PLEASANT VALLEY BRIDGE CROSSING
FISH HABITAT ASSESSMENT

FINAL REPORT

Submitted to:

Ministry of Transportation
Northern Region
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October 15, 2002
022-9005

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1.0 BACKGROUND

The Ministry of Transportation (MOT) has recently revitalized a bridge replacement plan for the Pleasant Valley Bridge (No. 1409) over the Bulkley River (WSC 460) located 5 km west of Houston on Yellowhead Highway 16 in the Morice Forest District. A design for a replacement bridge was completed in 1992. The goal is to replace the existing metal bridge with a clear span structure that does not have the high maintenance costs of the current structure while conforming to current environmental statues and stream crossing guidelines. However, a clear span structure is complicated by the need for deeper beams and issues associated with the Navigable Waters Act related to clearance and the use of pier(s). The 1992 design also incorporates the use of either an independent Detour Bridge or moving the existing bridge to act as a detour. The reactivation plan includes a review of the design history and a value engineering review of the 1992 design. Factors affecting the design include the presence of a nearby CNR line as well as a logging road and its associated overhead bridge. The Ministry requires information on preferred in-stream work windows, fisheries resource values within the study area, and potential mitigation/compensation works.

In response to the aforementioned, Golder Associates Ltd. conducted a fish and fish habitat assessment on a 600 m long study-area corridor of the Bulkley River around the Pleasant Valley Bridge on September 12, 2002, including one off-channel area and one tributary. Project work has also included a review of the 1992 bridge design plans and discussions about the proposed work and fisheries resource values in the area with Gord Wolf, Ministry of Water, Land and Air Protection (MWLAP), Water Resources Specialist, Smithers, B.C.; Paul Giroux (MWLAP), Fisheries Biologist, Smithers, B.C., Mark Beere (MWLAP), Senior Fish Biologist, Smithers, B.C.; Dana Atagi (MWLAP), Fish and Wildlife Section Head, Smithers, B.C.; Tom Pendray, Senior Habitat Biologist, Department of Fisheries and Oceans (DFO), Smithers, B.C.; and Mike O'Neil, Toboggan Creek Hatchery Manager, Smithers, B.C.

This final report has been updated from the original draft report dated September 23, 2002 based on both an office and field meeting involving staff from MOT and DFO and bridge design contractors (Acres International) held in Smithers, B.C. on October 9th, 2002.

2.0 FISH AND FISH HABITAT

2.1 Previous Assessments

Based on discussions with Tom Pendray (DFO) and in consideration of the extensive fisheries knowledge within the Bulkley River from previous studies, no fishing within the study corridor was done owing to its redundancy. The Fish Information Summary System (FISS 2002) lists more than 24 fish species for the Bulkley River. At least 14 of these are considered regionally important and/or sport fish. Seven species are anadromous, including five species of salmon, as well as cutthroat (*Oncorhynchus clarki)* and steelhead (*O. mykiss)* trout. Previous studies and observations within what has been characterized as a 10 km long reach (i.e., Reach 1) of the mid-Bulkley (also known as the Upper Bulkley or Little Bulkley River), starting at the Morice River confluence and moving upstream through the Pleasant Valley Bridge study area and beyond the town of Houston, have documented the presence of juvenile coho (*O. kisutch*) and chinook salmon (*O. tshawytscha)*, and adult chinook spawners above and below the Pleasant Valley Bridge crossing (BCCF 1999). Approximately 2% of the chinook salmon run in 2002 spawned downstream of the bridge; this is considered unusual in this area. This was likely linked to lower-than-normal water levels for these spawners, who ordinarily move further upstream (Mike O'Neil, pers. comm.). In addition, prickly sculpins (*Cottus asper)*, white suckers (*Catostomus commersoni*), and longnose dace (*Rhinichthys cataractae*) have been documented in the reach along with rainbow/steelhead trout (BCCF 1999). Discussions with provincial government fisheries staff indicate that steelhead are more common than resident rainbow trout (*O. mykiss*), although the latter cannot be ruled out as being present. Steelhead are also believed to spawn further upstream than the bridge site although they have formerly been tracked in its vicinity (Mark Beere, Dana Atagi, Mike O'Neil, pers. comm.). Cutthroat trout appear to be rare in the Upper Bulkley and localized in the system in general. Along with rainbow trout, cutthroat trout appear to be associated more with tributaries of lake systems, especially in the Morice River system. Sockeye, pink and coho spawners, and Dolly Varden/bull trout have also been documented in the reach (BCCF 1997). It is also possible that many of the Dolly Varden references are for bull trout. Previously tagged bull trout have been tracked by MWLAP in the vicinity of the study area within a period that suggests its possible importance as overwintering and adult rearing habitat (Paul Giroux, pers. comm.). Coho and sockeye spawners tend to be located further upstream from the bridge site while the latter species are unusual in the lower Bulkley River system and, if found, tend to be strays. It would also appear that pink salmon are not abundant in the mid-Bulkley River (Mike O'Neil, pers. comm.). Although not fished, Golder

field staff did observe one adult-sized salmonid just downstream of the CNR Bridge on September 12, 2002.

The aforementioned Reach 1 in the mid-Bulkley River was previously characterized as a very important area for holding/migrating, summer rearing, spawning, and overwintering habitats that were in a relatively pristine state with regard to the overall watershed productivity and diversity of fish. This is because of its position in the watershed, gradient, and channel morphology (BCCF 1999). It was felt that species such as steelhead and bull trout would not likely use the mainstem for rearing and spawning because of a preference for higher gradients and larger substrate. The mainstem is more conducive for overwintering and as a migration corridor between habitats. Coho salmon were also thought unlikely to use the mainstem for spawning and rearing (BCCF 1999). Previous survey results in Reach 1 suggested that coho will migrate out of tributaries to rear in the mainstem during late summer to avoid poor water quality, high temperatures, and low flows. Mainstem overwintering and off-channel areas were considered important because of low flow conditions in many tributaries during the winter, and the amount of open-water area versus iced-over area. Off-channel areas also provide refuges during high water events in mainstem channels (BCCF 1999). Habitat complexity in Reach 1 was considered moderate to good, although the ratio of pools to riffles was low. Off-channel units made up 10-15% of the available habitat. Pool frequency appeared low in comparison to smaller channels in the study area and extensive runs and riffles suggested the possibility of pool infilling due to sediment loading. Large woody debris (LWD) function ranged from minimal for small size classes to moderate for large size classes (BCCF 1999). Log jams were frequent throughout Reach 1. Spawning gravels were high in both coverage and size suitability for both resident and anadromous salmonid spawners. Cover complexity was minimal and was frequently of in-stream types. Boulders were dominant in runs and riffles, overhead vegetation in off-channel units, and LWD in pools (BCCF 1999). Canopy closure was low and water temperatures high at the time of the BCCF survey (18 °C). Typically, the Bulkley River is a warm system in summer ranging from 15-18 °C (Mike O'Neil, pers. comm.). Pools were found to be used by all species with the exception of white sucker, with the most abundant species/life stage found being rainbow/steelhead trout fry, and the least abundant being coho salmon fry (BCCF 1999). Salmon species were found to be present in highest densities in pools, while riffles were used by all species except coho and chinook. The highest densities of all other species and age classes represented were captured in riffles. All species except white sucker were present in runs. The minimal amount of off-channel habitat that

was sampled contained low densities of longnose dace and rainbow/steelhead trout fry (BCCF 1999).

