APPENDIX 6.3.1-A

Aquatic Investigations in Stream F, Stream T, and Peonan Creek

CanNorth
Canada North Environmental Services
Limited Partnership

STAR-ORION SOUTH DIAMOND PROJECT
2011 ADDITIONAL AQUATIC INVESTIGATIONS

Draft Report

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EXECUTIVE SUMMARY

Shore Gold Inc. and the participants of the Fort à la Corne Joint Venture are evaluating the feasibility of development of two open pit diamond mines: one at the Star Kimberlite deposit and the other at the Orion South Kimberlite deposit. On completion, the Star-Orion South Diamond Project will include facilities for kimberlite mining, processing, waste management, and associated infrastructure. Previous aquatic investigations conducted in the Project area between 2006 and 2008 documented baseline conditions in nine streams draining southwards to the Saskatchewan River and the adjacent reach of the Saskatchewan River. Three additional streams (Peonan Creek, Stream F, and Stream T) adjacent to the proposed project may also be potentially affected by development of the Project, specifically through the lowering of the groundwater table. Canada North Environmental Services (CanNorth) was retained to document the existing aquatic environment in these three streams.

The following stream regions were surveyed in July 2011: Peonan Creek within 500 m of the Saskatchewan River and approximately 11 km upstream from the Saskatchewan River; Stream F within 500 m of the Saskatchewan River and approximately 4.5 km upstream from the Saskatchewan River; and the uppermost 500 m reach of Stream T. The information collected in the study reach of Stream T and in the lower reaches of Peonan Creek and Stream F included: streamflow; field-measured and laboratory-analyzed water quality; fish communities and health; and aquatic habitat including feeding, spawning, nursery, early rearing, and overwintering preferences and requirements for key species. Fish communities were also assessed in the upper reaches of Peonan Creek and Stream F to determine if they were accessible to fish.

Discharge measurements represented baseflow conditions, ranging from 0.335 m^3/s in the low reach of Peonan Creek to 0.369 m^3/s in the low reach of Stream F. There was no flow (0.000 m^3/s) in the upper reach of Stream T, which was impounded by beaver dams.

In comparison to the Saskatchewan Surface Water Quality Objectives for the protection of aquatic life (SSWQOs) and Canadian Water Quality Guidelines for the protection of aquatic life (CWQGs), field-measured dissolved oxygen concentrations in Stream T were depleted (≤2.43 mg/L) below the lower limit for cold-water biota (6.5 mg/L for other life stages), while Peonan Creek and Stream F were well oxygenated meeting the lower dissolved oxygen limit. All field and laboratory pH results (7.4 to 8.4) were slightly

alkaline and compliant with the CWQG range of 6.5 to 9.0. The field and laboratory measurements of specific conductance were overall quite consistent during the July 2011 site visit, ranging from 272 µS/cm to 277 µS/cm in Stream T, 903 µS/cm to 929 µS/cm in Stream F, and 1400 µS/cm to 1415 µS/cm in Peonan Creek.

Similar to specific conductance, turbidity in Stream T (1.4 NTU to 1.7 NTU) was lower than in Peonan Creek (11 NTU) and Stream F (10 NTU). Similar patterns were found in other physical property parameters (sum of ions, total dissolved solids, total hardness), and several major ions (bicarbonate, calcium, magnesium, potassium, and sulphate). All of these parameters were measured at lower levels in Stream T than in Peonan Creek and Stream F.

The metals and trace elements that exceeded SSWQO and CWQG levels included chromium in Stream F, aluminum in Peonan Creek and Stream F, iron in all three streams, and arsenic in Peonan Creek and Stream F. Stream T contained concentrations of ammonia as nitrogen, total organic carbon, dissolved organic carbon, and phosphorus that were nearly twice as high as those in the other two streams. Concentrations of ammonia as nitrogen and nitrate in all three streams complied with SSWQOs and CWQGs.

Fish community surveys were conducted using minnow traps and backpack electrofishing in two study areas of each of Peonan Creek and Stream F and in one study area of Stream T in July 2011. A total of 12 fish species were collected in Peonan Creek and Stream F. All of these species were previously reported to occur in the Star-Orion South Diamond Project study area during 2006 to 2008 investigations. There were no fish captured in the study reach of Stream T, although tadpoles and crayfish (Orconectes virilis) were frequently collected in minnow traps. All fish collected lacked visual physical abnormalities and external parasites and were healthy in appearance.

Fish collections from Peonan Creek were more species-rich (12 species) than those from Stream F (8 species); however, Stream F yielded more fish (796) than Peonan Creek (204 fish). Lake chub (Couesius plumbeus) was the most abundant fish comprising 62% (Stream F) to 69% (Peonan Creek) of the total fish catch. All of the large-bodied species sighted were juveniles. These included white sucker (Catostomus commersoni) and walleye (Sander vitreus) captured in the lower reaches of both streams as well as northern pike (Esox lucius) and yellow perch (Perca flavescens) collected in the lower

reach of Peonan Creek only. These findings provided evidence of habitat utilization by all four of these large-bodied fish species in the lower reaches of both streams. The absence of large-bodied species in the upper reaches of these streams could be due to obstructions present throughout the stream courses acting to limit fish passage. Likewise, beaver dams present within the upper reach of Stream T would interfere with the upstream movement of fish, and this was supported by the lack of fish in this reach during the fish survey.

Spawning suitability indices were determined for the habitat within the lower reaches of Peonan Creek and Stream F documented to contain large-bodied species. Both streams provided more sites suitable for the spawning activity of sucker species than the other three large-bodied species. The prevalence of moderately suitable spawning habitat for white sucker was higher in Stream F (5 of 8 habitat sections) than in Peonan Creek (3 of 8 habitat sections). The shallowness and silt deposition would limit walleye spawning habitat throughout the majority of the areas assessed in Stream F and Peonan Creek. Marginally to moderately suitable northern pike spawning habitat occurred in Peonan Creek sections (3 of 8 habitat sections) featuring sparse emergent aquatic vegetation and/or other suitable streambed substrate, moderate streamflow, and shallow water depths. Marginally suitable (2 of 8 habitat sections) and marginally suitable to non-suitable (2 of 8 habitat sections) yellow perch spawning sites with sparse large woody debris were scattered throughout the lower reach of Peonan Creek.

For all of the species considered, the quality and quantity of suitable spawning habitat was similar to the available nursery and early rearing habitat. Small-bodied fish and juvenile fish occurred within the two study streams indicating that habitat was available to support large-bodied predatory fish (northern pike and walleye) and opportunistic feeders such as yellow perch. Based on water depths and taking into account that flowing water is resistant to freezing, only small portions of Peonan Creek and Stream F would provide suitable overwintering habitat. The Saskatchewan River, however, would provide highly suitable overwintering habitat.

In conclusion, the investigations conducted in July 2011 provided additional baseline information for three streams that may be potentially affected by the lowering of the groundwater table associated with the project.

1.0 INTRODUCTION

1.1 Background

Shore Gold Inc. (Shore) and the participants of the Fort à la Corne Joint Venture are evaluating the feasibility of developing two open pit diamond mines: one at the Star Kimberlite deposit and the other at the Orion South Kimberlite deposit. Both deposits are located within the Fort á la Corne forest in central Saskatchewan, approximately 60 km east of the city of Prince Albert (Figure 1). The proposed development, known as the Star-Orion South Diamond Project, will include construction and operation of the two open pit mines, processing and waste management facilities, and associated infrastructure to commercially extract diamonds from these kimberlites. Shore is the operator of both parts of the Project.

An Environmental Impact Assessment (EIA) of the proposed Project was completed in December 2010, followed by the Environmental Impact Statement (EIS) prepared in the same year (AMEC 2010). To establish aquatic baseline conditions in the project area, a comprehensive baseline monitoring program has been conducted from 2006 to 2008 (Golder 2006 and 2008; CanNorth 2007, 2008, and 2010). The study area for this program was based on the preliminary project footprint depicted in the project proposal (Shore 2008) and encompassed nine streams draining southward to the Saskatchewan River and the adjacent reach of the Saskatchewan River itself (CanNorth 2010).

A technical review of the EIS conducted by federal regulators (Fisheries and Oceans Canada [DFO] and Environment Canada [EC]) identified additional information required to predict the potential effects of the project on various components of the environment. Specifically, the proposed development will involve the excavation of surficial and deep aquifers (AMEC 2010) thereby potentially affecting the surface hydrology and aquatic recourses in three additional streams in the vicinity of the minesite, namely, Peonan Creek, Stream F, and Stream T. Canada North Environmental Services (CanNorth) was commissioned to conduct aquatic baseline investigations on these three streams during the summer of 2011.

1.2 Study Area

The study area lies in the La Corne Plain landscape area within the Boreal Transition ecoregion of the Boreal Plain ecozone of central Saskatchewan (Acton et al. 1998) and is

surrounded by the Fort á la Corne sand hills (Wolfe et al. 2006). Overall, this area is characterized by mixed forest and productive farmland (Acton et al. 1998).

Previous aquatic investigations conducted in the Star-Orion South Diamond Project during 2006 to 2008 included nine streams (Caution Creek, 101 Ravine, West Perimeter Ravine, West Ravine, East Ravine, Duke Ravine, FalC Ravine, Wapiti Ravine, and English Creek) located on the north side of the Saskatchewan River and the adjacent reach of the Saskatchewan River (CanNorth 2010). The study area for this study consists of three additional streams, namely, Peonan Creek, Stream F, and Stream T (Figure 2). Of these, the latter stream is located on the north side of the Saskatchewan River and forms part of the White Fox River drainage, while the former two streams are located on the south side of the Saskatchewan River and drain northward to the river.

1.3 Study Objectives and Scope of Work

The objective of this study was to characterize the current baseline conditions of the aquatic environment in three streams situated near the proposed project area. To fulfill the study objective, two field trips were undertaken during the summer of 2011. The first trip was conducted from June 20th to 22nd, 2011. Due to high water levels and sinking wet ground under high rainfall conditions in June 2011, only Stream F was safely accessible. This precluded collection of baseline data from Peonan Creek and Stream T. In addition, the lower study reach of Stream F was too fast and deep for wading, therefore streamflow measurements from ⅓ of the channel cross-section were the only data collected. All three streams were revisited during a second field survey completed from July 5th to 13th, 2011.

The collections and analyses conducted for each of the three study streams included:

- streamflow measurements;
- field and laboratory water quality measurements;
- fish communities and health; and,
- aquatic habitat assessment.

Described in this report, baseline conditions and environmental monitoring data generally follow the approach undertaken in the Star-Orion South Diamond Project EIS (AMEC

2010). This approach would, with little effort, allow the entire document to be appended to the updated Star-Orion South Diamond Project EIS in the future.

2.0 METHODS

2.1 Quality Assurance/Quality Control

To ensure that the sampling program produces technically sound and scientifically defensible results, all sampling and handling procedures followed appropriate CanNorth Standard Operating Procedures (SOPs). These SOPs, including record-keeping, sample collection, preservation, shipping, and laboratory analyses, are based on methods and procedures described in EC (2002), procedures developed by standard-setting organizations such as the U.S. EPA, as well as procedures referenced in the primary literature. Some of the specific components of the quality assurance/quality control (QA/QC) program included:

- sampling location documentation – coordinates of sampling locations were recorded using a handheld Global Positioning Satellite (GPS) receiver;
- sampling remedial actions – samples were discarded if the sampling quality control measures were not met (e.g.., discarding water samples if sediment was disturbed);
- contamination control – the sampling equipment was cleaned prior to the start of sampling and was rinsed on completion of sample collection at sampling station;
- sample preservation and storage – samples were preserved with the appropriate preservative/fixative, if applicable, and were kept in the freezer and/or refrigerated between time of collection and time of delivery to the analytical laboratory;
- sample shipping – chain-of-custody forms were used in the transportation of samples so the samples could be tracked from the field to the laboratory; and,
- use of blanks and field duplicate samples – water quality sampling program included one trip blank, one field blank, and one field duplicate sample per sampling program.
    - A field blank was used to check contamination from all potential sources of contamination in the field (EC 2002). A field blank sample was collected by bringing, in the field, deionized water that was supplied by the lab. The field blank sample underwent the same sample collection, handling, and processing steps as the test samples. One field blank sample was collected during the survey.
    - A trip blank sample was used to check contamination from sample bottles, caps, and preservatives during transport, storage, and analyses

(EC 2002). The sample bottle was filled with deionized water in the laboratory, and it was preserved in the same manner as the test samples. The trip blank sample was transported to and from the field without modification and was opened at the time of analyses. One trip blank sample was collected during the survey.

- A field duplicate sample was taken to ensure that sampling and laboratory analyses produced repeatable results (EC 2002).

All water chemistry samples were analyzed by the Saskatchewan Research Council (SRC) Analytical Laboratories in Saskatoon, Saskatchewan. SRC Analytical Laboratories are certified and accredited by the Canadian Association for Environmental Analytical Laboratories (CAEAL) and the Standard Council of Canada (SCC). As such, the SRC laboratories adhere to strict QA/QC standards and protocols. With each batch of samples run, SRC tested reference materials, duplicates, and spiked samples.

CanNorth's QA/QC procedures for laboratory chemistry analytical results included screening data for potential anomalous values. An arbitrary value of 40% relative percent difference (RPD) was applied as a data quality objective when comparing field test sample results to the corresponding field duplicate sample results. The intent of applying this 40% value was to provide an initial benchmark for the data screening process, which in turn determined whether the results were acceptable or required further investigation into the cause of any discrepancies.

2.2 Streamflow Measurements

Streamflow data were collected from three streams in the Star-Orion South Diamond Project study area in June and/or July 2011. The locations[1] where streamflow was gauged in July 2011 are illustrated on Figures 3 to 5.

Stream discharge calculations were based on the mid-section method (Shaw 1983). Stream velocity was measured with a Swoffer Model 2100 current meter equipped with a top-setting wading rod. A tag line (cable marked at 0.2 or 0.5 m intervals) was used to measure the channel width at the discharge measurement cross-section. The stream was divided into equal sections along a perpendicular transect and the point velocity was

[1] Streamflow in the lower reach of Stream F was measured at the same location during June and July 2011.

recorded for each section; the depth for each point was also measured using the wading rod. The velocity measurements were converted to cross-sectional discharge values by multiplying by the corresponding sub-areas and summing the products to give the total discharge.

During June 2011, Stream F within the study area was too fast and deep for wading, therefore discharge measurements were obtained at ⅓ of the channel cross-section. The total discharge, inferred by multiplying the partial discharge measured by three, is likely an underestimation of streamflow, however provides some indication of peak flows during extreme rainfall events.

2.3 Water Quality

Water quality is defined by both physical and chemical characteristics of water. Field-measured parameters (temperature, dissolved oxygen (DO), conductivity, and pH) and laboratory-analyzed parameters (e.g., nutrients, major ions, and metals) are both integral components of the water quality monitoring program.

2.3.1 Sampling Methods

2.3.1.1 Field Water Quality Measurements

Standard *in situ* water quality parameters, including temperature, dissolved oxygen (DO), specific conductance, and pH, were obtained from three streams in the Star-Orion South Diamond Project study area in July 2011. Sampling locations are depicted in Figures 3 to 5. Field water quality parameters were measured near the water surface using a digital YSI Model 556 multi-probe meter.

2.3.1.2 Laboratory Water Quality Measurements

Water quality samples were collected from each of the three study streams in July 2011 (Figures 3 to 5). The samples were collected as discrete grabs immediately below the water surface and preservatives were added where required. As described in Section 2.1, the water quality sampling program included collection of one trip blank, one field blank, and one field duplicate sample.

Samples were analyzed by the SRC laboratories in Saskatoon and included the following parameters:

Parameters	
Inorganic ions	Bicarbonate, Calcium, Carbonate, Chloride, Fluoride, Magnesium, Potassium, Sodium, Sulphate
Metals	Aluminum, Barium, Boron, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Molybdenum, Nickel, Selenium, Silver, Thallium, Tin, Titanium, Uranium, Zinc
Nutrients	Ammonia as nitrogen, Dissolved organic carbon, Nitrate, Phosphorus, Total Kjeldahl nitrogen, Total organic carbon, Total nitrogen
Trace elements	Antimony, Arsenic, Beryllium, Cobalt, Strontium, Vanadium
Physical properties	Hydroxide, P. alkalinity, pH, Specific conductivity, Sum of ions, Total alkalinity, Total dissolved solids, Total hardness, Turbidity

2.3.2 Data Analysis

Water quality data obtained from the Star-Orion South Diamond Project study area were compared to the Saskatchewan surface water quality objectives for the protection of aquatic life (SSWQO; SE 2006) and Canadian water quality guidelines for the protection of aquatic life (CWQG; CCME 2011). The available objectives and guidelines are summarized in Table 1. Exceedances of SSWQOs and CWQGs were indicated using the most conservative (lowest) objective or guideline value of each parameter for long-term exposure[2] (Table 1).

2.4 Fish

Fish investigations were conducted in Peonan Creek, Stream F, and Stream T in July 2011 to meet the following objectives:

- determine fish community composition and abundance;
- assess external fish health; and,
- map aquatic habitat and characterize critical fish habitat.

2.4.1 Fish Community Surveys

The fish community surveys were performed using minnow traps and backpack electrofishing in each of the three study streams in July 2011. The following stream areas were surveyed: Peonan Creek within 500 m of the Saskatchewan River and approximately 11 km upstream from the Saskatchewan River; Stream F within 500 m of the Saskatchewan River and approximately 4.5 km upstream from the Saskatchewan River; and the upstream 500 m section of Stream T. The general location of the stream

sections surveyed in the Star-Orion South Diamond Project study area is shown in Figure 2 and the location of electrofishing and minnow trapping effort are detailed in Figures 6, 7, and 8 (electrofished sections of Peonan Creek and Stream F are not illustrated).

Fish were collected under the authority of a *Special Collection Permit* issued by the Saskatchewan Ministry of Environment in Prince Albert. All captured fish were identified, measured, and visually assessed for external health. Lesions and other malformations on the body surface; eroded, frayed, or hemorrhagic fins; parasites, or other physical deformities were noted where present. Fish measurements[3] included fork length or total length depending on species. The relative abundance of fish species was assessed using catch per unit effort (CPUE) data from electrofishing. It is noted that during the fish surveys, every effort was made to reduce fish mortality.

2.4.1.1 Electrofishing

Electrofishing using a backpack electrofisher (Smith-Root Inc., Model LR-24) was the main sampling method in the study streams. This method has less impact on the resident fish communities compared to gill netting and it targets both small and large-bodied fish. Effort was quantified as the length of time the electrofisher was activated during each transect. Numerous habitat types were sampled throughout the stream study areas.

2.4.1.2 Minnow Traps

Cylindrical minnow traps were used to assess the presence of small-bodied and juvenile fishes in the streams. Each trap measured 41 cm in length and 22 cm in diameter (at the widest point), with a wire mesh spacing of 6.4 mm. The traps were placed in a variety of habitat types in each tributary in areas that contained adequate depth to submerge the trap. Minnow traps were baited with bread.

2.4.2 Aquatic Habitat Assessments

A detailed assessment of the quantity and quality of critical fish habitat in each of Peonan Creek, Stream F, and Stream T was undertaken in July 2011. Peonan Creek and Stream F were assessed within approximately 500 m of the Saskatchewan River. The study area

[2] For SSWQO, differentiation between exposure duration (short-term/long-term) is not applicable.
[3] Small-bodied fish and immature large-bodied fish captured in this study were not weighed.

in Stream T included the upstream 500 m reach of the stream. The locations of the stream study areas assessed are illustrated on Figures 9 to 11.

It is noted that in-stream habitat assessments reflect the conditions at the time of surveys, but habitat types tend to change due to changes in seasons or physical barriers such as beaver dams.

Critical fish habitat includes spawning, nursery, rearing, feeding, and overwintering habitat. The documentation of potential critical fish habitat was modified after the Habitat Evaluation Procedure (HEP) developed by the U.S. Fish and Wildlife Service (Cowardin et al .1979; Busch and Sly 1992) and other documents (e.g. DFO and BCMOEP 1987; Orth 1989; OMNR 1989; Plafkin et al. 1989; Langhorne et al. 2001).

2.4.2.1 Delineation and Description of Habitat Sections

Each study area was divided into a series of Habitat Sections (HS) based on physical characteristics. The upland, riparian, and in-stream/littoral zones of each HS were described and photographs were taken. In the tributaries, the in-stream habitat was characterized by recording percent composition of each substrate type (silt/clay, sand, gravel, cobble, boulder, or organic), the density of emergent, floating leaf, or submergent aquatic vegetation, the amount and type of fish cover (large woody debris, aquatic vegetation, rock, overhanging vegetation, undercut, or surface turbulence), the dominant habitat types (percentage of pools, riffles, runs, or glides), channel characteristics including wetted width, bank width, bank depth, mean center depth, maximum depth, braided channels, and the presence of obstructions (waterfalls, log jams, beaver dams, chutes, or subsurface flow).

Based on its physical description, each HS was assessed for spawning suitability for key large-bodied fish species captured during the fish community surveys. These species included northern pike (*Esox lucius*), walleye (*Sander vitreus*), white sucker (*Catostomus commersoni*), and yellow perch (*Perca flavescens*).

2.4.2.2 Spawning Habitat Suitability

Each HS was rated for its suitability as spawning habitat for each of the species investigated. Suitability was based on known spawning habitat characteristics that have

been described in the literature, and includes the appropriate habitat suitability models, where available, that have been developed for the species. The index ratings range from not suitable (0) to most or highly suitable (3). The assessment of spawning habitat was based on the following characteristics:

Northern Pike[4]

Not Suitable (0)	an area that does not support aquatic plant growth and predominantly consists of a rock and/or sand substrate;
Marginal (1)	an area supporting a sparse growth of aquatic plants, usually *Carex*;
Moderate (2)	an area that supports moderate to dense aquatic plant growth; and,
Most Suitable (3)	an area similar to 2 but the substrate is found in water <0.5 m in depth with little or no current covered with aquatic plant material, particularly "feather" moss but also senesced aquatic plants.

Yellow Perch[5]

Not Suitable (0)	an area that does not support aquatic plant growth and consists of a cobble or boulder substrate, especially with a moderate or strong current;
Marginal (1)	a relatively shallow area that does not support aquatic plant growth and consists of a sand or gravel substrate with little or no current;
Moderate (2)	an inshore area that supports sparse rooted aquatic plant growth, particularly with some submerged brush and/or fallen trees and little or no current; and
Most Suitable (3)	an inshore area that supports moderate to dense rooted aquatic plant growth, particularly with significant amounts of submerged brush and/or fallen trees and little or no current.

[4] Sources: Krochak and Crosby 1975; Inskip 1982; Casselman and Lewis 1996; Minns et al. 1996; Scott and Crossman 1998.
[5] Sources: Scott and Crossman 1998; Kreiger et al. 1983.

Walleye[6]

Not Suitable (0) an area with an organic or silt substrate, particularly with aquatic plant debris;

Marginal (1) an area with a sand and/or silt substrate but free of aquatic plant debris;

Moderate (2) an area with a clean gravel, cobble, and boulder substrate, in <1.5 m of water, particularly with spaces or crevices between the rock; and,

Most Suitable (3) an area similar to 2 but found in a shoal or reef area of a lake or riffle of a stream with good water circulation or movement from wave action or current.

White Sucker / Longnose Sucker[7]

Not Suitable (0) an area with an organic, silt, and/or sand substrate, particularly with aquatic plant debris;

Marginal (1) an area with a predominantly sand and/or silt substrate with some gravel and/or cobble but free of aquatic plant debris;

Moderate (2) an area with a clean gravel and/or cobble substrate, in <0.5 m of water with some water movement; and,

Most Suitable (3) an area, particularly in a stream, with a clean gravel substrate, in <0.3 m of water with good water movement due to currents.

2.4.2.3 Nursery and Early Life Stage Rearing Habitat Suitability

The quality and quantity of suitable spawning habitat within the study area is generally indicative of the nursery and early life stage rearing habitat available. Detailed

[6] Sources: Johnson 1961; Busch et al. 1975; Chevalier 1977; Chen 1980; Scott and Crossman 1998.
[7] Sources: Harris 1962; Geen et al. 1966; Edwards 1983; Twomey et al. 1984; Scott and Crossman 1998.

descriptions of preferred habitat and food sources during nursery and early life stage rearing life stages for each species assessed are provided below.

