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Ontario

2016 Assessment Report on the Metallurgical Test Work for the Separation Rapids Lithium-Petalite Project

Township/Area:	**Paterson Lake**	**(G-2634)**
	1178857	1178858
	1178859	1247024
	4218361	
Township/Area:	**Snook Lake**	**(G-2644)**
	4218354	
	4218355	
	4218356	
Mining Lease:	108395	CLM 469
Location UTM:	Zone 15, 386069m E, 5567332m N of Lease (NAD83)	

Prepared By: Ron Malashewski
Community Liaison, Separation Rapids Project
Avalon Advanced Materials Inc.
31 January 2017

Reviewed and Approved By: William Mercer Ph.D., P. Geo,
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Avalon Advanced Materials Inc.
31 January 2017

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Senior Vice President Metallurgy & Technology Development
Avalon Advanced Materials Inc.
31 January 2017

Contents

Introduction

This Assessment reports covers metallurgical test work and related activities by Avalon Advanced Materials Inc. (“Avalon”) that qualify for Assessment Credits in calendar year 2016.

During 2016, Avalon entered into several contracts with metallurgical laboratories overseas and in Canada to conduct the fundamental and critical metallurgical testing programs, the results of which were incorporated into Avalon’s Preliminary Economic Assessment (“PEA”). As such, Avalon is applying for $177,711.15 of assessment credits for the qualified work programs conducted during 2016.

The supporting technical document for the metallurgical test work is Avalon’s Preliminary Economic Assessment (“PEA”) which was announced on 27 September 2016 and filed on SEDAR on 11 November 2016. A copy of the PEA is attached to this report as Appendix 1 (*“NI 43-101 Technical Report on the Preliminary Economic Assessment of Lithium Hydroxide Production – Separation Rapids Lithium Project”).*

This Assessment Report was prepared by Ron Malashewski, Consultant to Avalon, under the supervision of Dr William Mercer, P.Geo, Vice-President of Exploration for Avalon, and Mr David Marsh Senior Vice-President Metallurgy and Technology Development for Avalon

Dr. Mercer has been VP, Exploration with Avalon since 2007. Dr. Mercer earned his BSc. in geology from Edinburgh University (1968) and a PhD from McMaster University (1975). For 32 years he worked with the Noranda/Falconbridge group, holding a series of managerial positions, working on international projects in over 30 countries, ultimately serving as Director-Geology and Geochemistry.

Mr. Marsh has been with Avalon for 4.5 years, and brings over 35 years of experience in the metallurgical and mineral processing industries. He has worked throughout Africa for over 25 years, as well as in Australia and Canada. Much of his experience has been in the engineering and technical side of the business and this is complemented by several years in operations. A native of the United Kingdom, Mr. Marsh received his B.Sc (Hons.) in Mineral Processing from the University of Leeds, England in 1980.

Mr. Malashewski practiced Engineering for many years in Alberta. He is currently a member of the Association of Professional Engineers and Geoscientists of Alberta (APEGA) under the “Non-Practicing” status, since most of his current employment activities are not directly involved in the practice of Engineering as defined under the *Alberta Engineering and Geoscience Professions Act* (AEGPA).

The primary authors of the supporting Technical Report (PEA) and Qualified Persons are:

Richard Gowans, P.Eng.,	President and Principal Metallurgist, Micon.
Christopher Jacobs, CEng, MIMMM,	Vice President, Micon.
Eur.Ing, **Bruce Pilcher**, CEng, FIMMM, FAusIMM(CP),	Senior Mining Engineer, Micon.
Jane Spooner, P.Geo.,	Vice President, Micon.
Steven R. Aiken, P.Eng.,	Knight Piésold Limited.
Kevin E. Hawton, P.Eng.,	Knight Piésold
Dr. David L. Trueman, Ph.D., P.Geo.	Independent Consultant

Background and Significance of the Separation Rapids Lithium Project

General: The Separation Rapids Lithium Deposit ("SRLD") is host to one of the largest "Complex-type" rare metal pegmatite deposits in the world. Known as the "Big Whopper Pegmatite", it is only the fourth example in the world of a rare metal pegmatite with the size required to be of major economic importance and only the second to be enriched in the rare lithium mineral called petalite. Petalite is a key ingredient used in the glass and ceramics industry and specialty composite materials. However, of more economic significance is that the petalite is a source of lithium minerals for the production of lithium carbonate or lithium hydroxide to supply the battery and energy storage sectors.

As well, there exists the potential for production of by-product sodium feldspar, tantalum and rubidium minerals, and high-purity quartz/silica.

Lithium / Petalite: One of the driving forces propelling the demand for lithium is its use in lithium-ion batteries, to the point where it now surpasses demand in ceramics and glass. Rechargeable lithium batteries are used in a wide range of applications including cell phones, cameras, portable electronic devices, hand-held tools and increasingly, in electric vehicles and electrical grid storage.

It is expected that battery demand will continue to outpace other lithium demand sectors and will drive overall lithium demand. While the automotive sector is expected to show the most rapid growth, projected growth in global lithium demand also includes consumer electronics and grid energy storage sectors.

It is projected that demand for lithium hydroxide will grow at a higher rate than that for lithium carbonate, based on improvements and enhancements in battery technologies. Avalon considers that the Separation Rapids Lithium Project will be well-placed to supply new battery production facilities in North America and globally.

From previous work, the lithium product, petalite, will be produced at Separation Rapids and will be the feedstock for the lithium production.

Petalite is used in a range of glass formulae:

(a) to reduce the energy inputs required to melt the batch,
(b) subject to the specific formulation of the glass serve, to displace more than one other ingredient,
(c) to strengthen glass thereby allowing glass containers to be thinner thus reducing the amount of glass needed in any one container or thinner for other applications (e.g. gorilla glass used in screen), and
(d) much improved thermal expansion/contraction characteristics for used in cookware (e.g. Corning ware, stovetops).

Feldspar: Feldspar is an important ingredient in the manufacture of glass and an important raw material in ceramics. Feldspar it acts as a fluxing agent, reducing the strength, toughness, and durability of the ceramic body, and cements the crystalline phase of other ingredients, softening, melting and wetting other batch constituents. Feldspars also are used as fillers and extenders in applications such as paints, plastics and rubber.

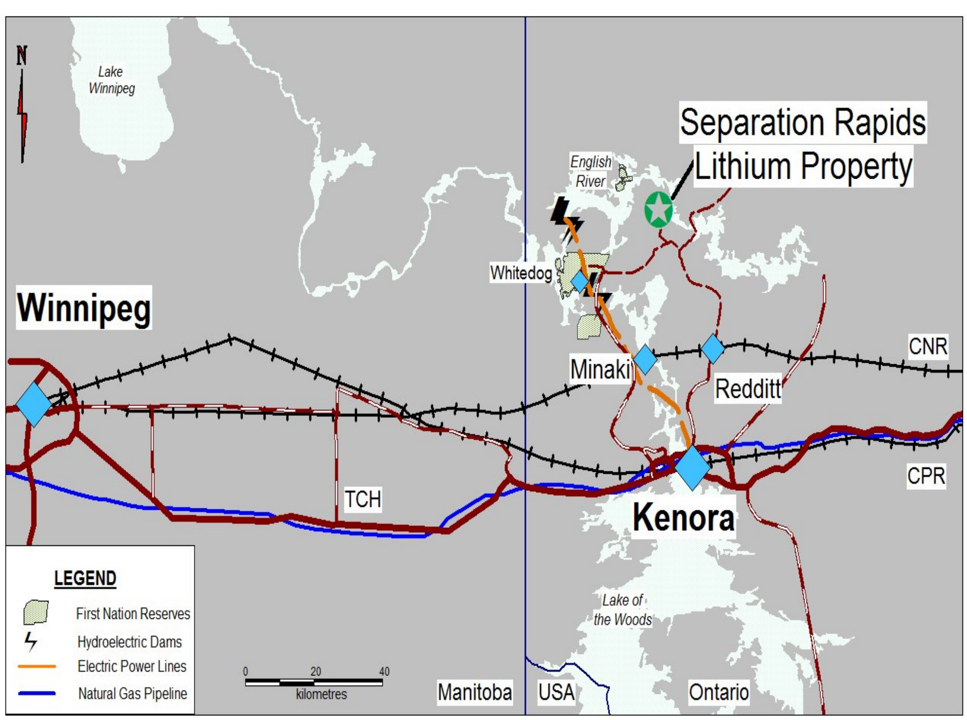
Through discussions with market participants and industry experts, and evaluation of data provided in purchased reports and publicly available information, Avalon estimates that 100,000 tonnes per year ("t/y") of feldspar can be sold into the glass, ceramics, frits/glazes and filler markets at an average price of US$170/t. Sales will be built up to 100,000 t/y over a period of five years.

A discussion of the markets for lithium and feldspar is presented in Appendix 5 – "*Market Studies for Lithium and Feldspar Markets".*

Property Description and Location

The Separation Rapids area is typical of much of northwestern Ontario and the Canadian Shield. The property is relatively flat with an average elevation of approximately 350 m above sea-level. Local topographic relief is limited to 50 m or less with typical Precambrian glaciated terrain. The English River system is proximal to all claim groups. The area is located within the Boreal Hardwood Transition or Mixed Boreal Forest. A Species at Risk Act assessment was completed and no endangered or at risk species were identified in the area of the proposed project. The climate is typical of Canada's mid-latitudes with long, cold winters and comparatively short spring-summer-fall periods.

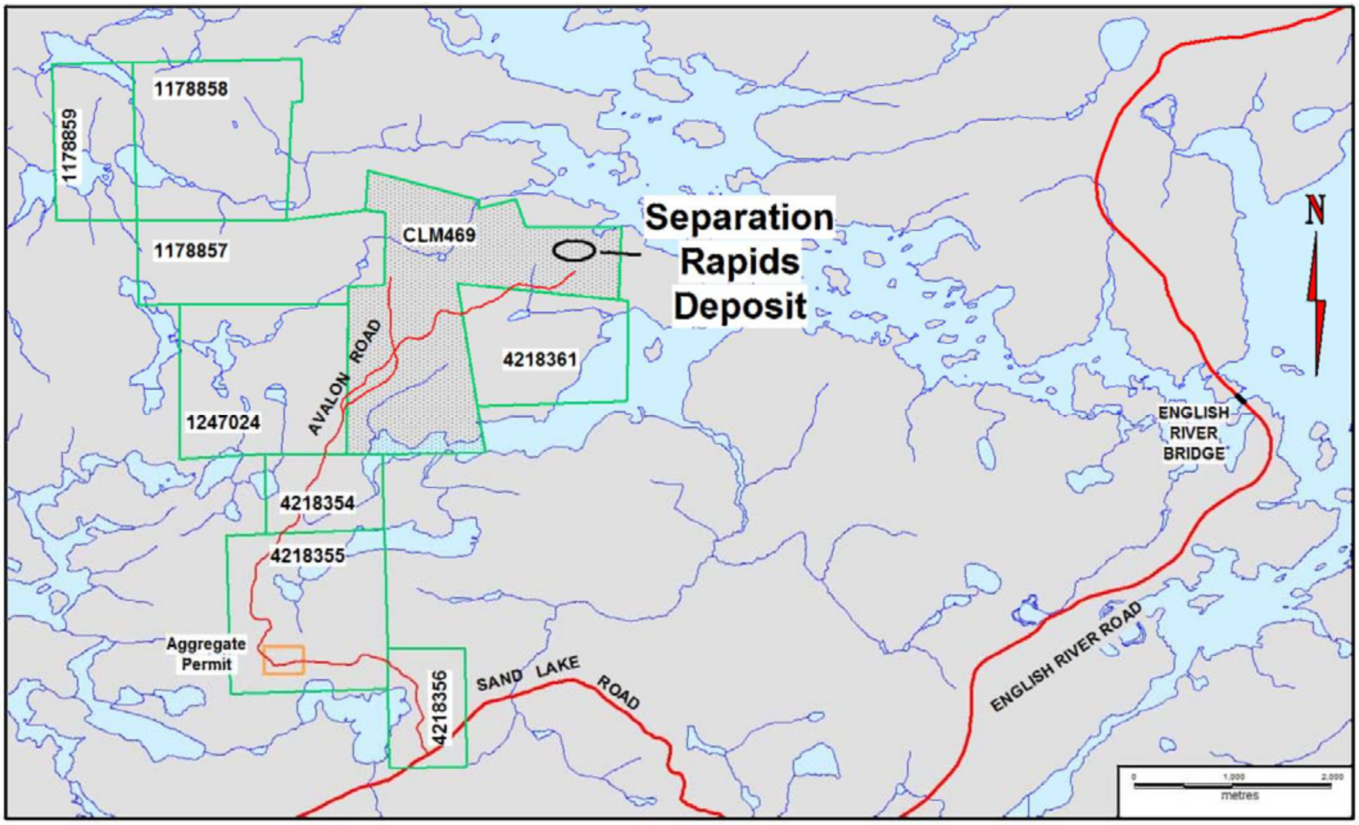
As of March 2016, The Separation Rapids property consists of 8 un-patented mineral claims totaling 90 claim units, covering approximately 3,558 acres (1,440 hectares) and one Mining and Surface Rights Lease CLM 469 covering 441.44 hectares in the Paterson Lake Area, Kenora Mining Division, Ontario. The lease and un-patented claims form one contiguous land package owned 100% by Avalon. It is centred on latitude 50 15' 30" N, longitude 94 35' W (UTM coordinates: 388441E 5568996N in Zone15, NAD83).



