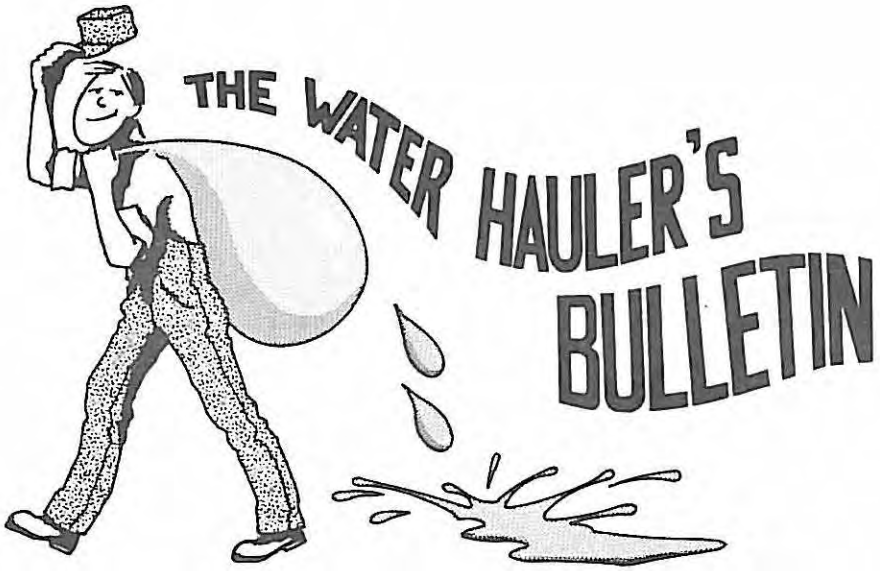

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WATER SUPPLY FORECASTING FOR SOUTHERN ALBERTA

In Alberta, the value of water and the need for water are probably most obvious in the southern part of the province where extensive irrigation takes place.

Almost all of the water which is used by irrigators in the south originates from the Rocky Mountains and the foothills. This water comes from the melting of the snow which accumulates in the mountains during the winter and spring. Summer rainfall is also an important contributor to the water supply. But since snowfall and rainfall are the result of weather conditions which vary from one day, week, month, or year, to the next, water supply conditions also vary throughout the irrigation season and from one year to the next.

Weighing snowcore to determine water equivalent.

In order to make the best possible use of the water in the rivers of the south, it is helpful to have forecasts of the seasonal water supply volume prior to the beginning of the season, and to monitor and forecast day to day streamflow conditions. These tasks are handled by the River Forecast Centre, a branch of Alberta Environment.

Water supply forecasts are prepared by the River Forecast Centre every month from March to June each year. These forecasts are issued in the "Water Supply Outlook and Snow Survey Bulletin", a publication which the Centre produces in cooperation with the Survey Branch (Water Survey Section) of Alberta Environment. Outlook updates are issued in July and August, and a summary report is issued in November.

The forecasts are based on data from a variety of sources. Snow surveys are conducted by the Water Survey Section in the headwaters of the Oldman, Bow and Red Deer River Basins monthly from January to June. Precipitation data is gathered by the River Forecast Centre from Alberta Environment's network of automatic weather stations in the Rocky Mountains, from the Alberta Forest Service's network of storage gauges throughout the East Slopes, and from the Atmospheric Environment Service (Environment Canada) network of human weather observers. Streamflow data is gathered by the Centre from the network of automatic telemetered hydrometric stations which Alberta Environment operates in cooperation with the Water Resources Branch (Water Survey of Canada) of Environment Canada. The data is analyzed by staff of the River Forecast Centre using statistical procedures and computer-based hydrological models to produce the forecasts.

Snow surveys are essential to the water supply forecasting effort. To perform these surveys, staff of the Water Survey Section visit established sites throughout the headwaters and take core samples of the snowpack, measuring its depth and the amount of water in the snow. To monitor the day to day accumulation of melting snowpack, the Alberta Environment network of automatic stations includes devices called "snow pillows" which look like big round waterbeds and which are used to measure the weight of the snowpack.

