FISHERIES AND OCEANS
CANADIAN ENVIRONMENTAL ASSESSMENT ACT (CEAA)
SCREENING REPORT

GENERAL INFORMATION

1. **EA Title:** Fraser River Sediment Removal 2011, Tranmer Bar
2. **Proponent:**
   Emergency Management British Columbia (EMBC)
   Ann Griffin, Manager Strategic Mitigation Programs
   Ministry of Public Safety and Solicitor General
   2nd Floor 525 Fort Street
   Victoria, BC V8W 9J1
   (250) 953-4098
3. **Other Contacts** (Other Proponent, Consultant or Contractor):
   Scott Resource Services Inc. (SRS)
   202-9300 Nowell Street,
   Chilliwack, BC V2P 4V7
   604-701-6311
   Kerr Wood Leidal Associates Ltd. (KWL)
   200 – 4185A Still Creek Drive
   Burnaby, BC V5C 6G9
   604-294-2088
4. **Role:**
   Fisheries Consultant for EMBC
   Hydraulic Consultant for EMBC
5. **Source:** EMBC
6. **EA Start Date:** November 12, 2010
7. **CEAR (or FEAI) No.: 10-01-59251**
8. **PATH No.:** 10-HPAC-PA6-00046
9. **DFO File No:**
10. **Provincial/Territorial File No.:**
    File No. A2005807 relating to Section 9 of the *Water Act* for *Works In and About a Stream* (BC Ministry of Natural Resource Operations)
    File No. 2410025 relating to Section 17 Land Act Designation (BC Integrated Land Management Bureau)
    File No. 1610445 relating to Chapter 293, section 10(2) of the Mines Act (BC Ministry of Energy, Mines and Petroleum Resources)

BACKGROUND

11. **Background about Proposed Development (including a description of the proposed development):**

    Emergency Management British Columbia (EMBC) is proposing to remove sediment from Tranmer Bar in the Fraser River near the city of Chilliwack, BC. The removal is scheduled for the winter 2011 sediment removal window (January 1 to March 15) and is proposed as part of EMBC's Fraser River Sediment Management Program (FRSMP) to remove sediment from the Fraser River gravel reach for water profile maintenance. EMBC considers this program as a second line of defence in flood protection to local communities, with the first line of defence being the protection provided by the dikes.

    Tranmer Bar is located 5 km upstream of the Highway 9 bridge between Agassiz and Rosedale, BC, on the right (northwest) bank of the Fraser River. The removal site is situated on the lower, main channel edge of Tranmer Bar. Access to the proposed removal site is via access ramp to Spaeti Bar, a temporary bridge crossing between Spaeti and Tranmer bars, and a 1,400-m long haul road across Tranmer Bar to the proposed excavation area. Preparation of the access ramp will disturb up to 50 square metres of riparian vegetation. Construction of the haul road (14,000 square metres) will require a 2,500 cubic metre borrow pit on Spaeti Bar; the pit will be replenished and site restored upon completion of the project. The temporary bridge will be supported by two mid-channel piers and spans a side channel with year-round flow. The east abutment is on dry gravel bar with a footprint of 50 square metres. The west abutment will extend into the channel with an instream footprint of up to 440 square metres. Bridge construction will require pile driving and no wet crossings for machinery are required. The excavation footprint size is 260,000 square

metres and the estimated total sediment volume removed is 167,000 (± 10%) based on the final construction design. The proposal includes sediment screeners operating on site to separate the bulk sediment into size classes and a temporary weigh station to track all sediment tonnage leaving the site. The removal area is designed for positive drainage to prevent fish stranding and the outer boundary ties in with the existing bar grade to ensure flow connectivity with the main channel.

Transport Canada previously approved construction of the temporary bridge at Tranmer Bar in 2009 under Section 5(1) of the *Navigable Waters Protection Act*. The approval (NWPA File# 8200-08-8655) remains valid for the proposed 2011 works.

Details of the proposed removal are available within the following documents: application titled "*Fraser River Sediment Removal Plan: Proposed Tranmer Bar Sediment Removal - 2011*", prepared by SRS and KWL for EMBC and provided to DFO November 10, 2010 (**Appendix A**); removal engineering design titled "*Emergency Management British Columbia 2011 Fraser River Sediment Removal Tranmer Bar Site Plan*" prepared by Kerr Wood Leidal Associated Ltd and provided to DFO January 10, 2011" (**Appendix B**); and bridge engineering design titled "*Temporary Bridge Crossing Over the Fraser River Near Chilliwack, BC, Tranmer Bar Bridge*", prepared by All North Consulting Engineers and Surveyors for EMBC and dated January 26, 2009 (**Appendix C**). **Appendix D** depicts the general project site plan.

ENVIRONMENTAL ASSESSMENT

12. DFO Trigger(s):

Law List Regulations - The authorization of the harmful alteration, disruption or destruction (HADD) of fish habitat.

13. Act & Section(s):

Subsection 35(2) of the *Fisheries Act*

14. Other RAs and RB(s):

none

15. CEAA Trigger(s) of Other RA(s) and RB(s):

16. Lead RA:

Fisheries & Oceans Canada

17. Other Jurisdiction:

none

18. FEAC:

Fisheries & Oceans Canada

19. Rationale for FEAC:

Lead RA

20. Expert Federal Authority (ies):

Jennifer Tennant
Senior Environmental Assessment Scientist
Environment Canada
200 – 401 Burrard Street
Vancouver, BC V6C 3S5
604-666-8342

21. Area(s) of Interest of Expert FA(s):

Water Quality, Waterfowl and Wildlife Habitat

22. Other Contacts and Responses:

In accordance with the 2004 LOA between DFO and BC, and as part of the federal-provincial cooperative management of fisheries in BC, the BC Ministry of Natural Resource Operations (MNRO) is required to assess Fraser River sediment removal applications for provincial fisheries interests, in particular potential impacts to white sturgeon. The MNRO Ecosystems Section provided advice to DFO by email on December 17, 2010 (**Appendix E**) regarding potential impacts of the proposal on white sturgeon and recommended monitoring and mitigation measures to minimize impacts. Follow-up advice from MNRO was provided to DFO on January 13, 2011 (**Appendix E**) in response to public comments regarding the project (discussed below). This collective advice has been incorporated into the environmental assessment.

Also on January 13, 2011, MNRO Ecosystems Section provided advice by email to DFO regarding potential impacts of the project on other provincially managed species including mountain whitefish and mountain sucker (**Appendix F**). This information has been incorporated into the environmental assessment.

On January 14, 2011, the MNRO Regional Water Manager provided advice to DFO regarding the engineering rationale for sediment removal at Tranmer Bar both in the context of site selection and long-term potential effects of

gravel removal (**Appendix G**). This information has been incorporated into the environmental assessment.

First Nation consultation has been carried out by the Proponent over the course of project planning and during the environmental assessment. The Proponent's consultation record is included in the application to DFO (**Appendix A**). Additionally, DFO sent letters to 22 First Nations (**Appendix H**) on November 19, 2010, informing them of the proposed works and requesting comments. Skawahlook First Nation responded by email on November 30, 2010 with no issues or comments on the proposal. Sto:lo Tribal Council responded by telephone on December 15, 2010 with questions about EMBC's Sediment Management Program, which were redirected to EMBC for response. Sto:lo Nation responded by letter on January 14, 2011 stating no objections to the proposal. No other comments from First Nations were received regarding the proposed project.

Public interest in sediment management along the Lower Fraser River is high and, as a result, the Proponent launched a website on September 27, 2010 for public access to information and reports related to BC's Sediment Management Program (http://www.pep.gov.bc.ca/floods/fraser_sediment_prog.html). Regarding the current proposal, on October 5, 2010 the Proponent first informed several environmental non-government organizations (BC Wildlife Federation, Fraser River Coalition, Fraser River Sturgeon Conservation Society, Fraser Basin Council, David Suzuki Foundation) about 2011 removal plans by email letter (email subject line: "*Fraser River Sediment Management Program update*", sent from Ann Griffin, EMBC, at 2:42pm). These groups previously had expressed interest in the provincial program. At the time, the Proponent had not finalized site choice for sediment removal in 2011 and three candidate sites were presented (Tranmer, Powerline, and Harrison bars), along with the above website for additional information. A follow-up email was sent to the same parties November 18, 2010 (email subject line: "*Fraser River Sediment management Program Update*", sent from Ann Griffin, EMBC, at 2:44pm). The latter email stated that Harrison Bar was no longer a candidate for removal in 2011.

