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WATER SUPPLY TOWN OF STETTLER

by: W. A. Meneley, February 1959

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WATER SUPPLY

TOWN OF STETTLER

During 1957 and 1958 the Research Council of Alberta undertook a groundwater survey of the Stettler area to investigate the distribution and characteristics of aquifers within the area. Several problems were encountered during the course of the investigation, the most important of these was the shortage of water in Stettler.

The Town of Stettler has relied upon wells as a source of water since the distribution system was first installed. There are no nearby sources of surface water, and in the past an adequate supply of water was obtained at low cost from a few wells located in the Town. The increased demand for water caused by the rapid increase in population since 1949, and increasing per capita consumption, severly overburdened the capacity of the existing supply wells. Despite the addition of several new wells to the supply system during the period from 1949 to 1958, the quantity of water available from the present total of 10 producing wells in the well field is insufficient to supply the peak-load demand to the distribution system. The problem now facing the Town is where to obtain the additional amount of water to satisfy both the immediate demand and to provide for increased requirements in the future.

This report summarizes the information obtained during the investigation and suggests methods of applying this information to the problem of locating and developing new sources of water supply for Stettler.

There are three possible sources of water to meet the anticipated demand.

They are:

1) to extend the existing well field outside the Town limits, to further exploit the bedrock aquifer presently being used;

2) to locate and develop new aquifers outside of Stettler;

3) to obtain water from a surface source such as Buffalo Lake or the Red Deer River.

Each alternative possesses definite advantages and disadvantages, but in the final analysis the best source is the one which will provide the required amount of water for a minimum cost. The evaluation of a source of surface water is beyond the scope of this report and will not be dealt with further.

No attempt was made to evaluate the potential productivity of every aquifer in the area; instead, the general habitat of groundwater within the area was studied. More detailed studies were carried out on two typical aquifers in the area, one a sand and grav aquifer in a buried channel, and the other an aquifer in the Edmonton formation at Stettler.

All water wells in the area obtain water either from sand and gravel deposits which occur within or at the base of the glacial drift, or from sandstone in the underlying bedrock, the Upper Cretaceous Edmonton formation. No wells in the area obtain water from formations underlying the Edmonton formation. The glacial drift was deposited on the eroded surface of the Edmonton formation by glacial action. Sand bodies occurring within the glacial deposits generally have a limited areal extent, and consequently high capacity wells can rarely be developed in deposits of this type. Sand and gravel deposits which occur in buried channels incised into the bedrock tend to be continuous over larger areas, and thus constitute much better potential aquifers. One such buried channel was discovered during this study. It extends eastward from Buffalo Lake through township 40, ranges 18, 19, and 20, W. 4th meridian. A total of 10 test holes were drilled by the Research Council of Alberta to prove the existence of this channel, and to evaluate its potential as an aquifer. Although this phase of the study is not yet complete, it appears that much more test drilling and development work is required before the potential yield of this aquifer can be assessed.

The regional map of the piezometric surface (the elevation to which water rises in a well) of wells completed in the bedrock shows that the Edmonton formation behaves hydrologically as a single aquifer. This aquifer is recharged from the upland south of the Stettler area. The piezometric surface slopes downward toward the north, indicating that the regional direction of groundwater movement is northward. The aquifer discharges into the buried channel through Buffalo Lake. The piezometric contours also indicate that the aquifer discharges into Red Willow Creek, and that the well field in Stettler is also an area of discharge.

Although the Edmonton formation behaves hydrologically as a unit, geological conditions control to a great extent the specific yield of individual wells tapping the aquifer. The upper part of the Edmonton formation is more sandy and generally speaking wells tapping the upper part of the formation have a higher specific yeild than those tapping the lower Edmonton formation. In addition, there are lateral variations in the amount and coarseness of sandstone present in the Edmonton formation. The Edmonton formation dips westward at 10 - 50 feet per mile, and the bedrock surface slopes downward toward the north at about 25 feet per mile. Thus erosion has removed the most productive part of the Edmonton formation to the east and north of Stettler.

Detailed study of the Edmonton formation aquifer within Stettler has disclosed several problems that must be considered in any further development of the Stettler well field. Unfortunately, no records were kept on water wells and test holes drilled by the Town prior to 1957. However, since that time the Town has drilled four test holes, three of which have been completed as water wells. Cutting samples were collected from all test holes during drilling and detailed geologic logs prepared. Pumping tests have been run on all test holes completed as water wells. Well #11, drilled in 1957 in the southwest corner of town, was initially drilled to a depth of 300 feet. No water-bearing horizons were encountered between 150 and 300 feet so the well was plutted back and completed at a total depth of 157 feet. This well is now capable of producing about 55,000 gallons per day, on continuous production. No further exploration was carried out in 1957. In August, 1958, a test hole (Stettler 58-1) was drilled in the northeast corner of town. This hole was abandoned at a total depth of 260 feet. This well produced about 1 gallon/min. on a bailer test. Another test hole was drilled beside the No. 1 reservoir, and completed as water well No. 1-A at a depth of 160 feet. This well was intended to provide auxiliary pumping capacity to supply the No. 1 reservoir. It is presently capable of producing about 7,000 gallons/day. A third test hole located beside the new skating rink was completed as Well #12, at a total depth of 140 feet. This well is presently capable of producing about 52,000 gallons per day.

