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APPENDIX A

Basis for Analytical Approach for RAMP 2004 Technical Report

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APPENDIX A

BASIS FOR ANALYTICAL APPROACH FOR RAMP 2004 TECHNICAL REPORT

A1.0 INTRODUCTION

This Appendix contains resource materials that were used to develop the outline, analytical approaches and contents of the 2004 RAMP Technical Report. This material comes from two main sources:

- the findings of the Scientific Peer Review of the Five-Year Report (1997-2001); and
- preliminary findings of the RAMP Program Design Documentation Project.

A1.1 RELEVANT RECOMMENDATIONS FROM SCIENTIFIC PEER REVIEW

The Scientific Peer Review of the Five-Year Report (1997-2001) makes a number of recommendations on many aspects of RAMP, and some of these are germane to RAMP technical report preparation (others are being addressed via the RAMP Program Design Documentation Project and still others are best left for consideration by the RAMP Steering Committee). With respect to items that are germane to RAMP reporting, the main recommendations of the Scientific Peer Review are as follows.

A1.1.1 Relevant Primary Technical Recommendations

Adoption of an Ecosystem Approach (Executive Summary: II.1, Page iv) It is recommended that RAMP measure development-related change at an ecosystem level while incorporating site-specific needs. Monitoring must fit within the context of an adaptive management framework and focus beyond project-specific needs. This should include:

- selecting appropriate indicators to be measured to assess a particular development activity; and
- deciding what the indicator will be compared against to determine when a change has occurred and whether the change is significant.

Adoption of Effects-Based Monitoring (Executive Summary: II.2, Page v) It is recommended that RAMP orient its efforts towards effects-based monitoring with the objective being to document environmental change that is occurring as a result of development. Included in the effects-based approach should be the following:

- selection of key response indicators for each RAMP component, based on potential changes resulting from oil sands development;

- on-going synthesis of information related to development pressures including: (i) type of development activity; (ii) location of activity; (iii) stressors released; (iv) effects predicted; (v) assumptions used in predictive tools; (vi) location of modeling nodes, i.e., information on oil sands development;

- selection and use of reference and "low-impact" stations within or outside the region for each component subject area;

- use of biostatistical analyses that report statistical confidence levels and power analyses for indicators of change in order to assist with the interpretation of observed environmental changes; and

- incorporation of other existing regional information.

Testing Environmental Impact Assessments (EIA) Predictions (Executive Summary: II.3, Page vi) It is recommended that RAMP complete an exercise to test predictions from already completed EIAs using actual data generated on a site or sites.

Increased Emphasis on the Athabasca River as a Priority Watershed (Executive Summary: II.5, Page vi) It is recommended that RAMP use the Athabasca River as a central focus for monitoring across component subject areas because it is the largest and most important aquatic ecosystem in the region and the natural recipient of many of the overall cumulative effects of oil sands developments.

A1.1.2 Relevant Secondary Technical Recommendations

Contributions to New Knowledge (Executive Summary: III.1, Page vi) It is recommended that RAMP recognize the importance of creating new knowledge and incorporating this knowledge into the monitoring program.

Traditional Ecological Knowledge (TEK) (Executive Summary: III.2, Page vi) It is recommended that RAMP actively promote the use of TEK.

A1.2 PRELIMINARY FINDINGS FROM RAMP PROGRAM DESIGN DOCUMENTATION PROJECT

Work on the RAMP Program Design Documentation Project is proceeding and there are a number of preliminary results and findings that were useful for preparing the 2004 RAMP Technical Report.

The following 14 EIAs were reviewed as part of the RAMP Program Design Documentation Project:

- Albian Shell Muskeg River
- CNRL Horizon
- Deer Creek Joslyn Phase 2
- Gulf Canada Surmont
- Opti/Nexen Longlake
- PetroCanada Mackay River
- PetroCanada Meadow Creek

- Shell Jackpine
- Suncor Firebag
- Suncor Mildred Lake
- Suncor Millenium
- Suncor South Tailings
- Suncor Steepbank
- Syncrude Aurora

In addition, approvals granted by the AEPEA for the following 12 projects were reviewed (approvals for PetroCanada Meadow Creek or Suncor South Tailings EIAs were not reviewed):

- Albian Shell Muskeg River
- CNRL Horizon
- Deer Creek Joslyn Phase 2
- Gulf Canada Surmont
- Opti/Nexen Longlake
- PetroCanada Mackay River
- Shell Jackpine
- Suncor Firebag
- Suncor Mildred Lake
- Suncor Millenium
- Suncor Steepbank
- Syncrude Aurora

First, a number of assessments and predictions are lumped across all project phases and are not disaggregated by project phase. In most cases, only overall (i.e., aggregated across construction, operation, and closure phases) assessments and predictions are made of the effects of project activities on a KIR/VEC. This makes it difficult, if not possible, to test impact predictions with RAMP according to the specific phase of projects.

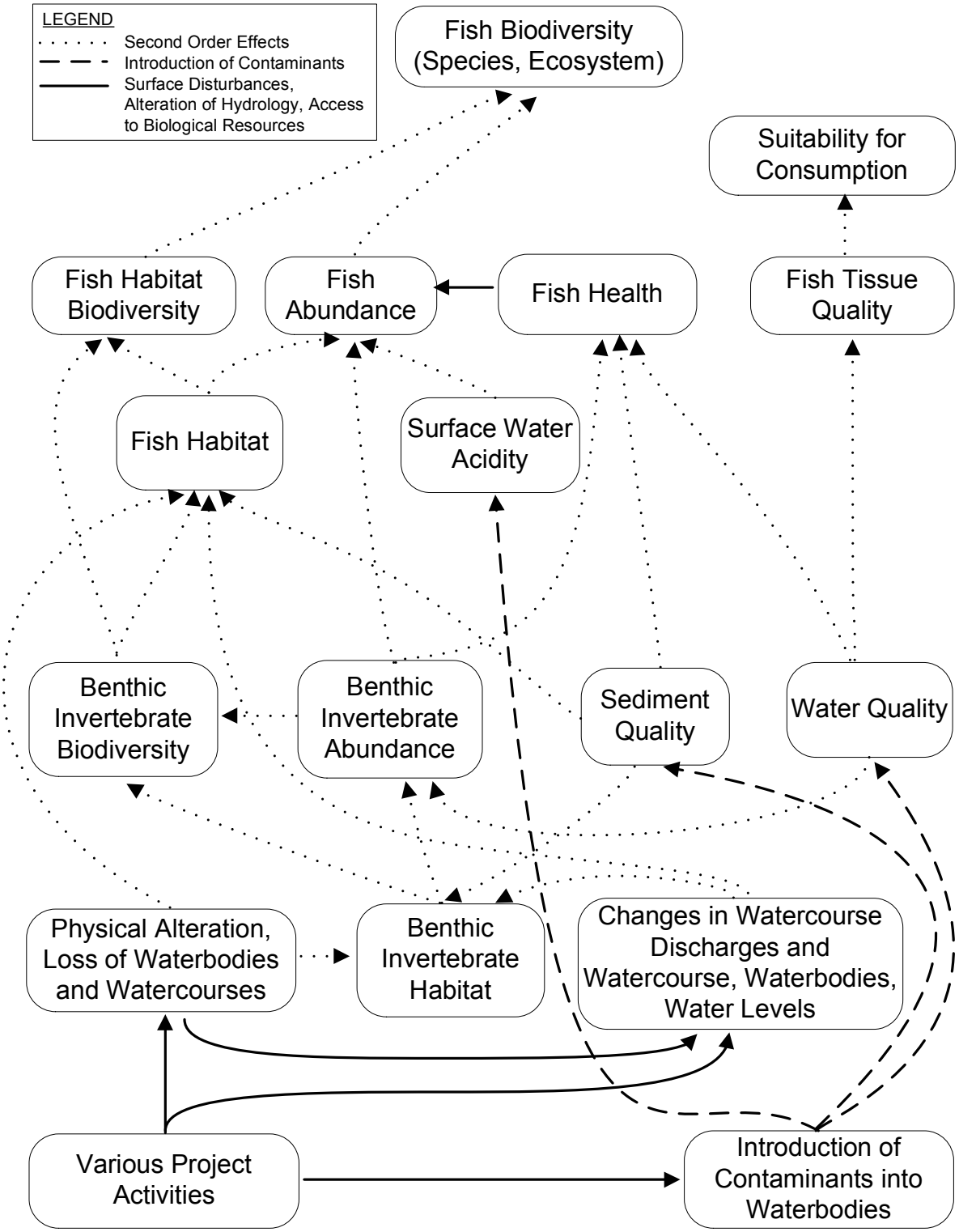
Second, the impact predictions made in the EIAs that were reviewed can essentially be synthesized into a relatively synoptic and aggregated description of expected effects of oil sands development activities on aquatic resources. That is, essentially the same aquatic effects issues appear again and again in the oil sands EIAs, with some variation according to whether the project is a mine project or an *in situ* type of project. Figure A-1 contains a synoptic description of impact predictions for open-pit mine oil sands developments, while Figure A-2 contains a synoptic description of impact predictions for *in situ* oil sands developments. Table A-1 and Table A-2 present the synoptic results in table form, and projects for which each of the major issues were assessed are noted.

Third, many of the EIAs define mostly quantifiable measurement endpoints for aquatic resources of concern, and also define mostly quantitative criteria which are used to determine the significance of impacts that are predicted. This is most often done in a number ways: direction, magnitude, geographic extent, duration, reversibility, and frequency of impact. These have been extracted from the EIAs that were reviewed and are presented below in Table A-3 (only criteria pertaining to magnitude are presented). Table A-3 contains both:

- the cases in which impacts on KIR/VEC RAMP components are assessed by measurement endpoints in those same components (e.g., cases in which prediction of effects on, say, fisheries, are assessed by predictions of fisheries measurement endpoints); and

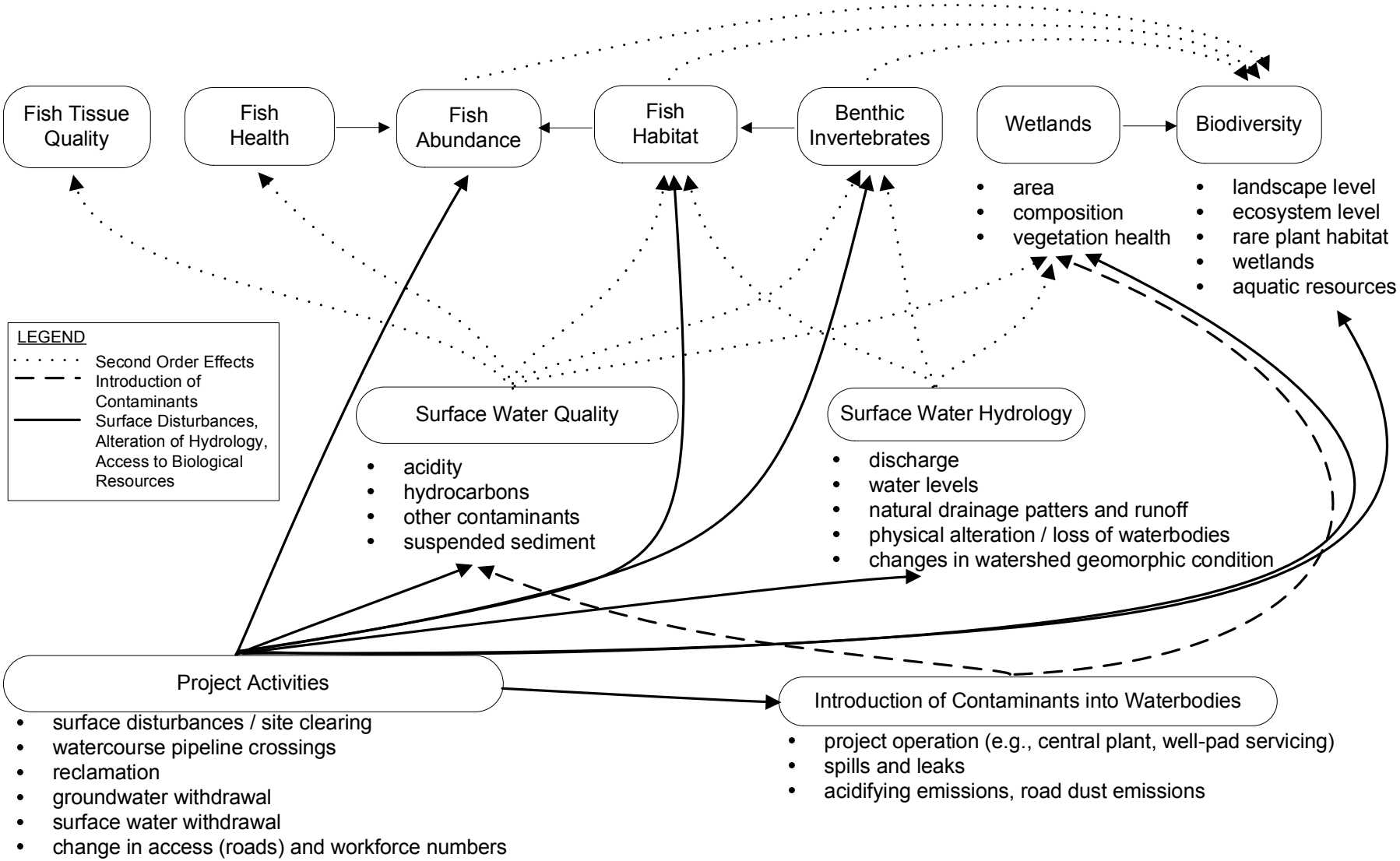
- cases in which impacts on KIR/VEC RAMP components are assessed by measurement endpoints in lower level components (e.g., cases in which predictions of effects on, say, fisheries, are assessed by predictions of effects on hydrological or water quality endpoints).

Figure A-1 Summary description of expected effects of open-pit mine oil sands projects on aquatic resources covered in RAMP.



RAMP1110: OpenPit_EnvImpact.VSD

Figure A-2 Summary description of expected effects of *in situ* oil sands projects on aquatic resources covered in RAMP.



RAMP1100: SAGD_EnvImpact.VSD

Table A-1 Synoptic Summary of Oil Sands EIA Predictions: Mines.

Issue/Description of Impact	Activities	Project							
		Albian Shell Muskeg River	CNRL Horizon	Shell Jackpine	Suncor Millenium	Suncor South Tailings	Suncor Steepbank	Syncrude Aurora	Syncrude Mildred Lake
Climate and Hydrology									
• changes in flows and levels in receiving streams, changes in open-water areas of lakes and streams	• infrastructure development, muskeg drainage and overburden dewatering, site clearing, mine pits, disposal areas, plants site and closed-circuit operation, diversion and disruption of natural drainages, water withdrawal from watercourses and waterbodies, runoff from reclaimed areas, residual seepage from mine areas, end-pit lake development	X	X	X	X	X	X	X	
• change in basin sediment yield and sediment concentrations in receiving streams	• infrastructure development, muskeg drainage and overburden dewatering, site clearing, diversion and disruption of natural drainages, reclamation	X	X	X		X			
• changes in water balance of nearby waterbodies caused by drawdown of surficial aquifer at perimeter areas of mine pits and EPLs, deep percolation loss, reduction in base flows of adjacent streams	• basal aquifer depressurization	X						X	
• changes in channel dimension, shape, gradient, meander pattern, and erosion/sedimentation due to changes in flows	• diversion and disruption of natural drainage patterns, inflows from project activities	X							
• sustainability of closure landscape and drainage system as affected by surface and gully erosion from reclaimed landscape with immature drainage density, channel evolution	• creation of closure landscape and drainage system	X	X						
Water Quality									
• changes in water quality caused by direct disturbance of natural watersheds affecting runoff and drainage patterns, in-stream flow, contamination from mine-related waters and assimilative capacity of receiving environment	• mine operations, muskeg and overburden dewatering, seepage of process-affected waters (external tailings disposal, in-pit and external tailings deposits), stream diversions, disruption of natural drainage, upward flux of process-affected water (in-pit and external tailings deposits), End Pit Lake Outflows, accidental releases and spills, mine drainage system	X	X	X	X	X	X	X	
• alteration of thermal regime of receiving waters	• muskeg and overburden dewatering	X	X	X	X				

Table A-1 (cont'd.)

Issue/Description of Impact	Activities	Project							
		Albian Shell Muskeg River	CNRL Horizon	Shell Jackpine	Suncor Millenium	Suncor South Tailings	Suncor Steepbank	Syncrude Aurora	Syncrude Mildred Lake
Water Quality Cont'd.									
• changes in dissolved oxygen levels	• muskeg and overburden dewatering	X	X	X	X				
• ecological viability of End Pit Lakes as determined by water quality of EPL discharge waters	• mine operations, seepage of process-affected waters (external tailings disposal, in-pit and external tailings deposits), End Pit Lake Outflows	X	X	X	X	X		X	
• year-round acidification caused by deposition of acids or acid-forming substances	• acidifying emissions, runoff containing acidifying substances released by the Project	X							
• changes in water quality of waterbodies (metals, PAHs) cause by deposition of particulates containing metals and PAHs	• emissions of particulates								X
Sediment Quality									
• increase in PAHs in sediments caused by mobilization of naturally occurring PAHs, discharge of PAH-containing mine-related waters to receiving waterbodies	• muskeg and overburden dewatering, mine operations, seepage of process-affected waters (external tailings disposal, in-pit and external tailings deposits), upward flux of process-affected water (in-pit and external tailings deposits), End Pit Lake Outflows	X	X	X	X	X			
Benthic Invertebrate Community									
• ecosystem level diversity indicators, taxonomic richness of benthic invertebrate communities caused by changes in water quality, sediment quality, direct uptake from water and sediments	• releases of consolidated tailings water from the Project; releases of seepage water from the Project; introduction of substances to Project area watercourses from surface runoff and/or accidental spills, water diversions, ecological viability of End-Pit Lakes		X	X		X	X		
• disturbance, alteration, or loss of productive fish habitat within Project development area	• damming of watercourses and watercourse re-establishment on closure; elimination of watercourses, diversion of watercourses, elimination of reaches of watercourses, creation of new exit route for watercourses from waterbodies, by damming current outlet and creation of new channel; repositioning of watercourses	X							

Table A-1 (cont'd.)

Issue/Description of Impact	Activities	Project							
		Albian Shell Muskeg River	CNRL Horizon	Shell Jackpine	Suncor Millenium	Suncor South Tailings	Suncor Steepbank	Syncrude Aurora	Syncrude Mildred Lake
Fish Populations									
• changes in fish health caused by direct effects on fish health through changes in water quality, sediment quality, direct uptake from water and sediments; indirect effects on fish health via direct effects on fish food organisms	• releases of consolidated tailings water from the Project; releases of seepage water from the Project; introduction of substances to Project area watercourses from surface runoff and/or accidental spills, muskeg and overburden dewatering	X	X	X		X		X	
• changes in fish tissue quality caused by the changes in water quality, including fish tainting	• releases of consolidated tailings water from the Project; releases of seepage water from the Project; introduction of substances to Project area watercourses from surface runoff and/or accidental spills, muskeg and overburden dewatering	X	X	X	X	X	X	X	
• changes in fish habitat diversity, species level fish biodiversity indicators, ecosystem level diversity indicators caused by: (i) direct effects of habitat changes; (ii) effects of habitat changes on benthic macroinvertebrate community diversity on fish habitat biodiversity	• releases of consolidated tailings water from the Project; releases of seepage water from the Project; introduction of substances to Project area watercourses from surface runoff and/or accidental spills, muskeg and overburden dewatering		X	X		X	X	X	
• types of aquatic habitats that will develop in Project reclamation watercourses and waterbodies	• constructed wetlands, stream development, End Pit Lakes	X	X	X	X	X		X	
• changes in forage fish habitat caused by changes in area of lakes/ponds, changes in flow regime	• diversion and disruption of natural drainage patterns, inflows from project-related waters, mine facilities and infrastructure	X	X		X			X	
• effect of acidity on fish and aquatic biota from deposition of acids and acid-forming substances	• acidifying emissions		X						X
• effect on aquatic resources from deposition of particulates containing metals and PAHs	• emissions of particulates								X
Aquatic Vegetation									
• changes in area of different wetland habitats, peatlands, and riparian areas; rare and traditional plants found in wetlands caused by loss or alteration of wetlands (including peatlands) and riparian communities; change in wetlands from water releases; drawdown of surficial aquifer; dust from vehicular traffic; loss of rare and traditional use plants	• various project activities at all stages, including reclamation and closure	X	X	X	X	X	X	X	

Table A-1 (cont'd.)

Issue/Description of Impact	Activities	Project							
		Albian Shell Muskeg River	CNRL Horizon	Shell Jackpine	Suncor Millenium	Suncor South Tailings	Suncor Steepbank	Syncrude Aurora	Syncrude Mildred Lake
Aquatic Vegetation Cont'd.									
• change in wetland and aquatic vegetation biodiversity at the landscape level and ecosystem levels	• site clearing, infrastructure construction, reclamation and closure	X	X	X	X	X	X		
• changes in vegetation health caused by deposition of acids or acidifying substances	• acidifying emissions		X		X				
Acid-Sensitive Lakes									
• changes in acidity of lakes caused by changes in acid deposition	• air emissions	X	X	X	X			X	X

Table A-2 Synoptic Summary of Oil Sands EIA Predictions: *in situ* Projects.

Issue/Description of Impact	Activities	Project					
		Deer Creek Joslyn Phase 2	Conoco Phillips Surmont	Opti/Nexen Long Lake	PetroCanada Mackay River	PetroCanada Meadow Creek	Suncor Firebag
Climate and Hydrology							
• changes in flow and water levels, open water areas caused by changes in groundwater flow discharges, near-surface water table	• groundwater withdrawal		X	X	X	X	X
• changes in flow and water levels, open water areas caused by changes in runoff to streams, drainage patterns, blockage of surface and near-surface flows	• surface disturbances (central facility, well pads, roads, etc.)	X	X	X	X	X	X
• changes in geomorphic conditions of watersheds and drainage systems caused by changes in surface water runoff and land cover	• surface disturbances (central facility, well pads, roads, etc.)					X	
• changes in geomorphic conditions of watersheds and drainage systems caused by sediment runoff, stream erosion and pipeline exposure during floods	• disturbance of bed and banks of stream channels at watercourse crossings					X	
• changes in basin sediment yield, sediment concentrations caused by changes in surface water and sediment runoff, channel erosion and pipeline exposure during floods	• surface disturbance from project infrastructure and facilities			X			
• change in flows	• water withdrawal	X					
Water Quality							
• changes in water quality caused by increased surface water runoff, increased sediment loading and transport of chemical contaminants	• surface disturbances (land clearing, road cut and fill, stream crossings, instream construction, bank excavation, pad construction, camps, central plant facility), drilling of wells, ancillary facilities (disposal pits), physical alteration of stream channels	X	X		X	X	X
• changes in water quality (total dissolved solids, conductivity, oil and grease) caused by small and infrequent releases of produced water to ground surface	• well servicing				X		
• changes in water quality caused by small releases of produced fluids and production chemicals, overflow (flood circumstances) and seepage of water from retention pond	• operation and maintenance of central plant facility and retention pond				X		

Table A-2 (cont'd.)

Issue/Description of Impact	Activities	Project					
		Deer Creek Joslyn Phase 2	Conoco Phillips Surmont	Opti/Nexen Long Lake	PetroCanada Mackay River	PetroCanada Meadow Creek	Suncor Firebag
Water Quality Cont'd.							
• changes in water quality: potential increase in total suspended sediments	• dismantling of facilities, removal of roads and contaminated soil, reclamation of sites		X		X		
• changes in water quality: potential contamination of groundwater and interactions between groundwater and surface water	• introduction of chemical species into groundwater from project facilities		X				
• changes in water quality caused by interaction of groundwater and surface water - migration of chloride into surface waters and exceedance of water quality guidelines	• potential leak from lime sludge lagoon		X				
Sediment Quality							
• changes in sedimentation of receiving streams caused by physical alteration of stream channels	• activities involving instream construction and bank excavation						X
Benthic Invertebrate Communities							
• changes in benthic invertebrate resources caused by alteration/loss of habitat through changes in surface water hydrology, sediment levels, and stream channels	• surface facilities and disturbances, watercourse crossings, reclamation activities		X	X	X	X	X
Fish Populations							
• changes in fish populations caused by changes in aquifer discharge to and flows in surface waters, changes in overwintering fish habitat	• groundwater withdrawal		X	X	X		
• changes in fish health caused by increased sediment loading, introduction of hydrocarbons	• watercourse crossings		X	X			
• changes in fish tissue quality caused by changes in water quality, including fish tainting	• project operation activities - well servicing, operation of the central plant		X		X		
• changes in fish or aquatic resources caused by changes in natural drainage patterns	• surface facilities and disturbances	X	X		X		
• changes in fish or aquatic resources caused by increased sediment or contaminant input to aquatic systems through surface run-off or sediment loadings	• surface facilities and disturbances, watercourse crossings, project operation activities - well servicing, operation of the central plant, reclamation activities	X	X	X	X	X	

Table A-2 (cont'd.)

Issue/Description of Impact	Activities	Project					
		Deer Creek Joslyn Phase 2	Conoco Phillips Surmont	Opti/Nexen Long Lake	PetroCanada Mackay River	PetroCanada Meadow Creek	Suncor Firebag
Fish Populations Cont'd.							
• changes in fisheries resources caused by increase in fishing pressure and fish harvest	• recreational angling by workforce		X	X	X		
• changes in fish habitat (spawning, nursery, rearing, food supply, overwintering, migration areas) caused by alteration/loss of fish habitat through changes in surface water hydrology, sediment levels, and stream channels	• surface facilities and disturbances, watercourse crossings	X	X	X		X	
• changes in forage fish habitat and forage fish health caused by increases in sediment loading, introduction of hydrocarbons	• watercourse crossings			X		X	
Aquatic Vegetation							
• changes in bogs and fens, wetlands, riparian communities, peatlands, traditional and rare plants caused by soil erosion, compaction, mixing, contamination, or changes to soil moisture regime, hydrology	• surface facilities and disturbances, alteration of natural drainage patterns, reclamation activities	X		X	X	X	X
• changes in landscape level biodiversity - landscape fragmentation from direct loss/alteration of ecosystem units	• surface facilities and disturbances, alteration of natural drainage patterns, reclamation	X	X	X		X	X
• changes in bogs and fens, wetlands, riparian communities, peatlands, traditional and rare plants caused by salinization, contamination, or changes in aquatic pH	• migration of solution from lime sludge pond, potential spills and leaks, reclamation activities				X	X	
• changes in landscape level biodiversity - landscape fragmentation, heterogeneity caused by indirect effects through changes in edge effects, barriers to dispersal, and non-native/invasive species	• surface facilities and disturbances, alteration of natural drainage patterns, reclamation activities		X	X		X	X
• acidity of wetlands, riparian communities, peatlands, traditional and rare plants from increasing acidity and change in community composition from moss-dominated to sedge/cottongrass-dominated communities	• road dust emissions (exploration, construction, operation)		X				
• changes in wetlands caused by deposition of acids and acid-forming substances	• acidifying emissions		X	X		X	
Acid-Sensitive Lakes							
• changes in acidity of regional lakes through deposition of acids and acid-forming substances	• acidifying emissions			X		X	

Table A-3 Measurement Endpoints and Impact Criteria for Oil Sands Projects used in Project EIAs.

RAMP Component	Measurement Endpoints	Criteria for Determining Impact (Magnitude)
Climate and Hydrology	• **Jackpine Mine** – % change in mean annual discharge in streams – % change in lake water levels and depths during open-water and ice-cover seasons – % change in daily mean water level and depth exceedance statistics at 10, 50, 90 percentiles – % change in 10-year peak flood discharge, with natural 10-year peak flood discharge in natural receiving stream being the baseline case • **CNRL Horizon** – mean annual discharge – mean annual flow depth – 7Q10 low flow – 10-yr flood peak flow • **Suncor Millenium** – mean annual discharge – maximum/minimum daily flows (1 in 50 yr flood) – 1 in 100 year peak flow • **Albian Shell Muskeg River** – mean annual discharge and flow depth – mean open-water season (mid April-mid Nov.) discharge, flow depth, and 7Q10 – mean ice-cover season discharge, flow depth, and 7Q10 – 10-year flood peak discharge and flow depth – area of lakes, ponds, streams, channels, and wetlands • **Syncrude Aurora** – mean annual flow – mean open water (April to October) discharge – mean winter discharge – 7Q10 open water discharge – 10 year peak discharge – drainage area	• **Jackpine and CNRL Horizon** – change on measurement endpoints of +/- 5% is negligible, +/- 10% is low, 10% to 30% is moderate, >30% is high • **Firebag, OptiNexen Longlake, Albian Shell/Muskeg River** – change on measurement endpoints of +/- 1% is negligible, +/- 1-5% is low, 5% to 15% is moderate, >15% is high • **Gulf Canada Surmont and Syncrude Aurora** – residual impact will represent the following change in the selected parameter from baseline conditions within the RSA: Low (<1% change), Moderate (1-10% change), High (>10% change).
Water Quality	• **Jackpine** – changes in average annual TSS concentrations – decreased compliance for barium, chromium, copper, total phenolics, total phosphorus, benzo(a)anthracene group; benzo(a)pyrene group; chromium, aluminum, ammonia, barium, benzo(a)pyrene group; cadmium; fish health; sulphide; total nitrogen, dissolved organic carbon and BOD	• **Jackpine – TSS** – change on measurement endpoints of +/- 5% is negligible, +/- 10% is low, 10% to 30% is moderate, >30% is high • **Jackpine – Other Water Quality Parameters** – significant impact defined as occurring under any of following conditions: (i) instream concentrations exceed water quality guidelines where no guideline was exceeded in baseline; (ii) instream concentrations are outside of range observed in baseline; (iii) general upward shift in concentrations range compared to baseline, as reflected by higher median concentrations within same concentrations range

Table A-3 (cont'd.)

RAMP Component	Measurement Endpoints	Criteria for Determining Impact (Magnitude)
Water Quality Cont'd.	• **CNRL Horizon** – % change in TSS – decreased compliance for aluminum, iron, total phosphorous, iron, mercury, chloride, arsenic, iron, mercury, chromium, copper, manganese, barium, benzo(a)anthracene group, aluminum, cadmium, copper, manganese, silver, sulphide, total phenolics, barium, lead, molybdenum, selenium, dissolved organic carbon, BOD, dissolved oxygen, summer waterbody temperature • **Firebag** – sediment concentration in receiving streams • **Suncor Millenium** – predicted level of pH, suspended solids, nutrients, major ions, BOD • **Gulf Canada Surmont** – levels of suspended sediments and chloride • **Albian Shell Muskeg River** – concentrations and change in exceedance in guidelines (protection of aquatic life and human health) for Al, As, B, Cd, Cr, Cu, Fe, Mn, Hg, Zn – chronic and acute toxicity units – BOD of muskeg/overburden drainage waters, % of river flow from muskeg/overburden drainage waters – concentrations of benzo(a)pyrene, benzo(a)anthracene, naphthenic acids, total dissolved solids	• **CNRL Horizon – for TSS** – change on measurement endpoints of +/- 5% is negligible, +/- 10% is low; 10% to 30% is moderate, >30% is high • **CNRL Horizon – Other Water Quality Parameters** – Negligible - instream concentrations do not cause elevation in exceedance, Low - releases contribute slightly to existing background exceedance, Moderate - releases cause exceedance of guidelines where guidelines were not previously exceeded, High - releases cause substantial exceedance of guidelines • **Firebag** – Negligible - instream concentrations do not cause elevation in exceedance, Low - releases contribute slightly to existing background exceedance, Moderate - releases cause exceedance of guidelines where guidelines were not previously exceeded, High - releases cause substantial exceedance of guidelines • **OptiNexen Longlake** – predicted change of <1% is negligible, 1-5% is low; 5-15% is moderate, >15% is high • **Gulf Canada Surmont and Syncrude Aurora** – residual impact will represent the following change in the selected parameter from baseline conditions within the RSA: Low (<1% change), Moderate (1-10% change), High (>10% change) • **Albian Shell Muskeg River** – Negligible - releases do not cause exceedance of guidelines, Low - releases contribute to existing background exceedances, Moderate - releases cause marginal exceedance of guidelines, High - releases cause substantial exceedance of guidelines
Sediment Quality	• **Jackpine, CNRL Horizon, Suncor Millenium, Mildred Lake** – PAHs in sediment	• **CNRL Horizon** – Negligible - instream concentrations do not cause elevation in exceedance, Low - releases contribute slightly to existing background exceedance, Moderate - releases cause exceedance of guidelines where guidelines were not previously exceeded, High - releases cause substantial exceedance of guidelines
Benthic Invertebrate Communities	• **Jackpine** – changes in macroinvertebrate species richness • **CNRL Horizon** – levels of benthic invertebrates • **Syncrude Aurora** – chronic toxicity units, % CT water in streams – predicted acid input (PAI) relative to critical load of lake	• **Jackpine, CNRL Horizon** – Negligible - no measurable change; Low, Moderate, High - <10%, 10%-20%, and >20% change in measurement endpoint, respectively • **Syncrude Aurora** – magnitude of impact - Low (<1%), Moderate (1-10%), High (>10%)

Table A-3 (cont'd.)

RAMP Component	Measurement Endpoints	Criteria for Determining Impact (Magnitude)
Benthic Invertebrate Communities Cont'd.	• **Suncor Millenium** – PAHs in sediment OptiNexen Longlake – mean monthly flow relative to recommended minimum monthly flow (determined using the Tessman approach); predicted % reduction in mean monthly flow • **Mildred Lake** – predicted acid input (PAI) relative to critical load of lake	• **OptiNexen Longlake** – Negligible - no measurable change, or releases do not cause exceedance of guidelines; Low - <10% change in measurement endpoint, or releases contribute slightly to existing background exceedances; Moderate - 10-20% change in measurement endpoint, or releases cause marginal exceedance of guidelines where guidelines were not previously exceeded; High - >20% change in measurement endpoint, or releases cause substantial exceedance of guidelines
Fish Populations	• **Jackpine** – fish habitat diversity – tainting potential units (TPUs) – ammonia, barium, benzo(a)pyrenes, chromium, naphthenic acids, nickel, beryllium, manganese, aluminum, strontium, TDS • **CNRL Horizon** – species level fish diversity indicators (species richness, rare/endangered species), ecosystem level diversity indicators (predator and prey/forage guild ratio) – watercourse and waterbody habitat heterogeneity indicator, stream order, waterbody maximum depth, waterbody area – mean annual flow, mean ice-cover period flow, mean ice-cover flow for 7Q10 case – levels of molybdenum, TDS, mercury, arsenic, barium, total nitrogen, zinc, aluminum, manganese, selenium, strontium, boron, iron, silver, sulphide, total phenolics, antimony, napthenic acids, vanadium – PAH levels in sediments – changes in Potential Acid Input (PAI) as compared to the critical loading for each lake – levels of benthic invertebrates – tainting potential units (TPUs) • **Albian Shell Muskeg River** – tissue PAH and trace metal concentrations – mean open-water flow, open-water 7Q10, mean ice-cover flow, area of ponds/lakes – acute and chronic toxicity of CT waters • **Suncor Millenium** – waterbody area, streamflow, water levels – sediment concentration, dissolved oxygen concentration, temperature regime – fish tissue quality	• **Jackpine and CNRL Horizon** – Negligible - no measurable change; Low, Moderate, High - <10%, 10%-20%, and >20% change in measurement endpoint, respectively. Where Guidelines or Criteria Exist: Negligible - guidelines not exceeded; Low, Moderate, High - existing background exceeded slightly, marginally, and substantially, respectively • **Jackpine (tainting potential units)** – change in tainting potential units (TPU) with TPU=1 equal to the threshold for tainting • **Jackpine (water quality parameters)** – Negligible - no measurable change; Low, Moderate, High - <10%, 10%-20%, and >20% change in measurement endpoint, respectively. Where Guidelines or Criteria Exist: Negligible - guidelines not exceeded; Low, Moderate, High - existing background exceeded slightly, marginally, and substantially, respectively • **CNRL Horizon (hydrology, most water quality measurement endpoints, benthic invertebrates, TPUs)** – Negligible - no measurable change; Low, Moderate, High - <10%, 10%-20%, and >20% change in measurement endpoint, respectively. Where Guidelines or Criteria Exist: Negligible - guidelines not exceeded; Low, Moderate, High - existing background exceeded slightly, marginally, and substantially, respectively • **CNRL Horizon (PAI)** – Negligible magnitude is defined as no increase in PAI or no new occurrence of PAI that is above CL; Low magnitude is defined as contribution of emissions to an existing occurrence above CL or results in a new occurrence above the CL • **Firebag** – Negligible - no measurable change; Low, Moderate, High - <10%, 10%-20%, and >20% change in measurement endpoint, respectively. Where Guidelines or Criteria Exist: Negligible - guidelines not exceeded; Low, Moderate, High - existing background exceeded slightly, marginally, and substantially, respectively

Table A-3 (cont'd.)

RAMP Component	Measurement Endpoints	Criteria for Determining Impact (Magnitude)
Fish Populations Cont'd.	• **OptiNexen Longlake** – mean monthly flow relative to recommended minimum monthly flow (determined using the Tessman approach); predicted % reduction in mean monthly flow – predicted acid input (PAI) relative to critical load of lake • **Gulf Canada Surmont** – levels of suspended sediments – streamflow and water levels • **Syncrude Aurora** – area of aquatic habitat (at summer 7Q10, mean winter, and 10-yr peak discharge) – sediment concentrations – chronic toxicity units • **Mildred Lake** – potential acid input (PAI) relative to critical load of lake – metals and PAH levels in surface waters and sediments	• **Albian Shell Muskeg River** – Negligible - no measurable change; Low - <10% change in measurement endpoint, Moderate - 10-20% change in measurement endpoint, High - >20% change in measurement endpoint • **Suncor Millenium (water quality and hydrology endpoints)** – Negligible - no measurable change; Low, Moderate, High - <10%, 10%-20%, and >20% change in measurement endpoint, respectively • **Suncor Millenium (fish tissue quality)** – Changes in measurement endpoints: Negligible (no measurable change, or no exceedance of guidelines); Low (<10% change, or releases contribute to existing baseline exceedances); Moderate (10-20% change, or releases cause marginal exceedance of guidelines); High (>20% change, or releases cause substantial exceedance of guidelines) • **OptiNexen Longlake (hydrology and PAI endpoints)** – Negligible - no measurable change, or releases do not cause exceedance of guidelines; Low - <10% change in measurement endpoing, or releases contribute slightly to existing background exceedances; Moderate - 10-20% change in measurement endpoint, or releases cause marginal exceedance of guidelines where guidelines were not previously exceeded; High - >20% change in measurement endpoint, or releases cause substantial exceedance of guidelines • **Gulf Canada Surmont (hydrology and water quality endpoints)** – Residual impact will represent a change in the selected parameter from baseline conditions: Low (<1% change), Moderate (1-10% change), High (>10% change). Residual effect is signficant if potential effect predicted to cause >5% change in productive capacity or survival of KIR, or productive capacity of its habitat. • **Syncrude Aurora** – magnitude of impact: Low (<1%), Moderate (1-10%), High (>10%)
Acid Sensitive Lakes	• **Jackpine, CNRL Horizon, Firebag, Suncor Millenium, Opti/Nexen Longlake, Mildred Lake, Albian Shell Muskeg River** – changes in Potential Acid Input (PAI) as compared to the critical loading for each lake • **Syncrude Aurora** – acid deposition	• **Jackpine, CNRL Horizon** – Negligible magnitude is defined as no increase in PAI or no new occurrence of PAI that is above CL; Low magnitude is defined as contribution of emissions to an existing occurrence above CL or results in a new occurrence above the CL • **Firebag, Opti/Nexen Longlake, Albian Shell Muskeg River** – Negligible - releases do not cause exceedance of guidelines; Low - releases contribute slightly to existing background exceedances; Moderate - releases cause exceedance of guidelines where guidelines were not previously exceeded; High - releases cause substantial exceedance of guidelines • **Syncrude Aurora** – magnitude of impact: Low (<1%), Moderate (1-10%), High (>10%)

APPENDIX B

Quality Assurance and Quality Control Procedures for 2004

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APPENDIX B

QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES FOR 2004

B1.0 QUALITY ASSURANCE PROCEDURES

Each technical component under RAMP is required to complete a series of procedures to facilitate the collection of a high level of data quality. Environment Canada (1998) defines quality assurance (QA) as:

> *Plans or programs that encompass a wide range of internal and external management and technical practices designed to ensure that the collection of data of known quality matches the intended use of the data.*

The following sections present the general procedures used by the Hatfield RAMP team for all RAMP-related data collection, handling and management. More detailed information regarding quality control for each technical component of RAMP follows the presentation of this general information.

B1.1 FIELD STAFF TRAINING

All personnel participating in 2004 field studies were professional biologists/engineers or technicians with specific training in the subject-matter area in which they were involved. Field crews were assembled based on level of expertise and seniority; although qualifications varied based on level of experience, crews typically included a field crew leader who may be either a Master's- or Ph.D.-level professional and a trained environmental field technician (B.Sc. or Dip. Tech). All 2004 field crew members have experience conducting data collection in support of scientifically defensible environmental monitoring programs.

Field crew responsibilities were clearly established prior to beginning field work through the use of Field Work Instructions (FWIs) prepared by the component or task leader. FWIs contained detailed information regarding sampling locations (e.g., coordinate location, access method), appropriate collection methodology, required supporting variables (e.g., water velocity, field water chemistry). FWIs were prepared and discussed prior to each field sampling trip (typically when the crew was still in the office).

2004 crew members have been trained in field sampling techniques through traditional education (i.e., university or college), work experience and participation in workshops/seminars. In addition, crews had training in Standard First Aid and CPR, as well as any oil sands specific site training that may have been necessary to access sites. In many cases, field personnel have additional training on the Workplace Hazardous Materials Information System (WHMIS), Transportation of Dangerous Goods (TDG) Regulations, Small Boat Safety (as required by the Coast Guard) and wilderness first aid.

B1.2 FIELD OPERATIONS

B1.2.1 Equipment

Sampling gear and equipment used for the RAMP field programs were maintained at the offices of the respective RAMP team member offices (i.e., Hatfield – Fort McMurray and West Vancouver; Mack Slack & Associates – Calgary; Jacques Whitford – Calgary). Each RAMP component manager (i.e., lead consultant responsible for a RAMP component) controlled specialized field equipment used to complete field studies. Where necessary, routine maintenance was conducted according to manufacturer's instructions to ensure valid data collection.

General field equipment that were used during field surveys (all components) include:

- provincial sampling permits (e.g., fish collection permits from Alberta Sustainable Resource Development);
- waterproof paper/data sheets, waterproof labels, indelible markers, pencils, pens, and other stationery (for recording data);
- topographical maps, hydrographic charts, and/or aerial photos of the oil sands area;
- Garmin 45, 45XL, 12XL or GPSII Global Positioning System (GPS) for obtaining data on sampling station position (latitude and longitude; accurate to approximately ±15 m);
- camera and film (to record sampling areas, specimens captured, unusual features in the environment, etc.);
- instruments for measuring the following water quality variables *in situ*: temperature, dissolved oxygen, conductivity, pH, current velocity and depth;
- miscellaneous equipment: tarpaulin, rope, measuring tape, coolers, plastic buckets, and tool box;
- waterproof clothing, including rain suits, rubber boots, etc.;
- floater jackets and/or survival suits, first aid kit and other safety equipment (including boat safety equipment);
- IBM-compatible portable (lap-top) computer, Intel Celeron 550 MHz, with 128 MB RAM. Typical programs installed include Microsoft Windows, Microsoft Excel and Microsoft Word; and
- publications and previous reports for reference.

Field operations were coordinated through the Hatfield Fort McMurray office. This role included coordination of personnel, sample handling and shipping, and end-of-day safety check-ins for field crews.

Information regarding specialized field equipment used for the RAMP program is provided in the following sections and in Appendices D to I for specific components.

B1.2.2 Data Collection, Data Tracking and Field Data Sheets

The following general data were typically recorded for field sampling activities conducted for RAMP (with some minor variability among technical components):

- date and time of sampling;
- sample numbers;
- station location (UTM coordinate, datum, zone);
- initials of field crew members;
- sampling methods/gear used;
- number of samples collected (water/sediment/benthos), number of specimens retained/ released/dissected/archived (biota), number of measurements take (climate and hydrology);
- volume of sample collected (water/sediment);
- number of samples in composite;
- handling techniques, preservation methods, sampling containers used; and
- photographs of sampling stations.

Field data collection was conducted according to procedures used for all previous RAMP studies (as described in Golder 1999).

B1.3 LABORATORY ANALYSES

Laboratories used to analyze water, sediment and fish tissue samples collected under the RAMP program are required to be accredited by the Canadian Association for Environmental Analytical Laboratories (CAEL). Responsibilities associated with this accreditation include participation in an annual performance evaluation assessment of the laboratory's procedures, methods and internal quality control.

Other samples, such as benthic invertebrate sorting and taxonomy, and fish aging, are conducted for RAMP by small independent laboratories or boutique consulting companies. These laboratories and companies are required to conduct QA/QC procedures that are considered industry standard for the respective disciplines. For example, QA/QC procedures for benthic invertebrate taxonomy meet or exceed guidelines established by Environment Canada (Glozier *et al.* 2002) for environmental effects monitoring (EEM) studies.

B1.4 DATA MANAGEMENT

Field data were entered into Microsoft Excel spreadsheets to facilitate production of tables, figures, etc., for reports.

Information on samples collected (biota/benthos/sediment/water) were carefully recorded on field data sheets, and secured at the end of each field day. All data sheets,

field notes, photographs, maps and other supporting documentation were filed within appropriate team members' secure offices. All hard-copy information will be retained for five years after the sampling date.

All products of field sampling (e.g., field notes, analytical results) were checked upon receipt for errors, analytical limits, and reasonable results and, prior to data analysis and reporting, entered data were checked for transcription errors.

B1.5 SAMPLE MANAGEMENT

All samples were handled (including preservation, storage and shipping) in accordance with established procedures (Golder 1999) and with guidelines from respective laboratories. Sample tracking was conducted by field crew leaders (or Fort McMurray-based team members). Where possible, samples were hand-delivered to laboratories; for instance, preserved benthic invertebrate samples (those collected near the end of the program) were commonly transported by field crews to the taxonomist in Calgary upon completion of the field program.

Detailed lists of samples shipped to analytical laboratories were made, such that samples could be tracked from point of shipment to the laboratory (water/sediment/benthic taxonomy). Chain of Custody (COC) forms (commonly issued by the receiving laboratory) were used to notify receiving laboratories of the number and type of samples that were being shipped. Data provided on this sheet included date, project, sample type (fish, sediment, water, benthic invertebrates, etc.), sampling location, sender's name, and any preservation added/required. Sample numbers of all specimens/containers collected, corresponding to field sample numbers, were listed. A description of each sample shipped was provided (i.e., station number, sediment, date and time collected, analyses to be performed). The receiver was required to check the shipping list to ensure all samples were accounted for and in good condition, and confirm (usually via fax) samples received, date, and analyses to be performed. To facilitate this process, a standard RAMP COC form was used by the Hatfield team, which simplified the management of sample processing and analysis.

B1.6 RAMP QUALITY ASSURANCE PLAN

In 2002, a formal RAMP-specific Quality Assurance Plan (QAP) was developed and implemented to cover all routine QA-related activities for the project. These methods were used in 2004 by the Hatfield RAMP team to ensure consistency of methods among years. Activities covered in the RAMP QAP include:

- pre-field meetings to discuss field methods (i.e., FWIs) and specifics of field tasks;
- post-field meetings to discuss results of the field activities and identify areas for improvement in future;
- routine check-ins with component leaders (24 or 48-hour interval) or the RAMP project manager during field work, as required;

- designation of staff member for each component/trip (i.e., water quality, fall field trip) to track sample handling, labeling (including COC forms), shipping and to confirm timely receipt of samples by the analytical laboratory;
- internal check of COC forms by component leaders upon field crew return (to confirm analyses requested were correct);
- internal check of data upon receipt from external labs; and
- internal check of entered field data for transcription errors.

B2.0 QUALITY CONTROL PROCEDURES

Quality control (QC) is a component of QA that pertains to internal techniques used to measure and assess data quality (APHA 1989, in Golder 2003b). QC activities for each RAMP technical component used in 2004 are described below.

B2.1 CLIMATE AND HYDROLOGY

B2.1.1 Quality Control Activities – Field

Climatic and hydrologic data collection and processing were subject to the following quality control field procedures to ensure that the published data were as accurate as possible (additional detail is provided in Appendix D):

- Stream discharge measurements and water level surveys were performed in accordance with standard procedures. Each discharge measurement was qualified according to the criteria presented in Appendix D, based on observations of site conditions and analysis of the collected data.
- Sensors from climatic and hydrologic monitoring stations were calibrated on a regular basis. Sensors at climatic stations have been rotated with spare units on a two-year frequency and the units retrieved from the field were recalibrated by the manufacturer. Calibration curves for pressure transducers installed at hydrologic monitoring stations were checked before they were reinstalled in the spring. Pressure transducers at year-round monitoring stations were checked on a less frequent basis, but consistency between water level surveys and pressure transducer readings was checked during every field visit.
- Manual discharge measurements and concurrent water levels were compared on a plot of stage versus discharge, to check for consistency between measurements and consistency with previously established stage-discharge relationships. Rating curves may shift due to changes in channel geometry or roughness.
- Snow course surveys were performed according to standard protocols (Appendix D).

B2.1.2 Quality Control Activities – Office

Climatic and hydrologic data collection and processing were subject to the following quality control office procedures to ensure that the published data were as accurate as possible (additional detail is provided in Appendix D):

- Apparent transducer elevations were calculated after each field visit as the difference between the surveyed water surface elevation and the sensor reading. The history of apparent transducer elevations was plotted for each station to check for physical sensor movement or calibration drift. Continuous water levels measured by the transducer were subsequently converted to elevations, adjusting for movement or drift.

- Rainfall and snowfall data from tipping bucket rain gauges were compared to other local and regional precipitation and temperature data and observations recorded during site visits.

- All discharge measurements were prepared by one person and checked by another person. The check included review of the original field notes and calculations.

- Hydrographs computed from continuous water level measurements and the stage-discharge rating curve were compared with manual measurements on the same plot. The resulting hydrographs were reviewed for consistency.

- Anomalies in the hydrographs, such as rapid changes in water level or discharge, were examined in detail to confirm whether the calculated discharges were likely to be representative of actual conditions. In cases where the anomalous data were inconsistent with other local and regional data (for instance, an isolated high water reading, without a subsequent recession curve), they were interpreted or discarded.

- Hydrographs computed for different stations in the same region were compared to identify anomalies.

B2.2 WATER QUALITY

B2.2.1 Methods

B2.2.1.1 Sample Collection

The following precautions were used in the field to prevent sample contamination:

- The sample bottle and cap were triple-rinsed with site water prior to sample collection;
- Grab samples were collected upstream of the boat and the person collecting the sample to avoid disturbing the substrate;
- Latex powder-free gloves were worn during sample collection;
- Sample containers were kept covered during collection of composite samples;

- Winter samples were collected from approximately 200 cm below the ice to minimize potential contamination from auger disturbance;
- Sampling was conducted sequentially from the least to the most contaminated sites; and
- Dissolved metals samples were filtered in the lab instead of in the field.

Potential contamination of samples during collection, handling, and transport was assessed using field blanks and trip blanks. Field blanks were used to assess potential contamination from sample handling, and were prepared in the field by filling sample bottles with deionized water provided by the lab. Trip blanks were prepared in the analytical laboratory prior to sampling, and were used to evaluate potential contamination from the sample container and the efficacy of sample preservation and storage conditions. Field blanks and trip blanks were utilized in all five sampling seasons (Winter-February, Winter-March, Spring, Summer, Fall), and were analyzed for the same variables as RAMP samples. Fall 2004 field blanks were labeled with dummy RAMP-style codes (e.g., POC-3 and FIB-2) to ensure "blind" laboratory analysis. All trip blanks and field blanks in other seasons were labeled as "Trip Blank" and "Field Blank".

Field and trip blank analytical results were compared to analytical detection limits. Blanks with analyte concentrations greater than five times the detection limit may demonstrate potential contamination of samples during sample collection or analysis or analytical error. Blanks with analyte concentrations below or near detection limits represent samples that were collected, handled, and analyzed without contamination or potential errors.

Two sets of field duplicates were collected from the Clearwater and Ells rivers during fall sampling to assess environmental variability and potential contamination. Analytical results for the duplicate samples were compared, and relative percent difference (difference between data values/average of data values, multiplied by 100%) was calculated for each analyte. Relative percent differences of greater than 20% were noted as potentially unacceptable levels of precision. However, because precision decreases as the analyte value approaches the detection limit, relative percent differences greater than 20% were only considered significant if the analyte values in both samples were greater than five times the detection limit.

B2.2.1.2 Sample Analysis

The chemical laboratory used a number of QA/QC samples to ensure that sample contamination did not occur during analysis and that results reported were precise and accurate. A method blank, consisting of a de-ionized water sample prepared at the initiation of the analysis, was used to assess potential contamination during analyses. A sample split into two aliquots (duplicate sample) was used to assess the precision of the analyses. Spiked samples, reference standards, and laboratory controls were used to establish the accuracy of the analyses.

For variables measured in the field, particularly dissolved oxygen, which was often measured using a multi-variable meter, comparative measurements were collected using a LaMott portable Winkler titration kit.

The toxicological laboratory also used a number of QA/QC samples to ensure that the results reported were precise and accurate. For each set of tests, a control group and reference toxicant test was used to assess the accuracy of the toxicity test and health of the test organisms. In addition, five replicates of each treatment group were used in each test to assess the precision of the results.

All laboratory QA/QC samples were assessed using in-house laboratory protocols to identify potential contamination and determine the precision and accuracy of the analyses. Any deviations from QA/QC criteria were identified in the laboratory reports and are noted in the results section that follows.

Any anomalous values identified in laboratory reports were followed up with the laboratory to determine if the value was a measurable value or due to a transcription or analytical error. If sufficient sample volumes were available, water and sediment chemistry samples that were anomalous were reanalyzed by the lab.

B2.2.2 Results and Discussion

B2.2.2.1 Field and Trip Blanks

Field blanks with analyte concentrations greater than five times the detection limit are shown in Table B-1. Conductivity was the only conventional variable that exceeded the detection limit by more than five times. The only organic compounds that exceeded detection limits by more than five times were pyrene and phenol. Concentrations of dissolved metals exceeded detection limits by up to 83 times (thorium, fall 2004 field blank), although most dissolved metal concentrations were less than 25 times the detection limit. Most total metals were less than 20 times the detection limit; however, some total metals exceeded the detection limit by a greater magnitude.

The greatest exceedance observed in the field blank was for total lead (0.771 µg/L), which exceeded the detection limit by 771 times in the March 2004 field blank. Comparison of dissolved and total lead concentrations for the field blank indicates that most (> 90%) of lead in this sample was particulate matter. A examination of lead concentrations in other samples collected during this sampling event indicates that lead contamination was not an issue; lead concentrations in 10 out of 11 samples collected during this sampling event were below this concentration, ranging from 0.20 to 0.43 mg/L.

Trip blanks with analyte concentrations greater than five times the detection limit are presented in Table B-2. Conventional variables including conductivity, dissolved organic carbon (DOC), and total organic carbon (TOC) exceeded detection limits by greater than five times. Metals including dissolved and total nickel, dissolved and total thorium, and total strontium exceeded detection limits by more than 100 times. Other metal exceedance ratios were less than 30, with the exception of total barium, lead, molybdenum, and uranium.

The number of blank exceedances for metals were similar across all seasons in 2004 for field and trip blanks, suggesting that the source of these exceedances was laboratory water, equipment or procedures, rather than contamination in the field. DOC and TOC collected in the spring trip blank were particularly high (approximately 800 times detection), indicating the sample was contaminated. The analytical lab reanalyzed these

samples multiple times and confirmed that these values were reflective of DOC and TOC content in the trip blank and not due to analytical error (ETL 2005); the source of high DOC and TOC in the trip blank is unknown, but is likely due to contaminated lab water or sample container.

Field and trip blanks were also screened against the Canadian Council of Ministers of the Environment (CCME 2003) and Alberta Environment (AENV 1999b) water quality guidelines for the protection of aquatic life. All analytes in field and trip blanks were below these guidelines, with the following exceptions: pyrene and fluoranthene at FIB-2, and phenols and nitrate+nitrite at POC-3.

Table B-1 Analytes in field blanks that were present at elevated concentrations (> 5 X detection limit).

Variable	Units	Detection Limit	Concentration in Field Blank						Range of Exceedance Ratio[1]
			Winter (Feb)	Winter (Mar)	Spring	Summer	Fall		
							Blank 1 (POC-3)	Blank 2 (FIB-2)	
Conventional Variables									
Conductivity	uS/cm	0.2	1.2	1.6	-	1.3	1.1	-	6-8
Dissolved Metals									
Arsenic	µg/L	0.002	-	-	-	-	0.0169	-	8
Barium	µg/L	0.0040	-	0.0887	-	-	-	-	22
Boron	µg/L	0.0300	-	-	0.43	-	-	0.375	13-14
Cadmium	µg/L	0.0020	-	0.0359	-	-	-	-	18
Calcium	µg/L	4.0	-	50.6	-	-	-	27.1	7-13
Chromium	µg/L	0.0300	-	-	-	-	0.522	0.487	16-17
Cobalt	µg/L	0.0010	-	-	-	-	0.0067	0.007	7
Lead	µg/L	0.0010	-	0.0566	0.0151	-	0.0159	0.0132	13-57
Lithium	µg/L	0.0200	-		0.166	-	0.187	-	8-9
Manganese	µg/L	0.0030	-	0.0676	0.039	-	0.0466	0.0418	13-23
Nickel	µg/L	0.0050	-	0.0251	0.0308	-	0.155	0.168	5-34
Strontium	µg/L	0.0040	-	0.18	0.0219	0.0377	0.0329	0.0547	5-45
Thallium	µg/L	0.0003	-	-	-	-	0.0029	-	10
Thorium	µg/L	0.0003	-	0.0029	-	-	0.0163	0.0248	10-83
Vanadium	µg/L	0.0050	-	0.0306	-	-	-	-	6
Zinc	µg/L	0.0500	-	0.94	0.297	0.34	0.27	-	5-19

Table B-1 (cont'd.)

Variable	Units	Detection Limit	Concentration in Field Blank						Range of Exceedance Ratio[1]
			Winter (Feb)	Winter (Mar)	Spring	Summer	Fall		
							Blank 1 (POC-3)	Blank 2 (FIB-2)	
Total Metals									
Aluminum	µg/L	0.1	1.5	-	-	-	-	-	15
Antimony	µg/L	0.0005	-	0.0036	0.0033	0.0188	-	-	7-38
Arsenic	µg/L	0.002	-	-			0.0227	-	11
Barium	µg/L	0.004	-	0.206	0.129	0.0253	0.0773	0.0623	6-52
Boron	µg/L	0.05 or 0.08[2]	2.1	0.5	0.55	-	-	0.621	10-26
Cadmium	µg/L	0.002	-	0.135	-	-	-	-	68
Calcium	µg/L	4	-	53.6	54.9	-	-	25.6	6-14
Chlorine	µg/L	100	-	-	-	-	580	-	6
Chromium	µg/L	0.03	-	0.151	-	-	0.565	0.503	5-19
Cobalt	µg/L	0.001	-	-	0.0108	-	0.0067	0.007	7-11
Copper	µg/L	0.05	-	-	0.525	-	-	-	11
Lead	µg/L	0.001	-	0.771	0.0359	0.0062	0.0165	0.0132	6-771
Lithium	µg/L	0.02	-	-	0.166	-	0.226	-	8-11
Manganese	µg/L	0.003	-	0.156	0.0636	0.0197	0.0576	0.0415	7-52
Molybdenum	µg/L	0.001	-	0.0124	0.0523	-	0.0121	-	12-52
Nickel	µg/L	0.005	-	0.0637	0.294	-	0.226	0.168	13-59
Silver	µg/L	0.0005	-	0.0037	-	-	-	-	7
Strontium	µg/L	0.004	0.03	0.196	0.351	0.0466	0.0601	0.0735	8-88

Table B-1 (cont'd.)

Variable	Units	Detection Limit	Concentration in Field Blank						Range of Exceedance Ratio[1]
			Winter (Feb)	Winter (Mar)	Spring	Summer	Fall		
							Blank 1 (POC-3)	Blank 2 (FIB-2)	
Total Metals Cont'd.									
Thallium	µg/L	0.0003	-	-	-	-	0.0029	0.0036	10-12
Thorium	µg/L	0.0003	-	0.0029	0.005	0.0031	0.017	0.0243	10-81
Titanium	µg/L	0.04	-	-	0.272	-	-	-	7
Uranium	µg/L	0.0001	-	-	0.0018	-	-	-	18
Vanadium	µg/L	0.005 or 0.008[2] (winter)	0.1	0.0644	0.0443	-	0.0389	-	8-13
Zinc	µg/L	0.1	-	0.53	-	-	-	-	5
Hydrocarbons									
Phenols	µg/L	1	-	-	-	-	10	-	10
PAHs									
Pyrene	µg/L	0.02	-	-	-	-	-	0.49	25

Table B-2 Analytes in trip blanks that were present at elevated concentrations (> 5 X detection limit).

Variable	Units	Detection Limit	Concentration in Trip Blank					Range of Exceedance Ratio[1]
			Winter (Feb)	Winter (Mar)	Spring	Summer	Fall	
Conventional Variables								
Conductivity	uS/cm	0.2	1.2	-	1.1	-	9.4	6-47
Dissolved Organic Carbon	mg/L	1	-	-	796	-	-	796
Total Organic Carbon	mg/L	1	-	-	841	-	-	841
Dissolved Metals								
Bismuth (Bi)	µg/L	0.0010	-	-	-	-	0.01	10
Boron (B)	µg/L	0.0300	-	-	-	-	0.751	25
Chromium (Cr)	µg/L	0.0300	-	-	-	-	0.624	21
Cobalt (Co)	µg/L	0.0010	-	-	-	-	0.0087	9
Copper (Cu)	µg/L	0.0500	-	-	-	-	0.382	8
Lead (Pb)	µg/L	0.0010	-	-	0.0119	-	0.0123	12
Manganese (Mn)	µg/L	0.0030	-	-	-	-	0.0404	13
Molybdenum (Mo)	µg/L	0.0010	-	-	-	-	0.0051	5
Nickel (Ni)	µg/L	0.0050	-	-	0.0283	-	0.85	6-170
Strontium (Sr)	µg/L	0.004	0.04	-	-	-	-	10
Thorium (Th)	µg/L	0.0003	-	0.0025	-	-	0.0438	8-146
Zinc (Zn)	µg/L	0.0500	-	0.61	0.33	-	0.809	7-16

Table B-2 (cont'd.)

Variable	Units	Detection Limit	Concentration in Trip Blank					Range of Exceedance Ratio[1]
			Winter (Feb)	Winter (Mar)	Spring	Summer	Fall	
Total Metals								
Aluminum (Al)	µg/L	0.1	2.1	-	-	-	-	21
Antimony (Sb)	µg/L	0.0005	-	-	-	-	0.0038	8
Arsenic (As)	µg/L	0.002	-	0.0132	-	-	-	7
Barium (Ba)	µg/L	0.004	-	0.041	0.386	-	0.108	10-97
Bismuth (Bi)	µg/L	0.001	-	-	-	-	0.0098	10
Boron (B)	µg/L	0.05 or 0.08[2]	1	-	-	-	0.79	13-16
Calcium (Ca)	µg/L	4	-	-	117	-		29
Chlorine (Cl)	µg/L	100	-	503	-	-	880	5-9
Chromium (Cr)	µg/L	0.03	-	0.152	-	-	0.795	5-27
Cobalt (Co)	µg/L	0.001	-	-	0.0114	-	0.0087	9-11
Copper (Cu)	µg/L	0.05	-	-	0.405	-	0.38	8
Lead (Pb)	µg/L	0.001	-	-	0.0445	-	0.0159	16-45
Lithium (Li)	µg/L	0.02	-	-	0.252	-		13
Manganese (Mn)	µg/L	0.003	-	-	0.0824	-	0.0641	21-27
Molybdenum (Mo)	µg/L	0.001	-	-	0.0523	-	0.0189	19-52
Nickel (Ni)	µg/L	0.005	-	-	0.32	-	0.891	64-178
Strontium (Sr)	µg/L	0.004	-	-	0.855	-	0.034	9-214
Thallium (Tl)	µg/L	0.0003	-	-	-	-	0.0031	10
Thorium (Th)	µg/L	0.0003	-	0.0092	0.0125	-	0.0432	31-144
Titanium (Ti)	µg/L	0.04	-	-	0.28	-	0.246	6-7
Uranium (U)	µg/L	0.0001	-	-	0.0032	-	-	32
Vanadium (V)	µg/L	0.005 or 0.008[2] (winter)	0.05	0.0582	0.0914	-	0.0499	6-18
Zinc (Zn)	µg/L	0.1	-	0.806	0.518	-	0.808	5-8

[1] Exceedance Ratio = Measured Concentration/Detection Limit

[2] Lower detection limit is for Winter (Feb) samples.

B2.2.2.2 Field Duplicates

Analytical results for field duplicates collected from the Clearwater River (CLR-1) and the Ells River (ELR-1) in September 2004 generally were very similar. Only a small number of analytes differed more than 20% and were elevated five times greater than their detection limit. These included, for the CLR-1 field duplicate (Table B-3), TSS, total dissolved phosphorus, dissolved lead and selenium, total bismuth and titanium, and dissolved and total chromium, nickel, thallium and thorium. For the ELR-1 field duplicate (Table B-4), true colour, total dissolved phosphorous, and dissolved chromium, thallium and thorium. These metals also were most frequently found in measurable concentrations in trip and field blanks, which may suggest consistently high analytical variability for these variables in water that may be related to laboratory water or practice.

Table B-3 Relative percent difference between duplicate water quality samples collected from the Clearwater River (CLR-1), September 2004.

Analyte	Units	Detection Limit	Duplicate 1 (FID-1)	Duplicate 2 (CLR-1)	Relative Percent Difference
Conventional Variables					
Alkalinity, Total (as CaCO3)	mg/L	5	69	69	0.0
Bicarbonate	mg/L	5	84	84	0.0
Carbonate	mg/L	5	<5	<5	0.0
Color, True	T.C.U.	3	50	50	0.0
Conductivity	uS/cm	0.2	234	233	0.4
Dissolved Organic Carbon	mg/L	1	9	9	0.0
Hardness (as CaCO3)	mg/L		68	69	-1.5
Hydroxide	mg/L	5	<5	<5	0.0
pH	pH	0.1	8.1	8.1	0.0
Total Dissolved Solids	mg/L	10	190	180	5.4
Total Organic Carbon	mg/L	1	9	9	0.0
Total Suspended Solids	mg/L	3	31	38	-20.3
Major Ions					
Calcium	mg/L	0.5	17.8	18	-1.1
Chloride	mg/L	1	34	34	0.0
Magnesium	mg/L	0.1	5.8	5.8	0.0
Potassium	mg/L	0.1	0.9	0.9	0.0
Sodium	mg/L	1	26	26	0.0
Sulfate	mg/L	0.5	6.6	6.8	-3.0
Sulphide	mg/L	0.003	<0.003	<0.003	0.0

Table B-3 (cont'd.)

Analyte	Units	Detection Limit	Duplicate 1 (FID-1)	Duplicate 2 (CLR-1)	Relative Percent Difference
Nutrients & BOD					
Ammonia	mg/L	0.05	<0.05	<0.05	0.0
Nitrate+Nitrite	mg/L	0.1	<0.1	<0.1	0.0
Phosphorus, Total Dissolved	mg/L	0.001	0.015	0.012	22.2
Phosphorus, Total	mg/L	0.001	0.054	0.051	5.7
Total Kjeldahl Nitrogen	mg/L	0.2	0.3	0.3	0.0
Biochemical Oxygen Demand	mg/L	2	<2	<2	0.0
Hydrocarbons					
Hydrocarbons, Recoverable	mg/L	0.5	<0.5	<0.5	0.0
Naphthenic Acids	mg/L	1	<1	<1	0.0
Phenols	mg/L	0.001	0.005	0.006	-18.2
Chlorophyll a					
Chlorophyll a	mg/L	0.001	0.003	0.004	-28.6
Dissolved Metals					
Aluminum	mg/L	0.000200	0.00641	0.00599	6.8
Antimony	mg/L	0.0000005	0.000014	0.0000137	2.2
Arsenic	mg/L	0.0000020	0.000416	0.000414	0.5
Barium	mg/L	0.0000040	0.0162	0.016	1.2
Beryllium	mg/L	0.0000030	<0.000003	<0.000003	0.0
Bismuth	mg/L	0.0000010	0.0000051	<0.000001	134.4
Boron	mg/L	0.0000300	0.0329	0.0335	-1.8
Cadmium	mg/L	0.0000020	0.0000032	0.0000049	-42.0
Calcium	mg/L	0.004	17.3	16.7	3.5
Chlorine	mg/L	0.100	32.2	30.4	5.8
Chromium	mg/L	0.0000300	0.000461	0.000942	-68.6
Cobalt	mg/L	0.0000010	0.0000529	0.0000552	-4.3
Copper	mg/L	0.0000500	0.000531	0.000622	-15.8
Iron	mg/L	0.00200	0.28	0.277	1.1
Lead	mg/L	0.0000010	0.0000369	0.0000495	-29.2
Lithium	mg/L	0.0000200	0.00552	0.00567	-2.7
Manganese	mg/L	0.0000030	0.00978	0.00845	14.6
Mercury	mg/L	0.0000100	<0.00001	<0.00001	0.0
Molybdenum	mg/L	0.0000010	0.000184	0.000189	-2.7
Nickel	mg/L	0.0000050	0.00055	0.00118	-72.8
Selenium	mg/L	0.0001000	0.000217	0.000172	23.1
Silver	mg/L	0.0000005	<0.0000005	<0.0000005	0.0
Strontium	mg/L	0.0000040	0.102	0.0998	2.2

Table B-3 (cont'd.)

Analyte	Units	Detection Limit	Duplicate 1 (FID-1)	Duplicate 2 (CLR-1)	Relative Percent Difference
Dissolved Metals Cont'd.					
Sulphur	mg/L	0.200	1.81	1.8	0.6
Thallium	mg/L	0.0000003	0.0000045	0.0000028	46.6
Thorium	mg/L	0.0000003	0.0000538	0.0000144	115.5
Tin	mg/L	0.0000300	<0.00003	<0.00003	0.0
Titanium	mg/L	0.0000400	0.0017	0.00161	5.4
Uranium	mg/L	0.0000001	0.0000528	0.0000538	-1.9
Vanadium	mg/L	0.0000050	0.000333	0.000321	3.7
Zinc	mg/L	0.0000500	0.00124	0.00116	6.7
Total Metals					
Aluminum	mg/L	0.0005	0.679	0.717	-5.4
Antimony	mg/L	0.0000005	0.0000207	0.0000223	-7.4
Arsenic	mg/L	0.000002	0.000717	0.00067	6.8
Barium	mg/L	0.000004	0.0235	0.0239	-1.7
Beryllium	mg/L	0.000003	0.0000326	0.0000286	13.1
Bismuth	mg/L	0.000001	0.0000086	0.0000064	29.3
Boron	mg/L	0.00005	0.0338	0.0342	-1.2
Cadmium	mg/L	0.000002	0.0000116	0.0000135	-15.1
Calcium	mg/L	0.004	17.7	16.9	4.6
Chlorine	mg/L	0.1	34.2	33	3.6
Chromium	mg/L	0.00003	0.00151	0.00215	-35.0
Cobalt	mg/L	0.000001	0.000465	0.000437	6.2
Copper	mg/L	0.00005	0.00138	0.00117	16.5
Iron	mg/L	0.002	1.43	1.55	-8.1
Lead	mg/L	0.000001	0.000434	0.000477	-9.4
Lithium	mg/L	0.00002	0.00592	0.00609	-2.8
Manganese	mg/L	0.000003	0.0696	0.0739	-6.0
Mercury	mg/L	0.00001	<0.00001	<0.00001	0.0
Mercury, ultra-trace	ng/L	0.6	<0.6	<0.6	0.0
Molybdenum	mg/L	0.000001	0.000188	0.000188	0.0
Nickel	mg/L	0.000005	0.00109	0.00182	-50.2
Selenium	mg/L	0.0001	0.000219	0.000301	-31.5
Silver	mg/L	0.0000005	0.0000038	0.0000034	11.1
Strontium	mg/L	0.000004	0.103	0.101	2.0
Sulphur	mg/L	0.2	1.85	1.79	3.3
Thallium	mg/L	0.0000003	0.0000147	0.0000119	21.1
Thorium	mg/L	0.0000003	0.000107	0.0000732	37.5

Table B-3 (cont'd.)

Analyte	Units	Detection Limit	Duplicate 1 (FID-1)	Duplicate 2 (CLR-1)	Relative Percent Difference
Total Metals Cont'd.					
Tin	mg/L	0.00003	<0.00003	0.000034	-12.5
Titanium	mg/L	0.00004	0.0125	0.0181	-36.6
Uranium	mg/L	0.0000001	0.0000922	0.0000906	1.8
Vanadium	mg/L	0.000005	0.0021	0.00221	-5.1
Zinc	mg/L	0.0001	0.00433	0.00432	0.2

Relative percent difference = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100

Relative percent difference for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences are valid only for analytical values that are at least five times the detection limit.

#	Analytes differ by > 20% between duplicates but is < 5X the DL.
#	Analyte differs by > 20% between duplicates but is > 5X the DL.

Table B-4 Relative percent difference between duplicate water quality samples collected from the Ells River (ELR-1), September 2004.

Analyte	Units	Detection Limit	Duplicate 1 (ELR-1)	Duplicate 2 (POC-2)	Relative Percent Difference
Conventional Variables					
Hardness (as CaCO3)	mg/L	-	142	140	-1.4
Color, True	T.C.U.	3	80	100	22.2
Dissolved Organic Carbon	mg/L	1	22	23	4.4
Total Dissolved Solids	mg/L	10	280	290	3.5
Total Organic Carbon	mg/L	1	25	25	0.0
Total Suspended Solids	mg/L	3	17	19	11.1
pH	pH	0.1	8.3	8.4	1.2
Conductivity	uS/cm	0.2	348	345	-0.9
Bicarbonate	mg/L	5	187	187	0.0
Carbonate	mg/L	5	<5	<5	0.0
Hydroxide	mg/L	5	<5	<5	0.0
Alkalinity, Total (as CaCO3)	mg/L	5	155	156	0.6
Major Ions					
Chloride	mg/L	1	12	12	0.0
Calcium	mg/L	0.5	35.9	35.4	-1.4
Potassium	mg/L	0.1	1.4	1.4	0.0

Table B-4 (cont'd.)

Analyte	Units	Detection Limit	Duplicate 1 (ELR-1)	Duplicate 2 (POC-2)	Relative Percent Difference
Major Ions Cont'd.					
Magnesium	mg/L	0.1	12.7	12.5	-1.6
Sodium	mg/L	1	35	34	-2.9
Sulfate	mg/L	0.5	30.4	30.2	-0.7
Sulphide	mg/L	0.003	0.009	0.011	20.0
Nutrients & BOD					
Ammonia-N	mg/L	0.05	<0.05	<0.05	0.0
Nitrate+Nitrite-N	mg/L	0.1	<0.1	0.7	150.0
Phosphorus, Total Dissolved	mg/L	0.001	0.008	0.013	47.6
Phosphorus, Total	mg/L	0.001	0.024	0.026	8.0
Total Kjeldahl Nitrogen	mg/L	0.2	0.8	0.8	0.0
Biochemical Oxygen Demand	mg/L	2	<2	<2	0.0
Hydrocarbons					
Hydrocarbons, Recoverable (I.R.)	mg/L	0.5	<0.5	<0.5	0.0
Naphthenic Acids	mg/L	1	1	1	0.0
Phenols (4AAP)	mg/L	0.001	<0.001	0.006	142.9
Chlorophyll-a					
Chlorophyll a	mg/L	0.001	0.001	0.002	66.7
Dissolved Metals					
Lithium	mg/L	0.0000200	0.0212	0.021	-0.9
Beryllium	mg/L	0.0000030	0.0000033	0.0000049	39.0
Boron	mg/L	0.0000300	0.107	0.103	-3.8
Aluminum	mg/L	0.000200	0.0105	0.0119	12.5
Sulphur	mg/L	0.200	9.89	9.72	-1.7
Chlorine	mg/L	0.100	11.8	11.5	-2.6
Calcium	mg/L	0.004	33.9	34.5	1.8
Titanium	mg/L	0.0000400	0.00174	0.00171	-1.7
Vanadium	mg/L	0.0000050	0.00028	0.000281	0.4
Chromium	mg/L	0.0000300	0.000323	0.000416	25.2
Manganese	mg/L	0.0000030	0.025	0.026	3.9
Iron	mg/L	0.00200	0.306	0.326	6.3
Cobalt	mg/L	0.0000010	0.000186	0.00018	-3.3
Nickel	mg/L	0.0000050	0.00126	0.00122	-3.2
Copper	mg/L	0.0000500	0.000811	0.000742	-8.9
Zinc	mg/L	0.0000500	0.00143	0.00124	-14.2
Arsenic	mg/L	0.0000020	0.000521	0.000531	1.9
Selenium	mg/L	0.0001000	<0.0001	0.000113	12.2

Table B-4 (cont'd.)

Analyte	Units	Detection Limit	Duplicate 1 (ELR-1)	Duplicate 2 (POC-2)	Relative Percent Difference
Dissolved Metals Cont'd.					
Strontium	mg/L	0.0000040	0.232	0.232	0.0
Molybdenum	mg/L	0.0000010	0.000348	0.000342	-1.7
Silver	mg/L	0.0000005	0.0000019	0.0000009	-71.4
Cadmium	mg/L	0.0000020	0.0000032	0.0000064	66.7
Tin	mg/L	0.0000300	0.0000409	0.0000328	-22.0
Antimony	mg/L	0.0000005	0.000039	0.0000397	1.8
Barium	mg/L	0.0000040	0.03	0.0303	1.0
Mercury	mg/L	0.0000100	<0.00001	<0.00001	0.0
Thallium	mg/L	0.0000003	0.0000049	0.0000065	28.1
Lead	mg/L	0.0000010	0.0000519	0.0000588	12.5
Bismuth	mg/L	0.0000010	0.0000016	0.0000024	40.0
Thorium	mg/L	0.0000003	0.0000202	0.0000373	59.5
Uranium	mg/L	0.0000001	0.000256	0.000258	0.8
Total Metals					
Lithium	mg/L	0.00002	0.0211	0.021	-0.5
Beryllium	mg/L	0.000003	0.0000236	0.0000252	6.6
Boron	mg/L	0.00005	0.107	0.104	-2.8
Aluminum	mg/L	0.0005	0.501	0.519	3.5
Sulphur	mg/L	0.2	9.89	9.74	-1.5
Chlorine	mg/L	0.1	13.1	13	-0.8
Calcium	mg/L	0.004	34.1	34.5	1.2
Titanium	mg/L	0.00004	0.0122	0.0113	-7.7
Vanadium	mg/L	0.000005	0.0017	0.00172	1.2
Chromium	mg/L	0.00003	0.00106	0.00107	0.9
Manganese	mg/L	0.000003	0.0542	0.0551	1.6
Iron	mg/L	0.002	1	1.01	1.0
Cobalt	mg/L	0.000001	0.000386	0.000383	-0.8
Nickel	mg/L	0.000005	0.00155	0.00153	-1.3
Copper	mg/L	0.00005	0.0014	0.00115	-19.6
Zinc	mg/L	0.0001	0.00432	0.00446	3.2
Arsenic	mg/L	0.000002	0.000714	0.000722	1.1
Selenium	mg/L	0.0001	0.000172	0.000112	-42.3
Strontium	mg/L	0.000004	0.232	0.234	0.9
Molybdenum	mg/L	0.000001	0.000357	0.000375	4.9
Silver	mg/L	0.0000005	0.0000039	0.0000038	-2.6
Cadmium	mg/L	0.000002	0.0000067	0.000007	4.4

Table B-4 (cont'd.)

Analyte	Units	Detection Limit	Duplicate 1 (ELR-1)	Duplicate 2 (POC-2)	Relative Percent Difference
Total Metals Cont'd.					
Tin	mg/L	0.00003	0.00012	0.0000605	-65.9
Antimony	mg/L	0.0000005	0.0000409	0.0000411	0.5
Barium	mg/L	0.000004	0.0348	0.0359	3.1
Mercury	mg/L	0.00001	0.0000131	0.0000122	-7.1
Thallium	mg/L	0.0000003	0.00001	0.0000106	5.8
Lead	mg/L	0.000001	0.000311	0.0003	-3.6
Bismuth	mg/L	0.000001	0.0000047	0.0000059	22.6
Thorium	mg/L	0.0000003	0.0000751	0.0000749	-0.3
Uranium	mg/L	0.0000001	0.000285	0.000285	0.0
Mercury, ultra-trace	ng/L	0.6	<0.6	<0.6	0.0

Relative percent difference = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100

Relative percent difference for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences are valid only for analytical values that are at least five times the detection limit.

#	Analytes differ by > 20% between duplicates but is < 5X the DL.
#	Analyte differs by > 20% between duplicates but is > 5X the DL.

B2.2.2.3 Other Issues

As in previous years, the concentration of dissolved forms of metals was often higher than the concentration of the total form. This trend was observed in every season, and did not seem to be limited to particular stations or analytes. Four spring samples (CAR-1, ATR-DD, FIR-2, HAR-1) were reported to have higher levels of dissolved selenium than total selenium, suggesting a systematic error (e.g., contaminated laboratory apparatus) may have occurred for this group of samples. However, lack of information on possible laboratory bias (e.g., analysis date/time or analyst) prevents further investigation into this issue.

B2.2.3 Conclusions and Recommendations

Overall, results from the QA/QC evaluation of water quality data indicates that data collected were of a high quality. However, anomalous results observed in a couple of samples for a couple of analytes demonstrate the importance of collecting a comprehensive set of QA/QC samples for each sampling event. The trip blank collected in the spring indicates that lab water or container used for the blank was contaminated with DOC and TOC; the field blank collected in March indicate that the samples were contaminated with particulate lead, in the field or in the lab. Duplicate samples collected from different sites demonstrate how variable duplicates can be between sites and how important it is to randomly sample a variety of stations. Given results from this year's monitoring program it may be advisable to include more QA/QC samples in future programs.

An evaluation of lab performance may also be prudent to ensure that data quality is as high as possible. Issues identified, such as the discrepancies between total and dissolved metals and contamination of blanks, should be discussed with analytical laboratories to minimize the occurrence of these data quality issues in the future. Laboratories should ensure that information regarding the date and time of analysis, as well as analyst's name, is recorded to allow potential sources of error to be identified.

B2.3 SEDIMENT QUALITY

The 2003 RAMP sediment quality QA/QC program was conducted to assess potential sample contamination during collection and analysis, as well as the precision and accuracy of the chemical and toxicological analyses. Methods used were generally consistent with those described in the RAMP 2002 Report (Golder 2003).

B2.3.1 Methods

B2.3.1.1 Sample Collection

The following field procedures were used to prevent sample contamination:

- Sampling equipment was rinsed with hexane and acetone, and triple-rinsed with ambient water prior to sample collection at a given station;
- Sampling equipment was rinsed with hexane and acetone, then washed with detergent and rinsed with ambient site water between sample collection at different stations;
- Sample grabs were kept only if they contained no large foreign objects, obtained adequate penetration depth, and were not overfilled or leaking;
- Sediments in direct contact with the grab were not used;
- Staff wore powder-free latex gloves during sampling; and
- Sampling was conducted sequentially from the least to the most contaminated sites.

Split and field duplicate samples were collected to assess environmental variation, analytical precision, and potential contamination. Split samples were collected from the MacKay River (MAR-1) and Christina River (CHR-1). Duplicate samples were collected from two stations along the Christina River (CHR-1 and CHR-2); all variables were measured in the sample collected from CHR-1, but only PAHs were measured in the sample collected from CHR-2.

In addition, two equipment rinsate blanks were collected to assess the effectiveness of cleaning and equipment decontamination, which if not done effectively could lead to sample contamination. Rinsate samples were comprised of deionized water that poured over the surface of cleaned equipment and collected.

The relative percent difference (difference between data values/average of data values, multiplied by 100%) between split sample and field duplicate analytes was calculated. Analytes for which the relative percent difference between duplicate samples exceeded

20% (and which were greater than five times the detection limit) were considered to exhibit unacceptable levels of imprecision.

Analyte concentrations in the equipment rinsate blanks were compared to analytical detection limits; analyte levels greater than five times the detection limit may indicate potential contamination of sampling equipment or quality control concerns with the samples (e.g., contamination during laboratory analysis). Because the equipment rinsate blanks were collected from two sets of sediment sampling equipment, these samples were not compared to each other.

B2.3.2 Results and Discussion

B2.3.2.1 Duplicates

The relative percent differences between duplicate samples from site CHR-1 along the Christina River is presented inTable B-5. Duplicate samples from CHR-1 were similar for most analytes, with the exception of a number of hydrocarbons, TOC, and a couple of metals. Total hydrocarbon concentrations varied by 25 to 67% between duplicates and were greater than five times above the analytical detection limits.. Copper was the only metal to vary more than 20% between duplicates and more than five times above the detection limit. Duplicate samples were also run for toxicity tests. Results indicate that mean growth of chironomids differed slightly more than 20% between duplicates.

The relative percent differences between PAHs in duplicate samples from site CHR-2 along the Christina River is presented inTable B-6; other analytes were not analyzed in this sample. The percent variability in PAHs between duplicates from this site was relatively low, ranging from 0 (i.e., non-detectable values) to 36%, except for one analyte, biphenyl. Biphenyls differed by 62% between duplicate samples. Absolute differences in PAH analytes between samples were very small in magnitude (nanograms) and were likely not significant relative to the environmental effect size of interest. Because no detection limit was provided for the analytical data, differences in analyte concentrations relative to the detection limit could not be assessed.

Table B-5 Relative percent difference between duplicate sediment quality samples for the Christina River site CHR-1, September 2004.

Variable	Units	Detection Limit	Duplicate 1 (FID-1)	Duplicate 2 (CHR-1)	Relative Percent Difference
BTEX					
Benzene	mg/kg	0.01	<0.01	<0.01	0.0
Toluene	mg/kg	0.01	<0.01	<0.01	0.0
Ethylbenzene	mg/kg	0.01	<0.01	<0.01	0.0
Xylenes	mg/kg	0.01	<0.01	<0.01	0.0
Total Hydrocarbons					
F1 (C6-C10)	mg/kg	5	<0.5	<0.5	0.0
F1-BTEX	mg/kg	5	<5	<5	0.0
F2 (C10-C16)	mg/kg	5	78	100	-24.7
F3 (C16-C34)	mg/kg	5	650	970	-39.5
F4 (C34-C50)	mg/kg	5	330	480	-37.0
Total Hydrocarbons (C6-C50)	mg/kg	5	1100	1600	-37.0
Chromatogram to baseline at nC50			NO	NO	0.0
TEH (C11-C30)	mg/kg	5	1100	1600	-37.0
TVH (C5-C10)	mg/kg	0.5	<0.5	<0.5	0.0
Recoverable Hydrocarbons	mg/kg	100	1500	2400	-46.2
Inorganic/Organic Carbon					
Inorganic Carbon	%	0.01	0.27	0.27	0.0
Total Organic Carbon	%	0.1	0.9	1.8	-66.7
Total Carbon by Combustion	%	0.1	1.2	2.1	-54.5
Total Metals					
Mercury (Hg)	mg/kg	0.05	<0.05	<0.05	0.0
Metals (ICP/MS)					
Silver (Ag)	mg/kg	0.2	<0.2	<0.2	0.0
Arsenic (As)	mg/kg	0.1	4.5	4.3	4.5
Barium (Ba)	mg/kg	0.5	60.9	59.3	2.7
Beryllium (Be)	mg/kg	0.2	0.3	0.4	-28.6

Table B-5 (cont'd.)

Variable	Units	Detection Limit	Duplicate 1 (FID-1)	Duplicate 2 (CHR-1)	Relative Percent Difference
Metals (ICP/MS) Cont'd.					
Bismuth (Bi)	mg/kg	0.5	<0.5	<0.5	0.0
Cadmium (Cd)	mg/kg	0.1	<0.1	<0.1	0.0
Cobalt (Co)	mg/kg	0.1	5.6	5.5	1.8
Chromium (Cr)	mg/kg	0.2	10.2	9.9	3.0
Copper (Cu)	mg/kg	0.5	16.3	7.9	69.4
Molybdenum (Mo)	mg/kg	0.1	0.2	0.2	0.0
Nickel (Ni)	mg/kg	0.5	10.4	10.6	-1.9
Lead (Pb)	mg/kg	0.5	5.6	5.3	5.5
Selenium (Se)	mg/kg	0.2	<0.2	0.4	-66.7
Tin (Sn)	mg/kg	2	<2	<2	0.0
Strontium (Sr)	mg/kg	1	22	23	-4.4
Thallium (Tl)	mg/kg	0.05	0.11	0.13	-16.7
Uranium (U)	mg/kg	0.05	0.61	0.69	-12.3
Vanadium (V)	mg/kg	0.2	17.9	17.8	0.6
Zinc (Zn)	mg/kg	5	36	36	0.0
Physical Properties					
% Sand	%	1	70	70	0.0
% Silt	%	1	19	17	11.1
% Clay	%	1	11	13	-16.7
Texture			Sandy loam	Sandy loam	0.0
% Moisture	%	0.1	25	25	0.0
Toxicity					
Hyalella azteca					
Mean survival (5 replicates)			7	6	15.4
Mean growth (dry weight/organism)	mg/organism		0.1	0.1	0.0
Chironomus tentans					
Mean survival (5 replicates)			9	9	0.0
Mean growth (dry weight/organism)			1.6	2.1	-7.0

Relative percent difference = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100

Relative percent difference for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean valid only for differences are analytical values that are at least five times the detection limit.

#	Analytes differ by > 20% between duplicates but is < 5X the DL.
#	Analyte differs by > 20% between duplicates but is > 5X the DL.

Table B-6 Relative percent difference in PAHs between duplicate sediment quality samples for the Christina River site CHR-2, September 2004.

Variable	Units	Duplicate 1 (CHR-2)	Duplicate 2 (CHR-2 dup)	Relative Percent Difference
PAHs				
Naphthalene	ng/g	1.41	1.76	-22.1
Biphenyl	ng/g	0.428	0.815	-62.3
Acenaphthylene	ng/g	<0.081	<0.0876	-7.8
Acenaphthene	ng/g	<0.191	0.195	-2.1
Fluorene	ng/g	*0.22*	0.284	-25.4
Phenanthrene	ng/g	1	1	0.0
Anthracene	ng/g	<0.142	*0.124*	13.5
Fluoranthene	ng/g	0.919	1	-8.4
Pyrene	ng/g	1.43	1.5	-4.8
Benz[a]anthracene	ng/g	*0.33*	*0.325*	1.5
Chrysene	ng/g	1.99	1.92	3.6
Benzo[b/j/k]fluoranthene	ng/g	3.38	3.37	0.3
Benzo[a]pyrene	ng/g	1.15	0.978	16.2
Dibenz[ah]anthracene	ng/g	*0.416*	*0.511*	-20.5
Indeno[1,2,3-cd]pyrene	ng/g	2.12	*2.14*	-0.9
Benzo[ghi]perylene	ng/g	2.71	2.7	0.4
C1-Naphthalenes	ng/g	1.49	1.75	-16.0
Methyl-Biphenyl	ng/g	0.332	0.307	7.8
Dimethyl-Biphenyl	ng/g	1.05	0.733	35.6
C2-Naphthalenes	ng/g	4.03	4.74	-16.2
C3-Naphthalenes	ng/g	3.33	3.45	-3.5
C4-Naphthalenes	ng/g	2.27	1.88	18.8
Methyl Acenaphthene	ng/g	<0.078	<0.109	-33.2
C1-Fluorenes	ng/g	0.522	0.588	-11.9
C2-Fluorenes	ng/g	2.12	2.41	-12.8
C3-Fluorenes	ng/g	2.57	3.33	-25.8
Dibenzothiophene	ng/g	*0.198*	*0.171*	14.6
C1-Dibenzothiophenes	ng/g	0.725	1	-31.9
C2-Dibenzothiophenes	ng/g	2.33	2.76	-16.9

Table B-6 (cont'd.)

Variable	Units	Duplicate 1 (CHR-2)	Duplicate 2 (CHR-2 dup)	Relative Percent Difference
PAHs Cont'd.				
C3-Dibenzothiophenes	ng/g	3.49	3.83	-9.3
C4-Dibenzothiophenes	ng/g	7.71	7.38	4.4
C1 Phenanthrenes/Anthracenes	ng/g	2.63	2.56	2.7
C2 Phenanthrenes/Anthracenes	ng/g	3.46	3.48	-0.6
C3-Phenanthrenes/Anthracenes	ng/g	3.17	3.05	3.9
Retene	ng/g	11	8.06	30.8
C4-Phenanthrenes/Anthracenes	ng/g	24.6	21.8	12.1
C1-Fluoranthenes/Pyrenes	ng/g	4.5	4.2	6.9
C2-Fluoranthenes/Pyrenes	ng/g	8.21	7.71	6.3
C3-Fluoranthenes/Pyrenes	ng/g	4.99	4.81	3.7
C1-Benz[a]anthracenes/Chrysenes	ng/g	23.1	24.5	-5.9
C2-Benz[a]anthracenes/Chrysenes	ng/g	7.26	7.45	-2.6
C1-Benzofluoranthenes/Pyrenes	ng/g	9.78	10.6	-8.0
C2-Benzofluoranthenes/Pyrenes	ng/g	3.99	2.82	34.4
% Moisture:	%	20.3	20.3	0.0

Relative percent difference = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100

Relative percent difference for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

#	Analytes differ by > 20% between duplicates.

Italicized values represent lab results for which a peak was detected but did not meet AXYS quantification criteria.
Values were not compared to detection limits due to variability in detection limits for PAHs between samples.

Generally, more variability is expected between duplicate samples for sediments than water, due to the difficulties in creating homogenous sediment samples. However, results of the QA/QC analyses indicate that variability between sediment samples was low.

B2.3.2.2 Split Samples

Relative percent differences between split samples from site CHR-1 along the Christina River are presented in Table B-7. Split samples were similar at CHR-1. Many of the same variables that differed between duplicate samples at this site differed between split samples, including some of the hydrocarbon fractions, TOC and copper. The magnitude of variability was relatively low, ranging from 0% (i.e., non-detectable concentrations) to 57%. Split samples were also run for toxicity tests. Results indicate that mean growth of *Hyallela* differed slightly more than 65% between duplicates.

Relative percent differences between split samples from the MacKay River are shown in Table B-8. Split samples were very similar; very few analytes differed more than 20%. The analytes that differed between split samples were the included the same variables

observed to differ between duplicate samples and the Christina River split sample (hydrocarbon fractions, total hydrocarbons and a couple of metals). The largest difference between split samples was observed between toluene concentrations; however, the relative magnitude of the difference was very small and very close to the analytical detection limit. The toxicity endpoint, *Hyallela* growth was observed to vary 35% between split samples.

Table B-7 Relative percent difference between QA/QC split sediment quality samples for the Christina River site CHR-1, September 2004.

Analyte	Units	Detection Limit	Split 1 (CHR-1)	Split 2 (FIS-1)	Relative Percent Difference
BTEX					
Benzene	mg/kg	0.01	<0.01	<0.01	0.0
Toluene	mg/kg	0.01	<0.01	<0.01	0.0
Ethylbenzene	mg/kg	0.01	<0.01	<0.01	0.0
Xylenes	mg/kg	0.01	<0.01	<0.01	0.0
Total Hydrocarbons					
F1 (C6-C10)	mg/kg	5	<0.5	<0.5	0.0
F1-BTEX	mg/kg	5	<5	<5	0.0
F2 (C10-C16)	mg/kg	5	100	65	42.4
F3 (C16-C34)	mg/kg	5	970	720	29.6
F4 (C34-C50)	mg/kg	5	480	390	20.7
Total Hydrocarbons (C6-C50)	mg/kg	5	1600	1200	28.6
Chromatogram to baseline at nC50			NO	NO	0.0
TEH (C11-C30)	mg/kg	5	1600	1900	-17.1
TVH (C5-C10)	mg/kg	0.5	<0.5	<0.5	0.0
Recoverable Hydrocarbons	mg/kg	100	2400	2900	-18.9
Inorganic/Organic Carbon calculations					
Inorganic Carbon	%	0.01	0.27	0.27	0.0
Total Organic Carbon	%	0.1	1.8	1	57.1
Total Carbon by Combustion	%	0.1	2.1	1.3	47.1
Total Metals					
Mercury (Hg)	mg/kg	0.05	<0.05	<0.05	0.0

Table B-7 (cont'd.)

Analyte	Units	Detection Limit	Split 1 (CHR-1)	Split 2 (FIS-1)	Relative Percent Difference
Metals (ICP/MS)					
Silver (Ag)	mg/kg	0.2	<0.2	<0.2	0.0
Arsenic (As)	mg/kg	0.1	4.3	4.5	-4.5
Barium (Ba)	mg/kg	0.5	59.3	62.6	-5.4
Beryllium (Be)	mg/kg	0.2	0.4	0.4	0.0
Bismuth (Bi)	mg/kg	0.5	<0.5	<0.5	0.0
Cadmium (Cd)	mg/kg	0.1	<0.1	<0.1	0.0
Cobalt (Co)	mg/kg	0.1	5.5	5.9	-7.0
Chromium (Cr)	mg/kg	0.2	9.9	10.7	-7.8
Copper (Cu)	mg/kg	0.5	7.9	11.2	-34.6
Molybdenum (Mo)	mg/kg	0.1	0.2	0.3	-40.0
Nickel (Ni)	mg/kg	0.5	10.6	11.5	-8.1
Lead (Pb)	mg/kg	0.5	5.3	5.7	-7.3
Selenium (Se)	mg/kg	0.2	0.4	0.4	0.0
Tin (Sn)	mg/kg	2	<2	<2	0.0
Strontium (Sr)	mg/kg	1	23	25	-8.3
Thallium (Tl)	mg/kg	0.05	0.13	0.11	16.7
Uranium (U)	mg/kg	0.05	0.69	0.69	0.0
Vanadium (V)	mg/kg	0.2	17.8	19.5	-9.1
Zinc (Zn)	mg/kg	5	36	41	-13.0
Physical Properties					
% Sand	%	1	70	69	1.4
% Silt	%	1	17	19	-11.1
% Clay	%	1	13	12	8.0
Texture			Sandy loam	Sandy loam	0.0
% Moisture	%	0.1	25	24	4.1
Toxicity					
Hyalella azteca					
Mean survival (5 replicates)			6	6	0.0
Mean growth (dry weight/organism)			0.1	0.2	-66.7

Table B-7 (cont'd.)

Analyte	Units	Detection Limit	Split 1 (CHR-1)	Split 2 (FIS-1)	Relative Percent Difference
Toxicity Cont'd.					
Chironomus tentans					
Mean survival (5 replicates)			9	9	0.0
Mean growth (dry weight/organism)			2.1	1.9	10.0

Relative percent difference = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100

Relative percent difference for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences are valid only for analytical values that are at least five times the detection limit.

#	Analytes differ by > 20% between split samples but is < 5X the DL.
#	Analyte differs by > 20% between split samples but is > 5X the DL

Table B-8 Relative percent difference between split sediment quality samples for the MacKay River site MAR-1, September 2004.

Variable	Units	Detection Limit	Split 1 (MAR-1)	Split 2 (MAR-4)	Relative Percent Difference
BTEX					
Benzene	mg/kg	0.01	<0.01	<0.01	0.0
Toluene	mg/kg	0.01	0.01	0.03	-100.0
Ethylbenzene	mg/kg	0.01	<0.01	<0.01	0.0
Xylenes	mg/kg	0.01	<0.01	<0.01	0.0
Total Hydrocarbons					
F1 (C6-C10)	mg/kg	5	<0.5	<0.5	0.0
F1-BTEX	mg/kg	5	<5	<5	0.0
F2 (C10-C16)	mg/kg	5	23	22	4.4
F3 (C16-C34)	mg/kg	5	290	360	-21.5
F4 (C34-C50)	mg/kg	5	160	260	-47.6
Total Hydrocarbons (C6-C50)	mg/kg	5	470	640	-30.6
Chromatogram to baseline at nC50			NO	NO	0.0
Recoverable Hydrocarbons	mg/kg	100	1700	1100	42.9
TEH (C11-C30)	mg/kg	5	580	650	-11.4
TVH (C5-C10)	mg/kg	0.5	<0.5	<0.5	0.0

Table B-8 (cont'd.)

Variable	Units	Detection Limit	Split 1 (MAR-1)	Split 2 (MAR-4)	Relative Percent Difference
Inorganic/Organic Carbon calculations					
Inorganic Carbon	%	0.01	0.87	1.05	-18.8
Total Organic Carbon	%	0.1	2.1	2	4.9
Total Carbon by Combustion	%	0.1	2.9	3.1	-6.7
Total Metals					
Mercury (Hg)	mg/kg	0.05	<0.05	<0.05	0.0
Metals (ICP/MS)					
Silver (Ag)	mg/kg	0.2	<0.2	<0.2	0.0
Arsenic (As)	mg/kg	0.1	7.2	7.3	-1.4
Barium (Ba)	mg/kg	0.5	168	176	-4.7
Beryllium (Be)	mg/kg	0.2	0.8	0.6	28.6
Bismuth (Bi)	mg/kg	0.5	<0.5	<0.5	0.0
Cadmium (Cd)	mg/kg	0.1	0.3	0.2	40.0
Cobalt (Co)	mg/kg	0.1	9.4	9.4	0.0
Chromium (Cr)	mg/kg	0.2	18.4	18.8	-2.2
Copper (Cu)	mg/kg	0.5	20.2	26.3	-26.2
Molybdenum (Mo)	mg/kg	0.1	0.5	0.5	0.0
Nickel (Ni)	mg/kg	0.5	22.4	22.4	0.0
Lead (Pb)	mg/kg	0.5	10.9	10.8	0.9
Selenium (Se)	mg/kg	0.2	0.6	0.6	0.0
Tin (Sn)	mg/kg	2	<2	<2	0.0
Strontium (Sr)	mg/kg	1	71	73	-2.8
Thallium (Tl)	mg/kg	0.05	0.26	0.23	12.2
Uranium (U)	mg/kg	0.05	1.07	1.11	-3.7
Vanadium (V)	mg/kg	0.2	29.7	29.2	1.7
Zinc (Zn)	mg/kg	5	77	77	0.0
Physical Properties					
% Sand	%	1	25	27	-7.7
% Silt	%	1	48	46	4.3
% Clay	%	1	26	27	-3.8
Texture			Loam	Loam	0.0
% Moisture	%	0.1	41	41	0.0

Table B-8 (cont'd.)

Variable	Units	Detection Limit	Split 1 (MAR-1)	Split 2 (MAR-4)	Relative Percent Difference
Toxicity					
Hyalella azteca					
Mean survival (5 replicates)			7	6	15.4
Mean growth (dry weight/organism)	mg/organism		0.10	0.07	35.3
Chironomus tentans					
Mean survival (5 replicates)			8	8	0.0
Mean growth (dry weight/organism)	mg/organism		2.5	2.4	4.1

Relative percent difference = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100

Relative percent difference for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences are valid only for analytical values that are at least five times the detection limit.

#	Analytes differ by > 20% between split samples but is < 5X the DL.
#	Analyte differs by > 20% between split samples but is > 5X the DL.

Generally, results from split samples indicate sediment samples submitted for analysis were homogenous.

B2.3.2.3 Equipment Rinsate Blanks

Equipment rinsate blanks were analyzed for concentrations of total metals (Table B-9) and PAH (Table B-10) to determine if samples were potentially contaminated by equipment.

Most metals were below or slightly elevated above analytical detection limits. Generally, concentrations of metals were higher in Rinsate Blank 1. In this sample, nine metals were five times higher than the detection limit; in Rinsate Blank 2 only 4 metals had an exceedance ratio greater than five. The highest exceedance rations were observed for barium and lead in Rinsate Blank 1; these metals were 86 times and 77 times, respectively, higher than their detection limits.

Similarly, PAH concentrations were higher in Rinsate Blank 1 than 2. Twenty-five PAHs in Rinsate Blank 1 exceeded their detection limits by more than five times; in Rinsate Blank 2, only six PAHs were greater than an exceedance ratio of five. Select dibenzothiophenes, phenanthrenes/anthracenes, fluoranthenes/pyrenes, and benz(a)anthracene/chrysenes exhibited exceedance ratios that were greater than 100. The highest exceedance ratio was observed for C4-phenanthrene/anthracene, which exceeded its detection limit by over 400 times.

Results of the rinsate blank analyses suggest that the equipment was not cleaned as thoroughly at one site, which could potentially contribute to sample contamination.

Table B-9 Metal concentrations in sediment rinsate blanks (RIN-8, RIN-9), September 2004.

Variable	Units	Detection Limit	Rinsate Blank 1 (RIN-8)	Rinsate Blank 2 (RIN-9)	Exceedance Ratio (Result/DL) RIN-8	Exceedance Ratio (Result/DL) RIN-9
Total Metals						
Arsenic (As)	mg/L	0.0004	0.0007	<0.0004	2	1
Barium (Ba)	mg/L	0.0002	0.0172	0.0022	86	11
Beryllium (Be)	mg/L	0.001	<0.001	<0.001	1	1
Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001	1	1
Cadmium (Cd)	mg/L	0.0002	<0.0002	<0.0002	1	1
Chromium (Cr)	mg/L	0.0008	0.0041	0.0018	5	2
Cobalt (Co)	mg/L	0.0002	0.0009	<0.0002	5	1
Copper (Cu)	mg/L	0.001	0.048	0.002	48	2
Lead (Pb)	mg/L	0.0001	0.0077	0.0004	77	4
Manganese (Mn)	mg/L	0.001	0.047	0.004	47	4
Mercury (Hg)	mg/L	0.0002	<0.0002	<0.0002	1	1
Molybdenum (Mo)	mg/L	0.0001	0.0006	<0.0001	6	1
Nickel (Ni)	mg/L	0.0002	0.0023	0.0051	12	26
Selenium (Se)	mg/L	0.0004	<0.0004	<0.0004	1	1
Silver (Ag)	mg/L	0.0004	<0.0004	<0.0004	1	1
Strontium (Sr)	mg/L	0.0002	0.0058	0.0022	29	11
Thallium (Tl)	mg/L	0.0001	<0.0001	<0.0001	1	1
Tin (Sn)	mg/L	0.0004	0.0042	<0.0004	11	1
Uranium (U)	mg/L	0.0001	0.0001	<0.0001	1	1
Vanadium (V)	mg/L	0.0002	0.0063	0.0005	32	3
Zinc (Zn)	mg/L	0.004	0.076	0.034	19	9

[1] Exceedance Ratio = Measured Concentration/Detection Limit.

For calculations, non-detect values were substitued with a value equal to the detection limit.

Table B-10 PAH concentrations in sediment rinsate blanks (RIN-8, RIN-9), September 2004.

Variable	Units	Rinsate Blank 1 (RIN-8)	Rinsate Blank 2 (RIN-9)	Lab blank	Exceedance Ratio (Result/Lab blank) RIN-8	RIN-9
PAHs						
Naphthalene	ng/L	32.8	27	4.84	7	6
Biphenyl	ng/L	2.38	1.77	<0.805	3	2
Acenaphthylene	ng/L	NDR 1.71	NDR 1.68	<0.472	4	4
Acenaphthene	ng/L	1.85	1.25	<0.668	3	2
Fluorene	ng/L	2.82	<1.23	<0.817	3	2
Phenanthrene	ng/L	10.2	3.87	NDR 1.13	9	3
Anthracene	ng/L	<0.659	0.454	<0.450	1	1
Fluoranthene	ng/L	3.17	1.06	0.384	8	3
Pyrene	ng/L	4.81	NDR 0.947	0.486	10	2
Benz[a]anthracene	ng/L	NDR 1.60	NDR 0.446	NDR 0.632	3	1
Chrysene	ng/L	11.2	0.835	0.888	13	1
Benzo[b/j/k]fluoranthene	ng/L	NDR 16.8	NDR 1.31	NDR 1.93	9	1
Benzo[a]pyrene	ng/L	NDR 6.40	<0.972	NDR 1.47	4	1
Dibenz[ah]anthracene	ng/L	NDR 5.52	NDR 2.30	NDR 3.78	1	1
Indeno[1,2,3-cd]pyrene	ng/L	NDR 8.05	NDR 2.41	NDR 3.01	3	1
Benzo[ghi]perylene	ng/L	NDR 8.88	NDR 1.94	NDR 2.53	4	1
C1-Naphthalenes	ng/L	13.2	4.53	3.7	4	1
Methyl-Biphenyl	ng/L	3.01	2.25	1.92	2	1
Dimethyl-Biphenyl	ng/L	10.8	12.4	8.27	1	1
C2-Naphthalenes	ng/L	29.7	24.6	23.9	1	1
C3-Naphthalenes	ng/L	23.2	9.29	4.33	5	2
C4-Naphthalenes	ng/L	44.2	5.52	<1.86	24	3
Methyl Acenaphthene	ng/L	<0.929	<0.572	<0.655	1	1
C1-Fluorenes	ng/L	6.89	2.99	<0.779	9	4
C2-Fluorenes	ng/L	37.8	7.09	<1.66	23	4
C3-Fluorenes	ng/L	76.8	<3.33	<3.51	22	1
Dibenzothiophene	ng/L	<1.39	<0.449	<0.367	4	1
C1-Dibenzothiophenes	ng/L	<2.06	0.827	<0.479	4	2
C2-Dibenzothiophenes	ng/L	44.4	4.09	<0.488	91	8

Table B-10 (cont'd.)

Variable	Units	Rinsate Blank 1 (RIN-8)	Rinsate Blank 2 (RIN-9)	Lab blank	Exceedance Ratio (Result/Lab blank) RIN-8	RIN-9
PAHs Cont'd.						
C3-Dibenzothiophenes	ng/L	91.3	8.58	<0.822	111	10
C4-Dibenzothiophenes	ng/L	167	22.2	<0.925	181	24
C1 Phenanthrenes/Anthracenes	ng/L	18.2	3.18	<0.894	20	4
C2 Phenanthrenes/Anthracenes	ng/L	54.8	7.87	<0.592	93	13
C3-Phenanthrenes/Anthracenes	ng/L	81.4	5.06	<0.605	135	8
Retene	ng/L	10.9	1.38	<0.490	22	3
C4-Phenanthrenes/Anthracenes	ng/L	199	14.3	<0.490	406	29
C1-Fluoranthenes/Pyrenes	ng/L	25.6	1.41	<0.293	87	5
C2-Fluoranthenes/Pyrenes	ng/L	57.1	2	<0.387	148	5
C3-Fluoranthenes/Pyrenes	ng/L	<2.20	0.794	<0.246	9	3
C1-Benz[a]anthracenes/Chrysenes	ng/L	131	1.96	<1.12	117	2
C2-Benz[a]anthracenes/Chrysenes	ng/L	41.5	1.78	<0.458	91	4
C1-Benzofluoranthenes/Pyrenes	ng/L	<7.04	<1.34	<1.19	6	1
C2-Benzofluoranthenes/Pyrenes	ng/L	<7.57	<1.30	<0.751	10	2

[1] Exceedance Ratio = Measured Concentration/Detection Limit

NDR = Peak detected but did not meet quantification criteria.

For calculations non-detect and NDR, values were substituted with a value equal to the detection limit.

B2.3.3 Conclusions and Recommendations

The low degree of variability between duplicate and split samples indicate that samples were generally homogenous within the grab and in the receiving environment at the sampling locations evaluated. Overall, results indicate that field and lab protocols are providing high quality data; however, the differences observed between the sediment rinsate samples suggest that efforts should be made to clean equipment as thoroughly as possible between stations to avoid potential sample contamination.

B2.4 BENTHIC INVERTEBRATE COMMUNITIES

B2.4.1 Quality Control Activities – Field

Field methods used for benthic invertebrate collection are considered to follow accepted methods for environmental effects monitoring (AENV 1990, Glozier *et al.* 2002). Instruments used for measuring supporting variables (e.g., temperature, dissolved oxygen, conductivity, pH, current velocity and depth) were calibrated according to manufacturer instructions (up to daily for water quality meters).

B2.4.2 Quality Control Activities – Laboratory

Taxonomic samples were sorted and identified by Dr. Jack Zloty of Calgary, AB, who has analyzed benthic invertebrate samples on behalf of RAMP consistently over the past five years. Laboratory methods used by Dr. Zloty include resorting of 10% of samples as a confirmation of the overall sorting efficiency of all samples. In 2004, a total of 18 samples were resorted. Sorted portions were verified by an independent analyst. As a result of large volumes of organic material and low abundance in some samples collected from depositional sites, a minimum removal efficiency of 90% was considered acceptable (as previous RAMP studies). This objective is considered acceptable by Environment Canada under current Environmental Effects Monitoring (EEM) strategies (Environment Canada 2002, Glozier *et al.* 2002).

Data were received in electronic format (Microsoft Excel) from the taxonomist. All data were checked upon data entry for transcription errors or other inconsistencies. Data analysis was conducted iteratively, using duplicate data files for processing. Original data was retained in back-up files for the project. Printed output from statistical analyses was retained in project files in the event that analyses may be reviewed and reproduced if needed.

B2.4.3 Quality Control Activities – Results

Results for quality control samples (10% re-sorts) from the 2004 RAMP benthic invertebrate program indicate that this objective was consistently achieved (Table B-11).

Table B-11 Results of quality control checks on sorting efficiency of benthic invertebrate samples, RAMP 2004.

Site	% sorting efficiency
FLC #1	[1-(33/(1239+33))]*100 = 97.4
SHL #5	[1-(14/(511+14))]*100 = 97.3
CLD-D #4	[1-(1/(80+1))]*100 = 98.8
CLR-D #30	[1-(1/(20+1))]*100 = 95.2
CHR-D #2	[1-(3/(58+3))]*100 = 95.1
CHR-D #30	[1-(0/(4+0))]*100 = 100
STR-E #1	[1-(24/(474+24))]*100 = 95.2
STR-E #27	[1-(60/(4006+60))]*100 = 98.5
MUR-E #3	[1-(31/(730+31))]*100 = 95.9
MUR-D #25	[1-(18/(277+18))]*100 = 93.9
JAC-D #14	[1-(6/(140+6))]*100 = 95.9
JAC-D #26	[1-(1/(46+1))]*100 = 97.9
FIR-E #1	[1-(7/(330+7))]*100 = 97.9
MAR-E #21	[1-(96/(1436+96))]*100 = 93.7

Table B-11 (cont'd.)

Site	% sorting efficiency
ELR-D #7	[1-(3/(203+3))]*100 = 98.5
TAR-E #6	[1-(6/(199+6))]*100 = 97.1
CAL-D #6	[1-(15/(245+15))]*100 = 94.2
HAR-E #1	[1-(11/(976+11))]*100 = 98.9

Note: % sorting efficiency = [1-(# in QA/AC re-sort / (# sorted originally + # QA/QC resort)]* 100

Invertebrate sorting efficiency ranged from 93.9% to 100%. Average sorting efficiency was 96.7% (n=18). Based on the criterion of 90% sorting efficiency, these results were considered acceptable and additional QC activities were not required.

B2.5 FISH POPULATIONS

B2.5.1 Quality Control Activities – Field

Fish and fish habitat sampling field activities were conducted in accordance with field methods considered to be standard scientific practice (e.g., Environment Canada 2002) and methods used in previous RAMP studies (Golder 1999). All field personnel were trained in the proper use of all field equipment to ensure accurate and safe data collection.

Instruments used for measuring supporting field water quality variables (e.g., temperature, dissolved oxygen, conductivity, pH, current velocity and depth) were calibrated according to recommendations from the respective manufacturer (as frequently as daily for pH and dissolved oxygen meters). Site locations were recorded using a GPS unit. All sampling details (date, time, methods used, personnel, measurements) were recorded on project-specific field data sheets and/or in waterproof field books.

Sample shipping (e.g., for fish tissues sent to EnviroTest Laboratories [ETL]) was conducted using lab-provided COC forms.

B2.5.2 Quality Control Activities – Laboratory

As in previous RAMP studies, fish aging in 2004 was conducted by John Tost of Northshore Environmental Services in Thunder Bay, ON. Mr. Tost (previously with the Ontario Ministry of Natural Resources) is considered a national expert at aging of fish. Fish aging structures (e.g., fin rays or otoliths) were read three times by independent persons and each structure is assigned a numerical estimate of the confidence associated with the age determination. The level of confidence was considered to be moderate to high for all fish submitted for ageing from the 2004 fish program (Clearwater River and Muskeg River tissue).

Fish tissue analysis results from ETL and Flett Research Ltd. (Flett) include a description of QC techniques used. If relevant, comments on the results of the analyses are indicated on the printed results received from the lab. QC results meet acceptable guidelines for the lab's own internal quality procedures (a condition of membership in CAEAL). In the event alternate procedures were required to achieve a result, this information is also

detailed on the laboratory output. QC procedures used by ETL and Flett include method blanks, laboratory duplicates, spike samples, calibration control, use of certified reference standards and internal standards.

Data were generally received in electronic format (Microsoft Excel) from the analytical lab or entered by hand for other field programs. All data were checked upon data entry for transcription errors or other inconsistencies. Analysis of collected data was done using an iterative approach, using duplicate data files for processing. Original data was retained in back-up files for the project. Where used, printed output from statistical analyses was retained in project files in the event that analyses may be reviewed and reproduced if needed.

B2.6 ACID SENSITIVE LAKES

Field sampling under the acid sensitive lakes component of RAMP is conducted entirely by personnel from Alberta Environment. Water samples collected at each lake are analyzed by the University of Alberta Limnology Laboratory. The lab uses a series of set procedures, outlined in detail below, for analytical quality control; the procedures used are identical to those used in previous RAMP studies (e.g., Golder 2003).

B2.6.1 Quality Control Activities – Field

Water sample collection in the field utilizes standard practices for quality control of samples to avoid contamination. Field instruments (e.g., water quality meters) are cared for so as to maximize data quality (i.e., proper calibration according to manufacturer specifications). Procedures used include the following:

- collection of samples away from the influence of the boat or float plane (i.e., to minimize chance of sample contamination from fuel that may be in the water);
- all sampling equipment is thoroughly cleaned between sites;
- sample containers are tripled-rinsed prior to filling (cap included);
- sample containers are filled to the top (i.e., no head space);
- samples are stored under cool (4 ˚C) conditions and in the dark (i.e., in a refrigerator); and
- samples are submitted to the appropriate analytical laboratory within established maximum holding period (typically 48 hours).

B2.6.2 Quality Control Activities – Laboratory

The University of Alberta (UofA) Limnology Laboratory maintains an internal QA/QC program to maximize quality of analytical results. Programs used include use of standard reference samples and periodic comparison samples (i.e., blanks) sent to other laboratories. In the event that QC objectives are not achieved, corrective actions are initiated to determine the cause. The laboratory prepares standard QC sample for each group of analyses from analytical grade chemicals or standard reference samples.

Annually, 10 samples of known chemistry are submitted by Environment Canada's National Water Research Institute (NWRI) for blind analysis and comparison. Two times per year, quality control samples are sent to the University of Alberta Limnology Laboratory by the Norwegian Institute for Water Research for analysis and comparison.

In all cases, analytical samples are run along with standard laboratory reference samples to create a standard results curve. QC solutions are then run in duplicate. If results for control are consistent for a series of analyses, no additional QC testing is required. If results from QC samples are divergent from standards, corrective action is initiated to determine the cause and results that may be affected. When new QC samples are prepared, each one is tested against the previous QC sample (for a given parameter) to assess comparability.

B2.7 REFERENCES

AENV (Alberta Environment). 1999. Surface water quality guidelines for use in Alberta. November 1999. Environmental Assurance Division, Science and Standards Branch, Edmonton, AB.

CCME (Canadian Council of Ministers of the Environment). 2003. Canadian water quality guidelines for the protection of aquatic life. Canadian Council of Ministers of the Environment, updated 2003.

ETL (Enviro-Test Laboratories). 2005. Personal communication (phone call to M. Davies, Hatfield Consultants Ltd., West Vancouver, BC, regarding anomalous water chemistry results). Edmonton. February 2005.

APPENDIX C

Description of RAMP Database

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APPENDIX C

DESCRIPTION OF RAMP DATABASE

C1.0 BACKGROUND

C1.1 RAMP DATABASE GOALS

The RAMP database is intended to provide a consistent and scalable framework for storage of all RAMP sampling data. The RAMP database web application provides web access to the database and tools to restrict query results to a certain subset of RAMP data. The data is organized by component, with some components (such as fish and hydrology) being split into several sub-components.

By using a single data storage and access point for all RAMP data, the differences between various data formats can be resolved and a consistent format can be created, enabling large-scale analysis spanning the entire set of sampling years and locations.

The relational nature of the MySQL database allows complex queries to be written which would be impossible in a spreadsheet (e.g. MS Excel) format. Not only can the entire dataset be easily included in any query, but programmatic methods can be used to create highly customized reports upon request. The options for data analysis are much improved due to the ability to interact with the data using SQL (structured query language) and modern programming languages.

C1.2 DATABASE OVERVIEW

The RAMP database is a relational database implemented using the open source database server MySQL 4.1. MySQL 4.1 provides a number of modern features[1] found in 'production-quality' databases such as Microsoft SQL Server, in an open-source and lightweight package. These features allow for a fast, flexible database which is ideal for connecting to a web application built in any number of formats.

The RAMP database uses a web front-end to allow end-user interaction with the database. This web application is built using the Java programming language, and the application structure is provided by the Apache Struts web application framework.

The front page of the RAMP Database web application includes an interactive map which allows the user to navigate to sampling site information pages. This map is not a full-fledged GIS-based Internet Map Service, but instead is a lightweight alternative using Macromedia Flash.

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[1] These features include: Referential Integrity; Indexing; Transaction support; Binary Object (BLOB) Support; Alter Table syntax (allows the database administrator to change structure of tables while running); Cross-Platform compatibility; and Open-Source ODBC Connectivity.

C1.3 ACCESSING THE RAMP DATABASE WEB APPLICATION

The RAMP database can be accessed through any modern web browser, although Internet Explorer 6 and Mozilla Firefox 1.x are the preferred browsers. The URL for the database is http://www.hatfieldgroup.net:8080/ramp/. The database can also be accessed through the main RAMP website's members' area.

C2.0 USING THE RAMP DATABASE

C2.1 MAP INTERFACE: LEASES AND SAMPLING SITE SHEETS

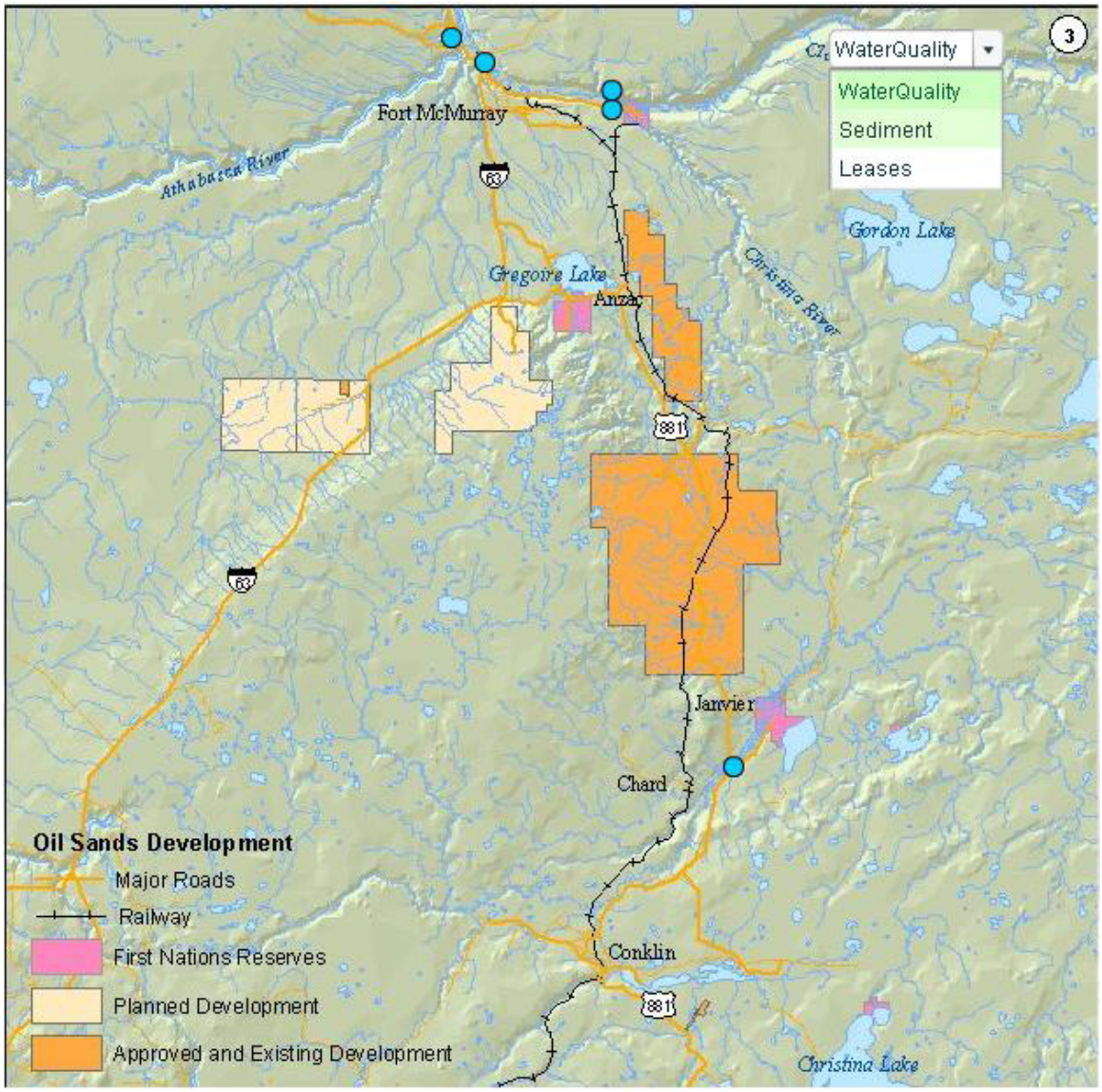
To provide simple, fast access to data regarding different sampling sites, the RAMP Database web application includes a Flash map interface that allows visual navigation between site data pages (examples are provided in Figure 2.2). The map interface contains a main map and three 'submaps' that show site locations for the different component sampling sites. These submaps show the user the locations of sampling sites for the selected RAMP component, and clicking on the site markers will take the user to the 'site sheet page' for that particular site, displaying information on the site such as location, seasonal access, associated sites (other component sampling done at that physical location), and maps/images of that site. The site sheet page for a site will also take the user to the subset of component data collected at that site for the particular year/season combination selected.[P McNamee1] Selecting 'leases' from the submap dropdown list will also show the locations of the different RAMP leases in that area. Currently, the Water Quality and Sediment RAMP sites can be accessed using the flash map.

C2.2 QUERY BUILDER: SELECTING DATA OF INTEREST

One of the main functions of the RAMP Database Web Application is to provide a quick and easy way to access a subset of the RAMP data based on a wide range and combination of parameter values. For example, a user may wish to view all Water Quality data at a certain site within a certain date range. To accomplish this, custom query builders have been provided for each data component.[P McNamee2]

Figure C-5 is a sample of what the user will see when they select 'search data' from the left-hand menu bar, then select 'Water Quality' as their component of interest. The different listboxes can be invoked to select a certain subset of the data. In the case of Figure C-5, when 'search' is clicked, the database will return all WQ results sampled at site ATR-FC-E, between April 4 1998 and April 9 2004, in the category 'Dissolved Metals'.

Figure C-1 RAMP Map Interface for Water Quality.



In Figure C-5 the 'Analyte' listbox has been left with the default value ('—'), which means that the database will ignore that listbox and will simply return all values in the Dissolved Metals category. If a value (for example, 'Aluminum (Al)') were selected, the analyte specified would be included in the search criteria. Likewise, if either or both of the 'results below' and 'results above' textboxes were set to numbers above 0.0, the search would be further restricted to only return result values within this range. Note that only one of the results boxes must be set to a positive value to invoke both boxes' inclusion in the search – the search will always return results according to the range specified by *both* boxes even if only one of the boxes has been set by the user.

Figure C-2 RAMP Map Interface for Sediment Quality.

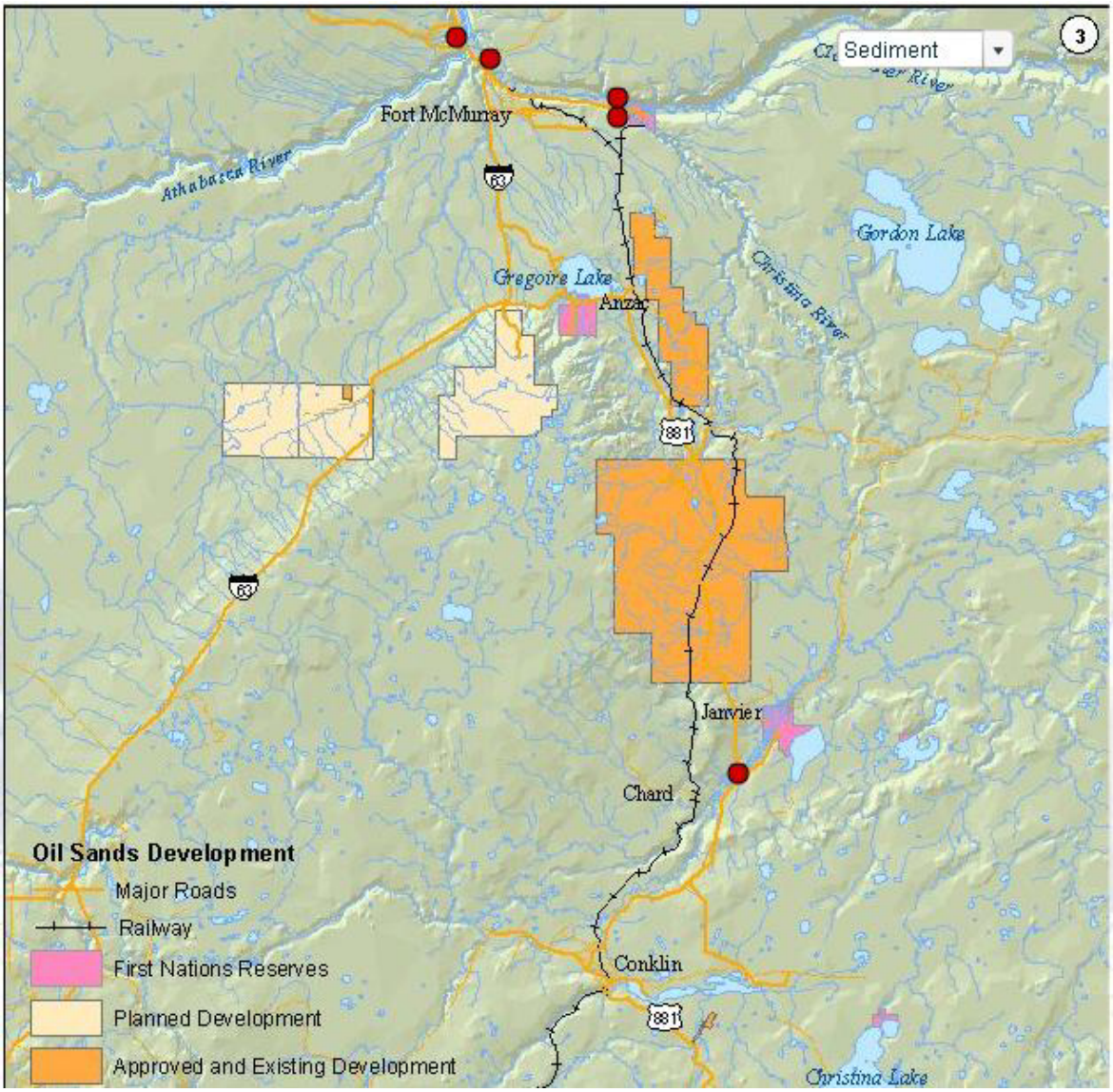


Figure C-3 Example Water Quality Site Sheet.

Site ID	MCL-1	Component	WaterQuality
Datum	NAD83	UTM Zone	12
Start Easting	478769	Start Northing	6374247
End Easting	0	End Northing	0
Winter Access	unknown	Spring Access	Boat
Summer Access	Boat	Fall Access	Boat
Waterbody	McClelland Lake		
Lease	Unknown		
Station Description		Comments	
Upload New Picture (jpg)	Browse...	Caption	Type Photo

Associated Sites:

- [x] Water Quality
- [ ] Hydrology
- [x] Sediment
- [ ] Fisheries
- [x] Benthos
- [ ] Aquatic Vegetation
- [ ] Acid Sensitive Lakes

Sampling History - Legend

Year:	Winter	Spring	Summer	Fall
2000	–	–	–	W1
2001	–	–	W1	W1
2002	–	–	–	W1
2003	–	–	–	W1
1997	–	–	–	–

[ ] Add Row

Submit Changes | Delete Site | Printable

Figure C-4 Example Sediment Quality Site Sheet.

Site ID	FOC-1	Component	Sediment
Datum	NAD83	UTM Zone	12
Start Easting	0	Start Northing	0
End Easting	0	End Northing	0
Winter Access	unknown	Spring Access	unknown
Summer Access	unknown	Fall Access	unknown
Waterbody	Athabasca River		
Lease	None		
Station Description		Comments	
Upload New Picture (jpg)	Browse...	Caption	Type Photo

Associated Sites:

- [x] Water Quality
- [ ] Hydrology
- [x] Sediment
- [ ] Fisheries
- [ ] Benthos
- [ ] Aquatic Vegetation
- [ ] Acid Sensitive Lakes

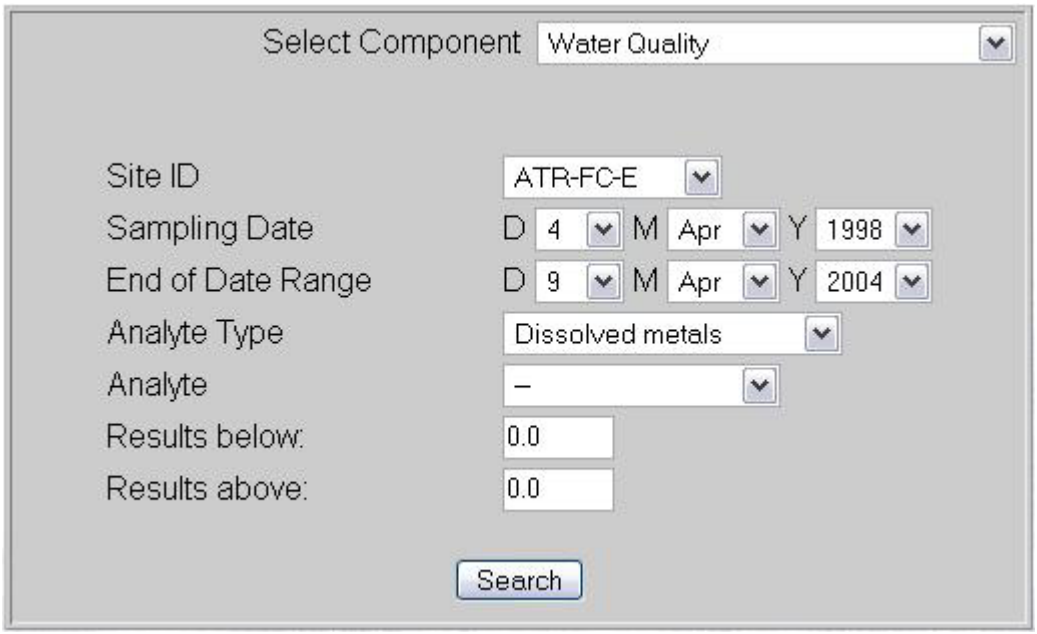
Sampling History - Legend

Year:	Winter	Spring	Summer	Fall
1997	–	–	–	–

[ ] Add Row

Submit Changes | Delete Site | Printable

Figure C-5 Query Screen for Water Quality.



The results of any query using the query builders will be available to the user in two formats. The first format available is the online web page format, where the resultant data is immediately shown to the user in the browser. For performance purposes, this data has been restricted to the first 250 records of the query result, and a limited number of columns are shown, as screen resolutions dictate that for some components, returning all columns may be impractical.

The second format is a standard, downloadable Microsoft Excel file – this file is generated with every query request and is available to the user through a link at the top of the results page. This Excel file will contain the entire dataset with all columns and records. However, only the most recent query results will be saved on the server, so the file must be downloaded by the user or it may be lost.

Examples of Query screens for other RAMP components are provided at the end of this Appendix in Figure C-6 (note, other queries are possible in addition to those in Figure C-5 and Figure C-6).

C3.0 DATA DICTIONARY

The RAMP Database currently consists of approximately 50 database tables. Some tables are standalone (or 'lookup') tables, and others are relationally linked tables. The relational database format allows the designer/administrator to enforce data integrity and eliminate null values.

The following section describes a number of the tables and interactions in the RAMP database for the overall database and various sampling components. Not all tables are included in this data dictionary, only the major component tables main site information tables.

C3.1 GENERAL SITE TABLES

C3.1.1 Site

Field Name	Field Type	Description
SiteID	Text – Primary Key	Unique ID of this site – e.g. 'ARD-1'
Component	Text – Primary Key	RAMP Component – e.g. 'Water Quality'
StationDesc	Text	Station Description – Optional
UTMZone	Text	UTM Zone – e.g. '12'
StartEasting	Integer	Coordinate data
StartNorthing	Integer	Coordinate data
EndEasting	Integer	Coordinate data
EndNorthing	Integer	Coordinate data
Datum	Text	Datum – e.g. 'NAD83'
WaterBodyID	Integer	ID of the River/Lake this site is on – linked to waterbody (waterbodyID)
Lease	Text	Lease this site is on – linked to lease (leaseName)

C3.1.2 Lease

Field Name	Field Type	Description
LeaseName	Text – Primary Key	Lease Name – e.g. 'Aurora North Mine'
LeaseCode	Text	Abbreviation – e.g. 'ONLL'

C3.1.3 Sampling History

Field Name	Field Type	Description
SiteID	Text – Primary Key	The Sampling Site ID – linked to site(siteID)
Component	Text – Primary Key	RAMP Component – e.g. 'Water Quality'
Year	Text – Primary Key	The Year this row refers to
Winter	Text	Winter sampling category – e.g. 'W1'
Spring	Text	Spring sampling category – e.g. 'W1'
Summer	Text	Summer sampling category – e.g. 'W1'
Fall	Text	Fall sampling category – e.g. 'W1'

C3.2 CLIMATE AND HYDROLOGY TABLES

C3.2.1 Dailydata

Field Name	Field Type	Description
SiteID	Text – Primary Key	Sampling site that this sample was collected at
Date	Text – Primary Key	Date of sample collection, in the format '20050415'
WaterLevel	Double (numeric)	Water level result
Discharge	Double (numeric)	Discharge result
ObservationQualifier	Text	e.g. 'B'

C3.2.2 Dailygovtclimate

Field Name	Field Type	Description
SiteID	Text – Primary Key	Sampling Site that this sample was collected at
Date	Text – Primary Key	Date of sample collection, in the format '20050415'
DataType	Integer – Primary Key	Data Type – linked to datatypes(DataType)
Value	Double (numeric)	Sampled value
Flag	Text	Qualifier – e.g. 'Trace' or 'Estimated'

C3.2.3 Datatypes

Field Name	Field Type	Description
DataType	Integer – Primary Key	Unique data type ID
Agency	Text	Agency – e.g. 'AES' or 'WSC'
Description	Text	Description of this data type – e.g. 'Snowfall'
DataFieldName	Text	Name of value field
Units	Text	Units of measurement – e.g. 'cm'
Factor	Integer	Optional – e.g. '10' or '1'
Cumulative	Integer	Binary – '1' or '0'
DisplayFormat	Integer	Display Format – e.g. '1' or 'S3'
AxisLabel	Text	Label from Axis data
MinRange	Integer	Minimum Range – e.g. '0' or '2'

C3.2.4 Manualmeasurements

Field Name	Field Type	Description
SiteID	Text – Primary Key	Sampling Site that this sample was collected at
MeasureDate	Text – Primary Key	Date of sample collection, in the format '20050415'
MeasureTime	Text	Time of sample collection, in the format '12:00:00'
Discharge	Double	Discharge value
WaterLevel	Double	Water Level Value
IceEffects	Binary	T/F for Ice Effects, e.g. '1' or '0'
Quality	Text	Quality, e.g. 'good', 'fair' or 'unknown'
DataSource	Text	Data Source, e.g. 'RAMP (MSA)'
Comments	Text	Optional Comment field

C3.3 WATER QUALITY TABLES

C3.3.1 wqsamplingbatch

Field Name	Field Type	Description
SiteID	Text – Primary Key	Sampling site that this batch was collected at – linked to site(siteID)
SamplingDate	Text – Primary Key	Date of sample collection, in the format '20050415'
ProjCode	Text	Project Code
Region	Text	Sampling Region (e.g. Muskeg R.)

C3.3.2 wqanalyte

Field Name	Field Type	Description
AnalyteName	Text – Primary Key	Name of the analyte – e.g. 'Aluminum (Al)'
AnalyteCategory	Text – Primary Key	Analyte Category – e.g. 'Dissolved Metals'
Units	Text	Units of measurement – e.g. 'mg/L'
Abbreviation	Text	Optional field

C3.3.3 wqsample

Field Name	Field Type	Description
SiteID	Text – Primary Key	Sampling site that this sample was collected at – linked to wqsamplingbatch (siteID)
SamplingDate	Text – Primary Key	Date of sample collection, in the format '20050415'
AnalyteName	Text – Primary Key	Name of the analyte – e.g. 'Aluminum (Al)' – linked to wqanalyte(analyteName)
AnalyteCategory	Text – Primary Key	Analyte Category – e.g. 'Dissolved Metals' – linked to wqanalyte (analyteName)
Method	Text – Primary Key	Sampling Method – e.g. 'APHA 4500-H, 2510, 2320'
Result	Double (numeric)	Sampled value
ResultQualifier	Text	'<' if result below detection limit
DetectionLimit	Double (numeric)	Detection Limit
Lab	Text	Lab – e.g. 'ETL'

C3.4 SEDIMENT QUALITY TABLES

C3.4.1 sedsamplingbatch

Field Name	Field Type	Description
SiteID	Text – Primary Key	Sampling site that this batch was collected at – linked to site(siteID)
SamplingDate	Text – Primary Key	Date of sample collection, in the format '20050415'
Region	Text	Sampling Region (e.g. Muskeg R.)
Comment	Text	Optional comment

C3.4.2 Sedanalyte

Field Name	Field Type	Description
AnalyteName	Text – Primary Key	Name of the analyte – e.g. 'Aluminum (Al)'
AnalyteCategory	Text – Primary Key	Analyte Category – e.g. 'Dissolved Metals'
Units	Text	Units of measurement – e.g. 'mg/L'

C3.4.3 Sedsample

Field Name	Field Type	Description
SiteID	Text – Primary Key	Sampling site that this sample was collected at – linked to wqsamplingbatch(siteID)
SamplingDate	Text – Primary Key	Date of sample collection, in the format '20050415'
AnalyteName	Text – Primary Key	Name of the analyte – e.g. 'Aluminum (Al)' – linked to sedanalyte(analyteName)
AnalyteCategory	Text – Primary Key	Analyte Category – e.g. 'Dissolved Metals' – linked to sedanalyte(analyteName)
Method	Text	Sampling Method – e.g. 'APHA 4500-H, 2510, 2320'
Result	Double (numeric)	Sampled Value
ResultQualifier	Text	'<' if result below detection limit
DetectionLimit	Double (numeric)	Detection Limit

C3.5 BENTHIC INVERTEBRATE COMMUNITY TABLES

C3.5.1 Benthicsample

Field Name	Field Type	Description
SiteID	Text – Primary Key	Sampling site that this sample was collected at
GenusID	Integer (numeric)	ID of the Genus sampled – linked to benthicgenus(genusID)
Quantity	Integer (numeric)	Sampling result

C3.5.2 Benthicgenus

Field Name	Field Type	Description
GenusID	Integer (numeric) – Primary Key	Unique ID of genus
Taxon	Text	Taxon of genus
Family	Text	Family of genus
Genus	Text	Genus name

C3.6 FISH POPULATION TABLES

C3.6.1 Fishinventory

Field Name	Field Type	Description
SampleNo	Integer – Primary Key	Unique ID of this sample
Method	Text	Sampling Method – e.g. 'Electrofishing'
SiteID	Text	Sampling Site that this sample was collected at – linked to site(siteID)
Year	Text	Year in which this sample was collected
SpeciesCode	Text	Species Code for this sample – e.g. 'FLCH' – linked to fishspecies(speciesCode)
FishLength	Integer	Length of fish
FishWeight	Integer	Weight of fish
FishSex	Text	Sex of fish
FishMaturity	Text	Maturity – e.g. 'Immature' or 'Ripe'

C3.6.2 Fishspecies

Field Name	Field Type	Description
SpeciesCode	Text – Primary Key	Species Code for this species – e.g. 'FLCH'
FirstName	Text	First name – e.g. 'Flathead'
LastName	Text	Last name – e.g. 'Chub'
Genus	Text	Genus – e.g. 'Notropis'
Species	Text	Species – e.g. 'atherinoides'
Family	Text	Family – e.g. 'Cyprinidae'
Remark	Text	Optional Comment Field

C3.7 AQUATIC VEGETATION TABLES

C3.7.1 Aquaticvegsample

Field Name	Field Type	Description
SiteID	Text – Primary Key	Sampling Site that this sample was collected at – e.g. 'IT1-1'
SpeciesName	Text – Primary Key	Species of sample – e.g. 'Carex aquatalis'
PercentCover	Double	Percentage of cover – e.g. '0.5'
Vigour	Integer	Sample Vigour – e.g. '3'

C3.8 ACID SENSITIVE LAKES TABLES

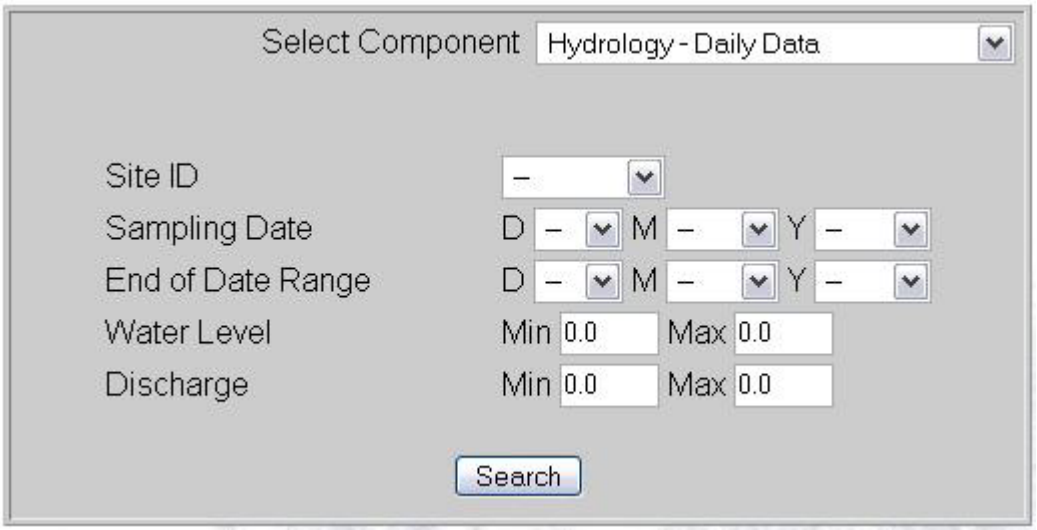
C3.8.1 aslsample

Field Name	Field Type	Description
SiteID	Text – Primary Key	Sampling site that this sample was collected at
Year	Text – Primary Key	Year in which this sample was collected
Analyte	Text – Primary Key	Name of the analyte – e.g. 'Sulphate' – linked to aslanalyte(analyteName)
Value	Double (numeric)	Result value
ValueQualifier	Text	'<' if value below detection limit

C3.8.2 aslAnalyte

Field Name	Field Type	Description
AnalyteName	Text – Primary Key	Name of the analyte – e.g. 'Sulphate'
MeasurementUnit	Text	Units of measurement – e.g. 'mg/L'

Figure C-6 Additional Examples of Query Builders for other RAMP Components.
Other queries are possible and available.



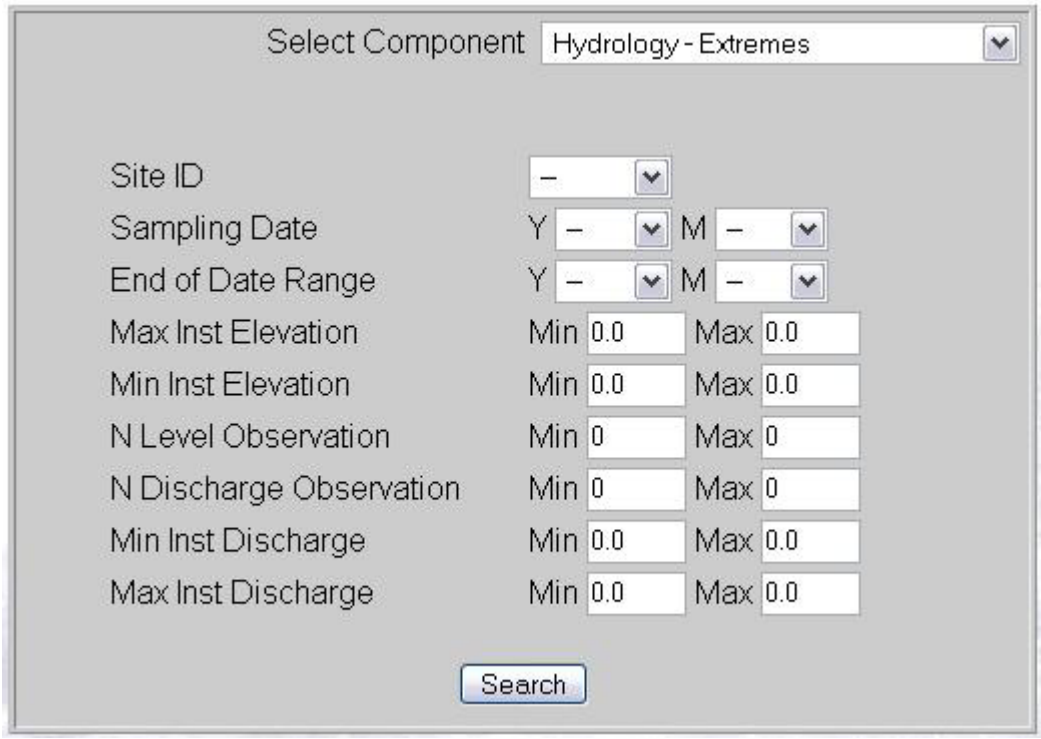
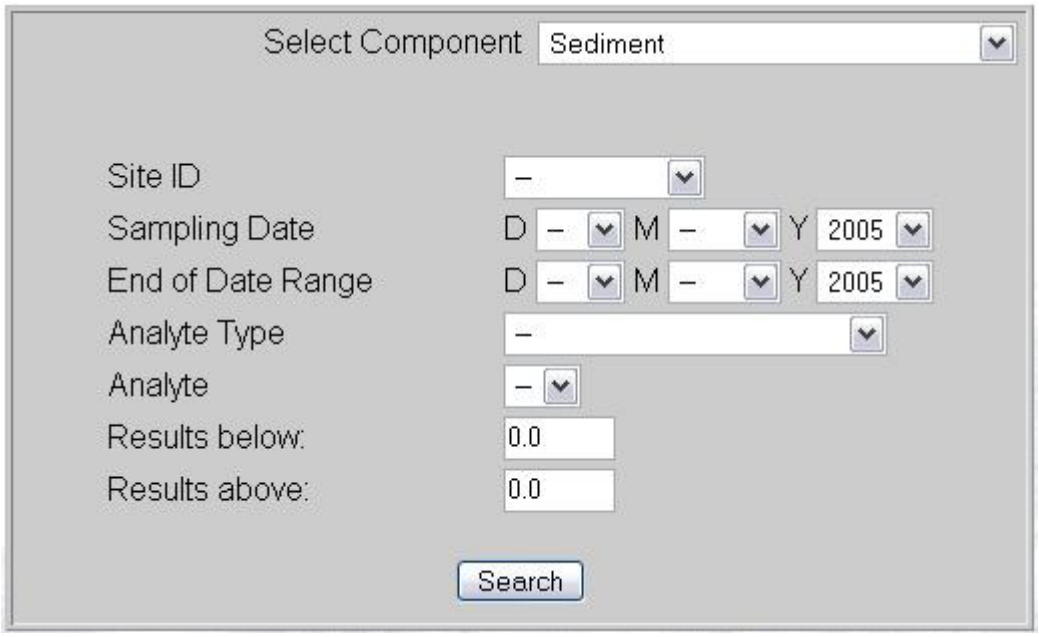


Figure C-6 (cont'd.)



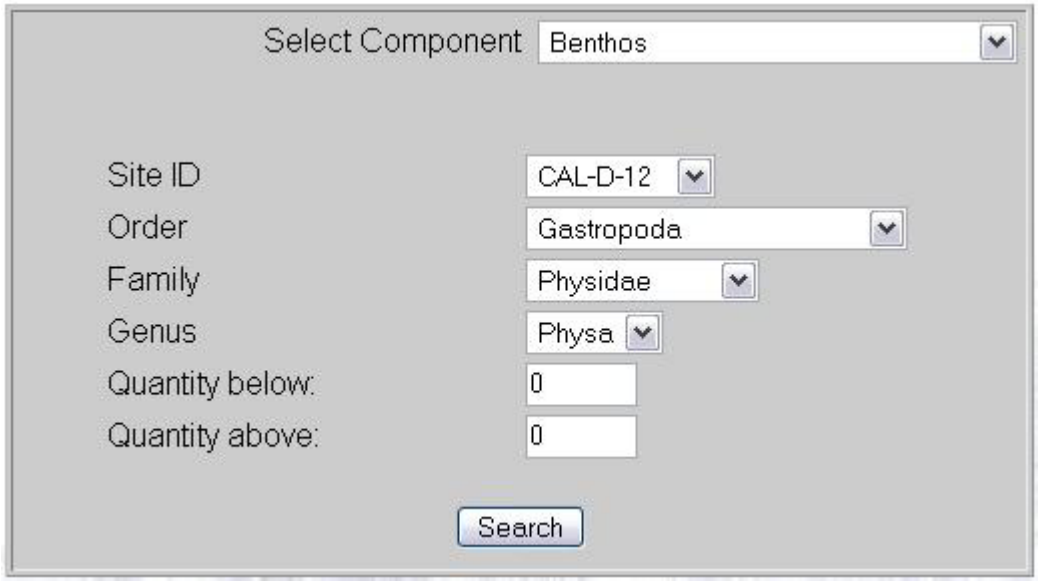
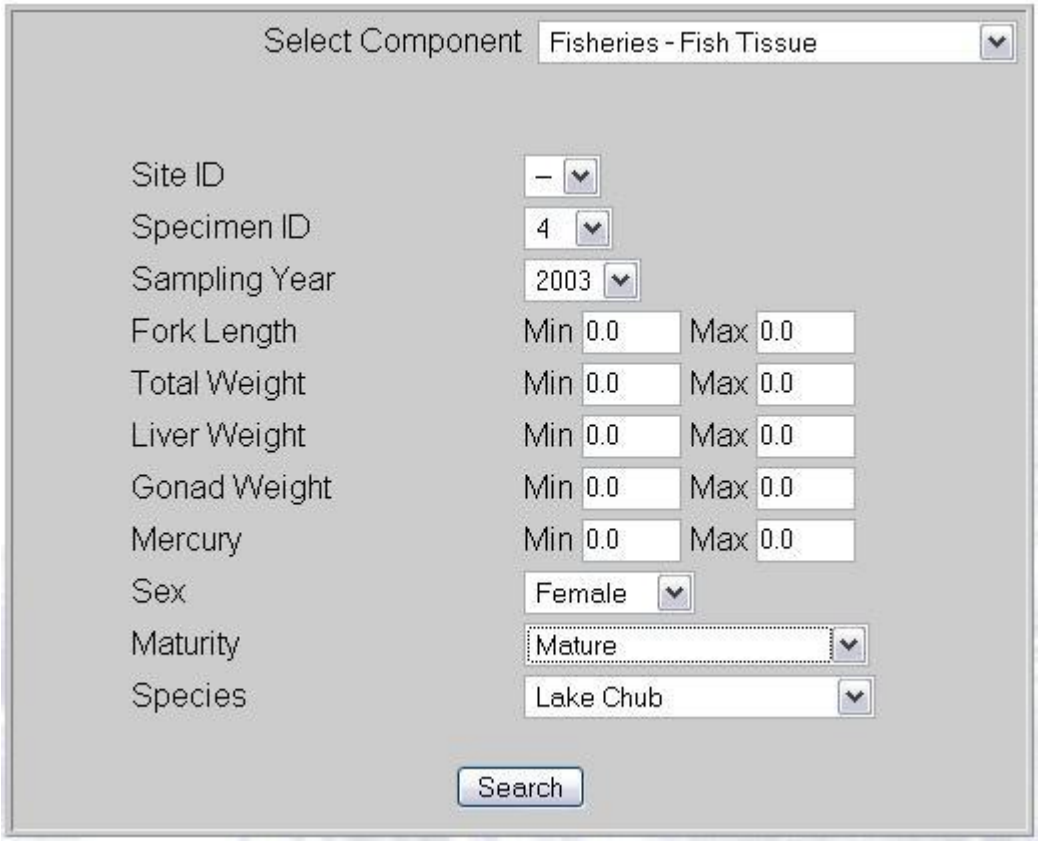
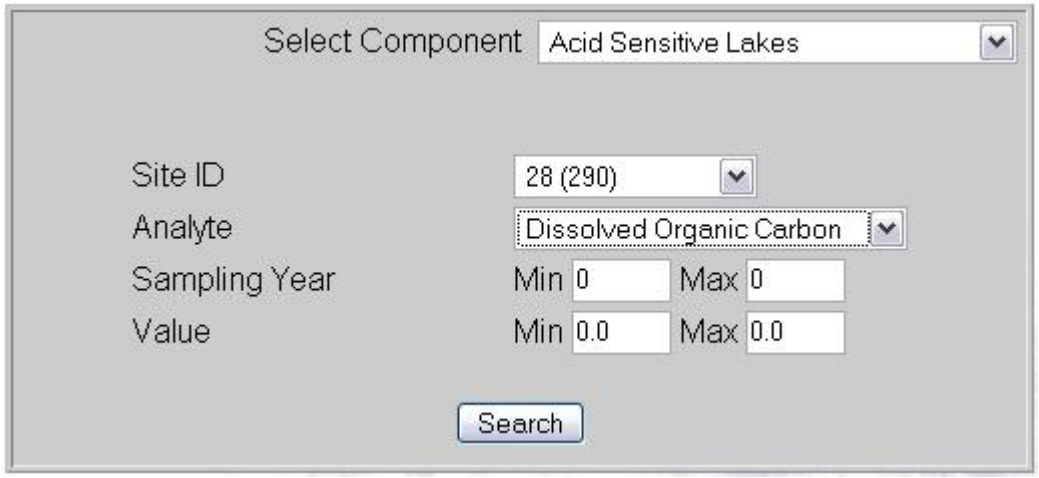


Figure C-6 (cont'd.)





APPENDIX D

Climate and Hydrology

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APPENDIX D

CLIMATE AND HYDROLOGY

D1.0 INVENTORY OF CLIMATE DATA COLLECTED IN 2004

D1.1 RAMP DATA

D1.1.1 Aurora Climate Station (C1)

The Aurora Climate Station (C1) sensors monitored air temperature, wind speed and direction, precipitation, solar radiation, and relative humidity throughout 2004.

Precipitation was recorded upon occurrence. Other parameters were sensed every 5 seconds. Table D-1 lists the hourly climate parameters developed from the sensor readings. Daily readings were computed from the hourly records.

Table D-1 Aurora Climate Station (C1) data elements.

Climate Element and Sensor	Parameter	Units	Derivation
Air Temperature Thermistor	Minimum	(°C)	Minimum of 1 minute means from readings every 5 sec.
	Mean	(°C)	Mean of readings every 5 sec.
	Maximum	(°C)	Maximum of 1 minute means from readings every 5 sec.
Precipitation Tipping bucket rain gauge	Total	(mm)	Sum of 0.1 mm tips.
Snowfall Water Equivalent Tipping Bucket rain gauge with snow adaptor	Total	(mm)	Sum of 0.1 mm tips.
Depth of Snow on Ground Sonic level sensor	Total	(cm)	Average of 5 second readings made in the last minute of each hour.
Mean Relative Humidity Humidity sensor	Mean	(%)	Mean of readings every 5 sec.
Total Global Solar Radiation Pyranometer	Total	(kWh/m^2)	Sum of time integrated readings every 5 sec.
Wind Speed and Direction Wind Vane and Propeller	Mean Daily Wind Speed	(km/h)	Magnitude of daily mean wind vector from readings averaged every 5 sec.
	Direction	(degrees)	Direction of daily mean wind vector from readings averaged every 5 sec.
	5 sec. Gust Speed	(km/h)	Maximum scalar wind speed from 5 sec readings.
	2 min. Gust Speed	(km/h)	Maximum of 1 minute scalar wind speed means from readings every 5 sec.
	10 min. Gust Speed	(km/h)	Maximum of 10 minute scalar wind speed means from readings every 5 sec.

Under severe winter conditions, variation in temperature and solar radiation can impact the performance of tipping bucket rain gauges used to collect snowfall data. Tipping bucket snow gauge data was therefore verified by considering concurrent temperature and snow depth readings and data collected at other RAMP or MSC stations.

The data logger had some problems towards the end of 2004, which resulted in missing data for some parameters such as temperature, depth of snow on ground, mean relative humidity and total global solar radiation for six days in November. Furthermore, there is missing data for all parameters from November 16 to December 31, 2004.

Monthly observations for 2004 are summarized in Table D-3.

D1.1.2 Other RAMP Climate Stations

Table D-2 summarizes the climate parameters monitored at RAMP stations other than the Aurora Climate Station.

Table D-2 Sensors at other RAMP climate stations.

Station	Parameter	Sensor
L1 McClelland Lake	Rainfall	Tipping Bucket Rain Gauge
S3 Iyinimin Creek above Kearl Lake	Rainfall	Tipping Bucket Rain Gauge
S5A Muskeg River above Muskeg Creek	Barometric Pressure	Pressure Transducer
S16 Calumet River near the Mouth	Rainfall Snowfall Air Temperature Water Temperature	Tipping Bucket Rain Gauge Tipping Bucket with Snow Adaptor Thermistor Thermistor
S19 Tar River Lowland Tributary near the Mouth	Rainfall	Tipping Bucket Rain Gauge

Climate sensors at S16 and S5A were operated throughout the year, while other sensors were operated during the open water season (May – October). Despite ongoing maintenance during regular site visits, the precipitation sensor at S19 was compromised by repeated damage to equipment, presumably by wildlife.

Table D-3 provides a monthly summary of the data collected at the other RAMP climate stations. Daily and cumulative precipitation depths at the various stations are compared to precipitation recorded at Fort McMurray A (Environment Canada station 3062693) in Figure D-1.

Table D-3 Summary of 2004 monthly climate data collected at C1 Aurora Climate Station.

Month	Temperature			Total Precip.	Snowfall Water Equivalent	Rainfall Depth	Month End Depth of Snow on Ground	Mean Relative Humidity	Total Global Solar Radiation	Wind Speed and Direction				
										Mean Monthly Wind		Maximum Sustained Speeds		
	Min.	Mean	Max.							Speed	Direction	5 sec.	2 min.	10 min.
	(°C)	(°C)	(°C)	(mm)	(mm)	(mm)	(cm)	(%)	(kWh/m^2)	(km/h)	(degrees)	(km/h)	(km/h)	(km/h)
January	-27.1	-22.3	-18.3	0.0	0.0	0.0	M	76.0	0.15	3.3	135	17.8	10.7	8.3
February	-16.6	-9.0	-1.5	0.5	0.0	0.5	40	77.6	1.08	2.8	137	19.3	11.8	9.0
March	-14.3	-4.2	4.4	M	M	M	25	62.5	2.75	3.5	165	26.5	15.6	12.5
April	-3.2	5.1	13.0	0.6	0.0	0.6	1	54.8	4.52	3.4	136	27.3	16.5	12.5
May	-0.5	7.8	14.9	1.8	0.1	1.7	0	58.6	5.05	3.4	79	27.8	16.2	12.3
June	6.1	16.9	25.6	0.4	0.0	0.4	0	57.4	6.53	2.8	139	25.7	14.4	10.6
July	11.8	21.6	30.6	1.6	0.0	1.6	0	64.5	5.94	2.3	156	23.3	13.5	9.9
August	7.4	15.8	24.2	1.1	0.0	1.1	0	76.4	4.07	1.9	130	20.0	11.2	8.1
September	3.1	10.1	16.8	2.7	0.0	2.7	0	78.5	2.43	2.8	157	24.0	13.3	9.7
October	-3.3	3.0	9.3	0.4	0.0	0.4	6	75.5	1.46	3.3	181	23.0	12.8	10.1
November	-7.5	-0.4	4.4	0.2	0.1	0.1	M	76.7	0.86	3.1	210	23.5	13.6	10.7
December	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Annual	-27.1	4.1	30.6	9.2	0.2	9.0		69.0	34.84	3.0	148	27.8	16.5	12.5

See notes in section D.1.1.3

Table D-4 Summary of 2004 climate data collected at other RAMP climate stations[1].

Period of Operation	S16 Calumet River Station Jan 1 - Dec 31, 2004						S3 Iyinimin Creek above Kearl Lake May 16-Oct 31	S5A Muskeg River Above Muskeg Creek Jan 1-Dec 31	L1 McClelland Lake Apr 26-Oct 31
Month	Temperature Min. (°C)	Temperature Mean (°C)	Temperature Max. (°C)	Snowfall Water Equivalent[2] (mm)	Rainfall Depth (mm)	Total Precip. (mm)	Rainfall Depth (mm)	Barometric Pressure (kPa)	Rainfall Depth (mm)
Jan	-49.2	-23.2	-8.9	0.3	0.0	0.3		98.9	
Feb	-35.5	-12.8	11.2	1.1	0.0	1.1		98.1	
Mar	-38.1	-7.8	20.9	0.0	0.0	0.0		98.0	
Apr	-17.1 P[3]	1.0 P	20.8 P	0.0	3.9 P	3.9 P		98.3	3.7 P
May	-9.8 P	8.5 P	27.2 P	0.0	54.9 P	54.9 P	31.4 P	98.1	50.8
Jun	-0.7 P	14.6 P	30.5 P	0.0	10.6 P	10.6 P	6.9	98.3	3.9
Jul	-1.4	17.6	34.8	0.0	45.3	45.3	35.6	97.9	38.4
Aug	-4.7	11.9	32.9	0.0	24.4	24.4	32.5	98.3	20.2
Sep	-8.8	6.4	23.9	0.0	70.5	70.5	5.1	97.8	17.6
Oct	-21.2	-1.5	21.2	0.3	8.0	8.3	1.8	97.6	0.0
Nov	-30.6	-9.0	10.9	9.4	2.6	12.0		97.8	
Dec	-42.9	-20.6	0.2	24.6	0.0	24.6		98.3	
Annual[4]	-49.2	-1.2	34.8	35.7	220.1	255.8	113.2	98.1	134.6

[1] A rain guage was also installed at S19 Tar River Lowland Tributary near the Mouth but produced no reliable data due to damage by wildlife.

[2] Snow records for Jan - April at S16 are believed to be incorrect. Although the gauge appeared to be operational, the actual snowfall is believed to have been more than was recorded.

[3] P = Partial month

[4] Annual values shown consist of extremes, averages or totals, depending on the parameter.

D1.1.3 Notes to Climate Data Tables

The following notes apply to the monthly climate data (Tables D-2 and D-4) and to the daily data provided in the RAMP database (www.ramp-alberta.org):

- Time distribution of snowfall is sometimes not measured correctly. Snow can accumulate in the gauge for some time and is then recorded when it melts. Therefore daily total snowfall depths may not be accurate and the snowfall may not have occurred on the date that it is recorded.

- The precipitation gauges fitted with snowfall adaptors (at C1 and S16) measure total precipitation but do not differentiate between rainfall and snowfall. Precipitation, temperature, and snow on the ground data were all considered in assessing whether a specific precipitation event was rain or snow.

- Annual values in the monthly table consist of the following: extremes in the case of minimum and maximum temperature data; means in the case of mean temperature and relative humidity; totals in the case of precipitation and solar radiation.

- Wind direction is the direction from which the wind is blowing, measured in degrees clockwise from North.

- Mean daily wind speed and direction describe the resultant vector obtained by adding the hourly wind vectors, which in turn were based on 5 second averaged readings. The daily aggregate values were used to determine monthly wind speed values.