2.2 Current Assessment

Golder field staff characterized and mapped fish habitat within a 600 m long mainstem corridor of the Bulkley River in the vicinity of the Pleasant Valley Bridge on September 12, 2002. An off-channel area upstream of the logging road crossing, one "tributary" near the south-east corner of the Highway Bridge, and one "ditch" that originates along the north side of Highway 16 and ends approximately 6 m from the Bulkley River at the LDB embankment near the rest area washrooms were investigated. Only the Bulkley River mainstem was mapped in detail, as fish habitat was virtually absent within the off-channel, "tributary" and "ditch" areas.

Appendices I and II provide data and illustrations derived from the fish habitat assessment. Appendix III contains the photograph descriptions and corresponding waypoint and frame references. The digital photographs were taken at 72 dpi in JPEG format and were burned onto the accompanying CD ROM. Appendix IV contains hard copies of the digital photos. Appendix V contains two graphs of water levels from May to October 2002 for the Bulkley River as recorded downstream of Houston near Smithers, B.C. at Quick. Although the river volume is larger at the Quick station, it is still somewhat representative of overall water level fluctuations within the system.

At current water levels, the Bulkley River mainstem within the 600 m study area corridor lacks habitat complexity. Water levels in the Bulkley River at the time of the survey were lower than normal (Mike O'Neil, pers. comm.), although rafted debris in the riparian zone indicated a very high 2002 freshet event. It is predominantly moderate to high-quality run habitat intermixed with occasional pools of moderate to high-quality, and shallow and narrow riffles. The most predominant runs are upstream of the Highway Bridge (R1/R3) and downstream of the CNR Bridge (R2). Pool quality and depth are highest (P1/P2) under the Highway and CNR bridges. Wetted widths average near 20 m with bankful widths around 35-40 m. Substrate is predominantly a mixture of cobble and gravel with occasional boulders; cobble dominates. Current water levels have exposed wide sidebars, dominated by cobble and gravel, along the inside bends of both the LDB and RDB. In-stream cover is poor and is largely provided by pool depth, boulder and some interfaced rip-rap with over-hanging vegetation becoming more predominant where banks are sloughing (e.g., WP 010). Banks are typically low and gently

sloping on inside bends and along the run between the CNR and Highway bridges, whereas they are notably higher and undercut causing sloughing on outside bends and areas of higher velocity. Rip-rap has been previously placed around the abutments of all three bridges and along the base of banks where sloughing has been occurring. The riparian zone has been severely impacted in the vicinity of all the bridge crossings, particularly between the highway corridor and the LDB upstream of the Highway Bridge and the RDB upstream of the Highway Bridge.

The off-channel area upstream of the logging road bridge along the RDB was characterized as a dry and vegetated back-channel or slough area that is wetted only during high or freshet flows. Rafted debris and a log jam near its confluence with the Bulkley River indicated previously notable flows through the area. However, the lack of channelization and water, silt substrate, and terrestrial vegetation does not provide any substantial fish habitat beyond freshet refuge.

Although photographs taken by MOT in June 2002 showed what appeared to be a channelized tributary stream near the southeast corner of the Highway Bridge along the LDB, there was no evidence of flow or a well-defined channel during the September 2002 habitat assessment. Dry scour holes near the Bulkley River, some rafted debris and patches of cobble and gravel amongst terrestrial vegetation, within what was more of an upstream drainage "gully" along the south side of the highway, indicate the presence of seasonal flow. However, fish habitat beyond freshet refuge at its confluence does not exist. DFO has indicated that this "gully" does not generally flow beyond the first part of July. The "ditch" noted behind the rest area washrooms contained both rip rap from the surrounding area and terrestrial vegetation; at best there is likely some seasonal flow. It also ends well before the Bulkley River at a reinforced LDB embankment and does not offer any fish habitat. Neither of these areas were considered streams as per the definition provided in the B.C. Fish-stream Identification guidebook (MOF 1998).

Based on the fish habitat survey and aforementioned discussions with fisheries professionals, the run and riffle habitat within the mainstem Bulkley River of study area should be considered as "important" fish habitat as defined in MOF (2002), whereas the pool habitat should be considered "critical" under the same guidelines. Both DFO and MWLAP staff have indicated a lack of habitat complexity in the Upper Bulkley River system, especially with regards to rearing and overwintering habitat. This is because of an apparent lack of deep pool habitat and functioning woody debris when water levels drop in summer and into winter. This was substantiated within the study area where there is a notable lack of interfacing LWD and a small ratio of high quality

pool area. Previously placed rip-rap is providing some of the best rearing habitat in combination with the deeper pools and runs. Pool (P1) and run (R1) depths appear to provide holding, overwintering and migration habitat. Available salmonid spawning habitat, which appears more suitable for salmon with regard to flow velocity and substrate size, is available in association with the run and riffle habitat found both upstream of the Highway Bridge and downstream of the CNR Bridge. Critical habitat for whitefish, burbot and Dolly Varden is not apparent within the study area. Both the surveyed off-channel area upstream of the logging road crossing and "gully" along the LDB just downstream of the Highway Bridge should be considered "marginal" habitat as per the MOF stream crossing guidelines (2002). The associated rest area "ditch" does not contain any fish habitat.

2.3 In-Stream Work

Table 1 outlines the in-stream work windows for fish species in the Morice Forest District that would be associated with the study area. These timing windows are periods when work in and about a stream can be completed with a reduced risk to fish and fish habitat. These have been developed in order to protect fish and fish habitat at crossing sites by preventing impacts on fish eggs and alevin, and migrating or rearing juvenile and adult fish (MOF 2002). Because of the diverse nature of both anadromous and resident salmonids in the mid-Bulkley River, in-stream work windows are typically narrow. Upon initial observations of windows listed in Table 1, there is no clear window that covers off all species, particularly because of steelhead, rainbow and cutthroat trout. However, cutthroat and rainbow trout appear to be predominantly associated with lake tributaries and steelhead have been indicated to spawn further upstream. Despite the apparent lack of spawning habitat or confirmed presence of spawning adults for these trout species in the study area, spawning movements and smolt out migration are still possible in May/June (Paul Giroux, pers. comm.). As a result of the current and historic knowledge of the Upper Bulkley River, the study area fish habitat assessment, and discussions with DFO and MWLAP staff, an in-stream work window of July 1 to August 15 would appear to be acceptable. There may be some additional flexibility depending on the water levels/flows found at the site during required work activities. The Ministry of Transportation has indicated that most of the work directly affecting the river (e.g., pier pile driving) can likely be done outside the actual wetted width within low flow periods. However, any work on dry sidebars such as the one along the LDB still falls under the definition of the work window with regard to "work in and about a stream". That is, work within the bankful width of the river still poses a risk to fish and fish habitat (e.g., substrate removal, sedimentation, etc.).

Table 1. In-stream Work Windows for the Morice Forest District[1]

Month	Jan		Feb		Mar		Apr		May		June		July		Aug		Sept		Oct		Nov		Dec	
Species																								
Chinook[2]												15		31										
Coho[2]													1			31								
Pink										15					15									
Sockeye												15	15											
Steelhead[2]																	1							31
Rainbow		31															1							
Cutthroat[3]																	1							31
D. Varden[3]												15				31								
Whitefish											1						15							
Bull trout[3]												15				31								

[1] Taken from MELP, 1999

[2] These species are thought to be in decline in the watershed (BCCF, 1997)

[3] CDC blue-listed species. Taxa of Special Concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events. Blue-listed taxa are at risk, but are not Extirpated, Endangered or Threatened.

3.0 DESIGN AND INSTALLATION

Based on the supplied 1992 bridge design plans, discussions with DFO and MWLAP staff, and the MOF stream crossing guidelines (2002), the following parameters require the most attention:

- abutments/footings and channel constriction,
- riparian area and bank stabilization,
- rip-rap,
- pier(s), and
- sediment control.

