

19 March 2019

ASX: GAL

## Corporate Directory

### Directors

**Non-Executive Chairman**  
Simon Jenkins

**Managing Director**  
Brad Underwood

**Technical Director**  
Noel O'Brien

### Fast Facts

Issued Shares	120.4m
Share Price	\$0.165
Market Cap	\$19.9m
Cash (31/12/18)	\$9.1m

### Projects

Norseman Cobalt Project  
Fraser Range Nickel Project



### Contact Details

T: +61 8 9463 0063  
E: [info@galmining.com.au](mailto:info@galmining.com.au)  
W: [www.galileomining.com.au](http://www.galileomining.com.au)

# NORSEMAN COBALT PROJECT SCOPING STUDY UPDATE

## Highlights

- Scoping study level process plant design confirms highly efficient beneficiation and processing methodology for cobalt extraction
- CSA Conceptual Mining Study has identified nickel mineralisation at the Mt Thirsty deposit outside of the current JORC compliant cobalt resource
- New JORC estimation of Mt Thirsty resource is underway to capture both nickel & cobalt mineralisation
- Ongoing test work aims to optimise beneficiation potential as a key project differentiator
- Conservative beneficiation assumptions used for the Conceptual Mining Study

**Galileo Mining Ltd** (ASX: GAL, "Galileo" or the "Company") is pleased to provide an update on the progress of the Norseman Cobalt Project scoping study.

SGS-Bateman have completed a scoping study level process plant design with CAPEX and OPEX estimates for the proposed processing plant. The design and cost estimates for the processing plant have been provided to CSA Global who are currently completing a Conceptual Mining Study based on the SGS-Bateman flow sheets.

Previously reported beneficiation and leach test work results have been incorporated into the study with conservative estimates used which provides the opportunity for further improvement as more test results become available.

Commenting on the Scoping Study progress, Galileo Technical Director Noel O'Brien said that the Norseman Cobalt Project has important mineralogical features which translate into key project differentiators.

"The beneficiation potential of the Norseman Cobalt Project, combined with the proposed low-cost processing methodology, provides Galileo with an advantage over other cobalt developers within Australia. The anticipated processing plant utilises conventional agitated leach tank technology and avoids any issues associated with high cost, High Pressure Acid Leach (HPAL) plants."

