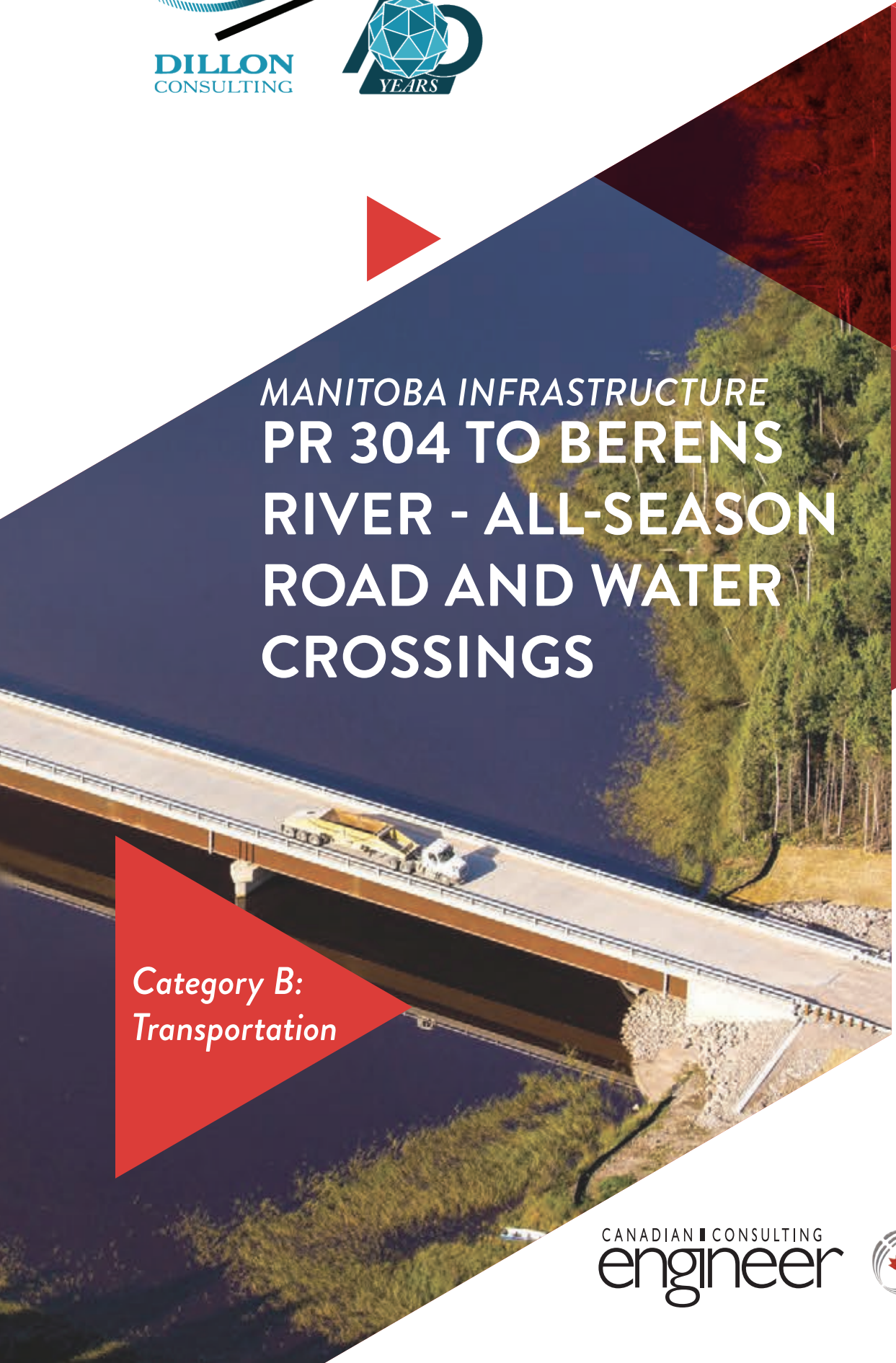
DILLON CONSULTING

75 YEARS

MANITOBA INFRASTRUCTURE

PR 304 TO BERENS RIVER - ALL-SEASON ROAD AND WATER CROSSINGS



Category B: Transportation

CANADIAN CONSULTING engineer

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Project Summary

Several communities along the east shore of Lake Winnipeg suffered for generations without all-season road access to the rest of the Province. Dillon Consulting Limited (Dillon), with AECOM Canada Ltd. (AECOM) and KGS Group (KGS) provided engineering services to administer the construction of 23 individual road segments and 9 bridges over 158 kilometers and 6 years. The undertaking generated significant economic development opportunities for local communities and provides dependable access for years to come.