The current bridge abutments and placement of the new footings in the 1992 design do not appear to constrict the stream channel. Although DFO has not looked closely at the current abutments, discussions indicated there likely would not be a problem if they stay. The potential for channel constriction should also be avoided during construction of the Detour Bridge.

Although the design and location of the Detour Bridge have not yet been finalized, riparian removal appears to be probable. This will require replanting of shrubs and trees or removal of hardwood trees in such a manner that regrowth from current root systems is possible. The potential location of the Detour Bridge upstream of the Highway Bridge will also raise concerns about bank stabilization along the steep west bank during abutment or footing construction.

Further rip-rap placement around bridge abutments also does not appear to be a problem with DFO although placement of excessive amounts that may reduce the size of the RDB pool under the Highway Bridge should be avoided. DFO in Smithers feels that rip-rap provides good juvenile fish rearing habitat.

Discussions with DFO did indicate a potential problem with the inclusion of piers in both the Highway and Detour bridge designs. The current stream crossing guidelines indicate that where possible, in-stream piers should be avoided. They can collect debris during freshet events, which can potentially alter the hydrology, causing bedload scour or deposition thereby altering fish habitat (MOF 2002). Their footprint on the streambed may also eliminate fish habitat. However, the creation of scour pools can also create fish habitat. The Ministry of Transportation has indicated that approximately 2 m of substrate depth may be affected in the vicinity of the Highway Bridge pier. The Ministry hydrologist is to supply DFO with further details on expected pier hydrology. Based on the current design and site visits, it appears that piers from the Highway

and Detour bridges would be located on the seasonally exposed LDB sidebar (i.e., at low water levels). However, the Highway Bridge pier would very likely be within the wetted area at high flows and freshet events leading to the aforementioned concerns. The Detour Bridge pier would only be a temporary structure that will be in place during low water levels only. The placement of a pier on the Highway Bridge will likely also require review under the *Navigable Waters Protection Act*.

Because of the importance of the potential rearing and spawning fish habitat in the mainstem Bulkley River around and downstream of the Highway Bridge crossing, any near or in-stream works would have to incorporate methods to minimize sediment deposition and avoid loss of current substrate on exposed gravel bars. This would be applicable to processes involved with moving the current bridge, installation of new abutments/footings, pier construction and placement and type of approach fill.

3.1 Environmental Application Process and Requirements

To initiate an environmental review, assessment, and procurement of approvals for the proposed replacement of the Pleasant Valley Bridge in accordance with a screening level assessment under the *Canadian Environmental Assessment Act* (CEAA), it will be necessary to provide DFO, Canadian Coast Guard (CCG), and MWLAP with final design details accompanied by the following supporting information:

- justification and rationale for the new structure;
- construction methodology and timing;
- biophysical resources within the vicinity of the crossing, including where applicable, site-specific descriptions of nearby spawning and rearing habitats, migration corridors, channel characteristics, etc.;
- assessment of potential impacts to water quality and aquatic habitat anticipated during construction and maintenance of the new crossing;
- assessment of potential impacts to water quality and aquatic habitat anticipated during the removal and decommissioning of the existing or former crossing, including removal of pilings, abutments, etc. (*as applicable*);
- potential to encounter site contamination within the sediments and soils as a result of historical and/or current land uses during construction of the bridge approaches and foundation structures;

- potential to encounter archaeological resources and cultural artifacts within the proposed bridge corridor;
- details on proposed scour and erosion protection measures for the bridge footings, abutments, and/or piles;
- mitigation measures to be taken during construction to minimize or reduce potential adverse impacts to aquatic, terrestrial, and cultural resources, as well as nearby land uses;
- habitat compensation plan for the creation and/or enhancement of productive fish habitat, in the event that it is determined that the design and construction of the new crossing will result in harmful alteration, disruption or destruction of fish habitat (i.e., HADD) (*note, inclusion of an in-stream pier substantially increases the chances that a HADD will occur, which will trigger a review under the CEAA and for which a fish habitat compensation plan will likely be required*);
- environmental monitoring program to inspect, evaluate, and report on the effectiveness of the mitigation measures and compensation strategies undertaken during construction of the new bridge; and
- post-construction environmental monitoring program to inspect, evaluate, and report on the long-term progress and success of the compensatory works.

The aforementioned information is required for a DFO Proponent Application Plan, which is to be submitted along with the crossing plan (MOF 2002). As indicated above, DFO's *Policy for the Management of Fish Habitat* (DFO 1986) normally requires that efforts be taken to avoid disturbing or altering aquatic habitat, unless it can be demonstrated that there are no reasonable alternatives to the proposed design, and/or if it can be demonstrated that the project is in the "interest of public health and safety".

Where impacts are unavoidable and cannot be managed through "mitigation" (i.e., such as redesigning the bridge crossing to avoid an alteration, disruption or destruction of fish habitat), then it will be necessary to develop a "compensation" strategy for the creation and/or enhancement of habitat which results in "no net loss" of aquatic habitat. Once accepted by DFO, the compensation plan forms the basis for a legally-binding Habitat Authorization Agreement, issued under Section 35(2) of the federal *Fisheries Act*.

3.2 Habitat Compensation Plan Framework

Typically, the Habitat Compensation Plan would need to include, at a minimum:

- detailed evaluation of the functions, values, and area of aquatic habitat to be impacted;
- development of alternatives for the creation, enhancement, and/or restoration of similar or more productive and diverse habitat nearby;
- description and characterization of the riparian vegetation types (e.g., native tree and shrub species, etc.) to be planted, soil characteristics, elevations, and any armouring or protective structures that may be necessary to protect the compensatory works from damage by flooding events, boats, etc.;
- habitat balance table summarizing the area and values of habitat to be lost versus potential habitat gains; and
- monitoring requirements to evaluate and report on the performance and productivity of the compensatory works (note, as a condition of a Habitat Authorization Agreement, DFO normally requires 5 years of post-construction monitoring to evaluate and report on the success of the compensatory works, and to make any necessary improvements that may be necessary to ensure a pre-determined and specified survival and growth rate).

Several fish habitat mitigation/compensation options are available within the study area that could be used to offset potential project impacts. These include:

- containment of any upslope or near stream sedimentation;
- rip-rapping the base of the Highway Bridge pier to create seasonal rearing habitat;
- armouring erosional banks on the RDB and LDB both upstream and downstream of the crossing (i.e., within WP 003, 004, 005 and 010);
- riparian planting along the LDB of WP 005 and 010 and within the remaining Detour Bridge approach areas;
- replacement of any lost substrate on exposed gravel/cobble bars;
- placement of rip-rap "groins"; and
- anchoring LWD into existing or newly placed rip-rap. This appears to be the most favored option by DFO in Smithers, in combination with some rip-rap placement and riparian planting.

The Ministry of Transportation has indicated a potentially aggressive time line for tendering a Contract for the Pleasant Valley Bridge work (possibly April 1, 2003). In order to expedite review and approval of the work as related to the potential design problems outlined in section 3.0 and the processes mentioned in sections 3.1 and 3.2, DFO in Smithers has indicated that they require clear and concise final work and bridge design plans (including a DFO Proponent Application Plan). Indications are that if sufficient work plan and design details are provided that the DFO regulatory process may take from 1-2 months depending on whether an Authorization for a HADD under subsection 35(2) of the *Fisheries Act* and a screening level assessment under the CEAA are required.

