

Appendix 6.7-D

*Peterson Creek Instream Flow Requirements for Rainbow Trout
– Preliminary Data Summary*

AJAX PROJECT

**Environmental Assessment Certificate Application / Environmental Impact Statement
for a Comprehensive Study**

January 23, 2015

File No.:VA101-246/35-A.01
Cont. No.:VA14-01575



Ms. Laura Smithies
Environmental Coordinator
KGHM Ajax Mining Inc.
200 - 124 Seymour St.
Kamloops, British Columbia
Canada, V2C 2E1

Dear Laura,

Re: Peterson Creek Instream Flow Requirements for Rainbow Trout – Preliminary Data Summary

1 – INTRODUCTION

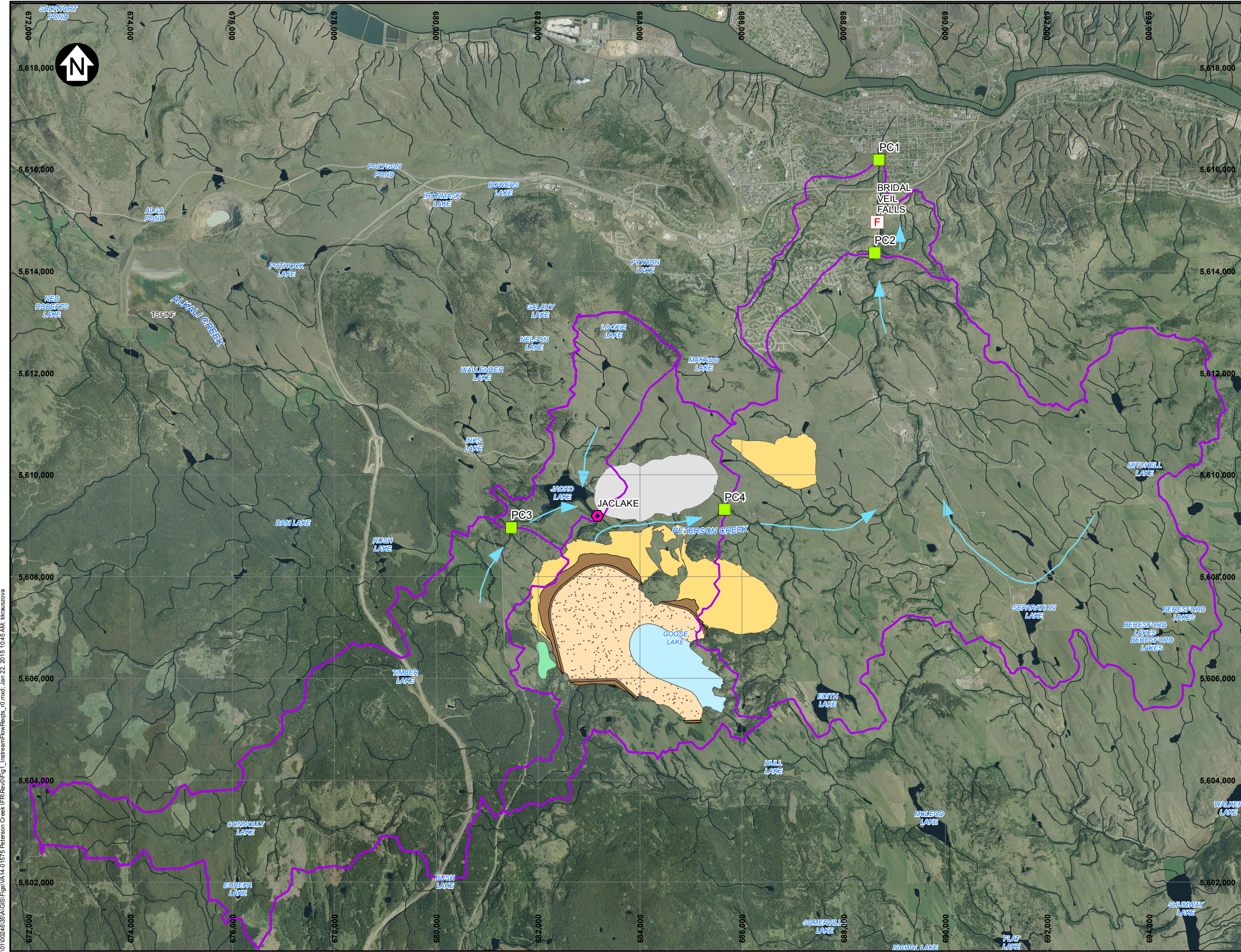
Construction, operation and closure of the Ajax Project is expected to cause changes to hydrologic conditions in Peterson Creek due to diversion of water, control of Jacko Lake releases, water management operations and retention of water in the tailings storage facility. The exact magnitude of these changes is not currently known, as water management design and water balance modelling is in-progress. However, a data collection program has been established to collect the data required to assess flow related impacts to fish habitat.

Water and Air Monitoring Guidance from BC Ministry of Environment (BCMoE, 2012) directs that assessment methods for fish habitat impacts due to flow modifications should follow the methods detailed in Lewis et al. (2004) and Hatfield et al. (2007). These documents provide flow threshold screening criteria. If flow modifications exceed the screening level criteria, detailed instream flow studies are required. Key steps in the detailed assessment include:

1. Identify the species of concern.
2. Identify all limiting life stage(s) for the species of concern.
3. Identify habitat parameters that are most important to the species of concern.
4. Establish surveyed habitat transects at locations deemed by a Professional Biologist to be limiting for maintenance of fish populations at the proposed instream flow regime.
5. Calculate habitat quantity for the life stage/species of concern within the reaches/mesohabitats of importance during the critical period.
6. Calculate physical habitat as a function of daily flow for each day in the critical period, using the historic flow record under baseline, operational and closure conditions.
7. Compare baseline, operational and closure conditions (tables, graphs).
8. Use site-specific information, scientific literature, and professional judgment to interpret the biological significance of the estimated changes in habitat.

Data have been collected to support this analysis, but calculation of baseline and operational habitat has not been completed. This letter has been prepared to present the modelling rationale and data collected to date. Before habitat calculations are commenced:

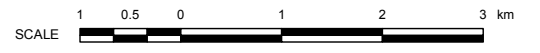
- Baseline and operational flow series are required and the magnitude of impacts should be reviewed and compared to the screening thresholds. If flow impacts are small, habitat modelling may not be justified.
- The information in this letter should be reviewed by KGHM and agencies for agreement on the modelling dataset. In particular, the number and placement of transects, and selection of habitat suitability indices is subjective and therefore agreement on model inputs prior to modelling is recommended.



- LEGEND:**
- HYDROMETRIC GAUGING STATION
 - FLOW DIRECTION
 - IFR SAMPLING SITE
 - BRIDAL VEIL FALLS
 - RIVER/CREEK
 - LAKE
 - CATCHMENTS
 - PROPOSED MINE SITE FACILITIES**
 - MINE ROCK STORAGE FACILITY
 - TAILINGS BEACH
 - EMBANKMENT
 - OPEN PIT
 - SUPERNATANT POND
 - TOPSOIL STOCKPILE

CATCHMENT	DRAINAGE AREA (km ²)
PC1	13165
PC2	125.9
PC3	32.5
PC4	616
JAKLAKE	39.6

- NOTES:**
- BASE MAP: ABACUS AERIAL ORTHOPHOTOGRAPHY AND NRCAN NATIONAL TOPOGRAPHIC DATABASE (NTDB) 1:50,000.
 - COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 83 UTM ZONE 10N.
 - THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:75,000 FOR 11X17 (TABLOID) PAPER. ACTUAL SCALE MAY DIFFER ACCORDING TO CHANGES IN PRINTER SETTINGS OR PRINTED PAPER SIZE.



KGHM AJAX MINING INC.
AJAX PROJECT
INSTREAM FLOW REQUIREMENTS ASSESSMENT
PETERSON CREEK

Knight Piésold CONSULTING	PIA NO. VA101-246/35	REF NO. VA14-01575
	FIGURE 1	

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2 – PROJECT DESCRIPTION

The Ajax Project is located immediately adjacent to the city of Kamloops, British Columbia. The Project is primarily within the Peterson Creek watershed, as shown on Figure 1. The locations of key Project infrastructure including the open pit, tailings storage facility and waste rock storage areas are also shown. Given the Project arrangement, negligible flow impacts are expected in Jacko Lake, however, changes to the timing and magnitude of flows in Peterson Creek downstream of the Project are anticipated. The details of these flow impacts are currently in preparation, but it should be noted that outflow from Jacko Lake is currently managed by the water bailiff and as such Peterson Creek flows are currently regulated.

3 – WATERSHED AND HYDROLOGY

The Peterson Creek watershed is approximately 130 km² at the confluence with the South Thompson River. Below Jacko Lake the watershed area is approximately 40 km². Mean annual discharge in Peterson Creek below Jacko Lake is estimated to be 0.03 m³/s, based on streamflow data collected on site and preliminary site wide water balance modelling (BGC, 2014). Mean annual discharge in Peterson Creek at the confluence with the South Thompson River is estimated to be 0.10 m³/s, assuming the same discharge per unit area at the mouth as in the Project area.

4 – FISH SPECIES OF CONCERN AND LIMITING LIFE STAGES

Coho fry have been documented in the lower 150 m of Peterson Creek, between the South Thompson River and the outlet of the culverts that divert Peterson Creek under downtown Kamloops.

Rainbow trout are the predominant fish species in Peterson Creek and are found from the South Thompson River to Jacko Lake. Jacko Lake has been stocked with hatchery raised fry, fingerling, and yearling rainbow trout since 1954 and has large rainbow trout populations. Rainbow trout have also been observed in the 800 m of Peterson Creek above Jacko Lake.

It is likely that the culverted section of Peterson Creek under the City of Kamloops limits fish movement from the South Thompson River up Peterson Creek although is not thought to be a complete barrier. Bridal Veil Falls, located 2.6 km upstream of the South Thompson River is a migration barrier. There are also several smaller (greater than 1 m) high falls within Peterson Creek Park. It is thought that the rainbow trout population at the site in Peterson Creek above Bridal Veil Falls is a feral population that established as a result of the hatchery fish escaping Jacko Lake (Knight Piésold 2013a). Mature fish have been observed moving downstream over the Jacko Lake spillway during freshet flows; no juvenile fish have been captured or observed in Peterson Creek in the Project area.

Due to the fish size and migration barriers, it is believed that rainbow trout in Peterson Creek at the site above Bridal Veil Falls are resident, with relatively limited range. Sampling between 2007 and 2011 noted several age classes (2+ to 4+), with fork length sizes varying between 32 mm and 190 mm (Knight Piésold 2013a). Periodicity, based on Fisheries and Oceans Canada (2013) guidance, is summarised in Table 1. Flows are highest in April to June. Summer rearing and overwintering is thought to be limiting life stage under reduced flow conditions, and 1 August to 31 March has been defined as the critical period.

Table 1 Rainbow Trout Periodicity

Life Stage	Dates	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning	15-Apr to 31-Jun												
Incubation	15-Apr to 31-Aug												
Rearing	1-Jun to 30-Nov												
Overwintering	1-Nov to 30-Apr												

NOTES:

1. Periodicity is based on timing presented by Fisheries and Oceans Canada (2013).

5 – HABITAT MAPPING AND TRANSECT SELECTION

Given the fish distribution and potential Project impacts, four study sites were selected and referred to as PC1, PC2, PC3 and PC4. The location of each study site is shown on Figure 1. Several transects were established at each site except PC4, which has just one transect at a site where spawning has been observed.

At PC1 and PC2 habitat mapping was completed over approximately 250 m of channel. The mapped reaches had relatively homogeneous morphology and no major flow changes. Downstream of the mapped reach at PC1, the channel becomes more confined by fill from the urban surroundings. The upstream end was the confluence with a large tributary. At PC2, the reach was confined by changes in morphology with a steep canyon section below the reach and a braided section upstream.

Habitat mapping was based on the level 1 assessment classification from Fish Habitat Assessment Procedures (Johnston and Slaney, 1996), which includes:

1. Pools - both scour pools and dammed pools;
2. Glides - non-turbulent fast-flowing water;
3. Riffles - turbulent fast-flowing water;
4. Cascades (higher-gradient “riffles”); and
5. Other.

The descriptions from Johnston and Slaney (1996) were used to characterise the habitat units, including the following quantitative characteristics:

1. Pools must have a minimum area of 1 m² and minimum residual depth of 0.2 m for channels with a bankfull width less than 2.5 m and a minimum area of 2 m² and minimum residual depth of 0.4 m for channels with a bankfull width between 2.5 m and 5 m.
2. Cascades must have a gradient steeper than 4%.
3. The minimum size of units is 1 m² for channels with a bankfull width less than 2.5 m and 2 m² for channels with a bankfull width between 2.5 m and 5 m.

Habitat units are shown on Figures 2 and 3, and summarized in Table 2. An example of each habitat unit is shown in Photo 1.

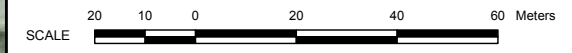
Table 2 Habitat Unit Summary

Reach	Habitat Type	Total Length	
		(m)	(%)
PC1	<i>Total</i>	238	100%
	Cascade	98	41%
	Pool	6	2%
	Riffle	135	57%
PC2	<i>Total</i>	260	100%
	Cascade	207	80%
	Pool	11	4%
	Riffle	42	16%



- LEGEND:**
- IFR SAMPLING SITE
 - RIVER/CREEK
 - STREAM MAPPING
 - CASCADE
 - POOL
 - RIFFLE

- NOTES:**
1. BASE MAP: ABACUS AERIAL ORTHOPHOTOGRAPHY AND NRCAN NATIONAL TOPOGRAPHIC DATABASE (NTDB) 1:50,000.
 2. WATERSHED BOUNDARIES OBTAINED FROM GEOBC (CWB WATERSHEDS).
 3. COORDINATE GRID IS IN METRES.
COORDINATE SYSTEM: NAD 83 UTM ZONE 10N.
 4. THIS FIGURE IS PRODUCED AT A NOMINAL SCALE OF 1:1,500 FOR 11X17 (TABLOID) PAPER. ACTUAL SCALE MAY DIFFER ACCORDING TO CHANGES IN PRINTER SETTINGS OR PRINTED PAPER SIZE.



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 INSTREAM FLOW REQUIREMENTS ASSESSMENT
 PETERSON CREEK - PC1

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 REF NO. VA14-01575

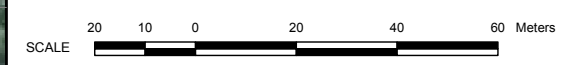
FIGURE 2

REV 0



- LEGEND:**
- IFR SAMPLING SITE
 - RIVER/CREEK
 - STREAM MAPPING**
 - CASCADE
 - POOL
 - RIFFLE

- NOTES:**
1. BASE MAP: ABACUS AERIAL ORTHOPHOTOGRAPHY AND NRCAN NATIONAL TOPOGRAPHIC DATABASE (NTDB) 1:50,000.
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KGHM AJAX MINING INC.
 AJAX PROJECT
 INSTREAM FLOW REQUIREMENTS ASSESSMENT
 PETERSON CREEK - PC2

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PIA NO. VA101-246/35
REF NO. VA14-01575
FIGURE 3
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Photo 1 Example of pool (left), riffle (middle) and cascade (right) habitats in Peterson Creek study reach PC1

It is evident from the habitat mapping that pool habitat is negligible. Riffles tend to be too hydraulically uniform and shallow to support fish use in low flow periods. Pocket water within cascade habitat units is thought to be the most viable summer rearing and overwintering habitat for these low flow periods and this was the focus of the transect site selection. Transect locations, relative to the Project are shown on Figure 1, while transect locations within study site PC1 and PC2 are shown on Figures 2 and 3. Habitat unit for each transect is summarized in Table 3.

Table 3 Transect habitat type

Site	Transect	Habitat
PC1	PC1-01	Riffle
	PC1-02	Cascade
	PC1-03	Cascade
PC2	PC2-01	Cascade
	PC2-02	Cascade
	PC2-03	Cascade
	PC2-04	Pool
	PC2-05	Cascade
PC3	PC3-01	Riffle
	PC3-02	Riffle
PC4	PC4-01	Glide

6 – TRANSECT DATA COLLECTION

Three site visits were completed by KP in 2014, occurring in July, September and November respectively. The goal of the visits were to observe three flow conditions that cover the range of expected flow conditions under baseline and operational conditions.

Each transect has left-bank and right-bank benchmarks (pins), which provide elevation control for water level surveys and horizontal control for depth and velocity observations. The benchmarks are typically nails put into wooden stakes in the ground or nail spikes put into the base of trees. Benchmarks are located above normal flow levels. The left-bank benchmark at each transect was assigned a local datum of 2.000 m.

A cross section survey was completed at each transect with a surveyors level and rod. All transects (except for the one at PC4) were surveyed at 10 cm intervals between the left and right-bank pins. Bed elevation is surveyed at the same location that depth and velocity observations are collected. The PC4 channel has been surveyed at 20 cm intervals. The spacing was selected to target 20 observation verticals in each cross-section, but 10 cm was considered the smallest interval that could be accurately assessed. Unless it is suspected that benchmarks have moved or significant channel change has occurred, a cross section survey has only been completed once. Some sites were surveyed in July 2014, while others weren't surveyed until September 2014. A significant rain storm occurred in Kamloops on July 23, 2014 just following the July site visit. This rain storm caused flooding in Kamloops and severe erosion to a tributary upstream of PC1. Although not visually evident, this event may have caused channel change at the transect locations. PC1-01 and PC1-03 were resurveyed in October 2014.

Water level is measured with a surveyor's level during each site visit. Water levels are surveyed relative to the transect benchmarks and both right and left wetted edge level is measured in order to obtain a reasonable average water level for the entire transect. Water depth and velocity measurements are then taken at each transect. These data are measured at set intervals from the left bank pin (i.e. the left bank pin always has a chainage of 0+000) during every visit. This ensures that depths and velocities are measured at the same location on each visit to facilitate depth and velocity modelling. Depth measurements have been made using a USGS Top-Set Flo-Mate rod, and velocity measurements have been taken using either a Flo-Mate 2000 or FH950 velocity meter.

Fish habitat transects are selected based on habitat requirements and are not necessarily established in locations suitable to obtain high quality discharge measurements. As a result, it is sometimes necessary, depending on flow conditions, to perform a separate discharge measurement at a nearby location in order to obtain the best possible estimate of discharge at a site. Flow conditions during the 2014 site visits are summarized in Table 4. Water level, depth and velocity data collected are presented in Appendices A to D. Photos collected during each site visit are also included in the Appendices.

Mean monthly flows and mean annual discharge (MAD) at each study site, based on streamflow data collected on site (KP, 2013b), preliminary site wide water balance modelling (BGC, 2014) and drainage area proration are shown in Table 5.

Table 4 Observed Flow Conditions for Depth and Velocity Data Collection

Date	PC1		PC2		PC3		PC4	
	m ³ /s	%MAD	m ³ /s	%MAD	m ³ /s	%MAD	m ³ /s	%MAD
23-Jul-14	0.049	51%	0.043	47%	0.004	18%	0.067	149%
16-Sep-14	0.008	9%	-	-	-	-	0.000	0%
17-Sep-14	-	-	0.004	4%	0.000	0%	-	-
5-Nov-14	0.010	10%	0.003	3%	0.000	0%	0.002	3%

NOTES:

1. TWO ADDITIONAL TRANSECTS WERE ESTABLISHED AT PC2 ON 17 SEPTEMBER 2014. THESE TRANSECTS ONLY HAVE TWO DEPTH - VELOCITY DATASETS.

Table 5 Mean Monthly Flow (m³/s)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
PC1	0.02	0.02	0.06	0.21	0.45	0.28	0.04	0.01	0.02	0.02	0.02	0.02	0.10
PC2	0.02	0.02	0.06	0.20	0.43	0.27	0.03	0.01	0.02	0.02	0.02	0.02	0.09
PC3	0.00	0.00	0.01	0.05	0.11	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.02
PC4	0.01	0.01	0.03	0.10	0.21	0.13	0.02	0.00	0.01	0.01	0.01	0.01	0.05

NOTES:

1. BASED ON UNIT AREA SCALING OF DATA FROM THE PRELIMINARY SITE WIDE WATER BALANCE (BGC, 2014)

7 – HABITAT SUITABILITY INDICES AND HABITAT MODELLING

Habitat data have been collected to support habitat modelling, which is based on the supposition that within a stream channel, certain portions of the channel are preferred by fish due to certain depth, velocity and substrate or cover conditions. For example, while the wetted area of a stream reach at a certain flow may be 100 m², if velocities are too high for fish to use in some parts of this area, then the usable area will be less than 100 m². Habitat suitability is characterized by depth, velocity and substrate or cover suitability indices that range from 0 to 1. These habitat suitability indices (HSI) are used to develop discharge versus weighted useable width (WUW) and weighted useable area (WUA) relationships to describe how habitat varies with flow conditions. WUA under baseline and operational flow conditions can then be calculated and compared.

