the
WATER HAULER'S BULLETIN

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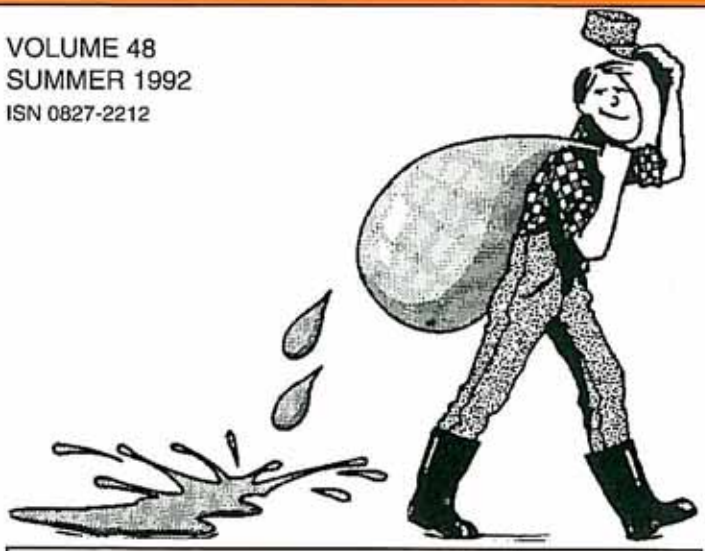


IN THIS ISSUE:

SINGLE DELIVERY FLOW MEASUREMENT DEVICES TESTED

Research Results Available

A recently published research study funded by the Farming For the Future Program has produced some interesting conclusions after three years of reviewing, selecting and testing flow measurement devices suitable for use on individual irrigation farm turnouts. The study was jointly undertaken by Alberta Agriculture and MPE Engineering Ltd.

Two meter categories were considered: open channel flow meters and inline flow meters. Three categories of open channel flow meters were investigated: fixed sill meters, constant head orifice meters and miscellaneous meters. The fixed sill meters include the Cipolletti Weir, Broad-Crested Weir, Sharp Crested Weir, Cutthroat Weir and Parshall Flume. The second category of meters includes the Constant Head Orifice Meter and Vortex Flow Limiter. The third category of meters includes the Vane Flow Meter, Floating Weir Gate, and the Dethridge Meter.

Inline flow meters consist of Magnetic, Doppler, Propeller, Impeller and minor variations of these types of meters. These meters were investigated for reliability,

The Broad-Crested Weir received the highest rating of the five tested.

Dethridge Meter.

cost and apparent suitability for flow measurement at farm turnouts.

In order to make a fair comparison between the open channel flow meters tested, a rating system was developed says Svat Jonas, research engineer with Alberta Agriculture. MPE Engineering developed a maximum 49 point scoring system based on seven different criteria. A maximum of seven points were awarded for each of the following: measurement accuracy, trash collection, stilling well requirements, datalogger compatibility, automated data collection, maintenance and cost.

The researchers found that an electronic datalogger is required with most water measuring devices. Manual operation would be tedious, expensive and inaccurate, says Jonas.

Investigation and testing of open channel flow meters have shown that the Broad Crested Weir has the best potential for turnout flow measurement when used in conjunction with a datalogger says Jozef Prozniak, project manager, MPE Engineering Ltd. The weir performed very well and there was no clogging from debris. The structure, however, is prone to water flowing beneath it and a membrane cutoff is required. The weir rated an impressive score of 45.

No problems were encountered with the Cipolletti Weir tested. Configuration of the weir prevents trash buildup. Some irrigation districts are using the weir and are experiencing good results. The research rating of this weir was 44.

The Cutthroat Weir required two stilling wells to house the two float assemblies for water level detection. The narrow throat section is prone to catching debris. A minimum headloss is required across the weir and the tailwater must not submerge the discharge flow over the weir. The water level readings obtained in the lower stilling well are less accurate due to the high velocity in the throat section. The researchers felt that from an operators point of view, operating two stilling wells instead of one is more time consuming and less accurate. The rating for this weir was 41.

The Dethridge Meter is a water wheel meter that passes a constant volume of water per revolution. The wheel is recessed into the floor of the structure and inlet and outlet transitions are required. Both Jonas and Prozniak feel the meter is a very good choice for open flow measurement where very little driving head is available and intermittent flows are encountered. Trash can be a major problem as well as wind. The meter does not require a datalogger, however some mechanical or electronic counter is necessary to count revolutions of the wheel. The research rating was 40.

