

## 5 June 2018

# OUTSTANDING INITIAL METALLURGICAL RESULTS

- Metallurgical testwork indicates successful separation of vanidiferous titanomagnetite can be achieved with low intensity magnetic separation
- Scoping testwork completed on high grade samples (> 2% V<sub>2</sub>O<sub>5</sub>) from magnetite pipes on the Project.
- Material tested had only undergone coarse crushing, indicating potential for low comminution requirements.
- Confirmation that these pipes represent significant upside, in addition to the historic resource of > 500Mt at the SPD Vanadium Project.
- Testwork programme now progressing to test amenability to leaching.
- Future work will trial both the established salt roasting process (Largo, Bushveld) and direct leaching similar to methods developed by TNG & KRC.

Tando Resources ("**Tando**" or "**the Company**") is pleased to announce initial metallurgical results from samples taken from outcropping magnetite "pipes" at the SPD Vanadium Project, a large, high grade vanadium deposit located in the established vanadium production hub in the Bushveld Complex of South Africa.

Wet low intensity magnetic separation ("WLIMS") was utilised to separate magnetic from nonmagnetic material. Using magnetic fields of 1,000 gauss 97% of the material reported to the magnetic concentrate which assayed 2.03%  $V_2O_5$ , 13.3% TiO<sub>2</sub> and low SiO<sub>2</sub> (<1%) and Al<sub>2</sub>O<sub>3</sub> (3.9%). The initial testwork was completed on **coarsely crushed sample material** at a size passing 1.7mm (Figure 1). This compares favourably with testwork reported by other ASX vanadium developers (refer ASX Announcements AVL.ASX 24 April 2018, KRC.ASX 21 August 2017 and TMT.ASX 4 April 2018).

These results indicate that **this material appear to be highly amenable to recovery by WLIMS at low Gauss settings and at coarse comminution sizes**, supporting the Company's belief that material from the magnetic pipes could represent a "direct shipping" type material that, after a relatively simple concentration process, may be able to be sold to an end user as feedstock for a downstream processing plant or processed cost effectively using a different method.

The current testwork programme will now move to testing the amenability of the concentrate to leaching. Two processing methodologies will be used - salt roasting followed by acid leaching, and direct leaching from the magnetic concentrate. Both these methods are planned to be tested in detail in future studies at the SPD Vanadium Project to determine the optimum processing path to achieve a "battery grade product" at economically viable costs.





Figure 1. Magnetic concentrate from the SPD Vanadium Project.

Roasting with alkali salts and acid leaching is the established extraction methodology and is used by vanadium producers such as Largo Resources, Bushveld Minerals and Glencore at operations such as Maracas Menchen, Vametco and Rhovan. The salt roasting testwork will be completed by SGS Metallurgy in Johannesburg under the supervision of ENC Minerals.

Direct leaching from magnetic concentrate is not currently used for commercial production but similar hydrometallurgical methods are proposed for projects under development by TNG Ltd and King River Copper ("**KRC**").

To facilitate testing of the direct leaching method a concentrate sample has been shipped to TSW Analytical Pty Ltd in Perth for testwork. TSW has been involved in developing a processing flowsheet for the Speewah Vanadium Project (owned by KRC). It should be emphasised that KRC and TSW have an exclusivity arrangement meaning none of the intellectual property developed for Speewah will be utilised in testwork on Tando samples.

Vanadium was historically produced from magnetite by chemical leaching at the Kennedy's Vale Mine, along strike to the north of the SPD Project. Vanadium mineralisation here was hosted in a magnetite pipe, also referred to as an "Iron Rich Ultramafic Pegmatite" (IRUP), similar to those sampled at the SPD Project. This pipe is reported to have measured 350m by 55m at surface and been mined to a depth of 180m by Xstrata (Scoon et. al., 2017).

Given the success of this operation Tando looks forward to investigating whether a similar direct leaching method would be successful both for the pipe material and also the broader SPD Vanadium Project.





Figure 2. Salt roast testwork underway on samples from the SPD Vanadium Project.

