

**MESILINKA, OSILINKA, PARSNIP and OMINECA RIVER
FISH HABITAT INVENTORY
AERIAL GPS/VIDEOGRAPHY
QUALITATIVE FINAL REPORT (1996/97)**

Prepared By

**TERRA•PRO GPS SURVEYS LTD.
&
WHITE PINE ENVIRONMENTAL RESOURCES INC.**

**3615 - 15th Avenue (Second Floor)
Prince George, B.C.
V2N 1A4**

INTRODUCTION

As part of the contract to complete overview and reconnaissance-level aerial GPS/videography of fish habitat associated with streams for the Ministry of Environment, Prince George (Region 7), Terra•Pro GPS Surveys Ltd. and White Pine Environmental Resources Inc. provided airborne videography and digital mapping services during the summer and fall of 1996 and 1997. As requested, this summary report provides a brief description of the methods used to complete the work program, describes the results, and summarizes gathered information. It also includes a discussion section which summarizes the employment generated by this program.

METHODS

The inventory area, as listed in section 4.0 of the contract, included: the mainstem and tributaries of the Mesilinka River; the tributaries of the Osilinka and Omineca Rivers; and selected tributaries of the Parsnip River. These selected tributaries included Braathen, Chuyazoga, Colbourne, Fast and Reynolds Creeks and associated drainages. The mainstem of the Omineca and Osilinka Rivers were contracted to Environmental Dynamics Inc. and not associated with this contract. All field work was completed in the summer field season of 1996 except for the tributaries of the Omineca River which were completed in 1997. Only the tributaries of the Omineca River up to and including Silver Creek were completed in this contract. The contract estimation of 1100 kilometers for the completion of all tributaries of this basin was approximately 30% below the total actual tributary length.

During the course of the contract the stream habitat description, as described by the onboard fisheries biologist, varied at the request of the Ministry of Environment contract monitors. The majority of the 1996 field data, the Mesilinka mainstem and tributaries and the Osilinka tributaries, was described as a general overview inventory identifying significant morphological stream features using a supplied attribute list (i.e. Falls, Barriers and Slumping Banks). On the tributaries of the Parsnip and Omineca Rivers, the fisheries biologist consecutively identified morphological stream features from a more comprehensive habitat feature list supplied by the Ministry of Environment contract monitor (Appendix 1).

This entire inventory was completed using a helicopter equipped with a GPS video system for Super VHS video capture. The GPS system used a video camera externally mounted to the helicopter, electronically stabilized and remotely controlled from within the helicopter. The resulting data stored on the videotape was superimposed with non-differential GPS coordinates from the aircraft's Garmin GPS receiver. In addition, habitat features were recorded and assigned a GPS position using the "Aspen Field Inventory" system and an eight channel Trimble ProXL differential GPS receiver. General area footage was also opportunistically collected with a hand held camcorder.

In order to collect and process the information for this program, several steps were followed. Field data was collected by field teams composed of one pilot, one fisheries biologist, one GPS/video technician and one ground support technician. The daily video capture procedure involved slowly flying upstream through individual stream reaches. There were, however, a few exceptions to this procedure when it was impossible to distinguish the stream channel through the thick forest canopy. In these rare situations the helicopter began video data capture at the headwaters of the

stream and moved downstream. Furthermore, weather conditions and associated safety considerations often determined progress. For example, when inclement weather was encountered the team would either proceed to another section of the contract area with acceptable weather conditions or remain on standby until conditions improved. Stream identification, including tributary delineation, was first manually recorded on appropriate 1:50,000 topographical map sheets in the field. Stream habitat features and distinct changes in stream gradient were described by the onboard fisheries biologist and simultaneously GPS tagged by the GPS technician. As mentioned above, for the 1996 field data, general overview information was gathered identifying significant morphological stream features (i.e. Falls, Barriers and Slumping Banks).