Over the period of project planning, DFO also regularly engaged with parties interested in Lower Fraser River sediment management including various private citizens, the Fraser River Gravel Stewardship Committee, Fraser River Coalition, BC Wildlife Federation, and David Suzuki Foundation. DFO offered to meet with these groups on several occasions to discuss DFO's role in the provincial Sediment Management Program and fish-related concerns, including on November 19, 2010 immediately following EMBC's November 18th notification mentioned above (email subject line: "FW: *Fraser River Sediment management Program Update*" sent from Jason Hwang, DFO, at 12:29pm), but no meetings were scheduled. In regards to the proposed project, DFO notified each of the above-mentioned groups and several private citizens on November 16, 2010 that an environmental assessment for sediment removal at Tranmer Bar had commenced (email subject line: "*Tranmer Bar – Fraser River gravel CEAA commencement*", sent from Jason Hwang, DFO, at 8:03am) and provided contact information for public comments. DFO maintained regular communication with these groups in regards to the proposed project, coordinated the public release of requested information, and extended the deadline for public comment on the environmental assessment based on the availability of project information in order to ensure a reasonable review time for all interested parties.

A total of 18 submissions were received by email from interested parties in response to the proposed project (**Appendix I**). All submissions expressed concern for potential environmental impacts of sediment removal at Tranmer Bar. Based on thorough review of each submission, DFO determined the issues and concerns relevant to the proposed gravel removal at Tranmer Bar to be:

- Hydraulic and Geomorphic Issues
    - Flood benefit rationale
    - Bar- and site-scale sediment aggradation rates
    - Tranmer Bar morphology/stability
- Fisheries Issues
    - White sturgeon stock status, effects of habitat disturbance on recruitment, baseline data
    - Maria Slough population of sockeye salmon
- Habitat Values and Impact Assessment
    - Lower Tranmer Bar groundwater features and habitat value
    - Assessment of weighted usable area for fish by habitat modelling
    - Pre-project assessment data
    - Habitat recovery in the context of local sediment recruitment rate
    - Habitat compensation
    - Cumulative effects of sediment removal at Tranmer Bar and across the Gravel Reach

- Potential effects on migratory birds
- Process
  - 2009 evaluation of the proposed removal site
  - Program planning, transparency, opportunities for input
  - Long-term planning

For some issues, DFO sought follow-up information from appropriate technical authorities in order to address specific concerns. All concerns relevant to this environmental assessment have been considered.

23. Scope of project (details of the project subject to screening):

Fisheries & Oceans Canada has determined the scope of the project for the environmental assessment conducted pursuant to the *Canadian Environmental Assessment Act* to be the proposed removal of 167,000 (± 10%) cubic metres of sediment from Tranmer Bar, Fraser River. The scope of the project includes the removal of up to 50 square metres of riparian vegetation, a temporary borrow pit on Spaeti Bar for road construction, and the construction, operation and decommissioning of a temporary approach ramp, bridge crossing, and haul road to the removal site. All gravel extraction activities will be isolated from flowing water during the entire work period.

Hereafter, the term "project" refers to the project as scoped in the preceding paragraph.

24. Location of project:

Tranmer Bar is located on the right bank of the Fraser River approximately 5 km upstream from the Highway 9 bridge.

UTM Zone 10U, N 5453085, E 593380

Latitude 49°13'24", Longitude 121°43'06"

Topographic Mapsheet: 092H04

25. Environment Description:

Fraser River Gravel Reach

The project is situated within the "Fraser River Gravel Reach", an 80 km reach of river wherein coarse sediment (coarse sand, gravel and cobble) is deposited annually during spring flooding. Sediment deposition within the active channel creates a complex network of gravel bars and vegetated islands around which the river flows. The location and form of these bars and islands are constantly changing as a result of the river's natural erosion and deposition processes. The bars and islands are sites of high ecological productivity, representing valuable fish habitat that is used by at least 28 native fish species.

Species of greatest cultural, commercial and/or recreational significance are chinook, chum, coho, pink and sockeye salmon; cutthroat and steelhead/rainbow; and white sturgeon. All species of anadromous Pacific salmon utilize habitat within the reach to a varying degree for adult holding and migration to spawning grounds, smolt migration to the ocean, and rearing habitat for juveniles. Large numbers of chinook salmon rear in the Fraser River Gravel Reach for up to one year before ocean migration and significant numbers of pink salmon spawn within the main channel in odd-years. COSEWIC-listed white sturgeon reside and spawn in the gravel reach, and the preferential use of side channels for spawning in June has been documented (Perrin *et al.* 2003). Mountain sucker, provincially listed as "Special Concern", occur year-round in the gravel reach in relatively large numbers. Provincial blue-listed Dolly Varden char/bull trout and cutthroat trout use habitats of the mainstem Gravel Reach, though in relatively low numbers, and other managed species such as mountain whitefish reside in the reach.

Just as sediment transfer processes are responsible for habitat creation and renewal in the Gravel Reach, sediment deposition over time also raises bed elevation locally, placing pressure on the existing dike system during the spring flood. Measures to increase flood protection over the past century have included diking and dike upgrades, flow control barriers at the mouth of sloughs, bank hardening using rip rap, and gravel removals from within the active channel. In-stream gravel mining also has been carried out historically for industrial and commercial purposes.

The objective of EMBC's Sediment Management Program is to maintain the flood profile by the strategic removal of sediment influx (termed 'water profile maintenance' by Church, 2010). The report by Church (2010), commissioned by EMBC, lays the foundation for a long-term plan of water profile maintenance in the Gravel Reach, something that has been lacking to date. Instead, the current regime is year-by-year project planning with significant timeline challenges for project managers and regulators. A long-term plan is expected to allow for more comprehensive project planning and strategic site selection, greater transparency in decisions, and improved opportunity for stakeholders and interest groups to provide input. EMBC is committed to developing this long-term plan to guide its Sediment Management Program and has scheduled planning meetings to begin in February 2011. According to the MNRO Regional Water Manager, "Tranmer Bar is a suitable site for sediment removal [in 2011] in keeping with the objectives of the Fraser River Sediment Management Program" (**Appendix G**).

Tranmer Bar – Morphology and Sedimentation

As described in KWL's hydraulic assessment (**Appendix A**), Tranmer Bar has formed over 60+ years. Significant sediment deposits are first visible at this location in 1949 air photos, which depict extensive lateral and mid-channel bars (Church and Ham 2004). Over the following 6 decades the bar has grown considerably in size, with primary growth by lateral accretion as new sediment has been deposited on the outer bar edge. According to Church and Rice (2009), this lateral growth is typical for gravel bars in the reach where "a newly formed gravel bar quickly assumes its ultimate thickness and relatively quickly approaches its equilibrium length", and that "growth continues mainly by lateral accretion of unit bars". For Tranmer Bar, this process is particularly pronounced as it has the lowest bar thickness, 3.5 m, of all bars in the Gravel Reach (Church and Rice, 2009). This pattern of bar growth may give the perception of morphologic stability over time because there is relatively little change over the formative, primary unit bar. However, the dynamic instability of Tranmer Bar through ongoing sediment deposition is revealed in the systematic lateral growth of the bar since 1949. Bar growth has forced more than 1000 m of compensatory bank and island erosion at Herrling Island, of which 120 m of erosion occurred in only 4 years between 2004 and 2008 (nhc, 2008). The 2009 freshet eroded a final 80-m strip of Herrling Island and caused a channel avulsion into the Herrling Island side channel. The main channel now divides at the downstream end of Tranmer, with some portion of the flow taking a straighter route through the lower Herrling Island side channel. It is within the upper Herrling Island side channel that white sturgeon spawning has been confirmed (Perrin *et al.* 2003, Liebe and Sykes, 2010).

The contemporary morphology of Tranmer Bar consists of several large and mature vegetated islands that form the bar's upper core, and younger island units establishing mid-bar. A perennial side channel flows around the backside of Tranmer Bar, into which Maria Slough drains. Spaeti Bar is a small point bar situated downstream of the Maria Slough confluence. Seasonal channels dissect the mature islands of Tranmer Bar and flow diagonally across the lower bar during spring and summer months. The lower and outer-most Tranmer bar consists of "crescentic" flank bars (cf. Rice et al. 2008) that have been deposited during previous freshet events. The flank bars take on this crescent shape due to the major bend in the river. Productive rearing habitat for fish tends to form as channel nooks and larger bays between the tails of each coalescing flank bar. Over time, these features infill with bar growth meanwhile new nooks and bays form in the lee of fresh bar deposits. Some channel nooks remain wet year-round due to the local water table elevation and hyporheic flow. Their morphology is described in more detail by Rice et al. (2008) and they are observed elsewhere along the gravel reach (e.g., Calamity Bar).