Northern Pike

Nursery and early stage rearing habitat for northern pike is generally the same as that of spawning habitat, as larvae tend to remain immobile for 6 to 10 days post hatch, by attaching to vegetation via their head adhesive gland and feeding via egg yolk absorption. After egg yolk absorption, they feed on invertebrates for 7 to 10 days before switching to a predominantly piscivorous diet. The young-of-the-year are also reported to utilize the same type of habitat sought for spawning, as they prefer silt to organic substrate, submergent macrophytes or flooded vegetation, and woody debris (Scott and Crossman 1973; Inskip 1982).

Walleye

Nursery and early stage rearing habitat for walleye is similar to that of spawning habitat, as the larvae do not disperse until 10 to 15 days post hatch after yolk sac absorption is completed. Young-of-the-year are reported to also utilize the same habitat type as that sought for spawning, as they prefer boulder to coarse-gravel, sunken trees, and weed beds. Walleye shift quickly after six weeks of age from feeding on invertebrates to fish. Yellow perch has been identified as an important food source for walleye; however, several other small-bodied species found within the study area are also reported to be consumed by walleye. When present, the most significant predator of walleye is reported to be northern pike (Scott and Crossman 1973; McMahon et al. 1984; Langhorne et al. 2001).

Yellow Perch

Nursery and early stage rearing habitat is generally the same as that for spawning, as larvae remain immobile for five days after hatching, while egg yolk absorption takes place. The young-of-the-year are also reported to utilize the same habitat as that sought for spawning, as they prefer gravel, sand, silt, and/or clay substrate and moderate cover resultant from rooted vegetation, submerged brush, and/or trees. The diet of the yellow perch varies considerably, consisting largely of immature insects, large invertebrates, and small-bodied fishes (Scott and Crossman 1973; Krieger et al. 1983; Langhorne et al. 2001).

White and Longnose Suckers

Nursery and early stage rearing habitat is the same as that for spawning, as the larvae are known to remain in the substrate for a period of 1 to 2 weeks until they have reached approximately 12 mm in length. Larval and juvenile white sucker are known to rear in shallow backwaters, riffles with moderate water velocity, and sand-rubble substrates in streams (Twomey et al. 1984). When they reach a length of 16 to 18 mm their diet switches reflecting development from a terminal to a ventral mouth. The most important food sources are chironomid larvae and pupae, molluscs, and cladocerans, as food is obtained by sucking up bottom material and straining it for a random variety of invertebrates. When young, individuals of this species are preyed upon by an assortment of piscivorous fishes, but adults are probably vulnerable to only large northern pike (Scott and Crossman 1973).

2.4.2.4 Feeding Habitat Suitability

The presence of small-bodied fish and young-of-the-year within the study area would indicate feeding habitat is available for large-bodied predatory fish species, such as northern pike and walleye. Furthermore, the presence of small-bodied fish would also indicate that various food sources must be present in the area that could be potentially utilized by bottom-feeding species such as suckers and juvenile piscivorous fishes.

2.4.2.5 Overwintering Habitat Suitability

The quality and quantity of overwintering habitat was assessed based on habitat type and depth of the study streams. Water depths and dissolved oxygen levels need to be adequate to support fish during the winter.

3.0 RESULTS

3.1 Streamflow

Located on the north side of the Saskatchewan River downstream of the project footprint, Stream T is a tributary to the White Fox River, which forms part of the Saskatchewan River drainage. Peonan Creek and Stream F are two additional streams that are located on the south side of, and drain northward into, the Saskatchewan River.

Of the three streams, only Stream F was safely accessible during extreme rainfall events in June 2011. Based on partial measurements taken at ⅓ of the channel cross-section, the water level in the lower reach of Stream F was estimated at 1.0 m and the total stream discharge was inferred to be 1.824 m^3/s. Water levels in Peonan Creek and Stream T also appeared to reflect precipitation events in the drainage area during June 2011; however these two creeks were not safely accessible to collect measurements.

Streamflow measurements collected from each of the three streams under baseflow conditions in July 2011 are detailed in Table 2. Discharge measured 0.335 m^3/s in the low reach of Peonan Creek and 0.369 m^3/s in the low reach of Stream F. Streamflow in the upper reach of Stream T (0.000 m^3/s) was obstructed by beaver dams.

3.2 Water Quality

3.2.1 Field Parameters

Field water quality parameters measured in the three streams in July 2011 are detailed in Table 3. Laboratory measurements of pH supplemented field measurements.

Water temperature among the streams during the July 2011 survey varied from 17.4°C to 23.7°C. Dissolved oxygen and pH are the only field-measured parameters for which provincial SSWQO (SE 2006) and federal CWQG (CCME 2011) water quality guidelines are available. Peonan Creek and Stream F contained DO levels compliant with the lower guideline limit for cold-water biota (6.5 mg/L[8]). In Stream T, the DO concentration (2.43 mg/L) was depleted below the most conservative benchmark level indicated in Table 1.

[8] Higher DO guideline (9.5 mg/L) is for the early life stages of cold-water biota. Lower DO guideline (6.5 mg/L) is for the other life stages of cold-water biota.

The field and laboratory measurements of specific conductance were overall quite consistent, ranging from 272 µS/cm to 277 µS/cm in Stream T, 903 µS/cm to 929 µS/cm in Stream F, and 1400 µS/cm to 1415 µS/cm in Peonan Creek.

All field and laboratory pH results (7.4 to 8.4) were slightly alkaline and compliant with the CWQG range of 6.5 to 9.0.

3.2.2 QA/QC Assessment

The results of the QA/QC assessments are provided in Table 4. Raw laboratory results and associated QA/QC reports are presented in Appendix A.

All RPDs calculated between the field test sample and its field duplicate were below the specified data quality control limit of 40% (Table 4). Within-run laboratory duplicates employed to assess problems with precision revealed that the RPD for iron exceeded the laboratory's specified control limit of 20% (Appendix A). Elevated iron concentrations in repeat analyses were attributable to contamination during the digestion process. Digested and undigested sample results for iron compared. The remainder of the RPDs between within-run laboratory duplicates were within the specified limits suggesting that all samples were processed appropriately.

All analytes in the field blank and trip blank samples measured less than five times the detection limit (DL) values. For those analytes recovered from the field blank and trip blank sample at concentrations close to their respectable DLs, the measurement uncertainty of the results were high. In addition, deionized water used to prepare the blank samples can absorb carbon dioxide (CO_2) from the air resulting in low pH in the blank samples. Samples spiked with a known quantity of the analyte to assess problems with the sample processing indicated that the percent recovery for titanium was outside the laboratory's specified limits of 80% to 120%. The elevated level of titanium was likely due to contamination during the digestion process. The remaining 52 measurements of analyte recovery were between 80% and 120%. Therefore, the DQO of more than 95% analytes recovered within the laboratory's specified recovery limits was met. Additional laboratory quality control measures in the same batch were within acceptable limits. In conclusion, the field blank and trip blank results were considered acceptable.

3.2.3 Laboratory Parameters

Water chemistry results from the three study streams sampled in July 2011 are detailed in Table 5. Raw laboratory results are presented in Appendix A. Exceedances of applicable benchmarks are bolded in Table 5.

3.2.3.1 Inorganic Ions and Physical Properties

Stream T contained concentrations of inorganic ions including magnesium, sodium, and sulphate that were a minimum twice lower as compared to Peonan Creek and Stream F (Table 5). Similar patterns were found in physical properties parameters (sum of ions, total dissolved solids [TDS], specific conductance, and total hardness), which occurred at lower levels in Stream T relative to Peonan Creek and Stream F (Table 5).

Background turbidity levels are potential sources of variability in water quality between sampling locations. Turbidity measured 11 NTU in Peonan Creek, 10 NTU in Stream F, and 1.4 NTU to 1.7 NTU in Stream T. Peonan Creek and Stream F are south of the Saskatchewan River downstream of agricultural fields, whereas Stream T was situated in the forested, relatively undeveloped area north of the Saskatchewan River (Figure 2). The physical properties and inorganic ion concentrations in the sediment-laden water of the study streams appeared to respond to the levels of turbidity. For example, Peonan Creek and Stream F contained sum of ions (1190 mg/L and 794 mg/L, respectively), TDS (1060 mg/L and 677 mg/L, respectively), and total hardness (745 mg/L and 507 mg/L, respectively) that were, respectively, three to two times higher than those measured in Stream T (sum of ions: 342 mg/L to 345 mg/L; TDS: 329 mg/L; and total hardness: 216 mg/L).

Besides pH, there are no provincial or federal objectives/guidelines available for inorganic ions and/or physical properties. As noted in Section 3.2.1, all pH measurements taken from each stream sampled during July 2011 and during May 2007 to November 2008 met the SSWQO (SE 2006) and CWQG (CCME 2011).

3.2.3.2 Metals and Trace Elements

Less pronounced differences among streams were observed for metals and trace elements. Concentrations of most metals and trace elements in water samples were

generally low and somewhat comparable among streams. Levels of boron, cadmium, copper, lead, molybdenum, nickel, selenium, silver, uranium, and zinc were below applicable water quality benchmarks. The exceptions were four analytes (aluminum, chromium, iron, and arsenic) that exceeded the SSWQOs/CWQGs at one or more sampling locations (Table 5).

The chromium concentration in Stream F (0.0021 mg/L) was above the benchmark of 0.001 mg/L. Chromium measurements from the other two streams were at or below the DL of 0.0005 mg/L. Considering that chromium measured less than five times the DL, the measurement uncertainty was high and guideline exceedance for chromium may in part be due to analytical precision (i.e., the coarse DL). Aluminum concentrations in Peonan Creek (0.37 mg/L) and Stream F (1.2 mg/L) exceeded the benchmark of 0.001 mg/L at pH >6.5, but occurred below the benchmark in Stream T (0.0089 mg/L). Iron concentrations exceeded the SSWQO/CWQG of 0.3 mg/L in all three streams sampled in July 2011 (Table 5). Arsenic concentrations in Peonan Creek (5.6 µg/L) and Stream F (6.4 µg/L) exceeded the benchmark of 5 µg/L, but occurred below the benchmark in Stream T (2.0 µg/L to 2.1 µg/L).

3.2.3.3 Nutrients

Stream T contained concentrations of ammonia as nitrogen (0.11 mg/L to 0.13 mg/L), organic carbon (58 mg/L), dissolved organic carbon (55 mg/L to 58 mg/L), and phosphorus (0.45 mg/L to 0.47 mg/L) that were nearly twice as high as those in the other two streams (ammonia as nitrogen: 0.06 mg/L to 0.08 mg/L; organic carbon: 27 mg/L to 30 mg/L; dissolved organic carbon: 24 mg/L to 28 mg/L; and phosphorus: 0.13 mg/L to 0.29 mg/L). Less pronounced differences among these streams were noted for Kjeldahl nitrogen and total nitrogen (Table 5). Nitrate levels in all three streams were consistently below the DL of 0.04 mg/L. On the basis of these data, all three streams can be classified[9] as hyper-eutrophic (Wetzel 2001).

Concentrations of ammonia as nitrogen and nitrate in all three study streams complied with applicable SSWQO and CWQG benchmark levels.

[9] Canadian trigger ranges for total phosphorus (mg/L): ultra-oligotrophic <0.004; oligotrophic 0.004 to 0.010; mesotrophic 0.010 to 0.020; meso-euthrophic 0.020 to 0.035; eutrophic 0.035 to 0.100; hyper-euthrophic >0.100.

3.3 Fish Communities and Health

3.3.1 Species Presence/Absence

A summary of fish species captured in each of Peonan Creek and Stream F is presented in Table 6. Fish catch by sampling method is summarized in Table 7. A detailed summary of sampling effort and fish capture statistics are provided in Appendix B, Table 1.

A total of twelve fish species were identified during the surveys conducted in the Star-Orion South Diamond Project study area in July 2011. There were no fish captured in Stream T. All of the species caught in this study have been previously reported in the Star-Orion South Diamond Project study area (AMEC 2010).

All species captured within the study area are federally ranked as G5 characterizing them as commonly occurring, widespread, and/or abundant (SKCDC 2011). The species captured varied in terms of their provincial conservation status. Burbot (*Lota lota*), brook stickleback (*Culaea inconstans*), fathead minnow (*Pimephales promelas*), lake chub (*Couesius plumbeus*), northern pike, spottail shiner (*Notropis hudsonius*), walleye, white sucker, and yellow perch are provincially ranked as S5 (SKCDC 2011), designating them as common and presently secure. however, it is recognized that the species could be rare in parts of its distribution and/or could be of long-term concern (SKCDC 2011). The species longnose dace (*Rhinichthys cataractae*), northern redbelly dace (*Phoxinus eos*), and river shiner (*Notropis blennius*) are provincially ranked S3S4 (SKCDC 2011), designating them as uncommon or rare to common and indicating that they are susceptible to extirpation by large-scale disturbances in parts of their range within Saskatchewan, while in other parts they may be abundant (SKCDC 2011).

Between the two streams that yielded fish, the fish catch from Peonan Creek was more species-rich (12 species) than that from Stream F (8 species). Lake chub was the most abundant fish caught in each of Peonan Creek and Stream F (Table 6). Stream F yielded a more abundant fish catch (796 fish) than Peonan Creek (204 fish).

Of the two methods of fishing employed, minnow trapping yielded more fish (79.2%) than backpack electrofishing (20.8%). With the exception of lake chub, most species made relatively similar contributions to total electrofishing catch, while the minnow trap catch was strongly dominated by small-bodied species such as lake chub, northern

redbelly dace, and river shiner. All four large-bodied species (white sucker, walleye, northern pike, and yellow perch) in the study streams were captured using minnow traps, while during electrofishing the latter three species evaded capture (Table 7).

3.3.2 Relative Abundance

A summary of electrofishing catch per unit effort (CPUE) and mean length of fish captured is presented in Table 8. Fish sampling effort in each of the study streams is detailed in Appendix B, Table 1.

3.3.2.1 Peonan Creek

In the lower reach of Peonan Creek within 500 m of the Saskatchewan River, 11 minnow traps set overnight (total effort 241.6 hr) resulted in the capture of 154 fish: 111 lake chub, 20 walleye, 8 white sucker, 7 brook stickleback, 3 northern redbelly dace, 3 river shiner, 1 northern pike, and 1 yellow perch. The virile crayfish (*Orconectes virilis*) and tadpoles were also collected in minnow traps. Backpack electrofishing was conducted for approximately 2,461 s across various in-stream habitat types yielding 50 fish: 30 lake chub, 7 brook stickleback, 4 white sucker, 4 burbot, 2 longnose dace, 1 fathead minnow, 1 river shiner, and 1 spottail shiner. In terms of relative abundance, this was the second largest CPUE during the survey, with a catch rate of 74.14 fish/hr (Table 8).

In the upper reach of Peonan Creek located approximately 11 km upstream of the Saskatchewan River, backpack electrofishing conducted for approximately 306 s downstream of the beaver dam resulted in the capture of no fish. No effort was made to capture fish in this location using other sampling methods.

3.3.2.2 Stream F

In the portion of Stream F within 500 m of the Saskatchewan River, 11 minnow traps were set overnight (total effort 239.9 hr) resulting in the capture of 638 fish: 400 lake chub, 113 northern redbelly dace, 76 river shiner, 29 fathead minnow, 15 white sucker, and 5 walleye. The virile crayfish and tadpoles were present in the collections made with minnow traps. Approximately 1,825 s of backpack electrofishing, which covered various in-stream habitat types, yielded 158 fish: 93 lake chub, 38 northern redbelly dace, 11 longnose dace, 7 white sucker, 6 brook stickleback, 2 fathead minnow, and 1 river shiner.

In terms of relative abundance, this was the largest CPUE during the survey, with a catch rate of 262.60 fish/hr (Table 8).

In the portion of Stream F approximately 4 km upstream of the Saskatchewan River, backpack electrofishing conducted for approximately 341 s. The fish catch consisted of 2 lake chub (Table 8). No effort was made to capture fish in this location using minnow traps

3.3.2.3 Stream T

No fish were captured in Stream T despite repeated sampling effort. In total, 934 s of backpack electrofishing and 211.5 hrs of minnow trapping were completed. These results collectively indicate that no fish resided in the stream study reach that was blocked from the downstream reaches and the White Fox River by beaver dams. Sampling of Stream T documented, however, the frequent occurrence of tadpoles and the virile crayfish, which were collected in minnow traps. Unlike fish, these organisms possess natural dispersal capabilities sufficient to overcome migration barriers to upstream colonization.

3.3.3 Fish Length and External Health

The mean lengths of fish collected in Peonan Creek and Stream F are presented in Table 9. All of the large-bodied fish captured during the community survey were juveniles. These included 32 white sucker (≤11.0 cm), 25 walleye (≤5.7 cm), 4 burbot (≤7.9 cm), 1 northern pike (9.9 cm), and 1 yellow perch (4.7 cm). The mean length for white sucker captured in Peonan Creek (5.8 ± 0.80 cm) was slightly smaller than in Stream F (6.5 ± 1.4 cm), although the confidence intervals (mean ± standard deviation) overlapped indicating that size differences were not meaningful. The walleye collected in Peonan Creek (5.2 ± 0.37 cm) and Stream F (5.3 ± 0.29 cm) represented the same size class ranging in size from 4.6 cm to 5.7 cm (Table 9).

All fish collected lacked visual physical abnormalities and external parasites and were healthy in appearance.

3.4 Aquatic Habitat

3.4.1 Detailed Habitat Description

Assessments of the aquatic habitat in Peonan Creek, Stream F, and Stream T were conducted in July 2011. Detailed habitat information for each stream is summarized in Table 10 and is described below. The location of each Habitat Section (HS) is shown in Figures 9 to 11. Photographs of the in-stream habitat in the Project study area can be found in Appendix C, Photos 1 to 22.

3.4.1.1 Peonan Creek

Eight distinct HSs were delineated in Peonan Creek within 500 m of the Saskatchewan River (Table 10; Figures 9; Appendix C, Photos 2 to 10).

The upland zone along the assessed area of the creek was predominantly forested with mixed or deciduous canopies and slopes varying from gentle to moderate. The riparian zone varied between forested with trees/shrubs and transitional vegetation with shrubs, grasses, and sedges. Throughout the assessed portion of the creek, shrubs were dominated by willows (*Salix* spp.), among which sandbar willow (*Salix exigua*) was frequently encountered. Less common in the riparian zone were mixed stands of trembling aspen (*Populus tremuloides*) and prickly rose (*Rosa aciluaris*). Some areas of the riparian zone were free of shrub/tree canopy supporting sparse emergent vegetation consisting of sedges (*Carex* spp.) and grasses (Appendix C, Photos 3, 4, and 8). In some areas (e.g., HS 7), the mature white spruce (*Picea mariana*) community extended to the stream edge (Appendix C, Photo 8).

In the upstream reach of Peonan Creek approximately 11 km upstream of the Saskatchewan River, the course of the stream was obstructed by the beaver dam (Appendix C, Photo 1). This resulted in increasing the variety of habitat available for emergent and floating leaved aquatic plants such as floating bur-reed (*Sparganium* sp.) within the footprint of the impoundment but also upstream and downstream of the impoundment. Sparse patches of floating bur-reed populated the streambed immediately downstream of the beaver dam (Appendix C, Photo 1).

Among the eight HSs identified, substrate composition of the streambed ranged from silt/clay to various combinations of sand, gravel, cobble, and boulder and consistently

lacked organic material (Table 10). In HSs 1 and 2, the substrate was entirely silt/clay; in HS 3 it contained a higher proportion (40%) of gravel and a lower proportion (30%) of cobble; in HS 5 it was high in silt/clay content (50%) and low in sand content (25%) and cobble content (20%); in HSs 5, 7, and 8 it was predominantly cobble (65% to 75%); and in HS 6 it consisted mainly of silt/clay (70%) with some inclusions of cobble and boulder.

Moderately dense to dense aquatic vegetation, sparse large woody debris, and overhanging shrubs provided fish cover in each of the eight HSs. Diverse emergent plants sheltered the creek's margins sometimes extending into shallow water areas. Prevalent among them were sedges (including water sedge, *Carex aquatilis*), bulrushes (including hardstem bulrush, *Scirpus acutus*, and panicled bulrush, *Scirpus microcarpus*), spike-rushes (*Eleocharis* sp.), and marsh reed grasses (*Calamagrostis* sp.). Less frequently recorded emergent plants were native horsetail (*Equisetum* sp.) and nonindigenous reed canary grass (*Phalaris arundinacea*). Floating leaved vegetation was represented by arrowhead (*Sagittaria* sp.) and water smartweed (*Polygonum amphibium*), which vegetated in combination with emergent macrophytes. In some instances, luxuriant growth of filamentous green algae (division Chlorophyta) was documented on the rock substrate.

Habitat type was variable throughout the assessed portion of Peonan Creek featuring pool habitat in HSs 1; equal parts run, pool, and glide in HS 2; equal proportions of riffle and run in HS 3; mostly glides in HSs 4 and 6; and mostly riffles in HSs 5, 7, and 8.

Mean wetted width varied between 3.0 and 4.8 m and maximum depth ranged from 0.5 m to 2.0 m. In the lower reaches of Peonan Creek no obstructions were found to restrict fish passage from the Saskatchewan River.

3.4.1.2 Stream F

A total of eight HSs were identified in Stream F within 500 m of the Saskatchewan River (Table 10; Figures 10; Appendix C, Photos 11 to 18).

The upland region of Stream F consisted of mature, deciduous forest and slopes varying from gentle to steep. The riparian zone was described as forest to bank with steep to

gentle unstable slopes vegetated with trees, shrubs, grasses, and sedges. Trembling aspen and balsam poplar (*Populus balsamifera*) were common tree species.
Cobble comprised the majority of stream substrate throughout HSs 1 to 5; the substrate was entirely silt/clay in HSs 7 and 8; HS 6 had more (45%) gravel content and less (30%) silt/clay content.

All 8 HSs contained fish cover in the forms of sparse to dense large woody debris, sparse aquatic vegetation, and/or sparse to dense overhanging vegetation. In the upstream HSs (1 to 6), aquatic vegetation (sedge and horsetail) was exceptionally sparse to nearly absent. In some areas (HSs 5 and 6), sparse amounts of filamentous green algae on rock were present. In the downstream HSs (7 and 8), sparse patches of emergent vegetation (primarily sedge, horsetail, and marsh reed grasses) were present. Overhanging vegetation consisted of golden alder (*Alnus incana*), beaked hazel (*Corylus cornuta*), and in some instances trembling aspen.

Habitat type was variable, with each of riffle, run, glide, or pool habitat dominating one or more HSs. In addition to having less aquatic vegetation and overall more riffles and run habitat, the upper section of the assessed area of the creek (HSs 1 to 6) was narrower (mean wetted width ≤3.1 m) than the downstream section (mean wetted width ≥4.6 m). Maximum depth ranged between 0.3 m and 0.8 m throughout HSs 1 to 6 and varied between 0.8 m and 1.0 m throughout HSs 7 and 9 (Table 10). Due to relatively steep gradient, shallow depths, and obstacles such as large boulders, which were piled up across the stream channel in HS 5 (Appendix C, Photo 15), fish passage at HS 5 would be limited under low flow conditions.

3.4.1.3 Stream T

Three distinct HSs were identified in the upper section of Stream T, which is part of the White Fox River drainage (Table 10; Figures 11; Appendix C, Photos 19 to 22).

The upland region along Stream T was forested with mixed canopies and predominantly gentle slopes. At the time of survey, normal streamflow and/or water paths in the study area were obstructed by beaver activity resulting in flooding of the riparian zone and lowlands. The signs of beaver activity included freshly cut trees or brush (Appendix C, Photo 19), mud mounds, and dams made of tree trunks, twigs, mud, and reeds. HS 3 represented an impoundment (wetted width >40 m) that developed on the portion of the

creek upstream of the beaver dam (Figure 11). The impoundment was likely temporary because its margins were vegetated with terrestrial plants, such as arrow-leaved colt's-foot (*Petasites sagittatus*), that are characteristic of a wet meadow habitat rather than an aquatic habitat. In addition to having terrestrial inundated vegetation, HS 3 was much wider (mean wetted width >40 m) as compared to HS 2 (mean wetted width 3 m) and HS 1 (mean wetted width 13 m). Downstream from HS 1, Stream T was likely impounded by another beaver dam although high water levels and sinking ground in this area precluded detailed site investigations. Stream T contained stagnant, brown water with a gray biofilm developed on the surface (Appendix C, Photo 21).

