APPENDIX V2

BIRD IN HAND PROCESSING REVIEW LETTER 2017

ANGAS PROCESSING FACILITY

MISCELLANEOUS PURPOSES LICENSE APPLICATION 2019/0826

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Bird-in-Hand Processing

A description of metallurgical test work and proposed processing if Bird-in-Hand ore through the existing Angas Concentrator follows.

Please do not hesitate to contact us if you have any queries.

Kind Regards

P.D. Munro

Director and Principal – Mineralurgy Pty Ltd

(2015-014)

Bird-in-Hand Ore Processing

1. MINERALOGY

1.1 Drill Core

Optical mineragraphy was performed by Dr Gary McArthur of McArthur Ore Deposit Assessments Pty Ltd (MODA) on four thin sections (McArthur 2016 Oct) taken from diamond drill holes into the Bird-in-Hand deposit.:

- Oxide: drill hole BH054 193.3-193.7m (Quartz with goethite)
- Sulphide: drill hole BH057 206.1-207.2m (Goethite-pyrite)
- Oxide: drill hole BH057 210.0-211.1m (Quartz with pyrite veins)
- Sulphide: drill hole BH057 212.5-213.1m (Massive pyrite-galena)

The following notes (from the MODA report) describe the mineralogical character of the sulphides and gold observed.

- Sulphide Occurrences
    - Pyrite is coarse-grained, but is variably oxidised to goethite. Occluded blebs of sphalerite and galena are common.
    - Galena is generally coarse-grained, interstitial to pyrite and is variably oxidised to an unidentified product, especially in sample BH057 210.0-211.1m. Also commonly occurs as irregular blebs in pyrite. Late deposition of ultrafine, secondary galena in open space was seen in sample BH054 193.3-193.7m.
    - Sphalerite occurs either as irregular aggregates with galena and pyrite, or as blebs in pyrite.
    - Chalcopyrite mainly occurs in sample BH057 212.5-213.1m infilling fine braided cracks in pyrite, partially oxidised to bornite and covellite, clearly paragenetically later than pyrite, galena and sphalerite.
- Gold Occurrences
    - Electrum is readily found in all samples apart from sample BH057 212.5-2131lm.
    - Sample BH054 193.3-193.7m
        - Approximately 100 occurrences of electrum are found as irregular blebs hosted by goethite and less commonly quartz. Grain sizes are 0.5-50um, mostly <20um.
    - Sample BH057 206.1-207.2m
        - Approximately 20 occurrences of electrum are found as irregular blebs hosted by goethite and less commonly pyrite. Grain sizes are 0.5-75um.
    - Sample BH057 210.0-211.1m
        - Approximately 120 occurrences of electrum are found as irregular blebs hosted by quartz, pyrite and chalcopyrite, and rarely in

sphalerite. Association with pyrite is strong. Grain sizes are 0.5-150um.

McArthur's observations on the mineralogy of the Bird-in-Hand deposit are in accordance with earlier work done by Griessmann (2011).

1.2 Mineralogical Assessment of Gold Gravity Concentrates

Knelson concentrates (see Section 2 below) were further upgraded by gravity means to increase the gold content for mineralogical assessment. Samples were mounted and submitted for optical and electron microprobe assessment. The descriptive and microprobe assessments are in a MODA report (McArthur 2016 Nov). Results indicate:

- Sulphide Composite gold grains have a mean size of 72um.
- Oxide Composite gold grains have a mean size of 37um
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- Sulphide Composite gold grains contain 29% Ag.
- Oxide Composite gold grains contain 15% Ag.

2. METALLURGICAL TEST WORK

2.1 Implications for Processing from Mineralogical Examination

Gold in the Bird-in-Hand deposit occurs as electrum with the grains hosted mainly in goethite, quartz and pyrite but rarely in sphalerite.

While gravity concentration using centrifugal separators of the Knelson or Falcon type may have some potential applicability, flotation was chosen as the main method of gold recovery over cyanidation. This was because of perceived difficulties in getting community acceptance and likely permitting delays to use the industry standard method of gold extraction by cyanidation. However, flotation is widely used in the gold mining industry (Dunne 2005; Marsden and House 2006). Free gold is naturally floatable in most industrial systems at neutral or near-neutral pH; increasing silver content of electrum particles is reported to improve their recovery. Using flotation conditions aimed at recovering all sulphide minerals can be expected to increase overall gold recovery.