The 2.0% Net Smelter Return (NSR) was purchased from the vendors in 2012 for $220,000.

Properties immediately adjacent to the Claim area held by Avalon are held by Pacific Iron Ore Corporation, GoldON Resources Ltd. and Gossan Resources Ltd.

Avalon's claims are illustrated below.



The project is well-situated in terms of proximity to major railway lines providing ready access into the main target markets for lithium hydroxide, as well as other ancillary products, and for petalite used in the glass and ceramics industry in the US (located primarily in the mid- and southwest) and Europe.

The property is situated approximately 70 km by road north of Kenora, Ontario and is directly accessible via a private road off the Sand Lake Road and English River Road, both Crown Land roads. The main line of the Canadian National Railway passes through the village of Redditt, just 50 km by road south of the Separation Rapids property. Forestry, tourism and mining are the three largest sectors of the Kenora economy.

The property exists within the Traditional Land Use Area of the Wabaseemoong Independent Nations of Whitedog, Ontario, an aboriginal community located approximately 35 km southwest of the property. Wabaseemoong Independent Nations is a merged entity comprised of the First Nations communities of Whitedog, One Man Lake, and Swan Lake.

Consultation with local First Nations and the public was initiated in 1997. This continued in a reduced manner during the period of inactivity, but was increased again in 2013. A Memorandum of Understanding ("MOU"), initially signed with the Wabaseemoong Independent Nation ("WIN") in 1999, was renewed in 2013.

Avalon maintains an Engagement Log which records the numerous meetings held and summaries of the meeting content, and reports this annually in its Sustainability Report.

An archaeological study was completed in 1998. This will be reviewed with the communities of interest and updated if required. There may be a requirement to complete additional traditional knowledge studies in the next phase of project development. A socioeconomic assessment of the project is included in the 2007 environmental study. This will be updated in the next phase of the project.

Avalon has a full time representative in Kenora who facilitates ongoing engagement with Indigenous Peoples, communities, regulators and politicians and that contributes to the strong support for the project.

The proposed model is that mining and mineral concentration will take place at the Separation Rapids property. Petalite concentrate will be shipped by truck to a hydrometallurgical processing plant proposed to be located in the City of Kenora, Ontario. A trans-shipment facility will be required in order to access rail transportation for product shipment and inbound supplies. Avalon has not yet made the final site selection for the hydrometallurgical plant and trans-shipment facility and has not acquired ownership or rights to any land for these facilities.

Geology

The Late Archean Separation Rapids Lithium Deposit (“SRLD”) belongs to the petalite sub-type of the complex-type class of rare-metal pegmatites. The SRLD, its parent granite, the Separation Rapids Pluton, and associated rare-metal pegmatites occur within the Archean Separation Lake Metavolcanic Belt (SLMB) which forms the boundary between the English River subprovince to the north and the Winnipeg River subprovince to the south. Both subprovinces are part of the larger Archean Superior Province of the Canadian Shield. Avalon has divided the SRLD into the Separation Rapids Pegmatite, the Western Pegmatite and the Eastern Swarm.

Petalite, potassium feldspar and sodium feldspar are the major rock-forming and primary minerals in the Separation Rapids Pegmatite (SRP), with subordinate amounts of other minerals including spodumene, lithian muscovite, lepidolite, and quartz. The petalite-bearing Unit 6 is the principal unit of interest within the Separation Rapids Pegmatite (SRP). Geological mapping and assays for surface and drill core samples show that mineralogy and lithium oxide (Li_2O) grades of the mineralization in the SRP are relatively homogeneous and that the petalite is close to the theoretical (stoichiometric) chemical composition, as well as being very pure, with marked absence of deleterious elements such as iron.

History and Past Work – Exploration

Rare-element mineralization in the area was first encountered along the English River near Separation Rapids in 1932. The petalite-bearing SRLD and an associated group of rare-metal pegmatites, were discovered by Dr. Fred Breaks of the Ontario Geological Survey (OGS) as a result of a detailed study of rare-metal pegmatites in the region between 1994 and 1996.

Following the discovery of the SRLD in 1996, Avalon carried out a brief prospecting and sampling program in November, 1996. This was followed by a program of geological mapping, trenching, line-cutting and magnetometry in 1997 and 1998. In the period from 2000 to 2014, little work of a geoscientific nature was carried out at the property. The main activity relating to advancing the project was metallurgical and, consequently, the main activities at site were collection of samples, up to bulk sample size, for metallurgical testing.

Avalon undertook a number of drilling campaigns between 1997 and 2001. Since 2001, no further drilling has taken place at the property (however a drill program is planned during the winter/spring of 2017). The total number of drill holes is 72 for a cumulative total of 10,708 m, as summarized below. Three of these holes were drilled between 26 April and 4 May, 2001 for the purposes of a geo-mechanical investigation of the rock mass at the proposed open pit mine and to develop suitable pit slope design parameters. The potential for water inflow into the open pit was also evaluated.

Until March 2016, Avalon held 5 Un-patented mining claims and the mining lease. In March 2016 Avalon staked an additional 3 claims thus adding 28 more claim units, bringing its total property holdings up to 8 un-patented mineral claims totaling 90 claim units, covering approximately 3,558 acres (1,440 hectares) and one Mining and Surface Rights Lease CLM 469 covering 441.44 hectares.

Summary Drilling Statistics, Separation Rapids Pegmatite

Year	Purpose	Number of Holes	Metres	Size
1997	Geological/resources	30	4,922	NQ
1998	Geological/resources	27	3,829	NQ
2001	Geotechnical	3	537	NQ
2001	Geological/resources	12	1,420	NQ
Total		**72**	**10,708**	

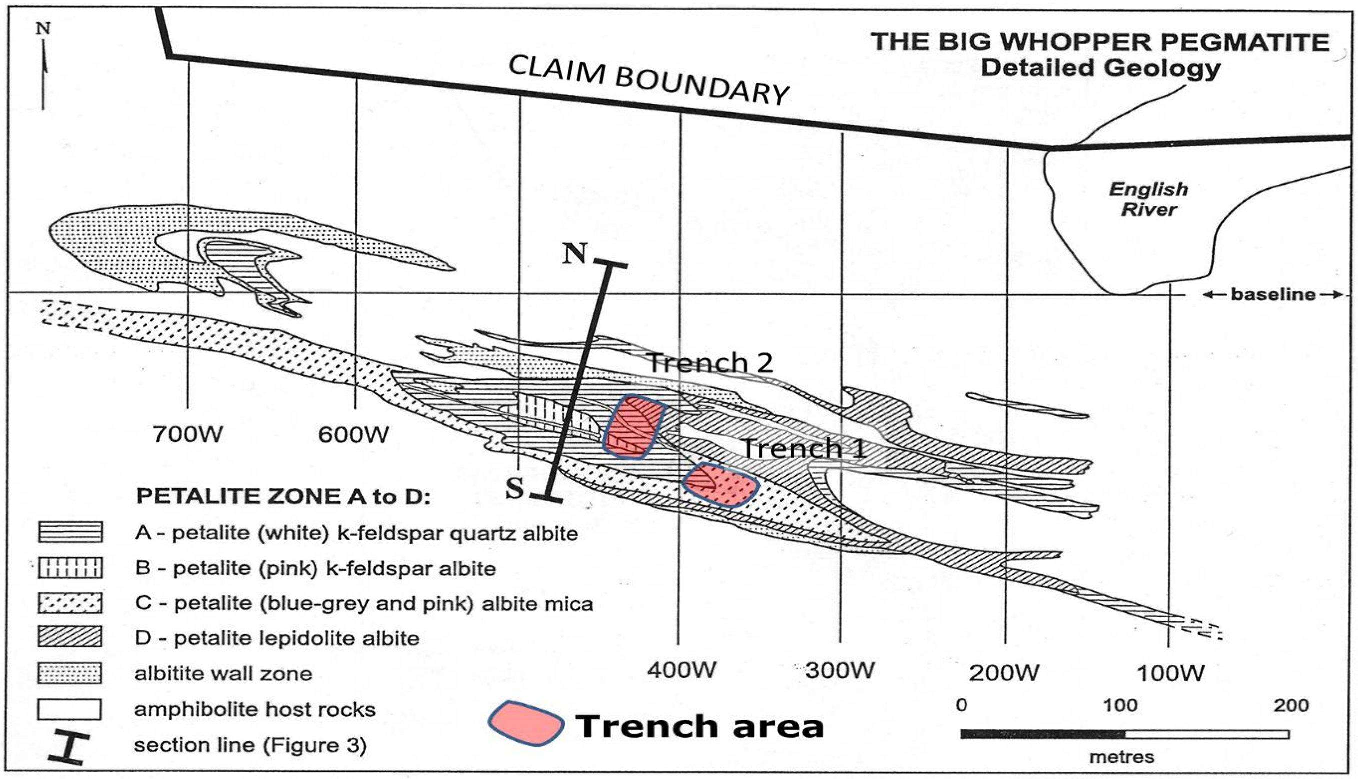
Notes on Sampling, Analysis and Data Verification of previous drill results

1. Surface samples taken in the 1990s were shipped to independent laboratories, the one in Thunder Bay, Ontario for preparation then to other independent laboratories in Mississauga, Ontario and Vancouver, British Columbia for subsequent assaying. Surface samples were analyzed for lithium and a range of other elements including tin, rubidium, cesium, tantalum, gallium and niobium.
2. In the 1990s, drill core was logged and split with half of the core being sent for assay and the other half being stored in core boxes on site. Core sample intervals were varied according to the lithology, to a maximum of 3 m. Split core samples were shipped to a laboratory in Don Mills, Ontario, where they were assayed for lithium, rubidium, cesium and tantalum. A total of 2,516 drill core samples were assayed with an additional 223 duplicate analyses. Check-assaying was routinely carried out for lithium and rubidium in an independent laboratory.
3. The drilling database contains 185 specific gravity values for various lithologies on the SRLD. This comprises 118 measurements on pegmatite, 66 on amphibolite and one measurement which was considered an outlier and was rejected. The average SG for pegmatite is 2.62 for the 118 samples (one high outlier at 3.16 removed). The average SG for amphibolite (waste) is 3.04 based on the 66 measurements. The SG measurements show low variability (standard deviation of 0.08, or 3% for pegmatite and 0.05 or 2% for amphibolite) indicating that the risk of significant error is also low.
4. The mineral resource estimate completed was based on the original drilling by Avalon in 1997 to 2001, and the assay database created in 1999. Quality assurance/quality control procedures were applied and included check assays at a second laboratory and independent assaying. Subsequently, Avalon completed further verification of the drill data, including cross-checking the database against original field records, such as drill logs, cross-checking the assays against laboratory assay certificates and re-assaying drill core splits with inserted internally certified lithium standards. The comparison of the different independent laboratory data sets is favourable. This indicates high and acceptable reliability in the analyses.
5. Avalon also verified the drill hole database against historic data records such as drill logs, assay certificates, and other original sources of data in order to ensure that there were no errors present in the Avalon database used for resource estimation. Drill hole angle, direction and the maximum hole depth were also verified.
6. As of 6 July, 2016, the Avalon database contained records for 2,790 downhole samples which were assayed for the 1997, 1998 and 2001 drill programs. A random sample of 12% of the assay values contained in the Avalon database were compared against the values as reported on the original certificates of analysis. No errors were found in the downhole assay values as entered into the Avalon database from the original historic database.
7. Avalon prepared a certified rock lithium analysis standard by shipping 16 kg of Separation Rapids Pegmatite to an independent laboratory in Langley, British Columbia that specializes in preparing samples for rock analysis standards. A Round Robin analysis procedure was then completed with five samples of the material being shipped to each of six laboratories for lithium analysis, with associated analytical methods performed.
8. It was concluded that the lithium standard was a suitable standard for QA/QC of Separation Rapids drill core samples. The certified value for the standard SR2016 is 1.48% Li_2O with a standard deviation of 0.03% Li_2O for future analyses of Separation Rapids samples.

