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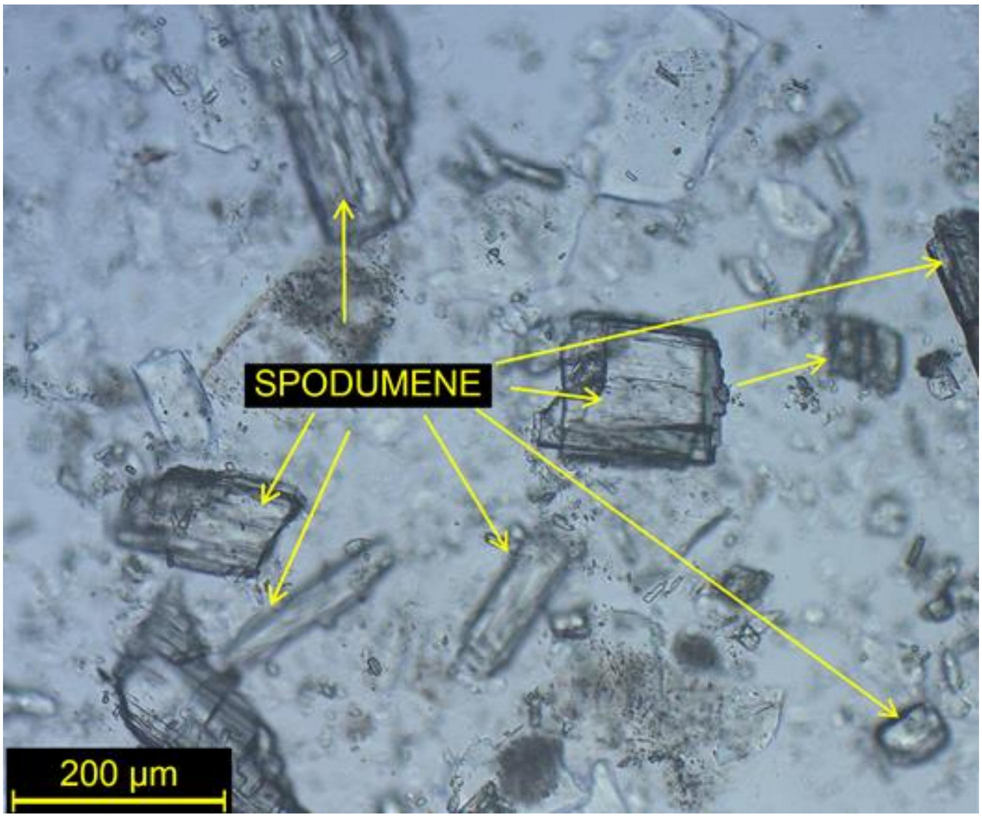
Ardiden Ltd (ADV)

Seymour Lake Lithium Project

Phase 2 Metallurgical Testwork

Project 5875

December 2017



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1 EXECUTIVE SUMMARY

Independent Metallurgical Operations Pty Ltd (IMO) was requested by Mr Brad Boyle of **Ardiden Ltd** to conduct initial process flowsheet development metallurgical testwork with the aim of producing a saleable Spodumene concentrate from the Seymour Lake Lithium Project. This report summarises the phase two metallurgical testwork program.

The Master Composite underwent:

1. Stage Crushing to minimise the generation of fines;
2. Chemical characterisation;
3. Optical mineralogy to determine liberation characteristics.
4. Size by size assay analysis to determine lithium and gangue deportments;
5. Heavy Liquid Separation (HLS) of coarser particles assess the liberation characteristics;
6. Dense Media Separation (DMS) at optimum conditions determined by HLS testwork;
7. DMS fines reject (-0.5 mm) Spodumene flotation.

1.1 Composite Head Assays and Mineralogy

Summarised head analysis results for the Seymour Lake Master Composite are presented in ***Table 1***.

Table 1: Seymour Lake Master Composite Head Assays

Analyte	Li_2O	BeO	Ta_2O_5	LOI_{1000}	SiO_2	Fe_2O_3	Al_2O_3	Nb_2O_5
Unit	%	ppm	ppm	%	%	%	%	ppm
Master Composite	2.59	601	225	0.67	71.80	0.82	16.1	176

Optical XRD analysis shows that the majority the lithium is present as Spodumene and is predominantly liberated with crystals up to 10 mm. Primary contaminants within Spodumene composites were quartz and muscovite occurring as inclusions within the Spodumene with the mica usually following the mica cleavage. Further analysis of the mica by laser ablation showed that the mica analysed contained an average Li_2O content of 0.7% and Rb content of 1.2%. IMO notes that the that the mica contains lepidolite characteristics however notes that the low Li_2O grade of 0.7% is less than lepidolite, which typically contains 1.2-5.9% Li_2O.

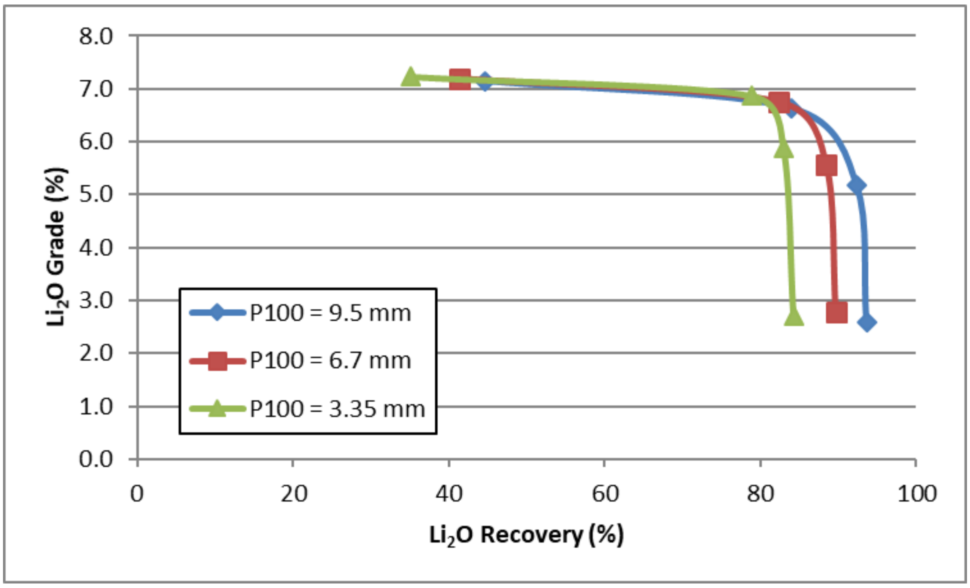
1.2 Heavy Liquid Separation Testwork

HLS testing conducted on the +0.5 mm fraction from crush sizes ranging between 9.5 mm to 3.35 mm resulted in maximum Li_2O concentrate grades consistently between 7.1 - 7.2% at Li_2O recoveries between 35.1% and 44.7% across all feed size distributions in the >3.10 density fraction. When combined with the SG >2.96, the Li_2O grade in the IMO deemed optimum grind size of 9.5 mm dropped to 6.62% however Li_2O recovery increased to 84.0%.

HLS testwork is conducted on +0.5 mm (-0.5 mm material screened out) as the commercial dense media separation (DMS) process which HLS is used to optimise conditions for is only suitable on material >0.5 mm.

The Li_2O grade recovery curves from the HLS testwork conducted at various grind sizes are shown in ***Figure 1***. The curves show that as grind size decreases the Li_2O lost to the -0.5mm fraction increases.

Figure 1: +0.5 mm HLS Li_2O Grade Recovery Curves



1.3 Dense Media Separation Testwork

A DMS concentrate with a Li_2O grade of 6.0% and Li_2O recovery of 90.8% was achieved (***Table 2***) utilising a two stage DMS operation. Only minimal Li_2O was lost to the DMS rejects / floats (1.9%) with a further 7.3% of the overall Li_2O reporting to the -0.5 mm fraction.

DMS was conducted in two stages as the optimum initial crush size (9.5 mm) determined from the HLS testwork was deemed to coarse for the pilot DMS cyclone unit as coarse Spodumene misreported to cyclone rejects (floats or OF) stream. The stage 1 DMS floats was stage crushed to 3.35 mm with the +0.5 mm material repassed through the DMS cyclone unit.

Mica observed in the Stage 2 (-3.35 mm) DMS concentrate, analysed by laser ablation determined that significant amounts of Rubidium were present.