The riparian zone along the assessed portion of Stream T was, for the most part, flooded aspen forest on gentle, stable slopes vegetated by trees, shrubs, sedges, and grasses.

The substrate of the streambed consisted of organic material. The assessed portion of the stream was characterized by dense large woody debris, dense beds of sedge and marsh reed grass, and sparse patches of cattail (*Typha* sp.) and water smartweed. Habitat type throughout the assessed area was classified as pool (Table 10). Beaver dams would hinder fish passage from the lower reaches of Stream T and White Fox River.

3.4.2 Spawning Habitat

Fish access to the study area in Stream T was deemed unlikely due to the presence of beaver dams, and no fish were captured in this stream during the fish survey. Therefore, spawning suitability indices were not completed for this stream. For Peonan Creek and Stream F, spawning suitability indices were completed for four large-bodied species captured during the fish community surveys. A particular focus of the critical habitat assessments was on white sucker and walleye, both of which were captured at the juvenile stages in the lower reaches of Peonan Creek and Stream F. This indicated that both white sucker and walleye likely ascend the lower reaches of these streams to spawn.

One juvenile of each of northern pike and yellow perch were captured in Peonan Creek providing evidence of habitat utilization by these two species. Hence, the habitat assessments in Peonan Creek also targeted northern pike and yellow perch. The assessed sections of Stream F were deemed unsuitable for northern pike and yellow perch spawning due to lack of aquatic macrophytes beds, strong currents, and predominantly

cobble substrate (Table 10). This was supported by the absence of northern pike and yellow perch in Stream F.

The absence of large-bodied species in the upper reaches of Peonan Creek and Stream F could be due to the obstructions present between the stream reaches surveyed acting to limit fish passage.

3.4.2.1 Peonan Creek

Areas (HSs 1 and 2) characterized by predominantly silt/clay substrate and sparse aquatic vegetation were considered unsuitable for white sucker spawning. The habitat in HSs 4 and 6 that had more sand and rock content with some pockets of silt/clay were rated unsuitable to marginally suitable white sucker spawning habitat. Marginally to moderately suitable white sucker spawning habitat in HS 3 was associated with riffle/run habitats and gravel/cobble substrate free of aquatic macrophytes and associated debris. The habitat in HSs 5, 7, and 8 that featured adequately sized, clean gravel/cobble substrate, water depth 0.4 m, and predominantly riffle habitat was ranked as moderately suitable for white sucker spawning (Table 10).

The majority of Peonan Creek (HSs 1 to 4 and 6) was rated unsuitable for walleye spawning largely due to prevalence of silt/clay substrate. Marginally suitable walleye spawning habitat was associated with gravel/cobble/boulder substrate with some silt/clay pockets in HSs 3, 7 and 8, while highly suitable walleye spawning habitat was associated with clean gravel/cobble/boulder substrate (Table 10).

Stream sections (HSs 3 to 5) with sparse to absent aquatic macrophyte beds and predominantly rock substrates were rated as unsuitable for northern pike spawning. The habitat in HS 8 featuring sparse emergent vegetation, riffles, and predominantly cobble substrate was ranked as marginally suitable to unsuitable for northern pike spawning. Marginally suitable habitat was found in HSs 7 and 2 with sparse emergent vegetation and mixed habitat types. The habitat at the mouth of Peonan Creek (HS 1) with dense willow and sparse emergent vegetation development in 1.5 m of water was rated marginally to moderately suitable for northern pike spawning (Table 10).

Stream sections (HSs 3, 5, 6, and 8) with predominantly rock substrate and strong flow were interpreted to be unsuitable yellow perch spawning habitat. Marginally suitable to

unsuitable yellow perch spawning sites occurred in HSs 4 and 7 where mixed habitat types were present along with various combinations of substrate types and sparse large woody debris. The habitat near the mouth of Peonan Creek (HSs 1 and 2) was rated marginally suitable for yellow perch spawning. This was primarily due to the silt/clay substrate, moderate streamflow, sparse large woody debris, and emergent plant cover in water ranging 0.6 m to 1.5 m in depth (Table 10).

3.4.2.2 Stream F

The majority of Stream F (HSs 3 to 8) where gravel/cobble/boulder occurred along with riffles and runs was rated marginally suitable for the spawning activity of walleye mostly because of some silt deposition and relatively shallowness (mean centre depth: 0.2 m to 0.3 m). Under conditions of high flow and low sediment settlement spawning habitat suitability ratings for walleye would be higher. The sections (HSs 1 and 2) in the mouth of Stream F accessible to walleye from the Saskatchewan River were ranked as unsuitable for walleye spawning due to predominantly silt/clay substrate with some aquatic plant debris and scrublands along the stream's margins (Table 10).

The majority of Stream F sections (HSs 4 to 8) as described above were rated moderately suitable for the spawning activity of white sucker. The habitat in HS 3 that featured riffles/runs and gravel/cobble substrate with some silt pockets was interpreted to be marginally to moderately suitable white sucker spawning. The remainder of the assessed area was ranked as unsuitable to marginally suitable for white sucker spawning owing to substrate consisting entirely of silt and clay and some aquatic plant debris.

3.4.3 Nursery and Early Life Stage Rearing Habitat

The absence of suitable spawning habitat for white sucker, walleye, and northern pike in the assessed sections of the streams (specifically Stream T) suggests a similar absence of nursery and rearing habitat for these three species since the habitat requirements are similar between these life stages.

Larval and juvenile white sucker are known to rear in shallow backwaters, riffles with moderate water velocity, and sand-rubble substrates in streams (Twomey et al. 1984). Juvenile white sucker were captured in the lower reaches of Peonan Creek and Stream F demonstrating that these streams provide nursery and early life stage rearing habitat for

this species. As discussed above, the study areas of these streams contain a variety of habitat types including riffles, runs, and glides, and substrate that is dominated by gravel and cobble. The white sucker captured in the streams were all ≤11 cm in length; it is likely these fish move downstream to the Saskatchewan River once adulthood is attained.

Juvenile walleye were captured in the lower reaches of Peonan Creek and Stream F, indicating that adequate cover was present to meet the habitat requirement of this species since they are known to be photosensitive and seek shelter and avoid predation (Ryder 1977). The nursery and rearing habitat needs for walleye resemble those for spawning.

The nursery and rearing habitat requirements for northern pike area are almost identical to those for spawning. Most sections in Peonan Creek were considered unsuitable for northern pike nursery and rearing habitat due to sparse to absent aquatic vegetation; however, the capture of juvenile northern pike in this creek indicates that it is utilized by this species.

3.4.4 Feeding Habitat

The presence of small-bodied species and juvenile fishes within the study streams indicate that feeding habitat is available for the large-bodied predatory fish species such as northern pike and walleye. It is noted that the abundance of white sucker foraging organisms was not measured as part of these investigations. However, the occurrence of juvenile white suckers in both streams suggests that food sources were sufficiently available to meet the feeding requirements of this species at different life stages.

3.4.5 Overwintering Habitat

The quality and quantity of overwintering habitat was assessed based on habitat type and depth. Areas of stagnant water and pools, all of which had the maximum water depth typically ≤1.3 m, were judged unsuitable for overwintering habitat since they may freeze solid in the winter. However, some of the pools located in the mouth of Peonan Creek with greater depths (maximum water depth 2 m) and some flow may provide some overwintering habitat.

4.0 SUMMARY AND CONCLUSIONS

Aquatic baseline investigations conducted in July 2011 characterized the physical and biological components of Peonan Creek, Stream F, and Stream T located near the proposed Star-Orion South Diamond Project prior to development of the open pit diamond mine. The information collected from Peonan Creek and Stream F within 500 m of the Saskatchewan River and the uppermost 500 m reach of Stream T included measurements of streamflow, field and laboratory water quality parameters, fish communities and health, and aquatic habitat assessments. Fish community surveys were also conducted in the upstream sections of Peonan Creek and Stream F to determine if they were accessible to fish. The following conclusions summarize the findings of the investigations:

During baseflow conditions, stream discharge ranged from 0.335 m^3/s in the lower reach of Peonan Creek to 0.369 m^3/s in the lower reach of Stream F. In the upper reach of Stream T, streamflow was obstructed by beaver dams.

Field water quality measurements demonstrated that dissolved oxygen levels met provincial and federal guidelines for cold-water biota stages other than early life stages in Peonan Creek and Stream F, but were depleted below guidelines in Stream T. All streams contained slightly alkaline pH within the federal guideline range of 6.5 to 9.0.

Levels of turbidity and other physical property parameters (specific conductance, sum of ions, total dissolved solids, and total hardness), as well as several major ions (bicarbonate, calcium, magnesium, potassium, and sulphate) in Stream T were markedly lower than in Peonan Creek and Stream F.

Concentrations of aluminum, chromium, iron, and arsenic at one or more streams exceeded applicable provincial and federal guidelines for the protection of aquatic life. Ammonia as nitrogen and nitrate in all three streams met provincial and federal guidelines, although concentrations of ammonia as nitrogen and phosphorus in Stream T were nearly as twice as high as those in the other two streams.

Twelve fish species were collected in Peonan Creek and Stream F using minnow traps and backpack electrofishing. There were no fish in Stream T. Stream F yielded more fish (796) than Peonan Creek (204 fish), although both streams were dominated by lake

chub comprising 62% to 69% of the total fish catch, respectively. All large-bodied species captured (white sucker, walleye, northern pike, yellow perch, and burbot) were juveniles.

A diversity of fish spawning habitat types were identified along the study reaches of Peonan Creek and Stream F surveyed in July 2011. The majority of the assessed regions of both streams provided more sites suitable for the spawning activity of white sucker than other large-bodied species. Beaver dams constructed near the upper reaches of Stream T prevented fish access to this stream section.

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TABLES

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TABLE 1

Provincial and federal water quality objectives and guidelines for the protection of aquatic life.

Parameter	Units	SSWQO[§]	CWQG*
Metals & Trace Elements			
Aluminum	mg/L	0.100[a]	0.100[a]
Arsenic	mg/L	0.005	0.005
Boron	mg/L	-	1.5
Cadmium	mg/L	0.0001[b]	0.0001[b]
Chromium	mg/L	0.001	0.001
Copper	mg/L	0.004[c]	0.004[c]
Iron	mg/L	0.3	0.3
Lead	mg/L	0.007[d]	0.007[d]
Mercury	mg/L	0.000026	0.000026
Molybdenum	mg/L	-	0.073
Nickel	mg/L	0.15[e]	0.15[e]
Selenium	mg/L	0.001	0.001
Silver	mg/L	0.0001	0.0001
Thallium	mg/L	-	0.0008
Uranium	mg/L	0.015	0.015[f]
Zinc	mg/L	0.03	0.03
Nutrients			
Ammonia as nitrogen	mg/L	1.8-39.7[g]	1.8-39.7[g]
Nitrate	mg/L	-	13.0
Nitrite (as nitrogen)	mg/L	-	0.06
Physical Properties			
Dissolved Oxygen, field	mg/L	-	6.5-9.5[h]
pH	pH units	-	6.5-9.0

Dash = no objective/guideline value available.

SSWQO = Saskatchewan surface water quality objectives for the protection of aquatic life (SE 2006).

CWQG = Canadian water quality guidelines for the protection of aquatic life (CCME 2011).

[§]Indicates no differentiation between exposure duration (short-term/long-term).

[*]CWQG values presented only for long-term exposure.

[a]Aluminum value dependent on pH: 0.005 mg/L at pH <6.5; 0.100 mg/L at pH ≥6.5.

[b]Cadmium value dependent on hardness: 0.000017 mg/L at hardness ≤48.5 mg/L; 0.000032 mg/L at hardness >48.5 mg/L and ≤97 mg/L; 0.0001 mg/L at hardness >194.0 mg/L.

[c]Copper value dependent on hardness: 0.002 mg/L at hardness ≤120 mg/L; 0.003 mg/L at hardness >120 mg/L and ≤120 mg/L; 0.004 mg/L at hardness >180 mg/L.

[d]Lead value dependent on hardness: 0.001 mg/L at hardness ≤60 mg/L; 0.002 mg/L at hardness >60 mg/L and ≤120 mg/L; 0.007 mg/L at hardness >180 mg/L.

[e]Nickel dependent on hardness: 0.025 mg/L at hardness ≤60 mg/L; 0.065 mg/L at hardness >60 mg/L and ≤120 mg/L; 0.15 mg/L at hardness >180 mg/L.

[f]Uranium value for short-term exposure: 0.033 mg/L.

[g]Ammonia as nitrogen dependent on pH and temperature: 1.83 mg/L NH_3-N at pH = 7.5 and temperature = 15 ^oC; 39.72 mg/L NH3-N at pH = 6.5 and temperature = 5^oC.

[h]Dissolved oxygen: 6.0 mg/L for early life stages of warm water biota, 5.5 mg/L for other life stages of warm water biota; 9.5 mg/L for early life stages of cold water biota and 6.5 for other life stages of cold water biota.

TABLE 2

Streamflow measurements for additional streams in the Star-Orion South Diamond Project study area, July 2011.

Date	Bankful Width (m)	Wetted Width (m)	Maximum Depth (m)	Discharge (m^3/s)
Peonan Creek				
08-Jul-2011	10.1	6.6	0.4	0.335
Stream F				
05-Jul-2011	6.7	4.1	0.3	0.369
Stream T				
12-Jul-2011	7.0	3.0	0.4	0.000

TABLE 3

Field water quality measurements for additional streams in the Star-Orion South Diamond Project study area, July 2011.

Date	Station Depth (m)	Sampling Depth (m)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Temperature (°C)	pH (units)
Peonan Creek						
08-Jul-2011	0.4	Surface	9.02	1415	19.8	7.9 (7.7*)
Stream F						
05-Jul-2011	0.3	Surface	6.92	903	23.7	8.3 (7.5*)
Stream T						
12-Jul-2011	0.5	Surface	**2.43**	372	17.4	7.4 (7.7*)

*indicates Hach pH field kit measurements; station depth measured with wading rod; all other parameters measured with digital YSI Model 556 multi-probe meter.
Bolded value indicates exceedances of dissolve oxygen guideline values:
6.0 mg/L for early life stages and 5.5 mg/L for other life stages of warm water biota;
9.5 mg/L for early life stages and 6.5 for other life stages of cold water biota.

TABLE 4

Water chemistry QA/QC results from additional streams in the Star-Orion South Diamond Project study area, July 2011.

Analyte	Units	DL	Stream T	Field Duplicate	RPD (%)	>5*DL?	Field Blank	>5*DL?	Trip Blank	>5*DL?
Inorganic Ions										
Bicarbonate	mg/L	1	254	251	1.2	Yes	<1	N/A	<1	N/A
Calcium	mg/L	0.1	67	67	0.0	Yes	<0.1	N/A	<0.1	N/A
Carbonate	mg/L	1	<1	<1	0.0	N/A	<1	N/A	<1	N/A
Chloride	mg/L	0.1	3	3	0.0	Yes	<0.1	N/A	<0.1	N/A
Fluoride	mg/L	0.01	0.08	0.06	28.6	Yes	<0.01	N/A	<0.01	N/A
Magnesium	mg/L	0.1	12	12	0.0	Yes	<0.1	N/A	<0.1	N/A
Potassium	mg/L	0.1	3.9	3.8	2.6	Yes	<0.1	N/A	<0.1	N/A
Sodium	mg/L	0.1	2.3	2.3	0.0	Yes	<0.1	N/A	<0.1	N/A
Sulphate	mg/L	0.2	2.3	2.3	0.0	Yes	<0.2	N/A	<0.2	N/A
Metals										
Aluminum	mg/L	0.0005	0.0089	0.0089	0.0	Yes	<0.0005	N/A	<0.0005	N/A
Barium	mg/L	0.0005	0.14	0.14	0.0	Yes	<0.0005	N/A	<0.0005	N/A
Boron	mg/L	0.01	0.02	0.02	0.0	No	<0.01	N/A	<0.01	N/A
Cadmium	mg/L	0.00001	0.00002	0.00002	0.0	No	0.00003	No	0.00001	No
Chromium	mg/L	0.0005	<0.0005	<0.0005	0.0	N/A	<0.0005	N/A	<0.0005	N/A
Copper	mg/L	0.0002	0.0002	0.0002	0.0	No	<0.0002	N/A	<0.0002	N/A
Iron	mg/L	0.0005	0.33	0.33	0.0	Yes	<0.0005	N/A	<0.0005	N/A
Lead	mg/L	0.0001	<0.0001	<0.0001	0.0	N/A	<0.0001	N/A	<0.0001	N/A
Manganese	mg/L	0.0005	0.93	0.99	6.2	Yes	<0.0005	N/A	<0.0005	N/A
Molybdenum	mg/L	0.0001	0.0003	0.0004	28.6	No	<0.0001	N/A	<0.0001	N/A
Nickel	mg/L	0.0001	0.0008	0.0008	0.0	Yes	<0.0001	N/A	<0.0001	N/A
Selenium	mg/L	0.0001	0.0002	0.0002	0.0	No	<0.0001	N/A	<0.0001	N/A
Silver	mg/L	0.00005	<0.00005	<0.00005	0.0	N/A	<0.00005	N/A	<0.00005	N/A
Thallium	mg/L	0.0002	<0.0002	<0.0002	0.0	N/A	<0.0002	N/A	<0.0002	N/A
Tin	mg/L	0.0001	<0.0001	<0.0001	0.0	N/A	<0.0001	N/A	<0.0001	N/A
Titanium	mg/L	0.0002	0.0005	0.0005	0.0	No	<0.0002	N/A	<0.0002	N/A
Uranium	µg/L	0.1	<0.1	<0.1	0.0	N/A	<0.1	N/A	<0.1	N/A
Zinc	mg/L	0.0005	0.0022	0.0022	0.0	No	<0.0005	N/A	<0.0005	N/A
Nutrients										
Ammonia as nitrogen	mg/L	0.01	0.13	0.11	16.7	Yes	<0.01	N/A	<0.01	N/A
Nitrate	mg/L	0.04	<0.04	<0.04	0.0	N/A	<0.04	N/A	<0.04	N/A
Organic carbon	mg/L	0.2	58	58	0.0	Yes	0.3	No	0.2	No
Organic carbon, dissolved	mg/L	0.2	55	58	5.3	Yes	0.3	No	<0.2	N/A
Phosphorus	mg/L	0.01	0.47	0.45	4.3	Yes	<0.01	N/A	<0.01	N/A
Total Kjeldahl nitrogen	mg/L	0.05	2.3	2.2	4.4	Yes	0.08	No	0.1	No
Total nitrogen	mg/L	0.05	2.3	2.2	4.4	Yes	0.08	No	0.1	No
Physical Properties										
Alkalinity, P.		1	<1	<1	0.0	N/A	<1	N/A	<1	N/A
Alkalinity, total	mg/L	1	208	206	1.0	Yes	<1	N/A	<1	N/A
Chemical oxygen demand	mg/L	4	132	135	2.2	Yes	<4	N/A	<4	N/A
Hydroxide	mg/L	1	<1	<1	0.0	N/A	<1	N/A	<1	N/A
pH	pH units	0.07	7.57	7.56	0.1	Yes	5.94	N/A	5.59	N/A
Specific conductivity	µS/cm	1	377	375	0.5	Yes	<1	N/A	<1	N/A
Sum of ions	mg/L	1	345	342	0.9	Yes	<1	N/A	<1	N/A
Total dissolved solids	mg/L	1	329	329	0.0	Yes	<1	N/A	<1	N/A
Total hardness	mg/L	1	216	216	0.0	Yes	<1	N/A	<1	N/A
Turbidity	NTU	0.1	1.4	1.7	19.4	Yes	<0.1	N/A	<0.1	N/A
Trace Elements										
Antimony	mg/L	0.0002	<0.0002	<0.0002	0.0	N/A	<0.0002	N/A	<0.0002	N/A
Arsenic	µg/L	0.1	2.1	2.0	4.9	Yes	<0.1	N/A	<0.1	N/A
Beryllium	mg/L	0.0001	<0.0001	<0.0001	0.0	N/A	<0.0001	N/A	<0.0001	N/A
Cobalt	mg/L	0.0001	0.0005	0.0005	0.0	No	<0.0001	N/A	<0.0001	N/A
Strontium	mg/L	0.0005	0.12	0.12	0.0	Yes	<0.0005	N/A	<0.0005	N/A
Vanadium	mg/L	0.0001	<0.0001	0.0001	0.0	N/A	<0.0001	N/A	<0.0001	N/A

All data considered acceptable.

N/A = not applicable.

TABLE 5

Water chemistry results from additional streams in the Star-Orion South Diamond Project study area, July 2011.

Analyte	Units	Benchmark[1]	Peonan Creek	Stream F	Stream T[2]
			12-Jul-2011	05-Jul-2011	12-Jul-2011
Inorganic Ions					
Bicarbonate	mg/L	-	386	377	254
Calcium	mg/L	-	137	116	67
Carbonate	mg/L	-	4	<1	<1
Chloride	mg/L	-	22	4	3
Fluoride	mg/L	-	0.12	0.13	0.08
Magnesium	mg/L	-	98	53	12
Potassium	mg/L	-	17	6.4	3.9
Sodium	mg/L	-	46	17	2.3
Sulphate	mg/L	-	480	220	2.3
Metals					
Aluminum	mg/L	0.100	**0.37**	**1.2**	0.0089
Barium	mg/L	-	0.091	0.3	0.14
Boron	mg/L	1.5	0.07	0.04	0.02
Cadmium	mg/L	0.0001	0.00002	0.00005	0.00002
Chromium	mg/L	0.001	0.0005	**0.0021**	<0.0005
Copper	mg/L	0.004	0.0018	0.0028	0.0002
Iron	mg/L	0.3	**0.81**	**2.68**	**0.33**
Lead	mg/L	0.007	0.0003	0.0008	<0.0001
Manganese	mg/L	-	0.18	0.22	0.93
Molybdenum	mg/L	0.073	0.0014	0.0026	0.0003
Nickel	mg/L	0.15	0.0044	0.0048	0.0008
Selenium	mg/L	0.001	0.0006	0.0006	0.0002
Silver	mg/L	0.0001	<0.00005	<0.00005	<0.00005
Thallium	mg/L	0.0008	<0.0002	<0.0002	<0.0002
Tin	mg/L	-	<0.0001	<0.0001	<0.0001
Titanium	mg/L	-	0.028	0.032	0.0005
Uranium	µg/L	15	5.9	5	<0.1
Zinc	mg/L	0.03	0.0019	0.0072	0.0022
Nutrients					
Ammonia as nitrogen	mg/L	1.8	0.06	0.08	0.13
Nitrate	mg/L	13	<0.04	<0.04	<0.04
Organic carbon, total	mg/L	-	27	30	58
Organic carbon, dissolved	mg/L	-	24	28	55
Phosphorus	mg/L	-	0.29	0.13	0.47
Total Kjeldahl nitrogen	mg/L	-	1.8	1.4	2.3
Total nitrogen	mg/L	-	1.8	1.4	2.3
Physical Properties					
Alkalinity, P.		-	3	<1	<1
Alkalinity, total	mg/L	-	322	309	208
Chemical oxygen demand	mg/L	-	69	76	132
Hydroxide	mg/L	-	<1	<1	<1
pH	pH units	6.5-9.0	8.35	8.24	7.57
Specific conductivity	µS/cm	-	1400	929	377
Sum of ions	mg/L	-	1190	794	345
Total dissolved solids	mg/L	-	1060	677	329
Total hardness	mg/L	-	745	507	216
Turbidity	NTU	-	11	10	1.4
Trace Elements					
Antimony	mg/L	-	0.0003	0.0002	<0.0002
Arsenic	µg/L	5	**5.6**	**6.4**	2.1
Beryllium	mg/L	-	<0.0001	0.0001	<0.0001
Cobalt	mg/L	-	0.0007	0.0011	0.0005
Strontium	mg/L	-	0.83	0.58	0.12
Vanadium	mg/L	-	0.003	0.0049	<0.0001

[1]Benchmark = water quality guideline or objective shown on Table 1 for particular constituent.