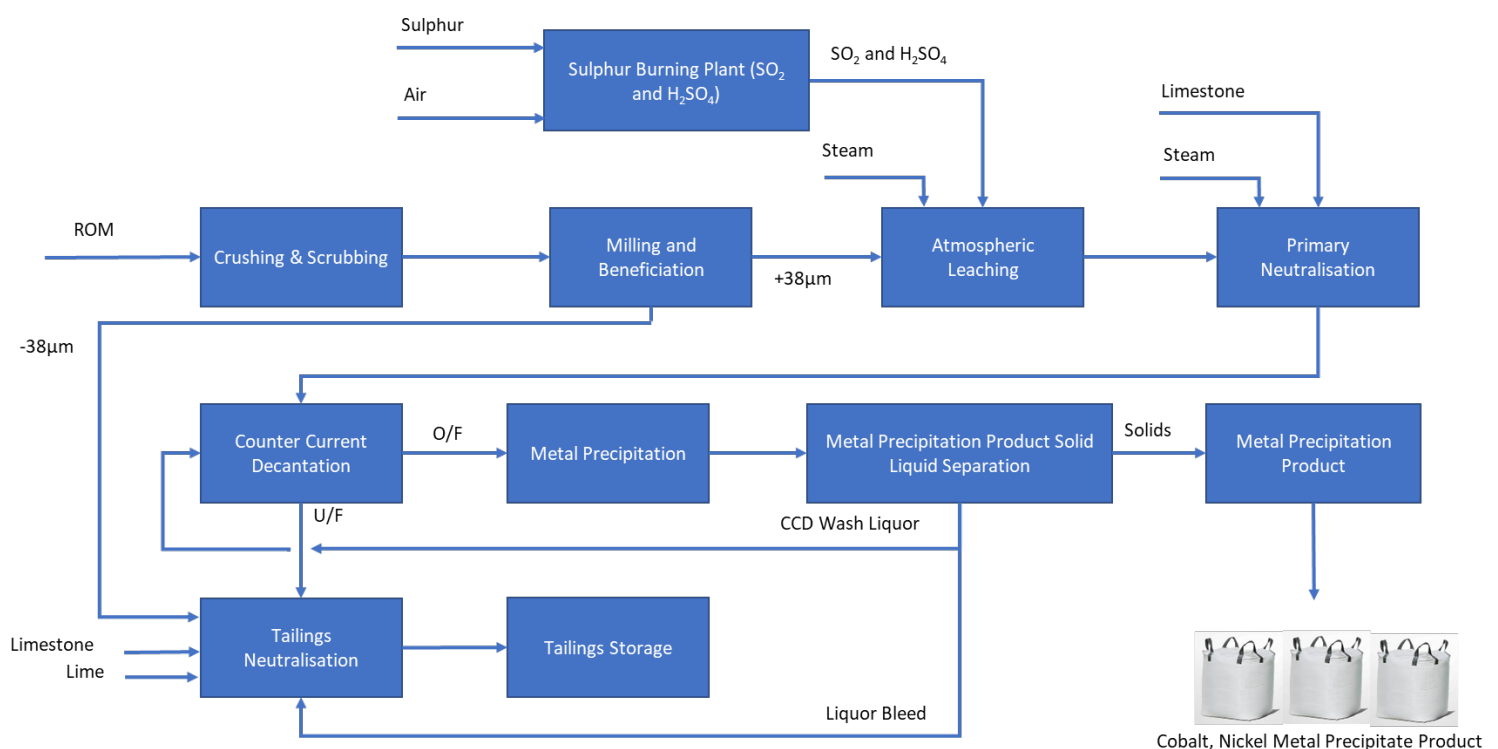
## Conceptual Mining Study

CSA Global is completing a Conceptual Mining Study based on Galileo's current JORC resources and utilising SGS-Bateman's processing plant design criteria outlined below. Initial results of optimisation work have shown that nickel mineralisation exists immediately adjacent to the Mt Thirsty JORC resource which is not contained within the resource model. The current JORC resource is based on a 0.06% cobalt cut-off which excludes nickel mineralisation with lower levels of cobalt. In order to include the additional nickel mineralisation in the Conceptual Mining Study, Galileo intends to complete a new JORC estimation of the Mt Thirsty deposit using a suitable nickel cut-off grade which will capture both the nickel and cobalt mineralisation.

## Norseman Cobalt Project Flow Sheet

SGS Bateman have completed a Process Plant Scoping Study based on an atmospheric leaching plant which treats beneficiated material. The proposed plant is designed to treat 254 tonnes per hour (2 Mtpa) of laterite ore which delivers 152 tonnes per hour (1.0 Mtpa) of beneficiated ore to the leach processing plant. The final product is expected to be a Mixed Sulphide Precipitate (MSP) which is traded globally as an intermediate product for use in the production of refined cobalt and nickel products, particularly battery chemicals.

Figure 1 – Simplified Block Flow Diagram for the Norseman Cobalt Project



## **Crushing and Beneficiation**

The process design envisages that ROM ore will pass over a 600mm square grizzly into the ROM bin, which discharges via an apron feeder to a sizer, to yield a product size of  $p_{100} = 100\text{mm}$ . The crushed ore will then be conveyed to a stockpile before being fed to a rotating drum scrubber which washes the crushed ore and separates fine clay particles from coarser particles ahead of being classified in a two-stage cyclone system. The first stage cyclone cuts at  $150\mu\text{m}$  with coarse underflow reporting to a ball mill for further size reduction, whilst the overflow is sent forward to a second stage of cycloning which cuts at  $38\mu\text{m}$ . This overflow is sent directly to tails thickening and disposal whilst the  $+38\mu\text{m}$  undersize is pumped to a pre-leach thickener to reduce the pulp volume before being advanced to the atmospheric leach circuit.

