the
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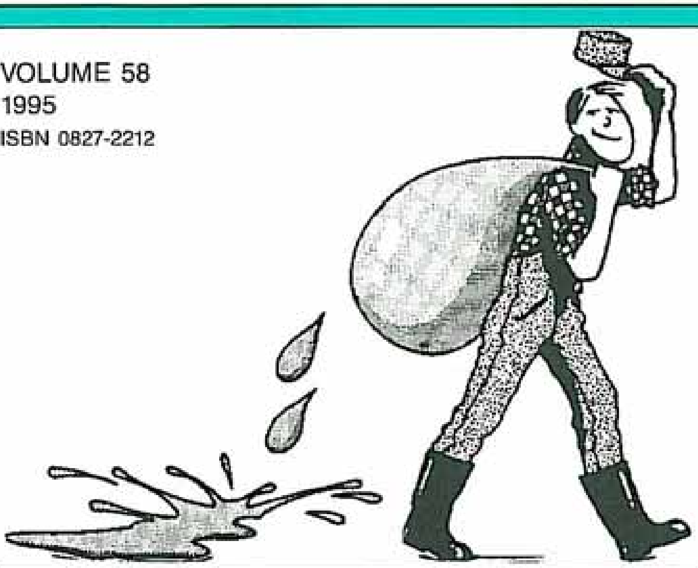


IN THIS ISSUE:

REDUCING ON-FARM IRRIGATION COSTS

More now than ever, in a global competitive agricultural economy, irrigation producers have to look at every feasible means to become more cost-effective. In the area of pumping costs alone, it is projected that annual on-farm irrigation pumping costs could be reduced by $1.5 million dollars.

Since 1981, when the irrigation branch started testing sprinkler systems, over 50 units have been tested. On average, the pumping units tested are not as efficient as they could be, says Alberta Agriculture, Food and Rural Development irrigation specialist Leigh Morrison, the result being excessive power consumption and inflated energy costs.

Of the variety of energy supply options being used, most pumping units tested were powered by either natural gas or three-phase electric power. The natural gas pumping units tested had an average efficiency of 15%. This is lower than the Nebraska Standard of 17.3%. The lowest efficiency tested was 7% and the most efficient natural gas pumping unit was tested at 25%.

The electric pumping units had an average tested efficiency of 65%, also less than the Nebraska Standard of 70%. The tested efficiencies ranged from 22% to 80%.

If the average efficiency of the systems tested could be improved to the level of the Nebraska Standards, the

Paul Maloff (right) and Leigh Morrison (center), of the Irrigation Branch, monitor pump discharge flow with farmer.

energy savings (based on 1995 energy costs) would be approximately $200.00 per pumping unit per year. This is based on energy savings of 4kW/h for electric power units and 0.115 Gj/h for natural gas pumping units. Irrigation Branch records indicate that there are 4255 natural gas and 3430 electric pumping units in service across the province. Assuming that the average pumping unit in the province is the same as the average of the systems tested, the total potential energy cost savings for all these Irrigators could be in the area of $1.5 million each year. This does not include associated potential savings from propane, diesel or gasoline pumping units totalling an additional 1050 units.

The most common reasons given by farmers to have their systems tested are to determine:

i) if the pumping unit is energy efficient
ii) if the sprinkler system is water efficient
iii) why energy costs are excessive
iv) if the sprinkler system is operating properly
v) if a more energy efficient and water efficient conversion is practical and cost effective
vi) the flow and application rates in relation to original design.

For example, in 1995, five sprinkler systems were tested in the Medicine Hat area. The following conditions were determined from the tests:

- two systems could not supply enough water for the crop
- three systems were inefficient energy users
- two did not have enough pressure
- one had excessive pressure
- two had faulty pressure gauges
- one had a crack in the fuel mixer diaphragm
- one had a faulty distributor
- one had poor water application efficiencies
- one had poor water application uniformity
- one had a section of pipeline that was too small.

Changes were recommended for all five systems tested. These improvements were subsequently carried out in all cases.

