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2D Resistivity and Magnetometer Geophysical Surveys for Placer Prospecting in the Livingstone Creek area, Yukon

Surveys and Assessment Report prepared for:

Constellation Mines Ltd.

Whitehorse Mining District Placer Claims

41297, P 03236, P 03237, P 03238

NTS MAPSHEET 105E08 (Livingstone Creek)

Location (UTM): 536790 6799206

*This report is a combination of two separate surveys,
performed October 11th, 2015 and March 24th & 25th, 2016*

OWNER: Constellation Mines Ltd.

1367 West 70th Ave, Suite 6; Vancouver; BC; V6P2Y9

CONSULTANT: Arctic Geophysics Inc.

PO Box 31441 RPO Main St, Whitehorse, YT, Y1A 6K8

AUTHORS: Stefan Ostermaier, Arctic Geophysics

Pearce Luck, Arctic Geophysics

DATE SUBMITTED: April 8th, 2016

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1. Location and Access

This geophysical investigation, using 2D Resistivity and magnetometer, was done at Livingstone Creek for Constellation Mines Ltd.

Geophysics work was conducted to prospect the ground for placer mining interests. The program was focused on measuring and interpreting the following subsurface characteristics:

Depth and topography of bedrock

Stratigraphy of surficial sediments

Location, size, and geometry of benches

Distribution of magnetite (black sand)

The resistivity survey consisted of one 375m long survey line done on October 11th, 2015.

Magnetometer work was carried out on March 24 and 25, 2016.

The survey area is located in the Whitehorse Mining District of Yukon, 80 km northeast of Whitehorse, YT.

The survey area was reached by helicopter from Whitehorse airport.

List of claims

Tenure Number	Claim Name	Claim/Lease Owner	Geophysical Method
41297	Discovery Claim	Constellation Mines Ltd.	Resistivity, Magnetometer
P 03236	Glacier 1	Constellation Mines Ltd.	Resistivity, Magnetometer
P 03237	Glacier 2	Constellation Mines Ltd.	Magnetometer
P 03238	Glacier 3	Constellation Mines Ltd.	Magnetometer

2. Crew

Resistivity crew: Stefan Ostermaier and Elijah Istchenko, Arctic Geophysics Inc.

Magnetometer crew: Pearce Luck and Elijah Istchenko, Arctic Geophysics Inc.

Support, Documentation: Heidi Kulcheski, Arctic Geophysics Inc.

Line planning: Constellation Mines Ltd, Arctic Geophysics Inc.

3. Fieldwork – Schedule

Fieldwork: The resistivity survey was conducted on October 11th, 2015. The magnetometer survey was conducted on March 24th and 25th, 2016.

Processing, Interpretation, First Documentation: Resistivity data on October 12th, 2015; Magnetometer data on March 25th, 2016.

4. Geophysical Methods

4.1 Resistivity

Resistivity is a material property that measures how strongly a material opposes the flow of electric current. The purpose of resistivity surveys is to measure the subsurface resistivity distribution. The resistivity of earth materials is related to mineral species, fluid content, porosity, and degree of water saturation. Resistivity measurements are commonly performed by injecting current through the ground with two current electrodes and measuring the resultant voltage difference between two potential electrodes. The equipment used in this study is designed to measure layer interfaces in depths from 1m to 100m by varying the spacing between electrodes.



Resistivity/IP measurement, Stefan Ostermaier, Arctic Geophysics Inc., Atlin, BC 2013

4.2 Magnetometer

A magnetometer survey measures the total magnetic field anomaly in the area of interest. Geological units with relatively high total field strength are likely to contain higher concentrations of ferrimagnetic minerals. By far the most common of these is magnetite, which has a specific gravity of 5.2 g/cm³. With its high density magnetite settles on stream beds to form black sands. Black sands are expected to be associated with heavy minerals, including gold. Total magnetic field is measured in nanotesla (nT).

5. Use of Geophysical Method

5.1.1 Resistivity Instrumentation

For this survey a lightweight, custom-built 2D RESISTIVITY imaging system with rapid data acquisition was used. The system includes¹:

“4 POINT LIGHT” EARTH RESISTIVITY METER²

128 ELECTRODE CONTROL MODULES³

128 STAINLESS STEEL ELECTRODES⁴

640m MULTICORE CABLE: CONNECTOR SPACING: 5m⁵

This system weighs approximately 120 kg which is about one third of regular standard equipment. It can be run with a 12V lead battery. The equipment facilitates high mobility and rapid data acquisition with a small crew.

5.1.2 Magnetometer Instrumentation

The equipment used includes:

GEMSYS GSM-19 GW (rover)

Integrated GPS

GEMSYS GSM-19 (base)

¹ In this survey only 80 electrodes were used

² Constructed and produced by LGM (Germany)

³ Ditto

⁴ Constructed and produced by GEOANALYSIS.DE (Germany)

⁵ Ditto

5.2.1 Resistivity Data Acquisition

The data acquisition is carried out by the automatic activation of 4-point-electrodes. Several thousand measurements are taken, one every 1-2 seconds. The AC transmitter current of 0.26 to 30 Hz is amplified by the electrode control modules, up to a maximum of 100mA and 400V peak to peak. The voltage measured at the receiver electrodes (M, N) is also amplified. In this resistivity survey the Wenner-Schlumberger-array was used. The Schlumberger array is appropriate to image horizontal layers and is ideal for placer prospecting.

The 2D Resistivity imaging system used for this survey, allows measurements with a depth of up to 100-120m. An electrode spacing of 5m was used, resulting in a horizontal measuring resolution of 2.5m. This spacing has proven itself reliable in the determination of bedrock topography and sedimentary stratigraphy for placer investigation under most environmental conditions.

5.2.2 Magnetometer Data Acquisition

The GEMSYS GSM-19 was used as a base station. It was set in exactly the same location on both survey days with the sensor coil positioned perpendicular to magnetic north. The cycling time (time between measurements) for the base station was set to 3s.