[2]Two duplicate samples collected (shown in Table 4).

Bolded values indicate exceedances of benchmark levels.

TABLE 6

Summary of fish catch by stream in the Star-Orion South Diamond Project study area, July 2011.

Common Name	Scientific Name	Peonan Creek	Stream F
Burbot	*Lota lota*	4	-
Brook stickleback	*Culaea inconstans*	14	6
Fathead minnow	*Pimephales promelas*	1	31
Lake chub	*Couesius plumbeus*	141	493
Longnose dace	*Rhinichthys cataractae*	2	11
Northern pike	*Esox lucius*	1	-
Northern redbelly dace	*Phoxinus eos*	3	151
River shiner	*Notropis blennius*	4	77
Spottail shiner	*Notropis hudsonius*	1	-
Walleye	*Sander vitreus*	20	5
White sucker	*Catostomus commersoni*	12	22
Yellow perch	*Perca flavescens*	1	-
Total		204	796

Dash = no fish captured.

Stream T is not shown because it yielded no fish.

TABLE 7

Summary of fish catch by fishing method in the Star-Orion South Diamond Project study area, July 2011.

Common Name	Scientific Name	Backpack Electrofisher	Minnow Trap
Burbot	*Lota lota*	4	-
Brook stickleback	*Culaea inconstans*	13	7
Fathead minnow	*Pimephales promelas*	3	29
Lake chub	*Couesius plumbeus*	123	511
Longnose dace	*Rhinichthys cataractae*	13	-
Northern pike	*Esox lucius*	-	1
Northern redbelly dace	*Phoxinus eos*	38	116
River shiner	*Notropis blennius*	2	79
Spottail shiner	*Notropis hudsonius*	1	-
Walleye	*Sander vitreus*	-	25
White sucker	*Catostomus commersoni*	11	23
Yellow perch	*Perca flavescens*	-	1
Total		208	792

Dash = no fish captured.

TABLE 8

Catch per unit electrofishing effort in the Star-Orion South Diamond Project study area, July 2011.

Stream	Area	Effort (hrs)	Species	Number Captured (# fish)	CPUE (# fish/hr)
Peonan Creek	1	0.68	Brook stickleback	7	10.24
			Burbot	4	5.85
			Fathead minnow	1	1.46
			Lake chub	30	43.88
			Longnose dace	2	2.93
			River shiner	1	1.46
			Spottail shiner	1	1.46
			White sucker	4	5.85
			Total	**50**	**73.14**
	2	0.09	No fish	0	0.00
Stream F	1	0.51	Brook stickleback	6	11.84
			Fathead minnow	2	3.95
			Lake chub	93	183.45
			Longnose dace	11	21.70
			Northern redbelly dace	38	74.96
			River shiner	1	1.97
			White sucker	7	13.81
			Total	**158**	**384.81**
	2	0.09	Lake chub	2	21.11
Stream T	1	0.26	No fish	0	0.00

TABLE 9

Summary of fish length measurements foe additional streams in the Star-Orion South Diamond Project study area, July 2011.

Species	Peonan Creek					Stream F				
	Sample Size	Mean	SD	Min	Max	Sample Size	Mean	SD	Min	Max
Burbot	4	6.9	0.79	6.0	7.9	-	-	-	-	-
Brook stickleback	14	4.5	0.33	4.0	5.1	6	4.5	0.43	4.0	5.1
Fathead minnow	1	6.0	N/A	6.0	6.0	31	6.2	0.39	5.1	7.0
Lake chub	141	4.6	0.58	2.0	6.1	493	4.9	0.54	2.4	7.7
Longnose dace	2	5.1	0.14	5.0	5.2	11	5.7	1.6	3.3	7.8
Northern pike	1	9.9	N/A	9.9	9.9	-	-	-	-	-
Northern redbelly dace	3	4.9	0.12	4.8	5.0	151	5.0	0.62	2.8	7.5
River shiner	4	4.9	1.22	4.2	6.7	77	5.2	0.42	4.5	6.8
Spottail shiner	1	3.8	N/A	3.8	3.8	-	-	-	-	-
Walleye	20	5.2	0.37	4.6	5.7	5	5.3	0.29	4.9	5.6
White sucker	12	5.8	0.80	4.7	7.1	22	6.5	1.4	4.7	11.0
Yellow perch	1	4.7	N/A	4.7	4.7	-	-	-	-	-

Dash = no fish captured.

N/A = not applicable.

SD = standard deviation.

TABLE 10

Detailed description of habitat sections in additional streams in the Star-Orion South Diamond Project study area, July 2011.

Habitat Section	Upland Zone				Riparian Zone						Crown Closure (%)	Channel Habitat Features																								Spawning Suitability Index			
							Bank Slope		Bank Stability			Substrate (%)						Cover (%)						Aquatic Vegetation				Habitat Types (%)				Channel Characteristics							Obstructions				
	Land Use	Forest Condition	Canopy	Slope	Category	Vegetation	Right	Left	Right	Left		Silt/Clay	Sand	Gravel	Cobble	Boulder	Organic	Large Woody Debris	Aquatic Vegetation	Rock	Overhanging Vegetation	Undercut	Surface Turbulence	Emergent	Floating Leaf	Submergent	Moss/Algae	Riffles	Run	Pools	Glide	Mean Bankfull Width (m)	Left Bank Depth (m)	Right Bank Depth (m)	Mean Wetted Width (m)	Maximum Depth (m)	Mean Centre Depth (m)	# Braided Channels		Longnose Sucker/ White Sucker	Northern Pike	Walleye/Sauger	Yellow Perch
Peonan Creek																																								
1	F/A/NG	M	D	M	FB/WL/GB	S/G/Sed	G	G	SU	SU	≤5	100	0	0	0	0	0	S	S	S	M	S	S	S	A	A	A	0	0	100	0	9.0	0.5	0.5	3.0	2.0	1.5	0	None	0	1-2	0	1
2	F/A	M	D	G	WL/GB	G/Sed	G	M	SU	HU	10	100	0	0	0	0	0	S	S	S	M	S	S	S	A	A	A	0	33	33	34	8.0	0.4	0.4	3.0	1.3	0.6	0	None	0	1	0	1
3	F	M	D	G	FB/GB	T/S/G/Sed	S	M	HU	SU	≤5	10	10	40	30	10	0	S	S	M	S	S	M	A	A	A	A	50	50	0	0	8.0	0.2	0.2	3.0	0.6	0.4	0	None	1-2	0	1	0
4	F	M	D	M	T	T/S/G/Sed	S	S	MU	MU	0	50	25	0	20	5	0	S	S	M	M	M	S	A	A	A	A	0	25	0	75	6.0	0.2	0.2	4.0	0.6	0.4	0	None	0-1	0	0	0-1
5	F	M	D	G	FB	T/S	S	G	SU	HU	≤5	0	0	10	75	15	0	S	S	D	M	M	M	A	A	A	A	90	10	0	0	6.8	0.2	0.2	4.8	0.6	0.4	0	None	2	0	3	0
6	F/NG	M	D	M	FB/GB	T/S/G/Sed	S	M	HU	MU	≤5	70	5	5	10	10	0	S	S	5	M	M	S	A	A	A	A	0	10	0	90	6.5	0.2	0.2	3.5	0.6	0.4	0	None	0-1	0	0	0
7	F	M	M	G	FB/GB	T/S/G/Sed	M	S	MU	HU	≤5	10	10	10	65	5	0	S	M	D	M	M	D	S	A	A	S	75	12	0	13	7.5	0.2	0.2	3.5	0.5	0.4	1	None	2	1	1	0-1
8	F/NG	M	D	G	FB/GB	T/S/G/Sed	S	M	HU	MU	≤5	10	5	5	70	10	0	S	M	D	M	M	D	S	A	A	A	90	10	0	0	7.5	0.2	0.2	3.0	0.5	0.4	1	None	2	0-1	1	0
Stream F																																								
1	F	M	D	G	FB	T/S/G/Sed	M	M	MU	MU	≤5	100	0	0	0	0	0	S	S	S	M	M	S	S	A	A	A	0	0	100	0	9.0	0.2	0.2	7.5	1.0	0.5	0	None	0-1	-	0	-
2	F	M	D	G	FB	T/S/G/Sed	M	M	MU	MU	20 to 30	100	0	0	0	0	0	S	S	S	M	M	S	S	A	A	A	0	0	100	0	7.6	0.1	0.2	4.6	0.8	0.7	0	None	0-1	-	0	-
3	F	M	D	G	FB	T/S/G/Sed	S	S	MU	MU	50 to 60	30	0	20	45	5	0	D	S	D	D	M	S	A	A	A	A	35	50	5	10	3.7	0.1	0.1	2.2	0.8	0.3	0	None	1-2	-	1	-
4	F	M	D	M	FB	T/S/G/Sed	S	G	HU	SU	60 to 70	5	0	10	70	15	0	D	S	D	D	M	M	A	A	A	A	45	45	0	10	3.7	0.1	0.1	2.2	0.8	0.3	0	None	2	-	1	-
5	F	M	D	M	FB	T/S/G/Sed	S	G	HU	SU	50 to 60	5	0	10	80	5	0	S	S	D	M	M	S	A	A	A	A	40	60	0	0	3.7	0.2	0.2	2.2	0.4	0.3	0	None	2	-	1	-
6	F	M	D	M	FB	T/S/G/Sed	S	G	HU	SU	50 to 60	5	0	10	65	20	0	S	A	D	S	S	M	A	A	A	A	85	10	0	5	3.7	0.2	0.1	2.2	0.4	0.3	0	None	2	-	1	-
7	F	M	D	M	FB	T/S	M	M	SU	SU	50 to 60	5	0	5	80	10	0	M	S	D	D	M	S	A	A	A	A	10	0	0	90	6.1	0.2	0.2	3.1	0.6	0.3	0	None	2	-	1	-
8	F	M/R	D	S	FB	T/S/G/Sed	S	S	SU	SU	≤5	5	0	10	80	5	0	S	S	D	M	S	M	A	A	A	S	80	17	0	3	6.3	0.1	0.1	2.3	0.3	0.2	0	None	2	-	1	-
Stream T																																								
1	F	R	M	G	FB	T/S/G/Sed	G	G	S	S	90	0	0	0	0	0	100	D	D	S	D	S	A	D	A	A	A	0	0	100	0	13	0.1	0.1	10	0.4	0.3	0	None*	-	-	-	-
2	F	R	M	G	FB	T/S/G/Sed	G	G	S	S	90 to 100	0	0	0	0	0	100	D	D	S	D	S	A	D	A	A	A	0	0	100	0	7.0	0.1	0.1	3.0	0.2	0.1	0	BD	-	-	-	-
3	F	R	M	G	FB	T/S/G/Sed	G	G	S	S	-	0	0	0	0	0	100	D	D	S	D	S	A	D	A	A	A	0	0	100	0	-	-	-	>40	-	-	0	None	-	-	-	-

Land use: A = agricultural; F = forest; NG = natural grassland.
Forest condition: M = mature; H = harvested, R = regenerating.
Canopy: D = deciduous; M = mixed; C = coniferous.
Slope: G = gentle; M = moderate; S = steep.
Riparian category: FB = forest to bank; GB = grass to bank; T = transition; WL = wetland.
Riparian vegetation: T = trees; S = shrubs; Sed = sedges; G = grasses.
Bank stability: S = stable; SU = slightly unstable; MU = moderately unstable; HU = highly unstable.
Littoral cover: A = absent; S = sparse (<30%); M = moderate (30 to 70%); D = dense (>70%).
Aquatic vegetation: A = absent; S = sparse density (<30%); M = moderate density (30 to 70%); D = dense (>70%).
Obstruction: BD = beaver dam.
*Indicates the presence of beaver dam(s) downstream of the study area.
Spawning suitability index: 0 = not suitable; 1 = marginally suitable; 2 = moderately suitable; 3 = highly suitable.

FIGURES

LIST OF FIGURES

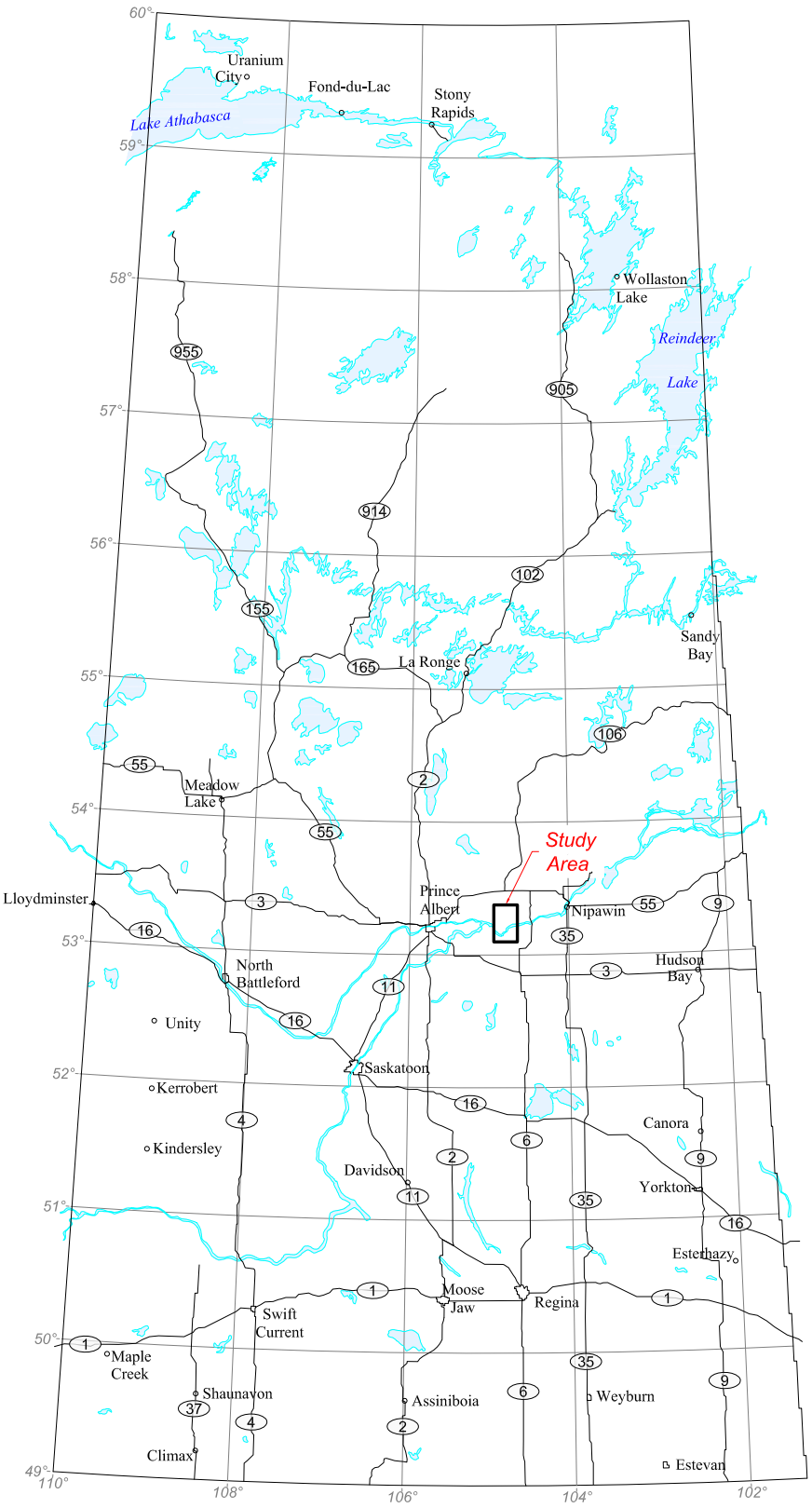

Figure 1 Study location.

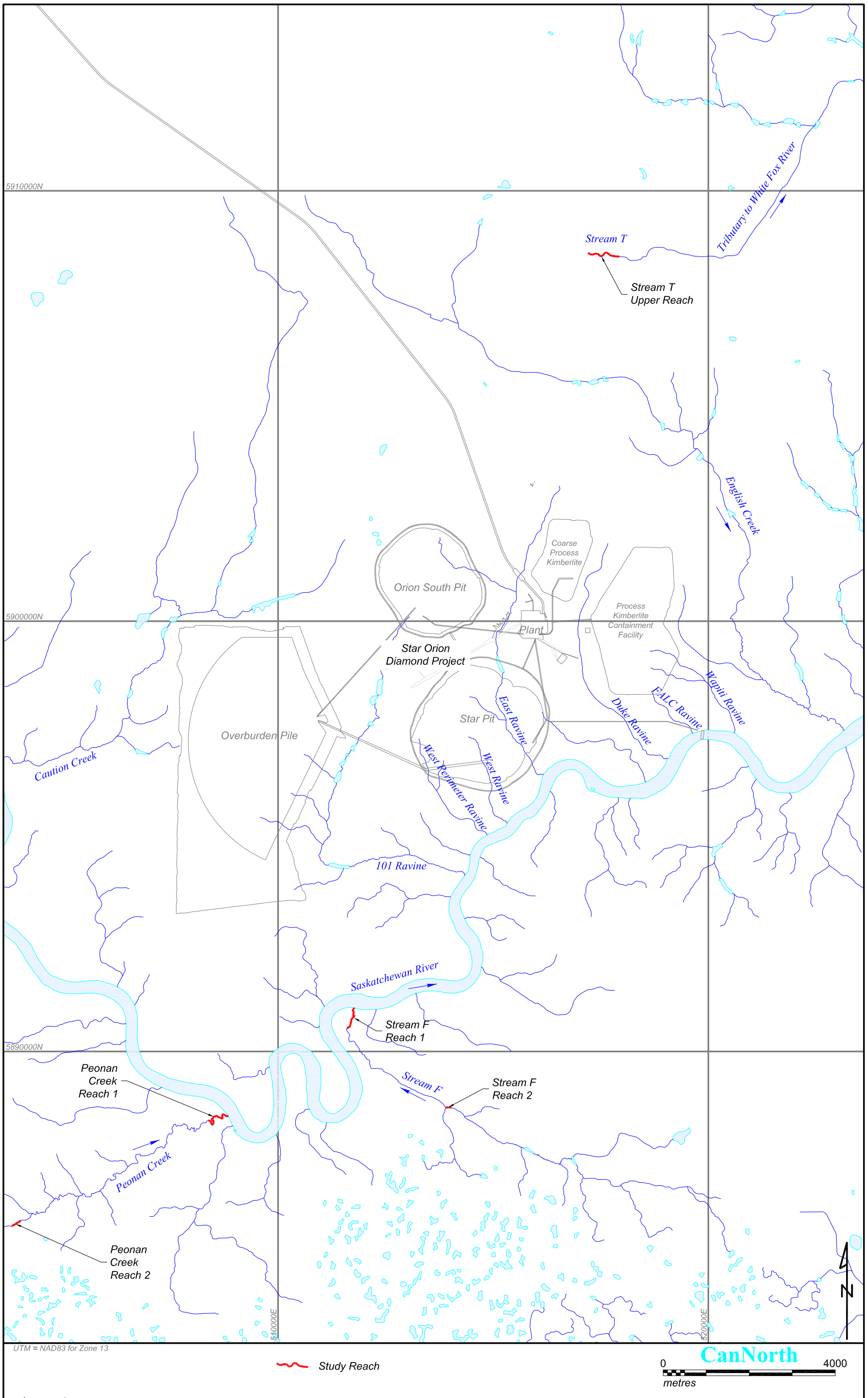

Figure 2
Star-Orion South Diamond Project study area, 2011.

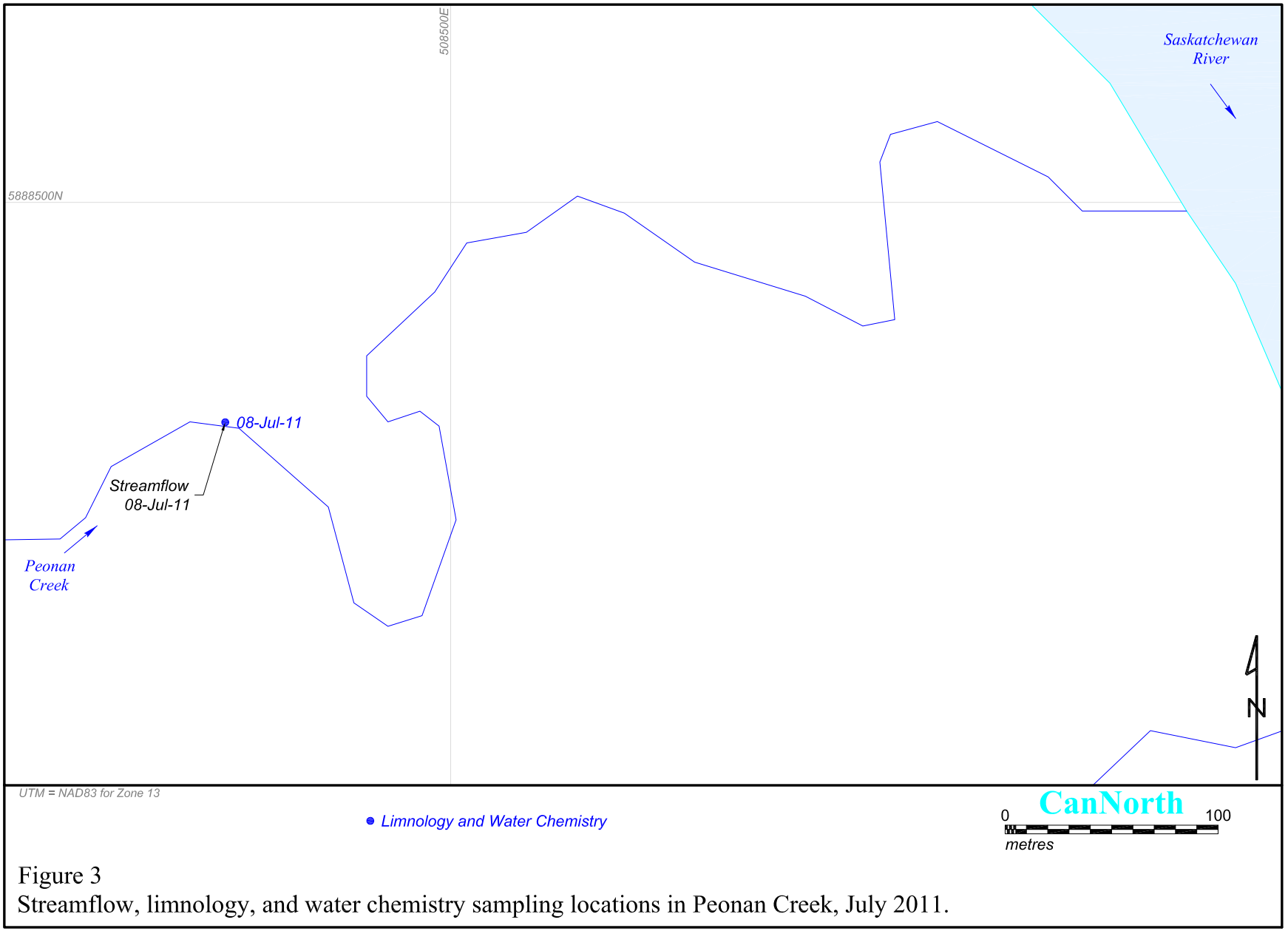

Figure 3
Streamflow, limnology, and water chemistry sampling locations in Peonan Creek, July 2011.