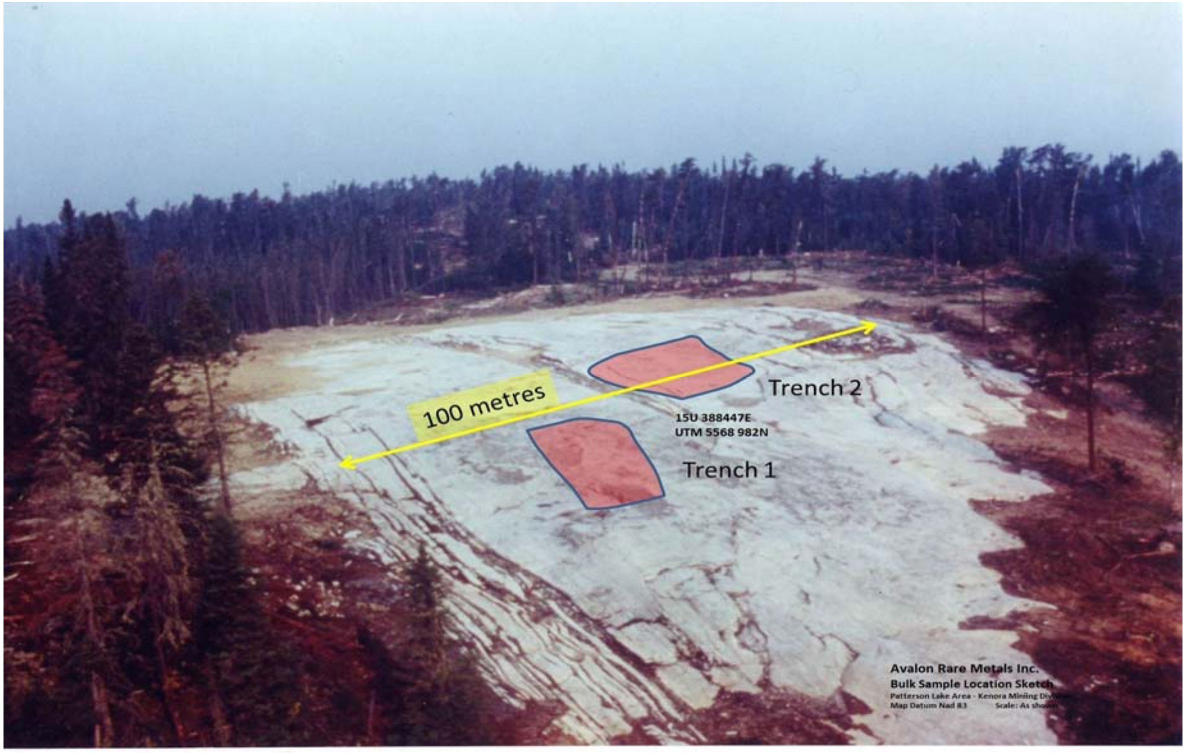
Past Work – Metallurgy

Approximately 300 tonnes of petalite ore was acquired in a bulk sampling program from two pits in 2006. The ore from this bulk sample was crushed and bagged and most of it was stored off site in Kenora. Subsequent to the initial crushing and bagging, the material was reprocessed, screened, and re-bagged as sample material for future testing and analysis with various laboratories. Since 2011, several tonnes of crushed ore were shipped to prospective customers and lab facilities for further testing and analysis. Currently, there remains approximately 55 tonnes of material remaining in storage in Kenora.

The diagram below shows the location from which the ore was extracted.



The photo below indicated more graphically the area from which the sample was obtained.



History - Mineral Processing and Metallurgical Testing

A number of phases of metallurgical testing since 1997 have been completed by Avalon using samples obtained from the SRLD. The work prior to 2014 was mainly undertaken at a lab in Ontario. This work not only included the recovery of petalite, but also a number of other mineral products which can be found in the lithium bearing pegmatite as well. The work since 2014 has focused on the recovery of a petalite flotation concentrate and the subsequent processing of this concentrate to produce a high quality lithium hydroxide product suitable for the lithium battery industry.

Avalon utilized a German company that specializes in the processing of high purity industrial and strategic minerals to develop a process for recovering the petalite and achieving target product grade of >4% LiO_2. This contractor also investigated the recovery of a low impurity feldspar by-product and tested this product to determine its suitability in a number of industrial applications.

Avalon investigated the potential to use petalite as a source of both lithium carbonate and lithium hydroxide. Initial investigations for producing these lithium chemicals were completed by two separate independent contractors.

Table 1.1 lists all the flotation/concentrator testwork reports issued since the project was re-activated in 2014 while Table 1.2 lists the hydrometallurgical testwork programs.

Note that the specific metallurgical testwork programs for this Assessment Report are listed in Table 1.3 *"2016 Separation Rapids Testwork History (Summary)"*.

Table 1.1 List of Mineral Processing Testwork Reports

Date	Title	Remarks
June 2014	Processing of Petalite Ore from Separation Rapids	Petalite and feldspar flotation testwork on coarse grained mineralized material.
August 2014	Physical Processing of Fine Grained Ore from Separation Rapids	As above but using fine grained mineralized material.
September 2014	Processing of Petalite Ceramic Application Tests	Sample of petalite was tested to determine key physical/chemical characteristics for ceramic applications.
September 2014	Sample Production of Petalite and Feldspar Concentrate	20 kg of both materials were produced for providing samples to potential clients.
November 2014	Flowsheet and Core Machinery	Base flotation flowsheet and preliminary equipment recommendations.
December 2014	Locked Cycle Petalite Flotation Tests on Fine Grained Ore (FGO)	Bench scale determination of petalite flotation recovery with locked cycle tests.
June 2015	Pretests Pilot Scale Sample Production of Petalite and Feldspar Concentrates	To determine optimum conditions for magnetic separation and product filtration.
July 2015	Analysis of Nb/Ta in Magnetic Fraction of Separation Rapids Ore	Determination of nature of Nb and Ta in magnetics discard stream.
December 2015	Testing and characterization of a feldspar filler	Sample of feldspar was tested to determine key physical/chemical characteristics for flier applications.
May 2016	Pilot Scale Sample Production of 1t Petalite Concentrate	Bulk sample processed to produce a 1 t sample of petalite.
June 2016	Evaluation of HPQ Potential of Flotation Tailings from the Big Whopper Pegmatite	Testwork investigations to determine if tailings from pilot plant could be used to produce a high purity quartz (HPQ) product.
May 2016	Testing of Feldspar sample as potential paint filler	Note confirming tests indicating Avalon feldspar matches existing paint fillers.
2015/2016	Various flotation tests analyses	Excel spreadsheets with test results plus various small petalite sample production tests.
October 2016	Sample Production – Feldspar Filler	Feldspar concentrate with lower silica content produced by introducing a number of cleaner flotation stages. This was then milled to a d50 of 6 µm and determined to have a SWERF value of 0.6%.

Table 1.2 List of Recent Hydrometallurgical Testwork Reports

Date	Title	Remarks
May 2015	Preliminary Li leaching, purification and Li carbonate and hydroxide preparation from petalite concentrate	Testwork to determine if battery specification carbonate and hydroxide can be produced from petalite.
December 2015	Li Carbonate Production from Petalite Concentrate	Bench optimization of process to produce battery specification lithium carbonate.
December 2015	Process Alternatives- High Level Operating Cost Assessment	Compared various lithium hydroxide production processes to identify most cost efficient.
September/October 2016	Hydrometallurgical Bench Scale Test Program/Process Simulation and Economic Model	Bench scale assessment of most favourable conditions for main stream unit operations including electrodialysis and development of process design criteria.

Current Work – Metallurgy

The metallurgical assessment and lab work to support the PEA was conducted though the facilities of Dorfner-Anzaplan (“Anzaplan”) in Hirschau Germany and Thibault and Associates (“Thibault”) of Fredericton, NB. Saskatchewan Research Council (“SRC”) was also contracted to conduct some environmental testing of tailings, the results of which are incorporated into the PEA.

Anzaplan is a specialist in the high purity industrial and strategic minerals and metals businesses, providing a multitude of services, such as materials testing and analysis, industry expertise and market intelligence, basic and advanced engineering services.

Thibault and Associates provides process engineering services from the development of process chemistry and economic assessment of cost competitive production strategies to detailed process engineering. Thibault has extensive experience in flowsheet development, engineering, construction and optimization of heavy industrial production facilities.

The Saskatchewan Research Council is one of Canada’s leading providers of applied research, development and demonstration (RD&D) and technology commercialization. For the mining sector SRC provides a wide range of services from pre-exploration to site reclamation.

The specific metallurgical assessment programs and lab work are summarized in the table below:

Table 1.3 2016 Separation Rapids Testwork History (Summary)

Proposal Number / Purchase Order Number	Cost of Contract	Contractor / Consultant	Description of Work	Relevant Sections in Technical Report (PEA)
211612904 /H201359	C$ 78,257.04	Anzaplan	Jan 1 – Jan 18, 2016- Installation of flotation equipment and preparation for to begin flotation tests to produce one tonne of petalite concentrate Jan 07- Jan 26, 2016- Flotation testwork to produce one tonne of petalite concentrate conducted in Germany. Petalite concentrate is produced and assayed.	See Appendix 6.1: *"One Tonne Petalite Concentration Production Test"* excerpt from 13.3.6 in PEA
211612967 /H201392	C$ 44,569.07	Anzaplan	February- June 2016 – Evaluation of HPQ Potential of Flotation Tailings from Big Whopper Pegmatite – testwork to investigate the potential to produce a high purity quartz from the flotation tailings of Separation Rapids. A variety of tests such as chemical leaching were conducted on the flotation tailings from Separation Rapids. Mineral inclusions in the final product make them unsuitable for the high purity quartz market. Results indicated that more testwork will need to be conducted to produce high purity quartz.	See Appendix *7 "Table 13.1 – List of Mineral Processing Testwork Reports"* from Section 13.3.1 of PEA
13820-3F16/ H201416	C$ 8,520.00	SRC	June 2016 – Tailings Environmental Testing – SRC in Saskatoon conducts a number of environmental tests required for PEA report. These tests included leachate test, material property tests for tailings dam construction. Knights Piesold (PEA consultants) has been notified of these results and designed the tailings dam facility accordingly.	See Appendix 8.1 *"Water Quality"* (Section 20.8 of PEA) and Appendix 8.2 *"Fisheries"* (Section 20.12 of PEA)
165-75 CO1 / H201419	C$ 32,110.19	Thibault and Associates	June - Oct 2016 – Thibault and Associates in New Brunswick prepared an equipment list for the Separation Rapids hydromet plant along with drawings and mass/energy balance.	See Appendix 9: *"Hydrometallurgical Plant Process Design"* Section 17.4 of PEA
21612966 Rev 1 –Pos1 / H201428	C$14,254.85	Anzaplan	Oct 2016- Sample Production Feldspar Filler – Anzaplan investigates the possibility to reduce free silica content in the feldspar flotation tailings to less than 1 %. Flotation and grinding tests were conducted. The final results produced a feldspar filler with less than 1 % free silica content that is more easily marketable.	See Appendix 6.2: "*Feldspar Filler Tests*" excerpt from section 13.3.7 in PEA

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Current Technical Report

The most recent Technical Report on the property is entitled "*NI 43-101 Technical Report on the Preliminary Economic Assessment of Lithium Hydroxide Production Separation Rapids Lithium Project Kenora, Ontario*" dated November 10, 2016, effective October 21, 2016 (the "Technical Report") and prepared by Steven R. Aiken, P.Eng. and Kevin E. Hawton, P.Eng. of Knight Piesold Limited, Richard Gowans, P.Eng., Christopher Jacobs, CEng, MIMMM, Eur Ing, Bruce Pilcher, CEng, FIMMM, FAusIMM(CP) and Jane Spooner, P.Geo, all of Micon, and David L. Trueman, Ph.D., P.Geo, each of whom is a qualified person pursuant to NI 43-101.

