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wood.

Canadian Consulting Engineering Awards 2019
Project: North Lateral Realignment Syphon
Category: C – Water Resources

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Submitted to:
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1.0 Confirmation Receipt from Online Official Entry Form & Project Outline

Receipt from Online Official Entry Form

Submitted separately.

Project Outline

The City of Lethbridge (City) was selected over ten jurisdictions as the site for Cavendish Farms $425 million new potato processing facility. Key to the City's bid was to agree to relocate a major irrigation supply canal that divided the designated 287-acre parcel into two. Relocation using an "open canal" was not possible due to the natural land slope. Wood Environment & Infrastructure Solutions (Wood) solution, an 1,870 m long, 3 m diameter inverted syphon located on the east and north boundaries of the development site was the deciding factor in the City's successful bid.

2.0 Entry Consent Form

Submitted separately.

3.0 Full Project Description

3.1 Innovation

Cavendish Farms, part of the J.D. Irving Group of Companies, creates classic and innovative frozen and fresh products found in grocery stores across Canada and the United States. Cavendish Farms products start with premium quality potatoes, sourced from growers on farms located in North America's prime potato regions. They currently operate four potato processing plants: two in Prince Edward Island and one each in Jamestown, North Dakota and Lethbridge, Alberta and a specialty plant in Wheatley, Ontario.

In 2015, Cavendish solicited bids from several regions across North America as part of their selection process to build a major new potato processing facility. The $425 million facility would create up to 400 jobs and would require 9,000 acres of potatoes. The City of Lethbridge (the City) was obviously interested in having Lethbridge selected as the site for this new facility. If successful in winning the bid, it would become the largest development ever made in the City. The plant would be in the City's Sherring Business Industrial Park (**Figure 1**). This area offered nearly 120 Ha. (300 acres) of undeveloped land ideally suited to such a development. The surrounding areas are irrigated agricultural lands well suited to potato production.

Figure 1: Project Location within Lethbridge's Sherring Development Industrial Park

The City competed against ten jurisdictions for Cavendish Farms to build the potato processing plant within the City's Industrial Park. Key to the City's bid was an agreement to relocate an irrigation supply canal that divided the parcel into two (**Figure 2**). The canal has a capacity of 8.0 m^3/s and services nearly 37,000 acres of irrigated agricultural lands.

In July 2016, Wood was approached by the City to provide concepts and preliminary cost estimates for realignment of the North Lateral to allow the City to finalize their proposal submission to attract Cavendish Farms. Due to the natural slope of the land, relocation via a simple construction of an open canal at the project boundaries was not feasible. Wood determined that the most cost-effective alternative would be to divert the lateral through an inverted syphon installed along the east and north borders of the development site. Based on this information, the City was able to finalize their submission, knowing that if successful, they would be required to proceed immediately with the final design and construction of the syphon.

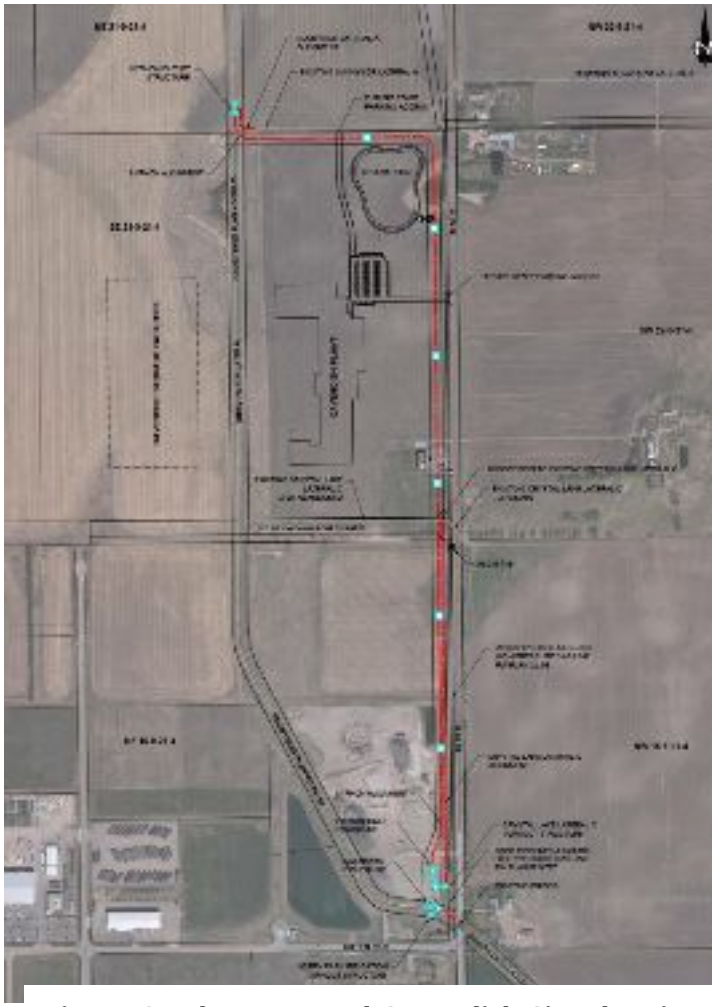

Figure 2: The proposed Cavendish Site showing severance caused by the SMR1D North Lateral and proposed Realignment Route

The lateral diversion proposed by Wood was the deciding factor in the City's successful bid.