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APPENDIX I

Fish Habitat Assessment

Pleasant Valley Bridge Fish Habitat Assessment

GENERAL SITE INFORMATION			
Crossing ID:	Pleasant Valley Bridge	Watercourse Name:	Bulkley River

FISH HABITAT

Stream length inspected upstream of crossing	350	m	u/s UTM WP	9.648389.6029965
Stream length inspected downstream of crossing	250	m	d/s UTM WP	9.647915.6030043

#	WP d/s	Habitat Type	Length (m)	Wet Width (m)	Unstable Bank (%)		Instream Cover (%)						Comments
					LDB	RDB	B	LWD	SWD	IV	OV	U	
1	001	P2	55	23	0	0	98			2			RDB=A4 with some E3 d/s of bridge; depth 0.75-1.5m deep; LDB=D1; Riprap cover on RDB under CNR bridge. Substrate is gravel/silt w/occasional cobble.
2	002	R3	30	20	0	70	98			2			RDB=some riprap; LDB=D2, 17-20m wide cobble sidebar u/s & d/s of hwy bridge; Substrate is gravel/ cobble/silt; algae apparent
3	003	R1/3	115	22	0	50	96			2	2		Section split into half, right d/s side is R1 & left d/s side is R2 (>1.0m vs. 0.5-0.75 m deep); RDB=E3, some riprap; LDB=D1/D2; Substrate is cobble/gravel/silt with occasional boulder.
4	004	RF	95	15	50	0	100						Shallow riffle u/s of logging road crossing; LDB=A4/A3, some riprap on LDB; RDB=D2; Substrate is cobble with some gravel.
5	005	R1	130	17	80	0	90				10		RDB=D2, sidebar ~12m wide; LDB=E3, some riparian zone eroding into channel on LDB; Substrate is cobble/boulder.
6	006	n/a	006-007 220 m	n/a									u/s limit of slough/back channel, length=220m, dry, silt substrate, heavy terrestrial and some emergent vegetation, no fish habitat. Off channel refuge from mainstem Bulkley R. at best.
7	007	n/a	006-007 220 m	n/a									d/s limit of slough/back channel, length=220m, dry, silt substrate, heavy terrestrial and some emergent vegetation, woody debris jam at mouth, no fish habitat. Off channel refuge from mainstem Bulkley R. at best.
8	008	RF	20	18	90	0							LDB=E3, some riprap along bottom, back eddy pool (P3) on LDB is ~12m long x 7m wide; RDB=D2; Substrate is cobble/ gravel. No instream cover except associated pool habitat.
9	009	n/a	n/a	n/a									u/s limit of study area.
10	010	R3	165	21	100	0		10			90		RDB=D2, sidebar ~15-20m wide; LDB=E3; Substrate is cobble/gravel/ silt; d/s limit of study area.

Pleasant Valley Bridge Fish Habitat Assessment

GENERAL SITE INFORMATION (cont'd)													
#	WP d/s	Habitat Type	Length (m)	Wet Width (m)	Unstable Bank (%)		Instream Cover (%)						Comments
					LDB	RDB	B	LWD	SWD	IV	OV	U	
11	011	n/a	11-12 120 m	n/a									d/s limit of dry trib, surveyed ~120m. No defined channel, terrestrial vegetation & grasses within channel, patches of gravel/cobble in scour holes near mouth. Evidence of flow (scour holes at mouth). No fish habitat except for possible off channel refuge from the Bulkley River in high water. Evidence of vehicular path u/s from mouth.
12	012	n/a	11-12 120 m	n/a									u/s limit of dry trib, surveyed ~120m. No defined channel, terrestrial vegetation & grasses within channel, patches of gravel/cobble. Evidence of flow (rafted debris). No fish habitat except for possible off channel refuge from the Bulkley River in high water.

RIPARIAN COMPOSITION (estimated from 50 m u/s to 50 m d/s of Hwy. bridge)					
Riparian Composition (%)	Within 3 m of bank		3-25 m away from bank		Comments
	LDB	RDB	LDB	RDB	
Bare					
Burned area					
Open tundra					
Muskeg/bog					
Grass/forbes	40	20	75		LDB has been altered away from bank re: Hwy/CNR bridge & logging road.
Shrubs	30	65	10		Logging road along riparian zone u/s of Hwy. bridge on RDB
Deciduous forest	30	15	15	100	
Coniferous forest					
Mixed forest					

Additional Comments:

pH = 8.3
Conductivity = 170 us
Gradient <=1%

Upstream bankful width ~35-40 m
Downstream bankful width ~35-40 m

Abbreviations:

LDB = left downstream bank
RDB = right downstream bank
Hwy = Highway 16
u/s = upstream
d/s = downstream
trib = tributary stream

Pleasant Valley Bridge Fish Habitat Assessment

Habitat Types

RF = High velocity/gradient relative to run habitat; surface broken due to submerged or exposed bed material; shallow relative to other channel units; coarse substrate; usually limited instream or overhead cover for juvenile or adult fish (generally <=0.5m deep)

R1 = Highest quality/deepest run habitat; generally deep/slow type; coarse substrate; high instream cover from substrate and/or depth (generally >1.0m deep)

R2 = Moderate quality/depth; high-mod instream cover except at low flow; generally deep/fast or moderately deep/slow type (generally 0.75-1.0m deep)

R3 = Lowest quality/depth; generally shallow/slow or shallow/fast type; low instream cover in all but high flows (generally 0.5-0.75m deep)

P1 = Highest quality pool habitat based on size and depth; high instream cover due to instream features and depth; suitable holding water for adults and for overwintering (generally >1.5m deep)

P2 = Moderate quality; shallower than P1 with high-mod instream cover except during low flow conditions, not suitable for overwintering.

Bank Types

A3 = similar to A2 with more larger boulder/bedrock; very irregular shoreline; bank velocities mod-high with low velocity BW/eddy pools providing instream cover; overhead cover from depth/turbidity.

A4 = artificial riprap substrates consisting of angular boulder sized fill; often associated with high velocity areas; shoreline usually regular; instream cover from substrate; overhead cover from depth/turbulence.

D1 = low relief, gently sloping bank; shallow/slow offshore; primarily fines; instream cover absent or consisting of shallow depressions or embedded cobble/boulder; generally associated with bars.

D2 = similar to D1 with gravel/cobble substrate; some areas of higher velocities producing riffles; instream/overhead cover provided by substrate/turbulence; often associated with bars/shoals.

E3 = high, steep eroding banks; loose till deposits (gravel/cobble/sand); mod-high velocities and depths; instream cover limited to substrate roughness; overhead cover provided by turbidity.

Substrate Types

Sand = 0.06 – 2.0 mm
Gravel = 2.0 – 64.0 mm
Cobble = 64 – 256 mm
Boulder = 256 – 762 mm (includes rip rap)

APPENDIX II

Figures 1 - 3 (Fish Habitat Maps)

Pleasant Valley Bridge Fish Habitat Assessment

GENERAL SITE INFORMATION			
Crossing ID:	Pleasant Valley Bridge	Watercourse Name:	Bulkley River

