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Tale of Two Dams

Development of storage for irrigation at Snake Lake had been contemplated since the initial construction of the Eastern Irrigation District (EID). Original surveys and studies undertaken by the Canadian Pacific Railway, identified Snake Lake's potential for internal storage. Snake Lake is a shallow body of water with no natural outlet. The lake is bordered on the south by the East Branch Canal. Snake Lake Reservoir will provide a more assured water supply for 71,500 assessed acres on the Springhill Canal system.

Although this project has many important components, this article will focus on the reservoir's East and West Dams.

East Dam

The East Dam is founded on a 4 m thick layer of very soft, highly plastic, clay. "This dam was expected to undergo approximately 0.5 m settlement during construction and up to 0.5 m settlement after construction," states Dennis Miller, senior technologist with UMA Engineering Ltd. The core of the dam was therefore constructed in two stages with a medium

Aerial view of Snake Lake Reservoir.

plastic clay and clay till placed at 2% above optimum moisture. Due to the potential for differential settlements an inclined chimney drain was provided on the downstream side of the core in the valley section of the embankment. The remaining main embankment segments were constructed with a drainage blanket under the downstream shell. In the valley section, the blanket is connected to the chimney and has finger drains beneath the downstream berm to discharge any seepage collected.

A unique technique was used to place the initial lifts of the dam embankment on the soft clay valley floor

Pneumatic piezometers were installed in the foundation after the initial lift of the embankment was constructed. These piezometers provided data regarding the buildup of pore pressures during construction and the dissipation of excess pore pressures between construction stages.

Pneumatic piezometers and settlement gauges were installed in the impervious fill of the embankment to provide data during construction and over the long term.

Inclinometers were installed to monitor horizontal deformations within the dam foundation.

"A unique technique was used to place the initial lifts of the dam embankment on the soft clay valley floor," says Miller. The soft foundation condition did not allow stripping of the surface materials with scrapers, as well it was deemed to be very important not to fracture and start "pumping" of the soft foundation during stripping or initial embankment operations. Due to the sparse vegetation and no topsoil to speak of, the entire base of the embankment was not stripped. Only a 15 m wide cutoff was excavated to a depth of 500 mm under the main core of the dam. The clay shale material which was available from the adjacent borrow area was used for the initial lift on both the unstripped area and the cutoff. The initial lift was dozed out with a Cat D5 wide pad dozer approximately 300 mm thick, a small self propelled pad foot packer was used to compact this lift, densities of 95% Standard Proctor Density and higher were achieved. A second lift, approximately 300 mm thick, was then dozed out with a Cat D7 dozer. A large 4 wheel drive tractor pulling a large size regular sheepsfoot packer compacted this second lift. A third lift was then placed approximately 300 mm thick with Cat 631 scrapers slowly running onto the second lift. A D7 dozer then levelled the lift, with the sheepsfoot packer following behind. After this third lift was completed, conventional embankment placement practices were used.

Pore pressure readings were as predicted indicating increased pressures during embankment construction, then decreased after construction stopped. No major problems were encountered.

West Dam

The West Dam's foundation is generally sandy silts and gravels. The dam was also expected to undergo settlement, therefore the design using a flexible middle core along with a chimney and blanket drains was basically the same as was used on the East Dam. Instrumentation installations and the two stage construction theory were also very similar to the East Dam. In the case of the West Dam, a cutoff approximately 10 m wide and 500 mm deep was provided under the main core and the vegetation under the remaining embankment foundation was burnt off but not stripped prior to the placement of the initial embankment lifts.

The material used for the first one metre of the dam embankment was a very dirty gravel type material available from adjacent borrow. "Again it was deemed essential that the foundation not be fractured and "pumping" action be started," says Miller. This dirty gravel material was used because of its strength characteristics as well as being sufficiently impermeable. The contractor was able to doze this material out over the foundation in a long thin wedge to a leading edge thickness of 150 mm with a Cat D7 dozer after which a large sheepsfoot packer was used for compaction. This material was applied in lifts approximately 100 to 150 mm thick to a total depth of one metre. After this, conventional embankment practices were used. A clay till material was used for the remainder of the embankment.