The current Technical Report follows an earlier Pre-feasibility Study ("PFS") completed in 1999 and updated in 2000, also by Micon. The PFS was based on the original development model of producing a lithium mineral product for glass-ceramics applications and did not consider battery materials as a potential primary product.

The current Technical Report was prepared to exclusively evaluate the lithium battery materials market opportunity and the economics of producing a lithium hydroxide product from the petalite concentrate, something which has not been done previously to the knowledge of the Company. This does not preclude the possibility of producing petalite concentrate for the glass-ceramics market, since it is an intermediate product for battery materials production. Future work will consider both markets as opportunities.

The metallurgical test work programs were critical for the evaluation off the potential for the production of a marketable product from the project.

Through the completion of these critical testwork programs Avalon was able to demonstrate the following in the PEA:

- A petalite concentrate assaying over 4% Li_2O can be produced which, because of its low impurity levels, is potentially an excellent feed material to the specialized glass/ceramics industries.
- A low impurity mixed (sodium/potassium) feldspar concentrate can also be produced which has applications in a number of ceramic applications as well as a filler in paints and other products.
- There is potential to produce other by-products from the mineralized material, including a high purity quartz, and for additional lithium recovery from the magnetic fraction.
- The petalite can be used as a feed source to produce both lithium carbonate and lithium hydroxide for the battery and energy storage industries.
- The use of electrodialysis has been shown as a viable for producing lithium hydroxide from a lithium sulphate solution.

The results of these key testwork programs conducted by Anzaplan and Thibault and Associates are included in the relevant sections of the PEA.

There remain a number of areas within the process flowsheet that have the potential for improvement and optimization in terms of lower costs and increased process efficiencies; the optimization work continues.

Recovery Methods

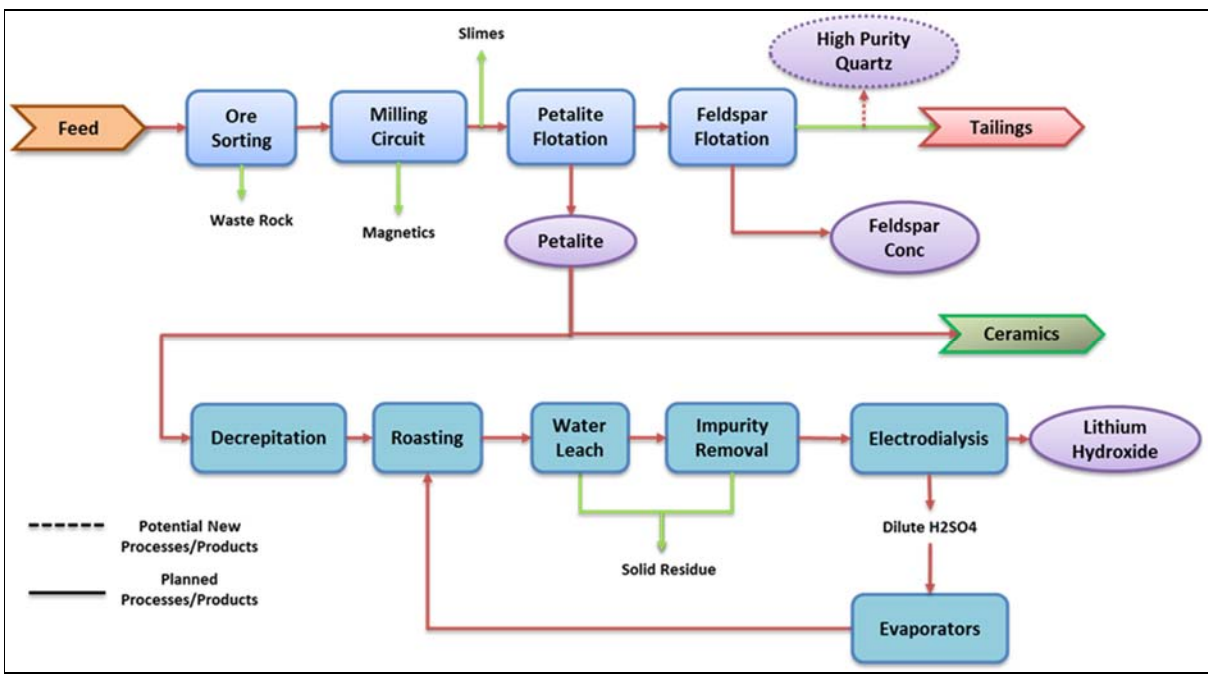
The process selected for the PEA comprises the mineral separation and recovery of a petalite concentrate containing >4.0% Li_2O and a mixed sodium/potassium feldspar from petalite tailings. The process includes processing of petalite by hydrometallurgical methods to produce battery grade lithium hydroxide.

Results from the testwork programs have been used to develop a processing flowsheet, mechanical equipment list and reagent consumptions. In addition a "Metsim" simulation model of the entire process has been generated, data from which has been used for sizing process equipment and calculating heat and energy balances. The selected flowsheet is shown in the figure below.

The process design is based on the following assumptions:

- Optical sorting mass waste rejection is 14.8% with lithium losses of 1.9%.
- Mass pull to slimes after comminution is 6% of sorted ore with 6.5% lithium losses.
- Mass pull to magnetics is 14.6% of sorted ore tonnage with lithium losses of 14.5%.The petalite flotation concentrate contains 4.0% Li_2O% and lithium recovery to petalite is 65.2% of flotation feed content.
- Water leach lithium extraction after decrepitation and roast is 93.8%.
- Lithium losses from impurity removal is 3%.
- A final lithium hydroxide product purity of 99.5% $LiOH.H_2O$.
- Plant availabilities of 93% for the concentrator and 85% for the hydrometallurgical plant.

Simplified Process Block Flow Diagram



Results and Conclusions of Metallurgical Testwork included within PEA

Interpretation and Conclusions

The PEA demonstrates that the SRLD can be developed into an economically robust mining and processing operation to produce a lithium hydroxide feedstock for the lithium ion battery and energy storage industries. It does not preclude the possibility of producing other lithium products for glass-ceramics applications.

The environmental impacts of the project are minor as a result of the low levels and nature of impurities in the SRLD material. This is expected to reduce risk of permitting delays.

The site is well located with easy access to important infrastructure facilities for power supply, skilled labour and material transportation. Engagement to date with local communities has resulted in good support for the project and the potential exists for greater engagement and utilization of local businesses.

Given the potential for a range of products to be recovered from the SRLD, the potential also exists to develop a staged approach to project development and financing that will allow Avalon to adapt to market uncertainties as the project advances.

Such a staged approach may start with the production of lithium mineral concentrates for glass-ceramics consumers, resulting in cash flow before investing further in a hydrometallurgical plant to produce a derivative battery material from the petalite concentrate. A petalite concentrate may be saleable to a third party battery material producer equipped to process similar lithium mineral concentrates. Such opportunities are likely to emerge over the next few years as the market for battery materials grows.

A staged approach has the potential to reduce capital investment risk. A staged approach would also include development of a demonstration plant in order to provide the required volumes of product samples to potential customers for evaluation and acceptance, as well as to provide improved operating and cost parameters, and potentially improved prospects for project financing.

This PEA has shown that the Separation Rapids Lithium Project offers a number of other advantages that will contribute to reduced capital investment risk. These include the relatively low environmental impacts and strong support for the project within the local community due to the long history of engagement and the positive relationships developed with local indigenous communities, notably Wabaseemoong Independent Nation.

Appendices:

Appendix 1: NI 43-101 Technical Report on the Preliminary Economic Assessment of Lithium Hydroxide Production – Separation Rapids Lithium Project

Appendix 2: Claim Status - Mining Lease

Appendix 3: Claim Status - Unpatented Mining Claims, as of 31 December 2016

Appendix 4: Mineral Resource Estimate

Appendix 5: Market Studies for Lithium and Feldspar Markets

Appendix 6: Part 1: "One Tonne Petalite Concentration Production Test"

Part 2: "Feldspar Filler Tests"

Appendix 7: Table 13.1 – List of Mineral Processing Testwork Reports"

Appendix 8: Part 1: "Water Quality"

Part 2: "Fisheries"

Appendix 9: "Hydrometallurgical Plant Process Design"

Appendix 1

NI 43-101 Technical Report on the "***Preliminary Economic Assessment of Lithium Hydroxide Production – Separation Rapids Lithium Project***".

Due to its size, this document can be viewed or downloaded from:

http://avalonadvancedmaterials.com/_resources/reports/Separation-Rapids-PEA-NI-43-101-10Nov16.pdf

Appendix 2: Claim Status - Mining Lease

Avalon Rare Metals Inc. Mining Lease CLM 469

Tenure Type:	Lease	**Sub-Tenure Type:**	21 Year
Lease or Licence:	108395	**Tenure Rights:**	Mining and Surface Rights
Start Date:	2009-Oct-01	**Lease Expiry Date:**	1930-Sep-30

LAND ATTRIBUTES

Status:	Active	**Area in Hectares:**	421.441
Township or Area:	PATERSON LAKE AREA		
Description:	CLM469 CLM469 comprising Mining Claims K1178304, K1178305, K1178306, K1178349 and K1247023, pts 1-5, 23R11732, Paterson and Snook Lake Areas		
Location No:	469	**Section or Block No:**	
Survey Plan:	23R11732	**Part on Plan:** 1-5	**CLM No:**
Land Registry Office:	KENORA (KENORA)	**Parcel No:**	**PIN No:**

Appendix 3: Status of Unpatented Mining Claims as of 31 December 2016

Township / Area	Claim Number	Units	Recording Date	Claim Due Date	Status	Percent Option	Work Required	Total Applied	Total Reserve	Claim Bank
PATERSON LAKE AREA	1178857	14	1997-Feb-13	2017-Feb-13	A	100%	$5,600	$100,800	$0	$0
PATERSON LAKE AREA	1178858	16	1997-Feb-13	2017-Feb-13	A	100%	$6,400	$115,200	$0	$0
PATERSON LAKE AREA	1178859	8	1997-Feb-13	2017-Feb-13	A	100%	$3,200	$57,600	$0	$0
PATERSON LAKE AREA	1247024	16	2001-Feb-01	2017-Feb-01	A	100%	$6,400	$89,600	$0	$0
PATERSON LAKE AREA	4218361	8	2010-Jan-19	2017-Jan-19	A	100%	$3,200	$16,000	$0	$0
SNOOK LAKE AREA	4218354	6	2016-Mar-16	2018-Mar-16	A	100%	$2,400	$0	$0	$0
SNOOK LAKE AREA	4218355	16	2016-Mar-16	2018-Mar-16	A	100%	$6,400	$0	$0	$0
SNOOK LAKE AREA	4218356	6	2016-Mar-16	2018-Mar-16	A	100%	$2,400	$0	$0	$0
	Total Units	90								

Appendix 4: Mineral Resource Estimate

Lithium and feldspar mineral resource estimates for the Separation Rapids project have been prepared by Benjamin Webb, P.Geo. (B.C.), Principal of BMW Geoscience LLC. The mineral resource estimates have been reviewed in detail by David L. Trueman, Ph.D., P.Geo., who is the Qualified Person for the resource estimates.