A list of past, current and proposed future operations using flotation to recover gold is shown the Appendix.

2.2 Results of Metallurgical Test Work

The limited metallurgical test programme at ALS Metallurgy - Burnie in late 2016 and early 2017 was aimed at a “proof of concept”, this reflected the limited amount of sample available.

In late 2016 ALS Metallurgy - Burnie generated two ore intersection composites from the drill hole interval samples received from Terramin Australia Limited. These were designated Oxide and Sulphide Composites for testing. Analyses are shown in Table 1. Mean gold head grades were 22.1 and 23.2 g/t Au for the Sulphide and Oxide Composites respectively. The Sulphide Composite contains elevated lead and iron values.

Table 1: Bird-in-Hand Oxide Composite and Sulphide Composite Assays

SAMPLE			Sulphide Comp	Oxide Comp
Au Average	Au	ppm	22.1	23.2
Ag-AA46	Ag	ppm	67	5
ME-XRF15d	Cu	%	0.17	0.01
ME-XRF15d	Pb	%	6.24	0.05
ME-XRF15d	Zn	%	0.26	0.06
ME-XRF15d	Al2O3	%	2.33	1.72
ME-XRF15d	Fe	%	9.06	3.71
ME-XRF15d	Bi	%	0.02	0.01
ME-XRF15d	SiO2	%	65.2	58.0

Gold recovery was assessed by diagnostic leaching, gravity concentration (Knelson Concentrator), (cyanidation) and flotation. A Bond Ball Work Index test was performed on each composite, flotation tailings were analysed for net acid production potential/net acid generation (NAPP/NAG) and an inductively coupled plasma (ICP) multi-element scan was done on a flotation concentrate made from the Sulphide Composite.

Bond Ball Mill Work Index values of 13.8 and 14.5 kWh/t were returned for the Sulphide and Oxide Composites respectively. These are moderate ore hardness numbers and, while higher than the 11.4 kWh/t for the Angas zinc-lead-silver ore, mean that the current likely throughput of 145 000 t/y of Bird-in-Hand ore could easily be treated through the comminution section of the Angas plant. The design capacity of the grinding section of the Angas plant was 50 t/h at a product sizing of 80% -106um whereas 145 000 t/y of Bird-in-Hand at 80% -75um to 150um is 18.125 t/h for 8000 h/y or 23.2 t/h for 6240 h/y i.e. 5 operating days per week.

Results of a diagnostic leach sequence on each Composite to determine gold residence are in Table 2.

Table 2: Bird-in-Hand Gold Residence in Oxide Composite and Sulphide Composite

Gold Residence	Sulphide Comp	Oxide Comp
Cyanide soluble (%)	90.3	86.9
Sulphide locked (%)	9.4	12.7
NSG locked (%)	0.2	0.3
Total (%)	100.0	100.0

Table 2 shows that for the materials examined nearly all the gold is either (a) “free” i.e. exists as discrete particles (of electrum) or “exposed” thus capable of attachment to an air bubble, or; (b) locked with sulphide minerals. This confirms the likely efficacy of flotation as a method of recovering the gold. There is a negligible amount of gold associated with non-sulphide gangue (NSG).
The results of gravity concentration tests on each Composite using a Knelson Concentrator were an upgrading to only 39 g/t Au at 9% mass recovery and 19.75% gold recovery for the Sulphide Composite and 57 g/t Au at 6.9% mass recovery and 26% gold recovery for the Oxide Composite. This strongly suggests that gravity concentration is likely to make only a minor contribution to gold recovery from Bird-in-Hand ore.

Flotation tests were done at flotation feed sizings P80 of 75um to 150um for the Sulphide Composite and 38um to 150um for the Oxide Composite. Satisfactory results were obtained with a conventional reagent scheme of a xanthate-type collector, methyl isobutyl carbinol (MIBC) frother and a small lime addition with the pH in the range 7.3 to 9.1.

Table 3 has the test results of a single stage of rougher flotation for both the Sulphide Composite and Oxide Composite.