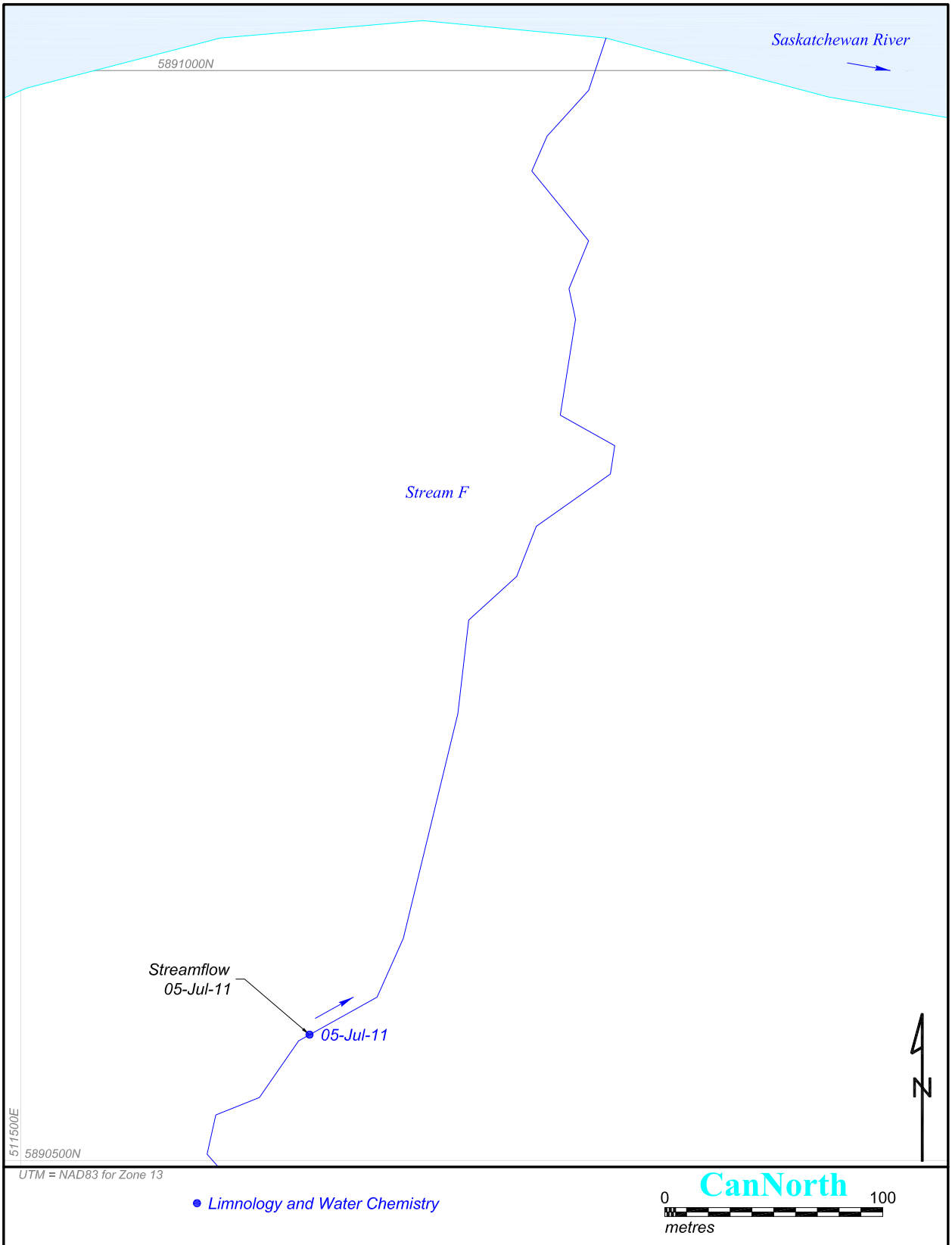

Figure 4
Streamflow, limnology, and water chemistry sampling locations in Stream F, July 2011.

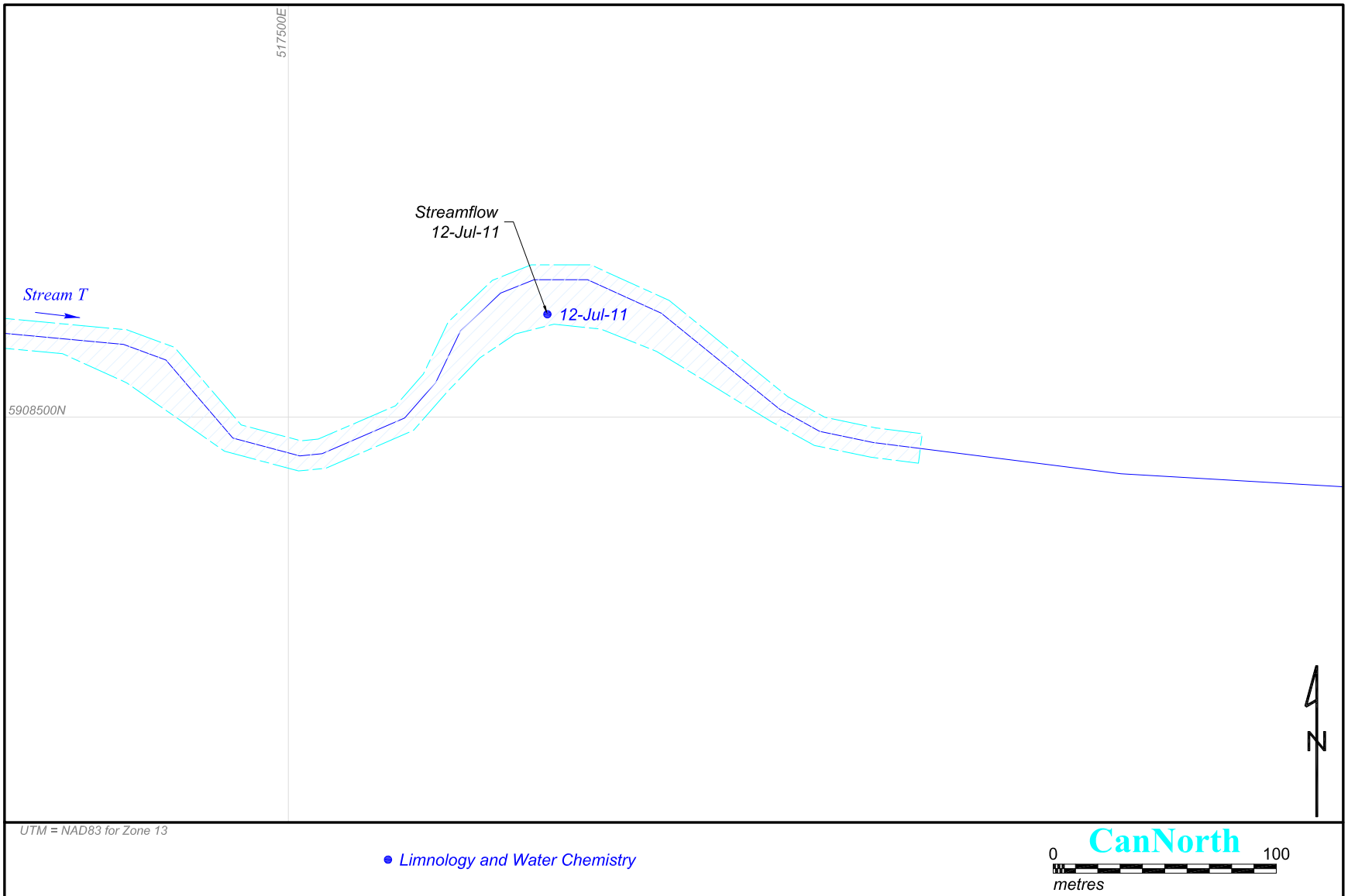

Figure 5
Streamflow, limnology, and water chemistry sampling locations in Stream T, July 2011.

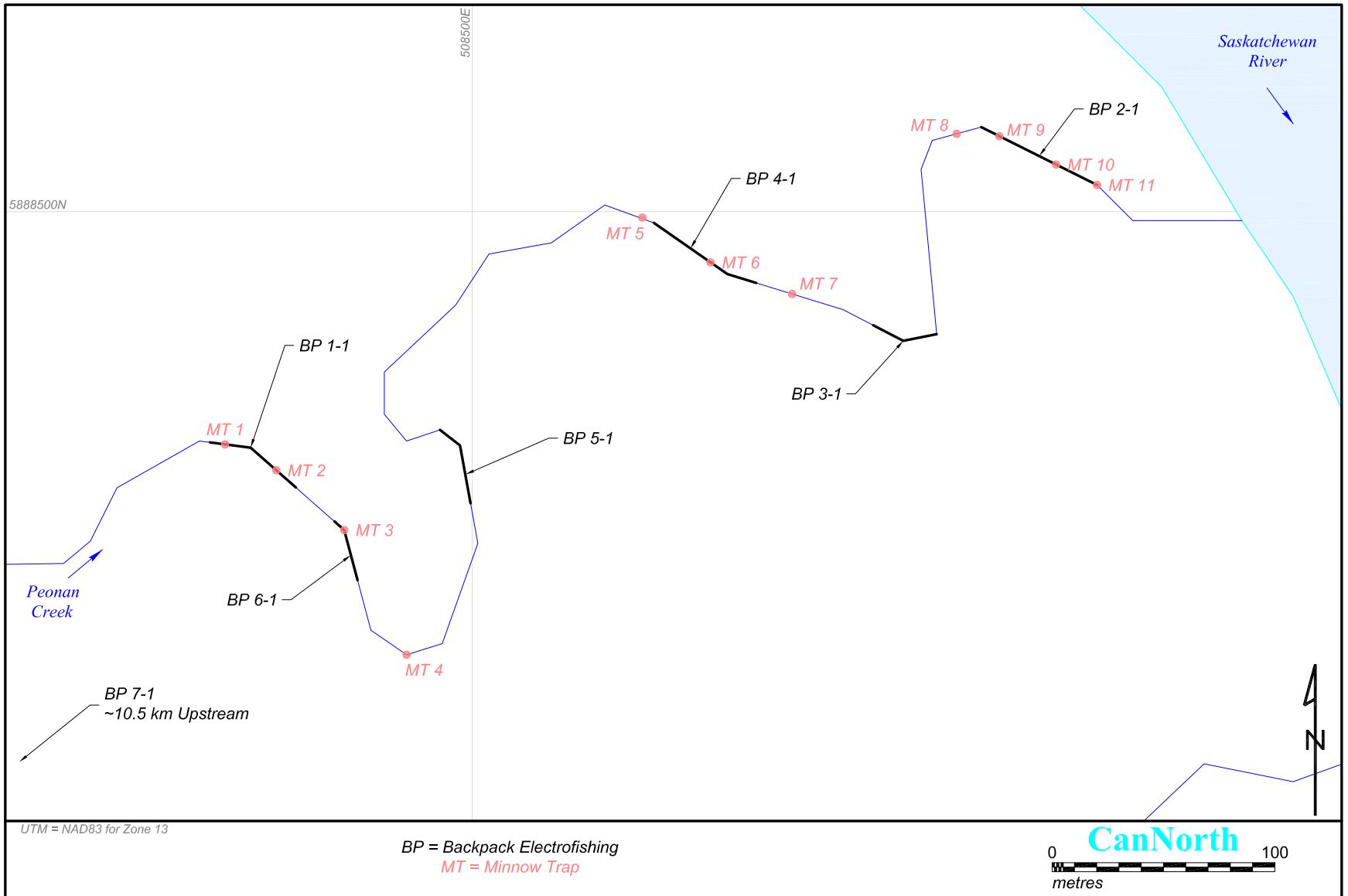

Figure 6
Fish sampling locations in the portion of Peonan Creek within 500 m of the Saskatchewan River, July 2011.

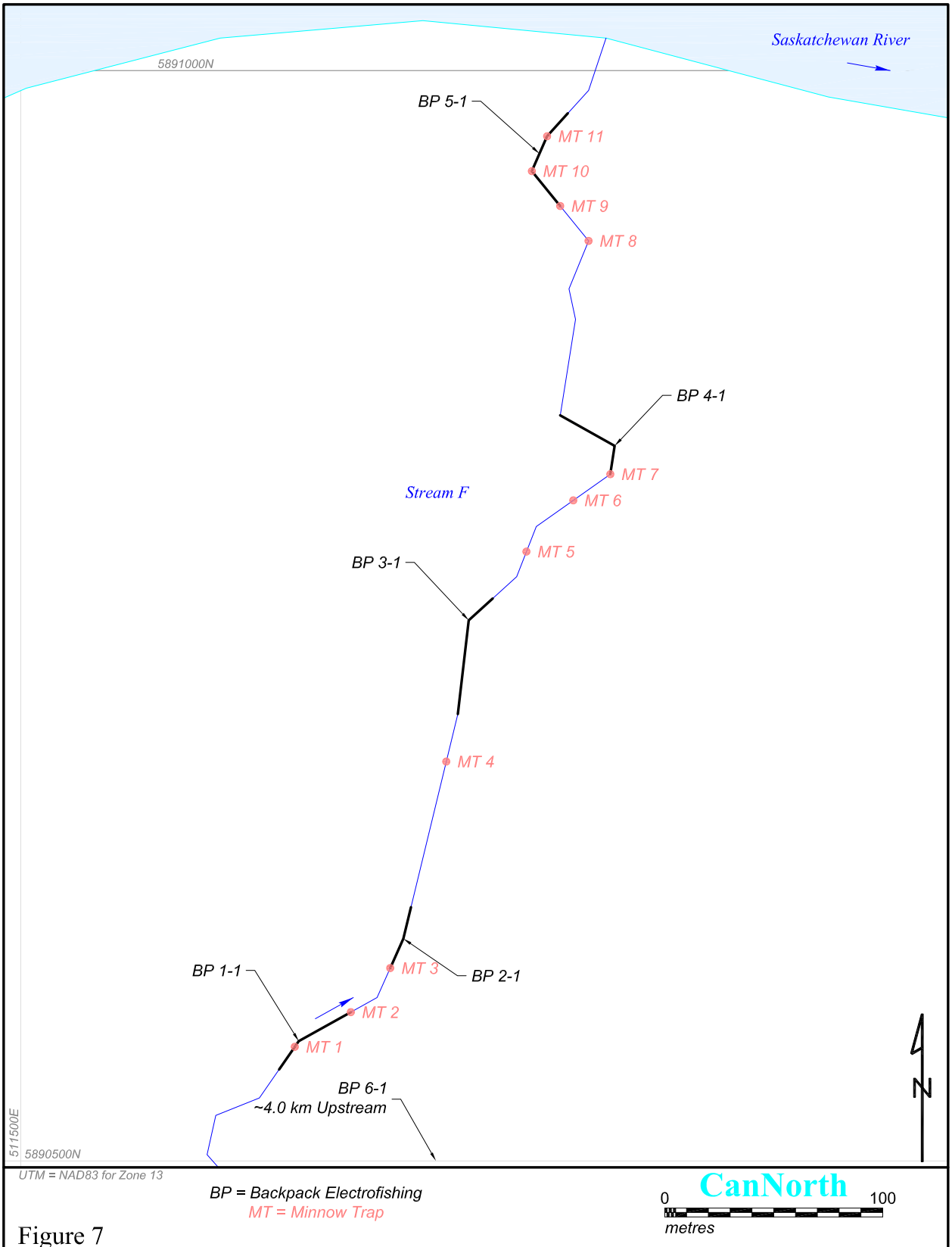

Figure 7
Fish sampling locations in the portion of Stream F within 500 m of the Saskatchewan River, July 2011.

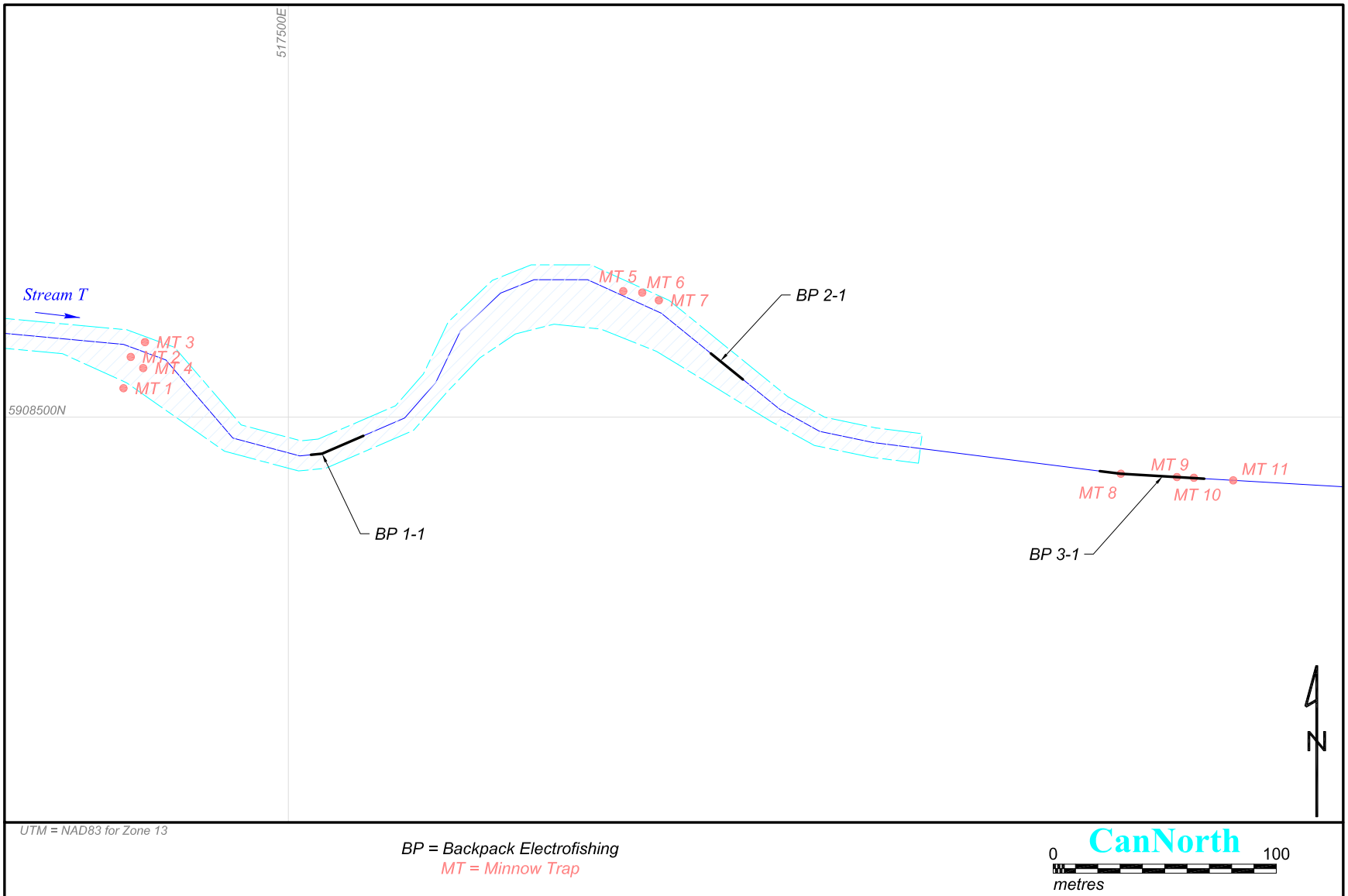

Figure 8
Fish sampling locations in the upper reach of Stream T, July 2011.

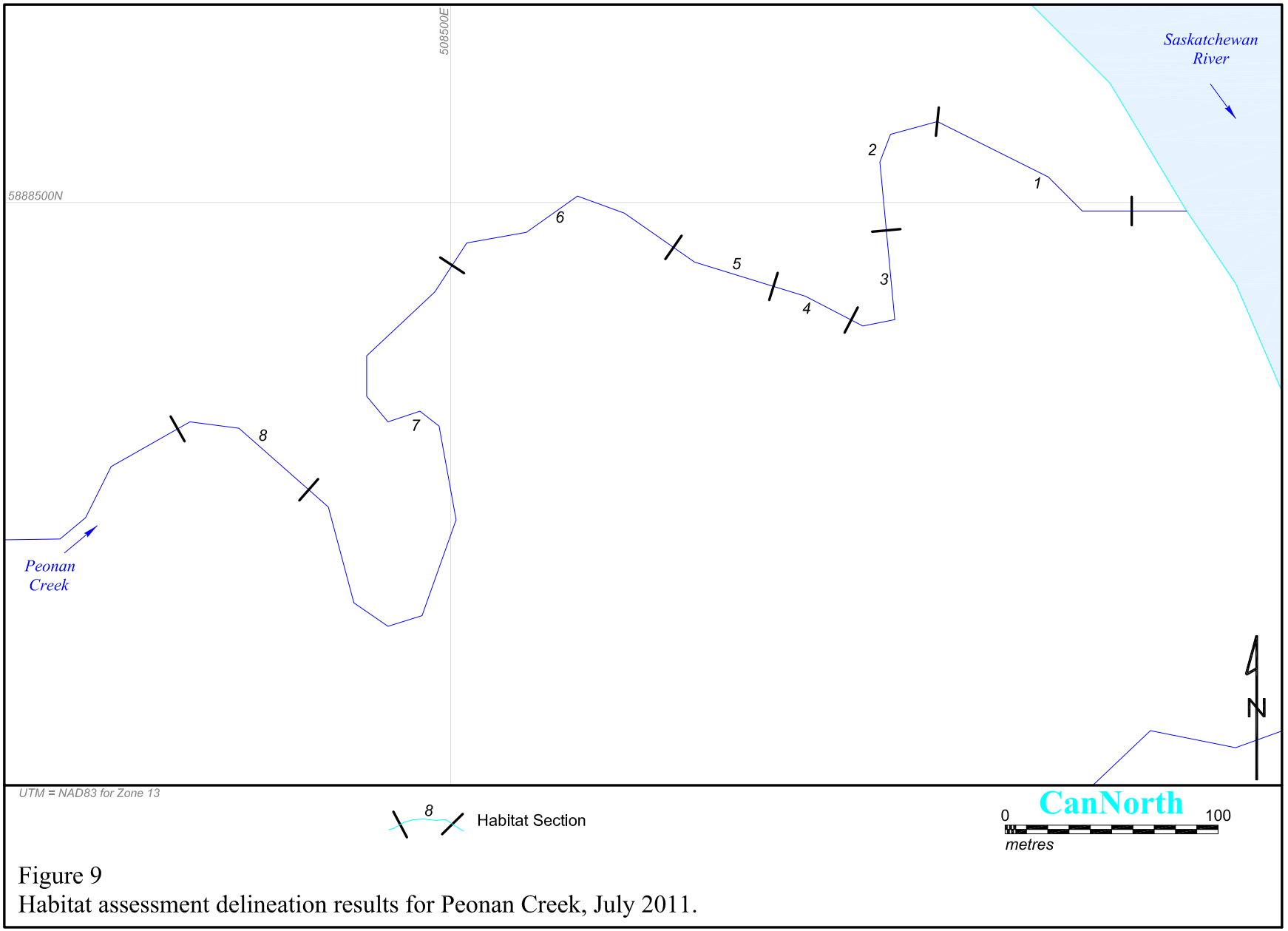

Figure 9
Habitat assessment delineation results for Peonan Creek, July 2011.

