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GROUNDWATER RESOURCES OF THE STONY INDIAN RESERVE, NUMBERS 142, 143, AND 144, ALBERTA

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Introduction

This report presents the results of a rapid reconnaissance survey of the groundwater resources of the Stony Indian Reserve, Numbers 142, 143, and 144, Alberta, conducted towards the end of August, 1961.

During this survey information was obtained from officers of the Stony Reserve, both at Calgary and Morley. In addition representative wellsites were visited and information obtained from the householders, from Mr. Dennis Anderberg - a leading driller of wells on the Reserve, from various geological and topographic maps, and from well logs supplied by the Stony Agency. The logs, though few in number, were extremely valuable, and equally good logs should be kept of future wells.

It is assumed that there will be a significant, steady increase in demand for water. In particular demand per household should increase markedly as pressure systems become more common. It would be poor economics to construct wells that are adequate at present but which with increased demand for water would shortly prove inadequate and have to be deepened or replaced.

GEOLOGY

The bedrock geology of the Stony Reserve is shown at a scale of 1 inch to 1 mile on Geological Survey of Canada maps number 653A (Jumping-pound) and 77A (Morley), but chiefly on the latter. Cross-sections are included. The geology is discussed in the descriptive notes of the Morley sheet, from which much of the following information, including the quotations,

is taken. The bedrock is strongly faulted and folded, and the structure is extremely variable. In particular there is marked repetition of beds at the surface, especially in the eastern third of the Reserve.

The Blairmore Formation of Lower Cretaceous age underlies some 4 square miles in the very southwestern part of the Reserve. Its local thickness is difficult to determine. A massive chert and quartzite-pebble conglomerate marks the base of the formation. This is overlain by about 250 feet of alternating thin beds of dark sandstone and carbonaceous shale with thin limestone beds at the top. Above these strata the upper and greater part of the formation consists mainly of massive shales weathering light greenish grey and, locally, maroon. Massive, coarse grained sandstones and conglomerate beds carrying pebbles of chert, quartzite, and porphyry, occur in the upper 300 to 400 feet of the formation. It is probably the lower and middle parts of the Blairmore that outcrop on the Reserve.

The Lower Alberta (Blackstone) Formation of Upper Cretaceous age appears in the western part of the Reserve, south of Bow River, and to a lesser extent in the eastern part of the Reserve, on both sides of the river. It 'has an estimated thickness of 600 feet.-----It consists of marine black shales, sandy shales, and minor thin sandstone beds'.

Narrow belts of the Upper Cretaceous Cardium Formation adjoin the Lower Alberta in the western and eastern parts of the Reserve. The sandstone ridges east of the Agency building are thought to be Cardium. 'It is 200 to 250 feet thick and comprises two (locally three) massive sandstone beds separated by rusty weathering sandy shales. A persistent bed of pebble conglomerate occurs at the top of the formation.'

The Upper Alberta Formation, also of Upper Cretaceous age, underlies about half the Reserve. It 'is 1,500 to 1,700 feet thick. It consists largely of dark marine shale, and sandy shale'. The Upper Alberta Formation is appreciably more sandy and more thickly bedded than the Lower Alberta.

The Upper Cretaceous Belly River Formation outcrops in the central part of the Reserve, including the region of Morley Townsite, and to a lesser extent in the eastern part. 'It is mainly a succession of massive, grey to greenish grey, cross-bedded sandstones alternating with crumbly green shales. Individual beds vary markedly in thickness within limited areas. Thin coal seams occur in the lower part of the formation.'

The surficial geology of the Reserve includes the surface materials generally overlying the bedrock, and former stream valleys which are now filled with drift and alluvium. Most, if not all of the Reserve was covered by ice of the Pleistocene glaciers, though not everywhere neccessarily by the last ice-sheet. In the mountainous areas, however, bedrock is generally exposed or covered by only thin drift (glacier deposits). Elsewhere the surficial cover is practically continuous and commonly thick.

