CANADIAN ZINC CORPORATION

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POST-EA INFORMATION PACKAGE INCLUDING AN UPDATED PROJECT DESCRIPTION ALL SEASON ROAD TO PRAIRIE CREEK MINE

APPENDIX 27-1

SUBMITTED IN SUPPORT OF:

Water Licences MV/PC2014L8-0006, and
Land Use Permits MV/PC2014F0013

SUBMITTED TO:

Mackenzie Valley Land and Water Board
Yellowknife, NT X1A 2N7

Parks Canada,
Nahanni National Park Reserve
Fort Simpson, NT X0E 0N0

SUBMITTED BY:

Canadian Zinc Corporation
Vancouver, BC, V6B 4N9

February 2019

PRAIRIE CREEK ACCESS ROAD

RARE PLANT MANAGEMENT PLAN

DECEMBER 2018

CANADIAN ZINC CORPORATION

TETRA TECH

Revision History

Revision	Description	Revised By (Initials)	Revision Date
1	Initial Version by Tetra Tech	Tetra Tech (TP)	2018-12-19

Review and Approval

The following signatures indicate that the undersigned have read and agreed to the contents of this document, and that they approve and accept its distribution and use.

Description	Authority	Signature	Date
Document Owner	David Harpley VP Environment & Permitting		2018-11-30
Reviewed by: Full Name, Job Title			
Approved by: Full Name, Job Title			

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This Plan and the most recent revisions have been distributed to:

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PLAIN LANGUAGE SUMMARY

This Rare Plant Management Plan (RPMP) was prepared for Canadian Zinc Corporation (CZN) by Tetra Tech Canada Inc. (Tetra Tech). The RPMP presents management practices to be employed during the construction and operation of the Prairie Creek All-Season Road (ASR) and associated infrastructure.

The Project is located in the south-west corner of the Northwest Territories (NWT), approximately 500 km southwest of Yellowknife in the Nahanni National Park Reserve (NNPR) area. The proposed Prairie Creek Access Road will span 170 kilometres through varying mountainous terrain. Approximately 85 km of the proposed route passes through the NNPR.

The RPMP establishes a framework to integrate the protection and management of rare plants identified in the vicinity of the ASR corridor, Prairie Creek Mine, and associated infrastructure with monitoring to determine their condition over the duration of construction and operations. It also provides for the inclusion and management of new rare plant or rare plant assemblage observations.

Four rare plant surveys have been completed as part of project baseline studies:

- July 2009 – along the Prairie Creek Mine winter road, proposed waste rock storage facility, camp and surrounding area, and beaver pond located south of the camp.
- August 2010 – along the proposed Polje By-Pass realignment.
- July 2016 – along the proposed ASR, borrow pits, road realignment areas, and areas supporting unusual landscape features within NNPR (from km 17 to km 101).
- June 2017 – within a 100 m buffer extending from either side of the proposed ASR centreline within NNPR (from km 17 to km 101).

In addition, an invasive plant species survey was conducted in August 2018 that covered where the access road overlapped with the historic winter road and exploration cutlines, the Nahanni Butte community access road that overlaps with the ASR, areas cleared by the Nahanni Butte community in 2017, some of which cover the proposed ASR alignment, and spot checks of undisturbed areas in the vicinity of the broader invasive plant survey areas. While the survey focused on the identification and establishment of invasive plant species, incidental observations of other plant species, particularly those considered rare, were made as well. No rare plants were identified during the invasive species survey.

During the 2009 rare plant survey, nine rare species were identified: few flower meadow rue (*Thalictrum sparsiflorum*), Hornemann willowherb (*Epilobium hornemanni*), linear-leaved willowherb (*Epilobium leptophyllum*); alpine anemone (*Anemone drummondii*), Northern bog birch (*Betula pumila*), lesser black-scaled sedge (*Carex atrosquama*), one-glume spikerush (*Eleocharis uniglumis*), alpine groundsel (*Packera pauciflora*), and yellow mountain heather (*Phyllodoce glanduliflora*). With the exception of one-glume spikerush and alpine groundsel (both still listed as Sensitive), these species have since been delisted.

In 2017, 21 meandering transects were carried out within a 100 m buffer extending from either side of the road centreline. Two rare plant species were identified over multiple locations: spleenwort (*Asplenium trichomanes-ramosum*, formerly *A. viride*) listed as May Be At Risk and small round-leaved bog orchid (*Platanthera orbiculata*) listed as Sensitive.

The management goals and objectives with respect to rare plants are as follows:

- Protect, manage, and monitor rare plant species and their habitat that may be affected by Project construction and/or operations
  - Data collection (e.g., descriptions of plant distribution (locally and more broadly within the NWT), relative abundance, and habitat quality), will allow for the efficient and repeatable detection of changes over time.
- Provide CZN and regulatory agencies with a process and framework for rare plant management and rare plant assemblages within the Project area.

The RPMP applies to rare plants located adjacent to project infrastructure, as rare plants that intersect with project disturbance footprints are to be collected and donated to various herbaria. The management strategy is based, in part, on the identification of management units (MUs), which are ecologically distinct areas of land that focus on populations of rare plants. MUs are assigned a set of goals and objectives, a desired future condition, and will be used to gauge the overall success of the management plan.

Monitoring will be conducted in individual MUs to verify whether the management strategy is having the expected effect on rare plants. Permanent plots or transects will be established within each MU to facilitate consistent, long term collection of data (e.g., the duration of the project).

Monitoring will be conducted at regular time intervals (e.g., during the growing season – June to August) following repeatable methods. MUs will be established and surveyed in the summer prior to the initiation of construction. Following construction, MUs will be surveyed at regular intervals. If rare plant densities are shown to be declining over time, habitat degradation (e.g., from dust) or disturbance is evident, or there is increased encroachment by invasive species, more intensive monitoring and adjustments to the management plan and project operations may be required.

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LIST OF ACRONYMS

Acronym/Abbreviation	Definition
ANPC	Alberta Native Plant Council
ASR	All Season Road
CIRNAC	Crown-Indigenous and Northern Affairs Canada
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CZN	Canadian Zinc Corporation
DAR	Developers Assessment Report
EM	Environmental Monitor
GNWT	Government of the Northwest Territories
ha	Hectares
km	Kilometre
KP	Kilometre Point
m	Metre
M	Million
Mine	Prairie Creek Mine
NNPR	Nahanni National Park Reserve
MVERB	Mackenzie Valley Environmental Review Board
MVLWB	Mackenzie Valley Land and Water Board
MVRMA	Mackenzie Valley Resource Management Act
NWT	Northwest Territories
REA	Report of Environmental Assessment
ROMP	Road Operations and Maintenance Plan
ROW	Right-of-Way
SARA	*Species at Risk Act*
SARC	Species at Risk Committee

GLOSSARY OF TERMS

Bedrock	The consolidated rock (harder than 3 Moh's scale of hardness) underlying the Earth's surface. Bedrock can be encountered at depths ranging from the Earth's surface to hundreds of meters below, depending on the level of exposure to erosion.
Bipinnate	Twice pinnate; with the divisions again pinnately divided.
Borrow Pit	Pit created to provide earth materials to be used as fill (i.e., roadbed) at another site.
Bract	Specialized leaf from the axil of which a flower arises; differing from foliage leaves in size, shape, or texture, but sometimes gradually modified from them.
Bracteole	Often denoting a small bract; better applied to small bract-like organs arising laterally on the pedicel.
Calyx	The outer perianth whorl; collective term for all the sepals of a flower.
Corolla	The second set of floral leaves on the perianth, often conspicuous by its size or colour, but in some plants, small and inconspicuous, or reduced to nectaries, or lacking.
Cut and Fill	Construction practice in which earth materials are excavated from part of an area and used as fill in adjacent areas.
Glabrous	Smooth; hairless.
Hydrology	The study water and its movement on land and in the atmosphere, and the effects it has on the earth's surface.
Indusia	A thin membranous covering on a fern leaf that covers the sorus.
Inflorescence	Complete flower-cluster, including the axis and bracts.
Nectary	A gland which secretes nectar, usually on the corolla or disk or within the spur of a flower.
Permafrost	Ground frozen for at least two consecutive years. Continuous permafrost is defined as an area where at least 90% of the land area is underlain by permafrost. Discontinuous permafrost is defined as an area where 10% to 90% of the land area is underlain by permafrost.
Pedicel	The stalk of a single flower in an inflorescence.
Pedicellate	Born on a pedicel.
Peduncle	The portion of a stem which bears an inflorescence or a solitary flower, either leafless or with bracts.
Perianth	The corolla and calyx considered together, or either of them if the other is lacking.
Pinna	One of the primary divisions or leaflets of a pinnate leaf.
Pinnate	Resembling a feather, as in a compound leaf with leaflets arranged on opposite sides of an elongated axis.
Pinnule	The pinnate division of a pinna in a bipinnately compound leaf, or the ultimate divisions of a leaf which is more than twice pinnately compound.
Progressive Reclamation	Action that can be taken during operations before permanent closure to take advantage of cost and operating efficiencies by using resources available from ongoing operations. Enhances environmental protection and shortens the time frame for achieving reclamation objectives.

GLOSSARY OF TERMS (CONTINUED)

Quarry	A type of open-pit development from which building materials are often extracted.
Raceme	Inflorescence with an elongate unbranched axis and lateral flowers, the lowest opening first.
Rachis	The main axis of a structure, such as a compound leaf or an inflorescence.
Rhizome	A horizontal underground stem; rootstock.
Riparian	Area of land adjacent to a stream, river, lake, or wetland containing vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas.
Scape	A peduncle with one or more flowers arising directly from the ground or from a very short stem, and either leafless or with bracts only.
Scarifying	Scarifying is the process of breaking up hard or compacted materials such as a gravel road, typically using the scarifier on a grader. Scarifying typically involves loosening up of the top 6 inches of a road surface.
Sepals	A segment of the calyx of a flower, enclosing the petals and usually green and leaflike.
Sheath	The portion of an organ which surrounds, at least partly, another organ, as the leaf base of a grass surrounds the stem.
Slash	Woody debris, such as branches, logs, and brush, that remains on the ground after clearing has been completed.
Spike	Elongate inflorescence of the racemose type with sessile or subsessile flowers; term loosely applied to an inflorescence of different morphological nature but of similar superficial appearance.
Spur	A hollow appendage projecting from the corolla or the calyx and usually nectarial in function.
Sorus/Sori	A cluster of sporangia on the surface of a fern leaf.
Sporangia	A spore-bearing case or sac.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Canadian Zinc Corporation and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Canadian Zinc Corporation, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

This draft Rare Plant Management Plan (RPMP) was prepared for Canadian Zinc Corporation (CZN) by Tetra Tech Canada Inc. (Tetra Tech). The RPMP outlines the management practices to be employed during the construction and operation of the Prairie Creek Mine (the Mine) All-Season Road (ASR) and associated infrastructure.

1.1 Company Name, Location, and Mailing Address

Company Name:
Canadian Zinc Corporation

Head Office:

Address:	Suite 1710 – 650 West Georgia Street, Vancouver, BC, V6B 4N9
Phone:	+1.604.688.2001
Fax:	+1.604.688.2043
Email:	david@canadianzinc.com

Prairie Creek Mine:
Iridium 9555 Satellite Phone 1 (yellow) 011.8816.315.30998
Iridium 9505A Satellite Phone 2 (black) 011.8816.315.30997
Iridium 9505A Satellite Phone 3 (orange) 011.8816.315.30996
Ground-To-Air Radio Handheld FREQ 122.800

1.2 Purpose

The purpose of the RPMP is to identify best management practices for the protection, management, and monitoring of rare plant species and their habitats that may be affected by the construction and operation of the full length of the Prairie Creek ASR leading to the Mine, both inside of and outside of the Nahanni National Park Reserve (NNPR).

1.3 Related Documents

This management plan is linked to a number of other CZN management plans including:

- Invasive Species Management Plan;
- Spill Contingency Plan;
- Sediment and Erosion Control Plan;
- Wildlife Management and Monitoring Plan;
- Road Operations and Maintenance Plan;
- Specific Borrow Pit Development Plans; and
- Road Closure and Reclamation Plan.

Details of the road, together with the schedule of road construction and operations/maintenance, are provided in CZN's Road Construction Plan (RCP) and Road Operations and Management Plan (ROMP). A map book of the road is provided in Appendix A.

1.4 Regulatory and Permitting Context

In the Northwest Territories (NWT), species information is compiled through a collaborative program geared towards reaching a common understanding of general status so that more informed management decisions can be made. The General Status Ranking Program provides a preliminary evaluation of species status. Those species assigned a status of "May Be At Risk" or "At Risk" receive the highest priority for a more detailed assessment by the NWT Species at Risk Committee (SARC) or the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (NWT Species at Risk Infobase 2018). Species ranked as "May Be At Risk" may be at risk of extinction or extirpation and are given the highest priority for a more detailed assessment by COSEWIC or SARC. The "May Be At Risk" rank is not a legal designation and has no legal consequences.

Species ranked as "Sensitive" are not at high risk of extinction or extirpation but may require special protection to prevent them from becoming at risk. These species are assigned a medium priority for a detailed assessment (Working Group on General Status of NWT Species 2016).

Both the territorial *Species at Risk (NWT) Act* and the federal *Species at Risk Act* (SARA) apply in the NWT and serve to identify, protect, and help in the recovery of species at risk. The legal listing of a species results in the identification of management or recovery goals for that species. The *Species at Risk (NWT) Act* specifically applies to species that are under the management authority of the Government of the Northwest Territories (GNWT) and is applicable to both public and private lands as well as private lands subject to a land claims agreement.

The Mackenzie Valley Review Board, within the Report of Environmental Assessment and Reasons for Decision – Canadian Zinc Corp. Prairie Creek All Season Road – Project EA1415-01 (2017, the 'REA') included the following measure (Measure 11-1, part 2) with respect to a management plan for rare plants and rare plant assemblages in the NNPR:

In order to prevent significant adverse impacts on rare plants as a result of construction and operation, CanZinc will develop a Rare Plant Management Plan prior to construction. This plan will include mitigation, monitoring, and adaptive management for rare plants.

- *Mitigation: CanZinc will use the information gathered in the surveys required by Measure 11-1 part 1, as well as any other relevant information, to identify appropriate mitigation within the plan to minimize significant adverse impacts on rare plants or rare plant assemblages.*
- *Effects monitoring: The plan will include details on how rare plants will be identified and monitored during construction and operations activities. The plan will include effects monitoring for any identified rare plants or rare plant assemblages.*
- *Adaptive management: The plan will include the principles of adaptive management outlined in Appendix B. This will include identifying the actions that will be taken if rare plants are identified at any time during construction and operation of the Project.*

The Rare Plant Management Plan will be reviewed and approved by Parks Canada prior to construction. The developer will operate in accordance with the approved plan.

Additionally, the Review Board suggested (Suggestion 11-2) that "*the Mackenzie Valley Land and Water Board consider requiring a Rare Plant Management Plan for the portion of the Project it regulates. The Review Board suggests that this plan could be combined with the one for NNPR and Parks Canada.*"

The results of the various rare plant and other vegetation surveys conducted by CZN (see Section 3.2) were used to inform mitigation measures and this RPMP, and to address the above noted Measure and Suggestion.

1.5 Roles and Responsibilities

This RPMP is a living document which incorporates an adaptive management approach. This document will be reviewed at least every five years and updated accordingly. More frequent revisions may be required if new rare species are detected, the number of monitored individuals appears to be in decline, and/or rare plant species legislation changes. CZN's Environmental Monitor (EM), in collaboration with affected communities and regulatory agencies, will be responsible for implementing the RPMP and CZN will be responsible for appointing appropriate, qualified staff to carry out the requirements of the RPMP.

CZN's EM will be responsible for:

- Monitoring for rare plant species;
- Evaluating rare plant species habitat quality;
- Detecting the establishment of invasive plant species in the vicinity of rare plant monitoring locations (see the Invasive Species Management Plan);
- Data entry, reporting, and maintaining a database;
- Trend tracking; and
- Updating this management plan to reflect changes to legislation, adjust for a decline in the number of monitored individuals, or the detection of new rare plant species, etc.

All staff utilizing the road should be introduced to the concept and importance of rare plant species and rare plant habitat during orientation so the importance of minimizing potential effects on their environment are understood.

2.0 PROJECT DESCRIPTION

CZN is planning to operate the Mine. The Mine is located at approximately 61° 33' north latitude and 124° 48' west longitude adjacent to Prairie Creek, a tributary of the South Nahanni River, south-west NWT (Figure 1).

A 170 km All Season Road (ASR) connecting the Mine (at Km 0) to the Liard Highway via the Nahanni Butte access road (Figure 2) will generally follow the alignment of a previously permitted Winter Road, while reflecting the terrain, site characteristics, and road specifications suitable and preferred for the ASR. Half of the proposed ASR (85 km between Km 17 to Km 102) is located within the NNPR. The NNPR, a world heritage site, is known for its globally-significant karst terrain, as well as the South Nahanni River, a Canadian Heritage River. Approximately half of the ASR alignment will also directly overlap with the alignment of the previously permitted Winter Road.

Construction of the ASR will take approximately three years to complete. Initial winter roads will be built to gain access to the Mine, allow further investigation of the ASR alignment to complete detailed design, and to provide

access for ASR construction. CZN's intent is to build the initial winter roads on the ASR alignment to minimize the total extent of disturbance

The ASR will cross approximately 18 major streams with clear span bridges or large diameter culverts, and 85 minor streams with culvert diameters ranging from 800 mm to 2,000 mm based on the size of the stream. Construction of the ASR will be supported by temporary camps at Km 23 (Sundog), Km 42 (Cat Camp), Km 65, Km 87, Km 121 (Grainger Gap), Km 151 or Km 158, and Km 177.5. The camps at Km 42, Km 87, and Km 121 will likely be retained in a reduced form to support on-going road maintenance.

3.0 RARE PLANT AND OTHER VEGETATION SURVEYS

3.1 Methods

The rare plant studies conducted to date have been a combination of desktop data compilation and field surveys. Given the extent of the ASR alignment study area, more recent studies have made efforts to link rare plant species habitat potential to the ecotype mapping developed by Parks Canada for NNPR (per Ponomarenko and Quirouette 2015) in order to focus field investigations.

3.1.1 Desktop Studies

Desktop studies have consisted of compiling lists of rare plants with the potential to occur within the study area, identifying their likely habitat requirements, reviewing ecosystem maps that overlap with the study area (current at the time), and ultimately linking this information to identify areas with a high potential of supporting rare plant habitat.

Information regarding rare plants and rare plant habitat was compiled from the NWT Species at Risk Infobase, COSEWIC, and SARA. Vascular plants in the NWT are assigned a General Status Rank as a way of prioritizing management decisions; those identified as being “May Be At Risk”, or “At Risk” receive the highest priority for a more detailed assessment by SARC or COSEWIC.

The species lists compiled for the Mine and ASR were generated periodically between 2009 to 2017 to account for the addition and removal of species, as well as changes to General Status Ranks that have occurred over the years. The most recent list, generated in 2017, included species ranked as being “At Risk”, “May Be At Risk”, as well as “Sensitive” within the Taiga Plain and Taiga Cordillera Ecozones (which broadly characterize the study area). The list was then refined by eliminating species with no habitat potential in the study area (e.g., species occupying coastal beaches), following the review and compilation of rare plant habitat descriptions and species distributions from various floras and literature sources (e.g., Porsild and Cody 1980; McJannet et al. 1995; Kershaw et al. 1998; Cody 2000; Burt 2002; Argus 2004; Aiken et al. 2007; and Ponomarenko and Quirouette 2015).

Ecosystem mapping information available for the study area includes Earth Observation for Sustainable Development of Forests (EOSD) mapping (Wulder et al. 2004) as well as ecotype mapping for the expanded NNPR (Ponomarenko and Quirouette 2015). The former dataset was used as the basis of the Developers Assessment Report (DAR) for the ASR. Once the ecotype information was available, efforts were made to correlate the two mapping products. General ecosystem types were developed that combine the ecotypes of Ponomarenko and Quirouette (2015) with the land cover classes of Wulder et al. (2004). Ecotypes and land cover classes with similar characteristics (e.g., relative moisture status, vegetation cover) were grouped into the same general ecosystem type based on available descriptions as well as from field observations.

Each rare plant species was then assigned at least one general ecosystem type based on the mapping and descriptions developed by Parks Canada (Ponomarenko and Quirouette 2015), Wulder et al. (2004), and the various literature sources listed previously. The results were summarized into classes that present the number of rare plant species potentially supported by each ecotype. This information was then linked to the ecotype mapping using GIS to spatially identify rare plant habitat potential within the study area.

3.1.2 Field Surveys

Four rare plant surveys of the ASR alignment, 1980's winter road, and other areas of proposed development (e.g., borrow sources) have been completed to date (2009, 2010, 2016, and 2017) at various times in the summer (June to August) to capture a range of flowering periods. Recent (2016 and 2017) surveys followed guidelines developed by the Alberta Native Plant Council (ANPC 2012) and involved meander searches within a 100 m buffer of the proposed ASR centreline (200 m total width). These surveys also had helicopter support which allowed for reconnaissance flights over areas of high rare plant habitat potential as well as the opportunistic identification of unusual or uncommon landscape features (i.e., that were too small to map) from the air which were then surveyed on the ground. Earlier surveys were conducted primarily on foot or by ATV along portions of the existing road and other proposed infrastructure.

Concurrently with the rare plant survey, areas were also assessed for their conformance with the ecotypes mapped for NNPR (per Ponomarenko and Quirouette 2015) as well as the land classification mapping of Wulder et al. (2004).

At each survey location, a species list (irrespective of status) was compiled and an ecosystem unit assigned. Plants were identified to species in the field wherever possible. When a definitive identification in the field could not be achieved, specimens were collected, provided the collection did not appear to threaten the immediate population.

3.2 Results

3.2.1 Desktop Studies

In 2016, a total of 217 rare vascular plants were identified as potentially occurring within the study area according to the NWT Species At Risk Infobase. In 2017, the list was refined to 145, due in part to updates to ecozone boundaries and species rankings as well as modifications based on rare plant habitat requirements and the likelihood of those habitats being present within the ASR study area.

The results of the model developed in 2017 to spatially identify rare plant habitat potential using the available ecotype mapping (per Ponomarenko and Quirouette 2015) along the ASR are presented in Table 1, with ecotypes potentially supporting anywhere from 12 rare plant species (aquatic ecotype) to 70 (alpine herb tundra and meadow). The model results were then grouped into classes identifying the approximate number of rare plant species within each class; these classes were used to theme field maps which helped stratify the study area and focus the rare plant survey effort.

Table 1: Rare Plant Habitat Potential along the ASR

Class (Number of Rare Plant Species)	Ecotype[1]	Number of Rare Plant Species Potentially Linked to an Ecotype[2]
>45	Alpine Herb Tundra and Meadow	70
	Low Sparse Shrub	67
	Wetland	63
	Medium – Low Shrub	51
31 to 45	Riparian	44
	Subalpine Tall Shrub	42
	Subalpine Shrub – Sparse Trees	38
	Subalpine Coniferous Woodland	37
26 to 30	Alluvial non-vegetated	30
	Mixed Predominantly Coniferous Forest	29
	Mixed Predominantly Deciduous Forest / Tall Shrub	28
	Coniferous Forest	27
16 to 25	Deciduous Forest / Tall Shrub	24
	Spruce – Lichen- Moss Woodland	22
	Rock – Lichen	22
	Spruce – Lichen Woodland	19
<15	Recently Burnt	14
	Aquatic	12
N/A	Water, Rock, Clouds, and Shadow	0

[1]Based on ecotype mapping and descriptions per Ponomarenko and Quirouette (2015)
[2]Based on potentially suitable rare plant habitat within the ecotype

3.2.2 Field Surveys

Four rare plant surveys have been completed to date as follows:

- July 2009 – along the existing Mine access road, the proposed waste rock storage facility, camp and surrounding area, and beaver pond located south of the camp.
- August 2010 – along the proposed Polje By-Pass realignment to the existing access road.
- July 2016 – along the proposed ASR, borrow pits, road realignment areas, and areas supporting unusual landscape features within NNPR (from km 17 to km 101).
- June 2017 – within a 100 m buffer extending from either side of the proposed ASR centreline within NNPR (from km 17 to km 101).

In addition to the rare plant surveys conducted above, an invasive plant species survey was carried out in August 2018, outside NNPR that covered where the access road overlapped with the historic winter road and exploration cutlines, the Nahanni Butte community access road that overlaps with the ASR, areas cleared by the Nahanni Butte community in 2017, some of which cover the proposed ASR alignment, and spot checks of undisturbed areas in the vicinity of the broader invasive plant survey areas. While the survey focused on the

identification and establishment of invasive plant species, incidental observations of other plant species, particularly those considered rare, were made as well. No rare plants were identified during the invasive species survey.

During the 2009 rare plant survey, nine rare species were identified: few flower meadow rue (*Thalictrum sparsiflorum*), Hornemann willowherb (*Epilobium hornemanni*), linear-leaved willowherb (*Epilobium leptophyllum*); alpine anemone (*Anemone drummondii*), bog birch (*Betula pumila*), lesser black-scaled sedge (*Carex atrosquama*), one-glume spikerush (*Eleocharis uniglumis*), alpine groundsel (*Packera pauciflora*), and yellow mountain heather (*Phyllodoce glanduliflora*). With the exception of one-glume spikerush and alpine groundsel (both still listed as Sensitive), these species have since been delisted.

In 2017, 21 meandering transects were carried out within a 100 m buffer extending from either side of the road centreline. Multiple individuals of two rare plant species were identified over several locations (Table 2, Figures 3a-c): green spleenwort (*Asplenium trichomanes ramosum,* formerly *A. viride*; Photo 1) listed as May Be At Risk and small round-leaved bog orchid (*Platanthera orbiculata*; Photo 2) listed as Sensitive. Based on the current ASR alignment, all individuals (4 spleenwort and 32 small round-leaved bog orchid) are within the disturbance footprint.

No rare plants were observed during the 2010 or 2016 surveys. In 2016, surveys specifically for Raup's willow (*Salix raupii*), ranked as May Be At Risk, were also conducted along Sundog Creek between km 36 and km 38.

Table 2: Rare Plant Observations

Name	Location (UTM – 10V, E, N)	Kilometre Point (KP)	General Ecosystem Type	Ecotype	# Individuals	Area (m^2)	Associated Species
Green Spleenwort	417202 6828983	24-25	Shrub – Subalpine	Medium – Low Shrub	4	5	Yellow Anemone, Pink Pyrola, Alpine Bearberry, Rock Cranberry, Shrubby Cinquefoil, Entire-leaved Mountain Avens, Arctic Sagebrush, Alpine Bilberry, Narrow-leaved Labrador Tea
Small Round-leaved Bog Orchid	454869 6815441	79	Mixedwood	Mixed Predominantly Coniferous Forest	1	N/A	Not recorded
Small Round-leaved Bog Orchid	462111 6815853	90	Mixedwood	Mixed Predominantly Coniferous Forest	6	100	Trailing Clubmoss, One-sided Wintergreen, Lodgepole Pine, Dwarf Dogwood, Rock Cranberry, Trembling Aspen, Small Round-leaved Bog Orchid, Common Labrador Tea
Small Round-leaved Bog Orchid	462680 6815156	91-92	Mixedwood	Mixed Predominantly Coniferous Forest	1	N/A	Not recorded
Small Round-leaved Bog Orchid	462717 6815134	91-92	Mixedwood	Mixed Predominantly Coniferous Forest	11	100	Prickly Rose, Black Spruce, Lodgepole Pine, Paper Birch, Northern Comandra, Rock Cranberry

Table 2: Rare Plant Observations

Name	Location (UTM – 10V, E, N)	Kilometre Point (KP)	General Ecosystem Type	Ecotype	# Individuals	Area (m^2)	Associated Species
Small Round-leaved Bog Orchid	463460 6815134	92	Mixedwood	Mixed Predominantly Coniferous Forest	2	100	Black Spruce, Lodgepole Pine, Paper Birch, Trembling Aspen, Northern Comandra, Pink Pyrola
Small Round-leaved Bog Orchid	463997 6814206	93	Mixedwood	Mixed Predominantly Coniferous Forest	5	100	Speckled Alder, Trembling Aspen, Paper Birch, Lodgepole Pine, Dwarf Dogwood, Rock Crranberry
Small Round-leaved Bog Orchid	466239 6812310	97	Mixedwood	Mixed Predominantly Coniferous Forest	6	100	Black Spruce, Paper Birch, Lodgepole Pine, Dwarf Dogwood
One-glume spikerush		Not formally recorded – adjacent to the existing Prairie Creek Mine access road					
Alpine groundsel		Not formally recorded – adjacent to the existing Prairie Creek Mine access road					

Photo 1: Green Spleenwort (*Asplenium trichomanes-ramosum*)

Photo 2: Small Round-leaved Bog Orchid (*Platanthera orbiculata*)

4.0 RARE PLANT ASSEMBLAGES

To our knowledge, neither the GNWT nor Parks Canada have formally established tracking lists and/or status ranks for rare plant assemblages in the NWT, including within NNPR. In the absence of this information, rare plant assemblages have been identified as described below. Areas in addition to those described below that may support uncommon plant assemblages include those overlying unusual landforms, such as karst, and in areas of glacial refugia.

Alluvial Assemblages – during the 2016 field survey, plots with the highest species richness were found along alluvial flood plains. These habitats are subject to occasional flooding (disturbance) which bring nutrients and seed sources to the site and helps maintain adequate moisture due to the presence of a high water table. These site conditions tend to be uncommon and as such, plant assemblages associated with alluvial areas may be considered rare due to their limited distribution on the landscape. These areas also have higher potential for supporting rare plant species (e.g., the Alluvial non-vegetated ecotype presented in Table 1 was associated with 30 rare plant species). Alluvial areas appear to be relatively uncommon within the Project area according to the mapping data available and were generally avoided during design of the ASR due in part to fish and fish habitat considerations.

Wetlands – wetland ecosystems are frequently biologically diverse areas that provide important habitats for various plants and plant assemblages. Disturbances that affect the features that define wetlands (such as local hydrology or nutrient availability) can change the characteristics of the wetland itself, along with those the plant assemblages that wetlands support. Within the Project area, wetlands appear to be relatively uncommon according to the mapping data available and were generally avoided during design of the ASR due in part to their environmentally sensitive nature.

Alpine – alpine ecotypes can be harsh environments full of tiny microhabitats for specialized plant species. Vegetation growing in alpine and subalpine environments must be adaptable to harsh climate conditions such as extreme temperatures, desiccation, and limited soil development. While alpine herb, tundra, and meadow areas have a restricted distribution within the ASR corridor, they have a broader distribution within the areas currently mapped. New disturbance to alpine areas was generally avoided during the design of the ASR by following the existing road alignment (developed in the 1980's).

5.0 RARE PLANT AND RARE PLANT ASSEMBLAGE MANAGEMENT

This RPMP establishes a framework to integrate the protection and management of rare plants identified in the vicinity of the ASR corridor, the Mine, and associated infrastructure with monitoring to determine their condition over the duration of construction and operations. No specific management actions are proposed for rare plant assemblages. Wherever feasible, CZN will minimize the disturbance footprint, particularly in areas that may be conducive to supporting rare plant assemblages.

5.1 Adaptive Management

Adaptive management is a systematic, iterative, continuous improvement process that allows for the review and modification of a management strategy based on the output produced (Sit and Taylor 1998; McEachern 2007). The RPMP is a living document based on adaptive management that will be reviewed on a regular basis and revised if established criteria for success are not being met.

The management plan involves developing species-specific strategies that establish desired ecological conditions, management goals, and measurable objectives. The strategies also identify factors that may limit the achievement of the desired goals and objectives. Following the development of the strategy, management and monitoring activities are designed along with evaluation criteria and the requirements for future implementation adjustments, if needed.

5.2 Management Objectives

The management goals and objectives with respect to rare plants are as follows:

- Protect, manage, and monitor rare plant species and their habitat that may be affected by Project construction and/or operations
  - Data collection (e.g., descriptions of plant distribution (locally and more broadly within the NWT), relative abundance, and habitat quality), will allow for the efficient and repeatable detection of changes over time.
- Provide CZN and regulatory agencies with a process and framework for the management of rare plants and rare plant assemblages within the Project area

5.3 Mitigation Measures

Mitigation measures offer ways of controlling, reducing, or eliminating potential adverse effects of development or activities on the environment (per terms and definitions provided by the Mackenzie Valley Environmental Review Board (MVERB)). Mitigation measures are often presented as a hierarchy (Figure 4), which is a best practice approach to managing environmental risks. Efforts should focus first on avoiding potential effects, followed next by reducing effects, then looking at options such as relocation and restoration. Education is another option presented as part of the mitigation proposed for rare plants identified within the ASR corridor.

Figure 4: Mitigation Hierarchy (adapted from PricewaterhouseCoopers LLP [2010])

5.3.1 Protect/Avoid

Protection or avoidance of an environmental resource is the first mitigation option to consider. Specific procedures to avoid effects include the relocation of infrastructure, adjusting the means of implementation (e.g., through alternate uses of technologies or design), adjusting the timing of implementation (e.g., avoiding sensitive times within a season), or not proceeding with the activity (BC MOE 2014).

5.3.2 Reduce/Minimize

If avoidance is not possible as a mitigation measure, the next step in the mitigation hierarchy is to verify whether there is some way to reduce or minimize the size of the potential effect. This includes measures such as reducing the size of the overall disturbance area so that effects are at least avoided in part. Similarly, reducing the effect might involve shortening the length of time an activity might take.

5.3.3 Relocate

The relocation of species is, in simplest terms, is the moving an organism from one location to another. There is increasing interest to incorporate relocation into recovery planning options for species at risk; however, there are levels of uncertainty and risk associated with such that require careful consideration (Maslovat 2009). Relocations often have low success rates, can be expensive, and require considerable pre- and post-relocation planning and follow up to verify established goals and objectives are being met. The relocation of rare plants that are within the development footprint of the ASR, the Mine, or other infrastructure is not currently proposed as a mitigation option in this RPMP.

5.3.4 Restore

Restoration measures are usually carried out on-site, within areas that have been disturbed by project construction. Restoration can encompass a range of activities and scales, from localized site stabilization efforts to measures that aim to re-establish ecosystem function and structure. Restoration activities require thoughtful planning, implementation, and monitoring using scientifically defensible methods, including the establishment of restoration targets, so that a determination as to the effectiveness of the restoration program can be made.

5.3.5 Offset

Restoration offsets are similar to on-site restoration, with the exception that restoration activities are instead carried out at an off-site location where another project or activity has resulted in environmental disturbance.

5.3.6 Collect/Educate

In situations where disturbance to rare plants or rare plant habitat cannot be avoided, one option available to proponents is the collection of rare plants from within project disturbance footprints for the furtherance of scientific education. Specimens can be collected ahead of construction and donated to a local or university herbarium where they can contribute to the understanding of plant taxonomy, species distributions, and rare plant population trends (amongst others).

With respect to the rare plants currently located within CZN project infrastructure footprints, should it prove unrealistic to realign road segments and/or relocate infrastructure to avoid them during detailed design, rare plants will be collected and submitted to various herbaria (yet to be determined). The general status ranks of the rare plants identified in the study area are either “May Be At Risk” or “Sensitive” within the NWT, which means they are not at high risk of extinction or extirpation (although plants ranked as “May Be At Risk” are earmarked for more in-depth assessments and possible listing by COSEWIC). As it currently stands’ however, the rare plants identified should be able to withstand some level of disturbance and collecting them for preservation in a herbarium is a more constructive mode of disturbance than simply building over them.

5.4 Management Plan Strategy

The management strategy for rare plants detected within the CZN project study area differs for plants located within the disturbance footprint and those located in areas adjacent.

5.4.1 Plants Located within the Disturbance Footprint

There are currently multiple occurrences of two species (spleenwort and small round-leaved bog orchid) with known locations within the ASR footprint (Table 2 and Figures 3a-c). Four individuals of spleenwort were identified from a single location between KP 24 and KP 25. Should it not be possible to preserve these with ASR development, they will be collected in accordance with standard botanical practice (e.g., per ANPC 2006) prior to the start of construction for submission to a herbarium.

Approximately 32 individuals of small round-leaved bog orchid were identified from seven locations along the ASR, at KP 79, between KP 90 and KP 93, and at KP 97 (Figures 3a-c). As with spleenwort, should it not be possible to preserve these rare plants, they will be collected prior to the start of construction for submission to a herbarium (and given that multiple individuals are potentially available for collection, the specimens could be distributed to several herbaria).

It is unclear whether the locations of one-glume spikerush and alpine groundsel are currently within disturbance footprints. Efforts will be made to watch for these species when working near their preferred habitat. Both species are ranked as Sensitive, so should they be inadvertently disturbed by project activities, it should not pose an immediate threat to their overall conservation.

5.4.2 Plants Located Adjacent the Disturbance Footprint

Should it be possible to avoid rare plants with ASR development, they will be earmarked for monitoring. The management strategy for rare plants located adjacent to project infrastructure is based, in part, on the identification of management units (MUs), which are ecologically distinct areas of land that focus on populations of rare plants (McEachern et al 2007). The exact method of identifying MUs has yet to be determined but will likely involve a review of existing maps, aerial photography, and field observations to establish MU boundaries. MUs are assigned a set of goals and objectives, a desired future condition, and will be used to gauge the overall success of the management plan.

The following steps outline the rare plant management strategy (adapted from McEachern et al. 2007):

1. Gather information on each rare species, including descriptions of their ecology, distribution (locally and more broadly within the NWT), and relative abundance.
2. Identify management units (MU).
3. Establish desired ecological conditions, goals, and objectives for each rare species and MU.
4. Identify threats that may prevent or impede progress toward the desired ecological condition.
5. Develop a sampling design that identifies the collection, analysis, reporting, and storage methods of data generated.

As part of the planning process, MUs will be surveyed in the field once they have been defined spatially. Rare plants identified from past surveys, as well as any new individuals, will be located in the field and clearly marked prior to the start of construction and development-related activities.

5.5 Monitoring and Reporting

Monitoring will be conducted in individual MUs to verify whether the management strategy is having the expected effect on rare plants. Permanent plots or transects will be established within each MU to facilitate consistent, long term collection of data (e.g., the duration of the project).

Data will be used to detect changes in the spatial extent, occupancy, abundance, and density of rare plants, as well as the quality of rare plant habitat. Once sufficient data have been collected, they will be analyzed for trends that demonstrate whether rare plant densities are increasing, remaining stable, or declining. If densities are shown to be in decline, further investigation into potential root causes (e.g., loss of local sites or habitat degradation) will be conducted and adjustments to the management strategy will be implemented as required.

Monitoring will be conducted at regular time intervals (e.g., during the growing season – June to August) following repeatable methods. MUs will be established and surveyed in the summer prior to the initiation of construction. During construction, environmental monitors will be present to verify activities occurring adjacent to rare plants and rare plant habitat are not having adverse effects. Following construction, MUs will be surveyed at yearly intervals for the next five years. If after five years rare plant densities are shown to be stable or increasing, the survey interval

can be extended to every two years for the next six years. If such trends are still stable or positive after six years, the survey interval can be extended again to every five years.

If rare plant densities are shown to be in decline, habitat degradation (e.g., from dust) or disturbance is evident, or there is increased encroachment by invasive species, monitoring will continue on (or revert back to) a yearly basis and adjustments to the management plan and project operations may be required.

Data will be entered into a database designed to track activities within and affecting each MU. Results will be compiled into an annual report that presents yearly activities and progress.

Per the Invasive Species Management Plan (Tetra Tech 2018x), weed control measures that may be required in the vicinity of known rare plant occurrences will be selected based on their ability to limit disturbances to rare plants. Particular effort will also be made to limit the establishment of invasive plant species in the vicinity of established rare plants and known rare plant habitat.

Additionally, per the Sediment and Erosion Control Plan (Tetra Tech 2018y), efforts will be made to prevent or limit soil erosion in the vicinity of rare plants or rare plant habitat.

6.0 MANAGEMENT OF KNOWN RARE PLANT OCCURRENCES

As presented in Section 3.2, four rare plant species were identified during past surveys of the various CZN study areas. Location information is not currently available for one-glume spikerush and alpine groundsel; however, efforts will be made to relocate them in the field as part of detailed design and avoid them if possible. If avoidance is not possible, they will be collected, per the management plan, and donated to a herbarium.

6.1 *Asplenium trichomanes-ramosum (A. viride)* – Green Spleenwort

Status

May Be At Risk (NWT GS Rank)

No federal status

Description

Deciduous with clustered leaves. Leaves narrowly lanceolate, 5 cm to 15 cm long, 0.5 cm to 1.2 cm wide, rachis not winged, green throughout, pinnae in pairs, egg-shaped to oblong, 3 mm to 7 mm long, 2 mm to 5 mm wide, with few notches towards the tip. Sori 1-2, narrow, 2 mm to 3 mm long, indusia linear, attached with their sides (Douglas et al. 2000).

Dwarf plants with delicate linear fronds 4 cm to 14 cm long. Rachis green, pinnate, the pinnules round; sori elongate; indusia straight or slightly curved, attached to the upper side of the fertile vein (Porsild and Cody 1980).

Favourable Habitat

Located in Shrub-Subalpine general ecosystem type and Medium-Low Shrub ecotype.

Mesic to moist crevices in limestone and other basic rocks from low elevations to subalpine zones (Klinkenberg 2017).

Rare on wet rocks; Nahanni Range, Mackenzie Mountains (Porsild and Cody 1980).

6.2 *Platanthera orbiculata* – Small Round-leaved Bog Orchid

Status

Sensitive (NWT GS Rank)

No federal status

Description

Leaves two, basal, orbicular-oval, 10 cm to 20 cm in diameter, usually flat on the ground; scape with 1 to several bracts; raceme open, the flowers pedicellate, greenish-white, the lip linear-oblong, blunt, about 10 mm long, the spur club-shaped, twice as long as the lip (Porsild and Cody 1980).

Perennial herb from fleshy, spindle-shaped stem bases, few fibrous roots; stems 20 cm to 50 cm tall without leaves, with 1-5 lance-shaped bracts (Klinkenberg 2017).

Inflorescence a terminal, loosely 5 to 25 flowered spike, bracted, the bracts shorter than the flowers; flowers whitish-green, stalks 3 mm to 7 mm long; lower sepals 8 mm to 13 mm long, triangular to broadly lanceolate, somewhat bent back, the upper sepal kidney-shaped to broadly egg-shaped. Petals shorter and lighter than sepals, egg-shaped to broadly lanceolate, bent back; lip 10 mm to 20 mm long, strap-shaped, whitish, hanging downward with slightly up-curved tip; spur somewhat club-shaped, curved, 15 mm to 25 mm long (Klinkenberg 2017).

Favourable Habitat

Located in Mixedwood general ecosystem type and Mixed Predominantly Coniferous Forest ecotype.

Spruce and tamarack woodland in the southern Mackenzie Mountains (Porsild and Cody 1980).

Moist to wet forests, bogs, swamps, and streambanks in the montane zone (Douglas et al. 2001b).

6.3 *Eleocharis uniglumis* – One-glume Spikerush

Status

Sensitive (NWT GS Rank)

No federal status

Description

Culms 15 cm to 25 cm tall, wiry, summit, or orifice of the sheaths square or barely oblique (Porsild and Cody 1980).

Perennial herb from freely branching rhizomes, stems scattered or in small clusters, slender to very stout, circular in cross-section, tapered or somewhat flattened, 10 cm to 100 cm tall. Leaf sheaths firm, reddish-brown, distinctly oblique, purplish or reddish below, somewhat flaring upwards, blades lacking. Spikes solitary, terminal, lanceolate or narrowly egg-shaped, 5 mm to 23 mm long, light to dark brown or chestnut, several-flowered (Douglas et al. 2001a).

Photo courtesy of Matti Virtala

Favourable Habitat

Calcareous or saline seepages along river banks or lake shores; rarely growing in water (Porsild and Cody 1980).

Wet meadows, ditches, and shorelines at low to montane elevations (Douglas et al. 2001a).

6.4 *Packera pauciflora* – Alpine Groundsel

Status

Sensitive (NWT GS Rank)

No federal status

Description

Essentially glabrous perennial, 3 dm to 6 dm tall, leaves somewhat fleshy, reddish-orange flower heads (Porsild and Cody 1980).

Perennial herb from fibrous-rooted, simple or slightly branched woody stem base, stems erect, solitary or several, simple or few-branched above, glabrous or nearly so, 10 cm to 50 cm tall (Klinkenberg 2017).

Basal leaves thick, succulent, elliptic, egg-shaped, or nearly round, stalked, 1.5 cm to 10 cm long, including the stalk, 1 cm to 4 cm wide, glabrous to sparsely white wooly-hairy, toothed; stem leaves similar, lanceolate, variously toothed, cleft, or lobed, progressively reduced upwards, becoming unstalked (Klinkenberg 2017).

Flower heads discoid, solitary to several at the tips of stems or branches; involucres 6 mm to 10 mm tall; involucral bracts linear-lanceolate, reddish-purple throughout or at least above the middle, rarely green, glabrous, or sparsely hairy; bracteoles few, purplish; discoid or rarely short and yellow; disk flowers orange or reddish (Klinkenberg 2017).

Favourable Habitat

Alpine, lakeshores and herb mats (Porsild and Cody 1980).

Wet to moist meadows in the subalpine and alpine zones (Klinkenberg 2017).