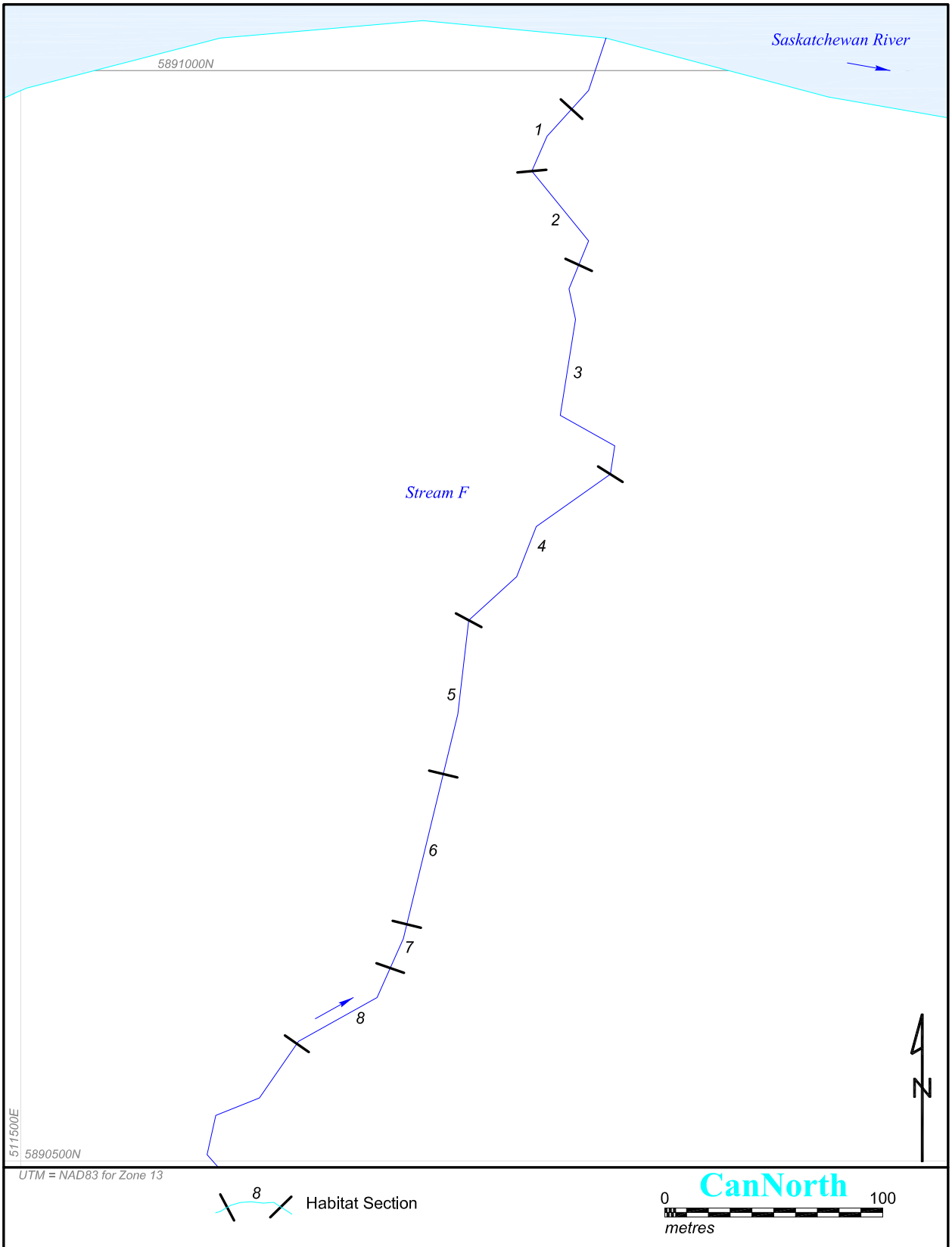

Figure 10
Habitat assessment delineation results for Stream F, July 2011.

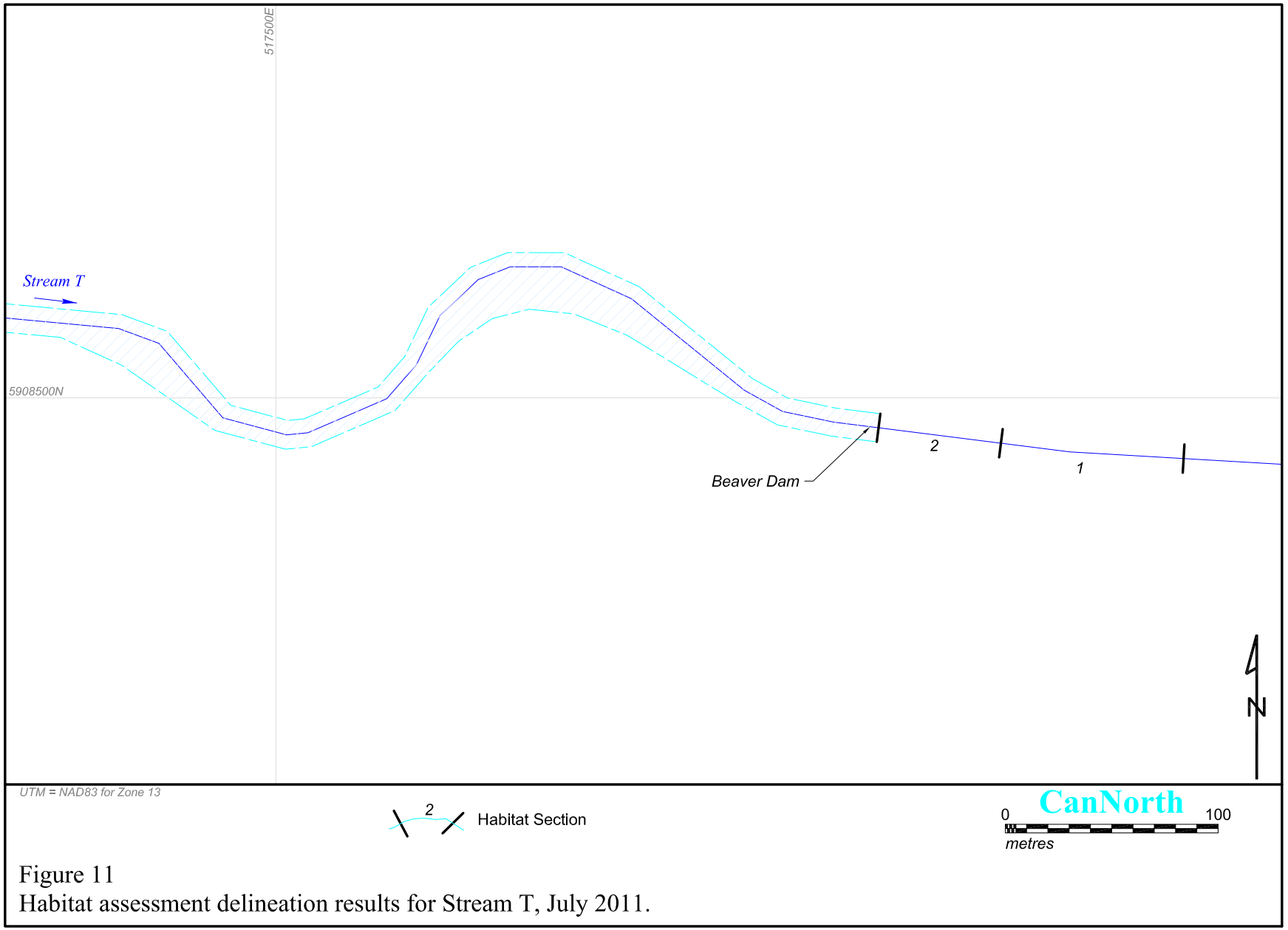

Figure 11
Habitat assessment delineation results for Stream T, July 2011.

APPENDICES

LIST OF APPENDICES

APPENDIX A

SRC QA/QC REPORTS AND RAW CHEMISTRY DATA

REVISED

SRC Group # 2011-6608

SRC ANALYTICAL

Aug 11, 2011

422 Downey Road
Saskatoon, Saskatchewan, Canada
S7N 4N1
(306) 933-6932 or 1-800-240-8808

CanNorth
Canada North Environmental Services Limited
4-130 Robin Crescent
Saskatoon, SK S7L 6M7
Attn: Cassandra Rees

Date Samples Received: Jul-15-2011 Client P.O.: 1533

This is a final report.

Organics results have been authorized by Pat Moser, Supervisor

ICP results have been authorized by Keith Gipman, Supervisor

Inorganics and Radiochemistry results have been authorized by Jeff Zimmer, Supervisor

SLOWPOKE-2 results have been authorized by Dave Chorney

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* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as

    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

REVISED

SRC Group # 2011-6608

SRC ANALYTICAL

Aug 11, 2011

422 Downey Road
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Canada North Environmental Services Limited
4-130 Robin Crescent
Saskatoon, SK S7L 6M7
Attn: Cassandra Rees

Date Samples Received: Jul-15-2011 Client P.O.: 1533

22167	07/12/2011 CANNORTH 1533 FORT A LA CORNE PEHONAN CREEK STN 1, SAMPLE 1 SURFACE *WATER*
22168	07/05/2011 CANNORTH 1533 STREAM F STN 1, SAMPLE 1 SURFACE *WATER*
22169	07/12/2011 CANNORTH 1533 STREAM T STN 1, SAMPLE 1 SURFACE *WATER*

Analyte	Units	22167	22168	22169
Inorganic Chemistry				
Bicarbonate	mg/L	386±20	377±20	251±10
Carbonate	mg/L	4±2	<1	<1
Chloride	mg/L	22±1	4±1	3±1
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	3±2	<1	<1
pH	pH units	8.35±0.1	8.24±0.1	7.56±0.1
Specific conductivity	uS/cm	1400±30	929±30	375±20
Sum of ions	mg/L	1190±30	794±20	342±20
Total alkalinity	mg/L	322±7	309±7	206±6
Total hardness	mg/L	745±20	507±20	216±10
Ammonia as nitrogen	mg/L	0.06±0.03	0.08±0.04	0.11±0.04
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	1.8±0.5	1.4±0.4	2.2±0.5
Total nitrogen	mg/L	1.8	1.4	2.2
Chemical oxygen demand	mg/L	69±20	76±20	135±20
Organic carbon	mg/L	27±0.4	30±0.5	58±0.9
Organic carbon, dissolved	mg/L	24±0.4	28±0.5	58±0.9
Fluoride	mg/L	0.12±0.03	0.13±0.03	0.06±0.02
Total dissolved solids	mg/L	1060±60	677±50	329±40
Turbidity	NTU	11±0.5	10±0.5	1.7±0.2
ICP				
Calcium	mg/L	137±10	116±8	67±5
Magnesium	mg/L	98±2	53±2	12±0.6
Potassium	mg/L	17±3	6.4±1	3.8±0.8
Sodium	mg/L	46±2	17±0.9	2.3±0.2
Sulfate	mg/L	480±20	220±10	2.3±0.5
Aluminum	mg/L	0.37±0.01	1.20±0.02	0.0089±0.002
Antimony	mg/L	0.0003±0.0002	0.0002±0.0002	<0.0002
Arsenic	ug/L	5.6±0.3	6.4±0.3	2.0±0.2
Barium	mg/L	0.091±0.006	0.30±0.01	0.14±0.007
Beryllium	mg/L	<0.0001	0.0001±0.0001	<0.0001
Boron	mg/L	0.07±0.03	0.04±0.02	0.02±0.01
Cadmium	mg/L	0.00002±0.00001	0.00005±0.00002	0.00002±0.00001

22167 (Cont.) 07/12/2011 CANNORTH 1533 FORT A LA CORNE PEHONAN CREEK STN 1, SAMPLE 1 SURFACE *WATER*

22168 07/05/2011 CANNORTH 1533 STREAM F STN 1, SAMPLE 1 SURFACE *WATER*

22169 07/12/2011 CANNORTH 1533 STREAM T STN 1, SAMPLE 1 SURFACE *WATER*

Analyte	Units	22167	22168	22169
ICP				
Chromium	mg/L	0.0005±0.0005	0.0021±0.0007	<0.0005
Cobalt	mg/L	0.0007±0.0003	0.0011±0.0003	0.0005±0.0002
Copper	mg/L	0.0018±0.0004	0.0028±0.0005	0.0002±0.0002
Iron	mg/L	0.81±0.02	2.68±0.03	0.33±0.01
Lead	mg/L	0.0003±0.0001	0.0008±0.0002	<0.0001
Manganese	mg/L	0.18±0.001	0.22±0.001	0.99±0.002
Molybdenum	mg/L	0.0014±0.0004	0.0026±0.0005	0.0004±0.0002
Nickel	mg/L	0.0044±0.001	0.0048±0.001	0.0008±0.0004
Phosphorus	mg/L	0.29±0.05	0.13±0.03	0.45±0.07
Selenium	mg/L	0.0006±0.0002	0.0006±0.0002	0.0002±0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.83±0.02	0.58±0.01	0.12±0.007
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.028±0.003	0.032±0.003	0.0005±0.0002
Uranium	ug/L	5.9±0.5	5.0±0.4	<0.1
Vanadium	mg/L	0.0030±0.0005	0.0049±0.0006	0.0001±0.0001
Zinc	mg/L	0.0019±0.001	0.0072±0.003	0.0022±0.001

"<": not detected at level stated above.

22170	07/12/2011 CANNORTH 1533 STREAM T STN 1, SAMPLE 1 D SURFACE *WATER*
22171	1533 FIELD *WATER*
22172	TRIP BLANK *WATER*

Analyte	Units	22170	22171	22172
Inorganic Chemistry				
Bicarbonate	mg/L	254±10	<1	<1
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	Not Requested	<0.1	<0.1
Chloride	mg/L	3±1	Not Requested	Not Requested
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	7.57±0.1	5.94±0.1	5.59±0.1
Specific conductivity	uS/cm	377±20	<1	<1
Sum of ions	mg/L	345±20	<1	<1
Total alkalinity	mg/L	208±6	<1	<1
Total hardness	mg/L	216±10	<1	<1
Ammonia as nitrogen	mg/L	0.13±0.05	<0.01	<0.01
Nitrate	mg/L	<0.04	<0.04	<0.04
Total Kjeldahl nitrogen	mg/L	2.3±0.5	0.08±0.06	0.10±0.07
Total nitrogen	mg/L	2.3	0.080	0.10
Chemical oxygen demand	mg/L	132±20	<4	<4
Organic carbon	mg/L	58±0.9	0.3±0.2	0.2±0.2
Organic carbon, dissolved	mg/L	55±0.9	0.3±0.2	<0.2
Fluoride	mg/L	0.08±0.02	<0.01	<0.01
Total dissolved solids	mg/L	329±40	<1	<1
Turbidity	NTU	1.4±0.2	<0.1	<0.1
ICP				
Calcium	mg/L	67±5	<0.1	<0.1
Magnesium	mg/L	12±0.6	<0.1	<0.1
Potassium	mg/L	3.9±0.9	<0.1	<0.1
Sodium	mg/L	2.3±0.2	<0.1	<0.1
Sulfate	mg/L	2.3±0.5	<0.2	<0.2
Aluminum	mg/L	0.0089±0.002	<0.0005	<0.0005
Antimony	mg/L	<0.0002	<0.0002	<0.0002
Arsenic	ug/L	2.1±0.2	<0.1	<0.1
Barium	mg/L	0.14±0.007	<0.0005	<0.0005
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	0.02±0.01	<0.01	<0.01
Cadmium	mg/L	0.00002±0.00001	0.00003±0.00001	0.00001±0.00001
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0005±0.0002	<0.0001	<0.0001
Copper	mg/L	0.0002±0.0002	<0.0002	<0.0002
Iron	mg/L	0.33±0.01	<0.0005	<0.0005
Lead	mg/L	<0.0001	<0.0001	<0.0001
Manganese	mg/L	0.93±0.002	<0.0005	<0.0005
Molybdenum	mg/L	0.0003±0.0002	<0.0001	<0.0001
Nickel	mg/L	0.0008±0.0004	<0.0001	<0.0001
Phosphorus	mg/L	0.47±0.07	<0.01	<0.01
Selenium	mg/L	0.0002±0.0001	<0.0001	<0.0001
Silver	mg/L	<0.00005	<0.00005	<0.00005
Strontium	mg/L	0.12±0.007	<0.0005	<0.0005

22170 (Cont.) 07/12/2011 CANNORTH 1533 STREAM T STN 1, SAMPLE 1 D SURFACE *WATER*
22171 1533 FIELD *WATER*
22172 TRIP BLANK *WATER*

Analyte	Units	22170	22171	22172
ICP				
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.0005±0.0002	<0.0002	<0.0002
Uranium	ug/L	<0.1	<0.1	<0.1
Vanadium	mg/L	<0.0001	<0.0001	<0.0001
Zinc	mg/L	0.0022±0.001	<0.0005	<0.0005

"<": not detected at level stated above.

Note for Sample # 22172
Note revised result for zinc. 8/10/2011 KG

SRC ANALYTICAL

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Jul 26, 2011

Quality Control Report

Cassandra Rees
CanNorth
Canada North Environmental Services Limited
4-130 Robin Crescent
Saskatoon, SK, S7L 6M7

This report was generated for samples included in SRC Group # 2011-6608

Reference Materials and Standards:

A reference material of known concentration is used whenever possible as either a control sample or control standard and analyzed with each batch of samples. These "QC" results are used to assess the performance of the method and must be within clearly defined limits; otherwise corrective action is required.

QC Analysis	Units	Target Value	Obtained Value	
Aluminum	mg/L	0.0586	0.0590	
Aluminum	mg/L	0.0590	0.0579	
Antimony	mg/L	0.00333	0.00358	
Arsenic	ug/L	3.99	3.97	
Arsenic	ug/L	4.02	4.05	
Barium	mg/L	0.146	0.150	
Barium	mg/L	0.146	0.151	
Beryllium	mg/L	0.0130	0.0132	
Beryllium	mg/L	0.0130	0.0137	
Boron	mg/L	0.0772	0.0784	
Cadmium	mg/L	0.00407	0.00426	
Cadmium	mg/L	0.00411	0.00418	
Calcium	mg/L	9.8	10	
Chemical oxygen demand	mg/L	40	42	
Chloride	mg/L	51.6	51.4	
Chloride	mg/L	8.27	8.39	
Chromium	mg/L	0.0444	0.0456	
Chromium	mg/L	0.0448	0.0457	
Cobalt	mg/L	0.0644	0.0651	
Cobalt	mg/L	0.0640	0.0658	
Copper	mg/L	0.167	0.166	
Copper	mg/L	0.167	0.166	
Fluoride	mg/L	1.72	1.65	
Iron	mg/L	0.224	0.228	
Iron	mg/L	0.224	0.295	* (1)
Lead	mg/L	0.00790	0.00798	
Lead	mg/L	0.00790	0.00808	
Magnesium	mg/L	15	14	
Manganese	mg/L	0.0473	0.0477	
Manganese	mg/L	0.0470	0.0480	
Molybdenum	mg/L	0.0671	0.0661	

QC Analysis	Units	Target Value	Obtained Value
Molybdenum	mg/L	0.0681	0.0689
N, Ammonia	mg/L	1.08	1.08
N, NO2 + NO3	mg/L	1.55	1.53
N, NO2 + NO3	mg/L	1.55	1.54
Nickel	mg/L	0.0825	0.0824
Nickel	mg/L	0.0820	0.0829
Organic carbon	mg/L	44.4	47.2
pH	pH units	4.00	4.00
Phosphorus	mg/L	2.08	2.13
Potassium	mg/L	20	20
Selenium	mg/L	0.00818	0.00823
Silver	mg/L	0.00990	0.00981
Sodium	mg/L	14	14
Specific Conductivity	uS/cm	330	318
Strontium	mg/L	0.244	0.244
Strontium	mg/L	0.244	0.249
Sulfate	mg/L	25	25
Thallium	mg/L	0.00830	0.00832
Tin	mg/L	0.0114	0.0114
Titanium	mg/L	0.0147	0.0143
Titanium	mg/L	0.0150	0.0146
TKN, dissolved	mg/L	0.05	0.02
Total alkalinity	mg/L	250	250.8
Total dissolved solids	mg/L	100	105
Total dissolved solids	mg/L	100	98
Total Kjeldahl nitrogen	mg/L	6.41	6.25
Total Kjeldahl nitrogen	mg/L	0.903	0.960
Turbidity	NTU	4.13	4.00
Uranium	ug/L	14.0	14.2
Uranium	ug/L	14.2	14.3
Vanadium	mg/L	0.0445	0.0446
Vanadium	mg/L	0.0440	0.0453
Zinc	mg/L	0.379	0.374
Zinc	mg/L	0.365	0.373

Duplicates:

Duplicates are used to assess problems with precision and help ensure that samples within a given batch were processed appropriately. The difference between duplicates must be within strict limits, otherwise corrective action is required. Please note, the duplicate(s) in this report are duplicates analyzed within a given batch of test samples and may not be from this specific group of samples.

Duplicate Analysis	Units	First Result	Second Result
Silver	mg/L	<0.00005	<0.00005
Aluminum	mg/L	0.0089	0.0084
Arsenic	ug/L	2.1	2.0
Boron	mg/L	0.02	0.02
Barium	mg/L	0.14	0.14
Beryllium	mg/L	<0.0001	<0.0001
Calcium	mg/L	3.7	3.8
Calcium	mg/L	1.0	1.1

Duplicate Analysis	Units	First Result	Second Result
Cadmium	mg/L	0.00002	0.00003
Chloride	mg/L	<0.1	<0.1
Chloride	mg/L	20	20
Cobalt	mg/L	0.0005	0.0005
Chemical oxygen demand	mg/L	7	<4
Chromium	mg/L	<0.0005	<0.0005
Copper	mg/L	0.0002	0.0002
Organic carbon, dissolved	mg/L	52	50
Fluoride	mg/L	0.12	0.12
Iron	mg/L	0.33	0.33
Potassium	mg/L	0.5	0.5
Potassium	mg/L	0.3	0.2
Magnesium	mg/L	1.3	1.3
Magnesium	mg/L	0.3	0.3
Manganese	mg/L	0.93	0.92
Molybdenum	mg/L	0.0003	0.0003
Sodium	mg/L	1.2	1.2
Sodium	mg/L	0.8	0.8
Ammonia as nitrogen	mg/L	0.02	0.02
Ammonia as nitrogen	mg/L	<0.01	<0.01
Nickel	mg/L	0.0008	0.0008
Nitrate	mg/L	<0.04	<0.04
Nitrate	mg/L	49	49
Nitrate	mg/L	25	25
Phosphorus	mg/L	<0.01	<0.01
Phosphorus	mg/L	<0.01	<0.01
Lead	mg/L	<0.0001	<0.0001
pH	pH units	8.33	8.37
Antimony	mg/L	<0.0002	<0.0002
Selenium	mg/L	0.0002	0.0002
Tin	mg/L	<0.0001	<0.0001
Sulfate	mg/L	1.0	1.0
Sulfate	mg/L	0.6	0.6
Specific conductivity	uS/cm	1390	1400
Strontium	mg/L	0.12	0.12
Total dissolved solids	mg/L	50	50
Total dissolved solids	mg/L	1060	1070
Titanium	mg/L	0.0005	0.0004
Total Kjeldahl nitrogen	mg/L	0.11	0.08
Total Kjeldahl nitrogen	mg/L	0.31	0.30
Thallium	mg/L	<0.0002	<0.0002
Organic carbon	mg/L	2.9	2.9
Organic carbon	mg/L	11	9.8
Total alkalinity	mg/L	152	153
Total alkalinity	mg/L	321	322
Turbidity	NTU	0.484	0.478
Turbidity	NTU	0.067	0.066
Uranium	ug/L	<0.1	<0.1
Vanadium	mg/L	<0.0001	0.0001
Zinc	mg/L	0.0022	0.0023

Spikes and/or Surrogates:

Samples spiked with a known quantity of the analyte of interest or a surrogate which is a known quantity of a compound which behaves in a similar manner to the analyte of interest, are used to assess problems with the sample processing or sample matrix. The recovery must be within clearly defined limits when the quantity of spike is comparable to the sample concentration.

Spike Analysis	% Recovered	
Cl, IC	85	
Aluminum	105	
Antimony	99	
Arsenic	99	
Arsenic	116	
Barium	102	
Beryllium	108	
Beryllium	107	
Boron	113	
Cadmium	101	
Cadmium	104	
Calcium	95	
Chloride	95	
Chromium	102	
Chromium	101	
Cobalt	101	
Cobalt	103	
COD	96	
Copper	99	
Copper	98	
DOC	85	
Iron	108	
Lead	101	
Lead	96	
Magnesium	97	
Manganese	101	
Molybdenum	99	
Molybdenum	106	
NH3-N	80	
Nickel	101	
Nickel	99	
NO2+NO3-N	92	
NO2+NO3-N	105	
Phosphorus	101	
Potassium	95	
Selenium	102	
Silver	101	
Sodium	93	
Strontium	102	
Sulfate	94	
Thallium	98	
Tin	98	
Titanium	100	
Titanium	146	* (2)
TKN (N, total Kjeldahl)	105	
TKN (N, total Kjeldahl)	89	

Spike Analysis	% Recovered
TOC	100
Uranium	100
Uranium	98
Vanadium	101
Vanadium	102
Zinc	101
Zinc	93

*(1) The Iron result for the quality control sample was outside the laboratory's specified limits. The data was reviewed and the elevated level was likely due to contamination during the digestion process. Digested and undigested sample results for iron compare. Additional quality control measures in the same batch were within specified limits.

