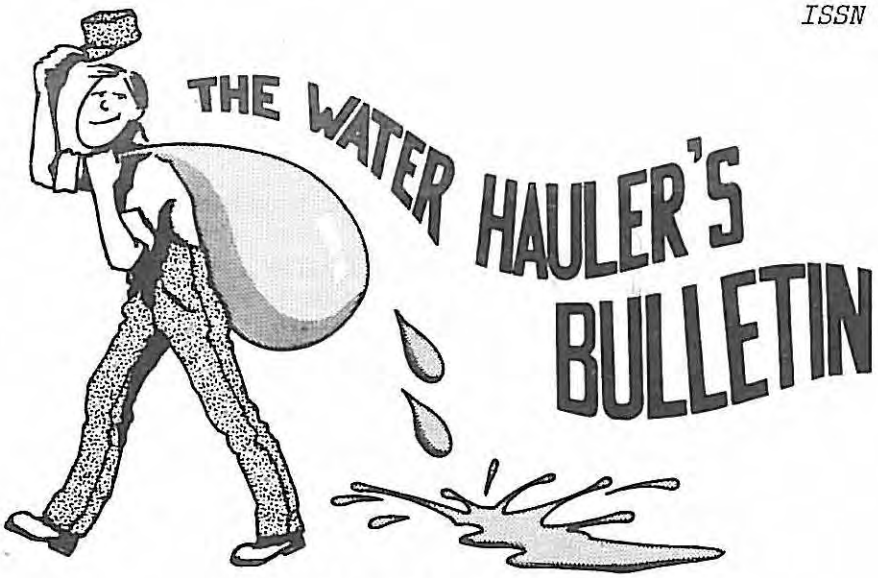
ISSN 0827-2212



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RED SHALE

Wet or saturated subsurface soil conditions cost Alberta Irrigation Districts and Contractors thousands of dollars each year. It is little wonder then, that considerable interest has been growing over an aggregate available in the Lethbridge area know as "red shale". Hardy Associates (1978) Ltd., in their testing laboratories have found this material to possess some interesting properties and have related them to use in construction over soft, saturated ground conditions.

Shale being loaded at the Jarvie Red Shale Operation at the old Galt #6 Mine.

This material originated as shale layers in close proximity to a coal bed found in the Oldman Formation of Cretaceous geological age. This coal bed is the one which was commercially mined from the late 1800's to 1958. The shales which were somewhat carbonaceous and presumably

slightly oil-bearing, were discarded as a waste product of the coal mining process, and either dumped over a convenient coulee slope or built into a stockpile.

After the material was placed, it oxidized by spontaneous combustion. Internal heat is estimated to have exceeded 1200° Celsius, judging by the degree of melting that iron underwent in the stockpiles (iron such as railway spikes and rails). A stockpile near the Galt No. 8 Mine is still hot.

The oxidation has resulted in a material having a relatively light unit weight of 1400 to 1500 kg/m^3 (compacted). A typical composition is 80% shale and 20% coal cinder, with a typical chemical composition of 60% silica, 20% alumina, 9% lime, 6% iron oxide, 2% magnesium oxide, and 3% trace minerals.

Red shale is not unique to the Lethbridge area. For example, the Drumheller, Alberta area is another source.

Red shale is an excellent material for use in bridging soft, wet soils in road, rail, or canal lining construction. This is demonstrated by the California Bearing Ratio, which is an index test that compares the resistance to penetration developed by a soils to that of a specimen of standardized crushed rock. Typical measured values are 70% when compacted at optimum moisture, and 60% when soaked. These values are unusual because of both the high initial value and also the relatively low loss when soaked. Other valuable characteristics are its light weight, which reduces stresses in underlying soft soil from those that would result with heavier conventional aggregates, and its angular, platey shape. The shape helps in distributing stresses over a broader area than would be achieved by typical pit-run gravels.

One drawback with red shale is its relatively high potential for attack of Portland Cement concrete. Precautions, such as damp-proofing and the use of type 50 cement, should be taken when placing concrete in contact, either directly or indirectly (through ground-water), with red shale.

For more information please contact Mr. Gerry Lewkowich, P. Eng. or Mr. Bill Dodd at Hardy Associates (1978) Ltd., Phone 327-7474, Lethbridge.

