the WATER HAULER'S BULLETIN

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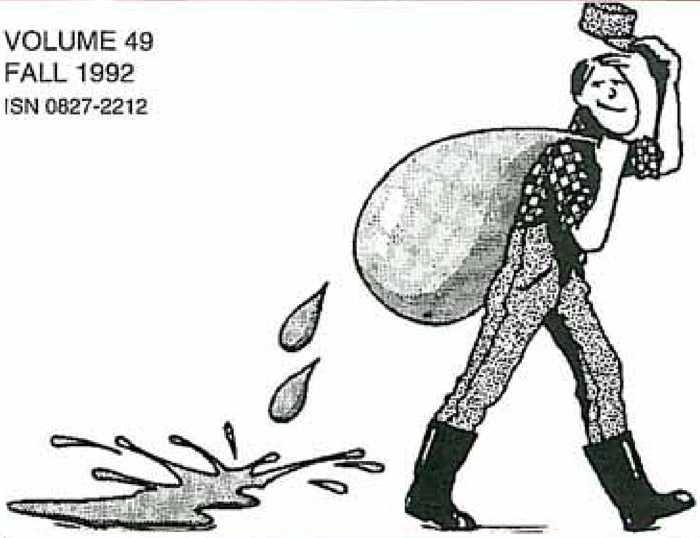

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TECHNICAL TRAINING PROGRAM FOR EID OPERATIONAL FIELD STAFF

On November 16, 1992, 15 Eastern Irrigation District (EID) operational field staff started an intensive 65-day training program. Rather than join the construction crews working on rehabilitation projects, they are in classes at the Brooks Campus of the Medicine Hat College. It was, for some, a daunting choice as school was a memory of 20 years past, says Jim Webber, P. Eng., EID manager. Response was excellent, as we had 24 volunteers for the first 15 positions. It is the EID's intention to run this course again in 1993 to pick up the remainder of those field staff that were not able to enroll this year.

The creation of this course comes from the EID recognizing that technological needs in the operational area will put new demands on our field staff, says Webber. We further recognize that water efficiencies of the future, have to be solved in the field rather than in the office. In an attempt to capture the enthusiasm of our field personnel, it was decided to put more tools at their disposal and to assist their ability to make their voice heard in a way that the District's systems operation should be changed. As such, the course is quite intensive and goes beyond the traditional roles of the ditchrider as we know it, states Webber.

Back to school for 15 EID operational field staff.

Subjects tackled will go across the fence-line into the farmer's operations and into soil and crop sciences, so the ditchrider may anticipate the farmer's needs and problems when tighter controls of water management become evident. Being the front-line operator for the District, much work will go into communication skills between client and our service industry. It is a fact that to the majority of farmers, the ditchrider is the sole representative of the irrigation system. It is, therefore, necessary to maintain the information flow to the field staff in such a way that he has the background in the laws and regulations, and can be a knowledgeable individual in expressing the views and concerns of an irrigation district "team," when expressing the new water constraints of this decade.

"The role of the ditchrider is being eased towards the broader technical activities in irrigation," says Webber. It is becoming apparent that you cannot just take an interest in water delivery, but you must be aware of all the elements from both the farm and multi-use side to deliver a more complete package of services, he adds.

Some of the course subjects are:

- **COMMUNICATION SKILLS** (both written and oral english, customer service, public relations, marketing, and dispute resolution)
- **LAW AND REGULATIONS** (Irrigation Act, Environmental Enhancement and Protection Act, Water Resources Act, record keeping with legal reporting in mind, and other relevant Acts where their jurisdiction affects the daily lives of the operation staff)
- **BASIC MATH** (specifically tailored to the practical experiences of the field staff)
- **RECORD KEEPING** (a practical course combining the use of custom design software packages, spread-sheets, law and regulations, and witness accounting)
- **PC COMPUTERS** (a very intensive computer study program requiring hands-on experience, software directly relating to EID in-house standardization, with computers placed in divisional offices for their practice and development)
- **WATER** (practical canal operation, water quality, weed control, and multi-use considerations)
- **SOILS** (structure, sampling, soil/water relationships, and salinity)
- **CROPS** (a home study course from Alberta Agriculture is used as the basis for the understanding of crop management, development, diseases, and irrigation design)
- **ELECTRONIC INSTRUMENTATION FOR FIELD USE** (fundamental theories on electrical devices, district electrical devices in use and troubleshooting on a basic level. May form the base of future courses.)

