# CHAPTER 4
# APPENDIX 4E

## Activities Involving Other Governments - Consultation Materials

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## 4E-1.0 ACTIVITIES INVOLVING OTHER GOVERNMENTS

The following Appendix describes the interaction between Yukon Energy and other governments, namely federal and territorial governments. Considerable informal interaction occurred as well with government agencies. Record of this communication is included in Appendix 4G. Various government departments, including the City of Whitehorse and Association of Yukon Communities were invited to participate in the Whitehorse Open House (for associated materials please see Appendix 4F).

## 4E-2.0 PROJECT INTRODUCTION AND ISSUES IDENTIFICATION

### 4E-2.1 NOVEMBER 4, 2008

#### 4E-2.1.1 Meeting Notes

# Meeting Report

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| Title: | Mayo B – Meeting with the Department of Fisheries and Oceans (DFO) | | |
| YEC Attendees: | Pat Tobler, Hector Campbell, Travis Ritchie, Patrick Bowman, Karl Schiefer (phone, first part of meeting) | | |
| DFO Attendees | Briar Young (Chief of Habitat), Sean Collins (Habitat Biologist) | | |
| Meeting Location: | YEC offices | | |
| Date: | November 4 | Minutes status: | |
| Author: | Patrick Bowman | Phone: | |
| Meeting Purpose: | First introduction to the Mayo B project for DFO staff, in advance of an anticipated workshop later in month. | | |
| Discussion: | Hector provided an overview of the YEC power systems, the concept of Carmacks-Stewart interconnection, and the expected benefits from developing enhancements at existing facilities.<br><br>Patrick Bowman described resource planning process, beginning with the 2005 Resource Plan and subsequent 2006 YUB review. This led to YEC's 2007 hydro site investigations. Key conclusions from those investigations are that enhancements of existing hydro plants are more economical and environmentally favourable compared to greenfield options. With new loads and load growth – both non-industrial and new prospective mines – the Yukon will have a need for additional power. Absent new renewable sources, this need will be met with diesel. | | |

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| | Patrick provided an overview of existing Mayo hydro facility and the components of the project. He described the operation of the facility during the operation of the Keno Mine and operation since, providing a summary of the water management regime in place.<br><br>He went on to provide an overview of Mayo B project, components of project as now anticipated, and a summary of changes to water management.<br><br>An overview of engineering was provided and related field work described. This includes fieldwork underway and recently completed such as the drilling program, survey work (including cross sections and water levels,) Mayo Lake cross sections, and Mayo Lake bathymetry.<br><br>Pat Tobler gave overview of biological fieldwork and heritage field work, with a focus on the aquatic environment. A summary of investigations undertaken during summer 2008 was provided, with good opportunities for data collection noted. The aquatic fieldwork focused on studies related to Salmon and Fall spawners. The benefits of getting observations at varying flow levels during the program were noted.<br><br>Patrick provided an overview of the project regulatory aspects<br>• YESAB Executive Committee submission expected this winter,<br>• Class A Water Licence required.<br>• Anticipation at this point that project will require FAA<br><br>Briar Young gave overview of the DFO structure to deal with proposals, the role of the DFO as regulator, and coordination with YESAB as assessor. He noted the DFO requirements to complete their assessment activities are heavily influenced by the quality and completeness of materials provided by proponent. He also noted requirement for Crown (DFO) consultation with First Nations, which is considerably simplified where the proponent has fully and adequately consulted prior to filing Project Proposal.<br><br>On structure, Briar noted that the DFO expectation on project of this size (requiring YESAB EC review) would have environmental assessment work completed in BC, with regulatory liaison completed by Yukon-based DFO staff. Briar noted benefits to getting good information early in |

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| | process, and having the proponent and DFO make the most of the time that is available during YESAB review to be completing many of the necessary discussions towards the DFO regulatory decision, to help streamline the process. He noted that projects can get sidelined in DFO regulatory process by filing just a project "concept" for regulatory review rather than a detailed project proposal (such as recent experience in NWT), based on proponents trying to delay committing engineering and design dollars before they "sequence" all of their required approvals. |
| Follow up required: | Agreed to check calendars ASAP to confirm meeting availability for afternoon of Nov 19 or morning of Nov 20, and get back to Pat Tobler. |

### 4E-2.2 NOVEMBER 24, 2008

#### 4E-2.2.1 Meeting Notes

# Meeting Report

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| Title: | Mayo B Project Briefing | | |
| Attendees: | Cathryn Paish – Tourism Resource Coordinator, Yukon Department of Tourism & Culture | | |
| YEC Attendees: | Kristin Kent and Darielle Talarico | | |
| Meeting Location: | Tourism Building | Whitehorse, Yukon | |
| Date: | November 24, 2008 | Minutes status: | Draft |
| Author: | Kristin Kent | Phone: | (204) 942-0654 |
| Meeting Purpose: | Introduce the Mayo B Project and determine whether Department of Tourism & Culture has any key perspectives or issues regarding the proposed development. | | |
| Discussion: | Darielle began by explaining the anticipated demand for electricity in the Yukon. Although this has changed over the past 6 months due to current market conditions and the associated changes to timelines for major new customers to come on line, it is still likely that a project such as Mayo B will be required in the future. There is also a need to complete the Carmacks-Stewart Transmission Project (CSTP) in order to integrate the Mayo-Dawson and Whitehorse-Aishihik-Faro grids.<br><br>The studies to date were briefly described including drilling, seismic, and heritage work.<br><br>Darielle explained the project components and detailed the two options for the conveyance of water. The project has the potential to affect water levels between Wareham Lake and the new power house, as well as on Mayo Lake. | | |
| Questions asked or issues raised: | Cathryn asked if there would be flooding. It was explained that the current thinking would be to work within the upper range of the current water license (i.e., no flooding) but to look at increasing the lower range of the water license to draw down water an additional meter.<br><br>Cathryn asked if water levels on the Stewart River would be affected. It was explained that no, water levels will only be affected on the Mayo River.<br><br>Cathryn asked for confirmation that Stage II of the CSTP was assessed. | | |

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| | Kristin asked whether there would be any concerns about the project from a tourism perspective. Cathryn thought that generally no, there would be no major concerns. She also expressed that she didn't have the best understanding of wilderness tourism in the area and recommended contacting the Wilderness Tourism Association of the Yukon (WTAY). WTAY would be able to provide information about what outfitters and guides use Mayo as a take-off point for their trips. A lack of hotel space may cause concern.<br><br>She also indicated it would be worthwhile to determine whether the Trans Canada Trail crosses anywhere in vicinity of the project |

### 4E-2.3 DECEMBER 3, 2008

#### 4E-2.3.1 Meeting Notes

# Meeting Report

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| Title: | Mayo B Project Introduction and collection of terrestrial wildlife data | | |
| Attendees: | Mike Setterington, EDI<br>Ben Schonewille, EDI<br>Nancy LeBlond, InterGroup<br>Mark O'Donoghue, YG | | |
| YEC Attendees: | | | |
| Meeting Location: | Conference Call | | |
| Date: | December 3, 2008 | Minutes status: | FINAL |
| Author: | Nancy LeBlond | Phone: | 204-942-0654 |
| Meeting Purpose: | Following the distribution of the Mayo B November Newsletter, EDI and InterGroup Consultants needed to collect additional terrestrial information from Mark O'Donoghue, the Northern Tutchone Regional Biologist. | | |
| Discussion: | Mike Setterington thanked Mark for joining us to discuss the Mayo B project, and described what we would discuss and the types of information we are looking to Mark to provide.<br>**Aquatic Field Work**<br>Ben provided an overview of the aquatic field studies that were done over the summer and fall seasons. The following are highlights:<br>Lower Mayo River (zones 1-3):<br>• 6 aerial counts of Chinook salmon spawning redds<br>o Found redds throughout the lower Mayo River (downstream of the existing plant to the Stewart R.)<br>• Undertook late summer and fall freshwater fish sampling to identify all species present in the Mayo River, and their life stages<br>• Detailed habitat mapping of the lower Mayo R. to characterize the river as main stem; primary, secondary and tertiary side channels; and back channels.<br>• Further divided the channels into habitat units of riffles, glides and pools; plus identified the type/amount of cover (in-stream or riparian). Analysis is still on-going.<br>• Water quality monitoring (field and lab analysis)<br>• Invertebrate drift sampling<br>• Photographic Reference Points<br>• Ben noted that the team also includes a geomorphologist doing channel | | |

dynamic analysis

Upper Mayo River (zone 4):

- Freshwater fish sampling (all species except for chinook; all life stages)
- Stream reach stratification
- Photographic Reference Points
- Invertebrate Sampling
- Water quality monitoring
- Geomorphology review

Mayo Lake:

- Classified littoral zones into 6 categories
- Fish sampling, including identification of spawning areas for lake trout and lake whitefish
- Radio tagged 16 lake whitefish; located a major spawning area up Edwards Creek and in the Roop Lakes area. Whitefish were tagged in late September and movement tracked to spawning locations Oct 5-10th. EDI did one last flight Oct. 21st and all but one lake whitefish had moved away from the Edwards Creek / Roop Lakes area and back into the lake. EDI ground-truthed the spawning site on Edwards Creek.
- Lake trout – targeted likely spawning locations and fished using small mesh nets – evidence of spawning around Gull Island ; also possible lake trout spawning near Edmonton Creek. Eleven lake trout were tagged.
- Overview assessment of major tributaries to determine fish habitat quality and distribution within 100 m of the lakeshore.
- Water quality monitoring
- Other members of the Project Team are doing erosion studies.

**Terrestrial Field Work**

Mike indicated that the terrestrial component will focus on species and habitat likely to be affected by the Project. An aerial waterfowl brood survey was undertaken in July along the entire Mayo R system. A key area for waterfowl is the wetland complex near the Minto bridge and Mease property. The Roop Lakes wetland was not included in the summer survey as it had not been identified as a key area of interest at the time.

- Rare plant survey was conducted in the construction footprint area. Still identifying plant species.
- Upland forest mapping has been completed in the construction footprint region (old powerhouse to new powerhouse)
- Habitat mapping of the construction footprint area – no key habitat features have surfaced.
- Incidental recordings of birds, raptors and waterfowl were done while the EDI team was in the field over the course of the summer and fall field season. Osprey and bald eagle nests were identified along the Mayo River (active nests) and Mayo Lake (1 was found on the Nelson Arm; 1 near Keystone Creek did not appear to be active this year). No

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| | cliff-nesting raptors within the Key Wildlife Area polygon identified by YG were noted. Mark indicated that documentation on cliff-nesting raptors (essentially peregrine falcons) is quite scant in the Mayo area. Key bald eagle nesting areas are at each end of the Mayo Lake arms (Roop and Nelson). Mark will look into whether there is any background information available. Mark also inquired about sharing the raptor nest information with YG to add to their database. EDI will request data release from YEC.<br><br>Mike asked Mark whether he was aware of any follow-up to the shooting of the black bear this summer. Mark indicated he was away most of the summer and suggested that Kevin Johnstone (CO) was the best contact. Kevin would also be most in tune with trapping and hunting levels in the area. Nancy requested Mark let Kevin know we are trying to contact him in regards to this Project. Several attempts had been made to date, but Kevin has not been available.<br><br>Mark noted that the area between Wareham Lake and Mayo Lake is important for moose hunting – both along the river and in Mayo Lake, especially up Roop Arm. Boats are often put in at Mayo Lake and then floated downstream to the Minto Bridge; plus people drive along the road which overlooks the Mayo River and the burn area. People often call moose in this area.<br><br>Mark indicated a moose survey was done around Mayo Lake in 2006 in November; however, this survey would not reflect moose using the Roop Lakes area as the time of the survey was when the moose were up high. Mark will send a copy to EDI.<br><br>Deer can be found in the area between the Village and Wareham Lake. They are not an important subsistence species.<br><br>Aquatic furbearers:<br>• Marten and lynx are the favoured species for trapping<br>• Some beaver are shot during spring – mostly along the Stewart R. Beaver is not trapped much anymore.<br>• EDI noted there were beaver stashes in the main body of Mayo Lake (in addition to along the Mayo River).<br><br>Mark mentioned increased hunting pressure since the McQuesten Lake was voluntarily closed to moose hunting. Mark indicated that over 20 moose used to be shot there; this has now dropped significantly. He noted that hunters from Whitehorse do come up to the Mayo Lake/Mayo R area to hunt moose.<br><br>Mark confirmed the key VECs are Chinook salmon, moose and the wetland habitats.<br><br>Noted interests/concerns:<br>i. Water fluctuations in wetland areas, especially Roop Lakes. Nancy indicated the lowest time will be late winter/early spring so impact on moose hunting and access will not be a concern. Mark agreed; indicating the impact will be on aquatic furbearers and possibly on lake whitefish/lake trout eggs if spawning areas are in the zone of influence |

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| | of the increased draw-down.<br>ii. Higher water levels in the fall and increases in erosion – this has been more severe in the last five years since Mayo Dawson was connected. If additional water is held back in the fall, will this increase the erosion issue? |
| Questions asked: | How far up into the Roop Lakes wetlands will there be back-water effects when Mayo Lake is drawn down? YEC is still modeling the effects of the possible draw-down.<br><br>Will fall erosion increase due to storage of more water? YEC has an erosion specialist looking at the Mayo Lake area. Will follow-up with them. |
| Follow-up: | Mark to provide the 2006 moose survey to EDI.<br>Mark will look into whether there is any background information available on raptors and get back to EDI. |

### 4E-2.4 DECEMBER 3, 2008

#### 4E-2.4.1 Meeting Notes

# Meeting Report

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| Title: | Mayo B Project – Proposed Project Briefing with Nancy Hughes, Canadian Wildlife Service | | |
| Attendees: | **CWS**:<br>Nancy Hughes<br>**Yukon Energy:**<br>Travis Ritchie<br>Mike Setterington (EDI)<br>Ben Schonewille (EDI)<br>Nancy LeBlond (InterGroup) | | |
| Meeting Location: | High Country Inn | Whitehorse, Yukon | |
| Date: | December 3, 2008 | Minutes status: | FINAL |
| Author: | Nancy LeBlond | Phone: | 204-942-0654 |
| Meeting Purpose: | Introduce the Mayo B Project and determine whether CWS may have any key perspectives or issues regarding the proposed development. | | |
| Discussion: | **Introduction and Rationale**<br>Travis thanked Nancy Hughes for meeting us to discuss the Mayo B Project and to seek initial thoughts she may have on CWS interests in respect to migratory birds and waterfowl.<br>Travis provided a brief overview of YEC's hydro system – the Whitehorse-Aishihik-Faro grid and associated hydro facilities; and the Mayo-Dawson t-line and existing hydro plant at Mayo. Travis explained Yukon Energy's 20 Year Resource Plan (2005) and that Yukon Energy has been considering options for increasing power production to meet anticipated electrical needs in the territory. Domestic load growth has increased in Yukon, most recently with the addition of the Minto Mine served by YEC's Carmacks Stewart Transmission Project (CSTP) Stage 1.<br>YEC is focusing on enhancing existing facilities through projects such as Mayo B for the following advantages:<br>• Uses an existing disturbed environment and existing footprint<br>• Less expensive to construct versus greenfield sites<br>• Mayo B will approximately double the power through a new powerhouse 3 km downstream of the existing plant, due to the increased vertical drop between the plants. The new plant will provide | | |

about 40 GWh/year of additional power.

YEC has not made any commitments to developing this project; and is still going through the planning and assessment phase leading to a Project Proposal submission to the Executive Committee of YESAB in Q1 2009.

Forecasted demand for power is for the Alexco mine in about Q1 2010. Currently there is an estimated 14 Gwh/yr. of surplus on the Mayo-Dawson system. The Alexco development would outstrip this capacity. In addition, Western Copper is expected to materialize in the future. Mayo B could not be assessed, permitted and constructed by 2010.

The first step in serving this load growth will be CSTP Stage Two which is targeted for completion by 2010. Stage Two still requires the permitting to be completed; however, this is manageable in time for forecasted demand in load growth. This will enable YEC to shift surplus power on the WAF grid to service Alexco.

YEC has now launched their public consultation program with interested parties, including YG and federal departments. A Newsletter was the first piece of information distributed; and this is being followed up with one-on-one meetings (such as today) with groups.

**Environmental Field Work**

Mike provided a brief overview of the terrestrial field work undertaken to date, including:

- Aerial waterfowl brood survey in July
- Followed by a jet boat trip up and down the Upper Mayo River.

The most common duck sighted was the Common Merganser. Other waterfowl broods observed included Canada Goose, American Widgeon, Mallards, Northern Pintail, Common Goldeneye and Ring-necked Duck. During the course of the environmental field work, osprey and bald eagle nests were also noted; and incidental songbirds were recorded. EDI did not see evidence of nesting loons on Mayo Lake.

Mike indicated their work also included terrestrial habitat mapping in the construction footprint area including forest cover types. The local terrestrial zone does not include riparian habitat; it is mostly a birch/spruce forest cover. This mapping will assist in identifying important bird habitat that could be potentially disturbed during construction of the Project.

Travis noted that during the open water season, there will be no significant increase in flows during the spring freshet as these are “uncontrolled, local inflows” between Mayo Lake and Wareham Lake. Peak flows generally occur in May-June. Mayo Lake is used for storage during the late summer/fall period, with flows released in the November through April time period when energy demand is greatest. The Mayo B Project will result in higher sustained winter

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| | flows; however, these do not reach the level of spring/early summer freshet flows.<br><br>Nancy Hughes noted that in dry years, if the water levels were changing rapidly during the flightless young season, there may be impacts to waterfowl. The key area of concern is the wetland complex near the Minto Bridge.<br><br>Nancy H. also noted that CWS did swan collaring in 2002/2003 – she will contact Dave Mossop who may have historical information. The next swan survey will be in 2010.<br><br>Nancy H. indicated there is one bird species which may be listed on SARA which we should note – the Olive-sided Flycatcher. It is most likely in our "regional terrestrial zone"; but could possibly be in the "local terrestrial zone". Mitigation measures to avoid nesting will need to be incorporated in the submission.<br><br>Information on greenhouse gas emission is through Environmental Protection – Benoit's group of people.<br><br>Travis noted that other forms of mitigation can include vegetation clearing outside the breeding period. |
| Follow up required: | Nancy Hughes will follow up with Dave Mossop on historical waterfowl information, including the swan collaring study in 2002/2003.<br><br>EDI will contact Benoit's department for information re: GHG. |

### 4E-2.4.2 Materials

The first project newsletter was distributed at this time. See Section 4B-2.2.

### 4E-2.5 DECEMBER 4, 2008

#### 4E-2.5.1 Meeting Notes

# Meeting Report

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| Title: | Mayo B Project – Introduction to YTG Fisheries | | |
| Attendees: | **YTG Fish & Wildlife**:<br>Nathan Millar, Sr. Fisheries Biologist<br>Lars Jessup, Fisheries Technician<br>**Yukon Energy:**<br>Patrick Bowman - InterGroup Consultants<br>Karl Schiefer, Aquatic Advisor | | |
| Meeting Location: | YEC Boardroom | Whitehorse, Yukon | |
| Date: | December 4, 2008 | Minutes status: | Draft 1 |
| Author: | Patrick Bowman | Phone: | 204-942-0654 |
| Meeting Purpose: | Introduce the Mayo B Project | | |
| Presentation and Discussion: | Copies of the Newsletter were provided. Patrick reviewed the content of the newsletter including the project rationale, the existing Mayo hydro facility, studies to date, and the components of the proposed Mayo B project.<br><br>Nathan noted they were aware of the field studies underway as some basic information was provided earlier as part of the permitting process (EDI summer investigations). Patrick indicated that EDI now had a field data report that we would provide to YTG Fish & Wildlife.<br><br>Discussed basic current operation of Mayo Lake, and how the existing water license may be amended to accommodate an additional meter drawdown range. Nathan indicated that lake trout and lake whitefish will require attention and the obvious concerns about spawning habitat will need to be addressed.<br><br>Nathan noted that discussions are presently underway between regulators and placer miners at Mayo Lake. YTG Fish & Wildlife will want to consider the full situation at Mayo Lake when dealing with this project.<br><br>Yukon Energy agreed to follow up by providing a copy of the EDI field study report. | | |

#### 4E-2.5.2 Materials

The first project newsletter was distributed at this time. See Section 4B-2.2.

### 4E-2.6 DECEMBER 16, 2008

#### 4E 2.6.1 Meeting Notes

# Meeting Report

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| Title: | Mayo B Project Introduction and collection of resource use information | | |
| Attendees: | Hector Campbell, YEC<br>Nancy LeBlond, InterGroup<br>Kevin Johnstone, Conservation Officer, YG - Mayo | | |
| Meeting Location: | YG Environment Office, Mayo | | |
| Date: | December 16, 2008 | Minutes status: | Draft 1 |
| Author: | Nancy LeBlond | Phone: | 204-942-0654 |
| Meeting Purpose: | To personally introduce the Mayo B Project to Kevin, and collect baseline resource use information. | | |
| Discussion: | Hector and Nancy thanked Kevin for making time on short notice to meet with him about the Mayo B Project. Hector gave him a copy of the newsletter and briefly described what YEC is considering for the Mayo B Project.<br>Nancy indicated we were interested in collecting baseline resource use information, particularly on the Community trapline (#407). Kevin provided the following details:<br>• It is a 5 km radius trapline concession controlled by YG Environment. It surrounds the community of Mayo.<br>• It provides elders and students an opportunity to go out on the land, and experience and/or learn about trapping.<br>• Elders use this area as it is close to the community, it is safe, and provides them the opportunity to continue trapping. They also take students out to teach them about trapping.<br>• Assistant Licenses are issued under Kevin's authority.<br>• Usually about 5 Assistant Licenses are issued in any given year; with generally 1-2 around the Five Mile Lake area. The concession does go out to Janet Lake area as well.<br>• The species usually trapped include marten, lynx, fox and wolf.<br>• 95% of trapping is for commercial purposes. People using this community trapping concession have the opportunity to sell their furs if they so desire.<br><br>Other Information:<br>• NND has a cultural camp/outpost out at Ethel Lake. There are other locations for cultural camps that move around.<br>• Most recreational use of the area between Mayo and Wareham Lake is | | |

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| | picnicking, walking and cross-country skiing.<br>• McIntyre Park is mostly day use, although there is some camping. It is not a YG area; it is maintained by the Village.<br>• Moose harvests area generally low in the Mayo to Wareham Lake area. Two moose in the past 7 years have been taken in the Five Mile Lake area. Most moose harvesting is along the Mayo River and out at Mayo Lake. People launch their boats at the dam at Mayo Lake and drift down-river looking for moose. They take their boat out by Minto Bridge.<br>• Duck and waterfowl hunting is not hugely popular. There is some spring hunting by NND; with lesser hunting in the fall as the birds are not as tasty.<br>• This past summer's bear kill was reported to him. It was an overly aggressive bear going after food from the drilling crew. It may have been an offspring of the brown-coloured sow living up near the existing plant. He knows of a den up that way. Bears are generally seen/present up on the bluff overlooking the Wareham dam road. The area is typical bear habitat as they follow the salmon down to the Stewart. |
| Follow-up: | |

## 4E-3.0 POTENTIAL PROJECT EFFECTS AND MITIGATION

### 4E-3.1 DECEMBER 4, 2008

#### 4E-3.1.1 Meeting Notes

# Meeting Report

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| Title: | Mayo B Project – Proposed Project Briefing with DFO | | |
| Attendees: | **DFO**:<br>Briar Young, Area Manager<br>Rob Smith, Habitat Biologist<br>**Yukon Energy:**<br>Hector Campbell, Project Sponsor, YEC<br>Travis Ritchie, Manager, Environmental Assessment & Licensing<br>Patrick Bowman, Project Manager, InterGroup Consultants<br>Karl Schiefer, Aquatic Advisor<br>Shaun Beatty, KGS Group - Engineering<br>Ben Schonewille, EDI - Aquatics<br>Nancy LeBlond, Socio-Economic Assessment, InterGroup Consultants | | |
| Meeting Location: | YEC Boardroom | Whitehorse, Yukon | |
| Date: | December 4, 2008 | Minutes status: | FINAL |
| Author: | Nancy LeBlond | Phone: | 204-942-0654 |
| Meeting Purpose: | Introduce the Mayo B Project, provide an overview of the aquatic field work undertaken and discuss preliminary project effects and possible mitigation | | |
| Discussion: | **Introduction and Rationale**<br>Hector thanked everyone for coming to this meeting to enable YEC to provide an introduction to the Mayo B Project, to update DFO on the work done to date and to discuss preliminary project effects and mitigation concepts. Round table introductions were made. The draft Agenda (attached) was accepted with no changes.<br><br>Hector discussed the rationale for proceeding with the Planning Phase of the Mayo B Project. YEC's 2005 20 year Resource Plan identified alternative options for energy projects to meet growing power requirements. YEC is focusing on renewable power through:<br>• Enhancement opportunities at their three existing facilities;<br>• Greenfield sites; and | | |

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| | • Geothermal and wind opportunities.<br><br>YEC has an obligation to serve load growth; so must plan for future demand. Projects either completed, currently underway or in the planning phase include:<br><br>• The third turbine at Aishihik which will add 7 MW of winter capacity to the system<br>• Carmacks Stewart Transmission Project (CSTP) Stage One from Carmacks to Pelly Crossing is a grid extension to the WAF grid. It provides hydro power to the Minto Mine and has taken the community of Pelly Crossing off diesel.<br>• Next phase is CSTP Stage Two – Pelly to Stewart Crossing. This is driven by mine loads such as Alexco, which will use the surplus power at Mayo and from the WAF grid once Stage Two is interconnected (2010).<br>• Mayo B will be driven by a second mine such as Carmacks Copper, which needs up to 50 GWh/yr of power.<br><br>Mayo B is an enhancement project that will see the re-development of an existing facility to generate up to 40 GWh/yr of additional energy (approximately double the output using the same amount of water).<br><br>YEC has started a public consultation program. A November newsletter was distributed, and meetings have occurred with Nacho Nyak Dun, the Mayo Village Mayor and Council, the Mayo Renewable Resource Council and the Yukon Conservation Society. Public consultation will continue with other interested parties.<br><br>Travis noted the purpose of today is to share a project concept as well as provide an update of the environmental field work done to date. Where we go from here is confirming an understanding of our planning as we go forward toward an environmental assessment process through YESAB.<br><br>Patrick confirmed that DFO received materials in advance. This included the draft Agenda and meeting notes from the last meeting; the November newsletter; and the letter report from EDI on their field season and key findings to date, with acknowledgement that analysis is on-going. Patrick noted this meeting will include an overview of the existing plant, an overview of the proposed Mayo B Project, details on EDI's aquatic field studies and a discussion on project effects and mitigation concepts. YEC is looking to hear DFO's reaction on whether we are on the right track in terms of level of detail needed in an assessment, and whether DFO sees any major gaps in the focal areas and/or approaches being considered.<br><br>**Project Introduction** |

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| | Patrick reviewed the PPT presentation – handouts were provided. The following is provided as additional information to the PPT slides.<br><br>Existing System:<br><br>• Current Mayo Hydro plant capacity is 5.4 MW – this compares to the WAF grid with 70 MW of hydro capacity.<br>• Existing plant was fully used during the Keno mine operations; however, historical data since the mine shut down in 1989 does not represent what the system was designed for. It currently has extra capacity.<br>• Patrick and Hector explained the large-scale photos and maps of the existing Wareham Dam, existing plant, intake and spillway, and the Mayo Lake control structure.<br>• The current Type A, Class 2 Water Licence was renewed in 2000, and covers both facilities.<br>• The original project in the 1950s raised Mayo Lake about 15 feet. Mayo Lake has a licensed operating range of 2.59 m.<br>• Wareham Lake has very little storage capacity. It has about a 2.3 meter operating range and is used to manage changes in electricity demand on a short term basis (not for seasonal storage of water).<br><br>Water Management:<br><br>• Most power is required in the winter.<br>• Mayo Lake is used for annual storage (not multi-year storage)<br>• During the time period from about 1993 to 2004, Mayo Lake's typical operating range was roughly 1 m (prior to the MD grid).<br>• The natural seasonality of Wareham Lake is maintained to some degree by the natural unregulated inflows.<br>• Below the existing plant, flows of less than 4 cms are too small to generate power with the existing equipment. The existing plant can handle flows of 18 cms; currently the plant is using 12-15 cms of flow since the MD grid was connected.<br><br>Proposed Mayo B Project – Project Description:<br><br>• There are no new dams associated with this Project.<br>• Tunnel conveyance option is the preferred option for the following reasons:<br>o Less surface/environmental disturbance<br>o Can be built in 1 year (all year round construction)<br>o Easier for maintenance<br>• Seismic work has been completed recently to help identify the bedrock profile.<br>• The Penstock option is the next preferred option – it is essentially a buried pipe. The canal option is the least likely.<br>• Looking at more storage options at Mayo Lake due to the projected |

increase in winter power demand. The team has reviewed raising Mayo Lake by 1 m; however, due to a variety of impacts (such as erosion, increased flooding), YEC is not pursuing raising the lake level.