- Mean annual wind speed and direction describe the vector resultant of the monthly wind vectors.

- M = Missing

D1.2 2004 SNOWCOURSE SURVEY RESULTS

Snowcourse surveys were made at sites representing five general terrain types across the RAMP study area:

- Flat Low Lying areas (FL)

- Open Land areas (OP)

- Open Lake (OP)

- Mixed Deciduous (MD)

- Jack Pine (JP)

Snow course surveys were completed between February 2 and 6, February 28 and March 4, and April 1 and 5, 2004.

Locations of the snow courses are shown on Figures 3.1 and 3.2 in the main text and the data is provided in the RAMP database (www.ramp-alberta.org).

D1.3 DATA FROM GOVERNMENT AGENCIES

Daily climate data published by Environment Canada for climate stations in the study area has been incorporated into the RAMP database. The station locations are shown on Figures 3.1-1 and 3.1-2 in Section 3 of the main report, and an inventory of the data obtained for the stations is provided in Section D.2.4, bellow.

D2.0 INVENTORY OF HYDROMETRIC DATA COLLECTED IN 2004

D2.1 RAMP DATA

D2.1.1 Hydrometric Monitoring

Table D-5 summarizes the hydrometric monitoring carried out at various stations in 2004. Water levels were monitored at two stations, whereas both water levels and discharge measurements were carried out at 24 stations. Daily discharges and water levels are provided in the RAMP database.

D2.1.2 Water Temperature

Water temperatures were measured at two stations, namely, S5A and S16, as mentioned in Table D-2. The water temperature was monitored all year at station S5A, whereas at S16 it was monitored only during the open-water season. Figure D-2 shows a comparison of the water temperatures measured at S5A and S16. Daily mean water temperatures are contained in the RAMP database.

D2.1.3 Suspended Sediment

Suspended sediment samples were collected at 28 RAMP streamflow stations six times during 2004. The suspended sediment data is provided in the RAMP database.

D2.2 DATA FROM OIL SANDS OPERATORS

The following information regarding oil sands operational water withdrawals and releases was provided to RAMP:

- Albian's daily withdrawals from the Athabasca River (Provided by Albian Sands Energy Inc.)
- Aurora North Clean Water Discharge daily discharges (Provided by Syncrude Canada Ltd.)
- Suncor's daily withdrawals from and releases to the Athabasca River (Provided by Alberta Environment)
- Syncrude's monthly withdrawals from the Athabasca River (Provided by Alberta Environment)

Data provided at a daily time increment is contained in the RAMP database (www.ramp-alberta.org).

D2.3 DATA FROM GOVERNMENT AGENCIES

Daily data published by Environment Canada for hydrometric stations in the study area has been incorporated into the RAMP database. The station locations are shown on Figures 3.3-3 and 3.3-4 in Section 3 of the main report, and an inventory of the data obtained for the stations is provided below.

D2.4 SUMMARY OF HYDROLOGIC DATA IN THE RAMP DATABASE

A complete summary of the daily hydrologic data contained in the RAMP database is provided on the following pages.

RAMP Hydrologic Data Inventory

Station	Name	Time Step	Data Type	From Date	To Date
07CD001	Clearwater River at Draper				
		Daily	1 - Discharge (m3/s)	15-Dec-1930	31-Dec-2004
07CD004	Hangingstone River at Fort McMurray				
		Daily	1 - Discharge (m3/s)	12-Mar-1965	31-Oct-2004
07CD005	Clearwater River above Christina River				
		Daily	1 - Discharge (m3/s)	16-Jun-1966	31-Oct-2004
07CE001	Gregoire Lake near Fort McMurray				
		Daily	8 - Water Level (m)	01-Aug-1969	31-Oct-2004
07CE002	Christina River near Chard				
		Daily	1 - Discharge (m3/s)	20-May-1982	31-Oct-2004
07DA001	Athabasca River below McMurray				
		Daily	1 - Discharge (m3/s)	01-Oct-1957	31-Dec-2004
07DA006	Steepbank River near Fort McMurray				
		Daily	1 - Discharge (m3/s)	20-Sep-1972	31-Oct-2004
07DA007	Poplar Creek near Fort Mcmurray				
		Daily	1 - Discharge (m3/s)	16-Mar-1972	31-Dec-1986
07DA008	Muskeg River near Fort MacKay				
		Daily	1 - Discharge (m3/s)	01-Jan-1974	31-Oct-2004
07DA015	Tar River near the Mouth				
		Daily	1 - Discharge (m3/s)	24-Aug-1975	31-Dec-1977
07DA017	Ells River near the mouth				
		Daily	1 - Discharge (m3/s)	28-Jul-1975	31-Dec-1986
07DA018	Beaver River above Syncrude				
		Daily	1 - Discharge (m3/s)	19-Aug-1975	01-Nov-2004
07DB001	MacKay River near Fort MacKay				
		Daily	1 - Discharge (m3/s)	15-Mar-1972	31-Oct-2004
07DC001	Firebag River near the mouth				
		Daily	1 - Discharge (m3/s)	06-May-1971	31-Oct-2004
3060110	Algar LO				
		Daily	001 - Daily Maximum Temperature (deg. C)	01-Aug-1965	31-Aug-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	01-Aug-1965	31-Aug-2004
		Daily	003 - Daily Mean Temperature (deg. C)	01-Aug-1965	31-Aug-2004
		Daily	010 - Total Rainfall (mm)	17-Apr-1959	31-Aug-2004
		Daily	012 - Total Precipitation (mm)	06-May-2004	31-Aug-2004
3060700	Birch Mountain LO				
		Daily	001 - Daily Maximum Temperature (deg. C)	01-May-1966	31-Aug-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	01-May-1966	31-Aug-2004
		Daily	003 - Daily Mean Temperature (deg. C)	01-May-1966	31-Aug-2004
		Daily	010 - Total Rainfall (mm)	01-Jun-1960	31-Aug-2004

Station	Name			
	Time Step	Data Type	From Date	To Date
	Daily	012 - Total Precipitation (mm)	01-May-2004	31-Aug-2004
3060705	Bitumont LO			
	Daily	001 - Daily Maximum Temperature (deg. C)	04-May-1962	31-Aug-2004
	Daily	002 - Daily Minimum Temperature (deg. C)	05-May-1962	31-Aug-2004
	Daily	003 - Daily Mean Temperature (deg. C)	05-May-1962	31-Aug-2004
	Daily	010 - Total Rainfall (mm)	04-May-1962	31-Aug-2004
	Daily	012 - Total Precipitation (mm)	21-Apr-2004	31-Aug-2004
3060922	Buckton LO			
	Daily	001 - Daily Maximum Temperature (deg. C)	01-Jun-1965	31-Jul-2004
	Daily	002 - Daily Minimum Temperature (deg. C)	01-Jun-1965	31-Jul-2004
	Daily	003 - Daily Mean Temperature (deg. C)	01-Jun-1965	31-Jul-2004
	Daily	010 - Total Rainfall (mm)	01-Jun-1965	31-Jul-2004
	Daily	012 - Total Precipitation (mm)	14-May-2004	31-Jul-2004
3061580	Christina LO			
	Daily	001 - Daily Maximum Temperature (deg. C)	01-Jun-1967	17-May-2002
	Daily	002 - Daily Minimum Temperature (deg. C)	01-Jun-1967	18-May-2002
	Daily	003 - Daily Mean Temperature (deg. C)	01-Jun-1967	17-May-2002
	Daily	010 - Total Rainfall (mm)	01-Jun-1967	17-May-2002
3061800	Conklin LO			
	Daily	001 - Daily Maximum Temperature (deg. C)	01-May-1965	31-Jul-2004
	Daily	002 - Daily Minimum Temperature (deg. C)	02-May-1965	31-Jul-2004
	Daily	003 - Daily Mean Temperature (deg. C)	02-May-1965	31-Jul-2004
	Daily	010 - Total Rainfall (mm)	21-May-1954	31-Jul-2004
	Daily	012 - Total Precipitation (mm)	22-Apr-2004	31-Jul-2004
3061930	Cowpar LO			
	Daily	001 - Daily Maximum Temperature (deg. C)	02-May-1965	31-Aug-2004
	Daily	002 - Daily Minimum Temperature (deg. C)	01-May-1965	31-Aug-2004
	Daily	003 - Daily Mean Temperature (deg. C)	02-May-1965	31-Aug-2004
	Daily	010 - Total Rainfall (mm)	01-Jul-1957	31-Aug-2004
	Daily	012 - Total Precipitation (mm)	01-May-2004	31-Aug-2004
3062300	Ells LO			
	Daily	001 - Daily Maximum Temperature (deg. C)	01-May-1964	31-Aug-2004
	Daily	002 - Daily Minimum Temperature (deg. C)	01-May-1964	31-Aug-2004
	Daily	003 - Daily Mean Temperature (deg. C)	01-May-1964	31-Aug-2004
	Daily	010 - Total Rainfall (mm)	18-Apr-1961	31-Aug-2004
	Daily	012 - Total Precipitation (mm)	05-May-2004	31-Aug-2004
3062693	Fort McMurray A			
	Daily	001 - Daily Maximum Temperature (deg. C)	01-Jan-1944	31-Oct-2004
	Daily	002 - Daily Minimum Temperature (deg. C)	01-Jan-1944	31-Oct-2004
	Daily	003 - Daily Mean Temperature (deg. C)	01-Jan-1944	31-Oct-2004
	Daily	010 - Total Rainfall (mm)	01-Jan-1944	31-Oct-2004
	Daily	011 - Total Snowfall (cm)	01-Jan-1944	31-Oct-2004
	Daily	012 - Total Precipitation (mm)	01-Jan-1944	31-Oct-2004
3062889	Gordon Lake LO			

Station	Name	Time Step	Data Type	From Date	To Date
		Daily	001 - Daily Maximum Temperature (deg. C)	01-May-1964	31-Jul-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	01-Jun-1964	31-Jul-2004
		Daily	003 - Daily Mean Temperature (deg. C)	01-Jun-1964	31-Jul-2004
		Daily	010 - Total Rainfall (mm)	01-May-1964	31-Jul-2004
		Daily	012 - Total Precipitation (mm)	06-May-2004	31-Jul-2004
3063120	Heart Lake LO				
		Daily	001 - Daily Maximum Temperature (deg. C)	01-May-1965	31-Aug-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	01-May-1965	31-Aug-2004
		Daily	003 - Daily Mean Temperature (deg. C)	01-May-1965	31-Aug-2004
		Daily	010 - Total Rainfall (mm)	01-Jul-1947	31-Aug-2004
		Daily	012 - Total Precipitation (mm)	19-Apr-2004	31-Aug-2004
3063563	Johnson Lake LO				
		Daily	001 - Daily Maximum Temperature (deg. C)	01-May-1965	31-Jul-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	01-May-1965	31-Jul-2004
		Daily	003 - Daily Mean Temperature (deg. C)	01-May-1965	31-Jul-2004
		Daily	010 - Total Rainfall (mm)	01-May-1965	31-Jul-2004
		Daily	012 - Total Precipitation (mm)	14-May-2004	31-Jul-2004
3064528	Mildred Lake				
		Daily	001 - Daily Maximum Temperature (deg. C)	01-Jan-1994	31-Oct-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	01-Jan-1994	31-Oct-2004
		Daily	003 - Daily Mean Temperature (deg. C)	01-Jan-1994	31-Oct-2004
		Daily	010 - Total Rainfall (mm)	01-Jan-1994	31-Oct-2004
		Daily	011 - Total Snowfall (cm)	01-Jan-1994	31-Oct-2004
		Daily	012 - Total Precipitation (mm)	01-Jan-1994	31-Oct-2004
3064531	Mildred Lake				
		Daily	001 - Daily Maximum Temperature (deg. C)	04-Jul-1973	31-Jul-1996
		Daily	002 - Daily Minimum Temperature (deg. C)	05-Jul-1973	31-Jul-1996
		Daily	003 - Daily Mean Temperature (deg. C)	05-Jul-1973	31-Jul-1996
		Daily	010 - Total Rainfall (mm)	01-Jul-1973	31-Jul-1996
		Daily	011 - Total Snowfall (cm)	01-Jul-1973	31-Jul-1996
		Daily	012 - Total Precipitation (mm)	01-Jul-1973	31-Jul-1996
3064740	Muskeg LO				
		Daily	001 - Daily Maximum Temperature (deg. C)	01-Aug-1965	31-Aug-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	01-Aug-1965	31-Aug-2004
		Daily	003 - Daily Mean Temperature (deg. C)	01-Aug-1965	31-Aug-2004
		Daily	010 - Total Rainfall (mm)	27-Apr-1965	31-Aug-2004
		Daily	012 - Total Precipitation (mm)	07-May-2004	31-Aug-2004
3065492	Richardson LO				
		Daily	001 - Daily Maximum Temperature (deg. C)	03-Jun-1964	31-Aug-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	01-Jun-1964	31-Aug-2004
		Daily	003 - Daily Mean Temperature (deg. C)	03-Jun-1964	31-Aug-2004
		Daily	010 - Total Rainfall (mm)	25-Apr-1960	31-Aug-2004
		Daily	012 - Total Precipitation (mm)	07-May-2004	31-Aug-2004
3065560	Round Hill LO				
		Daily	001 - Daily Maximum Temperature (deg. C)	06-Jul-1951	31-Aug-2004

Station	Name	Time Step	Data Type	From Date	To Date
		Daily	002 - Daily Minimum Temperature (deg. C)	06-Jul-1951	31-Aug-2004
		Daily	003 - Daily Mean Temperature (deg. C)	06-Jul-1951	31-Aug-2004
		Daily	010 - Total Rainfall (mm)	28-Apr-1952	31-Aug-2004
		Daily	012 - Total Precipitation (mm)	01-May-2004	31-Aug-2004
3066160	Stoney Mountian LO				
		Daily	001 - Daily Maximum Temperature (deg. C)	01-May-1964	22-Sep-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	01-May-1964	23-Sep-2004
		Daily	003 - Daily Mean Temperature (deg. C)	01-May-1964	22-Sep-2004
		Daily	010 - Total Rainfall (mm)	01-May-1954	22-Sep-2004
		Daily	012 - Total Precipitation (mm)	19-Apr-2004	22-Sep-2004
3066364	Tar Island				
		Daily	001 - Daily Maximum Temperature (deg. C)	01-Apr-1970	29-Jun-1984
		Daily	002 - Daily Minimum Temperature (deg. C)	01-Apr-1970	30-Jun-1984
		Daily	003 - Daily Mean Temperature (deg. C)	01-Apr-1970	29-Jun-1984
		Daily	010 - Total Rainfall (mm)	01-Jun-1970	30-Jun-1984
3066380	Thickwood LO				
		Daily	001 - Daily Maximum Temperature (deg. C)	02-Aug-1957	27-Aug-1992
		Daily	002 - Daily Minimum Temperature (deg. C)	02-Aug-1957	28-Aug-1992
		Daily	003 - Daily Mean Temperature (deg. C)	02-Aug-1957	27-Aug-1992
		Daily	010 - Total Rainfall (mm)	08-Apr-1957	27-Aug-1992
		Daily	011 - Total Snowfall (cm)	08-Apr-1957	27-Aug-1992
		Daily	012 - Total Precipitation (mm)	08-Apr-1957	27-Aug-1992
3067590	Winefred				
		Daily	001 - Daily Maximum Temperature (deg. C)	01-May-1965	31-Jul-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	01-May-1965	31-Jul-2004
		Daily	003 - Daily Mean Temperature (deg. C)	01-May-1965	31-Jul-2004
		Daily	010 - Total Rainfall (mm)	01-May-1957	31-Jul-2004
		Daily	012 - Total Precipitation (mm)	03-May-2004	31-Jul-2004
3073792	Legend LO				
		Daily	001 - Daily Maximum Temperature (deg. C)	06-May-1962	31-Aug-2004
		Daily	002 - Daily Minimum Temperature (deg. C)	06-May-1962	31-Aug-2004
		Daily	003 - Daily Mean Temperature (deg. C)	06-May-1962	31-Aug-2004
		Daily	010 - Total Rainfall (mm)	06-May-1962	31-Aug-2004
		Daily	012 - Total Precipitation (mm)	12-May-2004	31-Aug-2004
ALBATH	Albian Athabasca River Withdrawal				
		Daily	1 - Discharge (m3/s)	01-Jan-2004	30-Nov-2004
AUCWD	Aurora Clean Water Diversion				
		Daily	1 - Discharge (m3/s)	18-May-2003	31-Dec-2004
L1	McClelland Lake				
		Daily	010 - Total Rainfall (mm)	26-Apr-2004	03-Dec-2004
		Daily	1 - Discharge (m3/s)	01-Jan-2003	23-Nov-2004
		Daily	8 - Water Level (m)	22-Jun-1997	23-Nov-2004
L2	Kearl Lake				
		Daily	8 - Water Level (m)	19-Jan-1989	31-Dec-2004

Station	Name			
	Time Step	Data Type	From Date	To Date
L3	Isadore's Lake			
	Daily	8 - Water Level (m)	22-Feb-2000	31-Dec-2004
S01	Alsands Drain			
	Daily	1 - Discharge (m3/s)	10-Aug-1995	31-Dec-2002
	Daily	8 - Water Level (m)	16-Apr-1997	29-Dec-2002
S02	Jackpine Creek at Canterra Road			
	Daily	1 - Discharge (m3/s)	06-May-1995	31-Dec-2004
	Daily	8 - Water Level (m)	17-Apr-1997	31-Dec-2004
S03	Iyinimin Creek above Kearl Lake			
	Daily	010 - Total Rainfall (mm)	16-May-2004	31-Oct-2004
	Daily	1 - Discharge (m3/s)	18-Jan-1989	31-Oct-2004
	Daily	8 - Water Level (m)	20-Apr-1989	31-Oct-2004
S04	Blackfly Creek near the Mouth			
	Daily	8 - Water Level (m)	15-Feb-1989	27-Oct-1998
S05	Muskeg River above Stanley Creek			
	Daily	1 - Discharge (m3/s)	04-May-2003	31-Dec-2004
	Daily	8 - Water Level (m)	04-May-2003	31-Dec-2004
S05A	Muskeg River above Muskeg Creek			
	Daily	077 - Station pressure (kPa)	12-Dec-2002	31-Dec-2004
	Daily	1 - Discharge (m3/s)	11-Aug-1995	31-Dec-2004
	Daily	8 - Water Level (m)	17-Apr-1997	31-Dec-2004
	Daily	998 - Water Temperature (deg. C)	01-Jan-2004	31-Dec-2004
S06	Mills Creek at Highway 63			
	Daily	1 - Discharge (m3/s)	16-Apr-1997	29-Oct-2004
	Daily	8 - Water Level (m)	16-Apr-1997	29-Oct-2004
S07	Muskeg River near Fort MacKay (07DA008)			
	Daily	1 - Discharge (m3/s)	10-Dec-2002	31-Dec-2004
	Daily	8 - Water Level (m)	01-Jan-2000	31-Dec-2004
S08	Stanley Creek near the Mouth			
	Daily	1 - Discharge (m3/s)	03-May-2003	14-Oct-2003
	Daily	8 - Water Level (m)	14-Sep-1999	14-Oct-2003
S09	Kearl Lake Outlet			
	Daily	1 - Discharge (m3/s)	18-Jan-1989	29-Oct-2004
	Daily	8 - Water Level (m)	18-Jan-1989	29-Oct-2004
S10	Wapasu Creek at Canterra Road			
	Daily	1 - Discharge (m3/s)	08-May-1997	31-Dec-2004
	Daily	8 - Water Level (m)	08-May-1997	31-Dec-2004
S11	Poplar Creek at Highway 63 (07DA007)			
	Daily	1 - Discharge (m3/s)	05-May-1995	30-Oct-2004
	Daily	8 - Water Level (m)	05-May-1995	30-Oct-2004
S12	Fort Creek at Highway 63			
	Daily	8 - Water Level (m)	02-Apr-2000	23-Oct-2002
S13	Albian Pond 3 Outlet			

Station	Name	Time Step	Data Type	From Date	To Date
		Daily	8 - Water Level (m)	02-Mar-2000	07-Dec-2002
S14	Ells River above Joslyn Creek				
		Daily	1 - Discharge (m3/s)	13-May-2001	01-Nov-2004
		Daily	8 - Water Level (m)	13-May-2001	01-Nov-2004
S15	Tar River near the Mouth (07DA015)				
		Daily	1 - Discharge (m3/s)	09-May-2001	01-Nov-2004
		Daily	8 - Water Level (m)	09-May-2001	01-Nov-2004
S16	Calumet River near the Mouth				
		Daily	003 - Daily Mean Temperature (deg. C)	01-Jan-2004	31-Dec-2004
		Daily	010 - Total Rainfall (mm)	11-Apr-2004	31-Dec-2004
		Daily	011 - Total Snowfall (cm)	01-Jan-2004	31-Dec-2004
		Daily	1 - Discharge (m3/s)	12-May-2001	31-Oct-2004
		Daily	8 - Water Level (m)	12-May-2001	31-Oct-2004
		Daily	998 - Water Temperature (deg. C)	27-Jun-2004	31-Oct-2004
S17	Tar River Upland Tributary				
		Daily	1 - Discharge (m3/s)	12-May-2001	31-Oct-2004
		Daily	8 - Water Level (m)	12-May-2001	31-Oct-2004
S18A	Calumet River Upland Tributary				
		Daily	1 - Discharge (m3/s)	10-Jun-2002	31-Oct-2004
		Daily	8 - Water Level (m)	10-Jun-2002	31-Oct-2004
S19	Tar River Lowland Tributary near the Mouth				
		Daily	010 - Total Rainfall (mm)	27-Apr-2004	01-Nov-2004
		Daily	1 - Discharge (m3/s)	09-May-2001	01-Nov-2004
		Daily	8 - Water Level (m)	09-May-2001	01-Nov-2004
S20	Muskeg River Upland				
		Daily	1 - Discharge (m3/s)	09-May-2001	29-Oct-2004
		Daily	8 - Water Level (m)	09-May-2001	29-Oct-2004
S21	Shelley Creek near the Mouth				
		Daily	1 - Discharge (m3/s)	04-May-2003	14-Oct-2003
		Daily	8 - Water Level (m)	14-May-2001	14-Oct-2003
S22	Muskeg Creek near the Mouth				
		Daily	1 - Discharge (m3/s)	17-Jan-1989	29-Oct-2004
		Daily	8 - Water Level (m)	17-Jan-1989	29-Oct-2004
S23	Aurora Boundary Weir				
		Daily	8 - Water Level (m)	01-Jan-2001	31-Dec-2002
S24	Athabasca River below Eymundson Creek				
		Daily	1 - Discharge (m3/s)	21-Jun-2001	31-Dec-2004
		Daily	8 - Water Level (m)	21-Jun-2001	31-Dec-2004
S26	Mackay River near Fort McKay (07DB001)				
		Daily	1 - Discharge (m3/s)	31-Oct-2001	31-Dec-2004
		Daily	8 - Water Level (m)	31-Oct-2001	31-Dec-2004
S27	Firebag River near the Mouth (07DC001)				
		Daily	1 - Discharge (m3/s)	01-Jan-2002	31-Dec-2004

Station	Name			
	Time Step	Data Type	From Date	To Date
	Daily	8 - Water Level (m)	01-Jan-2002	31-Dec-2004
S28	Khahago Creek below Black Fly Creek			
	Daily	1 - Discharge (m3/s)	19-Jan-1989	31-Oct-2004
	Daily	8 - Water Level (m)	19-Jan-1989	31-Oct-2004
S29	Christina River near Chard (07CE002)			
	Daily	1 - Discharge (m3/s)	13-Jan-2002	31-Dec-2004
	Daily	8 - Water Level (m)	13-Jan-2002	31-Dec-2004
S31	Hangingstone Creek at North Star Road			
	Daily	1 - Discharge (m3/s)	10-Apr-2002	19-Oct-2004
	Daily	8 - Water Level (m)	10-Apr-2002	19-Oct-2004
S32	Surmont Creek at Highway 881			
	Daily	1 - Discharge (m3/s)	18-May-2002	30-Oct-2004
	Daily	8 - Water Level (m)	18-May-2002	30-Oct-2004
S33	Muskeg River at the Aurora / Albian Boundary			
	Daily	1 - Discharge (m3/s)	01-May-2003	31-Dec-2004
	Daily	8 - Water Level (m)	01-May-2003	31-Dec-2004
SUNATH	Suncor Athabasca River Withdrawal			
	Daily	1 - Discharge (m3/s)	01-Jan-2002	31-Dec-2004

D2.5 HYDROMETRIC INFORMATION

D2.5.1 Manual Water Level and Discharge Measurements

Details of the manual measurements made during each of the site visits are provided on the following pages (Note: a complete set of manual measurement sheets will be provided in the final draft)

The quality and expected precision of each manual discharge measurement was assessed considering the hydraulic conditions at the measurement section at the time of the measurement according to the following scale:

Excellent: Straight reach, prismatic section, no weeds, no boulders, no ice cover, no slush, no trash or brush affecting the flow, negligible wind, no equipment problems, no more than 10% of the discharge in any single panel.

Good: Possible minimal reduction of measurement precision due to slightly irregular hydraulic conditions caused by a curved reach at or upstream of the measurement section, non-prismatic channel, weeds, trash, brush, boulders, irregular bed, or upstream or downstream wind. No more than 15% of the discharge in any single panel.

Fair: Minor reduction of measurement precision due to irregular hydraulic conditions caused by one or more of the factors listed in the "Good" classification, or by ice cover. No more than 15% of the discharge in any single panel.

Poor: Significant reduction of measurement precision due to one or more of the factors listed above; or velocities near the lower detection limit of the current meter.

D2.5.2 Stage-Discharge Rating Curves

Water level and discharge measurements were used to derive or update stage-discharge rating curves. The derived rating curves are shown graphically for each station below (Note: a complete set of stage-discharge rating curves will be provided in the final draft).

Water level and discharge hydrographs presented in the main text of the report (Sections 3 and 5) are not repeated here.

The figures are organized by station, and the stations are presented in numerical order.

D2.5.3 2004 Hydrographs in Historical Context

Discharge hydrographs for stations that are not presented in the main text are presented in this section. Figures D-3 to D-30 show discharge hydrographs for 2004 for each RAMP station as compared to the historical maximum, mean and minimum discharges for that station.

Table D-5 Summary of hydrometric monitoring 2004.

Station	Catchment Area	Monitored Period	Maximum Daily Discharge		Minimum Daily Discharge[1]		Runoff Volume[1]		Data Quality Assesment[2]
			2004	Mean	2004	Mean	2004	Mean	
	(km^2)	2004	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(dam^3)	(dam^3)	
Athabasca River									
S24 - Athabasca River below Eymundson Creek	146,000	Jan 1 - Dec 31	2100	2090	362	334	15,400,000	12,800,000	Fair
Athabasca River at McMurray (07DA001)	133,000	Jan 2 - Dec 31	1960	2490	364	437	14,300,000	15,800,000	
Muskeg River Watershed									
S2 - Jackpine Creek at Canterra Road	358	Apr 23 - Dec 31	9.98	8.57	0.055	0.332	18,900	31,800	Good
S3 - Iyinimin Creek above Kearl Lake	32.2	May 16 - Oct 31[3]	1.06	1.22	0.002	0.065	1,990	5,370	Good
S5 - Muskeg River above Stanley Creek	395	Jan 1 - Dec 31	6.42	7.72	0.101	0.177	14,400	26,800	Good
S5A - Muskeg River above Muskeg Creek	552	Jan 1 - Dec 31	8.12	6.37	0.231	0.492	22,600	33,400	Good
S7 - Muskeg River near Fort MacKay (07DA008)	1460	Jan 1 - Dec 31	20.5	25.0	0.270	1.08	67,700	105,000	Good
S9 - Kearl Lake Outlet	73.6	Apr 23 - Oct 29	0.741	0.683	0.017	0.062	2,900	3,970	Fair
S10 - Wapasu Creek at Canterra Road	90.7	Jan 1 - Dec 31	3.39	2.59	0.017	0.074	5,960	7,540	Good
S20 - Muskeg River Upland	157	Apr 23 - Oct 29	3.63	2.39	0.036	0.086	5,130	6,670	Fair
S22 - Muskeg Creek near the Mouth	157	Apr 23 - Oct 29	5.94	6.32	0.000	0.239	15,700	25,200	Good
S28 - Khahago Creek below Blackfly Creek	212	Apr 26 - Oct 31	4.45	3.55	0.057	0.151	9,440	14,600	Fair
S33 - Muskeg River at the Aurora/Albian Boundary	728	Jan 1 - Dec 31	9.81	9.79	0.270	0.501	32,200	50,800	Good
L2 - Kearl Lake	72.6	Jan 1 - Dec 31	n/a[4]	n/a[4]	n/a[4]	n/a[4]	n/a[4]	n/a[4]	n/a[4]
Athabasca River Tributaries Upstream of Fort McMurray									
S29 - Christina River near Chard (07CE002)	4,860	Jan 1 - Dec 31	81.8	75.8	5.88	5.99	393,000	342,000	Good
S31 - Hangingstone Creek at North Star Road	160	Apr 25 - Oct 19	3.04	4.78	0.115	0.085	5,100	9,600	Good
S32 - Surmont Creek at Highway 881	158	Apr 25 - Oct 30	3.96	4.12	0.078	0.084	8,100	11,300	Good
Athabasca River Tributaries Downstream of Fort McMurray									
S6 - Mills Creek at Highway 63	23.8	Apr 24 - Oct 29	0.075	0.192	0.011	0.019	295	750	Fair
S11 - Poplar Creek at Highway 63 (07DA007)	422	Apr 24 - Oct 30	9.46	8.16	0.084	0.122	17,800	23,600	Good
S14 - Ells River above Joslyn Creek	2,450	May 16 - Nov 1[3]	45.7	49.0	1.96	2.96	97,700	178,000	Good
S15 - Tar River near the Mouth	301	May 15 - Nov 1[3]	6.68	4.80	0.149	0.307	8,560	12,200	Good
S16 - Calumet River near the Mouth	182	Jun 3 - Oct 31[3]	0.396	1.11	0.002	0.023	311	2,960	Fair
S17 - Tar River Upland Tributary	13.8	May 16 - Oct 31[3]	1.42	0.837	0.057	0.019	9,860	6,000	Poor
S18A - Calumet River Upland Tributary	53.4	Apr 27 - Oct 31	3.49	1.35	0.000	0.003	1,800	1,100	Fair
S19 - Tar River Lowland Tributary near the Mouth	11.5	Apr 27 - Nov 1	0.093	0.061	0.000	0.002	384	273	Fair
S26 - MacKay River near Fort MacKay (07DB001)	5570	Jan 1 - Dec 31	44.9	114	0.930	3.58	141,000	371,000	Good
S27 - Firebag River near the Mouth (07DC001)	5990	Jan 1 - Dec 31	150	104	14.3	15.2	583,000	583,000	Good
L1 - McClelland Lake	28	Jan 1 - Nov 23	0.043	0.202	0.000	0.001	112	565	Fair
L3 - Isadore's Lake	191	Jan 1 - Dec 31	n/a[4]	n/a[4]	n/a[4]	n/a[4]	n/a[4]	n/a[4]	n/a[4]

[1]Runoff volume and minimum daily discharge are for the period May 1 - Oct 31.

[2]Quality assesment refers to RAMP discharge data only.

[3]The runoff volume and minimum daily discharge is based on a shorter period than at the other stations.

[4] Only water levels were monitored, therefore no discharges available.

D3.0 REGULATORY APPROVALS

It is intended to replace the measurement weir at the existing RAMP station, S6 – Mills Creek at Highway 63. Fisheries and Oceans Canada has received and reviewed the proposal regarding the weir replacement and their letter is provided below.

D3.1 STANDARD PROCEDURES

Standard procedures adopted for obtaining consistent, accurate and reliable streamflow and climate data are presented below.

D3.1.1 Streamflow Measurement

D3.1.1.1 Site Selection

Assess river conditions to ensure that:

- The measurement can be completed safely,
- The measurement is completed at a location with appropriate hydraulics where the highest accuracy and precision can be maintained in the measurement, and
- The measurement will be consistent with previously collected data.

Safety

Wading measurements can generally be safely made if the depth (metres) multiplied by velocity (m/s) does not exceed a value of 1.0. At the discretion of the technician, more severe conditions may be waded, provided appropriate safety precautions such as a personal flotation device (PFD) or a safety line are used. For measurements from a bridge, boat, float tube or belly-boat the technician should use a PFD, guide line or safety line, or other safety equipment necessary to allow secure and comfortable operation of measurement equipment.

Hydraulics

Whenever possible, make the measurement at a consistent, specified measurement location. If no location is specified, or high discharges prevent metering at the specified location, choose a section where there are no sharp irregularities in the bed, the bed is firm and well established, flow is well distributed across the width, turbulence and wave action are minimal and the bed slope and water surface slopes are similar. In addition, the following factors should be considered:

- Weed growth at the metering section or on the control;
- Debris floating or lodged in the proximity of the section;
- Beaver activity;
- Deposition of gravel or development of sand bars or obstructions;

- Erosion of the channel banks;
- Overflow channels that are bypassing the metering section;
- High winds;
- River plan form alignment, bend radius, superelevation, or cross waves; and
- Ice conditions.

River sections where these factors may considerably impact the measurement should be avoided.

D3.1.1.2 Number of Verticals

Make determinations of depth and velocity at a minimum of 20 verticals distributed perpendicular to the direction of the flow such that no single panel captures more than 10% of the total river discharge. Typically, verticals will need to be more closely spaced near the thalweg. Where the stream width is less than 2 m fewer than 20 verticals are acceptable, as measurements at intervals of less than 0.1 m are impractical.

D3.1.1.3 Depth Measurements

Measure flow depth using a graduated wading rod or sounding reel and record the depth to the nearest centimeter (cm). Where the flow is turbulent, record the mean water level. Account for any runup on the measurement rod due to high flow velocity.

When sounding a soft channel bed, do not allow the bottom of the wading rod to sink into the bed material. When sounding over coarse cobble beds, adjust observed depths to reflect the tops of the boulders and the depths between them.

Sound ice thickness using a slush spoon or other rigid horizontal appendage firmly fixed on the ice wading rod.

D3.1.1.4 Velocity Measurements

When wading, stand to the side and downstream from the meter so as not to influence the flow velocity measured by the meter.

Velocity Averaging

When using an electromagnetic velocity sensor, perform linear averaging for at least 20 seconds. When using the "RC" mode, allow the sensor to stabilize for at least 5 time constants. When using mechanical "Price" meters, average over a minimum of 45 seconds.

Depth of Mean or Index Velocity at Verticals

Velocity determinations are intended to provide the depth-averaged flow velocity. Measure velocity at the point 60% of the total depth below the surface, for depths of 1.1 m or less. For greater depths, measure the velocity at 20 and 80% of the total depth. Where

an unusual vertical distribution of velocity is suspected, profile the velocity near the thalweg at 20, 40, 60, and 80% of the depth and compute the location of a mean velocity.

When measuring through ice, measure velocity at 60% of the depth for effective depths of less than 1 m and apply a correction factor of 0.90, or preferably measure a vertical velocity profile to determine an appropriate correction factor. Measure velocity at 20 and 80% of the effective depth for effective depths greater than 1 m, without a correction.

D3.1.1.5 Water Level Measurement

Ensure the level and tripod is secure. Ensure the level is in adjustment. The rodman should ensure the base of the rod is free of ice, mud or other debris. The rodman should slowly rotate the rod through vertical, along a plane to the instrument. Survey at least two local elevation reference bench marks. Survey the water level and river thalweg elevation. When surveying the water level, place the rod on the shore at the water's edge. Alternatively, place the rod on a firm point slightly below the water level, and subtract the depth of water on the rod from the instrument reading. If the rod can be placed at the elevation of an installed depth sensor, survey its elevation as well. Make and record two separate determinations of each sighting.

D3.1.1.6 Notes and Records

Record field notes on the RAMP Manual Discharge Measurement Form or in a waterproof field book. Describe river conditions, weather and other details. Note any modifications to permanent site equipment or measurement equipment. Transcribe all details to digital files as soon as possible.

D3.1.2 Snowcourse Surveys

Snowcourse surveys are conducted to measure the depth, density and water equivalent of the snowpack.

Sampling plots are distributed about the area of study with the aim of capturing representative slope, elevation, and aspect within each of 5 following vegetation/terrain types:

MD	mixed deciduous forest
FL	flat, low lying muskeg or other vegetated areas
OP	open land with low vegetation
OP Lake	frozen, unvegetated open lake areas
JP	coniferous jack pine forest

Select a plot size, shape and orientation on a site by site basis, typically incorporating a 10 m spaced regular grid pattern, with 50 m x 60 m dimensions. Expand the plot size to include up to 50 sampling points if snow conditions are unusually variable.

Make depth measurements at minimum of 30 locations within the plot, by inserting an Adirondack snow sampler into the snowpack and reading the depth from the outer graduations. Record snow depths to the nearest centimeter.

Near tree wells, or in uneven terrain, select representative sampling locations reflecting the distribution of high or low catch micro environments, observed from a preliminary site assessment.

Make density measurements by slowly twisting and pressing an Adirondack snow sampler through the snow column and into the ground, lodging a plug of substrate beneath the snow. Remove the debris plug and weigh the collected snow. Where lake or pond ice forms the substrate, ensure that snow confined within the sampler does not escape before weighing. A trowel can be slid beneath the tube and used to ensure that no snow is lost.

Compute the sample water equivalent based on the weight of the sample. Then use the measured snow depth to compute the snow density. Take a minimum of four density samples from representative locations within each plot.

Note the vegetation cover type, snow color, snow texture and consistency, wind, and meteorological conditions. Photograph each plot and mark it with flagging, and note its geographic coordinates.

Fisheries and Oceans Canada | Pêches et Océans Canada

Prairies Area, Edmonton District Office
4253 - 97th Street
Edmonton, Alberta
T6E 5Y7

September 20, 2004

Regional Aquatics Monitoring Program
C/O Wes Dick
Senior Water Resources Engineer
Mack Slack & Associates Inc.
Suite 2004, Victoria Square
1212 First Street S.E.
Calgary, Alberta, T2G 5H8

Your file *Votre réference*
200217.S6.04

Our file *Notre réference*
04-2315

Dear: Mr. Dick,

Re: Mills Creek Weir Replacement (NW-17-95-10-W4M, Alberta).

Fisheries & Oceans Canada (DFO) has received and reviewed the information regarding Mack Slack's proposal to replace a hydrometric Weir on Mills Creek, located in NE-32-70-67-W4M. Upon review of the above referenced project, DFO understands the project as follows:

- The existing hygrometric weir has been deteriorating due to ice action in the creek. A new weir with similar hydraulic characteristics will be installed.
- As assessed by Golder Associates Ltd. (1997) and Hatfield Consultants Ltd. (2004), the potential of the aquatic habitats in the creek to support fish is low. However, Isidore's Lake, the receiving waterbody is known to support northern pike populations (Golder associates Ltd. 1997).
- Appropriate sedimentation control measures will be implemented throughout the construction phase of the project (letter from Dave Kubik, Mack Slack & Associates Consulting Engineers, dated August 5, 2004).

DFO concludes that the proposed plan will not likely result in the harmful alteration, disruption or destruction of fish habitat, providing the following mitigation measures are undertaken:

1. Disturbance to the banks of Mills Creek should be minimized and confined to the immediate work site.
2. Disturbance to riparian vegetation should be minimized and any areas disturbed should be stabilized and re-vegetated upon completion of the work.
3. Any spoil materials removed should be separated from any waterbody by a well-vegetated area and stabilized in such a way that they do not re-enter any waterbody.

4. Suitable erosion and silt suppression measures should be implemented on disturbed areas during construction and until vegetation is established in order to prevent sedimentation entering any waterbody. If necessary additional short term and long term runoff control measures should be installed.

5. Equipment should be operated in dry weather conditions.

6. Appropriate precautions should be taken to ensure that deleterious substances do not enter any watercourse. All materials and equipment should be operated, maintained and stored in a manner that prevents any deleterious substances from entering fish habitat.

7. All construction-related debris should be removed from the construction site upon completion of the works.

Providing that the works are carried out as described and the aforementioned mitigation measures are implemented, the proposed work will not likely result in a harmful alteration, disruption or destruction of fish habitat. As such, Authorization under Subsection 35(2) of the *Fisheries Act* will not be necessary. DFO should be notified of all changes in plans, specifications, or operating conditions that have the potential to adversely affect fish or fish habitat. Any harmful alteration, disruption or destruction of fish habitat occurring as a result of a change in plans for the proposed works, or as a result of failing to implement the prescribed mitigation measures, may result in a contravention of the *Fisheries Act*. Upon finalizing the construction plans, please provide one copy of the final plans and notify the undersigned for the dates when the construction activities will take place, so a side inspection could be undertaken.

Please note that DFO has reviewed this project pursuant to the habitat protection provisions of the *Fisheries Act* and that none of the foregoing should be taken as approval of the undertaking in accordance with any federal, provincial or municipal legislation.

Thank you for providing DFO an opportunity to review this project. If you require additional information or clarification please contact the undersigned at (780) 495-8469.

Sincerely,

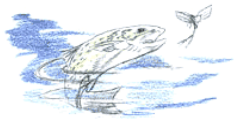
Ivan Stefanov
Fish Habitat Biologist

cc. B. Makowecki (Impact Assessment Biologist, DFO Edmonton)
J. Englert (District Manager, DFO Edmonton)

D4.0 MANUAL MEASUREMENT SHEETS

Hydrometric Measurement / Site Visit Record

L1 - McClelland Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	McClelland Lake
Location:	McClelland Lake
Site Name:	L1
Coordinates & Legal:	483430 E, 6371950 N NW-12-98-9-W4

Time of Measurement

Date of Measurement:	February 2, 2004
Start Time:	11:40 AM MDT
End Time:	

Weather Conditions:	-22 °C, Clear, calm
River Conditions:	Complete Ice Cover

Personnel & Equipment

Measurement Made By:	DM/FF
Data Entry By:	FF
Meter Type and No.:	N/A

Level Readings and Measurements

Bench Mark Reading:	PVC in forest	1.908	El:	295.84
Water Level Reading:		3.215	El:	294.533
Top of Ice Level Reading:		3.21	El:	294.538
Transducer Reading:		1.071	El:	293.462
Other:	Pin N of DL	2.880	El:	294.868
	Post near PVC in Forest	0.933		296.815

Datalogger Notes:		
Datalogger Internal Power:	4.6V	
Datalogger External Power:	15.2V	
Datalogger Memory Used:	57%	
Datalogger Clock:	Feb 02, 2004 12:21	MDT
Laptop Clock:	Feb 02, 2004 23:41	MDT
Dessicant:	60% Good	
Datalogger:	Optimum DD128, # 0105010607	
PT:	Keller 730-130-5 psi #0201631	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Notes:

Survey complicated by bush and position of helicopter. Rodman reported that ice and WL were very similar.

Hydrometric Measurement / Site Visit Record

L1 - McClelland Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	McClelland Lake
Location:	McClelland Lake
Site Name:	L1
Coordinates & Legal:	483430 E, 6371950 N NW-12-98-9-W4

Time of Measurement

Date of Measurement:	March 2, 2004
Start Time:	1:25 PM MDT
End Time:	

Weather Conditions: -19 °C, Clear, Windy

River Conditions: Complete Ice Cover

Personnel & Equipment

Measurement Made By:	DK/DB
Data Entry By:	DK
Meter Type and No.:	N/A

Level Readings and Measurements

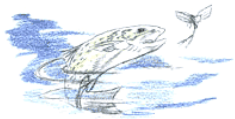
Bench Mark Reading:	PVC in forest		El:	295.84
Water Level Reading:			El:	294.554
Top of Ice Level Reading:			El:	294.552
Transducer Reading:		1.080268	El:	293.473
Other:	tall pin		El:	296.804

Datalogger Notes:		
Datalogger Internal Power:	4.588V	
Datalogger External Power:	15.34V	
Datalogger Memory Used:	59%	
Datalogger Clock:	Mar 02, 2004 13:25	MDT
Laptop Clock:	Mar 02, 2004 12:44	MDT
Dessicant:	60% Good	
Datalogger:	Optimum DD128, # 0105010607	
PT:	Keller 730-130-5 psi #0201631	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Notes:

Hydrometric Measurement / Site Visit Record

L1 - McClelland Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	McClelland Lake
Location:	McClelland Lake
Site Name:	L1
Coordinates & Legal:	483430 E, 6371950 N NW-12-98-9-W4

Time of Measurement

Date of Measurement:	April 5, 2004
Start Time:	8:20 AM MDT
End Time:	

Weather Conditions: +5 °C, Clear, Windy

River Conditions: Complete ice cover at site, open spots on West side of lake.

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	N/A

Level Readings and Measurements

Bench Mark Reading:	PVC in forest	1.931	El:	295.84
Water Level Reading:		3.2025	El:	294.569
Top of Ice Level Reading:		3.19	El:	294.614
Transducer Reading:		1.09742	El:	293.471
Other:	Pin N of DL	2.905	El:	294.866
	Post near PVC in Forest	0.955		296.816

Datalogger Notes:		
Datalogger Internal Power:	4.625V	
Datalogger External Power:	14.90V	
Datalogger Memory Used:	62%	
Datalogger Clock:	Apr 05, 2004 08:22	MDT
Laptop Clock:	Apr 05, 2004 09:23	MST
Dessicant:	100%, Added 50%	
Datalogger:	Optimum DD128, # 0105010607	
PT:	Keller 730-130-5 psi #0201631	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Notes: Possible Transducer movement on / around Mar 27.
Open spots west lake

Hydrometric Measurement / Site Visit Record

L1 - McClelland Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	McClelland Lake
Location:	McClelland Lake
Site Name:	L1
Coordinates & Legal:	483430 E, 6371950 N NW-12-98-9-W4

Time of Measurement

Date of Measurement:	April 26, 2004
Start Time:	12:53 PM MDT
End Time:	1:10 PM MDT

Weather Conditions: +8 C, Calm, partly cloudy

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: PVC in fo	1.765	El:	295.840	1.838	El:	295.840
Water Level Reading:	3.042	El:	294.563	3.118	El:	294.560
Bench Mark Rod Near PVC	0.792	El:	296.813	0.863	El:	296.815
Transducer Reading & Calc'd E	1.119	El:	293.444	1.119	El:	293.441
Other: Rod near DL	2.742	El:	294.863	2.811	El:	294.867

River Conditions: Complete ice cover on lake, open water at outlet. Outlet flow poorly concentrated and flowing through adjacent lowlands.

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	1.50	0.00	0.00			0.000	1.00	1	1.50	1.75	0.001	0.001	0.02	0.01	0.000
	2.00	0.09	0.00			0.003	1.00	2	1.75	2.50	0.003	0.003	0.09	0.07	0.000
	3.00	0.10	0.00			0.024	1.00	3	2.50	4.00	0.024	0.024	0.10	0.15	0.004
	5.00	0.17	0.00			0.040	1.00	4	4.00	6.00	0.040	0.040	0.17	0.34	0.013
	7.00	0.13	0.00			0.024	1.00	5	6.00	8.00	0.024	0.024	0.13	0.26	0.006
	9.00	0.16	0.00			0.046	1.00	6	8.00	9.50	0.046	0.046	0.16	0.24	0.011
	10.00	0.20	0.00			0.027	1.00	7	9.50	10.25	0.027	0.027	0.20	0.15	0.004
	10.50	0.20	0.00			0.027	1.00	8	10.25	10.75	0.027	0.027	0.20	0.10	0.003
	11.00	0.24	0.00			0.024	1.00	9	10.75	11.13	0.024	0.024	0.24	0.09	0.002
	11.25	0.34	0.00			0.021	1.00	10	11.13	11.38	0.021	0.021	0.34	0.09	0.002
	11.50	0.59	0.00			0.122	1.00	11	11.38	11.55	0.122	0.122	0.59	0.10	0.013
	11.60	0.55	0.00			0.122	1.00	12	11.55	11.68	0.122	0.122	0.55	0.07	0.008
	11.75	0.45	0.00			0.070	1.00	13	11.68	11.88	0.070	0.070	0.45	0.09	0.006
	12.00	0.40	0.00			0.052	1.00	14	11.88	12.25	0.052	0.052	0.40	0.15	0.008
	12.50	0.30	0.00			0.015	1.00	15	12.25	12.75	0.015	0.015	0.30	0.15	0.002
	13.00	0.33	0.00			0.024	1.00	16	12.75	13.50	0.024	0.024	0.33	0.25	0.006
	14.00	0.20	0.00			0.018	1.00	17	13.50	14.50	0.018	0.018	0.20	0.20	0.004
	15.00	0.14	0.00			0.015	1.00	18	14.50	16.00	0.015	0.015	0.14	0.21	0.003
	17.00	0.13	0.00			0.024	1.00	19	16.00	17.50	0.024	0.024	0.13	0.20	0.005
	18.00	0.10	0.00			0.009	1.00	20	17.50	18.65	0.009	0.009	0.10	0.12	0.001
LB	19.30	0.00	0.00			0.000	1.00	21	18.65	19.30	0.002	0.002	0.03	0.02	0.000
														Total Flow:	0.102

Total Flow:	**0.102**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**3.03**		**(m^2)**
Top Width:	**17.80**		**(m)**
Hydraulic Depth:	**0.170**		**(m)**
Mean Velocity:	**0.033**		**(m/s)**
Froude Number	**0.026**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database 607**	
Datalogger Internal Power:	4.65V	
Datalogger External Power:	14.62V	
Datalogger Memory Used:	64%	
Datalogger Clock:	Apr 26, 2004 11:07	MST
Laptop Clock:	Apr 26, 2004 12:08	MDT
Dessicant:	Good	

Datalogger: Optimum DD128, # 0105010607
PT: Keller 730-130-5 psi #0201631
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:

TR525M-R2 tipping bucket rain gauge installed with 9.6" top. Ignore tips up to 1913.
TSS sample collected.

Hydrometric Measurement / Site Visit Record

L1 - McClelland Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	McClelland Lake
Location:	McClelland Lake
Site Name:	L1
Coordinates & Legal:	483430 E, 6371950 N NW-12-98-9-W4

Time of Measurement

Date of Measurement:	June 2, 2004
Start Time:	2:43 PM MDT
End Time:	2:58 PM MDT

Weather Conditions: +8 C, light SW wind, cloudy

River Conditions: open, onshore wind, river in flood stage, channel not well defined

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: PVC in fo	1.838	El:	295.840	1.787	El:	295.840
Water Level Reading:	3.060	El:	294.618	3.025	El:	294.602
Bench Mark Rod Near PVC	0.861	El:	296.817	0.812	El:	296.815
Transducer Reading & Calc'd E	1.146	El:	293.472	1.146	El:	293.456
Other: Rod near DL		El:	297.678		El:	297.627

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	23.20	0.00	0.00			0.000	1.00	1	23.20	24.10	0.005	0.005	0.06	0.05	0.000
	25.00	0.23	0.00			0.018	1.00	2	24.10	25.45	0.018	0.018	0.23	0.31	0.006
	25.90	0.37	0.00			0.003	1.00	3	25.45	26.05	0.003	0.003	0.37	0.22	0.001
	26.20	0.38	0.00			0.000	1.00	4	26.05	26.30	0.000	0.000	0.38	0.10	0.000
	26.40	0.40	0.00			0.012	1.00	5	26.30	26.50	0.012	0.012	0.40	0.08	0.001
	26.60	0.45	0.00			0.009	1.00	6	26.50	26.70	0.009	0.009	0.45	0.09	0.001
	26.80	0.51	0.00			0.021	1.00	7	26.70	26.90	0.021	0.021	0.51	0.10	0.002
	27.00	0.60	0.00			0.101	1.00	8	26.90	27.10	0.101	0.101	0.60	0.12	0.012
	27.20	0.64	0.00			0.024	1.00	9	27.10	27.30	0.024	0.024	0.64	0.13	0.003
	27.40	0.58	0.00			-0.003	1.00	10	27.30	27.50	-0.003	-0.003	0.58	0.12	0.000
	27.60	0.53	0.00			0.000	1.00	11	27.50	27.70	0.000	0.000	0.53	0.11	0.000
	27.80	0.45	0.00			0.000	1.00	12	27.70	27.95	0.000	0.000	0.45	0.11	0.000
	28.10	0.42	0.00			0.000	1.00	13	27.95	28.35	0.000	0.000	0.42	0.17	0.000
	28.60	0.26	0.00			0.009	1.00	14	28.35	28.85	0.009	0.009	0.26	0.13	0.001
	29.10	0.31	0.00			0.006	1.00	15	28.85	29.60	0.006	0.006	0.31	0.23	0.001
	30.10	0.22	0.00			0.006	1.00	16	29.60	30.75	0.006	0.006	0.22	0.25	0.002
	31.40	0.17	0.00			0.006	1.00	17	30.75	32.50	0.006	0.006	0.17	0.30	0.002
LB	33.60	0.00	0.00			0.000	1.00	18	32.50	33.60	0.002	0.002	0.04	0.05	0.000
														Total Flow:	0.031

Total Flow:	**0.031**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**2.66**		**(m^2)**
Top Width:	**10.40**		**(m)**
Hydraulic Depth:	**0.256**		**(m)**
Mean Velocity:	**0.012**		**(m/s)**
Froude Number	**0.007**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TR525M-R2 tipping bucket rain gauge tips are at 2460.

Datalogger Notes:	**Database**	**607**
Datalogger Internal Power:	4.698V	
Datalogger External Power:	14.30V	
Datalogger Memory Used:	68%	
Datalogger Clock:	Jun 02, 2004 13:44	MST
Laptop Clock:	Jun 02, 2004 14:16	MDT
Dessicant:	Good	
Datalogger:	Optimum DD128, # 0105010607	
PT:	Keller 730-130-5 psi #0201631	

Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

L1 - McClelland Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	McClelland Lake
Location:	McClelland Lake
Site Name:	L1
Coordinates & Legal:	483430 E, 6371950 N NW-12-98-9-W4

Time of Measurement

Date of Measurement:	July 24, 2004	
Start Time:	1:00 PM	MDT
End Time:		MDT

Weather Conditions: +35 C, light wind, clear

River Conditions: open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: PVC in fo	1.683	El:	295.840	1.567	El:	295.840
Water Level Reading:	3.150	El:	294.373	2.985	El:	294.422
Bench Mark Rod Near PVC	0.707	El:	296.816	0.592	El:	296.815
Transducer Reading & Calc'd E	0.992	El:	293.381	0.992	El:	293.430
Other:		El:			El:	297.407

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)

Total Flow:			(m^3/s)
Perceived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TR525M-R2 tipping bucket rain gauge tips are at 2693.

Datalogger Notes:	**Database**	**607**
Datalogger Internal Power:	4.731V	
Datalogger External Power:	13.89V	
Datalogger Memory Used:	74%	
Datalogger Clock:	Jul 24, 2004 12:00	MST
Laptop Clock:	Jul 24, 2004 13:01	MDT
Dessicant:	Good	

Datalogger: Optimum DD128, # 0105010607
PT: Keller 730-130-5 psi #0201631
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

L1 - McClelland Lake

Regional Aquatics Monitoring Pro

Measurement Location

River/Stream:	McClelland Lake
Location:	McClelland Lake
Site Name:	L1
Coordinates & Legal:	483430 E, 6371950 N NW-12-98-9-W4

Time of Measurement

Date of Measurement:	August 26, 2004
Start Time:	5:38 PM MDT
End Time:	5:46 PM MDT

Weather Conditions: overcast, +15°C, light wind

River Conditions: open, outflow channel is very weedy

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings	**Setup No. 1**			**Setup No.**	
Bench Mark Reading: PVC in fo	1.817	El:	295.840	1.727	El:
Water Level Reading:	3.323	El:	294.334	3.231	El:
Bench Mark Rod Near PVC	0.842	El:	296.815	0.755	El:
Transducer Reading & Calc'd El	0.896	El:	293.438	0.896	El:
Other:		El:			El:

Measurement Data

	Measured Data						Calculated Data							
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)
RB	21.00	0.00	0.00			0.000	1.00	1	21.00	20.85	0.000	0.000	0.02	0.00
	20.70	0.07	0.00			0.000	1.00	2	20.85	20.65	0.000	0.000	0.07	0.01
	20.60	0.05	0.00			0.009	1.00	3	20.65	20.45	0.009	0.009	0.05	0.01
	20.30	0.08	0.00			0.006	1.00	4	20.45	20.20	0.006	0.006	0.08	0.02
	20.10	0.07	0.00			0.006	1.00	5	20.20	20.00	0.006	0.006	0.07	0.01
	19.90	0.10	0.00			0.021	1.00	6	20.00	19.85	0.021	0.021	0.10	0.01
	19.80	0.19	0.00			0.006	1.00	7	19.85	19.75	0.006	0.006	0.19	0.02
	19.70	0.10	0.00			0.006	1.00	8	19.75	19.65	0.006	0.006	0.10	0.01
	19.60	0.19	0.00			0.012	1.00	9	19.65	19.55	0.012	0.012	0.19	0.02
	19.50	0.25	0.00			0.015	1.00	10	19.55	19.45	0.015	0.015	0.25	0.03
	19.40	0.28	0.00			0.006	1.00	11	19.45	19.35	0.006	0.006	0.28	0.03
	19.30	0.30	0.00			0.012	1.00	12	19.35	19.20	0.012	0.012	0.30	0.04
	19.10	0.20	0.00			0.006	1.00	13	19.20	19.00	0.006	0.006	0.20	0.04
	18.90	0.15	0.00			-0.006	1.00	14	19.00	18.50	-0.006	-0.006	0.15	0.08
LB	18.10	0.00	0.00			0.000	1.00	15	18.50	18.10	-0.002	-0.002	0.04	0.01
														Total Flow:

Total Flow:	**0.002**		(m^3/s)
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.35**		(m^2)
Top Width:	**2.90**		(m)
Hydraulic Depth:	**0.121**		(m)
Mean Velocity:	**0.005**		(m/s)
Froude Number	**0.005**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**607**
Datalogger Internal Power:	4.698V	
Datalogger External Power:	13.97V	
Datalogger Memory Used:	78%	
Datalogger Clock:	6/08/2004 15:51:21 PI	
Laptop Clock:	Aug 26, 2004 16:54	
Dessicant:	Good -80%	
Datalogger:	Optimum DD128, # 0204100607	
PT:	Keller 730-130-5 psi	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Control	

Notes: TR525M-R2 tipping bucket rain gauge tips are at 2961.
An animal has tipped over the TBRG and ate the isotopes water sampling bucket
TBRG was re installed (no tips on installation), rain began just after installation,
tips were noted and recorded on logger

Hydrometric Measurement / Site Visit Record

L1 - McClelland Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	McClelland Lake
Location:	McClelland Lake
Site Name:	L1
Coordinates & Legal:	483430 E, 6371950 N NW-12-98-9-W4

Time of Measurement

Date of Measurement:	September 23, 2004
Start Time:	12:50 PM MDT
End Time:	1:10 PM MDT

Weather Conditions: raining, +8°C, light wind

River Conditions: open, outflow channel is very weedy

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: PVC in fo	1.701	El:	295.840	1.606	El:	295.840
Water Level Reading:	3.169	El:	294.372	3.070	El:	294.376
Bench Mark Rod Near PVC	0.725	El:	296.816	0.630	El:	296.816
Transducer Reading & Calc'd E	0.935	El:	293.437	0.935	El:	293.441
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	26.20	0.00	0.00			0.000	1.00	1	26.20	26.30	0.002	0.002	0.06	0.01	0.000
	26.40	0.23	0.00			0.006	1.00	1	26.40	26.50	0.006	0.006	0.23	0.02	0.000
	26.60	0.14	0.00			0.006	1.00	1	26.60	26.70	0.006	0.006	0.14	0.01	0.000
	26.80	0.19	0.00			0.006	1.00	1	26.80	26.90	0.006	0.006	0.19	0.02	0.000
	27.00	0.25	0.00			0.003	1.00	1	27.00	27.10	0.003	0.003	0.25	0.03	0.000
	27.20	0.17	0.00			0.009	1.00	1	27.20	27.30	0.009	0.009	0.17	0.02	0.000
	27.40	0.15	0.00			0.006	1.00	1	27.40	27.50	0.006	0.006	0.15	0.02	0.000
	27.60	0.10	0.00			0.006	1.00	1	27.60	27.70	0.006	0.006	0.10	0.01	0.000
	27.80	0.06	0.00			0.009	1.00	1	27.80	27.90	0.009	0.009	0.06	0.01	0.000
	28.00	0.07	0.00			0.003	1.00	1	28.00	28.10	0.003	0.003	0.07	0.01	0.000
	28.20	0.05	0.00			0.003	1.00	1	28.20	28.30	0.003	0.003	0.05	0.00	0.000
	28.40	0.05	0.00			0.006	1.00	1	28.40	28.55	0.006	0.006	0.05	0.01	0.000
LB	28.70	0.00	0.00			0.000	1.00	1	28.70	28.70	0.002	0.002	0.01	0.00	0.000
														Total Flow:	0.001

Total Flow:	**0.001**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.15**		**(m^2)**
Top Width:	**2.50**		**(m)**
Hydraulic Depth:	**0.062**		**(m)**
Mean Velocity:	**0.006**		**(m/s)**
Froude Number	**0.007**		

Photographs taken looking at:
no photos - camera broken

Notes: TR525M-R2 tipping bucket rain gauge tips are at 3259.

Datalogger Notes:	**Database 607**	
Datalogger Internal Power:	4.649V	
Datalogger External Power:	12.91V	
Datalogger Memory Used:	3%	
Datalogger Clock:	Sep 23, 2004 11:46	MST
Laptop Clock:	Sep 23, 2004 11:50	MST
Dessicant:	Good - 80%	

Datalogger: Optimum DD128, # 0204100607
PT: Keller 730-130-5 psi
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

L1 - McClelland Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	McClelland Lake
Location:	McClelland Lake
Site Name:	L1
Coordinates & Legal:	483430 E, 6371950 N NW-12-98-9-W4

Time of Measurement

Date of Measurement:	October 31, 2004
Start Time:	10:33 AM MST
End Time:	11:35 AM MST

Weather Conditions: 0 °C, Clear, Calm

River Conditions: Complete ice cover

Notes: After fixing the transducer chewed cable, the transducer reading was 0.909 m

Notes: Rain gauge 3259 tips
Transducer cable appears to be chewed

Personnel & Equipment

Measurement Made By:	ND/FF
Data Entry By:	FF
Meter Type and No.:	N/A

Level Readings and Measurements

Bench Mark Reading:	Rod in PVC	1.024	El:	295.84
Water Level Reading:		2.5085	El:	294.356
Top of Ice Level Reading:		2.496	El:	294.374
Transducer Reading:		0.036	El:	294.320
Other:	Rod on upper bank	0.05	El:	296.814

Datalogger Notes:	**Database**	**607**	
Datalogger Internal Power:	4.6V		
Datalogger External Power:	14.70V		
Datalogger Memory Used:	7% used		
Datalogger Clock:	Oct 31, 2004 10:31		MST
Laptop Clock:	Oct 31, 2004 09:36		MST
Dessicant:	60% used		
Datalogger:			
PT:	730130-5		
Power:			

Hydrometric Measurement / Site Visit Record

L1 - McClelland Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	McClelland Lake	
Location:	McClelland Lake	
Site Name:	L1	
Coordinates & Legal:	483430 E, 6371950 N	NW-12-98-9-W4

Time of Measurement

Date of Measurement:	December 4, 2004	
Start Time:	2:45 PM	MST
End Time:		MST

Weather Conditions: -28 °C, Clear, Calm

River Conditions: Frozen

Notes:

Personnel & Equipment

Measurement Made By:	ND/DB
Data Entry By:	ND
Meter Type and No.:	N/A

Level Readings and Measurements

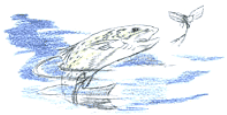
Bench Mark Reading:	Rod in PVC	1.8695	El:	295.84
Water Level Reading:		3.325	El:	294.385
Top of Ice Level Reading:		3.282	El:	294.423
Transducer Reading:		0.229064	El:	294.155
Other:	Rod on upper bank	0.9045	El:	296.805

Datalogger Notes:	**Database**	**607**	
Datalogger Internal Power:	4.548V		
Datalogger External Power:	12.64V		
Datalogger Memory Used:	11% used		
Datalogger Clock:	Dec 04, 2004 14:35		MST
Laptop Clock:	Dec 04, 2004 14:45		MST
Dessicant:	75% used-replaced		
Datalogger:	204100607		
PT:	730130-5		
Power:			

Notes:

Hydrometric Measurement / Site Visit Record

L2A - Kearl Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake
Location:	Kearl Lake
Site Name:	L2A
Coordinates & Legal:	484935 E, 6349023 N SE-32-95-8-4

Time of Measurement

Date of Measurement:	January 30, 2004
Start Time:	2:13 PM MST
End Time:	

Weather Conditions: -25 °C, Light snow

River Conditions: Complete Ice Cover

Personnel & Equipment

Measurement Made By:	DM/FF
Data Entry By:	FF
Meter Type and No.:	N/A

Level Readings and Measurements

Bench Mark Reading:	Nail in tree	2.079	El:	333.060
Water Level Reading:		3.154	El:	331.985
Top of Ice Level Reading:		3.119	El:	N/A
Transducer Reading & Elevation:		0.6675	El:	331.318
Other:				

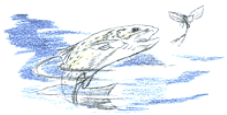
Total Flow:				-		**(m^3/s)**
Total Area:				-		**(m^2)**
Top Width:				-		**(m)**
Hydraulic Depth:				-		**(m)**
Mean Velocity:				-		**(m/s)**
Froude Number				-		
Photographs taken looking at: yes						

Datalogger Notes:	
Datalogger Internal Power:	4.32V
Datalogger External Power:	14.41V
Datalogger Memory Used:	37%
Datalogger Clock:	Jan 30, 2004 14:57 MDT
Laptop Clock:	Jan 30, 2004 14:13 MDT
Dessicant:	70% Good
Datalogger:	Optimum DD128, # 0105010657
PT:	Keller 730-130-5 psi #0101344
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:

Hydrometric Measurement / Site Visit Record

L2A - Kearl Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake
Location:	Kearl Lake
Site Name:	L2A
Coordinates & Legal:	484935 E, 6349023 N SE-32-95-8-4

Time of Measurement

Date of Measurement:	February 28, 2004
Start Time:	1:23 PM MST
End Time:	

Weather Conditions: 0 °C, Overcast, Calm

River Conditions: Complete Ice Cover

Personnel & Equipment

Measurement Made By:	DK/DB
Data Entry By:	DK
Meter Type and No.:	N/A

Level Readings and Measurements

Bench Mark Reading:	Nail in tree	2.057	El:	333.060
Water Level Reading:		3.202	El:	331.915
Top of Ice Level Reading:		3.171	El:	331.946
Transducer Reading & Elevation:		0.6291	El:	331.286
Other:				

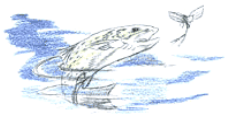
Total Flow:				-		**(m^3/s)**
Total Area:				-		**(m^2)**
Top Width:				-		**(m)**
Hydraulic Depth:				-		**(m)**
Mean Velocity:				-		**(m/s)**
Froude Number				-		
Photographs taken looking at: yes						

Datalogger Notes:	
Datalogger Internal Power:	4.394V
Datalogger External Power:	14.42V
Datalogger Memory Used:	40%
Datalogger Clock:	Feb 28, 2004 13:23 MST
Laptop Clock:	Feb 28, 2004 12:41 MST
Dessicant:	good
Datalogger:	Optimum DD128, # 0105010657
PT:	Keller 730-130-5 psi #0101344
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:

Hydrometric Measurement / Site Visit Record

L2A - Kearl Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake
Location:	Kearl Lake
Site Name:	L2A
Coordinates & Legal:	484935 E, 6349023 N SE-32-95-8-4

Time of Measurement

Date of Measurement:	April 2, 2004	
Start Time:	1:05 PM	MDT
End Time:		MDT

Weather Conditions: +15 °C, Clear, Calm

River Conditions: Complete Ice Cover

Personnel & Equipment

Measurement Made By:	DM/DK
Data Entry By:	DK
Meter Type and No.:	N/A

Level Readings and Measurements

Bench Mark Reading:	Nail in tree	1.858	El:	333.060
Water Level Reading:		3.012	El:	331.906
Top of Ice Level Reading:		2.977	El:	331.941
Transducer Reading & Elevation:		0.5949	El:	331.311
Other:				

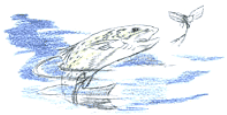
Total Flow:				-		**(m^3/s)**
Total Area:				-		**(m^2)**
Top Width:				-		**(m)**
Hydraulic Depth:				-		**(m)**
Mean Velocity:				-		**(m/s)**
Froude Number				-		
Photographs taken looking at: yes						

Notes:

Datalogger Notes:	
Datalogger Internal Power:	4.401V
Datalogger External Power:	14.07V
Datalogger Memory Used:	42%
Datalogger Clock:	Apr 02, 2004 13:11 MST
Laptop Clock:	Apr 02, 2004 12:12 MDT
Dessicant:	70% Good
Datalogger:	Optimum DD128, # 0105010657
PT:	Keller 730-130-5 psi #0101344
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

L2A - Kearl Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake
Location:	Kearl Lake
Site Name:	L2A
Coordinates & Legal:	484935 E, 6349023 N SE-32-95-8-4

Personnel & Equipment

Measurement Made By:	DB/FF/DM
Data Entry By:	FF
Meter Type and No.:	N/A

Time of Measurement

Date of Measurement:	April 23, 2004	
Start Time:	12:34 PM	MDT
End Time:		MDT

Weather Conditions: +8 °C, Clear Light wind from SE

River Conditions: 90% ice cover.

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Nail in Tre	2.036	El:	333.060	2.076	El:	333.060
Water Level Reading:	3.170	El:	331.926	3.181	El:	331.955
Top of Ice Level Reading:	3.141	El:	331.955	3.181	El:	331.955
Transducer Reading & Calc'd El	0.619	El:	331.307	0.619	El:	331.336
Other:		El:			El:	

Total Flow:				-		**(m^3/s)**
Total Area:				-		**(m^2)**
Top Width:				-		**(m)**
Hydraulic Depth:				-		**(m)**
Mean Velocity:				-		**(m/s)**
Froude Number				-		

Photographs taken looking at:
yes

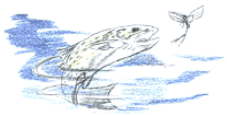
Datalogger Notes:	**Database 657**
Datalogger Internal Power:	4.42V
Datalogger External Power:	14.24V
Datalogger Memory Used:	44%
Datalogger Clock:	Apr 23, 2004 11:31 MST
Laptop Clock:	Apr 23, 2004 12:34 MDT
Dessicant:	50% Good

Datalogger: Optimum DD128, # 0105010657
PT: Keller 730-130-5 psi #0101344
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:

Hydrometric Measurement / Site Visit Record

L2A - Kearl Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake
Location:	Kearl Lake
Site Name:	L2A
Coordinates & Legal:	484935 E, 6349023 N SE-32-95-8-4

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	N/A

Time of Measurement

Date of Measurement:	May 31, 2004	
Start Time:	9:26 AM	MDT
End Time:		MDT

Weather Conditions: +9 °C, 9overcast, raining, light wind from NW

River Conditions: open

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Nail in Tre	2.090	El:	333.060	2.074	El:	333.060
Water Level Reading:	3.099	El:	332.051	3.082	El:	332.052
Top of Ice Level Reading:	n/a	El:		n/a	El:	
Transducer Reading & Calc'd El	0.745	El:	331.306	0.745	El:	331.307
Other:		El:			El:	

Total Flow:				-		(m^3/s)
Total Area:				-		(m^2)
Top Width:				-		(m)
Hydraulic Depth:				-		(m)
Mean Velocity:				-		(m/s)
Froude Number				-		

Photographs taken looking at:
yes

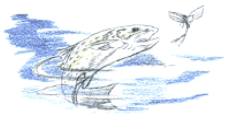
Datalogger Notes:	**Database 657**
Datalogger Internal Power:	4.352V
Datalogger External Power:	12.66V
Datalogger Memory Used:	47%
Datalogger Clock:	9:26:08 AM MST
Laptop Clock:	10:27:00 AM MDT
Dessicant:	70% - OK

Datalogger: Optimum DD128, # 0105010657
PT: Keller 730-130-5 psi #0101344
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:

Hydrometric Measurement / Site Visit Record

L2A - Kearl Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake
Location:	Kearl Lake
Site Name:	L2A
Coordinates & Legal:	484935 E, 6349023 N SE-32-95-8-4

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	N/A

Time of Measurement

Date of Measurement:	July 25, 2004	
Start Time:	1:07 PM	MDT
End Time:		MDT

Weather Conditions: +25 °C, light wind from S

River Conditions: open

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Nail in Tre	1.780	El:	333.060		1.775	El:	333.060
Water Level Reading:	2.852	El:	331.988		2.849	El:	331.986
Top of Ice Level Reading:	n/a	El:			n/a	El:	
Transducer Reading & Calc'd El	0.689	El:	331.299		0.689	El:	331.297
Other:		El:				El:	

Total Flow:				-		**(m^3/s)**
Total Area:				-		**(m^2)**
Top Width:				-		**(m)**
Hydraulic Depth:				-		**(m)**
Mean Velocity:				-		**(m/s)**
Froude Number				-		

Photographs taken looking at:
yes

Datalogger Notes:	**Database 657**
Datalogger Internal Power:	4.498V
Datalogger External Power:	13.36V
Datalogger Memory Used:	52%
Datalogger Clock:	Jul 25, 2004 13:07 MST
Laptop Clock:	Jul 25, 2004 14:09 MDT
Dessicant:	60% - OK

Datalogger: Optimum DD128, # 0105010657
PT: Keller 730-130-5 psi #0101344
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:

Hydrometric Measurement / Site Visit Record

old L2 - old Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	old Kearl Lake
Location:	old Kearl Lake
Site Name:	old L2
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 27, 2004	
Start Time:	n/a	MDT
End Time:	n/a	MDT

Weather Conditions: +10˚C, overcast, light wind (on shore)

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: rebar by (	0.510	El:		0.502	El:	
Water Level Reading:	1.985	El:	-1.475	1.977	El:	-1.475
Top of Ice Level Reading:		El:			El:	
Transducer Reading & at L2	0.623	El:	-2.098	0.623	El:	-2.098
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:		
Datalogger Internal Power:	4.439V	
Datalogger External Power:	14.02V	
Datalogger Memory Used:	54%	
Datalogger Clock:	Aug 27, 2004 11:56	MST
Laptop Clock:	Aug 27, 2004 12:57	MDT
Dessicant:	bad - replaced	

Datalogger:
PT:
Power:

Notes: Error message on download regarding date - pressed enter to download anyway for first 500 sectors.

Hydrometric Measurement / Site Visit Record

L2 - Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake
Location:	Kearl Lake
Site Name:	L2
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 27, 2004	
Start Time:	12:57 PM	MDT
End Time:		MDT

Weather Conditions: +10˚C, overcast, light wind

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tree	1.756	El:	333.060	1.778	El:	333.060
Water Level Reading:	2.872	El:	331.944	2.899	El:	331.939
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El.:	0.623	El:	331.321	0.623	El:	331.316
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:	**Database # 657**	
Datalogger Internal Power:	4.439V	
Datalogger External Power:	14.02V	
Datalogger Memory Used:	54%	
Datalogger Clock:	Aug 27, 2004 11:56	MST
Laptop Clock:	Aug 27, 2004 12:57	MDT
Dessicant:	bad - replaced	

Datalogger:
PT:
Power:

Notes: Error message on download regarding date - pressed enter to download anyway for first 500 sectors.

Hydrometric Measurement / Site Visit Record

L2 - Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake
Location:	Kearl Lake
Site Name:	L2
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 21, 2004	
Start Time:	3:42 PM	MDT
End Time:		MDT

Weather Conditions: +16˚C, clear, wind from SW

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: nail in tree	1.955	El:	333.060	1.912	El:	333.060
Water Level Reading:	3.049	El:	331.966	3.009	El:	331.963
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El.:	0.655	El:	331.311	0.655	El:	331.308
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
photos lost

Datalogger Notes:	**Database # 657**	
Datalogger Internal Power:	4.447V	
Datalogger External Power:	12.96V	
Datalogger Memory Used:	56%	
Datalogger Clock:	Sep 21, 2004 15:40	MST
Laptop Clock:	Sep 21, 2004 15:42	MST
Dessicant:	100% - good	

Datalogger:
PT:
Power:

Notes: Went to old L2 to measure WSE relative to BM, but too windy (setup) to be accurate

Hydrometric Measurement / Site Visit Record

old L2 - old Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	old Kearl Lake
Location:	old Kearl Lake
Site Name:	old L2
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 29, 2004	
Start Time:	n/a	MDT
End Time:	n/a	MDT

Weather Conditions: +5 C, clear

River Conditions: ice cover

Personnel & Equipment

Measurement Made By:	DM/FF/ND
Data Entry By:	ND
Meter Type and No.:	

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: rebar by e	0.618	El:		0.568	El:	
Water Level Reading:	2.056	El:	-1.438	1.990	El:	-1.422
Top of Ice Level Reading:	2.022	El:		1.975	El:	
Transducer Reading at L2	0.684	El:	-2.122	0.684	El:	-2.106
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, across

Notes:

Datalogger Notes:		
Datalogger Internal Power:	4.439V	
Datalogger External Power:	14.02V	
Datalogger Memory Used:	54%	
Datalogger Clock:	Aug 27, 2004 11:56	MST
Laptop Clock:	Aug 27, 2004 12:57	MDT
Dessicant:	bad - replaced	

Datalogger:
PT:
Power:

Hydrometric Measurement / Site Visit Record

L2 - Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake
Location:	Kearl Lake
Site Name:	L2
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 29, 2004	
Start Time:	12:06 PM	MDT
End Time:	12:38 PM	MDT

Weather Conditions: +3 C, clear, light wind

River Conditions: Complete ice cover

Personnel & Equipment

Measurement Made By:	DM/ND/FF
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tree	1.952	El:	333.060	1.831	El:	333.060
Water Level Reading:	3.026	El:	331.986	2.803	El:	332.088
Top of Ice Level Reading:	3.009	El:	332.003	2.888	El:	332.003
Transducer Reading & Calc'd El.:	0.684	El:	331.302	0.684	El:	331.404
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
across

Notes: Data downloaded - looks OK

Datalogger Notes:	**Database # 657**	
Datalogger Internal Power:	4.419V	
Datalogger External Power:	14.19V	
Datalogger Memory Used:	59%	
Datalogger Clock:	Oct 29, 2004 12:01	MST
Laptop Clock:	Oct 29, 2004 12:06	MST
Dessicant:	25% used	
Datalogger:		
PT:	101344	
Power:		

Hydrometric Measurement / Site Visit Record

old L2 - old Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	old Kearl Lake
Location:	old Kearl Lake
Site Name:	old L2
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	December 1, 2004	
Start Time:	n/a	MDT
End Time:	n/a	MDT

Weather Conditions: -16 C, overcast, light wind

River Conditions: ice cover

Personnel & Equipment

Measurement Made By:	DB/CT/ND
Data Entry By:	DB
Meter Type and No.:	

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: rebar by e	0.913	El:		0.935	El:	
Water Level Reading:	2.383	El:	-1.470	2.402	El:	-1.467
Top of Ice Level Reading:	2.365	El:		2.390	El:	
Transducer Reading at L2	0.633	El:	-2.103	0.633	El:	-2.100
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, across

Notes:

Datalogger Notes:		
Datalogger Internal Power:	4.439V	
Datalogger External Power:	14.02V	
Datalogger Memory Used:	54%	
Datalogger Clock:	Aug 27, 2004 11:56	MST
Laptop Clock:	Aug 27, 2004 12:57	MDT
Dessicant:	bad - replaced	

Datalogger:
PT:
Power:

Hydrometric Measurement / Site Visit Record

L2 - Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake
Location:	Kearl Lake
Site Name:	L2
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	December 1, 2004	
Start Time:	4:15 PM	MST
End Time:		MST

Weather Conditions: +16˚C, overcast, light wind

River Conditions: Complete ice cover

Personnel & Equipment

Measurement Made By:	DM/ND/FF
Data Entry By:	DB
Meter Type and No.:	

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tree	1.929	El:	333.060	1.824	El:	333.060
Water Level Reading:	3.053	El:	331.936	2.948	El:	331.936
Top of Ice Level Reading:	3.029	El:		2.929	El:	
Transducer Reading & Calc'd El.:	0.633	El:	331.303	0.633	El:	331.303
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

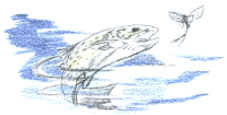
Photographs taken looking at:
across

Notes: Data downloaded - looks OK

Datalogger Notes:	**Database # 657**	
Datalogger Internal Power:	4.419V	
Datalogger External Power:	14.19V	
Datalogger Memory Used:	59%	
Datalogger Clock:	Dec 01, 2004 16:11	MST
Laptop Clock:	Dec 01, 2004 16:17	MST
Dessicant:	25% used	
Datalogger:		
PT:	101344	
Power:		

Hydrometric Measurement / Site Visit Record

L3 - Isadore's Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Isadore's Lake
Location:	Isadore's Lake
Site Name:	L3
Coordinates & Legal:	6343250 N, 463400 E 16-7-95-10-W4

Time of Measurement

Date of Measurement:	January 31, 2004
Start Time:	4:28 PM MST
End Time:	

Weather Conditions: -20 °C, Overcast, Calm

River Conditions: Complete Ice cover, Ice thickness of +/-35 cm at sample hole.

Personnel & Equipment

Measurement Made By:	DM/FF
Data Entry By:	FF
Meter Type and No.:	N/A

Level Readings and Measurements

Bench Mark Reading:	Tbar	2.339	El:	234.506
Water Level Reading:		3.082	El:	233.763
Top of Ice Level Reading:		3.055	El:	233.790
Transducer Reading & Elevation:		0.944	El:	232.819
Other:	Pin in Tree	0.937	El:	235.908

Total Flow:				-		**(m^3/s)**
Total Area:				-		**(m^2)**
Top Width:				-		**(m)**
Hydraulic Depth:				-		**(m)**
Mean Velocity:				-		**(m/s)**
Froude Number				-		
Photographs taken looking at: yes						

Datalogger Notes:	
Datalogger Internal Power:	100% Good
Datalogger External Power:	77% Good
Datalogger Memory Used:	20%
Datalogger Clock:	1/31/2004 5:19:00 PM MDT
Laptop Clock:	1/31/2004 4:28:00 PM MDT
Dessicant:	Good
Datalogger:	Lakewood UL RX-2 #94834-08
PT:	Keller 8363K-5 psi #996022
Power:	Lakewood Rechargeable

Notes:

Datalogger and transducer malfunctioning due to low battery power. Battery changed.
Power levels reported above were recorded after battery replacement.

Hydrometric Measurement / Site Visit Record

L3 - Isadore's Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Isadore's Lake
Location:	Isadore's Lake
Site Name:	L3
Coordinates & Legal:	6343250 N, 463400 E 16-7-95-10-W4

Personnel & Equipment

Measurement Made By:	DB/FF/DM
Data Entry By:	FF
Meter Type and No.:	N/A

Time of Measurement

Date of Measurement:	February 29, 2004	
Start Time:	7:00 PM	MDT
End Time:		MDT

Weather Conditions: -2 °C, Overcast, Calm, Light Snow

River Conditions: Complete ice cover

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Nail in Tre	2.036	El:	100.000	2.076	El:	100.000
Water Level Reading:	3.170	El:	98.866	3.181	El:	98.895
Top of Ice Level Reading:	3.141	El:	98.895	3.181	El:	98.895
Transducer Reading & Calc'd El	0.619	El:	98.247	0.619	El:	98.276
Other:		El:			El:	

Total Flow:				-		(m^3/s)
Total Area:				-		(m^2)
Top Width:				-		(m)
Hydraulic Depth:				-		(m)
Mean Velocity:				-		(m/s)
Froude Number				-		

Photographs taken looking at:
yes

Datalogger Notes:		
Datalogger Internal Power:	100%	Good
Datalogger External Power:	76%	Good
Datalogger Memory Used:	25%	
Datalogger Clock:	Feb 29, 2004 19:01	
Laptop Clock:	Feb 29, 2004 18:11	
Dessicant:	Good	
Datalogger:	Lakewood UL RX-2 #94834-08	
PT:	Keller 8363K-5 psi #996022	
Power:	Lakewood Rechargeable	

Notes:
Laptop and datalogger clock synchronized.

Hydrometric Measurement / Site Visit Record

L3 - Isadore's Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Isadore's Lake	
Location:	Isadore's Lake	
Site Name:	L3	
Coordinates & Legal:	6343250 N, 463400 E	16-7-95-10-W4

Time of Measurement

Date of Measurement:	April 3, 2004	
Start Time:	4:41 PM	MDT
End Time:		MDT

Weather Conditions: +15 °C, Clear, Calm

River Conditions: Complete ice cover

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	N/A

Level Readings and Measurements

Bench Mark Reading:	Tbar	2.256	El:	234.506
Water Level Reading:		2.910	El:	233.852
Top of Ice Level Reading:		2.864	El:	233.898
Transducer Reading & Elevation:		1.047	El:	232.805
Other:	Pin in Tree	0.859	El:	235.903
		1.397		

Total Flow:				-		**(m^3/s)**
Total Area:				-		**(m^2)**
Top Width:				-		**(m)**
Hydraulic Depth:				-		**(m)**
Mean Velocity:				-		**(m/s)**
Froude Number				-		
Photographs taken looking at: yes						

Datalogger Notes:		
Datalogger Internal Power:	95%	fair
Datalogger External Power:	67%	bad
Datalogger Memory Used:	10%	
Datalogger Clock:	Apr 03, 2004 16:31	
Laptop Clock:	Apr 03, 2004 16:33	
Dessicant:	Good	
Datalogger:	Lakewood UL RX-2 #94834-08	
PT:	Keller 8363K-5 psi #996022	
Power:	Lakewood Rechargeable	

Notes:
Battery in logger changed

Hydrometric Measurement / Site Visit Record

L3 - Isadore's Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Isadore's Lake
Location:	Isadore's Lake
Site Name:	L3
Coordinates & Legal:	6343250 N, 463400 E 16-7-95-10-W4

Personnel & Equipment

Measurement Made By:	DB/FF/DM
Data Entry By:	FF
Meter Type and No.:	N/A

Time of Measurement

Date of Measurement:	April 23, 2004	
Start Time:	3:47 PM	MDT
End Time:		MDT

Weather Conditions: +15 °C, partly cloudy, light wind

River Conditions: Complete ice cover

Level Readings		**Setup No. 1**			**Setup No. 2**		
BM Reading:	Tbar in P'	2.074	El:	234.506	1.915	El:	234.506
Water Level Reading:		2.810	El:	233.770	2.649	El:	233.772
Top of Ice Level Reading:			El:	236.580		El:	236.421
Transducer Reading & Calc'd El		0.973	El:	232.797	0.973	El:	232.799
Nail in Tree		0.682	El:	235.898	0.522	El:	235.899
		1.392			1.393		

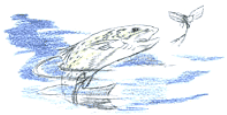
Total Flow:				-		(m^3/s)
Total Area:				-		(m^2)
Top Width:				-		(m)
Hydraulic Depth:				-		(m)
Mean Velocity:				-		(m/s)
Froude Number				-		
Photographs taken looking at:						
yes						

Datalogger Notes:			
Datalogger Internal Power:	100%	11.34V	
Datalogger External Power:	74%	11.44V	
Datalogger Memory Used:	95%		
Datalogger Clock:	Apr 23, 2004 15:47		MDT
Laptop Clock:	Apr 23, 2004 16:50		MST
Dessicant:	75% Good		
Datalogger:	Lakewood UL RX-2 #94834-08		
PT:	Keller 8363K-5 psi #996022		
Power:	Lakewood Rechargeable		

Notes:

Hydrometric Measurement / Site Visit Record

L3 - Isadore's Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Isadore's Lake
Location:	Isadore's Lake
Site Name:	L3
Coordinates & Legal:	6343250 N, 463400 E 16-7-95-10-W4

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	N/A

Time of Measurement

Date of Measurement:	June 4, 2004	
Start Time:	8:50 AM	MDT
End Time:		MDT

Weather Conditions: +10 °C, Clear, Calm

River Conditions: open

Level Readings		**Setup No. 1**			**Setup No. 2**		
BM Reading:	Tbar in P'	2.312	El:	234.506	2.252	El:	234.506
Water Level Reading:		3.067	El:	233.751	3.005	El:	233.753
Top of Ice Level Reading:			El:	236.818		El:	236.758
Transducer Reading & Calc'd El		0.953	El:	232.798	0.953	El:	232.800
Nail in Tree		0.900	El:	235.918	0.839	El:	235.919
		1.412			1.413		

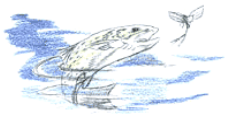
Total Flow:				-		(m^3/s)
Total Area:				-		(m^2)
Top Width:				-		(m)
Hydraulic Depth:				-		(m)
Mean Velocity:				-		(m/s)
Froude Number				-		
Photographs taken looking at: yes						

Datalogger Notes:			
Datalogger Internal Power:	100%	11.34V	
Datalogger External Power:	74%	11.19V	
Datalogger Memory Used:	28947 free%		
Datalogger Clock:	7:52:28 AM		MDT
Laptop Clock:	8:56:17 AM		MST
Dessicant:	60% Okasy		
Datalogger:	Lakewood UL RX-2 #94834-08		
PT:	Keller 8363K-5 psi #996022		
Power:	Lakewood Rechargeable		

Notes: Bring a spare dessicant next trip.

Hydrometric Measurement / Site Visit Record

L3 - Isadore's Lake



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Isadore's Lake
Location:	Isadore's Lake
Site Name:	L3
Coordinates & Legal:	6343250 N, 463400 E 16-7-95-10-W4

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	N/A

Time of Measurement

Date of Measurement:	July 25, 2004	
Start Time:	4:55 PM	MDT
End Time:		MDT

Weather Conditions: +35 °C, Clear, Calm

River Conditions: open

Level Readings		**Setup No. 1**			**Setup No. 2**		
BM Reading:	Tbar in P'	1.665	El:	234.506	1.732	El:	234.506
Water Level Reading:		2.518	El:	233.653	2.554	El:	233.684
Top of Ice Level Reading:			El:	236.171		El:	236.238
Transducer Reading & Calc'd El		0.872	El:	232.781	0.872	El:	232.812
Nail in Tree		0.279	El:	235.892	0.333	El:	235.905
		1.386			1.399		

Total Flow:				-		**(m^3/s)**
Total Area:				-		**(m^2)**
Top Width:				-		**(m)**
Hydraulic Depth:				-		**(m)**
Mean Velocity:				-		**(m/s)**
Froude Number				-		
Photographs taken looking at:						
yes						

Datalogger Notes:			
Datalogger Internal Power:	100%	11.34V	
Datalogger External Power:	72%	11.19V	
Datalogger Memory Used:	20%		
Datalogger Clock:	Jul 25, 2004 16:55		MDT
Laptop Clock:	Jul 25, 2004 17:59		MST
Dessicant:	20% good		
Datalogger:	Lakewood UL RX-2 #94834-08		
PT:	Keller 8363K-5 psi #996022		
Power:	Lakewood Rechargeable		

Notes:

Hydrometric Measurement / Site Visit Record

L3 - Isadore's Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Isadore's Lake
Location:	Isadore's Lake
Site Name:	L3
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 25, 2004	
Start Time:	12:30 PM	MDT
End Time:		MDT

Weather Conditions: +15 C, Calm, clear

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	bar in PV	1.693	El:	234.506	1.764	El:	234.506
Water Level Reading:		2.542	El:	233.657	2.627	El:	233.643
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.864	El:	232.793	0.864	El:	232.779
Other:	nail in tre	0.297	El:		0.368	El:	
		1.396			1.396		

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, across

Notes: Battery replaced (up to 76% from 70%)

Datalogger Notes:		
Datalogger Internal Power:	11.07V	97%
Datalogger External Power:	10.83V	70% - replaced
Datalogger Memory Used:	24757 free%	
Datalogger Clock:	Aug 25, 2004 11:34	MST
Laptop Clock:	Aug 25, 2004 12:29	MDT
Dessicant:	bad - replaced	

Datalogger:
PT:
Power:

Hydrometric Measurement / Site Visit Record

L3 - Isadore's Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Isadore's Lake
Location:	Isadore's Lake
Site Name:	L3
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 22, 2004	
Start Time:	11:00 AM	MDT
End Time:		MDT

Weather Conditions: +10 C, windy, clear

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	bar in PV	1.688	El:	234.506	1.772	El:	234.506
Water Level Reading:		2.467	El:	233.727	2.548	El:	233.730
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.924	El:	232.803	0.924	El:	232.806
Other:	nail in tre	0.292	El:		0.375	El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, across

Notes: Battery replaced (up to 78% from 74%)

Datalogger Notes:		
Datalogger Internal Power:	11.34 V	100%
Datalogger External Power:	11.56 V	74% - replaced
Datalogger Memory Used:	23331 free	
Datalogger Clock:	Sep 22, 2004 10:55	MST
Laptop Clock:	Sep 22, 2004 11:02	MDT
Dessicant:	good - 100%	
Datalogger:		
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

L3 - Isadore's Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Isadore's Lake
Location:	Isadore's Lake
Site Name:	L3
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 30, 2004	
Start Time:	12:38 PM	MST
End Time:	12:58 PM	MST

Weather Conditions: +5 C, calm, clear

River Conditions: Complete ice cover

Personnel & Equipment

Measurement Made By:	ND/FF
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	bar in PVC	1.648	El:	234.506	1.758	El:	234.506
Water Level Reading:		2.424	El:	233.730	2.546	El:	233.718
Top of Ice Level Reading:		2.410	El:	233.744	2.528	El:	233.736
Transducer Reading & Calc'd E		0.951	El:	232.779	0.951	El:	232.767
Other:	nail in tree	0.246	El:		0.364	El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:		
Datalogger Internal Power:	7.59 V	66%
Datalogger External Power:	1.7 V	11% - replaced
Datalogger Memory Used:	10% used	
Datalogger Clock:	Oct 30, 2004 12:27	MST
Laptop Clock:	Oct 30, 2004 12:29	MST
Dessicant:	Good	
Datalogger:	94834-08	
PT:	996022-5	
Power:		

Notes: Battery changed as the earlier one was very low, and the transducer reading was -0.9465 m
After battery change, transducer reading was 0.9512 m

Hydrometric Measurement / Site Visit Record

L3 - Isadore's Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Isadore's Lake
Location:	Isadore's Lake
Site Name:	L3
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	December 3, 2004	
Start Time:	1:50 PM	MST
End Time:	2:10 PM	MST

Weather Conditions: -12 C, overcast, snowing

River Conditions: Complete ice cover ~ 4"

Personnel & Equipment

Measurement Made By:	ND/DB/CT
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	bar in PVC	1.879	El:	234.506	1.818	El:	234.506
Water Level Reading:		2.631	El:	233.754	2.572	El:	233.752
Top of Ice Level Reading:		2.631	El:	233.754	2.572	El:	233.752
Transducer Reading & Calc'd E		0.937	El:	232.817	0.937	El:	232.815
Other:	nail in tree	0.583	El:		0.425	El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Lake

Notes:

Datalogger Notes:			
Datalogger Internal Power:	11.34 V	100%	
Datalogger External Power:	11.8 V	76%	Fair
Datalogger Memory Used:	28413 KB free		
Datalogger Clock:	Dec 03, 2004 13:56		MST
Laptop Clock:	Dec 03, 2004 14:01		MST
Dessicant:	Good		
Datalogger:	94834-08		
PT:	996022-5		
Power:			

Hydrometric Measurement / Site Visit Record

S2 - Jackpine Creek at Canterra Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Jackpine Creek
Location:	Jackpine Creek at Canterra Road
Site Name:	S2
Coordinates & Legal:	6343680 N, 475132 E SE-17-95-9-W4

Time of Measurement

Date of Measurement:	April 23, 2004	
Start Time:	8:43 AM	MDT
End Time:	8:59 AM	MDT

Weather Conditions: +1 C, Calm, partly cloudy

River Conditions: Marginal border ice adjacent to banks - open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	1.195	El:	297.990	0.961	El:	297.990
Water Level Reading:	2.164	El:	297.021	1.939	El:	297.012
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.575	El:	296.447	0.575	El:	296.438
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	2.60	0.00	0.00			0.000	1.00	1	2.60	3.00	0.002	0.002	0.04	0.01	0.000
	3.40	0.14	0.00			0.009	1.00	2	3.00	3.70	0.009	0.009	0.14	0.10	0.001
	4.00	0.17	0.00			0.091	1.00	3	3.70	4.25	0.091	0.091	0.17	0.09	0.009
	4.50	0.18	0.00			0.143	1.00	4	4.25	4.75	0.143	0.143	0.18	0.09	0.013
	5.00	0.18	0.00			0.122	1.00	5	4.75	5.25	0.122	0.122	0.18	0.09	0.011
	5.50	0.19	0.00			0.131	1.00	6	5.25	5.75	0.131	0.131	0.19	0.10	0.012
	6.00	0.18	0.00			0.149	1.00	7	5.75	6.25	0.149	0.149	0.18	0.09	0.013
	6.50	0.20	0.00			0.070	1.00	8	6.25	6.75	0.070	0.070	0.20	0.10	0.007
	7.00	0.30	0.00			0.204	1.00	9	6.75	7.25	0.204	0.204	0.30	0.15	0.031
	7.50	0.30	0.00			0.320	1.00	10	7.25	7.75	0.320	0.320	0.30	0.15	0.048
	8.00	0.28	0.00			0.506	1.00	11	7.75	8.25	0.506	0.506	0.28	0.14	0.071
	8.50	0.32	0.00			0.661	1.00	12	8.25	8.75	0.661	0.661	0.32	0.16	0.106
	9.00	0.30	0.00			0.576	1.00	13	8.75	9.25	0.576	0.576	0.30	0.15	0.086
	9.50	0.30	0.00			0.591	1.00	14	9.25	9.75	0.591	0.591	0.30	0.15	0.089
	10.00	0.30	0.00			0.786	1.00	15	9.75	10.25	0.786	0.786	0.30	0.15	0.118
	10.50	0.26	0.00			0.671	1.00	16	10.25	10.75	0.671	0.671	0.26	0.13	0.087
	11.00	0.32	0.00			0.613	1.00	17	10.75	11.25	0.613	0.613	0.32	0.16	0.098
	11.50	0.31	0.00			0.549	1.00	18	11.25	11.75	0.549	0.549	0.31	0.16	0.085
	12.00	0.25	0.00			0.451	1.00	19	11.75	12.25	0.451	0.451	0.25	0.13	0.056
	12.50	0.30	0.00			0.396	1.00	20	12.25	12.75	0.396	0.396	0.30	0.15	0.059
	13.00	0.31	0.00			0.436	1.00	21	12.75	13.25	0.436	0.436	0.31	0.16	0.068
	13.50	0.33	0.00			0.344	1.00	22	13.25	13.75	0.344	0.344	0.33	0.17	0.057
	14.00	0.24	0.00			0.250	1.00	23	13.75	14.15	0.250	0.250	0.24	0.10	0.024
RB	14.30	0.00	0.00			0.000	1.00	24	14.15	14.30	0.062	0.062	0.06	0.01	0.001
														Total Flow:	1.150

Total Flow:	**1.150**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**2.87**		**(m^2)**
Top Width:	**11.70**		**(m)**
Hydraulic Depth:	**0.245**		**(m)**
Mean Velocity:	**0.401**		**(m/s)**
Froude Number	**0.259**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	11.34V	
Datalogger External Power:	12.77V	
Datalogger Memory Used:	0%	
Datalogger Clock:	Apr 23, 2004 08:17	MST
Laptop Clock:	Apr 23, 2004 09:17	MDT
Dessicant:	Good	
Datalogger:	Lakewood UI RX s/n 207085	
PT:	Keller 984631 - 2psi	
Power:	Lakewood battery	

Notes:

Equipment installed. Transducer installed wired to a rock, rather than in sensor housing tube due to ice.
Stage was rising throughout the day. Later on the same day stage was observed to be 0.3 m higher than at time of installation.
TSS sample collected.

Hydrometric Measurement / Site Visit Record

S2 - Jackpine Creek at Canterra Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Jackpine Creek
Location:	Jackpine Creek at Canterra Road
Site Name:	S2
Coordinates & Legal:	6343680 N, 475132 E SE-17-95-9-W4

Time of Measurement

Date of Measurement:	June 1, 2004
Start Time:	11:23 AM MDT
End Time:	11:48 AM MDT

Weather Conditions: +13 C, Calm, partly cloudy

River Conditions: Open, flood stage

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	1.593	El:	297.990	1.553	El:	297.990
Water Level Reading:	2.313	El:	297.270	2.275	El:	297.268
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El	0.644	El:	296.626	0.644	El:	296.624
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	16.50	0.00	0.00			0.000	1.00	1	16.50	16.75	-0.016	-0.016	0.06	0.02	0.000
	17.00	0.25	0.00			-0.064	1.00	2	16.75	17.25	-0.064	-0.064	0.25	0.13	-0.008
	17.50	0.30	0.00			0.741	1.00	3	17.25	17.75	0.741	0.741	0.30	0.15	0.111
	18.00	0.40	0.00			0.914	1.00	4	17.75	18.25	0.914	0.914	0.40	0.20	0.183
	18.50	0.39	0.00			0.564	1.00	5	18.25	18.75	0.564	0.564	0.39	0.20	0.110
	19.00	0.46	0.00			1.137	1.00	6	18.75	19.25	1.137	1.137	0.46	0.23	0.261
	19.50	0.40	0.00			0.549	1.00	7	19.25	19.75	0.549	0.549	0.40	0.20	0.110
	20.00	0.41	0.00			0.256	1.00	8	19.75	20.25	0.256	0.256	0.41	0.21	0.052
	20.50	0.42	0.00			0.927	1.00	9	20.25	20.75	0.927	0.927	0.42	0.21	0.195
	21.00	0.50	0.00			0.960	1.00	10	20.75	21.25	0.960	0.960	0.50	0.25	0.240
	21.50	0.59	0.00			1.320	1.00	11	21.25	21.75	1.320	1.320	0.59	0.30	0.389
	22.00	0.54	0.00			1.335	1.00	12	21.75	22.25	1.335	1.335	0.54	0.27	0.360
	22.50	0.52	0.00			1.375	1.00	13	22.25	22.75	1.375	1.375	0.52	0.26	0.357
	23.00	0.60	0.00			1.231	1.00	14	22.75	23.25	1.231	1.231	0.60	0.30	0.369
	23.50	0.55	0.00			1.393	1.00	15	23.25	23.75	1.393	1.393	0.55	0.28	0.383
	24.00	0.64	0.00			1.177	1.00	16	23.75	24.25	1.177	1.177	0.64	0.32	0.376
	24.50	0.63	0.00			1.280	1.00	17	24.25	24.75	1.280	1.280	0.63	0.32	0.403
	25.00	0.62	0.00			1.399	1.00	18	24.75	25.25	1.399	1.399	0.62	0.31	0.434
	25.50	0.54	0.00			1.213	1.00	19	25.25	25.75	1.213	1.213	0.54	0.27	0.328
	26.00	0.59	0.00			1.256	1.00	20	25.75	26.25	1.256	1.256	0.59	0.30	0.370
	26.50	0.51	0.00			1.137	1.00	21	26.25	27.25	1.137	1.137	0.51	0.51	0.580
	27.00	0.61	0.00			1.058	1.00	22	27.25	27.75	1.058	1.058	0.61	0.31	0.323
	27.50	0.57	0.00			1.003	1.00	23	27.75	28.20	1.003	1.003	0.57	0.26	0.257
	28.00	0.48	0.00			1.015	1.00	24	28.20	28.43	1.015	1.015	0.48	0.11	0.114
	28.50	0.19	0.00			-0.091	1.00	25	28.43	28.65	-0.091	-0.091	0.19	0.04	-0.004
RB	28.80	0.00	0.00			0.000	1.00	26	28.65	28.80	-0.023	-0.023	0.05	0.01	0.000
														Total Flow:	6.294

Total Flow:	**6.294**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**5.92**		**(m^2)**
Top Width:	**12.30**		**(m)**
Hydraulic Depth:	**0.481**		**(m)**
Mean Velocity:	**1.063**		**(m/s)**
Froude Number	**0.489**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	11.34V	
Datalogger External Power:	12.90V	
Datalogger Memory Used:	57235 free	
Datalogger Clock:	Jun 01, 2004 10:10	MST
Laptop Clock:	Jun 01, 2004 11:10	MDT
Dessicant:	Good	
Datalogger:	Lakewood UI RX s/n 207085	
PT:	Keller 984631 - 2psi	
Power:	Lakewood battery	

Notes: TSS sample collected.
Changed "stop on memory full" from checked to unchecked
Flow is in flood stage, too high and fast to try to retreive transducer and re-install in housing.
Looks like transducer may have moved slightly, but is OK at present.

Hydrometric Measurement / Site Visit Record

S2 - Jackpine Creek at Canterra Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Jackpine Creek
Location:	Jackpine Creek at Canterra Road
Site Name:	S2
Coordinates & Legal:	6343680 N, 475132 E SE-17-95-9-W4

Time of Measurement

Date of Measurement:	July 22, 2004	
Start Time:	8:45 AM	MDT
End Time:	9:00 AM	MDT

Weather Conditions: +15 C, Calm, Clear

River Conditions: Open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: W Abut	0.418	El:	300.250	0.652	El:	300.250
Water Level Reading:		El:		4.067	El:	296.835
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.141	El:		0.141	El:	296.694
Other: Water @ Sect	3.741	El:	296.927	3.967	El:	296.935

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	9.90	0.00	0.00			0.000	1.00	1	9.90	9.55	0.001	0.001	0.02	0.01	0.000
	9.20	0.08	0.00			0.003	1.00	2	9.55	8.95	0.003	0.003	0.08	0.05	0.000
	8.70	0.13	0.00			0.107	1.00	3	8.95	8.45	0.107	0.107	0.13	0.07	0.007
	8.20	0.17	0.00			0.140	1.00	4	8.45	8.10	0.140	0.140	0.17	0.06	0.008
	8.00	0.18	0.00			0.058	1.00	5	8.10	7.90	0.058	0.058	0.18	0.04	0.002
	7.80	0.17	0.00			0.113	1.00	6	7.90	7.70	0.113	0.113	0.17	0.03	0.004
	7.60	0.14	0.00			0.125	1.00	7	7.70	7.50	0.125	0.125	0.14	0.03	0.003
	7.40	0.18	0.00			0.177	1.00	8	7.50	7.30	0.177	0.177	0.18	0.04	0.006
	7.20	0.23	0.00			0.256	1.00	9	7.30	7.10	0.256	0.256	0.23	0.05	0.012
	7.00	0.24	0.00			0.241	1.00	10	7.10	6.90	0.241	0.241	0.24	0.05	0.012
	6.80	0.26	0.00			0.332	1.00	11	6.90	6.70	0.332	0.332	0.26	0.05	0.017
	6.60	0.26	0.00			0.326	1.00	12	6.70	6.50	0.326	0.326	0.26	0.05	0.017
	6.40	0.26	0.00			0.326	1.00	13	6.50	6.30	0.326	0.326	0.26	0.05	0.017
	6.20	0.27	0.00			0.287	1.00	14	6.30	6.10	0.287	0.287	0.27	0.05	0.015
	6.00	0.27	0.00			0.317	1.00	15	6.10	5.90	0.317	0.317	0.27	0.05	0.017
	5.80	0.23	0.00			0.213	1.00	16	5.90	5.70	0.213	0.213	0.23	0.05	0.010
	5.60	0.22	0.00			0.018	1.00	17	5.70	5.50	0.018	0.018	0.22	0.04	0.001
	5.40	0.25	0.00			0.180	1.00	18	5.50	5.30	0.180	0.180	0.25	0.05	0.009
	5.20	0.23	0.00			0.265	1.00	19	5.30	5.10	0.265	0.265	0.23	0.05	0.012
	5.00	0.23	0.00			0.232	1.00	20	5.10	4.90	0.232	0.232	0.23	0.05	0.011
	4.80	0.22	0.00			0.174	1.00	21	4.90	4.70	0.174	0.174	0.22	0.04	0.008
	4.60	0.21	0.00			0.146	1.00	22	4.70	4.50	0.146	0.146	0.21	0.04	0.006
	4.40	0.20	0.00			0.125	1.00	23	4.50	4.30	0.125	0.125	0.20	0.04	0.005
	4.20	0.24	0.00			0.122	1.00	24	4.30	4.10	0.122	0.122	0.24	0.05	0.006
	4.00	0.23	0.00			0.055	1.00	25	4.10	3.75	0.055	0.055	0.23	0.08	0.004
	3.50	0.14	0.00			0.088	1.00	26	3.75	3.25	0.088	0.088	0.14	0.07	0.006
	3.00	0.08	0.00			0.052	1.00	27	3.25	2.40	0.052	0.052	0.08	0.07	0.004
RB	1.80	0.00	0.00			0.000	1.00	28	2.40	1.80	0.013	0.013	0.02	0.01	0.000
														Total Flow:	0.220

Total Flow:	**0.220**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**1.31**		**(m^2)**
Top Width:	**8.10**		**(m)**
Hydraulic Depth:	**0.161**		**(m)**
Mean Velocity:	**0.168**		**(m/s)**
Froude Number	**0.133**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected.

Datalogger Notes:		
Datalogger Internal Power:	100	%
Datalogger External Power:	81.00	%
Datalogger Memory Used:	81%	
Datalogger Clock:	Jul 22, 2004 07:27	MST
Laptop Clock:	Jul 22, 2004 08:29	MDT
Dessicant:	Good	
Datalogger:	Lakewood UI RX s/n 207085	
PT:	Keller 984631 - 2psi	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S2 - Jackpine Creek at Canterra Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Jackpine Creek
Location:	Jackpine Creek at Canterra Road
Site Name:	S2
Coordinates & Legal:	6343680 N, 475132 E SE-17-95-9-W4

Time of Measurement

Date of Measurement:	July 25, 2004	
Start Time:	11:40 AM	MDT
End Time:		MDT

Weather Conditions: +30 C, Calm, Clear

River Conditions: Open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings — **Setup No. 1**

Bench Mark Reading:	W Abut	0.871	El:	300.250
Water Level Reading:	OLD	4.382	El:	296.739
Water Level Reading:	NEW	4.301	El:	296.820
Transducer Reading & Calc'd E	OLD	0.130	El:	296.609
Transducer Reading & Calc'd E	NEW	0.255	El:	296.565
Transducer Difference				0.044

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected.

Datalogger Notes:			
Datalogger Internal Power:	100	%	
Datalogger External Power:	83.00	%	
Datalogger Memory Used:	25%		
Datalogger Clock:	Jul 25, 2004 11:41		MST
Laptop Clock:	Jul 25, 2004 12:42		MDT
Dessicant:	Good		
Datalogger:	Lakewood UI RX s/n 207085		
PT:	Keller 984631 - 2psi		
Power:	Lakewood battery		

Hydrometric Measurement / Site Visit Record

S2 - Jackpine Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Jackpine Creek
Location:	Jackpine Creek
Site Name:	S2
Coordinates & Legal:	6343680 N, 475132 E SE-17-95-9-W4

Time of Measurement

Date of Measurement:	August 27, 2004
Start Time:	5:41 PM MDT
End Time:	5:53 PM MDT

Weather Conditions: 17 °C, clear, calm

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: PVC	0.651	El:	297.990	0.676	El:	297.990
Water Level Reading:	1.843	El:	296.798	1.871	El:	296.795
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.242	El:	296.556	0.242	El:	296.553
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	19.70	0.00	0.00			0.000	1.00	1	19.70	19.85	0.011	0.011	0.02	0.00	0.000
	20.00	0.06	0.00			0.043	1.00	2	19.85	20.25	0.043	0.043	0.06	0.02	0.001
	20.50	0.09	0.00			0.128	1.00	3	20.25	20.65	0.128	0.128	0.09	0.04	0.005
	20.80	0.08	0.00			0.104	1.00	4	20.65	21.00	0.104	0.104	0.08	0.03	0.003
	21.20	0.19	0.00			0.204	1.00	5	21.00	21.35	0.204	0.204	0.19	0.07	0.014
	21.50	0.13	0.00			0.253	1.00	6	21.35	21.60	0.253	0.253	0.13	0.03	0.008
	21.70	0.17	0.00			0.195	1.00	7	21.60	21.80	0.195	0.195	0.17	0.03	0.007
	21.90	0.15	0.00			0.189	1.00	8	21.80	22.05	0.189	0.189	0.15	0.04	0.007
	22.20	0.10	0.00			0.235	1.00	9	22.05	22.35	0.235	0.235	0.10	0.03	0.007
	22.50	0.07	0.00			0.183	1.00	10	22.35	22.65	0.183	0.183	0.07	0.02	0.004
	22.80	0.10	0.00			0.143	1.00	11	22.65	22.95	0.143	0.143	0.10	0.03	0.004
	23.10	0.05	0.00			0.146	1.00	12	22.95	23.25	0.146	0.146	0.05	0.01	0.002
	23.40	0.06	0.00			0.201	1.00	13	23.25	23.60	0.201	0.201	0.06	0.02	0.004
	23.80	0.05	0.00			0.094	1.00	14	23.60	23.95	0.094	0.094	0.05	0.02	0.002
	24.10	0.04	0.00			0.055	1.00	15	23.95	24.35	0.055	0.055	0.04	0.02	0.001
	24.60	0.06	0.00			0.003	1.00	16	24.35	24.80	0.003	0.003	0.06	0.03	0.000
	25.00	0.10	0.00			0.030	1.00	17	24.80	25.25	0.030	0.030	0.10	0.04	0.001
	25.50	0.04	0.00			0.037	1.00	18	25.25	25.60	0.037	0.037	0.03	0.01	0.000
rb	25.70	0.00	0.00			0.00	1.00	19	25.60	25.70	0.01	0.01	0.01	0.00	0.000
														Total Flow:	0.070

Total Flow:	**0.070**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.49**		**(m^2)**
Top Width:	**5.80**		**(m)**
Hydraulic Depth:	**0.085**		**(m)**
Mean Velocity:	**0.142**		**(m/s)**
Froude Number	**0.156**		
Photographs taken looking at: Upstream, downstream, across			

Notes:
TSS Sample Taken

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	12.53V	81%
Datalogger Memory Used:		
Datalogger Clock:	Aug 27, 2004 16:33	MST
Laptop Clock:	Aug 27, 2004 17:36	MDT
Dessicant:	good	
Datalogger:	207085	
PT:	984631	
Power:		

Hydrometric Measurement / Site Visit Record

S2 - Jackpine Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Jackpine Creek
Location:	Jackpine Creek
Site Name:	S2
Coordinates & Legal:	6343680 N, 475132 E SE-17-95-9-W4

Time of Measurement

Date of Measurement:	September 21, 2004
Start Time:	1:32 PM MDT
End Time:	1:47 PM MDT

Weather Conditions: 1 °C, clear, windy

River Conditions: open, high

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: PVC	0.563	El:	297.990	0.746	El:	297.990
Water Level Reading:	1.612	El:	296.941	1.799	El:	296.937
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.381	El:	296.560	0.381	El:	296.556
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	17.75	0.00	0.00			0.000	1.00	1	17.75	17.88	0.135	0.135	0.07	0.01	0.001
	18.00	0.28	0.00			0.539	1.00	2	17.88	18.25	0.539	0.539	0.28	0.11	0.057
	18.50	0.22	0.00			0.149	1.00	3	18.25	18.75	0.149	0.149	0.22	0.11	0.016
	19.00	0.20	0.00			0.433	1.00	4	18.75	19.25	0.433	0.433	0.20	0.10	0.043
	19.50	0.29	0.00			0.646	1.00	5	19.25	19.65	0.646	0.646	0.29	0.12	0.075
	19.80	0.31	0.00			0.494	1.00	6	19.65	19.95	0.494	0.494	0.31	0.09	0.046
	20.10	0.35	0.00			0.713	1.00	7	19.95	20.25	0.713	0.713	0.35	0.10	0.075
	20.40	0.36	0.00			0.405	1.00	8	20.25	20.55	0.405	0.405	0.36	0.11	0.044
	20.70	0.35	0.00			0.573	1.00	9	20.55	20.85	0.573	0.573	0.35	0.11	0.060
	21.00	0.33	0.00			0.649	1.00	10	20.85	21.15	0.649	0.649	0.33	0.10	0.064
	21.30	0.30	0.00			0.229	1.00	11	21.15	21.55	0.229	0.229	0.30	0.12	0.027
	21.80	0.29	0.00			0.591	1.00	12	21.55	22.05	0.591	0.591	0.29	0.15	0.086
	22.30	0.25	0.00			0.570	1.00	13	22.05	22.55	0.570	0.570	0.25	0.13	0.071
	22.80	0.20	0.00			0.494	1.00	14	22.55	23.05	0.494	0.494	0.20	0.10	0.049
	23.30	0.20	0.00			0.640	1.00	15	23.05	23.55	0.640	0.640	0.20	0.10	0.064
	23.80	0.12	0.00			0.485	1.00	16	23.55	24.05	0.485	0.485	0.12	0.06	0.029
	24.30	0.11	0.00			0.393	1.00	17	24.05	24.80	0.393	0.393	0.11	0.08	0.032
	25.30	0.10	0.00			0.171	1.00	18	24.80	25.80	0.171	0.171	0.10	0.10	0.017
	26.30	0.11	0.00			0.183	1.00	19	25.80	26.80	0.183	0.183	0.11	0.11	0.020
	27.30	0.05	0.00			0.131	1.00	20	26.80	27.75	0.131	0.131	0.05	0.05	0.006
LB	28.20	0.00	0.00			0.000	1.00	21	27.75	28.20	0.03	0.033	0.01	0.01	0.000
														Total Flow:	0.883

Total Flow:	**0.884**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**1.94**		**(m^2)**
Top Width:	**9.55**		**(m)**
Hydraulic Depth:	**0.203**		**(m)**
Mean Velocity:	**0.456**		**(m/s)**
Froude Number	**0.323**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:			
Datalogger Internal Power:	11.34V	100%	
Datalogger External Power:	12.29	79%	
Datalogger Memory Used:			
Datalogger Clock:	Sep 21, 2004 20:27		MST
Laptop Clock:	Sep 21, 2004 20:31		MST
Dessicant:	good		
Datalogger:	207085		
PT:	984631		
Power:			

Notes:
TSS Sample Taken

Hydrometric Measurement / Site Visit Record

S2 - Jackpine Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Jackpine Creek
Location:	Jackpine Creek
Site Name:	S2
Coordinates & Legal:	6343680 N, 475132 E SE-17-95-9-W4

Time of Measurement

Date of Measurement:	October 29, 2004
Start Time:	9:05 AM MDT
End Time:	9:42 AM MDT

Weather Conditions: -1 °C, clear, calm

River Conditions: partial ice cover, ice broken out through MMT section on LB.

Personnel & Equipment

Measurement Made By:	FF/ND/DM
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Pin on RB	2.994	El:	297.990	2.845	El:	297.990
Water Level Reading:		4.070	El:	296.914	3.929	El:	296.906
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd El.		0.336	El:	296.578	0.336	El:	296.570
Other:	Bridge	0.729	El:	300.255	0.582	El:	300.253

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	2.80	0.00	0.00			0.000	1.00	1	2.80	2.90	0.001	0.001	0.01	0.00	0.000
	3.00	0.04	0.00			0.003	1.00	2	2.90	3.25	0.003	0.003	0.04	0.01	0.000
	3.50	0.05	0.00			0.003	1.00	3	3.25	3.68	0.003	0.003	0.05	0.02	0.000
	3.85	0.00	0.00			0.000	1.00	4	3.68	4.53	0.000	0.000	0.00	0.00	0.000
	5.20	0.00	0.00			0.000	1.00	5	4.53	5.35	0.000	0.000	0.00	0.00	0.000
	5.50	0.09	0.00			0.003	1.00	6	5.35	5.75	0.003	0.003	0.09	0.04	0.000
	6.00	0.10	0.00			0.034	1.00	7	5.75	6.25	0.034	0.034	0.10	0.05	0.002
	6.50	0.12	0.00			0.223	1.00	8	6.25	6.75	0.223	0.223	0.12	0.06	0.013
	7.00	0.18	0.00			0.232	1.00	9	6.75	7.25	0.232	0.232	0.18	0.09	0.021
	7.50	0.17	0.00			0.332	1.00	10	7.25	7.75	0.332	0.332	0.17	0.09	0.028
	8.00	0.22	0.00			0.311	1.00	11	7.75	8.13	0.311	0.311	0.22	0.08	0.026
	8.25	0.25	0.00			0.259	1.00	12	8.13	8.38	0.259	0.259	0.25	0.06	0.016
	8.50	0.25	0.00			0.323	1.00	13	8.38	8.75	0.323	0.323	0.25	0.09	0.030
	9.00	0.27	0.00			0.372	1.00	14	8.75	9.13	0.372	0.372	0.27	0.10	0.038
	9.25	0.30	0.00			0.329	1.00	15	9.13	9.38	0.329	0.329	0.30	0.08	0.025
	9.50	0.30	0.00			0.384	1.00	16	9.38	9.63	0.384	0.384	0.30	0.08	0.029
	9.75	0.29	0.00			0.296	1.00	17	9.63	9.88	0.296	0.296	0.29	0.07	0.021
	10.00	0.27	0.00			0.341	1.00	18	9.88	10.13	0.341	0.341	0.27	0.07	0.023
	10.25	0.28	0.00			0.332	1.00	19	10.13	10.38	0.332	0.332	0.28	0.07	0.023
	10.50	0.26	0.00			0.244	1.00	20	10.38	10.75	0.244	0.244	0.26	0.10	0.024
	11.00	0.14	0.00			0.195	1.00	21	10.75	11.25	0.195	0.195	0.14	0.07	0.014
	11.50	0.20	0.00			0.131	1.00	22	11.25	11.75	0.131	0.131	0.20	0.10	0.013
	12.00	0.23	0.00			0.113	1.00	23	11.75	12.13	0.113	0.113	0.23	0.09	0.010
	12.25	0.20	0.00			0.122	1.00	24	12.13	12.53	0.122	0.122	0.20	0.08	0.010
RB	12.80	0.00	0.00			0.000	1.00	25	12.53	12.80	0.03	0.030	0.05	0.01	0.000
														Total Flow:	0.366

Total Flow:	**0.366**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**1.50**		**(m^2)**
Top Width:	**10.00**		**(m)**
Hydraulic Depth:	**0.150**		**(m)**
Mean Velocity:	**0.243**		**(m/s)**
Froude Number	**0.200**		

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	12.17	78%
Datalogger Memory Used:		
Datalogger Clock:	Oct 29, 2004 08:18	MST
Laptop Clock:	Oct 29, 2004 08:20	MST
Dessicant:	good	
Datalogger:	207085	
PT:	984631	
Power:		

Notes:
TSS Sample Taken

Hydrometric Measurement / Site Visit Record

S2 - Jackpine Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Jackpine Creek
Location:	Jackpine Creek
Site Name:	S2
Coordinates & Legal:	6343680 N, 475132 E SE-17-95-9-W4

Time of Measurement

Date of Measurement:	October 30, 2004
Start Time:	11:51 AM MDT
End Time:	12:45 PM MDT

Weather Conditions: +2 °C, clear, calm

River Conditions: partial ice cover, ice broken out through MMT section on LB.

Personnel & Equipment

Measurement Made By:	FF/ND/DM
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: Pin on RB	2.345	El:	297.990	2.125	El:	297.990
Water Level Reading:	3.511	El:	296.824	3.302	El:	296.813
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El.	0.323	El:	296.502	0.323	El:	296.491
Other: New Transducer E	0.701	El:	296.185	0.701	El:	296.185

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	2.60	0.00	0.00			0.000	1.00	1	2.60	2.68	0.001	0.001	0.01	0.00	0.000
	2.75	0.03	0.00			0.003	1.00	2	2.68	2.88	0.003	0.003	0.03	0.01	0.000
	3.00	0.05	0.00			0.030	1.00	3	2.88	3.15	0.030	0.030	0.05	0.01	0.000
	3.30	0.04	0.00			0.122	1.00	4	3.15	3.50	0.122	0.122	0.04	0.01	0.002
	3.70	0.02	0.00			0.003	1.00	5	3.50	4.25	0.003	0.003	0.02	0.02	0.000
	4.80	0.05	0.00			0.003	1.00	6	4.25	5.15	0.003	0.003	0.05	0.05	0.000
	5.50	0.09	0.00			0.012	1.00	7	5.15	5.75	0.012	0.012	0.09	0.05	0.001
	6.00	0.10	0.00			0.107	1.00	8	5.75	6.25	0.107	0.107	0.10	0.05	0.005
	6.50	0.11	0.00			0.210	1.00	9	6.25	6.75	0.210	0.210	0.11	0.06	0.012
	7.00	0.16	0.00			0.253	1.00	10	6.75	7.25	0.253	0.253	0.16	0.08	0.020
	7.50	0.16	0.00			0.341	1.00	11	7.25	7.75	0.341	0.341	0.16	0.08	0.027
	8.00	0.17	0.00			0.405	1.00	12	7.75	8.13	0.405	0.405	0.17	0.06	0.026
	8.25	0.20	0.00			0.451	1.00	13	8.13	8.38	0.451	0.451	0.20	0.05	0.023
	8.50	0.25	0.00			0.375	1.00	14	8.38	8.63	0.375	0.375	0.25	0.06	0.023
	8.75	0.19	0.00			0.399	1.00	15	8.63	8.88	0.399	0.399	0.19	0.05	0.019
	9.00	0.20	0.00			0.390	1.00	16	8.88	9.00	0.390	0.390	0.20	0.03	0.010
	\9.25	0.24	0.00			0.463	1.00	17	9.00	9.50	0.463	0.463	0.24	0.12	0.056
	9.50	0.24	0.00			0.543	1.00	18	9.50	9.63	0.543	0.543	0.24	0.03	0.016
	9.75	0.24	0.00			0.500	1.00	19	9.63	9.88	0.500	0.500	0.24	0.06	0.030
	10.00	0.27	0.00			0.451	1.00	20	9.88	10.13	0.451	0.451	0.27	0.07	0.030
	10.25	0.23	0.00			0.402	1.00	21	10.13	10.38	0.402	0.402	0.23	0.06	0.023
	10.50	0.20	0.00			0.424	1.00	22	10.38	10.63	0.424	0.424	0.20	0.05	0.021
	10.75	0.13	0.00			0.250	1.00	23	10.63	10.88	0.250	0.250	0.13	0.03	0.008
	11.00	0.12	0.00			0.149	1.00	24	10.88	11.25	0.149	0.149	0.12	0.05	0.007
	11.50	0.11	0.00			0.341	1.00	25	11.25	11.75	0.341	0.341	0.11	0.06	0.019
	12.00	0.20	0.00			0.189	1.00	26	11.75	12.25	0.189	0.189	0.20	0.10	0.019
	12.50	0.11	0.00			0.149	1.00	27	12.25	12.63	0.149	0.149	0.11	0.04	0.006
RB	12.75	0.00	0.00			0.000	1.00	28	12.63	12.75	0.04	0.037	0.03	0.00	0.000
														Total Flow:	0.403

Total Flow:	**0.403**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**1.32**		**(m^2)**
Top Width:	**10.15**		**(m)**
Hydraulic Depth:	**0.130**		**(m)**
Mean Velocity:	**0.305**		**(m/s)**
Froude Number	**0.269**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	12.29	78%
Datalogger Memory Used:		
Datalogger Clock:	Oct 30, 2004 10:53	MST
Laptop Clock:	Oct 30, 2004 10:55	MST
Dessicant:	good	
Datalogger:	207085	
PT:	984631	
Power:		

Notes:
Transducer installed deeper in flow for winter.

Hydrometric Measurement / Site Visit Record

S2 - Jackpine Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Jackpine Creek
Location:	Jackpine Creek
Site Name:	S2
Coordinates & Legal:	6343680 N, 475132 E SE-17-95-9-W4

Time of Measurement

Date of Measurement:	December 1, 2004
Start Time:	11:00 AM MST
End Time:	MST

Weather Conditions: -17 °C, overcast

River Conditions: Full Ice cover, ice is very thin ~ 1" near edge, frozen to bottom at other locations

Personnel & Equipment

Measurement Made By:	ND/CT/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Pin on RB	0.753	El:	297.990	0.826	El:	297.990
Water Level Reading:		1.956	El:	296.787	2.032	El:	296.784
Top of Ice Level Reading:		1.814	El:		1.915	El:	
Transducer Reading & Calc'd El.		0.593	El:	296.194	0.593	El:	296.191
Other:			El:	296.787		El:	296.784

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:			
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	11.92V	77%
Datalogger Memory Used:		
Datalogger Clock:	Dec 01, 2004 11:03	MST
Laptop Clock:	Dec 01, 2004 11:08	MST
Dessicant:	Good	
Datalogger:	207085	
PT:		
Power:		

Notes:
Manual Measurement not taken due to marginal ice conditions. Wading measurement not taken due to cold temperatures.

Hydrometric Measurement / Site Visit Record

S3 - Lyinimin Creek above Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Iyinimin Creek
Location:	Iyinimin Creek above Kearl Lake
Site Name:	S3
Coordinates & Legal:	6345029 N, 489491 E NE-14-95-8-W4

Time of Measurement

Date of Measurement:	April 26, 2004
Start Time:	8:59 AM MDT
End Time:	9:07 AM MDT

Weather Conditions: +1 C, Clear, Calm,

River Conditions: Full ice cover at transducer / level monitoring location. Flow measurement made at partially open section 40 m downstream. Flow ice affected.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**		**Setup No. 2**	
Bench Mark Reading: Nail on LB	N/A	El: 360.610	N/A	El: 360.610	
Water Level Reading:	N/A	El:	N/A	El:	
Top of Ice Level Reading:		El:		El:	
Transducer Reading & Calc'd El	N/A	El:	N/A	El:	
Other:		El:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	4.50	0.00	0.00			0.000	1.00	1	4.50	4.95	0.002	0.002	0.07	0.03	0.000
	5.40	0.27	0.00			0.009	1.00	2	4.95	5.50	0.009	0.009	0.27	0.15	0.001
	5.60	0.30	0.00			0.165	1.00	3	5.50	5.70	0.165	0.165	0.30	0.06	0.010
	5.80	0.31	0.00			0.037	1.00	4	5.70	5.90	0.037	0.037	0.31	0.06	0.002
	6.00	0.35	0.00			0.021	1.00	5	5.90	6.10	0.021	0.021	0.35	0.07	0.001
	6.20	0.36	0.00			0.186	1.00	6	6.10	6.30	0.186	0.186	0.36	0.07	0.013
	6.40	0.39	0.00			0.232	1.00	7	6.30	6.50	0.232	0.232	0.39	0.08	0.018
	6.60	0.43	0.00			0.344	1.00	8	6.50	6.70	0.344	0.344	0.43	0.09	0.030
	6.80	0.39	0.00			0.445	1.00	9	6.70	6.90	0.445	0.445	0.39	0.08	0.035
	7.00	0.34	0.00			0.195	1.00	10	6.90	7.13	0.195	0.195	0.34	0.08	0.015
	7.25	0.35	0.00			0.012	1.00	11	7.13	7.38	0.012	0.012	0.35	0.09	0.001
	7.50	0.40	0.00			0.009	1.00	12	7.38	7.75	0.009	0.009	0.40	0.15	0.001
LB	8.00	0.00	0.00			0.000	1.00	13	7.75	8.00	0.002	0.002	0.10	0.03	0.000
														Total Flow:	0.128

Total Flow:	**0.128**		**(m^3/s)**
Perceived Measurement Quality:	**Poor**		
Total Area:	**1.02**		**(m^2)**
Top Width:	**3.50**		**(m)**
Hydraulic Depth:	**0.293**		**(m)**
Mean Velocity:	**0.125**		**(m/s)**
Froude Number	**0.074**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	11.34V 100%	
Datalogger External Power:	12.7V 82%	
Datalogger Memory Used:	0%	
Datalogger Clock:	26/04/2004 7:47	MST
Laptop Clock:	26/04/2004 8:47	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #41174-08	
PT:	Keller Pressure Transducer #871 (not installed)	
Power:	Lakewood battery	

Notes:
TSS sample collected. Rain gauge TR525M-R2 s/n 28107-101 installed with 8" rain catcher. Ignore all tips before 626.
Partial ice cover at flow measurement section with water flowing over intact bank ice. Flow measurement likely underestimates actual discharge.
Full ice cover at water level monitoring location, with some flow over ice.

Hydrometric Measurement / Site Visit Record

S3 - Iyinimin Creek above Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Iyinimin Creek
Location:	Iyinimin Creek above Kearl Lake
Site Name:	S3
Coordinates & Legal:	6345029 N, 489491 E NE-14-95-8-W4

Time of Measurement

Date of Measurement:	May 16, 2004	
Start Time:	9:59 AM	MDT
End Time:		MDT

Weather Conditions: +10 C, overcast

River Conditions: open

Personnel & Equipment

Measurement Made By:	DM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	in PVC	1.703	El:	360.610	1.632	El:	360.610
Water Level Reading:		3.267	El:	359.046	3.193	El:	359.049
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.492	El:	358.554	0.492	El:	358.557
Other:	Rod in Ri	2.487	El:	359.826	2.421	El:	359.821

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		
Photographs taken looking at:			

Datalogger Notes:		
Datalogger Internal Power:	12.34V 100%	
Datalogger External Power:	12.65V 81%	
Datalogger Memory Used:	0%	
Datalogger Clock:	May 16, 2004 09:01	MST
Laptop Clock:	May 16, 2004 09:59	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #41174-08	
PT:	Keller Pressure Transducer #871 (not installed)	
Power:	Lakewood battery	

Notes:
Transducer installed.
Tips at 761
Ignore tip #762 - this was a test of the rain gauge.

Hydrometric Measurement / Site Visit Record

S3 - Iyinimin Creek above Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Iyinimin Creek
Location:	Iyinimin Creek above Kearl Lake
Site Name:	S3
Coordinates & Legal:	6345029 N, 489491 E NE-14-95-8-W4

Time of Measurement

Date of Measurement:	June 2, 2004
Start Time:	10:28 AM MDT
End Time:	10:53 AM MDT

Weather Conditions: +10°C, Partly Cloudy,light wind,

River Conditions: open, high flood stage, very turbid flow

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Bar in PVC	1.682	El:	360.610	1.768	El:	360.610
Water Level Reading:		2.791	El:	359.501	2.882	El:	359.496
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd El		0.751	El:	358.750	0.751	El:	358.745
Other:			El:	362.292		El:	362.378

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	23.70	0.00	0.00			0.000	1.00	1	23.70	23.35	0.028	0.028	0.18	0.06	0.002
	23.00	0.70	0.00			0.113	1.00	2	23.35	22.95	0.113	0.113	0.70	0.28	0.032
	22.90	0.62	0.00			0.475	1.00	3	22.95	22.80	0.475	0.475	0.62	0.09	0.044
	22.70	0.66	0.00			0.158	1.00	4	22.80	22.60	0.158	0.158	0.66	0.13	0.021
	22.50	0.65	0.00			0.232	1.00	5	22.60	22.40	0.232	0.232	0.65	0.13	0.030
	22.30	0.76	0.00	0.88	0.05		1.00	6	22.40	22.20	0.466	0.466	0.76	0.15	0.071
	22.10	0.77	0.00	0.69	0.06		1.00	7	22.20	22.00	0.373	0.373	0.77	0.15	0.058
	21.90	0.77	0.00	0.54	0.10		1.00	8	22.00	21.80	0.319	0.319	0.77	0.15	0.049
	21.70	0.78	0.00	1.04	0.10		1.00	9	21.80	21.60	0.570	0.570	0.78	0.16	0.089
	21.50	0.81	0.00	1.08	-0.04		1.00	10	21.60	21.40	0.520	0.520	0.81	0.16	0.084
	21.30	0.83	0.00	1.14	0.52		1.00	11	21.40	21.20	0.828	0.828	0.83	0.17	0.137
	21.10	0.84	0.00	1.08	0.69		1.00	12	21.20	21.00	0.884	0.884	0.84	0.17	0.148
	20.90	0.81	0.00			0.838	1.00	13	21.00	20.80	0.838	0.838	0.81	0.16	0.136
	20.70	0.77	0.00			0.707	1.00	14	20.80	20.60	0.707	0.707	0.77	0.15	0.109
	20.50	0.73	0.00			0.168	1.00	15	20.60	20.40	0.168	0.168	0.73	0.15	0.024
	20.30	0.73	0.00			0.155	1.00	16	20.40	20.20	0.155	0.155	0.73	0.15	0.023
	20.10	0.73	0.00			0.329	1.00	17	20.20	20.00	0.329	0.329	0.73	0.15	0.048
	19.90	0.64	0.00			0.180	1.00	18	20.00	19.80	0.180	0.180	0.64	0.13	0.023
	19.70	0.57	0.00			0.061	1.00	19	19.80	19.60	0.061	0.061	0.57	0.11	0.007
	19.50	0.52	0.00			-0.040	1.00	20	19.60	19.40	-0.040	-0.040	0.52	0.10	-0.004
	19.30	0.48	0.00			-0.030	1.00	21	19.40	19.10	-0.030	-0.030	0.48	0.14	-0.004
LB	18.90	0.00	0.00			0.000	1.00	22	19.10	18.90	0.000	0.000	0.12	0.02	0.000
														Total Flow:	1.126

Total Flow:	**1.126**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**3.08**		**(m^2)**
Top Width:	**4.80**		**(m)**
Hydraulic Depth:	**0.641**		**(m)**
Mean Velocity:	**0.366**		**(m/s)**
Froude Number	**0.146**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	11.34V 100%	
Datalogger External Power:	12.72 V 82%	
Datalogger Memory Used:	255046 left	
Datalogger Clock:	9:19:39 AM	MST
Laptop Clock:	10:19:51 AM	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #41174-08	
PT:	Keller Pressure Transducer #871 (not installed)	
Power:	Lakewood battery	

Notes:
TSS sample collected. Rain gauge bottom removed at 10:25 AM, swapped with S16 and replaced at 8:28 PM. Tips at 960 prior to swap, tips up to 1049 (tipping during installation) these 69 tips do not represent rainfall, there was a rainfall in the area during the 10 hours the TBRG was not operating
River is very high, water is turbid.

Hydrometric Measurement / Site Visit Record

S3 - Iyinimin Creek above Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Iyinimin Creek
Location:	Iyinimin Creek above Kearl Lake
Site Name:	S3
Coordinates & Legal:	6345029 N, 489491 E NE-14-95-8-W4

Time of Measurement

Date of Measurement:	July 24, 2004	
Start Time:	8:18 AM	MDT
End Time:	8:37 AM	MDT

Weather Conditions: +10˚C, Clear, Calm

River Conditions: open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Bar in PVC	1.638	El:	360.610	1.519	El:	360.610
Water Level Reading:		3.411	El:	358.837	3.302	El:	358.827
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.236	El:	358.601	0.236	El:	358.591
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	2.85	0.00	0.00			0.000	1.00	1	2.85	2.78	0.000	0.000	0.02	0.00	0.000
	2.70	0.08	0.00			0.001	1.00	2	2.78	2.65	0.001	0.001	0.08	0.01	0.000
	2.60	0.09	0.00			0.001	1.00	3	2.65	2.55	0.001	0.001	0.09	0.01	0.000
	2.50	0.14	0.00			0.030	1.00	4	2.55	2.45	0.030	0.030	0.14	0.01	0.000
	2.40	0.11	0.00			0.030	1.00	5	2.45	2.35	0.030	0.030	0.11	0.01	0.000
	2.30	0.24	0.00			0.043	1.00	6	2.35	2.25	0.043	0.043	0.24	0.02	0.001
	2.20	0.28	0.00			0.034	1.00	7	2.25	2.15	0.034	0.034	0.28	0.03	0.001
	2.10	0.24	0.00			0.043	1.00	8	2.15	2.05	0.043	0.043	0.24	0.02	0.001
	2.00	0.24	0.00			0.040	1.00	9	2.05	1.95	0.040	0.040	0.24	0.02	0.001
	1.90	0.20	0.00			0.021	1.00	10	1.95	1.85	0.021	0.021	0.20	0.02	0.000
	1.80	0.19	0.00			0.018	1.00	11	1.85	1.75	0.018	0.018	0.19	0.02	0.000
	1.70	0.19	0.00			0.037	1.00	12	1.75	1.65	0.037	0.037	0.19	0.02	0.001
	1.60	0.20	0.00			0.040	1.00	13	1.65	1.55	0.040	0.040	0.20	0.02	0.001
	1.50	0.21	0.00			0.021	1.00	14	1.55	1.45	0.021	0.021	0.21	0.02	0.000
	1.40	0.22	0.00			0.027	1.00	15	1.45	1.35	0.027	0.027	0.22	0.02	0.001
	1.30	0.23	0.00			0.030	1.00	16	1.35	1.25	0.030	0.030	0.23	0.02	0.001
	1.20	0.19	0.00			0.030	1.00	17	1.25	1.15	0.030	0.030	0.19	0.02	0.001
	1.10	0.20	0.00			0.030	1.00	18	1.15	1.05	0.030	0.030	0.20	0.02	0.001
	1.00	0.18	0.00			0.018	1.00	19	1.05	0.95	0.018	0.018	0.18	0.02	0.000
	0.90	0.18	0.00			-0.007	1.00	20	0.95	0.85	-0.007	-0.007	0.18	0.02	0.000
	0.80	0.10	0.00			0.015	1.00	21	0.85	0.75	0.015	0.015	0.10	0.01	0.000
RB	0.70	0.00	0.00			0.000	1.00	22	0.75	0.70	0.000	0.000	0.03	0.00	0.000
														Total Flow:	0.010

Total Flow:	**0.010**		(m^3/s)
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.38**		(m^2)
Top Width:	**2.15**		(m)
Hydraulic Depth:	**0.175**		(m)
Mean Velocity:	**0.027**		(m/s)
Froude Number	**0.021**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected
1139 Tips in Rain Gauge

Datalogger Notes:		
Datalogger Internal Power:	11.34V 100%	
Datalogger External Power:	12.53 V 81%	
Datalogger Memory Used:	80%	
Datalogger Clock:	Jul 24, 2004 07:48	MST
Laptop Clock:	Jul 24, 2004 08:01	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #41174-08	
PT:	Keller Pressure Transducer #871 (not installed)	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S3 - Iyinimin Creek above Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Iyinimin Creek
Location:	Iyinimin Creek above Kearl Lake
Site Name:	S3
Coordinates & Legal:	6345029 N, 489491 E NE-14-95-8-W4

Time of Measurement

Date of Measurement:	August 26, 2004
Start Time:	12:25 PM MDT
End Time:	12:38 PM MDT

Weather Conditions: +10 C, Partly Cloudy, Calm

River Conditions: open, low flow

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2001463 (rental)

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Bar in PVC	1.730	El:	360.610	1.688	El:	360.610
Water Level Reading:		3.529	El:	358.811	3.487	El:	358.811
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.196	El:	358.615	0.196	El:	358.615
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	0.40	0.00	0.00			0.000	1.00	1	0.40	0.50	0.007	0.007	0.04	0.00	0.000
	0.60	0.16	0.00			0.027	1.00	2	0.50	0.65	0.027	0.027	0.16	0.02	0.001
	0.70	0.20	0.00			0.012	1.00	3	0.65	0.75	0.012	0.012	0.20	0.02	0.000
	0.80	0.19	0.00			0.009	1.00	4	0.75	0.85	0.009	0.009	0.19	0.02	0.000
	0.90	0.19	0.00			0.006	1.00	5	0.85	0.95	0.006	0.006	0.19	0.02	0.000
	1.00	0.17	0.00			0.018	1.00	6	0.95	1.05	0.018	0.018	0.17	0.02	0.000
	1.10	0.15	0.00			0.015	1.00	7	1.05	1.15	0.015	0.015	0.15	0.02	0.000
	1.20	0.16	0.00			0.034	1.00	8	1.15	1.25	0.034	0.034	0.16	0.02	0.001
	1.30	0.17	0.00			0.040	1.00	9	1.25	1.35	0.040	0.040	0.17	0.02	0.001
	1.40	0.21	0.00			0.043	1.00	10	1.35	1.45	0.043	0.043	0.21	0.02	0.001
	1.50	0.22	0.00			0.052	1.00	11	1.45	1.55	0.052	0.052	0.22	0.02	0.001
	1.60	0.26	0.00			0.027	1.00	12	1.55	1.65	0.027	0.027	0.26	0.03	0.001
	1.70	0.26	0.00			0.040	1.00	13	1.65	1.75	0.040	0.040	0.26	0.03	0.001
	1.80	0.26	0.00			0.049	1.00	14	1.75	1.85	0.049	0.049	0.26	0.03	0.001
	1.90	0.24	0.00			0.043	1.00	15	1.85	1.95	0.043	0.043	0.24	0.02	0.001
	2.00	0.24	0.00			0.040	1.00	16	1.95	2.05	0.040	0.040	0.24	0.02	0.001
	2.10	0.25	0.00			0.030	1.00	17	2.05	2.15	0.030	0.030	0.25	0.03	0.001
	2.20	0.20	0.00			0.012	1.00	18	2.15	2.25	0.012	0.012	0.20	0.02	0.000
	2.30	0.25	0.00			-0.006	1.00	19	2.25	2.35	-0.006	-0.006	0.25	0.02	0.000
	2.40	0.16	0.00			-0.012	1.00	20	2.35	2.45	-0.012	-0.012	0.16	0.02	0.000
	2.50	0.09	0.00			-0.015	1.00	21	2.45	2.63	-0.015	-0.015	0.09	0.02	0.000
LB	2.75	0.00	0.00			0.000	1.00	22	2.63	2.75	0.000	0.000	0.02	0.00	0.000
														Total Flow:	0.010

Total Flow:	**0.010**		(m^3/s)
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.42**		(m^2)
Top Width:	**2.35**		(m)
Hydraulic Depth:	**0.181**		(m)
Mean Velocity:	**0.025**		(m/s)
Froude Number	**0.018**		

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:		
Datalogger Internal Power:	11.34V 100%	
Datalogger External Power:	12.53 V 81%	
Datalogger Memory Used:	wrapped	
Datalogger Clock:	Aug 26, 2004 11:07	MST
Laptop Clock:	Aug 26, 2004 12:08	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #41174-08	
PT:	Keller Pressure Transducer #871 (not installed)	
Power:	Lakewood battery	

Notes: TSS sample collected
1288 Tips in Rain Gauge - bucket may have tipped on landing as helicopter landed beside TBRG

Hydrometric Measurement / Site Visit Record

S3 - Iyinimin Creek above Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Iyinimin Creek
Location:	Iyinimin Creek above Kearl Lake
Site Name:	S3
Coordinates & Legal:	6345029 N, 489491 E NE-14-95-8-W4

Time of Measurement

Date of Measurement:	September 23, 2004
Start Time:	10:01 AM MDT
End Time:	10:13 AM MDT

Weather Conditions: +18 C, Overcast, Calm

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Bar in PVC	1.340	El:	360.610	1.252	El:	360.610
Water Level Reading:		2.961	El:	358.989	2.878	El:	358.984
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.401	El:	358.588	0.401	El:	358.583
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	17.70	0.00	0.00			0.000	1.00	1	17.70	17.85	0.018	0.018	0.01	0.00	0.000
	18.00	0.05	0.00			0.073	1.00	2	17.85	18.10	0.073	0.073	0.05	0.01	0.001
	18.20	0.08	0.00			0.104	1.00	3	18.10	18.30	0.104	0.104	0.08	0.02	0.002
	18.40	0.15	0.00			0.024	1.00	4	18.30	18.50	0.024	0.024	0.15	0.03	0.001
	18.60	0.19	0.00			0.076	1.00	5	18.50	18.70	0.076	0.076	0.19	0.04	0.003
	18.80	0.35	0.00			0.067	1.00	6	18.70	18.90	0.067	0.067	0.35	0.07	0.005
	19.00	0.37	0.00			0.076	1.00	7	18.90	19.10	0.076	0.076	0.37	0.07	0.006
	19.20	0.35	0.00			0.122	1.00	8	19.10	19.30	0.122	0.122	0.35	0.07	0.009
	19.40	0.32	0.00			0.180	1.00	9	19.30	19.50	0.180	0.180	0.32	0.06	0.012
	19.60	0.35	0.00			0.134	1.00	10	19.50	19.70	0.134	0.134	0.35	0.07	0.009
	19.80	0.38	0.00			0.177	1.00	11	19.70	19.90	0.177	0.177	0.38	0.08	0.013
	20.00	0.33	0.00			0.201	1.00	12	19.90	20.10	0.201	0.201	0.33	0.07	0.013
	20.20	0.37	0.00			0.262	1.00	13	20.10	20.30	0.262	0.262	0.37	0.07	0.019
	20.40	0.43	0.00			0.268	1.00	14	20.30	20.50	0.268	0.268	0.43	0.09	0.023
	20.60	0.40	0.00			0.052	1.00	15	20.50	20.70	0.052	0.052	0.40	0.08	0.004
	20.80	0.18	0.00			0.003	1.00	16	20.70	20.90	0.003	0.003	0.18	0.04	0.000
	21.00	0.11	0.00			0.003	1.00	17	20.90	21.08	0.003	0.003	0.11	0.02	0.000
LB	21.15	0.00	0.00			0.000	1.00	18	21.08	21.15	0.000	0.000	0.03	0.00	0.000
														Total Flow:	0.119

Total Flow:	**0.119**		(m^3/s)
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.89**		(m^2)
Top Width:	**3.45**		(m)
Hydraulic Depth:	**0.257**		(m)
Mean Velocity:	**0.135**		(m/s)
Froude Number	**0.085**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:		
Datalogger Internal Power:	11.34V 100%	
Datalogger External Power:	12.17 V 78%	
Datalogger Memory Used:	wrapped	
Datalogger Clock:	Sep 23, 2004 08:56	MST
Laptop Clock:	Sep 23, 2004 08:58	MST
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #41174-08	
PT:	Keller Pressure Transducer #871 (not installed)	
Power:	Lakewood battery	

Notes: TSS sample collected
1344 Tips in Rain Gauge
TBRG was on an angle - perhaps hit by an animal, straightened bucket and leveled
tipped bucket 1x during straightening, memory was cleared

Hydrometric Measurement / Site Visit Record

S3 - Iyinimin Creek above Kearl Lake

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Iyinimin Creek
Location:	Iyinimin Creek above Kearl Lake
Site Name:	S3
Coordinates & Legal:	6345029 N, 489491 E NE-14-95-8-W4

Time of Measurement

Date of Measurement:	October 31, 2004
Start Time:	8:22 AM MST
End Time:	9:02 AM MST

Weather Conditions: -5 C, Clear, Calm

Personnel & Equipment

Measurement Made By:	ND/FF
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings

		Setup No. 1			Setup No. 2		
Bench Mark Reading:	Bar in PVC	1.862	El:	360.610	1.694	El:	360.610
Water Level Reading:		3.541	El:	358.931	3.384	El:	358.920
Top of Ice Level Reading:		3.469	El:		3.325	El:	
Transducer Reading & Calc'd El.		0.292	El:	358.639	0.292	El:	358.628
Other:			El:			El:	

River Conditions: Full ice cover in vicinity of station. Ice broken out at measurement section. Measurement made on locally steep gradient reach.

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	1.50	0.00	0.05			0.000	1.00	1	1.50	1.75	0.021	0.021	0.03	0.01	0.000
	2.00	0.17	0.05			0.085	1.00	2	1.75	2.13	0.085	0.085	0.12	0.05	0.004
	2.25	0.20	0.05			0.070	1.00	3	2.13	2.38	0.070	0.070	0.15	0.04	0.003
	2.50	0.20	0.00			0.098	1.00	4	2.38	2.63	0.098	0.098	0.20	0.05	0.005
	2.75	0.26	0.00			0.098	1.00	5	2.63	2.88	0.098	0.098	0.26	0.07	0.006
	3.00	0.12	0.00			0.177	1.00	6	2.88	3.13	0.177	0.177	0.12	0.03	0.005
	3.25	0.22	0.00			0.183	1.00	7	3.13	3.38	0.183	0.183	0.22	0.06	0.010
	3.50	0.20	0.00			0.277	1.00	8	3.38	3.63	0.277	0.277	0.20	0.05	0.014
	3.75	0.08	0.00			0.070	1.00	9	3.63	3.88	0.070	0.070	0.08	0.02	0.001
	4.00	0.06	0.00			0.046	1.00	10	3.88	4.50	0.046	0.046	0.06	0.04	0.002
	5.00	0.12	0.05			0.012	1.00	11	4.50	5.13	0.012	0.012	0.07	0.04	0.001
	5.25	0.12	0.04			0.024	1.00	12	5.13	5.38	0.024	0.024	0.08	0.02	0.000
	5.50	0.29	0.05			0.015	1.00	13	5.38	5.63	0.015	0.015	0.24	0.06	0.001
	5.75	0.15	0.05			0.058	1.00	14	5.63	5.88	0.058	0.058	0.10	0.03	0.001
	6.00	0.27	0.05			0.067	1.00	15	5.88	6.13	0.067	0.067	0.22	0.06	0.004
	6.25	0.20	0.05			0.070	1.00	16	6.13	6.38	0.070	0.070	0.15	0.04	0.003
RB	6.50	0.00	0.05			0.000	1.00	17	6.38	6.50	0.018	0.018	0.04	0.00	0.000
														Total Flow:	0.060

Total Flow:	**0.060**		**(m^3/s)**
Perceived Measurement Quality:	**Poor**		
Total Area:	**0.64**		**(m^2)**
Top Width:	**5.00**		**(m)**
Hydraulic Depth:	**0.129**		**(m)**
Mean Velocity:	**0.093**		**(m/s)**
Froude Number	**0.083**		

Photographs taken looking at:
Upstream, downstream, across

Notes: TSS sample collected
Equipment removed for winter.

Datalogger Notes:		
Datalogger Internal Power:	11.34V 100%	
Datalogger External Power:	11.92 V 77%	
Datalogger Memory Used:	50%	
Datalogger Clock:	October 31, 2004	MST
Laptop Clock:	October 31, 2004	MST
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #41174-08	
PT:	Keller Pressure Transducer #871 (not installed)	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S5 - Muskeg River Above Stanley Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Stanley Creek
Site Name:	S5
Coordinates & Legal:	6356737 N, 479893 E SE-26-96-9-W4

Time of Measurement

Date of Measurement:	February 2, 2004
Start Time:	10:20 AM MST
End Time:	11:01 AM MST

Weather Conditions: -25 °C, Clear, calm

River Conditions: Complete ice cover. Ice surface concave due to falling stage since ice formation.

Personnel & Equipment

Measurement Made By:	FF/DM
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	Mark on logg	-0.183	El:	100.000
Water Level Reading:		2.203	El:	97.614
Top of Ice Level Reading:		2.158	El:	97.660
Transducer Reading:		1.255	El:	96.359
Other:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	4.75	0.00	0.40			0.000	0.90	1	4.75	5.13	0.004	0.003	0.26	0.10	0.000
	5.50	1.44	0.40			0.015	0.90	2	5.13	5.70	0.015	0.014	1.04	0.60	0.008
	5.90	1.53	0.46			0.021	0.90	3	5.70	6.10	0.021	0.019	1.07	0.43	0.008
	6.30	1.68	0.52	0.027	0.030		0.90	4	6.10	6.48	0.029	0.026	1.16	0.44	0.011
	6.65	1.70	0.53	0.030	0.021		0.90	5	6.48	6.90	0.026	0.023	1.17	0.50	0.012
	7.15	1.68	0.57	0.030	0.024		0.90	6	6.90	7.33	0.027	0.025	1.11	0.47	0.012
	7.50	1.65	0.59	0.037	0.034		0.90	7	7.33	7.60	0.035	0.032	1.06	0.29	0.009
	7.70	1.64	0.58	0.040	0.037		0.90	8	7.60	7.80	0.038	0.034	1.06	0.21	0.007
	7.90	1.63	0.60	0.030	0.034		0.90	9	7.80	7.98	0.032	0.029	1.03	0.18	0.005
	8.05	1.62	0.60	0.034	0.027		0.90	10	7.98	8.20	0.030	0.027	1.02	0.23	0.006
	8.35	1.62	0.60	0.034	0.027		0.90	11	8.20	8.43	0.030	0.027	1.02	0.23	0.006
	8.50	1.62	0.61	0.030	0.030		0.90	12	8.43	8.68	0.030	0.027	1.01	0.25	0.007
	8.85	1.57	0.60			0.035	0.90	13	8.68	9.10	0.035	0.032	0.97	0.41	0.013
	9.35	1.55	0.55			0.037	0.90	14	9.10	9.63	0.037	0.033	1.00	0.53	0.017
	9.90	1.50	0.54			0.034	0.90	15	9.63	10.10	0.034	0.030	0.96	0.46	0.014
	10.30	1.52	0.52			0.024	0.90	16	10.10	10.53	0.024	0.022	1.00	0.42	0.009
	10.75	1.54	0.51			0.018	0.90	17	10.53	10.93	0.018	0.016	1.03	0.41	0.007
	11.10	1.51	0.47			0.018	0.90	18	10.93	11.35	0.018	0.016	1.04	0.44	0.007
	11.60	1.33	0.45			0.015	0.90	19	11.35	11.80	0.015	0.014	0.88	0.40	0.005
	12.00	1.15	0.43			0.012	0.90	20	11.80	12.30	0.012	0.011	0.72	0.36	0.004
	12.60	1.10	0.37			0.012	0.90	21	12.30	13.05	0.012	0.011	0.73	0.55	0.006
RB	13.50	0.00	0.37			0.000	0.90	22	13.05	13.50	0.003	0.003	0.18	0.08	0.000
														Total Flow:	**0.176**

Total Flow:				**0.176**		(m^3/s)
Perceived Measurement Quality:				**Good**		
Total Area:				**7.98**		(m^2)
Top Width:				**8.75**		(m)
Hydraulic Depth:				**0.912**		(m)
Mean Velocity:				**0.022**		(m/s)
Froude Number				**0.007**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: Complete ice cover. Ice surface concave due to falling stage since formation of ice.

Datalogger Notes:		
Datalogger Internal Power:	4.18V	
Datalogger External Power:	15.4V	
Datalogger Memory Used:	9%	
Datalogger Clock:	Feb 02, 2004 11:53	MDT
Laptop Clock:	Feb 02, 2004 11:00	MDT
Dessicant:	80% Good	

Datalogger: Optimum DD128, #
PT: Keller 730-130-5 psi #
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S5 - Muskeg River Above Stanley Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Stanley Creek
Site Name:	S5
Coordinates & Legal:	6356737 N, 479893 E SE-26-96-9-W4

Time of Measurement

Date of Measurement:	March 2, 2004
Start Time:	11:21 AM MST
End Time:	11:59 AM MST

Weather Conditions: -19 ˚C, Clear, calm

River Conditions: Complete ice cover. Ice surface concave due to falling stage since ice formation.

Personnel & Equipment

Measurement Made By:	DK/DB
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	Mark on logg -0.222	El:	100.000
Water Level Reading:	2.206	El:	97.572
Top of Ice Level Reading:	4.226	El:	95.552
Transducer Reading:	1.216	El:	96.356
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	5.10	0.00	0.35			0.000	0.90	1	5.10	5.35	0.003	0.003	0.27	0.07	0.000
	5.60	1.43	0.35	0.015	0.012		0.90	2	5.35	5.73	0.014	0.012	1.08	0.41	0.005
	5.85	1.50	0.45	0.012	0.018		0.90	2	5.73	6.10	0.015	0.014	1.05	0.39	0.005
	6.35	1.60	0.46	0.021	0.027		0.90	2	6.10	6.55	0.024	0.022	1.14	0.51	0.011
	6.75	1.66	0.49	0.024	0.018		0.90	2	6.55	6.98	0.021	0.019	1.17	0.50	0.010
	7.20	1.64	0.52	0.034	0.030		0.90	2	6.98	7.43	0.032	0.029	1.12	0.50	0.015
	7.65	1.60	0.52	0.024	0.030		0.90	2	7.43	7.83	0.027	0.025	1.08	0.43	0.011
	8.00	1.59	0.55	0.030	0.021		0.90	2	7.83	8.23	0.026	0.023	1.04	0.42	0.010
	8.45	1.58	0.57			0.027	0.90	2	8.23	8.68	0.027	0.025	1.01	0.45	0.011
	8.90	1.57	0.55			0.030	0.90	2	8.68	9.13	0.030	0.027	1.02	0.46	0.013
	9.35	1.50	0.54			0.034	0.90	2	9.13	9.63	0.034	0.030	0.96	0.48	0.014
	9.90	1.46	0.49			0.021	0.90	2	9.63	10.10	0.021	0.019	0.97	0.46	0.009
	10.30	1.48	0.50			0.027	0.90	2	10.10	10.50	0.027	0.025	0.98	0.39	0.010
	10.70	1.52	0.58			0.015	0.90	2	10.50	10.93	0.015	0.014	0.94	0.40	0.005
	11.15	1.51	0.45	0.030	0.006		0.90	2	10.93	11.38	0.018	0.016	1.06	0.48	0.008
	11.60	1.50	0.53			0.003	0.90	2	11.38	11.83	0.003	0.003	0.97	0.44	0.001
	12.05	1.26	0.45			0.012	0.90	2	11.83	12.30	0.012	0.011	0.81	0.38	0.004
	12.55	1.28	0.38			0.001	0.90	2	12.30	13.03	0.001	0.001	0.90	0.65	0.001
	13.50	0.82	0.28			0.001	0.90	2	13.03	13.75	0.001	0.001	0.54	0.39	0.000
RB	14.00	0.00	0.28			0.000	0.90	22	13.75	14.00	0.000	0.000	0.14	0.03	0.000
														Total Flow:	**0.143**

Total Flow:				**0.143**		**(m^3/s)**
Perceived Measurement Quality:				**Good**		
Total Area:				**8.25**		**(m^2)**
Top Width:				**8.90**		**(m)**
Hydraulic Depth:				**0.927**		**(m)**
Mean Velocity:				**0.017**		**(m/s)**
Froude Number				**0.006**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: Complete ice cover. Ice surface concave due to falling stage since formation of ice.

Datalogger Notes:		
Datalogger Internal Power:	4.187V	
Datalogger External Power:	15.3V	
Datalogger Memory Used:	11%	
Datalogger Clock:	Mar 02, 2003 11:18	MDT
Laptop Clock:	Mar 02, 2003 10:25	MDT
Dessicant:	0.90	

Datalogger: Optimum DD128, #
PT: Keller 730-130-5 psi #
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S5 - Muskeg River Above Stanley Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Stanley Creek
Site Name:	S5
Coordinates & Legal:	6356737 N, 479893 E SE-26-96-9-W4

Time of Measurement

Date of Measurement:	April 5, 2004
Start Time:	MST
End Time:	MST

Weather Conditions: +15 C, Clear, Windy

River Conditions: 90% Ice Covered, water flowing over ice, open holes.

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	Mark on logg	-0.076	El:	100.000
Water Level Reading:		1.992	El:	97.933
Top of Ice Level Reading:			El:	99.925
Transducer Reading:		1.589	El:	96.343
Other:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:				-		(m^3/s)
Perceived Measurement Quality:				-		
Total Area:				-		(m^2)
Top Width:				-		(m)
Hydraulic Depth:				-		(m)
Mean Velocity:				-		(m/s)
Froude Number				-		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: Conditions are not ideal or safe for a flow measurement

Datalogger Notes:		
Datalogger Internal Power:	4.283V	
Datalogger External Power:	14.52V	
Datalogger Memory Used:	14%	
Datalogger Clock:	Apr 05, 2004 09:38	MDT
Laptop Clock:	Apr 05, 2004 10:39	MST
Dessicant:	0.90	

Datalogger: Optimum DD128, #
PT: Keller 730-130-5 psi #
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S5 - Muskeg River Above Stanley Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Stanley Creek
Site Name:	S5
Coordinates & Legal:	6356737 N, 479893 E SE-26-96-9-W4

Time of Measurement

Date of Measurement:	April 26, 2004
Start Time:	11:12 AM MDT
End Time:	11:37 AM MDT

Weather Conditions: +5 C, Calm, partly cloudy, light wind

River Conditions: Open water conditions, no significant ice. Beaver dam roughly 70 m downstream of gauging station.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	0.105 m above btm of DL box	-0.383	El:	100.000	-0.340	El:	100.000
Water Level Reading:		1.713	El:	97.904	1.754	El:	97.906
Top of Ice Level Reading:			El:			El:	
Transducer Reading & El.:		1.584	El:	96.320	1.584	El:	96.322
Other:	Bar in PVC	2.351	El:	97.266	2.394	El:	97.266

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	6.30	0.00	0.00			0.000	1.00	1	6.30	6.65	0.003	0.003	0.18	0.06	0.000
	7.00	0.70	0.00			0.012	1.00	2	6.65	7.25	0.012	0.012	0.70	0.42	0.005
	7.50	0.91	0.00			0.021	1.00	3	7.25	7.75	0.021	0.021	0.91	0.46	0.010
	8.00	1.23	0.00	0.02	0.04		1.00	4	7.75	8.25	0.030	0.030	1.23	0.62	0.019
	8.50	1.40	0.00	0.05	0.06		1.00	5	8.25	8.75	0.055	0.055	1.40	0.70	0.038
	9.00	1.50	0.00	0.04	0.07		1.00	6	8.75	9.25	0.053	0.053	1.50	0.75	0.040
	9.50	1.53	0.00	0.09	0.11		1.00	7	9.25	9.75	0.099	0.099	1.53	0.77	0.076
	10.00	1.79	0.00	0.08	0.13		1.00	8	9.75	10.25	0.108	0.108	1.79	0.90	0.097
	10.50	1.85	0.00	0.09	0.13		1.00	9	10.25	10.75	0.111	0.111	1.85	0.93	0.103
	11.00	1.81	0.00	0.17	0.12		1.00	10	10.75	11.25	0.145	0.145	1.81	0.91	0.131
	11.50	1.84	0.00	0.17	0.13		1.00	11	11.25	11.75	0.152	0.152	1.84	0.92	0.140
	12.00	1.82	0.00	0.18	0.17		1.00	12	11.75	12.25	0.174	0.174	1.82	0.91	0.158
	12.50	1.87	0.00	0.17	0.16		1.00	13	12.25	12.75	0.166	0.166	1.87	0.94	0.155
	13.00	1.87	0.00	0.19	0.16		1.00	14	12.75	13.25	0.171	0.171	1.87	0.94	0.160
	13.50	1.94	0.00	0.18	0.16		1.00	15	13.25	13.75	0.172	0.172	1.94	0.97	0.167
	14.00	1.97	0.00	0.16	0.19		1.00	16	13.75	14.25	0.172	0.172	1.97	0.99	0.170
	14.50	2.00	0.00	0.11	0.18		1.00	17	14.25	14.75	0.148	0.148	2.00	1.00	0.148
	15.00	1.94	0.00	0.11	0.15		1.00	18	14.75	15.25	0.130	0.130	1.94	0.97	0.126
	15.50	1.80	0.00	0.12	0.12		1.00	19	15.25	15.75	0.120	0.120	1.80	0.90	0.108
	16.00	1.66	0.00	0.09	0.09		1.00	20	15.75	16.50	0.085	0.085	1.66	1.25	0.106
	17.00	0.72	0.00			0.027	1.00	21	16.50	17.35	0.027	0.027	0.72	0.61	0.017
LB	17.70	0.00	0.00			0.000	1.00	22	17.35	17.70	0.007	0.007	0.18	0.06	0.000
														Total Flow:	1.974

Total Flow:	**1.974**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**16.94**		**(m^2)**
Top Width:	**11.40**		**(m)**
Hydraulic Depth:	**1.486**		**(m)**
Mean Velocity:	**0.117**		**(m/s)**
Froude Number	**0.031**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**845**	
Datalogger Internal Power:	4.30V		
Datalogger External Power:	14.49V		
Datalogger Memory Used:	16%		
Datalogger Clock:	26/04/2004 10:00		MST
Laptop Clock:	26/04/2004 11:01		MDT
Dessicant:	Good		

Datalogger: Optimum datalogger s/n# 0308190845
PT: Keller s/n 021631 5 psi
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: TSS sample collected.
Open water condition with apparent backwater from downstream beaver dam.