The GEMSYS GSM-19 GW with integrated GPS attachment set to walking mode was used as the “rover” magnetometer. Once the integrated GPS acquired satellite coverage, it synced its internal clock with UTC (Coordinated Universal Time). The base and rover stations were connected with a six pin cable to sync the base station to UTC. For the rover unit, a cycling time of 1 second was used.

The endpoints for each of the 15 survey lines were programmed into the integrated GPS. Lines were positioned 20m apart and ran parallel along an azimuth of 353.33°. The tolerance for lateral movement on these lines was set to 5m. The first line was 375m long and positioned along the resistivity survey. The subsequent 14 lines were 225m long and were located to the east of the resistivity survey. In order to minimize noise, efforts were made to remove all magnetic items from the operator.



Magnetometer Survey – Livingstone Creek – photo taken March 25, 2016 --The rover magnetometer is strapped to the operator's chest and the sensor coil is above his head. The GPS antenna is attached at the top of the apparatus.

5.3.1 Resistivity Data Processing

The measured Resistivity data were processed with the RES2DINV inversion program⁶.

5.3.2 Magnetometer Data Processing

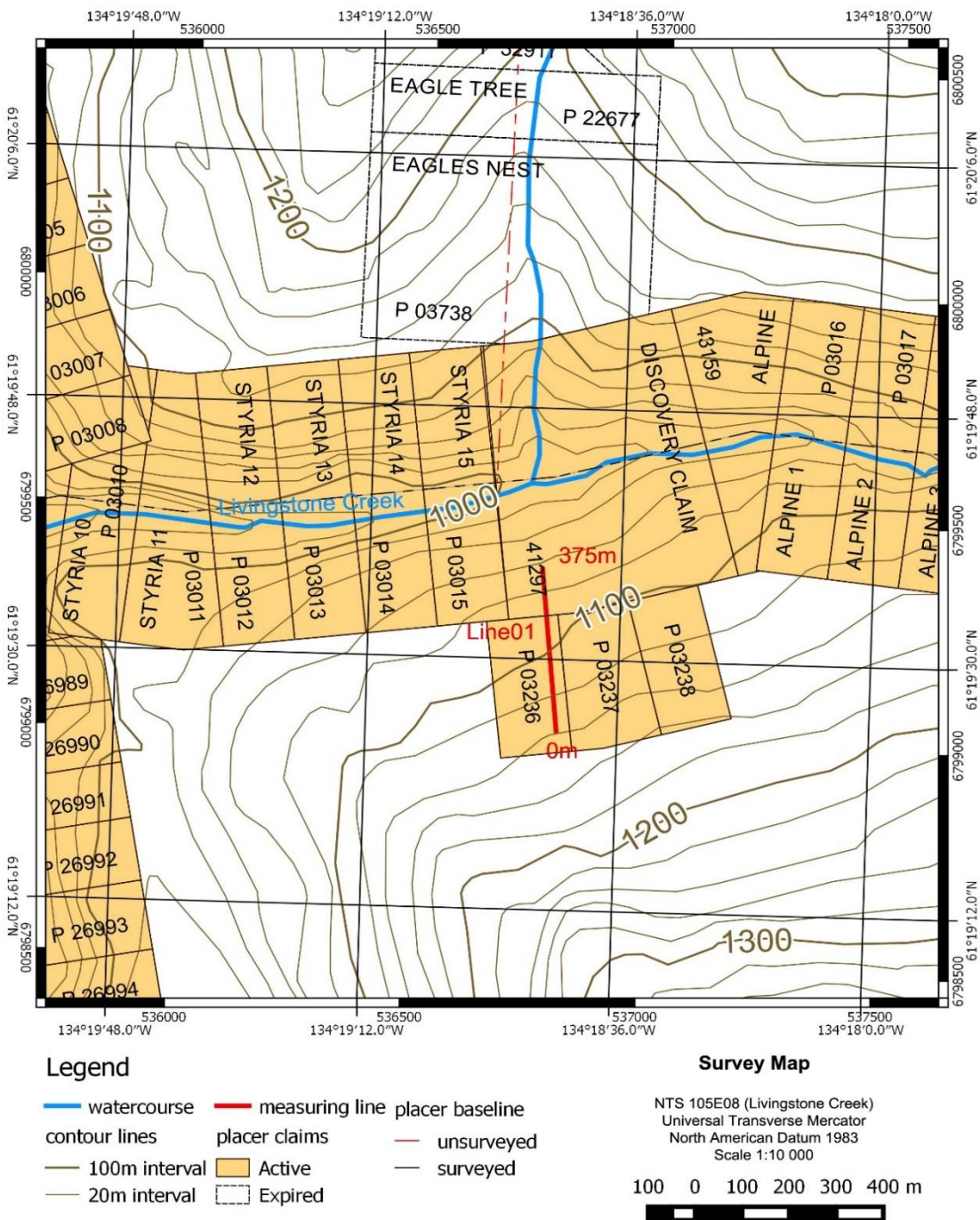
The magnetometer data was processed with GemLink 5.37 to correct for diurnal variation. A datum of 0 nT was chosen. Data was then checked for outliers with Microsoft Excel. Spatial interpolation of the data was performed with SAGA8. Ordinary kriging was used to produce a map of total field anomaly.