The most detailed description of the surficial geology of the Reserve is given by Tharin, 1960,[1] whose report includes all but the westernmost part of the Reserve. The deposits consist of stratified drift - generally coarse gravel - for about a mile back from the river on either side; and a belt of sandy, gravelly till between this stratified drift and the exposed bedrock on both sides of the river. In general

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[1] Tharin, J.C.; 1960: Glacial Geology of the Calgary, Alberta, Area; University of Illinois, unpublished Ph.D. thesis.

gravel underlies the broad, flat areas and till forms the small hills and covers the high, though non-mountainous areas. As the surficial deposits originated locally or else came from the mountains to the west they are very calcareous.

The buried preglacial and interglacial valleys of the area have not been mapped. In preglacial time Kananaskis River probably flowed northeastward from the southwestern corner of the Reserve through the valley in which Lake Chiniki lies, and past Chiniki Village to Bow River some 2 miles east of the Agency buildings. This course contrasts strongly with its present course northwestward into Bow River. In addition the Bow River, except for the stretch between 2 and 4 miles west of Morley, generally is ½ to 1 mile north of its previous course. The fill in the former valleys is thick; sections through it along Bow River reveal thicknessess of more than 100 feet, and thicker sections should be present in the old Bow Valley away from the present river and in the former Kananaskis Valley.

GROUNDWATER RESOURCES

The typical drilled well on the Reserve is shallow, generally less than 100 feet deep. As far as known all the drilled wells enter bedrock, but in general the bedrock aquifers are not satisfactory. Most of these wells have only a small supply of water, which has been adequate only because of limited demand, in many cases about a dozen buckets of water a day per well. Their limited capacity is indicated by the need to pump easily in order to keep silt from being drawn in, even under present small demand.

The water in the Wabash oil well may come from the Blairmore Formation, but more probably from lower down. No well was noted that drew from the Cardium Formation. From their composition both these formations should contain excellent aquifers but their outcrop area is small. In addition the Blairmore outcrop is distant from the settled districts of the Reserve, and the belts of outcrop of the rather thin Cardium Formation are narrow. As most of the Cardium boundary shown on the geological maps is only assumed, it will commonly prove difficult to forecast whether a well will enter its beds. Only two wells, both in the western part of the reserve, overlie Lower Alberta beds; these are the wells of Mr. George Labelle and a well about half a mile southeast of 'Fort Chiniquay'. However nearby thick deposits of gravel are a possible source of the water, which apparently is soft.

The main problem of water supply lies in the populated districts that overlie Lower Alberta, Upper Alberta, and Belly River Formations. The present drilled wells are about equally divided between Upper Alberta and Belly River Formations, and none can be said to be really satisfactory. Of these three formations the Belly River should have the best groundwater capacity, but the typical well into it yields only a small amount of soft water. Upper Alberta wells include the dry holes at the Community Hall and some of the poorer wells north of Bow River. The Lower Alberta Formation is less sandy than the Upper Alberta and consequently its groundwater potential should be even poorer. Here and there a good aquifer may occur in these formations - perhaps near one of the numerous faults or in a thin sandstone bed - but its presence would be difficult to forecast.

The extensive parts of the reserve covered with thick surface deposits include most of the populated districts. These deposits, and particularly the widespread gravels, appear very favourable for groundwater. As the gravel typically is coarse, porous, permeable, and readily yields its water, the diameter of a well into it is rarely important. The glacial till is generally coarse, loose, and probably fairly permeable, and in many places would yield water, but a large - diameter well is probably advisable to increase yield. The fill in the buried valleys is a potential source of very large supplies of water, such as might be desired for a village. However tracing of these channels and testing of their aquifers is necessary before their capacities can be stated.

The two most prolific wells seen, the Chiniki Village well and another about 300 feet from it, undoubtedly draw from gravel, or gravel and sand. These wells lie on a broad gravel flat and the intake area is large. (They also probably lie above the buried, former valley of Kananaskis River, but their water comes from surface deposits rather than from alluvium near the bottom of the valley fill.) Any well put down in this area should have high capacity. This flat extends past Mrs. Simeon's well and the adjacent gravel pits, and water in the gravel apparently was neglected during drilling of Mrs. Simeon's well in order to obtain softer water from the bedrock, with rather unsatisfactory results. Mr. P. Wesley's well also is reported to be in gravel, but in this instance the deposit is probably not extensive. Several of the better bedrock wells are in districts where surface gravel is present, and part or most of their water may come from the gravel. Examples are the well of Mr. G. Labelle, which is on a broad gravel flat which should contain much water, the well one-half mile southeast

of Fort Chiniquay which is near the same gravel flat, and several of the better wells north of Bow River.

