the WATER HAULER'S BULLETIN

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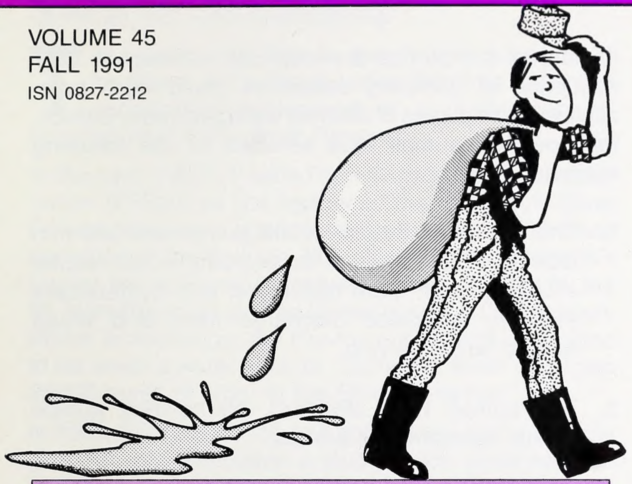


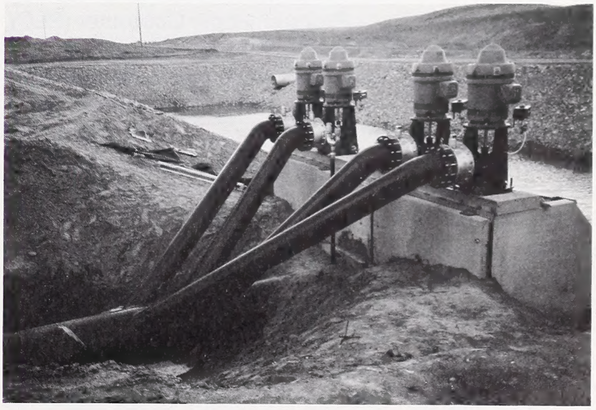
IN THIS ISSUE:

LATERAL M BIG BEND LOW PRESSURE PUMP SCHEME

One of the most difficult canals to rehabilitate in the Taber Irrigation District (TID) in recent years was the downstream reach of Lateral M in the Big Bend area. Lateral M was originally constructed in the early 1950's says Kent Bullock, manager of the district. The topography in the area is rolling and the soil is very sandy. The lateral was a contour ditch, constructed on the side hills and seepage from it affected adjacent land. The lateral was lined with a buried polyethylene liner around 1960 says Bullock, but has deteriorated over the years.

The upstream reach of the lateral was rehabilitated by relocating it on parcel boundaries and installing a buried polyethylene liner with gravel armour on the inside slopes. The topography for this reach of the lateral was flatter than for the downstream reach.

The downstream reach of Lateral M Big Bend was 4.1 km long. Bullock says that ''Because of the extremely rolling topography of the area, the costs would be prohibitive to relocate it in an open channel along parcel boundaries with deep cuts and high fills. Initially it was considered to re-line and gravel armour the canal in its existing location. However, because of the significant severance caused by the lateral and the district's policy



TID Lateral M's 40 Hp vertical turbine pumps.

to not allow the ditches to be sprinkled by irrigation equipment crossing them, it was decided that the long-term solution was to install a pipeline."

The existing lateral, states Bullock, was constructed on a very flat gradient and, therefore, a large gravity pipeline would have been required. There is a potential of 1478 acres to be served with a required capacity of 0.76 m^3/s (27 cfs). The gravity pipeline would have required a starting concrete pipe of 1.37 m diameter. Cost of the pipeline, settling reservoir and 2.3 km bypass spill ditch to Fincastle Lake was estimated to be $1,254,000.

Instead of going with the gravity pipeline, the district chose to go with a low pressure pipeline in order to reduce pipe size. This was accomplished, says Bullock, by installing 4-40 Hp vertical turbine pumps designed to pump the 0.76 m^3/s (12,150 US gallons/minute) at a total dynamic head of 10.6 m. The low pressure pipeline consists of various sizes of 100 psi PVC pipe starting with 760 mm diameter CIOD pipe and reducing down to 450 mm diameter IPS pipe. The cost of this alternative including the pumps, controls and installation of 3-phase electrical power was $886,000; a savings of $368,000 over the gravity pipeline alternative. The 14% savings (district's share of costs in the Irrigation Rehabilitation and Expansion Program 86% - 14%) to the district is $51,520. The interest on this money, when invested at a rate of return of 10%, is expected to nearly pay the energy costs to operate the pumps. In 1991, the interest would have been more than five times the cost of the power; however, this was a very wet year. The district also believes that PVC pipe will have a longer life than concrete pipe and with less maintenance, adds Bullock.