PROJECT HIGHLIGHTS

Innovation

Remote First Nations throughout Manitoba have long advocated for all-season road access. A dependable road network is critical to both their future and that of future generations. With improved transportation options, residents have better access to medical support, educational choices, social services, material goods and fuel. The East Side Road Authority (Manitoba Infrastructure) initiated a plan for new and reliable transportation alternatives.

In 2011, Dillon, in partnership with AECOM and KGS, was awarded the first phase (Project P1) to provide engineering services for Contract Administration and construction supervision of a 158 km link connecting PR304 to the communities of Loon Straits, Bloodvein and Berens River. A massive assignment, the work included 23 individual all-season roadway segments with nine bridges, two major crossings and associated elements (staging, maintenance & temporary camp areas with construction access to quarries & borrow pits). The overall complexity required input from Structural, Civil, Environmental, Geotechnical, Hydraulic, and Hydrologic disciplines for successful completion.

Recognizing the challenges of the site, **new technologies** were incorporated that provided benefits to schedule, costs and overall quality:

- Digital Terrain Models permitted the development of roadway alignments. To refine the accuracy of existing site surfaces, aerial photogrammetry was coupled with 3-D survey mapping and LiDAR. Multiple survey teams captured data with helicopters/fixed-wing aircraft tied to ground-truthed GPS reference targets.
- Geotechnical investigations incorporated Ground-Penetrating Radar (GPR), a non-destructive method using electromagnetic to detect the reflected signals from subsurface structures. Its ability to perform in fluctuating terrain (swamp, fen, water, ice, rock & till) helped define some of the harshest locations.

The remote and isolated site had unique limitations requiring novel solutions not common to conventional roadway/bridge builds.

- During the winter, **24-hour operations** minimized equipment breakdowns and eliminated cold-starts.
- Constructing **embankments through frozen swamps** simplified geotextile and rock spall (muck) placement. Warmer conditions led to immediate settlements and lost material.
- Selecting **swamp mats and specialized equipment** (Russian Hagglunds or snow groomers) made access to many difficult sites possible.
- **Careful planning of bridge mobilizations** considered the winter road's life (maximum 12 weeks) and barge/ferry schedules (approximately 12 weeks).
- Assembling **concrete batch plants for each bridge** improved product reliability.
- Variable bedrock at bridge foundations required **complex agreements** between the owner, designer, contract administrator, and contractor. Solutions included additional bedrock excavation, structural leveling base concrete, spread footing modifications and modified pile quantity/depths.

