open, you can use any of the following options to navigate (review) the consultant's report:

Option 1: Select the Table of Contents Bookmark and then select any of the Table of Contents items.

Option 2: Show Bookmarks (F5), scroll through bookmarks then click on bookmark to view page.

Option 3: Use the navigation keys to view the next page, previous page, previous view or next view.

Option 4: Show thumbnails (F8), scroll through list then double-click on the page you would like to view.

12.2. Accessing the Consultant's Maps on the CD-ROM

To view the report, you can use one of two methods to access the report:

Option 1: Insert CD-ROM into your CD-ROM drive, and select next (lower right) from the licence details screen, then select Report.

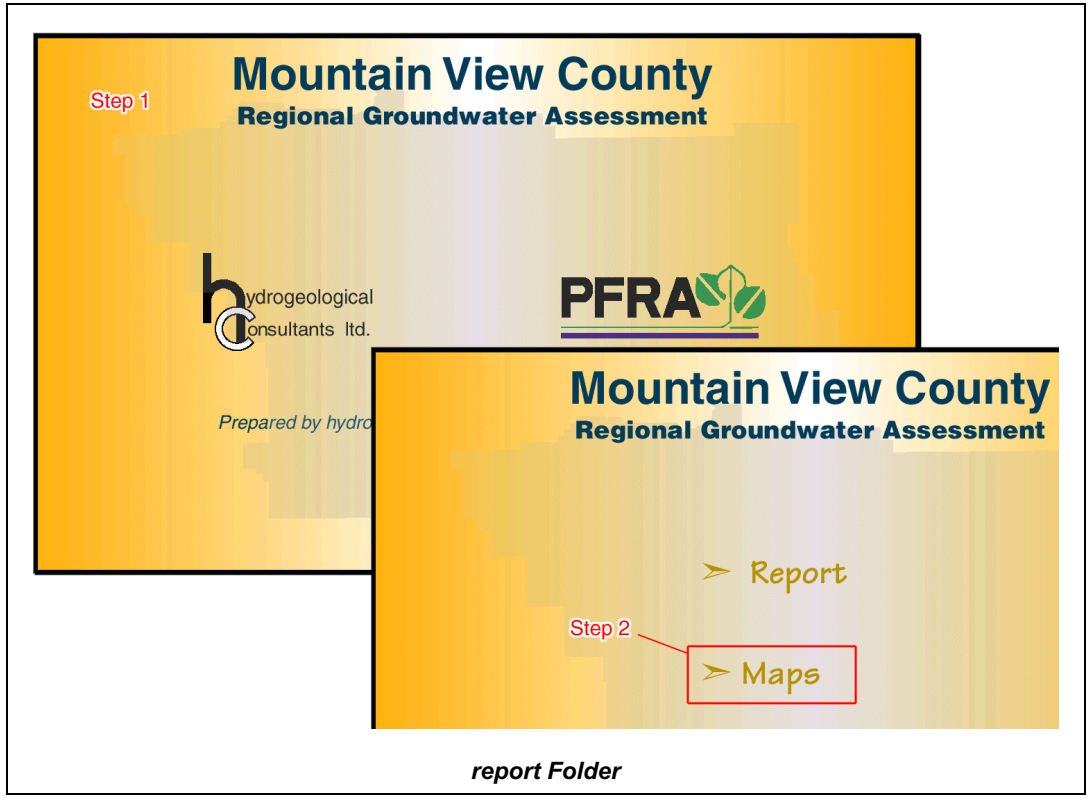
Option 2: Open Windows Explorer and navigate to your CD-ROM drive and then open the "Report" folder and double-click on the "Start.pdf" file.

Note: *In either case, Adobe Acrobat Reader must be installed on your computer.*

Once you have opened the "Start.pdf" using either method discussed above, please follow the steps listed below:

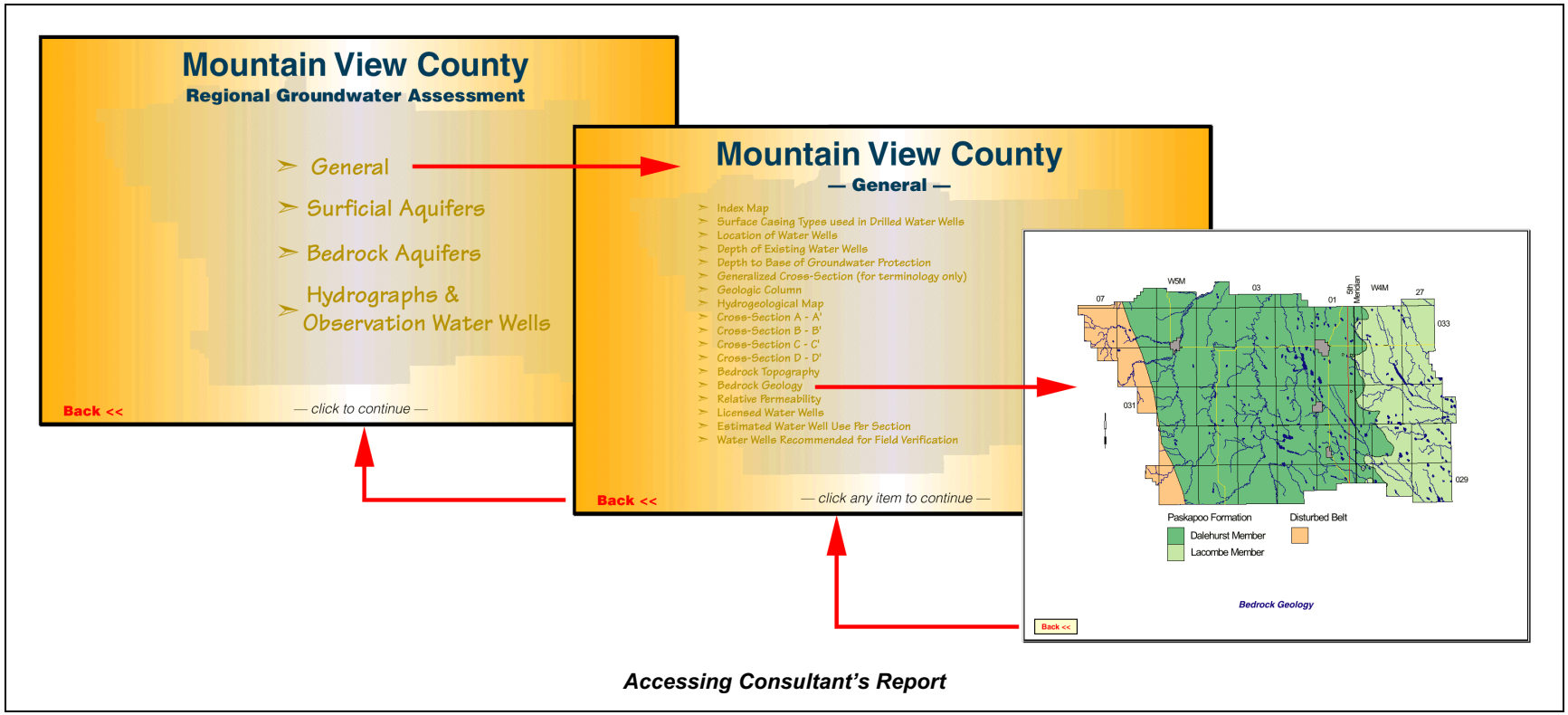
Step 1: Click anywhere on the screen to continue

Step 2: Select Maps from the following menu.



report Folder

12.3. Accessing the Consultant's Maps



Accessing Consultant's Report

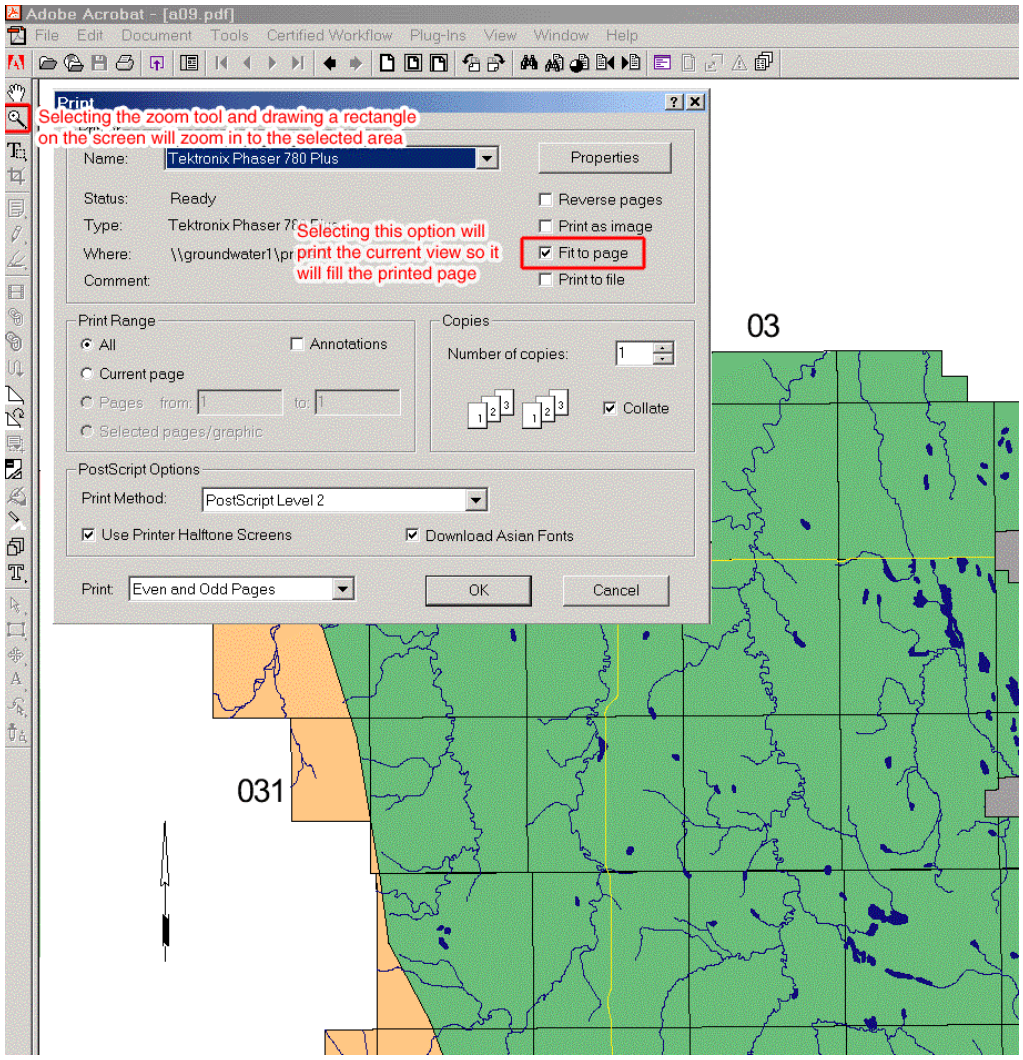
In finding maps, the key to remember is that the menus are nested as shown above.

Move to different maps by using menu and the "Back <<" key.

12.4. Printing the Consultant's Maps from the CD-ROM

You can print any of the maps using any of the printing options listed above. You can zoom in to any portion of the map using the zoom tool and print that view.

As each map is stored as a separate pdf file, only one map will be printed at a time (even if the print range is set to All).



Print Maps from CD-ROM (Current View)

12.5. How can others get the report or map data?

The following options are available for distributing report or map data:

- Get individuals with access to the Internet to go to the PFRA website to view the report (partial) http://www.agr.ca/pfra/water/groundw.htm
- Individuals with access to the Internet can go to The Groundwater Centre's website to view the report (complete) http://www.groundwatercentre.com/m_info_rgwa.asp
- Interested parties may purchase the entire CD-ROM for reasonable cost from either the Alberta Geological Survey or The Groundwater Centre. Contact information is as follows:

  Alberta Geological Survey Information Sales Office
  Phone 780.422.3767
  Fax 780.422.1918
  Alberta Geological Survey
  4th Floor, Twin Atria
  4999 - 98th Avenue
  Edmonton, Alberta
  T6B 2X3

  The Groundwater Centre
  10704 - 181 Street
  Edmonton, Alberta T5S 1K8
  info@groundwatercentre.com

- You can email copies of individual map PDF files. This is maybe best done by first opening the maps in Adobe Acrobat Reader.
  - Open the start.pdf (your CD-ROM drive letter:\report\start.pdf).
  - Navigate to the appropriate map that you want, note file name (e.g. A12.PDF).
  - From your email software, attach the PDF file with that file name, then double-click on it to test that it's the right file, Close, and send email message.

