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The Little Bow Gets Bigger – Alberta's Newest River Dam

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The Little Bow/Highwood Rivers Project includes Alberta's newest dam and provides the second major water project to follow the Oldman River Dam. The controversy surrounding the Oldman Dam attracted national attention that peaked in about 1990, and legal consideration up to the level of the Supreme Court over federal versus provincial jurisdiction and the nature and need for environmental impact analysis. A key outcome was that while environmental matters are substantially under provincial jurisdiction, rivers involve fisheries, navigation, and First Nations issues that invoke federal responsibility. As a consequence, any major water management project in Canada requires both provincial and federal review.

At the time of the Oldman Dam Project, three other proposed river projects in Alberta had received considerable support and even partial approval. Of these, the Pine Coulee Project was the first to advance, probably partly because it was expected to be the least controversial and complex. That project involved the construction of a small dam on Willow Creek, about an hour south of Calgary. A canal from that dam diverts water to be stored in a larger, offstream reservoir in Pine Coulee. That water would then be available for release back into Willow Creek during the late summer when flows are naturally low but irrigation demands are high.

Pine Coulee was generally a dry prairie coulee and reservoir flooding did not inundate riparian woodlands or an extensive stream channel. Consequently the anticipated environmental impacts were judged as considerably less severe than for other recent dams in Alberta such as the Oldman Dam or the Dickson Dam on the Red Deer River. A joint provincial-federal environmental review for the Pine Coulee Project proceeded in 1994 with little public attention and the project was developed from 1996 to 1999 with limited controversy. Following implementation there has been some groundwater leakage from the reservoir, but the project has otherwise proceeded relatively smoothly.

The Little Bow Project followed, and as anticipated, its environmental assessment was more complex and controversial. The project represented the expansion of an existing water management system that is primarily intended for irrigation in the warm and fertile agricultural region north of Lethbridge. There are two diversions from the Highwood River, which is part of the Bow River Basin, into the Little Bow River of the Oldman River system. One canal diverts water through Women's Coulee into Mosquito Creek, a tributary of the Little Bow, and the second and larger diversion, the Little Bow Canal, occurs within the Town of High River. The Little Bow Project involved a tripling of the capacity of the Little Bow Canal and the construction of a dam on the Little Bow River between Nanton and Champion, an hour southeast of Calgary.

The Little Bow and Highwood Rivers are naturally connected and have a particularly interesting past. The Little Bow valley is vastly larger than would be produced by the current flow regime and was probably scoured by much larger flows thousands of years ago when the Highwood River flowed south rather than north at the Town of High River. At some point in time and probably associated with glacial events, the Highwood River shifted northward and now flows into the Bow River downstream of Calgary. After being abandoned by the Highwood River water, the Little Bow River would only have naturally flowed due to rapid snow-melt, following heavy rains, or with flood overflows from the Highwood River. Without a mountain source, the Little Bow would naturally have dried up during most summers and the First Nations name, Naked River, reflects the lack of cottonwood groves, in contrast to the abundant woodlands along the adjacent perennial streams, the Highwood River and Willow Creek.

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Over the twentieth century, the flows of the Little Bow River were dramatically altered by human activities. The construction of a raised railway line and municipal diking in High River reduced the flood overflow contributions from the Highwood River. Conversely, the Little Bow Canal diverts flow from the Highwood into the Little Bow. As a result of the artificial year-round flow regime, true willows (*Salix* species) and riparian cottonwoods (balsam poplars) have become established at some sites, wolf willow (*Elaeagnus*) has expanded, and cattails have proliferated. Thus, the flow regime and current river environment of the Little Bow River are products of artificial water management, and by many measures it is a richer river ecosystem today than would have existed naturally a century ago.

With continued irrigation expansion along the Little Bow River, there has been pressure for increased water diversion from the Highwood. However, withdrawal of more water during the summer months when irrigation demands are greatest would impose stress on the Highwood River ecosystem. With reduced flows, water temperatures would rise and dissolved oxygen could fall, degrading conditions for aquatic organisms and particularly for trout, a cold water sport fish. The Highwood River provides the primary spawning tributary for the world-renowned “blue-ribbon” rainbow and brown trout fishery of the Bow River, and concern for this fishery prompted special consideration for sufficient flows along the Highwood River.

As an apparent solution, the expansion of the Little Bow Canal and the installation of another storage reservoir on the Little Bow River would permit increased diversion during the spring, when high flows occur along the Highwood River. The new reservoir on the Little Bow could subsequently be managed to release water downstream during the irrigation season, without the need for further diversion from the Highwood River during the hot and dry summer. Despite considerable economic cost, this project received favourable responses from a number of groups, including cautious support from a fisheries coalition, as technical analyses concluded that the new flow regime would provide a minor benefit for the rainbow trout and mountain whitefish populations of the Highwood and Bow Rivers.