⁶ Produced by GEOTOMO SOFTWARE (Malaysia)

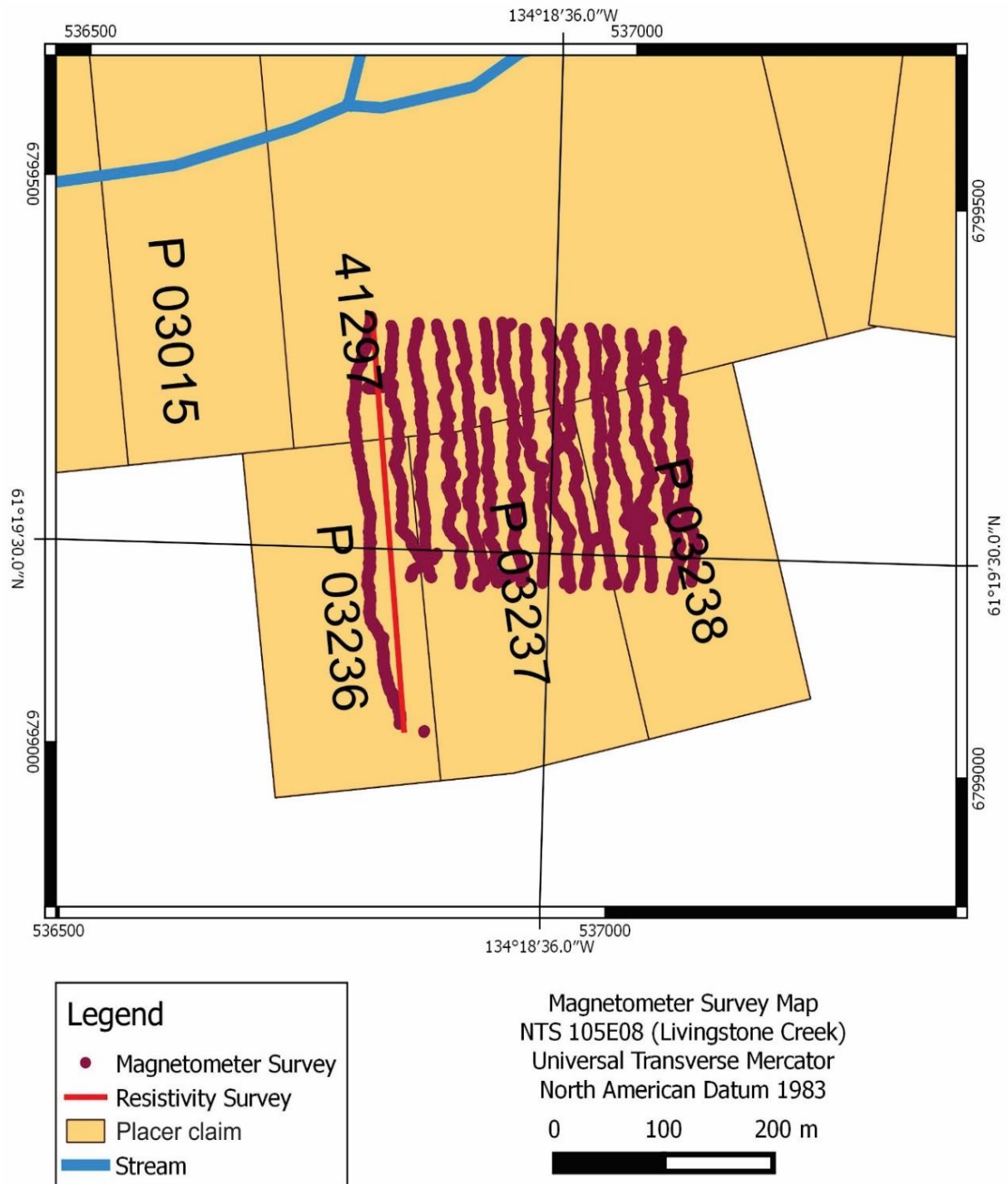
⁷ Produced by GEM Systems (Canada)

⁸ <http://www.saga-gis.org>

6.1 Resistivity Survey Map



6.2 Magnetometer Survey Map



7. Resistivity Profile Line 01

Line 01

2D Resistivity, Schlumberger array

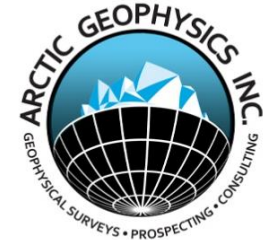
76 Electrodes: spacing 5m

Horizontal and vertical measure in [meter], Iteration error in [%]

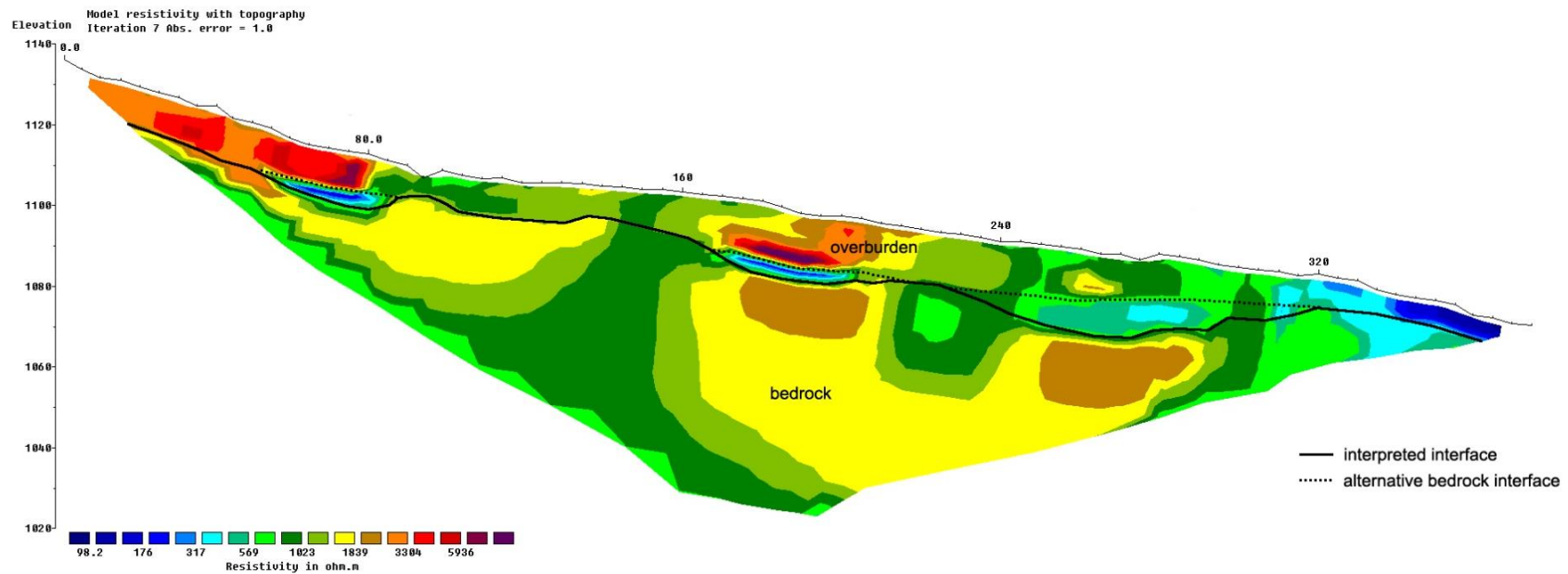
Vertical exaggeration in model section display: 1.0