The Vortex Flow Limiter is a proprietary device developed for the municipal market to restrict flow in storm water management systems. For the evaluation, the flow meter operated in a range outside its design limits but still performed reasonably well. The meter is prone to trash problems. Accuracy is lower than the weirs but is sufficient for regulation and measurement for flood irrigation. The research rating was 37.

Evaluation of the Mag and Doppler inline flow meters was satisfactory and the cost of the meters is relatively low says Prozniak. In the course of our three-year study, meter manufacturers are appearing to discontinue the insertion mag meter and leaning towards the Doppler. Meter technology is rapidly improving and costs are dropping. Current costs for supply and installation of full bore mag meters are estimated to be $4300.00 and it is anticipated that the cost will fall to about $2400.00 in the next five years, adds Prozniak.

Open Channel Flow Meter Performance Rating

	Cipolletti	Broad-Crested	Cutthroat	Dethridge	Vortex
Measurement Accuracy	6	7	6	6	3
Trash Collection	7	7	6	5	5
Stilling Wells Required	6	6	5	7	7
Datalogger Required	6	6	6	7	7
Automated Data Collection	7	7	7	5	5
Maintenance Required	6	6	6	5	7
Cost	6	6	5	5	3
Total	44	45	41	40	37

The St Mary River Irrigation District (SMRID) was selected for determining the costs of introducing district wide turnout flow measurement. The district serves 350,107 acres with approximately 3500 individual farm turnouts. Block surveys of the SMRID indicate that approximately 50% percent of the farm turnouts must be metered with inline flow meters and the remainder with open channel flow meters. The capital cost of purchasing, installation, turnout modifications for the flow meter, and internal accounting changes within the district is estimated to be $9,370,000.00 ($2680.00 per turnout, $26.80 per acre), concludes Prozniak.

In addition, says Prozniak, the district would incur an annual cost for meter reading, additional billing costs and annual maintenance costs associated with the flow meters. These costs are estimated to be $139,000.00 ($39.70 per turnout, $0.40 per acre).

Prozniak says, in municipal water systems, it has been found that introduction of water meters and billing by usage results in substantial reduction in water consumption. This reduction has been traced to the elimination of casual spillage due to poor lawn watering practice, overwatering, no repair of faucet and toilet leaks etc. This contrasts sharply with on-farm water usage for irrigation purposes. Application of water requires energy input for sprinkler irrigation or labour input where flood irrigation methods are used. Extra water application results in significant additional cost to the user and if overwatering occurs, spillage and runoff from the land results in erosion and flooding of downslope landowners.

Typical irrigation practice results in little direct water waste due to the financial and liability consequences of improper water management. The majority of water loss is resulting from the inherent distribution system inefficiencies of open channel flow. Introduction of turnout flow metering will not likely result in reduction of water usage. In fact, states Prozniak, it may result in increased water application per acre if a greater economic return can be achieved from a higher application of water.

For more information from their comprehensive report please contact Mr. Jozef Prozniak, P. Eng., President, MPE Engineering Ltd., 261 - 31 Street North, Lethbridge, Alberta T1H 3Z4. Telephone (403) 329-3442 or Mr. Svat Jonas, P. Eng., Alberta Agriculture, Irrigation Branch, Agriculture Centre, Lethbridge, Alberta T1J 4C7. Telephone (403) 381-5870.■

SYPHON PRIMING MADE EASY

Larry Burr, a water supervisor for the St. Mary River Irrigation District, admits it looks a little odd to see his truck hood up and the engine connected to a hose coupled to a low-side turnout syphon. Yes, second glances are warranted for there is something more than meets the eye. A syphon which used to take half a day to prime using a conventional 50 mm discharge pump now takes only 10 minutes with his invention. "Small syphons can be primed in just a couple of minutes" says Burr.

Burr has been using his vacuum primer since developing it eight years ago. "My system basically utilizes the truck's air intake and vacuum to suck the air out of a syphon" he says, "and it takes only minutes to install." First, he removes the truck's air cleaner and replaces it with a fabricated canister to which a length of hose and a three-way ball valve is attached. The whole apparatus is coupled to the syphon's valve outlet. To protect the truck's engine from water being sucked in through the manifold when all the air is removed, Burr has installed, in addition to the three-way ball valve, an oil-filled vacuum gauge. By watching the gauge for a sudden rise, Burr can determine when the syphon becomes primed and then he must quickly turn the ball valve to supply outside air to the engine.

