Decision Support Tool For Little Saskatchewan River Conservation District Abandoned Well Survey

Agricultureand Agri-FoodCanada
PrairieFarmRehabilitation Administration
Agricultureet AgroalimentaireCanada
Administrationdurétablissement agricoledesPrairies
KAP
Canada

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Thisreport providestheRMofBlanshardandtheRMofClanwilliamwithvaluabletoolsand knowledgethatwillassist them inmakinginformeddecisionsregardingsustainableagricultural and ruraldevelopment,protectingthewaterandsoilresource.

Thereport waspreparedby:
PatsyMichiels
DanMacDonald

Assistancewasprovidedby:
RaeganDalgliesh
SherriThompson
Conrad Wyrzykowski

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RuralMunicipality ofClanwilliam

Rural Municipality ofBlanshard

LittleSaskatchewanRiver ConservationDistrict

PFRA ARAP
PrairieFarmRehabilitation Administration
Administrationdurétablissementagricole desPrairies

Western Economic Diversification Canada
Canada

KAP

Abstract

The need to protect groundwater resources is well recognized. Surface runoff containing contaminants such as nutrients and pesticides can pose a great risk to water quality. Recognizing that improperly abandoned wells can act as a conduit for runoff to enter groundwater aquifers, a joint pilot project between Keystone Agricultural Producers and the Rural Municipality of Clanwilliam, the Rural Municipality of Blanshard and Little Saskatchewan River Conservation District (LSRCD) was initiated to identify the location and status of groundwater wells in the Rural Municipalities of Clanwilliam and Blanshard. Using a Geographical Information System (GIS), a preliminary priority list for capping abandoned wells was developed to help focus well capping resources at those wells that pose the greatest risk for contamination. Of the 56 abandon wells in the RM of Clanwilliam, 45 were identified as having a priority for capping. 74 of the 123 abandoned wells identified in the RM of Blanshard were identified as having a priority of capping. As exact well locations are determined through the use of a Global Position System a more detailed priority list for well abandonment will be created. With an accurate location of wells in the rural municipalities of Clanwilliam and Blanshard and other RMs of the Little Saskatchewan River Conservation District, an effective well abandonment program can be developed to assist the protection of groundwater in the District.

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1.0 Introduction

As crop and livestock production intensifies, the need to utilize information and expertise in land and water resource management becomes more evident. Local governments and other decision makers are under pressure to make decisions which must reflect sustainability in terms of environmental, social and economic issues. Resource based data for land use planning, although not complete, is advanced enough to be immediately useful by local governments in their decision making. Social and economic considerations are equally important, but will require additional data and development to be integrated into local decision making.

Within the Little Saskatchewan River Conservation District, the need to develop a well abandonment program has become evident. To protect groundwater the Little Saskatchewan River Conservation District (LSRCD) and the participating Rural Municipalities of Blanshard and Clanwilliam need information on the status of old wells to help ensure proper abandonment. Local decision makers also require the ability to acquire, interpret, and distribute information to make informed decisions regarding groundwater protection.

Geographic Information Systems (GIS) is a relatively new tool that can assist local governments in making sustainable resource development decisions regarding the livestock industry. GIS allows the user to spatially display information and produce maps in an accurate and timely fashion. Use of this tool can help local governments and planning districts find the appropriate solutions to resolve complicated resource planning issues and to ensure sustainable development of the agricultural industry.

2.0 Project Description and Objectives

To effectively develop, deliver and target well abandonment programs, local decision makers needed to develop capabilities that allow for the acquisition and utilization of well status information for use in decision making. Combining technical and facilitation skills, this project developed a methodology and process to support local decision regarding well abandonment. The methodology and process was created through the collection of well location and condition information, the incorporation of the data into a geographical information system, and the creation of products, including a priority list for capping wells, to support local decision making. The analysis will allow for effective well abandonment and the identify groundwater protection issues.