FISH HABITAT MAP

H. Van de Vosse Sept 12/02

Schematic diagram
- not to scale

N

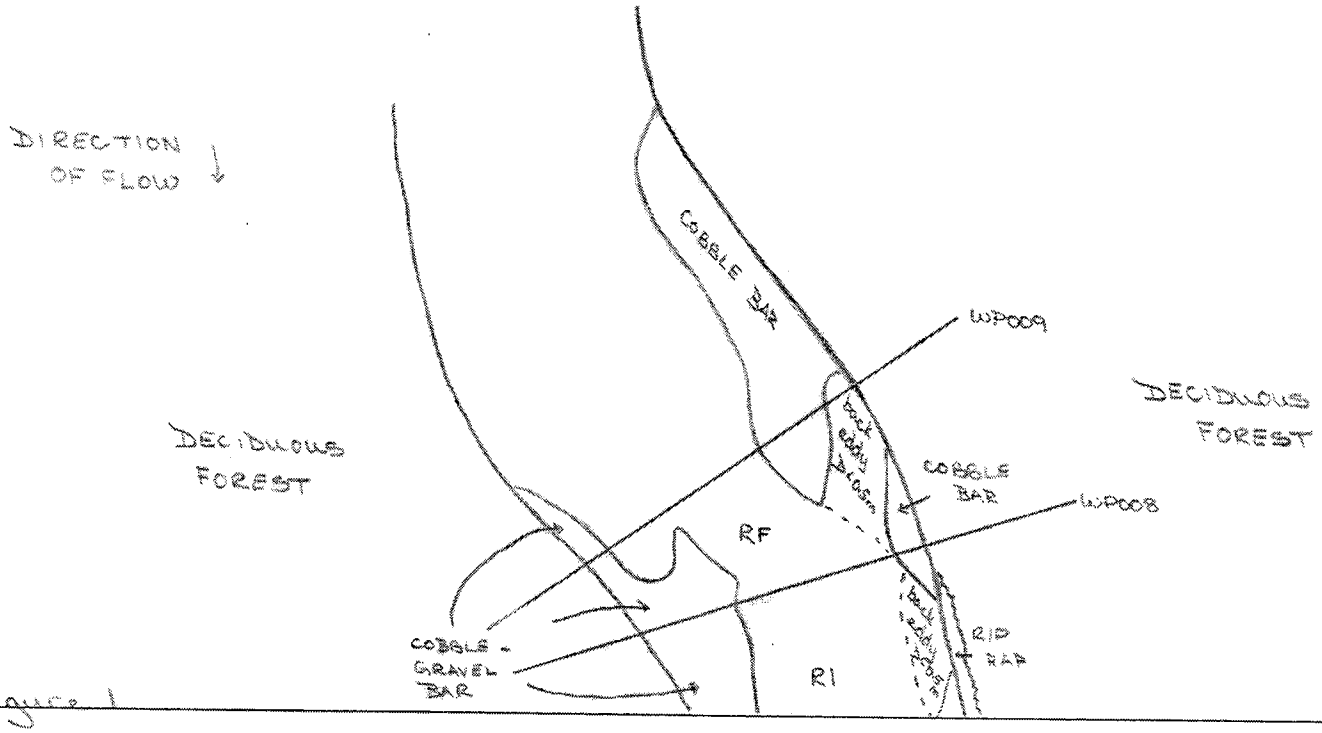


Figure 1

Pleasant Valley Bridge Fish Habitat Assessment

GENERAL SITE INFORMATION			
Crossing ID:	Pleasant Valley Bridge	Watercourse Name:	Buckley River