A unique feature of this pipeline, says Bullock, is that it can operate up to 40% of capacity by gravity flow. There is an insertion magnetic flow meter at the head of the pipeline just downstream of the manifold pipes from the pumps. The flow meter transmitter produces a 4-20 mA signal that is used by a Program Logic Computer (PLC) to sequence turning on and off the pumps as they are needed. There are five bays in the inlet structure with the two outside bays on each side for the pumps which are manifolded into the main pipeline. In the center bay there is an electrically actuated 500 mm diameter butterfly valve to the main pipeline. The butterfly valve is open for gravity flow until the pipeline reaches 40% capacity and then the PLC turns on the first 2 pumps in series (with about a 5-second lag time) and then closes the butterfly valve. When the water demand reaches 65% of capacity, pump #3 comes on and at 90%, pump #4 starts. The reverse process takes place as the water demand drops off. Coming down, the set points to shut the pumps off are programmed into the PLC at 5% less flow to prevent a pump from turning on and off with small variations in flow.

The transmitter for the flow meter, the PLC and all of the other electrical controls are housed in a metal building.

All four of the pumps are identical. Although a finer sequence of pumping capacities could have been achieved with pumps of different capacities, says Bullock, four identical pumps were selected for the following reasons:

1. The discharge heads for the pumps are 305 mm diameter cast heads. A larger pump would require a larger, much more expensive, less hydraulically efficient, fabricated discharge head and would require larger valving.

2. The pumps were standard, off-the-shelf pumps versus special-order pumps.

3. The district has to have only one set of replacement parts in inventory.

4. It simplifies operation and reduces the complexity of the system.

5. If one of the pumps breaks down, the remaining three pumps in the system are capable of pumping 90% of the design capacity.

The low pressure pipeline alternative was selected entirely for the short and long-term benefit of the district and not for the benefit of the individual farmer. Bullock says, at various times and especially at the top end of the pipeline, the landowners will benefit from the water pressure in the pipeline. However, this pressure will not be high nor will it be constant or continuous. At low demand on the system and under gravity flow, the user on the end of the line will benefit most; however, at high demand on the system and with pumps running, the user at the head of the pipeline will receive the most pressure. Because none of these pressures will be significant and the farmer will still have to operate his own pump, there will be no additional charge for the water, concludes Bullock.

For further information please contact Kent Bullock, P. Eng., Manager, Taber Irrigation District, P. O. Box 129, Taber, Alberta T0K 2G0. Telephone (403) 223-2148. ■

FROM THE FARM PERSPECTIVE:

Striving For Self-Sufficiency

The above sub-title is the theme adopted by members of the Blood Indian Band as they have undertaken development of a major block of irrigated land within their Reserve.

In the early 1950's Prairie Farm Rehabilitation Administration (PFRA), as the builder of the St. Mary's River Project, acquired a right-of-way for the construction and operation of the Belly-St. Mary Canal across Canada's largest Indian Reserve, including lands affected by the St. Mary Reservoir and the United Irrigation District headworks. In exchange, the Province of Alberta committed to set aside a water right for "sufficient water to irrigate 25,000 acres of land on the Blood Reserve."

In 1983, the Blood Tribe and the federal and provincial governments completed a study which confirmed the technical and economic feasibility of irrigating 25,000 acres, primarily within the "Big Lease" area of the Blood Indian Reserve.

Negotiations between the Blood Tribe, Alberta and Canada culminated in the signing of a formal Tripartite Agreement on February 24, 1989 for development of the project.

Total costs for the 25,000 acre irrigation project are estimated at $60.0 million over a 12-year development period. The Agreement provides for the federal and provincial governments to each contribute $15.5 million towards the cost of the project, with the Blood Tribe providing the remaining $29.0 million over the 12-year period of the Agreement. Canada, through PFRA, is providing the project management including the engineering investigations and design, contract preparation and construction management.