* * *

SOIL-CEMENT AS A CANAL LINER

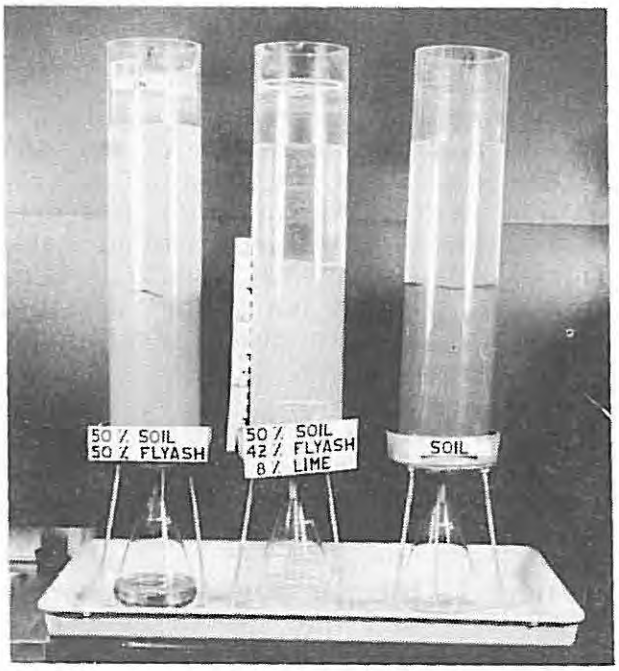
The Research Section of the Project Planning Branch of Alberta Agriculture was approached by the Magrath Irrigation District with a request to ascertain whether a portion of their Lowline Main Canal could be lined with a soil fly-ash mix. The purpose of this liner was to prevent seepage from the canal contributing to salinity problems in adjacent fields.

After laboratory experiments were conducted, it was found that a straight soil-fly ash mix would allow water to percolate through it more readily than the soil by itself, thus making it impractical as a canal lining. It was at this point that Svat Jonas, P. Eng., of the Research Section decided to add a cementing agent to the mix.

Soil-cementing consists of mixing existing soils with Portland cement, or Fujibeton (a trade name for Japanese cement), fly ash and lime in various proportions to form a durable type of material which could possibly be used as a liner for canals. Soil-cement has been used successfully in applications such as road construction and pond linings and is now being experimented with as a possible canal lining. Soil-cement liners have had the most success in sandy soil conditions.

Experiments were carried out to try and determine the best, the most economical and effective ratio of individual materials which could possibly be used for a lining. Various mix designs were prepared and tested for strength, flexibility, and freeze-thaw cycles using the A.S.T.M. D558 Method. In order to achieve a mixture of soil cement that was suitable for a canal lining, it was found that the amount of cement that had to be added was 16% or over. This high cement content made the mixture very expensive and uneconomical. "The cost would exceed the cost of concrete slip-form lining which is still a superior product to any soil-cement liner", says Jonas.

Research conducted by Alberta Agriculture has concluded that clay-loam soils, such as those encountered on the Lowline in the M.I.D., were not conducive for use in a soil-cement lining. It was further recommended that any District contemplating use of a soil-cement liner, undertake a thorough soil testing program and complete an economic analysis before any detailed work is started on the project. For further information please contact Mr. Svat Jonas, P. Eng. Phone 381-5164



As can be seen by the amount of water in the centre and left hand beakers, the flyash mixtures allowed more percolation than the standard soil sample.

* * *

CLOUD SEEDING TO INCREASE MOUNTAIN SNOWFALL

--A TOOL TO HELP THE IRRIGATION FARMER

As any good wind-blown Southern Albertan knows, the principal water source for the agricultural, domestic and industrial requirements of our region is the accumulated winter snowpack on the eastern slopes of the Rocky Mountains. This water resource provides the means for the significant irrigation agriculture of this region.

Future demands for water in Southern Alberta may not be satisfactorily fulfilled due to both the natural variability of the water supply and high rates of water usage, primarily for irrigation. The potential shortage of water is particularly acute for the Oldman River basin which currently has over 600,000 irrigated acres, with a potential for over 1,300,000 irrigated acres.

The Alberta Research Council has proposed to the Provincial Government a project to supplement mountain snowpack through the controlled use of cloud-seeding in an area straddling the Alberta-British Columbia border and including the Oldman River basin.

