FISH HABITAT COMPENSATION ON THE TRANS CANADA HIGHWAY PROJECT IN NEW BRUNSWICK

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ABSTRACT

The four-lane Trans-Canada highway in New Brunswick was recently completed with the final 98 km of new highway opened to traffic in October 2008. The *New Brunswick Department of Transportation (NBDOT), through the New Brunswick Highway Corporation (NBHC)* completed this work using a public-private partnership agreement. The *Brun-Way Group*, a joint venture owned by SNC-Lavalin and Atcon Construction was selected to carry out this work and signed a $543.8 million agreement in February 2005 called the *Trans Canada Highway Project*.

Prior to signing the agreement with Brun-Way, NBDOT initiated all Environmental Approvals required under the Canadian Environmental Assessment Act and the Provincial Clean Environment Act. It was determined that 58 water-course crossings would be required and studies determined that fish were present at 51 of these sites. It was estimated that approximately 27 970 m^2 of fish habitat would be affected. The Federal Department of Fisheries and Oceans (DFO) and NBDOT agreed that compensation would be required for Harmful Alteration, Disruption or Destruction (HADD) of fish habitat due to the large area affected. DFO required compensation at a ratio of 3:1 therefore a total of 83 900 m^2 of habitat compensation was required as part of the CEEA approval.

NBDOT entered in to a memorandum of understanding with DFO to establish a HADD Bank. The HADD Bank was funded through the Design-Build Agreement with Brun-Way where they were required to make a one time payment of $1.8 million based on 83 900 m^2 of compensation area. Brun-Way was fully responsible for all additional HADD compensation required if they exceeded the estimated 83 900 m^2.

Using the HADD Banks funds, NBDOT was able to complete 9 projects. These projects were a combination of NBDOT infrastructure improvements and Non-Governmental Organization (local watershed and angling associations) improvements to local waterways.

Brun-Way's actual HADD compensation requirement was 156 200 m^2 which surpassed the original estimate of 83 900 m^2. Brun-Way was therefore required to complete an additional 72 300 m^2 of compensation beyond the work that DOT completed under the HADD Bank. Brun-Way was able to meet their additional compensation requirements by completing 6 projects for which they received approximately 175 100 m^2 of fish habitat compensation credits.

The HADD compensation projects completed by NBDOT and Brun-Way exceeded the compensation requirements by 156 000 m^2 more than required. NBDOT is now in discussions with DFO to establish a new HADD Bank for current and future work. A significant portion of surplus compensation from the Trans Canada Highway Project may form part of the new Bank to help offset HADD of fish habitat from future projects.

1.0 Introduction and Project Description

The Province of New Brunswick recently celebrated the completion of the four lane Trans Canada Highway when the final 98 km of new highway was opened to traffic on October 31, 2007. This final section of the Trans Canada Highway in New Brunswick was completed through the Trans Canada Highway Project (TCHP) which is a public private partnership between the New Brunswick Highway Corporation (NBHC) and Brun-Way Group (Brun-Way). NBHC is a crown corporation established by the government of New Brunswick and it has been given responsibility to manage large highway projects. NBHC created the Trans Canada Highway Project Company (TCHP Co.) to administer this project on its behalf. Brun-Way Group is a joint venture owned by SNC-Lavalin Inc. and Atcon Construction Inc.

The scope of the TCHP covers 275 km of highway between the New Brunswick/Quebec border and Longs Creek (near Fredericton). It includes 98 km of new highway between Woodstock and Grand Falls that was designed and built by Brun-Way, 47 km of new highway built by the New Brunswick Department of Transportation (NBDOT), and 130 km of existing 4-lane. Refer to Figure 1.0 which shows the location and scope of the TCHP. Brun-Way is responsible for the operation, maintenance and rehabilitation of this entire 275 km section of highway until June 30, 2033.

The 98 km of new highway to be built as part of the TCHP was subject to an Environmental Assessment (EA) prior to selection of a private developer. The EA was the responsibility of NBDOT and through this process it was determined that due to the magnitude of this project there would be significant harmful alteration, disruption, or disturbance (HADD) of existing fish habitat. NBDOT and the Department of Fisheries and Oceans (DFO) realized that an alternative approach to fish habitat compensation would have to be developed to meet the challenge of providing adequate compensation prior to the project completion date of November 1, 2007. It was determined that a "*HADD Bank*" could be the best solution. This paper provides a description of how this HADD Bank was implemented on the TCHP and the associated results.

2.0 A Brief History of HADD at NBDOT

In the mid 1980's the Federal Department of Fisheries and Oceans developed policies that dealt with fish habitat in Canada. The policy was to be used as a guiding principle of "No Net Loss of Productive Capacity" of fish habitat. This set the stage for the compensation requirements that are under consideration today.

The policy was a result of Sections 35 (1) and 35 (2) of the federal Fisheries Act. These sections state that;

> 35 (1) No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat and
> 35 (2) No person contravenes subsection (1) by causing the alteration, disruption or destruction of fish habitat by any means or under any conditions authorized by the Minister or under regulations made by the Governor in Council under this Act.

As a result of the DFO Policy, in 1995, NBDOT began responding to the issue of HADD of fish habitat. Since that time the department has been carrying out compensation projects for watercourses that have been impacted by new highway construction or impacted by upgrades to existing infrastructure.