As shown in Figure 1, the source of water for the project will be the Belly-St. Mary Diversion Canal. The headworks include: a turnout structure on the canal, a 20 km canal along "Mokowan Ridge" and a 6,000 dam^3 internal storage reservoir north of Mokowan Ridge. The distribution system includes a 15 km "Header Canal" from the Mokowan Ridge Reservoir to the Big Lease area with water delivery to the irrigable fields by laterals and pipelines. The entire system will be gravity fed.

The construction costs for the various components are estimated as follows:

Headworks	$11,500,000
Distribution System	$23,700,000
Infrastructure (right-of-way, drainage system, roads, electrical grid)	$ 5,900,000
On-Farm Development (irrigation & farming equipment)	$19,300,000

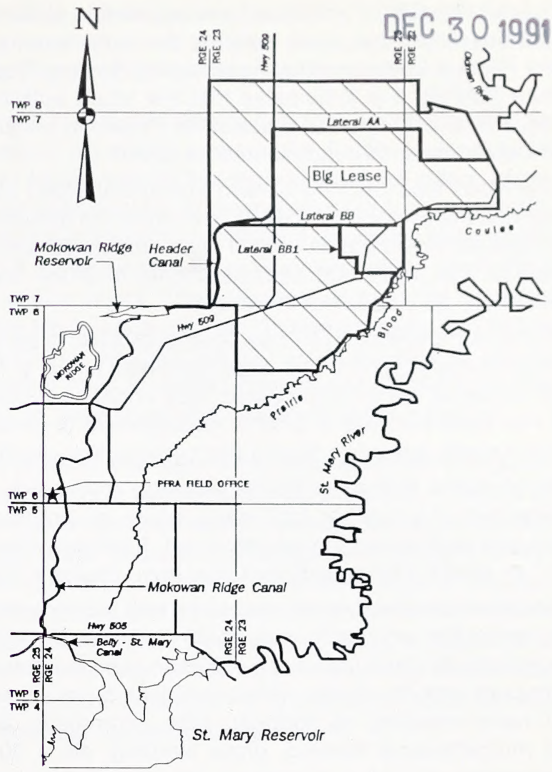


Figure 1

BLOOD TRIBE IRRIGATION PROJECT

The Blood Tribe Irrigation Project is directly managed by a Tripartite Committee consisting of officials of Canada as represented by the Department of Indian Affairs, Agriculture Canada and the Native Economic Development Program, the Government of Alberta as represented by Alberta Agriculture and Alberta Environment, and senior representatives of the Blood Band.

The function of the Tripartite Committee is to oversee the implementation of the Agreement to fund and build the Blood Tribe Irrigation Project. The committee has two subcommittees to assist in managing the broad range of activities associated with the Project. They are the Implementation Advisory Committee (IAC) and the Environmental Advisory Committee (EAC).

In addition, several project subcommittees operate to advise the IAC on parameters such as technical design, project operation and maintenance, as well as project on-farm management. A good number of participants from a variety of associated disciplines act as active members on these subcommittees, including representatives of private industry and irrigation districts.

Overall, the EAC's activities have assisted in ensuring that the project has been meeting the requirements of the Federal Environmental Assessment Review Procedure (EARP). It is anticipated that the future activities of the EAC will continue to assist the Project in meeting the environmental requirements of EARP.

The Blood Tribe has incorporated a company, Blood Tribe Agricultural Project Inc. (BTAP), to oversee construction, to operate the irrigation project once completed and to ensure that significant benefits accrue to Blood Tribe Members as a result of the project.

Since its inception, BTAP has been busy setting up the internal management and organization required to fulfill its role as owner of the Blood Tribe Irrigation Project. It has been involved in project management to ensure the smooth operation during the construction phase.

Blood Band human resource planning took place to determine the number, type and training requirements of future staffing over the next ten years. A feasibility study for an alfalfa cubing plant has also been implemented.

Construction over the last year and a half has included: a) excavation and armouring of 20 km of canal - 85% complete; b) construction of 4 of 6 main canal reinforced concrete drop structures - 80% complete; c) installation of canal crossing of Highway 509 - complete; and d) miscellaneous fencing, grass seeding, etc. - 50% complete.