"The cost of the vacuum primer is less than $300.00" says Burr. "The most expensive single item is the three-way ball valve, costing about $250.00. It's not expensive when you consider the time saved in priming the thirteen syphons in my area."

For more information, please contact Mr. Larry Burr, Water Supervisor, St. Mary River Irrigation District, P. O. Box 278, Lethbridge, Alberta T1J 3Y7. Telephone (403) 327-9382.■

Larry Burr stands ready to operate three-way ball valve once syphon is primed.

NEW ROD WEEDER BASKET

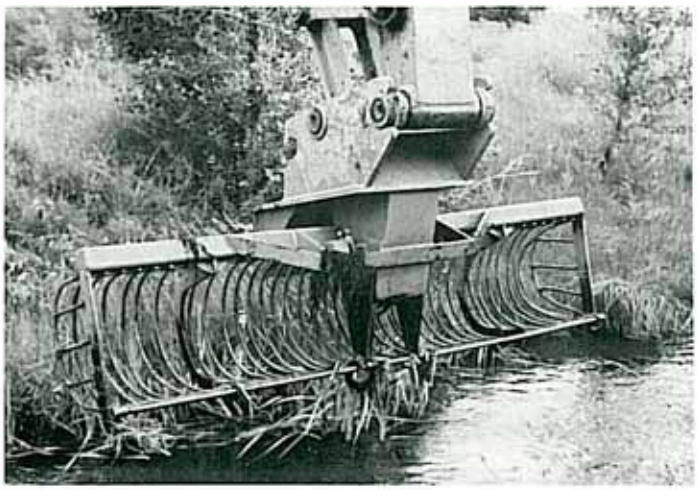
District Designs And Builds New Bucket

The "Rod Weeder Basket" is a hydraulic hoe bucket specifically designed for removing vast quantities of aquatic vegetation from flowing irrigation canals. Based on the first year's results of the prototype basket, Neil Johnson, operations manager with the Eastern Irrigation District, is confident they have a winner.

As Johnson puts it, "The design of the basket was not the brain child of any one employee, but a conglomeration of ideas from engineering, maintenance and operational staff. There didn't seem to be any commercially made bucket that fit our needs, so we took a shot at it and made our own in the Brooks shop." The cost was around $5,000.00.

"Our basket is three metres wide, 590 mm tall, 460 mm deep, and is made of 12 mm diameter steel rod spaced 7.5 mm apart," says Johnson. "Originally, our idea was to have a 25 mm diameter rotating shaft or rod attached to the front of the basket [powered by an Orbit hydraulic motor] which would wrap weeds around it and pull them out. This idea was soon abandoned. The weeds would wrap around but we couldn't get them to spin off. The weeds would soon begin to ball-up and eventually the mass quit turning even though the shaft continued," he concludes.

The basket is attached to a John Deere 790 hydraulic hoe. Operator Terry Smith says he can clean about 2 km of an average size canal or drain per day. He operates the basket so as to draw the rod basket through the bed material, thus up-rooting as many plants as possible but leaving the muck behind. Another use for the basket has been found. The district uses the basket to catch and remove the massive amount of floating weeds torn loose by the old traditional weed cleaning method. This method involves dragging a chain over the canal bottom attached to two crawler tractors on opposite banks of the canal.



Rod Weeder Basket.

Basket removes cattails including root material.

Johnson is left wondering just how much effect the up-rooting of the plants by the basket will affect next year's growth. He does know that the rod basket removes tonnes of the current year's plant growth, and again allows water to run unrestricted through the channel.

"Future improvements to the basket might include a swivel head to allow for better control on uneven slopes. Larger baskets are not contemplated, as they would become awkward to control and are flimsy," concludes Johnson.