To date a number of approaches have been undertaken by NBDOT to provide appropriate compensation projects for HADD impacts. NBDOT compensation projects have mainly been completed on a site-by-site basis where specific HADD compensation is determined for each affected watercourse. Some of the compensation methods used included:

- the elimination of hanging culverts (significant water drop at the outlet end of a culvert)
- placement of digger logs within the watercourse to promote habitat growth
- providing fish ladders to allow movement of fish further upstream
- removal of debris that has been deemed a barrier to fish passage
- removal of man made structures that are barriers such as abandoned mill dams and obsolete bridge piers
- removal of beaver dams (including relocation of builders)
- bank stabilization of chronic sedimentation problems

Hanging culverts have been eliminated by lowering the culvert invert (bottom of the culvert) through installation of new culverts so that water levels permit fish movement upstream. Also, downstream water levels have been raised sufficiently by constructing outlet pools and in-stream fish weirs to eliminate the hanging culvert. Some streams had natural elevation barriers or hanging culverts that could only be overcome by the use of a fish ladder. A fish ladder is a series of pools and weirs that allow fish to gradually swim upstream by moving from pool to pool in the fish ladder and at the same time increasing their vertical position within the watercourse.

Digger logs are logs that are placed in the stream bed to allow habitat to be created in an area on the downstream side of the log by creating small pools that allow the fish to rest as they journey upstream.

The removal of debris, beaver dams and man made structures can often be easily accomplished but may require special permits and agreement from DFO if there is significant in stream work.

Some HADD compensation projects may also need to be reviewed with the provincial Department of Environment (DOE) to determine if it needs to be registered under the Environmental Impact Assessment regulation. If a registration is required the timelines may become lengthy and not all projects will be accepted.

3.0 Environmental Assessment of the Trans Canada Highway Project

The planning for the portion of the Trans Canada Highway from Grand Falls to Woodstock involved routing approximately 100 km of new four lane highway through the Saint John River Valley. The size and expected impacts of this project triggered an Environmental Assessment (EA). NBOT initiated the EA and engaged Jacques-Whitford Limited of Fredericton, NB to

complete the assessment. The routing was planned to minimize as many environmental impacts as possible, many of which included wetlands, valued farmland, rare plants, Appalachian Hardwood Forest and watercourse crossings. However, even after avoidance efforts, the routing did cross 58 watercourses in which HADD compensation would be considered. Of the 58 watercourses, it was estimated that 51 (3,4) required compensation as per the Federal Fisheries Act. The EA on this portion to the TCH estimated that approximately 27 967 m^2 (3,4) of fish habitat would be impacted and require HADD Compensation. A compensation factor of 3:1 was required by DFO, which resulted in a total compensation requirement of 83 900 m^2.

As part of the approved EA, NBDOT had to include a HADD Compensation program for the new construction from Grand Falls to Woodstock. Through the approval process, and based on past highway EA's carried out by NBDOT, DFO recommended that the management of HADD Compensation projects would be best carried out by NBDOT rather than the private developer. At that time, the successful developer/operator was unknown and the aggressive construction schedule that was being proposed could negatively impact the completion of the HADD Compensation prior to the opening of the new portion of the TCH. The Department agreed to DFO's suggestion and tasked its Planning and Land Management Branch with completing the compensation program on time and on or under budget.

With the compensation plan being carried out and administered by NBDOT, the developer that would be eventually selected, would have all of their permit approvals for working and crossing each of the watercourses streamlined to avoid time delays during the construction process.

The EA process also included an evaluation of the estimated budget required to complete 83 900 m^2 of HADD compensation projects. A historical review of typical NBDOT compensation projects indicated that the average cost was $21.00 per m^2. Funding of approximately $1,762,000.00 would be required. Rather than fund this program through NBDOT's capital budget, it was decided to have the TCHP developer provide the funding through the project agreements. The Request for Proposals issued to the project proponents identified that a payment of $1,800,000.00 to fund the HADD Bank projects would be required on the date of signing. The specific TCHP project agreements related to this payment are discussed further in Section 5.0.

4.0 The TCHP HADD Bank

To ensure the HADD Compensation Program was successfully completed, NBDOT and DFO jointly developed a Memorandum of Understanding (MOU) to clearly define each department's obligations and responsibilities. The MOU was signed on August 29, 2005 and acknowledged the innovative nature of this HADD Bank by clearly stating the desire of both parties to work in spirit of co-operation and good faith. The MOU also acknowledged that this would not be a typical HADD Bank as defined under the Fisheries Act whereby proponents create habitat improvements for future use as compensation when a project is carried out. Instead, the MOU describes that authorizations can be issued by DFO approving the destruction of fish habitat in advance of compensation plans being completed (2).

NBDOT was responsible for ensuring the projects were completed as per the approved designs and for implementing a monitoring program as needed. A series of regular meetings were conducted to update DFO on the status of the HADD Bank and compensation projects.

4.1 *Selection Criteria for Compensation Sites*

The selection of compensation sites was based on the following criteria:

- First Order – projects developed on watercourses crossed by the TCHP within the project right-of-way.
- Second Order – projects developed on watercourses crossed by the TCHP but outside of the project right-of-way
- Third Order – projects developed on watercourses not crossed by the TCHP and outside of the project right-of way but located between Grand Falls and Woodstock
- Fourth Order – projects developed outside of the project limits but within the Saint John River drainage system

NBDOT's program did not consider First Order sites as work within the right-of-way was the responsibility of Brun-Way. Preference was given to projects within the Second Order over Third and Fourth Order if they were economically feasible. NBDOT was responsible for developing the conceptual design for each project site and then would review it with DFO to determine the feasibility, habitat issues, and potential compensation credits.

All compensation projects had to be agreed to and approved by DFO as outlined in the MOU before being undertaken by NBDOT. Also, before any site work was initiated, NBDOT and DFO would come to an agreement on the final compensation plan and the compensation credits that would form the final build out of the project (2).