Water Management – Mayo Lake:

- YEC is continuing discussions with placer miners and trappers concerning access concerns with lowering the minimum controlled level of Mayo Lake. Shoreline line work re: erosion is also continuing.
- Having an increased range provides YEC the ability to capture spring/summer high inflows
- KGS is running a series of models at different draw-down ranges.

Water Management - Mayo River :

- Option 1 – YEC is not looking at changing the minimum flows for this option. They would remain at 2.8 cms.
- Option 2 – dewater the 3 km section of river between the existing plant and the new plant. Compensation would be provided elsewhere.
- Option 3 - maintaining a stable minimum flow through Zone 2 above current minimum licensed levels as determined by fisheries studies (e.g., 4-6 cms range). This provides an opportunity to do a better job for the salmon as compared to the 1950s method of simply maximizing power production. There is significant promise on the environmental side; and YEC continues with modeling and discussions on the economic side.
- When YEC files a Project Proposal, YEC will have resolved the issue of options and will file a project description based on a preferred approach.

Consultation:

- YEC has distributed a November 2008 Newsletter describing the proposed Project; and has posted the newsletter on its website.
- Discussions are occurring with NND over potential investment opportunities in the Project.
- The Dec 4/5$^{th}$ workshops will involve several Lands & Resources staff, their environmental consultant they have hired to provide technical support, and members of their Development Corporation. NND is well-organized and wishes to be actively engaged in the Project.
- NND Chief and Council have formally accepted going forward with (a) technical discussions leading to a YESAB filing; and (b) negotiations towards a possible Project Agreement including employment and investment opportunities.

**Aquatic Field Work Undertaken**

Ben Schonewille (EDI) reviewed the presentation – Mayo B Aquatic Studies Preliminary Summary – handouts, including 11 x 17 maps, were provided. The

following is provided as additional information to the PPT slides.

- Aquatic Zone 1:
  - Low gradient, meandering river morphology
  - High complexity with numerous side and back channels
  - River is less confined through this zone
  - Substrate is made up of cobbles and gravel
- Aquatic Zone 2:
  - Higher gradient, more confined river channel
  - Higher velocities
  - Less complexity of the channel, especially in the canyon (lower photo)
  - Substrate is primarily boulders and cobbles
- Aquatic Zone 3:
  - Very short corner between the dam/spillway and existing plant
  - Very confined channel with little opportunity for Chinook salmon spawning; substrate is boulders and cobbles.
  - Velocities depend on the flows through the spillway – the upper photo was taken this past October with high spills.
  - When the spillway is shutdown over the winter, the reach may have decreased water flows.
- Aquatic Zone 4:
  - Divided the Upper Mayo River into reaches with similar characteristics.
  - The red arrows point to two major tributaries (Duncan and Davidson) with active placer mining activity.
  - Reach 7 is a meandering wetland upstream of the Minto Bridge. It has fine material substrate, and is affected by Wareham Lake. There is a lot of channel complexity, islands etc.
  - Reach 8 upstream of reach 7 also has channel complexity with side and back channels. Substrate is hard-textured.
  - Reach 9 and 10 are very similar – one main channel.
  - Reach 11 (upstream of Davidson Creek bridge) with decreased velocity, fine substrates and abundant aquatic plants.
  - Reach 12 is upstream of the placer mining activity at Duncan & Davidson Creeks, and below the Mayo Lake Control Structure. This reach parallels the Mayo Lake access road.
- Aquatic Zone 5 is Mayo Lake:
  - Photo is looking east towards the Roop Arm.
  - Edwards Creek, Roop Creek and the Roop Lakes drain into the Roop (north) Arm; the Nelson Creek drains into the Nelson (south) Arm.

<u>Question:</u>

- DFO enquired if there was data on the Mayo River/Mayo Lake area

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| | before the dam was constructed. YEC indicated there are some late 1940's aerial photos available.<br><br>Methodology Zones 1-3:<br><br>• Chinook salmon spawning investigations – 6 helicopter flights in early August to mid September of the entire Lower Mayo River. The Sept 15th flight was targeted at locating spawning redds.<br>• Fish sampling – targeted all species and life cycles. Three methods were used:<br>  o Beach seining for adult fish<br>  o Electrofishing along stream margins and in off channel habitats targeting juvenile fish<br>  o Minnow trapping – effective for catching juvenile Chinook<br>• Channel classification/habitat mapping<br>• Water quality – field measurements and lab analysis<br>• Water temperature monitoring (data loggers)<br>• Tributary assessment – there is 1 tributary into the Lower Mayo River which was assessed.<br>• Photo reference points – example is off the Silver Trail Bridge looking downstream<br>• Geomorphology review of the river channel<br><br>Methodology Zone 4:<br><br>• No Chinook salmon investigations or habitat mapping<br>• Fish sampling – same as for Zones 1-3 using all 3 methods. The photo is an example of beach seining<br>• The other points on the slide are the same as for Zones 1-3<br><br>Methodology Zone 5:<br><br>• Littoral Zone classification around the entire lake (based on substrate type, slope and presence of aquatic vegetation)<br>• Fish sampling – lake trout and lake whitefish – used small mesh nets to avoid fish mortality<br>• Radio tagging and tracking to locate spawning areas – tagged 16 lake whitefish and 11 lake trout<br>• Overview assessment of selected tributaries<br>• Water quality(field measured parameters and lab analysis)<br><br>The following additional work being done by other parties will tie into EDI's field work:<br><br>• Mayo Lake erosion studies<br>• Mayo River ice studies<br>• Compilation of historic Mayo River flow data<br>• Mayo River cross section data |

**Preliminary Results**

The following information is preliminary in nature as analysis is still on-going.

Preliminary Results – Zones 1-3

- Chinook salmon were observed spawning throughout Zones 1 and 2.
- Lower two-thirds of Zone 2 is canyon with high velocities; the upper one-third has a flatter gradient
- Chinook spawning locations are in the side channel as noted in the photos of Zone 2. The photos were taken when the flows had been reduced to 12-15 cms; however, spawning was occurring when the flows were 30 cms. Flights were done at both flow levels. A 12 cms flow would equate to normal plant operation with no spillage at Wareham. The minimum license flows of 2.8 cms would result in a very different picture of the river.
- The 7 confirmed redds shown in the lower photo correspond to the dot on Map 2. Confirmed redds were where EDI saw salmon attending the redds. The suspected redds have a very high likelihood of being actual redds.
- As Figure 3 notes, fish sampling was done throughout the Lower Mayo River. In addition to Chinook, EDI found Arctic grayling, round and lake whitefish, long-nose suckers, northern pike, slimy scuplin and burbot. They did not catch any inconnu.
- EDI's Chinook salmon work builds on a base of previous studies including four years of bi-monthly counts of juveniles; the Triton work in the early 1990s and a number of older studies.
- Figures 4 through 7 are habitat mapping of Zones 1-3. Channel classification was based on flow characteristics, amount of cover, ortho-photos taken in July 2008 and field knowledge:
    - Main stem (photo is from Zone 2).
    - Primary Side Channel – similar characteristics of a main channel, but with a lower proportion of the stream flow, minimal area under the influence of riparian cover.
    - Secondary Side Channel – smaller proportion of flow, with over-hanging vegetation cover and riparian influence.
    - Tertiary Side Channel – very small, tributary-like channel with greater cover. Not susceptible to high flows.
    - Back Channel – back-flooded from the river with no real flowing water.
- The mainstem, primary and secondary side channels were further divided into Habitat Units, classified as riffles, glides, and pools. Each habitat unit was assigned a value for riparian cover and one for in-stream cover. An example of the habitat units determined in upper Zone 2 and Zone 3 is shown in the presentation.

Question/Concern:

- DFO: Any sense how long those habitats are available to fish?

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| | • EDI: the habitat mapping will be linked to water levels. Other team members are also doing cross-sections of the river. Ben also noted there is a likely groundwater influence in winter which also provides habitat. A groundwater survey to be completed during the winter of 2008 / 2009.<br>• DFO: Compensation in Zone 2 would have to take into account all the side channels, not just the main stem.<br>• Karl: The Lower Mayo River is a very productive salmon river. In the 1950s, the salmon lost 70% of their habitat when the dam was built; and since then have been subjected to flow variations over many years. Despite these conditions, the river remains productive. Zone 1 has different side and tertiary channels where flows are stabilized. The Mayo B project is likely to further stabilize the flows during winter which will benefit salmon habitat in these areas.<br>• DFO: when preparing habitat classifications of Zones 1-3, you also need to include other freshwater fish species – but kept separate to Chinook.<br><br><u>Preliminary Results – Zone 4 (Figure 8)</u><br>• Freshwater fish sampling resulted in Arctic grayling, burbot, round and lake whitefish, northern pike, slimy sculpin (no inconnu).<br>• No sampling was done in Wareham Lake – previous work was down in 2005 and earlier. Wareham Lake will stay the same with or without the Mayo B Project; as will the majority of Zone 4.<br><u>Preliminary Results – Zone 5 Mayo Lake (Figure 9)</u><br>• Six types of Littoral areas are described.<br>o Type 1 – gravels/cobbles/boulders are areas with highest potential for spawning. The top left photo is at Gull Island which was later identified as an active lake trout spawning area.<br>o Type 2 – narrow band of gravels/cobbles/boulders with fines and woody debris beyond, is the predominant littoral area around the lake. The upper right photo is an example of this littoral type.<br>o Type 4 has extensive macrophytes – an example is the lower left photo of the end of Nelson Arm where aquatic plants are widespread.<br>o Type 5 has exposed bedrock outcroppings – an example is the lower right photo at the east end of Peggy's Island where Mike Mancini has a cabin.<br>• Mayo Lake – Lake whitefish spawning assessments:<br>o Tagged 16 lake whitefish with 1 mortality. The majority of the tagging occurred in the middle section of the lake.<br>o Figures 10 and 11 show lake whitefish movements – the majority went into the Edwards Creek/Roop Lakes area. The photos on the left are of Edwards Creek where EDI observed the lake whitefish spawning at night during early October. |

They were spawning at depths of approximately 40-70 cm in Edwards Creek.

- The lake whitefish likely retreated back into the lake as they were not relocated when the last aerial survey was done in late October.

- Mayo Lake – Lake trout spawning assessments:
  - Figure 12 shows lake trout movements.
  - There was evidence of spawning at the north and west end of Gull Island; after spawning, there is evidence of dispersal throughout the lake. The spawning area's substrate was gravels/cobbles/boulders with few bedrock outcroppings. The graph indicates that most of the lake trout were captured at a water depth of up to 4m.
  - Sampling was done at night with small mesh gillnetting and a variety of sizes were captured.
  - One lake trout in spawning condition was captured at the east end of Roop Arm.

<u>Salmon spawning at a variety of river flows – series of graphs:</u>

- Five graphs illustrate the variability of river flows (blue line) overlaid with the life cycle of Chinook salmon (orange is spawning; green is incubation).
- The salmon look for the ideal conditions (river levels, flows and substrate materials) each year for spawning.
  - In 1989/90, the graph shows spawning in flows of 20 cms or less; followed by low flows of 4cms during early stages of incubation.
  - In 1990/91 they picked a different spawning location (likely deeper and more secure channels) as the flows were 6-7 cms at the time of spawning.
  - The following year, 1991/92, spawning occurred at quite high flows of between 25 and 70 cms – they may have sought out side channels as the preferred spawning habitat. Later in the year, those side channels would have had 3-4 cms flows.
  - In 1992/93 – a typical year before MD was connected and loads were equivalent to the community of Mayo alone – summer flows during spawning were dropping form 65 cms to 30 cms. This was a year where the flows were spillway flows as the plant tops out at 18 cms. During incubation, the flows were reduced to less than 5 cms.
- Patrick noted that with the Mayo B Project, Zone 1 will be around 20 cms and will provide a more stable environment. In Zone 2, if flows were based on the current license limit of 2.8 cms, the issue of stranding eggs requires attention. The original plant was focused on power generation, and not salmon. The 100 cfs (2.8 cms) license minimum flow limit is a salmon constraint imposed later by the water license and DFO. The challenge today is to both optimize power

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| | generation and find ways to enhance the habitat for fish – looking for a balance.<br>• Briar noted that there is no existing DFO specific authorization for the existing facilities or for flow impacts on habitat or fish. DFO will want to look at the whole system and will work with the situation we have now. The current system is a productive system regardless of the lack of regard for fish in the past.<br>• Karl indicated there was a counting fence installed temporarily in 1994. Results found over 600 spawners returning to the Mayo River - a very good production given the size of the river. In reviewing mitigation options the team has been not only focused on habitat quantity and quality, but also on production capacity. The Mayo B Project offers an opportunity to take an historic system and make it good for fish, including Chinook, while also increasing power production.<br>• Patrick noted that a lack of DFO authorization on mid century (1950's) infrastructure projects is not a unique situation; in fact it is nation-wide. YEC purchased the existing Mayo facilities from Canada with the provision that all the required permits and licenses were in place. The challenge for the environmental assessment is amending an existing system and confirming a baseline. The ability to manage water levels and flows is of great benefit as we consider the mitigation options. Balancing benefits and costs of both power production and habitat enhancement is an on-going, interactive discussion amongst the Project Team.<br>• Karl indicated that local people have often raised the issue of a fishway. Pragmatically, from a cost/benefit and technical perspective, one can't justify a fishway (i.e., it would be much less costly and equally effective for an adult fish collection experimental 'trap and truck' program around Wareham Lake). However, there are other dynamics at play on the Mayo River system. There are two major placer mining operations which affect Zone 4. They presumably would not want salmon re-introduced to Zone 4 as there could be substantial resultant restrictions imposed on their operations. Wareham Lake acts as a settling basin which helps protect the Lower Mayo River from sediment plumes from placer mining so that they don't affect salmon in Zones 1-3.<br>• The side/back channel downstream of the proposed plant provides a possible opportunity to re-create spawning and rearing habitat for the Chinook. To do this, YEC would have to install a flow regulation at the plant to ensure water flows through this channel in addition to the mainstem. This area would provide good spawning habitat near the proposed plant; and rearing habitat throughout the length of the channel. There is good gradient through this section, and an excavator could dig out the old channel 'in the dry'. This type of compensation has been done before (e.g., Sechelt, BC; and Black River, Ontario are two examples). In addition to this enhancement, the team is looking at managing flows in Zone 2 to improve conditions for Chinook.<br>• Briar indicated that DFO will need a comprehensive package of all planned modifications for the entire system. Initial concerns include lowering Mayo Lake and effects on lake trout and whitefish spawning and affects at creek mouths possibly resulting in barriers to fish |

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| | movement. Reducing the flows through Zone 2 may be seen as a negative effect, despite the re-creation of the side channel. DFO will be taking the information to NND to understand their concerns from the perspective of their rights, and the requirement for fisheries resources to be protected.<br>• Briar also noted that by engaging in this process, the current license limit may need consideration.<br>• If YEC determines that a fish ladder is not required or feasible as part of this project, DFO may want to see any analysis that substantiates such a decision.<br>• If YEC suggests an experimental trap and truck program, YEC will also have to address the issue of turbine mortality and how the fish run downstream through the system. Karl noted there is substantial literature on turbine mortality of Chinook – juvenile mortality may not be higher than 20-30%.<br>• Patrick provided a brief summary of what he understood DFO was looking for:<br>o YEC has provided a good overview of the Project which is complicated with multiple facilities and a changed existing environment.<br>o The 2.8 cms minimum licensed flows would require consideration.<br>o YEC needs to detail all the components and how the system works together into a comprehensive package, documenting all the options.<br>o YEC needs to be attentive to community concerns.<br>o For Zone 2 specifically, options that hinge on compensation will be challenging and should be taken into account when deciding on options.<br>o Outside the scope of this Project, YEC and/or other may wish to address the issue of a fish ladder or experimental trap and truck program. Such a program would need to engage the local First Nation, be mindful of upstream users and need to ensure it works from DFO's perspective.<br>• YEC will be aiming at providing a Project Proposal that is specific enough to enable an assessment to move forward. From the information presented to date, does DFO think YEC is on the right track? Briar confirmed that YEC is on the right track. He noted that all of us will need to grapple with the productive capacity of the Mayo River system. He acknowledged there is not a lot of past data, so quantifying productive capacity will be a challenge. Also, determining whether any compensation package is adequate will be difficult if this is the approach YEC seeks to use to address loss of habitat in Zone 2. In such circumstances, DFO will rely on the precautionary principle.<br>• Briar suggested that YEC:<br>o include all the methodologies of field work in their documentation |

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| | o the habitat mapping and classification is important<br>o include cumulative effects, including placer mining<br>• Briar indicated that DFO and the Yukon Placer Secretariat are currently developing a class-authorization for Mayo Lake Placer mining. The class authorization process has looked at other watersheds to date; and Mayo Lake is next. This process will include discharge standards for placer mining, and impacts on the lake itself, not just the creek mouths. Sean Collins (DFO Biologist) is the lead contact.<br>• Water quality objectives have been based on Chinook salmon; however for Mayo Lake they will need to be based on lake trout. One issue is that Chinook water quality objectives don't translate well for lake trout. DFO was concerned about the impacts to lake trout and whitefish spawning areas and possible increased shoreline erosion from a proposed increase in the operational range of Mayo Lake, so if YEC is looking at lowering lake levels, there must be mitigation for lake trout and increased erosion.<br>• Briar suggested that for Zone 2, YEC work with the flow rates and natural habitat as much as possible, rather than relying on man-made habitat. Briar also commended YEC for not suggesting compensation off-system – not generally favored by DFO.<br>• Patrick indicated that YEC would like to re-engage DFO once a Project Proposal is more concrete and ready for filing – current target is late Q1 2009. YEC will be preparing a submission to the Executive Committee of YESAB. YEC held a brief project introduction meeting with YESAB staff on Monday, Dec. 1st.<br>• Briar inquired if additional field studies were planned after filing. Patrick indicated that as long as we are not raising the levels of Mayo Lake, we seem to have sufficient information to prepare a submission. |

### 4E-3.1.2 Materials

The first project newsletter was distributed at this time. See Section 4B-2.2.

**Draft Agenda**
**DFO Aquatic Session for Mayo B Project Planning**
**Thursday, December 4, 2008**
**9:00 am – noon, YEC Boardroom**

**1) Getting Started**

- Welcome and Round Table Introductions
- Review Agenda & Meeting Format
- Objectives of the Session:
  - To enable Yukon Energy to share more specific information about the key aspects of the Project and its planning/assessment to date
  - To confirm identification and develop understanding of DFO's interests with respect to the potential project
  - To hear from DFO their views on the type of information and detail that would be beneficial to include in a Project Proposal
  - To hear from DFO whether they see any major gaps in the focal areas and/or approaches being considered

**2) Mayo B Project Concept & Planning Studies Undertaken - Review**

**i. Project Introduction – Yukon Energy Presentation** (Patrick/Shaun)

a. Rationale for the project
b. Existing system
c. Key physical components of the project
d. Overview of water levels and flows
    i. Baselines
    ii. During Operations Phase (all Zones)

**ii. Aquatic Field Work Undertaken** (Ben Schonewille/Karl Schiefer)

**3) Discuss Preliminary Project Effects & Possible Mitigation – Discussion**

- Particular focus on:
  - Identification of interests
  - Potential effects, with focus on Chinook salmon
  - Approaches to mitigating significant adverse effects
  - Opportunities for enhancement

**4) Conclusions**

EDI ENVIRONMENTAL DYNAMICS INC.
*Natural Resource Consultants*

402 HAWKINS ST ▪ WHITEHORSE, YT ▪ Y1A 1X8 ▪ P: (867) 393-4882 ▪ F: (867) 393-4883

December 1st, 2008

**EDI Job Number: 08-YC-0037**

Yukon Energy Corporation
#2 Miles Canyon Road
Whitehorse, YT, Y1A 6S7

**Attention: Travis Ritchie, Manager, Environmental Assessment & Licensing**

**Re: Mayo B – Aquatic Studies Summary**

The purpose of this letter is to provide an overview and brief summary of the aquatic studies completed as a component of the Mayo B project during 2008. As you are aware, an extensive amount of field data was collected and the data analysis and reporting components are on-going. As such, this summary only describes some notable results that have appeared from data analysis to date.

A list of work completed during 2008 can be found below, separated by aquatic zone (See Appendix C: Figure 1 for locations of zones).

## Summary of Aquatic Work Completed

### *All Zones*

- Review and compilation of existing information.

### *Aquatic Zones 1 – 3 (Wareham Dam downstream to the Stewart River)*

- Chinook salmon spawning investigations
- Fish sampling (electrofishing, minnow trapping, beach seining)
- Channel classification and habitat mapping
- Invertebrate sampling (using drift nets)
- Water quality (field and laboratory analysis)
- Water temperature monitoring
- Tributary assessment
- Photo reference points
- Geomorphology Review (historic air photo assessment)

### *Aquatic Zones 4 (Wareham Dam to Mayo Lake Control Structure)*

- Fish sampling (electrofishing, minnow trapping, beach seining)
- Reach stratification and habitat data collection (BC site cards)
- Invertebrate sampling (using drift nets)
- Water quality (field and laboratory analysis)
- Photo reference points
- Geomorphology review (historic air photo assessment)

### *Aquatic Zones 4 (Mayo Lake)*

- Littoral zone classification
- Fish sampling
- Radio tagging/tracking leading to the identification of spawning areas utilized by fall spawning fish (lake trout and lake whitefish)
- Overview assessments of selected tributary streams to Mayo Lake
- Water quality (field and laboratory analysis)

As you are aware, there is notable work being completed by other project team members which will provide information to the environmental team during the assessment of this project. Examples of such works are listed below.

- Cross sectional data on the Mayo River
- Historic flow data compilation (i.e. see Appendix B for some outputs)
- Erosion studies on Mayo Lake
- Ice studies

## Summary of Preliminary Results In Aquatic Zones 1 – 3

### Chinook Salmon Spawning Investigations

Six overview flights were conducted by helicopter in order to document adult Chinook salmon and spawning activities within the lower Mayo River. Fish were observed on 3 of the 6 flights (August 19, 25 and September 2); however, flow levels and water clarity limited the number of fish visible from the air. Spawning activities (i.e. fish positioned over or near redds) were documented in two locations. In Zone 1, three active redds were observed downstream of the bridge (Reach 1), and in Zone 2, seven confirmed redds were observed in a side channel (Reach 4) (Photo 1 and Photo 2). All suspected redd locations were mapped during the last flight, which occurred at the end of the spawning season (September 15). Figure 2 outlines the distribution of both confirmed and suspected Chinook salmon redds.

**Photo 1. Upstream view of confirmed redd locations (circled) within Zone 2.**

**Photo 2. Confirmed redd locations within Zone 2.**

From the data collected this year and in previous years it is clear that Chinook spawning occurs throughout the lower Mayo River. Triton (1992) identified two main spawning areas, and several of the 2008 suspected redd locations fell within these areas; however, the confirmed 2008 redd locations were both outside of these previously identified spawning areas (note flows were similar in 1992 and 2008). Upon further

investigation, it was revealed that Triton (1992) identified these two areas after two aerial surveys (both completed on August 19) and the observation of 16 Chinook salmon in the upper spawning area and 13 Chinook in the lower spawning area (their estimate of spawning run size in 1992 was 588 to 1,940). While this is valuable information; it is likely that spawning occurred in other areas in 1992. The work completed in 2008 indicates that Chinook spawning is more widespread than these previously identified areas.

Spawning habitat exists in both zones 1 and 2. Strictly from a habitat perspective, there appears to be more available spawning habitat in Zone 1. This section of river is not only longer, but has a lower gradient with more pools, slower water velocities and higher amounts of suitable spawning bed material. McPhail (2007) indicates that Chinook salmon spawn in areas with subgravel flow, such as pool tailouts and in water velocities ranging from 0.10 $ms^{-1}$ to 1.89 $ms^{-1}$, but averaging 0.50 $ms^{-1}$. Regardless, it is apparent that Zone 2 is used by spawning Chinook salmon. Also, there have been several accounts of adult salmon as far upstream as the plunge pool below the spillway (1992 by Triton; 2004 by R&D 2004). Salmon have been known to migrate as far upstream as possible likely to provide their progeny with the opportunity to access more habitat. In this case, the lack of spawning habitat likely forces these fish to drop back downstream to spawn in the closest available habitat in Zone 2.

## Fish Sampling

Fish sampling was completed via electrofishing, minnow trapping and beach seining throughout all five reaches downstream of Wareham Dam. Figure 3 displays all sampling locations. Eight fish species were captured in zones 1-3. Appendix A displays a fish sampling summary for each stream reach. Further analysis is on-going.

## Habitat Mapping

Habitat mapping is being completed for zones 1 – 3 with the goal of quantifying the amount and the quality of habitat that would exist during different flow levels. The stream channel was first separated into channel types (Table 1) based on the July 3, 2008 orthophoto coinciding with a moderate flow level of 26.95 cms. Results of the stream channel type delineation habitat mapping are presented in Figure 4 through Figure 7. Further mapping to stratify habitats units (riffles, glides, pools) and cover attributes has been completed.

**Table 1. Channel type classification details.**

| Channel Type | Description | Typical Appearance |
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| Mainstem | Mainstem channel carrying > 50 % of the river flow. |  |
| Primary Side Channel | A side channel carrying approximately 25 - 50% of the river flow that has many of the geomorphologic characteristics of the mainstem. |  |
| Secondary Side Channel | A moderate sized side channel that has a slightly different geomorphology than the mainstem. Riparian vegetation is more prominent (i.e. narrower stream with less bars) and gradient is slightly lower (as detected by greater channel length in relation to the main stem). |  |
| Tertiary Side Channel | A small side channel that carries a small proportion of the river flow and due to narrow width (approximately 10 m or less) likely functions more like a small stream channel than a river channel. As these channels are quite narrow, the riparian vegetation plays a more prominent role in geomorphology and ultimately fish habitat. Habitat features (cover) for fish common in these habitats may include undercut banks, overhanging vegetation and small and large woody debris. |  |
| Back Channel | A channel that is not connected to the main river on the upstream end. As such, this area has no or limited flow; rather, it is back flooded as a result of water levels in the river. |  |

## Summary of Preliminary Results Within Aquatic Zone 4

Fish sampling was completed throughout the upper Mayo River from the Silver Trail upstream to the Mayo Lake Control Structure (reaches 7 to 12; Figure 8). Seven species were captured including: Arctic grayling, round whitefish, lake whitefish, longnose sucker, burbot, northern pike and slimy sculpin. Appendix A summarizes the fish captures within each reach, further data analysis is on-going.

## Summary of Preliminary Results Within Aquatic Zone 5

As the components involving the fall spawner assessments were identified as the priority activities, the analysis of water quality data and stream assessment data has not yet been completed, and as such, is excluded from this summary.

The littoral classification component identified six littoral types present within Mayo Lake (Figure 9). Littoral areas were classified based primarily upon bed material type, shoreline gradient, presence / type of aquatic macrophytes and spawning potential for lake whitefish and lake trout. The littoral type with the highest suitability for spawning lake whitefish and lake trout (type #1) was uncommon in Mayo Lake and constituted approximately 2% of the total littoral length of the lake.

Lake whitefish spawning assessments involved the radio tagging of 16 adults from different areas of Mayo Lake. Telemetry surveys were successful in the identification of two spawning areas located on tributary streams to Mayo Lake (Figure 10). Four of the radio tags were relocated in Edwards Creek, a tributary to the east (Roop) arm of Mayo Lake. Spawning was confirmed in Edwards Creek by conducting visual assessments on the evening of October 7. A second likely spawning area was located in the nearby Roop Lakes / Roop Creek area where an additional three radio tags were located. The remainder of radio tagged lake whitefish remained near the initial tagging location or made irregular movements within the central portion of the lake (Figure 11). To further investigate the potential for lake whitefish spawning in the central portion of the lake, a substantial amount of sampling was conducted in this area and failed to locate any spawning locations.

Efforts to capture lake trout prior to the spawning period were unsuccessful, and as such, the spawning assessments for this species involved the sampling of potential spawning areas identified through littoral classification. Two locations were identified as lake trout spawning sites; Gull Island and an area east of Edmonton Creek. At Gull Island, 36 mature lake trout in spawning condition were captured and 10 individuals were radio tagged. Sampling conducted from September 9 to 26 documented spawning at this location in water depths ranging from approximately 1.0 m to 11.0 m with over 50% of the fish captured in 3.0 m of water or less. The Gull Island spawning area represents a notable spawning location for the lake trout population in Mayo Lake and has a number of attributes similar to other lake trout spawning sites in other areas. Telemetry surveys conducted during the post-spawning period found that 2 of the lake trout tagged at Gull Island had moved a substantial distance, including one individual which travelled to the south end of Nelson Arm (Figure 12).

There is some indication that lake trout spawning may occur east of Edmonton Creek within another area classified as a Type 1 littoral. During the daytime hours, sonar investigations revealed congregations of large fish in this area (similar to that was found at Gull Island). Considerable effort was expended to capture lake trout at this location during one night during the spawning season (September 25); only one mature lake

trout in spawning condition was captured and radio tagged. The low capture rates suggest that the numbers of spawners at this location may not be as significant as at the Gull Island site.