Cloud-seeding for snow augmentation is based upon the fact that the atmosphere may not be naturally "efficient" in producing precipitation. Considerable quantities of moisture are contained in the atmosphere as it passes over the mountains. For example, in a moderate westerly air flow with clouds one-half mile deep and extending sixty miles along the mountains, about one million gallons of water pass over the mountains and evaporate each minute. Some of this moisture condenses to form clouds which often do not produce precipitation. There are atmospheric conditions when cloud seeding can be used to make these clouds snow in the mountains.

Cloud-seeding involves the delivery of "artificial" ice nuclei, either from silver iodide smoke or injected dry-ice pellets, to the regions of supercooled liquid water within clouds. These artificial ice nuclei then greatly increase the concentration of ice crystals which use the available cloud water to grow into snow crystals that eventually fall as snow to the surface. Thus, more of the cloud water would be converted to snow and not lost to evaporation on the barrier leeward side. The increased snowpack would then provide additional streamflow during spring melt.

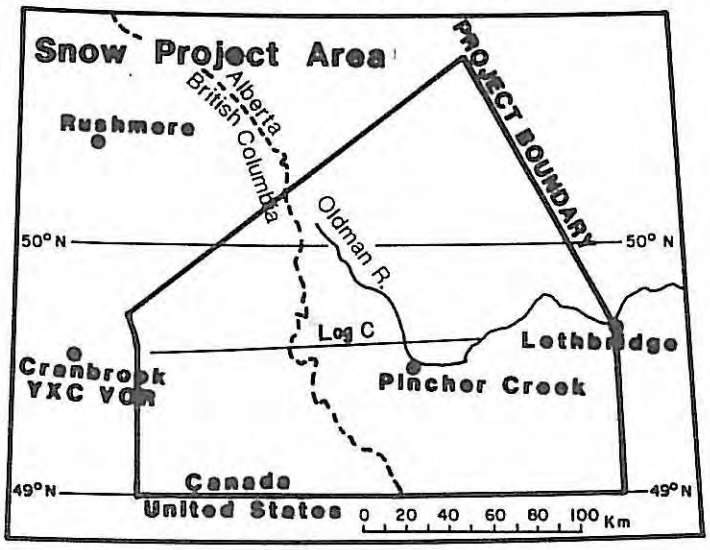
The Alberta Research Council has conducted some preliminary research into the feasibility of applying snow augmentation techniques to the Southern Canadian Rockies. This limited initial effort has focused on providing background information on the snow climate and winter cloud characteristics within the area.

Results of this research indicate that a potential exists for increasing the snowfall from clouds over Alberta's Rocky Mountains. Encouraging results from nearby U.S. projects suggest that snowpack increases on the order of 10% to 15% may be possible. The headwaters of the Oldman River

would be an appropriate region for the application of this technology. Assuming a 10% to 15% increase in snowpack, such application would yield up to an additional 250,000 acre-feet of water annually within this basin. Efficient use of the extra water produced from this augmented snowpack would require adequate storage and distribution.

Costs for water produced by snow augmentation from cloud-seeding have been estimated to be about $5 to $7 per acre-foot in the United States. For the Colorado River basin case, the benefit-to-cost ratio has been estimated between 9:1 and 12:1. For Alberta, this ratio would be 2.5:1 to 12:1, depending on the value of water.

In summary, cloud-seeding to stimulate mountain snowfall offers exciting possibilities for the irrigation farmer. The Research Council has a proposal to carry out a winter cloud-seeding project before the Alberta Government. Funding is required to get it off the ground so that equipment may be acquired and controlled seeding experiments carried out over several winter seasons. Once the benefits of cloud seeding are demonstrated, an operational seeding program could begin. For further information contact Mr. F. Robitaille at 438-0555.



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GENERAL REHABILITATION PLAN REMINDER

The following reminder from Gary Hartman:

"A message to all Irrigation Districts regarding Irrigation Council's wish to receive your General Rehabilitation Plans by December 31, 1985. As the General Rehabilitation Plans are nearing completion, the Boards should be reviewing and making pertinent decisions regarding overall (long term) development of the irrigation district. These plans are not intended to lock any district into a specific course of action, but are to provide a good planning guide for future development of your district. For further information call me at the Irrigation Secretariat at 381-5176."