4.2 *Non Governmental Organizations*

To avoid NBDOT undertaking new or improving existing infrastructure as the only form of compensation projects, DFO required through the MOU that an unspecified portion of the compensation requirements be undertaken by the private sector, namely, through Non Governmental Organizations (NGOs).

A new process was established to engage NGOs accordingly. NGOs were hired to complete 11 900 m^2 of the compensation requirement. Table 4.0 indicates the projects that were undertaken by NGOs and the details of each.

NBDOT noted many advantages in hiring NGOs for fish habitat compensation since these organizations typically have extensive experience in this type of work and have local knowledge of potential projects on most watercourses within their regions. Also,

they are able to carry out the required work at fairly low or reasonable costs per square meter because they typically use significant volunteer resources.

Table 4.0

Summary of NBDOT and NGO HADD Compensation Sites

Compensation Site Description	NBDOT or NGO	Habitat Area Improved (m^2)	Compensation Factor Partial Obstruction – 0.333 Complete Obstruction – 0.5 Work in Riparian Zone - 0.1	HADD Compensation Credit (m^2)
Little Presque Isle	NBDOT	52,000	0.333	17,316
Upper Guisiguit	NBDOT	12,100	0.333	4,029
Hales	NBDOT	14,000	0.5	7,000
Lily	NBDOT	32,000	0.333	10,650
Bumfrow	NBDOT	66,000	0.5	33,000
CWWA (5)	NGO	71,171	0.333	23,700
FAWA (6)	NGO	8,859	0.333	2,950
HRAA (7)	NGO	121,500	0.1	12,150
KWRC (8)	NGO	76,000	0.1 and 0.333	26,650
Total		**453,630**		**137,445**

4.3 NBDOT Compensation Projects

The projects that were completed as part of the HADD compensation program for the TCHP were the result of numerous field trips to many watercourses that contained NBDOT infrastructure (culverts) which created a barrier to fish passage. The barriers were in the form of hanging culverts (i.e. a vertical water drop at the outlet end of the culvert) and/or a stream grade too steep for fish passage (i.e. no fish ladders or baffles present). Other projects considered for the program consisted of in stream barriers to fish passage in the form of massive debris sites and abandoned dams. Table 4.0 summarizes all the projects that were undertaken in the compensation program Following is a brief description of the various projects:

Little Presque Isle - Fish passage restoration work was conducted at the derelict former sawmill dam, located on the Little Presque Isle Stream at Waterville, which had collapsed since operations of the sawmill were terminated in the mid 1960's. The concrete remaining from the former structure had trapped woody debris, and resulted in a partial to complete impediment to fish passage at this location. Concrete debris was removed from

the stream channel and placed on the bank for stabilization during high water flows, and a turbine was removed and placed off site. The low flow channel was excavated and boulders were placed to break-up the current and create eddies. Rip rap excavated from the channel was placed in the portions of the channel that were not being excavated. Refer to Figure 4.3a for photos of this project site before and after compensation work was completed.

Upper Guisiguit - Fish passage restoration work was conducted at Upper Guisiguit Brook, Carleton County, between the existing Route 2 and its' confluence with the Saint John River. Two barriers to fish passage during low water conditions existed, a cascade approximately 60 m downstream of the culvert at Route 2, and at the downstream end of the culvert at Route 2. The installation of control points immediately downstream of the culvert and in the cascade consisted of large boulders, that were installed and embedded with rip rap to back up water in lower flow conditions and to allow water to flow over them in higher water conditions.

Hales – This site was located on Route 105 near Upper Brighton in Carleton County. The existing concrete arch was installed in 1909 and had a hanging outlet that prevented fish passage. A fish ladder and fish baffles were added to the existing culvert to restore passage. Refer to Figure 4.3b for photos of this project site before and after compensation work was completed.

Lily – This site was located on Route 165 near Woodstock in Carleton County. The existing pipe was a concrete arch with 2.44 m metal pipe extensions on both ends, which caused partial obstructions to fish passage. The culvert was replaced which included fish baffles and an outlet pool was developed.

Bumfrow - This site was located on Route 105 near the Beechwood dam in Carleton County. The existing pipe had a hanging outlet that prevented fish passage. Twin box culverts, located immediately downstream under the NB Trail, were partially filled with debris/sediment. The pipe on Route 105 was replaced and the box culverts under the trail were cleaned out. Pools were developed downstream of both culverts and large boulders were placed in the stream to control flow.

CWWA – Canaan-Washedemaok Watershed Association(5) - A section of Ridge Brook, flowing through an agricultural operation near Havelock, had been identified as being in need of habitat/bank restoration due to bank erosion, sand and gravel deposits, and loss of quality habitat. After a detailed fluvial geomorphic assessment the channel was re-aligned based on the natural hydraulic characteristics, natural pool/riffle spacing was developed allowing fish to move freely through this section of the brook during any flow conditions as well as create excellent aquatic habitat for salmonids to spawn or rear. To complete the project, the banks were re-vegetated, a fording site was created for cattle and fencing will be placed along both sides of the bank.

FAWA – Fredericton Area Watersheds Association(6) - Ten habitat restoration projects were identified on 3 small urban waterways in Fredericton; Corbett Brook, Killarney

Brook, and Garden Creek. The objectives were to create and restore several fish passages, stabilize stream banks and restore channels, and to build community support, awareness and participation as part of a broad public education and stewardship campaign. Enhancement/restoration works were designed to be implemented by a volunteer and hand labor work force and the projects provided skills and job development opportunities for youth-at-risk enrolled in the District 18 Alternative Education Program.

