PRAIRIE PROVINCES WATER BOARD

MEMORANDUM #6

PROPOSALS

FOR THE STUDY OF

WATER SUPPLY AND WATER USE

IN THE

QU'APPELLE & ASSINIBOINE BASIN

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THE VALUE OF A WATER SUPPLY AND USE STUDY FOR THE QU'APPELLE AND ASSINIBOINE RIVERS

by E.F. Durrant

The Prairie Provinces Water Board has instructed the Secretary to outline a study of the Assiniboine and Qu'Appelle Basins. This is to provide the Board with background information necessary for the recommendation of reservations, allocations, and/or apportionment of waters between Manitoba and Saskatchewan. The study is also to indicate the amount of water which may be required from the South Saskatchewan River to provide an assured water supply for proposed developments (minute 24-05).

An outline has been prepared and is attached for consideration by the Manitoba and Saskatchewan members. Before work commences on the study I think it will be helpful to review the history of Water Board discussions on this subject, to point out why the study is needed, and to state the questions which will not be answered by the study.

HISTORY

When Saskatchewan applied for an allocation of waters from the Qu'Appelle River (minute 6-11) the Board recommended that a final allocation of 20,000 acre-feet be made for small projects. Saskatchewan had asked at that time for an additional 41,000 acre-feet to irrigate 34,100 acres of valley lands. The Board placed this request in the "recording" category and instructed the Secretary to make a complete water supply study of the basin. In minute 7-12 the Secretary pointed out the difficulties of carrying out such a study with the then inadequate information on evaporation losses from the eight large lakes in the Qu'Appelle system. The study was left in abeyance until 1956.

The severe floods of 1955 and 1956 prompted the Director of P.F.R.A. to request a comprehensive evaluation of the hydrology of the Qu'Appelle River. The results of this investigation were presented in a series of eight reports which were distributed to the Water Board members. At this point it is worth noting two of the conclusions reached from that study. On page 3 of Hydrology Report #24 entitled "Drought and Flood in the Qu'Appelle Watershed", the following statements are found:

"17. Full development of water resources in Saskatchewan will reduce flows to Manitoba noticeably in

dry years: if the runoff is average or greater, there will be little change.

"18. With a large reservoir near Victor, Manitoba, low flows could be supplemented so that downstream conditions under "full development" would be better than at present (during dry periods)."

No further action was taken by the Board until December 1960. At this time (minute 21-06) Mr. Boyson suggested that the conduit capacity in the Qu'Appelle Valley Dam of the South Saskatchewan Project should be planned so as to provide for the future requirements of Manitoba and Saskatchewan. In minute 22-08 Mr. Griffiths submitted a brief study outlining Manitoba's future requirements. In minute 23-06 Mr. Boyson reported to the Board on Saskatchewan's projected needs for water from the South Saskatchewan Reservoir. In the same minute, Mr. Griffiths indicated that he would be requesting a reservation on Manitoba's behalf for waters to be delivered from the South Saskatchewan Reservoir via the Qu'Appelle River. During this discussion the Secretary was instructed to outline the type of report required to support the request for a reservation. In preparing the outline the Secretary was to take into account the natural waters of the Qu'Appelle and Assiniboine Rivers.

Such an outline was prepared and distributed to the Board members and discussed further by the Board (minute 24-05). During this discussion it was pointed out that the conduit capacity of the Qu'Appelle Valley Dam could be increased at some future date should this be necessary, hence a study was not required for the sole purpose of recommending a conduit size. However, the Manitoba and Saskatchewan members felt the study would still be necessary in order to guide the Board in allocating or apportioning the waters of the Saskatchewan and Qu'Appelle Rivers, and to arrive at a figure for future water needs to be met from the South Saskatchewan Reservoir. Finally the Secretary was instructed to work with the Manitoba and Saskatchewan members to prepare such a study.

In preparing this history it became apparent to me that the Board has needed this study for some time. Through the years the emphasis has changed (conduit size, flood damage, water supply, etc.) but the basic need of the Board for information upon which to base recommendations for allocation and apportionment still exists. The sooner this information is obtained the better.

