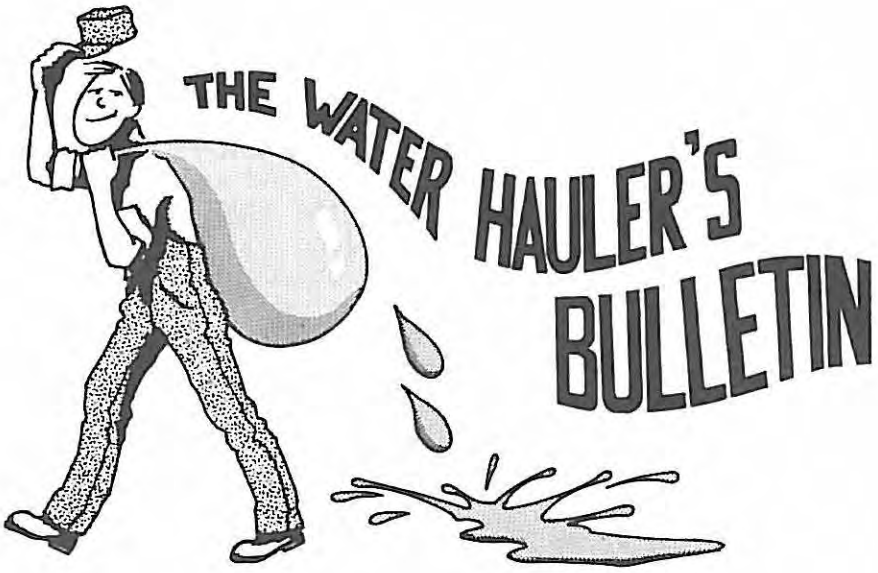

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UPDATE: REINFORCING WIRE MESH IN CONCRETE SLIP-FORM LINED CANALS

Wire mesh was first introduced by the St. Mary River Irrigation District as reinforcement in concrete slip-form lined canals of Southern Alberta in 1980 in hopes of minimizing severe crack separation and displacement. A test section was installed at that time using 15 m of 100 x 100 P13/P13 (4" x 4" 10 gauge) wire and 15 m of 50 x 50 P9/P9 (2" x 2" 12 gauge) wire. After two seasons of operation, no cracking has appeared in this section. Although the S.M.R.I.D. was the first to experiment with reinforcing in concrete lining, their initial success has encouraged the L.N.I.D. and T.I.D. to install test sections of their own. Since, approximately 10 km of reinforced concrete lining has been installed in the three Districts using 100 x 100 P13/P13 (4" x 4" 10 gauge) wire mesh with only 0.02% having cracks. No cracks larger than hairline were found and these appeared in the deeper canal sections.

The reinforced slip-form concrete lined canals have been and will continue to be monitored by the Evaluation and Management Section of the Project Planning Branch. An inventory of the cracking is recorded each spring before turning water into the reinforced sections and each fall before freeze-up.

Readers will be kept informed if any cracking should appear in reinforced concrete slip-form lining in future issues of "The Water Hauler's Bulletin".