HRAA – Hammond River Angling Association (7) - This project was identified because of the degradation and removal of vegetation in the river's riparian zone. The purpose of this project is to restore and enhance freshwater habitat in the Hammond River and Palmer Brook through remediation of the riparian zone. This remediation will involve planting tree, bush and shrub species indigenous to the watershed, "stream sweeps" to remove inorganic debris, fence installation in agricultural areas and posting signage in newly planted areas.

KWRC – Kennebecasis Watershed Restoration Committee(8) - This project was identified because of riparian zone degradation, erosion, and over widened streambeds in the system. The objectives for this project are to complete the rock sill pattern on Trout Creek through the Town of Sussex, initiate new habitat restoration efforts on Wards Creek through riparian zone planting, bank stabilization, and riparian zone fencing, and erect more educational signage along the town's walking trail.
As noted earlier, the compensation requirements for the project consisted of 83900 m^2. The projects illustrated in Table 4.0 will provide 137 445 m^2 of habitat compensation. The difference is a 53 545 m^2 surplus of the compensation identified through the Environmental Assessment.

The surplus credits realized from the TCH compensation program would ordinarily be lost at the completion of the project, however, DFO have indicated that their department is willing to enter into an agreement to have the surplus credits banked for future work.

The total cost to complete the NBDOT and NGO compensation projects was approximately $1.7 million pending final monitoring costs. NBDOT's costs to manage (internal costs, consultants, and engineering) the program was approximately $170,000.00 or 10 % of the total project costs. NBDOT also noted that the costs per square metre for the projects ranged from $2.00 - $60.00 with an average of $12.40/$m^2$ which was below NBDOT's historical cost of 21.00/m^2.

5.0 HADD Requirements – TCHP Design-Build Agreement

In order to implement the HADD compensation bank as recommended through the Environmental Assessment, specific requirements had to be included in the TCHP Design Build (DB) Agreement.

The Environmental Matters section of the DB Agreement outlined specific requirements for Brun-Way and TCHP Co. related to HADD.

Brun-Way's HADD obligations are outlined as follows:

1. Brun-Way was required to obtain all Environmental Approvals and was responsible for the associated permitting and costs related to HADD for each individual watercourse as required by DFO.
2. Brun-Way was required to make a one time payment of $1,800,000 to TCHP Co. on the execution date of the DB Agreement to fund the HADD Bank.
3. Brun-Way was required to minimize the actual amount of HADD related to fish habitat in their performance of the DB Work.
4. If, during the performance of the DB Work, Brun-Way exceeded the 83 900 m^2 of HADD compensation as determined by DFO, they were to immediately notify TCHP Co. of the DFO determination and then proceed with additional compensation.
5. Upon completion of construction, Brun-Way was required to submit an as-built report to DFO providing details on the actual HADD area for each watercourse and the associated compensation that was required.

Additional conditions were included in Schedule 8 – "Developer Environmental Conditions" to the DB Agreement to provide further guidance to minimize the amount of HADD compensation required. These conditions included:

- Watercourse crossings in fish bearing watercourses will be designed in consultation with DFO.
- The area of disturbance will be limited to that absolutely necessary to complete the DB Work.
- All work will be done in strict accordance with all Environmental Laws
- An on-site pre-construction meeting will be held with DFO, NB Department of Natural Resources and NB Department of Environment to review the Environmental Conditions.
- All streambeds and banks affected by the DB Work will be permanently restored as soon as possible following disturbance.
- Fish salvage will be conducted by a qualified biologist prior to dewatering.
- All culverts and temporary or permanent stream diversions associated with the DB Work shall allow for fish passage

These requirements were monitored by Brun-Way through their internal quality management system. TCHP Co. also monitored Brun-Way's adherence to these requirements through a formal auditing process of the DB Work and of Brun-Way's quality management system.

TCHP Co. also had HADD obligations as outlined below:

1. Following receipt of the $1,800,000 payment from Brun-Way, TCHP Co had to notify DFO in writing that the HADD payment had been received and that it would be used to set up a fish habitat compensation bank (the "HADD Bank") for up to 83 900 m^2 of fish habitat.

2. The Design-Build Agreement also required that TCHP Co provide a refund to Brun-Way if it was determined that their actual HADD compensation requirement was less than 83 900 m^2.

TCHP Co. transferred the $1,800,000 to NBDOT who managed the HADD Bank and the associated compensation projects. These projects are described in Section 4.3.

The refund amount identified in item 2 above would be based on subtracting the actual HADD compensation area from 83 900 m^2 and then multiplying it by $21.00 per m^2. Again, the $21.00 per m^2 was the estimated unit-cost used to determine the original HADD payment. It should be noted that the refund would only be provided to Brun-Way upon written certification from DFO that the actual HADD compensation area was less than 83 900 m^2.

6.0 Design Build HADD Compensation

As noted in Section 3.0, the EA completed during the planning phase of the TCHP estimated 51 watercourses would require HADD compensation. The actual design-build work on the TCHP affected 56 fish bearing watercourses due to the installation of new drainage structures. These structures included pre-cast concrete pipes, metal arches, concrete box culverts (pre-cast and cast-in-place), and large bridge structures. These structures all had varying impacts on fish habitat and therefore HADD compensation was required. Following is a list of the typical effects that the new construction had on habitats (1):

- Permanent loss of habitat under pier footings located in-stream or on stream banks
- Permanent loss of habitat in abandoned sections of natural channels due to permanent stream diversions
- Temporary alteration or disruption of habitat under footprint of temporary works
- Late season work (September 30 to June 1)
- Permanent or temporary loss of habitat due to the removal of vegetation within the riparian zone

Figure 6.0 demonstrates an example of the effects of new bridge construction on an existing TCHP watercourse where most of the natural vegetative cover was removed within the project right-of-way. It will take several years to re-establish vegetation in these areas. This site also includes a permanent stream diversion that bypasses the original stream and the associated fish habitat therein.