This course has been custom designed by the Medicine Hat College and a committee of the EID. The core subjects such as math and english are provided by college staff in a packaged form. A tutor has been hired, Douwe Schmid, a former district agriculturist from Vauxhall, to coordinate the classes and teach the major portion of the subject load. There will be specialist components from EID staff that will be intermixed with the course where the specialist knowledge can be best defined from an irrigation experience. This will involve items of law, surveying, canal design, and wildlife. Expertise is also being provided by Alberta Agriculture's local irrigation specialist, Greg Snaith and by staff of Alberta Forestry, Lands and Wildlife.

"As a custom designed course in a totally new area, there are constant adjustments as we go forward. It would be fair to say that the field staff have approached this burden with great enthusiasm. If we can match that with substance within the course work, we have achieved our goal. This is an adult education program, and it certainly won't be the last. The phrase "life-long learning" is commonly used for many adult programs, and as such we see this as only the first step in many upgrading courses to bring the current work force up to the technological challenges that lay before them," concludes Webber.

For more information please contact Jim Webber, P. Eng., Manager, Eastern Irrigation District, P.O. Bag 8, 550 Industrial Road, Brooks, Alberta T1R 1B2. Telephone (403) 362-1400.■

COMPUTERIZED DATA MANAGEMENT FOR IRRIGATION DISTRICT PLANNING

The Irrigation Rehabilitation and Expansion (IREP) program has resulted in the improvement of thousands of kilometres of canals, structures and drains throughout the 13 irrigation districts in southern Alberta. The amount of information generated from this program is contained in over 800 Irrigation Capital Works (ICW) reports and countless maps and drawings. Retrieval of information from these reports by district or government staff for planning purposes is time consuming and tedious. As new rehabilitation projects are constructed, updating the information becomes increasingly difficult.

