the WATER HAULER'S BULLETIN

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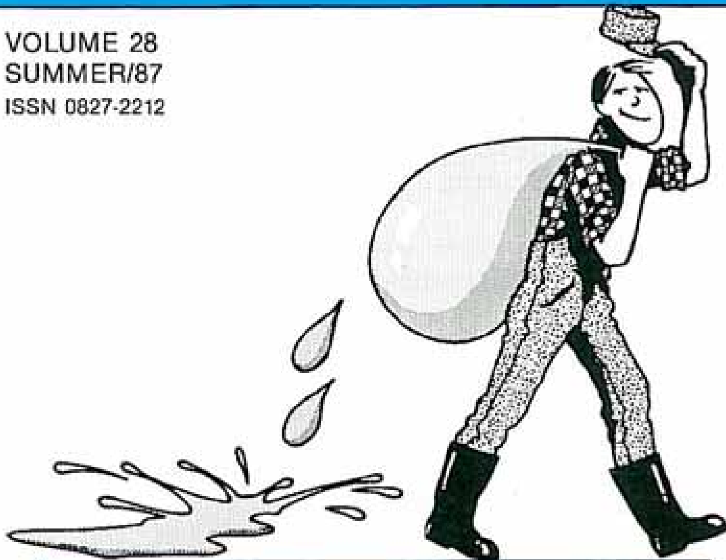


IN THIS ISSUE:

THE CHEMICAL SPILL

Can Your District Cope With A Chemical Spill?

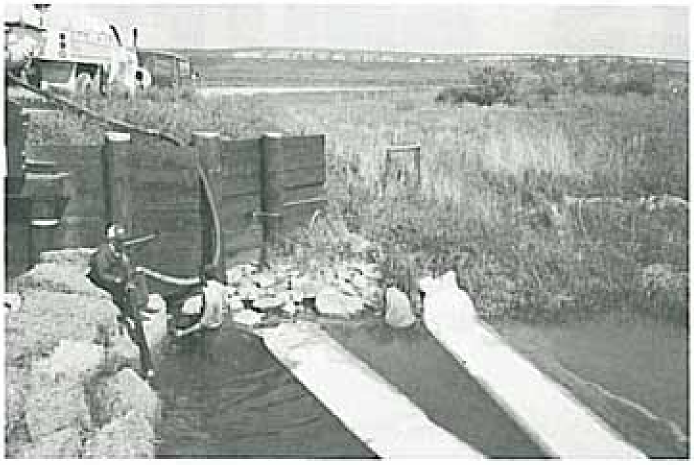
The transportation and use of toxic chemicals is an everyday occurrence, whether it be the farmer's tank sprayer or a fully loaded tanker truck travelling down a country road or highway. Although skilled handling and transportation of toxic chemicals is the rule in today's society, there is one eventuality that not all of us are prepared for – a toxic chemical spill into an irrigation system.

If your Ditchrider came across an overturned tanker spilling chemicals into his canal, what action would he take? Does he have any policy or guidelines to follow? Be it on land, into a reservoir or an irrigation canal, the seriousness is usually underestimated as far as hazards to the public and environment are concerned.

The serious threat to public health and damage to the environment makes it imperative that appropriate action be taken immediately. According to the Alberta Public Safety Services (APSS), a Government of Alberta agency regulating the transportation of dangerous goods in Alberta, there are no hard and fast rules set down regulating a chemical spill into an irrigation district works. APSS does have general guidelines as to what should be done in the case of a toxic spill.

Photo Courtesy of: Trimac Transportation Services Ltd.

This accident occurred near Magrath, Alberta. Tanker spilled 20,000 ℓ of diesel fuel into Pothole Creek.



Initial cleanup took Trimac Transportation Services Ltd. two weeks, however, the drain wells have just been removed after one year.