Pervious materials were known to exist under the foundations and some amount of seepage was expected. A drill hole near the north abutment of the

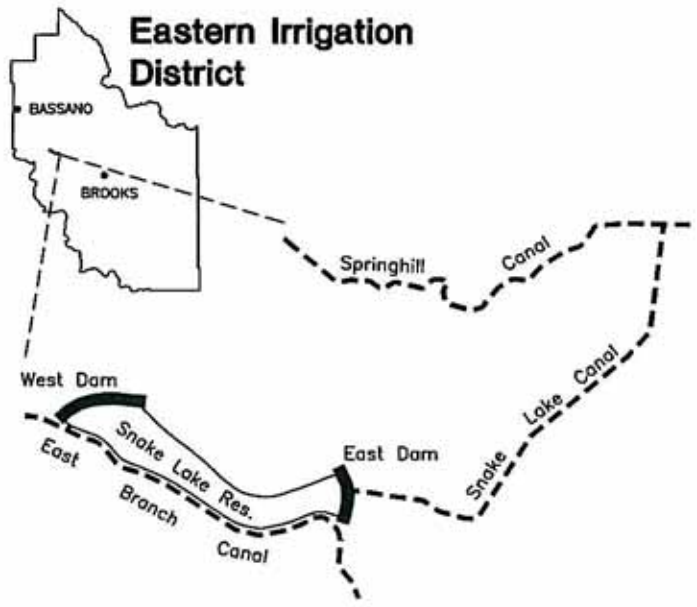
main valley did not encounter bedrock until a depth of 25 metres. Relief wells and cutoffs were contemplated in the design stage but not included in the initial construction contracts with the thought of adding relief wells only if necessary.

Low pore pressure response during the placement of the embankment and subsequent further geotechnical investigation and testing (due to low pore pressure response) confirmed that the West Dam foundation is more permeable than anticipated in the design stage. This increased seepage rate was cause for concern regarding stability (uplift pressures at the downstream toe of the embankment) and the effect of the seepage water on the downstream lands.

Several options were investigated: cutoffs, slurry trench and relief wells complete with a pumping system. "Relief wells again proved to be the most cost effective and practical to construct," states Miller.

A relief well/pump system was designed and installed which includes:

- 17 relief wells at 20 m spacings along the downstream toe of the dam with provision to add 3 more if required.
- 3 observation wells downstream on the valley floor.
- Submersible variable speed pumps installed in 13 of the 17 relief wells with provisions to increase this to 20 if required.
- Level monitoring probes installed in all wells with one central read out.



Location Plan

- A common collection header from the 17 relief wells with 2 discharge lines running the pumped water over the dam back into the reservoir. Each discharge line is fitted with a flow meter.

By the end of October 1996, the water in the reservoir produced 4.64 m of head (valley floor is at elevation 774.0 m).

Eight of the 17 relief wells had pumps installed and operating by mid December 1996. These eight pumps, operating at the low end of their capacity were able to lower and maintain the water table downstream of the West Dam to the desired level.

Monitoring of pumping and water table levels continued through the winter of 1996 in an effort to fine tune the pumping level settings and accurately predict the pumping required when the reservoir is filled to FSL (elevation 781.7 m) which is an increase of 3 m from the 1996 winter level.

In the spring of 1997 prior to completing reservoir filling, 5 more pumps were added to the system, expanding the pumping coverage area. The EID commenced filling of the reservoir in early May and FSL was reached on May 15, 1997. With the reservoir at FSL the pumps continued to maintain the downstream water table at an acceptable level, pumping at a rate of 70-72 gpm.

The EID will continue to monitor and fine tune the pump setting levels and pump location pattern through the summer of 1997.

The EID is anticipating officially opening of the project on August 20, 1997.

For more information, please contact Dennis Miller, R.E.T., Senior Technologist, UMA Engineering Ltd., Box 655, 514 Stafford Drive North, Lethbridge, Alberta, Canada, T1J 3Z4. Telephone (403) 329-4822. ■

Pesticide Containers "Take Them Back Clean"

Take Them Back Clean is the theme of the 1997 Crop Protection Institute of Canada (CPI) campaign to remind farmers and custom applicators to thoroughly rinse and safely dispose of their used pesticide containers.

