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29 January 2021

## ASX ANNOUNCEMENT

# Tungsten Mining's Mt Mulgine PFS confirms large scale, long life, low cost tungsten concentrate production

## Highlights

- Pre-Feasibility Study (PFS) **confirms technical and financial viability of a 6Mtpa mining and processing operation** at Tungsten Mining's Mt Mulgine Tungsten Project in the Murchison region of Western Australia (WA).
- **Maiden Ore Reserve Estimate of 140 million tonnes** @ 0.10% tungsten ($WO_3$), 288ppm molybdenum (Mo), 0.12g/t gold (Au), 5.9g/t silver (Ag) and 0.03% copper (Cu).[1]
- Long life operation **with 23.5 years of processing activities**.
- **Average annual production of approximately 460,000 MTU's of $WO_3$ in concentrate** over the Life of Mine (LOM). Production of by-product concentrates of molybdenum and copper/gold/silver with **contained metal of approximately 1,070t of molybdenum 1,265t of copper, 9,400 oz of gold and 525,000 oz of silver per annum**.
- **Low-cost tungsten concentrate production with LOM operating costs (net of by-product credits) of US$92 per MTU $WO_3$ and all-in sustaining costs of US$111 per MTU $WO_3$.**

## Commentary

Australian tungsten developer, Tungsten Mining NL (ASX: TGN) ("TGN" or "the Company") is pleased to announce the Pre-Feasibility results of its world class Mt Mulgine Tungsten Project, located in the Murchison Region of Western Australia, approximately 350km north northeast of Perth.

Craig Ferrier, Tungsten Mining CEO, said*: "The delivery of the maiden Ore Reserve and the completion of the Pre-Feasibility Study are major milestones for Tungsten Mining, underpinning the case for establishing large scale, long life and low-cost mining and processing operations at the Mt Mulgine Tungsten Project.*

*Tungsten is recognised as a critical mineral by the US, the European Commission, Japan, China and Australia, a key driver of industrialisation with high economic importance. The substantial scale of the Mt Mulgine Tungsten Project, its long life, low production costs and its location in a safe mining jurisdiction justifies the commitment of resources to support its development. Our focus now is on engaging with offtake and development partners to ensure Mt Mulgine fulfills its potential as a major tungsten producer for many years.*"

[1] Refer ASX (Tungsten Mining) Announcement 29 January 2021, "*Maiden Ore Reserve Estimate – Mt Mulgine Project*"

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**Tungsten Mining Strategy**

Through exploration and acquisition, the Company has established a globally significant tungsten resource inventory in its portfolio of advanced mineral projects across Australia. This provides the platform for the Company to become a major player within the global primary tungsten market through the development of low-cost tungsten concentrate production.

The Mt Mulgine Tungsten Project is the cornerstone of the Company's strategic development plan, focussed on demonstrating a pathway to long term sustainable mining activities.

**Tungsten Industry**

Tungsten, also known as wolfram, is a chemical element with symbol W and atomic number 74. The word tungsten comes from the Swedish language tungsten, which directly translates to heavy stone.

Tungsten, occurs naturally on Earth, not in its pure form but as a constituent of other minerals, only two of which currently support commercial extraction and processing - wolframite ($(Fe,Mn)WO_4$) and scheelite ($CaWO_4$). The free element is remarkable for its unique properties, It has the highest melting point of all the elements (~3,400°C), has a density that is 19.3 times that of water, making it among the heaviest metals, has excellent electrical conductivity and its coefficient of thermal expansion is the lowest of all metals.

These properties ensure tungsten makes an important contribution, through its use in cemented carbide and high-speed steel tools, to the achievement of high productivity levels in industries on which the world's economic well-being depend. It is used in lighting technology, electronics, power engineering, coating and joining technology, the automotive and aerospace industries, medical technology, the generation of high temperatures, the tooling industry and even in sports and jewellery.

Cemented carbides, also called hardmetals, are the most important usage of tungsten today. The main constituent is tungsten monocarbide ("WC"), which has hardness close to diamond. Hardmetal tools are the workhorses for the shaping of metals, alloys, wood, composites, plastics and ceramics, as well as for the mining and construction industries.

World tungsten supply has been dominated by production in and exports from China. According to Roskill, mine production of tungsten (primary tungsten) grew by 2.0% per year from 67.5kt W in 2011 to just under 78.9kt in 2019. Mine supply is, however, somewhat below its peak of over 81kt W in 2015. The main source of mine production is China, accounting for 82% of output in 2019.

Prices for tungsten concentrates have historically tended to follow the same trend as prices for ammonium paratungstate (APT), which is the key intermediary product in the tungsten supply chain. APT prices are quoted on the basis of metric tonne units. A metric tonne unit (MTU) is 10kg. An MTU of tungsten trioxide ($WO_3$) contains 7.93kgs of tungsten (W). Standard industry grade specification for tungsten concentrate is 65% $WO_3$.

**Project History**

Exploration activities at Mt Mulgine commenced in the early 1900's by prospectors seeking gold. Between 1910 and 1920 small-scale mining for molybdenum was conducted in the Mulgine Granite. Since 1938, several companies have undertaken exploration for molybdenum and tungsten, completing various soil sampling, percussion, diamond drilling programs and various levels of feasibility studies.

The Mt Mulgine Tungsten Project is located on granted mining leases held by Minjar Gold Pty Ltd. The Company's wholly owned subsidiary, Mid-West Tungsten Pty Ltd, acquired the tungsten and molybdenum rights at Mt Mulgine in December 2015 and also owns the rights to all by-products from the mining of tungsten and molybdenum.

Near surface Mineral Resources have been delineated at the Mulgine Trench and Mulgine Hill deposits, which have been the subject of ongoing evaluation by the Company.

The Company has invested heavily in resource development, drilling over 55,000 m of reverse circulation (RC) holes and 1,680 m of diamond core. Planning and early stage works for small scale production from the Mulgine Hill deposit was undertaken in 2018 prior to committing to a PFS in April 2019 to assess the viability of establishing large scale mining and processing operations at Mt Mulgine.

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**Location**

The Project is located approximately 350 km NNE of Perth in the Murchison Region of Western Australia (Figure 1). Road access to site from Perth is via the Great Northern Highway to the town of Perenjori. Access from Perenjori to site is via the Perenjori-Rothsay and Warriedar Copper Mine public roads. Air access is available with permission via Karara Mining Ltd's all-weather airstrip located approximately 60 km from site.