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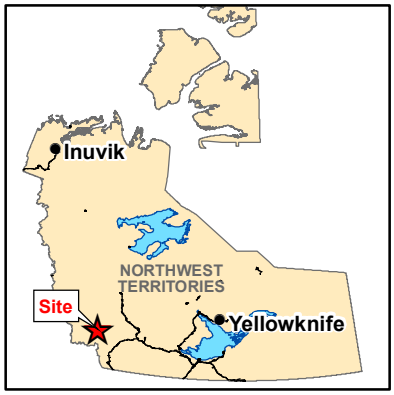
FIGURES

LEGEND

Proposed Prairie Creek Access Road



NOTES
Base data source:
Imagery from ESRI; DigitalGlobe (2016).

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Prairie Creek Mine Overview

PROJECTION	DATUM	CLIENT
NWT Lambert	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:15,000
200 100 0 200
Metres

FILE NO. EARC03145-01_Figure1.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	BB	RH	0

DATE November 21, 2018
PROJECT NO. ENG.EARC03145-01

TETRA TECH

Figure 1

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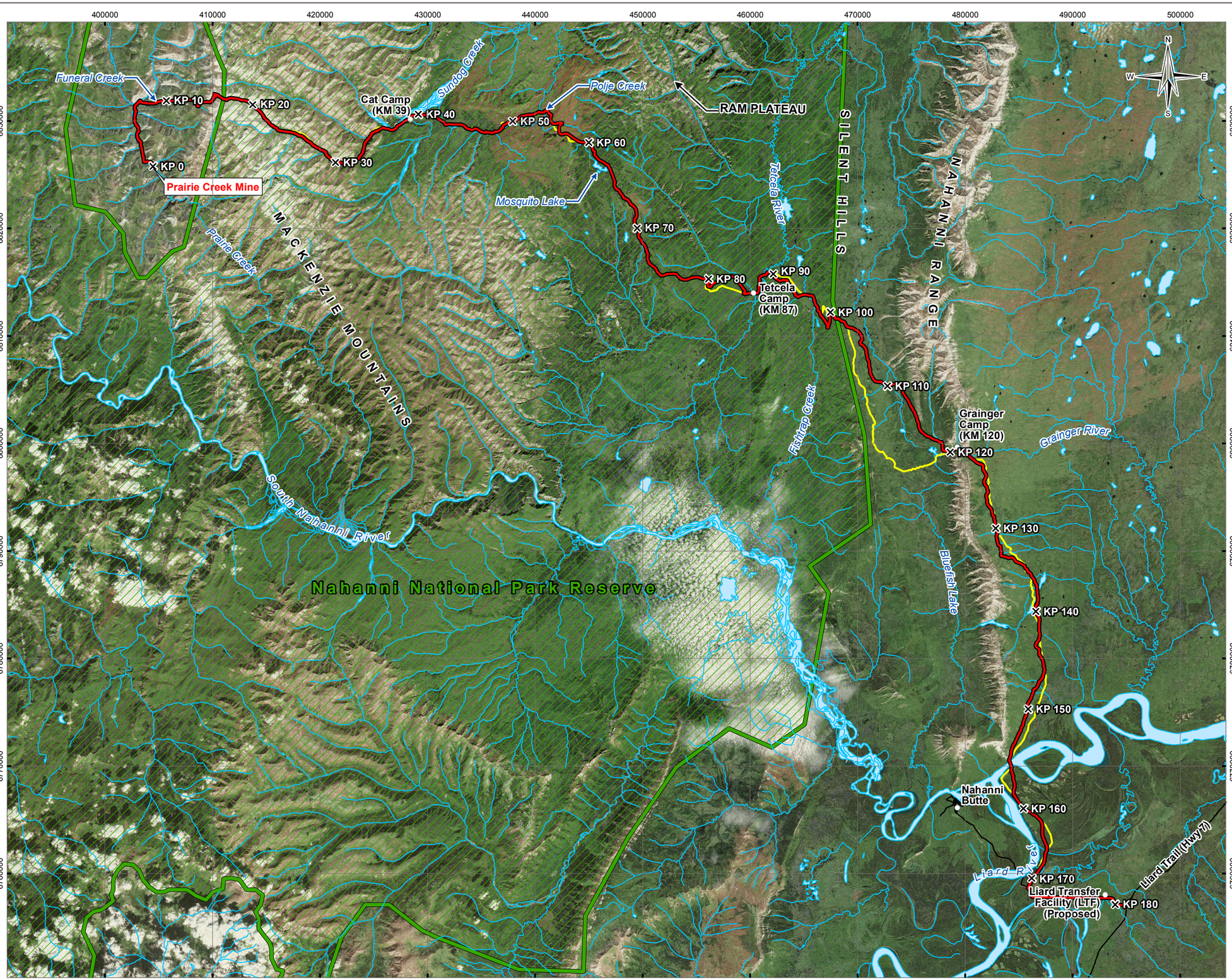

LEGEND

- Access Road Kilometre Marker
- Proposed Prairie Creek Access Road
- Proposed Winter Road Alignment
- Existing Road
- Nahanni National Park Reserve Boundary
- Watercourse
- Waterbody

NOTES
Base data source:
Road alignment provided by AllNorth (July 2018)
Existing roads from CanVec (1:50,000)
Watercourses from CanVec (1:250,000)

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Proposed Access Road Alignment

PROJECTION UTM Zone 10	**DATUM** NAD83			**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:350,000 (5 2.5 0 5 Kilometres)				TETRA TECH
FILE NO. EARC03145-01_Figure2.mxd				
OFFICE Tt-VANC	**DWN** SL	**CKD** BB	**APVD** RH	**REV** 0
DATE December 3, 2018	**PROJECT NO.** ENG.EARC03145-01			**Figure 2**

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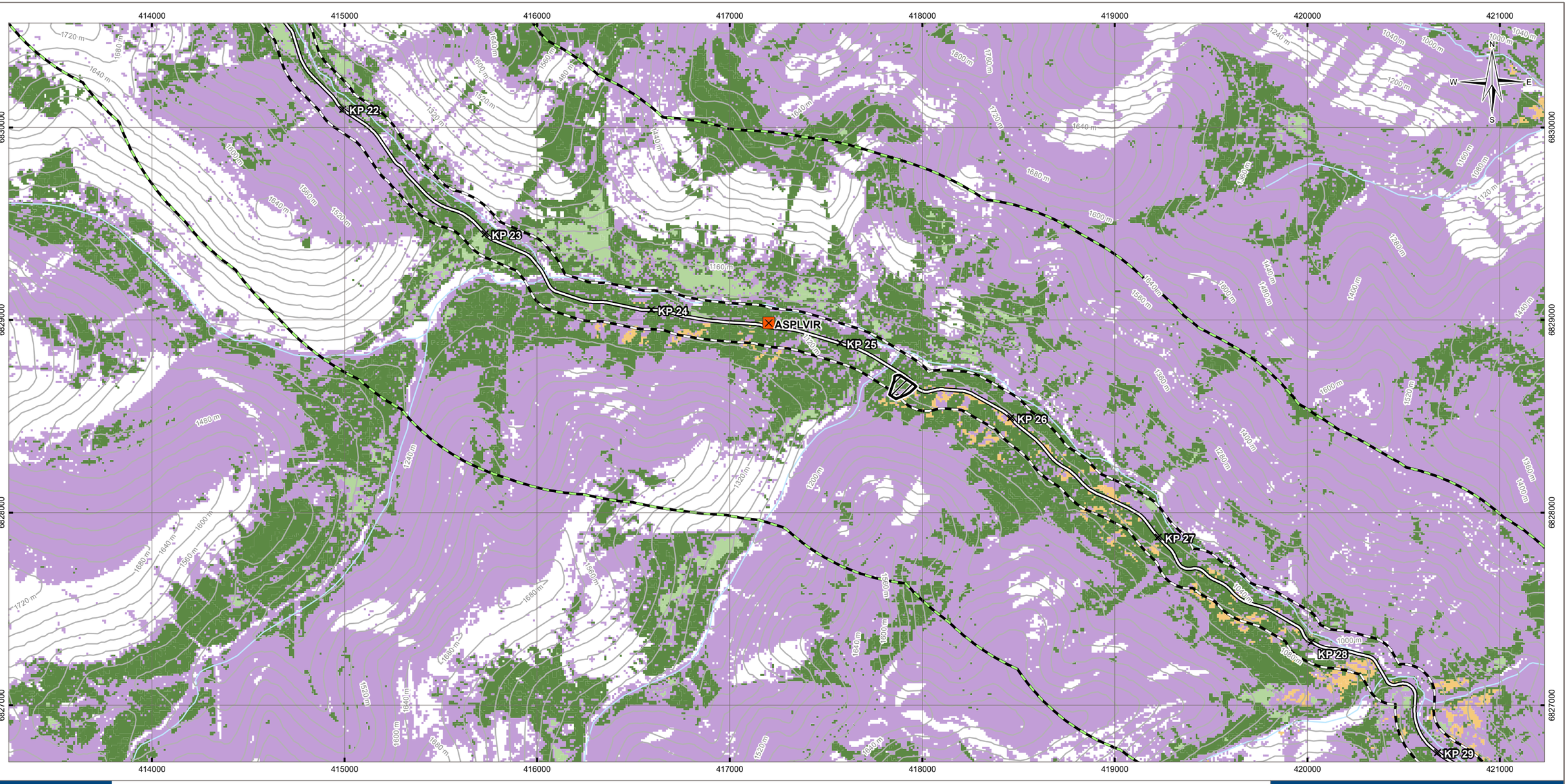

LEGEND

Rare Plant Observation (2017)

- Asplenium viride
  ASPLVIR (4 individuals)

Potential Number of Rare Plant Species

- 16 - 25
- 26 - 30
- 31 - 45
- > 45
- 100 m Buffer
- 1 km Buffer
- Borrow Pit

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Nahanni National Park Reserve Boundary

NOTES
Alignment provided by AllNorth (Nov 2018).
Base data source: CanVec; GeoBase.

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ALL-SEASON ROAD

Rare Plant Species Locations

PROJECTION: UTM Zone 10	DATUM: NAD83			CLIENT: CANADIAN ZINC CORPORATION
Scale: 1:20,000 (400 200 0 400 Metres)				TETRA TECH
FILE NO.: EARC03145-01_Figure01_RarePlants.mxd				
OFFICE: Tt-VANC	DWN: SL	CKD: MRV	APVD: TP	REV: 0
DATE: December 18, 2018	PROJECT NO.: ENW.EENW03326-01			Figure 3a

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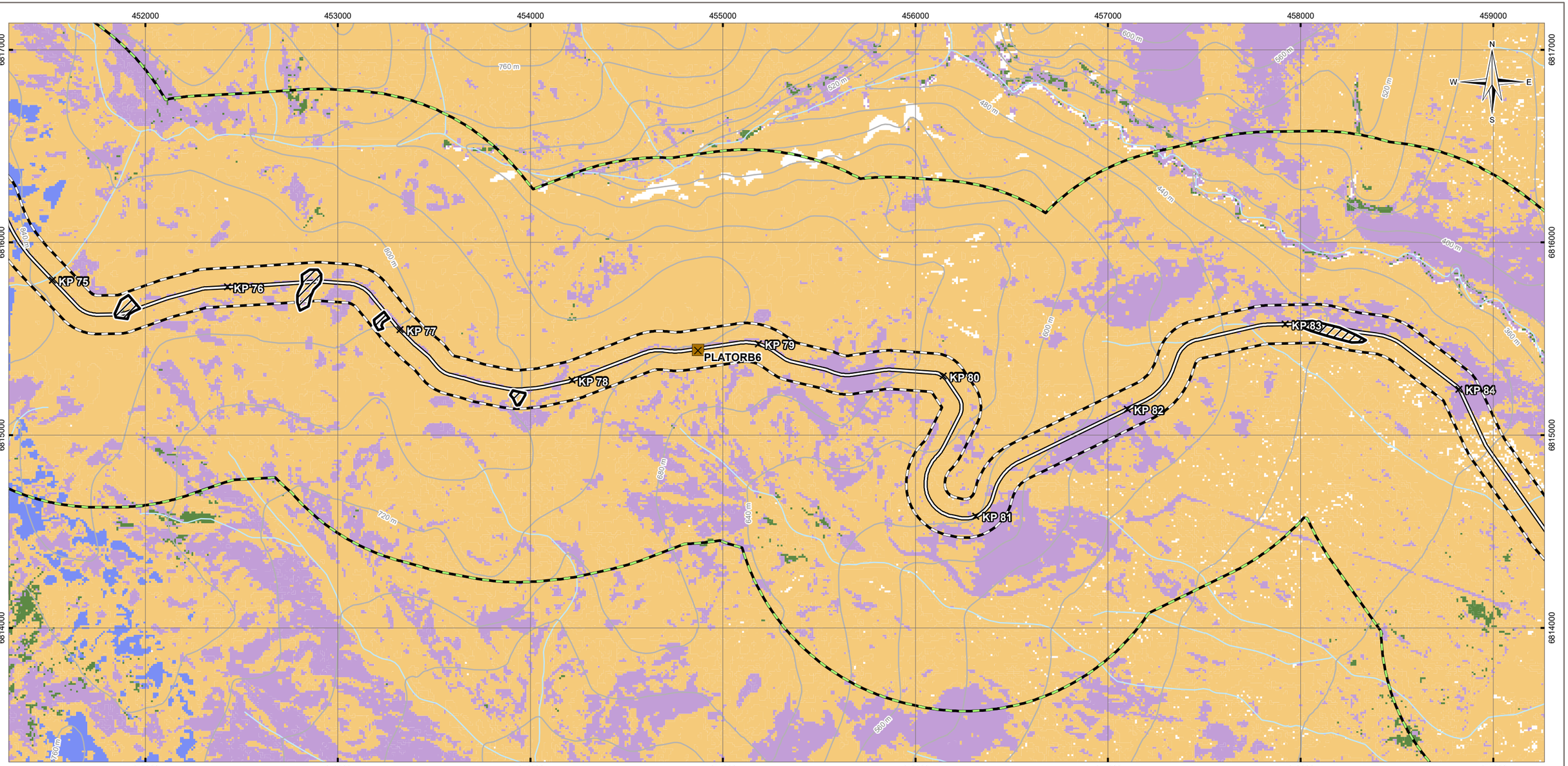


LEGEND

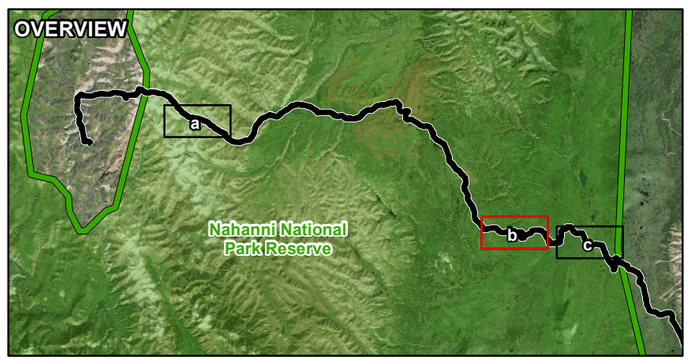
Rare Plant Observation (2017)

- Platanthera orbiculata
  PLATORB6 (1 individual)

Potential Number of Rare Plant Species

- <15
- 16 - 25
- 26 - 30
- 31 - 45
- > 45
- 100 m Buffer
- 1 km Buffer
- Borrow Pit

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Nahanni National Park Reserve Boundary



NOTES
Alignment provided by AllNorth (Nov 2018).
Base data source: CanVec; GeoBase.

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ALL-SEASON ROAD

Rare Plant Species Locations

PROJECTION: UTM Zone 10	DATUM: NAD83			CLIENT: Canadian Zinc Corporation
Scale: 1:20,000 (400 200 0 400 Metres)				TETRA TECH
FILE NO.: EARC03145-01_Figure01_RarePlants.mxd				
OFFICE: Tt-VANC	DWN: SL	CKD: MRV	APVD: TP	REV: 0
DATE: December 18, 2018	PROJECT NO.: ENW.EENW03326-01			Figure 3b

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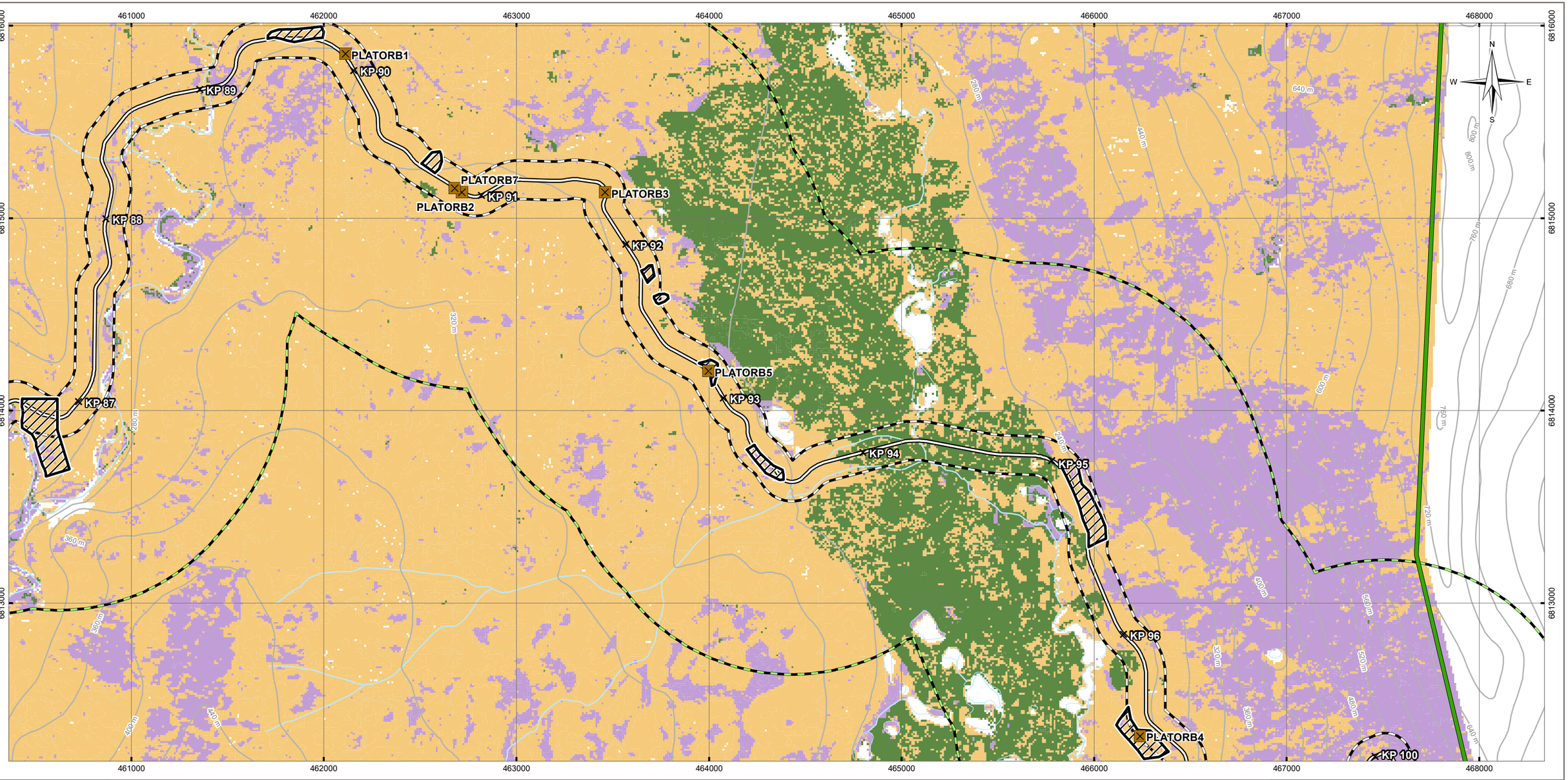

LEGEND

Rare Plant Observation (2017)

- Platanthera orbiculata
- PLATORB1 (6 individuals)
- PLATORB7 (1 individual)
- PLATORB2 (11 individuals)
- PLATORB3 (2 individuals)
- PLATORB5 (5 individuals)
- PLATORB4 (6 individuals)

Potential Number of Rare Plant Species

- 16 - 25
- 26 - 30
- 31 - 45
- > 45
- 100 m Buffer
- 1 km Buffer
- Borrow Pit

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- Nahanni National Park Reserve Boundary

NOTES
Alignment provided by AllNorth (Nov 2018).
Base data source: CanVec; GeoBase.

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ALL-SEASON ROAD

Rare Plant Species Locations

PROJECTION: UTM Zone 10	DATUM: NAD83			CLIENT: CANADIAN ZINC CORPORATION
Scale: 1:20,000 (400 200 0 400 Metres)				TETRA TECH
FILE NO.: EARC03145-01_Figure01_RarePlants.mxd				
OFFICE: Tt-VANC	DWN: SL	CKD: MRV	APVD: TP	REV: 0
DATE: December 18, 2018	PROJECT NO.: ENW.EENW03326-01			Figure 3c

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APPENDIX A

ACCESS ROAD MAP BOOK

LEGEND

- Access Road Kilometre Marker
- 2018 Borehole (Tetra Tech, 2018)
- 2014 Borehole (Tetra Tech EBA, 2014)
- 2012 Borehole (SNC-Lavalin, 2012)
- 2014 Testpit (Tetra Tech EBA, 2014)
- 2014 Testpit (Allnorth, 2014)
- Camp/Laydown
- Watercourse Crossing
- Prairie Creek Access Road (November 2018)
- Potential Permafrost Section
- Proposed Winter Road Alignment
- Nahanni National Park Reserve Boundary
- Potential Borrow Source
- Contour (40 m)
- Watercourse
- Waterbody

NOTES
Base data source: CanVec; GeoBase.
Base imagery source: DigitalGlobe, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION: UTM Zone 10				DATUM: NAD83	CLIENT: CANADIAN ZINC CORPORATION
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LEGEND

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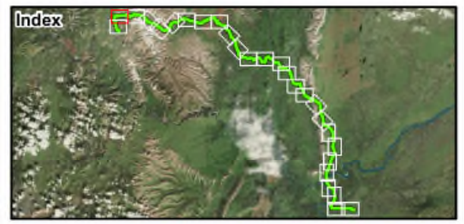

NOTES
Base data source: CanVec; GeoBase.
Base imagery source: DigitalGlobe, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

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LEGEND

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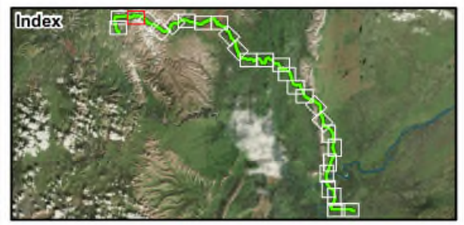

NOTES
Base data source: CanVec; GeoBase.
Base imagery source: DigitalGlobe, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

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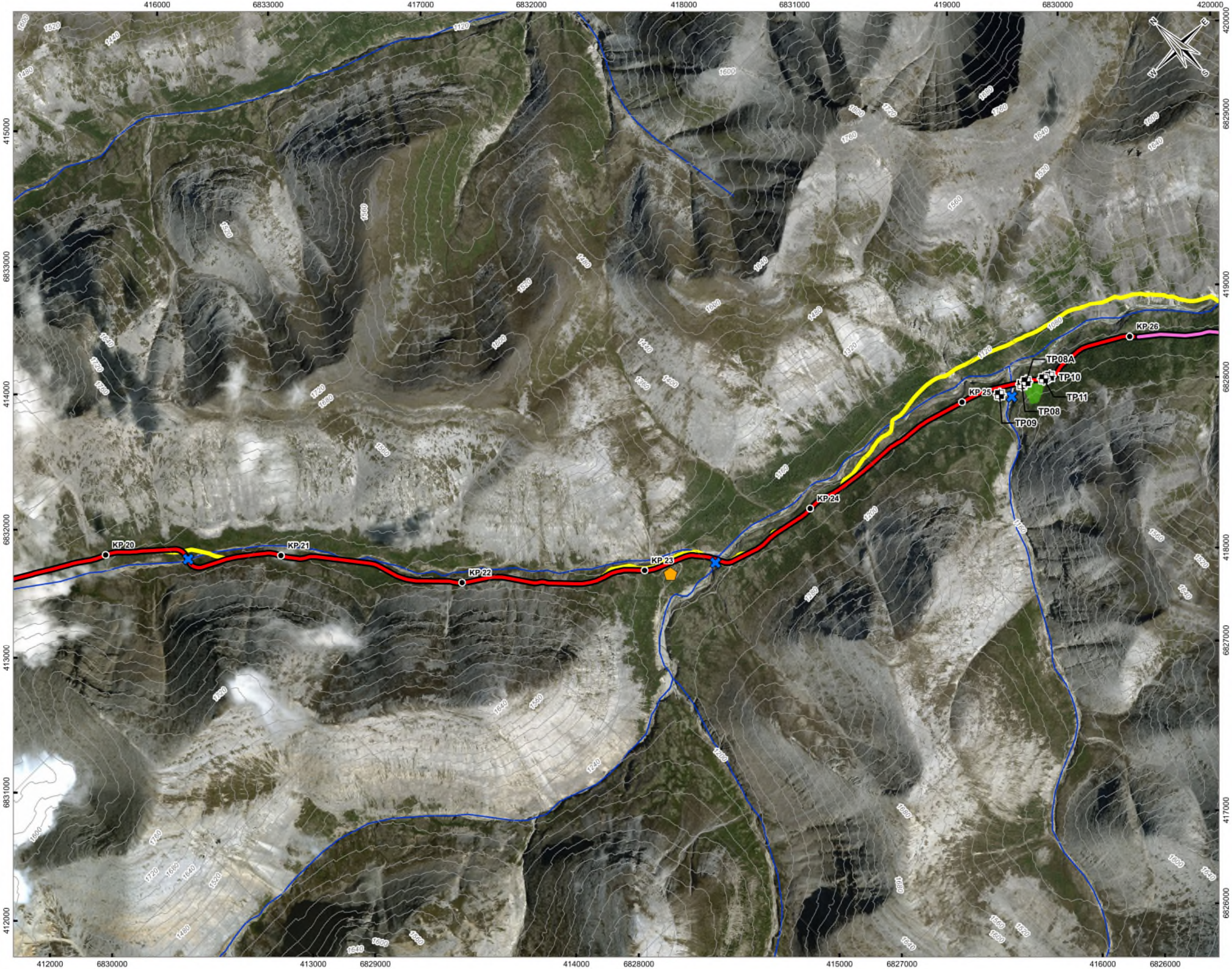

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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: DigitalGlobe, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000
400 200 0 400
Metres

TETRA TECH

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TI-VANC	MRV	SL	TB	4
DATE	**PROJECT NO.**			
November 29, 2018	ENG.EARC03145-01			

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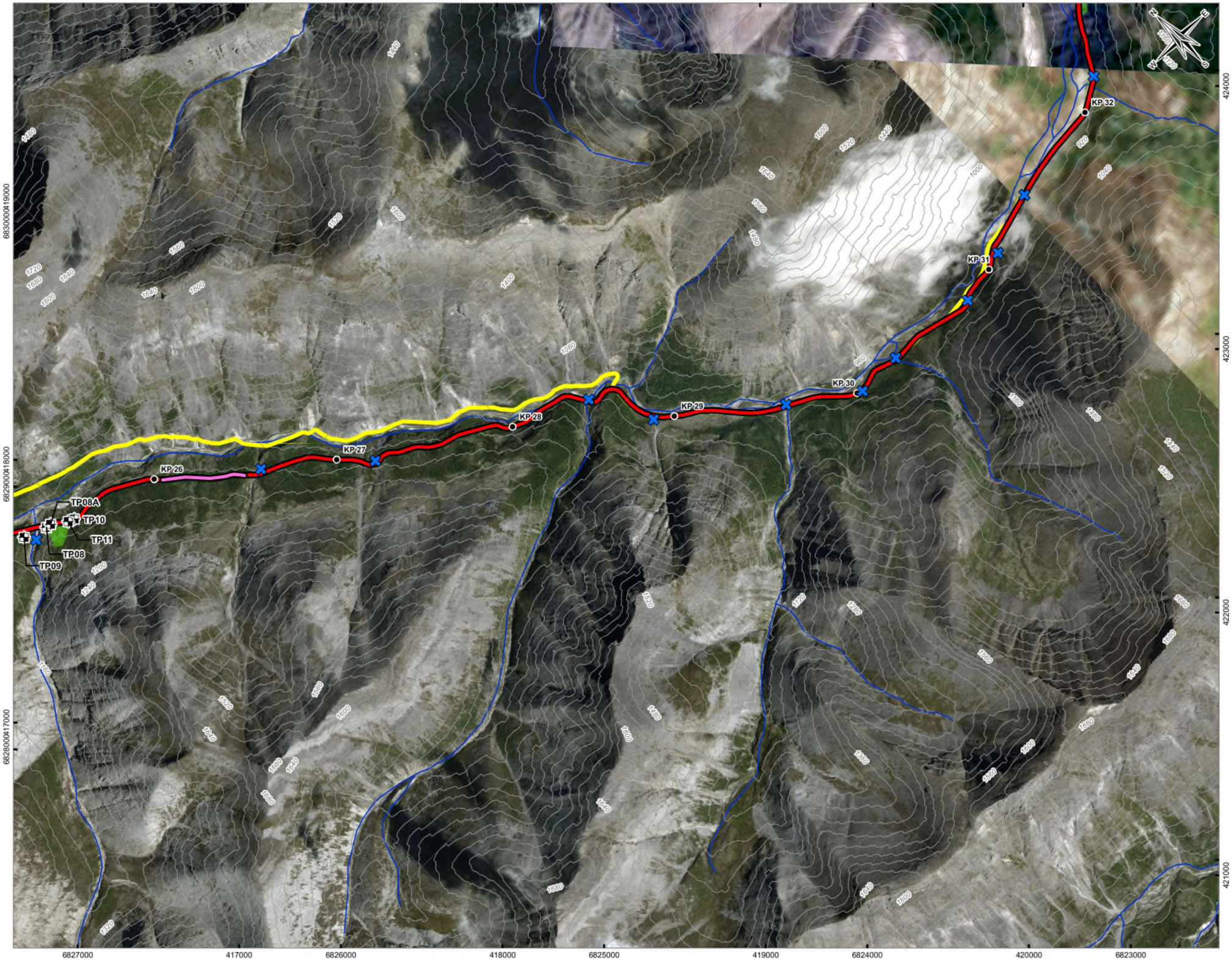

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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: DigitalGlobe, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION UTM Zone 10		**DATUM** NAD83		**CLIENT** CANADIAN ZINC CORPORATION
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DATE November 29, 2018	**PROJECT NO.** ENG.EARC03145-01			**A5**

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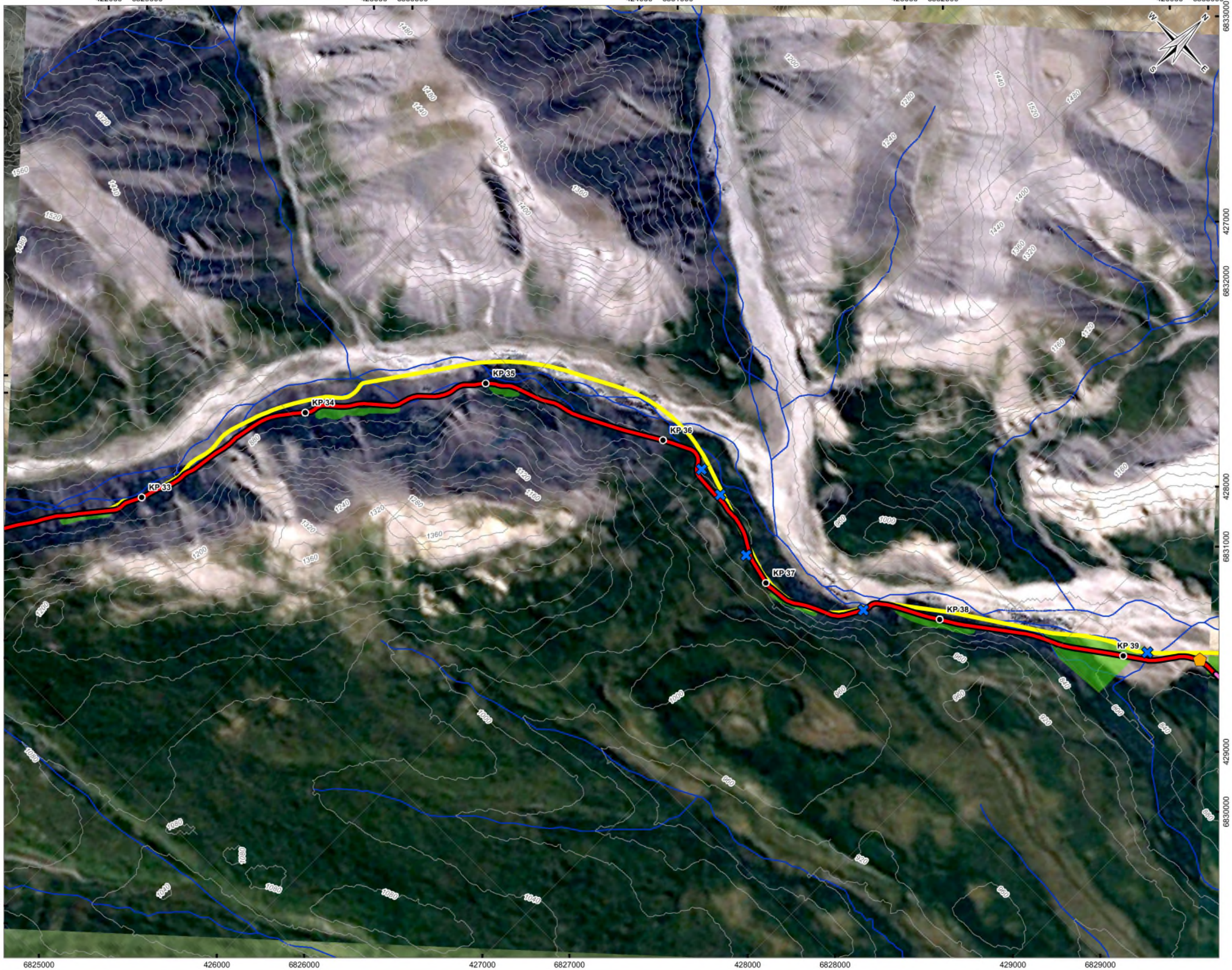

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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION UTM Zone 10		**DATUM** NAD83		**CLIENT** CANADIAN ZINC CORPORATION
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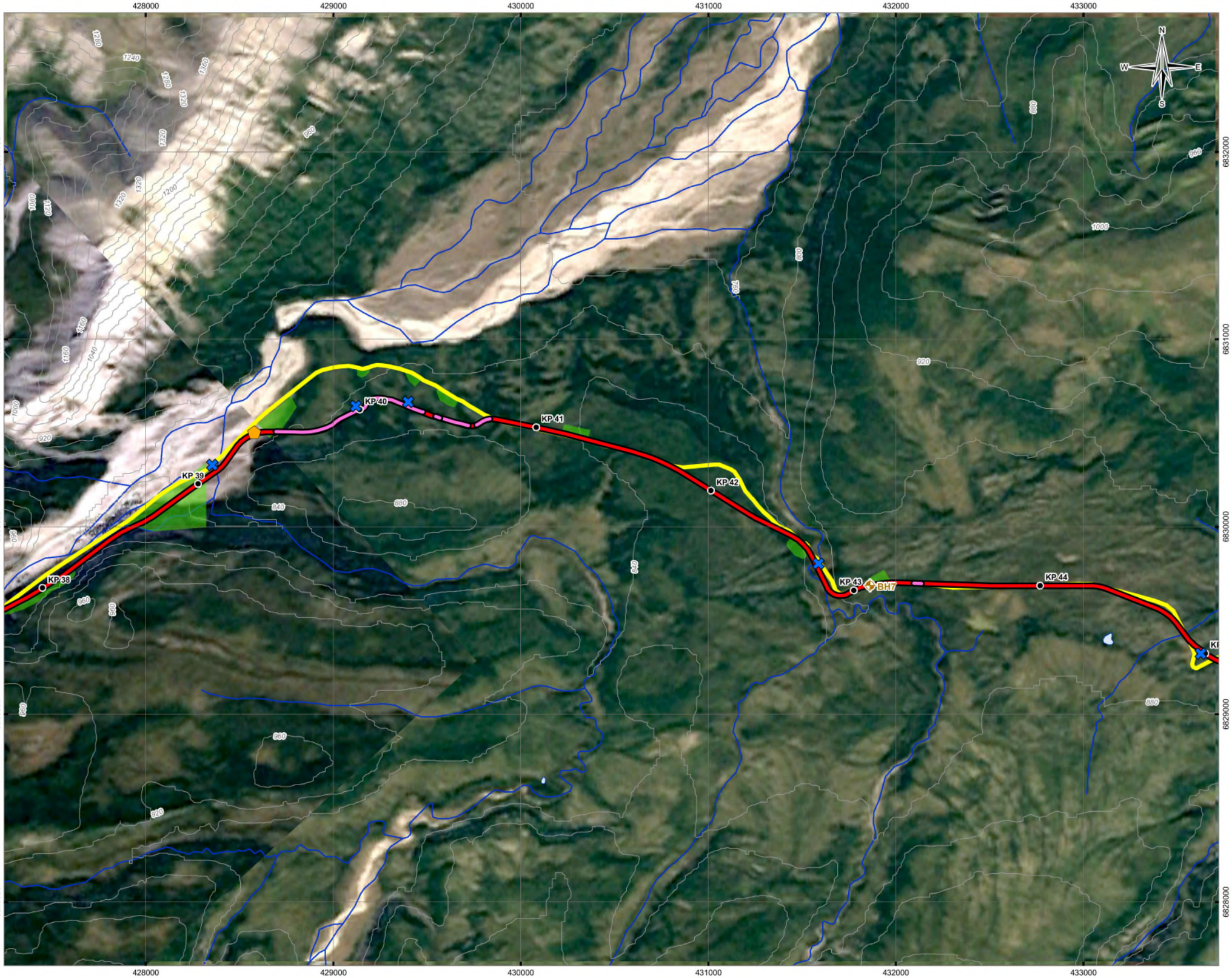

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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION: UTM Zone 10	DATUM: NAD83			CLIENT: CANADIAN ZINC CORPORATION
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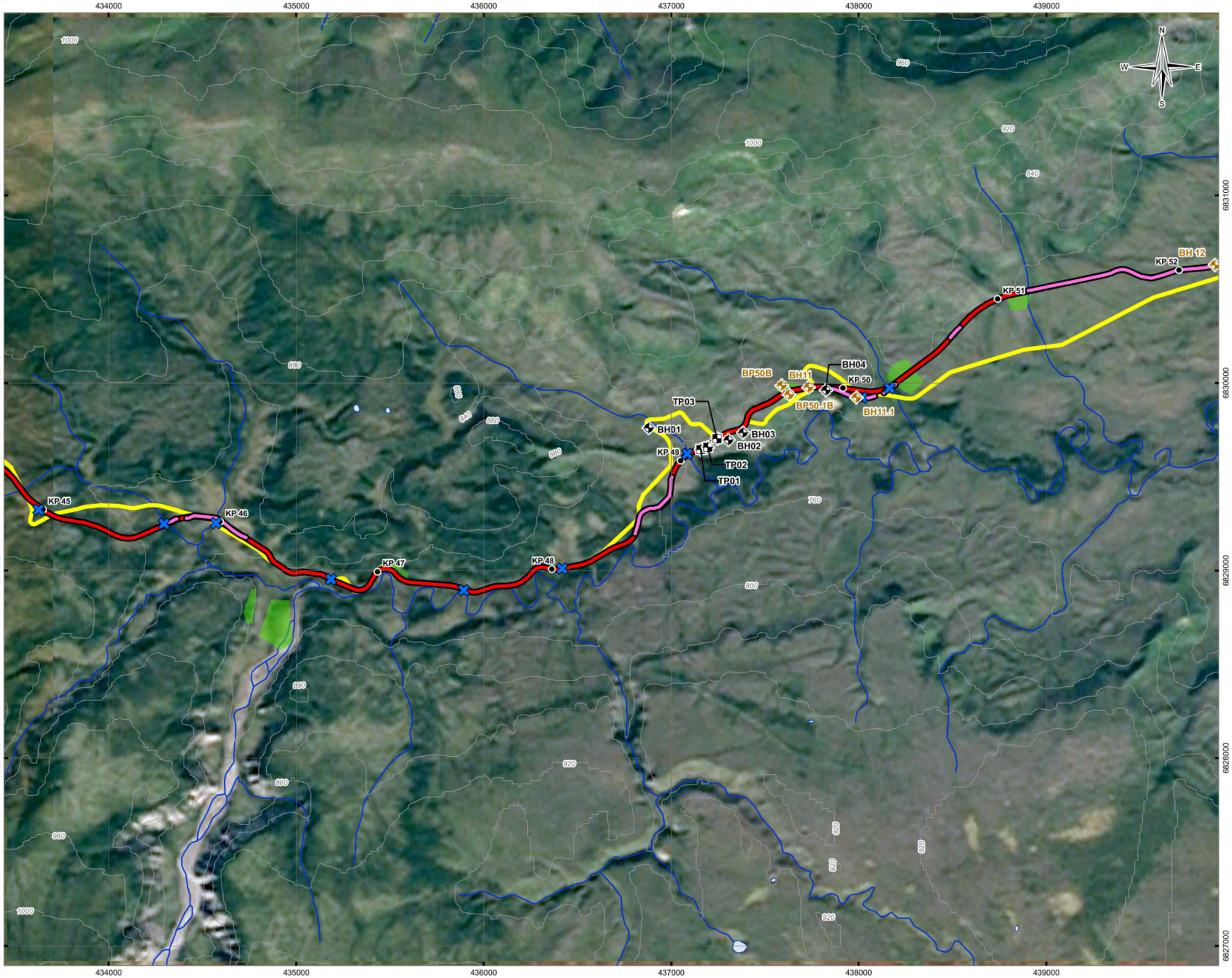

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NOTES
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Base imagery source: Google Earth, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION UTM Zone 10		**DATUM** NAD83		**CLIENT** CANADIAN ZINC CORPORATION
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DATE November 29, 2018	**PROJECT NO.** ENG.EARC03145-01			**A8**

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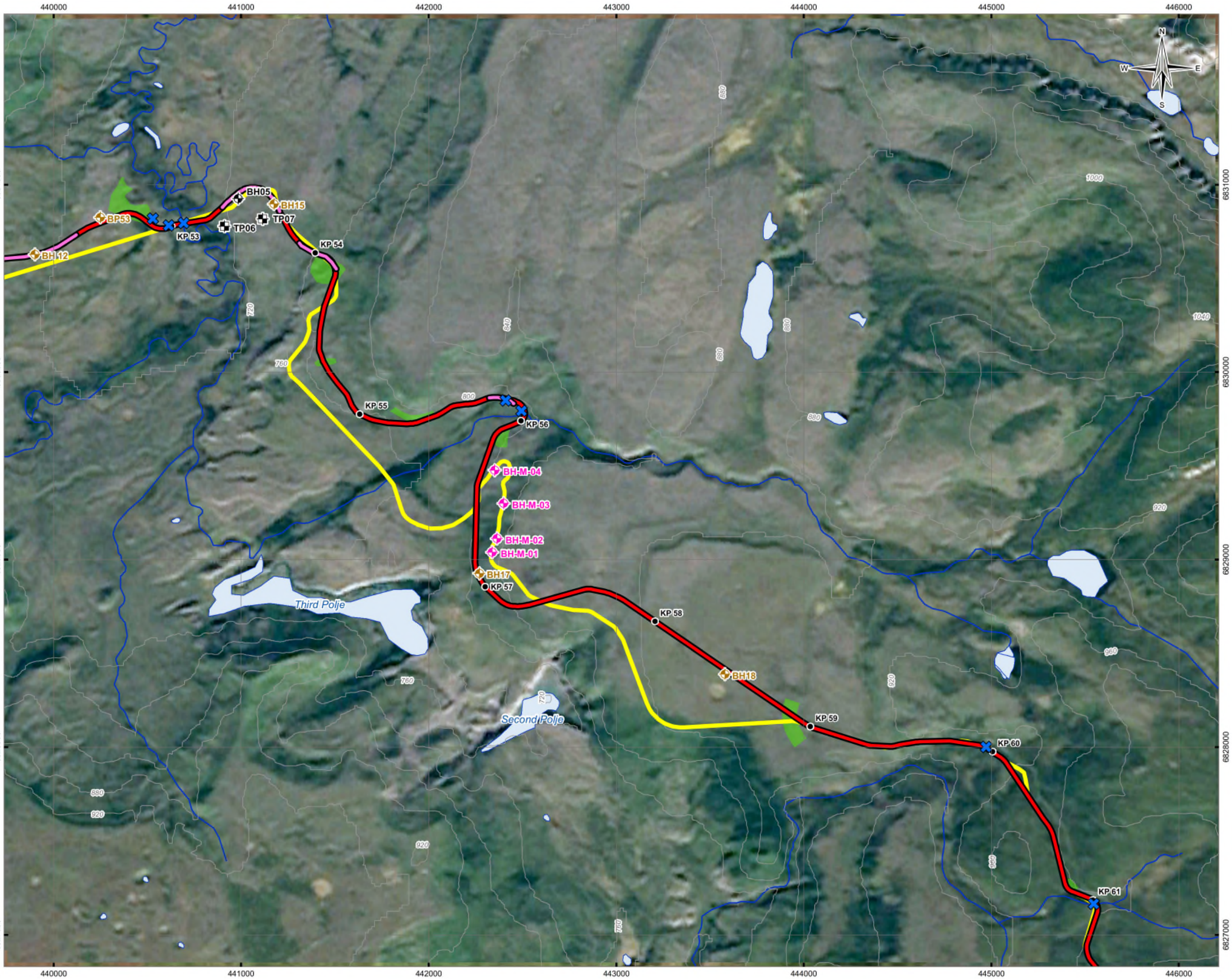