Hydrometric Measurement / Site Visit Record

S5 - Muskeg River Above Stanley Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Stanley Creek
Site Name:	S5
Coordinates & Legal:	6356737 N, 479893 E SE-26-96-9-W4

Time of Measurement

Date of Measurement:	June 2, 2004
Start Time:	12:08 PM MDT
End Time:	12:46 PM MDT

Weather Conditions: +10°C, light wind, clear

River Conditions: open, floodstage

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	1.0 m placed on btm of DL box	-0.105	El:	100.000	-0.162	El:	100.000
Water Level Reading:		1.603	El:	98.292	1.545	El:	98.293
Top of Ice Level Reading:			El:			El:	
Transducer Reading & El.:		1.959	El:	96.333	1.959	El:	96.334
Other:	Bar in PVC	full of mu	El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	17.90	0.00	0.00	0.00	0.00		1.00	1	17.90	18.35	0.016	0.016	0.33	0.15	0.002
	18.80	1.31	0.00	0.06	0.07		1.00	2	18.35	19.30	0.066	0.066	1.31	1.24	0.082
	19.80	1.83	0.00	0.11	0.07		1.00	3	19.30	20.30	0.088	0.088	1.83	1.83	0.162
	20.80	2.26	0.00	0.12	0.11		1.00	4	20.30	21.05	0.113	0.113	2.26	1.70	0.191
	21.30	2.29	0.00	0.14	0.11		1.00	5	21.05	21.55	0.123	0.123	2.29	1.15	0.141
	21.80	2.23	0.00	0.12	0.20		1.00	6	21.55	22.05	0.160	0.160	2.23	1.12	0.178
	22.30	2.22	0.00	0.17	0.16		1.00	7	22.05	22.55	0.163	0.163	2.22	1.11	0.181
	22.80	2.26	0.00	0.19	0.22		1.00	8	22.55	23.05	0.204	0.204	2.26	1.13	0.231
	23.30	2.24	0.00	0.27	0.23		1.00	9	23.05	23.55	0.245	0.245	2.24	1.12	0.275
	23.80	2.23	0.00	0.25	0.29		1.00	10	23.55	24.05	0.268	0.268	2.23	1.12	0.299
	24.30	2.34	0.00	0.28	0.22		1.00	11	24.05	24.55	0.247	0.247	2.34	1.17	0.289
	24.80	2.36	0.00	0.30	0.22		1.00	12	24.55	25.05	0.261	0.261	2.36	1.18	0.308
	25.30	2.38	0.00	0.26	0.20		1.00	13	25.05	25.55	0.230	0.230	2.38	1.19	0.274
	25.80	2.34	0.00	0.20	0.20		1.00	14	25.55	26.05	0.203	0.203	2.34	1.17	0.237
	26.30	2.27	0.00	0.19	0.21		1.00	15	26.05	26.55	0.198	0.198	2.27	1.14	0.225
	26.80	2.14	0.00	0.13	0.21		1.00	16	26.55	27.05	0.172	0.172	2.14	1.07	0.184
	27.30	1.90	0.00	0.13	0.01		1.00	17	27.05	27.80	0.069	0.069	1.90	1.43	0.098
	28.30	1.07	0.00	0.00	0.01		1.00	18	27.80	28.80	0.006	0.006	1.07	1.07	0.007
	29.30	0.90	0.00			0.003	1.00	19	28.80	30.10	0.003	0.003	0.90	1.17	0.004
LB	30.90	0.00	0.00			0.000	1.00	20	30.10	30.90	0.000	0.000	0.23	0.18	0.000
														Total Flow:	3.367

Total Flow:	**3.367**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**22.41**		**(m^2)**
Top Width:	**13.00**		**(m)**
Hydraulic Depth:	**1.724**		**(m)**
Mean Velocity:	**0.150**		**(m/s)**
Froude Number	**0.037**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**845**
Datalogger Internal Power:	4.323V	
Datalogger External Power:	14.32V	
Datalogger Memory Used:	19%	
Datalogger Clock:	Jun 02, 2004 10:53	MST
Laptop Clock:	Jun 02, 2004 11:54	MDT
Dessicant:	Good - 80%	

Datalogger: Optimum datalogger s/n# 0308190845
PT: Keller s/n 021631 5 psi
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: TSS sample collected.
Flow in flood stage
BM in PVC pipe is filled with sediment - could not measure

Hydrometric Measurement / Site Visit Record

S5 - Muskeg River Above Stanley Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Stanley Creek
Site Name:	S5
Coordinates & Legal:	6356737 N, 479893 E SE-26-96-9-W4

Time of Measurement

Date of Measurement:	July 24, 2004	
Start Time:	11:36 AM	MDT
End Time:	12:06 PM	MDT

Weather Conditions: +25° C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: (1.0 m placed on btm of DL box)	-0.422	El:	100.000	-0.328	El:	100.000
Water Level Reading:	1.915	El:	97.663	2.005	El:	97.667
Top of Ice Level Reading:		El:			El:	
Transducer Reading & El.:	1.333	El:	96.330	1.333	El:	96.334
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	28.50	0.00				0.000	1.00	1	28.50	28.25	0.003	0.003	0.20	0.05	0.000
	28.00	0.81				0.012	1.00	2	28.25	27.75	0.012	0.012	0.81	0.41	0.005
	27.50	1.26		0.01	0.00		1.00	3	27.75	27.25	0.006	0.006	1.26	0.63	0.004
	27.00	1.52		0.01	0.00		1.00	4	27.25	26.75	0.005	0.005	1.52	0.76	0.003
	26.50	1.58		0.01	0.01		1.00	5	26.75	26.25	0.008	0.008	1.58	0.79	0.006
	26.00	1.70		0.01	0.01		1.00	6	26.25	25.75	0.011	0.011	1.70	0.85	0.009
	25.50	1.73		0.02	0.01		1.00	7	25.75	25.25	0.012	0.012	1.73	0.87	0.011
	25.00	1.71		0.02	0.01		1.00	8	25.25	24.75	0.012	0.012	1.71	0.86	0.010
	24.50	1.67		0.03	0.01		1.00	9	24.75	24.25	0.018	0.018	1.67	0.84	0.015
	24.00	1.64		0.02	0.01		1.00	10	24.25	23.75	0.018	0.018	1.64	0.82	0.015
	23.50	1.60		0.03	0.02		1.00	11	23.75	23.25	0.023	0.023	1.60	0.80	0.018
	23.00	1.60		0.02	0.02		1.00	12	23.25	22.75	0.023	0.023	1.60	0.80	0.018
	22.50	1.61		0.02	0.02		1.00	13	22.75	22.25	0.017	0.017	1.61	0.81	0.013
	22.00	1.60		0.02	0.02		1.00	14	22.25	21.75	0.017	0.017	1.60	0.80	0.013
	21.50	1.60		0.02	0.01		1.00	15	21.75	21.25	0.016	0.016	1.60	0.80	0.013
	21.00	1.63		0.02	0.01		1.00	16	21.25	20.75	0.012	0.012	1.63	0.82	0.010
	20.50	1.50		0.01	0.01		1.00	17	20.75	20.25	0.011	0.011	1.50	0.75	0.008
	20.00	1.18		0.01	0.01		1.00	18	20.25	19.75	0.012	0.012	1.18	0.59	0.007
	19.50	1.12		0.00	0.00		1.00	19	19.75	19.25	0.003	0.003	1.12	0.56	0.002
	19.00	1.10				0.003	1.00	20	19.25	18.75	0.003	0.003	1.10	0.55	0.002
	18.50	0.86				0.003	1.00	21	18.75	18.25	0.003	0.003	0.86	0.43	0.001
	18.00	0.85				0.001	1.00	22	18.25	17.80	0.001	0.001	0.85	0.38	0.000
LB	17.60	0.00				0.000	1.00	23	17.80	17.60	0.000	0.000	0.21	0.04	0.000
														Total Flow:	0.185

Total Flow:	**0.185**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**14.99**		**(m^2)**
Top Width:	**10.90**		**(m)**
Hydraulic Depth:	**1.375**		**(m)**
Mean Velocity:	**0.012**		**(m/s)**
Froude Number	**0.003**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**845**
Datalogger Internal Power:	4.340V	
Datalogger External Power:	14.02V	
Datalogger Memory Used:	23%	
Datalogger Clock:	Jul 24, 2004 10:07	MST
Laptop Clock:	Jul 02, 2004 11:09	MDT
Dessicant:	Good - 50%	

Datalogger: Optimum datalogger s/n# 0308190845
PT: Keller s/n 021631 5 psi
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S5 - Muskeg River Above Stanley Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Stanley Creek
Site Name:	S5
Coordinates & Legal:	6356737 N, 479893 E SE-26-96-9-W4

Time of Measurement

Date of Measurement:	August 26, 2004
Start Time:	3:42 PM MDT
End Time:	4:17 PM MDT

Weather Conditions: +20°C, overcast, calm

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: (1.0 m placed on btm of DL box)	-0.281	El:	100.000	-0.293	El:	100.000
Water Level Reading:	2.005	El:	97.714	1.999	El:	97.708
Top of Ice Level Reading:		El:			El:	
Transducer Reading & El.:	1.371	El:	96.343	1.371	El:	96.337
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	14.60	0.00				0.000	1.00	1	14.60	14.30	-0.002	-0.002	0.24	0.07	0.000
	14.00	0.94				-0.009	1.00	2	14.30	13.75	-0.009	-0.009	0.94	0.52	-0.005
	13.50	0.86				0.024	1.00	3	13.75	13.25	0.024	0.024	0.86	0.43	0.010
	13.00	1.13		0.01	0.01		1.00	4	13.25	12.75	0.009	0.009	1.13	0.57	0.005
	12.50	1.35		0.01	0.00		1.00	5	12.75	12.25	0.005	0.005	1.35	0.68	0.003
	12.00	1.59		0.01	0.01		1.00	6	12.25	11.75	0.006	0.006	1.59	0.80	0.005
	11.50	1.64		0.00	0.00		1.00	7	11.75	11.25	0.003	0.003	1.64	0.82	0.002
	11.00	1.61		0.00	0.02		1.00	8	11.25	10.75	0.009	0.009	1.61	0.81	0.007
	10.50	1.60		0.02	0.02		1.00	9	10.75	10.25	0.023	0.023	1.60	0.80	0.018
	10.00	1.66		0.03	0.02		1.00	10	10.25	9.75	0.023	0.023	1.66	0.83	0.019
	9.50	1.75		0.03	0.01		1.00	11	9.75	9.25	0.021	0.021	1.75	0.88	0.019
	9.00	1.71		0.03	0.02		1.00	12	9.25	8.75	0.023	0.023	1.71	0.86	0.020
	8.50	1.72		0.03	0.01		1.00	13	8.75	8.25	0.020	0.020	1.72	0.86	0.017
	8.00	1.74		0.03	0.01		1.00	14	8.25	7.75	0.021	0.021	1.74	0.87	0.019
	7.50	1.75		0.03	0.01		1.00	15	7.75	7.25	0.023	0.023	1.75	0.88	0.020
	7.00	1.72		0.03	0.01		1.00	16	7.25	6.75	0.020	0.020	1.72	0.86	0.017
	6.50	1.59		0.02	0.01		1.00	17	6.75	6.25	0.014	0.014	1.59	0.80	0.011
	6.00	1.40		0.01	0.01		1.00	18	6.25	5.75	0.011	0.011	1.40	0.70	0.007
	5.50	1.25		0.01	0.01		1.00	19	5.75	5.25	0.008	0.008	1.25	0.63	0.005
	5.00	0.99				0.003	1.00	20	5.25	4.75	0.003	0.003	0.99	0.50	0.002
	4.50	0.57				0.003	1.00	21	4.75	4.25	0.003	0.003	0.57	0.29	0.001
	4.00	0.36				0.009	1.00	22	4.25	3.50	0.009	0.009	0.36	0.27	0.002
LB	3.00	0.00				0.000	1.00	23	3.50	3.00	0.002	0.002	0.09	0.05	0.000
														Total Flow:	0.205

Total Flow:	**0.205**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**14.72**		**(m^2)**
Top Width:	**11.60**		**(m)**
Hydraulic Depth:	**1.269**		**(m)**
Mean Velocity:	**0.014**		**(m/s)**
Froude Number	**0.004**		

Photographs taken looking at:
Upstream, downstream, across

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**845**
Datalogger Internal Power:	4.343V	
Datalogger External Power:	14.24V	
Datalogger Memory Used:	26%	
Datalogger Clock:	Aug 26, 2004 14:18	MST
Laptop Clock:	Aug 26, 2004 15:20	MDT
Dessicant:	OK - 25%, Replaced	

Datalogger: Optimum datalogger s/n# 0308190845
PT: Keller s/n 021631 5 psi
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S5 - Muskeg River Above Stanley Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Stanley Creek
Site Name:	S5
Coordinates & Legal:	6356737 N, 479893 E SE-26-96-9-W4

Time of Measurement

Date of Measurement:	September 23, 2004
Start Time:	11:20 AM MDT
End Time:	12:00 PM MDT

Weather Conditions: +17˚C, overcast, calm, light rain

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	1.0 m placed on btm of DL box	-0.261	El:	100.000	-0.334	El:	100.000
Water Level Reading:		1.828	El:	97.911	1.775	El:	97.891
Top of Ice Level Reading:			El:			El:	
Transducer Reading & El.:		1.564	El:	96.347	1.564	El:	96.327
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	28.10	0.00				0.000	1.00	1	28.10	27.90	0.000	0.000	0.18	0.04	0.000
	27.70	0.71				0.000	1.00	2	27.90	27.50	0.000	0.000	0.71	0.28	0.000
	27.30	0.87		0.00	0.00		1.00	3	27.50	27.10	0.000	0.000	0.87	0.35	0.000
	26.90	1.16		0.03	0.00		1.00	4	27.10	26.70	0.012	0.012	1.16	0.46	0.006
	26.50	1.44		0.03	0.02		1.00	5	26.70	26.30	0.029	0.029	1.44	0.58	0.017
	26.10	1.60		0.04	0.05		1.00	6	26.30	25.90	0.046	0.046	1.60	0.64	0.029
	25.70	1.77		0.04	0.06		1.00	7	25.90	25.50	0.049	0.049	1.77	0.71	0.035
	25.30	1.84		0.04	0.05		1.00	8	25.50	25.10	0.044	0.044	1.84	0.74	0.033
	24.90	1.93		0.05	0.05		1.00	9	25.10	24.70	0.050	0.050	1.93	0.77	0.039
	24.50	1.92		0.08	0.07		1.00	10	24.70	24.30	0.072	0.072	1.92	0.77	0.055
	24.10	1.92		0.05	0.05		1.00	11	24.30	23.90	0.049	0.049	1.92	0.77	0.037
	23.70	1.91		0.06	0.06		1.00	12	23.90	23.50	0.061	0.061	1.91	0.76	0.047
	23.30	1.90		0.07	0.08		1.00	13	23.50	23.10	0.073	0.073	1.90	0.76	0.056
	22.90	1.89		0.06	0.07		1.00	14	23.10	22.70	0.067	0.067	1.89	0.76	0.051
	22.50	1.93		0.06	0.06		1.00	15	22.70	22.30	0.059	0.059	1.93	0.77	0.046
	22.10	1.87		0.06	0.07		1.00	16	22.30	21.90	0.066	0.066	1.87	0.75	0.049
	21.70	1.80		0.06	0.04		1.00	17	21.90	21.50	0.052	0.052	1.80	0.72	0.037
	21.30	1.78		0.06	0.04		1.00	18	21.50	21.10	0.050	0.050	1.78	0.71	0.036
	20.90	1.79		0.06	0.03		1.00	19	21.10	20.70	0.047	0.047	1.79	0.72	0.034
	20.50	1.83		0.05	0.04		1.00	20	20.70	20.30	0.044	0.044	1.83	0.73	0.032
	20.10	1.82		0.04	0.03		1.00	21	20.30	19.90	0.035	0.035	1.82	0.73	0.026
	19.70	1.67		0.05	0.02		1.00	22	19.90	19.50	0.035	0.035	1.67	0.67	0.023
	19.30	1.40		0.04	0.05		1.00	23	19.50	19.20	0.043	0.043	1.40	0.42	0.018
	19.10	1.27		0.03	0.03		1.00	24	19.20	18.90	0.030	0.030	1.27	0.38	0.012
	18.70	1.07		0.02	0.02		1.00	25	18.90	18.45	0.020	0.020	1.07	0.48	0.010
	18.20	1.12		0.02	0.03		1.00	26	18.45	17.75	0.021	0.021	1.12	0.78	0.017
RB	17.30	0.00		0.00	0.00		1.00	27	17.75	17.30	0.005	0.005	0.28	0.13	0.001
														Total Flow:	0.742

Total Flow:	**0.742**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**16.37**		**(m^2)**
Top Width:	**10.80**		**(m)**
Hydraulic Depth:	**1.516**		**(m)**
Mean Velocity:	**0.045**		**(m/s)**
Froude Number	**0.012**		

Photographs taken looking at:
Upstream, downstream, across

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**845**	
Datalogger Internal Power:	4.300V		
Datalogger External Power:	14.02V		
Datalogger Memory Used:	28%		
Datalogger Clock:	Sep 23, 2004 10:02		MST
Laptop Clock:	Sep 23, 2004 10:06		MST
Dessicant:	100% Good		

Datalogger: Optimum datalogger s/n# 0308190845
PT: Keller s/n 021631 5 psi
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S5 - Muskeg River Above Stanley Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Stanley Creek
Site Name:	S5
Coordinates & Legal:	6356737 N, 479893 E SE-26-96-9-W4

Time of Measurement

Date of Measurement:	October 31, 2004
Start Time:	9:55 AM MST
End Time:	10:15 AM MST

Weather Conditions: 0 ˚C, Clear

River Conditions: Complete ice cover

Personnel & Equipment

Measurement Made By:	FF/ND
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	1.0 m placed on btm of DL box	-0.305	El:	100.000
Water Level Reading:		1.928	El:	97.767
Top of Ice Level Reading:		1.901	El:	97.794
Transducer Reading:		1.467	El:	96.300
Other:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Notes: Conditions are not ideal or safe for a flow measurement
TSS sample taken

Total Flow:				-		(m^3/s)
Perceived Measurement Quality:				-		
Total Area:				-		(m^2)
Top Width:				-		(m)
Hydraulic Depth:				-		(m)
Mean Velocity:				-		(m/s)
Froude Number				-		
Photographs taken looking at: Upstream, downstream, across						

Notes: TSS sample taken

Datalogger Notes:		
Datalogger Internal Power:	4.2V	
Datalogger External Power:	13.9V	
Datalogger Memory Used:	31% used	
Datalogger Clock:	Oct 31, 2004 09:52	MST
Laptop Clock:	Oct 31, 2004 08:56	MST
Dessicant:	Good	
Datalogger:	308190845	
PT:	304989	
Power:		

Hydrometric Measurement / Site Visit Record

S5 - Muskeg River Above Stanley Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Stanley Creek
Site Name:	S5
Coordinates & Legal:	6356737 N, 479893 E SE-26-96-9-W4

Time of Measurement

Date of Measurement:	December 4, 2004
Start Time:	1:00 PM MST
End Time:	1:42 PM MST

Weather Conditions: -30°C, calm, clear

River Conditions: Frozen

Personnel & Equipment

Measurement Made By:	DB/ND
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	1.0 m placed on btm of DL box	-0.141	El:	100.000	-0.172	El:	100.000
Water Level Reading:		2.148	El:	97.711	2.121	El:	97.707
Top of Ice Level Reading:		2.098	El:		2.069	El:	
Transducer Reading & El.:		1.373	El:	96.338	1.373	El:	96.334
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	18.50	0.00	0.00			0.000	0.90	1	18.50	18.95	0.002	0.002	0.09	0.04	0.000
	19.40	0.70	0.35			0.009	0.90	2	18.95	19.60	0.009	0.008	0.35	0.23	0.002
	19.80	1.58	0.24	0.00	0.01		0.90	3	19.60	20.10	0.005	0.004	1.34	0.67	0.003
	20.40	1.84	0.34	0.02	0.03		0.90	4	20.10	20.65	0.026	0.023	1.50	0.82	0.019
	20.90	1.86	0.42	0.02	0.01		0.90	5	20.65	21.18	0.017	0.015	1.44	0.76	0.011
	21.45	1.82	0.42	0.02	0.02		0.90	6	21.18	21.73	0.017	0.015	1.40	0.77	0.012
	22.00	1.84	0.42	0.02	0.02		0.90	7	21.73	22.30	0.018	0.016	1.42	0.82	0.013
	22.60	1.90	0.30	0.03	0.02		0.90	8	22.30	22.80	0.023	0.021	1.60	0.80	0.016
	23.00	1.90	0.25	0.02	0.01		0.90	9	22.80	23.25	0.018	0.016	1.65	0.74	0.012
	23.50	1.85	0.26	0.02	0.02		0.90	10	23.25	23.68	0.023	0.021	1.59	0.68	0.014
	23.85	1.80	0.26	0.03	0.02		0.90	11	23.68	24.03	0.027	0.025	1.54	0.54	0.013
	24.20	1.74	0.27	0.03	0.03		0.90	12	24.03	24.38	0.029	0.026	1.47	0.51	0.013
	24.55	1.70	0.26	0.03	0.03		0.90	13	24.38	24.69	0.030	0.027	1.44	0.45	0.012
	24.83	1.67	0.27	0.03	0.03		0.90	14	24.69	25.12	0.027	0.025	1.40	0.60	0.015
	25.40	1.65	0.27	0.03	0.02		0.90	15	25.12	25.70	0.026	0.023	1.38	0.81	0.019
	26.00	1.68	0.28	0.03	0.02		0.90	16	25.70	26.30	0.021	0.019	1.40	0.84	0.016
	26.60	1.67	0.35	0.02	0.01		0.90	17	26.30	26.88	0.015	0.014	1.32	0.76	0.010
	27.15	1.55	0.29	0.02	0.01		0.90	18	26.88	27.43	0.014	0.012	1.26	0.69	0.009
	27.70	1.46	0.35	0.02	0.01		0.90	19	27.43	28.00	0.011	0.010	1.11	0.64	0.006
	28.30	1.21	0.35			0.006	0.90	20	28.00	28.55	0.006	0.005	0.86	0.47	0.003
RB	28.80	0.00	0.00			0.000	0.90	21	28.55	28.80	0.002	0.001	0.22	0.05	0.000
														Total Flow:	0.220

Total Flow:	**0.220**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**12.69**		**(m^2)**
Top Width:	**10.30**		**(m)**
Hydraulic Depth:	**1.232**		**(m)**
Mean Velocity:	**0.017**		**(m/s)**
Froude Number	**0.005**		

Photographs taken looking at:
Upstream, downstream, across

Notes:

Datalogger Notes:	**Database**	**845**
Datalogger Internal Power:	4.217V	
Datalogger External Power:	15.454V	
Datalogger Memory Used:	34%	
Datalogger Clock:	Dec 04, 2004 12:19	MST
Laptop Clock:	Dec 04, 2004 12:25	MST
Dessicant:	Good	

Datalogger: Optimum datalogger s/n# 0308190845
PT: Keller s/n 021631 5 psi
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S5A - Muskeg River Aurora

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora
Site Name:	S5A
Coordinates & Legal:	6351600 N, 476100 E SE-9-96-9-W4

Time of Measurement

Date of Measurement:	January 31, 2004
Start Time:	1:10 PM MDT
End Time:	1:30 PM MDT

Weather Conditions: -25 °C, Light snow

River Conditions: Complete ice cover. Ice surface concave due to falling stage since ice formation.

Personnel & Equipment

Measurement Made By:	FF/DM
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading: Tbar in PVC	1.315	El:	282.380
Water Level Reading:	2.607	El:	281.089
Top of Ice Level Reading:	2.540	El:	281.155
Transducer Reading:	0.916	El:	280.173
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	6.50	0.00	0.57			0.000	0.90	1	6.50	7.05	0.000	0.000	0.16	0.09	0.000
	7.60	1.22	0.57			0.001	0.90	2	7.05	7.95	0.001	0.001	0.65	0.59	0.000
	8.30	1.26	0.61			0.009	0.90	3	7.95	8.60	0.009	0.008	0.65	0.42	0.003
	8.90	1.40	0.62			0.009	0.90	4	8.60	9.10	0.009	0.008	0.78	0.39	0.003
	9.30	1.49	0.63			0.009	0.90	5	9.10	9.55	0.009	0.008	0.86	0.39	0.003
	9.80	1.50	0.64			0.034	0.90	6	9.55	10.25	0.034	0.030	0.86	0.60	0.018
	10.70	1.45	0.62			0.037	0.90	7	10.25	10.73	0.037	0.033	0.83	0.39	0.013
	10.75	1.46	0.61			0.055	0.90	8	10.73	10.93	0.055	0.049	0.85	0.17	0.008
	11.10	1.50	0.61			0.043	0.90	9	10.93	11.30	0.043	0.038	0.89	0.33	0.013
	11.50	1.55	0.60			0.067	0.90	10	11.30	11.75	0.067	0.060	0.95	0.43	0.026
	12.00	1.62	0.60			0.076	0.90	11	11.75	12.15	0.076	0.069	1.02	0.41	0.028
	12.30	1.60	0.59			0.076	0.90	12	12.15	12.53	0.076	0.069	1.01	0.38	0.026
	12.75	1.59	0.58			0.079	0.90	13	12.53	13.00	0.079	0.071	1.01	0.48	0.034
	13.25	1.58	0.58			0.061	0.90	14	13.00	13.53	0.061	0.055	1.00	0.53	0.029
	13.80	1.48	0.59			0.058	0.90	15	13.53	14.03	0.058	0.052	0.89	0.45	0.023
	14.25	1.37	0.60			0.040	0.90	16	14.03	14.68	0.040	0.036	0.77	0.50	0.018
	15.10	1.03	0.58			0.006	0.90	17	14.68	15.45	0.006	0.005	0.45	0.35	0.002
LB	15.80	0.00	0.58			0.000	0.90	18	15.45	15.80	0.002	0.001	0.11	0.04	0.000
			0.60												
														Total Flow:	**0.249**

Total Flow:				**0.249**		**(m^3/s)**
Perceived Measurement Quality:				**Good**		
Total Area:				**6.93**		**(m^2)**
Top Width:				**9.30**		**(m)**
Hydraulic Depth:				**0.745**		**(m)**
Mean Velocity:				**0.036**		**(m/s)**
Froude Number				**0.013**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	4.78V	
Datalogger External Power:	14.64V	
Datalogger Memory Used:	100% Data Wrapping	
Datalogger Clock:	Jan 31, 2004 13:43	MDT
Laptop Clock:	Jan 31, 2004 13:02	MDT
Dessicant:	80% Good	

Datalogger: Optimum DD128, # 0110220407
PT: Keller 730-130-5 psi #0104640
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: Barometer: 987.04 hPa Water Temp: 0.163 C
db 407

Hydrometric Measurement / Site Visit Record

S5A - Muskeg River Aurora

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora
Site Name:	S5A
Coordinates & Legal:	6351600 N, 476100 E SE-9-96-9-W4

Time of Measurement

Date of Measurement:	March 1, 2004
Start Time:	10:01 AM MDT
End Time:	10:56 AM MDT

Weather Conditions: -5 ˚C, Clear, Light Wind

River Conditions: Complete ice cover. Ice surface concave due to falling stage since ice formation.

Personnel & Equipment

Measurement Made By:	DK/GB
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading: Tbar in PVC	1.355	El:	282.380
Water Level Reading:	2.674	El:	281.061
Top of Ice Level Reading:	2.515	El:	281.220
Transducer Reading:	0.845	El:	280.216
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	13.00	0.00	0.56			0.000	0.90	1	13.00	12.65	0.000	0.000	0.03	0.01	0.000
	12.30	0.67	0.56			0.001	0.90	2	12.65	12.00	0.001	0.001	0.11	0.07	0.000
	11.70	0.97	0.57			0.003	0.90	3	12.00	11.50	0.003	0.003	0.40	0.20	0.001
	11.30	1.16	0.62			0.009	0.90	4	11.50	11.10	0.009	0.008	0.54	0.22	0.002
	10.90	1.33	0.62			0.043	0.90	5	11.10	10.68	0.043	0.038	0.71	0.30	0.012
	10.45	1.39	0.63			0.082	0.90	6	10.68	10.15	0.082	0.074	0.76	0.40	0.030
	9.85	1.51	0.61			0.079	0.90	7	10.15	9.60	0.079	0.071	0.90	0.49	0.035
	9.35	1.56	0.72			0.098	0.90	8	9.60	9.18	0.098	0.088	0.84	0.36	0.031
	9.00	1.58	0.60			0.088	0.90	9	9.18	8.80	0.088	0.080	0.98	0.37	0.029
	8.60	1.59	0.61			0.082	0.90	10	8.80	8.43	0.082	0.074	0.98	0.37	0.027
	8.25	1.54	0.63			0.067	0.90	11	8.43	8.03	0.067	0.060	0.91	0.36	0.022
	7.80	1.50	0.65			0.046	0.90	12	8.03	7.65	0.046	0.041	0.85	0.32	0.013
	7.50	1.51	0.68			0.055	0.90	13	7.65	7.25	0.055	0.049	0.83	0.33	0.016
	7.00	1.54	0.68			0.052	0.90	14	7.25	6.80	0.052	0.047	0.86	0.39	0.018
	6.60	1.52	0.67			0.015	0.90	15	6.80	6.35	0.015	0.014	0.85	0.38	0.005
	6.10	1.41	0.68			0.006	0.90	16	6.35	5.85	0.006	0.005	0.73	0.37	0.002
	5.60	1.36	0.66			0.003	0.90	17	5.85	5.33	0.003	0.003	0.70	0.37	0.001
	5.05	1.27	0.64			0.006	0.90	18	5.33	4.68	0.006	0.005	0.63	0.41	0.002
	4.30	1.14	0.54			0.001	0.90	19	4.68	3.60	0.001	0.001	0.60	0.65	0.001
	2.90	0.82	0.43			0.001	0.90	20	3.60	2.25	0.001	0.001	0.39	0.53	0.000
RB	1.60	0.00	0.43			0.000	0.90	21	2.25	1.60	0.000	0.000	0.10	0.06	0.000
			0.61												
														Total Flow:	**0.248**

Total Flow:				**0.248**		(m^3/s)
Perceived Measurement Quality:				**Good**		
Total Area:				**6.95**		(m^2)
Top Width:				**11.40**		(m)
Hydraulic Depth:				**0.609**		(m)
Mean Velocity:				**0.036**		(m/s)
Froude Number				**0.015**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	4.795V	
Datalogger External Power:	14.84V	
Datalogger Memory Used:	100% Data Wrapping	
Datalogger Clock:	Mar 01, 2004 09:04	MDT
Laptop Clock:	Mar 01, 2004 09:04	MDT
Dessicant:	Good	

Datalogger: Optimum DD128, # 0110220407
PT: Keller 730-130-5 psi #0104640
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: Barometer: 994.16716 hPa Water Temp: 0.188381 C
db 407 Clocks synchronized

Hydrometric Measurement / Site Visit Record

S5A - Muskeg River Aurora

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora
Site Name:	S5A
Coordinates & Legal:	6351600 N, 476100 E SE-9-96-9-W4

Time of Measurement

Date of Measurement:	April 4, 2004	
Start Time:	10:55 AM	MDT
End Time:		MDT

Weather Conditions: +15 C, Clear, Light Wind

River Conditions: Holes in ice, 80% ice cover

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading:	Tbar in PVC	1.261	El:	282.380
Water Level Reading:		2.405	El:	281.236
Top of Ice Level Reading:			El:	283.641
Transducer Reading:		1.026	El:	280.209
Other:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)

Total Flow: -

Total Flow:				-		(m^3/s)
Perceived Measurement Quality:						
Total Area:						(m^2)
Top Width:						(m)
Hydraulic Depth:						(m)
Mean Velocity:						(m/s)
Froude Number						

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	4.889V	
Datalogger External Power:	14.24V	
Datalogger Memory Used:	100% Data Wrapping	
Datalogger Clock:	Apr 04, 2004 10:55	MDT
Laptop Clock:	Apr 04, 2004 11:58	MST
Dessicant:	Good	

Datalogger: Optimum DD128, # 0110220407
PT: Keller 730-130-5 psi #0104640
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: Barometer: 967.12816 hPa Water Temp: 0.281266 C
db 407
Unsafe for flow measurement.

Hydrometric Measurement / Site Visit Record

S5A - Muskeg River Above Muskeg Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Muskeg Creek
Site Name:	S5A
Coordinates & Legal:	6351600 N, 476100 E SE-9-96-9-W4

Time of Measurement

Date of Measurement:	April 24, 2004
Start Time:	7:45 AM MDT
End Time:	8:18 AM MDT

Weather Conditions: +5 C, light rain

River Conditions: Minimal border ice adjacent to banks - open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	1.295	El:	282.380	1.253	El:	282.380
Water Level Reading:	2.315	El:	281.360	2.277	El:	281.356
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	1.146	El:	280.214	1.146	El:	280.210
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	2.30	0.00	0.00			0.000	1.00	1	2.30	2.40	0.003	0.003	0.06	0.01	0.000
	2.50	0.25	0.00			0.012	1.00	2	2.40	2.75	0.012	0.012	0.25	0.09	0.001
	3.00	0.50	0.00			0.015	1.00	3	2.75	3.25	0.015	0.015	0.50	0.25	0.004
	3.50	1.02	0.00			0.015	1.00	4	3.25	3.75	0.015	0.015	1.02	0.51	0.008
	4.00	1.20	0.00	0.01	0.01		1.00	5	3.75	4.25	0.009	0.009	1.20	0.60	0.005
	4.50	1.44	0.00	0.03	0.05		1.00	6	4.25	4.75	0.038	0.038	1.44	0.72	0.027
	5.00	1.60	0.00	0.08	0.08		1.00	7	4.75	5.25	0.078	0.078	1.60	0.80	0.062
	5.50	1.73	0.00	0.15	0.11		1.00	8	5.25	5.75	0.128	0.128	1.73	0.87	0.111
	6.00	1.79	0.00	0.20	0.16		1.00	9	5.75	6.25	0.181	0.181	1.79	0.90	0.162
	6.50	1.82	0.00	0.20	0.16		1.00	10	6.25	6.75	0.178	0.178	1.82	0.91	0.162
	7.00	1.80	0.00	0.21	0.18		1.00	11	6.75	7.25	0.195	0.195	1.80	0.90	0.176
	7.50	1.75	0.00	0.22	0.18		1.00	12	7.25	7.75	0.197	0.197	1.75	0.88	0.172
	8.00	1.72	0.00	0.21	0.18		1.00	13	7.75	8.25	0.198	0.198	1.72	0.86	0.170
	8.50	1.70	0.00	0.26	0.19		1.00	14	8.25	8.75	0.227	0.227	1.70	0.85	0.193
	9.00	1.67	0.00	0.21	0.16		1.00	15	8.75	9.25	0.187	0.187	1.67	0.84	0.157
	9.50	1.70	0.00	0.23	0.16		1.00	16	9.25	9.75	0.198	0.198	1.70	0.85	0.168
	10.00	1.64	0.00	0.23	0.16		1.00	17	9.75	10.25	0.194	0.194	1.64	0.82	0.159
	10.50	1.65	0.00	0.23	0.16		1.00	18	10.25	10.75	0.194	0.194	1.65	0.83	0.160
	11.00	1.45	0.00	0.22	0.16		1.00	19	10.75	11.25	0.192	0.192	1.45	0.73	0.139
	11.50	1.46	0.00	0.22	0.16		1.00	20	11.25	11.75	0.191	0.191	1.46	0.73	0.139
	12.00	1.30	0.00	0.20	0.12		1.00	21	11.75	12.25	0.158	0.158	1.30	0.65	0.103
	12.50	1.10	0.00			0.158	1.00	22	12.25	12.75	0.158	0.158	1.10	0.55	0.087
	13.00	1.00	0.00			0.012	1.00	23	12.75	13.38	0.012	0.012	1.00	0.63	0.008
	13.75	0.27	0.00			0.009	1.00	24	13.38	13.93	0.009	0.009	0.27	0.15	0.001
RB	14.10	0.00	0.00			0.000	1.00	25	13.93	14.10	0.002	0.002	0.07	0.01	0.000
														Total Flow:	2.375

Total Flow:	**2.375**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**15.90**		**(m^2)**
Top Width:	**11.80**		**(m)**
Hydraulic Depth:	**1.347**		**(m)**
Mean Velocity:	**0.149**		**(m/s)**
Froude Number	**0.041**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**407**
Datalogger Internal Power:	4.85V	
Datalogger External Power:	12.56V	
Datalogger Memory Used:	wrapping	
Datalogger Clock:	Apr 24, 2004 06:31	MST
Laptop Clock:	Apr 24, 2004 07:34	MDT
Dessicant:	Good	

Datalogger: Optimum datalogger s/n#03110220407
PT: Keller s/n 0101356
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: TSS sample collected.
Apparent beaver dam downstream of site.

Hydrometric Measurement / Site Visit Record

S5A - Muskeg River Above Muskeg Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Muskeg Creek
Site Name:	S5A
Coordinates & Legal:	6351600 N, 476100 E SE-9-96-9-W4

Time of Measurement

Date of Measurement:	June 1, 2004	
Start Time:	2:38 PM	MDT
End Time:	3:08 PM	MDT

Weather Conditions: +15 C, partly cloudy

River Conditions: Open, flood stage, banks overtopped

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	1.215	El:	282.380	1.114	El:	282.380
Water Level Reading:	1.506	El:	282.089	1.412	El:	282.082
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El	1.883	El:	280.206	1.883	El:	280.199
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	16.60	0.00	0.00			0.000	1.00	1	16.60	17.05	0.000	0.000	0.07	0.03	0.000
	17.50	0.27	0.00			0.000	1.00	2	17.05	18.00	0.000	0.000	0.27	0.26	0.000
	18.50	1.19	0.00	0.00	0.00		1.00	3	18.00	19.00	0.000	0.000	1.19	1.19	0.000
	19.50	1.70	0.00	0.05	0.03		1.00	4	19.00	20.00	0.041	0.041	1.70	1.70	0.070
	20.50	2.13	0.00	0.13	0.10		1.00	5	20.00	21.00	0.114	0.114	2.13	2.13	0.243
	21.50	2.44	0.00	0.16	0.21		1.00	6	21.00	22.00	0.183	0.183	2.44	2.44	0.446
	22.50	2.57	0.00	0.20	0.23		1.00	7	22.00	23.00	0.218	0.218	2.57	2.57	0.560
	23.50	2.47	0.00	0.18	0.28		1.00	8	23.00	24.00	0.232	0.232	2.47	2.47	0.572
	24.50	2.37	0.00	0.17	0.23		1.00	9	24.00	25.00	0.201	0.201	2.37	2.37	0.477
	25.50	2.46	0.00	0.21	0.25		1.00	10	25.00	26.00	0.230	0.230	2.46	2.46	0.566
	26.50	2.42	0.00	0.22	0.25		1.00	11	26.00	27.00	0.233	0.233	2.42	2.42	0.564
	27.50	2.13	0.00	0.17	0.18		1.00	12	27.00	28.00	0.175	0.175	2.13	2.13	0.373
	28.50	1.97	0.00	0.15	0.18		1.00	13	28.00	29.00	0.163	0.163	1.97	1.97	0.321
	29.50	1.70	0.00	0.11	0.14		1.00	14	29.00	30.00	0.128	0.128	1.70	1.70	0.218
	30.50	0.85	0.00			0.009	1.00	15	30.00	31.60	0.009	0.009	0.85	1.36	0.012
RB	32.70	0.00	0.00			0.000	1.00	16	31.60	32.70	0.002	0.002	0.21	0.23	0.001
														Total Flow:	4.424

Total Flow:	**4.424**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**27.43**		**(m^2)**
Top Width:	**16.10**		**(m)**
Hydraulic Depth:	**1.704**		**(m)**
Mean Velocity:	**0.161**		**(m/s)**
Froude Number	**0.039**		
Photographs taken looking at: yes			

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**407**
Datalogger Internal Power:	4.914V	
Datalogger External Power:	13.89V	
Datalogger Memory Used:	wrapping	
Datalogger Clock:	1/06/2004 13:15:26	MST
Laptop Clock:	Jun 01, 2004 14:17	MDT
Dessicant:	Good	

Datalogger: Optimum datalogger s/n#03110220407
PT: Keller s/n 0101356
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S5A - Muskeg River Above Muskeg Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Muskeg Creek
Site Name:	S5A
Coordinates & Legal:	6351600 N, 476100 E SE-9-96-9-W4

Time of Measurement

Date of Measurement:	July 22, 2004
Start Time:	5:52 PM MDT
End Time:	6:30 PM MDT

Weather Conditions: +25 C, clear, calm

River Conditions: Open water

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**	
Bench Mark Reading: Rebar	0.974	El:	282.380
Water Level Reading:	2.362	El:	280.992
Top of Ice Level Reading:		El:	
Transducer Reading & Calc'd E	0.795	El:	280.197
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	13.10	0.00	0.00			0.000	1.00	1	13.10	12.80	0.001	0.001	0.16	0.05	0.000
	12.50	0.65	0.00			0.003	1.00	2	12.80	12.25	0.003	0.003	0.65	0.36	0.001
	12.00	0.77	0.00			0.020	1.00	3	12.25	11.75	0.020	0.020	0.77	0.39	0.008
	11.50	0.97	0.00			0.003	1.00	4	11.75	11.25	0.003	0.003	0.97	0.49	0.001
	11.00	1.07	0.00	0.00	0.01		1.00	5	11.25	10.75	0.006	0.006	1.07	0.54	0.003
	10.50	1.05	0.00	-0.02	-0.02		1.00	6	10.75	10.25	-0.015	-0.015	1.05	0.53	-0.008
	10.00	1.18	0.00	-0.02	-0.02		1.00	7	10.25	9.75	-0.017	-0.017	1.18	0.59	-0.010
	9.50	1.36	0.00	0.01	-0.02		1.00	8	9.75	9.25	-0.006	-0.006	1.36	0.68	-0.004
	9.00	1.40	0.00	0.00	0.01		1.00	9	9.25	8.75	0.002	0.002	1.40	0.70	0.001
	8.50	1.43	0.00	0.01	0.03		1.00	10	8.75	8.25	0.018	0.018	1.43	0.72	0.013
	8.00	1.42	0.00	0.00	0.04		1.00	11	8.25	7.75	0.020	0.020	1.42	0.71	0.014
	7.50	1.44	0.00	0.03	0.09		1.00	12	7.75	7.25	0.061	0.061	1.44	0.72	0.044
	7.00	1.50	0.00	0.04	0.06		1.00	13	7.25	6.75	0.049	0.049	1.50	0.75	0.037
	6.50	1.50	0.00	0.08	0.10		1.00	14	6.75	6.38	0.087	0.087	1.50	0.56	0.049
	6.25	1.50	0.00	0.07	0.10		1.00	15	6.38	6.13	0.085	0.085	1.50	0.38	0.032
	6.00	1.45	0.00	0.12	0.11		1.00	16	6.13	5.88	0.116	0.116	1.45	0.36	0.042
	5.75	1.48	0.00	0.09	0.11		1.00	17	5.88	5.63	0.101	0.101	1.48	0.37	0.037
	5.50	1.45	0.00	0.09	0.07		1.00	18	5.63	5.25	0.082	0.082	1.45	0.54	0.045
	5.00	1.38	0.00	0.08	0.07		1.00	19	5.25	4.75	0.073	0.073	1.38	0.69	0.050
	4.50	1.32	0.00	0.06	0.06		1.00	20	4.75	4.25	0.061	0.061	1.32	0.66	0.040
	4.00	1.18	0.00	0.04	0.02		1.00	21	4.25	3.75	0.030	0.030	1.18	0.59	0.018
	3.50	0.90	0.00			0.020	1.00	22	3.75	3.25	0.020	0.020	0.90	0.45	0.009
	3.00	0.72	0.00			0.030	1.00	23	3.25	2.75	0.030	0.030	0.72	0.36	0.011
	2.50	0.38	0.00			0.003	1.00	24	2.75	2.00	0.003	0.003	0.38	0.29	0.001
RB	1.50	0.00	0.00			0.000	1.00	25	2.00	1.50	0.001	0.001	0.10	0.05	0.000
														Total Flow:	0.434

Total Flow:	**0.434**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**12.50**		**(m^2)**
Top Width:	**11.60**		**(m)**
Hydraulic Depth:	**1.077**		**(m)**
Mean Velocity:	**0.035**		**(m/s)**
Froude Number	**0.011**		
Photographs taken looking at: yes			

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**407**	
Datalogger Internal Power:	4.932V		
Datalogger External Power:	13.49V		
Datalogger Memory Used:	wrapping		
Datalogger Clock:	Jul 22, 2004 16:20		MST
Laptop Clock:	Jul 22, 2004 17:23		MDT
Dessicant:	Good		

Datalogger: Optimum datalogger s/n#03110220407
PT: Keller s/n 0101356
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S5A - Muskeg River Aurora

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora
Site Name:	S5A
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 24, 2004	
Start Time:	12:55 PM	MDT
End Time:	1:36 PM	MDT

Weather Conditions: Partly Cloudy, 15 C, calm

River Conditions: Open, low

Personnel & Equipment

Measurement Made By:	CT/DB
Data Entry By:	DB
Meter Type and No.:	March Mc Birney Flo-Mate 2000 (r

Level Readings and Measurements

Bench Mark Reading:	bar in PVC pi	1.157	El:
Water Level Reading:		2.538	El:
Top of Ice Level Reading:			El:
Transducer Reading & Est. El.:		0.806	El:
Other:			El:

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	29.50	0.00				0.000	1.00	1	29.50	29.25	-0.004	-0.004	0.15	0.04	0.000
	29.00	0.58				-0.015	1.00	2	29.25	28.75	-0.015	-0.015	0.58	0.29	-0.004
	28.50	0.69				0.000	1.00	3	28.75	28.25	0.000	0.000	0.69	0.35	0.000
	28.00	0.80				-0.006	1.00	4	28.25	27.75	-0.006	-0.006	0.80	0.40	-0.002
	27.50	0.90				0.012	1.00	5	27.75	27.25	0.012	0.012	0.90	0.45	0.005
	27.00	1.01				0.003	1.00	6	27.25	26.75	0.003	0.003	1.01	0.51	0.002
	26.50	1.08		0.00	0.01		1.00	7	26.75	26.25	0.002	0.002	1.08	0.54	0.001
	26.00	1.25		0.00	0.01		1.00	8	26.25	25.75	0.008	0.008	1.25	0.63	0.005
	25.50	1.26		0.01	0.01		1.00	9	25.75	25.25	0.011	0.011	1.26	0.63	0.007
	25.00	1.29		0.02	0.01		1.00	10	25.25	24.75	0.011	0.011	1.29	0.65	0.007
	24.50	1.33		0.02	0.01		1.00	11	24.75	24.25	0.012	0.012	1.33	0.67	0.008
	24.00	1.38		0.02	0.01		1.00	12	24.25	23.75	0.012	0.012	1.38	0.69	0.008
	23.50	1.39		0.02	0.01		1.00	13	23.75	23.25	0.015	0.015	1.39	0.70	0.011
	23.00	1.44		0.02	0.02		1.00	14	23.25	22.75	0.015	0.015	1.44	0.72	0.011
	22.50	1.46		0.02	0.00		1.00	15	22.75	22.25	0.011	0.011	1.46	0.73	0.008
	22.00	1.44		0.03	0.01		1.00	16	22.25	21.75	0.020	0.020	1.44	0.72	0.014
	21.50	1.42		0.02	0.01		1.00	17	21.75	21.25	0.015	0.015	1.42	0.71	0.011
	21.00	1.28		0.02	0.01		1.00	18	21.25	20.75	0.014	0.014	1.28	0.64	0.009
	20.50	1.16		0.02	0.00		1.00	19	20.75	20.25	0.011	0.011	1.16	0.58	0.006
	20.00	0.91				0.003	1.00	20	20.25	19.75	0.003	0.003	0.91	0.46	0.001
	19.50	0.59				-0.006	1.00	21	19.75	19.25	-0.006	-0.006	0.59	0.30	-0.002
	19.00	0.35				-0.006	1.00	22	19.25	18.55	-0.006	-0.006	0.35	0.25	-0.001
LB	18.10	0.00				0.000	1.00	23	18.55	18.10	0.000	-0.002	0.09	0.04	0.000
														Total Flow:	**0.103**

Total Flow:	**0.103**		(m^3/s)
Perceived Measurement Quality:	**Fair**		
Total Area:	**11.65**		(m^2)
Top Width:	**11.40**		(m)
Hydraulic Depth:	**1.022**		(m)
Mean Velocity:	**0.009**		(m/s)
Froude Number	**0.003**		

Photographs taken looking at:
Upstream, downstream, across

Notes:
TSS Sample Taken
Databsae # 407
Barometer 967.609 hPA, Temp 12.77 C

Datalogger Notes:	**Database # 407**	
Datalogger Internal Power:		
Datalogger External Power:		
Datalogger Memory Used:	WRAPPED	
Datalogger Clock:	Aug 24, 2004 11:33	MST
Laptop Clock:	Aug 24, 2004 12:37	MDT
Dessicant:	Good	
Datalogger:		
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

S5A - Muskeg River Above Muskeg Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Muskeg Creek
Site Name:	S5A
Coordinates & Legal:	6351600 N, 476100 E SE-9-96-9-W4

Time of Measurement

Date of Measurement:	September 24, 2004
Start Time:	9:53 AM MDT
End Time:	10:30 AM MDT

Weather Conditions: +10 C, overcast, calm

River Conditions: open

Personnel & Equipment

Measurement Made By:	NM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	1.138	El:	282.380	1.161	El:	282.380
Water Level Reading:	2.237	El:	281.281	2.254	El:	281.287
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	1.069	El:	280.212	1.069	El:	280.218
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	29.70	0.00	0.00			0.000	1.00	1	29.70	29.45	-0.001	-0.001	0.23	0.06	0.000
	29.20	0.93	0.00			-0.003	1.00	2	29.45	28.95	-0.003	-0.003	0.93	0.47	-0.001
	28.70	0.95	0.00	0.00	0.00		1.00	3	28.95	28.45	0.000	0.000	0.95	0.48	0.000
	28.20	1.18	0.00	0.08	-0.01		1.00	4	28.45	27.95	0.032	0.032	1.18	0.59	0.019
	27.70	1.20	0.00	0.03	0.00		1.00	5	27.95	27.45	0.017	0.017	1.20	0.60	0.010
	27.20	1.30	0.00	0.03	-0.02		1.00	6	27.45	26.95	0.008	0.008	1.30	0.65	0.005
	26.70	1.40	0.00	0.07	0.02		1.00	7	26.95	26.45	0.046	0.046	1.40	0.70	0.032
	26.20	1.54	0.00	0.05	0.02		1.00	8	26.45	25.95	0.038	0.038	1.54	0.77	0.029
	25.70	1.63	0.00	0.04	0.08		1.00	9	25.95	25.45	0.059	0.059	1.63	0.82	0.048
	25.20	1.67	0.00	0.08	0.11		1.00	10	25.45	24.95	0.093	0.093	1.67	0.84	0.078
	24.70	1.60	0.00	0.10	0.15		1.00	11	24.95	24.45	0.125	0.125	1.60	0.80	0.100
	24.20	1.58	0.00	0.13	0.13		1.00	12	24.45	23.95	0.134	0.134	1.58	0.79	0.106
	23.70	1.65	0.00	0.14	0.14		1.00	13	23.95	23.45	0.142	0.142	1.65	0.83	0.117
	23.20	1.69	0.00	0.16	0.12		1.00	14	23.45	22.95	0.137	0.137	1.69	0.85	0.116
	22.70	1.72	0.00	0.07	0.12		1.00	15	22.95	22.45	0.094	0.094	1.72	0.86	0.081
	22.20	1.70	0.00	0.08	0.10		1.00	16	22.45	21.95	0.088	0.088	1.70	0.85	0.075
	21.70	1.70	0.00	0.11	0.09		1.00	17	21.95	21.45	0.101	0.101	1.70	0.85	0.085
	21.20	1.65	0.00	0.09	0.06		1.00	18	21.45	20.95	0.078	0.078	1.65	0.83	0.064
	20.70	1.52	0.00	0.06	0.05		1.00	19	20.95	20.45	0.052	0.052	1.52	0.76	0.039
	20.20	1.35	0.00	0.04	0.04		1.00	20	20.45	19.95	0.038	0.038	1.35	0.68	0.026
	19.70	1.12	0.00	0.04	0.00		1.00	21	19.95	19.45	0.021	0.021	1.12	0.56	0.012
	19.20	0.85	0.00	0.00	0.00		1.00	22	19.45	18.95	0.000	0.000	0.85	0.43	0.000
	18.70	0.55	0.00			0.009	1.00	23	18.95	18.30	0.009	0.009	0.55	0.36	0.003
LB	17.90	0.00	0.00			0.000	1.00	24	18.30	17.90	0.002	0.002	0.14	0.05	0.000
														Total Flow:	1.045

Total Flow:	**1.045**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**15.44**		**(m^2)**
Top Width:	**11.80**		**(m)**
Hydraulic Depth:	**1.308**		**(m)**
Mean Velocity:	**0.068**		**(m/s)**
Froude Number	**0.019**		
Photographs taken looking at: yes			

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**407**
Datalogger Internal Power:	4.844V	
Datalogger External Power:	13.56V	
Datalogger Memory Used:	wrapping	
Datalogger Clock:	Sep 24, 2004 08:45	MST
Laptop Clock:	Sep 24, 2004 08:50	MST
Dessicant:	Replaced - 100%	

Datalogger: Optimum datalogger s/n#03110220407
PT: Keller s/n 0101356
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S5A - Muskeg River Aurora

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora
Site Name:	S5A
Coordinates & Legal:	6351600 N, 476100 E SE-9-96-9-W4

Time of Measurement

Date of Measurement:	November 1, 2004
Start Time:	12:10 PM MST
End Time:	12:30 PM MST

Weather Conditions: +2 ˚C, Clear

River Conditions: Full ice cover

Personnel & Equipment

Measurement Made By:	FF/ND/DM
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading: Tbar in PVC	1.339	El:	282.380
Water Level Reading:	2.594	El:	281.125
Top of Ice Level Reading:	2.549	El:	281.170
Transducer Reading:	0.915	El:	280.210
Other:		El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)

Total Flow: -

Total Flow:				-		(m^3/s)
Perceived Measurement Quality:						
Total Area:						(m^2)
Top Width:						(m)
Hydraulic Depth:						(m)
Mean Velocity:						(m/s)
Froude Number						

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:		
Datalogger Internal Power:	4.8V	
Datalogger External Power:	14.39V	
Datalogger Memory Used:	6% used	
Datalogger Clock:	Nov 01, 2004 12:07	MST
Laptop Clock:	Nov 01, 2004 11:14	MST
Dessicant:	Good	
Datalogger:	Optimum DD128, # 0110220407	
PT:	Keller 730-130-5 psi #0104640	
Power:		

Notes: Barometer: 982 hPa Water Temp: 1.009 C
db 407 TSS sample taken
Unsafe for flow measurement.
Could not download data due to laptop port problem

Hydrometric Measurement / Site Visit Record

S5A - Muskeg River Above Muskeg Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Above Muskeg Creek
Site Name:	S5A
Coordinates & Legal:	6351600 N, 476100 E SE-9-96-9-W4

Time of Measurement

Date of Measurement:	December 2, 2004
Start Time:	9:44 AM MST
End Time:	10:48 AM MST

Weather Conditions: -7 C, snowing

River Conditions: Fully frozen

Personnel & Equipment

Measurement Made By:	ND/DB/CT
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	1.023	El:	282.380	1.192	El:	282.380
Water Level Reading:	2.344	El:	281.059	2.509	El:	281.063
Top of Ice Level Reading:	2.297	El:		2.465	El:	
Transducer Reading & Calc'd El	0.846	El:	280.213	0.846	El:	280.217
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	17.10	0.00	0.00	0.00	0.00	0.000	0.90	1	17.10	17.50	0.002	0.002	0.09	0.03	0.000
	17.90	0.67	0.32	0.00	0.00	0.027	0.90	2	17.50	18.10	0.009	0.008	0.35	0.21	0.002
	18.30	0.70	0.32	0.00	0.00	0.006	0.90	3	18.10	18.55	0.002	0.002	0.38	0.17	0.000
	18.80	0.86	0.27	0.00	0.00	0.009	0.90	4	18.55	19.05	0.003	0.003	0.59	0.30	0.001
	19.30	0.97	0.37	0.00	0.00	0.003	0.90	5	19.05	19.50	0.001	0.001	0.60	0.27	0.000
	19.70	1.08	0.29	0.00	0.00	0.012	0.90	6	19.50	19.95	0.004	0.004	0.79	0.36	0.001
	20.20	1.15	0.33	0.00	0.00	-0.006	0.90	7	19.95	20.50	-0.002	-0.002	0.82	0.45	-0.001
	20.80	1.37	0.36	0.00	0.00	0.000	0.90	8	20.50	21.05	0.000	0.000	1.01	0.56	0.000
	21.30	1.38	0.37	0.00	0.00	-0.006	0.90	9	21.05	21.45	-0.002	-0.002	1.01	0.40	-0.001
	21.60	1.40	0.31	0.00	0.00	0.000	0.90	10	21.45	21.80	0.002	0.002	1.09	0.38	0.001
	22.00	1.41	0.30	0.01	0.00	0.000	0.90	11	21.80	22.20	0.003	0.003	1.11	0.44	0.001
	22.40	1.38	0.31	0.00	0.00	0.000	0.90	12	22.20	22.70	0.001	0.001	1.07	0.54	0.000
	23.00	1.37	0.38	0.00	0.00	0.012	0.90	13	22.70	23.25	0.004	0.004	0.99	0.54	0.002
	23.50	1.37	0.31	0.02	0.04	0.000	0.90	14	23.25	23.70	0.017	0.016	1.06	0.48	0.007
	23.90	1.50	0.32	0.01	0.02	0.000	0.90	15	23.70	24.10	0.010	0.009	1.18	0.47	0.004
	24.30	1.50	0.30	0.02	0.03	0.000	0.90	16	24.10	24.55	0.018	0.016	1.20	0.54	0.009
	24.80	1.42	0.35	0.09	0.08	0.000	0.90	17	24.55	25.05	0.054	0.048	1.07	0.54	0.026
	25.30	1.49	0.35	0.07	0.06	0.000	0.90	18	25.05	25.55	0.042	0.037	1.14	0.57	0.021
	25.80	1.49	0.35	0.11	0.10	0.000	0.90	19	25.55	26.05	0.068	0.061	1.14	0.57	0.035
	26.30	1.40	0.35	0.09	0.08	0.000	0.90	20	26.05	26.53	0.055	0.049	1.05	0.50	0.025
	26.75	1.40	0.30	0.06	0.06	0.000	0.90	21	26.53	26.98	0.041	0.037	1.10	0.50	0.018
	27.20	1.27	0.30	0.00	0.00	0.046	0.90	22	26.98	27.40	0.015	0.014	0.97	0.41	0.006
	27.60	1.10	0.35	0.00	0.00	0.030	0.90	23	27.40	27.90	0.010	0.009	0.75	0.38	0.003
	28.20	0.85	0.28	0.00	0.00	0.009	0.90	24	27.90	28.40	0.003	0.003	0.57	0.29	0.001
	28.60	0.50	0.20	0.00	0.00	0.003	0.90	25	28.40	28.80	0.001	0.001	0.30	0.12	0.000
LB	29.00	0.00	0.00	0.00	0.00	0.000	0.90	26	28.80	29.00	0.000	0.000	0.08	0.01	0.000
														Total Flow:	0.163

Total Flow:	**0.163**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**10.02**		**(m^2)**
Top Width:	**11.90**		**(m)**
Hydraulic Depth:	**0.842**		**(m)**
Mean Velocity:	**0.016**		**(m/s)**
Froude Number	**0.006**		

Photographs taken looking at:
Upstream, downstream and across

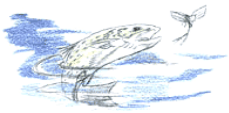
Datalogger Notes:	**Database**	**407**
Datalogger Internal Power:	4.811V	
Datalogger External Power:	12.67V	
Datalogger Memory Used:	10% used	
Datalogger Clock:	Dec 02, 2004 08:52	MST
Laptop Clock:	Dec 02, 2004 09:01	MST
Dessicant:	25% used	

Datalogger: Optimum datalogger s/n#03110220407
PT: Keller s/n 0101356
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: Data logger clock synchronized with laptop clock
Water temp 1.130635 C

Hydrometric Measurement / Site Visit Record

S6 - Mills Creek at Highway 63



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Mills Creek
Location:	Mills Creek at Highway 63
Site Name:	S6
Coordinates & Legal:	6344743 N, 463829 E NW-17-95-10-W4

Time of Measurement

Date of Measurement:	April 5, 2004		
Start Time:	10:00 AM MDT	u/s	
End Time:	10:15 AM MDT	d/s	

Weather Conditions: +10, Clear, Calm

River Conditions: No ice

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney

Level Readings and Measurements

Bench Mark Reading:	1.996	El:	273.600
Water Level Reading:	3.525	El:	272.071
Water Level Reading:	4.190	El:	271.406
Transducer Reading:		El:	
Other: V-notch invert	3.529	El:	272.067

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	0.40	0.00				0.000	1.00	1	0.40	0.50	0.002	0.002	0.01	0.00	0.000
	0.60	0.05				0.006	1.00	2	0.50	0.80	0.006	0.006	0.05	0.02	0.000
	1.00	0.10				0.001	1.00	3	0.80	1.25	0.001	0.001	0.10	0.05	0.000
	1.50	0.20				0.012	1.00	4	1.25	1.63	0.012	0.012	0.20	0.08	0.001
	1.75	0.28				0.001	1.00	5	1.63	1.88	0.001	0.001	0.28	0.07	0.000
	2.00	0.33				0.009	1.00	6	1.88	2.10	0.009	0.009	0.33	0.07	0.001
	2.20	0.36				0.030	1.00	7	2.10	2.30	0.030	0.030	0.36	0.07	0.002
	2.40	0.34				0.015	1.00	8	2.30	2.50	0.015	0.015	0.34	0.07	0.001
	2.60	0.32				0.046	1.00	9	2.50	2.65	0.046	0.046	0.32	0.05	0.002
	2.70	0.31				0.043	1.00	10	2.65	2.75	0.043	0.043	0.31	0.03	0.001
	2.80	0.31				0.049	1.00	11	2.75	2.90	0.049	0.049	0.31	0.05	0.002
	3.00	0.30				0.021	1.00	12	2.90	3.05	0.021	0.021	0.30	0.05	0.001
	3.10	0.28				0.058	1.00	13	3.05	3.15	0.058	0.058	0.28	0.03	0.002
	3.20	0.25				0.052	1.00	14	3.15	3.25	0.052	0.052	0.25	0.02	0.001
	3.30	0.24				0.073	1.00	15	3.25	3.35	0.073	0.073	0.24	0.02	0.002
	3.40	0.22				0.070	1.00	16	3.35	3.50	0.070	0.070	0.22	0.03	0.002
	3.60	0.18				0.001	1.00	17	3.50	3.75	0.001	0.001	0.18	0.05	0.000
LB	3.90	0.00				0.000	1.00	18	3.75	3.90	0.000	0.000	0.05	0.01	0.000
	Notes:													Total Flow:	0.019

					0.019	(m^3/s)
					Fair	
Total Area:					0.75	(m^2)
Top Width:					3.50	(m)
Hydraulic Depth:					0.215	(m)
Mean Velocity:					0.025	(m/s)
Froude Number					0.017	

Photographs taken looking at:
yes

Datalogger Notes:	
Datalogger Internal Power:	
Datalogger External Power:	
Datalogger Memory Used:	
Datalogger Clock:	MDT
Laptop Clock:	MDT
Dessicant:	
Datalogger:	
PT:	
Power:	
Temp:	

Notes: Measurements taken by wading.

Hydrometric Measurement / Site Visit Record

S6 - Mills Creek at Highway 63

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Mills Creek
Location:	Mills Creek at Highway 63
Site Name:	S6
Coordinates & Legal:	6344743 N, 463829 E NW-17-95-10-W4

Time of Measurement

Date of Measurement:	April 24, 2004
Start Time:	10:16 AM MDT
End Time:	10:27 AM MDT

Weather Conditions: +5 C, windy, partly cloudy

River Conditions: Open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	2.643	El:	273.600	2.590	El:	273.600
Water Level Reading:	4.199	El:	272.044	4.151	El:	272.039
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.595	El:	271.449	0.595	El:	271.444
Other: Invert of weir	4.362	El:	271.881	4.311	El:	271.879

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	0.45	0.00	0.00			0.000	1.00	1	0.45	0.73	0.001	0.001	0.03	0.01	0.000
	1.00	0.13	0.00			0.003	1.00	2	0.73	1.10	0.003	0.003	0.13	0.05	0.000
	1.20	0.19	0.00			0.003	1.00	3	1.10	1.30	0.003	0.003	0.19	0.04	0.000
	1.40	0.20	0.00			0.006	1.00	4	1.30	1.50	0.006	0.006	0.20	0.04	0.000
	1.60	0.23	0.00			0.012	1.00	5	1.50	1.70	0.012	0.012	0.23	0.05	0.001
	1.80	0.23	0.00			0.012	1.00	6	1.70	1.90	0.012	0.012	0.23	0.05	0.001
	2.00	0.24	0.00			0.015	1.00	7	1.90	2.10	0.015	0.015	0.24	0.05	0.001
	2.20	0.27	0.00			0.018	1.00	8	2.10	2.30	0.018	0.018	0.27	0.05	0.001
	2.40	0.29	0.00			0.024	1.00	9	2.30	2.50	0.024	0.024	0.29	0.06	0.001
	2.60	0.30	0.00			0.030	1.00	10	2.50	2.70	0.030	0.030	0.30	0.06	0.002
	2.80	0.30	0.00			0.034	1.00	11	2.70	2.90	0.034	0.034	0.30	0.06	0.002
	3.00	0.31	0.00			0.043	1.00	12	2.90	3.10	0.043	0.043	0.31	0.06	0.003
	3.20	0.28	0.00			0.044	1.00	13	3.10	3.30	0.044	0.044	0.28	0.06	0.002
	3.40	0.28	0.00			0.009	1.00	14	3.30	3.50	0.009	0.009	0.28	0.06	0.001
	3.60	0.27	0.00			0.006	1.00	15	3.50	3.70	0.006	0.006	0.27	0.05	0.000
	3.80	0.25	0.00			0.008	1.00	16	3.70	3.90	0.008	0.008	0.25	0.05	0.000
	4.00	0.25	0.00			0.009	1.00	17	3.90	4.10	0.009	0.009	0.25	0.05	0.000
	4.20	0.18	0.00			0.005	1.00	18	4.10	4.30	0.005	0.005	0.18	0.04	0.000
	4.40	0.13	0.00			0.005	1.00	19	4.30	4.53	0.005	0.005	0.13	0.03	0.000
LB	4.65	0.00	0.00			0.000	1.00	20	4.53	4.65	0.001	0.001	0.03	0.00	0.000
														Total Flow:	0.016

Total Flow:	**0.016**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.91**		**(m^2)**
Top Width:	**4.20**		**(m)**
Hydraulic Depth:	**0.215**		**(m)**
Mean Velocity:	**0.017**		**(m/s)**
Froude Number	**0.012**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	9.55V	
Datalogger External Power:	9.73V	
Datalogger Memory Used:	0%	
Datalogger Clock:	Apr 24, 2004 08:58	MST
Laptop Clock:	Apr 24, 2004 09:58	MDT
Dessicant:	Good	
Datalogger:	Datalogger #207110	
PT:	Keller Pressure Transducer #1747	
Power:	Lakewood battery	

Notes:

Equipment installed. Transducer wired to concrete block and placed in flow.
TSS sample collected.
New backup or auxillary battery needed for this Lakewood datalogger.

Hydrometric Measurement / Site Visit Record

S6 - Mills Creek at Highway 63

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Mills Creek
Location:	Mills Creek at Highway 63
Site Name:	S6
Coordinates & Legal:	6344743 N, 463829 E NW-17-95-10-W4

Time of Measurement

Date of Measurement:	April 27, 2004
Start Time:	5:45 PM MDT
End Time:	5:55 PM MDT

Weather Conditions: +5 C, windy, partly cloudy

River Conditions: Open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Time / Volume method used

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	1.891	El:	273.600	1.820	El:	273.600
Water Level Reading:	3.443	El:	272.048	3.367	El:	272.053
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.599	El:	271.449	0.599	El:	271.454
Other: Invert of weir		El:	275.491		El:	275.420

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB															
	Flow measurement made by 5 volume / time measurements. Flow estimated to be 0.010 cms.														
LB														Total Flow:	

Total Flow:	**0.010**		**(m^3/s)**
Perceived Measurement Quality:	**Poor**		
Total Area:	**0.00**		**(m^2)**
Top Width:	**0.00**		**(m)**
Hydraulic Depth:	**#DIV/0!**		**(m)**
Mean Velocity:	**#DIV/0!**		**(m/s)**
Froude Number	**#DIV/0!**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:			
Datalogger Internal Power:	9.55V	new	11.34V
Datalogger External Power:	9.73V	new	13.260
Datalogger Memory Used:	0%		
Datalogger Clock:	Apr 27, 2004 16:44		MST
Laptop Clock:	Apr 27, 2004 17:45		MDT
Dessicant:	Good		
Datalogger:	Datalogger #207110		
PT:	Keller Pressure Transducer #1747		
Power:	Lakewood battery		

Notes: Battery replaced.
Flow measurement made by volume / time method.

Hydrometric Measurement / Site Visit Record

S6 - Mills Creek at Highway 63

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Mills Creek
Location:	Mills Creek at Highway 63
Site Name:	S6
Coordinates & Legal:	6344743 N, 463829 E NW-17-95-10-W4

Time of Measurement

Date of Measurement:	June 1, 2004
Start Time:	5:37 PM MDT
End Time:	5:47 PM MDT

Weather Conditions: +19 C, clear, calm

River Conditions: Open water conditions.

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	1.942	El:	273.600	2.009	El:	273.600
Water Level Reading:	3.454	El:	272.088	3.514	El:	272.095
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.647	El:	271.441	0.647	El:	271.448
Other:		El:	275.542		El:	275.609

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	0.70	0.00	0.00			0.000	1.00	1	0.70	0.85	0.000	0.000	0.02	0.00	0.000
	1.00	0.07	0.00			0.000	1.00	2	0.85	1.15	0.000	0.000	0.07	0.02	0.000
	1.30	0.15	0.00			0.003	1.00	3	1.15	1.45	0.003	0.003	0.15	0.05	0.000
	1.60	0.20	0.00			0.024	1.00	4	1.45	1.70	0.024	0.024	0.20	0.05	0.001
	1.80	0.22	0.00			0.024	1.00	5	1.70	1.90	0.024	0.024	0.22	0.04	0.001
	2.00	0.22	0.00			0.018	1.00	6	1.90	2.10	0.018	0.018	0.22	0.04	0.001
	2.20	0.28	0.00			0.006	1.00	7	2.10	2.30	0.006	0.006	0.28	0.06	0.000
	2.40	0.34	0.00			0.018	1.00	8	2.30	2.50	0.018	0.018	0.34	0.07	0.001
	2.60	0.33	0.00			0.046	1.00	9	2.50	2.70	0.046	0.046	0.33	0.07	0.003
	2.80	0.39	0.00			0.055	1.00	10	2.70	2.90	0.055	0.055	0.39	0.08	0.004
	3.00	0.35	0.00			0.067	1.00	11	2.90	3.10	0.067	0.067	0.35	0.07	0.005
	3.20	0.33	0.00			0.034	1.00	12	3.10	3.30	0.034	0.034	0.33	0.07	0.002
	3.40	0.33	0.00			0.088	1.00	13	3.30	3.50	0.088	0.088	0.33	0.07	0.006
	3.60	0.28	0.00			0.073	1.00	14	3.50	3.70	0.073	0.073	0.28	0.06	0.004
	3.80	0.23	0.00			0.046	1.00	15	3.70	3.80	0.046	0.046	0.23	0.02	0.001
	4.10	0.17	0.00			0.006	1.00	16	3.80	4.10	0.006	0.006	0.17	0.05	0.000
LB	4.60	0.00	0.00			0.000	1.00	17	4.10	4.60	0.002	0.002	0.04	0.02	0.000
														Total Flow:	0.030

Total Flow:	**0.030**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**0.83**		**(m^2)**
Top Width:	**3.90**		**(m)**
Hydraulic Depth:	**0.212**		**(m)**
Mean Velocity:	**0.037**		**(m/s)**
Froude Number	**0.025**		

Photographs taken looking at:
yes

Notes: TSS sample collected.
Transducer appears to be in the same position

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	13.14V	0.9
Datalogger Memory Used:	0%	
Datalogger Clock:	Jun 01, 2004 16:30	MST
Laptop Clock:	Jun 01, 2004 17:31	MDT
Dessicant:	Good	
Datalogger:	Datalogger #207110	
PT:	Keller Pressure Transducer #1747	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S6 - Mills Creek at Highway 63

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Mills Creek
Location:	Mills Creek at Highway 63
Site Name:	S6
Coordinates & Legal:	6344743 N, 463829 E NW-17-95-10-W4

Time of Measurement

Date of Measurement:	July 25, 2004	
Start Time:	4:50 PM	MDT
End Time:	4:58 PM	MDT

Weather Conditions: +35 C, clear, calm

River Conditions: Open water conditions.

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	1.814	El:	273.600	1.789	El:	273.600
Water Level Reading:	3.379	El:	272.035	3.349	El:	272.040
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.596	El:	271.439	0.596	El:	271.444
Other:		El:	275.414		El:	275.389

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	2.40	0.00	0.00			0.000	1.00	1	2.40	2.30	0.000	0.000	0.01	0.00	0.000
	2.20	0.03	0.00			0.000	1.00	2	2.30	2.15	0.000	0.000	0.03	0.00	0.000
	2.10	0.10	0.00			0.052	1.00	3	2.15	2.05	0.052	0.052	0.10	0.01	0.001
	2.00	0.17	0.00			0.079	1.00	4	2.05	1.95	0.079	0.079	0.17	0.02	0.001
	1.90	0.19	0.00			0.073	1.00	5	1.95	1.85	0.073	0.073	0.19	0.02	0.001
	1.80	0.20	0.00			0.034	1.00	6	1.85	1.75	0.034	0.034	0.20	0.02	0.001
	1.70	0.21	0.00			0.082	1.00	7	1.75	1.65	0.082	0.082	0.21	0.02	0.002
	1.60	0.22	0.00			0.064	1.00	8	1.65	1.55	0.064	0.064	0.22	0.02	0.001
	1.50	0.21	0.00			0.040	1.00	9	1.55	1.45	0.040	0.040	0.21	0.02	0.001
	1.40	0.22	0.00			0.055	1.00	10	1.45	1.35	0.055	0.055	0.22	0.02	0.001
	1.30	0.24	0.00			0.030	1.00	11	1.35	1.25	0.030	0.030	0.24	0.02	0.001
	1.20	0.21	0.00			0.085	1.00	12	1.25	1.15	0.085	0.085	0.21	0.02	0.002
	1.10	0.19	0.00			0.037	1.00	13	1.15	1.05	0.037	0.037	0.19	0.02	0.001
	1.00	0.14	0.00			0.024	1.00	14	1.05	0.95	0.024	0.024	0.14	0.01	0.000
	0.90	0.10	0.00			0.030	1.00	15	0.95	0.85	0.030	0.030	0.10	0.01	0.000
	0.80	0.07	0.00			0.024	1.00	16	0.85	0.75	0.024	0.024	0.07	0.01	0.000
	0.70	0.07	0.00			0.009	1.00	17	0.75	0.65	0.009	0.009	0.07	0.01	0.000
	0.60	0.04	0.00			0.009	1.00	18	0.65	0.55	0.009	0.009	0.04	0.00	0.000
LB	0.50	0.00	0.00			0.000	1.00	19	0.55	0.50	0.002	0.002	0.01	0.00	0.000
														Total Flow:	0.013

Total Flow:	**0.013**		(m^3/s)
Perceived Measurement Quality:	**Good**		
Total Area:	**0.26**		(m^2)
Top Width:	**1.90**		(m)
Hydraulic Depth:	**0.138**		(m)
Mean Velocity:	**0.050**		(m/s)
Froude Number	**0.043**		
Photographs taken looking at: yes			

Notes: TSS sample collected.

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	12.90	83%
Datalogger Memory Used:	30%	
Datalogger Clock:	Jul 25, 2004 15:43	MST
Laptop Clock:	Jul 25, 2004 16:45	MDT
Dessicant:	Good	
Datalogger:	Datalogger #207110	
PT:	Keller Pressure Transducer #1747	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S6 - Mills Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Mills Creek
Location:	Mills Creek
Site Name:	S6
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 24, 2004	
Start Time:	4:12 PM	MDT
End Time:	4:21 PM	MDT

Weather Conditions: Clear, 20 C, calm

River Conditions: Open, low

Personnel & Equipment

Measurement Made By:	CT/DB
Data Entry By:	DB
Meter Type and No.:	March Mc Birney Flo-Mate 2000 (rental) s/n 2001463

Level Readings and Measurem

	Setup No. 1			Setup No. 2		
Bench Mark Reading: bar in PV	1.856	El:	273.600	1.778	El:	273.600
Water Level Reading:	3.429	El:	272.027	3.346	El:	272.032
V-notch	3.584	El:	271.872		El:	
Transducer Reading & Est. El.:	0.586	El:	271.441	0.586	El:	271.446
Other: culvet invert	4.190	El:	271.266		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	0.80	0.00				0.000	1.00	1	0.80	0.85	0.002	0.002	0.01	0.00	0.000
	0.90	0.03				0.009	1.00	2	0.85	0.95	0.009	0.009	0.03	0.00	0.000
	1.00	0.05				0.024	1.00	3	0.95	1.05	0.024	0.024	0.05	0.01	0.000
	1.10	0.11				0.046	1.00	4	1.05	1.15	0.046	0.046	0.11	0.01	0.001
	1.20	0.13				0.091	1.00	5	1.15	1.25	0.091	0.091	0.13	0.01	0.001
	1.30	0.13				0.070	1.00	6	1.25	1.35	0.070	0.070	0.13	0.01	0.001
	1.40	0.15				0.079	1.00	7	1.35	1.45	0.079	0.079	0.15	0.02	0.001
	1.50	0.19				0.098	1.00	8	1.45	1.55	0.098	0.098	0.19	0.02	0.002
	1.60	0.22				0.104	1.00	9	1.55	1.65	0.104	0.104	0.22	0.02	0.002
	1.70	0.25				0.091	1.00	10	1.65	1.75	0.091	0.091	0.25	0.03	0.002
	1.80	0.25				0.076	1.00	11	1.75	1.85	0.076	0.076	0.25	0.03	0.002
	1.90	0.22				0.079	1.00	12	1.85	1.95	0.079	0.079	0.22	0.02	0.002
	2.00	0.22				0.061	1.00	13	1.95	2.05	0.061	0.061	0.22	0.02	0.001
	2.10	0.20				0.049	1.00	14	2.05	2.15	0.049	0.049	0.20	0.02	0.001
	2.20	0.17				0.046	1.00	15	2.15	2.25	0.046	0.046	0.17	0.02	0.001
	2.30	0.06				0.040	1.00	16	2.25	2.40	0.040	0.040	0.06	0.01	0.000
LB	2.50	0.00				0.000	1.00	17	2.40	2.50	0.010	0.010	0.02	0.00	0.000
														Total Flow:	**0.017**

Total Flow:	**0.017**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**0.24**		**(m^2)**
Top Width:	**1.70**		**(m)**
Hydraulic Depth:	**0.143**		**(m)**
Mean Velocity:	**0.072**		**(m/s)**
Froude Number	**0.061**		
Photographs taken looking at: Upstream, downstream, across			

Notes:
TSS Sample Taken
S6 will be fished on Mon Aug 30, for permiting purposes, prior to replacing weir

Datalogger Notes:		
Datalogger Internal Power:		
Datalogger External Power:		
Datalogger Memory Used:	41020 k free%	
Datalogger Clock:	Aug 24, 2004 15:02	MST
Laptop Clock:	Aug 24, 2004 16:03	MDT
Dessicant:	Ok - 25%, replaced	
Datalogger:		
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

S6 - Mills Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Mills Creek
Location:	Mills Creek
Site Name:	S6
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 21, 2004	
Start Time:	11:46 AM	MDT
End Time:	12:02 PM	MDT

Weather Conditions: Clear, 10 C

River Conditions: Open

Personnel & Equipment

Measurement Made By:	NM/DB
Data Entry By:	DB
Meter Type and No.:	March Mc Birney Flo-Mate 2000 s/n 2004521

Level Readings and Measuren		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	bar in PV	1.775	El:	273.600	1.643	El:	273.600
Water Level Reading:		3.244	El:	272.131	3.11	El:	272.133
V-notch		3.500	El:	271.875		El:	
Transducer Reading & Est. El.:		0.685	El:	271.446	0.685	El:	271.448
Other:	culvet invert	4.112	El:	271.263		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	0.30	0.00				0.000	1.00	1	0.30	0.50	0.003	0.003	0.04	0.01	0.000
	0.70	0.16				0.012	1.00	2	0.70	0.85	0.012	0.012	0.16	0.02	0.000
	1.00	0.25				0.043	1.00	3	1.00	1.10	0.043	0.043	0.25	0.03	0.001
	1.20	0.25				0.064	1.00	4	1.20	1.30	0.064	0.064	0.25	0.03	0.002
	1.40	0.24				0.107	1.00	5	1.40	1.50	0.107	0.107	0.24	0.02	0.003
	1.60	0.23				0.110	1.00	6	1.60	1.70	0.110	0.110	0.23	0.02	0.003
	1.80	0.24				0.094	1.00	7	1.80	1.90	0.094	0.094	0.24	0.02	0.002
	2.00	0.26				0.049	1.00	8	2.00	2.10	0.049	0.049	0.26	0.03	0.001
	2.20	0.28				0.070	1.00	9	2.20	2.30	0.070	0.070	0.28	0.03	0.002
	2.40	0.27				0.104	1.00	10	2.40	2.50	0.104	0.104	0.27	0.03	0.003
	2.60	0.27				0.009	1.00	11	2.60	2.75	0.009	0.009	0.27	0.04	0.000
	2.90	0.24				0.024	1.00	12	2.90	3.05	0.024	0.024	0.24	0.04	0.001
	3.20	0.19				0.064	1.00	13	3.20	3.25	0.064	0.064	0.19	0.01	0.001
	3.30	0.17				0.125	1.00	14	3.30	3.40	0.125	0.125	0.17	0.02	0.002
	3.50	0.13				0.034	1.00	15	3.50	3.65	0.034	0.034	0.13	0.02	0.001
	3.80	0.11				0.006	1.00	16	3.80	3.95	0.006	0.006	0.11	0.02	0.000
	4.10	0.04				0.021	1.00	17	4.10	4.20	0.021	0.021	0.04	0.00	0.000
RB	4.30	0.00				0.000	1.00	18	4.30	4.30	0.000	0.000	0.01	0.00	0.000
														Total Flow:	**0.021**

Total Flow:	**0.021**		(m^3/s)
Perceived Measurement Quality:	**Good**		
Total Area:	**0.38**		(m^2)
Top Width:	**4.00**		(m)
Hydraulic Depth:	**0.094**		(m)
Mean Velocity:	**0.056**		(m/s)
Froude Number	**0.058**		
Photographs taken looking at:			

Notes:
TSS Sample Taken

Datalogger Notes:		
Datalogger Internal Power:	11.34 V	100%
Datalogger External Power:	12.29 V	79%
Datalogger Memory Used:	35594 k free	
Datalogger Clock:	Sep 21, 2004 10:32	MST
Laptop Clock:	Sep 21, 2004 10:37	MST
Dessicant:	Good - 100%	
Datalogger:	207110	
PT:	1747	
Power:		

Hydrometric Measurement / Site Visit Record

S6 - Mills Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Mills Creek
Location:	Mills Creek
Site Name:	S6
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 29, 2004	
Start Time:	4:10 PM	MDT
End Time:	4:35 PM	MDT

Weather Conditions: Clear, 3 C

River Conditions: Partial ice cover

Personnel & Equipment

Measurement Made By:	ND/DM/FF
Data Entry By:	ND
Meter Type and No.:	March Mc Birney Flo-Mate 2000 s/n 2004521

Level Readings and Measuren		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	bar in PV	2.920	El:	273.600	2.84	El:	273.600
Water Level Reading:		4.455	El:	272.065	4.385	El:	272.055
V-notch			El:	276.520		El:	
Transducer Reading & Est. El.:		0.605	El:	271.460	0.605	El:	271.450
Other:	culvet invert		El:	276.520		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	3.00	0.00				0.000	1.00	1	3.00	3.05	0.001	0.001	0.02	0.00	0.000
	3.10	0.08				0.003	1.00	2	3.05	3.15	0.003	0.003	0.08	0.01	0.000
	3.20	0.10				0.012	1.00	3	3.15	3.30	0.012	0.012	0.10	0.01	0.000
	3.40	0.14				0.012	1.00	4	3.30	3.50	0.012	0.012	0.14	0.03	0.000
	3.60	0.16				0.021	1.00	5	3.50	3.70	0.021	0.021	0.16	0.03	0.001
	3.80	0.17				0.024	1.00	6	3.70	3.90	0.024	0.024	0.17	0.03	0.001
	4.00	0.16				0.009	1.00	7	3.90	4.10	0.009	0.009	0.16	0.03	0.000
	4.20	0.23				0.012	1.00	8	4.10	4.30	0.012	0.012	0.23	0.05	0.001
	4.40	0.26				0.021	1.00	9	4.30	4.50	0.021	0.021	0.26	0.05	0.001
	4.60	0.29				0.015	1.00	10	4.50	4.65	0.015	0.015	0.29	0.04	0.001
	4.70	0.31				0.070	1.00	11	4.65	4.75	0.070	0.070	0.31	0.03	0.002
	4.80	0.30				0.067	1.00	12	4.75	4.85	0.067	0.067	0.30	0.03	0.002
	4.90	0.30				0.040	1.00	13	4.85	4.95	0.040	0.040	0.30	0.03	0.001
	5.00	0.31				0.027	1.00	14	4.95	5.10	0.027	0.027	0.31	0.05	0.001
	5.20	0.31				0.040	1.00	15	5.10	5.30	0.040	0.040	0.31	0.06	0.002
	5.40	0.29				0.061	1.00	16	5.30	5.50	0.061	0.061	0.29	0.06	0.004
	5.60	0.26				0.061	1.00	17	5.50	5.70	0.061	0.061	0.26	0.05	0.003
	5.80	0.22				0.006	1.00	18	5.70	5.90	0.006	0.006	0.22	0.04	0.000
	6.00	0.10				0.006	1.00	19	5.90	6.20	0.006	0.006	0.10	0.03	0.000
LB	6.40	0.00				0.000	1.00	20	6.20	6.40	0.002	0.002	0.03	0.01	0.000
														Total Flow:	**0.021**

Total Flow:	**0.021**		(m^3/s)
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.68**		(m^2)
Top Width:	**3.40**		(m)
Hydraulic Depth:	**0.200**		(m)
Mean Velocity:	**0.031**		(m/s)
Froude Number	**0.022**		

Photographs taken looking at:
Upstream, downstream, across

Notes:
TSS Sample Taken
Transducer removed for winter.

Datalogger Notes:		
Datalogger Internal Power:	10.34 V	
Datalogger External Power:	12.17 V	
Datalogger Memory Used:	15% used	
Datalogger Clock:	Oct 29, 2004 15:18	MST
Laptop Clock:	Oct 29, 2004 15:21	MST
Dessicant:	Good	
Datalogger:		
PT:	1714	
Power:		

Hydrometric Measurement / Site Visit Record

S7 - Muskeg River WSC

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River WSC
Site Name:	S7
Coordinates & Legal:	6338944 N, 465408 E SE-32-94-10-W4

Time of Measurement

Date of Measurement:	January 30, 2004	
Start Time:	4:34 PM	MDT
End Time:	5:04 PM	MDT

Weather Conditions: -25 ˚C, Light snow

River Conditions: Complete ice cover. Ice surface concave due to falling stage since ice formation.

Personnel & Equipment

Measurement Made By:	DM/FF
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading:	0.800	El:	275.565
Water Level Reading:	4.328	El:	272.037
Top of Ice Level Reading:		El:	
Transducer Reading & Calc'd El.:	0.919	El:	271.118
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	7.30	0.00	0.38			0.000	0.90	1	7.30	7.95	0.030	0.027	0.10	0.06	0.002
	8.60	0.78	0.38			0.122	0.90	2	7.95	9.25	0.122	0.110	0.40	0.52	0.057
	9.90	0.77	0.40			0.067	0.90	3	9.25	10.25	0.067	0.060	0.37	0.37	0.022
	10.60	0.73	0.44			0.076	0.90	4	10.25	10.98	0.076	0.069	0.29	0.21	0.014
	11.35	0.76	0.49			0.229	0.90	5	10.98	11.73	0.229	0.206	0.27	0.20	0.042
	12.10	0.75	0.51			0.232	0.90	6	11.73	12.45	0.232	0.208	0.24	0.17	0.036
	12.80	0.71	0.53			0.238	0.90	7	12.45	13.20	0.238	0.214	0.18	0.14	0.029
	13.60	0.74	0.51			0.262	0.90	8	13.20	13.88	0.262	0.236	0.23	0.16	0.037
	14.15	0.75	0.52			0.274	0.90	9	13.88	14.40	0.274	0.247	0.23	0.12	0.030
	14.65	0.75	0.52			0.256	0.90	10	14.40	14.85	0.256	0.230	0.23	0.10	0.024
	15.05	0.76	0.51			0.280	0.90	11	14.85	15.38	0.280	0.252	0.25	0.13	0.033
	15.70	0.70	0.55			0.247	0.90	12	15.38	15.98	0.247	0.222	0.15	0.09	0.020
	16.25	0.72	0.56			0.235	0.90	13	15.98	16.53	0.235	0.211	0.16	0.09	0.019
	16.80	0.72	0.58			0.250	0.90	14	16.53	17.28	0.250	0.225	0.14	0.11	0.024
	17.75	0.70	0.60			0.165	0.90	15	17.28	18.10	0.165	0.148	0.10	0.08	0.012
	18.45	0.72	0.65			0.082	0.90	16	18.10	18.98	0.082	0.074	0.07	0.06	0.005
	19.50	0.70	0.60			0.219	0.90	17	18.98	20.10	0.219	0.198	0.10	0.11	0.022
	20.70	0.62	0.51			0.204	0.90	18	20.10	21.23	0.204	0.184	0.11	0.12	0.023
LB	21.75	0.00	0.51			0.000	0.90	19	21.23	21.75	0.051	0.046	0.03	0.01	0.001
														Total Flow:	0.450

Total Flow:	**0.450**		**(m^3/s)**
Percieved Measurement Quality:	**Good**		
Total Area:	**2.86**		**(m^2)**
Top Width:	**14.45**		**(m)**
Hydraulic Depth:	**0.198**		**(m)**
Mean Velocity:	**0.157**		**(m/s)**
Froude Number	**0.113**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes:

Datalogger Notes:		
Datalogger Internal Power:	4.558V	
Datalogger External Power:	13.52V	
Datalogger Memory Used:	85%	
Datalogger Clock:	Jan 30, 2004 17:49	MST
Laptop Clock:	Jan 30, 2004 17:04	MDT
Dessicant:	Good	

Datalogger: Optimum DD128, # 0105010269
PT: Keller 730-130-3 psi #0101346
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S7 - Muskeg River WSC

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River WSC
Site Name:	S7
Coordinates & Legal:	6338944 N, 465408 E SE-32-94-10-W4

Time of Measurement

Date of Measurement:	February 24, 2004
Start Time:	6:41 PM MDT
End Time:	7:25 PM MDT

Weather Conditions: 0 ˚C, Light snow, Calm

River Conditions: Complete ice cover. Ice surface concave due to falling stage since ice formation.

Personnel & Equipment

Measurement Made By:	DK/DB
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading:	0.957	El:	275.565
Water Level Reading:	4.517	El:	272.005
Top of Ice Level Reading:	4.408	El:	
Transducer Reading & Calc'd El.:	0.891	El:	271.114
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	17.00	0.00	0.32			0.000	0.90	1	17.00	17.15	0.000	0.000	0.01	0.00	0.000
	17.30	0.36	0.32			0.000	0.90	2	17.15	17.70	0.000	0.000	0.04	0.02	0.000
	18.10	0.72	0.38			0.247	0.90	3	17.70	18.33	0.247	0.222	0.34	0.21	0.047
	18.55	0.82	0.43			0.287	0.90	4	18.33	18.88	0.287	0.258	0.39	0.21	0.055
	19.20	0.76	0.45			0.311	0.90	5	18.88	19.55	0.311	0.280	0.31	0.21	0.059
	19.90	0.70	0.50			0.329	0.90	6	19.55	20.23	0.329	0.296	0.20	0.14	0.040
	20.55	0.75	0.53			0.351	0.90	7	20.23	20.98	0.351	0.315	0.22	0.17	0.052
	21.40	0.69	0.59			0.344	0.90	8	20.98	21.75	0.344	0.310	0.10	0.08	0.024
	22.10	0.70	0.58			0.282	0.90	9	21.75	22.48	0.282	0.254	0.12	0.09	0.022
	22.85	0.70	0.55			0.302	0.90	10	22.48	23.13	0.302	0.272	0.15	0.10	0.026
	23.40	0.74	0.56			0.418	0.90	11	23.13	23.68	0.418	0.376	0.18	0.10	0.037
	23.95	0.75	0.58			0.381	0.90	12	23.68	24.20	0.381	0.343	0.17	0.09	0.031
	24.45	0.74	0.57			0.305	0.90	13	24.20	24.68	0.305	0.274	0.17	0.08	0.022
	24.90	0.67	0.60			0.229	0.90	14	24.68	25.18	0.229	0.206	0.07	0.04	0.007
	25.45	0.68	0.59			0.221	0.90	15	25.18	25.75	0.221	0.199	0.09	0.05	0.010
	26.05	0.60	0.59			0.146	0.90	16	25.75	27.28	0.146	0.132	0.01	0.02	0.002
	28.50	0.59	0.58			0.021	0.90	17	27.28	28.75	0.021	0.019	0.01	0.01	0.000
LB	29.00	0.00	0.58			0.000	0.90	18	28.75	29.00	0.005	0.005	0.00	0.00	0.000
														Total Flow:	0.435

Total Flow:	**0.435**		**(m^3/s)**
Percieved Measurement Quality:	**Good**		
Total Area:	**1.61**		**(m^2)**
Top Width:	**12.00**		**(m)**
Hydraulic Depth:	**0.134**		**(m)**
Mean Velocity:	**0.271**		**(m/s)**
Froude Number	**0.236**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes:

Datalogger Notes:		
Datalogger Internal Power:	4.617V	
Datalogger External Power:	13.67V	
Datalogger Memory Used:	87%	
Datalogger Clock:	Feb 28, 2004 18:29	MST
Laptop Clock:	Feb 28, 2004 17:54	MDT
Dessicant:	Good	

Datalogger: Optimum DD128, # 0105010269
PT: Keller 730-130-3 psi #0101346
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S7 - Muskeg River WSC

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River WSC
Site Name:	S7
Coordinates & Legal:	6338944 N, 465408 E SE-32-94-10-W4

Time of Measurement

Date of Measurement:	April 4, 2004	
Start Time:	9:45 AM	MDT
End Time:		MDT

Weather Conditions: +15 C, Light Wind, Clear

River Conditions: Open holes in ice, water flowing above and below ice layer.

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading:	0.637	El:	275.565
Water Level Reading:	4.049	El:	272.153
Top of Ice Level Reading:		El:	
Transducer Reading & Calc'd El.:	1.024	El:	271.129
Other:		El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Percieved Measurement Quality:			
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: Conditions are not ideal or safe enough to perform flow measurement.

Datalogger Notes:		
Datalogger Internal Power:	4.653V	
Datalogger External Power:	14.37V	
Datalogger Memory Used:	90%	
Datalogger Clock:	Apr 04, 2004 09:57	MST
Laptop Clock:	Apr 04, 2004 10:59	MDT
Dessicant:	Good	

Datalogger: Optimum DD128, # 0105010269
PT: Keller 730-130-3 psi #0101346
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S7 - Muskeg River Near Fort MacKay

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Near Fort MacKay
Site Name:	S7
Coordinates & Legal:	6338944 N, 465408 E SE-32-94-10-W4

Time of Measurement

Date of Measurement:	April 23, 2004
Start Time:	7:18 AM MDT
End Time:	7:48 AM MDT

Weather Conditions: +1 C, Calm, partly cloudy

River Conditions: Marginal border ice adjacent to banks - open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading:	0.709	El:	275.565	0.866	El:	275.565
Water Level Reading:	4.101	El:	272.173	4.264	El:	272.167
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	1.043	El:	271.130	1.043	El:	271.124
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	1.80	0.00	0.00			0.000	1.00	1	1.80	1.90	0.014	0.014	0.06	0.01	0.000
	2.00	0.25	0.00			0.055	1.00	2	1.90	2.25	0.055	0.055	0.25	0.09	0.005
	2.50	0.34	0.00			0.061	1.00	3	2.25	2.75	0.061	0.061	0.34	0.17	0.010
	3.00	0.70	0.00			0.140	1.00	4	2.75	3.25	0.140	0.140	0.70	0.35	0.049
	3.50	0.73	0.00			0.177	1.00	5	3.25	3.75	0.177	0.177	0.73	0.37	0.065
	4.00	0.80	0.00			0.195	1.00	6	3.75	4.50	0.195	0.195	0.80	0.60	0.117
	5.00	0.82	0.00			0.308	1.00	7	4.50	5.50	0.308	0.308	0.82	0.82	0.252
	6.00	0.81	0.00			0.354	1.00	8	5.50	6.50	0.354	0.354	0.81	0.81	0.286
	7.00	0.83	0.00			0.381	1.00	9	6.50	7.50	0.381	0.381	0.83	0.83	0.316
	8.00	0.87	0.00			0.344	1.00	10	7.50	8.25	0.344	0.344	0.87	0.65	0.225
	8.50	0.86	0.00			0.347	1.00	11	8.25	8.75	0.347	0.347	0.86	0.43	0.149
	9.00	0.83	0.00			0.418	1.00	12	8.75	9.25	0.418	0.418	0.83	0.42	0.173
	9.50	0.85	0.00			0.408	1.00	13	9.25	9.75	0.408	0.408	0.85	0.43	0.174
	10.00	0.86	0.00			0.396	1.00	14	9.75	10.25	0.396	0.396	0.86	0.43	0.170
	10.50	0.85	0.00			0.396	1.00	15	10.25	10.75	0.396	0.396	0.85	0.43	0.168
	11.00	0.88	0.00			0.399	1.00	16	10.75	11.25	0.399	0.399	0.88	0.44	0.176
	11.50	0.91	0.00			0.408	1.00	17	11.25	11.75	0.408	0.408	0.91	0.46	0.186
	12.00	0.87	0.00			0.439	1.00	18	11.75	12.25	0.439	0.439	0.87	0.44	0.191
	12.50	0.88	0.00			0.424	1.00	19	12.25	12.75	0.424	0.424	0.88	0.44	0.186
	13.00	0.88	0.00			0.396	1.00	20	12.75	13.25	0.396	0.396	0.88	0.44	0.174
	13.50	0.86	0.00			0.390	1.00	21	13.25	13.75	0.390	0.390	0.86	0.43	0.168
	14.00	0.80	0.00			0.393	1.00	22	13.75	14.50	0.393	0.393	0.80	0.60	0.236
	15.00	0.80	0.00			0.445	1.00	23	14.50	15.50	0.445	0.445	0.80	0.80	0.356
	16.00	0.83	0.00			0.332	1.00	24	15.50	16.50	0.332	0.332	0.83	0.83	0.276
	17.00	0.78	0.00			0.229	1.00	25	16.50	17.50	0.229	0.229	0.78	0.78	0.178
	18.00	0.44	0.00			0.082	1.00	26	17.50	18.25	0.082	0.082	0.44	0.33	0.027
RB	18.50	0.00	0.00			0.000	1.00	27	18.25	18.50	0.021	0.021	0.11	0.03	0.001
														Total Flow:	4.315

Total Flow:	**4.315**		(m^3/s)
Percieved Measurement Quality:	**Good**		
Total Area:	**12.82**		(m^2)
Top Width:	**16.70**		(m)
Hydraulic Depth:	**0.768**		(m)
Mean Velocity:	**0.337**		(m/s)
Froude Number	**0.123**		
Photographs taken looking at: Upstream, downstream, left bank, right bank, bench mark, datalogger/battery			

Datalogger Notes:	**Database 269**	
Datalogger Internal Power:	4.563V	
Datalogger External Power:	12.87V	
Datalogger Memory Used:	92%	
Datalogger Clock:	Apr 23, 2004 06:03	MST
Laptop Clock:	Apr 23, 2004 07:06	MDT
Dessicant:	Good	
Datalogger:	Optimum DD128, # 0105010269	
PT:	Keller 730-130-3 psi #0101346	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Notes: Datalogger clock set to MST, (i.e.1 hr earlier than laptop which was running on MDT). See previous manual measurement for datalogger clock times prior to this site visit. TSS sample collected.

Hydrometric Measurement / Site Visit Record

S7 - Muskeg River Near Fort MacKay

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Near Fort MacKay
Site Name:	S7
Coordinates & Legal:	6338944 N, 465408 E SE-32-94-10-W4

Time of Measurement

Date of Measurement:	May 30, 2004	
Start Time:	n/a	MDT
End Time:	n/a	MDT

Weather Conditions: Overcast, rainy, +10 C

River Conditions: Open

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	n/a

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	0.822	El:	275.565	0.902	El:	275.565
Water Level Reading:	4.143	El:	272.244	4.223	El:	272.244
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	1.131	El:	271.113	1.131	El:	271.113
Other: Database # 269		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Percieved Measurement Quality:	-		
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, across river, benchmark (note two adjacent trees have been cut down

Datalogger Notes:	**Database**	**269**
Datalogger Internal Power:	5	
Datalogger External Power:	14.04	
Datalogger Memory Used:	95%	
Datalogger Clock:	May 30 2004 16:37:35	MST
Laptop Clock:	May 30 2004 17:38	MDT
Dessicant:	Good	

Datalogger: Optimum DD128, # 0105010269
PT: Keller 730-130-3 psi #0101346
Power: Magnacharge 20V 10A DC Battery and
PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: no flow measurement taken as WSC station nearby is active.
TSS sample collected.

Hydrometric Measurement / Site Visit Record

S7 - Muskeg River Near Fort MacKay

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Near Fort MacKay
Site Name:	S7
Coordinates & Legal:	6338944 N, 465408 E SE-32-94-10-W4

Time of Measurement

Date of Measurement:	July 25, 2004	
Start Time:	n/a	MDT
End Time:	n/a	MDT

Weather Conditions: +10 °C, Slight Breeze

River Conditions: Open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	n/a

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	0.400	El:	275.565	0.323	El:	275.565
Water Level Reading:	4.049	El:	271.916	3.981	El:	271.907
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.795	El:	271.121	0.795	El:	271.112
Other: Database # 269		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Percieved Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, across river

Datalogger Notes:	**Database**	**269**
Datalogger Internal Power:	4.717V	
Datalogger External Power:	13.89V	
Datalogger Memory Used:	99%	
Datalogger Clock:	Jul 25, 2004 10:56	MST
Laptop Clock:	jul 25 2004 11:57	MDT
Dessicant:	Good	

Datalogger: Optimum DD128, # 0105010269
PT: Keller 730-130-3 psi #0101346
Power: Magnacharge 20V 10A DC Battery and
PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: no flow measurement taken as WSC station nearby is active.
TSS sample collected.

Hydrometric Measurement / Site Visit Record

S7 - Muskeg River 07DA008

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River 07DA008
Site Name:	S7
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 24, 2004	
Start Time:	n/a	MDT
End Time:	n/a	MDT

Weather Conditions: Clear, 17 C, calm

River Conditions: Open, low

Personnel & Equipment

Measurement Made By:	CT/DB
Data Entry By:	DB
Meter Type and No.:	

Level Readings

		Setup No. 1			Setup No. 2		
Bench Mark Reading:	Nail in t	0.888	El:	275.565	0.829	El:	275.565
Water Level Reading:		4.630	El:	271.823	4.575	El:	271.819
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Est. El.:		0.709	El:	271.114	0.709	El:	271.110
Other:			El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Percieved Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, across

Notes:
TSS Sample Taken
Database # 269
no discharge mmt - WSC site nearby

Datalogger Notes:		
Datalogger Internal Power:	4.714 V	
Datalogger External Power:	14.02 V	
Datalogger Memory Used:	2%	
Datalogger Clock:	Aug 24, 2004 15:43	MST
Laptop Clock:	Aug 24, 2004 16:46	MDT
Dessicant:	Replaced	
Datalogger:		
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

S7 - Muskeg River 07DA008

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River 07DA008
Site Name:	S7
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 21, 2004	
Start Time:	n/a	MDT
End Time:	n/a	MDT

Weather Conditions: Clear, 11 C, calm

River Conditions: Open

Personnel & Equipment

Measurement Made By:	NM/DB
Data Entry By:	DB
Meter Type and No.:	

Level Readings

		Setup No. 1			Setup No. 2		
Bench Mark Reading:	Nail in t	0.628	El:	275.565	0.578	El:	275.565
Water Level Reading:		4.098	El:	272.095	4.051	El:	272.092
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Est. El.:		0.972	El:	271.123	0.972	El:	271.120
Other:			El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Percieved Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, across

Notes:
TSS Sample Taken
Database # 269
no discharge mmt - WSC site nearby

Datalogger Notes:		
Datalogger Internal Power:	4.689 V	
Datalogger External Power:	14.24 V	
Datalogger Memory Used:	5%	
Datalogger Clock:	Sep 21, 2004 11:39	MST
Laptop Clock:	Sep 21, 2004 11:41	MST
Dessicant:	Good	
Datalogger:		
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

S7 - Muskeg River Near Fort MacKay

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Near Fort MacKay
Site Name:	S7
Coordinates & Legal:	6338944 N, 465408 E SE-32-94-10-W4

Time of Measurement

Date of Measurement:	October 29, 2004
Start Time:	8:05 AM MDT
End Time:	8:42 AM MDT

Weather Conditions: -1˚C, Calm, clear

Personnel & Equipment

Measurement Made By:	DM/FF/ND
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: pin in tree	0.955	El:	275.565	0.820	El:	275.565
Water Level Reading:	4.545	El:	271.975	4.415	El:	271.970
Top of Ice Level Reading:	4.522	El:	271.043	4.388	El:	271.177
Transducer Reading & Calc'd El	0.850	El:	271.125	0.850	El:	271.120
Other:		El:			El:	

River Conditions: Partial ice cover, full ice cover at MMT section and in adjacent reaches. Mean ice thickness +/- 7cm.

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	2.30	0.00	0.07			0.000	1.00	1	2.30	2.65	0.002	0.002	0.05	0.02	0.000
	3.00	0.25	0.07			0.009	1.00	2	2.65	3.50	0.009	0.009	0.18	0.15	0.001
	4.00	0.50	0.07			0.110	1.00	3	3.50	4.50	0.110	0.110	0.43	0.43	0.047
	5.00	0.52	0.07			0.128	1.00	4	4.50	5.50	0.128	0.128	0.45	0.45	0.058
	6.00	0.63	0.07			0.113	1.00	5	5.50	6.50	0.113	0.113	0.56	0.56	0.063
	7.00	0.65	0.07			0.122	1.00	6	6.50	7.50	0.122	0.122	0.58	0.58	0.071
	8.00	0.65	0.07			0.140	1.00	7	7.50	8.50	0.140	0.140	0.58	0.58	0.081
	9.00	0.68	0.07			0.137	1.00	8	8.50	9.50	0.137	0.137	0.61	0.61	0.084
	10.00	0.68	0.07			0.162	1.00	9	9.50	10.50	0.162	0.162	0.61	0.61	0.099
	11.00	0.72	0.07			0.165	1.00	10	10.50	11.50	0.165	0.165	0.65	0.65	0.107
	12.00	0.64	0.07			0.174	1.00	11	11.50	12.25	0.174	0.174	0.57	0.43	0.074
	12.50	0.64	0.07			0.213	1.00	12	12.25	12.75	0.213	0.213	0.57	0.29	0.061
	13.00	0.66	0.07			0.195	1.00	13	12.75	13.25	0.195	0.195	0.59	0.30	0.058
	13.50	0.68	0.07			0.180	1.00	14	13.25	13.75	0.180	0.180	0.61	0.31	0.055
	14.00	0.67	0.07			0.152	1.00	15	13.75	14.50	0.152	0.152	0.60	0.45	0.069
	15.00	0.68	0.07			0.091	1.00	16	14.50	15.50	0.091	0.091	0.61	0.61	0.056
	16.00	0.79	0.07			0.125	1.00	17	15.50	16.50	0.125	0.125	0.72	0.72	0.090
	17.00	0.62	0.07			0.030	1.00	18	16.50	17.50	0.030	0.030	0.55	0.55	0.017
	18.00	0.35	0.07			0.009	1.00	19	17.50	18.20	0.009	0.009	0.28	0.20	0.002
RB	18.40	0.00	0.07			0.000	1.00	20	18.20	18.40	0.002	0.002	0.07	0.01	0.000
														Total Flow:	1.091

Total Flow:	**1.091**		**(m^3/s)**
Percieved Measurement Quality:	**Fair**		
Total Area:	**8.49**		**(m^2)**
Top Width:	**16.10**		**(m)**
Hydraulic Depth:	**0.527**		**(m)**
Mean Velocity:	**0.128**		**(m/s)**
Froude Number	**0.056**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**269**
Datalogger Internal Power:	4.608V	
Datalogger External Power:	12.47V	
Datalogger Memory Used:	8%	
Datalogger Clock:	Oct 29, 2004 07:22	MST
Laptop Clock:	Oct 29, 2004 07:26	MST
Dessicant:	Good	

Datalogger: Optimum DD128, # 0105010269
PT: Keller 730-130-3 psi #0101346
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: Datalogger clock set to MST, (i.e.1 hr earlier than laptop which was running on MDT).
TSS sample collected.
Measurement considered fair due to variable ice conditions.

Hydrometric Measurement / Site Visit Record

S7 - Muskeg River Near Fort MacKay

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Near Fort MacKay
Site Name:	S7
Coordinates & Legal:	6338944 N, 465408 E SE-32-94-10-W4

Time of Measurement

Date of Measurement:	December 1, 2004
Start Time:	9:00 AM MST
End Time:	MST

Weather Conditions: -23 C, Calm, overcast, snow within past 24 hou

River Conditions: Partial ice cover, 4" at edge, 3" 2m in, thinner at middle

Personnel & Equipment

Measurement Made By:	ND/CT/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: pin in tree	0.879	El:	275.565	0.732	El:	275.565
Water Level Reading:	4.408	El:	272.036	4.261	El:	272.036
Top of Ice Level Reading:	4.400	El:	271.165	4.252	El:	271.313
Transducer Reading & Calc'd E	0.836	El:	271.200	0.836	El:	271.200
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Percieved Measurement Quality:			
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream,across

Notes: Measurement not taken due to marginal ice conditions, cold temperature made wading measurement impossible.

Datalogger Notes:	**Database**	**269**
Datalogger Internal Power:	4.577V	
Datalogger External Power:	12.77V	
Datalogger Memory Used:	10%	
Datalogger Clock:	Dec 01, 2004 09:48	MST
Laptop Clock:	Dec 01, 2004 09:55	MST
Dessicant:	Good	

Datalogger: Optimum DD128, # 0105010269
PT: Keller 730-130-3 psi #0101346
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S9 - Kearl Lake Outlet

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake Outlet
Location:	Kearl Lake Outlet
Site Name:	S9
Coordinates & Legal:	6346750 N, 483980 E SE-29-95-8-W4

Time of Measurement

Date of Measurement:	April 23, 2004
Start Time:	11:42 AM MDT
End Time:	11:55 AM MDT

Weather Conditions: +7 C, Calm, partly cloudy

River Conditions: Marginal border ice adjacent to banks - open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**		**Setup No. 2**	
Bench Mark Reading:	2.264	El: 330.400	2.272	El: 330.400	
Water Level Reading:	3.262	El: 329.402	3.269	El: 329.403	
Top of Ice Level Reading:		El:		El:	
Transducer Reading & Calc'd E	0.534	El: 328.868	0.534	El: 328.869	
Other: (from S Culvert Rt	3.412	El: H20 @ Culv	3.274	El:	
Lt	3.529				

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	4.75	0.00	0.00			0.000	1.00	1	4.75	4.88	0.002	0.002	0.14	0.02	0.000
	5.00	0.55	0.00			0.009	1.00	2	4.88	5.25	0.009	0.009	0.55	0.21	0.002
	5.50	0.61	0.00			0.043	1.00	3	5.25	5.63	0.043	0.043	0.61	0.23	0.010
	5.75	0.63	0.00			0.027	1.00	4	5.63	5.88	0.027	0.027	0.63	0.16	0.004
	6.00	0.68	0.00			0.015	1.00	5	5.88	6.13	0.015	0.015	0.68	0.17	0.003
	6.25	0.69	0.00			0.021	1.00	6	6.13	6.38	0.021	0.021	0.69	0.17	0.004
	6.50	0.69	0.00			0.024	1.00	7	6.38	6.63	0.024	0.024	0.69	0.17	0.004
	6.75	0.70	0.00			0.030	1.00	8	6.63	6.88	0.030	0.030	0.70	0.18	0.005
	7.00	0.70	0.00			0.073	1.00	9	6.88	7.13	0.073	0.073	0.70	0.18	0.013
	7.25	0.69	0.00			0.073	1.00	10	7.13	7.38	0.073	0.073	0.69	0.17	0.013
	7.50	0.64	0.00			0.070	1.00	11	7.38	7.63	0.070	0.070	0.64	0.16	0.011
	7.75	0.70	0.00			0.030	1.00	12	7.63	7.88	0.030	0.030	0.70	0.18	0.005
	8.00	0.69	0.00			0.058	1.00	13	7.88	8.13	0.058	0.058	0.69	0.17	0.010
	8.25	0.63	0.00			0.040	1.00	14	8.13	8.38	0.040	0.040	0.63	0.16	0.006
	8.50	0.59	0.00			0.034	1.00	15	8.38	8.63	0.034	0.034	0.59	0.15	0.005
	8.75	0.60	0.00			0.009	1.00	16	8.63	8.88	0.009	0.009	0.60	0.15	0.001
	9.00	0.56	0.00			0.006	1.00	17	8.88	9.18	0.006	0.006	0.56	0.17	0.001
	9.35	0.56	0.00			0.006	1.00	18	9.18	9.43	0.006	0.006	0.56	0.14	0.001
RB	9.50	0.00	0.00			0.000	1.00	19	9.43	9.50	0.002	0.002	0.14	0.01	0.000
														Total Flow:	0.098

Total Flow:	**0.098**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**2.93**		**(m^2)**
Top Width:	**4.75**		**(m)**
Hydraulic Depth:	**0.616**		**(m)**
Mean Velocity:	**0.034**		**(m/s)**
Froude Number	**0.014**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	11.34V	
Datalogger External Power:	12.29V	
Datalogger Memory Used:	0%	
Datalogger Clock:	Apr 23, 2004 10:31	MST
Laptop Clock:	Apr 23, 2004 11:31	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #703013	
PT:	Keller Pressure Transducer #971022	
Power:	Lakewood battery	

Notes:

Equipment installed. Transducerwired to concrete block and placed in flow.
TSS sample collected.

Hydrometric Measurement / Site Visit Record

S9 - Kearl Lake Outlet

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake Outlet
Location:	Kearl Lake Outlet
Site Name:	S9
Coordinates & Legal:	6346750 N, 483980 E SE-29-95-8-W4

Time of Measurement

Date of Measurement:	June 1, 2004	
Start Time:	9:37 AM	MDT
End Time:	9:50 AM	MDT

Weather Conditions: +10 C, Calm, partly cloudy

River Conditions: Open

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	2.314	El:	330.400	2.276	El:	330.400
Water Level Reading:	3.167	El:	329.547	3.124	El:	329.552
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.681	El:	328.866	0.681	El:	328.871
Other: (from S Culvert N	2.311	El:	H20 @ Culv	3.169	El:	
S	2.365					

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	0.20	0.00	0.00			0.000	1.00	1	0.20	0.35	0.041	0.041	0.07	0.01	0.000
	0.50	0.26	0.00			0.165	1.00	2	0.35	0.63	0.165	0.165	0.26	0.07	0.012
	0.75	0.90	0.00			0.165	1.00	3	0.63	0.88	0.165	0.165	0.90	0.23	0.037
	1.00	0.93	0.00			0.189	1.00	4	0.88	1.13	0.189	0.189	0.93	0.23	0.044
	1.25	0.90	0.00			0.143	1.00	5	1.13	1.38	0.143	0.143	0.90	0.23	0.032
	1.50	0.88	0.00			0.140	1.00	6	1.38	1.63	0.140	0.140	0.88	0.22	0.031
	1.75	0.80	0.00			0.122	1.00	7	1.63	1.88	0.122	0.122	0.80	0.20	0.024
	2.00	0.79	0.00			0.128	1.00	8	1.88	2.13	0.128	0.128	0.79	0.20	0.025
	2.25	0.87	0.00			0.146	1.00	9	2.13	2.38	0.146	0.146	0.87	0.22	0.032
	2.50	0.84	0.00			0.101	1.00	10	2.38	2.63	0.101	0.101	0.84	0.21	0.021
	2.75	0.82	0.00			0.143	1.00	11	2.63	2.88	0.143	0.143	0.82	0.21	0.029
	3.00	0.78	0.00			0.110	1.00	12	2.88	3.13	0.110	0.110	0.78	0.20	0.021
	3.25	0.77	0.00			0.098	1.00	13	3.13	3.38	0.098	0.098	0.77	0.19	0.019
	3.50	0.71	0.00			0.091	1.00	14	3.38	3.63	0.091	0.091	0.71	0.18	0.016
	3.75	0.65	0.00			0.052	1.00	15	3.63	3.88	0.052	0.052	0.65	0.16	0.008
	4.00	0.70	0.00			0.061	1.00	16	3.88	4.13	0.061	0.061	0.70	0.18	0.011
	4.25	0.50	0.00			0.052	1.00	17	4.13	4.50	0.052	0.052	0.50	0.19	0.010
	4.50	0.47	0.00			0.034	1.00	18	4.50	4.75	0.034	0.034	0.47	0.12	0.004
	4.75	0.40	0.00			0.021	1.00	19	4.75	4.88	0.021	0.021	0.40	0.05	0.001
RB	5.00	0.00	0.00			0.000	1.00	20	4.88	5.00	0.005	0.005	0.10	0.01	0.000
														Total Flow:	0.378

Total Flow:	**0.378**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**3.28**		**(m^2)**
Top Width:	**4.80**		**(m)**
Hydraulic Depth:	**0.684**		**(m)**
Mean Velocity:	**0.115**		**(m/s)**
Froude Number	**0.044**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: Unchecked "stop on memory full" button
TSS sample collected.

Datalogger Notes:		
Datalogger Internal Power:	11.34V	
Datalogger External Power:	12.41V	
Datalogger Memory Used:	24500 free	
Datalogger Clock:	Jun 01, 2004 08:24	MST
Laptop Clock:	Jun 01, 2004 09:25	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #703013	
PT:	Keller Pressure Transducer #971022	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S9 - Kearl Lake Outlet

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake Outlet
Location:	Kearl Lake Outlet
Site Name:	S9
Coordinates & Legal:	6346750 N, 483980 E SE-29-95-8-W4

Time of Measurement

Date of Measurement:	July 22, 2004	
Start Time:	11:16 AM	MDT
End Time:	12:17 PM	MDT

Weather Conditions: +22 C, Clear

River Conditions: Open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	2.283	El:	330.400	2.223	El:	330.400
Water Level Reading:	3.212	El:	329.471	3.155	El:	329.468
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.614	El:	328.857	0.614	El:	328.854
Other: (from S Culvert N		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	8.20	0.00	0.00			0.000	1.00	1	8.20	7.85	0.002	0.002	0.18	0.06	0.000
	7.50	0.70	0.00			0.009	1.00	2	7.85	7.30	0.009	0.009	0.70	0.39	0.004
	7.10	0.70	0.00			0.005	1.00	3	7.30	6.90	0.005	0.005	0.70	0.28	0.001
	6.70	0.72	0.00			0.011	1.00	4	6.90	6.50	0.011	0.011	0.72	0.29	0.003
	6.30	0.78	0.00			0.012	1.00	5	6.50	6.10	0.012	0.012	0.78	0.31	0.004
	5.90	0.81	0.00			0.009	1.00	6	6.10	5.70	0.009	0.009	0.81	0.32	0.003
	5.50	0.81	0.00			0.009	1.00	7	5.70	5.30	0.009	0.009	0.81	0.32	0.003
	5.10	0.79	0.00			0.006	1.00	8	5.30	4.90	0.006	0.006	0.79	0.32	0.002
	4.70	0.78	0.00			0.003	1.00	9	4.90	4.50	0.003	0.003	0.78	0.31	0.001
	4.30	0.81	0.00			0.011	1.00	10	4.50	4.10	0.011	0.011	0.81	0.32	0.003
	3.90	0.77	0.00			0.005	1.00	11	4.10	3.70	0.005	0.005	0.77	0.31	0.001
	3.50	0.64	0.00			0.001	1.00	12	3.70	3.30	0.001	0.001	0.64	0.26	0.000
LB	3.10	0.00	0.00			0.000	1.00	13	3.30	3.10	0.000	0.000	0.16	0.03	0.000
														Total Flow:	0.026

Total Flow:	**0.026**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**3.52**		**(m^2)**
Top Width:	**5.10**		**(m)**
Hydraulic Depth:	**0.691**		**(m)**
Mean Velocity:	**0.007**		**(m/s)**
Froude Number	**0.003**		

Photographs taken looking at:
Upstream, downstream.

Notes: TSS sample collected.

Datalogger Notes:		
Datalogger Internal Power:	100	
Datalogger External Power:	81.00	
Datalogger Memory Used:	55%	
Datalogger Clock:	Jul 22, 2004 11:16	MST
Laptop Clock:	Jul 22, 2004 12:17	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #703013	
PT:	Keller Pressure Transducer #971022	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S9 - Kearl Lake Outlet

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake Outlet
Location:	Kearl Lake Outlet
Site Name:	S9
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 28, 2004	
Start Time:	10:27 AM	MDT
End Time:	10:40 AM	MDT

Weather Conditions: raining, +8°C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	post in P\	2.238	El:	330.400	2.311	El:	330.400
Water Level Reading:		3.170	El:	329.468	3.243	El:	329.468
Top of Ice Level Reading:			El:			El:	
Transducer	Reading & Calc'd E	0.599	El:	328.869	0.599	El:	328.869
Other:	Water @ culvert		El:		3.249	El:	
	culvert crown				2.329		

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	0.10	0.00	0.00			0.000	1.00	1	0.10	0.20	-0.002	-0.002	0.17	0.02	0.000
	0.30	0.67	0.00			-0.006	1.00	2	0.20	0.40	-0.006	-0.006	0.67	0.13	-0.001
	0.50	0.73	0.00			0.021	1.00	3	0.40	0.60	0.021	0.021	0.73	0.15	0.003
	0.70	0.76	0.00			0.012	1.00	4	0.60	0.80	0.012	0.012	0.76	0.15	0.002
	0.90	0.75	0.00			0.009	1.00	5	0.80	1.00	0.009	0.009	0.75	0.15	0.001
	1.10	0.73	0.00			0.009	1.00	6	1.00	1.20	0.009	0.009	0.73	0.15	0.001
	1.30	0.70	0.00			0.012	1.00	7	1.20	1.40	0.012	0.012	0.70	0.14	0.002
	1.50	0.66	0.00			0.012	1.00	8	1.40	1.60	0.012	0.012	0.66	0.13	0.002
	1.70	0.56	0.00			0.024	1.00	9	1.60	1.80	0.024	0.024	0.56	0.11	0.003
	1.90	0.54	0.00			0.015	1.00	10	1.80	2.00	0.015	0.015	0.54	0.11	0.002
	2.10	0.56	0.00			0.012	1.00	11	2.00	2.20	0.012	0.012	0.56	0.11	0.001
	2.30	0.52	0.00			0.021	1.00	12	2.20	2.40	0.021	0.021	0.52	0.10	0.002
	2.50	0.48	0.00			0.015	1.00	13	2.40	2.60	0.015	0.015	0.48	0.10	0.001
	2.70	0.50	0.00			0.021	1.00	14	2.60	2.80	0.021	0.021	0.50	0.10	0.002
	2.90	0.52	0.00			0.021	1.00	15	2.80	3.00	0.021	0.021	0.52	0.10	0.002
	3.10	0.53	0.00			0.012	1.00	16	3.00	3.20	0.012	0.012	0.53	0.11	0.001
	3.30	0.53	0.00			0.012	1.00	17	3.20	3.40	0.012	0.012	0.53	0.11	0.001
	3.50	0.45	0.00			0.015	1.00	18	3.40	3.60	0.015	0.015	0.45	0.09	0.001
	3.70	0.39	0.00			0.012	1.00	19	3.60	3.80	0.012	0.012	0.39	0.08	0.001
	3.90	0.45	0.00			0.012	1.00	20	3.80	4.00	0.012	0.012	0.45	0.09	0.001
RB	4.10	0.00	0.00			0.000	1.00	21	4.00	4.10	0.003	0.003	0.11	0.01	0.000
														Total Flow:	0.030

Total Flow:	**0.030**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**2.23**		**(m^2)**
Top Width:	**4.00**		**(m)**
Hydraulic Depth:	**0.559**		**(m)**
Mean Velocity:	**0.013**		**(m/s)**
Froude Number	**0.006**		

Photographs taken looking at:
Upstream, downstream, across

Notes: TSS sample taken

Datalogger Notes:		
Datalogger Internal Power:	V	100%
Datalogger External Power:	V	97%
Datalogger Memory Used:		
Datalogger Clock:	Aug 28, 2004 08:58	MST
Laptop Clock:	Aug 28, 2004 10:01	MDT
Dessicant:	good - 75%	
Datalogger:	971022	
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

S9 - Kearl Lake Outlet

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake Outlet
Location:	Kearl Lake Outlet
Site Name:	S9
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 21, 2004	
Start Time:	3:42 PM	MDT
End Time:	3:57 PM	MDT

Weather Conditions: +15°C, clear, windy

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	post in P\	2.209	El:	330.400	2.149	El:	330.400
Water Level Reading:		3.089	El:	329.520	3.033	El:	329.516
Top of Ice Level Reading:			El:			El:	
Transducer	Reading & Calc'd E	0.652	El:	328.868	0.652	El:	328.864
Other:	Water @ culvert		El:		3.031	El:	
	culvert crown				2.167		

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	20.30	0.33	0.00			0.009	1.00	1	20.30	20.50	0.002	0.002	0.13	0.02	0.000
	20.70	0.50	0.00			0.006	1.00	2	20.50	20.85	0.006	0.006	0.50	0.18	0.001
	21.00	0.55	0.00			0.012	1.00	3	20.85	21.15	0.012	0.012	0.55	0.16	0.002
	21.30	0.70	0.00			0.003	1.00	4	21.15	21.50	0.003	0.003	0.70	0.25	0.001
	21.70	0.75	0.00			0.009	1.00	5	21.50	21.90	0.009	0.009	0.75	0.30	0.003
	22.10	0.80	0.00			0.009	1.00	6	21.90	22.30	0.009	0.009	0.80	0.32	0.003
	22.50	0.78	0.00			0.012	1.00	7	22.30	22.70	0.012	0.012	0.78	0.31	0.004
	22.90	0.74	0.00			0.006	1.00	8	22.70	23.10	0.006	0.006	0.74	0.30	0.002
	23.30	0.64	0.00			0.006	1.00	9	23.10	23.50	0.006	0.006	0.64	0.26	0.002
	23.70	0.65	0.00			0.012	1.00	10	23.50	23.90	0.012	0.012	0.65	0.26	0.003
	24.10	0.64	0.00			0.009	1.00	11	23.90	24.30	0.009	0.009	0.64	0.26	0.002
	24.50	0.68	0.00			0.003	1.00	12	24.30	24.70	0.003	0.003	0.68	0.27	0.001
	24.90	0.55	0.00			-0.003	1.00	13	24.70	25.20	-0.003	-0.003	0.55	0.28	-0.001
	25.50	0.32	0.00			0.000	1.00	14	25.20	25.70	0.000	0.000	0.32	0.16	0.000
RB	25.90	0.00	0.00			0.000	1.00	15	25.70	25.90	0.000	0.000	0.08	0.02	0.000
														Total Flow:	0.022

Total Flow:	**0.022**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**3.33**		**(m^2)**
Top Width:	**5.60**		**(m)**
Hydraulic Depth:	**0.595**		**(m)**
Mean Velocity:	**0.007**		**(m/s)**
Froude Number	**0.003**		
Photographs taken looking at: Upstream, downstream, across			

Notes: TSS sample taken

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	12.29V	79%
Datalogger Memory Used:		
Datalogger Clock:	Sep 21, 2004 14:29	MST
Laptop Clock:	Sep 21, 2004 14:33	MST
Dessicant:	good - 50%	
Datalogger:	703013	
PT:	971022	
Power:		

Hydrometric Measurement / Site Visit Record

S9 - Kearl Lake Outlet

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Kearl Lake Outlet
Location:	Kearl Lake Outlet
Site Name:	S9
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 29, 2004	
Start Time:	11:40 AM	MDT
End Time:	12:20 PM	MDT

Weather Conditions: -2°C, clear, calm

River Conditions: Complete ice cover at MMT section. Ice broken out of measurement section.

Personnel & Equipment

Measurement Made By:	FF/ND/DM
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: post in P\	2.453	El:	330.400	2.378	El:	330.400
Water Level Reading:	3.255	El:	329.598	3.190	El:	329.588
Top of Ice Level Reading:	3.242	El:	329.611	3.170	El:	329.608
Transducer Reading & Calc'd E	0.737	El:	328.861	0.737	El:	328.851
Other: Water @ culvert		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	1.50	0.00	0.17			0.000	1.00	1	1.50	1.55	0.011	0.011	0.12	0.01	0.000
	1.60	0.66	0.17			0.043	1.00	2	1.55	1.80	0.043	0.043	0.49	0.12	0.005
	2.00	0.78	0.17			0.094	1.00	3	1.80	2.13	0.094	0.094	0.61	0.20	0.019
	2.25	0.83	0.17			0.085	1.00	4	2.13	2.38	0.085	0.085	0.66	0.17	0.014
	2.50	0.87	0.17			0.049	1.00	5	2.38	2.63	0.049	0.049	0.70	0.18	0.009
	2.75	0.88	0.17			0.073	1.00	6	2.63	2.88	0.073	0.073	0.71	0.18	0.013
	3.00	0.92	0.17			0.064	1.00	7	2.88	3.13	0.064	0.064	0.75	0.19	0.012
	3.25	0.93	0.17			0.067	1.00	8	3.13	3.38	0.067	0.067	0.76	0.19	0.013
	3.50	0.92	0.17			0.104	1.00	9	3.38	3.63	0.104	0.104	0.75	0.19	0.019
	3.75	0.92	0.17			0.085	1.00	10	3.63	3.88	0.085	0.085	0.75	0.19	0.016
	4.00	0.92	0.17			0.082	1.00	11	3.88	4.13	0.082	0.082	0.75	0.19	0.015
	4.25	0.93	0.17			0.085	1.00	12	4.13	4.38	0.085	0.085	0.76	0.19	0.016
	4.50	0.87	0.17			0.049	1.00	13	4.38	4.63	0.049	0.049	0.70	0.18	0.009
	4.75	0.87	0.17			0.027	1.00	14	4.63	4.88	0.027	0.027	0.70	0.18	0.005
	5.00	0.85	0.17			0.037	1.00	15	4.88	5.13	0.037	0.037	0.68	0.17	0.006
	5.25	0.86	0.17			0.030	1.00	16	5.13	5.38	0.030	0.030	0.69	0.17	0.005
	5.50	0.86	0.17			0.040	1.00	17	5.38	5.63	0.040	0.040	0.69	0.17	0.007
	5.75	0.81	0.17			0.049	1.00	18	5.63	5.88	0.049	0.049	0.64	0.16	0.008
	6.00	0.77	0.17			0.024	1.00	19	5.88	6.13	0.024	0.024	0.60	0.15	0.004
	6.25	0.23	0.17			0.006	1.00	20	6.13	6.38	0.006	0.006	0.06	0.02	0.000
RB	6.50	0.00	0.17			0.000	1.00	21	6.38	6.50	0.002	0.002	0.02	0.00	0.000
														Total Flow:	0.195

Total Flow:	**0.195**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**3.17**		**(m^2)**
Top Width:	**5.00**		**(m)**
Hydraulic Depth:	**0.633**		**(m)**
Mean Velocity:	**0.061**		**(m/s)**
Froude Number	**0.025**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	11.44V	74%
Datalogger Memory Used:		
Datalogger Clock:	Oct 29, 2004 10:47	MST
Laptop Clock:	Oct 29, 2004 10:53	MST
Dessicant:	good - 50%	
Datalogger:	703013	
PT:	971022	
Power:		

Notes: TSS sample taken
Equipment removed for winter.

Hydrometric Measurement / Site Visit Record

S10 - Wapasu Creek at Canterra Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream: Wapasu Creek
Location: Wapasu Creek at Canterra Road
Site Name: S10
Coordinates & Legal: 6355500 N, 490350 E SE-24-96-8-W4

Time of Measurement

Date of Measurement: January 30, 2004
Start Time: 1:12 PM MST
End Time: 1:27 PM MST

Weather Conditions: -25 °C, Overcast, Light snow falling

River Conditions: Complete ice cover. Stage considerably lower than Dec 2003. Ice concave due to falling stage.

Personnel & Equipment

Measurement Made By: DM/FF
Data Entry By: FF
Meter Type and No.: Marsh McBirney s/n 2004521

Level Readings and Measurements

Bench Mark Reading: (LB BM)	1.424	El:	100.908
Water Level Reading:	2.852	El:	99.480
Top of ice:	2.820	El:	99.512
Transducer Reading:	0.526	El:	98.954
Other: D/S LB corner of bridge		El:	

Measurement Data

	Measured Data						Calculated Data									
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	3.75	0.00	0.45			0.000	0.90	1	3.75	4.00	0.028	0.025	0.00	0.00	0.000
	4.25	0.47	0.45			0.110	0.90	2	4.00	4.38	0.110	0.099	0.02	0.01	0.001
	4.50	0.42	0.40			0.030	0.90	3	4.38	4.65	0.030	0.027	0.02	0.01	0.000
	4.80	0.37	0.37			0.030	0.90	4	4.65	4.95	0.030	0.027	0.01	0.00	0.000
	5.10	0.41	0.39			0.050	0.90	5	4.95	5.30	0.050	0.045	0.02	0.01	0.000
	5.50	0.45	0.44			0.055	0.90	6	5.30	5.65	0.055	0.050	0.01	0.00	0.000
	5.80	0.64	0.50			0.055	0.90	6	5.65	5.98	0.055	0.050	0.14	0.05	0.002
	6.15	0.57	0.50			0.055	0.90	6	5.98	6.33	0.055	0.050	0.07	0.02	0.001
	6.50	0.19	0.19			0.055	0.90	6	6.33	6.65	0.055	0.050	0.01	0.00	0.000
LB	6.80	0.00	0.19			0.000	0.90	7	6.65	6.80	0.014	0.012	0.00	0.00	0.000
														Total Flow:	**0.005**

Total Flow:				**0.005**		(m^3/s)
Perceived Measurement Quality:				**Poor**		
Total Area:				**0.10**		(m^2)
Top Width:				**3.05**		(m)
Hydraulic Depth:				**0.032**		(m)
Mean Velocity:				**0.051**		(m/s)
Froude Number				**0.092**		

Datalogger Notes:		
Datalogger Internal Power:	11.34 V	Best
Datalogger External Power:	11.07 V	Fair
Datalogger Memory Used:	20%	
Datalogger Clock:	Jan 30, 2004 14:20	MDT
Laptop Clock:	Feb 04, 2004 13:35	MDT
Dessicant:	80% Good	
Datalogger:	Datalogger Lakewood UL-RX s/n 203095	
PT:	Keller #971024-8	
Power:		

Notes:

Measurements taken from ice cover.
Transducer left in though the flow was very low, as it reported 0.5 m of water depth.
Water level was surveyed and reported by transducer to be higher although flow was much lower than in Dec 2003.
Transducer may be impacted by anchor ice. Flow section may be impacted by downstream anchor ice.
No vertical velocity profile measurment completed.

Hydrometric Measurement / Site Visit Record

S10 - Wapasu Creek at Canterra Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Wapasu Creek
Location:	Wapasu Creek at Canterra Road
Site Name:	S10
Coordinates & Legal:	6355500 N, 490350 E SE-24-96-8-W4

Time of Measurement

Date of Measurement:	February 28, 2004
Start Time:	11:39 AM MST
End Time:	11:47 AM MST

Weather Conditions: 0 °C, Light Snow, Calm

River Conditions: Complete ice cover.

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney s/n 2004521

Level Readings and Measurements

Bench Mark Reading: (LB BM)	1.182	El:	100.908
Water Level Reading:	2.725	El:	99.365
Top of ice:	2.611	El:	99.479
Transducer Reading:	0.435	El:	98.930
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	22.80	0.00	0.35			0.000	0.90	1	22.80	22.65	0.004	0.003	0.02	0.00	0.000
	22.50	0.44	0.35			0.015	0.90	2	22.65	22.30	0.015	0.014	0.09	0.03	0.000
	22.10	0.46	0.32			0.049	0.90	3	22.30	21.93	0.049	0.044	0.14	0.05	0.002
	21.75	0.47	0.31			0.075	0.90	4	21.93	21.55	0.075	0.067	0.16	0.06	0.004
	21.35	0.50	0.29			0.067	0.90	5	21.55	21.20	0.067	0.060	0.21	0.07	0.004
	21.05	0.27	0.26			0.000	0.90	6	21.20	20.98	0.000	0.000	0.01	0.00	0.000
RB	20.90	0.00	0.26			0.000	0.90	7	20.98	20.90	0.000	0.000	0.00	0.00	0.000
														Total Flow:	**0.011**

Total Flow:				**0.011**		(m^3/s)
Perceived Measurement Quality:				**Poor**		
Total Area:				**0.21**		(m^2)
Top Width:				**1.90**		(m)
Hydraulic Depth:				**0.113**		(m)
Mean Velocity:				**0.052**		(m/s)
Froude Number				**0.049**		

Notes: Measurements taken from ice cover.

Datalogger Notes:		
Datalogger Internal Power:	11.34 V	
Datalogger External Power:	11.31 V	
Datalogger Memory Used:	25%	
Datalogger Clock:	Feb 28, 2004 11:43	MST
Laptop Clock:	Feb 28, 2004 11:47	MST
Dessicant:	Good	
Datalogger:	Datalogger Lakewood UL-RX s/n 203095	
PT:	Keller #971024-8	
Power:		

Hydrometric Measurement / Site Visit Record

S10 - Wapasu Creek at Canterra Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Wapasu Creek
Location:	Wapasu Creek at Canterra Road
Site Name:	S10
Coordinates & Legal:	6355500 N, 490350 E SE-24-96-8-W4

Time of Measurement

Date of Measurement:	April 2, 2004	
Start Time:	2:50 PM	MST
End Time:	3:10 PM	MST

Weather Conditions: +15 °C, Clear, Calm

River Conditions: Stream is breaking up, section for open water MMT cleared using axe.

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney s/n 2004521

Level Readings and Measurements

Bench Mark Reading: (LB BM)	1.170	El:	100.908
Water Level Reading:	2.461	El:	99.617
Top of ice:		El:	99.657
Transducer Reading:	0.586	El:	99.031
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	0.10	0.00				0.000	1.00	1	0.10	0.30	0.009	0.009	0.09	0.02	0.000
	0.50	0.35				0.037	1.00	2	0.30	0.58	0.037	0.037	0.35	0.10	0.004
	0.65	0.50				0.067	1.00	3	0.58	0.73	0.067	0.067	0.50	0.08	0.005
	0.80	0.35				0.107	1.00	4	0.73	0.85	0.107	0.107	0.35	0.04	0.005
	0.90	0.36				0.064	1.00	5	0.85	0.95	0.064	0.064	0.36	0.04	0.002
	1.00	0.36				0.076	1.00	6	0.95	1.05	0.076	0.076	0.36	0.04	0.003
	1.10	0.25				0.091	1.00	7	1.05	1.15	0.091	0.091	0.25	0.03	0.002
	1.20	0.25				0.082	1.00	8	1.15	1.25	0.082	0.082	0.25	0.03	0.002
	1.30	0.25				0.125	1.00	9	1.25	1.35	0.125	0.125	0.25	0.03	0.003
	1.40	0.30				0.101	1.00	10	1.35	1.45	0.101	0.101	0.30	0.03	0.003
	1.50	0.47				0.046	1.00	11	1.45	1.55	0.046	0.046	0.47	0.05	0.002
	1.60	0.45				0.046	1.00	12	1.55	1.65	0.046	0.046	0.45	0.04	0.002
	1.70	0.44				0.064	1.00	13	1.65	1.75	0.064	0.064	0.44	0.04	0.003
	1.80	0.51				0.088	1.00	14	1.75	1.85	0.088	0.088	0.51	0.05	0.005
	1.90	0.48				0.061	1.00	15	1.85	1.95	0.061	0.061	0.48	0.05	0.003
	2.00	0.46				0.061	1.00	16	1.95	2.05	0.061	0.061	0.46	0.05	0.003
	2.10	0.50				0.107	1.00	17	2.05	2.15	0.107	0.107	0.50	0.05	0.005
	2.20	0.47				0.101	1.00	18	2.15	2.25	0.101	0.101	0.47	0.05	0.005
	2.30	0.46				0.070	1.00	19	2.25	2.35	0.070	0.070	0.46	0.05	0.003
	2.40	0.44				0.058	1.00	20	2.35	2.50	0.058	0.058	0.44	0.07	0.004
	2.60	0.34				0.073	1.00	21	2.50	2.65	0.073	0.073	0.34	0.05	0.004
	2.70	0.44				0.061	1.00	22	2.65	2.75	0.061	0.061	0.44	0.04	0.003
	2.80	0.40				0.064	1.00	23	2.75	2.85	0.064	0.064	0.40	0.04	0.003
	2.90	0.39				0.034	1.00	24	2.85	2.95	0.034	0.034	0.39	0.04	0.001
	3.00	0.36				0.015	1.00	25	2.95	3.10	0.015	0.015	0.36	0.05	0.001
	3.20	0.37				0.009	1.00	26	3.10	3.30	0.009	0.009	0.37	0.07	0.001
	3.40	0.33				0.001	1.00	27	3.30	3.58	0.001	0.001	0.33	0.09	0.000
RB	3.75	0.00				0.000	1.00	28	3.58	3.75	0.000	0.000	0.08	0.01	0.000
														Total Flow:	**0.075**

Total Flow:				**0.075**		(m^3/s)
Perceived Measurement Quality:				**Good**		
Total Area:				**1.31**		(m^2)
Top Width:				**3.65**		(m)
Hydraulic Depth:				**0.358**		(m)
Mean Velocity:				**0.058**		(m/s)
Froude Number				**0.031**		

Notes: Recent flow over top of ice, 1-2" water on top of ice.
Data has some spikes in it, possible fouling of transducer by ice.

Datalogger Notes:			
Datalogger Internal Power:	11.34 V	Best	
Datalogger External Power:	11.44 V	Fair	
Datalogger Memory Used:	30%		
Datalogger Clock:	Apr 02, 2004 12:53		MST
Laptop Clock:	Apr 02, 2004 12:12		MST
Dessicant:	80% Good		
Datalogger:	Datalogger Lakewood UL-RX s/n 203095		
PT:	Keller #971024-8		
Power:			

Hydrometric Measurement / Site Visit Record

S10 - Wapasu Creek at Canterra Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Wapasu Creek
Location:	Wapasu Creek at Canterra Road
Site Name:	S10
Coordinates & Legal:	6355500 N, 490350 E SE-24-96-8-W4

Time of Measurement

Date of Measurement:	April 23, 2004
Start Time:	1:25 PM MDT
End Time:	1:39 PM MDT

Weather Conditions: +10 C, Calm, partly cloudy, light wind

River Conditions: open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**		**Setup No. 2**	
Bench Mark Reading: Rebar	1.180	El:	100.908	1.088	El: 100.908
Water Level Reading:	2.522	El:	99.566	2.423	El: 99.573
Top of Ice Level Reading:		El:			El:
Transducer Reading & Calc'd E	0.567	El:	98.999	0.567	El: 99.006
Other: RB BM - Rod in F	2.112	El:	99.976	2.020	El: 99.976

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	5.20	0.00	0.00			0.000	1.00	1	5.20	5.35	0.011	0.011	0.05	0.01	0.000
	5.50	0.20	0.00			0.043	1.00	2	5.35	5.63	0.043	0.043	0.20	0.06	0.002
	5.75	0.31	0.00			0.064	1.00	3	5.63	5.88	0.064	0.064	0.31	0.08	0.005
	6.00	0.51	0.00			0.119	1.00	4	5.88	6.13	0.119	0.119	0.51	0.13	0.015
	6.25	0.50	0.00			0.140	1.00	5	6.13	6.38	0.140	0.140	0.50	0.13	0.018
	6.50	0.60	0.00			0.171	1.00	6	6.38	6.63	0.171	0.171	0.60	0.15	0.026
	6.75	0.63	0.00			0.149	1.00	7	6.63	6.88	0.149	0.149	0.63	0.16	0.024
	7.00	0.64	0.00			0.226	1.00	8	6.88	7.13	0.226	0.226	0.64	0.16	0.036
	7.25	0.70	0.00			0.259	1.00	9	7.13	7.38	0.259	0.259	0.70	0.18	0.045
	7.50	0.79	0.00			0.210	1.00	10	7.38	7.63	0.210	0.210	0.79	0.20	0.042
	7.75	0.87	0.00			0.180	1.00	11	7.63	7.88	0.180	0.180	0.87	0.22	0.039
	8.00	0.97	0.00			0.235	1.00	12	7.88	8.13	0.235	0.235	0.97	0.24	0.057
	8.25	0.96	0.00			0.235	1.00	13	8.13	8.38	0.235	0.235	0.96	0.24	0.056
	8.50	0.97	0.00			0.168	1.00	14	8.38	8.63	0.168	0.168	0.97	0.24	0.041
	8.75	0.95	0.00			0.131	1.00	15	8.63	8.88	0.131	0.131	0.95	0.24	0.031
	9.00	0.90	0.00			0.021	1.00	16	8.88	9.10	0.021	0.021	0.90	0.20	0.004
RB	9.20	0.00	0.00			0.000	1.00	17	9.10	9.20	0.005	0.005	0.23	0.02	0.000
														Total Flow:	0.441

Total Flow:	**0.441**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**2.64**		**(m^2)**
Top Width:	**4.00**		**(m)**
Hydraulic Depth:	**0.659**		**(m)**
Mean Velocity:	**0.167**		**(m/s)**
Froude Number	**0.066**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected.
Datalogger clock set to MST, (i.e.1 hr earlier than laptop which was running on MDT).

Datalogger Notes:		
Datalogger Internal Power:	11.34V	
Datalogger External Power:	11.44V	
Datalogger Memory Used:	0%	
Datalogger Clock:	23/04/2004 13:09:00 PM	MST
Laptop Clock:	23/04/2004 13:32:00 PM	MDT
Dessicant:	Fair	
Datalogger:	Lakewood UltraLogger RX-2 #203095	
PT:	Keller Pressure Transducer #971024	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S10 - Wapasu Creek at Canterra Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Wapasu Creek
Location:	Wapasu Creek at Canterra Road
Site Name:	S10
Coordinates & Legal:	6355500 N, 490350 E SE-24-96-8-W4

Time of Measurement

Date of Measurement:	June 1, 2004	
Start Time:	8:25 AM	MDT
End Time:	8:44 AM	MDT

Weather Conditions: +9 C, Calm,overcast

River Conditions: open water conditions.

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: Rebar	1.169	El:	100.908	1.173	El:	100.908
Water Level Reading:	2.097	El:	99.980	2.099	El:	99.982
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.963	El:	99.017	0.963	El:	99.019
Other: RB BM - Rod in F	full of mu	El:		full of mud	El:	

Measurement Data

	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	16.20	0.00	0.00			0.000	1.00	1	16.20	16.40	0.088	0.088	0.21	0.04	0.004
	16.60	0.84	0.00			0.354	1.00	2	16.40	16.70	0.354	0.354	0.84	0.25	0.089
	16.80	0.90	0.00			0.329	1.00	3	16.70	16.95	0.329	0.329	0.90	0.23	0.074
	17.10	0.87	0.00			0.378	1.00	4	16.95	17.25	0.378	0.378	0.87	0.26	0.099
	17.40	0.90	0.00			0.576	1.00	5	17.25	17.55	0.576	0.576	0.90	0.27	0.156
	17.70	0.90	0.00			0.561	1.00	6	17.55	17.85	0.561	0.561	0.90	0.27	0.151
	18.00	0.82	0.00			0.576	1.00	7	17.85	18.10	0.576	0.576	0.82	0.21	0.118
	18.20	0.91	0.00			0.521	1.00	8	18.10	18.30	0.521	0.521	0.91	0.18	0.095
	18.40	0.84	0.00			0.668	1.00	9	18.30	18.55	0.668	0.668	0.84	0.21	0.140
	18.70	0.96	0.00			0.649	1.00	10	18.55	18.85	0.649	0.649	0.96	0.29	0.187
	19.00	0.98	0.00			0.585	1.00	11	18.85	19.15	0.585	0.585	0.98	0.29	0.172
	19.30	0.92	0.00			0.466	1.00	12	19.15	19.45	0.466	0.466	0.92	0.28	0.129
	19.60	0.85	0.00			0.311	1.00	13	19.45	20.10	0.311	0.311	0.85	0.55	0.172
	19.90	0.74	0.00			0.293	1.00	14	20.10	20.50	0.293	0.293	0.74	0.30	0.087
	20.20	0.64	0.00			0.223	1.00	15	20.50	20.95	0.223	0.223	0.64	0.29	0.064
	20.70	0.50	0.00			0.067	1.00	16	20.95	21.43	0.067	0.067	0.50	0.24	0.016
	21.20	0.36	0.00			-0.183	1.00	17	21.43	21.67	-0.183	-0.183	0.36	0.09	-0.016
	21.70	0.36	0.00			-0.064	1.00	18	21.67	21.90	-0.064	-0.064	0.36	0.08	-0.005
RB	22.10	0.00	0.00			0.000	1.00	19	21.90	22.10	-0.016	-0.016	0.09	0.02	0.000
														Total Flow:	1.730

Total Flow:	**1.730**	**(m^3/s)**
Perceived Measurement Quality:	Good	
Total Area:	**4.34**	**(m^2)**
Top Width:	**5.90**	**(m)**
Hydraulic Depth:	**0.735**	**(m)**
Mean Velocity:	**0.399**	**(m/s)**
Froude Number	**0.149**	

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	11.34V	
Datalogger External Power:	11.31V	
Datalogger Memory Used:	30110 free	
Datalogger Clock:	Jun 01, 2004 07:08	MST
Laptop Clock:	Jun 01, 2004 08:09	MDT
Dessicant:	good	
Datalogger:	Lakewood UltraLogger RX-2 #203095	
PT:	Keller Pressure Transducer #971024	
Power:	Lakewood battery	

Notes: TSS sample collected.
Unchecked "stop in memory full" button
Old BM - PVC is full of mud, not useable.

Hydrometric Measurement / Site Visit Record

S10 - Wapasu Creek at Canterra Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Wapasu Creek
Location:	Wapasu Creek at Canterra Road
Site Name:	S10
Coordinates & Legal:	6355500 N, 490350 E SE-24-96-8-W4

Time of Measurement

Date of Measurement:	July 22, 2004	
Start Time:	3:13 PM	MDT
End Time:	3:25 PM	MDT

Weather Conditions: +25 C, Calm

River Conditions: open water conditions.

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	1.954	El:	100.908	1.866	El:	100.908
Water Level Reading:	3.529	El:	99.333	3.443	El:	99.331
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El	0.321	El:	99.012	0.321	El:	99.010
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	5.90	0.00	0.00			0.000	1.00	1	5.90	5.70	0.001	0.001	0.06	0.01	0.000
	5.50	0.25	0.00			0.003	1.00	2	5.70	5.25	0.003	0.003	0.25	0.11	0.000
	5.00	0.48	0.00			0.003	1.00	3	5.25	4.90	0.003	0.003	0.48	0.17	0.001
	4.80	0.51	0.00			0.003	1.00	4	4.90	4.70	0.003	0.003	0.51	0.10	0.000
	4.60	0.56	0.00			0.009	1.00	5	4.70	4.50	0.009	0.009	0.56	0.11	0.001
	4.40	0.61	0.00			0.006	1.00	6	4.50	4.30	0.006	0.006	0.61	0.12	0.001
	4.20	0.64	0.00			0.006	1.00	7	4.30	4.10	0.006	0.006	0.64	0.13	0.001
	4.00	0.65	0.00			0.003	1.00	8	4.10	3.90	0.003	0.003	0.65	0.13	0.000
	3.80	0.68	0.00			0.009	1.00	9	3.90	3.70	0.009	0.009	0.68	0.14	0.001
	3.60	0.69	0.00			0.018	1.00	10	3.70	3.50	0.018	0.018	0.69	0.14	0.003
	3.40	0.76	0.00			0.015	1.00	11	3.50	3.30	0.015	0.015	0.76	0.15	0.002
	3.20	0.70	0.00			0.021	1.00	12	3.30	3.10	0.021	0.021	0.70	0.14	0.003
	3.00	0.50	0.00			0.034	1.00	13	3.10	2.90	0.034	0.034	0.50	0.10	0.003
	2.80	0.56	0.00			0.037	1.00	14	2.90	2.70	0.037	0.037	0.56	0.11	0.004
	2.60	0.52	0.00			0.034	1.00	15	2.70	2.50	0.034	0.034	0.52	0.10	0.003
	2.40	0.56	0.00			0.055	1.00	16	2.50	2.30	0.055	0.055	0.56	0.11	0.006
	2.20	0.49	0.00			0.049	1.00	17	2.30	2.10	0.049	0.049	0.49	0.10	0.005
	2.00	0.56	0.00			0.052	1.00	18	2.10	1.85	0.052	0.052	0.56	0.14	0.007
	1.70	0.32	0.00			0.049	1.00	19	1.85	1.43	0.049	0.049	0.32	0.14	0.007
RB	1.15	0.00	0.00			0.000	1.00	20	1.43	1.15	0.012	0.012	0.08	0.02	0.000
														Total Flow:	0.049

Total Flow:	**0.049**		**(m^3/s)**
Perceived Measurement Quality:	Fair		
Total Area:	**2.28**		**(m^2)**
Top Width:	**4.75**		**(m)**
Hydraulic Depth:	**0.479**		**(m)**
Mean Velocity:	**0.022**		**(m/s)**
Froude Number	**0.010**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected.

Datalogger Notes:		
Datalogger Internal Power:	11.34V	
Datalogger External Power:	11.31V	
Datalogger Memory Used:	10%	
Datalogger Clock:	Jul 22, 2004 14:09	MST
Laptop Clock:	Jul 22, 2004 15:10	MDT
Dessicant:	30% good	
Datalogger:	Lakewood UltraLogger RX-2 #203095	
PT:	Keller Pressure Transducer #971024	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S10 - Wapasu Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Wapasu Creek
Location:	Wapasu Creek
Site Name:	S10
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 27, 2004	
Start Time:	11:29 AM	MDT
End Time:	11:41 AM	MDT

Weather Conditions: overcast, calm, + 8°C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	rebar acr	0.862	El:	100.908	1.097	El:	100.908
Water Level Reading:		2.499	El:	99.271	2.738	El:	99.267
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.259	El:	99.012	0.259	El:	99.008
Other:	stake in F	2.138	El:		2.372	El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	16.90	0.00	0.00			0.000	1.00	1	16.90	17.00	0.003	0.003	0.17	0.02	0.000
	17.10	0.68	0.00			0.012	1.00	2	17.00	17.20	0.012	0.012	0.68	0.14	0.002
	17.30	0.69	0.00			0.009	1.00	3	17.20	17.40	0.009	0.009	0.69	0.14	0.001
	17.50	0.74	0.00			0.009	1.00	4	17.40	17.60	0.009	0.009	0.74	0.15	0.001
	17.70	0.70	0.00			0.018	1.00	5	17.60	17.80	0.018	0.018	0.70	0.14	0.003
	17.90	0.67	0.00			0.009	1.00	6	17.80	18.00	0.009	0.009	0.67	0.13	0.001
	18.10	0.60	0.00			0.021	1.00	7	18.00	18.20	0.021	0.021	0.60	0.12	0.003
	18.30	0.56	0.00			0.018	1.00	8	18.20	18.40	0.018	0.018	0.56	0.11	0.002
	18.50	0.45	0.00			0.018	1.00	9	18.40	18.60	0.018	0.018	0.45	0.09	0.002
	18.70	0.42	0.00			0.021	1.00	10	18.60	18.80	0.021	0.021	0.42	0.08	0.002
	18.90	0.37	0.00			0.027	1.00	11	18.80	19.00	0.027	0.027	0.37	0.07	0.002
	19.10	0.35	0.00			0.021	1.00	12	19.00	19.20	0.021	0.021	0.35	0.07	0.001
	19.30	0.34	0.00			0.018	1.00	13	19.20	19.40	0.018	0.018	0.34	0.07	0.001
	19.50	0.35	0.00			0.018	1.00	14	19.40	19.60	0.018	0.018	0.35	0.07	0.001
	19.70	0.33	0.00			0.009	1.00	15	19.60	19.80	0.009	0.009	0.33	0.07	0.001
	19.90	0.33	0.00			0.009	1.00	16	19.80	20.00	0.009	0.009	0.33	0.07	0.001
	20.10	0.25	0.00			0.003	1.00	17	20.00	20.20	0.003	0.003	0.25	0.05	0.000
LB	20.30	0.00	0.00			0.000	1.00	18	20.20	20.30	0.001	0.001	0.06	0.01	0.000
														Total Flow:	0.024

Total Flow:	**0.024**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**1.59**		**(m^2)**
Top Width:	**3.40**		**(m)**
Hydraulic Depth:	**0.467**		**(m)**
Mean Velocity:	**0.015**		**(m/s)**
Froude Number	**0.007**		
Photographs taken looking at: Upstream, downstream, across			

Notes: TSS Sample taken

Datalogger Notes:		
Datalogger Internal Power:	V	orgot to get
Datalogger External Power:	V	forgot to get
Datalogger Memory Used:		
Datalogger Clock:	Aug 27, 2004 10:16	MST
Laptop Clock:	Aug 27, 2004 11:18	MDT
Dessicant:	bad - replaqced	
Datalogger:		
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

S10 - Wapasu Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Wapasu Creek
Location:	Wapasu Creek
Site Name:	S10
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 21, 2004	
Start Time:	5:45 PM	MDT
End Time:	6:00 PM	MDT

Weather Conditions: clear, windy, +17°C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: rebar acr	0.955	El:	100.908	0.918	El:	100.908
Water Level Reading:	2.455	El:	99.408	2.420	El:	99.406
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.413	El:	98.995	0.413	El:	98.993
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	21.45	0.00	0.00			0.000	1.00	1	21.45	21.28	0.016	0.016	0.04	0.01	0.000
	21.10	0.14	0.00			0.064	1.00	2	21.28	21.05	0.064	0.064	0.14	0.03	0.002
	21.00	0.31	0.00			0.110	1.00	3	21.05	20.90	0.110	0.110	0.31	0.05	0.005
	20.80	0.61	0.00			0.149	1.00	4	20.90	20.70	0.149	0.149	0.61	0.12	0.018
	20.60	0.61	0.00			0.137	1.00	5	20.70	20.50	0.137	0.137	0.61	0.12	0.017
	20.40	0.66	0.00			0.128	1.00	6	20.50	20.30	0.128	0.128	0.66	0.13	0.017
	20.20	0.58	0.00			0.107	1.00	7	20.30	20.10	0.107	0.107	0.58	0.12	0.012
	20.00	0.52	0.00			0.119	1.00	8	20.10	19.90	0.119	0.119	0.52	0.10	0.012
	19.80	0.51	0.00			0.082	1.00	9	19.90	19.70	0.082	0.082	0.51	0.10	0.008
	19.60	0.47	0.00			0.085	1.00	10	19.70	19.50	0.085	0.085	0.47	0.09	0.008
	19.40	0.48	0.00			0.064	1.00	11	19.50	19.30	0.064	0.064	0.48	0.10	0.006
	19.20	0.45	0.00			0.061	1.00	12	19.30	19.00	0.061	0.061	0.45	0.13	0.008
	18.80	0.36	0.00			0.046	1.00	13	19.00	18.63	0.046	0.046	0.36	0.14	0.006
	18.45	0.32	0.00			0.003	1.00	14	18.63	18.33	0.003	0.003	0.32	0.10	0.000
	18.20	0.23	0.00			0.000	1.00	15	18.33	18.10	0.000	0.000	0.23	0.05	0.000
	18.00	0.16	0.00			0.000	1.00	16	18.10	17.85	0.000	0.000	0.16	0.04	0.000
LB	17.70	0.00	0.00			0.000	1.00	17	17.85	17.70	0.000	0.000	0.04	0.01	0.000
														Total Flow:	0.121

Total Flow:	**0.121**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**1.44**		**(m^2)**
Top Width:	**3.75**		**(m)**
Hydraulic Depth:	**0.383**		**(m)**
Mean Velocity:	**0.084**		**(m/s)**
Froude Number	**0.044**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:			
Datalogger Internal Power:	11.34V	100%	
Datalogger External Power:	11.07V	71%	
Datalogger Memory Used:			
Datalogger Clock:	Aug 27, 2004 10:16		MST
Laptop Clock:	Aug 27, 2004 11:18		MDT
Dessicant:	bad - replaqced		
Datalogger:			
PT:			
Power:			

Notes: TSS Sample taken
Replaced battery, power up to 12.29V, 79%

Hydrometric Measurement / Site Visit Record

S10 - Wapasu Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Wapasu Creek
Location:	Wapasu Creek
Site Name:	S10
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 29, 2004	
Start Time:	2:20 PM	MDT
End Time:	2:43 PM	MDT

Weather Conditions: clear, calm, +5°C

River Conditions: Partial ice cover, ice broken out at the measurement section.

Personnel & Equipment

Measurement Made By:	FF/ND/DM
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings

		Setup No. 1			Setup No. 2		
Bench Mark Reading:	rebar acr	1.219	El:	100.908	1.125	El:	100.908
Water Level Reading:		2.704	El:	99.423	2.600	El:	99.433
Top of Ice Level Reading:		2.645	El:	99.482	2.550	El:	99.483
Transducer Reading & Calc'd E		0.430	El:	98.993	0.430	El:	99.003
Other:	Rod in P\	2.150	El:	99.977	2.050	El:	99.983

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	2.00	0.00	0.00			0.000	1.00	1	2.00	2.05	0.002	0.002	0.02	0.00	0.000
	2.10	0.06	0.00			0.006	1.00	2	2.05	2.30	0.006	0.006	0.06	0.02	0.000
	2.50	0.16	0.00			0.012	1.00	3	2.30	2.63	0.012	0.012	0.16	0.05	0.001
	2.75	0.17	0.00			0.058	1.00	4	2.63	2.88	0.058	0.058	0.17	0.04	0.002
	3.00	0.20	0.00			0.134	1.00	5	2.88	3.13	0.134	0.134	0.20	0.05	0.007
	3.25	0.21	0.00			0.030	1.00	6	3.13	3.38	0.030	0.030	0.21	0.05	0.002
	3.50	0.20	0.00			0.034	1.00	7	3.38	3.63	0.034	0.034	0.20	0.05	0.002
	3.75	0.20	0.00			0.091	1.00	8	3.63	3.88	0.091	0.091	0.20	0.05	0.005
	4.00	0.23	0.00			0.162	1.00	9	3.88	4.13	0.162	0.162	0.23	0.06	0.009
	4.25	0.28	0.00			0.326	1.00	10	4.13	4.38	0.326	0.326	0.28	0.07	0.023
	4.50	0.32	0.00			0.223	1.00	11	4.38	4.55	0.223	0.223	0.32	0.06	0.012
	4.60	0.36	0.00			0.171	1.00	12	4.55	4.68	0.171	0.171	0.36	0.05	0.008
	4.75	0.36	0.00			0.165	1.00	13	4.68	4.78	0.165	0.165	0.36	0.04	0.006
	4.80	0.38	0.00			0.149	1.00	14	4.78	4.90	0.149	0.149	0.38	0.05	0.007
	5.00	0.36	0.00			0.165	1.00	15	4.90	5.13	0.165	0.165	0.36	0.08	0.013
	5.25	0.27	0.00			0.158	1.00	16	5.13	5.38	0.158	0.158	0.27	0.07	0.011
	5.50	0.26	0.00			0.070	1.00	17	5.38	5.63	0.070	0.070	0.26	0.07	0.005
	5.75	0.10	0.00			0.006	1.00	18	5.63	5.93	0.006	0.006	0.10	0.03	0.000
RB	6.10	0.00	0.00			0.000	1.00	19	5.93	6.10	0.002	0.002	0.03	0.00	0.000
														Total Flow:	0.112

Total Flow:	**0.112**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.87**		**(m^2)**
Top Width:	**4.10**		**(m)**
Hydraulic Depth:	**0.213**		**(m)**
Mean Velocity:	**0.128**		**(m/s)**
Froude Number	**0.089**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:			
Datalogger Internal Power:	11.34V	100%	
Datalogger External Power:	11.92	77%	
Datalogger Memory Used:			
Datalogger Clock:	Oct 29, 2004 13:26		MST
Laptop Clock:	Oct 29, 2004 13:32		MST
Dessicant:	Good		
Datalogger:			
PT:	971024		
Power:			

Notes: TSS Sample taken
Record rate set to hourly for winter.

Hydrometric Measurement / Site Visit Record

S10 - Wapasu Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Wapasu Creek
Location:	Wapasu Creek
Site Name:	S10
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	December 1, 2004	
Start Time:	2:02 PM	MST
End Time:	2:24 PM	MST

Weather Conditions: overcast, -20°C

River Conditions: Full Ice cover, 10 cm thick

Personnel & Equipment

Measurement Made By:	ND/CT/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: rebar acr	1.110	El:	100.908	1.113	El:	100.908
Water Level Reading:	2.753	El:	99.265	2.753	El:	99.268
Top of Ice Level Reading:	2.570	El:	99.448	2.568	El:	99.453
Transducer Reading & Calc'd E	0.314	El:	98.951	0.314	El:	98.954
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	1.95	0.00	0.00			0.000	0.90	1	1.95	2.23	0.001	0.001	0.12	0.03	0.000
	2.50	0.51	0.05			0.003	0.90	2	2.23	2.63	0.003	0.003	0.46	0.18	0.001
	2.75	0.49	0.11			0.046	0.90	3	2.63	2.93	0.046	0.041	0.38	0.11	0.005
	3.10	0.43	0.07			0.049	0.90	4	2.93	3.28	0.049	0.044	0.36	0.13	0.006
	3.45	0.37	0.10			0.037	0.90	5	3.28	3.63	0.037	0.033	0.27	0.09	0.003
	3.80	0.38	0.10			0.018	0.90	6	3.63	3.98	0.018	0.016	0.28	0.10	0.002
	4.15	0.32	0.13			0.006	0.90	7	3.98	4.35	0.006	0.005	0.19	0.07	0.000
	4.55	0.28	0.10			0.009	0.90	8	4.35	4.70	0.009	0.008	0.18	0.06	0.001
	4.85	0.22	0.12			0.015	0.90	9	4.70	5.03	0.015	0.014	0.10	0.03	0.000
	5.20	0.10	0.07			0.012	0.90	10	5.03	5.45	0.012	0.011	0.03	0.01	0.000
LB	5.70	0.00	0.00			0.000	0.90	11	5.45	5.70	0.003	0.003	0.01	0.00	0.000
														Total Flow:	0.017

Total Flow:	**0.017**		**(m^3/s)**
Perceived Measurement Quality:	**Poor**		
Total Area:	**0.83**		**(m^2)**
Top Width:	**3.75**		**(m)**
Hydraulic Depth:	**0.221**		**(m)**
Mean Velocity:	**0.020**		**(m/s)**
Froude Number	**0.014**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	11.31	72%
Datalogger Memory Used:		
Datalogger Clock:	Dec 01, 2004 12:47	MST
Laptop Clock:	Dec 01, 2004 12:54	MST
Dessicant:	Good	
Datalogger:		
PT:	971024	
Power:		

Notes: Came back on Dec 2, 2004 and replaced Lakewood Battery
Internal Power: 11.31V 100%
External Power: 12.65V 81%

Hydrometric Measurement / Site Visit Record

S11 - Poplar Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Poplar Creek
Location:	Poplar Creek
Site Name:	S11
Coordinates & Legal:	6307650 N, 472000 E NE-24-91-19-W4

Time of Measurement

Date of Measurement:	April 6, 2004	
Start Time:	8:50 AM	MDT
End Time:	9:20 AM	MDT

Personnel & Equipment

Measurement Made By:	DM/DK
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:		El:	245.550
Water Level (Sensor):		El:	241.045
Transducer Reading:	0.5686	El:	240.476
Top of Alberta Survey Marker		El:	

Weather Conditions: +5 °C, Clear, Calm

River Conditions: Ice cover d/s of measured section. Ice on banks broken away for measurement

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	34.7	0.00				0.000	1.00	1	34.70	34.50	0.002	0.002	0.04	0.01	0.000
	34.3	0.15				0.009	1.00	2	34.50	34.15	0.009	0.009	0.15	0.05	0.000
	34.0	0.35				0.070	1.00	3	34.15	33.75	0.070	0.070	0.35	0.14	0.010
	33.5	0.40				0.280	1.00	4	33.75	33.25	0.280	0.280	0.40	0.20	0.056
	33.0	0.40				0.280	1.00	5	33.25	32.75	0.280	0.280	0.40	0.20	0.056
	32.5	0.42				0.155	1.00	6	32.75	32.25	0.155	0.155	0.42	0.21	0.033
	32.0	0.44				0.076	1.00	7	32.25	31.50	0.076	0.076	0.44	0.33	0.025
	31.0	0.36				0.018	1.00	8	31.50	30.50	0.018	0.018	0.36	0.36	0.007
	30.0	0.43				0.001	1.00	9	30.50	29.50	0.001	0.001	0.43	0.43	0.000
	29.0	0.35				0.149	1.00	10	29.50	28.75	0.149	0.149	0.35	0.26	0.039
	28.5	0.33				0.381	1.00	11	28.75	28.25	0.381	0.381	0.33	0.17	0.063
	28.0	0.30				0.235	1.00	12	28.25	27.50	0.235	0.235	0.30	0.23	0.053
	27.0	0.40				0.006	1.00	13	27.50	26.50	0.006	0.006	0.40	0.40	0.002
	26.0	0.49				-0.040	1.00	14	26.50	25.50	-0.040	-0.040	0.49	0.49	-0.019
	25.0	0.53				-0.021	1.00	15	25.50	24.50	-0.021	-0.021	0.53	0.53	-0.011
	24.0	0.47				0.003	1.00	16	24.50	23.50	0.003	0.003	0.47	0.47	0.001
	23.0	0.39				0.030	1.00	17	23.50	22.75	0.030	0.030	0.39	0.29	0.009
	22.5	0.53				0.165	1.00	18	22.75	22.25	0.165	0.165	0.53	0.27	0.044
	22.0	0.50				0.280	1.00	19	22.25	21.75	0.280	0.280	0.50	0.25	0.070
	21.5	0.39				0.290	1.00	20	21.75	21.25	0.290	0.290	0.39	0.20	0.056
	21.0	0.44				0.335	1.00	21	21.25	20.75	0.335	0.335	0.44	0.22	0.074
	20.5	0.52				0.192	1.00	22	20.75	20.25	0.192	0.192	0.52	0.26	0.050
	20.0	0.54				0.186	1.00	23	20.25	19.75	0.186	0.186	0.54	0.27	0.050
	19.5	0.58				0.253	1.00	24	19.75	19.25	0.253	0.253	0.58	0.29	0.073
	19.0	0.59				0.393	1.00	25	19.25	18.75	0.393	0.393	0.59	0.30	0.116
	18.5	0.54				0.001	1.00	26	18.75	18.15	0.001	0.001	0.54	0.32	0.000
LB	17.8	0.00				0.000	1.00	27	18.15	17.80	0.000	0.000	0.14	0.05	0.000
														Total Flow:	**0.858**

Total Flow:				**0.858**		(m^3/s)
Perceived Measurement Quality:				**Good**		
Total Area:				**7.18**		(m^2)
Top Width:				**16.90**		(m)
Hydraulic Depth:				**0.425**		(m)
Mean Velocity:				**0.119**		(m/s)
Froude Number				**0.059**		

Notes: Measurements taken by wading.