## Summary

In summary, there was an extensive amount of environmental information collected within the Mayo River watershed in 2008. We look forward in providing you all the detailed results in the Aquatic Baseline report in the near future. If you have any questions or concerns regarding this summary, please let me know.

Sincerely,

**EDI Environmental Dynamics Inc.**

Pat Tobler, R.P.Bio., CPESC

Vice President / Branch Manager

## Attachments

**Appendix A: Summary of fish sampling results.**

**Appendix B: Historic flow data.**

**Appendix C: Figures (as below).**

**Figure 1. Study area map.**
**Figure 2. Map of confirmed and suspected redd locations.**
**Figure 3. Fish sampling locations zones 1-3.**
**Figure 4. Habitat mapping for Reach 1.**
**Figure 5. Habitat mapping for Reach 2.**
**Figure 6. Habitat mapping for Reach 3.**
**Figure 7. Habitat mapping for reaches 4 and 5.**
**Figure 8. Map of fish sampling locations within Zone 4.**
**Figure 9. Littoral mapping of Mayo Lake.**
**Figure 10. Movements of lake whitefish radio tagged in Mayo Lake (1 of 2).**
**Figure 11. Movements of lake whitefish radio tagged in Mayo Lake (2 of 2).**
**Figure 12. Movements of lake trout radio tagged in Mayo Lake.**

## Mayo River Fish Sampling Data (Aquatic Zones 1 through 3 – Reaches 1 through 5)

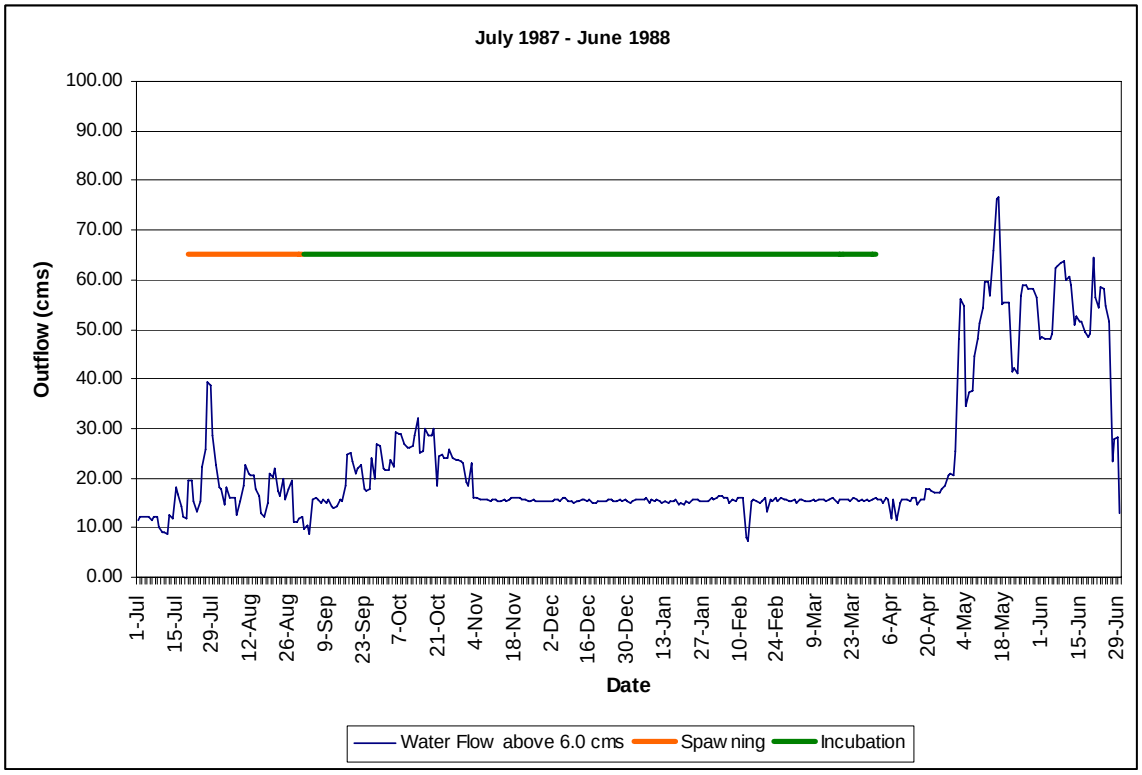
| Location | Sampling Method | Chinook | Grayling | | | Round Whitefish | | | Lake Whitefish | | | Longnose Sucker | | | Burbot | | | Northern Pike | | | Slimy Sculpin | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fry | Fry | Juvenile | Adult | Fry | Juvenile | Adult | Fry | Juvenile | Adult | Fry | Juvenile | Adult | Fry | Juvenile | Adult | Fry | Juvenile | Adult | All | |
| Reach 1 | Beach Seining | | | 1 | | | | 2 | | | | | | | | | | | | | | 3 |
| | Electrofishing | 46 | | 3 | | | | | | | | | | | | 3 | 1 | | | | 12 | 65 |
| | Minnow Trapping | 178 | | | | | | | | | | | | | | 2 | | | | | | 180 |
| | *TOTAL* | *224* | *0* | *4* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *5* | *1* | *0* | *0* | *0* | *12* | *248* |
| Reach 2 | Beach Seining | | | | 25 | | 1 | 1 | | 1 | 1 | | | 3 | | | | | | | | 32 |
| | Electrofishing | 39 | 2 | 1 | | | | | | 1 | | 5 | | | 2 | 8 | | | 1 | | 19 | 78 |
| | Minnow Trapping | 143 | | | | | | | | | | | | | | 3 | | | | | | 146 |
| | *TOTAL* | *182* | *2* | *1* | *25* | *0* | *1* | *1* | *0* | *2* | *1* | *5* | *0* | *3* | *2* | *11* | *0* | *0* | *1* | *0* | *19* | *256* |
| Reach 3 | Beach Seining | 0 | | | 2 | | | | | | | | | | | | | | | | | 2 |
| | Electrofishing | 57 | 1 | 1 | | | | | | | | 2 | | | 3 | 1 | 1 | | | | 8 | 74 |
| | Minnow Trapping | 63 | | | | | | | | | | | | | | 3 | | | | | | 66 |
| | *TOTAL* | *120* | *1* | *1* | *2* | *0* | *0* | *0* | *0* | *0* | *0* | *2* | *0* | *0* | *3* | *4* | *1* | *0* | *0* | *0* | *8* | *142* |
| Reach 4 | Beach Seining | | | | | | | | | | | | | | | | | | | | | 0 |
| | Electrofishing | 23 | 2 | 3 | 1 | | | | | | | | | | 1 | 2 | | | | | 3 | 35 |
| | Minnow Trapping | 53 | | | | | | | | | | | | | | 1 | | | | | | 54 |
| | *TOTAL* | *76* | *2* | *3* | *1* | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *1* | *3* | *0* | *0* | *0* | *0* | *3* | *89* |
| Reach 5 | Beach Seining | | | | | | | | | | | | | | | | | | | | | N/A |
| | Electrofishing | 9 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10 | 24 |
| | Minnow Trapping | 48 | | | | | | | | | | | | | | | | | | | | 48 |
| | *TOTAL* | *57* | *0* | *1* | *1* | *0* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *0* | *0* | *1* | *0* | *0* | *0* | *0* | *10* | *72* |
| **TOTAL** | | **659** | **5** | **10** | **29** | **0** | **1** | **3** | **0** | **4** | **1** | **7** | **0** | **3** | **6** | **24** | **2** | **0** | **1** | **0** | **52** | **807** |

## Mayo River Fish Sampling Data (Aquatic Zone 4 – Reaches 7 through 12)

| Location | Sampling Method | Effort | | | Arctic Grayling | | | Round Whitefish | | | Lake Whitefish | | | Longnose Sucker | | | Burbot | | | Northern Pike | | | Slimy Sculpin | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Beach Seining (# / m²) | Electrofishing (s / m) | Minnow Trapping (hrs) | Fry | Juvenile | Adult | Fry | Juvenile | Adult | Fry | Juvenile | Adult | Fry | Juvenile | Adult | Fry | Juvenile | Adult | Fry | Juvenile | Adult | All | |
| Reach 7 | Beach Seining | 4 / 3000 | | | | | | | | | | | | | | | | | | | | | | **0** |
| | Electrofishing | | 1161 / 125 | | 1 | | | | | | | | | | | | 3 | | 1 | | 3 | | 6 | **14** |
| | Minnow Trapping | | | 240.8 | | | | | | | | | | | | | | | | | 1 | | 1 | **2** |
| | *TOTAL* | | | | *1* | | | | | | | | | | | | *3* | | *1* | | *4* | | *7* | ***16*** |
| Reach 8 | Beach Seining | 4 / 3600 | | | | 4 | 14 | | 2 | | | 24 | | | | | | | | | | | | **44** |
| | Electrofishing | | 1662 / 245 | | 3 | 11 | 2 | | | | | | | 2 | | 2 | | 2 | 3 | | | | 25 | **50** |
| | Minnow Trapping | | | 271.8 | | | | | | | | | | | | | | 4 | | | 2 | | | **6** |
| | *TOTAL* | | | | *3* | *15* | *16* | | *2* | | | *24* | | *2* | | *2* | | *6* | *3* | | *2* | | *25* | ***100*** |
| Reach 9 | Beach Seining | 4 / 2600 | | | | | 1 | | | 2 | | | | | | | | | | | | | | **3** |
| | Electrofishing | | 2422 / 590 | | 8 | 1 | 1 | | | | | | | | | | | 10 | | | | | 43 | **63** |
| | Minnow Trapping | | | 282.7 | | | | | | | | | | | | | | 1 | | | | | | **1** |
| | *TOTAL* | | | | *8* | *1* | *2* | | *2* | *2* | | *24* | | *2* | | *2* | | *17* | *3* | | *2* | | *68* | ***167*** |
| Reach 10 | Beach Seining | 8 / 6000 | | | | | 1 | | | 1 | | | | | | | | | | | | | | **2** |
| | Electrofishing | | 2174 / 395 | | 4 | | | | | | | | | | | 1 | | 4 | | | | | 70 | **79** |
| | Minnow Trapping | | | 337.9 | 1 | | | | | | | | | | | | | 3 | | | | | 1 | **5** |
| | *TOTAL* | | | | *5* | | *1* | | | *1* | | | | | | *1* | | *7* | | | | | *71* | ***86*** |
| Reach 11 | Beach Seining | 4 / 2200 | | | | | | | | | 1 | | | | | | | | | | | | 1 | **2** |
| | Electrofishing | | 1014 / 198 | | 1 | | | | | | | | | | | | | | | | | | 18 | **19** |
| | Minnow Trapping | | | 265.7 | | | | | | | | | | | | | | 1 | | | | | | **1** |
| | *TOTAL* | | | | *1* | | | | | | *1* | | | | | | | *1* | | | | | *19* | ***22*** |
| Reach 12 | Beach Seining | 4 / 2400 | | | | | 3 | | | 1 | 2 | | | 1 | | | | | | | | 1 | | **8** |
| | Electrofishing | | 1280 / 270 | | 11 | | | | | | | | | | | | | 1 | | | | | 65 | **77** |
| | Minnow Trapping | | | 237.7 | 2 | | | | | | | | | | | | | | | | | | | **2** |
| | *TOTAL* | | | | *13* | | *3* | | | *1* | *2* | | | *1* | | | | *1* | | | | *1* | *65* | ***87*** |
| **TOTAL** | | | | | **34** | **31** | **38** | **4** | | **4** | **51** | | | **4** | | **6** | **3** | **32** | **7** | **8** | | **1** | **255** | **478** |