According to the most recent sediment budget (nhc, 2009), lower Tranmer Bar has been the site of significant sediment deposition since at least 1952 when the first bathymetric survey was completed. A 1999 to 2008 surface elevation comparison for Tranmer Bar shows very clear aggradation of 2 m to 4 m (vertical relief) along the downstream outer bar edge where the present excavation is proposed (Figure 2 of KWL's hydraulic assessment, **Appendix A**). Within the proposed removal area boundary, this aggradation has been quantified at approximately 325,000 m^3 since 1999, or 36,000 m^3/yr (KWL, pers comm.). The remainder of the bar is also dominantly aggradational, but with more modest accumulations. About 1.26 million m^3 of sediment has been deposited on the whole bar between 1999 and 2008 (nhc, 2009), corresponding to about 140,000 m^3/yr. In the context of sediment removal, this high rate of aggradation is expected to translate into relatively rapid habitat recovery by way of sediment replenishment in future freshet events.

The outer bar edge, where the proposed sediment removal is situated, was first identified as a candidate for removal by professional geoscientists in 2006 (BGC and KWL, 2006). A potential removal volume of 200,000 m^3 was proposed. In addition, the Tranmer Bar – Herrling Island area was identified by Church (2010) as 1 of 4 zones of "persistent sedimentation" in the gravel reach within which "major sediment removals should be focused". Previous sediment removals have occurred once on Tranmer Bar (2009) and 6 times on Spaeti Bar in the past 18 years. Spaeti Bar is privately owned and removal volumes in each of the 6 years were relatively modest (between 3,000 and 40,000 m^3). The 2009 removal at Tranmer Bar was a cross-bar channel design consisting of two hydraulically connected areas; about 146,000 m^3 of sediment was removed.

For sediment removal in the Gravel Reach, Church *et al.* (2001) and Church (2010) have recommended that "*the rate of gravel removal in any short sub-reach along the river should not exceed one-half the estimated local bed material transport rate in a sequence of three consecutive years*". The recommendation is intended to ensure sufficient downstream sediment transfer in order to maintain normal turnover and renewal of gravels (i.e., habitat recovery). KWL evaluated the proposed Tranmer Bar excavation in the context of this recommendation using the long-term (1952-1999) local bed material transport rate of 275,000 m^3/yr from Ham (2005, Figure 5-9a). Based on this analysis, the proposed removal of 167,000 m^3, coupled with the 2009 removal of 146,000 m^3, together represent 40% of the estimated local bed material transport rate over three years. Therefore, the proposed removal falls below the 50% limit recommended by Church (2010). KWL used the long-term transport rate rather than a more recent short-term estimate because Church (2010), in his recent review of sediment budget estimates for the Gravel Reach, concluded that "the 1952-1999 sediment budget remains the most reliable basis for designing a long term sediment management program". Church (2010) points out that the recent 1999-2008 sediment budget (nhc, 2009) produces physically impossible results of negative (i.e., upstream) sediment transport through 27 of the 65 km along the study reach. This

supports the analytical approach taken by KWL and indicates that whereas 1999-2008 survey comparison is useful for determining the recent, local aggradation trend of 140,000 m^3/yr for Tranmer Bar, the long-term sediment budget is the most reliable basis for estimating average sediment flux.

Tranmer Bar – Fish and Fish Habitat

Fish habitat mapping to evaluate the existing habitat characteristics at Tranmer Bar was conducted by Scott Resource Services (SRS) at two summer discharges (4,500 m^3/s and 2,520 m^3/s). Methods followed Church et al. (2000). At high flow, lower Tranmer Bar is a network of crescentic flank bars and young islands intersected by summer channels. Within the inner bar, there is a diverse range of habitat types and seasonal channels available as productive rearing habitat for a range of fish species. The removal area along the outer bar is submerged at high flow, and the wetted main channel edge consists of bar head, flat bar edge, channel nook and riffle habitat. Based on fish sampling at Tranmer Bar between 1999 and 2001 (Rempel, unpub. data), large numbers of juvenile chinook salmon use the bar head and edge units for rearing, a range of species dominated by cyprinids but including salmonids preferentially use channel nooks, and riffle habitat tends to be dominated by provincially blue-listed mountain sucker, as well as leopard and longnose dace. Mountain sucker collected by SRS in 2008 and 2009 along the main channel edge were in spawning condition (i.e., red lips and fin axils; SRS, 2010)

Based on habitat mapping at lower summer flow (2,520 m^3/s), the inner bar is mostly dry with localized natural strand pools. The exception was the 2009 cross-bar excavation channel, which conveyed flow and had flat, steep, and cut banks along its perimeter, as well as open nooks and riffles. Habitat in the immediate vicinity of the proposed removal area is dominated by flat bar edge habitat intersected by small open nooks, plus elongated channel nooks extending beyond the downstream boundary and forming between the tails of coalescing flank bars. Low summer velocities in these nook-type habitats and along the flat-sloped, main channel edge are favourable for rearing fish through the summer and autumn. Chinook salmon, mountain sucker and dace species are most common in nooks open to the main channel at Tranmer Bar whereas cyprinids tend to dominate channel nooks (Rempel, unpub. data). Spaeti Bar, the site of the proposed bridge crossing, was mostly exposed at 2,520 m3/s flow and habitat consisted of flat and steep bar edge units.

Habitat modelling using River2D was completed by KWL to quantify the amount of suitable summer habitat for select fish species both at the bar-scale over Tranmer Bar, and locally within the removal footprint (**Appendix A**). A modelled discharge of 4,000 m^3/s was chosen as a balance between characterizing habitat availability for mean annual flow (3,410 m^3/s) and evaluating the effects of high bar habitat loss due to sediment removal. [Although habitat modelling at multiple low and high flows is desirable, only one flow level is currently required as information requirements to DFO for authorization of sediment removal works.] The weighted usable area (WUA) based on Fraser-specific depth/velocity preference curves was calculated for 13 species/life stage combinations representing 6 priority fish species (chinook, chum, and sockeye salmon, mountain whitefish, rainbow trout and mountain sucker). Pre-removal, species with the highest percentage of suitable habitat within the removal site footprint are 2+ mountain whitefish (19.6%), 1+ rainbow trout (19.1%), 1+ chinook (18.8%), 0+ chinook (18.0%) and 3+ mountain sucker (18.2%). The same species have the highest amount of preferred habitat at the bar-scale over Tranmer Bar (ranging from 15-22% of the total bar area).

Significantly more of the proposed removal site on Tranmer bar becomes exposed through autumn and winter, although habitat characteristics along the main channel perimeter remain similar to late summer conditions. This is because of the relatively low elevation and featureless surface of outer Tranmer Bar. Beyond the downstream end of the removal area, the tails of coalescing flank bars create channel nooks on their lee side. These features provide over-wintering habitat for many fish species as their base elevation is below the water table and they are likely fed by through-bar hyporheic flow. Common species include chinook and sockeye salmon, mountain whitefish, and cyprinid species. The channel nooks at Tranmer Bar are a prominent example of flank bar accretion described by Rice et al. (2008), and the same process produces similar habitat features elsewhere (e.g., Calamity and Webster bars further downstream). Flank bar accretion more commonly produces larger bay habitats in the lee of the accreting sediment lobe (e.g., Seabird Island, Powerline Island, Little Big Bar, Harrison Bar), which likely have similarly high over-wintering habitat value and species usage.

In terms of spawning, large numbers of pink salmon spawn along the perimeters of Tranmer and Spaeti bars in odd years. Small numbers of chum and chinook salmon may spawn annually at these locations as well. During site visits by SRS in December 2008, salmon redds were observed along the main channel edge of Tranmer Bar, upstream of the 2011 proposed removal area. In fact, the 2009 sediment removal was originally designed as a main channel edge scalp similar but upstream of this 2011 proposal. Advice from SRS based on the presence of these redds was to relocate the sediment removal to the cross-bar channel where 146,000 m^3 was ultimately removed. Although no redds have been observed during field inspections in 2010/11, both chum and chinook salmon could have spawned this year in limited numbers along the bar edge.

At Spaeti Bar, a number of chum redds were observed upstream of the bridge location both in January 2009 and 2011. In 2011, these redds are located approximately 50 m upstream from the proposed bridge crossing site

(**Appendix J**). Balanced Environmental conducted an underwater assessment for salmon redds at the bridge crossing site on January 19, 2011. Based on a series of transects conducted by diving and covering a 20 m x 70 m area, it was confirmed that no salmon redds are located within the footprint of disturbance by bridge construction, which includes the footprint of the abutments, in-stream piles, and the probable zone of vibration impact from pile driving (**Appendix K**).