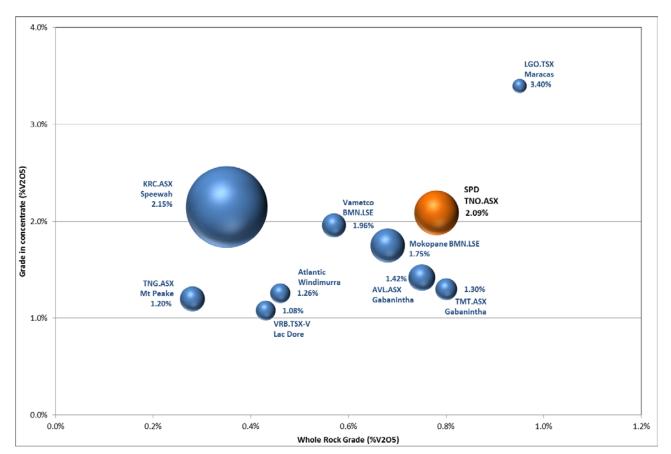
Material for this testwork was sourced from two magnetite pipes at the SPD Vanadium Project with analyses from these samples returning high grade results of **2.08%**  $V_2O_5$  and **2.02%**  $V_2O_5$  (Figure 4, ASX Announcement 7 May 2018). It should be emphasised that these are **whole rock** (or in situ) results, not concentrate grades, and compare favourably to the already high in situ grade of the SPD Project (0.78%  $V_2O_5$ , detailed below).

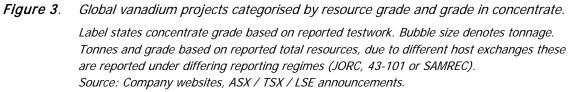
If communition and magnetic separation results are consistent with these results for samples from elsewhere in the SPD Vanadium Project then there is potential for the SPD Project to have reduced CAPEX and OPEX costs for processing in comparison to other vanadium projects under development due to lower comminution requirements. This will be further tested and confirmed during future test work on core samples from the forthcoming drill programme.

## Background on the SPD Vanadium Project

Global vanadium projects are summarised in Figure 10. Currently approximately 85% of the world's vanadium is produced in China, Russia and South Africa. The SPD Vanadium Project is located in one of these producing regions and has the potential to be globally significant based on its tonnage and grade in concentrate (Figure 3).







The SPD Vanadium Project is located in a similar geological setting to the mining operations of Rhovan (Glencore), Vametco (Bushveld Minerals) and Mapochs (International Resources Ltd) in the Gauteng and Limpopo provinces of South Africa (Figure 4). Both the Rhovan and Vametco processing plants include refining to generate products used in the global steel making industry and aim to develop downstream processing to produce materials used in the battery market. The SPD Vanadium Project is located only 30km from the currently dormant Mapochs mine which has a processing plant and railway infrastructure.

The region around the SPD Vanadium Project contains critical infrastructure such as:

- High voltage power lines and sub stations operated by the state provider ESKOM,
- Water resources including the De Hoop Dam 15km south of the project,
- Rail links,
- Sealed roads around the project area,
- Mining service companies and support business in the immediate area,
- Skilled workforce within the local community and the region.



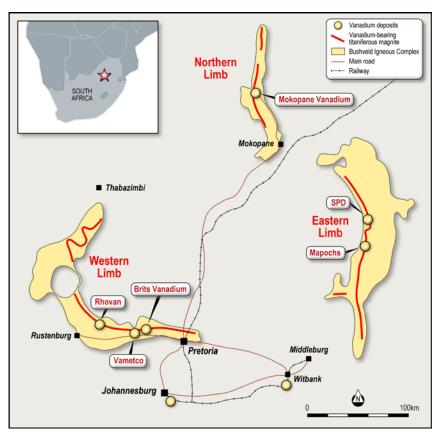


Figure 4. Location of the SPD Vanadium Project and other vanadium deposits in the Bushveld Igneous Complex.

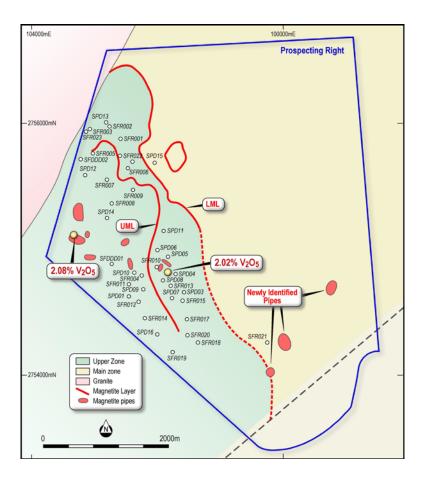
The SPD Vanadium Project was discovered in the 1990's during a regional exploration campaign to find new supply for active vanadium operations including the Kennedy's Vale Mine. Vanadium mineralisation at the SPD Project is hosted in two vandiferous titanomagnetite layers, the Upper Magnetite Layer and Lower Magnetite Layer, which dip shallowly (10-12deg) to the west (Figure 5). Initial exploration by Vantech in 1997 comprised 16 diamond core drill holes for 1051.6m (refer Figure 5 and ASX Announcement 22 March 2018) as well as detailed geological mapping.