As a result of the changes, says Morrison, "the energy efficiencies were increased on three of the pumping units with an average energy savings of $553.00 per unit per year. Increases in yields are expected to be even more profitable but the value is difficult to estimate due to many uncontrolled variables." The following table summarizes the improvements and resulting cost benefits.

SYSTEM NO.	MODIFICATION	ENERGY SAVINGS
1	• Change to a more efficient power unit	$432.00
2	• Tune up the power unit	$480.00
	• Replace small supply line	$300.00
3	• Tune up the power unit	$448.00

"In many cases," states Morrison, "notable improvements can be made with little capital expenditure. For example, an impeller trim or a tune-up costs only a few hundred dollars. In many cases, savings in energy costs are enough to pay for the improvement within the first year of operation. When the capital cost is higher, the irrigator may wait until the equipment is worn out before making additional capital investment" concludes Morrison.

For further information, contact Leigh Morrison, Irrigation Specialist, Alberta Agriculture, Food and Rural Development, Medicine Hat, Alberta, Canada T1B 3N3. Telephone (403) 529-3616. ■

CANADIAN WATER RESOURCES ASSOCIATION

1995 JOINT ALBERTA/SASKATCHEWAN BRANCH ANNUAL CONFERENCE

The Alberta and Saskatchewan Branches of the Canadian Water Resources Association will be holding a joint annual conference October 15-17, 1995 at the Medicine Hat Lodge in Medicine Hat, Alberta. Conference co-chairman Jim Brown says the theme — "Water: Managing a Shared Resource" — provides a good opportunity for participants to explore issues related to managing the increasing demands for water by the agricultural, municipal, industrial, environmental and recreational sectors within and between Alberta, Saskatchewan and Montana. For more information, please contact Dave Smith at telephone (403) 545-6866, FAX (403) 545-2517. ■

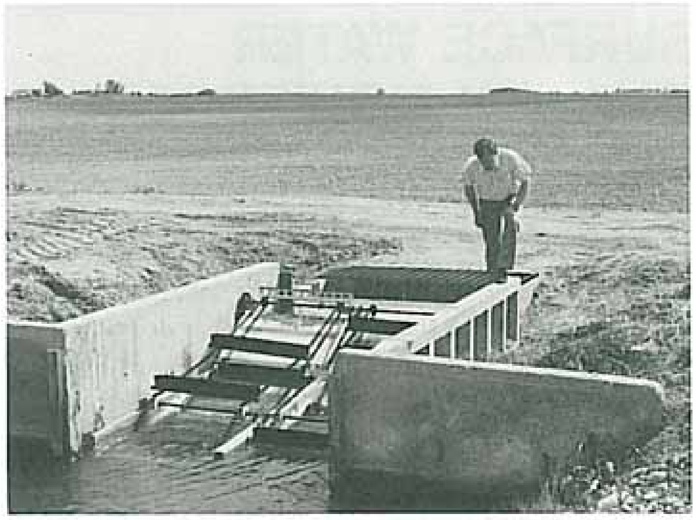
TID BEGINS AUTOMATING SCREENS

Unless you have experienced the frustration, and the feeling of utter helplessness, it's hard to imagine having to manually clean aquatic weeds off a bar screen every ten to 30 minutes, around the clock, seven days a week. "Having to literally camp beside a screened pipe inlet structure with a seemingly never-ending mass of aquatics floating down the canal towards you is enough to drive anyone mad, including district managers" says Kent Bullock, P.Eng., Taber Irrigation District manager." In our district we have about 20 pipelines that were built with no mechanical cleaning devices."

With the aquatic weed problems seeming to be getting worse, Bullock and his staff began to investigate various commercially built self-cleaning screens that might be retrofitted on concrete inlet structures. It soon became apparent, that although there are good ones available, we would have to extensively modify our concrete inlet structures to fit them. The cost of renovations were major. "We decided to try and build our own screens" stated Bullock.

The idea for our catenary-type brush screens was developed after seeing similar ones in the Lethbridge Northern and Leavitt Irrigation Districts. Bullock designed each screen to fit each individual site. Each unit uses the principle of a continuous chain of brushes that travel up the screen face then back down in the water. As the loaded brushes travel over the top, the weeds and debris fall off or are removed by the scraper bar. The weed pile on the backside must be forked away.