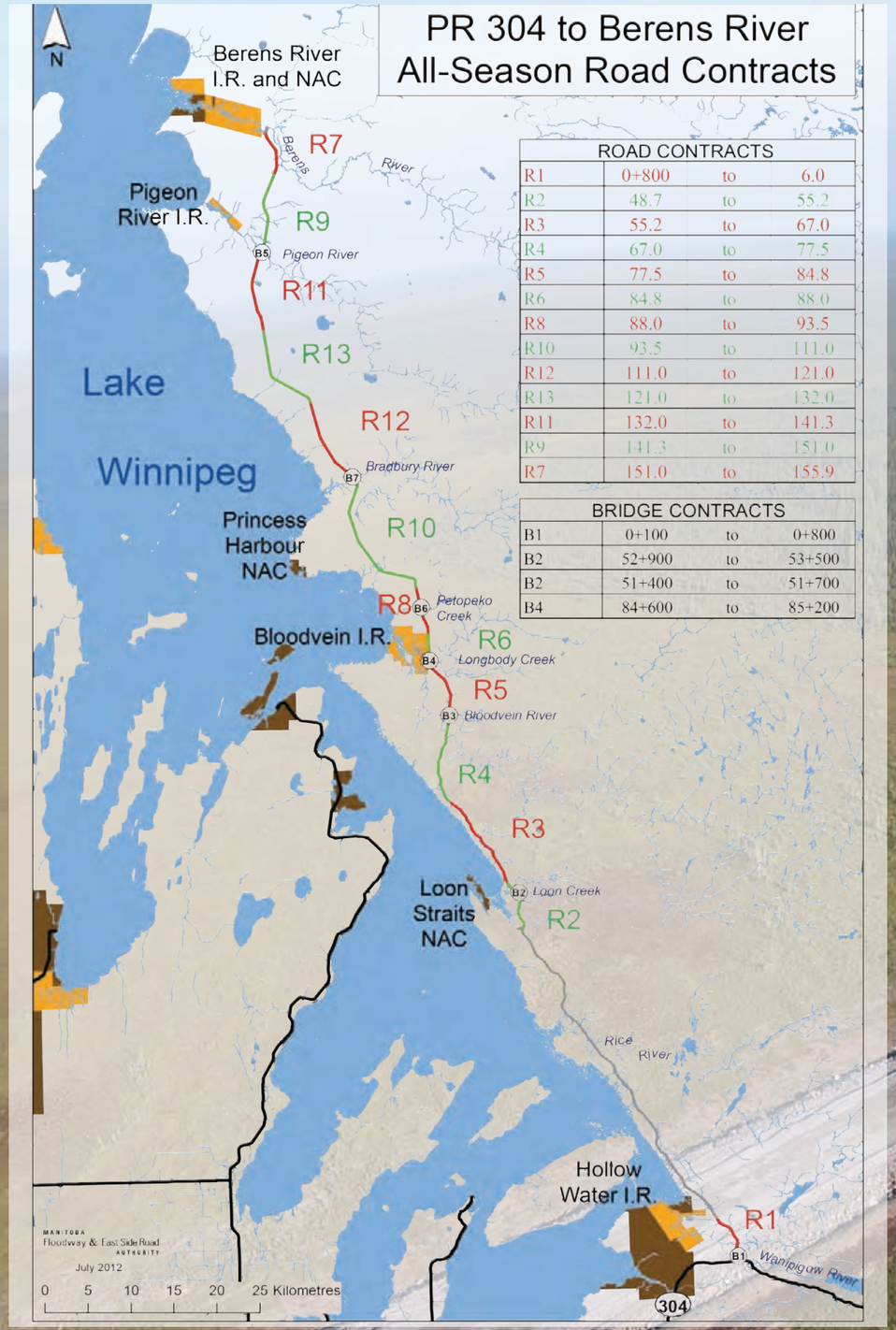
Following the completion of each contract, a Lessons Learned Session was held between the Dillon team, the contractor and East Side Road Authority to identify opportunities for future improvement.

Complexity

The challenges with the roadway and bridge design and construction along its remote 158 km route included:

- **Access:** The new All Season Road (ASR) was intended to replace the current access to the communities which was by air, water and winter road.
- **Wildlife Issues:** Due to the location of the Work, consideration to and procedures develop for wildlife in the area such as bears, wolves and cougars. First Nation Overwatches were employed to ensure the safety of the team.
- **Geotechnical Issues:** Innovative design using geosynthetic materials were employed to address the variable nature of the terrain, (Swamp, Fen, Rock, and Till). Specific multiple road cross sections were developed to deal with that variability.
- **Groundwater Issues:** Equilibrium flow was required across fens and was addressed by the utilization of rock fill embankments with equalization culverts.
- **Ice Issues:** Rigid frame design incorporating caissons was used for bridge piers.
- **Construction Issues:** The remote locations and seasonal dictated that winter construction incorporating rock embankments be utilized. Aggregates for concrete construction had to be barged or trucked to site to the mobile concrete plants.
- **Safety Issues:** Once specific concern was wildfires whereby site specific evacuation and emergency preparedness plans including escape by water using boats and helicopter. Site safety required that in some locations First Aiders Certification Level 3 were required.
- **Accommodation:** One of the difficulties was that in order to build the camps you first needed initial camps that were hauled in by winter road.