*(2) The percent recovery for Titanium in the spiked sample was outside the laboratory's specified limits of 80 - 120% recovery. The data was reviewed and the elevated level was likely due to contamination during the digestion process. Digested and undigested results for the unspiked sample compare. Additional quality control measures in the same batch were within specified limits.

Overall, there were no other indications of problems with the analysis and the results were considered acceptable.

Roxane Ortmann - Quality Control Supervisor

APPENDIX B

DETAILED FISH CATCH DATA

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Peonan Creek	1	1	BE	09/07/2011 12:00	09/07/2011 12:00	0:07:29	BSB	1	5.1	Yes	
							BSB	2	4.8	Yes	
							LKC	3	6.1	Yes	
		2	BE	10/07/2011 12:00:00 PM	10/07/2011 12:30:00 PM	0:06:35	STC	1	3.8	Yes	
							LKC	2	3.9	Yes	
							LKC	3	3.3	Yes	
							BSB	4	4.2	Yes	
							LKC	5	3.3	Yes	
							LKC	6	3.8	Yes	
							LKC	7	3.7	Yes	
							BSB	8	4.4	Yes	
							LKC	9	4.7	Yes	
							LKC	10	3.0	Yes	
							BSB	11	4.1	Yes	
							LKC	12	2.9	Yes	
		3	BE	10/07/2011 12:49:00 PM	10/07/2011 1:01:00 PM	0:04:55	LKC	1	3.5	Yes	
							LKC	2	3.8	Yes	
							LKC	3	3.9	Yes	
							RS	4	4.2	Yes	
							WSU	5	6.8	Yes	
		4	BE	10/07/2011 1:20:00 PM	10/07/2011 1:31:00 PM	0:07:41	LKC	1	5.0	Yes	
							LKC	2	4.0	Yes	
							LKC	3	3.6	Yes	
							FM	4	6.0	Yes	
		5	BE	10/07/2011 2:30:00 PM	10/07/2011 2:43:00 PM	0:09:21	LKC	1	5.5	Yes	
							LKC	2	4.0	Yes	
							LKC	3	4.4	Yes	
							WSU	4	6.7	Yes	
							WSU	5	7.1	Yes	
							LND	6	5.0	Yes	
							BB	7	7.1	Yes	
							WSU	8	5.8	Yes	
							LKC	9	4.7	Yes	
							LKC	10	4.7	Yes	
							LND	11	5.2	Yes	
							LKC	12	5.9	Yes	
							BB	13	6.0	Yes	
							BSB	14	4.0	Yes	
							LKC	15	3.1	Yes	
							LKC	16	4.3	Yes	
							LKC	17	4.2	Yes	
							LKC	18	4.8	Yes	
							LKC	19	4.0	Yes	
							BSB	20	4.4	Yes	
							BB	21	6.7	Yes	
							BB	22	7.9	Yes	
		6	BE	10/07/2011 3:15:00 PM	10/07/2011 3:30:00 PM	0:05:00	LKC	1	4.8	Yes	
							LKC	2	4.1	Yes	
							LKC	3	3.9	Yes	
							LKC	4	5.1	Yes	
	2	7	BE	10/07/2011 5:15:00 PM	10/07/2011 5:35:00 PM	0:05:06	NF	N/A	N/A	N/A	No fish captured
	1	1	MT	08/07/2011 2:50:00 PM	09/07/2011 10:56:00	20:06:00	LKC	1	5.8	Yes	
							LKC	2	4.8	Yes	
							LKC	3	4.8	Yes	
							BSB	4	5.1	Yes	
							LKC	5	5.0	Yes	
							LKC	6	4.3	Yes	
							LKC	7	4.5	Yes	
		2	MT	08/07/2011 2:55:00 PM	09/07/2011 11:08:00	20:13:00	LKC	1	4.6	Yes	
							LKC	2	4.7	Yes	
							WE	3	4.8	Yes	
							LKC	4	4.6	Yes	
							NRD	5	4.8	Yes	
							LKC	6	4.4	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Peonan Creek	1	2	MT				LKC	7	5.1	Yes	
							WE	8	5.5	Yes	
							LKC	9	4.7	Yes	
							LKC	10	4.3	Yes	
							WE	11	5.7	Yes	
							LKC	12	4.8	Yes	
							WSU	13	6.3	Yes	
							WE	14	5.4	Yes	
							LKC	15	4.8	Yes	
							WE	16	5.7	Yes	
							LKC	17	4.9	Yes	
							LKC	18	4.8	Yes	
							WSU	19	5.1	Yes	
							LKC	20	5.0	Yes	
							LKC	21	4.5	Yes	
							LKC	22	4.5	Yes	
							LKC	23	5.7	Yes	
							LKC	24	4.5	Yes	
							LKC	25	4.6	Yes	
							LKC	26	4.8	Yes	
							LKC	27	4.7	Yes	
							YP	28	4.7	Yes	
							LKC	29	4.8	Yes	
							LKC	30	4.5	Yes	
							LKC	31	4.6	Yes	
							LKC	32	4.7	Yes	
							WSU	33	4.9	Yes	
							LKC	34	4.7	Yes	
							WSU	35	5.3	Yes	
							LKC	36	5.0	Yes	
							LKC	37	5.7	Yes	
							WSU	38	5.4	Yes	
							LKC	39	4.4	Yes	
							WSU	40	6.0	Yes	
							LKC	41	4.9	Yes	
							WE	42	5.3	Yes	
							LKC	43	4.3	Yes	
							LKC	44	5.1	Yes	
							LKC	45	4.7	Yes	
							LKC	46	4.7	Yes	
							LKC	47	5.3	Yes	
							WE	48	4.7	Yes	
							LKC	49	4.9	Yes	
							RS	50	6.7	Yes	
							WE	51	4.8	Yes	
							WE	52	5.7	Yes	
							LKC	53	4.9	Yes	
							LKC	54	4.8	Yes	
							WE	55	4.9	Yes	
							WE	56	5.2	Yes	
							WE	57	4.8	Yes	
							WE	58	5.4	Yes	
							WSU	59	5.2	Yes	
							WE	60	5.0	Yes	
							WE	61	4.8	Yes	
							LKC	62	5.0	Yes	
							LKC	63	4.4	Yes	
							LKC	64	5.0	Yes	
							LKC	65	4.7	Yes	
							LKC	66	4.8	Yes	
							LKC	67	4.4	Yes	
							LKC	68	4.4	Yes	
							LKC	69	4.6	Yes	
							LKC	70	4.5	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Peonan Creek	1	2	MT				LKC	71	4.7	Yes	
							LKC	72	5.0	Yes	
							LKC	73	4.4	Yes	
							WSU	74	4.7	Yes	
							LKC	75	5.2	Yes	
							LKC	76	4.7	Yes	
							LKC	77	4.8	Yes	
							LKC	78	4.6	Yes	
							LKC	79	5.1	Yes	
							LKC	80	4.3	Yes	
							LKC	81	4.6	Yes	
							LKC	82	5.0	Yes	
							NRD	83	5.0	Yes	
							LKC	84	4.6	Yes	
							LKC	85	4.8	Yes	
							LKC	86	4.8	Yes	
							LKC	87	5.5	Yes	
							LKC	88	4.9	Yes	
							LKC	89	4.8	Yes	
							LKC	90	4.8	Yes	
							LKC	91	4.2	Yes	
							LKC	92	4.9	Yes	
							LKC	93	4.5	Yes	
							LKC	94	4.3	Yes	
							LKC	95	4.6	Yes	
		3	MT	08/07/2011 3:08:00 PM	09/07/2011 11:55:00	20:47:00	LKC	1	4.0	Yes	
							LKC	2	4.4	Yes	
							LKC	3	4.3	Yes	
							LKC	4	5.0	Yes	
							LKC	5	4.4	Yes	
							LKC	6	5.0	Yes	
							LKC	7	4.2	Yes	
							LKC	8	5.1	Yes	
							LKC	9	5.5	Yes	
							LKC	10	5.0	Yes	
							LKC	11	6.1	Yes	
							LKC	12	4.7	Yes	
							WE	13	5.3	Yes	
							LKC	14	4.1	Yes	
							LKC	15	4.2	Yes	
							LKC	16	5.0	Yes	
							LKC	17	5.1	Yes	
							LKC	18	4.3	Yes	
							LKC	19	5.2	Yes	
							WE	20	5.2	Yes	
							WE	21	5.7	Yes	
							BSB	22	4.5	Yes	
							WE	23	5.4	Yes	
							LKC	24	4.0	Yes	
							BSB	25	4.7	Yes	
							BSB	26	4.6	Yes	
							LKC	27	4.5	Yes	
							LKC	28	4.2	Yes	
							LKC	29	4.6	Yes	
							LKC	30	4.9	Yes	
							BSB	31	4.4	Yes	
							BSB	32	4.7	Yes	
							LKC	33	4.3	Yes	
							LKC	34	4.4	Yes	
							LKC	35	4.7	Yes	
							LKC	36	4.1	Yes	
							LKC	37	5.3	Yes	
							LKC	38	4.2	Yes	
							LKC	39	4.4	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Peonan Creek	1	3	MT				LKC	40	4.2	Yes	
							LKC	41	4.4	Yes	
							RS	42	4.4	Yes	
							NRD	43	4.8	Yes	
		4	MT	08/07/2011 3:14:00 PM	09/07/2011 12:33:00 PM	21:19:00	LKC	1	4.7	Yes	
		5	MT	08/07/2011 3:44:00 PM	09/07/2011 1:47:00 PM	22:03:00	LKC	1	4.3	Yes	
		6	MT	08/07/2011 3:50:00 PM	09/07/2011 1:55:00 PM	22:05:00	LKC	1	2.0	Yes	
		7	MT	08/07/2011 3:53:00 PM	09/07/2011 2:00:00 PM	22:07:00	LKC	1	4.4	Yes	
							BSB	2	4.5	Yes	
							WE	3	4.6	Yes	
							LKC	4	4.4	Yes	
							RS	5	4.2	Yes	
		8	MT	08/07/2011 4:15:00 PM	09/07/2011 2:28:00 PM	22:13:00	NP	1	9.9	Yes	
		9	MT	08/07/2011 4:20:00 PM	09/07/2011 2:38:00 PM	22:18:00	NF	N/A	N/A	N/A	No fish captured
		10	MT	08/07/2011 2:28:00 PM	09/07/2011 2:42:00 PM	24:14:00	NF	N/A	N/A	N/A	No fish captured
		11	MT	08/07/2011 2:33:00 PM	09/07/2011 2:45:00 PM	24:12:00	NF	N/A	N/A	N/A	No fish captured
Stream F	1	1	BE	07/07/2011 11:00:00	07/07/2011 11:11:00	0:02:46	LKC	1	4.8	Yes	
							NRD	2	4.8	Yes	
							WSU	3	6.1	Yes	
							LKC	4	5.0	Yes	
							LKC	5	4.2	Yes	
							LKC	6	4.9	Yes	
							LKC	7	4.0	Yes	
							NRD	8	5.0	Yes	
							NRD	9	5.6	Yes	
							WSU	10	11.0	Yes	
							NRD	11	4.5	Yes	
							NRD	12	5.3	Yes	
							NRD	13	4.5	Yes	
							NRD	14	4.6	Yes	
							LKC	15	4.8	Yes	
							NRD	16	4.9	Yes	
							LND	17	5.9	Yes	
							NRD	18	4.2	Yes	
							NRD	19	5.8	Yes	
							NRD	20	5.2	Yes	
							NRD	21	4.7	Yes	
							LND	22	3.7	Yes	
							RS	23	5.1	Yes	
							LKC	24	4.9	Yes	
							LKC	25	4.3	Yes	
							LND	26	7.3	No	Kept for ID
							BSB	27	5.1	Yes	
							LKC	28	4.7	Yes	
							LKC	29	4.7	Yes	
							BSB	30	4.8	Yes	
							LND	31	6.2	Yes	
							LKC	32	3.8	Yes	
		2	BE	07/07/2011 11:50:00	07/07/2011 12:09:00 PM	0:07:04	LKC	1	4.7	Yes	
							LKC	2	4.6	Yes	
							LKC	3	4.0	Yes	
							FM	4	5.8	Yes	
							LKC	5	4.9	Yes	
							NRD	6	4.6	Yes	
							WSU	7	6.5	Yes	
							NRD	8	4.0	Yes	
							LKC	9	5.2	Yes	
							LKC	10	4.0	Yes	
							LND	11	6.6	Yes	
							WSU	12	6.6	Yes	
							LKC	13	4.6	Yes	
							LKC	14	4.5	Yes	
							LKC	15	4.3	Yes	
							NRD	16	4.0	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	2	BE				NRD	17	4.8	Yes	
							LKC	18	5.3	Yes	
							LKC	19	4.9	Yes	
							FM	20	6.1	Yes	
							LKC	21	4.8	Yes	
							LKC	22	4.1	Yes	
							NRD	23	5.0	Yes	
							LKC	24	4.3	Yes	
							LKC	25	4.1	Yes	
							NRD	26	4.6	Yes	
							LKC	27	4.4	Yes	
							LKC	28	5.3	Yes	
							LKC	29	4.4	Yes	
							NRD	30	4.0	Yes	
							LKC	31	4.9	Yes	
							LKC	32	3.9	Yes	
							NRD	33	4.5	Yes	
							LKC	34	5.5	Yes	
							NRD	35	3.6	Yes	
							LND	36	4.4	Yes	
							LKC	37	4.6	Yes	
							NRD	38	4.0	Yes	
		3	BE	07/07/2011 1:25:00 PM	07/07/2011 1:36:00 PM	0:06:11	WSU	1	6.8	Yes	
							NRD	2	4.4	Yes	
							NRD	3	3.9	Yes	
							LKC	4	4.5	Yes	
							LND	5	6.2	Yes	
							LKC	6	4.9	Yes	
							LKC	7	4.8	Yes	
							LKC	8	5.3	Yes	
							NRD	9	4.9	Yes	
							LKC	10	5.3	Yes	
							LKC	11	3.4	Yes	
							LKC	12	3.9	Yes	
							LKC	13	3.8	Yes	
							LKC	14	3.8	Yes	
		4	BE	07/07/2011 2:04:00 PM	07/07/2011 2:15:00 PM	0:05:50	WSU	1	4.7	Yes	
							LKC	2	4.6	Yes	
							LKC	3	4.8	Yes	
							LKC	4	5.3	Yes	
							LKC	5	5.2	Yes	
							LND	6	7.8	Yes	
							NRD	7	3.3	Yes	
							LKC	8	5.3	Yes	
							LKC	9	3.8	Yes	
							LKC	10	3.8	Yes	
							LKC	11	4.2	Yes	
							LKC	12	4.0	Yes	
							NRD	13	2.8	Yes	
							LKC	14	4.0	Yes	
							BSB	15	4.5	Yes	
							NRD	16	4.9	Yes	
							LKC	17	4.2	Yes	
							LKC	18	4.3	Yes	
							LKC	19	4.2	Yes	
							NRD	20	5.0	Yes	
							LKC	21	5.0	Yes	
							LKC	22	4.2	Yes	
							LKC	23	4.9	Yes	
							LKC	24	7.7	Yes	
							LKC	25	4.8	Yes	
							LKC	26	5.7	Yes	
							LKC	27	4.8	Yes	
							LKC	28	4.4	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	4	BE				LKC	29	3.9	Yes	
							LKC	30	4.2	Yes	
							LKC	31	5.0	Yes	
							LKC	32	4.4	Yes	
							LKC	33	4.0	Yes	
							LKC	34	4.4	Yes	
							LND	35	7.2	Yes	
		5	BE	07/07/2011 3:00:00 PM	07/07/2011 3:20:00 PM	0:08:34	LKC	1	3.8	Yes	
							LKC	2	4.4	Yes	
							LKC	3	4.5	Yes	
							LKC	4	3.8	Yes	
							LKC	5	3.0	Yes	
							NRD	6	4.4	Yes	
							NRD	7	3.3	Yes	
							LKC	8	6.2	Yes	
							NRD	9	3.8	Yes	
							LKC	10	3.9	Yes	
							WSU	11	6.3	Yes	
							LKC	12	4.3	Yes	
							NRD	13	4.3	Yes	
							LKC	14	4.4	Yes	
							BSB	15	4.2	Yes	
							LKC	16	2.8	Yes	
							LKC	17	4.2	Yes	
							LKC	18	4.4	Yes	
							LKC	19	3.9	Yes	
							NRD	20	6.0	Yes	
							LKC	21	2.8	Yes	
							LND	22	4.0	Yes	
							LKC	23	3.9	Yes	
							BSB	24	4.0	Yes	
							LND	25	3.3	Yes	
							LKC	26	3.8	Yes	
							LKC	27	3.3	Yes	
							LKC	28	2.8	Yes	
							LKC	29	3.5	Yes	
							BSB	30	4.1	Yes	
							NRD	31	3.6	Yes	
							LKC	32	3.4	Yes	
							LKC	33	3.3	Yes	
							NRD	34	4.3	Yes	
							NRD	35	3.2	Yes	
							LKC	36	2.4	Yes	
							NRD	37	3.2	Yes	
	2	6	BE	07/07/2011 5:40:00 PM	07/07/2011 6:00:00 PM	0:05:41	LKC	1	4.5	Yes	Settings at 86 V
							LKC	2	5.8	Yes	
	1	1	MT	05/07/2011 4:10:00 PM	06/07/2011 5:50:00 PM	25:40:00	RS	1	5.0	Yes	
							FM	2	6.4	Yes	
							NRD	3	6.0	Yes	
							LKC	4	5.2	Yes	
							LKC	5	5.0	Yes	
							LKC	6	5.5	Yes	
							NRD	7	5.2	Yes	
							RS	8	5.6	Yes	
							RS	9	5.0	Yes	
							LKC	10	5.5	Yes	
							LKC	11	4.6	Yes	
							RS	12	5.1	Yes	
							RS	13	6.8	Yes	
							LKC	14	4.5	Yes	
							FM	15	6.8	Yes	
							LKC	16	4.7	Yes	
							RS	17	5.5	Yes	
							LKC	18	5.0	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	1	MT				RS	19	6.5	Yes	
							LKC	20	5.0	Yes	
							LKC	21	4.3	Yes	
							LKC	22	5.2	Yes	
							LKC	23	4.9	Yes	
							RS	24	6.4	Yes	
							LKC	25	4.8	Yes	
							LKC	26	5.3	Yes	
							FM	27	6.0	Yes	
							RS	28	5.1	Yes	
							NRD	29	5.1	Yes	
							NRD	30	5.3	Yes	
							LKC	31	5.2	Yes	
							NRD	32	5.0	Yes	
							LKC	33	5.0	Yes	
							LKC	34	5.0	Yes	
							LKC	35	5.0	Yes	
							NRD	36	5.5	Yes	
							LKC	37	5.1	Yes	
							LKC	38	5.5	Yes	
							LKC	39	4.9	Yes	
							LKC	40	5.1	Yes	
							LKC	41	5.8	Yes	
							RS	42	5.1	Yes	
							NRD	43	5.8	Yes	
							LKC	44	5.6	Yes	
							LKC	45	5.1	Yes	
							FM	46	6.0	Yes	
							RS	47	5.0	Yes	
							LKC	48	5.0	Yes	
							NRD	49	5.0	Yes	
							LKC	50	5.5	Yes	
							LKC	51	5.0	Yes	
							LKC	52	5.0	Yes	
							LKC	53	5.3	Yes	
							LKC	54	5.2	Yes	
							RS	55	5.5	Yes	
							NRD	56	5.3	Yes	
							RS	57	5.4	Yes	
							LKC	58	5.4	Yes	
							LKC	59	5.0	Yes	
							LKC	60	4.8	Yes	
							LKC	61	5.2	Yes	
							NRD	62	4.7	Yes	
							LKC	63	5.0	Yes	
							LKC	64	5.0	Yes	
							RS	65	5.3	Yes	
							FM	66	5.1	Yes	
							NRD	67	5.0	Yes	
							LKC	68	5.6	Yes	
							NRD	69	5.0	Yes	
							NRD	70	6.0	Yes	
							RS	71	5.2	Yes	
							RS	72	5.1	Yes	
							LKC	73	5.7	Yes	
							RS	74	5.3	Yes	
							NRD	75	5.2	Yes	
							NRD	76	5.0	Yes	
							NRD	77	5.0	Yes	
							LKC	78	5.1	Yes	
							LKC	79	4.9	Yes	
							NRD	80	5.1	Yes	
							RS	81	5.3	Yes	
							NRD	82	5.9	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	1	MT				NRD	83	5.4	Yes	
							NRD	84	5.2	Yes	
							LKC	85	5.4	Yes	
							LKC	86	5.2	Yes	
							LKC	87	5.0	Yes	
							FM	88	6.0	Yes	
							NRD	89	5.3	Yes	
							NRD	90	5.4	Yes	
							RS	91	5.4	Yes	
							NRD	92	5.0	Yes	
							WSU	93	6.2	Yes	
							LKC	94	4.8	Yes	
							NRD	95	5.5	Yes	
							NRD	96	4.5	Yes	
							RS	97	5.2	Yes	
							NRD	98	5.2	Yes	
							NRD	99	5.3	Yes	
							LKC	100	5.2	Yes	
							NRD	101	5.0	Yes	
							LKC	102	5.2	Yes	
							RS	103	5.8	Yes	
							LKC	104	4.8	Yes	
							RS	105	4.5	Yes	
							NRD	106	5.3	Yes	
							NRD	107	5.5	Yes	
							RS	108	5.5	Yes	
							NRD	109	5.3	Yes	
							LKC	110	5.3	Yes	
							RS	111	5.5	Yes	
							NRD	112	4.8	Yes	
							RS	113	4.7	Yes	
							FM	114	6.1	Yes	
							NRD	115	5.5	Yes	
							LKC	116	5.5	Yes	
							LKC	117	5.5	Yes	
							RS	118	5.2	Yes	
							RS	119	5.4	Yes	
							RS	120	5.0	Yes	
							RS	121	5.2	Yes	
							NRD	122	4.8	Yes	
							FM	123	6.2	Yes	
							NRD	124	5.0	Yes	
							FM	125	6.0	Yes	
							LKC	126	4.5	Yes	
							NRD	127	4.8	Yes	
							NRD	128	4.5	Yes	
							RS	129	5.3	Yes	
							FM	130	6.6	Yes	
							LKC	131	4.7	Yes	
							NRD	132	5.5	Yes	
							NRD	133	5.2	Yes	
							RS	134	4.7	Yes	
							NRD	135	4.5	Yes	
							LKC	136	5.2	Yes	
							NRD	137	4.9	Yes	
							WSU	138	5.5	Yes	
							WSU	139	5.8	Yes	
							LKC	140	5.0	Yes	
							FM	141	6.7	Yes	
							RS	142	5.2	Yes	
							LKC	143	5.5	Yes	
							NRD	144	5.3	Yes	
							NRD	145	5.2	Yes	
							LKC	146	5.4	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	1	MT				LKC	147	5.2	Yes	
							LKC	148	5.4	Yes	
							LKC	149	5.7	Yes	
							WSU	150	5.6	Yes	
							LKC	151	4.8	Yes	
							LKC	152	4.5	Yes	
							RS	153	5.2	Yes	
							FM	154	6.3	Yes	
							LKC	155	5.4	Yes	
							LKC	156	5.4	Yes	
							NRD	157	4.8	Yes	
							LKC	158	5.2	Yes	
							NRD	159	5.3	Yes	
							RS	160	5.2	Yes	
							LKC	161	5.0	Yes	
							NRD	162	4.4	Yes	
							LKC	163	4.5	Yes	
							LKC	164	5.0	Yes	
							LKC	165	5.0	Yes	
							LKC	166	5.5	Yes	
							RS	167	5.0	Yes	
							NRD	168	4.8	Yes	
							NRD	169	5.2	Yes	
							NRD	170	5.3	Yes	
							RS	171	5.3	Yes	
							LKC	172	4.8	Yes	
							NRD	173	4.8	Yes	
							NRD	174	4.6	Yes	
							RS	175	5.3	Yes	
							NRD	176	4.3	Yes	
							LKC	177	5.0	Yes	
							NRD	178	4.8	Yes	
							NRD	179	5.0	Yes	
							NRD	180	5.0	Yes	
							LKC	181	5.2	Yes	
							LKC	182	4.6	Yes	
							NRD	183	5.0	Yes	
							LKC	184	5.5	Yes	
							RS	185	5.2	Yes	
							NRD	186	5.1	Yes	
							LKC	187	5.0	Yes	
							NRD	188	5.0	Yes	
							LKC	189	5.0	Yes	
							LKC	190	4.8	Yes	
							LKC	191	5.1	Yes	
							LKC	192	4.4	Yes	
							NRD	193	4.8	Yes	
							NRD	194	5.2	Yes	
							NRD	195	5.0	Yes	
							NRD	196	4.8	Yes	
							LKC	197	5.0	Yes	
							RS	198	5.1	Yes	
							NRD	199	5.2	Yes	
							LKC	200	4.8	Yes	
							NRD	201	6.0	Yes	
							NRD	202	5.2	Yes	
							LKC	203	4.4	Yes	
							LKC	204	4.6	Yes	
							LKC	205	4.6	Yes	
							LKC	206	5.4	Yes	
							NRD	207	4.6	Yes	
							FM	208	6.0	Yes	
							FM	209	6.2	Yes	
							FM	210	5.8	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	1	MT				LKC	211	5.0	Yes	
							FM	212	6.0	Yes	
							LKC	213	4.7	Yes	
							RS	214	5.2	Yes	
							NRD	215	5.0	Yes	
							LKC	216	5.2	Yes	
							LKC	217	5.3	Yes	
							LKC	218	5.6	Yes	
							LKC	219	5.0	Yes	
							FM	220	7.0	Yes	
							LKC	221	5.0	Yes	
							LKC	222	5.5	Yes	
							NRD	223	5.2	Yes	
							NRD	224	4.8	Yes	
							LKC	225	5.0	Yes	
							LKC	226	5.5	Yes	
							NRD	227	4.6	Yes	
							LKC	228	5.0	Yes	
							LKC	229	5.4	Yes	
							FM	230	6.0	Yes	
							LKC	231	5.1	Yes	
							FM	232	6.0	Yes	
							FM	233	6.6	Yes	
							NRD	234	5.5	Yes	
							NRD	235	4.6	Yes	
							LKC	236	4.8	Yes	
							LKC	237	4.6	Yes	
							RS	238	5.9	Yes	
							NRD	239	6.0	Yes	
							FM	240	6.0	Yes	
							FM	241	6.4	Yes	
							NRD	242	5.0	Yes	
							NRD	243	5.0	Yes	
							NRD	244	5.4	Yes	
							NRD	245	5.8	Yes	
							FM	246	6.6	Yes	
							NRD	247	5.6	Yes	
							NRD	248	4.8	Yes	
							RS	249	5.6	Yes	
							NRD	250	5.6	Yes	
							NRD	251	5.1	Yes	
							NRD	252	6.0	Yes	
							NRD	253	5.8	Yes	
							NRD	254	4.8	Yes	
							RS	255	5.5	Yes	
							FM	256	6.0	Yes	
							RS	257	4.6	Yes	
							FM	258	5.8	Yes	
							NRD	259	5.3	Yes	
							LKC	260		Yes	Not measured
							LKC	261		Yes	Not measured
							LKC	262		Yes	Not measured
							LKC	263		Yes	Not measured
							LKC	264		Yes	Not measured
							LKC	265		Yes	Not measured
							LKC	266		Yes	Not measured
							LKC	267		Yes	Not measured
							LKC	268		Yes	Not measured
							LKC	269		Yes	Not measured
							LKC	270		Yes	Not measured
							LKC	271		Yes	Not measured
							LKC	272		Yes	Not measured
							LKC	273		Yes	Not measured
							LKC	274		Yes	Not measured