Datalogger Notes:	
Datalogger Internal Power:	
Datalogger External Power:	
Datalogger Memory Used:	
Datalogger Clock:	MDT
Laptop Clock:	MDT
Dessicant:	
Datalogger:	Lakewood UltraLogger RX-1A #203058
PT:	Keller 8363K 8 psi Pressure Transducer #203058
Power:	

Hydrometric Measurement / Site Visit Record

S11 - Poplar Creek at Highway 63

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Poplar Creek
Location:	Poplar Creek at Highway 63
Site Name:	S11
Coordinates & Legal:	6307650 N, 472000 E NE-24-91-19-W4

Time of Measurement

Date of Measurement:	April 24, 2004
Start Time:	3:23 PM MDT
End Time:	3:58 PM MDT

Weather Conditions: +10 C, windy, partly cloudy

River Conditions: Open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Brass Ca	0.962	El:	245.550	0.963	El:	245.550
Water Level Reading:		5.315	El:	241.197	5.328	El:	241.185
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.691	El:	240.507	0.691	El:	240.495
Other:	ASCM pin	4.431	El:	242.081	4.431	El:	242.081

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	3.30	0.00	0.00			0.000	1.00	1	3.30	3.65	0.078	0.078	0.09	0.03	0.002
	4.00	0.36	0.00			0.314	1.00	2	3.65	4.50	0.314	0.314	0.36	0.31	0.096
	5.00	0.39	0.00			0.488	1.00	3	4.50	5.25	0.488	0.488	0.39	0.29	0.143
	5.50	0.39	0.00			0.728	1.00	4	5.25	5.75	0.728	0.728	0.39	0.20	0.142
	6.00	0.40	0.00			1.064	1.00	5	5.75	6.25	1.064	1.064	0.40	0.20	0.213
	6.50	0.40	0.00			1.049	1.00	6	6.25	6.75	1.049	1.049	0.40	0.20	0.210
	7.00	0.38	0.00			1.006	1.00	7	6.75	7.25	1.006	1.006	0.38	0.19	0.191
	7.50	0.42	0.00			1.049	1.00	8	7.25	7.75	1.049	1.049	0.42	0.21	0.220
	8.00	0.36	0.00			1.079	1.00	9	7.75	8.25	1.079	1.079	0.36	0.18	0.194
	8.50	0.34	0.00			1.122	1.00	10	8.25	8.75	1.122	1.122	0.34	0.17	0.191
	9.00	0.33	0.00			0.722	1.00	11	8.75	9.25	0.722	0.722	0.33	0.17	0.119
	9.50	0.33	0.00			0.768	1.00	12	9.25	9.75	0.768	0.768	0.33	0.17	0.127
	10.00	0.32	0.00			0.692	1.00	13	9.75	10.50	0.692	0.692	0.32	0.24	0.166
	11.00	0.26	0.00			0.600	1.00	14	10.50	11.50	0.600	0.600	0.26	0.26	0.156
	12.00	0.26	0.00			0.558	1.00	15	11.50	12.50	0.558	0.558	0.26	0.26	0.145
	13.00	0.24	0.00			0.509	1.00	16	12.50	13.50	0.509	0.509	0.24	0.24	0.122
	14.00	0.27	0.00			0.344	1.00	17	13.50	14.50	0.344	0.344	0.27	0.27	0.093
	15.00	0.23	0.00			0.317	1.00	18	14.50	15.50	0.317	0.317	0.23	0.23	0.073
	16.00	0.18	0.00			0.204	1.00	19	15.50	16.30	0.204	0.204	0.18	0.14	0.029
RB	16.60	0.00	0.00			0.000	1.00	20	16.30	16.60	0.051	0.051	0.05	0.01	0.001
														Total Flow:	2.633

Total Flow:	**2.633**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**3.96**		**(m^2)**
Top Width:	**13.30**		**(m)**
Hydraulic Depth:	**0.298**		**(m)**
Mean Velocity:	**0.665**		**(m/s)**
Froude Number	**0.389**		
Photographs taken looking at: Upstream, downstream, left bank, right bank, bench mark, datalogger/battery			

Datalogger Notes:		
Datalogger Internal Power:	11.34V	
Datalogger External Power:	12.41V	
Datalogger Memory Used:	0%	
Datalogger Clock:	Apr 24, 2004 14:16	MST
Laptop Clock:	Apr 24, 2004 15:16	MDT
Dessicant:	Good	
Datalogger:	Datalogger #203058	
PT:	Keller Pressure Transducer #101183	
Power:	Lakewood battery	

Notes:

Equipment installed. Transducer wired to concrete block and placed in flow, due to ice in housing.
TSS sample collected.

Hydrometric Measurement / Site Visit Record

S11 - Poplar Creek at Highway 63

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Poplar Creek
Location:	Poplar Creek at Highway 63
Site Name:	S11
Coordinates & Legal:	6307650 N, 472000 E NE-24-91-19-W4

Time of Measurement

Date of Measurement:	June 1, 2004
Start Time:	7:30 PM MDT
End Time:	7:45 PM MDT

Weather Conditions: +19°C, calm, clear

River Conditions: Open water conditions, high flow.

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Brass Ca	0.980	El:	245.550	0.827	El:	245.550
Water Level Reading:		5.042	El:	241.488	4.873	El:	241.504
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.974	El:	240.514	0.974	El:	240.530
Other:	ASCM Marker	3.469	El:	243.061	3.325	El:	243.205

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	18.10	0.00	0.00			0.000	1.00	1	18.10	18.45	0.023	0.023	0.16	0.05	0.001
	18.80	0.62	0.00			0.091	1.00	2	18.45	19.30	0.091	0.091	0.62	0.53	0.048
	19.80	0.80	0.00			0.783	1.00	3	19.30	20.30	0.783	0.783	0.80	0.80	0.627
	20.80	0.82	0.00			0.564	1.00	4	20.30	21.30	0.564	0.564	0.82	0.82	0.462
	21.80	0.72	0.00			0.686	1.00	5	21.30	22.30	0.686	0.686	0.72	0.72	0.494
	22.80	0.72	0.00			0.713	1.00	6	22.30	23.30	0.713	0.713	0.72	0.72	0.514
	23.80	0.84	0.00			0.713	1.00	7	23.30	24.30	0.713	0.713	0.84	0.84	0.599
	24.80	0.78	0.00			0.692	1.00	8	24.30	25.30	0.692	0.692	0.78	0.78	0.540
	25.80	0.80	0.00			0.768	1.00	9	25.30	26.30	0.768	0.768	0.80	0.80	0.614
	26.80	0.80	0.00			0.786	1.00	10	26.30	27.30	0.786	0.786	0.80	0.80	0.629
	27.80	0.85	0.00			0.652	1.00	11	27.30	28.30	0.652	0.652	0.85	0.85	0.554
	28.80	0.80	0.00			0.829	1.00	12	28.30	29.30	0.829	0.829	0.80	0.80	0.663
	29.80	0.72	0.00			0.732	1.00	13	29.30	29.80	0.732	0.732	0.72	0.36	0.263
	30.80	0.72	0.00			0.835	1.00	14	29.80	30.80	0.835	0.835	0.72	0.72	0.601
	31.80	0.67	0.00			0.479	1.00	15	30.80	31.80	0.479	0.479	0.67	0.67	0.321
	32.80	0.30	0.00			0.207	1.00	16	31.80	32.80	0.207	0.207	0.30	0.30	0.062
RB	33.20	0.00	0.00			0.000	1.00	17	32.80	33.20	0.052	0.052	0.08	0.03	0.002
														Total Flow:	6.995

Total Flow:	**6.995**		**(m^3/s)**
Perceived Measurement Quality:	Good		
Total Area:	**10.59**		**(m^2)**
Top Width:	**15.10**		**(m)**
Hydraulic Depth:	**0.701**		**(m)**
Mean Velocity:	**0.660**		**(m/s)**
Froude Number	**0.252**		
Photographs taken looking at: yes			

Datalogger Notes:		
Datalogger Internal Power:	11.34V	
Datalogger External Power:	12.41V	
Datalogger Memory Used:	24637 left	
Datalogger Clock:	Jun 01, 2004 17:42	MST
Laptop Clock:	Jun 01, 2004 18:44	MDT
Dessicant:	Good	
Datalogger:	Datalogger #203058	
PT:	Keller Pressure Transducer #101183	
Power:	Lakewood battery	

Notes: TSS sample collected.
Flow measurement taken upstream of bridge due to high flow depth at transducer

Hydrometric Measurement / Site Visit Record

S11 - Poplar Creek at Highway 63

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Poplar Creek
Location:	Poplar Creek at Highway 63
Site Name:	S11
Coordinates & Legal:	6307650 N, 472000 E NE-24-91-19-W4

Time of Measurement

Date of Measurement:	July 25, 2004
Start Time:	8:00 PM MDT
End Time:	8:30 PM MDT

Weather Conditions: +30˚C, calm, clear

River Conditions: Open water

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings **See Level Circuit**

Bench Mark Reading: Brass Cap		245.550
Water Level Reading:		240.984
Top of Ice Level Reading:		
Transducer Reading & Calc'd El.:	0.479	240.505
Other: ASCM Marker		242.071

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	36.00	0.00	0.00			0.000	1.00	1	36.00	35.50	0.018	0.018	0.09	0.05	0.001
	35.00	0.37	0.00			0.073	1.00	2	35.50	34.50	0.073	0.073	0.37	0.37	0.027
	34.00	0.34	0.00			0.113	1.00	3	34.50	33.50	0.113	0.113	0.34	0.34	0.038
	33.00	0.27	0.00			0.079	1.00	4	33.50	32.50	0.079	0.079	0.27	0.27	0.021
	32.00	0.23	0.00			0.082	1.00	5	32.50	31.50	0.082	0.082	0.23	0.23	0.019
	31.00	0.29	0.00			0.094	1.00	6	31.50	30.50	0.094	0.094	0.29	0.29	0.027
	30.00	0.31	0.00			0.094	1.00	7	30.50	29.50	0.094	0.094	0.31	0.31	0.029
	29.00	0.26	0.00			0.034	1.00	8	29.50	28.50	0.034	0.034	0.26	0.26	0.009
	28.00	0.20	0.00			0.094	1.00	9	28.50	27.50	0.094	0.094	0.20	0.20	0.019
	27.00	0.22	0.00			0.064	1.00	10	27.50	26.50	0.064	0.064	0.22	0.22	0.014
	26.00	0.25	0.00			0.027	1.00	11	26.50	25.50	0.027	0.027	0.25	0.25	0.007
	25.00	0.30	0.00			0.052	1.00	12	25.50	24.50	0.052	0.052	0.30	0.30	0.016
	24.00	0.30	0.00			0.073	1.00	13	24.50	23.50	0.073	0.073	0.30	0.30	0.022
	23.00	0.28	0.00			0.098	1.00	14	23.50	22.50	0.098	0.098	0.28	0.28	0.027
	22.00	0.26	0.00			0.091	1.00	15	22.50	21.50	0.091	0.091	0.26	0.26	0.024
	21.00	0.23	0.00			0.101	1.00	16	21.50	20.50	0.101	0.101	0.23	0.23	0.023
	20.00	0.30	0.00			0.085	1.00	17	20.50	19.70	0.085	0.085	0.30	0.24	0.020
	19.40	0.30	0.00			0.061	1.00	18	19.70	19.28	0.061	0.061	0.30	0.13	0.008
LB	19.15	0.00	0.00			0.000	1.00	19	19.28	19.15	0.015	0.015	0.08	0.01	0.000
														Total Flow:	0.352

Total Flow:	**0.352**		**(m^3/s)**
Perceived Measurement Quality:	Good		
Total Area:	**4.53**		**(m^2)**
Top Width:	**16.85**		**(m)**
Hydraulic Depth:	**0.269**		**(m)**
Mean Velocity:	**0.078**		**(m/s)**
Froude Number	**0.048**		
Photographs taken looking at: yes			

Notes: TSS sample collected.

Datalogger Notes:		
Datalogger Internal Power:	11.34V	
Datalogger External Power:	12.41V	
Datalogger Memory Used:	55%	
Datalogger Clock:	Jul 25, 2004 18:42	MST
Laptop Clock:	Jul 25, 2004 19:44	MDT
Dessicant:	Good	
Datalogger:	Datalogger #203058	
PT:	Keller Pressure Transducer #101183	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S11 - Poplar Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Poplar Creek
Location:	Poplar Creek
Site Name:	S11
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 24, 2004	
Start Time:	10:47 AM	MDT
End Time:	11:06 AM	MDT

Weather Conditions: Partly Cloudy, 15 C, calm

River Conditions: Open, low

Personnel & Equipment

Measurement Made By:	CT/DB
Data Entry By:	DB
Meter Type and No.:	March Mc Birney Flo-Mate 2000 (rental) s/n 2001463

Level Readings and Measurements

Bench Mark Reading:	Bridge AE	0.882	El:	245.550	0.992	El:	245.550
Water Level Reading:		2.639	El:	240.840	2.689	El:	240.822
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Est. El.:		0.340	El:	240.501	0.34	El:	240.482
Other:	top of ora	0.430	El:			El:	
Turn BS/FS	3.434/0.481				3.544/0.513		

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	3.90	0.00				0.000	1.00	1	3.90	4.10	0.002	0.002	0.03	0.01	0.000
	4.30	0.12				0.009	1.00	2	4.10	4.50	0.009	0.009	0.12	0.05	0.000
	4.70	0.10				0.009	1.00	3	4.50	4.90	0.009	0.009	0.10	0.04	0.000
	5.10	0.24				0.012	1.00	4	4.90	5.30	0.012	0.012	0.24	0.10	0.001
	5.50	0.22				0.024	1.00	5	5.30	5.70	0.024	0.024	0.22	0.09	0.002
	5.90	0.26				0.037	1.00	6	5.70	6.10	0.037	0.037	0.26	0.10	0.004
	6.30	0.30				0.012	1.00	7	6.10	6.40	0.012	0.012	0.30	0.09	0.001
	6.50	0.33				0.003	1.00	8	6.40	6.70	0.003	0.003	0.33	0.10	0.000
	6.90	0.27				0.009	1.00	9	6.70	7.10	0.009	0.009	0.27	0.11	0.001
	7.30	0.18				0.015	1.00	10	7.10	7.50	0.015	0.015	0.18	0.07	0.001
	7.70	0.16				0.000	1.00	11	7.50	7.90	0.000	0.000	0.16	0.06	0.000
	8.10	0.15				0.015	1.00	12	7.90	8.30	0.015	0.015	0.15	0.06	0.001
	8.50	0.09				0.015	1.00	13	8.30	8.70	0.015	0.015	0.09	0.04	0.001
	8.90	0.09				0.018	1.00	14	8.70	9.10	0.018	0.018	0.09	0.04	0.001
	9.30	0.16				0.012	1.00	15	9.10	9.50	0.012	0.012	0.16	0.06	0.001
	9.70	0.13				-0.006	1.00	16	9.50	9.95	-0.006	-0.006	0.13	0.06	0.000
LB	10.20	0.00				0.000	1.00	17	9.95	10.20	-0.002	-0.002	0.03	0.01	0.000
														Total Flow:	**0.014**

Total Flow:	**0.014**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**1.08**		**(m^2)**
Top Width:	**6.30**		**(m)**
Hydraulic Depth:	**0.171**		**(m)**
Mean Velocity:	**0.013**		**(m/s)**
Froude Number	**0.010**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:		
Datalogger Internal Power:		
Datalogger External Power:		
Datalogger Memory Used:	100%	
Datalogger Clock:	Aug 24, 2004 09:24	MST
Laptop Clock:	Aug 24, 2004 10:26	MDT
Dessicant:	Replaced	
Datalogger:		
PT:		
Power:		

Notes:

TSS Sample Taken (Aug 23rd)

site was vandalized, logger was found on river bank, upstream of TD, looger appeared wet and connections damaged

installed new logger box on 24th

Hydrometric Measurement / Site Visit Record

S11 - Poplar Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Poplar Creek
Location:	Poplar Creek
Site Name:	S11
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 22, 2004	
Start Time:	5:56 PM	MDT
End Time:	6:16 PM	MDT

Weather Conditions: Partly Cloudy, 18 C, windy

River Conditions: Open

Personnel & Equipment

Measurement Made By:	NM/DB
Data Entry By:	DB
Meter Type and No.:	March Mc Birney Flo-Mate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading:	Bridge AE see circul	El:	245.550		El:	245.550
Water Level Reading:		El:	240.995		El:	240.996
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Est. El.:	0.493	El:	240.502	0.493	El:	240.503
Other:	top of orange post	El:	243.047		El:	243.049

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	12.40	0.00				0.000	1.00	1	12.40	12.05	0.014	0.014	0.02	0.01	0.000
	11.70	0.08				0.058	1.00	2	12.05	11.50	0.058	0.058	0.08	0.04	0.003
	11.30	0.15				0.009	1.00	3	11.50	11.15	0.009	0.009	0.15	0.05	0.000
	11.00	0.15				0.027	1.00	4	11.15	10.80	0.027	0.027	0.15	0.05	0.001
	10.60	0.27				0.049	1.00	5	10.80	10.40	0.049	0.049	0.27	0.11	0.005
	10.20	0.34				0.219	1.00	6	10.40	10.05	0.219	0.219	0.34	0.12	0.026
	9.90	0.34				0.149	1.00	7	10.05	9.75	0.149	0.149	0.34	0.10	0.015
	9.60	0.36				0.070	1.00	8	9.75	9.45	0.070	0.070	0.36	0.11	0.008
	9.30	0.30				0.030	1.00	9	9.45	9.15	0.030	0.030	0.30	0.09	0.003
	9.00	0.36				0.082	1.00	10	9.15	8.85	0.082	0.082	0.36	0.11	0.009
	8.70	0.35				0.079	1.00	11	8.85	8.55	0.079	0.079	0.35	0.11	0.008
	8.40	0.31				0.027	1.00	12	8.55	8.25	0.027	0.027	0.31	0.09	0.003
	8.10	0.34				0.174	1.00	13	8.25	7.95	0.174	0.174	0.34	0.10	0.018
	7.80	0.38				0.082	1.00	14	7.95	7.65	0.082	0.082	0.38	0.11	0.009
	7.50	0.36				0.037	1.00	15	7.65	7.35	0.037	0.037	0.36	0.11	0.004
	7.20	0.39				0.076	1.00	16	7.35	7.05	0.076	0.076	0.39	0.12	0.009
	6.90	0.39				0.082	1.00	17	7.05	6.75	0.082	0.082	0.39	0.12	0.010
	6.60	0.33				0.076	1.00	18	6.75	6.45	0.076	0.076	0.33	0.10	0.008
	6.30	0.34				0.256	1.00	19	6.45	6.15	0.256	0.256	0.34	0.10	0.026
	6.00	0.39				0.293	1.00	20	6.15	5.85	0.293	0.293	0.39	0.12	0.034
	5.70	0.41				0.347	1.00	21	5.85	5.55	0.347	0.347	0.41	0.12	0.043
	5.40	0.43				0.360	1.00	22	5.55	5.25	0.360	0.360	0.43	0.13	0.046
	5.10	0.44				0.149	1.00	23	5.25	4.95	0.149	0.149	0.44	0.13	0.020
	4.80	0.37				0.229	1.00	24	4.95	4.65	0.229	0.229	0.37	0.11	0.025
	4.50	0.36				0.360	1.00	25	4.65	4.35	0.360	0.360	0.36	0.11	0.039
	4.20	0.38				0.171	1.00	26	4.35	4.05	0.171	0.171	0.38	0.11	0.019
	3.90	0.35				0.143	1.00	27	4.05	3.75	0.143	0.143	0.35	0.11	0.015
	3.60	0.37				0.094	1.00	28	3.75	3.45	0.094	0.094	0.37	0.11	0.010
	3.30	0.37				0.015	1.00	29	3.45	3.15	0.015	0.015	0.37	0.11	0.002
	3.00	0.37				0.040	1.00	30	3.15	2.85	0.040	0.040	0.37	0.11	0.004
	2.70	0.30				0.024	1.00	31	2.85	2.55	0.024	0.024	0.30	0.09	0.002
	2.40	0.17				0.018	1.00	32	2.55	2.20	0.018	0.018	0.17	0.06	0.001
LB	2.00	0.00				0.000	1.00	33	2.20	2.00	0.005	0.005	0.04	0.01	0.000
														Total Flow:	**0.426**

Total Flow:	**0.426**		(m^3/s)
Perceived Measurement Quality:	**Good**		
Total Area:	**3.18**		(m^2)
Top Width:	**10.40**		(m)
Hydraulic Depth:	**0.306**		(m)
Mean Velocity:	**0.134**		(m/s)
Froude Number	**0.077**		

Photographs taken looking at:
Upstream, downstream, across

Notes:
TSS Sample Taken
Check fmt file is old S8 file (graph of data starts in August, logger was installed in Sept)

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	12.90V	0.8
Datalogger Memory Used:	26356 free	
Datalogger Clock:	Sep 22, 2004 16:35	MST
Laptop Clock:	Sep 22, 2004 16:38	MST
Dessicant:	Good - 100%	
Datalogger:		
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

S11 - Poplar Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Poplar Creek
Location:	Poplar Creek
Site Name:	S11
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 30, 2004	
Start Time:	4:55 PM	MDT
End Time:	5:25 PM	MDT

Weather Conditions: Clear, 7 C

River Conditions: Partial ice cover

Personnel & Equipment

Measurement Made By:	ND/DM/FF
Data Entry By:	ND
Meter Type and No.:	March Mc Birney Flo-Mate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading:	on corner of bridge	0.643	El: 245.550	0.52	El:	245.550
Water Level Reading:		5.280	El: 240.913	5.16	El:	240.910
Top of Ice Level Reading:			El:		El:	
Transducer Reading & Est. El.:		0.413	El: 240.500	0.413	El:	240.497
Other:	Alberta survey marker	4.141	El:	4.02	El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	6.30	0.00				0.000	1.00	1	6.30	6.40	0.010	0.010	0.02	0.00	0.000
	6.50	0.07				0.040	1.00	2	6.40	7.00	0.040	0.040	0.07	0.04	0.002
	7.50	0.07				0.009	1.00	3	7.00	7.75	0.009	0.009	0.07	0.05	0.000
	8.00	0.12				0.107	1.00	4	7.75	8.13	0.107	0.107	0.12	0.05	0.005
	8.25	0.10				0.280	1.00	5	8.13	8.38	0.280	0.280	0.10	0.03	0.007
	8.50	0.13				0.216	1.00	6	8.38	8.63	0.216	0.216	0.13	0.03	0.007
	8.75	0.13				0.469	1.00	7	8.63	8.88	0.469	0.469	0.13	0.03	0.015
	9.00	0.10				0.308	1.00	8	8.88	9.13	0.308	0.308	0.10	0.03	0.008
	9.25	0.13				0.411	1.00	9	9.13	9.38	0.411	0.411	0.13	0.03	0.013
	9.50	0.18				0.445	1.00	10	9.38	9.63	0.445	0.445	0.18	0.05	0.020
	9.75	0.15				0.347	1.00	11	9.63	9.88	0.347	0.347	0.15	0.04	0.013
	10.00	0.15				0.149	1.00	12	9.88	10.13	0.149	0.149	0.15	0.04	0.006
	10.25	0.13				0.244	1.00	13	10.13	10.38	0.244	0.244	0.13	0.03	0.008
	10.50	0.10				0.354	1.00	14	10.38	10.63	0.354	0.354	0.10	0.03	0.009
	10.75	0.12				0.274	1.00	15	10.63	10.88	0.274	0.274	0.12	0.03	0.008
	11.00	0.12				0.491	1.00	16	10.88	11.13	0.491	0.491	0.12	0.03	0.015
	11.25	0.13				0.408	1.00	17	11.13	11.38	0.408	0.408	0.13	0.03	0.013
	11.50	0.09				0.232	1.00	18	11.38	11.63	0.232	0.232	0.09	0.02	0.005
	11.75	0.08				0.186	1.00	19	11.63	11.88	0.186	0.186	0.08	0.02	0.004
	12.00	0.15				0.104	1.00	20	11.88	12.25	0.104	0.104	0.15	0.06	0.006
	12.50	0.08				0.034	1.00	21	12.25	12.50	0.034	0.034	0.08	0.02	0.001
LB	13.50	0.00				0.000	1.00	22	12.50	13.50	0.008	0.008	0.02	0.02	0.000
														Total Flow:	**0.165**

Total Flow:	**0.165**		(m^3/s)
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.70**		(m^2)
Top Width:	**7.20**		(m)
Hydraulic Depth:	**0.097**		(m)
Mean Velocity:	**0.236**		(m/s)
Froude Number	**0.242**		
Photographs taken looking at: Upstream, downstream, across			

Notes:
TSS Sample Taken
Transducer removed for winter

Datalogger Notes:		
Datalogger Internal Power:	11.4V	100%
Datalogger External Power:	12.65V	81%
Datalogger Memory Used:	40% used	
Datalogger Clock:	Oct 30, 2004 16:03	MST
Laptop Clock:	Oct 30, 2004 16:09	MST
Dessicant:	Good	
Datalogger:	41157-08	
PT:	101183	
Power:		

Hydrometric Measurement / Site Visit Record

S14 - Ells River above Joslyn Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Ells River
Location:	Ells River above Joslyn Creek
Site Name:	S14
Coordinates & Legal:	6349466 N, 457310 E NW-34-95-11-W4

Time of Measurement

Date of Measurement:	April 26, 2004	
Start Time:	5:10 PM	MDT
End Time:		MDT

Personnel & Equipment

Measurement Made By:	DB/FF
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	Nail in Tree	0.000	El:	236.416
Water Level Reading:		0.000	El:	236.416
Top of Ice Level Reading:			El:	
Transducer Reading & Calc'd El.:		0.000	El:	236.416
Other:				

Weather Conditions: +15℃, Clear, Calm

River Conditions: Complete ice cover with small amount of flow (0.25 m deep x 5 m wide) over ice.

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:				-		(m^3/s)
Perceived Measurement Quality:						
Total Area:						(m^2)
Top Width:						(m)
Hydraulic Depth:						(m)
Mean Velocity:						(m/s)
Froude Number						

Notes: Transducer housing standpipe not visible, still covered in ice.
TSS Sample taken.

Datalogger Notes:	
Datalogger Internal Power:	
Datalogger External Power:	
Datalogger Memory Used:	
Datalogger Clock:	MDT
Laptop Clock:	MDT
Dessicant:	

Datalogger: Optimum DD128, # 0110220407
PT: Keller 730-130-5 psi #0104640
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S14 - Ells River above Joslyn Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Ells River
Location:	Ells River above Joslyn Creek
Site Name:	S14
Coordinates & Legal:	6349466 N, 457310 E NW-34-95-11-W4

Time of Measurement

Date of Measurement:	May 16, 2004	
Start Time:	2:55 PM	MDT
End Time:		MDT

Weather Conditions: +15°C, Partly Cloudy, Calm

River Conditions: Open

Personnel & Equipment

Measurement Made By:	DM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	Nail in Tree	1.242	El:	236.416
Water Level Reading:		3.814	El:	233.844
Top of Ice Level Reading:			El:	
Transducer Reading & Calc'd El.:		0.501	El:	233.343
Other:				

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:				-		(m^3/s)
Perceived Measurement Quality:						
Total Area:						(m^2)
Top Width:						(m)
Hydraulic Depth:						(m)
Mean Velocity:						(m/s)
Froude Number						

Notes: Transducer installed on rock (standpipe still frozen)
No ground wire available from sensor, not grounded.

Datalogger Notes:		
Datalogger Internal Power:	4.636V	
Datalogger External Power:	14.27V	
Datalogger Memory Used:	0%	
Datalogger Clock:	May 16, 2004 13:43	MDT
Laptop Clock:	May 16, 2004 14:55	MDT
Dessicant:		

Datalogger: Optimum DD128, # 0110220407
PT: Keller 730-130-5 psi #0104640
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S14 - Ells River above Joslyn Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Ells River
Location:	Ells River above Joslyn Creek
Site Name:	S14
Coordinates & Legal:	6349466 N, 457310 E NW-34-95-11-W4

Time of Measurement

Date of Measurement:	June 2, 2004	
Start Time:	6:54 PM	MDT
End Time:		MDT

Weather Conditions: +20 C, overcast, calm

River Conditions: open, floodstage

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tree	1.298	El:	236.416	1.239	El:	236.416
Water Level Reading:	3.368	El:	234.346	3.305	El:	234.350
Top of Ice Level Reading:		El:			El:	
Transducer Reading & El.:	0.966	El:	233.380	0.966	El:	233.384
Other:		El:			El:	
Transducer Reading & El.after mov	1.156		233.190	1.156		233.194

Measurement Data

Measured Data						Calculated Data								
Station	**Depth**	**Ice Thickness**	**Velocity at 0.2 Depth**	**Velocity at 0.8 Depth**	**Velocity at 0.6 Depth**	**Velocity Correction Factor**	**Panel No.**	**Panel Starts at Station**	**Panel Ends at Station**	**Measured Panel Velocity**	**Effective Average Panel Velocity**	**Panel Effective Depth**	**Panel Area**	**Panel Discharge**
(m)	**(m)**	**(m)**	**(m/s)**	**(m/s)**	**(m/s)**			**(m)**	**(m)**	**(m/s)**	**(m/s)**	**(m)**	**(m^2)**	**(m^3/s)**
													Total Flow:	-

Total Flow:	-		**(m^3/s)**
Perceived Measurement Quality:			
Total Area:			**(m^2)**
Top Width:			**(m)**
Hydraulic Depth:			**(m)**
Mean Velocity:			**(m/s)**
Froude Number			

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**771**
Datalogger Internal Power:	4.621V	
Datalogger External Power:	14.22V	
Datalogger Memory Used:	1%	
Datalogger Clock:	Jun 02, 2004 17:39	MST
Laptop Clock:	Jun 02, 2004 18:54	MDT
Dessicant:	Good - 80%	

Datalogger: Optimum DD128, # 0110220407
PT: Keller 730-130-5 psi #0104640
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:
TSS sample collected.
Flow in flood stage could not do maunal measurement.
Cord is very difficult to plug into data logger, try to find a 9-pin that has a shorter plug.
Synched laptop and datalogger, minus 1 hour.
Transducer appears to have moved in high flow - cable was snagged with debris, cable was moved to transducer housing at 7:15 PM, depth = 1.156438

Hydrometric Measurement / Site Visit Record

S14 - Ells River above Joslyn Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Ells River
Location:	Ells River above Joslyn Creek
Site Name:	S14
Coordinates & Legal:	6349466 N, 457310 E NW-34-95-11-W4

Time of Measurement

Date of Measurement:	July 22, 2004	
Start Time:	6:00 PM	MDT
End Time:	6:30 PM	MDT

Weather Conditions: +35 C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: nail in tree	0.848	El:	236.416	0.934	El:	236.416
Water Level Reading:	3.620	El:	233.644	3.700	El:	233.650
Top of Ice Level Reading:		El:			El:	
Transducer Reading & El.:	0.472	El:	233.172	0.472	El:	233.178
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	19.80	0.00				0.000	1.00	1	19.80	19.90	0.022	0.022	0.03	0.00	0.000
	20.00	0.10				0.088	1.00	2	19.90	20.50	0.088	0.088	0.10	0.06	0.005
	21.00	0.31				0.433	1.00	3	20.50	21.50	0.433	0.433	0.31	0.31	0.134
	22.00	0.41				0.451	1.00	4	21.50	22.25	0.451	0.451	0.41	0.31	0.139
	22.50	0.43				0.503	1.00	5	22.25	22.75	0.503	0.503	0.43	0.22	0.108
	23.00	0.45				0.616	1.00	6	22.75	23.25	0.616	0.616	0.45	0.23	0.139
	23.50	0.49				0.579	1.00	7	23.25	23.75	0.579	0.579	0.49	0.25	0.142
	24.00	0.52				0.634	1.00	8	23.75	24.25	0.634	0.634	0.52	0.26	0.165
	24.50	0.56				0.607	1.00	9	24.25	24.75	0.607	0.607	0.56	0.28	0.170
	25.00	0.59				0.555	1.00	10	24.75	25.25	0.555	0.555	0.59	0.30	0.164
	25.50	0.69				0.524	1.00	11	25.25	25.75	0.524	0.524	0.69	0.35	0.181
	26.00	0.75				0.585	1.00	12	25.75	26.25	0.585	0.585	0.75	0.38	0.219
	26.50	0.65				0.503	1.00	13	26.25	26.75	0.503	0.503	0.65	0.33	0.163
	27.00	0.61				0.530	1.00	14	26.75	27.25	0.530	0.530	0.61	0.31	0.162
	27.50	0.84				0.555	1.00	15	27.25	27.75	0.555	0.555	0.84	0.42	0.233
	28.00	0.85				0.515	1.00	16	27.75	28.25	0.515	0.515	0.85	0.43	0.219
	28.50	0.75				0.390	1.00	17	28.25	28.75	0.390	0.390	0.75	0.38	0.146
	29.00	0.62				0.366	1.00	18	28.75	29.50	0.366	0.366	0.62	0.47	0.170
	30.00	0.62				0.503	1.00	19	29.50	30.50	0.503	0.503	0.62	0.62	0.312
	31.00	0.52				0.543	1.00	20	30.50	31.50	0.543	0.543	0.52	0.52	0.282
	32.00	0.59				0.497	1.00	21	31.50	32.50	0.497	0.497	0.59	0.59	0.293
	33.00	0.50				0.326	1.00	22	32.50	33.50	0.326	0.326	0.50	0.50	0.163
	34.00	0.75				0.052	1.00	23	33.50	34.50	0.052	0.052	0.75	0.75	0.039
	35.00	0.78				0.116	1.00	24	34.50	35.50	0.116	0.116	0.78	0.78	0.090
	36.00	0.74				0.268	1.00	25	35.50	36.50	0.268	0.268	0.74	0.74	0.198
	37.00	0.25				0.094	1.00	26	36.50	37.30	0.094	0.094	0.25	0.20	0.019
	37.60	0.15				0.003	1.00	27	37.30	37.85	0.003	0.003	0.15	0.08	0.000
LB	38.10	0.00				0.000	1.00	28	37.85	38.10	0.001	0.001	0.04	0.01	0.000
														Total Flow:	4.056

Total Flow:	**4.056**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**10.03**		**(m^2)**
Top Width:	**18.30**		**(m)**
Hydraulic Depth:	**0.548**		**(m)**
Mean Velocity:	**0.405**		**(m/s)**
Froude Number	**0.174**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**771**
Datalogger Internal Power:	4.647V	
Datalogger External Power:	13.62V	
Datalogger Memory Used:	6%	
Datalogger Clock:	Jul 24, 2004 16:44	MST
Laptop Clock:	Jul 24, 2004 17:45	MDT
Dessicant:	Good - 50%	

Datalogger: Optimum DD128, # 0110220407
PT: Keller 730-130-5 psi #0104640
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S14 - Ells River above Joslyn Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Ells River
Location:	Ells River above Joslyn Creek
Site Name:	S14
Coordinates & Legal:	6349466 N, 457310 E NW-34-95-11-W4

Time of Measurement

Date of Measurement:	August 26, 2004
Start Time:	9:05 AM MDT
End Time:	9:23 AM MDT

Weather Conditions: +8 C

River Conditions: open, low flow

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tree	1.188	El:	236.416	1.208	El:	236.416
Water Level Reading:	4.061	El:	233.543	4.082	El:	233.542
Top of Ice Level Reading:		El:			El:	
Transducer Reading & El.:	0.372	El:	233.171	0.372	El:	233.170
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	2.90	0.00				0.000	1.00	1	2.90	3.40	0.065	0.065	0.03	0.01	0.001
	3.90	0.11				0.259	1.00	2	3.40	4.40	0.259	0.259	0.11	0.11	0.028
	4.90	0.17				0.372	1.00	3	4.40	5.40	0.372	0.372	0.17	0.17	0.063
	5.90	0.23				0.393	1.00	4	5.40	6.40	0.393	0.393	0.23	0.23	0.090
	6.90	0.30				0.369	1.00	5	6.40	7.40	0.369	0.369	0.30	0.30	0.111
	7.90	0.32				0.439	1.00	6	7.40	8.40	0.439	0.439	0.32	0.32	0.140
	8.90	0.43				0.381	1.00	7	8.40	9.40	0.381	0.381	0.43	0.43	0.164
	9.90	0.43				0.372	1.00	8	9.40	10.40	0.372	0.372	0.43	0.43	0.160
	10.90	0.40				0.445	1.00	9	10.40	11.40	0.445	0.445	0.40	0.40	0.178
	11.90	0.43				0.408	1.00	10	11.40	12.40	0.408	0.408	0.43	0.43	0.176
	12.90	0.42				0.396	1.00	11	12.40	13.40	0.396	0.396	0.42	0.42	0.166
	13.90	0.56				0.366	1.00	12	13.40	14.40	0.366	0.366	0.56	0.56	0.205
	14.90	0.56				0.317	1.00	13	14.40	15.40	0.317	0.317	0.56	0.56	0.178
	15.90	0.52				0.174	1.00	14	15.40	16.40	0.174	0.174	0.52	0.52	0.090
	16.90	0.36				0.094	1.00	15	16.40	17.40	0.094	0.094	0.36	0.36	0.034
	17.90	0.22				0.037	1.00	16	17.40	18.40	0.037	0.037	0.22	0.22	0.008
	18.90	0.15				0.024	1.00	17	18.40	19.40	0.024	0.024	0.15	0.15	0.004
	19.90	0.23				0.043	1.00	18	19.40	20.40	0.043	0.043	0.23	0.23	0.010
	20.90	0.09				-0.006	1.00	19	20.40	21.10	-0.006	-0.006	0.09	0.06	0.000
LB	21.30	0.00				0.000	1.00	20	21.10	21.30	-0.002	-0.002	0.02	0.00	0.000
														Total Flow:	1.806

Total Flow:	**1.806**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**5.92**		**(m^2)**
Top Width:	**18.40**		**(m)**
Hydraulic Depth:	**0.322**		**(m)**
Mean Velocity:	**0.305**		**(m/s)**
Froude Number	**0.172**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**771**
Datalogger Internal Power:	4.613V	
Datalogger External Power:	14.47V	
Datalogger Memory Used:	8%	
Datalogger Clock:	Aug 26, 2004 07:51	MST
Laptop Clock:	Aug 26, 2004 08:53	MDT
Dessicant:	OK -25%, replaced	

Datalogger: Optimum DD128, # 0110220407
PT: Keller 730-130-5 psi #0104640
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: TSS sample collected.
Database # 771.

Hydrometric Measurement / Site Visit Record

S14 - Ells River above Joslyn Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Ells River
Location:	Ells River above Joslyn Creek
Site Name:	S14
Coordinates & Legal:	6349466 N, 457310 E NW-34-95-11-W4

Time of Measurement

Date of Measurement:	September 23, 2004
Start Time:	5:09 PM MDT
End Time:	5:22 PM MDT

Weather Conditions: +15 C, partly cloudy, light wind

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tree	1.123	El:	236.416	1.232	El:	236.416
Water Level Reading:	3.836	El:	233.703	3.944	El:	233.704
Top of Ice Level Reading:		El:			El:	
Transducer Reading & El.:	0.526	El:	233.177	0.526	El:	233.178
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	18.50	0.00				0.000	1.00	1	18.50	19.00	0.091	0.091	0.05	0.03	0.002
	19.50	0.21				0.366	1.00	2	19.00	20.00	0.366	0.366	0.21	0.21	0.077
	20.50	0.39				0.536	1.00	3	20.00	21.00	0.536	0.536	0.39	0.39	0.209
	21.50	0.45				0.527	1.00	4	21.00	22.00	0.527	0.527	0.45	0.45	0.237
	22.50	0.51				0.527	1.00	5	22.00	23.00	0.527	0.527	0.51	0.51	0.269
	23.50	0.55				0.570	1.00	6	23.00	24.00	0.570	0.570	0.55	0.55	0.313
	24.50	0.59				0.549	1.00	7	24.00	25.00	0.549	0.549	0.59	0.59	0.324
	25.50	0.65				0.546	1.00	8	25.00	26.00	0.546	0.546	0.65	0.65	0.355
	26.50	0.70				0.347	1.00	9	26.00	27.00	0.347	0.347	0.70	0.70	0.243
	27.50	0.70				0.555	1.00	10	27.00	28.00	0.555	0.555	0.70	0.70	0.388
	28.50	0.70				0.442	1.00	11	28.00	29.00	0.442	0.442	0.70	0.70	0.309
	29.50	0.75				0.475	1.00	12	29.00	30.00	0.475	0.475	0.75	0.75	0.357
	30.50	0.68				0.448	1.00	13	30.00	31.00	0.448	0.448	0.68	0.68	0.305
	31.50	0.57				0.274	1.00	14	31.00	32.00	0.274	0.274	0.57	0.57	0.156
	32.50	0.50				0.146	1.00	15	32.00	33.00	0.146	0.146	0.50	0.50	0.073
	33.50	0.45				0.134	1.00	16	33.00	34.00	0.134	0.134	0.45	0.45	0.060
	34.50	0.50				0.171	1.00	17	34.00	35.00	0.171	0.171	0.50	0.50	0.085
	35.50	0.47				0.073	1.00	18	35.00	36.00	0.073	0.073	0.47	0.47	0.034
	36.50	0.17				-0.037	1.00	19	36.00	37.05	-0.037	-0.037	0.17	0.18	-0.007
LB	37.60	0.00				0.000	1.00	20	37.05	37.60	-0.009	-0.009	0.04	0.02	0.000
														Total Flow:	3.792

Total Flow:	**3.792**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**9.60**		**(m^2)**
Top Width:	**19.10**		**(m)**
Hydraulic Depth:	**0.503**		**(m)**
Mean Velocity:	**0.395**		**(m/s)**
Froude Number	**0.178**		
Photographs taken looking at: no - camera broken			

Notes: TSS sample collected.
Database # 771.

Datalogger Notes:	**Database**	**771**
Datalogger Internal Power:	4.588V	
Datalogger External Power:	13.99V	
Datalogger Memory Used:	11%	
Datalogger Clock:	Sep 23, 2004 15:54	MST
Laptop Clock:	Sep 23, 2004 15:57	MST
Dessicant:	Good - 100%	
Datalogger:	Optimum DD128, # 0110220407	030430771
PT:	Keller 730-130-5 psi #0104640	0303326
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller		

Hydrometric Measurement / Site Visit Record

S14 - Ells River above Joslyn Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Ells River
Location:	Ells River above Joslyn Creek
Site Name:	S14
Coordinates & Legal:	6349466 N, 457310 E NW-34-95-11-W4

Time of Measurement

Date of Measurement:	November 1, 2004
Start Time:	2:00 PM MST
End Time:	MST

Weather Conditions: +2 C, clear, calm

River Conditions: Full ice cover

Personnel & Equipment

Measurement Made By:	DM/ND/FF
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tree	1.079	El:	236.416	1.175	El:	236.416
Water Level Reading:	3.689	El:	233.806	3.781	El:	233.810
Top of Ice Level Reading:	3.642	El:	233.853	3.729	El:	233.862
Transducer Reading & El.:	0.639	El:	233.167	0.639	El:	233.171
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
no - camera broken

Datalogger Notes:	**Database**	**771**
Datalogger Internal Power:	4.59V	
Datalogger External Power:	14.8V	
Datalogger Memory Used:	14% used	
Datalogger Clock:	Nov 01, 2004 14:17	MST
Laptop Clock:	Nov 01, 2004 13:21	MST
Dessicant:	Good - 100%	
Datalogger:	Optimum DD128, # 0110220407	030430771
PT:	Keller 730-130-5 psi #0104640	0303326
Power:		

Notes: River conditions unsafe for flow measurement. TSS sample collected.
Database # 771. Data downloaded, PT removed for winter

Hydrometric Measurement / Site Visit Record

S15 - Tar River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River near the Mouth
Site Name:	S15
Coordinates & Legal:	6356983 N, 454453 E SW-29-96-11-W4

Time of Measurement

Date of Measurement:	April 27, 2004
Start Time:	10:46 AM MDT
End Time:	MDT

Weather Conditions: +5 C, intermittent drizzle

River Conditions: 0.3 m deep flow over partial ice covered cross section.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	0.000	El:	285.908	0.000	El:	285.908
Water Level Reading:	0.000	El:	285.908	0.000	El:	285.908
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.000	El:	285.908	0.000	El:	285.908
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	
Datalogger Internal Power:	
Datalogger External Power:	
Datalogger Memory Used:	
Datalogger Clock:	MST
Laptop Clock:	MDT
Dessicant:	
Datalogger:	
PT:	
Power:	

Notes:
Levels not measured as not meaningful due to backup from ice.
Equipment installed. Transducer wired to concrete block and placed in flow.
TSS sample collected.
New backup or auxillary battery needed for this Lakewood datalogger.

Hydrometric Measurement / Site Visit Record

S15 - Tar River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River	
Location:	Tar River near the Mouth	
Site Name:	S15	
Coordinates & Legal:	6356983 N, 454453 E	SW-29-96-11-W4

Time of Measurement

Date of Measurement:	May 15, 2004	
Start Time:	3:36 PM	MDT
End Time:		MDT

Weather Conditions:

River Conditions: open

Personnel & Equipment

Measurement Made By:	DM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	nail in tre	1.503	El:	285.321	1.409	El:	285.321
Water Level Reading:		3.987	El:	282.837	3.887	El:	282.843
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.419	El:	282.418	0.419	El:	282.424
Other:	BM 2 bar	0.918	El:	285.906	0.825	El:	285.905

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			
Photographs taken looking at:			

Notes: Equipment installed in tube.
DB # 608

Datalogger Notes:		
Datalogger Internal Power:	4.736V	
Datalogger External Power:	13.09V	
Datalogger Memory Used:	0%	
Datalogger Clock:	5/05/2004 15:36:41 PM	MST
Laptop Clock:	15/5/2004 15:36:41 PM	MDT
Dessicant:		
Datalogger:		
PT:	Transducer # 101356 - 3 psi	
Power:	Solar panel & Internal battery	

Hydrometric Measurement / Site Visit Record

S15 - Tar River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River near the Mouth
Site Name:	S15
Coordinates & Legal:	6356983 N, 454453 E SW-29-96-11-W4

Time of Measurement

Date of Measurement:	May 31, 2004
Start Time:	4:13 PM MDT
End Time:	5:02 PM MDT

Weather Conditions: +9 C, overcast, light rain

River Conditions: open, in flood stage, too deep to wade

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	t-bar	0.843	El:	285.908	0.787	El:	285.908
Water Level Reading:		3.049	El:	283.702	2.998	El:	283.697
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		1.247	El:	282.455	1.247	El:	282.450
Other:	BM 2 nail	1.426	El:	285.325	1.373	El:	285.322

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	18.50	0.00	0.00			0.000	1.00	1	18.50	18.85	0.113	0.113	0.10	0.03	0.004
	19.20	0.40	0.00			0.451	1.00	2	18.85	19.45	0.451	0.451	0.40	0.24	0.107
	19.70	0.64	0.00			0.445	1.00	3	19.45	19.95	0.445	0.445	0.64	0.32	0.142
	20.20	0.79	0.00			0.384	1.00	4	19.95	20.45	0.384	0.384	0.79	0.40	0.152
	20.70	0.79	0.00			0.436	1.00	5	20.45	20.95	0.436	0.436	0.79	0.40	0.173
	21.20	0.82	0.00			0.631	1.00	6	20.95	21.45	0.631	0.631	0.82	0.41	0.260
	21.70	0.79	0.00			0.741	1.00	7	21.45	21.95	0.741	0.741	0.79	0.40	0.293
	22.20	1.07	0.00	0.84	0.68		1.00	8	21.95	22.45	0.762	0.762	1.07	0.53	0.406
	22.70	1.31	0.00	1.15	0.31		1.00	9	22.45	22.95	0.732	0.732	1.31	0.66	0.479
	23.20	1.37	0.00	1.20	0.67		1.00	10	22.95	23.45	0.936	0.936	1.37	0.69	0.642
	23.70	1.46	0.00	0.98	0.45		1.00	11	23.45	23.95	0.716	0.716	1.46	0.73	0.524
	24.20	1.43	0.00	0.72	0.59		1.00	12	23.95	24.45	0.654	0.654	1.43	0.72	0.468
	24.70	1.34	0.00	0.83	0.76		1.00	13	24.45	24.95	0.792	0.792	1.34	0.67	0.531
	25.20	1.40	0.00	0.37	0.92		1.00	14	24.95	25.45	0.643	0.643	1.40	0.70	0.451
	25.70	1.34	0.00	0.21	1.10	0.497	1.00	15	25.45	25.95	0.657	0.657	1.34	0.67	0.440
	26.20	1.25	0.00	0.66	1.35	0.899	1.00	16	25.95	26.45	1.003	1.003	1.25	0.62	0.627
	26.70	1.43	0.00	0.89	1.00	1.137	1.00	17	26.45	26.95	0.948	0.948	1.43	0.72	0.679
	27.20	1.37	0.00	1.12	0.62	1.094	1.00	18	26.95	27.45	0.873	0.873	1.37	0.69	0.599
	27.70	1.28	0.00	0.27	0.01	0.174	1.00	19	27.45	27.95	0.140	0.140	1.28	0.64	0.090
	28.20	1.22	0.00	0.34	0.19	0.344	1.00	20	27.95	28.45	0.267	0.267	1.22	0.61	0.163
	28.70	1.04	0.00	0.21	0.03	0.594	1.00	21	28.45	28.95	0.594	0.594	1.04	0.52	0.308
	29.20	0.61	0.00	0.00	0.00	0.107	1.00	22	28.95	29.45	0.107	0.107	0.61	0.30	0.033
	29.70	0.43	0.00	0.00	0.00	0.094	1.00	23	29.45	29.85	0.094	0.094	0.43	0.17	0.016
RB	30.00	0.00	0.00	0.00	0.00	0.000	1.00	24	29.85	30.00	0.024	0.024	0.11	0.02	0.000
														Total Flow:	7.588

Total Flow:	**7.588**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**11.84**		**(m^2)**
Top Width:	**11.50**		**(m)**
Hydraulic Depth:	**1.030**		**(m)**
Mean Velocity:	**0.641**		**(m/s)**
Froude Number	**0.202**		
Photographs taken looking at:			

Datalogger Notes:		
Datalogger Internal Power:	4.763V	
Datalogger External Power:	14.54V	
Datalogger Memory Used:	1%	
Datalogger Clock:	13:59:31	MST
Laptop Clock:	3:00	MDT
Dessicant:		
Datalogger:	Datalogger #207110	
PT:	Keller Pressure Transducer #1747	
Power:	Lakewood battery	

Notes:

River too deep to wade, very high flow, discharge from bridge, note water level at bottom of bridge
TSS sample collected.

Hydrometric Measurement / Site Visit Record

S15 - Tar River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River near the Mouth
Site Name:	S15
Coordinates & Legal:	6356983 N, 454453 E SW-29-96-11-W4

Time of Measurement

Date of Measurement:	July 23, 2004
Start Time:	8:31 AM MDT
End Time:	9:34 AM MDT

Weather Conditions: +10 C, Clear, Calm

River Conditions: Open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: t-bar	0.632	El:	285.908	0.529	El:	285.908
Water Level Reading:	3.711	El:	282.829	3.612	El:	282.825
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.373	El:	282.456	0.373	El:	282.452
Other: BM 2 nail	1.219	El:	285.321	1.119	El:	285.318

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	8.80	0.00	0.00			0.000	1.00	1	8.80	8.65	0.022	0.022	0.02	0.00	0.000
	8.50	0.09	0.00			0.088	1.00	2	8.65	8.38	0.088	0.088	0.09	0.02	0.002
	8.25	0.10	0.00			0.107	1.00	3	8.38	8.13	0.107	0.107	0.10	0.03	0.003
	8.00	0.14	0.00			0.101	1.00	4	8.13	7.88	0.101	0.101	0.14	0.04	0.004
	7.75	0.17	0.00			0.113	1.00	5	7.88	7.63	0.113	0.113	0.17	0.04	0.005
	7.50	0.19	0.00			0.128	1.00	6	7.63	7.38	0.128	0.128	0.19	0.05	0.006
	7.25	0.22	0.00			0.113	1.00	7	7.38	7.13	0.113	0.113	0.22	0.06	0.006
	7.00	0.25	0.00			0.131	1.00	8	7.13	6.88	0.131	0.131	0.25	0.06	0.008
	6.75	0.28	0.00			0.128	1.00	9	6.88	6.63	0.128	0.128	0.28	0.07	0.009
	6.50	0.33	0.00			0.134	1.00	10	6.63	6.38	0.134	0.134	0.33	0.08	0.011
	6.25	0.41	0.00			0.134	1.00	11	6.38	6.13	0.134	0.134	0.41	0.10	0.014
	6.00	0.44	0.00			0.152	1.00	12	6.13	5.88	0.152	0.152	0.44	0.11	0.017
	5.75	0.49	0.00			0.168	1.00	13	5.88	5.63	0.168	0.168	0.49	0.12	0.021
	5.50	0.55	0.00			0.140	1.00	14	5.63	5.38	0.140	0.140	0.55	0.14	0.019
	5.25	0.64	0.00			0.149	1.00	15	5.38	5.13	0.149	0.149	0.64	0.16	0.024
	5.00	0.66	0.00			0.140	1.00	16	5.13	4.88	0.140	0.140	0.66	0.17	0.023
	4.75	0.60	0.00			0.137	1.00	17	4.88	4.63	0.137	0.137	0.60	0.15	0.021
	4.50	0.62	0.00			0.137	1.00	18	4.63	4.38	0.137	0.137	0.62	0.16	0.021
	4.25	0.64	0.00			0.146	1.00	19	4.38	4.13	0.146	0.146	0.64	0.16	0.023
	4.00	0.62	0.00			0.143	1.00	20	4.13	3.88	0.143	0.143	0.62	0.16	0.022
	3.75	0.61	0.00			0.149	1.00	21	3.88	3.63	0.149	0.149	0.61	0.15	0.023
	3.50	0.57	0.00			0.162	1.00	22	3.63	3.38	0.162	0.162	0.57	0.14	0.023
	3.25	0.52	0.00			0.146	1.00	23	3.38	3.13	0.146	0.146	0.52	0.13	0.019
	3.00	0.33	0.00			0.134	1.00	24	3.13	2.88	0.134	0.134	0.33	0.08	0.011
	2.75	0.39	0.00			0.073	1.00	25	2.88	2.63	0.073	0.073	0.39	0.10	0.007
	2.50	0.29	0.00			0.088	1.00	26	2.63	2.35	0.088	0.088	0.29	0.08	0.007
RB	2.20	0.00	0.00			0.000	1.00	27	2.35	2.20	0.022	0.022	0.07	0.01	0.000
														Total Flow:	0.349

Total Flow:	**0.349**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**2.56**		**(m^2)**
Top Width:	**6.60**		**(m)**
Hydraulic Depth:	**0.388**		**(m)**
Mean Velocity:	**0.136**		**(m/s)**
Froude Number	**0.070**		
Photographs taken looking at:			

Notes: TSS sample collected.

Datalogger Notes:		
Datalogger Internal Power:	4.786V	
Datalogger External Power:	14.85V	
Datalogger Memory Used:	6%	
Datalogger Clock:	Jul 23, 2004 08:31	MST
Laptop Clock:	Jul 23, 2004 09:34	MDT
Dessicant:		
Datalogger:	Datalogger #608	
PT:	Keller Pressure Transducer #1747	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S15 - Tar River

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River
Site Name:	S15
Coordinates & Legal:	6356983 N, 454453 E SW-29-96-11-W4

Time of Measurement

Date of Measurement:	August 25, 2004
Start Time:	9:00 AM MDT
End Time:	9:23 AM MDT

Weather Conditions: +12 C, Calm, clear

River Conditions: open, very low flow

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings		**Setup No. 1**		**Setup No. 2**	
Bench Mark Reading: t post	0.738	El:	285.908	0.701	El: 285.908
Water Level Reading:	~~3.794~~	El:	282.852	3.890	El: 282.719
Top of Ice Level Reading:		El:			El:
Transducer Reading & Calc'd E	0.293	El:	282.559	0.293	El: 282.426
Other: nail in tre	1.326	El:	285.320	1.289	El: 285.320

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	1.50	0.00	0.00			0.000	1.00	1	1.50	1.75	0.011	0.011	0.05	0.01	0.000
	2.00	0.21	0.00			0.046	1.00	2	1.75	2.13	0.046	0.046	0.21	0.08	0.004
	2.25	0.27	0.00			0.052	1.00	3	2.13	2.38	0.052	0.052	0.27	0.07	0.003
	2.50	0.28	0.00			0.076	1.00	4	2.38	2.63	0.076	0.076	0.28	0.07	0.005
	2.75	0.32	0.00			0.076	1.00	5	2.63	2.88	0.076	0.076	0.32	0.08	0.006
	3.00	0.42	0.00			0.076	1.00	6	2.88	3.13	0.076	0.076	0.42	0.11	0.008
	3.25	0.46	0.00			0.073	1.00	7	3.13	3.38	0.073	0.073	0.46	0.12	0.008
	3.50	0.48	0.00			0.067	1.00	8	3.38	3.63	0.067	0.067	0.48	0.12	0.008
	3.75	0.53	0.00			0.058	1.00	9	3.63	3.88	0.058	0.058	0.53	0.13	0.008
	4.00	0.54	0.00			0.061	1.00	10	3.88	4.13	0.061	0.061	0.54	0.14	0.008
	4.25	0.61	0.00			0.064	1.00	11	4.13	4.38	0.064	0.064	0.61	0.15	0.010
	4.50	0.56	0.00			0.070	1.00	12	4.38	4.63	0.070	0.070	0.56	0.14	0.010
	4.75	0.52	0.00			0.058	1.00	13	4.63	4.88	0.058	0.058	0.52	0.13	0.008
	5.00	0.43	0.00			0.067	1.00	14	4.88	5.13	0.067	0.067	0.43	0.11	0.007
	5.25	0.38	0.00			0.055	1.00	15	5.13	5.38	0.055	0.055	0.38	0.10	0.005
	5.50	0.34	0.00			0.058	1.00	16	5.38	5.63	0.058	0.058	0.34	0.09	0.005
	5.75	0.29	0.00			0.046	1.00	17	5.63	5.88	0.046	0.046	0.29	0.07	0.003
	6.00	0.24	0.00			0.040	1.00	9	5.88	6.13	0.040	0.040	0.24	0.06	0.002
	6.25	0.18	0.00			0.043	1.00	10	6.13	6.38	0.043	0.043	0.18	0.05	0.002
	6.50	0.17	0.00			0.043	1.00	11	6.38	6.75	0.043	0.043	0.17	0.06	0.003
	7.00	0.11	0.00			0.018	1.00	12	6.75	7.43	0.018	0.018	0.11	0.07	0.001
RB	7.85	0.00	0.00			0.000	1.00	13	7.43	7.85	0.005	0.005	0.03	0.01	0.000
														Total Flow:	0.115

Total Flow:	**0.115**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**1.95**		**(m^2)**
Top Width:	**6.35**		**(m)**
Hydraulic Depth:	**0.308**		**(m)**
Mean Velocity:	**0.059**		**(m/s)**
Froude Number	**0.034**		

Photographs taken looking at:
Upstream, downstream, across

Notes: TSS taken

Datalogger Notes:	**Database # 608**	
Datalogger Internal Power:	4.737V	
Datalogger External Power:	16.57V	
Datalogger Memory Used:	8%	
Datalogger Clock:	Aug 25, 2004 07:43	MST
Laptop Clock:	Aug 25, 2004 08:47	MDT
Dessicant:	Good - 75%	

Datalogger:
PT:
Power:

Hydrometric Measurement / Site Visit Record

S15 - Tar River

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River
Site Name:	S15
Coordinates & Legal:	6356983 N, 454453 E SW-29-96-11-W4

Time of Measurement

Date of Measurement:	September 22, 2004
Start Time:	2:35 PM MDT
End Time:	2:48 PM MDT

Weather Conditions: +18 C, windy, partly cloudy

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	t post	0.815	El:	285.908	0.759	El:	285.908
Water Level Reading:		3.811	El:	282.912	3.752	El:	282.915
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.487	El:	282.425	0.487	El:	282.428
Other:	nail in tre	1.402	El:	285.321	1.347	El:	285.320

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	17.10	0.00	0.00			0.000	1.00	1	17.10	17.15	0.025	0.025	0.15	0.01	0.000
	17.20	0.59	0.00			0.101	1.00	2	17.15	17.35	0.101	0.101	0.59	0.12	0.012
	17.50	0.62	0.00			0.198	1.00	3	17.35	17.65	0.198	0.198	0.62	0.19	0.037
	17.80	0.67	0.00			0.283	1.00	4	17.65	17.95	0.283	0.283	0.67	0.20	0.057
	18.10	0.69	0.00			0.399	1.00	5	17.95	18.25	0.399	0.399	0.69	0.21	0.083
	18.40	0.65	0.00			0.454	1.00	6	18.25	18.55	0.454	0.454	0.65	0.19	0.089
	18.70	0.64	0.00			0.405	1.00	7	18.55	18.85	0.405	0.405	0.64	0.19	0.078
	19.00	0.60	0.00			0.360	1.00	8	18.85	19.15	0.360	0.360	0.60	0.18	0.065
	19.30	0.42	0.00			0.396	1.00	9	19.15	19.45	0.396	0.396	0.42	0.13	0.050
	19.60	0.47	0.00			0.326	1.00	10	19.45	19.75	0.326	0.326	0.47	0.14	0.046
	19.90	0.45	0.00			0.360	1.00	11	19.75	20.05	0.360	0.360	0.45	0.14	0.049
	20.20	0.41	0.00			0.369	1.00	12	20.05	20.35	0.369	0.369	0.41	0.12	0.045
	20.50	0.40	0.00			0.369	1.00	13	20.35	20.65	0.369	0.369	0.40	0.12	0.044
	20.80	0.38	0.00			0.372	1.00	14	20.65	20.95	0.372	0.372	0.38	0.11	0.042
	21.10	0.38	0.00			0.375	1.00	15	20.95	21.25	0.375	0.375	0.38	0.11	0.043
	21.40	0.39	0.00			0.341	1.00	16	21.25	21.60	0.341	0.341	0.39	0.14	0.047
	21.80	0.38	0.00			0.201	1.00	17	21.60	22.00	0.201	0.201	0.38	0.15	0.031
	22.20	0.30	0.00			0.027	1.00	18	22.00	22.40	0.027	0.027	0.30	0.12	0.003
	22.60	0.25	0.00			0.043	1.00	19	22.40	22.80	0.043	0.043	0.25	0.10	0.004
	23.00	0.30	0.00			0.003	1.00	20	22.80	23.20	0.003	0.003	0.30	0.12	0.000
	23.40	0.31	0.00			-0.003	1.00	21	23.20	23.65	-0.003	-0.003	0.31	0.14	0.000
RB	23.90	0.00	0.00			0.000	1.00	22	23.65	23.90	-0.001	-0.001	0.08	0.02	0.000
														Total Flow:	0.824

Total Flow:	**0.824**		(m^3/s)
Perceived Measurement Quality:	**Good**		
Total Area:	**2.95**		(m^2)
Top Width:	**6.80**		(m)
Hydraulic Depth:	**0.433**		(m)
Mean Velocity:	**0.279**		(m/s)
Froude Number	**0.136**		

Photographs taken looking at:
Upstream, downstream, across

Notes: TSS taken

Datalogger Notes:	**Database # 608**	
Datalogger Internal Power:	4.765V	
Datalogger External Power:	14.22V	
Datalogger Memory Used:	11%	
Datalogger Clock:	Sep 22, 2004 13:21	MST
Laptop Clock:	Sep 22, 2004 13:27	MST
Dessicant:	Good - 60%	

Datalogger:
PT:
Power:

Hydrometric Measurement / Site Visit Record

S15 - Tar River

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River
Site Name:	S15
Coordinates & Legal:	6356983 N, 454453 E SW-29-96-11-W4

Time of Measurement

Date of Measurement:	November 1, 2004
Start Time:	8:55 AM MST
End Time:	9:14 AM MST

Weather Conditions: -5 C, clear

River Conditions: partially frozen (~90%)

Personnel & Equipment

Measurement Made By:	DM/FF
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	0.892	El:	285.908	0.803	El:	285.908
Water Level Reading:	3.979	El:	282.821	3.898	El:	282.813
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.373	El:	282.448	0.373	El:	282.440
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	1.50	0.00	0.07			0.00	1.00	1	1.50	1.63	0.008	0.008	0.01	0.00	0.000
	1.75	0.11	0.07			0.03	1.00	2	1.63	1.88	0.030	0.030	0.04	0.01	0.000
	2.00	0.13	0.07			0.03	1.00	3	1.88	2.25	0.030	0.030	0.06	0.02	0.001
	2.50	0.20	0.07			0.06	1.00	4	2.25	2.63	0.060	0.060	0.13	0.05	0.003
	2.75	0.23	0.07			0.19	1.00	5	2.63	2.88	0.190	0.190	0.16	0.04	0.008
	3.00	0.25	0.07			0.19	1.00	6	2.88	3.25	0.190	0.190	0.18	0.07	0.013
	3.50	0.31	0.07			0.20	1.00	7	3.25	3.75	0.200	0.200	0.24	0.12	0.024
	4.00	0.37	0.07			0.19	1.00	8	3.75	4.13	0.190	0.190	0.30	0.11	0.021
	4.25	0.36	0.07			0.19	1.00	9	4.13	4.38	0.190	0.190	0.29	0.07	0.014
	4.50	0.38	0.07			0.20	1.00	10	4.38	4.63	0.200	0.200	0.31	0.08	0.016
	4.75	0.35	0.07			0.22	1.00	11	4.63	4.88	0.220	0.220	0.28	0.07	0.015
	5.00	0.35	0.07			0.17	1.00	12	4.88	5.25	0.170	0.170	0.28	0.11	0.018
	5.50	0.26	0.07			0.13	1.00	13	5.25	5.75	0.130	0.130	0.19	0.10	0.012
	6.00	0.17	0.07			0.12	1.00	14	5.75	6.25	0.120	0.120	0.10	0.05	0.006
	6.50	0.19	0.07			0.11	1.00	15	6.25	6.75	0.110	0.110	0.12	0.06	0.007
	7.00	0.19	0.07			0.21	1.00	16	6.75	7.13	0.210	0.210	0.12	0.05	0.009
	7.25	0.20	0.07			0.33	1.00	17	7.13	7.38	0.330	0.330	0.13	0.03	0.011
	7.50	0.20	0.07			0.35	1.00	18	7.38	7.63	0.350	0.350	0.13	0.03	0.011
	7.75	0.21	0.07			0.30	1.00	19	7.63	7.88	0.300	0.300	0.14	0.04	0.011
	8.00	0.16	0.07			0.14	1.00	20	7.88	8.13	0.140	0.140	0.09	0.02	0.003
	8.25	0.12	0.07			0.14	1.00	21	8.13	8.58	0.140	0.140	0.05	0.02	0.003
RB	8.90	0.00	0.07			0.00	1.00	22	8.58	8.90	0.035	0.035	0.01	0.00	0.000
														Total Flow:	0.206

Total Flow:	**0.206**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**1.15**		**(m^2)**
Top Width:	**7.40**		**(m)**
Hydraulic Depth:	**0.155**		**(m)**
Mean Velocity:	**0.179**		**(m/s)**
Froude Number	**0.146**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:	**Database # 608**	
Datalogger Internal Power:	4.676V	
Datalogger External Power:	15.91V	
Datalogger Memory Used:	14%	
Datalogger Clock:	Nov 01, 2004 08:32	MST
Laptop Clock:	Nov 01, 2004 07:39	MST
Dessicant:	OK-Fine	
Datalogger:		
PT:	101356	
Power:		

Notes: TSS taken Transducer removed for winter
Ice 7 cm thick

Hydrometric Measurement / Site Visit Record

S16 - Calumet River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River near the Mouth
Site Name:	S16
Coordinates & Legal:	6361693 N, 458152 E NE-10-97-11-W4

Time of Measurement

Date of Measurement:	April 26, 2004
Start Time:	2:45 PM MDT
End Time:	3:12 PM MDT

Weather Conditions: +18 C, calm, partially cloudy

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: Rebar	0.625	El:	266.300	0.574	El:	266.300
Water Level Reading:	2.891	El:	264.034	2.844	El:	264.030
Water Level Abv Beaver Dam	2.112	El:	264.813	2.058	El:	264.816
Transducer Reading & Calc'd E	0.272	El:	263.762	0.272	El:	263.758
Other: Nail in Tree on LE	1.313	El:	265.612	1.255	El:	265.619

River Conditions: Beaver dam immediately upstream of WL sensor, partial ice cover downstream of sensor. Ice broken out of MMT section to make readings.

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	5.30	0.00	0.00			0.000	1.00	1	5.30	5.40	0.010	0.010	0.04	0.00	0.000
	5.50	0.14	0.00			0.040	1.00	2	5.40	5.55	0.040	0.040	0.14	0.02	0.001
	5.60	0.17	0.00			0.040	1.00	3	5.55	5.65	0.040	0.040	0.17	0.02	0.001
	5.70	0.12	0.00			0.067	1.00	4	5.65	5.75	0.067	0.067	0.12	0.01	0.001
	5.80	0.14	0.00			0.116	1.00	5	5.75	5.85	0.116	0.116	0.14	0.01	0.002
	5.90	0.16	0.00			0.253	1.00	6	5.85	5.95	0.253	0.253	0.16	0.02	0.004
	6.00	0.23	0.00			0.226	1.00	7	5.95	6.05	0.226	0.226	0.23	0.02	0.005
	6.10	0.18	0.00			0.253	1.00	8	6.05	6.15	0.253	0.253	0.18	0.02	0.005
	6.20	0.15	0.00			0.213	1.00	9	6.15	6.25	0.213	0.213	0.15	0.01	0.003
	6.30	0.16	0.00			0.460	1.00	10	6.25	6.35	0.460	0.460	0.16	0.02	0.007
	6.40	0.12	0.00			0.436	1.00	11	6.35	6.45	0.436	0.436	0.12	0.01	0.005
	6.50	0.20	0.00			0.204	1.00	12	6.45	6.55	0.204	0.204	0.20	0.02	0.004
	6.60	0.27	0.00			0.198	1.00	13	6.55	6.70	0.198	0.198	0.27	0.04	0.008
	6.80	0.36	0.00			0.171	1.00	14	6.70	6.85	0.171	0.171	0.36	0.05	0.009
	6.90	0.35	0.00			0.058	1.00	15	6.85	6.95	0.058	0.058	0.35	0.03	0.002
	7.00	0.35	0.00			0.253	1.00	16	6.95	7.05	0.253	0.253	0.35	0.03	0.009
	7.10	0.25	0.00			0.189	1.00	17	7.05	7.15	0.189	0.189	0.25	0.02	0.005
	7.20	0.23	0.00			0.390	1.00	18	7.15	7.25	0.390	0.390	0.23	0.02	0.009
	7.30	0.18	0.00			0.457	1.00	19	7.25	7.35	0.457	0.457	0.18	0.02	0.008
	7.40	0.21	0.00			0.064	1.00	20	7.35	7.45	0.064	0.064	0.21	0.02	0.001
	7.50	0.21	0.00			0.143	1.00	21	7.45	7.65	0.143	0.143	0.21	0.04	0.006
	7.60	0.16	0.00			0.393	1.00	22	7.65	7.75	0.393	0.393	0.16	0.02	0.006
	7.70	0.12	0.00			0.445	1.00	23	7.75	7.85	0.445	0.445	0.12	0.01	0.005
	7.80	0.11	0.00			0.287	1.00	24	7.85	8.08	0.287	0.287	0.11	0.02	0.007
	7.90	0.13	0.00			0.229	1.00	25	8.08	8.17	0.229	0.229	0.13	0.01	0.003
	8.00	0.10	0.00			0.006	1.00	26	8.17	8.30	0.006	0.006	0.10	0.01	0.000
RB	8.60	0.00	0.00			0.000	1.00	27	8.30	8.60	0.002	0.002	0.03	0.01	0.000
														Total Flow:	0.117

Total Flow:	**0.117**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.57**		**(m^2)**
Top Width:	**3.30**		**(m)**
Hydraulic Depth:	**0.172**		**(m)**
Mean Velocity:	**0.206**		**(m/s)**
Froude Number	**0.159**		
Photographs taken looking at: Upstream, downstream, left bank, right bank, bench mark, datalogger/battery			

Datalogger Notes:	**Database**	**277**
Datalogger Internal Power:	4.02V	
Datalogger External Power:	14.14V	
Datalogger Memory Used:	wrapping	
Datalogger Clock:	Apr 26, 2004 13:04	MST
Laptop Clock:	Apr 26, 2004 14:07	MDT
Dessicant:	Good	
Datalogger:	Optimum datalogger s/n#0104170277	
PT:	Keller s/n 0104639	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Notes: TSS sample collected. MMT Fair due to possible D/S ice effects.
Transducer installed downstream of beaver dam downstream of previous transducer installation site.
Water temperature thermistor did not work properly - as it reported 480 C temperatures. Test and reinstall during next site visit.
TE525USW with 9.6" top that is in place at site should be relocated to S3 and fitted with the 8" top at S3. Correction factor needs to be calculated for wrong top.

Hydrometric Measurement / Site Visit Record

S16 - Calumet River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River near the Mouth
Site Name:	S16
Coordinates & Legal:	6361693 N, 458152 E NE-10-97-11-W4

Time of Measurement

Date of Measurement:	June 2, 2004
Start Time:	4:05 PM MDT
End Time:	4:23 PM MDT

Weather Conditions: +20 C, calm, overcast

River Conditions: Beaver dam immediately upstream of WL sensor, flow in floodstage

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: T-bar	0.612	El:	266.300	0.518	El:	266.300
Water Level Reading:	2.729	El:	264.183	2.636	El:	264.182
Water Level Abv Beaver Dam		El:	266.912		El:	266.818
Transducer Reading & Calc'd E	-0.033	El:	264.216	-0.033	El:	264.215
Other: Nail in Tree on LE	1.299	El:	265.613	1.202	El:	265.616

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	17.90	0.00	0.00			0.000	1.00	1	17.90	18.05	0.101	0.101	0.08	0.01	0.001
	18.20	0.30	0.00			0.405	1.00	2	18.05	18.30	0.405	0.405	0.30	0.08	0.030
	18.40	0.28	0.00			0.796	1.00	3	18.30	18.50	0.796	0.796	0.28	0.06	0.045
	18.60	0.30	0.00			0.738	1.00	4	18.50	18.70	0.738	0.738	0.30	0.06	0.044
	18.80	0.38	0.00			0.914	1.00	5	18.70	18.90	0.914	0.914	0.38	0.08	0.069
	19.00	0.42	0.00			0.863	1.00	6	18.90	19.10	0.863	0.863	0.42	0.08	0.072
	19.20	0.42	0.00			0.975	1.00	7	19.10	19.30	0.975	0.975	0.42	0.08	0.082
	19.40	0.45	0.00			0.908	1.00	8	19.30	19.50	0.908	0.908	0.45	0.09	0.082
	19.60	0.60	0.00			0.716	1.00	9	19.50	19.70	0.716	0.716	0.60	0.12	0.086
	19.80	0.28	0.00			1.167	1.00	10	19.70	19.90	1.167	1.167	0.28	0.06	0.065
	20.00	0.18	0.00			1.122	1.00	11	19.90	20.10	1.122	1.122	0.18	0.04	0.040
	20.20	0.49	0.00			0.808	1.00	12	20.10	20.30	0.808	0.808	0.49	0.10	0.079
	20.40	0.39	0.00			0.631	1.00	13	20.30	20.50	0.631	0.631	0.39	0.08	0.049
	20.60	0.49	0.00			0.546	1.00	14	20.50	20.70	0.546	0.546	0.49	0.10	0.053
	20.80	0.50	0.00			0.814	1.00	15	20.70	20.90	0.814	0.814	0.50	0.10	0.081
	21.00	0.42	0.00			0.207	1.00	16	20.90	21.10	0.207	0.207	0.42	0.08	0.017
	21.20	0.37	0.00			0.253	1.00	17	21.10	21.30	0.253	0.253	0.37	0.07	0.019
	21.40	0.28	0.00			0.546	1.00	18	21.30	21.50	0.546	0.546	0.28	0.06	0.031
	21.60	0.37	0.00			0.552	1.00	19	21.50	21.70	0.552	0.552	0.37	0.07	0.041
	21.80	0.28	0.00			0.357	1.00	20	21.70	21.90	0.357	0.357	0.28	0.06	0.020
	22.00	0.28	0.00			0.094	1.00	21	21.90	22.25	0.094	0.094	0.28	0.10	0.009
RB	22.50	0.00	0.00			0.000	1.00	22	22.25	22.50	0.024	0.024	0.07	0.02	0.000
														Total Flow:	1.018

Total Flow:	**1.018**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**1.58**		**(m^2)**
Top Width:	**4.60**		**(m)**
Hydraulic Depth:	**0.344**		**(m)**
Mean Velocity:	**0.644**		**(m/s)**
Froude Number	**0.350**		
Photographs taken looking at: yes			

Datalogger Notes:	**Database**	**277**
Datalogger Internal Power:	4.800V	
Datalogger External Power:	13.66V	
Datalogger Memory Used:	wrapping	
Datalogger Clock:	Jun 02, 2004 14:31	MST
Laptop Clock:	Jun 02, 2004 15:32	MDT
Dessicant:	Good	
Datalogger:	Optimum datalogger s/n#0104170277	
PT:	Keller s/n 0104639	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Notes: TSS sample collected. Raingauge at 1932 Tips. Air temperature at 21.12 °C.
Transducer appears to not be working. On re-examination of power, external power was at ~ 4 V.
Datalogger box was found open on arrival
TE525USW with 9.6" top that is in place at site was switched with bucket from S3 at 3:45 PM.

Hydrometric Measurement / Site Visit Record

S16 - Calumet River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River near the Mouth
Site Name:	S16
Coordinates & Legal:	6361693 N, 458152 E NE-10-97-11-W4

Time of Measurement

Date of Measurement:	June 3, 2004
Start Time:	4:04 PM MDT
End Time:	

Weather Conditions: +23 C, gusty, clear

River Conditions: Beaver dam immediately upstream of WL sensor, flow in floodstage

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: T-bar	0.503	El:	266.300	0.406	El:	266.300
Water Level Reading:	2.636	El:	264.167	2.533	El:	264.173
Water Level Abv Beaver Dam		El:	266.803		El:	266.706
Transducer Reading & Calc'd E	0.414	El:	263.753	0.414	El:	263.759
Other: Nail in Tree on LE	1.188	El:	265.615	1.091	El:	265.615

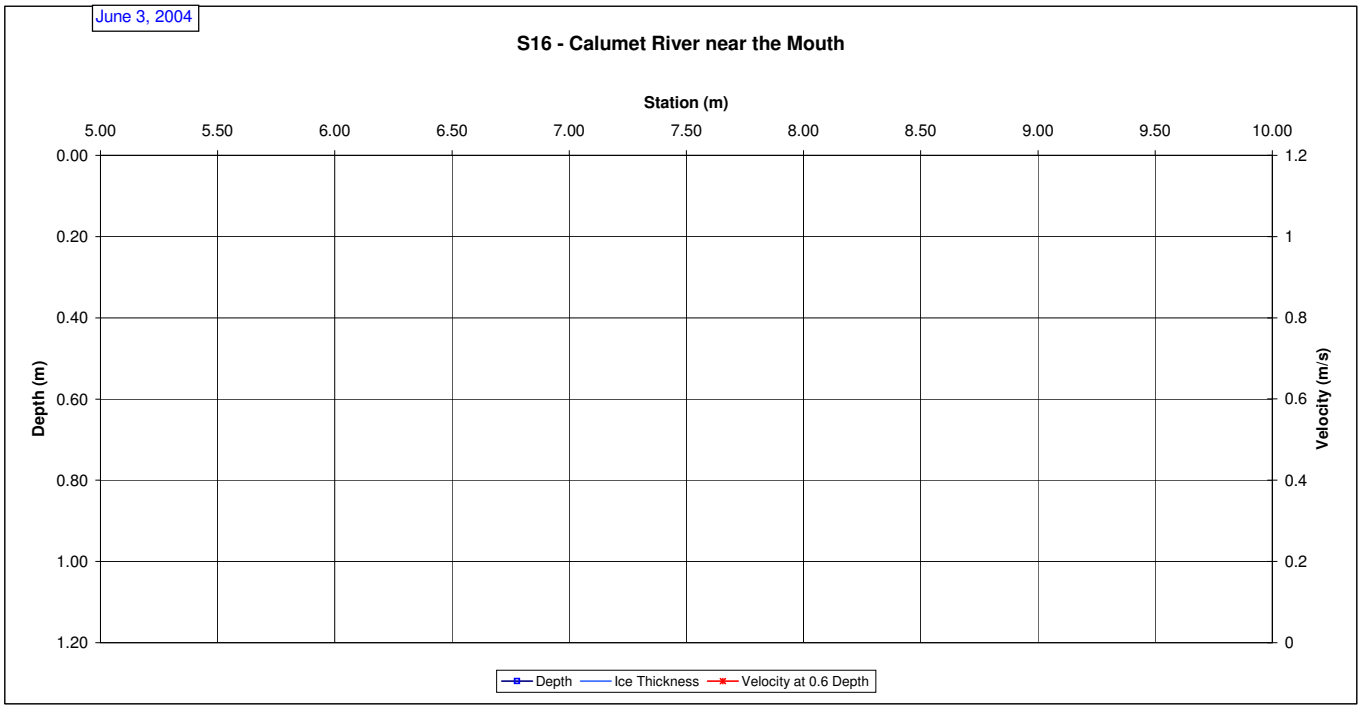
Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			
Photographs taken looking at: yes			

Datalogger Notes:	**Database**	**277**	
Datalogger Internal Power:	4.637V	dolphin	**1.34V (100%**
Datalogger External Power:	4.929V	dolphin	**3.14V (85%**
Datalogger Memory Used:	wrapping		
Datalogger Clock:	Jun 03, 2004 16:04		MST
Laptop Clock:	Jun 03, 2004 17:04		MDT
Dessicant:	Good		
Datalogger:	Optimum datalogger s/n#0104170277		
PT:	Keller s/n 0104639		
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller		

Notes: At 4:40 PM, replaced battery, but no improvement on external power or transducer noted, cables all look OK, other sensors appear to be operating well.
At 5:00 PM, installed temporary probe from S34 (Lakewood) TD # 971332, Lakewood DL # 206094.
Water temperature thermistor installed - water 11.897 °C
Air temp = 24.19960 °C



Hydrometric Measurement / Site Visit Record

S16 - Calumet River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River near the Mouth
Site Name:	S16
Coordinates & Legal:	6361693 N, 458152 E NE-10-97-11-W4

Time of Measurement

Date of Measurement:	July 24, 2004
Start Time:	1:00 PM MDT
End Time:	2:00 PM MDT

Weather Conditions: +32 C, clear

River Conditions: Beaver dam immediately upstream of WL sensor

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: T-bar	0.395	El:	266.300	0.442	El:	266.300
Water Level Reading:	2.838	El:	263.857	2.885	El:	263.857
Water Level Abv Beaver Dam		El:		2.129	El:	264.613
Transducer Reading & Calc'd E	0.062	El:	263.795	0.062	El:	263.795
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	0.20	0.00				0.000	1.00	1	0.20	0.30	0.000	0.000	0.01	0.00	0.000
	0.40	0.05				0.001	1.00	2	0.30	0.55	0.001	0.001	0.05	0.01	0.000
	0.70	0.14				0.001	1.00	3	0.55	0.85	0.001	0.001	0.14	0.04	0.000
	1.00	0.25				0.001	1.00	4	0.85	1.10	0.001	0.001	0.25	0.06	0.000
	1.20	0.40				0.009	1.00	5	1.10	1.25	0.009	0.009	0.40	0.06	0.001
	1.30	0.41				0.001	1.00	6	1.25	1.35	0.001	0.001	0.41	0.04	0.000
	1.40	0.41				0.012	1.00	7	1.35	1.45	0.012	0.012	0.41	0.04	0.000
	1.50	0.33				0.006	1.00	8	1.45	1.55	0.006	0.006	0.33	0.03	0.000
	1.60	0.32				0.012	1.00	9	1.55	1.65	0.012	0.012	0.32	0.03	0.000
	1.70	0.30				0.012	1.00	10	1.65	1.75	0.012	0.012	0.30	0.03	0.000
	1.80	0.29				0.018	1.00	11	1.75	1.85	0.018	0.018	0.29	0.03	0.001
	1.90	0.29				0.015	1.00	12	1.85	1.95	0.015	0.015	0.29	0.03	0.000
	2.00	0.30				0.006	1.00	13	1.95	2.05	0.006	0.006	0.30	0.03	0.000
	2.10	0.34				0.024	1.00	14	2.05	2.15	0.024	0.024	0.34	0.03	0.001
	2.20	0.33				0.009	1.00	15	2.15	2.25	0.009	0.009	0.33	0.03	0.000
	2.30	0.30				0.021	1.00	16	2.25	2.35	0.021	0.021	0.30	0.03	0.001
	2.40	0.17				-0.009	1.00	17	2.35	2.45	-0.009	-0.009	0.17	0.02	0.000
	2.50	0.33				-0.003	1.00	18	2.45	2.60	-0.003	-0.003	0.33	0.05	0.000
	2.70	0.14				-0.012	1.00	19	2.60	2.85	-0.012	-0.012	0.14	0.04	0.000
	3.00	0.25				-0.012	1.00	20	2.85	3.35	-0.012	-0.012	0.25	0.13	-0.002
	3.70	0.12				-0.003	1.00	21	3.35	3.85	-0.003	-0.003	0.12	0.06	0.000
	4.00	0.07				0.001	1.00	22	3.85	4.20	0.001	0.001	0.07	0.02	0.000
RB	4.40	0.00				0.000	1.00	23	4.20	4.40	0.000	0.000	0.02	0.00	0.000
														Total Flow:	0.003

Total Flow:	**0.003**		**(m^3/s)**
Perceived Measurement Quality:	**Poor**		
Total Area:	**0.85**		**(m^2)**
Top Width:	**4.20**		**(m)**
Hydraulic Depth:	**0.204**		**(m)**
Mean Velocity:	**0.003**		**(m/s)**
Froude Number	**0.002**		
Photographs taken looking at: yes			

Notes: Solar unit or panel should be replaced.
1932 Counts
9047 Counts
16.39 °C - Water
Air temp = 32.4 °C

Datalogger Notes:	**Database**	**277**	
Datalogger Internal Power:	4.644V	dolphin	**11.34V (100%)**
Datalogger External Power:	5.031V	dolphin	**13.02 (84%)**
Datalogger Memory Used:	0%		
Datalogger Clock:	Jul 24, 2004 13:00		MST
Laptop Clock:	Jul 24, 2004 14:00		MDT
Dessicant:	Good		

Datalogger: Optimum datalogger s/n#0104170277
PT: Keller s/n 0104639
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S16 - Calumet River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River near the Mouth
Site Name:	S16
Coordinates & Legal:	6361693 N, 458152 E NE-10-97-11-W4

Time of Measurement

Date of Measurement:	August 26, 2004
Start Time:	5:37 PM MDT
End Time:	5:55 PM MDT

Weather Conditions: +11˚C, rainy

River Conditions: open, Beaver dam immediately upstream of WL sensor

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2001463 (rental)

Level Readings

		Setup No. 1		Setup No. 2	
Bench Mark Reading: T-bar	0.332	El:	266.300	0.266	El: 266.300
Water Level Reading:	2.769	El:	263.863	2.698	El: 263.868
		El:			El: 266.566
Transducer Reading & Calc'd El.:		El:			El:
Other: nail in tree	1.027	El:		0.962	El:

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	19.20	0.00				0.000	1.00	1	19.20	19.30	-0.003	-0.003	0.01	0.00	0.000
	19.40	0.05				-0.012	1.00	2	19.30	19.50	-0.012	-0.012	0.05	0.01	0.000
	19.60	0.05				0.003	1.00	3	19.50	19.68	0.003	0.003	0.05	0.01	0.000
	19.75	0.06				0.003	1.00	4	19.68	19.88	0.003	0.003	0.06	0.01	0.000
	20.00	0.04				-0.003	1.00	5	19.88	20.15	-0.003	-0.003	0.04	0.01	0.000
	20.30	0.02				0.012	1.00	6	20.15	20.45	0.012	0.012	0.02	0.01	0.000
	20.60	0.07				0.006	1.00	7	20.45	20.70	0.006	0.006	0.07	0.02	0.000
	20.80	0.10				0.021	1.00	8	20.70	20.90	0.021	0.021	0.10	0.02	0.000
	21.00	0.13				0.018	1.00	9	20.90	21.10	0.018	0.018	0.13	0.03	0.000
	21.20	0.13				0.034	1.00	10	21.10	21.30	0.034	0.034	0.13	0.03	0.001
	21.30	0.10				0.076	1.00	11	21.30	21.40	0.076	0.076	0.10	0.01	0.001
	21.40	0.09				0.040	1.00	12	21.40	21.50	0.040	0.040	0.09	0.01	0.000
	21.50	0.07				0.037	1.00	13	21.50	21.60	0.037	0.037	0.07	0.01	0.000
	21.60	0.04				0.003	1.00	14	21.60	21.70	0.003	0.003	0.04	0.00	0.000
	21.70	0.08				0.021	1.00	15	21.70	21.80	0.021	0.021	0.08	0.01	0.000
	21.80	0.04				0.024	1.00	16	21.80	21.90	0.024	0.024	0.04	0.00	0.000
	21.90	0.10				0.061	1.00	17	21.90	22.00	0.061	0.061	0.10	0.01	0.001
	22.00	0.08				0.070	1.00	18	22.00	22.13	0.070	0.070	0.08	0.01	0.001
	22.10	0.08				0.037	1.00	19	22.13	22.33	0.037	0.037	0.08	0.02	0.001
	22.30	0.03				0.043	1.00	20	22.33	22.45	0.043	0.043	0.03	0.00	0.000
LB	22.60	0.00				0.000	1.00	21	22.45	22.60	0.011	0.011	0.01	0.00	0.000
														Total Flow:	0.006

Total Flow:	**0.006**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.22**		**(m^2)**
Top Width:	**3.40**		**(m)**
Hydraulic Depth:	**0.065**		**(m)**
Mean Velocity:	**0.025**		**(m/s)**
Froude Number	**0.032**		

Photographs taken looking at:
US, DS, across

Datalogger Notes:	**Database**	**277**	
Datalogger Internal Power:	4.582V	dolphin	
Datalogger External Power:	4.958V	dolphin	
Datalogger Memory Used:	10%		
Datalogger Clock:	26/08/2004 17:16:55 PM		MST
Laptop Clock:	Aug 26, 2004 18:20		MDT
Dessicant:	none		

Datalogger: Optimum datalogger s/n#0104170277
PT: Keller s/n 0104639
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:

PR525USW 1932 Counts (same as last time)
PR525M 9588 Counts
10.312 °C - Water
Air temp = 11.60 °C

Had to leave site due to bad weather, were unable to download Lakewood depth data, downloaded on Aug 27

Hydrometric Measurement / Site Visit Record

S16 - Calumet River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River near the Mouth
Site Name:	S16
Coordinates & Legal:	6361693 N, 458152 E NE-10-97-11-W4

Time of Measurement

Date of Measurement:	August 27, 2004
Start Time:	see Aug 26 MDT
End Time:	see Aug 26 MDT

Weather Conditions: +15 C, clear, calm

River Conditions: open, Beaver dam immediately upstream of WL sensor

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	see Aug 26

Level Readings	**Setup No. 1**		**Setup No. 2**	
Bench Mark Reading: T-bar	El:	266.300	El:	266.300
Water Level Reading:	El:	266.300	El:	266.300
	El:		El:	266.300
Transducer Reading & Calc'd El.:	El:	266.300	El:	266.300
Other: nail in tree	El:		El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
US, DS, across

Datalogger Notes:	**Database old S34 equipment**	
Datalogger Internal Power:	11.34V (100% Lakewood	
Datalogger External Power:	12.65V (81% Lakewood	
Datalogger Memory Used:	10%	
Datalogger Clock:	Aug 27, 2004 13:42	MST
Laptop Clock:	Aug 27, 2004 14:44	MDT
Dessicant:	replaced	

Datalogger: Optimum datalogger s/n#0104170277
PT: Keller s/n 0104639
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:
Lookup depth on Aug 26 to add to previous sheet, equipment was switched over to S21 equipment

TBRG (PR525USW)
before move: 1932
after move: 11

TBRG (PR525M)
before move: 9597
after move: 13

AIR THERMISTOR
before move: 14.04
after move: 15.638

WATER THERMISTOR
before move: 10.409
after move: 10.4571

WATER DEPTH
before move: -0.04107
after move: 0.136421

Hydrometric Measurement / Site Visit Record

S16 - Calumet River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River near the Mouth
Site Name:	S16
Coordinates & Legal:	6361693 N, 458152 E NE-10-97-11-W4

Time of Measurement

Date of Measurement:	August 27, 2004
Start Time:	see Aug 26 MDT
End Time:	see Aug 26 MDT

Weather Conditions: +15 C, clear, calm

River Conditions: open, Beaver dam immediately upstream of WL sensor

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	see Aug 26

Level Readings		**Setup No. 1**		**Setup No. 2**	
Bench Mark Reading: T-bar		El:	266.300	El:	266.300
Water Level Reading:		El:	266.300	El:	266.300
		El:		El:	266.300
Transducer Reading & Calc'd E	0.136	El:	266.164	El:	266.300
Other: nail in tree		El:		El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
US, DS, across

Datalogger Notes:	**Database 274**	
Datalogger Internal Power:	4.812V	
Datalogger External Power:	14.04V	
Datalogger Memory Used:	0%	
Datalogger Clock:	Aug 27, 2004 15:26	MST
Laptop Clock:	Aug 27, 2004 16:27	MDT
Dessicant:	100% - new	

Datalogger: Optimum datalogger s/n#0104170277
PT: Keller s/n 0104639
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:
New Installation (old S21 equipment)

TBRG (PR525USW)
before move: 1932
after move: 11

TBRG (PR525M)
before move: 9597
after move: 13

AIR THERMISTOR
before move: 14.04
after move: 15.638

WATER THERMISTOR
before move: 10.409
after move: 10.4571

WATER DEPTH
before move: -0.04107
after move: 0.136421

Hydrometric Measurement / Site Visit Record

S16 - Calumet River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River near the Mouth
Site Name:	S16
Coordinates & Legal:	6361693 N, 458152 E NE-10-97-11-W4

Time of Measurement

Date of Measurement:	September 23, 2004
Start Time:	2:03 PM MDT
End Time:	2:16 PM MDT

Weather Conditions: +12 C, partly cloudy, light wind

River Conditions: open, Beaver dam immediately upstream of WL sensor

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney 2000 SN # 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: T-bar	0.515	El:	266.300	0.511	El:	266.300
Water Level Reading:	2.838	El:	263.977	2.834	El:	263.977
		El:			El:	266.811
Transducer Reading & Calc'd E	0.255	El:	263.722	0.255	El:	263.722
Other: nail in tree	1.212	El:		1.207	El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	23.25	0				0.000	1.00	1	23.25	23.13	0.025	0.025	0.01	0.00	0.000
	23.00	0.05				0.101	1.00	2	23.00	22.90	0.101	0.101	0.05	0.01	0.001
	22.80	0.05				0.055	1.00	3	22.80	22.65	0.055	0.055	0.05	0.01	0.000
	22.50	0.12				0.256	1.00	4	22.50	22.40	0.256	0.256	0.12	0.01	0.003
	22.30	0.20				0.405	1.00	5	22.30	22.20	0.405	0.405	0.20	0.02	0.008
	22.10	0.16				0.320	1.00	6	22.10	22.00	0.320	0.320	0.16	0.02	0.005
	21.90	0.10				0.448	1.00	7	21.90	21.80	0.448	0.448	0.10	0.01	0.004
	21.70	0.20				0.277	1.00	8	21.70	21.60	0.277	0.277	0.20	0.02	0.006
	21.50	0.22				0.302	1.00	9	21.50	21.40	0.302	0.302	0.22	0.02	0.007
	21.30	0.13				0.283	1.00	10	21.30	21.20	0.283	0.283	0.13	0.01	0.004
	21.10	0.18				0.018	1.00	11	21.10	21.00	0.018	0.018	0.18	0.02	0.000
	20.90	0.16				0.287	1.00	12	20.90	20.80	0.287	0.287	0.16	0.02	0.005
	20.70	0.11				0.372	1.00	13	20.70	20.60	0.372	0.372	0.11	0.01	0.004
	20.50	0.10				0.162	1.00	14	20.50	20.40	0.162	0.162	0.10	0.01	0.002
	20.30	0.04				0.061	1.00	15	20.30	20.20	0.061	0.061	0.04	0.00	0.000
	20.10	0.05				0.027	1.00	16	20.10	19.95	0.027	0.027	0.05	0.01	0.000
	19.80	0.07				0.046	1.00	17	19.80	19.70	0.046	0.046	0.07	0.01	0.000
	19.60	0.08				0.265	1.00	18	19.60	19.50	0.265	0.265	0.08	0.01	0.002
	19.40	0.10				0.003	1.00	19	19.40	19.20	0.003	0.003	0.10	0.02	0.000
	19.00	0.05				0.012	1.00	20	19.00	18.95	0.001	0.001	0.03	0.00	0.000
RB	18.90	0.00				0.000	1.00	21	18.90	18.90	0.000	0.000	0.01	0.00	0.000
														Total Flow:	0.051

Total Flow:	**0.051**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.23**		**(m^2)**
Top Width:	**4.10**		**(m)**
Hydraulic Depth:	**0.056**		**(m)**
Mean Velocity:	**0.224**		**(m/s)**
Froude Number	**0.303**		
Photographs taken looking at: US, DS, across			

Datalogger Notes:	**Database # 274 (old S21 equipment)**	
Datalogger Internal Power:	4.812V	
Datalogger External Power:	14.55 V	
Datalogger Memory Used:	7%	
Datalogger Clock:	Sep 23, 2004 12:47	MST
Laptop Clock:	Sep 23, 2004 12:48	MST
Dessicant:	replaced	
Datalogger:	Optimum datalogger s/n#0104170274	
PT:	Keller s/n 0101878	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Notes:

WL probe wires were all unplugged, happened approx 2 weeks prior to site visit, must have been an animal, wire re-installed

TBRG (PR525USW)	11
TBRG (PR525M)	776
AIR THERMISTOR	14.171816
WATER THERMISTOR	7.039948
WATER DEPTH	-0.088222, before re-installed, 0.255300 after

Need to bring non-toxic antifreeze for winter.

Hydrometric Measurement / Site Visit Record

S16 - Calumet River near the Mouth

LAKEWOOD LOGGER (old S34 Logger)

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River near the Mouth
Site Name:	S16
Coordinates & Legal:	6361693 N, 458152 E NE-10-97-11-W4

Time of Measurement

Date of Measurement:	September 23, 2004
Start Time:	see Sep 23 MDT
End Time:	see Sep 23 MDT

Weather Conditions: +12 C, clear, light wind

River Conditions: open, Beaver dam immediately upstream of WL sensor

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	see Sep 23 (1)

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	T-bar	0.515	El:	266.300	0.511	El:	266.300
Water Level Reading:		2.838	El:	263.977	2.834	El:	263.977
			El:			El:	266.811
Transducer	Reading & Calc'd E	0.162	El:	263.815	0.162	El:	263.815
Other:	nail in tree	1.212	El:		1.207	El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
no - camera broken

Datalogger Notes:	**Database 274**		
Datalogger Internal Power:	11.34V	100%	
Datalogger External Power:	12.53V	81%	
Datalogger Memory Used:	34862 k left		
Datalogger Clock:	Sep 23, 2004 12:36		MST
Laptop Clock:	Sep 23, 2004 12:39		MST
Dessicant:	Good - 100%		
Datalogger:	Lakewood data logger 206095		
PT:	Keller s/n 971332		
Power:			

Notes:
TSS taken.

Hydrometric Measurement / Site Visit Record

S16 - Calumet River near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River near the Mouth
Site Name:	S16
Coordinates & Legal:	6361693 N, 458152 E NE-10-97-11-W4

Time of Measurement

Date of Measurement:	October 31, 2004	
Start Time:	1:50 PM	MST
End Time:	3:17 PM	MST

Weather Conditions: +5 C, partially cloudy

River Conditions: Partial ice cover

Personnel & Equipment

Measurement Made By:	ND/FF
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Rod on LB	0.512	El:	266.300	0.691	El:	266.300
Water Level Reading:		2.940	El:	263.872	3.120	El:	263.871
Water Level Abv Beaver Dam			El:			El:	
Transducer Reading & Calc'd E		0.146	El:	263.726	0.146	El:	263.725
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	3.30	0.00				0.000	1.00	1	3.30	3.40	0.001	0.001	0.01	0.00	0.000
	3.50	0.02				0.003	1.00	2	3.40	3.75	0.003	0.003	0.02	0.01	0.000
	4.00	0.04				0.003	1.00	3	3.75	4.10	0.003	0.003	0.04	0.01	0.000
	4.20	0.06				0.070	1.00	4	4.10	4.35	0.070	0.070	0.06	0.02	0.001
	4.50	0.06				0.165	1.00	5	4.35	4.63	0.165	0.165	0.06	0.02	0.003
	4.75	0.10				0.064	1.00	6	4.63	4.83	0.064	0.064	0.10	0.02	0.001
	4.90	0.10				0.094	1.00	7	4.83	4.95	0.094	0.094	0.10	0.01	0.001
	5.00	0.07				0.232	1.00	8	4.95	5.05	0.232	0.232	0.07	0.01	0.002
	5.10	0.07				0.158	1.00	9	5.05	5.15	0.158	0.158	0.07	0.01	0.001
	5.20	0.06				0.104	1.00	10	5.15	5.30	0.104	0.104	0.06	0.01	0.001
	5.40	0.06				0.043	1.00	11	5.30	5.45	0.043	0.043	0.06	0.01	0.000
	5.50	0.07				0.088	1.00	12	5.45	5.55	0.088	0.088	0.07	0.01	0.001
	5.60	0.09				0.067	1.00	13	5.55	5.65	0.067	0.067	0.09	0.01	0.001
	5.70	0.07				0.207	1.00	14	5.65	5.75	0.207	0.207	0.07	0.01	0.001
	5.80	0.07				0.122	1.00	15	5.75	5.85	0.122	0.122	0.07	0.01	0.001
	5.90	0.11				0.052	1.00	16	5.85	5.95	0.052	0.052	0.11	0.01	0.001
	6.00	0.12				0.018	1.00	17	5.95	6.05	0.018	0.018	0.12	0.01	0.000
	6.10	0.09				0.030	1.00	18	6.05	6.15	0.030	0.030	0.09	0.01	0.000
	6.20	0.06				0.006	1.00	19	6.15	6.30	0.006	0.006	0.06	0.01	0.000
LB	6.40	0.00				0.000	1.00	20	6.30	6.40	0.002	0.002	0.02	0.00	0.000
														Total Flow:	0.015

Total Flow:	**0.015**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.19**		**(m^2)**
Top Width:	**3.10**		**(m)**
Hydraulic Depth:	**0.061**		**(m)**
Mean Velocity:	**0.079**		**(m/s)**
Froude Number	**0.102**		
Photographs taken looking at: Upstream ,downstream and across			

Datalogger Notes:	**Database**	**274**	
Datalogger Internal Power:	4.8V	dolphin	**100%**
Datalogger External Power:	14.9V	dolphin	**80%**
Datalogger Memory Used:	16% used		**50% used**
Datalogger Clock:	Oct 31, 2004 13:52		MST
Laptop Clock:	Oct 31, 2004 12:57		MST
Dessicant:	Good		
Datalogger:			
PT:			
Power:			

Notes:
TSS sample taken
Transducer removed for winter.
Tipping bucket rain guage No. 1 is 11 counts
Tipping bucket rain guage No. 2 is 882 counts
Ignore counts for 11 to 24 for snow guage
New antifreeze solution put in
Water temperature 1.13 C

Hydrometric Measurement / Site Visit Record

S17 - Tar River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River Upland Tributary
Site Name:	S17
Coordinates & Legal:	6357804 N, 444486 E NW-29-96-12-W4

Time of Measurement

Date of Measurement:	April 26, 2004
Start Time:	4:52 PM MDT
End Time:	4:57 PM MDT

Weather Conditions: +15 C, Calm, partly cloudy, light wind

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Rebar	0.164	El:	366.546	0.164	El:	366.546
Water Level Reading:		1.584	El:	365.126	1.579	El:	365.131
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd El.:			El:			El:	
Other:	LB Nail in Tree	1.085	El:	365.625	1.087	El:	365.623

River Conditions: Flow over and below ice. Beaverdam near previous transducer installation location. MMT made at part-open section d/s of logger - poor measurement.

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	0.85	0.00	0.00			0.000	1.00	1	0.85	0.88	0.062	0.062	0.13	0.00	0.000
	0.90	0.50	0.00			0.247	1.00	2	0.88	0.95	0.247	0.247	0.50	0.04	0.009
	1.00	0.51	0.00			0.607	1.00	3	0.95	1.05	0.607	0.607	0.51	0.05	0.031
	1.10	0.51	0.00			0.805	1.00	4	1.05	1.15	0.805	0.805	0.51	0.05	0.041
	1.20	0.52	0.00			0.732	1.00	5	1.15	1.25	0.732	0.732	0.52	0.05	0.038
	1.30	0.51	0.00			0.582	1.00	6	1.25	1.35	0.582	0.582	0.51	0.05	0.030
	1.40	0.50	0.00			0.366	1.00	7	1.35	1.45	0.366	0.366	0.50	0.05	0.018
	1.50	0.47	0.00			0.268	1.00	8	1.45	1.55	0.268	0.268	0.47	0.05	0.013
	1.60	0.48	0.00			0.180	1.00	9	1.55	1.65	0.180	0.180	0.48	0.05	0.009
ice	1.70	0.20	0.00			0.189	1.00	10	1.65	1.75	0.189	0.189	0.20	0.02	0.004
ice	1.80	0.17	0.00			0.183	1.00	11	1.75	1.85	0.183	0.183	0.17	0.02	0.003
ice	1.90	0.05	0.00			0.012	1.00	12	1.85	2.00	0.012	0.012	0.05	0.01	0.000
LB	2.10	0.00	0.00			0.000	1.00	13	2.00	2.10	0.003	0.003	0.01	0.00	0.000
														Total Flow:	0.196

Total Flow:	**0.196**		**(m^3/s)**
Perceived Measurement Quality:	**Poor**		
Total Area:	**0.44**		**(m^2)**
Top Width:	**1.25**		**(m)**
Hydraulic Depth:	**0.349**		**(m)**
Mean Velocity:	**0.448**		**(m/s)**
Froude Number	**0.242**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	
Datalogger Internal Power:	
Datalogger External Power:	
Datalogger Memory Used:	
Datalogger Clock:	MST
Laptop Clock:	MDT
Dessicant:	
Datalogger:	Optimum DD128 & modem, #0104170272
PT:	Keller 730-130-3 psi #0101356
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: TSS sample collected.
Due to partially open conditions portions of flow under the ice near the LB could not be measured. MMT likely underestimates actual flow.
MMT therfore of poor quality. Heavy local beaver activity.
WL sensor could not be installed due to ice.

Hydrometric Measurement / Site Visit Record

S17 - Tar River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River Upland Tributary
Site Name:	S17
Coordinates & Legal:	6357804 N, 444486 E NW-29-96-12-W4

Time of Measurement

Date of Measurement:	May 16, 2004
Start Time:	11:47 AM MDT
End Time:	MDT

Weather Conditions: +10 C, overcast

River Conditions:

Personnel & Equipment

Measurement Made By:	DM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	T-bar	0.244	El:	366.546	0.161	El:	366.546
Water Level Reading:		2.006	El:	364.784	1.916	El:	364.791
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.875	El:	363.909	0.875	El:	363.916
Other:	LB Nail in Tree	1.170	El:	365.620	1.085	El:	365.622

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			
Photographs taken looking at:			

Notes: TSS sample collected. Transducer installed.

Datalogger Notes:		
Datalogger Internal Power:	4.389V	
Datalogger External Power:	13.27V	
Datalogger Memory Used:	0%	
Datalogger Clock:	May 16, 2004 10:25	MST
Laptop Clock:	May 16, 2004 11:47	MDT
Dessicant:	good	
Datalogger:	Optimum DD128 & modem, #0104170272	
PT:	Keller 730-130-3 psi #0101356	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Hydrometric Measurement / Site Visit Record

S17 - Tar River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River Upland Tributary
Site Name:	S17
Coordinates & Legal:	6357804 N, 444486 E NW-29-96-12-W4

Time of Measurement

Date of Measurement:	June 2, 2004
Start Time:	6:15 PM MDT
End Time:	6:34 PM MDT

Weather Conditions: +20 C, overcast, light wind

River Conditions:

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	T-bar	0.335	El:	366.546	0.287	El:	366.546
Water Level Reading:		2.204	El:	364.677	2.162	El:	364.671
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.775	El:	363.902	0.775	El:	363.896
Other:	LB Nail in Tree	1.265	El:	365.616	1.265	El:	365.568

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	18.50	0.00	0.00			0.000	1.00	1	18.50	18.75	0.037	0.037	0.09	0.02	0.001
	19.00	0.35	0.00			0.149	1.00	2	18.75	19.10	0.149	0.149	0.35	0.12	0.018
	19.20	0.39	0.00			0.168	1.00	3	19.10	19.30	0.168	0.168	0.39	0.08	0.013
	19.40	0.40	0.00			0.277	1.00	4	19.30	19.50	0.277	0.277	0.40	0.08	0.022
	19.60	0.50	0.00			0.250	1.00	5	19.50	19.70	0.250	0.250	0.50	0.10	0.025
	19.80	0.60	0.00			0.235	1.00	6	19.70	19.85	0.235	0.235	0.60	0.09	0.021
	19.90	0.66	0.00			0.244	1.00	7	19.85	19.95	0.244	0.244	0.66	0.07	0.016
	20.00	0.64	0.00			0.232	1.00	8	19.95	20.05	0.232	0.232	0.64	0.06	0.015
	20.10	0.68	0.00			0.259	1.00	9	20.05	20.15	0.259	0.259	0.68	0.07	0.018
	20.20	0.70	0.00			0.287	1.00	10	20.15	20.25	0.287	0.287	0.70	0.07	0.020
	20.30	0.70	0.00			0.293	1.00	11	20.25	20.35	0.293	0.293	0.70	0.07	0.020
	20.40	0.73	0.00			0.317	1.00	12	20.35	20.45	0.317	0.317	0.73	0.07	0.023
	20.50	0.74	0.00			0.311	1.00	13	20.45	20.55	0.311	0.311	0.74	0.07	0.023
	20.60	0.70	0.00			0.268	1.00	14	20.55	20.65	0.268	0.268	0.70	0.07	0.019
	20.70	0.70	0.00			0.226	1.00	15	20.65	20.75	0.226	0.226	0.70	0.07	0.016
	20.80	0.67	0.00			0.177	1.00	16	20.75	20.85	0.177	0.177	0.67	0.07	0.012
	20.90	0.61	0.00			0.131	1.00	17	20.85	20.95	0.131	0.131	0.61	0.06	0.008
	21.00	0.59	0.00			0.122	1.00	18	20.95	21.05	0.122	0.122	0.59	0.06	0.007
	21.10	0.57	0.00			0.046	1.00	19	21.05	21.15	0.046	0.046	0.57	0.06	0.003
	21.20	0.45	0.00			0.052	1.00	20	21.15	21.25	0.052	0.052	0.45	0.05	0.002
LB	21.30	0.00	0.00			0.000	1.00	21	21.25	21.30	0.013	0.013	0.18	0.01	0.000
														Total Flow:	0.302

Total Flow:	**0.302**		(m^3/s)
Perceived Measurement Quality:	**Good**		
Total Area:	**1.42**		(m^2)
Top Width:	**2.80**		(m)
Hydraulic Depth:	**0.505**		(m)
Mean Velocity:	**0.214**		(m/s)
Froude Number	**0.096**		
Photographs taken looking at:			

Notes: TSS sample collected.
Datalogger clock synched to laptop clock - 1 hour (ie 17:06:37 DL, 6:07 PM laptop)
Beaver dams in area may be affecting flow.

Datalogger Notes:		
Datalogger Internal Power:	4.416V	
Datalogger External Power:	12.74V	
Datalogger Memory Used:	1%	
Datalogger Clock:	Jun 02, 2004 16:39	MST
Laptop Clock:	Jun 02, 2004 18:02	MDT
Dessicant:	good	
Datalogger:	Optimum DD128 & modem, #0104170272	
PT:	Keller 730-130-3 psi #0101356	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Hydrometric Measurement / Site Visit Record

S17 - Tar River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River Upland Tributary
Site Name:	S17
Coordinates & Legal:	6357804 N, 444486 E NW-29-96-12-W4

Time of Measurement

Date of Measurement:	July 24, 2004
Start Time:	4:55 PM MDT
End Time:	5:05 PM MDT

Weather Conditions: +30 C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	T-bar	0.186	El:	366.546	0.083	El:	366.546
Water Level Reading:		1.935	El:	364.797	1.800	El:	364.829
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.909	El:	363.888	0.909	El:	363.920
Other:	LB Nail in Tree	1.068	El:	365.664	1.068	El:	365.561

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	2.70	0.00				0.000	1.00	1	2.70	2.60	0.001	0.001	0.20	0.02	0.000
	2.50	0.79				0.003	1.00	2	2.60	2.45	0.003	0.003	0.79	0.12	0.000
	2.40	0.79				0.000	1.00	3	2.45	2.35	0.000	0.000	0.79	0.08	0.000
	2.30	0.81				-0.003	1.00	4	2.35	2.25	-0.003	-0.003	0.81	0.08	0.000
	2.20	0.83				-0.006	1.00	5	2.25	2.15	-0.006	-0.006	0.83	0.08	-0.001
	2.10	0.80				-0.009	1.00	6	2.15	2.05	-0.009	-0.009	0.80	0.08	-0.001
	2.00	0.80				0.000	1.00	7	2.05	1.95	0.000	0.000	0.80	0.08	0.000
	1.90	0.77				-0.006	1.00	8	1.95	1.85	-0.006	-0.006	0.77	0.08	0.000
	1.80	0.79				-0.003	1.00	9	1.85	1.75	-0.003	-0.003	0.79	0.08	0.000
	1.70	0.80				0.009	1.00	10	1.75	1.65	0.009	0.009	0.80	0.08	0.001
	1.60	0.80				0.006	1.00	11	1.65	1.55	0.006	0.006	0.80	0.08	0.000
	1.50	0.82				-0.006	1.00	12	1.55	1.45	-0.006	-0.006	0.82	0.08	0.000
	1.40	0.83				-0.009	1.00	13	1.45	1.35	-0.009	-0.009	0.83	0.08	-0.001
	1.30	0.83				0.003	1.00	14	1.35	1.25	0.003	0.003	0.83	0.08	0.000
	1.20	0.83				0.006	1.00	15	1.25	1.15	0.006	0.006	0.83	0.08	0.001
	1.10	0.48				0.003	1.00	16	1.15	1.00	0.003	0.003	0.48	0.07	0.000
LB	0.90	0.00				0.000	1.00	17	1.00	0.90	0.001	0.001	0.20	0.02	0.000
														Total Flow:	-0.001

Total Flow:	**-0.001**	**≈0**	**(m^3/s)**
Perceived Measurement Quality:	**Poor**		
Total Area:	**1.28**		**(m^2)**
Top Width:	**1.80**		**(m)**
Hydraulic Depth:	**0.711**		**(m)**
Mean Velocity:	**-0.001**		**(m/s)**
Froude Number	**0.000**		
Photographs taken looking at:			

Notes: TSS sample collected.

Datalogger Notes:		
Datalogger Internal Power:	4.497V	
Datalogger External Power:	12.91V	
Datalogger Memory Used:	6%	
Datalogger Clock:	024/07/2004 15:45 PM	MST
Laptop Clock:	024/07/2004 16:46 PM	MDT
Dessicant:	good	
Datalogger:	Optimum DD128 & modem, #0104170272	
PT:	Keller 730-130-3 psi #0101356	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Hydrometric Measurement / Site Visit Record

S17 - Tar River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River Upland Tributary
Site Name:	S17
Coordinates & Legal:	6357804 N, 444486 E NW-29-96-12-W4

Time of Measurement

Date of Measurement:	August 26, 2004
Start Time:	10:19 AM MDT
End Time:	10:32 AM MDT

Weather Conditions: +12 C, clear, light wind

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	T-bar	0.120	El:	366.546	0.108	El:	366.546
Water Level Reading:		2.191	El:	364.475	2.166	El:	364.488
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.550	El:	363.925	0.550	El:	363.938
Other:	LB Nail in Tree	0.995	El:	365.671	0.982	El:	365.672

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	0.70	0.00				0.000	1.00	1	0.70	0.75	0.000	0.000	0.08	0.00	0.000
	0.80	0.32				0.000	1.00	2	0.75	0.85	0.000	0.000	0.32	0.03	0.000
	0.90	0.33				0.009	1.00	3	0.85	0.95	0.009	0.009	0.33	0.03	0.000
	1.00	0.31				0.015	1.00	4	0.95	1.05	0.015	0.015	0.31	0.03	0.000
	1.10	0.30				0.015	1.00	5	1.05	1.15	0.015	0.015	0.30	0.03	0.000
	1.20	0.32				0.009	1.00	6	1.15	1.25	0.009	0.009	0.32	0.03	0.000
	1.30	0.32				0.003	1.00	7	1.25	1.35	0.003	0.003	0.32	0.03	0.000
	1.40	0.30				-0.006	1.00	8	1.35	1.45	-0.006	-0.006	0.30	0.03	0.000
	1.50	0.30				-0.006	1.00	9	1.45	1.55	-0.006	-0.006	0.30	0.03	0.000
	1.60	0.33				-0.003	1.00	10	1.55	1.65	-0.003	-0.003	0.33	0.03	0.000
	1.70	0.34				-0.006	1.00	11	1.65	1.75	-0.006	-0.006	0.34	0.03	0.000
	1.80	0.36				-0.006	1.00	12	1.75	1.85	-0.006	-0.006	0.36	0.04	0.000
	1.90	0.45				-0.009	1.00	13	1.85	1.95	-0.009	-0.009	0.45	0.04	0.000
	2.00	0.47				-0.015	1.00	14	1.95	2.05	-0.015	-0.015	0.47	0.05	-0.001
	2.10	0.48				-0.015	1.00	15	2.05	2.15	-0.015	-0.015	0.48	0.05	-0.001
	2.20	0.49				-0.015	1.00	16	2.15	2.25	-0.015	-0.015	0.49	0.05	-0.001
	2.30	0.50				-0.015	1.00	17	2.25	2.35	-0.015	-0.015	0.50	0.05	-0.001
	2.40	0.51				-0.003	1.00	18	2.35	2.45	-0.003	-0.003	0.51	0.05	0.000
	2.50	0.45				0.006	1.00	19	2.45	2.55	0.006	0.006	0.45	0.04	0.000
LB	2.60	0.00				0.000	1.00	20	2.55	2.60	0.002	0.002	0.11	0.01	0.000
														Total Flow:	-0.003

Total Flow:	**-0.003**	**≈0**	**(m^3/s)**
Perceived Measurement Quality:	**Poor**		
Total Area:	**0.70**		**(m^2)**
Top Width:	**1.90**		**(m)**
Hydraulic Depth:	**0.367**		**(m)**
Mean Velocity:	**-0.004**		**(m/s)**
Froude Number	**-0.002**		
Photographs taken looking at:			

Datalogger Notes:	**Database #272**	
Datalogger Internal Power:	4.461V	
Datalogger External Power:	12.12V	
Datalogger Memory Used:	8%	
Datalogger Clock:	Aug 26, 2004 09:12	MST
Laptop Clock:	Aug 26, 2004 10:13	MDT
Dessicant:	good - 80%	
Datalogger:	Optimum DD128 & modem, #0104170272	
PT:	Keller 730-130-3 psi #0101356	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Notes: TSS sample collected.
Beaver has downed many trees in the area - BM tree with nail is down, but it is broken above BM
Mining activity is evident in the area.

Hydrometric Measurement / Site Visit Record

S17 - Tar River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River Upland Tributary
Site Name:	S17
Coordinates & Legal:	6357804 N, 444486 E NW-29-96-12-W4

Time of Measurement

Date of Measurement:	September 23, 2004
Start Time:	4:02 PM MDT
End Time:	4:12 PM MDT

Weather Conditions: +15 C, partly cloudy, light wind

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		Setup No. 1			Setup No. 2		
Bench Mark Reading:	T-bar	0.145	El:	366.546	0.116	El:	366.546
Water Level Reading:		1.638	El:	365.053	1.609	El:	365.053
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		1.110	El:	363.943	1.110	El:	363.943
Other:	LB Nail in Tree	1.018	El:	365.673	0.988	El:	365.674

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	19.60	0.00				0.000	1.00	1	19.60	19.75	0.000	0.000	0.10	0.01	0.000
	19.90	0.40				0.000	1.00	2	19.90	20.00	0.000	0.000	0.40	0.04	0.000
	20.10	1.00				0.006	1.00	3	20.10	20.25	0.006	0.006	1.00	0.15	0.001
	20.40	1.03				0.003	1.00	4	20.40	20.50	0.003	0.003	1.03	0.10	0.000
	20.60	1.05				0.003	1.00	5	20.60	20.70	0.003	0.003	1.05	0.11	0.000
	20.80	1.09				0.003	1.00	6	20.80	20.90	0.003	0.003	1.09	0.11	0.000
	21.00	1.10				0.006	1.00	7	21.00	21.10	0.006	0.006	1.10	0.11	0.001
	21.20	1.05				0.009	1.00	8	21.20	21.30	0.009	0.009	1.05	0.10	0.001
	21.40	0.93				0.009	1.00	9	21.40	21.50	0.009	0.009	0.93	0.09	0.001
	21.60	0.94				0.009	1.00	10	21.60	21.70	0.009	0.009	0.94	0.09	0.001
	21.80	0.96				0.006	1.00	11	21.80	21.90	0.006	0.006	0.96	0.10	0.001
	22.00	0.94				0.003	1.00	12	22.00	22.10	0.003	0.003	0.94	0.09	0.000
	22.20	0.92				0.003	1.00	13	22.20	22.30	0.003	0.003	0.92	0.09	0.000
	22.40	0.51				-0.003	1.00	14	22.40	22.50	-0.003	-0.003	0.51	0.05	0.000
RB	22.60	0.00				0.000	1.00	15	22.60	22.60	-0.001	-0.001	0.13	0.00	0.000
														Total Flow:	0.006

Total Flow:	**0.006**	**≈0**	**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**1.26**		**(m^2)**
Top Width:	**3.00**		**(m)**
Hydraulic Depth:	**0.419**		**(m)**
Mean Velocity:	**0.005**		**(m/s)**
Froude Number	**0.002**		

Photographs taken looking at:
no - camera broken

Notes: TSS sample collected.

Datalogger Notes:	**Database #272**	
Datalogger Internal Power:	4.48V	
Datalogger External Power:	13.01V	
Datalogger Memory Used:	11%	
Datalogger Clock:	Sep 23, 2004 14:57	MST
Laptop Clock:	Sep 23, 2004 14:59	MST
Dessicant:	good - 75%	
Datalogger:	Optimum DD128 & modem, #0104170272	
PT:	Keller 730-130-3 psi #010187	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Hydrometric Measurement / Site Visit Record

S17 - Tar River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River
Location:	Tar River Upland Tributary
Site Name:	S17
Coordinates & Legal:	6357804 N, 444486 E NW-29-96-12-W4

Time of Measurement

Date of Measurement:	October 31, 2004
Start Time:	4:20 PM MST
End Time:	4:43 PM MST

Weather Conditions: +2 C, partly cloudy

River Conditions: Fully frozen

Personnel & Equipment

Measurement Made By:	FF/ND
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	0.090	El:	366.546	0.335	El:	366.546
Water Level Reading:	1.543	El:	365.093	1.790	El:	365.091
Top of Ice Level Reading:	1.523	El:	365.113	1.770	El:	365.111
Transducer Reading & Calc'd E	1.153	El:	363.940	1.153	El:	363.938
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
-	-	-	-	-	-	-	-	-	-	-	-	-		-
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream and across

Datalogger Notes:	**Database #272**	
Datalogger Internal Power:	4.437V	
Datalogger External Power:	9.9V	
Datalogger Memory Used:		
Datalogger Clock:	31/10/2004 4:17: PM	MST
Laptop Clock:	Oct 31, 2004 15:21	MST
Dessicant:	good - 60%	
Datalogger:		
PT:	Keller 730-130-3 psi #010187	
Power:		

Notes: TSS sample collected. Transducer removed for winter.
Many trees broken
Manual measurement not possible

Hydrometric Measurement / Site Visit Record

S18A - Calumet River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River Upland Tributary
Site Name:	S18A
Coordinates & Legal:	450662 E, 6363488 N SE-14-97-12-W4

Time of Measurement

Date of Measurement:	April 26, 2004
Start Time:	3:59 PM MDT
End Time:	4:13 PM MDT

Weather Conditions: +20 C, Calm, partly cloudy, light wind

River Conditions: Marginal border ice adjacent to banks - open water conditions. Snow bridge crossing stream 50 m u/s of measurement site.

Personnel & Equipment

Measurement Made By:	FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Nail in Tree	0.402	El:	100.000	0.403	El:	100.000
Water Level Reading:		2.948	El:	97.454	2.954	El:	97.449
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.466	El:	96.988	0.466	El:	96.983
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	17.85	0.00	0.00			0.000	1.00	1	17.85	17.93	0.002	0.002	0.09	0.01	0.000
	18.00	0.36	0.00			0.006	1.00	2	17.93	18.05	0.006	0.006	0.36	0.05	0.000
	18.10	0.40	0.00			0.001	1.00	3	18.05	18.15	0.001	0.001	0.40	0.04	0.000
	18.20	0.44	0.00			0.015	1.00	4	18.15	18.25	0.015	0.015	0.44	0.04	0.001
	18.30	0.50	0.00			0.018	1.00	5	18.25	18.35	0.018	0.018	0.50	0.05	0.001
	18.40	0.50	0.00			0.012	1.00	6	18.35	18.45	0.012	0.012	0.50	0.05	0.001
	18.50	0.63	0.00			0.012	1.00	7	18.45	18.55	0.012	0.012	0.63	0.06	0.001
	18.60	0.69	0.00			0.015	1.00	8	18.55	18.65	0.015	0.015	0.69	0.07	0.001
	18.70	0.65	0.00			0.027	1.00	9	18.65	18.75	0.027	0.027	0.65	0.07	0.002
	18.80	0.68	0.00			0.015	1.00	10	18.75	18.85	0.015	0.015	0.68	0.07	0.001
	18.90	0.70	0.00			0.009	1.00	11	18.85	18.95	0.009	0.009	0.70	0.07	0.001
	19.00	0.71	0.00			0.015	1.00	12	18.95	19.05	0.015	0.015	0.71	0.07	0.001
	19.10	0.67	0.00			0.030	1.00	13	19.05	19.15	0.030	0.030	0.67	0.07	0.002
	19.20	0.69	0.00			0.037	1.00	14	19.15	19.25	0.037	0.037	0.69	0.07	0.003
	19.30	0.68	0.00			0.018	1.00	15	19.25	19.35	0.018	0.018	0.68	0.07	0.001
	19.40	0.63	0.00			0.027	1.00	16	19.35	19.45	0.027	0.027	0.63	0.06	0.002
	19.50	0.62	0.00			0.012	1.00	17	19.45	19.55	0.012	0.012	0.62	0.06	0.001
	19.60	0.60	0.00			0.006	1.00	18	19.55	19.65	0.006	0.006	0.60	0.06	0.000
	19.70	0.57	0.00			0.006	1.00	19	19.65	19.75	0.006	0.006	0.57	0.06	0.000
	19.80	0.54	0.00			0.006	1.00	20	19.75	19.90	0.006	0.006	0.54	0.08	0.000
	20.00	0.48	0.00			0.006	1.00	21	19.90	20.15	0.006	0.006	0.48	0.12	0.001
RB	20.30	0.00	0.00			0.000	1.00	22	20.15	20.30	0.002	0.002	0.12	0.02	0.000
														Total Flow:	0.019

Total Flow:	**0.019**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**1.31**		**(m^2)**
Top Width:	**2.45**		**(m)**
Hydraulic Depth:	**0.533**		**(m)**
Mean Velocity:	**0.015**		**(m/s)**
Froude Number	**0.006**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**404**
Datalogger Internal Power:	4.64V	
Datalogger External Power:	12.52V	
Datalogger Memory Used:	0%	
Datalogger Clock:	Apr 26, 2004 14:47	MST
Laptop Clock:	Apr 26, 2004 15:48	MDT
Dessicant:	Good	
Datalogger:	Optimum datalogger # 0109050404	
PT:	Keller # 101346 3 psi	
Power:	Optimum battery	

Notes: TSS sample collected.
Equipment installed. Transducer wired to re-bar placed in channel.
Remnants of snow bridge, including earthen debris and ice crossing stream 50 m u/s of site, from winter oil/exploration activity.

Hydrometric Measurement / Site Visit Record

S18A - Calumet River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River Upland Tributary
Site Name:	S18A
Coordinates & Legal:	450662 E, 6363488 N SE-14-97-12-W4

Time of Measurement

Date of Measurement:	June 2, 2004
Start Time:	5:14 PM MDT
End Time:	5:32 PM MDT

Weather Conditions: +20 C, partly cloudy, light wind

River Conditions: open

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Nail in Tree	0.682	El:	100.000	0.557	El:	100.000
Water Level Reading:		2.875	El:	97.807	2.743	El:	97.814
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.912	El:	96.895	0.912	El:	96.902
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	19.30	0.00	0.00	0.00		0.000	1.00	1	19.30	19.45	0.000	0.000	0.05	0.01	0.000
	19.60	0.20	0.00	0.00		0.009	1.00	2	19.45	19.80	0.005	0.005	0.20	0.07	0.000
	20.00	0.26	0.00	0.00		0.009	1.00	3	19.80	20.15	0.005	0.005	0.26	0.09	0.000
	20.30	0.44	0.00	0.15	0.00	0.000	1.00	4	20.15	20.45	0.076	0.076	0.44	0.13	0.010
	20.60	0.54	0.00	0.19		0.003	1.00	5	20.45	20.75	0.096	0.096	0.54	0.16	0.016
	20.90	0.66	0.00	0.16		0.003	1.00	6	20.75	21.05	0.082	0.082	0.66	0.20	0.016
	21.20	0.75	0.00	0.16		0.003	1.00	7	21.05	21.30	0.081	0.081	0.75	0.19	0.015
	21.40	0.77	0.00	0.13		0.006	1.00	8	21.30	21.45	0.069	0.069	0.77	0.12	0.008
	21.50	0.76	0.00	0.15	0.01	0.015	1.00	9	21.45	21.55	0.078	0.078	0.76	0.08	0.006
	21.60	0.74	0.00	0.22		0.003	1.00	10	21.55	21.65	0.110	0.110	0.74	0.07	0.008
	21.70	0.70	0.00			0.049	1.00	11	21.65	21.75	0.049	0.049	0.70	0.07	0.003
	21.80	0.70	0.00			0.058	1.00	12	21.75	21.85	0.058	0.058	0.70	0.07	0.004
	21.90	0.73	0.00			0.085	1.00	13	21.85	21.95	0.085	0.085	0.73	0.07	0.006
	22.00	0.72	0.00			0.229	1.00	14	21.95	22.05	0.229	0.229	0.72	0.07	0.016
	22.10	0.74	0.00			0.329	1.00	15	22.05	22.15	0.329	0.329	0.74	0.07	0.024
	22.20	0.76	0.00			0.341	1.00	16	22.15	22.25	0.341	0.341	0.76	0.08	0.026
	22.30	0.72	0.00			0.317	1.00	17	22.25	22.35	0.317	0.317	0.72	0.07	0.023
	22.40	0.63	0.00			0.219	1.00	18	22.35	22.45	0.219	0.219	0.63	0.06	0.014
	22.50	0.60	0.00			0.201	1.00	19	22.45	22.55	0.201	0.201	0.60	0.06	0.012
	22.60	0.55	0.00			0.094	1.00	20	22.55	22.65	0.094	0.094	0.55	0.05	0.005
	22.70	0.54	0.00			0.149	1.00	21	22.65	22.80	0.149	0.149	0.54	0.08	0.012
RB	22.90	0.00	0.00			0.000	1.00	22	22.80	22.90	0.037	0.037	0.14	0.01	0.001
														Total Flow:	0.227

Total Flow:	**0.227**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**1.89**		**(m^2)**
Top Width:	**3.60**		**(m)**
Hydraulic Depth:	**0.526**		**(m)**
Mean Velocity:	**0.120**		**(m/s)**
Froude Number	**0.053**		
Photographs taken looking at: yes			

Datalogger Notes:	**Database**	**404**
Datalogger Internal Power:	4.76V	
Datalogger External Power:	12.76V	
Datalogger Memory Used:	0.5Kb	
Datalogger Clock:	02/06/2004 16:04:19 PM	MST
Laptop Clock:	Jun 02, 2004 17:05	MDT
Dessicant:	Good	
Datalogger:	Optimum datalogger # 0109050404	
PT:	Keller # 101346 3 psi	
Power:	Optimum battery	

Notes: TSS sample collected.
Flow appears to be receding (from marks on bank).

Hydrometric Measurement / Site Visit Record

S18A - Calumet River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River Upland Tributary
Site Name:	S18A
Coordinates & Legal:	450662 E, 6363488 N SE-14-97-12-W4

Time of Measurement

Date of Measurement:	July 24, 2004	
Start Time:	3:50 PM	MDT
End Time:	4:02 PM	MDT

Weather Conditions: +35 C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Nail in Tree	0.071	El:	100.000	0.172	El:	100.000
Water Level Reading:		2.813	El:	97.258	2.910	El:	97.262
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd El		0.442	El:	96.816	0.442	El:	96.820
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	0.50	0.00				0.000	1.00	1	0.50	0.55	0.000	0.000	0.08	0.00	0.000
	0.60	0.30				0.000	1.00	2	0.55	0.70	0.000	0.000	0.30	0.05	0.000
	0.80	0.35				0.001	1.00	3	0.70	0.90	0.000	0.000	0.35	0.07	0.000
	1.00	0.46				0.003	1.00	4	0.90	1.10	0.002	0.002	0.46	0.09	0.000
	1.20	0.60				0.006	1.00	5	1.10	1.25	0.003	0.003	0.60	0.09	0.000
	1.30	0.57				0.003	1.00	6	1.25	1.35	0.002	0.002	0.57	0.06	0.000
	1.40	0.55				0.006	1.00	7	1.35	1.45	0.003	0.003	0.55	0.05	0.000
	1.50	0.67				0.001	1.00	8	1.45	1.55	0.000	0.000	0.67	0.07	0.000
	1.60	0.58				0.000	1.00	9	1.55	1.65	0.000	0.000	0.58	0.06	0.000
	1.70	0.57				0.003	1.00	10	1.65	1.75	0.002	0.002	0.57	0.06	0.000
	1.80	0.58				-0.003	1.00	11	1.75	1.85	-0.002	-0.002	0.58	0.06	0.000
	1.90	0.54				0.003	1.00	12	1.85	1.95	0.002	0.002	0.54	0.05	0.000
	2.00	0.54				0.003	1.00	13	1.95	2.05	0.002	0.002	0.54	0.05	0.000
	2.10	0.60				-0.006	1.00	14	2.05	2.20	-0.003	-0.003	0.60	0.09	0.000
	2.30	0.45				0.001	1.00	15	2.20	2.40	0.000	0.000	0.45	0.09	0.000
	2.50	0.28				0.000	1.00	16	2.40	2.65	0.000	0.000	0.28	0.07	0.000
	2.80	0.05				0.000	1.00	17	2.65	2.90	0.000	0.000	0.05	0.01	0.000
RB	3.00	0.00				0.000	1.00	18	2.90	3.00	0.000	0.000	0.01	0.00	0.000
														Total Flow:	0.001

Total Flow:	**0.001**		**(m^3/s)**
Perceived Measurement Quality:	**Poor**		
Total Area:	**1.02**		**(m^2)**
Top Width:	**2.50**		**(m)**
Hydraulic Depth:	**0.410**		**(m)**
Mean Velocity:	**0.001**		**(m/s)**
Froude Number	**0.000**		
Photographs taken looking at: yes			

Datalogger Notes:	**Database**	**404**
Datalogger Internal Power:	4.829V	
Datalogger External Power:	12.73V	
Datalogger Memory Used:	0%	
Datalogger Clock:	Jul 24, 2004 14:39	MST
Laptop Clock:	Jul 24, 2004 15:41	MDT
Dessicant:	Good	
Datalogger:	Optimum datalogger # 0109050404	
PT:	Keller # 101346 3 psi	
Power:	Optimum battery	

Notes: TSS sample collected.
Flow is so slow, extensive weed growth, hard to measure
Changed sample rate from once a day to once every 15 minutes

Hydrometric Measurement / Site Visit Record

S18A - Calumet River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River Upland Tributary
Site Name:	S18A
Coordinates & Legal:	450662 E, 6363488 N SE-14-97-12-W4

Time of Measurement

Date of Measurement:	August 26, 2004
Start Time:	11:12 AM MDT
End Time:	11:29 AM MDT

Weather Conditions: +15 C, partly cloudy, calm

River Conditions: open, low, very weedy

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Nail in Tree	0.011	El:	100.000	0.081	El:	100.000
Water Level Reading:		2.723	El:	97.288	2.786	El:	97.295
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.451	El:	96.837	0.451	El:	96.844
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	1.30	0.00				0.000	1.00	1	1.30	1.35	0.000	0.000	0.03	0.00	0.000
	1.40	0.12				0.015	1.00	2	1.35	1.45	0.008	0.008	0.12	0.01	0.000
	1.50	0.16				0.006	1.00	3	1.45	1.55	0.003	0.003	0.16	0.02	0.000
	1.60	0.31				-0.009	1.00	4	1.55	1.65	-0.005	-0.005	0.31	0.03	0.000
	1.70	0.36				-0.012	1.00	5	1.65	1.75	-0.006	-0.006	0.36	0.04	0.000
	1.80	0.39				-0.009	1.00	6	1.75	1.85	-0.005	-0.005	0.39	0.04	0.000
	1.90	0.43				-0.009	1.00	7	1.85	1.95	-0.005	-0.005	0.43	0.04	0.000
	2.00	0.45				-0.009	1.00	8	1.95	2.05	-0.005	-0.005	0.45	0.04	0.000
	2.10	0.45				0.000	1.00	9	2.05	2.15	0.000	0.000	0.45	0.05	0.000
	2.20	0.44				0.000	1.00	10	2.15	2.25	0.000	0.000	0.44	0.04	0.000
	2.30	0.50				0.015	1.00	11	2.25	2.35	0.008	0.008	0.50	0.05	0.000
	2.40	0.47				0.009	1.00	12	2.35	2.45	0.005	0.005	0.47	0.05	0.000
	2.50	0.48				0.015	1.00	13	2.45	2.55	0.008	0.008	0.48	0.05	0.000
	2.60	0.46				0.012	1.00	14	2.55	2.65	0.006	0.006	0.46	0.05	0.000
	2.70	0.46				0.015	1.00	15	2.65	2.75	0.008	0.008	0.46	0.05	0.000
	2.80	0.44				0.015	1.00	16	2.75	2.85	0.008	0.008	0.44	0.04	0.000
	2.90	0.43				0.012	1.00	17	2.85	2.95	0.006	0.006	0.43	0.04	0.000
	3.00	0.42				0.012	1.00	18	2.95	3.05	0.006	0.006	0.42	0.04	0.000
	3.10	0.40				0.009	1.00	19	3.05	3.15	0.005	0.005	0.40	0.04	0.000
	3.20	0.44				0.000	1.00	20	3.15	3.25	0.000	0.000	0.44	0.04	0.000
	3.30	0.38				0.003	1.00	21	3.25	3.35	0.002	0.002	0.38	0.04	0.000
	3.40	0.30				0.003	1.00	22	3.35	3.45	0.002	0.002	0.30	0.03	0.000
RB	3.50	0.00				0.000	1.00	23	3.45	3.50	0.000	0.000	0.08	0.00	0.000
														Total Flow:	0.002

Total Flow:	**0.002**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.83**		**(m^2)**
Top Width:	**2.20**		**(m)**
Hydraulic Depth:	**0.379**		**(m)**
Mean Velocity:	**0.002**		**(m/s)**
Froude Number	**0.001**		
Photographs taken looking at: yes			

Datalogger Notes:	**Database**	**404**
Datalogger Internal Power:	4.780V	
Datalogger External Power:	12.61V	
Datalogger Memory Used:	3%	
Datalogger Clock:	Aug 26, 2004 10:05	MST
Laptop Clock:	Aug 26, 2004 11:07	MDT
Dessicant:	Good - 75%	
Datalogger:	Optimum datalogger # 0109050404	
PT:	Keller # 101346 3 psi	
Power:	Optimum battery	

Notes: TSS sample collected.
Flow is so slow, extensive weed growth, hard to measure

Hydrometric Measurement / Site Visit Record

S18A - Calumet River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River Upland Tributary
Site Name:	S18A
Coordinates & Legal:	450662 E, 6363488 N SE-14-97-12-W4

Time of Measurement

Date of Measurement:	September 23, 2004
Start Time:	2:51 PM MDT
End Time:	3:04 PM MDT

Weather Conditions: +15 C, partly cloudy, light wind

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Nail in Tree	0.239	El:	100.000	0.099	El:	100.000
Water Level Reading:		2.815	El:	97.424	2.672	El:	97.427
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.555	El:	96.869	0.555	El:	96.872
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	20.70	0.00				0.000	1.00	1	20.70	20.60	0.000	0.000	0.01	0.00	0.000
	20.50	0.04				0.009	1.00	2	20.50	20.40	0.005	0.005	0.04	0.00	0.000
	20.30	0.07				0.012	1.00	3	20.30	20.20	0.006	0.006	0.07	0.01	0.000
	20.10	0.24				0.015	1.00	4	20.10	20.05	0.008	0.008	0.24	0.01	0.000
	20.00	0.47				0.006	1.00	5	20.00	19.95	0.003	0.003	0.47	0.02	0.000
	19.90	0.57				0.015	1.00	6	19.90	19.85	0.008	0.008	0.57	0.03	0.000
	19.80	0.58				0.012	1.00	7	19.80	19.75	0.006	0.006	0.58	0.03	0.000
	19.70	0.54				0.037	1.00	8	19.70	19.65	0.018	0.018	0.54	0.03	0.000
	19.60	0.50				0.027	1.00	9	19.60	19.55	0.014	0.014	0.50	0.03	0.000
	19.50	0.55				-0.012	1.00	10	19.50	19.45	-0.006	-0.006	0.55	0.03	0.000
	19.40	0.58				0.009	1.00	11	19.40	19.35	0.005	0.005	0.58	0.03	0.000
	19.30	0.67				0.018	1.00	12	19.30	19.25	0.009	0.009	0.67	0.03	0.000
	19.20	0.67				0.009	1.00	13	19.20	19.15	0.005	0.005	0.67	0.03	0.000
	19.10	0.60				0.006	1.00	14	19.10	19.00	0.003	0.003	0.60	0.06	0.000
	18.90	0.54				0.012	1.00	15	18.90	18.80	0.006	0.006	0.54	0.05	0.000
	18.70	0.51				0.003	1.00	16	18.70	18.60	0.002	0.002	0.51	0.05	0.000
	18.50	0.50				0.009	1.00	17	18.50	18.40	0.005	0.005	0.50	0.05	0.000
	18.30	0.42				0.024	1.00	18	18.30	18.20	0.012	0.012	0.42	0.04	0.001
	18.10	0.16				0.015	1.00	19	18.10	18.00	0.008	0.008	0.16	0.02	0.000
	17.90	0.07				0.015	1.00	20	17.90	17.80	0.008	0.008	0.07	0.01	0.000
	17.70	0.10				0.006	1.00	21	17.70	17.60	0.003	0.003	0.10	0.01	0.000
RB	17.50	0.00				0.000	1.00	22	17.50	17.50	0.001	0.001	0.03	0.00	0.000
														Total Flow:	0.003

Total Flow:	**0.003**	(m^3/s)
Perceived Measurement Quality:	**Fair**	
Total Area:	**0.57**	(m^2)
Top Width:	**3.20**	(m)
Hydraulic Depth:	**0.178**	(m)
Mean Velocity:	**0.006**	(m/s)
Froude Number	**0.005**	

Photographs taken looking at:
yes

Datalogger Notes:	**Database**	**404**
Datalogger Internal Power:	4.775V	
Datalogger External Power:	12.56V	
Datalogger Memory Used:	5%	
Datalogger Clock:	Sep 23, 2004 13:42	MST
Laptop Clock:	Sep 23, 2004 13:46	MST
Dessicant:	Good - 50%	
Datalogger:	Optimum datalogger # 0109050404	
PT:	Keller # 101346 3 psi	
Power:	Optimum battery	

Notes: TSS sample collected.
Flow is so slow, extensive weed growth, hard to measure

Hydrometric Measurement / Site Visit Record

S18A - Calumet River Upland Tributary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Calumet River
Location:	Calumet River Upland Tributary
Site Name:	S18A
Coordinates & Legal:	450662 E, 6363488 N SE-14-97-12-W4

Time of Measurement

Date of Measurement:	October 31, 2004
Start Time:	3:30 PM MST
End Time:	3:58 PM MST

Weather Conditions: +5 C, overcast

River Conditions: Full ice cover

Personnel & Equipment

Measurement Made By:	FF/ND
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**		**Setup No. 2**	
Bench Mark Reading: Nail in Tree	0.040	El:	100.000	0.125	El: 100.000
Water Level Reading:	2.675	El:	97.365	2.749	El: 97.376
Top of Ice Level Reading:	2.605	El:	97.435	2.682	El: 97.443
Transducer Reading & Calc'd E	0.538	El:	96.827	0.538	El: 96.838
Other:		El:			El:

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Perceived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:	**Database**	**404**	
Datalogger Internal Power:	4.7V		
Datalogger External Power:	12.5V		
Datalogger Memory Used:	8% used		
Datalogger Clock:	Oct 31, 2004 15:29		MST
Laptop Clock:	Oct 31, 2004 14:29		MST
Dessicant:	Good		
Datalogger:			
PT:	Keller # 101346 3 psi		
Power:			

Notes: TSS sample collected. Transducer removed for winter.
No manual mesurements possible as river frozen to about
60-70% of its depth

Hydrometric Measurement / Site Visit Record

S19 - Tar River Lowland Tributary near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River Lowland
Location:	Tar River Lowland Tributary near the Mouth
Site Name:	S19
Coordinates & Legal:	6352849 N, 457329 E SE-10-96-11-W4

Personnel & Equipment

Measurement Made By:	DM/DB/FF
Data Entry By:	FF
Meter Type and No.:	Time / Volume Method

Time of Measurement

Date of Measurement:	April 24, 2004	
Start Time:	11:48 AM	MDT
End Time:	11:54 AM	MDT

Level Readings

		Setup No. 1		Setup No. 2	
Bench Mark Reading: Nail on LB	1.582	El:	101.478	1.660	El: 101.478
Water Level Reading:	1.982	El:	101.078	2.058	El: 101.080
Top of Ice Level Reading:		El:			El:
Transducer Reading & Calc'd El.:		El:			El:
Other:		El:			El:

Weather Conditions: +10 °C, Overcast, Calm

River Conditions: Significant ice in channel at previous sensor installation and MMT locations. MMT should not fit rating curve due to ice effects.

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB															
RB															

Flow measured by 5 determinations using a volume / time method.
Flow estimated to be 0. 015 cms

Notes:

Total Flow: 0.000

Total Flow:			0.015			(m^3/s)
Perceived Measurement Quality			Poor			
Total Area:						(m^2)
Top Width:						(m)
Hydraulic Depth:						(m)
Mean Velocity:						(m/s)
Froude Number						

Notes: Equipment not installed as channel still ice affected.
TSS sample taken.

Datalogger Notes:	**Database 271**
Datalogger Internal Power:	
Datalogger External Power:	
Datalogger Memory Used:	
Datalogger Clock:	MDT
Laptop Clock:	MST
Dessicant:	
Datalogger:	Optimum DD-128 with modem 0104170271
PT:	Keller 730-130-0003 psi Pressure Transducer #101352
Power:	12V 20A battery and solar panel
Temp:	

Hydrometric Measurement / Site Visit Record

S19 - Tar River Lowland Tributary near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River Lowland
Location:	Tar River Lowland Tributary near the Mouth
Site Name:	S19
Coordinates & Legal:	6352849 N, 457329 E SE-10-96-11-W4

Personnel & Equipment

Measurement Made By:	DM/DB/FF
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000

Time of Measurement

Date of Measurement:	April 27, 2004
Start Time:	12:48 PM MDT
End Time:	12:54 PM MDT

Level Readings

		Setup No. 1			Setup No. 2		
Bench Mark Reading: Nail on LB	1.977	El:	101.478		1.930	El:	101.478
Water Level Reading:	2.575	El:	100.880		2.525	El:	100.883
Top of Ice Level Reading:		El:				El:	
Transducer Reading & Calc'd E	0.442	El:	100.438		0.442	El:	100.441
Other:		El:				El:	

Weather Conditions: +10 °C, Overcast, Calm

River Conditions: Section open at MMT section with some border ice. D/S channel significantly iced-up. Some ice at downstream culvert.

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	0.90	0.00				0.000	1.00	1	0.90	1.10	0.002	0.002	0.10	0.02	0.000
	1.30	0.40				0.006	1.00	2	1.10	1.40	0.006	0.006	0.40	0.12	0.001
	1.50	0.43				0.006	1.00	3	1.40	1.55	0.006	0.006	0.43	0.06	0.000
	1.60	0.45				0.006	1.00	4	1.55	1.70	0.006	0.006	0.45	0.07	0.000
	1.80	0.50				0.009	1.00	5	1.70	1.90	0.009	0.009	0.50	0.10	0.001
	2.00	0.39				0.046	1.00	6	1.90	2.10	0.046	0.046	0.39	0.08	0.004
	2.20	0.55				0.052	1.00	7	2.10	2.25	0.052	0.052	0.55	0.08	0.004
	2.30	0.55				0.058	1.00	8	2.25	2.35	0.058	0.058	0.55	0.05	0.003
	2.40	0.53				0.058	1.00	9	2.35	2.45	0.058	0.058	0.53	0.05	0.003
	2.50	0.54				0.055	1.00	10	2.45	2.55	0.055	0.055	0.54	0.05	0.003
	2.60	0.52				0.052	1.00	11	2.55	2.70	0.052	0.052	0.52	0.08	0.004
	2.80	0.50				0.034	1.00	12	2.70	2.90	0.034	0.034	0.50	0.10	0.003
	3.00	0.30				0.012	1.00	13	2.90	3.15	0.012	0.012	0.30	0.08	0.001
RB	3.30	0.00				0.000	1.00	14	3.15	3.30	0.003	0.003	0.08	0.01	0.000
														Total Flow:	**0.028**

Notes:

Total Flow:			**0.028**		(m^3/s)
Perceived Measurement Quality			**Fair**		
Total Area:			**0.96**		(m^2)
Top Width:			**2.10**		(m)
Hydraulic Depth:			**0.457**		(m)
Mean Velocity:			**0.029**		(m/s)
Froude Number			**0.014**		

Datalogger Notes:	**Database 271**	
Datalogger Internal Power:	4.56V	
Datalogger External Power:	13.02V	
Datalogger Memory Used:	0%	
Datalogger Clock:	Apr 27, 2004 10:08	MST
Laptop Clock:	Apr 27, 2004 11:09	MDT
Dessicant:	Good	

Datalogger: Optimum DD-128 with modem 0104170271
PT: Keller 730-130-0003 psi Pressure Transducer #101352
Power: 12V 20A battery and solar panel
Temp:

Notes:
Transducer installed, although D/S channel still ice affected.
TR 525M-R1 TBRG installed (s/n 25758-200) with 9.6" top. Ignore all tips up to 1:00 pm.
TSS sample taken on earlier visit - Apr 24, 2004.
Datalogger and solar panel installed on a tree on left bank, 15 m from channel.
Chanel strongly ice affected, MMT should not correspond to open water rating curve.

Hydrometric Measurement / Site Visit Record

S19 - Tar River Lowland Tributary near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River Lowland
Location:	Tar River Lowland Tributary near the Mouth
Site Name:	S19
Coordinates & Legal:	6352849 N, 457329 E SE-10-96-11-W4

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000

Time of Measurement

Date of Measurement:	May 31, 2004	
Start Time:	6:10 PM	MDT
End Time:	6:20 PM	MDT

Weather Conditions: +10 °C, Overcast, Calm

River Conditions: open, significant flooding, inflows from roadway ditch

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Nail on LB	1.969	El:	101.478		1.909	El:	101.478
Water Level Reading:	2.463	El:	100.984		2.405	El:	100.982
Top of Ice Level Reading:		El:				El:	
Transducer Reading & Calc'd E	0.528	El:	100.456		0.528	El:	100.454
Other:		El:				El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	21.90	0.00				0.000	1.00	1	21.90	21.70	0.008	0.008	0.11	0.02	0.000
	21.50	0.42				0.030	1.00	2	21.70	21.40	0.030	0.030	0.42	0.13	0.004
	21.30	0.44				0.024	1.00	3	21.40	21.20	0.024	0.024	0.44	0.09	0.002
	21.10	0.47				0.119	1.00	4	21.20	21.00	0.119	0.119	0.47	0.09	0.011
	20.90	0.46				0.088	1.00	5	21.00	20.80	0.088	0.088	0.46	0.09	0.008
	20.70	0.44				0.088	1.00	6	20.80	20.60	0.088	0.088	0.44	0.09	0.008
	20.50	0.48				0.098	1.00	7	20.60	20.40	0.098	0.098	0.48	0.10	0.009
	20.30	0.60				0.076	1.00	8	20.40	20.20	0.076	0.076	0.60	0.12	0.009
	20.10	0.63				0.116	1.00	9	20.20	20.00	0.116	0.116	0.63	0.13	0.015
	19.90	0.65				0.110	1.00	10	20.00	19.80	0.110	0.110	0.65	0.13	0.014
	19.70	0.55				0.110	1.00	11	19.80	19.60	0.110	0.110	0.55	0.11	0.012
	19.50	0.35				0.018	1.00	12	19.60	19.40	0.018	0.018	0.35	0.07	0.001
	19.30	0.34				0.003	1.00	13	19.40	18.90	0.003	0.003	0.34	0.17	0.001
RB	18.50	0.00				0.000	1.00	14	18.90	18.50	0.001	0.001	0.09	0.03	0.000
														Total Flow:	**0.094**

Notes:

Total Flow:			**0.094**		(m^3/s)
Perceived Measurement Quality			**Fair**		
Total Area:			**1.37**		(m^2)
Top Width:			**2.60**		(m)
Hydraulic Depth:			**0.525**		(m)
Mean Velocity:			**0.069**		(m/s)
Froude Number			**0.031**		

Notes: Channel is in flood, no clearly defined channel
Inflows occuring from roadway ditches, contain large amount of sediments
TSS Sample taken.

Datalogger Notes:	**Database 271**	
Datalogger Internal Power:	4.506V	
Datalogger External Power:	13.60V	
Datalogger Memory Used:	4%	
Datalogger Clock:	16:47:13	MDT
Laptop Clock:	5:47:00 PM	MST
Dessicant:	Good	

Datalogger: Optimum DD-128 with modem 0104170271
PT: Keller 730-130-0003 psi Pressure Transducer #101352
Power: 12V 20A battery and solar panel
Temp:

Hydrometric Measurement / Site Visit Record

S19 - Tar River Lowland Tributary near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Tar River Lowland
Location:	Tar River Lowland Tributary near the Mouth
Site Name:	S19
Coordinates & Legal:	6352849 N, 457329 E SE-10-96-11-W4

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000

Time of Measurement

Date of Measurement:	July 23, 2004	
Start Time:	11:16 AM	MDT
End Time:	11:25 AM	MDT

Weather Conditions: +10 °C, Clear, Calm

River Conditions: Open

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Nail on LB	1.739	El:	101.478		1.681	El:	101.478
Water Level Reading:	2.550	El:	100.667		2.502	El:	100.657
Top of Ice Level Reading:		El:				El:	
Transducer Reading & Calc'd E	0.143	El:	100.524		0.143	El:	100.514
Other:		El:				El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	2.60	0.00				0.000	1.00	1	2.60	2.55	0.000	0.000	0.00	0.00	0.000
	2.50	0.01				0.000	1.00	2	2.55	2.45	0.000	0.000	0.01	0.00	0.000
	2.40	0.03				0.012	1.00	3	2.45	2.35	0.012	0.012	0.03	0.00	0.000
	2.30	0.09				0.015	1.00	4	2.35	2.25	0.015	0.015	0.09	0.01	0.000
	2.20	0.11				0.015	1.00	5	2.25	2.15	0.015	0.015	0.11	0.01	0.000
	2.10	0.11				0.009	1.00	6	2.15	2.05	0.009	0.009	0.11	0.01	0.000
	2.00	0.10				0.018	1.00	7	2.05	1.95	0.018	0.018	0.10	0.01	0.000
	1.90	0.13				0.018	1.00	8	1.95	1.85	0.018	0.018	0.13	0.01	0.000
	1.80	0.14				0.034	1.00	9	1.85	1.75	0.034	0.034	0.14	0.01	0.000
	1.70	0.18				0.037	1.00	10	1.75	1.65	0.037	0.037	0.18	0.02	0.001
	1.60	0.19				0.046	1.00	11	1.65	1.55	0.046	0.046	0.19	0.02	0.001
	1.50	0.20				0.061	1.00	12	1.55	1.45	0.061	0.061	0.20	0.02	0.001
	1.40	0.20				0.058	1.00	13	1.45	1.35	0.058	0.058	0.20	0.02	0.001
	1.30	0.20				0.061	1.00	14	1.35	1.25	0.061	0.061	0.20	0.02	0.001
	1.20	0.18				0.055	1.00	15	1.25	1.15	0.055	0.055	0.18	0.02	0.001
	1.10	0.15				0.067	1.00	16	1.15	1.05	0.067	0.067	0.15	0.02	0.001
	1.00	0.03				0.009	1.00	17	1.05	0.95	0.009	0.009	0.03	0.00	0.000
RB	0.90	0.00				0.000	1.00	18	0.95	0.90	0.002	0.002	0.01	0.00	0.000
														Total Flow:	**0.008**

Notes:

Total Flow:			**0.008**		(m^3/s)
Perceived Measurement Quality			**Fair**		
Total Area:			**0.21**		(m^2)
Top Width:			**1.60**		(m)
Hydraulic Depth:			**0.128**		(m)
Mean Velocity:			**0.041**		(m/s)
Froude Number			**0.037**		

Notes: TSS Sample taken.
878 tips in rain bucket

Datalogger Notes:	**Database 271**	
Datalogger Internal Power:	4.623V	
Datalogger External Power:	14.16V	
Datalogger Memory Used:	10%	
Datalogger Clock:	Jul 23, 2004 09:49	MDT
Laptop Clock:	Jul 23, 2004 10:50	MST
Dessicant:	Good	

Datalogger: Optimum DD-128 with modem 0104170271
PT: Keller 730-130-0003 psi Pressure Transducer #101352
Power: 12V 20A battery and solar panel
Temp:

Hydrometric Measurement / Site Visit Record

S19 - Lowland Tar River

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Lowland Tar River
Location:	Lowland Tar River
Site Name:	S19
Coordinates & Legal:	6352849 N, 457329 E SE-10-96-11-W4

Time of Measurement

Date of Measurement:	August 25, 2004
Start Time:	10:20 AM MDT
End Time:	10:26 AM MDT

Weather Conditions: +15 C, Calm, clear

River Conditions: open, very low flow

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	1.886	El:	101.478	1.929	El:	101.478
Water Level Reading:	2.875	El:	100.489	2.918	El:	100.489
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.179	El:	100.310	0.179	El:	100.310
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	0.65	0.00	0.00			0.000	1.00	1	0.65	0.68	0.002	0.002	0.02	0.00	0.000
	0.70	0.09	0.00			0.009	1.00	2	0.68	0.73	0.009	0.009	0.09	0.00	0.000
	0.75	0.10	0.00			0.021	1.00	3	0.73	0.78	0.021	0.021	0.10	0.01	0.000
	0.80	0.10	0.00			0.061	1.00	4	0.78	0.83	0.061	0.061	0.10	0.01	0.000
	0.85	0.10	0.00			0.107	1.00	5	0.83	0.88	0.107	0.107	0.10	0.01	0.001
	0.90	0.11	0.00			0.137	1.00	6	0.88	0.93	0.137	0.137	0.11	0.01	0.001
	0.95	0.10	0.00			0.125	1.00	7	0.93	0.98	0.125	0.125	0.10	0.01	0.001
	1.00	0.09	0.00			0.119	1.00	8	0.98	1.03	0.119	0.119	0.09	0.00	0.001
	1.05	0.08	0.00			0.128	1.00	9	1.03	1.08	0.128	0.128	0.08	0.00	0.001
	1.10	0.07	0.00			0.116	1.00	10	1.08	1.13	0.116	0.116	0.07	0.00	0.000
	1.15	0.06	0.00			0.119	1.00	11	1.13	1.18	0.119	0.119	0.06	0.00	0.000
	1.20	0.05	0.00			0.088	1.00	12	1.18	1.23	0.088	0.088	0.05	0.00	0.000
	1.25	0.04	0.00			0.046	1.00	13	1.23	1.25	0.046	0.046	0.04	0.00	0.000
RB	1.55	0.00	0.00			0.000	1.00	14	1.25	1.55	0.011	0.011	0.01	0.00	0.000
														Total Flow:	0.004

Total Flow:	**0.004**		(m^3/s)
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.05**		(m^2)
Top Width:	**0.90**		(m)
Hydraulic Depth:	**0.058**		(m)
Mean Velocity:	**0.086**		(m/s)
Froude Number	**0.114**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:	**Database # 271**	
Datalogger Internal Power:	4.630V	
Datalogger External Power:	13.87V	
Datalogger Memory Used:	14%	
Datalogger Clock:	Aug 25, 2004 08:56	MST
Laptop Clock:	Aug 25, 2004 09:57	MDT
Dessicant:	Good	
Datalogger:		
PT:		
Power:		

Notes:

Transducer was buried in mud, out of the water. Transducer was moved to the deepest part of the stream. TSS sample taken.

Hydrometric Measurement / Site Visit Record

S19 - Lowland Tar River

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Lowland Tar River
Location:	Lowland Tar River
Site Name:	S19
Coordinates & Legal:	6352849 N, 457329 E SE-10-96-11-W4

Time of Measurement

Date of Measurement:	September 22, 2004
Start Time:	3:52 PM MDT
End Time:	4:06 PM MDT

Weather Conditions: +22 C, partly cloudy, windy

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	1.678	El:	101.478	1.569	El:	101.478
Water Level Reading:	2.224	El:	100.932	2.107	El:	100.940
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.629	El:	100.303	0.629	El:	100.311
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	0.50	0.00	0.00			0.000	1.00	1	0.50	0.60	0.005	0.005	0.04	0.00	0.000
	0.70	0.15	0.00			0.021	1.00	2	0.70	0.80	0.021	0.021	0.15	0.02	0.000
	0.90	0.17	0.00			0.027	1.00	3	0.90	1.00	0.027	0.027	0.17	0.02	0.000
	1.10	0.23	0.00			0.015	1.00	4	1.10	1.15	0.015	0.015	0.23	0.01	0.000
	1.20	0.25	0.00			0.027	1.00	5	1.20	1.25	0.027	0.027	0.25	0.01	0.000
	1.30	0.32	0.00			0.040	1.00	6	1.30	1.35	0.040	0.040	0.32	0.02	0.001
	1.40	0.33	0.00			0.027	1.00	7	1.40	1.45	0.027	0.027	0.33	0.02	0.000
	1.50	0.46	0.00			0.052	1.00	8	1.50	1.55	0.052	0.052	0.46	0.02	0.001
	1.60	0.52	0.00			0.064	1.00	9	1.60	1.65	0.064	0.064	0.52	0.03	0.002
	1.70	0.55	0.00			0.098	1.00	10	1.70	1.75	0.098	0.098	0.55	0.03	0.003
	1.80	0.56	0.00			0.137	1.00	11	1.80	1.83	0.137	0.137	0.56	0.01	0.002
	1.85	0.56	0.00			0.134	1.00	12	1.85	1.88	0.134	0.134	0.56	0.01	0.002
	1.90	0.55	0.00			0.125	1.00	13	1.90	1.93	0.125	0.125	0.55	0.01	0.002
	1.95	0.54	0.00			0.146	1.00	14	1.95	1.98	0.146	0.146	0.54	0.01	0.002
	2.00	0.54	0.00			0.152	1.00	15	2.00	2.03	0.152	0.152	0.54	0.01	0.002
	2.05	0.52	0.00			0.131	1.00	16	2.05	2.08	0.131	0.131	0.52	0.01	0.002
	2.10	0.50	0.00			0.155	1.00	17	2.10	2.13	0.155	0.155	0.50	0.01	0.002
	2.15	0.48	0.00			0.152	1.00	18	2.15	2.18	0.152	0.152	0.48	0.01	0.002
	2.20	0.50	0.00			0.143	1.00	19	2.20	2.23	0.143	0.143	0.50	0.01	0.002
	2.25	0.47	0.00			0.128	1.00	20	2.25	2.28	0.128	0.128	0.47	0.01	0.002
	2.30	0.47	0.00			0.104	1.00	21	2.30	2.35	0.104	0.104	0.47	0.02	0.002
	2.40	0.47	0.00			0.052	1.00	22	2.40	2.45	0.052	0.052	0.47	0.02	0.001
	2.50	0.44	0.00			0.040	1.00	23	2.50	2.55	0.040	0.040	0.44	0.02	0.001
	2.60	0.35	0.00			0.021	1.00	24	2.60	2.70	0.021	0.021	0.35	0.04	0.001
	2.80	0.31	0.00			0.024	1.00	25	2.80	2.90	0.024	0.024	0.31	0.03	0.001
	3.00	0.28	0.00			0.030	1.00	26	3.00	3.10	0.030	0.030	0.28	0.03	0.001
	3.20	0.14	0.00			0.009	1.00	27	3.20	3.35	0.009	0.009	0.14	0.02	0.000
RB	3.50	0.00	0.00			0.000	1.00	28	3.50	3.50	0.002	0.002	0.04	0.00	0.000
														Total Flow:	0.033

Total Flow:	**0.033**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**0.48**		**(m^2)**
Top Width:	**3.00**		**(m)**
Hydraulic Depth:	**0.161**		**(m)**
Mean Velocity:	**0.069**		**(m/s)**
Froude Number	**0.055**		
Photographs taken looking at: Upstream, downstream, across			

Notes: Rain Gauge at 2015 tips
TSS sample taken.