A small number of adult sockeye salmon have been sporadically recorded between September and January in nearby Maria Slough, a floodplain anabranch of the Fraser River that drains into Tranmer side channel upstream of Spaeti Bar. It is uncertain whether the fish are strays from other populations or a unique stream-type population native to Maria Slough. According to DFO Fisheries Management branch, there is "very little evidence to support that a *persistent* sockeye population exists in Maria Slough" and given the frequency and duration of annual spawning surveys in the area for chinook, chum and coho, it is believed that a persistent population would have already been confirmed. However, this possibility cannot be ruled based on the collection of ≤80 aduit sockeye in Maria Slough by DFO staff in 1985 and 1986, and peak spawning between late November and early December, well after most sockeye have migrated through the Gravel Reach (M. Foy, DFO, pers. Comm.).

Despite the uncertainty, what is agreed upon is that Maria Slough juvenile sockeye, as passive migrants having no fidelity to particular sites for rearing, are unlikely to migrate upstream to rear in habitats associated with the proposed removal site. Rather, they will opportunistically rear in whatever suitable habitat features they passively encounter where predators may be avoided. Based on the catch of 221 juvenile sockeye in the Gravel Reach between 1999 and 2001 (Rempel, unpub. data), most suitable habitats based on average sockeye density include eddy pools and channel nooks (both 0.02 sockeye/m^2), open nooks (0.009 sockeye/m^2), and bays (0.008 sockeye/m^2); all are widely available in the Gravel Reach. The collection of sockeye by SRS and others at Tranmer Bar is typical of the incidental occurrence of sockeye salmon throughout the Gravel Reach (representing about 0.8% of fish collected between 1999 and 2001 by Rempel, 2004b). River 2D habitat modelling predicted only 4.3% of the removal site area had suitable habitat for juvenile sockeye salmon at 4,000 m^3/s (8.1% suitability over the entire Tranmer Bar) (**Appendix A**).

COSEWIC-listed white sturgeon are believed to use habitats throughout the Gravel Reach for spawning and rearing. EMBC initiated a multi-year sampling program in 2010 to identify and characterize these habitats in the context of potential effects from sediment removal. Eight gravel bars were sampled for summer spawning and autumn rearing in 2010, including several locations in the main channel and side channel at Tranmer Bar. Because the multi-year monitoring program aims to collect baseline data for a range of sites in the Gravel Reach, and because Tranmer had not yet been selected for removal in 2011, most sampling sites on Tranmer Bar were located outside the removal footprint. No sturgeon were collected in the main channel adjacent to the removal site but four sturgeon were captured immediately downstream of Spaeti Bar ranging in length from 285 mm to 1,810 mm length (Liebe and Sykes, 2010). According to MNRO staff, sturgeon habitat use for rearing and feeding in the Fraser Gravel Reach is seasonal "and includes nearly all available lower Fraser River habitats" (**Appendix E**). Habitat modelling described above did not include sturgeon because appropriate depth/velocity preference data were not available.

Benthic invertebrate and surface substrate data are among several information requirements to DFO as part of the application for authorization of sediment removal works. Sampling protocols were developed in the early 2000s and since that time, these protocols have been critically evaluated (G3, 2009). DFO and EMBC acknowledge the need to review and improve these protocols and expect to complete this review in 2011. In the meantime, existing protocols as per the information requirements apply. Invertebrate sampling occurred on November 10, 2010 and a second pre-removal sampling episode is scheduled for January 2011. Based on samples from the removal site in 2009 (collected for a different project), the invertebrate community is dominated by Dipteran chironomids and mayflies (Ephemerellidae and Heptageniidae) are also common (SRS, 2010).

Surface substrate within the proposed extraction boundary on Tranmer Bar was sampled on September 28, 2010. Sampling revealed three general sedimentary units: gravel along the outer mid area, cobble at the upstream end, and sand in the interior (**Appendix A**). Median grain size for the gravel and cobble areas were 23 mm and 38 mm, respectively. Reference sites located immediately opposite Tranmer Bar on Herring Island had comparable grain size distributions (D_{50} of 27 mm).

26. Factors and Scope of Factors Considered:

Factors considered in the environmental assessment, pursuant to Section 16 of CEAA, are as follows:

- The environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in conjunction with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- The significance of the environmental effects referred to above;
- Comments from the public that are received in accordance with CEAA and the regulations;
- Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and

- The need for, and the requirements of, any follow-up program in respect of the project.

Environmental components potentially affected by the project, as scoped by DFO, include:

- Surface water quality;
- Hydraulics;
- Vegetation resources;
- Fish and fish habitat; and
- Wildlife.

The assessment of potential effects of malfunctions or accidents included:

- fuel spills from machinery used to construct, operate and decommission the project; and
- inappropriate operation of machinery or equipment causing the harmful alteration, disruption or destruction of fish habitat or destruction of fish.

The assessment of potential effects of the environment on the project, as scoped by DFO, included:

- extreme weather events; and
- a sudden increase in Fraser River water levels by either artificial (e.g., upstream dam release) or natural (e.g., extreme rainfall or unseasonal warming period causing snowmelt) mechanisms.

The assessment of cumulative effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out included:

- prior gravel extractions at the project location and proposed future extractions within the Fraser River gravel reach.

27. Environmental Effects:

Surface Water Quality

The potential effect to surface water quality during the project is elevated turbidity during the following project activities:

- Pile installation and removal in the wetted portion of Tranmer side channel. These effects are expected to be localized and minor, and not requiring mitigation.
- Placement and removal of fill for the western bridge abutment, which is expected to extend up to 20 m into Tranmer side channel.
- Following project de-commissioning when rising freshet flows in 2011 inundate the Spaeti Bar borrow pit, bridge abutment areas, and the excavation site on Tranmer Bar.

Hydraulics

Gravel extraction at Tranmer Bar will alter local flow patterns in the vicinity of Tranmer Bar, with increased flow conveyance through the extraction area. At a flow of 4,000 m^3/s, hydraulic modelling indicates that water surface elevations would be reduced at, around, and immediately upstream of the proposed removal site (**Appendix A**). Both water depths and velocities would increase. The velocity increase comes about because the distribution of flow becomes more even across the channel due to the increased depth and so velocities would increase over the removal site but decrease in the thalweg.

Vegetation Resources

A partially vegetated ramp along the right bank of Fraser River will be used to access Spaeti Bar. The ramp is private property and regularly disturbed as an access route to the river; it therefore does not support functional riparian habitat (only sparse grasses and Himalayan blackberry).

Fish and Fish Habitat

Potential effects of the project on fish and fish habitat are summarized below.

Disruption to Fish Passage

- Fish passage through Tranmer side channel is expected to be unaffected by project activities because the bridge crossing allows for unimpeded flow.
- The excavation has the potential to disrupt fish passage if not carried out according to engineered design, which ties into the existing bar grade and provides flow connectivity to the main channel. If the grade tie-in is not achieved, low-lying excavation areas may trap fish as water levels recede after freshet.

Disturbance to Salmon Spawning and Rearing Habitat

- The project has the potential to disturb chum and/or chinook salmon redds by pile driving and bridge construction in Tranmer side channel. Effects may be direct through destruction of redds within the footprint

of the piles, or indirect through noise vibration transmitting through the substrate during pile driving. Based on ground assessment, SRS observed salmon redds approximately 50 m upstream from the bridge crossing site (**Appendix J**). Based on underwater dive assessment, no redds were identified within the potential zone of impact from bridge construction (**Appendix K**). The redds observed upstream by SRS were confirmed to be chum salmon and they are not expected to be impacted based on the distance from pile driving and the relatively low sound pressure levels expected during pile driving. In 2009 during bridge construction at Tranmer Bar, hydroacoustic monitoring recorded typical pressure waves between 1 kPa and 3 kPa, and to a maximum of 7 kPa. This is well below the authorized standard of 30 kPa set to protect aquatic life (Stol, 2009).

- The flat bar edge along the outer perimeter of Tranmer Bar is suitable spawning habitat for chum and chinook salmon, although no evidence of salmon spawning was observed during surveys by SRS in 2011. No disturbance to salmon redds is expected based on the requirement for a minimum 10-m setback from the water's edge. Future habitat suitability for spawning may be affected as the extraction will modify surface sediment texture, topography and hydrology, as well as decrease bar elevation for time into the future. However, the removal footprint is not expected to encroach on viable incubating habitat since the base elevation of the removal will remain above typical low water levels where viable redds would be situated.
- Pink salmon spawn in the autumn of odd years and therefore will not be directly impacted by the proposed sediment removal. Future habitat suitability for pink salmon spawning at Tranmer Bar is not likely to be affected based on the rationale above.
- The project is unlikely to have any effect on spawning sockeye salmon that are speculated to use Maria Slough because fish access to Maria Slough will remain unaffected by the project.
- The project has the potential to impact the availability and quality of rearing habitat for chinook salmon within the removal footprint and downstream on both Tranmer and Spaeti bars.
- The project has the potential to disturb sockeye salmon rearing habitat that may include channel nook, eddy pool, open nook and bay habitats associated with lower Tranmer Bar and Spaeti Bar. The effects may be direct within the footprint of the removal, or indirect by way of modification of valuable rearing habitats located downstream that could be modified as a result of sediment deposition from the excavated bar surface.