Table 2: +0.5 mm Dense Media Separation Testwork Summary

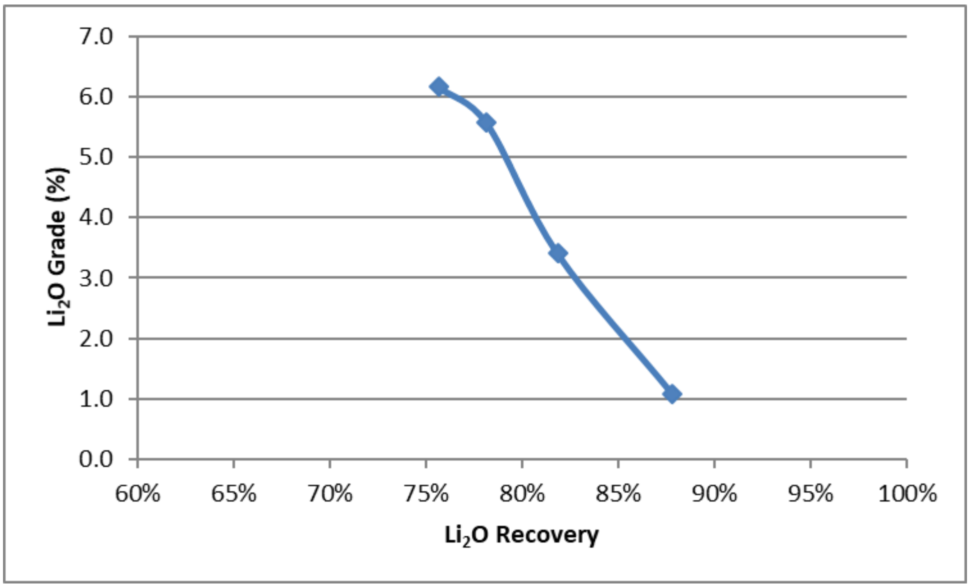
Stream	Mass	Li_2O	
	%	%	% Rec.
-9.5mm DMS Sinks (+2.80 Sg)	31.3	6.4	75.2
-3.35mm DMS Sinks (+2.80 Sg)	9.4	4.4	15.6
Total DMS Sinks (+2.80 Sg)	**40.7**	**6.0**	**90.8**
-9.5mm DMS Feed: -0.5mm Fraction	7.9	1.4	4.3
-9.5mm DMS Floats (-2.80 Sg): -0.5mm Fraction	11.2	0.7	3.1
Total DMS: -0.5mm Fraction	**19.1**	**1.0**	**7.3**
-3.35mm DMS Floats (-2.80 Sg)	**40.1**	**0.1**	**1.9**
Total -0.5mm and -3.35mm Floats (-2.80 Sg)	59.3	0.4	**9.2**
Calculated Head	**100.0**	**2.7**	**100.0**
Assay Head		**2.6**	

1.4 -0.5 mm Flotation Testwork

Open circuit flotation testwork was performed on the -0.5mm material too fine for upgrading by DMS. The -0.5mm material was further stage ground to a P_{100} = 150 µm prior to being deslimed to remove the majority of -20 µm material (12.2% Li_2O lost to) which is known to interfere with Spodumene upgrade by flotation. A final concentrate grade of 6.2% Li_2O was achieved at a 75.7% Li_2O recovery. Approximately 70% of the Ta_2O_5 was recovered achieving a grade of 1,100 ppm. All recoveries quoted are as a percentage of the -0.5mm fraction.

Flotation Li_2O grade recovery curve is shown in ***Figure 2***.

Figure 2: -0.5 mm Flotation Li_2O Grade Recovery Curve



1.5 Observations and Conclusions

Based on analysis of all testwork phases conducted during the Phase 2 Flowsheet Development Testwork program, IMO presents the following conclusions:

- Size by size assay analysis of the crushed (P_{100} 9.5 mm) Master Composite indicate that upgrading by size is not a viable option as similar distributions for mass and Li_2O resulted;
- Based on heavy liquid testwork, reducing the liberation size below P_{100} = 9.5 mm resulted in minimal improvement in Li_2O grade but a significant reduction in Li_2O recovery;
- A coarse liberation size (P_{100} 9.5 mm) resulted in concentrate grades of 6.0% Li_2O at a recovery of 90.8% based on dense media separation at an SG of 2.8;
- Flotation of the -0.5 mm size fraction produced at a concentrate containing 6.2% Li_2O at an open-circuit recovery of 75.7%;
- The main contaminant of the DMS concentrate was mica. This mineral was also found to contain Rubidium at grades of 1.2%.

1.6 Recommendations

IMO presents the following recommendations for further flowsheet development and verification:

- IMO recommends reanalysing the DMS products for rubidium to determine if it's contained within any of the other minerals in the deposit and how it's distributed throughout the beneficiation process;
- Undertake comminution characterisation testwork shown below on representative drill core intervals from various zones to enable comminution circuit design and costing:
    - SAG Mill Comminution (SMC);
    - Bond Ball Mill Work Index Testing.
- Perform HLS testwork at a range of coarser crush sizes to determine Spodumene liberation top size and maximum DMS operation top size;
- Perform HLS variability testwork across different Li_2O grades, lithology and weathering zones across the ore deposit to enable process plant modelling and expected performance;
- Perform bulk DMS pilot testwork using a cyclone suitable for the optimum top size to generate a bulk concentrate suitable for marketing, downstream testwork and to provide information for process plant design;
- Conduct further flotation optimisation testwork on the -0.5mm material to improve both Li_2O grade and recovery;
- Conduct locked cycle flotation testwork to confirm Li_2O recoveries and effects of recycle stream on final concentrate Li_2O grades;
- Conduct pilot flotation testwork to confirm scale up factors, confirm effects of continual recycling of intermediate streams and provide material for downstream testwork, marketing and process plant design;
- Perform further testwork to investigate mica rejection and the opportunity to produce a Rubidium by-product;
- Perform downstream testwork to confirm Ardiden's final DMS and flotation Spodumene concentrates are suitable for producing battery grade lithium carbonate (Li_2CO_3) or lithium hydroxide (LiOH) products;
- Based on the outcomes of this testwork, IMO can provide a Process Design Package (consisting of process design criteria, flowsheets and mass balance) as a component of a future Conceptual or Pre-feasibility Study.

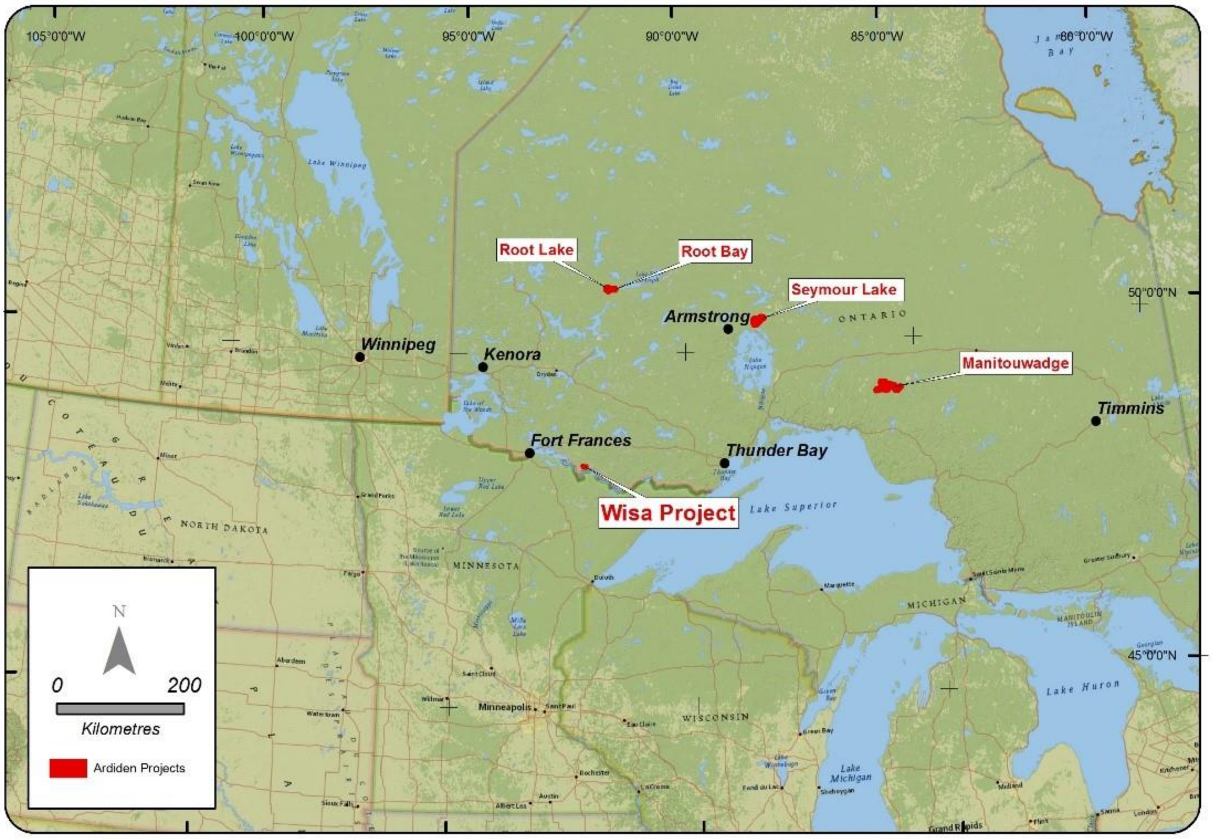
2 INTRODUCTION

Independent Metallurgical Operations Pty Ltd (IMO) was requested by Mr Brad Boyle of **Ardiden Ltd** to conduct initial process flowsheet development metallurgical testwork with the aim of producing a saleable Spodumene concentrate from the Seymour Lake Lithium Project Spodumene concentrate from the Seymour Lake Lithium Project. This report summarises the phase two metallurgical testwork program.