At completion, the project delivered

i. a methodology that supports resource based decision making by local governments and organizations to deal with well abandonment and groundwater protection

ii. a demonstrated capacity among participating project partners to utilize advanced decision making tools on their decision making

iii. reports for each participating local government and local decision makers that includes hard copy (tabular and map form) results of analysis

iv. digital products and data for continued analysis by the Little Saskatchewan River Conservation District and the Rural Municipalities of Blanshard and Clanwilliam

3.0 Methodology

3.1 Needs of the Rural Municipality of Blanshard and Clanwilliam

Through discussions with the Rural Municipalities of Blanshard and Clanwilliam and the Little Saskatchewan River Conservation District the following statements about the need and scope of the project were determined. To develop effective well abandonment programs the rural municipalities and the conservation district wish to have a decision support tool for planning capable of spatially illustrating the location and current status of wells. Information will also identify areas where problems related to ground water quality may occur in the rural municipalities. Data requirements were discussed and agreed upon.

3.2 Data

Basemap Features

The basemap is a digital map that all other information is plotted or corrected to. Essentially the basemap is the frame upon which the rest of the data is placed. Basemap information included the position of roads, lakes, rivers, streams, rail lines and other features. The National Topographical Survey (NTS) with associated quarter section grid was utilized for creating the base map for the RM's of Clanwilliam and Blanshard (Maps 1 and 2). The quarter section fabric was used to position well symbols in appropriate quarter sections.

Location of Rural Residences and Livestock Operations

Residence locations were determined through ortho-photos, tax roles, and the assistance of RM staff. The proximity of a residence to an abandoned well was used in determining priority of the well for capping.

Knowing the location of existing livestock operations, a potential source of contamination, is essential in developing an abandoned well capping program. Livestock locations were determined through the use of ortho-photos, tax roles, and the assistance of RM staff. Abandoned wells located within 1/3 of a mile of livestock operations are given high priority for capping.

Groundwater Pollution Hazard

Possible groundwater hazard was mapped by Manitoba Water Resources using existing aquifer, geological and soils maps and water well and groundwater test hole records. The scale of mapping is very large and therefore the information provided is only an estimate of groundwater hazard. Areas with surface sand or gravel and/or sand and gravel within the uppermost 6 m of the soil profile, or areas with a known unconfined aquifer are considered to have a groundwater pollution hazard. While there is no groundwater hazard in the RM of Clanwilliam, there are a few small areas in the RM of Blanshard (Map 2). Further evaluation is needed to determine the extent and severity of the hazard at these areas.

Well Data

Information about water wells, including well depth, flow rates, and location to nearest quarter section, registered within the RM's of Blanshard and Clanwilliam by licenced drillers was acquired from Manitoba Conservation. This data was used as a starting point to identify well locations.

In order to collect as much information about wells in the RM's of Clanwilliam and Blanshard, a survey form and a corresponding database was created. Questions on the survey included location of well (to nearest quarter section), year well was dug, current status of well (production, abandoned, or abandoned and sealed), use of well, and land use surrounding well (see Appendix 1). Councillors from both RM's took the survey forms back to their wards and talked with landowners about wells on their land which they were aware of.

Table 1 summarizes the well information obtained from Manitoba Conservation and from the survey conducted for this study. Production wells are wells that are in use. In the case of the registered wells with the province, production wells were for use at the time of drilling but their present status has not been tracked. Therefore, the actual status of these registered 'production' wells is not known. In Clanwilliam, 112 production wells have been registered with Manitoba Conservation, dating back to 1962. In Blanshard, 128 production wells have been registered, dating back to 1903.

The number of wells found through the survey is greater than what is registered with Manitoba Conservation. In Clanwilliam, a total of 188 wells were found, versus the 112 wells that are registered. In Blanshard, a total of 287 wells were found, 159 more wells than what is registered with the Province.

Table 1 - The number of production wells in the RM's of Clanwilliam and Blanshard registered with Manitoba Conservation versus total number of wells found through the survey.