The springs above the hospital and school flow from river terrace gravel, which has a maximum thickness of some 15 feet. The high temperature of the water in the hospital spring - 50° when visited - suggested that the water had not been long in the gravel. This indicates rapid turnover of water in the terrace gravels, and that the springs would be unreliable during a prolonged dry spell. The capacity of these gravels is probably represented by present flow from the springs. If similar terraces lie along Bow River elsewhere, they should likewise yield a limited quantity of water.

A rapid, limited study was made of the sites of five projected wells and the following comments are made to give an indication of the possibilities in each location. The well planned for Mr. A. Bearspaw is on the gravel of a river terrace, from which springs now flow. This well certainly should obtain water, but from surface gravel. This well is near the contact of Upper Alberta and Belly River Formations, and if over the former it is doubtful if any aquifers better than those in the dry Community Hall wells will be found in the bedrock. Belly River aquifers should give a limited supply. It might be advisable to try first a shallow well, drawing from gravel, rather than drilling deeply into bedrock.

The projected wellsite of Mr. C. Simeon apparently is over Upper Alberta shale, which comes practically to the surface, and only a very limited, probably unsatisfactory, supply of water is likely from deep in the bedrock. A shallow well to the north, near the old spring, might collect sufficient water for present needs from the thin surface cover

and top part of the bedrock.

The well planned for Mr. S. Baptiste also appears to be in the dark, Upper Alberta shale, and its chance of success is small. If gravel is present in the flats below the house, near the garden, a shallow well there might be successful.

The well projected for Mr. F. Holloway would probably be into Belly River Formation, and whereas it undoubtedly will obtain water, the amount is likely to be insufficient for future demands. It might prove more satisfactory to rehabilitate the shallow well now used, or put down another similar well nearby. This present well is in a draw that collects water from a fairly large area of recessional moraine.

North of the Bow River, the well planned about one mile west of Morley is in Belly River Formation, and should obtain a limited supply of water. But due to a hundred foot deep coulee just west of the house which would tend to drain the top of the bedrock, this well would probably be deep. The two hundred foot deep valley of the Bow River, one-half mile to the south, may also partly drain the topmost bedrock. A shallow drift well in the slight depression east of the house is a possible alternative.

The outstanding feature that appears from the overall study is the limited supply of water in many of the bedrock wells. Several of these wells are barely satisfactory under only small demand, and the projected wells should be similar. With increased demand for water a significant number of these wells will be inadequate. In many districts, however, the extensive gravel deposits can supply large quantities of water to relatively shallow wells. In addition other surface deposits, such as till and alluvium, can locally yield significant amounts. In

general the larger the diameter of the hole put into the drift, the greater the yield is apt to be. Boring would be a very satisfactory means of constructing many of these wells. Hand-digging beyond a shallow depth is not advocated until more is known about possible presence of poisonous gases in the bedrock. The extent of this danger here is not known, but it has been a source of trouble in the Edmonton equivalent of the Belly River Formation on the plains, with a number of deaths. There may be similar danger with the other bedrock formations.

A policy of finding the water supply before a house is built on the Reserve, and only building if a supply were available, could in many cases save much future trouble and expense. An alternative would be to build in a district known to be favourable for water-supply. There is presently a marked tendency to build on bedrock hills, or on almost the worst locations possible for groundwater supply.

CONCLUSIONS AND RECOMMENDATIONS

1. The bedrock, except for the small areas underlain by Blairmore and Cardium Formations, is a poor source for water.

2. The gravel river terraces above the hospital and school cannot supply more water than now seeps out in the various springs.

3. The surface deposits will commonly yield a moderate supply of water; in some instances large diameter holes are advisable.

4. The fill in buried preglacial and interglacial valleys is a potential source of large water supplies and merits further investigation.

5. More attention should be given to developing water resources of

the surface deposits by means of shallow wells. In many places deep wells into bedrock should be used only as a last resort. Boring would appear to be an economical means of constructing such shallow wells.

6. Hand-digging of wells beyond a few feet should at present be discouraged because of the possible danger from gases in the bedrock.

7. A suitable water supply should be found before a new house is built.