DESIGN
CONSTRUCT
OPERATE

TECHNICAL REPORT SUMMARY

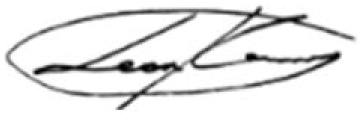
CAROLINA LITHIUM PROJECT

18605-REP-GE-002

Date	Revision	Status	Prepared	Reviewed	Approved
13-Jan-2022	A	Draft	S. Normandin		
19-Jan-2022	B	Issued for review	S. Normandin	P. Grigsby	P. Grigsby
25-Jan-2022	C	Issued for Study	S. Normandin	P. Grigsby	P. Grigsby
25-Jan-2022	D	Issued for Study	S. Normandin	P. Grigsby	P. Grigsby

DATE AND SIGNATURE

This Report entitled "Technical Report Summary of a Definitive Feasibility Study of the Carolina Lithium Project in North Carolina", issue date January 25, 2022 was prepared and signed by the following Authors:



Leon McGarry, P. Geo.

January 25, 2022

McGarry Geoconsulting Corp.

Kevin Andrews, CPG

January 25, 2022

Marshall, Miller & Associates.

Dr. Steven Keim,

January 25, 2022

Marshall, Miller & Associates.

Dr. Jarrett Quinn, P.Eng.

January 25, 2022

Primero Americas Inc.

Andrew Siemon,

January 25, 2022

Primero Americas Inc.

Stephane Normandin, P. Eng

January 25, 2022

Primero Americas Inc.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX

1 EXECUTIVE SUMMARY

Piedmont Lithium Inc. (PLL) contracted with Primero Group Americas Inc. (Primero) to develop a Definitive Feasibility Study (DFS) for their Carolina Lithium Project (Project) near Charlotte, NC, including a spodumene mine, a spodumene concentrator and a lithium hydroxide (LiOH) conversion plant to convert the spodumene concentrate (SC6) into lithium hydroxide monohydrate ($LiOH·H_2O$).

Since the Scoping Study Update report in September 2021 (internal ref no. 18602-REP-GE-001), the study scope has been adjusted and enhanced with the key production values presented in Table 1-1. Note, all references to mass within the report are metric units.

Table 1-1 - Project Main Production Values

Production Target	Value	Units
ROM (ore)	1.95	Mt/y
SC6	242,000	t/y
LiOH	30,000	t/y
Quartz by-product	252,000	t/y
Feldspar by-product	392,000	t/y
Mica by-product	28,000	t/y

With the assistance of Minviro, PLL conducted a Life Cycle Analysis (LCA) of the project with the following main recommendations that are included in the study:

- LiOH Conversion Plant including an alkaline pressure leach technology;
- By-Product (Quartz, Feldspar and Mica) plant recovery and handling facility for commercialization;
- Electric powered conveyors eliminate mine trucks, reduce noise, dust and diesel-based CO_2 emissions;
- On-site solar complex to power concentrate operations.

These project enhancements are supported by the delineation and increase of the Mineral Resources made possible by additional exploration work and metallurgical testwork. The key highlights are listed below.

1.1 PROPERTY DESCRIPTION

The Project is located in a rural area of Gaston County, North Carolina, USA approximately 40 km northwest of the city of Charlotte. The Property is centered at approximately 35°23’20”N 81°17”20”W and is comprised of approximately 3,245 total acres, of which: 1,526 acres are claims on private property through option or deferred purchase agreements, 113 acres are under a long-term mineral leased agreement, 79 acres are under lease to own agreements, and 1,527 acres are owned by PLL. For the properties hosting the MREs in this report, PLL controls 100% of the surface and mineral rights per one or more of the agreement scenarios described above.

1.2 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

Topography of the area surrounding the Project is typical of the Piedmont Plateau characterized by relatively low, rolling hills. Several creeks bisect the property and are surrounded by flat, swampy floodplains that can extend up to 100 m away from the drainage channel. Surface elevations at the Project range from approximately 300 m above sea level in upland regions to approximately 220 m at stream level.

The area surrounding the Property is considered rural with a mixture of cleared farmland and forest in the temperate broadleaf category. Vegetation, where present, is a combination of large trees with smaller underbrush and is easily traversable by foot.

General access to the Project is via a well-developed network of primary and secondary roads. Interstate highway I-85 lies 10 km to the south of the Project area and provides easy access to Charlotte Douglas International Airport 30 km to the east. A rail line borders the Property to the northwest. Transport links provide access to Charlotte, North Carolina's largest city, within an hour's drive from the Project. The Charlotte metropolitan region has a 2020 population of 2.66 million people.

1.3 HISTORY

The Project lies within the Carolina tin-spodumene belt. Mining in the belt began in the 1950's with the Kings Mountain Mine, currently owned by Albemarle Corporation, and the Hallman-Beam mine near Bessemer City, currently owned by Martin Marietta Corporation. Both former mines are located within approximately 20 km of the Project to the south, near Bessemer City and Kings Mountain, respectively. Portions of the Project area were explored and excavated to shallow depths in the 1950's as the Murphy-Houser mine, owned by the Lithium Corporation of America (predecessor to Livent) (Cooley, 2010).