LEGEND

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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION: UTM Zone 10			DATUM: NAD83		CLIENT: CANADIAN ZINC CORPORATION
Scale: 1:20,000 (400 200 0 400 Metres)					TETRA TECH
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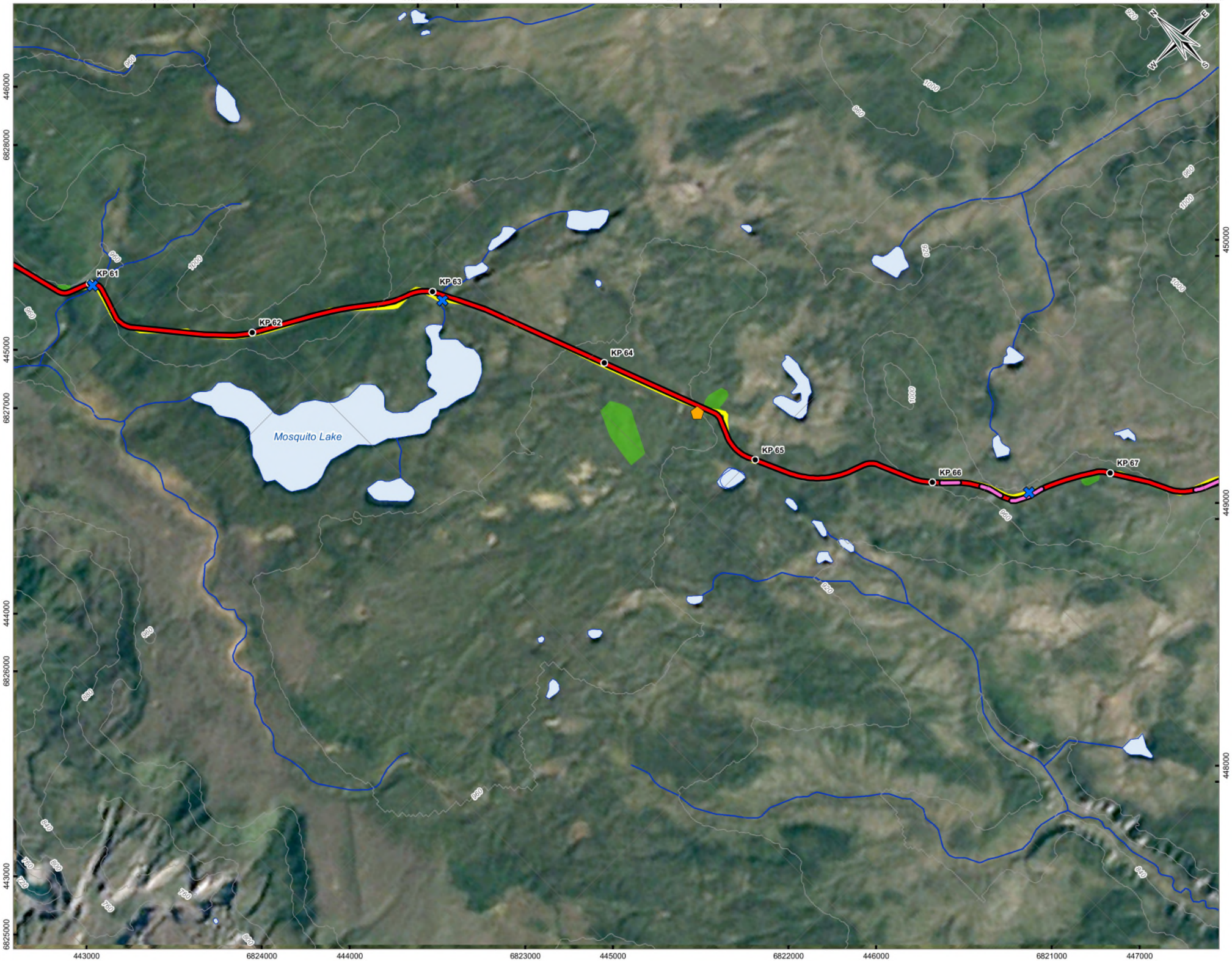

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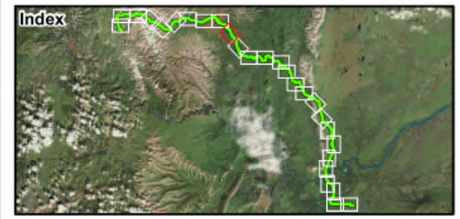

NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000
400 200 0 400
Metres

TETRA TECH

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November 29, 2018	ENG.EARC03145-01			

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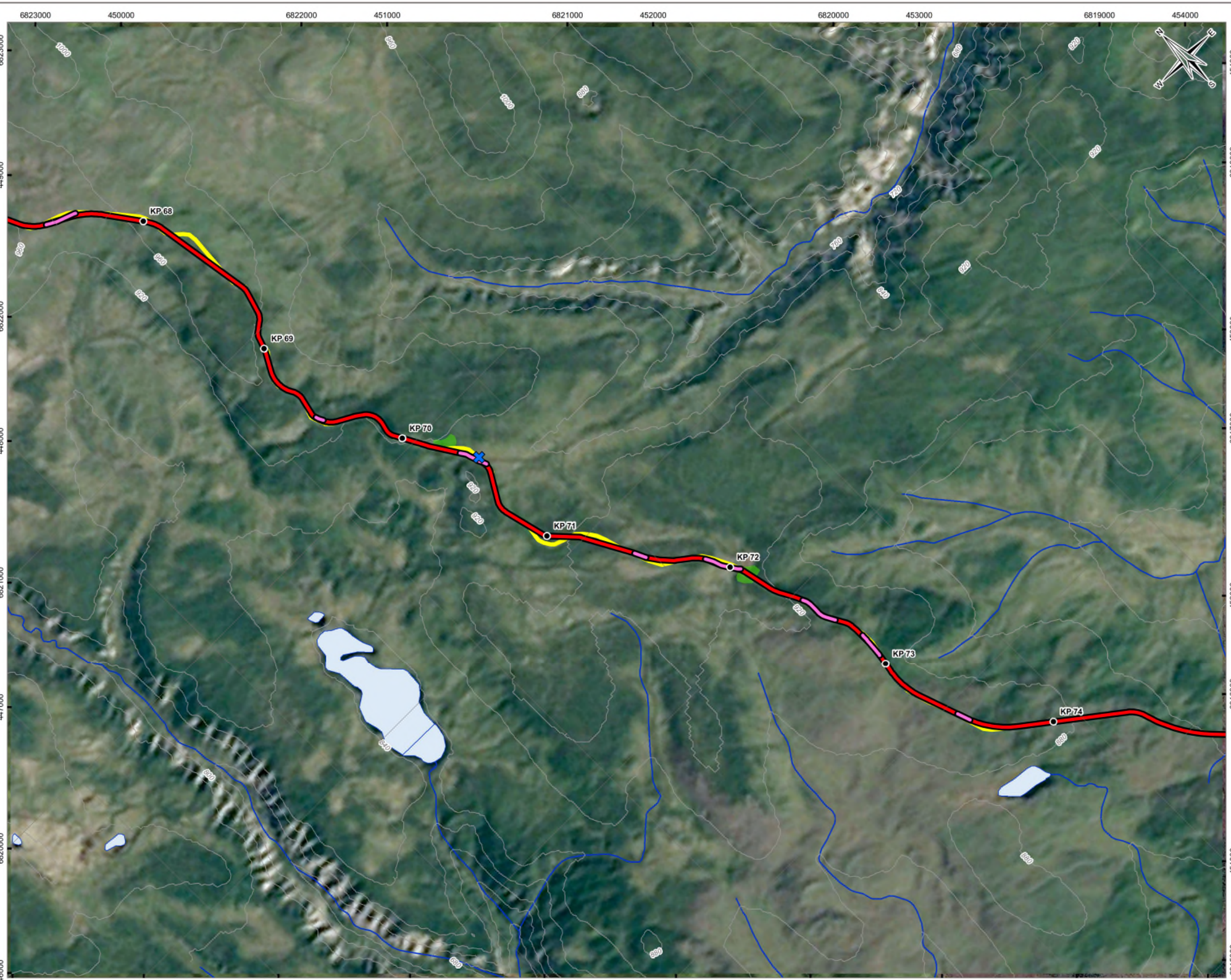

LEGEND

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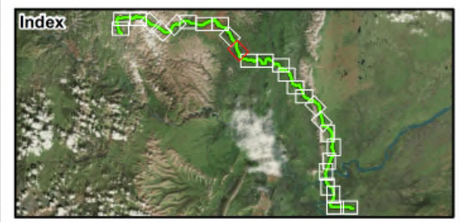

NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2016

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION UTM Zone 10	**DATUM** NAD83			**CLIENT** CANADIAN ZINC CORPORATION
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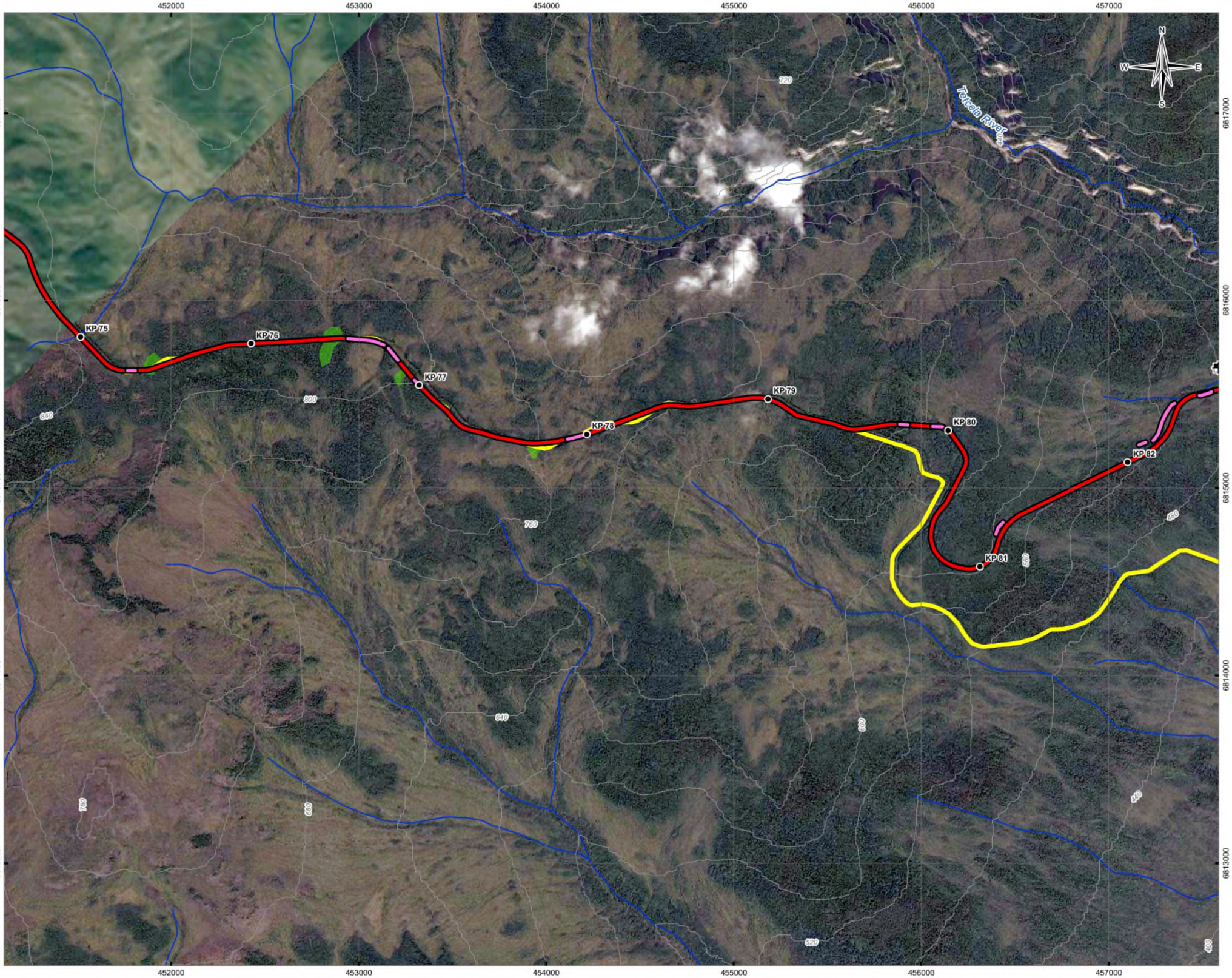

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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Bing Maps Aerial

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION UTM Zone 10				**DATUM** NAD83	**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:20,000 400 200 0 400 Metres					TETRA TECH
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DATE November 29, 2018	**PROJECT NO.** ENG.EARC03145-01				

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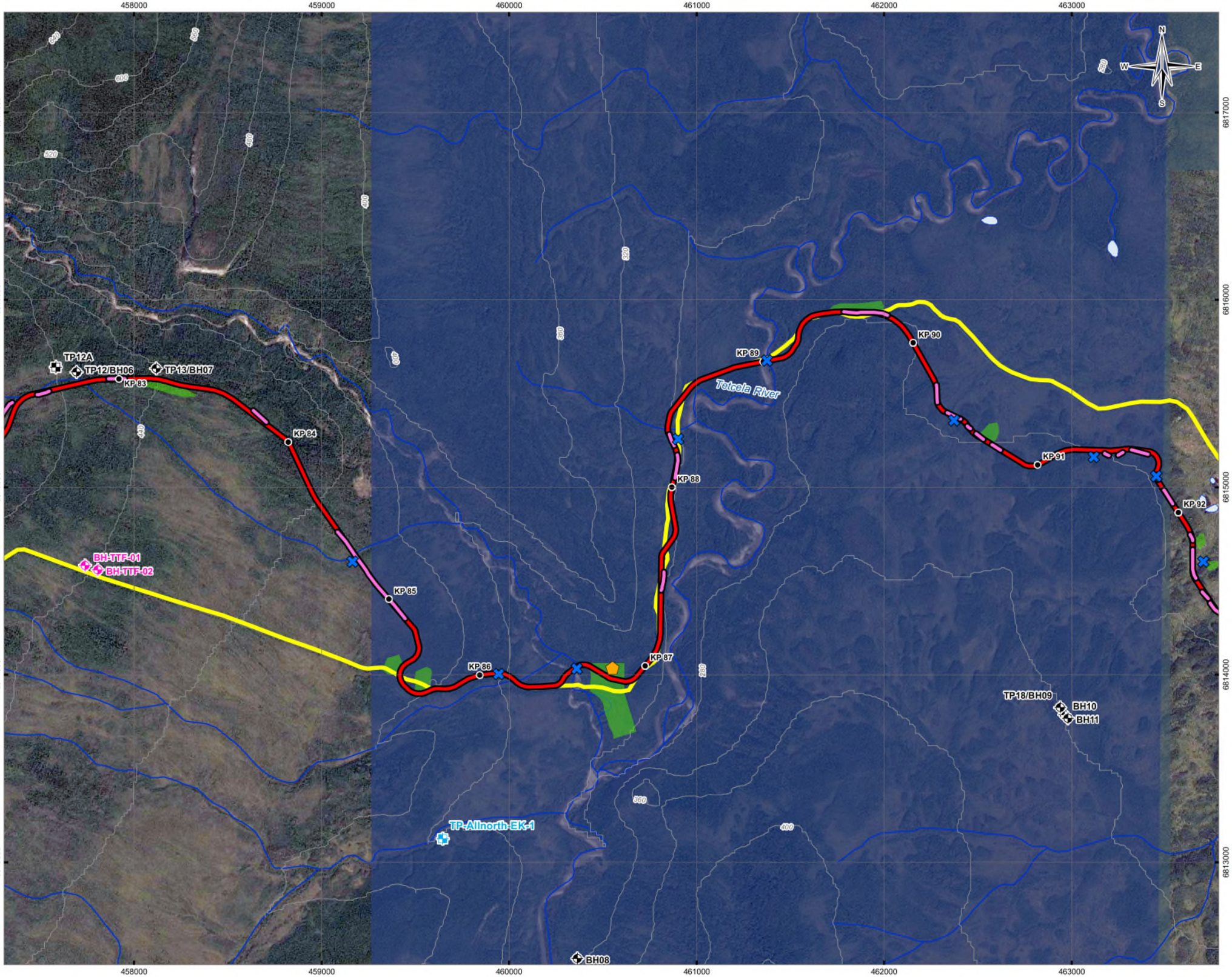

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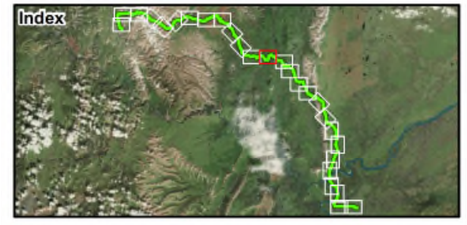


NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Bing Maps Aerial

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000
400 200 0 400
Metres

TETRA TECH

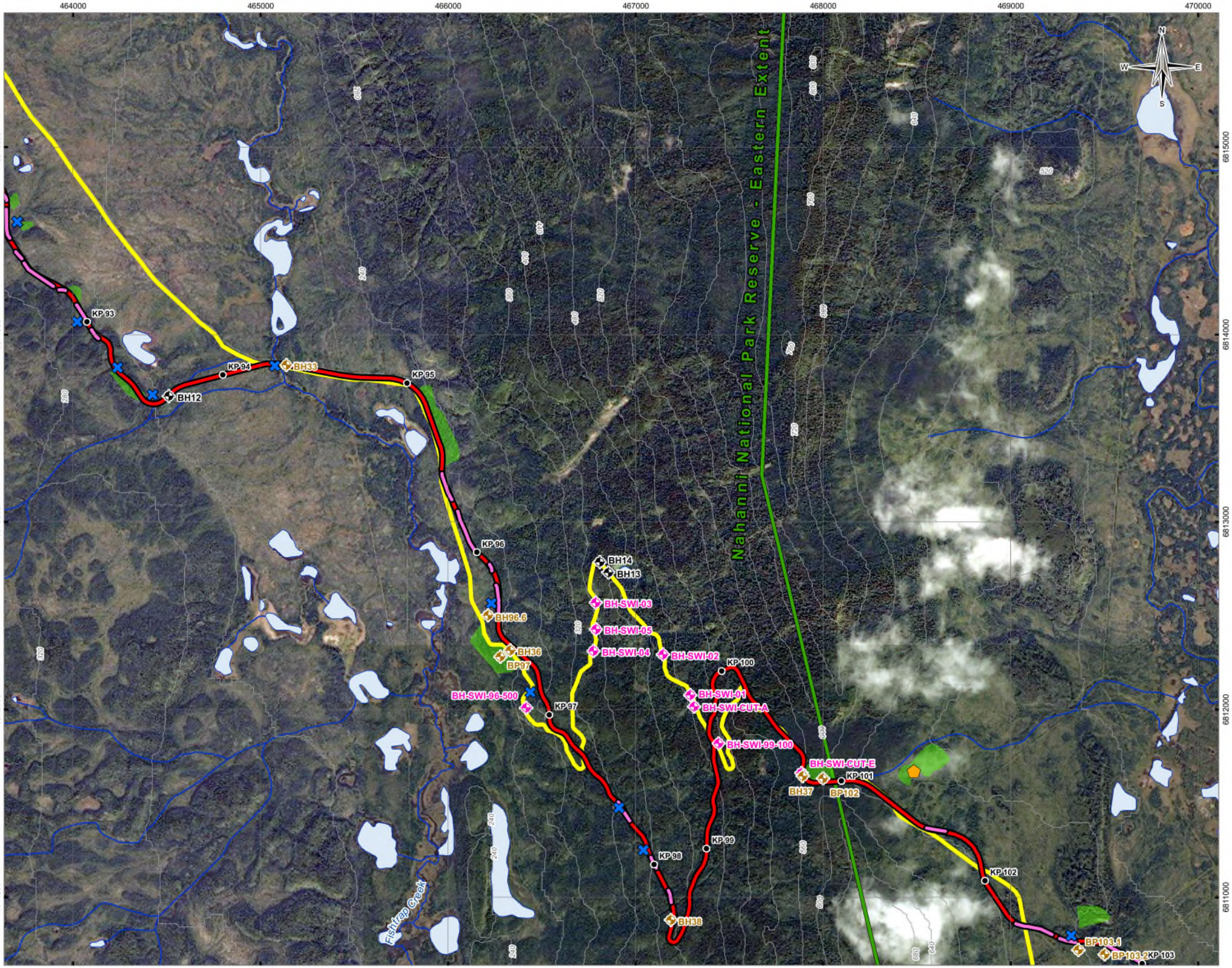
FILE NO.
EARC03145-01_FigureA.mxd

OFFICE	DWN	CKD	APVD	REV
TI-VANC	MRV	SL	TB	4

DATE
November 29, 2018

PROJECT NO.
ENG.EARC03145-01

A13



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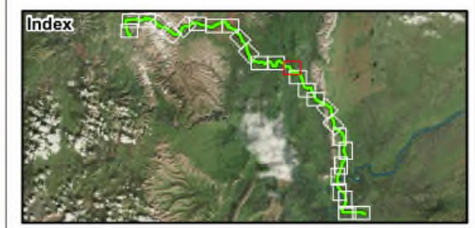
- Contour (40 m)
- Watercourse
- Waterbody



NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Bing Maps Aerial

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION: UTM Zone 10	DATUM: NAD83			CLIENT: CANADIAN ZINC CORPORATION
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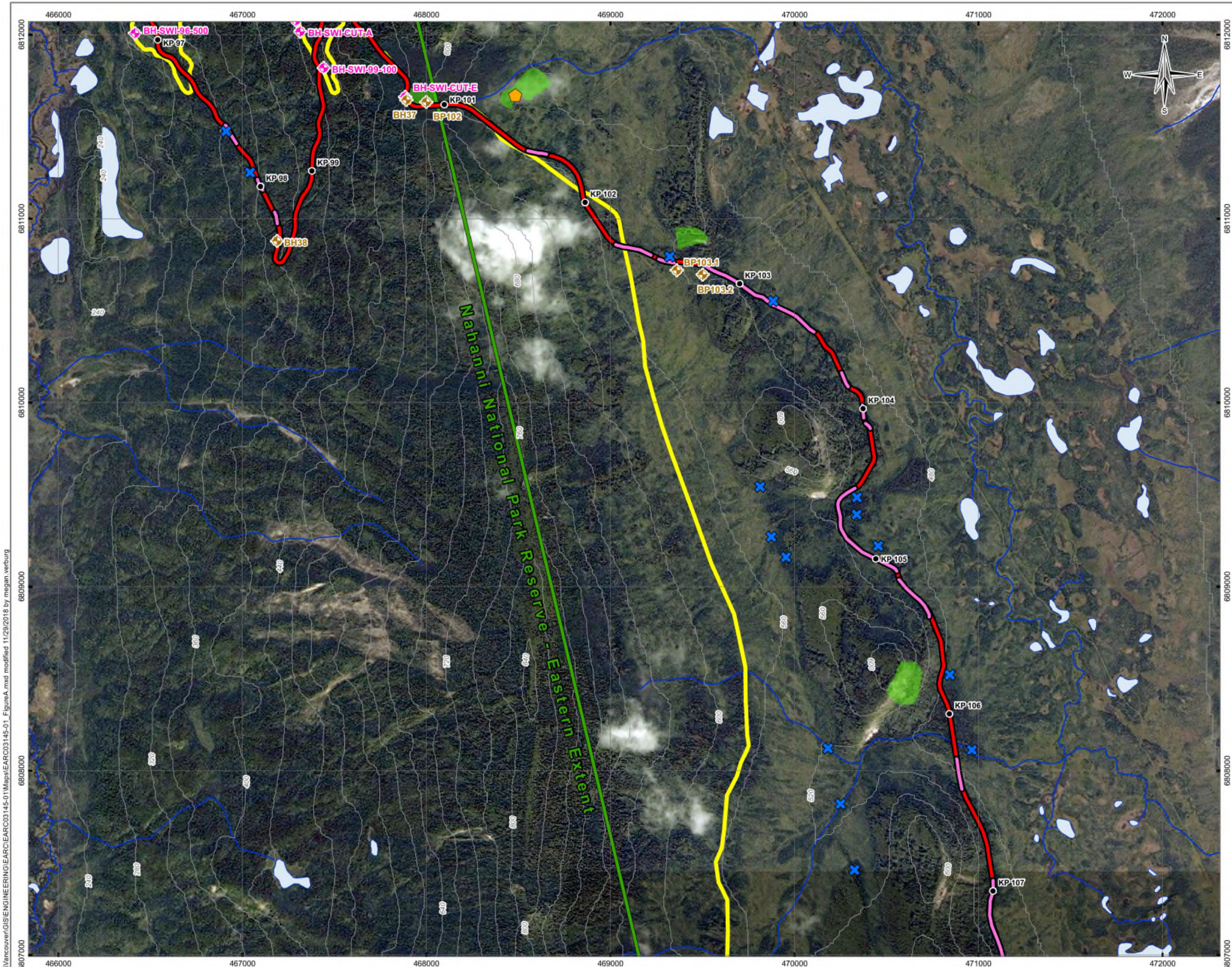

LEGEND

- Access Road Kilometre Marker
- 2018 Borehole (Tetra Tech, 2018)
- 2014 Borehole (Tetra Tech EBA, 2014)
- 2012 Borehole (SNC-Lavalin, 2012)
- 2014 Testpit (Tetra Tech EBA, 2014)
- 2014 Testpit (Allnorth, 2014)
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- Potential Permafrost Section
- Proposed Winter Road Alignment
- Nahanni National Park Reserve Boundary
- Potential Borrow Source
- Contour (40 m)
- Watercourse
- Waterbody

NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Bing Maps Aerial

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000
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Metres

TETRA TECH

FILE NO.
EARC03145-01_FigureA.mxd

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BP109
KP 109
KP 110
BH43.2
BH43.1
KP 111
KP 112
KP 113
KP 114
KP 115

Nahanni National Park Reserve - Eastern Extent

LEGEND

- Access Road Kilometre Marker
- 2018 Borehole (Tetra Tech, 2018)
- 2014 Borehole (Tetra Tech EBA, 2014)
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- Watercourse
- Waterbody

NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Bing Maps Aerial

STATUS
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PRAIRIE CREEK ACCESS ROAD

Map Book

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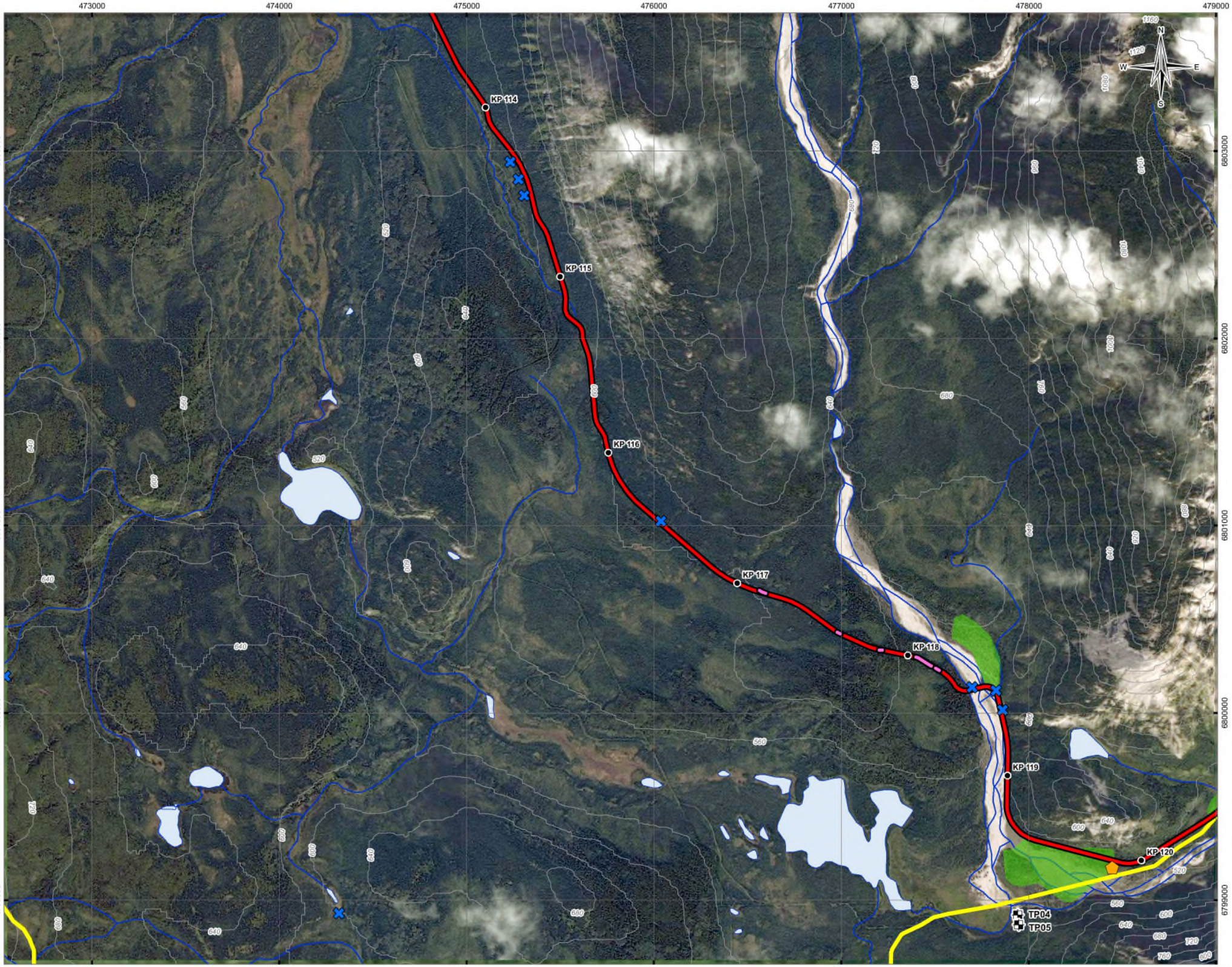

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- Access Road Kilometre Marker
- 2018 Borehole (Tetra Tech, 2018)
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- Watercourse
- Waterbody

NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Bing Maps Aerial

STATUS
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PRAIRIE CREEK ACCESS ROAD

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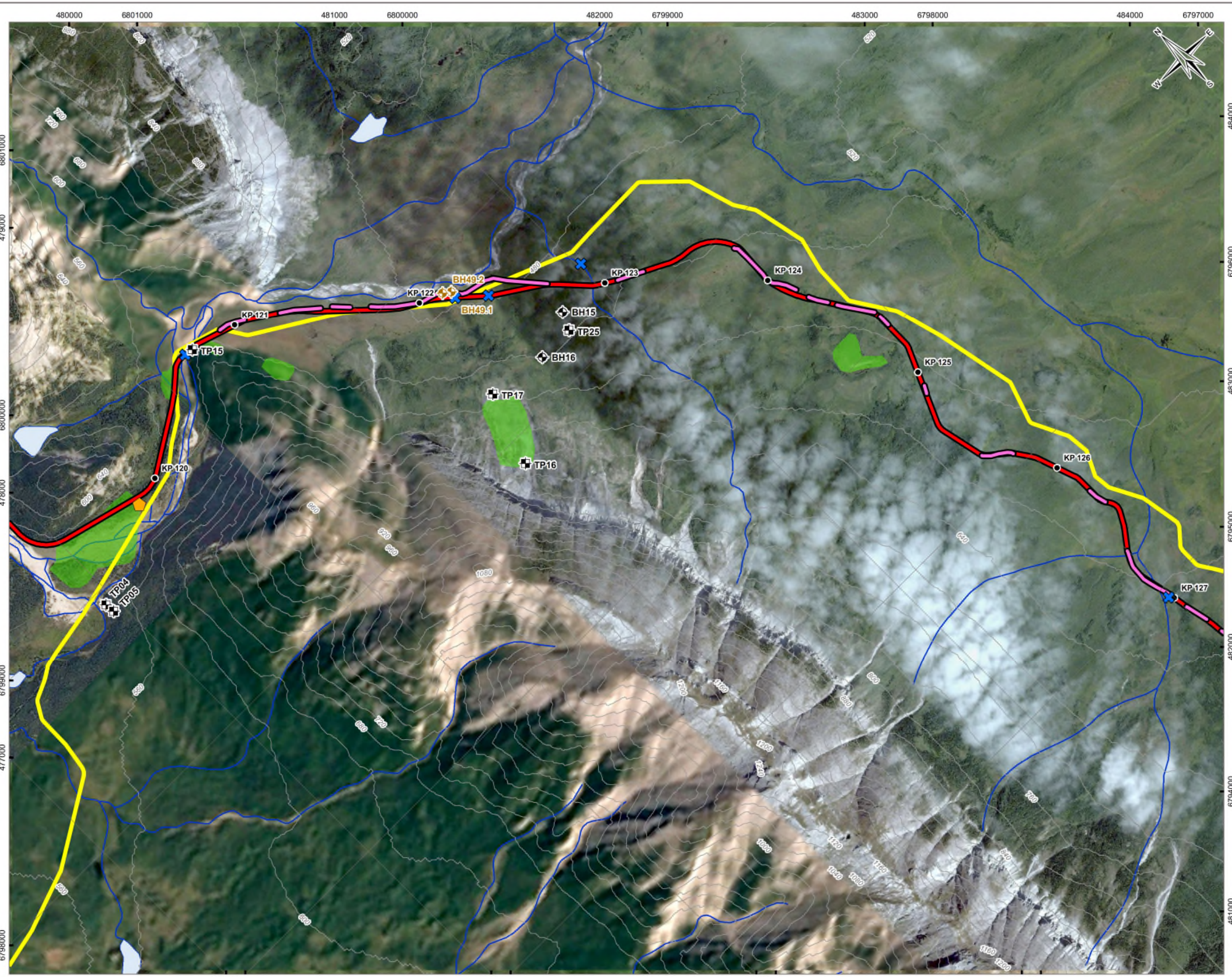

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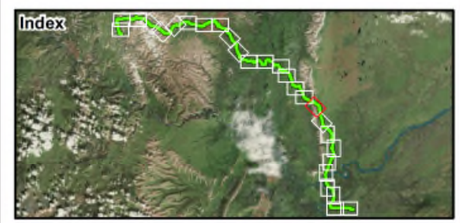

NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2007

STATUS
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PRAIRIE CREEK ACCESS ROAD

Map Book

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FILE NO. EARC03145-01_FigureA.mxd			
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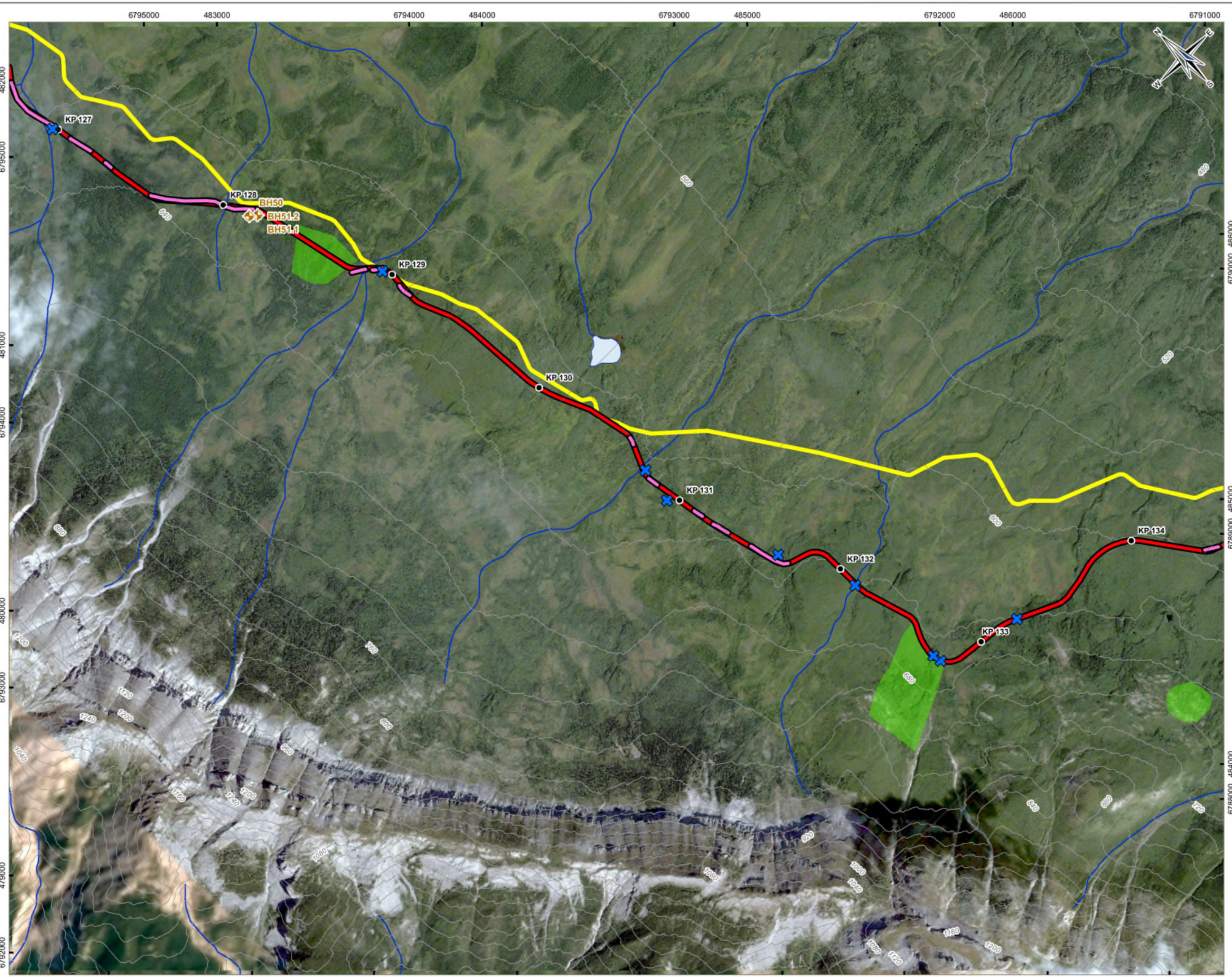

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- Access Road Kilometre Marker
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- Watercourse
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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2007

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000
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Metres

TETRA TECH

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KP 133 KP 134 KP 135 KP 136 KP 137 KP 138 KP 139 KP 140

BH137.1 BH54

LEGEND

- Access Road Kilometre Marker
- 2018 Borehole (Tetra Tech, 2018)
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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2007

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

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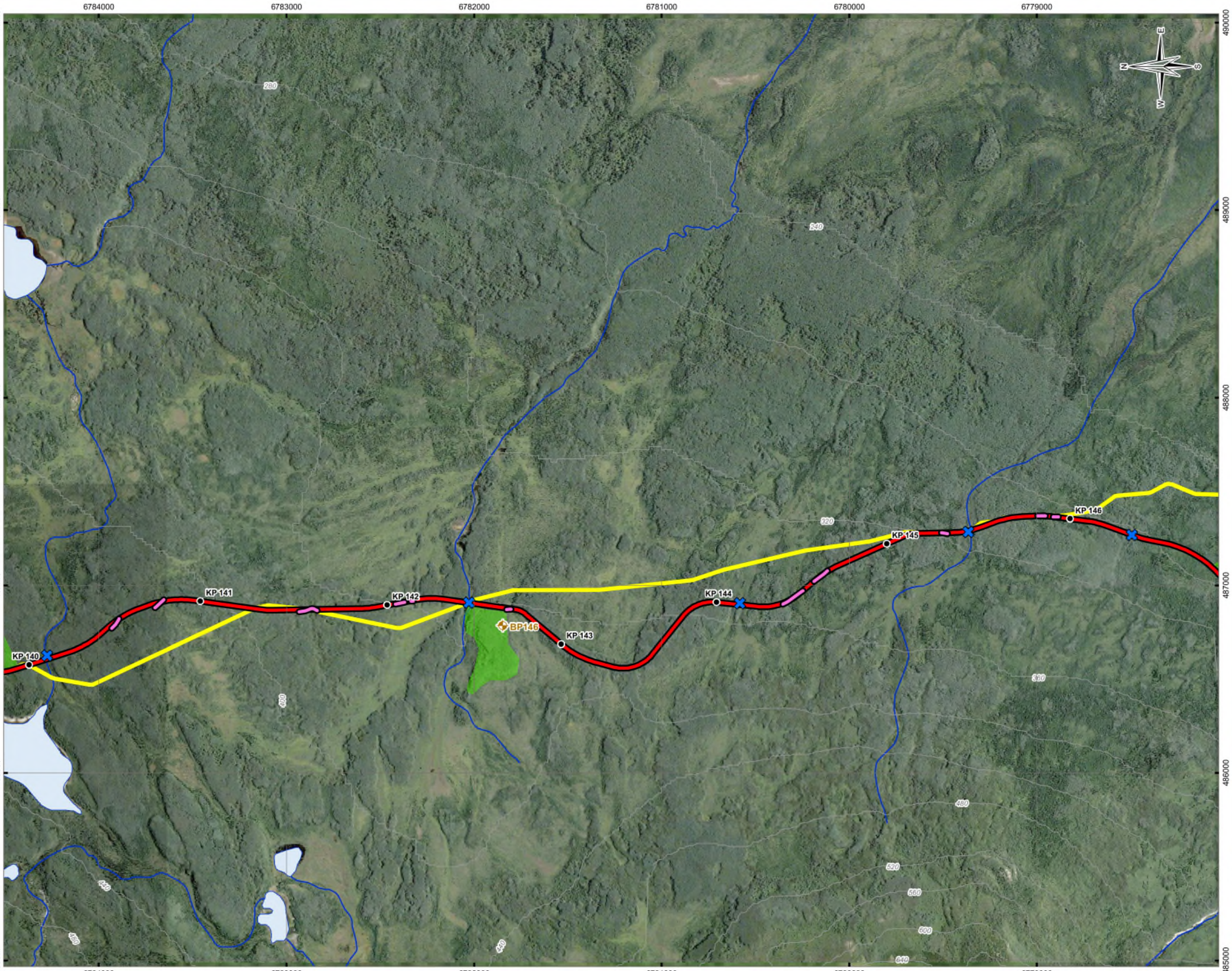

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- Access Road Kilometre Marker
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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2007

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

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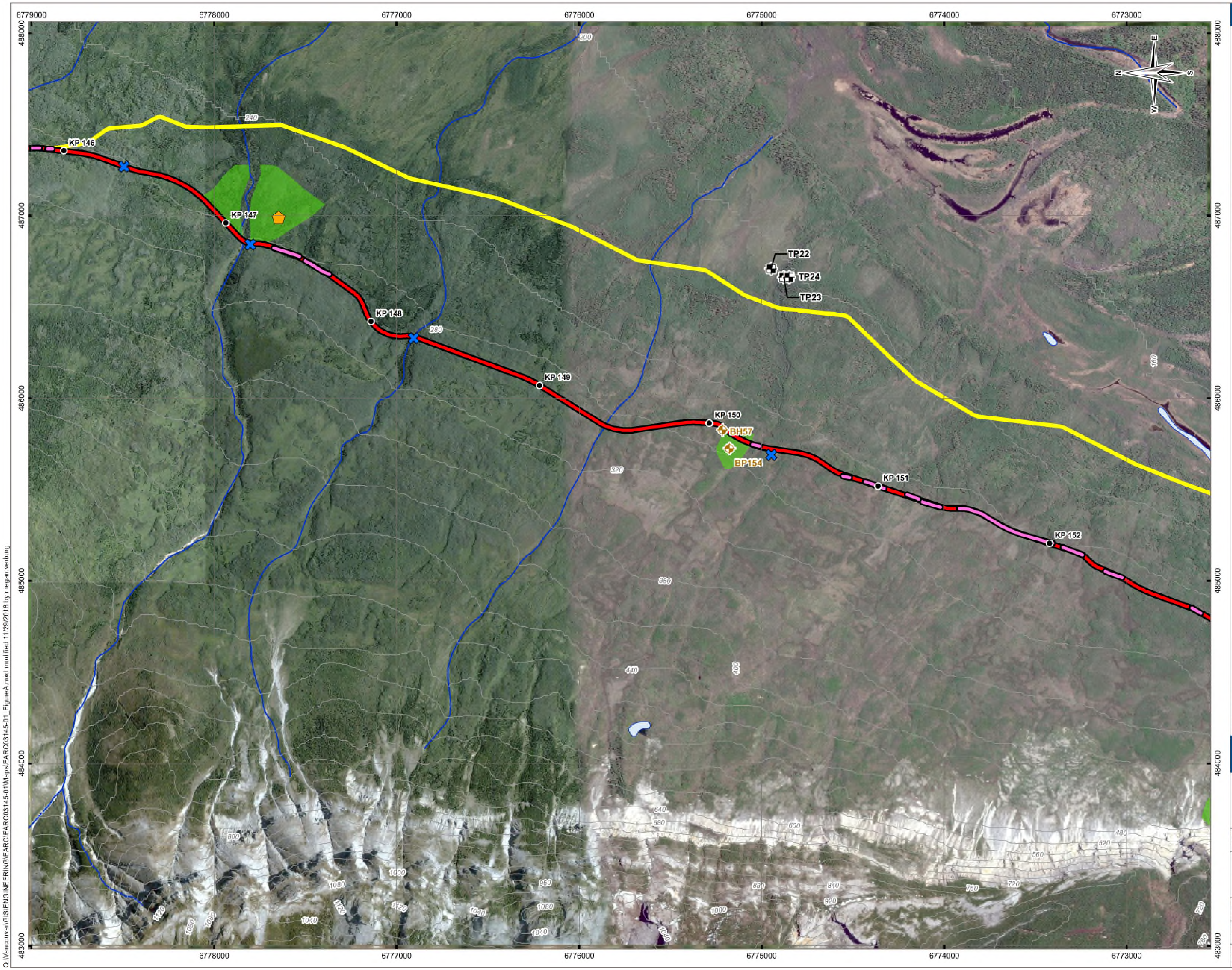