A single pipe was significantly more cost effective than using multiple pipes, and the final construction footprint would be smaller. A single pipe required an inside pipe diameter of 3 m. Pipe products meeting that criteria was limited. Pipe materials could be rigid (concrete) or flexible (PVC, HDPE, etc.) but pipe design and installation practices would be different, and constructability was considered as part of the final pipe selection - DuraMaxx Steel Reinforced Polyethylene Pipe. This would be the largest diameter flexible pipe installed in Canada for this type of application. The total syphon pipe length was 1,870 m.

Wood added stringent requirements to the construction specifications including the responsibility of the performance of the final product to be shared with the supplier and the contractor. The supplier was required to take equal responsibility for the installation and to inspect every pipe delivered to the site and direct the installation to ensure that all joints were tested and confirmed to be water tight.

Other project components included a cast-in-place concrete inlet structure with automated overshot gates to maintain a constant up-stream water level, a cast-in-place concrete outlet structure, tee riser access points and a low point pump out (**Figure 2**).

Construction commenced September 2017 and was completed in March 2018. The syphon was available for operation at the start of the 2018 irrigation season.

3.2 Complexity

Project challenges were numerous: the required capacity of 8.0 m^3/s; limited available gravity driving head as canals have very flat bed gradient; limited available right-of-way; remaining canal section upstream of the syphon can be subjected to sudden changes in flows – thus syphon could see sudden flow surges; requirement to maintain constant upstream canal water level during operation regardless of surges and flow adjustments; and need to relocate existing delivery points (pipelines) along the abandoned canal section.

As a single pipe was more economical than multiple pipes and required less right-of-way, available pipe products were researched. Pipes had to be smooth (provide less resistance) due to limited driving head. Inlet and outlet structures were designed with minimal head losses. Inlet gates were designed to maintain constant upstream water levels on the upstream approach canal, but also adjust to react to sudden surges. Routing was of significant importance as it was required that the realignment would be along 43rd Street, which had an elevation drop of approximately 5 m lower than the current canal route (**Figure 2**).

Other criteria included sourcing a pipe capable of handling a required internal service pressure of 105 kPa due to the elevation difference from the start to end of the realignment and the added requirement to support truck traffic overtop the syphon. The syphon would need to be drained in the winter. Construction scheduling had to accommodate water delivery late into the fall by keeping the existing canal operable and then transitioning to the syphon over the winter to be ready for use by mid-April 2018. Any delay would have significant consequences due the number of agricultural producers depending on the system.

Three pipe products were selected for meeting the criteria and suitability for the conveyance pipe.

Concrete

Suppliers:
- Inland Concrete
- Lafarge

Weholite HDPE

Supplier:
- Uponar Infra Ltd.

DuraMaxx

Supplier:
- Canada Culvert

St. Mary River Irrigation District (SMRID), the owner of the canal, didn't receive any significant benefits in either a realignment of the canal or replacement of a section of a canal as an inverted syphon. Their input was required and ultimately their acceptance of the solution, as the consequence of any failure was very high.

The project design incorporated all the project requirements.

Because all three products were significantly different, with different bedding and installation requirements it was decided that final designs and technical specifications for the supply and installation of all three pipe materials be prepared and tendered. Prequalified contractors would select their preferred pipe material and bid accordingly. The City would therefore get the lowest price based on both the combined supply and installation cost. Total length of the 3.0 m dia. syphon pipe would be 1,870 m.

As previously indicated, the pipe would be operated under pressure and any failure would have significant impacts. Unprecedented on any other project, we added to the specifications the responsibly of the performance of the final product be shared with the supplier and the contractor. The supplier is required to take equal responsibility for the installation and must provide a qualified professional to inspect every pipe delivered to the site and observe and direct the installation to ensure that the pipe is installed in accordance to the manufactures' requirements and that all joints are tested and confirmed to be water tight.