Current weather and streamflow data is also important in assessing the status of water supply conditions. Most of the data collected at the Alberta Environment's automatic stations is transmitted to the Edmonton offices of the River Forecast Centre by way of satellite and computer, giving the Centre virtually instant access to the data and allowing the Centre to closely monitor weather, snowpack, and streamflow conditions.

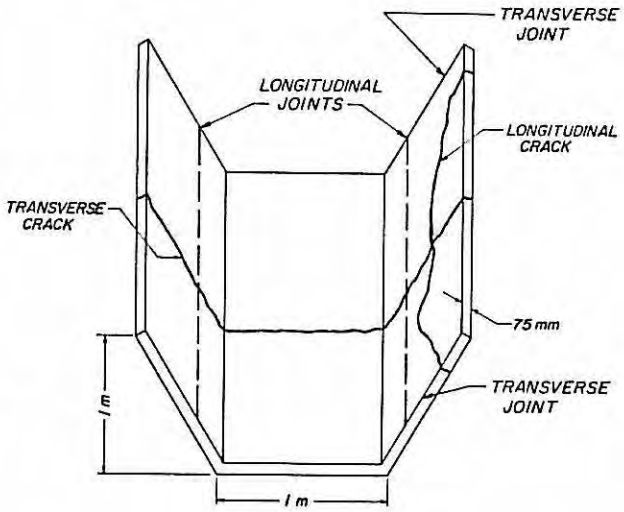
As the demand for water increases in southern Alberta, it becomes necessary to make the best possible use of the water available. Water supply forecasting, and streamflow monitoring and forecasting provided by Alberta Environment through the River Forecast Centre will assist water managers in decision-making to take full advantage of the water supply.

For more information, contact the River Forecast Centre, Alberta Environment, 10th Floor, 9820 - 106 Street, Edmonton, Alberta, T5K 2J6, 427-6278 (or 147-6278 on the RITE system).

* * *

REINFORCED SLIP-FORM CONCRETE - "LOOKING VERY GOOD"

In April 1984, the annual spring crack inventory was taken to measure and categorize the cracking in the wire mesh reinforced concrete slip-form lined canals. It became very evident from the 1983 spring inventory that transverse cracks, where present, were appearing just about in the middle between the transverse joints. Thus, in the 1984 inventory, a new classification system was employed to distinguish between the transverse and the longitudinal cracks. In previous inventories no method was used to distinguish between the two.



X-SECTION OF CONCRETE LINED DITCH

Summary of Longitudinal and Transverse Cracking - April 1984

	Virtually Uncracked	Up to 5 mm	5 mm to 40 mm	Over 40 mm
Wire Mesh Reinforced	98.84%	1.08%	0.07%	0.01%
Research Sections*	96.68%	3.32%	--	--

*Includes steel fibre, wire mesh, with various design mixes.

Interesting facts derived from the 1984 Inventory:

(1) When compared to 1983 inventory, there was a slight increase in the number of transverse cracks.

(2) There is no increase in longitudinal cracks.

(3) No displacement has been observed in any reinforced lining.

From observations made, wire mesh reinforcement in concrete slip-form lining has prevented the serious cracking and displacement found in the unreinforced lining.