The CPI's container management program is an industry program funded by crop protection product manufacturers. But it is the combined support of farmers, custom applicators, dealers, contractors, provincial committees, irrigation districts, governments and manufacturers that has made it a success. The program which operates in all provinces led the world in 1995 with a recovery rate of 64% of the pesticide containers supplied to the market place. Germany, at 41%, ranked second and the USA, at 28%, ranked third.

The 1997 awareness campaign focuses on thoroughly rinsing pesticide containers before taking them to the collection site

In Alberta, over 989,000 pesticide containers were collected from 99 municipally operated container sites in 1996 (an increase of 86,000 over 1995).

Cleanliness of containers is a key issue in recycling containers. With a view to improving program performance, CPI commissioned a survey of 457 farmers and 151 custom applicators, including 31 aerial applicators, in the prairie provinces during July and August of 1996 to determine their pesticide container return and rinsing practices.

The results showed that of those interviewed in the CPI study, 99% of the custom applicators and 97% of the farmers said they were able to rinse the containers where they filled their sprayer. The survey also estimated that 85% of the containers taken to the container site had been triple/pressure rinsed. However, an Alberta Environmental Protection survey of containers at container sites in 1996 suggested that only 72% of containers were being rinsed. In addition over 17,000 litres of liquid pesticide, adjuvant and rinsate collected at container sites required disposal.

The 1997 awareness campaign focuses on thoroughly rinsing pesticide containers before taking them to the collection site with its theme "Take Them Back Clean."

The Alberta Container Management Committee is asking pesticide users to "take the time to do the right thing" by rinsing containers immediately after emptying. It makes sense because pesticide residues can be removed from containers more easily and the rinse water can be put in the spray tank - eliminating any pesticide residue disposal problem.

Triple rinsing (or pressure rinsing) will ensure all the product you paid for goes to where it belongs - protecting the crop. Also, clean and drained containers will:

- be safer to handle,
- cost less to process and to dispose of liquid pesticide and rinsate from containers,

Program logo

- reduce container site liability concerns,
- increase opportunities for recycling containers.

We all have a role in protecting our environment, please rinse your pesticide containers and take them to one of the municipally operated container sites around the province. Site locations are listed in the 1997 edition of the "Blue Book," the 1997 edition of the "Pesticide Quick Reference" (available from Lakeland College) or contact the local agricultural fieldman, any office of the pesticide management branch, or the Action on Waste Recycle Information Line (1-800-463-6326) for site locations and operating hours.

For more information, please contact Bill Sherk, Telephone (403) 250-7294 or David Pledger, Telephone (403) 297-5920, Alberta Container Management Committee, Calgary, Alberta, Canada. ■

Water Development Program Focussed

Rural water projects supporting economic development and protecting the environment now receive priority under the Rural Water Development Program (RWDP) in southern Alberta. Administered by the Prairie Farm Rehabilitation Administration (PFRA) of Agriculture and Agri-Food Canada, the program has focussed on environmentally friendly water development projects which provide long term economic benefits to the surrounding rural community. "Water is a crucial element of rural economy and diversification," says PFRA Lethbridge's District water programs head, Vic Brown. "It is the very foundation of most new agri-business ventures, and its availability often determines whether or not existing value-added operations can expand or diversify."

Emphasis on Planning

With this in mind, Brown says, PFRA has adapted the RWDP to be as focussed and effective as possible. Technical and financial assistance available under the program places emphasis on the planning, investigation and design of water projects that make the greatest contribution to jobs, growth and the environment. This focus sees group and community projects such as pipelines and tank loaders being emphasized, along with projects that investigate or demonstrate innovative ways to protect or enhance water resources. Ground and surface water data collection ranging from exploration and mapping to test drilling, e-logging and pump testing are also targeted under the program. In addition, priority is given to water conservation measures which improve water quality or extend the life of a project, such as remote watering systems, well screens, aeration systems, and snow and sediment management. "We are starting to see more long term planning in the water development project applications that we receive," says Brown. "The result is the construction of projects which improve water quality, increase the longevity of water sources, and at the same time, make a meaningful contribution to the rural prairie economy."