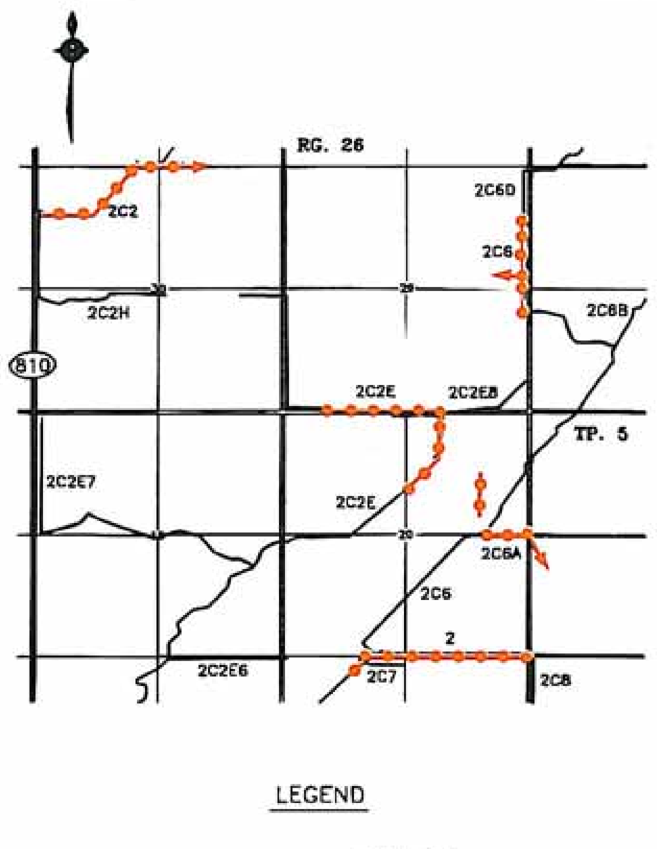

FIG. 1

The irrigation and resource management division initiated a project which would provide an inventory of the irrigation distribution systems, structures and reservoirs for each of the 13 irrigation districts. It will allow district and government staff to quickly extract relevant information associated with any or all completed rehabilitation projects. To accomplish this, it was evident that some form of computer based system would be required. Ultimately, a combination of software packages, including AutoCAD®, RBASE® and Geo/SQL®, were chosen and linked together to allow us to compile, store and retrieve all data related to the rehabilitation projects within the districts.

The development of this program has been arduous and much slower than originally expected, due in part to software difficulties, staff turnover and training requirements. At present, we are proceeding with an inventory of all rehabilitation works for each district. The inventory information is placed into a computer database and subsequently into a mapping system. This complete database is called the Irrigation Infrastructure Management System (IIMS).

All information stored in this computer system can be retrieved as data and/or as a map. For example, a user can request the length and location of all pipelines having a capacity greater than 0.3 m^3/s for a specified portion of an irrigation district. A map is generated which highlights (in color) all pipelines with the requested characteristics and a table will be generated showing all relevant information about the selected pipelines, including: land location, lateral name, ICW number, specific pipeline length, capacity and pipe diameter (Figures 1 & 2).

Segment Location	Lateral Name	ICW #	Length (m)	Capacity (m3/s)	Type Mat'l	Dia. (mm)
NW 17-5-26	2	856	925	2.55	concrete	900
NW 17-5-26	2	856	152	2.55	concrete	1050
NW 30-5-26	2C2	1453	900	0.5	PVC	600
SW 29-5-26	2C2E	1031	70	0.31	Steel	450
SW 29-5-26	2C2E	1031	248	0.31	PVC	450
NE 20-5-26	2C2E	1031	615	0.57	PVC	600
SE 29-5-26	2C6	755	407	0.34	concrete	375
SE 20-5-26	2C6A	876	314	0.34	Poly	400
Total length 4135						

FIG. 2

The United Irrigation District, which was used as the pilot for this project, is now complete. As time permits, information is being collected for all rehabilitation projects within the other districts and placed within the computer database.

The results from the United Irrigation District have been very positive and demonstrate the significant advantages of the computerized system for rapid, accurate data management retrieval. Upon completion, the system is expected to greatly assist the irrigation districts, Irrigation Council and Alberta Agriculture in project management and future planning.

It was originally hoped that this computer retrieval system would be completed and operational within 1-2 years. However, this time-frame has been somewhat revised because of the very large amount of data and shrinking resources within the irrigation and resource management division. With current resources, it is now expected to take 3-5 years for the entire system to be operational.

Once an irrigation district is complete, the operational part of the database and mapping system can be provided to district management for data retrieval and management, providing compatible computer hardware and software is available. It is hoped that each irrigation district will provide update information on a regular basis in order to keep the entire database current.

For more information, please contact Echo McCarley, Head, Computer and Mapping Services Unit, Land Evaluation and Reclamation Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta T1J 4C7. Telephone (403) 381-5906.■

POLY-LINERS DETERIORATE QUICKLY IN SUNLIGHT

Buried polyethylene canal liners exposed to sunlight are an issue of increasing concern and cannot be ignored, says Allan Herbig, P. Eng., section head, irrigation branch. It is all too common to find polyethylene canal liners where the cover has been removed and are now exposed to the sunlight.

Alberta Agriculture staff found that in some cases simply touching or stepping on an exposed liner shattered it; much like the shattering of glass or crumbling of a cookie or cracker, says Herbig.

Mr. Bob Ransom, P. Eng. with Quality Monitoring Services of Spruce Grove, Alberta stated, "The life of poly liners when exposed to direct sunlight will vary from less than one year to five years."