WUW is calculated as:

$$WUW = \sum W \times D_{HSI} \times V_{HSI} \times S_{HSI}$$

Where:

W = cell width

D_{HSI} = depth suitability

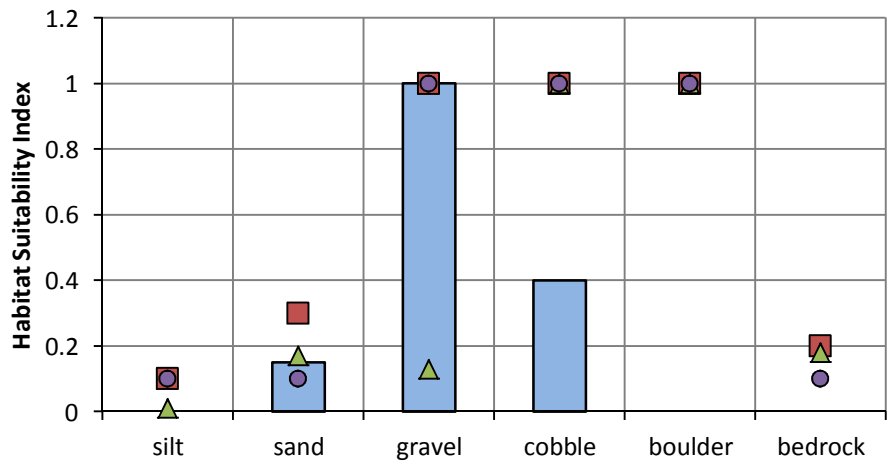
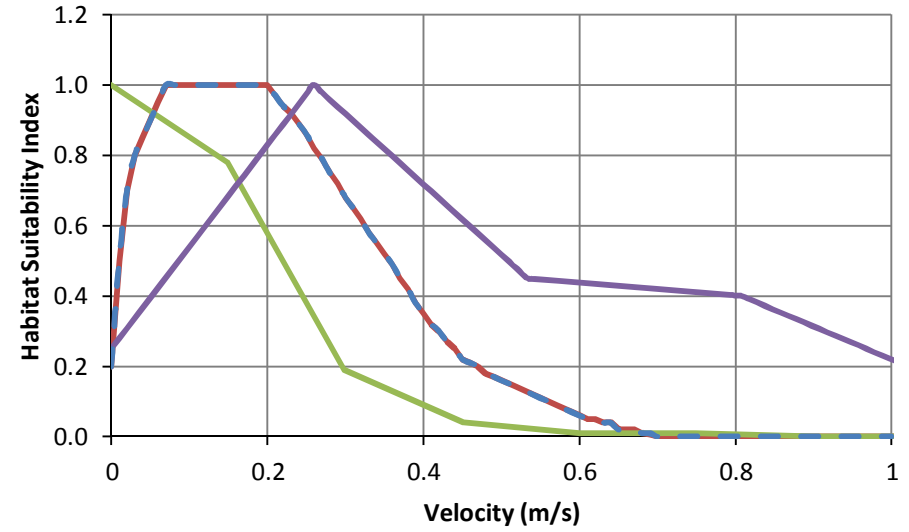
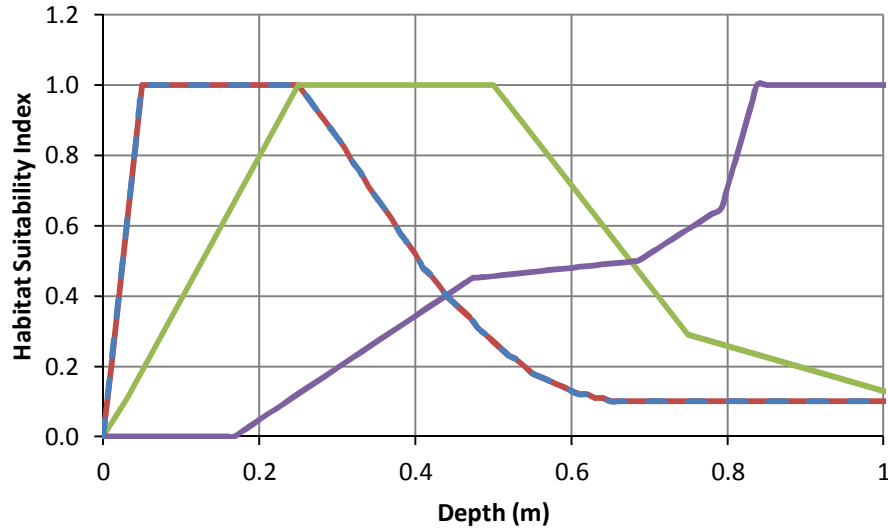
V_{HSI} = velocity suitability

S_{HSI} = substrate or cover suitability

WUW relationships were translated into discharge-weighted useable area (WUA) relationships by multiplying the WUW values by the length of mesohabitat that each relationship represents, as per the “Idealized River Reach Approach” (USGS, 2001).

Several sources of depth, velocity and substrate HSI curves for rainbow trout were reviewed. In a study of Lower Fraser River juvenile fish HSI, Rempel et. al. (2012) presents data for 0+ and 1+ age class rainbow trout and show strong agreement with steelhead fry and parr HSI, respectively, derived from Water Use Planning (WUP) Delphi derived HSI (Ptolemy, 2001). These criteria were also compared to HSI criteria for rainbow trout presented by Raleigh et. al. (2004), which tended to show preference for lower velocities and greater depths. In comparison, Washington State criteria (WDFW and WDE, 2004) tended to show preference for higher velocities and greater depths. All four data sets are shown on Figure 4.

Although derived from larger rivers, the WUP Delphi curves were considered representative of the depths and velocities where fish were observed in Peterson Creek. Although they are specified as 0+ or fry age class, they are considered suitable for all age classes in Peterson Creek. WUW and WUA were calculated for rainbow trout from the measured data collected during the 2014 site visits and are shown in Table 6.



- Fraser River HSI
- WUP Delphi (Steelhead Fry)
- Raliegh et al. (Rainbow Trout Fry)
- Washington State (Rainbow Trout Juvenile)

KGHM AJAX MINING INC		
AJAX PROJECT		
RAINBOW TROUT FRY HSI CURVES FOR DEPTH, VELOCITY AND SUBSTRATE		
<i>Knight Piésold</i> CONSULTING	P/A NO. VA101-00246/35	REF. NO. VA14-01575
	FIGURE 4	
		REV 0

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Table 6 Measured Wetted Width, WUW and WUA at PC1

Date	Discharge (m ³ /s)	Wetted Width (m)			WUW (m)			WUA (m ²)
		PC1-01	PC1-02	PC1-03	PC1-01	PC1-02	PC1-03	
23-Jul-14	0.05	1.5	0.8	1.1	0.5	0.1	0.3	82
16-Sep-14	0.01	1.2	0.8	0.8	0.3	0.5	0.1	71
5-Nov-14	0.01	1.1	0.7	0.9	0.9	0.5	0.2	157

Table 7 Measured Wetted Width, WUW and WUA at PC2

Date	Discharge (m ³ /s)	Wetted Width (m)					WUW (m)					WUA (m ²)
		PC2-01	PC2-02	PC2-03	PC2-04	PC2-05	PC2-01	PC2-02	PC2-03	PC2-04	PC2-05	
23-Jul-14	0.043	1.9	1.3	1.8	-	-	0.5	0.6	0.3	-	-	
17-Sep-14	0.004	1.9	1.3	1.5	2.2	1.8	0.6	0.6	0.3	1.2	0.2	99
5-Nov-14	0.003	1.8	1.3	0.9	2.1	0.7	0.6	0.5	0.3	0.7	0.2	91

The results of these observations show a slight reduction in wetted width with reduced flows, although most of the channel has relatively steep banks, particularly at PC1 where this urban channel has most likely been modified by the surrounding development. In general, WUW and WUA show little difference between the moderate July flows and the low late summer flows. Reviewing the depth and velocity data shows that depths were typically in the 'ideal' range during all site visits, but velocity was typically higher than ideal in July. Additional data are required at approximately 0.02 m³/s to better represent baseline and operational flow conditions during the critical period.

8 – SUMMARY

Data have been collected to support an assessment of instream flow requirements and the effects of flow modifications on fish habitat in Peterson Creek. This letter presents methodology and data collected. Before further analysis is completed baseline and operational flow series are required and the magnitude of impacts should be reviewed. If flow impacts are negligible (e.g. less than guideline flow thresholds), further data collection and habitat modelling may not be justified. If modelling is required, the information in this letter should be reviewed by KGHM Ajax Mining Inc. (KAM) and agencies for agreement on the modelling dataset, in particular, the number and placement of transects, and selection of habitat suitability indices. Agreement on model inputs prior to modelling is recommended. If modelling is required, additional data should be collected at approximately 0.02 m³/s to better represent baseline and operational flow conditions during the critical period.

We look forward to discussing the next steps with you. If you have any questions or comments, please feel free to contact the undersigned.

Yours truly,

KNIGHT PIESOLD LTD.

ORIGINAL SIGNED



Prepared:

Toby Perkins, M.A.Sc, P.Eng.
Senior Engineer

Reviewed:

ORIGINAL SIGNED



Stephanie Eagen, R.P.Bio
Senior Scientist

Approval that this document adheres to Knight Piésold Quality Systems:

References

- BGC Engineering (BGC), 2014. Preliminary water balance results, 9 October 2014, pers. comm.
- Fisheries and Oceans Canada. 2013. Underwater World: Rainbow Trout. Pacific Ocean and freshwater lakes. Available at: <http://www.dfo-mpo.gc.ca/science/publications/uww-msm/articles/rainbowtrout-truitearcenciel-eng.html>. Accessed November 26, 2014.
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- Johnston, N.T. and Slaney, P.A., 1996. Fish Habitat Assessment Procedures. Watershed Restoration Technical Circular No. 8, revised April 1996. BC Ministry of Environment, Victoria, BC.
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- Lewis, A.; T. Hatfield, B. Chilibeck, C. Roberts. 2004. Assessment Methods for Aquatic Habitat and Instream Flow Characteristics in Support of Applications to Dam, Divert, or Extract Water from Streams in British Columbia.
- Ptolemy, R. 2001. Water use planning (WUP) Delphi curves. BC Ministry of Environment, Victoria, BC.
- Raleigh, R.F., Hickman, T., Solomon, R.C. and Nelson, P.C. 1984. Habitat suitability information: Rainbow trout. US Fish Wildl. Serv. FWS/OBS-82/10.60. 64 p
- Rempel, L.L., Healey, K. and Lewis, F.J.A. 2012. Lower Fraser River juvenile fish habitat suitability criteria. Can. Tech. Rep. Fish. Aquat. Sci. 2991: ix + 73 p.
- USGS (Waddle, T.J., (ed)), 2001. PHABSIM for Windows user's manual and exercises. US Geological Survey, Fort Collins, CO. Waddle, T.J. (ed.). 2012. PHABSIM for Windows user's manual and exercises. U.S. Geological Survey. Fort Collins, Colorado.

Washington State Department of Fish and Wildlife (WDFW) and Washington State Department of Ecology (WDE). 2004. Instream Flow Study Guidelines: Technical and Habitat Suitability Issues including Fish Preference Curves.

Attachments:

- Appendix A Measured data and photos at study site PC1
 - Appendix A1 Measured data and photos at PC1-01
 - Appendix A2 Measured data and photos at PC1-02
 - Appendix A3 Measured data and photos at PC1-03
- Appendix B Measured data and photos at study site PC2
 - Appendix B1 Measured data and photos at PC2-01
 - Appendix B2 Measured data and photos at PC2-02
 - Appendix B3 Measured data and photos at PC2-03
 - Appendix B4 Measured data and photos at PC2-04
 - Appendix B5 Measured data and photos at PC2-05
- Appendix C Measured data and photos at study site PC3
 - Appendix C1 Measured data and photos at PC3-01
 - Appendix C2 Measured data and photos at PC3-02
- Appendix D Measured data and photos at study site PC4

/tjp

APPENDIX A

MEASURED DATA AND PHOTOS AT PC1

Appendix A1	Measured data and photos at PC1-01
Appendix A2	Measured data and photos at PC1-02
Appendix A3	Measured data and photos at PC1-03

APPENDIX A1
MEASURED DATA AND PHOTOS AT PC1-01
(Pages A1-1 to A1-9)

TABLE A1-1

**KGHM AJAX MINING INC
AJAX PROJECT**

PC1-01 SITE VISIT SUMMARY

Print Jan/21/15 10:06:31

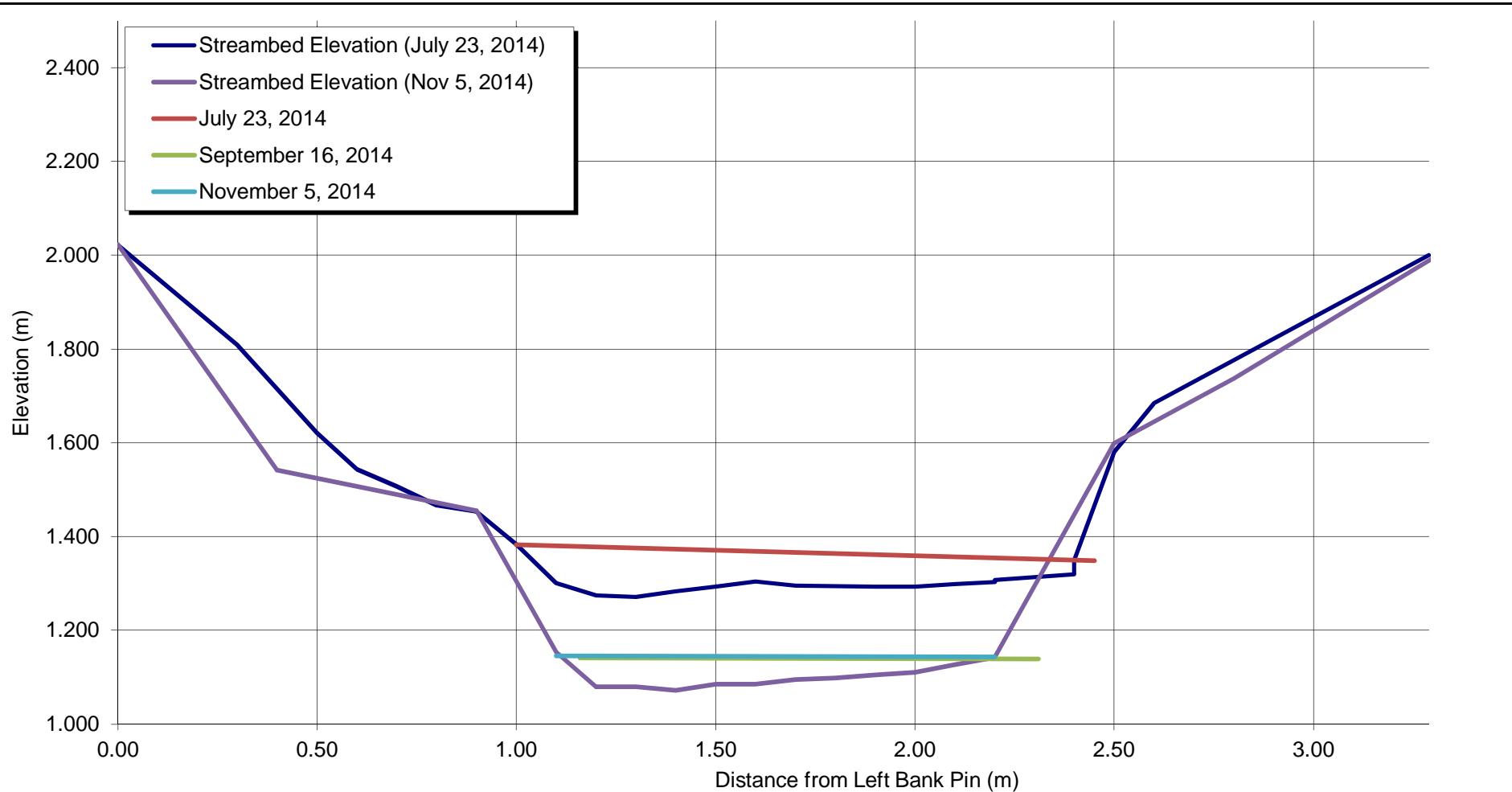
Date	Measured Discharge	Best Discharge Estimate		Left Water Level	Right Water Level	Best Estimate Water Level	Right Bank Pin	Left Bank Pin
	(m ³ /s)	(m ³ /s)	%MAD	(m)	(m)	(m)	(m)	(m)
23-Jul-14	0.048	0.049	51%	1.383	1.349	1.366	2.000	2.022
16-Sep-14	0.008	0.008	9%	1.141	1.139	1.140	1.994	2.022
5-Nov-14	0.010	0.010	10%	1.146	1.143	1.145	1.994	2.022

M:\1\01\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC1\PC1-01.xlsx\Summary Table

NOTES

- BEST ESTIMATE OF DISCHARGE TAKEN FROM THIS TRANSECT.

0	21JAN'15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

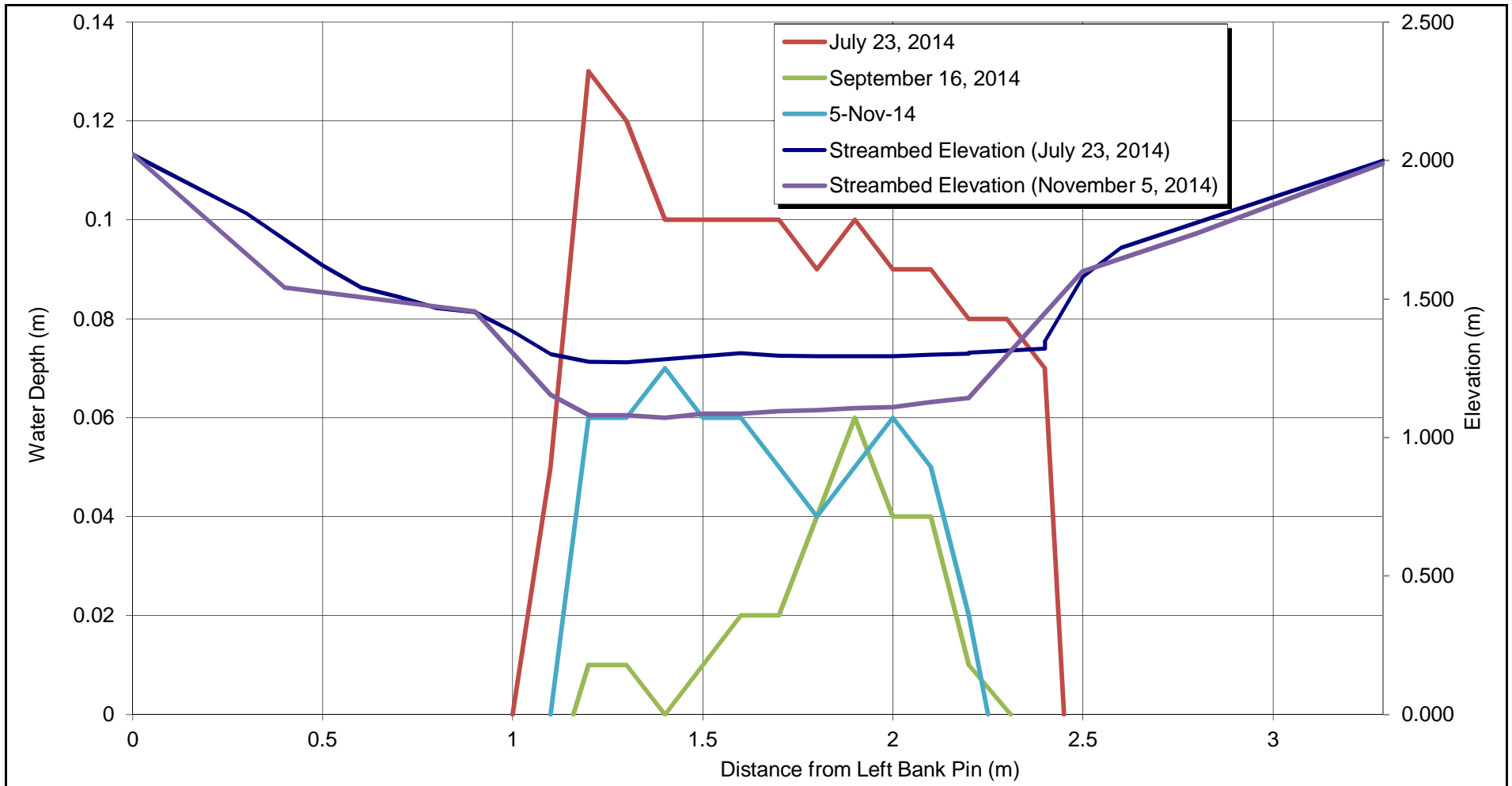


NOTES:

1. ELEVATION RELATIVE TO RIGHT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0m

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT CROSS SECTIONAL SURVEY PC1-01	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE A1-1	
	REV 0

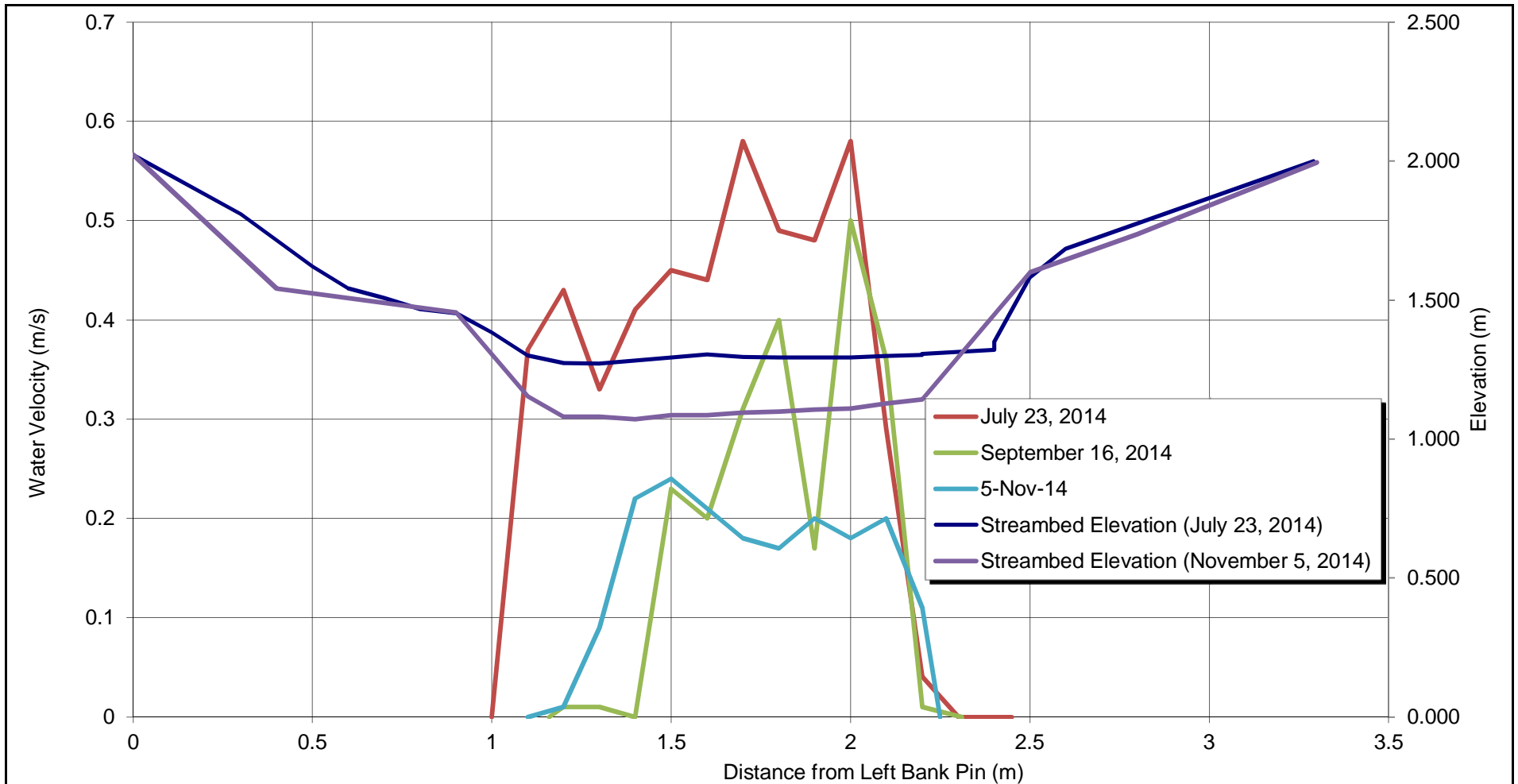
0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