On the tributaries of the Omineca River, the fisheries biologist consecutively identified morphological stream features from a predetermined habitat feature list. Importantly, on these tributaries, habitat features were only recorded sequentially if 90% of the total habitat features could be reliably documented (as visually estimated by the team fisheries biologist). In general, due to this 90% "hit rate" requirement, habitat was not sequentially documented in smaller tributaries (approximately 5m or less in wetted width), areas of dense canopy cover or areas of uniform wetland habitat with torturous meandering streams. These areas were flown and video taped but only general habitat features were described as per the procedure prescribed by the contract monitor. Streams of this nature are indicated on the maps as "unreliable" or "non-sequential" on the Omineca tributaries only and the attribute data is flagged in the database as such so it would not be included in GIS analysis. As well, LOD (woody debris) has not been displayed on the Omineca tributary maps due to mapping display density.

The procedure used on the Omineca river system in 1997, as described in the preceding paragraph, produced a more comprehensive habitat data set than the 1996 work on the Mesilinka and Parsnip rivers. During the 1996 work, areas that were unable to be completely surveyed due to stream size or canopy cover, were not indicated as such. Consequently, areas surveyed that appear to have few habitat attributes, may simply have had dense crown closure prohibiting habitat attribute identification. The current procedure to delineate areas of "unreliable" attribute identification is an improvement on the original methodology and should be maintained.

This field inventory process generated 4 items: video footage, 1:20,000 TRIM map sheet labeled with the collected fish habitat attribute data, an electronic copy of the habitat and stream data and a database. The final maps and data set produced from the 1996 work used a different habitat attribute list and parameters than the 1997 work. Differences appear between the map legend/attribute symbolization on the maps for the Mesilinka/Osilinka/Parship maps and the Omineca maps. Also, the database from the 1996 work is provided in an ASCII format database of attributes, coordinates and feature codes only. The 1997 work database has been returned in an Oracle compatible format, built around a predetermined structure (as per DH Kumka and Associates guidelines). This new database format is consistent with the habitat inventory work performed elsewhere in the Mackenzie TSA in 1997.

In the office, technicians performed several data processing and quality control tasks. All rough GPS data was initially differentially corrected to a 5 meter accuracy level and used to generate rough mapping check plots. The video footage was then reviewed and edited (removing extraneous or repetitive material). All video records were subsequently cross-referenced against all check plots of "Aspen Field Inventory" generated habitat locations, to fill in areas where generic "X" habitat points were entered and to ensure accuracy. "X" habitat points were collected in areas of complex habitat, where the GPS technician could not record all habitat labels due to the volume

and frequency of attributes. The verified or corrected check plot data was then placed on appropriate 1:20,000 TRIM mapping sheets. The resulting TRIM mapping sheets were again cross-checked against the video footage to ensure accuracy. Finally, Super VHS time tags, tape counter tags and accompanying tributary names were summarized, creating an index.

RESULTS AND DISCUSSIONS

Data collection occurred from June 1996 to September 1996 and from July 18, 1997 to August 12, 1997, during the low flow period for all streams in the area. General data processing followed throughout the winter of 1996/97 and 1997/98. Several pieces of fisheries habitat information were generated for each river system. These were:

Mesilinka River Mainstem and Tributaries / Osilinka River Tributaries (1996):

- 47 map sheets covering 172 streams and tributaries totaling 1005 kms of stream survey.
- 22 hours of final edited videotape with non-differential GPS coordinates. Stream names were not superimposed on this footage. watershed codes were included on the maps.
- An accompanying database of fish habitat attributes and GPS differential (5-10 m accuracies) coordinates - ASCII format of attributes, coordinates and feature codes only.

Parsnip River Tributaries:

- 7 map sheets covering 31 streams and tributaries totaling 210 kms of stream survey.
- 28 hours of final edited videotape with non-differential GPS coordinates. Stream names were not superimposed on this footage. watershed codes were included on the maps.
- An accompanying database of fish habitat attributes and GPS differential (5-10 m accuracies) coordinates - ASCII format of attributes, coordinates and feature codes only.

Omenica River Tributaries upstream to Silver Creek (1997):

- 35 map sheets covering 184 streams and tributaries totaling 1190 kms of stream survey.
- 27 hours of final edited videotape with non-differential GPS coordinates and superimposed stream names. Watershed codes were not included with the 1997 – this is to be done by another consultant during the reach break analysis work.
- An accompanying database of fish habitat attributes and GPS differential (5-10 m accuracies) coordinates – complete database format as supplied by DH Kumka and Associates.