The method for contracting out work is by invitational tender. All contractors are required either to be Band members or have an identifiable business association with a Band member. In addition, contractors are required to hire a minimum of 75% of their workforce from the Blood Reserve, with preference given to contractors providing Blood Tribe member participation over and above the 75% level. As a result of these stipulations and the fact that the many individual contracts let allow for generous construction periods, the construction skill levels of Band members have had an opportunity to mature.

Upcoming construction will include: the main Belly River-St. Mary Canal turnout structure, the remaining canal drop structure, the reservoir inlet chute and retention embankment, and the initial reaches of the "Header Canal" and lateral system. The timeline on the final construction of the primary works is for first irrigation of 2,500 acres in 1994 and a further 2,500 acres in 1995, the first steps in "striving for self-sufficiency"!

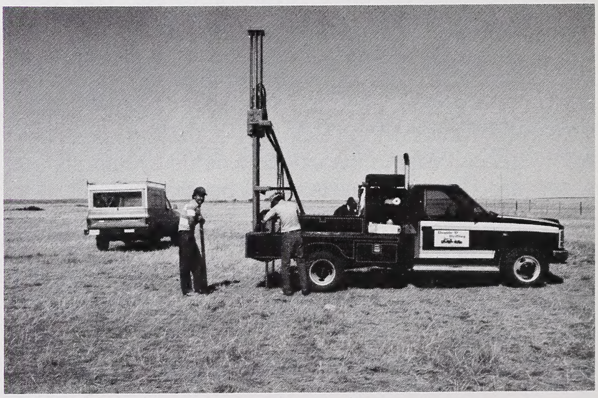
For further information/discussion, contact Wally Chinn, Head, Irrigation Development Section, Irrigation Branch, Alberta Agriculture, Agriculture Center, Lethbridge, Alberta T1J 4C7. Telephone (403) 381-5864. ■

LAND CLASSIFICATION – A KEY TO SUSTAINABLE IRRIGATION DEVELOPMENT IN ALBERTA

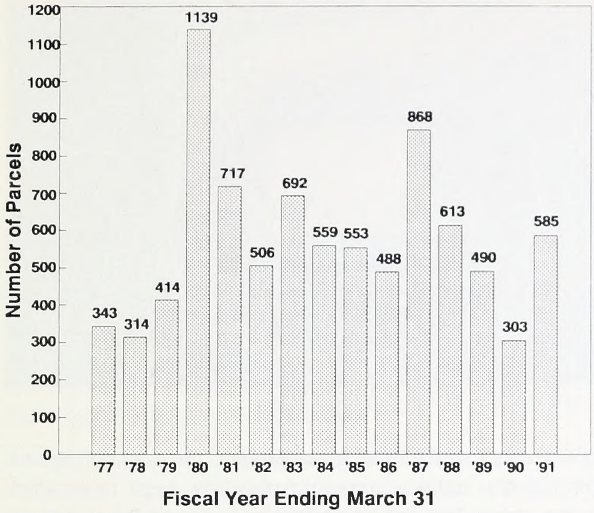
Appropriate standards for irrigation land classification are essential to ensure the orderly development and responsible management of land and water resources in Alberta. Limited water supplies, the potential for environmental degradation and the high costs associated with irrigated agriculture, have necessarily resulted in the development of standards that set out the minimum requirements for land to be considered suitable for irrigation.

The Irrigation Act stipulates that land within irrigation districts must be classified "irrigable" before water rights may be granted and the parcel may be added to the assessment roll of an irrigation district. Land classification for irrigation is also an essential input to the agricultural feasibility report that is required under the Water Resources Act for the licensing of private irrigation projects that divert water from sources outside the works of irrigation districts.

Irrigation Council adopted the first set of land classification standards in 1969. These standards were revised in 1983, in light of current irrigation practices and recent research findings. The minimum requirement with which land must comply in order to be considered suitable for irrigation was initially identified as Land Class 4 in the 1983 standards. Irrigation Council adopted a change to the land classification standards in 1990, wherein the minimum requirement for irrigation was amended to include Land Class 5R – land that is undergoing reclamation after the implementation of an appropriate improvement such as drainage or canal rehabilitation.