NOTES:
 1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT WATER DEPTH PC1-01	
Knight Piésold CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE A1-2	
REV 0	

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT VELOCITY PC1-01	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE A1-3	
REV 0	

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



PHOTO 1 – Upstream - July 23, 2014 (0.049 m³/s)



PHOTO 2 – Downstream - July 23, 2014 (0.049 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 3 – Upstream - September 16, 2014 (0.008 m³/s)



PHOTO 4 – Left to Right Bank - September 16, 2014 (0.008 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 5 – Right to Left Bank - September 16, 2014 (0.008 m³/s)



PHOTO 6 – Downstream - September 16, 2014 (0.008 m³/s)

KGHM AJAX MINING INC.
AJAX MINE

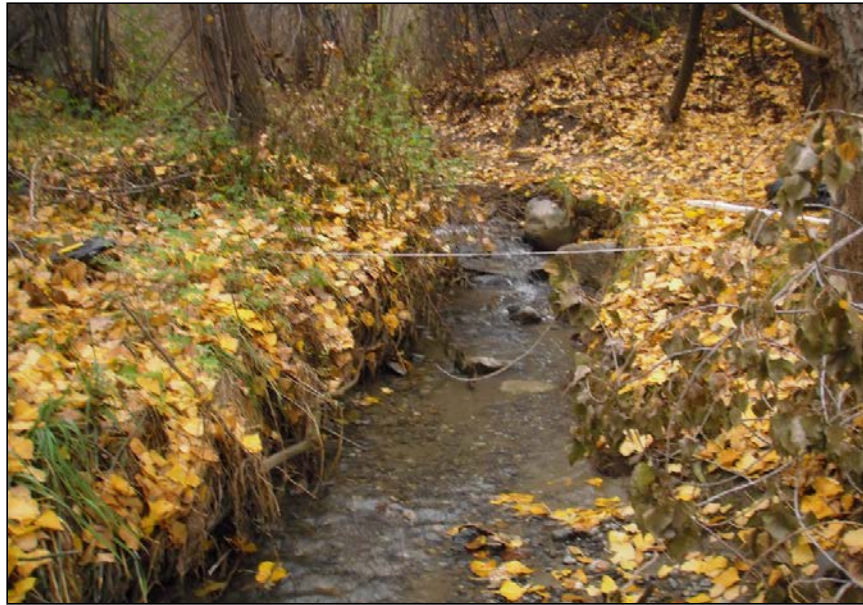


PHOTO 7 – Upstream - November 5, 2014 (0.010 m³/s)



PHOTO 8 – Left to Right Bank - November 5, 2014 (0.010 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 9 – Right to Left Bank - November 5, 2014 (0.010 m³/s)



PHOTO 10 – Downstream - November 5, 2014 (0.010 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**

APPENDIX A2
MEASURED DATA AND PHOTOS AT PC1-02
(Pages A2-1 to A2-10)

TABLE A2-1

**KGHM AJAX MINING INC
AJAX PROJECT**

PC1-02 SITE VISIT SUMMARY

Print Jan/21/15 10:31:28

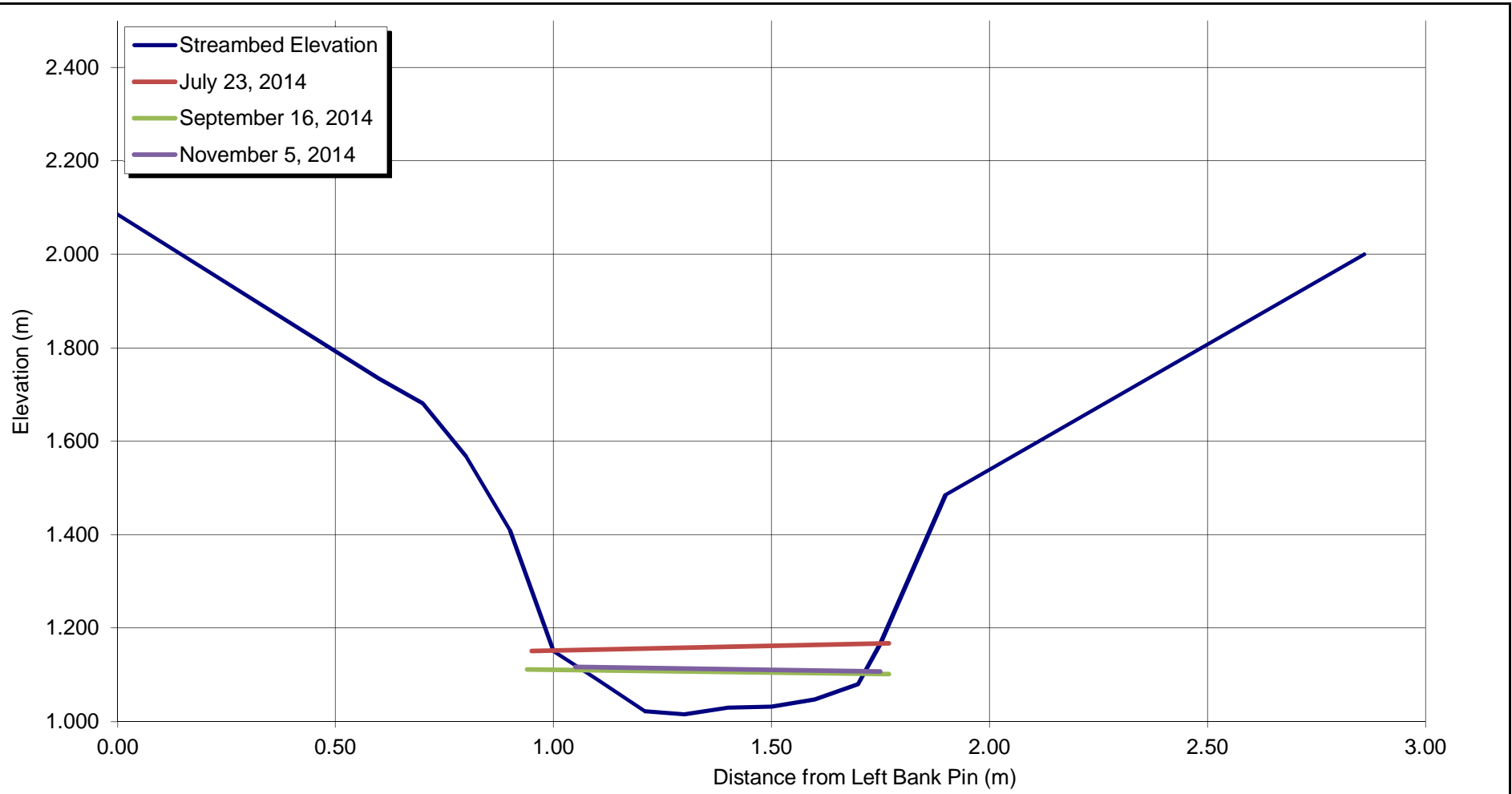
Date	Measured Discharge	Best Discharge Estimate		Left Water Level	Right Water Level	Best Estimate Water Level	Right Bank Pin	Left Bank Pin
	(m ³ /s)	(m ³ /s)	%MAD	(m)	(m)	(m)	(m)	(m)
23-Jul-14	0.090	0.049	51%	1.151	1.167	1.159	2.000	2.086
16-Sep-14	0.005	0.008	9%	1.111	1.102	1.107	1.996	2.086
5-Nov-14	0.010	0.010	10%	1.117	1.107	1.112	1.997	2.086

M:\1\01\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC1\PC1-02.xlsx]Summary Table

NOTES

1. BEST ESTIMATE OF DISCHARGE TAKEN FROM TRANSECT PC-01.

0	21JAN15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

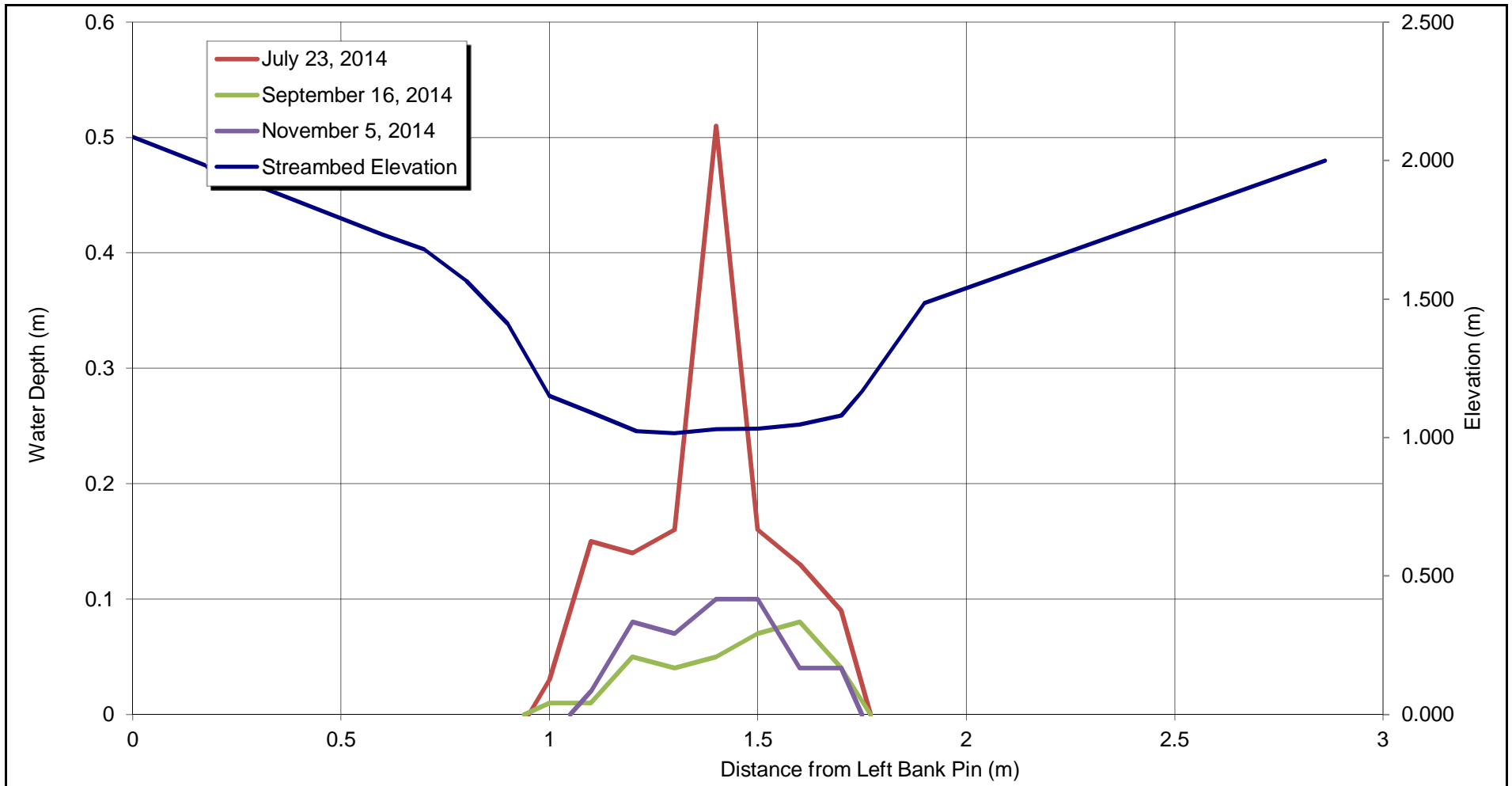


NOTES:

1. ELEVATION RELATIVE TO RIGHT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0m

KGHM AJAX MINING INC		
AJAX PROJECT		
TRANSECT CROSS SECTIONAL SURVEY PC1-02		
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE A2-1	
		REV 0

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

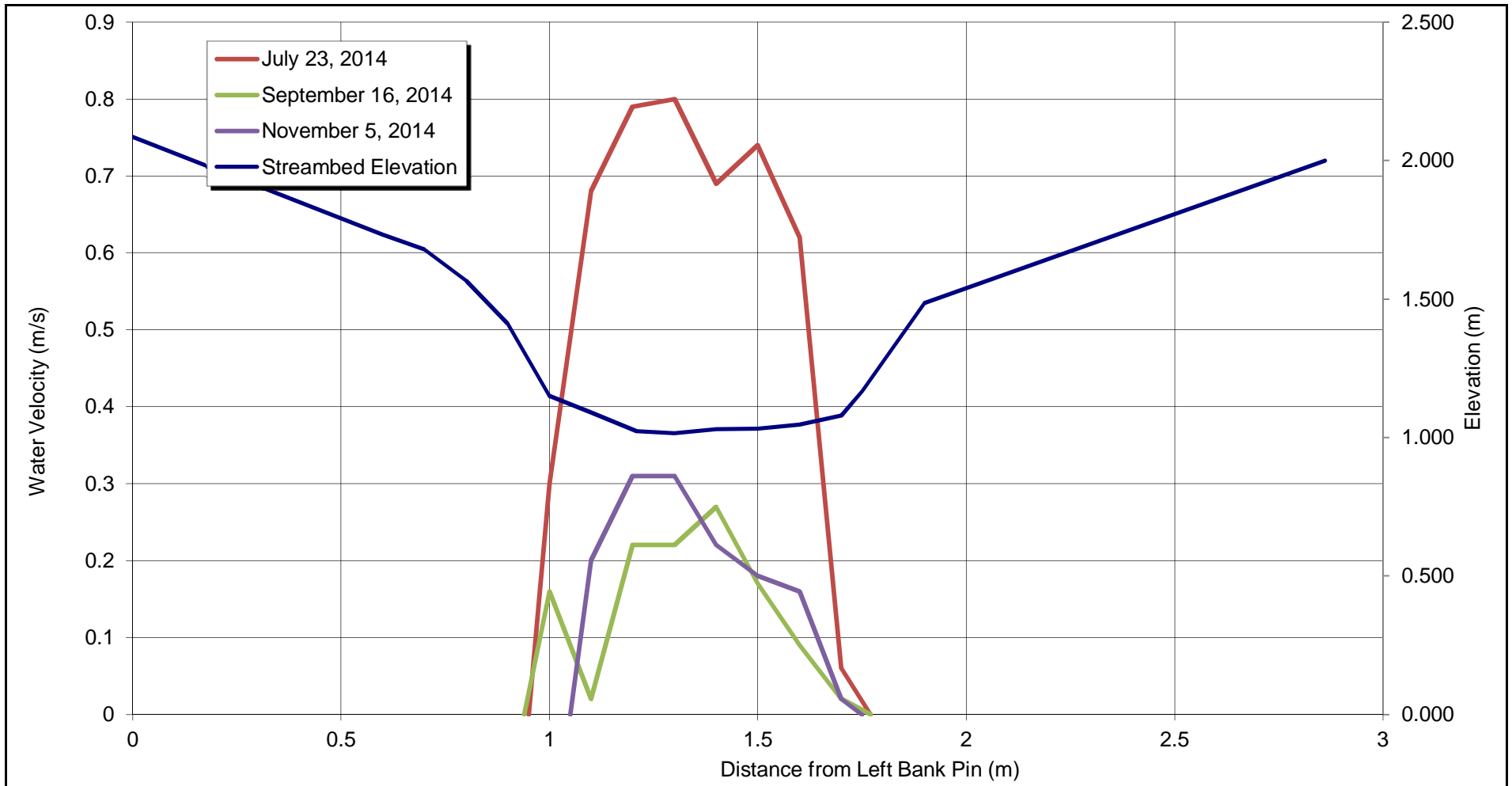


NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC		
AJAX PROJECT		
TRANSECT WATER DEPTH PC1-02		
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE A2-2	
		REV 0

0	21JAN15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT VELOCITY PC1-02	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35 REF. NO. VA14-01575
FIGURE A2-3	
	REV 0

0	21JAN15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



PHOTO 1 – Upstream - July 22, 2014 (0.05 m³/s)



PHOTO 2 – Left to Right Bank - July 22, 2014 (0.05 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 3 – Downstream - July 22, 2014 (0.05 m³/s)



PHOTO 4 – Upstream - September 16, 2014 (0.008 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 5 – Left to Right Bank September 16, 2014 (0.008 m³/s)



PHOTO 6 – Right to Left Bank September 16, 2014 (0.008 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**



PHOTO 7 – Downstream September 16, 2014 (0.008 m³/s)



PHOTO 8 – Upstream - November 5, 2014 (0.010 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 9 – Left to Right Bank - November 5, 2014 (0.010 m³/s)



PHOTO 10 – Right to Left Bank - November 5, 2014 (0.010 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 11 – Downstream - November 5, 2014 (0.010 m³/s)

KGHM AJAX MINING INC.
AJAX MINE

APPENDIX A3
MEASURED DATA AND PHOTOS AT PC1-03
(Pages A3-1 to A3-9)

TABLE A3-1

**KGHM AJAX MINING INC
AJAX PROJECT**

PC1-03 SITE VISIT SUMMARY

Print Jan/21/15 10:46:52

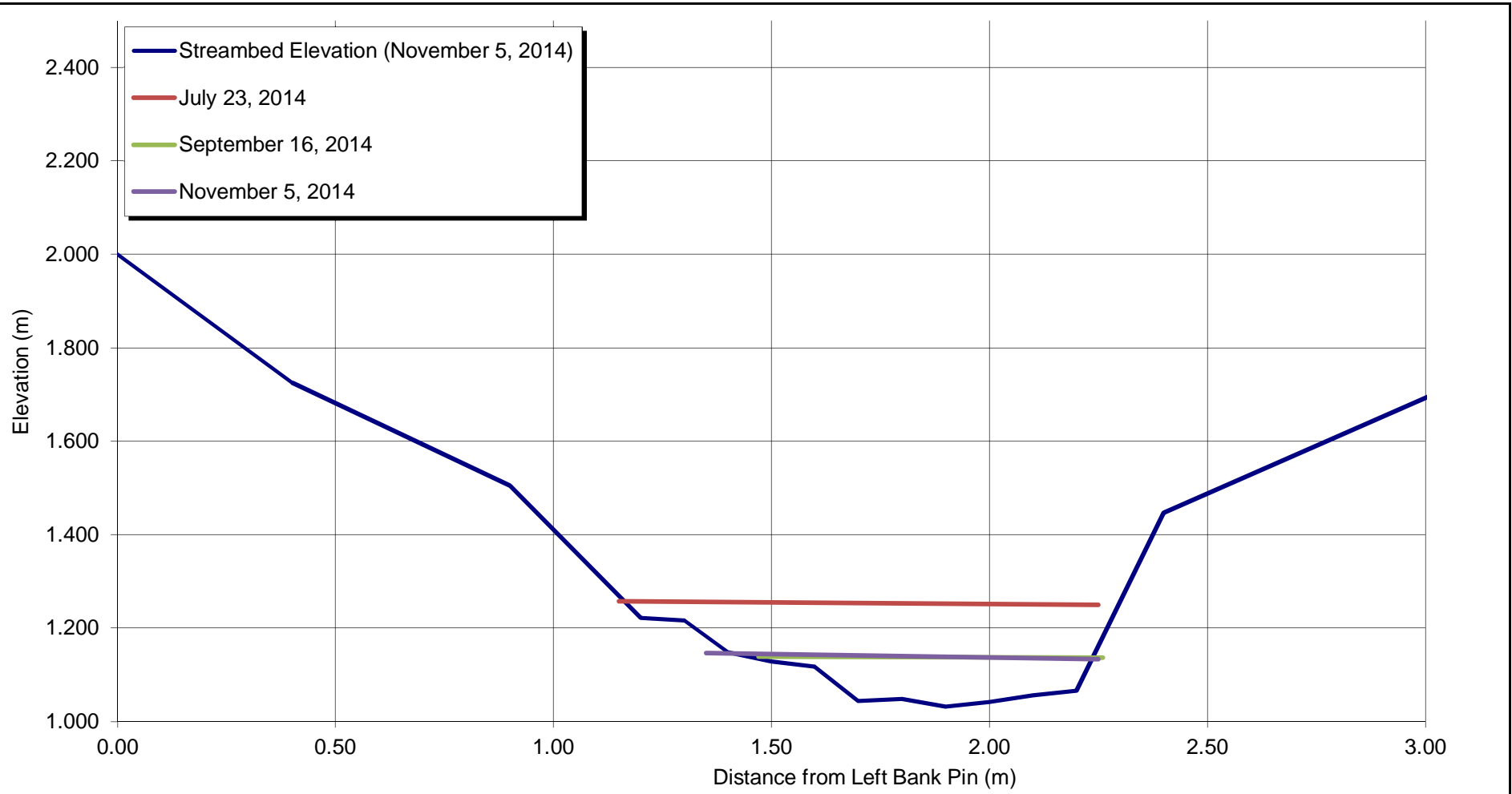
Date	Measured Discharge	Best Discharge Estimate		Left Water Level	Right Water Level	Best Estimate Water Level	Right Bank Pin	Left Bank Pin
	(m ³ /s)	(m ³ /s)	%MAD	(m)	(m)	(m)	(m)	(m)
23-Jul-14	0.041	0.049	51%	1.257	1.250	1.254	2.023	2.000
16-Sep-14	0.009	0.008	9%	1.139	1.137	1.138	2.026	2.000
5-Nov-14	0.011	0.010	10%	1.147	1.134	1.140	2.025	2.000

M:\1\01\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC1\PC1-03.xlsx\Summary Table

NOTES:

- BEST DISCHARGE ESTIMATE TAKEN FROM TRANSECT PC1-01.