Description	RM of Clanwilliam	RM of Blanshard
Total # of production wells registered (MB Conservation)	112	128
Total # of wells determined through survey	188	287
- # production wells	129	118
- # abandoned wells	56	123
- # abandoned & sealed wells	3	46

In the RM of Clanwilliam, of the 188 wells found through the survey, 129 are in use while 56 wells are abandoned never to be used again. The three abandoned and sealed wells identified in the survey will have to be visited to determine the quality of the seal. In the RM of Blanshard, of the 287 wells found through the survey 118 are currently being used, while another 123 are abandoned never to be used again. There are 46 wells which are considered abandoned and sealed by the landowners which will have to be visited by the LSRCD to determine the quality of the seal.

Maps 3 and 4 show the location of all of the wells (production, abandoned, and abandoned and sealed) found in the survey in the RM of Clanwilliam and in the RM of Blanshard respectively. Included on these maps are the provincially registered production wells (to the nearest quarter section) in each RM. In some quarter sections where there are both provincially registered wells and wells found through the survey, the provincially registered well could be the same well found in the survey. However, with the exact location of the registered wells is unknown, more work would needed to determine which wells found in the survey are the actual registered well with the province.

4.0 Analysis and Discussion

The protection of the groundwater resources is an important issue for the residents in both RM's and the value of sealing abandoned wells is understood. The main concern for abandoned wells is the potential for contamination of aquifers. Abandoned wells which have not been sealed properly can act as a conduit for contaminated surface runoff to enter the aquifer. Contaminants can include nutrients from livestock and human waste and pesticide chemicals.

The goal of the Little Saskatchewan River Conservation District is to seal all abandoned wells within its boundaries, starting with the ones that have the greatest potential for contaminating the groundwater. Using GIS, well data from the survey was plotted on the quarter section fabric for the RM's of Clanwilliam and Blanshard. As the exact location of the wells are not known yet, well symbols were located on or offset from the centre of the quarter section.

Once wells were identified, a priority list for capping of abandoned wells at high risk for contamination was determined. Abandoned wells were identified as having a priority for capping if wells met one or more of the following criteria:

1) The well is located 1/3* mile from
    a) production wells listed from survey,
    b) livestock operations,
    c) rural dwellings which are located within 1/4 mile of a production well, or
    d) groundwater pollution hazard

    * As the exact location of well is not known, a distance of 1/3 of a mile was used so that any abandoned wells within the same quarter section of a livestock operation or rural dwelling would be selected.

2) There is more than one abandoned well within the quarter section.

3) There is an unsuitable land use (ie. slough) near the well as indicated in the survey.

In Clanwilliam, using the criteria listed above, of the 56 abandoned wells identified in the RM, 45 were listed as having priority for capping (Map 5). In the RM of Blanshard, 74 of the 123 abandoned wells, were listed as having priority for capping (Map 6). Table 2 and 3 in Appendix 2 lists these priority wells as well as their location for both RM's.

It should be noted that this priority list does not indicate whether one abandoned well has a higher risk for groundwater contamination than another, rather it indicates that the abandoned well meets one or more of the criteria listed above. In order to make a more precise priority list, the exact location of all the wells found in the survey (production, abandoned, abandoned and sealed) need to be determined using Global Positioning System (GPS) and mapped. Using GIS, distances of abandoned wells from production wells, livestock operations, groundwater pollution hazard, etc can be calculated and used with the above criteria in creating a more accurate priority list for the LSRCD to use in their well capping program.

5.0 Summary and Conclusions

An abandoned well has the potential to be a direct conduit for contaminants from surface to the aquifer below. Contaminants that enter the well are introduced directly into the aquifer with no opportunity for natural filtration by roots, soils or geologic materials. As such, abandoned wells in close proximity to production wells, livestock operations and areas of groundwater pollution hazard pose a possible threat to the quality of the groundwater. Contamination of an abandoned well puts production wells in the same aquifer at risk, especially those wells on the same farmstead that are close to the abandoned well.