## Mayo Lake Fish Sampling Data (Aquatic Zone 5)

| Date | Sampling Method | # of Sets | Sampling Timing | Effort (hrs) | Total Fish Captured | Lake Whitefish Tagged | Lake Trout Tagged | Live | | | | | | | | | | Mortality | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Burbot | Arctic Grayling | Longnose Sucker | | Lake Trout | | Lake Whitefish | | Northern Pike | Round Whitefish | Arctic Grayling | Lake Trout | Lake Whitefish | | Round Whitefish |
| | | | | | | | | Adult | Juvenile | Juvenile | Adult | Juvenile | Adult | Juvenile | Adult | Adult | Adult | Adult | Juvenile | Juvenile | Adult | Adult |
| Sept 5 - Oct 8 | Gillnet | 81 | daytime | 63.98 | 98 | 8 | 0 | | 3 | | | 1 | | 2 | 26 | 30 | 21 | 1 | 1 | 6 | 4 | 3 |
| Sept 9 - Oct 8 | Gillnet | 60 | evening | 18.33 | 80 | 8 | 11 | 3 | | 1 | 3 | 2 | 39 | | 28 | 2 | 7 | | | | | 1 |
| Sept 5 - Sept 8 | Angling | NA | daytime | 17 | 14 | | | | | | | 2 | 10 | | | | | | 1 | | | |
| TOTAL | | 141 | | | 192 | 16 | 11 | 3 | 3 | 1 | 3 | 5 | 49 | 2 | 54 | 32 | 28 | 1 | 2 | 6 | 4 | 4 |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40.00
30.00
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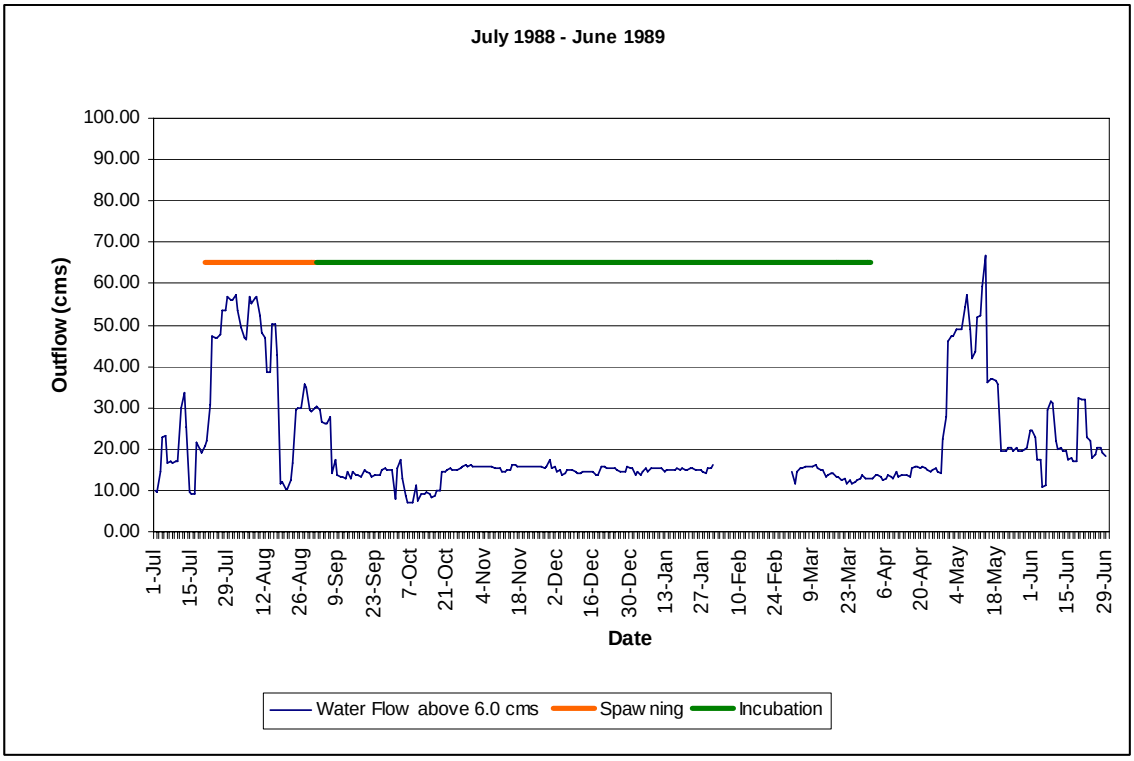
10.00
0.00
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow above 6.0 cms
Spaw ning
Incubation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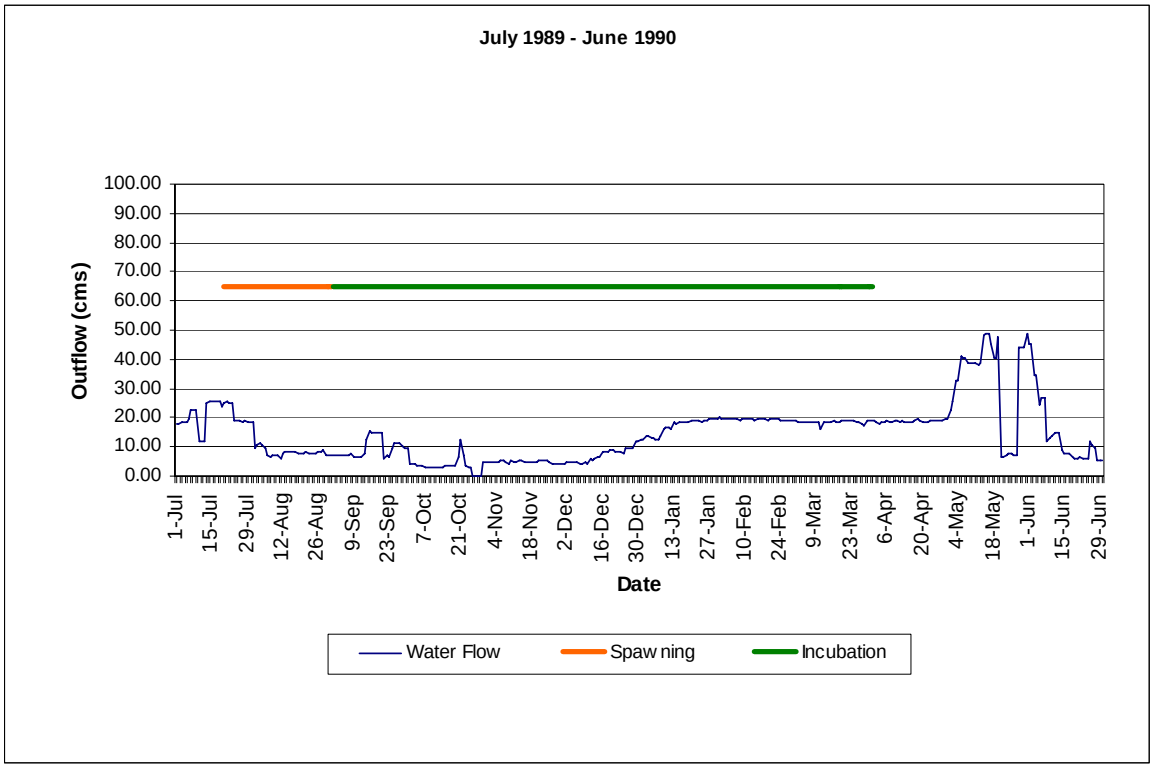
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow above 6.0 cms
Spaw ning
Incubation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Outflow (cms)
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60.00
50.00
40.00
30.00
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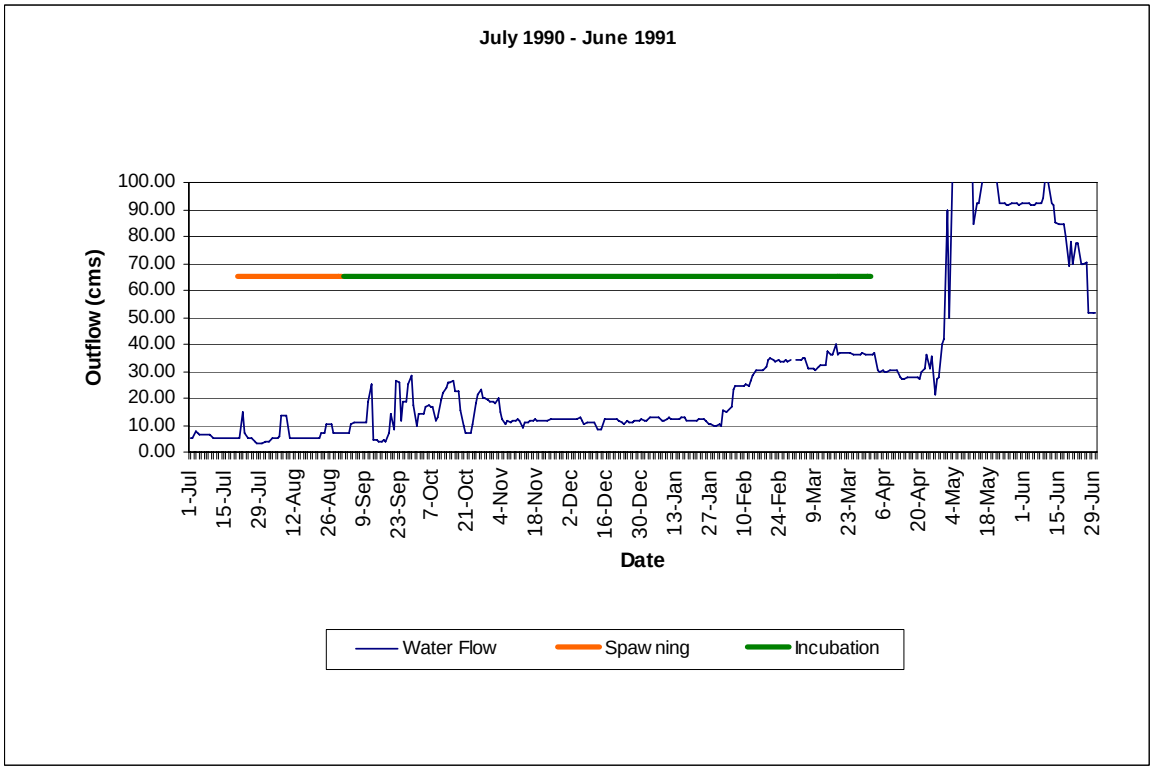
10.00
0.00
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spaw ning
Incubation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Outflow (cms)
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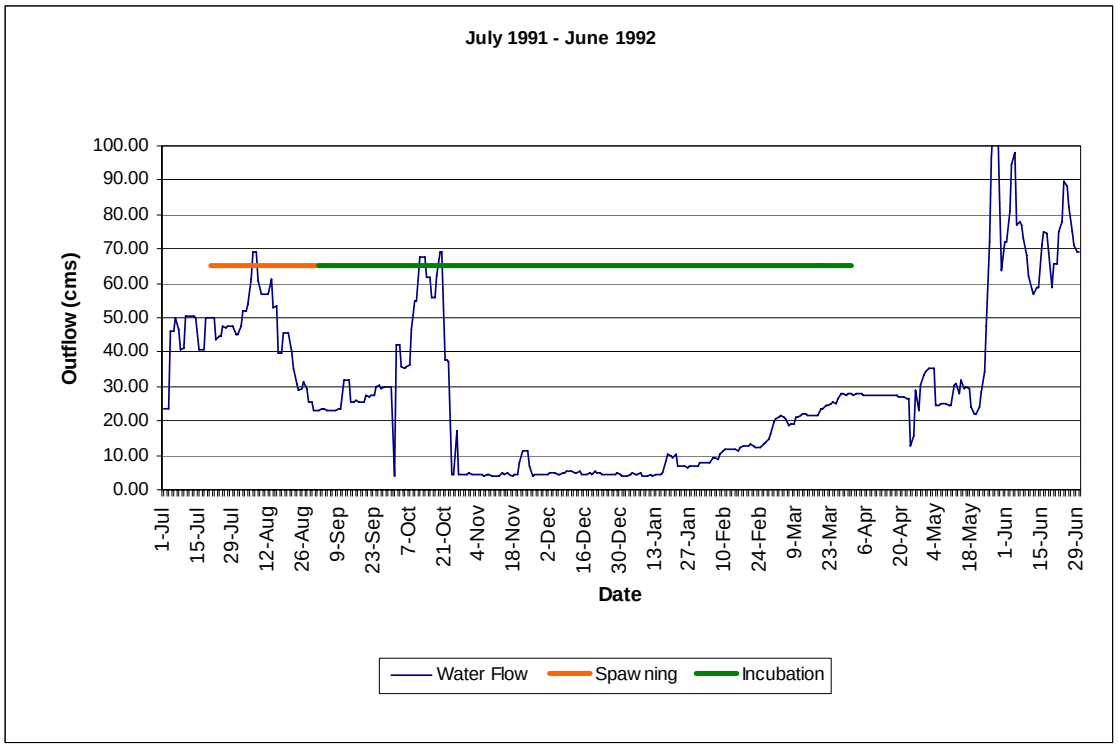
0.00
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spaw ning
Incubation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12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
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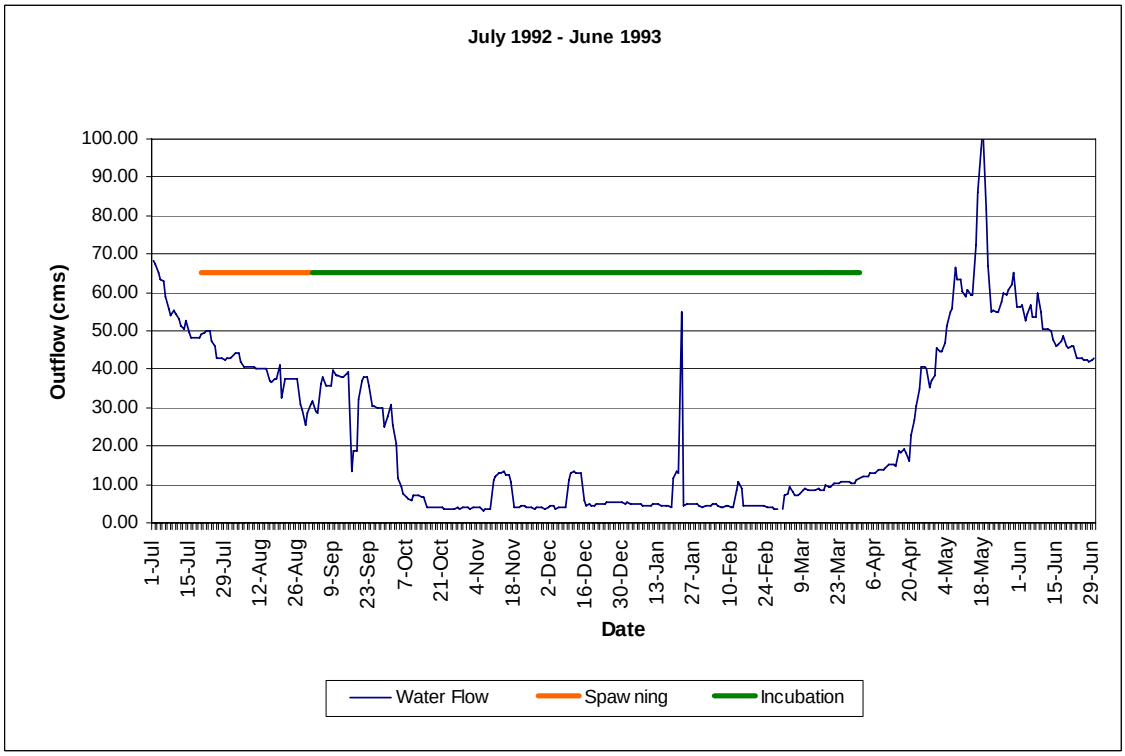
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spawning
Incubation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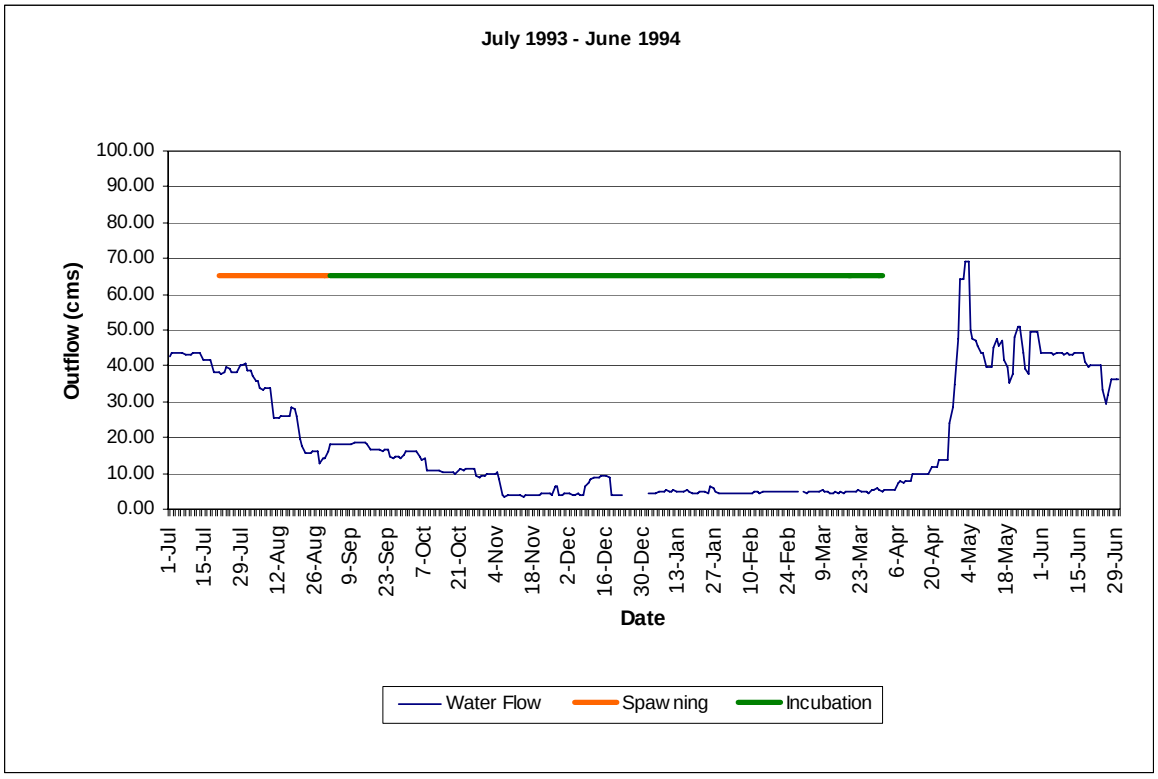
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spawning
Incubation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10.00
0.00
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
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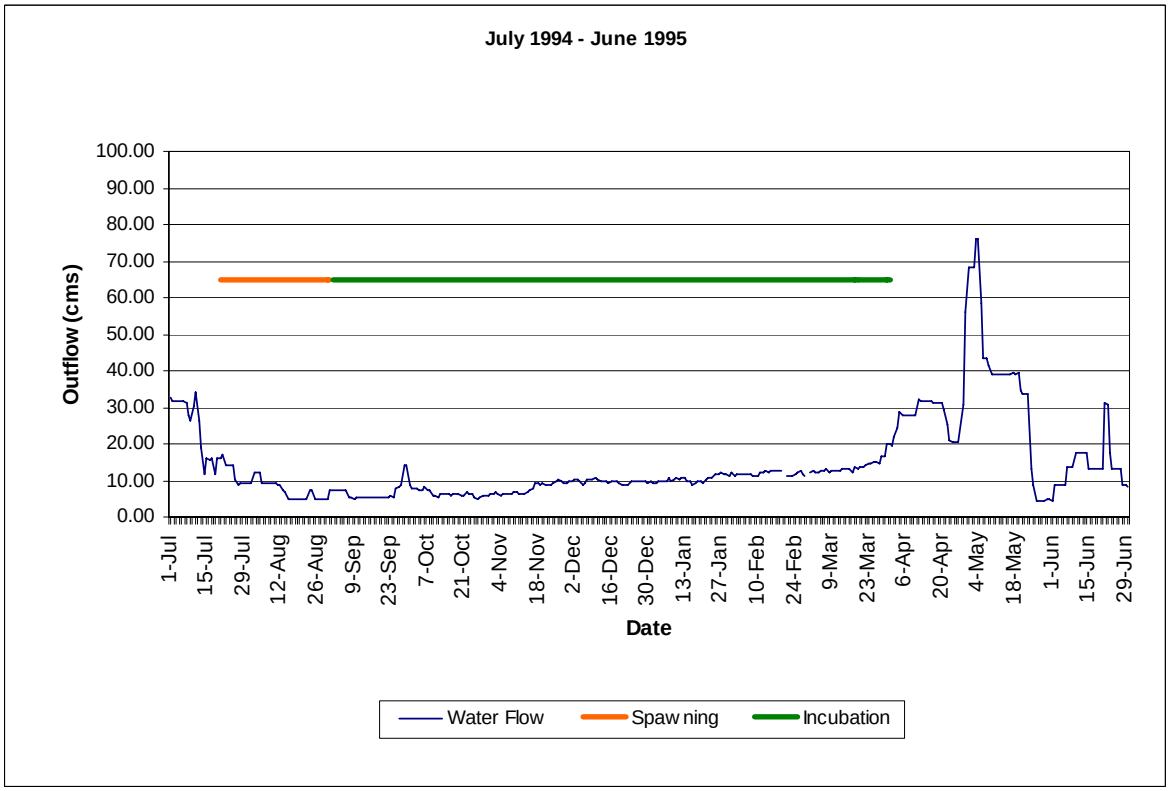
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spawning
Incubation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10.00
0.00
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
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6-Apr
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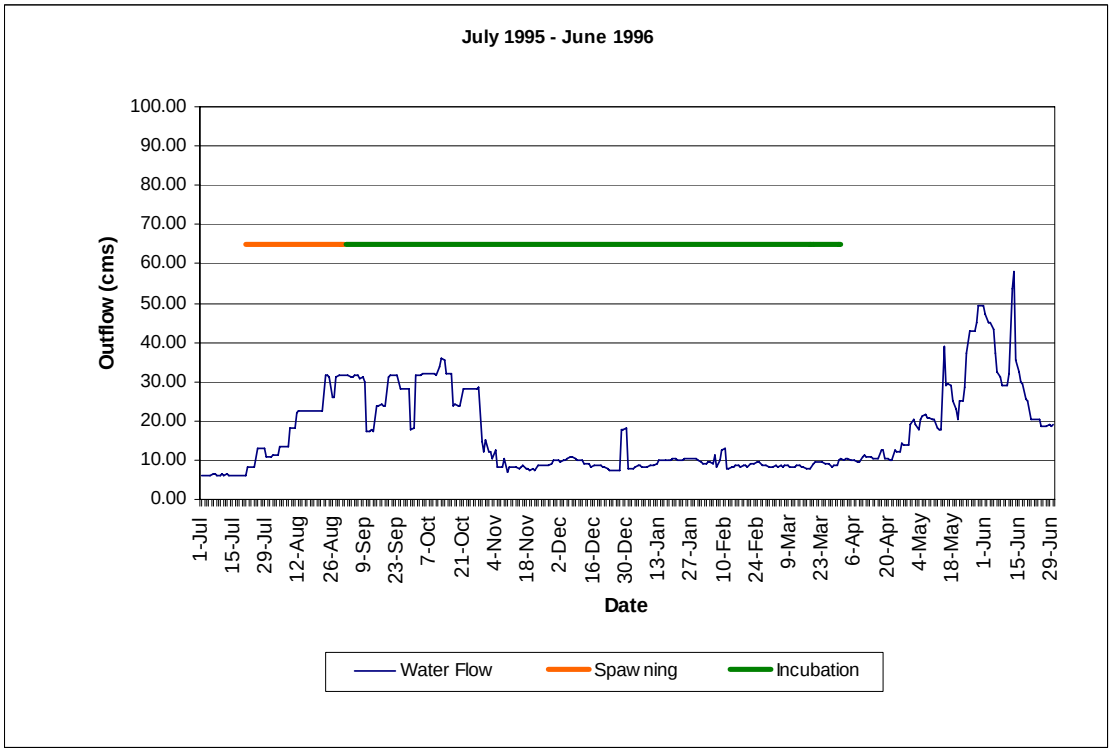
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spawning
Incubation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12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
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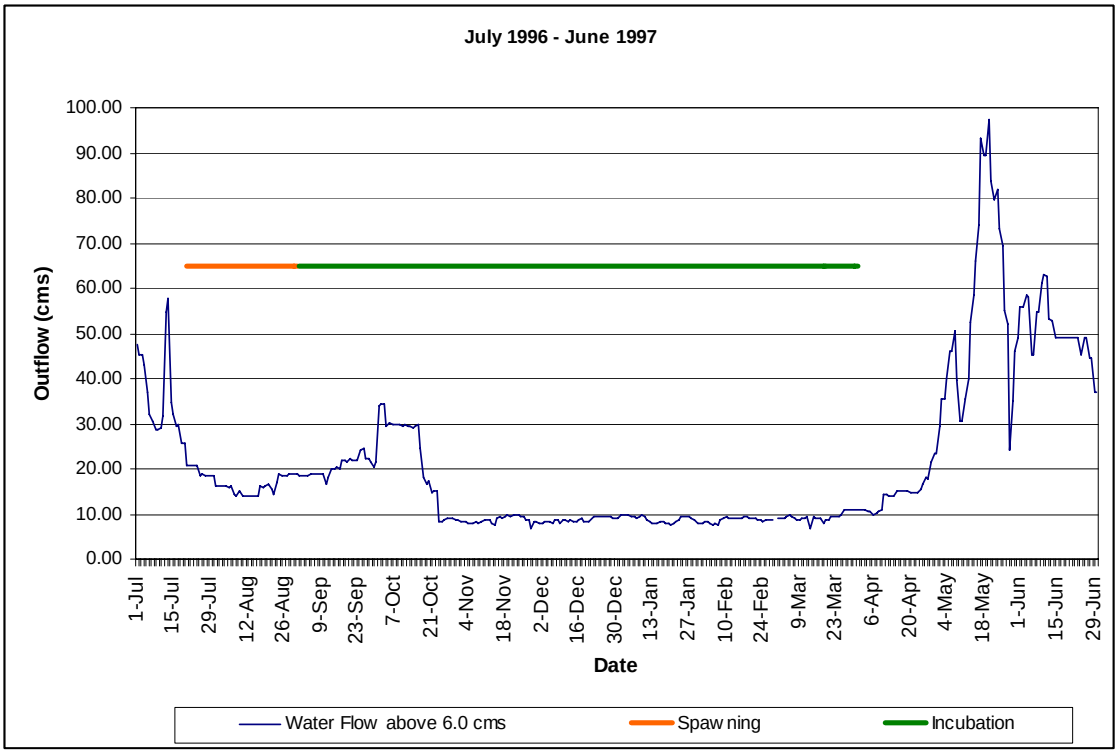
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spaw ning
Incubation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15-Jul
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12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
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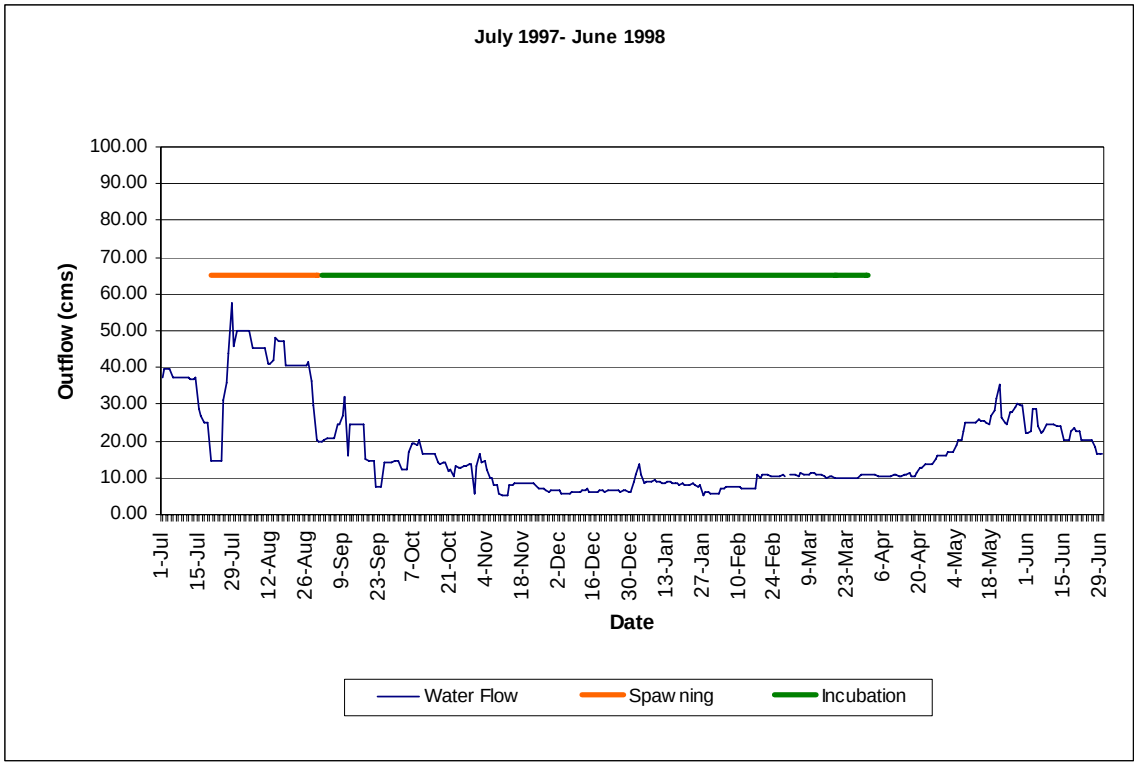
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow above 6.0 cms
Spaw ning
Incubation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40.00
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10-Feb
24-Feb
9-Mar
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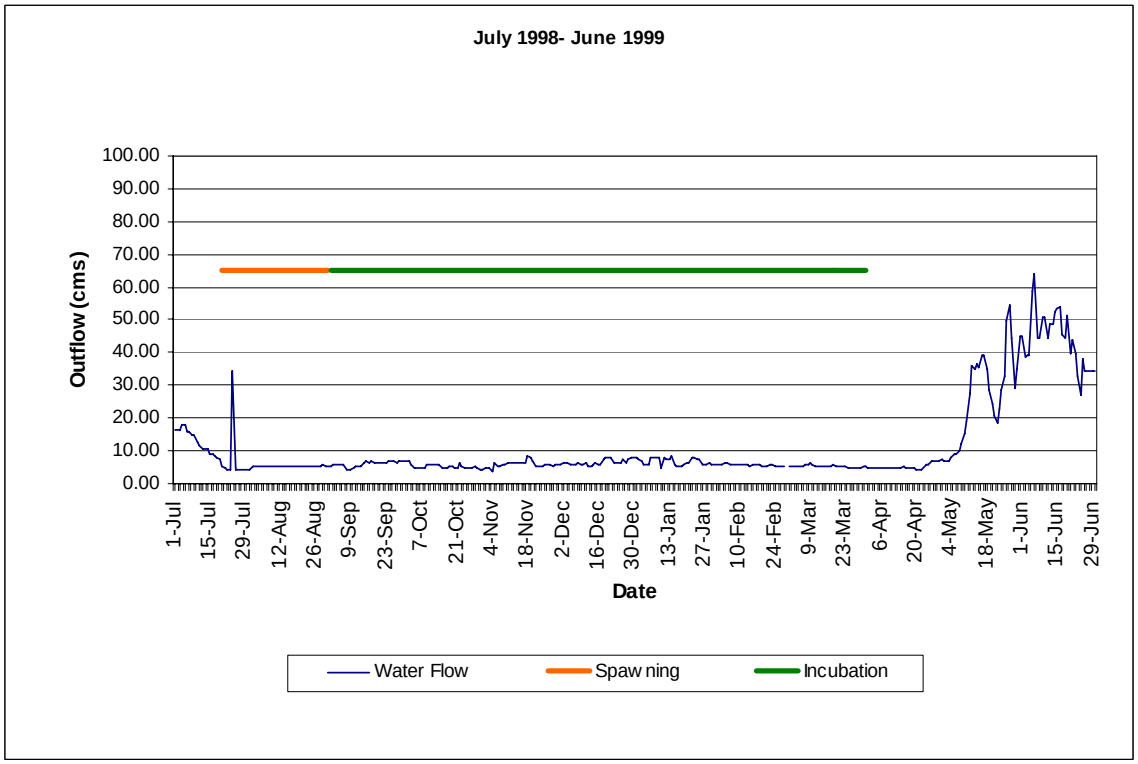
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spaw ning
Incubation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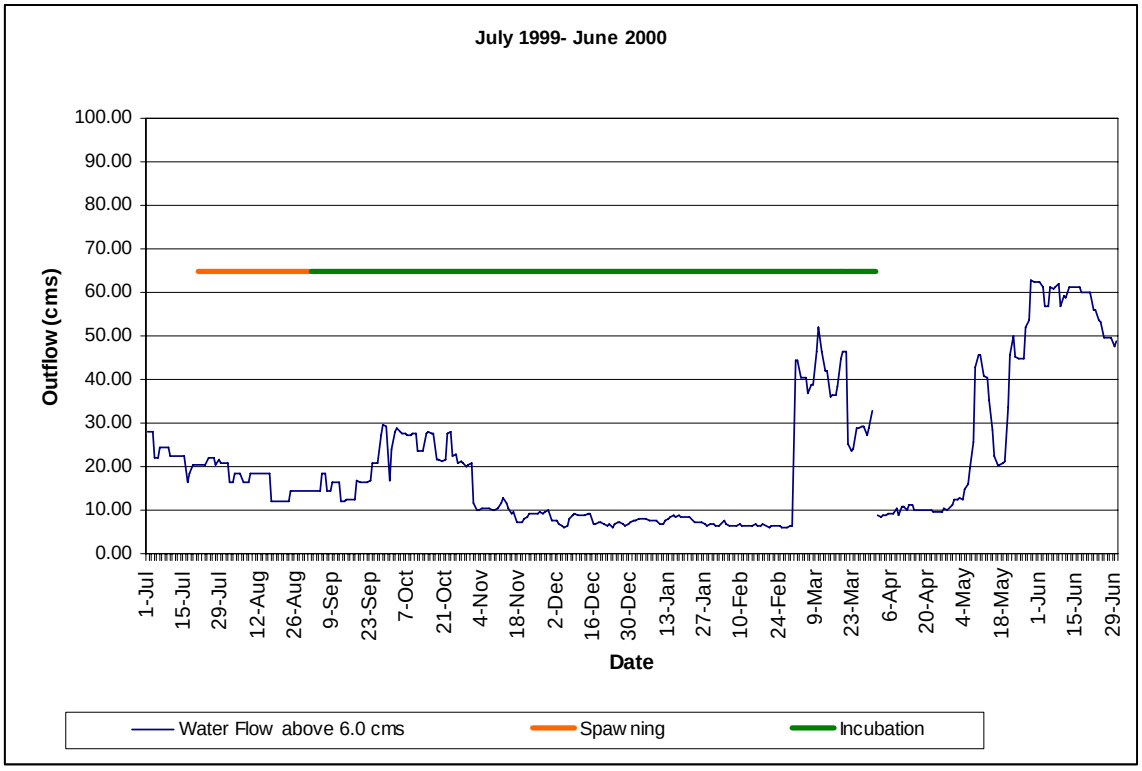
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spaw ning
Incubation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20.00
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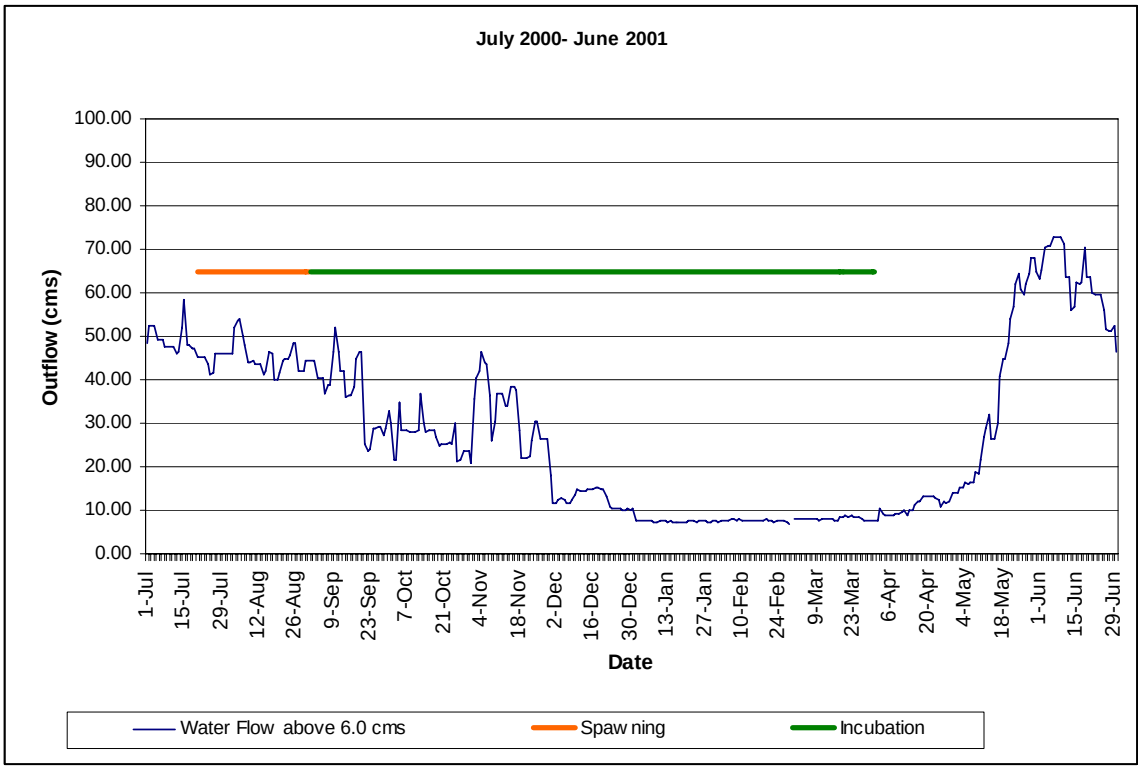
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow above 6.0 cms
Spawning
Incubation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Outflow (cms)
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30.00
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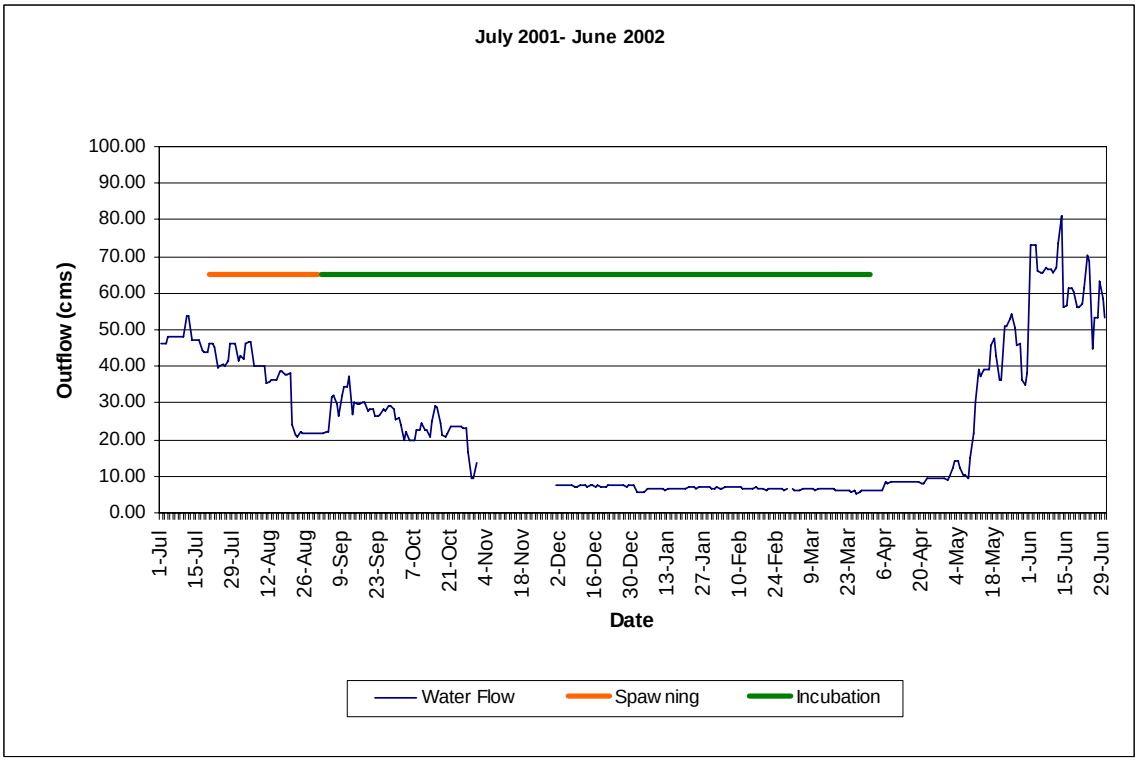
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow above 6.0 cms
Spawning
Incubation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Outflow (cms)
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70.00
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30.00
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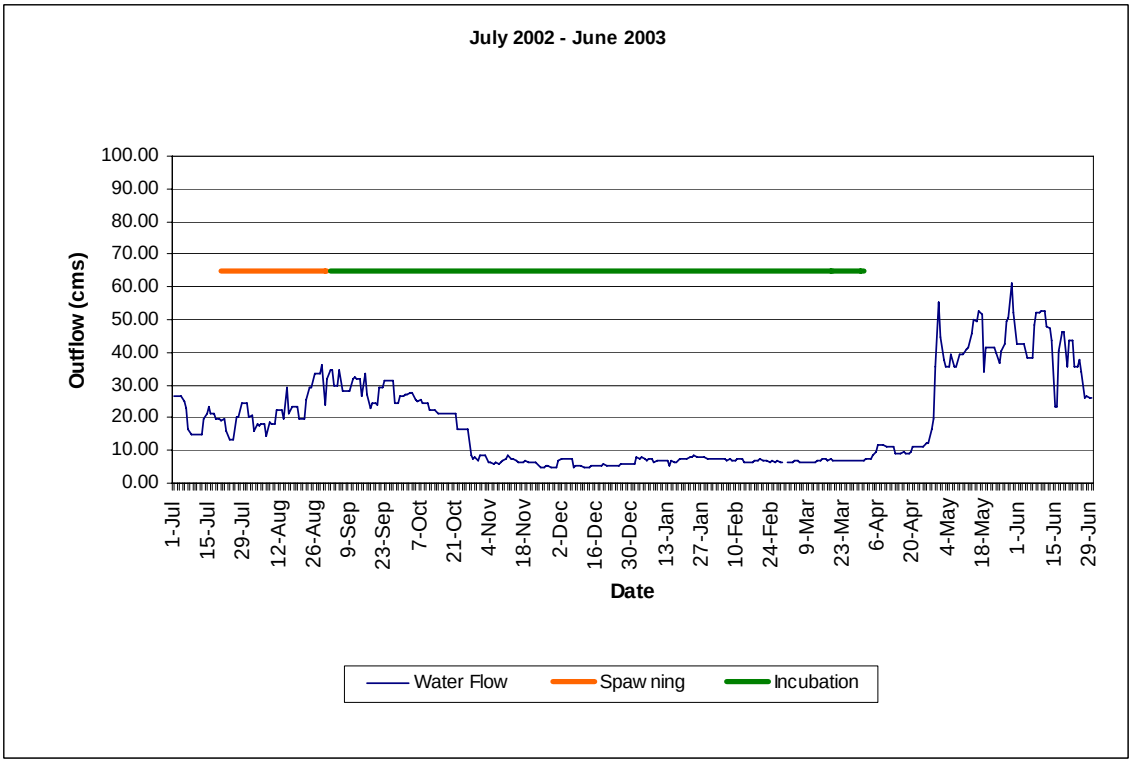
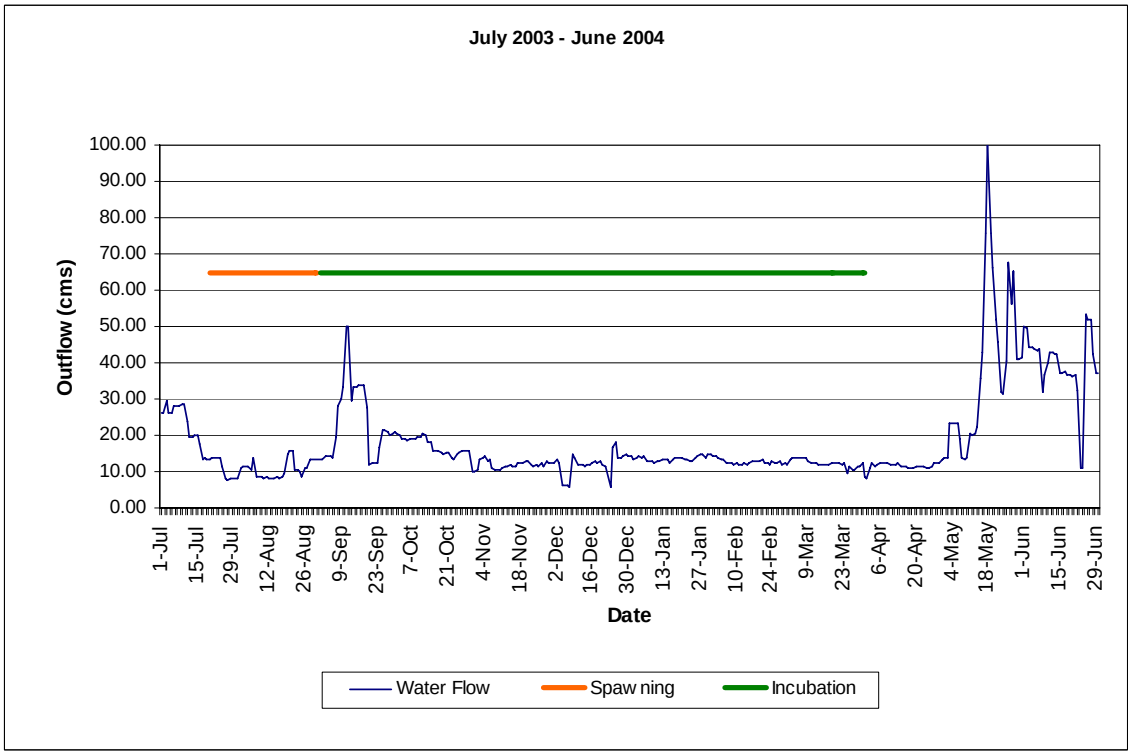
0.00
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spaw ning
Incubation


July 2002 - June 2003
Outflow (cms)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spaw ning
Incubation