Other project components included the following:

- A cast-in-place concrete inlet structure from the North Lateral into the syphon pipe. The dual bay structure included automated overshot gates to maintain a constant upstream water level. Gates would adjust as necessary when inflows changed. The inlet structure also included a trash rack to prevent large debris from entering the syphon and for safety issues;
- A cast-in-place concrete outlet structure that would reintroduce flows from the syphon pipe back into the North Lateral Canal;

- Tee-risers to allow access for video inspections and other equipment access into the syphon, if necessary; and
- A pump-out structure at the low point of the syphon.

An additional challenge was how to best provide services to two existing small supply pipelines that were currently serviced from the canal where it would be abandoned. Rather than having the two small pipelines impacted by the project being serviced directly from the syphon, it was decided to service the pipelines off the retained open canal portion. Turnout upstream of the inlet structure from the inlet canal was constructed. A second turnout which included an automated screen and cleaning device was incorporated into the outlet structure. Both turnouts tie into the respective existing pipeline and were included in the bid package.

Bids were received from four prequalified contractors on 26 July 2017. The lowest bidder chose DuraMaxx Steel Reinforced Polyethylene Pipe (SRPE) as the pipe material of choose. It combines the strength of steel with the durability and smoothness of plastic. This would be the largest diameter flexible pipe installed in Canada for this type of application.

3.3 Social and/or Economic Benefits

The North Lateral Realignment Syphon was the deciding factor in the City of Lethbridge's successful bid to have Cavendish Farms build the $425 million potato processing plant within the City's Industrial Park. It allowed for the backfill of a large open canal that severed the plant site, that the City had to agree to if they wished to be considered. The syphon removed any limitations that otherwise would have been imposed on Cavendish Farms' preferred plant layout.

The economic impact is enormous. Construction of the facility currently employs hundreds of trades people of many skills. Many workers are local but global expertise has been brought in where necessary. Once the plant is completed in the fall of 2019, it will become the largest development ever made in the City. It is estimated that it will create up to 400 full time jobs.

The plant will contract 9,000 acres of potatoes grown annually. Agricultural producers will benefit from the increased demand. This additional need for potatoes has resulted in new lands placed under irrigation, resulting in the need to design and construct the supporting infrastructure such as pump stations and pipeline distribution systems. Agricultural producers will need to invest in the equipment and facilities to grow, harvest and store the potatoes. Irrigation districts have increased demand for remaining water license allotments.

Project Pictures

First Pipe Delivered to Site

First Pipe Being Installed

Aerial View of Syphon Installation Along 43rd St.

Inlet Structure with Automated Overshot Gates

Approach Canal to Syphon Inlet Structure

Outlet Structure Prior to Operation of Canal

Wood also benefitted from this increased demand for irrigated agriculture. The Hutterian Brethren Church of White Lake engaged Wood to design and provide construction support for a project that would provide water to approximately 2,000 additional irrigated acres. The project includes a pump station located adjacent to a major canal and a pipeline distribution system to service 15 center-pivot irrigation systems. Two other landowners submitted drawings of pump station designs for review and comment by Wood that would service additional new irrigated acres.

Lethbridge Major Chris Spearman said:

> *"It's the biggest single investment in Lethbridge. It boosts the total current investment and construction in our city to over $1-billion for the very first time in our city's history. It's very exciting for people who are working in the construction sector; people who are looking for on-going jobs in the agricultural centre, whether it be in farming or in food processing. I really want to thank Cavendish Farms for their vote of confidence in our city. I think it enhances our reputation as one of the best cities in Canada for new investments."*

3.4 Environmental Benefits

Representatives from several Irrigation District's located in Alberta and Saskatchewan visited the project during construction. The use of pipe this large in diameter has previously not been used to modernize their irrigation infrastructure. After seeing the results of this very successful application of large diameter flexible pipe, districts are considering it as an option for future canal rehabilitation. This would reduce water loss due to evaporation and seepage, improving overall conveyance efficiency.

3.5 Meeting Client's Needs

The City competed against ten jurisdictions for Cavendish Farms to build a $425 million potato processing plant within the City's Industrial Park. Key to the City's bid was an agreement to relocate an irrigation supply canal that divided the parcel into two. Wood determined that the most cost-effective alternative would be to divert the lateral through an inverted syphon installed along the east and north borders of the development site. Wood's solution, a 1870 m long, 3 m diameter inverted syphon was deciding factor in the City's successful bid.

Wood was committed to providing a cost-effective solution and to address the construction schedule requirements. The success of the project is best summarized by the following quote from the City's Urban Construction Manager, Byron J. Buzunis, M.Eng. PMP., P.Eng.:

> *"The delivery of the SMRID North Lateral Syphon was an extraordinary effort facing technical, logistical and construction constraints. Over 30,000 acres of irrigated farm land and the $425 million Cavendish plant were depending on timely completion. The team, led by the Wood Environment and Infrastructure Solutions, rose to the challenge of completing the work on time and within budget."*