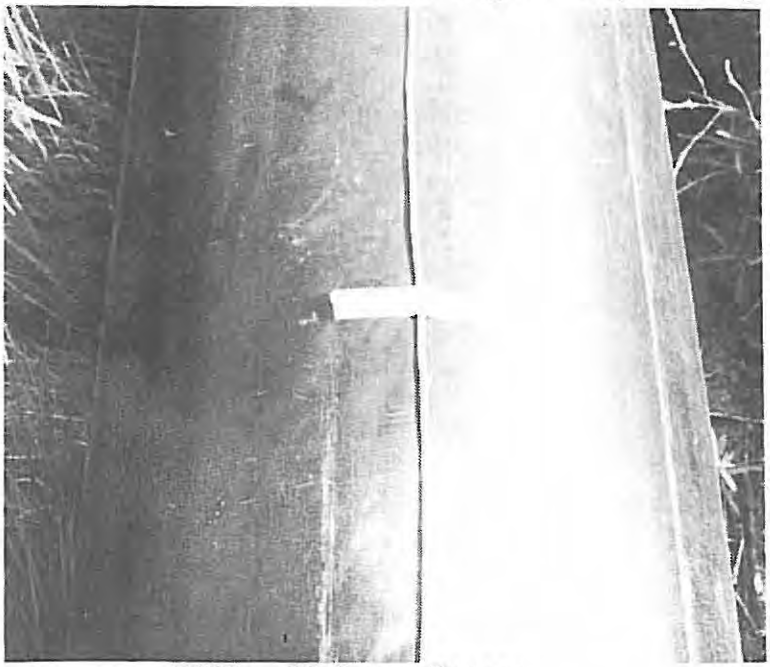
* * *

WHERE ARE THOSE BURIED PIPES?

Have you ever had the experience of trying to locate a buried pipeline that runs through an open field and has never had a referenced location? This can be a problem especially when the pipe used is not metal and is nonconductive. The use of buried polyethylene and PVC (polyvinyl chloride) pipe by the various Irrigation Districts is becoming more and more common. It is replacing the open channel method of distributing irrigation water in areas where steeper grades are prevalent. The problem arises of how to locate these pipelines in the future when traces of the pipe trench have disappeared over time and when the line traverses farm lands under cultivation. It is sometimes difficult to locate such lines by survey methods because key reference points have been destroyed.

A method of pipe location which is presently used by the Canadian Western Natural Gas Co. was applied on some buried poly pipe installed by the Taber Irrigation District. This method consists of burying an insulated copper wire of approximately 16 gauge along the top of the pipe. The wire is attached to the pipe with PVC tape such as that used by electricians. With smaller diameter pipe, the wire may be wound around it spirally. The wire is then brought up to the surface at each end of the pipeline and protected by a capped riser pipe or is attached to a structure. The continuity of the wire must not be broken otherwise this method will not work. It is suggested that if the pipeline is more than one-half mile long, then wire leads should be brought up to the surface at half mile intervals allowing that the pipe kit to be hooked to these leads.

When the buried pipe is to be located, a small current of electricity is introduced into the wire by a 9 volt power pack. This power pack is part of a pipe locator kit which also consists of a hand held receiver. The receiver is carried along the buried wire which is induced with an electrical current and a signal is picked up by the receiver when it is directly over the wire indicating the location of the buried pipe.



NOTE: 16 Gauge Tracer Wire taped to polyethylene pipe prior to installation.

One particular type of pipe locator that is used is called the "Ferret". There are others which may be used in a similar way. An approximate cost of one of these kits is $1200.

The Irrigation Division recommends that the Districts install the copper wires when installing buried PVC or poly pipe, even though a locator kit is not purchased at that time. A kit may be purchased or possibly rented at a later date when the pipe location is required.

* * *

IRRIGATION DRAINAGE OF GLACIAL TILL SOILS

Glacial tills are generally considered to have low hydraulic conductivity and are believed to retard the vertical migration of irrigation water to the groundwater regime when found at shallow depths. Temporary perched water-table conditions may develop on top of these shallow tills during periods of irrigation. Prolonged saturation of the soil zone caused by temporary perched water-table conditions can result in a reduction in soil aeration causing adverse effects upon plant growth and metabolism. Tills can preclude the flushing of salts to the groundwater regime which may result in a build up of soluble salts in the soil zone. If allowed to accumulate, these salts can affect plant growth or prevent seed germination.

Since tills underlie much of the irrigated lands in southern Alberta at shallow depths (<1.0 m), it was concluded by some researchers that irrigation in southern Alberta would result in serious subsurface drainage problems. However, in the Bow River Irrigation District (B.R.I.D.) soils with glacial till near ground surface (<1.5 m) have been irrigated for over 60 years with no apparent land deterioration. Thus, a paradox exists: soil salinization and perched water-table conditions, which should be commonplace in the irrigated lands of the B.R.I.D. because of the presence of shallow till, do not exist.