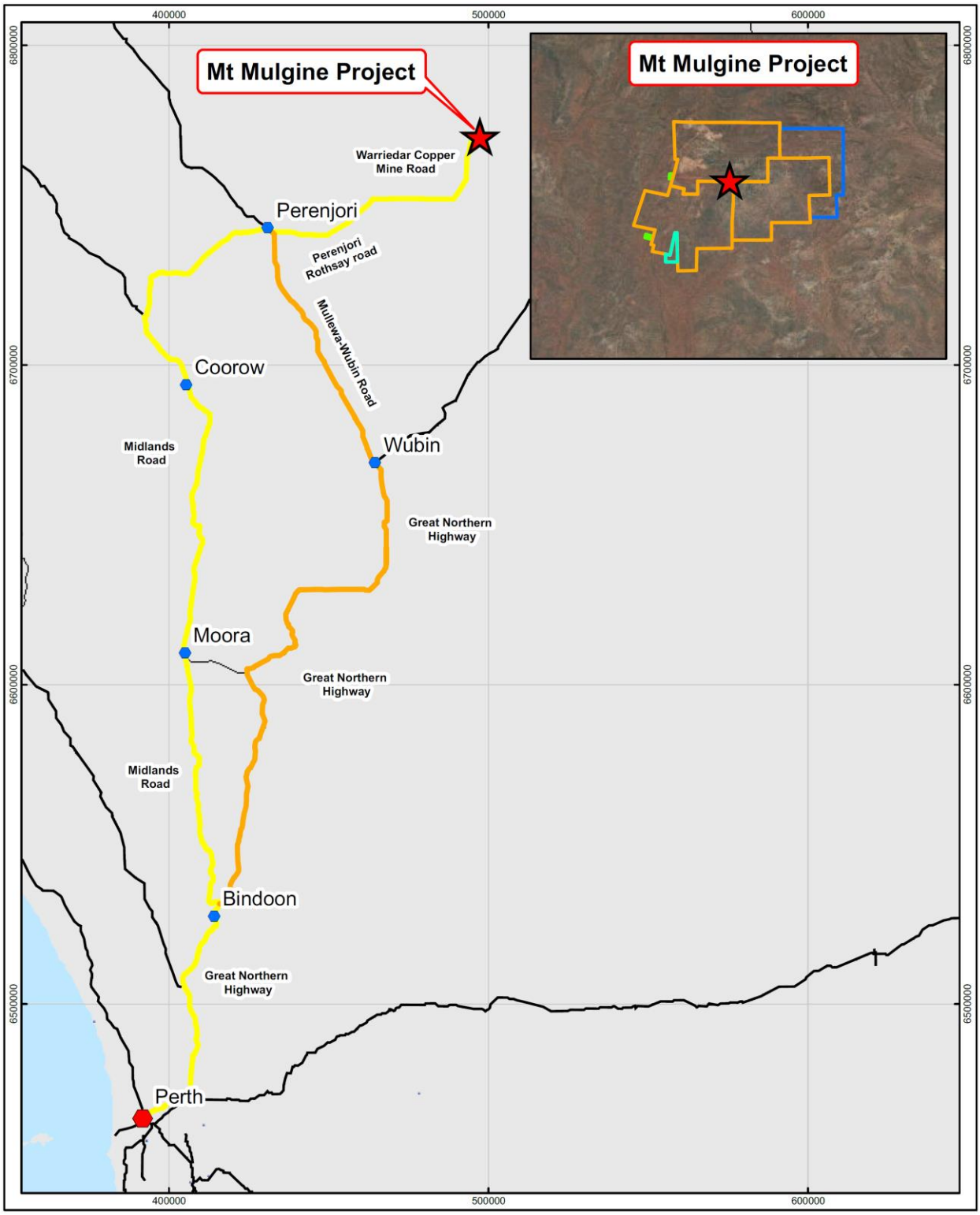


*Figure 1 – Project Location*

**Table 1 – Project Overview**

| | | |
|---|---|---|
| **Geology** | Mineral Resource Estimate | Indicated: 183Mt @ 0.11% $WO_3$, 290ppm Mo, 0.13 g/t Au, 5 g/t Ag, 0.04% Cu.<br>Inferred: 76Mt @ 0.11% $WO_3$, 240ppm Mo, 0.09g/t Au, 5 g/t Ag, 0.03% Cu. |
| **Mining** | Pits | Mulgine Trench and Mulgine Hill |
| | Ore Reserve Estimate | 140Mt (100% Probable) at 0.10% $WO_3$, 288ppm Mo, 0.12g/t Au, 5.9g/t Ag and 0.03% Cu. |
| | Cut Off Grade | 0.074% $WO_3$ equivalent cut-off grade[2]. |
| | Mining Rate | 6mtpa of ore (matched to processing rate) |
| | Strip Ratio (waste to ore) | 1.1:1 |
| | Life of Mine | 24.5 years |
| | Mining Profile | 3 months site establishment, 12 months of pre-strip. Ore production 13 to 15 months after commencement of site establishment. |
| | Operations | Contract Mining – drill, blast, load, haul |
| **Processing** | Flowsheet | Crush, ore sort, grinding, flotation producing separate Mo and Cu (containing Au & Ag) concentrates, gravity separation for $WO_3$ concentrate. |
| | Nominal Processing Rate | 6 Mtpa |
| | Feed Grade | 0.10% $WO_3$, 288ppm Mo, 0.12g/t Au, 5.9g/t Ag and 0.03% Cu. |
| | Recovery ($WO_3$) | 74% $WO_3$ |
| | Recovery of by-products (Mo) (Cu, Au, & Ag) | 63% Mo<br>62% Cu, (41% Au and 47% Ag in Cu concentrate). |
| | Annual Metal Production $WO_3$ | 460,000 MTU's |
| | Mo | 1,070 t |
| | Cu | 1,265 t |
| | Au | 9,400 oz |
| | Ag | 525,000 oz |
| **Infrastructure** | Roads | Access via the unsealed Warriedar Copper Mine Road |
| | Tailings Storage | Single cell storing wet tails and ore sort rejects, recycle water back to process plant. |
| | Village and Airstrip | 300 person permanent village (600 man during construction), allowance for airstrip located at site. Potential to use existing airstrips in local area. |
| | Water | Nominal 1.6 Gl/annum raw water demand at steady state, supplied from number of sources (to be determined). |
| | Power | LNG plant with 30MW of installed power. |
| | Logistics | Concentrate trucked in containers to Fremantle Port for export. |

[2] Refer ASX (Tungsten Mining) Announcement 29 January 2021, "*Maiden Ore Reserve Estimate – Mt Mulgine Project*" – Appendix C for details of conversion factors used to calculate tungsten equivalent grade.