0	21JAN15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREPD	CHK'D	APP'D

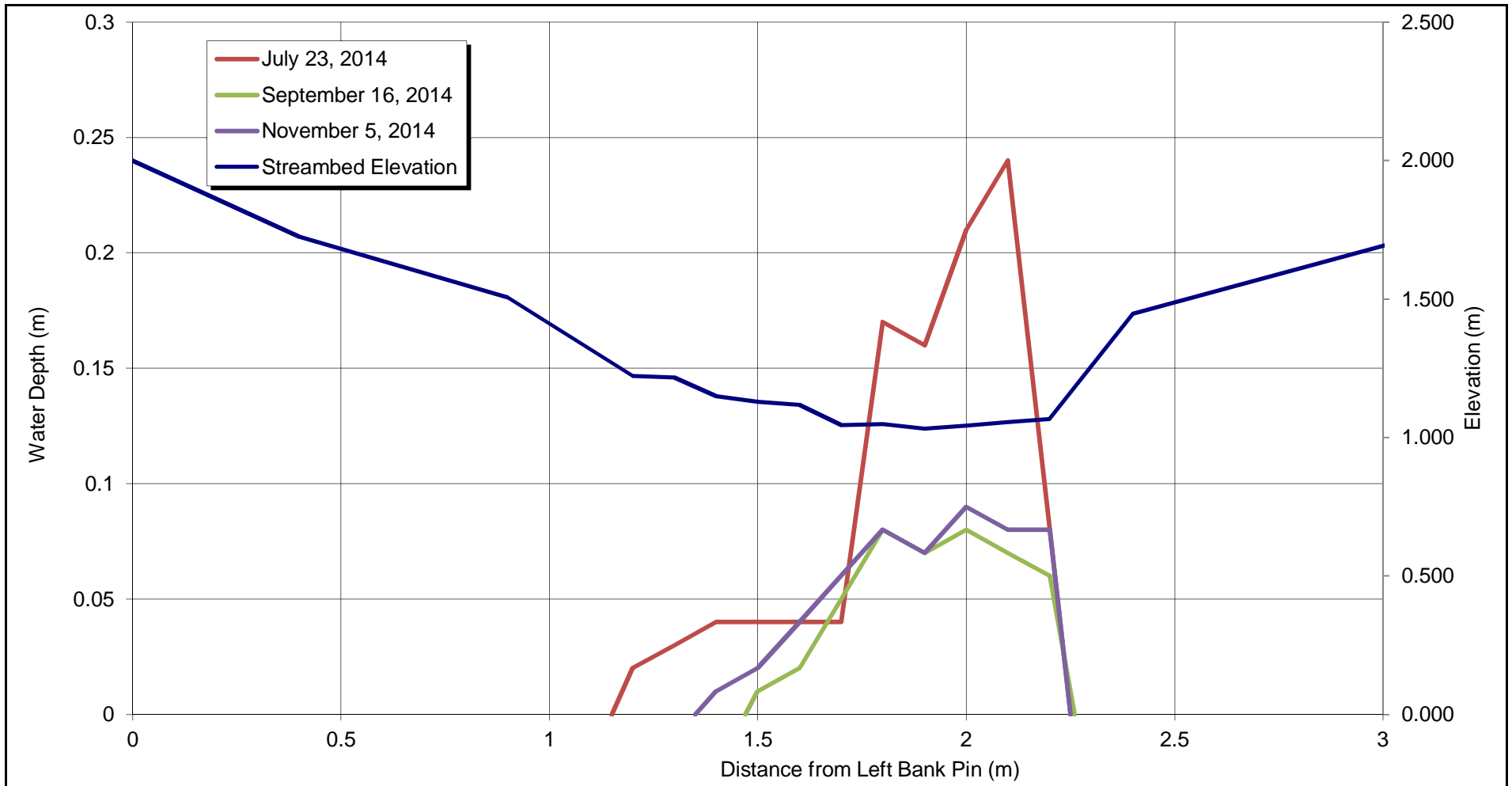


NOTES:

1. ELEVATION RELATIVE TO RIGHT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0m

KGHM AJAX MINING INC.		
AJAX PROJECT		
TRANSECT CROSS SECTIONAL SURVEY PC1-03		
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE A3-1	
		REV 0

0	21JAN15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

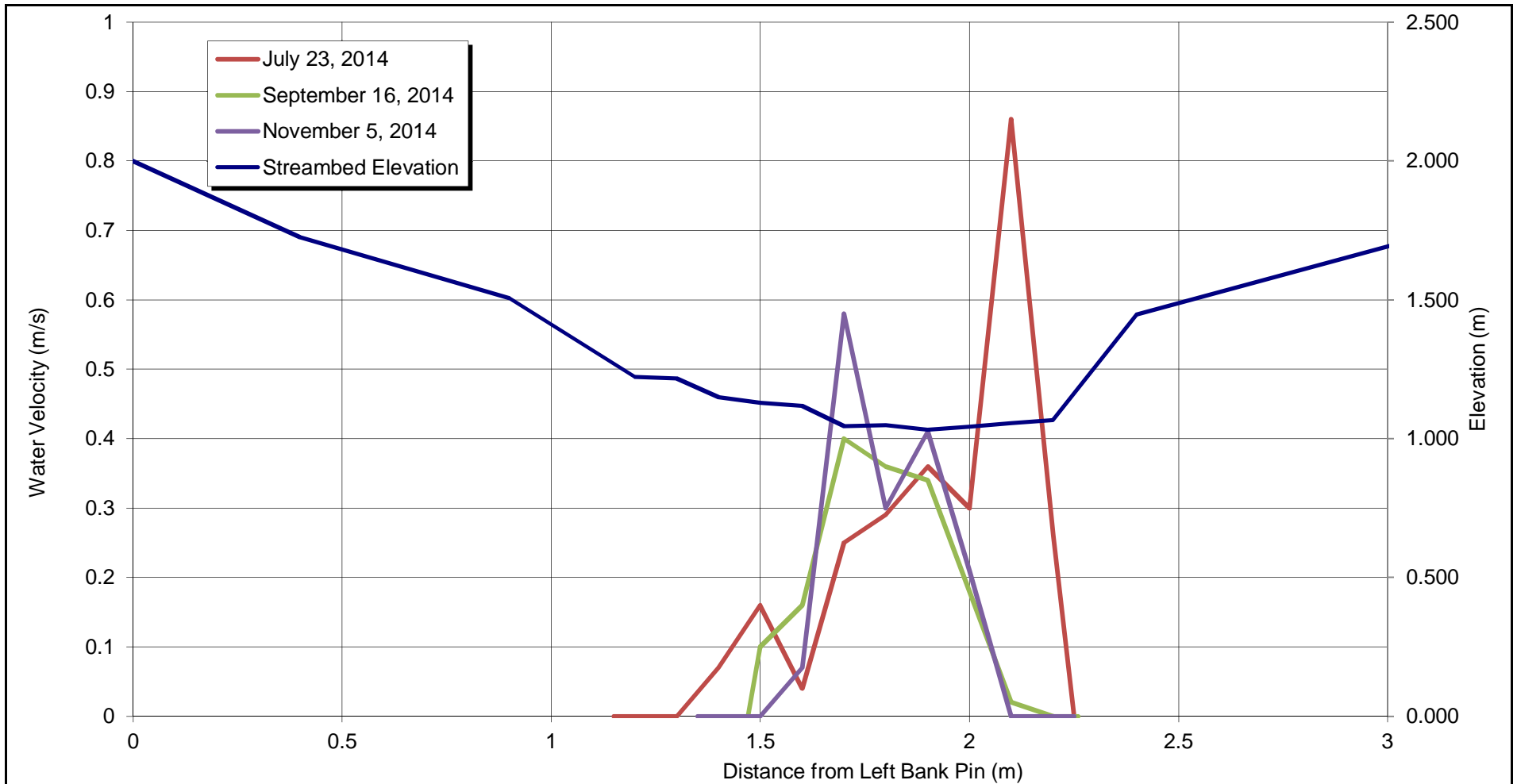


NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC.	
AJAX PROJECT	
TRANSECT WATER DEPTH PC1-03	
Knight Piésold CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE A3-2	
REV 0	

0	21JAN15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC.	
AJAX PROJECT	
TRANSECT VELOCITY PC1-03	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35 REF. NO. VA14-01575
FIGURE A3-3	
REV 0	

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



PHOTO 1 – Downstream - July 22, 2014 (0.049 m³/s)



PHOTO 2 – Upstream - September 16, 2014 – (0.008 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 3 – Left to Right Bank - September 16, 2014 – (0.008 m³/s)



PHOTO 4 – Right to Left Bank - September 16, 2014 – (0.008 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 5 – Downstream - September 16, 2014 – (0.008 m³/s)

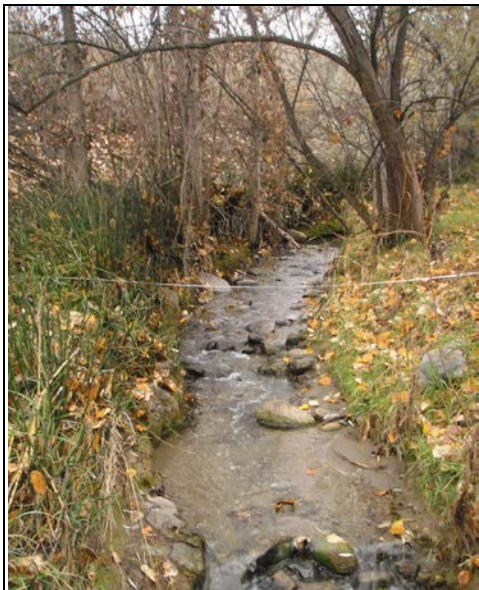


PHOTO 6 – Upstream - November 5, 2014 (0.010 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 7 – Left to Right Bank - November 5, 2014 (0.010 m³/s)



PHOTO 8 – Right to Left Bank - November 5, 2014 (0.010 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 9 – Downstream - November 5, 2014 (0.010 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**

APPENDIX B

MEASURED DATA AND PHOTOS AT PC2

Appendix B1	Measured data and photos at PC2-01
Appendix B2	Measured data and photos at PC2-02
Appendix B3	Measured data and photos at PC2-03
Appendix B4	Measured data and photos at PC2-04
Appendix B5	Measured data and photos at PC2-05

APPENDIX B1

MEASURED DATA AND PHOTOS AT PC2-01

(Pages B1-1 to B1-10)

TABLE B1-1

**KGHM AJAX MINING INC
AJAX PROJECT**

PC2-01 SITE VISIT SUMMARY

Print Jan/21/15 10:57:56

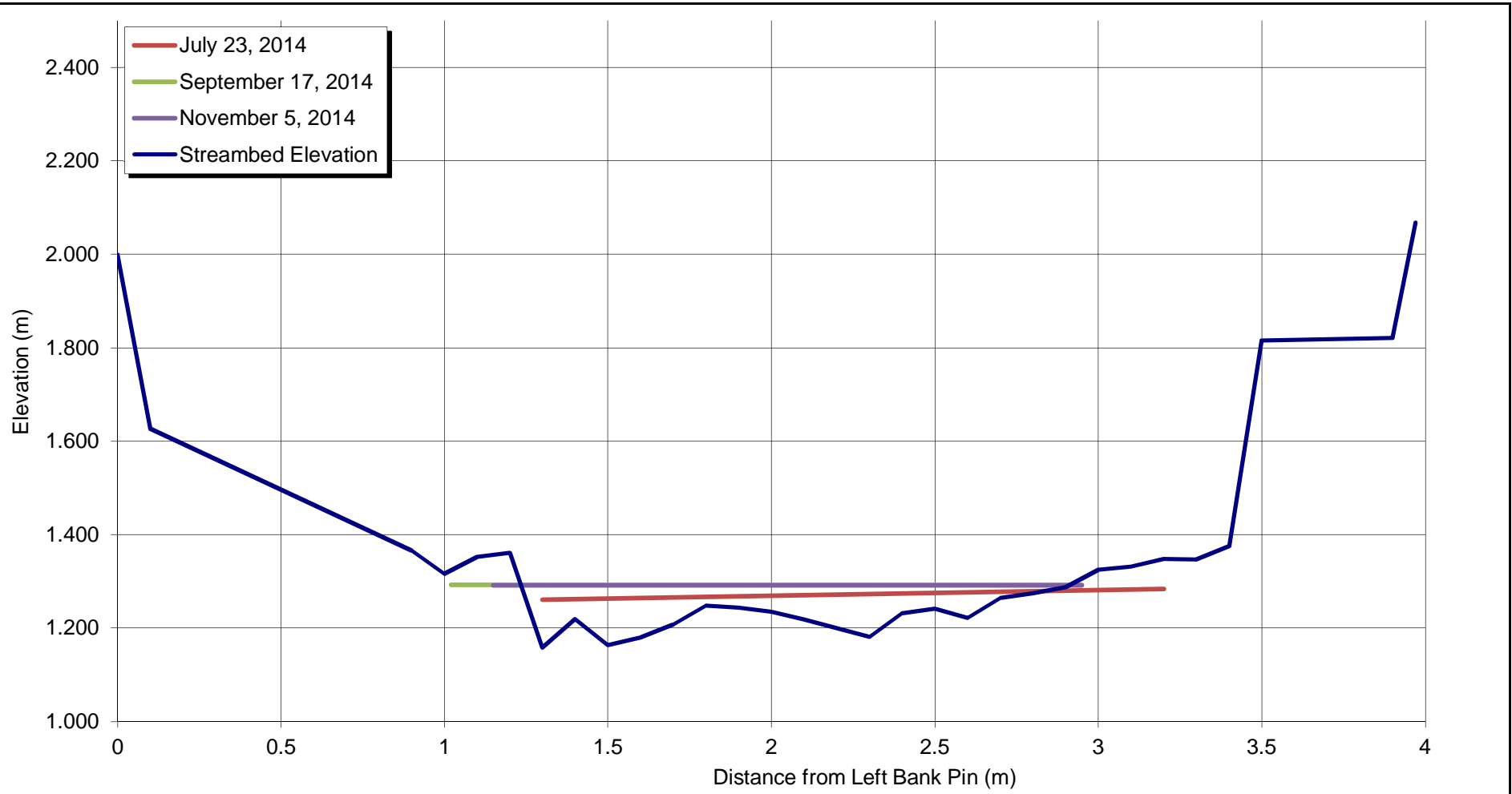
Date	Measured Discharge	Best Discharge Estimate		Left Water Level	Right Water Level	Best Estimate Water Level	Right Bank Pin	Left Bank Pin
	(m ³ /s)	(m ³ /s)	%MAD	(m)	(m)	(m)	(m)	(m)
23-Jul-14	0.058	0.043	47%	1.261	1.284	1.273	2.067	2.000
17-Sep-14	0.007	0.004	4%	1.293	1.293	1.293	2.068	2.000
5-Nov-14	0.007	0.003	3%	1.292	1.292	1.292	2.069	2.000

M:\1\01\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC2\PC2-01.xlsx\Summary Table

NOTES:

- BEST DISCHARGE ESTIMATE TAKEN FROM TRANSECT PC2-02 FOR JULY AND FROM PC2-04 IN REMAINING MONTHS

0	21JAN15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

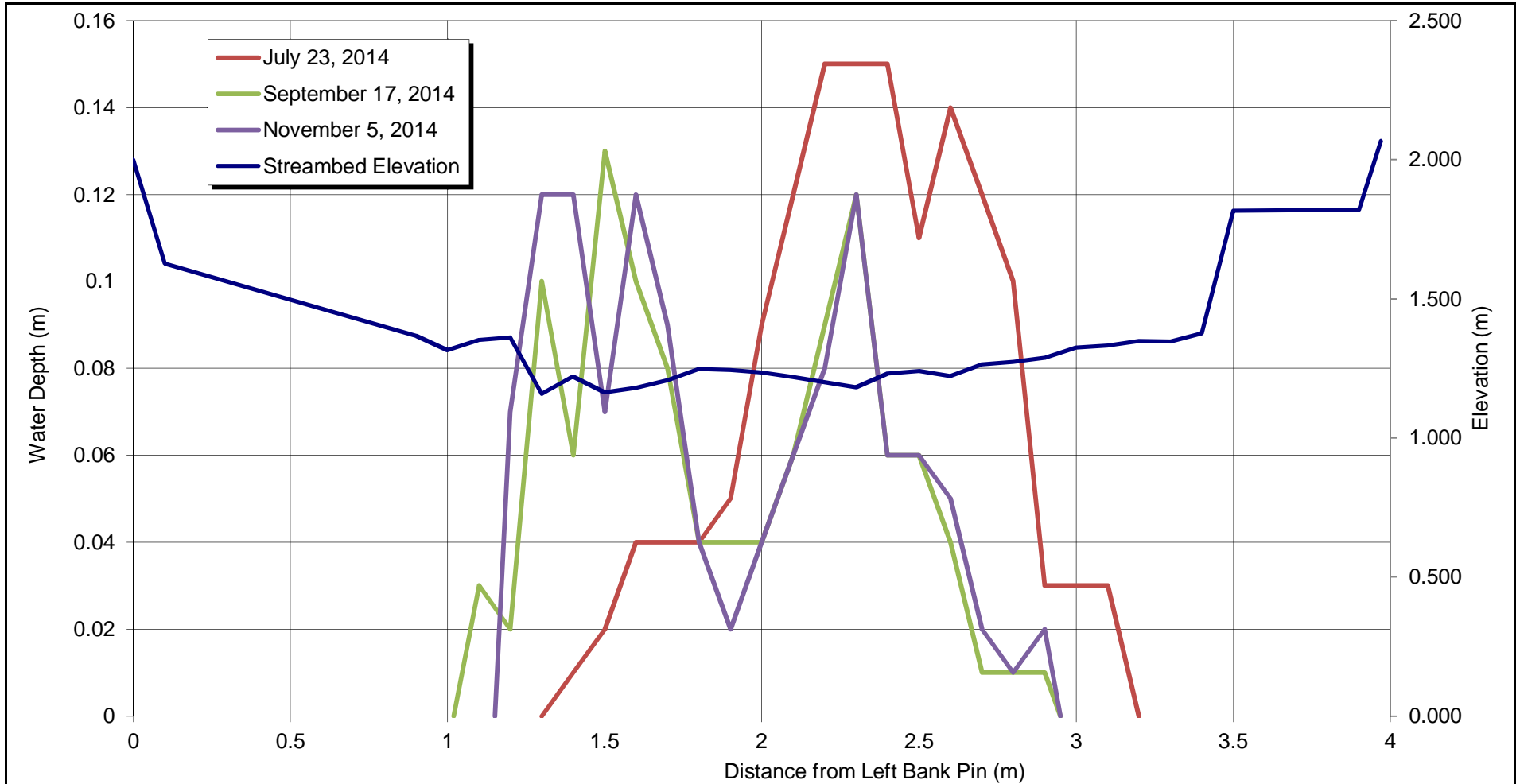


NOTES:

1. ELEVATION RELATIVE TO RIGHT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0m

KGHM AJAX MINING INC		
AJAX PROJECT		
TRANSECT CROSS SECTIONAL SURVEY PC2-01		
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE B1-1	
REV 0		

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

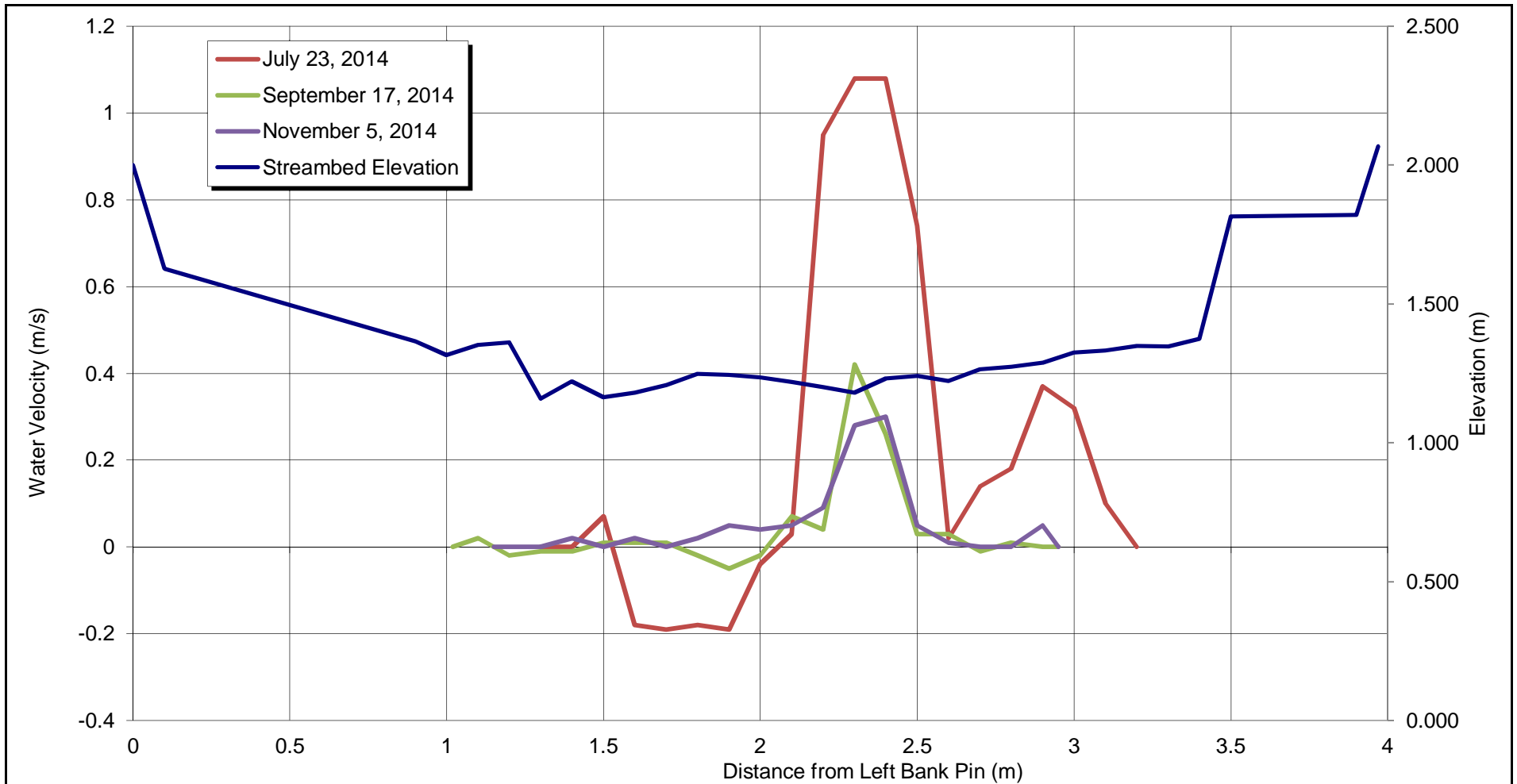


NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC		
AJAX PROJECT		
TRANSECT WATER DEPTH PC2-01		
Knight Piésold CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE B1-2	
		REV 0

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT VELOCITY PC2-01	
Knight Piésold CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE B1-3	
REV 0	

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB



PHOTO 1 – Upstream - July 22, 2014 (0.043 m³/s)



PHOTO 2 – Right to Left Bank - July 22, 2014 (0.043 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 3 – Downstream - July 22, 2014 (0.043 m³/s)



PHOTO 4 – Upstream - September 17, 2014 (0.004 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 5 – Left to Right Bank - September 17, 2014 (0.004 m³/s)



PHOTO 6 – Right to Left Bank - September 17, 2014 (0.004 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 7 – Downstream - September 17, 2014 (0.004 m³/s)



PHOTO 8 – Upstream - November 5, 2014 (0.003 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**



PHOTO 9 – Left to Right Bank - November 5, 2014 (0.003 m³/s)



PHOTO 10 – Right to Left Bank - November 5, 2014 (0.003 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 11 – Downstream - November 5, 2014 (0.003 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**