An investigation was conducted to describe the hydrogeologic properties of till underlying one of these areas and to assess the properties with regard to drainage. Study techniques consisted of detailed test drilling and sampling, excavation of test pits, installation and monitoring of groundwater instrumentation, field and laboratory hydraulic conductivity testing and environmental isotope analyses of groundwater samples.

The investigation revealed that fracturing (Figure 1) imparts secondary permeabilities to an otherwise impermeable till matrix. These fractures are permeable enough to allow the movement of irrigation water to the groundwater flow system, thereby preventing the formation of perched water-table conditions and a build up of soluble salts in the soil zone.

This investigation also showed that random hydraulic conductivity testing of tills without detailed field inspection may lead to erroneous conclusions regarding the hydraulic conductivity of a till. In many instances, detailed hydrogeologic studies may be required to determine the bulk hydraulic conductivity of tills.

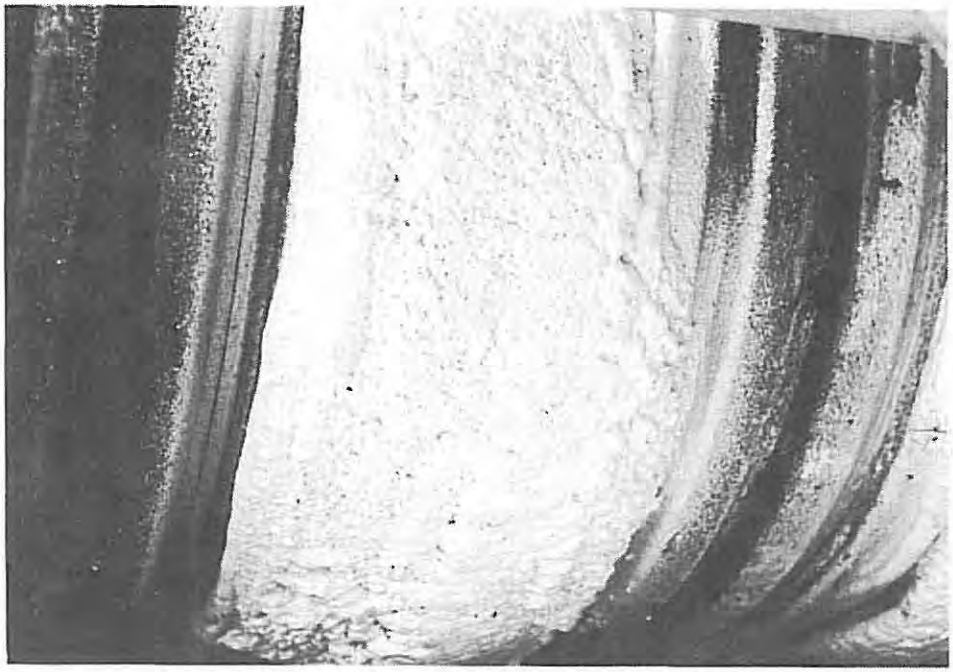
For further information contact Mr. Jim Hendry at 329-5160.

Fracturing in Till Soils approximately 3 m below ground surface.

* * *

BIG 'O' PREVENTS LEAKAGE

Big 'O' Drain Tile Company Limited, of Taber, Alberta, the people who brought to you the corrugated polyethylene culvert and drainage tubing, now have developed a water tight seal for their couplings on the Big 'O' culvert pipe, says George Waselenak, sales representative. Lengths of culvert pipe are joined by specially designed screw on couplings, thus eliminating the use of costly bolts, clamps and tools. The couplings are sprayed on the outside of the coupler and pipe with a urethane foam which prevents leakage. "Company tests were completed using an upright 6 m length of 600 mm diameter culvert with a coupling attached to an end cap and filled with water. This is approximately 10 psi (20 feet of head on an unsupported pipe. Proper backfilling and support in the ground may increase this pressure rating" says Waselenak.