13. Key Report Findings and Main Recommendations

13.1. Key Report General Findings

1. Consultant able to assign MOST water wells to aquifers.
2. Other value added to each water well log:
    - top of bedrock
    - thickness of sand and gravel in water well log
    - transmissivity and Q20 yield estimate made where adequate aquifer test data available
    - converted to metric
3. Consultant creates maps showing important information (depth to top of aquifer, yield, water quality parameters) for:
    - Surficial aquifers
        - Thicknesses of sand and gravel in drift (unsaturated and saturated)
    - Bedrock aquifers
        - Upper bedrock aquifers - in top 200 metres
        - Maps for individual bedrock aquifers
4. Consultant shows estimated soil permeability - Risk of Contamination.
5. Consultant shows location of water wells.
6. Consultant identifies most groundwater related reports in the County/MD.
7. Consultant stores everything digitally so future updates much easier.
8. Using groundwater query, consultant identifies potential aquifer yield and quality for individual landowners.
9. County can print water well completion reports for individuals (including value-added parameters added by Consultant). ***REMINDER*** *- for more recent records, contact Alberta Environment Groundwater Information Centre or The Groundwater Centre (http://www.groundwatercentre.com).*
10. Consultant identifies water wells where it might be worthwhile over time to collect more data to improve the maps.

13.2. Main Recommendations

- County/MD should strive to improve database by collecting key data at identified “super database” water wells: water samples, four hour aquifer test, improved x,y coordinates.
- Get Alberta Environment to review Base of Groundwater Protection if too shallow.
- Test drilling could be carried out in identified areas to improve the maps for some aquifers.
- Get water well owners to start monitoring their own water levels to increase our knowledge of water-level fluctuations across the County/MD. Could also identify unused water wells to use as observation water wells.
- Have the Province modify how drilling reports are submitted.
- Partner with the petroleum industry to try to improve regional data collection.

14. GIS – Key GIS Files

14.1. Key GIS project files

The following is a list of the key GIS project files contained on the CD-ROM:

- **County.apr** ArcView project file (generally uses geographic data, and then projects it using the software).
- **County_?.aep** ArcExplorer project file (uses projected data in 10TM).

14.2. Key GIS database files

The following is a list of the key GIS database files contained on the CD-ROM:

- **wwell.dbf / wwells.dbf / water_well.dbf** water well records with value added data. For Legend, see Appendix A.

UID	LAST	FIRST	LOCATION	DRILLER	DATE	ELEVATION	CI_TOP	CI_BOTTOM	AQUIFER	DEPTH	NPWL	YIELD_M3_D	TDS	HARDNESS	CHLORIDE	SULPHATE	AEP_NO	UTME	UTMN
35402.411944			NE 34-042-09 4			0	3.05	7.62		25.91	8.84	0	314	201	10	63		256185.078	5839067
35430.424582	Amandson	Lory	SW 04-043-08 4	Losness Drilling (1975) Ltd.	24-Oct-74	696	93.87	99.66	Continental Foremost	99.66	44.19	0	0	0	0	0	105590	262905.25	5840293
35430.424583	Jeckells	G.H.	SW 04-043-08 4	Unknown Driller	01-Jan-25	639	0	0	Continental Foremost	63.40	32.92	0	0	0	0	0	105591	262905.25	5840293
35430.424584	Amundson	Bob	SE 05-043-08 4	Losness Drilling (1975) Ltd.	08-Aug-79	696	103.02	106.37	Continental Foremost	106.37	48.46	48.15	537	10	2.84	39.86	105592	262088.156	5840248
35430.424585	Imperial Oil L		03-06-043-08 4	Unknown Driller	20-Oct-45	702	0	0		298.69	0.00	0	0	0	0	0	105593	259853.922	5839902
35430.424586	Taylor	Bruce	SW 10-043-08 4	Losness Drilling (1975) Ltd.	20-Nov-80	678	83.51	86.86	Continental Foremost	88.39	38.10	50.23	0	0	0	0	105594	264448.25	5842060.5
35430.424587	Taylor	Bruce	SW 10-043-08 4	Larson's Waterwell Servicing Ltd.	25-Mar-83	678	51.81	54.86	Lower Surficial	56.39	27.13	0	423	33	0	20.17	105595	264448.25	5842060.5
35430.424588	Imperiol Oil L		13-10-043-08 4	Unknown Driller	02-May-46	679	0	0		277.35	0.00	0	0	0	0	0	105596	264190.594	5843054
35430.425078	Presthin	Nels	SE 04-041-06 4	Erickson Drilling	01-Jan-20	684	0	0	Oldman	56.39	0.00	0	0	0	0	0	130013	284829	5821915.5

Partial Sample wwell.dbf / wwells.dbf / water_well.dbf (M.D. of Provost No. 52- wwells.dbf)

Note:

- *Some fields are empty or entered as 0.0000*
- *Not all water wells have an AEP_No (Alberta Environment WELLID).*
- *The UID is a unique identifier added by The Groundwater Centre.*
- *UTME and UTMN are UTM NAD27 coordinates for each water well.*
- *Units are metric (metres, litres, mg/L).*

The following is a list of the key GIS database files contained on the CD-ROM:

- **gw_data.dbf or av_data.dbf** point data used by MOW-TECH LTD. gwQuery program. For Legend, see Appendix B.

PT_ID	EASTING_10	NORTHING_1	ELEVATION	SRFTHC	SRFSAT	SRFTDS	SRFTH	SRFSO4	SRFCL	SRFWL	UPSRFTHC	LOSRFTOPEL	LOSRFTHC	LOSRFWL	SGTHC	SGSAT	SGQ	UPSGTHC	UPSGSAT	UPSGQ	BDR	BDRQ	BDRWL	BDRDR	BDRTDS	BDRTH
PR00388	335695.5	5780301.5	698.70	41.02	27.19	1350.86	495.10	735.03	6.34	686.92	40.78	652.43	0.23	641.93	2.49	0.84	25.62	2.24	1.44	21.65	651.43	43.08	668.47	18.42	663.88	148.11
PR00389	335673.156	5780706.5	700.55	37.86	25.12	1337.43	487.11	725.51	6.03	684.61	37.68	652.21	0.18	642.42	1.82	0.72	27.65	2.61	1.77	23.37	651.21	43.67	665.25	19.37	655.70	142.83
PR00390	336085.531	5780729	697.94	30.95	19.49	1337.75	487.05	725.09	7.58	683.16	30.89				2.40	0.79	22.45	2.65	1.68	18.98	659.63	43.50	665.88	17.28	640.37	146.55
PR00391	336491.594	5780758.5	687.24	26.62	16.27	1337.34	486.70	724.06	9.04	681.53	26.65				3.02	1.05	16.53	2.77	1.64	13.99	661.29	44.71	666.73	14.80	624.55	150.01
PR00392	336893.781	5780781	676.47	20.06	12.12	1321.36	462.43	721.98	9.09	680.38	20.09				2.81	0.91	12.45	2.88	1.60	10.56	664.77	46.25	666.65	13.73	602.01	152.95
PR00393	335890.5	5780516	699.00	37.71	24.76	1344.29	490.18	730.47	7.03	684.57	37.55	652.42	0.16	642.34	2.24	0.79	23.69	2.44	1.53	20.03	651.42	43.50	666.95	17.62	650.79	147.41
PR00394	336704	5780565	679.71	24.60	14.76	1336.21	477.41	728.56	9.31	681.79	24.63				2.98	0.86	13.81	2.57	1.40	11.70	663.60	44.32	667.87	13.93	616.47	154.30
PR00395	335944.75	5779702	699.71	35.22	21.80	1371.58	509.73	747.33	7.10	693.52	35.10				4.71	1.48	20.02	1.76	0.99	16.91	668.12	41.82	674.57	18.87	669.68	157.44
PR00396	336759.875	5779752	695.29	24.41	13.56	1377.16	498.85	756.56	10.06	687.01	24.42				5.07	0.99	11.52	1.83	0.88	9.75	672.55	41.70	674.77	12.18	639.42	165.05

Partial Sample gw_data.dbf (M.D. of Provost No. 52)

Note:

- *Easting_10TM and Northing_10TM are 10TM NAD27 coordinates.*
- *Units are metric (metres, litres, mg/L).*

15. What GIS-Ready Thematic Mapping Data are Available?

Every CD-ROM contains many, many GIS-ready shape files that can be used in your County/MD GIS. All GIS-ready data are contained as ESRI shape files and accompanying databases in the AV_Data folder.

Typically available shape files (all counties will be slightly different) using MD of Provost CD-ROM as an example:

```
\AV_Data Folder            (from Consultant)
      gw_data
      Q65+Q65Cl250
      Q65TDS1000
\Culture – County          (from Altalis)
      Lake
      River
      Road
      Section              (from MOW-TECH LTD.)
      Town
      Township             (from MOW-TECH LTD.)
\Other - hc_water well     (from Consultant)
      wwells
      Wwells15m-
\Rel_Perm – highsurf       (from Consultant)
      Modsurf
      Lowsurf
\Risk - v_highrisk         (from Consultant)
      highrisk
      modrisk
      lowrisk
```

NOTE: For the MD of Provost, a total of about 20 shape files are available on the CD-ROM and could be viewed in either ArcExplorer or ArcView.

16. GIS Viewer – ArcExplorer

16.1. General Details

ArcExplorer is a lightweight GIS data viewer developed by ESRI. This freely available software offers an easy way to perform basic GIS functions. ArcExplorer is used for a variety of display, query, and data-retrieval applications and supports a wide variety of standard data sources. It can be used on its own with local data sets or as a client to Internet data and map servers. ArcExplorer is included on each CD-ROM.

16.2. How do I use ArcExlorer?

- Install ArcExplorer on your computer using the Autorun Menu or go to your CD-ROM drive:\software\explorer\aeclient.exe.
- You must know the drive letter of your CD-ROM drive (D). Then using Windows Explorer, go to d:\av_data\county_d.aep and double-click on this file.

  NOTE: The last letter of the file name refers to the CD-ROM drive it is being started from, so if Drive E was your CD-ROM drive, you would go to file County_E.aep.

16.3. Using ArcExplorer

16.3.1. Working with themes (shape files)

- themes are layers that are turned off and on using the check mark box.
- themes at the top of the list will plot over themes further down the list.

16.3.2. Zoom and Unzoom

- the magnifying glass icon is used to zoom in to areas. The Section lines don't show until you zoom in enough.
- applying the re-magnifying glass zooms you out one step at a time

16.3.3. Pan

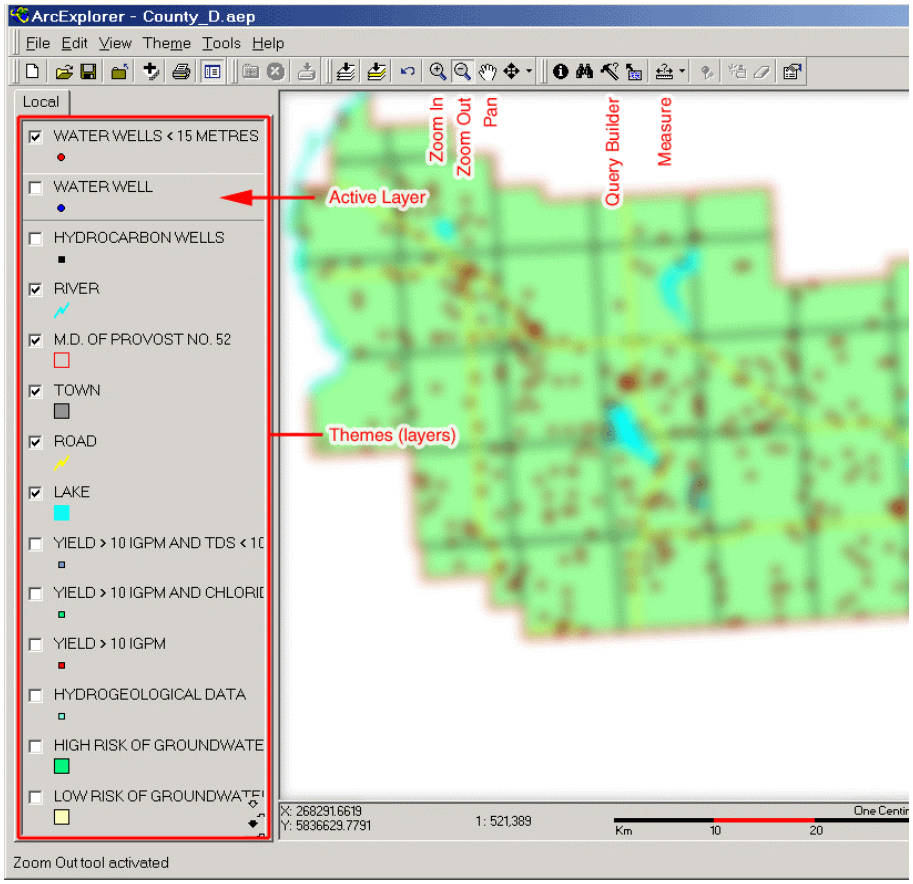
- moves the map in whichever direction you drag the map, at the current zoom level.