For more information, please contact Mr. Neil Johnson, Operations Manager, Eastern Irrigation District, P. O. Box 8, Brooks, Alberta T1R 1B2. Telephone (403) 362-1400.■

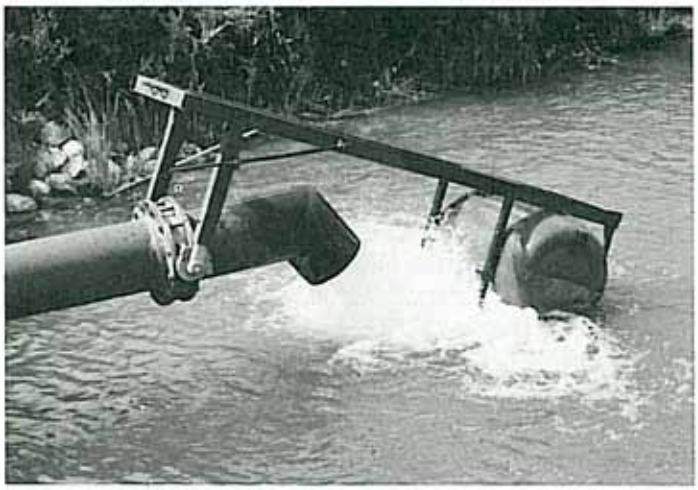
FROM THE FARM PERSPECTIVE

Innovative Water Level Control For Turbine Sump

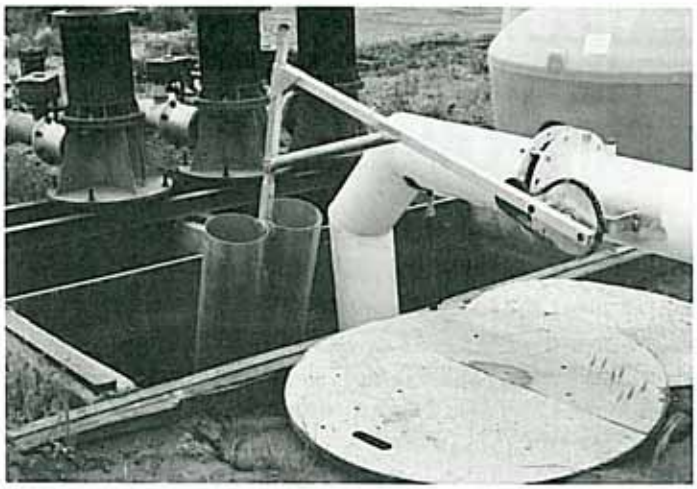
Knud Petersen, a farmer in the Chin area, was presented with a bit of a dilemma after the installation of the East Cameron Extension pipeline system by the St. Mary River Irrigation District (SMRID). Knud's turbines used to operate in a dugout adjacent to the open ditch with a relatively constant water elevation. With the positive pressure at his new pipeline turnout, he needed a way to control the level of water in his turbine sump. The system had to be self regulating and fail-safe to prevent flooding should his irrigation system shut down unexpectedly.

A neighbour, Herman Kleissen, had installed a couple of self-regulating float valves in his dugouts several years ago. These systems have operated very well and provide self-levelling control for the dugout water levels. Kleissen's system consists of a foam-filled barrel attached to a parallel linkage. The linkage is bolted directly to the lever operated butterfly valve. Petersen saw the opportunity to use the same concept, but abandon his dugout completely, delivering water directly into a concrete pumping sump.

As shown in the accompanying photo, the self-regulating system consists of a butterfly valve, a lever arm, and a float. The lever arm and butterfly valve have been connected using a drive chain and sprocket system. This allows for adjustment of the opening angle of the butterfly valve. "One modification that I would like to see is the addition of a chain idler to remove any chance of the chain jumping off the gears," says Petersen; "otherwise, the system has worked very well." The dual float system provides security should one of the canisters spring a leak. "I may fill them with urethane foam, just to be safe," says Petersen.



Herman Kleissen's self-regulating float valve in dugout.



Chain drive connects leveler arm and floats to butterfly valve.

The float system was constructed by Bill Hacker of Major Irrigation in Lethbridge. The discharge piping extends deep into the sump, with the back side of it cut away. "This reduces turbulence in the sump," adds Hacker," and avoids any potential problems with the intakes of the turbines." The floats, constructed from aluminum tubing, are mounted on an extendible arm for water level adjustment in addition to the chain and sprocket assembly. Hacker comments that, "We have built a number of similar systems, and we try to accommodate the individual needs and objectives of each installation. Total cost for a similar system would start around $1,500.00, depending on the location of the pumps and turnout and the amount of on-site fabrication necessary."