DFO determined that Brun-Way's actual design and construction of watercourse crossings required total habitat compensation of 156 200 m^2. This exceeded the HADD Bank value of 83 900 m^2 therefore Brun-Way was required to provide additional compensation for the remaining 72 300 m^2 (1). This also meant that Brun-Way was unable to receive any refund on the $1,800,000 they paid to TCHP Co. to set up the HADD Bank.

Brun-Way's actual HADD footprint for most watercourse installations was not significantly different than the estimate calculated during the project EA. However, they incurred significant additional HADD compensation for two main reasons:

1. Due to scheduling concerns, Brun-Way requested permission from DFO and DOE to alter the Watercourse and Wetland Alteration Permits to allow work in-stream between September 30 and June 1. In New Brunswick, work is typically not permitted during this period due to the greater potential for harm to fish and fish habitat. DFO and DOE allowed Brun-Way's request at 24 selected watercourse locations on the condition that Brun-Way provide additional HADD compensation at a 3:1 ratio. This extra compensation totalled approximately 56 200 m^2.

2. Brun-Way also requested some major design changes to three structures that increased the HADD compensation due to greater impact on fish habitat. Two sites were originally intended to be bridge structures when the EA was approved. Brun-Way, through the Change Request process, asked that these structures be changed to a cast-in-place box culvert at one site and a metal arch at the other. At a third site, the bridge structure was reduced from three spans to a single span which had greater impact on the existing stream. DFO again required extra HADD compensation at these sites at an additional 3:1 ratio. The approximate total compensation as a result of approved design changes was 19 700 m^2.

Table 6.0 provides a summary of the estimated and actual HADD compensation values.

Table 6.0
Estimated vs Actual HADD due to Design-Build Work

Affect	Estimated HADD Compensation from EA	Actual HADD Compensation (1)	Additional HADD Compensation
Sites with no Major Design Changes	79 900	76 300	- 3600
Late Season Work (September 30 to June 1)	0	56 200	56 200
Sites with Major Design Changes	4000	23 700	19 700
Totals	83 900	156 200	72 300

6.1 Brun-Way HADD Compensation Program

In order to provide compensation for the 72 300 m^2 of additional HADD, Brun-Way implemented its own HADD compensation program to find and carry out improvements to appropriate watercourse sites. Brun-Way's compensation program was independent of the NBDOT HADD Bank and Brun-Way was entirely responsible to work with DFO to select appropriate sites. They were able to find six sites that were acceptable to DFO where obstruction to fish passage could be removed thereby allowing upstream movement.

Table 6.1 and the following site descriptions summarize the Brun-Way HADD compensation sites and the associated habitat improvement achieved at each site.

Table 6.1
Summary of Brun-Way HADD Compensation Program (1)

Compensation Site Description	Habitat Area Improved (m^2)	Compensation Factor Partial Obstruction – 0.333 Complete Obstruction – 0.500	HADD Compensation Credit (m^2)
Site #1	1980	0.333	653
Site #2	100	0.500	50
Site #3	1400	0.333	466
Site #4	5340	0.500	2670
Site #5	8040	0.333	2677
Site #6	506 620	0.333	168581
Total	**523 840**		**175 097**

Site #1 Tributary to Saint John River – This site was located near Aroostook in Victoria County and was adjacent to the new Route #2 being constructed by Brun-Way. A small earth dam and undersized drainage culvert was present in the watercourse which caused a partial obstruction to fish passage. Brun-Way removed these features and re-established an open stream channel.

Site #2 Tributary to Hunters Brook – This site was located on Sipprell Road immediately upstream of a new pipe installation for Route 2 near Lamereaux Corner in Carleton County. A small metal pipe was present on Sipprell Road with a hanging outlet that prevented fish passage. This section of Sipprell Road was realigned as part of the DB Work and therefore the existing culvert was removed and an open stream channel was re-established.

Site #3 Tributary to Hunters Brook – This site was located near Florenceville in Carleton County and was adjacent to the work Brun-Way was doing on the same watercourse.

Two old rock causeways were present in the watercourse and caused partial obstructions to fish passage. Brun-Way removed the causeways by hand to re-establish the natural channel width.

Site # 4 Tributary to Hunters Brook - This site was immediately upstream of Site #3. Another small metal drainage pipe with a hanging outlet was present and caused a complete obstruction to fish passage. This farm access was cut off due to the new Route 32 construction and therefore the pipe was no longer required. Brun-Way removed the pipe and re-established an open stream channel.

Site #5 Stickney Brook – This site was located downstream of Route #105 at Stickney in Carleton County. The remains of a small wooden dam were present and it was a partial obstruction to fish passage. Brun-Way had the dam removed and large boulders relocated to provide a wider stream channel.

Site #6 Quisibis River – This site was located near Montagne-de-la-Croix in Madawaska County. The remains of the Quisibis River Dam were a partial obstruction to fish passage mainly during low flow conditions and also the remaining dam buttresses often accumulated logs and other debris which affected fish passage. Brun-Way removed the accumulation of debris and also removed one concrete buttress to provide improved fish passage. This project was by far Brun-Way largest compensation site (refer to Figure 6.1 for photos of the site prior to and after the rehabilitation work).

Following completion of the six compensation projects, Brun-Way retained the services of a fish habitat biologist who verified that the habitat improvements were properly implemented and that the fish passage objectives had been met. Brun-Way also had their own environmental inspectors monitor the completed sites for several months up until the Fall of 2007 to ensure that the site improvements were working as intended.