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LEGEND

- Access Road Kilometre Marker
- 2018 Borehole (Tetra Tech, 2018)
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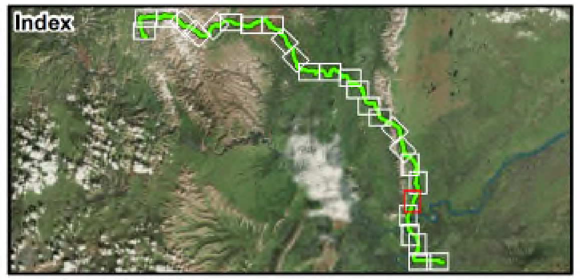

NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2007-2015

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

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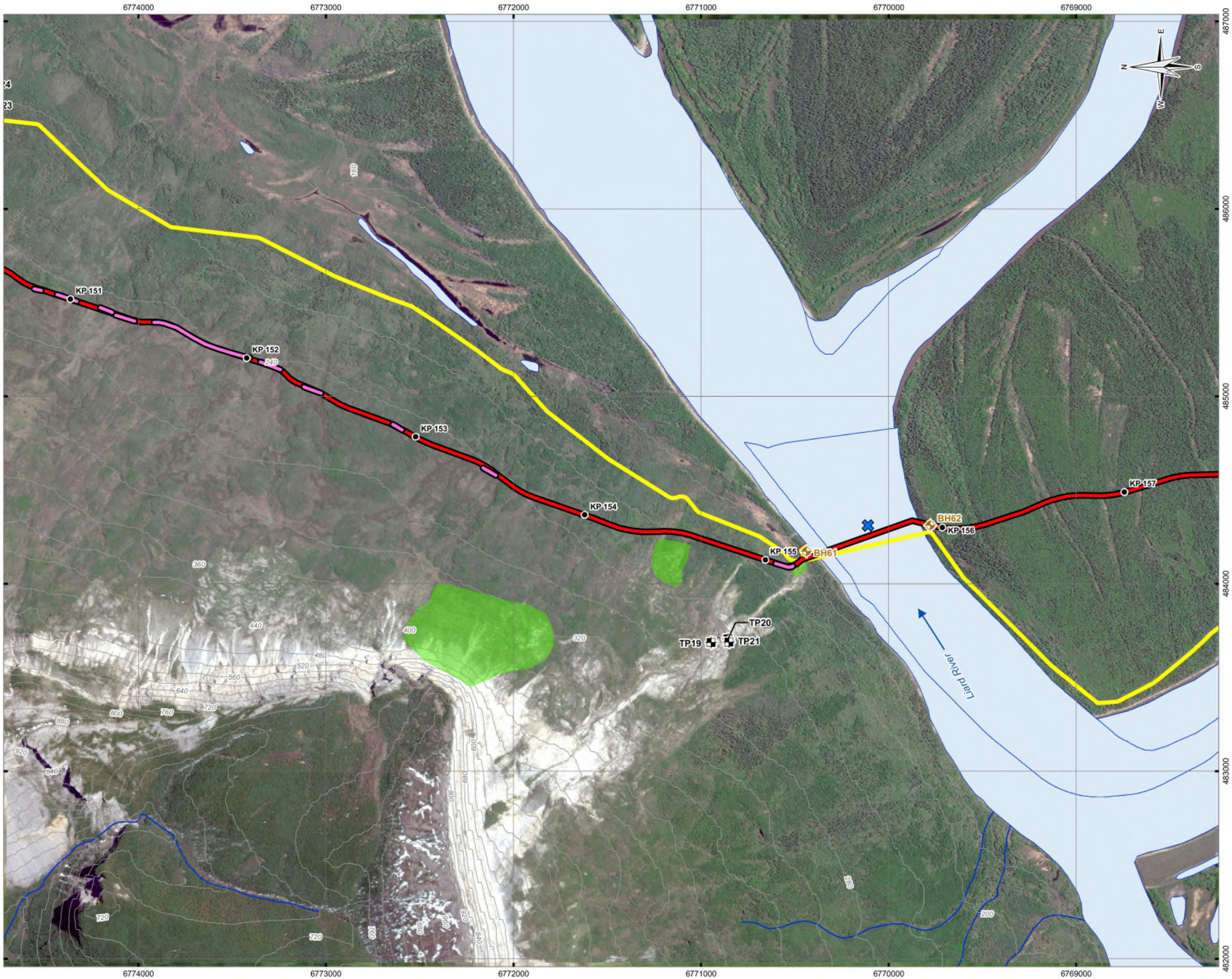

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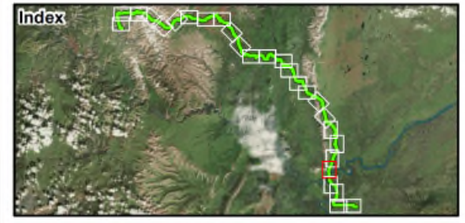

NOTES
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Base imagery source: Google Earth, 2015

STATUS
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PRAIRIE CREEK ACCESS ROAD

Map Book

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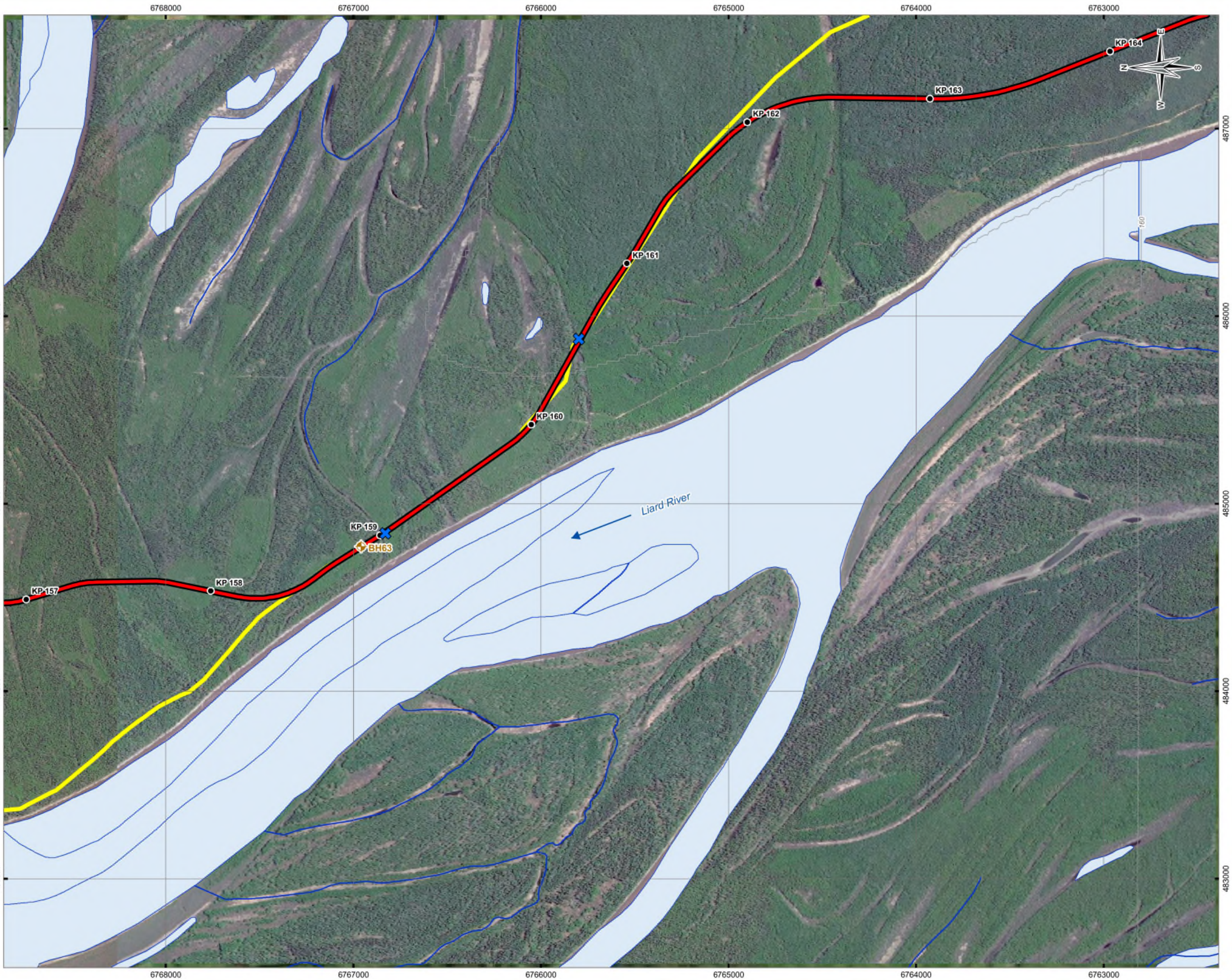

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- Access Road Kilometre Marker
- 2018 Borehole (Tetra Tech, 2018)
- 2014 Borehole (Tetra Tech EBA, 2014)
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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Google Earth, 2015

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

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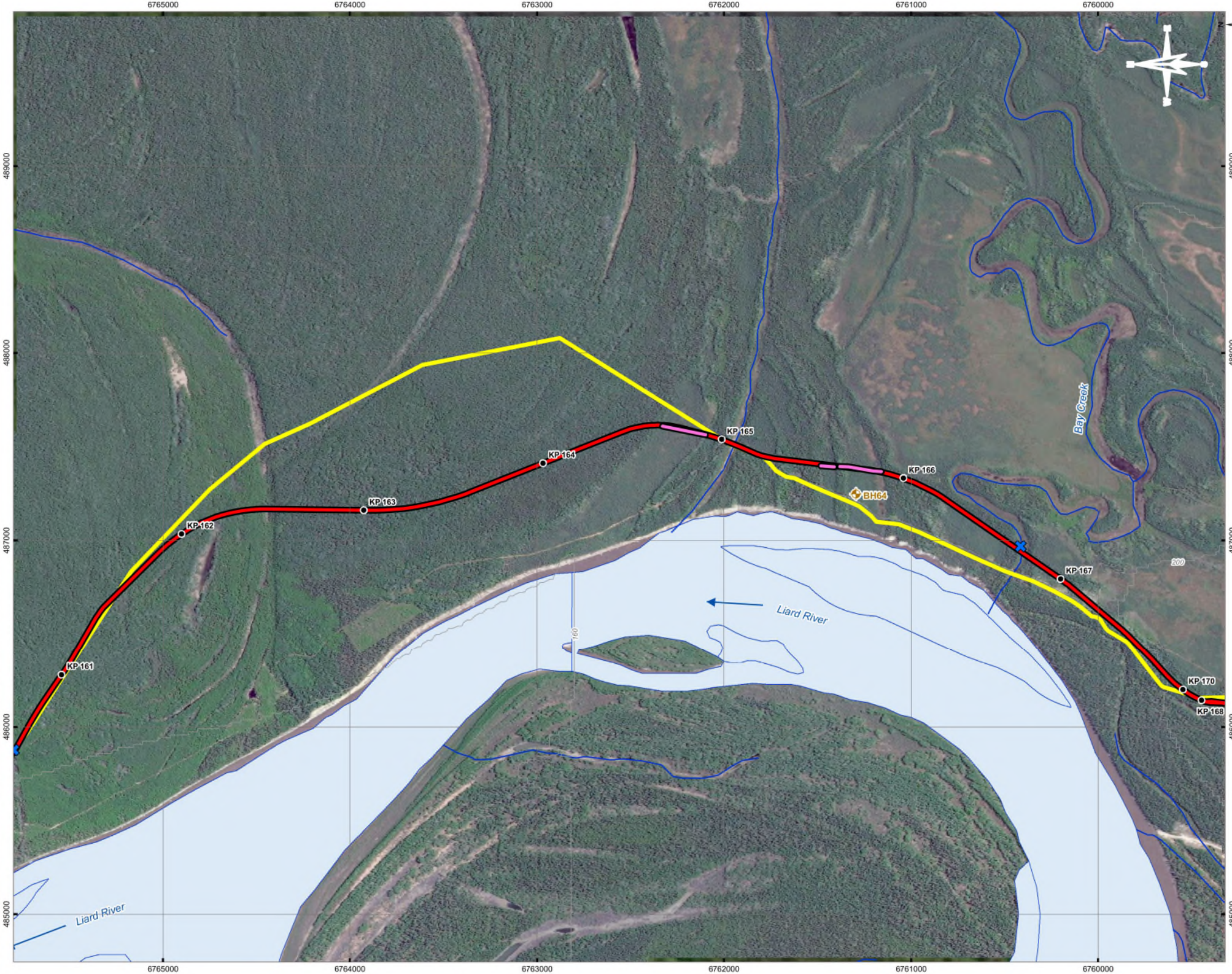

LEGEND

- Access Road Kilometre Marker
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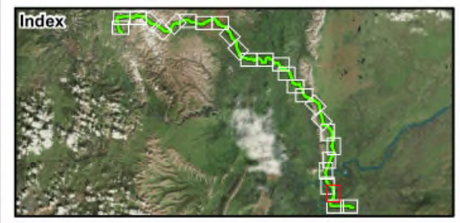

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Base imagery source: Google Earth, 2015

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PRAIRIE CREEK ACCESS ROAD

Map Book

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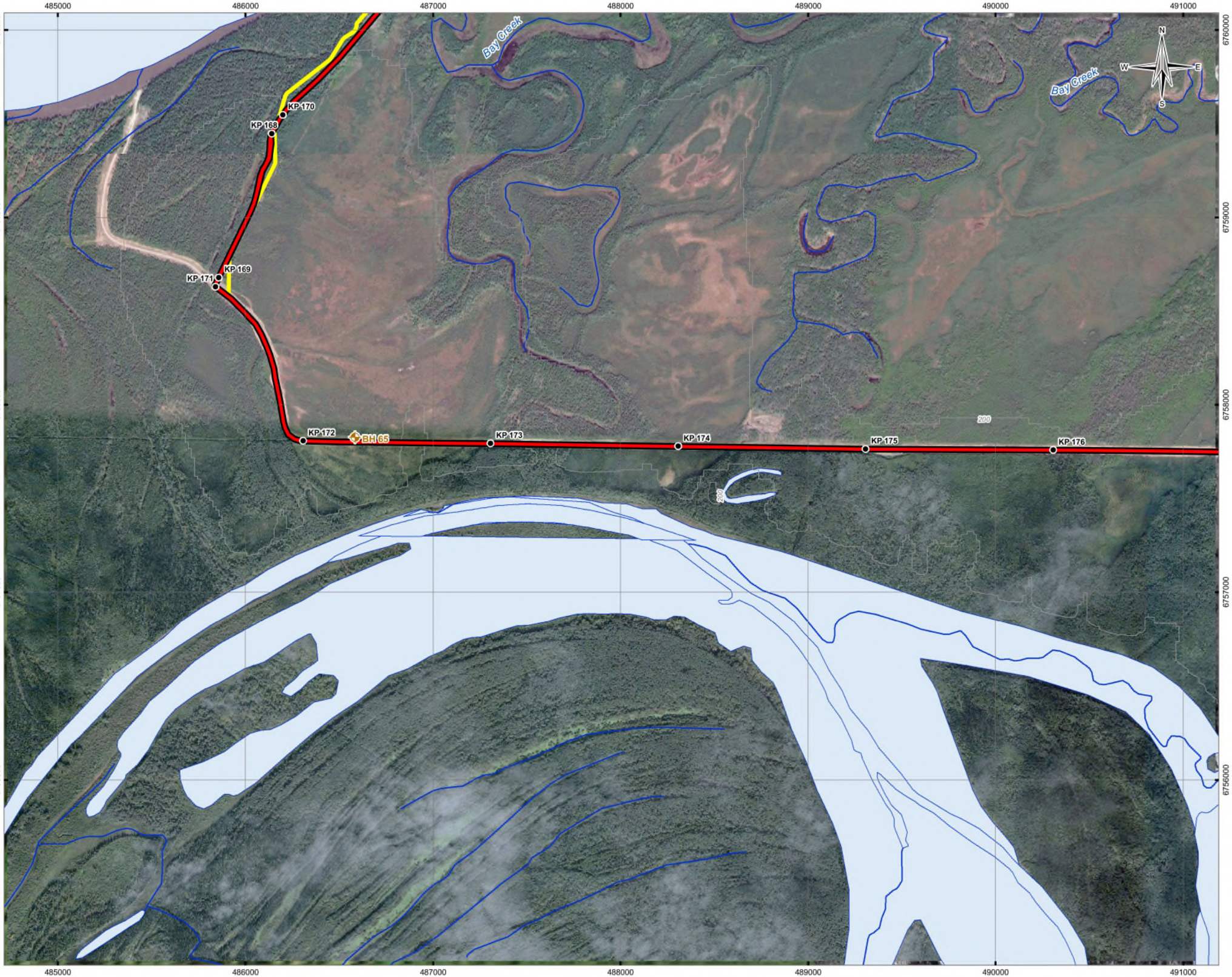

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NOTES
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Base imagery source: Google Earth, 2007-2015

STATUS
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PRAIRIE CREEK ACCESS ROAD

Map Book

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Bay Creek

KP 176 KP 177 BH66 KP 178 KP 179 KP 180 KP 181 BH 67

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N W E S

LEGEND

- Access Road Kilometre Marker
- 2018 Borehole (Tetra Tech, 2018)
- 2014 Borehole (Tetra Tech EBA, 2014)
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NOTES
Base data source: CanVec; GeoBase.
Base imagery source: Bing Maps Aerial

STATUS
ISSUED FOR REVIEW

PRAIRIE CREEK ACCESS ROAD

Map Book

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000
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Metres

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PROJECT NO.
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APPENDIX B

TETRA TECH'S LIMITATIONS ON USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

1.1 USE OF DOCUMENT AND OWNERSHIP

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PRAIRIE CREEK ACCESS ROAD

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POST-EA INFORMATION PACKAGE INCLUDING AN UPDATED PROJECT DESCRIPTION ALL SEASON ROAD TO PRAIRIE CREEK MINE

APPENDIX 5-1

SUBMITTED IN SUPPORT OF:

Water Licences MV/PC2014L8-0006, and
Land Use Permits MV/PC2014F0013

SUBMITTED TO:

Mackenzie Valley Land and Water Board
Yellowknife, NT X1A 2N7

Parks Canada,
Nahanni National Park Reserve
Fort Simpson, NT X0E 0N0

SUBMITTED BY:

Canadian Zinc Corporation
Vancouver, BC, V6B 4N9

February 2019

2017 Baseline Wildlife and Vegetation Field Report
Proposed Prairie Creek All-Season Access Road

PRESENTED TO
Canadian Zinc Corporation

AUGUST 14, 2018
ISSUED FOR USE
FILE: ENW.EENW03326-01

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
ARU	Autonomous Recording Unit
cm	Centimetre
DAR	Developers Assessment Report
ECCC	Environment and Climate Change Canada
ENR	Government of Northwest Territories Environment and Natural Resources
kHz	kilohertz
km	Kilometre
KP	Kilometre Point
m	Metre
NNPR	Nahanni National Park Reserve

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1.0 INTRODUCTION

Canadian Zinc Corporation (CZN) submitted a Developers Assessment Report (DAR) to the Mackenzie Valley Review Board (MVRB) in 2015 for a proposed Prairie Creek Mine all-season road (the Project; CZN 2015). The proposed road would be five metres wide with an average 30 m (total) right-of-way. In expectations of a positive environmental assessment review and to support subsequent permitting, CZN retained Tetra Tech Canada Inc. (Tetra Tech) to conduct baseline wildlife and vegetation surveys in summer 2017, and to consider whether modifications to the existing DAR effects assessment and mitigations are necessary following the new baseline information. Wildlife and vegetation Study Areas varied depending on the species and discipline.

The 2017 baseline wildlife and vegetation survey scope of work on and near the proposed all-season access road alignment included:

Wildlife:

1. Evaluate occupancy, relative abundance, and distribution of migratory birds, including avian species at risk along the entire proposed road; and

2. Evaluate the occupancy and relative abundance of Collared Pika (*Ochontona collaris*) in talus habitat present within 300 metres (m) of the proposed road.

Vegetation:

1. Assess the presence of rare plant species and rare assemblages within the Nahanni National Park Reserve (NNPR) that could potentially occur along the all-season road corridor through habitat modelling; and

2. Survey areas of high rare plant potential and high rare vegetation assemblage potential within 50 m of the proposed centerline within the NNPR.

Additional baseline wildlife and vegetation surveys were conducted in 2016 on and near the proposed all-season alignment, including a Black Bear (*Ursus americanus*) habitat suitability evaluation, Collared Pika presence and relative abundance at proposed borrow sources, Harlequin Duck (*Histrionicus histrionicus*), Trumpeter Swan (*Cygnus buccinator*), and beaver (*Castor canadensis*) presence and distribution, ecosystem classification ground-truth, and rare plant and rare vegetation assemblages. The results of these surveys are reported in the 2016 Baseline Wildlife and Vegetation Field Report (Tetra Tech 2016).

Methods:

Field surveys were designed in consultation with Parks Canada, Government of Northwest Territories Environment and Natural Resources (ENR), and or Environment and Climate Change Canada (ECCC), as appropriate. Tetra Tech and Parks Canada staff and Nahanni Butte research assistants conducted the 2017 field surveys.

1.1 Breeding Birds

Autonomous recording units (ARUs) to remotely survey bird vocalizations were used to collect baseline breeding bird data. The baseline survey design was based on the following priorities set during consultations with ECCC and Parks Canada:

- Use a random sampling design;

- Spatially distribute survey stations along the length of the proposed all-season access road to support geographical representation;
- Locate survey stations such that a range of habitats are surveyed, in approximate proportion to their availability along the road (to the extent possible based on the habitat data available and randomized survey design); and
- Use a design that allows for addition of new survey locations for future migratory bird monitoring, including species at risk, to address potential effects from the all-season road.

A total of 80 ARUs were deployed in late May and retrieved in mid-August to survey birds during the breeding season. Parks Canada, Allnorth, and Tetra Tech staff deployed and retrieved the units with Nahanni Butte assistants.

1.1.1 Survey Station Selection

The survey design was developed in ArcGIS using stratified random sampling from a systematic grid. A systematic grid (referred to as the Survey Station Grid), with centre points spaced 600 m apart, was placed along the road length to represent all possible survey stations. A 600 m minimum spacing between grid cells (or survey stations) was used to reduce double counting vocalizing birds. Many songbird territories are smaller than 600 m radius (Beer et al. 1956, Whitaker & Warkentin 2010), and ARU detection radii also vary depending on several factors such as habitat type, tone and height of vocalization, relative humidity, and wind (Darras et al. 2016, Yip et al. 2017). Detection radii of ARUs tend to be smallest in forested habitats and with birds vocalizing from the ground, and largest in open habitats and with birds vocalizing from height (Darras et al. 2016, Yip et al. 2017). Though highly variable, effective ARU detection radii are typically below 600 m (Darras et al. 2016, Drake et al. 2016, Stiffler et al. 2018, Yip et al. 2016). Thus, survey stations at road bends were manually adjusted to avoid potential overlap of ARU detections.

Approximately 115 kilometres (km) of the proposed 180 km road length were accessible by ground or helicopter. These Accessible Areas were overlaid on the Survey Station Grid and treated as strata. Survey stations were then selected in the Accessible Areas strata by random draw, and the total number of survey stations per Accessible Area was proportional to the Accessible Area length.

Sampling intensity was adjusted in some Accessible Areas to reduce sampling in strata with common habitats (e.g., Broadleaf Dense) and allow additional sampling in strata with uncommon habitats along the proposed all-season road. This helped target habitats more likely to support species at risk and supports a comprehensive assessment of species presence.

Open wetlands and waterbodies (habitats appropriate for Yellow Rail and other species at risk) on or immediately near the proposed road alignment are uncommon. Thus, additional adjustment to purposefully select wetlands and lake shoreline survey stations was completed after the random draw. Purposeful selection of open wetlands and waterbodies was completed both prior to and during the field studies.

While in the field, survey stations determined to be inaccessible (e.g., large creek crossing, heavy snow cover at deployment, other logistical constraints) were relocated. This included either marginal adjustment from its pre-selected location to the extent possible, relocation to a new random draw survey station, or purposeful selection of uncommon habitats.

1.1.2 ARU Operating Schedule

The ARUs were programmed to record wildlife vocalizations at predetermined intervals each day until: 1) ARUs were retrieved; 2) batteries expired; and/or 3) memory cards were full. Units were programmed to record in 10-minute increments at the following times:

- every hour starting one hour before sunset until one hour before sunrise (Yellow Rail and Common Nighthawk active period);
- every hour starting one hour before sunrise until five hours after sunrise (forest birds active period); and
- at noon and 03:00 PM.

1.1.3 ARU Data Processing and Analyses

Alberta Biodiversity Monitoring Institute's Bioacoustic Unit (Bioacoustic Unit) processed the ARU sound files using human listening and a computer-automated recognizer to identify species and abundance. Human listening was performed on all ARU survey stations. Three-minute long recordings were listened to at a minimum of three-time intervals (i.e., on or around 3:30 AM, 4:30 AM, and 7:30 AM) on three different days (i.e., June 5, 11, and 15). Thus, a minimum of 27 audio minutes per survey station were processed for all diurnal species vocalizations. Human listening for nocturnal species was completed at survey stations where computer-automated recognizers identified potential Yellow Rail and Common Nighthawk vocalizations. Three-minute long recordings were listened to at survey stations determined to potentially include these nocturnal species at a minimum of three-time intervals (i.e. on or around 10:00 PM, 12:30 PM, and 2:00 AM) on three different days (i.e. June 5, 11, and 19).

During the human listening, all vocalizations were recorded to species, as well as the number of individual's calling.

Computer-automated species recognizers were also used to document the presence of bird species at risk at survey stations deployed within the species known range (Table 1). Recognizer analyses were performed for Horned Grebe (*Podiceps auratus*), Yellow Rail (*Coturnicops noveboracensis*), Red-necked Phalarope (*Phalaropus lobatus*), Common Nighthawk (*Chordeiles minor*), Olive-sided Flycatcher (*Contopus cooperi*), Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*), Canada Warbler (*Cardellina canadensis*), and Rusty Blackbird (*Euphagus carolinus*). Four species recognizers were developed for the proposed all-season road; the Bioacoustic Unit utilized existing recognizers for the remaining species. Recognizers for Trumpeter Swan, Harlequin Duck, Short-eared Owl, and Peregrine Falcon were not developed, as recommended by the Bioacoustic Unit as sufficient quantity of vocalization recordings are unavailable to currently develop recognizers for these species.

Table 1: Species and Survey Stations Processed by Computer-automated Recognizer

Species	Survey Stations Processed (all-season road KPs)
Horned Grebe	ARUs within the boreal forest zone (KP 39 to 170; n=62)
Yellow Rail	ARUs within the boreal forest zone (KP 39 to 170; n=62)
Red-necked Phalarope	ARUs within the boreal forest zone (KP 39 to 170; n=62)
Common Nighthawk	All ARUs (km 0-170; n=80)
Olive-sided Flycatcher	All ARUs (km 0-170; n=80)
Bank Swallow	All ARUs (km 0-170; n=80)
Barn Swallow	All ARUs (km 0-170; n=80)
Canada Warbler	All ARUs (km 0-170; n=80)
Rusty Blackbird	All ARUs (km 0-170; n=80)

A computer-automated recognizer was also utilized to detect Western Toad (*Anaxyrus boreas*) at survey stations located within the species known range (i.e., from KP 138 to 165); refer to Section 3.3 *Incidental Wildlife Species.*

1.2 Collared Pika

Based on Parks Canada and GNWT Environment and Natural Resources recommendations (and further discussion via telephone meeting July 14, 2017), the objectives of the 2017 baseline Collared Pika field survey were to:

- Record Collared Pika occupancy (presence-absence) and distribution within 300 m of the proposed all-season access road from KP 12-39 (only includes talus on the same side of a river/major stream as the proposed all-season road).

Survey methods primarily followed those outlined by Parks Canada in Nahanni National Park Reserve (NNPR) and Banff National Park for pika occupancy surveys (Parks Canada 2015a, 2015b, 2016a, 2016b). These methods allow for future comparison with Parks Canada NNPR pika monitoring data.

1.2.1 Survey Station Selection

Potential talus sites within 300 m of the proposed all-season access road were identified using an evaluation of orthophotos (2012) prior to the field survey.

Talus sites, pre-identified using orthophotos and as encountered in the field, were assessed for appropriate pika habitat following standard criteria (Appendix A). Using a literature review of known Collared and American Pika habitat, the pika habitat criteria included an assessment of talus and talus size, boulder diameter, and available meadow within 10 m of the talus. Talus was assessed for appropriate pika habitat from both ground and/or helicopter evaluation.

1.2.2 Pika Field Survey

Talus sites meeting the pika habitat criteria were ground surveyed for pika and pika sign. Talus sites not meeting the criteria (or deemed unsafe to traverse, i.e., steep slope) were not surveyed for pika.

Upon arrival, the Talus Site[1], date, and weather were described and recorded on a standard pika survey datasheet. Talus Site details, including aspect, approximate length and width, approximate distance to the existing all-season road (if present), and site photos were collected.

A team of two surveyors searched for pika and pika sign (e.g., haypile, latrine); one person while walking along the talus/meadow edge and the other walking a transect 10-15 m upslope, along the entire downslope portion of the Talus Site. Surveyors stopped roughly every 10 minutes, or at least once per Talus Site, to look and listen for pika.

During the transects, surveyors conducted a 15 m radius search from the main haypile, visual observation, and/or location of vocalization for evidence of additional pika sign. All haypiles, latrines, visual, and vocalizations within the 15 m radius search area were described and recorded on the standard datasheet as an individual Pika Station[2]. Pika and pika sign were recorded with a handheld Global Positioning System (GPS) and described as fresh or old sign (i.e., active or inactive territory, respectively), and each Pika Station was described including the average rock size (i.e., small boulder (30-50 centimetres (cm)), medium boulder (50-100 cm), large boulder (>100 cm)), distance to nearest meadow, meadow composition, elevation, and site photos. Haypiles were considered active when a single piece of fresh plant matter or more was present. Once the 15 m radius Pika Station was surveyed, the team continued the walking transect across the Talus Site.

[1] Talus Site is defined as the overall patch of talus that is separated from other talus by more than 30 m. Talus Sites can be large (e.g., 200 m in length) or small (e.g., 20 m in length).

[2] Pika Station is defined as one or more pika observations (i.e., haypiles, latrines) within an approximate 15 m radius (e.g., representing 1 possible home range).

Surveyors also hiked to all pika(s) observed/heard off transect; and recorded these sightings as incidental observations for each Talus Site.

1.3 Rare Plants

Based on recommendations from Parks Canada, the objectives of the 2017 rare plant program were to:

- Develop a method to link rare plant species habitat potential within the Project area to the ecotype mapping developed by Parks Canada for NNPR to help target field investigations.
- Conduct a rare plant survey to capture early flowering species in particular.

1.3.1 Rare Plant Habitat Modelling

Given the extent of the Study Area, efforts were made to stratify the rare plant sampling program so field work could proceed efficiently (e.g., by targeting areas with a higher potential of supporting rare plant habitat). The habitat requirements and specific growing conditions of many rare plant species are often poorly understood (ANPC 2012). Rare plants tend to occupy habitats that are uncommon or have a restricted distribution across a landscape, and these features are not often adequately captured by ecological maps that are typically designed to describe ecosystems at smaller scales than that of rare plant habitat. However, the ecotype maps and supporting documentation developed by Parks Canada for NNPR (e.g., Ponomarenko and Quirouette 2015) provided descriptions of ecotypes (plant communities/ecosystems) that could also support rare plant habitat. This information, as well as available habitat descriptions for rare plants potentially occurring within the Study Area, was reviewed as part of the rare plant habitat modelling exercise.

A list identifying rare plant species with the potential to occur within the Project area was compiled from various sources, including databases maintained by the Government of the Northwest Territories (GNWT), the federal *Species at Risk Act* (SARA), and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Species that are designated by COSEWIC may qualify for legal protection under SARA; however, SARA only applies to species on the SARA legal list.

Vascular plants considered rare in the Northwest Territories are given status ranks in the GNWT General Status database of (ENR 2013). Plants assigned a status of “Sensitive” or “May Be At Risk” were included for consideration:

- Sensitive – species with small population sizes (1,000 to 3,000 individuals), small number of occurrences (6-20), restricted distribution (4-10 percent (%) of jurisdiction), declining distribution, and with moderate threats to habitat and populations.
- May Be At Risk – species with small population sizes (<1,000 individuals), small number of occurrences (0-5), restricted distribution (<3% of jurisdiction), rapid decline in population (>50% in 10 years) or a general decline in population (>20% in ten years), a rapid decline in distribution, and with extreme threats to habitat and populations.

The list of rare plant species started with those that are known to occur within the Taiga Plain and Taiga Cordillera ecozones (which characterize the Study Area). The list was refined by eliminating species with no habitat potential in the Study Area (e.g., species occupying coastal beaches), resulting in the identification of 145 rare vascular plants. Each species was then assigned an ecotype using the descriptions developed by Parks Canada (Ponomarenko and Quirouette 2015) and habitat descriptions obtained from various literature sources (e.g., Porsild and Cody 1980; Kershaw, et al. 1998; Cody 2000). The results were then summarized into classes that present the number of rare plant species potentially supported by each ecotype. This information was then linked to the ecotype mapping using GIS to spatially identify rare plant habitat potential within the Study Area.

1.3.2 Field Surveys

Field surveys were conducted June 20-26, 2017 to capture early flowering species (previous surveys were conducted in July and August, thus missing the early flowering period). Three field crews completed the surveys. During the first day, all three individuals worked together to align the collection method so that data would be collected consistently for the remainder of the survey. The surveys focused on areas with high rare plant habitat potential. As time allowed, areas with moderate to low habitat potential were also surveyed.

Rare plant surveys followed the ANPC *Guidelines for Rare Vascular Plant Surveys in Alberta – 2012 Update*. Due to the large size of the overall study area, a meander survey was conducted. Surveys occurred within a 100 m buffer of the all-season road. Plants were identified to species in the field whenever possible. Specimens were collected, provided the collection did not appear to threaten the immediate population if a definitive identification to species in the field was not possible. At each survey location, a species list (irrespective of status) was compiled by ecosystem; common, identifiable bryoids were also recorded, but the survey focused on vascular plants.

Species were grouped according to general ecosystem types, as defined in Tetra Tech's 2016 Vegetation and Wildlife Baseline Surveys Report (Tetra Tech 2016). Ecotypes/land cover classes defined by Parks Canada with similar characteristics (e.g., relative moisture status, vegetation type) were grouped into the same general ecosystem type (e.g., Parks Canada ecotypes characterized as upland forest with a conifer-dominated overstory were grouped into the "conifer forest" general ecosystem type). The general ecosystem types used are: deciduous, coniferous, mixedwood, shrub – alluvial, shrub – fire regen, shrub – subalpine, herb, bryoids, and wetland.

The species observed in each general ecosystem type is presented in Appendix B.

2.0 RESULTS

2.1 Breeding Birds

ARUs were deployed at 80 survey stations on the proposed all-season road alignment in May 2017 (Figure 1). In August, all ARUs were retrieved from the field, except for a single unit that was lost. Recordings from all retrieved ARUs were processed except one which malfunctioned, and the data were unextractable. Thus, a total of 78 units were processed. Of these 78 units, two units (CZN-012-020 and CZN-029-046) did not detect any birds. These units picked up background noise from running water/rain and wind that may have impeded identification of any bird vocalizations potentially in the recording.

The ARU surveys identified 89 bird species occurring along the proposed all-season road (Table 2). On average, 12 different bird species were detected at each survey station (excluding unidentified species); number of species detected ranged from 0 to 24.

The most commonly found species were Swainson's Thrush (n=144), Tennessee Warbler (n=125), White-throated Sparrow (n=108), and Chipping Sparrow (n=71; Table 2). These bird species are representative of coniferous and mixed-forest habitats, including open woodlands throughout the road length (Fisher and Acorn 1998, Sibley 2016). The Ovenbird, the fifth most common species (n=61), inhabits mature deciduous and mixed forests, preferring large, unfragmented forest blocks (Fisher and Acorn 1998, Sibley 2016). Ovenbirds were found primarily between Kilometre Points (KP) 82 -119 and 138-165, where there are more broadleaf and mixed wood forests (Figure 1).

Table 2: Species and Number of Individuals of Each Bird Species Detected

Common Name	Scientific Name	Human Listening		Recognizer	% of Survey Stations Detected
		Number of Individuals Detected	Total Survey Stations Present	Additional Survey Stations Present	
Canada Goose	*Branta canadensis*	2	2	-	2.6
Trumpeter Swan	*Cygnus buccinator*	5	4	-	5.1
American Wigeon	*Anas americana*	2	2	-	2.6
Green-winged Teal	*Anas crecca*	2	2	-	2.6
Ruffed Grouse	*Bonasa umbellus*	25	19	-	24.4
Spruce Grouse	*Falcipennis canadensis*	2	2	-	2.6
Pied-billed Grebe	*Podilymbus podiceps*	4	4	-	5.1
Horned Grebe	*Podiceps auritus*	0	0	0	0.0
Common Nighthawk	*Chordeiles minor*	33	25	21	57.7
Yellow Rail	*Coturnicops noveboracensis*	0	0	0	0.0
Sora	*Porzana carolina*	7	7	-	9.0
American Coot	*Fulica americana*	2	2	-	0.0
Sandhill Crane	*Antigone canadensis*	1	1	-	1.3
Wilson's Snipe	*Gallinago delicata*	8	6	-	7.7
Solitary Sandpiper	*Gallinago solitaria*	6	6	-	7.7
Spotted Sandpiper	*Actitis macularius*	12	12	-	15.4
Red-nicked Phalarope	*Phalaropus lobatus*	0	0	0	0.0
Common Loon	*Gavia immer*	1	1	-	1.3
American Bittern	*Botaurus lentiginosus*	1	1	-	1.3
Red-tailed Hawk	*Buteo jamaicensis*	1	1	-	1.3
Great Horned Owl	*Bubo virginianus*	1	1	-	1.3
Barred Owl	*Strix varia*	2	2	-	2.6
Great Gray Owl	*Strix nebulosa*	2	2	-	2.6
Boreal Owl	*Aegolius funereus*	1	1	-	1.3
Yellow-bellied Sapsucker	*Sphyrapicus varius*	6	5	-	6.4
Hairy Woodpecker	*Picoides villosus*	1	1	-	1.3
Black-backed Woodpecker	*Picoides arcticus*	1	1	-	1.3
Northern Flicker	*Colaptes auratus*	7	7	-	9.0
Pileated Woodpecker	*Dryocopus pileatus*	2	2	-	2.6
Merlin	*Falco columbarius*	1	1	-	1.3
Olive-sided Flycatcher	*Contopus cooperi*	9	9	2	14.1
Western Wood-Pewee	*Contopus sordidulus*	1	1	-	1.3
Yellow-bellied Flycatcher	*Empidonax flaviventris*	14	9	-	11.5
Alder Flycatcher	*Empidonax alnorum*	24	18	-	23.1
Least Flycatcher	*Empidonax minimus*	17	14	-	17.9
Say's Phoebe	*Sayornis saya*	1	1	-	1.3
Blue-headed Vireo	*Vireo solitarius*	1	1	-	1.3
Warbling Vireo	*Vireo gilvus*	11	10	-	12.8
Red-eyed Vireo	*Vireo olivaceus*	14	11	-	14.1

Table 2: Species and Number of Individuals of Each Bird Species Detected

Common Name	Scientific Name	Human Listening		Recognizer	% of Survey Stations Detected
		Number of Individuals Detected	Total Survey Stations Present	Additional Survey Stations Present	
Gray Jay	*Perisoreus canadensis*	13	13	-	16.7
Common Raven	*Corvus corax*	7	7	-	9.0
Bank Swallow	*Riparia*	3	3	0	3.8
Barn Swallow	*Hirundo rustica*	0	0	0	0.0
Black-capped Chickadee	*Poecile atricapillus*	2	2	-	2.6
Boreal Chickadee	*Poecile hudsonicus*	7	7	-	9.0
Red-breasted Nuthatch	*Sitta canadensis*	4	4	-	5.1
Winter Wren	*Troglodytes hiemalis*	3	3	-	3.8
Ruby-crowned Kinglet	*Regulus calendula*	29	27	-	34.6
Mountain Bluebird[1]	*Sialia currucoides*	1	1	-	1.3
Townsend's Solitaire	*Myadestes townsendi*	2	2	-	2.6
Gray-cheeked Thrush	*Catharus minimus*	9	9	-	11.5
Swainson's Thrush	*Catharus ustulatus*	144	64	-	82.1
Hermit Thrush	*Catharus guttatus*	59	38	-	48.7
American Robin	*Turdus migratorius*	25	22	-	28.2
Varied Thrush	*Ixoreus naevius*	10	8	-	10.3
Le Conte's Sparrow	*Toxostoma lecontei*	7	5	-	6.4
Bohemian Waxwing	*Bombycilla garrulus*	1	1	-	1.3
Cedar Waxwing	*Bombycilla cedrorum*	2	1	-	1.3
White-winged Crossbill	*Loxia leucoptera*	21	21	-	26.9
Common Redpoll	*Acanthis flammea*	2	2	-	2.6
Pine Siskin	*Spinus pinus*	12	12	-	15.4
Evening Grosbeak	*Coccothraustes vespertinus*	1	1	-	1.3
Ovenbird	*Seiurus aurocapilla*	61	30	-	38.5
Northern Waterthrush	*Parkesia noveboracensis*	7	7	-	9.0
Black-and-white Warbler	*Mniotilta varia*	10	10	-	12.8
Tennessee Warbler	*Oreothlypis peregrina*	125	55	-	70.5
Orange-crowned Warbler	*Oreothlypis celata*	14	10	-	12.8
Nashville Warbler	*Oreothlypis ruficapilla*	1	1	-	1.3
Common Yellowthroat	*Geothlypis trichas*	20	18	-	23.1
American Redstart	*Setophaga ruticilla*	19	11	-	14.1
Cape May Warbler	*Setophaga tigrina*	4	4	-	5.1
Magnolia Warbler	*Setophaga magnolia*	37	28	-	35.9
Bay-breasted Warbler	*Setophaga castanea*	17	12	-	15.4
Yellow Warbler	*Setophaga petechia*	7	5	-	6.4
Blackpoll Warbler	*Setophaga striata*	2	2	-	2.6
Palm Warbler	*Setophaga palmarum*	6	6	-	7.7
Yellow-rumped Warbler	*Setophaga coronata*	60	48	-	76.9
Canada Warbler	*Cardellina canadensis*	11	8	2	12.8

Table 2: Species and Number of Individuals of Each Bird Species Detected

Common Name	Scientific Name	Human Listening		Recognizer	% of Survey Stations Detected
		Number of Individuals Detected	Total Survey Stations Present	Additional Survey Stations Present	
Wilson's Warbler	*Cardellina pusilla*	6	6	-	7.7
American Tree Sparrow	*Spizelloides arborea*	3	3	-	3.8
Chipping Sparrow	*Spizella passerina*	71	50	-	64.1
Clay-colored Sparrow	*Spizella pallida*	4	4	-	5.1
Savannah Sparrow	*Passerculus sandwichensis*	2	2	-	2.6
Fox Sparrow	*Passerella iliaca*	7	7	-	9.0
Lincoln's Sparrow	*Melospiza lincolnii*	47	30	-	38.5
Swamp Sparrow	*Melospiza georgiana*	10	8	-	10.3
White-throated Sparrow	*Zonotrichia albicollis*	108	50	-	64.1
White-crowned Sparrow	*Zonotrichia leucophrys*	18	13	-	23.1
Dark-eyed Junco	*Junco hyemalis*	51	35	-	44.9
Western Tanager	*Piranga ludoviciana*	5	5	-	6.4
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	5	4	-	5.1
Rusty Blackbird	*Euphagus carolinus*	0	0	0	0.0
Total		**1332**			

[1] Species identification uncertain (Bioacoustic Unit).

Some of the least commonly found species favour wetland and lakeshore habitats, such as the Sandhill Crane, American Bittern, and Common Loon (all n=1), and the American Widgeon, Green-winged Teal, and American Coot (all n=2; Fisher and Acorn 1998, Sibley 2016). Wetlands, ponds, and lakes infrequently occur on and immediately adjacent to the proposed all-season road. Therefore, it is expected that fewer wetland species were detected.