WHY THE STUDY IS NEEDED

I would like to point out some of the more obvious reasons why the Board needs this information before it can deal intelligently with allocations in the Qu'Appelle and Assiniboine Basins.

1. Saskatchewan has conducted studies through the South Saskatchewan River Development Commission which imply that future uses of water along the Qu'Appelle system will exceed the natural flow. If the deficits in natural flow are to be made up by importing water from the South Saskatchewan system the Board will need to know "how much" and "how often" before recommending an allocation for this purpose.

2. Manitoba has a projected need for water which exceeds the natural unregulated flow of the Assiniboine and Qu'Appelle Rivers. Some of this need might be satisfied by developing reservoirs to regulate the natural waters of the Qu'Appelle and Assiniboine Basins. The amount of the need which can be satisfied by regulation and the amount which can only be satisfied by importing water must be known before the Board can make intelligent recommendations.

3. Whether the applications of Manitoba and Saskatchewan are for water reservations or for allocations, the Board must be specific in stating how much water is needed, from what sources the water will be taken, for what purposes the water will be used, and the locations of the various uses. Much of this information is not available at the present time and can only be obtained through this study.

ITEMS WHICH NEED STUDY

At this point I do not intend to describe in detail the steps which should be followed in making the study, I will merely describe briefly the questions which must be answered before any conclusions could be drawn. These questions are related to available runoff, uses of water, works for stream regulation and various methods of operating these works.

1. Available runoff

For the Qu'Appelle Basin the available runoff at the Manitoba boundary can be taken directly from previous studies. Similarly the available flows at various points in the upper and lower Assiniboine Basin can be taken from previous studies. Some work will be needed to adjust these figures for increased upstream use and for regulation by proposed works.

2. Uses of water

For the Saskatchewan portion of the Qu'Appelle the use of residual flows at the Manitoba boundary from previous studies eliminates the need for a new study of water use in Saskatchewan. On the Assiniboine River and its tributaries above Kamsack consideration must be given to expanding municipal needs, potential industrial needs, potential irrigation and stockwatering needs, and the effects of recreational developments. For the Manitoba portion of the Assiniboine Basin a brief review should be made of the material submitted by Mr. Griffiths in minute 22-08.

3. Regulation

There is a large storage potential in the upper Assiniboine Basin which might be developed either for flood control or for water supply purposes. Operation of such reservoirs wholly or partly for water supply purposes would improve the ability of the Assiniboine River to supply increasing consumptive uses.

4. Operation

The larger reservoirs proposed for the Assiniboine Basin could be operated either for flood control or for water supply. The relative benefits which would be obtained from both methods of operation is worth some study.

ANSWERS WHICH SHOULD BE PROVIDED BY THE STUDY

This study should inform the Board as to the water requirements of the area within the foreseeable future. It should describe deficiencies which would be experienced if the natural waters are not regulated. It should also describe the deficiencies in natural water supplies assuming that several major storage reservoirs are in operation for flood control, water supply, - or both. If these questions are answered it will then be possible to suggest how much water must be imported to meet the foreseeable water requirements.

QUESTIONS NOT ANSWERED BY THE STUDY

If the study is completed as outlined, the Board will still be faced with a decision concerning the requests by Manitoba and Saskatchewan for reservations and/or allocations. In the past these requests have been supported by reports describing in detail the manner in which water will be used. The reports have included, for example, damsite locations and plans, main canal locations and

elements, location of irrigable acreages and duty of water, etc.

In minute 4-12 the Board describes the information necessary to support a request for a reservation as follows:

> "When a project has progressed to the point where its feasibility seems assured and an approximate estimate of its water requirements can be made, the Board may make a reservation covering the estimated amount of the water required."

In that same minute, a tentative allocation is described for projects investigated to the point where construction is imminent.

It is also worth noting, that within each province, an authorization interim license, or what have you, is not issued unless definite plans for a project have been submitted.

This proposed study will not provide information in such detail. Therefore, it would not be advisable for the Water Board to recommend reservations and/or allocations on the basis of the study. However, the Board might consider apportionment between Manitoba and Saskatchewan of Assiniboine and Qu'Appelle waters without submission of definite project plans; supplemented by a reservation for the importation of South Saskatchewan waters to this area.