July 2003 - June 2004
Outflow (cms)
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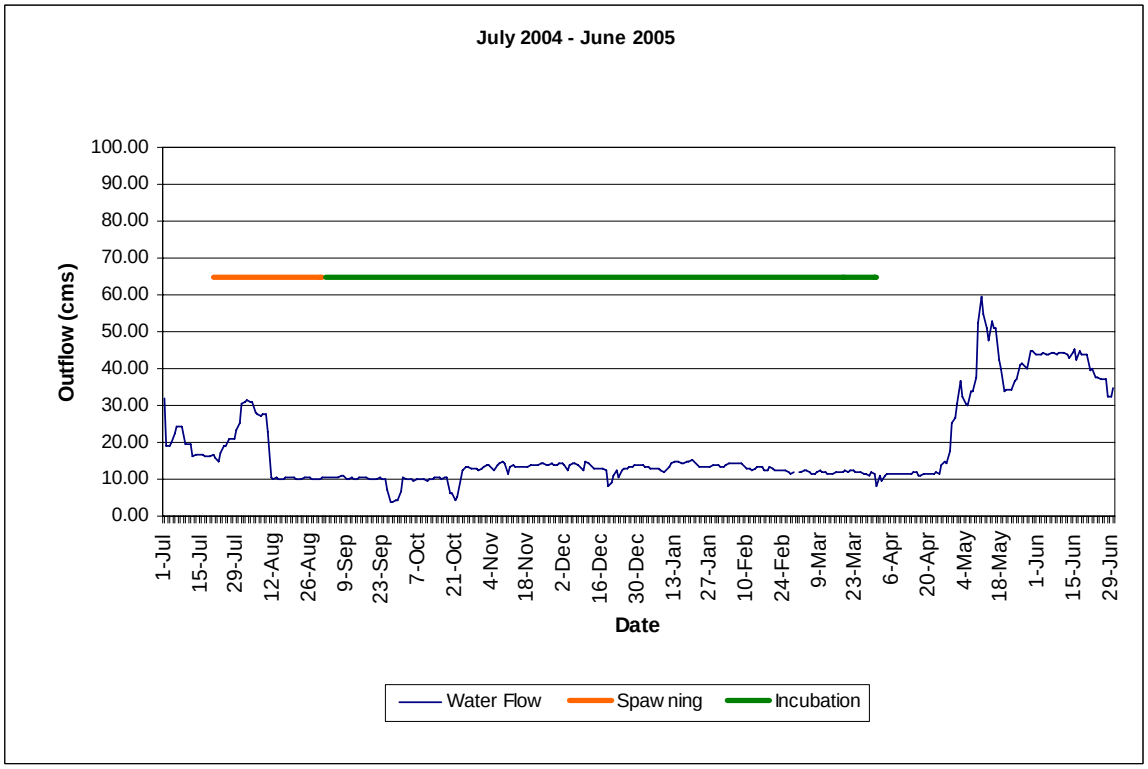
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spaw ning
Incubation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Outflow (cms)
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70.00
60.00
50.00
40.00
30.00
20.00
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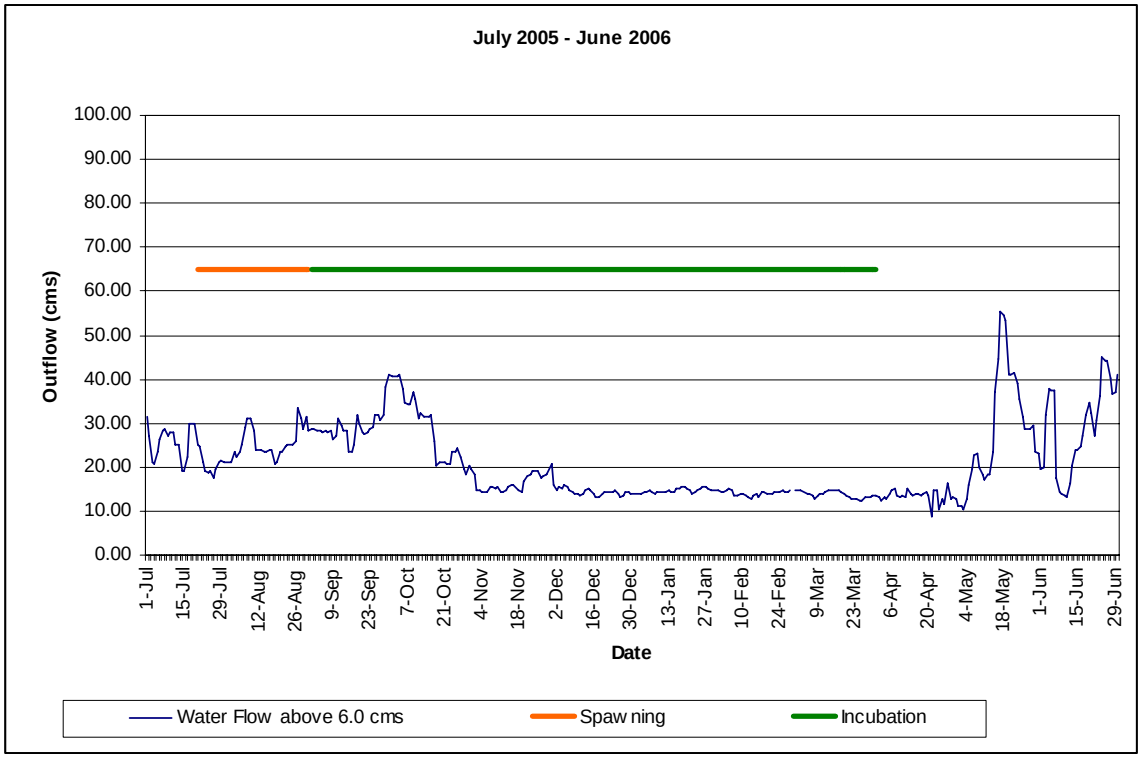
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow
Spaw ning
Incubation


July 2005 - June 2006
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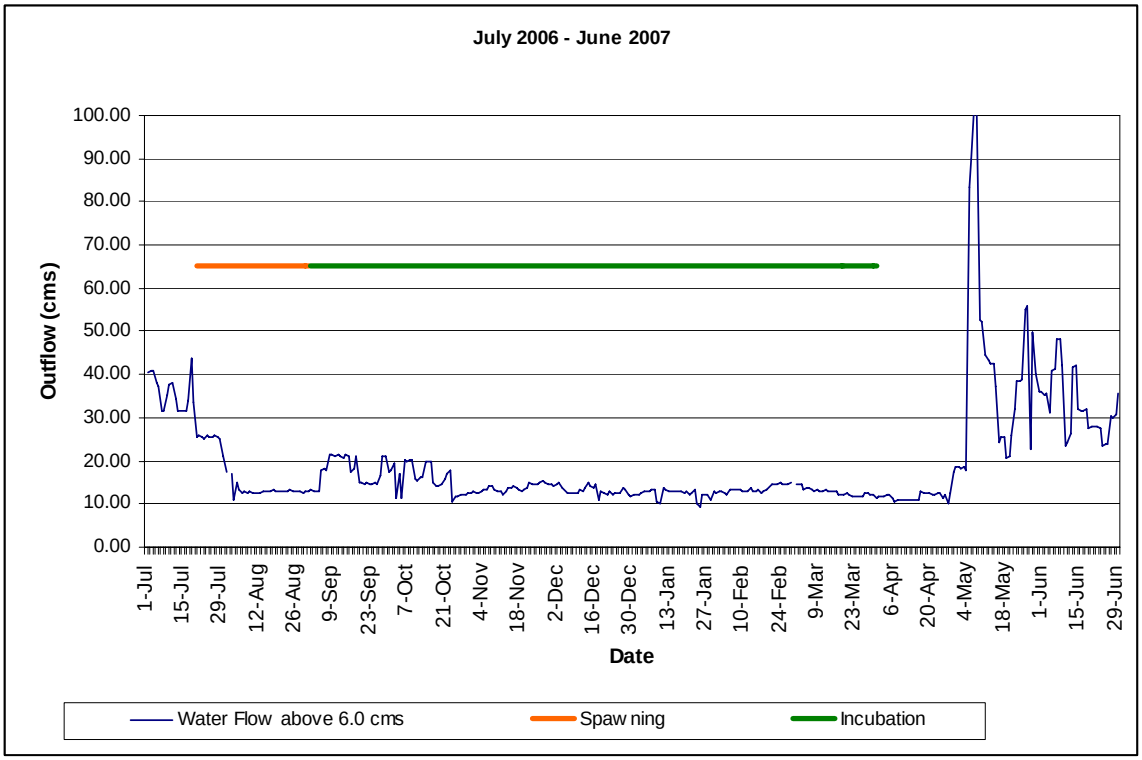
50.00
40.00
30.00
20.00
10.00
0.00
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow above 6.0 cms
Spawning
Incubation


July 2006 - June 2007
Outflow (cms)
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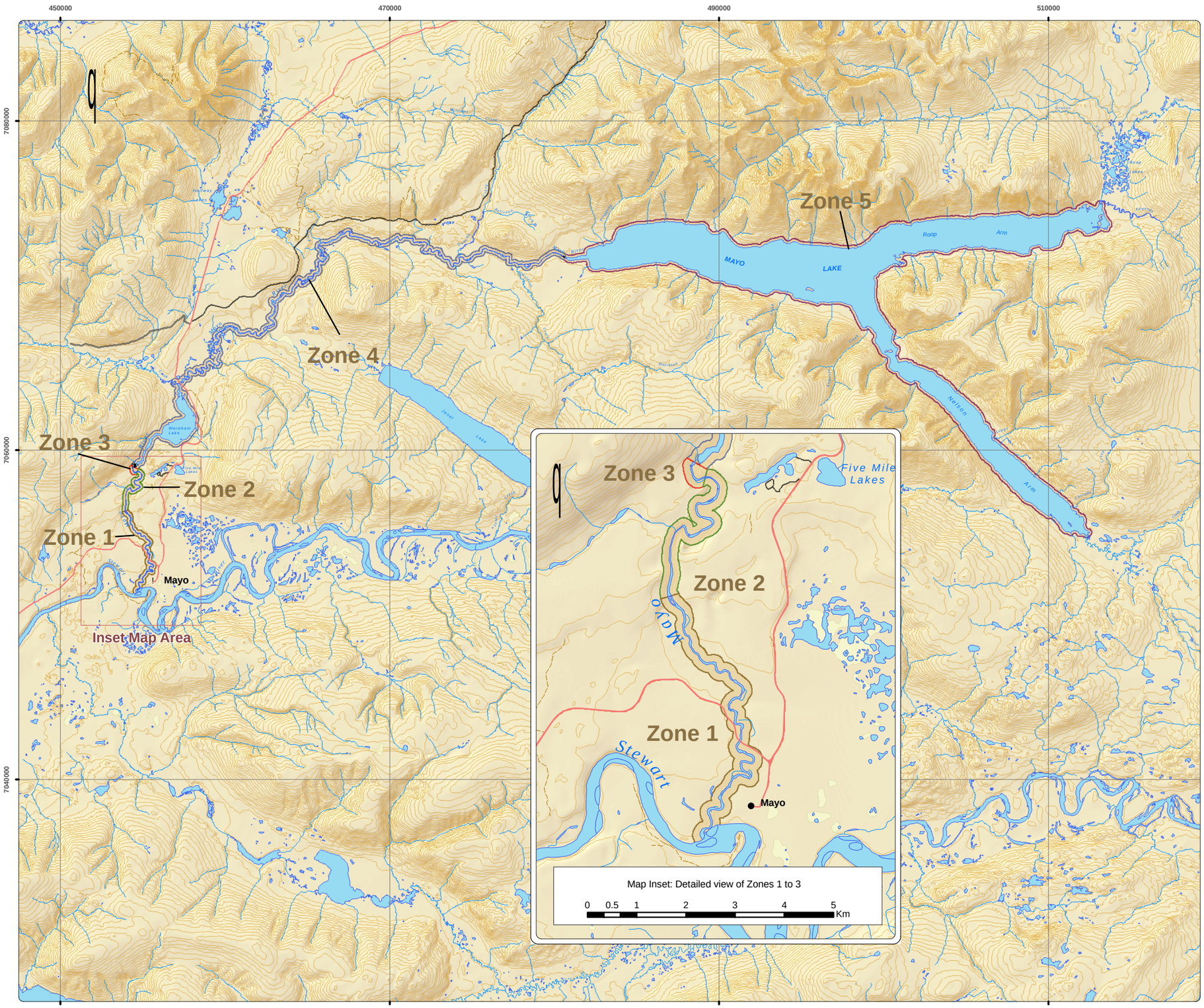
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1-Jul
15-Jul
29-Jul
12-Aug
26-Aug
9-Sep
23-Sep
7-Oct
21-Oct
4-Nov
18-Nov
2-Dec
16-Dec
30-Dec
13-Jan
27-Jan
10-Feb
24-Feb
9-Mar
23-Mar
6-Apr
20-Apr
4-May
18-May
1-Jun
15-Jun
29-Jun
Date
Water Flow above 6.0 cms
Spawning
Incubation





## Legend

**Aquatic Zone Classification**

- .....Zone 1- Downstream of New Powerhouse
- .....Zone 2 - Between Existing to New Powerhouse
- .....Zone 3 - Spillway to Existing Powerhouse
- .....Zone 4 - Wareham Lake to Mayo Lake
- .....Zone 5 - Mayo Lake

**Topography**

- ! .....Village of Mayo
- .....Roads
- .....Contours
- .....Watercourse
- .....Waterbody
- .....Wetlands
- .....Trails

0 2.5 5 10 15
Kilometres

Drawn By: M. Power
Checked By: P. Tobler
Date: 18 November 2008

Projection: NAD 1983 UTM Zone 8
EDI Project #: 08-YC-0037

**DRAFT**

Digital Data Sources:

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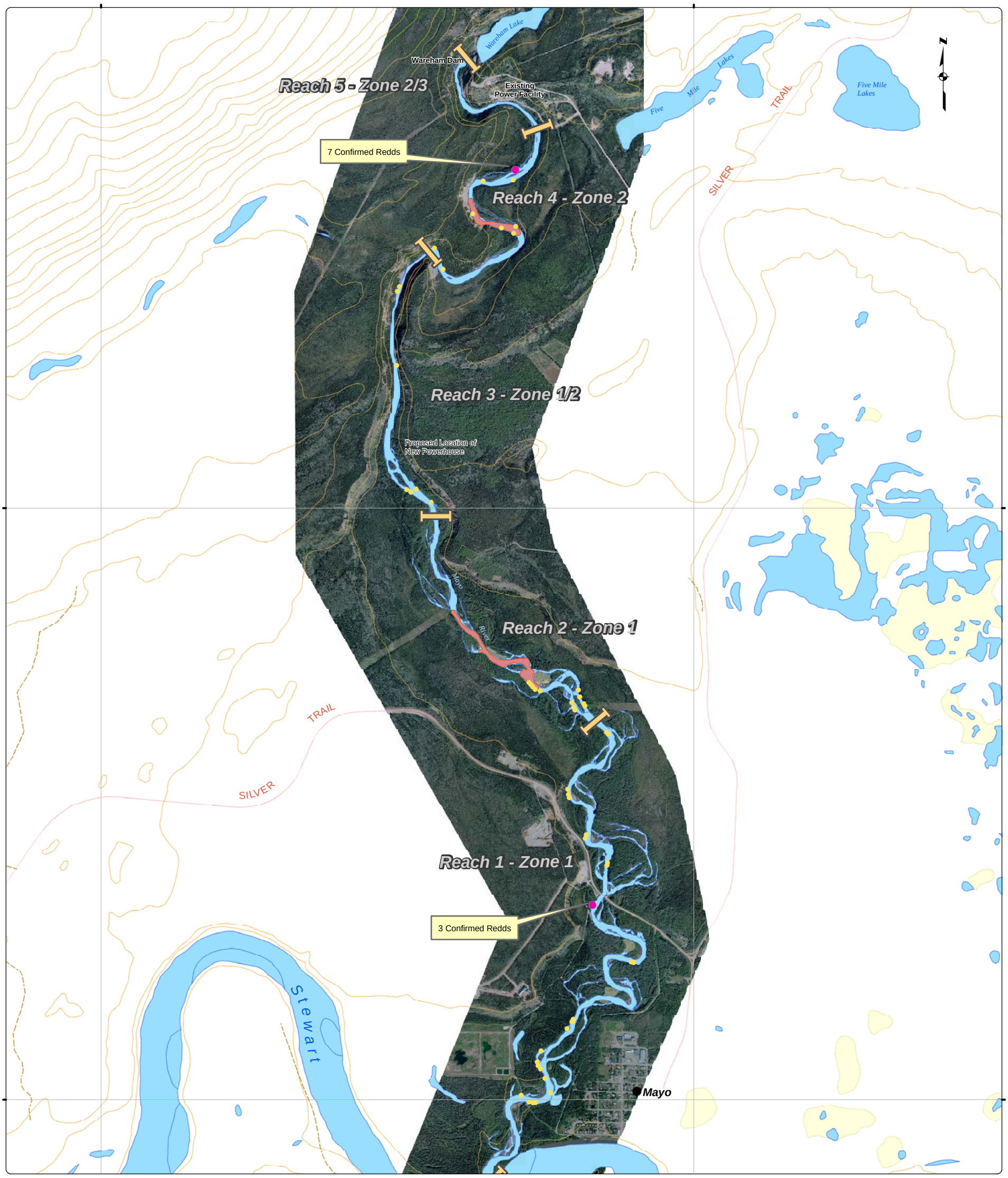
**Figure 1: Study Area Map**

YUKON ENERGY

EDI ENVIRONMENTAL DYNAMICS INC.
Natural Resource Consultants




**Legend**

**Topographic Features**

- .....Village of Mayo
- .....Roads
- .....Contours
- .....Watercourse
- .....Waterbody
- .....Wetlands

**Salmon Redd Locations (Sept. 15, 2008)**

- .....Confirmed
- .....Unconfirmed
- .....Chinook Spawning Area (Triton,1992)

**Mayo River Reaches**

- .....Reach Break

0 250 500 1,000 1,500 2,000

Metres

Drawn By: M. Power
Checked By: P. Tobler
Date: 18 November 2008
Projection: NAD 1983 UTM Zone 8
EDI Project #: 08-YC-0037

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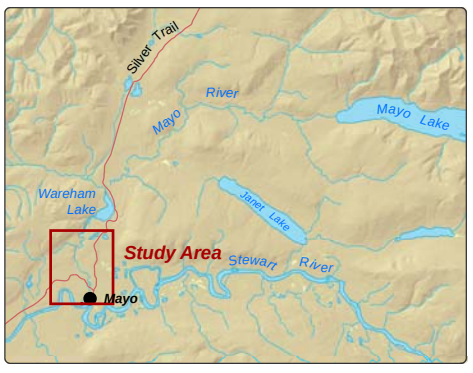


**Figure 2:**
**Confirmed/Suspected Redd Locations**

EDI ENVIRONMENTAL DYNAMICS INC.
Natural Resource Consultants

YUKON ENERGY

45200 45600

Reach 5 - Zone 2/3
Reach 4 - Zone 2
Reach 3 - Zone 1/2
Reach 2 - Zone 1
Reach 1 - Zone 1

Wareham Dam
Existing Power Facility
Proposed Location of New Powerhouse
Five Mile Lakes
Five Mile Lakes TRAIL
SILVER TRAIL
Mayo River
Stewart
Mayo

5EF2 5T02 5EF3 5T08 5T06 5T09 5T07 5T10 4T02 5EF1 4T03
4B01 4T04 4T05 4B02 4EF4 4EF1 4EF3 3B01 3T10 4T10 4T07 4T08 4T09
3T09 3T08 3T07 3T06 3EF3 3T05 3EF2 3T04 3T03 3EF1 3T02 3T01
2T08 2T09 2EF3 2EF2 2EF4 2EF1 2T07 2B01 2B02 2T10 2B03 2T11 2T06 2T05
1B 1A 1C 1B01 2T04 2T03 1B02 1EF3 2T01 1B03 1T14 1EF4 1T13 1T12 1T11 1B04 1EF2 1T10 1T09 1EF1 1T08 1T06 1T07 1T03 1T04 1T05 1T02 1T01

70560 70560
70520 70520

**Legend**

**Topographic Features**
- .....Village of Mayo
- .....Roads
- .....Contours
- .....Watercourse
- .....Wetlands
- .....Waterbody

**Fish Sampling Sites (July - October 2008)**
**Sampling Method**
- .....Beach Seining
- .....Electrofishing
- .....Minnow Trapping

**Mayo River Reaches**
- .....Reach Break

0 250 500 1,000 1,500 2,000
Metres

Drawn By: M. Power
Checked By: P. Tobler
Date: 18 November 2008
Projection: NAD 1983 UTM Zone 8
EDI Project #: 08-YC-0037

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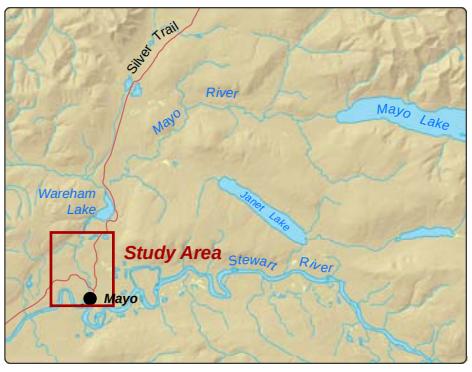
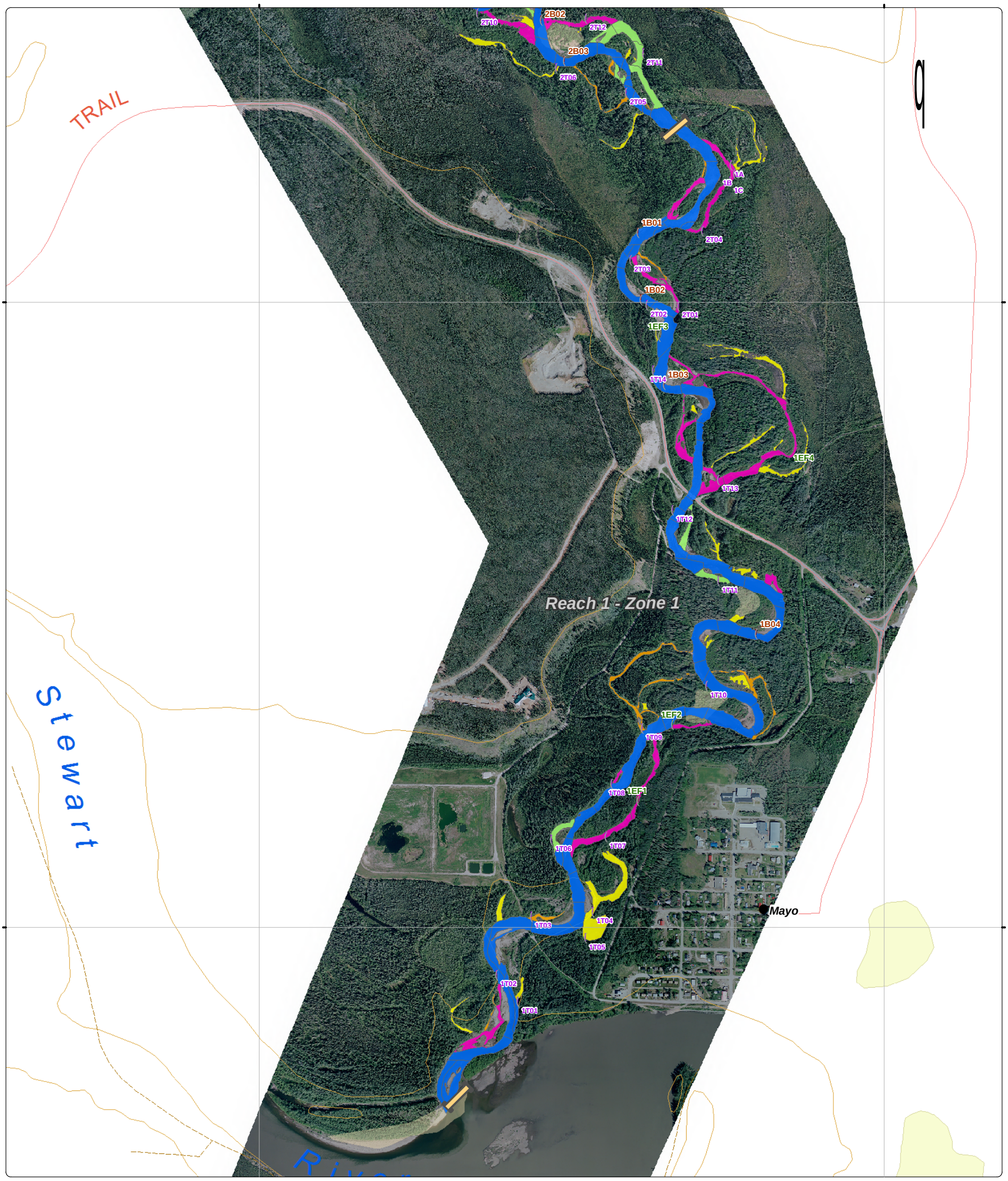



**Figure 3:**
**Fish Sampling Locations - Zones 1 to 3**

EDI ENVIRONMENTAL DYNAMICS INC.
YUKON ENERGY




**Legend**

**Topographic Features**

- ! .....Village of Mayo
- .....Roads
- .....Contours
- .....Wetlands

**Mayo River Habitat Classification**

- .....Main Channel
- .....Primary Side Channel
- .....Secondary Side Channel
- .....Tertiary Side Channel
- .....Back Channel

**Fish Sampling Sites (July - Oct.)**

**Sampling Method**

- .....Beach Seining
- .....Electrofishing
- .....Minnow Trapping

**Mayo River Reaches**

- .....Reach Break

0 100 200 400 600 800 1,000

Metres

Drawn By: M. Power
Checked By: P. Tobler
Date: 18 November 2008
Projection: NAD 1983 UTM Zone 8
EDI Project #: 08-YC-0037

**DRAFT**

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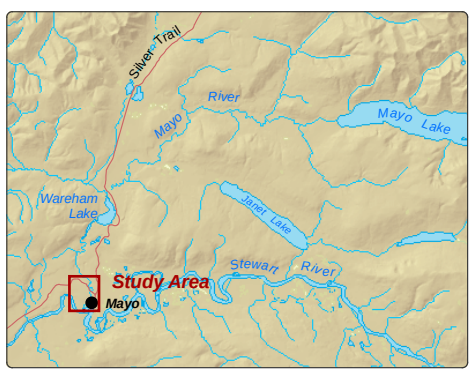
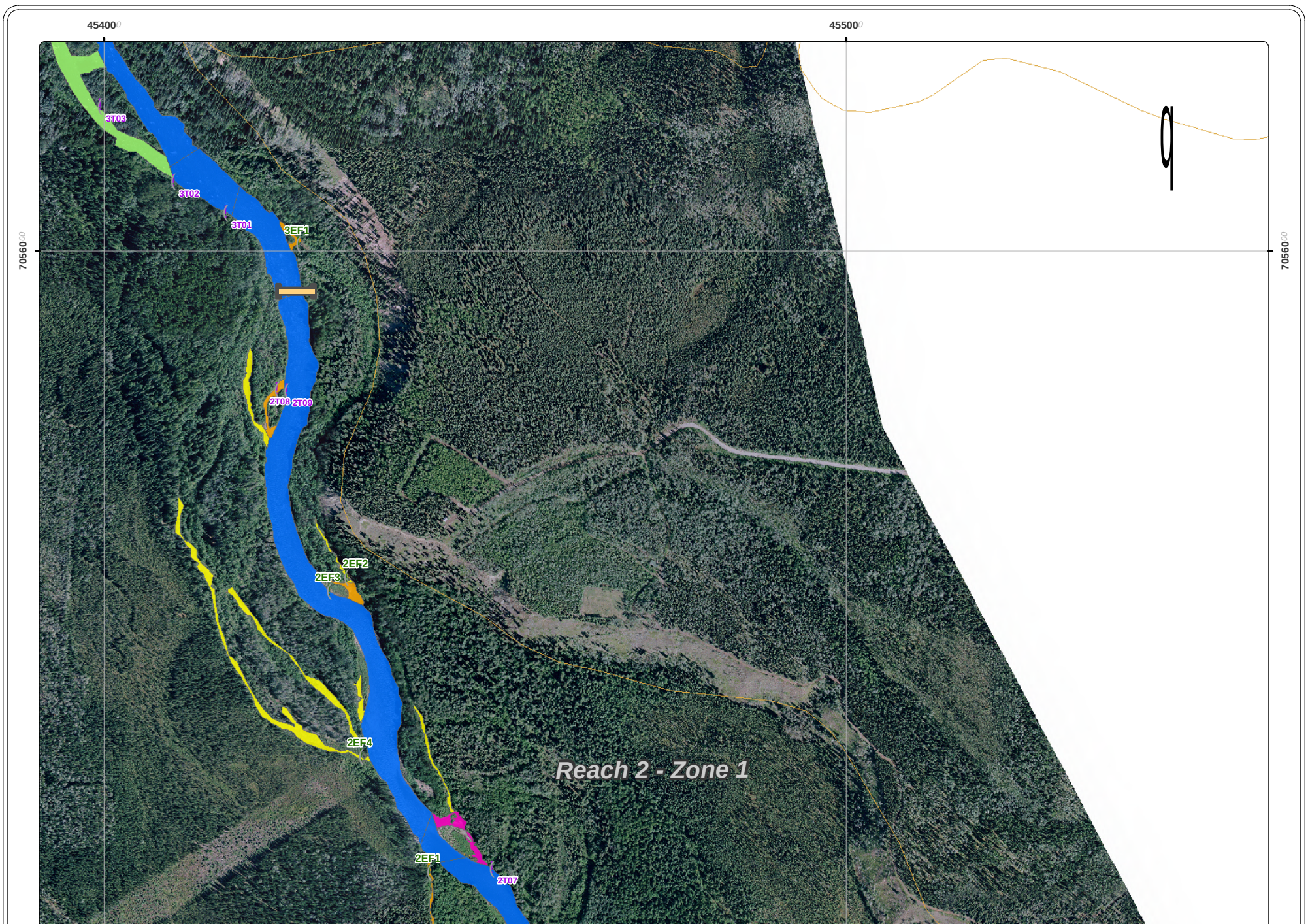