This unit is powered by a 110-volt electric motor.



Kent Bullock checks water driven self-cleaning screen.

The galvanized and stainless steel units are built in the district's shop, transported to the field as a unit and attached to the concrete structure by anchor bolts. To date, the TID have built three screens, each powered differently.

Screen #1 is powered directly off the TransAlta electrical grid system. It runs on a 110-volt electric motor. The screen is activated by an auto-timer and can be programmed at whatever interval is required to keep the screen clean.

The second unit is powered by two 60-watt solar panels connected to 12-volt storage batteries. The unit is programmed to operate for ten minutes (two full rotational cycles) every two hours.

Unit number three is water driven by a paddle wheel. When flows become restricted as the screen plugs, insufficient water volumes expose the wheel (differential head) and it begins turning, activating the chain-driven cleaning brushes. "By not continuously turning when there isn't a weed problem will make the unit last a lot longer" says Bullock.

District superintendent Ron Lloyd likes the three new units and feels they will solve a very frustrating operational problem. He warns however " they are not cheap, we spent between $5,000 to $6,000 per unit."

For more information please contact Kent Bullock, P.Eng. Taber Irrigation District manager, or Ron Lloyd district superintendent, 4900 D 50 St. Taber, Alberta, Canada T1G 1T3, Telephone (403) 223-2148. ■

SURFACE WATER QUALITY MONITORED IN TWO IRRIGATION BLOCKS

Good quality water is essential for cost-effective crop and livestock production, and for safe domestic use. Alberta Agriculture, Food and Rural Development has been monitoring surface water quality in several Alberta irrigation districts since 1989, to help ensure irrigation waters continue to meet quality standards. A current monitoring project was initiated in 1994 by Graeme Greenlee, a scientist with the irrigation branch in Lethbridge.

"Results from this project are helping define current irrigation water quality. This is an important step in maintaining good quality irrigation waters," Greenlee explains. Once we know the current situation — if there are pollutants and we know where they are coming from — we can develop guidelines for improved agricultural production practices. The effects of changed practices can then be evaluated through continued monitoring.

The quality of water used for irrigation in southern Alberta's irrigation districts is generally considered excellent, says Greenlee. But studies show agriculture, including irrigated agriculture, can affect surface and groundwater quality. For example, a 1991 U.S. study reported pollution from agricultural land was serious and widespread in the United States, and agricultural runoff accounted for more than half the pollution in rivers and lakes. In Alberta, the Bow River Water Quality Task Force reported in 1991 that irrigation return flows were direct sources of pollutants into the Bow River and its tributaries. The Task Force report prompted more detailed studies of irrigation water quality.

Irrigation branch staff monitored surface water quality from May 11 through October 11, 1994 at 14 sites in two irrigation blocks and associated regions. One block was in the Lethbridge Northern Irrigation District (LNID) and the other was in the Bow River Irrigation District (BRID) (Figure 1). Surface water quality monitoring sites for the LNID included the inlet and outlet of Keho Lake, the inflow and outflow of the irrigation block and the Battersea Drain return flow stream. BRID monitoring sites included the inlet of McGregor Lake (reservoir), the outlet of Little Bow Lake (reservoir), the inflow and outflow of the irrigation block, four drains entering the block and the New West Coulee return flow stream.

Surface water samples were collected weekly, and analyzed for constituents that could affect crop and livestock