Datalogger Notes:	**Database # 271**	
Datalogger Internal Power:	4.678V	
Datalogger External Power:	14.04V	
Datalogger Memory Used:	18%	
Datalogger Clock:	Sep 22, 2004 14:42	MST
Laptop Clock:	Sep 22, 2004 14:45	MST
Dessicant:	Bad - replaced	
Datalogger:		
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

S19 - Lowland Tar River

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Lowland Tar River
Location:	Lowland Tar River
Site Name:	S19
Coordinates & Legal:	6352849 N, 457329 E SE-10-96-11-W4

Time of Measurement

Date of Measurement:	November 1, 2004
Start Time:	10:25 AM MST
End Time:	10:30 AM MST

Weather Conditions: -5 C, clear

River Conditions: mostly open at transducer, frozen downstream

Personnel & Equipment

Measurement Made By:	DM/FF
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	2.020	El:	101.478	1.918	El:	101.478
Water Level Reading:	2.945	El:	100.553	2.848	El:	100.548
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El	0.235	El:	100.318	0.235	El:	100.313
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	0.50	0.00	0.00			0.000	1.00	1	0.50	0.55	0.004	0.004	0.02	0.00	0.000
	0.60	0.08	0.00			0.015	1.00	2	0.55	0.65	0.015	0.015	0.08	0.01	0.000
	0.70	0.17	0.00			0.012	1.00	3	0.65	0.75	0.012	0.012	0.17	0.02	0.000
	0.80	0.15	0.00			0.040	1.00	4	0.75	0.85	0.040	0.040	0.15	0.02	0.001
	0.90	0.15	0.00			0.037	1.00	5	0.85	0.95	0.037	0.037	0.15	0.02	0.001
	1.00	0.10	0.00			0.064	1.00	6	0.95	1.05	0.064	0.064	0.10	0.01	0.001
	1.10	0.11	0.00			0.091	1.00	7	1.05	1.15	0.091	0.091	0.11	0.01	0.001
	1.20	0.10	0.00			0.116	1.00	8	1.15	1.25	0.116	0.116	0.10	0.01	0.001
	1.30	0.12	0.00			0.119	1.00	9	1.25	1.35	0.119	0.119	0.12	0.01	0.001
	1.40	0.12	0.00			0.088	1.00	10	1.35	1.45	0.088	0.088	0.12	0.01	0.001
	1.50	0.11	0.00			0.067	1.00	11	1.45	1.55	0.067	0.067	0.11	0.01	0.001
	1.60	0.10	0.00			0.046	1.00	12	1.55	1.65	0.046	0.046	0.10	0.01	0.000
	1.70	0.10	0.00			0.006	1.00	13	1.65	1.80	0.006	0.006	0.10	0.01	0.000
RB	1.89	0.00	0.00			0.000	1.00	14	1.80	1.89	0.002	0.002	0.03	0.00	0.000
														Total Flow:	0.008

Total Flow:	**0.008**		(m^3/s)
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.15**		(m^2)
Top Width:	**1.39**		(m)
Hydraulic Depth:	**0.107**		(m)
Mean Velocity:	**0.054**		(m/s)
Froude Number	**0.053**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:	**Database # 271**	
Datalogger Internal Power:	4.585V	
Datalogger External Power:	12.97V	
Datalogger Memory Used:	23%	
Datalogger Clock:	Nov 01, 2004 09:59	MST
Laptop Clock:	Nov 01, 2004 09:02	MST
Dessicant:	Good	
Datalogger:		
PT:	101352	
Power:		

Notes: Rain Gauge at 2148 tips Transducer removed for winter
TSS sample taken.

Hydrometric Measurement / Site Visit Record

S20 - Muskeg River Upland

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Upland
Site Name:	S20
Coordinates & Legal:	6354787 N, 492178 E SE-19-96-7-W4

Time of Measurement

Date of Measurement:	April 23, 2004
Start Time:	2:45 PM MDT
End Time:	3:00 PM MDT

Weather Conditions: +10 C, Calm, partly cloudy, light wind

River Conditions: Marginal border ice adjacent to banks - open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: Rebar	0.707	El:	50.000	0.687	El:	50.000
Water Level Reading:	2.299	El:	48.408	2.276	El:	48.411
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.413	El:	47.995	0.413	El:	47.998
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	2.70	0.00	0.00			0.000	1.00	1	2.70	2.80	0.002	0.002	0.08	0.01	0.000
	2.90	0.30	0.00			0.009	1.00	2	2.80	2.95	0.009	0.009	0.30	0.05	0.000
	3.00	0.33	0.00			0.009	1.00	3	2.95	3.25	0.009	0.009	0.33	0.10	0.001
	3.50	0.60	0.00			0.009	1.00	4	3.25	3.75	0.009	0.009	0.60	0.30	0.003
	4.00	0.64	0.00			0.012	1.00	5	3.75	4.13	0.012	0.012	0.64	0.24	0.003
	4.25	0.58	0.00			0.015	1.00	6	4.13	4.38	0.015	0.015	0.58	0.15	0.002
	4.50	0.61	0.00			0.015	1.00	7	4.38	4.63	0.015	0.015	0.61	0.15	0.002
	4.75	0.61	0.00			0.037	1.00	8	4.63	4.88	0.037	0.037	0.61	0.15	0.006
	5.00	0.65	0.00			0.098	1.00	9	4.88	5.13	0.098	0.098	0.65	0.16	0.016
	5.25	0.70	0.00			0.125	1.00	10	5.13	5.38	0.125	0.125	0.70	0.18	0.022
	5.50	0.74	0.00			0.186	1.00	11	5.38	5.63	0.186	0.186	0.74	0.19	0.034
	5.75	0.72	0.00			0.210	1.00	12	5.63	5.88	0.210	0.210	0.72	0.18	0.038
	6.00	0.78	0.00			0.274	1.00	13	5.88	6.13	0.274	0.274	0.78	0.20	0.053
	6.25	0.78	0.00			0.259	1.00	14	6.13	6.38	0.259	0.259	0.78	0.20	0.051
	6.50	0.78	0.00			0.229	1.00	15	6.38	6.63	0.229	0.229	0.78	0.20	0.045
	6.75	0.79	0.00			0.204	1.00	16	6.63	6.88	0.204	0.204	0.79	0.20	0.040
	7.00	0.80	0.00			0.189	1.00	17	6.88	7.13	0.189	0.189	0.80	0.20	0.038
	7.25	0.75	0.00			0.210	1.00	18	7.13	7.38	0.210	0.210	0.75	0.19	0.039
	7.50	0.70	0.00			0.174	1.00	19	7.38	7.75	0.174	0.174	0.70	0.26	0.046
	8.00	0.62	0.00			0.104	1.00	20	7.75	8.25	0.104	0.104	0.62	0.31	0.032
	8.50	0.42	0.00			0.107	1.00	21	8.25	8.80	0.107	0.107	0.42	0.23	0.025
RB	9.10	0.00	0.00			0.000	1.00	22	8.80	9.10	0.027	0.027	0.11	0.03	0.001
														Total Flow:	0.496

Total Flow:	**0.496**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**3.85**		**(m^2)**
Top Width:	**6.40**		**(m)**
Hydraulic Depth:	**0.601**		**(m)**
Mean Velocity:	**0.129**		**(m/s)**
Froude Number	**0.053**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**770**
Datalogger Internal Power:	4.5V	
Datalogger External Power:	11.61V	
Datalogger Memory Used:	0%	
Datalogger Clock:	23/04/2004 13:40:00 PM	MST
Laptop Clock:	23/04/2004 14:40:00 PM	MDT
Dessicant:	Good	
Datalogger:	Optimum datalogger s/n#0304300770	
PT:	Keller s/n 0104638 5 psi	
Power:	Car Battery	

Notes:
TSS sample collected.
Equipment installed. Transducer wired to a rock and placed in channel.
New bridge installed downstream, debris and beaver dam removed with old bridge.
New gate at entrance to access road from Canterra road - call 780 720-2220 or 743-8515 for access.

Hydrometric Measurement / Site Visit Record

S20 - Muskeg River Upland

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Upland
Site Name:	S20
Coordinates & Legal:	6354787 N, 492178 E SE-19-96-7-W4

Time of Measurement

Date of Measurement:	May 31, 2004	
Start Time:	8:52 AM	MDT
End Time:	9:12 AM	MDT

Weather Conditions: +9 C, Overcast, Light Rain

River Conditions: open water

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.696	El:	50.000	0.595	El:	50.000
Water Level Reading:	1.992	El:	48.704	1.892	El:	48.703
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.735	El:	47.969	0.735	El:	47.968
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	18.60	0.00	0.00			0.000	1.00	1	18.60	19.05	0.039	0.039	0.19	0.09	0.003
	19.50	0.76	0.00			0.155	1.00	2	19.05	19.75	0.155	0.155	0.76	0.53	0.083
	20.00	0.85	0.00			0.445	1.00	3	19.75	20.25	0.445	0.445	0.85	0.43	0.189
	20.50	0.94	0.00			0.555	1.00	4	20.25	20.63	0.555	0.555	0.94	0.35	0.196
	20.75	0.88	0.00			0.539	1.00	5	20.63	20.88	0.539	0.539	0.88	0.22	0.119
	21.00	0.85	0.00			0.436	1.00	6	20.88	21.13	0.436	0.436	0.85	0.21	0.093
	21.25	0.90	0.00			0.549	1.00	7	21.13	21.38	0.549	0.549	0.90	0.23	0.123
	21.50	0.67	0.00			0.594	1.00	8	21.38	21.63	0.594	0.594	0.67	0.17	0.100
	21.75	0.74	0.00			0.567	1.00	9	21.63	21.88	0.567	0.567	0.74	0.19	0.105
	22.00	0.77	0.00			0.515	1.00	10	21.88	22.13	0.515	0.515	0.77	0.19	0.099
	22.25	0.92	0.00			0.546	1.00	11	22.13	22.38	0.546	0.546	0.92	0.23	0.125
	22.50	0.97	0.00			0.539	1.00	12	22.38	22.63	0.539	0.539	0.97	0.24	0.131
	22.75	0.91	0.00			0.427	1.00	13	22.63	22.88	0.427	0.427	0.91	0.23	0.097
	23.00	0.90	0.00			0.448	1.00	14	22.88	23.13	0.448	0.448	0.90	0.23	0.101
	23.25	0.82	0.00			0.509	1.00	15	23.13	23.38	0.509	0.509	0.82	0.21	0.104
	23.50	0.77	0.00			0.469	1.00	16	23.38	23.75	0.469	0.469	0.77	0.29	0.136
	24.00	0.61	0.00			0.418	1.00	17	23.75	24.25	0.418	0.418	0.61	0.31	0.127
	24.50	0.50	0.00			0.390	1.00	18	24.25	24.50	0.390	0.390	0.50	0.13	0.049
	25.00	0.39	0.00			0.262	1.00	19	24.50	25.30	0.262	0.262	0.39	0.31	0.082
RB	25.60	0.00	0.00			0.000	1.00	20	25.30	25.60	0.066	0.066	0.10	0.03	0.002
														Total Flow:	2.063

Total Flow:	**2.063**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**4.79**		**(m^2)**
Top Width:	**7.00**		**(m)**
Hydraulic Depth:	**0.684**		**(m)**
Mean Velocity:	**0.431**		**(m/s)**
Froude Number	**0.166**		
Photographs taken looking at:			

Datalogger Notes:	**Database**	**770**
Datalogger Internal Power:	4.515V	
Datalogger External Power:	11.24V	
Datalogger Memory Used:	3%	
Datalogger Clock:	May 31, 2004 07:36	MST
Laptop Clock:	31/05/2004 8:37: AM	MDT
Dessicant:	Good	
Datalogger:	Optimum datalogger s/n#0304300770	
PT:	Keller s/n 0104638 5 psi	
Power:	Car Battery	

Notes: TSS sample collected.
Transducer looks good, no movement

Hydrometric Measurement / Site Visit Record

S20 - Muskeg River Upland

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Upland
Site Name:	S20
Coordinates & Legal:	6354787 N, 492178 E SE-19-96-7-W4

Time of Measurement

Date of Measurement:	July 22, 2004	
Start Time:	2:17 PM	MDT
End Time:	2:33 PM	MDT

Weather Conditions: +25 C, Calm, Clear

River Conditions: open water, low flow

Personnel & Equipment

Measurement Made By:	CT/DK
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.661	El:	50.000	0.670	El:	50.000
Water Level Reading:	2.415	El:	48.407	2.423	El:	48.407
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.288	El:	48.119	0.288	El:	48.119
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	7.20	0.00	0.00			0.000	1.00	1	7.20	6.85	0.000	0.000	0.03	0.01	0.000
	6.50	0.12	0.00			0.001	1.00	2	6.85	6.25	0.001	0.001	0.12	0.07	0.000
	6.00	0.22	0.00			0.012	1.00	3	6.25	5.90	0.012	0.012	0.22	0.08	0.001
	5.80	0.26	0.00			0.015	1.00	4	5.90	5.70	0.015	0.015	0.26	0.05	0.001
	5.60	0.33	0.00			0.027	1.00	5	5.70	5.50	0.027	0.027	0.33	0.07	0.002
	5.40	0.42	0.00			0.034	1.00	6	5.50	5.30	0.034	0.034	0.42	0.08	0.003
	5.20	0.43	0.00			0.030	1.00	7	5.30	5.10	0.030	0.030	0.43	0.09	0.003
	5.00	0.48	0.00			0.037	1.00	8	5.10	4.90	0.037	0.037	0.48	0.10	0.004
	4.80	0.50	0.00			0.040	1.00	9	4.90	4.70	0.040	0.040	0.50	0.10	0.004
	4.60	0.48	0.00			0.043	1.00	10	4.70	4.50	0.043	0.043	0.48	0.10	0.004
	4.40	0.52	0.00			0.055	1.00	11	4.50	4.30	0.055	0.055	0.52	0.10	0.006
	4.20	0.50	0.00			0.058	1.00	12	4.30	4.10	0.058	0.058	0.50	0.10	0.006
	4.00	0.53	0.00			0.073	1.00	13	4.10	3.90	0.073	0.073	0.53	0.11	0.008
	3.80	0.50	0.00			0.076	1.00	14	3.90	3.70	0.076	0.076	0.50	0.10	0.008
	3.60	0.38	0.00			0.104	1.00	15	3.70	3.50	0.104	0.104	0.38	0.08	0.008
	3.40	0.45	0.00			0.082	1.00	16	3.50	3.30	0.082	0.082	0.45	0.09	0.007
	3.20	0.41	0.00			0.091	1.00	17	3.30	3.10	0.091	0.091	0.41	0.08	0.007
	3.00	0.39	0.00			0.064	1.00	18	3.10	2.90	0.064	0.064	0.39	0.08	0.005
	2.80	0.40	0.00			0.076	1.00	19	2.90	2.70	0.076	0.076	0.40	0.08	0.006
	2.60	0.37	0.00			0.030	1.00	20	2.70	2.50	0.030	0.030	0.37	0.07	0.002
	2.40	0.37	0.00			0.046	1.00	21	2.50	2.30	0.046	0.046	0.37	0.07	0.003
	2.20	0.36	0.00			0.049	1.00	22	2.30	2.10	0.049	0.049	0.36	0.07	0.004
	2.00	0.32	0.00			0.006	1.00	23	2.10	1.80	0.006	0.006	0.32	0.10	0.001
	1.60	0.17	0.00			0.021	1.00	24	1.80	1.40	0.021	0.021	0.17	0.07	0.001
RB	1.20	0.00	0.00			0.000	1.00	25	1.40	1.20	0.005	0.005	0.04	0.01	0.000
														Total Flow:	0.093

Total Flow:	**0.093**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**1.95**		**(m^2)**
Top Width:	**6.00**		**(m)**
Hydraulic Depth:	**0.325**		**(m)**
Mean Velocity:	**0.048**		**(m/s)**
Froude Number	**0.027**		
Photographs taken looking at:			

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**770**	
Datalogger Internal Power:	4.606V		
Datalogger External Power:	5.343V		
Datalogger Memory Used:	20%		
Datalogger Clock:	Jul 22, 2004 13:10		MST
Laptop Clock:	Jul 22, 2004 14:10		MDT
Dessicant:	20% Good		
Datalogger:	Optimum datalogger s/n#0304300770		
PT:	Keller s/n 0104638 5 psi		
Power:	Car Battery		

Hydrometric Measurement / Site Visit Record

S20 - Upland Muskeg River

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Upland Muskeg River	
Location:	Upland Muskeg River	
Site Name:	S20	
Coordinates & Legal:	6354787 N, 492178 E	SE-19-96-7-W4

Time of Measurement

Date of Measurement:	August 27, 2004	
Start Time:	10:41 AM	MDT
End Time:	10:50 AM	MDT

Weather Conditions: overcast, calm, +8°C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: t post	0.780	El:	50.000	0.773	El:	50.000
Water Level Reading:	2.608	El:	48.172	2.604	El:	48.169
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.221	El:	47.951	0.221	El:	47.948
Other:	0.067	El:	48.105	0.067	El:	48.102

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	19.10	0.00	0.00			0.000	1.00	1	19.10	19.30	-0.003	-0.003	0.04	0.01	0.000
	19.50	0.15	0.00			-0.012	1.00	2	19.30	19.70	-0.012	-0.012	0.15	0.06	-0.001
	19.90	0.39	0.00			0.006	1.00	3	19.70	20.10	0.006	0.006	0.39	0.16	0.001
	20.30	0.40	0.00			0.003	1.00	4	20.10	20.50	0.003	0.003	0.40	0.16	0.000
	20.70	0.38	0.00			0.012	1.00	5	20.50	20.90	0.012	0.012	0.38	0.15	0.002
	21.10	0.37	0.00			0.052	1.00	6	20.90	21.30	0.052	0.052	0.37	0.15	0.008
	21.50	0.37	0.00			0.009	1.00	7	21.30	21.70	0.009	0.009	0.37	0.15	0.001
	21.90	0.37	0.00			0.009	1.00	8	21.70	22.10	0.009	0.009	0.37	0.15	0.001
	22.30	0.36	0.00			0.049	1.00	9	22.10	22.40	0.049	0.049	0.36	0.11	0.005
	22.50	0.30	0.00			0.037	1.00	10	22.40	22.60	0.037	0.037	0.30	0.06	0.002
	22.70	0.40	0.00			0.030	1.00	11	22.60	22.85	0.030	0.030	0.40	0.10	0.003
	23.00	0.37	0.00			0.018	1.00	12	22.85	23.20	0.018	0.018	0.37	0.13	0.002
	23.40	0.33	0.00			0.030	1.00	13	23.20	23.55	0.030	0.030	0.33	0.12	0.004
	23.70	0.28	0.00			0.030	1.00	14	23.55	23.85	0.030	0.030	0.28	0.08	0.003
	24.00	0.20	0.00			0.021	1.00	15	23.85	24.15	0.021	0.021	0.20	0.06	0.001
	24.30	0.10	0.00			0.021	1.00	16	24.15	24.45	0.021	0.021	0.10	0.03	0.001
RB	24.60	0.00	0.00			0.000	1.00	17	24.45	24.60	0.005	0.005	0.03	0.00	0.000
														Total Flow:	0.034

Total Flow:	**0.034**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**1.67**		**(m^2)**
Top Width:	**5.50**		**(m)**
Hydraulic Depth:	**0.304**		**(m)**
Mean Velocity:	**0.020**		**(m/s)**
Froude Number	**0.012**		

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:	**Database # 770**	
Datalogger Internal Power:	4.436V	
Datalogger External Power:	4.832V	
Datalogger Memory Used:	10%	
Datalogger Clock:	Aug 27, 2004 09:20	MST
Laptop Clock:	Aug 27, 2004 10:22	MDT
Dessicant:	bad - replaced	
Datalogger:		
PT:		
Power:		

Notes:
Replaced car battery - new external power is 12.66 V
transducer depth changed from 0.067166 to 0.220985

Hydrometric Measurement / Site Visit Record

S20 - Upland Muskeg River

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Upland Muskeg River
Location:	Upland Muskeg River
Site Name:	S20
Coordinates & Legal:	6354787 N, 492178 E SE-19-96-7-W4

Time of Measurement

Date of Measurement:	September 21, 2004
Start Time:	6:34 PM MDT
End Time:	6:52 PM MDT

Weather Conditions: partly cloudy, calm, +18°C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: t post	0.845	El:	50.000	0.848	El:	50.000
Water Level Reading:	2.508	El:	48.337	2.507	El:	48.341
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.385	El:	47.952	0.385	El:	47.956
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	16.70	0.00	0.00			0.000	1.00	1	16.70	16.85	0.004	0.004	0.04	0.01	0.000
	17.00	0.14	0.00			0.015	1.00	2	17.00	17.20	0.015	0.015	0.14	0.03	0.000
	17.40	0.23	0.00			0.030	1.00	3	17.40	17.60	0.030	0.030	0.23	0.05	0.001
	17.80	0.32	0.00			0.043	1.00	4	17.80	18.00	0.043	0.043	0.32	0.06	0.003
	18.20	0.35	0.00			0.064	1.00	5	18.20	18.40	0.064	0.064	0.35	0.07	0.004
	18.60	0.41	0.00			0.079	1.00	6	18.60	18.75	0.079	0.079	0.41	0.06	0.005
	18.90	0.52	0.00			0.082	1.00	7	18.90	19.05	0.082	0.082	0.52	0.08	0.006
	19.20	0.58	0.00			0.101	1.00	8	19.20	19.35	0.101	0.101	0.58	0.09	0.009
	19.50	0.59	0.00			0.110	1.00	9	19.50	19.65	0.110	0.110	0.59	0.09	0.010
	19.80	0.61	0.00			0.119	1.00	10	19.80	19.95	0.119	0.119	0.61	0.09	0.011
	20.10	0.56	0.00			0.165	1.00	11	20.10	20.25	0.165	0.165	0.56	0.08	0.014
	20.40	0.57	0.00			0.143	1.00	12	20.40	20.55	0.143	0.143	0.57	0.09	0.012
	20.70	0.53	0.00			0.189	1.00	13	20.70	20.85	0.189	0.189	0.53	0.08	0.015
	21.00	0.52	0.00			0.213	1.00	14	21.00	21.15	0.213	0.213	0.52	0.08	0.017
	21.30	0.50	0.00			0.101	1.00	15	21.30	21.45	0.101	0.101	0.50	0.08	0.008
	21.60	0.42	0.00			0.125	1.00	16	21.60	21.80	0.125	0.125	0.42	0.08	0.010
	22.00	0.44	0.00			0.064	1.00	17	22.00	22.15	0.064	0.064	0.44	0.07	0.004
	22.30	0.34	0.00			0.098	1.00	18	22.30	22.45	0.098	0.098	0.34	0.05	0.005
	22.60	0.23	0.00			0.082	1.00	19	22.60	22.80	0.082	0.082	0.23	0.05	0.004
LB	23.00	0.00	0.00			0.000	1.00	20	23.00	23.00	0.021	0.021	0.06	0.00	0.000
														Total Flow:	0.138

Total Flow:	**0.138**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**1.27**		**(m^2)**
Top Width:	**6.30**		**(m)**
Hydraulic Depth:	**0.201**		**(m)**
Mean Velocity:	**0.109**		**(m/s)**
Froude Number	**0.078**		

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:	**Database # 770**	
Datalogger Internal Power:	4.595V	
Datalogger External Power:	12.53V	
Datalogger Memory Used:	12%	
Datalogger Clock:	Sep 21, 2004 17:58	MST
Laptop Clock:	Sep 21, 2004 18:00	MST
Dessicant:	good	

Datalogger:
PT:
Power:

Notes:
TSS sample taken

Hydrometric Measurement / Site Visit Record

S20 - Upland Muskeg River

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Upland Muskeg River
Location:	Upland Muskeg River
Site Name:	S20
Coordinates & Legal:	6354787 N, 492178 E SE-19-96-7-W4

Time of Measurement

Date of Measurement:	October 29, 2004
Start Time:	2:57 PM MDT
End Time:	3:28 PM MDT

Personnel & Equipment

Measurement Made By:	DM/DM/FF
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: t post	0.732	El:	50.000	0.552	El:	50.000
Water Level Reading:	2.471	El:	48.261	2.295	El:	48.257
Top of Ice Level Reading:	2.395	El:	48.337	2.215	El:	48.337
Transducer Reading & Calc'd E	0.307	El:	47.954	0.307	El:	47.950
Other:		El:			El:	

Weather Conditions: clear, calm, +5°C

River Conditions: Partial ice cover with full ice cover at MMT section. Ice broken out at MMT section.

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	1.75	0.00	0.00			0.000	1.00	1	1.75	1.88	0.001	0.001	0.05	0.01	0.000
	2.00	0.20	0.00			0.003	1.00	2	2.00	2.25	0.003	0.003	0.20	0.05	0.000
	2.50	0.41	0.00			0.009	1.00	3	2.50	2.75	0.009	0.009	0.41	0.10	0.001
	3.00	0.62	0.00			0.082	1.00	4	3.00	3.13	0.082	0.082	0.62	0.08	0.006
	3.25	0.61	0.00			0.076	1.00	5	3.25	3.38	0.076	0.076	0.61	0.08	0.006
	3.50	0.64	0.00			0.110	1.00	6	3.50	3.75	0.110	0.110	0.64	0.16	0.018
	4.00	0.65	0.00			0.122	1.00	7	4.00	4.13	0.122	0.122	0.65	0.08	0.010
	4.25	0.70	0.00			0.134	1.00	8	4.25	4.38	0.134	0.134	0.70	0.09	0.012
	4.50	0.70	0.00			0.119	1.00	9	4.50	4.63	0.119	0.119	0.70	0.09	0.010
	4.75	0.76	0.00			0.131	1.00	10	4.75	4.88	0.131	0.131	0.76	0.10	0.012
	5.00	0.80	0.00			0.128	1.00	11	5.00	5.13	0.128	0.128	0.80	0.10	0.013
	5.25	0.80	0.00			0.091	1.00	12	5.25	5.38	0.091	0.091	0.80	0.10	0.009
	5.50	0.73	0.00			0.046	1.00	13	5.50	5.63	0.046	0.046	0.73	0.09	0.004
	5.75	0.72	0.00			0.043	1.00	14	5.75	5.88	0.043	0.043	0.72	0.09	0.004
	6.00	0.67	0.00			0.034	1.00	15	6.00	6.25	0.034	0.034	0.67	0.17	0.006
	6.50	0.55	0.00			0.012	1.00	16	6.50	6.75	0.012	0.012	0.55	0.14	0.002
	7.00	0.50	0.00			0.009	1.00	17	7.00	7.25	0.009	0.009	0.50	0.13	0.001
	7.50	0.36	0.00			0.003	1.00	18	7.50	7.85	0.003	0.003	0.36	0.13	0.000
	8.20	0.00	0.00			0.003	1.00	19	8.20	8.21	0.003	0.003	0.00	0.00	0.000
LB	8.21	0.00	0.00			0.000	1.00	20	8.21	8.21	0.001	0.001	0.00	0.00	0.000
														Total Flow:	0.114

Total Flow:	**0.114**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**1.76**		**(m^2)**
Top Width:	**6.46**		**(m)**
Hydraulic Depth:	**0.273**		**(m)**
Mean Velocity:	**0.065**		**(m/s)**
Froude Number	**0.040**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:	**Database # 770**	
Datalogger Internal Power:	4.544V	
Datalogger External Power:	12.26V	
Datalogger Memory Used:	15%	
Datalogger Clock:	Oct 29, 2004 14:04	MST
Laptop Clock:	Oct 29, 2004 14:09	MST
Dessicant:	good	
Datalogger:		
PT:	104638	
Power:		

Notes:
TSS sample taken
Equipment removed for winter.

Hydrometric Measurement / Site Visit Record

S22 - Muskeg Creek near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg Creek
Location:	Muskeg Creek near the Mouth
Site Name:	S22
Coordinates & Legal:	6348856 N, 481036 E SE-36-95-9-W4

Time of Measurement

Date of Measurement:	April 23, 2004
Start Time:	10:43 AM MDT
End Time:	10:54 AM MDT

Weather Conditions: +7 C, windy, partly cloudy

River Conditions: Marginal border ice adjacent to banks - open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: t-bar	1.434	El:	306.476	1.323	El:	306.476
Water Level Reading:	4.387	El:	303.523	4.282	El:	303.517
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.290	El:	303.233	0.290	El:	303.227
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	2.50	0.00	0.00			0.000	1.00	1	2.50	2.63	0.072	0.072	0.05	0.01	0.000
	2.75	0.18	0.00			0.290	1.00	2	2.63	2.88	0.290	0.290	0.18	0.05	0.013
	3.00	0.15	0.00			0.287	1.00	3	2.88	3.25	0.287	0.287	0.15	0.06	0.016
	3.50	0.18	0.00			0.134	1.00	4	3.25	3.75	0.134	0.134	0.18	0.09	0.012
	4.00	0.25	0.00			0.375	1.00	5	3.75	4.13	0.375	0.375	0.25	0.09	0.035
	4.25	0.34	0.00			0.387	1.00	6	4.13	4.38	0.387	0.387	0.34	0.09	0.033
	4.50	0.38	0.00			0.360	1.00	7	4.38	4.63	0.360	0.360	0.38	0.10	0.034
	4.75	0.43	0.00			0.341	1.00	8	4.63	4.88	0.341	0.341	0.43	0.11	0.037
	5.00	0.48	0.00			0.469	1.00	9	4.88	5.13	0.469	0.469	0.48	0.12	0.056
	5.25	0.51	0.00			0.546	1.00	10	5.13	5.38	0.546	0.546	0.51	0.13	0.070
	5.50	0.54	0.00			0.814	1.00	11	5.38	5.63	0.814	0.814	0.54	0.14	0.110
	5.75	0.46	0.00			0.786	1.00	12	5.63	5.88	0.786	0.786	0.46	0.12	0.090
	6.00	0.35	0.00			0.924	1.00	13	5.88	6.13	0.924	0.924	0.35	0.09	0.081
	6.25	0.40	0.00			0.777	1.00	14	6.13	6.38	0.777	0.777	0.40	0.10	0.078
	6.50	0.38	0.00			0.555	1.00	15	6.38	6.63	0.555	0.555	0.38	0.10	0.053
	6.75	0.37	0.00			0.466	1.00	16	6.63	6.88	0.466	0.466	0.37	0.09	0.043
	7.00	0.43	0.00			0.155	1.00	17	6.88	7.13	0.155	0.155	0.43	0.11	0.017
	7.25	0.39	0.00			0.018	1.00	18	7.13	7.50	0.018	0.018	0.39	0.15	0.003
	7.75	0.34	0.00			0.012	1.00	19	7.50	7.88	0.012	0.012	0.34	0.13	0.002
	8.00	0.20	0.00			0.009	1.00	20	7.88	8.25	0.009	0.009	0.20	0.08	0.001
	8.50	0.11	0.00			0.009	1.00	21	8.25	8.65	0.009	0.009	0.11	0.04	0.000
RB	8.80	0.00	0.00			0.000	1.00	22	8.65	8.80	0.002	0.002	0.03	0.00	0.000
														Total Flow:	0.783

Total Flow:	**0.783**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**1.96**		**(m^2)**
Top Width:	**6.30**		**(m)**
Hydraulic Depth:	**0.310**		**(m)**
Mean Velocity:	**0.401**		**(m/s)**
Froude Number	**0.230**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database 602**	
Datalogger Internal Power:	4.71V	
Datalogger External Power:	13.89V	
Datalogger Memory Used:	0%	
Datalogger Clock:	Apr 23, 2004 09:32	MST
Laptop Clock:	Apr 23, 2004 10:32	MDT
Dessicant:	Good	

Datalogger: Optimum DD128, #0204100602
PT: Keller 730-130-5 psi #0101348
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:

Equipment installed. Transducer installed into housing tube, but not placed as deeply as in 2003 due to ice. Sensor roughly 300 mm less far in than in 2003.
Stage was rising throughout the day. Later on the same day stage was observed to be 0.08 m higher than at time of installation.
TSS sample collected.

Hydrometric Measurement / Site Visit Record

S22 - Muskeg Creek near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg Creek
Location:	Muskeg Creek near the Mouth
Site Name:	S22
Coordinates & Legal:	6348856 N, 481036 E SE-36-95-9-W4

Time of Measurement

Date of Measurement:	May 31, 2004
Start Time:	11:20 AM MDT
End Time:	11:42 AM MDT

Weather Conditions: overcast, raining, +9 C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: t-bar	1.406	El:	306.476	1.393	El:	306.476
Water Level Reading:	3.895	El:	303.987	3.884	El:	303.985
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.755	El:	303.232	0.755	El:	303.230
Other:	0.774	El:	303.213	0.774	El:	303.211

Measurement Data

	Measured Data						Calculated Data									
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	25.40		0.00			0.000	1.00	1	25.40	25.33	0.000	0.000	0.05	0.00	0.000
	25.25	0.18	0.00			0.000	1.00	2	25.33	25.13	0.000	0.000	0.18	0.04	0.000
	25.00	0.27	0.00			0.009	1.00	3	25.13	24.88	0.009	0.009	0.27	0.07	0.001
	24.75	0.32	0.00			0.000	1.00	4	24.88	24.63	0.000	0.000	0.32	0.08	0.000
	24.50	0.38	0.00			0.149	1.00	5	24.63	24.38	0.149	0.149	0.38	0.10	0.014
	24.25	0.45	0.00			0.134	1.00	6	24.38	24.13	0.134	0.134	0.45	0.11	0.015
	24.00	0.52	0.00			0.415	1.00	7	24.13	23.88	0.415	0.415	0.52	0.13	0.054
	23.75	0.64	0.00			0.494	1.00	8	23.88	23.63	0.494	0.494	0.64	0.16	0.079
	23.50	0.59	0.00			0.780	1.00	9	23.63	23.38	0.780	0.780	0.59	0.15	0.115
	23.25	0.64	0.00			1.055	1.00	10	23.38	23.13	1.055	1.055	0.64	0.16	0.169
	23.00	0.75	0.00			0.994	1.00	11	23.13	22.88	0.994	0.994	0.75	0.19	0.186
	22.75	0.83	0.00			1.061	1.00	12	22.88	22.63	1.061	1.061	0.83	0.21	0.220
	22.50	0.86	0.00			1.006	1.00	13	22.63	22.38	1.006	1.006	0.86	0.22	0.216
	22.25	0.83	0.00			0.963	1.00	14	22.38	22.13	0.963	0.963	0.83	0.21	0.200
	22.00	0.83	0.00			1.058	1.00	15	22.13	21.88	1.058	1.058	0.83	0.21	0.219
	21.75	0.82	0.00			0.936	1.00	16	21.88	21.63	0.936	0.936	0.82	0.21	0.192
	21.50	0.80	0.00			0.637	1.00	17	21.63	21.25	0.637	0.637	0.80	0.30	0.191
	21.00	0.46	0.00			0.625	1.00	18	21.25	20.75	0.625	0.625	0.46	0.23	0.144
	20.50	0.81	0.00			0.604	1.00	19	20.75	20.25	0.604	0.604	0.81	0.41	0.244
	20.00	0.80	0.00			0.482	1.00	20	20.25	19.00	0.482	0.482	0.80	1.00	0.482
	19.50	0.84	0.00			0.332	1.00	21	19.00	18.28	0.332	0.332	0.84	0.60	0.200
	19.00	0.73	0.00			0.287	1.00	22	18.28	18.04	0.287	0.287	0.73	0.18	0.051
	18.50	0.68	0.00			0.323	1.00	23	18.04	17.80	0.323	0.323	0.68	0.16	0.053
	18.00	0.63	0.00			0.232	1.00	24	19.00	17.57	0.232	0.232	0.63	0.90	0.209
	17.50	0.46	0.00			0.067	1.00	25	18.28	17.35	0.067	0.067	0.46	0.43	0.029
	17.20		0.00			0.000	1.00	26	17.57	17.20	0.058	0.058	0.12	0.04	0.002
														Total Flow:	3.285

Total Flow:	**3.285**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**6.47**		**(m^2)**
Top Width:	**8.20**		**(m)**
Hydraulic Depth:	**0.789**		**(m)**
Mean Velocity:	**0.508**		**(m/s)**
Froude Number	**0.183**		
Photographs taken looking at:			

Datalogger Notes:	**Database**	**602**
Datalogger Internal Power:	5	
Datalogger External Power:	13.60	
Datalogger Memory Used:	3%	
Datalogger Clock:	9:57:42 AM	MST
Laptop Clock:	10:58 AM	MDT
Dessicant:	Good	

Datalogger: Optimum DD128, #0204100602
PT: Keller 730-130-5 psi #0101348
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: Data downloaded, transducer was pushed further into tube to 2003 level. Transducer reading changed from 0.754876 to 0.774466 m.

TSS sample collected.

Hydrometric Measurement / Site Visit Record

S22 - Muskeg Creek near the Mouth

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg Creek
Location:	Muskeg Creek near the Mouth
Site Name:	S22
Coordinates & Legal:	6348856 N, 481036 E SE-36-95-9-W4

Time of Measurement

Date of Measurement:	July 22, 2004
Start Time:	10:59 AM MDT
End Time:	11:12 AM MDT

Weather Conditions: + 23 °C, Clear

River Conditions: open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**		**Setup No. 2**
Bench Mark Reading:		El:		El:
Water Level Reading:		El:	303.330	El:
Top of Ice Level Reading:		El:		El:
Transducer Reading & Calc'd E	0.101	El:	303.229	El:
Other: W Abut		El:		El:

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	0.46		0.00			0.000	1.00	1	0.46	0.58	0.112	0.112	0.01	0.00	0.000
	0.70	0.05	0.00			0.448	1.00	2	0.58	0.75	0.448	0.448	0.05	0.01	0.004
	0.80	0.06	0.00			0.674	1.00	3	0.75	0.85	0.674	0.674	0.06	0.01	0.004
	0.90	0.07	0.00			0.686	1.00	4	0.85	0.95	0.686	0.686	0.07	0.01	0.005
	1.00	0.06	0.00			0.628	1.00	5	0.95	1.05	0.628	0.628	0.06	0.01	0.004
	1.10	0.11	0.00			0.649	1.00	6	1.05	1.15	0.649	0.649	0.11	0.01	0.007
	1.20	0.11	0.00			0.878	1.00	7	1.15	1.25	0.878	0.878	0.11	0.01	0.010
	1.30	0.11	0.00			1.076	1.00	8	1.25	1.35	1.076	1.076	0.11	0.01	0.012
	1.40	0.10	0.00			1.204	1.00	9	1.35	1.45	1.204	1.204	0.10	0.01	0.012
	1.50	0.13	0.00			1.186	1.00	10	1.45	1.55	1.186	1.186	0.13	0.01	0.015
	1.60	0.13	0.00			1.088	1.00	11	1.55	1.65	1.088	1.088	0.13	0.01	0.014
	1.70	0.13	0.00			1.055	1.00	12	1.65	1.75	1.055	1.055	0.13	0.01	0.014
	1.80	0.13	0.00			0.972	1.00	13	1.75	1.85	0.972	0.972	0.13	0.01	0.013
	1.90	0.13	0.00			0.936	1.00	14	1.85	1.95	0.936	0.936	0.13	0.01	0.012
	2.00	0.13	0.00			0.689	1.00	15	1.95	2.05	0.689	0.689	0.13	0.01	0.009
	2.10	0.12	0.00			0.722	1.00	16	2.05	2.15	0.722	0.722	0.12	0.01	0.009
	2.20	0.07	0.00			0.454	1.00	17	2.15	2.25	0.454	0.454	0.07	0.01	0.003
	2.30	0.08	0.00			0.628	1.00	18	2.25	2.35	0.628	0.628	0.08	0.01	0.005
	2.40	0.11	0.00			0.216	1.00	19	2.35	2.45	0.216	0.216	0.11	0.01	0.002
	2.50	0.07	0.00			0.223	1.00	20	2.45	2.55	0.223	0.223	0.07	0.01	0.002
	2.60	0.06	0.00			0.162	1.00	21	2.55	2.65	0.162	0.162	0.06	0.01	0.001
	2.70	0.02	0.00			0.040	1.00	22	2.65	2.75	0.040	0.040	0.02	0.00	0.000
RB	2.80		0.00			0.000	1.00	23	2.75	2.80	0.010	0.010	0.01	0.00	0.000
														Total Flow:	0.156

Total Flow:	**0.156**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**0.20**		**(m^2)**
Top Width:	**2.34**		**(m)**
Hydraulic Depth:	**0.087**		**(m)**
Mean Velocity:	**0.768**		**(m/s)**
Froude Number	**0.832**		
Photographs taken looking at:			

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**602**
Datalogger Internal Power:	4.777 V	
Datalogger External Power:	13.44 V	
Datalogger Memory Used:	7%	
Datalogger Clock:	9:40: AM	MST
Laptop Clock:	10:41 AM	MDT
Dessicant:	60% Good	

Datalogger: Optimum DD128, #0204100602
PT: Keller 730-130-5 psi #0101348
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S22 - Muskeg Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg Creek
Location:	Muskeg Creek
Site Name:	S22
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 28, 2004	
Start Time:	9:12 AM	MDT
End Time:	9:23 AM	MDT

Weather Conditions:

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: t post	1.017	El:	306.476	1.043	El:	306.476
Water Level Reading:	4.252	El:	303.241	4.277	El:	303.242
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.008	El:	303.233	0.008	El:	303.234
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	0.50	0.00	0.00			0.000	1.00	1	0.50	0.60	-0.001	-0.001	0.01	0.00	0.000
	0.70	0.05	0.00			-0.003	1.00	2	0.60	0.80	-0.003	-0.003	0.05	0.01	0.000
	0.90	0.12	0.00			0.040	1.00	3	0.80	1.00	0.040	0.040	0.12	0.02	0.001
	1.10	0.23	0.00			0.043	1.00	4	1.00	1.15	0.043	0.043	0.23	0.03	0.001
	1.20	0.25	0.00			0.082	1.00	5	1.15	1.25	0.082	0.082	0.25	0.03	0.002
	1.30	0.27	0.00			0.082	1.00	6	1.25	1.35	0.082	0.082	0.27	0.03	0.002
	1.40	0.30	0.00			0.079	1.00	7	1.35	1.45	0.079	0.079	0.30	0.03	0.002
	1.50	0.33	0.00			0.073	1.00	8	1.45	1.55	0.073	0.073	0.33	0.03	0.002
	1.60	0.34	0.00			0.043	1.00	9	1.55	1.65	0.043	0.043	0.34	0.03	0.001
	1.70	0.37	0.00			0.049	1.00	10	1.65	1.75	0.049	0.049	0.37	0.04	0.002
	1.80	0.36	0.00			0.034	1.00	11	1.75	1.90	0.034	0.034	0.36	0.05	0.002
	2.00	0.37	0.00			0.021	1.00	12	1.90	2.10	0.021	0.021	0.37	0.07	0.002
	2.20	0.38	0.00			0.006	1.00	13	2.10	2.30	0.006	0.006	0.38	0.08	0.000
	2.40	0.38	0.00			-0.006	1.00	14	2.30	2.50	-0.006	-0.006	0.38	0.08	0.000
	2.60	0.35	0.00			0.000	1.00	15	2.50	2.70	0.000	0.000	0.35	0.07	0.000
	2.80	0.27	0.00			-0.003	1.00	16	2.70	2.90	-0.003	-0.003	0.27	0.05	0.000
	3.00	0.22	0.00			-0.003	1.00	17	2.90	3.10	-0.003	-0.003	0.22	0.04	0.000
	3.20	0.17	0.00			0.003	1.00	18	3.10	3.30	0.003	0.003	0.17	0.03	0.000
RB	3.40	0.00	0.00			0.000	1.00	19	3.30	3.40	0.001	0.001	0.04	0.00	0.000
														Total Flow:	0.018

Total Flow:	**0.018**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.74**		**(m^2)**
Top Width:	**2.90**		**(m)**
Hydraulic Depth:	**0.256**		**(m)**
Mean Velocity:	**0.024**		**(m/s)**
Froude Number	**0.015**		

Photographs taken looking at:
Upstream, downstream, across

Notes:

Datalogger Notes:	**Database # 602**	
Datalogger Internal Power:	4.625 V	
Datalogger External Power:	12.01 V	
Datalogger Memory Used:	10%	
Datalogger Clock:	Aug 28, 2004 07:58	MST
Laptop Clock:	Aug 28, 2004 09:01	MDT
Dessicant:	25% - replaced with new	

Datalogger:
PT:
Power:

Hydrometric Measurement / Site Visit Record

S22 - Muskeg Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg Creek
Location:	Muskeg Creek
Site Name:	S22
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 21, 2004	
Start Time:	2:37 PM	MDT
End Time:	2:47 PM	MDT

Weather Conditions:

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: t post	0.222	El:	306.476	0.428	El:	306.476
Water Level Reading:	3.317	El:	303.381	3.515	El:	303.389
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.147	El:	303.234	0.147	El:	303.242
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	17.90	0.00	0.00			0.000	1.00	1	17.90	18.05	0.010	0.010	0.01	0.00	0.000
	18.20	0.04	0.00			0.040	1.00	2	18.05	18.35	0.040	0.040	0.04	0.01	0.000
	18.50	0.05	0.00			0.000	1.00	3	18.35	18.65	0.000	0.000	0.05	0.01	0.000
	18.80	0.10	0.00			0.329	1.00	4	18.65	18.90	0.329	0.329	0.10	0.03	0.008
	19.00	0.16	0.00			0.415	1.00	5	18.90	19.10	0.415	0.415	0.16	0.03	0.013
	19.20	0.19	0.00			0.393	1.00	6	19.10	19.30	0.393	0.393	0.19	0.04	0.015
	19.40	0.19	0.00			0.436	1.00	7	19.30	19.50	0.436	0.436	0.19	0.04	0.017
	19.60	0.21	0.00			0.799	1.00	8	19.50	19.70	0.799	0.799	0.21	0.04	0.034
	19.80	0.22	0.00			0.792	1.00	9	19.70	19.90	0.792	0.792	0.22	0.04	0.035
	20.00	0.23	0.00			0.832	1.00	10	19.90	20.10	0.832	0.832	0.23	0.05	0.038
	20.20	0.20	0.00			0.762	1.00	11	20.10	20.30	0.762	0.762	0.20	0.04	0.030
	20.40	0.17	0.00			0.841	1.00	12	20.30	20.50	0.841	0.841	0.17	0.03	0.029
	20.60	0.15	0.00			0.783	1.00	13	20.50	20.70	0.783	0.783	0.15	0.03	0.024
	20.80	0.12	0.00			0.722	1.00	14	20.70	20.90	0.722	0.722	0.12	0.02	0.017
	21.00	0.05	0.00			0.290	1.00	15	20.90	21.10	0.290	0.290	0.05	0.01	0.003
	21.20	0.03	0.00			-0.012	1.00	16	21.10	21.30	-0.012	-0.012	0.03	0.01	0.000
LB	21.40	0.00	0.00			0.000	1.00	17	21.30	21.40	-0.003	-0.003	0.01	0.00	0.000
														Total Flow:	0.263

Total Flow:	**0.263**		**(m^3/s)**
Perceived Measurement Quality:	**Fair**		
Total Area:	**0.44**		**(m^2)**
Top Width:	**3.50**		**(m)**
Hydraulic Depth:	**0.125**		**(m)**
Mean Velocity:	**0.600**		**(m/s)**
Froude Number	**0.541**		
Photographs taken looking at: Upstream, downstream, across (may have been lost with camera)			

Datalogger Notes:	**Database # 602**	
Datalogger Internal Power:	4.745 V	
Datalogger External Power:	13.59 V	
Datalogger Memory Used:	12%	
Datalogger Clock:	Sep 21, 2004 13:14	MST
Laptop Clock:	Sep 21, 2004 13:21	MST
Dessicant:	Good - 100%	
Datalogger:	0204100602	
PT:	?	
Power:		

Notes:

Switch wire was unplugged, likely got unplugged at the end of the last visit, bad data from Aug 28 - Sept 21
TSS Sample Taken
Database # 602

Hydrometric Measurement / Site Visit Record

S22 - Muskeg Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg Creek
Location:	Muskeg Creek
Site Name:	S22
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 29, 2004	
Start Time:	10:32 AM	MDT
End Time:	11:15 AM	MDT

Weather Conditions: -5 C clear, calm.

River Conditions: Partial ice cover, ice cover at both banks; ice broken out for MMT.

Personnel & Equipment

Measurement Made By:	FF/DM/ND
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: t post	0.383	El:	306.476	0.315	El:	306.476
Water Level Reading:	3.488	El:	303.371	3.415	El:	303.376
Top of Ice Level Reading:	3.454	El:	303.405	3.380	El:	303.411
Transducer Reading & Calc'd E	0.114	El:	303.257	0.114	El:	303.262
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	3.10	0.00	0.00			0.000	1.00	1	3.10	3.18	0.001	0.001	0.01	0.00	0.000
	3.25	0.04	0.00			0.003	1.00	2	3.18	3.38	0.003	0.003	0.04	0.01	0.000
	3.50	0.12	0.00			0.320	1.00	3	3.38	3.55	0.320	0.320	0.12	0.02	0.007
	3.60	0.16	0.00			0.616	1.00	4	3.55	3.65	0.616	0.616	0.16	0.02	0.010
	3.70	0.17	0.00			0.619	1.00	5	3.65	3.75	0.619	0.619	0.17	0.02	0.011
	3.80	0.17	0.00			0.753	1.00	6	3.75	3.85	0.753	0.753	0.17	0.02	0.013
	3.90	0.16	0.00			0.613	1.00	7	3.85	3.95	0.613	0.613	0.16	0.02	0.010
	4.00	0.19	0.00			0.594	1.00	8	3.95	4.05	0.594	0.594	0.19	0.02	0.011
	4.10	0.18	0.00			0.597	1.00	9	4.05	4.15	0.597	0.597	0.18	0.02	0.011
	4.20	0.22	0.00			0.732	1.00	10	4.15	4.25	0.732	0.732	0.22	0.02	0.016
	4.30	0.21	0.00			0.744	1.00	11	4.25	4.35	0.744	0.744	0.21	0.02	0.016
	4.40	0.20	0.00			0.872	1.00	12	4.35	4.45	0.872	0.872	0.20	0.02	0.017
	4.50	0.23	0.00			0.872	1.00	13	4.45	4.55	0.872	0.872	0.23	0.02	0.020
	4.60	0.24	0.00			0.802	1.00	14	4.55	4.65	0.802	0.802	0.24	0.02	0.019
	4.70	0.21	0.00			0.878	1.00	15	4.65	4.75	0.878	0.878	0.21	0.02	0.018
	4.80	0.21	0.00			0.768	1.00	16	4.75	4.85	0.768	0.768	0.21	0.02	0.016
	4.90	0.20	0.00			0.668	1.00	17	4.85	4.95	0.668	0.668	0.20	0.02	0.013
	5.00	0.17	0.00			0.430	1.00	18	4.95	5.10	0.430	0.430	0.17	0.03	0.011
	5.20	0.17	0.00			0.341	1.00	19	5.10	5.30	0.341	0.341	0.17	0.03	0.012
	5.40	0.08	0.00			0.445	1.00	20	5.30	5.55	0.445	0.445	0.08	0.02	0.009
	5.70	0.04	0.00			0.082	1.00	21	5.55	5.85	0.082	0.082	0.04	0.01	0.001
	6.00	0.04	0.00			0.098	1.00	22	5.85	6.13	0.098	0.098	0.04	0.01	0.001
LB	6.25	0.00	0.00			0.000	1.00	23	6.13	6.25	0.024	0.024	0.01	0.00	0.000
														Total Flow:	0.242

Total Flow:	**0.242**		**(m^3/s)**
Perceived Measurement Quality:	**Good**		
Total Area:	**0.41**		**(m^2)**
Top Width:	**3.15**		**(m)**
Hydraulic Depth:	**0.130**		**(m)**
Mean Velocity:	**0.592**		**(m/s)**
Froude Number	**0.525**		

Photographs taken looking at:
Upstream, downstream, across (may have been lost with camera)

Datalogger Notes:	**Database # 602**	
Datalogger Internal Power:	4.683 V	
Datalogger External Power:	14.17 V	
Datalogger Memory Used:	16%	
Datalogger Clock:	Oct 29, 2004 09:43	MST
Laptop Clock:	Oct 29, 2004 09:49	MST
Dessicant:	Good - 100%	
Datalogger:	0204100602	
PT:		
Power:		

Notes:
Transducer removed for winter.
TSS Sample Taken
Database # 602

Hydrometric Measurement / Site Visit Record

S24 - Athabasca River Below Eymundsen Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Athabasca River
Location:	Athabasca River Below Eymundsen Creek
Site Name:	S24
Coordinates & Legal:	466313 E, 6372760 N NE-9-98-10-W4

Time of Measurement

Date of Measurement:	February 3, 2004
Start Time:	12:36 PM MDT
End Time:	1:15 PM MDT

Weather Conditions: -20 °C, Clear, windy

River Conditions: Complete ice cover.

Personnel & Equipment

Measurement Made By:	DM/FF
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	Nail in Tree	0.193	El:	231.096
Water Level Reading:		5.260	El:	226.029
Top of Ice Level Reading:		5.038	El:	N/A
Transducer Reading & Level:		0.672	El:	225.357
Other:	T-bar	-0.066	El:	231.355

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	0.00	0.00	0.60			0.000	0.90	1	0.00	9.71	0.033	0.029	0.11	1.07	0.031
	19.42	1.04	0.60			0.131	0.90	2	9.71	29.68	0.131	0.118	0.44	8.79	1.036
	39.93	1.97	0.60	0.30	0.28		0.90	3	29.68	48.00	0.290	0.261	1.37	25.10	6.541
	56.06	2.55	0.63	0.24	0.22		0.90	4	48.00	65.07	0.232	0.208	1.92	32.79	6.835
	74.09	2.63	0.60	0.32	0.33		0.90	5	65.07	81.72	0.325	0.292	2.03	33.79	9.872
	89.35	2.92	0.56	0.38	0.24		0.90	6	81.72	98.54	0.309	0.278	2.36	39.71	11.056
	107.74	3.80	0.60	0.44	0.39		0.90	7	98.54	117.04	0.413	0.372	3.20	59.18	21.996
	126.34	3.80	0.59	0.43	0.33		0.90	8	117.04	137.74	0.378	0.340	3.21	66.45	22.605
	149.14	3.65	0.52	0.37	0.40		0.90	9	137.74	155.66	0.384	0.346	3.13	56.09	19.388
	162.18	3.20	0.59	0.27	0.20		0.90	10	155.66	171.40	0.233	0.210	2.61	41.08	8.620
	180.62	2.49	0.65	0.15	0.15		0.90	11	171.40	195.73	0.148	0.133	1.84	44.78	5.957
LB	210.85	0.00	0.65			0.000	0.90	12	195.73	210.85	0.037	0.033	0.46	6.95	0.231
														Total Flow:	**114**

Total Flow:	**114**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**415.77**		**(m^2)**
Top Width:	**210.85**		**(m)**
Hydraulic Depth:	**1.972**		**(m)**
Mean Velocity:	**0.275**		**(m/s)**
Froude Number	**0.062**		
Photographs taken looking at: Upstream, downstream, cross-section			

Datalogger Notes:	
Datalogger Internal Power:	4.66V
Datalogger External Power:	14.76V
Datalogger Memory Used:	82%
Datalogger Clock:	2/3/2004 2:25PM MDT
Laptop Clock:	2/3/2004 13:38PM MDT
Dessicant:	50% Good
Datalogger:	Optimum DD128 #0104170278
PT:	Keller 735-130-15 psi #0101879
Power:	Magnacharge SLA 12V 20 A battery and PhotoWatt Int. PWX 200 Solar Panel with SunSaver Controller

Notes:

Measurements taken from boat. Stationing obtained using GPS and EMXSACAD. Survey somewhat uncertain as a reference point on ice surface was used to boost rod.
WSC report a flow of +/- 130 cms around January 18, 2004 near Ft. Mc Murray. Time on site constrained by the need to do water quality sampling nearby.

Hydrometric Measurement / Site Visit Record

S24 - Athabasca River below Eymundson Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Athabasca River
Location:	Athabasca River below Eymundson Creek
Site Name:	S24
Coordinates & Legal:	466313 E, 6372760 N NE-9-98-10-W4

Time of Measurement

Date of Measurement:	March 3, 2004
Start Time:	2:14 PM MDT
End Time:	4:48 PM MDT

Weather Conditions: -5 °C, Clear

River Conditions: Complete Ice Cover

Personnel & Equipment

Measurement Made By:	DK/DB
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	Nail in Tree	0.567	El:	231.096
Water Level Reading:		4.474	El:	226.121
Top of Ice Level Reading:		4.461	El:	226.139
Transducer Reading & Level:		1.397	El:	224.724
Other:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	0.80		0.67				0.90	1	0.80	7.30	0.046	0.041	0.08	0.49	0.020
	13.80	0.97	0.67			0.18	0.90	2	7.30	18.75	0.183	0.165	0.30	3.44	0.565
	23.70	1.46	0.64			0.26	0.90	3	18.75	29.45	0.262	0.236	0.82	8.77	2.070
	35.20	2.05	0.74	0.37	0.34		0.90	4	29.45	41.20	0.354	0.318	1.31	15.39	4.898
	47.20	2.48	1.07	0.36	0.25		0.90	5	41.20	53.10	0.302	0.272	1.41	16.78	4.557
	59.00	2.28	1.09	0.42	0.28		0.90	6	53.10	64.55	0.351	0.315	1.19	13.63	4.298
	70.10	2.77	1.10	0.42	0.34		0.90	7	64.55	75.00	0.384	0.346	1.67	17.45	6.032
	79.90	3.03	1.05	0.43	0.38		0.90	8	75.00	85.35	0.405	0.365	1.98	20.49	7.477
	90.80	3.44	1.09	0.45	0.34		0.90	9	85.35	95.95	0.395	0.355	2.35	24.91	8.849
	101.10	3.35	1.05	0.49	0.38		0.90	10	95.95	106.00	0.434	0.391	2.30	23.12	9.036
	110.90	3.81	1.11	0.50	0.39		0.90	11	106.00	116.00	0.445	0.401	2.70	27.00	10.814
	121.10	3.90	1.48	0.48	0.37		0.90	12	116.00	126.10	0.427	0.384	2.42	24.44	9.387
	131.10	4.05	1.54	0.40	0.41		0.90	13	126.10	136.15	0.401	0.361	2.51	25.23	9.100
	141.20	3.79	1.11	0.36	0.31		0.90	14	136.15	145.95	0.335	0.302	2.68	26.26	7.925
	150.70	3.42	1.03	0.33	0.34		0.90	15	145.95	156.55	0.337	0.303	2.39	25.33	7.679
	162.40	3.23	1.09	0.22	0.21		0.90	16	156.55	168.00	0.215	0.193	2.14	24.50	4.739
	173.60	2.50	0.72	0.11	0.16		0.90	17	168.00	178.65	0.134	0.121	1.78	18.96	2.288
	183.70	1.26	0.72			0.08	0.90	18	178.65	190.90	0.079	0.071	0.54	6.62	0.472
RB	198.10		0.72				0.90	19	190.90	198.10	0.020	0.018	0.14	0.97	0.017
														Total Flow:	**100**

Total Flow:	**100.223**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**323.78**		**(m^2)**
Top Width:	**197.30**		**(m)**
Hydraulic Depth:	**1.641**		**(m)**
Mean Velocity:	**0.310**		**(m/s)**
Froude Number	**0.077**		
Photographs taken looking at: Upstream, downstream, cross-section			

Datalogger Notes:	
Datalogger Internal Power:	4.651V
Datalogger External Power:	14.91V
Datalogger Memory Used:	85%
Datalogger Clock:	Mar 03, 2004 13:00 MDT
Laptop Clock:	Mar 03, 2004 12:15 MDT
Dessicant:	Good
Datalogger:	Optimum DD128 #0104170278
PT:	Keller 735-130-15 psi #0101879
Power:	Magnacharge SLA 12V 20 A battery and PhotoWatt Int. PWX 200 Solar Panel with SunSaver Controller

Notes: DL Clock Synchronized

Hydrometric Measurement / Site Visit Record

S24 - Athabasca River below Eymundson Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Athabasca River
Location:	Athabasca River below Eymundson Creek
Site Name:	S24
Coordinates & Legal:	466313 E, 6372760 N NE-9-98-10-W4

Personnel & Equipment

Measurement Made By:	FF/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000

Time of Measurement

Date of Measurement:	April 27, 2004
Start Time:	2:24 PM MDT
End Time:	3:35 PM MDT

Weather Conditions: 10 °C, Overcast, strong N wind

River Conditions: Open water conditions. Choppy water surface with 20 to 50 cm wind generated waves.

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: Nail in tree	0.401	El:	231.096	0.398	El:	231.096
Water Level Reading:	4.712	El:	226.785	4.635	El:	226.859
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El.:	1.531	El:	225.254	1.531	El:	225.328
T-bar	0.148	El:	231.349	0.075	El:	231.422

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	0.00	0.00	0.00			0.00	1.00	1	0.00	7.50	0.155	0.155	0.23	1.71	0.267
	15.00	0.91	0.00			0.62	1.00	2	7.50	21.00	0.622	0.622	0.91	12.34	7.676
	27.00	0.67	0.00			0.48	1.00	3	21.00	40.00	0.482	0.482	0.67	12.74	6.136
	53.00	0.37	0.00			0.33	1.00	4	40.00	99.00	0.329	0.329	0.37	21.58	7.104
	145.00	0.52	0.00			0.48	1.00	5	99.00	175.00	0.475	0.475	0.52	39.38	18.725
	205.00	1.10	0.00	0.58	0.67		1.00	6	175.00	242.50	0.626	0.626	1.10	74.07	46.393
	280.00	0.98	0.00	0.44	0.34		1.00	7	242.50	301.00	0.393	0.393	0.98	57.06	22.435
	322.00	0.52	0.00			0.02	1.00	8	301.00	346.50	0.024	0.024	0.52	23.58	0.575
	371.00	2.44	0.00	0.42	0.45		1.00	9	346.50	376.50	0.433	0.433	2.44	73.15	31.661
	382.00	2.71	0.00	0.56	0.41		1.00	10	376.50	401.50	0.486	0.486	2.71	67.82	32.970
	421.00	3.23	0.00	0.69	0.87		1.00	11	401.50	423.00	0.777	0.777	3.23	69.46	53.990
	425.00	3.23	0.00	0.83	0.99		1.00	12	423.00	438.50	0.910	0.910	3.23	50.08	45.563
	452.00	3.54	0.00	1.06	1.05		1.00	13	438.50	481.50	1.053	1.053	3.54	152.03	160.105
	511.00	2.71	0.00	0.86	1.00		1.00	14	481.50	531.50	0.931	0.931	2.71	135.64	126.299
	552.00	1.40	0.00	0.41	0.52		1.00	15	531.50	573.00	0.463	0.463	1.40	58.19	26.957
	594.00	0.43	0.00			0.12	1.00	16	573.00	604.50	0.122	0.122	0.43	13.44	1.639
RB	615.00	0.00	0.00			0.00	1.00	17	604.50	615.00	0.030	0.030	0.11	1.12	0.034
														Total Flow:	**589**

Total Flow:	**589**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**863.39**		**(m^2)**
Top Width:	**615.00**		**(m)**
Hydraulic Depth:	**1.404**		**(m)**
Mean Velocity:	**0.682**		**(m/s)**
Froude Number	**0.184**		
Photographs taken looking at: Upstream, downstream, cross-section			

Datalogger Notes:	
Datalogger Internal Power:	4.70V
Datalogger External Power:	14.27V
Datalogger Memory Used:	89%
Datalogger Clock:	Apr 27, 2004 14:38 MDT
Laptop Clock:	apr 27 2004 15:40 MST
Dessicant:	75% Good
Datalogger:	Optimum DD128 #0104170278
PT:	Keller 735-130-15 psi #0101879
Power:	Magnacharge SLA 12V 20 A battery and PhotoWatt Int. PWX 200 Solar Panel with SunSaver Controller

Notes: Very heavy upstream wind causing significant wave action (0.6 m max. height) likely influenced vertical velocity distributions during measurement significantly. Transducer appeared to have shifted due to ice action or high flow and was replaced slightly deeper in the flow. Rocks were placed over the connecting cable.

Hydrometric Measurement / Site Visit Record

S24 - Athabasca River below Eymundson Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Athabasca River
Location:	Athabasca River below Eymundson Creek
Site Name:	S24
Coordinates & Legal:	466313 E, 6372760 N NE-9-98-10-W4

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000

Time of Measurement

Date of Measurement:	June 4, 2004
Start Time:	10:18 AM MDT
End Time:	12:12 PM MDT

Weather Conditions: 15 °C, clear, calm

River Conditions: open, high stage, debris and high turbidity

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: Nail in tree	0.493	El:	231.096	0.429	El:	231.096
Water Level Reading:	3.736	El:	227.853	3.672	El:	227.853
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El.:	2.631	El:	225.222	2.631	El:	225.222
Tpost	0.240	El:	231.349	0.175	El:	231.414

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	0.00	0.00	0.00	0.00	0.00		1.00	1	0.00	6.37	0.157	0.157	0.00	0.00	0.000
	12.73	0.00	0.00	0.73	0.53		1.00	2	6.37	20.23	0.628	0.628	0.00	0.00	0.000
	27.72	2.07	0.00	0.72	0.63		1.00	3	20.23	41.71	0.677	0.677	2.07	44.52	30.125
	55.69	1.83	0.00	0.73	0.50		1.00	4	41.71	73.57	0.613	0.613	1.83	58.27	35.702
	91.45	1.55	0.00	0.76	0.67		1.00	5	73.57	107.14	0.713	0.713	1.55	52.18	37.219
	122.83	1.43	0.00	0.77	0.61		1.00	6	107.14	150.90	0.689	0.689	1.43	62.68	43.178
	178.96	1.62	0.00	0.80	0.60		1.00	7	150.90	204.86	0.701	0.701	1.62	87.18	61.115
	230.76	2.16	0.00	0.69	0.59		1.00	8	204.86	254.26	0.637	0.637	2.16	106.89	68.095
	277.75	1.68	0.00	0.37	0.26		1.00	9	254.26	305.46	0.315	0.315	1.68	85.83	27.077
	333.16	1.58	0.00	0.52	0.46		1.00	10	305.46	357.24	0.491	0.491	1.58	82.08	40.278
	381.32	1.62	0.00	0.71	0.53		1.00	11	357.24	401.44	0.622	0.622	1.62	71.39	44.392
	421.55	3.66	0.00	0.79	0.59		1.00	12	401.44	433.38	0.693	0.693	3.66	116.82	81.008
	445.20	4.02	0.00	1.05	0.70		1.00	13	433.38	459.28	0.875	0.875	4.02	104.23	91.174
	473.36	4.85	0.00	1.12	0.84		1.00	14	459.28	527.38	0.980	0.980	4.85	330.05	323.423
	520.82	5.70	0.00	1.10	0.90		1.00	15	527.38	562.63	1.000	1.000	5.70	200.92	200.865
	539.15	5.36	0.00	0.77	0.82		1.00	16	562.63	594.25	0.796	0.796	5.36	169.60	134.920
	576.20	4.66	0.00	0.31	0.32		1.00	17	594.25	612.61	0.314	0.314	4.66	85.65	26.889
	614.36	1.89	0.00	0.48	0.39		1.00	18	612.61	630.82	0.436	0.436	1.89	34.41	14.996
RB	647.28	1.52	0.00	0.00	0.00		1.00	19	630.82	647.28	0.109	0.109	0.47	7.78	0.847
														Total Flow:	**1261**

Total Flow:	**1261**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**1700.48**		**(m^2)**
Top Width:	**647.28**		**(m)**
Hydraulic Depth:	**2.627**		**(m)**
Mean Velocity:	**0.742**		**(m/s)**
Froude Number	**0.146**		
Photographs taken looking at: Upstream, downstream, cross-section			

Datalogger Notes:	**Database # 278**
Datalogger Internal Power:	4.737V
Datalogger External Power:	13.97V
Datalogger Memory Used:	92%
Datalogger Clock:	Jun 04, 2004 11:23 MDT
Laptop Clock:	Jun 04, 2004 00:23 MST
Dessicant:	good
Datalogger:	Optimum DD128 #0104170278
PT:	Keller 735-130-15 psi #0101879
Power:	Magnacharge SLA 12V 20 A battery and PhotoWatt Int. PWX 200 Solar Panel with SunSaver Controller

Notes:

Hydrometric Measurement / Site Visit Record

S24 - Athabasca River below Eymundson Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Athabasca River
Location:	Athabasca River below Eymundson Creek
Site Name:	S24
Coordinates & Legal:	466313 E, 6372760 N NE-9-98-10-W4

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000

Time of Measurement

Date of Measurement:	July 23, 2004	
Start Time:	2:30 PM	MDT
End Time:	5:30 PM	MDT

Weather Conditions: 15 °C, clear, calm

River Conditions: open, high stage

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: Nail in tree	0.302	El:	231.096	0.348	El:	231.096
Water Level Reading:	3.611	El:	227.787	3.649	El:	227.795
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El.:	2.573	El:	225.214	2.573	El:	225.222
Tpost	0.049	El:	231.349	0.090	El:	231.308

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	1.25	0.00	0.00	0.00	0.00		1.00	1	1.25	14.06	0.204	0.204	0.33	4.16	0.849
	26.87	1.30	0.00	0.84	0.79		1.00	2	14.06	36.99	0.815	0.815	1.30	29.81	24.304
	47.11	1.10	0.00	0.86	0.72		1.00	3	36.99	75.94	0.791	0.791	1.10	42.84	33.884
	104.76	1.45	0.00	0.62	0.49		1.00	4	75.94	123.04	0.553	0.553	1.45	68.30	37.786
	141.32	1.65	0.00	0.79	0.84		1.00	5	123.04	160.07	0.812	0.812	1.65	61.10	49.631
	178.82	1.95	0.00	1.13	0.74		1.00	6	160.07	194.38	0.933	0.933	1.95	66.89	62.392
	209.93	1.75	0.00	0.87	0.72		1.00	7	194.38	224.11	0.794	0.794	1.75	52.04	41.317
	238.29	1.40	0.00	0.62	0.48		1.00	8	224.11	251.92	0.553	0.553	1.40	38.93	21.535
	265.54	1.20	0.00	0.27	0.24		1.00	9	251.92	279.58	0.258	0.258	1.20	33.20	8.550
	293.62	0.50	0.00			0.60	1.00	10	279.58	304.38	0.600	0.600	0.50	12.40	7.444
	315.13	0.65	0.00			0.57	1.00	11	304.38	328.22	0.573	0.573	0.65	15.50	8.881
	341.31	1.25	0.00	0.70	0.71		1.00	12	328.22	353.83	0.707	0.707	1.25	32.01	22.633
	366.34	1.70	0.00	0.86	0.60		1.00	13	353.83	384.62	0.728	0.728	1.70	52.35	38.137
	402.90	2.40	0.00	1.05	0.75		1.00	14	384.62	422.08	0.896	0.896	2.40	89.89	80.553
	441.25	3.90	0.00	1.06	0.98		1.00	15	422.08	464.67	1.017	1.017	3.90	166.18	168.925
	488.09	5.12	0.00	1.34	0.94		1.00	16	464.67	514.32	1.137	1.137	5.12	254.21	289.017
	540.54	4.18	0.00	1.11	0.85		1.00	17	514.32	569.03	0.981	0.981	4.18	228.46	224.219
	597.51	3.14	0.00	0.71	0.54		1.00	18	569.03	609.67	0.628	0.628	3.14	127.59	80.110
	621.82	2.87	0.00	0.48	0.33		1.00	19	609.67	627.91	0.402	0.402	2.87	52.26	21.026
RB	633.99	0.00	0.00	0.00	0.00		1.00	20	627.91	633.99	0.101	0.101	0.72	4.36	0.438
														Total Flow:	**1222**

Total Flow:	**1222**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**1432.47**		**(m^2)**
Top Width:	**632.74**		**(m)**
Hydraulic Depth:	**2.264**		**(m)**
Mean Velocity:	**0.853**		**(m/s)**
Froude Number	**0.181**		
Photographs taken looking at: Upstream, downstream, cross-section			

Datalogger Notes:	
Datalogger Internal Power:	4.679V
Datalogger External Power:	13.69V
Datalogger Memory Used:	92%
Datalogger Clock:	Jul 23, 2004 16:52 MDT
Laptop Clock:	Jul 23, 2004 18:55 MST
Dessicant:	good
Datalogger:	Optimum DD128 #0104170278
PT:	Keller 735-130-15 psi #0101879
Power:	Magnacharge SLA 12V 20 A battery and PhotoWatt Int. PWX 200 Solar Panel with SunSaver Controller

Notes:

Hydrometric Measurement / Site Visit Record

S24 - Athabasca River below Edymundson Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Athabasca River below Edymundson Creek
Location:	Athabasca River below Edymundson Creek
Site Name:	S24
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 25, 2004	
Start Time:	2:40 PM	MDT
End Time:	16:08 PM	MDT

Weather Conditions: +15 C, NW wind, partly cloudy

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tree	0.089	El:	231.096	0.161	El:	231.096
Water Level Reading:	4.564	El:	226.621	4.649	El:	226.608
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El.	1.418	El:	225.203	1.418	El:	225.190
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	0.00	0.00	0.00	0.000	0.000	0.000	1.00	1	0.00	28.57	-0.016	-0.016	0.34	9.57	-0.153
	57.14	1.34	0.00	-0.064	-0.064	0.000	1.00	2	28.57	79.82	-0.064	-0.064	1.34	68.67	-4.396
	102.50	2.36	0.00	-0.009	-0.034	0.000	1.00	3	79.82	121.87	-0.021	-0.021	2.36	99.25	-2.118
	141.25	1.88	0.00	0.009	-0.006	0.000	1.00	4	121.87	161.38	0.002	0.002	1.88	74.27	0.113
	181.51	1.33	0.00	0.040	-0.049	0.000	1.00	5	161.38	203.55	-0.005	-0.005	1.33	56.09	-0.256
	225.60	2.38	0.00	0.344	0.213	0.000	1.00	6	203.55	231.39	0.279	0.279	2.38	66.24	18.475
	237.17	1.95	0.00	0.189	0.287	0.000	1.00	7	231.39	255.17	0.238	0.238	1.95	46.39	11.029
	273.18	0.78	0.00	0.000	0.000	0.155	1.00	8	255.17	289.82	0.155	0.155	0.78	27.02	4.200
	306.46	0.87	0.00	0.000	0.000	0.223	1.00	9	289.82	319.37	0.223	0.223	0.87	25.71	5.720
	332.27	1.04	0.00	0.000	0.000	0.293	1.00	10	319.37	349.18	0.293	0.293	1.04	31.01	9.073
	366.09	1.29	0.00	0.268	0.198	0.000	1.00	11	349.18	376.73	0.233	0.233	1.29	35.54	8.286
	387.37	1.64	0.00	0.497	0.625	0.000	1.00	12	376.73	399.65	0.561	0.561	1.64	37.59	21.082
	411.93	1.95	0.00	0.671	0.607	0.000	1.00	13	399.65	411.93	0.639	0.639	1.95	23.95	15.292
	450.70	1.91	0.00	0.689	0.457	0.000	1.00	14	411.93	450.70	0.573	0.573	1.91	74.06	42.437
	480.82	2.27	0.00	0.661	0.579	0.000	1.00	15	450.70	480.82	0.620	0.620	2.27	68.37	42.410
	525.88	1.94	0.00	0.710	0.491	0.000	1.00	16	480.82	525.88	0.600	0.600	1.94	87.42	52.492
	565.32	1.82	0.00	0.744	0.677	0.000	1.00	17	525.88	565.32	0.710	0.710	1.82	71.77	50.972
	617.88	2.09	0.00	0.777	0.604	0.000	1.00	18	565.32	617.88	0.690	0.690	2.09	109.85	75.835
RB	681.00	0.00	0.00	0.000	0.000	0.000	1.00	19	411.93	681.00	0.160	0.160	0.52	140.59	22.444
														Total Flow:	372.935

Total Flow:	**372.935**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**1153.35**		**(m^2)**
Top Width:	**681.00**		**(m)**
Hydraulic Depth:	**1.694**		**(m)**
Mean Velocity:	**0.323**		**(m/s)**
Froude Number	**0.079**		

Photographs taken looking at:
Upstream, downstream, across

Notes: TSS Sample Taken
Error message on download.

Datalogger Notes:		
Datalogger Internal Power:	4.72V	
Datalogger External Power:	14.17V	
Datalogger Memory Used:	99% - cleared memory	
Datalogger Clock:	Aug 25, 2004 16:19	MST
Laptop Clock:	8/25/2004 15:14 PM	MDT
Dessicant:	bad- replaced	

Datalogger:
PT:
Power:

Hydrometric Measurement / Site Visit Record

S24 - Athabasca River below Edymundson Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Athabasca River below Edymundson Creek
Location:	Athabasca River below Edymundson Creek
Site Name:	S24
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 22, 2004	
Start Time:	8:58 AM	MDT
End Time:	10:22 AM	MDT

Weather Conditions: +8 C, light D/S wind, sunny

River Conditions: open (high)

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings

		Setup No. 1			Setup No. 2		
Bench Mark Reading:	nail in tre	0.331	El:	231.096	0.302	El:	231.096
Water Level Reading:		4.009	El:	227.418	3.976	El:	227.422
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		2.199	El:	225.219	2.199	El:	225.223
Other:	T-post	0.077	El:		0.048	El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	0.00	0.00	0.00	0.000	0.000	0.000	1.00	1	0.00	32.83	0.192	0.192	0.30	10.01	1.921
	65.65	1.22	0.00	0.000	0.000	0.768	1.00	2	65.65	93.23	0.768	0.768	1.22	33.63	25.828
	120.81	1.71	0.00	0.802	0.713	0.000	1.00	3	120.81	148.89	0.757	0.757	1.71	47.92	36.296
	176.96	0.64	0.00	0.000	0.000	0.774	1.00	4	176.96	190.85	0.774	0.774	0.64	8.89	6.881
	204.73	0.55	0.00	0.000	0.000	0.640	1.00	5	204.73	225.63	0.640	0.640	0.55	11.47	7.340
	246.53	0.37	0.00	0.000	0.000	0.591	1.00	6	246.53	292.11	0.591	0.591	0.37	16.67	9.857
	337.68	0.61	0.00	0.000	0.000	0.546	1.00	7	337.68	358.24	0.546	0.546	0.61	12.53	6.836
	378.79	1.77	0.00	0.969	0.838	0.000	1.00	8	378.79	404.78	0.904	0.904	1.77	45.95	41.523
	430.77	2.56	0.00	1.149	0.905	0.000	1.00	9	430.77	458.86	1.027	1.027	2.56	71.91	73.861
	486.94	4.45	0.00	0.823	1.164	0.000	1.00	10	486.94	563.71	0.994	0.994	4.45	341.63	339.463
RB	640.48	0.00	0.00	0.000	0.000	0.000	1.00	11	640.48	640.48	0.248	0.248	1.11	0.00	0.000
														Total Flow:	549.805

Total Flow:	**549.805**		**(m^3/s)**
Pereived Measurement Quality:	**Poor**		
Total Area:	**600.59**		**(m^2)**
Top Width:	**640.48**		**(m)**
Hydraulic Depth:	**0.938**		**(m)**
Mean Velocity:	**0.915**		**(m/s)**
Froude Number	**0.302**		
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:		
Datalogger Internal Power:	4.74V	
Datalogger External Power:	14.09V	
Datalogger Memory Used:	2%	
Datalogger Clock:	Sep 22, 2004 09:29	MST
Laptop Clock:	Sep 22, 2004 09:29	MST
Dessicant:	good - 100%	
Datalogger:		
PT:		
Power:		

Notes: TSS Sample Taken
Anchor got stuck after 10th measurement, so no further flow measurements were possible
Athabasca River below Fort McMurray discharge (from AENV Figure ~ 1100 m^3/s)

Hydrometric Measurement / Site Visit Record

S24 - Athabasca River below Edymundson Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Athabasca River below Edymundson Creek
Location:	Athabasca River below Edymundson Creek
Site Name:	S24
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 31, 2004	
Start Time:	1:01 PM	MST
End Time:		MST

Weather Conditions: +3 C, partial clouds

River Conditions: Partial ice cover

Personnel & Equipment

Measurement Made By:	FF/ND
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	nail in tree	0.511	El:	231.096	0.339	El:	231.096
Water Level Reading:		5.200	El:	226.407	5.021	El:	226.414
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		1.182	El:	225.225	1.182	El:	225.232
Other:	T-post	0.259	El:		0.105	El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
														-

Total Flow:	-		(m^3/s)
Pereived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, across

Notes: No manual measurements possible

Datalogger Notes:	**Database #278**	
Datalogger Internal Power:	4.7V	
Datalogger External Power:	14.4V	
Datalogger Memory Used:	5% used	
Datalogger Clock:	Oct 31, 2004 12:57	MST
Laptop Clock:	Oct 31, 2004 12:05	MST
Dessicant:	Good	
Datalogger:	104170278	
PT:	101353	
Power:		

Hydrometric Measurement / Site Visit Record

S24 - Athabasca River below Edymundson Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Athabasca River below Edymundson Creek
Location:	Athabasca River below Edymundson Creek
Site Name:	S24
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	December 5, 2004	
Start Time:	1.30 PM	MST
End Time:		MST

Weather Conditions: -25 C, cloudy, light wind

River Conditions: Partial ice cover

Personnel & Equipment

Measurement Made By:	ND/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	nail in tree	0.477	El:	231.096	0.363	El:	231.096
Water Level Reading:		4.743	El:	226.830	4.633	El:	226.826
Top of Ice Level Reading:		4.741	El:		4.622	El:	
Transducer Reading & Calc'd El.:		1.451	El:	225.379	1.451	El:	225.375
Other:	T-post	0.224	El:		0.107	El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
														-

Total Flow:	-		(m^3/s)
Pereived Measurement Quality:	-		
Total Area:	-		(m^2)
Top Width:	-		(m)
Hydraulic Depth:	-		(m)
Mean Velocity:	-		(m/s)
Froude Number	-		

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:	**Database #278**	
Datalogger Internal Power:		
Datalogger External Power:		
Datalogger Memory Used:		
Datalogger Clock:		MST
Laptop Clock:		MST
Dessicant:		
Datalogger:	104170278	
PT:	101353	
Power:		

Notes: No manual measurements possible
Appears to be something broken off in the logger box lock, unable to open lock, or cut open. Will have to bring bolt cutters next rip. The data was therefore remotely downloaded from office on Dec 8, 2004
There were footprints in the snow, so someone has been at the site within the past week.

Hydrometric Measurement / Site Visit Record

S26 - MacKay River near Fort MacKay WSC 07DB001

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	MacKay River
Location:	MacKay River near Fort MacKay WSC 07DB001
Site Name:	S26
Coordinates & Legal:	458031 E, 6341078 N SE-3-95-11-W4

Time of Measurement

Date of Measurement:	February 2, 2004	
Start Time:	2:27 PM	MST
End Time:	2:52 PM	MST

Weather Conditions: -20 ˚C, clear, calm

River Conditions: Complete ice cover both upstream and downstream. Ice surface concave with 1m break in ice at banks due to falling stage since ice formation.

Personnel & Equipment

Measurement Made By:	FF/DM
Data Entry By:	FF
Meter Type and No.:	Marsh Mc Birney FloMate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading:	Yellow mark	0.545	El:	100.000
Water Level Reading:		3.117	El:	97.428
Top of Ice Level Reading:		3.089	El:	97.456
Transducer Reading:		0.989	El:	96.439
Other:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	7.60	0.00	0.31			0.000	0.90	1	7.60	8.00	0.000	0.000	0.00	0.00	0.000
	8.40	0.32	0.31			0.001	0.90	2	8.00	9.25	0.001	0.001	0.01	0.01	0.000
	10.10	0.50	0.39			0.119	0.90	3	9.25	10.50	0.119	0.107	0.11	0.14	0.015
	10.90	0.68	0.44			0.219	0.90	4	10.50	11.35	0.219	0.198	0.24	0.20	0.040
	11.80	0.79	0.48			0.244	0.90	5	11.35	12.15	0.244	0.219	0.31	0.25	0.054
	12.50	0.84	0.60			0.146	0.90	6	12.15	12.85	0.146	0.132	0.24	0.17	0.022
	13.20	0.90	0.64			0.125	0.90	7	12.85	13.65	0.125	0.112	0.26	0.21	0.023
	14.10	0.92	0.70			0.134	0.90	8	13.65	14.45	0.134	0.121	0.22	0.18	0.021
	14.80	0.92	0.71			0.198	0.90	9	14.45	15.15	0.198	0.178	0.21	0.15	0.026
	15.50	0.93	0.68			0.253	0.90	10	15.15	15.80	0.253	0.228	0.25	0.16	0.037
	16.10	0.92	0.60			0.259	0.90	11	15.80	16.35	0.259	0.233	0.32	0.18	0.041
	16.60	0.88	0.57			0.265	0.90	12	16.35	16.85	0.265	0.239	0.31	0.16	0.037
	17.10	0.93	0.56			0.287	0.90	13	16.85	17.40	0.287	0.258	0.37	0.20	0.052
	17.70	0.85	0.52			0.287	0.90	14	17.40	17.95	0.287	0.258	0.33	0.18	0.047
	18.20	0.83	0.50			0.244	0.90	15	17.95	18.50	0.244	0.219	0.33	0.18	0.040
	18.80	0.76	0.46			0.265	0.90	16	18.50	19.15	0.265	0.239	0.30	0.20	0.047
	19.50	0.70	0.44			0.247	0.90	17	19.15	20.05	0.247	0.222	0.26	0.23	0.052
	20.60	0.55	0.39			0.216	0.90	18	20.05	21.70	0.216	0.195	0.16	0.26	0.051
	22.80	0.36	0.30			0.021	0.90	19	21.70	23.90	0.021	0.019	0.06	0.13	0.003
RB	25.00	0.00	0.30			0.000	0.90	20	23.90	25.00	0.005	0.005	0.02	0.02	0.000
														Total:	**0.609**

Total Flow:	**0.609**		**(m^3/s)**
Pereived Quality of Measurement:	**Good**		
Total Area:	**3.20**		**(m^2)**
Top Width:	**17.40**		**(m)**
Hydraulic Depth:	**0.184**		**(m)**
Mean Velocity:	**0.190**		**(m/s)**
Froude Number	**0.141**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, existing datalogger box

Datalogger Notes:	
Datalogger Internal Power:	4.128 V
Datalogger External Power:	13.12 V
Datalogger Memory Used:	38%
Datalogger Clock:	Feb 02, 2004 14:39 MST
Laptop Clock:	Feb 02, 2004 14:51 MST
Dessicant:	Good
Datalogger:	Optimum DD128 #0209170658
PT:	Keller 735-130-5 psi #0205462
Power:	Magnacharge SLA 12V 20A Battery and PhotoWatt Int. PwX 200 Solar Panel with Morning Star Sunsaver 6 solar controller

Notes:
Solar panel receiving minimal light due to incised valley.

Hydrometric Measurement / Site Visit Record

S26 - MacKay River near Fort MacKay WSC 07DB001

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	MacKay River
Location:	MacKay River near Fort MacKay WSC 07DB001
Site Name:	S26
Coordinates & Legal:	458031 E, 6341078 N SE-3-95-11-W4

Time of Measurement

Date of Measurement:	March 2, 2004
Start Time:	4:11 PM MST
End Time:	4:33 PM MST

Weather Conditions: -17 ˚C, Clear, Light Wind

River Conditions: Complete ice cover both upstream and downstream. Concave ice surface due to falling stage under ice cover.

Personnel & Equipment

Measurement Made By:	DB/DK
Data Entry By:	DK
Meter Type and No.:	Marsh Mc Birney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	Yellow mark	0.191	El:	100.000
Water Level Reading:		2.644	El:	97.547
Top of Ice Level Reading:		2.714	El:	97.477
Transducer Reading:		1.124	El:	96.423
Other:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	14.50	0.00	0.58			0.000	0.90	1	14.50	14.05	0.011	0.010	0.03	0.01	0.000
	13.60	0.70	0.58			0.043	0.90	2	14.05	13.13	0.043	0.038	0.12	0.11	0.004
	12.65	0.81	0.61			0.165	0.90	3	13.13	12.23	0.165	0.148	0.20	0.18	0.027
	11.80	0.91	0.70			0.155	0.90	4	12.23	11.45	0.155	0.140	0.21	0.16	0.023
	11.10	0.98	0.79			0.180	0.90	5	11.45	10.73	0.180	0.162	0.19	0.14	0.022
	10.35	0.94	0.82			0.149	0.90	6	10.73	9.88	0.149	0.134	0.12	0.10	0.014
	9.40	1.03	0.85			0.229	0.90	7	9.88	9.08	0.229	0.206	0.18	0.14	0.030
	8.75	1.05	0.84			0.290	0.90	8	9.08	8.43	0.290	0.261	0.21	0.14	0.036
	8.10	1.05	0.85			0.277	0.90	9	8.43	7.80	0.277	0.250	0.20	0.13	0.031
	7.50	0.95	0.78			0.329	0.90	10	7.80	7.23	0.329	0.296	0.17	0.10	0.029
	6.95	1.02	0.76			0.201	0.90	11	7.23	6.70	0.201	0.181	0.26	0.14	0.025
	6.45	1.06	0.75			0.369	0.90	12	6.70	6.18	0.369	0.332	0.31	0.16	0.054
	5.90	0.99	0.71			0.396	0.90	13	6.18	5.65	0.396	0.357	0.28	0.15	0.052
	5.40	0.94	0.69			0.320	0.90	14	5.65	5.10	0.320	0.288	0.25	0.14	0.040
	4.80	0.90	0.76			0.332	0.90	15	5.10	4.43	0.332	0.299	0.14	0.09	0.028
	4.05	0.82	0.61			0.314	0.90	16	4.43	3.78	0.314	0.283	0.21	0.14	0.039
	3.50	0.75	0.59			0.308	0.90	17	3.78	3.25	0.308	0.277	0.16	0.08	0.023
	3.00	0.70	0.63			0.259	0.90	18	3.25	2.45	0.259	0.233	0.07	0.06	0.013
RB	1.90	0.00	0.63			0.000	0.90	19	2.45	1.90	0.065	0.058	0.02	0.01	0.001
														Total Flow:	**0.490**

Total Flow:	**0.490**		**(m^3/s)**
Pereived Quality of Measurement:	**Good**		
Total Area:	**2.17**		**(m^2)**
Top Width:	**12.60**		**(m)**
Hydraulic Depth:	**0.173**		**(m)**
Mean Velocity:	**0.225**		**(m/s)**
Froude Number	**0.173**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, existing datalogger box

Datalogger Notes:	
Datalogger Internal Power:	4.415V
Datalogger External Power:	15.21V
Datalogger Memory Used:	40%
Datalogger Clock:	Mar 02, 2004 15:09
Laptop Clock:	Mar 02, 2004 15:21 MST
Dessicant:	Good
Datalogger:	Optimum DD128 #0209170658
PT:	Keller 735-130-5 psi #0205462
Power:	Magnacharge SLA 12V 20A Battery and PhotoWatt Int. PwX 200 Solar Panel with Morning Star Sunsaver 6 solar controller

Notes:
Manual MMT done at same station as transducer, upstream of WSC cableway.

Hydrometric Measurement / Site Visit Record

S26 - MacKay River near Fort MacKay WSC 07DB001

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	MacKay River
Location:	MacKay River near Fort MacKay WSC 07DB001
Site Name:	S26
Coordinates & Legal:	458031 E, 6341078 N SE-3-95-11-W4

Time of Measurement

Date of Measurement:	April 5, 2004
Start Time:	MST
End Time:	MST

Weather Conditions: +15 C, Clear, Windy

River Conditions: Flow over and under ice, open sections u/s and d/s of site

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	Marsh Mc Birney FloMate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading:	Yellow mark	0.414	El:	100.000
Water Level Reading:		2.611	El:	97.803
Top of Ice Level Reading:			El:	
Transducer Reading:		1.378	El:	96.425
Other:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
													Total	-

Total Flow:	-		(m^3/s)
Pereived Quality of Measurement:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, existing datalogger box

Notes: River conditions not safe or ideal for discharge measurement.

Datalogger Notes:	
Datalogger Internal Power:	4.207 V
Datalogger External Power:	14.67 V
Datalogger Memory Used:	43%
Datalogger Clock:	Apr 05, 2004 11:38 MST
Laptop Clock:	Apr 05, 2204 12:40 MST
Dessicant:	Good
Datalogger:	Optimum DD128 #0209170658
PT:	Keller 735-130-5 psi #0205462
Power:	Magnacharge SLA 12V 20A Battery and PhotoWatt Int. PwX 200 Solar Panel with Morning Star Sunsaver 6 solar controller

Hydrometric Measurement / Site Visit Record

S26 - MacKay River near Fort MacKay WSC 07DB001

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	MacKay River
Location:	MacKay River near Fort MacKay WSC 07DB001
Site Name:	S26
Coordinates & Legal:	458031 E, 6341078 N SE-3-95-11-W4

Personnel & Equipment

Measurement Made By:	FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh Mc Birney FloMate 2000 s/n 2004521

Time of Measurement

Date of Measurement:	April 26, 2004
Start Time:	MST
End Time:	MST
Weather Conditions:	+15 C, Clear, Windy
River Conditions:	Flow over and under ice, open sections u/s and d/s of site

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: Yellow mark	0.353	El:	100.000	0.322	El:	100.000
Water Level Reading:	2.563	El:	97.790	2.541	El:	97.781
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El.:	1.303	El:	96.487	1.303	El:	96.478
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
													Total	-

Total Flow:	-		(m^3/s)
Pereived Quality of Measurement:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, existing datalogger box

Datalogger Notes:	
Datalogger Internal Power:	
Datalogger External Power:	
Datalogger Memory Used:	
Datalogger Clock:	MST
Laptop Clock:	MST
Dessicant:	Good
Datalogger:	Optimum DD128 #0209170658
PT:	Keller 735-130-5 psi #0205462
Power:	Magnacharge SLA 12V 20A Battery and PhotoWatt Int. PwX 200 Solar Panel with Morning Star Sunsaver 6 solar controller

Notes: River flow too high to perform wading MMT. WSC reporting +/- 27 cms.
Equipment mast and datalogger damaged by ice action and landslide failure of upper bank. Equipment removed. Solar panel and aerial left on site.

Hydrometric Measurement / Site Visit Record

S26 - MacKay River near Fort MacKay WSC 07DB001

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	MacKay River
Location:	MacKay River near Fort MacKay WSC 07DB001
Site Name:	S26
Coordinates & Legal:	458031 E, 6341078 N SE-3-95-11-W4

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh Mc Birney FloMate 2000 s/n 2004521

Time of Measurement

Date of Measurement:	June 2, 2004
Start Time:	MST
End Time:	MST
Weather Conditions:	+18 °C, overcast, light wind
River Conditions:	Flow over and under ice, open sections u/s and d/s of site

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: Yellow mark	0.332	El:	100.000	0.302	El:	100.000
Water Level Reading:	2.353	El:	97.979	2.322	El:	97.980
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El.:		El:			El:	
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
													Total	-

Total Flow:	-		(m^3/s)
Pereived Quality of Measurement:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, existing datalogger box

Datalogger Notes:
Datalogger Internal Power:
Datalogger External Power:
Datalogger Memory Used:
Datalogger Clock:
Laptop Clock:
Dessicant:

Datalogger:	Optimum DD128 #0209170658
PT:	Keller 735-130-5 psi #0205462
Power:	Magnacharge SLA 12V 20A Battery and PhotoWatt Int. PwX 200 Solar Panel with Morning Star Sunsaver 6 solar controller

Notes: River flow too high to perform wading MMT.
TSS sample taken, no measurement as datalogger has been removed.

Hydrometric Measurement / Site Visit Record

S26 - MacKay River near Fort MacKay WSC 07DB001

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	MacKay River
Location:	MacKay River near Fort MacKay WSC 07DB001
Site Name:	S26
Coordinates & Legal:	458031 E, 6341078 N SE-3-95-11-W4

Time of Measurement

Date of Measurement:	December 5, 2004	
Start Time:	11:20 AM	MST
End Time:	12:30 PM	MST

Weather Conditions: -25 °C, clear, calm

River Conditions: Complete ice cover both upstream and downstream.
Concave ice surface due to falling stage under ice cover.

Personnel & Equipment

Measurement Made By:	ND/DB
Data Entry By:	DB
Meter Type and No.:	Marsh Mc Birney FloMate 2000

Level Readings and Measurements Set Up #1

Bench Mark Reading:	Yellow mark	1.087	El:	100.000
Water Level Reading:		3.740	El:	97.347
Top of Ice Level Reading:		3.735	El:	97.352
Transducer Reading:			El:	97.347
Other:			El:	
	WL at old TD	3.685		
	Ice at old TD	3.661		

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	21.40	0.00	0.00			0.000	0.90	1	21.40	24.80	0.000	0.000	0.00	0.00	0.000
	28.20	0.43	0.43			0.000	0.90	2	24.80	29.10	0.000	0.000	0.00	0.00	0.000
	30.00	0.67	0.32			0.210	0.90	3	29.10	30.50	0.210	0.189	0.35	0.49	0.093
	31.00	0.76	0.30			0.302	0.90	4	30.50	31.50	0.302	0.272	0.46	0.46	0.125
	32.00	0.77	0.31			0.372	0.90	5	31.50	32.50	0.372	0.335	0.46	0.46	0.154
	33.00	0.74	0.31			0.363	0.90	6	32.50	33.25	0.363	0.326	0.43	0.32	0.105
	33.50	0.69	0.32			0.399	0.90	7	33.25	33.75	0.399	0.359	0.37	0.19	0.066
	34.00	0.69	0.31			0.427	0.90	8	33.75	34.25	0.427	0.384	0.38	0.19	0.073
	34.50	0.64	0.32			0.399	0.90	9	34.25	34.65	0.399	0.359	0.32	0.13	0.046
	34.80	0.64	0.32			0.265	0.90	10	34.65	35.00	0.265	0.239	0.32	0.11	0.027
	35.20	0.61	0.32			0.311	0.90	11	35.00	35.50	0.311	0.280	0.29	0.15	0.041
	35.80	0.64	0.33			0.271	0.90	12	35.50	36.05	0.271	0.244	0.31	0.17	0.042
	36.30	0.59	0.32			0.265	0.90	13	36.05	36.55	0.265	0.239	0.27	0.14	0.032
	36.80	0.52	0.31			0.265	0.90	14	36.55	37.40	0.265	0.239	0.21	0.18	0.043
	38.00	0.51	0.30			0.232	0.90	15	37.40	38.50	0.232	0.208	0.21	0.23	0.048
	39.00	0.43	0.32			0.140	0.90	16	38.50	39.50	0.140	0.126	0.11	0.11	0.014
	40.00	0.44	0.34			0.061	0.90	17	39.50	40.00	0.061	0.055	0.10	0.05	0.003
	42.00	0.28	0.28			0.000	0.90	18	40.00	46.00	0.000	0.000	0.00	0.00	0.000
RB	50.00	0.00	0.00			0.000	0.90	19	46.00	50.00	0.000	0.000	0.00	0.00	0.000
														Total Flow:	**0.911**

Total Flow:	**0.911**		**(m^3/s)**
Pereived Quality of Measurement:	**Fair**		
Total Area:	**3.37**		**(m^2)**
Top Width:	**28.60**		**(m)**
Hydraulic Depth:	**0.118**		**(m)**
Mean Velocity:	**0.270**		**(m/s)**
Froude Number	**0.252**		

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:	
Datalogger Internal Power:	no transducer
Datalogger External Power:	using WSC Levels
Datalogger Memory Used:	
Datalogger Clock:	
Laptop Clock:	
Dessicant:	
Datalogger:	
PT:	
Power:	

Notes:
Manual MMT done at same station as WSC cableway.

Hydrometric Measurement / Site Visit Record

S27 - Firebag River Near the Mouth (07DC001)

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Firebag River
Location:	Firebag River Near the Mouth (07DC001)
Site Name:	S27
Coordinates & Legal:	63887706 N 488685 E SE-35-99-8-W4

Time of Measurement

Date of Measurement:	January 31, 2004
Start Time:	9:15 AM MST
End Time:	10:50 AM MST

Weather Conditions: -20°C, Light snow

River Conditions: Complete Ice Cover, Ice bridge in place upstream of site.

Personnel & Equipment

Measurement Made By:	DM/FF
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings and Measurements

Bench Mark Reading: Tbar on RB	1.425	El:	99.773
Water Level Reading:	3.520	El:	97.678
Top of Ice Level Reading:	3.531	El:	97.667
Transducer Reading & Calc'd El.:	1.174	El:	96.504
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	3.70	0.00	0.64			0.000	0.90	1	3.70	4.85	0.000	0.000	0.01	0.01	0.000
	6.00	0.66	0.64			0.001	0.90	2	4.85	6.90	0.001	0.001	0.02	0.04	0.000
	7.80	0.73	0.65			0.180	0.90	3	6.90	8.90	0.180	0.162	0.08	0.16	0.026
	10.00	0.91	0.64			0.134	0.90	4	8.90	11.05	0.134	0.121	0.27	0.58	0.070
	12.10	1.05	0.61			0.174	0.90	5	11.05	13.00	0.174	0.156	0.44	0.86	0.134
	13.90	1.13	0.60			0.238	0.90	6	13.00	14.95	0.238	0.214	0.53	1.03	0.221
	16.00	1.07	0.57			0.283	0.90	7	14.95	16.90	0.283	0.255	0.50	0.98	0.249
	17.80	0.99	0.57			0.323	0.90	8	16.90	18.95	0.323	0.291	0.42	0.86	0.250
	20.10	0.95	0.59			0.226	0.90	9	18.95	20.90	0.226	0.203	0.36	0.70	0.143
	21.70	1.14	0.67			0.186	0.90	10	20.90	22.85	0.186	0.167	0.47	0.92	0.153
	24.00	0.90	0.61			0.162	0.90	11	22.85	25.00	0.162	0.145	0.29	0.62	0.091
	26.00	0.78	0.52			0.046	0.90	12	25.00	27.00	0.046	0.041	0.26	0.52	0.021
	28.00	0.63	0.50			0.001	0.90	13	27.00	29.00	0.001	0.001	0.13	0.26	0.000
	30.00	0.67	0.54			0.003	0.90	14	29.00	31.15	0.003	0.003	0.13	0.28	0.001
	32.30	0.76	0.51			0.125	0.90	15	31.15	33.20	0.125	0.112	0.25	0.51	0.058
	34.10	0.73	0.52			0.101	0.90	16	33.20	35.05	0.101	0.091	0.21	0.39	0.035
	36.00	0.73	0.53			0.098	0.90	17	35.05	37.00	0.098	0.088	0.20	0.39	0.034
	38.00	0.77	0.52			0.223	0.90	18	37.00	39.00	0.223	0.200	0.25	0.50	0.100
	40.00	0.91	0.49			0.293	0.90	19	39.00	41.00	0.293	0.263	0.42	0.84	0.221
	42.00	0.98	0.52			0.332	0.90	20	41.00	43.00	0.332	0.299	0.46	0.92	0.275
	44.00	0.99	0.53			0.448	0.90	21	43.00	45.10	0.448	0.403	0.46	0.97	0.390
	46.20	0.93	0.46			0.378	0.90	22	45.10	47.04	0.378	0.340	0.47	0.91	0.309
	47.87	0.95	0.48			0.463	0.90	23	47.04	48.94	0.463	0.417	0.47	0.89	0.372
	50.00	1.00	0.55			0.482	0.90	24	48.94	50.85	0.482	0.433	0.45	0.86	0.374
	51.70	1.00	0.57			0.558	0.90	25	50.85	52.73	0.558	0.502	0.43	0.81	0.405
	53.75	1.14	0.64			0.561	0.90	26	52.73	55.93	0.561	0.505	0.50	1.60	0.808
	58.10	1.13	0.63			0.625	0.90	27	55.93	60.10	0.625	0.562	0.50	2.09	1.174
	62.10	1.05	0.66			0.686	0.90	28	60.10	63.60	0.686	0.617	0.39	1.37	0.843
RB	65.10	0.00	0.66			0.000	0.90	29	63.60	65.10	0.171	0.154	0.10	0.15	0.023
														Total:	**6.779**

Total Flow:	**6.779**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**21.00**		**(m^2)**
Top Width:	**61.40**		**(m)**
Hydraulic Depth:	**0.342**		**(m)**
Mean Velocity:	**0.323**		**(m/s)**
Froude Number	**0.176**		
Photographs taken looking at: Upstream, downstream			

Datalogger Notes:	Database #333	
Datalogger Internal Power:	4.76 V	
Datalogger External Power:	12.00 V	
Datalogger Memory Used:	38%	
Datalogger Clock:	Jan 31, 2003 11:49	MDT
Laptop Clock:	Jan 31, 2003 11:04	MDT
Dessicant:	Changed - 100% Good	
Datalogger:	Optimum DD128, # 0104170268	
PT:	Keller 730-130-3 psi #0101348	
Power:	Magnacharge 20V 10A DC Battery	

Notes:

Ice bridge constructed by flooding of the ice with river water approximately 25 m upstream of gauging location.

T-bar on right bank near datalogger surveyed as local bench mark. Current meter mount was damaged and repaired during the course of the measurement.

Hydrometric Measurement / Site Visit Record

S27 - Firebag River Near the Mouth (07DC001)

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Firebag River
Location:	Firebag River Near the Mouth (07DC001)
Site Name:	S27
Coordinates & Legal:	63887706 N, 488685 E SE-35-99-8-W4

Time of Measurement

Date of Measurement:	February 29, 2004	
Start Time:	1:35 PM	MDT
End Time:	2:04 PM	MDT

Weather Conditions: -7°C, Light snow, Light wind

River Conditions: Complete Ice Cover, Ice bridge in place upstream of site.

Personnel & Equipment

Measurement Made By:	DK/DB
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading: Tbar on RB	1.469	El:	99.773
Water Level Reading:	3.519	El:	97.723
Top of Ice Level Reading:	3.553	El:	97.690
Transducer Reading & Calc'd El.:	1.201	El:	96.522
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	17.00	0.00	0.38			0.000	0.90	1	17.00	17.85	0.174	0.157	0.23	0.19	0.030
	18.70	1.29	0.38			0.698	0.90	2	17.85	19.55	0.698	0.628	0.91	1.55	0.972
	20.40	1.17	0.49			0.796	0.90	3	19.55	21.18	0.796	0.716	0.68	1.11	0.791
	21.95	1.03	0.70			0.680	0.90	4	21.18	23.43	0.680	0.612	0.33	0.74	0.454
	24.90	1.14	0.68			0.594	0.90	5	23.43	25.98	0.594	0.535	0.46	1.17	0.627
	27.05	1.17	0.63			0.829	0.90	6	25.98	28.15	0.829	0.746	0.54	1.17	0.876
	29.25	1.20	0.62			0.799	0.90	7	28.15	30.28	0.799	0.719	0.58	1.23	0.886
	31.30	1.10	0.60			0.811	0.90	8	30.28	32.38	0.811	0.730	0.50	1.05	0.766
	33.45	1.05	0.56			0.655	0.90	9	32.38	34.48	0.655	0.590	0.49	1.03	0.607
	35.50	0.98	0.65			0.570	0.90	10	34.48	36.30	0.570	0.513	0.33	0.60	0.309
	37.10	0.96	0.65			0.546	0.90	11	36.30	38.45	0.546	0.491	0.31	0.67	0.327
	39.80	1.01	0.54			0.479	0.90	12	38.45	40.83	0.479	0.431	0.47	1.12	0.481
	41.85	1.01	0.59			0.396	0.90	13	40.83	42.83	0.396	0.357	0.42	0.84	0.300
	43.80	0.95	0.57			0.448	0.90	14	42.83	44.75	0.448	0.403	0.38	0.73	0.295
	45.70	0.91	0.60			0.314	0.90	15	44.75	46.80	0.314	0.283	0.31	0.64	0.180
	47.90	0.84	0.62			0.232	0.90	16	46.80	48.80	0.232	0.208	0.22	0.44	0.092
	49.70	0.80	0.59			0.162	0.90	17	48.80	50.70	0.162	0.145	0.21	0.40	0.058
	51.70	0.78	0.62			0.067	0.90	18	50.70	52.70	0.067	0.060	0.16	0.32	0.019
	53.70	0.69	0.61			0.012	0.90	19	52.70	54.95	0.012	0.011	0.08	0.18	0.002
	56.20	0.65	0.59			0.001	0.90	20	54.95	57.45	0.001	0.001	0.06	0.15	0.000
	58.70	0.86	0.76			0.043	0.90	21	57.45	60.05	0.043	0.038	0.10	0.26	0.010
	61.40	1.08	0.82			0.174	0.90	22	60.05	62.93	0.174	0.156	0.26	0.75	0.117
	64.45	0.91	0.67			0.216	0.90	23	62.93	66.03	0.216	0.195	0.24	0.74	0.145
	67.60	1.05	0.66			0.287	0.90	24	66.03	68.60	0.287	0.258	0.39	1.00	0.259
	69.60	1.16	0.67			0.293	0.90	25	68.60	70.75	0.293	0.263	0.49	1.05	0.277
	71.90	1.05	0.82			0.076	0.90	26	70.75	73.00	0.076	0.069	0.23	0.52	0.035
	74.10	0.91	0.72			0.131	0.90	27	73.00	75.05	0.131	0.118	0.19	0.39	0.046
	76.00	0.78	0.74			0.043	0.90	28	75.05	76.70	0.043	0.038	0.04	0.07	0.003
RB	77.40	0.00	0.74			0.000	0.90	29	76.70	77.40	0.011	0.010	0.01	0.01	0.000
														Total:	**8.965**

Total Flow:	**8.965**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**20.12**		**(m^2)**
Top Width:	**60.40**		**(m)**
Hydraulic Depth:	**0.333**		**(m)**
Mean Velocity:	**0.446**		**(m/s)**
Froude Number	**0.247**		
Photographs taken looking at:			
Upstream, downstream			

Datalogger Notes:	Database #333	
Datalogger Internal Power:	4.773V	
Datalogger External Power:	12.12V	
Datalogger Memory Used:	40%	
Datalogger Clock:	Feb 29, 2004 13:56	MDT
Laptop Clock:	Feb 29, 2004 13:14	MDT
Dessicant:	good	
Datalogger:	Optimum DD128, # 0104170268	
PT:	Keller 730-130-3 psi #0101348	
Power:	Magnacharge 20V 10A DC Battery	

Notes:

Ice bridge constructed by flooding of the ice with river water approximately 25 m upstream of gauging location.
T-bar on right bank near datalogger surveyed as local bench mark.

Hydrometric Measurement / Site Visit Record

S27 - Firebag River Near the Mouth (07DC001)

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Firebag River
Location:	Firebag River Near the Mouth (07DC001)
Site Name:	S27
Coordinates & Legal:	63887706 N, 488685 E SE-35-99-8-W4

Time of Measurement

Date of Measurement:	April 3, 2004	
Start Time:	11:30 AM	MDT
End Time:	12:38 PM	MDT

Weather Conditions: +12 °C, Clear, Light wind

River Conditions: Complete Ice Cover, Ice bridge in place upstream of site.

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading: Tbar on RB	1.543	El:	99.773
Water Level Reading:	3.496	El:	97.820
Top of Ice Level Reading:	3.535	El:	97.781
Transducer Reading & Calc'd El.:	1.301	El:	96.519
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	21.20	0.00	0.62			0.000	0.90	1	21.20	22.05	0.161	0.145	0.13	0.11	0.016
	22.90	1.14	0.62			0.643	0.90	2	22.05	24.10	0.643	0.579	0.52	1.07	0.617
	25.30	1.06	0.55			0.335	0.90	3	24.10	26.40	0.335	0.302	0.51	1.17	0.354
	27.50	1.18	0.50			0.677	0.90	4	26.40	28.45	0.677	0.609	0.68	1.39	0.849
	29.40	1.22	0.52			0.658	0.90	5	28.45	30.35	0.658	0.593	0.70	1.33	0.788
	31.30	1.15	0.48			0.628	0.90	6	30.35	32.35	0.628	0.565	0.67	1.34	0.757
	33.40	1.09	0.43			0.524	0.90	7	32.35	34.40	0.524	0.472	0.66	1.35	0.638
	35.40	1.07	0.40			0.488	0.90	8	34.40	36.80	0.488	0.439	0.67	1.61	0.706
	38.20	1.07	0.47			0.402	0.90	9	36.80	40.35	0.402	0.362	0.60	2.13	0.771
	42.50	1.06	0.48			0.326	0.90	10	40.35	43.75	0.326	0.294	0.58	1.97	0.579
	45.00	0.99	0.46			0.329	0.90	11	43.75	46.30	0.329	0.296	0.53	1.35	0.400
	47.60	0.94	0.54			0.216	0.90	12	46.30	49.00	0.216	0.195	0.40	1.08	0.210
	50.40	0.88	0.55			0.180	0.90	13	49.00	51.55	0.180	0.162	0.33	0.84	0.136
	52.70	0.79	0.55			0.168	0.90	14	51.55	53.65	0.168	0.151	0.24	0.50	0.076
	54.60	0.73	0.55			0.134	0.90	15	53.65	55.65	0.134	0.121	0.18	0.36	0.043
	56.70	0.75	0.59			0.116	0.90	16	55.65	58.05	0.116	0.104	0.16	0.38	0.040
	59.40	0.91	0.72			0.177	0.90	17	58.05	60.60	0.177	0.159	0.19	0.48	0.077
	61.80	1.23	0.81			0.223	0.90	18	60.60	62.90	0.223	0.200	0.42	0.97	0.193
	64.00	1.07	0.70			0.219	0.90	19	62.90	65.05	0.219	0.198	0.37	0.80	0.157
	66.10	1.11	0.66			0.287	0.90	20	65.05	67.05	0.287	0.258	0.45	0.90	0.232
	68.00	1.22	0.68			0.314	0.90	21	67.05	69.53	0.314	0.283	0.54	1.34	0.378
	71.05	1.20	0.76			0.238	0.90	22	69.53	72.23	0.238	0.214	0.44	1.19	0.254
	73.40	1.09	0.78			0.201	0.90	23	72.23	76.60	0.201	0.181	0.31	1.36	0.246
RB	79.80	0.00	0.78			0.000	0.90	24	76.60	79.80	0.050	0.045	0.08	0.25	0.011
														Total:	**8.530**

Notes: 1. Meltwater from ice bridge, flowing over top of ice along the RB.

Total Flow:	**8.530**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**25.27**		**(m^2)**
Top Width:	**58.60**		**(m)**
Hydraulic Depth:	**0.431**		**(m)**
Mean Velocity:	**0.338**		**(m/s)**
Froude Number	**0.164**		
Photographs taken looking at: Upstream, downstream			

Datalogger Notes:	Database #333	
Datalogger Internal Power:	4.803V	
Datalogger External Power:	12.07V	
Datalogger Memory Used:	43%	
Datalogger Clock:	Apr 03, 2004 10:49	MDT
Laptop Clock:	Apr 03, 2004 10:50	MDT
Dessicant:	good	
Datalogger:	Optimum DD128, # 0104170268	
PT:	Keller 730-130-3 psi #0101348	
Power:	Magnacharge 20V 10A DC Battery	

Notes:

Ice bridge constructed by flooding of the ice with river water approximately 25 m upstream of gauging location.
T-bar on right bank near datalogger surveyed as local bench mark.
Meltwater from ice bridge, flowing over top of ice along the RB.

Hydrometric Measurement / Site Visit Record

S27 - Firebag River Near the Mouth (07DC001)

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Firebag River
Location:	Firebag River Near the Mouth (07DC001)
Site Name:	S27
Coordinates & Legal:	63887706 N, 488685 E SE-35-99-8-W4

Time of Measurement

Date of Measurement:	October 31, 2004
Start Time:	11:58 AM MST
End Time:	12:38 PM MST

Weather Conditions: -1 ℃, Little cloudy

River Conditions: Partial Ice Cover

Personnel & Equipment

Measurement Made By:	FF/ND
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading: Rod in PVC	1.302	El:	99.773
Water Level Reading:	3.484	El:	97.592
Top of Ice Level Reading:	3.450	El:	97.626
Transducer Reading & Calc'd El.:	1.097	El:	96.495
Other:		El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total:	-

Total Flow:	-		(m^3/s)
Pereived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			
Photographs taken looking at: Upstream, downstream, across			

Notes: 1. Battery replaced, Aux = 12.62V, Memory 60%, OK
2. Dessicant changed

Datalogger Notes:	Database #333	
Datalogger Internal Power:	4.8V	
Datalogger External Power:	11.84V	
Datalogger Memory Used:	60% used	
Datalogger Clock:	Oct 31, 2004 11:52	MST
Laptop Clock:	Oct 31, 2004 11:00	MST
Dessicant:	Completely used	
Datalogger:		
PT:	Keller 730-130-3 psi #0101348	
Power:		

Hydrometric Measurement / Site Visit Record

S27 - Firebag River Near the Mouth (07DC001)

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Firebag River
Location:	Firebag River Near the Mouth (07DC001)
Site Name:	S27
Coordinates & Legal:	63887706 N, 488685 E SE-35-99-8-W4

Time of Measurement

Date of Measurement:	December 6, 2004	
Start Time:	11:00 AM	MST
End Time:		MST

Weather Conditions: -20, cloudy, light snow

River Conditions: Partial ice cover, soft in the middle

Personnel & Equipment

Measurement Made By:	DB/ND/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements Set up #1

Bench Mark Reading: Rod in PVC	1.372	El:	99.773
Water Level Reading:	3.571	El:	97.574
Top of Ice Level Reading:	3.560	El:	97.585
Transducer Reading & Calc'd El.:	1.073	El:	96.501
Other:		El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total:	-

Total Flow:	-		(m^3/s)
Pereived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, across

Datalogger Notes:	Database #333	
Datalogger Internal Power:	4.711 V	
Datalogger External Power:	12.35 V	
Datalogger Memory Used:	63% used	
Datalogger Clock:	Dec 06, 2004 11:07	MST
Laptop Clock:	Dec 06, 2004 11:16	MST
Dessicant:	Good - 100%	
Datalogger:		
PT:	Keller 730-130-3 psi #0101348	
Power:		

Notes: Ice bridge builder stated that the center of the river was open until the day prior.
Ice was soft, DB and CT's boots went through the ice near the shore, so ice was deemed unsafe for flow measurement.
Datalogger clock was sychronized with laptop.
DB #333

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	April 26, 2004
Start Time:	10:10 AM MDT
End Time:	10:34 AM MDT

Weather Conditions: +3 C, Calm, partly cloudy, light wind

River Conditions: Open water conditions, no significant ice.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.466	El:	325.175	0.521	El:	325.175
Water Level Reading:	1.594	El:	324.047	1.659	El:	324.037
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.614	El:	323.433	0.614	El:	323.423
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	5.50	0.00	0.00			0.000	1.00	1	5.50	5.70	0.008	0.008	0.17	0.03	0.000
	5.90	0.67	0.00			0.030	1.00	2	5.70	6.20	0.030	0.030	0.67	0.34	0.010
	6.50	1.70	0.00	0.03	0.10		1.00	3	6.20	6.75	0.067	0.067	1.70	0.94	0.063
	7.00	1.79	0.00	0.08	0.12		1.00	4	6.75	7.13	0.098	0.098	1.79	0.67	0.065
	7.25	1.98	0.00	0.09	0.13		1.00	5	7.13	7.38	0.110	0.110	1.98	0.50	0.054
	7.50	2.03	0.00	0.09	0.12		1.00	6	7.38	7.63	0.104	0.104	2.03	0.51	0.053
	7.75	2.05	0.00	0.11	0.13		1.00	7	7.63	7.88	0.120	0.120	2.05	0.51	0.062
	8.00	2.01	0.00	0.08	0.14		1.00	8	7.88	8.13	0.108	0.108	2.01	0.50	0.054
	8.25	2.00	0.00	0.11	0.13		1.00	9	8.13	8.38	0.122	0.122	2.00	0.50	0.061
	8.50	1.96	0.00	0.09	0.14		1.00	10	8.38	8.63	0.116	0.116	1.96	0.49	0.057
	8.75	1.92	0.00	0.10	0.12		1.00	11	8.63	8.88	0.110	0.110	1.92	0.48	0.053
	9.00	1.89	0.00	0.09	0.12		1.00	12	8.88	9.13	0.110	0.110	1.89	0.47	0.052
	9.25	1.88	0.00	0.06	0.12		1.00	13	9.13	9.38	0.091	0.091	1.88	0.47	0.043
	9.50	1.71	0.00	0.10	0.13		1.00	14	9.38	9.63	0.114	0.114	1.71	0.43	0.049
	9.75	1.69	0.00	0.09	0.09		1.00	15	9.63	9.88	0.087	0.087	1.69	0.42	0.037
	10.00	1.60	0.00	0.07	0.09		1.00	16	9.88	10.13	0.082	0.082	1.60	0.40	0.033
	10.25	1.55	0.00	0.07	0.07		1.00	17	10.13	10.38	0.070	0.070	1.55	0.39	0.027
	10.50	1.50	0.00	0.07	0.08		1.00	18	10.38	10.63	0.073	0.073	1.50	0.38	0.027
	10.75	1.44	0.00	0.03	0.06		1.00	19	10.63	10.88	0.047	0.047	1.44	0.36	0.017
	11.00	1.33	0.00	0.03	0.05		1.00	20	10.88	11.50	0.044	0.044	1.33	0.83	0.037
	12.00	0.70	0.00			0.034	1.00	21	11.50	12.65	0.034	0.034	0.70	0.81	0.027
LB	13.30	0.00	0.00			0.000	1.00	22	12.65	13.30	0.008	0.008	0.18	0.11	0.001
														Total Flow:	0.882

Total Flow:	**0.882**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**10.53**		**(m^2)**
Top Width:	**7.80**		**(m)**
Hydraulic Depth:	**1.350**		**(m)**
Mean Velocity:	**0.084**		**(m/s)**
Froude Number	**0.023**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**414**	
Datalogger Internal Power:	4.74V		
Datalogger External Power:	13.94V		
Datalogger Memory Used:	0%		
Datalogger Clock:	26/04/2004 8:35		MST
Laptop Clock:	26/04/2004 9:35		MDT
Dessicant:	Good		
Datalogger:	Optimum datalogger s/n#0110220414		
PT:	Keller s/n 0104639 3 psi		
Power:	Car Battery		

Notes: TSS sample collected.
Equipment installed. Transducer wired to rebar and embedded near the left bank.
Open water condition with apparent backwater from downstream obstruction or beaver dam.

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	June 2, 2004	
Start Time:	8:53 AM	MDT
End Time:	9:38 AM	MDT

Weather Conditions: +10 C, overcast

River Conditions: open water, flood stage

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.836	El:	325.175	0.770	El:	325.175
Water Level Reading:	1.541	El:	324.470	1.477	El:	324.468
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	1.064	El:	323.406	1.064	El:	323.404
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	20.30	0.00	0.00	0.00	0.00	0.000	1.00	1	20.30	20.65	0.050	0.050	0.42	0.15	0.007
	21.00	1.67	0.00	0.21	0.20	0.000	1.00	2	20.65	21.25	0.201	0.201	1.67	1.00	0.202
	21.50	1.82	0.00	0.27	0.27		1.00	3	21.25	21.75	0.273	0.273	1.82	0.91	0.248
	22.00	2.01	0.00	0.32	0.32		1.00	4	21.75	22.25	0.322	0.322	2.01	1.01	0.323
	22.50	2.18	0.00	0.34	0.33		1.00	5	22.25	22.75	0.337	0.337	2.18	1.09	0.367
	23.00	2.27	0.00	0.37	0.30		1.00	6	22.75	23.13	0.334	0.334	2.27	0.85	0.284
	23.25	2.31	0.00	0.41	0.24		1.00	7	23.13	23.38	0.323	0.323	2.31	0.58	0.187
	23.50	2.32	0.00	0.42	0.35		1.00	8	23.38	23.63	0.386	0.386	2.32	0.58	0.224
	23.75	2.24	0.00	0.34	0.33		1.00	9	23.63	23.88	0.334	0.334	2.24	0.56	0.187
	24.00	2.20	0.00	0.41	0.33		1.00	10	23.88	24.13	0.372	0.372	2.20	0.55	0.205
	24.25	2.14	0.00	0.39	0.34		1.00	11	24.13	24.38	0.363	0.363	2.14	0.54	0.194
	24.50	2.17	0.00	0.40	0.31		1.00	12	24.38	24.75	0.357	0.357	2.17	0.81	0.290
	25.00	2.00	0.00	0.41	0.32		1.00	13	24.75	25.25	0.367	0.367	2.00	1.00	0.367
	25.50	1.90	0.00	0.36	0.25		1.00	14	25.25	25.75	0.305	0.305	1.90	0.95	0.290
	26.00	1.82	0.00	0.29	0.22		1.00	15	25.75	26.25	0.255	0.255	1.82	0.91	0.232
	26.50	1.60	0.00	0.17	0.17		1.00	16	26.25	26.75	0.171	0.171	1.60	0.80	0.137
	27.00	1.30	0.00	0.16	0.14		1.00	17	26.75	27.50	0.146	0.146	1.30	0.98	0.143
	28.00	0.61	0.00	0.00	0.00	0.024	1.00	18	27.50	28.15	0.000	0.000	0.61	0.40	0.000
LB	28.30	0.00	0.00	0.00		0.000	1.00	19	28.15	28.30	0.000	0.000	0.15	0.02	0.000
														Total Flow:	3.885

Total Flow:	**3.885**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**13.68**		**(m^2)**
Top Width:	**8.00**		**(m)**
Hydraulic Depth:	**1.709**		**(m)**
Mean Velocity:	**0.284**		**(m/s)**
Froude Number	**0.069**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**414**
Datalogger Internal Power:	4.752V	
Datalogger External Power:	13.92V	
Datalogger Memory Used:	3%	
Datalogger Clock:	Jun 02, 2004 07:34	MST
Laptop Clock:	Jun 02, 2004 08:36	MDT
Dessicant:	Good -90%	
Datalogger:	Optimum datalogger s/n#0110220414	
PT:	Keller s/n 0104639 3 psi	
Power:	Car Battery	

Notes: TSS sample collected.
Stream has flooded banks, LB and RB measured at point where water appears to be standing and not contributing to the flow.

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	July 24, 2004	
Start Time:	9:37 AM	MDT
End Time:	10:20 AM	MDT

Weather Conditions: +20 C, calm

River Conditions: open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.281	El:	325.175	0.348	El:	325.175
Water Level Reading:	1.511	El:	323.945	1.585	El:	323.938
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.525	El:	323.420	0.525	El:	323.413
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	19.30	0.00		0.00	0.00		1.00	1	19.30	19.50	0.000	0.000	0.30	0.06	0.000
	19.70	1.19		0.00	0.00		1.00	2	19.50	19.85	0.000	0.000	1.19	0.42	0.000
	20.00	1.36		0.00	0.00		1.00	3	19.85	20.25	0.002	0.002	1.36	0.54	0.001
	20.50	1.55		0.00	0.00		1.00	4	20.25	20.65	0.000	0.000	1.55	0.62	0.000
	20.80	1.70		0.00	0.00		1.00	5	20.65	20.95	0.002	0.002	1.70	0.51	0.001
	21.10	1.90		0.01	0.00		1.00	6	20.95	21.25	0.003	0.003	1.90	0.57	0.002
	21.40	1.94		0.01	0.00		1.00	7	21.25	21.55	0.003	0.003	1.94	0.58	0.002
	21.70	2.00		0.00	0.00		1.00	8	21.55	21.85	0.002	0.002	2.00	0.60	0.001
	22.00	1.95		0.01	0.00		1.00	9	21.85	22.15	0.003	0.003	1.95	0.58	0.002
	22.30	1.94		0.01	0.00		1.00	10	22.15	22.45	0.003	0.003	1.94	0.58	0.002
	22.60	1.91		0.01	0.00		1.00	11	22.45	22.75	0.003	0.003	1.91	0.57	0.002
	22.90	1.83		0.01	0.00		1.00	12	22.75	23.05	0.003	0.003	1.83	0.55	0.002
	23.20	1.81		0.00	0.00		1.00	13	23.05	23.30	0.002	0.002	1.81	0.45	0.001
	23.40	1.68		0.01	0.00		1.00	14	23.30	23.55	0.005	0.005	1.68	0.42	0.002
	23.70	1.62		0.01	0.00		1.00	15	23.55	23.85	0.006	0.006	1.62	0.49	0.003
	24.00	1.54		0.03	0.00		1.00	16	23.85	24.15	0.014	0.014	1.54	0.46	0.006
	24.30	1.40		0.00	0.00		1.00	17	24.15	24.45	0.002	0.002	1.40	0.42	0.001
	24.60	1.30		0.00	0.00		1.00	18	24.45	24.80	0.002	0.002	1.30	0.45	0.001
	25.00	1.11		0.01	0.00		1.00	19	24.80	25.25	0.003	0.003	1.11	0.50	0.002
	25.50	0.89		0.00	0.00		1.00	20	25.25	25.75	0.000	0.000	0.89	0.45	0.000
	26.00	0.65		0.00	0.00		1.00	21	25.75	26.30	0.000	0.000	0.65	0.36	0.000
LB	26.60	0.00		0.00	0.00		1.00	22	26.30	26.60	0.000	0.000	0.16	0.05	0.000
														Total Flow:	0.028

Total Flow:	**0.028**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**10.24**		**(m^2)**
Top Width:	**7.30**		**(m)**
Hydraulic Depth:	**1.402**		**(m)**
Mean Velocity:	**0.003**		**(m/s)**
Froude Number	**0.001**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**414**
Datalogger Internal Power:	4.777V	
Datalogger External Power:	13.54V	
Datalogger Memory Used:	7%	
Datalogger Clock:	Jul 24, 2004 08:12	MST
Laptop Clock:	Jul 24, 2004 09:13	MDT
Dessicant:	Good -50%	
Datalogger:	Optimum datalogger s/n#0110220414	
PT:	Keller s/n 0104639 3 psi	
Power:	Car Battery	

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	August 26, 2004
Start Time:	1:22 PM MDT
End Time:	1:51 PM MDT

Weather Conditions: +15 C, calm, partly cloudy

River Conditions: open, weedy

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.487	El:	325.175	0.409	El:	325.175
Water Level Reading:	1.757	El:	323.905	1.683	El:	323.901
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.505	El:	323.400	0.505	El:	323.396
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	8.30	0.00		0.00	0.00		1.00	1	8.30	8.05	0.000	0.000	0.16	0.04	0.000
	7.80	0.63		0.00	0.00		1.00	2	8.05	7.55	0.000	0.000	0.63	0.32	0.000
	7.30	0.88		0.00	0.00		1.00	3	7.55	7.05	0.000	0.000	0.88	0.44	0.000
	6.80	1.12		0.00	0.00		1.00	4	7.05	6.55	0.002	0.002	1.12	0.56	0.001
	6.30	1.54		0.00	0.00		1.00	5	6.55	6.05	0.002	0.002	1.54	0.77	0.001
	5.80	1.99		0.00	0.00		1.00	6	6.05	5.55	-0.002	-0.002	1.99	1.00	-0.002
	5.30	2.16		0.01	0.00		1.00	7	5.55	5.05	0.006	0.006	2.16	1.08	0.007
	4.80	2.23		0.02	0.00		1.00	8	5.05	4.55	0.008	0.008	2.23	1.12	0.008
	4.30	2.16		0.01	0.00		1.00	9	4.55	4.05	0.006	0.006	2.16	1.08	0.007
	3.80	2.09		0.01	0.00		1.00	10	4.05	3.55	0.006	0.006	2.09	1.05	0.006
	3.30	2.03		0.01	0.00		1.00	11	3.55	3.05	0.006	0.006	2.03	1.02	0.006
	2.80	2.01		0.01	0.00		1.00	12	3.05	2.55	0.005	0.005	2.01	1.01	0.005
	2.30	1.74		0.01	0.00		1.00	13	2.55	2.05	0.003	0.003	1.74	0.87	0.003
	1.80	1.25		0.01	0.00		1.00	14	2.05	1.50	0.005	0.005	1.25	0.69	0.003
LB	1.20	0.00		0.00	0.00		1.00	15	1.50	1.20	0.000	0.000	0.31	0.09	0.000
														Total Flow:	0.045

Total Flow:	**0.045**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**11.11**		**(m^2)**
Top Width:	**7.10**		**(m)**
Hydraulic Depth:	**1.565**		**(m)**
Mean Velocity:	**0.004**		**(m/s)**
Froude Number	**0.001**		

Photographs taken looking at:
Upstream, downstream, across

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**414**	
Datalogger Internal Power:	4.785V		
Datalogger External Power:	13.56V		
Datalogger Memory Used:	10%		
Datalogger Clock:	Aug 26, 2004 12:05		MST
Laptop Clock:	Aug 26, 2004 13:07		MDT
Dessicant:	Good -50%		
Datalogger:	Optimum datalogger s/n#0110220414		
PT:	Keller s/n 0104639 3 psi		
Power:	Car Battery		

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	September 23, 2004
Start Time:	8:35 AM MDT
End Time:	9:10 AM MDT

Weather Conditions: +2 C, calm, cloudy

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.346	El:	325.175	0.441	El:	325.175
Water Level Reading:	1.489	El:	324.032	1.586	El:	324.030
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El	0.616	El:	323.416	0.616	El:	323.414
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	25.25	0.00		0.00	0.00	0.000	1.00	1	25.25	24.83	0.002	0.002	0.09	0.04	0.000
	24.40	0.35		0.00	0.00	0.009	1.00	2	24.83	24.20	0.009	0.009	0.35	0.22	0.002
	24.00	0.71		0.00	0.00	0.015	1.00	3	24.20	23.80	0.015	0.015	0.71	0.28	0.004
	23.60	0.95		0.00	0.00	0.009	1.00	4	23.80	23.40	0.009	0.009	0.95	0.38	0.003
	23.20	1.16		0.01	0.00	0.000	1.00	5	23.40	23.05	0.003	0.003	1.16	0.41	0.001
	22.90	1.31		0.00	0.00	0.000	1.00	6	23.05	22.75	0.002	0.002	1.31	0.39	0.001
	22.60	1.56		0.02	0.00	0.000	1.00	7	22.75	22.45	0.008	0.008	1.56	0.47	0.004
	22.30	1.93		0.02	0.00	0.000	1.00	8	22.45	22.15	0.011	0.011	1.93	0.58	0.006
	22.00	2.02		0.01	0.00	0.000	1.00	9	22.15	21.85	0.006	0.006	2.02	0.61	0.004
	21.70	2.17		0.03	0.00	0.000	1.00	10	21.85	21.55	0.015	0.015	2.17	0.65	0.010
	21.40	2.28		0.04	0.00	0.000	1.00	11	21.55	21.25	0.020	0.020	2.28	0.68	0.014
	21.10	3.33		0.05	0.00	0.000	1.00	12	21.25	20.95	0.023	0.023	3.33	1.00	0.023
	20.80	3.33		0.05	0.00	0.000	1.00	13	20.95	20.65	0.024	0.024	3.33	1.00	0.024
	20.50	2.26		0.02	0.00	0.000	1.00	14	20.65	20.35	0.011	0.011	2.26	0.68	0.007
	20.20	2.24		0.03	0.00	0.000	1.00	15	20.35	20.05	0.017	0.017	2.24	0.67	0.011
	19.90	2.17		0.05	0.00	0.000	1.00	16	20.05	19.75	0.023	0.023	2.17	0.65	0.015
	19.60	2.19		0.04	0.00	0.000	1.00	17	19.75	19.45	0.018	0.018	2.19	0.66	0.012
	19.30	2.13		0.04	0.00	0.000	1.00	18	19.45	19.10	0.020	0.020	2.13	0.75	0.015
	18.90	2.06		0.04	0.00	0.000	1.00	19	19.10	18.75	0.020	0.020	2.06	0.72	0.014
	18.60	1.92		0.02	0.00	0.000	1.00	20	18.75	18.45	0.011	0.011	1.92	0.58	0.006
	18.30	1.76		0.01	0.00	0.000	1.00	21	18.45	18.15	0.006	0.006	1.76	0.53	0.003
	18.00	1.37		0.02	0.00	0.000	1.00	22	18.15	17.85	0.008	0.008	1.37	0.41	0.003
	17.70	1.20		0.00	0.00	0.000	1.00	23	17.85	17.45	0.000	0.000	1.20	0.48	0.000
LB	17.20	0.00		0.00	0.00	0.000	1.00	24	17.45	17.20	0.000	0.000	0.30	0.08	0.000
														Total Flow:	0.183

Total Flow:	**0.183**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**12.90**		**(m^2)**
Top Width:	**8.05**		**(m)**
Hydraulic Depth:	**1.602**		**(m)**
Mean Velocity:	**0.014**		**(m/s)**
Froude Number	**0.004**		
Photographs taken looking at: Upstream, downstream, across (photos lost)			

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**414**
Datalogger Internal Power:	4.712V	
Datalogger External Power:	12.84V	
Datalogger Memory Used:	12%	
Datalogger Clock:	Sep 23, 2004 07:11	MST
Laptop Clock:	Sep 23, 2004 07:16	MST
Dessicant:	Replaced	
Datalogger:	Optimum datalogger s/n#0110220414	
PT:	Keller s/n 0104639 3 psi	
Power:	Car Battery	

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	October 31, 2004	
Start Time:	9:13 AM	MST
End Time:	9:36 AM	MST

Weather Conditions: -5 C, clear

River Conditions: Fully frozen

Personnel & Equipment

Measurement Made By:	DM/FF/ND
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.445	El:	325.175	0.480	El:	325.175
Water Level Reading:	1.621	El:	323.999	1.670	El:	323.985
Top of Ice Level Reading:	1.611	El:	324.009	1.656	El:	323.999
Transducer Reading & Calc'd E	0.582	El:	323.417	0.582	El:	323.403
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
													Total Flow:	-

Total Flow:	-		(m^3/s)
Pereived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:	**Database**	**414**
Datalogger Internal Power:	4.7V	
Datalogger External Power:	14.4V	
Datalogger Memory Used:	15% used	
Datalogger Clock:	Oct 31, 2004 09:10	MST
Laptop Clock:	Oct 31, 2004 08:16	MST
Dessicant:	10% used	
Datalogger:		
PT:	Keller s/n 0104639 3 psi	
Power:		

Notes: No manual measurements possible due to ice cover
TSS sample collected. Transducer removed for winter.

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	April 26, 2004
Start Time:	10:10 AM MDT
End Time:	10:34 AM MDT

Weather Conditions: +3 C, Calm, partly cloudy, light wind

River Conditions: Open water conditions, no significant ice.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.466	El:	325.175	0.521	El:	325.175
Water Level Reading:	1.594	El:	324.047	1.659	El:	324.037
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.614	El:	323.433	0.614	El:	323.423
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	5.50	0.00	0.00			0.000	1.00	1	5.50	5.70	0.008	0.008	0.17	0.03	0.000
	5.90	0.67	0.00			0.030	1.00	2	5.70	6.20	0.030	0.030	0.67	0.34	0.010
	6.50	1.70	0.00	0.03	0.10		1.00	3	6.20	6.75	0.067	0.067	1.70	0.94	0.063
	7.00	1.79	0.00	0.08	0.12		1.00	4	6.75	7.13	0.098	0.098	1.79	0.67	0.065
	7.25	1.98	0.00	0.09	0.13		1.00	5	7.13	7.38	0.110	0.110	1.98	0.50	0.054
	7.50	2.03	0.00	0.09	0.12		1.00	6	7.38	7.63	0.104	0.104	2.03	0.51	0.053
	7.75	2.05	0.00	0.11	0.13		1.00	7	7.63	7.88	0.120	0.120	2.05	0.51	0.062
	8.00	2.01	0.00	0.08	0.14		1.00	8	7.88	8.13	0.108	0.108	2.01	0.50	0.054
	8.25	2.00	0.00	0.11	0.13		1.00	9	8.13	8.38	0.122	0.122	2.00	0.50	0.061
	8.50	1.96	0.00	0.09	0.14		1.00	10	8.38	8.63	0.116	0.116	1.96	0.49	0.057
	8.75	1.92	0.00	0.10	0.12		1.00	11	8.63	8.88	0.110	0.110	1.92	0.48	0.053
	9.00	1.89	0.00	0.09	0.12		1.00	12	8.88	9.13	0.110	0.110	1.89	0.47	0.052
	9.25	1.88	0.00	0.06	0.12		1.00	13	9.13	9.38	0.091	0.091	1.88	0.47	0.043
	9.50	1.71	0.00	0.10	0.13		1.00	14	9.38	9.63	0.114	0.114	1.71	0.43	0.049
	9.75	1.69	0.00	0.09	0.09		1.00	15	9.63	9.88	0.087	0.087	1.69	0.42	0.037
	10.00	1.60	0.00	0.07	0.09		1.00	16	9.88	10.13	0.082	0.082	1.60	0.40	0.033
	10.25	1.55	0.00	0.07	0.07		1.00	17	10.13	10.38	0.070	0.070	1.55	0.39	0.027
	10.50	1.50	0.00	0.07	0.08		1.00	18	10.38	10.63	0.073	0.073	1.50	0.38	0.027
	10.75	1.44	0.00	0.03	0.06		1.00	19	10.63	10.88	0.047	0.047	1.44	0.36	0.017
	11.00	1.33	0.00	0.03	0.05		1.00	20	10.88	11.50	0.044	0.044	1.33	0.83	0.037
	12.00	0.70	0.00			0.034	1.00	21	11.50	12.65	0.034	0.034	0.70	0.81	0.027
LB	13.30	0.00	0.00			0.000	1.00	22	12.65	13.30	0.008	0.008	0.18	0.11	0.001
														Total Flow:	0.882

Total Flow:	**0.882**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**10.53**		**(m^2)**
Top Width:	**7.80**		**(m)**
Hydraulic Depth:	**1.350**		**(m)**
Mean Velocity:	**0.084**		**(m/s)**
Froude Number	**0.023**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**414**	
Datalogger Internal Power:	4.74V		
Datalogger External Power:	13.94V		
Datalogger Memory Used:	0%		
Datalogger Clock:	26/04/2004 8:35		MST
Laptop Clock:	26/04/2004 9:35		MDT
Dessicant:	Good		
Datalogger:	Optimum datalogger s/n#0110220414		
PT:	Keller s/n 0104639 3 psi		
Power:	Car Battery		

Notes: TSS sample collected.
Equipment installed. Transducer wired to rebar and embedded near the left bank.
Open water condition with apparent backwater from downstream obstruction or beaver dam.

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	June 2, 2004	
Start Time:	8:53 AM	MDT
End Time:	9:38 AM	MDT

Weather Conditions: +10 C, overcast

River Conditions: open water, flood stage

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.836	El:	325.175	0.770	El:	325.175
Water Level Reading:	1.541	El:	324.470	1.477	El:	324.468
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	1.064	El:	323.406	1.064	El:	323.404
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	20.30	0.00	0.00	0.00	0.00	0.000	1.00	1	20.30	20.65	0.050	0.050	0.42	0.15	0.007
	21.00	1.67	0.00	0.21	0.20	0.000	1.00	2	20.65	21.25	0.201	0.201	1.67	1.00	0.202
	21.50	1.82	0.00	0.27	0.27		1.00	3	21.25	21.75	0.273	0.273	1.82	0.91	0.248
	22.00	2.01	0.00	0.32	0.32		1.00	4	21.75	22.25	0.322	0.322	2.01	1.01	0.323
	22.50	2.18	0.00	0.34	0.33		1.00	5	22.25	22.75	0.337	0.337	2.18	1.09	0.367
	23.00	2.27	0.00	0.37	0.30		1.00	6	22.75	23.13	0.334	0.334	2.27	0.85	0.284
	23.25	2.31	0.00	0.41	0.24		1.00	7	23.13	23.38	0.323	0.323	2.31	0.58	0.187
	23.50	2.32	0.00	0.42	0.35		1.00	8	23.38	23.63	0.386	0.386	2.32	0.58	0.224
	23.75	2.24	0.00	0.34	0.33		1.00	9	23.63	23.88	0.334	0.334	2.24	0.56	0.187
	24.00	2.20	0.00	0.41	0.33		1.00	10	23.88	24.13	0.372	0.372	2.20	0.55	0.205
	24.25	2.14	0.00	0.39	0.34		1.00	11	24.13	24.38	0.363	0.363	2.14	0.54	0.194
	24.50	2.17	0.00	0.40	0.31		1.00	12	24.38	24.75	0.357	0.357	2.17	0.81	0.290
	25.00	2.00	0.00	0.41	0.32		1.00	13	24.75	25.25	0.367	0.367	2.00	1.00	0.367
	25.50	1.90	0.00	0.36	0.25		1.00	14	25.25	25.75	0.305	0.305	1.90	0.95	0.290
	26.00	1.82	0.00	0.29	0.22		1.00	15	25.75	26.25	0.255	0.255	1.82	0.91	0.232
	26.50	1.60	0.00	0.17	0.17		1.00	16	26.25	26.75	0.171	0.171	1.60	0.80	0.137
	27.00	1.30	0.00	0.16	0.14		1.00	17	26.75	27.50	0.146	0.146	1.30	0.98	0.143
	28.00	0.61	0.00	0.00	0.00	0.024	1.00	18	27.50	28.15	0.000	0.000	0.61	0.40	0.000
LB	28.30	0.00	0.00	0.00		0.000	1.00	19	28.15	28.30	0.000	0.000	0.15	0.02	0.000
														Total Flow:	3.885

Total Flow:	**3.885**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**13.68**		**(m^2)**
Top Width:	**8.00**		**(m)**
Hydraulic Depth:	**1.709**		**(m)**
Mean Velocity:	**0.284**		**(m/s)**
Froude Number	**0.069**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**414**
Datalogger Internal Power:	4.752V	
Datalogger External Power:	13.92V	
Datalogger Memory Used:	3%	
Datalogger Clock:	Jun 02, 2004 07:34	MST
Laptop Clock:	Jun 02, 2004 08:36	MDT
Dessicant:	Good -90%	
Datalogger:	Optimum datalogger s/n#0110220414	
PT:	Keller s/n 0104639 3 psi	
Power:	Car Battery	

Notes: TSS sample collected.
Stream has flooded banks, LB and RB measured at point where water appears to be standing and not contributing to the flow.

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	July 24, 2004	
Start Time:	9:37 AM	MDT
End Time:	10:20 AM	MDT

Weather Conditions: +20 C, calm

River Conditions: open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.281	El:	325.175	0.348	El:	325.175
Water Level Reading:	1.511	El:	323.945	1.585	El:	323.938
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.525	El:	323.420	0.525	El:	323.413
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	19.30	0.00		0.00	0.00		1.00	1	19.30	19.50	0.000	0.000	0.30	0.06	0.000
	19.70	1.19		0.00	0.00		1.00	2	19.50	19.85	0.000	0.000	1.19	0.42	0.000
	20.00	1.36		0.00	0.00		1.00	3	19.85	20.25	0.002	0.002	1.36	0.54	0.001
	20.50	1.55		0.00	0.00		1.00	4	20.25	20.65	0.000	0.000	1.55	0.62	0.000
	20.80	1.70		0.00	0.00		1.00	5	20.65	20.95	0.002	0.002	1.70	0.51	0.001
	21.10	1.90		0.01	0.00		1.00	6	20.95	21.25	0.003	0.003	1.90	0.57	0.002
	21.40	1.94		0.01	0.00		1.00	7	21.25	21.55	0.003	0.003	1.94	0.58	0.002
	21.70	2.00		0.00	0.00		1.00	8	21.55	21.85	0.002	0.002	2.00	0.60	0.001
	22.00	1.95		0.01	0.00		1.00	9	21.85	22.15	0.003	0.003	1.95	0.58	0.002
	22.30	1.94		0.01	0.00		1.00	10	22.15	22.45	0.003	0.003	1.94	0.58	0.002
	22.60	1.91		0.01	0.00		1.00	11	22.45	22.75	0.003	0.003	1.91	0.57	0.002
	22.90	1.83		0.01	0.00		1.00	12	22.75	23.05	0.003	0.003	1.83	0.55	0.002
	23.20	1.81		0.00	0.00		1.00	13	23.05	23.30	0.002	0.002	1.81	0.45	0.001
	23.40	1.68		0.01	0.00		1.00	14	23.30	23.55	0.005	0.005	1.68	0.42	0.002
	23.70	1.62		0.01	0.00		1.00	15	23.55	23.85	0.006	0.006	1.62	0.49	0.003
	24.00	1.54		0.03	0.00		1.00	16	23.85	24.15	0.014	0.014	1.54	0.46	0.006
	24.30	1.40		0.00	0.00		1.00	17	24.15	24.45	0.002	0.002	1.40	0.42	0.001
	24.60	1.30		0.00	0.00		1.00	18	24.45	24.80	0.002	0.002	1.30	0.45	0.001
	25.00	1.11		0.01	0.00		1.00	19	24.80	25.25	0.003	0.003	1.11	0.50	0.002
	25.50	0.89		0.00	0.00		1.00	20	25.25	25.75	0.000	0.000	0.89	0.45	0.000
	26.00	0.65		0.00	0.00		1.00	21	25.75	26.30	0.000	0.000	0.65	0.36	0.000
LB	26.60	0.00		0.00	0.00		1.00	22	26.30	26.60	0.000	0.000	0.16	0.05	0.000
														Total Flow:	0.028

Total Flow:	**0.028**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**10.24**		**(m^2)**
Top Width:	**7.30**		**(m)**
Hydraulic Depth:	**1.402**		**(m)**
Mean Velocity:	**0.003**		**(m/s)**
Froude Number	**0.001**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**414**
Datalogger Internal Power:	4.777V	
Datalogger External Power:	13.54V	
Datalogger Memory Used:	7%	
Datalogger Clock:	Jul 24, 2004 08:12	MST
Laptop Clock:	Jul 24, 2004 09:13	MDT
Dessicant:	Good -50%	
Datalogger:	Optimum datalogger s/n#0110220414	
PT:	Keller s/n 0104639 3 psi	
Power:	Car Battery	

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	August 26, 2004
Start Time:	1:22 PM MDT
End Time:	1:51 PM MDT

Weather Conditions: +15 C, calm, partly cloudy

River Conditions: open, weedy

Personnel & Equipment

Measurement Made By:	DB/CT
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.487	El:	325.175	0.409	El:	325.175
Water Level Reading:	1.757	El:	323.905	1.683	El:	323.901
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.505	El:	323.400	0.505	El:	323.396
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	8.30	0.00		0.00	0.00		1.00	1	8.30	8.05	0.000	0.000	0.16	0.04	0.000
	7.80	0.63		0.00	0.00		1.00	2	8.05	7.55	0.000	0.000	0.63	0.32	0.000
	7.30	0.88		0.00	0.00		1.00	3	7.55	7.05	0.000	0.000	0.88	0.44	0.000
	6.80	1.12		0.00	0.00		1.00	4	7.05	6.55	0.002	0.002	1.12	0.56	0.001
	6.30	1.54		0.00	0.00		1.00	5	6.55	6.05	0.002	0.002	1.54	0.77	0.001
	5.80	1.99		0.00	0.00		1.00	6	6.05	5.55	-0.002	-0.002	1.99	1.00	-0.002
	5.30	2.16		0.01	0.00		1.00	7	5.55	5.05	0.006	0.006	2.16	1.08	0.007
	4.80	2.23		0.02	0.00		1.00	8	5.05	4.55	0.008	0.008	2.23	1.12	0.008
	4.30	2.16		0.01	0.00		1.00	9	4.55	4.05	0.006	0.006	2.16	1.08	0.007
	3.80	2.09		0.01	0.00		1.00	10	4.05	3.55	0.006	0.006	2.09	1.05	0.006
	3.30	2.03		0.01	0.00		1.00	11	3.55	3.05	0.006	0.006	2.03	1.02	0.006
	2.80	2.01		0.01	0.00		1.00	12	3.05	2.55	0.005	0.005	2.01	1.01	0.005
	2.30	1.74		0.01	0.00		1.00	13	2.55	2.05	0.003	0.003	1.74	0.87	0.003
	1.80	1.25		0.01	0.00		1.00	14	2.05	1.50	0.005	0.005	1.25	0.69	0.003
LB	1.20	0.00		0.00	0.00		1.00	15	1.50	1.20	0.000	0.000	0.31	0.09	0.000
														Total Flow:	0.045

Total Flow:	**0.045**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**11.11**		**(m^2)**
Top Width:	**7.10**		**(m)**
Hydraulic Depth:	**1.565**		**(m)**
Mean Velocity:	**0.004**		**(m/s)**
Froude Number	**0.001**		

Photographs taken looking at:
Upstream, downstream, across

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**414**	
Datalogger Internal Power:	4.785V		
Datalogger External Power:	13.56V		
Datalogger Memory Used:	10%		
Datalogger Clock:	Aug 26, 2004 12:05		MST
Laptop Clock:	Aug 26, 2004 13:07		MDT
Dessicant:	Good -50%		
Datalogger:	Optimum datalogger s/n#0110220414		
PT:	Keller s/n 0104639 3 psi		
Power:	Car Battery		

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	September 23, 2004
Start Time:	8:35 AM MDT
End Time:	9:10 AM MDT

Weather Conditions: +2 C, calm, cloudy

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.346	El:	325.175	0.441	El:	325.175
Water Level Reading:	1.489	El:	324.032	1.586	El:	324.030
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd El	0.616	El:	323.416	0.616	El:	323.414
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	25.25	0.00		0.00	0.00	0.000	1.00	1	25.25	24.83	0.002	0.002	0.09	0.04	0.000
	24.40	0.35		0.00	0.00	0.009	1.00	2	24.83	24.20	0.009	0.009	0.35	0.22	0.002
	24.00	0.71		0.00	0.00	0.015	1.00	3	24.20	23.80	0.015	0.015	0.71	0.28	0.004
	23.60	0.95		0.00	0.00	0.009	1.00	4	23.80	23.40	0.009	0.009	0.95	0.38	0.003
	23.20	1.16		0.01	0.00	0.000	1.00	5	23.40	23.05	0.003	0.003	1.16	0.41	0.001
	22.90	1.31		0.00	0.00	0.000	1.00	6	23.05	22.75	0.002	0.002	1.31	0.39	0.001
	22.60	1.56		0.02	0.00	0.000	1.00	7	22.75	22.45	0.008	0.008	1.56	0.47	0.004
	22.30	1.93		0.02	0.00	0.000	1.00	8	22.45	22.15	0.011	0.011	1.93	0.58	0.006
	22.00	2.02		0.01	0.00	0.000	1.00	9	22.15	21.85	0.006	0.006	2.02	0.61	0.004
	21.70	2.17		0.03	0.00	0.000	1.00	10	21.85	21.55	0.015	0.015	2.17	0.65	0.010
	21.40	2.28		0.04	0.00	0.000	1.00	11	21.55	21.25	0.020	0.020	2.28	0.68	0.014
	21.10	3.33		0.05	0.00	0.000	1.00	12	21.25	20.95	0.023	0.023	3.33	1.00	0.023
	20.80	3.33		0.05	0.00	0.000	1.00	13	20.95	20.65	0.024	0.024	3.33	1.00	0.024
	20.50	2.26		0.02	0.00	0.000	1.00	14	20.65	20.35	0.011	0.011	2.26	0.68	0.007
	20.20	2.24		0.03	0.00	0.000	1.00	15	20.35	20.05	0.017	0.017	2.24	0.67	0.011
	19.90	2.17		0.05	0.00	0.000	1.00	16	20.05	19.75	0.023	0.023	2.17	0.65	0.015
	19.60	2.19		0.04	0.00	0.000	1.00	17	19.75	19.45	0.018	0.018	2.19	0.66	0.012
	19.30	2.13		0.04	0.00	0.000	1.00	18	19.45	19.10	0.020	0.020	2.13	0.75	0.015
	18.90	2.06		0.04	0.00	0.000	1.00	19	19.10	18.75	0.020	0.020	2.06	0.72	0.014
	18.60	1.92		0.02	0.00	0.000	1.00	20	18.75	18.45	0.011	0.011	1.92	0.58	0.006
	18.30	1.76		0.01	0.00	0.000	1.00	21	18.45	18.15	0.006	0.006	1.76	0.53	0.003
	18.00	1.37		0.02	0.00	0.000	1.00	22	18.15	17.85	0.008	0.008	1.37	0.41	0.003
	17.70	1.20		0.00	0.00	0.000	1.00	23	17.85	17.45	0.000	0.000	1.20	0.48	0.000
LB	17.20	0.00		0.00	0.00	0.000	1.00	24	17.45	17.20	0.000	0.000	0.30	0.08	0.000
														Total Flow:	0.183

Total Flow:	**0.183**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**12.90**		**(m^2)**
Top Width:	**8.05**		**(m)**
Hydraulic Depth:	**1.602**		**(m)**
Mean Velocity:	**0.014**		**(m/s)**
Froude Number	**0.004**		
Photographs taken looking at: Upstream, downstream, across (photos lost)			

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**414**
Datalogger Internal Power:	4.712V	
Datalogger External Power:	12.84V	
Datalogger Memory Used:	12%	
Datalogger Clock:	Sep 23, 2004 07:11	MST
Laptop Clock:	Sep 23, 2004 07:16	MST
Dessicant:	Replaced	
Datalogger:	Optimum datalogger s/n#0110220414	
PT:	Keller s/n 0104639 3 psi	
Power:	Car Battery	

Hydrometric Measurement / Site Visit Record

S28 - Khahago Creek below Black Fly Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Khahago Creek
Location:	Khahago Creek below Black Fly Creek
Site Name:	S28
Coordinates & Legal:	6342185 N, 480489 E SW-12-95-9-W4

Time of Measurement

Date of Measurement:	October 31, 2004	
Start Time:	9:13 AM	MST
End Time:	9:36 AM	MST

Weather Conditions: -5 C, clear

River Conditions: Fully frozen

Personnel & Equipment

Measurement Made By:	DM/FF/ND
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.445	El:	325.175	0.480	El:	325.175
Water Level Reading:	1.621	El:	323.999	1.670	El:	323.985
Top of Ice Level Reading:	1.611	El:	324.009	1.656	El:	323.999
Transducer Reading & Calc'd E	0.582	El:	323.417	0.582	El:	323.403
Other:		El:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
													Total Flow:	-

Total Flow:	-		(m^3/s)
Pereived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			
Photographs taken looking at: Upstream, downstream, across			

Datalogger Notes:	**Database**	**414**
Datalogger Internal Power:	4.7V	
Datalogger External Power:	14.4V	
Datalogger Memory Used:	15% used	
Datalogger Clock:	Oct 31, 2004 09:10	MST
Laptop Clock:	Oct 31, 2004 08:16	MST
Dessicant:	10% used	
Datalogger:		
PT:	Keller s/n 0104639 3 psi	
Power:		

Notes: No manual measurements possible due to ice cover
TSS sample collected. Transducer removed for winter.

Hydrometric Measurement / Site Visit Record

S29 - Christina River Near Chard WSC 07CE002

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Christina River
Location:	Christina River Near Chard WSC 07CE002
Site Name:	S29
Coordinates & Legal:	6252434 N, 476998 E SE-16-79-6-W4

Time of Measurement

Date of Measurement:	February 4, 2004
Start Time:	9:05 AM MST
End Time:	9:31 AM MST

Weather Conditions: -10 ˚C, overcast, calm

River Conditions: Complete ice cover both upstream and downstream of site.

Personnel & Equipment

Measurement Made By:	DM/FF
Data Entry By:	FF
Meter Type and No.:	March Mc Birney Flo-Mate 2000

Level Readings and Measurements

Bench Mark Reading: Tbar in PVC	1.426	El:	99.076
Water Level Reading:	5.284	El:	95.218
Top of Ice Level Reading:	5.230	El:	95.272
Transducer Reading & Est. El.:	1.077	El:	94.141
Other: Nail tree LB, near logger	0.908	El:	99.594

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	9.00	0.00	0.42			0.000	0.90	1	9.00	9.80	0.000	0.000	0.00	0.00	0.000
	10.60	0.42	0.42			0.001	0.90	2	9.80	11.60	0.001	0.001	0.01	0.01	0.000
	12.60	0.98	0.96			0.049	0.90	3	11.60	12.90	0.049	0.044	0.02	0.03	0.001
	13.20	0.98	0.77			0.719	0.90	4	12.90	13.73	0.719	0.647	0.21	0.17	0.112
	14.25	1.04	0.64			0.741	0.90	5	13.73	14.65	0.741	0.667	0.40	0.37	0.247
	15.05	1.10	0.61			0.774	0.90	6	14.65	15.38	0.774	0.697	0.49	0.36	0.248
	15.70	1.12	0.63			0.771	0.90	7	15.38	15.95	0.771	0.694	0.49	0.28	0.196
	16.20	1.10	0.67			0.674	0.90	8	15.95	16.40	0.674	0.606	0.43	0.19	0.117
	16.60	1.10	0.68			0.677	0.90	9	16.40	16.95	0.677	0.609	0.42	0.23	0.141
	17.30	1.13	0.70			0.686	0.90	10	16.95	17.60	0.686	0.617	0.43	0.28	0.173
	17.90	1.12	0.72			0.674	0.90	11	17.60	18.45	0.674	0.606	0.40	0.34	0.206
	19.00	1.13	0.80			0.646	0.90	12	18.45	19.35	0.646	0.582	0.33	0.30	0.173
	19.70	1.14	0.84			0.622	0.90	13	19.35	20.10	0.622	0.560	0.30	0.23	0.126
	20.50	1.15	0.91			0.616	0.90	14	20.10	20.80	0.616	0.554	0.24	0.17	0.093
	21.10	1.14	0.91			0.576	0.90	15	20.80	21.40	0.576	0.518	0.23	0.14	0.072
	21.70	1.12	0.92			0.558	0.90	16	21.40	22.15	0.558	0.502	0.20	0.15	0.075
	22.60	1.05	0.87			0.533	0.90	17	22.15	23.18	0.533	0.480	0.18	0.18	0.089
	23.75	1.02	0.70			0.524	0.90	18	23.18	24.38	0.524	0.472	0.32	0.38	0.181
LB	25.00	0.00	0.70			0.000	0.90	19	24.38	25.00	0.131	0.118	0.08	0.05	0.006
														Total Flow:	**2.254**

Total Flow:	**2.254**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**3.86**		**(m^2)**
Top Width:	**16.00**		**(m)**
Hydraulic Depth:	**0.241**		**(m)**
Mean Velocity:	**0.584**		**(m/s)**
Froude Number	**0.380**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes:
Ice surface concave due to lower stage following ice formation.
Data processed with Dolphin settings.

Datalogger Notes:	**Database #268**	
Datalogger Internal Power:	4.52 V	
Datalogger External Power:	12.36 V	
Datalogger Memory Used:	55%	
Datalogger Clock:	Feb 04, 2004 10:34	MST
Laptop Clock:	Feb 04, 2004 09:34	MST
Dessicant:	50% Good	

Datalogger: Optimum DD128, # 0104170268
PT: Keller 730-130-5 psi #0205463
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S29 - Christina River Near Chard WSC 07CE002

Regional Aquatics Monitoring Program

Measurement Location

River/Stream: Christina River
Location: Christina River Near Chard WSC 07CE002
Site Name: S29
Coordinates & Legal: 6252434 N, 476998 E SE-16-79-6-W4

Time of Measurement

Date of Measurement: March 4, 2004
Start Time: 12:03 PM MST
End Time: 1:32 PM MST

Weather Conditions: -16 ˚C, Overcast, Light Snow

River Conditions: Complete ice cover both upstream and downstream of site.

Personnel & Equipment

Measurement Made By: DK/DM
Data Entry By: DK
Meter Type and No.: March Mc Birney Flo-Mate 2000

Level Readings and Measurements

Bench Mark Reading:	Tbar in PVC	1.257	El:	99.076
Water Level Reading:		4.969	El:	95.365
Top of Ice Level Reading:		4.884	El:	95.450
Transducer Reading & Est. El.:		1.215	El:	94.149
Other:	Nail tree LB, near logger	0.742	El:	99.591

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	1.20	0.00	0.78			0.000	0.90	1	1.20	1.50	0.075	0.067	0.01	0.00	0.000
	1.80	0.82	0.78			0.299	0.90	2	1.50	2.13	0.299	0.269	0.04	0.03	0.007
	2.45	0.92	0.50			0.756	0.90	3	2.13	3.03	0.756	0.680	0.42	0.38	0.257
	3.60	1.12	0.73			0.738	0.90	4	3.03	3.95	0.738	0.664	0.39	0.36	0.239
	4.30	1.14	0.93			0.674	0.90	5	3.95	4.58	0.674	0.606	0.21	0.13	0.080
	4.85	1.16	0.98			0.591	0.90	6	4.58	5.10	0.591	0.532	0.18	0.09	0.050
	5.35	1.19	1.05			0.646	0.90	7	5.10	5.58	0.646	0.582	0.14	0.07	0.039
	5.80	1.24	1.06			0.613	0.90	8	5.58	6.00	0.613	0.551	0.18	0.08	0.042
	6.20	1.25	1.15			0.536	0.90	9	6.00	6.38	0.536	0.483	0.10	0.04	0.018
	6.55	1.27	1.08			0.683	0.90	10	6.38	6.80	0.683	0.614	0.19	0.08	0.050
	7.05	1.28	1.11			0.661	0.90	11	6.80	7.25	0.661	0.595	0.17	0.08	0.046
	7.45	1.29	1.12			0.655	0.90	12	7.25	7.63	0.655	0.590	0.17	0.06	0.038
	7.80	1.26	1.10			0.716	0.90	13	7.63	8.03	0.716	0.645	0.16	0.06	0.041
	8.25	1.28	1.07			0.683	0.90	14	8.03	8.43	0.683	0.614	0.21	0.08	0.052
	8.60	1.25	1.02			0.753	0.90	15	8.43	8.85	0.753	0.678	0.23	0.10	0.066
	9.10	1.27	1.02			0.750	0.90	16	8.85	9.38	0.750	0.675	0.25	0.13	0.089
	9.65	1.26	0.79			0.847	0.90	17	9.38	9.88	0.847	0.763	0.47	0.24	0.179
	10.10	1.27	0.76			0.853	0.90	18	9.88	10.28	0.853	0.768	0.51	0.20	0.157
	10.45	1.26	0.80			0.866	0.90	19	10.28	10.65	0.866	0.779	0.46	0.17	0.134
	10.85	1.24	0.75			0.811	0.90	20	10.65	11.05	0.811	0.730	0.49	0.20	0.143
	11.25	1.24	0.86			0.844	0.90	21	11.05	11.45	0.844	0.760	0.38	0.15	0.115
	11.65	1.26	0.87			0.884	0.90	22	11.45	11.85	0.884	0.796	0.39	0.16	0.124
	12.05	1.23	0.86			0.829	0.90	23	11.85	12.25	0.829	0.746	0.37	0.15	0.110
	12.45	1.25	0.67			0.917	0.90	24	12.25	12.65	0.917	0.826	0.58	0.23	0.192
	12.85	1.23	0.80			0.920	0.90	25	12.65	13.05	0.920	0.828	0.43	0.17	0.142
	13.25	1.17	0.85			0.917	0.90	26	13.05	13.50	0.917	0.826	0.32	0.14	0.119
	13.75	1.17	0.82			0.856	0.90	27	13.50	14.03	0.856	0.771	0.35	0.18	0.142
	14.30	1.12	0.84			0.917	0.90	28	14.03	14.58	0.917	0.826	0.28	0.15	0.127
	14.85	1.13	1.02			0.001	0.90	29	14.58	15.20	0.001	0.001	0.11	0.07	0.000
LB	15.55	0.00	1.02			0.000	0.90	30	15.20	15.55	0.000	0.000	0.03	0.01	0.000
														Total Flow:	**2.798**

Total Flow:	**2.798**		(m^3/s)
Pereived Measurement Quality:	**Good**		
Total Area:	**4.00**		(m^2)
Top Width:	**14.35**		(m)
Hydraulic Depth:	**0.279**		(m)
Mean Velocity:	**0.700**		(m/s)
Froude Number	**0.423**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes:
Ice surface concave due to lower stage following ice formation.

Datalogger Notes:	**Database #268**	
Datalogger Internal Power:	4.546V	
Datalogger External Power:	12.35V	
Datalogger Memory Used:	57%	
Datalogger Clock:	Mar 04, 2004 12:36	MST
Laptop Clock:	Mar 04, 2004 13:32	MST
Dessicant:	75% Good	

Datalogger: Optimum DD128, # 0104170268
PT: Keller 730-130-5 psi #0205463
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S29 - Christina River Near Chard WSC 07CE002

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Christina River
Location:	Christina River Near Chard WSC 07CE002
Site Name:	S29
Coordinates & Legal:	6252434 N, 476998 E SE-16-79-6-W4

Time of Measurement

Date of Measurement:	April 1, 2004	
Start Time:	2:30 PM	MST
End Time:	3:15 PM	MST

Weather Conditions: +15 ˚C, clear, calm

River Conditions: Complete ice cover both upstream and downstream of site.