The Federal Transportation of Dangerous Goods (TDG) Legislation separates goods into a total of nine classes. These are: (1) Explosives, (2) Gases, (3) Flammable Liquids, (4) Flammable Solids), (5) Oxidizing Substances, (6) Poisonous & Infectious Substances, (7) Radioactives, (8) Corrosives, and (9) Miscellaneous Goods. The classes are further divided into a total of 24 Divisions, most of which are again divided into one of three possible hazard groups called Packing Groups. All Classes, Divisions and Packing Groups are determined by the severity of the substance's properties which may create a potential danger to humans, animals or the environment.

How much toxic chemical has to be lost to constitute reporting the chemical spill? According to APSS a Class 6 dangerous goods such as a poisonous or infectious substance where many herbicides and pesticides are classified, the minimum quantity spilled that requires reporting is 5 kg or 5 ℓ. For a compressed gas such as anhydrous ammonia, which is environmentally hazardous, any amount spilled must be reported immediately. Whether the chemical spill is a release into the air or a soluable material spill into water, the handling of each incident will vary with the type of product, topography, prevailing weather conditions, etc. This makes it difficult to specifically outline what to do in a given situation.

Should a ditchrider come across a chemical spill, what should he do? - report it to the Local Police who will in turn get in touch with the appropriate authorities. However, the Police will want to know the following: the location, if possible identify the chemical being spilled (all commercial containers have identification marks or labels), type of vehicle, number of injuries/deaths, and environmental site conditions. The next step would be to notify the district manager, who, in turn, would notify the Pollution Control Branch of Alberta Environment and the local municipal government. Time is of the essence in a chemical spill; the canal system may have to be shut down, all downstream water users notified, heavy equipment moved in, and containment materials hauled to the site. This is where a well planned and thought-out emergency action plan is invaluable, making for less chance of an error and the spill cleaned up with the least damage to public health and the environment.

Although an ounce of prevention is worth a pound of cure, accidents still happen. Is your District prepared?

For more information contact Gary Beatty, Lethbridge District Inspector, or Garnet Walker, Field Service Officer, Alberta Public Safety Services, Room 229, 909 - 3 Avenue North, Lethbridge, Alberta, T1H 0H5, phone (403) 381-5222; or the APSS Compliance Centre at Edmonton (Toll Free 1-800-272-9600). ■

IN CASE OF A CHEMICAL SPILL THE FOLLOWING 24-HOUR TOLL FREE EMERGENCY NUMBERS MAY BE CALLED:

1-800-272-9600

(Compliance Information Centre)

1-800-222-6514

(Alberta Environment)

GRAVEL ARMOUR STUDY

Second Year of Study – Produces Interesting Results.

The gravel armour canal study was first reported on in the 1986 Summer Edition of the Water Hauler's Bulletin. Since that time, the study has been repeated with a larger number of canals evaluated during the fall and the spring to gather additional information. As in the first report, the main emphasis is to determine the severity of sloughing and siltation in the gravel armoured sections of rehabilitated canals.

Approximately 292 km of armour lined canals were inventoried in the fall of 1986 as compared with 177 km in the spring of that year. This large increase in canal length was due to new construction and the inclusion of canals in the Eastern Irrigation District. The 1987 spring study was undertaken on some of the major problem canals to determine if freeze/thaw cycles contributed to canal sloughing. No differences were found from the spring study when compared to the results of the previous fall study.

For each of the canals evaluated, a form was filled out which listed the particular design criteria to be studied. This criteria included: the design capacity, bed width, bed grade, canal velocity, side slopes, graduation of gravel armour, lining, total length of the project and the length of time the armour had been in place.

In most cases, the sloughing on main canals was repaired before the water was turned on in the spring, therefore, the areas of sloughing seen in the fall were new failures and would require repair before the following operating season. In the smaller canals the sloughs were not repaired, therefore, the fall study included both old and new failures.

No sloughing present on this lateral after two years of service.