The Seymour Lake Project is located approximately 50km North East of Armstrong in Ontario, Canada.

The location of the Seymour Lake Project is shown in ***Figure 3***.

Figure 3: Seymour Lake Lithium Project Location



3 SCOPE OF WORK

3.1 Testwork Management

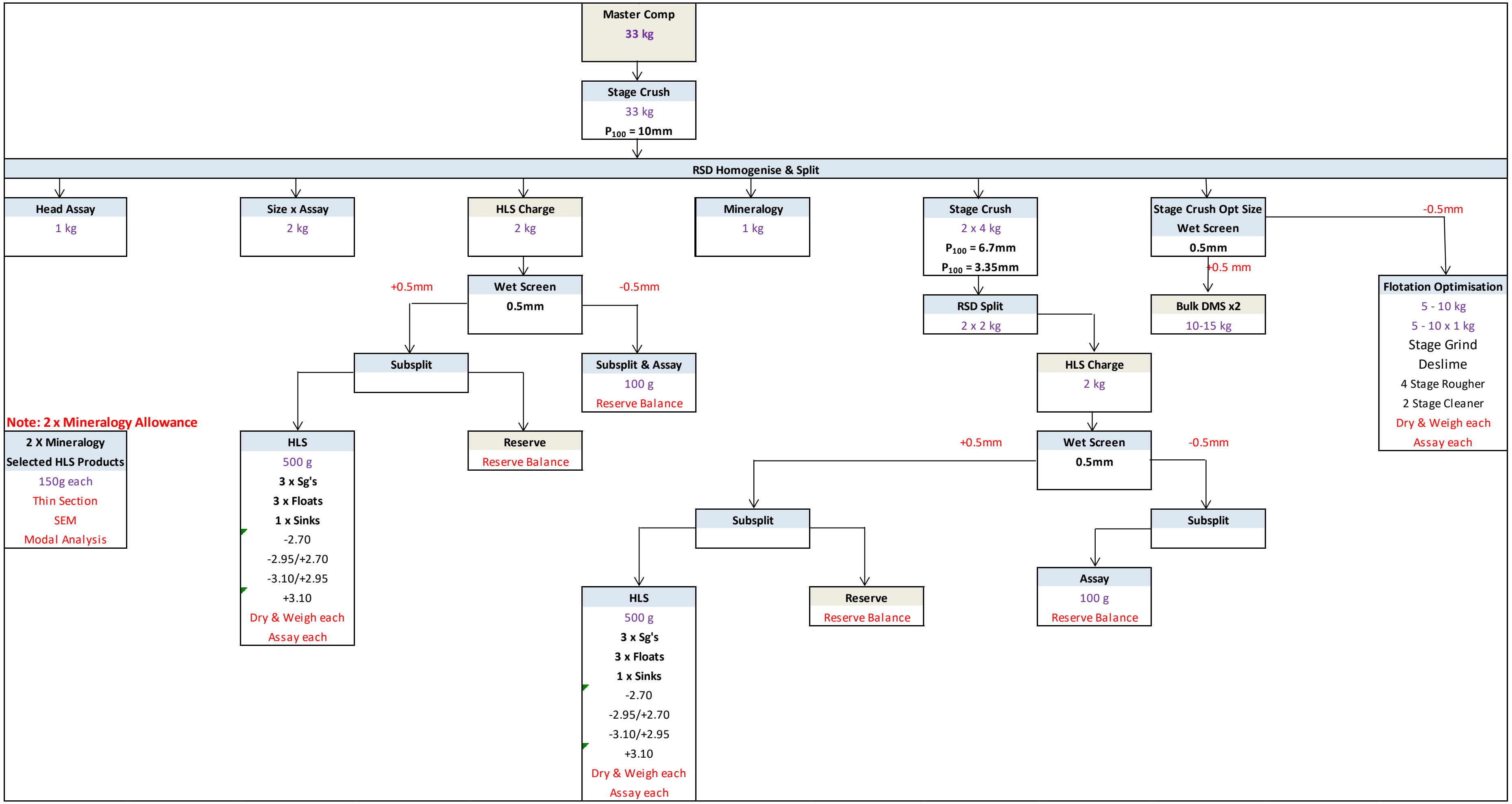
IMO's experience in Spodumene specific process flowsheet development, testwork management and product characterisation has provided IMO with the understanding required for the metallurgical investigation into the generation of a saleable Spodumene concentrate.

Key components of this stage include:

1. Stage Crushing at a coarse grind size of 9.5 mm to minimise the generation of fines;
2. Master Composite chemical characterisation;
3. Optical mineralogy on a crushed product to determine Spodumene liberation characteristics;
4. Mica analysis by laser ablation to determine composition;
5. Crushed composite size by size assay analysis to determine lithium and gangue deportments;
6. Heavy Liquid Separation (HLS) at a range of crush sizes (9.5, 6.7 and 3.35 mm) on +0.5 mm material to assess the Spodumene liberation characteristics;
7. Bulk dense media separation (DMS) to confirm HLS optimum conditions;
8. Size by size assay analysis of DMS Stage 2 Concentrate;
9. Flotation of the -0.5 mm fraction to determine fine Spodumene production potential.

A preliminary testwork flowsheet is shown in ***Figure 4.***

Figure 4: Spodumene Flowsheet Development Testwork Program



4 TESTWORK RESULTS AND ANALYSIS

4.1 Sample Receipt, Preparation and Composite Head Assays

Samples were received at Metallurgy on the 14th February 2017 from Ardiden as pre-selected half HQ Core. Individual sample ID's and masses are shown in ***Table 3***.

Table 3: Seymour Lake Master Composite Sample Information

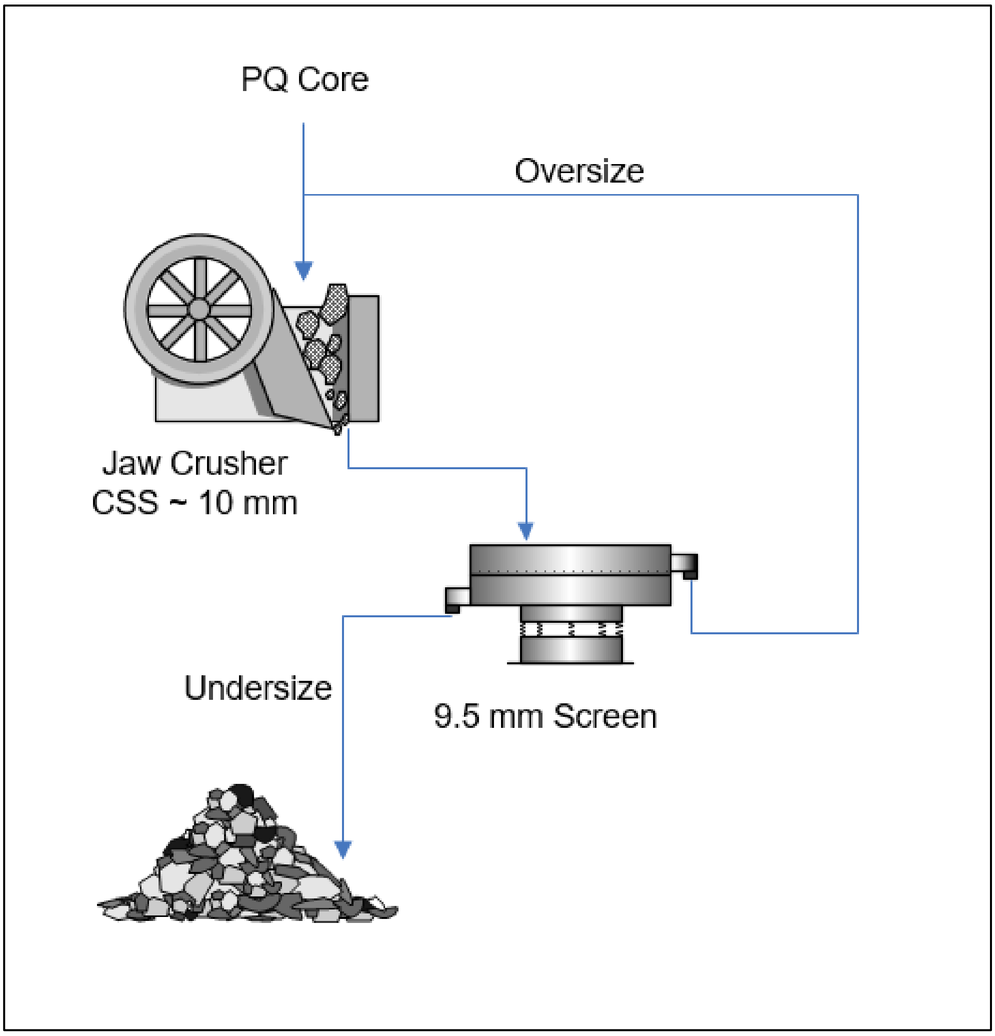
Sample ID	Bag #	Sample Mass kg
SL-09-33 Seymour Lake	1 of 3	4.24
SL-09-33 Seymour Lake	2 of 3	4.57
SL-09-33 Seymour Lake	3 of 3	5.73
SL-09-27A Seymour Lake	1 of 1	4.23
SL-09-45	1 of 3	4.79
SL-09-45	2 of 3	5.05
SL-09-45	3 of 3	4.95
Total		**33.55**

These composites were combined in their entirety and stage crushed to < 9.5 mm by initially conducting a coarse crush using a jaw crusher with a Close Size Setting (CSS) of approximately 10 mm. The crushed material was then screened at 9.5 mm with the oversize crushed by re- feeding the same jaw crusher. This final stage was repeated until all material was below 9.5 mm.