PR 304 to Berens River
All-Season Road Contracts



ROAD CONTRACTS			
R1	0+800	to	6.0
R2	48.7	to	55.2
R3	55.2	to	67.0
R4	67.0	to	77.5
R5	77.5	to	84.8
R6	84.8	to	88.0
R8	88.0	to	93.5
R10	93.5	to	111.0
R12	111.0	to	121.0
R13	121.0	to	132.0
R11	132.0	to	141.3
R9	141.3	to	151.0
R7	151.0	to	155.9

BRIDGE CONTRACTS			
B1	0+100	to	0+800
B2	52+900	to	53+500
B2	51+400	to	51+700
B4	84+600	to	85+200

Social and/or Economic Benefits

There are 22 First Nation and aboriginal communities located on the east side of Lake Winnipeg with only four of the communities having ASR access. The purpose of the project was to provide accessibility to the local to improve the safety and quality of life of those communities, and provide long term sustainability of the region.

Community Benefit Agreements (CBAs) were key to providing the First Nations opportunities to develop a skilled, trained workforce, as well as provide commercial opportunities. In particular, these agreements were designed to:

- Ensure hiring of residents from the east side communities
- Provide appropriate training and mentoring
- Encourage community enterprises and capacity building.

Specifically, CBAs were agreements designed to generate jobs, training and economic opportunities for local communities for construction activities such as:

- Gravel crushing
- Right-of-way clearing
- Access road exploratory clearing
- Road improvements.

The Dillon, AECOM and KGS team provided mentorship dealing with:

- **Inexperienced workers:** explain and justify contract requirements, provide background on the design or specifications
- **Construction challenge coaching:** assess upcoming challenges, communicate effectively with contractor
- **Community benefits agreements:** understand fundamental intent of the CBA
- **Environment:** emphasize long-term impacts / ramifications
- **Schedule and progress:** regularly review and update progress estimates
- **Contract cost**: regularly update contract costs

By engaging the First Nation communities in a unique manner through the CBA process, over 600,000 hours of local resident hours was enabled on the construction of the All Season Road.

Environmental Benefits

The project area is home to forests, wetlands, wildlife and a unique cultural history, running alongside the proposed 4.3 hectare Pimachiowin Aki UNESCO biosphere reserve. Environmental considerations extended beyond licensing requirements, incorporating special measures to protect and preserve natural and cultural assets.

Native plant species were used to revegetate the road embankment side slopes for erosion control; the required seed was hand-harvested from the existing right-of-way in prior construction seasons for a stable and balanced ecosystem. During construction, select native species were used in wood-slash bundles for sediment control. The bundles were fully biodegradable and renewable using manually-harvested biomass within the existing right-of-way.

Local wildlife was carefully and continuously protected throughout construction. Caribou migration routes were mapped to identify “no-go” zones for quarries or borrow areas. Construction activities avoided fish spawning and bird nesting windows. Natural movements of animals, including local wolves and bears, were permitted to continue unimpeded throughout construction. The impacts of construction on local species-at-risk were continuously monitored.

The **historical human environment** was preserved by identifying established traditional trapping routes and routing work to avoid them, and by incorporating portage landings at select water crossings. Partnerships with local communities preserved traditional animal harvesting opportunities by prohibiting hunting along areas newly accessible by road.

Long-term side-effects of construction were reduced by locating laydowns, camps and yards in areas with underlying impermeable soils. Each site was reclaimed and re-naturalized after construction. Work in streams and creeks was completed during winter freeze-up to prevent contamination of downstream water bodies.

Meeting Manitoba Infrastructure's Needs

The East Side Road Project is a significant infrastructure project for the Province of Manitoba. The Dillon, AECOM and KGS Team offered their services to fulfill the contract administrative roles and the project specific tasks included project meetings, developed Project Management Manual, coordinated utility with the utility stakeholders, resident and non-resident services, quality assurance and quality control, attended stakeholder meetings and delivered the final contract administration packages. Contractors were able to work with many challenges and completed the project on time and within budget.

More importantly, this project generated significant economic development opportunities for the First Nation communities. The First Nation communities gained a skilled, trained workforce that will provide benefits for many years to come. Communities that have waited generations for access now have their road.

While the development of the ASR had strong focus on engineering, relationships with the Client and public liaison with the local First Nations communities and other stakeholders was the key to the ultimate success of the project.

The success of this project and the requirement for access to the First Nations can be summed up perfectly in the comments made by Chief Hartley Everett of Berens River First Nation:

"There are always challenges for winter road travel in the spring and fall, but the completion of this road will provide year-round travel for our community. The completion of this road is something our community has been eagerly anticipating."

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