APPENDIX B2

MEASURED DATA AND PHOTOS AT PC2-02

(Pages B2-1 to B2-10)

TABLE B2-1

**KGHM AJAX MINING INC
AJAX PROJECT**

PC2-02 SITE VISIT SUMMARY

Print Jan/21/15 10:56:04

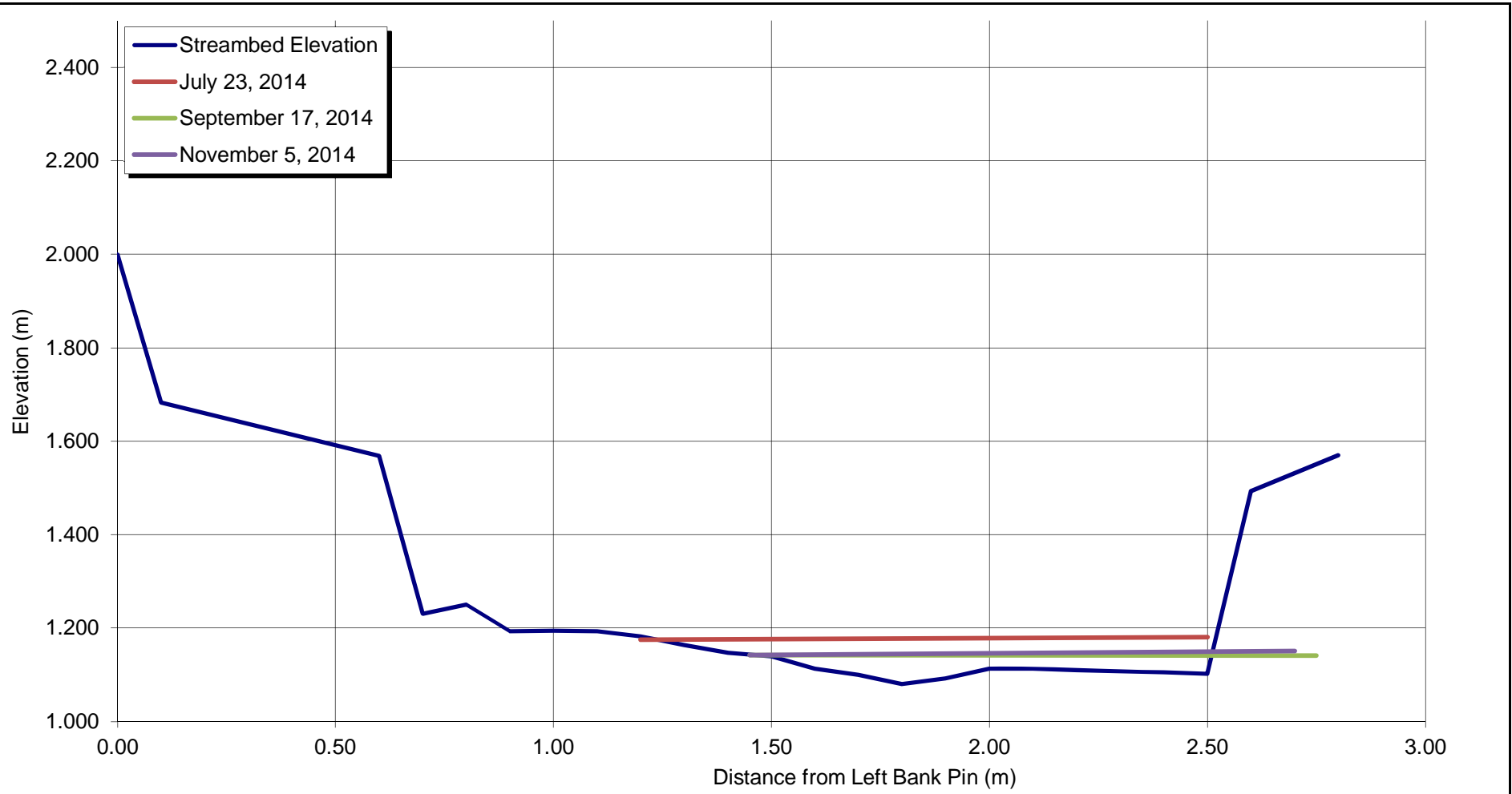
Date	Measured Discharge	Best Discharge Estimate		Left Water Level	Right Water Level	Best Estimate Water Level	Right Bank Pin	Left Bank Pin
	(m ³ /s)	(m ³ /s)	%MAD	(m)	(m)	(m)	(m)	(m)
23-Jul-14	0.041	0.043	47%	1.175	1.181	1.178	1.813	2.000
17-Sep-14	0.006	0.004	4%	1.142	1.141	1.142	1.713	2.000
5-Nov-14	0.005	0.003	3%	1.143	1.151	1.147	1.715	2.000

M:\1\01\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC2\PC2-02.xlsx]Summary Table

NOTES:

- BEST ESTIMATE DISCHARGE TAKEN FROM PC2-02 IN JULY AND FROM PC2-04 IN REMAINING MONTHS
- RIGHT BANK PIN HAS MOVED DOWN SINCE JULY. THIS OCCURRED DURING THE SEPTEMBER 2014 SITE VISIT.

0	21JAN15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

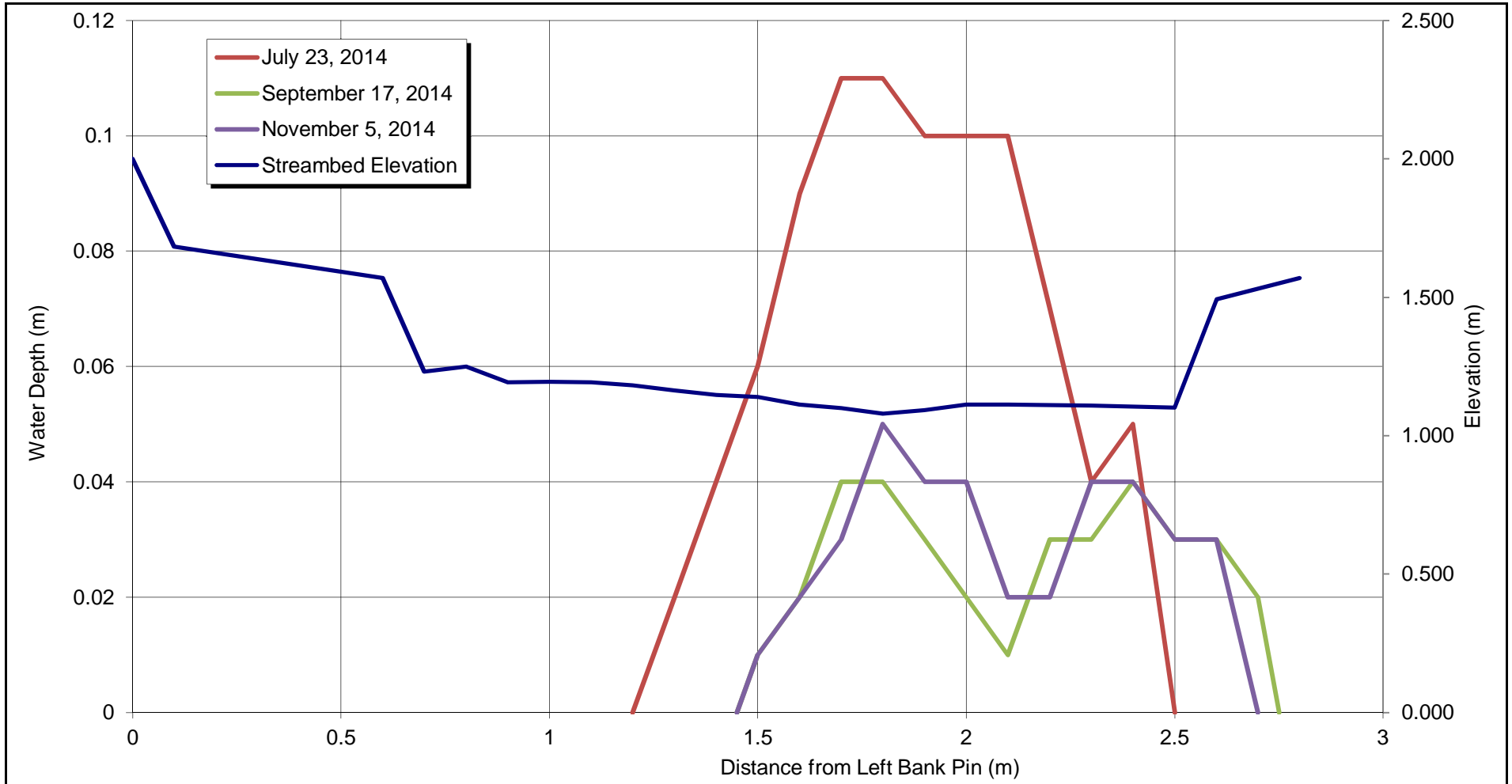


NOTES:

1. ELEVATION RELATIVE TO RIGHT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0m

KGHM AJAX MINING INC		
AJAX PROJECT		
TRANSECT CROSS SECTIONAL SURVEY PC2-02		
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE B2-1	
		REV 0

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

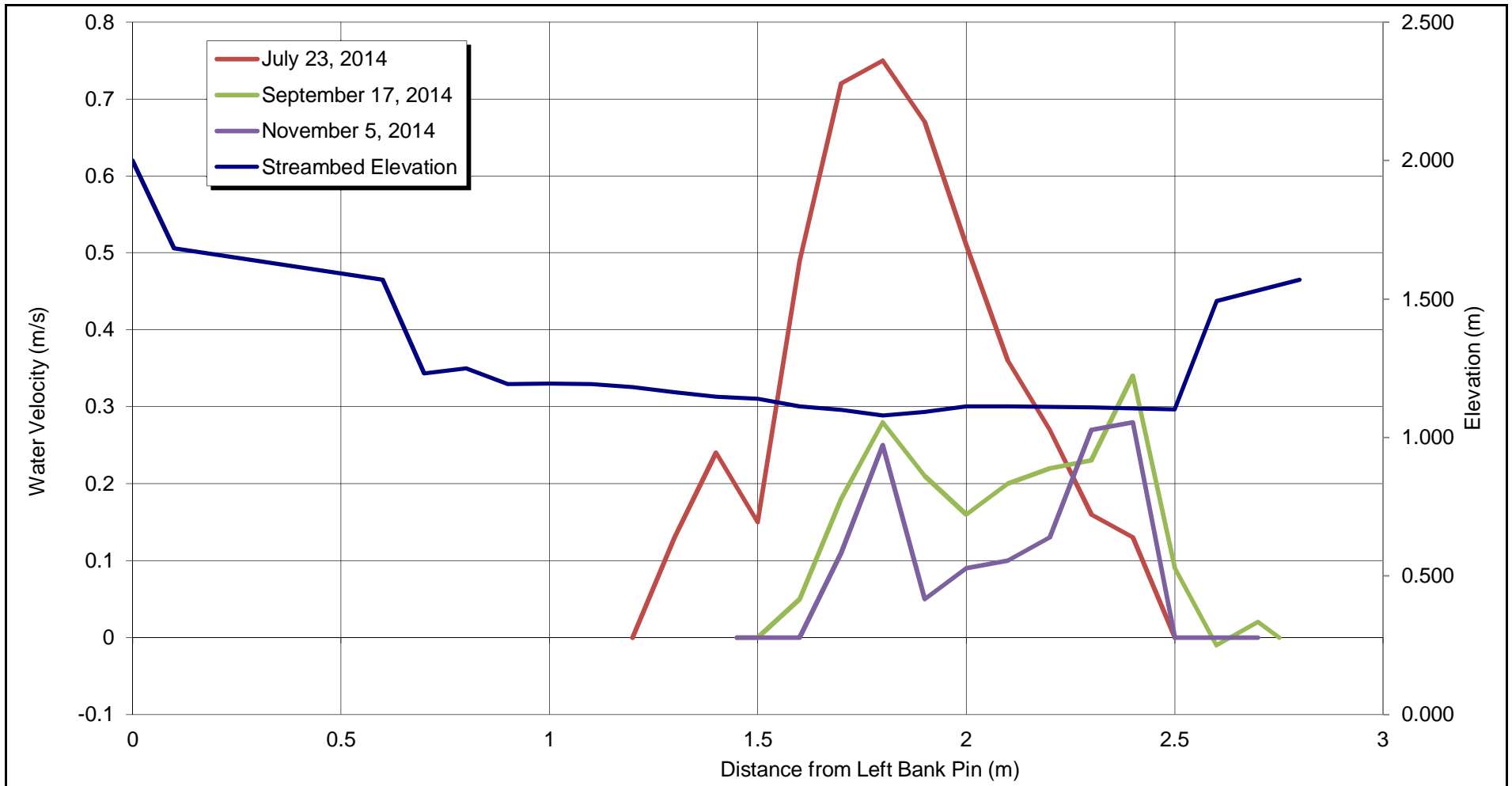


NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT WATER DEPTH PC2-02	
	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE B2-2	
	REV 0

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB



NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT VELOCITY PC2-02	
Knight Piésold CONSULTING	P/A NO. 101-00246/35 REF. NO. VA14-01575
FIGURE B2-3	
	REV 0

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



PHOTO 1 – Upstream - July 22, 2014 (0.043 m³/s)



PHOTO 2 – Left to Right Bank - July 22, 2014 (0.043 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 3 – Downstream - July 22, 2014 (0.043 m³/s)

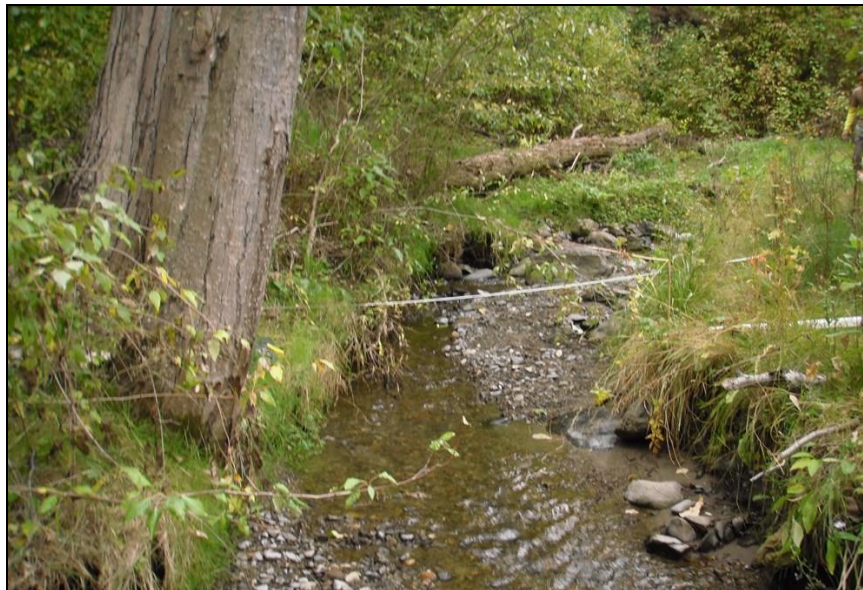


PHOTO 4 – Upstream - September 17, 2014 (0.004 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**



PHOTO 5 – Left to Right Bank September 17, 2014 (0.004 m³/s)



PHOTO 6 – Right to Left Bank September 17, 2014 (0.004 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 7 – Downstream September 17, 2014 (0.004 m³/s)



PHOTO 8 – Upstream - November 5, 2014 (0.003 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 9 – Left to Right Bank November 5, 2014 (0.003 m³/s)



PHOTO 10 – Right to Left Bank November 5, 2014 (0.003 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 11 – Downstream November 5, 2014 (0.003 m³/s)

KGHM AJAX MINING INC.
AJAX MINE

APPENDIX B3
MEASURED DATA AND PHOTOS AT PC2-03
(Pages B3-1 to B3-10)

TABLE B3-1

**KGHM AJAX MINING INC
AJAX PROJECT**

PC2-03 SITE VISIT SUMMARY

Print Jan/21/15 11:01:42

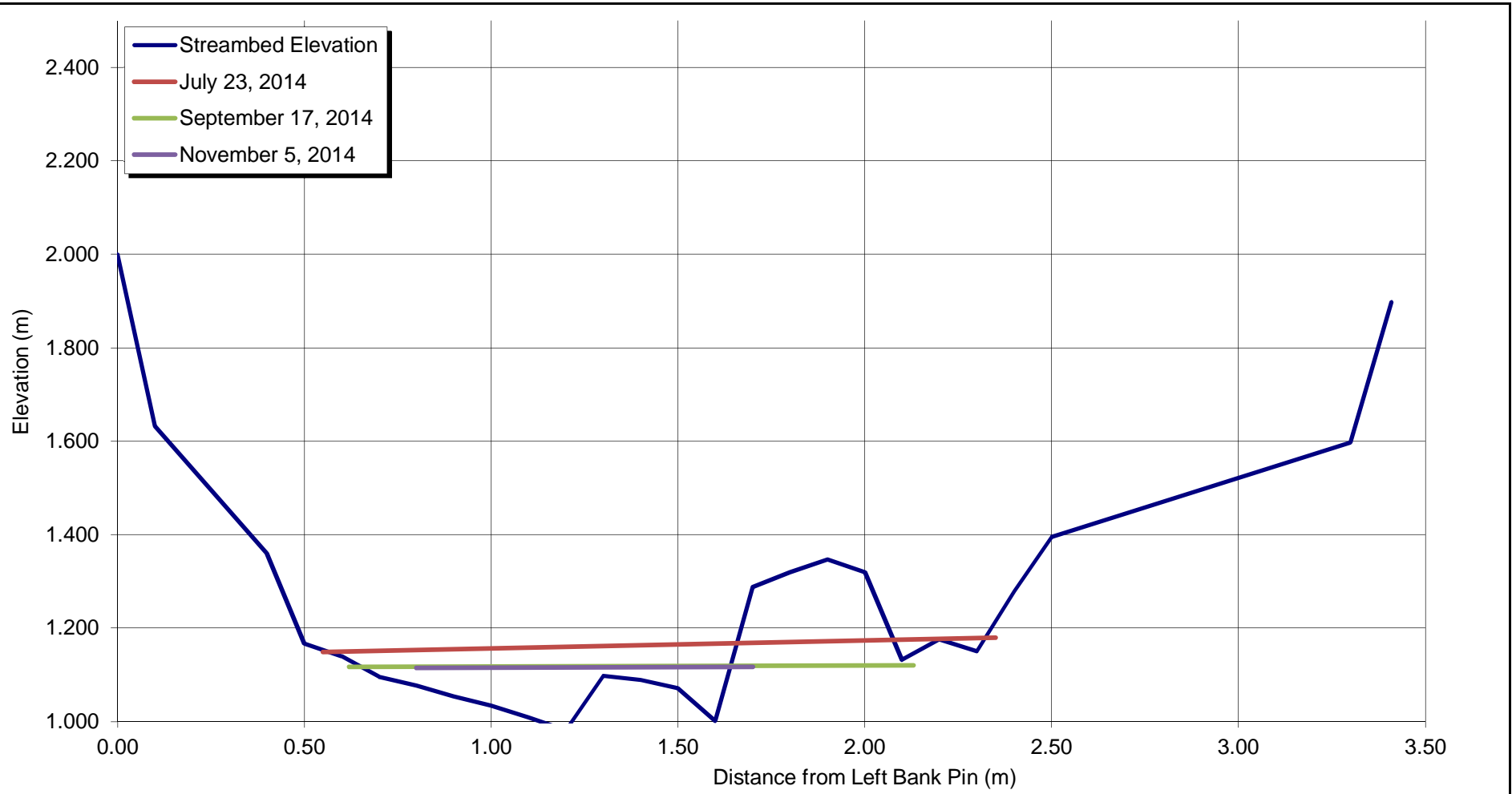
Date	Measured Discharge	Best Discharge Estimate		Left Water Level	Right Water Level	Best Estimate Water Level	Right Bank Pin	Left Bank Pin
	(m ³ /s)	(m ³ /s)	%MAD	(m)	(m)	(m)	(m)	(m)
23-Jul-14	0.033	0.043	47%	1.149	1.179	1.164	1.902	2.000
17-Sep-14	0.005	0.004	4%	1.117	1.120	1.119	1.895	2.000
5-Nov-14	0.004	0.003	3%	1.115	1.117	1.116	1.896	2.000

M:\1\01\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC2\PC2-03.xlsx\Summary Table

NOTES:

- BEST DISCHARGE ESIMTAE IS TAKEN FROM PC2-02 IN JULY AND PC2-04 FOR THE REMAINING MONTHS.