NOTE: "Ramfawg" Foam sprayed on outside of coupler and abutting pipes.

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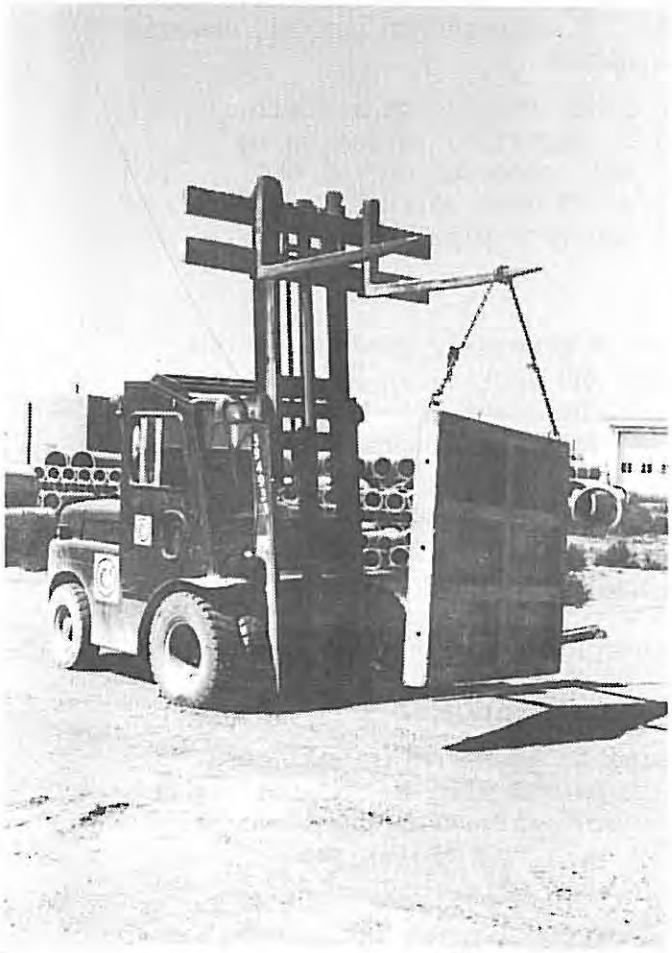
SAFETY FIRST: LIFTING PRECAST PANEL

Lifting and placing heavy materials such as precast panels by the use of any type of machine should always be done slowly and smoothly. Fast and jerky action increases the forces on the machine several times. Although this may not be a problem for the machine itself, the additional stress on the lifting cables or chains and the lifting hooks on the precast panel could cause either of these devices to fail. Since the lifting chains or cables and other lifting devices are usually designed for a much higher loading capacity, they may not be affected but there is no assurance that the mild steel lifting hooks on the concrete panel may not break. The construction workers adhering to all the safety measures may not escape injuries and the panel may be damaged in falling.

Another extremely important precautionary measure that should be adhered to when lifting a precast panel is the use of a spreader bar. Without it the lifting chains have a horizontal force component tending to pull the lifting hooks towards each other. This action often deforms the hooks and may cause them to break or pull out. The spreader bar allows the direction of pull on the chains to be vertical only (the direction of lift). The resulting stress absorbed by the lifting hooks is less and the hooks are not pulled inward.

The watch-words when lifting, placing and assembling precast reinforced concrete panels are: slow smooth motion of the machine of adequate size, construction workers safely located and protected, use of spreader bar to lift and place panels, frequent check of chains, cables, hooks, eyelets, etc. for wear or sign of fracture.



Note: No spreader bar, creating horizontal force which all to often causes hooks to break or pull out.

Urb Gallant of Consolidated Concrete demonstrates the proper way to lift a precast panel, using lifting hooks provided and the use of a spreader bar.

* * *

T.V. INSPECTION OF IRRIGATION PIPELINE

This is a followup report to the January 1982 issue of "The Water Hauler's Bulletin".