As a major water management project, the Little Bow Project underwent considerable study with respect to technical aspects, environmental impacts, and economic considerations. These were presented to a joint provincial-federal environmental review panel involving the Natural Resources Conservation Board (NRCB) and the Canadian Environmental Assessment Agency (CEAA). In 1998 the joint panel concluded that the project would provide a net benefit to Alberta and thus recommended approval of the project infrastructure. However, the panel considered that the project was insufficient with respect to the overall water budget and in a peculiar twist, recommended the implementation of additional water storage. Thus, the joint review panel effectively recommended approval of another water storage project, even though it hadn’t been proposed.

Project construction began in 2000 but the controversy continued and additional complexities emerged. The focus of the environmental impact assessment had often been on the charismatic fishery of the Highwood and Bow Rivers, but the project would have much greater environmental impact on the Little Bow River. A technical analysis of river impacts predicted rather minor channel erosion and change along the Little Bow River, but local landowners were skeptical of this conclusion. As the project unfolded and project engineers visited the river during different flow periods, they recognized that the residents’ concerns were well founded. Thus, further environmental impact analysis was undertaken to reconsider the impacts of the tripling of flow along the upper Little Bow River.

The renewed analyses recognized that the Little Bow River would increase in physical size, and particularly channel width, in response to the increased flow. With a larger channel, there were concerns that the future river could actually require higher summer flows to maintain water quality and a healthy aquatic environment along the Little Bow. With these concerns, the fisheries coalition expressed further concerns about the overall water budget. At a follow-up hearing of the joint provincial-federal review panel in 2001, an interesting reversal occurred relative to water development advocacy. Alberta Transportation, the project’s proponent, argued that the supplemental water storage sites recommended by the joint

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review panel would be extremely costly and thus of questionable net value to the public. Conversely, a lawyer for the fisheries coalition argued that additional storage was needed and thus another reservoir or reservoir expansion was essential.

Meanwhile, a move was underway to provide a novel solution to the water budget problem, the use of "non-storage options." Thus, rather than increasing storage (supply), the preference of some experts was to reduce demand. While this might not fully resolve the potential problem, it could diminish the scale and thus economic and environmental costs of additional water storage. Regrettably, the non-storage option received limited initial support, but it did emphasize the need to more broadly consider Alberta's growing water problems.

In 2004 the three major components of the Little Bow Project – (1) the new dam, (2) the expanded Little Bow Canal, and (3) an expanded canal to supplement nearby Clear Lake – are now complete and fully operational. The Little Bow dam has been named the Twin Valley Dam to recognize the two inflowing tributaries, the Little Bow River and Mosquito Creek. The reservoir created by the dam is virtually full. With tripled flows along the upper reach of the Little Bow River, changes to the channel have begun and there will probably be progressive change over more than a decade as the system responds to the new flow regime.

However, with respect to environmental impacts, it is not simply the presence or absence of a dam, but often even more importantly the pattern of dam operation that is critical. In the case of the Little Bow Project, the operations plan was the final component of the initial proposal and the component that the joint provincial-federal review board deferred ruling on due to their concerns about the water budget. While construction was underway, a joint team from Alberta Environment and Alberta Transportation developed a sequence of management scenarios that were assessed with respect to watershed demands and supplies over a sequence of years with a natural range of wet and dry cycles. Scenarios were evaluated relative to the delivery of water for irrigation and municipal needs and the maintenance of instream flows for environmental conservation. The modeling indicated that the further storage recommended by the joint panel would not solve the rare water challenges, and a set of drought operational rules were proposed for those occasional years.

To complement the government efforts, a Public Advisory Committee (PAC) was established in 2001 consisting of volunteer representatives of municipalities, industry, and local landowner and interest groups. In an encouraging display of public participation and advocacy, the PAC achieved consensus support for the refined operations plan and also provided an insightful cluster of recommendations to Alberta Environment. These recommendations included aspects such as the need to monitor the system and provide flexibility for adaptive management in which the operations plan would be refined in response to the actual impacts. The PAC, along with Alberta Environment and Alberta Transportation, held public open houses in October 2004, and following subsequent feedback, the three groups will likely provide common recommendations to the joint provincial-federal review board. With this range of consideration and support, approval seems likely.

Thus, the project is approaching its completion and with the supplemental flows, there will likely even be some environmental benefits along the Little Bow River. These should include the prospects for more riparian willows and cottonwoods, as well as potential improvements to water quality, which has been a perpetual problem along this small prairie river. Aspects related to the fish populations along the Highwood and Bow Rivers are still unfolding, but it is anticipated that the new project will have minor impact. The project has cost the provincial taxpayers more than $100 million; the government and joint review panel consider this as an investment in the regional economy, as it will provide additional water for irrigation and regional municipalities.