The following table shows the results of the spring and fall studies:

	SPRING	FALL
LENGTH OF CANALS STUDIED	177 km	292 km

	SPRING		FALL	
	Sloughing %	Siltation %	Sloughing %	Siltation %
Total canals studied	4.00	20.4	2.20	14.7
Canals with 3:1 side slopes	1.00	24.7	0.70	15.7
Canals with 2:1 & 2½:1 side slopes	5.30	19.5	2.70	14.3
Canals less than 5.0 m³/s	0.70	1.17	1.83	5.11
Canals greater than 5.0 m³/s	4.82	25.5	2.32	16.50
Canal velocities less than 0.61 m/s	1.52	5.70	2.40	7.55
Canal velocities from 0.61 - 0.76 m/s	5.00	24.2	2.12	17.4
Canal velocities over 0.76 m/s	3.60	22.0	2.40	15.2
Canals with gravel on liner	2.22	9.68	1.86	13.2
Canals with earth and gravel	0.56	29.0	2.86	17.1
Total canals over 3 years old	2.00	27.5	2.83	28.0

From the results of the two season study, it appears that, overall, the best canals are those which are less than 5.0 m³/s in size. Canals which are designed with 3:1 side slopes tend to have the least sloughing but also seem to have siltation problems. The velocity of flow in the canals indicates some interesting trends. Canals with velocities of 0.61 m/s or less tend to be in the best condition with very little silt buildup. As the canals get older they tend to deteriorate by first, silting in, and then by bank sloughing.

Overall, the canals studied tended to be in good to excellent condition with siltation being the major concern. Sloughing is a problem on only a few main canals built on 2:1 or 2½:1 side slopes.

The Project Planning Branch will continue to do periodic evaluations of these canals.■

MAINTENANCE — MONITORING AND RECORD KEEPING

Saves Time and Money – Assures L-o-o-o-o-ng Life.

Preventative maintenance and good record keeping can extend the life of your irrigation system while still saving money, but more important, ensures effective and efficient water delivery. Our irrigation delivery systems have been designed for a minimum 50 year life span, but anyone who believes these systems will last the 50 years plus without good maintenance and record keeping, is fooling themselves.

Maintenance programs should be well planned and developed utilizing a feedback system of monitoring, reporting, and good record keeping. Monitoring and reporting should provide information to evaluate the type of maintenance activity, type of repair, the rate of deterioration of a specific installation or type of material used. For instance, during monitoring, it is discovered that severe erosion is occurring on a recently rehabilitated canal. By reporting this, the problem can be investigated and something done to correct the erosion problem before it becomes serious. The monitoring and reporting is done by the ditchrider.

The record keeping system is very important to the maintenance program in providing trends, general problems, common solutions or common problems. The main objective is that the record can be retrieved quickly and that the category of problems, solutions or types of installation are clearly recorded. Over time, these records may establish trends and general solutions for a host of problems that could be widely spread across the district.

The actual maintenance program should be designed to deal with preventative maintenance separate from the normal yearly maintenance that becomes necessary because of wear, tear, erosion, silt accretion, etc. Preventative maintenance should cover such things as exposed linings, erosion below drop structures, excessive seepage through canal banks, cracking of major structures, etc. Any one of these problems has the potential to cause failures if they are not corrected quickly.

Normal yearly maintenance should be designed to deal with less pressing problems. Such problems may be gradual siltation, erosion or aquatic weed growth which will accentuate the aging process of the canal. These can only be dealt with by the process of monitoring and record keeping. To the ditchrider these problems will appear minor, however, with time they will affect his ability to deliver water to the water user with efficiency and promptness. Since this will be a gradual process, he should review his own records.

Aquatic weed infestation of the canal may need more serious consideration. For instance each ditchrider should be familiar with the various types of aquatic weeds. He should include in his report the type of weed, the lateral where it was found, and the extent of the infestation, by length of canal and surface area covered. If this data or information is centrally recorded, trends can be found in the type of aquatic infestation so that control may be more specific and less expensive.

Categorizing of specific kinds of structures or waterways has several advantages too. The problems arising that are specific for installations of a similar type can be solved accordingly. For example, if spillway structures are categorized as to a kind of structure, then all types including pipe drops, a series of precast drop structures, fabriform chute, gabion chute, grouted riprap, etc. can be included in the category. Monitoring and adequate record keeping can bring out the outstanding positive and negative features of each type of installation and the method of maintenance required for each type. This approach will be far more effective than treating each structure separately. This information can be used by design engineers in future projects.