* * *

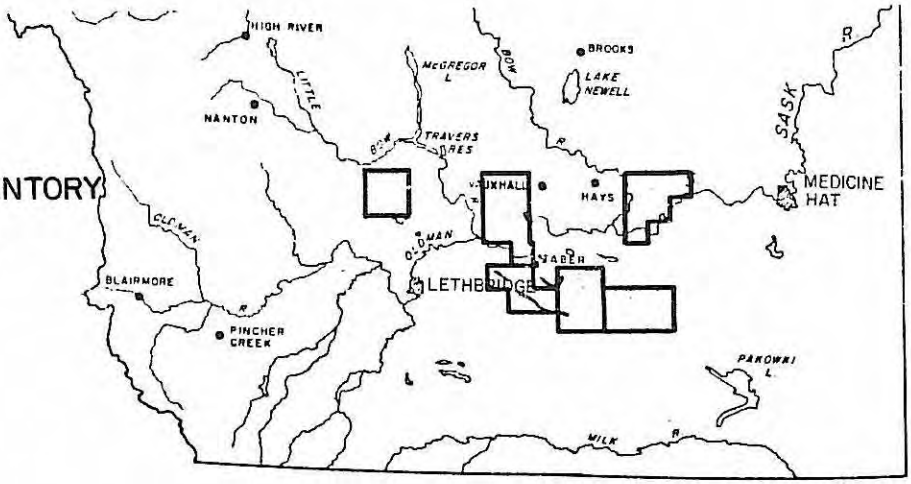
IRRIGABLE LAND INVENTORY PROJECT

Alberta Water Resources Commission (AWRC) has requested the Land Classification Branch of the Resource Planning Division, Alberta Agriculture, to organize and coordinate the Irrigable Land Inventory Project.

Funding for the project is provided by the Alberta Water Resources Commission. It is expected that during the next four years, approximately 2.4 million acres of southern Alberta will be classified regarding its suitability for irrigation. Irrigable land inventory is required by the AWRC for making long term water development plans.

A Steering Committee, with members from Alberta Agriculture and the Environment, was set up to organize and direct the land classification project. Work commenced in April 1984. The area to be classified has been divided into four to seven township size blocks of which four have been contracted out to date, to private consultants. Classification is being conducted at the Level III intensity, which is the normal requirement for planning water development projects. The first three blocks are located south of the Taber and St. Mary River Irrigation Districts, from Chin in the west to Forty Mile Coulee in the east.

IRRIGABLE LAND INVENTORY
PROJECT AREA
FOR 1984



The fourth block is located north of the Oldman River between the river and Lost Lake, northwest of Vauxhall. Two more blocks have been priorized, one north of Keho Lake and the other north of Bow Island, north of the South Saskatchewan River.

It is expected that the land classification will extend further north and east, until most of the land that has some irrigability potential has been covered.

Blocks are priorized, based on the land suitability, access to water supply and whether or not lift pumps will be required for irrigation.

To date 529,920 acres have been included in the mentioned four blocks. When the project is completed a reliable inventory of land irrigability potential will be avilable for water resource development.

Additional information is available from the Chairman of the Steering Committee: K. Pohjakas, Telephone: 329-5121.

* * *

MUNICIPAL EFFLUENT DOESN'T HAVE TO BE WASTEWATER

The sewage from almost all municipalities is almost completely water. Treatment methods presently being used remove almost all the solids and what is left is often a very large volume of liquid effluent which must be disposed of. In most cases this effluent can be discharged to streams but where this is not feasible then municipalities have to look at further treatment of alternative disposal methods.

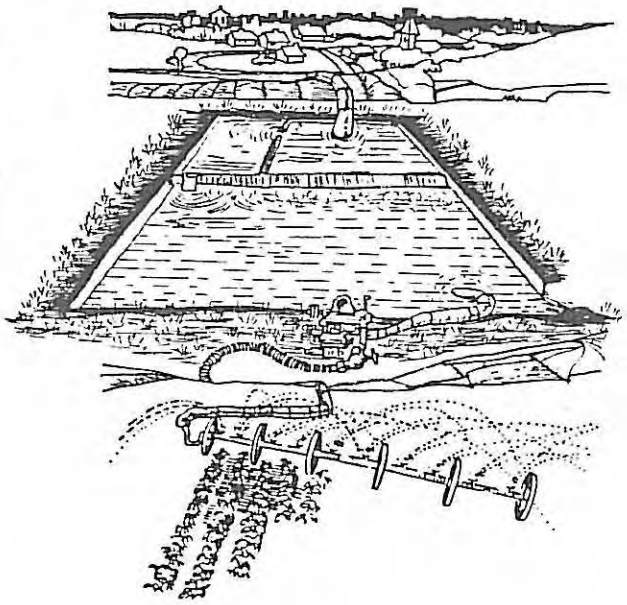
In many Western Canadian municipalities this wastewater is being turned into a valuable resource by applying it to the land. Ironically, with Taber being a notable exception, the communities practising wastewater irrigation are not usually those within the major irrigated areas of Alberta. In fact in some areas of the province where water is almost unavailable for irrigation, municipalities are still disposing of their effluent without putting it to beneficial use.