In this project, an abandoned well that is within 1/3 of a mile of a production well, of a livestock operations, of a rural dwellings which is located with 1/4 mile of a production well, or of a groundwater pollution hazard area are considered to have a greater potential for groundwater contamination than those further away. If an abandoned well is one of more than one abandoned well within a quarter sections, or if there is an unsuitable land use near the abandoned well, it was also given priority for capping. Using these criteria, 60% of the abandoned wells found in the RM of Blanshard and 80% of the abandoned wells found in the RM of Clanwilliam have been given priority for well capping. The high percentage of abandoned wells given priority can be attributed to the high number of production wells, rural residences and livestock operations in the RMs , as well as the fact that the exact location of the wells is unknown. Once an exact location is determined, the criteria of proximity to rural dwellings can be removed due to the fact that any production well in or near a yard will be accurately located and any abandoned well near the production well will be flagged.

Using a global positioning system (GPS), the exact location of wells can be determined and mapped out and a more accurate priority list can be made of abandoned wells which might pose the greatest risk for groundwater contamination due to their condition, surroundings land use, or proximity to other production wells, livestock operations, etc. As time and dollars may restrict the number of wells that can be capped in a year, using this priority information allows municipalities to start their well capping programs with the wells that pose the greatest risk for contamination.

From this study, it is apparent that the existing well database from Manitoba Conservation is not complete as several additional wells not registered with the Province were identified in the survey. In order to create an accurate database containing the location all wells (productive, abandoned, and sealed) in a municipality, a survey of current and previous landowners needs to be conducted.

Having all wells in the rural municipality mapped on a GIS system can also provide useful information for the RM and its people. For example, for new development, it may be important to know where both productive and abandoned wells are located. Or, in the event of a disaster or accident which could potentially contaminate groundwater, preventative measures could be taken if all wells in area can be located.

5.1 Future Direction

The LSRCD plans to GPS the wells identified in this project and wells located in the other RM's in the conservation district using a similar survey. As wells are GPS'ed, other important and relevant information can collected at the same time (ie. land use surrounding well, elevation, well depth, condition of well casing, etc). With the exact locations of the wells, the distance of an abandoned well from a potential contamination hazard (for example a livestock operation) will be known and a more accurate priority list can be made. With this information, the LSRCD will be able to plan their well abandonment programming, starting with the abandoned wells with the greatest hazard for contamination.

6.0 Acknowledgments

Support for this project has been provided by Western Economic Diversification, Keystone Agricultural Producers, Agriculture and Agri-Food Canada (Prairie Farm Rehabilitation Administration), the Rural Municipalities of Blanshard and Clanwilliam and the Little Saskatchewan River Conservation District.

7.0 Data Sources

Quarter section grid: Linnet Geomatics International Inc., Winnipeg, Manitoba. 1:60 000, 1997

National Topographic Survey: Department of Energy, Mines and Resources, Surveys and Mapping Branch, Ottawa Canada. 1:50 000

Livestock, Residence, Business, Recreational and Urban areas: RM of Blanshard, Oak River, Manitoba, and RM of Clanwilliam, Erickson, Manitoba

Water Well Locations: Manitoba Department of Conservation, Water Resources Branch, Winnipeg, Manitoba.

Groundwater pollution hazard maps: Water Resources Division, Dept. of Mines, resources and Environmental Management, Province of Manitoba, 1:250 000, 1978

Appendix 1

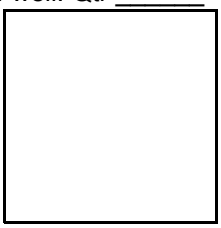
Data collection for Well Information

Little Saskatchewan River Conservation District

Date Collected: _____
Ward#: _____
What rural municipality are you in? _____
Name of data collector:_____
Farm Name: _____
Farm Address: _____
Contact Name: _____
Contact Phone#: _____
Contact Fax#: _____

Well Information
How many wells are on your land?