Data acquisition: Stefan Ostermaier 11th October 2015

Processing: Stefan Ostermaier 12th October 2015



Interpretation



This 2D Resistivity measuring result is an interpretation of geophysical data. We recommend the verification of the profile interpretation with test pits, drilling, or shafting.

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7.1 Interpretation Resistivity Survey - Line 01

The profile shows heterogeneous overburden with a thickness of 5-20m.

The overburden is interpreted as a two layered system. With the topmost layer 5-10m thick. And the second layer in possible bedrock depressions.

From 0m to just past 80m the overburden is interpreted as 10m thick. The interpreted overburden in this section has high resistivity values, (orange, red) this is due to permafrost in the ground.

From 82m to 310m the overburden is interpreted as 7m – 15m thick. The resistivity of the overburden in this section is moderate to high (green – yellow, orange) and is interpreted to be thawed gravel in the green areas and partly frozen, yellow, to fully frozen in the red zones.

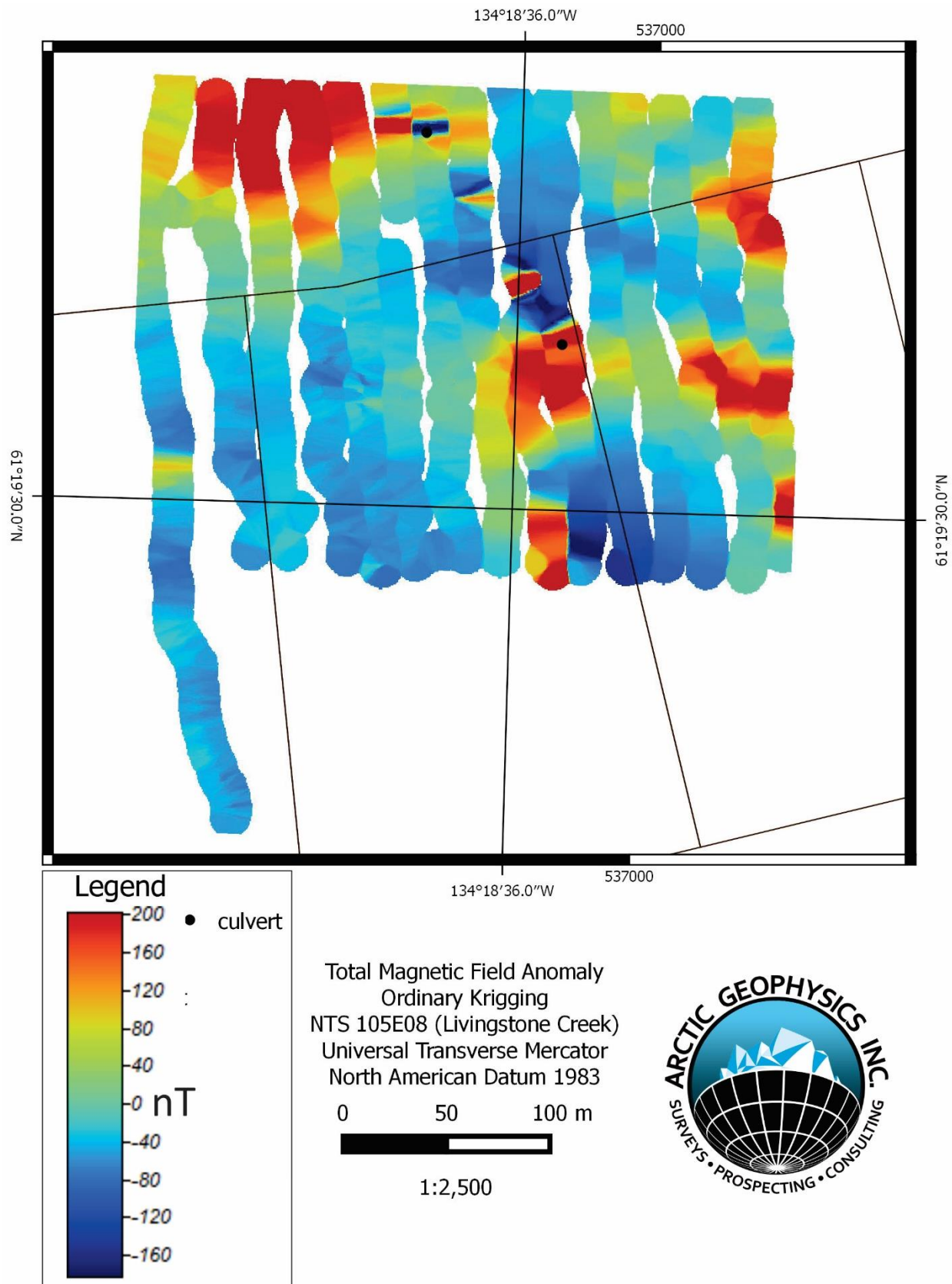
From 310m to the end of the profile the overburden shows a thickness of 5m and very low resistivity values (blue). The overburden in this area is interpreted to have a very clay rich matrix with possibly very little gravel.