Studies have been done for a number of years by Alberta Environment, Agriculture Canda and other provincial, university, state and private agencies which determined that this method of treatment not only provides a safe method of disposing of wastewater but is also a source of the moisture and nutrients needed to improve crop yields. In 1970 a project was started in Granum and a year later a larger project was started in Taber. The Taber project is one of the best known projects in Alberta and is presently in the process of converting from wheel-roll to centre-pivot irrigation.

The low labor requirements of centre-pivot irrigation systems makes wastewater irrigation much more attractive to many municipalities. The City of Cranbrook presently utilizes a number of centre-pivots to irrigate about 1600 acres of alfalfa and other crops. This sytem has been in operation since 1978 and is the largest in Canada. In addition other wastewater irrigation projects are operating at Vernon, B.C., Swift Current, Saskatchewan, and Moose Jaw, Saskatchewan. Estimates of the number of communities in Alberta presently using wastewater irrigation as a means of disposing of part of their effluent range from 25 to 40. In many of these situations local area farmers have entered into an agreement with the municipality to take the water from the lagoons and apply it to their own land. In the United States irrigation with municipal effluent is an accepted practice and in fact to receive federal funding for treatment facilties this possible treatment method must be investigated. Some projects have been operating for over 30 years and golf courses, parks and cemeteries are often irrigated with wastewater in "water-poor" states.

As part of the Phase II studies of the Oldman River Basin Study Management Committee, the Earth Sciences Division of Alberta Environment examined wastewater utilization within the basin. Their study dealt not only with municipal effluent but also industrial wastewater irrigation. It pointed out the advantages of wastewater irrigation (lower operating costs, increased land value, nutrients available, complete waste treatment and increased food production) and also the disadvantages (unpleasant odors, large land requirements, unsuitable soil and or water, restriction on the type of crop, necessity for groundwater monitoring).

From their study they determined that 21 million cubic metres of municipal and industrial wastewater were produced in 1979. The amount of nutrients available in the wastewater was estimated at approximately 95,000 kilograms of phosphorus and 429,000 kilograms of nitrogen with a total value of approximately $250,000. They also found that only 7.2% of the total wastewater produced could not be used for irrigation. However, only 18.6% could be readily used and 74% of the wastewater was associated with projects classed as marginal due to large land requirements or problems with storage and transportation. They also pointed out that the nutrients contained in runoff from a 16 acre feedlot are more than those contributed by a town with a population in excess of 4,000.



In conclusion the report presented policy recommendations including subsidies for wastewater irrigation, examination of wastewater irrigation potential for all future projects, location of new industries close to large tracts of land suitable for waste disposal and further study into the health hazards of wastewater irrigation.

In 1972 Temple University prepared a publication entitled "Green Land, Clean Streams". In that publication the following quotation appeared which still has application here in Alberta:

"If waste treatment utilizes the resources that are out of place, the economic criteria upon which treatment is judged will be different from those used for waste disposal. Waste treatment cannot be assessed simply on the basis of lowest cost per unit disposed; it must also be judged on the value of resources saved, its contribution to production, and the value saved through non-pollution".

Any people or organizations with a potential wastewater irrigation site are invited to contact Mr. Len Ring, P. Eng.* (Phone 329-5152) for more information.

*Mr. Ring is Irrigation Systems Engineer with Alberta Agriculture in Lethbridge and has had minor involvement with wastewater irrigation projects in Taber, Cranbrook and Moose Jaw.

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REMINDER OF WATER RESOURCES CONFERENCE

The Canadian Water Resources Association Alberta Branch, is holding its annual conference in Red Deer on October 30 and 31. The main theme is: Drinking Water Quality in Alberta.

Contact: Mr. Gus Ribeiro, Registration Chairman, c/o ECOS Engineering Services Ltd., #201, 11830 111 Avenue, Edmonton, Alberta (Phone 452-0090).

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UPDATE ON ELASTOMERIC MODIFIED BITUMEN LINERS

In the spring 1983 edition of the Water Hauler's Bulletin an article appeared discussing a relatively new geomembrane (Awaplan) which the Western Irrigation District had been experimenting with. To date the W.I.D. has installed this type of material in three separate canals and it proposes to use this material later this fall to rehabilitate another two canals.