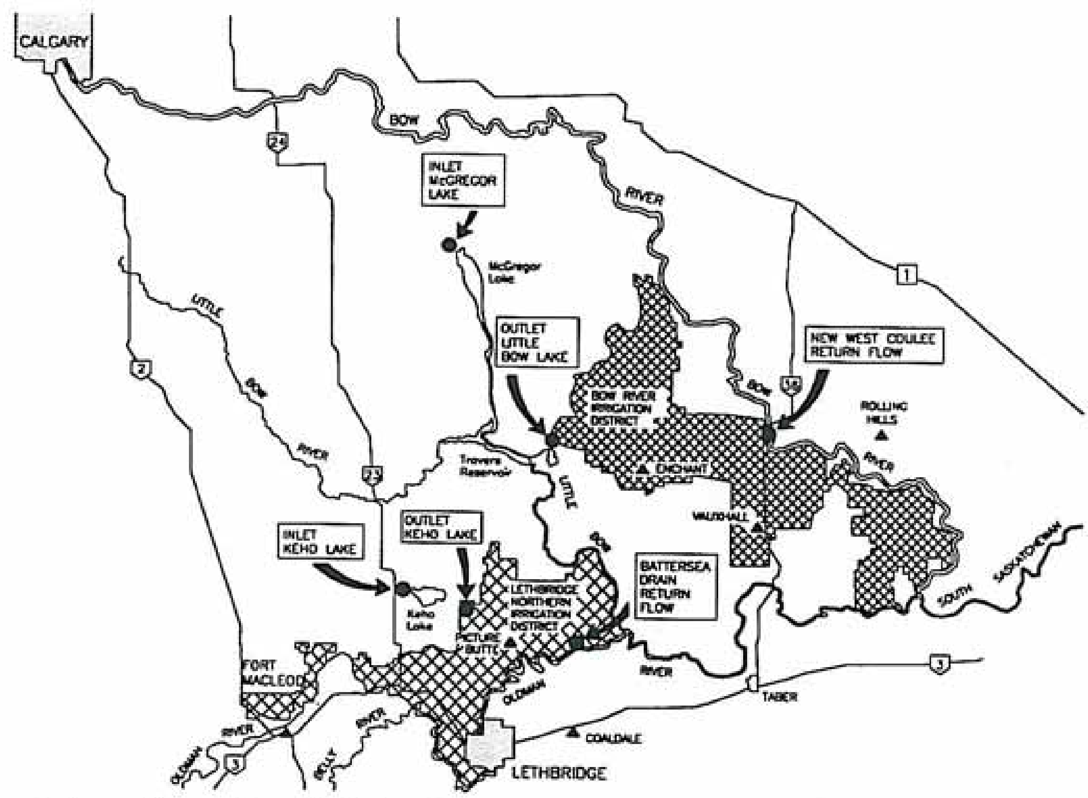


Figure 1. Location of Lethbridge Northern and Bow River irrigation districts, and surface water quality monitoring sites.

production or human health. The specific constituents measured were: pH (a measure of acidity or alkalinity), electrical conductivity (an indicator of salinity), soluble cations and anions (sodium, calcium, carbonates and sulfates — indicators of the kinds of salts present), nitrate-nitrogen (toxic to humans and animals in high concentrations), phosphate-phosphorus (high levels lead to eutrophication of lakes and streams), total and faecal coliforms (indicators of the potential occurrence of disease-causing organisms), and five trace elements (arsenic, cadmium, copper, lead, selenium). Sodium adsorption ratios (SAR) and total dissolved solid levels (TDS) were calculated. SAR is an indicator of sodicity or sodium hazard, and TDS is a measure of the total dissolved mineral constituents in water. Results were compared to the Canadian water quality guidelines and to surface water quality in the Bow and Oldman Rivers, both upstream and downstream of irrigation water quality monitoring sites. These comparisons are important to determine whether irrigation return flows have an impact on surface water quality in the Bow and Oldman Rivers.

Greenlee found slight increases in salinity and TDS concentrations, and SAR levels doubled between the inlet and outlet of the irrigation reservoirs. Salinity, sodicity and TDS levels showed small fluctuations in both irrigation blocks and in both return flow streams. TDS levels exceeded the Canadian drinking water quality guideline on the initial sampling day of the season at three of fourteen sampling sites. All other levels of these three constituents were below the guidelines for human/livestock consumption and irrigation at all sites throughout the monitoring period.