* * *

DEPTH OF SUBSURFACE DRAINAGE IN IRRIGATED LANDS

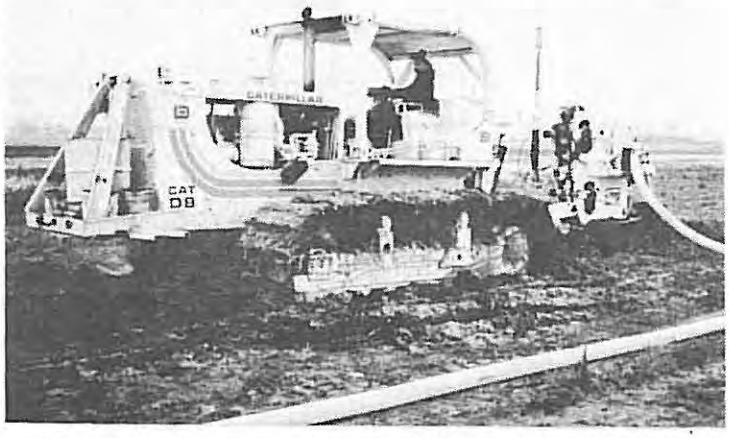
With our temperate climate and relatively low evapotranspiration in Southern Alberta, salinity control can be achieved with subsurface drains installed at shallower depths (less than 2.0 metres), relative to other irrigated regions of the world (usually greater than 2.0 metres). The practical depth of drainage ranges from 0.7 to 1.8 m. The Drainage Branch and Agriculture Canada recently completed a Farming for Future project which assessed reclamation of saline soils with drains installed within this depth range.

Subsurface drains were installed at two locations (Raymond Irrigation District and Lethbridge Northern Irrigation District) at depths of 0.8, 1.2 and 1.7 m. The soils were leached over the 1983 and 1984 irrigation seasons, and soil reclamation was monitored.

Reclamation resulting from leaching during 1983 was about the same for all drain depths. During the drought year of 1984 the soil above the 0.8 m drains resalinized. The soil above the 1.2 and 1.7 m drains continued to reclaim. Reclamation was slower at the R.I.D. site compared to the L.N.I.D. site, because less water was applied and the soil hydraulic conductivity (permeability) was lower.

As well, a preliminary evaluation of the cost of drainage, as related to drain depth, was undertaken. As drain depth increases, so does drain spacing, such that the cost of drainage materials decreases. Conversely, increasing drain depth increases installation costs because of higher power, fuel and labour requirements. Using three hypothetical drainage cases (one each for drain depths of 0.8, 1.2 and 1.7 m, and their associated drain spacings) we approached two drainage contractors for cost estimates. Both contractors agreed the 0.7 m depth was the most costly.

Given the short duration of this study, drainage at a depth of 0.8 m is inferior to drainage at depths of 1.2 or 1.7 m. Gary Buckland (Drainage Specialist), however, believes long term trends under 'average' irrigation management are better indicators of the influence of drain depth on soil reclamation, and therefore, monitoring will be continued for several years. For further information contact Gary Buckland or Brook Harker of the Drainage Branch at 381-5159.



Filtered Corrugated Plastic Drainage Pipe being plowed-in at a depth of 1.7 metres. This trenchless method is the "norm" for Alberta.

* * *

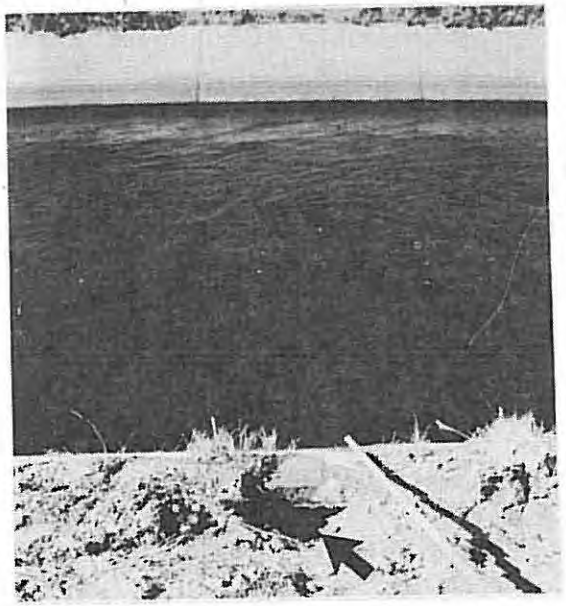
A QUICK FIX

On a recent Northwest Irrigation Operations Tour in the Yakima area of Washington, we viewed repairs being made to a concrete slip-form lined channel, while the canal was still in service. The concrete channel was cracked and had voids underneath it.