The stage crushing process is shown in ***Figure 5***. Stage crushing aims to minimise the generation of fines, resulting in higher yields to coarse beneficiation. At the conclusion of the stage crushing process the Seymour Lake Master Composite was blended prior to splitting for head assay and downstream testing.

Separate sub-samples were further stage crushed to a P_{100} of 6.7 and 3.35 mm using a similar methodology as described above.

Figure 5: Stage Crushing Process Flowsheet



The head assay was completed by Intertek Group PLC (Intertek) for peroxide fusion and 4 acid digest followed by ICP-OES+MS finish. LOI_{1000} was conducted by thermo gravimetric analysis. Summarised head analysis results for the Seymour Lake Master Composite are presented in ***Table 4***. Complete assays are presented in ***APPENDIX B***.

Table 4: Seymour Lake Master Composite Head Assays

Analyte	Li_2O	BeO	Ta_2O_5	LOI_{1000}	SiO_2	Fe_2O_3	Al_2O_3	Nb_2O_5
Unit	**%**	**ppm**	**ppm**	**%**	**%**	**%**	**%**	**ppm**
Master Composite	2.59	601	225	0.67	71.80	0.82	16.1	176

4.2 Mineralogy

A sub-sample of the Master Composite was submitted for optical XRD mineralogy to Townend Mineralogy Laboratory (Townend). Mineralogy was conducted on the as received Master Composite and on a SG>2.96 kg/L sub-sample (labelled as Sinks) which was separated using a heavy liquid.

The analysis concluded that the majority of the lithium is present as Spodumene and was predominantly liberated with crystals up to 10 mm. The main contaminants of the sinks Spodumene composites were quartz and muscovite occurring as inclusions within the Spodumene with the mica usually following the mica cleavage. There is evidence that lithium also occurs in mica with further analysis conducted by laser ablation detailed below to confirm the lithium content within the mica.

A summary of the X-Ray Diffraction (XRD) analysis is shown in ***Table 5***.

Table 5: Master Composite XRD Analysis

Mineral	Head (%)	Sinks (%)
Plagioclase	25	
Quartz	30	8
K Feldspar	5-10	
Mica	5-10	2
Spodumene	25	90
Apatite	1	
Rutile	<0.5	

Optical images of liberated Spodumene Sinks and a composite Spodumene particle from the Head Sample are respectively shown in ***Figure 6*** and ***Figure 7.***

Figure 6: Optical Image – Spodumene Sinks

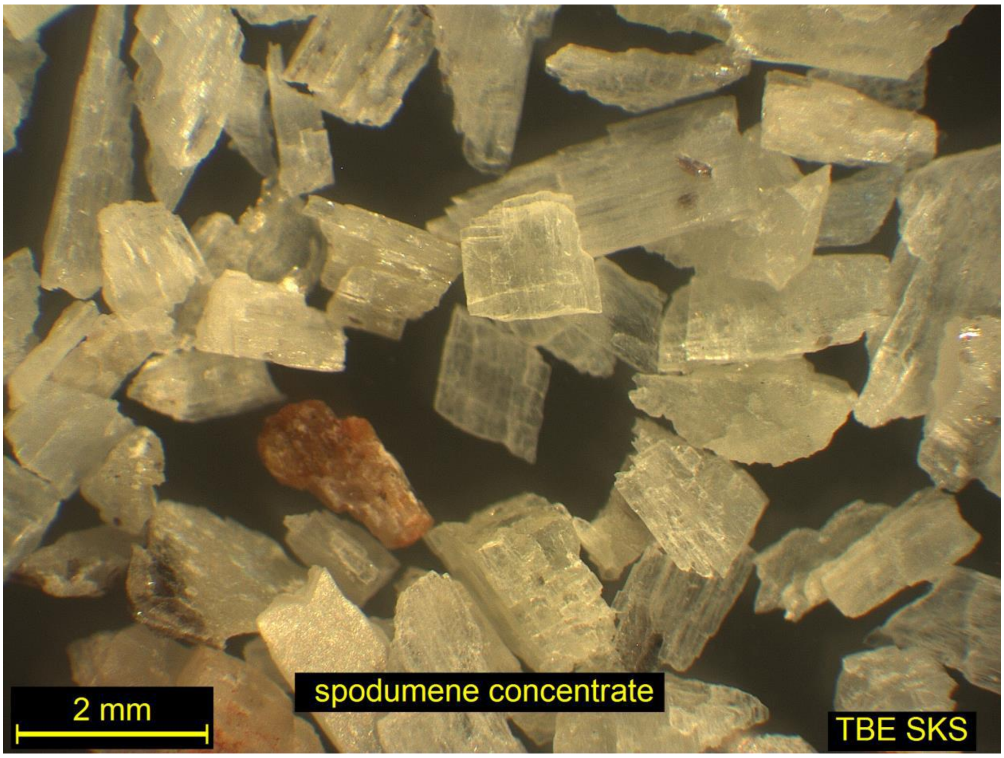
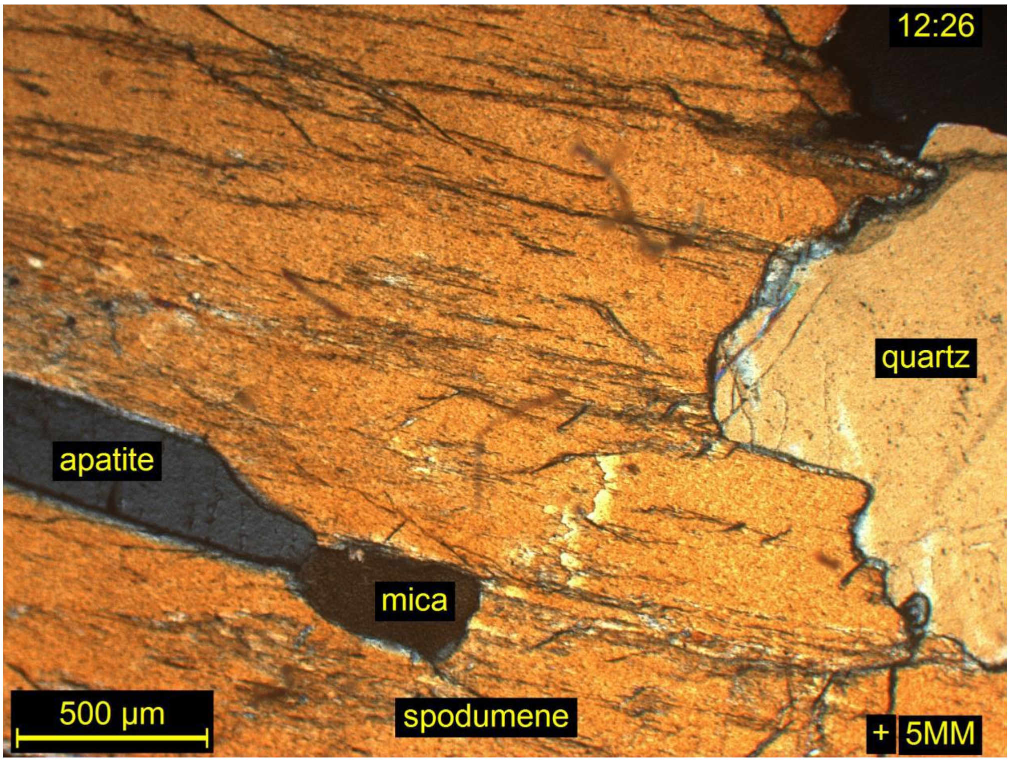


Figure 7: Optical Image – Spodumene Composite



Laser ablation was conducted by Bureau Veritas on mica samples selected from various size fractions from the –3.35 mm Stage 2 DMS cyclone UF / concentrate (***Section 4.4.3***) and analysed by laser ablation to determine the lithium content and mineral classification.

Results from the laser ablation analysis of the various size fractions along with a statistical analysis are shown in ***Table 6***. Based on high Al_2O_3 and SiO_2 and low Fe_2O_3 concentrations, IMO has concluded that the mica contains lepidolite characteristics however notes that the low Li_2O grade of 0.7% is less than lepidolite, which typically contains 1.2-5.9% Li_2O.