Typical water project showing a solar pumping unit and windmill aerator designed to automatically supply water to cattle on demand.

Flexible Program

The RWDP is a flexible program which addresses local conditions and promotes input from rural municipalities regarding spending priorities. Financial assistance is available to qualified applicants according to established priorities. Technical assistance for individual projects such as wells, dugouts, springs and pipelines continues to be provided throughout the year under the program, however financial support for these projects is dependent on the availability of funds and the criteria set by local priorities.

Innovative Skill Sets

Like the Rural Water Development Program, PFRA is built around meeting the needs of rural prairie people. A wide range of innovative skill sets are available in each of PFRA's district offices. Areas of expertise range from soil conservation, agroforestry and rangeland management, to shelterbelts, wildlife habitat, rural development, and resource analysis and mapping. PFRA's technical skills are used to analyse opportunities, help clients develop ideas, and make initial assessments of project feasibility. Staff work closely with clients to develop land management and water development systems that are good for the economy and the environment. The idea, says Brown, is to give local people the chance to focus PFRA's resources on their most pressing issues in the areas of rural development, water development and land management.

"Whether it's through the Rural Water Development Program, or some other PFRA service, we are working with rural clients and partners to support projects which reflect a commitment to jobs, growth, the environment, and a high quality of life in our rural communities," says Brown.

For more information contact Vic Brown, Head, PFRA District Water Programs, Telephone (403) 327-4340. ■

Researching Crop Water Use at the Farm Level

The irrigation districts in southern Alberta have been put under increasing pressure from environmental and urban interests to increase the water use efficiencies within the limits of their existing water diversion licenses. "The Eastern Irrigation District (EID) began a process to "audit" its overall use and management of water, beginning with the 1994 diversion period," states Rod MacLean, planning section head with the irrigation branch. A monitoring project dealing with annual water balances in the Rolling Hills area of the district, has just completed its third year of operation. In 1995, the irrigation branch - Brooks district office of Alberta Agriculture, Food and Rural Development entered into the ongoing research project, assisting the EID in determining some of the on-farm aspects of the "water audit." This project, funded through a Farming for the Future - On Farm Demonstration grant examines; how water is used once it is delivered to the farms, how much water is consumed by crops, what losses there may be and where they occur. The data collected and processed in this project will be compared to both the return flow data collected from the North Rolling Hills drainage channel, and the results from the Irrigation Requirements Model. This added component is intended to provide opportunities to determine where water savings, either from an irrigation network management or on-farm irrigator perspective might be achieved.

Growers reported better than average yields

Twelve fields were measured within the North Rolling Hills Drain watershed under the following crop types: wheat, barley, alfalfa and canola. The hydrology of each field was determined to examine the "water in - water out" elements, including rainfall, diversion water, spillage, water tables, deep percolation, drain outflow and crop consumptive use.

"Measurements of rainfall, soil moisture, irrigations, water table wells and crop growth stage were taken at weekly intervals during the 1996 growing season," says MacLean. Two monitoring sites, consisting of a neutron probe access tube, a water table well and a rain gauge were placed in each field. The probe access tubes were buried to a depth of 1.25 metres. A weather station owned and operated by the EID was placed near the centre of the watershed, and includes a tipping-bucket rain gauge, temperature gauge, solar radiation meter, wind velocity dial and a datalogger. The datalogger was accessible through a cellular modem installed at the site.

In return for the use of their field, farmers were assisted by the Brooks staff with the scheduling of irrigations. They were provided with actual soil moisture

Monitoring site with water table well, rain gauge and neutron probe.

contents and crop water use predictions for each site. This information was sent to each farmer either by fax or e-mail. With this information, the farmer was able to order water in advance, allowing the local EID water supervisor to better manage his delivery system.