Disturbance to White Sturgeon Spawning and Rearing Habitat

- The project may affect egg and larval stages of white sturgeon by way of a change in the quality of potential spawning and incubation habitat at Tranmer Bar. This effect may be immediate, during the period of sturgeon spawning in 2011, and last through the period required for site recovery. Concerning immediate effects, there is the potential for sturgeon eggs to be deposited within the removal footprint and on substrates that have not yet been reworked by freshet flows. Such material will be mobile and unstable, and not likely favourable for egg incubation. This may have negative implications for population recruitment. The timing of sturgeon spawning in the lower Fraser River has been estimated as early as June 18 (Perrin *et al.* 2003, Liebe and Sykes 2010), and freshet flow generally peaks in mid-June based on the historic record.
- Concerning long-lasting effects on sturgeon, the project may modify downstream spawning and rearing habitats or destabilize the channel and neighbouring bars, thereby reducing the amount of suitable habitat for sturgeon. That the proposed removal is within the main channel diminishes risk to white sturgeon spawning habitat following results of Perrin *et al.* (2003) and Liebe and Sykes (2010), both of whom found sturgeon spawning in side channels. However, juvenile sturgeon likely rear throughout the area and the long-lasting project effects on sturgeon rearing habitat are uncertain. Sturgeon likely use a range of habitats throughout the Gravel Reach for seasonal rearing and feeding (**Appendix E**). Tangle net sampling by Liebe and Sykes (2010) in Tranmer side channel downstream of Spaeti Bar collected four sturgeon in autumn 2010.

Reduction in Habitat Suitability for Life Stages of All Fish Species

- The project may alter riverbed sediment characteristics, which is a major component of fish habitat. As reported by Rempel and Church (2009), gravel extractions typically cause a temporary change in substrate conditions thereby affecting habitat. This change is likely localized to the excavation footprint and occurs when coarse material that acts as an armour layer is removed and replaced by an unconsolidated mix of fine gravel and sand. It may also occur as a result of sediment screening operations on-site.
- The temporary change in substrate may lead to a decrease in habitat quality for invertebrate taxa because higher sediment transport rates discourage settlement. Habitat quality for juvenile salmonids as well as incubating sturgeon eggs and larvae may be reduced both directly, due to the change in substrate texture, and indirectly, because a decrease in the number of invertebrates reduces the local food supply.
- Habitat modeling using River2D predicts an increase in depth and velocity over the removal site at moderate summer flows (**Appendix A**). This change in hydraulic conditions is expected to change the weighted

useable area for select fish species by between +2.4% (0+ sockeye) and -9.7% (1-2+ mountain sucker), and averaging -3.6% for 13 species/life stage combinations. Although this prediction is only a single snap-shot of project effects over the annual flow hydrograph, the indication is that project effects on habitat suitability within the project footprint will be relatively minor.

- The suitability of fish habitat downstream of the removal site may be impacted by way of increased sediment transport off the freshly disturbed removal surface and deposition into nearby habitats downstream. These include channel nook and bay habitats that may represent important spawning and rearing habitat for cyprinids, catastomids and salmonids including mountain whitefish, chinook and sockeye salmon. These habitat types do not occur within the removal footprint and so the potential effect is only indirectly to such habitats downstream.

Loss of High-Elevation Refuge Habitat

- Due to the relatively shallow depth of removal, and the fact that the area is submerged at flows of only 4,500 m^3/s based on habitat mapping described above, the removal area footprint on Tranmer Bar is not considered to provide truly high-bar refuge habitat (i.e., providing shallow water habitat for refuge during flood flows >5,000 m^3/s). Its habitat value at lower flows, however, is undisputed.

Wildlife

Effects to wildlife, including waterfowl and migratory birds, as a result of gravel extraction are a concern when impacts to riparian vegetation occur.

Malfunctions or Accidents

Possible malfunctions or accidents during construction, operation and de-commissioning of the project that could adversely affect fish and fish habitat include fuel spills causing the release of toxic/hazardous materials or the inappropriate operation of equipment. Elevated turbidity may result if machinery accidentally enters the river during project activities.

Effects of the Environment on the Project

Potential effects of the environment on the project include extreme weather events causing a rise in water level and forcing a change in project design or pre-empting completion of the project, as well as natural or artificial factors causing a sudden increase in river water level.

Cumulative Effects

The proposed project at Tranmer Bar, coupled with previous and future sediment removals, may have cumulative effects on river channel processes and fish habitat productivity. Cumulative effects are possible because of the frequency of removals carried out by EMBC, the locations of removals throughout the Gravel Reach, and likelihood for more removals in the future. Persistent sediment removals in excess of sediment supply may ultimately lead towards simplifying or otherwise changing the morphology of the channel over a distance of several kilometers, which in turn may reduce the availability and/or quality of fish habitat at a site- and/or reach-scale. Case studies from other rivers (summarized in Church *et al.* 2001) have shown this effect.

The possibility for this effect is based on the frequency and volume of removals in the Gravel Reach upstream of the Highway 9 bridge, totaling 703, 500 m^3 since 2005 (Tranmer Bar (2009), Spring Bar and Powerline Island (2008), Seabird Island (2007 and 2004), and Popkum Bar (2005 and 2006)), and the likelihood for more sediment removal in years to come.

The fact that Tranmer Bar is situated towards the upstream end of the Gravel Reach raises additional concern. The removal of sediment at an upstream site may "trap" sediment that would be otherwise available for the creation and renewal of habitat downstream, including the recovery of downstream sites where prior sediment removals have occurred. Sediment removal at Tranmer Bar may therefore delay the recovery of downstream removal sites just as removal sites upstream of Tranmer Bar may delay its post-removal recovery. Furthermore, inadequate mitigation of impacts to any removal site may accumulate over time and contribute to incremental declines in overall fish habitat productivity.

28. Mitigation Measures:

Surface Water Quality

Environment Canada administers Section 36(3) of the federal *Fisheries Act* and has provided expert federal advice to DFO regarding water quality. The Proponent will be made aware of, and must adhere to Environment Canada's guidelines for work in around water (**Appendix L**). Key guidelines applicable to this project are:

- The proponent shall ensure that sediment or sediment laden waters are not allowed to enter the aquatic environment during the proposed work. Work should be conducted in accordance to best management practices.

- Any material such as rip rap, gravel, etc., placed below the higher high water mark must be free of silt, overburden, debris or any other substances deleterious to aquatic life.
- Only clean, uncontaminated material may be used as fill.

The following mitigation measures will be applied to ensure these guidelines are met:

- the use of appropriate sediment control measures (e.g., silt curtain) during western bridge abutment construction and de-commissioning;
- sediment removal only from dry bar surfaces (no in-stream sediment removal);
- a minimum 10-m horizontal buffer to be maintained between the extraction boundary and any nearby waterbody; and
- the presence of environmental monitors on-site at all times of sensitive work to ensure that project activities comply with *Fisheries Act* 36(3) legislation.

After the project, elevated turbidity may occur as water inundates project work areas and mobilizes fine sediment on the bar surfaces. This effect is expected to be temporary, localized, and during a period of naturally increased turbidity in the Fraser River. Moreover, with on average 5.5 million tonnes of sand transported through the gravel reach each year (McLean *et al.* 1999), an increase in fine sediment as a consequence of the proposed gravel extraction is likely to be undetectable.

Specific to the borrow pit site on Spaeti Bar, de-commissioning will involve replenishing the pit with a natural size distribution of sediment and capping the pit area with coarse, clean substrate matching the calibre of the surrounding bar surface. This measure is expected to minimize turbidity generated from the borrow site.

Hydraulics

Project effects on channel hydraulics are predicted to be limited to the excavation area and likely to recover to similar, pre-excavation conditions by way of sediment replenishment to the site in subsequent freshets. The excavation will not interfere with the existing flow path of the main channel.

Vegetation

Vegetation disturbance at the access ramp is not expected to have negative environmental effects because the site is chronically disturbed and host to invasive species. A revegetation plan has been agreed upon with the land owner.

Fish and Fish Habitat

Disruption to Fish Passage

- The contractor will routinely survey the construction site against the engineered design to confirm the as-built slopes and boundaries, and to ensure the outer and downstream removal perimeter ties in to the natural bar slope for positive drainage and to prevent fish stranding.