The deterioration of polyethylene liners in sunlight is caused by ultraviolet radiation, the same rays that cause sunburn to our bodies. Canal liners, just like human bodies can be severely damaged by direct sunlight and by reflected rays from the water surface. Liners under water are also affected by UV rays, which penetrate below the water surface.

Ultraviolet rays are invisible, and are made up of three types: UV-A, UV-B, and UV-C. UV-A is the weakest form and is the type responsible for sunburn, skin aging, wrinkles, cataracts and the one that damages outside plastics and paint. UV-B is stronger and is the type most harmful to humans and wildlife, causing cancer and sunburns. Type UV-C is even stronger but fortunately is filtered out by the earth's atmosphere.

Reduction in the ozone layer is also a factor that will speed the deterioration of polyethylene liners. Ultraviolet rays are partly blocked by the atmospheric ozone layer. Thinning of this layer will increase UV-A and UV-B radiation.

Liners that are black in color usually have a UV inhibitor, called carbon black that will extend the life of the liner, while those that are white in color have no inhibitor, and may last only a year when exposed to sunlight.

Once the liner becomes brittle, the value of the liner is lost as a seepage control membrane.

To avoid this very costly loss to canal liners, several steps can be taken:

Allan Herbig, P.Eng., inspects damaged exposed canal liner.

- Regularly inspect canals for evidence of exposed sections of liner.
- Analyze the cause of the original problem. Was it by water erosion on the outside of a curve, rapid drawdown upstream of the control structure, sweepout of a hydraulic jump below a structure, erosion of the bank by field runoff, groundwater uplift of the liner, etc.
- Determine the best method to repair the problem so that it will not happen again. Different causes may require different solutions.
- Repair the problem as soon as possible.

The best longer-term solution to preventing the problem is a strong offence; one where a ditchrider spots a potential erosion problem, reports it to his supervisor and the problem is soon corrected.

For more information please contact Allan Herbig, P. Eng., Section Head, Irrigation Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta T1J 4C7. Telephone (403) 381-5152.■

CWRA/CANCID

Conference
Banff, Alberta
June 16-19, 1993

The Canadian Committee on Irrigation and Drainage (CANCID) is calling for papers. Abstracts of 250 words should be sent immediately to Dr. David Manz, University of Calgary, Department of Civil Engineering, 2500 University Drive N.W., Calgary, Alberta, Canada T2N 1N4. Telephone (403) 220-5503. Fax (403) 282-7026.■

SMALL HYDRO POWER DEVELOPMENT COMES OF AGE ON IRRIGATION STRUCTURES

The main ingredient is water, says Dale Miller, P. Eng. of UMA Engineering Ltd. The recipe includes flowing water, a drop in elevation and a machine to capture the water's kinetic and potential energy. The result is electrical energy. Southern Albertans are "eating it up" with growing enthusiasm, says Miller.

The system of canals and reservoirs has been in existence for a number of years, but it was the enactment of the Small Power Research and Development Act in 1988 that guaranteed long-term prices and a market for small power producers. Simply put, says Miller, it was not economical until provincial enactment of this Act, which provides a guaranteed long-term price and market for small power production. Energy price options are either 4.64 cents per kilowatt hour (1990) inflated with the Consumer Price Index or 5.2 cents per kilowatt hour increased to 6.0 cents after 1994, adds Miller.

Small hydro uses a naturally renewable fuel – Water. Integrated with the existing canal and reservoir system, it has little negative environmental impact. It requires little maintenance over its lifespan, typically over 50 years. It is a proven technology and the engineering expertise is available locally. And above all, it can produce significant revenue for the owners and investors, adds Miller.

The theoretical Power equation, $P = Q \times H \times e \times 9.81$ where:

- P = Power (kilowatts)
- Q = Flow (cubic metres per second)
- H = Gross Head (metres)
- e = Plant Efficiency

demonstrates that the two most important components in the calculation of available energy is head and flow. These are, therefore, the most important consideration in selecting a site, says Miller.