FISH HABITAT MAP

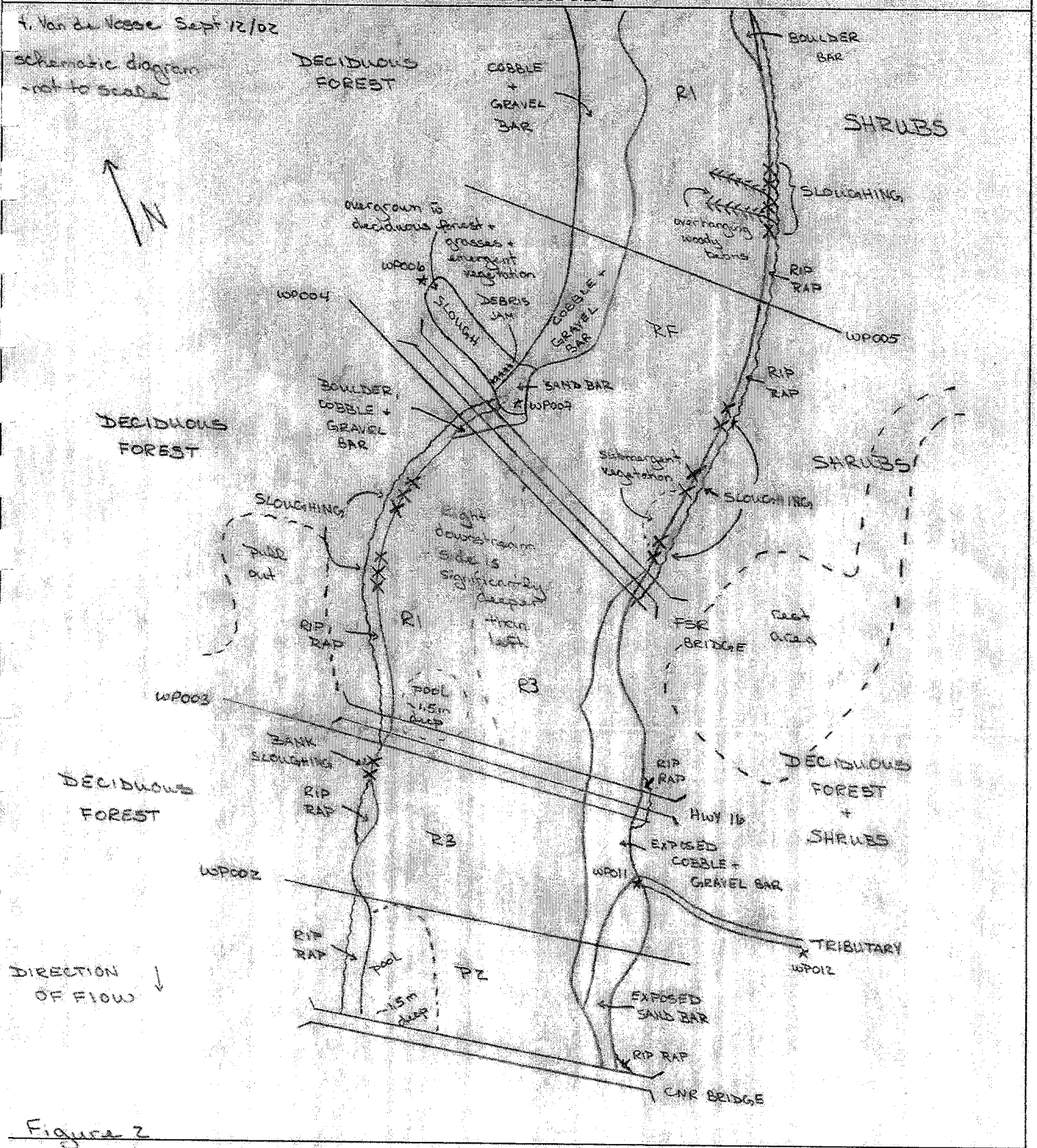


Figure 2

Pleasant Valley Bridge Fish Habitat Assessment

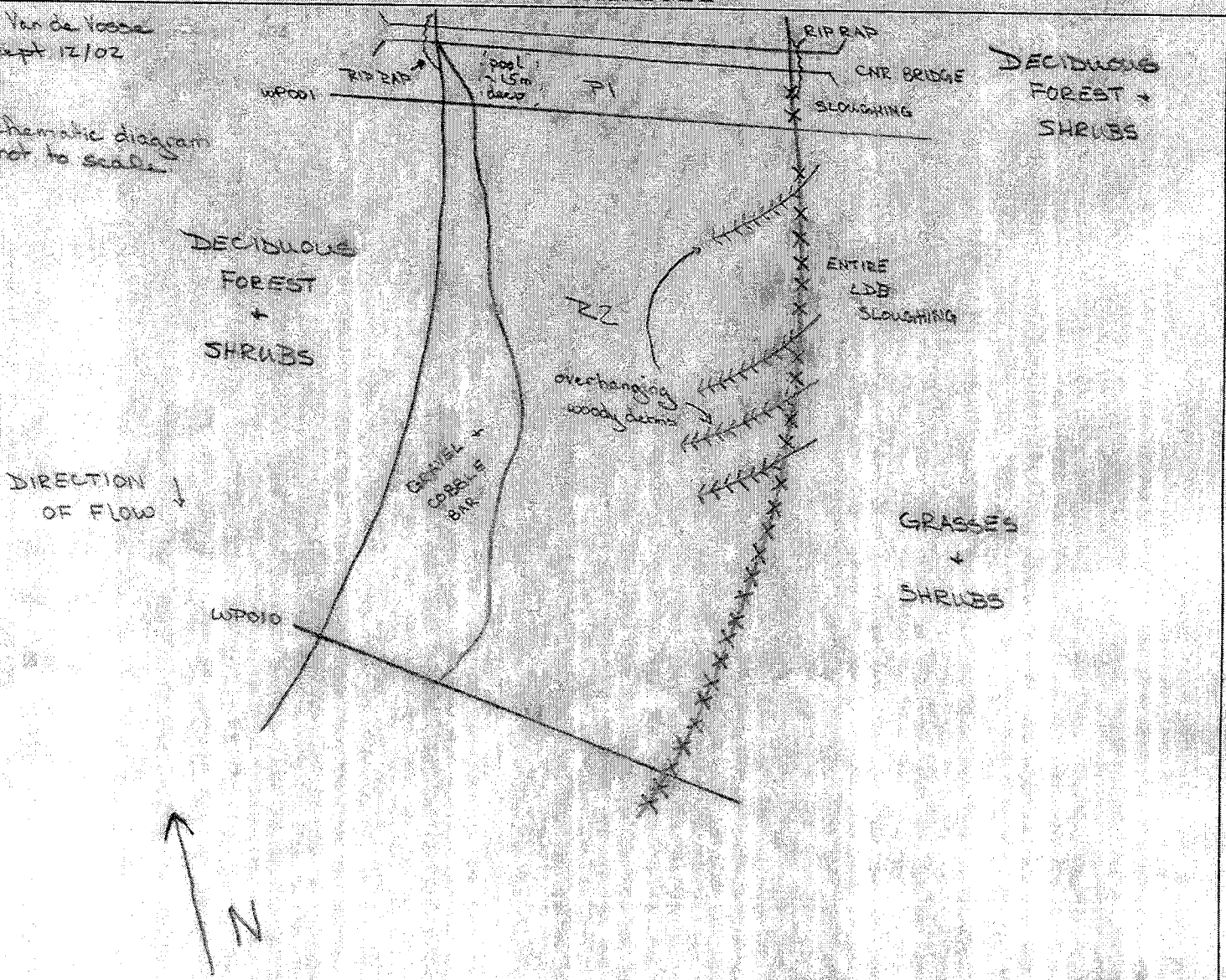
GENERAL SITE INFORMATION

Crossing ID:	Pleasant Valley Bridge	Watercourse Name:	Buckley River

FISH HABITAT MAP

H. Van de Vosse
Sept 12/02

schematic diagram
- not to scale -



Waypoint	Zone	Eastings	Northings
WP001	9	648065	6030045
WP002	9	648098	6030083
WP003	9	648109	6030106
WP004	9	648209	6030140
WP005	9	648284	6030053
WP006	9	648437	6030059
WP007	9	648255	6030126
WP008	9	648335	6029993
WP009	9	648389	6029965
WP010	9	647915	6030043
WP011	9	648106	6030099
WP012	9	648195	6030001

Figure 3

APPENDIX III

Photodocumentation

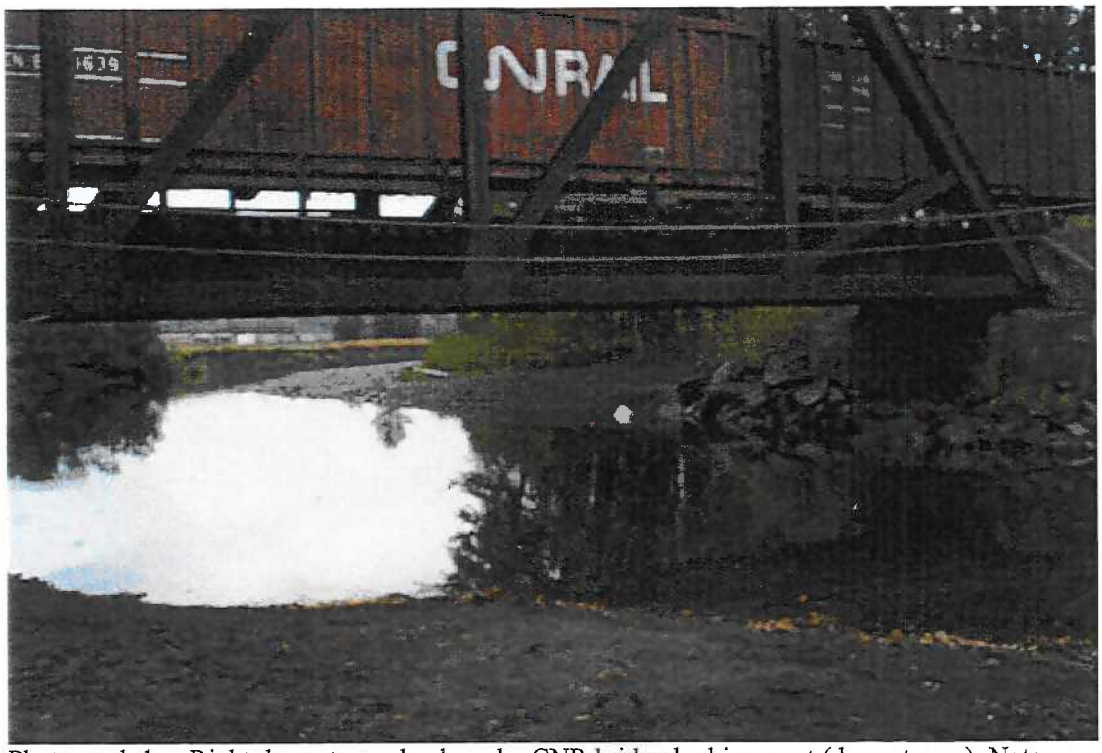
Pleasant Valley Bridge Fish Habitat Assessment

SITE PHOTODOCUMENTATION			
Crossing ID:	Pleasant Valley Bridge	**Watercourse Name:**	Bulkley River