Disturbance to Salmon Spawning and Rearing Habitat

- Pile driving activities will be monitored by hydrophone to ensure that the 30 kPa (210 dB) guidelines for sound pressure are not exceeded. Should sound pressure levels exceed this guideline, mitigation measures will be applied such as a bubble curtain, the use of a smaller hammer, or reducing the force of the hammer blow. If mitigation measures are ineffective and sound pressure levels still exceed 30 kPa, other mitigation will be required through consultation with DFO.
- A minimum 10-m set back will be maintained from the wetted perimeter of Fraser River during all gravel removal operations except bridge construction. This 10-m set back provides a conservative outer boundary to the project's footprint in order to mitigate impacts to any viable salmon redds that may not have been observed by SRS during their site assessment.
- The environmental monitor must be present at all times when works are occurring in proximity to sensitive habitat and must continuously assess the possibility for disturbance to spawning habitat and viable redds. The environmental monitor has the authority to cease extraction work and increase the buffer zone between the waterline and extraction boundary, or reduce the depth of extraction, if either is deemed necessary to minimize the risk to viable redds.
- In terms of spawning habitat, natural sediment replenishment and reworking of the removal site will occur during the 2012 freshet before salmon arrive in the gravel reach to spawn. Surface sediment texture is expected to mostly recover during a single freshet and be suitable for spawning. This is based on the high aggradation rate at Tranmer Bar, and monitoring results from several Fraser sediment removals that found no significant decrease in median substrate size one freshet post-removal (e.g., Rempel and Church 2009 [Harrison Bar], Rempel 2004a [Harrison Bar], SRS 2008 [Gill Central]).

- In terms of salmon rearing habitat, natural sediment replenishment is predicted to be on the order of 36,000 m^3/yr within the removal boundary. Annual sediment deposition will mitigate project effects on salmon rearing habitat by way of habitat rebuilding and the reworking of surface sediment.
    - Chinook salmon are unlikely to be affected because the species uses a wide variety of habitats throughout the gravel reach for rearing. Rearing habitat at Tranmer Bar is not unique and therefore habitat requirements may be met even in the event that habitat rebuilding is delayed and project effects are more long-lasting than predicted.
    - Sockeye salmon that use rearing habitat downstream of the removal area are unlikely to be affected because the removal boundary ties into a channel nook, but does not extend into these over-wintering habitat features. Any physical and/or hydrological changes that may occur by way of elevated sediment transport from the upstream removal area are not expected to exceed the natural rate of change in this aggradational area of the bar. Moreover, sockeye are passive migrants and a fidelity to particular habitat units on Tranmer Bar is unlikely; channel nooks and bays are available elsewhere in the gravel reach.
- Based on the local aggradation rate, predicted site recovery time is approximately 4-5 years and, in the meantime, the excavation design includes several features intended to provide habitat complexity to benefit rearing juvenile fish at various flow levels. These include 3 bays and at least 7 open nook features along the inner edge of the removal area, and 3 topographic steps oriented crosswise to the river flow.

Disturbance to White Sturgeon Spawning and Rearing Habitat

- Advice on project effects to white sturgeon from BC MNRO states that "the alteration of habitats is likely to be temporary and is not likely to be greater than expected or irreversible provided that the removal is conducted correctly, that adjacent habitats are protected, and that gravel recruitment continues into this habitat area". Additionally, "provided that key removal design features and mitigation measures are followed during the removal, that the removal is appropriately monitored and reported on, and that post removal assessment work is conducted, there is likely to be an acceptable (not irreversible) alteration of habitats associated with this removal".
- The multi-year monitoring program for sturgeon spawning and rearing habitat will continue following methodology from the former BC Ministry of Environment (**Appendix M**).

Reduction in Habitat Suitability for Life Stages of All Fish Species

- Surface sediment characteristics, a major component of fish habitat, are expected to recover quickly at Tranmer Bar based on the high rate of sediment deposition at the site and evidence from prior removals (cited above).
- The borrow pit on Spaeti Bar will be refilled with sub-surface sediment similar in size distribution to the surrounding bar and a top layer of coarse cobble-gravel will be applied and contoured to the surrounding bar. The coarse surface cap is expected to minimize any change in habitat suitability at the site.
- Sediment screener operation is not predicted to produce fine sediment that might smother fish habitat. This prediction will be verified by comparative sediment sampling between areas of screener operation and non-screener areas.
- The temporary change in substrate is not expected to have a lasting effect on invertebrate species abundance and diversity based on previous experience. Rempel (2004a) found no change in invertebrate species abundance and diversity following the 2004 sediment removal at Little Big Bar. At Harrison Bar following gravel extraction in 2000, the impact to invertebrate abundance and community composition were short-lived, lasting only through the first freshet (Rempel and Church 2009). DFO recognizes that certainty around these results is not high and therefore intends to review and update monitoring protocols for future removals.
- Project effects on habitat suitability will be mitigated by the creation of engineered habitat features described above and natural sediment replenishment to the site, which will favour rebuilding of Tranmer Bar and its habitats at the removal site within 4 to 5 freshets based on the rate of recent local aggradation (**Appendix A**).
- Mitigative advice from BC MNRO on project effects to provincially managed species such as mountain whitefish and mountain sucker is as follows: "Provided that key removal design features and mitigation measures are followed during the removal, that the removal is appropriately monitored and reported on, and that post removal assessment work is conducted, there is likely to be an acceptable (not irreversible) alteration of habitats associated with this removal. However, the strict monitoring of these works will be critical to their acceptable impact, and the design should also clearly reflect, account for and restore temporary disturbance areas, including, but not limited to the temporary access road and bridge".
- Post-extraction monitoring will be carried out, as described below, to evaluate the functionality of engineered

habitats as fish habitat, quantify the magnitude of impact, and track habitat recovery of the site over time.

- Compensatory measures may be required to offset habitat losses detected by this monitoring in order to ensure that gravel removal does not contribute to incremental declines in overall fish habitat productivity.

Loss of High-Elevation Refuge and Rearing Habitat

- The removal site on Tranmer Bar is not considered to function as high-elevation refuge habitat during flooding because of its relatively low elevation.

Additional general mitigation measures to reduce project effects on fish and fish habitat include the following:

- All work will be completed during the winter fisheries window between January 1 and March 15, 2011.
- All project activities will be supervised by a qualified environmental monitor according to standards outlined in the document "Specifications for On-site Environmental Monitoring of Active Sediment Removal Projects" **(Appendix N)**.
- All project activities except construction and de-commissioning of the western bridge abutment will take place on dry sediment isolated from the river flow in order to protect the aquatic environment, fish and fish habitat.
- Sediment and erosion control measures will be in place at the western bridge abutment during instream works to mitigate turbidity and the effects of fine sediment smothering downstream fish habitat.
- A fish salvage will be carried out prior to in-stream works for construction of the western bridge abutment, and the work area remain isolated from fish access for the duration of the construction works.
- Project area boundaries will be clearly staked for the duration of project works.
- The Environmental Monitor will be required to track daily removal volumes and monitor the excavation perimeter to ensure that the project effects do not exceed what has been assessed in this Screening Report.
- The Proponent will replace any large woody debris occurring within the excavation boundary following the extraction. The wood will be re-positioned at the site so as to benefit fish habitat, as directed by the environmental monitor or DFO staff.
- All equipment and machinery will be power-washed off-site and in good operating condition. Refueling and lubrication of equipment will occur outside of the active channel and will require spill containment in place.
- The haul road over Tranmer Bar will be constructed and maintained along routes that minimize the area of disruption to fish and fish habitat.
- The haul road across the gravel bar surface will be de-commissioned by scarifying with an excavator.
- No stockpiling of excavated material will occur within the active channel of the Fraser River.
- On-site sediment screening will be monitored for problems associated with dust, noise, and fine sediment deposition. Any issues potentially affecting fish and fish habitat will result in halting of screening operations and must be resolved before the machinery is allowed to resume operation.
- A biophysical monitoring program (the "Monitoring Program"), as specified in the DFO *Fisheries Act* Authorization, will be carried out by the Proponent to monitor effects of the project on fish and fish habitat. The Monitoring Program includes pre-project sampling (already completed) and post-project sampling for multiple years in order to track habitat recovery and to assess if any compensatory measures are necessary to resolve a negative habitat balance. The Monitoring Program also includes a program to assess sturgeon spawning and rearing in the Gravel Reach **(Appendix M)**. Hence, the Monitoring Program for this project includes:
    1. Topographic surveys to assess the volume of sediment removed, footprint area disturbed, conformity of the post-excavation profile to the engineered design, rate of sediment replenishment after future freshets, and effects on habitats immediately downstream.
    2. Hydraulic surveys of the excavation area and habitat modeling to calculate the weighted usable area for select fish species/life stage combination post-removal. These results will be compare to pre-removal habitat suitability. Surveys will occur in 2011 and biennially thereafter until habitat recovery at the site has been demonstrated or, if channel alignment has shifted, it is no longer relevant.
    3. Surface sediment sampling to assess the change in sediment texture and rate of recovery.
    4. Benthic macroinvertebrate sampling to evaluate habitat quality, site recolonization and fish food availability before and after the excavation in comparison to designated reference sites.
    5. Habitat mapping to compare the type and extent of available habitat over a range of flows before and after the excavation, including habitats immediately downstream.