VanRes held a prospecting right over the SPD Project from 2009 until 2015 when an application for a Mining Right was lodged. Exploration by VanRes comprised 23 RC drillholes for 1,073m and 2 diamond core drillholes for 278m drilled in 2010 (refer Figure 5 and ASX Announcement 22 March 2018). Best whole-rock drilling results included:

- 9m at 1.34% V<sub>2</sub>O<sub>5</sub> + 10.5% TiO<sub>2</sub> from 9m (SFR019)
- 13m at 1.13% V<sub>2</sub>O<sub>5</sub> + 7.43% TiO<sub>2</sub> from 10m (SFR017)
- 14m at 1.08% V<sub>2</sub>O<sub>5</sub> + 7.07% TiO<sub>2</sub> from 9m (SFR013)
- 20m at 0.96% V<sub>2</sub>O<sub>5</sub> + 8.35% TiO<sub>2</sub> from 11m (SFR011)
- 15m at 0.92% V<sub>2</sub>O<sub>5</sub> + 6.44% TiO<sub>2</sub> from 8m (SFR018)
- 12.2m at 0.90% V<sub>2</sub>O<sub>5</sub> from 127.2m & 26.9m at 0.80% V<sub>2</sub>O<sub>5</sub> from 43.1m (SFDD001)

Drill samples were passed through a Davis Tube to obtain a magnetic concentrate. Vanadium and titanium content analyses in the concentrate was very consistent, **averaging 2% V<sub>2</sub>O<sub>5</sub> and 13% TiO<sub>2</sub>** (ASX Announcement 22 March 2018).





*Figure 5.* Plan showing location of surface samples and magnetite pipes at the SPD Vanadium Project along with historical drilling and geology.

The resource for the SPD Vanadium Project as shown in Table 1 was estimated by GEMECS Pty Ltd based on all available drilling data in accordance with the SAMREC Code (2007) and is therefore a "qualifying foreign resource estimate" as defined in the ASX Listing Rules (further detail below and in the ASX Announcement of 22 March 2018). The resource was classed as inferred under the SAMREC Code. Bill Oliver, Managing Director of Tando, is acting as the Competent Person and has reviewed reports and data compiled and used in the resource estimation. The authors of the report on the 2010 exploration activities and resource estimate have confirmed that there are no material changes to the resource or underlying data since the date of the report (June 2010), and that the information presented here is consistent with the data it reported.

The Competent Person has not yet completed sufficient review on the qualifying foreign resource estimate to classify it in accordance with the JORC Code at this time and consequently it is uncertain that, following evaluation and/or further exploration work that the qualifying foreign resource estimate will be able to be reported as a Mineral Resource in accordance with the JORC Code. The Company plans to to implement a drilling programme to verify the Mineral Resource and, provided results are consistent with previous drilling, carry out further drilling aimed at increasing the confidence in the Mineral Resource.



Reef	Avge Thickness (m)	Tonnes (Mt)	Whole Rock V₂O₅%	Mt%	Magnetite Tonnes	V₂O₅% in Magnetite
Upper Layer	24	184.2	0.73	42.4	78.1	1.99
Lower Layer	22	329.1	0.81	41.6	136.0	2.20
Averages & Totals	23	513.3	0.78	41.9	215.0	2.09

Table 1.SPD Vanadium Project resource (classed as inferred under the SAMREC Code).

**Table 1 Notes**: While this foreign resource is not reported in compliance with the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (**JORC Code**), it is the Company's opinion (and the opinion of the Competent Person for this document), that the data quality and validation criteria, as well as the resource methodology and check procedures, are reliable and consistent with criteria as defined by the JORC Code. All tabulated data has been rounded to one decimal place for tonnage and two decimal places for grades.  $%V_2O_5$  is derived from XRF analysis by multiplying %V by 1.785.

## Background on Vanadium

The Company has targeted vanadium as a commodity of interest due to its usage in energy storage, specifically vanadium redox flow batteries (VRFB). It is anticipated that forecast increase in battery usage for large scale energy storage will lead to a significant increase in the demand for vanadium. VRFB technology was developed in Australia and has the following advantages:

- a substantially longer lifespan than most current batteries (up to 20 years),
- being able to hold charge for a substantial time (up to 12 months),
- the ability to discharge 100% of its charge without damage,
- scalability to enable larger scale storage facilities to be constructed, and
- greater chemical stability as only a single element is present in the electrolyte.