16.3.4. Measuring

- first set measurement units and then use mouse to click the two end points, defining the distance to measure.

16.3.5. Activating a Theme

- activating a theme will allow you to query and receive information from the selected theme.
- to make active, click on theme, should get a raised bar around the theme.



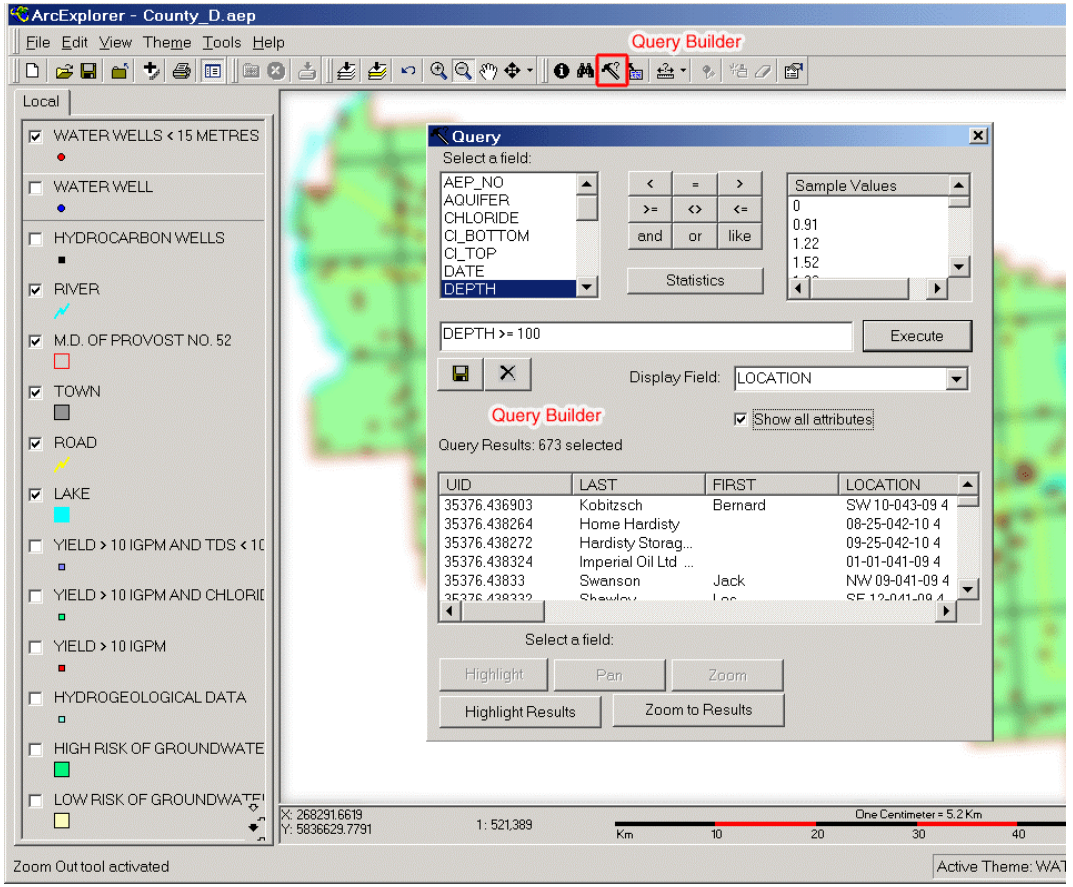
ArcExplorer – Query Builder

16.4. Running queries on active themes

Using the Query Builder tool, you can build queries to access the supplied GIS data.

- Use the pop-down menu and use the hammer.
- You can save query results using the Save button.

Note: *PFRA GIS specialists are willing to spend more time with County/MD staff to go through the use of ArcExplorer.*



ArcExplorer – Query Builder

17. GIS Software - ArcView Demonstration

With more than 500,000 users worldwide, ArcView GIS is the world's most popular desktop mapping and GIS software. It puts hundreds of mapping and spatial analysis capabilities at your fingertips. ArcView GIS makes it easy to create maps and add your own data to them. Using ArcView GIS software's powerful visualization tools, you can access records from existing databases and display them on maps.

18. APPENDIX A - Sample Descriptions of Fields in wwwell.dbf / wwells.dbf / water_well.dbf

NOTE: Taken from "Water_Water Well_Field_Descriptions.txt" from County of Stettler No. 18 Regional Groundwater Assessment CD-ROM by Hydrogeological Consultants Ltd., July, 1999.

Field Name	Description
UID	Groundwater Centre UID (GCID)
Owner	Water Well Owner
AEP_No	Alberta Environmental Protection Number
Elevation	Ground Elevation - Above Mean Sea Level (metres)
E_10tm	Easting - 10TM NAD27
N_10tm	Northing - 10TM NAD27
Location	Legal Location
Date	Date Water Well Completed
Driller	Drilling Contractor
CI_TOP	Depth to Top of the Completion Interval (metres)
CI_BOT	Depth to Bottom of the Completion Interval (metres)
Depth	Total Depth of Water Well (metres)
NPWL	Non-Pumping Water Level (metres)
Yield_m3_d	Rate that Water Well was Tested at Time of Water Well Completion (m^3/day)
T_App	Apparent Tranmissivity (m^2/day)
T_Aquifer	Aquifer Transmissivity (m^2/day)
T_Eff	Effective Transmissivity (m^2/day)
Aquifer	Aquifer Name in which Water Well is Completed
Bdr_Top	Top of Bedrock (metres)
SgThc_Tot	Total Sand & Gravel Thickness (metres)
Sg_Below15m	Sand & Gravel Thickness Below 15 Metres (metres)
TDS	Total Dissolved Solids (mg/L)
Hardness	Hardness (mg/L)
Chloride	Chloride (mg/L)
Sulfate	Sufate (mg/L)

19. APPENDIX B - Field Descriptions for av_data.dbf / gw_data.dbf

NOTE: Taken from "Field Descriptions.txt" from M.D. of Provost No. 52 Regional Groundwater Assessment CD-ROM by Hydrogeological Consultants Ltd., April 22, 1999.

***All Units expressed in Metric ** (Yield - m³/day; thickness - Meters; elevation – metres AMSL)*

Field_Name	Description
PT_ID	Point ID
SrfTHC	Surficial Deposits - Thickness of
SrfTDS	Surficial Deposits - Total Dissolved Solids
SrfTH	Surficial Deposits - Total Hardness
SrfSO4	Surficial Deposits - Sulfate
SrfCL	Surficial Deposits - Chloride
SrfF	Surficial Deposits - Fluoride
SrfWL	Surficial Deposits - NPWL in water wells shallower than 15m
UpSrfTHC	Upper Surficial Deposits - Thickness of
UpSrfWL	Upper Surficial Deposits - Water Level
LoSrfTOPel	Lower Surficial Deposits - Elevation of Top
LoSrfTHC	Lower Surficial Deposits - Thickness of
LoSrfWL	Lower Surficial Deposits - NPWL
SgTHC	Sand & Gravel (all) - Thickness of
SgQ	Sand & Gravel (all) - Apparent yield for water well completed through sand and gravel aquifer
UpSgTHC	Upper Sand & Gravel - Thickness of
UpSgQ	Upper Sand & Gravel - Apparent yield for water well completed through upper sand and gravel aquifer
LoSgTHC	Lower Sand & Gravel - Thickness of
LoSgQ	Lower Sand & Gravel - Apparent yield for water well completed through lower sand and gravel
LoSgWL	Lower Sand & Gravel - Water Level
bdr	Bedrock Surface
bdrQ	General bedrock - Apparent yield for water well completed in upper bedrock aquifers
bdrWL	General bedrock - NPWL
bdrDR	General bedrock - Recharge/Discharge area between aquifers in surficial deposits and upper bedrock aquifers
bdrTDS	General bedrock - Total Dissolved Solids
bdrTH	General bedrock - Total Hardness

bdrSO4	General bedrock - Sulfate
bdrCL	General bedrock - Chloride
bdrF	General bedrock - Fluoride
PaskTOPel	Paskapoo - Elevation of Top
PaskTHC	Paskapoo - Thickness
PaskQ	Paskapoo - Apparent yield for water wells completed through Paskapoo Formation
PaskWL	Paskapoo - NPWL
PaskDR	Paskapoo - Discharge/Recharge area between water in surficial aquifers and water in Paskapoo Aquifer
PaskTDS	Paskapoo - Total Dissolved Solids
PaskTH	Paskapoo - Total Hardness
PaskSO4	Paskapoo - Sulfate
PaskCL	Paskapoo - Chloride
PaskF	Paskapoo - Fluoride
ScolTOPel	Scollard - Elevation of Top of Scollard Formation
ScolTHC	Scollard - Thickness
ScolQ	Scollard - Apparent Yield for Water wells Completed through Scollard Formation
ScolWL	Scollard - NPWL
ScolDR	Scollard - Discharge/Recharge area between water in surficial aquifers and water in Scollard Aquifer
ScolTDS	Scollard - Total Dissolved Solids
ScolTH	Scollard - Total Hardness
ScolSO4	Scollard - Sulfate
ScolCL	Scollard - Chloride
ScolF	Scollard - Fluoride
UpScTOPel	Upper Scollard - Elevation of Top
UpScTHC	Upper Scollard - Thickness
UpScQ	Upper Scollard - Apparent Yield for Water wells Completed through Scollard Formation
UpScWL	Upper Scollard - NPWL
UpScDR	Upper Scollard - Discharge/Recharge area between water in surficial aquifers and water in Scollard Aquifer
UpScTDS	Upper Scollard - Total Dissolved Solids
UpScTH	Upper Scollard - Total Hardness
UpScSO4	Upper Scollard - Sulfate
UpScCL	Upper Scollard - Chloride
UpScF	Upper Scollar - Fluoride
LoScTOPel	Lower Scollard - Elevation of Top
LoScTHC	Lower Scollard - Thickness
LoScQ	Lower Scollard - Apparent Yield for Water wells Completed through Scollard Formation

LoScWL	Lower Scollard - NPWL
LoScDR	Lower Scollard - Discharge/Recharge area between water in surficial aquifers and water in Scollard Aquifer
LoScTDS	Lower Scollard - Total Dissolved Solids
LoScTH	Lower Scollard - Total Hardness
LoScSO4	Lower Scollard - Sulfate
LoScCL	Lower Scollard - Chloride
LoScF	Lower Scollard - Fluoride
UpHcTOPel	Upper Horseshoe Canyon - Elevation of Top
UpHcTHC	Upper Horseshoe Canyon - Thickness of Upper Horseshoe Canyon Formation
UpHcQ	Upper Horseshoe Canyon - Apparent yield for water wells completed through Upper Horseshoe Canyon Formation
UpHcWL	Upper Horseshoe Canyon - NPWL
UpHcDR	Upper Horseshoe Canyon - Discharge/Recharge area between water in surficial aquifers and water in Upper Horseshoe Canyon Aquifer
UpHcTDS	Upper Horseshoe Canyon - Total Dissolved Solids
UpHcTH	Upper Horseshoe Canyon - Total Hardness
UpHcSO4	Upper Horseshoe Canyon - Sulfate
UpHcCL	Upper Horseshoe Canyon - Chloride
UpHcF	Upper Horseshoe Canyon - Fluoride
MdHcTOPel	Middle Horseshoe Canyon - Elevation of Top
MdHcTHC	Middle Horseshoe Canyon - Thickness
MdHcQ	Middle Horseshoe Canyon - Apparent yield for water wells completed through Oldman Formation
MdHcWL	Middle Horseshoe Canyon - NPWL
MdHcDR	Middle Horseshoe Canyon - Discharge/Recharge area between water in surficial aquifers and water in Middle Horseshoe Canyon Aquifer
MdHcTDS	Middle Horseshoe Canyon - Total Dissolved Solids
MdHcTH	Middle Horseshoe Canyon - Total Hardness
MdHcSO4	Middle Horseshoe Canyon - Sulfate
MdHcCL	Middle Horseshoe Canyon - Chloride
MdHcF	Middle Horseshoe Canyon - Fluoride
LoHcTOPel	Lower Horseshoe Canyon - Elevation of Top
LoHcTHC	Lower Horseshoe Canyon - Thickness
LoHcQ	Lower Horseshoe Canyon - Apparent yield for water wells completed through Lower Horseshoe Canyon Formation
LoHcWL	Lower Horseshoe Canyon - NPWL
LoHcDR	Lower Horseshoe Canyon - Discharge/Recharge area between water in surficial aquifers and water in Lower Horseshoe Canyon Aquifer
LoHcTDS	Lower Horseshoe Canyon - Total Dissolved Solids
LoHcTH	Lower Horseshoe Canyon - Total Hardness