In summary, the study will provide the Board with valuable background material, and a possible basis for apportionment, but, if past procedures are followed, reservations and/or allocations cannot be considered until definite project plans are available.

SUGGESTED PROCEDURES FOR STUDYING WATER SUPPLY & WATER USE FOR THE QU'APPELLE AND ASSINIBOINE RIVERS

I. INTRODUCTION

The reasons for conducting the study for water supply and water use for the Qu'Appelle and Assiniboine Rivers have been described in another memorandum. This memorandum is concerned with how such a study should be conducted. As with all water supply studies there are two basic questions, namely, "How much water is needed?" and "How much water is available?"

The Qu'Appelle and Assiniboine Basins are split by the Manitoba-Saskatchewan boundary. This divided jurisdiction for the administration of water resources raises further questions of primary interest to the Board.

(a) What are the foreseeable water requirements in Manitoba and how do they compare with the foreseeable water requirements in Saskatchewan? What proportion of these requirements can be met by the natural waters in the watersheds?

(b) How much imported water is needed? Where will it come from? and what relation would it bear to the allocation made to Saskatchewan for the South Saskatchewan River Project?

(c) If the Assiniboine and Qu'Appelle waters are to be apportioned, what proportion should be given to each province?

The following work outline has been designed to answer the above questions as fully as possible. It begins with an assessment of water requirements, followed by a study of available runoff. There is provision for miscellaneous studies of problems such as possible transmission losses in releasing water from upstream reservoirs to downstream points of use. Finally, under the heading "Operation", various methods are suggested for comparing water supply with water use assuming various conditions of reservoir development and operation.

II. WATER REQUIREMENTS

A. SASKATCHEWAN

Water requirements for the Qu'Appelle portion of the Assiniboine Basin have been studied many times with comparable results. It would be reasonable to accept these results without reconstructing once more how they were obtained[1].

For the Assiniboine Basin an assessment of irrigation potential is required. This would include an assessment of the storage requirements associated with various amounts of irrigation. Some work will be needed to determine the duty of water in this area. Also transmission losses will be extremely important. There are a sufficient number of gauges in tandem on major streams to permit an analysis of water losses between upstream and downstream points. The potential use of water for irrigation on individual projects must be dealt with.

The recent drought years have pointed out the unreliable nature of upper Assiniboine tributaries for stockwatering purposes. Permanent stockwatering can be obtained through individual dugouts and farm ponds, or by the construction of major reservoirs for stream maintenance. These alternatives should be studied to determine which is more desirable from a water supply standpoint.

Melville, Yorkton, Canora, Kamsack, Sturgis and Preeceville are some of the major urban centres in Saskatchewan which discharge sewage effluent into the Assiniboine River. These centres are also relying more and more on surface water supplies. As these centres continue to grow the streams will be less able to function as both water supplies and sewers. This suggests the consideration of large reservoirs for stream-regulation purposes. In this way the return flow from the cities - which is very significant in low flow maintenance - could be diluted and form a useful part of the downstream flow. The amount of growth which should be allowed for in these urban centres will depend upon our definition of the foreseeable future. It would seem reasonable to look ahead for approximately 40 years.

Industrial water use in the upper Assiniboine area is insignificant at the moment. Before assuming that it will continue this way some consideration should be given to the possibility of large scale stream-power generation, mineral recovery, packing plants and poultry processing, etc.

Immediately south of Yorkton there is an extensive system of shallow lakes. At the present time, with only a little artificial control, the runoff from Crescent Creek is entirely controlled. Firm proposals exist for diverting a large portion of the upper Whitesand River watershed into the same area. The impounded waters would serve as water supply for the Town of Yorkton, recreational areas for people, and waterfowl refuges. Recreation and wildlife would be the predominant features. There are many other opportunities, particularly in the upper Whitesand River for impounding water for recreation purposes. The possible effects of such developments on Assiniboine River flows need to be evaluated.

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[1] PFRA studies and South Saskatchewan River Development Commission.

Some study must be given to the Saskatchewan portion of the Souris River Basin since the Souris waters enter the Assiniboine River a few miles downstream from Brandon. Our concern would be with the amounts of water released by the U.S.A. at Westhope and future Saskatchewan uses on the tributaries entering below that point, namely, Antler River, Gainsborough-, Graham-, Jackson- and Stoney Creeks.