While pressurized turnouts provide a potential energy savings benefit for direct hook-up to a centrifugal pump, turbine installations still require some type of sump or dugout. The capital cost of replacing turbine pumps before the end of their service life often outweighs the potential energy savings payback from a new centrifugal installation.

For more information, contact Mr. Knud Petersen (403) 345-3123, Mr. Bill Hacker (403) 329-0533, or Mr. Gordon Cook, Irrigation Specialist, Alberta Agriculture, Box 640, Taber, Alberta T0K 0G0 (403) 223-7908.■

A DATE TO REMEMBER

AIPA Annual Conference

Date: November 16 & 17, 1992

Place: Lethbridge Lodge Hotel

Theme: Irrigation - The Future in Farming

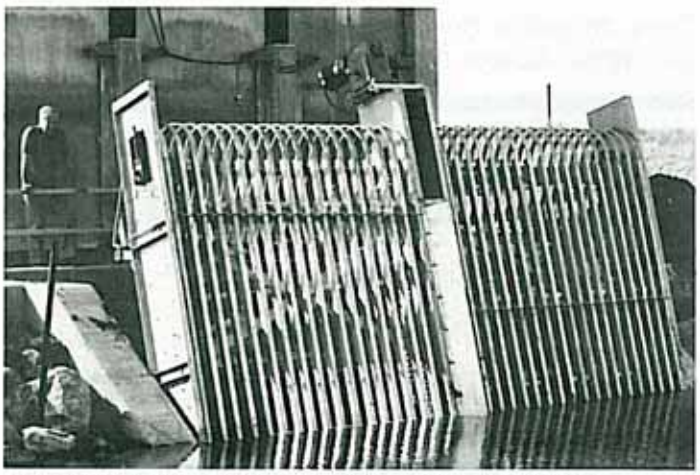
AUTOMATED SCREEN REPLACES MANPOWER

One of the most persistent problems irrigation districts face each summer is how to prevent floating aquatic weeds from entering their pumping plants and pipelines. A unique new design for a travelling screen has been developed by the Bow River Irrigation District (BRID) staff in conjunction with Urvold Industries Ltd. of Nobleford, Alberta for their Lost Lake Water Re-use Pumphouse.

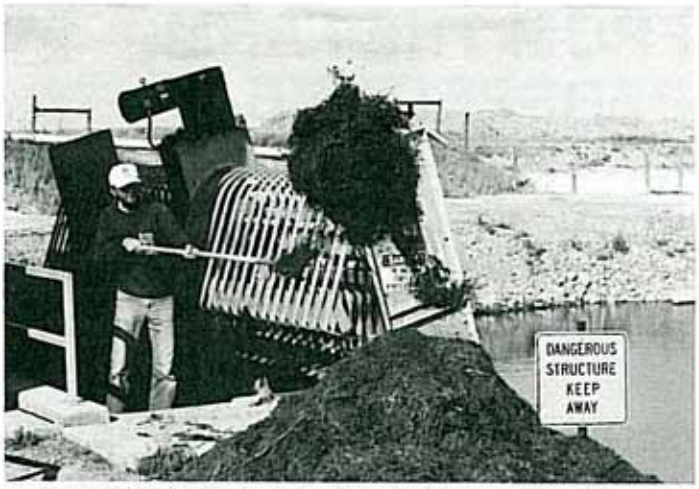
Like many irrigation impoundments, Lost Lake is full of submerged aquatic vegetation. This vegetation begins to break off in late summer and fall and floats up against the inlet channel and pumphouse bar-screens. Henry Holst, superintendent of maintenance and operations for the district says the problem becomes so acute that he has had to station, almost permanently at times, a Bantam hydraulic hoe to clean off the huge amounts of aquatic plant biomass that collects on the bar-screens. "Our ditchrider couldn't even begin to manually keep up with the mass and soon our pumps would shut down," says Holst.

The idea for the screen came from Holland. Local farmer, Jan Lanser, took pictures of catenary-type screens he had seen when visiting the country and gave them to the district. From these came the basis for a new design.

The catenary-type screen was built by Urvold Industries Ltd. It was manufactured entirely from galvanized metal, except for the stainless steel chain and the Delrin composite rollers. An electric 5 hp motor powers through a gear box the continuous chain of rakes that travel up the rack face, then back down into the water. As the loaded rakes 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 manually forked away," says Emil Johnson, district water master, "but in future, the district plans to fully automate with a conveyor belt."