LoHcSO4	Lower Horseshoe Canyon - Sulfate
LoHcCL	Lower Horseshoe Canyon - Chloride
LoHcF	Lower Horseshoe Canyon - Fluoride
BearTOPel	Bearpaw - Elevation of Top
BearTHC	Bearpaw - Thickness
BearQ	Bearpaw - Apparent yield for water wells completed through Bearpaw Formation
BearWL	Bearpaw - NPWL
BearDR	Bearpaw - Discharge/Recharge area between water in surficial aquifers and water in Bearpaw Aquifer
BearTDS	Bearpaw - Total Dissolved Solids
BearTH	Bearpaw - Total Hardness
BearSO4	Bearpaw - Sulfate in groundwater from bearpaw Aquifer
BearCL	Bearpaw - Chloride in groundwater from bearpaw Aquifer
BearF	Bearpaw - Fluoride
DinoTOPel	Belly River Group - Elevation of Top
BrTHC	Belly River Group - Thickness
BrQ	Belly River Group - Apparent yield for water wells completed through Belly River
BrWL	Belly River Group - NPWL
BrDR	Belly River Group - Discharge/Recharge area between water in surficial aquifers and water in Belly River Aquifer
BrTDS	Belly River Group - Total Dissolved Solids
BrTH	Belly River Group - Total Hardness
BrSO4	Belly River Group - Sulfate
BrCL	Belly River Group - Chloride
BrF	Belly River Group - Fluoride
OldmTOPel	Oldman - Elevation of Top
OldmTHC	Oldman - Thickness
OldmQ	Oldman - Apparent yield for water wells completed through Oldman Formation
OldmWL	Oldman - NPWL
OldmDR	Oldman - Discharge/Recharge area between water in surficial aquifers and water in Oldman Aquifer
OldmTDS	Oldman - Total Dissolved Solids
OldmTH	Oldman - Total Hardness
OldmSO4	Oldman - Sulfate
OldmCL	Oldman - Chloride
OldmF	Oldman - Fluoride
FoCnTOPel	continential Foremost - Elevation of Top
FoCnTHC	continential Foremost - Thickness
FoCnQ	continential Foremost - Apparent yield for water wells completed through Continental Foremost Formation

FoCnWL	continential Foremost - NPWL
FoCnDR	continential Foremost - Discharge/Recharge area between water in surficial aquifers and water in Continetal Foremost Aquifer
FoCnTDS	continential Foremost - Total Dissolved Solids
FoCnTH	continental Foremost - Total Hardness
FoCnSO4	continential Foremost - Sulfate
FoCnCL	continential Foremost - Chloride
FnCnF	continental Foremost - Fluoride
MlnTOPel	Milan - Elevation of Top
MlnTHC	Milan - Thickness
MlnQ	Milan - Apparent yield for water wells completed through Milan Aquifer
MlnWL	Milan - NPWL in Milan Aquifer
MlnDR	Milan - Discharge/Recharge area between water in surficial aquifers and water in Milan Aquifer
MlnTDS	Milan - Total Dissolved Solids in groundwater from Milan Aquifer
MlnTH	Milan - Total Hardness
MlnSO4	Milan - Sulfate
MlnCL	Milan - Chloride
MlnF	Milan - Fluoride
FoMaTOPel	marine Foremost - Elevation of Top
FoMaTHC	marine Foremost - Thickness
FoMaQ	marine Foremost - Apparent yield for water wells completed through Marine Foremost
FoMaWL	marine Foremost - NPWL
FoMaDR	marine Foremost - Discharge/Recharge area between water in surficial aquifers and water in Marine Foremost
FoMaTDS	marine Foremost - Total Dissolved Solids
FoMnTH	marine Foremost - Total Hardness
FoMaSO4	marine Foremost - Sulfate
FoMaCL	marine Foremost - Chloride
FoMaF	marine Foremost - Fluoride
BlakTOPel	Birch Lake - Elevation of Top
BlakTHC	Birch Lake - Thickness
BlakQ	Birch Lake - Apparent yield for water wells completed through Birch Lake
BlakWL	Birch Lake - NPWL
BlakDR	Birch Lake - Discharge/Recharge area between water in surficial aquifers and water in Birch Lake
BlakTDS	Birch Lake - Total Dissolved Solids in groundwater from Birch Lake
BlakTH	Birch Lake - Total Hardness
BlakSO4	Birch Lake - Sulfate
BlakCL	Birch Lake - Chloride

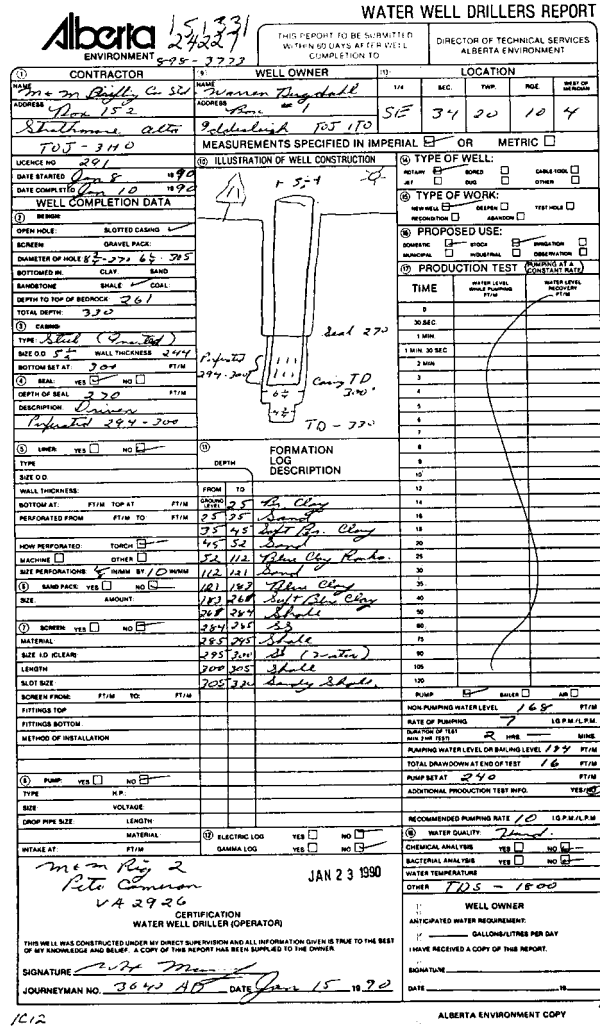
BlakF	Birch Lake - Fluoride
RibcTOPel	Ribstone Creek - Elevation of Top
RibcTHC	Ribstone Creek - Thickness
RibcQ	Ribstone Creek - Apparent yield for water wells completed through Ribstone Creek
RibcWL	Ribstone Creek - NPWL
RibcDR	Ribstone Creek - Discharge/Recharge area between water in surficial aquifers and water in Ribstone Creek
RibcTDS	Ribstone Creek - Total Dissolved Solids
RibcTH	Ribstone Creek - Total Hardness
RibcSO4	Ribstone Creek - Sulfate in groundwater from Ribstone Creek
RibcCL	Ribstone Creek - Chloride in groundwater from Ribstone Creek
RibcF	Ribstone Creek - Fluoride
VictTOPel	Victoria - Elevation of Top
VictTHC	Victoria - Thickness
VictQ	Victoria - Apparent yield for water wells completed through Victoria
VictWL	Victoria - NPWL
VictDR	Victoria - Discharge/Recharge area between water in surficial aquifers and water in Victoria
VictTDS	Victoria - Total Dissolved Solids
VictTH	Victoria - Total Hardness
VictSO4	Victoria - Sulfate
VictCL	Victoria - Chloride
VictF	Victoria - Fluoride
BrosTOPel	Brosseau - Elevation of Top
BrosTHC	Brosseau - Thickness
BrosQ	Brosseau - Apparent yield for water wells completed through Brosseau
BrosWL	Brosseau - NPWL
BrosDR	Brosseau - Discharge/Recharge area between water in surficial aquifers and water in Brosseau
BrosTDS	Brosseau - Total Dissolved Solids
BrosTH	Brosseau - Total Hardness
BrosSO4	Brosseau - Sulfate
BrosCL	Brosseau - Chloride
BrosF	Brosseau - Fluoride
LepkTOPel	Lea Park - Elevation of Top
LepakTHC	Lea Park - Thickness
LepkQ	Lea Park - Apparent yield for water wells completed through Lea Park Aquitard
LepkWL	Lea Park - NPWL
LepkDR	Lea Park - Discharge/Recharge area between water in surficial aquifers and water in Lea Park Aquitard

LepkTDS	Lea Park - Total Dissolved Solids
LepkTH	Lea Park - Total Hardness
LepkSO4	Lea Park - Sulfate
LepkCL	Lea Park - Chloride
LepkF	Lea Park - Fluoride
BGP	Base of Groundwater Protection
WWMAX	Water well Maximum Depth
WWMIN	Water well Minimum Depth

20. APPENDIX C - Example water well completion records

20.1. Original Water Well Drillers Report

- Completed by original driller from notes taken in the field
- Often includes driller's best estimate of "recommended pumping rate"



WATER WELL DRILLERS REPORT

Alberta ENVIRONMENT

15 24227 331

THIS REPORT TO BE SUBMITTED WITHIN 60 DAYS AFTER WELL COMPLETION TO

DIRECTOR OF TECHNICAL SERVICES ALBERTA ENVIRONMENT

CONTRACTOR: Mr + Mrs Bailly C. Sr

ADDRESS: Box 152 Rathmore, Alta TOJ-2M0

LICENCE NO. 291

DATE STARTED: Jan 8 19 90

DATE COMPLETED: Jan 10 19 90

WELL COMPLETION DATA

OPEN HOLE / SLOTTED CASING ✓

SCREEN / GRAVEL PACK:

DIAMETER OF HOLE 8 5/8 - 270 6 5/8 - 705

BOTTOMED IN: CLAY / SAND

SANDSTONE / SHALE ✓ / COAL

DEPTH TO TOP OF BEDROCK 261

TOTAL DEPTH: 330

CASING: TYPE Steel (Galvanized)

SIZE O.D 5 1/2 WALL THICKNESS .244

BOTTOM SET AT: 304 FT/M

SEAL: YES ☑ NO ☐

DEPTH OF SEAL 270 FT/M

DESCRIPTION Bentonite

Perforated 294 - 304

LINER: YES ☐ NO ☑

TYPE

SIZE O.D

WALL THICKNESS:

BOTTOM AT: FT/M TOP AT FT/M

PERFORATED FROM FT/M TO FT/M

HOW PERFORATED: TORCH ☐

MACHINE ☐ OTHER ☐

SIZE PERFORATIONS: 5 IN/MM BY 10 IN/MM

SAND PACK: YES ☐ NO ☑

SIZE AMOUNT

SCREEN: YES ☐ NO ☑

MATERIAL

SIZE I.D (CLEAR)

LENGTH

SLOT SIZE

SCREEN FROM: FT/M TO: FT/M

FITTINGS TOP

FITTINGS BOTTOM

METHOD OF INSTALLATION

PUMP: YES ☐ NO ☑

TYPE H.P.