It is reasonable to assume that during dry periods the Pipestone Creek-Oak Lake system would have no water supply value for the lower Souris area.

B. MANITOBA

A brief review should be made of the report on foreseeable water uses which Mr.Griffiths submitted to the Board in minute 22-08. Some of the points which should be gone over include:

(a) Duty of water.

(b) Possible variability of demands from year to year.

(c) Do the municipal and industrial estimates allow adequately for return flow?

(d) Are the sewage-dilution requirements based on primary or secondary treatment?

Future uses of Assiniboine River tributaries between Kamsack and Brandon have not been evaluated. Although the needs may not be as great as in the Saskatchewan portion of the basin a review should be made of potential municipal, industrial, and recreational developments on the Shell River, Conjuring-, Silver-, Birdtail- and Minnewasta Creeks, Arrow-, Oak, Minnedosa- and Cypress Rivers. It is unlikely that there are irrigation demands in these arears, however, the possibility should not be dismissed without some examination.

Future uses of water for all purposes along the Souris River in Manitoba will affect the contribution of that stream to the natural inflow between Brandon and Portage. I believe there are sufficient data available to permit a reliable estimate of these effects without intensive study.

C. ESTIMATES

It is my opinion that these estimates of future water requirements may be worked up by the staffs of the provincial Water Board members. The Secretariat of the Water Board should contribute comments from time to time so that the results obtained by Manitoba and Saskatchewan are based on comparable criteria.

III. AVAILABLE RUNOFF

A. SASKATCHEWAN

It will not be necessary to reconstruct Qu'Appelle River flows. Two major studies of future development have been done for the Qu'Appelle River in Saskatchewan and for both studies we have the monthly residual flows available for Manitoba. One of these studies was made by P.F.R.A. in 1956 and the other was made by Blackwell in January 1962.

For the upper Assiniboine River a fairly comprehensive study of streamflow was made for the P.F.R.A. report "Water Supply and Flood Control Aspects of the Upper Assiniboine River Storage Investigations" April 1959. Unfortunately this report does not deal with flows occurring after 1956. The runoff records from 1958 to 1962 inclusive indicate that the most critical drought on record for this area began about 1958 and is still in progress. For a proper water study, flows for these recent years must be reconstructed at all key points.

A recent study of the role of the Theodore Dam in supplying water to Canora and Kamsack revealed unusually high water losses. From the few records available at the time the study was made it was estimated that more than 50% of the water released from Theodore Reservoir would be lost in transit to Canora. Sufficient studies should be carried out to determine whether or not this phenomenon is widespread through the upper Assiniboine area.

B. MANITOBA

Almost all of the necessary hydrometric information (except for the recent drought) can be abstracted from former reports. If significant water uses are foreseen on the Manitoba tributaries it may be necessary to reconstruct flows on the smaller streams. To my knowledge there has neverbeen an adequate study of transmission losses from major reservoir sites to the Brandon area. Such a study is a necessary part of this investigation.

The streamflow records indicate a major groundwater inflow between Brandon and Portage. Some study should be made of this inflow to see if its variations can be linked to climatological conditions or to properly lagged streamflow conditions.

C. INVESTIGATIONS

For those cases where old reports are to be used as sources for the above material, the data should be acceptable to the provincial members. It is suggested that reconstruction of flows for other cases and particularly for the recent drought be done by the Water Board Secretariat.

IV. MISCELLANEOUS STUDIES

A. SWAN RIVER

The Swan River rises to the north of the Assiniboine River and at one point along its course near Pelly, Saskatchewan, it is almost connected to the Assiniboine River by an old glacial channel. This suggests the possibility that a major storage work on the Swan River might be used to supplement low flows on the Assiniboine River. A preliminary assessment of this possibility would require:

(a) some understanding of future water requirements along the Swan River;

(b) estimates of available runoff with and without regulation;

(c) some appreciation of the physical works required in order to accomplish diversion from one basin to the other.