Personnel & Equipment

Measurement Made By:	DM/DK
Data Entry By:	DK
Meter Type and No.:	March Mc Birney Flo-Mate 2000

Level Readings and Measurements

Bench Mark Reading: Tbar in PVC	1.348	El:	99.076
Water Level Reading:	5.010	El:	95.415
Top of Ice Level Reading:	5.123	El:	95.301
Transducer Reading & Est. El.:	1.261	El:	94.153
Other: Nail tree LB, near logger	0.829	El:	99.596

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	18.80	0.00	0.80			0.000	0.90	1	18.80	19.35	0.184	0.166	0.10	0.05	0.009
	19.90	1.19	0.80			0.738	0.90	2	19.35	20.35	0.738	0.664	0.39	0.39	0.259
	20.80	1.19	0.91			0.725	0.90	3	20.35	21.13	0.725	0.653	0.28	0.22	0.142
	21.45	1.26	1.02			0.716	0.90	4	21.13	21.85	0.716	0.645	0.24	0.17	0.112
	22.25	1.28	1.00			0.658	0.90	5	21.85	22.58	0.658	0.593	0.28	0.20	0.120
	22.90	1.29	1.01			0.695	0.90	6	22.58	23.20	0.695	0.625	0.28	0.18	0.109
	23.50	1.32	0.99			0.762	0.90	7	23.20	23.80	0.762	0.686	0.33	0.20	0.136
	24.10	1.31	0.97			0.738	0.90	8	23.80	24.50	0.738	0.664	0.34	0.24	0.158
	24.90	1.32	0.87			0.820	0.90	9	24.50	25.30	0.820	0.738	0.45	0.36	0.266
	25.70	1.30	0.83			0.823	0.90	10	25.30	26.05	0.823	0.741	0.47	0.35	0.261
	26.40	1.30	0.78			0.750	0.90	11	26.05	26.70	0.750	0.675	0.52	0.34	0.228
	27.00	1.29	0.76			0.759	0.90	12	26.70	27.30	0.759	0.683	0.53	0.32	0.217
	27.60	1.28	0.74			0.796	0.90	13	27.30	27.95	0.796	0.716	0.54	0.35	0.251
	28.30	1.28	0.71			0.744	0.90	14	27.95	28.63	0.744	0.669	0.57	0.38	0.258
	28.95	1.28	0.72			0.771	0.90	15	28.63	29.28	0.771	0.694	0.56	0.36	0.253
	29.60	1.22	0.74			0.741	0.90	16	29.28	29.93	0.741	0.667	0.48	0.31	0.208
	30.25	1.18	0.82			0.671	0.90	17	29.93	30.55	0.671	0.604	0.36	0.23	0.136
	30.85	1.20	0.99			0.351	0.90	18	30.55	31.18	0.351	0.315	0.21	0.13	0.041
RB	31.50	0.00	0.99			0.000	0.90	19	31.18	31.50	0.088	0.079	0.05	0.02	0.001
														Total Flow:	**3.165**

Total Flow:	**3.165**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**4.80**		**(m^2)**
Top Width:	**12.70**		**(m)**
Hydraulic Depth:	**0.378**		**(m)**
Mean Velocity:	**0.659**		**(m/s)**
Froude Number	**0.342**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes:
Ice surface concave due to lower stage following ice formation.
Data processed with Dolphin settings.
Installed TBRG 3563 - 3573 Test

Datalogger Notes:	**Database #268**	
Datalogger Internal Power:	4.618V	
Datalogger External Power:	12.49V	
Datalogger Memory Used:	59%	
Datalogger Clock:	Apr 01, 2004 11:59	MST
Laptop Clock:	Apr 01, 2004 12:00	MST
Dessicant:	0.75	

Datalogger: Optimum DD128, # 0104170268
PT: Keller 730-130-5 psi #0205463
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S29 - Christina River Near Chard WSC 07CE002

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Christina River
Location:	Christina River Near Chard WSC 07CE002
Site Name:	S29
Coordinates & Legal:	6252434 N, 476998 E SE-16-79-6-W4

Time of Measurement

Date of Measurement:	April 25, 2004	
Start Time:	8:30 AM	MDT
End Time:	9:50 AM	MDT

Weather Conditions: -2 C, clear, calm

River Conditions: Open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	Setup No. 1			Setup No. 2		
Bench Mark Reading: T-bar	1.306	El:	99.076	1.147	El:	99.076
Water Level Reading:	5.044	El:	95.338	4.868	El:	95.355
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.000	El:	95.338	0.000	El:	95.355
Nail in Tree on LB	0.790	El:	99.592	0.635	El:	99.747

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	6.20	0.00	0.00	0.00	0.00		1.00	1	6.20	6.85	0.119	0.119	0.43	0.28	0.034
	7.50	1.74	0.00	0.58	0.37		1.00	2	6.85	8.25	0.475	0.475	1.74	2.43	1.157
	9.00	2.01	0.00	0.98	0.92		1.00	3	8.25	9.50	0.951	0.951	2.01	2.51	2.391
	10.00	2.10	0.00	1.05	0.92		1.00	4	9.50	10.50	0.986	0.986	2.10	2.10	2.074
	11.00	2.16	0.00	1.00	1.00		1.00	5	10.50	11.50	1.000	1.000	2.16	2.16	2.164
	12.00	1.98	0.00	1.04	0.80		1.00	6	11.50	12.50	0.922	0.922	1.98	1.98	1.827
	13.00	1.83	0.00	1.04	1.00		1.00	7	12.50	13.50	1.018	1.018	1.83	1.83	1.862
	14.00	1.68	0.00	1.02	0.84		1.00	8	13.50	14.50	0.933	0.933	1.68	1.68	1.564
	15.00	1.68	0.00	1.03	0.97		1.00	9	14.50	15.50	0.998	0.998	1.68	1.68	1.673
	16.00	1.68	0.00	1.01	0.89		1.00	10	15.50	16.50	0.949	0.949	1.68	1.68	1.592
	17.00	1.55	0.00	0.93	0.80		1.00	11	16.50	17.50	0.869	0.869	1.55	1.55	1.350
	18.00	1.52	0.00	0.96	0.80		1.00	12	17.50	18.50	0.879	0.879	1.52	1.52	1.340
	19.00	1.31	0.00	0.94	0.78		1.00	13	18.50	19.50	0.863	0.863	1.31	1.31	1.131
	20.00	1.34	0.00	0.94	0.60		1.00	14	19.50	20.40	0.768	0.768	1.34	1.21	0.927
	20.80	1.37	0.00	0.86	0.60		1.00	15	20.40	21.40	0.730	0.730	1.37	1.37	1.001
	22.00	1.16	0.00	0.92	0.74		1.00	16	21.40	22.50	0.831	0.831	1.16	1.27	1.058
	23.00	1.22	0.00	0.83	0.76		1.00	17	22.50	23.50	0.791	0.791	1.22	1.22	0.964
	24.00	1.34	0.00	0.83	0.62		1.00	18	23.50	24.50	0.725	0.725	1.34	1.34	0.973
	25.00	1.25	0.00	0.80	0.59		1.00	19	24.50	25.50	0.696	0.696	1.25	1.25	0.870
	26.00	1.19	0.00	0.77	0.60		1.00	20	25.50	26.50	0.686	0.686	1.19	1.19	0.815
	27.00	1.31	0.00	0.75	0.47		1.00	21	26.50	27.50	0.613	0.613	1.31	1.31	0.803
	28.00	1.19	0.00	0.85	0.70		1.00	22	27.50	28.50	0.776	0.776	1.19	1.19	0.922
	29.00	1.19	0.00	0.82	0.64		1.00	23	28.50	29.50	0.728	0.728	1.19	1.19	0.866
	30.00	1.10	0.00	0.80	0.68		1.00	24	29.50	30.50	0.741	0.741	1.10	1.10	0.813
	31.00	1.19	0.00	0.86	0.66		1.00	25	30.50	31.50	0.759	0.759	1.19	1.19	0.902
	32.00	1.28	0.00	0.80	0.64		1.00	26	31.50	32.65	0.721	0.721	1.28	1.47	1.061
	33.30	0.98	0.00	0.69	0.70		1.00	27	32.65	33.90	0.698	0.698	0.98	1.22	0.851
	34.50	1.10	0.00	0.57	0.70		1.00	28	33.90	35.85	0.636	0.636	1.10	2.14	1.360
RB	37.20	0.00	0.00	0.00	0.00		1.00	29	35.85	37.20	0.159	0.159	0.27	0.37	0.059
														Total Flow:	34.403

Total Flow:	**34.403**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**42.75**		**(m^2)**
Top Width:	**31.00**		**(m)**
Hydraulic Depth:	**1.379**		**(m)**
Mean Velocity:	**0.805**		**(m/s)**
Froude Number	**0.219**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**268**
Datalogger Internal Power:	4.55V	
Datalogger External Power:	12.28V	
Datalogger Memory Used:	20%	
Datalogger Clock:	Apr 25, 2004 06:34	MST
Laptop Clock:	Apr 25, 2004 07:35	MDT
Dessicant:	Good	
Datalogger:	Optimum DD128, # 0104170268	
PT:	Keller 730-130-5 psi #0205463	
Power:	Magnacharge 20V 10A DC Battery and	

Notes:
Recent ice out (April 22, 2004) or high flow event caused transducer to be moved and damaged. Transducer removed for servicing. Level data collected until April 22.
TSS sample collected. Rain gauge TR 525M-R3 s/n 30496-402 with 9.6" top removed.
Flow measurement made from bridge.

Hydrometric Measurement / Site Visit Record

S29 - Christina River Near Chard WSC 07CE002

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Christina River
Location:	Christina River Near Chard WSC 07CE002
Site Name:	S29
Coordinates & Legal:	6252434 N, 476998 E SE-16-79-6-W4

Time of Measurement

Date of Measurement:	December 3, 2004	
Start Time:	MDT	**AT WSC**
End Time:	MDT	

Weather Conditions: -5 C, windy, freezing rain

River Conditions: Partially frozen, water flowing over ice on edges

Personnel & Equipment

Measurement Made By:	ND/CT/DB
Data Entry By:	DB
Meter Type and No.:	

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: T-bar	2.575	El:	99.076	2.641	El:	99.076
Water Level Reading:	4.241	El:	97.410	4.302	El:	97.415
Top of Ice Level Reading:	4.301	El:		4.368	El:	
Transducer Reading & Calc'd El.:		El:	97.410		El:	97.415
Nail in Tree on LB	2.053	El:	99.598	2.122	El:	99.529

Measurement Data

Measured Data						Calculated Data								
Station	**Depth**	**Ice Thickness**	**Velocity at 0.2 Depth**	**Velocity at 0.8 Depth**	**Velocity at 0.6 Depth**	**Velocity Correction Factor**	**Panel No.**	**Panel Starts at Station**	**Panel Ends at Station**	**Measured Panel Velocity**	**Effective Average Panel Velocity**	**Panel Effective Depth**	**Panel Area**	**Panel Discharge**
(m)	**(m)**	**(m)**	**(m/s)**	**(m/s)**	**(m/s)**			**(m)**	**(m)**	**(m/s)**	**(m/s)**	**(m)**	**(m^2)**	**(m^3/s)**
													Total Flow:	-

Total Flow:	-		**(m^3/s)**
Pereived Measurement Quality:			
Total Area:			**(m^2)**
Top Width:			**(m)**
Hydraulic Depth:			**(m)**
Mean Velocity:			**(m/s)**
Froude Number			

Photographs taken looking at:
US, DS and across

Datalogger Notes:	**Database**
Datalogger Internal Power:	
Datalogger External Power:	
Datalogger Memory Used:	
Datalogger Clock:	
Laptop Clock:	
Dessicant:	
Datalogger:	
PT:	
Power:	

Notes:
Water level taken at WSC shack only. Ice conditions too dangerous for flow measurement.

Hydrometric Measurement / Site Visit Record

S31 - Hanginstone Creek Above at North Star Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Hanginstone Creek
Location:	Hanginstone Creek Above at North Star Road
Site Name:	S31
Coordinates & Legal:	6236084 N, 469784 E NW 10-84-10 W4M

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Time of Measurement

Date of Measurement:	April 25, 2004	
Start Time:	2:00 PM	MDT
End Time:	2:20 PM	MDT

Weather Conditions: +15 C, Clear, Calm,

River Conditions: Open water condition. Some debris in channel downstream of flow measurement section.

Level Readings

		Setup No. 1			Setup No. 2		
Bench Mark Reading:	Nail on LB	2.541	El:	100.000	0.562	El:	100.000
Water Level Reading:		3.907	El:	98.634	1.921	El:	98.641
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.790	El:	97.844	0.790	El:	97.851
Other:			El:	102.541		El:	100.562

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	2.10	0.00	0.00			0.000	1.00	1	2.10	2.30	0.051	0.051	0.08	0.02	0.001
	2.50	0.33	0.00			0.204	1.00	2	2.50	2.75	0.204	0.204	0.33	0.08	0.017
	3.00	0.37	0.00			0.305	1.00	3	3.00	3.25	0.305	0.305	0.37	0.09	0.028
	3.50	0.42	0.00			0.381	1.00	4	3.50	3.75	0.381	0.381	0.42	0.11	0.040
	4.00	0.48	0.00			0.399	1.00	5	4.00	4.25	0.399	0.399	0.48	0.12	0.048
	4.50	0.54	0.00			0.433	1.00	6	4.50	4.63	0.433	0.433	0.54	0.07	0.029
	4.75	0.62	0.00			0.491	1.00	7	4.75	4.88	0.491	0.491	0.62	0.08	0.038
	5.00	0.68	0.00			0.494	1.00	8	5.00	5.13	0.494	0.494	0.68	0.09	0.042
	5.25	0.67	0.00			0.485	1.00	9	5.25	5.38	0.485	0.485	0.67	0.08	0.041
	5.50	0.69	0.00			0.421	1.00	10	5.50	5.75	0.421	0.421	0.69	0.17	0.073
	6.00	0.69	0.00			0.448	1.00	11	6.00	6.25	0.448	0.448	0.69	0.17	0.077
	6.50	0.66	0.00			0.408	1.00	12	6.50	6.75	0.408	0.408	0.66	0.17	0.067
	7.00	0.66	0.00			0.326	1.00	13	7.00	7.25	0.326	0.326	0.66	0.17	0.054
	7.50	0.74	0.00			0.290	1.00	14	7.50	7.75	0.290	0.290	0.74	0.19	0.054
	8.00	0.72	0.00			0.259	1.00	15	8.00	8.25	0.259	0.259	0.72	0.18	0.047
	8.50	0.48	0.00			0.235	1.00	16	8.50	8.63	0.235	0.235	0.48	0.06	0.014
	8.75	0.55	0.00			0.186	1.00	17	8.75	8.98	0.186	0.186	0.55	0.12	0.023
RB	9.20	0.00	0.00			0.000	1.00	18	8.98	9.20	0.046	0.046	0.14	0.03	0.001
														Total Flow:	0.693

Total Flow:	**0.693**		(m^3/s)
Pereived Measurement Quality:	**Good**		
Total Area:	**1.98**		(m^2)
Top Width:	**7.10**		(m)
Hydraulic Depth:	**0.280**		(m)
Mean Velocity:	**0.349**		(m/s)
Froude Number	**0.211**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	11.34V 100%	
Datalogger External Power:	11.1V 72%	
Datalogger Memory Used:	0%	
Datalogger Clock:	25/04/2004 13:08:00 PM	MST
Laptop Clock:	25/04/2004 14:32:00 PM	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #95185-05	
PT:	Keller Pressure Transducer #3499	
Power:	Lakewood battery	

Notes:

TSS sample collected. Equipmnent installed. Transducer wired to concrete block near RB 30 m d/s of bridge.
Beaver dam upstream of bridge. Some submerged logs and woody debris in channel downstream.

Hydrometric Measurement / Site Visit Record

S31 - Hanginstone Creek Above at North Star Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Hanginstone Creek
Location:	Hanginstone Creek Above at North Star Road
Site Name:	S31
Coordinates & Legal:	6236084 N, 469784 E NW 10-84-10 W4M

Time of Measurement

Date of Measurement:	June 3, 2004	
Start Time:	8:40 AM	MDT
End Time:	9:10 AM	MDT

Weather Conditions: clear, light wind, +10 C

River Conditions: open, flood stage

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Nail on LB	1.453	El:	100.000	1.375	El:	100.000
Water Level Reading:		2.486	El:	98.967	2.404	El:	98.971
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		1.132	El:	97.835	1.132	El:	97.839
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	8.90	0.24	0.00			0.714	1.00	1	8.90	8.55	0.271	0.271	0.21	0.07	0.020
	8.20	0.82	0.00			1.085	1.00	2	8.20	8.05	1.085	1.085	0.82	0.12	0.134
	7.90	0.85	0.00			1.189	1.00	3	7.90	7.55	1.189	1.189	0.85	0.30	0.355
	7.20	0.88	0.00			0.987	1.00	4	7.20	7.05	0.987	0.987	0.88	0.13	0.131
	6.90	0.85	0.00			1.186	1.00	5	6.90	6.75	1.186	1.186	0.85	0.13	0.152
	6.60	0.88	0.00			1.033	1.00	6	6.60	6.45	1.033	1.033	0.88	0.13	0.137
	6.30	0.85	0.00			1.022	1.00	7	6.30	6.15	1.022	1.022	0.85	0.13	0.131
	6.00	0.85	0.00			0.878	1.00	8	6.00	5.85	0.878	0.878	0.85	0.13	0.112
	5.70	0.79	0.00			0.818	1.00	9	5.70	5.55	0.818	0.818	0.79	0.12	0.097
	5.40	0.79	0.00			0.918	1.00	10	5.40	5.25	0.918	0.918	0.79	0.12	0.109
	5.10	0.79	0.00			0.849	1.00	11	5.10	4.95	0.849	0.849	0.79	0.12	0.101
	4.80	0.70	0.00			0.806	1.00	12	4.80	4.65	0.806	0.806	0.70	0.11	0.085
	4.50	0.67	0.00			0.757	1.00	13	4.50	4.35	0.757	0.757	0.67	0.10	0.076
	4.20	0.55	0.00			0.754	1.00	14	4.20	4.00	0.754	0.754	0.55	0.11	0.083
RB	3.80	0.00	0.00			0.000	1.00	15	3.80	3.80	0.000	0.000	0.00	0.00	0.000
														Total Flow:	1.723

Total Flow:	**1.723**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**1.82**		**(m^2)**
Top Width:	**5.10**		**(m)**
Hydraulic Depth:	**0.356**		**(m)**
Mean Velocity:	**0.949**		**(m/s)**
Froude Number	**0.508**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected. River in flood stage - too high for wading, used bomb from bridge.

Datalogger Notes:		
Datalogger Internal Power:	11.34V (100%)	
Datalogger External Power:	10.95V (70%)	
Datalogger Memory Used:	24530 left	
Datalogger Clock:	7:17:07 AM	MST
Laptop Clock:	8:18:05 AM	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #95185-05	
PT:	Keller Pressure Transducer #3499	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S31 - Hanginstone Creek Above at North Star Road

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Hanginstone Creek
Location:	Hanginstone Creek Above at North Star Road
Site Name:	S31
Coordinates & Legal:	6236084 N, 469784 E NW 10-84-10 W4M

Time of Measurement

Date of Measurement:	July 25, 2004	
Start Time:	9:49 AM	MDT
End Time:	10:02 AM	MDT

Weather Conditions: +20 °C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings

		Setup No. 1			Setup No. 2		
Bench Mark Reading:	Nail on LB	0.785	El:	100.000	0.705	El:	100.000
Water Level Reading:		2.476	El:	98.309	2.393	El:	98.312
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		0.455	El:	97.854	0.455	El:	97.857
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	17.80	0.00				0.000	1.00	1	17.80	17.90	0.007	0.007	0.04	0.00	0.000
	18.00	0.14				0.027	1.00	2	18.00	18.25	0.027	0.027	0.14	0.04	0.001
	18.50	0.23				0.049	1.00	3	18.50	18.75	0.049	0.049	0.23	0.06	0.003
	19.00	0.20				0.082	1.00	4	19.00	19.25	0.082	0.082	0.20	0.05	0.004
	19.50	0.22				0.076	1.00	5	19.50	19.65	0.076	0.076	0.22	0.03	0.003
	19.80	0.22				0.116	1.00	6	19.80	19.95	0.116	0.116	0.22	0.03	0.004
	20.10	0.24				0.104	1.00	7	20.10	20.25	0.104	0.104	0.24	0.04	0.004
	20.40	0.26				0.116	1.00	8	20.40	20.55	0.116	0.116	0.26	0.04	0.005
	20.70	0.30				0.122	1.00	9	20.70	20.85	0.122	0.122	0.30	0.04	0.005
	21.00	0.39				0.125	1.00	10	21.00	21.15	0.125	0.125	0.39	0.06	0.007
	21.30	0.44				0.143	1.00	11	21.30	21.45	0.143	0.143	0.44	0.07	0.009
	21.60	0.46				0.146	1.00	12	21.60	21.75	0.146	0.146	0.46	0.07	0.010
	21.90	0.47				0.143	1.00	13	21.90	22.05	0.143	0.143	0.47	0.07	0.010
	22.20	0.50				0.171	1.00	14	22.20	22.30	0.171	0.171	0.50	0.05	0.009
	22.40	0.50				0.143	1.00	15	22.40	22.50	0.143	0.143	0.50	0.05	0.007
	22.60	0.50				0.152	1.00	16	22.60	22.70	0.152	0.152	0.50	0.05	0.008
	22.80	0.51				0.146	1.00	17	22.80	22.90	0.146	0.146	0.51	0.05	0.007
	23.00	0.50				0.128	1.00	18	23.00	23.10	0.128	0.128	0.50	0.05	0.006
	23.20	0.50				0.073	1.00	19	23.20	23.35	0.073	0.073	0.50	0.08	0.005
	23.50	0.48				0.085	1.00	20	23.50	23.65	0.085	0.085	0.48	0.07	0.006
	23.80	0.40				0.131	1.00	21	23.80	23.95	0.131	0.131	0.40	0.06	0.008
	24.10	0.33				0.104	1.00	22	24.10	24.30	0.104	0.104	0.33	0.07	0.007
	24.50	0.22				0.098	1.00	23	24.50	24.70	0.098	0.098	0.22	0.04	0.004
	24.90	0.14				0.058	1.00	24	24.90	25.15	0.058	0.058	0.14	0.04	0.002
LB	25.40	0.00				0.000	1.00	25	25.40	25.40	0.000	0.000	0.00	0.00	0.000
														Total Flow:	0.135

Total Flow:	**0.135**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**1.20**		**(m^2)**
Top Width:	**7.60**		**(m)**
Hydraulic Depth:	**0.158**		**(m)**
Mean Velocity:	**0.112**		**(m/s)**
Froude Number	**0.090**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Notes: TSS sample collected.

Datalogger Notes:		
Datalogger Internal Power:	11.34V (100%)	
Datalogger External Power:	10.83V (70%)	
Datalogger Memory Used:	55%	
Datalogger Clock:	Jul 25, 2004 08:27	MST
Laptop Clock:	Jul 25, 2004 09:29	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 #95185-05	
PT:	Keller Pressure Transducer #3499	
Power:	Lakewood battery	

Hydrometric Measurement / Site Visit Record

S31 - Hangingstone Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Hangingstone Creek
Location:	Hangingstone Creek
Site Name:	S31
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 23, 2004	
Start Time:	12:03 PM	MDT
End Time:	12:25 PM	MDT

Weather Conditions: Partly Cloudy, 15 C, calm

River Conditions: Open, low

Personnel & Equipment

Measurement Made By:	CT/DB
Data Entry By:	DB
Meter Type and No.:	March Mc Birney Flo-Mate 2000 (rental) s/n 2001463

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tre	0.741	El:	100.000	0.708	El:	100.000
Water Level Reading:	2.516	El:	98.225	2.482	El:	98.226
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Est. El.:	0.377	El:	97.848	0.377	El:	97.849
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	24.30	0.00				0.000	1.00	1	24.30	24.10	0.011	0.011	0.03	0.00	0.000
	23.90	0.10				0.046	1.00	2	24.10	23.75	0.046	0.046	0.10	0.04	0.002
	23.60	0.23				0.037	1.00	3	23.75	23.45	0.037	0.037	0.23	0.07	0.003
	23.30	0.26				0.079	1.00	4	23.45	23.15	0.079	0.079	0.26	0.08	0.006
	23.00	0.28				0.085	1.00	5	23.15	22.85	0.085	0.085	0.28	0.08	0.007
	22.70	0.32				0.104	1.00	6	22.85	22.55	0.104	0.104	0.32	0.10	0.010
	22.40	0.30				0.107	1.00	7	22.55	22.25	0.107	0.107	0.30	0.09	0.010
	22.10	0.30				0.146	1.00	8	22.25	21.95	0.146	0.146	0.30	0.09	0.013
	21.80	0.28				0.146	1.00	9	21.95	21.65	0.146	0.146	0.28	0.08	0.012
	21.50	0.28				0.137	1.00	10	21.65	21.35	0.137	0.137	0.28	0.08	0.012
	21.20	0.26				0.134	1.00	11	21.35	21.05	0.134	0.134	0.26	0.08	0.010
	20.90	0.26				0.122	1.00	12	21.05	20.75	0.122	0.122	0.26	0.08	0.010
	20.60	0.26				0.125	1.00	13	20.75	20.45	0.125	0.125	0.26	0.08	0.010
	20.30	0.28				0.113	1.00	14	20.45	20.15	0.113	0.113	0.28	0.08	0.009
	20.00	0.28				0.088	1.00	15	20.15	19.85	0.088	0.088	0.28	0.08	0.007
	19.70	0.27				0.073	1.00	16	19.85	19.55	0.073	0.073	0.27	0.08	0.006
	19.40	0.26				0.067	1.00	17	19.55	19.35	0.067	0.067	0.26	0.05	0.003
	19.30	0.26				0.067	1.00	18	19.35	19.15	0.067	0.067	0.26	0.05	0.003
	19.00	0.21				0.067	1.00	19	19.15	18.85	0.067	0.067	0.21	0.06	0.004
	18.70	0.18				0.052	1.00	20	18.85	18.55	0.052	0.052	0.18	0.05	0.003
	18.40	0.14				0.015	1.00	21	18.55	18.25	0.015	0.015	0.14	0.04	0.001
	18.10	0.12				0.003	1.00	22	18.25	17.85	0.003	0.003	0.12	0.05	0.000
	17.60	0.00				0.000	1.00	23	18.25	17.60	0.004	0.004	0.04	0.02	0.000
														Total Flow:	**0.141**

Total Flow:	**0.141**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**1.52**		**(m^2)**
Top Width:	**6.70**		**(m)**
Hydraulic Depth:	**0.227**		**(m)**
Mean Velocity:	**0.093**		**(m/s)**
Froude Number	**0.062**		

Photographs taken looking at:
Upstream, downstream, across

Notes:
TSS Sample Taken
Laptop battery died during download, data was re-downloaded on Tues Aug 31 by CT

Datalogger Notes:		
Datalogger Internal Power:		
Datalogger External Power:		
Datalogger Memory Used:		
Datalogger Clock:		MST
Laptop Clock:		MDT
Dessicant:	Replaced	
Datalogger:		
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

S31 - Hangingstone Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Hangingstone Creek
Location:	Hangingstone Creek
Site Name:	S31
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 31, 2004
Start Time:	MDT
End Time:	MDT

Weather Conditions: Raining, 10 C

River Conditions: Open, low

Personnel & Equipment

Measurement Made By:	CT
Data Entry By:	DB
Meter Type and No.:	

Level Readings	**Setup No. 1**			**Setup No. 2**	
Bench Mark Reading: nail in tree		El:	100.000	El:	100.000
Water Level Reading:		El:	100.000	El:	100.000
Top of Ice Level Reading:		El:		El:	
Transducer Reading & Est. El.:	0.384	El:	99.616	El:	100.000
Other:		El:		El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Pereived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			
Photographs taken looking at:			

Notes:

Data re-downloaded as previous download (Aug 23) was lost when laptop battery died

Datalogger Notes:			
Datalogger Internal Power:	10.98V	96%	
Datalogger External Power:	10.46V	67%	
Datalogger Memory Used:	7199 K free%		
Datalogger Clock:	Aug 31, 2004 14:16		MST
Laptop Clock:	Aug 31, 2004 15:18		MDT
Dessicant:			
Datalogger:	95185-05		
PT:	3499		
Power:			

Hydrometric Measurement / Site Visit Record

S31 - Hangingstone Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Hangingstone Creek
Location:	Hangingstone Creek
Site Name:	S31
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 20, 2004	
Start Time:	12:44 PM	MDT
End Time:	1:04 PM	MDT

Weather Conditions: Partly cloudy, light snow, + 3 C

River Conditions: open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney 2000 SN# 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tre	0.929	El:	100.000	0.68	El:	100.000
Water Level Reading:	2.344	El:	98.585	2.089	El:	98.591
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Est. El.:	0.740	El:	97.845	0.740	El:	97.851
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	18.60	0.00				0.000	1.00	1	18.60	18.80	0.048	0.048	0.09	0.02	0.001
	19.00	0.35				0.192	1.00	2	19.00	19.20	0.192	0.192	0.35	0.07	0.013
	19.40	0.25				0.204	1.00	3	19.40	19.60	0.204	0.204	0.25	0.05	0.010
	19.80	0.53				0.308	1.00	4	19.80	19.95	0.308	0.308	0.53	0.08	0.024
	20.10	0.64				0.393	1.00	5	20.10	20.25	0.393	0.393	0.64	0.10	0.038
	20.40	0.71				0.393	1.00	6	20.40	20.55	0.393	0.393	0.71	0.11	0.042
	20.70	0.69				0.408	1.00	7	20.70	20.85	0.408	0.408	0.69	0.10	0.042
	21.00	0.65				0.436	1.00	8	21.00	21.15	0.436	0.436	0.65	0.10	0.042
	21.30	0.56				0.451	1.00	9	21.30	21.50	0.451	0.451	0.56	0.11	0.051
	21.70	0.60				0.515	1.00	10	21.70	21.85	0.515	0.515	0.60	0.09	0.046
	22.00	0.56				0.552	1.00	11	22.00	22.15	0.552	0.552	0.56	0.08	0.046
	22.30	0.52				0.539	1.00	12	22.30	22.45	0.539	0.539	0.52	0.08	0.042
	22.60	0.48				0.536	1.00	13	22.60	22.75	0.536	0.536	0.48	0.07	0.039
	22.90	0.46				0.506	1.00	14	22.90	23.05	0.506	0.506	0.46	0.07	0.035
	23.20	0.49				0.491	1.00	15	23.20	23.35	0.491	0.491	0.49	0.07	0.036
	23.50	0.44				0.283	1.00	16	23.50	23.70	0.283	0.283	0.44	0.09	0.025
	23.90	0.35				0.375	1.00	17	23.90	24.10	0.375	0.375	0.35	0.07	0.026
	24.30	0.29				0.296	1.00	18	24.30	24.50	0.296	0.296	0.29	0.06	0.017
	24.70	0.28				0.332	1.00	19	24.70	24.90	0.332	0.332	0.28	0.06	0.019
	25.10	0.28				0.256	1.00	20	25.10	25.30	0.256	0.256	0.28	0.06	0.014
	25.50	0.20				0.241	1.00	21	25.50	25.80	0.241	0.241	0.20	0.06	0.014
LB	26.10	0.00				0.000	1.00	22	26.10	26.10	0.060	0.060	0.05	0.00	0.000
														Total Flow:	**0.624**

Total Flow:	**0.624**		(m^3/s)
Pereived Measurement Quality:	**Good**		
Total Area:	**1.59**		(m^2)
Top Width:	**7.50**		(m)
Hydraulic Depth:	**0.212**		(m)
Mean Velocity:	**0.393**		(m/s)
Froude Number	**0.273**		
Photographs taken looking at:			

Notes:
Data logger was sychronized with laptop clock after data download

Datalogger Notes:		
Datalogger Internal Power:	92%	up to 100%
Datalogger External Power:	64%	up to 73% w
Datalogger Memory Used:	3243 K free	
Datalogger Clock:	Sep 20, 2004 11:20	MST
Laptop Clock:	Sep 20, 2004 11:25	MST
Dessicant:		
Datalogger:	95185-05	
PT:	0003499	
Power:		

Hydrometric Measurement / Site Visit Record

S31 - Hangingstone Creek

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Hangingstone Creek
Location:	Hangingstone Creek
Site Name:	S31
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 30, 2004	
Start Time:	7:36 AM	MDT
End Time:	8:25 AM	MDT

Weather Conditions: Partly cloudy, very light rain, -1 C

River Conditions: Partial ice cover

Personnel & Equipment

Measurement Made By:	DM/ND/FF
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney 2000 SN# 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in tre	0.865	El:	100.000	0.751	El:	100.000
Water Level Reading:	2.590	El:	98.275	2.472	El:	98.279
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Est. El.:	0.430	El:	97.845	0.430	El:	97.849
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	2.30	0.00				0.000	1.00	1	2.30	2.55	0.002	0.002	0.01	0.00	0.000
	2.80	0.04				0.009	1.00	2	2.55	2.90	0.009	0.009	0.04	0.01	0.000
	3.00	0.10				0.012	1.00	3	2.90	3.25	0.012	0.012	0.10	0.04	0.000
	3.50	0.16				0.098	1.00	4	3.25	3.63	0.098	0.098	0.16	0.06	0.006
	3.75	0.23				0.091	1.00	5	3.63	3.88	0.091	0.091	0.23	0.06	0.005
	4.00	0.26				0.143	1.00	6	3.88	4.13	0.143	0.143	0.26	0.07	0.009
	4.25	0.32				0.140	1.00	7	4.13	4.38	0.140	0.140	0.32	0.08	0.011
	4.50	0.33				0.149	1.00	8	4.38	4.63	0.149	0.149	0.33	0.08	0.012
	4.75	0.33				0.146	1.00	9	4.63	4.88	0.146	0.146	0.33	0.08	0.012
	5.00	0.29				0.165	1.00	10	4.88	5.13	0.165	0.165	0.29	0.07	0.012
	5.25	0.35				0.162	1.00	11	5.13	5.38	0.162	0.162	0.35	0.09	0.014
	5.50	0.37				0.180	1.00	12	5.38	5.63	0.180	0.180	0.37	0.09	0.017
	5.75	0.40				0.189	1.00	13	5.63	5.88	0.189	0.189	0.40	0.10	0.019
	6.00	0.39				0.168	1.00	14	5.88	6.13	0.168	0.168	0.39	0.10	0.016
	6.25	0.37				0.162	1.00	15	6.13	6.38	0.162	0.162	0.37	0.09	0.015
	6.50	0.41				0.158	1.00	16	6.38	6.63	0.158	0.158	0.41	0.10	0.016
	6.75	0.40				0.152	1.00	17	6.63	6.88	0.152	0.152	0.40	0.10	0.015
	7.00	0.39				0.101	1.00	18	6.88	7.25	0.101	0.101	0.39	0.15	0.015
	7.50	0.40				0.088	1.00	19	7.25	7.75	0.088	0.088	0.40	0.20	0.018
	8.00	0.36				0.037	1.00	20	7.75	8.25	0.037	0.037	0.36	0.18	0.007
	8.50	0.27				0.009	1.00	21	8.25	8.80	0.009	0.009	0.27	0.15	0.001
RB	9.10	0.00				0.000	1.00	22	8.80	9.10	0.002	0.002	0.07	0.02	0.000
														Total Flow:	**0.221**

Total Flow:	**0.221**		(m^3/s)
Pereived Measurement Quality:	**Good**		
Total Area:	**1.92**		(m^2)
Top Width:	**6.80**		(m)
Hydraulic Depth:	**0.282**		(m)
Mean Velocity:	**0.115**		(m/s)
Froude Number	**0.069**		
Photographs taken looking at:			

Notes:
TSS sample taken
Transducer removed for winter.

Datalogger Notes:		
Datalogger Internal Power:	10.36V	
Datalogger External Power:	9.85V	
Datalogger Memory Used:	30% used	
Datalogger Clock:	Oct 29, 2004 10:21	MST
Laptop Clock:	Oct 30, 2004 06:41	MST
Dessicant:	Fine	
Datalogger:	95185-05	
PT:	0003499	
Power:		

Hydrometric Measurement / Site Visit Record

S32 - Surmont Creek at Highway 881

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Surmont Creek
Location:	Surmont Creek at Highway 881
Site Name:	S32
Coordinates & Legal:	6254511 N, 490252 E NE 3-86-8 W4M

Time of Measurement

Date of Measurement:	April 25, 2004	
Start Time:	10:30 AM	MDT
End Time:		MDT

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings

		Setup No. 1			Setup No. 2		
Bench Mark Reading:	Nail on LB	2.835	El:	97.942	2.783	El:	97.942
Water Level Reading:		3.225	El:	97.552	3.181	El:	97.544
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd E		1.008	El:	96.544	1.008	El:	96.536
Other:			El:			El:	

Weather Conditions: +5 C, Clear, Calm,

River Conditions: 0.3 to 0.4 m deep flow over shelf ice adjacent to banks. Flow over complete ice cover at some sections.Levels still highly ice affected. No MMT made due to ice affects and unsafe wading conditions.

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Pereived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	11.34V 100%	
Datalogger External Power:	12.53 81%	
Datalogger Memory Used:	0%	
Datalogger Clock:	25/04/2004 10:36	MST
Laptop Clock:	25/04/2004 11:36	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 # 203149	
PT:	Keller Pressure Transducer #971889	
Power:	Lakewood battery	

Notes:

TSS sample collected. Equipmnent installed. Transducer wired to concrete block near LB 25 m d/s of bridge.
Channel still highly ice affected despite significant flow over ice.

Hydrometric Measurement / Site Visit Record

S32 - Surmont Creek at Highway 881

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Surmont Creek
Location:	Surmont Creek at Highway 881
Site Name:	S32
Coordinates & Legal:	6254511 N, 490252 E NE 3-86-8 W4M

Time of Measurement

Date of Measurement:	June 3, 2004
Start Time:	10:29 AM MDT
End Time:	11:09 AM MDT

Weather Conditions: clear, light wind, +16 C

River Conditions: open, flood stage (receeding)

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Nail in Abut	2.312	El:	97.942	2.351	El:	97.942
Water Level Reading:	2.413	El:	97.841	2.453	El:	97.840
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	1.319	El:	96.523	1.319	El:	96.522
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	2.20	0.00	0.00	0.00	0.00	0.000	1.00	1	2.20	2.65	-0.018	-0.018	0.11	0.05	-0.001
	3.10	0.46	0.00	0.00	0.00	-0.073	1.00	2	3.10	3.30	-0.073	-0.073	0.46	0.09	-0.007
	3.50	0.64	0.00	0.00	0.00	-0.003	1.00	3	3.50	3.75	-0.003	-0.003	0.64	0.16	0.000
	4.00	1.01	0.00	0.32	0.37	0.000	1.00	4	4.00	4.25	0.347	0.347	1.01	0.25	0.087
	4.50	1.10	0.00	0.28	0.28	0.000	1.00	5	4.50	4.75	0.283	0.283	1.10	0.27	0.078
	5.00	1.25	0.00	0.48	0.63	0.000	1.00	6	5.00	5.25	0.559	0.559	1.25	0.31	0.175
	5.50	1.34	0.00	0.77	0.99	0.000	1.00	7	5.50	5.75	0.878	0.878	1.34	0.34	0.294
	6.00	1.25	0.00	0.80	0.94	0.000	1.00	8	6.00	6.25	0.870	0.870	1.25	0.31	0.272
	6.50	1.34	0.00	0.59	1.01	0.000	1.00	9	6.50	6.75	0.797	0.797	1.34	0.34	0.267
	7.00	1.40	0.00	0.64	0.92	0.000	1.00	10	7.00	7.25	0.780	0.780	1.40	0.35	0.274
	7.50	1.49	0.00	0.44	0.98	0.000	1.00	11	7.50	7.75	0.709	0.709	1.49	0.37	0.265
	8.00	1.37	0.00	0.64	0.73	0.000	1.00	12	8.00	8.25	0.687	0.687	1.37	0.34	0.236
	8.50	1.28	0.00	0.34	0.47	0.000	1.00	13	8.50	8.75	0.404	0.404	1.28	0.32	0.129
	9.00	1.01	0.00	0.12	0.20	0.000	1.00	14	9.00	9.25	0.162	0.162	1.01	0.25	0.041
	9.50	0.64	0.00	0.00	0.00	0.088	1.00	15	9.50	9.75	0.088	0.088	0.64	0.16	0.014
	10.00	0.76	0.00	0.00	0.00	0.037	1.00	16	10.00	10.25	0.037	0.037	0.76	0.19	0.007
	10.50	0.88	0.00	0.00	0.00	0.390	1.00	17	10.50	10.75	0.390	0.390	0.88	0.22	0.086
	11.00	0.70	0.00	0.00	0.00	0.244	1.00	18	11.00	11.25	0.244	0.244	0.70	0.18	0.043
	11.50	0.61	0.00	0.00	0.00	-0.085	1.00	19	11.50	11.85	-0.085	-0.085	0.61	0.21	-0.018
RB	12.20	0.00	0.00	0.00	0.00	0.000	1.00	20	11.25	12.20	0.000	0.000	0.00	0.00	0.000
														Total Flow:	2.241

Total Flow:	**2.241**		(m^3/s)
Pereived Measurement Quality:	**Fair**		
Total Area:	**4.72**		(m^2)
Top Width:	**10.00**		(m)
Hydraulic Depth:	**0.472**		(m)
Mean Velocity:	**0.474**		(m/s)
Froude Number	**0.220**		
Photographs taken looking at:			

Datalogger Notes:		
Datalogger Internal Power:	11.34 V (100%)	
Datalogger External Power:	12.30 V (81%)	
Datalogger Memory Used:	23961 free	
Datalogger Clock:	9:09:02 AM	MST
Laptop Clock:	10:10:36 AM	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 # 203149	
PT:	Keller Pressure Transducer #971889	
Power:	Lakewood battery	

Notes: TSS sample collected. Equipment appears to be in same place.
River is in flood stage, flow is receeding, but was still too deep to wade, so bomb was used from bridge.

Hydrometric Measurement / Site Visit Record

S32 - Surmont Creek at Highway 881

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Surmont Creek
Location:	Surmont Creek at Highway 881
Site Name:	S32
Coordinates & Legal:	6254511 N, 490252 E NE 3-86-8 W4M

Time of Measurement

Date of Measurement:	July 25, 2004
Start Time:	8:03 AM MDT
End Time:	8:16 AM MDT
Weather Conditions:	+10 °C
River Conditions:	open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	Nail in Abutme	1.731	El:	97.942	1.668	El:	97.942
Water Level Reading:		2.867	El:	96.806	2.812	El:	96.798
Top of Ice Level Reading:			El:			El:	
Transducer Reading & Calc'd El.:	OLD	2.672	El:	94.134	2.672	El:	94.126
Transducer Reading & Calc'd El.:	NEW	0.3961	El:	96.410	0.3961	El:	96.402
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	16.90	0.00				0.000	1.00	1	16.90	17.05	0.035	0.035	0.03	0.00	0.000
	17.20	0.10				0.140	1.00	2	17.20	17.35	0.140	0.140	0.10	0.02	0.002
	17.50	0.17				0.183	1.00	3	17.50	17.65	0.183	0.183	0.17	0.03	0.005
	17.80	0.23				0.235	1.00	4	17.80	17.95	0.235	0.235	0.23	0.03	0.008
	18.10	0.21				0.274	1.00	5	18.10	18.25	0.274	0.274	0.21	0.03	0.009
	18.40	0.22				0.323	1.00	6	18.40	18.55	0.323	0.323	0.22	0.03	0.011
	18.70	0.26				0.344	1.00	7	18.70	18.85	0.344	0.344	0.26	0.04	0.013
	19.00	0.31				0.390	1.00	8	19.00	19.15	0.390	0.390	0.31	0.05	0.018
	19.30	0.31				0.436	1.00	9	19.30	19.45	0.436	0.436	0.31	0.05	0.020
	19.60	0.29				0.442	1.00	10	19.60	19.75	0.442	0.442	0.29	0.04	0.019
	19.90	0.31				0.500	1.00	11	19.90	20.05	0.500	0.500	0.31	0.05	0.023
	20.20	0.33				0.494	1.00	12	20.20	20.35	0.494	0.494	0.33	0.05	0.024
	20.50	0.35				0.442	1.00	13	20.50	20.65	0.442	0.442	0.35	0.05	0.023
	20.80	0.39				0.424	1.00	14	20.80	20.95	0.424	0.424	0.39	0.06	0.025
	21.10	0.38				0.381	1.00	15	21.10	21.25	0.381	0.381	0.38	0.06	0.022
	21.40	0.40				0.323	1.00	16	21.40	21.55	0.323	0.323	0.40	0.06	0.019
	21.70	0.39				0.357	1.00	17	21.70	21.85	0.357	0.357	0.39	0.06	0.021
	22.00	0.38				0.308	1.00	18	22.00	22.15	0.308	0.308	0.38	0.06	0.018
	22.30	0.32				0.335	1.00	19	22.30	22.45	0.335	0.335	0.32	0.05	0.016
	22.60	0.30				0.305	1.00	20	22.60	22.75	0.305	0.305	0.30	0.04	0.014
	22.90	0.25				0.219	1.00	21	22.90	23.05	0.219	0.219	0.25	0.04	0.008
	23.20	0.20				0.207	1.00	22	23.20	23.35	0.207	0.207	0.20	0.03	0.006
	23.50	0.15				0.131	1.00	23	23.50	23.70	0.131	0.131	0.15	0.03	0.004
RB	23.90	0.00				0.000	1.00	24	23.35	23.90	0.000	0.000	0.00	0.00	0.000
														Total Flow:	0.329

Total Flow:	**0.329**		(m^3/s)
Pereived Measurement Quality:	**Good**		
Total Area:	**0.95**		(m^2)
Top Width:	**7.00**		(m)
Hydraulic Depth:	**0.136**		(m)
Mean Velocity:	**0.346**		(m/s)
Froude Number	**0.300**		
Photographs taken looking at:			

Datalogger Notes:		
Datalogger Internal Power:	11.34 V (100%)	
Datalogger External Power:	12.41 V (81%)	
Datalogger Memory Used:	60%	
Datalogger Clock:	Jul 25, 2004 06:40	MST
Laptop Clock:	Jul 25, 2004 07:43	MDT
Dessicant:	Good	
Datalogger:	Lakewood UltraLogger RX-2 # 203149	
PT:	Keller Pressure Transducer #971889	
Power:	Lakewood battery	

Notes: TSS sample collected.
Transducer was replaced under water.

Hydrometric Measurement / Site Visit Record

S32 - Surmont Creek at Highway 881

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Surmont Creek
Location:	Surmont Creek at Highway 881
Site Name:	S32
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 23, 2004	
Start Time:	10:50 AM	MDT
End Time:	11:11 AM	MDT

Weather Conditions: Clear, 10 C, calm

River Conditions: Open, low

Personnel & Equipment

Measurement Made By:	CT/DB
Data Entry By:	DB
Meter Type and No.:	March Mc Birney Flo-Mate 2000 (rental) s/n 2001463

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: nail in bric	2.229	El:	97.942	2.232	El:	97.942
Water Level Reading:	3.455	El:	96.716	3.457	El:	96.717
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Est. El.:	0.337	El:	96.379	0.337	El:	96.380
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	17.70	0.00				0.000	1.00	1	17.70	18.00	0.002	0.002	0.03	0.01	0.000
	18.30	0.13				0.009	1.00	2	18.00	18.45	0.009	0.009	0.13	0.06	0.001
	18.60	0.20				0.046	1.00	3	18.45	18.80	0.046	0.046	0.20	0.07	0.003
	19.00	0.35				0.034	1.00	4	18.80	19.10	0.034	0.034	0.35	0.11	0.004
	19.20	0.44				0.030	1.00	5	19.10	19.30	0.030	0.030	0.44	0.09	0.003
	19.40	0.50				0.052	1.00	6	19.30	19.50	0.052	0.052	0.50	0.10	0.005
	19.60	0.56				0.055	1.00	7	19.50	19.70	0.055	0.055	0.56	0.11	0.006
	19.80	0.56				0.064	1.00	8	19.70	19.90	0.064	0.064	0.56	0.11	0.007
	20.00	0.55				0.131	1.00	9	19.90	20.10	0.131	0.131	0.55	0.11	0.014
	20.20	0.56				0.213	1.00	10	20.10	20.30	0.213	0.213	0.56	0.11	0.024
	20.40	0.59				0.165	1.00	11	20.30	20.50	0.165	0.165	0.59	0.12	0.019
	20.60	0.58				0.113	1.00	12	20.50	20.70	0.113	0.113	0.58	0.12	0.013
	20.80	0.54				0.094	1.00	13	20.70	20.90	0.094	0.094	0.54	0.11	0.010
	21.00	0.44				0.088	1.00	14	20.90	21.15	0.088	0.088	0.44	0.11	0.010
	21.30	0.33				0.052	1.00	15	21.15	21.45	0.052	0.052	0.33	0.10	0.005
	21.60	0.25				0.064	1.00	16	21.45	21.75	0.064	0.064	0.25	0.07	0.005
	21.90	0.22				0.034	1.00	17	21.75	22.05	0.034	0.034	0.22	0.07	0.002
	22.20	0.22				0.094	1.00	18	22.05	22.40	0.094	0.094	0.22	0.08	0.007
	22.60	0.16				0.137	1.00	19	22.40	22.75	0.137	0.137	0.16	0.06	0.008
	22.90	0.13				0.073	1.00	20	22.75	22.90	0.073	0.073	0.13	0.02	0.001
	23.20	0.14				0.043	1.00	21	22.90	23.45	0.043	0.043	0.14	0.08	0.003
	23.70	0.00				0.000	1.00	22	23.45	23.70	0.011	0.011	0.04	0.01	0.000
														Total Flow:	**0.151**

Total Flow:	**0.151**		(m^3/s)
Pereived Measurement Quality:	**Fair**		
Total Area:	**1.81**		(m^2)
Top Width:	**6.00**		(m)
Hydraulic Depth:	**0.301**		(m)
Mean Velocity:	**0.084**		(m/s)
Froude Number	**0.049**		

Photographs taken looking at:
Upstream, downstream, across

Notes:
TSS Sample Taken

Datalogger Notes:		
Datalogger Internal Power:	11.3V	
Datalogger External Power:	12.17 V	
Datalogger Memory Used:	8162 free%	
Datalogger Clock:	Aug 23 2004 9:35	MST
Laptop Clock:	Aug 23 2004 10:39	MDT
Dessicant:	75% Good	
Datalogger:		
PT:		
Power:		

Hydrometric Measurement / Site Visit Record

S32 - Surmont Creek at Highway 881

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Surmont Creek
Location:	Surmont Creek at Highway 881
Site Name:	S32
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 31, 2004
Start Time:	MDT
End Time:	MDT

Weather Conditions: Raining, 10 C

River Conditions: Open, low

Personnel & Equipment

Measurement Made By:	CT
Data Entry By:	DB
Meter Type and No.:	

Level Readings	**Setup No. 1**		**Setup No. 2**		
Bench Mark Reading: nail in bridge		El:	97.942	El:	97.942
Water Level Reading:		El:	97.942	El:	97.942
Top of Ice Level Reading:		El:		El:	
Transducer Reading & Est. El.:	0.456	El:	97.486	El:	97.942
Other:		El:		El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
													Total Flow:	-

Total Flow:	-		(m^3/s)
Pereived Measurement Quality:			
Total Area:			(m^2)
Top Width:			(m)
Hydraulic Depth:			(m)
Mean Velocity:			(m/s)
Froude Number			

Photographs taken looking at:
Upstream, downstream, across

Notes:
Data downloaded as previous download (Aug 23) was lost with laptop battery failure

Datalogger Notes:		
Datalogger Internal Power:	11.3V	100%
Datalogger External Power:	12.17 V	78%
Datalogger Memory Used:	6572 free%	
Datalogger Clock:	Aug 31 2004 1:28:34 FMST	
Laptop Clock:	Aug 31 2004 2:30:39 FMDT	
Dessicant:	75% Good	
Datalogger:	203149	
PT:	971889	
Power:		

Hydrometric Measurement / Site Visit Record

S32 - Surmont Creek at Highway 881

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Surmont Creek
Location:	Surmont Creek at Highway 881
Site Name:	S32
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 20, 2004	
Start Time:	3:12 PM	MDT
End Time:	3:51 PM	MDT

Weather Conditions: Partly cloudy, light wind, +6 C

River Conditions: Open

Personnel & Equipment

Measurement Made By:	DB/NM
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney 2000 SN#2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: nail in bric	2.032	El:	97.942	2.072	El:	97.942
Water Level Reading:	2.792	El:	97.182	2.832	El:	97.182
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Est. El.:	0.810	El:	96.372	0.810	El:	96.372
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	25.50	0.00		0.000	0.000	0.000	1.00	1	25.50	25.30	0.001	0.001	0.06	0.01	0.000
	25.10	0.24		0.000	0.000	0.003	1.00	2	25.30	24.90	0.003	0.003	0.24	0.10	0.000
	24.70	0.29		0.000	0.000	0.027	1.00	3	24.90	24.50	0.027	0.027	0.29	0.12	0.003
	24.30	0.41		0.000	0.000	0.116	1.00	4	24.50	24.10	0.116	0.116	0.41	0.16	0.019
	23.90	0.51		0.000	0.000	0.094	1.00	5	24.10	23.70	0.094	0.094	0.51	0.20	0.019
	23.50	0.55		0.000	0.000	0.082	1.00	6	23.70	23.35	0.082	0.082	0.55	0.19	0.016
	23.20	0.60		0.000	0.000	0.177	1.00	7	23.35	23.05	0.177	0.177	0.60	0.18	0.032
	22.90	0.68		0.000	0.000	0.149	1.00	8	23.05	22.75	0.149	0.149	0.68	0.20	0.030
	22.60	0.77		0.000	0.000	0.177	1.00	9	22.75	22.45	0.177	0.177	0.77	0.23	0.041
	22.30	0.93		0.000	0.000	0.223	1.00	10	22.45	22.15	0.223	0.223	0.93	0.28	0.062
	22.00	1.04		0.000	0.000	0.305	1.00	11	22.15	21.85	0.305	0.305	1.04	0.31	0.095
	21.70	1.10		0.381	0.223	0.000	1.00	12	21.85	21.55	0.302	0.302	1.10	0.33	0.100
	21.40	1.11		0.509	0.223	0.000	1.00	13	21.55	21.25	0.366	0.366	1.11	0.33	0.122
	21.10	1.10		0.430	0.259	0.000	1.00	14	21.25	20.95	0.344	0.344	1.10	0.33	0.114
	20.80	1.11		0.405	0.259	0.000	1.00	15	20.95	20.65	0.332	0.332	1.11	0.33	0.111
	20.50	1.10		0.320	0.299	0.000	1.00	16	20.65	20.35	0.309	0.309	1.10	0.33	0.102
	20.20	1.05		0.000	0.000	0.213	1.00	17	20.35	20.05	0.213	0.213	1.05	0.32	0.067
	19.90	0.88		0.000	0.000	0.207	1.00	18	20.05	19.70	0.207	0.207	0.88	0.31	0.064
	19.50	0.83		0.000	0.000	0.131	1.00	19	19.70	19.30	0.131	0.131	0.83	0.33	0.044
	19.10	0.87		0.000	0.000	0.168	1.00	20	19.30	19.10	0.168	0.168	0.87	0.17	0.029
	18.70	0.78		0.000	0.000	0.058	1.00	21	19.10	18.70	0.058	0.058	0.78	0.31	0.018
	18.30	0.57		0.000	0.000	0.076	1.00	22	18.70	18.30	0.076	0.076	0.57	0.23	0.017
	17.90	0.40		0.000	0.000	0.006	1.00	23	18.30	17.90	0.006	0.006	0.40	0.16	0.001
	17.50	0.25		0.000	0.000	0.024	1.00	24	17.90	17.50	0.024	0.024	0.25	0.10	0.002
	16.95	0.00		0.000	0.000	0.000	1.00	25	17.50	16.95	0.006	0.006	0.06	0.03	0.000
														Total Flow:	**1.108**

Total Flow:	**1.108**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**5.61**		**(m^2)**
Top Width:	**8.55**		**(m)**
Hydraulic Depth:	**0.656**		**(m)**
Mean Velocity:	**0.198**		**(m/s)**
Froude Number	**0.078**		
Photographs taken looking at:			

Notes:

Data logger clock sychronized with laptop clock after download.

Datalogger Notes:		
Datalogger Internal Power:	11.3V	100%
Datalogger External Power:	12.04 V	77%
Datalogger Memory Used:	2668 free	
Datalogger Clock:	Sep 20 2004 1:46:59 FMST	
Laptop Clock:	Sep 20 2004 1:52:55 FMST	
Dessicant:	60% OK	
Datalogger:	203149	
PT:	971889	
Power:		

Hydrometric Measurement / Site Visit Record

S32 - Surmont Creek at Highway 881

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Surmont Creek
Location:	Surmont Creek at Highway 881
Site Name:	S32
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	October 30, 2004	
Start Time:	9:10 AM	MDT
End Time:	9:47 AM	MDT

Weather Conditions: Partly cloudy, +1 C

River Conditions: 80% ice cover, had to cut ice for measurement

Personnel & Equipment

Measurement Made By:	DM/ND/FF
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney 2000 SN#2004521

Level Readings		**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading:	nail in bridge	2.050	El:	97.942	2.02	El:	97.942
Water Level Reading:		3.050	El:	96.942	3.03	El:	96.932
Top of Ice Level Reading:		3.019	El:	96.973	3.028	El:	96.934
Transducer Reading & Est. El.:		0.562	El:	96.381	0.562	El:	96.371
Other:			El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	1.70	0.00				0.000	1.00	1	1.70	1.85	0.001	0.001	0.03	0.00	0.000
	2.00	0.13				0.003	1.00	2	1.85	2.25	0.003	0.003	0.13	0.05	0.000
	2.50	0.27				0.006	1.00	3	2.25	2.63	0.006	0.006	0.27	0.10	0.001
	2.75	0.24				0.040	1.00	4	2.63	2.88	0.040	0.040	0.24	0.06	0.002
	3.00	0.29				0.226	1.00	5	2.88	3.13	0.226	0.226	0.29	0.07	0.016
	3.25	0.34				0.396	1.00	6	3.13	3.38	0.396	0.396	0.34	0.09	0.034
	3.50	0.35				0.347	1.00	7	3.38	3.63	0.347	0.347	0.35	0.09	0.030
	3.75	0.35				0.354	1.00	8	3.63	3.88	0.354	0.354	0.35	0.09	0.031
	4.00	0.31				0.439	1.00	9	3.88	4.13	0.439	0.439	0.31	0.08	0.034
	4.25	0.31				0.415	1.00	10	4.13	4.38	0.415	0.415	0.31	0.08	0.032
	4.50	0.31				0.451	1.00	11	4.38	4.63	0.451	0.451	0.31	0.08	0.035
	4.75	0.31				0.360	1.00	12	4.63	4.88	0.360	0.360	0.31	0.08	0.028
	5.00	0.30				0.244	1.00	13	4.88	5.13	0.244	0.244	0.30	0.08	0.018
	5.25	0.29				0.293	1.00	14	5.13	5.38	0.293	0.293	0.29	0.07	0.021
	5.50	0.30				0.256	1.00	15	5.38	5.63	0.256	0.256	0.30	0.08	0.019
	5.75	0.32				0.213	1.00	16	5.63	5.88	0.213	0.213	0.32	0.08	0.017
	6.00	0.33				0.280	1.00	17	5.88	6.13	0.280	0.280	0.33	0.08	0.023
	6.25	0.32				0.165	1.00	18	6.13	6.38	0.165	0.165	0.32	0.08	0.013
	6.50	0.30				0.155	1.00	19	6.38	6.70	0.155	0.155	0.30	0.10	0.015
RB	6.90	0.00				0.000	1.00	20	6.70	6.90	0.039	0.039	0.08	0.02	0.001
														Total Flow:	**0.371**

Total Flow:	**0.371**		(m^3/s)
Pereived Measurement Quality:	**Good**		
Total Area:	**1.44**		(m^2)
Top Width:	**5.20**		(m)
Hydraulic Depth:	**0.277**		(m)
Mean Velocity:	**0.258**		(m/s)
Froude Number	**0.157**		

Photographs taken looking at:
Upstream, downstream, across

Notes:
TSS sample taken
Transducer removed for winter.

Datalogger Notes:		
Datalogger Internal Power:	11.34V	100%
Datalogger External Power:	11.8 V	77%
Datalogger Memory Used:	30% used	
Datalogger Clock:	Oct 30 2004 8:14:40 AM MST	
Laptop Clock:	Oct 30 2004 8:17:00 AM MST	
Dessicant:	Good	
Datalogger:		
PT:	971889	
Power:		

Hydrometric Measurement / Site Visit Record

S33 - Muskeg River Aurora/Albian Boundary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora/Albian Boundary
Site Name:	S33
Coordinates & Legal:	6350204 N, 474876 E SE-5-96-5-W4

Time of Measurement

Date of Measurement:	January 31, 2004
Start Time:	2:10 PM MST
End Time:	2:50 PM MST

Weather Conditions: -25 ˚C, Light snow

River Conditions: Complete ice cover. Ice surface concave due to falling stage since ice formation.

Personnel & Equipment

Measurement Made By:	FF/DM
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	Rebar on RB	1.034	El:	281.740
Water Level Reading:		2.611	El:	280.163
Top of Ice Level Reading:		2.533	El:	280.241
Transducer Reading:		1.116	El:	279.047
Other:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	5.50	0.00	0.47			0.000	0.90	1	5.50	5.90	0.000	0.000	0.21	0.08	0.000
	6.30	1.30	0.47			0.001	0.90	2	5.90	6.65	0.001	0.001	0.83	0.62	0.001
	7.00	1.46	0.50			0.052	0.90	3	6.65	7.25	0.052	0.047	0.96	0.58	0.027
	7.50	1.49	0.50			0.049	0.90	4	7.25	7.70	0.049	0.044	0.99	0.45	0.020
	7.90	1.55	0.52			0.049	0.90	5	7.70	8.10	0.049	0.044	1.03	0.41	0.018
	8.30	1.63	0.51			0.058	0.90	6	8.10	8.40	0.058	0.052	1.12	0.34	0.018
	8.50	1.65	0.52			0.056	0.90	7	8.40	8.70	0.056	0.051	1.13	0.34	0.017
	8.90	1.70	0.53	0.07	0.07		0.90	8	8.70	9.00	0.070	0.063	1.17	0.35	0.022
	9.10	1.71	0.53	0.05	0.05		0.90	9	9.00	9.23	0.053	0.048	1.18	0.27	0.013
	9.35	1.77	0.55	0.08	0.07		0.90	10	9.23	9.48	0.076	0.069	1.22	0.31	0.021
	9.60	1.77	0.54	0.06	0.05		0.90	11	9.48	9.70	0.055	0.049	1.23	0.28	0.014
	9.80	1.79	0.54	0.06	0.07		0.90	12	9.70	10.05	0.066	0.059	1.25	0.44	0.026
	10.30	1.76	0.53	0.04	0.05		0.90	13	10.05	10.40	0.043	0.038	1.23	0.43	0.017
	10.50	1.75	0.52	0.04	0.04		0.90	14	10.40	10.65	0.038	0.034	1.23	0.31	0.011
	10.80	1.62	0.46	0.04	0.04		0.90	15	10.65	11.03	0.038	0.034	1.16	0.44	0.015
	11.25	1.41	0.40			0.034	0.90	16	11.03	11.60	0.034	0.030	1.01	0.58	0.018
LB	11.95	0.00	0.40			0.000	0.90	17	11.60	11.95	0.008	0.008	0.25	0.09	0.001
														Total Flow:	**0.255**

					Total Flow:	**0.255**

Total Flow:				**0.255**		(m^3/s)
Pereived Measurement Quality:				**Good**		
Total Area:				**6.29**		(m^2)
Top Width:				**6.45**		(m)
Hydraulic Depth:				**0.975**		(m)
Mean Velocity:				**0.041**		(m/s)
Froude Number				**0.013**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:

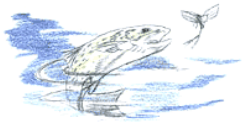
Datalogger Internal Power:	4.65V	
Datalogger External Power:	11.11V	
Datalogger Memory Used:	9%	
Datalogger Clock:	Jan 31, 2004 15:51	MDT
Laptop Clock:	Jan 31, 2004 15:00	MDT
Dessicant:	80% Good	
Datalogger:	Dolphin DD-128 #290	
PT:	#0304988	
Power:	12/20 Battery	

PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes:

Hydrometric Measurement / Site Visit Record

S33 - Muskeg River Aurora/Albian Boundary



Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora/Albian Boundary
Site Name:	S33
Coordinates & Legal:	6350204 N, 474876 E SE-5-96-5-W4

Time of Measurement

Date of Measurement:	March 1, 2004
Start Time:	12:30 PM MDT
End Time:	1:30 AM MDT

Weather Conditions: -5 ˚C, Clear, Calm

River Conditions: Complete ice cover. Ice surface concave due to falling stage since ice formation.

Personnel & Equipment

Measurement Made By:	DK/GB
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading: Rebar on RB	1.100	El:	281.740
Water Level Reading:	2.759	El:	280.081
Top of Ice Level Reading:	2.469	El:	280.371
Transducer Reading:	1.052	El:	279.029
Other:		El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	3.50	0.00	0.00			0.000	0.90	1	3.50	3.80	0.005	0.005	0.15	0.04	0.000
	4.10	1.10	0.51			0.020	0.90	2	3.80	4.30	0.020	0.018	0.59	0.30	0.005
	4.50	1.24	0.49			0.050	0.90	3	4.30	4.80	0.050	0.045	0.75	0.38	0.017
	5.10	1.37	0.56			0.070	0.90	4	4.80	5.38	0.070	0.063	0.81	0.47	0.029
	5.65	1.41	0.58			0.090	0.90	5	5.38	5.93	0.090	0.081	0.83	0.46	0.037
	6.20	1.48	0.58			0.100	0.90	6	5.93	6.38	0.100	0.090	0.90	0.40	0.036
	6.55	1.48	0.59			0.082	0.90	7	6.38	6.88	0.082	0.074	0.89	0.45	0.033
	7.20	1.64	0.60	0.09	0.06		0.90	8	6.88	7.45	0.073	0.066	1.04	0.60	0.039
	7.70	1.70	0.69			0.091	0.90	9	7.45	7.90	0.091	0.082	1.01	0.45	0.037
	8.10	1.74	0.58	0.06	0.07		0.90	10	7.90	8.30	0.064	0.058	1.16	0.46	0.027
	8.50	1.68	0.55	0.05	0.07		0.90	11	8.30	8.75	0.059	0.053	1.13	0.51	0.027
	9.00	1.59	0.46	0.05	0.04		0.90	12	8.75	9.23	0.046	0.041	1.13	0.54	0.022
	9.45	1.40	0.45			0.040	0.90	13	9.23	9.78	0.040	0.036	0.95	0.52	0.019
LB	10.10	0.00	0.40			0.000	0.90	14	9.78	10.10	0.010	0.009	0.24	0.08	0.001
														Total Flow:	**0.330**

													Total Flow:	**0.330**

Total Flow:				**0.330**		(m^3/s)
Pereived Measurement Quality:				**Good**		
Total Area:				**5.65**		(m^2)
Top Width:				**6.60**		(m)
Hydraulic Depth:				**0.856**		(m)
Mean Velocity:				**0.058**		(m/s)
Froude Number				**0.020**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:		
Datalogger Internal Power:	4.699V	
Datalogger External Power:	14.88V	
Datalogger Memory Used:	11%	
Datalogger Clock:	Mar 01, 2004 12:45	MDT
Laptop Clock:	Mar 01, 2004 12:45	MDT
Dessicant:	Good	
Datalogger:	Dolphin DD-128 #290	
PT:	#0304988	
Power: 12/20 Battery		
PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller		

Notes: Clocks synchronized.
db #290

Hydrometric Measurement / Site Visit Record

S33 - Muskeg River Aurora/Albian Boundary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora/Albian Boundary
Site Name:	S33
Coordinates & Legal:	6350204 N, 474876 E SE-5-96-5-W4

Time of Measurement

Date of Measurement:	April 4, 2004	
Start Time:	12:30 PM	MDT
End Time:		MDT

Weather Conditions: +15 °C, Clear, Calm

River Conditions: Water flowing over ice, holes in ice visible.

Personnel & Equipment

Measurement Made By:	DK/DM
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

Bench Mark Reading:	Rebar on RB	0.779	El:	281.740
Water Level Reading:		2.316	El:	280.204
Top of Ice Level Reading:			El:	
Transducer Reading:		1.192	El:	279.011
Other:			El:	

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
													Total Flow:	-

Total Flow:				-		(m^3/s)
Pereived Measurement Quality:						
Total Area:						(m^2)
Top Width:						(m)
Hydraulic Depth:						(m)
Mean Velocity:						(m/s)
Froude Number						

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:

Datalogger Internal Power:	4.699V	
Datalogger External Power:	14.88V	
Datalogger Memory Used:	11%	
Datalogger Clock:	Mar 01, 2004 12:45	MDT
Laptop Clock:	Mar 01, 2004 12:45	MDT
Dessicant:	Good	
Datalogger:	Dolphin DD-128 #290	
PT:	#0304988	

Power: 12/20 Battery
PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: River conditions unsafe for flow measurement.

Hydrometric Measurement / Site Visit Record

S33 - Muskeg River at Aurora / Albian Boundary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River at Aurora / Albian Boundary
Site Name:	S33
Coordinates & Legal:	6350204 N, 474876 E SE-5-96-5-W4

Time of Measurement

Date of Measurement:	April 24, 2004	
Start Time:	8:53 AM	MDT
End Time:	9:14 AM	MDT

Weather Conditions: +5 C, light rain, windy

River Conditions: Minimal border ice adjacent to banks - open water conditions.

Personnel & Equipment

Measurement Made By:	DM/FF/DB
Data Entry By:	FF
Meter Type and No.:	Marsh McBirney FloMate 2000 s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.907	El:	281.740	0.861	El:	281.740
Water Level Reading:	2.176	El:	280.471	2.129	El:	280.472
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	1.462	El:	279.009	1.462	El:	279.010
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	1.90	0.00	0.00			0.000	1.00	1	1.90	2.20	0.001	0.001	0.11	0.03	0.000
	2.50	0.43	0.00			0.003	1.00	2	2.20	3.00	0.003	0.003	0.43	0.34	0.001
	3.50	1.41	0.00	0.018	0.018		1.00	3	3.00	3.75	0.018	0.018	1.41	1.06	0.019
	4.00	1.68	0.00	0.070	0.058		1.00	4	3.75	4.25	0.064	0.064	1.68	0.84	0.054
	4.50	2.00	0.00	0.149	0.122		1.00	5	4.25	4.75	0.136	0.136	2.00	1.00	0.136
	5.00	1.99	0.00	0.152	0.186		1.00	6	4.75	5.25	0.169	0.169	1.99	1.00	0.168
	5.50	2.00	0.00	0.189	0.213		1.00	7	5.25	5.75	0.201	0.201	2.00	1.00	0.201
	6.00	2.04	0.00	0.271	0.287		1.00	8	5.75	6.25	0.279	0.279	2.04	1.02	0.284
	6.50	2.05	0.00	0.338	0.308		1.00	9	6.25	6.75	0.323	0.323	2.05	1.03	0.331
	7.00	1.98	0.00	0.335	0.326		1.00	10	6.75	7.25	0.331	0.331	1.98	0.99	0.327
	7.50	1.98	0.00	0.344	0.277		1.00	11	7.25	7.75	0.311	0.311	1.98	0.99	0.308
	8.00	1.95	0.00	0.357	0.287		1.00	12	7.75	8.25	0.322	0.322	1.95	0.98	0.314
	8.50	1.90	0.00	0.366	0.250		1.00	13	8.25	8.75	0.308	0.308	1.90	0.95	0.292
	9.00	1.82	0.00	0.201	0.201		1.00	14	8.75	9.25	0.201	0.201	1.82	0.91	0.183
	9.50	1.76	0.00	0.247	0.171		1.00	15	9.25	9.75	0.209	0.209	1.76	0.88	0.184
	10.00	1.65	0.00	0.210	0.155		1.00	16	9.75	10.25	0.183	0.183	1.65	0.83	0.151
	10.50	1.30	0.00	0.104	0.091		1.00	17	10.25	10.75	0.098	0.098	1.30	0.65	0.063
	11.00	0.95	0.00			0.006	1.00	18	10.75	11.40	0.006	0.006	0.95	0.62	0.004
RB	11.80	0.00	0.00			0.000	1.00	19	11.40	11.80	0.002	0.002	0.24	0.10	0.000
														Total Flow:	3.021

Total Flow:	**3.021**		**(m^3/s)**
Pereived Measurement Quality:	**Good**		
Total Area:	**15.20**		**(m^2)**
Top Width:	**9.90**		**(m)**
Hydraulic Depth:	**1.535**		**(m)**
Mean Velocity:	**0.199**		**(m/s)**
Froude Number	**0.051**		

Photographs taken looking at:
Upstream, downstream, left bank, right bank, bench mark, datalogger/battery

Datalogger Notes:	**Database**	**290**
Datalogger Internal Power:	4.72V	
Datalogger External Power:	13.07V	
Datalogger Memory Used:	16%	
Datalogger Clock:	Apr 24, 2004 07:36	MST
Laptop Clock:	Apr 24, 2004 08:36	MDT
Dessicant:	Good	

Datalogger: Optimum datalogger s/n#0105010290
PT: Keller s/n 304988
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Notes: TSS sample collected.
Datalogger clock set to MST, (i.e.1 hr earlier than laptop which was running on MDT).
See previous measurement record for clock times prior to this site visit.

Hydrometric Measurement / Site Visit Record

S33 - Muskeg River at Aurora / Albian Boundary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River at Aurora / Albian Boundary
Site Name:	S33
Coordinates & Legal:	6350204 N, 474876 E SE-5-96-5-W4

Time of Measurement

Date of Measurement:	June 1, 2004	
Start Time:	4:03 PM	MDT
End Time:	4:45 PM	MDT

Weather Conditions: +18 C, calm, partly cloudy

River Conditions: Open, flood stage

Personnel & Equipment

Measurement Made By:	DM/DB
Data Entry By:	DB
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.721	El:	281.740	0.680	El:	281.740
Water Level Reading:	1.359	El:	281.102	1.329	El:	281.091
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	2.087	El:	279.015	2.087	El:	279.004
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
LB	16.75	0.00	0.00	0.000	0.000		1.00	1	16.75	17.13	0.003	0.003	0.38	0.14	0.000
	17.50	1.51	0.00	0.018	0.006		1.00	2	17.13	18.00	0.012	0.012	1.51	1.32	0.016
	18.50	2.16	0.00	0.149	0.091		1.00	3	18.00	19.00	0.120	0.120	2.16	2.16	0.260
	19.50	2.67	0.00	0.277	0.229		1.00	4	19.00	20.00	0.253	0.253	2.67	2.67	0.675
	20.50	2.82	0.00	0.180	0.335		1.00	5	20.00	20.75	0.258	0.258	2.82	2.12	0.545
	21.00	2.88	0.00	0.366	0.451		1.00	6	20.75	21.25	0.408	0.408	2.88	1.44	0.588
	21.50	2.80	0.00	0.399	0.469		1.00	7	21.25	21.75	0.434	0.434	2.80	1.40	0.608
	22.00	2.77	0.00	0.421	0.420		1.00	8	21.75	22.25	0.420	0.420	2.77	1.39	0.582
	22.50	2.47	0.00	0.445	0.497		1.00	9	22.25	22.75	0.471	0.471	2.47	1.24	0.582
	23.00	2.50	0.00	0.186	0.296		1.00	10	22.75	23.25	0.241	0.241	2.50	1.25	0.301
	23.50	2.50	0.00	0.457	0.378		1.00	11	23.25	24.00	0.418	0.418	2.50	1.88	0.783
	24.50	1.71	0.00	0.399	0.396		1.00	12	24.00	25.00	0.398	0.398	1.71	1.71	0.680
	25.50	1.11	0.00	0.341	0.201		1.00	13	25.00	26.10	0.271	0.271	1.11	1.22	0.331
	26.70	0.27	0.00	0.000	0.000		1.00	14	26.10	26.70	0.000	0.000	0.27	0.16	0.000
RB	27.50	0.00	0.00	0.00	0.00	0.000	1.00	15	27.50	27.50	0.000	0.000	0.07	0.00	0.000
														Total Flow:	5.952

Total Flow:	**5.952**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**20.09**		**(m^2)**
Top Width:	**10.75**		**(m)**
Hydraulic Depth:	**1.868**		**(m)**
Mean Velocity:	**0.296**		**(m/s)**
Froude Number	**0.069**		
Photographs taken looking at: yes			

Datalogger Notes:	**Database**	**290**
Datalogger Internal Power:	4.805V	
Datalogger External Power:	14.09V	
Datalogger Memory Used:	19%	
Datalogger Clock:	01/06/2004 14:42:18 PM	MST
Laptop Clock:	Jun 01, 2004 15:43	MDT
Dessicant:	Good	
Datalogger:	Optimum datalogger s/n#0105010290	
PT:	Keller s/n 304988	
Power:	Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller	

Notes: TSS sample collected.
Flow is turbulent, difficult to keep the wading tube steady for measurement

Hydrometric Measurement / Site Visit Record

S33 - Muskeg River at Aurora / Albian Boundary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River at Aurora / Albian Boundary
Site Name:	S33
Coordinates & Legal:	6350204 N, 474876 E SE-5-96-5-W4

Time of Measurement

Date of Measurement:	July 22, 2004	
Start Time:	7:41 PM	MDT
End Time:	8:16 PM	MDT

Weather Conditions: +25 C, calm, clear

River Conditions: Open

Personnel & Equipment

Measurement Made By:	DK/CT
Data Entry By:	DK
Meter Type and No.:	Marsh McBirney FloMate 2000
	s/n 2004521

Level Readings	**Setup No. 1**			**Setup No. 2**		
Bench Mark Reading: Rebar	0.541	El:	281.740	0.441	El:	281.740
Water Level Reading:	2.287	El:	279.994	2.179	El:	280.002
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Calc'd E	0.981	El:	279.013	0.981	El:	279.021
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
LB	0.90	0.00	0.00			0.000	1.00	1	0.90	1.20	0.001	0.001	0.15	0.04	0.000
	1.50	0.58	0.00			0.003	1.00	2	1.20	1.75	0.003	0.003	0.58	0.32	0.001
	2.00	0.97	0.00	0.000	0.000		1.00	3	1.75	2.25	0.000	0.000	0.97	0.49	0.000
	2.50	1.40	0.00	-0.018	0.003		1.00	4	2.25	2.75	-0.008	-0.008	1.40	0.70	-0.005
	3.00	1.50	0.00	0.024	0.046		1.00	5	2.75	3.25	0.035	0.035	1.50	0.75	0.026
	3.50	1.60	0.00	0.021	0.061		1.00	6	3.25	3.75	0.041	0.041	1.60	0.80	0.033
	4.00	1.65	0.00	0.052	0.091		1.00	7	3.75	4.25	0.072	0.072	1.65	0.83	0.059
	4.50	1.64	0.00	0.076	0.070		1.00	8	4.25	4.75	0.073	0.073	1.64	0.82	0.060
	5.00	1.58	0.00	0.061	0.085		1.00	9	4.75	5.25	0.073	0.073	1.58	0.79	0.058
	5.50	1.52	0.00	0.101	0.070		1.00	10	5.25	5.75	0.085	0.085	1.52	0.76	0.065
	6.00	1.55	0.00	0.091	0.082		1.00	11	5.75	6.25	0.087	0.087	1.55	0.78	0.067
	6.50	1.44	0.00	0.073	0.040		1.00	12	6.25	6.75	0.056	0.056	1.44	0.72	0.041
	7.00	1.41	0.00	0.046	0.024		1.00	13	6.75	7.25	0.035	0.035	1.41	0.71	0.025
	7.50	1.26	0.00	0.030	0.027		1.00	14	7.25	7.75	0.029	0.029	1.26	0.63	0.018
	8.00	1.05	0.00	0.040	0.046		1.00	15	7.75	8.25	0.043	0.043	1.05	0.53	0.022
	8.50	0.82	0.00			0.049	1.00	16	8.25	8.80	0.049	0.049	0.82	0.45	0.022
RB	9.10	0.00	0.00			0.000	1.00	17	9.10	9.10	0.012	0.012	0.21	0.00	0.000
														Total Flow:	0.492

Total Flow:	**0.492**		(m^3/s)
Pereived Measurement Quality:	**Fair**		
Total Area:	**10.10**		(m^2)
Top Width:	**8.20**		(m)
Hydraulic Depth:	**1.232**		(m)
Mean Velocity:	**0.049**		(m/s)
Froude Number	**0.014**		

Photographs taken looking at:
yes

Notes: TSS sample collected.

Datalogger Notes:	**Database**	**290**
Datalogger Internal Power:	4.805V	
Datalogger External Power:	14.09V	
Datalogger Memory Used:	19%	
Datalogger Clock:	01/06/2004 14:42:18 PM	MST
Laptop Clock:	Jun 01, 2004 15:43	MDT
Dessicant:	Good	

Datalogger: Optimum datalogger s/n#0105010290
PT: Keller s/n 304988
Power: Magnacharge 20V 10A DC Battery and PhotoWatt Int. PWX 200 Solar panel with SunSaver Controller

Hydrometric Measurement / Site Visit Record

S33 - Muskeg River Aurora/Albian Boundary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora/Albian Boundary
Site Name:	S33
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	August 24, 2004	
Start Time:	2:23 PM	MDT
End Time:	2:49 PM	MDT

Weather Conditions: Clear, 17 C, calm

River Conditions: Open, low

Personnel & Equipment

Measurement Made By:	CT/DB
Data Entry By:	DB
Meter Type and No.:	March Mc Birney Flo-Mate 2000 (rental) s/n 2001463

Level Readings	**Setup No. 1**				**Setup No. 2**	
Bench Mark Reading: rebar on (	0.693	El:	281.740	0.648	El:	281.740
Water Level Reading:	2.509	El:	279.924	2.458	El:	279.930
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Est. El.:	0.909	El:	279.015	0.909	El:	279.021
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	24.50	0.00				0.000	1.00	1	24.50	24.25	-0.002	-0.002	0.13	0.03	0.000
	24.00	0.50				-0.009	1.00	2	24.25	24.00	-0.009	-0.009	0.50	0.13	-0.001
	23.50	0.68				-0.003	1.00	2	24.00	23.25	-0.003	-0.003	0.68	0.51	-0.002
	23.00	0.87				0.012	1.00	3	23.25	22.75	0.012	0.012	0.87	0.44	0.005
	22.50	1.22		0.01	0.00		1.00	4	22.75	22.25	0.005	0.005	1.22	0.61	0.003
	22.00	1.32		0.01	0.01		1.00	5	22.25	21.75	0.008	0.008	1.32	0.66	0.005
	21.50	1.46		0.03	0.01		1.00	6	21.75	21.25	0.018	0.018	1.46	0.73	0.013
	21.00	1.50		0.02	0.01		1.00	7	21.25	20.75	0.015	0.015	1.50	0.75	0.011
	20.50	1.45		0.02	0.01		1.00	8	20.75	20.25	0.014	0.014	1.45	0.73	0.010
	20.00	1.53		0.02	0.02		1.00	9	20.25	19.75	0.020	0.020	1.53	0.77	0.015
	19.50	1.51		0.03	0.02		1.00	10	19.75	19.25	0.023	0.023	1.51	0.76	0.017
	19.00	1.44		0.01	0.00		1.00	11	19.25	18.75	0.008	0.008	1.44	0.72	0.005
	18.50	1.36		0.02	0.01		1.00	12	18.75	18.25	0.015	0.015	1.36	0.68	0.010
	18.00	1.21		0.02	0.01		1.00	13	18.25	17.75	0.011	0.011	1.21	0.61	0.006
	17.50	0.96				0.006	1.00	14	17.75	17.50	0.006	0.006	0.96	0.24	0.001
LB	16.40	0.00				0.000	1.00	15	17.50	16.40	0.000	0.002	0.24	0.26	0.000
														Total Flow:	**0.102**

Total Flow:	**0.102**		(m^3/s)
Pereived Measurement Quality:	**Fair**		
Total Area:	**8.61**		(m^2)
Top Width:	**8.10**		(m)
Hydraulic Depth:	**1.062**		(m)
Mean Velocity:	**0.012**		(m/s)
Froude Number	**0.004**		

Photographs taken looking at:
Upstream, downstream, across

Notes:
TSS Sample Taken
Database #290
wasp nest in data logger box, box sealed and pesticide applied.

Datalogger Notes:	
Datalogger Internal Power:	4.814 V
Datalogger External Power:	14.17 V
Datalogger Memory Used:	26%
Datalogger Clock:	Aug 24, 2004 14:06 MST
Laptop Clock:	Aug 24, 2004 15:10 MDT
Dessicant:	OK - 25%, BUT IN WASP'S NEST.
Datalogger:	
PT:	
Power:	

Hydrometric Measurement / Site Visit Record

S33 - Muskeg River Aurora/Albian Boundary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora/Albian Boundary
Site Name:	S33
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	September 24, 2004	
Start Time:	11:18 AM	MDT
End Time:	11:47 AM	MDT

Weather Conditions: Overcast, 8 C, calm

River Conditions: open

Personnel & Equipment

Measurement Made By:	NM/DB
Data Entry By:	DB
Meter Type and No.:	March Mc Birney Flo-Mate 2000 s/n 2004521

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: rebar on (	0.768	El:	281.740	0.748	El:	281.740
Water Level Reading:	2.245	El:	280.263	2.225	El:	280.263
Top of Ice Level Reading:		El:			El:	
Transducer Reading & Est. El.:	1.257	El:	279.006	1.257	El:	279.006
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station (m)	Depth (m)	Ice Thickness (m)	Velocity at 0.2 Depth (m/s)	Velocity at 0.8 Depth (m/s)	Velocity at 0.6 Depth (m/s)	Velocity Correction Factor	Panel No.	Panel Starts at Station (m)	Panel Ends at Station (m)	Measured Panel Velocity (m/s)	Effective Average Panel Velocity (m/s)	Panel Effective Depth (m)	Panel Area (m^2)	Panel Discharge (m^3/s)
RB	18.10	0.00				0.000	1.00	1	18.10	18.30	0.005	0.005	0.17	0.03	0.000
	18.50	0.67				0.018	1.00	2	18.30	18.75	0.018	0.018	0.67	0.30	0.006
	19.00	1.20		0.05	0.06		1.00	2	18.75	19.25	0.055	0.055	1.20	0.60	0.033
	19.50	1.37		0.11	0.09		1.00	3	19.25	19.75	0.101	0.101	1.37	0.69	0.069
	20.00	1.55		0.14	0.10		1.00	4	19.75	20.25	0.122	0.122	1.55	0.78	0.094
	20.50	1.60		0.16	0.14		1.00	5	20.25	20.75	0.146	0.146	1.60	0.80	0.117
	21.00	1.66		0.15	0.16		1.00	6	20.75	21.25	0.152	0.152	1.66	0.83	0.126
	21.50	1.68		0.16	0.14		1.00	7	21.25	21.75	0.148	0.148	1.68	0.84	0.124
	22.00	1.70		0.20	0.15		1.00	8	21.75	22.25	0.174	0.174	1.70	0.85	0.148
	22.50	1.80		0.18	0.19		1.00	9	22.25	22.75	0.184	0.184	1.80	0.90	0.166
	23.00	1.82		0.11	0.19		1.00	10	22.75	23.25	0.148	0.148	1.82	0.91	0.135
	23.50	1.80		0.10	0.15		1.00	11	23.25	23.75	0.125	0.125	1.80	0.90	0.112
	24.00	1.75		0.04	0.15		1.00	12	23.75	24.25	0.091	0.091	1.75	0.88	0.080
	24.50	1.65		0.07	0.03		1.00	13	24.25	24.75	0.049	0.049	1.65	0.83	0.040
	25.00	1.50		0.02	0.03		1.00	14	24.75	25.25	0.024	0.024	1.50	0.75	0.018
	25.50	1.18		0.01	0.00		1.00	15	25.25	25.75	0.002	0.002	1.18	0.59	0.001
	26.00	0.80		0.00	0.00		1.00	16	25.75	26.25	0.000	0.000	0.80	0.40	0.000
	26.50	0.30				-0.018	1.00	17	26.25	26.70	-0.018	-0.018	0.30	0.14	-0.002
LB	26.90	0.00				0.000	1.00	18	26.70	26.90	0.000	0.000	0.08	0.01	0.000
														Total Flow:	**1.267**

Total Flow:	**1.267**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**12.02**		**(m^2)**
Top Width:	**8.80**		**(m)**
Hydraulic Depth:	**1.365**		**(m)**
Mean Velocity:	**0.105**		**(m/s)**
Froude Number	**0.029**		

Photographs taken looking at:
no - camera broken

Notes:
TSS Sample Taken
Database #290

Datalogger Notes:	
Datalogger Internal Power:	4.789 V
Datalogger External Power:	14.49 V
Datalogger Memory Used:	28%
Datalogger Clock:	Sep 24, 2004 11:04 MST
Laptop Clock:	Sep 24, 2004 11:08 MST
Dessicant:	Replaced - 100%

Datalogger:
PT:
Power:

Hydrometric Measurement / Site Visit Record

S33 - Muskeg River Aurora/Albian Boundary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora/Albian Boundary
Site Name:	S33
Coordinates & Legal:	6350204 N, 474876 E SE-5-96-5-W4

Time of Measurement

Date of Measurement:	November 1, 2004
Start Time:	12:40 PM MST
End Time:	12:50 PM MST

Weather Conditions: +2 °C, Clear, Calm

River Conditions: Full ice cover

Personnel & Equipment

Measurement Made By:	FF/ND/DM
Data Entry By:	ND
Meter Type and No.:	Marsh McBirney FloMate 2000

Level Readings and Measurements

			Setup #1		Setup #2
Bench Mark Reading: Rebar on	0.711	El:	281.740	0.854	
Water Level Reading:	2.320	El:	280.131	2.459	280.135
Top of Ice Level Reading:	2.279	El:	280.172	2.424	280.170
Transducer Reading:	1.151	El:	278.980		278.984
Other:		El:			

Measurement Data

Measured Data						Calculated Data								
Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
													Total Flow:	-

Total Flow:				-		(m^3/s)
Pereived Measurement Quality:						
Total Area:						(m^2)
Top Width:						(m)
Hydraulic Depth:						(m)
Mean Velocity:						(m/s)
Froude Number						
Photographs taken looking at: Upstream, downstream, across						

Datalogger Notes:		
Datalogger Internal Power:	4.7V	
Datalogger External Power:	14.7V	
Datalogger Memory Used:	31% used	
Datalogger Clock:	Nov 01, 2004 12:38	MST
Laptop Clock:	Nov 01, 2004 11:44	MST
Dessicant:	Fine	
Datalogger:		
PT:		
Power:		

Notes: TSS sample taken
River conditions unsafe for flow measurement as ice too thin.

Hydrometric Measurement / Site Visit Record

S33 - Muskeg River Aurora/Albian Boundary

Regional Aquatics Monitoring Program

Measurement Location

River/Stream:	Muskeg River
Location:	Muskeg River Aurora/Albian Boundary
Site Name:	S33
Coordinates & Legal:	

Time of Measurement

Date of Measurement:	December 2, 2004	
Start Time:	11:53 AM	MST
End Time:	12:31 PM	MST

Weather Conditions: Partly cloudy, -1°C

River Conditions: ice cover

Personnel & Equipment

Measurement Made By:	ND/DB/CT
Data Entry By:	DB
Meter Type and No.:	March Mc Birney Flo-Mate 2000 s/n 2004521

Level Readings

	Setup No. 1			Setup No. 2		
Bench Mark Reading: rebar on grass	0.698	El:	281.740	0.778	El:	281.740
Water Level Reading:	2.395	El:	280.043	2.466	El:	280.052
Top of Ice Level Reading:	2.302	El:	280.136	2.358	El:	280.160
Transducer Reading & Est. El.:	1.039	El:	279.004	1.039	El:	279.013
Other:		El:			El:	

Measurement Data

	Measured Data						Calculated Data								
	Station	Depth	Ice Thickness	Velocity at 0.2 Depth	Velocity at 0.8 Depth	Velocity at 0.6 Depth	Velocity Correction Factor	Panel No.	Panel Starts at Station	Panel Ends at Station	Measured Panel Velocity	Effective Average Panel Velocity	Panel Effective Depth	Panel Area	Panel Discharge
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)			(m)	(m)	(m/s)	(m/s)	(m)	(m^2)	(m^3/s)
RB	18.80	0.00	0.00			0.000	0.90	1	18.80	19.00	0.002	0.002	0.11	0.02	0.000
	19.20	0.71	0.28			0.009	0.90	2	19.00	19.45	0.009	0.008	0.43	0.19	0.002
	19.70	0.84	0.35			0.009	0.90	2	19.45	19.90	0.000	0.000	0.49	0.22	0.000
	20.10	1.00	0.30			0.012	0.90	3	19.90	20.25	0.000	0.000	0.70	0.25	0.000
	20.40	1.33	0.31	0.02	0.02		0.90	4	20.25	20.60	0.020	0.018	1.02	0.36	0.006
	20.80	1.48	0.29	0.01	0.01		0.90	5	20.60	21.05	0.008	0.007	1.19	0.54	0.004
	21.30	1.50	0.29	0.05	0.03		0.90	6	21.05	21.50	0.040	0.036	1.21	0.54	0.019
	21.70	1.56	0.36	0.07	0.02		0.90	7	21.50	21.90	0.043	0.038	1.20	0.48	0.018
	22.10	1.52	0.27	0.07	0.03		0.90	8	21.90	22.35	0.049	0.044	1.25	0.56	0.025
	22.60	1.54	0.31	0.04	0.06		0.90	9	22.35	22.90	0.052	0.047	1.23	0.68	0.032
	23.20	1.64	0.36	0.06	0.05		0.90	10	22.90	23.40	0.053	0.048	1.28	0.64	0.031
	23.60	1.73	0.36	0.03	0.04		0.90	11	23.40	23.85	0.035	0.032	1.37	0.62	0.019
	24.10	1.70	0.29	0.03	0.05		0.90	12	23.85	24.30	0.044	0.040	1.41	0.63	0.025
	24.50	1.66	0.29	0.02	0.05		0.90	13	24.30	24.75	0.035	0.032	1.37	0.62	0.019
	25.00	1.62	0.29	0.03	0.03		0.90	14	24.75	25.15	0.029	0.026	1.33	0.53	0.014
	25.30	1.56	0.28	0.02	0.01		0.90	15	25.15	25.55	0.018	0.016	1.28	0.51	0.008
	25.80	1.44	0.28	0.02	0.01		0.90	16	25.55	26.00	0.011	0.010	1.16	0.52	0.005
	26.20	0.70	0.32			0.009	0.90	17	26.00	26.80	0.009	0.008	0.38	0.30	0.003
LB	27.40	0.00	0.00			0.000	0.90	18	26.80	27.40	0.000	0.000	0.10	0.06	0.000
														Total Flow:	**0.230**

Total Flow:	**0.230**		**(m^3/s)**
Pereived Measurement Quality:	**Fair**		
Total Area:	**8.27**		**(m^2)**
Top Width:	**8.60**		**(m)**
Hydraulic Depth:	**0.962**		**(m)**
Mean Velocity:	**0.028**		**(m/s)**
Froude Number	**0.009**		

Photographs taken looking at:
US, DS, across

Notes:

Datalogger Notes:		
Datalogger Internal Power:	4.74	
Datalogger External Power:	14.81 V	
Datalogger Memory Used:	34% used	
Datalogger Clock:	Dec 02, 2004 11:15	MST
Laptop Clock:	Dec 02, 2004 11:24	MST
Dessicant:	fine	

Datalogger:
PT:
Power:

D5.0 FIGURES

Figure D-1
Precipitation at Fort McMurray and RAMP Climate Stations 2004

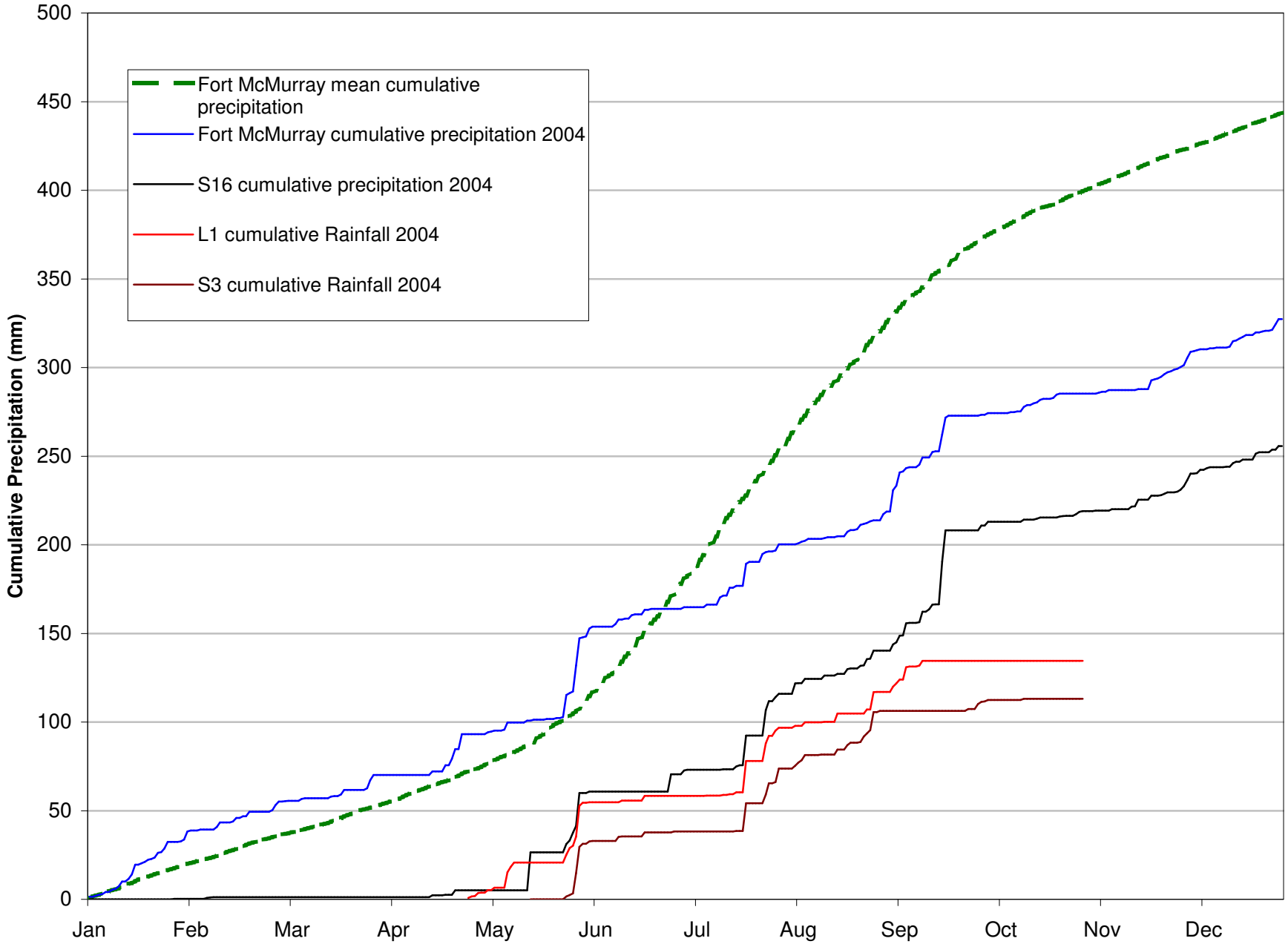


Figure D-2 Mean daily water temperature at RAMP stations.

Figure D-3 L1 - McClelland Lake stage-discharge rating curve.

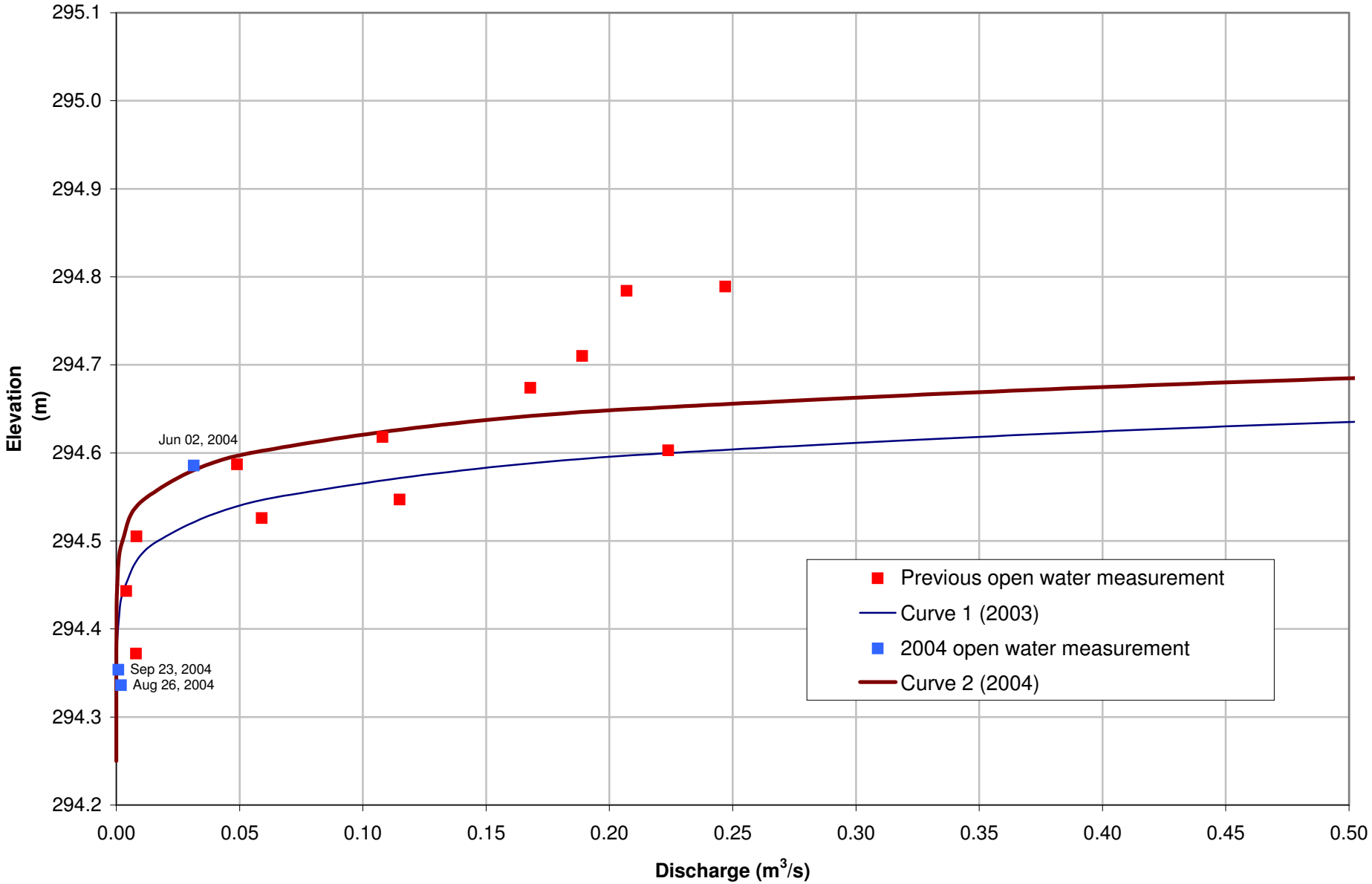


Figure D-4 S2 - Jackpine Creek at Canterra Road stage-discharge rating curve.

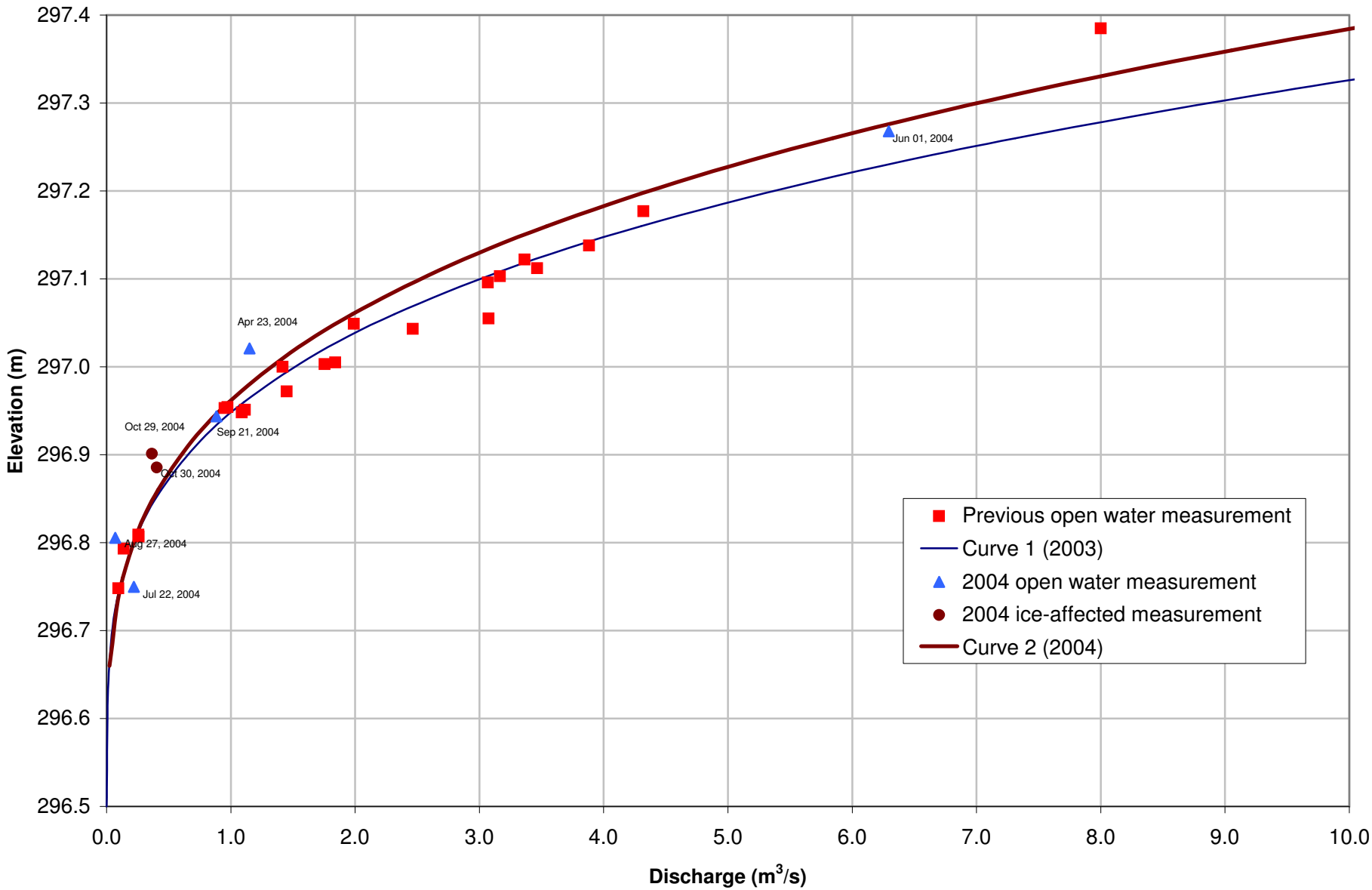


Figure D-5 S3 - Iyinimin Creek above Kearl Lake stage-discharge rating curve.

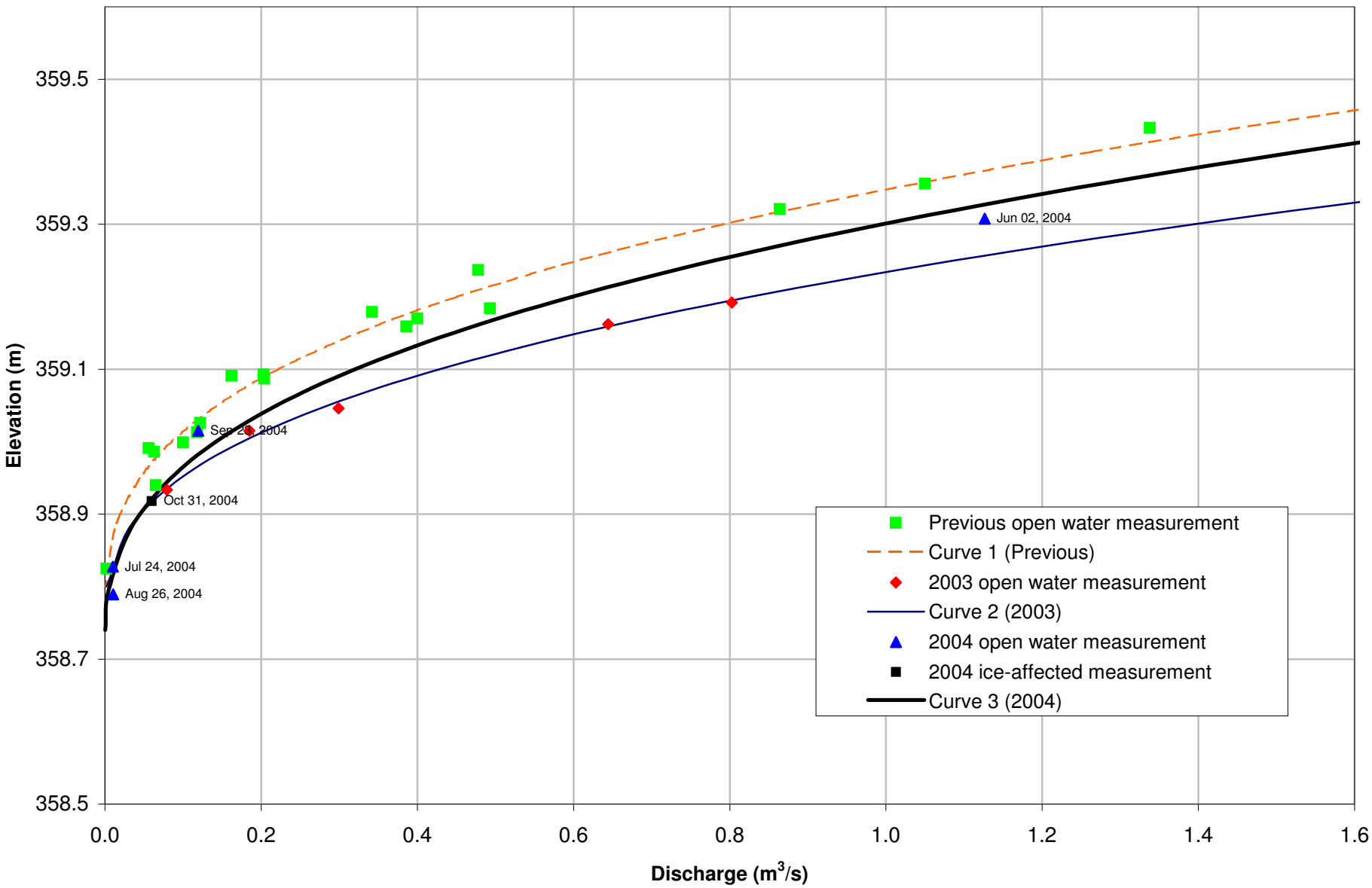


Figure D-6 S5 - Muskeg River above Stanley Creek stage-discharge rating curve.

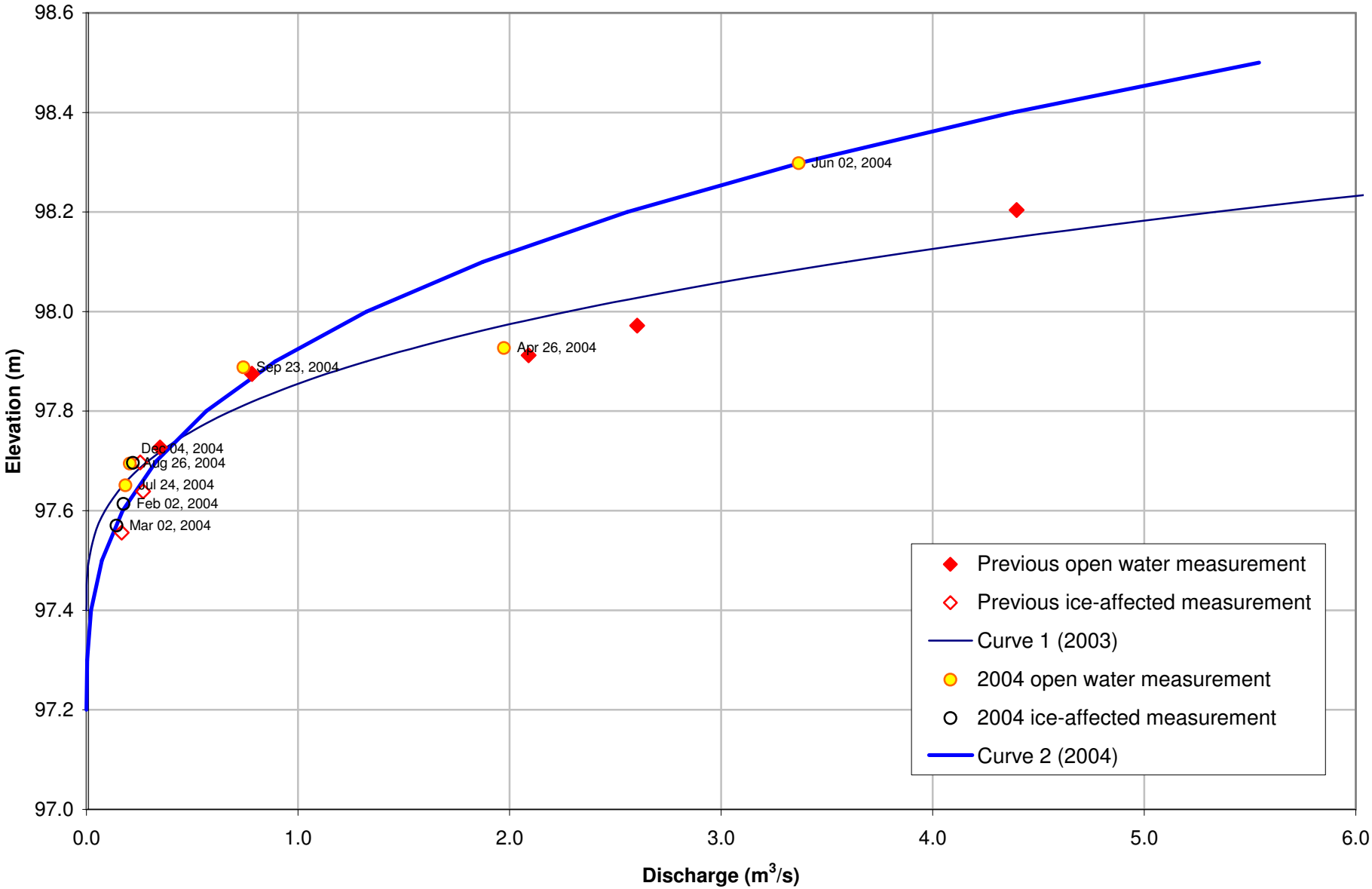


Figure D-7 S5A - Muskeg River above Muskeg Creek stage-discharge rating curve.

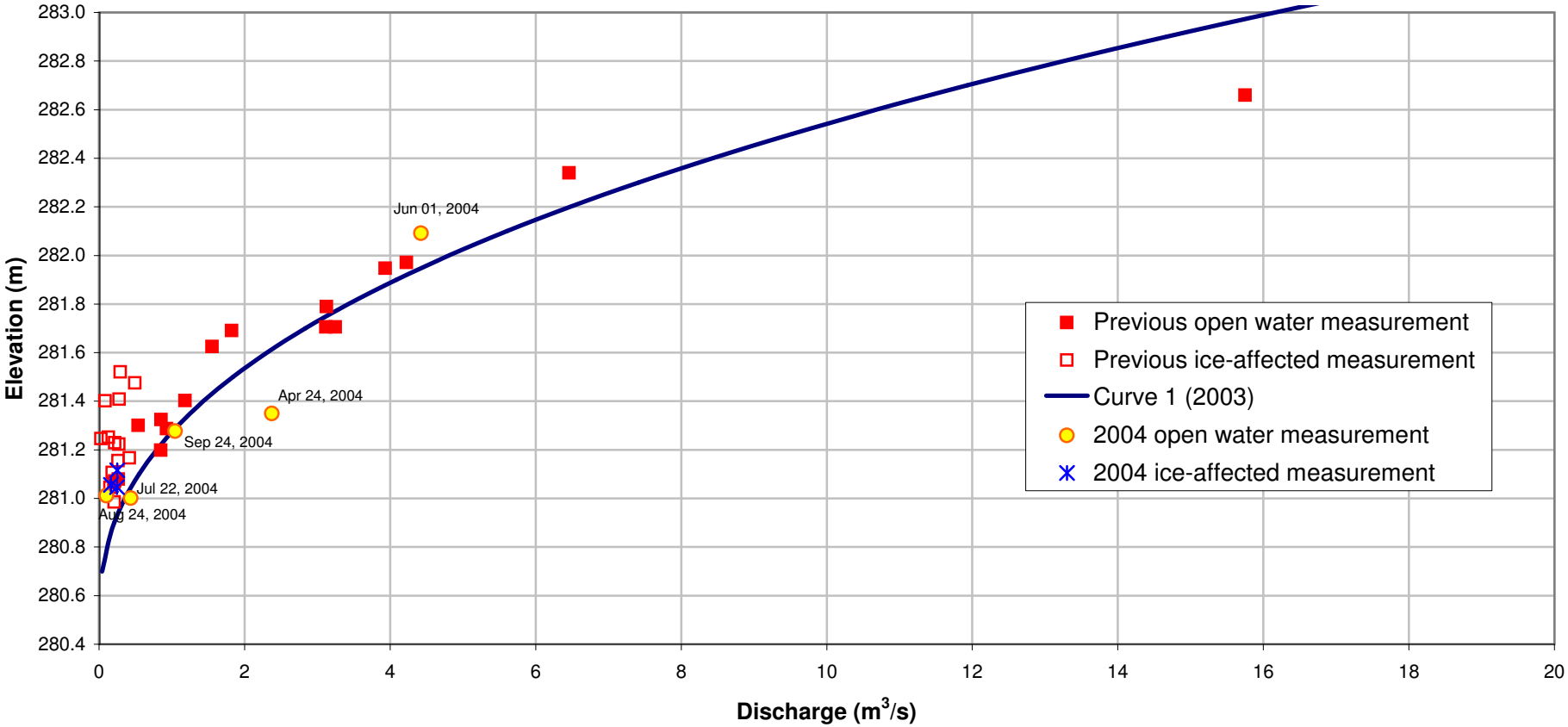


Figure D-8 S6 - Mills Creek at Highway 63 stage-discharge rating curve.

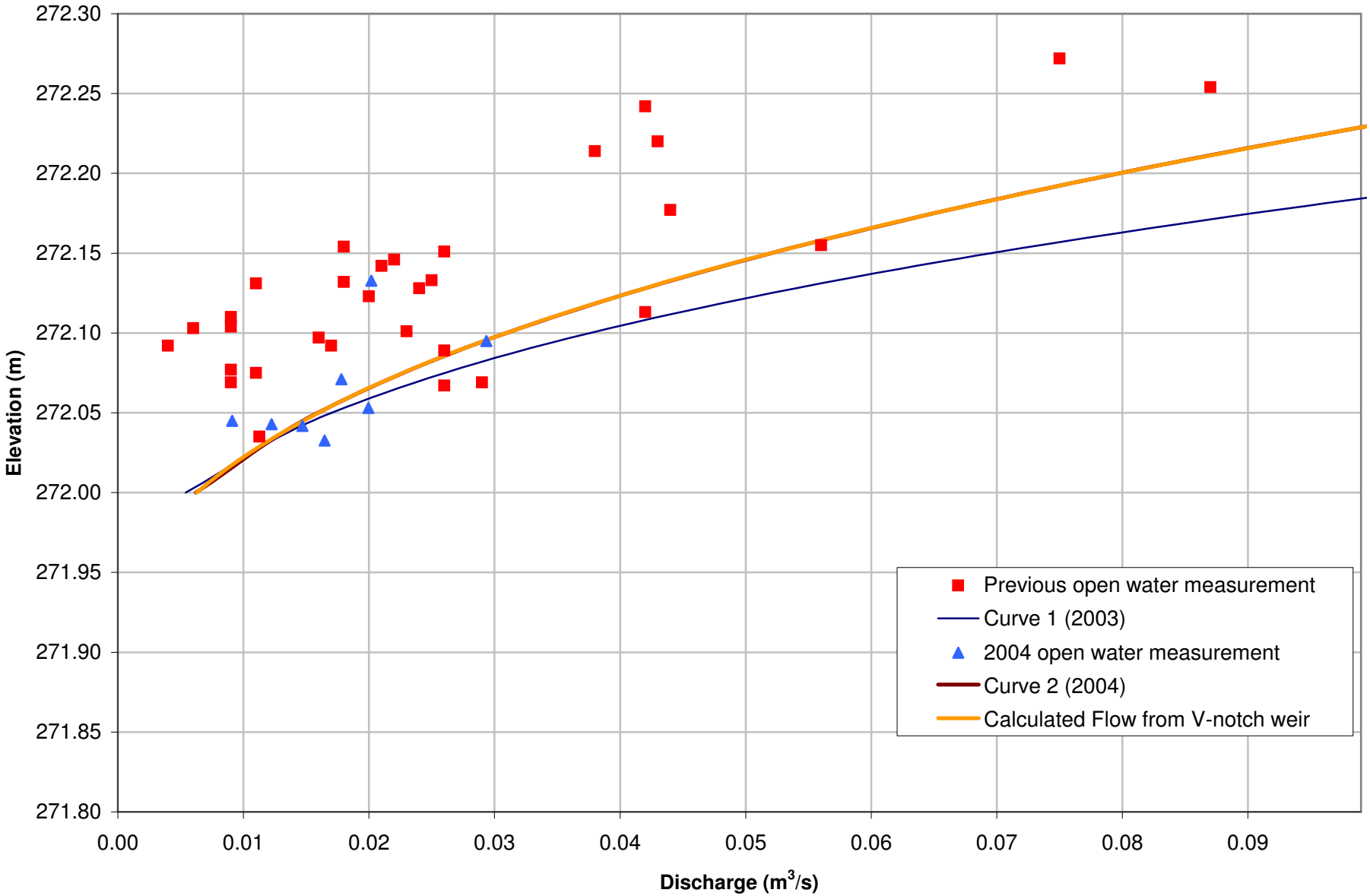


Figure D-9 S7 - Muskeg River near Fort McKay (07DA008) stage-discharge rating curve.

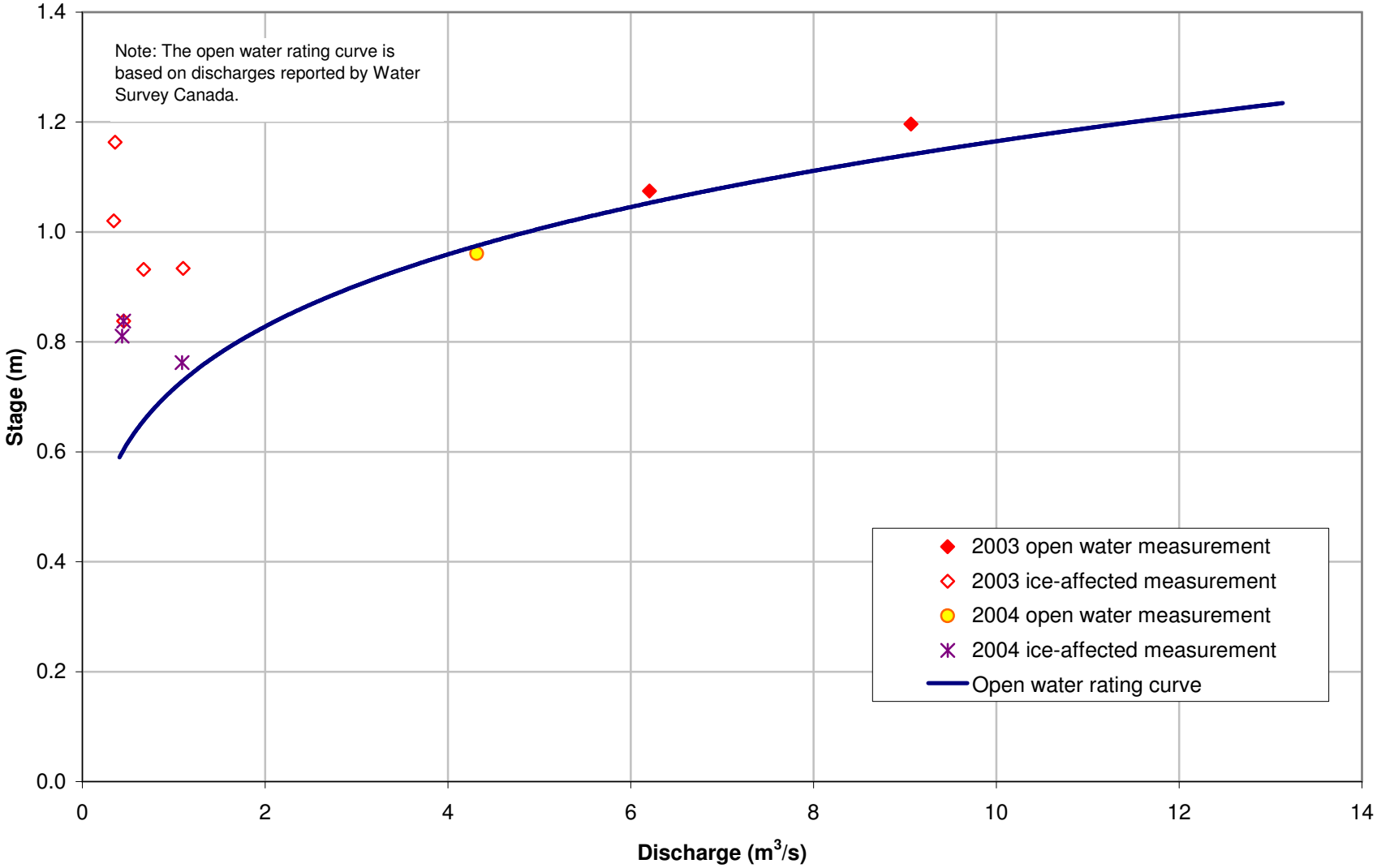


Figure D-10 S9 - Kearl Lake Outlet stage-discharge rating curve.

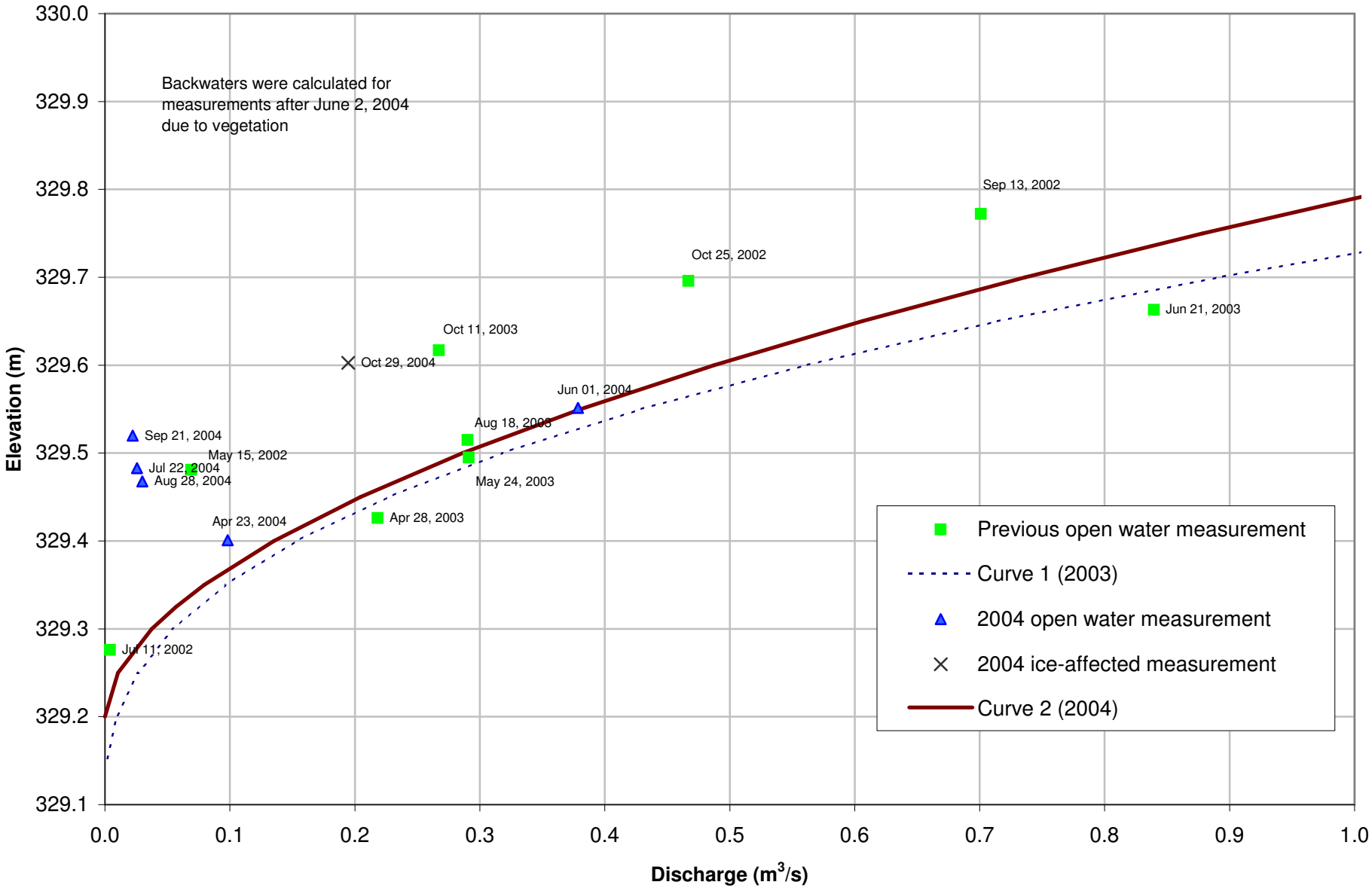


Figure D-11 S10 - Wapasu Creek at Canterra Road stage-discharge rating curve.

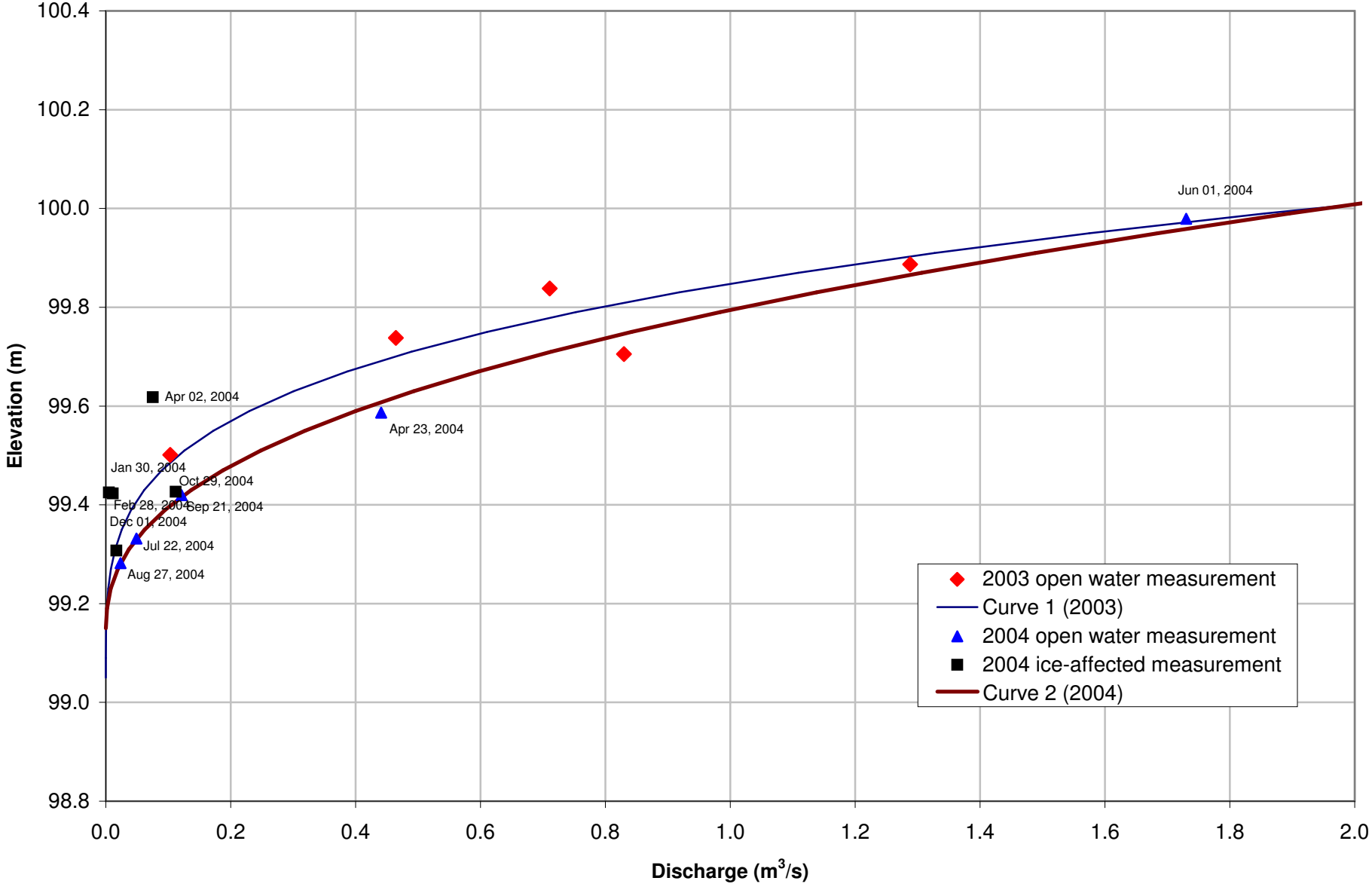


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Figure D-12 S11 - Poplar Creek at Highway 63 (07DA007) stage-discharge rating curve.

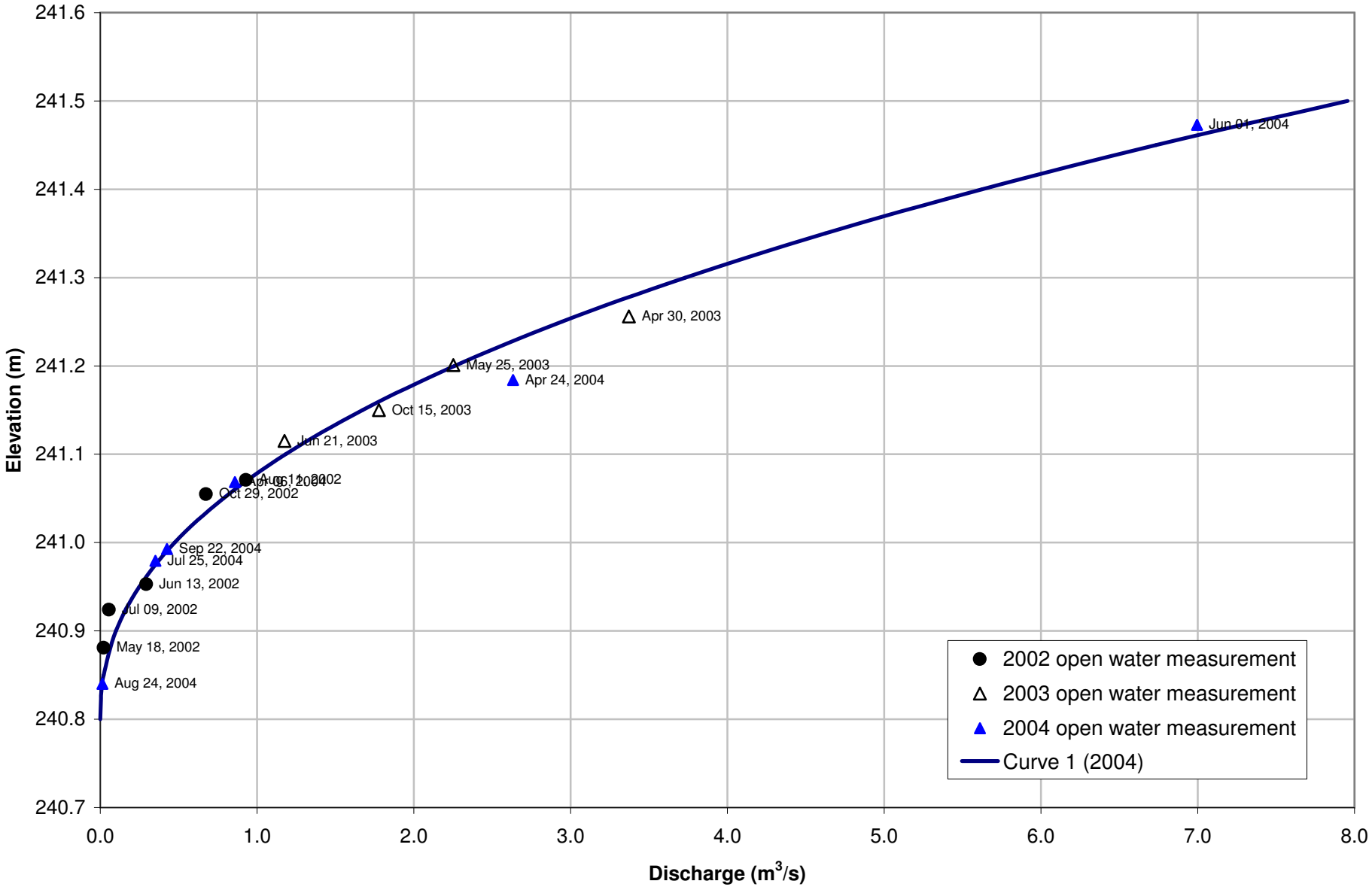

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Figure D-13 S14 - Ells River above Joslyn Creek stage discharge rating curve.

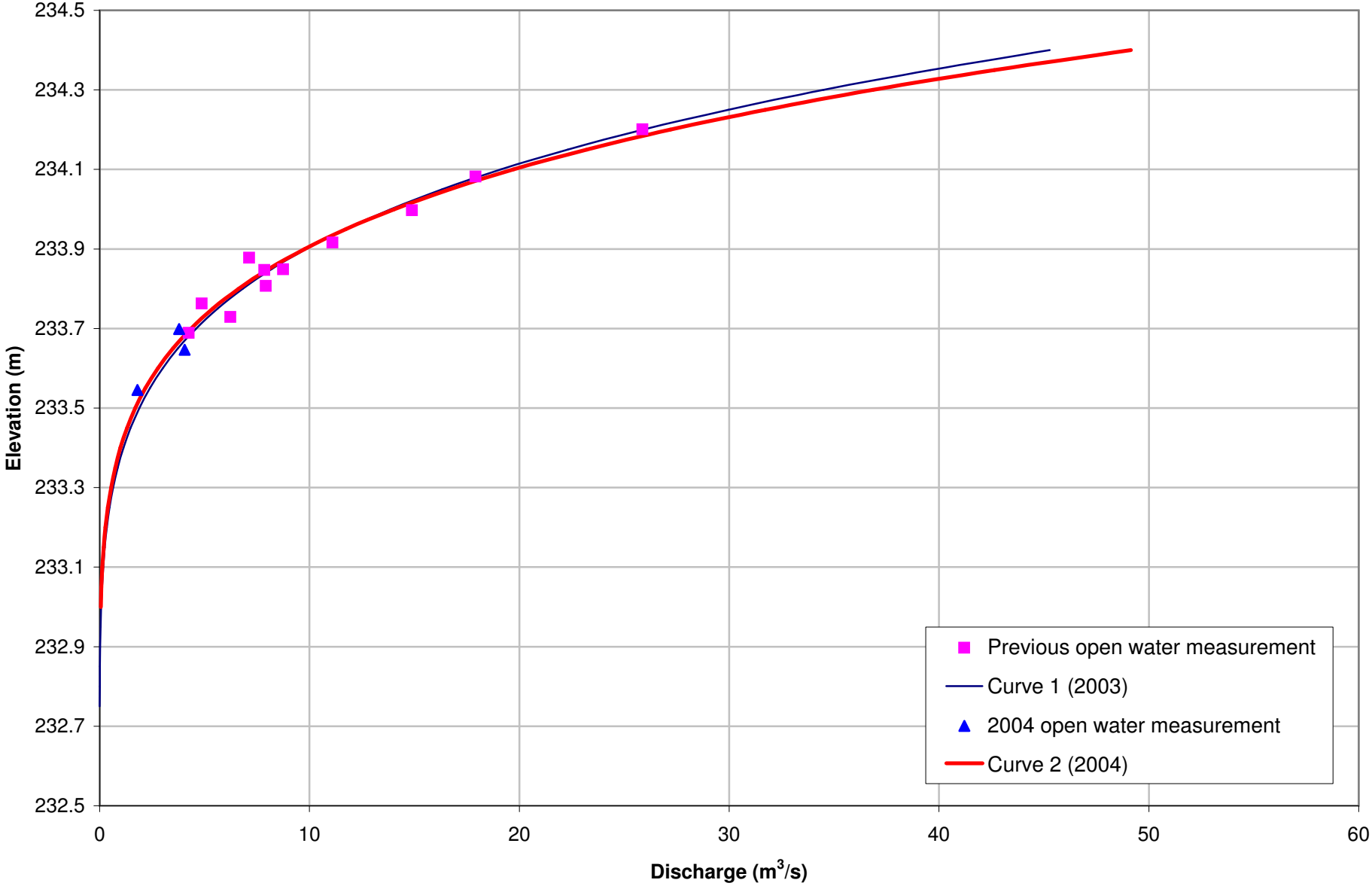

Figure D-14 S15 - Tar River near the Mouth stage-discharge rating curve.

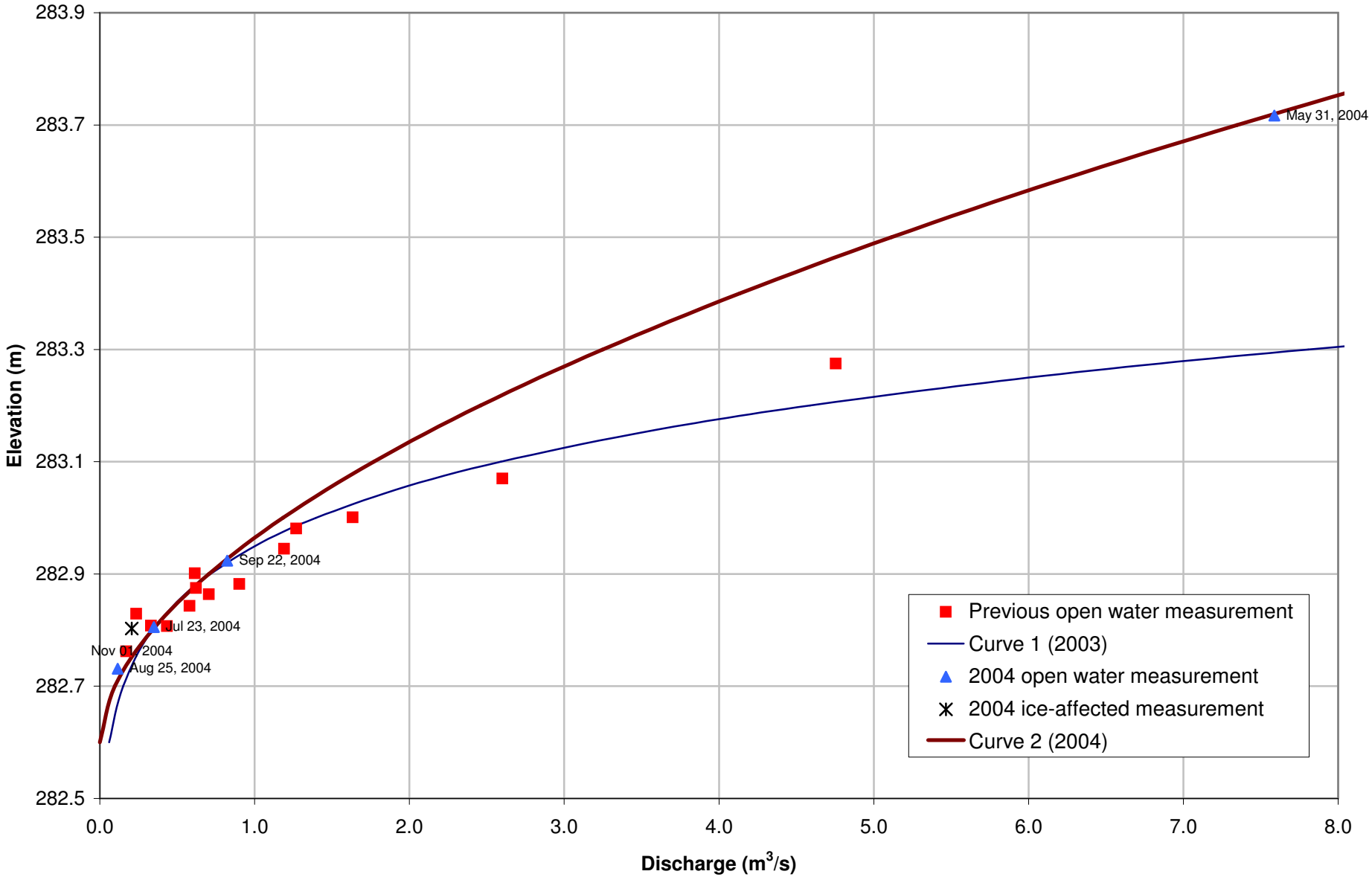

Figure D-15 S16 - Calumet River near the Mouth stage-discharge rating curve.

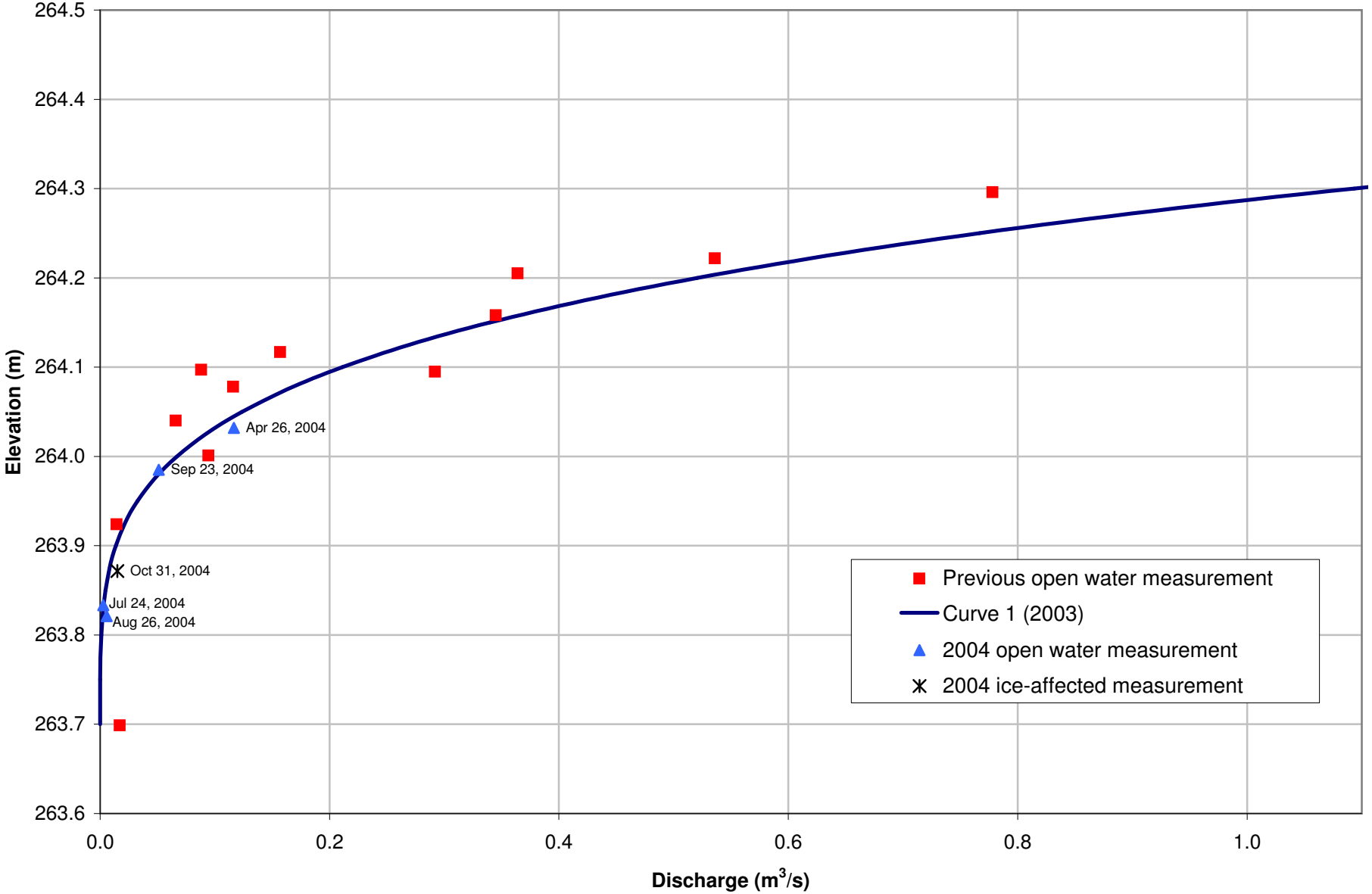

Figure D-16 S17 - Tar River Upland Tributary stage-discharge rating curve.

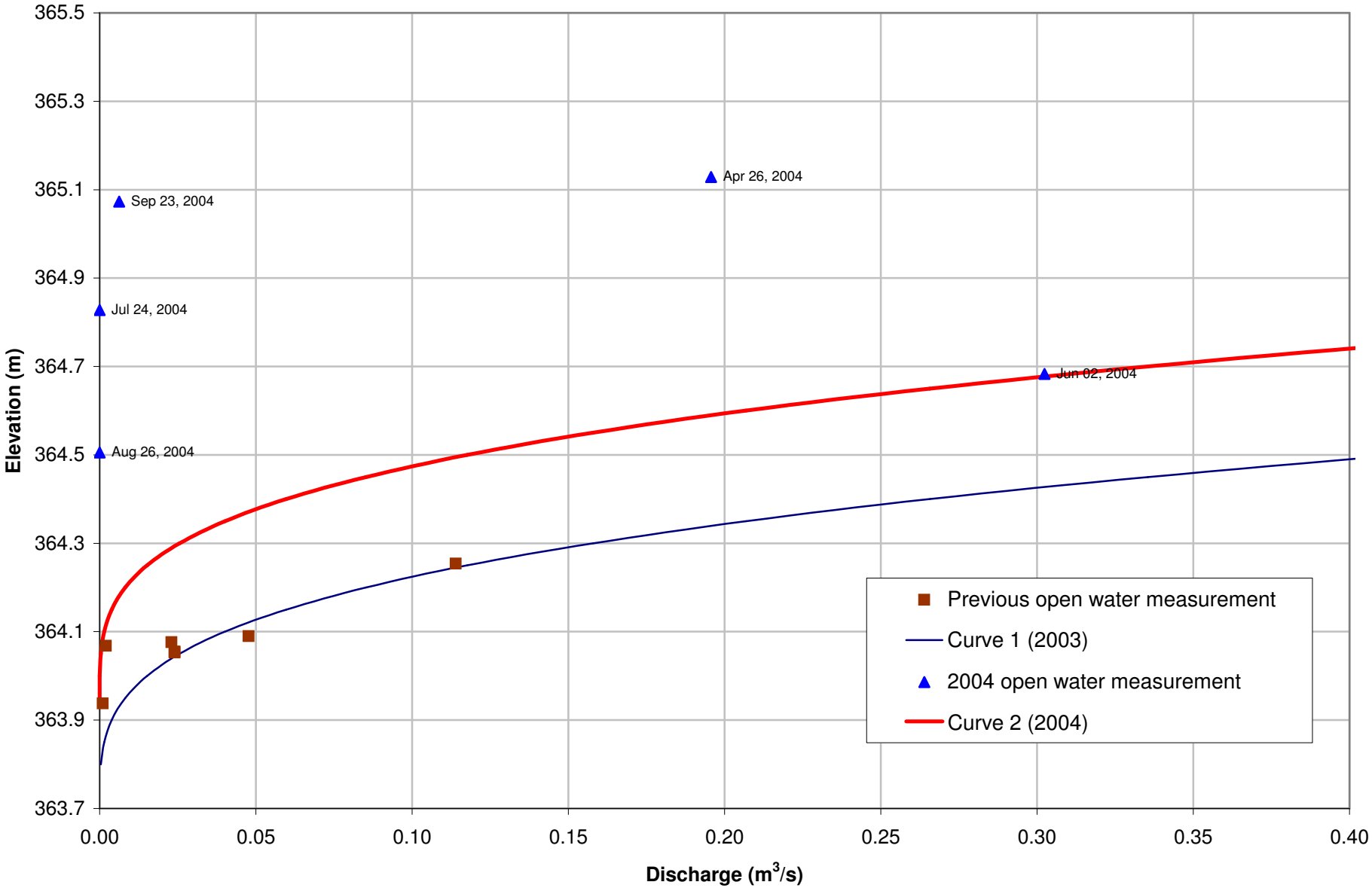

Figure D-17 S18A - Calumet River Upland Tributary stage-discharge rating curve.

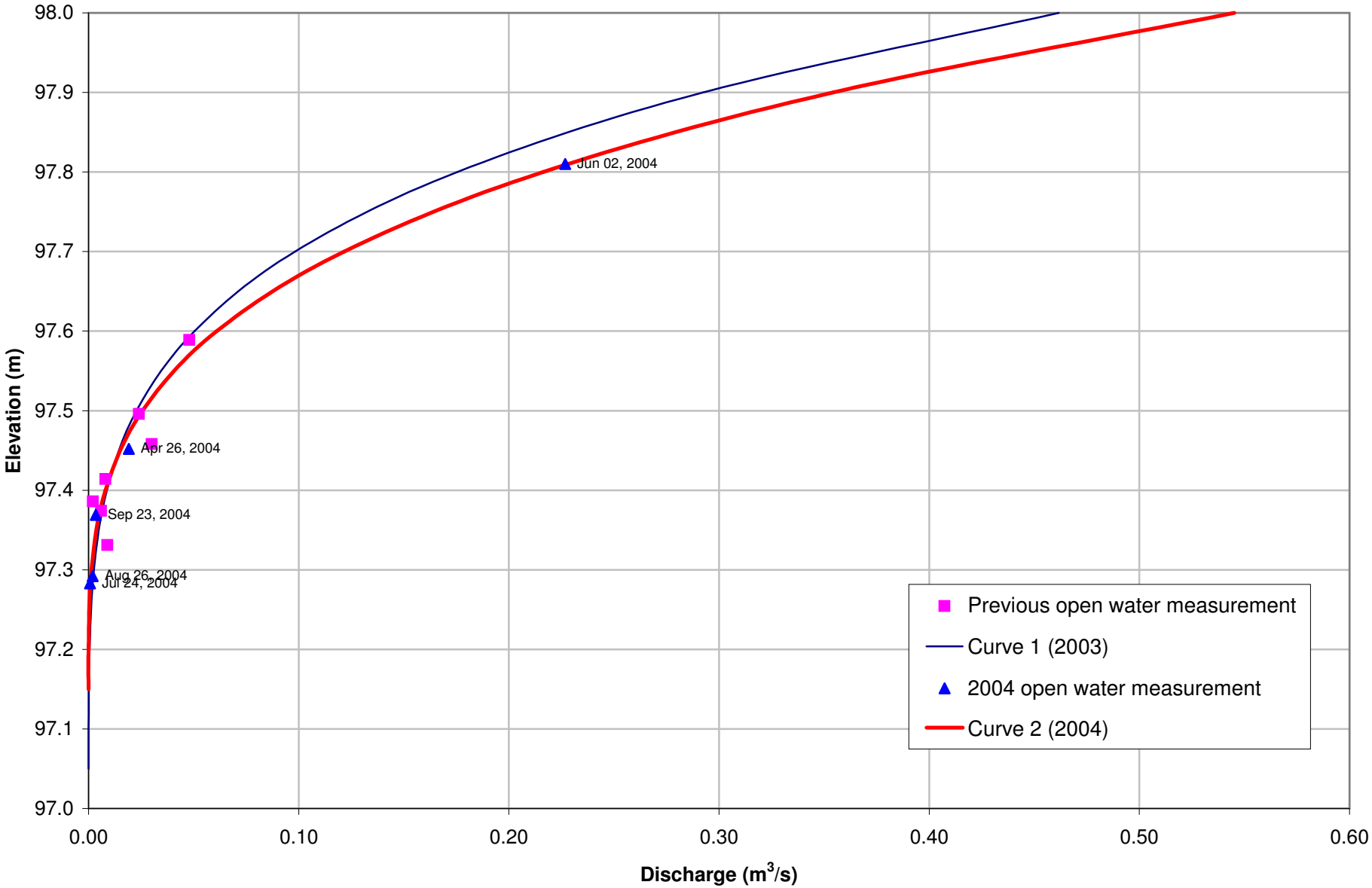

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Figure D-18 S19 - Tar River Lowland Tributary near the mouth stage-discharge rating curve.

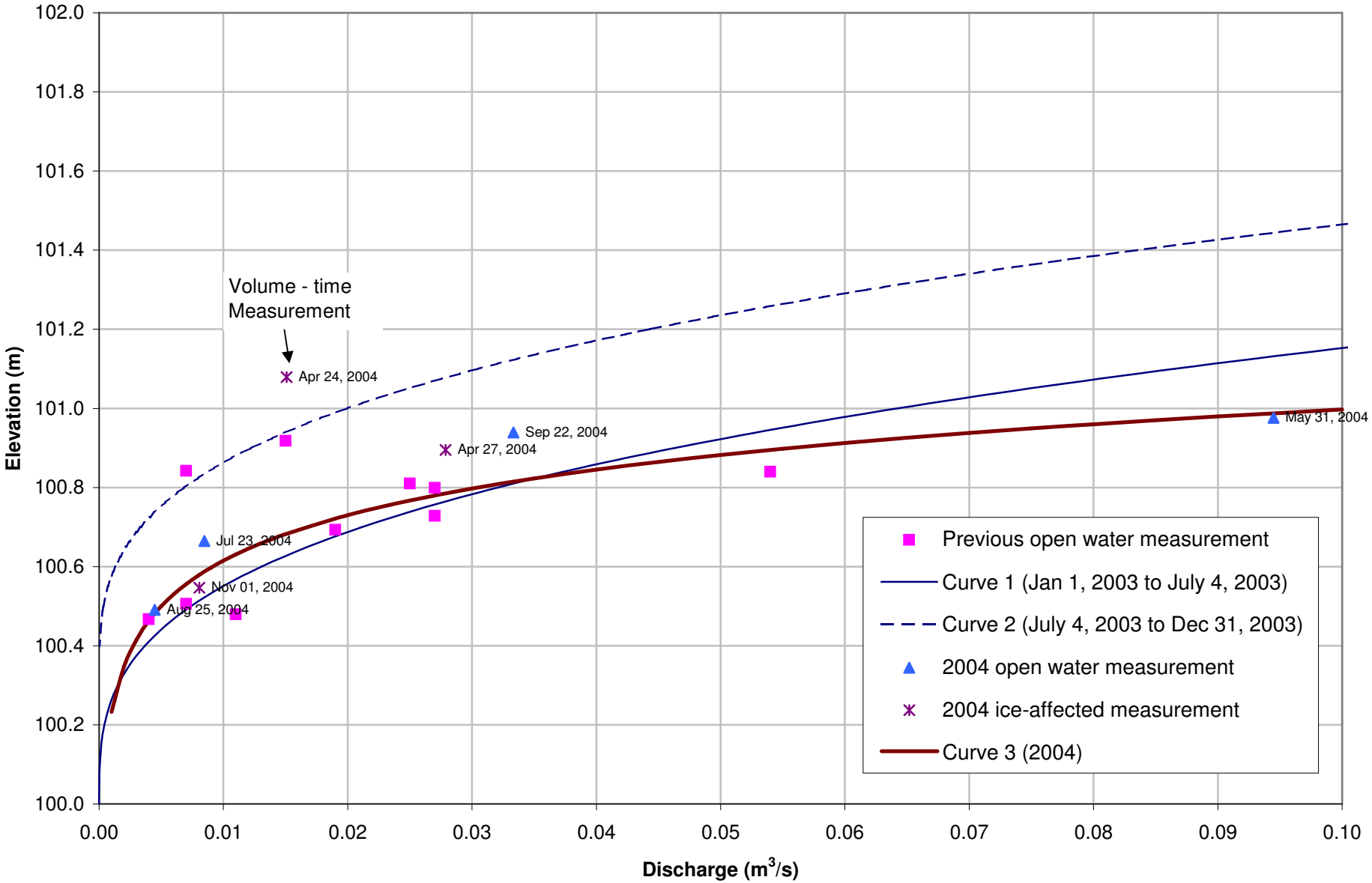

Figure D-19 S20 - Muskeg River Upland stage-discharge rating curve.

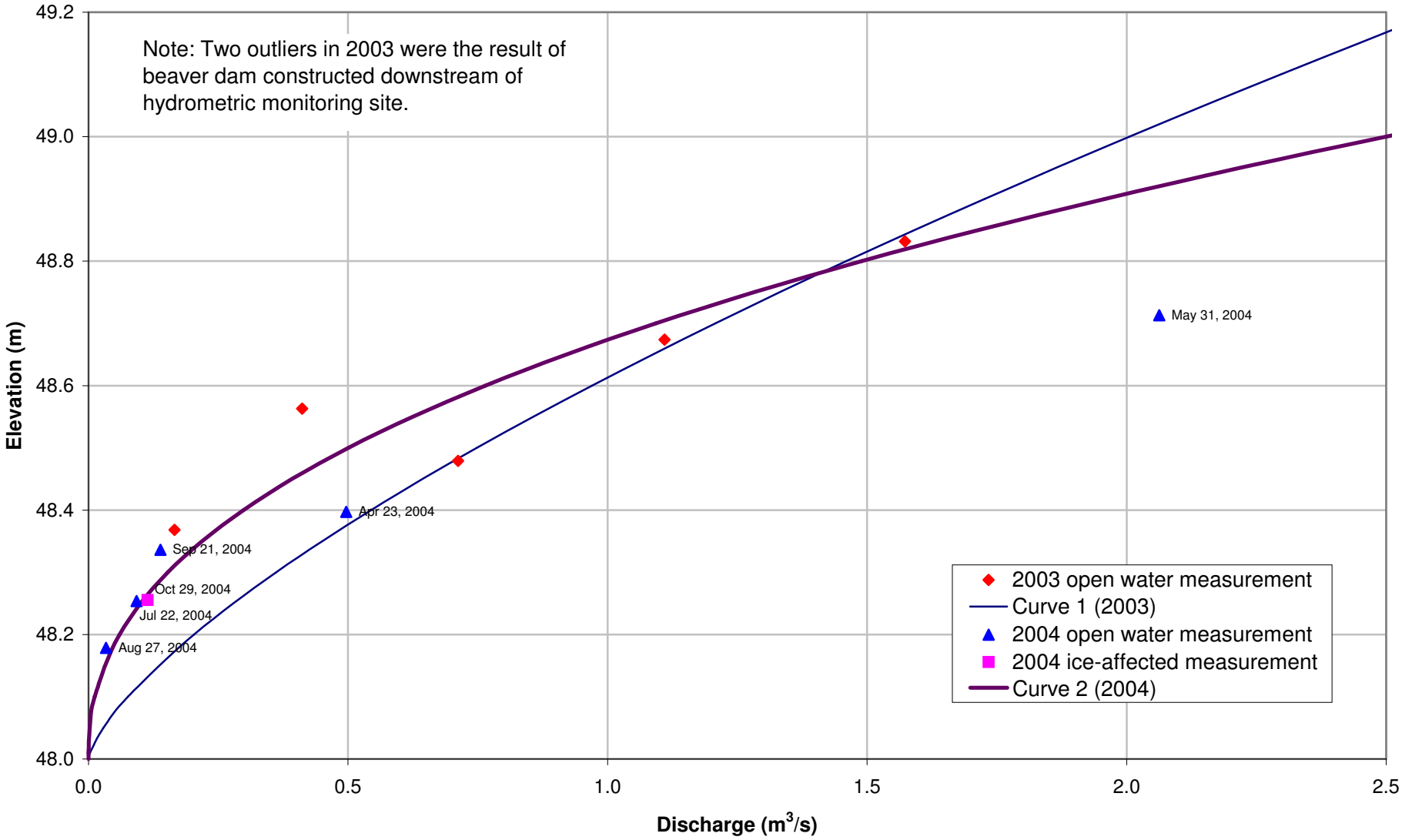

Figure D-20 S22 - Muskeg Creek near the Mouth stage-discharge rating curve.

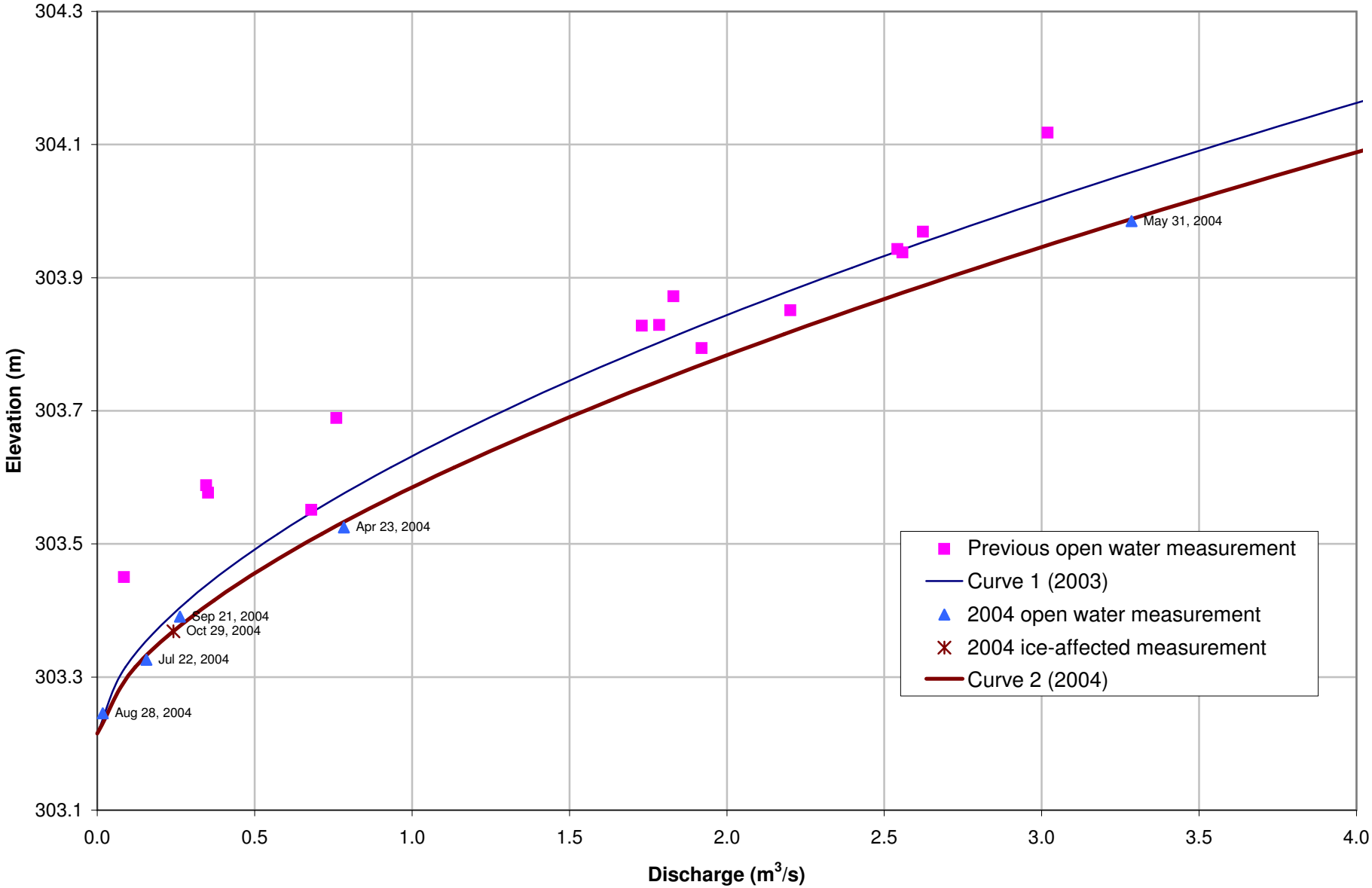

Figure D-21 S24 - Athabasca River below Eymundson Creek stage-discharge rating curve.