## **Beneficiation of Norseman Cobalt Project Samples**

Preliminary beneficiation results from Norseman samples showed a significant increase in cobalt grade using commercially available sizing techniques. The coarse fraction of the samples was found to contain most of the cobalt which presented an opportunity to maximise the value of the project through pre-concentration. Initial results showed a 280% increase in cobalt grade from 0.1% to 0.28% with an accompanying 72.5% reduction in sample mass<sup>(1)</sup>. Follow up tests on additional samples showed the coarse grade portion to have similar upgrades while the medium grade portion displayed a lower total cobalt upgrade<sup>(1)</sup>. For the purposes of the scoping study, a conservative beneficiation assumption is made where the coarse and medium portions of the samples were combined to result in a 60% increase in cobalt grade and 15% increase in nickel grade, accompanied by an overall mass reduction of 50%. Based on these assumptions the recovery of total cobalt from the beneficiation plant is calculated to be 80% and 57.5% for nickel.

## **Atmospheric Tank Leaching**

The pre-leach thickener underflow will be continuously pumped to the atmospheric leach tanks where it will react with sulphuric acid and sulphur dioxide (produced on site from a sulphur burning plant). The leach tanks will be heated to a temperature of  $70^{\circ}\text{C}$  with steam generated from excess heat produced by the sulphur burning plant. Solids to the leach will be introduced at a feed solids density of 40% and be leached for a 24-hour period. Development work will focus on possible improvements to leach kinetics and a reduction in leach time to improve plant throughput for little additional capital cost. The final acidity in the atmospheric leach circuit will be controlled to minimise excess acid and downstream neutralisation costs. The leached slurry will gravitate from the last tank to a Counter Current Decantation (CCD) circuit to wash and separate the leach residue from the pregnant solution liquor. The final CCD thickener underflow would then be pumped to the tailings neutralisation and disposal circuit, whilst the pregnant solution from the primary thickener overflow would move forward to the neutralisation circuit for the removal of residual acid, iron and aluminium from solution, ahead of final product precipitation.

(1) Refer to the Company's ASX announcements dated 10th August 2018 and 16th October 2018 accessible at <https://www.asx.com.au/asx/statistics/announcements.do?by=asxCode&asxCode=gil&timeframe=Y&year=2018>

## **Product Metal Precipitation**

The filtered neutralised Pregnant Liquor Solution (PLS) is reacted with hydrogen sulphide gas or sodium sulphide to produce a mixed nickel/cobalt sulphide product. The main advantage of sulphide precipitation over the alternative MHS or Mixed Hydroxide route is that the sulphide precipitates have lower levels of impurities, specifically manganese.

## **Metallurgical Extraction of Cobalt and Nickel**

Previously reported metallurgical results demonstrated that up to 95% of the cobalt and up to 66% of the nickel can be extracted from concentrate samples <sup>(2)</sup>. For the purpose of the scoping study a 90% cobalt extraction and a 60% nickel extraction from the beneficiated concentrate has been assumed. This results in an overall extraction of 72% of the cobalt from the ROM and 34.5% of nickel from the ROM. One of the main advantages of pre-concentration prior to leaching is that most of the cobalt which is not recoverable by atmospheric leaching is removed prior to treatment. Additional advantages include the reduction in mass going through the leach circuit and the reduction in high acid consuming minerals such as iron and alumina which are preferentially rejected to the fine fraction during beneficiation.

## **Opportunities for Value Improvement**

A 24-hour leach residence time has been used in the process design. Optimisation of leach residence times may reduce the time needed to reach economic metal extraction at reduced consumption rates. Such reductions would allow the possibility of an incremental plant throughput increase for little to no extra capital expenditure.