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In terms of policy and process, the Little Bow Project has provided a dramatic contrast to the Oldman River Dam. The project underwent a reasonably comprehensive environmental impact analysis before it was approved, and that analysis involved deliberation by a joint panel representing federal and provincial agencies and concerns. While there were a number of frictions along the way, the recent consensus-building by the PAC provides an encouraging model of community involvement.

While the Little Bow Project was underway, the province has been evaluating two other river dam proposals. The Meridian Dam would have been built along the South Saskatchewan River downstream of Medicine Hat, near the Alberta-Saskatchewan border (hence Meridian). A pre-feasibility study concluded that the project would be uneconomical even without considering environmental costs and thus, the proposal has been shelved. Another pre-feasibility study is underway for a proposed dam on the Milk River, the third project that was under consideration at the time of the Oldman Dam Project. The Milk River Dam pre-feasibility study has been considerably delayed, probably in response to additional complexities and information requirements. Recently, the Milk River gained international attention due to aspects involving water sharing between Alberta and Montana, and these aspects will further complicate any future projects.

With changes in senior personnel in the Alberta government, the fate of the Milk River proposal is uncertain. If it is advanced, the experience from the Little Bow Project will be valuable. And finally, as demonstrated by the Oldman Dam and the Little Bow Project, while river dams have profound impacts on the physical environment and on aquatic and riparian ecosystems, it may well be the human dimension that provides the greatest challenge, and opportunity.

For further information about the Pine Coulee and Little Bow projects, the Natural Resources Conservation Board Web site provides the joint federal-provincial reviews: http://www.nrcb.gov.ab.ca/web/nrp/reviews.cfm.

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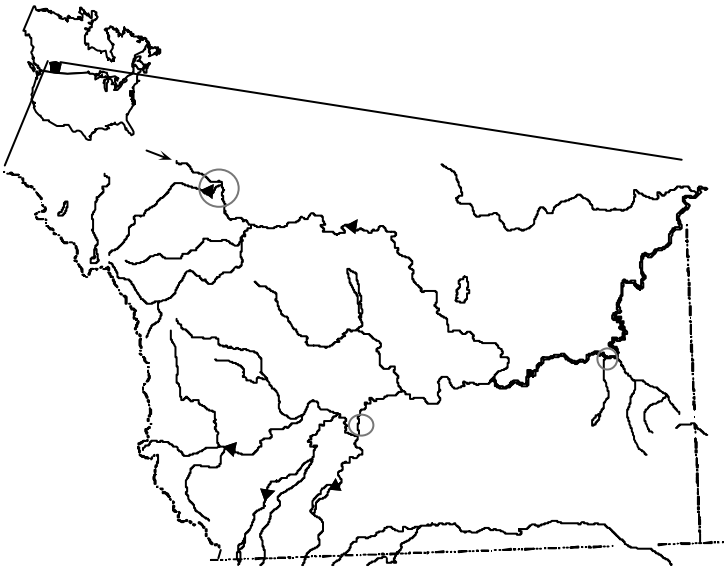

Map showing Alberta's portion of the South Saskatchewan River Basin, and sites of the dams described in this report.

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An aerial view of the Pine Coulee Reservoir near Claresholm, Alberta, which was completed in 1999. This is an 'offstream reservoir', so designated since the reservoir is filled with water that is diverted off stream from Willow Creek. While offstream reservoirs typically have fewer environmental impacts than onstream reservoirs they are incapable of trapping high springtime flows. (S. Rood)

An aerial view of the 'onstream' Twin Valley Dam and reservoir along the Little Bow River, which was completed in 2004. The reservoir floods reaches (segments) of the Little Bow and Mosquito Creek valleys (hence the name) but is largely filled with water which is diverted from the Highwood River in the Town of High River, Alberta. (S. Rood)

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Both the Pine Coulee and Little Bow projects included fish screens, metal structures intended to prevent fish passage into the diversion canals. This photograph shows the fish screen in the Little Bow Canal in the Town of High River that traps large and even fairly small fish, which are then flushed back into the Highwood River. (S. Rood)

A view of the riparian or streamside zone along the Little Bow River near the Town of High River during the initial test flow in 2003. With the tripling of inflow originating from the Highwood River, low-level flooding occurs along the Little Bow River. This inundation should lead to mortality of some riparian grasses while flood-tolerant willows should thrive. Over time, the scour due to swift flows and the loss of plant cover should result in channel widening. Consequently the future, expanded channel would convey the increase flow without over-bank flooding. This process will produce a rare opportunity for the establishment of cottonwoods (balsam poplars) and other riparian plants along the Little Bow River. (S. Rood)

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