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**Capital Cost Estimate**

The PFS capital cost estimate to construct a 6 Mtpa ore processing plant and associated mine infrastructure at the Mt Mulgine Tungsten Project to produce tungsten and molybdenum concentrates and copper concentrate containing gold and silver is A$669M to a level of accuracy of +/- 25%. This estimate includes a contingency determined by Tungsten Mining of 10% applied to all initial capital costs.

This capital cost estimate is made up as shown in Table 2 below.

**Table 2: Capital Cost Estimate**

| Capital Cost Estimate | A$M | Source |
|---|---|---|
| Mining | 74 | MineGeoTech and Tungsten Mining estimate. Includes pre-production mining (including pre-strip) and mine fixed infrastructure. |
| Process Plant | 253 | GR Engineering review of Ausenco estimate. Includes crushing, ore sorting, grinding, flotation, gravity, storage and handing. |
| Tailing Storage Facility (TSF) | 11 | Knight Piésold estimate, includes initial TSF costs. |
| Non-Process Infrastructure | 78 | GR Engineering review of Ausenco estimate. Includes accommodation camp, airstrip, communications, mine facilities and mobile plant. |
| Project Preliminaries | 104 | GR Engineering review of Ausenco estimate. Includes construction camp, cranes & equipment, capital spares, first fill reagents and other indirect costs. |
| Project Delivery | 64 | GR Engineering review of Ausenco estimate. Includes Engineering, Procurement, Construction and Management (EPCM) costs. |
| Owners Costs & Working Capital | 24 | Tungsten Mining estimate. |
| Contingency | 61 | Tungsten Mining estimate of 10%. Applied to all initial capital estimates. |
| **Total Capital Cost Estimate[1]** | **669** | |

*1) The capital cost estimate does not include amounts recognised as sustaining capital during operations, including TSF lift costs and a transfer payment pursuant to the proposed third party power supply arrangement.*

Ausenco completed the review of metallurgy, process design and an estimate of certain capital and operating costs as described in Table 2 and 3. A peer review and revision of the Ausenco capital cost estimate was undertaken by GR Engineering and adopted for the purposes of the PFS. There was a net difference of only $17m between the two estimates.

The above estimate represents the initial capital cost only and does not include sustaining capital or TSF lift costs over a 23.5 year life of processing. Costs on raising the TSF is assumed to be invested at a constant rate over the life of the facility and is included in the operating costs at the rate of A$1.86/t of ore processed multiplied by the number of tonnes of ore processed in each year.

As described on page 12, power supply for the Project is proposed by way of a third party supplied and operated LNG power plant pursuant to a Build Own Operate Transfer (BOOT) model defraying the initial capital cost. An amount of $30m has been included in sustaining capital at the end of year 7, for payment of the transfer sum.

**Operating Cost Estimate**

The PFS confirms a Project of substantial scale, long life and with by-products of molybdenum concentrate and copper concentrate containing gold and silver.

Consistent with industry practice and accounting convention, by-product revenues are off-set against operating costs to report a unit operating cost for tungsten concentrate (the primary product). This has resulted in a PFS operating cost estimate of US$92 per MTU $WO_3$ produced and, after accounting for sustaining capital, an all-in sustaining cost of US$111 per MTU $WO_3$ over the life of the Project.

This cost of production forecasted by the PFS Financial Model places the Mt Mulgine Tungsten Project in the second quartile of tungsten producers in a global cost curve.

The operating cost estimate is the summation from various sources as outlined in Table 3 below.

**Table 3: LOM Average Operating Cost**

| Operating Cost Item | A$/t Ore | US$/MTU $WO_3$ | Source |
|---|---|---|---|
| Mining | 8.2 | 75 | MineGeoTech and reviewed by Tungsten Mining. |
| Process Plant | 9.8 | 89 | Estimated by Ausenco from a variety of sources. |
| Non-Process Infrastructure | 1.1 | 10 | Estimated by Ausenco and Tungsten Mining from a variety of sources |
| G&A, concentrate transport and royalties | 3.7 | 33 | Estimated by Tungsten Mining, state government royalties are 5%. |
| **Sub-total Operating Cost** | **22.8** | **207** | |
| By-product credit revenue (BPC) | (12.7) | (115) | Molybdenum and Copper concentrate by-product revenue. |
| **Operating Cost (Net of BPC)** | **10.1** | **92** | |
| TSF Lifts | 1.9 | 17 | Estimated by Knight Piésold. |
| Other – Rehabilitation etc | 0.2 | 2 | Estimated by Tungsten Mining. |
| **All in Sustaining Costs (Net BPC)** | **12.2** | **111** | |

1) *$A:US$ exchange rate of 0.70.*

*2) The additional cost of the BOOT power supply arrangement equates to A$0.70/t ore for the initial seven years of operations, however is reflected as a LOM cost in the above table.*

*3) TSF operating costs have been included in processing plant operating costs. The annual TSF wall lifts are treated as sustaining capital and as such are not in operating costs but rather reflected in All-in Sustaining Costs. Expenditure on raising the TSF is assumed to be invested at an approximately constant rate over the life of the facility and is included in the financial model at the rate of A$1.86 /t of ore processed multiplied by the number of tonnes of ore processed in each year.*

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**Financial Analysis**

Table 4 shows key financial parameters from the PFS financial model.

**Table 4: Financial Analyses**

| Metric | | | |
|---|---|---|---|
| *Commodity Prices* | | *Metal Price* | *Payable Factor[1]* |
| APT | US$/MTU | $300 | 80% |
| Molybdenum | US$/lb | $11 | 85% |
| Copper | US$/t | $6,600 | 96% |
| Gold | US$/oz | $1,600 | 97% |
| Silver | US$/oz | $20 | 90% |
| | | | |
| *Other Metrics* | | | |
| Exchange Rate | A$:US$ | 0.70 | |
| Discount Rate | % | 5% | |
| Net Present Value (before tax) | A$ | $422M | |
| Internal Rate of Return (before tax) | % | 10.83% | |
| Project Post-Capital Cashflow Surplus (pre tax) | A$ | $1,285M | |
| Net Present Value (after tax) | A$ | $265M | |
| Internal Rate of Return (after tax) | % | 9.31% | |
| Project Post-Capital Cashflow Surplus (after tax) | A$ | $904M | |

*1) Concentrates are typically sold to smelters (including APT producers) at a discount to the metal price and sellers receive a percentage of the metal price ("Payable Factor") for the contained metal to account for certain factors such as costs of conversion, metal losses and other processing costs.*

Table 5 shows the sensitivity analysis on the PFS financial model by considering independent changes to certain inputs to determine the impact on the Project Net Present Value.