IMO notes the micas contain an average Fe_2O_3 equivalent content of 2.4% which IMO believes has primarily contributed to the colour of the mica, see ***Figure 8***. IMO also notes that the micas also contain a high portion of rubidium (1.2% Rb) which IMO believes warrants further investigation to determine if a saleable rubidium product can be economically produced. IMO recommends reanalysing the DMS products for rubidium to determine if it's contained within any of the other minerals in the deposit and how it's distributed throughout the beneficiation process.

Table 6: -3.35 mm Stage 2 DMS Sinks Mica Laser Ablation Results

Sample	Li_2O	Fe_2O_3	SiO_2	Al_2O_3	Ta_2O_5	Rb
Average Mica +3.35 mm	0.7	2.57	46.7	36.9	117	1.0
Average Mica +2.8 mm	0.8	2.46	46.9	36.5	139	1.2
Average Mica +2.36 mm	0.7	2.46	46.1	37.7	134	1.2
Average Mica -2.36 mm	0.7	2.26	46.3	37.6	120	1.3
Average Mica	**0.7**	**2.44**	**46.5**	**37.2**	**127**	**1.2**
Minimum	**0.7**	**2.26**	**46.1**	**36.5**	**117**	**1.0**
Maximum	**0.8**	**2.57**	**46.9**	**37.7**	**139**	**1.3**
Std Dev.	**0.05**	**0.13**	**0.37**	**0.58**	**11**	**0.09**
Std Dev. % From Avg	**6.8%**	**5.4%**	**0.8%**	**1.6%**	**8.4%**	**8.1%**

Figure 8: +3.35 mm DMS Stage 2 Underflow Mica Minerals

Mineralogy and laser ablation results can be found in *Error! Reference source not found.***.**

4.3 Size by Assay

Size by size assay analysis was conducted on a sub sample of the stage crushed (<9.5 mm) Master Composite to determine oxide distribution by size and if the sample was amenable to pre-beneficiation by size.

Figure 9 presents the upgrade ratio for select analytes. Marginal increases in Li_2O grades in the coarser size fractions were observed, depicted by an increasing difference between the column heights. The finer size fractions showed an increase in tantalum (Ta_2O_5) and iron (Fe_2O_3) grades.

Figure 9: Feed (P_{100} = 9.5 mm) Upgrade Ratio by Size Distribution

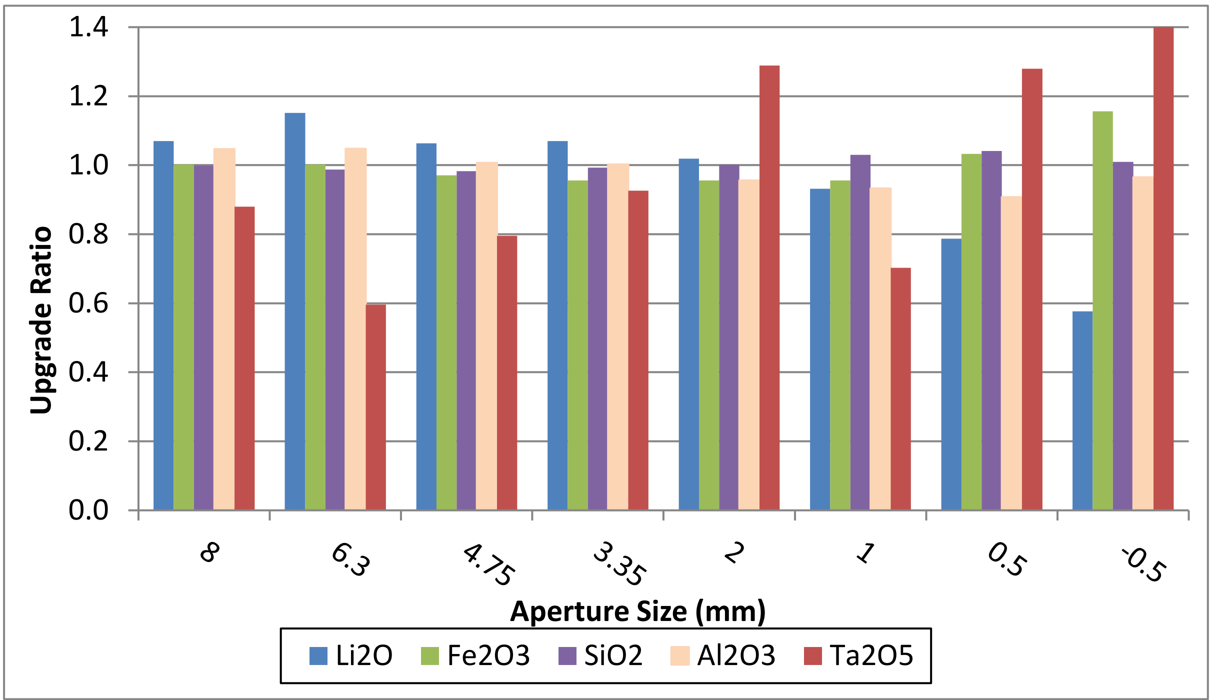


Table 7 presents summarised results for the size by size analysis. Distributions for the analytes presented below indicate that upgrading by size is not a viable option as observed by similar distributions for mass and Li_2O.

Table 7: Summarised Feed (P_{100} = 9.5 mm) Size by Size Assay Results

Screen Size	Mass	Li_2O		Fe_2O_3		Al_2O_3		Ta_2O_5		SiO_2	
µm	%	%	Dist'n	%	Dist'n	%	Dist'n	ppm	Dist'n	%	Dist'n
8.0	20.55	2.7	22.0	0.65	20.6	17.1	21.5	122	18.1	73.6	20.5
6.0	16.95	2.9	19.5	0.65	17.0	17.1	17.8	83	10.1	72.8	16.7
4.75	15.91	2.7	16.9	0.63	15.5	16.4	16.0	110	12.7	72.4	15.6
3.35	11.90	2.7	12.7	0.62	11.4	16.4	11.9	128	11.0	73.2	11.8
2.0	10.36	2.6	10.6	0.62	9.9	15.6	9.9	179	13.4	73.8	10.4
1.0	8.81	2.4	8.2	0.62	8.4	15.2	8.2	97	6.2	75.9	9.1
0.5	5.35	2.0	4.2	0.67	5.5	14.8	4.9	177	6.8	76.7	5.6
-0.5	10.17	1.5	5.9	0.75	11.8	15.8	9.8	296	21.7	74.4	10.3
Calc Head	**100**	**2.5**	**100**	**0.65**	**100**	**16.3**	**100**	**138**	**100**	**73.7**	**100**

4.4 Beneficiation Testwork

Stage crushed sub-samples of the Master Composite at P_{100} values of 9.5, 6.7 and 3.35 mm were initially wet screened at 0.5 mm with the +0.5 mm component subjected to heavy liquid separation (HLS) testwork. Wet Screening mass and Li_2O distributions are shown in ***Table 8***.

Only the +0.5 mm fraction underwent HLS separation as this is the practical size limit for commercial separation by DMS.

4.4.1 0.5 mm Wet Screen Results

All samples were wet screened at 0.5 mm resulting in the mass distribution presented in ***Table 8***. IMO have noted that the Li_2O grade of the +0.5 mm fraction marginally increased and the -0.5 mm fraction significantly decreased.

Table 8: 0.5 mm Screen Mass and Li_2O Distribution

Screen	P_{100} = 9.5 mm			P_{100} = 6.7 mm			P_{100} = 3.35 mm		
mm	Mass %	Li_2O		Mass %	Li_2O		Mass %	Li_2O	
		%	Dist.		%	Dist.		%	Dist.
+0.5	89.1	2.60	93.6	84.4	2.77	89.7	77.8	2.71	84.2
-0.5	10.9	1.44	6.37	15.6	1.73	10.3	22.2	1.77	15.8
Calc Head	**100.0**	**2.47**	**100.0**	**100.0**	**2.66**	**100.0**	**100.0**	**2.61**	**100.0**

4.4.2 +0.5 mm Heavy Liquid Separation

The +0.5 mm fraction was sub sub-sampled and submitted for HLS at liquid densities of 2.70, 2.96 and 3.10.