SIZE VOLTAGE

DROP PIPE SIZE LENGTH

MATERIAL

INTAKE AT: FT/M

WELL OWNER: Name Warren Ringdahl

ADDRESS Box #1 Edgeley Sask TOJ 1TO

LOCATION: 1/4 SE, SEC. 34, TWP. 20, RGE. 10, W4M

MEASUREMENTS SPECIFIED IN IMPERIAL ☑ OR METRIC ☐

ILLUSTRATION OF WELL CONSTRUCTION

TYPE OF WELL:

TYPE OF WORK:

PROPOSED USE:

PRODUCTION TEST (PUMPING AT A CONSTANT RATE)

TIME	WATER LEVEL WHILE PUMPING FT/M	WATER LEVEL RECOVERY FT/M
0		
30 SEC		
1 MIN		
1 MIN 30 SEC		
2 MIN		
3		
4		
5		
6		
7		
8		
9		
10		
12		
14		
16		
18		
20		
25		
30		
35		
40		
50		
60		
75		
90		
105		
120		

PUMP ☑ BAILER ☐ AIR ☐

NON PUMPING WATER LEVEL 168 FT/M

RATE OF PUMPING 7 I.G.P.M./L.P.M.

DURATION OF TEST 2 HRS — MINS.

PUMPING WATER LEVEL OR BAILING LEVEL 184 FT/M

TOTAL DRAWDOWN AT END OF TEST 16 FT/M

PUMP SET AT 240 FT/M

ADDITIONAL PRODUCTION TEST INFO. YES/NO ☑

RECOMMENDED PUMPING RATE 10 I.G.P.M./L.P.M.

WATER QUALITY: Hard.

CHEMICAL ANALYSIS YES ☐ NO ☑

BACTERIAL ANALYSIS YES ☐ NO ☑

WATER TEMPERATURE

OTHER TDS - 1800

FORMATION LOG DESCRIPTION

DEPTH FROM	DEPTH TO	FORMATION LOG DESCRIPTION
GROUND LEVEL	25	Th. Clay
25	75	Sand
75	95	Light Grey Clay
95	112	Sand
112	121	Blue Clay Rocks
121	182	Sand
182	268	Blue Clay
268	284	Soft Blue Clay
284	285	Shale
285	295	Sand (Water)
295	300	Shale
300	305	Sandy Shale
305	330	Shale

ELECTRIC LOG YES ☐ NO ☑

GAMMA LOG YES ☐ NO ☑

Mem Rig 2
Pete Common
VA 2926

JAN 23 1990

CERTIFICATION
WATER WELL DRILLER (OPERATOR)

THIS WELL WAS CONSTRUCTED UNDER MY DIRECT SUPERVISION AND ALL INFORMATION GIVEN IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF. A COPY OF THIS REPORT HAS BEEN SUPPLIED TO THE OWNER

SIGNATURE

JOURNEYMAN NO. 3640 AB DATE Jan 15 19 90

WELL OWNER

ANTICIPATED WATER REQUIREMENT:

GALLONS/LITRES PER DAY

I HAVE RECEIVED A COPY OF THIS REPORT.

SIGNATURE

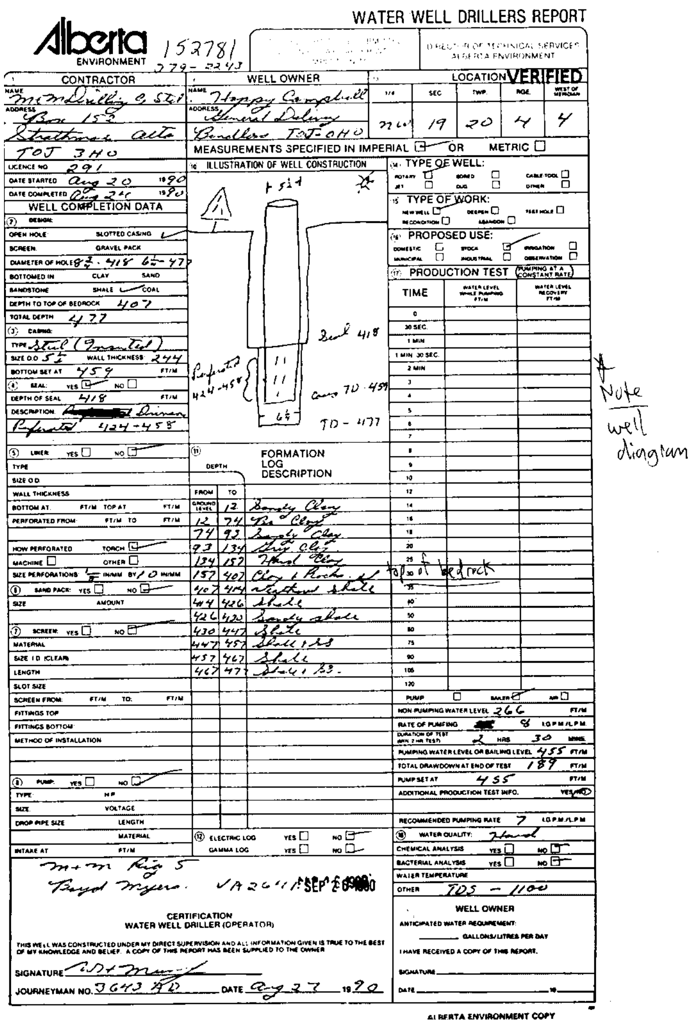
DATE 19

IC12

ALBERTA ENVIRONMENT COPY

* Note
1) Diagram showing well completion
2) Says top of bedrock at 261 ft

Original Driller's Report (imperial)



WATER WELL DRILLERS REPORT

Alberta ENVIRONMENT 153781

CONTRACTOR — WELL OWNER — LOCATION VERIFIED

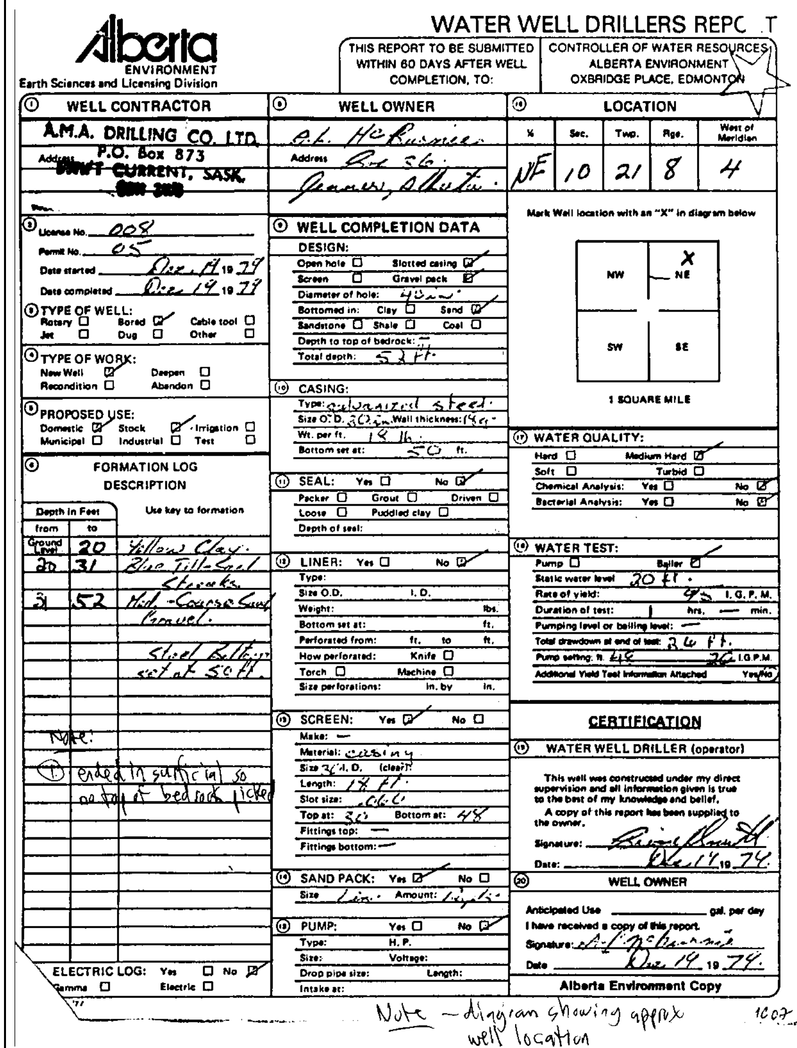
FORMATION LOG DESCRIPTION

Note well diagram

CERTIFICATION WATER WELL DRILLER (OPERATOR)

ALBERTA ENVIRONMENT COPY

Original Driller's Report (imperial)



WATER WELL DRILLERS REPORT

Alberta ENVIRONMENT Earth Sciences and Licensing Division

THIS REPORT TO BE SUBMITTED WITHIN 60 DAYS AFTER WELL COMPLETION, TO: CONTROLLER OF WATER RESOURCES ALBERTA ENVIRONMENT OXBRIDGE PLACE, EDMONTON

WELL CONTRACTOR	WELL OWNER	LOCATION
A.M.A. DRILLING CO. LTD. P.O. Box 873 SWIFT CURRENT, SASK.		NE 10 21 8 4

WELL COMPLETION DATA

FORMATION LOG DESCRIPTION

WATER QUALITY

WATER TEST

CERTIFICATION

WATER WELL DRILLER (operator)

This well was constructed under my direct supervision and all information given is true to the best of my knowledge and belief. A copy of this report has been supplied to the owner.

WELL OWNER

Alberta Environment Copy

Note – diagram showing approx well location

Original Driller's Report (imperial)

Mer. 4 Tp. 21 R. 8 Sec. 10 ¼ or LSD NE Identification No. Altitude 2500'±

Map Sheet No. Co-ordinates 72L | 14E Contents CHEM ANALYSIS

FIELD OBSERVATIONS:

Type of observation: Original Water Quality Data

Comments:

Date ☆

Observed by:

WELL AND BOREHOLE DATA

Owner A. McBurnie Address Jenner Date Dec. 79

Driller Type of Rig

Completed Depth of Well 50 ← Note – similar but not the same as driller's log

Water-Bearing Intervals	Depth to Water
From ... to ...	
From ... to ...	
From ... to ...	
From ... to ...	

Well Construction

- (a) Slotted casing From to
- (b) Open hole From to
- (c) Screen From to
- (d) Dug
- (e) Bored (circled)

Depth to water in Finished Well 25 Water Temp. °F °C

↖ Note in driller's log, non-pumping water level shown as being 20 ft

AQUIFER TESTS

Type	Transmissivity	Q_{20}
Pump Test		
Bail Test		
Recovery Test		
Apparent-Yield Test		

Test rate igpm. for min.

Total Drawdown

Original available drawdown

Storage Coeff. at r_1 at r_2 at r_3

CHEMISTRY 1·5·80

	ppm	epm %
Calcium	147	41
Magnesium	78	37
Sodium	82	20
Potassium	11.3	2
Iron	.39	.1
Nitrate (NO_3)	.66	.1
Chloride	15	3
Sulfate (SO_4)	477	59
Fluoride	.23	.1
Carbonate (CO_3)	-	-
Bicarbonate (HCO_3)	399	39
Silica (H_4SiO_4)	19.6	-
Hardness (as $CaCO_3$)	687	-
Alkalinity (as $CaCO_3$)	327	-

Total Solids ppm 1007 epm

Conduct. at 25°C lab 1490 field

pH lab 8.1 field

Cation: Anion Balance 4.59 %

Total Solids Balance 2.01 %

LITHOLOGY

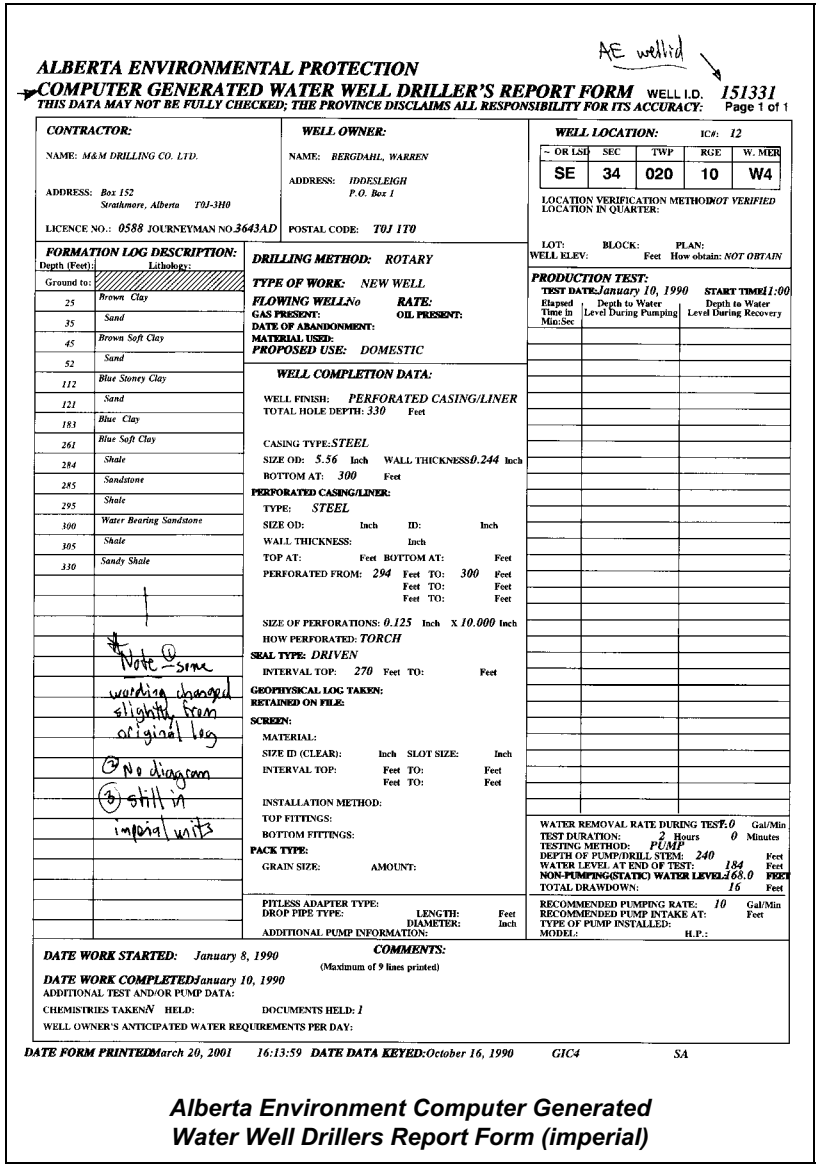
Note – sample date suggests sample was taken likely just after well was completed (and done on January 5, 1980) – Sample taken by well owner (not driller)