Soil profile description and sampling.



(FIGURE 1). Statistics from the past one and a half years indicate that about 70 percent of the parcels investigated have been classified as suitable for irrigation.

The same standards utilized to evaluate land being considered for irrigation development are used for reclassification of land that is undergoing reclamation.

The irrigation land classification process includes a systematic assessment of the general capability of land for sustained irrigation and is based on the nature and degree of both permanent characteristics, such as profile development and soil texture, and changeable characteristics, like soil salinity and water-table depth. Assignment of a final land class includes prediction of potential changes to characteristics such as soil salinity or water-table levels that may result from irrigation.

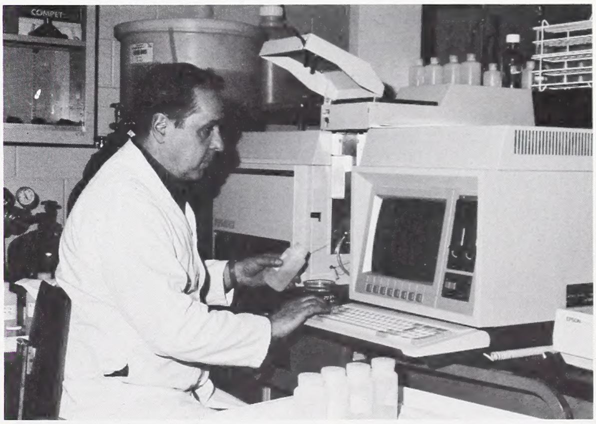
Land classification in Alberta has served to exclude land from irrigation development that has relatively low, long-term productive capability or increased potential for deterioration under irrigation. A consistently high level of crop production is needed to meet the high capital and operating costs related to irrigated agriculture. Low productive capability of marginal land, or a high degree of variability in yield, greatly increases the economic risks associated with crop production under irrigation. Development of marginal land for irrigation also increases the on-farm and off-farm environmental hazards to land and water resources and minimizes the benefits to the individual farmer and to the rest of society.

Classification of land for irrigation has been used extensively in Alberta for water allocation and irrigation system planning on an individual parcel and a project basis. More than 8500 parcels (quarter sections or parts thereof) have been classified over the past 15 years for allocation of water rights or for use in granting a water license.

Land resource inventories, conducted on a broad scale on about 5.5 million acres in the South Saskatchewan River Basin, indicate that approximately 3.5 million acres, or about 64 percent of the investigated area, is suitable for irrigated agriculture. Irrigation expansion limits for the South Saskatchewan River Basin have been set at about 1.7 million acres. The assessed acreage for irrigation within the irrigation districts is presently about 1.15 million acres, with another 250,000 acres irrigated in private irrigation projects, leaving a balance of 300,000 acres that may be developed with projected water supplies.

The availability of water is the major limitation to irrigation development in southern Alberta. Evaluation of land prior to irrigation development promotes wise use of Alberta's limited water resources, increases the chances for a high level of crop production under a wide range of management practices, and minimizes the environmental hazards to land and water. Land classification is expected to continue to play a key role in ensuring responsible management of Alberta's land and water resources and in fostering sustainable agriculture.

Land classification for irrigation is subject to a fee that is based on the number of acres classified. More information concerning land classification for irrigation in Alberta is contained in Agdex 560-2 (August, 1991), or may be obtained from Rod Bennett or Frank Hecker (381-5121), Land Evaluation Section, Land Evaluation and Reclamation Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta T1J 4C7. ■



Lab supervisor, Stan Smetana, operates atomic absorption spectrometer to analyze soil extracts.

GALVANIC VOLTAGES AND DATALOGGERS

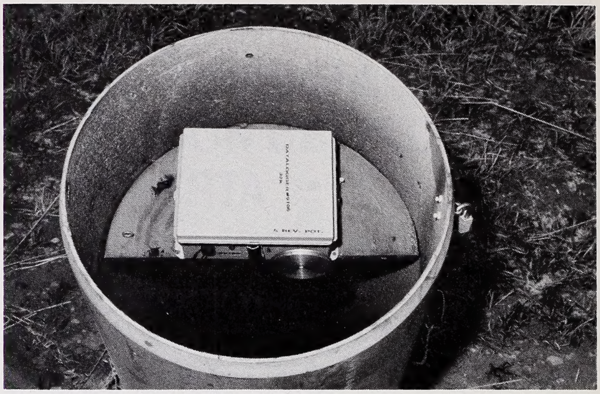
Update

This is an update to the article "Electronic Dataloggers Fail in Steel Recording Wells," Volume 38, Winter 1990 of the Water Hauler's Bulletin. It was noted in that article that the dataloggers were failing because galvanic activity around the corrugated metal wells was causing a flow of current to the datalogger. The recommendation was to avoid use of metal wells for electronic dataloggers.