6. White sturgeon sampling post-extraction to evaluate spawning and juvenile rearing activity.

It should be noted that the Monitoring Program is currently under review and the specific requirements may be changed by DFO to align with a new, comprehensive monitoring plan in the future.

Wildlife

Based on advice provided January 14, 2011 by Environment Canada as an expert Federal Authority on the project (**Appendix N**), possible effects on wildlife will be mitigated by project timing (i.e., project activities do not coincide with breeding activity by birds) and ensuring that important riparian habitat is not disturbed by project activities. If steel piles are to be used, they must be capped to prevent the entry of wildlife (**Appendix K**). Hence, no negative effects on wildlife are expected from the project.

Environment Canada confirmed this position regarding resident and migratory birds by email to DFO on January 20, 2011 (email subject line "*RE: MIN-142917 Tranmer Bar – Otto Langer DUE JAN. 24*", sent from Coral DeShield, Canadian Wildlife Service, at 9:32am).

In the event of unforeseen riparian disturbance, the environmental monitor will be responsible for replanting the area promptly upon project completion using native species and according to the DFO Riparian Areas and Revegetation guidelines (http://www.pac.dfo-mpo.gc.ca/habitat/reveg/index-eng.htm) and *MELP Tree Replacement Criteria* (1996).

Malfunctions or Accidents

Consistent with advice from Environment Canada (**Appendix K**), Section 36(3) of the *Fisheries Act* prohibits the discharge of deleterious substances to waters frequented by fish, or to a place where those substances might enter such waters. An appropriate spill prevention, containment, and clean up contingency plan for hydrocarbon products (e.g., fuel, oil, hydraulic fluid, etc.), and other deleterious substances shall be put in place prior to work commencing, and appropriate spill containment and cleanup supplies shall be kept available onsite whenever the works are occurring. Therefore, standard spill prevention best practices are required during the project.

All machinery used on-site will be in good working condition and the BC Water Act Approval requires all hydraulic machinery operating near water to use environmentally sensitive hydraulic fluids that are non-toxic to aquatic life and readily or inherently bio-degradable. Appropriate storage and refuelling locations for machinery will be identified to prohibit fuels and lubricants from entering the Fraser River. These sites must be outside of the active channel of the Fraser River and be a minimum of 30 m from any watercourse or surface water drainage.

In the event of a spill, it is expected that prompt clean-up will occur and that volumes will be small, local, and on a dry gravel surface. Spills shall be reported to the 24-hr Provincial Emergency Program Spill Reporting hotline (1-800-PEP-663-3456)

Construction waste or any miscellaneous unused materials for causeway and crossing construction will be removed from the project area for either disposal in a designated facility or placed in storage.

Environmental monitors on-site during the project will ensure the appropriate operation of all equipment and machinery and have the authority to halt the project if potential impacts to fish or fish habitat are identified.

Effects of the Environment on the Project

Environmental monitors on-site at all times have the authority to halt the project if weather conditions or water level pose an environmental risk. A minimum 10-m buffer between the water's edge and removal boundary will be maintained to reduce the likelihood for the river to inundate the project area during work. A Contingency plan, agreed upon by the contractor and environmental monitor, must be in place at the start of the works to prepare for the possibility of an unexpected increase in water level prior to completion of the project. The plan will describe measures to ensure the work site is de-commissioned such that no unexpected environmental effects result and according to *Fisheries Act* requirements.

Habitat Compensation

The nature and duration of the harmful alteration, disruption and/or destruction to fish habitat is predicted to be non-significant and temporary as a result of 1) design features and mitigation measures described herein, and 2) natural sediment recruitment and stabilization of the site by subsequent freshets. There remains, however, uncertainty associated with this prediction because rates and patterns of sediment transport and deposition are highly variable over time and space. This variability is reflected in the inconsistency among the three sediment budgets reported since 1999 (Church et al. 2001; Ham and Church 2003; nhc 2009).

The uncertainty will be addressed through post-excavation hydraulic surveys and habitat modeling described above following the 2011 freshet. The monitoring program includes methods to evaluate the positive effects of mitigative habitat design features within the project footprint, post-excavation habitat conditions and magnitude of project effects, available habitat area for select fish species, and the duration of change. The results of this monitoring will be used to calculate an overall habitat balance resulting from the works; compensatory activities will be required of the Proponent

to offset a negative habitat balance.

Cumulative Effects

Cumulative effects from sediment removal are most likely where extraction rates persistently exceed the natural rate of sediment recruitment. In Church's (2010) analysis of sediment budget estimates for the Gravel Reach, he concluded that "the most reliable estimates of long-term gravel influx into the reach remain those of the 1952-1999 period". He went further to recommend "using 230,000 m^3/yr as the current estimate of average annual bed material recruitment". This volume has been adopted by EMBC for their Sediment Management Program and was the limit set for sediment removal in 2011. This project proposes to remove 167,000 ±10% from Tranmer Bar, which represents roughly 73% of annual influx. The reach-wide extraction rate for the past decade (since 2002) is 190,000 m^3/yr, or 83% of the decadal influx. Based on this result, the Sediment Management Program objective of water profile maintenance (removal rate approximating influx rate) appears to have been more or less achieved and there doesn't appear to be evidence for reach-scale cumulative effects based on extraction rate alone. But the fact that 50% of the removal volume since 2002 has been extracted upstream of the Highway 9 bridge at Agassiz, BC, in the upper sub-reach of the Gravel Reach, identifies a concern.

Concern for upstream removals "trapping" gravel that would otherwise be available for onward transport is raised in Church et al. (2001) and Church (2010), and recommendations are provided therein to avoid it. KWL considered these warnings in their hydraulic assessment (**Appendix A**) and evaluated the proposed removal in the context of the local bed material transport rate to determine if the removals at Tranmer Bar may constitute gravel "trapping". KWL has stated that two years of removals at Tranmer Bar (2009 and 2011) is reasonable and does not produce a "trapping" situation, and analyses presented in their report are meant to caution decision makers regarding site selection for gravel removal in years to come (KWL, pers. comm.).

The types of recommendations made by Church et al. (2001) and Church (2010), which are intended to prevent irreversible morphological and ecological impacts, will lay the foundation for a long-term plan that EMBC will begin developing in 2011. Long-term planning for sediment management will facilitate a more comprehensive assessment of the morphological, ecological and hydrological effects of sediment removal, and allow for more strategic site selection, transparency in decisions, and opportunity for stakeholders and interest groups to provide input. A long-term plan may also include guidelines and conditions to minimize both site-specific effects, and the potential for cumulative effects into the future.

While site-specific effects on fish and fish habitat may not all be mitigated by measures described above, or be immediately reversed by sediment replenishment, they are expected to be mitigated by the creation of other productive fish habitat available for fish populations to exploit. The project is situated in a zone of significant recent sediment accumulation that is expected to continue with the current channel alignment; such conditions are conducive to the creation and renewal of productive habitat and the site is "therefore a logical place to locate a removal from the perspective of minimizing persistent disturbance" (KWL, pers. comm.). Annual changes in habitat characteristics and availability as a result of sediment transport during flooding is the natural ecological context to which local fish populations are likely adapted (Rempel and Church 2009).

In summary, considering the removal volume, geomorphic information, calculations of local aggradation and annual sediment influx to the Fraser River Gravel Reach, and with the implementation of mitigation measures outlined in this Screening Report, cumulative effects are expected to be avoided.

29. Significance of Adverse Environmental Effects:

The determination of whether the project is likely to lead to significant adverse environmental effects was based on the Canadian Environmental Assessment Agency reference guide entitled "Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects", and the Environmental Effects and Proposed Mitigation as described in Section 27 and Section 28 of this Screening Report. As outlined in the CEAA guidance document, the significance of adverse environmental effects is based on the following criteria:

- Magnitude of the adverse environmental effect
- Geographic extent of the adverse environmental effect
- Duration and frequency of the adverse environmental effect
- Degree to which adverse environmental effects are reversible or irreversible
- Ecological context

Environmental effects of the project at Tranmer Bar are expected to be moderate in magnitude, localized in geographic extent, temporary in duration, and reversible. Effects on microhabitat features and substrate texture are expected to recover to pre-excavation conditions following one to several freshets. Recovery of suitable habitat for species of interest in the Gravel Reach may also require several freshets depending on the magnitude of sediment transport during future freshets to rebuild this habitat. In the interim, habitat loss due to sediment removal is mitigated

by the provision of other productive types of fish habitat; provisions for habitat compensation have been outlined should they be required to offset any residual effects. Effects on white sturgeon habitat are likely to be temporary and not irreversible, and the project is not believed to compromise management objectives of the species (**Appendix E**).