The generic name of this geomembrane is elastomeric modified bitumen (E.M.B.). It can come in many forms but typically has a polyester reinforced mat saturated with a bitumen and a layer of slate deeply embedded into the top coat. It normally comes in rolls of one metre width and up to ten metres long.

A project that the W.I.D. rehabilitated in the fall of 1983 utilized one of the many popular brands of E.M.B.'s available. The total length of the reach rehabilitated was 1800 m. The bed of the canal was prepared just as stringently as would be demanded if the lining medium were slip-form concrete. Although bed preparation does not have to be constructed to the same tolerances as required for slip-form concrete it was required to evaluate the E.M.B. versus slip-form concrete and therefore the test had to be on a comparative basis.

Alan Winter viewing project.

The rehabilitation of this project was let under two separate contracts. The first contract was for the earth works and bed preparation; the second contract was for the supply and installation of the liner. The earthwork portion of the project was straight forward with no complications. The installation of the liner went smoothly with only a few hitches. When liner installation commenced the temperature was about -15° C and snow had drifted into the canal. However, this did not deter the contractor as he constructed a mobile workshop over the canal. The workshop was about 10 m by 10 m and advanced as the liner was laid on the canal bed. Rolls were 8.5 m long and laid transverse to the direction of flow. Although the process may seem slow at roughly 80 m per day, the quality was consistent and did not digress even when the ambient air temperature dropped to -27° C.

According to Alan Winter, District Engineer, the greatest concern arising from those who have seen the product and its installation is that the rolls are only 1 m wide. This requires many joints which results in a very labor intensive process; not to mention a potential quality assurance and quality control problem. This is all true, but the W.I.D. has found through their experience that joints provide the

required rigidity in order that the product can be left exposed. The material itself is quite flexible (even under extreme cold temperatures) and without some external stiffening mechanism the liner may require ballast to avoid creeping and sloughing. Joints at 1 m intervals seem to provide adequate stiffness.

A unique feature was incorporated into the design and construction of this project. Vertical cutoff walls extending 1 to 2 m below bed grade and spaced at 90 m intervals were installed prior to liner installation. These cutoff walls were constructed using the same material and installed perpendicular to the direction of flow. The cutoff walls served many purposes; firstly, intercept any water piping beneath the liner; secondly, anchor the liner to the canal bed in order to avoid liner migration; thirdly, anchor the liner in order to minimize floatation from uplift forces arising from groundwater discharge, since the canal was constructed on a steep sidehill.

The use of this liner had many advantages.

(1) The canal formed a natural legal boundary and was contained within a narrow right of way owned by the District. Since the liner is flexible, construction of curves is fairly simple and rehabilitation followed the existing canal alignment, thus avoiding right of way alteration and expensive land negotiations.
(2) The installation of the liner was in very inclement weather. Installation of other commonly used liners would not have been possible.
(3) The liner was bonded to corrugated steel pipe road crossings thus making an integral water-tight seal.
(4) Drop structures downstream of this rehabilitated reach can be eliminated if this material is used as the lining medium.
(5) Higher velocities are permitted and thus canal response time is decreased.
(6) Erosion was totally eliminated.
(7) Excavation and borrow requirements were reduced.

Supply and installation cost of E.M.B. material is generally about $12 per square metre. This cost does not include bed preparation or earthworks. Rolls of this material can be specially ordered in any length up to 10 m and thus wastage is minimized.

The Western Irrigation District is very satisfied with the installation and performance of this geomembrane. Although their experience is limited with this product, it is felt that they may be finally onto something. They invite comments and interested parties to contact Alan Winter at 934-3542.

* * *

THE WATER HAULER'S BULLETIN

Designed to provide the operation and management personnel of Irrigation Districts with items of interest in their line of work. Comments are welcome. Please contact Duncan Lloyd at 329-5164, Lethbridge.

Published quarterly by the Evaluation & Management Section, Project Planning Branch, Resource Planning Division, Alberta Agriculture, Agriculture Center, Lethbridge, Alberta T1J 4C7.

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