Well #1
Land location of well: Qtr _____ Sec _____ Twp _____ Rge _____



Please indicate with a dot, where your well is located on the quarter section.

What year was the well dug? _____
Current Status: ‘ Abandoned
‘ Production
‘ Abandoned/Sealed

Use of well: ‘ Livestock
‘ Household
‘ Other _____

Have these wells been tested?
‘ Yes
‘ No

What is the land use surrounding well: (ie. pasture, yard, crop, slough, etc.)
_____

Are there any old farm sites in your area? ‘ Yes
‘ No

Do you know if there are any old wells located on these yard sites?
‘ Yes If yes, what is the land location?
‘ No

If you are unsure, is there someone you know who might have information about wells on this property?

Appendix 2

Table 2: RM of Clanwilliam - Abandoned Wells Selected as High Priority for Capping

Record ID	Well#	Qtr	Sec	Twp	Rge	Year	Status	Land Use
100	2	SW	9	18	17	0	abandoned	pasture land
7	1	SW	4	17	18		abandoned	
24	2	SE	24	17	18		abandoned	
26	2	SE	24	17	18		abandoned	
27	3	SE	25	17	18		abandoned	
43	2	SW	7	17	17		abandoned	
48	4	NE	22	17	17		abandoned	
49	5	NE	22	17	17	0	abandoned	
50	6	NW	23	17	17		abandoned	
58	5	SE	31	17	17	0	abandoned	
61	3	SE	29	17	17	0	abandoned	
65	4	SE	28	17	17	0	abandoned	
66	5	SE	28	17	17	0	abandoned	
68	1	NW	23	17	17		abandoned	
72	3	NE	36	17	17	0	abandoned	
73	4	NE	36	17	17		abandoned	
74	5	NW	36	17	17	0	abandoned	
75	6	NW	36	17	17	0	abandoned	
78	3	SW	15	17	17	0	abandoned	
79	4	SW	15	17	17	0	abandoned	
93	2	NE	14	18	17	0	abandoned	
124	2	SW	14	18	18	1975	abandoned	
126	4	SW	14	18	18	0	abandoned	
133	3	SE	29	17	17	0	abandoned	farm yard
134	1	NW	33	17	17	0	abandoned	
135	2	NW	33	17	17	0	abandoned	Under crop now.
137	4	NW	2	18	17	0	abandoned	native bush
138	5	NW	2	18	17	0	abandoned	Field
139	6	NW	2	18	17	1981	abandoned	swamp, filled with rocks
140	7	NE	3	18	17	0	abandoned	
147	1	SW	16	18	17	0	abandoned	farm yard
156	2	SE	2	18	18	0	abandoned	
157	1	Se	31	18	18	0	abandoned	
159	2	SW	15	18	18	0	abandoned	
160	3	SW	15	18	18	0	abandoned	
165	3	NE	24	17	18	0	abandoned	
167	4	SW	15	18	18	0	abandoned	
169	2	SW	10	17	17	0	abandoned	
179	9	SW	25	17	17	0	abandoned	
180	10	SW	25	17	17	0	abandoned	
181	1	SE	9	17	17	0	abandoned	
184	2	SW	22	17	17	0	abandoned	
185	3	SW	22	17	17	0	abandoned	
190	8	SW	13	17	17	0	abandoned	
191	9	SW	3	18	17	0	abandoned	

