Route 1 Gateway Project

A. Introduction

The Route 1 Gateway Project is a Private Public Partnership (P3) between Dexter Developer General Partnership (DDGP) and the Province of New Brunswick through its agent the New Brunswick Highway Corporation (NBHC). Route 1 Gateway Project Company Ltd., a wholly owned subsidiary of NBHC, was created to administer the contract for the Route 1 Gateway Project. The Project includes the Design, Build, and Finance, Operation, Maintenance and Rehabilitation of Route 1 from the US Border at St. Stephen to River Glade along the south coast of New Brunswick. Work includes the construction of 55 km of new four-lane highway and selected upgrades to 180 km of existing sections of Route 1. The contract was awarded March 31, 2010 and construction will be completed no later than July 2013.

The Route 1 Gateway Project has numerous environmental challenges including crossing through three public potable water supplies (involving both Watershed Protected Areas and Wellfield Protected Areas), approximately 100 watercourses (several with multiple crossings) and about 85 wetlands, several locations with species of special concern, known heritage resource (archaeological) locations, and numerous other environmental aspects as identified in the environmental assessment documents. The Project includes construction of 35 bridge structures crossing rivers and highways, 13 wildlife crossings, and over 100 linear kilometres of wildlife fence with 125 ungulate gates.

A wide range of environmental permits were required for the Project including Watercourse and Wetland Alteration (WAWA) Permits, 105 Site Specific Environmental Protection Plans (SSEPP), 44 Fisheries Act Authorizations (HADD) and 8 NWPA applications for major river crossings. Preconstruction site meetings with federal and provincial regulatory agencies were completed in conjunction with each of the 105 SSEPPs.

Management of large volumes of waste materials such as grubbings (tree stumps, etc.), unsuitable materials such as clay soils and organics, and large boulders represented a more difficult environmental challenge than had been anticipated. Whenever possible, waste material was deposited within the highway right of way. Berms were constructed at the top of backslopes, at the bottom of fills outside the toe of slope, and in the medians where there was sufficient space available. Wherever possible the berms were constructed to a height above the final grade of the road to provide a barrier to headlights from the opposing lanes.

Disposal of material outside the right of way was still necessary in some locations. Over 25 ancillary (off right of way) locations were approved through an environmental review process. The regulatory agencies required a field assessment of watercourses and wetlands, archaeological resources, species of conservation concern, migratory birds, and other resources. Avoidance of the environmental constraint or feature was the

preferred option in the majority of cases and this approach was felt to have streamlined the regulatory review process.

B. New Archaeological Discovery

Four previously unknown archaeological sites were identified in the Pennfield area of the Route 1 alignment after the start of construction. Two of the archaeological sites were determined to be Paleoindian in age (approximately 11,000 years old) and are some of the oldest sites in Northeastern North America. Given the significance of the find and the length of time that would be required to adequately investigate and mitigate impacts to the site, avoidance was recommended and alternative alignments were considered.

DDPG's design team determined that the alignment could be redesigned to bypass the site if the new properties needed met environmental assessment requirements and could be acquired in a timely manner to prevent delays to the completion of the Project. The proposed re-alignment was approximately 200 m north of the original alignment and required realigning about 3 km of the highway. Figure 1 shows an aerial view of the realignment and archaeological sites.

DDGP and NBDOT worked with representatives of First Nations groups and the Archaeological Services Unit (AS) of the Heritage Branch, Department of Wellness, Culture and Sport to investigate the site and to minimize the impact on the construction schedule. The Developer was delayed several months by the investigations and needed to adjust construction schedules to maintain the original Project completion date.

The initial discovery of an artifact triggered a requirement to carry out additional archaeological work on this high potential site, as well as other high potential adjacent sites. Once the extent of a potential 10,000-11,000 year old Paleoindian site was roughly determined NBDOT quickly began to gather information on initial artifact locations and conducted preliminary alignment changes to avoid the site. One restriction to the planning was to hold the alignment at Cripp's Stream, a major stream crossing, where DDGP had already invested significant resources into new infrastructure. In discussions with AS, DDGP and NBDOT, conceptual alignments were developed to avoid the estimated boundaries of the site until field work could confirm the actual limits.

1) Additional Right-of-Way Requirements

In parallel, DDGP and NBDOT started early looking at the potential impacts to adjacent lands outside and adjacent to the existing right-of-way. Typically, projects of this nature require that the extra right-of-way would be acquired through the expropriation process, which could take upwards of a year to complete in New Brunswick. There were three main properties that were affected by the alignment shift. Fortunately, the adjacent land owners were open to a quickly negotiated settlement for the additional property, which shortened the land acquisition process by approximately nine months.