Nitrate-nitrogen and phosphate-phosphorus concentrations were very low at all sites for most of the monitoring period. The highest nitrate-nitrogen levels occurred on the initial sampling day of the season, and concentrations were consistently below the Canadian water quality guidelines for human and livestock consumption. Phosphate-phosphorus concentrations were generally below the maximum desirable level for flowing water. Concentrations slightly above this level were detected occasionally at the outlet of Little Bow Lake and at three monitoring sites in the BRID block. Phosphate-phosphorus was not detected in the LNID block, at the head of McGregor Lake and at the BRID block outflow site.

Levels of total and faecal coliforms fluctuated widely throughout the monitoring period at all monitoring sites. Total and faecal coliform levels were consistently above the Canadian water quality guidelines for human and livestock consumption and were often above the guideline for irrigation. Greenlee noted coliform counts at river monitoring sites were above the guidelines for human and livestock consumption before the water was diverted for irrigation.

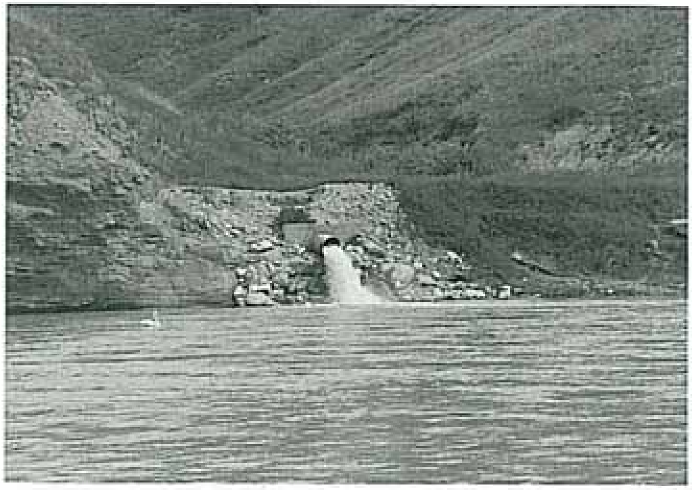
Levels of most trace elements were either below detection limits or were very low throughout the monitoring period. Copper was found at very low concentrations on most sampling days at all monitoring sites, and cadmium was not detected during the monitoring period. A lead concentration equal to the Canadian drinking water quality guideline was found at the Keho Lake inlet site on one sampling date, and a lead concentration slightly above this level occurred on the initial sampling day of the season at two sites in the BRID block. All other trace elements detected were at levels below the guidelines for human and livestock consumption and for irrigation throughout the monitoring period.

''Our study showed the impact of irrigation return flow waters on receiving rivers was slight,'' says Greenlee.

Constituent levels at river monitoring sites (data from environmental assessment division, surface water monitoring branch, Alberta Environmental Protection) were generally lower than or similar to constituent concentrations at irrigation reservoir monitoring sites, irrigation district monitoring sites and irrigation return flow stream monitoring sites.

The impact of irrigation return flow water on receiving rivers is diminished by the dilution effect. This ranged from

Flow metering station on open drain.



Return flow from Battersea Drain back into Oldman River.

47 to 316 times in the Oldman River (Battersea Drain from LNID) and 9 - 59 times in the Bow River (New West Coulee from BRID). Other processes that reduce constituent concentrations in receiving streams and major water bodies to lower levels than those in edge-of-field runoff include sedimentation, vegetative trapping and degradation in transport.

In conclusion, Greenlee says, "the quality of water at 14 monitoring sites in southern Alberta was generally excellent for human and livestock consumption and for irrigation. The exceptions were the coliform levels that were consistently above the Canadian water quality guidelines for human and livestock consumption; these levels were above the guidelines before the water was diverted for irrigation."

Coliform bacteria counts consistently above the Canadian drinking water guidelines indicate raw water from irrigation canals, return flow streams and rivers should receive adequate filtration and treatment to make it safe for human consumption.

More details on deleterious effects of elevated constituent levels on agricultural production, the environment, animals or humans; factors that lead to elevated constituent levels; and practices producers can use to minimize or prevent the buildup of elevated constituent levels will appear in the next issue of the Water Hauler's Bulletin.