Lithium Mineral Resource Estimate

The project database contains 69 drill holes for 10,171 m with 2,790 assay results. The data were used to create a 3D model of the host lithology which was used to constrain the interpolation of assays. The project database is maintained in Maxwell DataShed™ software and the resource estimation utilized MineSight 3D.

The Separation Rapids Lithium Project Measured plus Indicated and Inferred mineral resource effective October 21, 2106 are presented in the table 9.1 below.

Separation Rapids, Mineral Resource Estimate at 0.6% Li_2O Cut-off Grade

Class	Tonnes (Mt)	Li_2O (%)	Total Feldspar (%)	Ta_2O_5 (%)	Cs_2O (%)	Rb_2O (%)	SG
Measured	4.03	1.32	39	0.006	0.017	0.343	2.66
Indicated	3.97	1.26	39	0.007	0.025	0.362	2.67
Measured plus Indicated	8.00	1.29	39	0.006	0.021	0.352	2.66
Inferred	1.63	1.42	39	0.008	0.016	0.360	2.64

Notes:

1. CIM Definition Standards for Mineral Resources and Mineral Reserves, 10 May, 2014 were followed for this mineral resource estimate.
2. The Qualified Person for this mineral resource is David L. Trueman, Ph.D.,P.Geo.(MB).
3. The resource estimate is constrained by a 3D geologic model of the mineralized material.
4. Assay intervals for Li_2O, Ta_2O_5, Cs_2O and Rb_2O were interpolated using the Inverse Distance Weighted method to create a 3D block model.
5. The resource cut-off grade of 0.6% Li_2O was chosen to capture mineralization that is potentially amenable to mining, mineral concentration and off-site processing.
6. Li, Ta, Cs and Rb were originally analyzed on all samples at an independent laboratory in Thunder Bay, Ontario utilizing ICP (Li, Ta) and AA (Rb and Cs) and check analyses completed at a second independent laboratory in Don Mills, Ontario utilizing AA (Li) and ICP (Rb).
7. As well as due diligence to verify historic data, Avalon completed additional check analyses of historic drill core in 2016 utilizing an independent laboratory in Vancouver with a combination of fusion and ICP (method CCP-PKG01). Included as QA/QC procedures was a lithium rock standard within the check analysis batches.
8. Total Feldspar is the total of potassium feldspar (microcline) and sodium feldspar (albite) and the value reflects the mean and median value of all samples with quantitative mineralogy determined.
9. The percentage of Total Feldspar is based on analyses completed utilizing X-Ray diffraction and Qemscan® instrumentation on samples representing all lithological subunits of the mineral deposit. These analyses were completed at a Canadian university in 1999 (method: XRD) and an independent laboratory in 2016 (XRD and Qemscan®, Kamloops). This is supported by quantitative mineralogy of metallurgical samples determined at two independent facilities.
10. All figures are rounded to reflect the relative accuracy of the estimates. Summation of individual columns may not add-up due to rounding.
11. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability. There is no certainty that all or any part of the Mineral Resource will be converted into Mineral Reserves.
12. In addition, while the terms "measured", "indicated" and "inferred" mineral resources are required pursuant to National Instrument 43-101, the U.S. Securities and Exchange Commission does not recognize such terms. Canadian standards differ significantly from the requirements of the U.S. Securities and Exchange Commission, and mineral resource information contained herein is not comparable to similar information regarding mineral reserves disclosed in accordance with the requirements of the U.S. Securities and Exchange Commission. U.S. investors should understand that "inferred" mineral resources have a great amount of uncertainty as to their existence and great uncertainty as to their economic and legal feasibility. In addition, U.S. investors are cautioned not to assume that any part or all of Avalon's mineral resources constitute or will be converted into reserves.

Variographic analysis was undertaken to support the classification of the resource.

A block model covering the entire Separation Rapids Pegmatite consisting of 10 m by 3 m by 10 m blocks was constructed using MineSight 3D software. Blocks were elongated east-west to fit the strike of the deposit and were not rotated.

Interpolation of block values was done in two passes using the Inverse Distance Weighted with a power parameter of 2 (IDW2) method and block matching on ore code (OREC). A mineralization code of 6 was assigned to all blocks at least 1% within the 3D geological model of Unit 6 and a mineralization code of 1 was assigned for all other blocks. This ensures that all blocks containing mineralization received an interpolated grade. The search ellipsoid was rotated 105° to match the strike of the deposit so that the narrowest search distance was at a 15° azimuth perpendicular to strike.

Estimated Feldspar Resources

The Separation Rapids Project is a potential producer of high purity feldspar, a mixture of albite and potassium feldspar, in addition to lithium chemicals and/or petalite. In order to determine the feldspar content of the SRLD various mineralogical studies have been completed. As reported in the technical report, these included Qemscan and X-Ray diffraction. It is considered that Qemscan® measurement of 39% on individual samples can be accepted as a reasonable estimate of the feldspar content of the whole pegmatite body. In addition, Qemscan of bulk metallurgical test samples gave similar values with a mean of 41.3% total feldspar and a median of 39.7% total feldspar.

Appendix 5: Market Studies for Lithium and Feldspar Markets

Lithium Demand

The U.S. Geological Survey (USGS) reports production of lithium minerals and products. In terms of gross product weight, Australia is the largest single producer of lithium minerals and chemicals, with output exceeding 400,000 t/y spodumene. Chile is the second ranking producer with a range of lithium chemicals recovered from subsurface brines. In terms of contained lithium, Australia and Chile are also significant producers of lithium.

Lithium consumption in batteries has increased significantly over the past five years, to the point where it now surpasses demand in ceramics and glass. Rechargeable lithium batteries are used in a wide range of applications including cell phones, cameras, portable electronic devices, hand-held tools and increasingly, in electric vehicles and electrical grid storage. It is expected that battery demand will continue to outpace other lithium demand sectors and will drive overall lithium demand. While the automotive sector is expected to show the most rapid growth, projected growth in global lithium demand also includes consumer electronics and grid energy storage sectors.

It is projected that demand for lithium hydroxide will grow at a higher rate than that for lithium carbonate based on changes in battery technologies. Avalon considers that the Separation Rapids Lithium Project will be well-placed to supply new battery production facilities in North America.

Lithium Prices

Lithium is not traded on any formally recognized exchange and there are few sources of reliable publicly available price data. Transactions are negotiated directly between seller and buyer and payment terms are rarely reported.

Apart from a sharp correction in 2010, prices for both lithium carbonate and lithium hydroxide have risen steadily over the past decade. Prices reported by Industrial Minerals journal as of mid-August, 2016 were US$8,500-11,000/t delivered in Europe, or US$8,300-10,000/t delivered in Europe for Chinese material.

Avalon has reviewed all publicly available lithium price forecasts. There is no consensus among analysts on future lithium chemicals prices. For Lithium hydroxide prices in 2019-2020, when Avalon may enter the market, forecasts range from current price levels to as high as US$25,000/t, with the average being around US$16,000-17,000/t. For the purposes of the PEA, Avalon has used a relatively conservative average price assumption of US$11,000/t FOB plant for lithium hydroxide consistent with reported current price levels.

Feldspar Demand

The feldspar group is by far the most abundant group of minerals in the earth's crust, forming about 60% of terrestrial rocks. They are widely produced with global output estimated by the USGS in 2015 at 21.2 Mt. Turkey, Italy, India and China are by far the largest producers. Production in the United States has declined steadily over the past five years. The USGS does not report any production from Canada.

Feldspar is an important ingredient in the manufacture of glass and an important raw material in ceramics because it acts as a fluxing agent, reducing the strength, toughness, and durability of the ceramic body, and cements the crystalline phase of other ingredients, softening, melting and wetting other batch constituents. Feldspars also are used as fillers and extenders in applications such as paints, plastics and rubber. The glass market for feldspar in the United States represents the largest market at around 68% while ceramics account for 23% and filler and other applications, including chemicals, paints, rubber and plastics, represent less than 10%.

It is projected that between 2015 and 2022, feldspar demand in the United States will grow at a compound average annual growth rate of 3.8% to reach nearly 800,000 t/y. Through discussions with market participants and industry experts, and evaluation of data provided in purchased reports and publicly available information, Avalon estimates that 100,000 t/y of feldspar can be sold into the glass, ceramics, frits/glazes and filler markets at an average price of US$170/t. Sales will be built up to 100,000 t/y over a period of five years.

A potential additional application for petalite is to reduce the coefficient of thermal expansion in ceramic bodies and glazes.

Part 1:

13.3.6 One Tonne Petalite Concentrate Production Test

In August, 2015, Avalon engaged ANZAPLAN to produce one tonne of petalite concentrate, using the flowsheet and conditions developed from previous tests. For this test program, the coarse and fine grained mineralized samples were combined.

Approximately 30 t of crushed mineralized sample, sized 8-25 mm, was delivered to Germany for processing in a pilot plant facility. The sample was first wet screened to remove any -6 mm material, optically sorted to remove dark coloured gangue minerals then crushed to -0.3 mm and classified to remove -0.1 mm fines before undergoing magnetic separation to remove iron minerals using a Metso unit. Non-magnetic material was then forwarded to petalite flotation with the objective to produce a >4.0% Li_2O low iron petalite product.

The flotation pilot plant was initially set-up to recycle the brine streams to minimize flotation reagent consumptions. However, selectivity issues in the rougher flotation stages prevented the production of a suitable petalite product at reasonable recoveries. Following some additional bench scale testing the pilot test continued with reduced collector dosages and open circuit production without brine recirculation and the 1 tonne sample of petalite concentrate was successfully produced. The analysis of the petalite concentrate is presented in Table 13.7.

Table 13.7
Chemical Analysis of the Pilot Plant One Tonne Petalite Concentrate Product

Description	Formula	Assay (%)	Trace elements	
			Element	ppm
Lithium oxide	Li_2O	4.0	Fe	44
Rubidium oxide	Rb_2O	0.06	Cr	0.6
Silicon oxide	SiO_2	77.8	Mn	22
Aluminum oxide	Al_2O_3	16.6	Ti	2.5
Iron oxide	Fe_2O_3	<0.01	Co	<0.5
Titanium dioxide	TiO_2	<0.01	Ni	<0.5
Potassium oxide	K_2O	0.6	Cu	1.0
Sodium oxide	Na_2O	0.4	V	<0.5
Calcium oxide	CaO	<0.01	F	500
Magnesium oxide	MgO	<0.01		
Manganese oxide	MnO	<0.01		
Phosphorus pentoxide	P_2O_5	<0.01		
LOI 1,000°C		0.5		

Subsequent investigations identified a number of key recommendations which need to be incorporated into the flotation circuit. These include the following:

- Grind top size should be reduced from 0.3 mm to around 0.25 mm.

- HF dosage to be controlled by flotation feed tonnage and not simply by slurry pH.
- Some of the recycled water will need to be neutralized before recycling in order to control pH.
- It will be necessary to partially remove dissolved ions (especially Al, S, Mg, Ca) in the recycle water as these tend to interfere with the flotation chemistry as their concentration increases.
- Collector dosage needs to be reduced.