B. VICTOR RESERVOIR

Using small scale aerial photography and ground control from 20-year-old surveys, preliminary reservoir contours have been prepared for this site. The indications are that a dam which is less than 50 feet in height would be adequate to regulate "residual" flows.

C. TRANSMISSION LOSSES

The subject of transmission losses has been mentioned twice previously in this memorandum; however, it is worth mentioning as a separate study because of the importance it will have in studying the efficiency of reservoirs in supplying downstream requirements.

D. FLOOD CONTROL vs. WATER SUPPLY

There is no need to explain here the basic incompatibility between flood control and water supply demands on the same reservoir. In the Assiniboine watershed both flood control and water supply regulation are badly needed and have been the subject of considerable planning. For projects which are being designed to serve both purposes it has been assumed that reservoir drawdown for water supply purposes will be limited to that portion of the reservoir known as the conservation pool. The balance of the storage is reserved for regulating possible floods. This study provides an opportunity to evaluate the capabilities of these reservoirs if their entire function were devoted to one purpose or the other. It may be that the improvement in flood control which could be achieved through taking over the conservation pool might exceed the water supply benefits credited to the conservation pool. On the other hand, if the entire capacity of the reservoir were used for water supply regulation the value of the reservoir for this purpose might exceed the flood control value, particularly if importation of water is being considered from distant sources. The results of such an analysis might suggest the best places to locate flood control and water supply reservoirs so that the two functions are not competing.

V. OPERATION

After the available runoff has been documented and future water requirements have been estimated it will be necessary to compare the two in order to come up with the deficiencies - if any. These deficiencies would indicate the amount of water which must be imported into the basin to satisfy future developments. Three or four such studies may be required. They will differ mainly according to the following assumptions:

(a) The assumption as to how much future development will take place upstream of Brandon.

(b) Assumptions regarding the amount of reservoir capacity which may be developed.

(c) Assumptions regarding the use of reservoirs for either flood control or water supply.

(d) The assumption that all reservoirs will be multi-purpose.

The exact nature of these assumptions could be defined better after the preceding portions of the study have been completed. It will be necessary for Manitoba and Saskatchewan to agree on these assumptions. It would probably be most suitable if the Water Board Secretariat would carry out the actual water accounting studies.

PROPOSED REPORT OUTLINE

SUMMARY & CONCLUSIONS

Stating (each point to be covered in one short paragraph):

1. physical works proposed for diversion and use of water in Saskatchewan and Manitoba;
2. the amount of water required by Saskatchewan and Manitoba and the purposes for which the water would be used;
3. the sources from which the water is proposed to be taken;
4. the amount of water required from each of the Qu'Appelle, Assiniboine and South Saskatchewan Rivers.

INTRODUCTION

1. A one-paragraph summary of Water Board discussions leading up to this report.
2. Purpose of report.
3. One-paragraph description of works considered in the report.
4. One paragraph on the basic assumptions.
5. Organization and/or outline of the report.

WATER REQUIREMENTS

1. Explanation of domestic, municipal, industrial, irrigation and other requirements for the present and for the foreseeable future.

WATER SUPPLY

1. Available "natural" flows at various points on the Qu'Appelle and Assiniboine Rivers.
2. Residual Qu'Appelle flows from P.F.R.A.'s 1956 studies.
3. " " " from Blackwell's 1961 studies.
4. Flows at other important points on other important streams.

WATER ACCOUNTING STUDIES

1. Assumptions

2. Various levels of development considered.

3. Study of amount of water requirement which can be supplied by natural or local run-off with and without various amounts of reservoir regulation.

4. Study of amount if imported water required and how it might be obtained.

RESULTS

Tabulate results to show the incremental gain in water supply from each reservoir, or reservoir group. The results should also show how each increase in regulation decreases the amount of imported water which is needed.

CONCLUSIONS

1. Total water requirements present and foreseeable future.

2. Proportions of Assiniboine flow which can be beneficially used in Saskatchewan and in Manitoba.

3. Capability of Qu'Appelle River with Victor Reservoir to match or exceed "natural" low flows. Proportions of Qu'Appelle water which can be beneficially used by Saskatchewan and Manitoba.

4. Present requirements from South Saskatchewan River and similar requirements within the foreseeable future.

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