**Table 5: Sensitivities on Financial Inputs**

| Base Case Project NPV ~A$422M (pre-tax) | | |
|---|---|---|
| | **-20%** | **+20%** |
| APT price | A$25M | A$820M |
| By-product prices | A$235M | A$610M |
| Capital Cost – Life of Mine | A$575M | A$270M |
| Operating Cost | A$762M | A$83M |

The unique nature of the Mt Mulgine Tungsten Project, with its ability to produce substantial volumes of a critical mineral over many years suggests that the Project not be assessed solely on the basis of conventional financial measures (eg. NPV and IRR). Importantly, the Project has the potential to generate substantial positive cashflows, and offers considerable leverage to two designated critical minerals (tungsten and molybdenum) as demand and supply conditions evolve further within the critical mineral space.

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**Mineral Resource**

Near surface tungsten mineral resources have been delineated at the Mulgine Trench and Mulgine Hill deposits, which have been the subject of extensive historical work and ongoing evaluation by the Company.

As part of the PFS, the Company completed a comprehensive review and data validation of historical work, exploration and resource definition drilling at Mt Mulgine, including over 49,000m of resource definition drilling at Mulgine Trench to support an update to the JORC 2012 Mineral Resource Estimate.

Extremely encouraging results throughout the entirety of the program were achieved, intersecting multiple broad zones of tungsten-molybdenum-gold-silver-copper mineralisation within a 160 m to 260 m thick horizon over a strike length of 1.4 km.

An interim update to the Mulgine Trench Mineral Resource Estimate was completed in December 2019 and following completion of resource definition drilling, a further update was released to ASX on 4 May 2020. This compliments the earlier update of the Mulgine Hill Mineral Resource Estimate of April 2019.

Together, this work has defined a combined Indicated and Inferred Mineral Resource Estimate of 259 Mt at 0.11% $WO_3$, 270 ppm Mo, 0.12 g/t Au, 5 g/t Ag and 0.03% Cu (at a 0.05% $WO_3$ cut-off). A breakdown of the Mulgine Trench and Mulgine Hill Mineral Resource Estimates is presented in Table 6 below.

**Table 6 - Mulgine Trench and Mulgine Hill Mineral Resource Estimate at 0.05% $WO_3$ Cut-off**

| Classification | Mt | $WO_3$ | | Mo | | Au | | Ag | | Cu | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % | kt | ppm | kt | g/t | koz | g/t | Moz | % | kt |
| **Mulgine Trench (May 2020) [1]** | | | | | | | | | | | |
| Measured | - | - | - | - | - | - | - | - | - | - | - |
| Indicated | 175 | 0.11 | 190 | 290 | 51 | 0.14 | 770 | 6 | 32 | 0.04 | 69 |
| Inferred | 72 | 0.11 | 80 | 250 | 18 | 0.10 | 230 | 5 | 12 | 0.03 | 24 |
| **Total** | **247** | **0.11** | **270** | **280** | **69** | **0.13** | **1000** | **6** | **44** | **0.04** | **92** |
| **Mulgine Hill (April 2019) [2]** | | | | | | | | | | | |
| Measured | - | - | - | - | - | - | - | - | - | - | - |
| Indicated | 8.3 | 0.18 | 15 | 128 | 1.1 | - | - | - | - | - | - |
| Inferred | 4.0 | 0.12 | 4.8 | 118 | 0.5 | - | - | - | - | - | - |
| **Total** | **12.3** | **0.16** | **20** | **125** | **1.5** | **-** | **-** | **-** | **-** | **-** | **-** |
| **Mt Mulgine (Total)** | | | | | | | | | | | |
| Measured | - | - | - | - | - | - | - | - | - | - | - |
| Indicated | 183 | 0.11 | 205 | 290 | 52 | 0.13 | 770 | 5 | 32 | 0.04 | 69 |
| Inferred | 76 | 0.11 | 85 | 240 | 18 | 0.09 | 230 | 5 | 12 | 0.03 | 24 |
| **Total** | **259** | **0.11** | **290** | **270** | **71** | **0.12** | **1000** | **5** | **44** | **0.03** | **92** |

*Notes:*
1. *Refer ASX (Tungsten Mining) Announcement 4 May 2020, "Mineral Resource Estimate Update for Mulgine Trench Deposit".*
2. *Refer ASX (Tungsten Mining) Announcement 12 April 2019, "Update on Activities at Mount Mulgine"*

The Mineral Resource Estimate has an increased confidence level with 70% now in the Indicated category (December 2019 Resource was all Inferred).

As a result of the PFS drilling there has been a 244% increase in the Mulgine Trench Mineral Resource compared to the Mineral Resource Estimate prior to the PFS drilling, and an increase of contained tungsten (131%), molybdenum (283%) and accessory minerals, including 1 million ounces of gold, 44 million ounces of silver and 92,000 tonnes of copper.

**Mining**

The Mulgine Trench and Hill deposits are both suitable for open pit mining as a result of the orebody geometry, grade and deposit geotechnical conditions.

To balance ore and waste production and improve cashflow by focusing on high value, low cost areas first, Mulgine Trench will be a 4 stage pit, while Hill will be a 2 stage pit. The pit stages will mine concentrically out from the first stage, reaching a maximum depth of 220m.

The Mt Mulgine Tungsten Project will be mined by conventional bulk drill and blast and load and haul methods.

The open pits have been scheduled to generate practical and realistically achievable outcomes. A total material movement of 21Mtpa will be achieved with a mining fleet of 190t hydraulic excavators and 140t payload trucks. This equipment has proven to be efficient in other similar sized operations.

The mining strategy employed in the schedule blends higher grade ore from the Mulgine Hill pit over the first two years of production with the remainder of the feed from the Mulgine Trench pit. The strategy employed in the schedule is to open multiple mining faces to facilitate blending of ore to the Run of Mine (ROM) pad.

The ore mined will be preferentially direct dumped into the crusher feed bin and any additional ore mined will be stockpiled on the ROM pad adjacent to the primary crusher. The stockpiled material will be fed into the crusher via a front-end loader and trucks.

The mining will be undertaken by contractors presenting a low risk, low capital option. The mining contactor will be selected and engaged through a competitive tender process.

During the early years of the mine life the waste material mined from the Mulgine Trench and Mulgine Hill pits will primarily be used in the construction of key infrastructure. The ROM pad and the first lift of the Tailings Storage Facility (TSF) will be the initial priority. Waste will continue to be directed to the TSF over the life of the mine for the downstream ‘paddock’ embankment construction for the life of the facility.