Confirmation of the effectiveness of these changes will be determined during the next program of flotation testing.

Part 2

13.3.7 Feldspar Filler Tests

The potential to use the feldspar concentrate filler for the paint and other industries was investigated by ANZAPLAN. The material was milled to three different product sizes (50% passing size (d50) of 2.5, 6.3 and 23 µm) and analyzed for a number of physical characteristics.

The results from these tests were considered promising although the two finer products contained slightly elevated amounts (1.3% and above) of size-weighted respirable crystalline silica (SWERFcs) which could possibly be reduced during flotation by introducing additional cleaner stages. A SWERFcs value greater than 1% means that the material is classified as hazardous.

A sample of the d50 6.3 µm material was also tested as filler in a number of actual commercial indoor paint recipes (2 German and 1 US) and compared to a commercially available material currently being used as paint filler. Avalon's material compared favourably showing almost the same results with regards rheology, density, brightness, colour, scrub resistance and gloss.

The feldspar used to produce the above filler products was recovered from a simple rougher-only flotation circuit so ANZAPLAN then produced a feldspar concentrate through a process involving cleaner stages. The impact of this was a reduction in silica content of the concentrate from 2% to 1.5%, plus a final SWERFcs value of 0.6% after grinding to a d50 of 6µm.

13.3.8 Hydrometallurgical Testwork

Table 13.8 lists the hydrometallurgical testwork reports issued since the project was re-activated in 2014.

Table 13.8
List of Recent Hydrometallurgical Testwork Reports

Date	Author	Title	Remarks
May 2015	SRC	Preliminary Li leaching, purification and Li carbonate and hydroxide preparation from petalite concentrate	Testwork to determine if battery specification carbonate and hydroxide can be produced from petalite.
December 2015	SRC	Li Carbonate Production from Petalite Concentrate	Bench optimization of process to produce battery specification lithium carbonate.
December 2015	Thibault & Associates	Process Alternatives- High Level Operating Cost Assessment	Thibault compare various lithium hydroxide production processes to identify most cost efficient.
October 2016	Thibault & Associates	Hydrometallurgical Bench Scale Test Program/Process Simulation and Economic Model	Bench scale assessment of most favourable conditions for main stream unit operations including electrodialysis and development of process design criteria .

13.3.9 Saskatchewan Research Council Testwork

13.3.9.1 Preliminary Petalite Leaching Test

Saskatchewan Research Council (SRC) completed four preliminary bench scale tests for Avalon in 2014 to investigate effective methods for the leaching of petalite to recover lithium. Each of the four tests included calcination, roasting and water leaching. The best test result was from Test 4 where the petalite was calcined for two hours at 1,100°C before roasting at 300°C for 1 hour and leached with water. The results from Test 4 are summarized in Table 13.9. The lithium extraction achieved was 96.6%.

Table 13.9
Summary of SRC Preliminary Petalite Leaching Test 4 Results

Component	Feed Analysis (%)	Extraction (%)
Solids mass	100.0	0.32
Li_2O	4.0	96.6
Rb_2O	0.06	5.8
SiO_2	77.8	1.5
Al_2O_3	16.6	5.0
Fe_2O_3	<0.01	0.3
TiO_2	<0.01	0
K_2O	0.6	0
Na_2O	0.4	34.5
CaO	<0.01	0
MgO	<0.01	0
MnO	<0.01	0.06
P_2O_5	<0.01	-
LOI	0.5	-

flotation process to recover separate concentrates of mica, petalite, sodium feldspar, potassium feldspar and spodumene from the Separation Rapids deposit.

13.3 RECENT METALLURGICAL TESTWORK

Following renewed interest in the Separation Rapids Lithium Project in 2013 and 2014, Avalon was requested by potential customers to provide fresh samples of petalite concentrate. However, attempts by SGS-L to reproduce the results from 2009 were unsuccessful.

Avalon approached Dorfner ANZAPLAN (ANZAPLAN), a German company that specializes in the processing of high purity industrial and strategic minerals, to develop a process for recovering the petalite and achieving target product grade of >4% LiO_2. ANZAPLAN also investigated the recovery of a low impurity feldspar by-product and tested these products to determine their suitability in a number of industrial applications.

With the increasing demand for lithium chemicals to satisfy the growth in the battery and energy storage industries, Avalon investigated the potential to use petalite as a source of both lithium carbonate and hydroxide. Initial investigations for producing carbonate were completed by the Saskatchewan Research Council (SRC) and subsequently by Thibault and Associates Inc. (Thibault), which developed the process for producing lithium hydroxide.

13.3.1 Mineral Processing

Table 13.1 lists all the flotation/concentrator testwork reports issued since the project was re-activated in 2014:

Table 13.1
List of Mineral Processing Testwork Reports

Date	Author	Title	Remarks
June 2014	ANZAPLAN	Processing of Petalite Ore from Separation Rapids	Petalite and feldspar flotation testwork on coarse grained mineralized material.
August 2014	ANZAPLAN	Physical Processing of Fine Grained Ore from Separation Rapids	As above but using fine grained mineralized material.
September 2014	ANZAPLAN	Processing of Petalite Ceramic Application Tests	Sample of petalite was tested to determine key physical/chemical characteristics for ceramic applications.
September 2014	ANZAPLAN	Sample Production of Petalite and Feldspar Concentrate	20 kg of both materials were produced for providing samples to potential clients.
November 2014	ANZAPLAN	Flowsheet and Core Machinery	Base flotation flowsheet and preliminary equipment recommendations.
December 2014	ANZAPLAN	Locked Cycle Petalite Flotation Tests on Fine Grained Ore (FGO)	Bench scale determination of petalite flotation recovery with locked cycle tests.
June 2015	ANZAPLAN	Pretests Pilot Scale Sample Production of Petalite and Feldspar Concentrates	To determine optimum conditions for magnetic separation and product filtration.
July 2015	ANZAPLAN	Analysis of Nb/Ta in Magnetic Fraction of Separation Rapids Ore	Determination of nature of Nb and Ta in magnetics discard stream.
December 2015	ANZAPLAN	Testing and characterization of a feldspar	Sample of feldspar was tested to determine

Date	Author	Title	Remarks
		filler	key physical/chemical characteristics for flier applications.
May 2016	ANZAPLAN	Pilot Scale Sample Production of 1t Petalite Concentrate	Bulk sample processed to produce a 1 t sample of petalite.
June 2016	ANZAPLAN	Evaluation of HPQ Potential of Flotation Tailings from the Big Whopper Pegmatite	Testwork investigations to determine if tailings from pilot plant could be used to produce a high purity quartz product.
May 2016	Dorfner	Testing of Feldspar sample as potential paint filler	Note from Dorfner confirming their tests indicating Avalon feldspar matches existing paint fillers.
2015/2016	SRC	Various flotation tests' analyses	Excel spreadsheets with test results plus various small petalite sample production tests.
October 2016	ANZAPLAN	Sample Production – Feldspar Filler	Feldspar concentrate with lower silica content produced by introducing a number of cleaner flotation stages. This was then milled to a d50 of 6 μm and determined to have a SWERF value of 0.6%.

The results and conclusions generated by this work are summarized as follows:

13.3.2 Preliminary Physical Separation Testwork – ANZAPLAN

In late 2013, Avalon sent a small mineralized sample to ANZAPLAN to investigate producing a petalite concentrate containing >4.0% Li_2O with a low iron content (<100ppm). An analysis of the sample is presented in Table 13.2.

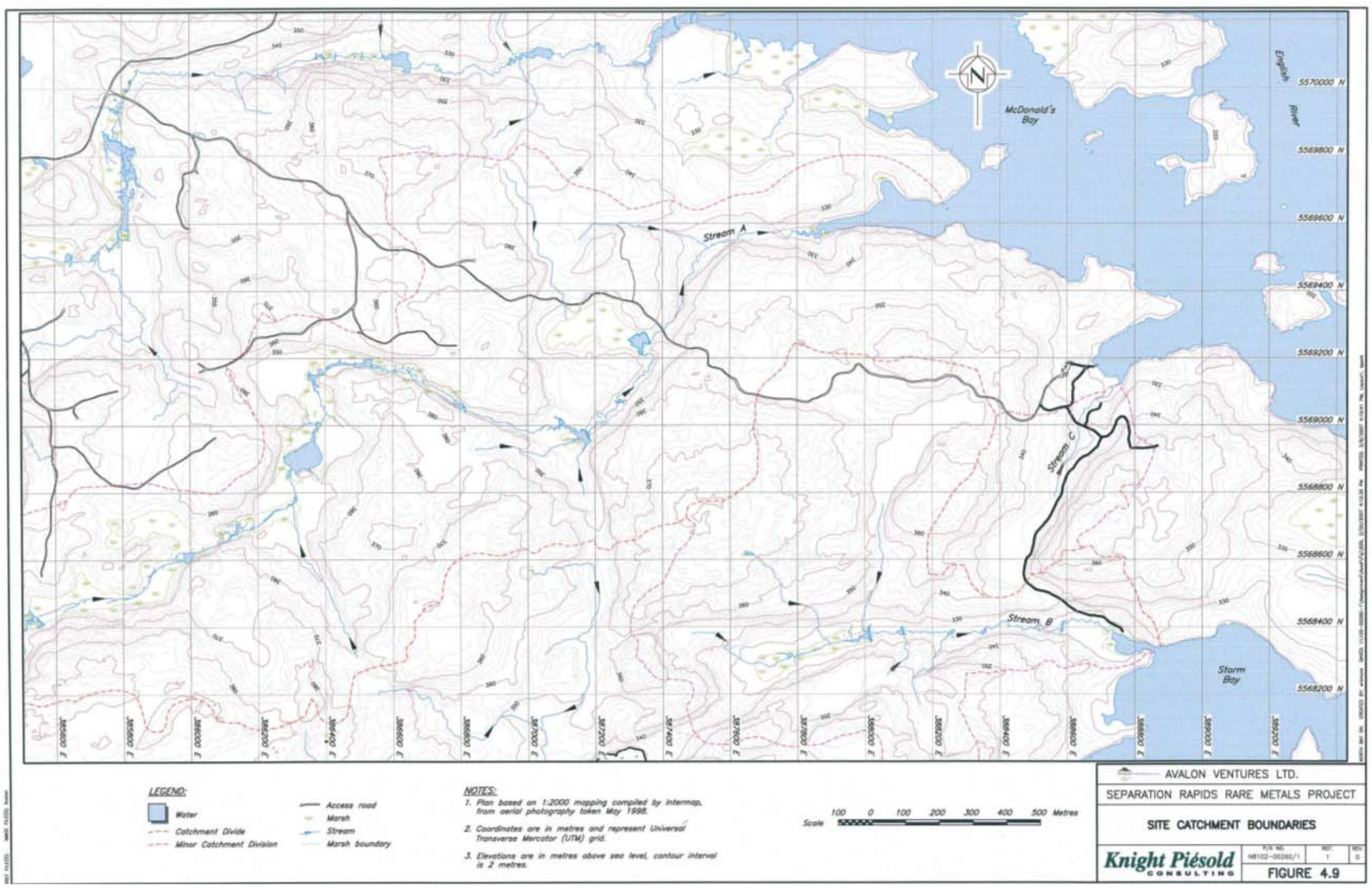
Table 13.2
Analysis of the 2013 Metallurgical Test Sample to ANZAPLAN

Description	Formula	Assay (%)
Lithium oxide	Li_2O	1.64
Rubidium oxide	Rb_2O	0.34
Silicon oxide	SiO_2	74.9
Aluminum oxide	Al_2O_3	16.2
Iron oxide	Fe_2O_3	0.25
Titanium dioxide	TiO_2	<0.01
Potassium oxide	K_2O	2.29
Sodium oxide	Na_2O	3.26
Calcium oxide	CaO	0.10
Magnesium oxide	MgO	0.04
Manganese oxide	MnO	0.24
Phosphorus pentoxide	P_2O_5	0.05
LOI 1,000°C		0.65

The sample was a mix of coarse and fine grained pegmatitic rock. Since the degree of mineral inter-growth for the coarse and fine grained texture differed, ANZAPLAN used

Local and regional hydrology will not be affected by mine development, as the proposed mine will occupy less than 2 km^2 in area. This is not significant in terms of total size of the English River and the Storm Bay watersheds and, since no significant effluent discharge quantities are projected from mine operations, no hydrological impacts are predicted. The site drainage system is shown in Figure 20.2.