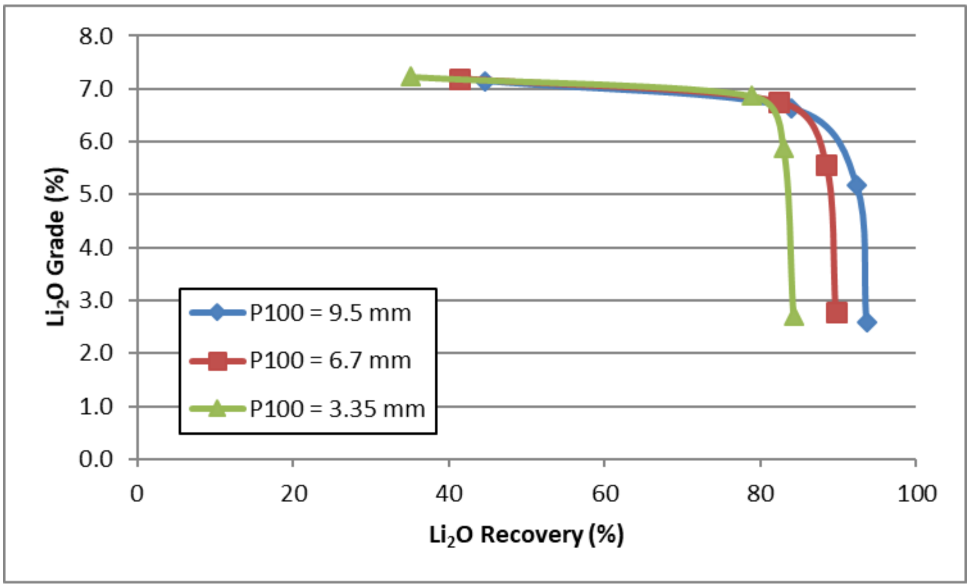
Li_2O assays and recoveries for individual density fractions are shown in ***Table 9***. Results indicate a Li_2O concentrate grades were consistently between 7.1 - 7.2% across all feed size distributions in the >3.10 density fraction. However, Li_2O recovery decreases in this fraction from 44.7% to 35.1% as the grind size decreases. Optimum results were achieved at a crush size (P_{100}) of 9.5 mm at an SG >2.96 with a respective Li_2O grade and overall (including the -0.5 mm fraction) recovery of 6.62% and 84.0%.

HLS grade recovery curves at various crush sizes are shown in ***Figure 10***. Li_2O recovery differs most after screening however Li_2O recoveries at the optimum HLS SG of 2.96 are less pronounced.

Table 9: +0.5 mm Heavy Liquid Separation Results

Stream	P_{100} = 9.5 mm			P_{100} = 6.7 mm			P_{100} = 3.35 mm		
	Mass %	Li_2O		Mass %	Li_2O		Mass %	Li_2O	
		%	Dist.		%	Dist.		%	Dist.
+0.5 mm SG>3.10	15.5	7.14	44.7	15.0	7.19	41.3	12.1	7.23	35.1
+0.5mm SG>2.96	31.3	6.62	84.0	31.8	6.75	82.4	28.8	6.87	78.9
+0.5 mm SG>2.70	44.1	5.17	92.4	41.5	5.56	88.4	35.3	5.88	83.0
+0.5 mm Combined	89.1	2.60	93.6	84.4	2.77	89.7	77.8	2.71	84.2
Total Feed	100.0	2.47	100.0	100.0	2.61	100.0	100.0	2.50	100.0

Figure 10: Heavy Liquid Separation Li_2O Grade Recovery Curves



Heavy liquid results for other key elements are shown in ***Table 10***. Gangue grade and recovery is consistent across all feed size distributions. Ta_2O_5 recovery was considerably lower at a P_{100} = 6.7 mm compared to the other feed size distributions which IMO has concluded is due to experimental limitations rather than differences in mineral liberation.

Table 10: Cumulative +0.5 mm Metal Oxide (Excluding Li_2O) Heavy Liquid Separation Results

P_{100} = 9.5 mm									
SG	**Mass**	**Fe_2O_3**		**SiO_2**		**Al_2O_3**		**Ta_2O_5**	
Fraction	**Dist'n**	**%**	**Dist'n**	**%**	**Dist'n**	**%**	**Dist'n**	**ppm**	**Dist'n**
Feed		0.89		70.5		16.8		128	
>3.10	15.5	1.39	27.2	61.9	15.3	25.4	26.3	160	21.6
>2.96	31.3	1.40	55.5	62.3	31.1	24.5	51.2	125	34.2
>2.70	44.1	1.41	78.4	62.8	44.2	23.0	67.9	162	62.4
P_{100} = 6.7 mm									
SG	**Mass**	**Fe_2O_3**		**SiO_2**		**Al_2O_3**		**Ta_2O_5**	
Fraction	**Dist'n**	**%**	**Dist'n**	**%**	**Dist'n**	**%**	**Dist'n**	**ppm**	**Dist'n**
Feed		0.92		71.0		17.3		112	
>3.10	15.0	1.61	31.2	62.0	15.5	25.6	26.3	47	7.4
>2.96	31.8	1.51	62.1	62.5	33.2	25.0	54.5	56	18.9
>2.70	41.5	1.53	81.7	62.4	43.2	24.0	68.2	91	40.1
P_{100} = 3.35 mm									
SG	**Mass**	**Fe_2O_3**		**SiO_2**		**Al_2O_3**		**Ta_2O_5**	
Fraction	**Dist'n**	**%**	**Dist'n**	**%**	**Dist'n**	**%**	**Dist'n**	**ppm**	**Dist'n**
Feed		0.90		72.3		16.8		105	
>3.10	12.1	1.60	27.8	61.7	13.3	25.4	23.6	180	26.7
>2.96	28.8	1.47	60.5	62.5	32.0	25.2	55.5	134	46.9
>2.70	35.3	1.55	78.7	61.6	38.7	24.7	66.8	180	77.5

4.4.3 +0.5 mm Dense Media Separation

Based on the results of the heavy liquid separation testwork, DMS testwork was performed at an SG value of 2.8 with a cyclone at Diamond Recovery Services Pty Ltd.

The testwork was performed in two stages with the ore initially crushed to 9.5 mm and screened at 0.5 mm to remove the fines unsuitable for DMS. During the initial DMS test, IMO observed that a significant portion of Spodumene was misreporting into the cyclone overflow (OF).

The cyclone OF from the first stage was then stage crushed to 3.35 mm and the -0.5 mm size fraction again removed. The -3.35 +0.5 mm material was re-treated in the DMS cyclone at an SG value of 2.8. The two-stage treatment was necessary due to short-circuiting of coarse Spodumene to the OF in the first stage due to size limitation of the pilot cyclone.

A summary of grades and recoveries from the DMS testwork is respectively shown in ***Table 11*** and ***Table 12***.

A combined stage 1 and 2 DMS concentrate with a Li_2O grade 6.0% was achieved at a Li_2O recovery of 90.8%. The stage 1 DMS concentrate contained a Li_2O grade of 6.4% however a Li_2O recovery of only 75.4% was achieved. The stage 2 DMS concentrate Li_2O grade significantly reduced to 4.4% and visually contained a high portion of mica.

Stage 1 Li_2O lost to the -0.5 mm fraction was 4.3% with a further 3.1% lost to the same fraction after stage crushing to 3.35 mm. The cumulative Li_2O lost to this fraction (7.4%) was significantly lower than the Li_2O loss of 15.8% to the -0.5 mm after stage crushing to <3.35 mm as the majority of the Li_2O was recovered during the initial DMS stage.

A minor upgrade of tantalum was observed in the final concentrate.

Table 11: +0.5 mm Dense Media Testwork Grade Summary

Stream	Mass	Li_2O	Fe_2O_3	SiO_2	Al_2O_3	Ta_2O_5
	%					ppm
-9.5mm DMS Sinks (+2.80 Sg)	31.3	6.4	1.16	68.00	23.85	312
-3.35mm DMS Sinks (+2.80 Sg)	9.4	4.4	1.22	65.40	20.47	395
Total DMS Sinks (+2.80 Sg)	**40.7**	**6.0**	**1.17**	**67.40**	**23.07**	**331**
-9.5mm DMS Feed: -0.5mm Fraction	7.9	1.4	0.64	61.00	14.45	281
-9.5mm DMS Floats (-2.80 Sg): -0.5mm Fraction	11.2	0.7	0.95	74.40	14.39	220
Total DMS: -0.5mm Fraction	**19.1**	**1.0**	**0.82**	**68.87**	**14.41**	**245**
-3.35mm DMS Floats (-2.80 Sg)	**40.1**	**0.1**	**0.43**	**80.90**	**10.32**	**144**
Total -0.5mm and -3.35mm Floats (-2.80 Sg)	59.3	0.4	0.56	77.02	11.64	177
Calculated Head	**100.0**	**2.7**	**0.81**	**73.10**	**16.30**	**240**
Assay Head		**2.6**	**0.83**	**72.10**	**16.21**	**237**

Table 12: +0.5 mm Dense Media Testwork Recovery Summary

Stream	Mass	Li_2O	Fe_2O_3	SiO_2	Al_2O_3	Ta_2O_5
	%					ppm
-9.5mm DMS Sinks (+2.80 Sg)	31.3	75.2	44.96	29.14	45.84	41
-3.35mm DMS Sinks (+2.80 Sg)	9.4	15.6	14.20	8.42	11.82	16
Total DMS Sinks (+2.80 Sg)	**40.7**	**90.8**	**59.17**	**37.55**	**57.65**	**56**
-9.5mm DMS Feed: -0.5mm Fraction	7.9	4.3	6.25	6.59	7.00	9
-9.5mm DMS Floats (-2.80 Sg): -0.5mm Fraction	11.2	3.1	13.22	11.44	9.93	10
Total DMS: -0.5mm Fraction	**19.1**	**7.3**	**19.47**	**18.03**	**16.93**	**20**
-3.35mm DMS Floats (-2.80 Sg)	**40.1**	**1.9**	**21.36**	**44.42**	**25.42**	**24**
Total -0.5mm and -3.35mm Floats (-2.80 Sg)	**59.3**	**9.2**	**40.83**	**62.45**	**42.35**	**44**
Total	**100.0**	**100.0**	**100.00**	**100.00**	**100.00**	**100**