Photo #	WP section	Description
1	001 and 010	Right downstream bank under CNR bridge looking west (downstream). Note: resolution = 150 dpi.
2	001	Right downstream bank under CNR bridge looking west (downstream). Note: resolution = 72 dpi.
3	001-002	Left downstream bank under CNR bridge looking southeast (downstream).
4	002-003	Run section looking north (upstream) between CNR bridge and highway bridge.
5	010	Looking south (downstream) from CNR bridge.
6	002-003	Left downstream bank between CNR & highway bridges, looking north (upstream) towards highway.
7	003-004	Right downstream bank highway bridge abutment (west side).
8	003-004	Left downstream bank highway bridge abutment (east side).
9	003-004	Taken along left downstream bank (looking south or downstream) showing current water level & exposed sidebar that exists under the CNR & highway bridges.
10	003-004	Taken underneath highway bridge, looking north (upstream).
11	003-004	Top of left downstream bank upstream of highway bridge, looking southwest.
12	003-004	Top of left downstream bank upstream of highway bridge, looking southwest.
13	004-005	Riffle habitat unit, looking northeast (upstream).
14	004-005	Riffle habitat unit, looking northwest (downstream) towards the logging road crossing.
15	005-008	Run habitat unit, looking northeast (upstream).
16	006-007	Back channel looking southwest towards Bulkley River.
17	006-007	Stagnant pool within back channel (mid-area).
18	006-007	Back channel looking southwest towards Bulkley River.
19	007	Debris jam in back channel, approximately 3 m from river. Photograph looking in southwest direction.
20	005-008	View of upstream run habitat unit looking northwest (downstream). Note logging road crossing in background.
21	007	Back channel confluence with Bulkley River, looking northeast.
22	008-009	Photograph taken looking east, and showing riffle habitat unit and back eddy along the right downstream bank (upstream).
23	u/s of 009	Looking east (upstream) showing typical run habitat u/s of site.
24	010	Downstream end of P1 habitat unit near CNR bridge, looking south (downstream).
25	010	Downstream end of P1 habitat unit near CNR bridge, looking south (downstream).
26	011	Upstream view of tributary, showing left downstream bank and side bar of river. Photo taken at confluence with Bulkley River and looking east.
27	011	Downstream view of tributary showing confluence with Bulkley River, looking west.
28	011-012	Upstream view of tributary, looking southeast. Note scour holes. Photo taken just upstream from confluence with Bulkley River.
29	011-012	Upstream view of tributary approximately 30 m upstream from confluence with Bulkley River. Looking southeast. Note vehicle path.
30	011-012	Upstream view of tributary approximately 60 m upstream from confluence with Bulkley River. Looking southeast.
31	011-012	Upstream view of tributary approximately 95 m upstream from confluence with Bulkley River. Looking southeast.
32	012	Downstream view of tributary at top of site approximately 120 m upstream from confluence with Bulkley River. Looking northwest.

APPENDIX IV

Site Photographs



Photograph 1. Right downstream bank under CNR bridge looking west (downstream). Note: resolution is 150 dpi.

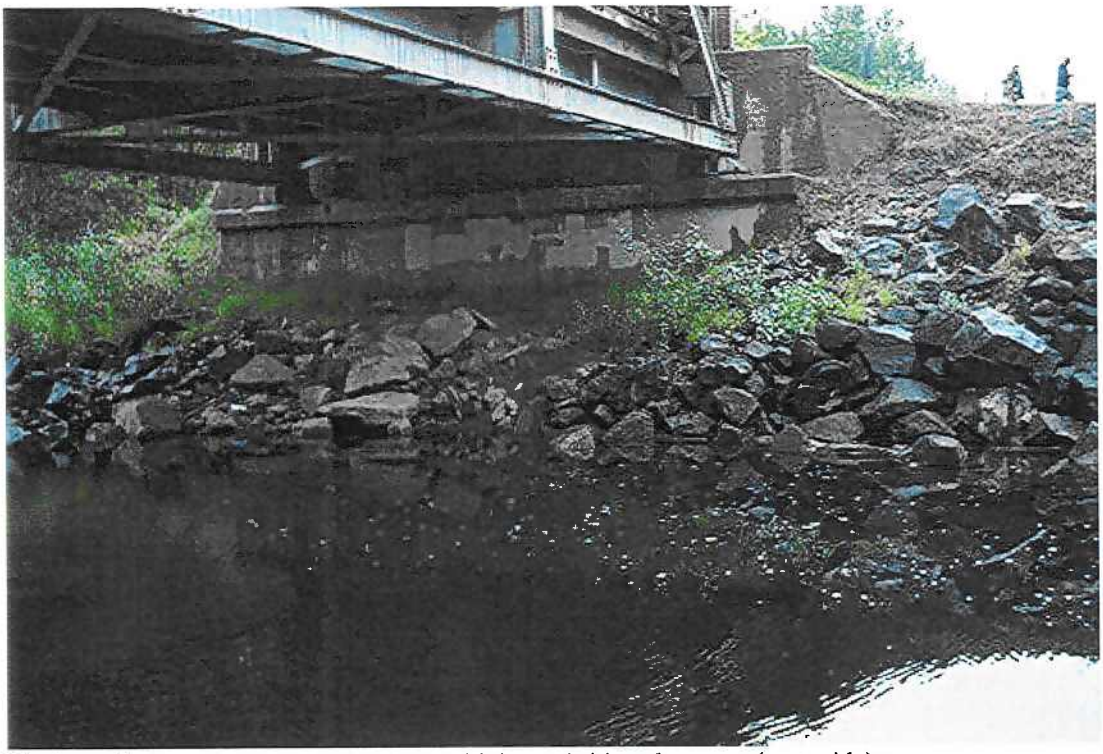
Photograph 2. Right downstream bank under CNR bridge looking west (downstream). Note: resolution is 72 dpi.

Photograph 3. Left downstream bank under CNR bridge looking southeast (downstream).

Photograph 4. Run section looking north (upstream) between CNR bridge and Highway 16 bridge.

Photograph 5. Looking south (downstream) from CNR bridge.

Photograph 6. Left downstream bank between the CNR and highway bridges, looking north (upstream) towards highway.



Photograph 7. Right downstream bank highway bridge abutment (west side).

Photograph 8. Left downstream bank highway bridge abutment (east side).

Photograph 9. Taken along left downstream bank (looking south or downstream) showing current water level and exposed side bar that exists under the CNR and highway bridges.

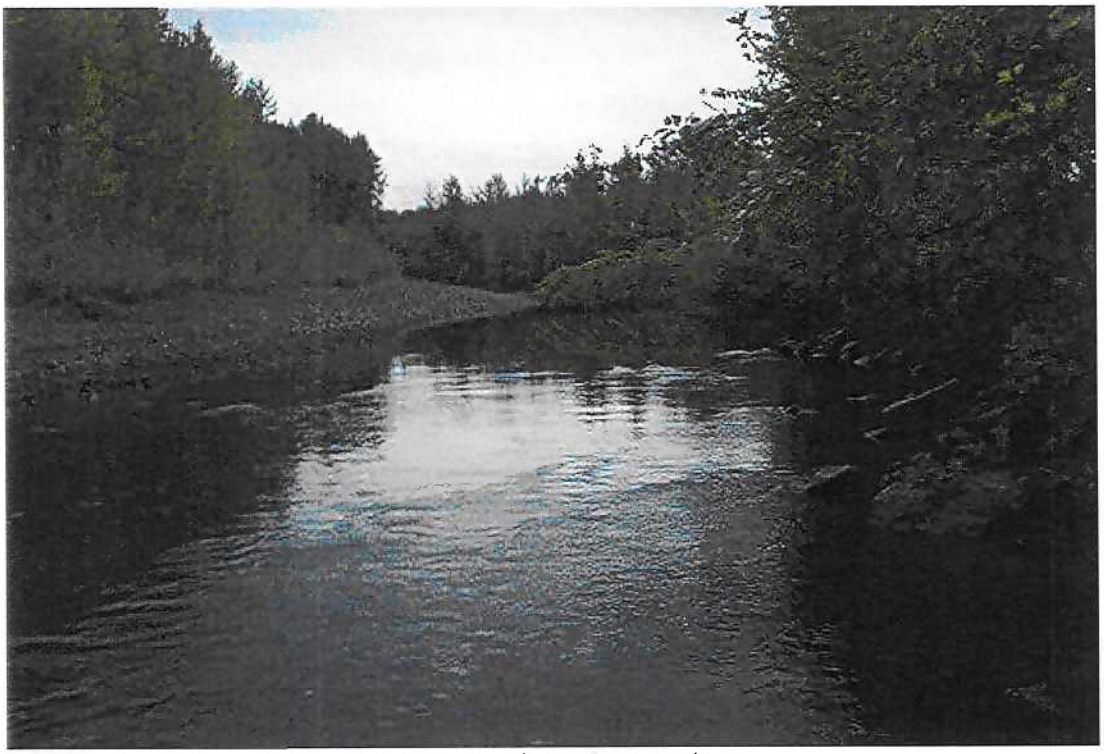
Photograph 10. Taken underneath highway bridge, looking north (upstream)

Photograph 11. Top of left upstream bank, upstream of highway bridge, looking southwest.