In general, the methodology was applied without significant problems arising which would compromise the quality of the resulting map sheets, videotape or GPS attribute data. One issue which did arise during data collection involved poor weather conditions which occasionally resulted in a repeat flight of a small tributary (or stream sections) at a later date. Furthermore, on the odd occasion (estimated at less than 1% of total), TRIM map data and GPS stream data did not coincide. When the GPS stream data was very close to the TRIM data, the GPS data was placed to the TRIM data. However, when the TRIM and GPS stream data sets were significantly different, the GPS data location was identified and noted on the TRIM map sheet.

The main issue identified during the 1996/97 field program was the procedural requirement for identifying habitat features when sequential habitat designation was impossible. Sequential habitat description can become problematic in different situations. The first scenario alluded to earlier, involves dense forest canopy, which prevents clear contiguous view of the stream. The second scenario involves the need for the helicopter mounted Super VHS camera to be directly over the stream to accurately capture videotape. Torturous meanders, encountered in some tributaries, limit the ability of the steeply banking helicopter to capture the information at a 90% "hit-rate" as well as limit the ability of the fisheries biologist to keep the stream in his field of vision. In these cases habitat features were identified as best possible but sequential habitat collection was impossible.

SUMMARY AND RECOMMENDATIONS

The 1996/97 aerial GPS/videography of fish habitat associated with tributaries of the Williston watershed represented an excellent opportunity to integrate emerging technology with environmental inventory. The program, budgeted at \$160,000.00 to complete 2640 kms of stream survey was completed according to the proposed methodology without significant complications. Actual work was completed for two consecutive years from summer through winter of 1996/97 and covered 2405 kms of stream. This program generated 315 person days of employment for British Columbians, largely in the Prince George area.

The main recommendations for future inventories of this nature involve methodological confirmation. The contract requirements, as requested by the Ministry of Environment contract monitors, changed from a basic overview video survey to a more intensive reconnaissance level inventory midway through the contract. Future inventories should be consistent with the reconnaissance inventory methodology in order to assess morphological changes to stream habitat in the future. The 90% "hit-rate" and "unreliable" data requirements should be reviewed to balance completeness of the survey with cost efficiencies. In areas where it is impossible to reliably sequentially describe habitat but still possible to identify key habitat components, markers should be created to identify these stretches. Furthermore, habitat descriptors should be extended to key fluvial morphological parameters including slumping banks, falls, cascades and other possible impediments to fish movement or migration.

ANOMALIES AND DEFICIENCIES FROM 1996/7 PROJECT

DATA COLLECTION AND MAPPING

- Flat wetlands generally have very numerous backwater areas and side channels and unclear mainstems which, didn't coincide with TRIM base, hence the need to show GPS flight line.
- Tape #23 (970719A)- Germansen River starts at 32:00 (date and time not set on the video time stamp).
- Trib 8 of Germansen Lake has a small portion of video missing due to problems with the Hi-8 tape recorder. The GPS data for this tributary is complete.
- Final compilation of two hour field Hi-tapes to 6 hour SVHS tapes is as follows:
 - #S1- (23,24,25)
 - #S2- (26,27,28)
 - #S3- (29,30,31)
 - #S4- (32,33,34)
 - #S5- (35,36,37,38)
 - #S6- (39,40,41,42)

DATA BASE

- Some feature codes are missing from the database still, as we are awaiting official word from the MOELP. Updated database with all codes will be supplied or the missing codes can be included by the MOELP later.
- Reach breaks and some other features that were added after the fact do not have GPS times or elevations, naturally.
- One extra column was added to the original database/.CSV file structure to accommodate sequential/non-sequential or reliable/unreliable; as discussed in the beginning the column was named "RELIABILITY" and entries are 'R' or 'U'.
- Field maps seem to show Trib 1 (Kenny Cr) was captured as Trib 3 and Trib 3 as Trib 4 and Trib 4 not flown.
- The data of Trib 6a and 6b of Duckling Creek is confusing due to the low gradient and uncertainty in the location of the stream channels
- File 072697b reflowed in 072697c. First flown as Trib 1 but, actually Trib 8 (Germansen Lake). First 40 min of 072697b removed from digital.