During the last irrigation season, says Don Roth, hydrometric technologist, irrigation branch, Alberta Agriculture, we experienced a similar type of failure as reported earlier but, this time, in PVC wells. The electronic dataloggers were subject to interruption of readings, loss of data and even complete failure. This was probably due to an electric potential causing a current flow to the dataloggers. However, there was no corrugated metal well to conduct electricity. If there was a current, how was it reaching the datalogger, questions Roth.

Roth says the puzzling question was solved by some very radical thinking. The problem was discovered only on a few of the 40 stations he has in the field. We surmised there was an electrical potential between the water and the PVC well or the soil. How can there be a potential between the water and the soil or the PVC well when they are in constant contact? We do not know, says Roth, but this is what we discovered. By use of an electronic meter we detected an electrical potential of 0.2 to 0.8 volts between the water and the canal bank (earth) and between the metal pulley of the datalogger and the body

Typical Alberta Agriculture PVC recording well.



Inside view of well with datalogger in place.

of the datalogger. This apparently is enough voltage to disrupt the datalogging and damage most integrated micro chips. The voltage varied from day to day and from station to station.

Roth speculates that the cause of the stray voltage is probably tied to the mineral content of the water and the development of a very primitive galvanic cell. The mineralized water is the electrolyte and the soil and PVC well providing the simple anode and cathode, he states.

We may not know the total cause of the problem, says Roth, but we do know how to avoid it. By installing a plastic connection from the float to the steel cable, we isolated the water from the pulley of the datalogger and the problem was solved. There are probably several simple methods to solve this problem, he adds. Two of these are: install a plastic bushing to insulate the pulley from the datalogger or install the datalogger in a metal box. The metal box protects the datalogger by dissipating any stray voltage and current. We have not experienced this problem with any of the newer dataloggers that are installed in metal boxes, he concludes.

For more information please contact Don Roth, Hydrometric Technologist, Irrigation Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta T1J 4C7. Telephone (403) 381-5875. ■

INTERCEPTOR DRAINAGE

Drainage Scheme May Extend Life of Concrete Lining

Concrete slip-form lined laterals and high groundwater levels don't complement one another very well in southern Alberta. It's not that water and concrete don't mix, but when the water in the ground freezes and expands against the concrete, things begin to happen. The unreinforced concrete eventually gives way and cracks. Come spring, the heaved concrete slabs settle back but the large cracks remain.

A study undertaken by Underwood McLellan Ltd. in 1980, inventoried and inspected concrete lined canals in southern Alberta in hope of finding a solution to the cracking problem. One of their findings was a possible correlation between soil moisture and cracking severity. Further follow-up work by Alberta Agriculture indicated that if the water table could be maintained at a level of 0.5 m below the bed of the concrete lining, it may extend the life of the concrete.

The Taber Irrigation District (TID), in an attempt to try and extend the life of Lateral #1 near Barnwell, has installed along the outside toe, a buried perforated polyethylene drain. The drain, says Ron Hadden, P. Eng., district engineer, picks up the seepage that passes through the cracks in the concrete liner. Minimum burial depth is one metre below the concrete bed. A polyester sock and gravel filter was also installed around the drain pipe, he adds.

There was approximately 19.5 acres of land affected by seepage along both sides of the lateral. Due to the lay of the land, one drain was constructed from the south and west and the other from the east. The drain from the south and west has a total length of 434 m on a slope of 0.0022 while the east drain is 271 m long and has a slope of 0.0015. The two drains outlet into a corrugated metal manhole containing a submersible pump which operates on a float system. The water is then pumped back into the lateral. Operation of the pump will conclude with freeze up.