From 60-85m and 170m to 210m the bedrock shows a possible shallow depression that appears to be filled with low resistivity material (blue). These structures could be channels in the bedrock, however the resistivity values, high values directly besides low values could indicate an inversion artefact so these structures are assigned a likelihood of 50%.

From 240m to 300m a paleo-channel with a maximum depth to bedrock of 20m is interpreted. The lower 10m of this possible channel is filled a different kind of overburden, with low resistivity (blue). This could indicate either a clay rich matrix or groundwater saturated gravels.

The bedrock shows moderately high resistivity values (yellow) and appears to be fairly homogeneous.

8. Ground Magnetics



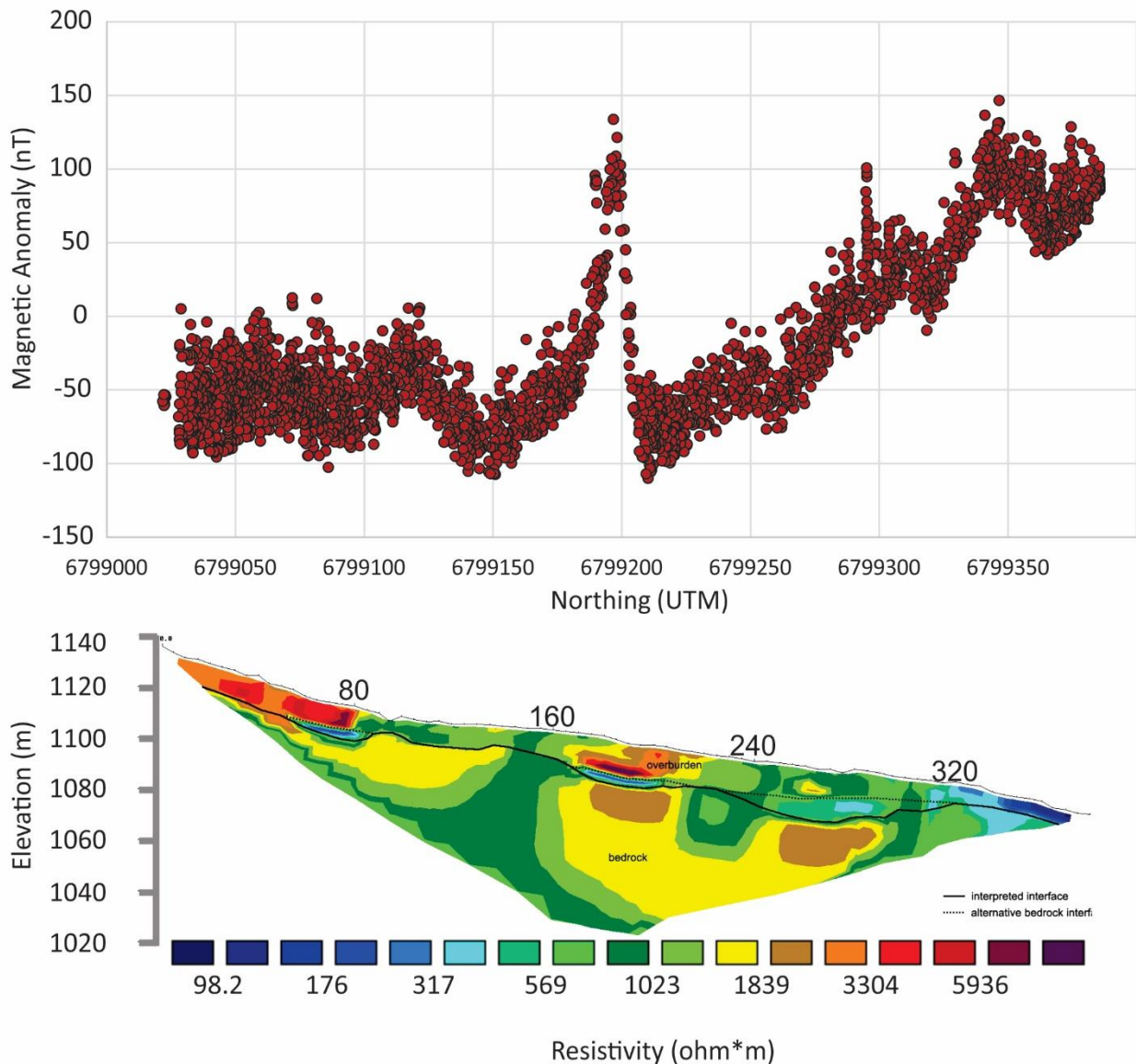
8.1 Interpretation – Ground Magnetics:

The largest magnetic high is located in the northwest section of the survey area. The anomaly tapers out to the east where it meets abruptly with a magnetic low. The black circles on the map indicate the endpoints of a steel drainage culvert which is 12 inches in diameter. It was composed of several loosely adjoined sections. The magnetic highs and lows which follow the length of the culvert likely represent the magnetic poles of these sections. Directly to the south of the culvert is a larger magnetic high. Smaller magnetic highs are located at the eastern and southern edges of the survey area. At roughly the midpoint of the westernmost magnetometer line is a small local magnetic high which does not appear on the lines directly to its east.



Steel Drainage Culvert – photo taken March 2016

9. Comparison of Resistivity and Magnetometer Surveys



The first magnetometer survey line was performed over resistivity Line 01. From 6799025 to 6799150 the majority of measurements fall between -100 and 0 nT. At 6799150 the magnetic anomaly increases to a maximum of 136 nT at 6799197. This local maximum of total field strength matches the position of an area of high resistivity from 170-210m along Line 01. The magnetic anomaly sharply decreases to a minimum of -110 nT at 6799210. From this point the magnetic anomaly increases with two local peaks until the end of the survey line. According to the results of these two surveys, the areas between 170m and 210m between 240m and 375m on Line 01 are the most prospective exploration targets.

10. Recommendations

We would recommend drilling the main channel at 265m where a maximum depth to bedrock of 21m is expected. Drilling is also recommended on the possible channel at 190m; with an expected depth to bedrock of 15m to determine the source of a sharp magnetic anomaly.