For more information, please contact Graeme Greenlee, Resource Conservation Section, Irrigation Branch, Alberta Agriculture, Food and Rural Development, Agriculture Centre, Lethbridge, Alberta, Canada T1J 4C7. Telephone (403) 381-5893. ■

COMMUNICATION TOOLS — TOWN HALL MEETING STYLE

Keeping water users informed about irrigation district activities is a challenge. The local coffee shop variety of public information can often be a breeding ground for rumors, or at best, less than complete or accurate information. Continued support for irrigation district activities requires water users to be well informed. With the decreasing amount of time that irrigators have to attend meetings or read information material, keeping them advised of such activities requires some innovation.

For many years the board of directors of the Eastern Irrigation District (EID) was host to many "Town Hall" style meetings. These meetings are usually held in February. The EID is host to four such meetings each year. Staggering the meeting locations ensures that water users have a meeting in their own community at least once every two years.

"It is much easier to get water users to deal openly with issues important to the district if you are talking to them in their own backyard," comments board chairman Bill Mortensen. "We are sometimes concerned, as directors, that the turnout at these meetings could be better, but the water users value these meetings and encourage us to keep holding them each year. We recognize that the success of the district is very dependant upon the support provided by our irrigators. Keeping them informed, and with good information, is an important part of keeping support level high."

EID general manager, Jim Webber states, "We always bring along several staff members to these meetings so that they can deal directly with presenting information and answering questions. Our field staff, in particular the water district supervisors, are encouraged to attend the meetings held in their communities. This helps foster a good working relationship between the board, the water users and the staff of the district."

The meetings are publicized in local papers and through public information announcements in various locations throughout the community. They follow an agenda of prepared information that the board wishes to share and obtain feedback to. There is also a chance for water users to raise issues and deal with specific concerns. The meetings are informal in nature — are punctuated by close contact and humorous exchanges. The official business ends with a move to adjourn and the opportunity to get at the coffee, juice and doughnuts. This is the opportunity for the one-on-one "real meetings" to take place. ■

A GEOGRAPHIC INFORMATION SYSTEM FOR THE EASTERN IRRIGATION DISTRICT

Editors Note: This is the second of 3 parts regarding the GIS of the Eastern Irrigation District.

Part 2 — Selecting the GIS System

For many years information about the Eastern Irrigation District's irrigation system, land ownership and management, canal design and system operational requirements has been located in hard copy files in individual offices at various locations. Making sure that all of the pertinent information about a given project or issue was available for planning and decision making was seen as a critical component in meeting long-term management objectives.

Much of the baseline information kept and used by the Eastern Irrigation District (EID) in its water and land management activities originated more than 80 years ago. Contour drawings, canal designs and locations, and technical data recorded on linens were fast becoming out-of-date and fragile with age. The EID recognized that updating information such as contours and canal locations on the original medium was no longer feasible. An alternate method needed to be found where old data and new data could exist side-by-side.

As irrigation assessments approach the practical limits of the available water supply, it is increasingly important to stay on top of on-farm irrigation practices. Changes in irrigation equipment, canal locations, drainage and land levelling all contribute to shifts in the overall irrigation assessment. In order to be able to adapt to a ceiling in assessment, having an updated accurate record of todays irrigation was required. This "check" of assessments has traditionally been accomplished by acquiring updated aerial photographs and comparing current practices to hard copy records.

The increase in the level of activity on lands owned by the district (in excess of 600,000 acres) for oil and gas, livestock grazing and recreation activities has also meant that a more coordinated approach to land management activities is required. Preserving the long-term sustainability of these lands requires increased levels of cooperation between sometimes competing uses. In particular, the activities of oil and gas companies engaged in exploration and production has expanded at a rapid rate during the past decade. The pace of their operations requires the EID to be able to respond quickly and accurately to issues such as wellsite, processing facilities and pipeline locations.