Photograph 12. Top of left upstream bank, upstream of highway bridge, looking southwest.

Photograph 13. Riffle habitat unit, looking northeast (upstream).

Photograph 14. Riffle habitat unit, looking northwest (downstream) towards the logging road crossing.



Photograph 15. Run habitat unit, looking northeast (upstream).

Photograph 16. Back channel looking southwest towards Bulkley River.

Photograph 17. Stagnant pool within back channel (mid area).

Photograph 18. Back channel looking southwest towards Bulkley River.

Photograph 19. Debris jam in back channel, approximately 3 m from river. Photograph looking in southwest direction.

Photograph 20. Upstream run habitat unit looking northwest (downstream). Note logging road crossing in background.

Photograph 21. Back channel confluence with Bulkley River, looking northeast.

Photograph 22. Photograph taken looking east, and showing riffle habitat unit and back eddy along the left downstream bank (upstream).

Photograph 23. Looking east (upstream) showing typical run habitat upstream of site.

Photograph 24. Downstream end of P1 habitat unit near CNR bridge, looking south (downstream).

Photograph 25. Downstream end of P1 habitat unit near CNR bridge, looking south (downstream).

Photograph 26. Tributary at confluence with Bulkley River, showing left downstream bank and side bar of river. Photograph looking east (towards headwater of tributary).

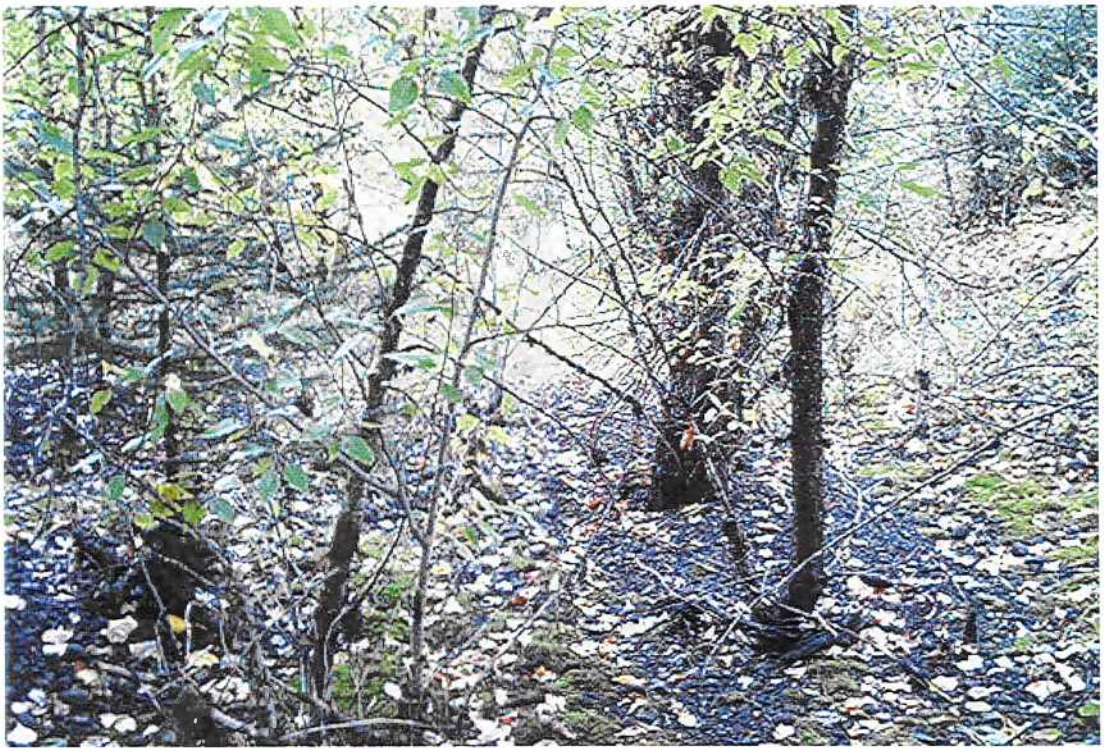
Photograph 27. Tributary near confluence with Bulkley River, looking west (towards mouth of tributary).

Photograph 28. Tributary upstream of confluence with Bulkley River, looking southeast. Note scour holes.

Photograph 29. Upstream view of tributary approximately 30 m upstream from confluence with Bulkley River. Looking southeast. Note vehicle path.

Photograph 30. Upstream view of tributary approximately 60 m upstream from confluence with Bulkley River. Looking southeast.

Photograph 31. Upstream view of tributary approximately 95 m upstream from confluence with Bulkley River. Looking southeast.



Photograph 32. Downstream view of tributary at top of site approximately 120 m upstream from confluence with Bulkley River. Looking northwest.

APPENDIX V

Bulkley River Water Levels at Quick

Figure AV-1. Bulkley River water levels at Quick, BC, May - October 2002.
Taken from Environment Canada's website (http://scitech.pyr.ec.gc.ca/waterweb/full graph.asp)

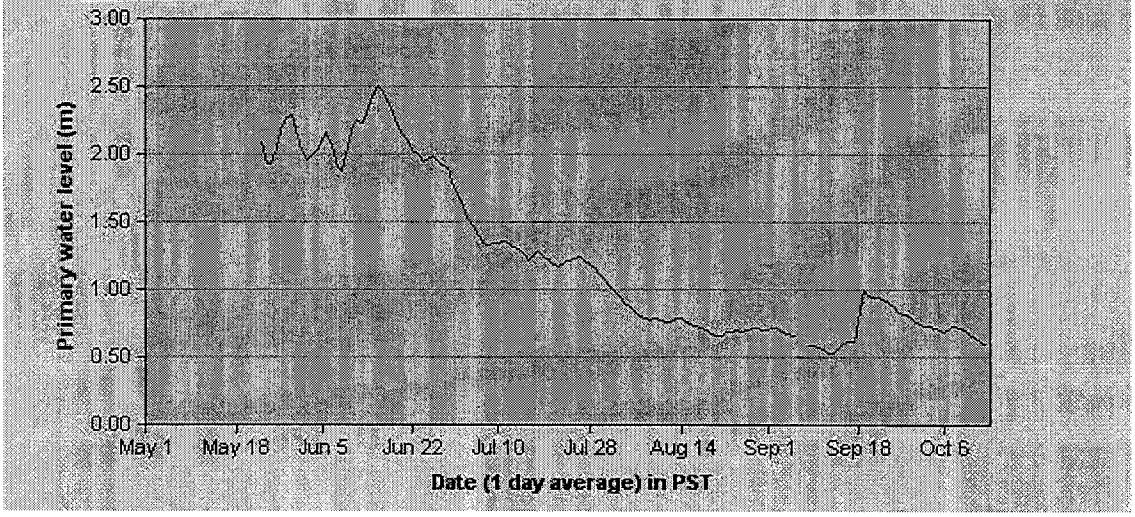


Figure AV-2. Bulkley River water levels at Quick, BC, July - August 2002.
Taken from Environment Canada's website (http://scitech.pyr.ec.gc.ca/waterweb/full graph.asp)