**Figure 4:**
**Habitat Mapping for Reach 1**

EDI ENVIRONMENTAL DYNAMICS INC.
*Natural Resource Consultants*

YUKON ENERGY




**Legend**

**Topographic Features**

- ! .....Village of Mayo
- .....Roads
- .....Contours
- .....Wetlands

**Mayo River Habitat Classification**

- .....Main Channel
- .....Primary Side Channel
- .....Secondary Side Channel
- .....Tertiary Side Channel
- .....Back Channel

**Fish Sampling Sites (July - Oct.)**

**Sampling Method**

- .....Beach Seining
- .....Electrofishing
- .....Minnow Trapping

**Mayo River Reaches**

- .....Reach Break

0 50 100 200 300 400 500

Metres

| | |
|---|---|
| Drawn By: | M. Power |
| Checked By: | P. Tobler |
| Date: | 18 November 2008 |
| Projection: | NAD 1983 UTM Zone 8 |
| EDI Project #: | 08-YC-0037 |

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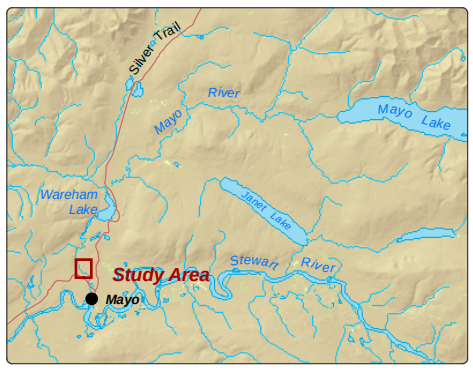
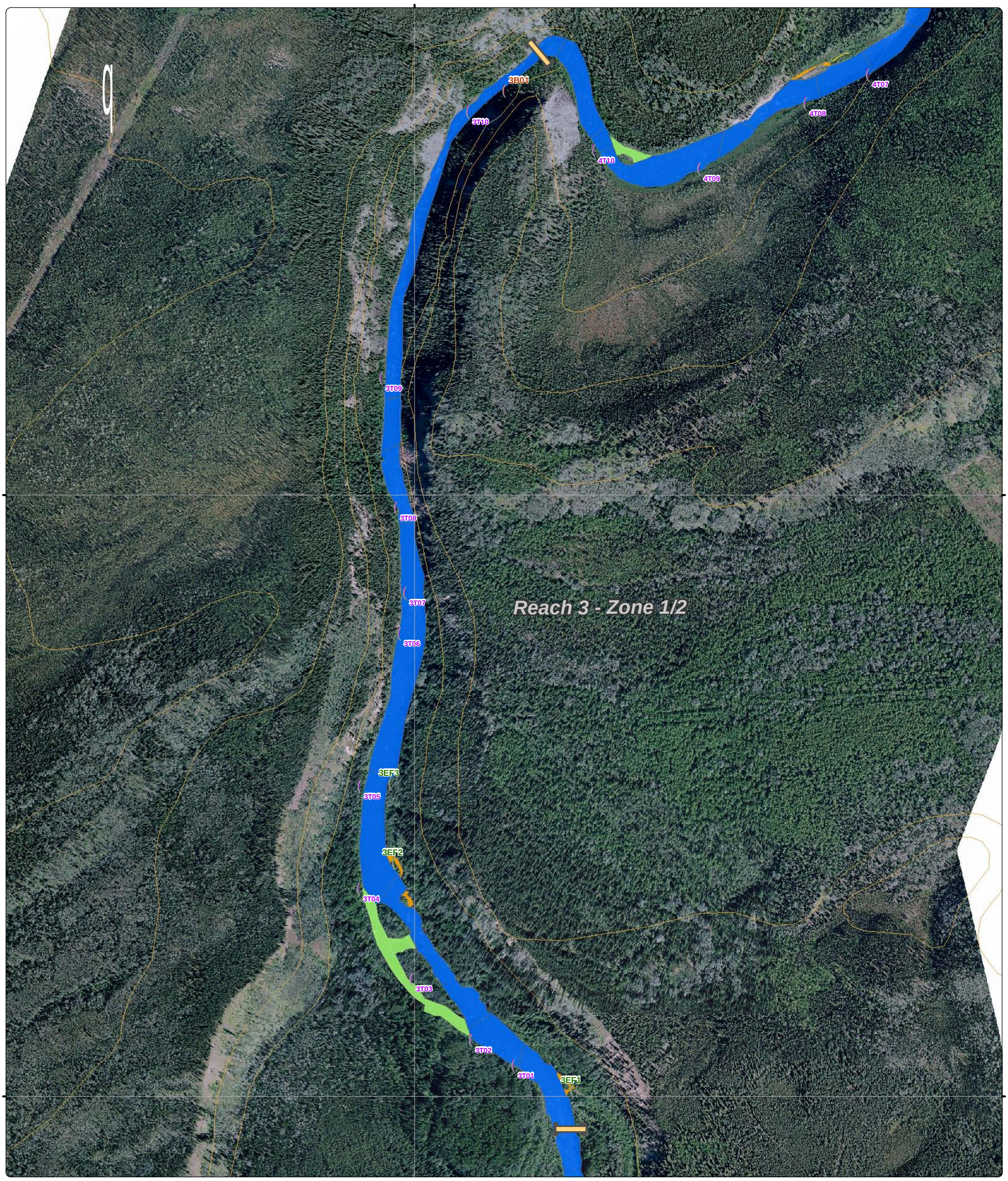



**Figure 5:**
**Habitat Mapping for Reach 2**

EDI ENVIRONMENTAL DYNAMICS INC.
Natural Resource Consultants

YUKON ENERGY




**Legend**

**Topographic Features**

- ! .....Village of Mayo
- .....Roads
- .....Contours
- .....Wetlands

**Mayo River Habitat Classification**

- .....Main Channel
- .....Primary Side Channel
- .....Secondary Side Channel
- .....Tertiary Side Channel
- .....Back Channel

**Fish Sampling Sites (July - Oct.)**

**Sampling Method**

- .....Beach Seining
- .....Electrofishing
- .....Minnow Trapping

**Mayo River Reaches**

- .....Reach Break

0 50 100 200 300 400 500

Metres

Drawn By: M. Power
Checked By: P. Tobler
Date: 18 November 2008
Projection: NAD 1983 UTM Zone 8
EDI Project #: 08-YC-0037

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Digital Data Sources:

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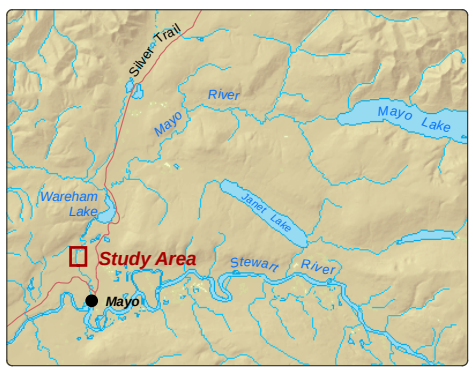


**Figure 6:**
**Habitat Mapping for Reach 3**

EDI ENVIRONMENTAL DYNAMICS INC.
Natural Resource Consultants

YUKON ENERGY


**Legend**

**Topographic Features**

- ! .....Village of Mayo
- .....Roads
- .....Contours
- .....Wetlands

**Mayo River Habitat Classification**

- .....Main Channel
- .....Primary Side Channel
- .....Secondary Side Channel
- .....Tertiary Side Channel
- .....Back Channel

**Fish Sampling Sites (July - Oct.)**

**Sampling Method**

- .....Beach Seining
- .....Electrofishing
- .....Minnow Trapping

**Mayo River Reaches**

- .....Reach Break

0 50 100 200 300 400 500

Metres

| | |
|---|---|
| Drawn By: | M. Power |
| Checked By: | P. Tobler |
| Date: | 18 November 2008 |
| Projection: | NAD 1983 UTM Zone 8 |
| EDI Project #: | 08-YC-0037 |

**DRAFT**

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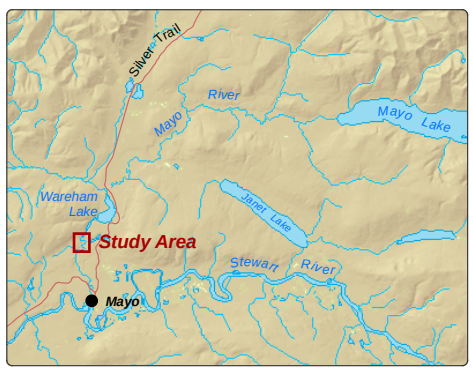
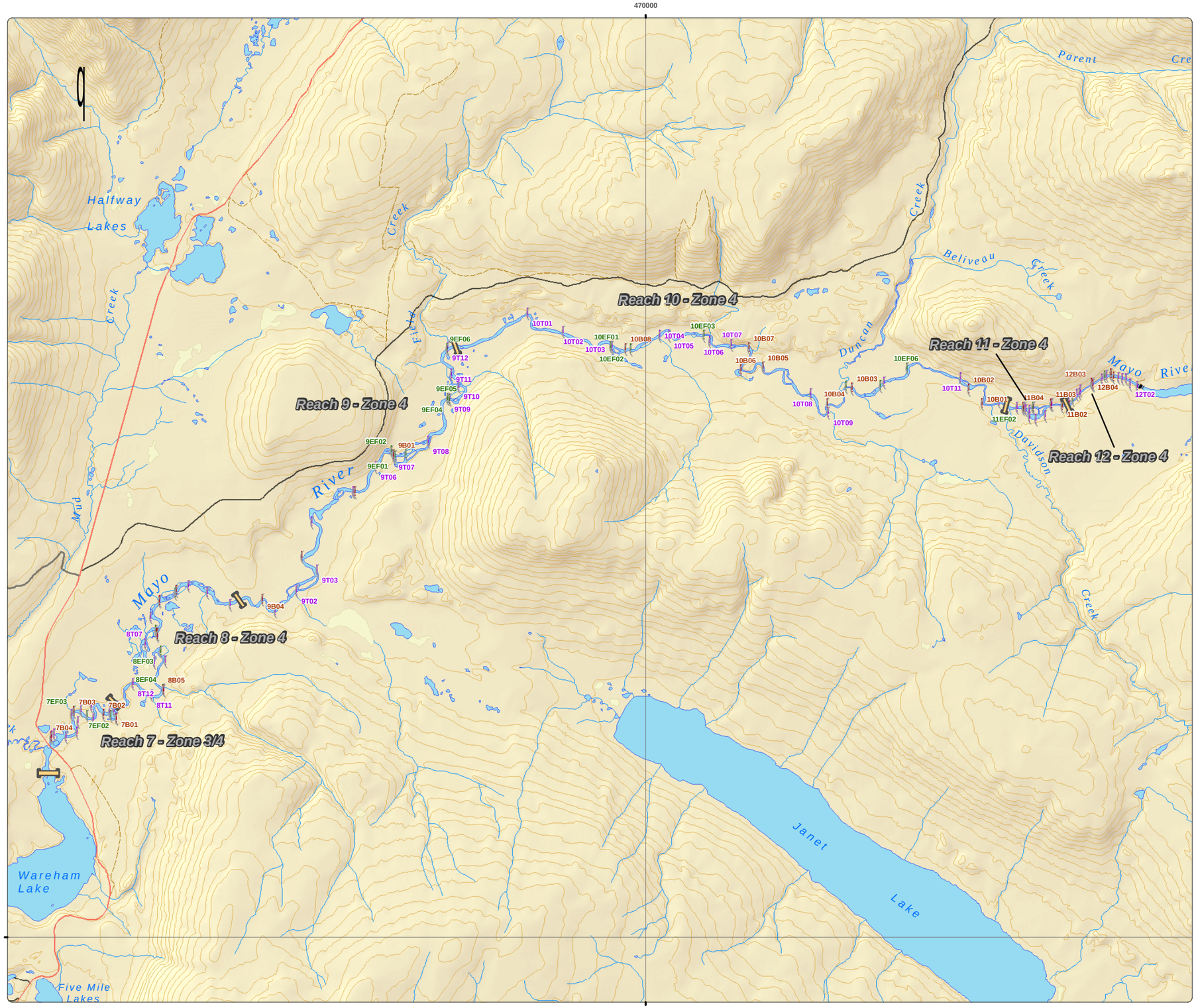
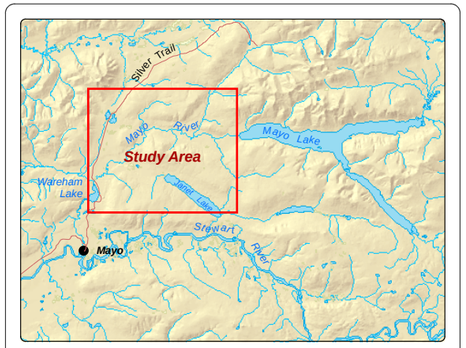



**Figure 7:**
**Habitat Mapping for Reach 4 and 5**

EDI ENVIRONMENTAL DYNAMICS INC.
*Natural Resource Consultants*

YUKON ENERGY




**Legend**

**Topography**

- ! .....Village of Mayo
- .....Roads
- .....Contours
- .....Trails
- .....Watercourse
- .....Waterbody
- .....Wetlands

**Fish Sampling Sites**

**Sampling Method**

- .....Beach Seining
- .....Electrofishing
- .....Minnow Trapping

**Mayo River Reaches**

- .....Reach Break

0 0.5 1 2 3 4 5
Kilometres

Drawn By: M. Power
Checked By: P. Tobler
Date: 18 November 2008

DRAFT

Projection: NAD 1983 UTM Zone 8
EDI Project #: 08-YC-0037

Digital Data Sources:

1:50,000 Topographic Spatial Data: Canvec and National Topographic Database (NTDB) Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved. Data obtained October 2008.

Digital Elevation Model and Orthophoto of Mayo region provided by Geomatics - Yukon Government; Summer 2008

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**Figure 8: Fish Sampling Locations within Zone 4**

YUKON ENERGY

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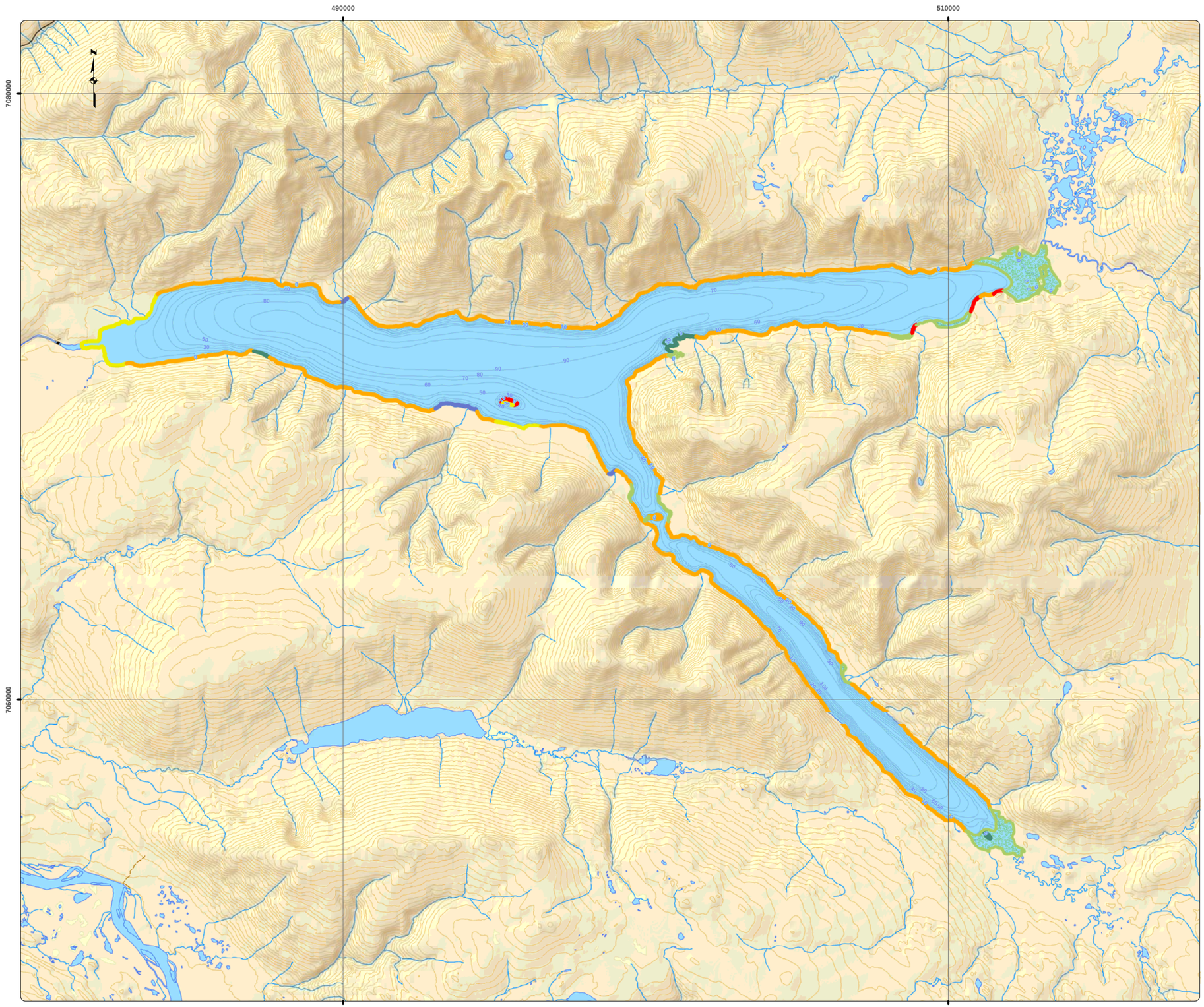
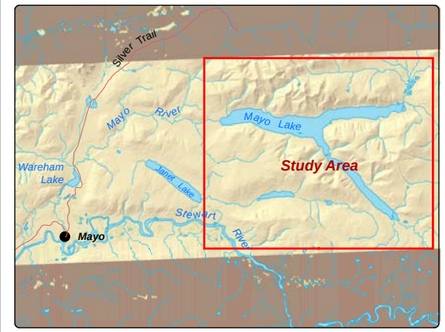
Natural Resource Consultants




## Legend

**Mayo Lake Littoral Area Classification**

- Type 1: Gravels/cobbles/boulders
- Type 2: Narrow band of gravels/cobbles/boulders
- Type 3: Fine bed material and woody debris predominant
- Type 4: Fine bed material and extensive growth of macrophytes
- Type 5: Extensive bedrock outcroppings
- Type 6: Sand

**Topography**

- .....Village of Mayo
- .....Roads
- .....Contours
- .....Trails
- .....Watercourse
- .....Waterbody
- .....Wetlands

0 0.5 1 2 3 4 5
Kilometres

Drawn By: M. Power
Checked By: P. Tobler
Date: 18 November 2008

DRAFT

Projection: NAD 1983 UTM Zone 8
EDI Project #: 08-YC-0037

Digital Data Sources:

1:50,000 Topographic Spatial Data: Canvec and National Topographic Database (NTDB) Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved. Data obtained October 2008.

Bathymetry Data aquired from YG - Environment; summer 2008

Digital Elevation Model and Orthophoto of Mayo region provided by Geomatics - Yukon Government; Summer 2008

Project data displayed is site specific. All data collected by EDI Environmental Dynamics Inc. (2008) was obtained using Garmin GPS technology (GPSMap 76 CSx).

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**Figure 9: Mayo Lake Littoral Delineation**

YUKON ENERGY

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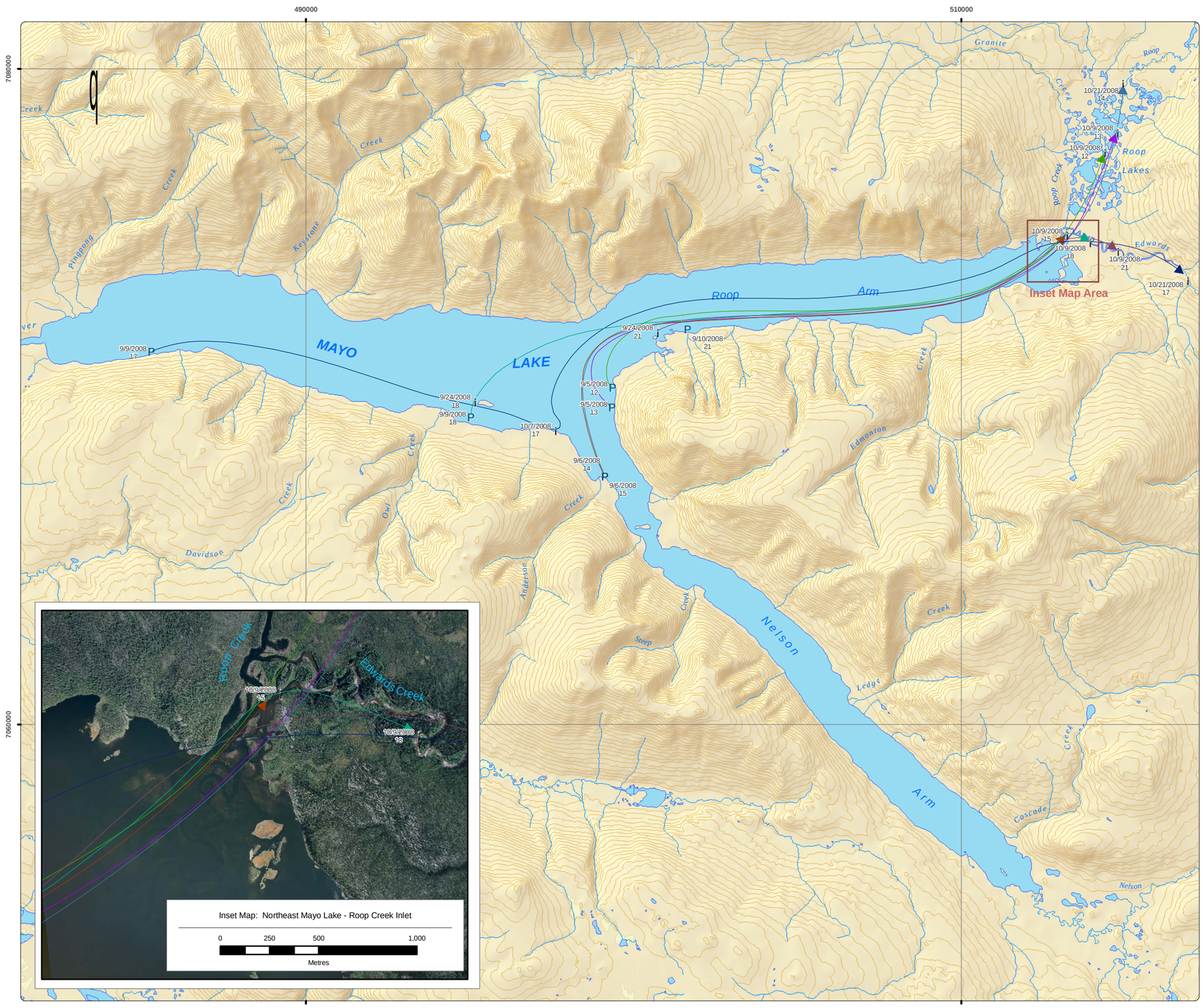


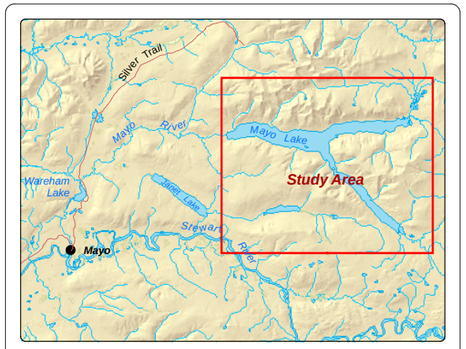


## Legend

**Lake Whitefish Movement**

Tag numbers displayed: 12 - 15, 17, 18 and 21.

- P .....Original Tag Location
- ¡ .....Relocated Tag Location
- .....Direction of Travel (varied colour theme)

**Topography**

- ! .....Village of Mayo
- .....Roads
- .....Contours
- .....Trails
- .....Watercourse
- .....Waterbody
- .....Wetlands

0 0.5 1 2 3 4 5
Kilometres

Drawn By: M. Power
Checked By: P. Tobler
Date: 18 November 2008

Projection: NAD 1983 UTM Zone 8
EDI Project #: 08-YC-0037

**DRAFT**

Digital Data Sources:

1:50,000 Topographic Spatial Data: Canvec and National Topographic Database (NTDB) Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved. Data obtained October 2008.

Digital Elevation Model and Orthophoto of Mayo region provided by Geomatics - Yukon Government; Summer 2008

Project data displayed is site specific. All data collected by EDI Environmental Dynamics Inc. (2008) was obtained using Garmin GPS technology (GPSMap 76 CSx).