These features make VRFBs attractive for household or small town sized energy storage requirements. According to research conducted by Lazard (NYSE.LAZ) VRFB's already have a levelised cost of storage that exceeds Li-ion battery storage by 26 to 32% on a comparative basis (full report available at https://www.lazard.com/perspective/). Current VRFB facilities in usage or in development are located in China and Japan with development of further facilities constrained by an absence of supply of "battery grade"  $V_2O_5$ .

The price for >98% Vanadium Pentoxide ( $V_2O_5$ ), a more commonly traded intermediate product, has increased from US\$3.50/lb at the start of 2017 to current prices around US\$15/lb (source: Metal Bulletin) and a substantial premium is currently ascribed for higher purity "battery grade" vanadium electrolyte.

Current day demand for vanadium arises from its use in steel making. Vanadium is principally used to add strength via various alloys as well as other speciality uses. This usage accounts for over 90% of current vanadium demand in todays market (with the balance supplying chemical usages). Demand from steel makers is forecast to increase with stricter standards on the strength of steel to be used in construction (specifically rebar).



## For and on behalf of the board:

Mauro Piccini Company Secretary

#### **Competent Persons Statement**

The information in this announcement that relates to Exploration Results and other technical information complies with the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (**JORC Code**) and has been compiled and assessed under the supervision of Mr Bill Oliver, the Managing Director of Tando Resources Ltd. Mr Oliver is a Member of the Australasian Institute of Mining and Metallurgy and the Australasian Institute of Geoscientists. He has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the JORC Code. Mr Oliver consents to the inclusion in this announcement of the matters based on his information in the form and context in which it appears. The Exploration Results are based on standard industry practises for drilling, logging, sampling, assay methods including quality assurance and quality control measures as detailed in Appendix 1.

#### Disclaimer

Some of the statements appearing in this announcement may be in the nature of forward looking statements. You should be aware that such statements are only predictions and are subject to inherent risks and uncertainties. Those risks and uncertainties include factors and risks specific to the industries in which Tando operates and proposes to operate as well as general economic conditions, prevailing exchange rates and interest rates and conditions in the financial markets, among other things. Actual events or results may differ materially from the events or results expressed or implied in any forward looking statement. No forward looking statement is a guarantee or representation as to future performance or any other future matters, which will be influenced by a number of factors and subject to various uncertainties and contingencies, many of which will be outside Tando's control.

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## **APPENDIX 1**.

The following Tables are provided to aid compliance with the JORC Code (2012 Edition) requirements for the reporting of Exploration Results at the SPD Project.

## Section 1: Sampling Techniques and Data

(Criteria in this section applies to all succeeding sections)

Criteria	JORC Code explanation	Commentary
Sampling techniques	Nature and quality of sampling (eg cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling.	Rockchip samples taken from outcrops of vandiferous titanomagnetite.
	Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used.	Multiple rocks taken from each location across the width of the outcrop to improve representivity.
	Aspects of the determination of mineralisation that are Material to the Public Report. In cases where 'industry standard' work has been done this would be relatively	All aspects of the determination of mineralisation are described in this table.
	simple (eg 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30 g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual	The sampling method is considered appropriate as a first pass test for the presence of mineralisation. All of the samples (whole rock and magnetic separates) were sent to a commercial laboratory for crushing,
	commodities or mineralisation types (eg submarine nodules) may warrant disclosure of detailed information.	pulverising and chemical analysis by industry standard practises.
Drilling techniques	Drill type (e.g. core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic etc) and details (e.g. core diameter, triple of standard tube, depth of diamond tails, face-sampling bit or other type, whether core is orientated and if so, by what method, etc).	No drilling is being reported.
Drill sample recovery	Method of recording and assessing core and chip sample recoveries and results assessed.	No drilling is being reported.
	Measures taken to maximise sample recovery and ensure representative nature of the samples.	No drilling is being reported.
	Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.	No drilling is being reported.
Logging	Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.	Appropriate geological observations noted.
	Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography.	Both qualitative (eg. colour) and quantitative (eg. minerals percentages).
	The total length and percentage of the relevant intersections logged.	No drilling is being reported.
Sub-sampling techniques and sample	If core, whether cut or sawn and whether quarter, half or all core taken.	No core drilling is being reported.
preparation	If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry.	Entire sample submitted to laboratory.
	For all sample types, the nature, quality and	The sampling techniques are appropriate, nothing this