0	21JAN'15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

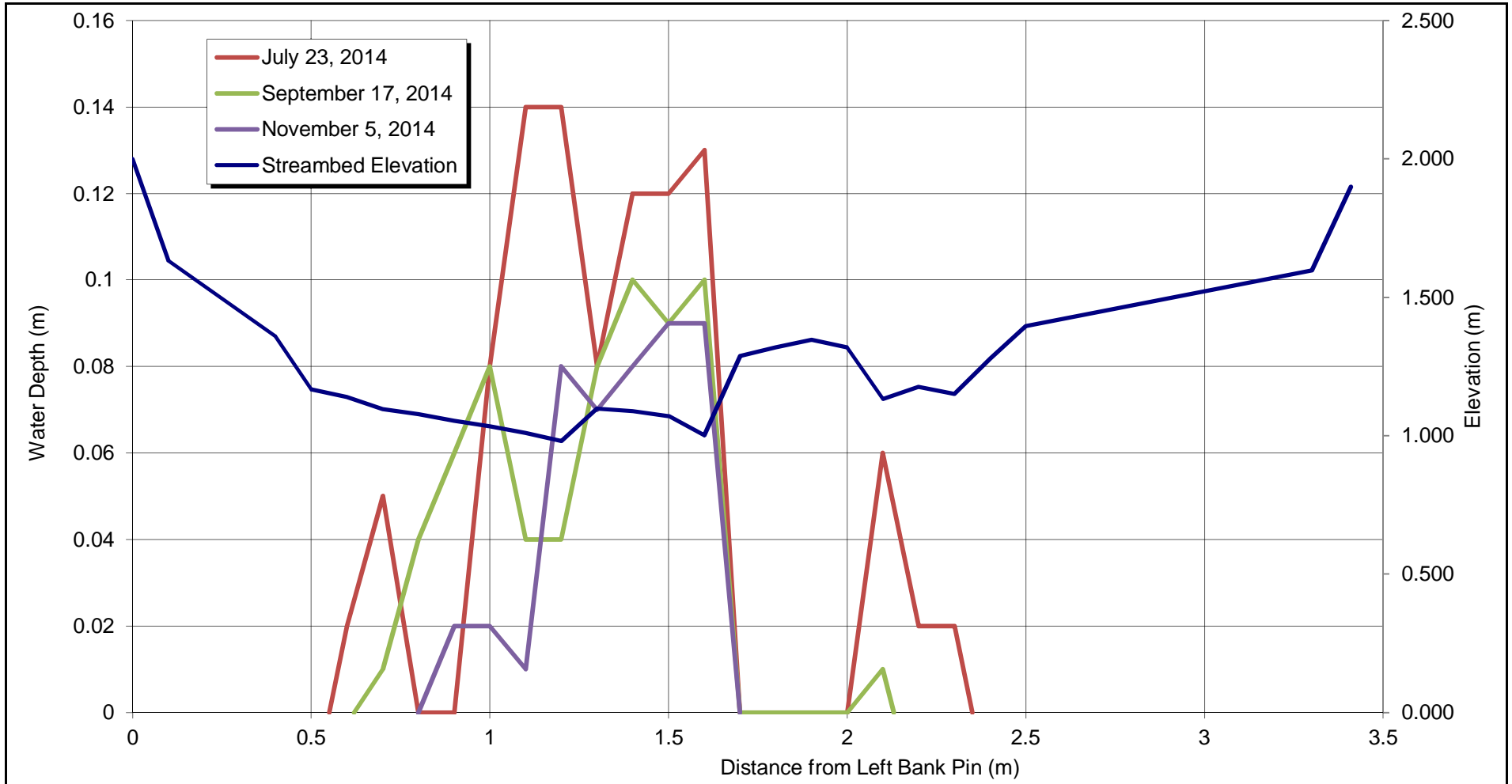


NOTES:

1. ELEVATION RELATIVE TO RIGHT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0m

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT CROSS SECTIONAL SURVEY PC2-03	
Knight Piésold CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE B3-1	
REV	0

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

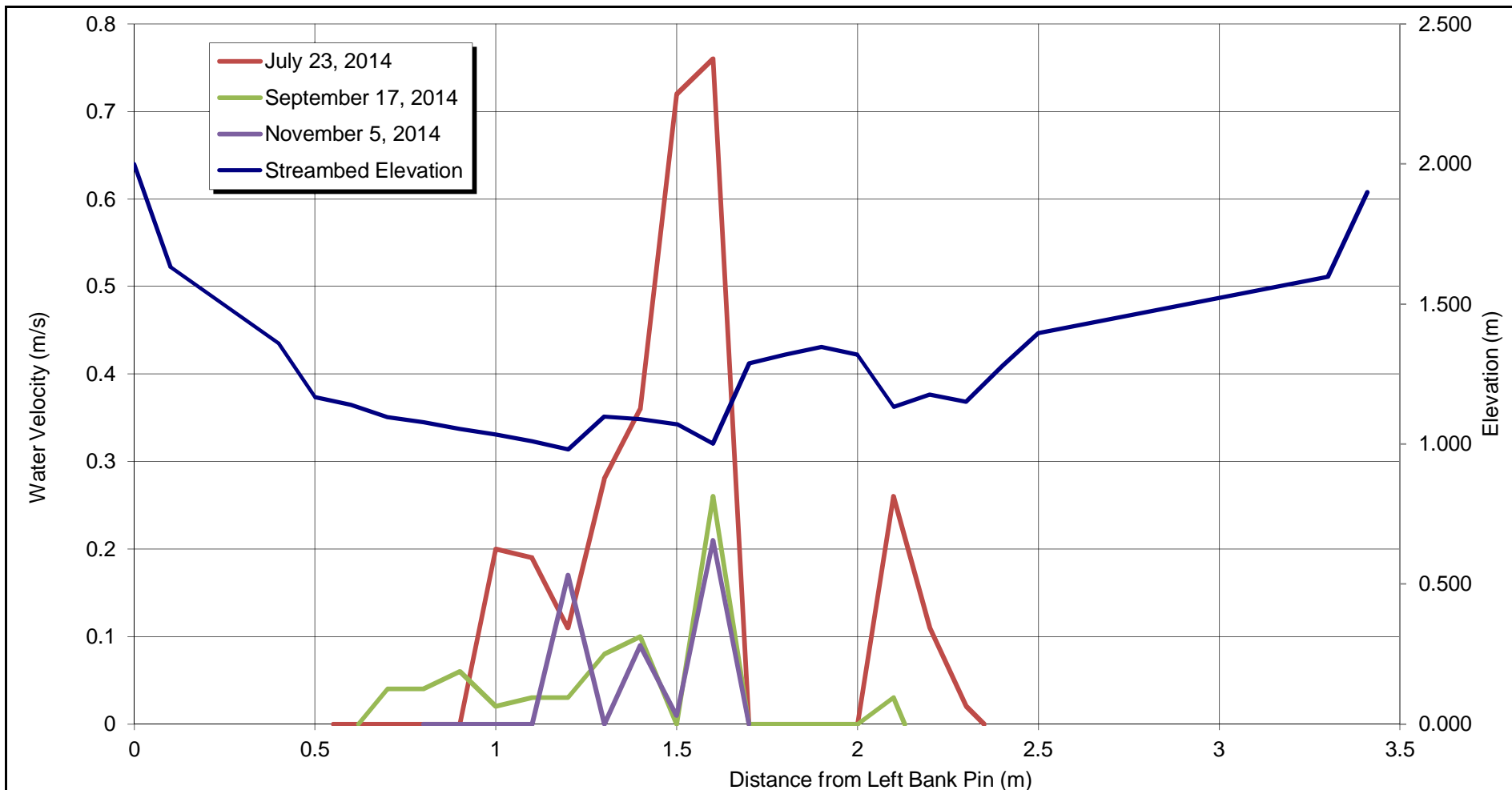


NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT WATER DEPTH PC2-03	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35 REF. NO. VA14-01575
FIGURE B3-2	
REV 0	

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	21JAN15	ISSUED WITH LETTER	BW	TJP	KJB



NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT VELOCITY PC2-03	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35 REF. NO. VA14-01575
FIGURE B3-3	
REV 0	

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



PHOTO 1 – Upstream - July 22, 2014 (0.043 m³/s)



PHOTO 2 – Left to Right Bank - July 22, 2014 (0.043 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**



PHOTO 3 – Downstream - July 22, 2014 (0.043 m³/s)



PHOTO 4 – Upstream - September 17, 2014 (0.004 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 5 – Left to Right Bank - September 17, 2014 (0.004 m³/s)



PHOTO 6 – Right to Left Bank - September 17, 2014 (0.004 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 7 – Downstream - September 17, 2014 (0.004 m³/s)



PHOTO 8 – Upstream - November 5, 2014 (0.003 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**



PHOTO 9 – Left to Right Bank - November 5, 2014 (0.003 m³/s)



PHOTO 10 – Right to Left Bank - November 5, 2014 (0.003 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 11 – Downstream - November 5, 2014 (0.003 m³/s)

KGHM AJAX MINING INC.
AJAX MINE

APPENDIX B4
MEASURED DATA AND PHOTOS AT PC2-04
(Pages B4-1 to B4-8)

TABLE B4-1

**KGHM AJAX MINING INC
AJAX PROJECT**

PC2-04 SITE VISIT SUMMARY

Print Jan/21/15 11:03:40

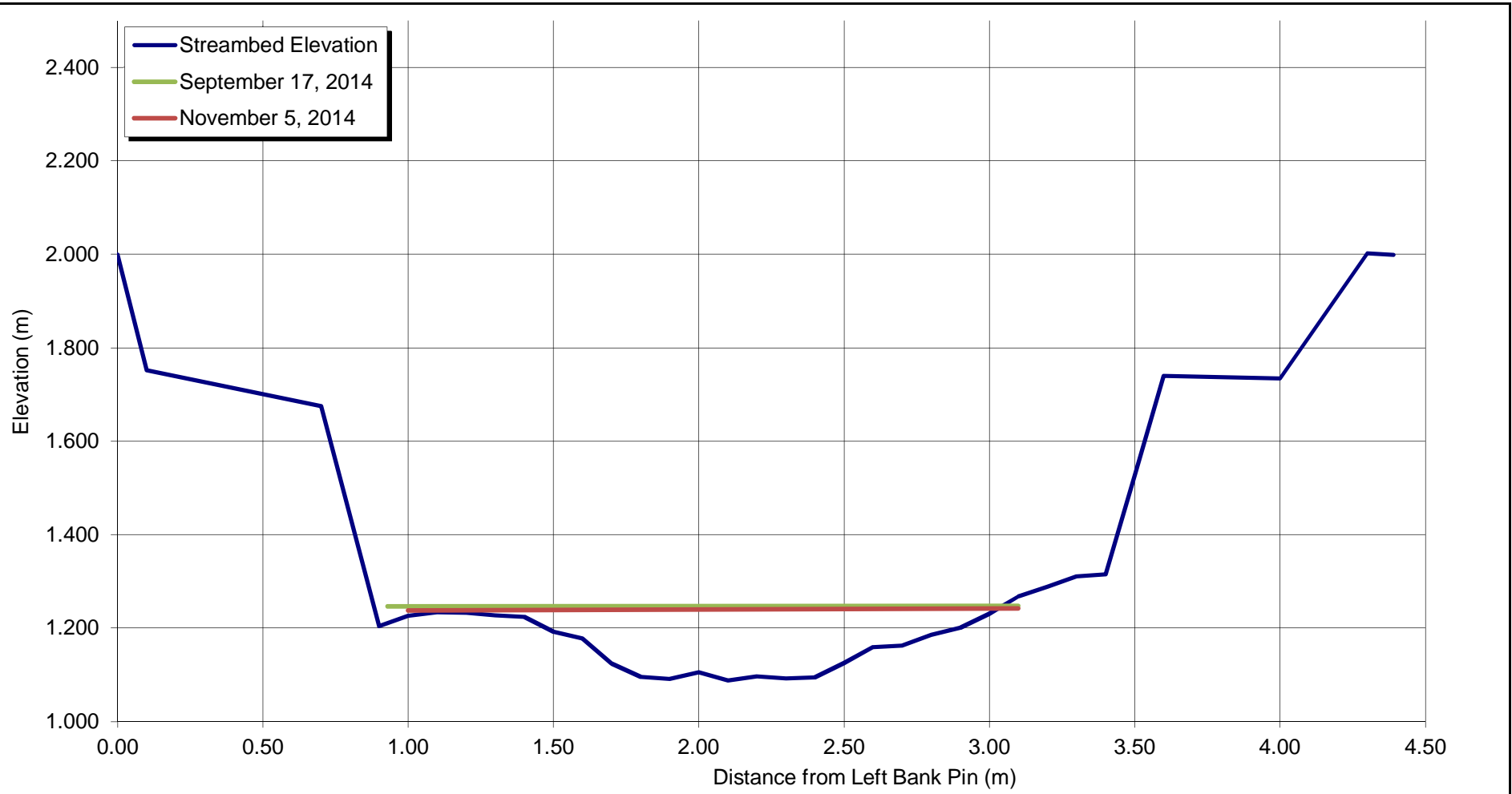
Date	Measured Discharge	Best Discharge Estimate		Left Water Level	Right Water Level	Best Estimate Water Level	Right Bank Pin	Left Bank Pin
	(m ³ /s)	(m ³ /s)	%MAD	(m)	(m)	(m)	(m)	(m)
17-Sep-14	0.005	0.004	4%	1.246	1.248	1.247	2.002	2.000
5-Nov-14	0.004	0.003	3%	1.238	1.242	1.240	2.003	2.000

M:\1\01\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC2\PC2-04.xlsx\Summary Table

NOTES:

- BEST DISCHARGE ESTIMATE TAKEN FROM THIS TRANSECT.

0	21JAN15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

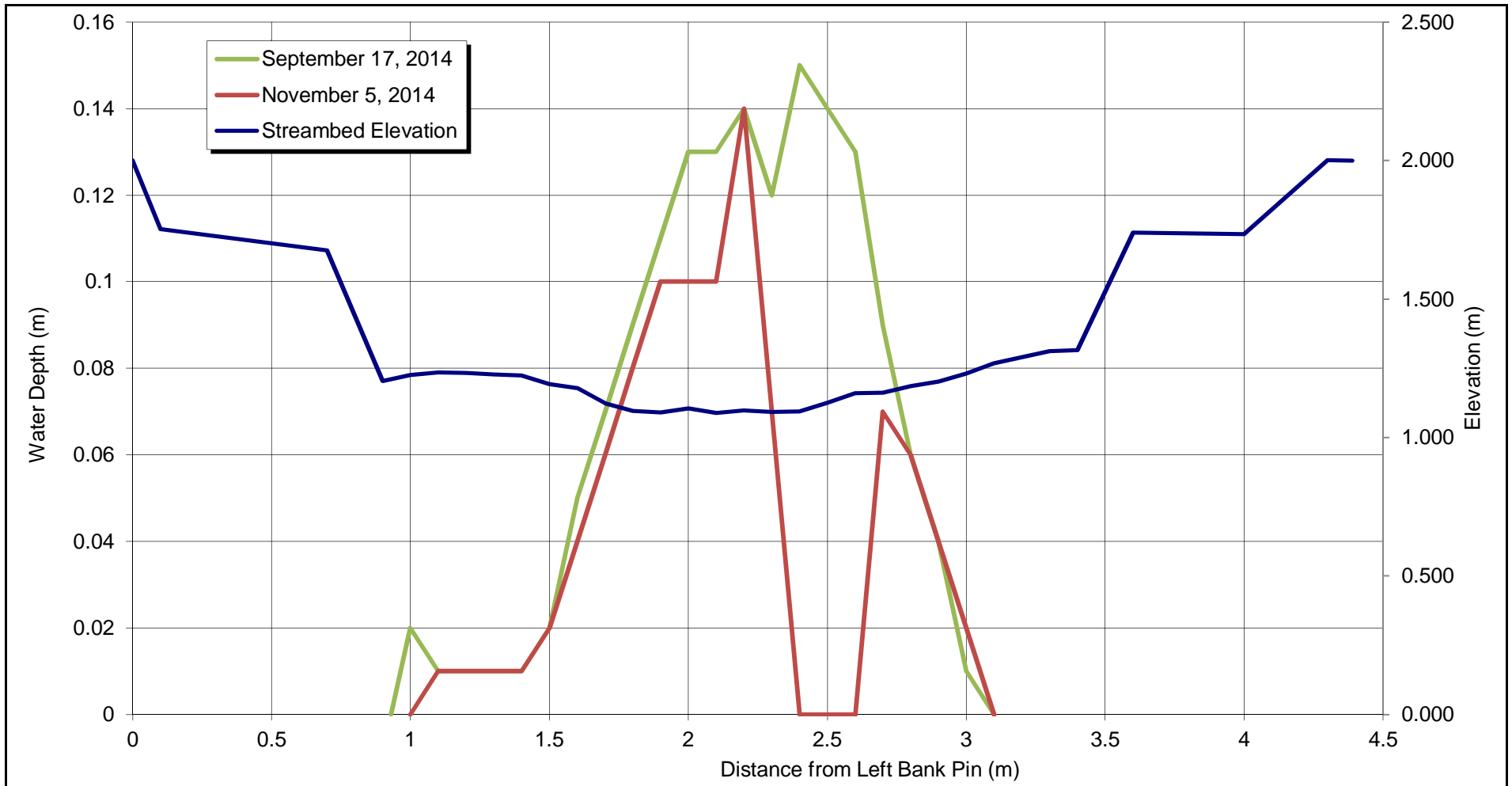


NOTES:

1. ELEVATION RELATIVE TO RIGHT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0m

KGHM AJAX MINING INC		
AJAX PROJECT		
TRANSECT CROSS SECTIONAL SURVEY PC2-04		
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE B4-1	
		REV 0

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB

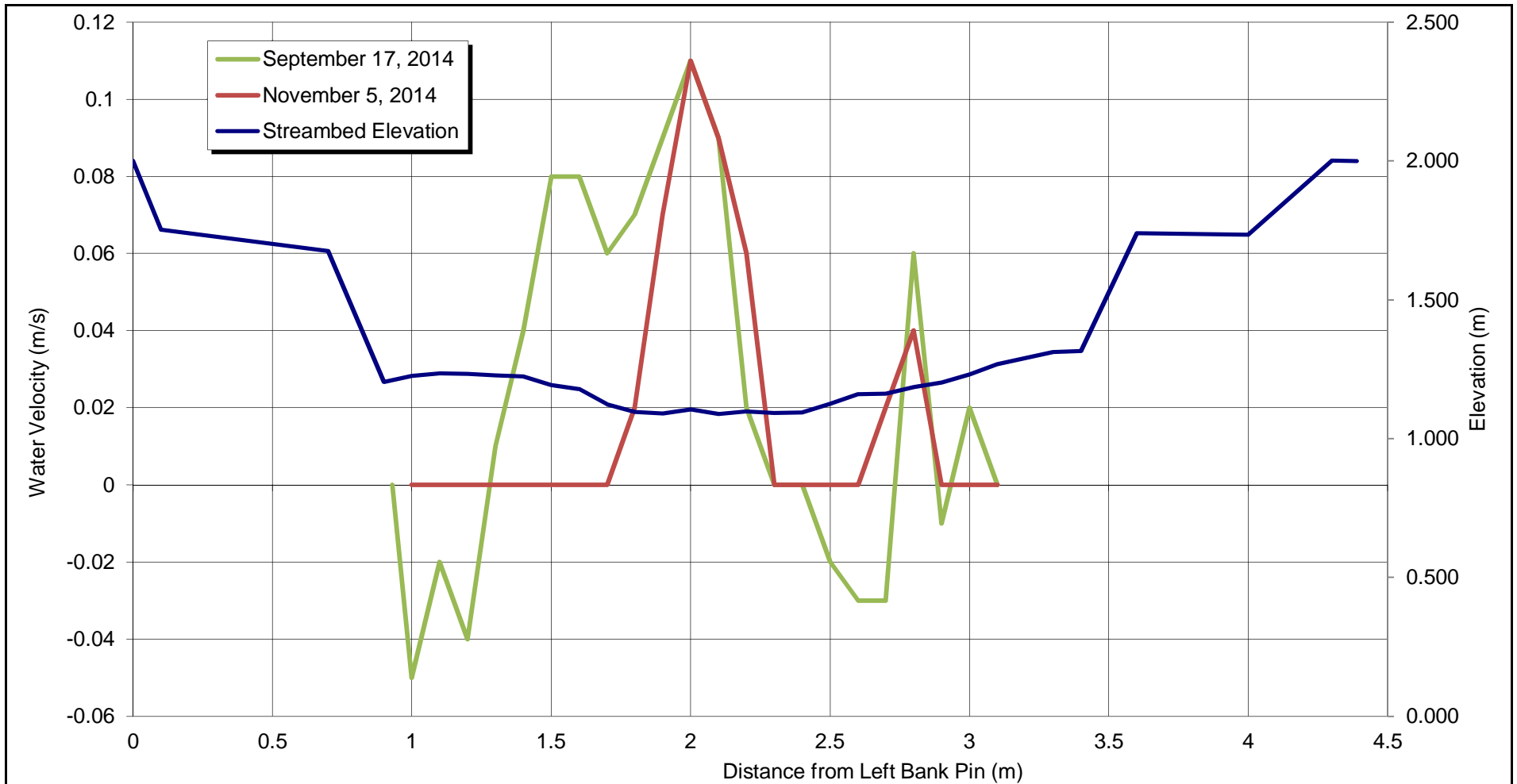


NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT WATER DEPTH PC2-04	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE B4-2	
REV 0	

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC		
AJAX PROJECT		
TRANSECT VELOCITY PC2-04		
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE B4-3	
		REV 0

0	21JAN15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



PHOTO 1 – Upstream - September 17, 2014 (0.004 m³/s)



PHOTO 2 – Left to Right Bank - September 17, 2014 (0.004 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 3 – Right to Left bank - September 17, 2014 (0.004 m³/s)



PHOTO 4 – Downstream - September 17, 2014 (0.004 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 5 – Upstream – November 5, 2014 (0.003 m³/s)



PHOTO 6 – Left to Right Bank - November 5, 2014 (0.003 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 7 – Right to Left Bank - November 5, 2014 (0.003 m³/s)



PHOTO 8 – Downstream - November 5, 2014 (0.003 m³/s)

KGHM AJAX MINING INC.
AJAX MINE

APPENDIX B5
MEASURED DATA AND PHOTOS AT PC2-05
(Pages B5-1 to B5-8)

TABLE B5-1

**KGHM AJAX MINING INC
AJAX PROJECT**

PC2-05 SITE VISIT SUMMARY

Print Jan/21/15 11:06:43

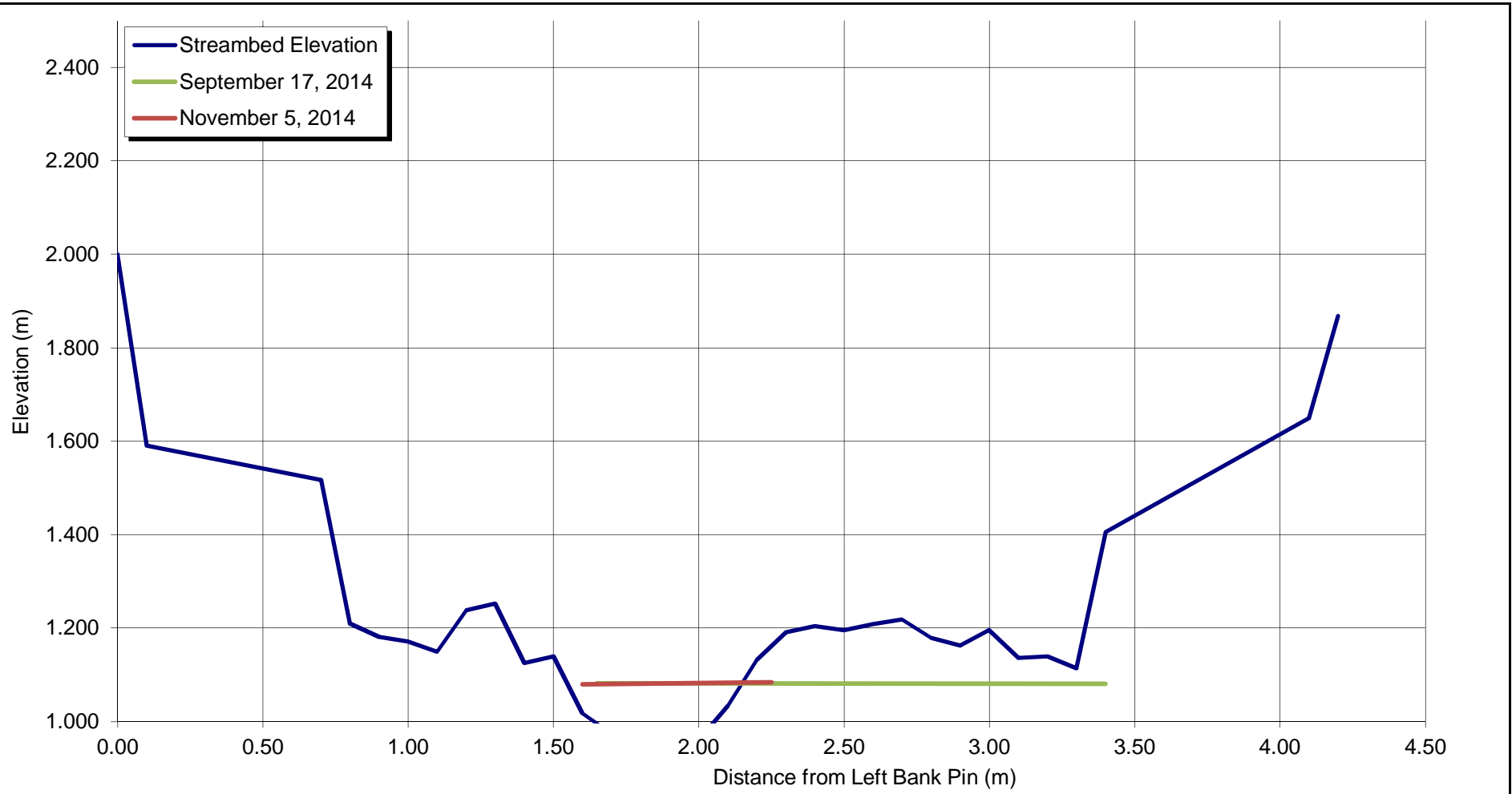
Date	Measured Discharge	Best Discharge Estimate		Left Water Level	Right Water Level	Best Estimate Water Level	Right Bank Pin	Left Bank Pin
	(m ³ /s)	(m ³ /s)	%MAD	(m)	(m)	(m)	(m)	(m)
17-Sep-14	0.008	0.004	4%	1.082	1.081	1.082	1.868	2.000
5-Nov-14	0.006	0.003	3%	1.080	1.084	1.082	1.866	2.000

M:\101\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC2\PC2-05.xlsx\Summary Table

NOTES:

- BEST DISCHARGE ESTIMATE TAKEN FROM TRANSECT PC2-04.