Further resistivity surveying in the eastern section of the ground magnetics grid could help identify the nature of positive anomalies in that area.

11. Conclusion

The resistivity survey discovered two possible and one likely channel and an overburden thickness of 7-15m throughout most of the profile. The structure with high resistivity from 170m to 210m and a sharp positive magnetic anomaly is of definite interest for further exploration. Approximately 50% of the overburden was frozen during the October 2015 resistivity survey.

The channel-like structures found in the interpretation show low resistivity values which indicates that they are either clay rich or groundwater saturated.

The main target for further prospecting in this survey is the interpreted paleo-channel at 240m - 300m. It is coincident with the largest positive magnetic anomaly in the survey area. With a 60m width and 20m depth there may be enough volume, provided it is gold bearing, to make a placer operation viable. Additional volume may be found along the continuation (up and downstream) of the proposed elevated paleochannel however this needs further exploration.

10. Qualifications

Stefan Ostermaier, Geophysical Surveyor, Managing Partner, Arctic Geophysics Inc.

stefan.ostermaier@arctic-geophysics.com

Work Experience

Founded and employed at Arctic Geophysics Inc. since June 2007

Geophysical Surveying for Mining Exploration in the Yukon since 2005

Geological prospecting for precious metals and minerals in the Yukon and Alaska since 2001

Publications:

Numerous Assessment Reports BC & YT including:

2008	Dredge Master Gold Ltd.	Dawson Mining District	Yukon	Sixty Mile Area
2009	10796 Yukon Ltd.	Dawson Mining District	Yukon	Scroggie Creek
2010	Mel Zeiler	Mayo Mining District	Yukon	Duncan Creek
2010	YGS	Dawson Mining District	Yukon	White River
2011	Gold Miners Group Inc.	Whitehorse Mining District	Yukon	Kluane Lake
2011	Al Dendys	Atlin Mining Division	BC	Atlin
2012	Stephen Swaim	Whitehorse Mining District	Yukon	Livingston Area
2012	Bonnyville Oilfield Service & Supply Ltd	Whitehorse Mining District	Yukon	Carmacks
2013	Victor Casavant	Atlin Mining Division	BC	Atlin
2014	Bens Contracting & Rental	Whitehorse Mining District	Yukon	Kluane Lake
2014	Angel Jade Mines Ltd.	Liard Mining Division	BC	Liard area
2014	Ron Berdahl	Whitehorse Mining District	Yukon	Carmacks
2014	Zenith Mineral Resources Ltd.	Cariboo Mining Division	BC	Likely

Geophysical survey (45 field days) for Yukon Government: Yukon Geological Survey, 2D Resistivity/IP Data Release for Placer Mining & shallow Quartz Mining-Yukon 2010

<http://virtua.gov.yk.ca:8080/lib/item?id=chamo:164867&theme=emr> "2D resistivity / IP data release for placer mining and shallow quartz mining - Yukon 2010 : Los Angeles Creek, Wolf Creek, Ladue River, and Rice Creek ; Philipp Moll and Stefan Ostermaier"

Education

Study of Geology, University of Tübingen, Germany

Geophysical field courses, University of Karlsruhe and University of Stuttgart, Germany

Study of Computer Science, University of Stuttgart, Germany

Pearce Luck, Geologist (GIT), Arctic Geophysics Inc.

pearce.luck@arctic-geophysics.com

Work Experience

Arctic Geophysics Inc.

Whitehorse, YT

Geological Consultant

May 2015-present

British Columbia Geological Survey

Victoria, BC

Geological Assistant

September 2013-May 2015

Miocene Metals Ltd

Pemberton, BC

Geologic Field Assistant

May-June 2012

SJ Geophysics Ltd

Izok Camp, NU/Nakusp, BC

Geophysics Technician

June-August 2011

Publications

Luck, P. and Simandl, G.J., 2014. Portable X-ray fluorescence in stream sediment chemistry and indicator mineral surveys, Lonnie carbonatite complex, British Columbia. In: Geological Fieldwork 2013, BC Geological Survey Paper 2014-1, pp. 169-182.

Fajber, R., Simandl, G.J., and Luck, P., 2015. Exploration for carbonatite-hosted niobium-tantalum deposits using biogeochemical methods (orientation survey), Blue River area, British Columbia, Canada. Proceedings of the 47th Forum on the Geology of Industrial Minerals, held May 15-17 in Champaign, Illinois, In Press.

Luck, P. 2016. 2D Resistivity Survey for Placer Gold Prospecting at Congdon Creek, Yukon. Assessment Report. 25p.

Education

University of Victoria

Victoria, BC

BSc (Honors) Earth Science

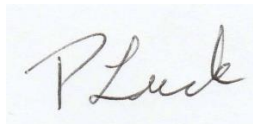
Graduated 2013

Confirmation

We have interpreted the data and prepared this report entitled **2D Resistivity and Magnetometer Geophysical Surveys for Placer Prospecting in the Livingstone Creek area, Yukon** for assessment credit, the surveys were carried out by Arctic Geophysics Inc. of Whitehorse, Yukon Territory

A handwritten signature in blue ink, appearing to read 'Stefan Ostermaier'.

Stefan Ostermaier

A handwritten signature in black ink, appearing to read 'P Luck'.