A website was developed at "http://www.eidnet.org/rhills/index.htm" which served as a base for the project information. The combination of this project, the centrally located weather station and precise return flow measurements will help find a more accurate method of determining where the water is going within the irrigation district. "Accurate knowledge of district consumptive use factors goes a long way in determining new parameters for future irrigation development in southern Alberta," says MacLean.

It was a fairly dry year in Rolling Hills. Rainfall during the cropping season was 70 mm. The average irrigation for the 12 sites was 255 mm, the highest being 328 mm. Although the project will examine consumptive uses over three years, the data collected from the first year's operations showed some interesting results. The highest water use of the 12 fields in 1996 was 423 mm from an alfalfa crop under intensive pivot irrigation. The lowest water use, 247 mm was a canola field under wheels. Growers reported better than average yields, notwithstanding one alfalfa field under flood irrigation, which suffered some winter kill and a subsequent reduction in yield.

There will be a few modifications to the project for 1997. One modification will be to change from a two neutron probe tube to a three neutron probe tube per site. This will allow better comparisons of consumptive use values presently being used in the Current Irrigation Management Project, part of the Year 2000 initiative. The web page will be updated to include various weather information from the station.

For more information please contact Rod MacLean, Head, Planning Section, Irrigation Branch, Alberta Agriculture, Food and Rural Development, Lethbridge, Alberta, T1J 4C7. Telephone: (403) 381-5152 or E-mail at maclean@agric.gov.ab.ca ■

Alberta Agriculture, Food and Rural Development Announces Hall of Fame Inductees

Alberta Agriculture, Food and Rural Development is pleased to announce the 1997 inductees to the Alberta Agriculture Hall of Fame. For their distinguished service to agriculture, Dr. Peter Bergen of Taber, Harvey Buckley of Cochrane, and Jacob Thiessen of Edmonton were honoured at a ceremony attended by Walter Paszkowski, the Minister of Agriculture, Food and Rural Development, at that time, and currently the Minister of Transportation and Utilities.

In making the announcement, Mr. Paszkowski remarked that each inductee exhibited a common commitment to improving Alberta's agriculture industry. "Dr. Bergen, Mr. Buckley and Mr. Thiessen have offered their wisdom over the past 30 years so that both rural and urban consumers alike could benefit from their achievements," said Mr. Paszkowski. "By responding positively to change and tirelessly promoting the agriculture industry, their efforts have impacted everyone from agricultural producers to

consumers. These individuals have changed the way agriculture operates in Alberta today."

Jacob Werner Thiessen

An agricultural engineer, Jake Thiessen has had a significant influence on decisions regarding irrigation water supply infrastructure in Alberta and across Canada. For more than 30 years, Mr. Thiessen has provided all levels of government with sound judgement on water and irrigation policy. Throughout his career, he provided counsel on the restructuring and rehabilitation of numerous headworks and canal systems in southern Alberta. His unending perseverance saw the Old Man Dam completed on time and on budget, despite the many political and legal challenges the dam faced.

Harvey J. Buckley

The development and administration of farm policy in Alberta has thrived under Harvey Buckley's guidance. Known and trusted by both industry and producers, Mr. Buckley provided steady leadership to a majority of Alberta's commodity organizations for nearly 25 years. As chairperson of the Alberta Agricultural Products Marketing Council, Mr. Buckley established the new Marketing of Agricultural Products Act in 1987.

Dr. Peter Bergen

Dr. Peter Bergen has played an integral role in the advancement of Alberta's sugar beet industry. Dr. Bergen's research and developmental innovations in sugar beet genetics and agronomics, tailored for Alberta's irrigated conditions, has been one of the key factors in sustaining viable systems of production for Alberta growers. Both a scientist and an extension specialist, Dr. Bergen sought to bridge scientific research and field application to benefit all producers.

The Hall of Fame Selection Committee chooses Hall of Fame inductees on the basis of their exceptional personal qualities and their significant contributions to agriculture and rural life in Alberta. The Government of Alberta is proud to salute this year's deserving inductees for their outstanding achievements. ■

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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 Brian Taylor, editor, at Area Code (403) 381-5542, Lethbridge.

View the Water Hauler's Bulletin on Internet web site: http://www.agric.gov.ab.ca/irrigate/hauler/index.html

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