In light of these considerations, DFO concludes that the project as scoped in Section 23 of this Screening Report is not likely to result in significant adverse environmental effects.

30. Public Participation in Screening under Subsection 18(3) of CEAA:

Was it considered appropriate in the circumstances? Yes ☐ No X

Explain why public participation was or was not considered appropriate.

In accordance with the *Canadian Environmental Assessment Act*, the Notice of Commencement notified the public that the review of the project commenced, outlined the federal scope of the project and established the public registry for the project at www.ceaa.gc.ca. Through this process, the public may request documents from the public registry and comments from the public pertaining to environmental effects may be considered as part of the environmental assessment. Additionally, the Proponent posted all application documents to a publically accessible website at http://www.pep.gov.bc.ca/floods/fraser_sediment_prog.html and notified most environmental non-government organizations with prior interest in Fraser sediment removals of the proposed project by email on October 5, 2010 and again on November 18, 2010.

By email and telephone communication, DFO also solicited input from all environmental non-government organizations and private citizens known to have an interest in Fraser River sediment management. Substantial effort was made to ensure documents were available to all interested groups and that they were given a reasonable amount of time for review and comment. Although DFO did offer to meet with interested groups to discuss concerns, no meetings occurred. In total, DFO received 18 submissions from interested parties with comments on the project. All relevant comments have been considered in the environmental assessment.

As a result of these actions by the Proponent, DFO and public notification through the Canadian Environmental Assessment Registry, public participation in this Screening under Subsection 18(3) was not invoked.

31. Summary of Public Comments and Concerns Related to Screening under Subsection 18(3):

Subsection 18(3) of CEAA was not invoked.

32. Follow-up Program:

Was it considered appropriate in the circumstances? Yes ☐ No X

Explain why a follow-up program was or was not considered appropriate.

The Monitoring Program, described in Section 28 of this Screening Report, will be carried out for several years post-excavation. No additional follow-up program was considered necessary because the project does not involve technology or mitigation measures that are new or unproven, and it is anticipated that the proposed mitigation measures, including post-project monitoring and possible compensation, as well as the Fraser River's natural tendency for sediment transport and deposition in the gravel reach, will address the predicted environmental effects.

33. Other Monitoring and Compliance Requirements:

Implementation of all mitigation measures will be monitored under approvals or permits from government agencies and departments. Environmental monitors on contract to EMBC will adhere to the standards outlined in **Appendix N** for on-site monitoring during all project activities. Additional site visits, inspections or reporting will be conducted by EMBC or consultants working on behalf of the Proponent and results of these will be provided to the appropriate government agencies or departments. This will include mitigation and monitoring to ensure compliance with Subsection 35(2) *Fisheries Act* Authorizations.

SCREENING CONCLUSION

34. Conclusion on Significance of Adverse Environmental Effects:

Fisheries and Oceans Canada has completed the screening of the project under the CEAA. DFO has determined, taking into account the implementation of the proposed mitigation measures, that the project is not likely to cause significant adverse environmental effects.

35. Confirmation by Proponent

I, Rebecca F. Denlinger, having the authority to commit funds and activities on behalf of EMBC have read and understood the above material outlining conditions for the above project. I confirm that EMBC will undertake all of the mitigation conditions outlined in this environmental screening report and any additional measures necessary to ensure protection of the environment and compliance with environmental regulations during the operation, maintenance and decommissioning of this project.

Signed by: Rebecca F. Denlinger **Date:** Jan 21/11

Title: Fire : Emergency Management Commissioner / ADM

36. CEAA Decision Approved by: for **37. Date:** 21-Jan-11

38. Name: Jason Hwang

39. Title: Area Manager, BC Interior Area, Fisheries and Oceans Canada

COURSE OF ACTION DECISION

40. Course of Action Decision: (under Section 20 of CEAA)

X DFO may exercise its power, duty or function, i.e. may issue the authorization - where the project is not likely to cause significant adverse environmental effects. Confirm below the specific power, duty or function that may be exercised.

- X DFO to issue *Fisheries Act* Authorization or Approval
- ☐ DFO to recommend to Governor in Council to exercise power, duty or function
- ☐ DFO to proceed with project (as proponent)
- ☐ DFO to provide financial assistance for project to proceed
- ☐ DFO to provide federal land for project to proceed

☐ DFO may not exercise its power, duty or function - the project is likely to cause significant adverse environmental effects that cannot be justified in the circumstances.

☐ DFO shall refer the project to the Minister of the Environment for referral to a mediator or review panel if it is uncertain whether the project is likely to cause significant adverse environmental effects.

☐ DFO shall refer the project to the Minister of the Environment for referral to a mediator or panel - the project is likely to cause significant adverse environmental effects that may be justified in the circumstances.

☐ DFO shall refer the project to the Minister of the Environment for referral to a mediator or review panel - public concerns warrant a reference to a mediator or review panel.

41. References:

BGC Engineering Inc. and Kerr Wood Leidal Associates Ltd. 2006. Fraser River potential gravel removals 2007 –

2011. Report prepared for BC Integrated Land Management Bureau, Surrey, BC.

Church, M. 2010. **Sediment management in Lower Fraser River: Criteria for a sustainable long-term plan for the gravel-bed reach**. Report prepared for Emergency Management BC, Victoria, BC. 38 p.

Church, M. and S.P. Rice. 2009. **Form and growth of bars in a wandering gravel-bed river**. Earth Surface Processes and Landforms 34: 1422-1432.

Church, M., D.G. Ham and H. Weatherly. 2001. **Gravel management in the Fraser River**. UBC Dept. of Geography, Vancouver, BC. 119 p. http://www.geog.ubc.ca/fraserriver/reports/report2001.pdf

Church, M., Rempel, L. and S. Rice. 2000. **Morphological and habitat classification for the lower Fraser River gravel-bed reach**. UBC Dept. of Geography, Vancouver, BC. 81 p. http://www.geog.ubc.ca/fraserriver/reports/DFO_report.pdf

G3 Consulting Ltd. 2009. **Fraser River gravel extraction surveys: Statistical meta-analysis**. Report prepared for Emergency Management BC, Victoria, BC. 109 p.

Liebe, R. and G. Sykes. 2010. Fraser **River sturgeon sampling and monitoring program 2010**. Report prepared for Emergency Management BC, Victoria, BC. 103 p.

McLean, D.G., M. Church and B. Tassone. 1999. **Sediment transport along lower Fraser River. 1. Measurements and hydraulic computations**. Water Resour. Res. 35: 2533-2548.

nhc (northweswt hydraulic consultants). 2008. **Fraser River management geomorphic assessment of gravel removal at Tranmer Bar**. Report prepared for Emergency Management BC, Victoria, BC. 12 p.

nhc (northwest hydraulic consultants). 2009. **Fraser River sediment budget Phase 2: final draft report**. Report prepared for Emergency Management BC, Victoria, BC. 56 p.

Perrin, C.J., L.L. Rempel and M.L. Rosenau. 2003. **White sturgeon spawning habitat in an unregulated river: Fraser River, Canada**. Trans. Am. Fish. Soc. 132(1):154-165.

Rempel, L. 2004a. **Ecological effects assessment of Fraser River gravel removals in 2004: draft report**. Report prepared for Land and Water BC (LWBC), Surrey, BC. 70 p.

Rempel, L. 2004b. **Physical and ecological organization in a large gravel-bed river and response to disturbance**. PhD Thesis, UBC Dept of Geography, Vancouver, BC. 405 p. http://www.geog.ubc.ca/fraserriver/reports/physical_ecological_org_all.pdf

Rempel, L.L. and Church, M. 2009. **Physical and ecological response to disturbance by gravel mining in a large alluvial river**. Can. J. Fish. and Aquat. Sci. 66: 52-71.

Rice , S.P., M. Church, C.L. Woolridge, and E.J. Hickin. 2008. **Morphology and evolution of bars in a wandering gravel-bed river; lower Fraser river, British Columbia, Canada**. Sedimentology doi: 10.1111/j.1365-3091.2008.00994.x

Scott Resource Services, 2010. **Tranmer Bar 2009 biological monitoring program report Fraser River sediment removal**. Report prepared for Emergency Management BC, Victoria, BC. 74 p.

Scott Resource Services, 2009. **Environmental Monitor's 60 day report for the January 2009 sediment removal at Tranmer Bar, Fraser River**. Report prepared for Emergency Management BC, Victoria, BC. 36 p.