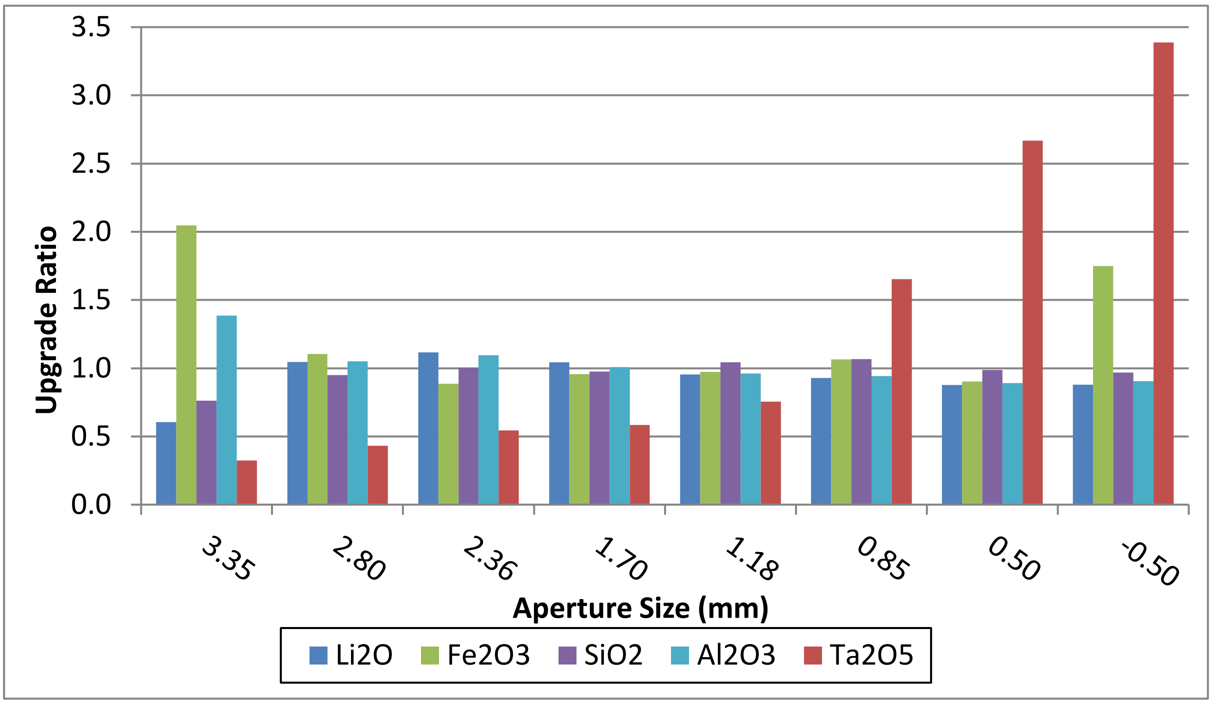
A size by size assay analysis was conducted on the DMS Stage 2 concentrate to determine metal oxide distribution through this product. Summarised results from the size by assay are shown in ***Table 13***.

Figure 11 presents the upgrade ratio for selected analytes. There is a significant Li_2O downgrade in the 3.35 mm size fraction with a minor downgrade also evident in the finer size fractions. During the 3.35 mm stage crushing prior to the second stage DMS operation, +3.35 mm flat platelike material was pushed through screen. Based on this and visual observations of the +3.35mm material IMO has concluded that this size fraction metal oxide ratios are due to this material comprising primarily of mica. The Ta_2O_5 significantly upgrades in the finer size fractions indicating it that it is naturally finer grained.

Table 13: DMS Stage 2 Concentrate (UF) Size by Assay

Screen Size	Mass	Li_2O		Fe_2O_3		Al_2O_3		Ta_2O_5		SiO_2	
µm	**%**	**%**	**Dist'n**	**%**	**Dist'n**	**%**	**Dist'n**	**ppm**	**Dist'n**	**%**	**Dist'n**
3.35	1.03	2.4	0.6	2.63	2.1	28.7	1.4	86	0.3	50.1	0.8
2.80	9.62	4.2	10.1	1.42	10.6	21.7	10.1	115	4.2	62.3	9.1
2.36	17.58	4.5	19.6	1.14	15.6	22.6	19.2	144	9.6	65.9	17.6
1.70	28.43	4.2	29.6	1.23	27.2	20.8	28.6	155	16.6	64.1	27.8
1.18	19.55	3.9	18.6	1.25	19.0	19.9	18.8	200	14.8	68.5	20.4
0.85	10.68	3.7	9.9	1.37	11.4	19.5	10.1	437	17.7	70.0	11.4
0.50	10.44	3.5	9.2	1.16	9.4	18.4	9.3	706	27.9	64.8	10.3
-0.50	2.67	3.6	2.3	2.25	4.7	18.7	2.4	897	9.0	63.5	2.6
Feed		**4.0**		**1.29**		**20.7**		**265**		**65.6**	

Figure 11: DMS Stage 2 Concentrate (UF) Upgrade Ratio by Size Distribution



4.4.4 -0.5 mm Flotation

Open circuit flotation testwork was performed on a representative 1kg sub-sample of -0.5 mm material from the combined -0.5 mm material rejected prior to the DMS stage 1 and 2 operations. This material was further stage ground to a P_{100} = 150 µm prior to desliming using a 2" hydrocyclone with the aim of removing the majority of the -20 µm material which typically affects Spodumene flotation performance.

The flotation conditions are shown in ***Table 14***. The testwork was conducted utilising a Denver D12 flotation machine with cell sizes ranging from 2 L to 1 L, dependent on concentrate volume and summarised as follows:

- Rougher flotation: 2 L Denver Cell;
- Cleaner stage 1: 2 L Denver Cell;
- Cleaner stage 2: 1 L Denver Cell.

Table 14: Combined -0.5 mm Flotation Conditions

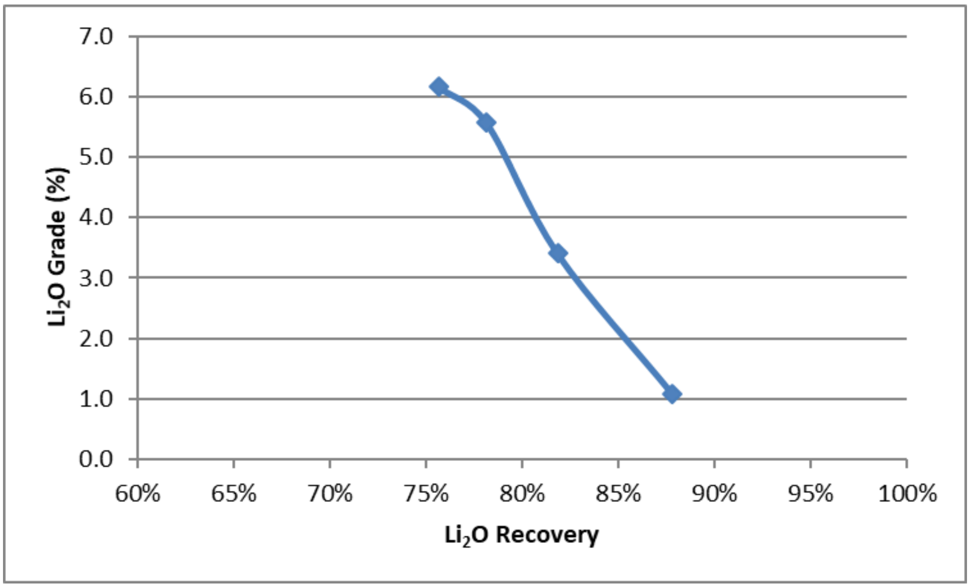
Conditions	Value
Collector Type	Saponified FS2
Collector Addition (g/t)	2851
Depressant Type	Sodium silicate
Depressant Addition (g/t)	63
pH Modifier Type	Sodium hydroxide
pH Modifier Addition (g/t)	7.5
Flotation Slurry pH	8.1 - 8.8
No. of Rougher Stages	2
Rougher Ret. Time (mins)	8.0
No. of Cleaner Stages	2
Cleaner Ret. Time (mins)	9.5

A final concentrate grade of 6.2% Li_2O was achieved at a 75.7% Li_2O recovery. Approximately 70% of the Ta_2O_5 was recovered achieving a grade of 1,100 ppm. Rejection of silica and aluminium was excellent although approximately 40% of the Fe_2O_3 was recovered to final concentrate. 12.2% of the Li_2O was lost to deslime OF (slimes) fraction. Flotation results are shown in ***Table 15.*** A Li_2O grade recovery curve is shown in ***Figure 12***.