2) Environmental Assessment Revisions

The Environmental Assessment (EA) for this section of the Route 1 upgrading project was approved in June 2009 covering a specific environmental footprint. The EA for the

new footprint would have to be updated to acquire the appropriate approvals to continue the work on the three (3) kilometer re-alignment. An EA consultant in the fall of 2010 carried out typical EA requirements related to Valued Environmental Components (VECs) on the corridor for the proposed new alignment of Route 1 in this area. The corridor assessment would provide enough flexibility to ensure the final alignment could tolerate later adjustments during the design stage. Also, part of the EA was to develop a test pitting program for areas that could not be avoided by the shift in the alignment. This was done in consultation with AS under the appropriate Archaeological license using a 10 meter grid pattern.

Once the program was approved, the EA consultant prepared to undertake the test pitting. As a result of the test pitting the sites were able to be delineated. This allowed a final adjustment to the alignment and defined those high potential archaeological areas that could be avoided, but also indicated the areas that would need further mitigation (detailed and meticulous archaeological excavation) before sections of the new alignment could be constructed. An extensive test pitting program was undertaken to avoid significant delays in the construction schedule, during the latter half of December 2010 and into early January 2011.

During the winter of 2011 an addendum to the original EA Registration for this section of Route 1 was submitted to the Department of Environment (DENV) for review. The approval for the alignment shift of Route 1 was received in late March 2011 allowing construction to begin on the new alignment, except in archaeological areas within the new alignment that required mitigation through a meticulous field excavation program.

As the timelines were edging closer to the spring/summer field season for archaeological investigation, discussions were on going with AS to determine the most effective mitigation approach to be pursued in order to avoid delays to the Project and to DDGP. Major considerations on any approach were closely tied to time (schedule) and the overall costs to complete the mitigation. It was determined that the most expedient and cost effective approach to mitigation was through an internal team, led by AS to manage and conduct the required field excavation and assessment. A total of four high potential archaeological sites required mitigation. Figure 2 shows an aerial view of the archaeological area in relation to the old alignment.

3) Important Considerations Faced at Outset

Five primary goals were recognized for the proposed archaeological mitigation:

1) expediting the excavations, 2) limiting the costs of the mitigation where possible, 3) maximizing the quality and amount of data collected while still in the field, 4) meeting or surpassing all minimum Archaeological field standards required by the Archaeological Permits, and 5) maintaining a full and open consultation process with First Nations throughout the process and ensuring that all parties were in agreement with the methodologies employed and the proposed approach.

4) Project Components

Due to one organizational framework overseeing the simultaneous excavations of four archaeological sites, the complex project was broken into segments; 1) detailed site delineation; 2) infrastructure set-up; 3) excavation/documentation; 4) environmental sampling; 5) construction monitoring; and 6) site consolidation and closure. Each site had at least four of the six project components, which were approached in such a way that all sites interacting with the proposed alignment were completed first, before proceeding on to the Paleoindian sites.

5) Innovative Approaches Developed

The innovative solutions developed to meet these challenges were primarily in six areas: 1) First Nations consultation; 2) Photogrammetry and Laser Imaging of all excavated layers; 3) Forensic quality standards of artifact and sample collection; 4) Establishment of a fully-equipped field laboratory with trained professional staff; 5) direct hire of field crew as casual employees and use of existing permittable provincial staff archaeologists as directors. Each of these will be discussed in detail below.

i. First Nations Consultation

The approach to First Nations consultation utilized for this Project built upon framework which developed out of the challenging excavations at the Jemseg Crossing Project, a NBDOT project which occurred in 1997. From this project developed an advisory committee on Archaeology for the Wolastoqiyik called the Maliseet Advisory Committee on Archaeology (MACA). MACA was created to facilitate open discussion of archaeological issues between the Province (AS) and First Nations Chiefs and Council Members through appointed representatives.

For this Project the innovation in this area came from involving First Nations early in the process to help develop goals, and enshrining regular reporting to First Nations representatives in the project management scheme.