The Ore Reserve Estimate and mine plan are based entirely on Indicated Mineral Resources. In addition, there is 12.2Mt at 0.10% $WO_3$ of Inferred Mineral Resources, above a COG of 0.074% $WO_3$ equivalent and within the current pit designs for Mulgine Hill and Mulgine Trench. The Inferred Resource tonnes also contain Mo (0.02%), Au (0.07 g/t), Ag (4.32 g/t) and Cu (0.05%). There is lower geological confidence associated with Inferred Mineral Resources and further drilling is required to upgrade to Indicated category.

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**Table 7 – Mt Mulgine Ore Reserve Estimate**

| Deposit | Reserve Category | Tonnes (Mt) | Grade $WO_3$ (%) | Grade Mo (ppm) | Grade Au (g/t) | Grade Ag (g/t) | Grade Cu (%) |
|---|---|---|---|---|---|---|---|
| **Mulgine Trench** | | | | | | | |
| | Proved | - | - | - | - | - | - |
| | Probable | 135 | 0.10 | 293 | 0.12 | 6.1 | 0.04 |
| | **Total** | **135** | **0.10** | **293** | **0.12** | **6.1** | **0.04** |
| **Mulgine Hill** | | | | | | | |
| | Proved | - | - | - | - | - | - |
| | Probable | 5 | 0.21 | 134 | - | - | - |
| | **Total** | **5** | **0.21** | **134** | **-** | **-** | **-** |
| **Mt Mulgine Project** | | | | | | | |
| | Proved | - | - | - | - | - | - |
| | Probable | 140 | 0.10 | 288 | 0.12 | 5.9 | 0.03 |
| | **Total** | **140** | **0.10** | **288** | **0.12** | **5.9** | **0.03** |

*Estimate for Mt Mulgine Project using:*

- *A 0.074% $WO_3$ equivalent cut-off grade*
- *Mining assumes 5% dilution at zero grade and 5% ore loss*
- *All tonnes quoted are dry tonnes*
- *Data is reported using significant figures to reflect appropriate precision and may not sum precisely due to rounding*

*Refer ASX (Tungsten Mining) Announcement 29 January 2021, "Maiden Ore Reserve Estimate – Mt Mulgine Project"- (including Appendix A – JORC 2012 Checklist of Assessment and Reporting Criteria, Appendix B - Mt Mulgine Mineral Resource and Appendix C - Conversion factors used to calculate tungsten equivalent grade.)*

## Metallurgy and Processing

Five ore samples selected for the metallurgical testwork program were representative of the three major rock types identified from the Mulgine Trench deposit, namely basalt, ultramafic and felsic. Lower saprolite and saprock basalt ore samples were also selected. (Metallurgical test work on samples recovered from Mulgine Hill was completed in 2017).

The test work was performed in two phases with the initial phase focused on development of a 6 Mtpa flowsheet consisting of a "fine" (212 µm) grind followed by bulk sulphide flotation ahead of gravity separation. The initial development also focused on the metallurgical performance of the different rock types in the deposit to understand process variability and to de-risk the process flowsheet. This work consisted of mineralogy, QEMScan, comminution, ore sorting, bulk sulphide flotation, gravity separation and copper and molybdenum flotation.

A second phase of testing was undertaken based on an alternative flowsheet, consisting of a "coarse" (1.18mm) grind followed by gravity separation ahead of bulk sulphide flotation. The coarse case test work was only conducted on the basalt rock.

Five concentrates were produced including tungsten (as scheelite), copper, molybdenum, pyrite and magnetite. Further work is required to determine the potential value contribution of both the pyrite and magnetite.

The "fine" flowsheet compared a number of cases including coarse and fine ore sorting, coarse ore sorting only, no ore sorting and a no ore sorting case at 3 Mtpa. The "coarse" flowsheet was developed as no ore sort only at 6mtpa.

The "fine" flowsheet was preferred over the "coarse" flowsheet as it provided a better combination of grade and recovery, less complexity in the process design, simpler operability and less capital expenditure.

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When comparing the different cases for the “fine’ flowsheet, the fine and coarse ore sorting option provided the best economic return and was used as the basis for the flowsheet design in the PFS (the base case).

The base case design (Figure – 2) produces a nominal 7.1 kt of tungsten, 2.4 kt of molybdenum and 5.7 kt of copper as concentrate per year. The copper concentrate contains 9.5 koz of gold and 530 koz of silver. The base case process encompasses crushing of the ROM ore, x-ray ore sorting, grinding, bulk sulphide flotation (BSF), regrind and concentrate dewatering to first produce a bulk sulphide concentrate. BSF concentrate is upgraded to a molybdenum and copper concentrate via flotation. Molybdenum and copper concentrate are dewatered and bagged prior to transport. Tungsten concentrate is produced from the BSF tails via the tungsten gravity and flotation circuit consisting of magnetic separators, hydrosizers, shaking tables and spiral concentrators. Tungsten concentrate is dewatered, dried and bagged prior to being trucked to port, shipped and sold to an APT plant. Tailings and slimes from the tungsten gravity circuit are thickened prior to being pumped to the tailings storage facility.