In all testing to date, no economic amount of water has been obtained at depths greater than 150 feet. A well drilled in the Red Willow district encountered salt water and gas at an elevation of approximately 2,200 feet. Gas has been reported at an elevation of about 2,400 feet in a water well drilled in Stettler. It appears that there is little chance of finding potable water at elevations lower than 2,400 feet (i.e. at depths greater than 300 feet) in the immediate vicinity of Stettler.

Study of the cutting samples obtained from the four test holes shows there is a marked decrease in the amount and coarseness of sandstone encountered in the test holes located east of Main St., compared to Wells No. 11 and No. 12, located west of Main St. Pumping tests also show that the specific yield of Well 12-A is much lower than Well #11. A short pumping test run on Well No. 7, and a bailer test of the well at the Stettler Chronic Hospital, indicate that the specific yield of wells also decreases toward the north away from Wells No. 11 and No. 12.

Several pumping tests have been conducted on Wells No. 11 and No. 12, to determine the transmissibility and storage coefficient. If these aquifer coefficients are known it should be possible to predict the capacity and optimum spacing of wells tapping the aquifer. It was not possible to obtain accurate values for the aquifer coefficients from any of the pumping tests conducted because of erratic influence of other pumping wells, and because there were too few properly located observation wells. The pumping tests do indicate that the hydrology of the aquifer is complex and will require considerably more detailed study before accurate predictions are possible.

The most important general conclusion based upon the pumping tests conducted, and on well production records kept by the town, is that the wells presently pumping in the Stettler well field are producing nearly all the water that the formation is capable of yielding from the area now developed. This means that if any new wells are located within the present town limits, no great increase in the over-all pumping capacity of the well field should be anticipated since any increase in production from any new wells will be offset by a corresponding decrease in production of pre-existing wells adjacent to the new wells.

Of the two aquifers studied in this area, the Edmonton formation aquifer in the vicinity of Stettler offers the better prospects for immediate development. The feasibility of extending the existing well field can be more cheaply investigated, and there is a reasonable expectation that additional supplies of groundwater can be obtained from this source. Existing information indicates that the most favorable area for exploration lies to the south and west of Stettler, and further, very careful test drilling will be necessary so that new production wells may be located so as to obtain maximum production with a minimum of interference between wells.

I would definitely recommend a comprehensive testing program to be carried out before any new production wells are completed. The objectives of this testing program should be:

(i) to determine the areal extent and lithology of the aquifer

(ii) to determine the yield of individual wells at different locations in the aquifer

(iii) to determine the aquifer coefficients, so that the behavior of wells in the proposed well field, and the behavior of the well field as a unit, may be predicted with reasonable accuracy

(iv) to find the best locations for new production wells and to calculate the optimum well spacing

The following is an outline of a typical test-drilling program.

(i) Drill 4 1/2 inch diameter hole to bedrock and set 4 1/2 inch casing, either driven or cemented a few feet into bedrock. Drill inside the surface casing to a total depth of 150 feet or to a bottom elevation of 2,500 feet, whichever is deeper.

(ii) Catch and save cutting samples at 5-foot intervals and at any marked change in lithology. A drilling rate log should be kept by the driller. If drilling is done by a rotary rig it would be advantageous to have a resistivity log of each hole. Records should be kept of static water level in the hole during drilling, any zones where there is a loss of drilling fluid, etc.

(iii) Bail test: bailing should be carried out for a minimum of one hour, at a constant rate. If drilled by rotary methods, the bailing test should be rotary methods, the bailing test should be started after all drilling fluid has been circulated or bailed from the hole,
A complete record must be kept of the initial water level in the test hole, the rate of bailing, and the volume of the bailer. After the bailing test is complete, water-level measurements should be taken at intervals until the water rises to its original level.

(iv) Cap the test hole with a removable cap, so that periodic measurements of fluid level can be made.

The locations of six proposed test holes are shown on the enclosed sketch map. On the basis of information obtained from these test holes it should be possible to decide the most favorable direction for immediate expansion. The next step is to drill three more test holes located less than 500 feet apart so that a proper pumping test may be conducted. The group of wells for the pumping test should be located where the aquifer is well developed, and should be at least 1/2 mile from Wells No. 11 and No. 12. Complete pumping tests should be run on one or more of the test holes in the group described above. The other test holes are used as observation wells. A portable pump, preferably a jet pump, or an air-lift pump should be used. It is best to use a pump which is flexible, since it is difficult to drill a small diameter hole which is straight and plumb. It may prove necessary to pump test several test holes to evaluate the hydrologic characteristics of the aquifer.

The optimum well locations and spacing are then decided from the information obtained and the cost to obtain a given quantity of water can then be calculated.

If the cost estimate shows that the proposed extension is feasible, then the required number of production wells can then be drilled.

The program of test drilling outlined above should provide sufficient information for future planning. The primary advantage of such a program is that information can be obtained at relatively low cost, before expensive production wells and a gathering system are installed. Testing should also aid in proper location of production wells and the gathering system to conform with future patterns of residential expansion.

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