Regular site visits for any First Nations representatives who wished to visit were arranged, and opening and closing ceremonies led by a Wolastoqiyik elder were held before work had begun and upon completion of excavations. The Project was jointly directed by a Native and non-Native archaeologist; and the crew was composed of approximately one half First Nations field workers, some of which had direct ties to MACA to act as informal observers and participants.

ii. Photogrammetry and Laser Imaging

One of the most time consuming yet important aspects of archaeological excavation is the documentation before removal of artifacts and cultural features. Generally, this is performed by generating scale drawings from field measurements.

For this Project, it was decided that in addition to hand drawing these objects, a professional photographer with archaeological experience would be employed to take ultra-high resolution photographs and 3D video of any object or feature we wished to

document. These photographs were taken with calibrated targets which when placed throughout the frame allowed for the generation of a 1:1 scale 3D colour digital model of the object photographed (See Figure). The system we established for taking these photos allowed for 100% of the layers and features to be documented during the large

excavations at the site (BgDq-39). The models produced are of sufficient quality to allow the depiction and measurement of any aspect of the subject as it existed prior to collection or removal.

iii. Forensic Approach to Artifact/Sample Documentation and Recovery

With the importance of the sites being excavated recognized early in the planning process, it was decided that every effort would be taken to ensure that little to no modern contaminants would be brought onto the site by establishing a 30m buffer around the site where no food or drink were permitted. Smoking was moved some 150 m further still to ensure no possible contamination of samples or artifacts.

Excavation of cultural-bearing sediments was conducted through 1/8" screens to maximize the data recovered; all artifacts identified in excavation units were handled with sterile gloves and documented/collected by experienced field lab personnel. This approach ensured custody of the excavated material was documented from discovery through mapping/photography and collection/cataloging. The efficiency of this approach cannot be over-emphasized, as all artifacts and samples are cross-referenced in photos, video, catalogue and field notes to ensure provenance is duplicated. This approach also allowed investigators to focus on careful excavation and did not require down-time while they documented the artifacts, as they would generally move to an adjacent excavation unit and begin work while the find was documented.

This approach has made post-excavation analysis much quicker as any provenance was duplicated in at least three times. However, the biggest contribution to this approach has been to recover the entire assemblage from the site in such a way as to enable new developments in archaeological analysis to be conducted and interpreted – some techniques (protein residue extraction, pollen/phytolith analysis) have not previously been on any project in Eastern Canada to the authors' knowledge.

iv. Field Laboratory

Post excavation artifact and sample processing and analysis are a major component of all archaeological excavation projects. These analytical and clerical activities can often add months to an excavation budget to ensure a site is adequately documented and interpreted. For this Project we sought to minimize this expense by establishing a well-equipped field laboratory with academically-trained archaeologists to handle all artifact recovery, documentation and analysis/cataloging immediately upon identification of a new find. Based on a comparable project using traditional post-field laboratory analysis – this Project would have been expected to have required a further 5-6 months with a crew of at least six to process and analyze the finds/samples. Using the Field Lab approach, a staff of four was required for 3 months to recheck field identifications, enter artifacts into the Province's artifact database and ensure artifacts were prepared for curation/study. While providing better field results, this approach also resulted in a savings of between

40% and 60% when compared to the projected processing cost using traditional post-field cataloging and analysis.

v. Direct Hire of Field Crew and Use of Existing Staff Archaeologists as Directors

A significant savings was found by direct hiring the field crew as casual employees rather than subcontracting to private industry subject to a maximum 2.2 multiplier atop each supplied crew member to cover overhead. By using existing government resources, the Project was able to absorb some of the clerical and human resources tasks by spreading them across existing staff.

In this area alone, assuming the same number of work hours for a comparable sized crew would have amounted to $660,000 for salaries, compared to the $300,000 actually spent on this Project. This one line item would have surpassed the final cost of the whole of the actual project costs, had NBDOT and AS approached it in the conventional way through the use of third party consultants.

6) Project Outcomes:

The excavations of the four sites were completed in 19 weeks, with an average crew size of 22 people (ranging between 14 and 30 throughout the Project). In total, the area excavated was 270 square meters; with about 9,500 artifacts and samples recovered.

Using the established lines of communication (direct to chiefs and through designated representatives) and enshrining the consultation within the organizational structure of the Project meant that feedback to and from First Nations' representatives was immediate and present through all of the phases of the Project. The proposal to avoid impacting the Paleoindian sites while mitigating the other two later sites was approved, but there was an additional request from First Nations to investigate the Paleoindian sites further to recover information to allow for future interpretation of these important sites.