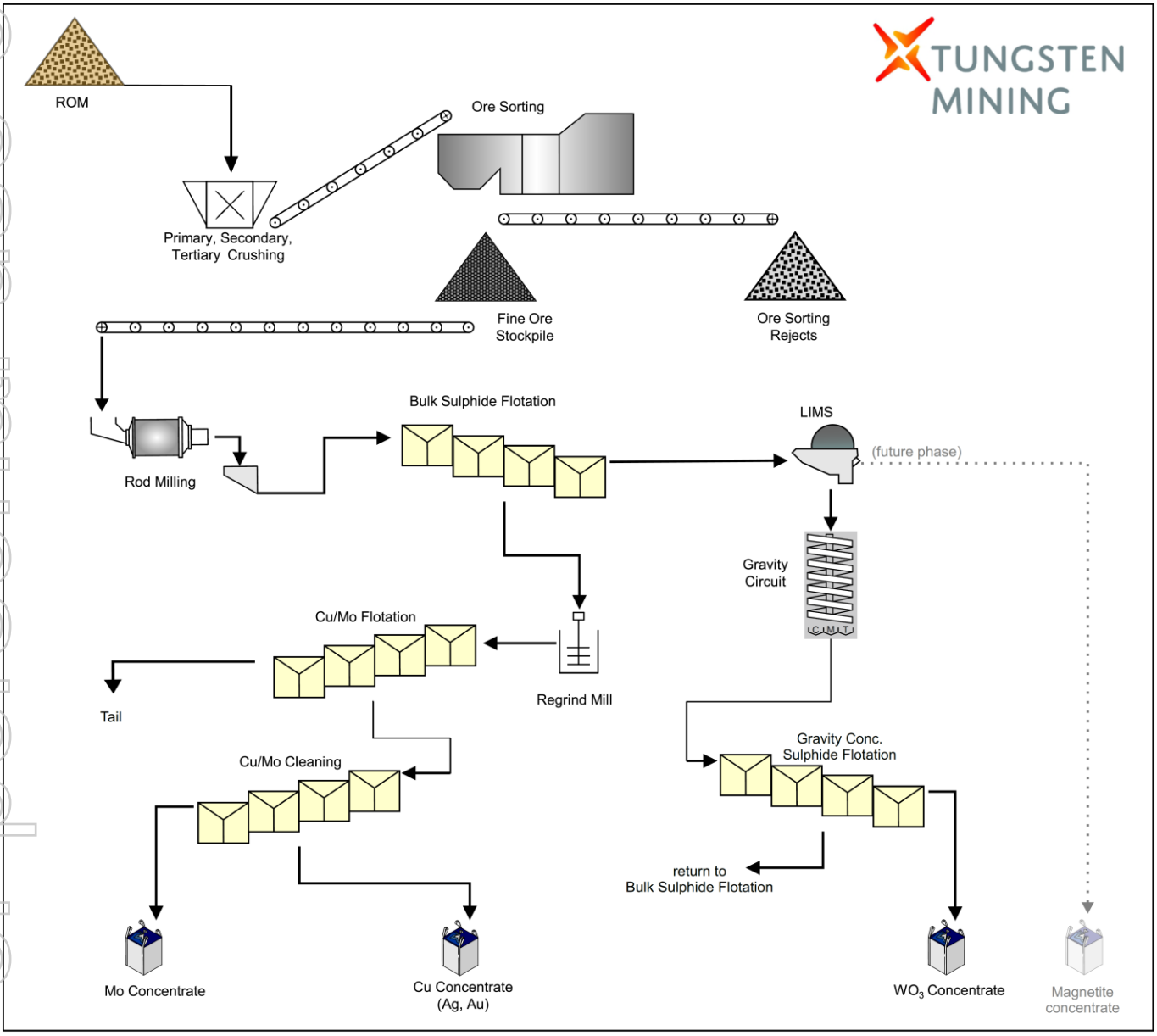


*Figure 2 – Base Case simplified flowsheet*

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### Mine Waste Management

Based on the available mining and processing data and the absence of geotechnical test work, the design of the TSF is considered conceptual. Further work including geotechnical testing and analysis, waste scheduling and water balance modelling is planned. The final design of the TSF will also depend upon the final process flowsheet and compliance with construction standards and environmental compliance.

Tailings will be stored in a single TSF, designed to hold a nominal 138Mt of tailings over the LOM including wet tailings from the concentrator and ore sorter reject material. The TSF is located to the south west of the currently proposed process plant site (see figure 3) and within ~2.5 km of the mining areas. Expansion of the embankments will be done in annual stages over the life of the mine using waste, direct tipped on the embankment as the primary embankment construction material. The design incorporates monitoring bores, piezometers and survey stations to ensure an adequate level of information is obtained on the performance of the embankment and drainage systems during operation. It is proposed that any potential acid forming (PAF) material identified in the waste will be encapsulated in the TSF walls. This will be dependent upon specific test work planned in the next phase of study.

### Power and Water Supply

A 30 MW base case installed power supply is proposed utilising an LNG plant located on site and deliveries of LNG fuel to site. The power station size is based on a maximum connected load of 23.2 MW which caters for the processing plant, the non-process infrastructure and the accommodation camp. The resultant number of generators required to supply the site equates to 10 x 2.5 MW units. An additional 2 x 2.5 MW generators have been included to allow for rolling reserve (i.e. ‘n+2’ redundancy).

The site power station has been located to be close to the processing plant which minimises distribution and optimises access for delivery and maintenance. A BOOT arrangement is the basis of the capital and operating cost estimates, with a buy-out (capital payment) recognised at the end of year 7.

Raw water supply quantities will suit the estimated raw water demands for processing, dust suppression, camp and other miscellaneous demands. For the base case, raw water make-up equates to approximately 1.6 GL/annum.

Given the local water sources in the Project vicinity are fractured bedrock aquifers and paleochannels, access to a sustainable supply of groundwater will likely be a combination of multiple offsite and onsite sources. Storage tanks will be used to store raw water onsite providing service to the potable water treatment plant, sewerage system, infrastructure requirements and all water activities including the processing plant.

Water supply is still under investigation with several options being considered for the bulk of the supply.

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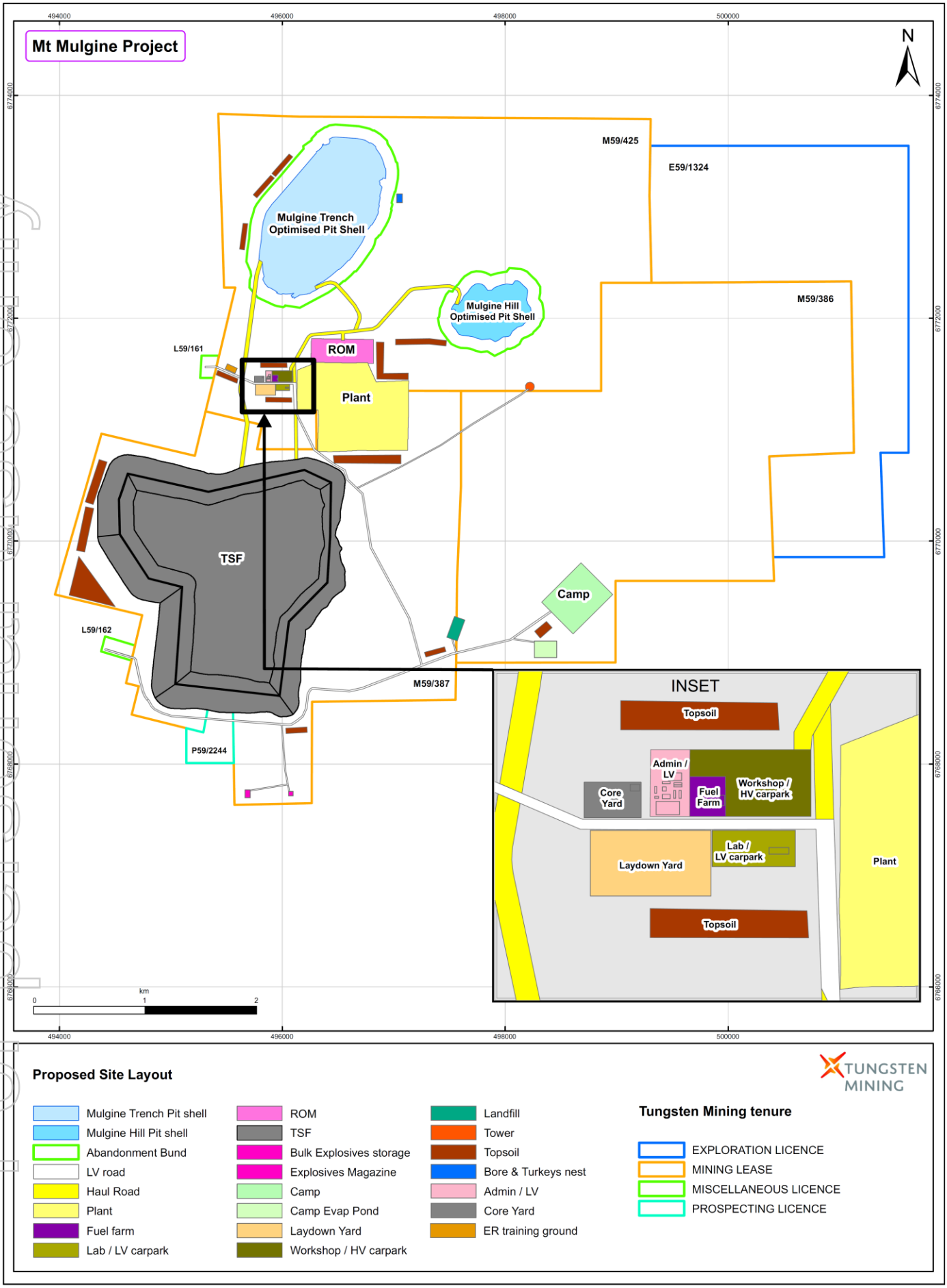