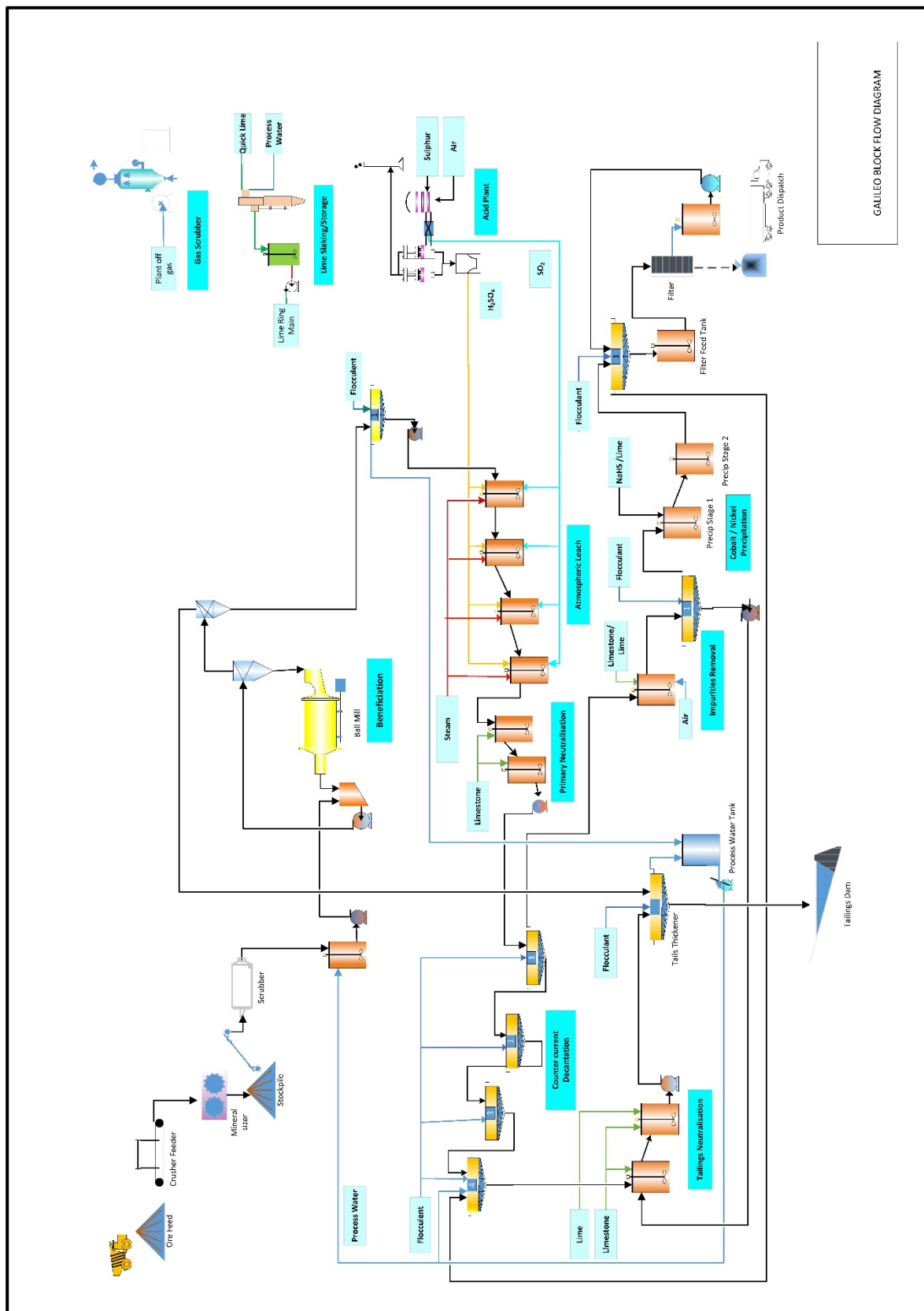
Optimisation of size classification at the beneficiation plant may allow for higher grade feed to the atmospheric leach circuit with reduced mass. Initial test work results suggest a cobalt upgrade of over 200% can be achieved with a mass reduction of approximately 70% as opposed to the much more conservative optimisation study assumptions which use a 60% cobalt increase associated with a 50% mass reduction. An ongoing program of concentration test work is planned to assist in the optimisation of concentrate sizing.