- Apparently, 072297b is redundant and is also found on 072897b and 072897a
- Trib 6 of Duckling (080997c) redone in 081097a
- Trib 4 of Germansen Lake in 072397b reflowed in 072697c.
- Trib 9 of Omineca in 072797c2 redone in 080597a.
- Trib 25 of Omineca data is actually Trib 27 (Jackfish Creek).

- **BRIEF RUN-DOWN OF MAPPING PROCEDURE/SET-UP**
- We used a seed file containing nothing but reference file attachments and settings required for this project (i.e. color table, working units, etc.).
- The references attached are one of each TRIM file from any sheet (i.e. 93J092p, t, n, g), a neatline, the surrounds, one master inventory file containing all of the symbols, one master file containing all of the miscellaneous notes and video time tags.
- Set-up like this, you would copy the seed file to a new file named for the sheet you are about to compile a map for.
- In this file you need only change the attachment settings for each TRIM file and neatline to the coinciding sheet. We are keeping all of our TRIM in one sub-directory called 'TRIM'. Our master files and seedless are kept a directory above TRIM called 'SEEDFILE'. This way when the TRIM files are first attached in the original seed file we can save the path so MicroStation always knows where to find the TRIM.
- When you have the TRIM you need attached you move the surrounds reference, snapping the white construction line in the bottom left to the lower left corner of the neatline and rotate the surrounds to the angle of the neatline.
- Use the neatline to place a fence-shape around the TRIM area and do a clip boundary on the symbols master file and the video/notes master file.
- Rotate your view to flatten the display.
- Copy data fields which apply to each new sheet (i.e. sheet numbers, map area names, dates, etc.) from surrounds into your empty file and fill them with the pertinent info.

APPENDIX 1

1996/97 HABITAT ATTRIBUTE LISTS

PEACE FISHERIES SECTION
AERIAL VIDEO/GPS STREAM INVENTORY PROJECT

Fish Habitat Annotation Categories and Codes

Habitat Features.

- Riffles:** (Shallow rapids where the water flows swiftly over completely or partially submerged materials to produce surface agitation).
- 1) **Downstream (d/s) extent of riffle area;**
 - 2) **Upstream (u/s) extent of riffle area;**
- Pools:** (Portions of the stream with reduced current velocity at low flow and with deeper water than the surrounding area).
- 3) **Class 1** -behind single structure or relatively small pool at the tail-out of a small riffle area;
 - 4) **Class 2** -mid-sized between a Class 1 and 3 pool;
 - 5) **Class 3** -encompasses entire channel width which is usually wider than the average channel width at this point.
- LOD:** (Large Organic Debris)
- 6) **Class 1** -single root wad or single downed tree;
 - 7) **Class 2** -several accumulated logs;
 - 8) **Class 3** -large accumulation of logs.
- Rock:**
- 9) **Bedrock outcrops** (significant enough to cause flow alterations, pool formation etc.);
 - 10) **Boulder Gardens** (significant groupings of boulders causing flow alteration and providing good cover habitat).

Channel Features.

Side-channels:

- 11) **D/S extent of side-channel area;**
- 12) **U/S extent of side-channel area.**

Braided Channel:

- 13) **D/S extent of braided channel area;**
- 14) **U/S extent of braided channel area.**

Bedrock Confined Channel:

- 15) **D/S extent of confined channel area;**
- 16) **U/S extent of confined channel area.**

Channel Features (cont.).

Island:

- 17) Any island with established vegetation.

Slump:

- 18) Any slump area involving >10m of bank area, threatening to deposit material into watercourse.

Obstructions.

Chutes and Falls:

- 19) Class 1 -fish passage questionable (may pass some species or life history stages);
- 20) Class 2 -definite barrier to all species and life history stages.

Beaver Dams:

- 21) All intact beaver dams (does not include breached dams).

Tributaries.

- 22) Tributary entering from the left bank, looking u/s;
- 23) Tributary entering from the right bank, looking u/s.

Anthropogenic Features.

- 24) Bridge crossing.
- 25) Ford crossing.
- 26) Right of Way crossing the stream.
- 27) Seismic Line crossing the stream.