Table 15: Combined -0.5 mm Flotation Results

Product	Mass	Li_2O		Fe_2O_3		SiO_2		Ta_2O_5	
	(%)	Assay (%)	Dist'n (%)	Assay (%)	Dist'n (%)	Assay (%)	Dist'n (%)	Assay (ppm)	Dist'n (%)
Cleaner 2 Con	12.9%	6.2	75.7%	2.85	41.6%	58.8	10.6%	1124	69.8%
Cleaner 2 Tail	1.8%	1.4	2.5%	1.13	2.4%	72.3	1.9%	345	3.0%
Cleaner 1 Tail	10.5%	0.4	3.7%	0.44	5.2%	73.3	10.8%	109	5.5%
Rougher Tail	60.8%	0.1	6.0%	0.23	15.8%	75.8	64.3%	19	5.7%
COF	13.9%	0.9	12.2%	2.22	35.0%	64.3	12.5%	239	16.0%
Total	100%		100%		100%		100%		100%
Calc'd Grade		1.1		0.88		71.7		208	
Assay Grade		1.0		0.82		68.9		245	
<u>**CUMULATIVE**</u>									
Cleaner 2 Con	12.9%	6.16	75.7%	2.85	41.6%	58.8	10.6%	1124	69.8%
Cleaner 1 Con	14.8%	5.57	78.1%	2.64	44.0%	60.5	12.4%	1027	72.8%
Rougher Con	25.3%	3.40	81.8%	1.72	49.2%	65.8	23.2%	644	78.4%
CUF	86.1%	1.07	87.8%	0.67	65.0%	72.9	87.5%	203	84.0%

Figure 12: Combined -0.5 mm Flotation Li_2O Grade Recovery Curve



Full flotation results can be found in *Error! Reference source not found.*.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Observations and Conclusions

Based on analysis of all testwork phases conducted during the Phase 2 Flowsheet Development Testwork program, IMO presents the following conclusions:

- Size by size assay analysis of the crushed (P_{100} 9.5 mm) Master Composite indicate that upgrading by size is not a viable option as similar distributions for mass and Li_2O resulted;
- Based on heavy liquid testwork, reducing the liberation size below P_{100} = 9.5 mm resulted in minimal improvement in Li_2O grade but a significant reduction in Li_2O recovery;
- A coarse liberation size (P_{100} 9.5 mm) resulted in concentrate grades of 6.0% Li_2O at a recovery of 90.8% based on dense media separation at an SG of 2.8;
- Flotation of the -0.5 mm size fraction produced at a concentrate containing 6.2% Li_2O at an open-circuit recovery of 75.7%;
- The main contaminant of the DMS concentrate was mica. This mineral was also found to contain Rubidium at grades of 1.2%.

5.2 Recommendations

IMO presents the following recommendations for further flowsheet development and verification:

- IMO recommends reanalysing the DMS products for rubidium to determine if it's contained within any of the other minerals in the deposit and how it's distributed throughout the beneficiation process;
- Undertake comminution characterisation testwork shown below on representative drill core intervals from various zones to enable comminution circuit design and costing:
  - SAG Mill Comminution (SMC);
  - Bond Ball Mill Work Index Testing.
- Perform HLS testwork at a range of coarser crush sizes to determine Spodumene liberation top size and maximum DMS operation top size;
- Perform HLS variability testwork across different Li_2O grades, lithology and weathering zones across the ore deposit to enable process plant modelling and expected performance;
- Perform bulk DMS pilot testwork using a cyclone suitable for the optimum top size to generate a bulk concentrate suitable for marketing, downstream testwork and to provide information for process plant design;
- Conduct further flotation optimisation testwork on the -0.5mm material to improve both Li_2O grade and recovery;
- Conduct locked cycle flotation testwork to confirm Li_2O recoveries and effects of recycle stream on final concentrate Li_2O grades;
- Conduct pilot flotation testwork to confirm scale up factors, confirm effects of continual recycling of intermediate streams and provide material for downstream testwork, marketing and process plant design;

- Perform further testwork to investigate mica rejection and the opportunity to produce a Rubidium by-product;
- Perform downstream testwork to confirm Ardiden's final DMS and flotation Spodumene concentrates are suitable for producing battery grade lithium carbonate (Li_2CO_3) or lithium hydroxide (LiOH) products;
- Based on the outcomes of this testwork, IMO can provide a Process Design Package (consisting of process design criteria, flowsheets and mass balance) as a component of a future Conceptual or Pre-feasibility Study.

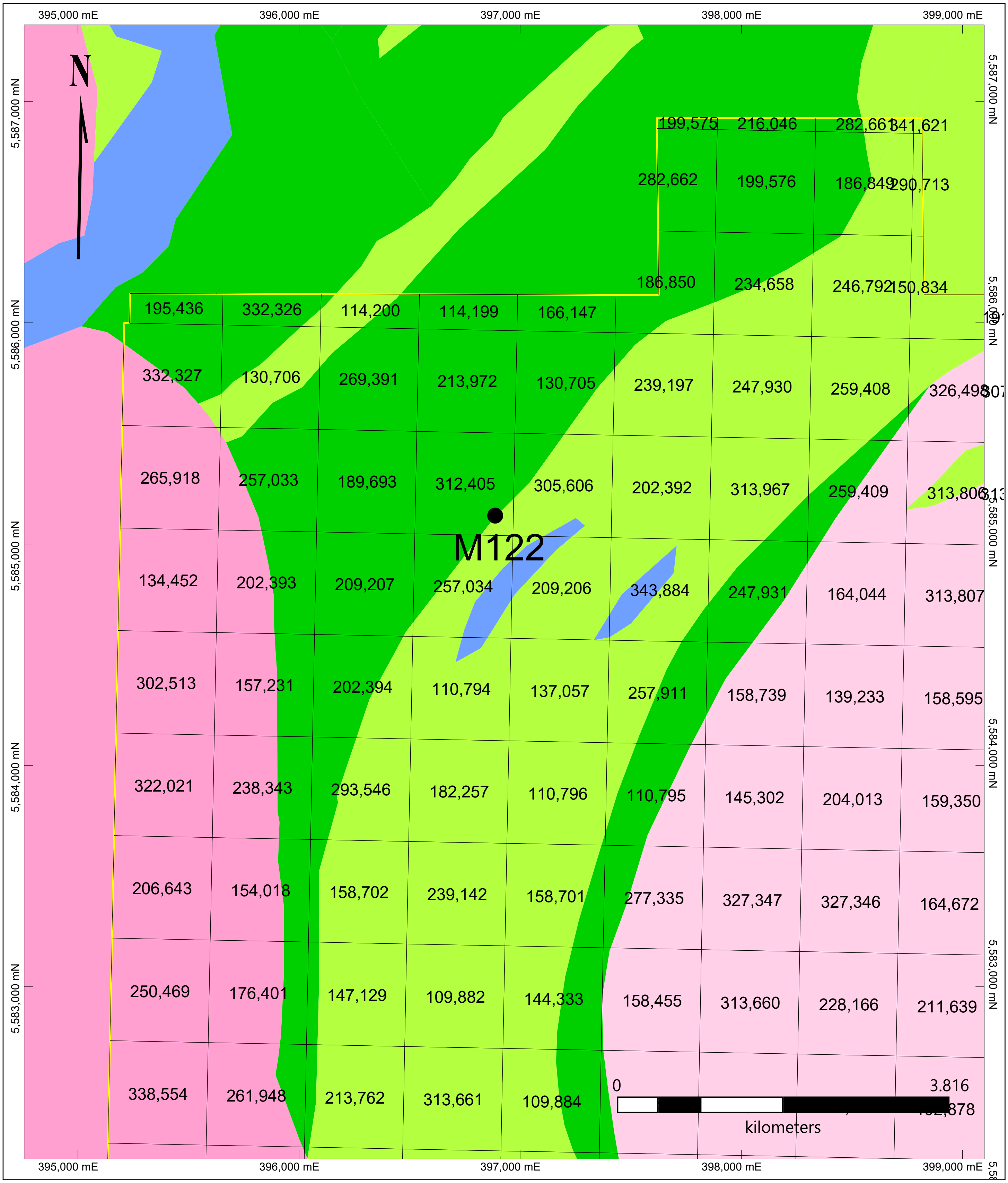
APPENDIX A SAMPLE RECEIPT

APPENDIX B HEAD ASSAY, MINERALOGY AND FEED SIZE BY SIZE ASSAY RESULTS

APPENDIX C HLS TESTWORK RESULTS

APPENDIX D DMS TESTWORK RESULTS

APPENDIX E FLOTATION RESULTS



M122

Mafic Volcanics

Intermediate Volcanics

Gabbro

Geopoly_Ontario_2018

Claim Boundary

ARD SEY Property Boundary

Date: Oct. 4, 2019	Seymour Lake Project Ardiden Ltd.
L. Clapp	
Office: Thunder Bay	
Drawing:	
	Projection: UTM Zone 16 (NAD 83)