Table 3: Bird-in-Hand Gold Recovery to Flotation Rougher Concentrate

Test	Composite	Product	Wt (%)	Au ppm	Dist %
T05	Sulphide	Ro Con	20.58	85.9	93.3
T06	Oxide	Ro Con	3.84	451.7	74.8
T07	Oxide	Ro Con	3.73	554.1	83.3
T08	Oxide	Ro Con	3.93	533.1	82.2
T09	Sulphide	Ro Con	20.72	96.1	89.0
T10	Oxide	Ro Con	3.15	435.4	57.4
T11	Oxide	Ro Con	8.65	213.3	79.5
T12	Oxide	Ro Con	3.60	564.0	81.6
T13	Sulphide	Ro Con	10.36	194.6	83.4
T14	Sulphide	Ro Con	3.84	419.5	56.0

Points from the flotation tests are as follows:

- Flotation is and effective method of recovering gold from Bird-in-Hand from both Sulphide and Oxide mineralisation
  - Sulphide Composite - ~90% recovery into a concentrate grade ~90 g/t Au at ~20% mass recovery. The flotation concentrate contained ~275 g/t Ag at over 90% silver recovery.
  - Oxide Composite - ~83% recovery into a concentrate grade ~500 g/t Au at ~4% mass recovery
- The Sulphide Composite has a lower gold grade than the Oxide Composite because of the recovery of sulphide minerals, principally pyrite and galena
- The results in Table 3 **are not optimised** with further test work required to determine the effects of:
  - Flotation feed sizing
  - Regrinding the rougher flotation concentrate
  - Cleaner flotation

The flotation concentrate could either be (a) sold to a lead smelter or copper smelter, or (b) treated at another site to produce gold bullion.

2.3 Tailings Disposal

The chemical and mineralogical composition of the rougher flotation tailing for both the Oxide Composite and Sulphide Composite are shown in Table 4 and Table 5

Table 4 Chemical Composition of Rougher Flotation Tailing for Oxide Composite and Sulphide Composite

SAMPLE			T05 Sulphide Ro Tail 1019144	T08 Oxide Ro Tail 1019145
ME-ICP61a	Ag	ppm	6	2
ME-ICP61a	Al	%	0.88	0.59
ME-ICP61a	As	ppm	<50	<50
ME-ICP61a	Ba	ppm	<50	<50
ME-ICP61a	Be	ppm	<10	<10
ME-ICP61a	Bi	ppm	<20	<20
ME-ICP61a	Ca	%	1.90	10.4
ME-ICP61a	Cd	ppm	20	10
ME-ICP61a	Co	ppm	10	20
ME-ICP61a	Cr	ppm	230	120
ME-ICP61a	Cu	ppm	280	40
ME-ICP61a	Fe	%	4.36	3.63
ME-ICP61a	Ga	ppm	<50	<50
ME-ICP61a	K	%	0.40	0.30
ME-ICP61a	La	ppm	<50	<50
ME-ICP61a	Mg	%	0.32	0.17
ME-ICP61a	Mn	ppm	1030	1110
ME-ICP61a	Mo	ppm	10	<10
ME-ICP61a	Na	%	<0.05	<0.05
ME-ICP61a	Ni	ppm	30.0	30.0
ME-ICP61a	P	ppm	250	280
ME-ICP61a	Pb	ppm	4650	580
ME-ICP61a	S	%	0.80	<0.05
ME-ICP61a	Sb	ppm	<50	<50
ME-ICP61a	Sc	ppm	<10	<10
ME-ICP61a	Sr	ppm	10.0	160
ME-ICP61a	Th	ppm	<50	<50
ME-ICP61a	Ti	%	<0.05	<0.05
ME-ICP61a	Tl	ppm	<50	<50
ME-ICP61a	U	ppm	<50	<50
ME-ICP61a	V	ppm	30.0	30.0
ME-ICP61a	W	ppm	<50	<50
ME-ICP61a	Zn	ppm	1460	360
Ag-OG62	Ag	ppm		
Pb-OG62	Pb	%		

Table 5 Mineralogical Composition of Rougher Flotation Tailing for Oxide Composite and Sulphide Composite