Also, among the least common were species that are typically found in open and semi-open habitats, such as the Say's Phoebe (n=1; Fisher and Acorn 1998, Sibley 2016). A Say's Phoebe was detected in an open rock/rubble habitat at KP 17. Other infrequently detected species include the Blue-headed Vireo (n=1), Bohemian Waxwing (n=1), and the Western Wood-pewee (n=1), which prefer open mixed-wood forests and woodlands, and habitat edges around lakes/wetlands/burns, respectively (Fisher and Acorn 1998, Sibley 2016).

Relatively non-vocal species were also rarely detected, as found in previous studies (Alquezar and Machado 2015, Haselmayer and Quinn 2000). Infrequently vocal species such as the Red-tailed Hawk and the Merlin were only recorded once each. The ARU monitoring program used in this study is not ideally suited for these species. Few detections of these species should not be interpreted as presence of few individuals. Few detections of nocturnal raptors, such as the Great Grey Owl (n=2), Barred Owl (n=2), Boreal Owl (n=1), and Great-horned Owl (n=1) were recorded. This is most likely because night-time recordings were only analyzed by human listening for stations where the recognizers detected potential Common Nighthawk or Yellow Rail hits, limiting the probability of detection for these nocturnal raptor species.

2.1.1 Trumpeter Swan

A total of five Trumpeter Swans were detected in the Fishtrap Creek and wetlands (Figure 1); part of the Southeastern Mackenzie Mountain Key Migratory Habitat Site.

2.1.2 Horned Grebe

Horned Grebes are typically found in wetlands, ponds, and lakes in the boreal forest zone (Fisher and Acorn 1998, Sibley 2016). Yip et al. (2017) report Wildlife Acoustics SM3 ARU models can detect 4 kilohertz (kHz) calls (estimated calling frequency of Horned Grebes; Stedman 2018) at 388 m distance in coniferous habitat. All graminoid and shrub wetlands and 53% of waterbodies within 388 m of the proposed all-season road were assumed to be sampled by the ARUs. No Horned Grebe were detected at any ARU survey station, including the 14 ARUs placed within 388 m of suitable habitat (Figure 1; Table 2).

2.1.3 Yellow Rail

Yellow Rail are typically found in sedge marshes and some grassy meadows (Fisher and Acorn 1998, Sibley 2016). The effective ARU detection distance for the quiet and secretive Yellow Rail is ≤175 m (Drake et al 2016). All graminoid and shrub wetlands and 63% of waterbodies within 175 m of the proposed all-season road were assumed to be sampled by the ARUs. No Yellow Rails were detected at any of the ARUs, including the 10 ARU survey stations within 175 m of suitable habitat (Figure 1; Table 2). Though present on the landscape, wetlands and waterbodies represent only a small fraction of available habitat along the proposed all-season road.

2.1.4 Red-necked Phalarope

Red-necked Phalaropes are typically found in ponds and large sloughs during the breeding season (Fisher and Acorn 1998, Sibley 2016). Red-necked Phalarope vocalizations are typically between 1-5 kHz (Rubega et al. 2000). According to Yip *et al*. (2017), a Wildlife Acoustics SM3 ARU can detect a 5 kHz call from 313 m away in coniferous habitat. All graminoid and shrub wetlands and 63% of waterbodies within 313 m of the road were assumed to be sampled by the ARUs. No Red-necked Phalaropes were detected at any ARU survey stations, including the 14 placed within 313 m of wetlands and waterbodies (Figure 1; Table 2).

2.1.5 Short-eared Owl

Short-eared Owls hunt over grasslands, fields, and marshes, and nest on the ground, often in tall grass or under small shrubs (Environment Canada 2018, Fisher and Acorn 1998, Sibley 2016). Open habitat types (e.g. low shrub, herb, bryoid) suitable for Short-eared Owl nesting and hunting are available. However, they are scattered in patches of open habitat within a forest-dominated landscape (Figure 1). No Short-eared Owls were detected in this study (Table 2). Short-eared Owls are a relatively non-vocal species and no computer-automated recognizer was available, limiting the detection potential for this species along the proposed all-season road.

2.1.6 Common Nighthawk

Fifty-seven percent of the ARU survey stations (n=46) detected Common Nighthawk. Human listening identified 33 individual Common Nighthawks at 25 survey stations. Common Nighthawk were detected at 21 additional survey stations using the computer-automated recognizer (Table 2; abundance was not measured by the recognizer). Two thirds of the stations (n=17) recorded a single individual and one third recorded two individuals together (n=8). Territories are known to vary in size depending on habitat suitability and nest site availability; ranging from <1 to 28 hectares (Environment Canada 2016). Nine survey stations recorded wingbooms indicating breeding males marking their territories (Roth & Jones 2000). It is not possible to estimate the number of individuals from these data, as a single individual could be detected on multiple ARUs.

Common Nighthawk were present at stations throughout the boreal forest zone (Figure 1). Thirty-two percent of detections were between KP 39-63 and 34% between KP 112-143 (Figure 1). In addition, a single survey station at KP 7 along Prairie Creek also detected Common Nighthawk (Figure 1). Individuals were detected in a variety of habitats, though most commonly detected in open/sparse coniferous forests with or without a shrub understory (25%) and shrub habitats (14%).

2.1.7 Olive-sided Flycatcher

Olive-sided Flycatchers were detected at 14.1% of the ARU survey stations (n=11; Table 2). A total of 11 individuals were reported from the human listening counts; species abundance was not recorded at survey stations identified by the computer-automated recognizer (Table 2). Olive-sided flycatchers inhabit open coniferous forests (Altman and Sallabanks 2012). Accordingly, the most common habitat type at stations detecting Olive-sided Flycatchers was open coniferous forest (55.6%; Figure 1).

2.1.8 Bank and Barn Swallow

Bank swallows are found along lakes and rivers with steep banks and in open areas such as meadows (Fisher and Acorn 1998, Sibley 2016). Three Bank Swallows were detected, one individual each at three ARU survey stations (detected at 3.8% of all survey stations; Table 2). The surveys stations were in three different habitat types: exposed land, treed/shrub wetland, and open coniferous forest. Stations at CZN-057-092 and CZN-095-153 were near open water (a polje and Fishtrap Creek), but station CZN-112-180 was not (Figure 1). No Bank Swallows were detected at the survey stations near the Liard River.

Like Bank Swallows, Barn Swallows feed over rivers and in open meadows, though they also feed over marshes and prefer to nest in structures such as bridges and buildings (Fisher and Acorn 1998, Sibley 2016). No Barn Swallows were detected in the ARU recordings.

2.1.9 Canada Warbler

Canada Warbler were detected at 12.8% of the ARU survey stations (n= 10; Table 2). Eleven individuals were identified (Table 2). Three stations recorded two individuals vocalizing and six survey stations recorded one individual (Table 2). Canada Warbler is typically found in mixed and deciduous forest with shrubby understory (Fisher and Acorn 1998, Sibley 2016). This species was detected at all three survey stations deployed in the Silent Hills (KP 100), an extensive area of deciduous forest, as well as near Tall Shrub habitats from KP 140 to the Liard River (Figure 1).

2.1.10 Rusty Blackbird

Rusty Blackbirds are typically found near ponds, bogs, and wetlands, and nest in spruce trees in the boreal forest (Fisher and Acorn 1998, Sibley 2016). Despite presence of a few waterbodies and wetlands along the proposed all-season road, no Rusty Blackbirds were detected (Figure 1; Table 2).

2.2 Collared Pika

Collared Pika surveys were completed between August 12 to 15, 2018 from KP 12 to 39 (Figure 2). A total of 38 Talus Sites satisfied pika habitat criteria and were surveyed (including marginal habitats). An additional 71 Talus Sites, pre-identified from orthophotos and or encountered in the field, were assessed and determined to not satisfy pika habitat criteria.

Talus Sites surveyed for pika ranged in size from 175 m^2 to 15,000 m^2; average approximately 1,750 m^2, and were at elevations ranging from 806 m to 1,543 m. Most Talus Sites generally faced North (Northwest (292.5°) to Northeast (67.5°)).

Of the 38 Talus Sites surveyed, 32 had evidence of active and/or inactive (current and past) pika use. Overall, a total of 219 pika active/inactive haypiles, latrines, vocalizations, and visuals were recorded, representing 74 Pika Stations (i.e., one or more pika observations (i.e., haypiles) within an approximate 15 m radius (e.g., representing 1 possible home range)) (Figure 2). Seventeen percent (n=37) of total observations indicated an active pika presence. The number of possible home ranges (active and inactive) per Talus Site ranged from 1 to 9 and averaged approximately 2.1. Additional details for each surveyed Talus Site are included in Appendix C.

Active pika use was observed in ten Talus Sites located near KPs 15, 18, 26, 32, and 34 (or 26% occupancy of suitable habitat; Figure 2). Active territories ranged from 7 m to 244 m away from the proposed all-season road, and 0 to 2,054 m from the nearest proposed borrow source (both preferred and alternate borrow sources; Table 3 and Figure 2).

Table 3: Distance of Active Pika Home Ranges from Proposed All-Season Road and Borrow Sources

Talus Site Name	KP	Possible Active Home Ranges	Distance to Access Road (m)	Distance to Nearest Borrow Source (m)
15-003	15	7	33	311 (BP 14)
15-023	15	1	35	302 (BP 16)
19-112	19	1	165	2054 (BP 16)
26-125	26	3	224	329 (BP 25)
26-125	26	9	244	483 (BP 25)
32-61A	33	1	11	Within Borrow Pit (BP 33)
33-61A #2	33	1	7	Within Borrow Pit (BP 33)
34-086/61G	34	1	27	Within Borrow Pit (BP 34)
34-086/61G	34	2	22	Within Borrow Pit (BP 34)
34-086/61G	34	5	33	Within Borrow Pit (BP 34)

Pika showed a preference for talus within proximity to meadows; 88% of pika observations (active and inactive) were within 5 m of the nearest meadow and none further than 10 m. This agrees with the typical habitat described by COSEWIC (2011). Nearby meadows ranged from predominantly forb/graminoid and lichen/moss meadows with a moderate to low cover of trees/shrubs.

Talus composed of medium-sized (average 50 -100 cm diameter) boulders were most common at active and inactive Pika Stations (55%). However, Pika Stations were also observed in talus dominated by small (average 30-50 cm diameter) and large (>100 cm diameter) sized boulders (20% and 25%, respectively). The majority (50%) of active and inactive pika observations were recorded in Talus Sites ranging in size between 750 m^2 and 3,000 m^2. Although, 38% of Talus Sites were smaller than 750 m^2 and 12% were larger than 3,000 m^2.

2.3 Incidental Wildlife Species

Wildlife incidental to the breeding bird and Collared Pika surveys were also recorded. In particular, ARUs record all sounds picked up by the microphones, including sounds emitted from insects, amphibians, and mammals as well as birds (e.g., Lehmann et al. 2014, Mielke and Zuberbuhler 2013). Seven species, incidental to the ARU breeding bird survey were identified, including a Collared Pika at Talus Site 15-023 (also identified as an active Pika Station during the pika survey; Table 4).

Table 4: Incidental Species Detected by ARUs

Common Name	Scientific Name	Total Individuals Detected	Number of ARU Stations Present	KP(s) Nearest to Observations
American Beaver	*Castor canadensis*	1	1	138
Boreal Chorus Frog	*Pseudacris maculata*	1	1	47
Collared Pika	*Ochotona collaris*	1	1	15
Domestic Dog	*Canis lupus familiaris*	2	2	151 and 154
Red Squirrel	*Sciurus vulgaris*	23	19	6, 43-165
Wood Frog	*Lithobates sylvaticus*	1	1	62
Woodborer Beetle	*Coleoptera spp.*	4	4	44, 100, and 165

ARU recordings were also analyzed for Western Toad using a computer-automated recognizer. Predictably, none were detected as the Western Toad population, if occur near the southern extent of the proposal all-season road, is non-calling.

During the pika field surveys, incidental wildlife observations were recorded at 16 separate locations totaling 27 animals. Table 5 provides additional details on the species observed.

Table 5: Incidental Wildlife Species Observed During the Pika Field Surveys

Common Name	Scientific Name	Number Observed	Type of Observation	KP(s) Nearest to Observations
Arctic Ground Squirrel	*Spermophilus parryii*	5	Visual and Scat	15, 16, 19, and 22
Mountain Caribou	*Rangifer tarandus caribou*	6	Tracks and Scat	15, 16 and 17
Dall's Sheep	*Ovis dalli*	10	Visual and Tracks	9, 11, 15, and 16
Grizzly Bear	*Ursus arctos*	2	Visual	5 and 10
Least Chipmunk	*Tamias minimus*	2	Visual	15 and 38
Peregrine Falcon	*Falco peregrinus*	2	Visual and Vocalization	38

Similarly, all field staff (i.e., Allnorth survey crews and vegetation/wildlife teams) while working along and near the proposed all-season road and borrow sources in 2017 were requested to search for bear dens. No bear dens were observed.

2.4 Rare Plants

The Government of the Northwest Territories (GNWT) ranks 145 vascular plants as either "May Be At Risk", or "Sensitive" between the Taiga Plain and Taiga Cordillera ecozones which may be found within the Study Area. Rare plant habitat potential for these species was modelled as described in Section 2.3. 17% of the Study Area has ecotypes with the potential to support >45 species of rare plants, 1% of the Study Area has ecotypes with the potential to support between 31-45 species of rare plants, 42% of the Study Area has ecotypes with the potential to support between 26-30 species of rare plants, 28% of the Study Area has ecotypes with the potential to support between 16-25 species of rare plants, and 2% of the Study Area has ecotypes with the potential to support <15 species of rare plants (Figures 3a-3q). Within a 100 m buffer around the all season road, rare plant habitat potential and species observations are presented in Table 6.

Table 6: Rare Plant Habitat Potential and Species Observations

Class (Number of Rare Plant Species)	Ecotype[1]	Number of Rare Plant Species Potentially Linked to an Ecotype[2]	Rare Plant Species Observed in the Field	Class % of Study Area
>45	Alpine Herb Tundra and Meadow	70	1	17
	Low Sparse Shrub	67		
	Wetland	63		
	Medium – Low Shrub	51		
31 to 45	Riparian	44	0	1
	Subalpine Tall Shrub	42		
	Subalpine Shrub – Sparse Trees	38		
	Subalpine Coniferous Woodland	37		
26 to 30	Alluvial non-vegetated	30	7	42
	Mixed Predominantly Coniferous Forest	29		
	Mixed Predominantly Deciduous Forest / Tall Shrub	28		
	Coniferous Forest	27		
16 to 25	Deciduous Forest / Tall Shrub	24	0	28
	Spruce – Lichen- Moss Woodland	22		
	Rock – Lichen	22		
	Spruce – Lichen Woodland	19		
<15	Recently Burnt	14	0	2
	Aquatic	12		
N/A	Water, Rock, Clouds and Shadow	0	0	10

[1] Based on Parks Canada ecotype mapping and descriptions.
[2] Based on potentially suitable rare plant habitat within the ecotype.

One species protected under SARA, *Symphyotrichum nahanniense* (Nahanni aster), has the potential to occur in the Project Area; however, its habitat type is dependent on hot springs which are not present within the Project Area. A 100 m buffer surrounding the entire all-season road alignment within NNPR was surveyed between km 17 and km 101 using meandering transects. Transects averaged approximately 4 km per day per biologist for a total of 21 transects. A total of 251 plant species were recorded during the survey effort (Appendix B); two rare plant species were identified over multiple locations (Figures 3a-3q): Spleenwort (*Asplenium viride*; Photo 1) listed as May Be At Risk and Small Round-leaved Bog Orchid (*Platanthera orbiculata*; Photo 2) listed as Sensitive. Locations and habitat types are discussed in Table 7 below.

Photo 1: Spleenwort

Photo 2: Small Round-leaved Bog Orchid

Table 7: Rare Plant Observations

Name	Location (UTM – 10V, E, N)	General Ecosystem Type	Ecotype	# Individuals	Area (m^2)	Associated Species
Spleenwort	417202 6828983	Shrub – Subalpine	Medium – Low Shrub	4	5	Yellow Anemone, Pink Pyrola, Alpine Bearberry, Rock Cranberry, Shrubby Cinquefoil, Entire-leaved Mountain Avens, Arctic Sagebrush, Alpine Bilberry, Narrow-leaved Labrador Tea
Small Round-leaved Bog Orchid	462111 6815853	Mixedwood	Mixed Predominantly Coniferous Forest	6	100	Trailing Clubmoss, One-sided Wintergreen, Lodgepole Pine, Dwarf Dogwood, Rock Cranberry, Trembling Aspen, Small Round-leaved Bog Orchid, Common Labrador Tea
Small Round-leaved Bog Orchid	454869 6815441	Mixedwood	Mixed Predominantly Coniferous Forest	1	N/A	Not recorded
Small Round-leaved Bog Orchid	463460 6815134	Mixedwood	Mixed Predominantly Coniferous Forest	2	100	Black Spruce, Lodgepole Pine, Paper Birch, Trembling Aspen, Northern Comandra, Pink Pyrola
Small Round-leaved Bog Orchid	462717 6815134	Mixedwood	Mixed Predominantly Coniferous Forest	11	100	Prickly Rose, Black Spruce, Lodgepole Pine, Paper Birch, Northern Comandra, Rock Cranberry
Small Round-leaved Bog Orchid	463997 6814206	Mixedwood	Mixed Predominantly Coniferous Forest	5	100	Speckled Alder, Trembling Aspen, Paper Birch, Lodgepole Pine, Dwarf Dogwood, Rock Crranberry

Table 7: Rare Plant Observations

Name	Location (UTM – 10V, E, N)	General Ecosystem Type	Ecotype	# Individuals	Area (m^2)	Associated Species
Small Round-leaved Bog Orchid	466239 6812310	Mixedwood	Mixed Predominantly Coniferous Forest	6	100	Black Spruce, Paper Birch, Lodgepole Pine, Dwarf Dogwood
Small Round-leaved Bog Orchid	462680 6815156	Mixedwood	Mixed Predominantly Coniferous Forest	1	N/A	Not recorded

During the field survey, seven occurrences of Small Round-leaved Bog Orchid were identified within the Mixed Predominantly Coniferous ecotype, and the one occurrence of Spleenwort was found in the Medium – Low Shrub ecotype. One of the three rare species observed in the field were found in areas characterized as having high rare plant habitat potential (e.g., ecotypes supporting >45 species).

3.0 DISCUSSION

3.1 Breeding Birds

No modifications to the existing Effects Assessment and/or mitigations are recommended based on the 2017 baseline surveys. The 2017 baseline survey was designed to support future monitoring of breeding bird species richness, relative abundance, and distribution during road operations.

Construction and operational mitigations to avoid nesting mortality and minimize disturbance to birds will be undertaken. This includes future monitoring of breeding birds, including bank and barn swallow nest inspections at borrow sources/gravel piles during operation.

Canada Warbler, a Threatened species, was detected at ten survey stations. An assessment of Canada Warbler was not included in the Effects Assessment, and therefore, an assessment is required based on the 2017 field results.

3.2 Collared Pika

The 2017 field results demonstrate that pikas are present in, or have once occupied, talus habitat from approximately KP 15 to 38. Eighty-four percent of the Talus Sites surveyed showed active and/or inactive pika presence. No modifications to the effects assessment and/or mitigations are recommended based on the 2017 baseline surveys.

Avoidance and other mitigation to minimize disturbance to pika will be undertaken. In 2016, due to the presence of active pika sites, CZN moved the proposed all-season road alignment, to the extent possible, away from available talus habitat in the Sundog Creek area.

Collared Pika surveys should be undertaken at suitable talus habitat within road realignments and Borrow Sources prior to intended development. Alternative Borrows Sources and minor road realignments should be selected to avoid active Collared Pika sites.

No modifications to the impact assessment and or mitigations are recommended as avoidance measures will be undertaken. The draft Wildlife Management and Monitoring Plan (WMMP) for the Prairie Creek Mine and proposed all-season road requires that ground surveys will be completed immediately prior to construction between km 15 and 40 to determine active pika territories, and if detected, modify the development plan if possible (i.e., select new borrow source, minor road re-alignment).

3.3 Rare Plants

Spleenwort and five occurrences of Small Round-leaved Bog Orchid were located on the all-season road alignment (one within a borrow pit) and are likely to be disturbed assuming no adjustments to the alignment are made. Two occurrences of Small Round-leaved Bog Orchid were located adjacent to the proposed road and may be exposed to more indirect effects of road operation from dust, spills, or invasive species (for example).

A Rare Plant Management Plan should be developed to avoid significant adverse effects to rare plants for the construction and operation of the all-season road. Key components of a Rare Plant Management Plan include desired goals and outcomes, mitigation, monitoring and adaptive management for each species. Mitigation strategies (e.g., avoidance or translocation) would be developed and monitored for effectiveness during the course of the Project; adaptive management may be required if goals of the monitoring plan are not met or additional rare plants are discovered during construction.

If the alignment of the all-season road changes significantly from what was surveyed, further rare plant surveys may be required, particularly in areas with high rare plant potential.

Rare plant assemblages were not considered in this scope of work. The Mackenzie Valley Review Board recommended Parks Canada provide more guidance and definitions on what rare plant assemblages are important in the region. This information was not available at the time of the survey.

The results of this vegetation baseline survey have changed the Effects Assessment, in that residual effects to rare plants are now anticipated, based on the assumption that the primary mitigation strategy of rare plant avoidance cannot be completely achieved. Translocation as a mitigation strategy still requires the disturbance of rare plants and translocations vary in their success, depending (in part) on the quality of the receiving environment and the flexibility of the species to be moved.

Residual effects are characterized as having an adverse direction, low magnitude, low (local) geographic extent, high duration, low frequency, and moderate reversibility. The overall residual effects to rare plants are anticipated to be not significant, as populations of the species identified within the Project footprint have also been identified in the vicinity of NNPR, and elsewhere in the NWT.

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4.0 CLOSURE

We trust this proposal/report meets your present requirements. If you have any questions or comments, please contact the undersigned.

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FIGURES

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6834000 6832000 6830000 6828000 6826000

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KP 20
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CZN-025-040
CZN-027-043
CZN-029-046
KP 30
KP 0

N W E S

LEGEND

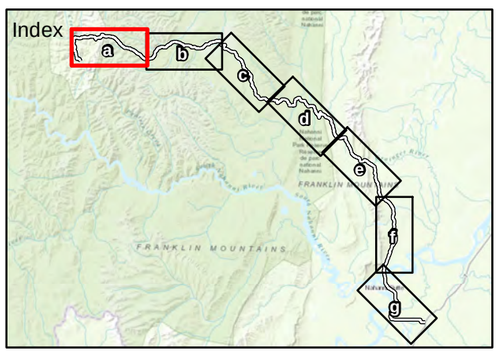
- Kilometre Point
- Access Road
- Bird Survey Station
- 100 m Detection Radius

Species At Risk

- Bank Swallow
- Canada Warbler
- Common Nighthawk
- Olive-sided Flycatcher
- Trumpeter Swan

Land Cover

- Shadow
- Water
- Snow/Ice
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub Tall
- Shrub Low
- Herb
- Confierous Dense
- Confierous Open
- Confierous Sparse
- Broadleaf Dense
- Broadleaf Open



NOTES
Base data source: Land Cover circa 2000

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Bird Survey Stations

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:50,000
1 0.5 0 1
Kilometres

FILE NO.
EENW03326-01_Figure01_Birds.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	KL	0

DATE	PROJECT NO.
August 13, 2018	ENW.EENW03326-01

TETRA TECH

Figure 1a

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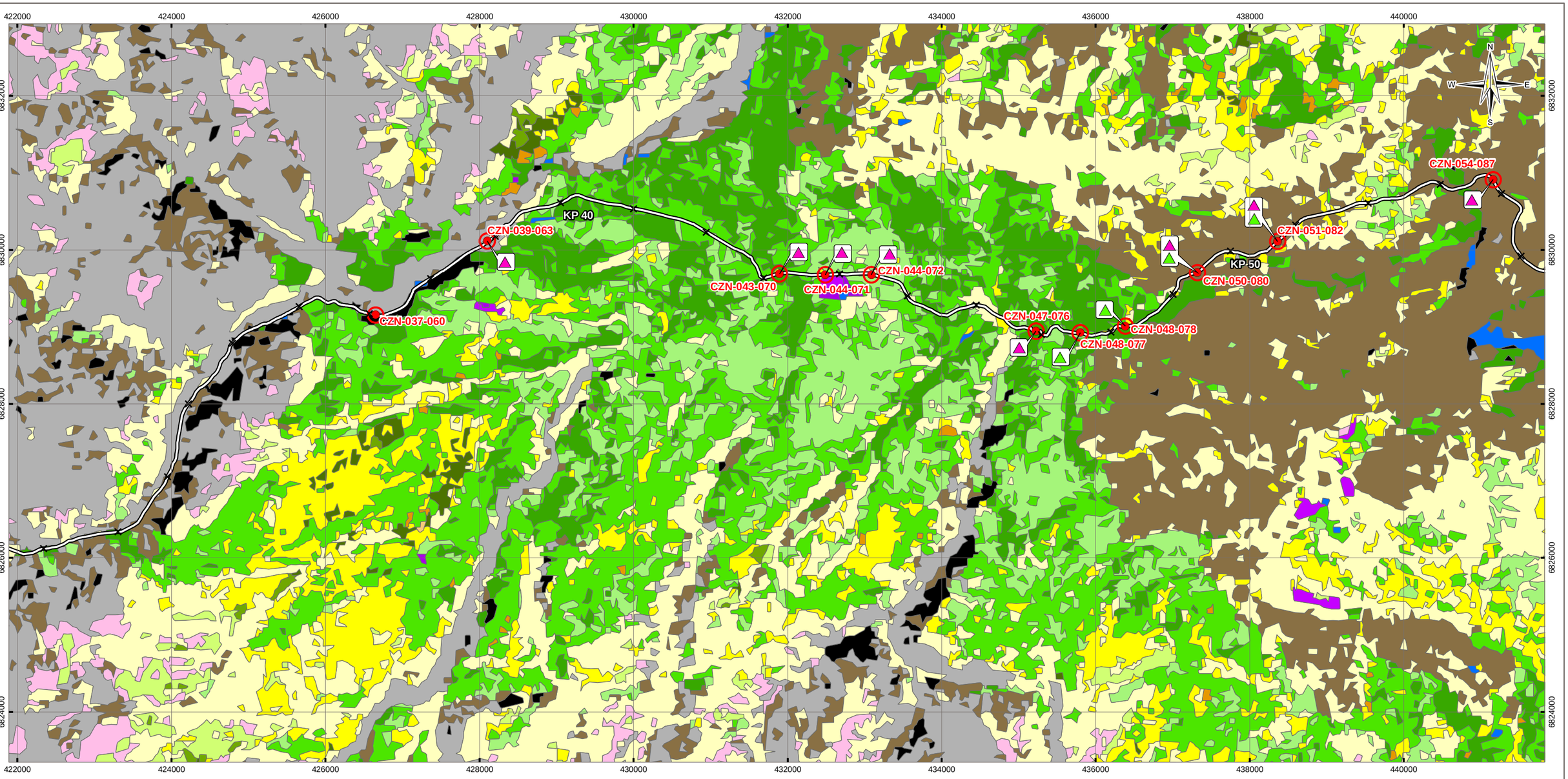


LEGEND

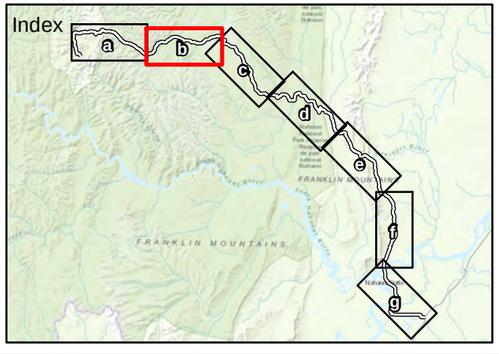
- Kilometre Point
- Access Road
- Bird Survey Station
- 100 m Detection Radius

Species At Risk

- Bank Swallow
- Canada Warbler
- Common Nighthawk
- Olive-sided Flycatcher
- Trumpeter Swan

Land Cover

- Shadow
- Water
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub Tall
- Shrub Low
- Wetland Treed
- Wetland Shrub
- Herb
- Confierous Dense
- Confierous Open
- Confierous Sparse
- Broadleaf Dense
- Broadleaf Open
- Mixedwood Dense
- Mixedwood Open



NOTES
Base data source: Land Cover circa 2000

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Bird Survey Stations

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:50,000
1 0.5 0 1
Kilometres

TETRA TECH

FILE NO.				
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OFFICE	**DWN**	**CKD**	**APVD**	**REV**
Tt-VANC	SL	MRV	KL	0
DATE	**PROJECT NO.**			
August 13, 2018	ENW.EENW03326-01			

Figure 1b

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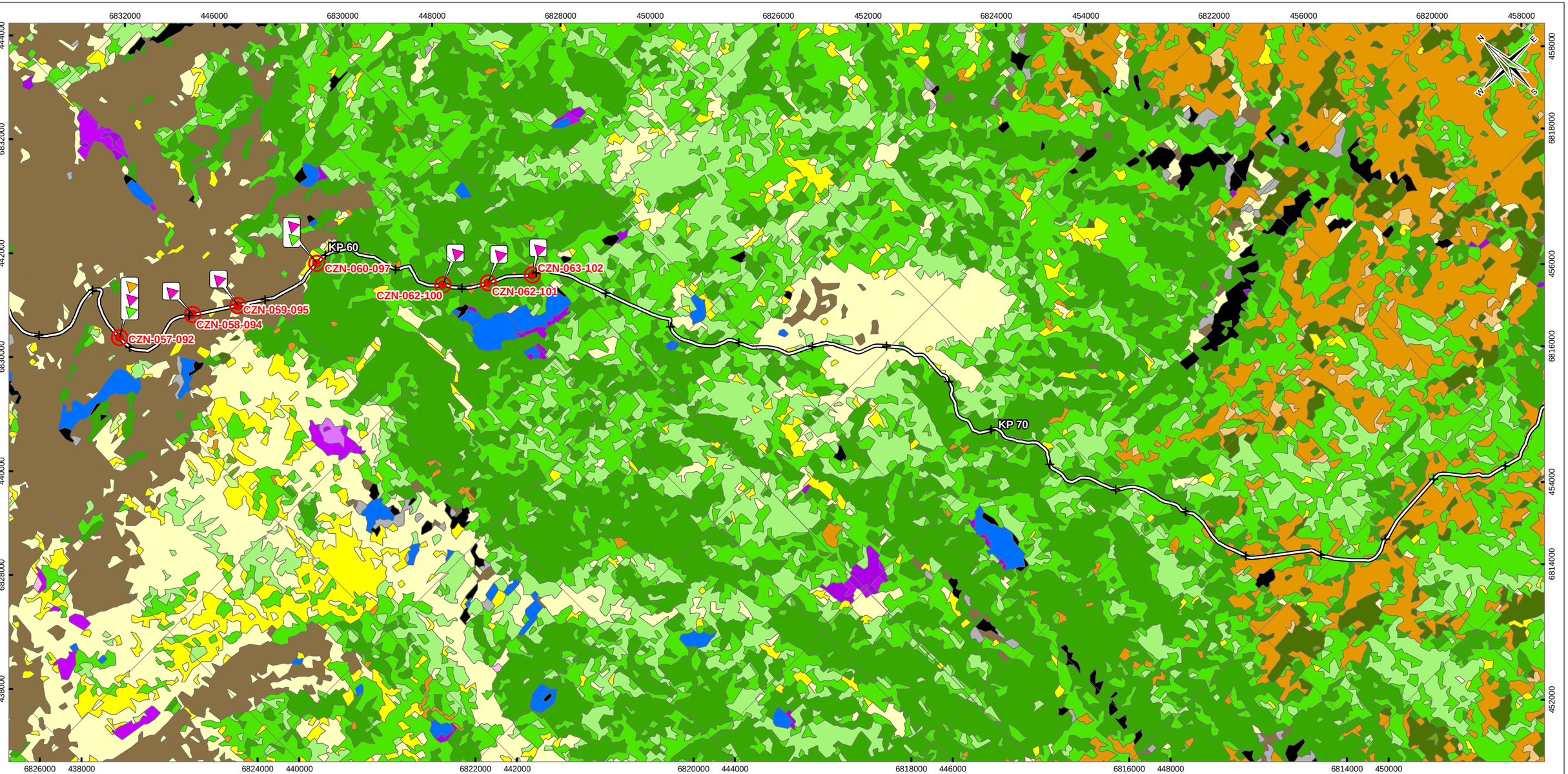


LEGEND

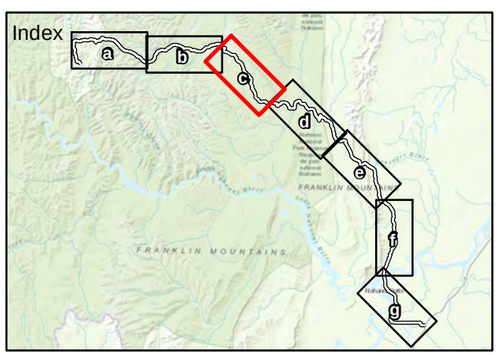
- Kilometre Point
- Access Road
- Bird Survey Station
- 100 m Detection Radius

Species At Risk

- Bank Swallow
- Canada Warbler
- Common Nighthawk
- Olive-sided Flycatcher
- Trumpeter Swan

Land Cover

- Shadow
- Water
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub Tall
- Shrub Low
- Wetland Treed
- Wetland Shrub
- Wetland Herb
- Herb
- Confierous Dense
- Confierous Open
- Confierous Sparse
- Broadleaf Dense
- Broadleaf Open
- Mixedwood Dense
- Mixedwood Open



NOTES
Base data source: Land Cover circa 2000

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Bird Survey Stations

PROJECTION UTM Zone 10			**DATUM** NAD83	**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:50,000 — 1 0.5 0 1 — Kilometres				TETRA TECH
FILE NO. EENW03326-01_Figure01_Birds.mxd				
OFFICE Tt-VANC	**DWN** SL	**CKD** MRV	**APVD** KL	**REV** 0
DATE August 13, 2018	**PROJECT NO.** ENV.EENW03326-01			**Figure 1c**

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462000 464000 466000 468000 470000 472000 474000

460000 458000 456000 454000

6820000 6818000 6816000

474000 472000 470000 468000

6806000 6804000 6802000

CZN-101-163
CZN-100-162
KP 100
CZN-100-161
CZN-095-154
CZN-095-153
CZN-094-152
KP 90
CZN-090-146
CZN-090-145
CZN-089-144
CZN-088-142
CZN-086-139
CZN-086-140
CZN-084-136
CZN-082-133
CZN-081-131
KP 80

454000 6814000 456000 6812000 458000 6810000 460000 6808000 462000 6806000 464000 6804000 466000 6802000

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LEGEND

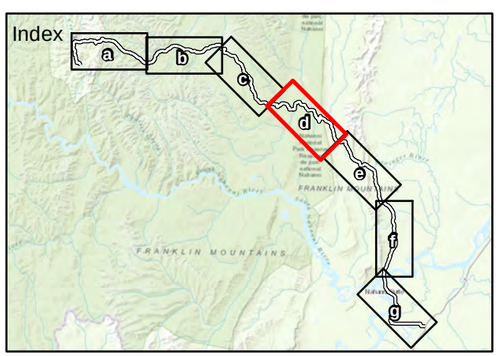
- Kilometre Point
- Access Road
- Bird Survey Station
- 100 m Detection Radius

Species At Risk

- Bank Swallow
- Canada Warbler
- Common Nighthawk
- Olive-sided Flycatcher
- Trumpeter Swan

Land Cover

- Shadow
- Water
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub Tall
- Shrub Low
- Wetland Treed
- Wetland Shrub
- Herb
- Confierous Dense
- Confierous Open
- Confierous Sparse
- Broadleaf Dense
- Broadleaf Open
- Mixedwood Dense
- Mixedwood Open



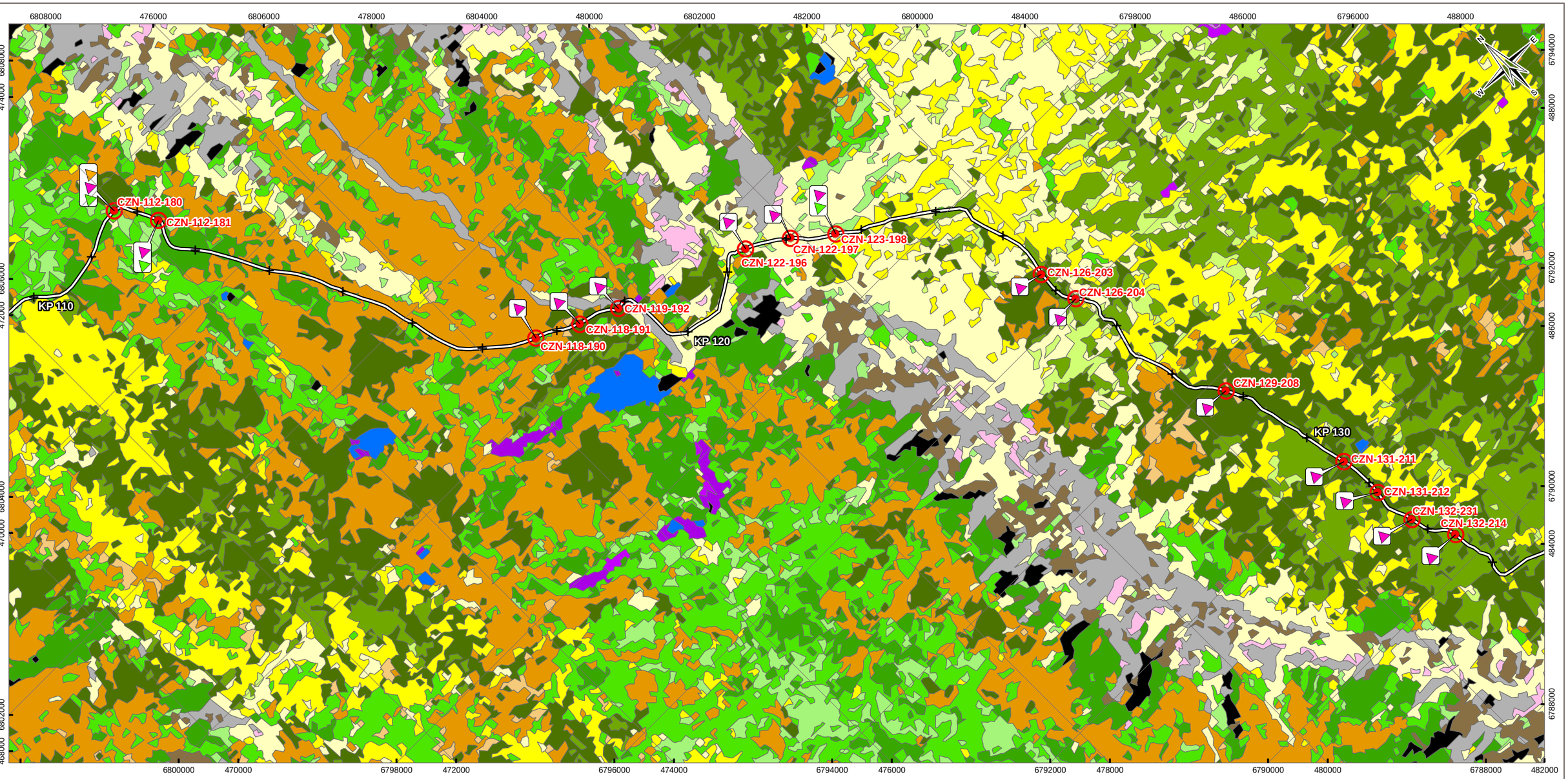
NOTES
Base data source: Land Cover circa 2000

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Bird Survey Stations

PROJECTION UTM Zone 10		**DATUM** NAD83	**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:50,000 — 1 0.5 0 1 — Kilometres			TETRA TECH
FILE NO. EENW03326-01_Figure01_Birds.mxd			
OFFICE Tt-VANC	**DWN** SL / **CKD** MRV / **APVD** KL / **REV** 0		**Figure 1d**
DATE August 13, 2018	**PROJECT NO.** ENW.EENW03326-01		



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LEGEND

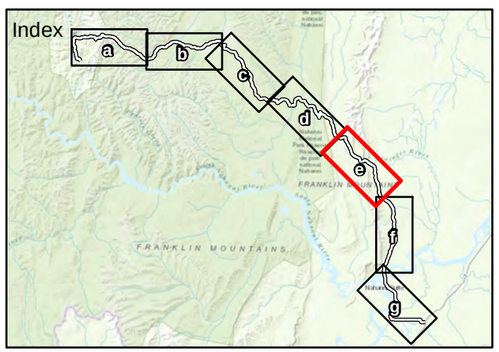
- Kilometre Point
- Access Road
- Bird Survey Station
- 100 m Detection Radius

Species At Risk

- Bank Swallow
- Canada Warbler
- Common Nighthawk
- Olive-sided Flycatcher
- Trumpeter Swan

Land Cover

- Shadow
- Water
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub Tall
- Shrub Low
- Wetland Treed
- Wetland Shrub
- Wetland Herb
- Herb
- Confierous Dense
- Confierous Open
- Confierous Sparse
- Broadleaf Dense
- Broadleaf Open
- Mixedwood Dense
- Mixedwood Open



NOTES
Base data source: Land Cover circa 2000

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Bird Survey Stations

PROJECTION UTM Zone 10		**DATUM** NAD83			**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:50,000 (1 0.5 0 1 Kilometres)					TETRA TECH
FILE NO. EENW03326-01_Figure01_Birds.mxd					
OFFICE Tt-VANC	**DWN** SL	**CKD** MRV	**APVD** KL	**REV** 0	**Figure 1e**
DATE August 13, 2018	**PROJECT NO.** ENW.EENW03326-01				

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6790000 490000 488000 486000 484000

CZN-139-224
CZN-138-223
KP 140
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CZN-143-231
CZN-143-232
KP 150
CZN-150-243
CZN-151-244
CZN-151-245
CZN-152-247
CZN-154-249

N E S W

LEGEND

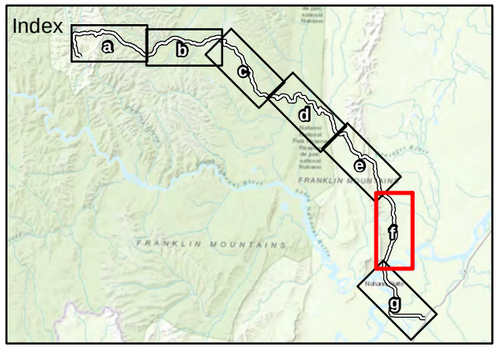
- Kilometre Point
- Access Road
- Bird Survey Station
- 100 m Detection Radius

Species At Risk

- Bank Swallow
- Canada Warbler
- Common Nighthawk
- Olive-sided Flycatcher
- Trumpeter Swan

Land Cover

- Shadow
- Water
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub Tall
- Shrub Low
- Wetland Treed
- Wetland Shrub
- Herb
- Confierous Dense
- Confierous Open
- Confierous Sparse
- Broadleaf Dense
- Broadleaf Open
- Mixedwood Dense
- Mixedwood Open



NOTES
Base data source: Land Cover circa 2000

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Bird Survey Stations

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:50,000
1 0.5 0 1
Kilometres

TETRA TECH

FILE NO.
EENW03326-01_Figure01_Birds.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	KL	0

DATE
August 13, 2018

PROJECT NO.
ENW.EENW03326-01

Figure 1f

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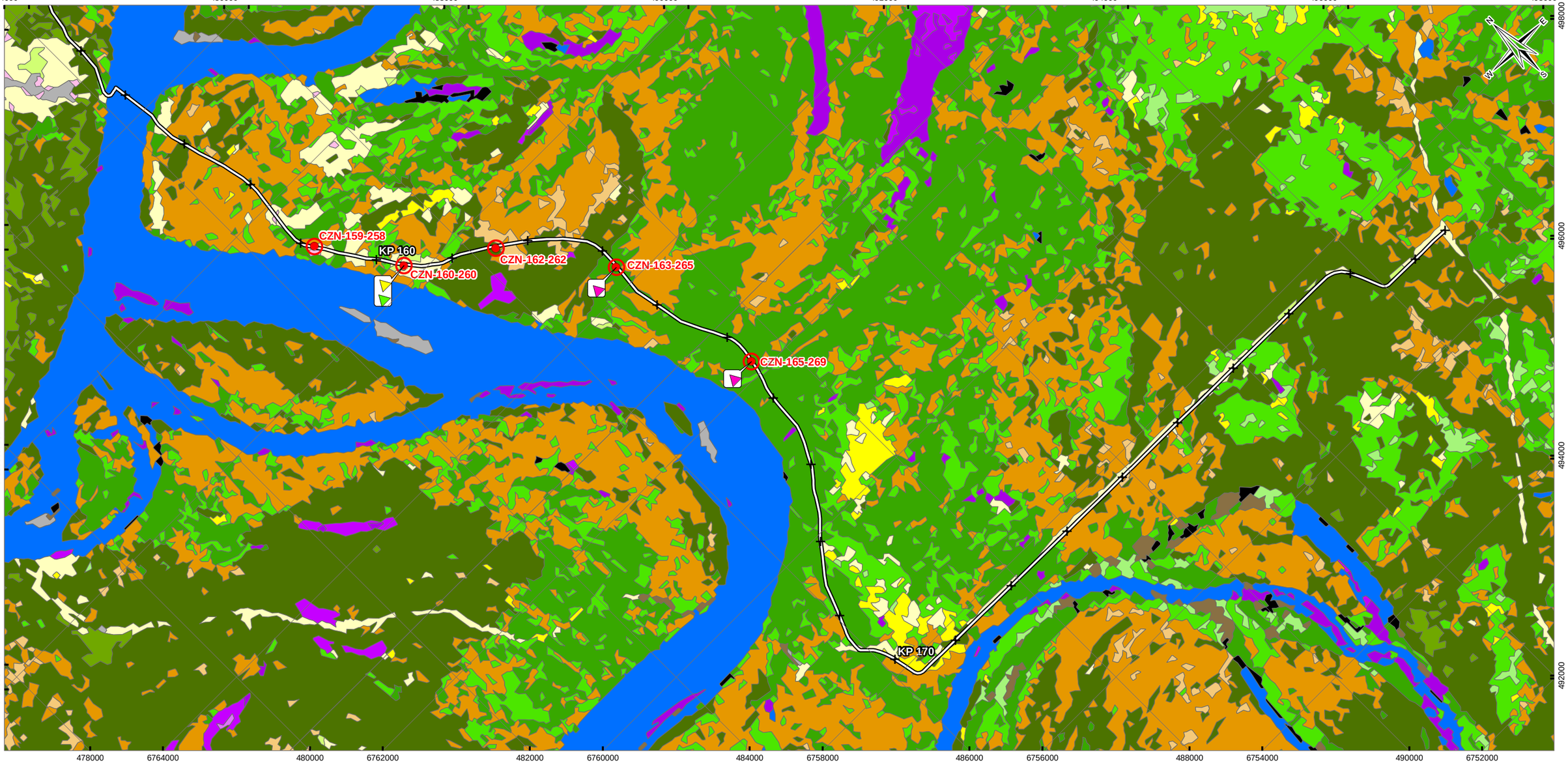