Comments:

Original Chemistry Analysis on Submitted Water Sample

20.2. Alberta Environment computer generated water well drillers report forms

- is based on information contained in Original Water Well Drillers Report
- generated from information entered from the Orginal Water Well Drillers Report by students
- many contain typos
- some information on the log may have been missed or omitted
- water quality data is often contained on a separate form



ALBERTA ENVIRONMENTAL PROTECTION

AE wellid

COMPUTER GENERATED WATER WELL DRILLER'S REPORT FORM WELL I.D. 151331

THIS DATA MAY NOT BE FULLY CHECKED; THE PROVINCE DISCLAIMS ALL RESPONSIBILITY FOR ITS ACCURACY: Page 1 of 1

CONTRACTOR:
NAME: M&M DRILLING CO. LTD.
ADDRESS: Box 152 Strathmore, Alberta T0J-3H0
LICENCE NO.: 0588 JOURNEYMAN NO.3643AD

WELL OWNER:
NAME: BERGDAHL, WARREN
ADDRESS: IDDESLEIGH P.O. Box 1
POSTAL CODE: T0J 1T0

WELL LOCATION: IC#: 12

~ OR LSD	SEC	TWP	RGE	W. MER
SE	34	020	10	W4

LOCATION VERIFICATION METHOD: NOT VERIFIED
LOCATION IN QUARTER:
LOT: BLOCK: PLAN:
WELL ELEV: Feet How obtain: NOT OBTAIN

FORMATION LOG DESCRIPTION:

Depth (Feet): Ground to:	Lithology:
25	Brown Clay
35	Sand
45	Brown Soft Clay
52	Sand
112	Blue Stoney Clay
121	Sand
183	Blue Clay
261	Blue Soft Clay
284	Shale
285	Sandstone
295	Shale
300	Water Bearing Sandstone
305	Shale
330	Sandy Shale

Note ① some wording changed slightly from original log
② No diagram
③ still in imperial units

DRILLING METHOD: ROTARY
TYPE OF WORK: NEW WELL
FLOWING WELL: No **RATE:**
GAS PRESENT: **OIL PRESENT:**
DATE OF ABANDONMENT:
MATERIAL USED:
PROPOSED USE: DOMESTIC

WELL COMPLETION DATA:
WELL FINISH: PERFORATED CASING/LINER
TOTAL HOLE DEPTH: 330 Feet
CASING TYPE: STEEL
SIZE OD: 5.56 Inch WALL THICKNESS 0.244 Inch
BOTTOM AT: 300 Feet
PERFORATED CASING/LINER:
TYPE: STEEL
SIZE OD: Inch ID: Inch
WALL THICKNESS: Inch
TOP AT: Feet BOTTOM AT: Feet
PERFORATED FROM: 294 Feet TO: 300 Feet
Feet TO: Feet
Feet TO: Feet
SIZE OF PERFORATIONS: 0.125 Inch X 10.000 Inch
HOW PERFORATED: TORCH
SEAL TYPE: DRIVEN
INTERVAL TOP: 270 Feet TO: Feet
GEOPHYSICAL LOG TAKEN:
RETAINED ON FILE:
SCREEN:
MATERIAL:
SIZE ID (CLEAR): Inch SLOT SIZE: Inch
INTERVAL TOP: Feet TO: Feet
Feet TO: Feet
INSTALLATION METHOD:
TOP FITTINGS:
BOTTOM FITTINGS:
PACK TYPE:
GRAIN SIZE: AMOUNT:

PITLESS ADAPTER TYPE:
DROP PIPE TYPE: LENGTH: Feet
DIAMETER: Inch
ADDITIONAL PUMP INFORMATION:

PRODUCTION TEST:
TEST DATE: January 10, 1990 START TIME 1:00

Elapsed Time in Min:Sec	Depth to Water Level During Pumping	Depth to Water Level During Recovery

WATER REMOVAL RATE DURING TEST: 0 Gal/Min
TEST DURATION: 2 Hours 0 Minutes
TESTING METHOD: PUMP
DEPTH OF PUMP/DRILL STEM: 240 Feet
WATER LEVEL AT END OF TEST: 184 Feet
NON-PUMPING(STATIC) WATER LEVEL 168.0 FEET
TOTAL DRAWDOWN: 16 Feet

RECOMMENDED PUMPING RATE: 10 Gal/Min
RECOMMENDED PUMP INTAKE AT: Feet
TYPE OF PUMP INSTALLED:
MODEL: H.P.:

DATE WORK STARTED: January 8, 1990
DATE WORK COMPLETED: January 10, 1990
ADDITIONAL TEST AND/OR PUMP DATA:
CHEMISTRIES TAKEN: N HELD: DOCUMENTS HELD: 1
WELL OWNER'S ANTICIPATED WATER REQUIREMENTS PER DAY:

COMMENTS:
(Maximum of 9 lines printed)

DATE FORM PRINTED: March 20, 2001 16:13:59 **DATE DATA KEYED:** October 16, 1990 GIC4 SA

Alberta Environment Computer Generated Water Well Drillers Report Form (imperial)

AE weltid

ALBERTA ENVIRONMENTAL PROTECTION

COMPUTER GENERATED WATER WELL DRILLER'S REPORT FORM WELL I.D. *152781*

THIS DATA MAY NOT BE FULLY CHECKED; THE PROVINCE DISCLAIMS ALL RESPONSIBILITY FOR ITS ACCURACY: Page 1 of 1

CONTRACTOR:
NAME: *M&M DRILLING CO. LTD.*
ADDRESS: *Box 152 Strathmore, Alberta T0J-3H0*
LICENCE NO.: *0588* JOURNEYMAN NO. *3643AD*

WELL OWNER:
NAME: *CAMPBELL, HAPPY*
ADDRESS: *GENERAL DELIVERY, BINDLOSS*
POSTAL CODE: *T0J 0H0*

WELL LOCATION: IC#:

~ OR LSD	SEC	TWP	RGE	W. MER
NW	19	020	04	W4

LOCATION VERIFICATION METHOD *MAP*
LOCATION IN QUARTER:
LOT: BLOCK: PLAN:
WELL ELEV: Feet How obtain: *NOT OBTAIN*

FORMATION LOG DESCRIPTION:

Depth (Feet): Ground to:	Lithology:
12	Sandy Clay
74	Brown Clay
93	Sandy Clay
134	Gray Clay
157	Clay
407	Stoney Clay
414	Weathered Shale
426	Shale
430	Sandy Shale
447	Shale
457	Shale & Sandstone
467	Shale
477	Shale & Sandstone

Note
① no well diagram
② all in imperial units
③ Top of bedrock on original log is not shown

DRILLING METHOD: *ROTARY*
TYPE OF WORK: *NEW WELL*
FLOWING WELL: *No* **RATE:**
GAS PRESENT: **OIL PRESENT:**
DATE OF ABANDONMENT:
MATERIAL USED:
PROPOSED USE: *STOCK*

WELL COMPLETION DATA:
WELL FINISH: *PERFORATED CASING/LINER*
TOTAL HOLE DEPTH: *477* Feet

CASING TYPE: *STEEL*
SIZE OD: *5.56* Inch WALL THICKNESS *0.244* Inch
BOTTOM AT: *459* Feet
PERFORATED CASING/LINER:
TYPE: *STEEL*
SIZE OD: Inch ID: Inch
WALL THICKNESS: Inch
TOP AT: Feet BOTTOM AT: Feet
PERFORATED FROM: *424* Feet TO: *458* Feet
Feet TO: Feet
Feet TO: Feet
SIZE OF PERFORATIONS: *0.125* Inch X *10.000* Inch
HOW PERFORATED: *TORCH*
SEAL TYPE: *DRIVEN*
INTERVAL TOP: *418* Feet TO: Feet
GEOPHYSICAL LOG TAKEN:
RETAINED ON FILE:
SCREEN:
MATERIAL:
SIZE ID (CLEAR): Inch SLOT SIZE: Inch
INTERVAL TOP: Feet TO: Feet
Feet TO: Feet
INSTALLATION METHOD:
TOP FITTINGS:
BOTTOM FITTINGS:
PACK TYPE:
GRAIN SIZE: AMOUNT:

PITLESS ADAPTER TYPE:
DROP PIPE TYPE: LENGTH: Feet
DIAMETER: Inch
ADDITIONAL PUMP INFORMATION:

PRODUCTION TEST:
TEST DATE: *August 24, 1990* START TIME *1:00*

Elapsed Time in Min:Sec	Depth to Water Level During Pumping	Depth to Water Level During Recovery

WATER REMOVAL RATE DURING TEST *8.0* Gal/Min
TEST DURATION: *2* Hours *30* Minutes
TESTING METHOD: *BAILER*
DEPTH OF PUMP/DRILL STEM: *455* Feet
WATER LEVEL AT END OF TEST: *455* Feet
NON-PUMPING(STATIC) WATER LEVEL *266.0* FEET
TOTAL DRAWDOWN: *189* Feet

RECOMMENDED PUMPING RATE: *7* Gal/Min
RECOMMENDED PUMP INTAKE AT: Feet
TYPE OF PUMP INSTALLED:
MODEL: H.P.:

COMMENTS: *TDS 1100 PPM*
(Maximum of 9 lines printed)

DATE WORK STARTED: *August 20, 1990*
DATE WORK COMPLETED *August 24, 1990*
ADDITIONAL TEST AND/OR PUMP DATA:
CHEMISTRIES TAKEN *N* HELD: DOCUMENTS HELD: *1*
WELL OWNER'S ANTICIPATED WATER REQUIREMENTS PER DAY:

DATE FORM PRINTED *March 20, 2001* *16:13:59* ***DATA KEYED:*** *November 6, 1990* *GIC4* *SA*

Alberta Environment Computer Generated Water Well Drillers Report Form (imperial)

ALBERTA ENVIRONMENTAL PROTECTION

COMPUTER GENERATED WATER WELL DRILLER'S REPORT FORM WELL I.D. *154703*

THIS DATA MAY NOT BE FULLY CHECKED; THE PROVINCE DISCLAIMS ALL RESPONSIBILITY FOR ITS ACCURACY: Page 1 of 1

CONTRACTOR:
NAME: *AMA DRILLING CO. LTD.*
ADDRESS: *14, 7611 49 Avenue Red Deer, Alberta T4P-1M3*
LICENCE NO.: *0365* JOURNEYMAN NO.:

WELL OWNER:
NAME: *MCBURNIE, A.L.*
ADDRESS: *JENNER P.O. Box 36*
POSTAL CODE: *T0J 1W0*

WELL LOCATION: IC#: *02*

~ OR LSD	SEC	TWP	RGE	W. MER
NE	10	021	08	W4

LOCATION VERIFICATION METHOD *MAP*
LOCATION IN QUARTER:
LOT: BLOCK: PLAN:
WELL ELEV: *2575.00* Feet How obtain: *ESTIMATED*