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	1	MT				LKC	275		Yes	Not measured
							LKC	276		Yes	Not measured
							LKC	277		Yes	Not measured
							LKC	278		Yes	Not measured
							LKC	279		Yes	Not measured
							LKC	280		Yes	Not measured
							LKC	281		Yes	Not measured
							LKC	282		Yes	Not measured
							LKC	283		Yes	Not measured
							LKC	284		Yes	Not measured
							LKC	285		Yes	Not measured
							LKC	286		Yes	Not measured
							LKC	287		Yes	Not measured
							LKC	288		Yes	Not measured
							LKC	289		Yes	Not measured
							LKC	290		Yes	Not measured
							LKC	291		Yes	Not measured
							LKC	292		Yes	Not measured
		2	MT	05/07/2011 4:19:00 PM	06/07/2011 5:20:00 PM	25:01:00	NRD	1	5.7	Yes	
							LKC	2	5.6	Yes	
							WSU	3	6.0	Yes	
							NRD	4	5.4	Yes	
							LKC	5	5.0	Yes	
							LKC	6	5.8	Yes	
							NRD	7	5.0	Yes	
							LKC	8	5.2	Yes	
							LKC	9	5.4	Yes	
							FM	10	6.2	Yes	
							LKC	11	5.2	Yes	
							LKC	12	5.4	Yes	
							LKC	13	5.0	Yes	
							LKC	14	5.6	Yes	
							LKC	15	4.8	Yes	
							LKC	16	5.2	Yes	
							LKC	17	5.5	Yes	
							NRD	18	5.1	Yes	
							LKC	19	5.8	Yes	
							LKC	20	5.1	Yes	
							LKC	21	5.1	Yes	
							LKC	22	5.3	Yes	
							LKC	23	5.0	Yes	
							LKC	24	5.1	Yes	
							FM	25	6.6	Yes	
							LKC	26	5.0	Yes	
							LKC	27	5.4	Yes	
							NRD	28	5.0	Yes	
							LKC	29	5.2	Yes	
							LKC	30	4.5	Yes	
							LKC	31	4.6	Yes	
							LKC	32	4.8	Yes	
							LKC	33	5.5	Yes	
							NRD	34	5.0	Yes	
							LKC	35	4.6	Yes	
							LKC	36	5.5	Yes	
							LKC	37	4.5	Yes	
							LKC	38	5.0	Yes	
							LKC	39	5.0	Yes	
							NRD	40	4.6	Yes	
							FM	41	6.5	Yes	
							NRD	42	7.5	Yes	
							NRD	43	4.8	Yes	
							LKC	44	5.8	Yes	
							LKC	45	5.1	Yes	
							LKC	46	5.3	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	2	MT				LKC	47	5.1	Yes	
							LKC	48	4.7	Yes	
							LKC	49	5.6	Yes	
							LKC	50	4.2	Yes	
							LKC	51	5.0	Yes	
							LKC	52	4.4	Yes	
							NRD	53	5.4	Yes	
							NRD	54	5.2	Yes	
		3	MT	05/07/2011 4:30:00 PM	06/07/2011 2:53:00 PM	22:23:00	NRD	1	4.5	No	Kept for ID
							LKC	2	4.6	Yes	
							RS	3	4.8	Yes	
							LKC	4	4.5	Yes	
							LKC	5	4.8	Yes	
							LKC	6	5.0	Yes	
							LKC	7	5.6	Yes	
							LKC	8	4.4	Yes	
							RS	9	4.6	Yes	
							LKC	10	4.8	Yes	
							LKC	11	5.2	Yes	
							LKC	12	4.6	Yes	
							NRD	13	4.7	Yes	
							LKC	14	4.6	Yes	
							LKC	15	4.8	Yes	
							LKC	16	5.5	Yes	
							LKC	17	5.2	Yes	
							LKC	18	5.0	Yes	
							LKC	19	4.9	Yes	
							LKC	20	5.2	Yes	
							RS	21	6.0	No	Kept for ID
							NRD	22	5.5	Yes	
							RS	23	5.0	Yes	
							LKC	24	4.6	Yes	
							RS	25	5.2	Yes	
							LKC	26	5.0	Yes	
							WSU	27	7.2	Yes	
							LKC	28	6.0	Yes	
							LKC	29	5.0	Yes	
							LKC	30	5.1	Yes	
							LKC	31	5.3	Yes	
							NRD	32	4.4	Yes	
							LKC	33	4.9	Yes	
							LKC	34	4.9	Yes	
							LKC	35	5.4	Yes	
							LKC	36	4.5	Yes	
							LKC	37	4.6	Yes	
							LKC	38	4.9	Yes	
							LKC	39	5.3	Yes	
							LKC	40	5.5	Yes	
							LKC	41	4.6	Yes	
							LKC	42	5.5	Yes	
							LKC	43	4.4	Yes	
							LKC	44	4.9	Yes	
							NRD	45	5.2	Yes	
							LKC	46	5.5	Yes	
							LKC	47	5.0	Yes	
							LKC	48	4.6	Yes	
							NRD	49	5.0	Yes	
							LKC	50	4.6	Yes	
							RS	51	5.0	Yes	
							RS	52	4.9	Yes	
							LKC	53	5.4	Yes	
							LKC	54	4.7	Yes	
							RS	55	5.0	Yes	
							LKC	56	5.0	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	3	MT				LKC	57	5.0	Yes	
							LKC	58	5.0	Yes	
							LKC	59	5.0	Yes	
							LKC	60	5.6	Yes	
							LKC	61	4.6	Yes	
							LKC	62	5.4	Yes	
							LKC	63	5.2	Yes	
							LKC	64	4.5	Yes	
							NRD	65	5.5	Yes	
							NRD	66	4.8	Yes	
							RS	67	5.0	Yes	
							LKC	68	5.0	Yes	
							LKC	69	4.8	Yes	
							LKC	70	5.3	Yes	
							LKC	71	5.2	Yes	
							LKC	72	5.3	Yes	
							LKC	73	5.3	Yes	
							RS	74	5.2	Yes	
							LKC	75	5.6	Yes	
							RS	76	5.2	Yes	
							LKC	77	5.2	Yes	
							LKC	78	4.2	Yes	
							LKC	79	4.8	Yes	
							LKC	80	5.2	Yes	
							LKC	81	4.6	Yes	
							LKC	82	4.9	Yes	
							LKC	83	4.5	Yes	
							LKC	84	5.0	Yes	
							LKC	85	5.0	Yes	
							LKC	86	5.2	Yes	
							RS	87	4.6	Yes	
							LKC	88	5.3	Yes	
							LKC	89	5.3	Yes	
							LKC	90	4.8	Yes	
							LKC	91	5.6	Yes	
							LKC	92	4.4	Yes	
							LKC	93	4.6	Yes	
							LKC	94	5.0	Yes	
							LKC	95	5.4	Yes	
							LKC	96	4.6	Yes	
							LKC	97	5.2	Yes	
							RS	98	5.0	Yes	
							LKC	99	4.8	Yes	
							NRD	100	5.4	Yes	
							LKC	101	5.3	Yes	
							RS	102	5.2	Yes	
							LKC	103	5.2	Yes	
							LKC	104	5.0	Yes	
							LKC	105	5.2	Yes	
							LKC	106	5.3	Yes	
							NRD	107	4.8	Yes	
							NRD	108	5.0	Yes	
							LKC	109	4.9	Yes	
							NRD	110	6.0	Yes	
							RS	111	4.8	Yes	
							RS	112	5.0	Yes	
							LKC	113	5.0	Yes	
							LKC	114	5.8	Yes	
							LKC	115	5.8	Yes	
							LKC	116	4.9	Yes	
							LKC	117	5.2	Yes	
							RS	118	5.0	Yes	
							LKC	119	5.1	Yes	
							RS	120	4.8	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	3	MT				LKC	121	5.0	Yes	
							LKC	122	5.3	Yes	
							LKC	123	5.1	Yes	
							LKC	124	5.1	Yes	
							LKC	125	5.0	Yes	
							LKC	126	4.8	Yes	
							NRD	127	5.1	Yes	
							RS	128	5.0	Yes	
							LKC	129	4.8	Yes	
							LKC	130	4.8	Yes	
							LKC	131	4.8	Yes	
							LKC	132	5.2	Yes	
							LKC	133	5.3	Yes	
							LKC	134	5.1	Yes	
							LKC	135	4.8	Yes	
							LKC	136		Yes	Not measured
							LKC	137		Yes	Not measured
							LKC	138		Yes	Not measured
							LKC	139		Yes	Not measured
							LKC	140		Yes	Not measured
							LKC	141		Yes	Not measured
							LKC	142		Yes	Not measured
							LKC	143		Yes	Not measured
							LKC	144		Yes	Not measured
							LKC	145		Yes	Not measured
							LKC	146		Yes	Not measured
							LKC	147		Yes	Not measured
							LKC	148		Yes	Not measured
							LKC	149		Yes	Not measured
							LKC	150		Yes	Not measured
							LKC	151		Yes	Not measured
							LKC	152		Yes	Not measured
							LKC	153		Yes	Not measured
							LKC	154		Yes	Not measured
							LKC	155		Yes	Not measured
							LKC	156		Yes	Not measured
							LKC	157		Yes	Not measured
		4	MT	05/07/2011 4:40:00 PM	06/07/2011 2:53:00 PM	22:13:00	LKC	1	4.9	Yes	
							LKC	2	5.2	Yes	
							LKC	3	5.0	Yes	
							LKC	4	5.3	Yes	
							LKC	5	4.9	Yes	
							LKC	6	4.7	Yes	
							LKC	7	5.1	Yes	
							LKC	8	5.0	Yes	
							LKC	9	5.2	Yes	
							WSU	10	5.3	Yes	
							LKC	11	5.0	Yes	
							LKC	12	4.8	Yes	
							LKC	13	5.0	Yes	
							LKC	14	5.2	Yes	
							LKC	15	4.8	Yes	
							LKC	16	4.1	Yes	
							RS	17	5.1	Yes	
							LKC	18	5.2	Yes	
							LKC	19	5.0	Yes	
							LKC	20	5.4	Yes	
							LKC	21	5.2	Yes	
							LKC	22	5.0	Yes	
							LKC	23	4.8	Yes	
							LKC	24	5.2	Yes	
							RS	25	5.2	Yes	
							LKC	26	5.0	Yes	
							RS	27	5.1	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	4	MT				RS	28	5.0	Yes	
							LKC	29	5.3	Yes	
							LKC	30	5.6	Yes	
							LKC	31	5.4	Yes	
							LKC	32	4.8	Yes	
							WSU	33	5.2	Yes	
							LKC	34	5.5	Yes	
							LKC	35	4.8	Yes	
							LKC	36	5.0	Yes	
							LKC	37	5.2	Yes	
							LKC	38	4.9	Yes	
							LKC	39	5.0	Yes	
							LKC	40	5.9	Yes	
							LKC	41	5.3	Yes	
							LKC	42	4.8	Yes	
							RS	43	4.8	Yes	
							LKC	44	4.9	Yes	
							LKC	45	5.6	Yes	
							LKC	46	5.3	Yes	
							RS	47	5.3	Yes	
							LKC	48	5.4	Yes	
							LKC	49	5.2	Yes	
							LKC	50	5.2	Yes	
							WSU	51	5.6	Yes	
							LKC	52	4.2	Yes	
							LKC	53	4.9	Yes	
							LKC	54	4.9	Yes	
							LKC	55	5.2	Yes	
							LKC	56	5.8	Yes	
							RS	57	5.2	Yes	
							LKC	58	5.2	Yes	
							LKC	59	4.9	Yes	
							LKC	60	5.0	Yes	
		5	MT	05/07/2011 4:52:00 PM	06/07/2011 2:32:00 PM	21:40:00	LKC	1	5.0	Yes	
							LKC	2	5.2	Yes	
							RS	3	4.6	Yes	
							LKC	4	5.0	Yes	
							LKC	5	5.0	Yes	
							WSU	6	6.8	Yes	
							RS	7	4.6	Yes	
							LKC	8	5.4	Yes	
							LKC	9	5.0	Yes	
							LKC	10	4.2	Yes	
		6	MT	05/07/2011 5:00:00 PM	06/07/2011 2:30:00 PM	21:30:00	NF	N/A	N/A	N/A	Gap in the trap
		7	MT	05/07/2011 5:03:00 PM	06/07/2011 1:55:00 PM	20:52:00	LKC	1	4.7	Yes	
							LKC	2	4.5	Yes	
							WE	3	5.6	Yes	
							LKC	4	4.4	Yes	
							WSU	5	7.3	Yes	
							LKC	6	5.3	Yes	
							WE	7	5.2	Yes	
							LKC	8	5.5	Yes	
							LKC	9	4.7	Yes	
							LKC	10	4.3	Yes	
							LKC	11	4.7	Yes	
							LKC	12	4.6	Yes	
							WE	13	5.5	Yes	
							LKC	14	5.0	Yes	
							LKC	15	4.3	Yes	
							FM	16	5.5	Yes	
							LKC	17	5.0	Yes	
							LKC	18	5.5	Yes	
							LKC	19	4.5	Yes	
							LKC	20	5.0	Yes	

APPENDIX B, TABLE 1

Fish Catch Results from the Star-Orion South Diamond Project study area, July 2011.

Waterbody	Area	Station	Method	Set Date	Catch Date	Effort (h:mm:ss)	Species	Fish (#)	Length (cm)	Released?	Comments
Stream F	1	7	MT				WSU	21	5.3	Yes	
							LKC	22	5.2	Yes	
							WSU	23	5.7	Yes	
							WE	24	4.9	No	Kept for ID
							WSU	25	8.0	Yes	
							LKC	26	5.4	Yes	
							LKC	27	4.6	Yes	
							LKC	28	5.4	Yes	
							LKC	29	5.7	Yes	
							LKC	30	4.6	Yes	
							LKC	31	5.0	Yes	
							LKC	32	5.4	Yes	
							WSU	33	9.2	Yes	
							WE	34	5.1	No	
							LKC	35	5.2	Yes	
							LKC	36	5.7	Yes	
							LKC	37	4.8	Yes	
							LKC	38	4.7	Yes	
							LKC	39	4.7	Yes	
							LKC	40	4.4	Yes	
							LKC	41	5.0	Yes	
							LKC	42	5.4	Yes	
							LKC	43	5.1	Yes	
							LKC	44	4.7	Yes	
							LKC	45	4.7	Yes	
							LKC	46	5.2	Yes	
							LKC	47	5.3	Yes	
		8	MT	05/07/2011 5:15:00 PM	06/07/2011 1:32:00 PM	20:17:00	NF	N/A	N/A	N/A	No fish captured
		9	MT	05/07/2011 5:30:00 PM	06/07/2011 1:23:00 PM	19:53:00	LKC	1	4.8	Yes	
							RS	2	4.9	Yes	
		10	MT	05/07/2011 3:37:00 PM	06/07/2011 1:11:00 PM	21:34:00	NF	N/A	N/A	N/A	No fish captured
		11	MT	05/07/2011 5:41:00 PM	06/07/2011 12:33:00 PM	18:52:00	NRD	1	5.3	No	
							LKC	2	4.0	Yes	
							LKC	3	4.0	Yes	
							LKC	4	4.6	Yes	
							RS	5	4.8	No	Kept for ID
							LKC	6	4.2	Yes	
							RS	7	4.6	Yes	
							RS	8	4.6	Yes	
							NRD	9	4.6	Yes	
							NRD	10	4.9	Yes	
							NRD	11	4.8	Yes	
							LKC	12	4.8	Yes	
							LKC	13	4.5	Yes	
							LKC	14	5.0	Yes	
							LKC	15	4.2	Yes	
							LKC	16	4.5	Yes	
Stream T	1	1	BE	13/07/2011 11:20:00	13/07/2011 11:35:00	0:06:48	NF	N/A	N/A	N/A	No fish captured
		2	BE	13/07/2011 12:00:00 PM	13/07/2011 12:15:00 PM	0:04:00	NF	N/A	N/A	N/A	No fish captured
		3	BE	13/07/2011 12:50:00 PM	13/07/2011 12:59:00 PM	0:04:46	NF	N/A	N/A	N/A	No fish captured
		1	MT	11/07/2011 4:46:00 PM	12/07/2011 11:20:00	18:34:00	NF	N/A	N/A	N/A	No fish captured
		2	MT	11/07/2011 4:53:00 PM	12/07/2011 11:23:00	18:30:00	NF	N/A	N/A	N/A	No fish captured
		3	MT	11/07/2011 4:57:00 PM	12/07/2011 11:35:00	18:38:00	NF	N/A	N/A	N/A	No fish captured
		4	MT	11/07/2011 5:03:00 PM	12/07/2011 11:37:00	18:34:00	NF	N/A	N/A	N/A	No fish captured
		5	MT	11/07/2011 5:31:00 PM	12/07/2011 1:15:00 PM	19:44:00	NF	N/A	N/A	N/A	No fish captured
		6	MT	11/07/2011 5:53:00 PM	12/07/2011 1:17:00 PM	19:24:00	NF	N/A	N/A	N/A	No fish captured
		7	MT	11/07/2011 5:38:00 PM	12/07/2011 1:19:00 PM	19:41:00	NF	N/A	N/A	N/A	No fish captured
		8	MT	11/07/2011 6:05:00 PM	12/07/2011 1:45:00 PM	19:40:00	NF	N/A	N/A	N/A	No fish captured
		9	MT	11/07/2011 6:10:00 PM	12/07/2011 1:46:00 PM	19:36:00	NF	N/A	N/A	N/A	No fish captured
		10	MT	11/07/2011 6:16:00 PM	12/07/2011 1:48:00 PM	19:32:00	NF	N/A	N/A	N/A	No fish captured
		11	MT	11/07/2011 6:18:00 PM	12/07/2011 1:53:00 PM	19:35:00	NF	N/A	N/A	N/A	No fish captured

Methods: BE = backpack electrofishing; MT = minnow trapping.
Species: NF = no fish; BB = burbot; BNS = blacknose shiner; BSB = brook stickleback; ESC = emerald shiner; FHC = Flathead chub; FM = fathead minnow; LKC = lake chub; LND = longnose dace; NP = northern pike; NRD = northern redbelly dace; PD = pearl dace; RS = river shiner; STC = spottail shiner; WE = walleye; WSU = white sucker; YP = yellow perch.
N/A = not applicable.

APPENDIX C

AQUATIC HABITAT PHOTOGRAPHS

LIST OF PHOTOGRAPHS

Photo 1. Peonan Creek showing a beaver dam at (UTM NAD83 Zone 13U) 502442.2 E, 5883784.1 N, July 10th, 2011.

Photo 2. Peonan Creek, Habitat Section 1, July 8th, 2011.

Photo 3. Peonan Creek, Habitat Section 2, July 8th, 2011.

Photo 4. Peonan Creek, Habitat Section 3, July 8th, 2011.

Photo 5. Peonan Creek, Habitat Section 4, July 8th, 2011.

Photo 6. Peonan Creek, Habitat Section 5, July 8th, 2011.

Photo 7. Peonan Creek, Habitat Section 6, July 8th, 2011.

Photo 8. Peonan Creek, Habitat Section 7, July 9th, 2011.

Photo 9. Peonan Creek, Habitat Section 7, July 9th, 2011.

Photo 10. Peonan Creek, Habitat Section 8, July 9th, 2011.

Photo 11. Stream F, Habitat Section 1, July 6th, 2011.

Photo 12. Stream F, Habitat Section 2, July 6th, 2011.

Photo 13. Stream F, Habitat Section 3, July 6th, 2011.

Photo 14. Stream F, Habitat Section 4, July 6th, 2011.

Photo 15. Stream F, Habitat Section 5, July 6th, 2011.

Photo 16. Stream F, Habitat Section 6, July 6th, 2011.

Photo 17. Stream F, Habitat Section 7, July 6th, 2011.

Photo 18. Stream F, Habitat Section 8, July 6th, 2011.

Photo 19. A tree stump showing evidence of beaver activity in Stream T at (UTM NAD83 Zone 13U) 517436.2 E, 5908522.3 N, July 11th, 2011.

Photo 20. Stream T, Habitat Section 1, July 12th, 2011.

Photo 21. Stream T showing in a gray biofilm visible against the dark water background, Habitat Section 1, July 12th, 2011.

Photo 22. Stream T, Habitat Section 2, July 12th, 2011.