Henry Holst stands beside screen built by Urvold Industries Ltd.



Emil Johnson forks weeds from holding pit. An automated conveyor belt will make this manual task unnecessary in the future.

The screen is programmed through an auto-timer to cycle at whatever interval is required to keep the rack clean. "A normal cycle" says Johnson, "might be to program the screen to start up every six hours for one minute." The total cost of the screen including the timer was $32,000.00.

Johnson and Holst are pleased with the screen. "It has allowed me to remove the upstream channel trash rack and free-up a hydraulic hoe," says Hoist. Johnson adds that "a real dollar savings has been gained in eliminating the overtime required to keep the structure free of weeds."

For more information, please contact Henry Holst or Emil Johnson, Bow River Irrigation District, P. O. Box 140, Vauxhall, Alberta T0K 2K0. Telephone (403) 654-2111.■

CWRA 46TH ANNUAL CONFERENCE, BANFF, ALBERTA JUNE 16-19, 1993

November 1, 1992. CALL FOR PAPERS DEADLINE. Canadian Water Resources Association, 46th Annual Conference, Banff, Alberta, Canada, June 16-19, 1993. Theme "WATER AND THE WILDERNESS: DEVELOPMENT, STEWARDSHIP, MANAGEMENT." Abstracts of 250 words 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.■

EYE LEVEL MEASURING UNIT

Simple, But It Works

It isn't high tech," says Larry Burr, a water supervisor for the St. Mary River Irrigation District, "but my eye level measuring unit sure works better than a staff gauge down in the Chin II measuring well. For the past two irrigation seasons, I've had to climb down the well to read the water level in the structure. It's inconvenient and often hard to read the staff gauge."

"This past winter, I persuaded Monty Flexhaug, our manager of operations, to allow me to build and install in the corrugated steel stilling well my eye level measuring unit. In the well, I installed a simple float device (toilet tank float) on a small diameter aluminum rod which protrudes up through the manhole cover. I used an aluminum tube because it's light and won't rust. Attached by a bracket to the lid is a staff gauge," Burr says. In order to calibrate the measuring device, Burr installed an adjustable pointer.

Burr adds "Calibration is easy. I allow just enough water in the canal to trickle over the crest of the weir and then set the pointer at '0' on the staff gauge, then tighten the locknut. That's it -- it's done," he smiles. "There is no need for a survey instrument or a highly trained technical person to calibrate this measuring device," he adds.

Flexhaug is so impressed with the measuring device, he is going to install a number of them this next winter. "They are easy to install and even easier to read," he adds.

For more information, please contact Mr. Larry Burr, Water Supervisor, or Mr. Monty Flexhaug, Manager of Operations, St. Mary River Irrigation District, P. O. Box 278, Lethbridge, Alberta T1J 3Y7. Telephone (403) 328-4401.■

Larry Burr reads his eye level measuring unit.

IRRIGATION WATER QUALITY GUIDELINES EXAMINED

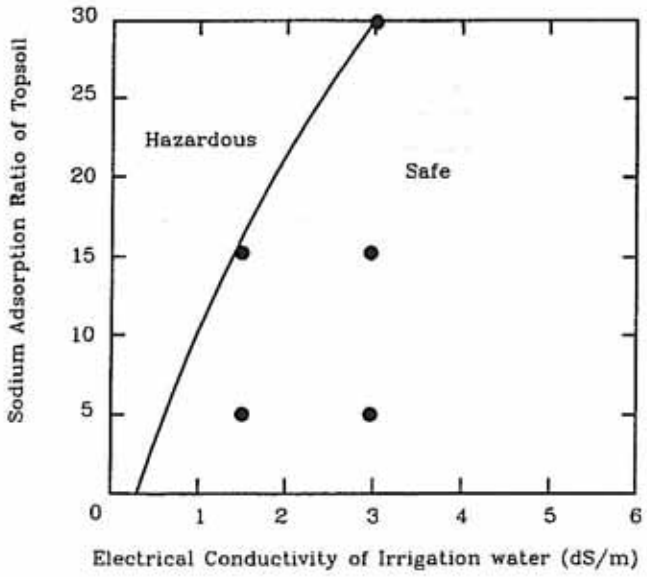
Sustainability of irrigation requires that only suitable soils and irrigation water are used. Alberta Agriculture has comprehensive land classification standards, says Gary Buckland, a manager with the land evaluation and reclamation branch, Alberta Agriculture. "The quality of irrigation water has not been of concern in the past because most waters diverted from rivers in the South Saskatchewan Basin are of excellent quality. Recently, however, an increasing number of farmers are using irrigation water from different sources to supplement rainfall. In some instances the quality of this water is poor and soil or crop deterioration may result," states Buckland.