Criteria	JORC Code explanation	Commentary
	appropriateness of the sample preparation technique.	is a first pass test for presence of mineralisation.
	Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples.	Entire sample submitted to laboratory.
	Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/second-half sampling.	Multiple rocks taken from each location across the width of the outcrop to improve representivity.
	Whether sample sizes are appropriate to the grain size of the material being sampled.	The material and sample sizes are considered appropriate given the style of mineralisation being targeted.
Quality of assay data and laboratory tests	The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total.	Analysis was carried out at SGS Laboratories Johannesburg, Samples were crushed to < 12mm, passed through a wet magnetic drum separator at magnetic intensity of 1000 G, then a sub sample pulverised to -75um for analysis. The samples were then prepared by borate fusion and analysed by XRF for, Al <sub>2</sub> O <sub>3</sub> , SiO <sub>2</sub> , Fe <sub>2</sub> O <sub>3</sub> , MgO, MnO, CaO, Na <sub>2</sub> O, K <sub>2</sub> O, P <sub>2</sub> O <sub>5</sub> , V <sub>2</sub> O <sub>5</sub> , TiO <sub>2</sub> , Cr <sub>2</sub> O <sub>3</sub> and loss on ignition.
	For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc.	Hand held assay devices have not been reported.
	Nature of quality control procedures adopted (eg standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (ie lack of bias) and precision have been established.	Internal laboratory standards and blanks were used. This is deemed appropriate given that these samples solely confirm the presence of mineralisation, further testing to quantify mineralisation will employ more rigorous QA/QC protocols.
Verification of sampling and assaying	The verification of significant intersections by either independent or alternative company personnel.	No drilling is being reported.
assaying	The use of twinned holes.	No drilling is being reported.
	Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols.	Primary data is collected in the field and entered into logsheets or Excel worksheets.
	Discuss any adjustment to assay data.	No adjustment to assay data.
Location of data points	Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation.	Locations surveyed using handheld GPS.
	Specification of the grid system used.	The grid system is a UTM grid (Zone 35, WGS84 projection).
	Quality and adequacy of topographic control.	Adequate.
Data spacing and distribution	Data spacing for reporting of Exploration Results.	Rockchips samples are taken on an ad hoc basis.
	Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied.	Data spacing and sample type not appropriate for Mineral Resouce. Drill data required.
	Whether sample compositing has been applied.	No sample compositing has been applied.
Orientation of data in relation to geological	Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type.	No drilling is being reported.



Criteria	JORC Code explanation	Commentary
structure	If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.	5 5 1
Sample security	The measures taken to ensure sample security.	Samples were submitted to the laboratory by representatives of the Company.
Audits or reviews	The results of any audits or reviews of sampling techniques and data.	No independent audits have been undertaken.

## Section 2: Reporting of Exploration Results

(Criteria listed in the preceding section also apply to this section)

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings.	The SPD Project comprises a single prospecting right, covering the farm Steelpoortdrift 365 KT, and an application for a Mining Right.
	The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.	The tenement is represented to be in good standing. Title DD will verify this.
Exploration done by other parties	Acknowledgment and appraisal of exploration by other parties.	The Project has previously been explored for magnetite-hosted Fe-V-Ti deposits.
Geology	Deposit type, geological setting and style of mineralisation.	Vanadium mineralisation at the SPD Project is located close to the contact between the Upper Zone and Main Zone of the Bushveld Igneous Complex and adjacent to the Steelpoort Fault. Mineralisation is hosted in two layers, the Upper Magnetite Layer (UML) and Lower Magnetite Layer (LML), which dip shallowly (10-12deg) to the west.
Drill hole Information	<ul> <li>A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes:</li> <li>easting and northing of the drill hole collar</li> <li>elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar</li> <li>dip and azimuth of the hole</li> <li>down hole length and interception depth</li> <li>hole length.</li> </ul>	No drilling is being reported.
	If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the Competent Person should clearly explain why this is the case.	Not applicable, information has been included.
Data aggregation methods	In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off	No averaging or aggregating has been completed.



Criteria	JORC Code explanation	Commentary
	grades are usually Material and should be stated.	
	Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail.	No drilling is being reported.
	The assumptions used for any reporting of metal equivalent values should be clearly stated.	No metal equivalent values are being used for reporting exploration results.
Relationship between mineralisation widths and intercept lengths	These relationships are particularly important in the reporting of Exploration Results. If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported. If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').	No drilling is being reported.
Diagrams	Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.	A plan view of sample locations along with mapped geology is shown in the text.
Balanced reporting	Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.	All results have been reported.
Other substantive exploration data	Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.	Exploration data will be reviewed and compiled as part of the DD process.
Further work	The nature and scale of planned further work (eg tests for lateral extensions or depth extensions or large-scale step-out drilling). Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	<ul> <li>Due diligence investigations.</li> <li>Magnetic survey to identify further pipes</li> <li>Drilling to verify and infill historical drilling and provide a sub surface test of the extent of the pipes.</li> </ul>