With more and more oil and gas facilities located within the boundaries of the EID, maintaining hard copy records for all sites and recording their proximity to EID land or irrigation facilities was becoming more difficult. The chance for human error, in omitting an important component in decision making, was increasing in potential. The EID's current working relationship with oil and gas companies has also established a need for the EID to respond to potential oil and gas facility locations in a short turn-around time. Identifying the potential for future canal relocations or deepenings in advance of construction saves costs for the EID and oil companies alike. The required turn-around was not possible based on our previous data structures. This type of information was of such value to oil companies in the region that Pan Canadian Petroleum Ltd. became a funding partner with the EID in the GIS initiative.

All of these issues coming together at the same time led the EID to look for a coordinated way to solve all of these problems, if possible, with one solution. To assist the EID in determining and evaluating the various solutions, the EID retained Sobeco Lennox of Calgary (a management consulting organization with a demonstrated expertise in high tech solutions). The EID was looking for the most bang for the buck and wanted to ensure that any recommended solution met our baseline information requirements. Sobeco prepared performance criteria to test the viability of various GIS solutions. A grouping of 4 firms were short-listed and contacted for the purposes of making demonstrations. A critical element in the selection process for the EID was the ability of a GIS to handle both raster and vector data. "Our baseline information requirements indicated that aerial photographs would form the backdrop of our future information management processes," says the district's information specialist, Mark Porter.

Following the demonstrations, the EID selected PAMAP Geographic Information Systems from EPS of Victoria, British Columbia. For consistency with other computer applications, the EID selected the Windows)™ version of PAMAP software. The complete PAMAP GIS software package sells for $15,000 for the first copy and $10,000 for the second copy. In addition to the software purchase, 4 EID staff members completed a week of hands-on software training at PAMAP's facilities on Vancouver Island.

For further information or a demonstration of the EID's GIS please contact Mark Porter, Eastern Irrigation District, P.O. Bag 8, 550 Industrial Road, Brooks, Alberta, Canada T1R 1B2. Telephone (403) 362-1400 or Fax (403) 362-6206. ■

ARMORTHANE® USED TO REPAIR CONCRETE SLIP-FORM LINING

It's been eight years since the last concrete slip-form lining was installed in the Lethbridge Northern Irrigation District (LNID). But with each passing spring, the repair of the cracks in the lining becomes more and more of a problem. Not only are the cracks getting wider but there are more of them says district superintendent Kevin Morris. This year, after hearing and reading about a new product, ArmorThane®, (see Water Hauler's Bulletin #57) the district decided to try the plural component spray on cracks in their South Park Lake Lateral.

ArmorThane®, says Svat Jonas, P.Eng. research engineer with the irrigation branch, might just be the product that reduces this annual crack repair event. Armorthane® is applied as a plural component spray using isocyanate, polyol blend resin and chain extenders. "The product has some very impressive characteristics: resistant to abrasion, highly resistant to impact, suitable for high-flex applications, remains flexible at very low temperatures, won't support mold, doesn't sweat or deteriorate in water, bonds to wood, metal and, of course, concrete," states Jonas.

The South Park Lake Lateral, like many other unreinforced concrete slip-form lined laterals, has many cracks ranging in size from hairline to 50 mm wide. Selected were 39 cracked panels, (each panel is 2.5 metres in length).

As with most coatings, a prerequisite to good bonding is a clean surface. The LNID tried two methods, power washing and sand blasting.

ArmorThane® has an elongation factor of 250-300% and remains flexible at very low temperatures. To further improve the elongation factor on 50% of the cracks, Jonas taped over the cracks with 50 mm masking tape to prevent bonding of the material right up to the crack's edge. "This will allow a crack to expand much larger without the material breaking," stated Jonas.

Scott Industries sprayed the coating on to a depth of 1 mm on some cracks and to a 2 mm thickness on others. Because of the experimental nature of this work Jonas did not calculate cost. Results of this trial will be evaluated next spring.

For more information please contact Svat Jonas, P. Eng., Irrigation Branch, Alberta Agriculture, Food and Rural Development, Agriculture Centre, Lethbridge, Alberta, Canada T1J 4C7. Telephone (403) 381-5870. ■

Armorthane® being applied over cracks in early spring at test site.

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, editor, at Area Code (403) 381-5539, Lethbridge.

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