The current guidelines for irrigation water quality in Alberta are based on the salt content of the irrigation water (as measured by the electrical conductivity) and the relative sodium content (as measured by the sodium adsorption ratio). The salt content affects crop production directly by reducing the availability of water to the crops through a process analogous to osmosis: if the salt content in the soil is higher than that in plant roots, then water is "sucked" from the plant roots. The result is various levels of plant stress or death of the crop. The effects of high sodium are less direct on plants but potentially damaging to both soil and plant. High sodium causes breakdown of the soil structure resulting in reduced infiltration and percolation of water and in a difficult to manage "cloddy" seedbed. Indirect effects on plant growth include the extremes of water stress or waterlogging, restricted rooting depth and poor germination.

Present irrigation water quality guidelines are based on the continued and almost exclusive use of a given quality of irrigation water. These guidelines are well researched but apply to arid areas such as California. In southern Alberta and other semi-arid areas, rainfall normally provides about half of the water requirements for crops. Local field evidence and research from other regions suggests that the use of current guidelines is not appropriate where rainfall is substantial. Levels of sodium within acceptable limits appear to be causing soil structure to deteriorate and this may be largely due to the effects of rainfall.

To address this problem, the land evaluation and reclamation branch of Alberta Agriculture, in cooperation with Agriculture Canada, the St. Mary River Irrigation District and the University of Saskatchewan has initiated a series of research projects to modify the current

irrigation water quality guidelines for southern Alberta. According to Gary Buckland, who leads the project, the research will examine several aspects including salt buildup in the soil and its effect on crop yield, different irrigation practices for minimizing the effect of salt and sodium buildup, and a comprehensive evaluation of



"Approximate curve for assessing the suitability of an irrigation water (after J.D. Rhoades, 1982)."

water quality and its effects on soil infiltration and percolation. Based on recent experience in southern Saskatchewan, the latter is very important because irreversible soil deterioration may occur if the irrigation water is unsuitable.

Although the planned research is extensive, the results will, by no means, be comprehensive. According to Buckland, "research in irrigation water quality in arid areas has been conducted for over forty years and refinements still continue. The limited research on irrigation water quality in semi-arid areas is about ten years old. We hope the present study will provide a firm basis for developing new guidelines for irrigation water quality and that these guidelines will be accepted in a manner similar to the existing land classification standards." As with any guideline or standard, they will also undergo refinements based on subsequent research, experience and observation.

For more information, please contact Gary Buckland, Land Evaluation and Reclamation Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta T1J 4C7. Telephone (403) 381-5882. (Editor's Note: Gary Buckland will be on leave at the University of Saskatchewan from Sept. 1992 to April 1993. Written requests will be forwarded for reply. Telephone requests should be directed to Brent Paterson or Murray Riddell.)■

CANADIAN WATER RESOURCES ASSOCIATION

1992 Alberta Branch Annual Conference

The Alberta Branch of the Canadian Water Resources Association will be holding its annual conference on October 5, 6 and 7, 1992 (Lethbridge Lodge Hotel) in Lethbridge, Alberta. Conference chairman, Brent Paterson, says the theme Water Use Challenges . . . achieving "resourceful" management is an opportunity to explore a number of water use issues and management challenges facing government, industry and individual stakeholders. For more information please contact Ms. Sharon Ouwerkerk at telephone (403) 329-1344, Fax (403) 327-6847.■

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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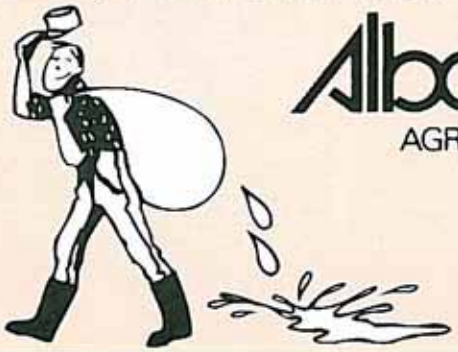

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