The Roza Irrigation District's repair method was quite simple. First, they used a high pressure water wand to jet a hole in the earth behind the concrete from the top of the bank to the void. Once completed, the next step is simply to mix and pump a slurry of silt, portland cement, and water into the void. Their mix design consisted of four parts native silt material to one part portland cement with enough water added to make it soupy. The mixture gets its initial set within hours and becomes very hard in twenty-four. A word of caution; little or no clay or sand must be present in the mix. Clay or sand cause clogging of the pumping equipment.

To lessen the chance of uplift of the section under repair, Don Schramm, an engineer with the Roza District, suggests that repairs be made when water is running in the system. Bleeding does not seem to be a problem.

They not only use this method for repair of their concrete slip-form lined channels but, on occasion have filled holes under structures and plugged muskrat holes in unlined channels.



Arrow: points to the opening of a void underneath the concrete.

Slurry is pumped through 50 mm hose into void while system is still in operation.

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CONGRATULATIONS ARMCO-WESTEEL INC.

Thursday, September 26, was the official opening of the new Armco-Westeel Inc. office and pipe manufacturing plant at 3210 - 39th Street North, Lethbridge. Mr. Murray McCaig states they will be manufacturing helical corrugated steel pipe from 300 to 1800 mm in diameter, along with manholes, elbows, couplers, etc. They will also have in stock a number of Armco Gates. GOOD LUCK!

* * *

ON THE LIGHTER SIDE

Part of the T.I.D. Board & Management on Blackbird Patrol in the Hogue Vineyard, Yakima Valley, after spending considerable time at the Hogue Winery.

Sitting: Ron Lloyd
L to R - John Sparks, Jake Stolk, Bill Kirkvold, Kent Bullock.

* * *

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 at 381-5164, Lethbridge.

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Published quarterly by the Evaluation & Management Section, Project Planning Branch, Resource Planning Division, Alberta Agriculture, Agriculture Center, Lethbridge, Alberta T1J 4C7.

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UPCOMING EVENTS:

October 24 & 25/85 — URBAN & RURAL RUNOFF MANAGEMENT CONFERENCE

The Canadian Water Resources Association (Alberta Branch) is jointly holding its Fall Conference with the Alberta Chapter of the Soil Conservation Society of America. The Conference will be held at the Mayfield Inn in Edmonton. Topics to be addressed are: urban runoff, stormwater management, snow management, flood retention, erosion control, land drainage and gabion evaluation. For more information, please contact Mr. John Hodgson at 483-4777.

November 18 & 19/85 — A.I.P.A. ANNUAL CONFERENCE

The Annual Conference of the Alberta Irrigation Projects Association will be held on Monday, November 18, 1985 at the Lethbridge Lodge Hotel. Mr. Gordon Zobell is again the Conference Chairman and he states the theme for this year's Conference is "Water Use Efficiency/Versus Effectiveness". Speakers will focus on such topics as: optimum crop use, a panel discussion on "Efficiency Versus Effectiveness", winter construction, Noon Luncheon speaker - Blaine Thacker, M.P., slide presentation showing rehabilitation of the L.N.I.D. Main Canal, seepage control methods, a panel discussion on "Design Capacity Standards", and

Banquet Speaker - Dennis Surrendi, A.D.M., Energy & Natural Resources. Cost for the full day session including lunch and dinner is $40.00 or $25.00 for the session and lunch. Everyone must pre-register by calling:

Mrs. Diane Virostek, Secretary-Treasurer

Alberta Irrigation Projects Association

Box 140

Vauxhall, Alberta T0K 2K0

(403) 654-4150 - (Tuesdays only)

(403) 739-3932 - (Residence)

Your prompt reply would be appreciated, as Diane states "they may have to limit the number of persons attending to approximately 275".

December 2 thru 6/85 LEVEL II DITCH RIDER'S COURSE

The Lethbridge Community College (LCC), Irrigation Projects Association and the Resource Planning Division are jointly sponsoring a five day Level II Ditchrider Training Course from December 2 to 6, 1985. This course will be a carry-on from the Level I Course and will be geared to meet the needs of the more seasoned ditchrider.

You can register now, by phoning the LCC at 320-3323. Participation is limited to the first twenty registrants.