Table 3: RM of Blanshard - Abandoned Wells Selected as High Priority for Capping

Record ID	Well#	Qtr	Sec	Twp	Rge	Status	Land Use
5	2	SW	3	13	22	abandoned	
10	2	NW	10	14	22	abandoned	farm yard
12	4	NE	28	14	22	abandoned	farm yard
13	5	SW	10	14	22	abandoned	pasture land
41	3	NE	32	13	21	abandoned	
45	2	NW	28	13	21	abandoned	
50	2	SE	14	13	22	abandoned	
54	4	NE	26	13	22	abandoned	farm yard
55	5	NE	26	13	22	abandoned	
56	6	NE	26	13	22	abandoned	farm yard
57	1	SW	22	13	21	abandoned	
62	3	NW	23	14	22	abandoned	farm yard
66	2	SW	11	14	22	abandoned	
68	2	SW	12	14	22	abandoned	
70	2	SE	20	14	22	abandoned	farm yard
76	2	NE	13	14	21	abandoned	farm yard
80	2	SW	13	14	21	abandoned	farm yard
81	3	SW	13	14	21	abandoned	
17	2	SW	10	14	22	abandoned	farm yard
32	1	SW	25	13	21	abandoned	pasture land
97	2	NW	29	15	21	abandoned	farm yard
100	3	SW	33	15	22	abandoned	farm yard
102	5	NE	20	15	22	abandoned	farm yard
103	6	NE	20	15	22	abandoned	farm yard
113	5	SE	8	15	21	abandoned	slough
125	2	SW	30	15	21	abandoned	farm yard
132	1	SE	33	14	22	abandoned	farm yard
133	2	SE	33	14	22	abandoned	farm yard
135	1	SE	6	14	21	abandoned	farm yard
136	2	SE	6	14	21	abandoned	farm yard
137	3	SE	6	14	21	abandoned	farm yard
147	3	SW	23	14	21	abandoned	farm yard
148	1	NE	26	14	21	abandoned	crop land
153	2	SE	3	15	21	abandoned	pasture land
154	3	SE	3	15	21	abandoned	
160	2	SE	16	13	22	abandoned	
164	2	SW	20	14	21	abandoned	
169	2	NE	21	14	21	abandoned	
172	2	SE	8	14	21	abandoned	
177	2	SW	5	15	22	abandoned	pasture land
178	3	SW	5	15	22	abandoned	pasture land
181	3	NW	18	13	22	abandoned	
182	4	NW	18	13	22	abandoned	
191	2	SW	7	13	22	abandoned	
196	2	SE	18	15	21	abandoned	

Table 3 Con't: RM of Blanshard - Abandoned Wells Selected as High Priority for Capping

Record ID	Well#	Qtr	Sec	Twp	Rge	Status	Land Use
206	3	SE	21	15	21	abandoned	
211	3	SE	23	15	22	abandoned	pasture land
212	1	SE	22	15	22	abandoned	farm yard
213	2	SE	22	15	22	abandoned	farm yard
221	10	SW	15	15	22	abandoned	farm yard
222	1	NE	18	15	21	abandoned	farm yard
227	2	SE	7	15	21	abandoned	farm yard
228	3	SE	7	15	21	abandoned	farm yard
230	5	NW	5	15	21	abandoned	crop land
231	6	NW	5	15	21	abandoned	farm yard
232	7	NW	5	15	21	abandoned	crop land
233	8	SW	7	15	21	abandoned	crop land
234	9	SW	7	15	21	abandoned	crop land
235	10	SW	7	15	21	abandoned	crop land
236	1	SE	32	15	22	abandoned	farm yard
239	2	NW	12	15	22	abandoned	
241	2	SW	32	15	21	abandoned	farm yard
242	3	SW	32	15	21	abandoned	farm yard
244	5	SW	28	15	21	abandoned	
245	6	SW	28	15	21	abandoned	
247	2	NE	36	15	22	abandoned	pasture land
252	2	SW	32	14	22	abandoned	farm yard
254	2	NW	30	14	22	abandoned	pasture land
256	2	SE	30	14	22	abandoned	farm yard
264	1	SW	32	13	22	abandoned	
265	2	SW	32	13	22	abandoned	
267	4	NE	31	13	22	abandoned	crop land
268	5	NE	31	13	22	abandoned	farm yard
274	2	SW	36	14	22	abandoned	farm yard
275	3	SW	25	14	22	abandoned	
279	3	NW	6	15	21	abandoned	slough