Work on the project began in the fall of 1981. With irrigation water still flowing in the pipelines a 5 mm ϕ polypropylene rope attached to a float was floated through them. Mar-Tech Engineering (now ISIS) began the inspection by towing a steel cable through the pipeline. The camera was attached to this cable and connected with the video equipment in a mobile van. In later stages it was found the 5 mm ϕ rope was sufficient for towing the camera through the pipeline.

Inspection of irrigation pipelines was a new experience for both the Irrigation Division and the Contractor. Silt conditions in pipelines, equipment breakdowns, weather conditions and pipeline accessibility created delays in completing the project. The experience gained, however, was valuable for future projects of this nature.

The pipelines chosen for inspection were lines felt to be installed under poor soil conditions. Deformation of pipeline, variation in grade, failures and cleanliness were the main concerns during the inspection. Of an actual 7.8 km inspected 74% were polyethylene, 11% polyvinyl chloride, 8% fibreglass and 7% concrete pipelines.

Results

The two concrete pipelines inspected were in generally good condition. It appeared that one had a failure as silt and rocks were found near the center of the pipeline and, therefore, prevented inspection of the actual point of failure. Misaligned or broken joints occurred in about 5% of joints inspected.

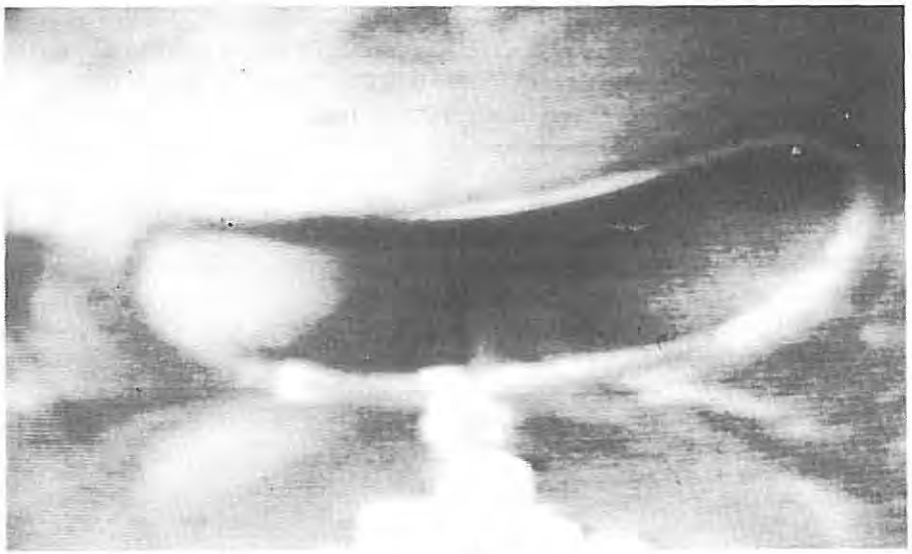
Of the two PVC pipelines inspected, one was in good condition: clean with good grade and joints with deformation not over 15%. The second pipeline (375 mm ϕ) was badly deformed, especially in a section where the worst conditions during construction were encountered. There were two portions in this area where the deformation was about 50%. In addition, silt and poor grade were found in this line. Perhaps, the low class of the pipe caused the excessive deformations.

The only fibreglass line inspected appeared to be in relatively good condition for grade and deformation but there was silt in the line. One pipe in the pipeline did have a deformation of 25% and another one had a broken spigot.

There were seven polyethylene lines inspected. One line of 300 mm ϕ was in very poor condition. Apparently construction was very difficult with equipment getting stuck in the excavation area. Two large diameter pipes (700 mm ϕ, 900 mm ϕ) were found in relatively good condition one year after construction. Another line was filled with silt and could not be inspected. The two 550 mm ϕ lines inspected had silt in the line and there was some variation in the grade, much more than it was specified. One line had a maximum deflection of 25% while the other line had one deflection in a joint at 40% and another over 50%. The 500 mm ϕ pipe inspected was in generally good condition with small grade variations and a maximum of 20% deflection.