As noted in Table 5.1, Brun-Way's actual HADD compensation credit from these six sites was 175 097 m^2 which exceeded their requirement for 72 300 m^2. The resulting surplus was 102 797 m^2 of HADD compensation credits. DFO, Brun-Way, and TCHP Co. were able to work out an arrangement where 90 000 of these credits could be transferred to NBDOT for their use as part of a new NBDOT HADD Bank initiative. Brun-Way had no use for most of the credits as the construction work was complete and their need for HADD credits as part of the Operations, Maintenance and Rehabilitation component of the TCHP Agreement was minimal. Most of the surplus credits would have been lost had the transfer to NBDOT not been allowed.

7.0 Looking Forward

The HADD Bank process used on the TCHP was deemed a success by NBDOT, Brun-Way and by DFO. For NBDOT, they were able to receive additional funding that allowed them to address some long outstanding fish passage issues and to gain infrastructure improvements. NBDOT was also able put in place a process to engage non-governmental agencies that can be continued in the future. NBDOT also noted an increased knowledge base and awareness of HADD compensation which can be applied to future work.

The benefits to DFO were timely completion of compensation projects and the major improvements to fish passage and fish habitat at the compensation sites. DFO also noted the importance of increased awareness of fish habitat issues and HADD compensation in the private sector partners involved in the TCHP.

Brun-Way noted the following benefits:

- Timely approval and permitting related to HADD for their design and construction activities
- The process fostered a sense of co-operation with the regulatory agencies as opposed to an adversarial relationship.
- Access to resources allowed Brun-Way to consider larger compensation projects than typically explored when compensation is based on a site by site program.

The HADD compensation projects completed by NBDOT and by Brun-Way improved fish habitat of approximately 977 500 m^2 and generated 312 500 m^2 of HADD credits. The result was a surplus of approximately 143 000 m^2 of credits. NBDOT and DFO are currently in the process of finalizing a new MOU that will allow these surplus credits to be deposited in to a new HADD Compensation Bank. The present NBDOT HADD Compensation Bank initiative is a more typical bank in that deposits are made to the bank when NBDOT (or a third party) completes a habitat improvement project. NBDOT makes a withdrawal from the bank when it initiates a project or contract that requires HADD compensation.

In the spring of 2007, NBDOT created a new HADD Co-ordinator position within its Design Branch. This position manages the approval, permitting, and compensation process and will also be responsible for implementing and managing the new HADD Compensation Bank. The Department believes this dedicated position will greatly improve the HADD approval and compensation process.

The TCHP HADD Bank has demonstrated the greater profile of fish habitat loss related to highway projects in New Brunswick. NBDOT will continue to try to avoid and minimize the impacts on fish habitat through the planning, design, and construction process but we are now confident that the relationships we have built with DFO through the HADD Bank and other initiatives will help us affectively address future HADD related issues.

8.0 References

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3. Jacques Whitford Environment Limited, *Final Comprehensive Study Report New Route 2 Trans-Canada highway Project, Perth-Andover to Woodstock,* Section 5.4, Final report prepared for the New Brunswick Department of Transportation, Fredericton, NB, May 2004.
4. Jacques Whitford Environment Limited, *Final Comprehensive Study Report NewRoute 2 Trans-Canada Highway Project, Grand Falls to Aroostook,* Section 4.4, Final report prepared for the New Brunswick Department of Transportation, Fredericton, NB, August 2004.
5. Canaan-Washademoak Watershed Association, *Ridge Brook Habitat and Bank Restoration: Phase II*, a proposal for funding submitted to the New Brunswick Department of Transportation. May 2007.
6. Fredericton Area Watersheds Association, *Inventory of Habitat Restoration Projects in Fredericton's Urban Stream System*, a proposal for funding submitted to the New Brunswick Department of Transportation. Fredericton, New Brunswick, May 2007.
7. Hammond River Angling Association, *Grant Application Form*, Nauwigewauk, NB. May 2007
8. Kennebecasis Watershed Restoration Committee. *Trout Creek Restoration Project, HADD Funding Program*, Grant Application Form. April 2007.