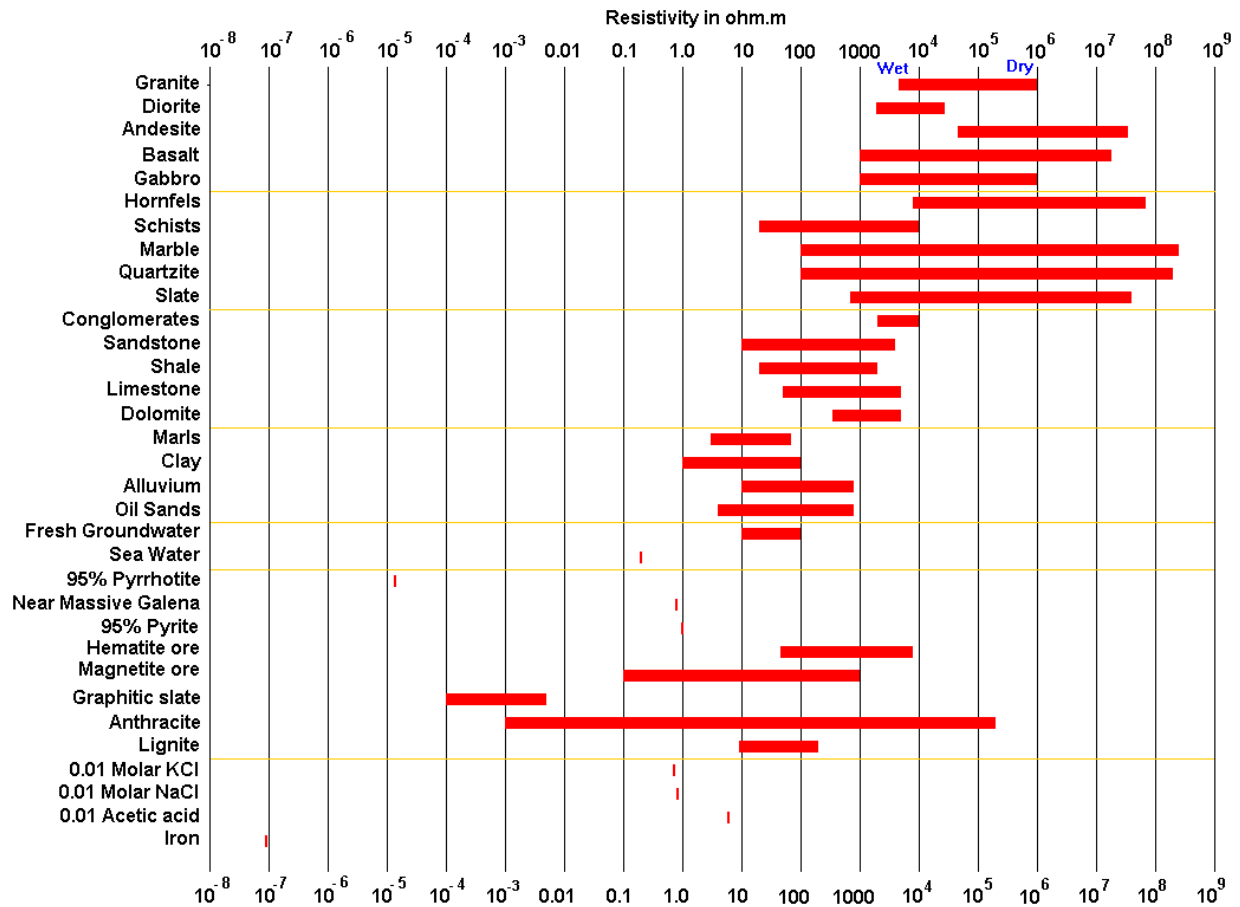
Pearce Luck

Appendix

Work Cited

Loke , M.H., 2015. Tutorial : 2-D and 3-D electrical imaging surveys

Resistivity of Common Earth Materials



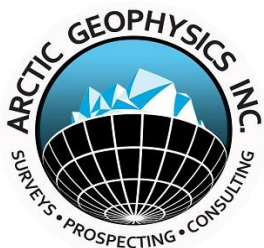
From Loke (2015).

GPS Data

Electrode No.	Location in Profile [m]	GPS Coordinates Lat / Long WGS 84	GPS Accuracy [m]	Post
1	0	N61 19 24.9 W134 18 44.7	3	*
2	5	N61 19 25.0 W134 18 44.8	3	
3	10	N61 19 25.1 W134 18 44.8	3	
4	15	N61 19 25.4 W134 18 44.8	3	
5	20	N61 19 25.5 W134 18 44.8	3	
6	25	N61 19 25.7 W134 18 44.8	3	
7	30	N61 19 25.8 W134 18 44.9	3	
8	35	N61 19 26.0 W134 18 44.9	3	
9	40	N61 19 26.1 W134 18 44.9	3	
10	45	N61 19 26.3 W134 18 45.0	3	
11	50	N61 19 26.4 W134 18 45.0	3	
12	55	N61 19 26.5 W134 18 45.0	3	
13	60	N61 19 26.7 W134 18 45.1	3	
14	65	N61 19 26.9 W134 18 45.1	3	
15	70	N61 19 27.1 W134 18 45.1	3	
16	75	N61 19 27.2 W134 18 45.2	3	
17	80	N61 19 27.4 W134 18 45.1	3	
18	85	N61 19 27.5 W134 18 45.1	3	
19	90	N61 19 27.6 W134 18 45.1	3	
20	95	N61 19 27.8 W134 18 45.2	3	
21	100	N61 19 27.9 W134 18 45.2	3	
22	105	N61 19 28.1 W134 18 45.3	3	
23	110	N61 19 28.3 W134 18 45.3	3	
24	115	N61 19 28.4 W134 18 45.4	3	
25	120	N61 19 28.6 W134 18 45.5	3	
26	125	N61 19 28.7 W134 18 45.6	3	
27	130	N61 19 28.9 W134 18 45.5	3	
28	135	N61 19 29.1 W134 18 45.5	3	
29	140	N61 19 29.3 W134 18 45.5	3	
30	145	N61 19 29.4 W134 18 45.5	3	
31	150	N61 19 29.5 W134 18 45.6	3	
32	155	N61 19 29.7 W134 18 45.6	3	
33	160	N61 19 29.8 W134 18 45.6	3	
34	165	N61 19 30.0 W134 18 45.7	3	
35	170	N61 19 30.1 W134 18 45.8	3	
36	175	N61 19 30.3 W134 18 45.7	3	
37	180	N61 19 30.5 W134 18 45.7	3	
38	185	N61 19 30.7 W134 18 45.9	3	
39	190	N61 19 30.8 W134 18 45.9	3	
40	195	N61 19 30.9 W134 18 46.0	3	
41	200	N61 19 31.1 W134 18 46.0	3	
42	205	N61 19 31.3 W134 18 45.9	3	