Constant communication between AS, NBDOT and DDGP allowed for completion priorities to be set and met, and provided a communication stream through which safety and scheduling concerns were addressed rapidly when identified.

7) Comparison with Other Projects:

The combination of greater efficiencies and greater data recovery are the greatest successes of this Project. While individually each project generated a significant savings, taken together they led to a Project that led to between 40% and 90% savings depending upon the unit of comparison with projects using more traditional methodologies (Table 1).

8) Implications of Project Outcomes:

While the goals and efficiencies developed for this Project and discussed above are significant contributions to the area of efficient mitigation of archaeological sites interacting with proposed developments; we believe the largest contribution will be in the information on the factors may have influenced the selection of these unusual

landforms as occupation sites. One of the reasons these sites were not identified until late in the assessment process was that they occupied areas which are not commonly ascribed elevated potential for encountering Pre-Contact archaeological sites.

All available selection factors have been considered which has allowed for the development for the first time in New Brunswick of a Predictive Model for these early sites to add to the established predictive models for later sites. As of February 2012, this model is available to all developers, researchers and consultants for planning and assessment purposes. Development of the model was facilitated by recent high quality surficial geology maps and interpretation from the Geological Survey Branch of NB Department of Natural Resources.

It is our hope that the predictive modeling of potential areas will allow developers to plan around these possible sites and where avoidance cannot be attained, to ensure that the assessments include these areas and that sites are identified early on in the design phase to provide decision makers with time to consider the issues and if mitigation is selected, to allow time to complete this mitigation before Project delays are experienced.

C. Concluding Statements

A very significant archeological site was discovered along the proposed corridor for the Route 1 Gateway Project. Although a Design-Build project with critical timelines, the New Brunswick Department of Transportation (NBDOT), Archaeological Services (AS) and Dexter Development General Partnership (DDGP) worked in close cooperation to reduce the impact and collect all the relevant archaeological material affected by the highway corridor and minimize the impact on the Project schedule. This combined effort from all stakeholders allowed AS to collect significant archaeological data and preserve important cultural material which is previously unknown in New Brunswick and rare in Northeastern North America.

The work completed by all parties, the findings within the Project area, and how the findings were managed makes the Route 1 Gateway Project a significant candidate for the Transportation Association of Canada Environmental Achievement Award.