The district felt at the time of construction that, because of the moderately coarse-textured soils that the concrete lateral was constructed on, the seepage water would migrate to the drain even though it was constructed on just one side.

It would appear, says Hadden, that our assumption was correct and the evidence has shown up in this first year of operation. With the tile drain installed on the south side

Portable pump at manhole (picture taken before submersible pump was installed).

of the canal, the water user on the north side, who did not farm some of the land because of the seepage, has broken the land again and put the land back into production.

The engineering department monitored the drainage system through the operating season. Included were: the start and stop time of the pump, filling time of the manhole, any irrigation being done in the adjacent fields, rainfall and depth of water in the canal. On one particular day, says Hadden, the flow rates in the drains were measured and calculations indicated a flow of 2.59 USGPM (US gallons per minute) from the east line and 12.67 USGPM from the west line.

Hadden feels there may be more than one contributor to the high water table. There appears to be some correlation between the depth of water in the canal and the filling time of the manhole which would indicate that the water is coming from the canal. In addition, there also appears to be a correlation between irrigation on the adjacent fields and the filling time of the manhole. This may suggest that the farmers themselves are contributing to the seepage problem, he concludes.

This fall, the TID installed water-table wells which will be monitored to see if any further information can be concluded.

One thing is for certain, says Hadden, the water users involved with the project are very happy with the results of the interceptor drain and the TID feels that the $29,700 spent through the Irrigation Rehabilitation and Expansion program was money well spent.

For more information please contact Ron Hadden, P. Eng., District Engineer, Taber Irrigation District, P. O. Box 129, Taber, Alberta T0K 2G0. Telephone (403) 223-2148. ■

IRRIGATION BRANCH APPOINTMENTS

Mr. Brian Colgan, director of the irrigation and resource management division, is pleased to announce the appointments of Larry Spiess, P. Eng. (branch head) and Allan Herbig, P. Eng. (section head) to vacancies in the irrigation branch.

Irrigation Branch Head

Larry Spiess is the new head of Alberta Agriculture's irrigation branch filling a vacancy left with the retirement of Akos Pungor. Spiess has 25 years experience with the department's irrigation branch, starting as an irrigation specialist in Brooks in 1966. As acting branch head since April, Spiess has already had first-hand experience with his duties.

"These are most challenging times for the branch. So many critical issues are coming to the fore – soil and water conservation concerns and irrigation efficiency, the potential for and challenges of diversification in irrigated agriculture, the limitations of irrigation expansion and public debate on irrigation developments," he says, adding, "Perhaps the biggest challenge will be helping the public understand how irrigation is tied into the whole fabric of life in southern Alberta. It's for much more than crop production. Irrigation canals and reservoirs provide water for domestic, municipal and industrial users, for recreation, and even for significant commercial fishing."

As branch head he will be responsible for providing leadership in planning, implementing, coordinating and evaluating province-wide irrigation management, development and rehabilitation programs. He will also provide irrigated agriculture's input on a wide range of complex soil and water issues including long-range planning, irrigation feasibility and river basin planning.

Most recently Spiess spent the last three years as research, planning and monitoring section head in the branch. He was also irrigation systems specialist in Lethbridge for 16 years and was involved in applied research in a variety of on-farm irrigation systems.

Originally from southwestern Saskatchewan, Spiess holds a BSc in agricultural engineering from the University of Saskatchewan and a MSc in the same discipline from Montana State University.

Spiess can be contacted in Lethbridge at telephone (403) 381-5140.

Section Head

Allan Herbig is the new head of the research, planning and monitoring section. He has a wealth of experience in the irrigation field dating back to 1967. The section will benefit from his experience as: a design and construction engineer, irrigation district manager, irrigation on-farm specialist and researcher.

Herbig grew up on a ranch near High River. He obtained both a BSc and MSc in agricultural engineering from the University of Idaho.

Herbig looks forward to the time when our irrigation industry will be upheld by the public as an excellent example of wise and sound water management (providing food for our people and an infrastructure for a diversity of uses and spin-off industries). He believes that as we address legitimate environmental concerns, provide leadership in conservation measures and develop innovative public relations strategies, we will be recognized as a friend of the people.

Herbig can be contacted in Lethbridge at telephone (403) 381-5152. ■

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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