FORMATION LOG DESCRIPTION:

Depth (Feet): Ground to:	Lithology:
20	Yellow Clay
31	Blue See Comments Till
52	Medium Grained Sand & Gravel

Note
① again slight change in lithology description from original log
② Driller recommended rate was 20 igpm based on 1 hour test @ 45 igpm

DRILLING METHOD: *BORED*
TYPE OF WORK: *NEW WELL*
FLOWING WELL: *No* **RATE:**
GAS PRESENT: **OIL PRESENT:**
DATE OF ABANDONMENT:
MATERIAL USED:
PROPOSED USE: *DOMESTIC & STOCK*

WELL COMPLETION DATA:
WELL FINISH: *SCREEN*
TOTAL HOLE DEPTH: *52* Feet

CASING TYPE: *GALVANIZED STEEL*
SIZE OD: *30.00* Inch WALL THICKNESS *0.700* Inch
BOTTOM AT: *50* Feet
PERFORATED CASING/LINER:
TYPE:
SIZE OD: Inch ID: Inch
WALL THICKNESS: Inch
TOP AT: Feet BOTTOM AT: Feet
PERFORATED FROM: Feet TO: Feet
Feet TO: Feet
Feet TO: Feet
SIZE OF PERFORATIONS: Inch X Inch
HOW PERFORATED:
SEAL TYPE:
INTERVAL TOP: Feet TO: Feet
GEOPHYSICAL LOG TAKEN:
RETAINED ON FILE:
SCREEN:
MATERIAL: *STEEL*
SIZE ID (CLEAR): *30.00* Inch SLOT SIZE: Inch
INTERVAL TOP: *30* Feet TO: *48* Feet
Feet TO: Feet
INSTALLATION METHOD:
TOP FITTINGS:
BOTTOM FITTINGS:
PACK TYPE: *ARTIFICIAL*
GRAIN SIZE: *1"* AMOUNT: *12* *YARDS*

PITLESS ADAPTER TYPE:
DROP PIPE TYPE: LENGTH: Feet
DIAMETER: Inch
ADDITIONAL PUMP INFORMATION:

PRODUCTION TEST:
TEST DATE: *December 19, 1979* START TIME *1:00*

Elapsed Time in Min:Sec	Depth to Water Level During Pumping	Depth to Water Level During Recovery

WATER REMOVAL RATE DURING TEST *95* Gal/Min
TEST DURATION: *1* Hours *0* Minutes
TESTING METHOD: *BAILER*
DEPTH OF PUMP/DRILL STEM: Feet
WATER LEVEL AT END OF TEST: *48* Feet
NON-PUMPING(STATIC) WATER LEVEL *20.0* FEET
TOTAL DRAWDOWN: *28* Feet

RECOMMENDED PUMPING RATE: *20* Gal/Min
RECOMMENDED PUMP INTAKE AT: Feet
TYPE OF PUMP INSTALLED:
MODEL: H.P.:

COMMENTS:
(Maximum of 9 lines printed)

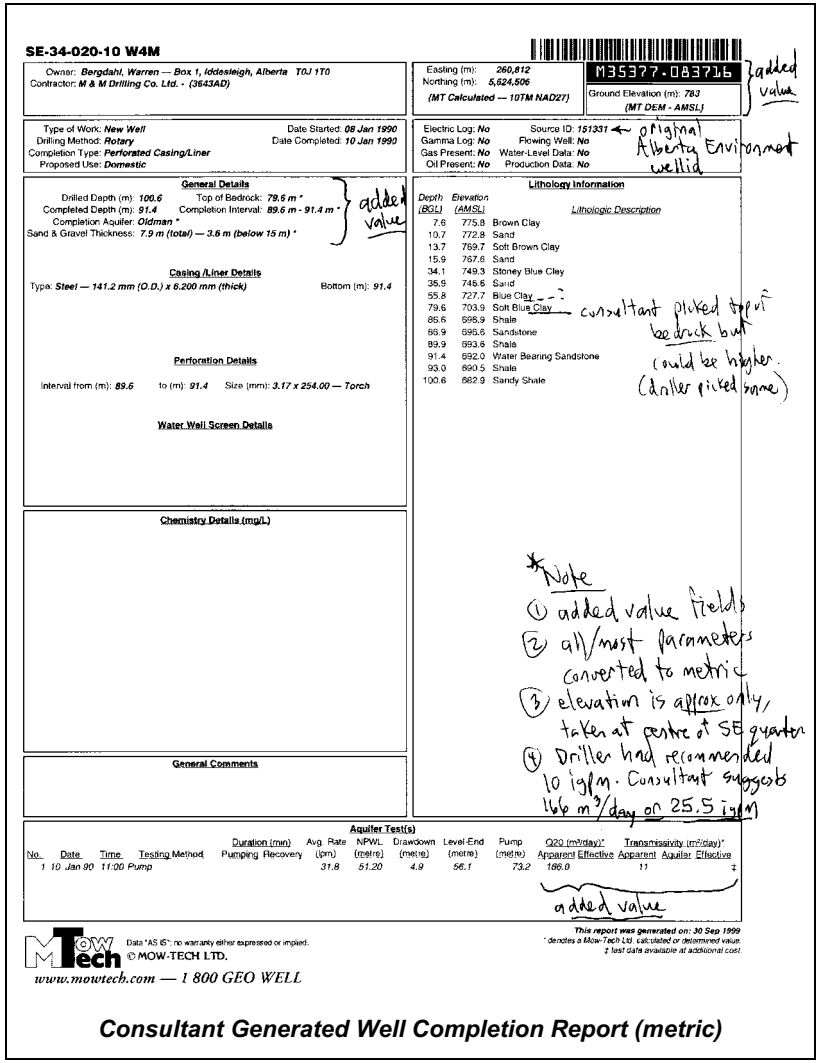
DATE WORK STARTED: *December 19, 1979*
DATE WORK COMPLETED *December 19, 1979*
ADDITIONAL TEST AND/OR PUMP DATA:
CHEMISTRIES TAKEN *N* HELD: *2* DOCUMENTS HELD: *3*
WELL OWNER'S ANTICIPATED WATER REQUIREMENTS PER DAY:

DATE FORM PRINTED *March 20, 2001* *16:14:00* ***DATA KEYED:*** *March 7, 1991* *GIC4* *SA*

Alberta Environment Computer Generated Water Well Drillers Report Form (imperial)

20.3. Consultant Generated Well Completion Reports

- is based on information form Alberta Environment Computer Generated Water Well Drillers Report Electronic Data
- some effort is made to correct obvious typos
- value added information is added
    - all units are in metric
    - geological formation or material into which well is completed
    - calculated completion zone (based on existing information)
    - spacial location (easting, northing, and ground elevation)
    - top of bedrock depth
    - elevation from Digital Elevation Model (DEM) surface (usually taken at centre of quarter or centre of LSD)
    - aquifer transmissivity (from pump/aquifer test)
    - calculated long term (20 year) sustainable water well yeidl (Q20) This is calculated from the rate at which the water well was pumped during an aquifer test, the transmissivity, and amount of “available drawdown” (distance from non-pumping water level to the depth of the pump).
    - where possible, water quality (chemical analysis) is linked to the well and shown on the same form



SE-34-020-10 W4M

M35377-083716

Owner: Bergdahl, Warren — Box 1, Iddesleigh, Alberta T0J 1T0
Contractor: M & M Drilling Co. Ltd. - (3643AD)

Easting (m): 260,812
Northing (m): 5,624,506
(MT Calculated — 10TM NAD27)
Ground Elevation (m): 783
(MT DEM - AMSL)

added value

Type of Work: New Well
Drilling Method: Rotary
Completion Type: Perforated Casing/Liner
Proposed Use: Domestic
Date Started: 08 Jan 1990
Date Completed: 10 Jan 1990

Electric Log: No
Gamma Log: No
Gas Present: No
Oil Present: No
Source ID: 151331
Flowing Well: No
Water-Level Data: No
Production Data: No

original Alberta Environment well id

General Details
Drilled Depth (m): 100.6
Completed Depth (m): 91.4
Completion Aquifer: Oldman *
Sand & Gravel Thickness: 7.9 m (total) — 3.6 m (below 15 m) *
Top of Bedrock: 79.6 m *
Completion Interval: 89.6 m - 91.4 m *

added value

Casing/Liner Details
Type: Steel — 141.2 mm (O.D.) x 6.200 mm (thick)
Bottom (m): 91.4

Perforation Details
Interval from (m): 89.6 to (m): 91.4 Size (mm): 3.17 x 254.00 — Torch

Water Well Screen Details

Chemistry Details (mg/L)

General Comments

Lithology Information

Depth (BGL)	Elevation (AMSL)	Lithologic Description
7.6	775.8	Brown Clay
10.7	772.8	Sand
13.7	769.7	Soft Brown Clay
15.9	767.6	Sand
34.1	749.3	Stoney Blue Clay
35.9	748.6	Sand
55.8	727.7	Blue Clay
79.6	703.9	Soft Blue Clay
86.6	696.9	Shale
86.9	696.6	Sandstone
89.9	693.6	Shale
91.4	692.0	Water Bearing Sandstone
93.0	690.5	Shale
100.6	682.9	Sandy Shale

consultant picked top of bedrock but could be higher. (driller picked some)

*Note
① added value fields
② all/most parameters converted to metric
③ elevation is approx only, taken at centre of SE quarter
④ Driller had recommended 10 igpm. Consultant suggests 166 m³/day on 25.5 igpm

Aquifer Test(s)

No.	Date	Time	Testing Method	Duration (min) Pumping	Duration (min) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	10 Jan 90	11:00	Pump			31.8	51.20	4.9	56.1	73.2	186.0		11		‡

added value

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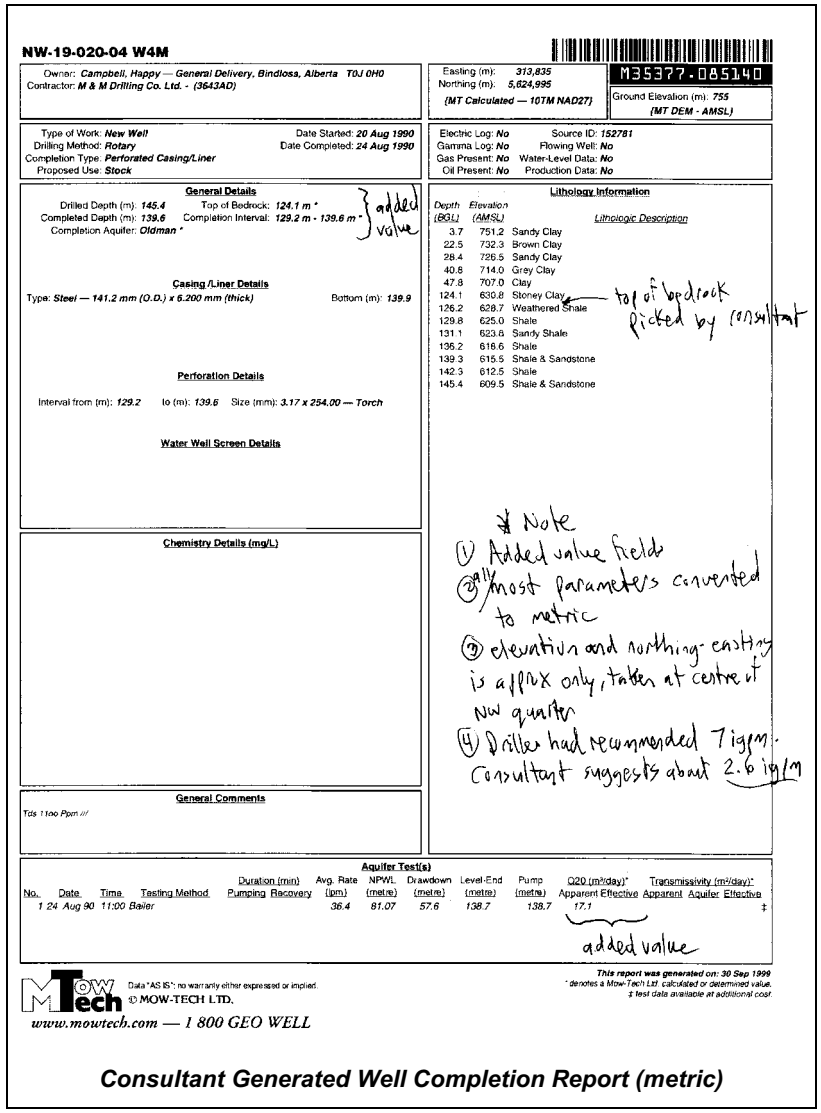
This report was generated on: 30 Sep 1999
* denotes a Mow-Tech Ltd. calculated or determined value.
‡ test data available at additional cost