Figure 20.2
Site Catchment Boundaries



20.8 WATER QUALITY

Results of a 12-month surface water quality monitoring program on the English River during 1998-1999 revealed that median concentrations of the majority of parameters monitored are comparable to those expected in a river free of major contaminant inputs. Provincial Water Quality Objectives (PWQO) were at times exceeded for aluminum, cadmium, copper, mercury, lead, silver and zinc, which is not unusual for catchments containing mineralized zones.

A baseline water quality monitoring program was initiated in streams on the proposed mine site. Aluminum was found to exceed PWQO which, in the absence of known anthropogenic sources, is most likely due to natural weathering of soils and bedrock. PWQO concentrations for cadmium, copper, iron, lead and zinc were also exceeded. Baseline water quality data will be used to define water quality goals on closure of the proposed mine.

The preliminary characterization testing indicates that the mine rock and mineralized material will not be acid generating. Additional work in 2015 analyzed selected "worst case" mine rock samples. Even the single highest and rare sulphide bearing samples with visible sulphidic material had a carbonate: sulphur ratio of 8:1, further supporting this conclusion. Impacts to the water quality of receiving waters could potentially result from runoff from the waste rock storage facilities or TCMA. Parameters of potential concern may include suspended solids, organic reagents and brine used during processing, and residual trace metals from weathering of waste rock and tailings. However, the preliminary Synthetic Precipitation Leaching Procedure (SPLP) tests on mineralized material, mine rock and tailing suggest that runoff would not contain any parameters that would exceed the Metal Mining Effluent Regulations. All mine rock will thus be stored as aggregate for future utilization.

Nitrate is a potential nutrient of concern that can be generated by the use of ammonium nitrate blasting agents. Phosphorus is not a concern from the mineralized material, mine rock aggregate, processing or the minor quantities of treated sewage. On this basis, eutrophication from nitrate is unlikely due to the fact that phosphorus is normally the limiting nutrient in northern Ontario waters. Regardless, best management practices for blasting will be incorporated, and monitoring of nitrate concentrations will be part of the ongoing monitoring plans. In the event that nitrates approach concentrations of concern, strategies can include the use of emulsions, mine employee retraining in ammonium nitrate management and investigation of the maintenance of ammonium nitrate storage and/or loading equipment or using wetland treatment.

Several measures to mitigate impacts to water quality will be incorporated into the project plan, including:

1) Recycling and potentially treating process water to minimize fresh water requirements and the rate of discharge to the environment.

2) Diversion of non-impacted site runoff away from the site to reduce impacted water volume.

3) To significantly reduce the risk from tailing water at the TCMA, tailings will not be hydraulically placed and will be filtered and trucked to the TCMA as solids.

4) Collection and treatment of process and pit water in the concentrator.

5) Construction of a final clarification pond to remove suspended solids and facilitate treatment from the TCMA and mine rock aggregate surface runoff (if necessary) prior to discharge to the environment.

6) Installation of a submerged pipe fitted with an end diffuser to discharge water from the settling/event pond and/or the treated water from the concentrator into the main channel of the English River in order to maximize mixing and the assimilative capacity of the river. This would reduce potential impacts to water quality in Storm Bay, which has a relatively small catchment area and outflow, and therefore would have a low assimilative capacity for effluent.

During the next phase of the project when additional water and waste products are available from the final process flow sheet, including internal recycle and/or water treatment, additional water quality testing will be completed on all waste streams. Humidity cell and additional water quality and biological toxicity studies are proposed on additional mine rock aggregate, concentrate and tailing samples. A water treatment process will be developed and tested if necessary to meet regulatory requirements. Impacts to water quality as a result of mine development are considered to be mitigable and not significant.

20.9 GROUNDWATER

Groundwater hydrogeology will be of major importance during mine development due to the close proximity of the planned open pit to the English River. A detailed hydrogeological assessment of the mine site is scheduled for completion during the next phase of the project, including an assessment of groundwater and an evaluation of the hydrogeological conditions near the proposed open pit. A key focus will be on the future pit dewatering requirements, pit stability and the engineering requirements for the mine rock aggregate, tailings and concentrate management areas.

Existing data suggests that bedrock underlying the site is relatively impermeable, which would reduce the risk of groundwater impacts. As the tailing/concentrate and mine rock aggregate will also not be acid generating, acid mine drainage is not considered an issue at this site. Dry stacking of tailing and concentrate further reduces this risk.

Dewatering of the open pit will create a groundwater drawdown cone in the vicinity of the pit. The planned detailed hydrogeological investigation will evaluate the potential impacts of the drawdown cone between the pit and the river. This may result in elevated flows from the river into the pit that will require management and to ensure the safe operation of the pit. During development and operation of the pit, water inflow from the English River to the open pit via groundwater will be monitored. Significant groundwater inflows to the pit may be controlled by grouting.

20.10 VEGETATION

The project is located in the boreal forest region. The dominant tree species found on the project site are jack pine and black spruce. The site is characterized by thin soils and dry site vegetation communities, as well as several wetland communities, including a black spruce swamp immediately adjacent and to the southwest of the deposit, as well as several marsh communities adjacent to the English River. Upland vegetation communities observed

20.11 WILDLIFE

Wildlife in the project area is abundant, with the species observed typical of Ontario's boreal forests. Large flocks of common mergansers were observed at Separation Rapids during spring migration, while common mergansers, common goldeneyes, buffleheads and mallards were observed breeding in the project area. Moose were the most common ungulate observed on the project site, while black bear, wolf, fisher, red fox, marten, mink, and otter are common carnivorous species. Small mammals, rodents and lagomorphs observed included deer mouse, beaver, red squirrel, muskrat and snowshoe hare. Wood frog, leopard frog and American toad were the most common amphibian species, while painted turtles were observed in Avalon Bay, and garter snakes were observed on site. Woodland caribou were not observed.

As noted above, a SARA was completed in 2013 (Knight Piésold, 2013). Bald eagles and white pelicans, which are on the Ontario Endangered Species list, were encountered in the project area. Bald eagles and white pelicans are both piscivores and no feeding opportunities for these species exist on the project site. Bald eagles nest in close proximity to water in conspicuous large stick nests that are used year after year and are usually located in trees a few metres from the shores of large water bodies. The closest bald eagle nest is over I km east of the proposed mine development. The white pelicans observed on the English River near the project site had likely moved into the area for summer feeding from the main pelican population and breeding ground on the Three Sisters Island in Lake of the Woods. It is concluded that mine development will not adversely impact bald eagle or white pelican populations. Little Brown Bats were identified on site, but no nesting habitat was identified. Some additional SARA work may be required following additional engagement or to address potential new areas impacted.

The project site is relatively small in a regional context, and contains no rare or significant wildlife habitat components. Most of the mammals inhabiting the site, with the possible exception of small mammals, will simply be displaced to the adjacent abundant suitable habitat. Since small mammals are generally prolific breeders, they are not sensitive to extirpation, and populations will re-expand to the capacity of the environment very quickly. The proposed mine development is not predicted to have a significant impact on wildlife.

Part 2

20.12 FISHERIES

A significant recreational fishery exists on the English River in the project area, providing income to local tourism outfitters and recreation for local anglers. The use of the fishery for subsistence by local First Nation communities has been restricted following historical contamination of the river with mercury, discharged from a pulp and paper mill located upstream. The major target species were identified as walleye, northern pike, and smallmouth bass. A benthic macroinvertebrate community monitoring program was conducted in 1998 to characterize fish habitat.

A northern pike spawning site was observed in Goose Bay, at the mouth of the stream flowing south of the proposed mine site into Storm Bay. The streams immediately to the north and the south of the project site both have populations of baitfish, including finescale dace, northern redbelly dace, fathead minnow, bluntnose minnow and ninespine stickleback. Since these streams are within a licensed baitfish block, there is a potential for commercial exploitation of the bait fishery, and therefore, the streams would be classified as fisheries habitat by the DFO. For this reason, no deposits of any mine rock or tailings are planned in these streams.

A third stream further south and west of the project has been selected for the TMCA. This facility is planned to be located in the upper intermittent reaches of this stream in an effort to avoid direct impacts on fisheries habitat. Additional study is required to validate this. Potential for impacts are low given that the tailings are non-acid generating and are not hydraulically deposited. Further, preliminary SPLP tests suggest little potential to impact streams. Unanticipated impacts to the downstream area dominated by wetland also have water quality polishing capability. Significant impacts to fisheries are expected to be mitigable. Similarly, the mine rock aggregate is not expected to generate leachates of concern, and simple settling of solids will be completed to mitigate this risk. Additional testing is planned, including toxicity testing, in the next project phase.

20.13 TAILINGS AND CONCENTRATE MANAGEMENT

The principal objective of the TCMA is to provide the safe and secure storage of the process waste products while ensuring the protection of the environment during operations and in the long-term (after closure). The conceptual level design of the TCMA has taken into account the following requirements:

- Permanent, secure and total confinement of all process waste products within an engineered facility.

- Control, collection and removal of free draining liquids from the tailings during operations for recycling as process water to the maximum practical extent.

- The inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved and design criteria and assumptions are met.

- Secure reclamation and closure of the impoundment after mining is complete.

- The flexibility to reprocess select by-products (concentrates) at a future date.

The TCMA design includes the initial starter arrangement and ongoing raises to the facility throughout the life of the operation.

Approximately 1.2 Mt of magnetics concentrate, 0.5 Mt of tailing slime, 1.4 Mt of hydrometallurgical plant tailings, and 3.8 Mt of feldspar concentrate will be produced over

17.3.11 Water

17.3.11.1 Fresh Water

Fresh water will be obtained from the nearby English River and pumped to a storage tank. Fresh water will be used to provide gland service water, potable water (after treatment in the potable water plant), reagent make-up water and filter wash water for the concentrate and tailings filter washing. If required, fresh water will also be used as a source of fire water.

17.3.11.2 Process Water

The water balance within the flotation plant is very complex; there will be a number of separate process water circuits at the flotation plant that will have their own dedicated process water storage tank and distribution systems. These circuits include:

- Comminution, classification, desliming and magnetic separation circuits.
- Petalite rougher, scavenger, primary cleaning and secondary cleaning circuits.
- Petalite third and fourth stage flotation cleaning circuits.
- Feldspar flotation circuit.

17.3.11.3 Water Treatment

Final water treatment testwork has not yet been concluded but for the PEA it is assumed that the treatment process will concentrate the contained salts into a high concentration brine, which may need to be stored and evaporated at the mine site or, preferably, sent to an approved waste facility. However, the potential exists for this solution to be utilized in part as brine make-up water for the petalite flotation circuit depending on residual flotation reagent levels. Cleaned, treated water will be recycled back to plant as much as practical with any excess being discharged to the environment (the treatment plant will be designed to ensure the water meets all necessary discharge criteria).

Appendix 9

17.4 HYDROMETALLURGICAL PLANT PROCESS DESCRIPTION

The hydrometallurgical facility will be located close to Kenora, approximately 70 km south of the mine site. The petalite flotation concentrate will be dried and loaded into 2 t bulk bags at the concentrator and delivered by truck from which it will be off-loaded at the hydrometallurgical plant into a bulk bag delivery hopper system.

17.4.1 Pyrometallurgical, Leaching and Impurity Precipitation Circuits

From the feed bin, petalite concentrate is fed at a controlled rate into a direct fired rotary kiln operating at a temperature of 1,100°C to cause "decrepitation" of the petalite mineral. The decrepitation kiln is equipped with an integrated dust collection system to recover petalite dust and minimize particulate emissions with the kiln off-gasses. The decrepitated material is then cooled to approximately 200°C by direct and indirect water cooling in a rotary cooler before being mixed with concentrated sulphuric acid in a paddle blender to prepare the material for roasting.