*Figure 3 – Project Layout*

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### Operating Philosophy

The Project will be a 24/7 365 days per year operation and operate as fly-in-fly-out from Perth. Given the Project's close proximity to Perth and major regional centres, a proportion of the workforce is expected to drive-in-drive-out. The accommodation camp is a dual purpose facility initially constructed to provide sufficient accommodation during the construction phase of the Project and reconfigured to provide permanent accommodation for operations. Total camp capacity is 600 during construction and 300 during operations.

### Transport of Concentrate

The transport of the various concentrates is not a major component of the overall Project. However, a logistics study will be included in subsequent study phases. It is anticipated that scheelite, copper and molybdenum concentrates will be trucked in containers (in bulka bags) from site via the Warriedar Coppermine Rd and Great Northern Hwy to Fremantle Port for export.

### Native Title and Heritage

There is no native title, or native title claims, in respect of the Project footprint area and largely, in respect to 99.86% of the land covered by the Mt Mulgine tenements. Widi Mob Native Title claim no. WC1997/072 covers a small portion (4.41 ha) of the south-western tip of mining lease M59/387 or 0.14% of the area of the Mt Mulgine tenements.

The Company liaises with the Badimia people in relation to heritage matters over the Project area. Since 2017, three archaeological and ethnographic surveys have been completed at Mt Mulgine with the Badimia people and Terra Rosa Consulting with the aim of identifying culturally sensitive areas or artefacts.

Further heritage surveys and consultation with the Badimia people and Widi Mob are anticipated in the next study phase to ensure all archaeological and ethnographic considerations within the wider Project area are recognised.

### Regulatory Approvals

TGN is committed to complying with legislation in relevant jurisdictions. This means developing relationships and maintaining communications with Government agencies to ensure appropriate environmental standards are set and maintained, developing appropriate approvals and reporting incidents or mandated statistics. The EPA has provided advice and recommendations on the regulatory pathway deemed the best fit for the development of the Mt Mulgine Tungsten Project.

During the PFS, multiple studies were completed to provide a comprehensive understanding of the environment. These included a detailed flora and vegetation survey, terrestrial and subterranean fauna survey, surface and groundwater studies and waste characterisation studies. These surveys and studies will assist the preparation of the required regulatory approvals documentation as the Project progresses. Surveys to date have not identified any threatened flora or fauna on the Mt Mulgine tenements. Prior to commencing operations, the Company will be required to obtain the necessary approvals, permits and licenses for the conduct of the proposed mining and mineral processing activities on site.

### Execution and Project Delivery Schedule

The capital cost estimate for the PFS has been developed assuming an Engineering, Procurement, Construction Management (EPCM) delivery model. Different execution models will be investigated in future study phases.

The execution strategy to deliver the Project to operational status has yet to be formalised, however it is likely that different strategies that best match the various phases of the development pathway will be implemented. The PFS assumes an indicative project timeline as set out in figure 4 below.

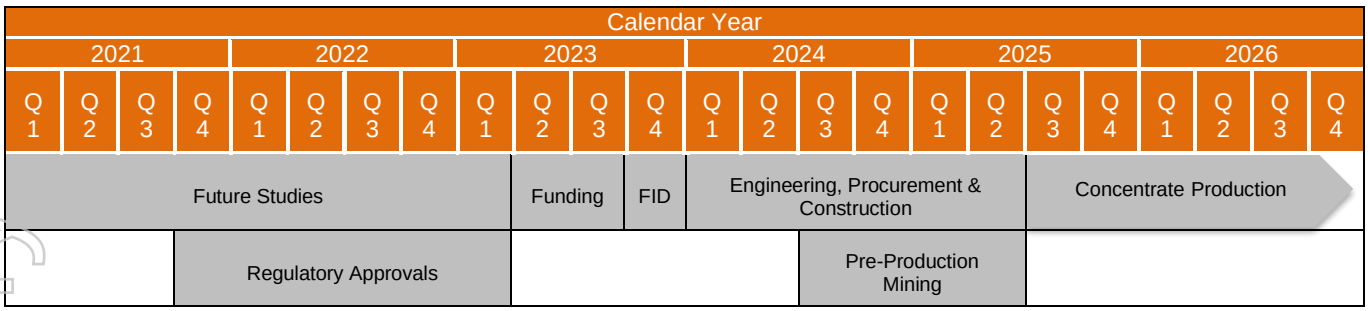


*Figure 4 – Indicative project timeline*

**Project Funding**

As set out in Table 2, the Project capital cost estimate is A$669m. Given both tungsten and molybdenum are recognised as "critical minerals", and having regard for the PFS results, there are reasonable grounds to believe that the Mt Mulgine Tungsten Project is capable of being financed in the future.

Given the large scale, long mine life and low production costs for a project located in a safe mining jurisdiction a combination of debt and equity will likely be utilised to fund the development of the project, with such arrangements related to either off-take, EPC construction arrangements, ECA (export credit) style finance or a combination of these. Such funding arrangements may be dilutive to, or otherwise affect the value of the Company's existing shares.