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**Figure 10: Movements of Lake Whitefish in Mayo Lake (1 of 2)**

YUKON ENERGY

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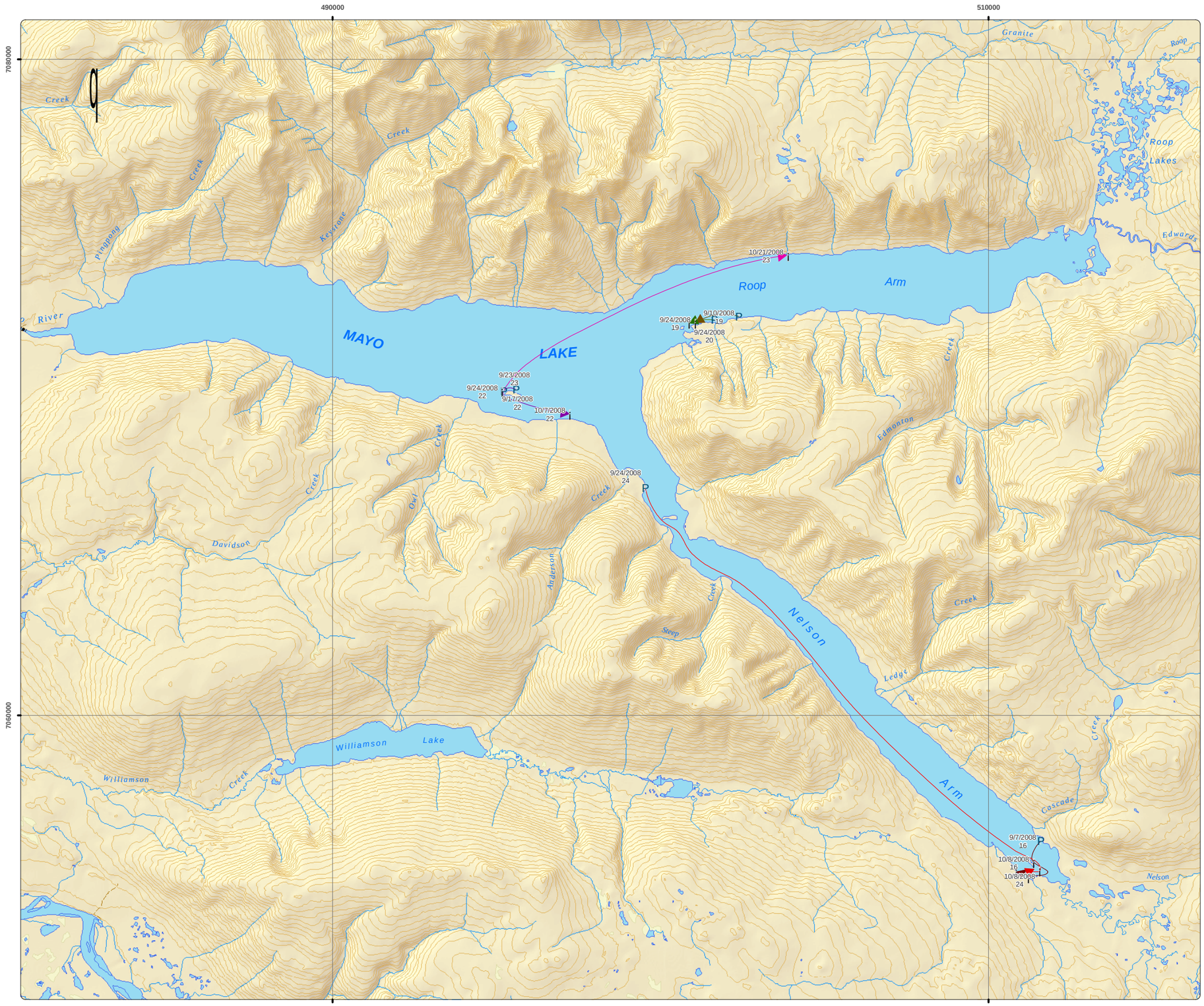


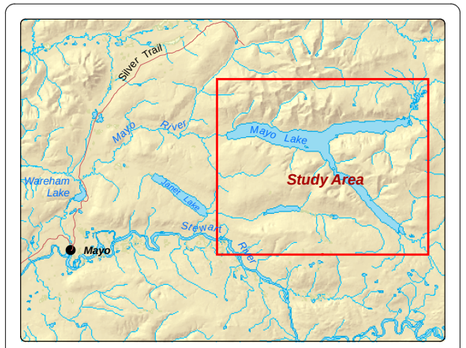


## Legend

**Lake Whitefish Movement**

Tag numbers displayed: 16, 19, 20, 22 to 24

- P .....Tag Application
- i .....Relocated Tag Location
- .....Direction of Travel (varied colour theme)

**Topography**

- ! .....Village of Mayo
- .....Roads
- .....Contours
- .....Trails
- .....Watercourse
- .....Waterbody
- .....Wetlands

0 0.5 1 2 3 4 5
Kilometres

Drawn By: M. Power
Checked By: P. Tobler
Date: 18 November 2008

Projection: NAD 1983 UTM Zone 8
EDI Project #: 08-YC-0037

**DRAFT**

Digital Data Sources:

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Digital Elevation Model and Orthophoto of Mayo region provided by Geomatics - Yukon Government; Summer 2008

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**Figure 11: Movements of Lake Whitefish in Mayo Lake (2 of 2)**

YUKON ENERGY

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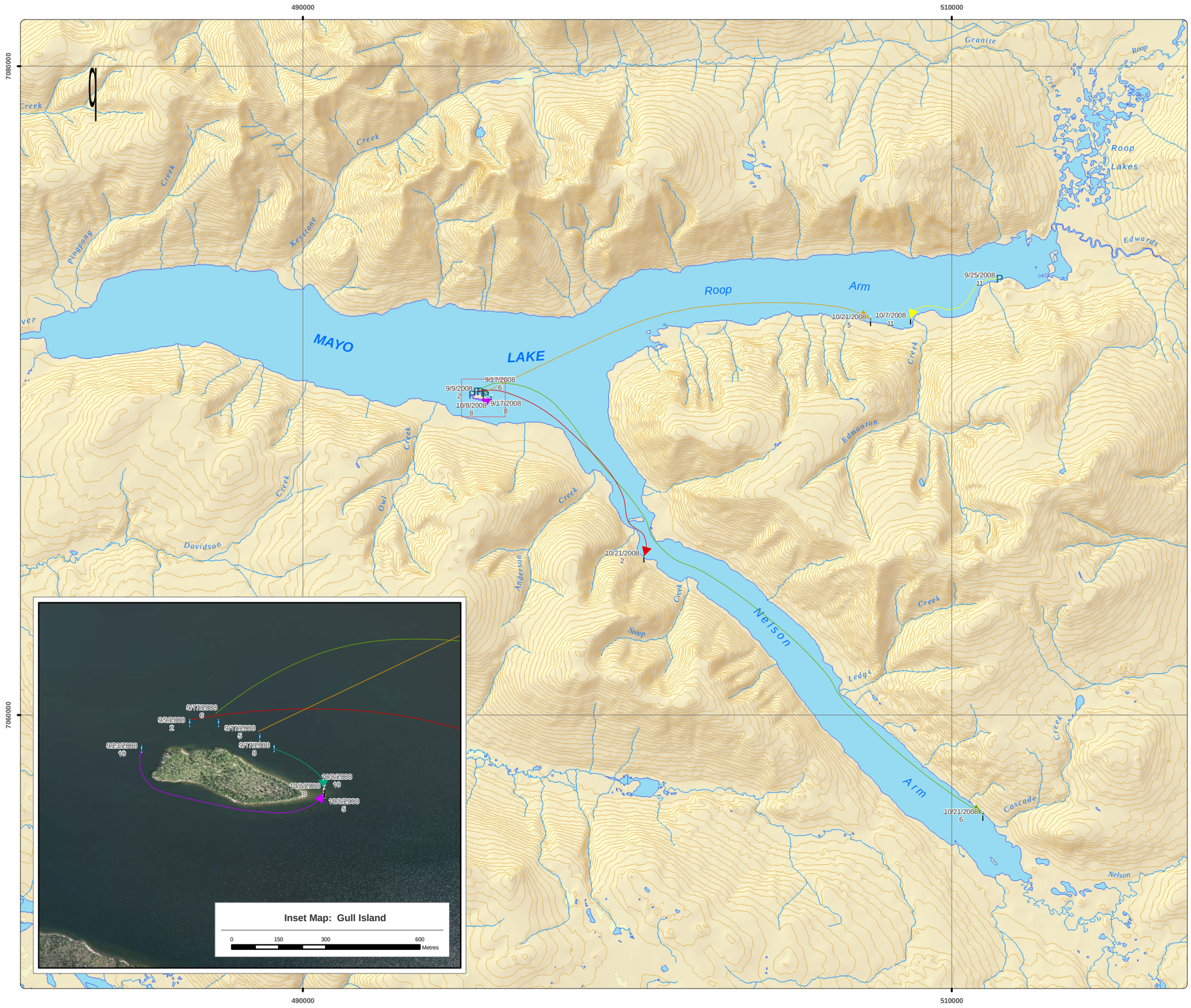
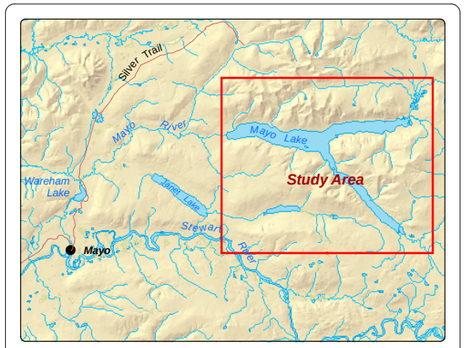
Natural Resource Consultants




## Legend

**Lake Trout Movement**

- P .....Tag Application
- ¡ .....Relocated Tag Location
- .....Direction of Travel

**Topography**

- ! .....Village of Mayo
- .....Roads
- .....Contours
- .....Trails
- .....Watercourse
- .....Waterbody
- .....Wetlands

0 0.5 1 2 3 4 5
Kilometres

Drawn By: M. Power
Checked By: P. Tobler
Date: 18 November 2008

DRAFT

Projection: NAD 1983 UTM Zone 8
EDI Project #: 08-YC-0037

Digital Data Sources:

1:50,000 Topographic Spatial Data: Canvec and National Topographic Database (NTDB) Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved. Data obtained October 2008.

Digital Elevation Model and Orthophoto of Mayo region provided by Geomatics - Yukon Government; Summer 2008

Project data displayed is site specific. All data collected by EDI Environmental Dynamics Inc. (2008) was obtained using Garmin GPS technology (GPSMap 76 CSx).

This map is a geographical representation of known geographic features. Although the data collected and presented herein has been obtained with the utmost attention to quality, this document is not an official land survey and should not be considered for spatial calculation. EDI Environmental Dynamics Inc. does not accept any liablility for errors, ommissions or inaccuracies in the data.

**Figure 12: Movements of Lake Trout in Mayo Lake**

YUKON ENERGY

EDI ENVIRONMENTAL DYNAMICS INC.
Natural Resource Consultants

# Proposed Mayo B Hydro Plant Session Yukon Energy/DFO

Dec.4, 2008

Whitehorse

# Purpose of Session

- To enable Yukon Energy to share more specific information about the key aspects of the Project and its planning/assessment to date
- To confirm identification and develop understanding of DFO's interests with respect to the potential project
- To hear from DFO their views on the type of information and detail that would be beneficial to include in a Project Proposal
- To hear from DFO whether they see any major gaps in the focal areas and/or approaches being considered

# Introduction

- Yukon Energy is looking at enhancing the existing Mayo GS to serve an integrated Yukon-wide grid
- **No decisions have been made at this time to proceed with the project.**
- If developed, the project would be used to serve new loads in Yukon, rather than serve these loads with diesel generation – could displace up to 28000 tonnes of GHG emissions
- Currently, consultation activities are underway as well as detailed analysis of possible environmental and socio-economic effects.

# Existing Mayo GS Plant and System

# Existing System

- 1st Unit In-service in 1951; 2 units now with approx 40 GWh/yr capability, 36 metres of head
  - Operated to serve Keno mine and Mayo up until 1988/89 (32-35 GWh); only Mayo up until 2003 (7-10 GWh), now Mayo/Dawson (27-30 GWh)
- Comprises:
  - Impoundment of Mayo River to form Wareham Lake
  - Spillway at Wareham Lake
  - Powerhouse downstream from Wareham Lake – now 5.4 MW installed, peak flow in the range of up to approx 18 cms.
  - Upstream storage dam at Mayo Lake – wood crib structure rebuilt in 1988/89; operating range of 2.59m

# Existing System (con't)

- Current Type A, Class 2 Water Licence through December 31, 2025; requires:
  - Mayo Lake:
    - Minimum release of 2.8 cms
    - Maximum controlled elevation 665.84m (licence in ft)
    - Minimum controlled elevation 663.25m
  - Wareham Lake
    - Minimum release of 2.8 cms below the plant (combined flow through the plant and the spillway)
    - Maximum controlled elevation 574.50m
    - Minimum controlled elevation 572.21m

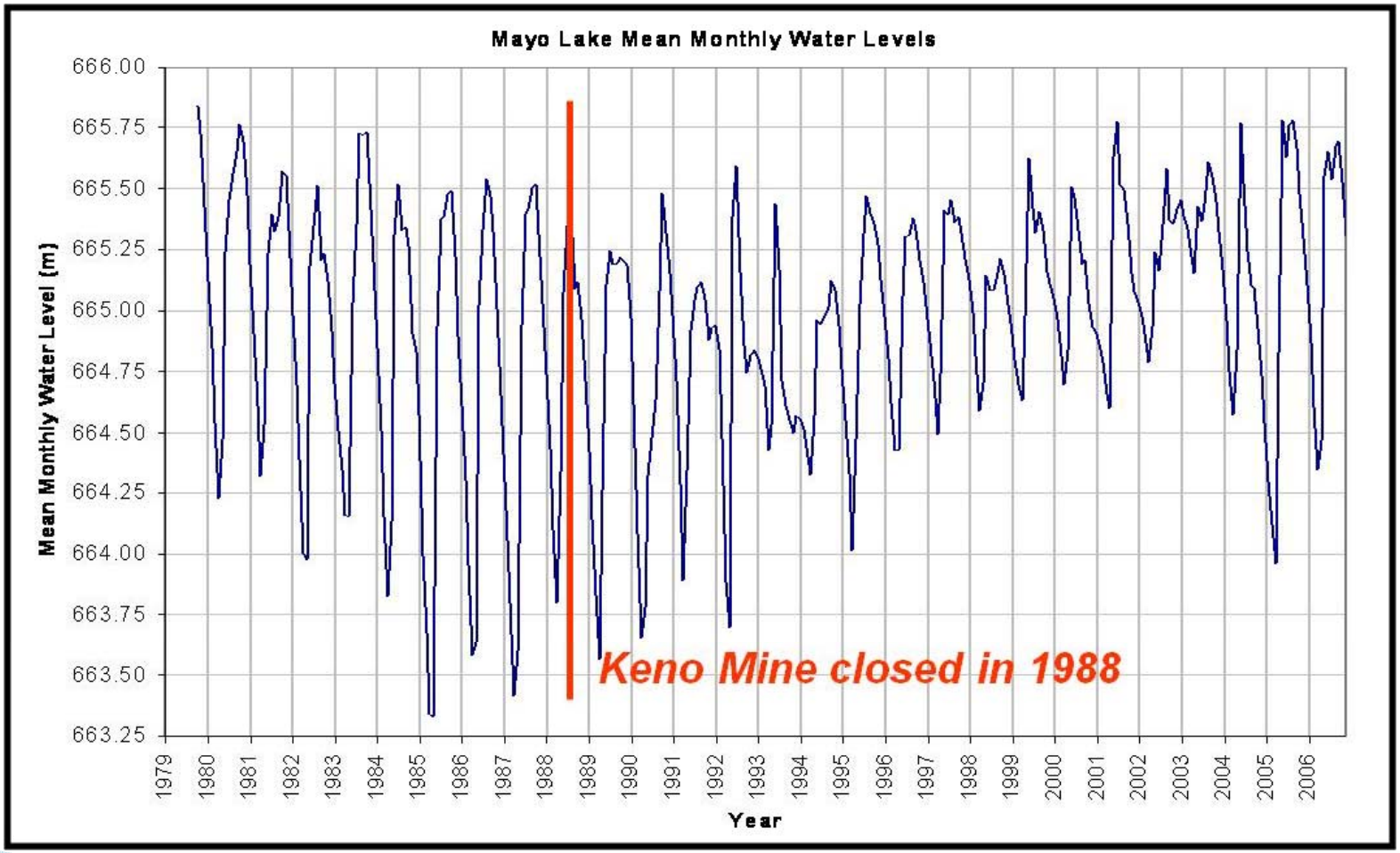
# Water Management Objectives

- Yukon Energy Water Management Objectives – a balancing act:
  - Use water before non-renewable energy sources such as diesel to produce power for Yukon Energy's customer needs
  - Optimize the water in order to minimize electricity costs to Yukon Energy's customers
  - Respect and protect the environment through a sustainability focus
  - Utilize the Corporation's water management resources to the benefit of other water users

# Water Management – Mayo Lake

- Water management focuses on use of Mayo Lake storage to enhance winter flows (256 mcm managed storage range; approx 100 mcm/metre)
- Mayo Lake spring freshet (50% of annual inflows in May/June) is prioritized for storage where required.
- In low inflow years reservoir cannot refill
  - such as 1998 (191 mcm total summer inflow, with 45 mcm of this required to be released to meet licenced minimum releases over the summer)
- In about 70% of years, reservoir has sufficient summer inflows to at least meet minimum flows and add 256 mcm to storage. 1988 highest at 587 mcm

# Water Management – Mayo Lake Historic Operation



# Water Mgmt – Wareham Lake

- Approx 1/3 of Wareham inflows are local and uncontrolled – i.e.,tributaries below of Mayo Lake
  - As a result, Wareham retains natural spring freshet
- Wareham licenced range of 2.29 metres offers limited storage (approx 10 mcm)
  - also drawing down Wareham storage reduces head at plant, so is not drawn down except when req'd – i.e., in most instances releases equal inflows
- System is operated to minimize spills – in most cases starts in May/June due to uncontrolled inflows; can continue as late as October
- Spillway is shut down in fall as soon as possible

# Water Mgmt – Below Wareham Lk.

- Winter flows since closure of Keno mine were only at levels needed to generate power
  - Since Keno mine closed, winter flows were well below full plant capacity – typically:
    - 4–6 cms when only town loads (most of the years)
    - 7–12 cms on limited occasions when Keno minesite was taking notable amounts of power
    - 12–15 cms since Mayo–Dawson connected
- In summer, sustained spills were experienced due to lower load on system.
- Minimum flow requirements were typically fully met by plant flows (except when out of service for maintenance, etc.)

# Pictures

# Proposed Mayo B Plant and System

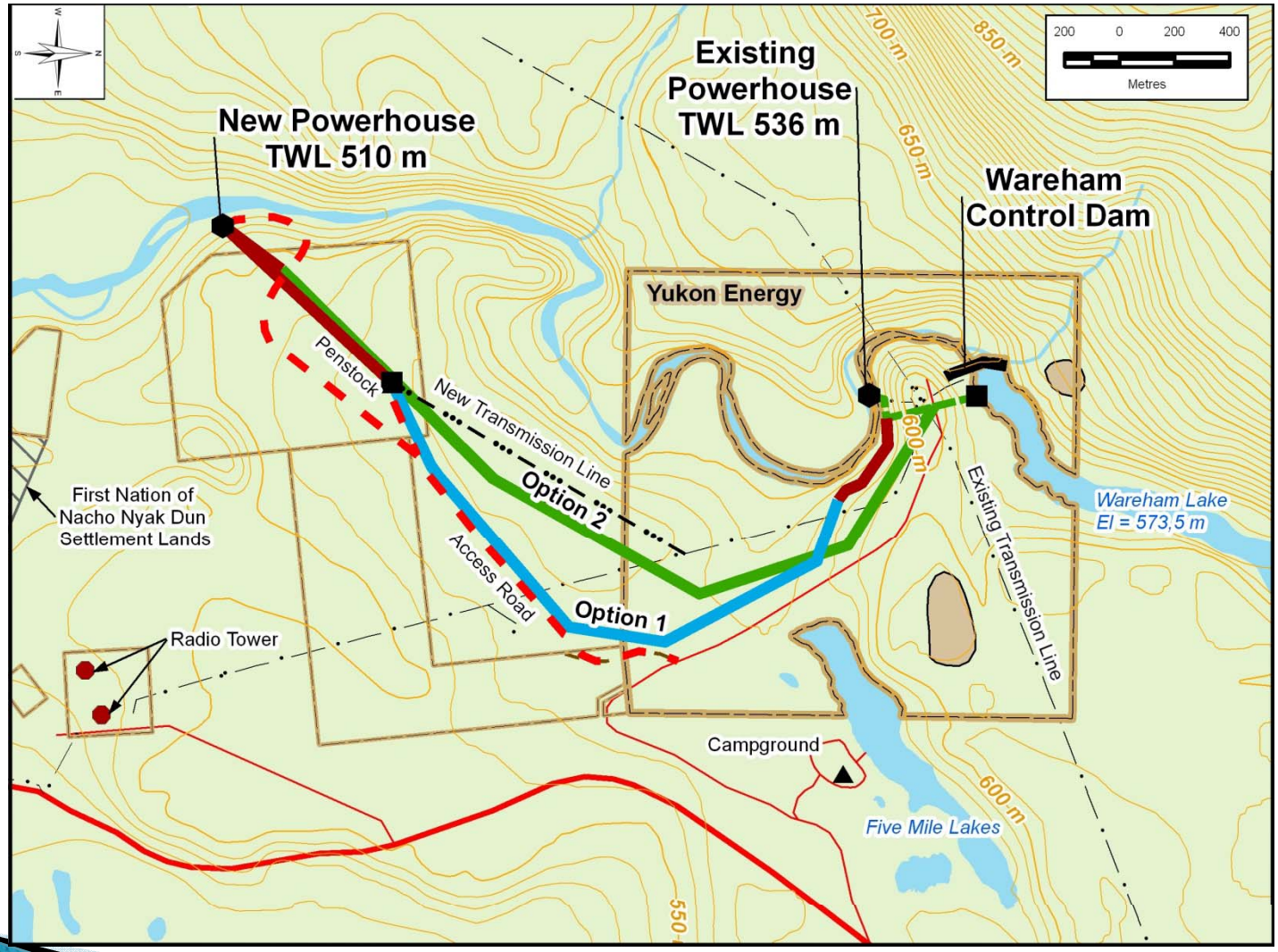
# Project Description – Mayo B

- Project Components – New Powerhouse
  - approx 64 m of head
  - Maximum design flows of 19-25 cms being considered
  - Anticipated to be 2-3 Francis turbines
  - Capacity expected to exceed 10 MW, requiring a Type A Class 3 Water Licence
  - Considering options to maintain existing plant for use as required; possibly replace one unit with a smaller turbine

# Project Description – Mayo B (con't)

- Water Diversion Options:
  - Tunnel Option or Canal/Penstock Option
  - Continue to use same Wareham Lake intake
- Additional Infrastructure:
  - New all-weather road access and low voltage power line
  - Temporary work camp for 50 – 75 people
- See following map

# Construction Footprint



# Project Description – Mayo B (con't)

- No changes req'd to Wareham Dam or Lake
- Project constructed largely "in the dry"
  - No major work in aquatic environment until remove the rock/overburden plug once plant is nearly complete
- Consider lowering the minimum controlled level of Mayo Lake up to 1 metre
  - No changes anticipated to be required to structure;
  - Still considering requirement for limited channel improvements for flows
- Also assessed raising Mayo Lake

# Water Management – Mayo Lake

- Water Mgmt Objectives and "balancing act" remain
- Limited number of years would permit the entire range to be used
  - Only approx 6 out of 19 years of data have sufficient inflows to fully refill this range
  - Very bottom of range would be rarely used due to "rule curves" to prevent violating licence conditions in very dry years; as a result many years do not fully draw down due to early freshet on system (including Whitehorse GS)
- Even with 3.59 metre range, preliminary work suggests 30% of years are not anticipated to use more than 2.5 metres of drawdown, and a further 30% not more than 3.0 metres.

# Water Management – Mayo Lake (con't)

- In respect of water levels, particularly during fall periods (when erosion risks are expected to be highest), an expanded licenced range is likely beneficial to any erosion risk presently existing
  - With an increased range (lower minimum licenced elevation) more years in fall will be below FSL
- In regard to fall spawners, if assessment indicates potential for concern, likely mitigation is via some periodic limitation on winter drawdowns
  - options to be considered involve ensuring periodic caps on maximum drawdown (e.g., such as assurance that drawdowns will not exceed 2.5 to 3 metres for 5 straight years or more in a row)

# Water Management – Wareham

- Ideal economic feasibility for project is to minimize spills, and route maximum water to new plant
  - Higher head permits more power to be produced using the same amount of water than if routed through existing plant
- Existing licence has conditions for fish (Salmon) protection of 2.8 cms continuous minimum flow below existing plant (Zone 2) – not consistent with maximizing output of new plant
- Evidence that Chinook Salmon use Zone 2 for spawning, rearing
  - See EDI summary report dated Dec 1

# Water Management – Wareham (con't)

- In respect of Mayo B Water Mgmt, 3 types of options have been considered :
  - Option 1: Meet all existing licence conditions, including 2.8 cms minimum flow in Zone 2.
  - Option 2: Dewater "Zone 2" where beneficial for power production. Address adverse effects through habitat compensation.
    - good options for habitat compensation likely exist near the new plant, by re-establishing an old river channel as a spawning and rearing habitat.
  - Option 3: Ensure adverse effects are addressed, or enhancement is achieved by maintaining a stable minimum flow through Zone 2 above current minimum licenced levels as determined by fisheries studies (e.g., 4-6 cms range)

# Water Management – Summary

- Yukon Energy has not completed assessment yet to know the full environmental aspects of the options, or the full impacts on power production
- Based on fisheries studies and assessment to date, it appears that the environmental effects of Mayo B are manageable, with potential opportunities to improve salmon habitat conditions
- Yukon Energy wants to ensure the Mayo B project is straight-forward to assess, and to ensure the project proposal is as complete as possible to support DFO regulatory process.

# Yukon Energy Process for Consultation

# Consultation to Date

- Public consultation throughout the planning assessment process will help shape the project
- YEC met with NNDFN Chief and Council in July to initiate project, with follow-up in November
- YEC met with the Mayo RRC and NND Lands in September focused on summer and fall field studies
- Week of Nov. 24-26th meetings were held with the Mayo RRC, the Village of Mayo and NNDFN Lands & Resources staff to formally introduce the Project and elicit identification of stakeholder interests
- A drop-in event in the Village of Mayo was also held that week

# Continuing Consultation

- Dec 4/5 YEC is holding workshops with NNDFN Lands & Resources staff and resource users to discuss in detail land and resource use activities; and to discuss the aquatic environment, including water management regarding, in particular, Chinook salmon in the Lower Mayo R., and lake trout and lake whitefish in Mayo Lake.
- YEC will continue with on-going involvement with NNDFN at the technical, working-group level until the Project Proposal is filed with YESAB, including a community meeting with NND in the New Year.

# Broader Public Consultation

- YEC is also meeting with other interested stakeholders one-on-one; and will be planning additional meetings with the Village and RRC in Mayo in the New Year.
- Other stakeholder meetings and/or discussions include ENGOs, the Yukon Salmon Sub-Committee, federal and territorial government departments (e.g., fisheries, lands, highways etc.), placer miners and property owners.

### 4E-3.2 JANUARY 22, 2009

#### 4E-3.2.1 Meeting Notes

# Meeting Report

| | | | |
|---|---|---|---|
| Title: | Mayo B Project – Project Briefing to YTG Fisheries | | |
| Attendees: | **YTG Dept. of Environment**:<br>Nathan Millar, Sr. Fisheries Biologist<br>Lars Jessup, Fisheries Technician<br>Aaron Foos, Fisheries Technician<br>**Yukon Energy:**<br>Hector Campbell (YEC)<br>Travis Ritchie (YEC)<br>Pat Tobler (EDI)<br>Ben Schonewille (EDI)<br>Nancy LeBlond (InterGroup Consultants)<br>Patrick Bowman (InterGroup Consultants) | | |
| Meeting Location: | YEC Meeting Room | Whitehorse, Yukon | |
| Date: | January 22, 2009 | Minutes status: | Draft Final |
| Author: | Nancy LeBlond | Phone: | 204-942-0654 |
| Meeting Purpose: | Introduce the Mayo B Project and aquatic field studies from the 2008 summer/fall field season. | | |
| Presentation and Discussion: | Copies of the Introductory power point presentation, Aquatic Studies Preliminary Summary and associated maps were provided.<br><br>Hector thanked everyone for coming and round table introductions were made. Hector reviewed the objectives of the session, what stage Yukon Energy is at in terms of its project planning and assessment, as well as preparations for the potential filing of a Project Proposal to YESAB and approximate timing of same.<br><br>**Introduction:**<br>• Mayo B was identified in Yukon Energy's 20 Year Resource Plan as an enhancement project to the existing Mayo facility that would provide more renewable power.<br>• Project costs are currently estimated to be slightly over $100 million and the corporation is looking to the federal government for funding (which is not yet secured).<br>• Mayo B is an enhancement project that will see the re-development of an existing facility to generate up to 40 GWh/yr of additional energy | | |

(approximately double the output using the same amount of water). This is additional to the 40 GWh/yr that can be produced from the existing plant. Final power production numbers will depend on plant size, water flows and changes being considered to Mayo Lake water levels.

- As part of good project planning and assessment, Yukon Energy has been undertaking a comprehensive consultation program; it is understood that there will be additional consultation done through the YESAB process, should a proposal be filed for the Project. Several meetings have been held with the Village of Mayo and the Mayo District RRC. A community drop-in event was held last fall, and a community meeting with over 60 people attending was held this week in Mayo. An Open House in Whitehorse attracted about 20 people yesterday. In addition, Yukon Energy has had extensive meetings and workshops with FNNND Lands and Resources staff. Additional meetings and conference calls have been had with DFO, ENGOs, the YG Regional Biologist and private land owners and other interested parties. Consultation is effective for the planning phase of the project in understanding the interests of people, local stakeholders and government in the context of this potential Project.

Hector reviewed the Introductory PPT presentation. The following is provided as additional information to the PPT slides.

<u>Existing System:</u>

- Current Mayo Hydro plant has two turbines at 2.5 MW each. In 2002 new blades were installed (re-runnered) to achieve greater capacity.
- Existing operations with Mayo-Dawson on line (27-30GWh/yr) is also closer to the early historical use of the plant when serving United Keno Hill Mines Ltd.
- There is some surplus power at the existing plant.
- Design flow of the existing plant is 18 cms. When local inflows exceed the demand or plant capacity (like this summer), water is spilled. Spilling can be as late as October as experienced this past fall.
- Wareham Lake acts as the head-pond for the existing plant and was created when the 100 ft. Wareham dam was built across the Mayo River.
- Mayo Lake control structure – top of the splashboards is top of licensed full supply level (FSL). Water flows this past year have been high enough to be spilling over the splashboards into November. Mayo Lake was raised about 15 feet when the control structure was built in the early 1950s.
- Combined inflows of Mayo Lake and the upper Mayo River have gone up to 60 cms+ (30-40% are uncontrolled inflows in Zone 4).
- Current operating range of Mayo Lake is 2.59 m; and Wareham Lake is 2.29 m. The full operating range of Wareham is rarely used except for maintenance purposes; Wareham Lake levels typically stay at the top 2-3 feet.