From results obtained it appears that construction, inspection and maintenance procedures require adjustment especially where the soil conditions are poor. Silting of pipelines was found to be a general problem and perhaps considerations should be made in the design stages to account for this. Tamping around the pipes appears to be a crucial operation, as well as, ring stiffness of the pipe. The PVC pipes of higher pressure ratings (over 100 psi) are much stiffer than the polyethylene ones.

When selection of pipe material for a given job is made, careful analysis of different materials should be done. The economy should not be the only criteria for the selection but also future performance of the pipe.



"Pipe Failure"
Picture taken inside buried polyethylene pipe indicating high degree of deflection.

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CALIBRATION OF HYDRAULIC STRUCTURES

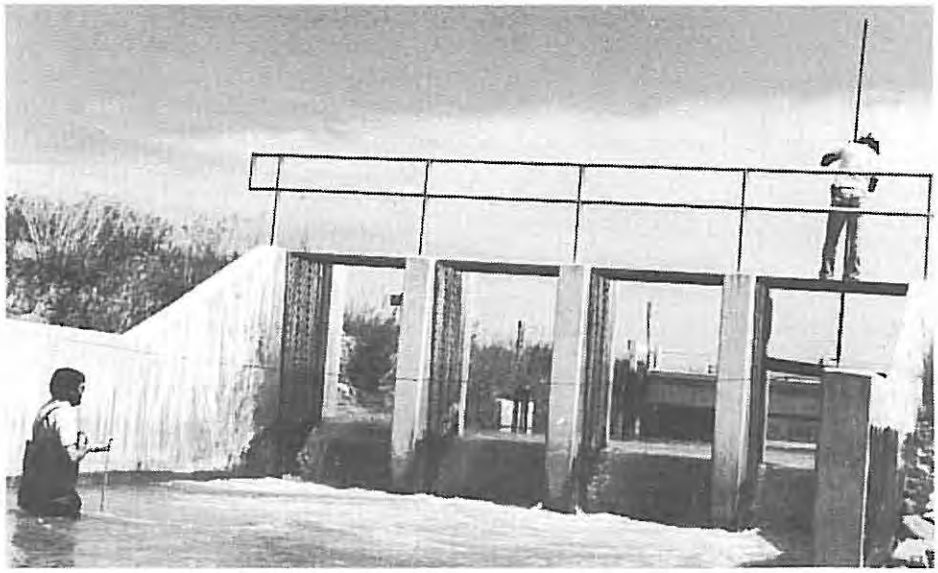
Water is one of the most essential ingredients necessary to grow and produce crops with high yields. Unfortunately, water is not always available in sufficient quantities and, therefore, it is important that the supply be used and managed with intelligence and efficiency. To aid in this objective, many Irrigation Districts have set up flow metering programs with emphasis on the calibration of structures. Calibrating structures will result in a better understanding of the flows throughout the District and will take most of the guess work out of water deliveries.

Simply speaking, calibration means to establish a rating experimentally by repeated observations and measurements. Calibration of hydraulic structures is done by measuring the flow passing through the structure, the hydraulic head, and the gate openings in order to ascertain the exact relationship between the gate openings and flow capacity. In many instances, the initial calibration is done on a staff gauge installed below the structure.

Although flow metering and the calibration of structures is a time consuming task, the Irrigation Division encourages the field staff to be involved in the actual process so they are familiar with the technique and may better understand how the information thus obtained will help them in more efficient water deliveries to their farmers.

We, at the Irrigation Division, feel the overall results of this program will be of definite advantage to the Districts and are, therefore, willing to extend a helping hand wherever necessary.

For additional information contact Mr. Roger Hohm at 329-5164.



Alberta Agriculture personnel taking a flow measurement for the purpose of calibrating the structure.

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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 E. D. Lloyd at 329-5164, Lethbridge.

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