Phase	1019064 T05 Sulphide Ro Tail	1019085 T08 Oxide Ro Tail
Plagioclase	0.1	0*
Apatite	0.7	1
Calcite	3.4	19.2
Chlorite	1.6	0.4
Dolomite	0.9	0*
Galena?	0.3	0*
Goethite	2.1	1.9
Muscovite	5	2.1
Pyrite	1.2	0*
Pyrrhotite	0	0*
Quartz	84.6	75.2
Siderite	0*	0*
Sphalerite	0.1*	0*

The Nett Acid Producing Potential (NAPP) and Nett Acid Generation (NAG) data for the flotation tailings are shown in Table 6. The reader is referred to the reference *ARD Test Handbook*, AMIRA Project P387A Prediction & Kinetic Control of Acid Mine Drainage of April 2002 by Ian Wark Research Institute and Environmental Chemistry International Pty for a full description of the test methods used.

Table 6 NAPP and NAG for Bird-in-Hand Flotation Tailing

Sample	Units	1019064 T05 Sulphide Ro Tail	1019085 T08 Oxide Ro Tail
EA009: Nett Acid Production Potential			
Net Acid Production Potential	kg H2SO4/t	-25.1	-261
EA011: Net Acid Generation			
pH (OX)	pH Unit	8.4	11.0
NAG (pH 4.5)	kg H2SO4/t	<0.1	<0.1
NAG (pH 7.0)	kg H2SO4/t	<0.1	<0.1
EA013: Acid Neutralising Capacity			
ANC as H2SO4	kg H2SO4 equiv./t	47.1	262
ANC as CaCO3	% CaCO3	4.8	26.7
Fizz Rating	Fizz Unit	2	4
ED042T: Total Sulfur by LECO			
Sulfur - Total as S (LECO)	%	0.72	0.03

The above clearly shows that the expected chemical and mineralogical composition of the Bird-in-Hand flotation tailings will not generate acid because the sulphur content is very low and the calcite present will neutralise the small amount of acid that might be formed.

Table 7 shows the chemical composition of the Angas zinc-lead-silver ore tailings for April 2013. Mixing Bird-in-Hand flotation tailing with the tailing from the previous treatment of zinc-lead-silver ore will have a beneficial environmental outcome because the higher carbonate content of the former will neutralise acid formed due the higher sulphur content of the latter.

Table 7 Angas tailings April 2013

Element - Compound	Unit % unless otherwise stated	Value
Au	ppm or g/t	0.05
Ag	ppm or g/t	3
As		0.0308
Cd		0.0017
Co		0.0045
Cu		0.0283
Fe		20.51
MnO		0.37
Ni		0.0039
Pb		0.284
S		15.09
SiO_2		45.41
Zn		0.617

3. BIRD-in-HAND ORE TREATMENT AT THE ANGAS PLANT

A preliminary flowsheet for the treatment of Bird-in-Hand ore is shown in Figure 1.

As mentioned in section 2.2 the Angas Concentrator was designed to treat 50 t/h of ore grinding to 80% -106um so there should not be any difficulty in preparing less than half that hourly rate of Bird-in-Hand material which is at most 27% "harder" for feed to flotation. The flotation circuit at Angas was designed for differential flotation of zinc-lead-silver ore so the expectation would be that that there will be sufficient flotation cell capacity to process the Bird-in-Hand ore. Issues identified to date that need to be checked include:

- Flotation feed sizing
- Role of gravity concentration
- Requirement for regrinding of rougher flotation concentrate
- Need for cleaner flotation
- Dewatering capacity for flotation concentrate
- Need to filter tailings for:
    - Dry stacking at Angas
    - Transport back to Bird-in-Hand Mine for fill