LEGEND

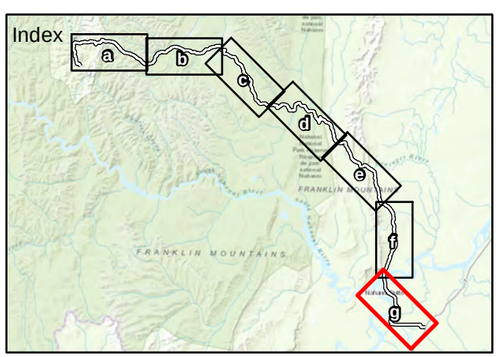
- Kilometre Point
- Access Road
- Bird Survey Station
- 100 m Detection Radius

Species At Risk

- Bank Swallow
- Canada Warbler
- Common Nighthawk
- Olive-sided Flycatcher
- Trumpeter Swan

Land Cover

- Shadow
- Water
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub Tall
- Shrub Low
- Wetland Treed
- Wetland Shrub
- Wetland Herb
- Herb
- Confierous Dense
- Confierous Open
- Confierous Sparse
- Broadleaf Dense
- Broadleaf Open
- Mixedwood Dense
- Mixedwood Open



NOTES
Base data source: Land Cover circa 2000

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Bird Survey Stations

PROJECTION UTM Zone 10		**DATUM** NAD83		**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:50,000 (1 0.5 0 1 Kilometres)				TETRA TECH
FILE NO. EENW03326-01_Figure01_Birds.mxd				
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DATE August 13, 2018	**PROJECT NO.** ENW.EENW03326-01			**Figure 1g**

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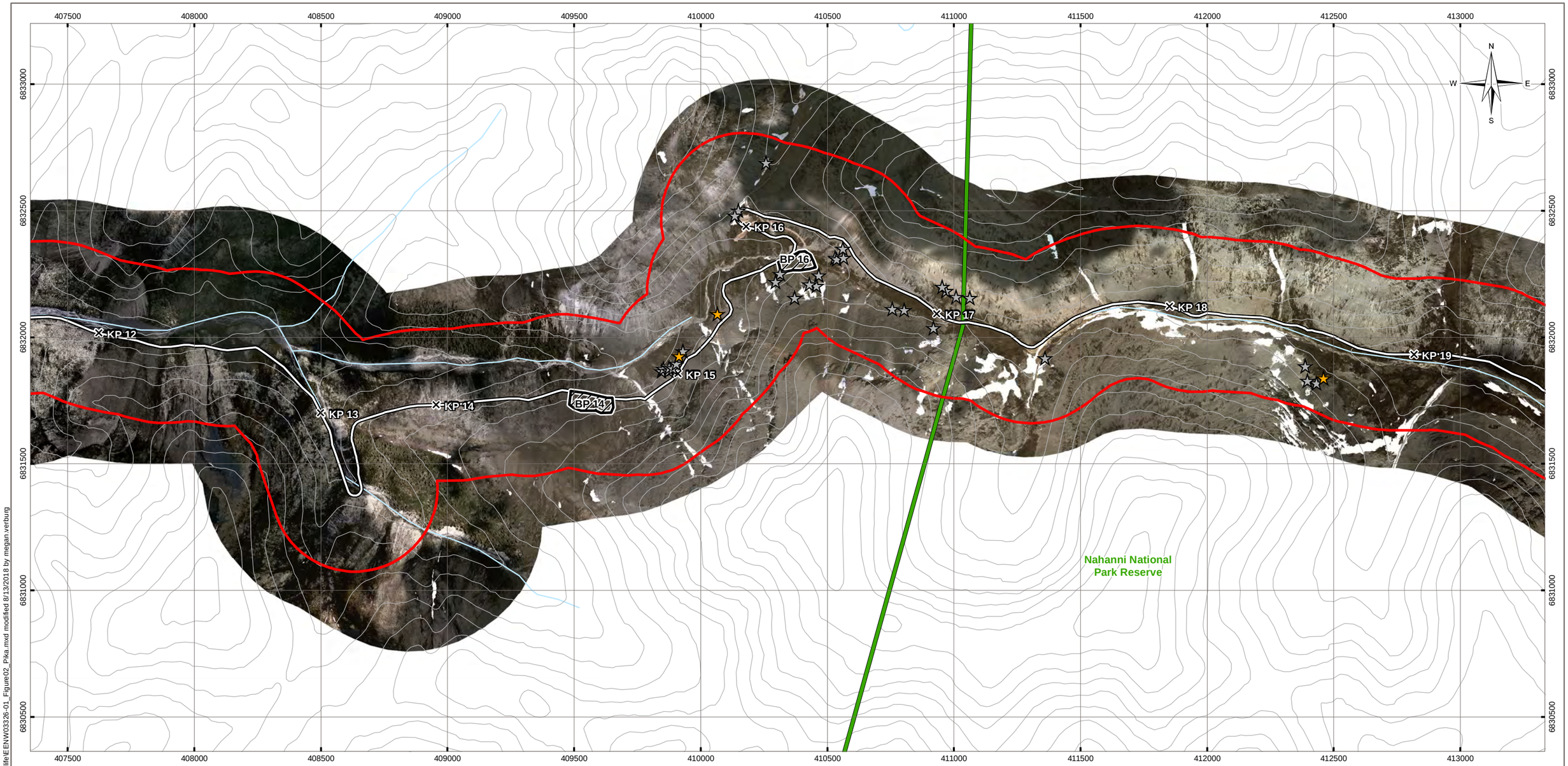
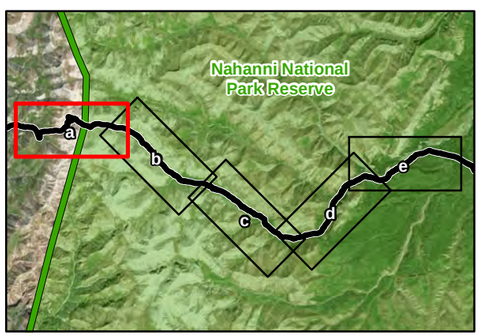


LEGEND

- Active Pika Station
- Inactive Pika Station
- Kilometre Point
- Access Road
- Contour
- Watercourse
- Waterbody
- 300 m Buffer
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Collared Pika Survey Stations

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:15,000
250 125 0 250
Metres

TETRA TECH

FILE NO.				
EENW03326-01_Figure02_Pika.mxd				
OFFICE	**DWN**	**CKD**	**APVD**	**REV**
Tt-VANC	SL	MRV	KL	0
DATE	**PROJECT NO.**			
August 13, 2018	ENW.EENW03326-01			

Figure 2a

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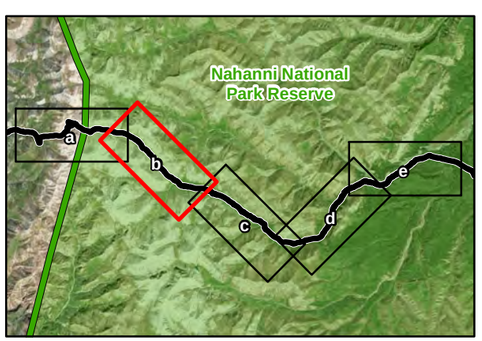
Nahanni National Park Reserve

KP 19
KP 20
KP 21
KP 22
KP 23
KP 24
KP 25

LEGEND

- Active Pika Station
- Inactive Pika Station
- Kilometre Point
- Access Road
- Contour
- Watercourse
- 300 m Buffer
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Collared Pika Survey Stations

PROJECTION: UTM Zone 10			DATUM: NAD83	CLIENT: CANADIAN ZINC CORPORATION
Scale: 1:15,000 — 250 125 0 250 — Metres				TETRA TECH
FILE NO.: EENW03326-01_Figure02_Pika.mxd				
OFFICE: Tt-VANC	DWN: SL	CKD: MRV	APVD: KL	REV: 0
DATE: August 13, 2018	PROJECT NO.: ENW.EENW03326-01			Figure 2b

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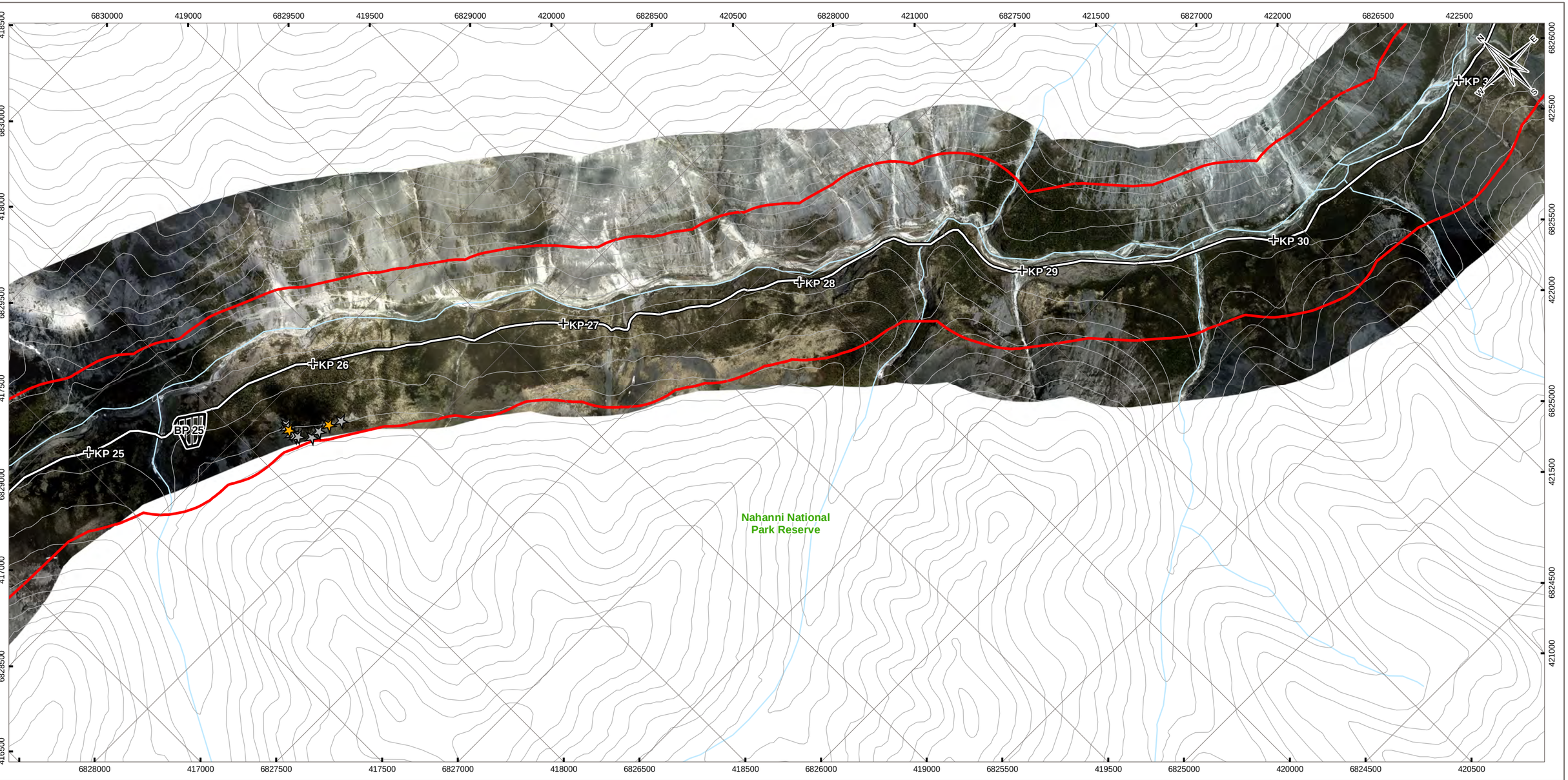
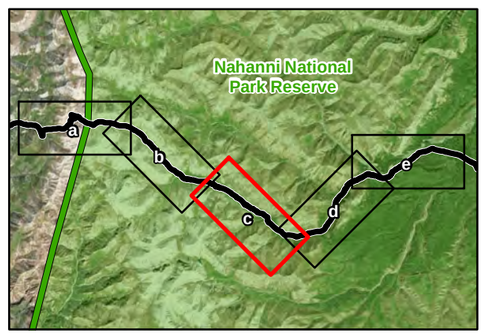


LEGEND

- Active Pika Station
- Inactive Pika Station
- Kilometre Point
- Access Road
- Contour
- Watercourse
- Waterbody
- 300 m Buffer
- Borrow Pit
- Nahanni National Park Reserve Boundary



PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Collared Pika Survey Stations

PROJECTION: UTM Zone 10	DATUM: NAD83	CLIENT: Canadian Zinc Corporation
Scale: 1:15,000 (250 125 0 250 Metres)		TETRA TECH
FILE NO.: EENW03326-01_Figure02_Pika.mxd		
OFFICE: Tt-VANC	DWN: SL / CKD: MRV / APVD: KL / REV: 0	Figure 2c
DATE: August 13, 2018	PROJECT NO.: ENW.EENW03326-01	

STATUS: ISSUED FOR USE

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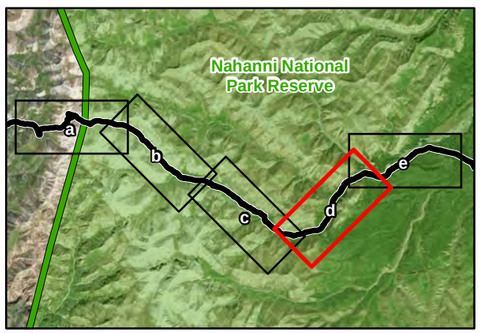
Nahanni National Park Reserve

KP 30
KP 31
KP 32
KP 33
BP 33
BP 34
KP 34
KP 35
BP 35
KP 36
KP 37

LEGEND

- Active Pika Station
- Inactive Pika Station
- Kilometre Point
- Access Road
- Contour
- Watercourse
- Waterbody
- 300 m Buffer
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Collared Pika Survey Stations

PROJECTION UTM Zone 10			**DATUM** NAD83		**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:15,000 (250 125 0 250 Metres)					TETRA TECH
FILE NO. EENW03326-01_Figure02_Pika.mxd					
OFFICE Tt-VANC	**DWN** SL	**CKD** MRV	**APVD** KL	**REV** 0	**Figure 2d**
DATE August 13, 2018	**PROJECT NO.** ENW.EENW03326-01				

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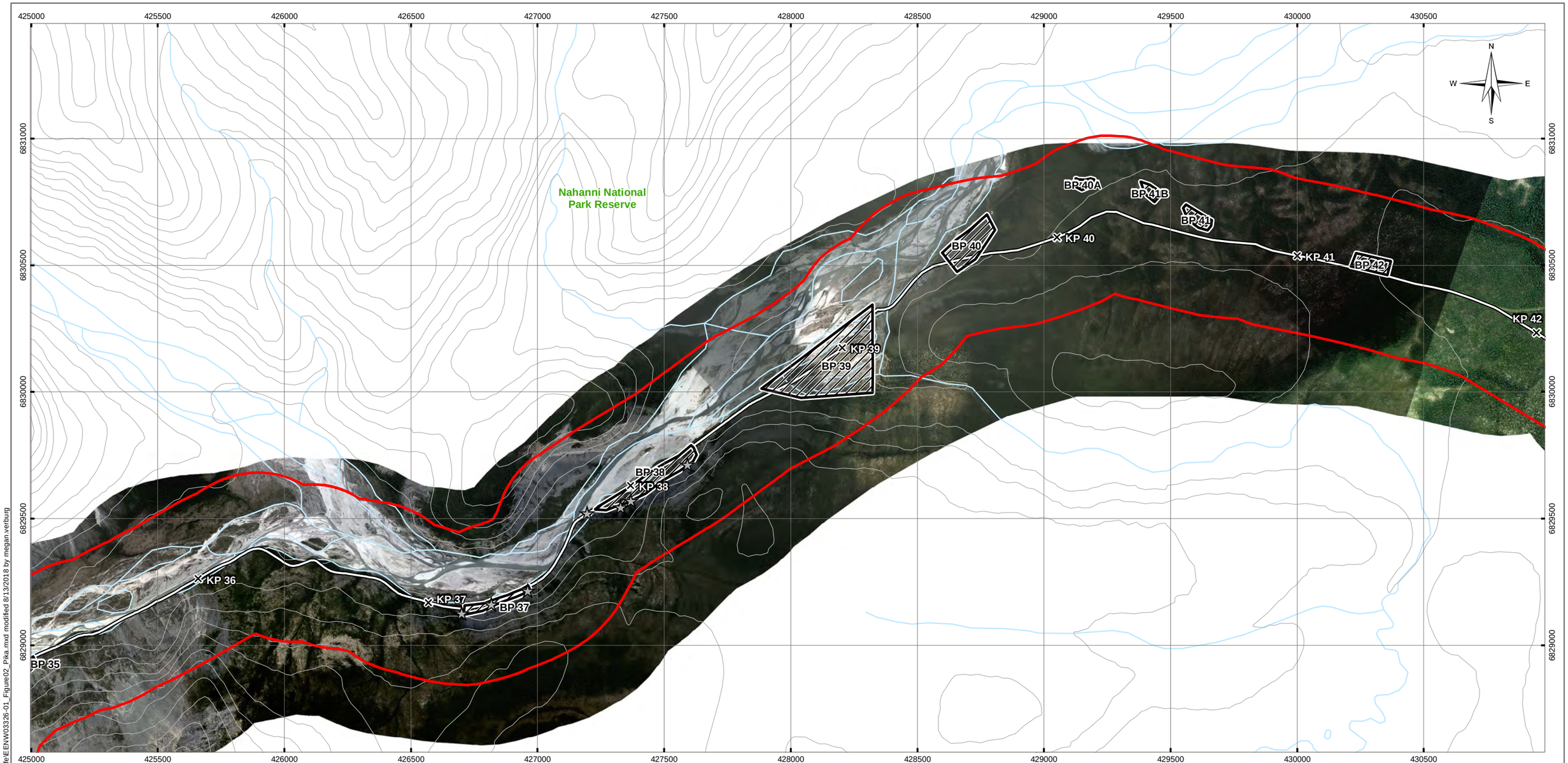
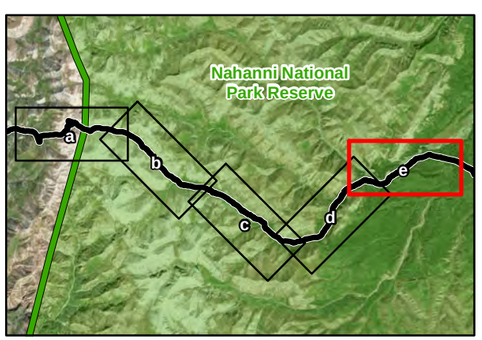


LEGEND

- Active Pika Station
- Inactive Pika Station
- Kilometre Point
- Access Road
- Contour
- Watercourse
- Waterbody
- 300 m Buffer
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Collared Pika Survey Stations

PROJECTION UTM Zone 10			**DATUM** NAD83	**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:15,000 250 125 0 250 Metres				TETRA TECH
FILE NO. EENW03326-01_Figure02_Pika.mxd				
OFFICE Tt-VANC	**DWN** SL	**CKD** MRV	**APVD** KL	**REV** 0
DATE August 13, 2018	**PROJECT NO.** ENW.EENW03326-01			**Figure 2e**

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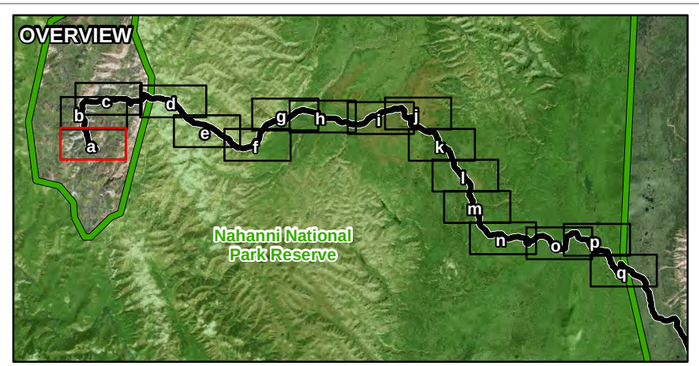
LEGEND

Potential Number of Rare Plant Species

- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION: UTM Zone 10	DATUM: NAD83				CLIENT: CANADIAN ZINC CORPORATION
Scale: 1:20,000 (400 200 0 400 Metres)					TETRA TECH
FILE NO.: EENW03326-01_Figure03_VegetationR01.mxd					
OFFICE: Tt-VANC	DWN: SL	CKD: MRV	APVD: AM	REV: 1	Figure 3a
DATE: February 19, 2019	PROJECT NO.: ENW.EENW03326-01				

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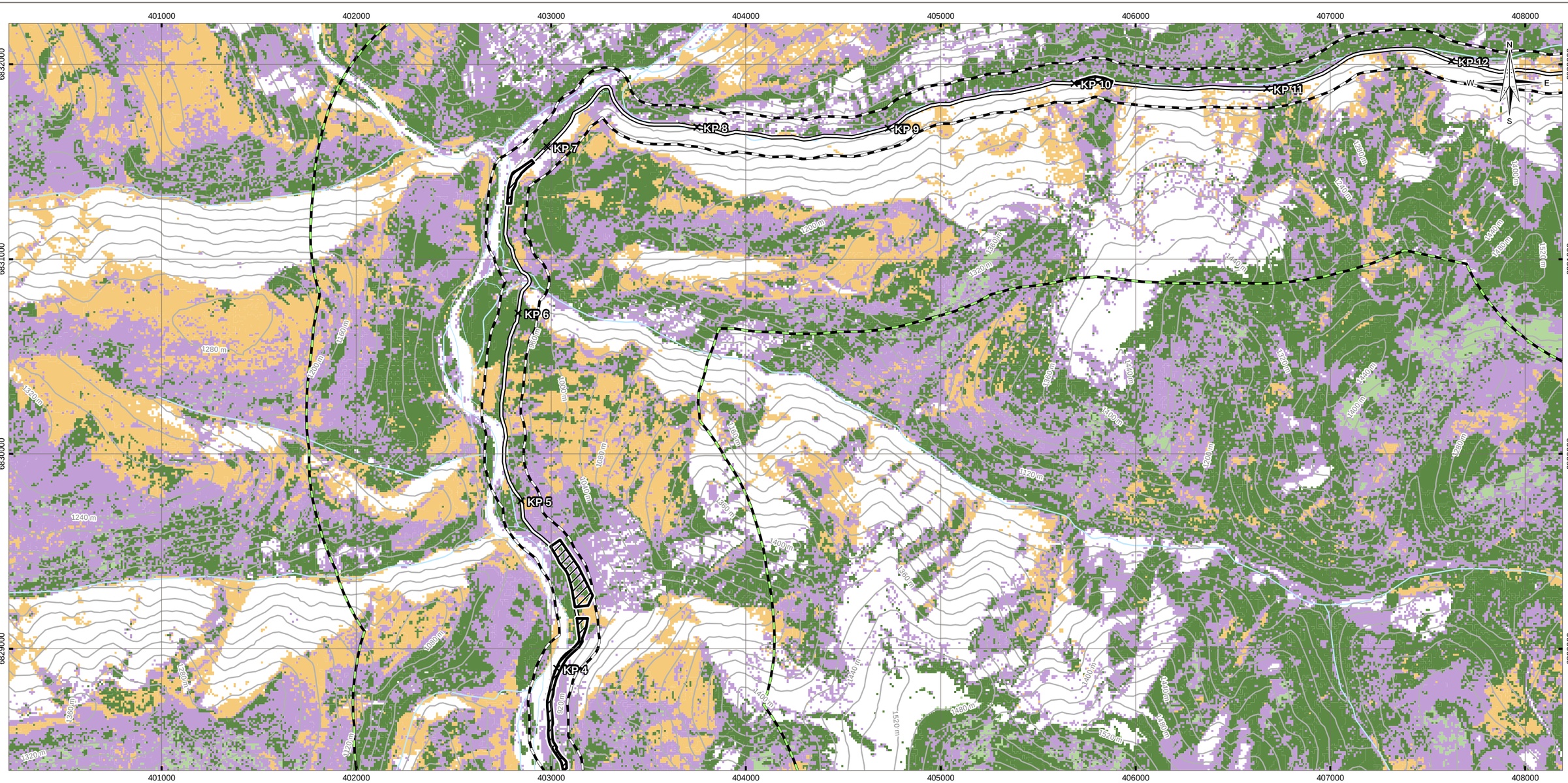
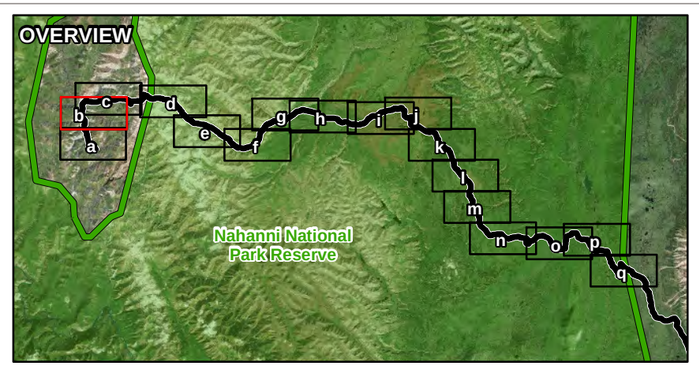


LEGEND

Potential Number of Rare Plant Species

- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION: UTM Zone 10	DATUM: NAD83			CLIENT: CANADIAN ZINC CORPORATION
Scale: 1:20,000 (400 200 0 400 Metres)				TETRA TECH
FILE NO.: EENW03326-01_Figure03_VegetationR01.mxd				
OFFICE: Tt-VANC	DWN: SL	CKD: MRV	APVD: AM	REV: 1
DATE: February 19, 2019	PROJECT NO.: ENW.EENW03326-01			Figure 3b

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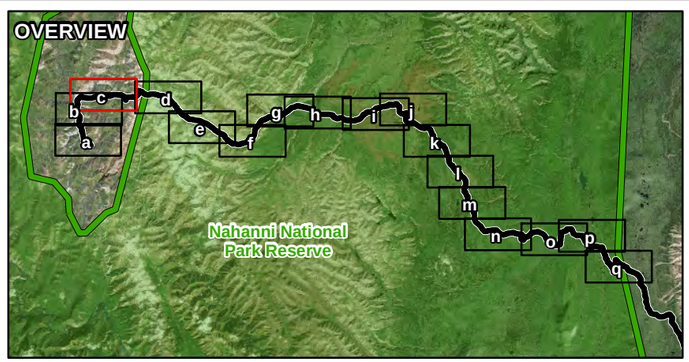
LEGEND

Potential Number of Rare Plant Species

- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000

400 200 0 400

Metres

FILE NO.
EENW03326-01_Figure03_VegetationR01.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	AM	1

DATE
February 19, 2019

PROJECT NO.
ENW.EENW03326-01

TETRA TECH

Figure 3c

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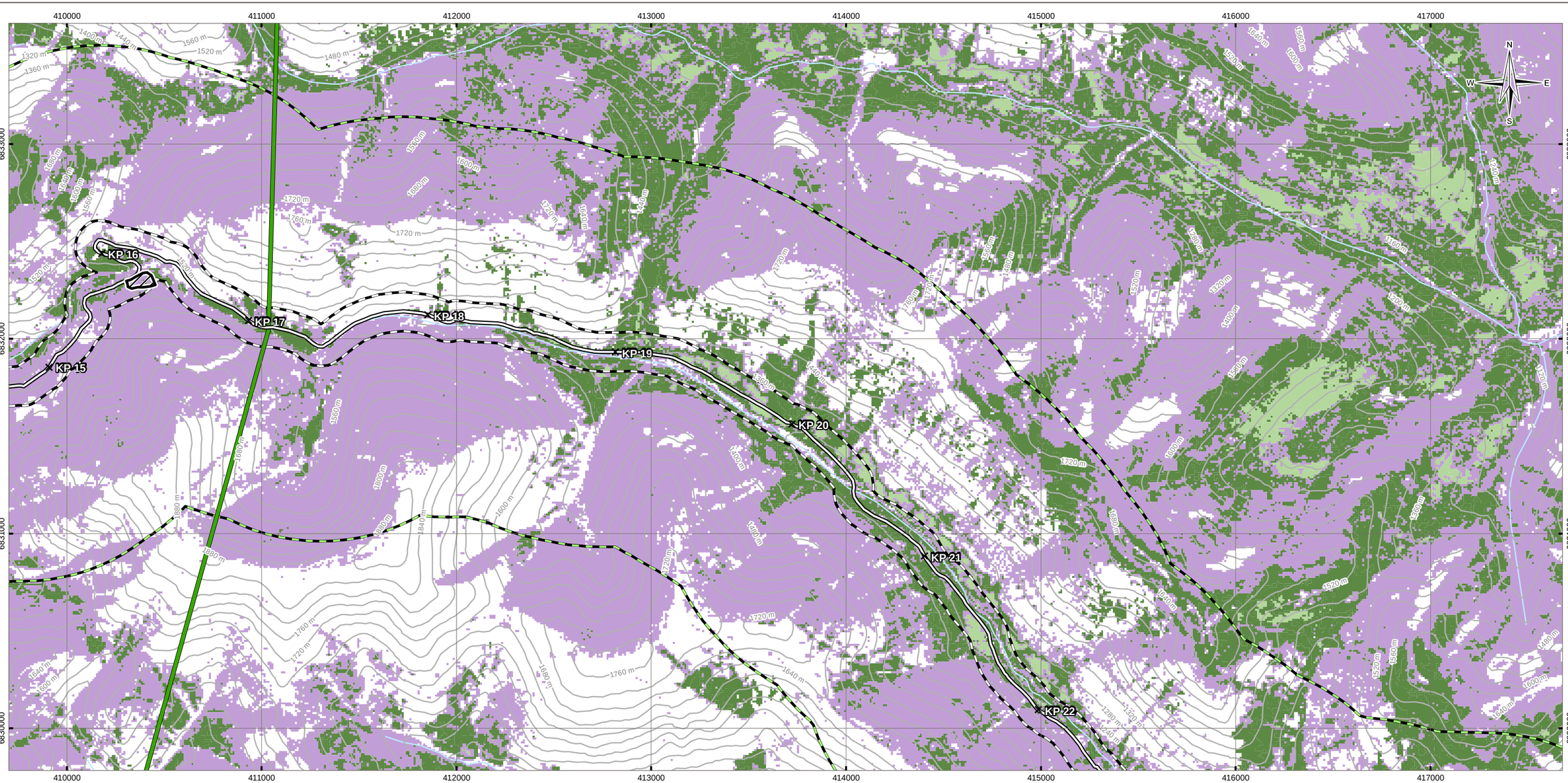
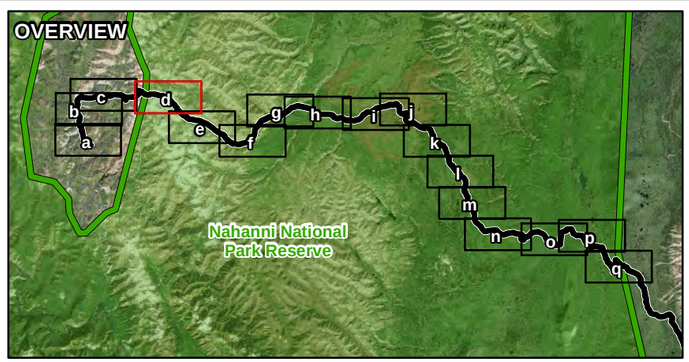


LEGEND

Potential Number of Rare Plant Species

- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION: UTM Zone 10	DATUM: NAD83			CLIENT: CANADIAN ZINC CORPORATION
Scale: 1:20,000 (400 200 0 400 Metres)				TETRA TECH
FILE NO.: EENW03326-01_Figure03_VegetationR01.mxd				
OFFICE: Tt-VANC	DWN: SL	CKD: MRV	APVD: AM	REV: 1
DATE: February 19, 2019	PROJECT NO.: ENW.EENW03326-01			Figure 3d

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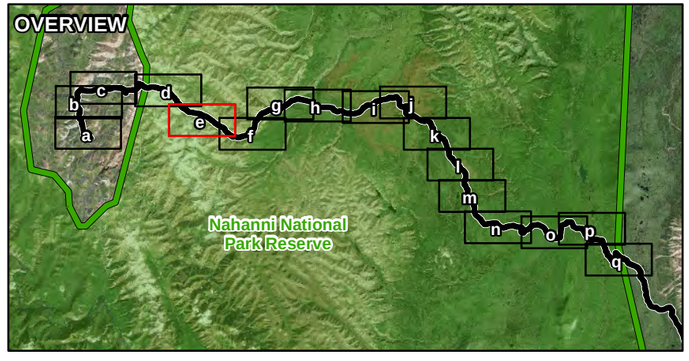
KP 23
KP-24
ASPLVIR
KP 25
KP 26
KP 27
KP 28
KP 29

LEGEND

Rare Plant Observation (2017)
- Asplenium viride

Potential Number of Rare Plant Species
- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION: UTM Zone 10	DATUM: NAD83				CLIENT: CANADIAN ZINC CORPORATION
Scale: 1:20,000 (400 200 0 400 Metres)					TETRA TECH
FILE NO.: EENW03326-01_Figure03_VegetationR01.mxd					
OFFICE: Tt-VANC	DWN: SL	CKD: MRV	APVD: AM	REV: 1	Figure 3e
DATE: February 19, 2019	PROJECT NO.: ENW.EENW03326-01				

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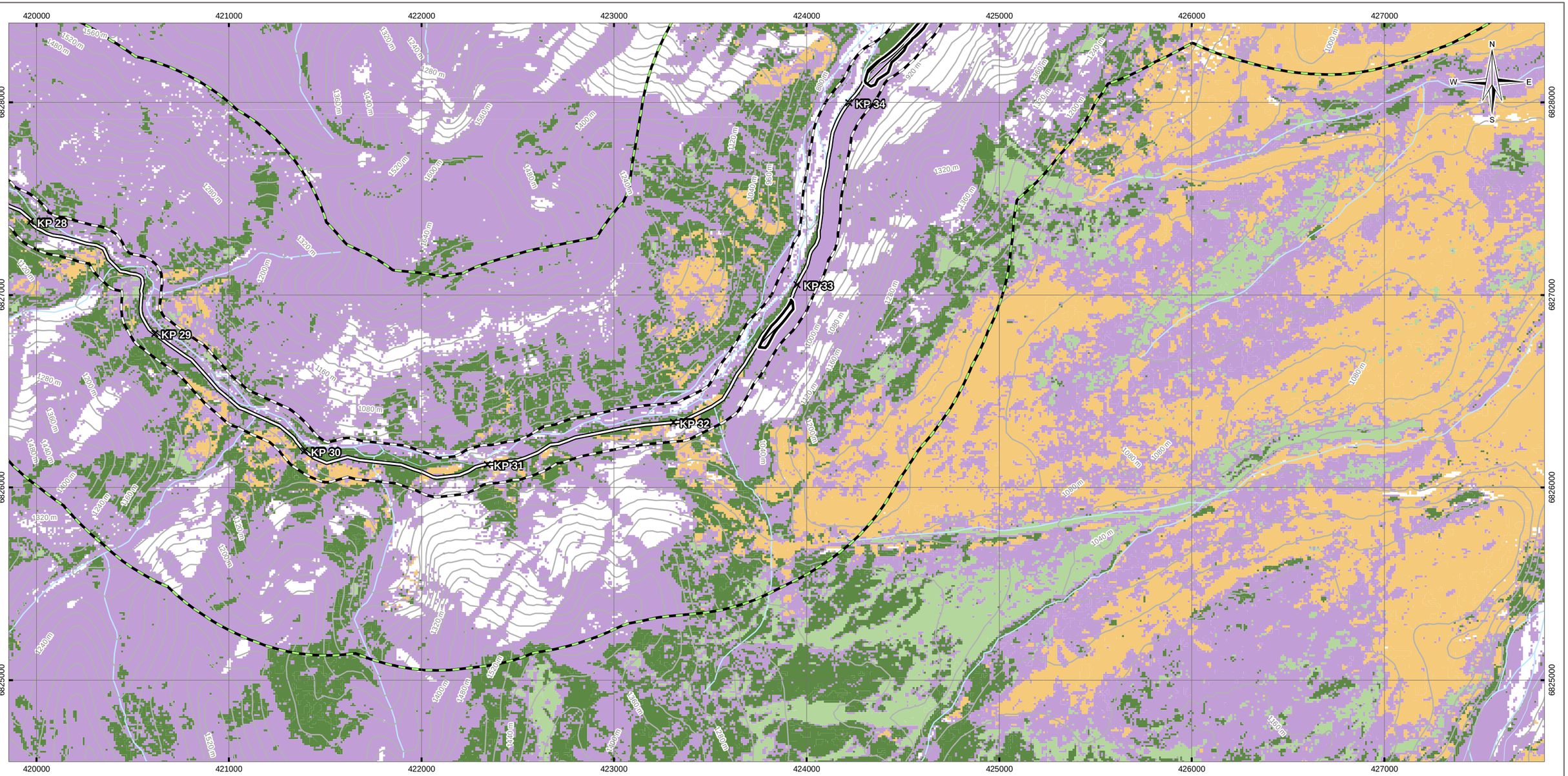
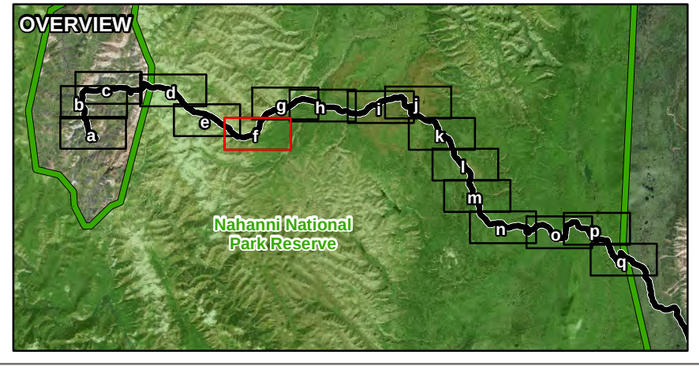


LEGEND

Potential Number of Rare Plant Species

- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION: UTM Zone 10	DATUM: NAD83	CLIENT: Canadian Zinc Corporation
Scale: 1:20,000 (400 200 0 400 Metres)		TETRA TECH
FILE NO.: EENW03326-01_Figure03_VegetationR01.mxd		
OFFICE: Tt-VANC	DWN: SL / CKD: MRV / APVD: AM / REV: 1	Figure 3f
DATE: February 19, 2019	PROJECT NO.: ENW.EENW03326-01	

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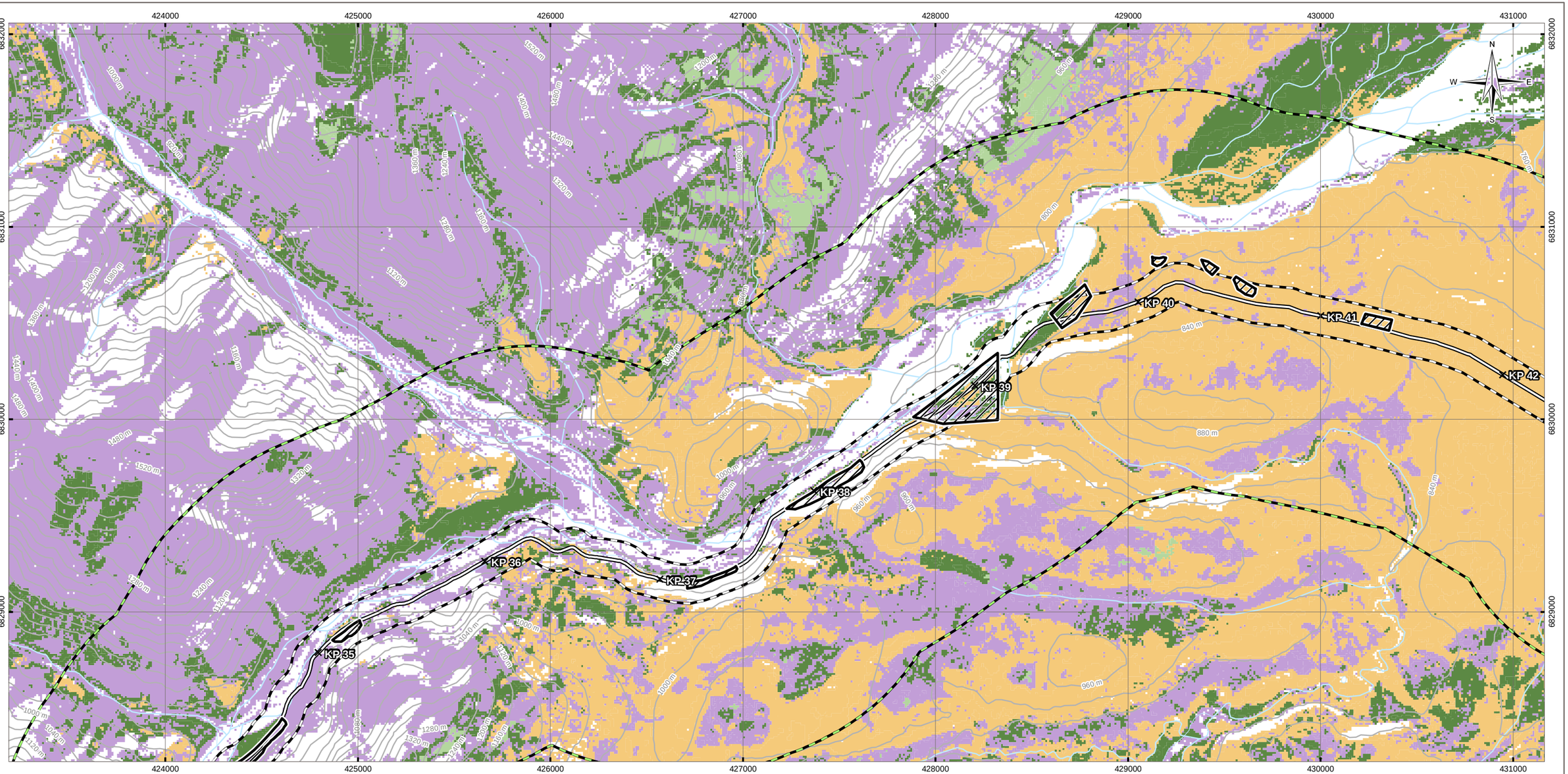
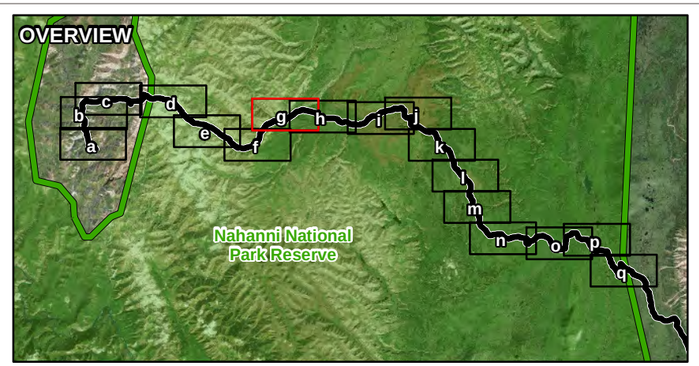


LEGEND

Potential Number of Rare Plant Species

- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000
400 200 0 400
Metres

TETRA TECH

FILE NO. EENW03326-01_Figure03_VegetationR01.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	AM	1