0	21JAN15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

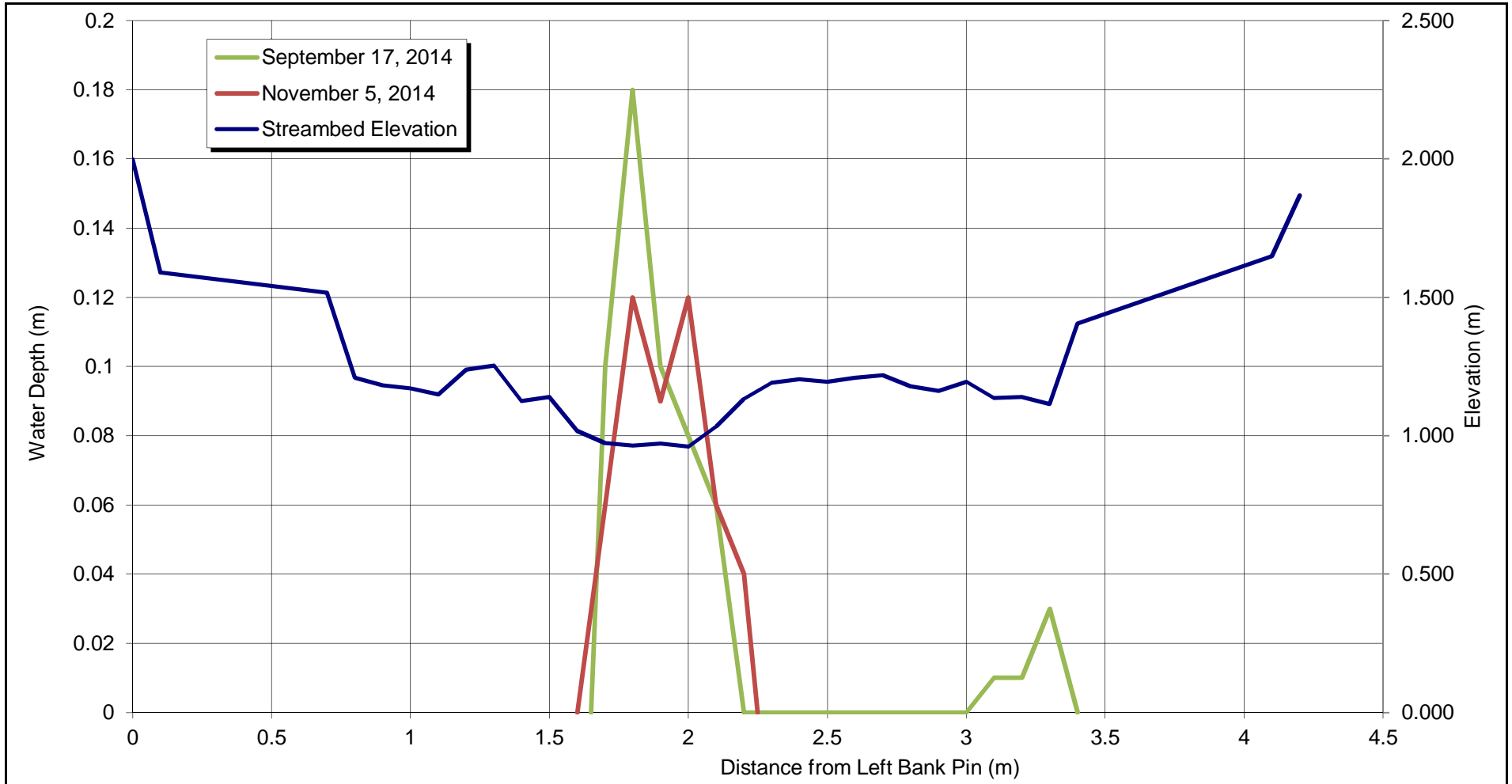


NOTES:

1. ELEVATION RELATIVE TO RIGHT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0m

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT CROSS SECTIONAL SURVEY PC2-05	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE B5-1	
	REV 0

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB

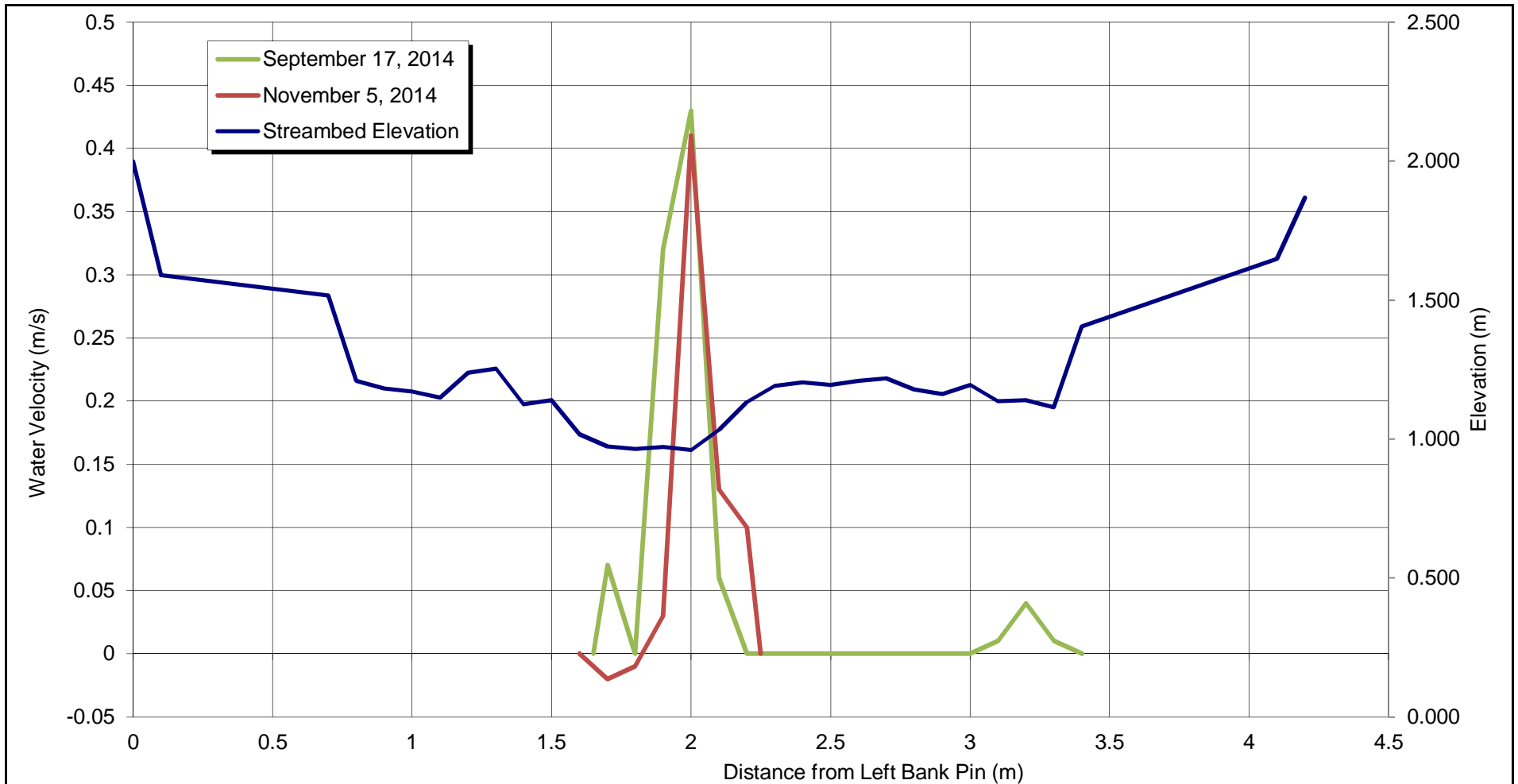


NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT WATER DEPTH PC2-05	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE B5-2	
REV 0	

REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	21JAN15	ISSUED WITH LETTER	BW	TJP	KJB



NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC		
AJAX PROJECT		
TRANSECT VELOCITY PC2-05		
Knight Piésold CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE B5-3	
		REV 0

0	21JAN15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



PHOTO 1 – Upstream - September 17, 2014 (0.004 m³/s)



PHOTO 2 – Left to Right Bank - September 17, 2014 (0.004 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 3 – Right to Left Bank - September 17, 2014 (0.004 m³/s)



PHOTO 4 – Downstream - September 17, 2014 (0.004 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 5 – Upstream - November 5, 2014 (0.003 m³/s)



PHOTO 6 – Left to Right Bank - November 5, 2014 (0.003 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 7 – Right to Left Bank - November 5, 2014 (0.003 m³/s)

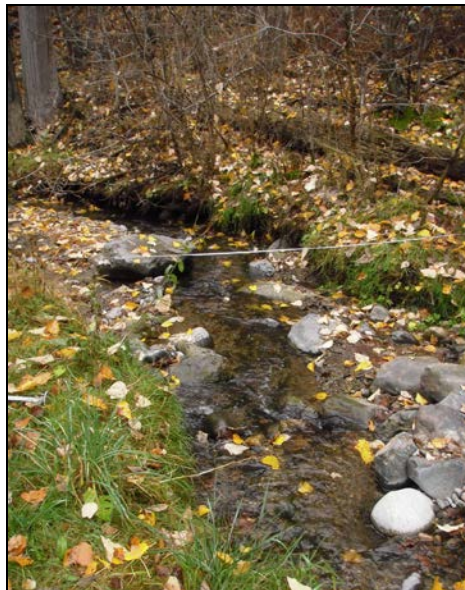


PHOTO 8 – Downstream - November 5, 2014 (0.003 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**

APPENDIX C

MEASURED DATA AND PHOTOS AT PC3

- Appendix B1 Measured data and photos at PC3-01
- Appendix B5 Measured data and photos at PC3-02

APPENDIX C1
MEASURED DATA AND PHOTOS AT PC3-01
(Pages C1-1 to C1-7)

TABLE C1-1

**KGHM AJAX MINING INC
AJAX PROJECT**

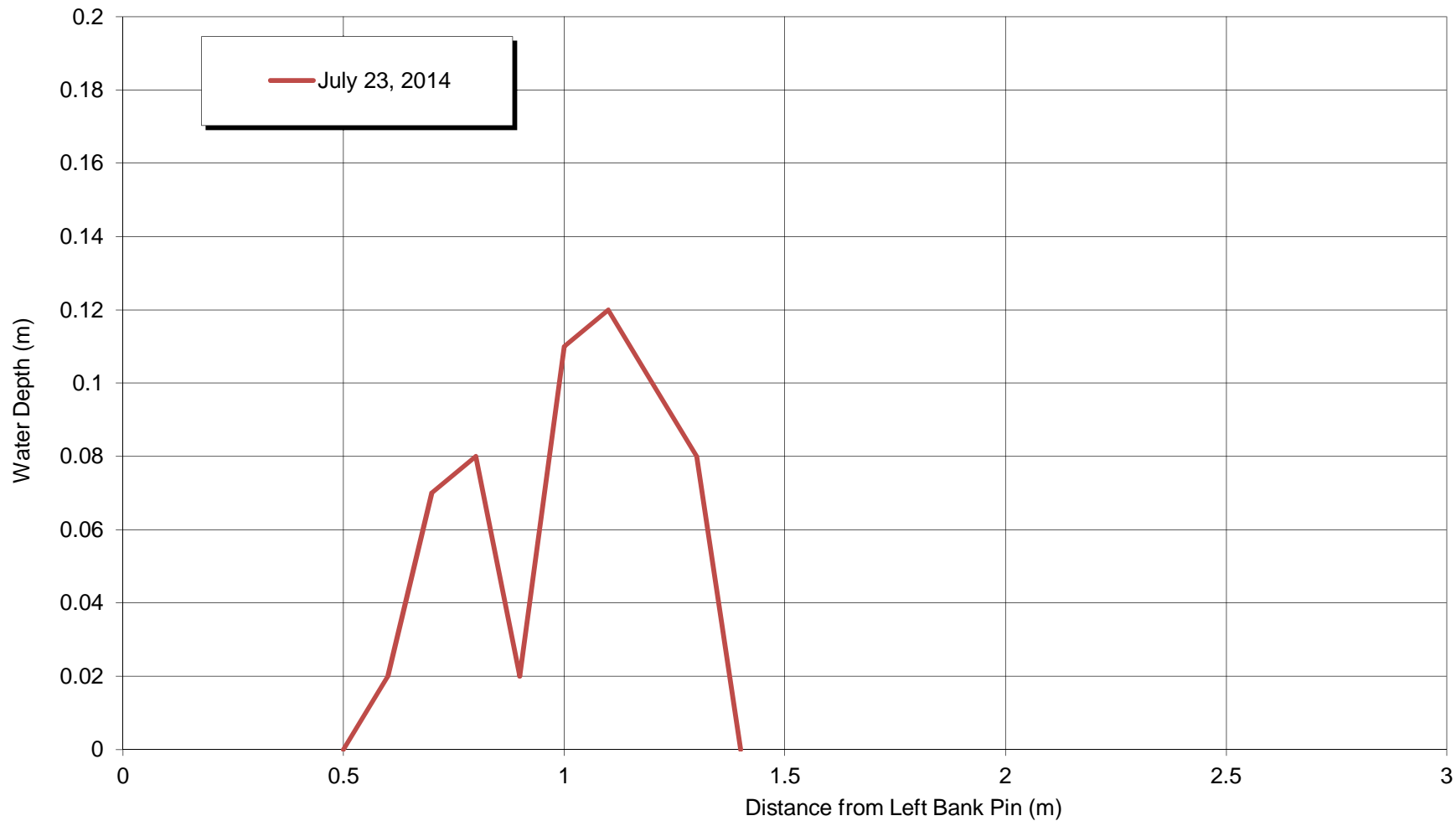
PC3-01 SITE VISIT SUMMARY

Print Jan/21/15 11:08:34

Date	Measured Discharge	Best Discharge Estimate	
	(m ³ /s)	(m ³ /s)	%MAD
23-Jul-14	0.002	0.004	18%
17-Sep-14	0.000	0.000	0%
5-Nov-14	0.000	0.000	0%

M:\1\01\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC3\PC3-01.xlsx]Site Summary

0	21JAN'15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

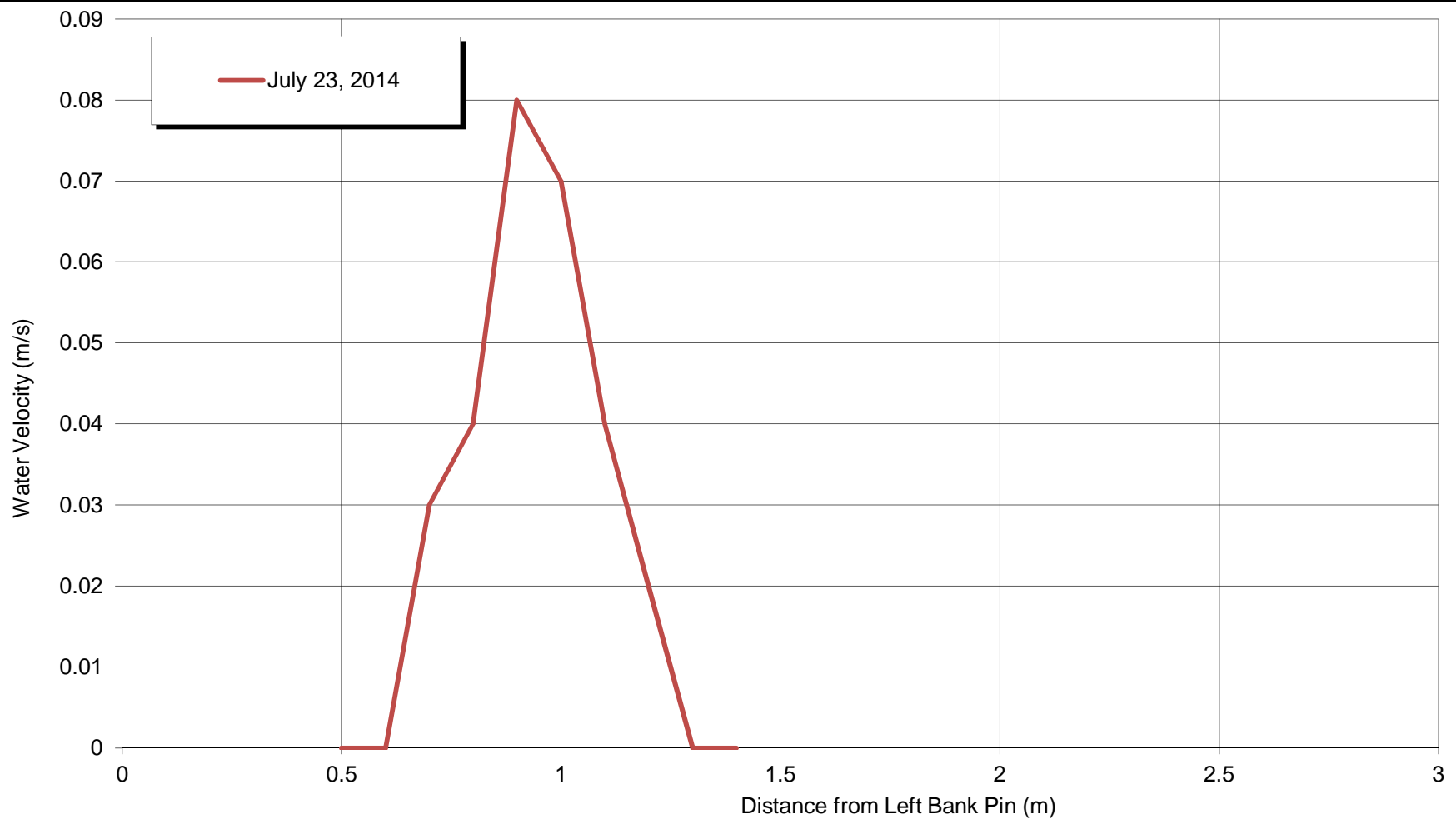


NOTES:

- 1. NO CROSS SECTION SURVEY COMPLETED DURING JULY VISIT.
- 2. CHANNEL WAS DRY DURING SUBSEQUENT SITE VISITS

KGHM AJAX MINING INC		
AJAX PROJECT		
TRANSECT WATER DEPTH PC3-01		
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE C1-1	
		REV 0

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



NOTES:

- 1. NO CROSS SECTION SURVEY COMPLETED DURING JULY VISIT.
- 2. CHANNEL WAS DRY DURING SUBSEQUENT SITE VISITS.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT VELOCITY PC3-01	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35 REF. NO. VA14-01575
FIGURE C1-2	
	REV 0

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



PHOTO 1 – Upstream - July 22, 2014 (0.004 m³/s)



PHOTO 2 – Right to Left Bank - July 22, 2014 (0.004 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**



PHOTO 3 – Downstream - July 22, 2014 (0.004 m³/s)



PHOTO 4 – Upstream - September 16, 2014 (0.000 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**



PHOTO 5 – Right to Left Bank - September 16, 2014 (0.000 m³/s)



PHOTO 6 – Upstream - November 5, 2014, 2014 (0.000 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 7 – Right to Left Bank - November 5, 2014, 2014 (0.000 m³/s)



PHOTO 8 – Downstream - November 5, 2014, 2014 (0.000 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**

APPENDIX C2

MEASURED DATA AND PHOTOS AT PC3-02

(Pages C2-1 to C2-6)