In conclusion, the best way to get the maximum benefit from maintenance is to develop a plan that allows for the flexibility of procedure, method and material based on the incoming results from monitoring and evaluation. The review and analysis of past records from monitoring and evaluation may provide some general and long range solutions for a host of problems that do not individually appear to belong to a specific group. The ditchriders are the ones who know the canals, structures and their problems better than anyone else. Therefore, they should be the ones to carry out the monitoring and reporting of these problems to a central record keeping unit. Long after a ditchrider has retired or been assigned to another area, his monitoring/repair records will continue to be useful.■

ROMAN AQUADUCT FOR SOUTHERN ALBERTA

Not Quite But It's Unique.

Concrete aquaducts like the Romans built centuries ago, not quite, but the Taber Irrigation District has designed and is building something new in irrigation water conveyance systems for Southern Alberta. The idea came to Kent Bullock, TID District Engineer, as a result of an irrigation tour, not to Rome, but to the North Western United States and Southern British Columbia. A rectangular concrete box flume was used to divert water from Trout Creek to the Summerland Irrigation District and the Town of Summerland. After seeing this, Bullock adapted a similar box design for conveying irrigation water in a 1600 metre long reach of canal known as the North Fincastle West Lateral. His cast-in-place concrete channel is 1.0 m wide with 1.2 m high walls and capable of carrying 1.17 m^3/s (41 cfs) with a water depth of 0.9 m. Five chutes and a concrete box field crossing are also incorporated into the design.

Construction starts with stripping of topsoil and excavating a trench with 1:1 side slopes to 300 mm below design bed grade of the finished concrete channel. Forms are placed 1.5 m apart at floor elevation and bed grade on 150 mm of crushed pit-run bedding. Steel rebar (10 M) used for the floor and walls is welded together on site and placed at 300 mm oc spacings both horizontally and vertically. The 150 mm floor is then poured and trowelled. A 40 mm square waterstop groove is made in the floor where the walls join. After the floor has set, forms are set up for the walls.

Using the leap-frog method, the floor forms are removed and placed ahead for the next pour. This same procedure is used for the wall forms. In this way, the District is able to complete approximately 60 m of channel per day.

The canal section is widened for the chute drop and the resulting hydraulic jump.

Buried polyethylene lining was compared to the concrete channel as a construction alternative. The concrete channel was selected for several reasons: cost was approximately the same as for polyethylene; maintenance will be reduced by eliminating aquatic weed growth and reducing silt build-up; a steeper gradient is used thus reducing the number of drop structures required; and less right of way is required.

Check structures also are easily installed in the rectangular concrete channel and if there is a need in the future to install checking facilities at any point in the channel, it can be done easily at very low cost.

Mr. Bullock says the rectangular section was designed with thick walls and heavy reinforcement to make the structure less susceptible to frost action and increase the life expectancy. When asked if his concrete box channel would last as long as the Roman aquaducts, Bullock replied — "50 years plus."

For more information please contact Mr. Kent Bullock, P. Eng., Taber Irrigation District, Box 129, Taber, Alberta, T0K 2G0. Phone (403) 223-2148. ■

AQUATIC PLANT POPULATIONS IN IRRIGATION CANALS IN SOUTHERN ALBERTA

The War is Just Beginning.

Excessive rooted submerged aquatic vegetative growth is becoming a more serious problem in irrigation delivery and drainage systems. Every year more and more kilometres of primary, secondary and on-farm irrigation and drainage systems are infested with unwanted algae and aquatic plants. These infestations can reduce delivery efficiencies by up to 91% of design capacity. Field surveys at the Lethbridge Research Centre have identified a number of aquatic plant infestation characteristics which will enable an effective Integrated Aquatic Plant Management Program to be implemented.