DATE February 19, 2019
PROJECT NO. ENW.EENW03326-01

Figure 3g

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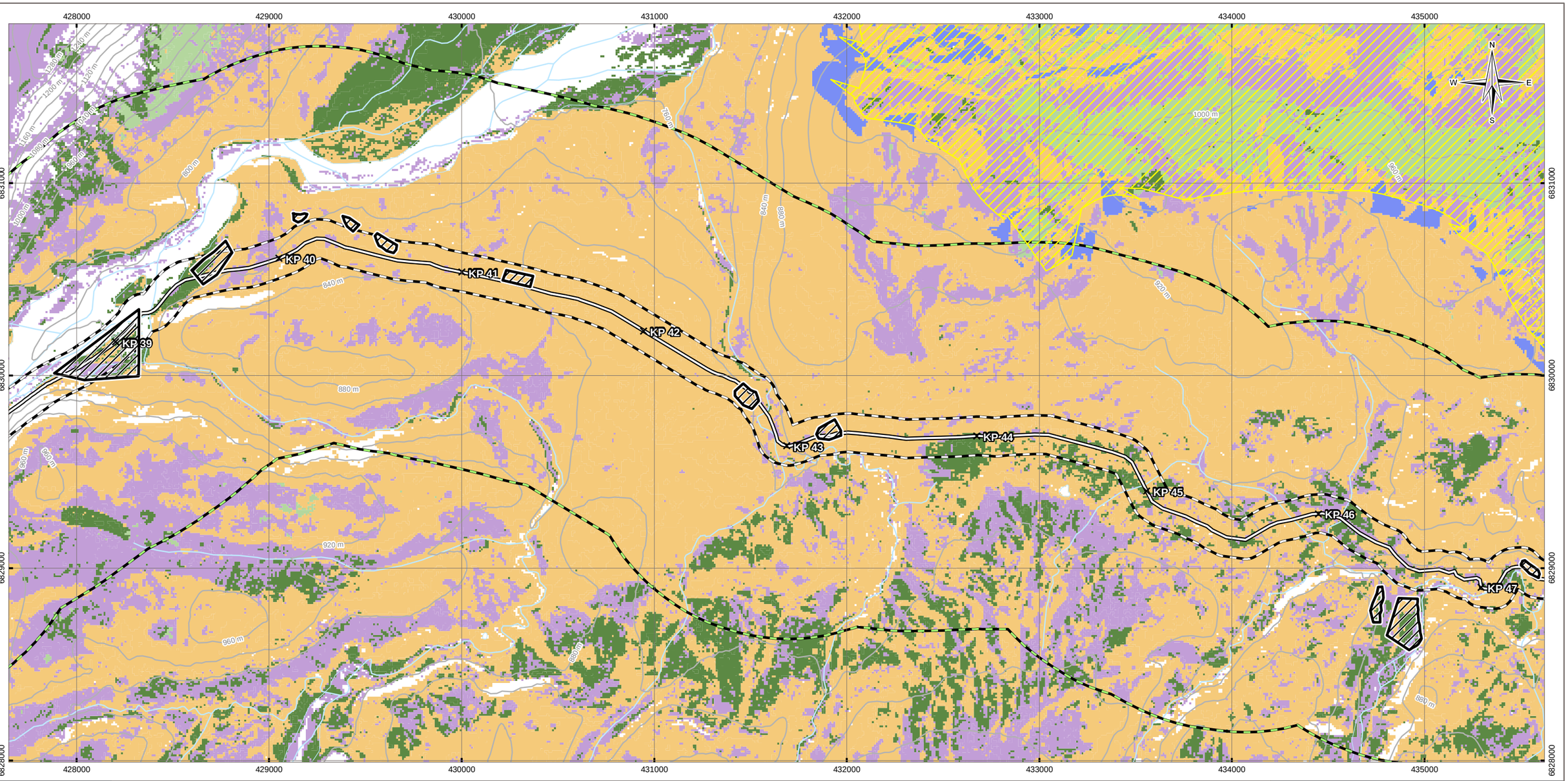
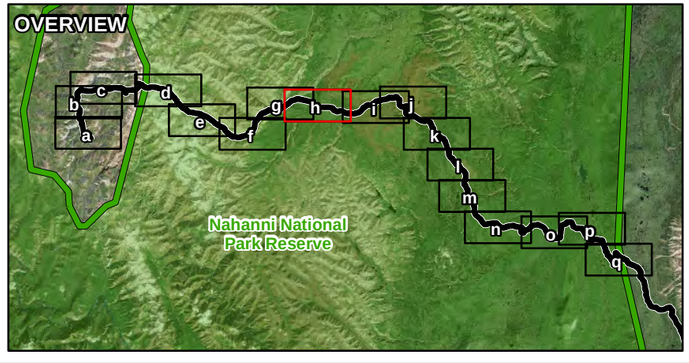


LEGEND

Potential Number of Rare Plant Species

- <15
- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Previously Burned Area
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000

400 200 0 400

Metres

FILE NO.
EENW03326-01_Figure03_VegetationR01.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	AM	1

DATE
February 19, 2019

PROJECT NO.
ENW.EENW03326-01

TETRA TECH

Figure 3h

435000 436000 437000 438000 439000 440000 441000 442000

6831000 6830000 6829000 6828000

1000 m 920 m 880 m 840 m 800 m 760 m 720 m 680 m 640 m 600 m

KP 47 KP 48 KP 49 KP 50 KP 51 KP 52 KP 53 KP 54 KP 55 KP 56 KP 57

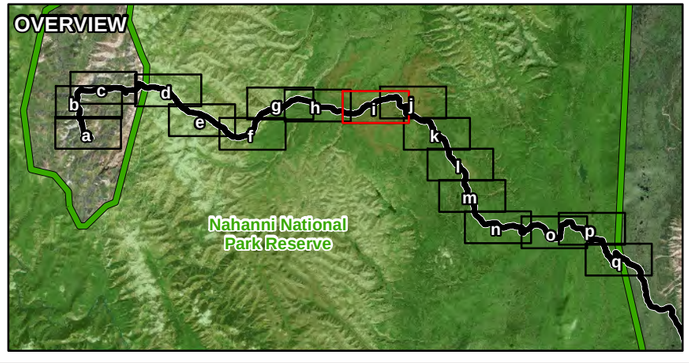
N W E S

LEGEND

Potential Number of Rare Plant Species

- <15
- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Previously Burned Area
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION: UTM Zone 10	DATUM: NAD83			CLIENT: CANADIAN ZINC CORPORATION
Scale: 1:20,000 (400 200 0 400 Metres)				TETRA TECH
FILE NO.: EENW03326-01_Figure03_VegetationR01.mxd				
OFFICE: Tt-VANC	DWN: SL	CKD: MRV	APVD: AM	REV: 1
DATE: February 19, 2019	PROJECT NO.: ENW.EENW03326-01			Figure 3i

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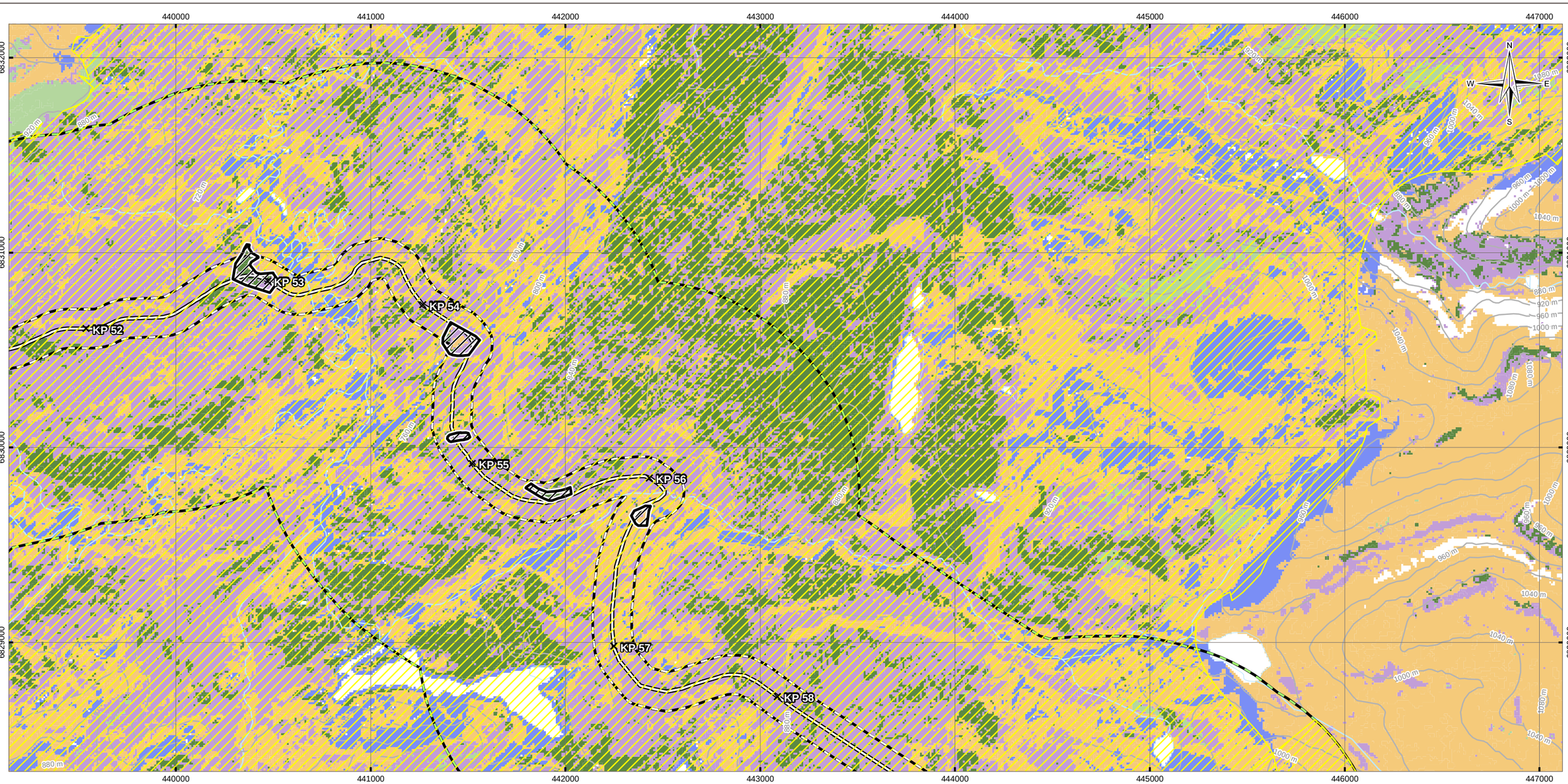
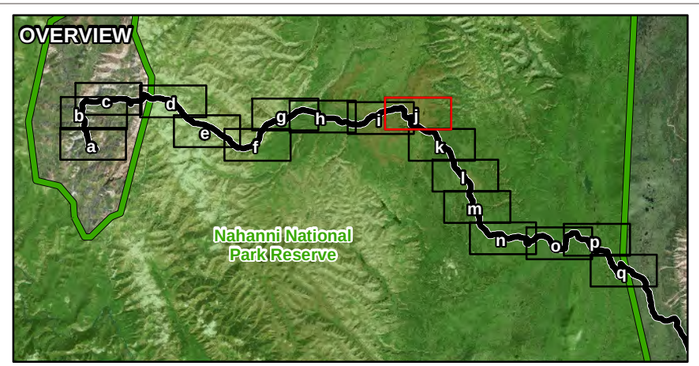


LEGEND

Potential Number of Rare Plant Species

- <15
- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Previously Burned Area
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000

400 200 0 400

Metres

TETRA TECH

FILE NO.				
EENW03326-01_Figure03_VegetationR01.mxd				
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	AM	1
DATE	PROJECT NO.			
February 19, 2019	ENW.EENW03326-01			

Figure 3j

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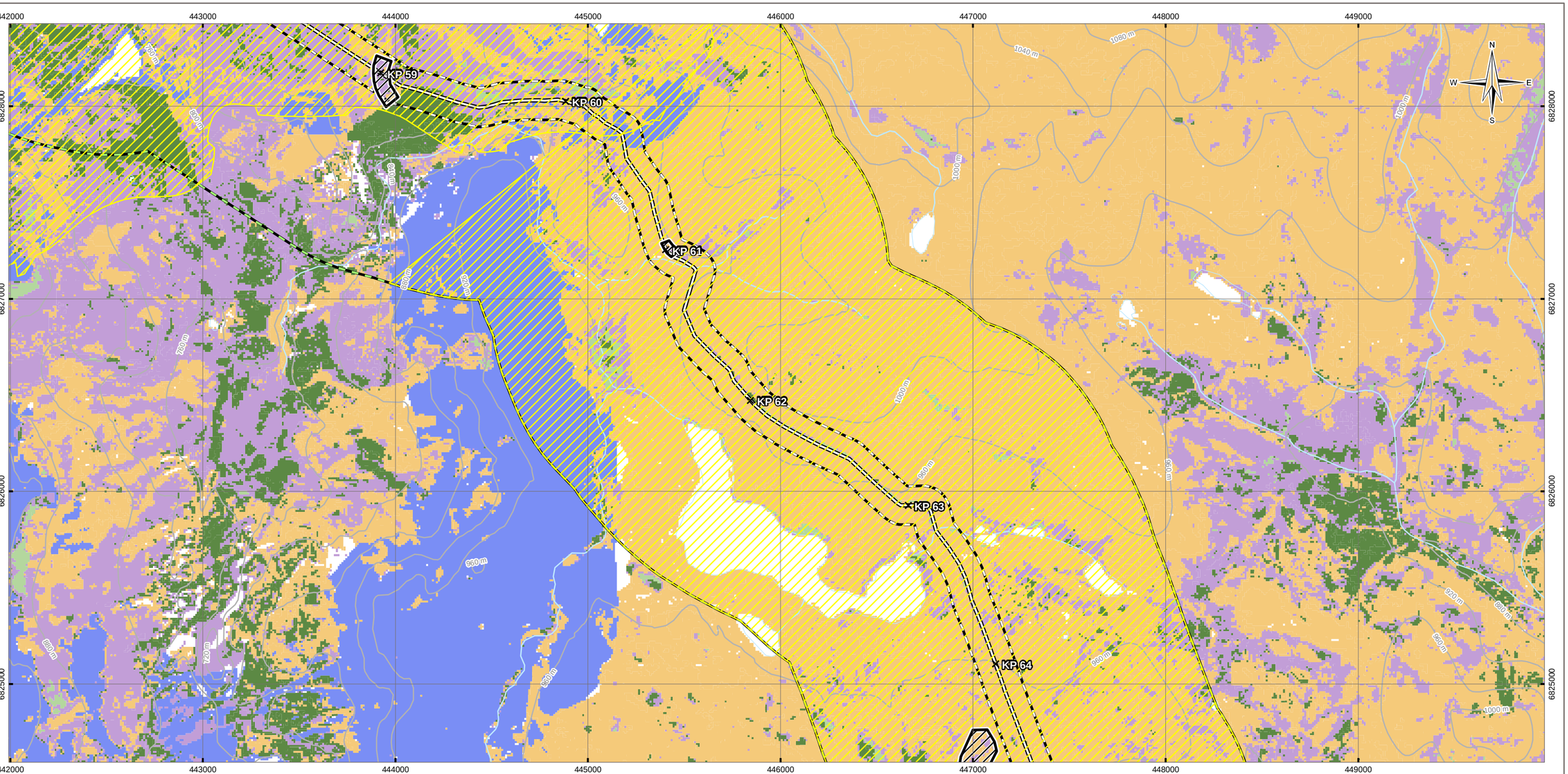
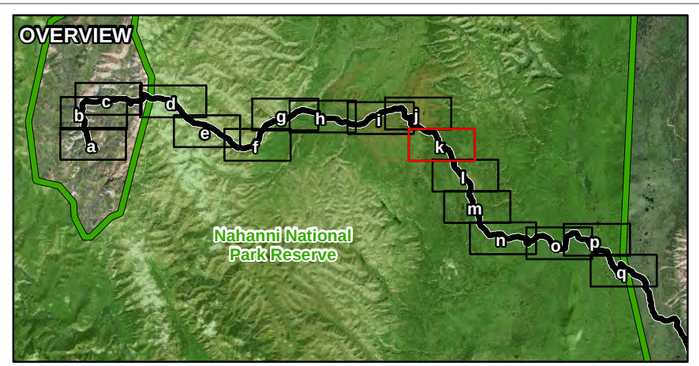


LEGEND

Potential Number of Rare Plant Species

- <15
- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Previously Burned Area
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000

400 200 0 400

Metres

TETRA TECH

FILE NO.
EENW03326-01_Figure03_VegetationR01.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	AM	1

DATE	PROJECT NO.
February 19, 2019	ENW.EENW03326-01

Figure 3k

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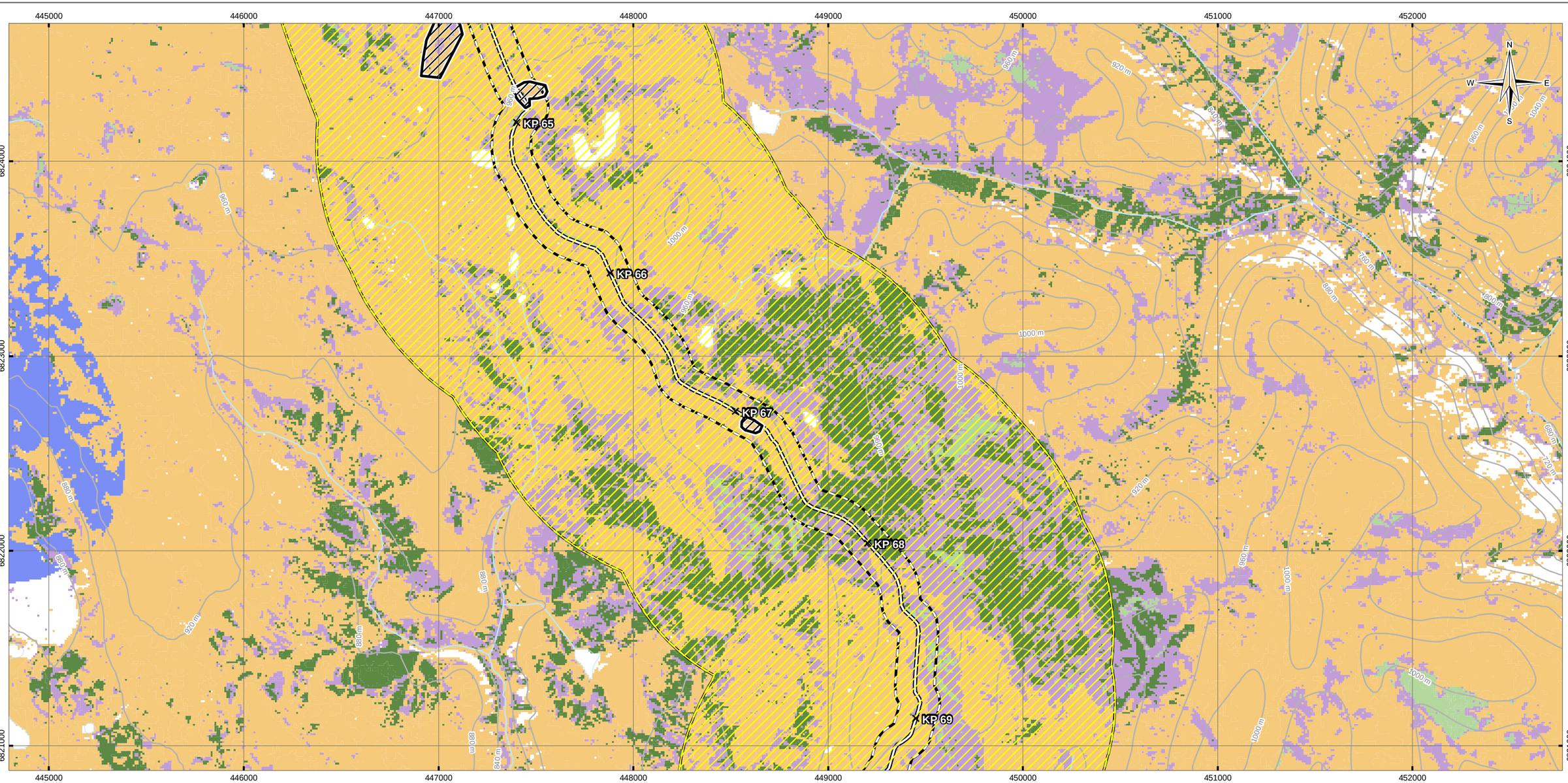
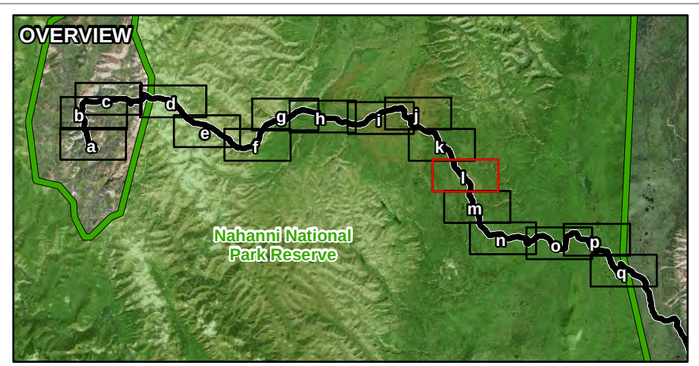


LEGEND

Potential Number of Rare Plant Species

- <15
- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Previously Burned Area
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000

400 200 0 400

Metres

TETRA TECH

FILE NO. EENW03326-01_Figure03_VegetationR01.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	AM	1

DATE February 19, 2019

PROJECT NO. ENW.EENW03326-01

Figure 3l

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447000 448000 449000 450000 451000 452000 453000 454000

6820000 6819000 6818000

KP 70 KP 71 KP 72 KP 73

N W E S

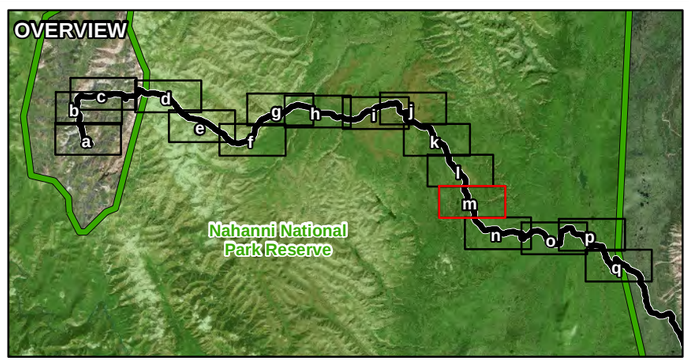
LEGEND

Potential Number of Rare Plant Species

- <15
- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Previously Burned Area
- Nahanni National Park Reserve Boundary

OVERVIEW



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000

400 200 0 400

Metres

FILE NO.
EENW03326-01_Figure03_VegetationR01.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	AM	1

DATE
February 19, 2019

PROJECT NO.
ENW.EENW03326-01

TETRA TECH

Figure 3m

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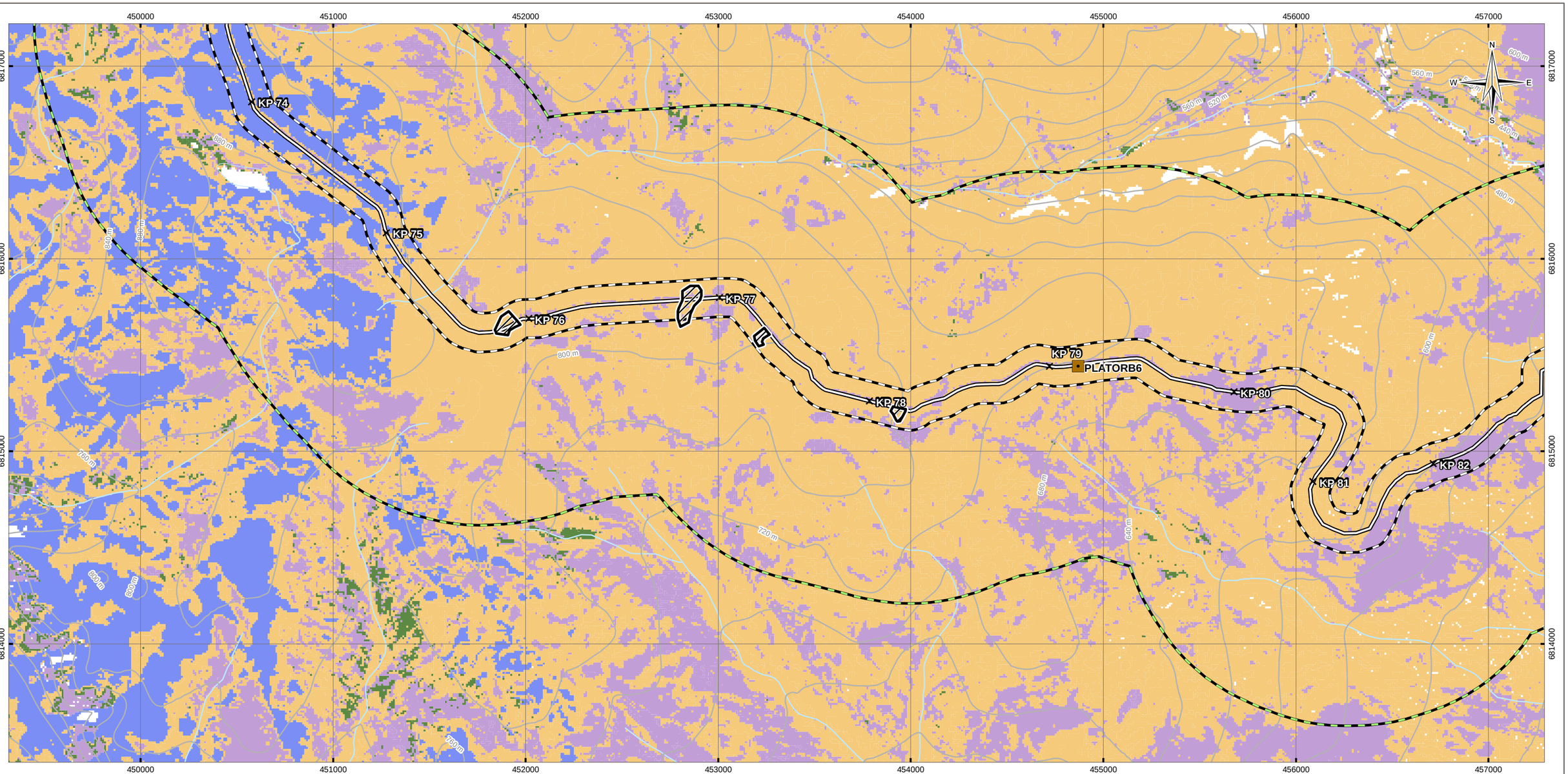

LEGEND

Rare Plant Observation (2017)

- Platanthera orbiculate

Potential Number of Rare Plant Species

- <15
- 16 - 25
- 26 - 30
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
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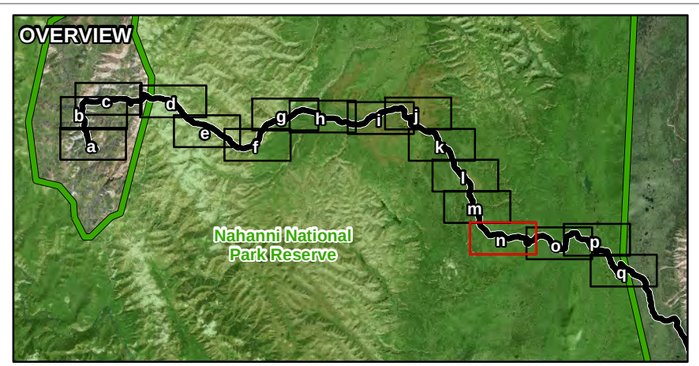
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION: UTM Zone 10	DATUM: NAD83			CLIENT: CANADIAN ZINC CORPORATION
Scale: 1:20,000 (400 200 0 400 Metres)				TETRA TECH
FILE NO.: EENW03326-01_Figure03_VegetationR01.mxd				
OFFICE: Tt-VANC	DWN: SL	CKD: MRV	APVD: AM	REV: 1
DATE: February 19, 2019	PROJECT NO.: ENW.EENW03326-01			Figure 3n

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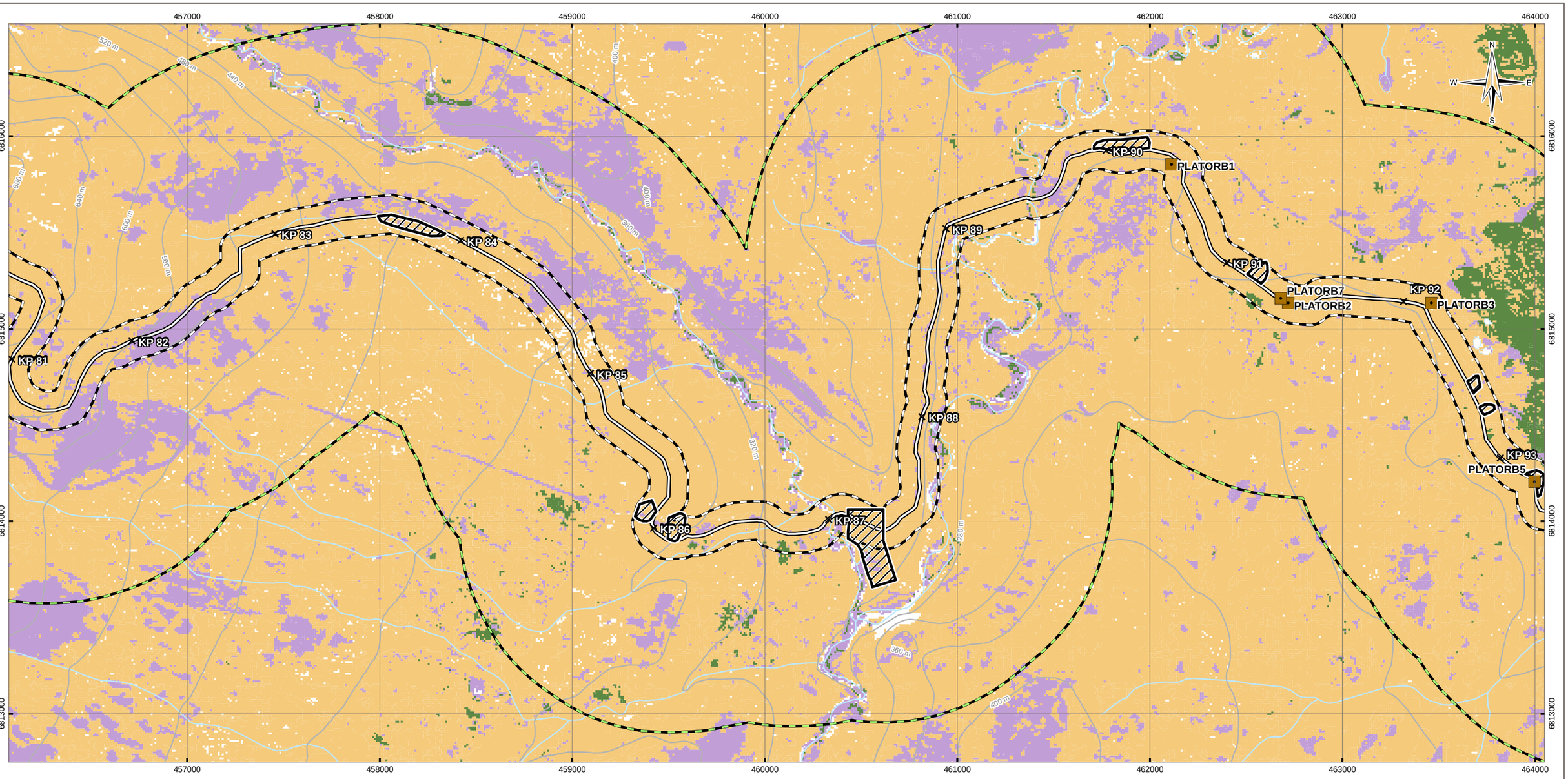

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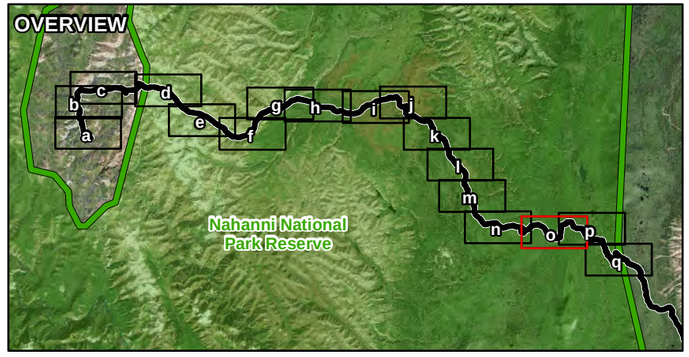
LEGEND

Rare Plant Observation (2017)
- Platanthera orbiculate

Potential Number of Rare Plant Species
- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD
2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION UTM Zone 10	**DATUM** NAD83			**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:20,000 (400 200 0 400 Metres)				TETRA TECH
FILE NO. EENW03326-01_Figure03_VegetationR01.mxd				
OFFICE Tt-VANC	**DWN** SL	**CKD** MRV	**APVD** AM	**REV** 1
DATE February 19, 2019	**PROJECT NO.** ENW.EENW03326-01			**Figure 3o**

461000 462000 463000 464000 465000 466000 467000 468000

6817000 6816000 6815000 6814000

KP 90 PLATORB1 KP 89 KP 91 PLATORB7 PLATORB2 KP 92 PLATORB3 KP 88 KP 93 PLATORB5 KP 94 KP-95

N W E S

LEGEND

Rare Plant Observation (2017)
- Platanthera orbiculate

Potential Number of Rare Plant Species
- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
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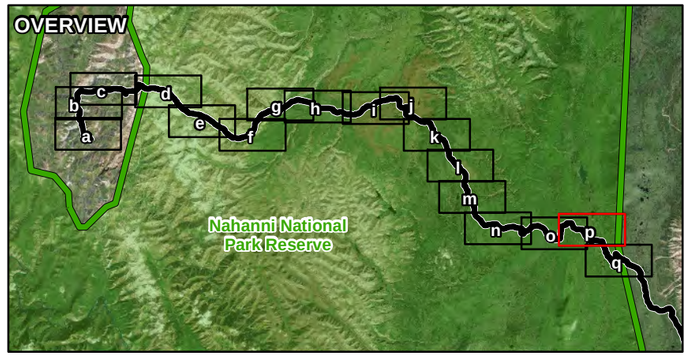
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000

400 200 0 400

Metres

FILE NO. EENW03326-01_Figure03_VegetationR01.mxd

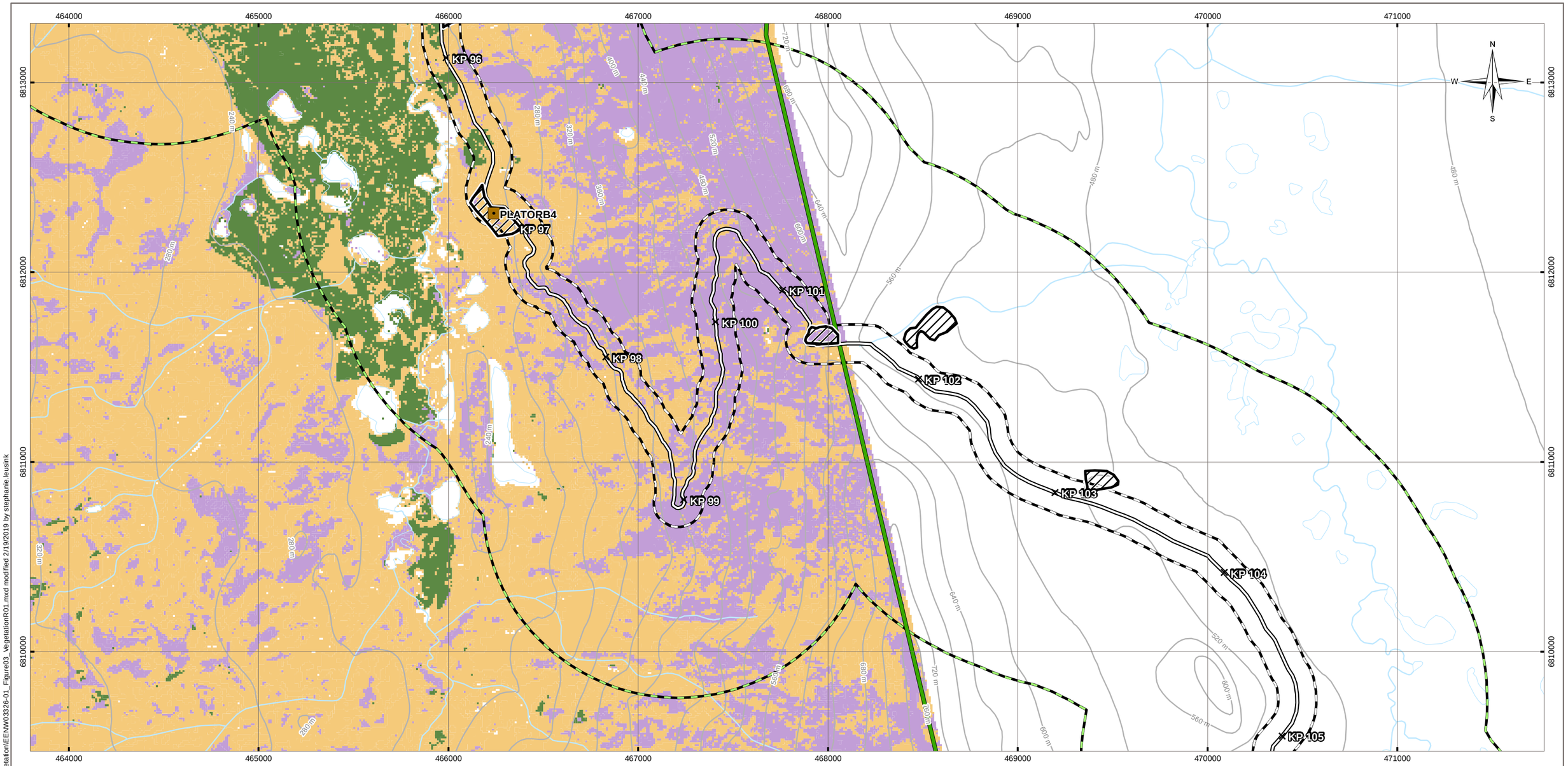
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	AM	1

DATE February 19, 2019

PROJECT NO. ENW.EENW03326-01

TETRA TECH

Figure 3p



LEGEND

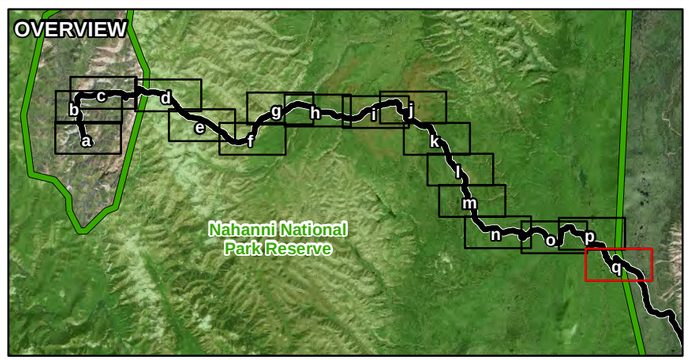
Rare Plant Observation (2017)

- Platanthera orbiculate

Potential Number of Rare Plant Species

- 16 - 25
- 26 - 30
- 31 - 45
- > 45

- Kilometre Point
- Access Road
- Contour (40 m)
- Watercourse
- Waterbody
- 100 m Buffer
- 1 km Buffer
- Borrow Pit
- Nahanni National Park Reserve Boundary



STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL-SEASON ROAD 2017 WILDLIFE & VEGETATION

Vegetation Transects and Rare Plant Survey

PROJECTION	DATUM	CLIENT
UTM Zone 10	NAD83	CANADIAN ZINC CORPORATION

Scale: 1:20,000

400 200 0 400

Metres

FILE NO.
EENW03326-01_Figure03_VegetationR01.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	MRV	AM	1

DATE
February 19, 2019

PROJECT NO.
ENW.EENW03326-01

TETRA TECH

Figure 3q

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APPENDIX A

COLLARED PIKA HABITAT ASSESSMENT CRITERIA

Pika Habitat Assessment Checklist

1	**Is it talus?**	
	Yes - Rock boulder field consisting of large rocks with crevices & cracks with little exposed soil. *Go to #2*	
	No - Scree rock field consisting of small, flat, and looser rocks that lack crevices and cracks. Note, if the scree is too loose to hike on (rocks slide underfoot) then it's not pika habitat. Not pika habitat; Do NOT survey. Stop assessing for habitat and move on to the next location.	
	No - A meadow with few boulders/rocks. The depth of rocks need to be approx. ≥30 cm. Not pika habitat; Do NOT survey. Stop assessing for habitat and move on to the next location.	
2	**Does the talus consist of large boulders?**	
	Yes – majority of the boulders ≥30 cm diameter *If yes, go to #3*	
	No – majority of the boulders <30 cm diameter (as per Parks Canada Nahanni National Park Reserve Collared Pika Field Survey Protocol "scree patches (rocks <30 cm) are not suitable". Not pika habitat, do NOT survey. Record observation on Habitat Evaluation Datasheet (including GPS location) and take photos.	
3	**Is there a meadow/vegetation patch within 10 m of the talus boulder field?**	
	If Yes, go to #4	
	No – follow talus boulder field further downslope. If still no vegetation within 10 m of talus boulder then not pika habitat, do NOT survey. Record on Habitat Evaluation Datasheet (including GPS location) and take photos.	
4	**Is talus of sufficient size?** Parks Canada Pika Monitoring Protocol for the Montane Cordillera Bioregion, Version 2 (provided by Parks Canada) indicated "previous research has indicated that pika are territorial and their territory has been identified as approximately 30 m in diameter…"	
	Yes – Boulder talus field is at least 20 m diameter. If yes, **complete pika survey**.	
	No – Boulder talus field is <20 m diameter. Do NOT survey.	