Today five hydroelectric facilities are either operating or being constructed within the irrigation infrastructure existing in southern Alberta. They include:

Belly River Plant	2.5 MW (1990)
Waterton Hydro Plant	2.4 MW (1992)
St. Mary Reservoir Plant	2.0 MW (1993)
Chin Chute Hydro Plant	11.8 MW (1994)
Raymond Reservoir Plant	20.5 MW (1994)

Getting approval to build a small hydro power facility is a long drawn-out affair that takes time and patience, says Jim Brown, manager, St. Mary River Irrigation District. For us it was a 14 step process that took place over 3 years. It became very frustrating at times.

PHOTO: JAYLYN DESIGNS LTD.

Belly River Hydro Project

The potential for other developments on southern Alberta's canal systems exist, says Miller, including facilities with a potential of greater than 1 MW installed (estimated) at:

	Estimated
Oldman River Dam	+35.0 MW
Taylor Chute	20.0 MW
Bassano Dam	3.0 MW
BRID Headworks Drop 2	1.3 MW
BRID Headworks Drop 3	1.3 MW
McGregor/Travers	2.5 MW
Chestermere (WID)	15.5 MW
Langdon Drop (WID)	1.3 MW
Gleichen Drop (WID)	2.0 MW
Secondary B Drop (EID)	1.5 MW
Springhill Turnout (EID)	1.4 MW
Bantry Canal Inlet (EID)	1.6 MW
Lake Newell Inlet (EID)	2.1 MW
Drop #3 (BRID)	1.2 MW
Drop #5 (BRID)	1.2 MW
Drops #5 and #7 combo (BRID)	1.8 MW
Drop #1 (SMRID)	2.7 MW
Drop #15 (SMRID)	3.0 MW
Misc. drops (SMRID)	30.0 MW

So what about the future, questions Miller. As coal fired production (91% of Alberta's current total capacity of 734 MW) is expected to decrease its market share due to environmental concerns, small hydro development is a favorable position to meet Alberta's growing electrical needs.

For more information please contact Dale Miller, P. Eng., UMA Engineering Ltd., 514 Stafford Drive North, Lethbridge, Alberta T1H 2B2 at telephone (403) 329-4822; or Jim Brown, Manager, St. Mary River Irrigation District, Box 278, Lethbridge, Alberta T1J 3Y7 at telephone (403) 328-4401.■

A NEW MATERIAL FOR REPAIR OF CRACKED CONCRETE

Almost since the first concrete slip-form lining was placed in a St. Mary River Irrigation District (SMRID) lateral back in 1959, cracking has been a major problem in approximately 300 km of lined channel. Various repair methods and products have been tried. Some have experienced fair success but are costly while others were a complete failure.

A new product currently under test for the past year and a half by the SMRID and the irrigation branch looks very promising, says Svat Jonas, P. Eng., research engineer with the irrigation branch.

Installed as a surrogate liner, Teranap 431 TP (distributed by Siplast Canada Inc.) is a 4 mm thick modified membrane reinforced with polyester. It is manufactured in 2 m x 20 m rolls and is actually made by modifying Styrene-Butadiene-Styrene. Jonas states that it is an asphalt based product which behaves more like rubber. It has good elastomeric properties along with improved thermal properties and an ability to withstand joint movement. Teranap has been used extensively in Europe since the mid 70's. It has been used in installations such as containment ponds, lagoons, embankments and canals.

Alberta Agriculture and the SMRID invited Siplast Canada Inc. to install a short section of this material in the SMRID Six Mile Lateral. A test section 38 m long was installed in early April of 1991.

Installing the membrane was fairly simple says Jonas. The existing concrete ditch (600 x 780 mm) was power washed with a high pressure washer and all debris removed. The concrete liner was cut at the upstream end and the new liner folded into this cut and grouted in place. It was torch heated and bonded to the upper sides of the canal. A trench 300 mm deep was excavated into the berm on both sides of the canal and the leading edge of the Teranap liner was terminated in the trench. The downstream end of the Teranap liner was torch bonded to the concrete for approximately 600 mm.