Large supply canals, with flow rates over 28.3 m/s (1000 cfs) and water depths of 3 m or more, are infested predominantly with:

Giant Pondweed	Potamogeton vaginatus
Sago Pondweed	Potamogeton pectinatus
Flat-stemmed Pondweed	Potamogeton zosteriformis
Richardson's Pondweed	Potamogeton richardsonii

These canals have the highest silt loading and have very fine, organic-rich hydrosoil in the canal bed. They offer a minimum of 300 mm of hydrosoil depth for the overwintering tubers which are the major asexual means of reproduction of the pondweeds.

Medium-size canals, with flow rates of 9.9 to 28.3 m^3/s (350 to 1000 cfs), have a greatly reduced silt loading and have less organic-rich hydrosoil. The major aquatics are:

Richardson's Pondweed	Potamogeton richardsonii
Narrow-leaf Plantain	Alisma gramineum
Sago Pondweed	Potamogeton pectinatus
Small-leaved Pondweed	Potamogeton pusillus

The overwintering of the above aquatics is by tubers located shallowly (less than 150 mm) in the hydrosoil, or in the case of the small-leaved pondweed, by overwintering buds at the apical tips.

Small canals with flow rates of 1.4 to 9.9 m^3/s (50 to 350 cfs) have almost no silt loading. The water is clear and the solar radiation readily penetrates to the canal bed. The slower moving water allows more delicate-leaved aquatic plants to become established:

Richardson's Pondweed	Potamogeton richardsonii
Northern Water Milfoil	Myriophyllum exalbescens
Variable-leaf Water Milfoil	Myriophyllum heterophyllum
Small-leaved Pondweed	Potamogeton pusillus
Fries' Pondweed	Potamogeton friesii
Narrow-leaved Plantain	Alisma gramineum
Horned Pondweed	Zannichellia palustris

Further differences are found between the type of material in the canal bed (fine silt, coarse sand, small gravel, or pit-run gravel). While no definite pattern has been established, generally the shallow rooted aquatics (small-leaved pondweeds, horned pondweed, Fries pondweed) become established in canals with 50 – 100 mm of silt over or between gravel in slow moving canals.

Richardson's Pondweed has reduced the cross-sectional area of this canal to where it has become a Ditchrider's nightmare.

On-stream storage reservoirs contain a much more diverse population (in order of relative contribution to the total population) than do delivery systems.

Richardson's Pondweed	Potamogeton richardsonii
Canada Waterweed	Elodea canadensis
Sago Pondweed	Potamogeton pactinatus
Northern Water Milfoil	Myriophyllum exalbescens
Flat-stemmed Pondweed	Potamogeton zosterformis
Small-leaved Pondweed	Potamogeton pusillus
Coontail	Ceratophyllum demersum
White Water Buttercup	Ranunculus aquatilis
Water Smartweed	Polygonum natans
Floating-leaved Pondweed	Potamogeton natans
Duckweed	Lemna minor

Therefore, on-stream storage reservoirs, while critical to constant water supply, will always offer a constant potential source of aquatic infestations for the irrigation delivery canals. Total vegetation control in these reservoirs is never desirable or feasible and the populations must be manipulated to cause a minimal amount of interference to water delivery.

A general knowledge by the ditchrider of the diversity of aquatic populations in his canals, along with keeping records as to what extent the weeds are spreading, will aid management in implementing a control program. This information is critical for determining the most effective mechanical, chemical, biological, or nutrient limitation technique to use to control specific problem aquatic plants.

Dr. Jack Allan of the Lethbridge Research Centre will be publishing an Aquatic Plant Identification Manual early in 1988. For more information, please contact him at Agriculture Centre, Jail Road, Lethbridge, Alberta, T1J 4C7. Telephone (403) 327-4561.■

CLARIFICATION: SHEERNESS — DEADFISH WATER SUPPLY

In response to questions Mr. Rodney Jones, P. Eng. received regarding his article entitled "Sheerness — Deadfish Water Supply Scheme" in the '87 Spring edition of the Water Hauler's, his reply is as follows: "This paragraph will clarify the question of water duty available to the 11,000 acres (4,450 ha) of irrigable land situated along the Sheerness Power Generating Station's cooling water supply and discharge system. The annual allocation of 14,800 dam³ is an assured supply for the irrigation of the initial 8,000 acres (3,250 ha) of land to be developed. It is anticipated, however, that the complete area development will not be achieved in the near future; consequently the remaining 3,000 acres (1,200 ha) of land will be delivered with an unassured water supply of up to 5,600 dam³ per year. This supply will be through 'borrowed' pumping capacity as available from Alberta Power's Sheerness pipeline pumping facilities."■

UPDATE: REINFORCED CONCRETE SLIP-FORM LINING INVENTORY

97.42% Uncracked.