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| | Water Management:<br>• Yukon Energy manages the system to minimize diesel use.<br>• Greatest electrical demand for power in Yukon is highest in the winter, so the objective is to store water over the summer and release it in the winter to match demand.<br>• Yukon Energy manages its facilities for power generation, protection of the environment and to meet the needs of other users of the water (i.e., recreation).<br>• Mayo Lake is used for annual storage capability. Store the water in the summer and release in the winter. The lake fills up quite quickly with the spring freshet.<br>• The 256 million cubic meters (mcm) managed storage range is the volume of the water in the lake between minimum and maximum licensed range.<br>• If energy is not needed, Mayo Lake is under its FSL and the system is managed to avoid spilling in the winter (which causes operational problems with icing of the gates etc.)<br>Proposed Mayo B Plant and System:<br>• New powerhouse would be located about 3 km downstream of the existing plant and would generate twice as much power.<br>• As our understanding of flows and management of the system increases, our planning is moving towards a 10 MW plant plus retaining partial use of the existing plant (rather than a 13 MW plant).<br>• If the system were managed strictly from a power perspective, all the water would be diverted through the new plant. This would cause unacceptable environmental effects that would be difficult to mitigate – so this option is not being seriously considered. Instead, Yukon Energy is looking at opportunities to enhance or improve the habitat for fish in the lower Mayo River.<br>• There will not be any new dams associated with this Project.<br>• Recent seismic results have shown there is considerable overburden material in the area opposite Five Mile Lake; and the depth to bedrock is 30 m deeper. This would result in a very deep tunnel that would not be self-draining, but would require a pumping system. The tunnel option is hence more risky and costly.<br>• This recent information has led to the canal/penstock combination option to be more favourable.<br>o The canal water surface would be approximately 30 m wide and 4 m deep<br>o There would be a short penstock at the intake (Wareham) end and an approximately 800 m steel penstock at the new plant end.<br>• Associated infrastructure would include a new all-weather access road diverting off the existing YEC access road. A work camp would be required for 50-75 people at peak times, depending on the |

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| | conveyance option and availability of local people to be employed on the Project. The canal/penstock option is essentially an earth-moving project which may be able to offer greater local job opportunities.<br>• The construction phase is about two years.<br>• Mayo Lake level options – currently considering power benefits of up to 1 m of additional bottom storage at Mayo Lake, and the potential impacts to fall spawners in particular. Options for management of the water levels are still being assessed; however, we are looking at increments of between zero and up to 1m of additional licensed range.<br>• Limited channel improvements at the Mayo Lake structure are still being assessed. There has been some siltation; however, based on bathymetry work done this past field season, the engineers don't feel dredging will be required if an additional 0.5 m of bottom storage was used. Further design work is required to determine if dredging will be needed if the additional storage was 1 m.<br>• Water models have been developed to help determine what type of lake level management would be effective for both power generation and to avoid substantive impacts on the environment. Part of the modeling includes developing rule curves to manage the last part of the additional bottom storage range, and looking at draw-down from fall to spring water levels to prevent freezing of some fish eggs. If the assessment indicates potential for concern at certain draw-down levels re: fall spawners, then mitigation measures through periodic limitation on winter draw-downs will be developed to ensure fish populations stay viable. Yukon Energy is still exploring these various options noted in the presentation.<br>• Water management of the lower Mayo River (Zones 1-3):<br>o Existing license includes condition of 2.8 cms continuous minimum flow below the existing plant in Zone 2 to protect fish populations. This level is too low for the turbines at the existing powerhouse to function efficiently; minimum levels have more normally been in the range of 4 cms.<br>o There is evidence that Chinook salmon as well as other freshwater fish species use Zone 2 (between the existing and proposed plants) for spawning and rearing habitat.<br>o The lower Mayo River (about 12km reach) is a very productive river despite its size. For Chinook, Pat noted that a previous counting weir found 600+ Chinook returning to the river; other data sources suggest up to 1500 salmon may have used the river in certain years. EDI's preliminary estimate is in a range of 100-1500 Chinook for 2008. There is also anecdotal information from traditional knowledge that suggests that Chinook may have historically spawned downstream of Mayo Lake; and possibly in the Roop Lakes area, although the latter is unclear.<br>o The option receiving the most attention for management of the lower Mayo River is Option 3: |

| | |
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| | ▪ Maintaining a stable min. flow of 4-6 cms in Zone 2<br>▪ Re-establishment of an old side channel downstream of the tailrace as spawning and rearing habitat<br>• Nathan asked if there will be a lot of spilling during the spring freshet with the Mayo B Project.<br>o Hector indicated that once CSTP Stage Two is completed and the system is interconnected, a larger load can be handled by the Mayo system (18 cms currently; and about 25 cms with Mayo B Project).<br>o Large spring uncontrolled inflows (greater than 25 cms) will be spilled. At Mayo Lake, water will be stored until it reaches its FSL.<br><u>Summary:</u><br>• Analysis and assessment work is on-going.<br>• EDI will be quantifying the amount and quality of habitat in Zones 1-3.<br>• Mayo Lake options are being developed to ensure viable lake trout and whitefish populations are maintained, while balancing the need for additional storage for power generation.<br>• The Project Team is fine-tuning the right range of options (both for Mayo Lake and the lower Mayo River) in order to prepare a competent submission to YESAB – potentially as soon as March 2009. |
| Aquatic Studies Preliminary Summary | Ben Schonewille (EDI) reviewed the presentation – Mayo B Aquatic Studies Preliminary Summary – handouts, including 11 x 17 maps, were provided. The following is provided as additional information to the PPT slides.<br>By way of introduction, Ben explained how the aquatic study area was divided into zones:<br>• Zone 1: Stewart River to location of new powerhouse<br>• Zone 2: New powerhouse to existing plant<br>• Zone 3: Existing plant to Wareham spillway<br>• Zone 4: Upper Mayo River<br>• Zone 5: Mayo Lake<br>• Aquatic Zone 1:<br>o Lower gradient, meandering river morphology<br>o High channel complexity with numerous side and back channels<br>o River is less confined through this zone<br>o Substrate is primarily a mixture of cobbles and gravel<br>o Velocity is low compared to Zones 2 and 3<br>• Aquatic Zone 2:<br>o Higher gradient, more confined river channel<br>o Higher velocities<br>o Less complexity of the channel, especially in the canyon (lower photo) |

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| | o Substrate is primarily boulders and cobbles<br>o Upper photo is upstream of the canyon; there are a few side channels upstream of the canyon<br><br>• Aquatic Zone 3:<br>o Very short corner between the dam/spillway and existing plant (about 500 m)<br>o Very confined channel with little opportunity for Chinook salmon spawning; substrate is boulders and cobbles.<br>o Velocities depend on the flows through the spillway – the upper photo was taken this past October with high spills (plunge pool visible)<br>• Aquatic Zone 4:<br>o Classified the upper Mayo River into reaches, each with similar characteristics.<br>o The red arrows point to two major tributaries (Duncan and Davidson Creeks) with active placer mining activity. The largest tributary is Minto Creek (Reach 7) – which also has placer activity.<br>o Reach 7 is a meandering wetland upstream of the Minto Bridge. It has fine material substrate, and is affected by Wareham Lake. There is a lot of channel complexity, islands, low gradient and lots of aquatic vegetation.<br>Aaron asked what the effect of Wareham Lake had on the wetland and if it gets de-watered. Ben noted that the wetland was formed as a result of Wareham Lake. Hector noted the area doesn't fluctuate more than 3 feet; some sections of the wetland are quite deep.<br>o Reach 8 upstream of reach 7 also has channel complexity with side and back channels and more gradient than Reach 7. Substrate is a mix of gravel, cobbles and a few boulders.<br>o Reach 9 and 10 are very similar – one main channel with little meandering or side channels. Substrate is mostly cobbles.<br>o Reach 11 is a short reach which is primarily comprised of slow moving, wetland type habitat.<br>o Reach 12 is upstream of the placer mining activity at Duncan & Davidson Creeks, and below the Mayo Lake Control Structure and is relatively short. This reach provides valuable habitat to freshwater fish species.<br>• Aquatic Zone 5 is Mayo Lake:<br>o Photo is looking east towards the Roop Arm.<br>o Edwards Creek, Roop Creek and the Roop Lakes drain into the Roop (north) Arm; the Nelson Creek drains into the Nelson (south) Arm.<br>o Ben noted the moderately sized tributaries such as Anderson, Edmonton, Cascade, Ledge, Owl etc. Placer mining activity influences many of these tributaries and Mayo Lake itself. |

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| | Methodology Zones 1-3:<br>• Chinook salmon spawning investigations – 6 helicopter flights in early August to mid September of the entire lower Mayo River. The Sept 15th flight was a final redd count.<br>• Fish sampling – targeted all species and life stages. Three methods were used:<br>o Beach seining for adult fish<br>o Electrofishing along stream margins and in off channel habitats targeting juvenile fish<br>o Minnow trapping – effective for catching juvenile Chinook<br>• Channel classification/habitat mapping<br>• Water quality – monitoring sites in each reach; field measurements and lab analysis<br>• Water temperature monitoring (data loggers in each reach; downloaded the data in November)<br>• Tributary assessment – there is one tributary into the lower Mayo River which was assessed.<br>• Photo reference points – A number of points were selected to visit in different seasons and at different water flows. The example shown in the presentation is taken off the Silver Trail Bridge looking downstream<br>• Geomorphology review – assessment of the river channel using historic air photos and high definition video to provide insight into future channel changes<br>• An over-flight was conducted Dec. 17th to investigate icing conditions and evidence of groundwater discharge in the lower Mayo River (also Edwards Creek in Mayo Lake).<br>YG Fisheries asked where water flows are measured. Hector indicated that the outflows at the spillway and the plant are recorded for the Mayo River; and outflows at Mayo Lake control structure are measured. The difference between them is the local inflows into Wareham Lake. At Wareham, operator logs are kept of any flow adjustments, plus Yukon Energy calculates the daily average flows.<br>• It was also noted that 25 cross sections of the river in Zones 1-3 were done; plus Yukon Energy has a continuous surface water level profile of the lower river at two flows. This type of information provides input into the aquatic and icing studies.<br>Methodology Zone 4:<br>• No Chinook salmon investigations or detailed habitat mapping<br>• Fish sampling – same as for Zones 1-3 using all 3 methods. The photo is an example of beach seining in Reach 12.<br>• The other points on the slide are the same as for Zones 1-3<br>• Habitat data collection used the BC RICS Fish and Fish Habitat Inventory Cards |

- Photo reference points were in side and back channels, as well as in wetlands associated with the river.

Methodology Zone 5:

- Littoral Zone classification around the entire lake (based on substrate type, slope and presence of aquatic vegetation)
- Fish sampling – lake trout and lake whitefish – used short set, small mesh nets to minimize fish mortality
- Radio tagging and tracking to locate spawning areas – tagged 16 lake whitefish and 11 lake trout
- Overview assessment of selected tributaries – lower portion of the tributaries to identify critical habitat and to collect fish habitat information
- Water quality monitoring of temperature & dissolved oxygen up to 30 m; 10m incremental depths for nutrients and metals (field measured parameters and lab analysis)

The following additional work being done by other parties will tie into EDI's field work:

- Mayo River cross section data & bathymetry (west end of the lake)
- Compilation of historic Mayo River flow data
- Mayo Lake erosion studies
- Mayo River ice studies

**Preliminary Results**

The following information is preliminary in nature as analysis is still on-going.

Preliminary Results – Zones 1-3 (Map 2)

- Chinook salmon redds were observed throughout Zones 1 and 2.
- Lower two-thirds of Zone 2 is canyon with high velocities; the upper one-third has a flatter gradient
- One notable Chinook spawning location was a side channel as noted in the photos of Zone 2. The photos were taken when the flows had been reduced to 12-15 cms; however, spawning was occurring when the flows were higher.
- This area had open water in December – possibly due to slightly warmer water coming out of the powerhouse.
- The 7 confirmed redds shown in the lower photo correspond to the dot on Map 2. Confirmed redds were where EDI saw salmon attending the redds. The suspected redds have a very high likelihood of being actual redds, but adult Chinook were not observed in the vicinity (which could be related to water clarity/visibility issues during the prior flights).
- Previous work documenting spawning areas is the 1992 Triton Report which was based on one flight, looking for fish and not redds – so

relevance is not high.

- EDI noted that anchor ice was visible on Dec. 17th in Reach 3 and the lower portion of Reach 4.
- As Figure 3 notes, fish sampling was done throughout the Lower Mayo River. In addition to Chinook, EDI found Arctic grayling (most common species), round and lake whitefish (mostly juveniles & not high numbers), longnose sucker, northern pike, slimy sculpin and burbot. They did not catch any inconnu. The 2002 fish salvage of the plunge pool, conducted in advance of maintenance of the spillway, caught 8-9 adult inconnu.
- Each sampling method was used in each reach. Minnow trapping was very successful for juvenile Chinook; beach seining targeted adult fish. More details on species caught can be found in the Appendix to the EDI Summary Report.
- Existing information on this area complements EDI's field work including the habitat restoration project downstream of the Mayo Bridge in Reach 1.
- There is a high likelihood that several fish species are spawning in the lower reaches of the Mayo River.
- EDI's Chinook salmon work builds on a base of previous studies including four years of bi-monthly counts of juveniles; the Triton work in the early 1990s and a number of other studies.
- Figures 4 through 7 are habitat mapping/channel classification of Zones 1-3 with fish sampling sites overlaid on the maps. Channel classification was based on flow characteristics, amount of cover, ortho-photos taken in July 2008 (with flows of about 27 cms) and field knowledge:
    - Main stem (photo is from Zone 2) – majority of river flow, higher velocities.
    - Primary Side Channel – similar characteristics of a main channel, but with a lower proportion of the stream flow, with a bit more riparian influence than the main stem.
    - Secondary Side Channel – smaller proportion of flow, with more over-hanging vegetation cover and riparian influence; lower gradient due to increased length in comparison to the mainstem.
    - Tertiary Side Channel – very small, tributary-like channel with greater riparian influence over the whole channel. Lots of woody debris; valuable fish habitat as a refuge from the higher velocities of the main-stem. Not as susceptible to high flows.
    - Back Channel – back-flooded from the river with limited flowing water.

Ben noted that EDI also collected invertebrate drift samples throughout the Mayo River system for biomass and abundance to aid in the identification of good feeding areas. This work was done in late August/early September over 1-2 days at consistent flow levels during a 6 hr. daylight period. The process

follows Hatfield's work in BC.

The main-stem, primary and secondary side channels were further divided into habitat units, classified as riffles, glides, and pools. Each habitat unit was assigned a value for riparian cover and one for in-stream cover. An example of the habitat units determined in upper Zone 2 and Zone 3 is shown in the presentation on pg. 9.

EDI will next quantify changes in habitat that may result with the Project:

- Assign values to the habitat and quantify change and relative value change to help determine what the habitat will look like with the Project.

Preliminary Results – Zone 4 (Figure 8)

- Freshwater fish sampling (using all three methods) resulted in Arctic grayling, burbot, round and lake whitefish, northern pike, slimy sculpin (no inconnu or Chinook salmon). Arctic grayling was most common with individuals captured at all life stages. Due to sampling issues in Reach 12, the data likely underestimated fish presence. Reach 8 had relatively high quality habitat for grayling and whitefish, especially spawning habitat.
- There is a high likelihood of spawning for these species in this zone due to the constraints at Wareham Dam and the Mayo Lake control structure (barriers to fish passage).
- No sampling was done in Wareham Lake – previous small net gillnetting was done in 2000 and 2005, finding pike, whitefish and suckers. No field work was done in Wareham Lake as there is no substantive Project-related change to Wareham Lake.

Preliminary Results – Zone 5 Mayo Lake (Figure 9)

- Six types of Littoral areas are described.
    - Type 1 – gravels/cobbles/boulders to maximum visible depth of 3 to4 m. Two percent of the total littoral area is Type 1; these are the areas with highest potential for lake trout (and possibly lake whitefish) spawning. The top left photo is at Gull Island which was later identified as an active lake trout spawning area. Other areas of Type 1 littoral areas were located in Roop Arm, east of Edmonton Creek.
    - Type 2 – narrow band at waterline of gravels/cobbles/boulders with fines and woody debris beyond (boundary typically near 3m depth), is the predominant littoral area around the lake. The upper right photo is an example of this littoral type.
    - Type 3 has some aquatic plants. This area is related to erosion along the lakeshore, with fine materials and some woody debris.
    - Type 4 has fine substrates and more extensive plant growth– an example is the lower left photo of the end of Nelson Arm where aquatic plants are widespread. Most of this type is at the ends of Roop and Nelson arms and in areas of sheltered,

shallow bays.

- Type 5 has exposed bedrock outcroppings – an example is the lower right photo at the east end of Peggy's Island where Mike Mancini has a cabin. No aquatic vegetation present.
- Type 5 (sand) is only in a few locations, generally associated with placer mining activity (i.e., Owl and Anderson Creeks)

- YG Fisheries asked if Mayo Lake was originally logged when the dam was built.
  - Hector indicated that in general the lake was not logged. You can see woody debris lying on the bottom in shallower areas. There was some attempt at removing trees at the west end of the lake according to historic files.
  - Shoreline erosion has also caused trees to fall in to the lake or sit along the shores. In windy conditions, this debris starts to mobilize. The dominant wind direction appears to be east or west along the main part of the lake and the Roop Arm. Local people indicate the wind blows from the east and builds up the water from the arms into the main portion of the lake.
  - This year saw very high sustained lake levels up to November.
- Mayo Lake – Lake whitefish spawning assessments:
  - Tagged 16 lake whitefish with one likely mortality. The majority of the tagging occurred in the middle section of the lake.
  - Radio tagged fish at depths between 30-40 feet could be heard up to 1 km away. At depths greater than 100 m., you had to be near the fish to hear the radio tracking. Radio tracking was done by boat and helicopter.
  - Figures 10 and 11 show lake whitefish movements – the majority went into the Edwards Creek/Roop Lakes area (7 tags were tracked to this area). The photos on the left are of Edwards Creek where EDI observed the lake whitefish spawning at night during early October. They were spawning at depths of approximately 40-70 cm in Edwards Creek on the edge of a gravel bed; some up to 1.5 m depths. About 50-60 fish were located at this spot – some moving upstream and some spawning. Three tags went into the Roop Lakes area. One tag was found at the mouth of Granite Creek. There were signs of groundwater discharge in the Roop Lakes area.
  - The same area was visited the next day in daylight – lake whitefish were observed moving upstream. Upstream of tag 17, Edwards Creek changes a lot – higher gradient and velocities and different substrate materials, so not as good spawning habitat.
  - The remaining five tagged lake whitefish had different movements – but EDI was not able to confirm shallow water spawning at any of these locations:
    - #24 went into Nelson Arm

- #23 stayed in main portion of lake
- # 19 and 20 didn't move far – intensive sampling in this area showed groupings of fish on the sonar but very few shallow water captures
- Sonar investigations did not find congregations of lake whitefish at the south end of the Nelson Arm.

o There are several reasons why lake whitefish spawning is difficult to detect/track:

- Fish may not spawn every year
- Fish could be spawning in deeper water
- Lake whitefish are known to use different spawning sites, including deeper locations
- The fish that were tagged may not have been mature fish

o Most of the juvenile lake whitefish were caught previously in the Roop arm.

- The lake whitefish likely retreated back into the lake as they were not relocated when the last aerial survey was done in late October.
- During the Dec. 17th over-flight, EDI observed some sections of Edwards Creek with open water (not continuous ice cover), with groundwater indications. Dennis Buyck (NND Lands Director) noted this was an area commonly with open water conditions during winter as well.
- Mayo Lake – Lake trout spawning assessments:
  - o Figure 12 shows lake trout movements.
  - o EDI was not successful catching lake trout prior to spawning; so used the littoral classification and sonar investigations to identify potential spawning habitat and investigated those sites.
  - o They tagged ten lake trout at Gull Island and one at the east end of the Roop Arm. Sampling was done at night with small mesh gillnetting and they caught a mixture of sizes of both sexes.
  - o There was evidence of spawning at the north and west end of Gull Island; after spawning, there is evidence of dispersal throughout the lake. The spawning area's substrate was a mixture of gravels/cobbles/boulders with few bedrock outcroppings – textbook lake trout spawning habitat. The graph indicates that most of the lake trout were captured at a water depth of up to 4m.
  - o The spawning period was about 10-14 days.
  - o Other locations that looked suitable for lake trout spawning, i.e., the narrows (in Nelson Arm) and the east end of Roop Arm. One mature lake trout in spawning condition was captured at the eastern end of Roop Arm but more intense sampling failed to locate congregating individuals. Sonar showed large numbers of lake trout around Gull Island and

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| | the east end of Roop Arm - some at depths of 120-140 feet.<br><br>EDI was asked if they planned to do more lake trout/whitefish tag and capture next year. Ben indicated that the existing tags will "turn-on" again and provide additional data next fall if there is a program to monitor them. A summer fish monitoring program has not yet been developed. Aaron noted such a monitoring program for lake trout and lake whitefish would be very valuable information to contribute to data collection and knowledge of the lake. Pat Tobler noted that a fair number of studies, age class data, frequency data etc. will be included in the baseline report (not just field data).<br><br><u>Salmon spawning at a variety of river flows – series of graphs:</u><br><br>• Five graphs illustrate the variability of river flows through the lower Mayo River (blue line) overlaid with the life cycle of Chinook salmon (orange is spawning; green is incubation). These graphs are all during the period of local Mayo loads only (i.e., after YKHM shut down mining operations in 1989 and before Mayo-Dawson hook up in 2003).<br>o In 1989/90, the graph shows spawning in flows of 20 cms or less; followed by low flows of 4cms during early stages of incubation and then flows back to 20 cms for the remainder of the incubation period.<br>o In 1990/91 they likely picked a different spawning location (likely deeper and more secure channels) as the flows were 6-8 cms at the time of spawning. Incubation included flows as high as 40 cms (spill + plant flows)<br>o The following year, 1991/92, spawning occurred at quite high flows of between 25 and 60+ cms; incubation occurred in very high flows at the start, then levels dropping drastically to less than 5cms flows for a period.<br>o In 1992/93 – a typical year before MD was connected and loads were equivalent to the community of Mayo alone – summer flows during spawning were dropping from 65 cms to 30 cms. This was a year where the flows were largely spillway flows as the plant tops out at 18 cms. During incubation, the flows were reduced to less than 5 cms (similar to the year before).<br>• It was noted that in the past, the Mayo River was not managed for fish; yet despite these swings the Mayo River is still productive for Chinook and other freshwater fish species.<br>• In the future, with or without Mayo B, there will be an opportunity for Yukon Energy to manage the flows better downstream of the plant (for the benefit of fish).<br><br><u>Sample graphs of lake trout spawning areas at Mayo Lake:</u><br><br>The graphs are an approximation of lake profile and lake trout spawning depths at Gull Island during different lake levels. In all cases, the maximum and minimum licensed lake levels are included, as well as the approximate |

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| | pre-impoundment elevation.<br>o The first graph is an estimate of the cross-section of the lake bottom. The green line shows the area where mature lake trout were caught (indication of spawning depth).<br>o The second graph (1984/85) shows a condition when UKHM mining operations were active mine and almost the full operating range of the lake was used. During these types of conditions, a notable portion of the spawning area used in 2008 would be de-watered by the spring (i.e., emergence time).<br>o 1994/95 graph shows conditions where only a small portion of the operating range was used (UKHM shut-down and only local loads at Mayo). The graph shows that more potential spawning habitat (as used during 2008) would be available.<br>o 2004/05 after Mayo-Dawson was connected was a very dry year. Not as much water would have been available therefore the drawdown would be less. This condition has less area available for spawning, but not much of that area would have been de-watered as compared to the 1984/85 conditions.<br>o An important note is that the approximate pre-impoundment elevation is lower than most of this spawning area, indicating that lake trout have adapted to current spawning conditions over time. |
| Questions or concerns: | • Is there ice thickness data for Mayo Lake? No, not that Yukon Energy is aware of.<br>• Where is the water measured at Mayo Lake? At the outlet (west arm) of the lake. Fall levels will not be the same every year as levels depend on inflows over the spring/summer and whether the reservoir fills up completely or not.<br>• Is there a Fisheries Act Authorization for Mayo? No, it has not been required. Patrick noted that it is common across Canada for hydro plants not to have an FAA. When Yukon Energy bought the facilities from NCPC (federal) they were fully permitted; an FAA has not come up since and the facilities were relicensed in 2000 without a FAA.<br>• Nathan indicated that Yukon Energy has collected a lot of valuable information and he welcomed the fact that the information has been presented in a geographic/spatial scale under different draw-down scenarios. YG Fisheries will send comments to Hector. He has a few concerns such as:<br>o Not convinced the lake whitefish are not spawning in Mayo Lake proper. Aishihik experience indicates there is a threshold below which there is no recruitment. He feels there is a need for understanding of lake whitefish spawning and viability of the population.<br>o As minimum water levels occur in the spring, this might suit a study in spring to collect year-class data.<br>o It was noted however when index netting you only really capture 7+ year old lake whitefish and thus there is a delay in responding |

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| | to patterns when monitoring with this method (it was also mentioned by the group that it may not be acceptable to kill many fish in this lake to get ideas of age class strength). Seven years ago the plant wasn't using the full operating range as loads were only the local Mayo load. Such a program would be useful in another 5 years.<br>• Pat noted there is 1990 age class data based on 40 lake trout and 105 lake whitefish (collected just after the mine closed down). The information did not indicate missing year classes. There is also some gillnetting data for 2000 and 2005. The data was presented on a graph, and it was noted that the distribution appeared to represent a healthy population.<br>• Nathan indicated it would be nice to see the lake trout spawning area displayed spatially to determine how much area would be impacted and noted that this would require detailed bathymetry of the near shore perimeter of the lake.<br>• It was noted that more lake trout could be radio-tagged in the spring to further understand if there are additional spawning areas.<br>• Tracking of movements of existing tags would also provide good data.<br>• Concern was expressed on possible impacts of drawdown on shallow littoral areas where young of year lake whitefish may rear. |

### 4E-3.2.2 Materials

The Preliminary Aquatic Summary was provided. See Section 4E-3.1.2.

## 4E-4.0 COMMENTS FROM VARIOUS DEPARTMENTS

Certain departments provided written comment upon learning about the project via the first newsletter. These written comments are provided here.

**Yukon Water Board**

*Office des eaux du Yukon*

2008 DEC -3 AM 11: 27

December 4, 2008

Yukon Energy
Hector Campbell
Director, Resource Planning & CIO
P.O. Box 5920
Whitehorse, Yukon
Y1A 5L6

Re: Proposed Mayo Hydro Generation Enhancement Project ("Mayo B")

Dear Mr. Campbell:

Thank you for providing us with preliminary information on the proposed upgrades at the Mayo hydroelectric facility.

As laid out in your newsletter, such an endeavour will entail an assessment by YESAB as well as a new or amended water licence from the Yukon Water Board. Once you have completed your consultation efforts and have finalized your project application, we are inviting you to set up a meeting with us to discuss your project in more detail.

Once we are in receipt of your Schedule 4 and accompanying project application, we will initiate the review of the water use portion of your project. Please keep in mind that you can apply to us at the same time as you apply with YESAB.

If you have any questions in the mean time, please give me a call at 456-3984.

Sincerely,

Carola Scheu
Manager, Yukon Water Board

cc: HY99-012

Transport Canada / Transports Canada

Environmental Affairs – Programs
P.O. Box 8550
3rd Floor, 344 Edmonton Street
Winnipeg, Manitoba
R3C 0P6

Your File / Votre référence

Our file / Notre référence

December 17, 2008

Yukon Energy Corporation
energy.ca
P.O. Box 5920
Whitehorse, Yukon
Y1A 5L6

via email: communications@yukon

Yukon Energy:

**Re: Proposed Mayo Hydro Generation Enhancement Project ("Mayo B")**

Thank you for your November 8, 2008 letter requesting that Transport Canada (TC) assess the proposal with respect to the above referenced project. Transport Canada has conducted a cursory review of the project proposal in accordance with our mandate and has identified several areas of potential interest.

Based upon this initial review, TC is of the opinion that components of the project proposal may have the potential to cause interference to safe navigation. Potential areas of interest could include, but not limited to, any work(s) to be built or placed in, on, over, under, through, or across any navigable waterway. This could include facilities and infrastructure associated with the construction of the proposed powerhouse, components of either water diversion 1 (canal and/or penstock) or 2 (tunnel), and various structures related with the development of the temporary camp at the project site. The proponent will need a formal submission to the Navigable Waters Protection Program (NWPP) to subsequently determine if a NWPA Approval is required for the proposed works and associated activities to be constructed, operated, and decommissioned. The proponent shall also inform the NWPP of any design, construction, or operational changes accordingly. If the proponent is uncertain of the NWPP's requirements as they pertain to an application for a specific work, please refer to the NWPP Internet site or contact the following NWPP office; http://www.tc.gc.ca/marinesafety/oep/nwpp/menu.htm.

Transport Canada
Prairie and Northern Region
Navigable Waters Protection Program
1100, 9700 Jasper Avenue
Edmonton, Alberta T5J 4E6

Tel: (780) 495-8215
Fax (780) 495-4748

Canada

Transport Canada would like to thank Yukon Energy for the opportunity to review the project proposal for the Mayo Hydro Enhancement Project (Mayo B) and thank you in advance for your consideration of our comments. Should you have any questions regarding these comments or require additional information, please feel free to contact Christopher Aguirre at (204) 984-2615 or by email at christopher.aguirre@tc.gc.ca.

Regards,

Christopher Aguirre
Environmental Officer (North)

Cc : Doug Soloway - Superintendent, Environmental Assessment Management Program (