Figure 1.0

Trans Canada Highway Project

Quebec to Longs Creek – 275 km
February 2005 to November 2007

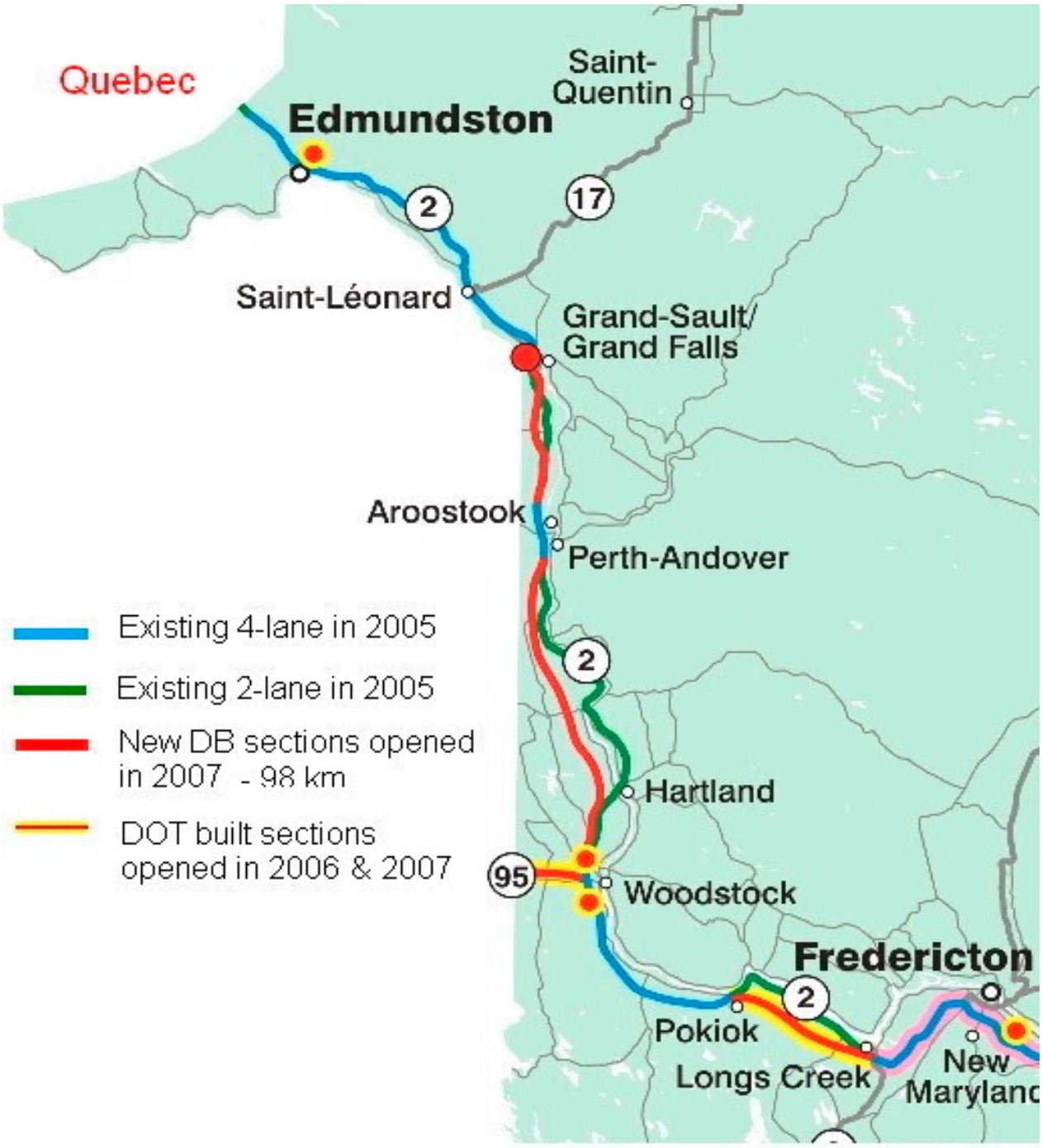


Figure 4.3a
Little Presque Isle Stream Compensation Site

Prior to Rehabilitation Work by DOT

After Compensation Work Completed

Figure 4.3b
Hales Brook Compensation Site

Prior to Rehabilitation Work by DOT

After Compensation Work Completed

Figure 6.0
Example of Effects of New Construction on Fish Habitat
(River-de-Chute Bridge)

Natural stream condition with significant vegetative cover prior to construction

Stream condition after construction – natural vegetation along stream channel and slopes removed along with installation of a permanent stream diversion.