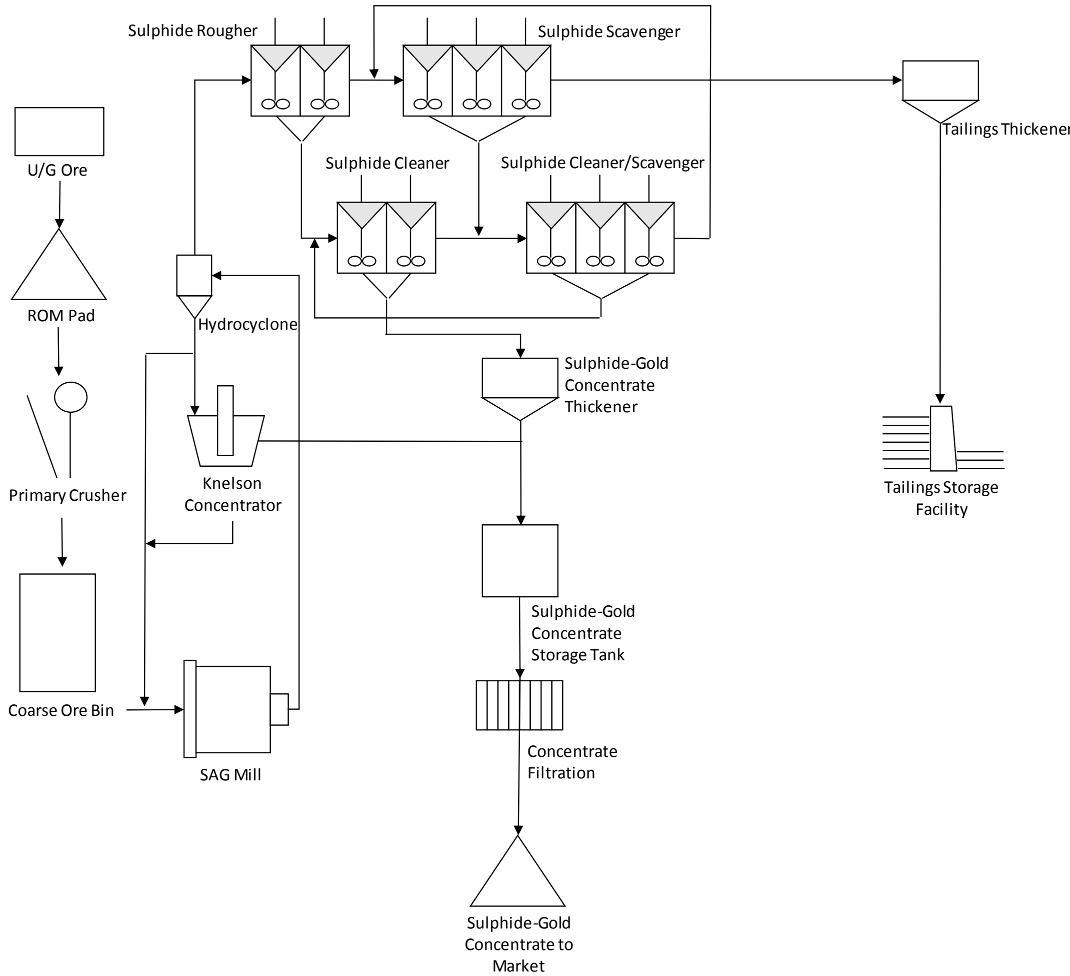

Figure1: Flowsheet for Bird-in-Hand Ore Treatment at the Angas Plant

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APPENDIX
Gold Flotation Plants

Gold Plants with Flotation before Cyanide Leaching

The refers to plants treating generally non refractory gold ores i.e. free milling that use flotation as a preconcentration step before CIL/CIP. This is sometimes done because gold is associated with pyrite and gives a low gold extraction by direct cyanide leaching which improves after regrinding a flotation concentrate.

Note: * = project, # = closed, others = operating

Plants:

- Bendigo Gold #, Australia; most gold recovered by gravity
- Dargues Reef *, Australia
- Edikan, Ghana
- Efemcukuru, Turkey; flotation concentrate trucked to Kisladag for ultra-fine regrinding + leaching
- Eléonore, Canada
- Esaase *, Ghana
- Goldex, Canada
- Haile, USA
- Joutel, Canada
- Kastanelik *, Turkey
- Pogo, USA
- Rio Paracatu, Brazil
- Royal Oak Pamour #, Canada
- Stawell, Australia
- Sukari, Egypt
- Telfer, Australia

Gold Plants Making a Flotation Concentrate for Treatment Off-site

Plants:

- Björkdal, Sweden; direct sale to a smelter
- Cannon #, USA; direct sale to copper smelter in Germany
- Curraghinalt *, Northern Ireland
- Echo Bay #, Canada; direct sale to a smelter
- Eskay Creek #, Canada; direct sale to a smelter
- Kensington, USA; direct sale to copper smelters in China and Germany
- Omagh # (?) Northern Ireland; direct sale to smelter
- Snip #, Canada