In October 1992, approximately 1.5 years after installation, a careful inspection of the liner was made, says Jonas. There were no signs of damage caused to the liner by the concrete shifting or cracking. The concrete in the test section is cracked and movement of the concrete slabs is up to 50 mm.

NOTE: Darkened area where Teranap 431 TP was bonded to concrete.

The Teranap liner showed shallow hairline cracking on the north bank of the canal, where it was exposed to sun. The cracks were only superficial and did not weaken the liner itself. A 300 mm x 300 mm sample was cut from the north bank liner and sent for testing. The removal proved to be difficult as the Teranap was so well bonded to the canal sides, says Jonas.

The specification sheet for Teranap 431 TP indicates the resistance to tearing for this material should be no less than 18 deca newtons per centimetre (daN/cm) in a longitudinal direction and 12 daN/cm crosswise. The results after 1.5 years in the field showed 24 and 18 daN/cm respectively. Elongation to tearing is listed as a minimum of 50% in both directions. The test shows 63% and 69% respectively. These results indicate that the material, although not tested before the installation, still possess properties quite a bit above the minimum specifications, says Jonas.

In conclusion, says Jonas, the Teranap 431 TP material and installation costs are about $10.75 per square metre. Jonas feels that the product holds promise as a good and viable re-lining material for cracked concrete lined canals, but may, in future, be used as an exposed liner for earth ditches.

For more information please contact Svat Jonas, P. Eng., Research Engineer, Irrigation Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta T1J 4C7. Telephone (403) 381-5870 or Dan O'Neil, Siplast Canada Inc. Telephone (403) 235-4667.■

IRMAA BBS UPDATE

The possibility exists in the near future that the Irrigation and Resource Management division Alberta Agriculture Bulletin Board System (IRMAA BBS) will terminate as an on-line service, says Pat McIlhargey, systems analyst, irrigation branch. How will the termination of the service effect you? If you have used the service, what changes could be made that would increase your frequency of use? If you have not used the service, what changes could be made that would prompt you to use the service?

The IRMAA BBS is a computerized system designed to provide access to information relevant to the irrigation community. The IRMAA BBS is targeted for the general irrigation community with farmers, irrigation district staff, agribusiness, consulting firms and Alberta Agriculture staff as potential users.

The IRMAA BBS information (bulletins) consists of four main areas:

1. Events Calendar
2. Water Supply Outlook and Climatic Information
3. Division Information Package
4. Other Miscellaneous Information

Users can display information to the screen or information can be downloaded to the user's system for browsing offline.

Requirements for the use of the IRMAA BBS are an IBM PC, XT, AT, PS/2 or compatible with one floppy disk drive, a 300/1200/2400 baud modem connected to a standard telephone line, and a PC communications software package (e.g. ProComm).

The IRMAA BBS current hours of operation are 24 hours per day, seven days per week. The access telephone number is (403) 329-0286.

If you have any questions or comments please contact Pat McIlhargey, Information Systems Analyst, Irrigation Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta T1J 4C7. Telephone (403) 381-5855.■

STRIVING TO GET THE MOST OUT OF THE WATER DELIVERED

With the "well" running dry for most irrigation districts, every effort is being made to "stretch" diverted water supplies as far as possible. Twenty plus years of significant rehabilitation work has done wonders, but other options, especially at the farm level, hold some opportunity for improvement.

The historical percentage of return flow from irrigation districts has been one area where the districts have come under increased scrutiny and criticism. The operational characteristics of both the district infrastructure and on-farm irrigation systems contribute to the return flow. Not only does on-farm tailwater spill contribute to the return flow but it also creates problems when diverted into road ditches causing soft shoulders, increased frost damage and silted-in ditches.