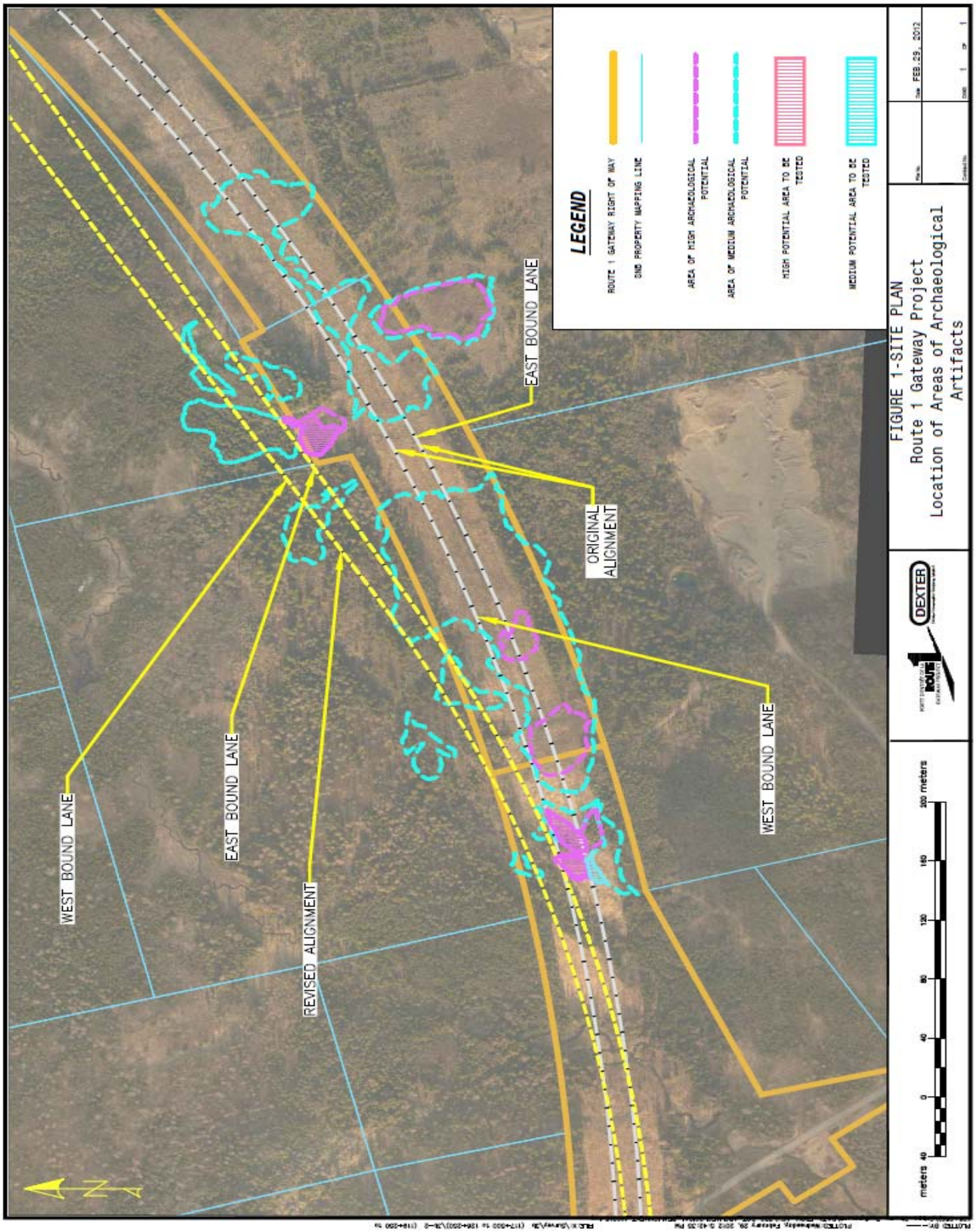

Figure 1 - Aerial View of the Highway Realignment and Archaeological Sites

Figure 2 - Aerial View of the Archaeological Area in relation to the Old Alignment

Photos of Test Pitting at Archaeological Site

Table 1 – Comparison between Route 1 Gateway Project and Comparable Projects

Project Name	**Route 1 Gateway Project (Pennfield)**	**Swan Creek Lake**	**Mill Brook**	**Lower Guisiguit Brook**
Number of Sites	**4**	**1**	**1**	**1**
Total Area Excavated (Manual Excavation)	270 sq. m 100% excavation by hand. 65cm Avg. Depth **175.5m³ - Total Soil Excavated**	56 sq. m 100% excavation by hand 22cm Avg. Depth **12.32m³ - Total Soil Excavated**	52 sq. m 100% Excavation by hand 41cm Avg. Depth **39.77m³ - Total Soil Excavated**	97 sq. m 100% excavation by hand 63cm Avg. Depth **61.11m³ - Total Soil Excavated**
Methodology	Trowel and ¼" – 1/8" screen	Trowel and ¼" screen	Trowel and ¼" screen	Trowel and ¼" screen
Report Writing/Translation/ Dissemination Costs:	Detailed Analysis and Dissemination	No detailed analysis/Dissemination	No detailed analysis/Dissemination	No detailed analysis/Dissemination
Monitoring Costs:	Included	Included	Not Included	Included
Site Stabilization/Capping Costs:	Included	Not Included	No Capping	No Capping
Total Project Costs:	$620,000 (2012) Accommodations and dissemination removed for direct comparison (-$78,000 accommodations,	$143,000 (as of December 1999)	Ca. $300,000 (2009)	Ca. $500,000 (2006-2007)

Project Name	Route 1 Gateway Project (Pennfield)	Swan Creek Lake	Mill Brook	Lower Guisiguit Brook
	All field gear maintained by Province for use in future projects ($47,000 net benefit not removed from final figure) $542,000			
Corrected for Inflation	$542,000	$188,635 (BoC)	$320, 442 (BoC)	$551,645 (BoC)
Cost/sq. m excavation – Excavation to Dissemination	$2,007.00	$3,368.48	Ca. $6,153.85	Ca. $5,687.06
Cost/m³ of manually excavated soil	$3,088	$15,311.28	Ca. $8057	Ca. $9,027
Cost/Artifact/Sample Recovered	$57.05 (9500 Artifacts/Samples)	$323.01 (584 Artifacts/Samples)	$196.69 (1629 Artifacts/Samples)	$641.44 (860 Artifacts/Samples)
Extenuating Costs:	Project Timeline/Importance of best possible documentation due to site significance. *Crew lodged completely in field	Project Timeline	Project Timeline	Project Timeline – Winter Excavation