TABLE C2-1

**KGHM AJAX MINING INC
AJAX PROJECT**

PC3-02 SITE VISIT SUMMARY

Print Jan/21/15 11:10:52

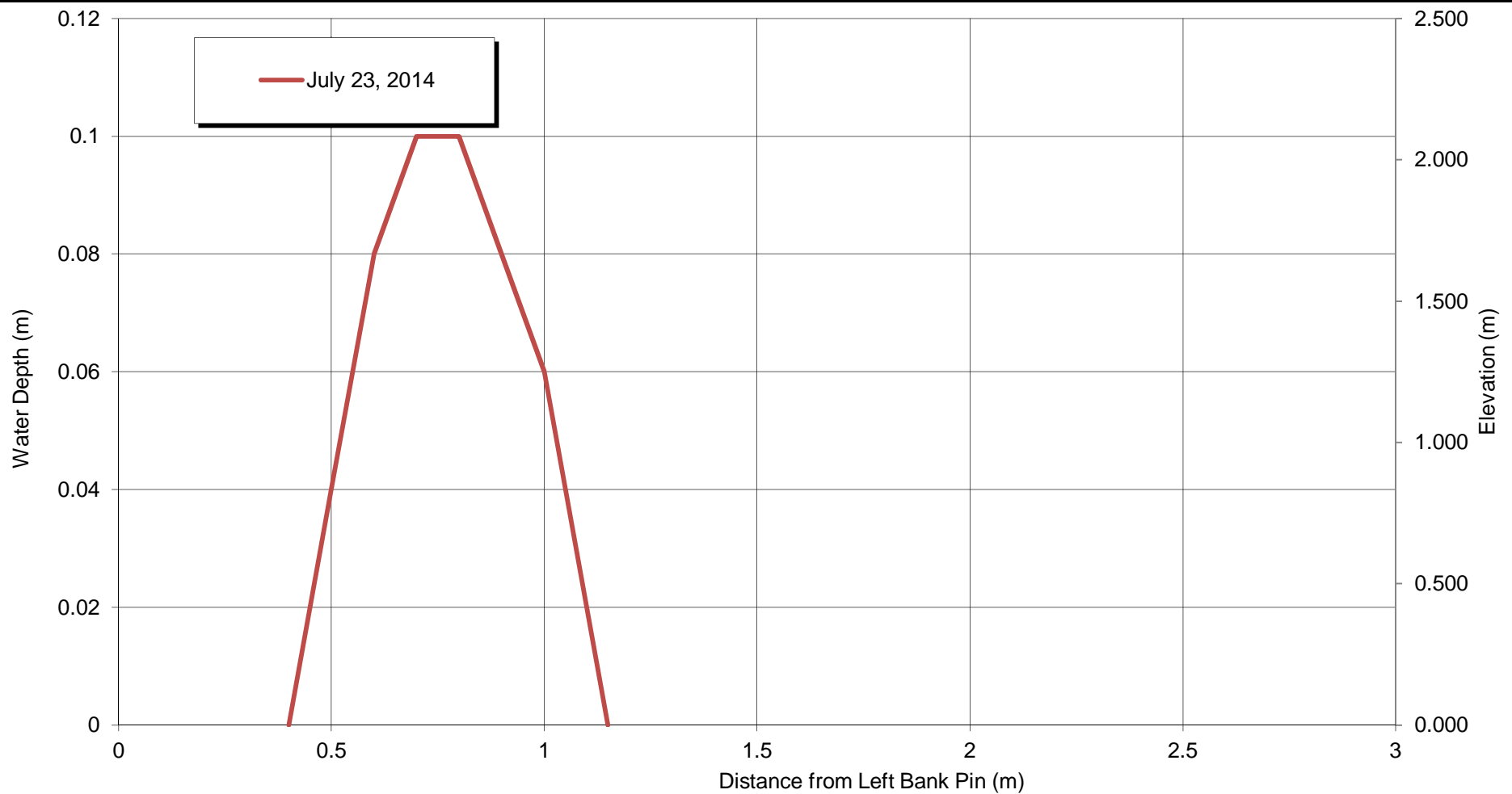
Date	Measured Discharge	Best Discharge Estimate	
	(m ³ /s)	(m ³ /s)	%MAD
23-Jul-14	0.005	0.003	15%
17-Sep-14	0.000	0.000	0%
5-Nov-14	0.000	0.000	0%

M:\1\01\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC3\PC3-02.xlsx]Summary Table

NOTES:

1. DATA FOR JULY ARE ONLY AVAILABLE, AS SUBSEQUENT SITE VISITS REVEALED NO FLOW
2. NO SURVEY COMPLETED IN JULY, 2014

0	21JAN'15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

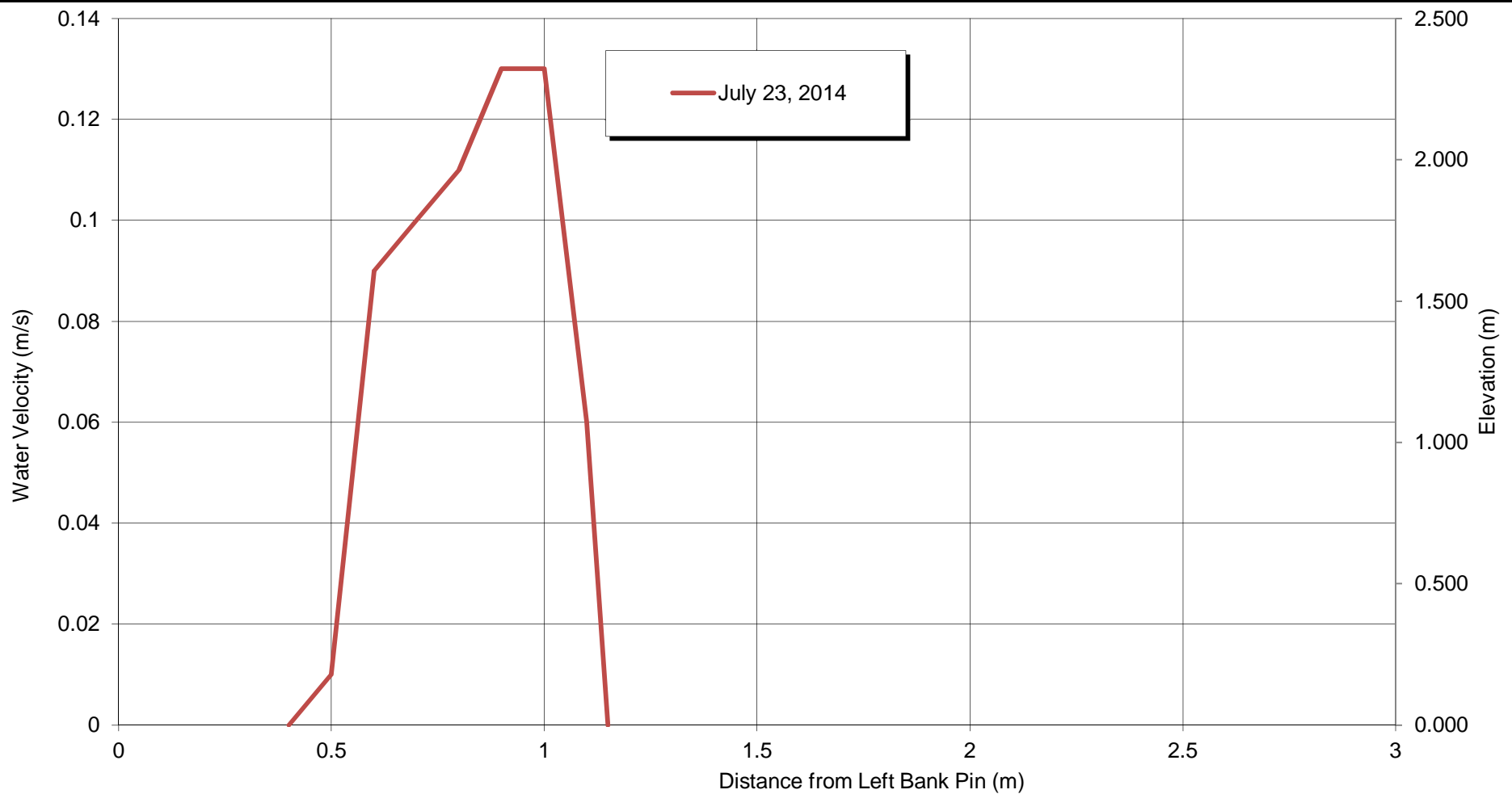


NOTES:

1. NO SURVEYS COMPLETED IN JULY VISIT.
2. SUBSEQUENT VISITS SHOWED NOW WATER.

KGHM AJAX MINING INC		
AJAX PROJECT		
TRANSECT WATER DEPTH PC3-02		
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35	REF. NO. VA14-01575
	FIGURE C2-1	
		REV 0

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



NOTES:

1. NO SURVEYS COMPLETED IN JULY VISIT.
2. SUBSEQUENT VISITS SHOWED NOW WATER.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT VELOCITY PC3-02	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35 REF. NO. VA14-01575
FIGURE C2-2	
REV 0	

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



PHOTO 1 – Right to Left Bank - July 22, 2014 (0.004 m³/s)



PHOTO 2 – Downstream - July 22, 2014 (0.004 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 3 – Upstream - September 16, 2014 (0.000 m³/s)



PHOTO 4 – Left to Right Bank - September 16, 2014 (0.000 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 5 – Right to Left Bank - September 16, 2014 (0.000 m³/s)



PHOTO 6 – Downstream - September 16, 2014 (0.000 m³/s)

KGHM AJAX MINING INC.
AJAX MINE

APPENDIX D
MEASURED DATA AND PHOTOS AT PC4
(Pages D-1 to D-9)

TABLE D1-1

**KGHM AJAX MINING INC
AJAX PROJECT**

PC4-01 SITE VISIT SUMMARY

Print Jan/21/15 11:25:50

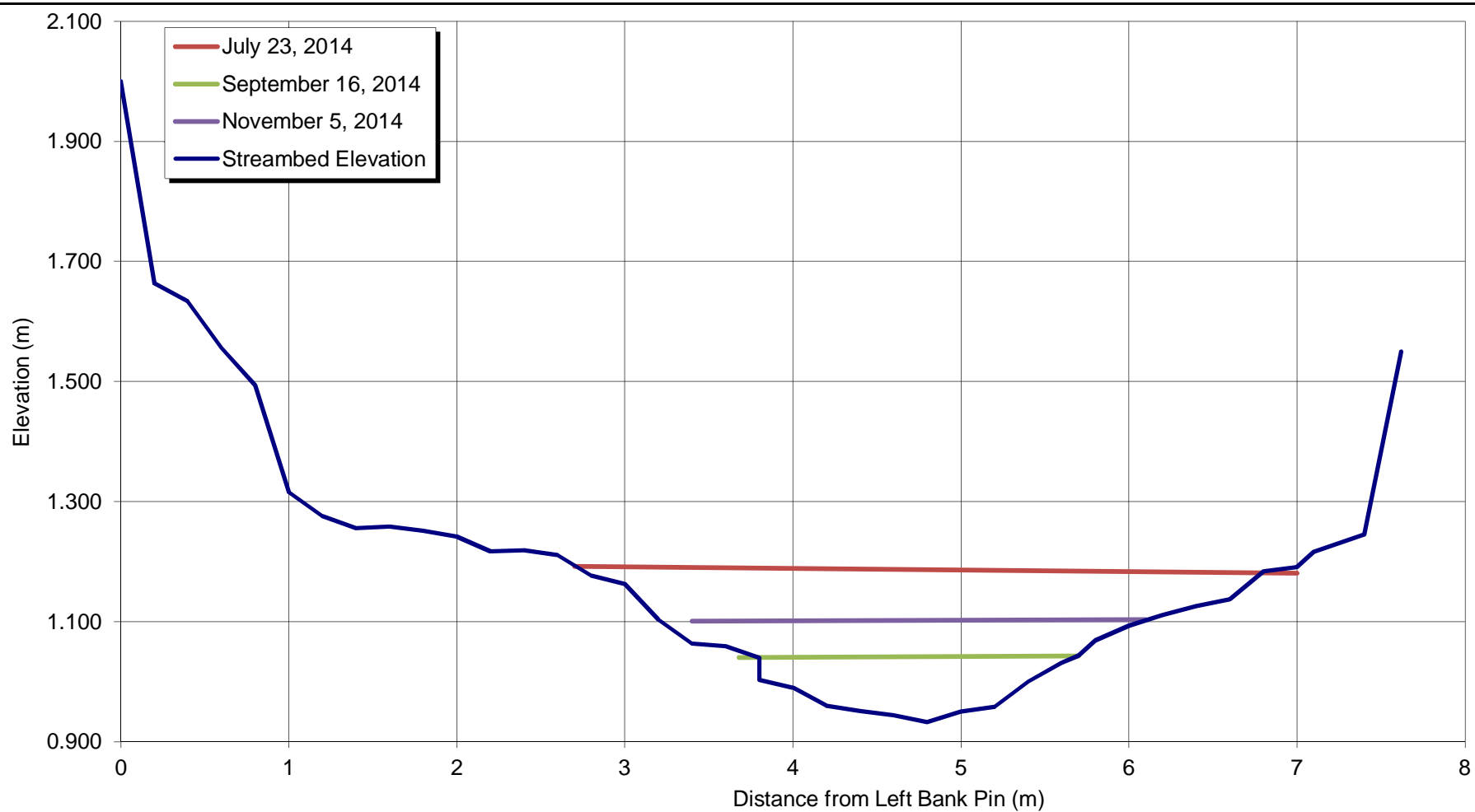
Date	Measured Discharge	Best Discharge Estimate		Left Water Level	Right Water Level	Best Estimate Water Level	Right Bank Pin	Left Bank Pin
	(m ³ /s)	(m ³ /s)	%MAD	(m)	(m)	(m)	(m)	(m)
23-Jul-14	0.068	0.067	149%	1.192	1.181	1.187	1.549	2.000
16-Sep-14	0.000	0.000	0%	1.040	1.043	1.042	1.550	2.000
5-Oct-14	0.002	0.002	3%	1.101	1.104	1.102	1.549	2.000

M:\1\01\00246\35\A\Data\Instream Flow Assessment\Site Summary\PC4\PC4-01.xlsx)Summary Table

NOTES:

1. NO FLOW PRESENT DURING SEPTEMBER 2014 VISIT. SURVEY COMPLETED THOUGH AS WATER WAS PRESENT AT THE TRANSECT.

0	21JAN'15	ISSUED WITH LETTER VA14-01575	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

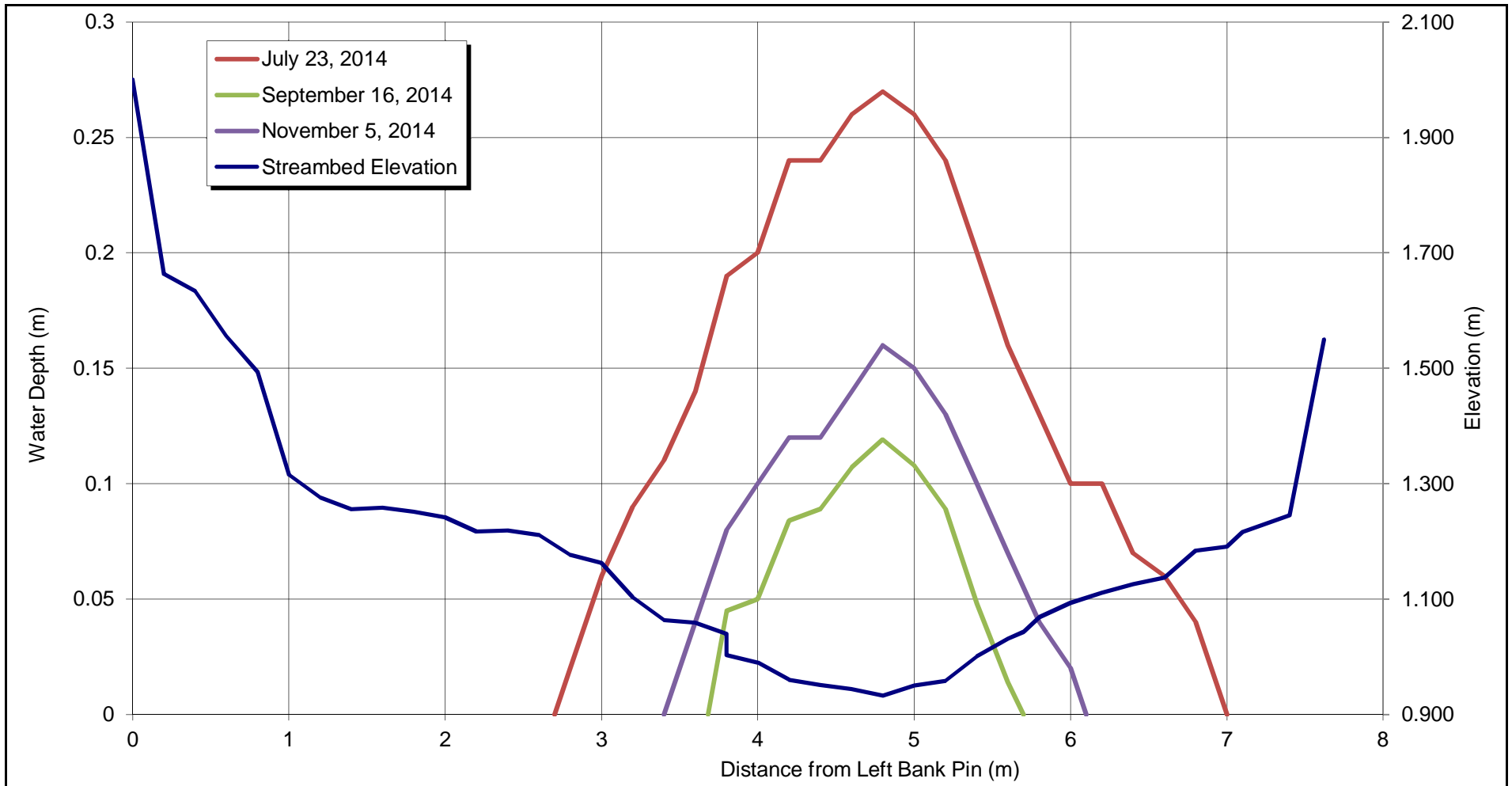


NOTES:

1. ELEVATION RELATIVE TO RIGHT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0m

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT CROSS SECTIONAL SURVEY PC4-01	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE D1-1	
	REV 0

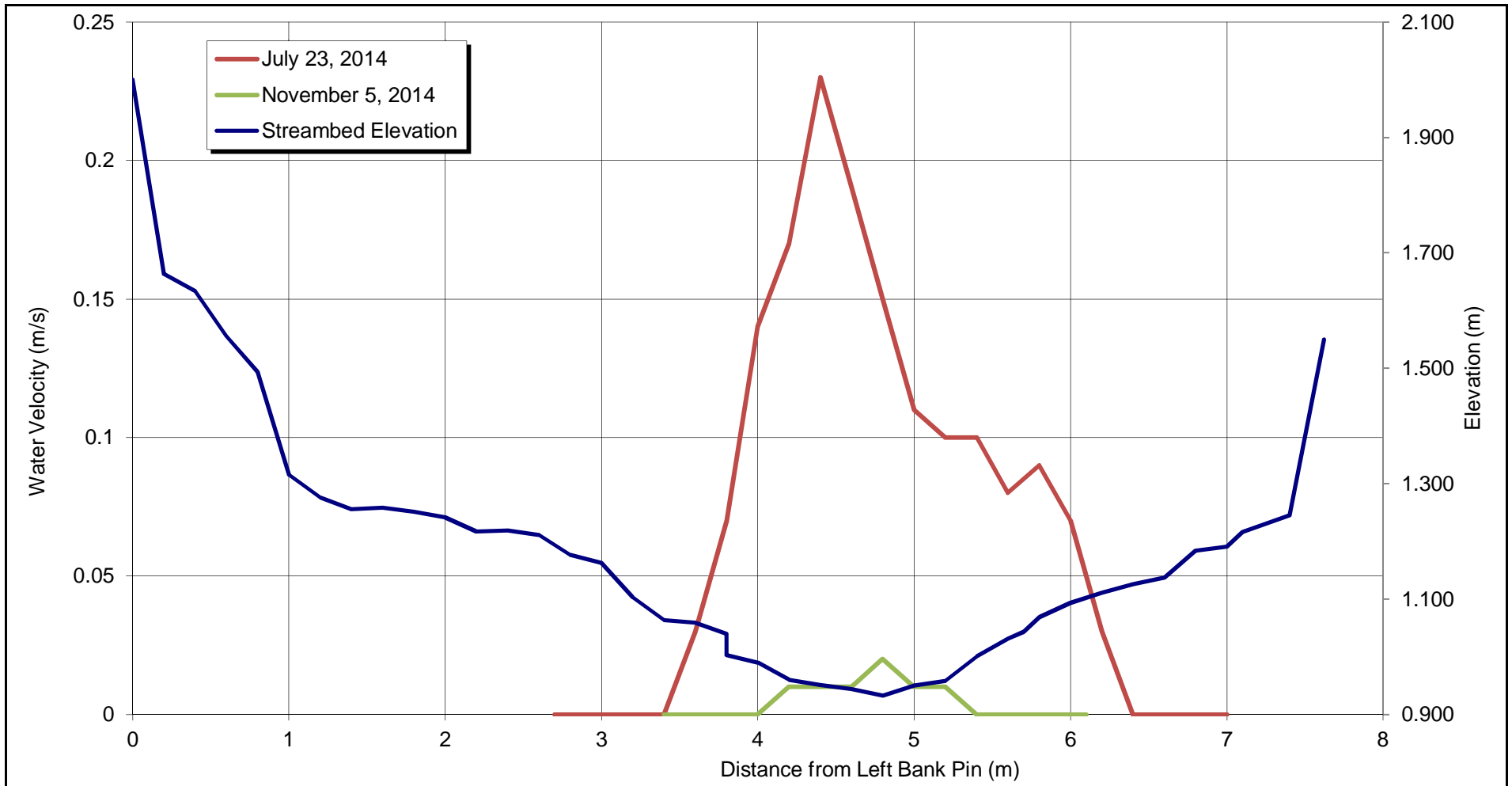
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D
0	21JAN15	ISSUED WITH LETTER	BW	TJP	KJB



NOTES:
 1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT WATER DEPTH PC4-01	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35 REF. NO. VA14-01575
FIGURE D1-2	
REV 0	

0	21JAN'15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



NOTES:

1. ELEVATION RELATIVE TO LEFT BANK PIN WHICH HAS BEEN ASSUMED TO BE 2.0 m.

KGHM AJAX MINING INC	
AJAX PROJECT	
TRANSECT VELOCITY PC4-01	
<i>Knight Piésold</i> CONSULTING	P/A NO. 101-00246/35
	REF. NO. VA14-01575
FIGURE D1-3	
REV 0	

0	21JAN15	ISSUED WITH LETTER	BW	TJP	KJB
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



PHOTO 1 – Left to Right Bank - July 23, 2014 (0.067 m³/s)



PHOTO 2 – Right to Left Bank - July 23, 2014 (0.067 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 3 – Downstream - July 23, 2014 (0.067 m³/s)



PHOTO 4 – Upstream - September 16, 2014 (0.000 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 5 – Left to Right Bank - September 16, 2014 (0.000 m³/s)



PHOTO 6 – Right to Left Bank - September 16, 2014 (0.000 m³/s)

KGHM AJAX MINING INC.
AJAX MINE



PHOTO 7 – Downstream - September 16, 2014 (0.000 m³/s)



PHOTO 8 – Upstream - November 5, 2014 (0.000 m³/s)

**KGHM AJAX MINING INC.
AJAX MINE**



PHOTO 9 – Left to Right Bank - November 5, 2014 (0.000 m³/s)



PHOTO 10 – Right to Left Bank - November 5, 2014 (0.000 m³/s)

KGHM AJAX MINING INC.
AJAX MINE