Electrode No.	Location in Profile [m]	GPS Coordinates Lat / Long WGS 84	GPS Accuracy [m]	Post
43	210	N61 19 31.4 W134 18 46.0	3	
44	215	N61 19 31.6 W134 18 46.1	3	
45	220	N61 19 31.8 W134 18 46.1	3	
46	225	N61 19 31.9 W134 18 46.2	3	
47	230	N61 19 32.1 W134 18 46.2	3	
48	235	N61 19 32.2 W134 18 46.2	3	
49	240	N61 19 32.3 W134 18 46.3	3	
50	245	N61 19 32.5 W134 18 46.2	3	
51	250	N61 19 32.7 W134 18 46.2	3	
52	255	N61 19 32.8 W134 18 46.3	3	
53	260	N61 19 32.9 W134 18 46.4	3	
54	265	N61 19 33.1 W134 18 46.5	3	
55	270	N61 19 33.3 W134 18 46.5	3	
56	275	N61 19 33.4 W134 18 46.6	3	
57	280	N61 19 33.6 W134 18 46.6	3	
58	285	N61 19 33.7 W134 18 46.7	3	
59	290	N61 19 33.9 W134 18 46.7	3	
60	295	N61 19 34.0 W134 18 46.8	3	
61	300	N61 19 34.2 W134 18 46.8	3	
62	305	N61 19 34.3 W134 18 46.9	3	
63	310	N61 19 34.4 W134 18 46.9	3	
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69	340	N61 19 35.3 W134 18 47.1	3	
70	345	N61 19 35.5 W134 18 47.3	3	
71	350	N61 19 35.7 W134 18 47.4	3	
72	355	N61 19 35.9 W134 18 47.3	3	
73	360	N61 19 36.1 W134 18 47.3	3	
74	365	N61 19 36.2 W134 18 47.3	3	
75	370	N61 19 36.4 W134 18 47.3	3	
76	375	N61 19 36.5 W134 18 47.3	3	*

Costs – Magnetics Survey – March 2016



INVOICE

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Attn: Max

Constellation Mines Ltd

Suite 6-1637 West 70th Ave

Vancouver, BC, V6P 2Y9

604-275-2201

Date : 2016-04-08

Invoice No.: 2016-C(M)03-1001

Job:		Payment Terms
Livingstone Creek		Due upon Receipt.
Mag Survey		
Quantity	Description	Amount
<u>Mob/Demob</u>		
1 day	Remove/return gear/equip etc to storage-off season	\$400.00
2 days	Mileage - Whse Airport / Return @ .55/km	\$77.00
2 days	Ford F350 1 ton Diesel Pickup @ 125.00/day	\$250.00
1	Airfare/Ferry/Cab fees - bring/return Geologist from Victoria	\$1,194.86
4 days	Accommodations/Meals for Geologist @ 165.00/day	\$660.00
3 days	Accommodations (private)/Meals Field Tech @ 115.00/day	\$345.00
4.4 hours	Jet Ranger -\$1100.00 hour x 4.4 hours	\$4,840.00
4.4 hours	Fuel 114 l/hr @ 1.50 litre	\$752.40
		\$8,119.26
<u>Survey</u>		
2 days	GEM GSM-19 High Precision Over Hauser Magnetometer	
	GPS/Mag Operator (geologist) Winter rate @ 945.00/day	\$1,890.00
2 days	Field Technician - Line / Brush Cutting/Clearing Winter Rate @ 460.00/day	\$920.00
2 days	Satellite Phone	\$70.00
2 days	Chainsaw/Fuel	\$60.00
2 days	Snowshoe Rental for 2	\$170.00
1.75	Data Analysis, Interpretation/Processing - Assessment Reporting	\$1,400.00
	Combine and integrate data from Resistivity and Magnets results into single assessment report	\$4,510.00
	Subtotal	\$ 12,629.26
	G.S.T. (5%) #846363216RT0001	631.46
	TOTAL	\$ 13,260.72

Costs – Resistivity Survey – October 2015



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Invoice

DATE: October 26, 2015
INVOICE #: 2015-C-110024

BILL TO:
Constellation Mines Ltd
Suite 6-1637 West 70th Ave
Vancouver, BC, V6P 2Y9

JOB	2D Resistivity for Placer Prospecting Discovery 41297, Livingstone Creek		PAYMENT TERMS
			Invoices are due upon receipt
QTY	DESCRIPTION		AMOUNT
	Mob/Demob		
0	Travel time		\$0.00
70 kms	Mileage - to Whse Airport & return @ .55/km		\$38.50
2 days	Ford F350 Diesel 1 ton Pick up @ \$120.00 day		\$240.00
4 trips	Long Ranger Helicopter & Fuel costs (Below estimate of \$5810.00)	GST Incl	\$4,634.50
	Total Mob/Demob		\$4,913.00
	Geophysical Survey		
1 day	Geoelectrical 2D Resistivity Imaging System: 96 electrodes, 6 Electrode Control Modules, 475m multi-core cable, PC, GPS, altimeter, 2 man crew @ \$1750.00/day		\$1,750.00
1.5 days	Remote Camp Fee - 2 man		\$135.00
1.5 days	Sat Phone		\$52.50
1 day	Data analysis, Interpretation, Processing Formal Assessment Reporting @ 75% of survey rate		\$1,312.50
	Total Survey Costs		\$3,250.00
	Sub Total - Survey & Mob/demob costs		\$8,163.00
	Sub Total - Taxable amount of services (Tax on Helicopter already paid)		\$3,528.50
	G.S.T. (5%) #846363216RT0001		\$176.43
	GST already paid on helicopter		\$220.69
	Total Due		\$8,560.12
	Invoices are due upon receipt		