Consultant Generated Well Completion Report (metric)



NW-19-020-04 W4M

M35377-085140

Owner: *Campbell, Happy — General Delivery, Bindloss, Alberta T0J 0H0*
Contractor: *M & M Drilling Co. Ltd. - (3643AD)*

Easting (m): *313,835*
Northing (m): *5,624,995*
{MT Calculated — 10TM NAD27}
Ground Elevation (m): *755*
{MT DEM - AMSL}

Type of Work: *New Well*
Drilling Method: *Rotary*
Completion Type: *Perforated Casing/Liner*
Proposed Use: *Stock*
Date Started: *20 Aug 1990*
Date Completed: *24 Aug 1990*

Electric Log: *No* Source ID: *152781*
Gamma Log: *No* Flowing Well: *No*
Gas Present: *No* Water-Level Data: *No*
Oil Present: *No* Production Data: *No*

General Details } added value

Drilled Depth (m): *145.4* Top of Bedrock: *124.1 m ** } added value
Completed Depth (m): *139.6* Completion Interval: *129.2 m - 139.6 m **
Completion Aquifer: *Oldman **

Casing /Liner Details

Type: *Steel — 141.2 mm (O.D.) x 6.200 mm (thick)* Bottom (m): *139.9*

Perforation Details

Interval from (m): *129.2* to (m): *139.6* Size (mm): *3.17 x 254.00 — Torch*

Water Well Screen Details

Lithology Information

Depth (BGL)	Elevation (AMSL)	Lithologic Description
3.7	751.2	Sandy Clay
22.5	732.3	Brown Clay
28.4	726.5	Sandy Clay
40.8	714.0	Grey Clay
47.8	707.0	Clay
124.1	630.8	Stoney Clay ← top of bedrock picked by consultant
126.2	628.7	Weathered Shale
129.8	625.0	Shale
131.1	623.6	Sandy Shale
135.2	618.6	Shale
139.3	615.5	Shale & Sandstone
142.3	612.5	Shale
145.4	609.5	Shale & Sandstone

Chemistry Details (mg/L)

General Comments

Tds 1100 Ppm ///

* Note
(1) Added value fields
(2) all/most parameters converted to metric
(3) elevation and northing-easting is approx only, taken at centre of NW quarter
(4) Driller had recommended 7 igpm. Consultant suggests about 2.6 igpm

Aquifer Test(s)

No.	Date	Time	Testing Method	Duration (min) Pumping	Duration (min) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	24 Aug 90	11:00	Bailer			36.4	81.07	57.6	138.7	138.7	17.1				‡

added value

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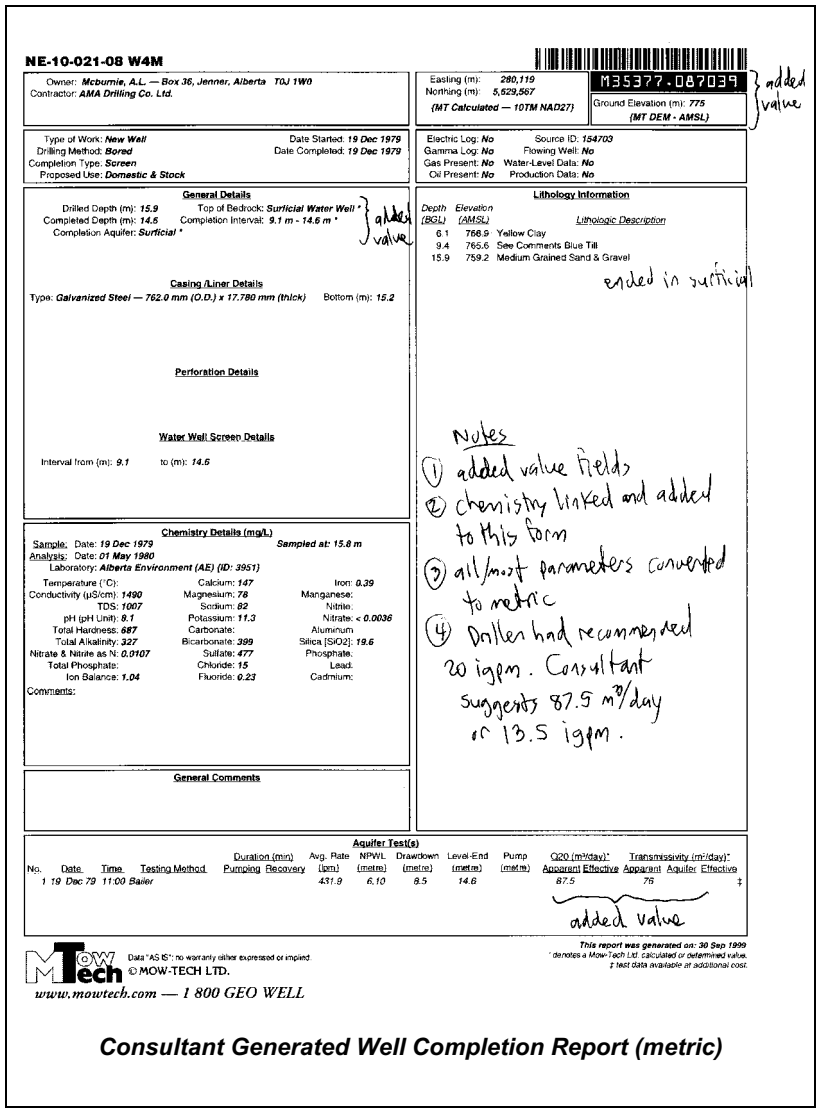
This report was generated on: 30 Sep 1999
** denotes a Mow-Tech Ltd. calculated or determined value.*
‡ test data available at additional cost.

Consultant Generated Well Completion Report (metric)



NE-10-021-08 W4M

M35377-087039 } added value

Owner: *Mcburnie, A.L. — Box 36, Jenner, Alberta T0J 1W0*
Contractor: *AMA Drilling Co. Ltd.*

Easting (m): *280,119*
Northing (m): *5,629,567*
{MT Calculated — 10TM NAD27}
Ground Elevation (m): *775*
{MT DEM - AMSL}

Type of Work: *New Well*
Drilling Method: *Bored*
Completion Type: *Screen*
Proposed Use: *Domestic & Stock*
Date Started: *19 Dec 1979*
Date Completed: *19 Dec 1979*

Electric Log: *No* Source ID: *154703*
Gamma Log: *No* Flowing Well: *No*
Gas Present: *No* Water-Level Data: *No*
Oil Present: *No* Production Data: *No*

General Details } added value

Drilled Depth (m): *15.9* Top of Bedrock: *Surficial Water Well ** } added value
Completed Depth (m): *14.5* Completion Interval: *9.1 m - 14.6 m **
Completion Aquifer: *Surficial **

Casing /Liner Details

Type: *Galvanized Steel — 762.0 mm (O.D.) x 17.780 mm (thick)* Bottom (m): *15.2*

Perforation Details

Water Well Screen Details

Interval from (m): *9.1* to (m): *14.6*

Lithology Information

Depth (BGL)	Elevation (AMSL)	Lithologic Description
6.1	768.9	Yellow Clay
9.4	765.6	See Comments Blue Till
15.9	759.2	Medium Grained Sand & Gravel

ended in surficial

Chemistry Details (mg/L)

Sample: Date: *19 Dec 1979* *Sampled at: 15.8 m*
Analysis: Date: *01 May 1980*
Laboratory: *Alberta Environment (AE) (ID: 3951)*

Temperature (°C):	Calcium: *147*	Iron: *0.39*
Conductivity (µS/cm): *1490*	Magnesium: *78*	Manganese:
TDS: *1007*	Sodium: *82*	Nitrite:
pH (pH Unit): *8.1*	Potassium: *11.3*	Nitrate: *< 0.0036*
Total Hardness: *687*	Carbonate:	Aluminum
Total Alkalinity: *327*	Bicarbonate: *399*	Silica [SiO2]: *19.6*
Nitrate & Nitrite as N: *0.0107*	Sulfate: *477*	Phosphate:
Total Phosphate:	Chloride: *15*	Lead:
Ion Balance: *1.04*	Fluoride: *0.23*	Cadmium:

Comments:

General Comments

Notes
(1) added value fields
(2) chemistry linked and added to this form
(3) all/most parameters converted to metric
(4) Driller had recommended 20 igpm. Consultant suggests 87.5 m³/day or 13.5 igpm.

Aquifer Test(s)

No.	Date	Time	Testing Method	Duration (min) Pumping	Duration (min) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
1	19 Dec 79	11:00	Bailer			431.9	6.10	8.5	14.6		87.5		76		‡

added value

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‡ test data available at additional cost.

Consultant Generated Well Completion Report (metric)

21. APPENDIX D - Example GIS Query Expressions

21.1. ArcExplorer

NOTE: Modified from "AE Query Expression.txt" from County of Stettler No. 6 Regional Groundwater Assessment CD-ROM by Hydrogeological Consultants Ltd., August 2000.

21.1.1. To find Yield > 65 m³/day (10 igpm)

- `FOCNQ >=65 or FOMAQ >=65 or LEPKQ >=65 or LOSGQ >=65 or MLNQ >=65 or OLDMQ >=65 or UPSGQ >=65`

21.1.2. Yield > 65 m³/day (10igpm) and Chloride < 250 mg/L

- `(FOCNQ >=65 and FOCNCL <=250) or (FOMAQ >=65 and FOMACL <=250) or (LEPKQ >=65 and LEPKCL <=250) or (LOSGQ >=65 and SRFCL <=250) or (MLNQ >=65 and MLNCL <=250) or (OLDMQ >=65 and OLDMCL <=250) or (UPSGQ >=65 and SRFCL <=250)`

21.2. ArcView GIS

NOTE: Modified from "AV Query Expression.txt" from M.D. of Stettler No. 6 Regional Groundwater Assessment CD-ROM by Hydrogeological Consultants Ltd., August 2000.

21.2.1. Yield > 65m³/day (10 igpm)

- `([Upsgq] > 65) or ([Losgq] > 65) or ([Oldmq] > 65) or ([Focnq] > 65) or ([Fomaq] > 65) or ([Mlnq] > 65) or ([Lepkq] > 65 )`

21.2.2. Yield > 65m³/day and SO4 < 300 mg/L

- `(([UpSndGrav_Q] > 65) and ([Surf_SO4] < 300)) or (([LoSndGrav_Q] > 300) and ([Surf_SO4] < 300)) or (([Oldman_Q] > 300) and ([Oldman_SO4] < 300)) or (([ForCn_Q] > 300) and ([ForCn_SO4] < 300)) or (([ForMa_Q] > 300) and ([ForMa_SO4] < 300)) or (([Milan_Q] > 300) and ([Milan_SO4] < 300)) or (([LeaPk_Q] > 300) and ([LeaPk_SO4] < 300))`

21.2.3. Yield > 65m³/day and Cl < 250 mg/L

- `(([Upsgq] >= 65) and ([Srfcl] <= 250)) or (([Losgq] >= 65) and ([Srfcl] <= 250)) or (([Oldmq] >= 65) and ([Oldmcl] <= 250)) or (([Focnq] >= 65) and ([Focncl] <= 250)) or (([Fomaq] >= 65) and ([Fomacl] <= 250)) or (([Mlnq] >= 65) and ([Mlncl] <= 250)) or (([Lepkq] >= 65) and ([Lepkcl] <= 250))`

22. APPENDIX E - File Extensions - What do they mean?

22.1. GIS-type file extensions

shp	ESRI shape file that stores the features geometry (imported as individual themes)
shx	ESRI shape file index file (stores the index of the feature geometry)
shb and shn	optional ESRI files that store the spatial index of features
dbf	xBASE compatible data base table file containing attribute information of features
avl	ESRI legend file for themes
aep	ArcExplorer project file - will open a project and the shape files that are already installed
apr	ArcView project file - will open a project and the shape files that are installed

22.2. Adobe Acrobat files

pdf	Acrobat Reader file

22.3. Microsoft Excel spreadsheet files

xls	Microsoft Excel

22.4. Text files

wpd	WordPerfect
doc	Microsoft Word
txt	Text file

22.5. Program files

exe	Program Executable (compiled)
com	Program Command file (compiled)
bat	DOS batch file