July 15, 1994

Habitat Attributes

Reconnaissance Level Stream Inventory - Aerial GPS/videography 1997

Note: Aerial GPS video review procedure usually entails mapping from the confluence upstream to the headwaters. All left and right features are described in relation to downstream flow (therefore the left bank is described to be on the right when flying upstream).

"x" point - habitat or stream feature that could not be mapped by video/GPS technician during survey. Correct feature to be added during video review process.

backwater channel - side channel of stream/creek with no noticeable flow; usually inlet and outlet are the same.

beaver dam - beaver dam partially or totally blocking the stream. *water flowing over top*

bedrock confinement start - upstream point on stream where bedrock confines the channel on either side; commentary and video will clarify location.

bedrock confinement end - downstream point on stream where bedrock confines the channel on either side; commentary and video will clarify location.

bedrock outcrop - point where bedrock overhangs or protrudes into the stream on either bank; commentary and video will clarify location. Bedrock is classified as <4000 mm (larger than a car).

boulder cluster - point where two or more boulders are clustered in the stream providing usable fish habitat; boulders are classified as 256-4000 mm (basketball to car in size).

braided channel - low gradient area of a stream having *more than two* ~~two or more~~ flow branches (anastomosing islands).

bridge - bridge (logging or other) over stream - ~~includes culvert crossings~~

* *add culvert crossings*

cascade - a series of two or more consecutive drops structures/steps approximately 0.5-2.0m in height each.

chute - all/most of the stream flows through a narrow, confined feature caused by bedrock confinement or large boulders.

* *class 1 possible*
falls - waterfalls/drops greater than two meters in height. *class 2 definite Fish barrier.*

* *possible*
fish barrier (~~probable~~) - probable barrier to fish migration upstream.

islands ~~vegetated~~ - instream island or gravel bar that has growing (green) vegetation *over one meter tall.*

barrel bars
islands ~~non-vegetated~~ - instream island or gravel bar that does not having growing (green) vegetation over one meter tall.

OD1 small organic debris class 1 - relatively stable woody material having a minimum diameter greater than 10 cm and a length greater than one meter that lies within the stream channel but *does not* noticeably alter the stream flow. *provides some element of cover.*

OD2 medium organic debris class 2 - relatively stable woody material having a minimum diameter greater than 10 cm and a length greater than one meter that lies within the stream channel and noticeably alters the stream flow.

OD3 large organic debris class 3 - *Bank to Bank / Channel shift /*

pool class 1 - a portion of the stream with reduced velocity, deeper than the surrounding area, and useable by fish for resting or cover (contains some surface cover or flow turbulence) that comprises less than 50% of the wetted stream width. *Behind Single Structure / Scar pools*

pool class 2 - a portion of the stream with reduced velocity, deeper than the surrounding area, and useable by fish for resting or cover (contains some surface cover or flow turbulence) that comprises 50% or more of the wetted stream width.

Pool class 3 - Full channel or size of average channel width.

reach break (potential) - boundary between two reaches (reach being defined as a segment of stream with relatively homogenous gradient, flow, cover and habitat features).

riffle start - upstream point on stream where riffle habitat unit begins.


riffle end - downstream point on stream where riffle habitat unit ends.

riffle - habitat unit with fast, turbulent, white water. Surface of the water is broken but habitat unit is not falls, cascades or chutes. Used when riffle areas are less than 100m in length. *agitated surface*

side channel *start* - upstream point on stream where lateral channel, parallel to mainstream, begins.

Side channel only. no bank or start or end.

Side channel end - downstream point on stream where lateral channel, parallel to mainstem, ends.

slumping bank left - area where left bank has/is eroding into stream. 

slumping bank right - area where right bank has/is eroding into stream.

tributary right - confluence point where tributary flows into the stream (being surveyed) from the right bank.

tributary left - confluence point where tributary flows into the stream (being surveyed) from the right bank.

wetlands left - wetland area adjacent to or incorporating the left bank of the stream. Wetlands areas can be marshes, swamps or other areas of standing water.

wetlands right - wetlands area adjacent to or incorporating the right bank of the stream. Wetlands areas can be marshes, swamps or other areas of standing water.

Logging Start
- Logging end.

logging video only.