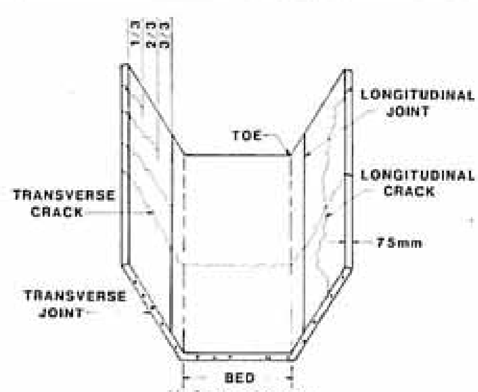
An assessment of the wire mesh reinforced concrete slip-form lined canals inventoried since the first test section was installed in the spring of 1981 can only be described as minimal – Minimal cracking that is!

Overall, only 2.58% of the 37 km of laterals inventoried in April 1987 have cracks which range in width from hairline to 40 mm.

The inventory was conducted in five Irrigation Districts of southern Alberta on laterals that have been in place for at least one winter. Exceptions to this rule are 4750 m of Lateral A2, WID and Lateral 62H, LNID which were withdrawn from the inventory and are not included in the tabulated results of this article. These laterals have unique problems not common to the other laterals inventoried and discriminatory results would be obtained if included in the inventory. As a result of the withdrawals, this year's percentage of cracking is a little bit lower than in 1986.

1987 Results:

Cracking	Length Uncracked	Up To 5 mm	5 mm To 40 mm	Over 40 mm
overall	97.420%	2.50%	0.07%	0.01%
transverse	98.825%	1.15%	0.015%	0.01%
longitudinal	98.595%	1.35%	0.055%	—



X-SECTION OF CONCRETE LINED DITCH

ALTERNATIVE TO ROCK RIPRAP

Flexible Concrete Revetments Engineered Into Irrigation Structures.

Recognizing the increasing need for cost-effective replacement of scarce local rock for erosion control purposes in many Alberta regions, GST Erosion Control Inc., a GBR company (formerly Genstar), has undertaken a major research and development program. The program consists of design, hydraulic model testing and optimization of flexible concrete block revetment systems for various erosion control applications, including: canal drop structures, stilling basins, reservoir overflows, wave protection, bridge and culvert aprons, river training works and protection for plastic liners.

What Is a Flexible Concrete Revetment?

The flexible concrete revetment consists of precast concrete blocks, laced together with structural cables and pre-assembled into flexible mats. On site, the mats are installed on a geotextile and connected together. Where required, the mats can be anchored into the sub-base soil by industrial soil anchors.

The ability of these flexible mats to tolerate sub-base deformations caused by settlement, frost action, local erosion, etc., is the main reason for this system being preferred over rigid concrete systems.

Concrete revetments can be installed in the off-season without conventional heating and hoarding costs.

The St. Mary River Irrigation District has installed one of GST's new flexible concrete revetments on a drain inlet into their Main Canal just east of Lethbridge. According to Jim Brown, District Manager, an alternative to rock riprap and the old standard cast-in-place concrete slab was needed as neither of them worked very well. The riprap always ended up slipping off the side slope and into the bottom of the canal. While the cast-in-place concrete slab is susceptible to frost heaving and the resulting damage. The Project Planning Branch will be monitoring this new installaion and will keep readers posted in a future "Update" article.

For more information on this new approach to erosion control, please contact Mr. Brian Murphy, P. Eng., Suite 1200, 1015 - 4 Street S.W., Calgary, Alberta, T2R 1J4. Telephone (403) 262-2928.■

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) 381-5164, Lethbridge.

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