The Company could pursue other strategies to provide alternative funding options including undertaking a corporate transaction, seeking a joint venture partner or asset sales.

The Company is debt free and had cash reserves of $20.5m at 31 December 2020, which will enable the Company increase definition to the project and execution plan and to progress off-take and funding arrangements as planned.

**Risks**

Multiple risk workshops have been held to develop a risk management framework and a risk and control register aimed at the early identification, analysis and effective control of risks to ensure the achievement of project objectives, particularly through the course of the PFS.

From the list of risks identified, five were highlighted as priority and each assigned a set of controls aimed at reducing the residual risk rating to acceptable levels. These controls have either been implemented as part of the PFS, or planned as part of subsequent study phases, and in particular, security of water supply and level of metallurgical and process definition.

**Next Steps**

The Company will engage with potential off-take partners for tungsten concentrate, government and other industry participants to identify government support and financing opportunities supportive of project development and for partnering opportunities in conjunction with offtake engagement.

The Project focus will now be on critical path activities, in particular increasing the level of metallurgical and process definition and securing a long term water supply. Environmental surveys will continue to ensure the time required to meet the regulatory approval requirements is within the project development timeframe.

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## Compliance Statements

The information is this report that relates to Ore Reserves is based on information compiled by Ms Nicole Player, who is a Competent Person and a Member of the Australasian Institute of Mining and Metallurgy (AusIMM). Ms Player is a full time employee of the resource industry consultancy MineGeoTech Pty Ltd and has sufficient experience that is relevant to this 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 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Ms Player consents to the inclusion in the report of the matters based on her information in the form and context in which it appears.

The information in this report that relates to geology and Mineral Resources is based on, and fairly represents, information and supporting documentation compiled by Peter Bleakley, who is a Member of the Australasian Institute of Mining and Metallurgy. Mr Bleakley is a full-time employee of the Company. Mr Bleakley 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 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr Bleakley consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

The information in this announcement that relates to Metallurgy and Engineering Process design was compiled by Mr Mark Merry who is a Fellow of the Australasian Institute of Mining and Metallurgy. Mr Merry is a full time employee of the Company. Mr Merry has sufficient experience that is relevant to the style of mineralisation and proposed processing and to the activity currently being undertaken to qualify as a Competent Persons as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Mr Merry consents to the inclusion in this announcement of the matters based on his information in the form and context in which it appears.

## Previously Reported Information

This report includes information that relates to Mineral Resources and Ore Reserves which were prepared and first disclosed under JORC Code 2012. The information was extracted from the Company's previous ASX announcements as follows:

- Ore Reserves – "Maiden Ore Reserve Estimate – Mt Mulgine Project" 29 January 2021.
- Mulgine Trench Resource Update: "Update of Mineral Resource Estimate for Mulgine Trench Deposit" 4 May 2020
- Mulgine Hill Resource Update: "Update on Activities at Mount Mulgine" 12 April 2019

The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcement and, in the case of reporting Mineral Resources and Ore Reserves that all material assumptions and technical parameters underpinning the estimates in the relevant market announcements continue to apply and have not materially changed. The Company confirms that the form and context in which any Competent Persons findings are presented have not been materially modified from the original market announcement.

Copies of the announcements referred to above are available to view on the Company's website at www.tungstenmining.com.

## ASX Chapter 5 Compliance and PFS Cautionary Statement

The Company has concluded that it has a reasonable basis for providing the forward looking statements and forecast financial information included in this announcement. The detailed reasons for that conclusion are outlined throughout this announcement and all material assumptions including the JORC modifying factors, upon which the forecast financial information is based are disclosed in this announcement. This announcement has been prepared in accordance with JORC Code 2012 and the ASX Listing Rules.

The actual results could differ materially from a conclusion, forecast or projection in the forward-looking information. Certain modifying factors were applied in drawing a conclusion or making a forecast or projection as reflected in the forward looking and cautionary statements.

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The Mt Mulgine Tungsten Project is in the PFS phase and although reasonable care has been taken to ensure that the facts are accurate and/or that the opinions expressed are fair and reasonable, no reliance can be placed for any purpose whatsoever on the information contained in this document or on its completeness. Actual results and development of projects may differ materially from those expressed or implied by these forward looking statements depending on a variety of factors. A key conclusion of the PFS, which is based on forward looking statements, is that the Mt Mulgine Tungsten Project is considered to have positive economic potential.

A Probable Ore Reserve classified under JORC 2012 Guidelines was used for the PFS and all relevant details are set out in this announcement.

The Company believes it has a reasonable basis to expect to be able to fund and further develop the Mt Mulgine Tungsten Project. However, there is no certainty that the Company can raise funding when required.

**Forward Looking Statement**

Any statements, estimates, forecasts or projections with respect to the future performance of the Company and/or its subsidiaries contained in this announcement are based on subjective assumptions made by the Company's management and about circumstances and events that have not yet taken place. Such statements, estimates, forecasts and projections involve significant elements of subjective judgement and analysis which, whilst reasonably formulated, cannot be guaranteed to occur. Accordingly, no representations are made by the Company or its affiliates, subsidiaries, directors, officers, agents, advisers or employees as to the accuracy of such information; such statements, estimates, forecasts and projections should not be relied upon as indicative of future value or as a guaranteed of value or future results; and there can be no assurance that the projected results will be achieved.

-ENDS-

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*This ASX announcement was authorised for release by the Board of Tungsten Mining NL*

# About Tungsten Mining

Australian tungsten developer, Tungsten Mining NL is an Australian based resources company listed on the Australian Securities Exchange. The Company's prime focus is the exploration and development of tungsten projects in Australia.

Tungsten (chemical symbol W), occurs naturally on Earth, not in its pure form but as a constituent of other minerals, only two of which support commercial extraction and processing - wolframite ((Fe, Mn) $WO_4$) and scheelite ($CaWO_4$).

Tungsten has the highest melting point of all elements except carbon – around 3400°C giving it excellent high temperature mechanical properties and the lowest expansion coefficient of all metals. Tungsten is a metal of considerable strategic importance, essential to modern industrial development (across aerospace and defence, electronics, automotive, extractive and construction sectors) with uses in cemented carbides, high-speed steels and super alloys, tungsten mill products and chemicals.

Through exploration and acquisition, the Company has established a globally significant tungsten resource inventory in its portfolio of advanced mineral projects across Australia. This provides the platform for the Company to become a major player within the global primary tungsten market through the development of low-cost tungsten concentrate production.

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