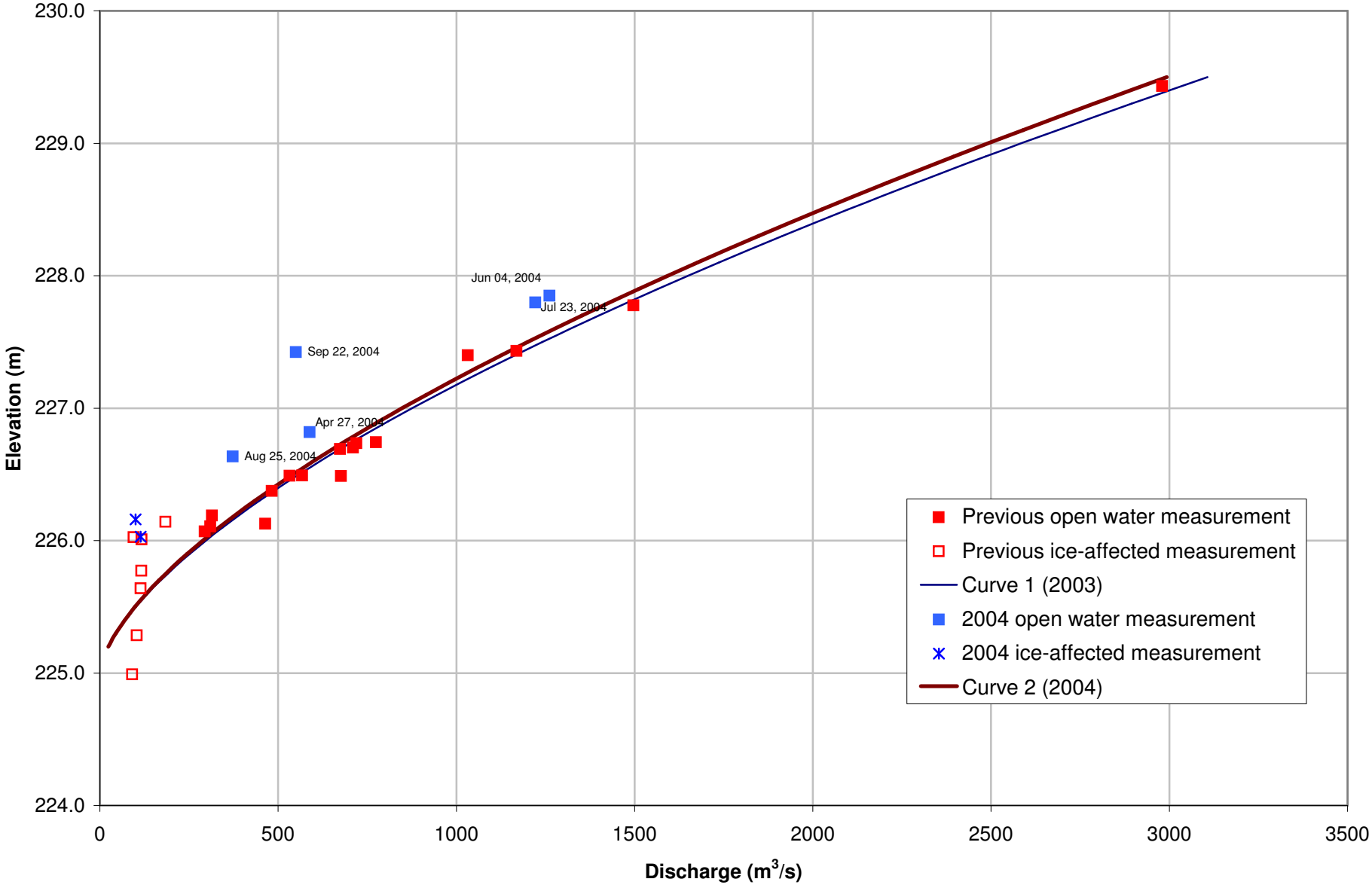

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Figure D-22 S26 - MacKay River near Fort MacKay (07DB001) stage-discharge rating curve.

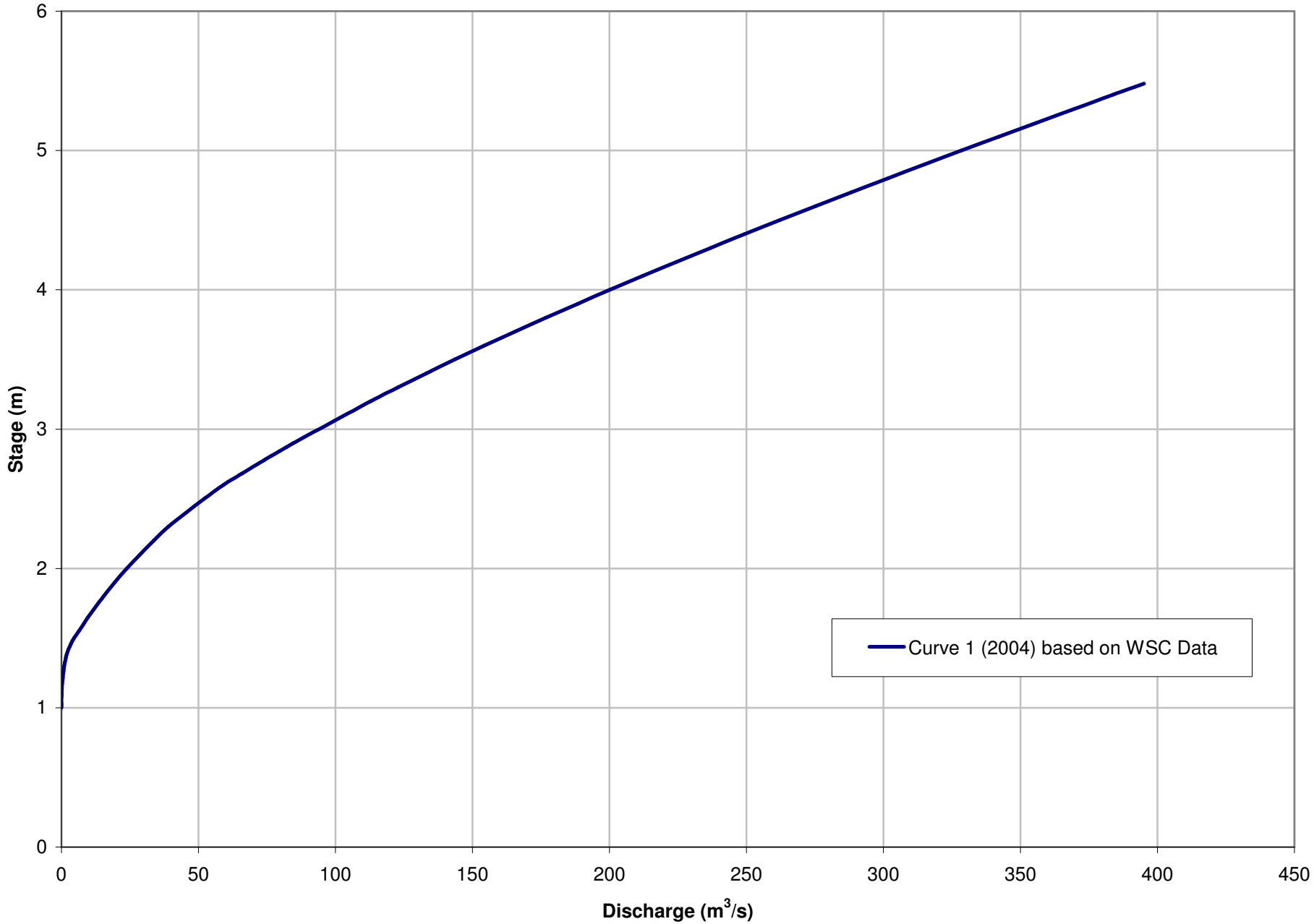

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Figure D-23 S27 - Firebag River near the Mouth (07DC001) stage-discharge rating curve.

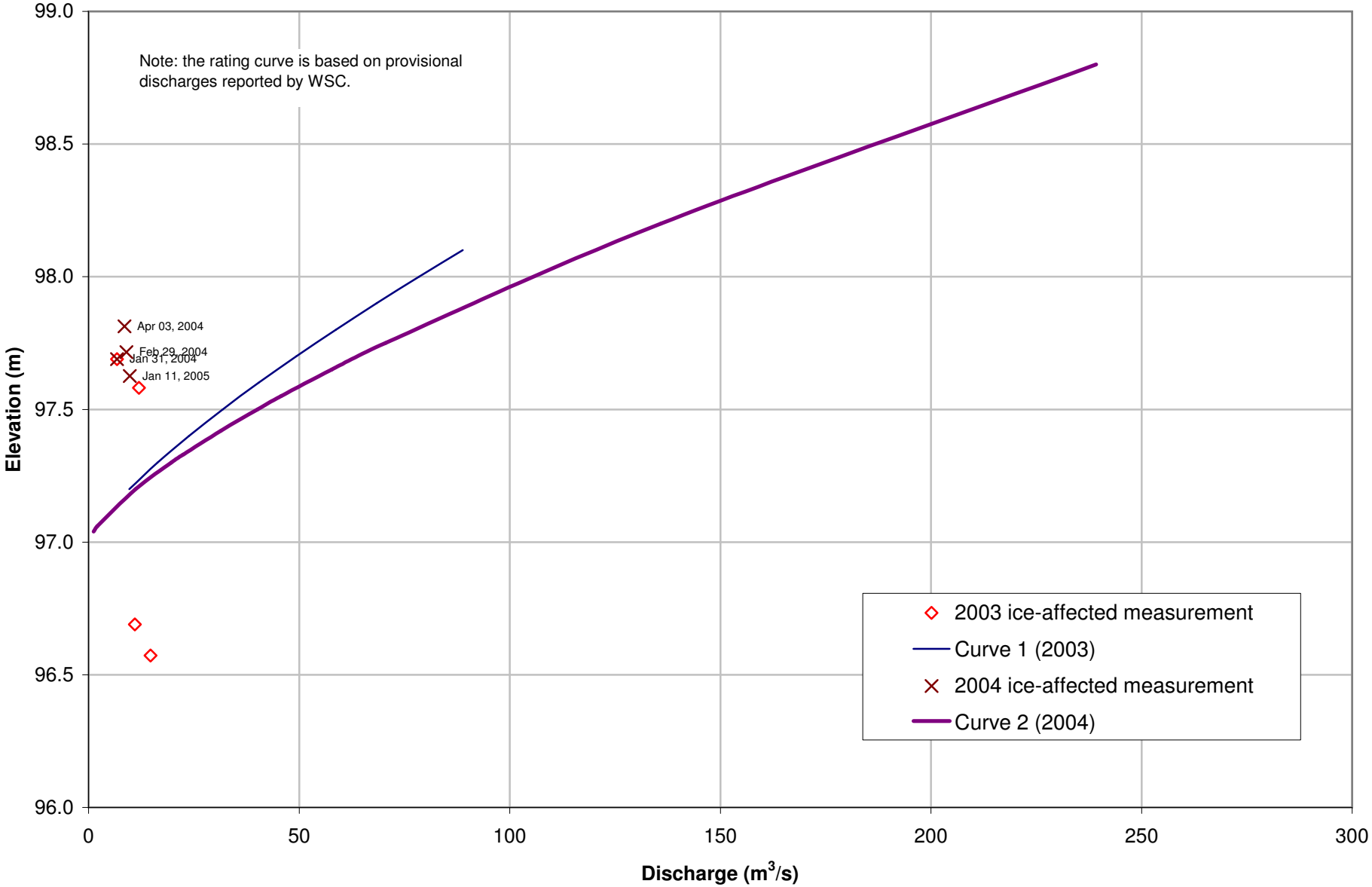

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Figure D-24 S28 Khahago Creek below Black Fly Creek stage-discharge rating curve.

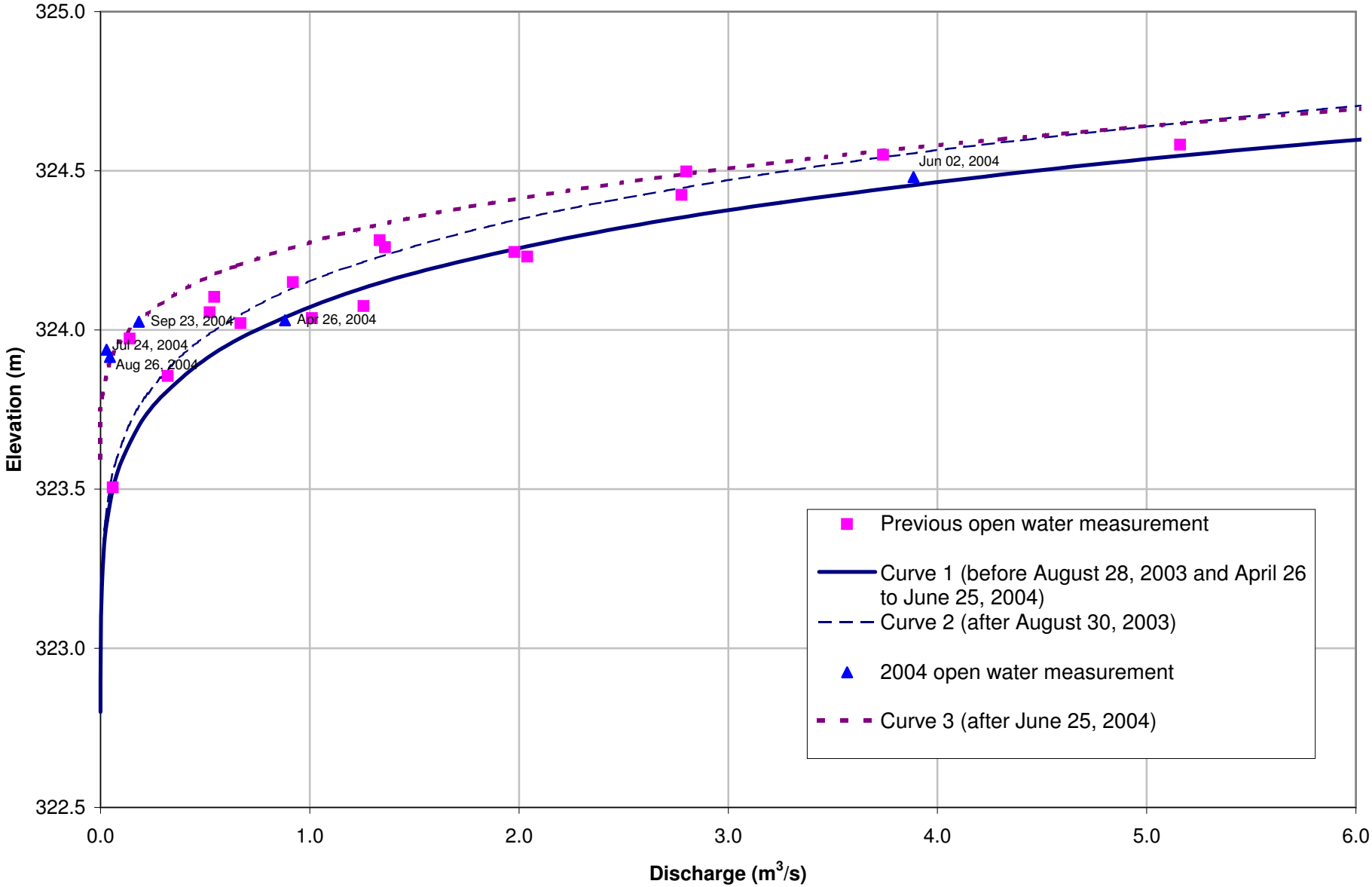

Figure D-25 S29 Christina River near Chard (07CE002) stage-discharge rating curve.

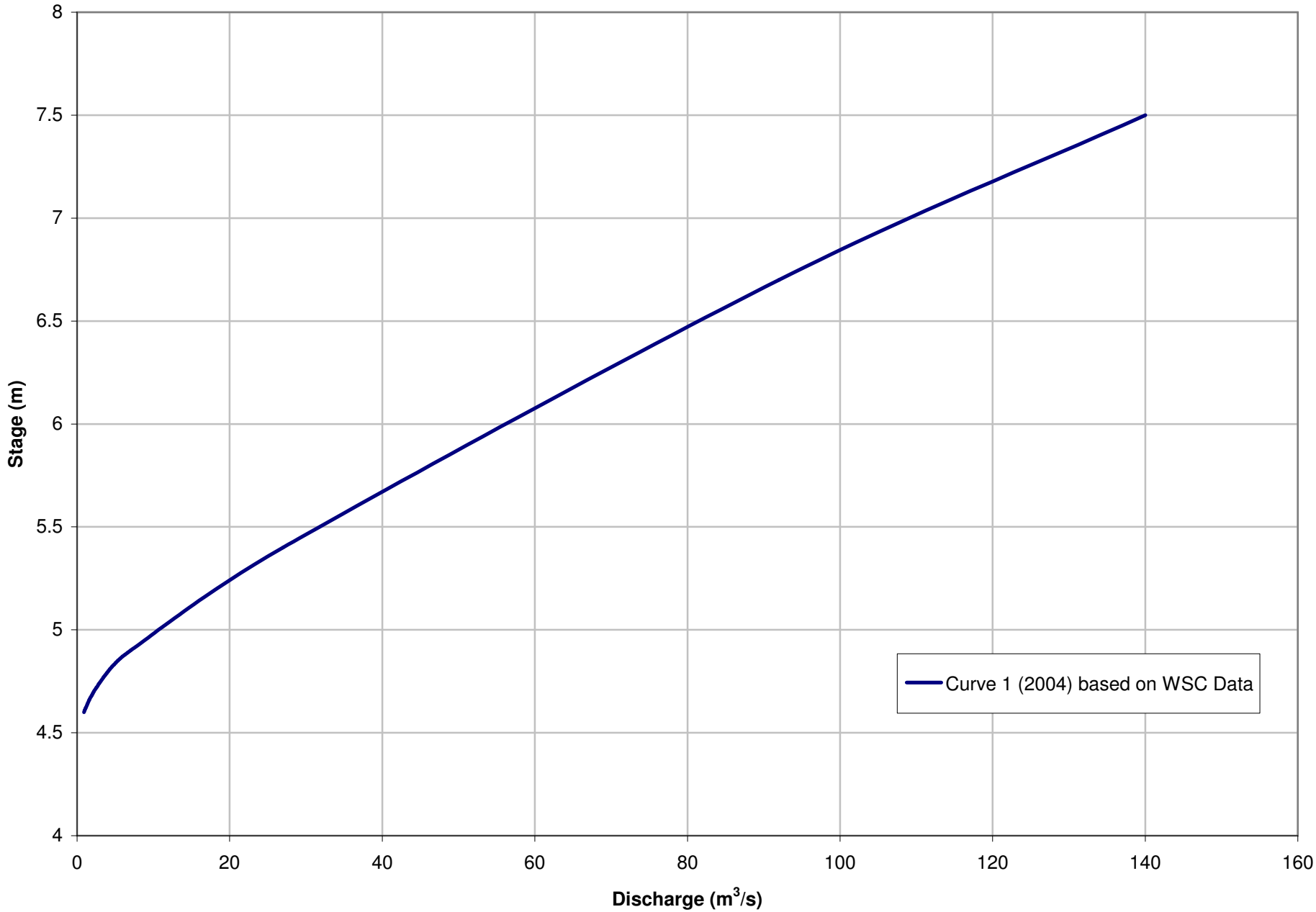

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Figure D-26 S31 - Hangingstone Creek at North Star Road stage-discharge rating curve.

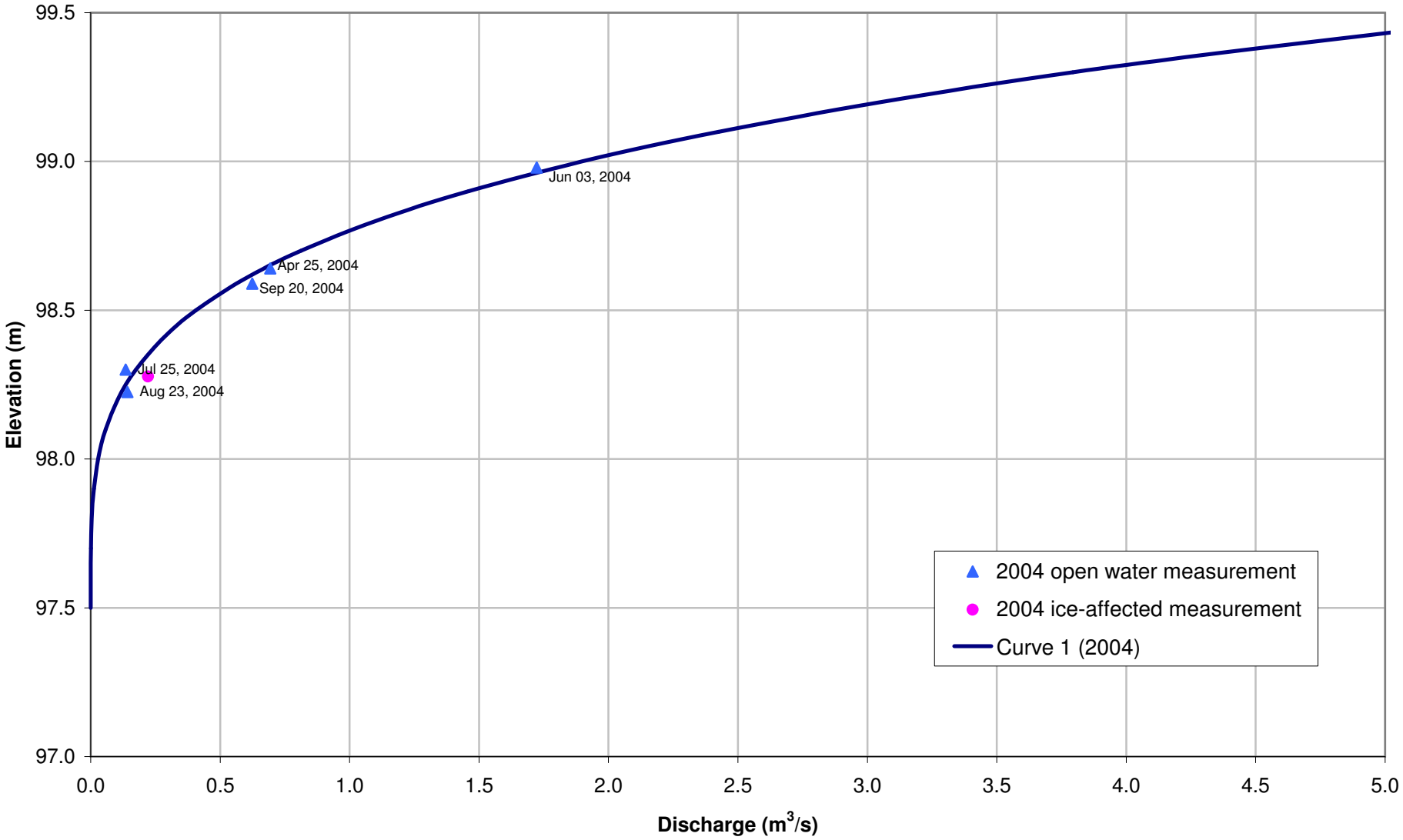

Figure D-27 S32 - Surmont Creek at Highway 881 stage-discharge rating curve.

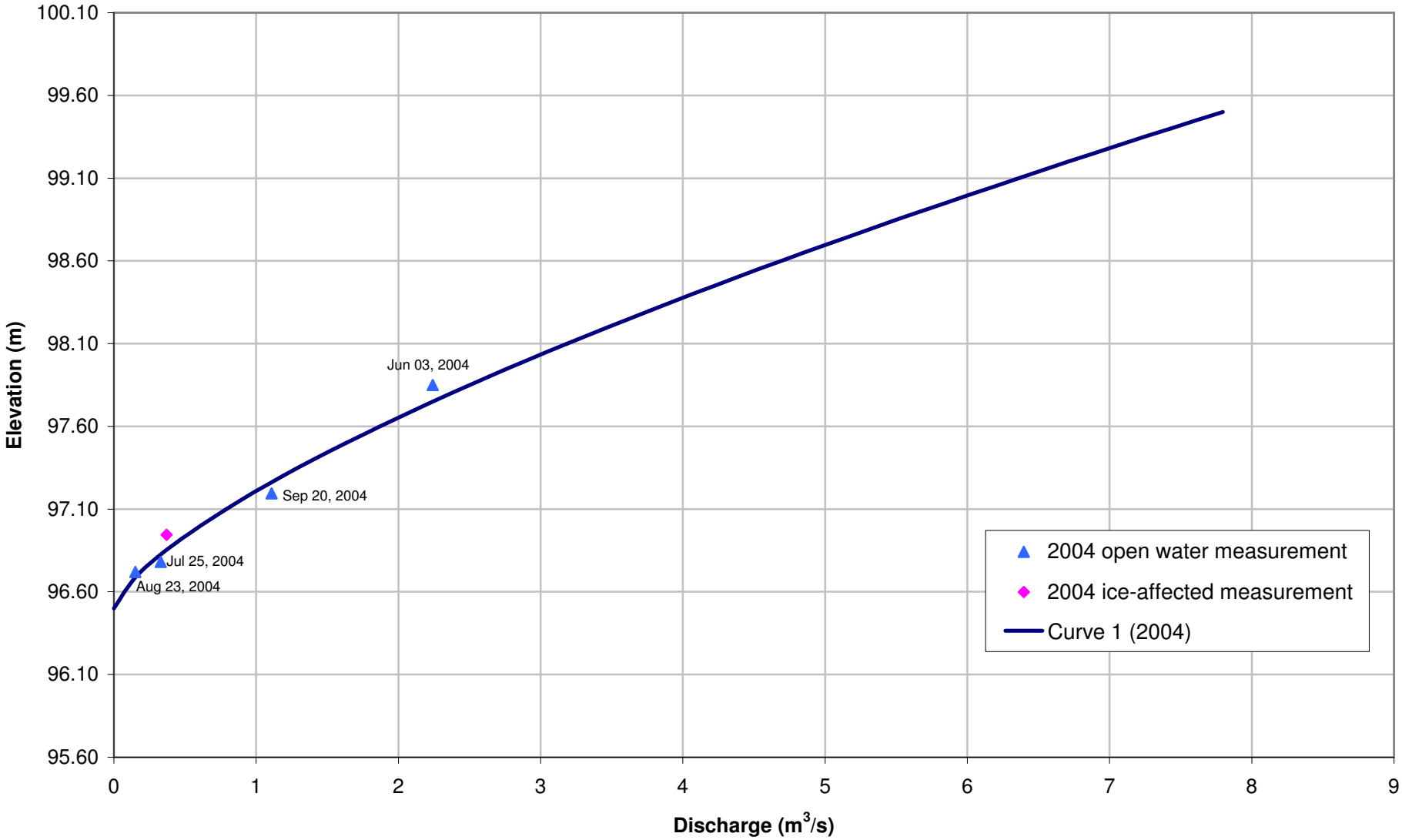

Figure D-28 S33 - Muskeg River at the Aurora/Albian Boundary stage-discharge rating curve.

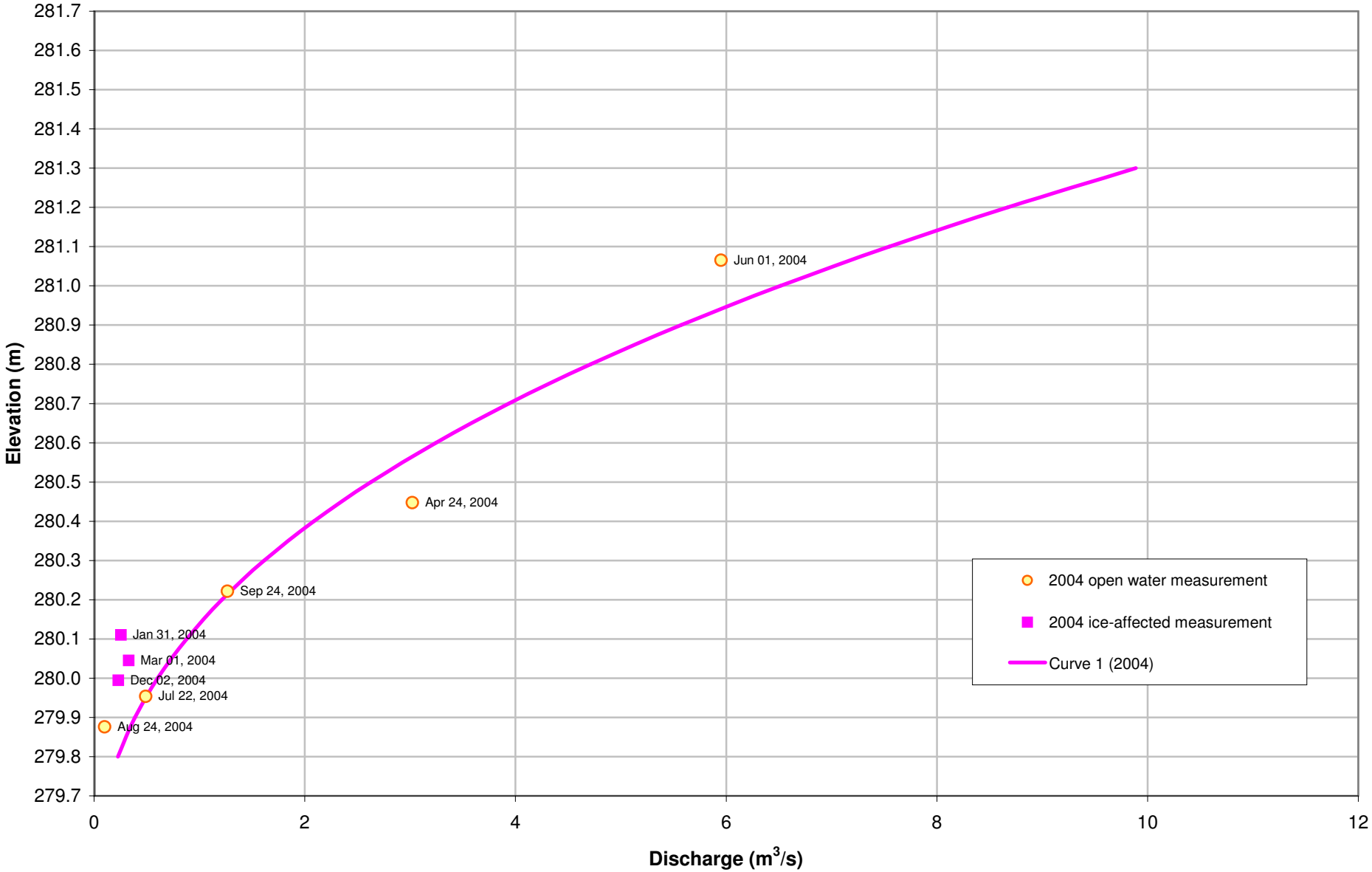

Figure D-29
S02 - Jackpine Creek at Canterra Road
2004 Hydrograph in Historical Context

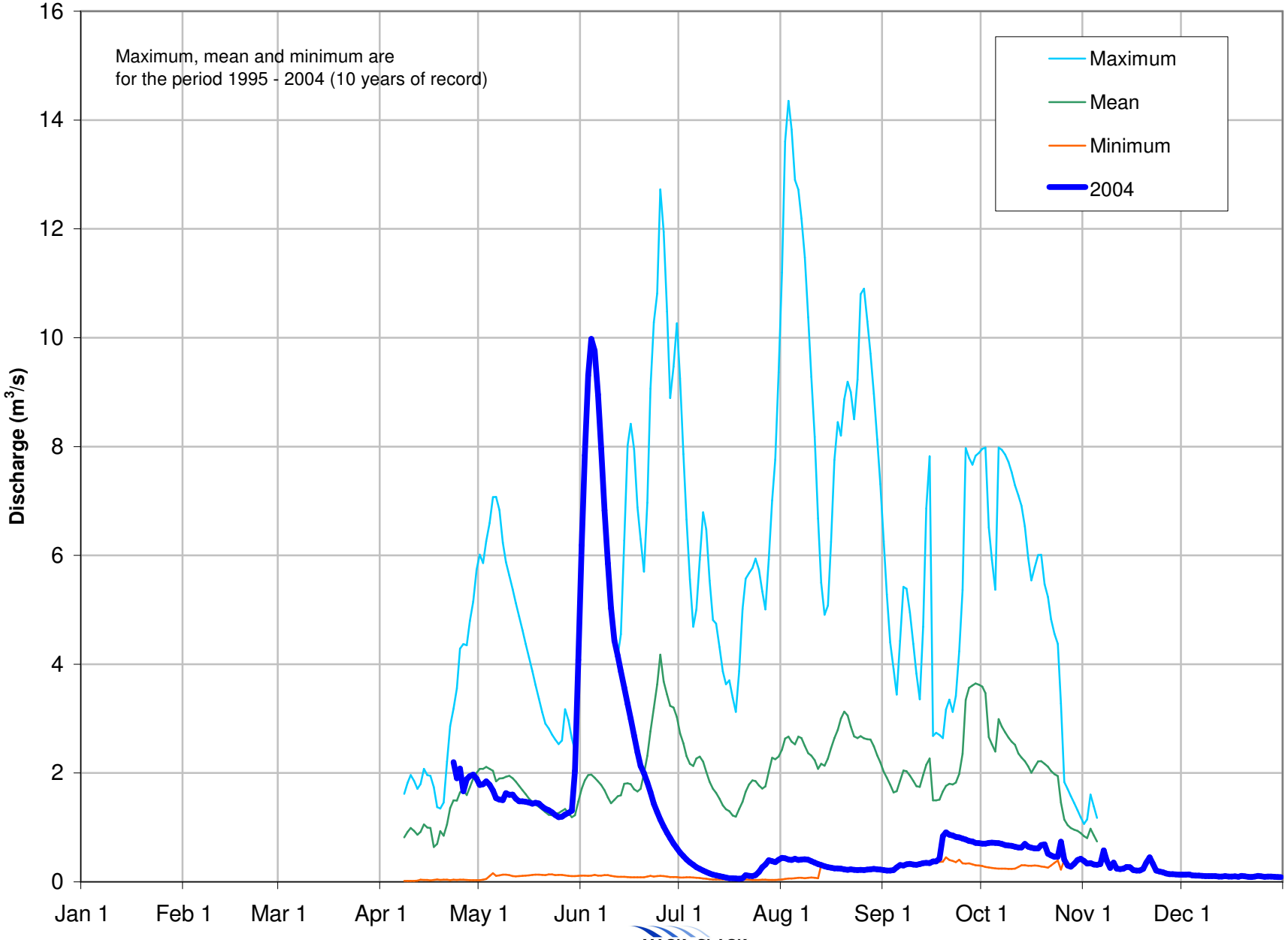

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Figure D-30
S03 - Iyinimin Creek above Kearl Lake
2004 Hydrograph in Historical Context

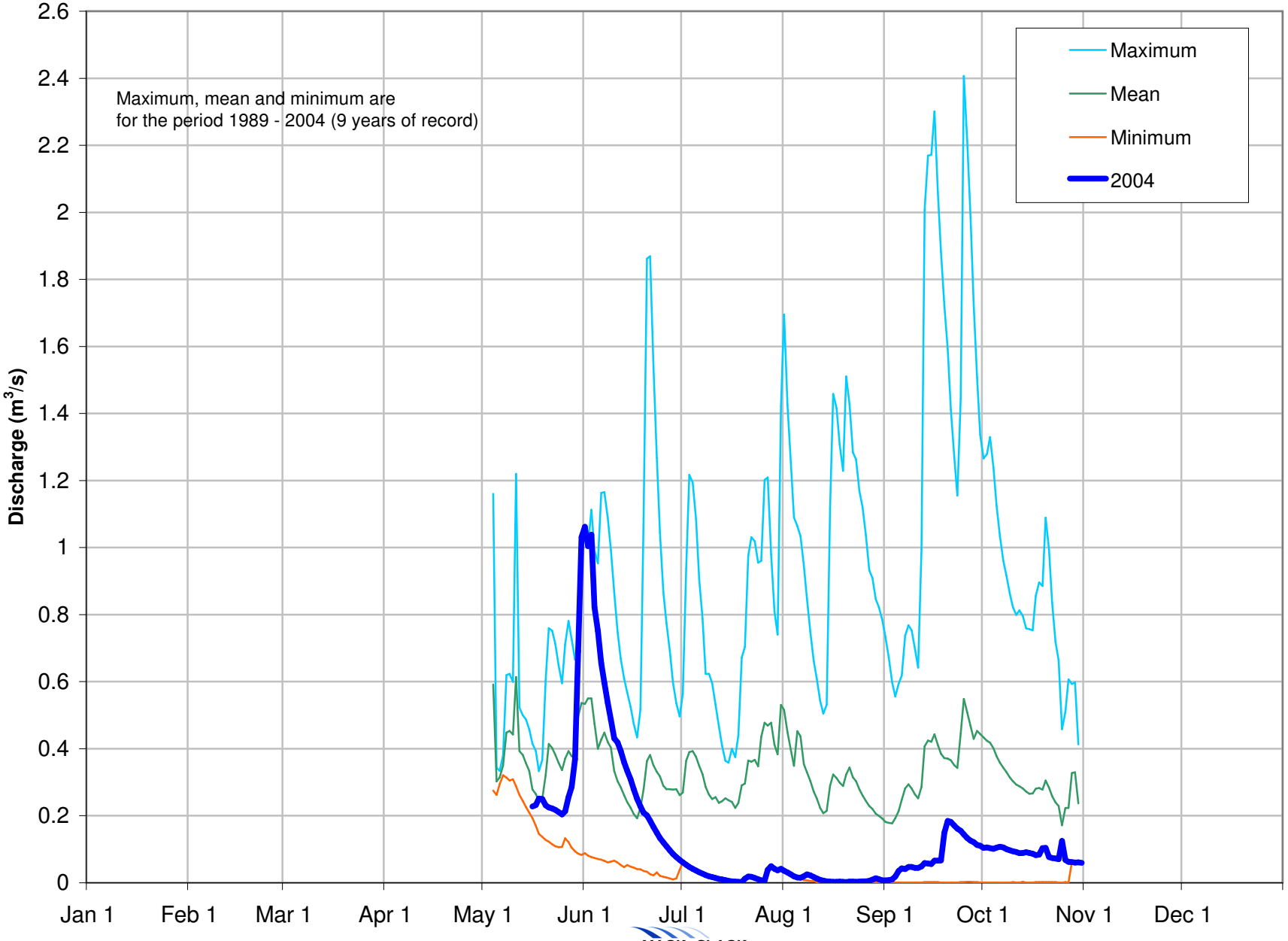

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Figure D-31
S05 - Muskeg River above Stanley Creek
2004 Hydrograph in Historical Context

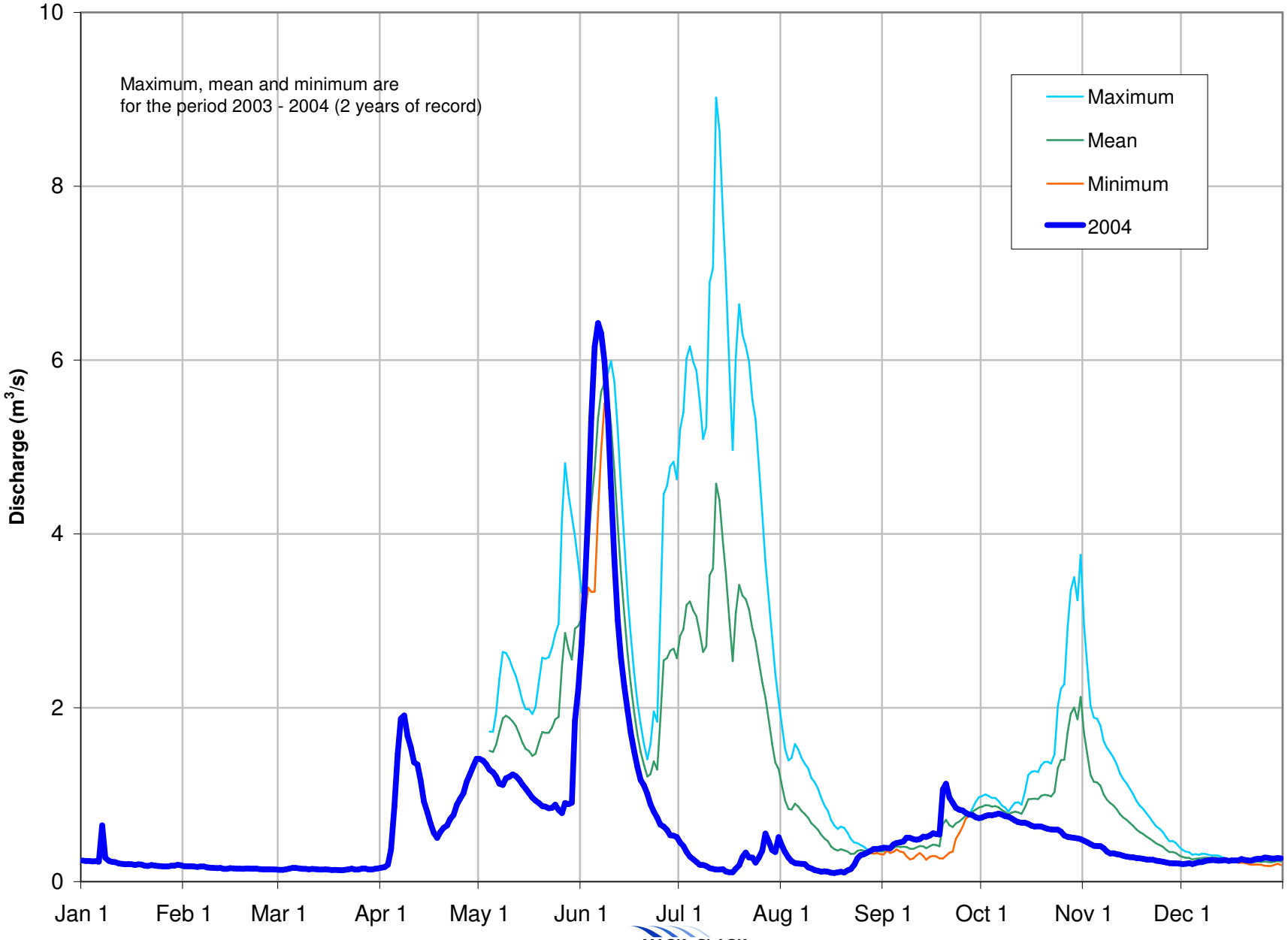

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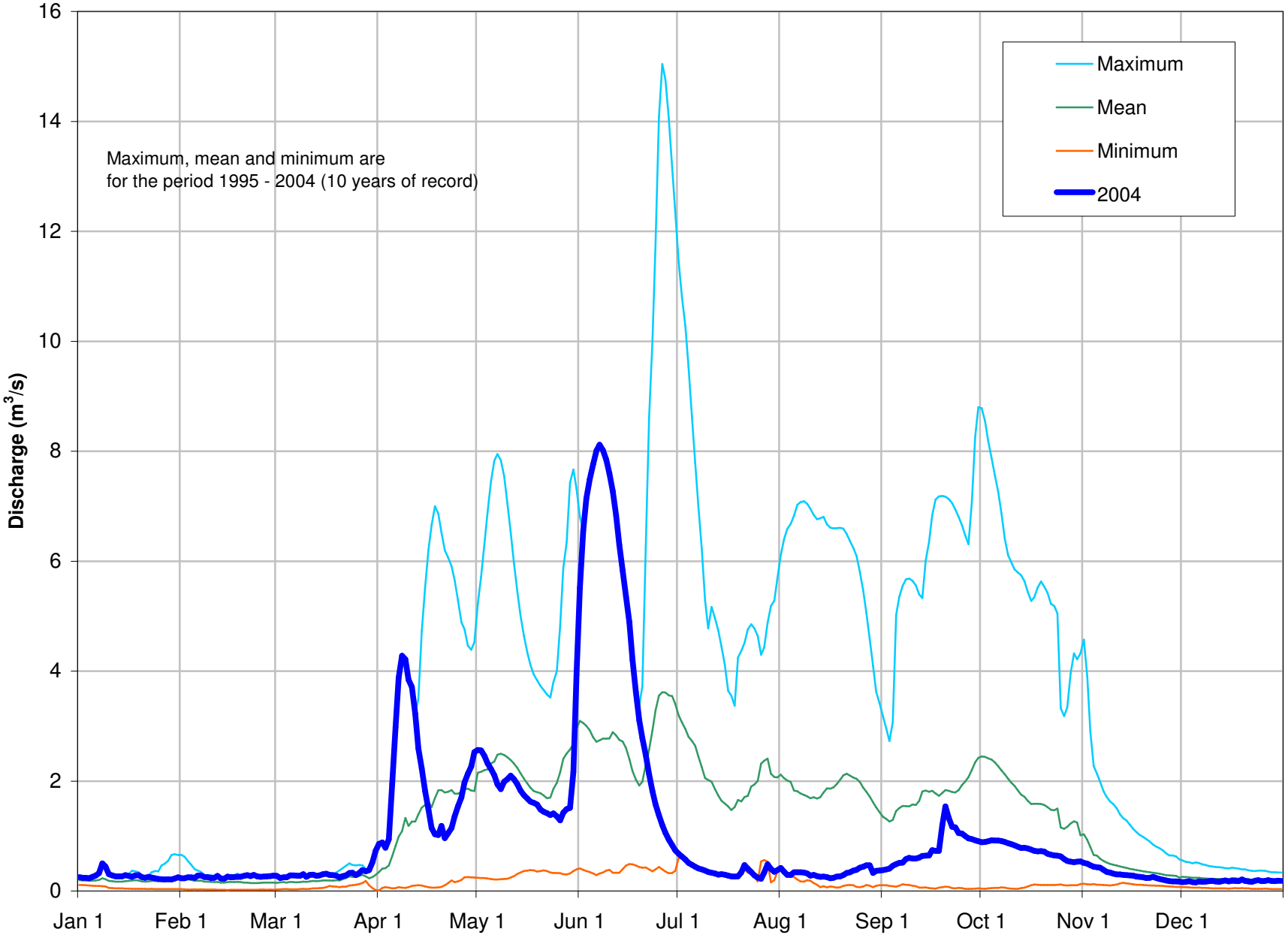
Figure D-32
S05A - Muskeg River above Muskeg Creek
2004 Hydrograph in Historical Context



MSA 200217.4
RAMP 2004

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2005-03-23
Max-Mean-Min plot(Discharges).xls

Figure D-33
S09 - Kearl Lake Outlet
2004 Hydrograph in Historical Context

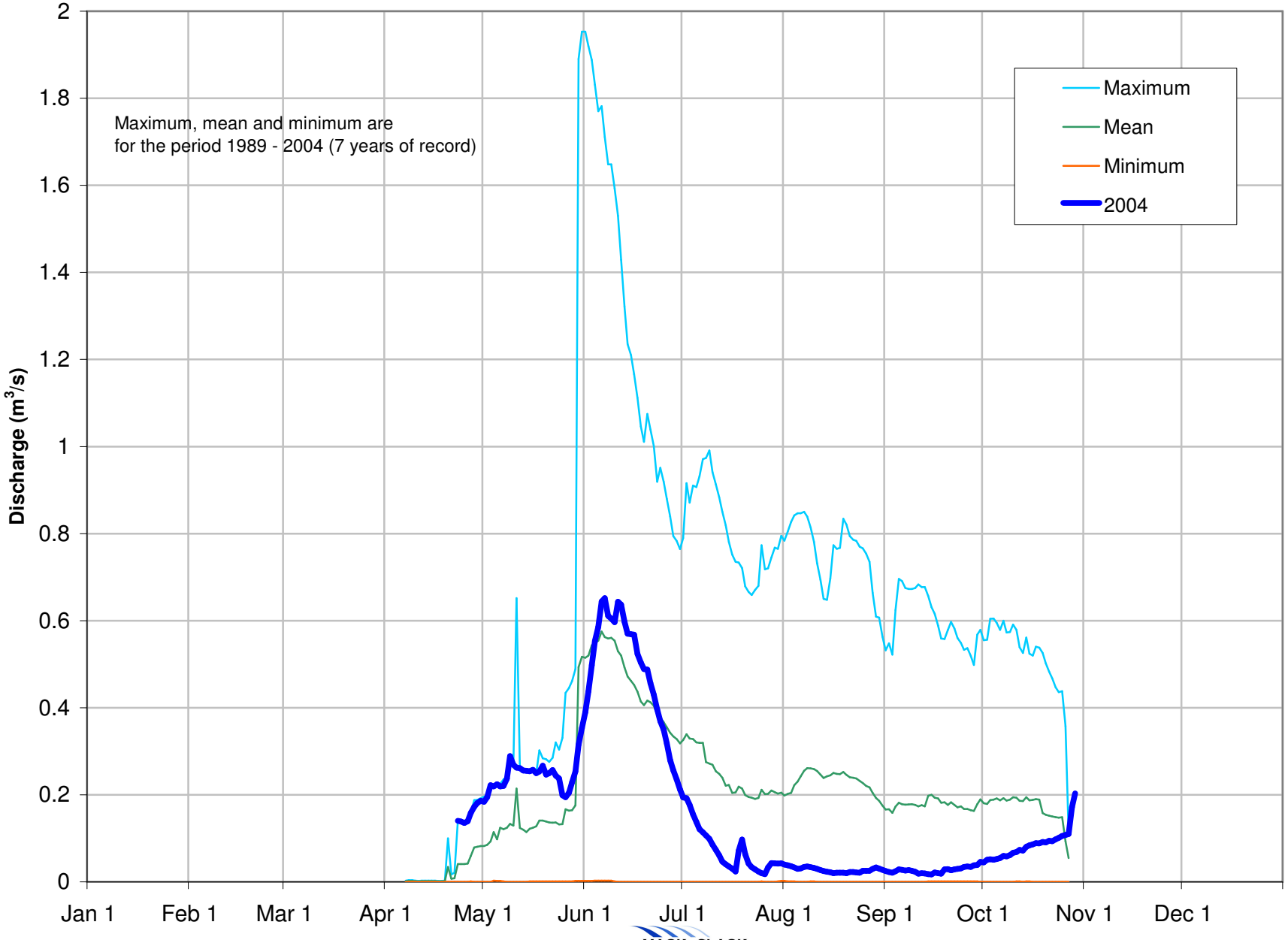

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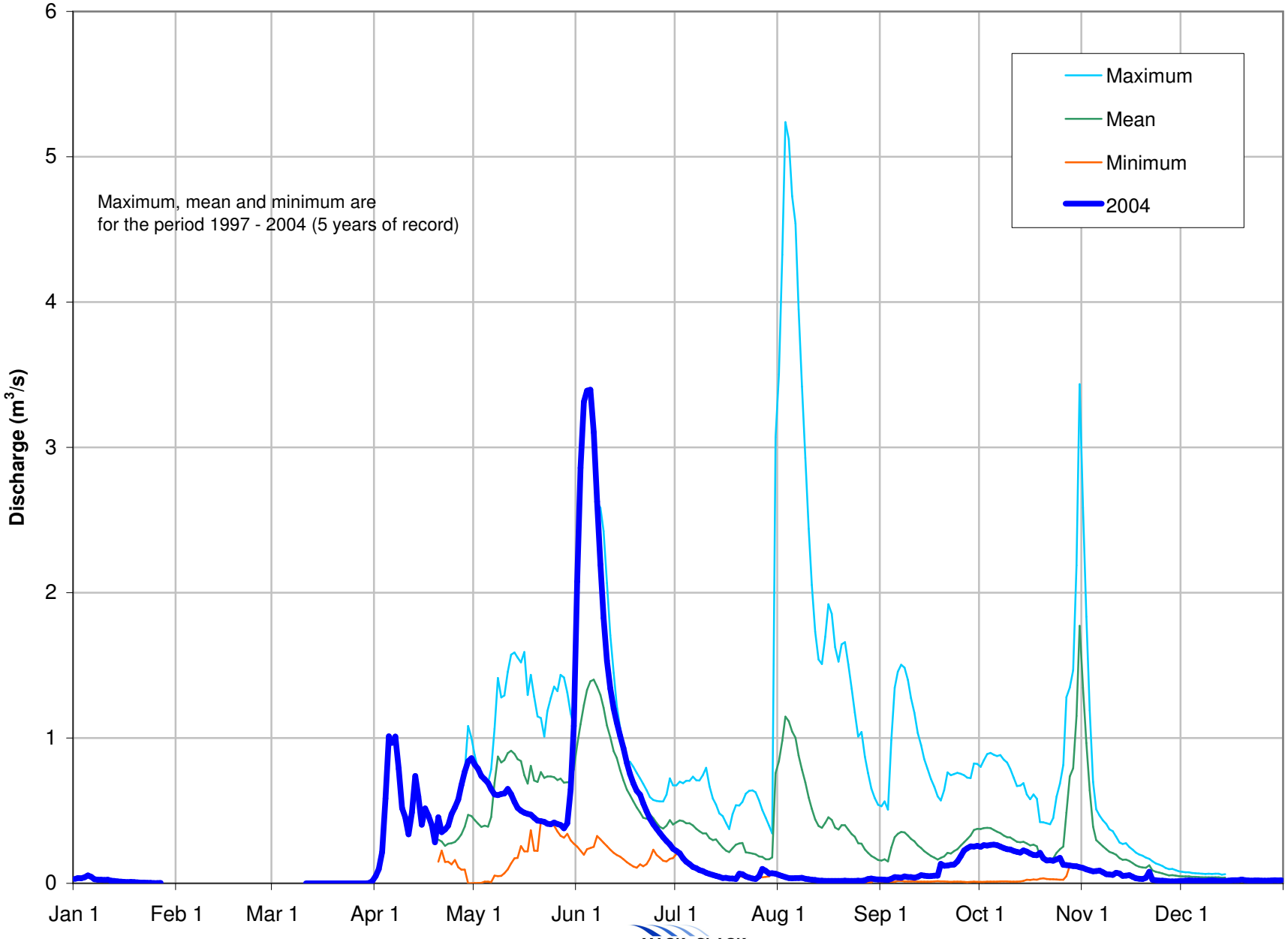
Figure D-34
S10 - Wapasu Creek at Canterra Road
2004 Hydrograph in Historical Context



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2005-03-23

Max-Mean-Min plot(Discharges).xls

Figure D-35
S17 - Tar River Upland Tributary
2004 Hydrograph in Historical Context

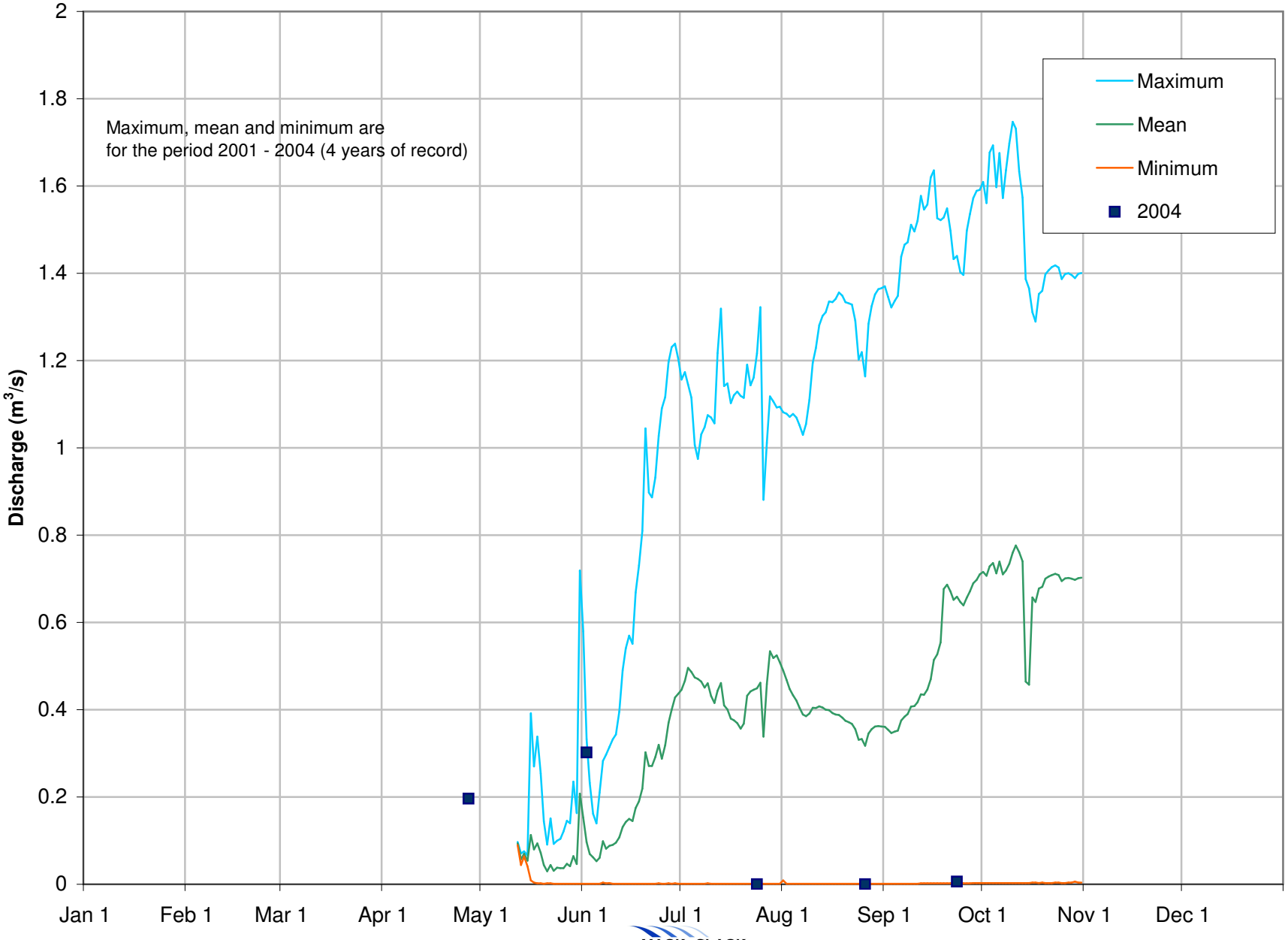

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Figure D-36
S18A - Calumet River Upland Tributary
2004 Hydrograph in Historical Context

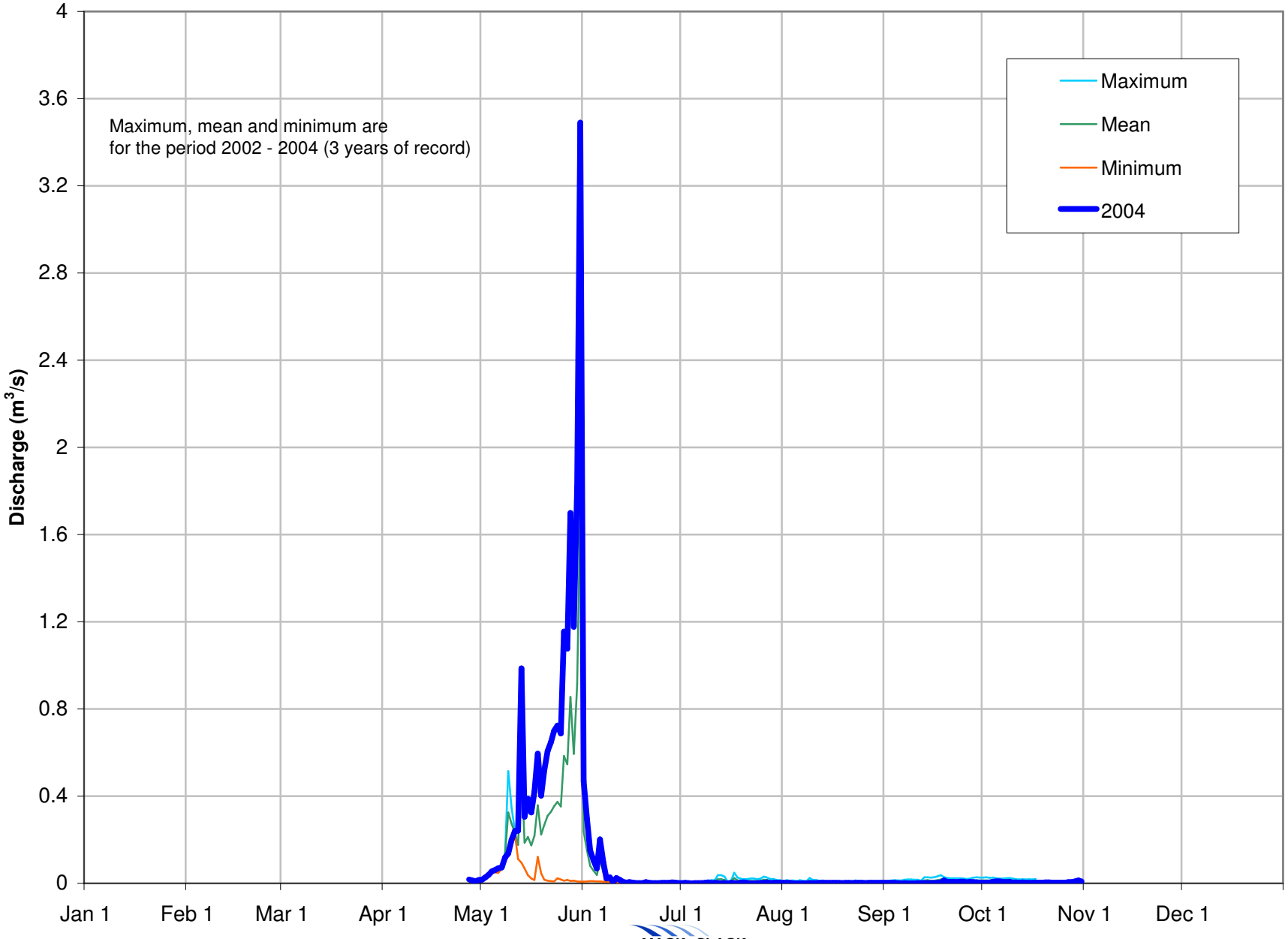

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Figure D-37
S19 - Tar River Lowland Tributary near the Mouth
2004 Hydrograph in Historical Context

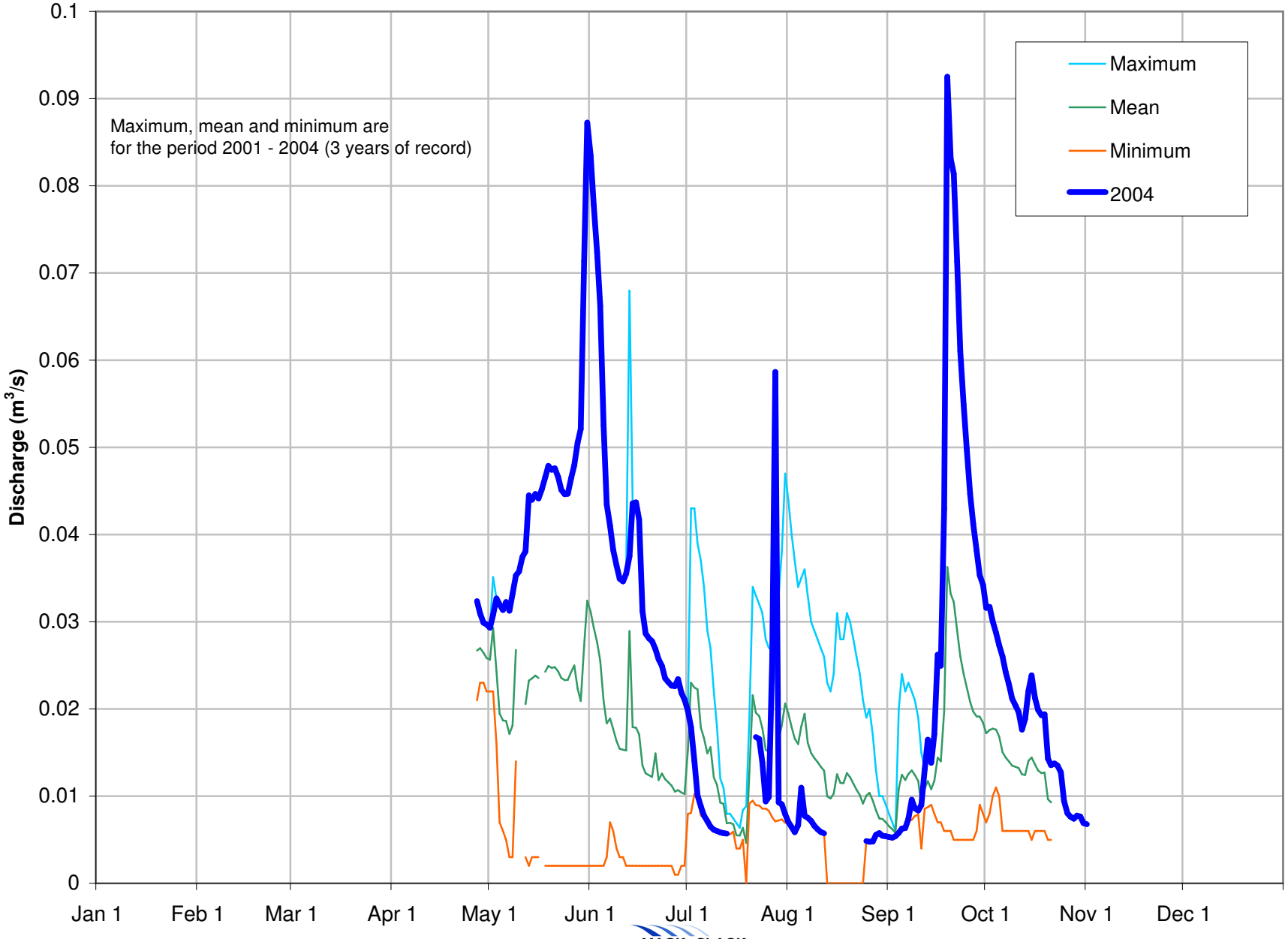

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Figure D-38
S20 - Muskeg River Upland
2004 Hydrograph in Historical Context

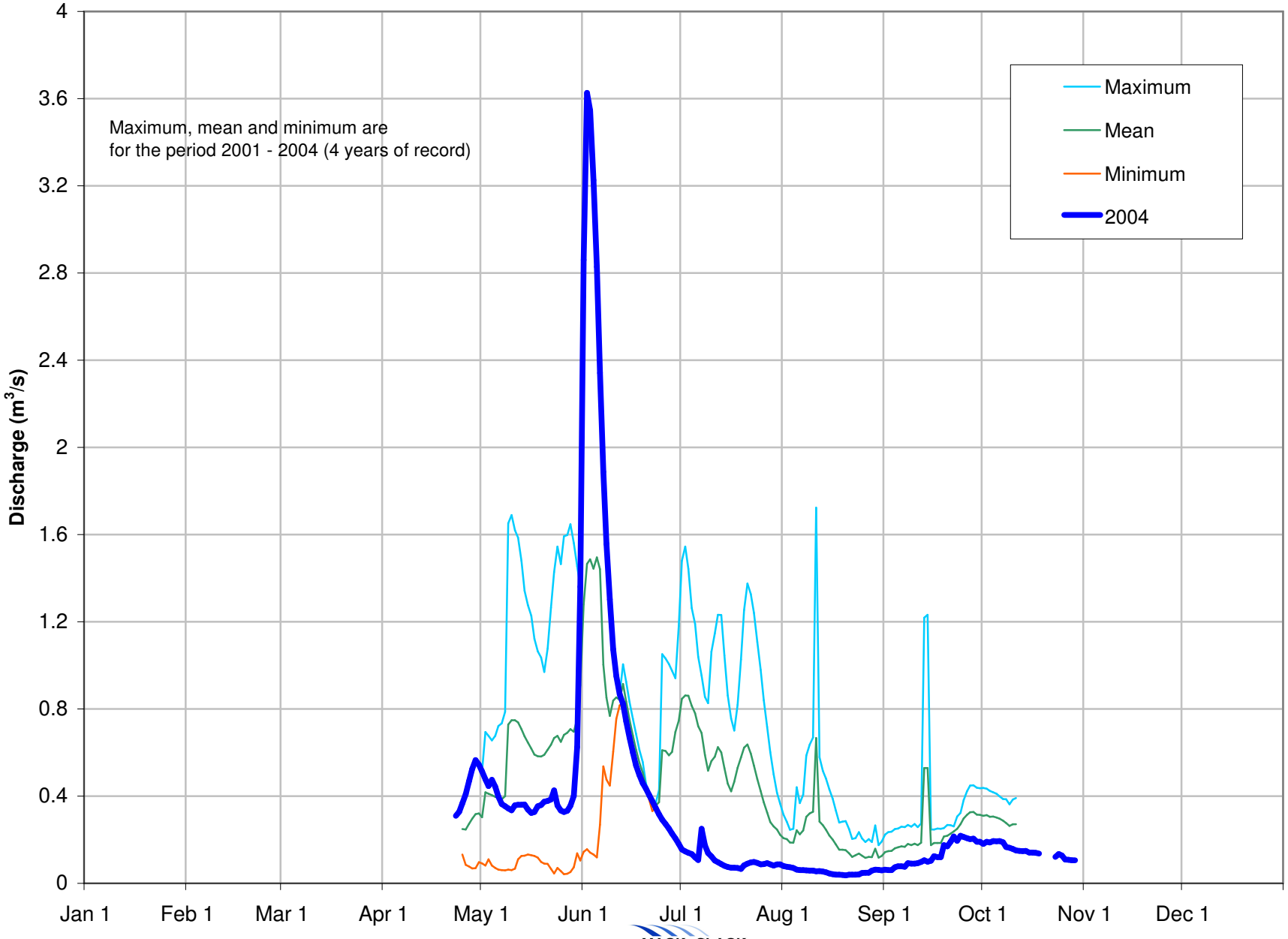

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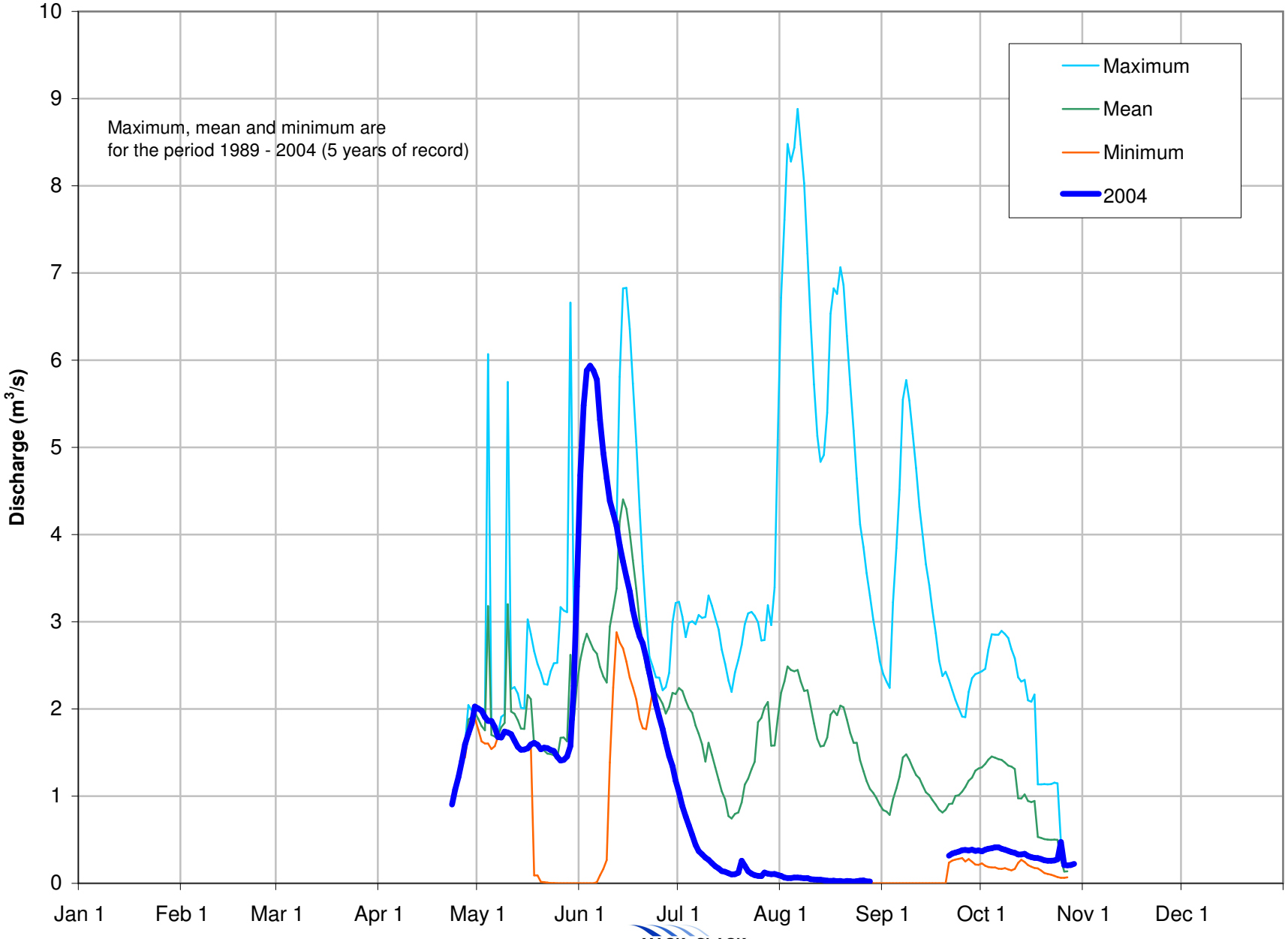
Figure D-39
S22 - Muskeg Creek near the Mouth
2004 Hydrograph in Historical Context



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2005-03-23

Max-Mean-Min plot(Discharges).xls

Figure D-40
S28 - Khahago Creek below Black Fly Creek
2004 Hydrograph in Historical Context

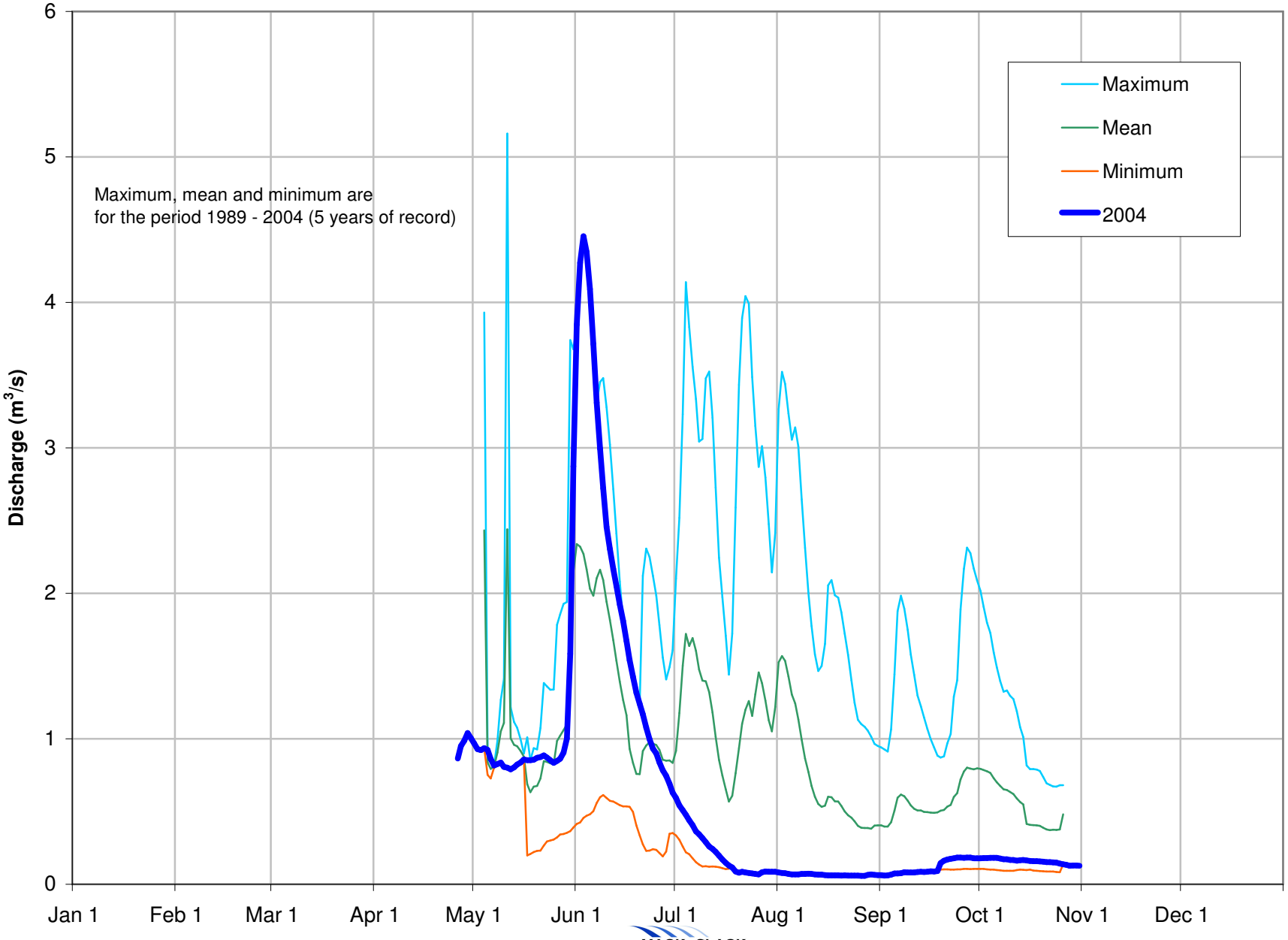

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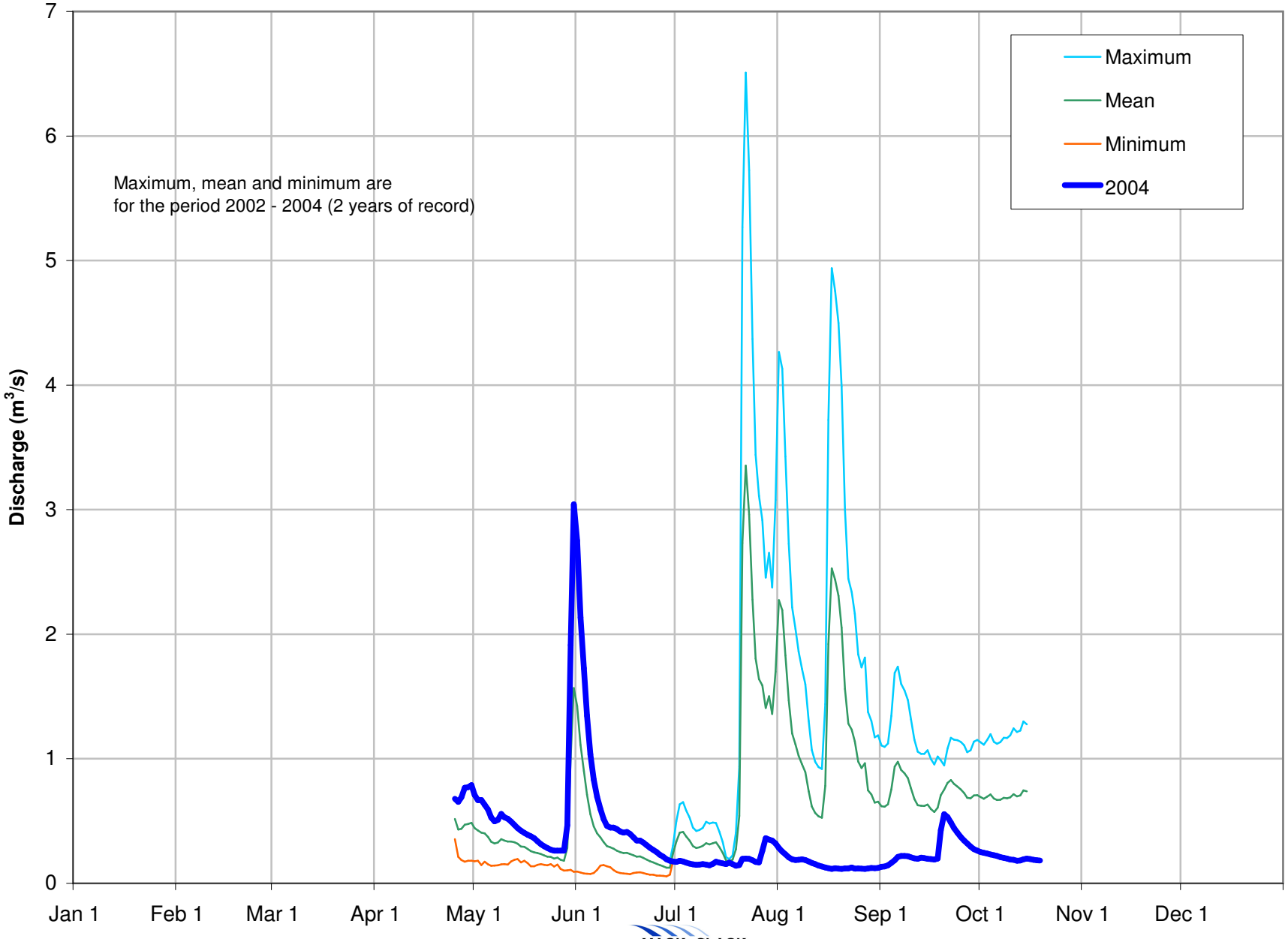
Figure D-41
S31 - Hangingstone Creek at North Star Road
2004 Hydrograph in Historical Context



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2005-03-23

Max-Mean-Min plot(Discharges).xls

Figure D-42
S32 - Surmont Creek at Highway 881
2004 Hydrograph in Historical Context

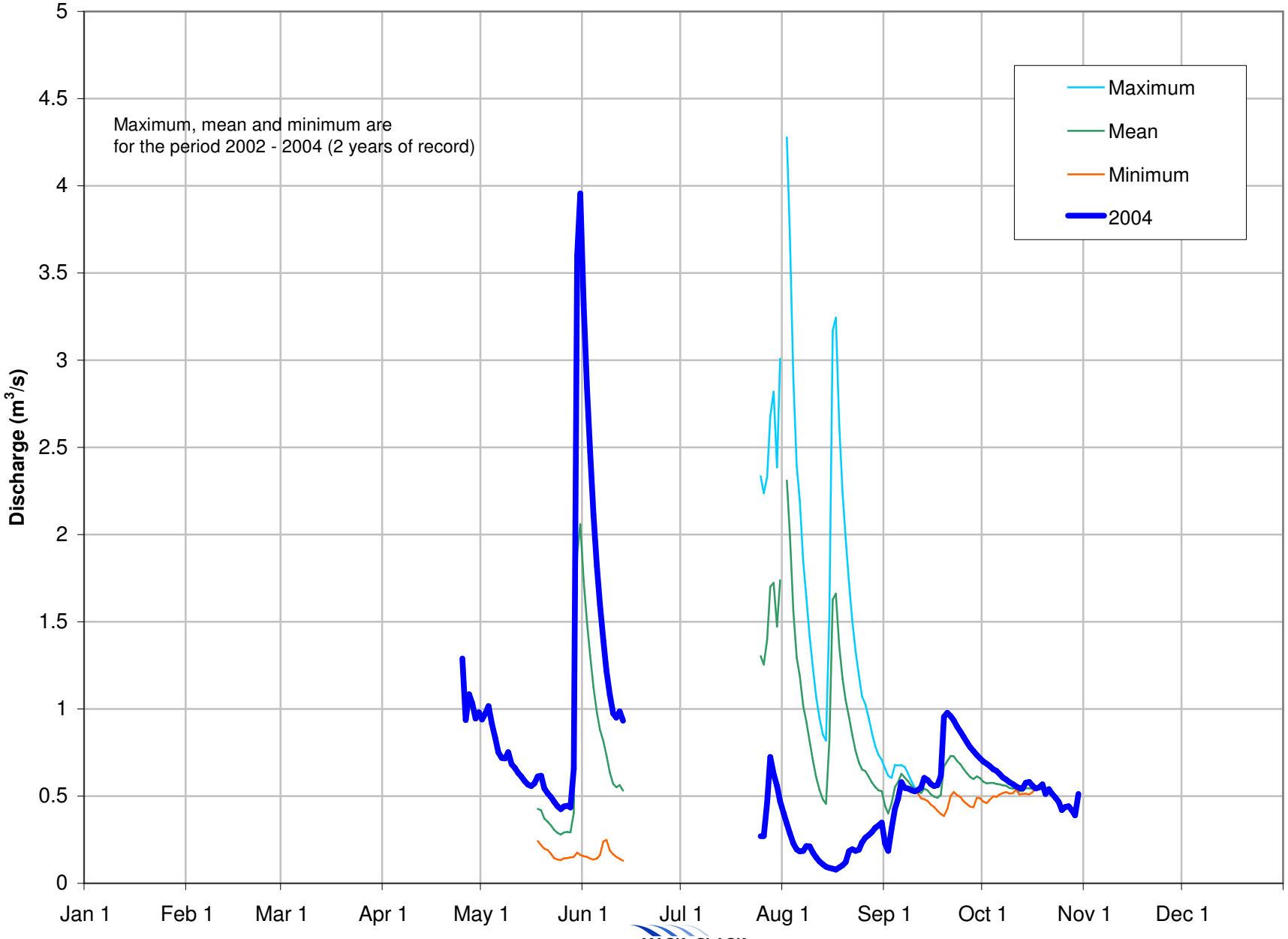

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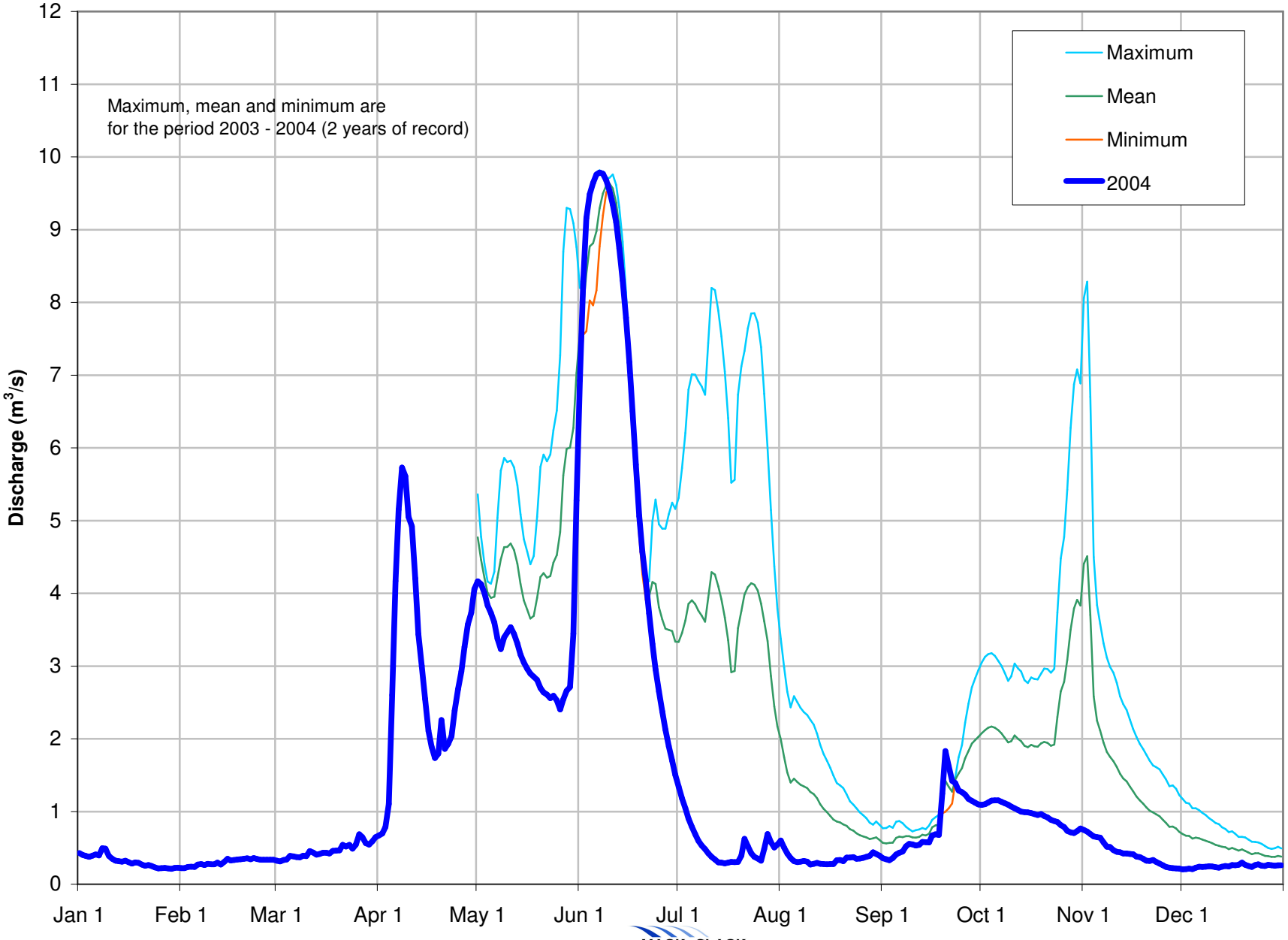
Figure D-43
S33 - Muskeg River at the Aurora / Albian Boundary
2004 Hydrograph in Historical Context



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APPENDIX E

Statistical Analysis of Water Quality Data

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E2.0 ANALYSIS OF WATER CHEMISTRY DATA 1

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E2.1.1 Principal Components Analysis (PCA) 3
E2.1.2 Cluster Analysis 4
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APPENDIX E

STATISTICAL ANALYSIS OF WATER QUALITY DATA

E1.0 INTRODUCTION

Historical water and sediment chemistry data sets for the Athabasca River mainstem, delta, and its eastern, western, and southern tributaries, and the Muskeg and Steepbank rivers, and lakes were analyzed using objective classification analysis (OCA) to determine if there were any spatial or temporal patterns present. OCA is a multivariate statistical technique that first uses principal components analysis (PCA) to reduce the data set, followed by cluster analysis to classify stations based on water or sediment quality (Jones and Boyer 2002).

Additional correlation analyses were used to evaluate relationships within and between groups of chemical and conventional variables.

E2.0 ANALYSIS OF WATER CHEMISTRY DATA

The historical water chemistry data set included 62 monitoring stations, which were monitored in the fall for 1 to 8 years (data for other seasons was excluded), for a total of 199 observations (i.e., station/year combinations).

Table E-1 RAMP water quality stations included in the historical data set, 1997 to 2004.

Region	Station	1997	1998	1999	2000	2001	2002	2003	2004
Athabasca River	ATR-DC-CC						√	√	√
	ATR-DC-CC-D	√							
	ATR-DC-E		√		√	√	√	√	√
	ATR-DC-M				√				
	ATR-DC-W		√		√	√	√	√	√
	ATR-DD						√	√	√
	ATR-ER				√	√			√
	ATR-FC-CC-D	√							
	ATR-FC-E				√	√	√	√	
	ATR-FC-E-D		√						
	ATR-FC-M				√				
	ATR-FC-W				√	√	√	√	
	ATR-FC-W-D		√						
	ATR-FR						√	√	√

Table E-1 (cont'd.)

Region	Station	1997	1998	1999	2000	2001	2002	2003	2004
Athabasca River Cont'd.	ATR-MR-E				√	√	√	√	√
	ATR-MR-E-D		√						
	ATR-MR-M				√				
	ATR-MR-W				√	√	√	√	√
	ATR-MR-W-D		√						
	ATR-SR-E				√	√	√	√	√
	ATR-SR-M				√				
	ATR-SR-W				√	√	√	√	√
	EMR-1							√	
Athabasca River Delta	ARD-1				√	√		√	√
Eastern Tributaries	FIR-1						√	√	√
	FIR-2							√	√
	FIR-2X						√		
	FOC-1				√	√	√	√	
	MCC-1			√	√	√	√	√	√
	UNC-1				√				
Western Tributaries	BER-1							√	√
	CAR-1						√	√	√
	ELR-1		√				√	√	√
	ELR-2								√
	MAR-1		√		√	√	√	√	√
	MAR-2						√	√	√
	POC-1				√	√	√	√	√
	TAR-1		√				√	√	√
	TAR-2								√
Southern Tributaries	CHR-1						√	√	√
	CHR-2						√	√	√
	CLR-1					√	√	√	√
	CLR-2					√	√	√	√
	HAR-1								√
Muskeg River	ALD-1			√					
	JAC-1			√	√	√	√	√	√
	MUC-1			√	√	√	√	√	√
	MUR-1	√	√	√	√	√	√	√	√
	MUR-2			√					
	MUR-4			√					

Table E-1 (cont'd.)

Region	Station	1997	1998	1999	2000	2001	2002	2003	2004
Muskeg River Cont'd.	MUR-6		√	√	√	√	√	√	√
	SHC-1			√					
	STC-1					√	√	√	√
	WAC-1		√	√					√
Steepbank River	NSR-1						√	√	√
	STR-1	√	√		√	√	√	√	√
	STR-2						√	√	√
	STR-3								√
Lakes	ISL-1				√	√			√
	KEL-1		√		√	√	√	√	√
	MCL-1				√	√	√	√	
	SHL-1			√	√	√	√	√	√

E2.1 METHODS

E2.1.1 Principal Components Analysis (PCA)

PCA was used to reduce the water chemistry data set, and to facilitate broad comparisons of water quality among stations. PCA is a data reduction technique that reduces a large number of variables into a small number of summary variables called principal components (PCs). These summary variables, which are independent and orthogonal, are formed from linear combinations of the original variables. PCA is a useful technique because it can often reveal patterns or relationships that were not previously apparent, particularly when analyzing large data sets containing numerous variables.

E2.1.1.1 Data Screening

Before PCA were conducted, data were screened to exclude:

- any variables with concentrations below detection limits in over 50% of observations (i.e., station/year combinations); and
- any variables with missing values for 15% or more of observations (i.e., station/year combinations).

For the remaining analytes in the data set, non-detectable values were substituted with a value equal to the detection limit and missing values were substituted with the mean for all years for a given station.

The historical data set was comprised of results of metals analyses conducted by two different laboratories, EnviroTest Laboratories (ETL), who conducted the analyses from 1997-2001, and Alberta Research Council (ARC), who conducted analyses from 2002-2004. In general, detection limits for metals were higher (i.e., analytical methods were less sensitive) at ETL. As a result, the analytical detection limits reported by ARC were

revised to be consistent with results reported by ETL, to ensure the variable detection limits did not confound results of the statistical analyses.

E2.1.1.2 Data Reduction

Data were ranked prior to PCA to standardize the data set. Separate PCAs were conducted for dissolved metals, total metals, and major ions. PCAs were conducted using no rotation. Unstandardized principal components were saved for use as summary variables in subsequent analysis.

Relationships between the input variables and output summary variables were evaluated using correlation analysis, to determine which input variables were most strongly influencing the summary variables. The magnitude and direction of these correlations were used to interpret PC scores in subsequent analyses. The magnitude of the correlation was used to identify input variables that were strongly influencing the summary variable. Correlations (r) between either 0.50 and 0.75 or -0.50 and -0.75 were classified as moderate correlations, while those > |0.75| were classified as strong. The direction of correlation was used to determine whether metals or ion input variables increased or decreased with factor scores (i.e., principal components).

E2.1.2 Cluster Analysis

Cluster analysis is a multivariate procedure used to identify groupings of data. Two types of cluster analysis, hierarchical and K-means cluster analyses, were used to identify spatial and temporal trends in water quality; cluster analysis was conducted on individual station/year combinations.

In the first step of the analysis, hierarchical clustering was conducted. In hierarchical cluster analysis, the closest pair of objects is combined to form a cluster; this procedure is repeated until all data are clustered (SPSS 1999). A dendogram is generated from the cluster analysis illustrating which groups are most similar and dissimilar from each other, based on their proximity in the tree. Hierarchical clustering was used to guide the selection of the number of clusters used in the K-mans cluster analysis.

In the next step of the analysis, k-means cluster analysis was used to identify groupings of stations/years. K-means clustering moves objects between a pre-selected number of clusters with the objective of minimizing variability within clusters and maximizing variability between clusters (Guler *et al.* 2002).

All cluster analyses were conducted using SPSS v. 9.0. Analyses were conducted on PC scores. Hierarchical cluster analysis was conducted using Ward's linkage methods and Euclidean distance measures. K-means cluster analysis was conducted using the number of clusters identified in the hierarchical cluster analysis. Results from hierarchical cluster analysis were not presented in the report because these results were used solely to guide selections of cluster numbers for K-means cluster analysis.

E2.1.3 Correlation Analyses

Rank correlations were used to evaluate the relationships between conventional variables, nutrients, and principal components.

E2.2 RESULTS

E2.2.1 Principal Components Analysis

E2.2.1.1 Data Screening

Analytes with missing values for 15% or more of station/year combinations or non-detectable values for 50% or more of station/year combinations were excluded from the data set. Variables excluded included:

- **Non-detectable values** – metals including dissolved aluminum, antimony, beryllium, cadmium, chromium, cobalt, lead mercury, selenium, silver, and tin, total antimony, arsenic, beryllium, cadmium, calcium, chromium, copper, mercury, selenium, silver, and tin; ions including carbonate and hydroxide; BOD and nitrates+nitrites; and

- **Missing values** – dissolved bismuth, calcium, chlorine, silicon, sulphur, thallium, and thorium, and total bismuth, chlorine, magnesium, potassium, silicon, sodium, sulphur, thallium, and thorium.

E2.2.1.2 Data Reduction

Three separate PCAs were conducted on the dissolved metals, total metals, and ion data sets.

Dissolved Metals

The dissolved metals PCA produced a total of 5 principal components. The first three principal components, DISMET PC1, DISMET PC2, and DISMET PC3, which accounted for a total of 59% (or 32%, 16%, and 11%, respectively) of the variance in the data set, were used in subsequent analysis. The relationships between the input variables and output summary variables are summarized below.

Table E-2 Pearson correlations (or loadings) of input variables with output summary variables (i.e., principal components) for dissolved metals data set.

	Summary Variable (Principal Component)		
Input Variable	**DISMET PC1**	**DISMET PC2**	**DISMET PC3**
Uranium	0.87	-0.18	-0.14
Strontium	0.83	0.12	0.13
Molybdenum	0.77	-0.23	-0.27
Barium	0.70	0.04	0.36
Copper	0.67	-0.10	0.16
Nickel	0.67	0.12	0.16

Table E-2 (cont'd.)

Input Variable	Summary Variable (Principal Component) DISMET PC1	DISMET PC2	DISMET PC3
Lithium	0.09	0.82	0.34
Boron	0.02	0.77	0.17
Iron	-0.19	0.73	-0.14
Manganese	0.06	0.68	0.37
Vanadium	0.29	0.23	-0.66
Titanium	0.17	0.40	-0.54
Arsenic	0.40	0.36	-0.54
Zinc	0.34	-0.23	0.51

#	moderate correlation (|0.50| > r < |0.75|) between input variable and summary variable (i.e., PC)
#	strong correlation (r > |0.75|) between input variable and summary variable (i.e., PC)

DISMET PC1, the first summary variable that explained a majority of the variance in the data set, was moderately or strongly positively correlated with 6 of the 14 input variables including dissolved uranium, strontium, molybdenum, barium, copper, and nickel. The direction of the correlation indicates that as concentrations of these metals increase, the DISMET PC1 score increases. DISMET PC1 was used to represent these metals in subsequent analysis.

DISMET PC2 was strongly and moderately positively correlated with four metals including dissolved lithium, iron, boron, and manganese. Elevated concentrations of iron, manganese, and boron are often associated with the weathering of rock. The direction of the correlation indicates that as concentrations of these metals increase, the DISMET PC2 score increases. DISMET PC2 was used to represent these metals in subsequent analysis.

DISMET PC3 was moderately correlated with four metals dissolved vanadium, titanium, and arsenic, which exhibited negative correlations, and zinc, which had positive correlations. The direction of the correlation indicates that as concentrations of zinc increase, the DISMET PC3 score increases; whereas, as concentrations of vanadium, titanium, and arsenic increase the PC score decreases. Therefore, in subsequent analyses, any positive correlations observed with DISMET PC3 actually represent decreases in zinc concentrations.

Total Metals

The total metals PCA produced a total of 4 principal components. The first four principal components, TOTMET PC1, TOTMET PC2, TOTMET PC3, and TOTMET PC4, which accounted for a total of 79% (or 44%, 15%, 13%, and 7%, respectively) of the variance in the data set, were used in subsequent analysis. The relationships between the input variables and output summary variables are summarized below.

Table E-3 Pearson correlations (or loadings) of input variables with output summary variables (i.e., principal components) for total metals data set.

	Summary Variable (Principal Component)			
Input Variable	**TOTMET PC1**	**TOTMET PC2**	**TOTMET PC3**	**TOTMET PC4**
Aluminum	0.87	-0.15	-0.28	0.22
Vanadium	0.86	-0.13	-0.28	0.23
Titanium	0.85	-0.11	-0.32	0.21
Lead	0.83	-0.14	-0.07	-0.09
Cobalt	0.81	0.19	-0.15	-0.20
Uranium	0.71	-0.22	0.44	0.30
Nickel	0.67	0.14	0.20	-0.28
Iron	0.66	0.44	-0.46	-0.04
Molybdenum	0.64	-0.34	0.39	0.29
Barium	0.61	0.14	0.48	-0.26
Strontium	0.58	0.14	0.67	0.10
Manganese	0.51	0.57	-0.40	-0.15
Lithium	-0.04	0.89	0.25	0.15
Boron	-0.11	0.81	0.23	0.28
Zinc	0.48	-0.12	0.24	-0.64

#	moderate correlation (|0.50| < r < |0.75|) between input variable and summary variable (i.e., PC)
#	strong correlation (r > |0.75|) between input variable and summary variable (i.e., PC)

TOTMET PC1 was moderately and strongly positively correlated with a majority of metals in the data set (12 of 15 metals), including total aluminum, vanadium, titanium, lead, cobalt, uranium, nickel, iron, molybdenum, barium, strontium, and manganese. The direction of the correlation indicates that as concentrations of these metals increase, the TOTMET PC1 score increases. This summary variable was used to represent these metals in subsequent analysis.

TOTMET PC2 was strongly positively correlated with lithium and boron, and moderately correlated with manganese, which was also correlated with TOTMET PC1. This PC was used to represent lithium and boron in subsequent analysis.

TOTMET PC3 and PC4 showed moderate correlations with only one metal. TOTMET PC3 was positively correlated with strontium, and TOTMET PC4 was negatively correlated with zinc. The direction of the correlation indicates that any positive correlations with TOTMET PC4 actually represent decreases in zinc concentrations. These principal components were used to represent these metals in subsequent analysis. The separation of these metals into these principal components indicates that they behave differently over time and/or space from the other metals.

Ions

The ion PCA generated 3 principal components, ION PC1, ION PC2, and ION PC3, which accounted for a total of 82% (or 44%, 24%, and 14%, respectively) of the variance in the data set were used in subsequent analysis. The relationships between the input variables and output summary variables are summarized below.

Table E-4 Pearson correlations (or loadings) of input variables with output summary variables (i.e., principal components) for ions data set.

	Summary Variable (Principal Component)		
Input Variable	**ION PC1**	**ION PC2**	**ION PC3**
Magnesium	0.88	-0.40	-0.10
Calcium	0.87	-0.34	-0.07
Bicarbonate	0.87	-0.43	0.03
Potassium	0.72	0.16	-0.03
Sodium	0.53	0.70	0.30
Chloride	0.42	0.78	0.19
Sulphate	0.46	0.52	-0.39
Sulphide	0.11	-0.22	0.89

#	moderate correlation (|0.50| > r < |0.75|) between input variable and summary variable (i.e., PC)
#	strong correlation (r > |0.75|) between input variable and summary variable (i.e., PC)

ION PC1 was moderately and strongly correlated with 5 of the 8 input variables including magnesium calcium, bicarbonate, potassium, and sodium. ION PC1 was used to represent all of these ions, except sodium. Sodium was more strongly correlated with PC2.

ION PC2 was strongly and moderately correlated with sodium, chloride, and sulphate. ION PC2 was used to represent these ions in subsequent analysis.

ION PC3 was moderately correlated with sulphide. The separation of sulphide from the other ions indicates that this ion behaves differently from the other ions over time and/or space.

Relationships among Principal Components

Rank correlations, which are presented Table E-5, were used to assess whether any strong relationships exist among the principal components. The strongest correlations were observed between DISMET PC2 and TOTMET PC2 (r_s = 0.87) and DISMET PC1 and TOTMET PC1 (r_s = 0.72); these results were not surprising given that the metals that loaded most strongly with both sets of principal components, including lithium, boron, molybdenum, strontium, barium, and uranium, were found predominantly in their dissolved form. Moderate positive correlations were also observed for ions and metals including IONPC1 and TOTMET PC1 and 2, and IONPC2 and TOTMET PC1.

Correlations observed between total and dissolved metal principal components were driven by a common metal that was strongly loaded with both principal components. The correlation between DISMET PC1 and TOTMET PC3 was driven by strontium concentrations. DISMET PC3 and TOTMET PC4 were correlated due to the influence of zinc concentrations.

Although, a number of statistically significant relationships were observed between the principal components, many of the observed correlations were not particularly meaningful, given that a correlation (r_s) as low as |0.28| was significant, due to the large sample size.

Table E-5 Rank correlations among ion, dissolved metal, and total metal principal components.

	Rank Correlations (r_s)								
	ION PC1	**ION PC2**	**ION PC3**	**DISMET PC1**	**DISMET PC2**	**DISMET PC3**	**TOTMET PC1**	**TOTMET PC2**	**TOTMET PC3**
ION PC2	-0.02	-	-	-	-	-	-	-	-
ION PC3	0.01	-0.01	-	-	-	-	-	-	-
DISMET PC1	**0.42**	**0.48**	**-0.32**	-	-	-	-	-	-
DISMET PC2	**0.48**	-0.06	**0.43**	-0.04	-	-	-	-	-
DISMET PC3	**0.38**	**-0.43**	-0.17	-0.01	0.00	-	-	-	-
TOTMET PC1	0.11	**0.51**	-0.17	**0.72**	-0.07	-0.19	-	-	-
TOTMET PC2	**0.52**	-0.15	**0.35**	-0.05	**0.87**	0.22	-0.02	-	-
TOTMET PC3	**0.57**	0.07	**-0.39**	**0.54**	-0.02	**0.43**	0.03	-0.02	-
TOTMET PC4	0.02	**0.34**	0.05	0.05	0.18	**-0.54**	0.00	0.04	0.01

Bolded values represent significant correlations where $|r_s| \geq |0.28|$ for n = 199.

#	moderate correlation ($|0.50| > r_s < |0.75|$) between variables
#	strong correlation ($r_s > |0.75|$) between variables

E2.2.2 Cluster Analysis

E2.2.2.1 Cluster Membership

Based on results of hierarchical cluster analysis, k-means cluster analysis was conducted using three clusters. The cluster membership for each region is Table E-6. Cluster memberships for each observation (i.e., station/year combination) are presented in Annex E1-1.

The first cluster was comprised of a total of 74 station/year combinations, consisting of a majority of the lakes, Muskeg River, Steepbank River, southern tributary observations and half of the eastern tributary observations (including Firebag River, Fort Creek, and Unnamed Creek). In addition, one of the Athabasca River mainstem stations, located upstream of Donald Creek that was sampled in 2003, and one of the western tributaries, the Ells River, which was sampled in 2002 and 2004, were grouped with this cluster.

The second cluster included 69 station/year combinations and was comprised almost exclusively of Athabasca River mainstem and delta stations, except for the one mainstem station that was grouped with Cluster 1 (mentioned above); in addition, stations from the Clearwater River sampled in 2004, the Steepbank River sampled in 2000, and the Ells River sampled in 1998, grouped with this cluster.

The third cluster, which was comprised of 54 station/year combinations, included a majority of the western tributaries (including Beaver, Calumet, Ells River, MacKay, and Tar rivers, and Poplar Creek), and half of the eastern tributaries (including Fort Creek and McLean Creek). A small number of the lakes, Muskeg River, Steepbank River, and southern tributary (Christina and Hangingstone Rivers) observations also grouped with this cluster.

Table E-6 Summary of cluster membership by region.

Region	Total # of Station/ Year Combinations	Cluster		
		1	2	3
Athabasca River mainstem	**63**	**1**	**62**	**0**
Athabasca River Delta	**4**	**0**	**4**	**0**
Eastern Tributaries	**17**	**8**	**0**	**9**
Firebag River	6	6	0	0
Fort Creek	4	1	0	3
McLean Creek	6	0	0	6
Unnamed Creek	1	1	0	0
Western Tributaries	**29**	**2**	**1**	**26**
Beaver River	2	0	0	2
Calumet River	3	0	0	3
Ells River	5	2	1	2
MacKay River	9	0	0	9
Poplar Creek	5	0	0	5
Tar River	5	0	0	5
Southern Tributaries	**15**	**10**	**1**	**4**
Christina River	6	3	0	3
Clearwater River	8	7	1	0
Hangingstone River	1	0	0	1
Muskeg River	**38**	**27**	**0**	**11**
Alsands Drain	1	0	0	1
Jackpine Creek	6	5	0	1
Muskeg Creek	6	4	0	2
Muskeg River	17	12	0	5
Shelley Creek	1	0	0	1
Stanley Creek	4	4	0	0
Wapasu Creek	3	2	0	1
Steepbank River	**14**	**10**	**1**	**3**
N. Steepbank River	3	3	0	0
Steepbank River	11	7	1	3
Lakes	**19**	**16**	**0**	**3**
Isadore's Lake	3	2	0	1
Kearl Lake	6	6	0	0
McClelland Lake	4	4	0	0
Shipyard Lake	6	4	0	2
Total	**199**	**74**	**69**	**56**

E2.2.2.2 Cluster Characteristics

The characteristics of each cluster were evaluated by examining scatterplots of the primary principal components (i.e., PC1 and PC2) for ions, dissolved metals, and total metals, to identify trends in water quality common to each cluster (Figure E-1 to Figure E-2). By examining the direction and magnitude of factor scores for the primary principal components and relating those scores back to loadings of the input variables, the water quality of stations grouped in the cluster was characterized.

According to results of cluster analysis, the key drivers for the clustering were principal components for dissolved (both principal components) and total metals (TOTMET PC2). The plots for these variables will be examined first, given that they were the primary variables used to form clusters.

Dissolved Metals

Three clusters are evident in the plot of the dissolved metals principal components (Figure E-1). Cluster 1 exhibited negative DISMET PC1 and PC2 scores, indicating that stations grouped with this cluster had low concentrations of most metals (Table E-8). Conversely, Cluster 2 was characterized by positive DISMET PC1 and negative DISMET PC2 scores, which indicates that stations in this cluster have high concentrations of metals that were correlated with DIS MET PC1 (i.e., uranium, strontium, molybdenum, barium, copper, and nickel) and low concentrations of metals that were correlated with DIS MET PC2 (lithium, boron, iron, and manganese). Cluster 3 exhibited positive DISMET PC1 and PC2 scores, suggesting that this cluster include stations with high concentrations of most metals.

Total Metals

Three clusters are evident in the plot of the total metals principal components (Figure E-2). Cluster 1 exhibited negative TOTMET PC1 and a range of TOTMET PC2 scores, indicating that stations grouping with these clusters have low concentrations of most metals and a range of manganese, lithium, and boron concentrations. Conversely, Cluster 2 had positive TOTMET PC1 and negative TOTMET PC2 scores, which indicates that stations in this cluster have low concentrations of most metals, except for manganese, lithium, and boron. Cluster 3 exhibited positive TOTMET PC1 and PC2 scores, suggesting that this cluster include stations with high concentrations of most metals.

Figure E-1 Scatterplot of dissolved metal principal components 1 and 2 grouped by cluster number.

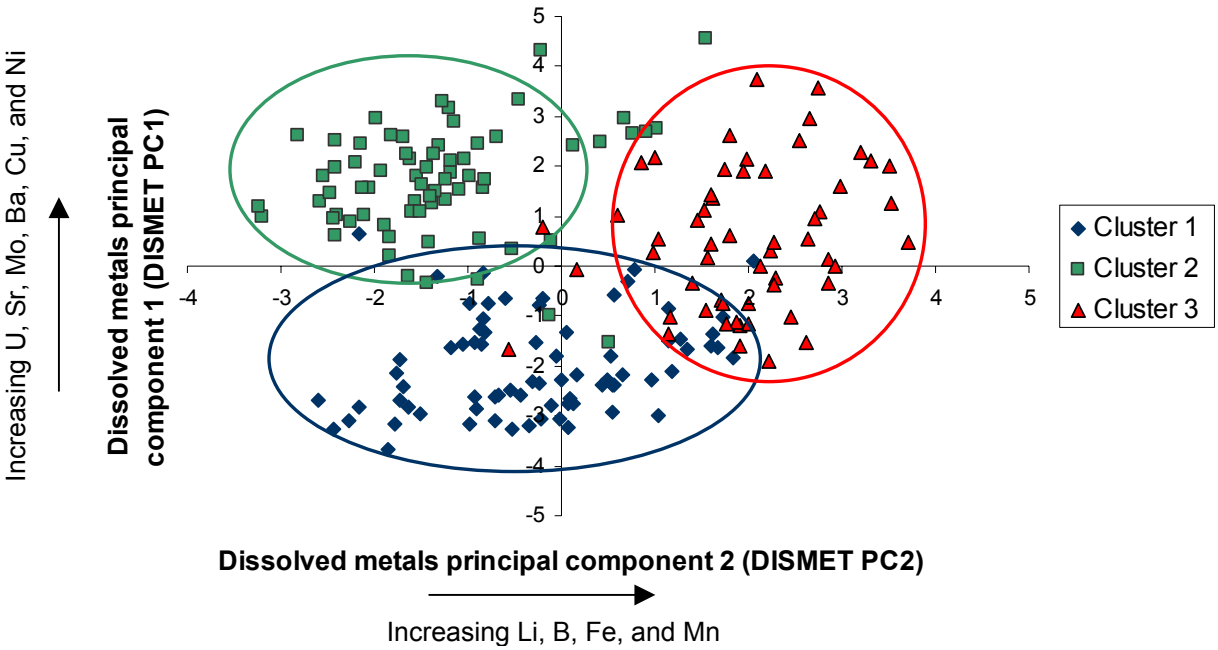
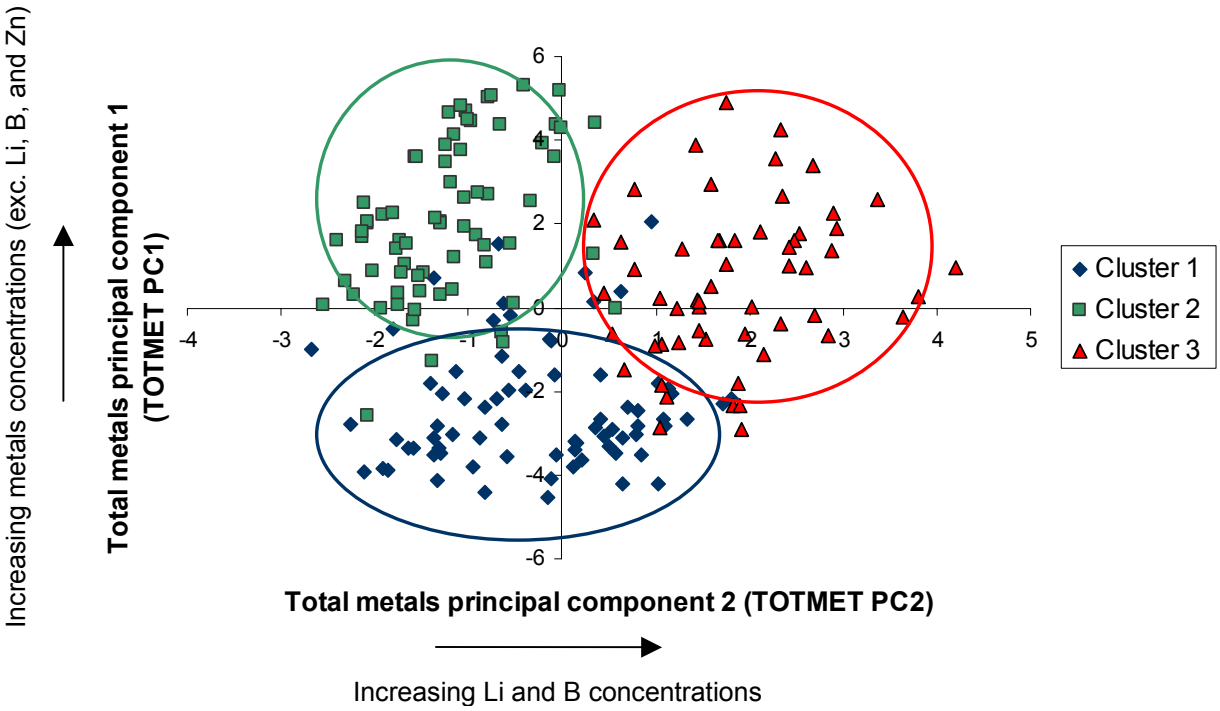


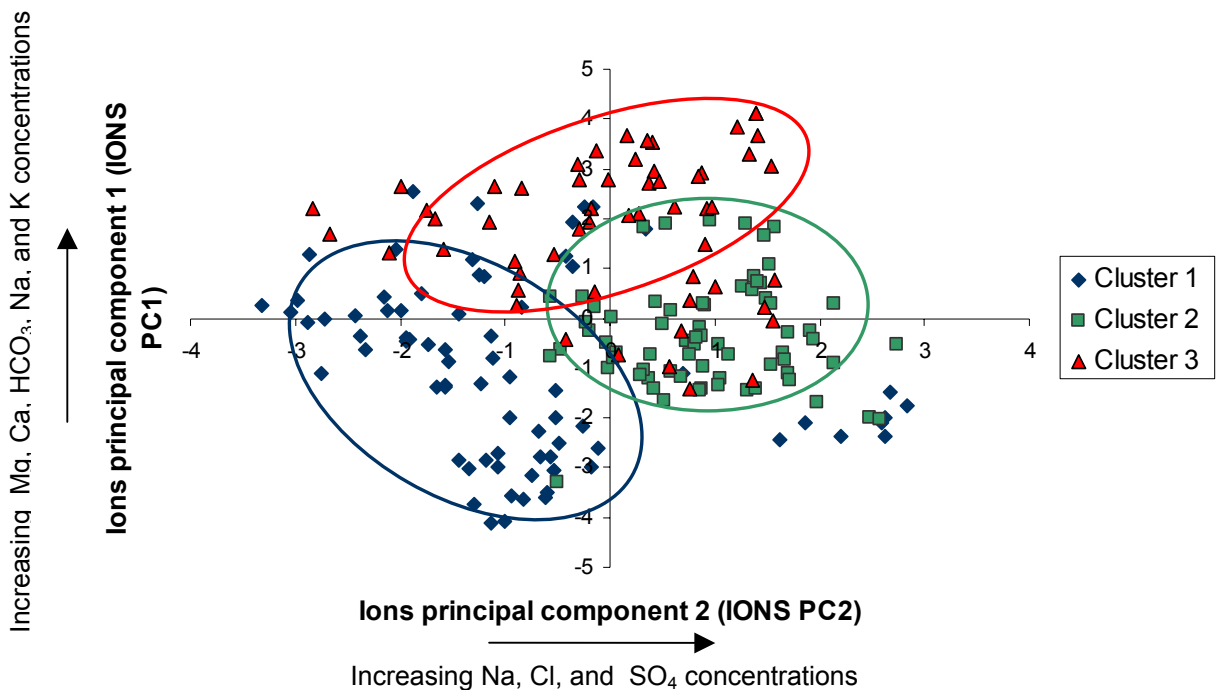
Figure E-2 Scatterplot of total metal principal components 1 and 2 grouped by cluster number.



Ions

Three distinct clusters are visible in the plot for the ion principal components. Cluster 1 was characterized by low concentrations of all ions (except sulphide), which were positively correlated with ION PC1 and PC2; whereas, Cluster 2 was comprised of stations with high concentrations of these ions. Cluster 3 exhibited high concentrations of ions that were positively correlated with ION PC1 (magnesium, calcium, bicarbonate, and potassium) and a range of concentrations of ions correlated with ION PC2 (sodium, chloride, and sulphate).

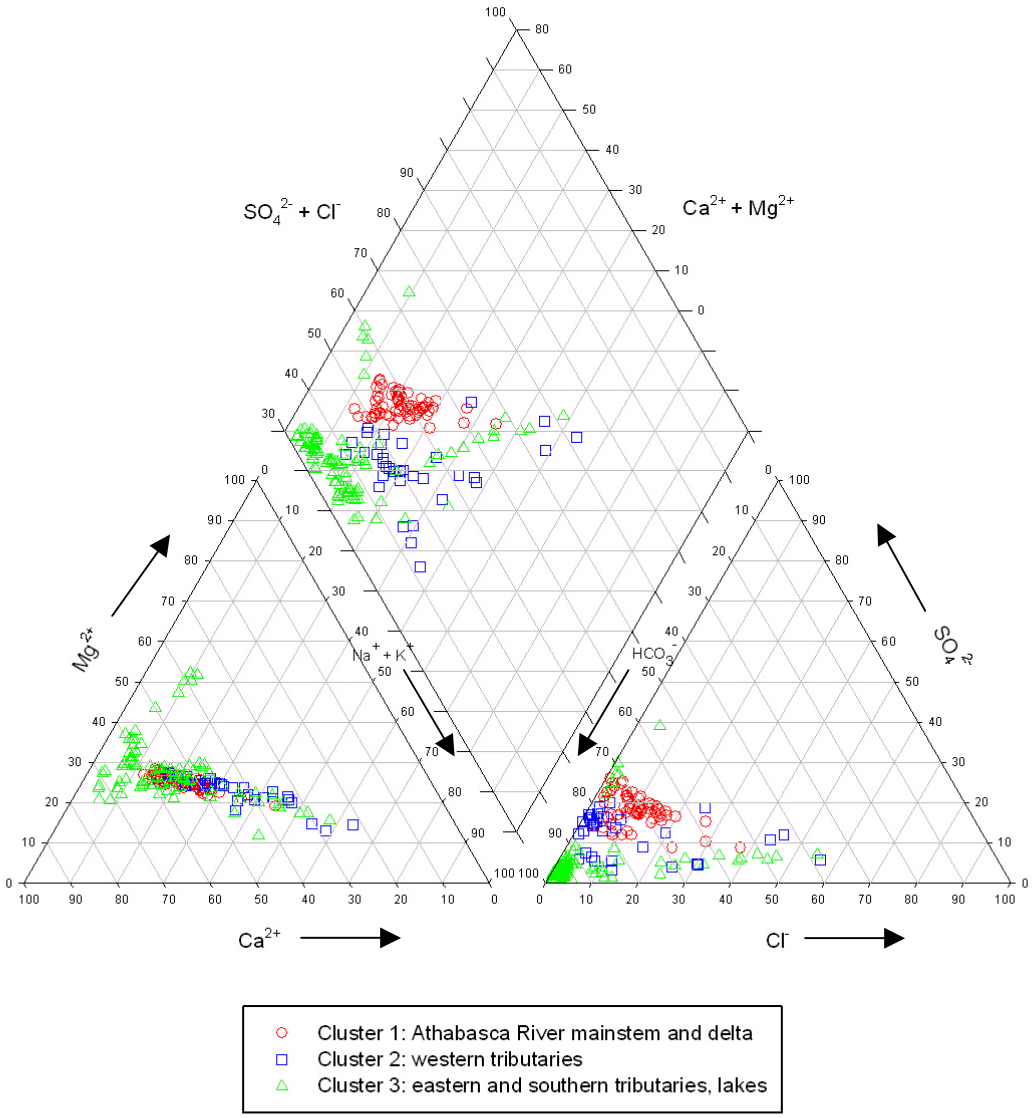
Figure E-3 Scatterplot of ions principal components 1 and 2 grouped by cluster number.



Similarities in ion concentrations among stations are illustrated in Figure E-4 using a different format (a Piper plot). In a Piper plot, triangular plots for total cations and anions are projected onto a diamond-shaped grid that can be used to identify stations that have similar cation and anion compositions; further guidance on the interpretation of Piper plots is provided in Figure 3.2-3 of Section 3 of the report. This diamond-shaped plot indicates that the Athabasca River stations exhibit similar concentrations of cations and anions, forming a tight cluster. Examination of the triangular plots shows that Athabasca River stations generally were characterized by high bicarbonate, calcium, sodium and potassium concentrations, and low magnesium, chloride, and sulphate concentrations. A large number of the eastern and southern tributaries and lakes grouped together, although a number of stations exhibited variable cation and anion concentrations. Eastern and southern tributary and lake stations generally were characterized by high calcium, sodium, potassium, and bicarbonate concentrations, low sulphate concentrations, and variable magnesium and chloride concentrations. Western tributary stations did not exhibit similarities in cation and anion concentrations. Most stations had

high sodium, potassium, and bicarbonate concentrations, low magnesium and sulphate concentrations, and highly variable calcium and chloride concentrations

Figure E-4 Piper plot of ion concentrations by station.



Other variables

Variables that exhibited strong correlations with the principal components also were used to characterize clusters. Rank correlations for principal components and nutrients, conventional variables, and total phenols are presented in Table E-7. Correlations between input variables for principal components and nutrients, conventional variables, and total phenols are presented in Annex E1-2.

The only principal component that exhibited strong correlations with conventional variables and nutrients was ION PC1. This principal component was strongly correlated with hardness, alkalinity, TDS, and DOC. These correlations were primarily driven by bicarbonate, calcium, and magnesium ion (Appendix E1-2). These relationships are not surprising given that these conventional analytes are derived from or strongly influenced by these ions. These results indicate that stations with high calcium, magnesium, and bicarbonate concentrations also have high concentrations of these variables.

Moderate correlations, ranging from 0.51 to 0.73, were observed between conventional variables and nutrients and a number of the other principal components. The highest correlation (r_s = 0.73) observed was between TOTMET PC1 scores and TSS concentrations, indicating that stations with high metal concentrations have high solid loads (i.e., metals are bound to particulates). TOC and conductivity exhibited higher correlations, ranging from 0.61 to 0.64, with DISMETPC2 and TOTMET PC2. These correlations appeared to be driven by manganese, lithium, and boron concentrations.

Table E-7 Rank correlations (r_s) between principal components and nutrients, conventional variables, and total phenols.

	ION PC1	ION PC2	ION PC3	DISMET PC1	DISMET PC2	DISMET PC3	TOTMET PC1	TOTMET PC2	TOTMET PC3	TOTMET PC4
Conventional Variables										
Conductivity	0.13	**-0.36**	**0.54**	**-0.42**	**0.64**	0.11	**-0.29**	**0.63**	**-0.30**	0.00
Hardness	**0.91**	**-0.35**	-0.09	0.28	**0.37**	**0.51**	-0.02	**0.44**	**0.51**	-0.18
pH	0.27	0.03	-0.14	0.20	0.08	-0.17	0.03	0.14	0.26	**0.42**
Total Alkalinity	**0.88**	**-0.40**	0.02	0.16	**0.53**	**0.52**	-0.12	**0.60**	**0.44**	-0.15
TDS	**0.81**	-0.09	0.16	0.23	**0.58**	**0.36**	0.01	**0.62**	**0.35**	-0.09
TSS	-0.11	**0.31**	-0.08	**0.37**	-0.13	-0.24	**0.73**	0.01	-0.28	-0.07
Colour	-0.07	-0.15	**0.46**	-0.15	**0.49**	-0.20	0.14	**0.44**	**-0.49**	0.08
Nutrients										
Dissolved P	-0.07	-0.20	0.28	-0.21	**0.34**	-0.06	-0.03	0.20	**-0.41**	-0.18
Total P	-0.02	0.07	0.20	0.10	0.25	-0.28	**0.43**	0.27	**-0.47**	-0.12
TKN	0.21	-0.25	**0.32**	-0.16	**0.47**	0.08	-0.14	**0.45**	-0.09	-0.11
DOC	**0.93**	0.07	-0.03	**0.41**	**0.43**	**0.42**	0.13	**0.47**	**0.52**	-0.10
TOC	0.13	**-0.37**	**0.51**	**-0.38**	**0.61**	0.15	-0.24	**0.62**	**-0.29**	-0.06
Other Analytes										
Total Phenol	0.05	-0.25	0.18	-0.09	0.19	0.12	-0.04	0.25	-0.08	-0.22

Bolded values represent significant correlations where $|rs| \geq |0.28|$ for n = 199.

#	moderate correlation (|0.50| > r < |0.75|) between variables
#	strong correlation (r > |0.75|) between variables

E2.2.2.3 Summary of Cluster Characteristics

The key characteristics of each cluster including the predominant stations in the cluster and trends for dissolved and total metals, ions, nutrients and conventional variables are summarized in Table E-8.

Cluster One, which includes a majority of the lakes, Muskeg River, Steepbank River, southern tributary, and eastern tributary stations, represents stations characterized by low concentrations of ions, dissolved metals, and most total metals, with the possible exception of manganese, lithium, and boron. These stations also exhibited low hardness, alkalinity, TDS, and DOC.

Cluster Two includes all but one of the Athabasca River mainstem and delta stations. These stations exhibit relatively high concentrations of most ions and dissolved and total metals (except lithium, boron, iron, and manganese), and high hardness, alkalinity, TDS, and DOC.

Cluster Three is comprised of a majority of the western tributary stations and about half of the eastern tributary stations. These stations have high concentrations of various ions, including magnesium, calcium, bicarbonate, and potassium, and most dissolved and total metals, and high hardness, alkalinity, TDS, and DOC.

Table E-8 Summary of cluster membership and characteristics.

Cluster	Predominant stations present in cluster	General Characteristics of Cluster			
		Ion Concentrations	Dissolved Metal Concentrations	Total Metal Concentrations	Other Variables
One	Lakes, Muskeg R., Steepbank R., southern tributary (Christina R. and Clearwater R.), and eastern tributary (Firebag R., Fort Cr., and Unnamed Cr.) stations	Low concentrations of most ions	Low concentrations of most metals	Low concentrations of most metals and a range of Mn, Li, and B concentrations	Low hardness, alkalinity, TDS, and DOC
Two	Athabasca R. mainstem and delta stations	High concentrations of most ions	High concentrations of U, Sr, Mo, Ba, Cu, and Ni and low concentrations of Li, B, Fe, Mn	High concentrations of most metals and low concentrations of Mn, Li, and B	High hardness, alkalinity, TDS, and DOC
Three	Western tributary (including Beaver R., Calumet R., Ells R., MacKay R., Poplar Cr., and the Tar R.), and eastern tributary (Fort Cr. and McLean Cr.) stations	High concentrations of Mg, Ca, HCO_3, and K and a range of Na, Cl, and SO_4 concentrations	High concentrations of most metals	High concentrations of most metals	High hardness, alkalinity, TDS, and DOC

E3.0 REFERENCES

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ANNEXES

Annex E1-1
Cluster Memberships and Distances by Station

Table E1-1 Summary of cluster membership and cluster distances by site ID and year for the water chemistry data set.

Region	Site ID	Year	Cluster #	Distance
Athabasca River Mainstem	ATR-DC-CC	2002	2	2.40
	ATR-DC-CC	2003	2	2.90
	ATR-DC-CC	2004	2	2.83
	ATR-DC-CC-D	1997	2	3.46
	ATR-DC-E	1998	2	3.29
	ATR-DC-E	2000	2	4.18
	ATR-DC-E	2001	2	5.41
	ATR-DC-E	2002	2	2.76
	ATR-DC-E	2003	1	4.79
	ATR-DC-E	2004	2	3.32
	ATR-DC-M	2000	2	5.29
	ATR-DC-W	1998	2	3.54
	ATR-DC-W	2000	2	3.22
	ATR-DC-W	2001	2	4.67
	ATR-DC-W	2002	2	3.05
	ATR-DC-W	2003	2	3.23
	ATR-DC-W	2004	2	3.52
	ATR-DD	2002	2	1.92
	ATR-DD	2003	2	1.53
	ATR-DD	2004	2	2.64
	ATR-ER	2000	2	4.10
	ATR-ER	2001	2	4.43
	ATR-ER	2004	2	3.95
	ATR-FC-CC-D	1997	2	3.64
	ATR-FC-E	2000	2	2.23
	ATR-FC-E	2001	2	6.43
	ATR-FC-E	2002	2	2.16
	ATR-FC-E	2003	2	2.54
	ATR-FC-E-D	1998	2	2.98
	ATR-FC-M	2000	2	2.26
	ATR-FC-W	2000	2	1.16
	ATR-FC-W	2001	2	4.66
	ATR-FC-W	2002	2	2.09

Table E1-1 (cont'd.)

Region	Site ID	Year	Cluster #	Distance
Athabasca River Mainstem Cont'd.	ATR-FC-W	2003	2	3.40
	ATR-FC-W-D	1998	2	4.72
	ATR-FR	2002	2	2.73
	ATR-FR	2003	2	2.57
	ATR-FR	2004	2	3.34
	ATR-MR-E	2000	2	2.10
	ATR-MR-E	2001	2	3.50
	ATR-MR-E	2002	2	2.95
	ATR-MR-E	2003	2	2.89
	ATR-MR-E	2004	2	3.43
	ATR-MR-E-D	1998	2	2.88
	ATR-MR-M	2000	2	2.67
	ATR-MR-W	2000	2	1.61
	ATR-MR-W	2001	2	3.41
	ATR-MR-W	2002	2	4.01
	ATR-MR-W	2003	2	2.67
	ATR-MR-W	2004	2	3.94
	ATR-MR-W-D	1998	2	3.41
	ATR-SR-E	2000	2	4.07
	ATR-SR-E	2001	2	3.01
	ATR-SR-E	2002	2	4.10
	ATR-SR-E	2003	2	2.78
	ATR-SR-E	2004	2	2.93
	ATR-SR-M	2000	2	1.46
	ATR-SR-W	2000	2	4.13
	ATR-SR-W	2001	2	3.75
	ATR-SR-W	2002	2	3.81
	ATR-SR-W	2003	2	2.12
	ATR-SR-W	2004	2	3.56
	EMR-1	2003	2	2.56
Athabasca River Delta	ARD-1	2000	2	4.30
	ARD-1	2001	2	3.63
	ARD-1	2003	2	2.35
	ARD-1	2004	2	4.17

Table E1-1 (cont'd.)

Region	Site ID	Year	Cluster #	Distance
Muskeg River	ALD-1	1999	3	5.01
	JAC-1	1999	3	3.25
	JAC-1	2000	1	2.69
	JAC-1	2001	1	3.65
	JAC-1	2002	1	3.16
	JAC-1	2003	1	2.91
	JAC-1	2004	1	2.19
	MUC-1	1999	3	2.93
	MUC-1	2000	1	3.79
	MUC-1	2001	1	3.12
	MUC-1	2002	1	2.87
	MUC-1	2003	1	2.54
	MUC-1	2004	3	3.67
	MUR-1	1997	1	5.74
	MUR-1	1998	3	3.70
	MUR-1	1999	3	4.15
	MUR-1	2000	1	3.01
	MUR-1	2001	1	3.32
	MUR-1	2002	1	2.97
	MUR-1	2003	1	3.08
	MUR-1	2004	1	4.10
	MUR-2	1999	3	3.90
	MUR-4	1999	3	3.99
	MUR-6	1998	3	5.39
	MUR-6	1999	1	4.12
	MUR-6	2000	1	4.69
	MUR-6	2001	1	4.07
	MUR-6	2002	1	3.88
	MUR-6	2003	1	3.34
	MUR-6	2004	1	4.15
	SHC-1	1999	3	4.03
	STC-1	2001	1	3.66
	STC-1	2002	1	3.00
	STC-1	2003	1	4.66
	STC-1	2004	1	3.04
	WAC-1	1998	3	5.05
	WAC-1	1999	1	3.06
	WAC-1	2004	1	2.86

Table E1-1 (cont'd.)

Region	Site ID	Year	Cluster #	Distance
Steepbank River	NSR-1	2002	1	4.30
	NSR-1	2003	1	3.50
	NSR-1	2004	1	2.43
	STR-1	1997	1	5.55
	STR-1	1998	3	5.02
	STR-1	2000	2	5.52
	STR-1	2001	1	3.72
	STR-1	2002	1	5.12
	STR-1	2003	1	3.45
	STR-1	2004	3	3.45
	STR-2	2002	1	3.78
	STR-2	2003	1	4.60
	STR-2	2004	3	2.56
	STR-3	2004	1	3.30
Eastern tributaries	FIR-1	2002	1	4.37
	FIR-1	2003	1	2.80
	FIR-1	2004	1	3.29
	FIR-2	2003	1	3.50
	FIR-2	2004	1	3.45
	FIR-2X	2002	1	4.68
	FOC-1	2000	3	4.55
	FOC-1	2001	3	4.54
	FOC-1	2002	1	4.17
	FOC-1	2003	3	3.18
	MCC-1	1999	3	4.02
	MCC-1	2000	3	5.44
	MCC-1	2001	3	3.11
	MCC-1	2002	3	5.20
	MCC-1	2003	3	2.77
	MCC-1	2004	3	2.92
	UNC-1	2000	1	5.09
Western tributaries	BER-1	2003	3	3.99
	BER-1	2004	3	3.47
	CAR-1	2002	3	3.50
	CAR-1	2003	3	3.33
	CAR-1	2004	3	3.07
	ELR-1	1998	2	3.84
	ELR-1	2002	1	3.41

Table E1-1 (cont'd.)

Region	Site ID	Year	Cluster #	Distance
Western tributaries Cont'd	ELR-1	2003	3	3.95
	ELR-1	2004	3	3.42
	ELR-2	2004	1	4.38
	MAR-1	1998	3	5.11
	MAR-1	2000	3	4.23
	MAR-1	2001	3	2.93
	MAR-1	2002	3	3.75
	MAR-1	2003	3	3.37
	MAR-1	2004	3	2.24
	MAR-2	2002	3	5.06
	MAR-2	2003	3	3.98
	MAR-2	2004	3	4.54
	POC-1	2000	3	2.00
	POC-1	2001	3	5.20
	POC-1	2002	3	3.73
	POC-1	2003	3	2.78
	POC-1	2004	3	2.94
	TAR-1	1998	3	5.88
	TAR-1	2002	3	3.97
	TAR-1	2003	3	4.00
	TAR-1	2004	3	4.90
	TAR-2	2004	3	2.95
Southern tributaries	CHR-1	2002	3	3.96
	CHR-1	2003	3	4.42
	CHR-1	2004	3	4.48
	CHR-2	2002	1	2.59
	CHR-2	2003	1	3.56
	CHR-2	2004	1	4.50
	CLR-1	2001	1	4.13
	CLR-1	2002	1	5.47
	CLR-1	2003	1	4.43
	CLR-1	2004	2	5.90
	CLR-2	2001	1	4.07
	CLR-2	2002	1	4.75
	CLR-2	2003	1	4.72
	CLR-2	2004	1	5.47
	HAR-1	2004	3	4.70

Table E1-1 (cont'd.)

Region	Site ID	Year	Cluster #	Distance
Lakes	ISL-1	2000	1	5.73
	ISL-1	2001	3	5.55
	ISL-1	2004	1	4.60
	KEL-1	1998	1	5.72
	KEL-1	2000	1	3.33
	KEL-1	2001	1	3.83
	KEL-1	2002	1	3.04
	KEL-1	2003	1	3.21
	KEL-1	2004	1	3.17
	MCL-1	2000	1	3.84
	MCL-1	2001	1	3.59
	MCL-1	2002	1	3.29
	MCL-1	2003	1	2.98
	SHL-1	1999	1	3.63
	SHL-1	2000	1	4.08
	SHL-1	2001	3	4.00
	SHL-1	2002	3	4.56
	SHL-1	2003	1	4.17
	SHL-1	2004	1	4.52

Annex E2-2

Correlations of PC Input Variables with Conventional Variables and Nutrients

Table E1-2 **Rank correlations of conventional variables, nutrients, and total phenols with ions and dissolved and total metals for the water quality data set.**

	Rank Correlations (r_s)												
	Conventional Variables							Nutrients					Total Phenol
	Conductivity	Hardness	pH	Alkalinity	TDS	TSS	Colour	TOC	DOC	Diss. P	Total P	TKN	
Ions													
Bicarbonate	0.82	0.95	0.21	1.00	0.80	-0.25	0.06	0.34	0.34	0.07	-0.04	0.34	0.20
Calcium	0.84	0.97	0.20	0.91	0.77	-0.12	-0.02	0.12	0.11	0.00	0.00	0.17	0.15
Chloride	0.46	0.12	0.11	0.07	0.28	0.21	-0.09	-0.18	-0.17	-0.07	0.13	-0.06	-0.10
Magnesium	0.81	0.96	0.28	0.94	0.73	-0.22	-0.07	0.20	0.21	-0.04	-0.09	0.25	0.11
Potassium	0.57	0.49	0.16	0.48	0.47	0.02	-0.09	0.06	0.08	-0.20	0.05	0.18	-0.07
Sodium	0.51	0.17	0.18	0.22	0.45	0.06	0.09	0.08	0.12	-0.07	0.05	0.07	-0.06
Sulphate	0.43	0.24	0.13	0.09	0.23	0.23	-0.29	-0.43	-0.46	-0.28	-0.02	-0.26	-0.23
Sulphide	0.04	0.09	-0.15	0.15	0.22	-0.10	0.42	0.47	0.48	0.24	0.18	0.31	0.18
Dissolved Metals													
Arsenic	0.09	-0.06	0.17	-0.04	0.09	0.22	0.24	0.06	0.06	0.17	0.32	0.08	-0.20
Barium	0.61	0.65	0.11	0.51	0.44	0.15	-0.25	-0.34	-0.37	-0.18	0.07	-0.08	0.01
Boron	0.36	0.27	0.24	0.44	0.45	-0.22	0.23	0.50	0.53	0.03	-0.09	0.37	0.05
Copper	0.19	0.14	0.13	0.08	0.08	0.29	-0.07	-0.16	-0.22	-0.13	0.05	-0.06	0.03
Iron	0.12	0.11	-0.10	0.25	0.29	-0.09	0.59	0.52	0.54	0.47	0.32	0.33	0.27
Lithium	0.57	0.52	0.16	0.66	0.61	-0.18	0.23	0.52	0.53	0.10	0.02	0.40	0.09
Manganese	0.53	0.50	-0.22	0.56	0.61	-0.05	0.35	0.43	0.41	0.44	0.28	0.32	0.19
Molybdenum	0.05	-0.11	0.18	-0.21	-0.14	0.33	-0.22	-0.53	-0.56	-0.16	0.01	-0.38	-0.22
Nickel	0.29	0.22	0.06	0.20	0.28	0.29	0.07	-0.08	-0.11	-0.09	0.13	0.05	0.24
Strontium	0.58	0.46	0.24	0.34	0.36	0.25	-0.17	-0.29	-0.30	-0.25	0.04	-0.11	-0.08
Titanium	0.00	0.01	0.35	0.03	0.15	0.18	0.27	0.06	0.11	0.07	0.31	0.16	0.18
Uranium	0.21	0.09	0.16	-0.05	0.05	0.32	-0.20	-0.48	-0.52	-0.31	0.01	-0.26	-0.18
Vanadium	0.01	-0.19	-0.02	-0.19	-0.06	0.21	0.16	-0.02	-0.01	0.10	0.26	0.08	-0.12
Zinc	0.19	0.11	-0.17	0.08	0.07	-0.04	-0.25	-0.09	-0.16	0.01	-0.15	-0.07	-0.11
Total Metals													
Aluminum	-0.14	-0.30	0.05	-0.39	-0.22	0.74	0.19	-0.23	-0.26	-0.03	0.42	-0.19	-0.16
Barium	0.51	0.52	0.12	0.38	0.38	0.38	-0.15	-0.31	-0.35	-0.16	0.22	-0.07	0.03
Boron	0.43	0.33	0.25	0.49	0.53	-0.14	0.24	0.48	0.51	0.00	-0.04	0.34	0.07
Cobalt	0.05	-0.05	-0.12	-0.08	0.00	0.68	0.26	-0.01	-0.04	0.06	0.48	0.00	0.15
Iron	0.06	0.01	-0.13	0.04	0.14	0.62	0.62	0.27	0.25	0.39	0.74	0.18	0.20
Lead	-0.04	-0.17	-0.01	-0.25	-0.11	0.62	0.05	-0.21	-0.27	-0.09	0.25	-0.13	-0.08
Lithium	0.54	0.51	0.21	0.67	0.62	-0.13	0.29	0.52	0.53	0.07	0.07	0.40	0.17
Manganese	0.23	0.17	-0.06	0.17	0.28	0.54	0.46	0.26	0.24	0.31	0.66	0.21	0.18
Molybdenum	-0.02	-0.17	0.12	-0.25	-0.19	0.29	-0.18	-0.50	-0.54	-0.17	0.00	-0.35	-0.19
Nickel	0.16	0.10	0.00	0.08	0.17	0.39	0.11	-0.04	-0.08	-0.09	0.20	0.01	0.20
Strontium	0.59	0.45	0.26	0.33	0.37	0.26	-0.20	-0.30	-0.33	-0.29	0.00	-0.11	-0.08
Titanium	-0.12	-0.24	0.08	-0.32	-0.18	0.72	0.19	-0.22	-0.24	0.01	0.47	-0.16	-0.07

Table E1-2 (cont'd)

	Rank Correlations (r_s)												
	Conventional Variables							Nutrients					Total
	Conductivity	Hardness	pH	Alkalinity	TDS	TSS	Colour	TOC	DOC	Diss. P	Total P	TKN	Phenol
Uranium	0.12	0.07	0.26	-0.05	0.01	**0.34**	-0.10	**-0.41**	**-0.42**	**-0.30**	0.06	-0.18	-0.08
Vanadium	-0.12	-0.26	-0.01	**-0.34**	-0.18	**0.71**	0.20	-0.22	-0.25	0.00	**0.42**	-0.18	-0.13
Zinc	0.20	0.12	-0.28	0.05	0.06	**0.29**	-0.15	-0.15	-0.24	0.06	0.12	-0.03	-0.03

Bolded values represent significant correlations where $|rs| \geq |0.28|$ for n = 31.

#	moderate correlation (|0.50| > r < |0.75|) between variables
#	strong correlation (r > |0.75|) between variables

APPENDIX F

Statistical Analysis of Sediment Quality Data

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APPENDIX F

STATISTICAL ANALYSIS OF WATER AND SEDIMENT QUALITY DATA

F1.0 INTRODUCTION

Historical water and sediment chemistry data sets for the Athabasca River mainstem, delta, and its eastern, western, and southern tributaries, and the Muskeg and Steepbank rivers, and lakes were analyzed using objective classification analysis (OCA) to determine if there were any spatial or temporal patterns present. OCA is a multivariate statistical technique that first uses principal components analysis (PCA) to reduce the data set, followed by cluster analysis to classify stations based on water or sediment quality (Jones and Boyer 2002).

Additional correlation analyses were used to evaluate relationships within and between groups of chemical and conventional variables.

F2.0 ANALYSIS OF SEDIMENT CHEMISTRY DATA

The historical sediment chemistry data set included 58 monitoring stations, which were monitored in the fall for 1 to 8 years, for a total of 167 station/year combinations.

Table F-1 RAMP sediment quality stations included in the historical data set, 1997 to 2004.

Region	Station	1997	1998	1999	2000	2001	2002	2003	2004
Athabasca River Mainstem	ATR-DC-CC	√							
	ATR-DC-E		√		√	√	√	√	√
	ATR-DC-W		√		√	√	√	√	√
	ATR-DD-E						√	√	√
	ATR-DD-W						√	√	√
	ATR-ER				√	√	√	√	√
	ATR-FC-CC-D	√							
	ATR-FC-E				√	√	√	√	
	ATR-FC-E-D		√						
	ATR-FC-W				√	√	√	√	
	ATR-FC-W-D		√						
	ATR-FR-E						√	√	√

Table F-1 (cont'd.)

Region	Station	1997	1998	1999	2000	2001	2002	2003	2004
Athabasca River Mainstem Cont'd.	ATR-FR-W						√	√	√
	ATR-MR-E				√	√	√	√	√
	ATR-MR-E-D		√						
	ATR-MR-W				√	√	√	√	√
	ATR-MR-W-D		√						
	ATR-SR-E				√	√	√	√	√
	ATR-SR-W				√	√	√	√	√
	ATR-UFM						√	√	√
Athabasca River Delta	BPC			√	√	√	√	√	
	FLB				√				
	FLC					√	√	√	
	GIC					√	√	√	
Eastern Tributaries	FIR-1						√	√	√
	FIR-2							√	√
	FIR-2X						√		
	FOC-1				√		√		
	MCC-1			√	√	√	√		
Western Tributaries	CAR-1						√		√
	ELR-1		√				√	√	√
	ELR-2								√
	MAR-1	√	√			√	√		√
	MAR-2					√			√
	POC-1	√					√		√
	TAR-1		√				√	√	√
	TAR-2								√
Southern Tributaries (south of Fort McMurray)	CHR-1						√	√	√
	CHR-2						√	√	√
	CLR-1					√	√	√	
	CLR-2					√	√	√	
	HAR-1								√

Table F-1 (cont'd.)

Region	Station	1997	1998	1999	2000	2001	2002	2003	2004
Muskeg River	JAC-1	√							√
	MUR-1	√	√	√	√	√	√	√	√
	MUR-1b				√			√	
	MUR-2				√			√	√
	MUR-4	√			√			√	
	MUR-5				√			√	
	MUR-6				√			√	
	MUR-D2							√	√
	STC-1							√	
Steepbank River	NSR-1						√	√	√
	STR-1	√	√				√		
	STR-2						√		
Lakes	ISL-1					√			
	KEL-1					√			√
	MCL-1						√	√	
	SHL-1					√	√	√	√

F2.1 METHODS

F2.1.1 Principal Components Analysis (PCA)

PCA was used to reduce the sediment chemistry data set, and to facilitate broad comparisons of sediment quality among stations. Separate analyses were conducted on the total metals and PAHs data sets. Data preparation and analyses were conducted using the same methods used for the water quality data set, which are described in Appendix E.

F2.1.2 Cluster Analysis

Hierarchical and K-means cluster analysis were conducted in accordance with procedures described in Appendix E, except for the following deviations. Cluster analysis was conducted on the total metals and PAHs principal components, as well as grain size, total organic carbon (TOC), and total inorganic carbon (TIC). Due to the large differences in magnitudes among these chemical and physical variables, data were standardized to z-scores prior to conducting the analyses.

Relationships among variables used in cluster analysis were evaluated using rank correlations.

F2.1.3 Additional Correlations Analyses

Additional correlation analyses were conducted to evaluate the relationships between:

- total extractable hydrocarbons (TEH), which are comprised of the C11 to C30 chains, and the sum of the F2 and F3 fractions, which are comprised of the C10 to C16, and C16 to C34 chains, respectively; and

- total hydrocarbons and sum of F2, F3, and F4 fractions, which are comprised of the C10 to C50 chains, to ensure these two representations of hydrocarbon data are comparable.

F2.2 RESULTS

F2.2.1 Principal Components Analysis

F2.2.1.1 Data Screening

Analytes with missing values for 15% or more of station/year combinations or non-detectable values for 50% or more of station/year combinations were excluded from the data set. Variables excluded included:

- **Non-detectable values** – PAHs including total volatile hydrocarbons (TVH), acenaphthylene, anthracene, dibenzo(ah)anthracene, methyl acenaphthene, methyl-biphenyl, and metals including antimony, bismuth, cadmium, mercury, silver, and tin; and

- **Missing values** – metals including aluminum, boron, calcium, iron, magnesium, manganese, potassium, sodium, sulphur, titanium, total phosphorous, thallium, and uranium.

F2.2.1.2 Data Reduction

Two separate PCAs were conducted on the total metals and PAHs data sets.

Total Metals

The total metals PCA produced a total of two principal components. These principal components, SEDMET PC1 and SEDMET PC2, which accounted for a total of 82% (74% and 8%, respectively) of the variance in the data set, were used in subsequent analysis. The relationships between the input variables and output summary variables are summarized below.

Table F-2 Pearson correlations (or loadings) of input variables with output summary variables (i.e., principal components) for total metals data set.

Input Variable	Summary Variable (Principal Component)	
	SEDMET PC1	SEDMET PC2
Lead	0.95	-0.06
Cobalt	0.94	0.07
Copper	0.94	0.10
Nickel	0.94	-0.05
Barium	0.91	0.19
Chromium	0.91	-0.13
Vanadium	0.90	-0.04
Zinc	0.87	0.27
Arsenic	0.86	0.13
Strontium	0.85	0.09
Selenium	0.72	0.42
Beryllium	0.72	-0.57
Molybdenum	0.62	-0.64

#	moderate correlation (|0.50| > r < |0.75|) between input variable and summary variable (i.e., PC)
#	strong correlation (r > |0.75|) between input variable and summary variable (i.e., PC)

The first PC, SEDMET PC1, explained most of the variance in the data set, and was strongly or moderately correlated with all of the input variables. Molybdenum had slightly stronger loadings with SEDMET PC2, which was used to represent this metal in subsequent analysis.

PAHS

The PAHS PCA produced a total of 4 principal components. The first two principal components, SEDPAH PC1, SEDPAH PC2, accounted for 81% (73% and 8%, respectively) of variability in the sediment chemistry data set, and were used in subsequent analysis. The relationships between the input variables and output summary variables are summarized below.

Table F-3 Pearson correlations (or loadings) of input variables with output summary variables (i.e., principal components) for PAHs data set.

Input Variable	Summary Variable (Principal Component)	
	SEDPAH PC1	SEDPAH PC2
C2 phenanthrene/anthracene		0.08
C1 dibenzothiophene		0.07
C1 fluoranthene/pyrene		0.13
Pyrene		-0.05
Chrysene		0.13
C3 phenanthrene/anthracene		0.16
C2 dibenzothiophene		0.20
Benzo(a)anthracene		-0.03
Benzo(a)pyrene		0.01
C2 Fluoranthene		0.14
C1 phenanthrene/anthracene		-0.13
Dibenzothiophene		-0.13
Benzo(bjk)fluoranthene		-0.03
Benzo(ghi)perylene		0.07
C4 naphthalene		0.20
Fluoranthene		-0.27
C3 naphthalene		-0.24
C3 fluorene		0.18
Phenanthrene		-0.37
C3 Fluoranthene		0.17
Indeno(123-cd)pyrene		0.00
C1 fluorene		-0.06
C3 dibenzothiophene		0.32
C4 phenanthrene/anthracene		0.23
C2 Benzofluoranthene/Pyrene		0.37
C2 benzo(a)anthracene/Chrysene		0.33
Fluorene		-0.45
C1 Benzofluoranthene/Pyrene		0.40
C2 fluorene		0.28
Acenaphthene		-0.31
C1 benzo(a)anthracene/Chrysene		0.29

Table F-3 (cont'd.)

Input Variable	Summary Variable (Principal Component)	
	SEDPAH PC1	SEDPAH PC2
C4 dibenzothiophene		0.29
Retene		-0.12
Dimethyl-Biphenyl	0.72	-0.07
C2 naphthalene	0.69	-0.57
Biphenyl	0.66	-0.50
C1 naphthalene	0.60	-0.66
Naphthalene	0.60	-0.67

#	moderate correlation (|0.50| > r < |0.75|) between input variable and summary variable (i.e., PC)
#	strong correlation (r > |0.75|) between input variable and summary variable (i.e., PC)

All of the PAHs were strongly or moderately correlated with SEDPAH PC1. Only two of the PAHs, C1 naphthalene and naphthalene, exhibited stronger negative correlations with SEDPAH PC2. The second PC was used to represent these chemicals in subsequent analysis; however, because the correlations between these PAHs and the PCs were negative, any negative correlations observed with other variables will represent positive correlations (i.e., negative correlation + negative correlation = positive correlation).

Relationships among Principal Components

Rank correlations, which are presented Table F-4, were used to assess whether any strong relationships exist among the principal components. Only one moderate correlation was observed between SEDMET PC1 and SEDPAH PC2. This correlation indicates that concentrations of most metals are positively related to the concentrations of C1 napthalene and naphthalene.

Table F-4 Rank correlations (r_s) between principal components.

	SEDMET PC1	SEDMET PC2	SEDPAH PC1
SEDMET PC1	-	-	-
SEDMET PC2	-0.01	-	-
SEDPAH PC1	**0.44**	-0.16	-
SEDPAH PC2	**-0.61**	0.12	-0.05

Bolded values represent significant correlations where $|rs| \geq |0.28|$ for n = 167.

#	moderate correlation (|0.50| > r < |0.75|) between variables
#	strong correlation (r > |0.75|) between variables)

F2.2.2 Cluster Analysis

F2.2.2.1 Cluster Membership

Based on results of hierarchical cluster analysis, k-means cluster analysis was conducted using four clusters. The cluster membership for each region is Table F-5. Cluster memberships for each observation (i.e., station/year combination) are presented in Annex F1-1.

The first cluster was comprised of a total of 7 station/year combinations, including two Muskeg River stations, MUR-1, which was sampled in 1997 and 2001 to 2004, and MUR-1B, which was sampled in 2000 and 2003.

The second cluster, which included 10 station/year combinations, represented most of the lakes, including Kearl, McClelland, and Shipyard lakes. Two Muskeg River stations (MUR-5 and 6 sampled in 2000) and Stanley Creek (sampled in 2003) station also grouped with this cluster.

The third cluster was the second largest cluster, comprised of 73 station/year combinations. Most of the stations grouped in this cluster (53 station/year combinations) were Athabasca River mainstem stations and delta stations. Athabasca River stations that grouped with this cluster included most or all of stations located upstream of the Embarras River, upstream and downstream of Fort Creek, upstream and downstream of the Muskeg River, upstream of the Steepbank River (west bank only), upstream of Fort McMurray, and downstream of development (east bank stations only). Almost half of the western tributary station/year combinations, including the Calumet River (2002), Ells River (ELR-1 in 2004), MacKay River (MAR-1 in 2001 to 2004 and MAR-4 in 2004), Poplar Creek (1997 and 2002), and Tar River (2002 and 2004), also grouped with this cluster. A couple of the eastern tributaries, including Fort Creek (2000 and 2002) and McLean Creek (1999), southern tributaries, including the Clearwater and Christina Rivers (2002), lakes (Isadore's Lake in 2001 and Shipyard Lake in 2004), and Muskeg River stations (MUR-1 in 1998 and 1999 and MUR-4 in 2003) also were included in this grouping of stations.

The fourth cluster formed the largest cluster, accounting for 77 station/year combinations. This cluster included the remainder of the Athabasca River mainstem stations, along with a majority of the eastern, southern, and western tributary stations, Muskeg River stations, and all of the Steepbank River stations. The Athabasca River mainstem stations that grouped with this cluster included most or all of the stations located upstream of Donald Creek, upstream of the Firebag River, upstream of the Steepbank River (east bank only), and downstream of development (west bank only). The eastern tributary stations included all of the Firebag River stations and McLean Creek (2000 to 2002). The southern tributary stations included the remaining Clearwater and Christina River stations, as well as the Hangingstone River station. The western tributary stations included the Calumet River (2004), Ells River (ELR-1 in 1998, 2000, 2003, and ELR-2 in 2004), MacKay River (MAR-1 in 2001 and 2002 and MAR-2). The Muskeg River stations included MUR-1 in 2000, MUR-2 in 2000, 2003, and 2004, MUR-3 in 1998 and 2000, MUR-5 and 6 in 2003 and MUR-D in 2003 and 2004.

Table F-5 Summary of cluster membership by region.

Region/Waterbody	Total Number of Station/Year Combinations				Total
	Cluster				
	1	2	3	4	
Athabasca River	**0**	**0**	**41**	**25**	**66**
Delta	**0**	**0**	**12**	**0**	**12**
Big Point Channel	0	0	5	0	5
Fletcher Channel	0	0	3	0	3
Flour Bay	0	0	1	0	1
Goose Island Channel	0	0	3	0	3
Eastern Tributaries	**0**	**0**	**3**	**9**	**12**
Firebag R.	0	0	0	6	6
Fort Creek	0	0	2	0	2
McLean Creek	0	0	1	3	4
Western Tributaries	**0**	**0**	**10**	**13**	**23**
Calumet River	0	0	1	1	2
Ells River	0	0	1	4	5
MacKay River	0	0	4	4	8
Poplar Creek	0	0	2	1	3
Tar River	0	0	2	3	5
Southern Tributaries	**0**	**0**	**2**	**11**	**13**
Christina River	0	0	1	5	6
Clearwater River	0	0	1	5	6
Hangingstone River	0	0	0	1	1
Muskeg River	**7**	**3**	**3**	**12**	**25**
Jackpine Creek	0	0	0	2	2
Muskeg River	7	2	3	10	22
Stanley Creek	0	1	0	0	1
Steepbank River	**0**	**0**	**0**	**7**	**7**
N. Steepbank River	0	0	0	3	3
Steepbank River	0	0	0	4	4

Table F-5 (cont'd.)

Region/Waterbody	Total Number of Station/Year Combinations				Total
	Cluster				
	1	2	3	4	
Lakes	**0**	**7**	**2**	**0**	**9**
Isadore's Lake	0	0	1	0	1
Kearl Lake	0	2	0	0	2
McClelland Lake	0	2	0	0	2
Shipyard Lake	0	3	1	0	4
Total	**7**	**10**	**73**	**77**	**167**

F2.2.2.2 Cluster Characteristics

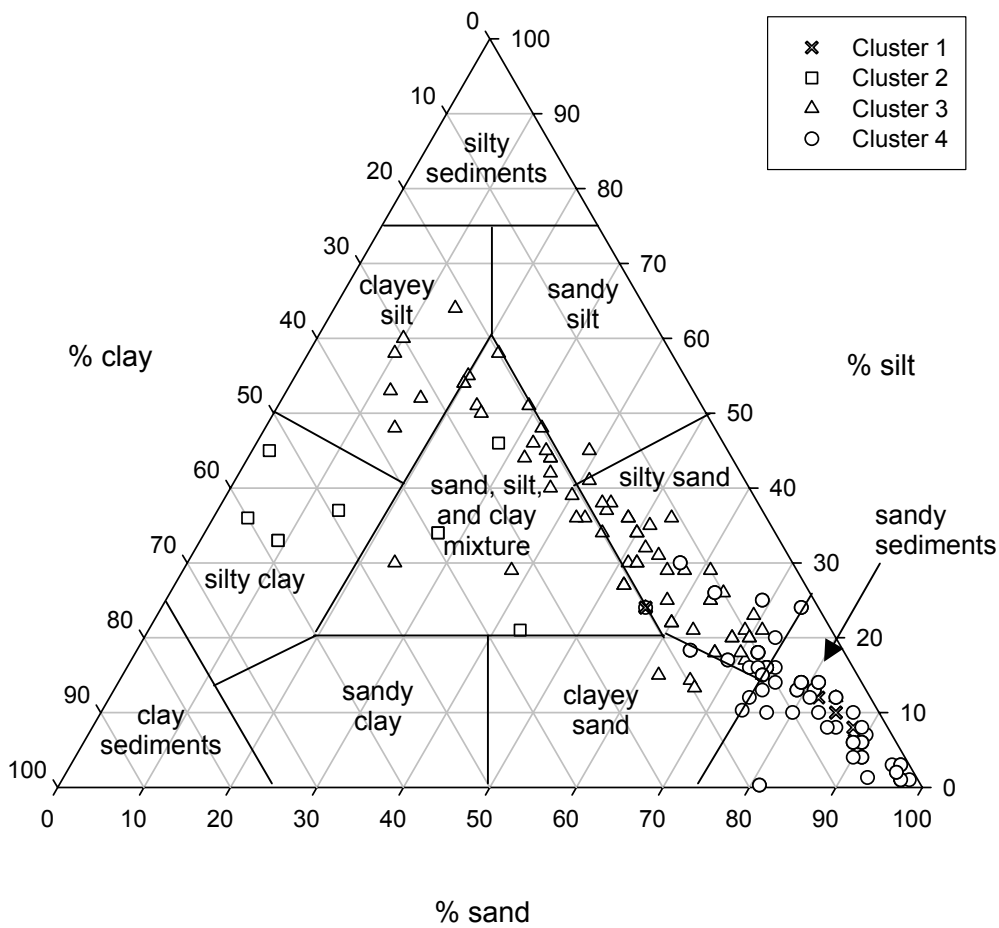
The characteristics of each cluster were evaluated by examining scatterplots of variables used for cluster analysis including the primary principal components (i.e., PC1 and PC2) for metals and PAHs, as well as grain size, and TOC and TIC, to identify trends in sediment quality common to each cluster.

According to results of cluster analysis, the key drivers for the clustering were percent clay, percent sand, and metals. The plots for these variables will be examined first, given that they were the primary variables used to form clusters.

Grain Size

In Figure F-1, the grain size composition of stations grouped with each cluster is plotted. Cluster 1, which represents the two Muskeg River stations, MUR-1 and MUR-1B, and Cluster 4, which represents a number of the Athabasca River mainstem stations, along with a majority of the eastern, southern, and western tributary stations, Muskeg River stations, and all of the Steepbank River stations, were comprised almost exclusively with sandy sediments. Cluster 2, which consisted of most of the lake stations and two Muskeg River stations, had silty clay and sand, silt, clay sediments. Cluster 3, which represented most of the Athabasca River stations, all of the delta stations, and about half of the western tributary stations, exhibited a range of sediment types; a majority of stations had silty sand sediments, while the remaining stations were clayey silt or a mixture of sand, silt, and clay.

Figure F-1 Shepard's diagram of percent clay, sand, and silt grouped by cluster number.



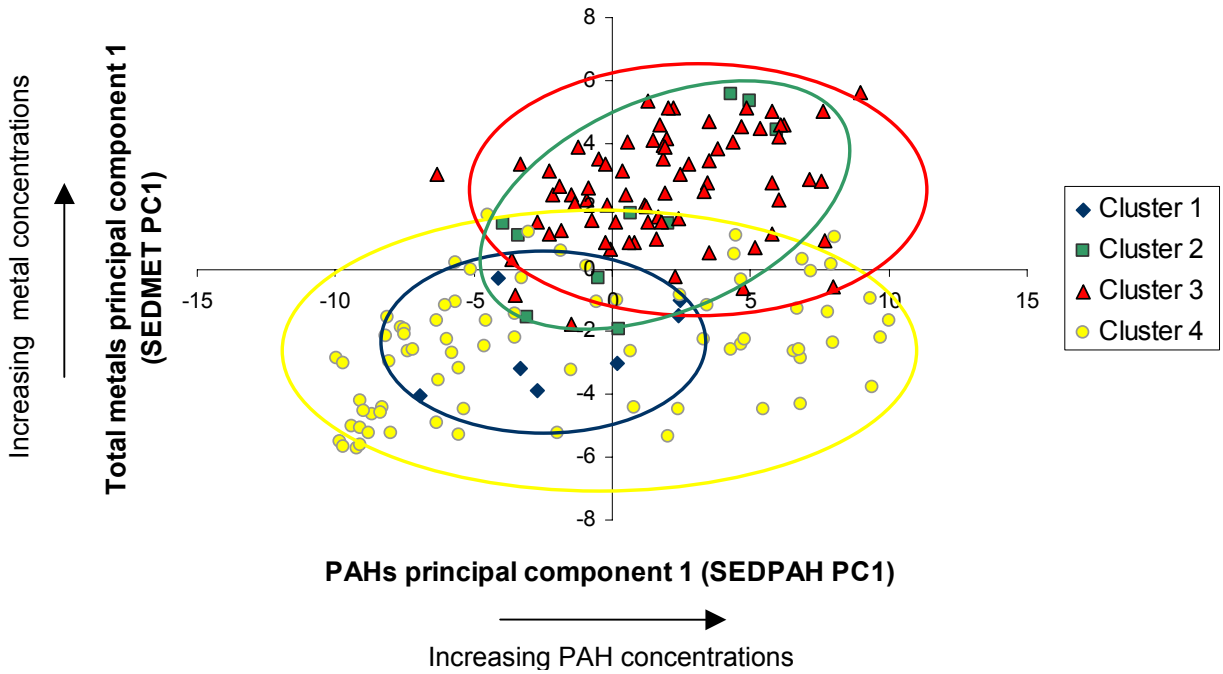
Metals and PAHs

The first PC for metals (i.e., SEDMET PC1) was plotted against both of the PAHs principal components (i.e., SEDPAH PC1 and PC2) to determine if there were any spatial patterns in metals and PAHs concentrations that were driving the cluster groupings. The second metals PC was not plotted against the first metals PC or PAHs PC because it accounted for a very small percentage of the variability in metals that was partially explained by the first PC.