APPENDIX B

VEGETATION SPECIES LIST

Herb Species List

Layer	Scientific Name	Common Name	Provincial General Status
Trees and Shrubs	*Andromeda polifolia*	Bog Rosemary	Secure
	Arctous alpina	Alpine Bearberry	Secure
	Betula glandulosa	Glandular Birch	Secure
	Cassiope tetragona	Arctic White Heather	Secure
	Dasiphora fruticosa	Shrubby Cinquefoil	Secure
	Empetrum nigrum	Black Crowberry	Secure
	Juniperus communis	Common Juniper	Secure
	Kalmia polifolia	Bog Laurel	Secure
	Picea glauca	White Spruce	Secure
	Populus balsamifera	Balsam Poplar	Secure
	Rhododendron lapponicum	Lapland Rosebay	Secure
	Rhododendron tomentosum	Narrow-leaved Labrador Tea	Secure
	Salix alaxensis	Alaska Willow	Secure
	Salix arbusculoides	Littletree Willow	Secure
	Salix arctica	Arctic Willow	Secure
	Salix brachycarpa	Short-fruit Willow	Secure
	Salix glauca	Gray willow	Secure
	Salix myrtillifolia	Blueberry Willow	Secure
	Salix planifolia	Diamond-leaved Willow	Secure
	Salix polaris	Snow-bed Willow	Secure
	Salix pyrifolia	Balsam Willow	Secure
	Salix reticulata	Net-veined Willow	Secure
	Vaccinium uliginosum	Alpine Bilberry	Secure
	Vaccinium vitis-idaea	Rock Cranberry	Secure
	Androsace chamaejasme	Sweet-flower Rock-jasmine	Secure
	Anemone parviflora	Small-flower Anemone	Secure
	Anemone richardsonii	Yellow Anemone	Secure
	Antennaria rosea	Rosy Pussytoes	Secure
	Anticlea elegans	Mountain Death Camas	Secure
	Arctagrostis latifolia	Broad-leaf Arctic-bent	Secure
	Arnica angustifolia	Narrowleaf Arnica	Secure
	Askellia pygmaea	Dwarf Alpine Hawksbeard	Secure
	Asplenium viride	Spleenwort	May Be At Risk
	Astragalus umbellatus	Tundra Milk-vetch	Secure
	Bistorta vivipara	Alpine Knotweed	Secure
	Braya glabella	Smooth Rockcress	Secure
	Braya humilis	Alpine Northern Rockcress	Secure
	Calamagrostis purpurascens	Purple Reed Grass	Secure
	Carex capillaris	Hairlike Sedge	Secure
	Carex membranacea	Fragile-seed Sedge	Secure
	Carex rupestris	Rock Sedge	Secure
	Carex scirpoidea	Bulrush Sedge	Secure
	Carex siccata	Dry-spike Sedge	Secure
	Carex vaginata	Sheathed Sedge	Secure
	Chamerion angustifolium	Fireweed	Secure
	Chamerion latifolium	River Beauty	Secure
	Cornus canadensis	Dwarf Dogwood	Secure
	Cypripedium parviflorum	Small Yellow Lady's-slipper	Secure
	Cypripedium guttatum	Spotted Lady's-slipper	Secure
	Cystopteris fragilis	Fragile Fern	Secure
	Delphinium glaucum	Pale Larkspur	Secure
	Draba lactea	Milky Whitlow-grass	Secure
	Dryas drummondii	Yellow Mountain Avens	Secure
	Dryas integrifolia	Entire-leaved Mountain Avens	Secure
	Equisetum arvense	Field Horsetail	Secure
	Equisetum pratense	Meadow Horsetail	Secure
	Equisetum scirpoides	Dwarf Scouring-rush	Secure

Herb Species List

Layer	Scientific Name	Common Name	Provincial General Status
	Equisetum variegatum	Variegated Horsetail	Secure
	Erigeron humilis	Low Fleabane	Secure
	Erigeron hyssopifolius	Hyssop-leaved Fleabane	Secure
	Festuca saximontana	Rocky Mountain Fescue	Secure
	Galearis rotundifolia	Small Round-leaved Orchis	Secure
	Hedysarum alpinum	Alpine Sweet-Vetch	Secure
	Hedysarum boreale	Boreal Sweet- vetch	Secure
	Huperzia selago	Fir Clubmoss	Secure
	Mertensia paniculata	Northern Bluebell	Secure
	Orthilia secunda	One-sided Wintergreen	Secure
	Oxyria digyna	Mountain Sorrel	Secure
	Oxytropis campestris	Field Locoweed	Secure
	Oxytropis nigrescens	Blackish Locoweed	Secure
	Packera hyperborealis	Boreal Groundsel	Secure
	Parnassia palustris	Marsh Grass-of-parnassus	Secure
	Parrya nudicaulis	Naked-stemmed Wallflower	Secure
	Pedicularis labradorica	Labrador Lousewort	Secure
	Pedicularis lanata	Woolly Lousewort	Secure
	Pinguicula vulgaris	Common Butterwort	Secure
	Platanthera obtusata	Blunt-leaved Bog Orchid	Secure
	Poa alpina	Alpine Bluegrass	Secure
	Poa arctica	Arctic Bluegrass	Secure
	Primula stricta	Stiff Primrose	Secure
	Pyrola asarifolia	Pink Pyrola	Secure
	Pyrola grandiflora	Arctic Pyrola	Secure
	Saussurea angustifolia	Narrow-leaf Saw-wort	Secure
	Saxifraga aizoides	Yellow Mountain Saxifrage	Secure
	Saxifraga oppositifolia	Purple Mountain Saxifrage	Secure
	Saxifraga tricuspidata	Prickly Saxifrage	Secure
	Silene acaulis	Moss Campion	Secure
	Silene uralensis	Apetalous Campion	Secure
	Solidago multiradiata	Alpine Goldenrod	Secure
	Solidago simplex	Sticky Goldenrod	Secure
	Stellaria longifolia	Longleaf Stitchwort	Secure
	Tephroseris frigida	Arctic Groundsel	Secure
	Thalictrum sparsiflorum	Few Flower Meadow Rue	Secure
	Tofieldia coccinea	Northern False Asphodel	Secure
	Tofieldia pusilla	Scotch False Asphodel	Secure
	Viola epipsila	Northern Marsh Violet	Secure
	Woodsia glabella	Smooth Cliff-fern	Secure
Bryoid	*Selaginella sibirica*	Siberian Spikemoss	Secure

Wetland Species List

Layer	Scientific Name	Common Name	Provincial General Status
Tree and Shrubs	*Alnus viridis*	Green Alder	Secure
	Alnus incana	Speckled Alder	Secure
	Andromeda polifolia	Bog Rosemary	Secure
	Arctous alpina	Alpine Bearberry	Secure
	Betula glandulosa	Glandular Birch	Secure
	Betula papyrifera	Paper Birch	Secure
	Chamaedaphne calyculata	Leatherleaf	Secure
	Cornus stolonifera	Red Osier Dogwood	Secure
	Dasiphora fruticosa	Shrubby Cinquefoil	Secure
	Kalmia polifolia	Bog Laurel	Secure
	Larix laricina	Tamarack	Secure
	Myrica gale	Sweet Gale	Secure
	Pedicularis labradorica	Labrador Lousewort	Secure
	Picea mariana	Black Spruce	Secure
	Populus balsamifera	Balsam Poplar	Secure
	Rhododendron groenlandicum	Common Labrador Tea	Secure
	Rhododendron lapponicum	Lapland Rosebay	Secure
	Rosa acicularis	Prickly Rose	Secure
	Salix arbusculoides	Littletree Willow	Secure
	Salix glauca	Gray willow	Secure
	Salix myrtillifolia	Blueberry Willow	Secure
	Salix planifolia	Diamond-leaved Willow	Secure
	Salix polaris	Polar Willow	Secure
	Salix pseudomonticola	False Mountain Willow	Secure
	Salix reticulata	Net-veined Willow	Secure
	Vaccinium uliginosum	Alpine Bilberry	Secure
	Vaccinium vitis-idaea	Rock Cranberry	Secure
Graminoids and Forbs	*Achillea alpina*	Siberian Yarrow	Secure
	Galearis rotundifolia	Small Round-leaved Orchis	Secure
	Arctagrostis latifolia	Broad-leaf Arctic-bent	Secure
	Bistorta vivipara	Alpine Knotweed	Secure
	Calamagrostis canadensis	Blue-jointed Reed Grass	Secure
	Calla palustris	Wild Calla	Secure
	Carex aquatilis	Water Sedge	Secure
	Carex aurea	Golden Fruit Sedge	Secure
	Carex diandra	Lesser Panicled Sedge	Secure
	Carex gynocrates	Northern Bog Sedge	Secure
	Carex limosa	Mud Sedge	Secure
	Carex utriculata	Northwest Territory Sedge	Secure
	Carex vaginata	Sheathed Sedge	Secure
	Cicuta bulbifera	Bulbous Water-hemlock	Secure
	Comarum palustre	Marsh Cinquefoil	Secure
	Comarum palustre	Marsh Cinquefoil	Secure
	Coptidium lapponicum	Lapland Buttercup	Secure
	Cornus canadensis	Dwarf Dogwood	Secure
	Cypripedium guttatum	Spotted Lady's-slipper	Secure
	Eleocharis palustris	Common Spike Rush	Secure
	Equisetum arvense	Field Horsetail	Secure
	Equisetum fluviatile	Water Horsetail	Secure
	Equisetum palustre	Marsh Horsetail	Secure
	Equisetum scirpoides	Dwarf Scouring-rush	Secure
	Equisetum variegatum	Variegated Horsetail	Secure
	Eriophorum angustifolium	Narrow-leaved Cotton-grass	Secure
	Eriophorum brachyantherum	Short-anther Cotton-grass	Secure
	Eriophorum viridicarinatum	Tassel Cotton-grass	Secure
	Galium trifidum	Small Bedstraw	Secure
	Geocaulon lividum	Northern Comandra spp	Secure
	Geum aleppicum	Yellow Avens	Secure
	Geum macrophyllum	Large-leaved Avens	Secure
	Hippuris vulgaris	Common Marestail	Secure

Wetland Species List

Layer	Scientific Name	Common Name	Provincial General Status
Graminoids and Forbs	*Juncus alpinoarticulatus*	Northern Green Rush	Secure
	Juncus castaneus	Chestnut Rush	Secure
	Linnaea borealis	Twinflower	Secure
	Lysimachia thyrsiflora	Tufted Yellow Loosetrife	Secure
	Maianthemum trifolium	Three-leaved False Solomon's Seal	Secure
	Mentha canadensis	Canada Mint	Secure
	Neottia borealis	Northern Twayblade	Secure
	Persicaria amphibia	Water Smartweed	Secure
	Petasites frigidus	Arctic Sweet Coltsfoot	Secure
	Petasites sagittatus	Arrow-Leaved Sweet-Coltsfoot	Not Assessed
	Pinguicula vulgaris	Common Butterwort	Secure
	Platanthera aquilonis	Tall Northern Green Orchid	Secure
	Poa alpina	Alpine Bluegrass	Secure
	Potamogeton richardsonii	Richardson's pondweed	Secure
	Potentilla norvegica	Norwegian Cinquefoil	Secure
	Pyrola asarifolia	Pink Pyrola	Secure
	Pyrola grandiflora	Arctic Pyrola	Secure
	Rubus arcticus	Arctic Raspberry	Secure
	Rubus chamaemorus	Cloudberry	Secure
	Rumex occidentalis	Western Dock	Secure
	Scutellaria galericulata	Hooded Skullcap	Secure
	Sium suave	Water Parsnip	Secure
	Stellaria longipes	Long-stalked Stitchwort	Secure
	Tofieldia pusilla	Scotch False Asphodel	Secure
	Triantha glutinosa	Sticky False Asphodel	Secure
	Triglochin palustris	Marsh Arrowgrass	Secure
	Typha latifolia	Broad-leaf Cattail	Secure
	Utricularia intermedia	Flatleaf Bladderwort	Secure
	Utricularia vulgaris	Greater Bladderwort	Secure
	Viola epipsila	Northern Marsh Violet	Secure

Mixedwood Species List

Layer	Scientific Name	Common Name	Provincial General Status
Trees and Shrubs	*Alnus incana*	Speckled Alder	Secure
	Alnus viridis	Green Alder	Secure
	Amelanchier alnifolia	Saskatoon Berry, Serviceberry	Secure
	Arctostaphylos uva-ursi	Common Bearberry	Secure
	Arctous alpina	Alpine Bearberry	Secure
	Betula glandulosa	Glandular Birch	Secure
	Betula papyrifera	Paper Birch	Secure
	Cornus stolonifera	Red Osier Dogwood	Secure
	Dasiphora fruticosa	Shrubby Cinquefoil	Secure
	Juniperus communis	Common Juniper	Secure
	Lonicera dioica	Mountain Honeysuckle	Secure
	Picea glauca	White Spruce	Secure
	Pinus contorta	Lodgepole Pine	Secure
	Populus balsamifera	Balsam Poplar	Secure
	Populus tremuloides	Trembling Aspen	Secure
	Rhododendron groenlandicum	Common Labrador Tea	Secure
	Ribes lacustre	Bristly Black Currant	Secure
	Ribes oxyacanthoides	Canada Gooseberry	Secure
	Ribes triste	Swamp Red Currant	Secure
	Rosa acicularis	Prickly Rose	Secure
	Rubus idaeus	Red Raspberry	Secure
	Salix alaxensis	Alaska Willow	Secure
	Salix arbusculoides	Littletree Willow	Secure
	Salix bebbiana	Bebb Willow	Secure
	Salix glauca	Gray willow	Secure
	Salix myrtillifolia	Blueberry Willow	Secure
	Salix niphoclada	Barren-ground Willow	Secure
	Salix planifolia	Diamond-leaved Willow	Secure
	Salix scouleriana	Scouler Willow	Secure
	Salix serissima	Autumn Willow	Secure
	Shepherdia canadensis	Buffalo-berry	Secure
	Vaccinium uliginosum	Alpine Bilberry	Secure
	Vaccinium vitis-idaea	Rock Cranberry	Secure
	Viburnum edule	Squashberry	Secure
Graminoids and Forbs	*Actaea rubra*	Red Baneberry	Secure
	Anemone parviflora	Small-flower Anemone	Secure
	Anticlea elegans	Mountain Death Camas	Secure
	Aquilegia brevistyla	Blue Columbine	Secure
	Arnica angustifolia	Narrowleaf Arnica	Secure
	Astragalus americanus	American Milk-vetch	Secure
	Boschniakia rossica	Northern Groundcone	Secure
	Botrychium lunaria	Common Moonwort	Secure
	Carex aquatilis	Water Sedge	Secure
	Carex capillaris	Hairlike Sedge	Secure
	Carex disperma	Softleaf Sedge	Secure
	Carex membranacea	Fragile-seed Sedge	Secure
	Chamerion angustifolium	Fireweed	Secure
	Coptidium lapponicum	Lapland Buttercup	Secure
	Corallorhiza trifida	Early Coral Root	Secure
	Cornus canadensis	Dwarf Dogwood	Secure
	Cornus canadensis	Dwarf Dogwood	Secure
	Cypripedium guttatum	Spotted Lady's-slipper	Secure
	Cypripedium passerinum	Sparrow's-egg Lady's-slipper	Secure
	Delphinium glaucum	Pale Larkspur	Secure
	Diphasiastrum complanatum	Trailing Clubmoss	Secure
	Dryas integrifolia	Entire-leaved Mountain Avens	Secure
	Empetrum nigrum	Black Crowberry	Secure
	Equisetum arvense	Field Horsetail	Secure
	Equisetum fluviatile	Water Horsetail	Secure
	Equisetum pratense	Meadow Horsetail	Secure
	Equisetum scirpoides	Dwarf Scouring-rush	Secure

Mixedwood Species List

Layer	Scientific Name	Common Name	Provincial General Status
Graminoids and Forbs	*Equisetum sylvaticum*	Woodland Horsetail	Secure
	Equisetum variegatum	Variegated Horsetail	Secure
	Festuca baffinensis	Baffin Fescue	Secure
	Fragaria vesca	Woodland Strawberry	Secure
	Fragaria virginiana	Virginia Strawberry	Secure
	Galearis rotundifolia	Small Round-leaved Orchis	Secure
	Galium boreale	Northern Bedstraw	Secure
	Gentianella propinqua	Four-parted Gentian	Secure
	Geocaulon lividum	Northern Comandra	Secure
	Goodyera repens	Lesser Rattlesnake Plantain	Secure
	Gymnocarpium dryopteris	Common Oak-fern	Secure
	Linnaea borealis	Twinflower	Secure
	Lycopodium annotinum	Bristly Clubmoss	Secure
	Lycopodium annotinum	Bristly Clubmoss	Secure
	Lycopodium clavatum	Running Clubmoss	Not Assessed
	Maianthemum canadense	Wild Lily-of-the-Valley	Secure
	Mertensia paniculata	Northern Bluebell	Secure
	Mertensia paniculata	Northern Bluebell	Secure
	Mitella nuda	Bare-stem Bishop's Cap	Secure
	Orthilia secunda	One-sided Wintergreen	Secure
	Oxytropis campestris	Field Locoweed	Secure
	Oxytropis deflexa	Pendant-pod Locoweed	Secure
	Pedicularis labradorica	Labrador Lousewort	Secure
	Petasites frigidus	Arctic Sweet Coltsfoot	Secure
	Pinguicula vulgaris	Common Butterwort	Secure
	Platanthera obtusata	Blunt-leaved Bog Orchid	Secure
	Platanthera orbiculata	Small Round-leaved Bog Orchid	Sensitive
	Poa alpina	Alpine Bluegrass	Secure
	Pyrola asarifolia	Pink Pyrola	Secure
	Pyrola chlorantha	Greenish-flowered Pyrola	Secure
	Rubus arcticus	Arctic Raspberry	Secure
	Rubus chamaemorus	Cloudberry	Secure
	Rubus pubescens	Dwarf Red Raspberry	Secure
	Solidago multiradiata	Alpine Goldenrod	Secure
	Symphyotrichum ciliolatum	Lindley's Aster	Secure
	Tephroseris frigida	Arctic Groundsel	Secure
	Tofieldia pusilla	Scotch False Asphodel	Secure
	Viola epipsila	Northern Marsh Violet	Secure
	Viola renifolia	Kidney-leaf White Violet	Secure

Coniferous Species List

Layer	Scientific Name	Common Name	Provincial General Status
Trees and Shrubs	*Alnus viridis*	Green Alder	Secure
	Andromeda polifolia	Bog Rosemary	Secure
	Arctostaphylos uva-ursi	Common Bearberry	Secure
	Arctous alpina	Alpine Bearberry	Secure
	Arctous rubra	Red Bearberry	Secure
	Betula glandulosa	Glandular Birch	Secure
	Betula papyrifera	Paper Birch	Secure
	Cassiope tetragona	Arctic White Heather	Secure
	Chamaedaphne calyculata	Leatherleaf	Secure
	Dasiphora fruticosa	Shrubby Cinquefoil	Secure
	Empetrum nigrum	Black Crowberry	Secure
	Juniperus communis	Common Juniper	Secure
	Kalmia polifolia	Bog Laurel	Secure
	Larix laricina	Tamarack	Secure
	Picea glauca	White Spruce	Secure
	Picea mariana	Black Spruce	Secure
	Populus balsamifera	Balsam Poplar	Secure
	Rhododendron groenlandicum	Common Labrador Tea	Secure
	Rhododendron tomentosum	Narrow-leaved Labrador Tea	Secure
	Ribes lacustre	Bristly Black Currant	Secure
	Ribes triste	Swamp Red Currant	Secure
	Rosa acicularis	Prickly Rose	Secure
	Rubus arcticus	Arctic Raspberry	Secure
	Salix arbusculoides	Littletree Willow	Secure
	Salix barclayi	Barclay Willow	Secure
	Salix bebbiana	Bebb Willow	Secure
	Salix brachycarpa	Short-fruit Willow	Secure
	Salix glauca	Gray willow	Secure
	Salix myrtillifolia	Blueberry Willow	Secure
	Salix niphoclada	Barren-ground Willow	Secure
	Salix polaris	Polar Willow	Secure
	Salix reticulata	Net-veined Willow	Secure
	Salix scouleriana	Scouler Willow	Secure
	Salix serissima	Autumn Willow	Secure
	Shepherdia canadensis	Buffalo-berry	Secure
	Vaccinium oxycoccos	Small Cranberry	Secure
	Vaccinium uliginosum	Alpine Bilberry	Secure
	Viburnum edule	Squashberry	Secure
Graminoids and Forbs	*Aconitum delphinifolium*	Mountain Monkshood	Secure
	Anticlea elegans	Mountain Death Camas	Secure
	Galearis rotundifolia	Small Round-leaved Orchis	Secure
	Androsace chamaejasme	Sweet-flower Rock-jasmine	Secure
	Anemone parviflora	Small-flower Anemone	Secure
	Anemone richardsonii	Yellow Anemone	Secure
	Arctagrostis latifolia	Broad-leaf Arctic-bent	Secure
	Artemisia norvegica	Arctic Sagebrush	Secure
	Astragalus umbellatus	Tundra Milk-vetch	Secure
	Bistorta vivipara	Alpine Knotweed	Secure
	Boschniakia rossica	Northern Groundcone	Secure
	Calamagrostis canadensis	Blue-jointed Reed Grass	Secure
	Calypso bulbosa	Caypso	Secure

Coniferous Species List

Layer	Scientific Name	Common Name	Provincial General Status
Graminoids and Forbs	*Carex capillaris*	Hairlike Sedge	Secure
	Carex siccata	Dry-spike Sedge	Secure
	Carex vaginata	Sheathed Sedge	Secure
	Chamerion angustifolium	Fireweed	Secure
	Chrysosplenium tetrandrum	Northern Golden Saxifrage	Secure
	Coptidium lapponicum	Lapland Buttercup	Secure
	Corallorhiza trifida	Early Coral Root	Secure
	Cornus canadensis	Dwarf Dogwood	Secure
	Cypripedium parviflorum	Yellow Lady's-slipper	Secure
	Delphinium glaucum	Pale Larkspur	Secure
	Diphasiastrum complanatum	Trailing Clubmoss	Secure
	Draba lactea	Milky Whitlow-grass	Secure
	Equisetum arvense	Field Horsetail	Secure
	Equisetum scirpoides	Dwarf Scouring-rush	Secure
	Equisetum sylvaticum	Woodland Horsetail	Secure
	Equisetum variegatum	Variegated Horsetail	Secure
	Eriophorum vaginatum	Tussock Cotton-grass	Secure
	Fragaria vesca	Woodland Strawberry	Secure
	Galearis rotundifolia	Small Round-leaved Orchis	Secure
	Geocaulon lividum	Northern Comandra	Secure
	Goodyera repens	Lesser Rattlesnake Plantain	Secure
	Hedysarum boreale	Boreal Sweet- vetch	Secure
	Lathyrus ochroleucus	Cream Vetchling	Secure
	Linnaea borealis	Twinflower	Secure
	Luzula parviflora	Small-flowered Wood Rush	Secure
	Lycopodium annotinum	Bristly Clubmoss	Secure
	Maianthemum canadense	Wild Lily-of-the-Valley	Secure
	Mertensia paniculata	Northern Bluebell	Secure
	Mitella nuda	Bare-stem Bishop's Cap	Secure
	Neottia borealis	Northern Twayblade	Secure
	Orthilia secunda	One-sided Wintergreen	Secure
	Parnassia palustris	Marsh Grass-of-parnassus	Secure
	Parrya nudicaulis	Naked-stemmed Wallflower	Secure
	Pedicularis labradorica	Labrador Lousewort	Secure
	Pedicularis sudetica	Sudetan Lousewort	Secure
	Petasites frigidus	Arctic Sweet Coltsfoot	Secure
	Petasites vitifolius	Sweet Coltsfoot spp	Not Assessed
	Pinguicula vulgaris	Common Butterwort	Secure
	Platanthera obtusata	Blunt-leaved Bog Orchid	Secure
	Platanthera orbiculata	Small Round-leaved Bog Orchid	Sensitive
	Poa alpina	Alpine Bluegrass	Secure
	Polemonium acutiflorum	Tall Jacob's Ladder	Secure
	Primula stricta	Stiff Primrose	Secure
	Pyrola asarifolia	Pink Pyrola	Secure
	Pyrola grandiflora	Arctic Pyrola	Secure
	Rubus arcticus	Arctic Raspberry	Secure
	Rubus chamaemorus	Cloudberry	Secure
	Tephroseris frigida	Arctic Groundsel	Secure
	Thalictrum sparsiflorum	Few Flower Meadow Rue	Secure
	Tofieldia pusilla	Scotch False Asphodel	Secure
Bryoid	*Hylocomium splendens*	stair-step moss	Secure

Deciduous Species List

Layer	Scientific Name	Common Name	Provincial General Status
Trees and Shrubs	*Alnus viridis*	Green Alder	Secure
	Arctostaphylos uva-ursi	Common Bearberry	Secure
	Betula papyrifera	Paper Birch	Secure
	Cornus stolonifera	Red Osier Dogwood	Secure
	Juniperus communis	Common Juniper	Secure
	Picea glauca	White Spruce	Secure
	Populus balsamifera	Balsam Poplar	Secure
	Populus tremuloides	Trembling Aspen	Secure
	Ribes lacustre	Bristly Black Currant	Secure
	Rosa acicularis	Prickly Rose	Secure
	Salix glauca	Gray willow	Secure
	Salix scouleriana	Scouler Willow	Secure
	Shepherdia canadensis	Buffalo-berry	Secure
	Vaccinium vitis-idaea	Rock Cranberry	Secure
	Viburnum edule	Squashberry	Secure
Graminoids and Forbs	*Actaea rubra*	Red Baneberry	Secure
	Anticlea elegans	Mountain Death Camas	Secure
	Aquilegia brevistyla	Blue Columbine	Secure
	Aralia nudicaulis	Wild Sarsaparilla	Secure
	Astragalus americanus	American Milk-vetch	Secure
	Chamerion angustifolium	Fireweed	Secure
	Cornus canadensis	Dwarf Dogwood	Secure
	Equisetum arvense	Field Horsetail	Secure
	Festuca baffinensis	Baffin Fescue	Secure
	Fragaria vesca	Woodland Strawberry	Secure
	Fragaria virginiana	Virginia Strawberry	Secure
	Galium boreale	Northern Bedstraw	Secure
	Lathyrus ochroleucus	Cream Vetchling	Secure
	Linnaea borealis	Twinflower	Secure
	Lycopodium annotinum	Bristly Clubmoss	Secure
	Maianthemum canadense	Wild Lily-of-the-Valley	Secure
	Mertensia paniculata	Northern Bluebell	Secure
	Mitella nuda	Bare-stem Bishop's Cap	Secure
	Orthilia secunda	One-sided Wintergreen	Secure
	Petasites frigidus	Arctic Sweet Coltsfoot	Secure
	Petasites palmatus	Sweet Coltsfoot spp	Not Assessed
	Pyrola asarifolia	Pink Pyrola	Secure
	Pyrola grandiflora	Arctic Pyrola	Secure
	Rubus arcticus	Arctic Raspberry	Secure
	Rubus pubescens	Dwarf Red Raspberry	Secure
	Symphyotrichum ciliolatum	Lindley's Aster	Secure
	Symphyotrichum ciliolatum	Lindley's Aster	Secure
	Vicia americana	American Purple Vetch	Secure
	Viola epipsila	Northern Marsh Violet	Secure
	Viola renifolia	Kidney-leaf White Violet	Secure

Shrub - Alluvial Species List

Layer	Scientific Name	Common Name	Provincial General Status
Trees and Shrubs	*Alnus viridis*	Green Alder	Secure
	Andromeda polifolia	Bog Rosemary	Secure
	Arctous rubra	Red Bearberry	Secure
	Arctostaphylos uva-ursi	Common Bearberry	Secure
	Arctous alpina	Alpine Bearberry	Secure
	Betula glandulosa	Glandular Birch	Secure
	Cassiope tetragona	Arctic White Heather	Secure
	Dasiphora fruticosa	Shrubby Cinquefoil	Secure
	Empetrum nigrum	Black Crowberry	Secure
	Juniperus communis	Common Juniper	Secure
	Juniperus horizontalis	Creeping Juniper	Secure
	Picea glauca	White Spruce	Secure
	Populus balsamifera	Balsam Poplar	Secure
	Rhododendron lapponicum	Lapland Rosebay	Secure
	Rosa acicularis	Prickly Rose	Secure
	Salix alaxensis	Alaska Willow	Secure
	Salix candida	Hoary Willow	Secure
	Salix reticulata	Net-veined Willow	Secure
	Vaccinium uliginosum	Alpine Bilberry	Secure
	Vaccinium vitis-idaea	Rock Cranberry	Secure
	Viburnum edule	Squashberry	Secure
Graminoids and Forbs	*Achillea millefolium*	Common Yarrow	Secure
	Galearis rotundifolia	Small Round-leaved Orchis	Secure
	Anemone parviflora	Small-flower Anemone	Secure
	Anemone richardsonii	Yellow Anemone	Secure
	Antennaria alpina	Alpine Pussytoes	Secure
	Antennaria pulcherrima	Showy Pussytoes	Secure
	Anticlea elegans	Mountain Death Camas	Secure
	Arnica angustifolia	Narrowleaf Arnica	Secure
	Arnica angustifolia	Narrowleaf Arnica	Secure
	Artemisia norvegica	Arctic Sagebrush	Secure
	Bistorta plumosa	Meadow Bistort	Secure
	Calamagrostis canadensis	Blue-jointed Reed Grass	Secure
	Carex concinna	Low Northern Sedge	Secure
	Carex membranacea	Fragile-seed Sedge	Secure
	Carex rotundata	Pumpkin-fruited Sedge	Secure
	Carex scirpoidea	Bulrush Sedge	Secure
	Carex siccata	Dry-spike Sedge	Secure
	Carex vaginata	Sheathed Sedge	Secure
	Castilleja raupii	Ruap Indian Paintbrush	Secure
	Chamerion latifolium	River Beauty	Secure
	Cypripedium guttatum	Spotted Lady's-slipper	Secure
	Cypripedium parviflorum	Yellow Lady's-slipper	Secure
	Cypripedium parviflorum	Yellow Lady's-slipper	Secure
	Cypripedium passerinum	Sparrow's-egg Lady's-slipper	Secure
	Delphinium glaucum	Pale Larkspur	Secure
	Draba micropetala	Alpine Whitlow-grass	Secure
	Dryas drummondii	Yellow Mountain Avens	Secure
	Dryas integrifolia	Entire-leaved Mountain Avens	Secure
	Equisetum arvense	Field Horsetail	Secure
	Equisetum pratense	Meadow Horsetail	Secure
	Equisetum scirpoides	Dwarf Scouring-rush	Secure
	Equisetum variegatum	Variegated Horsetail	Secure
	Erigeron hyssopifolius	Hyssop-leaved Fleabane	Secure
	Eriophorum vaginatum	Tussock Cotton-grass	Secure
	Fragaria virginiana	Virginia Strawberry	Secure
	Galium boreale	Northern Bedstraw	Secure
	Galium trifidum	Small Bedstraw	Secure
	Hedysarum alpinum	Alpine Sweet-vetch	Secure
	Hedysarum boreale	Boreal Sweet- vetch	Secure

Shrub - Alluvial Species List

Layer	Scientific Name	Common Name	Provincial General Status
	Juncus arcticus	Arctic Rush	Secure
	Leymus innovatus	Downy Lyme Grass	Secure
	Linnaea borealis	Twinflower	Secure
	Parrya nudicaulis	Naked-stemmed Wallflower	Secure
	Pedicularis sudetica	Sudetan Lousewort	Secure
	Petasites frigidus	Arctic Sweet Coltsfoot	Secure
	Petasites palmatus	Sweet Coltsfoot spp	Not Assessed
	Petasites sagittatus	Arrow-Leaved Sweet-Coltsfoot	Not Assessed
	Phalaris arundinacea	Reed Canary Grass	Undetermined
	Pinguicula vulgaris	Common Butterwort	Secure
	Platanthera aquilonis	Tall Northern Green Orchid	Secure
	Poa alpina	Alpine Bluegrass	Secure
	Poa palustris	Fowl Bluegrass	Secure
	Polemonium acutiflorum	Tall Jacob's Ladder	Secure
	Pyrola asarifolia	Pink Pyrola	Secure
	Pyrola grandiflora	Arctic Pyrola	Secure
	Rubus arcticus	Arctic Raspberry	Secure
	Saxifraga aizoides	Yellow Mountain Saxifrage	Secure
	Saxifraga oppositifolia	Purple Mountain Saxifrage	Secure
	Selaginella sibirica	Siberian Spikemoss	Secure
	Silene acaulis	Moss Campion	Secure
	Silene uralensis	Apetalous Campion	Secure
	Symphyotrichum ciliolatum	Lindley's Aster	Secure
	Thalictrum sparsiflorum	Few Flower Meadow Rue	Secure
	Tofieldia pusilla	Scotch False Asphodel	Secure

Shrub - Subalpine Species List

Layer	Scientific Name	Common Name	Provincial General Status
Trees and Shrubs	*Andromeda polifolia*	Bog Rosemary	Secure
	Arctostaphylos uva-ursi	Common Bearberry	Secure
	Arctous alpina	Alpine Bearberry	Secure
	Betula glandulosa	Glandular Birch	Secure
	Cassiope tetragona	Arctic White Heather	Secure
	Dasiphora fruticosa	Shrubby Cinquefoil	Secure
	Empetrum nigrum	Black Crowberry	Secure
	Juniperus communis	Common Juniper	Secure
	Juniperus horizontalis	Creeping Juniper	Secure
	Kalmia polifolia	Bog Laurel	Secure
	Picea glauca	White Spruce	Secure
	Populus balsamifera	Balsam Poplar	Secure
	Populus tremuloides	Trembling Aspen	Secure
	Rhododendron groenlandicum	Common Labrador Tea	Secure
	Rhododendron lapponicum	Lapland Rosebay	Secure
	Rhododendron tomentosum	Narrow-leaved Labrador Tea	Secure
	Salix alaxensis	Alaska Willow	Secure
	Salix arbusculoides	Littletree Willow	Secure
	Salix glauca	Gray willow	Secure
	Salix interior	Sandbar Willow	Secure
	Salix myrtillifolia	Blueberry Willow	Secure
	Salix polaris	Polar Willow	Secure
	Salix pyrifolia	Balsam Willow	Secure
	Salix reticulata	Net-veined Willow	Secure
	Shepherdia canadensis	Buffalo-berry	Secure
	Vaccinium uliginosum	Alpine Bilberry	Secure
	Vaccinium vitis-idaea	Rock Cranberry	Secure
	Viburnum edule	Squashberry	Secure
	Aconitum delphinifolium	Mountain Monkshood	Secure
	Galearis rotundifolia	Small Round-leaved Orchis	Secure
	Androsace chamaejasme	Sweet-flower Rock-jasmine	Secure
	Anemone parviflora	Small-flower Anemone	Secure
	Anemone richardsonii	Yellow Anemone	Secure
	Antennaria monocephala	Pygmy Pussytoes	Not Assessed
	Anticlea elegans	Mountain Death Camas	Secure
	Arctagrostis latifolia	Broad-leaf Arctic-bent	Secure
	Arnica angustifolia	Narrowleaf Arnica	Secure
	Artemisia norvegica	Arctic Sagebrush	Secure
	Asplenium viride	Green Spleenwort	May Be At Risk
	Astragalus umbellatus	Tundra Milk-vetch	Secure
	Bistorta vivipara	Alpine Knotweed	Secure
	Braya humilis	Alpine Northern Rockcress	Secure
	Bromus pumpellianus	Pumpelly Brome	Secure
	Calamagrostis purpurascens	Purple Reed Grass	Secure
	Campanula lasiocarpa	Mountain Bellflower	Secure
	Campanula uniflora	Arctic Harebell	Secure
	Carex albonigra	Black-and-White-Scale Sedge	Secure
	Carex capillaris	Hairlike Sedge	Secure
	Carex disperma	Softleaf Sedge	Secure
	Carex rariflora	Loose-flowered Sedge	Secure
	Carex rupestris	Rock Sedge	Secure
	Carex scirpoidea	Bulrush Sedge	Secure
	Carex siccata	Dry-spike Sedge	Secure
	Carex vaginata	Sheathed Sedge	Secure
	Castilleja hyperborea	Northern Paintbrush	Secure
	Castilleja pallida	Boreal Paintbrush	Secure
	Chamerion angustifolium	Fireweed	Secure
	Cypripedium guttatum	Spotted Lady's-slipper	Secure
	Cypripedium passerinum	Sparrow's-egg Lady's-slipper	Secure
	Cystopteris fragilis	Fragile Fern	Secure
	Delphinium glaucum	Pale Larkspur	Secure
	Diphasiastrum complanatum	Trailing Clubmoss	Secure
	Draba glabella	Rock Whitlow-grass	Secure
	Draba lactea	Milky Whitlow-grass	Secure
	Dryas drummondii	Yellow Mountain Avens	Secure
	Dryas integrifolia	Entire-leaved Mountain Avens	Secure

Shrub - Subalpine Species List

Layer	Scientific Name	Common Name	Provincial General Status
Graminoids and Forbs	*Equisetum pratense*	Meadow Horsetail	Secure
	Equisetum scirpoides	Dwarf Scouring-rush	Secure
	Erigeron humilis	Low Fleabane	Secure
	Erigeron hyssopifolius	Hyssop-leaved Fleabane	Secure
	Festuca brachyphylla	Short-leaved Fescue	Secure
	Galium boreale	Northern Bedstraw	Secure
	Geocaulon lividum	Northern Comandra	Secure
	Hedysarum alpinum	Alpine Sweet-vetch	Secure
	Huperzia selago	Fir Clubmoss	Secure
	Juncus castaneus	Chestnut Rush	Secure
	Leymus innovatus	Downy Lyme Grass	Secure
	Linnaea borealis	Twinflower	Secure
	Lycopodium annotinum	Bristly Clubmoss	Secure
	Mertensia paniculata	Northern Bluebell	Secure
	Minuartia arctica	Arctic Stitchwort	Secure
	Minuartia rubella	Boreal Stitchwort	Secure
	Mitella nuda	Bare-stem Bishop's Cap	Secure
	Oxytropis campestris	Field Locoweed	Secure
	Oxytropis maydelliana	Maydell Locoweed	Secure
	Packera paupercula	Balsam Groundsel	Secure
	Parnassia palustris	Marsh Grass-of-parnassus	Secure
	Parrya nudicaulis	Naked-stemmed Wallflower	Secure
	Pedicularis labradorica	Labrador Lousewort	Secure
	Pedicularis lanata	Woolly Lousewort	Secure
	Pedicularis lapponica	Lapland Lousewort	Secure
	Pinguicula vulgaris	Common Butterwort	Secure
	Platanthera aquilonis	Tall Northern Green Orchid	Secure
	Platanthera obtusata	Blunt-leaved Bog Orchid	Secure
	Poa alpigena	Kentucky Bluegrass	Not Assessed
	Poa alpina	Alpine Bluegrass	Secure
	Poa arctica	Arctic Bluegrass	Secure
	Polemonium acutiflorum	Tall Jacob's Ladder	Secure
	Primula stricta	Stiff Primrose	Secure
	Pyrola asarifolia	Pink Pyrola	Secure
	Pyrola chlorantha	Greenish-flowered Pyrola	Secure
	Pyrola grandiflora	Arctic Pyrola	Secure
	Rubus arcticus	Arctic Raspberry	Secure
	Sabulina rubella	Boreal Stitchwort	Secure
	Saussurea angustifolia	Narrow-leaf Saw-wort	Secure
	Saxifraga aizoides	Yellow Mountain Saxifrage	Secure
	Saxifraga oppositifolia	Purple Mountain Saxifrage	Secure
	Saxifraga tricuspidata	Prickly Saxifrage	Secure
	Silene acaulis	Moss Campion	Secure
	Solidago simplex	Sticky Goldenrod	Secure
	Stellaria crassifolia	Fleshy Stitchwort	Secure
	Symphyotrichum ciliolatum	Lindley's Aster	Secure
	Tephroseris frigida	Arctic Groundsel	Secure
	Thalictrum sparsiflorum	Few Flower Meadow Rue	Secure
	Tofieldia coccinea	Northern False Asphodel	Secure
	Tofieldia pusilla	Scotch False Asphodel	Secure
	Triantha glutinosa	Sticky False Asphodel	Secure
	Viola epipsila	Northern Marsh Violet	Secure
	Woodsia glabella	Smooth Cliff-fern	Secure

Shrub - Burn Species List

Layer	Scientific Name	Common Name	Provincial General Status
Trees and Shrubs	*Alnus viridis*	Green Alder	Secure
	Andromeda polifolia	Bog Rosemary	Secure
	Arctous rubra	Red Bearberry	Secure
	Arctostaphylos uva-ursi	Common Bearberry	Secure
	Betula glandulosa	Glandular Birch	Secure
	Cassiope tetragona	Arctic White Heather	Secure
	Dasiphora fruticosa	Shrubby Cinquefoil	Secure
	Larix laricina	Tamarack	Secure
	Picea glauca	White Spruce	Secure
	Pinus contorta	Lodgepole Pine	Secure
	Populus balsamifera	Balsam Poplar	Secure
	Rhododendron groenlandicum	Common Labrador Tea	Secure
	Ribes lacustre	Bristly Black Currant	Secure
	Rosa acicularis	Prickly Rose	Secure
	Rubus idaeus	Red Raspberry	Secure
	Salix arbusculoides	Littletree Willow	Secure
	Salix bebbiana	Bebb Willow	Secure
	Salix glauca	Gray willow	Secure
	Salix myrtillifolia	Blueberry Willow	Secure
	Salix niphoclada	Barren-ground Willow	Secure
	Salix reticulata	Net-veined Willow	Secure
	Shepherdia canadensis	Buffalo-berry	Secure
	Vaccinium oxycoccos	Small Cranberry	Secure
	Vaccinium vitis-idaea	Rock Cranberry	Secure
	Viburnum edule	Squashberry	Secure
	Arctagrostis latifolia	Broad-leaf Arctic-bent	Secure
	Arnica angustifolia	Narrowleaf Arnica	Secure
	Carex siccata	Dry-spike Sedge	Secure
	Carex vaginata	Sheathed Sedge	Secure
	Chamerion angustifolium	Fireweed	Secure
	Cornus canadensis	Dwarf Dogwood	Secure
	Delphinium glaucum	Pale Larkspur	Secure
	Equisetum arvense	Field Horsetail	Secure
	Equisetum scirpoides	Dwarf Scouring-rush	Secure
	Equisetum sylvaticum	Woodland Horsetail	Secure
	Eriophorum vaginatum	Tussock Cotton-grass	Secure
	Galearis rotundifolia	Small Round-leaved Orchis	Secure
	Geocaulon lividum	Northern Comandra spp	Secure
	Hedysarum alpinum	Alpine Sweet-vetch	Secure
	Leymus innovatus	Downy Lyme Grass	Secure
	Linnaea borealis	Twinflower	Secure
	Mertensia paniculata	Northern Bluebell	Secure
	Mitella nuda	Bare-stem Bishop's Cap	Secure
	Parnassia palustris	Marsh Grass-of-parnassus	Secure
	Pedicularis labradorica	Labrador Lousewort	Secure
	Petasites frigidus	Arctic Sweet Coltsfoot	Secure
	Platanthera obtusata	Blunt-leaved Bog Orchid	Secure
	Polemonium acutiflorum	Tall Jacob's Ladder	Secure
	Pyrola grandiflora	Arctic Pyrola	Secure
	Rubus arcticus	Arctic Raspberry	Secure
	Rubus chamaemorus	Cloudberry	Secure
	Senecio lugens	Black-tip Ragwort	Secure
	Tofieldia pusilla	Scotch False Asphodel	Secure

Bryoid Species List

Layer	Scientific Name	Common Name	Provincial General Status
Trees and Shrubs	*Betula glandulosa*	Glandular Birch	Secure
	Dasiphora fruticosa	Shrubby Cinquefoil	Secure
	Salix reticulata	Net-veined Willow	Secure
Graminoids and Forbs	*Anemone parviflora*	Small-flower Anemone	Secure
	Carex siccata	Dry-spike Sedge	Secure
	Cystopteris fragilis	Fragile Fern	Secure
	Dryas integrifolia	Entire-leaved Mountain Avens	Secure
	Silene acaulis	Moss Campion	Secure
	Thalictrum sparsiflorum	Few Flowered Meadow Rue	Secure
	Woodsia glabella	Smooth Cliff-fern	Secure

APPENDIX C

TALUS HABITAT RESULTS

Talus Site Name	Overall Talus Aspect	Average Elevation (m)	Distance to Road (m)	Talus Size (m^2)	Average Boulder Size (Small: 30-50cm; Medium: 50-100cm; Large: >100cm)	Meadow Composition (Dominant Cover)	Total Pika Territories	Total Active Observations (Fresh Haypiles, Visual, and Vocalizations)[1]	Total Inactive Observations
15-003	NW	1353	10	1000	Small - Medium	Forbs and Bare Ground/Rocks	8	1	15
15-023	W	1382	10	600	Large	Forbs	1	4	5
15-031	W	1435	30	900	Medium	Forbs	2	0	12
16-10-1	E	1455	30	1800	Small to Medium	Graminoids and Bare Ground/Rocks	1	0	4
16-14	NE	1458	75	8000	Large	Forbs and Bare Ground/Rock	4	0	14
16-E of 12-1	SE	1467	60	3200	Small - Large	Forbs and Bare Ground/Rocks	4	0	8
16-near 10	SE	1459	60	900	Small - Medium	Forbs and Bare Ground/Rocks	2	0	6
17-(15)	SW	1543	100	3750	Medium	Forbs and Bare Ground/Rocks	5	0	11
17-(16-1)	NW	1489	100	200	Medium	Graminoids	1	0	3
17-14b-14a	NE	1502	80	15000	Large	Forbs, Graminoids and Bare Ground/Rock	3	0	5
19-112	S	1401	75	750	Small - Medium	Forbs and Bare Ground/Rocks	4	4	8
24-094	N	1197	250	1500	Medium	Forbs and Bare Ground/Rocks	4	0	16
26-125	NE	1163	200	2400	Small	Forbs	9	3	26
26-155	N	1157	200	250	Small	Lichen/Moss	1	0	1
32-61A	NW	897	20	400	Medium	Lichen/Moss and Graminoids	1	10	0
33-001	NW	946	180	1500	Small	Tree/Shrubs, Graminoid, Forb, Moss/Lichen	2	0	6
33-61A #2	NW	899	15	200	Medium	Lichen/Moss	1	7	1
33-61B	NW	896	15	1000	Medium	Tree/Shrubs and Graminoids	1	0	2
33-61D	NW	886	10	200	Medium	Tree/Shrubs and Graminoids	1	0	2
33-near 61D	NW	900	10	900	Medium	Graminoids	1	0	3
34-077	NW	850	5	800	-	-	1	0	1
34-080	NW	862	25	300	Medium	Forbs	2	0	5
34-086/61G	W	866	27	2500	Medium-Large	Forbs and Lichen/Moss	5	8	9
34-after 61 E (before 34)	NW	872	50	225	Medium	Tree/Shrubs, Forbs and Graminoids	1	0	6
35-069	NW	853	25	3000	Medium	Lichen/Moss and Tree/Shrubs	2	0	5
37-057	NW	810	25	1500	Small	Lichen/Moss, Forbs and Bare Ground/Rock	1	0	1
37-059	N	813	20	200	Small - Medium	Lichen/Moss and Forbs	2	0	2
38-045	NW	806	50	3000	Medium	Tree/Shrubs and Forbs	1	0	1
38-050	NW	818	50	900	Small	-	1	0	2
38-052	NW	819	60	500	Small	Lichen/Moss	1	0	1
38-054	NW	816	0	250	Small	Bare Ground/Rock	1	0	1
22-111[2]	NE	Not Recorded	0	175	Not Recorded	Not Recorded	0	0	0
27-158[2]	NE	Not Recorded	Not Recorded	1500	Not Recorded	Not Recorded	0	0	0
27-160[2]	NE	Not Recorded	Not Recorded	200	Not Recorded	Not Recorded	0	0	0
14-002[2,3]	Not Recorded	Not Recorded	Not Recorded	Not Recorded	Not Recorded	Not Recorded	0	0	0
36-26-157[2,3]	Not Recorded	Not Recorded	Not Recorded	Not Recorded	Not Recorded	Not Recorded	0	0	0
50-28-501[2,3]	Not Recorded	Not Recorded	Not Recorded	Not Recorded	Not Recorded	Not Recorded	0	0	0
76-38-049[2,3]	Not Recorded	Not Recorded	Not Recorded	Not Recorded	Not Recorded	Not Recorded	0	0	0

1. Fresh haypiles that also had a latrine were counted as a single Pika observation.
2. Talus Sites surveyed that provided no Pika haypile, latrine, visual, or vocal observations.
3. Recorded in Habitat Evaluation data.

APPENDIX D

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

NATURAL SCIENCES

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