Approximately 20% of the irrigated area in Alberta is irrigated by gravity irrigation. With increasing capital and energy costs for sprinkler irrigation, surface methods that are more conducive for the production of some crops will continue to be viable practices. Unfortunately, surface, or "flood" irrigation as it is poorly referred to, is commonly perceived to be an inefficient methodology. However, the inefficiency usually lies with the management of the system rather than the method itself. (Sprinklers can be very much the same!)

Surface irrigation is more complex than one might initially believe. A relatively fixed water supply is applied to a wide variety of field shapes, slopes, soil types and conditions with the objective of achieving uniform application without excess tailwater runoff. Properly developed and managed surface irrigation has a potential application efficiency of 80% or better, but unfortunately is typically operated, on average, at approximately 50%. When surface irrigation is used effectively, efficiencies can exceed 90% with very low labour and power requirements (Merriam, 1981). The extent of tailwater is largely controlled by how far back from the lower end of the field the water has advanced when the applied stream is cut off. Up to 10% of the applied volume is a reasonable tailwater amount. For surface irrigation, only four elements are adjustable, and the last of these is often not practical. They are stream size, duration of time water is applied, distance of water advancement at cut off and length of the field.

Surface irrigation operators tend to make physical changes to enhance system operations such as land levelling, but lack the desire to make corresponding management changes such as set times and an increase in irrigation frequency due to inconvenient labour requirements.

"Top of field" automated water control means increased water use efficiency and decreased labour.

A considerable amount of research to reduce on-farm tailwater has been ongoing in the United States because of their high profile needs in the water management area.

One method to reduce excess runoff is Tailwater Recovery which has been funded and implemented by the Imperial Irrigation District, California. The purpose was to evaluate the on-farm technical and economic feasibility of reducing tailwater flows over a five year period. Among the objectives of this program was to increase irrigation efficiency and conserve water. The results included a 12% potential savings of delivered water. However, the estimated capital cost of a pump-back system was approximately $480.00/acre (1990 U.S. cost basis) with an annualized capital and capital/maintenance cost of about $70/acre (1990 U.S. cost basis).

A perhaps less costly and more practical solution for Alberta is automated surface irrigation. By this method, greater control of water use is achieved at the source rather than at the problem end without increasing the on-farm labour. Many of these systems have been developed and promoted in the past but without gaining widespread acceptance. Automation can provide surface irrigation operators an alternative from switching to higher capital and energy consuming sprinkler systems while achieving a more effective and efficient system with lower labour inputs. Lack of private sector promotion is a primary reason for lack of innovation in surface irrigation. The only recent exception has been the private development and promotion of automatic irrigation valves for gated pipe where the controller on the valve can be preset to desired irrigation times. Therefore, a field with inconvenient set times can be automated and as a result the irrigator's time and labour is decreased while maintaining a high application efficiency and minimizing the tailwater amount.

The alternative to gated pipe is to automate the existing head ditch used to convey the water to each field strip. In the past two decades, a considerable amount of research on prototypes has been developed. However, much of the equipment has been either expensive, operationally clumsy or limited in field adaptation. Among the best alternatives have been check gates and turnout gates that are controlled by digital timers, leading to the sophistication of "Surge" irrigation which is quite equipment intensive.

For every two irrigated acres where the efficiency is increased from 50% up to 75%, one more acre, essence, could be added to the irrigated and supported by limited water supplies. In addition there would be reduced negative off-farm soil and water resource impacts. Without private sector involvement, promoting and designing improved surface irrigation systems is left to public sector agencies such as Alberta Agriculture and possibly even Irrigation Districts. The key step toward system improvement within this decade is the greater use of automated equipment and controls to provide greater convenience for the irrigator to control his labour and irrigation efficiency. As the irrigator gains, so may irrigation districts and local authorities.

For further information on proposed demonstrations or the locations of existing automated systems, please contact Gregory Snaith, P. Eng., Irrigation Specialist, Alberta Agriculture, Brooks, Alberta T1R 0E9. Telephone (403) 362-1212.■

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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Alberta
AGRICULTURE