In the first plot of SEDMET PC1 and SEDPAH PC1, four clusters are apparent (Figure F-2). Two sets of clusters overlap with one another, suggesting that stations grouped with Clusters 2 and 3 and those grouped with Clusters 1 and 4 tend to exhibit similar sediment metal and organic concentrations. Cluster 1, representing select Muskeg River stations, was characterized by mostly negative SEDMET PC1 and SEDPAH PC1 scores, indicating these stations exhibited low concentrations of most metals and PAHs. The second cluster, representing a majority of the lakes, and the third cluster, representing a majority of Athabasca River and delta stations, exhibited mostly

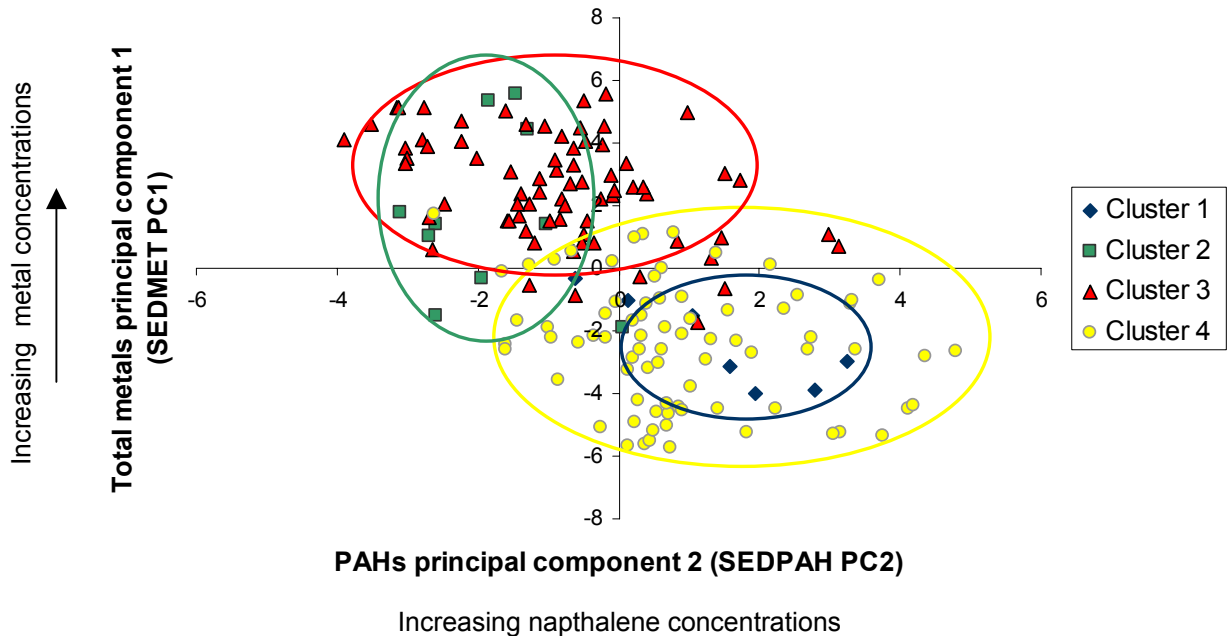
positive metal and organic scores, indicating these stations exhibited high concentrations of metals and PAHs. The fourth cluster, representing a majority of the tributary stations, had negative SEDMET PC1 scores and a range of both positive and negative SEDPAH PC1 scores indicating these stations had low metals concentrations and a range of PAH concentrations.

Figure F-2 Scatterplot of total metal principal component 1 (SEDMET PC1) and PAHs principal component 1 (SEDPAH PC1) grouped by cluster number.



A plot of SEDMETPC1 against SEDPAH PC2, which represents low molecular constituents including C1 napthalene and naphthalene, is presented in Figure F-3. A similar pattern of overlapping clusters that was observed in Figure F-2 was also observed for these principal components. Clusters 2 and 3 exhibited positive SEDMET PC1 scores and negative SEDPAH PC2 scores, indicating that these stations exhibited high metals and C1 napthalene and naphthalene concentrations (these PAHs were negatively correlated with the SEDPAH PC2). Clusters 1 and 4 tended to exhibit negative SEDMET PC1 scores and positive SEDPAH PC2 scores indicating that these stations had low concentrations of sediment metals and C1 napthalene and naphthalene.

Figure F-3 Scatterplot of total metal principal component 1 (SEDMET PC1) and PAHs principal component 2 (SEDPAH PC2) grouped by cluster number.



TIC/TOC

A scatterplot of TIC and TOC concentrations is presented in Figure F-4. TIC and TOC concentrations were similar between Clusters 1 to 4, occupying a tight range of low TOC/TIC concentrations. Concentrations of TOC at stations grouped in Cluster 2 were much more variable.

Relationships between Variables used for Cluster Analysis

Rank correlations were used to evaluate the relationships between variables used for cluster analysis. These relationships are summarized in Table F-6.

A small number of strong and moderate correlations were observed between principal components and grain size and organic content. Percent fines (i.e., clay and silt) and TIC were positively correlated with MET PC1, while percent sand was negatively correlated with this variable. PAH PC1 was positively correlated with TOC.

Within the grain size variables, not surprisingly, percent clay and silt were negatively correlated with percent sand and positively correlated with each other. Percent silt was also positively correlated with TIC.

Figure F-4 Scatterplot of total organic carbon (TOC) and total inorganic carbon (TIC) grouped by cluster number.

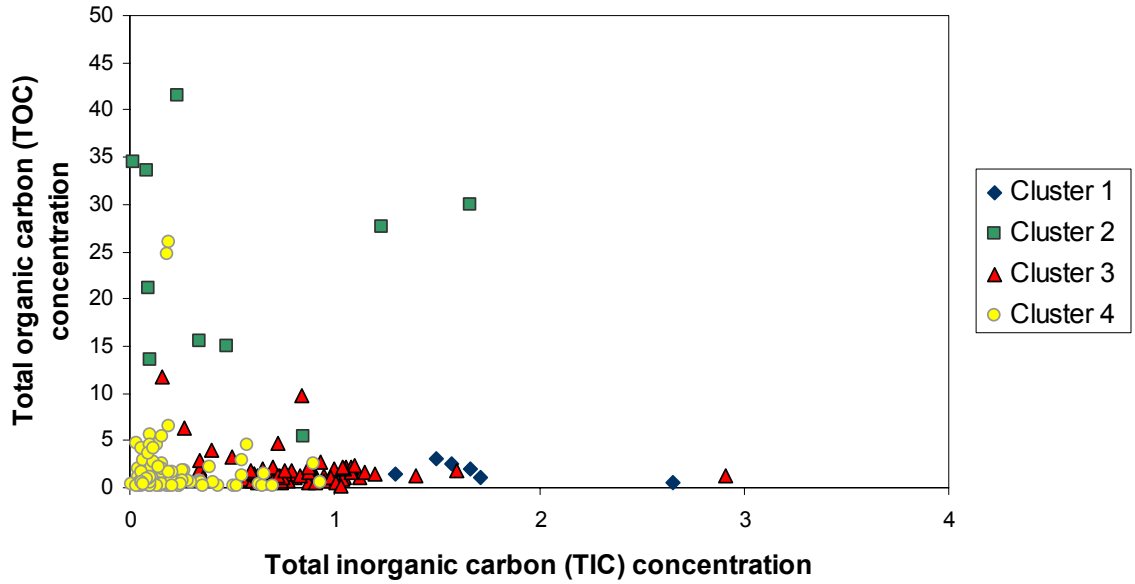


Table F-6 Rank correlations (r_s) between principal components, grain size, TOC, and TIC.

	MET PC1	MET PC2	PAH PC1	PAH PC2	% clay	% sand	% silt	TIC
% clay	**0.76**	0.17	**0.41**	**-0.45**	-	-	-	-
% sand	**-0.80**	-0.21	**-0.41**	**0.49**	**-0.92**	-	-	-
% silt	**0.77**	0.23	**0.41**	**-0.42**	**0.81**	**-0.94**	-	-
TIC	**0.62**	-0.03	0.24	**-0.42**	**0.41**	**-0.49**	**0.52**	-
TOC	**0.34**	0.13	**0.62**	-0.15	**0.47**	**-0.47**	**0.43**	0.09

Bolded values represent significant correlations where $|rs| \geq |0.28|$ for n = 167.

#	moderate correlation (|0.50| > r < |0.75|) between variables
#	strong correlation (r > |0.75|) between variables

F2.2.2.3 Summary of Groupings

Cluster One included two Muskeg River stations, MUR-1 and MUR-1B, which are located downstream of operations at or upstream of the mouth of the Muskeg River. These stations were characterized by low concentrations of metals, PAHs, TIC/TOC, and a high percentage of sand and low percentage of fines.

Cluster Two included most of the lakes, including Kearl, McClelland, and Shipyard Lakes, and three of the Muskeg River stations (MUR-5 and 6 and STC). These stations were characterized by high concentrations of metals and PAHs, low concentrations of TIC/TOC, and high percentage of fines and low percentage of sand.

Cluster Three was comprised of approximately 60% of the Athabasca River mainstem station/year combinations, all of the delta stations, and half of the western tributary stations. Stations grouped with this cluster had high concentrations of metals and PAHs, low concentrations of TIC/TOC, and a high percentage of fines and low percentage of sand.

Cluster Four included a majority of the eastern, western, and southern tributary, Muskeg River, and Steepbank River stations. In addition, approximately 40% of the Athabasca River mainstem stations grouped with this cluster. These stations were characterized by low concentrations of metals, a range of organic and TOC concentrations, and a high percentage of sand and low percentage of fines.

Table F-7 Summary of cluster membership and characteristics for sediments.

Cluster	Predominant stations present in cluster	General Characteristics of Cluster			
		Metal Concentrations	Organic Concentrations	Grain Size	TIC/TOC
One	2 Muskeg R. stations (MUR-1 and MUR-1B) located downstream of development	Low concentrations of metals used in PCA	Low concentrations of PAHs used in PCA	Sandy sediments	Low concentrations
Two	Lakes (including Kearl, McClelland, and Shipyard lakes), 3 Muskeg River stations (MUR5 and 6 and STC)	High concentrations of metals used in PCA	High concentrations of PAHs used in PCA	Silty clay and a mixture of sand, silt, and clay sediments	Variable TOC concentrations
Three	~ 60% of Athabasca River mainstem station/year and all delta stations, half of Western tributary stations	High concentrations of metals used in PCA	High concentrations of PAHs used in PCA	Mostly silty sand sediments	Low concentrations
Four	Majority of eastern, western, and southern tributary, Muskeg R., and Steepbank R. stations, ~ 40% of Athabasca R. mainstem station/year	Low concentrations of metals used in PCA	Range of organic concentrations	Sandy sediments	Low concentrations

F2.2.3 Additional Correlation Analyses

Correlation analyses were conducted to assess the comparability of two different representations of hydrocarbon data. Total extractable hydrocarbons, which have been used traditionally in the RAMP program, are comprised of the C11 to C30 chains, were compared to the sum of the F2 and F3 fractions, which are new to the RAMP program; the rank correlation between these variables was $r_s = 0.78$, indicating that these two representations of extractable hydrocarbons were equivalent. Total hydrocarbons and the sum of F2, F3, and F4 fractions, which are comprised of the C10 to C50 chains, were also strongly correlated ($r_s = 0.93$), confirming these representations of total hydrocarbons were comparable.

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ANNEXES

Annex F1-1
Cluster Memberships and Distances by Station

Table F1-1 Summary of cluster membership and cluster distances by site ID and year for the sediment chemistry data set.

Region	Site ID	Year	Cluster	Distance
Athabasca River Mainstem	ATR-DC-CC	1997	3	1.35
	ATR-DC-E	1998	3	2.27
	ATR-DC-E	2000	4	2.29
	ATR-DC-E	2001	4	2.94
	ATR-DC-E	2002	4	2.42
	ATR-DC-E	2003	4	2.76
	ATR-DC-E	2004	3	2.67
	ATR-DC-W	1998	4	3.08
	ATR-DC-W	2000	4	1.82
	ATR-DC-W	2001	4	2.60
	ATR-DC-W	2002	4	2.15
	ATR-DC-W	2003	4	1.41
	ATR-DC-W	2004	4	1.54
	ATR-DD-E	2002	4	2.39
	ATR-DD-E	2003	3	0.94
	ATR-DD-E	2004	3	0.53
	ATR-DD-W	2002	3	1.79
	ATR-DD-W	2003	4	2.09
	ATR-DD-W	2004	4	1.65
	ATR-ER	2000	3	1.80
	ATR-ER	2001	3	0.91
	ATR-ER	2002	3	1.02
	ATR-ER	2003	3	0.60
	ATR-ER	2004	3	1.14
	ATR-FC-CC-D	1997	3	1.75
	ATR-FC-E	2000	3	2.32
	ATR-FC-E	2001	4	1.99
	ATR-FC-E	2002	3	1.23
	ATR-FC-E	2003	3	1.16
	ATR-FC-E-D	1998	3	2.45
	ATR-FC-W	2000	4	2.28
	ATR-FC-W	2001	3	2.22
	ATR-FC-W	2002	3	1.29

Table F1-1 (cont'd.)

Region	Site ID	Year	Cluster	Distance
Athabasca River Mainstem Cont'd.	ATR-FC-W	2003	3	3.43
	ATR-FC-W-D	1998	3	1.91
	ATR-FR-E	2002	3	1.86
	ATR-FR-E	2003	4	1.94
	ATR-FR-E	2004	4	1.37
	ATR-FR-W	2002	3	1.02
	ATR-FR-W	2003	4	1.71
	ATR-FR-W	2004	4	1.16
	ATR-MR-E	2000	3	0.95
	ATR-MR-E	2001	4	2.88
	ATR-MR-E	2002	3	1.18
	ATR-MR-E	2003	3	1.52
	ATR-MR-E	2004	3	0.97
	ATR-MR-E-D	1998	3	2.37
	ATR-MR-W	2000	3	2.32
	ATR-MR-W	2001	4	2.63
	ATR-MR-W	2002	3	2.85
	ATR-MR-W	2003	3	1.34
	ATR-MR-W	2004	3	1.51
	ATR-MR-W-D	1998	3	2.44
	ATR-SR-E	2000	4	1.61
	ATR-SR-E	2001	4	2.06
	ATR-SR-E	2002	3	1.34
	ATR-SR-E	2003	4	1.92
	ATR-SR-E	2004	3	1.69
	ATR-SR-W	2000	3	2.16
	ATR-SR-W	2001	3	1.46
	ATR-SR-W	2002	3	1.05
	ATR-SR-W	2003	3	1.78
	ATR-SR-W	2004	3	0.89
	ATR-UFM	2002	3	0.78
	ATR-UFM	2003	4	2.03
	ATR-UFM	2004	3	1.63

Table F1-1 (cont'd.)

Region	Site ID	Year	Cluster	Distance
Athabasca River Delta	BPC	1999	3	2.63
	BPC	2000	3	2.89
	BPC	2001	3	1.70
	BPC	2002	3	1.78
	BPC	2003	3	1.08
	FLB	2000	3	2.56
	FLC	2001	3	1.93
	FLC	2002	3	1.05
	FLC	2003	3	0.59
	GIC	2001	3	2.07
	GIC	2002	3	1.25
	GIC	2003	3	1.34
Eastern Tributaries	FIR-1	2002	4	1.55
	FIR-1	2003	4	2.08
	FIR-1	2004	4	1.75
	FIR-2	2003	4	2.03
	FIR-2	2004	4	2.08
	FIR-2X	2002	4	1.77
	FOC-1	2000	3	2.70
	FOC-1	2002	3	1.94
	MCC-1	1999	3	2.90
	MCC-1	2000	4	2.68
	MCC-1	2001	4	3.21
	MCC-1	2002	4	2.41
Lakes	ISL-1	2001	3	4.82
	KEL-1	2001	2	2.36
	KEL-1	2004	2	2.27
	MCL-1	2002	2	2.90
	MCL-1	2003	2	2.33
	SHL-1	2001	2	3.52
	SHL-1	2002	2	2.41
	SHL-1	2003	2	2.49
	SHL-1	2004	3	2.63

Table F1-1 (cont'd.)

Region	Site ID	Year	Cluster	Distance
Muskeg River	JAC-1	1997	4	3.04
	JAC-1	2004	4	2.15
	MUR-1	1997	1	2.59
	MUR-1	1998	3	2.76
	MUR-1	1999	3	2.64
	MUR-1	2000	4	2.35
	MUR-1	2001	1	2.53
	MUR-1	2002	1	1.97
	MUR-1	2003	1	1.46
	MUR-1	2004	1	1.35
	MUR-1b	2000	1	1.75
	MUR-1b	2003	1	1.39
	MUR-2	2000	4	2.05
	MUR-2	2003	4	2.43
	MUR-2	2004	4	1.99
	MUR-4	1997	4	2.22
	MUR-4	2000	4	1.48
	MUR-4	2003	3	2.96
	MUR-5	2000	2	3.01
	MUR-5	2003	4	4.12
	MUR-6	2000	2	2.98
	MUR-6	2003	4	2.15
	MUR-D2	2003	4	3.84
	MUR-D2	2004	4	2.16
	STC-1	2003	2	4.65
Southern Tributaries	CHR-1	2002	3	2.78
	CHR-1	2003	4	2.44
	CHR-1	2004	4	2.47
	CHR-2	2002	4	2.07
	CHR-2	2003	4	2.12
	CHR-2	2004	4	1.31
	CLR-1	2001	4	1.31
	CLR-1	2002	3	2.90
	CLR-1	2003	4	2.10
	CLR-2	2001	4	2.13

Table F1-1 (cont'd.)

Region	Site ID	Year	Cluster	Distance
Southern Tributaries Cont'd.	CLR-2	2002	4	1.54
	CLR-2	2003	4	2.14
	HAR-1	2004	4	1.82
Steepbank River	NSR-1	2002	4	1.54
	NSR-1	2003	4	2.11
	NSR-1	2004	4	2.18
	STR-1	1997	4	3.23
	STR-1	1998	4	3.08
	STR-1	2002	4	2.28
	STR-2	2002	4	1.79
Western Tributaries	CAR-1	2002	3	1.00
	CAR-1	2004	4	2.28
	ELR-1	1998	4	2.74
	ELR-1	2002	4	1.69
	ELR-1	2003	4	2.30
	ELR-1	2004	3	2.22
	ELR-2	2004	4	2.31
	MAR-1	1997	4	2.81
	MAR-1	1998	4	3.21
	MAR-1	2001	3	2.75
	MAR-1	2002	3	1.78
	MAR-1	2004	3	1.43
	MAR-2	2001	4	1.55
	MAR-2	2004	4	1.87
	MAR-4	2004	3	1.47
	POC-1	1997	3	2.50
	POC-1	2002	3	2.53
	POC-1	2004	4	2.00
	TAR-1	1998	4	2.16
	TAR-1	2002	3	1.72
	TAR-1	2003	4	1.87
	TAR-1	2004	3	2.63
	TAR-2	2004	4	1.42

APPENDIX G

Benthic Invertebrate Community Component

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APPENDIX G

BENTHIC INVERTEBRATE COMMUNITY COMPONENT

G1.0 BENTHIC INVERTEBRATE SAMPLE PROCESSING PROCEDURES

G1.1 LABORATORY METHODS

In preparation for laboratory processing, samples should be checked immediately to ensure that they are adequately sealed, labeled and that the preservative has effectively penetrated the entire sample. The first step in processing invertebrate samples is rinsing the residual fine debris and preservative (provided a minimum exposure of 72 hours to formalin occurred) and from the sample. Samples can be sorted immediately, or transferred to 80% ethanol, prior to sorting and taxonomic work. After sorting and identification, freshwater macro-invertebrates should be stored in a solution of 70 to 80% ethanol, and 5% glycerin in vials or jars with airtight lids. Since preservatives can have a variety of effects on the lengths and weights of invertebrates (Ellis, 1987; Leuven *et al.* 1985; Howmineer 1972), it is essential that the exact preservation protocol for all steps be drafted *a priori* and that it be consistently applied between all phases, areas, replicate stations and habitats.

To expedite the sorting process, for samples which have large pieces of organic matter, the samples can be divided in the laboratory into appropriate size fractions. The most commonly used fractions are coarse (> 1.00 mm) and fine (250 µm - 1.00 mm), which correspond to the divisions used to define coarse and fine particulate organic matter (CPOM and FPOM) respectively. If there are very large pieces or organic material or large invertebrates it is sometimes beneficial to separate these from the rest of the sample with a 4.00-mm sieve. All fractions should then be sorted and if warranted by large numbers of organisms, the fractions can be sub-sampled independently. Careful note taking is recommended for these more complex sorting procedures so that densities are calculated accurately. After the initial washing and fractionation of samples, the invertebrates should be sorted from the debris by trained technicians on a gridded tray or petri dish under a dissecting microscope at 10X to 20X magnification.

Large samples or samples with large amounts of sediment debris may require laboratory sub-sampling prior to sorting. Sub-sampling of the invertebrate sample in the laboratory is acceptable, providing that the method used is quantitative. Various methods of laboratory sub-sampling are available, and are outlined in Klemm *et al.* (1990) as well as Canton (1991), Mason (1991b), Plafkin *et al.* (1989), Wrona *et al.* (1982), Marchant (1989) and Sebastien *et al.* (1988). The method used should be thoroughly documented. Generally, a minimum of one-quarter of the sample should be sorted, however, a more definitive guideline is that sub-sampling should continue until a minimum number of animals is counted to obtain a predefined variance level (see Wrona *et al.* 1982). For example, for the cone subsampler described by Wrona *et al.* (1982), as the number of animals counted exceeds 50 and approaches 100, the improvement in the error term for a given unit of additional effort decreases. The extra information gained by taking more sub-samples is not worth the extra time invested. In this case (Wrona *et al.* 1982) and

others (Hickley 1975, Elliott 1977) the recommendation for the minimum number of animals which should be counted was 100. It is recommended that this minimum number be determined for each sorting and laboratory sub-sampling protocol utilized during an MM EEM program using a similar approach.

Sorting procedures should be reviewed after an initial examination of the type of samples. Sorting procedures may differ depending on whether large amounts of algal material, bryophyte or detrital material are present.

If a sample contains large numbers of single taxa (e.g. >1000 chironomids), or large numbers of organisms in a given fraction, sub-sampling can be performed for those organisms or fractions independently and the remainder of the sample sorted completely.

When undertaking a laboratory sub-sampling regime for a given project, error associated with sub-sampling technique should be estimated. This can be accomplished by continuing to sort sub-samples until the entire sample is sorted for a minimum of 10% of all samples. This is especially important if different, but sample appropriate, sub-sampling protocols are undertaken on samples from different areas or stations.

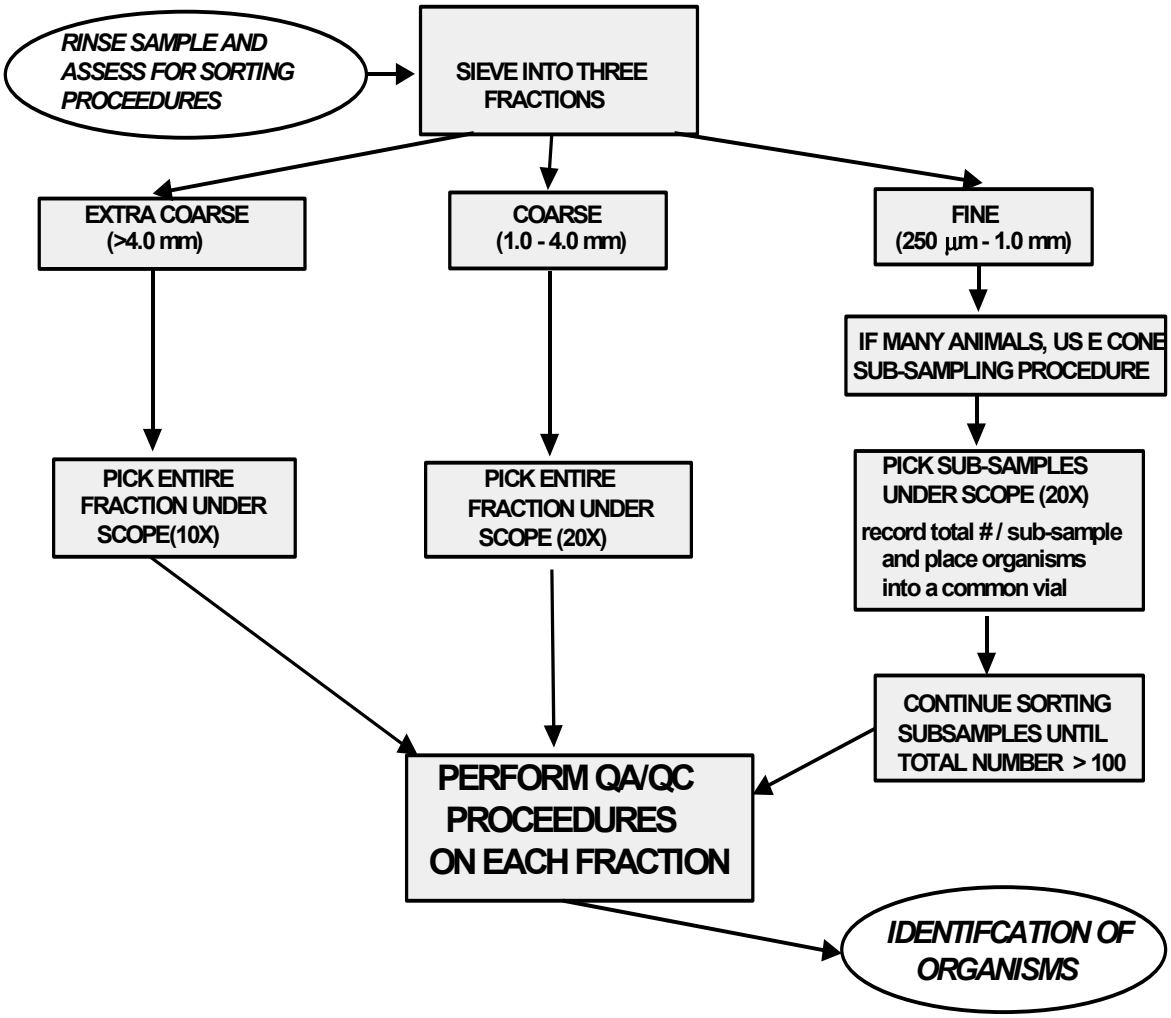
Careful note taking is recommended for these laboratory sub-sampling procedures so that the accuracy of the calculations of total density and other metrics is not compromised.

A schematic diagram of a sorting and sub-sampling protocol is provided in Figure G-1. This is an illustrative example only which should be modified according to the type of material and the number of organisms in the sample. For example, some sub-sampling protocols are not applicable for samples with large amounts of algae or if organisms are not abundant. The example depicted in Figure G-1 would be applicable for samples which have large pieces of detrital material (e.g., leaves or small branches) and hence the fractionation speeds the sorting procedures and large numbers of small organisms which would be concentrated into the fine fraction (250µm -1.00mm). Each laboratory should outline sample-specific sorting and sub-sampling procedures and provide full documentation of the methods used.

G1.2 QA/QC FOR BENTHIC INVERTEBRATE LABORATORY OPERATIONS

Ecological sample processing involves, as a first step, sorting of organisms from debris and, possibly, sub-sampling sorted organisms for detailed identification. Inevitably, processing errors are associated with these activities and must be estimated (e.g. Kreis 1986, 1989). Verification of sorting efficiency is easily performed on a spot-check basis if the leftover debris from a sample is retained. It is recommended that at least 10 % of all samples be resorted, and that the criteria for an acceptable sort be that ~ 10% of the total number of organisms were missed. If > 10% of the total number is found during the resort, then all the samples within that group of samples requires resorting. The factors which should be considered when determining similar groups of samples include: 1) sampling area, 2) habitat class, and 3) individual sorters. A further criterion which would require a resort is if an entire taxonomic group of benthic invertebrates was missed by the sorter, even if the missed organisms constituted < 10 % of the total. Unsorted and sorted fractions should be retained until taxonomy and sorting efficiency are confirmed.

Figure G-1 Benthic invertebrate sorting and sub-sampling protocol, which would be applicable for samples with large detrital material and large numbers of small organisms. This is an illustrative example only, which should be modified as necessary for station-specific samples.



G1.3 BENTHIC INVERTEBRATE SAMPLE PROCESSING METHODS

The field samples (usually three or five for each station) are processed separately. Each sample is divided into the coarse and the fine fractions. The coarse fractions are sorted completely and the fine fractions are sub-sampled independently using a modification of the sub-sampling method (Wrona *et al.*, 1982).

Pour sample into sieves (2 mm, 1 mm, 0.180 mm) and wash through well with running water to remove preservative and silt); if there is only small amounts of larger organic material, the 2 mm sieve can be omitted.

Transfer the coarse fraction (contents of the 2-mm and 1 mm sieves) into individual container and add 70 % alcohol. Label container with station number and fraction size. Now this fraction is ready for sorting.

Transfer the fine fraction (contents of 0.180-mm sieve) into 2-L container for decanting. Add warm water to the 2 L container, swirl and decant water and organic material into the 0.180 mm sieve, repeating until all organic material is washed out of the sand; then scan container under magnifying glass for heavy-shelled or stone-cased animals and pick them out; then discard sand and gravel. Transfer this fine fraction into individual container and add 70 % alcohol. Label container with station number and fraction size. Now this fraction is ready for sorting.

G1.3.1 Coarse Fraction

Sort out all organisms from the coarse fraction by the "grid method" and place them into properly labeled vials (if there are large numbers of Ephemeroptera, Plecoptera, Trichoptera or any other group place them in a separate vial). The grid method consists of a petri dish with a gridded bottom (1 x 1-cm). Add small amounts of organic material into the petri dish and pick out all benthic invertebrates with fine (#5) forceps under ~ 6 X magnification, proceeding row by row. Once done with a dish, re-mix material and quickly re-scan to catch any animals that were missed.

In some situations there is very little organic material in the fine fractions and usually very few organisms, in which case sub-sampling as described below, is not required for the fine fractions.

G1.3.2 Fine Fraction

When there is a lot of organic material in the fine fractions and/or large numbers of organisms, a sub-sampling of the fine fractions is to be done.

Pour contents of 0.180-mm fraction container into the Imhoff cone and ensure that all material is transferred from the container. Fill the cone to the 1-L mark with diluted alcohol and allow bubbling for about 5 minutes to ensure thorough mixing. Remove ten 25-ml sub-samples from the Imhoff cone with the 25-ml sub-sampler container and pour into gridded petri dishes (total volume of 250 ml removed). Examine each 25 ml sub-sample under the microscope (~12 X magnification) and go through each petri dish twice.

Generally, the recommended portion to sub-sample is a minimum of one-quarter (250-ml). However, if very large numbers of organisms are present the following guidelines are provided:

- if each 25 ml sub-sample contains 35-50 organisms, then do all ten 25 ml sub-samples (total volume of 250 ml);
- if each 25 ml sub-sample contains 50-75 organisms, then do eight 25 ml sub-samples (total volume of 200 ml;

- if each 25 ml sub-sample contains 75-100 organisms, then do five 25 ml sub-samples (total volume of 125 ml;
- if each 25 ml sub-sample contains 100-150 organisms, then do four 25 ml sub-samples (total volume of 100 ml;
- for samples with very large number of organisms – if each 25 ml sub-sample contains >150 organisms, contact the project manager for confirmation, prior to doing two 25 ml sub-samples (total volume of 50 ml); and
- for samples with very few organisms – if each 25 ml sub-sample contains less than 35 organisms, then do twenty 25 ml sub-samples (total volume 500ml).

Place the sorted and the unsorted material from the sub-samples into a container for archiving and label them properly.

Return all sorted organisms, and archived sorted and unsorted samples to the Project Manager.

G1.3.3 Hints on sub-sampling

G1.3.3.1 Coarse Fraction

If there is a lot of material (takes more than 3-4 h to pick through), add the entire coarse fraction to a petri dish, distribute it evenly, and use an L-shaped piece of plastic to delineate a quarter of the dish and remove a quarter of the coarse fraction for sorting. The sorted and unsorted detritus should be dried and weighed to determine the exact amount sorted.

Other methods, such as evenly distributing the coarse fraction (after removing the water with a sieve) on a gridded surface (e.g. 4x4 grid) and randomly picking a sufficient number of cells on the grid to add up to ¼ of the sample (4 for this example) are also acceptable. At least 1/4 of the coarse fraction should be sorted.

G1.3.3.2 Fine Fraction

If the amount of material is low, sort the entire fine fraction. If there is a lot of material, sub-sample it using cone with bubbler (Wrona *et al.* 1982), method described above. Aim for sorting a minimum of a quarter of the fine fraction, or for removing at least 100 individuals of the dominant animals (at the level of genus or Chironomidae subfamily/tribe). Staining of the fine fraction (with haematoxalin or rose bengal) will improve sorting quality.

G1.3.3.3 Lake Samples with Large Amount of Debris

Some modification to the protocol is made if the sample consists of a large amount of material. For example, I can use 3 large sieves (4-mm, 2-mm and 0.5-mm). Contents of the 4-mm and 2-mm sieves can be examined under a magnifying glass for larger organisms. Content of 2-mm sieve is also examined under the microscope (6 X magnification). Fine fraction (content of 0.5-mm sieve) is transferred into a container

with ~50% alcohol and then into a 10 L pail with warm water. Floating material is skimmed off and examined under the microscope (12 X magnification). This process is repeated ~3 times. Fine fraction then is further sub-sampled, but only 1/10th or 1/20th of the material is sorted due to the large amount of material.

G1.4 IDENTIFICATION

Once the field sub-samples have been sorted, they are ready for the identification. All organisms should be identified to the lowest practical taxonomic level (genus or species wherever feasible) using current literature and nomenclature.

Level of taxonomic identification

Group	Level
Nematoda	Phylum
Oligochaeta	Family
Gastropoda	Genus/Species
Turbellaria	Family
Hirudinea	Species
Mollusca	Genus/Species
Hydracarina	Leave at this level
Cladocera	Leave at this level
Copepoda	Order
Ostracoda	Leave at this level
Amphipoda	Genus
Insecta	Genus/Species
Terrestrial	Leave at this level

The level of taxonomy should be consistent in each major group for all samples from a survey and from survey to survey. Organisms that cannot be identified to the desired level of taxonomic precision should be reported as a separate category (at the finest level of taxonomic resolution possible).

Organisms that require detailed microscopic examination for identification (e.g., Chironomidae and Oligochaeta) will be mounted onto microscope slides using an appropriate mounting medium (e.g. Canada balsam, Permount, Hohers's). The commonest species may be distinguishable on the basis of gross morphology and may require only a few mounts (5-10) as checks. All rare or less commonly occurring species are mounted for identification.

A reference collection (if required) is prepared of all taxa identified from the samples. These collections are retained for taxonomic verification, ensuring consistent taxonomy and for quality control checks.

APPENDIX H

Fish Population Component

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APPENDIX H

FISH POPULATION COMPONENT

H1.0 COMMON AND SCIENTIFIC NAMES FOR FISH SPECIES CAPTURED IN THE 2004 RAMP FISHERIES PROGRAM

Table H-1 Common and Scientific Names for Fish Species Captured in the 2003 RAMP Fisheries Program.

Common Name	Scientific Name	Code
Arctic grayling	*Thymallus arcticus*	ARGR
brook stickleback	*Culaea inconstans*	BRST
cisco	*Coregonus artedii*	CISC
emerald shiner	*Notropis atherinoides*	EMSH
flathead chub	*Platygobio gracilis*	FLCH
goldeye	*Hiodon alsoides*	GOLD
lake chub	*Couesius plumbeus*	LKCH
lake whitefish	*Coregonus clupeaformis*	LKWH
longnose dace	*Rhinicthys cataractae*	LNDC
longnose sucker	*Catostomus catostomus*	LNSC
mountain whitefish	*Prosopium williamsoni*	MNWH
northern pike	*Esox lucius*	NRPK
pearl dace	*Semotilus margarita*	PRDC
slimy sculpin	*Cottus cognatus*	SLSC
spoonhead sculpin	*Cottus ricei*	SPSC
spottail shiner	*Notropis hudonius*	SPSH
trout-perch	*Percopsis omiscomaycus*	TRPR
walleye	*Sander vitreus*	WALL
white sucker	*Catostomus commersoni*	WHSC
yellow perch	*Perca flavescens*	YLPR

H2.0 EXTERNAL PATHOLOGY CODES FOR FISH EXAMINATION

Table H-2 External Pathology Codes for Fish Examination.

Variable	Variable Condition	Code	Pathology Index Value
eyes	no aberrations; good "clear" eye	N	0
	blind; an opaque eye (one or both)	B	30
	swollen, protruding eye (one or both)	E	30
	hemorrhaging or bleeding in the eye (one or both)	H	30
	missing one or both eyes	M	30
	other; any condition not covered above	OT	30
gills	normal; no apparent aberrations	N	0
	frayed; erosion of tips of gill lamellae resulting in "ragged" gills	F	30
	clubbed; swelling of the tips of gill lamellae	C	30
	marginate; gills with light, discoloured margin along tips the lamellae	M	30
	pale; very light in colour	P	30
	other; any condition not covered above	OT	30
pseudobranchs	normal; flat, containing no aberrations	N	0
	swollen; convex in aspect	S	30
	lithic; mineral deposits, white, somewhat amorphous spots	L	30
	inflamed; redness, hemorrhage, or other	I	30
	other; any condition not covered above	OT	30
thymus	no hemorrhage	0	0
	mild hemorrhage	1	10
	moderate hemorrhage	2	20
	severe hemorrhage	3	30
skin	normal; no skin aberrations	0	0
	mild skin aberrations	1	10
	moderate skin aberrations	2	20
	severe skin aberrations	3	30
fins	no active erosion	0	0
	light active erosion	1	10
	moderate active erosion with some hemorrhaging	2	20
	severe active erosion with hemorrhaging	3	30
opercle	no shortening	0	0
	mild shortening	1	30
	severe shortening	2	30

Table H-2 (cont'd.)

Variable	Variable Condition	Code	Pathology Index Value
hindgut	normal; no inflammation or reddening	0	0
	slight inflammation or reddening	1	10
	moderate inflammation or reddening	2	20
	severe inflammation or reddening	3	30
body deformities	None	none	0
	any deformity (provide details)	n/a	30
mesenteric fat	None	0	n/a
	< 50 % coverage of mesentery	1	n/a
	50 % coverage of mesentery	2	n/a
	> 50 % coverage of mesentery	3	n/a
	100% of mesentery covered	4	n/a
liver	normal; solid red or light red colour	A	0
	"fatty" liver; "coffee with cream" colour	C	30
	nodules in the liver; cysts or nodules	D	
	focal discolouration; distinct localized colour changes	E	30
	general discolouration; colour change in whole liver	F	30
	other; any condition not covered above	OT	30
spleen	normal; black, very dark red, or red	B	0
	granular; rough appearance of spleen	G	30
	nodular; containing fistulas or nodules of varying sizes	D	30
	enlarged; noticeable enlarged	E	30
	other; any condition not covered above	OT	30
gall bladder	Normal	0	0
	enlarged	1	30
	Parasites	2	n/a
kidney	normal; firm dark red colour, lying relatively flat along vertebral column	N	0
	swollen; enlarged or swollen wholly or in part	S	30
	mottled; gray discolouration	M	30
	granular; granular appearance and texture	G	30
	urolithiasis/nephrocalcinosis; white/cream mineral material in tubules	U	30
	other; any condition not covered above	OT	30
parasites	no observed parasites	0	0
	few observed parasites	1	10
	moderate parasite infestation	2	20
	numerous parasites	3	30

H3.0 SAMPLING AND HANDLING PROTOCOLS FOR OPPORTUNISTIC FISH TISSUE ANALYSIS

H3.1 BACKGROUND

Preliminary information from several sources, including a study completed for RAMP by Golder Associates on potential contaminants in traditional foods consumed by First Nations people, has identified elevated mercury levels in food fish caught within the RAMP study area. Although most chemical tests show that fish from the Athabasca River and other waterbodies in the study area are safe for human consumption, First Nations and other regular consumers of fish have concerns with respect to mercury contamination.

RAMP currently includes sampling for contaminants in fish tissue collected from the Athabasca River and the Muskeg River. However, a number of lakes in the project area support important First Nations fisheries and a need has been identified for contaminant testing on fish from these waterbodies to ensure that they are safe for human consumption. In this regard, a preliminary testing program was established in 2002 that involves mercury testing of fish tissue collected from lakes on an opportunistic basis. Plans are for this activity to continue with financial and logistical support from RAMP as available, but there is a need to provide further clarification on sampling protocols to ensure that data generated from the samples are of high quality and satisfy program objectives. Therefore, a conference call meeting of the RAMP Fisheries Group was held on January 17, 2003 to discuss and reach a consensus on appropriate sampling protocols. The draft program objectives and sampling protocols are provided below.

H3.2 PROGRAM OBJECTIVES

- To undertake a long-term opportunistic testing program designed to identify potential mercury and possibly other metal contamination in fish tissues collected from lakes located within the RAMP study area;

- To assist First Nations groups and other stakeholders to interpret and understand the results of the testing program, particularly with respect to fish consumption and potential human health risks; and

- To involve First Nations groups as appropriate in program design and implementation.

H3.3 GENERAL SAMPLING PROTOCOLS

- Fish sampling activities will be conducted on an opportunistic basis, although further input will be requested from First Nations groups concerning their priority lakes. Fish from Lake Athabasca will not be included in the testing program since the Freshwater Fisheries Marketing Corporation (FFMC) has an ongoing contaminant testing program for fish caught in the Lake Athabasca fishery. The RAMP Fisheries Group will undertake to obtain the FFMC data for comparative purposes.

- The testing of primary food fish species will be the priority. The primary food fish species include northern pike, walleye and lake whitefish.

- Where possible First Nations and/or other local people will be directly involved in sample collection. This will provide opportunities for technology transfer and skills development, and hopefully enhance local confidence in the data generated by the program.

- A sampling kit, including appropriate equipment items (e.g. dissection kit, fish measuring board, and sample containers) and a detailed description of sampling procedures, will be provided to interested local groups/individuals. As appropriate, on-site training on the use of the kit and effective QA/QC, will be provided to local participants by RAMP personnel.

- The first round of tissue testing will be carried out on fish previously collected from Lake Claire.

H3.4 SPECIFIC SAMPLING AND HANDLING PROTOCOLS

- For each lake sampled, collect 10 fish of each food fish species.

- All fish should be in the size range normally used for human consumption. Generally, these are the larger fish.

- An appropriate data recording system must be developed that ensures information on the waterbody sampled, date and time of sampling, fish species, fish number, length, and other required parameters is recorded accurately during each sampling event.

- Measure and record the fork length in millimetres of each fish sampled. If a set of scales is available determine and record the weight of each fish.

- Remove and bag the tail section of each fish collected. These constitute the bulk samples, which are further processed in the laboratory. The tail section is located between the last rib and the end of caudal peduncle.

- All samples are to be individually bagged and labeled, and cutting implements are to be washed between the sampling of each fish.

- All fish samples are to be shipped COD to the Hatfield Consultants Ltd. representative in Fort McMurray for transfer to the analytical laboratory.

- In the laboratory, the following tissue will be sampled from the set of 10 fish per species:

    - From the three largest fish, individual tissue samples will be collected and analyzed for mercury (total of 3 samples);

    - Two groups of 5 fish will be derived from the 10 available fish (including the 3 largest fish sampled above). Efforts should be made to duplicate the size range between groups. For each group, tissue samples

will be taken from each fish and pooled with samples from fish of the same group. This will result in 2 composite samples that will be analyzed for mercury; and

- Finally, a tissue sample will also be collected from each of the 10 fish (in addition to the samples collected above) and archived pending possible future analysis.

- A lake-specific follow-up testing program may be needed if elevated mercury levels are found in any of the samples. An elevated level is defined by the Health Canada guideline for mercury of 0.2 mg/kg (subsistence consumption) divided by the number of fish in the composite sample.

- Results from the mercury testing program will be compiled and analyzed by Hatfield Consultants Ltd. and a brief interpretive report will be prepared for the RAMP Fisheries Group. The RAMP Fisheries Group would then make the results known to the local stakeholders as appropriate.

H4.0 DECISION FRAMEWORK AND FIELD PROTOCOLS FOR OPERATION OF THE MUSKEG RIVER FISH FENCE, 2003

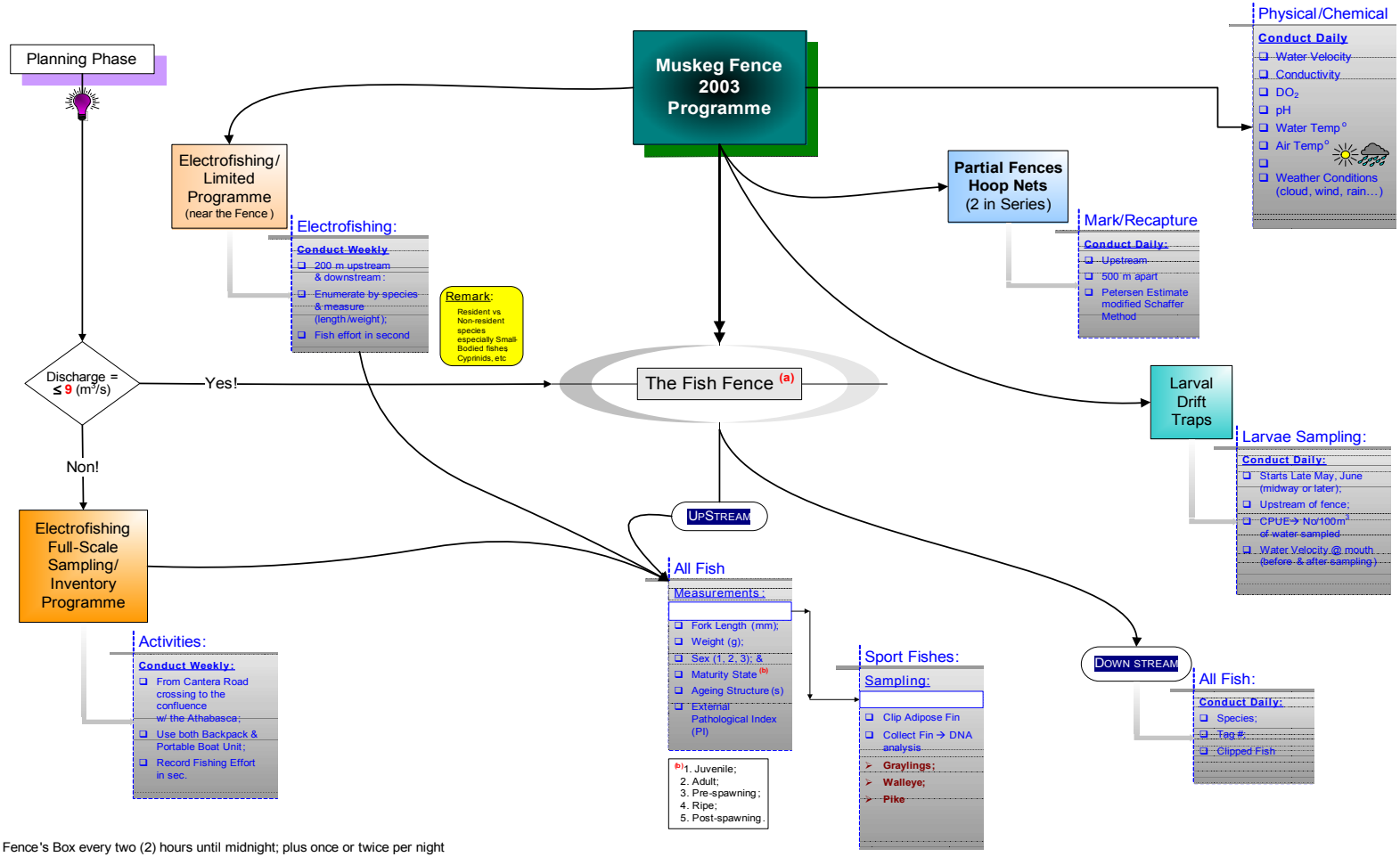
H4.1 BACKGROUND

In order to meet its long-term monitoring objectives it is essential that RAMP have access to high quality environmental baseline data on all designated waterbodies within the project area. Fisheries is one of the core components of RAMP and will be implemented consistently over time to evaluate the health and sustainability of fish resources within the Oil Sands Region. Monitoring activities in the Fisheries Program will focus on the Athabasca River, as well as tributaries potentially influenced by current or future oil sands development. The Muskeg River has been designated as an important tributary system due to its proximity to various existing and proposed oil sands developments and its importance to the local community. Therefore, accurate information on fish and fish habitat in the watershed is needed to support impact monitoring and follow-up initiatives.

The operation of a spring fish fence near the mouth of the river has been identified as a viable method of acquiring a wide range of data on adult spawning populations that use the Muskeg drainage. The fish fence, which is a repeatable survey method, will provide quantitative and qualitative data on major large-bodied fish species, including Arctic grayling, northern pike, walleye, longnose sucker and white sucker. Several previous efforts at installing and operating a fish fence on the lower Muskeg River have been carried out under RAMP. Historically, the success of a spring fish fence on the Muskeg River has been limited due to a variety of factors including low and high water levels, instability of the fence from scouring and erosion, large beaver dams limiting spawning run movement, and late ice conditions. Early spring spawning migrations by Arctic grayling, often under ice, also presents a challenge for accurately monitoring fish species. In this regard, appropriate planning and design initiatives are needed in order to minimize risk for future fish fence installations.

This document provides specific guidance on operating protocols for the Muskeg River fish fence study to be carried out in 2003. Protocols developed for subsequent fish fence projects, either on the Muskeg or other designated rivers in the project area, will build on this material by incorporating lessons learned from previous projects and information on current methodology.

Contribution to Baseline Knowledge on Fish Populations in the System in support of Long -term Env. Monitoring & Follow-up actions



[x] Check Fence's Box every two (2) hours until midnight; plus once or twice per night depending on migration patterns

H4.2 OBJECTIVES

The overall goal of the RAMP Muskeg River fish fence initiative is: to make a significant contribution to baseline knowledge on fish populations in the system in support of long-term environmental monitoring and follow-up actions in the Oil Sands Region.Specific objectives of the fish fence project are:

- to generate ongoing data on the biology and movement of large bodied fish species that use the Muskeg River drainage;
- to use these data to assist in the identification and quantification of local and regional environmental impacts/effects in the Muskeg watershed; and
- to create an opportunity for the provision of practical, hands-on training in the installation and operation of a fish fence and other fish sampling techniques for local First Nations personnel and other appropriate local people (e.g., community college students, RAMP members).

H4.3 GENERAL OPERATIONAL PARAMETERS

- As a preliminary planning step a screening level hydrological assessment to predict the spring discharge of the Muskeg River based on snow pack levels will be conducted around the end of March. If the discharge is predicted to be > 9 m^3/s, then the RAMP Fisheries management team will make a decision on whether the full fish fence program will be cancelled and replaced with two partial fences (hoop nets).
- If discharge is predicted to be ≤ 9 m^3/s, planning will proceed for the installation of a full fish fence. Discharge levels will be evaluated in the field to confirm they are ≤ 9 m^3/s and an on-site decision will be made as to whether a full or partial fence should deployed.
- During the first year of the full fish fence (2003), two partial fish fences consisting of hoop nets will also be set-up to evaluate and compare both approaches for quantifying the spawning run. The hoop nets will be used to carry out a mark-recapture study to estimate population sizes (Petersen/modified Schaffer method). The hoop nets will be sited upstream of the fish fence at locations to be determined by the field manager.
- The 2003 fish fence program will also include the use of larval drift traps to assess their potential usefulness as a tool for estimating fish abundance (particularly grayling). A primary objective during the first year of larval trapping will be to establish the timing of downstream drift for each fish species relative to the timing of upstream migration. It will be important to collect catch per unit effort (CPUE) data (fish per 100 m^3 of water sampled) to assess the feasibility of using this method for conducting meaningful abundance estimates. The traps will be deployed upstream of the fish fence during the later part of May or early June.

- If the discharge is too high to safely and effectively run partial fish fences, then an electrofishing (backpack, or portable boat units) inventory will be conducted from the Cantera Road crossing to the confluence with the Athabasca River. Depending on the time available to the field crew, a limited electrofishing program will be conducted in the vicinity of the fish fence to provide information on resident and non-resident fish, particularly small-bodies species, which will not be captured at the fence.

- In order to capture the largest possible portion of the spring spawning run and to enhance the probability of capturing migrating Arctic grayling, the fish fence and the other sampling gear will have to be in-place immediately after ice-out. Timing will vary from year to year, but based on historical data the earliest fence installations have occurred during the last week in April. Therefore, the fence and crew will be available for project start-up by early April. HCL personnel in Fort McMurray can provide regular updates on flow conditions based on field observations.

- During a previous reconnaissance study it was decided that Site #3 (see Figure H-1 below) is the preferred location for fence installation. This site is located on the Muskeg River approximately 0.8 km upstream from its confluence with the Athabasca River at the following UTM coordinates: Zone 12 Easting 464030 Northing 6332063. A decision final site location will be made by the Field Manager.

Figure H-1 RAMP climate monitoring 2003.

H4.4 SPECIFIC OPERATIONAL PROTOCOLS FOR ALL FISH FENCE PROGRAM ELEMENTS

Fish Fence:

- Water quality field parameters, including water velocity, conductivity, dissolved oxygen and pH, and the maximum and minimum air and water temperatures (using max-min thermometers) are to be recorded daily during fence operations.

- It is assumed that the field crew will be camping at the fence site for most of the sampling program. Therefore, each day, the trap boxes are to be checked for fish every two hours during daylight hours, as well as once or twice during the night, depending on the pattern of fish migration. The Field Manager will determine the frequency of nighttime checks.

- All fish captured in the traps are to be enumerated by species, date, time and direction of movement (upstream or downstream), as well as measured, including fork length in millimetres and weight in grams. When discernible from external examination, life stage (juvenile or adult), sex and state-of-maturity (pre-spawning, ripe or post-spawning) are also to be recorded. Non-lethal ageing structures are also to be taken (according to MacKay *et al.* 19901) from all fish caught.

- Tag all sport fish (pike, walleye), with the exception of Arctic grayling, captured using RAMP Floy tags and ensure that appropriate data recording is carried out so that fish can be properly identified if they are recaptured.

- The adipose fin on all grayling will be clipped for identification and archived in individually labeled envelops pending future DNA analysis.

- Floy tag the first 50 longnose and the first 50 white suckers captured each day, and fin clip all suckers so that fish captured more than once can be identified.

- Examined all fish for any external abnormalities or pathological conditions to provide an external Pathological Index (PI).

- Ensure that all fish are then released to continue migrating past the fish fence site in the direction they were moving when captured.

- Record tag and fin clip information from fish captured in the downstream trap box.

- Practice appropriate fish handling procedures at all times when processing fish captured in the trap boxes.

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[1] MacKay, W.C., G.R. Ash and H.J. Norris. (eds.). 1990. Fish Ageing Methods for Alberta. RL&L Environmental Services Ltd., in association with the Alberta Fish and Wildlife Division and the University of Alberta. Edmonton, AB. 113 pp.

- As indicated above, a limited electrofishing program will be carried out in conjunction with fish fence operation. Depending on instream flow conditions, electrofishing will be conducted on a weekly basis for the duration of the fish fence program in an area 200 m upstream and downstream of the fence. All fish captured will be enumerated by species and measured (length and weight). Fishing effort in seconds will also be recorded from the electrofishing unit.

- The HCL Field Manager will consult with the Fisheries Program Manager and the Fisheries Group to determine the timing for removal of the fish fence and hoop nets.

Hoop Nets:

- The two hoop nets will be deployed in series upstream of the fish fence approximately 500 m apart, and will remain in the river for the duration of the fish fence program.

- A mark recapture approach will be used to generate an estimate of migrating fish populations.

- Each day the nets will be checked for fish every two hours and tag and fin clip information recorded for each fish captured. Any debris accumulated on/in the nets or the wings will be removed.

- Any fish captured in the downstream hoop net that are not tagged are to be tagged and measured as described in the previous section (i.e. species, length, weight, external examination).

- Ensure that all fish are released unharmed and that appropriate data recording is carried out for the duration of the study.

- The HCL Field Manager will be responsible for removing the nets if there are problems with excessive stream flows or debris.

Drift Traps:

- Three or four drift traps will be installed at a site just upstream from the fish fence during the final week or two of the fish fence program (starting approximately mid May).

- Ensure that the traps are fully submerged and that accumulated debris in or on the traps is removed on a regular basis.

- Traps are to be checked for larval fish once per day, usually in the morning. Trap mouth water velocity is to be measured before and after taking each sample.

- Drift samples are to be preserved appropriately and sample containers labeled as specified. If possible, it is recommended that a preliminary sort of samples be carried out in the field in an effort to remove most of the extraneous material prior to preservation and storage.

- The HCL Field Manager will be responsible for removing the traps if there are problems with excessive stream flows or debris accumulation.

Electrofishing:

- In the event that the full or partial fish fence installations are unsuccessful, an electrofishing inventory will be carried out to provide some basic presence/absence and catch per unit effort (CPUE) data on spring spawning migration in the Muskeg River.

- A portable boat electrofishing unit will be deployed for this inventory, which will be conducted from the Cantera Road crossing downstream to the confluence with the Athabasca River.

- Sampling will be carried out three times over a three-week period in May.

- All fish captured will be Floy tagged and processed as specified above (i.e. species, length, weight and external examination) and released unharmed.

- The adipose fin on all grayling will be clipped and archived in individually labeled envelops pending future DNA analysis.

- In order to avoid or reduce injuries and mortalities, appropriate fish handling procedures will be practiced at all times.

H4.5 EQUIPMENT AND SUPPLIES

A comprehensive equipment checklist should be developed well in advance of the field program start-up date. Major equipment items and supplies required for operation of the fish fence include the following:

- All fish fence components, including T-bars and sandbags.

- Tools and equipment for installation and maintenance of the fence.

- Three hoop nets (two for installation and one backup) and associated hardware for partial fence installation.

- Five drift nets (three or four for installation and one or two as backup) and associated hardware for installation.

- Electrofishing units to be used as backup to the fence and in other concurrent fisheries activities. This may include one backpack shocker and one portable unit designed for stream float downs.

- Fish measuring boards and weigh scales.

- Dip nets and plastic tubes for fish handling at the fence and hoop nets.

- Instruments for acquiring non-lethal aging structure and DNA samples.

- Ramp Floy tags and associated equipment.
- Containers, preservatives and labels for larval fish samples.
- Water quality testing equipment.
- Flow meter for stream discharge measurements and assist in determining larval trapping CPUE.
- Small inflatable boat for use during fence installation.
- Comprehensive first aid kit.
- Dry or wet suits, as well as chest waders for instream work on fence installation, maintenance and operation.
- Viewing box for instream use.
- Tool kit containing appropriate tools and hardware.

H4.6 PERSONNEL REQUIREMENTS

Personnel from North/South Consultants Inc. in collaboration with Hatfield Consultants Ltd. (HCL) have been assigned the responsibility for designing and manufacturing the fish fence that will be used on the Muskeg River. This activity is currently underway and the fence components should be in Fort McMurray and ready for installation before the end of March 2003. HCL and North/South will also provide on-site personnel for the installation and initial operation of the fish fence. In this regard, it is anticipated that one North/South staff member with appropriate experience in fish fence installation and operation will be on site for approximately three to four days to oversee instream works and ensure that the fence is functioning effectively. It is expected that the fish fence will be operational for about one month.

Once the fence is operational, it will be monitored by a two-person crew. The crew will consist of one HCL Field Manager who will be responsible for coordinating all aspects of fence operation and one fisheries technician (a second technician may be required for some activities such as electrofishing). The technician position can be filled on a continuous or rotating basis from the following groups:

- *As available, local First Nations will supply at least one Fisheries Technician to assist in monitoring the fence.*
- *Students from Keyano College in Fort McMurray will be welcome to assist in fence deployment and monitoring activities as part of their practicum requirement.*
- *Volunteers (e.g., DFO, ATC, ASRD, ALPAC, RAMP member companies) could also participate.*

Major responsibilities of the HCL Field Manager include the following:

- Coordinate all day-to-day activities associated with operation of the fence;
- Supervise technician(s) assisting with fence monitoring activities;
- In consultation with the RAMP fisheries management team, make decisions concerning the safety and integrity of the fence and whether it should be removed or relocated;
- In consultation with the RAMP fisheries management team, decide on and engage alternative sampling method in the event that the fence is removed; and
- Supply weekly reports to the Fisheries Group on fence operation.

H4.7 SAFETY CONSIDERATIONS

Installation and operation of the fish fence involves intensive instream activities that will be carried out by the field crew under a range of flow conditions. There are a number of potential safety concerns associated with these activities and it is important that field personnel are provided with appropriate operating procedures that ensure a safe working environment. Important procedural considerations are as follows:

- *The HCL Field Manager is responsible for on-site safety and has the power to remove the fence or restrict its operation if there are related safety concerns;*
- *Ensure that all existing applicable RAMP Health and Safety Operating Procedures are followed as appropriate;*
- *The Field Manager will have a functioning cellular telephone with him at all times for emergency use and to communicate with the RAMP Fisheries Manager;*
- *At least one person on the field crew should have WCB Level 1 first aid certification or high.*
- *At least one person on the electrofishing crew should have appropriate electrofishing certification (BC or Alberta);*
- *Project personnel are to wear appropriate safety gear (e.g., wet/dry suits, chest waders, gloves, etc.) when carrying out their assigned duties at the fence;*
- *A comprehensive first aid kit will be kept on site for the duration of fish fence operation; and*
- *Proper procedures, as defined by the Field Manager, will be used for installation and maintenance of the fish fence, as well as for fish removal and processing.*

H4.8 LOGISTICS

The fish fence will be fabricated in Winnipeg, and the North/South Fisheries Technician/Biologist will transport the fence and associated materials by truck to Fort McMurray. Ideally helicopter support will be available to move the fence materials and other field equipment/supplies into the Muskeg River site. In this regard, there may be opportunities to coordinate helicopter use with other RAMP programs. At the termination of the fish fence program all materials will be removed by helicopter.

Accommodation for the field crew will be on-site camping. Although there are obvious limitations to creature comforts, there are a number of advantages to camping, including general operating efficiencies, elimination of vandalism/theft problems, and facilitation of nighttime fence monitoring. Hopefully a rotating staffing schedule can be arranged that allows for a maximum of one week on-site followed by several days off in Fort McMurray.

Logistical arrangements will need to be further refined once more site-specific information is available.

H5.0 SENTINEL SPECIES MONITORING SITE HABITAT DATA SHEETS

Please see attached data sheets.

AQUATIC HABITAT SITE DATA

Hatfield CONSULTANTS LTD

Referencing Information	
Project Name:	RAMP Sentinel Sp.
Project Number:	RAMP 1110-3101
Waterbody Name:	Muskeg River
Site Type:	Exposure
Date:	Aug. 6/04
Time:	16:00
Crew Members:	AS / WG / CT
Site Length (m):	80
Site UTM:	12. 463927. 6332188
Access:	Truck

Cover	
Total Cover:	Trace Amounts
Dominant Cover Type:	Deep Pool
Secondary Cover Type:	Boulder
Functional LWD:	Few
Functional SWD:	None
Bank Shape:	Sloping
Bank Texture:	Fine
Riparian Vegetation:	Stable Mixed Forest
Vegetation Stage:	Young/Mature Forest
Instream Vegetation:	None
Crown Closure (%):	1-20

Water Quality	
Temperature (°C):	14
Conductivity (uS/cm):	380
Dissolved Oxygen (mg/L):	8.9
Visibility:	Clear

Channel Characteristics		
Avg. Channel Width (m):		21.6
Avg. Wetted Width (m):		10.9
Gradient (%):		1.5
Stage:		Low
Average Velocity (m/s):	*Riffle*	0.79
	Glide	0.53

Channel Morphology	
Dominant Bed Material:	Gravel
Sub-Dom. Bed Material:	Cobble
Flood Signs:	Debris
Pattern:	Irregular Meandering
Islands:	None
Bars:	Mid-stream
Confinement:	Confined
Disturbance Indicators:	LWD Orientation
D95 (cm):	35-40
Morphology:	Riffle-Pool

Comments

Sampling conducted in the immediate vicinity of the 2003 fish fence site

Looking Upstream at Site

Looking Downstream at Site

AQUATIC HABITAT SITE DATA

Hatfield CONSULTANTS LTD

Referencing Information

Project Name:	RAMP Sentinel Sp.
Project Number:	RAMP 1110-3101
Waterbody Name:	Steepbank River
Site Type:	Reference
Date:	Aug. 8/04
Time:	14:00
Crew Members:	AS / CT / WG
Site Length (m):	48
Site UTM:	12. 479536. 6316239
Access:	Helicopter

Cover

Total Cover:	Trace Amounts
Dominant Cover Type:	Boulder
Secondary Cover Type:	Deep Pool
Functional LWD:	Few
Functional SWD:	None
Bank Shape:	Sloping
Bank Texture:	Fine
Riparian Vegetation:	Stable Mixed Forest
Vegetation Stage:	Young/Mature Forest
Instream Vegetation:	None
Crown Closure (%):	0

Water Quality

Temperature (°C):	10
Conductivity (uS/cm):	280
Dissolved Oxygen (mg/L):	10.2
Visibility:	Clear

Channel Characteristics

Avg. Channel Width (m):		28.2
Avg. Wetted Width (m):		21.4
Gradient (%):		1.5
Stage:		Low
Average Velocity (m/s):	*Riffle*	0.51
	Glide	0.22

Channel Morphology

Dominant Bed Material:	Cobble
Sub-Dom. Bed Material:	Boulder
Flood Signs:	Debris
Pattern:	Irregular Meandering
Islands:	None
Bars:	Mid-stream
Confinement:	Confined
Disturbance Indicators:	LWD Orientation
D95 (cm):	45
Morphology:	Riffle-Pool

Comments

Looking Upstream at Site

Looking Downstream at Site

AQUATIC HABITAT SITE DATA

Hatfield CONSULTANTS LTD

Referencing Information	
Project Name:	RAMP Sentinel Sp.
Project Number:	RAMP 1110-3101
Waterbody Name:	Steepbank River
Site Type:	Exposure
Date:	Aug. 12/04
Time:	10:00
Crew Members:	AS / CT
Site Length (m):	73
Site UTM:	12. 471458. 6319948
Access:	Helicopter

Cover	
Total Cover:	Trace Amounts
Dominant Cover Type:	Deep Pool
Secondary Cover Type:	Boulder
Functional LWD:	Few
Functional SWD:	None
Bank Shape:	Sloping
Bank Texture:	Fine
Riparian Vegetation:	Stable Mixed Forest
Vegetation Stage:	Young/Mature Forest
Instream Vegetation:	None
Crown Closure (%):	1-20

Water Quality	
Temperature (°C):	13
Conductivity (uS/cm):	350
Dissolved Oxygen (mg/L):	9.8
Visibility:	Clear

Channel Characteristics		
Avg. Channel Width (m):		21.3
Avg. Wetted Width (m):		12.6
Gradient (%):		1.5
Stage:		Low
Average Velocity (m/s):	*Riffle*	0.84
	Glide	0.41

Channel Morphology	
Dominant Bed Material:	Gravel
Sub-Dom. Bed Material:	Cobble
Flood Signs:	Debris
Pattern:	Irregular Meandering
Islands:	None
Bars:	Mid-stream
Confinement:	Confined
Disturbance Indicators:	LWD Orientation
D95 (cm):	65
Morphology:	Riffle-Pool

Comments

Sampling conducted in the immediate vicinity of the power lines stream crossing to mine site

Looking Upstream at Site

Looking Downstream at Site

AQUATIC HABITAT SITE DATA

Hatfield CONSULTANTS LTD

Referencing Information

Project Name:	RAMP Sentinel Sp.
Project Number:	RAMP 1110-3101
Waterbody Name:	Horse River
Site Type:	Reference
Date:	Aug. 9/04
Time:	13:30
Crew Members:	AS / CT
Site Length (m):	40
Site UTM:	12. 427318. 6246933
Access:	Helicopter

Cover

Total Cover:	Trace Amounts
Dominant Cover Type:	Boulder
Secondary Cover Type:	Overhanging Veg.
Functional LWD:	Few
Functional SWD:	None
Bank Shape:	Sloping
Bank Texture:	Fine
Riparian Vegetation:	Stable Mixed Forest
Vegetation Stage:	Young/Mature Forest
Instream Vegetation:	Trace
Crown Closure (%):	1-20

Water Quality

Temperature (°C):	10
Conductivity (uS/cm):	180
Dissolved Oxygen (mg/L):	9.8
Visibility:	Clear

Channel Morphology

Dominant Bed Material:	Cobble
Sub-Dom. Bed Material:	Gravel
Flood Signs:	Debris
Pattern:	Irregular Meandering
Islands:	None
Bars:	Mid-stream
Confinement:	Confined
Disturbance Indicators:	LWD Orientation
D95 (cm):	45
Morphology:	Riffle-Pool

Channel Characteristics

Avg. Channel Width (m):		17.1
Avg. Wetted Width (m):		14.2
Gradient (%):		1.0
Stage:		Low
Average Velocity (m/s):	*Riffle*	0.29
	Glide	0.14

Comments

Spent two days on the river for fish sampling.

Looking Upstream at Site

Looking Downstream at Site

AQUATIC HABITAT SITE DATA

Hatfield CONSULTANTS LTD

Referencing Information

Project Name:	RAMP Sentinel Sp.
Project Number:	RAMP 1110-3101
Waterbody Name:	Dunkirk River
Site Type:	Reference
Date:	Aug. 10/04
Time:	14:00
Crew Members:	AS / CT
Site Length (m):	50
Site UTM:	12. 395846. 6302143
Access:	Helicopter

Cover

Total Cover:	Moderate Amounts
Dominant Cover Type:	Boulder
Secondary Cover Type:	Large Woody Debris
Functional LWD:	Few
Functional SWD:	None
Bank Shape:	Sloping
Bank Texture:	Fine
Riparian Vegetation:	Stable Mixed Forest
Vegetation Stage:	Young/Mature Forest
Instream Vegetation:	Vascular / Algae
Crown Closure (%):	1-20

Water Quality

Temperature (°C):	11
Conductivity (uS/cm):	220
Dissolved Oxygen (mg/L):	8.2
Visibility:	Clear

Channel Characteristics

Avg. Channel Width (m):		26.8
Avg. Wetted Width (m):		26.5
Gradient (%):		1
Stage:		Low
Average Velocity (m/s):	*Riffle*	0.79
	Glide	0.41

Channel Morphology

Dominant Bed Material:	Gravel
Sub-Dom. Bed Material:	Cobble
Flood Signs:	None
Pattern:	Irregular Meandering
Islands:	Occasional
Bars:	Mid-stream
Confinement:	Confined
Disturbance Indicators:	LWD Orientation
D95 (cm):	85
Morphology:	Riffle-Pool

Comments

Looking Upstream at Site

Looking Downstream at Site

APPENDIX I

Acid Sensitive Lakes

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Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001	2002	2003	2004	Mean	1999	2000	2001	2002	2003	2004	Mean ug/L
Nox-Sox GIS No.	Original RAMP Designation	Lab pH							Total Alkalinity (mg/L $CaCO_3$)						
168	A21	4.62	4.99	5.02	5.00	5.03	4.91	4.93	0.8	1.85	1.8	1.75	1.71	1.20	30.07
169	A24	4.40	4.63	4.80	4.74	4.76	4.87	4.70	0.0	0.55	1.2	1.03	1.13	1.30	17.33
170	A26	6.46	5.14	5.34	5.45	5.40	5.28	5.51	9.3	1.74	2.1	2.48	2.39	1.80	66.13
167	A29	5.43	5.9	5.93	5.67	5.95	5.67	5.76	2.3	3.19	3.1	3.02	3.55	2.60	59.17
166	A86	6.12	6.62		6.69	6.63	6.66	6.54	5.6	6.81		7.62	7.85	7.60	141.92
287	25				5.18	5.16	5.13	5.15				1.86	1.84	1.60	35.33
289	27				6.47	6.46	6.37	6.43				5.16	5.05	4.80	100.07
290	28				5.89	5.79	5.82	5.84				3.93	4.68	3.50	80.73
342	82				6.84	6.76	6.66	6.75				11.39	10.73	10.60	218.13
354	94				7.24	7.15	7.00	7.13				26.56	18.41	17.60	417.13
165	A42	6.89	6.49	6.66	7.01	7.07	6.95	6.85	9.9	11.33	11.3	18.57	16.89	21.80	299.07
171	A47	5.35	6.66	5.41	6.69	6.71	6.53	6.22	2.0	7.89	3.5	9.85	10.18	7.90	137.60
172	A59	4.87	5.24	6.56	5.36	5.67	5.12	5.47	2.1	3.49	6.1	3.48	4.79	3.00	76.43
223	P94				7.40	7.42	7.33	7.38				40.12	41.38	41.20	818.00
225	P96				7.41	7.43	7.14	7.33				37.53	31.18	34.30	686.73
226	P97				6.83	6.86	6.67	6.78				15.31	15.28	13.50	293.93
227	P98				7.32	7.46	7.30	7.36				35.29	34.81	33.70	692.00
267	1				7.64	7.97	7.65	7.75				46.31	42.17	42.10	870.53
452	L4	5.81	5.61	6.15	5.69	6.04	6.07	5.89	5.1	4.69	5.7	4.81	5.56	5.10	102.90
470	L7	6.29	6.58	6.70	6.08	6.36	6.46	6.41	9.0	8.66	10.1	7.07	8.39	7.50	168.93
471	L8	6.75	7.06	7.16	6.98	7.24	7.00	7.03	21.7	20.30	20.4	18.78	23.97	19.80	416.63
400	L39	6.49	6.8	6.89	6.85	6.75	6.89	6.78	11.5	11.98	12.2	9.93	9.73	11.00	220.97
268	E15		7.07	7.12	7.14	7.28	7.01	7.12		21.30	21.9	27.91	22.33	17.50	443.68
182	P23				6.87	7.34	9.27	7.83				11.90	42.91	51.00	705.40
185	P27				5.20	5.37	5.28	5.28				3.43	3.92	2.90	68.33
209	P7				6.35	6.42	6.32	6.36				7.15	8.51	6.60	148.40
270	4				8.03	8.50	8.28	8.27				81.00	78.66	68.20	1,519.07
271	6				7.87	9.46	9.44	8.92				84.53	69.57	65.30	1,462.67
418	Kearl L.					7.94	8.04	7.99					78.84	78.20	1,570.40
436	L18	6.86	7.09	7.29	7.12	7.18	7.28	7.14	19.9	20.21	20.9	21.28	21.53	22.20	419.77
442	L23	6.34	6.79	6.80	6.82	6.82	6.84	6.74	8.0	8.43	8.7	9.54	9.03	9.20	176.33
444	L25	6.51	6.87	6.91	6.63	6.85	6.89	6.78	9.0	9.95	10.5	8.55	9.17	10.50	192.03
447	L28	4.99	5.02	5.31	5.19	5.36	5.54	5.23	2.1	2.16	3.0	2.62	3.09	3.50	54.60
448	L29	3.97		4.44	4.17	4.33	4.27	4.24	0.0		0.0	0.00	0.00	0.00	0.00
454	L46	6.64	7.04	6.90	6.81	6.93	6.54	6.81	24.2	15.10	11.8	12.07	11.13	11.20	284.80
455	L47	6.69	6.82	6.76	6.78	6.93	6.66	6.77	16.0	13.34	10.7	12.25	12.81	16.60	272.33
457	L49	6.15	6.84	6.43	6.60	6.71	6.63	6.56	6.6	10.10	6.8	8.38	9.38	11.00	174.33
464	L60	6.29	6.99	7.02	6.87	7.30	7.26	6.96	9.6	11.75	16.1	15.24	16.76	18.60	293.50
175	P13				7.53	8.08	9.12	8.24				49.30	45.30	44.40	926.67
199	P49				6.76	6.64	6.66	6.69				9.17	8.73	8.60	176.67
473	A301			7.25	7.21	7.20	7.20	7.21			22.5	22.51	22.59	22.10	448.55
118	L107		7.17	7.18	7.16	7.25	7.29	7.21		24.06	23.1	23.34	24.28	23.90	474.92
84	L109	6.66	7.18	7.14	7.00	7.10	7.01	7.02	18.2	21.44	20.6	19.19	19.74	18.40	391.77
88	O-10	6.47	6.93	6.77	6.85	7.03	6.86	6.82	10.4	13.06	11.1	10.99	12.81	12.00	234.53
90	R1	6.58	7.09	7.12	7.03	7.10	7.04	6.99	13.5	15.80	15.6	15.23	15.40	15.50	303.33
146	E52	6.56	7.13	7.16	7.11	7.17	7.20	7.06	14.7	17.63	18.8	20.03	19.41	20.60	370.33
152	E59	6.46	6.83	6.87	6.80	6.91	6.99	6.81	9.7	9.01	9.7	9.91	11.12	12.10	205.03
89	E68		7.03	6.93	6.80	6.87	6.85	6.90		14.81	13.3	11.74	12.36	12.20	257.44
91	O-1/E55	5.64	5.99	6.04	6.15	6.48	6.46	6.13	3.9	4.46	4.2	4.82	6.11	6.10	98.67
97	O-2 E67	6.35	6.79	6.75	6.88	6.87	6.87	6.75	9.7	10.26	10.1	11.47	11.21	11.50	214.13
428	L1	6.24						6.24	6.7						133.80
83	O3/E64	6.95						6.95	35.5						710.60
85	R2	6.51						6.51	11.0						219.80
86	R3	7.44						7.44	48.3						965.40
474	A300			6.96				6.96			15.3				305.60

Annex 1: Summary of RAMP Data 1999-2004

		2000	2001	2002	2003	2004	Mean ug/L	1999	2000	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Gran Alkalinity (mg/L as $CaCO_3$)**						**Specific Cond. (µS/cm)**						
168	A21	0.21	0.55	0.12	0.20	0.00	4.32	17.3	14	16.2	16.4	14.20	13.80	15.32
169	A24	0	0.00	0.00	-0.57	0.00	-2.28	14.1	14	16.7	14.8	15.10	12.50	14.53
170	A26	-1.53	0.00	0.57	0.60	0.10	-1.04	13.9	12	13.5	15.6	14.00	14.30	13.88
167	A29	-0.60	0.56	1.22	1.60	0.90	14.72	12.0	13	12.9	13.5	13.70	12.60	12.95
166	A86	5.03		6.10	6.10	5.90	115.65	22.2	25		25.8	27.30	28.50	25.76
287	25			0.00	0.20	0.10	2.00				14.1	14.00	12.60	13.57
289	27			3.90	3.30	3.20	69.33				15.0	16.50	17.20	16.23
290	28			2.66	2.40	1.30	42.40				18.2	21.70	17.00	18.97
342	82			10.94	8.70	8.70	188.93				34.1	31.10	36.10	33.77
354	94			26.49	16.90	15.90	395.27				62.7	45.00	44.40	50.70
165	A42	12.13	10.63	19.43	14.80	20.20	308.76	31.4	35	34.8	49.1	43.40	55.40	41.52
171	A47	6.64	1.61	8.79	7.90	6.20	124.56	29.1	31	22.3	38.2	32.10	34.10	31.13
172	A59	3.56	4.01	2.59	2.30	1.10	54.24	21.2	25[a]	22.6	25.0	27.40	28.80	25.00
223	P94			41.67	40.50	40.50	817.80				120.2	117.10	117.40	118.23
225	P96			37.97	29.90	33.20	673.80				85.2	72.80	83.40	80.47
226	P97			15.21	13.30	11.70	268.07				42.0	45.00	45.20	44.07
227	P98			35.66	33.60	32.60	679.07				83.6	79.40	80.10	81.03
267	1			45.66	40.90	41.20	851.73				97.2	89.60	90.00	92.27
452	L4	4.73	3.83	4.23	2.60	3.30	74.76	23.8	24	22.6	22.3	21.50	21.80	22.67
470	L7	8.94	9.25	6.49	6.50	5.50	146.72	31.1	36	30.6	26.0	27.50	25.90	29.52
471	L8	20.11	19.60	18.32	22.10	18.40	394.12	54.8	46	49.4	45.8	49.30	49.20	49.08
400	L39	10.26	9.13	8.48	7.80	9.40	180.28	30.6	32	30.0	26.5	25.40	28.50	28.83
268	E15	24.03	22.88	28.23	20.60	15.80	446.16		49[a]	57.1	68.1	53.80	45.30	56.07
182	P23			11.00	41.70	49.80	683.33				31.4	88.90	101.50	73.93
185	P27			3.17	1.90	1.60	44.47				24.0	22.30	19.30	21.87
209	P7			6.89	6.80	5.00	124.60				22.2	28.00	22.80	24.33
270	4			81.17	78.00	67.40	1,510.47				163.9	150.80	140.80	151.83
271	6			84.36	68.20	64.10	1,444.40				172.3	137.00	129.20	146.17
418	Kearl L.				78.00	77.40	1,554.00					163.80	165.90	164.85
436	L18	18.08	18.38	19.19	20.00	20.60	385.00	60.7	61	62.7	63.7	63.20	64.50	62.63
442	L23	6.99	6.31	7.96	7.20	7.50	143.84	26.1	22	25.8	26.2	24.40	25.30	24.97
444	L25	8.30	7.69	6.44	7.60	8.80	155.32	28.6	26	30.3	28.1	28.70	30.60	28.72
447	L28	1.45	0.89	1.13	1.20	1.90	26.28	21.7	17	20.7	20.3	18.90	19.50	19.68
448	L29		0.00	0.00	-1.9	0.00	-9.5	21.0		15.9	22.1	16.50	14.70	18.04
454	L46	14.95	10.01	11.17	9.00	9.60	218.92	89.4	58	58.0	54.6	49.30	53.60	60.48
455	L47	12.88	9.08	11.08	11.00	14.90	235.76	71.5	55[a]	59.2	56.4	47.50	52.30	57.38
457	L49	9.71	4.99	7.34	7.10	9.30	153.76	67.2	57[a]	59.3	62.7	55.00	59.00	60.64
464	L60	11.35	14.20	14.11	15.10	17.00	287.04	57.0	54	60.9	60.4	55.90	56.80	57.50
175	P13			50.48	44.40	43.30	921.20				117.2	109.90	109.50	112.20
199	P49			7.70	7.00	6.90	144.00				25.4	24.80	26.00	25.40
473	A301		20.30	21.05	21.00	20.40	413.75			55.0	55.1	53.20	54.00	54.33
118	L107	22.29	20.25	21.33	22.50	22.30	434.68		60	61.0	60.3	60.70	61.70	60.74
84	L109	20.60	18.53	18.21	17.90	16.70	367.76	51.2	59	54.9	51.3	49.80	48.90	52.52
88	O-10	12.55	9.18	10.13	11.00	10.30	212.64	33.7	32	32.7	32.9	37.10	35.60	34.00
90	R1	14.68	13.79	13.94	13.70	14.10	280.84	39.4	37	41.6	49.8	40.30	41.10	41.53
146	E52	17.55	16.86	19.41	18.00	19.00	363.28	45.2	46	51.0	53.2	52.60	52.70	50.12
152	E59	7.41	7.14	8.48	9.50	10.30	171.32	29.4	24	29.2	29.8	31.60	32.40	29.32
89	E68	14.50	12.04	10.81	10.60	10.40	233.38		40	41.7	41.7	39.70	38.20	40.26
91	O-1/E55	3.35	1.98	3.30	3.80	3.70	64.52	20.8	25	19.5	19.8	21.10	22.30	21.42
97	O-2 E67	9.83	8.56	10.61	9.20	9.70	191.60	31.1	31	30.3	31.0	31.60	32.20	31.20
428	L1							27.4						27.40
83	O3/E64							59.7						59.70
85	R2							36.9						36.90
86	R3							106.1						106.10
474	A300		14.48							41.9				41.90

Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001	2002	2003	Mean	1999	2000	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Total Dissolved Solids (mg/L)**						**Turbidity (NTU)**						
168	A21	70.5	52.0	54	45.0	49.30	54.12	6.5	2.8	3.20	2.70	3.60		3.76
169	A24	41.5	42.8	52	58.5	27.30	44.32	8.1	4.6	2.70	5.00	8.50		5.78
170	A26	55.5	36.2	44	33.0	74.70	48.68	1.6	7.9	9.80	1.40	7.40		5.62
167	A29	28.5	37.0	43	39.5	32.00	36.04	1.4	1.5	2.30	1.30	3.70		2.04
166	A86	45.0	44.5		47.0	59.30	48.95	1.2	0.79		1.40	1.60		1.25
287	25				33.0	74.70	53.85				2.70	4.20		3.45
289	27				28.0	35.30	31.65				1.60	2.70		2.15
290	28				48.5	63.30	55.90				0.91	4.10		2.51
342	82				122.5	92.00	107.25				1.00	4.50		2.75
354	94				88.5	80.00	84.25				1.20	2.80		2.00
165	A42	_[a]	114.4	108	139.0	137.30	124.55	15.0	30.0	26.00	18.00	18.00		21.40
171	A47	27.5	56.7	61	30.0	53.50	45.74	3.0	1.4	1.30	2.70	2.70		2.22
172	A59	115.0	95.9	18	69.5	84.00	76.38	7.8	2.5	1.70	3.40	1.50		3.38
223	P94				151.5	179.00	165.25				2.30	1.50		1.90
225	P96				81.5	102.50	92.00				1.80	1.00		1.40
226	P97				60.5	110.50	85.50				1.30	0.67		0.99
227	P98				105.5	114.00	109.75				1.40	0.63		1.02
267	1				60.5	93.00	76.75				2.00	2.30		2.15
452	L4	64.0	67.5	52	50.5	70.00	60.80	1.4	0.46	0.63	0.56	0.69	0.60	0.72
470	L7	66.5	84.0	69	84.5	100.50	80.86	0.9	1.1	1.00	0.57	1.00	1.00	0.92
471	L8	79.0	72.5	74	52.0	81.00	71.64	3.9	2.5	2.10	1.40	1.10	1.85	2.14
400	L39	61.5	50.7	62	31.5	62.00	53.50	9.1	7.0	11.00	4.90	7.10		7.82
268	E15		178.6	219	90.5	90.50	144.73		9.5	4.00	1.80	1.50	1.50	3.66
182	P23				34.5	84.00	59.25				1.30	6.20		3.75
185	P27				64.0	67.00	65.50				0.52	0.60		0.56
209	P7				35.0	71.00	53.00				1.40	0.72		1.06
270	4				132.0	144.50	138.25				2.40	2.40	1.80	2.20
271	6				101.5	120.00	110.75				3.10	2.70		2.90
418	Kearl L.					146.00	146.00					8.30	1.50	4.90
436	L18	45.0	45.3	47	23.0	39.30	40.00	0.5	0.8	0.68	0.87	0.65		0.71
442	L23	50.5	37.4	45	29.5	45.30	41.48	1.3	1.1	2.40	1.50	1.60		1.58
444	L25	22.5	38.1	38	33.0	32.00	32.64	3.5	2.5	3.20	1.30	1.50		2.40
447	L28	82.5	76.0	63	65.5	76.70	72.74	1.7	1.4	4.30	2.10	4.10		2.72
448	L29	37.5		58	27.5	41.30	41.02	4.1		21.00	3.90	8.00		9.25
454	L46	93.0	95.0	64	83.0	86.00	84.20	15.0	11.0	13.00	20.00	29.00		17.60
455	L47	66.5	84.5	102	72.5	84.70	82.04	15.0	7.3	53.00	5.30	20.00		20.12
457	L49	75.5	84.5	98	59.5	85.30	80.60	4.6	7.0	14.00	6.10	6.30		7.60
464	L60	74.4	81.0	77	61.5	78.00	74.40	2.5	4.7	5.20	3.60	2.80		3.76
175	P13				117.0	171.70	144.35				7.50	11.00		9.25
199	P49				14.0	50.50	32.25				1.80	2.30	2.80	2.30
473	A301			44	27.0	63.00	44.50			1.40	1.90	1.50		1.60
118	L107		48.0	34	25.5	62.00	42.25		0.43	0.58	0.48	0.53		0.50
84	L109	69.5	67.0	49	41.0	82.00	61.60	0.9	1.3	1.40	1.40	1.70		1.34
88	O-10	80.5	73.2	54	37.5	73.50	63.74	4.7	5.3	6.40	4.90	1.00		4.46
90	R1	55.4	55.5	40	32.0	78.00	52.08	1.4	0.91	0.96	1.70	1.10		1.21
146	E52	86.1	71.0	86	35.0	80.00	71.60	1.2	1.3	1.10	1.50	1.50		1.32
152	E59	43.0	37.5	44	19.0	44.00	37.40	2.1	1.4	1.10	1.20	1.80		1.52
89	E68		71.5	81	50.0	55.00	64.27		3.7	4.10	2.70	6.40		4.21
91	O-1/E55	55.0	48.0	55	20.5	37.00	43.00	0.7	1.6	1.20	1.60	1.70		1.35
97	O-2 E67	72.5	62.0	63	43.5	53.50	58.90	1.0	0.87	0.89	1.10	1.00		0.96
428	L1	48.0					48.00	0.8						0.81
83	O3/E64	73.9					73.90	2.4						2.40
85	R2	74.0					74.00	1.4						1.40
86	R3	85.0					85.00	0.4						0.35
474	A300			64			63.80			17.00				17.00

Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001.00	2002	2003	Mean	1999	2000	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Total Suspended Solids (mg/L)**						**Colour (TCU)**						
168	A21	14.1	6.4		4.0	11.50	9.00	308	276.2	322	272	285.80	233.30	282.82
169	A24	8.0	2.7	8.80	15.3	40.50	15.05	250	223.9	270	297	226.70		253.52
170	A26	2.3	15.6	28.00	1.9	34.00	16.35	77	103.8	106	124	151.70	110.70	112.20
167	A29	1.2	5.0		4.0	2.00	3.05	43	78.1	103	74	82.20	61.50	73.55
166	A86	2.0	2.3		2.1	2.00	2.11	47	47.7		30	50.20		43.58
287	25				8.4	16.70	12.57				146	223.20		184.70
289	27				5.3	8.70	7.02				43	43.20	37.40	41.30
290	28				2.6	19.30	10.94				126	340.30	106.50	190.83
342	82				4.4	12.50	8.47				52	63.60	60.70	58.77
354	94				2.7	6.30	4.51				25	43.30	33.60	33.87
165	A42	-	175.0		122.5	85.00	127.50	54	87.0	92	60	79.50	42.70	69.20
171	A47	6.6	2.1		4.0	3.60	4.08	60	88.2	261	107	91.10	62.60	111.68
172	A59	70.0	8.4	0.75	15.0	5.00	19.83	256	316.0	43	232	429.40	371.00	274.40
223	P94				6.8	2.70	4.77				154	156.40		155.40
225	P96				5.4	0.90	3.17				57	105.60		81.30
226	P97				4.0	2.00	3.00				95	233.50		164.10
227	P98				4.9	0.60	2.73				118	143.70		130.65
267	1				5.8	4.70	5.23				19	25.80		22.40
452	L4	7.9	1.6	1.20	2.7	1.00	2.88	208	337.4	216	245	269.90	217.10	248.88
470	L7	1.6	0.9	0.60	2.9	1.30	1.45	202	371.9	278	300	361.70	251.50	294.03
471	L8	6.6	4.8	3.20	3.3	0.70	3.72	105	152.2	162	148	179.30	142.60	148.27
400	L39	16.4	22.0	41.30	17.5	7.60	20.96	55	76.7	63	114	76.00	86.50	78.60
268	E15		56.0	18.00	1.4	4.70	20.03		132.1	103	129	152.50	138.10	130.94
182	P23				2.7	7.20	4.96				179	73.00		126.05
185	P27				0.3	0.60	0.45				257	297.20		276.90
209	P7				4.3	1.00	2.65				236	289.50		262.60
270	4				5.5	6.00	5.75				34	34.10	38.30	35.47
271	6				7.3	4.00	5.65				31	27.90		29.35
418	Kearl L.					3.50	3.50					75.60	62.20	68.90
436	L18	0.4	1.4	0.60	5.6	1.50	1.89	13	14.1	14	12	11.90	10.90	12.70
442	L23	1.7	1.4	3.00	3.1	1.20	2.09	47	50.2	44	37	54.30	42.60	45.88
444	L25	3.9	2.6	4.80	5.9	3.20	4.07	20	40.4	46	29	25.10	25.30	30.92
447	L28	0.3	2.1	10.20	5.7	9.50	5.56	381	426.6	466	422	485.60	435.10	435.98
448	L29	5.0		60.00	10.5	16.50	23.00	215		164	238	218.90		208.78
454	L46	3.6	10.7	3.80	7.6	32.00	11.53	207	251.5	233	249	372.00	308.70	270.10
455	L47	11.8	10.3	148.00	3.4	28.20	40.35	133	162.6	111	153	166.80	100.00	137.78
457	L49	4.3	10.0	16.20	4.1	3.20	7.57	98	199.4	179	177	222.30	223.60	183.33
464	L60	3.5	3.3	4.83	7.0	8.00	5.33	72	193.4	152	164	162.40	150.50	149.20
175	P13				25.5	29.00	27.25				150	143.20		146.55
199	P49				4.0	3.00	3.50				57	71.20	67.60	65.13
473	A301			2.40	2.5	1.50	2.13			30	29	41.80	39.10	34.98
118	L107		0.8		0.3	0.40	0.51		8.0	11	11	12.40	8.80	10.22
84	L109	0.1	0.9	0.70	2.0	0.50	0.84	140	111.4	94	119	132.90	125.70	120.45
88	O-10	10.9	25.0	37.00	18.0	1.00	18.38	107	69.8	63	79	89.80	81.10	81.57
90	R1	1.2	1.3	1.50	1.4	0.70	1.23	81	57.0	51	55	68.60	72.10	64.25
146	E52	2.8	0.5	0.20	0.6	2.00	1.21	283	283.5	255	241	221.70	215.20	249.88
152	E59	2.2	1.6	1.60	1.3	1.30	1.60	96	82.3	94	73	61.50	46.10	75.50
89	E68		5.9	3.83	5.2	24.30	9.79		311.2	310	217	205.70	147.30	238.28
91	O-1/E55	0.8	2.4	2.80	3.3	2.80	2.43	277	286.1	276	239	247.00	185.80	251.70
97	O-2 E67	1.0	1.2		0.7	0.60	0.87	294	307.0	302	280	238.80	210.60	272.02
428	L1	1.4						38						
83	O3/E64	2.4						124						
85	R2	1.6						183						
86	R3	0.1						11						
474	A300			10.00						56				

Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001	2002	2003	2004	Mean	1999	2000	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Sodium (mg/L)**							**Potassium (mg/L)**						
168	A21	0.99	0.79	0.960	0.51	0.74	0.48	0.74	0.48	0.41	0.330	0.31	0.34	0.30	0.36
169	A24	0.57	0.57	0.370	0.91	0.98	0.79	0.70	0.45	0.47	0.420	0.47	0.44	0.33	0.43
170	A26	0.90	0.67	0.610	0.45	0.77	0.44	0.64	0.64	0.38	0.410	0.52	0.50	0.50	0.49
167	A29	0.70	1.03	1.160	0.77	0.71	1.30	0.94	0.35	0.47	0.200	0.35	0.37	0.34	0.35
166	A86	0.78	0.59		0.67	0.78	1.20	0.80	1.45	1.43		1.67	1.95	2.09	1.72
287	25				0.48	0.68	0.90	0.69				0.40	0.54	0.45	0.46
289	27				0.62	0.62	0.61	0.62				0.37	0.40	0.41	0.39
290	28				0.53	0.99	0.55	0.69				0.41	0.53	0.46	0.47
342	82				1.36	1.42	2.21	1.66				1.33	1.19	1.22	1.25
354	94				1.44	1.38	1.60	1.47				1.00	0.85	0.71	0.85
165	A42	8.13	3.11	1.890	2.04	2.99	4.20	3.73	0.34	0.47	0.440	0.79	0.59	0.66	0.55
171	A47	0.75	0.42	0.820	0.70	0.68	0.70	0.68	0.53	0.63	0.320	0.91	0.76	0.78	0.65
172	A59	2.50	0.76	0.770	1.47	0.96	1.00	1.24	0.44	0.36	1.380	0.53	0.66	0.57	0.66
223	P94				7.10	6.17	7.09	6.79				1.60	1.41	1.47	1.49
225	P96				1.07	0.82	1.44	1.11				0.93	0.80	1.14	0.96
226	P97				1.29	1.10	1.09	1.16				0.66	1.02	1.14	0.94
227	P98				1.38	1.08	1.16	1.21				0.65	0.36	0.70	0.57
267	1				1.44	2.07	1.53	1.68				0.92	0.92	0.84	0.89
452	L4	1.02	0.45	0.430	0.46	0.48	0.48	0.55	0.22	0.13	0.130	0.07	0.09	0.13	0.13
470	L7	0.92	0.64	0.780	0.68	0.62	0.64	0.71	0.51	0.34	0.240	0.10	0.12	0.23	0.26
471	L8	2.56	2.07	2.540	2.09	2.63	1.92	2.30	0.29	0.11	0.110	0.12	0.05	0.16	0.14
400	L39	5.39	1.76	1.650	1.90	2.28	1.61	2.43	0.47	0.55	0.550	0.46	0.42	0.44	0.48
268	E15		3.85	3.880	3.42	3.19	3.01	3.47		0.55	0.570	0.51	0.40	0.37	0.48
182	P23				0.85	1.67	2.90	1.81				0.11	0.04	0.16	0.10
185	P27				0.46	0.50	0.61	0.52				0.06	0.04	0.15	0.08
209	P7				0.72	0.47	0.54	0.58				0.10	0.03	0.07	0.07
270	4				2.00	2.11	1.81	1.97				0.32	0.22	0.16	0.23
271	6				6.28	6.35	5.95	6.19				1.60	1.16	0.54	1.10
418	Kearl L.					8.41	9.16	8.79					0.91	0.84	0.88
436	L18	2.56	2.28	2.450	2.45	2.64	2.68	2.51	1.07	1.06	1.400	1.06	1.10	1.07	1.13
442	L23	0.91	0.82	0.850	0.88	0.86	0.93	0.88	0.42	0.43	0.390	0.40	0.43	0.39	0.41
444	L25	0.98	0.81	1.060	0.84	0.91	0.99	0.93	0.60	0.71	0.630	0.60	0.67	0.64	0.64
447	L28	1.41	0.95	1.390	1.32	1.15	1.84	1.34	0.47	0.28	0.290	0.26	0.35	0.38	0.34
448	L29	0.61		1.430	0.34	0.83	0.92	0.83	0.17		0.110	0.08	0.12	0.22	0.14
454	L46	5.16	3.31	3.580	3.26	3.46	4.17	3.82	1.07	0.82	0.720	0.51	0.72	0.90	0.79
455	L47	3.62	3.01	3.580	2.95	2.97	3.23	3.23	1.05	0.80	0.690	0.66	0.79	2.40	1.06
457	L49	4.33	3.45	3.910	3.77	3.22	4.04	3.79	0.88	0.72	0.670	0.70	0.86	0.90	0.79
464	L60	3.08	2.68	2.760	2.80	2.45	2.82	2.76	0.59	0.76	0.550	0.56	0.66	0.63	0.63
175	P13				8.75	8.55	10.30	9.20				0.69	0.71	0.39	0.60
199	P49				0.92	0.88	1.88	1.23				0.43	0.41	0.49	0.44
473	A301			1.530	1.70	1.50	1.60	1.58			0.590	0.61	0.61	0.60	0.60
118	L107		1.77	2.990	1.91	1.89	2.05	2.12		1.03	0.650	1.20	0.99	0.98	0.97
84	L109	2.04	1.90	2.040	1.96	1.96	2.02	1.99	0.43	0.57	0.600	0.58	0.45	0.55	0.53
88	O-10	5.24	3.00	2.830	2.62	1.24	1.21	2.69	0.50	0.53	0.700	0.60	0.46	0.45	0.54
90	R1	1.63	1.49	1.630	1.64	1.52	1.62	1.59	0.39	0.43	0.470	0.50	0.52	0.55	0.48
146	E52	1.50	0.82	1.250	1.05	1.01	1.01	1.11	0.80	0.70	0.580	0.70	0.71	0.69	0.70
152	E59	0.48	0.40	0.510	0.50	0.54	0.67	0.52	0.27	0.27	0.260	0.42	0.32	0.30	0.31
89	E68		1.04	1.450	1.04	1.25	1.11	1.18		0.28	0.190	0.26	0.29	0.30	0.26
91	O-1/E55	0.42	0.37	0.330	0.43	0.54	1.02	0.52	0.23	0.14	0.140	0.18	0.19	0.16	0.17
97	O-2 E67	0.54	0.44	0.930	0.46	0.45	0.47	0.55	0.16	0.16	0.080	0.16	0.16	0.16	0.15
428	L1	0.75							0.28						
83	O3/E64	1.64							0.34						
85	R2	1.58							0.28						
86	R3	3.16							1.64						
474	A300			1.590							1.390				

Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001	2002	2003	2004	Mean	1999	2000	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Calcium (mg/L)**							**Magnesium (mg/L)**						
168	A21	1.63	1.62	1.730	1.52	1.40	1.24	1.52	0.55	0.50	0.5000	0.45	0.35	0.36	0.45
169	A24	0.88	0.74	1.020	0.89	1.16	0.97	0.94	0.35	0.36	0.3700	0.36	0.34	0.26	0.34
170	A26	4.29	1.18	1.170	1.39	1.34	1.26	1.77	0.94	0.35	0.3600	0.50	0.40	0.42	0.50
167	A29	1.17	1.25	1.600	1.25	1.50	1.32	1.35	0.48	0.48	0.4600	0.54	0.44	0.49	0.48
166	A86	1.89	2.16		2.33	2.45	2.50	2.27	0.88	0.86		0.93	0.91	0.93	0.90
287	25				1.17	1.32	0.99	1.16				0.35	0.33	0.28	0.32
289	27				1.74	1.90	1.89	1.84				0.50	0.56	0.59	0.55
290	28				1.81	2.87	1.62	2.10				0.88	0.79	0.82	0.83
342	82				3.30	3.12	2.33	2.92				1.58	1.39	1.27	1.41
354	94				7.57	5.69	5.09	6.12				2.66	1.94	1.88	2.16
165	A42	4.82	5.44	5.510	7.87	6.75	8.40	6.47	1.19	1.31	1.3400	1.70	1.38	1.82	1.46
171	A47	1.32	4.18	3.100	5.13	4.49	4.22	3.74	0.46	0.83	0.7300	1.14	0.91	0.91	0.83
172	A59	2.78	3.36	2.110	2.81	3.20	3.30	2.93	0.77	0.78	0.8300	0.83	0.71	0.85	0.79
223	P94				12.80	12.80	12.90	12.83				5.95	5.20	5.25	5.47
225	P96				11.90	10.00	10.80	10.90				4.21	3.40	4.07	3.89
226	P97				5.63	6.43	5.22	5.76				1.95	1.98	1.76	1.90
227	P98				11.70	11.80	11.20	11.57				4.09	3.92	3.91	3.97
267	1				13.20	11.90	11.70	12.27				4.05	3.62	3.77	3.81
452	L4	3.31	3.67	3.510	3.47	3.41	3.11	3.41	1.13	1.16	0.9300	1.00	0.92	0.82	0.99
470	L7	4.18	5.19	4.990	4.31	4.61	3.68	4.49	1.39	1.55	1.4700	1.31	1.28	1.09	1.35
471	L8	5.87	5.84	5.900	5.61	6.16	5.75	5.86	2.72	2.61	2.6700	2.14	2.22	1.97	2.39
400	L39	3.13	3.25	2.970	2.84	2.66	2.97	2.97	1.48	1.42	1.4000	1.23	1.09	1.21	1.30
268	E15		8.96	9.020	8.01	6.51	5.40	7.58		1.93	1.9500	1.77	1.64	1.56	1.77
182	P23				4.76	13.10	14.70	10.85				1.30	2.98	3.83	2.70
185	P27				3.78	3.53	2.30	3.20				0.99	0.91	0.79	0.90
209	P7				3.97	4.63	3.23	3.94				1.11	1.30	1.10	1.17
270	4				24.10	21.20	19.20	21.50				8.09	7.33	6.98	7.47
271	6				21.50	15.80	14.50	17.27				6.65	5.89	5.10	5.88
418	Kearl L.					16.90	16.60	16.75					6.54	6.34	6.44
436	L18	6.13	6.47	6.280	6.52	6.53	6.26	6.37	2.02	2.02	2.0900	2.08	2.04	2.02	2.04
442	L23	3.01	2.94	2.890	3.05	2.79	2.75	2.91	1.08	1.06	1.0600	1.07	0.96	0.94	1.03
444	L25	3.27	3.51	3.510	3.04	3.17	3.36	3.31	0.94	0.99	1.0300	0.86	0.84	0.92	0.93
447	L28	2.17	2.21	2.150	2.15	2.08	2.27	2.17	0.70	0.68	0.6600	0.66	0.62	0.68	0.67
448	L29	0.70		0.580	0.50	0.56	0.52	0.57	0.19		0.2000	0.16	0.15	0.14	0.17
454	L46	7.81	6.74	5.310	5.58	5.37	4.69	5.92	2.88	2.37	2.0300	1.96	1.80	1.72	2.13
455	L47	7.32	6.29	5.680	6.05	5.19	17.60	8.02	2.42	1.99	1.8000	1.83	1.57	7.53	2.86
457	L49	5.43	6.31	5.110	5.72	5.38	5.34	5.55	1.89	2.07	1.6700	1.85	1.68	1.78	1.82
464	L60	5.24	6.47	6.510	6.51	6.69	6.14	6.26	1.78	2.26	2.2500	2.12	2.08	2.05	2.09
175	P13				13.40	12.00	10.20	11.87				5.05	4.60	4.51	4.72
199	P49				2.65	2.66	2.59	2.63				1.35	1.30	1.23	1.29
473	A301			6.220	6.11	5.97	5.78	6.02			2.4730	2.38	2.18	2.17	2.30
118	L107		7.78	7.460	7.48	7.42	7.24	7.48		1.59	1.6000	1.57	1.52	1.56	1.57
84	L109	6.01	6.50	6.220	5.98	5.89	5.49	6.01	2.24	2.29	2.2900	2.12	2.04	1.97	2.16
88	O-10	3.94	3.95	3.260	3.33	4.47	4.13	3.85	1.43	1.58	1.4900	1.49	1.49	1.43	1.49
90	R1	4.54	4.82	4.810	4.60	4.67	4.56	4.67	1.57	1.65	1.6900	1.63	1.56	1.58	1.61
146	E52	7.23	7.99	7.990	8.26	8.05	7.74	7.88	1.63	1.74	1.8600	1.88	1.78	1.82	1.79
152	E59	4.24	3.84	4.130	3.97	4.17	4.27	4.10	1.12	1.00	1.0800	1.06	1.07	1.11	1.07
89	E68		6.59	6.210	5.23	5.35	4.87	5.65		2.06	1.9300	1.59	1.58	1.44	1.72
91	O-1/E55	3.23	3.19	3.080	3.02	3.20	3.29	3.17	0.73	0.68	0.6700	0.69	0.70	0.76	0.71
97	O-2 E67	5.42	5.70	5.290	5.23	5.04	4.93	5.27	1.36	1.42	1.3400	1.33	1.23	1.26	1.32
428	L1	2.73							1.31						
83	O3/E64	8.13							2.74						
85	R2	4.59							1.56						
86	R3	11.50							4.78						
474	A300			5.870							1.2100				

Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001	2002	2003	2004	Mean	1999	2000	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Bicarbonate (mg/L)**							**Chloride (mg/L)**						
168	A21	0.9	2.26	2.1	2.13	2.08	1.50	1.84	0.1	0.10	0.15	0.15	0.09	0.16	0.13
169	A24	-	0.67	1.5	1.25	1.37	1.60	1.27	0.1	0.11	0.15	0.21	0.11	0.23	0.16
170	A26	11.4	2.12	2.6	3.02	2.91	2.20	4.03	0.2	0.10	0.15	0.18	0.12	0.12	0.15
167	A29	2.8	3.89	3.8	3.68	4.33	3.10	3.59	0.1	0.18	0.15	0.20	0.13	0.17	0.15
166	A86	6.8	8.31		9.29	9.57	9.30	8.66	0.2	0.20		0.38	0.26	0.48	0.31
287	25				2.26	2.24	2.00	2.17				0.20	0.11	0.23	0.18
289	27				6.29	6.15	5.90	6.11				0.21	0.13	0.24	0.19
290	28				4.79	5.71	4.30	4.93				0.21	0.11	0.26	0.19
342	82				13.88	13.08	12.90	13.29				0.39	0.28	0.68	0.45
354	94				32.38	22.45	21.40	25.41				0.44	0.21	0.30	0.31
165	A42	12.0	13.81	13.7	22.64	20.59	26.50	18.22	0.3	0.22	0.15	0.53	0.26	1.23	0.45
171	A47	2.4	9.62	4.2	12.01	12.41	9.60	8.38	0.1	0.21	0.15	0.47	0.26	0.38	0.26
172	A59	2.5	4.25	7.4	4.24	5.83	3.70	4.66	0.1	0.12	0.15	0.29	1.49	0.22	0.40
223	P94				48.92	50.45	50.20	49.86				0.61	0.34	0.41	0.45
225	P96				45.76	38.01	41.80	41.86				0.54	0.15	0.37	0.35
226	P97				18.67	18.63	16.50	17.93				0.14	0.17	0.23	0.18
227	P98				43.03	42.44	41.10	42.19				0.34	0.12	0.31	0.26
267	1				56.46	51.42	51.40	53.09				0.34	0.25	0.26	0.28
452	L4	6.2	5.72	6.9	5.86	6.78	6.20	6.27	0.6	<0.03	0.15	0.10	0.07	0.15	0.22
470	L7	10.9	10.56	12.3	8.62	10.23	9.10	10.29	0.1	0.08	0.15	0.10	0.09	0.11	0.11
471	L8	26.5	24.75	24.9	22.90	29.23	24.20	25.41	0.1	0.06	0.15	0.12	0.14	0.25	0.14
400	L39	14.0	14.60	14.9	12.10	11.87	13.50	13.48	0.6	0.26	0.4	0.34	0.42	0.42	0.41
268	E15		25.97	26.7	34.03	27.23	21.40	27.06		0.20	0.15	0.29	0.10	0.23	0.20
182	P23				14.51	52.32	43.50	36.78				0.18	0.15	0.22	0.18
185	P27				4.19	4.77	3.50	4.15				0.10	0.07	0.13	0.10
209	P7				8.72	10.37	8.10	9.06				0.11	0.09	0.08	0.09
270	4				98.76	91.57	83.20	91.18				0.35	0.25	0.50	0.37
271	6				103.07	59.04	50.90	71.00				0.48	0.10	0.47	0.35
418	Kearl L.					96.12	95.40	95.76					0.28	0.46	0.37
436	L18	24.2	24.64	25.4	25.95	26.25	27.10	25.60	0.1	0.20	0.15	0.18	0.14	0.25	0.18
442	L23	9.8	10.27	10.6	11.63	11.00	11.20	10.74	-	0.09	0.15	0.15	0.09	0.12	0.12
444	L25	10.9	12.13	12.8	10.42	11.18	12.80	11.71	0.1	0.11	0.15	0.22	0.09	0.24	0.15
447	L28	2.5	2.64	3.6	3.20	3.76	4.30	3.33	0.1	0.05	0.15	0.26	0.07	0.19	0.14
448	L29	-		0.0	0.00	0.00	0.00	0.00	-		0.3	0.10	0.06	0.08	0.15
454	L46	29.4	18.41	14.4	14.72	13.56	13.70	17.37	0.1	0.08	0.15	0.19	0.10	0.20	0.14
455	L47	19.5	16.26	13.0	14.93	15.62	20.30	16.61	0.1	0.09	0.15	0.18	0.10	0.58	0.21
457	L49	8.1	12.31	8.3	10.22	11.44	13.40	10.63	-	0.07	0.15	0.18	0.10	0.36	0.17
464	L60	11.8	14.33	19.6	18.58	20.43	22.60	17.88	-	0.09	0.15	0.19	0.07	0.17	0.13
175	P13				60.11	55.23	44.20	53.18				0.32	0.21	0.23	0.25
199	P49				11.18	10.65	10.40	10.74				0.17	0.15	0.49	0.27
473	A301			27.5	27.45	27.55	26.90	27.34			1.4	1.08	1.08	1.06	1.16
118	L107		29.34	28.2	28.46	29.60	29.10	28.95		2.42	2.6	2.36	2.40	2.62	2.49
84	L109	22.1	26.14	25.1	23.39	24.07	22.40	23.88	1.6	1.80	2.1	1.78	1.52	1.61	1.73
88	O-10	12.7	15.93	13.5	13.40	15.61	14.70	14.31	0.9	0.82	1.0	0.89	0.70	0.84	0.86
90	R1	16.5	19.26	19.0	18.56	18.77	19.00	18.50	1.0	1.05	1.3	1.26	1.06	1.31	1.17
146	E52	17.9	21.49	22.9	24.43	23.67	25.10	22.57	0.8	0.13	0.15	0.34	0.15	0.18	0.29
152	E59	11.8	10.99	11.8	12.09	13.56	14.70	12.49	0.2	0.09	0.15	0.15	0.11	0.18	0.14
89	E68		18.06	16.2	14.31	15.07	14.80	15.68		0.11	0.15	0.31	2.50	0.18	0.65
91	O-1/E55	4.8	5.44	5.1	5.88	7.45	7.40	6.01	0.2	0.10	0.15	0.14	0.10	0.17	0.15
97	O-2 E67	11.8	12.51	12.4	13.98	13.67	14.10	13.07	0.1	0.07	0.15	0.22	0.10	0.14	0.13
428	L1	8.2							0.1						
83	O3/E64	43.3							0.1						
85	R2	13.4							1.0						
86	R3	58.9							1.2						
474	A300			18.6							0.4				

Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001	2002	2003	2004	Mean	1999	2000	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Sulphate (mg/L)**							**Total Dissolved Nitrogen (µg/L)**						
168	A21	2.1	1.67	1.3	1.61	1.39	1.31	1.57	1068	586	1783	586	539	446.38	834.92
169	A24	1.6	1.45	1.0	0.63	0.73	0.75	1.02	965	617	1425	722	544	829.34	850.29
170	A26	1.5	1.83	1.7	1.40	1.00	1.11	1.41	1074	595	733	789	675	698.83	760.82
167	A29	1.3	0.66	0.5	0.87	0.35	0.90	0.77	572	635	875	587	657	532.05	643.04
166	A86	1.3	1.15		2.26	1.52	2.08	1.67	819	791		903	845	798.34	831.45
287	25				1.91	1.27	1.51	1.57				748	780	619.38	715.90
289	27				0.38	0.76	0.98	0.71				459	460	461.33	460.05
290	28				0.88	0.70	0.74	0.78				668	698	546.02	637.34
342	82				0.52	0.42	1.20	0.71				1282	1243	2,154.48	1,559.87
354	94				0.25	0.27	0.62	0.38				1378	1040	1,074.61	1,164.15
165	A42	1.4	1.38	0.7	0.61	0.27	1.12	0.91	105	1836	-	2608	1537	1,574.37	1,532.25
171	A47	2.0	0.90	1.0	2.02	0.92	1.58	1.40	536	1176	978	1924	1148	1,454.65	1,202.72
172	A59	2.8	0.48	1.3	2.55	1.72	2.72	1.93	838	961	945	774	1465	969.82	992.21
223	P94				13.74	9.07	9.70	10.84				2195	2043	2,081.88	2,106.79
225	P96				0.90	0.73	2.00	1.21				1576	1461	2,149.29	1,728.66
226	P97				0.56	0.43	1.85	0.95				1045	1054	1,314.67	1,137.85
227	P98				2.14	1.13	1.64	1.64				1624	1097	1,085.73	1,268.92
267	1				0.72	0.30	0.61	0.54				1108	1102	1,059.16	1,089.78
452	L4	1.2	0.71	0.9	0.61	0.56	0.83	0.78	588	592	684	577	502	630.72	595.74
470	L7	1.4	1.11	0.6	0.75	0.40	0.66	0.82	939	597	511	576	570	455.05	608.14
471	L8	1.8	1.37	1.1	0.70	1.01	1.39	1.22	817	819	735	765	662	624.14	737.24
400	L39	2.9	1.25	1.1	0.95	0.73	1.42	1.38	602	419	543	486	479	398.39	487.82
268	E15		0.35	0.25	0.39	0.44	0.21	0.33		1465	1232	2689	1459	855.02	1,540.09
182	P23				1.20	0.32	0.30	0.60				401	536	1,065.15	667.54
185	P27				0.76	0.30	0.44	0.50				699	618	527.84	614.82
209	P7				0.38	0.32	0.25	0.32				535	572	573.95	560.34
270	4				0.38	0.18	0.28	0.28				1695	1332	1,210.68	1,412.54
271	6				0.48	0.23	0.26	0.32				2177	1343	1,282.18	1,600.84
418	Kearl L.					3.09	3.81	3.45					1127	941.64	1,034.55
436	L18	7.1	7.42	7.8	7.62	6.79	6.90	7.26	258	340	297	324	271	318.53	301.53
442	L23	1.8	1.49	1.3	1.13	0.74	0.76	1.20	340	396	787	342	326	466.72	442.79
444	L25	3.1	2.84	2.6	3.41	2.76	2.69	2.90	246	404	386	398	283	388.31	350.90
447	L28	1.9	1.08	1.2	1.41	0.70	1.11	1.23	567	537	850	690	534	605.63	630.61
448	L29	0.7		0.7	0.34	0.27	0.18	0.44	422		631	498	345	354.19	450.05
454	L46	13.7	10.08	11.3	10.55	6.57	8.33	10.08	2028	712	1003	940	1046	1,180.44	1,151.42
455	L47	13.3	9.84	13.1	10.60	5.33	5.38	9.59	1425	1040	2180	1242	1052	2,188.71	1,521.45
457	L49	19.0	14.06	14.4	16.71	9.97	11.15	14.22	672	690	1968	966	966	1,146.73	1,068.07
464	L60	13.1	10.12	9.3	9.64	5.85	5.18	8.86	644	659	1591	808	705	807.39	868.94
175	P13				9.18	3.95	4.70	5.94				2385	2458	2,891.18	2,578.17
199	P49				1.32	0.69	1.43	1.15				673	652	695.00	673.33
473	A301			1.2	1.18	0.98	1.29	1.16			-	470	388	424.37	427.52
118	L107		1.00	0.9	0.96	0.95	1.07	0.98		328	776	388	298	445.93	447.18
84	L109	0.8	0.68	0.6	0.49	0.47	0.56	0.61	601	496	918	610	550	573.67	624.62
88	O-10	1.2	1.10	<0.5	0.45	0.89	0.25	0.78	851	839	2248	953	644	736.34	1,045.23
90	R1	0.8	0.58	0.7	0.50	0.35	0.51	0.57	515	450	636	546	399	600.86	524.56
146	E52	2.7	2.71	2.7	3.51	2.45	2.35	2.74	1060	557	-	633	482	648.70	676.29
152	E59	2.0	2.32	2.1	2.54	1.56	2.09	2.10	384	357	1050	439	417	433.18	513.39
89	E68		3.58	3.4	5.02	2.72	2.91	3.53		634	1800	588	568	726.22	863.18
91	O-1/E55	1.6	1.36	1.4	1.30	0.88	1.44	1.33	708	504	2425	566	641	571.49	902.57
97	O-2 E67	1.4	1.21	1.1	1.05	0.94	1.03	1.12	500	602	848	753	519	469.84	615.31
428	L1	3.7							836						
83	O3/E64	2.6							614						
85	R2	1.0							574						
86	R3	1.2							852						
474	A300			<0.5							2235				

Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001	2002	2003	2004	Mean	1999	2000	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Ammonia (µg/L)**							**Nitrate + Nitrite (µg/L)**						
168	A21	62.5	19.3	12.4	18.1	13.8	20.09	24.4	72	2.71	7.24	1.29	4.50	LOD	17.49
169	A24	91.4	8.0	79.7	10.4	24.2	61.94	45.9	12	10.75	72.03	1.16	2.78	1.29	16.60
170	A26	33.1	9.0	16.5	76.0	15.9	69.21	36.6	3	6.00	12.78	63.69	10.23	127.32	37.11
167	A29	12.7	20.5	23.0	6.9	53.1	4.32	20.1	2	0.67	6.02	0.64	2.84	0.27	2.07
166	A86	18.0	54.1		54.7	57.0	46.01	46.0	3	0.17		39.2	9.57	0.75	10.61
287	25				9.4	20.4	60.56	30.1				0.58	2.47	2.00	1.68
289	27				11.4	6.9	6.90	8.4				0.48	0.19	1.33	0.67
290	28				31.0	10.4	8.08	16.5				21.35	2.06	3.83	9.08
342	82				5.9	22.6	1,088.98	372.5				0.99	1.32	33.89	12.07
354	94				150.2	14.7	21.75	62.2				6.44	0.16	LOD	3.30
165	A42	8.4	94.1		79.8	13.5	30.47	45.3	0.50	160.96	-	1.08	0.50	LOD	40.76
171	A47	55.4	12.7	12.2	46.1	22.3	66.00	35.8	4	367.29	15.66	732.93	84.53	620.98	304.24
172	A59	9.3	85.1	10.6	13.1	390.7	17.78	87.7	5	7.59	6.19	0.96	42.33	LOD	12.43
223	P94				56.4	22.9	34.42	37.9				16.18	1.39	LOD	8.79
225	P96				8.9	215.7	597.84	274.2				0.44	1.67	14.58	5.56
226	P97				10.8	100.7	455.28	188.9				0.75	1.71	20.36	7.61
227	P98				219.1	25.6	23.61	89.4				43.69	2.32	LOD	23.01
267	1				6.2	5.1	10.02	7.1				1.2	0.50	1.51	1.07
452	L4	3.5	25.7	11.6	11.7	9.1	72.04	22.3	2	3.90	76.8	5.19	0.12	135.30	37.24
470	L7	22.3	16.7	5.2	11.2	13.9	40.56	18.3	3	17.54	8.31	0.94	0.50	LOD	6.03
471	L8	17.0	36.9	9.6	7.9	6.8	28.32	17.8	1	9.24	3.68	77.97	0.50	3.84	16.12
400	L39	6.5	18.4	101.2	7.5	8.5	40.48	30.4	1	6.71	6.94	0.95	0.50	1.42	2.97
268	E15		32.9	12.5	1509.2	356.1	29.48	388.0		6.00	2.49	8.42	1.62	LOD	4.63
182	P23				28.4	5.0	33.59	22.3				2.11	0.50	0.97	1.19
185	P27				13.2	18.5	41.27	24.3				72.42	0.50	LOD	36.46
209	P7				9.8	5.2	36.93	17.3				0.76	0.50	LOD	0.63
270	4				122.6	6.7	12.20	47.2				11.28	0.50	0.60	4.13
271	6				440.8	2.8	13.02	152.2				91.86	0.50	LOD	46.18
418	Kearl L.					247.6	52.57	150.1					1.97	0.38	1.18
436	L18	15.1	5.2	11.6	15.5	310.5	10.51	61.4	2	5.12	2.3	13.23	0.50	0.48	3.91
442	L23	17.0	11.9	21.6	2.7	5.1	27.44	14.3	1	0.62	8.69	0.44	0.50	2.23	2.22
444	L25	1.6	17.3	11.8	32.9	2.4	63.97	21.6	1	6.30	3.31	35.52	0.36	1.02	7.89
447	L28	9.6	20.0	12.8	18.2	13.8	10.56	14.1	18	13.72	52.75	14.55	0.20	LOD	19.92
448	L29	3.0		18.6	15.5	10.9	43.31	18.2	3		5.61	1.09	0.50	0.66	2.13
454	L46	597.0	22.3	24.9	16.1	26.2	105.58	132.0	60	19.47	54.74	172.22	1.34	195.62	83.90
455	L47	81.8	64.7	215.3	67.0	11.3	314.16	125.7	26	40.56	72.78	277.37	21.81	287.76	121.08
457	L49	15.2	20.0	82.5	47.9	51.3	89.63	51.1	13	17.84	278.62	200.17	131.11	46.09	114.40
464	L60	-	10.8	47.2	55.4	15.2	16.46	29.0	1	9.46	9.03	61.32	0.50	LOD	16.16
175	P13				24.0	22.9	94.26	47.1				9.77	0.36	1.49	3.87
199	P49				16.4	6.6	9.04	10.7				0.96	0.50	LOD	0.73
473	A301			11.1	3.6	3.3	23.96	10.5			12.26	0.69	0.50	1.57	3.76
118	L107		0.4	12.4	1.1	2.7	4.05	4.1		0.45	13.54	5.26	0.50	0.02	3.95
84	L109	13.0	0.0005	16.8	13.9	4.1	113.44	26.9	4	3.38	12.49	23.16	2.79	7.35	8.80
88	O-10	2.7	0.0005	38.9	7.4	12.2	47.46	18.1	1	2.52	6.08	0.54	0.50	1.09	1.99
90	R1	5.8	0.1700	17.5	3.4	2.4	72.29	16.9	4	0.37	19.88	4.74	0.12	0.92	5.05
146	E52	10.6	0.0005	26.9	14.6	6.2	62.91	20.2	48	35.48	18.39	45.14	0.50	1.73	24.87
152	E59	16.1	3.9	12.6	18.1	28.1	202.99	47.0	3	4.29	9.61	55.56	2.85	0.04	12.47
89	E68		9.0	41.6	15.0	12.2	53.81	26.3		20.60	109.93	1.03	9.07	81.54	44.43
91	O-1/E55	27.1	2.4	7.5	14.0	13.5	71.03	22.6	9	6.02	46.26	5.23	11.52	0.56	13.14
97	O-2 E67	10.3	3.1	23.0	23.4	15.9	80.98	26.1	6	22.41	14.1	24.67	10.10	7.46	14.05
428	L1	24.3							1						
83	O3/E64	12.8							5						
85	R2	<1							1						
86	R3	2.1							1						
474	A300			100.9							3.64				

Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001	2002	2003	2004	Mean	1999	2000	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Total Phosphate (µg/L)**							**Dissolved Phosphate (µg/L)**						
168	A21	112.5	55.4	57.9	57.9	76.7	53.20	68.9	67.0	33.3	39.6	24.9	32.0	32.00	38.1
169	A24	109.3	63.3	62.0	76.1	106.9	65.70	80.6	61.5	34.1	46.5	29.3	20.1	34.90	37.7
170	A26	53.9	56.1	65.7	40.1	108.9	39.50	60.7	22.3	20.6	16.7	21.5	26.9	22.50	21.8
167	A29	27.8	27.5	32.1	25.7	42.9	26.80	30.5	6.5	5.9	7.5	5.8	7.1	7.10	6.7
166	A86	26.8	23.4		31.5	41.0	38.20	32.2	8.5	8.4		9.9	13.2	13.00	10.6
287	25				52.8	84.0	55.90	64.2				20.2	33.2	29.70	27.7
289	27				28.3	30.8	17.50	25.5				6.2	5.7	5.20	5.7
290	28				21.2	95.6	17.10	44.6				8.9	35.3	6.70	17.0
342	82				23.0	48.8	41.70	37.8				9.5	7.9	9.60	9.0
354	94				18.9	30.4	25.60	25.0				4.6	4.1	4.30	4.3
165	A42	200.4	299.1	256.3	209.6	199.0	104.70	211.5	12.5	16.5	17.4	17.9	15.0	8.40	14.6
171	A47	41.4	52.6	36.3	97.6	94.8	43.90	61.1	10.3	29.2	13.5	70.3	29.4	29.70	30.4
172	A59	192.2	62.1	27.9	74.3	79.7	74.20	85.1	42.2	21.8	7.1	14.4	38.6	50.20	29.0
223	P94				77.2	61.9	66.20	68.4				23.6	27.3	23.40	24.8
225	P96				34.1	20.6	71.90	42.2				12.5	10.2	15.10	12.6
226	P97				29.9	25.1	38.80	31.3				8.8	10.8	15.60	11.7
227	P98				31.9	19.1	32.40	27.8				14.7	11.0	13.00	12.9
267	1				31.8	30.6	29.70	30.7				6.0	5.0	5.10	5.4
452	L4	45.0	21.4	17.4	14.8	22.0	35.80	26.1	13.4	11.2	8.9	7.3	10.9	19.90	11.9
470	L7	27.4	17.3	18.3	23.3	23.7	20.40	21.7	14.7	11.0	11.7	6.4	10.6	10.20	10.8
471	L8	57.3	44.1	39.9	27.4	30.5	42.80	40.3	13.2	13.8	13.0	10.5	12.3	15.50	13.1
400	L39	53.9	41.9	55.6	36.0	36.6	27.70	41.9	4.1	5.7	5.8	4.1	2.8	5.60	4.7
268	E15		127.0	61.3	27.8	27.6	34.50	55.6		12.7	9.7	18.2	8.4	7.90	11.4
182	P23				23.2	105.0	215.20	114.5				7.5	16.6	28.50	17.5
185	P27				12.4	17.8	19.60	16.6				6.9	7.9	8.10	7.6
209	P7				21.4	20.1	20.30	20.6				7.5	10.0	10.70	9.4
270	4				39.2	40.9	37.70	39.3				11.7	9.6	7.20	9.5
271	6				51.5	43.2	39.30	44.7				15.8	11.1	8.00	11.6
418	Kearl L.					23.0	27.20	25.1					5.6	6.60	6.1
436	L18	20.0	20.8	16.7	29.8	18.2	17.30	20.5	7.5	9.6	10.9	12.2	7.9	7.70	9.3
442	L23	22.4	14.8	14.7	15.1	22.8	18.30	18.0	7.2	5.9	6.0	4.7	8.0	7.20	6.5
444	L25	40.7	37.4	42.4	34.6	30.7	39.40	37.5	7.2	10.9	10.8	15.3	6.7	11.40	10.4
447	L28	69.2	57.1	86.8	83.8	129.3	98.80	87.5	59.3	47.5	65.5	57.6	84.0	79.20	65.5
448	L29	26.3		76.2	28.0	61.4	30.50	44.5	7.9		6.4	6.2	7.1	9.60	7.4
454	L46	150.4	127.8	156.4	189.9	340.8	265.00	205.0	97.6	46.4	102.7	96.7	155.8	141.80	106.8
455	L47	128.7	74.1	214.3	86.1	171.2	167.60	140.3	55.8	46.9	30.7	52.3	47.9	23.20	42.8
457	L49	79.7	75.0	126.1	79.7	112.5	124.60	99.6	38.8	34.4	73.9	50.9	70.2	57.70	54.3
464	L60	94.9	128.4	94.1	90.3	90.2	154.60	108.7	40.0	84.8	49.2	58.6	31.1	39.10	50.5
175	P13				174.8	291.6	323.60	263.3				35.3	52.0	44.30	43.9
199	P49				41.8	50.4	51.30	47.8				10.6	10.5	10.80	10.6
473	A301			14.5	18.0	15.4	18.00	16.5			4.5	4.0	3.8	5.00	4.3
118	L107		4.2	3.6	6.6	5.7	6.00	5.2		2.4	2.3	2.7	1.8	2.10	2.3
84	L109	13.9	13.5	12.3	13.7	13.2	13.90	13.4	7.7	9.3	7.8	6.9	6.4	7.10	7.5
88	O-10	44.5	38.8	52.9	47.4	15.1	22.40	36.9	5.1	4.9	4.8	5.1	4.7	5.40	5.0
90	R1	13.6	7.9	6.8	9.5	8.3	12.30	9.7	6.0	4.6	3.8	3.2	2.9	4.10	4.1
146	E52	52.1	48.4	39.1	45.8	44.7	31.60	43.6	39.8	42.7	32.9	38.5	26.7	27.40	34.7
152	E59	31.1	21.9	23.9	29.0	26.1	28.90	26.8	8.4	11.7	10.4	14.2	7.4	8.60	10.1
89	E68		50.6	60.5	60.1	129.7	51.20	70.4		25.8	28.4	28.2	30.7	25.60	27.7
91	O-1/E55	34.0	27.1	31.4	46.3	51.4	44.10	39.0	19.9	14.2	21.3	17.5	23.5	14.30	18.4
97	O-2 E67	34.2	33.7	28.6	35.9	33.0	34.00	33.2	20.8	28.2	24.2	26.4	24.6	23.50	24.6
428	L1	23.2						23.2	7.5						
83	O3/E64	33.6						33.6	11.6						
85	R2	19.9						19.9	9.6						
86	R3	7.7						7.7	4.0						
474	A300			168.4				168.4			10.8				

Annex 1: Summary of RAMP Data 1999-2004

		2000	2001	2002	2003	2004	Mean	1999	2000	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Dissolved Inorganic Carbon (mg/L)**						**Dissolved Organic Carbon (mg/L)**						
168	A21	0.17	0.4	0.38	0.30	0.49	0.34	23.0	19.66	23.3	21.76	19.68	16.79	20.71
169	A24	0.14	0.3	0.29	0.33	0.31	0.27	15.5	15.38	16.6	26.06	19.75	37.27	21.75
170	A26	0.24	0.4	0.36	0.42	0.34	0.34	18.1	10.83	12.0	16.70	16.54	14.83	14.83
167	A29	0.46	0.7	0.45	0.58	0.71	0.59	12.8	13.28	17.1	16.54	15.91	14.84	15.08
166	A86	1.08		1.36	1.43	1.55	1.36	15.5	13.89		14.69	16.32	21.60	16.40
287	25			0.32	0.37	0.33	0.34				15.56	18.64	20.12	18.11
289	27			1.01	0.87	0.96	0.95				12.17	12.97	11.88	12.34
290	28			0.38	0.47	0.48	0.44				20.06	28.73	19.06	22.62
342	82			1.90	1.71	1.96	1.86				26.09	25.01	25.21	25.44
354	94			5.20	3.44	3.46	4.03				25.44	23.60	22.14	23.73
165	A42	2.23	1.8	2.98	2.82	4.75	2.91	36.6	40.60	49.8	55.52	47.34	46.16	46.02
171	A47	1.07	0.3	1.48	1.60	1.34	1.16	11.3	15.46	31.3	20.79	20.62	19.00	19.73
172	A59	0.30	1.2	0.34	0.40	0.34	0.51	44.3	37.12	17.7	30.01	35.64	35.27	33.34
223	P94			6.83	6.91	7.33	7.02				49.46	51.51	50.40	50.46
225	P96			7.09	5.49	6.87	6.48				31.95	34.06	34.65	33.55
226	P97			2.56	2.04	2.18	2.26				27.60	36.31	29.97	31.29
227	P98			6.38	6.42	6.47	6.42				33.57	34.22	32.54	33.44
267	1			10.01	9.03	8.92	9.32				22.43	22.81	23.01	22.75
452	L4	0.25	0.6	0.24	0.48	0.68	0.45	23.0	27.40	24.8	26.25	26.60	20.71	24.79
470	L7	0.81	1.3	0.52	0.65	0.97	0.85	22.9	30.97	28.5	31.37	33.66	30.77	29.70
471	L8	4.00	4.0	3.45	3.98	3.93	3.87	20.3	20.66	25.6	21.60	23.53	20.41	22.01
400	L39	2.63	2.9	2.32	2.44	2.67	2.58	12.1	11.97	13.0	16.02	13.45	25.88	15.40
268	E15	3.50	4.0	5.16	3.63	3.15	3.90		16.66	81.2	43.30	30.83	32.27	40.84
182	P23			2.04	9.37	9.68	7.03				18.46	15.38	20.09	17.98
185	P27			0.27	0.26	0.36	0.30				31.47	31.31	34.20	32.33
209	P7			0.82	0.96	1.08	0.95				25.72	30.70	19.39	25.27
270	4			17.79	14.52	14.51	15.61				28.41	28.13	58.53	38.36
271	6			18.69	14.14	12.74	15.19				23.97	26.42	53.63	34.67
418	Kearl L.				15.67	17.59	16.63					23.53	25.15	24.34
436	L18	4.56	4.6	4.67	4.73	4.95	4.69	7.6	7.08	8.7	8.35	8.04	13.71	8.91
442	L23	1.49	1.5	1.77	1.61	1.73	1.63	13.9	11.31	13.6	13.30	13.38	19.38	14.14
444	L25	1.87	2.2	1.71	1.89	2.31	1.99	6.8	7.79	11.0	8.61	8.02	13.04	9.21
447	L28	0.17	0.4	0.33	0.30	0.65	0.37	26.5	27.46	28.2	27.98	28.78	30.87	28.30
448	L29		0.4	0.33	0.26	0.28	0.31	17.7		13.0	20.34	16.81	13.55	16.27
454	L46	1.40	1.8	2.05	1.59	2.62	1.89	16.9	23.40	23.2	23.25	29.43	22.90	23.18
455	L47	2.10	1.9	2.15	2.11	20.27	5.71	19.3	20.46	18.4	20.29	24.12	36.62	23.19
457	L49	1.45	1.0	1.35	1.34	1.92	1.41	16.3	23.00	19.9	20.72	25.15	26.71	21.96
464	L60	1.85	2.9	2.85	2.98	3.73	2.86	15.4	18.65	17.3	19.71	23.10	23.32	19.59
175	P13			9.56	7.98	7.07	8.20				44.79	48.96	52.21	48.65
199	P49			1.86	1.59	1.73	1.73				14.74	17.07	21.20	17.67
473	A301		4.8	4.82	4.43	4.73	4.69			13.8	13.32	14.37	24.20	16.43
118	L107	5.40	5.4	5.04	5.16	5.78	5.36		6.99	8.3	9.84	9.70	22.48	11.45
84	L109	4.51	4.2	3.88	3.49	4.13	4.04	19.1	14.34	15.7	19.09	21.73	30.17	20.01
88	O-10	2.60	2.4	2.17	2.20	2.27	2.32	24.4	21.65	14.8	24.83	20.94	34.86	23.58
90	R1	2.90	3.1	3.01	2.84	3.29	3.04	15.8	12.82	23.9	15.26	16.62	33.40	19.63
146	E52	2.86	3.5	3.61	3.68	3.94	3.52	24.0	21.22	22.1	22.88	22.85	24.74	22.97
152	E59	1.42	1.8	1.95	2.20	2.99	2.06	13.9	10.47	12.0	12.51	12.53	15.90	12.88
89	E68	2.27	2.3	2.10	2.40	2.30	2.28		22.59	24.9	20.15	20.61	21.52	21.96
91	O-1/E55	0.35	0.5	0.54	0.73	1.07	0.64	20.9	18.96	17.8	19.59	20.26	28.17	20.95
97	O-2 E67	1.27	1.7	1.49	1.81	2.11	1.67	24.4	22.01	24.2	22.56	21.77	26.69	23.61
428	L1							13.6						13.55
83	O3/E64							17.6						17.58
85	R2							21.7						21.66
86	R3							12.9						12.92
474	A300		2.9							32.2				32.24

Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001	2002	2003	2004	Mean	2001	2002	2004	mean	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Chlorophyll *a* (µg/L)**							**Gran Bicarbonate (mg/L)**				**Iron (mg/L)**				
168	A21	14.9	9.66	8	8.33	7.33	10.34	9.82	0.7	0.15	0.00	0.27	1.03	0.81	0.65	0.635	0.78
169	A24	29.7	15.01	4	1.44	14.79	17.17	13.73	0.0	0.00	0.00	0.00	0.68	0.71	0.49	0.507	0.60
170	A26	16.1	18.43	22	9.23	21.93	11.84	16.51	0.0	0.70	0.20	0.30	0.33	0.31	0.52	0.319	0.37
167	A29	8.2	14.70	37	3.75	13.34	12.15	14.82	0.7	1.49	1.10	1.09	0.09	0.08	0.07	0.039	0.07
166	A86	13.6	6.89		13.34	13.29	9.95	11.41		7.44	7.10	7.27		<DL	0.08	0.067	0.07
287	25				9.64	16.27	7.89	11.27		0.00	0.10	0.05		0.34	0.63	0.381	0.45
289	27				9.07	9.57	9.00	9.21		4.75	3.80	4.28		0.03	<LOD	0.038	0.03
290	28				3.40	17.52	6.89	9.27		3.24	1.60	2.42		0.11	0.85	0.097	0.35
342	82				5.82	16.03	25.67	15.84		13.34	10.70	12.02		0.02	<LOD	0.012	0.02
354	94				2.74	8.76	5.76	5.75		32.30	19.40	25.85		<DL	<LOD	0.015	0.02
165	A42	112.4	368.77	285	144.03	92.47	89.71	181.99	12.9	23.68	24.70	20.44	0.03	0.06	<LOD	0.012	0.03
171	A47	16.7	9.69	31	5.46	19.21	6.33	14.75	2.0	10.71	7.50	6.73	0.32	0.19	0.14	0.091	0.19
172	A59	75.6	48.24	18	4.38	26.93	14.87	31.25	4.9	3.16	1.30	3.12	0.03	0.28	0.50	0.510	0.33
223	P94				22.12	7.66	12.29	14.02		50.80	49.30	50.05		<DL	<LOD	0.005	0.01
225	P96				10.42	5.16	7.83	7.80		46.30	40.50	43.40		<DL	<LOD	0.024	0.02
226	P97				11.64	5.97	13.28	10.30		18.55	14.30	16.42		0.03	0.30	0.122	0.15
227	P98				9.69	1.53	6.54	5.92		43.48	39.80	41.64		0.03	<LOD	0.016	0.02
267	1				7.70	6.09	6.56	6.78		55.67	50.20	52.93		0.02	<LOD	0.008	0.01
452	L4	19.9	9.03	13	4.18	6.78	7.04	9.91	4.7	5.15	4.00	4.60	0.23	0.24	0.36	0.180	0.25
470	L7	7.3	7.62	5	2.54	8.23	2.68	5.63	11.3	7.92	6.70	8.63	0.65	0.37	0.76	0.497	0.57
471	L8	27.1	17.96	25	10.29	6.52	13.99	16.84	23.9	22.33	22.50	22.91	0.16	0.06	0.22	0.098	0.13
400	L39	32.7	38.51	66	28.50	31.64	10.80	34.75	11.1	10.34	11.40	10.96	<0.02	0.05	0.07	0.086	0.07
268	E15		370.98	47	3.61	18.55	12.64	90.57	27.9	34.42	19.30	27.20	0.02	0.14	0.06	0.049	0.07
182	P23				8.25	28.41	140.45	59.04		13.41	38.60	26.00		0.22	0.18	0.163	0.19
185	P27				1.80	3.60	5.39	3.60		3.87	2.00	2.93		0.30	0.30	0.251	0.28
209	P7				3.94	3.84	2.79	3.52		8.40	6.10	7.25		0.42	0.54	0.210	0.39
270	4				11.45	15.99	11.18	12.87		98.97	74.60	86.79		<DL	0.05	0.003	0.03
271	6				3.74	7.32	8.12	6.39		102.85	52.70	77.77		<DL	<LOD	0.020	0.02
418	Kearl L.					9.72	8.43	9.08			88.50	88.50			<LOD	0.003	0.00
436	L18	7.1	6.81	5	14.47	2.61	2.81	6.51	22.4	23.40	25.00	23.60	0.03	<DL	<LOD	<DL	0.03
442	L23	8.2	5.85	15	11.88	7.24	7.26	9.17	7.7	9.71	9.10	8.84	0.08	<DL	0.23	0.113	0.14
444	L25	29.5	12.81	16	3.20	6.14	13.71	13.52	9.4	7.85	10.70	9.31	0.06	0.03	<LOD	0.034	0.04
447	L28	2.6	2.65	4	3.43	5.07	6.14	4.03	1.1	1.37	2.30	1.58	1.63	1.38	1.87	1.510	1.60
448	L29	8.0		35	20.89	15.01	11.90	18.19	0.0	0.00	0.00	0.00	0.22	0.41	0.32	0.350	0.32
454	L46	2.6	57.13	6	7.37	103.94	7.30	30.80	12.2	13.61	11.70	12.51	1.38	2.20	3.88	2.160	2.40
455	L47	25.1	4.25	60	1.34	36.31	71.20	33.03	11.1	13.51	18.20	14.26	0.60	0.76	1.11	1.320	0.95
457	L49	10.0	40.04	19	8.11	3.38	8.84	14.89	6.1	8.95	11.30	8.78	1.00	1.17	1.61	2.370	1.54
464	L60	18.1	19.87	18	2.58	53.03	173.06	47.47	17.3	17.20	20.70	18.40	0.81	0.86	0.74	0.915	0.83
175	P13				51.43	128.03	135.65	105.04		61.55	43.50	52.52		0.10	0.12	0.078	0.10
199	P49				14.81	24.74	10.22	16.59		9.38	8.40	8.89		0.04	<LOD	0.101	0.07
473	A301			7	3.94	6.20	6.22	5.96	24.8	25.66	24.90	25.10	0.03	<DL	0.06	0.017	0.04
118	L107		1.53	3	2.88	1.93	2.16	2.23	24.7	26.01	27.20	25.97	<0.02	0.04	<LOD	0.317	0.18
84	L109	2.9	3.63	4	2.17	3.49	2.70	3.15	22.6	22.20	20.30	21.70	0.64	0.62	0.47	0.554	0.57
88	O-10	24.3	29.87	34	30.83	4.76	7.12	21.76	11.2	12.35	12.50	12.01	0.02	<DL	0.06	0.086	0.06
90	R1	3.7	3.88	4	3.08	4.09	5.37	4.04	16.8	16.99	17.10	16.97	0.13	0.06	0.16	0.000	0.09
146	E52	5.1	4.37	7	2.14	7.61	12.93	6.53	20.6	23.66	23.20	22.47	0.83	0.83	0.65	0.646	0.74
152	E59	10.2	4.18	7	2.31	7.60	6.99	6.32	8.7	10.34	12.60	10.55	0.18	0.24	<LOD	0.034	0.15
89	E68		12.88	10	14.20	11.46	8.85	11.55	14.7	13.17	12.70	13.52	0.96	0.79	0.77	0.342	0.72
91	O-1/E55	9.4	13.06	12	11.66	17.89	28.07	15.39	2.4	4.02	4.50	3.64	0.50	0.32	0.40	0.165	0.35
97	O-2 E67	10.0	2.87	3	2.00	5.54	6.38	4.95	10.4	12.94	11.80	11.73	0.85	0.95	0.82	0.823	0.86
428	L1	5.2															
83	O3/E64	14.3															
85	R2	4.0															
86	R3	1.3															
474	A300			161					17.6				0.03				

Annex 1: Summary of RAMP Data 1999-2004

		2001	2003	2004	Mean	2001	2002	2003	2004	Mean	2001	2002	2003	2004	Mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Silica (mg/L)**				**Total Nitrogen (µg/L)**					**Total Kjeldahl Nitrogen (µg/L)**				
168	A21	-	0.25	0.16	0.21	2731	642	718	753.39	1211	2724	640	714	753.39	1208
169	A24	<0.3	0.93		0.93	1305	950	1131	1,014.75	1100	1233	948	1128	1,013.46	1081
170	A26	<0.3	0.55	0.13	0.34	2995	940	1197	955.39	1522	2982	876	1187	828.07	1468
167	A29	-	0.26	0.09	0.18	1754	758	1031	874.71	1104	1748	758	1028	874.44	1102
166	A86		0.12		0.12		997	967	1,292.43	1085		958	958	1,291.68	1069
287	25		0.33		0.33		840	1236	898.06	991		840	1234	896.06	990
289	27		0.14	0.09	0.11		565	621	560.64	582		564	621	559.31	581
290	28		0.09	0.18	0.13		970	1076	661.42	902		948	1074	657.59	893
342	82		0.16	0.06	0.11		1281	1714	2,625.70	1874		1280	1713	2,591.81	1862
354	94		0.12	0.04	0.08		1511	1332	1,224.93	1356		1505	1332	1,224.93	1354
165	A42	-	0.48	0.04	0.26	-	5664	5040	3,800.62	4835	-	5663	5040	3,800.62	4835
171	A47	-	1.76	1.78	1.77	1341	1929	1534	1,647.69	1613	1325	1196	1449	1,026.71	1249
172	A59	-	2.31	1.41	1.86	2386	1386	1627	1,154.16	1638	2380	1385	1585	1,154.16	1626
223	P94		3.00	3.42	3.21	0	2786	2165	2,369.92	1830		2769	2164	2,369.92	2434
225	P96		0.48	1.39	0.93	0	1693	1616	2,623.98	1483		1692	1615	2,609.40	1972
226	P97		0.21	1.29	0.75	0	1165	1139	1,501.53	951		1164	1137	1,481.17	1261
227	P98		2.20	1.85	2.02	0	1812	1137	1,245.80	1049		1768	1135	1,245.80	1383
267	1		0.49	0.36	0.42	0	1471	1337	1,370.77	1045		1470	1337	1,369.26	1392
452	L4	-	0.11	0.77	0.44	610	627	593	774.00	651	533	621	592	638.70	596
470	L7	-	1.72	0.23	0.97	521	620	608	506.60	564	513	619	608	506.60	562
471	L8	-	1.50	1.65	1.57	971	974	734	942.46	905	967	896	734	938.62	884
400	L39	3.3	1.88	2.24	2.48	4050	1015	1134	728.92	1732	4043	1014	1134	727.50	1730
268	E15	-	0.47	0.38	0.42	2127	2773	1603	1,149.76	1913	2125	2765	1602	1,149.76	1910
182	P23		0.59	2.58	1.58		483	953	2,429.66	1289		481	953	2,428.69	1288
185	P27		1.16	0.48	0.82		687	611	604.90	634		614	611	604.90	610
209	P7		0.49	0.20	0.34		610	717	631.09	653		609	717	631.09	652
270	4		2.13	2.67	2.40		1998	1639	1,600.94	1746		1987	1639	1,600.34	1742
271	6		1.76		1.76		2390	1555	1,529.16	1825		2298	1555	1,529.16	1794
418	Kearl L.		2.01	2.87	2.44			1385	1,251.14	1318			1383	1,250.76	1317
436	L18	-	0.28	0.43	0.35	284	349	307	382.93	331	282	336	307	382.45	327
442	L23	1.0	1.07	1.22	1.11	828	384	646	682.67	635	819	384	646	680.44	632
444	L25	-	0.07	0.05	0.06	445	432	443	659.72	495	442	396	443	658.70	485
447	L28	2.7	0.36	1.22	1.42	1984	665	620	707.19	994	1931	650	620	707.19	977
448	L29	<0.3	0.03	0.02	0.03	4141	553	748	508.69	1488	4135	552	748	508.03	1486
454	L46	4.4	2.15	4.65	3.75	1761	1393	2075	1,605.26	1709	1707	1221	2074	1,409.64	1603
455	L47	1.4	1.53	2.14	1.68	3443	1265	1737	3,208.52	2413	3370	987	1715	2,920.76	2248
457	L49	3.0	0.71	0.41	1.38	4436	1126	1017	1,371.76	1988	4157	926	886	1,325.67	1824
464	L60	0.7	0.04	0.39	0.38	2640	874	1111	2,034.67	1665	2631	813	1111	2,034.67	1647
175	P13		0.88	1.26	1.07		3480	3816	4,306.77	3868		3471	3816	4,305.28	3864
199	P49		0.12	0.06	0.09		910	834	967.91	904		909	834	967.91	904
473	A301	1.5	1.62	1.73	1.63	1085	568	426	982.06	765	1072	567	426	980.49	762
118	L107	0.3	0.18	0.14	0.21	944	341	301	575.71	540	930	336	301	575.69	536
84	L109	2.5	2.00	2.53	2.34	1834	568	523	586.99	878	1822	545	520	579.64	867
88	O-10	1.1	0.27	0.11	0.50	2484	1535	690	843.91	1388	2478	1534	690	842.82	1386
90	R1	2.8	2.24	2.63	2.56	2204	468	434	563.86	917	2185	463	434	562.94	911
146	E52	1.5	0.47	0.61	0.84	894	559	583	807.60	711	876	514	583	805.87	695
152	E59	<0.3	0.06	0.56	0.31	2175	464	513	594.44	937	2165	409	510	594.40	920
89	E68	0.3	0.34	0.44	0.37	3802	724	1057	858.17	1611	3693	723	1048	776.63	1560
91	O-1/E55	<0.3	0.04	0.02	0.03	2159	736	944	997.55	1209	2113	731	932	996.99	1193
97	O-2 E67	0.9	0.70	0.42	0.67	2318	593	460	579.31	987	2303	568	450	571.85	973
428	L1														
83	O3/E64														
85	R2														
86	R3														
474	A300	-				6188					6184				

Annex 1: Summary of RAMP Data 1999-2004

		1999	2000	2001	2002	2003	2004	Mean	2003	2004	mean
Nox-Sox GIS No.	**Original RAMP Designation**	**Sum base cations (µeq/L)**							**Dissolved Aluminum (µg/L)**		
168	A21	181.9	166.8	177.6	142.9	139.5	120.0	154.8	251	173	212.00
169	A24	109.0	103.3	108.1	125.6	139.7	112.6	116.4	172	173	172.50
170	A26	346.8	126.5	125.0	143.3	146.0	129.3	169.5	113	105	109.00
167	A29	137.2	158.7	173.2	149.2	151.4	171.4	156.8	47.4	37.3	42.35
166	A86	237.7	240.7		264.6	280.9	306.8	266.1	21	22.3	21.65
287	25				118.3	136.4	123.1	125.9	197	116	156.50
289	27				164.3	178.0	179.8	174.1	17.9	15.3	16.60
290	28				196.2	264.8	183.9	215.0	197	54.9	125.95
342	82				387.7	362.2	348.0	366.0	17.4	16.1	16.75
354	94				684.6	525.2	496.3	568.7	12.6	11.5	12.05
165	A42	700.6	526.4	478.5	641.3	595.3	768.3	618.4	9.7	7.38	8.54
171	A47	149.9	311.1	258.5	403.4	347.8	335.7	301.1	15.1	12	13.55
172	A59	322.0	274.0	242.3	285.9	276.7	292.6	282.2	73.7	76.7	75.20
223	P94				1477.7	1370.7	1421.3	1423.2	8.2	6.54	7.37
225	P96				1010.2	834.6	965.3	936.7	12.5	12.5	12.50
226	P97				514.2	557.5	481.7	517.8	41.4	41.4	41.40
227	P98				996.7	967.2	948.6	970.8	4.66	4.66	4.66
267	1				1077.7	1004.9	981.7	1021.5	3.2	2.25	2.73
452	L4	308.0	301.4	273.6	277.1	268.9	246.8	279.3	43.2	41.9	42.55
470	L7	375.9	422.9	409.9	354.9	365.3	306.9	372.6	201	135	168.00
471	L8	635.3	598.9	627.2	549.8	605.5	536.5	592.2	14.3	20.3	17.30
400	L39	524.3	369.5	349.1	337.2	332.3	329.0	373.6	21.3	32.3	26.80
268	E15		787.2	793.7	706.9	608.6	538.1	686.9	6.3	7.31	6.81
182	P23				384.1	972.2	1178.5	844.9	3.7	18	10.85
185	P27				291.5	273.7	210.1	258.4	66.2	50.5	58.35
209	P7				323.2	359.1	276.9	319.7	39.3	24.7	32.00
270	4				1962.7	1757.8	1614.7	1778.4	1	1.15	1.08
271	6				1933.5	1578.5	1415.4	1642.5	6.9	6.38	6.64
418	Kearl L.				0.0	1770.0	1769.4	1179.8	0.94	0.94	0.94
436	L18	610.6	615.2	627.5	630.0	636.5	622.3	623.7	1.6	0.25	0.93
442	L23	289.3	280.5	278.3	288.7	266.5	264.9	278.0	9.4	3.43	6.42
444	L25	298.4	309.9	322.0	274.3	283.9	302.7	298.5	3.5	5.32	4.41
447	L28	239.2	214.7	229.4	225.6	213.7	258.9	230.2	366	244	305.00
448	L29	81.4		110.4	54.9	79.4	83.1	81.9	140	128	134.00
454	L46	878.3	696.1	606.0	594.4	584.8	579.8	656.6	516	369	442.50
455	L47	748.5	628.8	604.7	597.5	537.4	1699.2	802.7	681	397	539.00
457	L49	637.2	653.5	579.5	619.4	568.6	611.5	611.6	259	568	413.50
464	L60	556.8	644.6	643.9	635.2	628.2	613.7	620.4	22.2	16.2	19.20
175	P13				1482.0	1367.0	1337.8	1395.6	16.1	14.8	15.45
199	P49				294.2	288.4	324.7	302.4	30.3	20.4	25.35
473	A301			595.3	590.1	558.0	551.7	573.8	4.27	1.32	2.80
118	L107		622.2	650.4	616.0	602.7	603.7	619.0	3.92	7.8	5.86
84	L109	583.8	609.8	602.7	572.8	558.4	537.8	577.5	36	38.1	37.05
88	O-10	554.9	471.0	426.2	418.0	411.2	387.8	444.8	48.7	50.4	49.55
90	R1	436.5	452.0	461.9	447.7	440.7	442.0	446.8	5.9	5.9	5.90
146	E52	580.4	595.2	620.7	630.2	610.0	597.3	605.7	52.3	52	52.15
152	E59	331.4	298.1	323.7	317.7	327.7	341.1	323.3	6.7	3.48	5.09
89	E68		549.8	536.4	443.5	458.6	417.3	481.1	78.3	64.5	71.40
91	O-1/E55	245.3	234.7	226.7	230.7	245.5	275.1	243.0	95.8	76.7	86.25
97	O-2 E67	409.8	424.3	416.6	394.4	376.2	374.1	399.2	55	52.6	53.80
428	L1	283.7						283.7			
83	O3/E64	710.9						710.9			
85	R2	433.2						433.2			
86	R3	1146.2						1146.2			
474	A300			497.0				497.0			

Annex 2: Results of Analysis of Organic Component of the DOC in the RAMP Lakes

Lake	Original Name	Free Organic Anions by Anion Defict (µeq/L)			Charge Densities (µeq/mg C)			Strong Acid Anions (µeq/L)		
		2003	2004	Mean Case	2003	2004	Mean Case	2003	2004	Mean Case
168	A21	130.4	107.7	141.0	6.6	6.4	6.8	127.3	108.8	137.5
169	A24	146.6	113.2	119.6	7.4	3.0	5.5	147.2	113.9	120.0
170	A26	127.0	111.7	140.4	7.7	7.5	9.5	117.8	111.5	143.2
167	A29	130.6	139.4	128.8	8.2	9.4	8.5	109.9	129.7	122.2
166	A86	169.5	169.2	159.2	10.4	7.8	9.7	118.7	130.5	105.5
287	25	122.4	97.1	101.4	6.6	4.8	5.6	119.9	96.3	100.7
289	27	119.2	113.6	112.4	9.2	9.6	9.1	89.5	85.3	81.3
290	28	251.3	154.4	192.4	8.7	8.1	8.5	210.3	135.9	157.1
342	82	247.9	242.5	246.7	9.9	9.6	9.7	168.6	169.0	160.4
354	94	271.5	248.0	273.1	11.5	11.2	11.5	171.8	153.5	154.8
165	A42	389.5	407.5	412.4	8.2	8.8	9.0	282.4	302.9	275.3
171	A47	232.9	230.4	226.8	11.3	12.1	11.5	160.4	166.5	137.7
172	A59	212.2	237.1	234.1	6.0	6.7	7.0	170.8	216.4	183.8
223	P94	649.2	665.7	658.2	12.6	13.2	13.0	358.7	394.6	363.9
225	P96	405.4	457.8	431.6	11.9	13.2	12.9	221.4	268.5	234.2
226	P97	424.4	340.6	370.7	11.7	11.4	11.8	279.7	218.9	230.5
227	P98	449.6	430.9	452.5	13.1	13.2	13.5	264.4	249.9	249.2
267	1	253.7	257.0	256.3	11.1	11.2	11.3	168.8	133.0	145.6
452	L4	243.5	210.5	248.7	9.2	10.2	10.0	202.6	160.8	182.0
470	L7	341.0	256.5	327.1	10.1	8.3	11.0	235.0	187.0	214.1
471	L8	291.6	244.2	305.2	12.4	12.0	13.9	134.7	130.1	165.5
400	L39	167.3	124.0	185.9	12.4	4.8	12.1	146.0	98.4	151.2
268	E15	342.7	319.4	418.1	11.1	9.9	10.2	193.8	207.8	239.0
182	P23	266.3	293.9	260.2	17.3	14.6	14.5	122.6	167.6	140.3
185	P27	268.4	200.7	248.9	8.6	5.9	7.7	232.1	170.6	205.9
209	P7	309.6	230.2	273.3	10.1	11.9	10.8	212.1	167.9	184.1
270	4	528.0	389.8	468.8	18.8	6.7	12.2	182.2		248.5
271	6	259.4	218.2	323.9	9.8	4.1	9.3	202.3		182.7
418	Kearl L.	434.4	239.5	337.0	18.5	9.5	13.8	142.4	126.1	134.3
436	L18	166.8	108.4	141.5	20.7	7.9	15.9	98.4	55.1	80.0
442	L23	150.8	140.0	156.9	11.3	7.2	11.1	100.4	91.9	101.8
444	L25	107.4	96.9	117.8	13.4	7.4	12.8	67.2	61.7	74.6
447	L28	222.0	240.7	222.6	7.7	7.8	7.9	199.9	208.4	198.0
448	L29	124.6	136.6	132.0	7.4	10.1	8.1	124.8	136.8	132.2
454	L46	380.0	308.9	366.7	12.9	13.5	15.8	299.4	235.5	
455	L47	338.5	571.8	316.8	14.0	15.6	13.7	249.4		
457	L49	303.2	314.7	272.9	12.1	11.8	12.4	232.6	224.1	184.7
464	L60	284.2	228.9	248.9	12.3	9.8	12.7	199.5	157.6	142.6
175	P13	623.1	607.7	584.5	12.7	11.6	12.0	387.7	366.9	341.3
199	P49	187.5	189.2	177.7	11.0	8.9	10.1	127.5	140.0	124.3
473	A301	190.1	157.8	180.0	13.2	6.5	11.0	82.4	82.9	98.7
118	L107	140.3	83.5	144.2	14.5	3.7	12.6	60.5	57.1	89.2
84	L109	266.5	215.0	251.5	12.3	7.1	12.6	145.4	149.1	147.1
88	O-10	227.3	223.9	268.8	10.9	6.4	11.4	151.9	153.4	190.9
90	R1	206.2	175.6	202.1	12.4	5.3	10.3	124.7	110.5	117.1
146	E52	296.6	266.6	305.9	13.0	10.8	13.3	193.7	164.5	176.8
152	E59	153.1	103.9	153.7	12.2	6.5	11.9	98.5	89.8	101.4
89	E68	188.2	217.1	251.1	9.1	10.1	11.4	120.7	145.5	157.1
91	O-1/E55	196.2	199.5	196.9	9.7	7.1	9.4	151.3	170.0	149.3
97	O-2 E67	244.5	224.3	280.2	11.2	8.4	11.9	169.4	156.9	180.6

Annex 2: Results of Analysis of Organic Component of the DOC in the RAMP Lakes

Lake	Original Name	ANC Attributable to Weak Organic Acid Anions - ANC_{org} (µeq/L)			ANC_{org} Charge Density (µeq/mg C)			Percent Total ANC Attributable to Weak Organic Acids		
		2003	2004	Mean Case	2003	2004	Mean Case		Mean Case	
168	A21	0.6	-1.1	3.2	0.0	-0.1	0.2		74.5	
169	A24	-0.7	-0.7	4.2	0.0	0.0	0.2			
170	A26	9.3	-2.4	0.0	0.6	-0.2	0.0			
167	A29	15.2	6.0	2.1	1.0	0.4	0.1		14.6	
166	A86	41.1	29.9	44.4	2.5	1.4	2.7		38.4	
287	25	2.6	-0.2	0.0	0.1	0.0	0.0			
289	27	21.6	20.6	23.2	1.7	1.7	1.9		33.5	
290	28	31.7	13.8	28.5	1.1	0.7	1.3		67.3	
342	82	65.1	60.3	72.6	2.6	2.4	2.9		38.4	
354	94	81.7	77.4	100.9	3.5	3.5	4.3		25.5	
165	A42	90.2	84.1	118.4	1.9	1.8	2.6		38.3	
171	A47	62.4	50.6	77.9	3.0	2.7	3.9		62.5	
172	A59	33.3	15.1	42.0	0.9	0.4	1.3		77.5	
223	P94	265.0	243.8	267.9	5.1	4.8	5.3		32.8	
225	P96	163.2	165.9	175.4	4.8	4.8	5.2		26.0	
226	P97	126.0	105.1	122.6	3.5	3.5	3.9		45.8	
227	P98	163.7	159.2	181.6	4.8	4.9	5.4		26.7	
267	1	69.5	102.3	91.6	3.0	4.4	4.0		10.8	
452	L4	35.4	41.1	60.2	1.3	2.0	2.4		80.5	
470	L7	90.3	58.7	100.0	2.7	1.9	3.4		68.2	
471	L8	140.8	102.7	126.1	6.0	5.0	5.7		32.0	
400	L39	13.0	15.7	25.7	1.0	0.6	1.7		14.3	
268	E15	131.3	94.9	162.0	4.3	2.9	4.0		36.3	
182	P23	123.4	215.0	101.6	8.0	10.7	5.7		14.9	
185	P27	26.9	21.7	34.4	0.9	0.6	1.1		77.5	
209	P7	82.3	50.1	75.6	2.7	2.6	3.0		60.7	
270	4	347.7		212.1	12.4		5.5		14.0	
271	6			193.2			5.6		13.4	
418	Kearl L.	272.5	99.1	185.7	11.6	3.9	7.6		12.0	
436	L18	54.7	41.5	48.6	6.8	3.0	5.5		12.6	
442	L23	39.1	37.3	44.2	2.9	1.9	3.1		30.7	
444	L25	30.5	26.4	33.9	3.8	2.0	3.7		21.8	
447	L28	14.6	23.2	18.5	0.5	0.8	0.7		70.3	
448	L29	0.3	-0.3	7.9	0.0	0.0	0.5			
454	L46	66.7	59.5	95.9	2.3	2.6	4.1		43.8	
455	L47	73.2			3.0					
457	L49	59.7	77.2	76.0	2.4	2.9	3.5		49.5	
464	L60	67.5	55.6	89.7	2.9	2.4	4.6		31.2	
175	P13	214.3	276.1	225.8	4.4	5.3	4.6		24.5	
199	P49	47.9	38.0	41.8	2.8	1.8	2.4		29.0	
473	A301	92.1	60.2	66.2	6.4	2.5	4.0		16.0	
118	L107	67.3	13.1	42.0	6.9	0.6	3.7		9.7	
84	L109	106.1	50.5	89.2	4.9	1.7	4.5		24.3	
88	O-10	61.0	57.2	64.1	2.9	1.6	2.7		30.2	
90	R1	66.4	51.1	70.5	4.0	1.5	3.6		25.1	
146	E52	84.3	84.7	110.9	3.7	3.4	4.8		30.5	
152	E59	42.2	3.9	41.0	3.4	0.2	3.2		23.9	
89	E68	54.1	57.7	80.3	2.6	2.7	3.7		34.4	
91	O-1/E55	37.9	22.4	41.0	1.9	0.8	2.0		63.6	
97	O-2 E67	61.4	54.2	86.1	2.8	2.0	3.6		44.9	

Annex 3: Estimates of Charge Density in the Literature (WRS 1999)

Location	Water	DOC	Method[1]	Charge Density	Source
		mg/L		ueq/mg C	
Spencer Creek (Ont.)	River	8	O	11.5	Oliver et al. (1983)
Missouri River	River	3.8	O	11	Oliver et al. (1983)
Ohio River (OH)	River	3.5	O	11.4	Oliver et al. (1983)
Yampa River (CO)	River	2	O	11.3	Oliver et al. (1983)
Ogeechee R. (GA)	River	7	O	10.4	Oliver et al. (1983)
Shawsheen R. (MA)	River	7	O	10.4	Oliver et al. (1983)
Como Creek (CO)	River	6.4	O	10.1	Oliver et al. (1983)
Deer Creek (CO)	River	0.7	O	11.3	Oliver et al. (1983)
Pebbleloggitch (NS)	Lake	18	O	8.3	Oliver et al. (1983)
Brainard L.(CO)	Lake	2.8	O	10.7	Oliver et al. (1983)
Island L. (NE)	Lake	30	O	13.4	Oliver et al. (1983)
Castle Lake (OR)	Lake	145	O	10.6	Oliver et al. (1983)
Sphagnum Bog (ME)	Wetland	30	O	9.9	Oliver et al. (1983)
Suwanee R. (GA)	Wetland	32	O	11	Oliver et al. (1983)
Hawaii Marsh (HI)	Wetland	12	O	10.3	Oliver et al. (1983)
Thoreau's Bog (MA)	Wetland	30	O	10.1	Oliver et al. (1983)
Alpine Bog (CO)	Wetland	3	O	9.2	Oliver et al. (1983)
Biscayne (FL)	Groundwater	13	O	11.4	Oliver et al. (1983)
Tupper L (NS)	Lake	11.8	O	7.2	Clair et al. (1992)
Tupper L (NS)	Lake	11.8	C	2.2	Clair et al. (1992)
Moose Pit Brook (NS)	River	9.3	O	5.6	Clair et al. (1992)
Moose Pit Brook (NS)	River	9.3	C	3.4	Clair et al. (1992)
Mersey River	River	13.9	O	7.1	Clair et al. (1992)
Mersey River	River	13.9	C	1.7	Clair et al. (1992)
Beaverskin Lake	Lake	2	O	8.6	Clair et al. (1992)
Beaverskin Lake	Lake	2	C	1.1	Clair et al. (1992)
Skjervatjern Lake (Norway)	Lake	6.85	O	6.6	Clair et al. (1992)
Skjervatjern Lake (Norway)	Lake	6.85	C	4.3	Clair et al. (1992)
Finnish Lake Survey	Lake	12	AD	7.5	Kortelainen (1992)
Quebec Lakes	Lake	4.7-6.2	OM	6-8.1	Wilkinson et al. (1992)
East Bear Brook	River	2.20	EM	7.1-7.7	David et al. (1992)
West Bear Brook	River	2.02	EM	7.6-7.7	David et al. (1992)
Maine Soils	Soil Leachates	58	AD	3-13	Vance and David (1991)

[1] O = method of Oliver et al. (1983); AD = anion deficit; OM = modified method of Oliver et al. (1983); C = method of Clair et al. (1992)