The roaster kiln is an indirect fired rotary kiln designed to provide residence time at 300°C to cause the conversion of the decrepitated petalite mineral to solid phase lithium sulphate. The roaster kiln is equipped with a wet scrubber system to remove any particulate and acid mist from the off-gas prior to release to the atmosphere. Roasted solids discharged from the kiln are leached in recycled spent electrolyte from electrodialysis as well as recycled leach residue wash filtrate and distilled water.

The final roast solids are cooled and discharged to the water leach circuit where soluble sulphates of lithium, sodium, potassium, aluminum, iron, calcium and magnesium are dissolved into the solution phase, leaving behind a barren leach residue containing primarily alumina-silicates. The leach residue is separated from the pregnant leach solution (PLS) using a combination of a thickener and a vacuum belt filter with counter-current washing capability. The washed leach residue filter cake is loaded into trucks for transport back to the Separation Rapids mine site for co-disposal with concentrator tailings in the dry stacked tailings management facility. (The possibility that this material may be of economic value is also to be investigated).

The PLS is fed into a steam-driven triple effect falling film evaporator to increase the lithium concentration to a target value of approximately 25 g/L (as Li), which has been defined as the initial specification for advance electrolyte feed to electrodialysis. Concentrating the PLS upstream of solution purification unit operations also improves on the efficiency of impurity precipitation. A PLS storage tank having a surge residence time is provided upstream of the PLS evaporation system to buffer any short-term fluctuations or interruptions in PLS flow.

The concentrated PLS is pumped to the primary impurity precipitation (PIP) circuit, where a bleed stream of crude mother liquor (containing a mixture of lithium, sodium and potassium hydroxides) from the crude lithium hydroxide crystallizer is used to neutralize acidity and adjust the pH of the PLS to a suitable range for precipitation of soluble aluminum as aluminum hydroxide (target pH range of 6 to 7). A total reaction time is provided for in the PIP circuit, which allows for gradual pH adjustment to avoid encapsulation of lithium ions in the freshly formed precipitate and to avoid post-precipitation of residual impurities after filtration. Effluent from the PIP circuit is filtered using a plate and frame style filter press and the filtrate is collected and pumped to the secondary impurity precipitation (SIP) circuit.

In the SIP circuit, crude mother liquor is once again used to adjust the pH of the solution, this time to an optimum range for precipitation of magnesium (target pH range of >12). A batch reaction time is provided in the SIP circuit to optimize on precipitation reactions and the resulting precipitate is filtered using a plate and frame style filter press, complete with pre-coat system. The solid residue from both the PIP and SIP circuits is combined with the filtered and washed leach residue for transport back to the mine site for final disposal. Since the impurity loadings are relatively low and the neutralizing reagent has high solubility in aqueous solutions, the amount of solid residue generated in the impurity precipitation steps is minimal (represents approximately 0.1 wt/% of the total solid residue generated from the hydrometallurgical process).

17.4.2 Ion Exchange, Electrodialysis and Lithium Hydroxide Crystallization

Minor metallic impurities such as chromium, copper, iron, nickel and zinc are also removed to low part per million (ppm) levels by the PIP and SIP unit operations, leaving calcium, residual magnesium and manganese as the main impurities to be removed in the ion exchange unit operation. The ion exchange resin is designed to be selective for removal of calcium and magnesium, and the equipment configuration is similar to that used for industrial water softening and calcium and magnesium removal from brine solutions used in the chlor-alkali industry.

The ion exchange columns are operated on a lead-lag basis, with redundant columns provided to improve on the overall process reliability. The ion exchange resin is stripped/regenerated using purchased sulphuric acid and is conditioned/neutralized with crude mother liquor from the crude lithium hydroxide crystallizer. It should be noted that this waste stream (effluent generated from re-conditioning of the ion exchange resin) is the only bleed stream from the hydrometallurgical circuit where impurities such as sodium and potassium, which are not removed in other solution purification steps, are removed from the circuit. Since this stream also contains soluble lithium hydroxide, there is a small associated loss of lithium with this effluent that represents approximately 0.1% w/% of lithium contained in the petalite flotation concentrate.

The purified solution from the ion exchange circuit represents the advance electrolyte feed to electrodialysis. A solution storage surge tank provides buffer capacity for the advance electrolyte solution. In the electrodialysis cells, an applied electrical current and ion selective membranes are used to convert lithium sulphate to lithium hydroxide and dilute sulphuric acid. Similar transformations occur for other monovalent sulphates in the advance electrolyte, such as sodium and potassium sulphate, resulting in the contamination of the lithium hydroxide solution with sodium and potassium hydroxide. Three separate solutions are produced from electrodialysis, these are:

i) A relatively dilute lithium/sodium/potassium hydroxide solution (maximum total hydroxide ion concentration of approximately 2.5 mol/L).

ii) A relatively dilute sulphuric acid solution (maximum acid concentration of approximately 10 wt% as H_2SO_4).

iii) A relatively dilute spent electrolyte solution containing unconverted lithium/sodium/potassium sulphate. The spent electrolyte solution is recycled to the water leach unit operations.

The dilute sulphuric acid stream is concentrated back to 93% H_2SO_4 in a dedicated spent acid concentration plant using multi-stage evaporation technology and is reused in the acid roasting stage of the hydrometallurgical process. With the proposed process configuration, it is possible to regenerate sufficient acid to satisfy approximately 80% of the total demand for sulphuric acid within the hydrometallurgical process.

The lithium hydroxide solution enters a two-stage evaporative crystallization circuit for production of battery grade lithium hydroxide monohydrate (minimum 99.5% $LiOH.H_2O$). The first stage is referred to as the "crude" crystallization stage in which water is evaporated from the lithium hydroxide solution produced from electrodialysis until a significant portion of the lithium hydroxide crystallizes in the form of lithium hydroxide monohydrate. Since both sodium and potassium hydroxide have much higher solubility in aqueous solution than lithium hydroxide, a bulk separation between lithium hydroxide and sodium/potassium hydroxide can be completed using selective crystallization techniques. The lithium hydroxide monohydrate crystals from the crude crystallization stage are dewatered in a centrifuge and washed with mother liquor from the "product" lithium hydroxide crystallization stage to remove excess sodium and potassium hydroxide remaining in the aqueous phase after dewatering the crude crystals.

The crude lithium hydroxide crystals are re-dissolved in a minimal amount of distilled water before entering the "product" lithium hydroxide crystallization stage. In the product crystallization stage, water is once again removed from the solution by evaporation, causing the majority of the lithium hydroxide to crystallize in the monohydrate form. Due to the limited carryover of sodium and potassium impurities from the crude to the pure crystallization stage, the resulting lithium hydroxide monohydrate crystals produced in the "ultra-pure" crystallization stage contain very low levels of impurities.

The crystals are dewatered in a centrifuge and washed with a minimal amount of distilled water (to minimize re-dissolution) before being dried under nitrogen atmosphere. Drying under nitrogen atmosphere is necessary to avoid adsorption of carbon dioxide from the air as the product is dried. The final lithium hydroxide monohydrate product is packaged in bags for shipment to the end user.

17.4.3 Residue

Solid waste will be generated from the following areas in the hydrometallurgical plant:

- Water Leach.
- Primary Impurity Removal.
- Secondary Impurity Removal.
- Wastewater Treatment Solids.

Solids generated from these areas will be washed and filtered separately before being transported by truck back to the mine site to be dry-stacked with feldspar tailings solids in the TCMA.

17.4.4 Reagents

There are a number of reagents used in the hydrometallurgical process. These reagents will be safely offloaded, stored and distributed to the various usage points within the plant. These reagents include:

- Sulphuric acid (93%).
- Sodium hydroxide (50%).
- Filter pre-coat, diatomaceous earth.
- Water Treatment chemicals.

17.4.5 Metal Accounting

The following measurements and samples will be automatically taken on a shift basis for metallurgical accounting and quality control purposes:

- A truck scale will be used to weigh trucks arriving and leaving the plant. The loads on these trucks will include petalite concentrate, lithium hydroxide, waste solids returning to mine site, sulphuric acid and caustic soda.

- Each bag of petalite fed into the plant and each bag of hydroxide produced will be labelled and weighed individually.

- Flowmeters and samplers will be installed at off-gas scrubbers and vents to detect the amount of water vapour and off-gas generated and general off-gas quality.

- A weightometer on the discharge conveyor of the petalite silo will measure daily tonnage treated and a small sample will be taken for assays for metallurgical accounting.

- Primary impurity removal feed (PLS): the impurity removal feed stream will be measured by a flow meter and an automated pipe sampler will produce a sample for metallurgical accounting.

- Secondary impurity removal feed: the impurity removal stream will be measured by a flowmeter and an automated pipe sampler will produce a sample for metallurgical accounting.

- Ion exchange feed: the feed stream will be measured by a flowmeter and an automated pipe sampler will produce a sample for metallurgical accounting.

- Membrane electrodialysis: the feed stream will be measured by a flowmeter and an automated pipe sampler will produce a sample for metallurgical accounting.

17.4.6 Plant Services

17.4.6.1 Compressed Air

The site will utilize compressed air, instrument air and blower air. Compressed air will be split into plant air, and instrument air (which will also be filtered and dried). Low pressure blowers will supply air for the combustion fans in the decrepitation kiln and roaster kiln.

17.4.6.2 Natural Gas

Natural gas will be used in a number of areas, most notably for the kilns and evaporation circuits. A supply line from the local distribution network will supply gas to the plant.

17.4.6.3 Steam

Steam will be used in a number of areas in the plant such as the product drier and sulphuric acid evaporator. There will be two natural gas powered steam boilers to create the steam. Off-gas from the boilers will be sent to a boiler stack which will be continuously cooled by cooling water. De-ionized water will be used as the boiler feed water to reduce future scaling during operations.

17.4.6.4 Nitrogen Generation System

Nitrogen is used for lithium hydroxide drying after the second crystallization stage. Avalon will work with a supplier to design a package system for the nitrogen generation area to meet this requirement.

17.4.7 Water Circuits

17.4.7.1 Fresh Water

Potable fresh water will be obtained from the municipality supply system. Process water will be stored in a stock tank. Large volumes of process water may be obtained from the nearby river. From here it will be used to provide gland service water, filter wash water for the water leach and impurity removal filter washing as well as reagent make-up. If required, potable water will also be used as a source of fire water.

17.4.7.2 Distilled Water

Distilled water is required for several purposes through the hydrometallurgical process including the water leach, electrodialysis (to control the concentration of the dilute acid and hydroxide solution streams), redissolution of the crude crystallization product, washing of solids residues, and washing of the final lithium hydroxide monohydrate product. Approximately 95% of the distilled water requirement for the hydrometallurgical facility can be met by condensing and recycling process vapours generated by the PLS evaporator, the spent acid concentration plant, and the lithium hydroxide crystallization circuit. Makeup high purity water is generated by a packaged reverse osmosis plant.

17.4.7.3 Cooling water

Cooling water is used in a number of areas in the plant, such as roaster cooling and in the product drier. It is expected that cooling water will be obtained from the Winnipeg River near the site. The cooling water will be pumped to the various areas as required from a supply tank. Returning cooling water will be stored in a tank before being cooled in a series of cooling towers and returned to the supply tank.

17.4.7.4 Water Treatment

A reverse osmosis system will be used to clean and treat waste water generated at the plant. Waste water will come from a number of areas such as ion exchange regeneration and boiler blowdown. The water will be collected and neutralized before it is sent to a wastewater clarifier. The clarifier underflow is pumped to a wastewater solids filter to dewater the solids (which are subsequently returned to the mine site for disposal). Clarifier overflow volume will be very small and sufficiently clean such that it can be accepted by the local municipal sewage system.