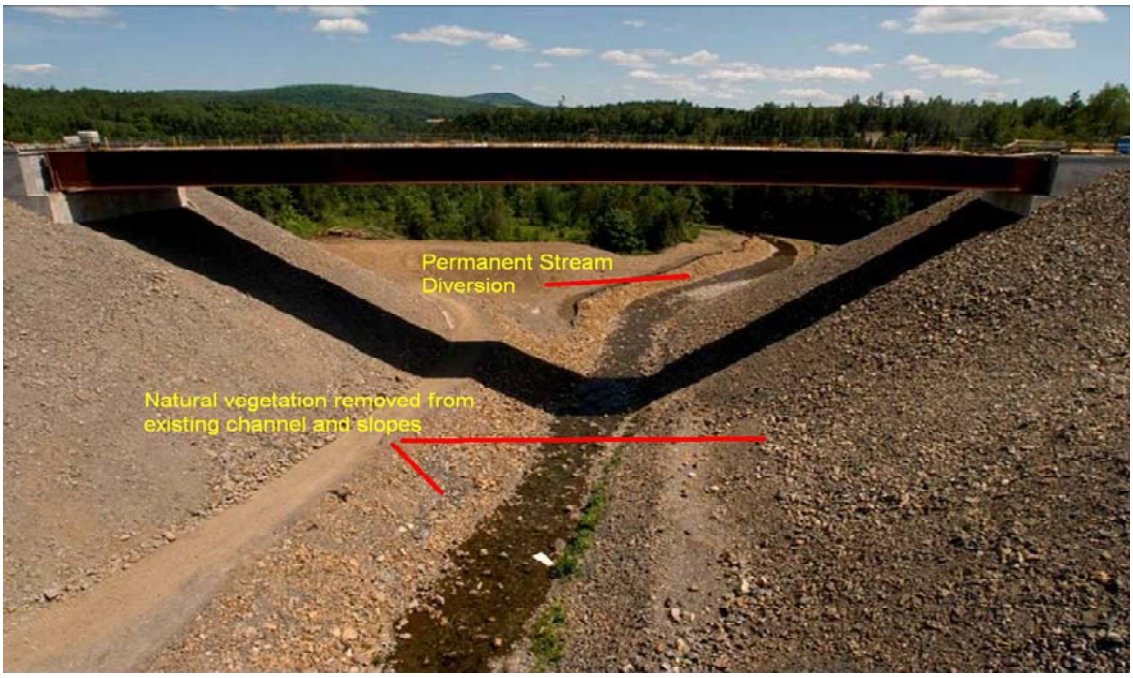
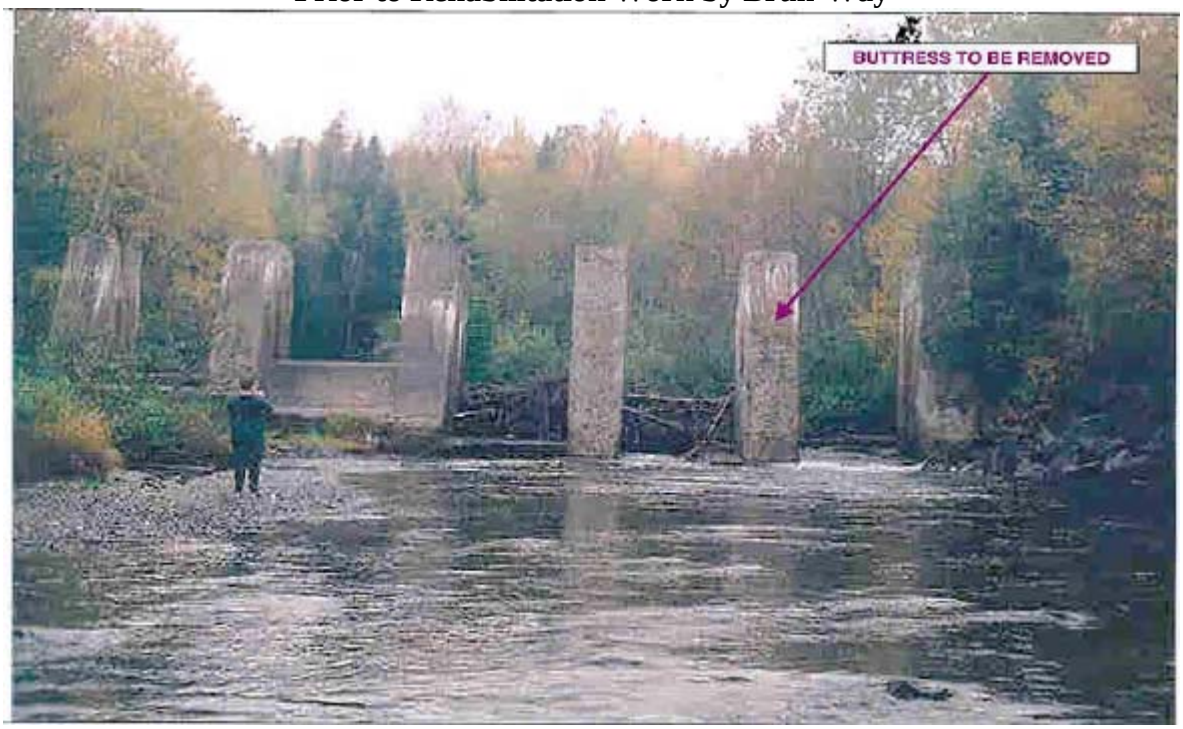
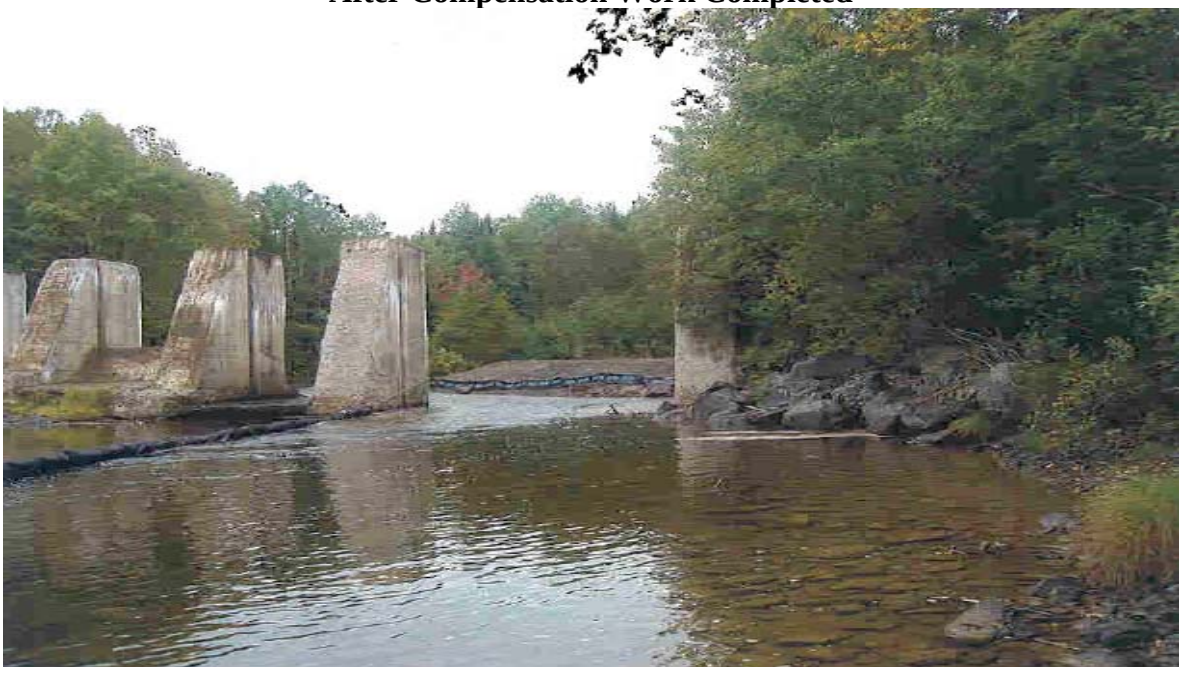


Figure 6.1
Quisibis River Compensation Site

Prior to Rehabilitation Work by Brun-Way



After Compensation Work Completed



Photos courtesy of Brun-Way Construction Inc. (1)