## **Cobalt Market Review**

The cobalt market has been under significant pressure over the last six months with additional supply from miners offsetting the global increase in cobalt demand. Other factors affecting the cobalt price include higher than expected metal production from China, and destocking of metal, both of which helped ease pressure on the end-user metal market. Approximately 70% of the world's cobalt supply now comes from the Democratic Republic of Congo. Such a concentrated production profile increases the downside risk of global cobalt availability should supply be disrupted. The Norseman Cobalt Project represents a high-quality cobalt project, in the premier mining district of Western Australia, with the potential to significantly benefit from an increase in future cobalt demand.

(2) Refer to the Company's ASX announcements dated 4th December 2018 accessible at <https://www.asx.com.au/asx/statistics/announcements.do?by=asxCode&asxCode=gal&timeframe=Y&year=2018>

Figure 2 – Process Flow Schematic for the Norseman Cobalt Project





## Competent Person Statement

The information in this release that relates to Metallurgy and metallurgical test work has been reviewed by Mr Noel O'Brien, FAusIMM, MBA, B. Met Eng. Mr O'Brien is a Director of the company and is employed as a contract consultant. Mr O'Brien is a Fellow of the Australasian Institute of Mining and Metallurgy, he has sufficient experience with the style of processing response and type of deposit under consideration, and to the activities undertaken, to qualify as a competent person as defined in the 2012 edition of the "Australian Code for the Reporting of Exploration Results, Mineral Resources and Ore Reserves" (The JORC Code). Mr O'Brien consents to the inclusion in this report of the contained technical information in the form and context as it appears.

The information in this report that relates to Exploration Results is based on information compiled by Mr Brad Underwood, a Member of the Australasian Institute of Mining and Metallurgy, and a full time employee of Galileo Mining Ltd. Mr Underwood has sufficient experience that is relevant to the styles of mineralisation and types of deposit under consideration, and to the activity being undertaken, to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves" (JORC Code). Mr Underwood consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

**Investor information:** phone Galileo Mining on + 61 8 9463 0063 or email [info@galmining.com.au](mailto:info@galmining.com.au)

### Media:

David Tasker

Managing Director

Chapter One Advisors

E: [dtasker@chapteroneadvisors.com.au](mailto:dtasker@chapteroneadvisors.com.au) T: +61 433 112 936

### About Galileo Mining:

Galileo Mining Ltd (ASX: GAL) is focussed on the exploration and development of cobalt and nickel resources in Western Australia. GAL holds tenements near Norseman with over 26,000 tonnes of contained cobalt, and 122,000 tonnes of contained nickel, in JORC compliant resources (see Figure 5 below). GAL also has Joint Ventures with the Creasy Group over tenements in the Fraser Range which are highly prospective for nickel-copper-cobalt sulphide deposits.

*Figure 3: JORC Mineral Resource Estimates for the Norseman Cobalt Project ("Estimates") (refer to ASX "Prospectus" announcement dated May 25<sup>th</sup> 2018 and ASX announcement dated 11<sup>th</sup> December 2018, accessible at <http://www.galileomining.com.au/investors/asx-announcements/>). Galileo confirms that all material assumptions and technical parameters underpinning the Estimates continue to apply and have not materially changed).*

Cut-off Cobalt %	Class	Tonnes Mt	Co		Ni	
			%	Tonnes	%	Tonnes
MT THIRSTY SILL						
0.06 %	Indicated	10.5	0.12	12,100	0.58	60,800
	Inferred	2.0	0.11	2,200	0.51	10,200
	Total	12.5	0.11	14,300	0.57	71,100
MISSION SILL						
0.06 %	Inferred	7.7	0.11	8,200	0.45	35,000
GOBLIN						
0.06 %	Inferred	4.9	0.08	4,100	0.36	16,400
TOTAL JORC COMPLIANT RESOURCES						
0.06 %	Total	25.1	0.11	26,600	0.49	122,500