In 2009, Vancouver based North Arrow Minerals Inc. ("North Arrow") commenced exploration at the property. Extensive geological mapping outlined over 37 spodumene-bearing pegmatite dikes at the Core Property and confirmed localized historical trenching of these dikes by Lithium Corporation of America (Cooley, 2010). North Arrow completed 19 diamond drillholes in 2009/2010. North Arrow subsequently terminated all their property agreement soon thereafter.

In 2016, Piedmont (formerly WCP Resources Limited) began optioning surface and mineral rights at the property. Piedmont commenced a renewed exploration effort at the Project.

1.4 GEOLOGICAL SETTINGS, MINERALIZATION AND DEPOSIT

Within the Project, spodumene-bearing pegmatites are hosted in amphibolite and metasedimentary host rocks. Pegmatites range from fine-grained (aplite) to very coarse-grained with primary mineralogy consisting of spodumene, quartz, plagioclase, potassium-feldspar (K-spar) and muscovite. Bench-scale and pilot-plant scale metallurgical test work on pegmatites within the Mineral Resource model demonstrate that lithium occurs almost exclusively within spodumene and that concentrates of greater than 6.0% Li_2O were achievable with an iron content less than 1.0% Fe_2O_3. Quartz, feldspar, and mica concentrates were produced as by-products of the spodumene concentrate. Initial results demonstrate commercial potential for each by-product.

1.5 EXPLORATION

Between 2017 and 2021, PLL completed five phases of exploratory drilling that has defined the Mineral Resources presented in this report. The current Mineral Resource block models were prepared using all drilling data available on 3 August 2021.

A total of 542 core holes amounting to 80,029 meters (*m*) define the Core Property deposit. As of the cut-off date, 511 assayed drillholes intersect 76 interpreted mineralized pegmatite bodies. A total of 36 diamond core holes totaling 5,563 m define the Central Property deposit, with 31 holes intersecting 11 interpreted mineralized pegmatite bodies. A total of 14 diamond core holes totaling 2,151 m define the Huffstetler Property deposit, with 11 holes intersecting six interpreted mineralized pegmatite bodies.

1.6 SAMPLE PREPARATION, ANALYSIS AND SECURITY

Diamond drill core was cut in half with a diamond saw. Standard sample intervals were a minimum of 0.35 m and a maximum of 1.5 m for both HQ and NQ drill core, taking into account lithological boundaries (i.e., sampled to, and not across, major contacts).

Samples were numbered sequentially with no duplicates and no missing numbers. Triple tag books using nine-digit numbers were used, with one tag inserted into the sample bag and one tag stapled or otherwise affixed into the core tray at the interval the sample was collected. Samples were placed inside pre-numbered sample bags with numbers coinciding to the sample tag.

Drill core samples and surface rock samples were shipped directly from the core shack by the project geologist in sealed rice bags or similar containers using a reputable transport company with shipment tracking capability to maintain chain of custody. Each bag was sealed with a security strap with a unique security number. The containers were locked in a shed if they were stored overnight at any point during transit, including at the drill site prior to shipping. The laboratory confirmed the integrity of the rice bag seals upon receipt.

1.7 DATA VERIFICATION

MGG's QP Leon McGarry visited the site on several occasions. Visual validation of mineralization against assay results was undertaken for several holes. Verification core samples were collected by Leon McGarry.

All drill hole data was imported into Micromine™ software version 15.08. Validation of the data was then completed which included checks for:

- Logical integrity checks of drillhole deviation rates;
- Presence of data beyond the hole depth maximum;
- Overlapping from-to errors within interval data.

Visual validation checks were also made for obviously spurious collar coordinates or downhole survey values.

Sufficient data have been obtained through various exploration and sampling programs to support the geological interpretations at the Property. The data are of sufficient quantity and reliability to reasonably support the lithium resource estimates in this TRS.

1.8 METALLURGICAL TESTING AND MINERAL PROCESSING

1.8.1 Concentrate Metallurgy

In 2019, Piedmont engaged SGS Canada Inc. in Lakefield, Ontario to undertake testwork on variability and composite samples. Dense Medium Separation ("DMS") and locked-cycle flotation tests produced high-quality spodumene concentrate with a grade above 6.0% Li_2O, iron oxide below 1.0%, and low impurities from composite samples. The feed grade of the composite sample was 1.11% Li_2O.

In 2020, a pilot plant testwork program was undertaken at SGS Canada Inc. A 54-t bulk outcrop sample from the Carolina Lithium Project was processed through a DMS and flotation pilot plant. Using the optimized results from the flotation pilot plant, the combined DMS and flotation concentrates graded >6% Li_2O and <1% Fe_2O_3 with lithium recoveries >70%. Optimized testing on the master composite sample resulted in lithium recovery of 82% and concentrate grading 6.13% Li_2O.

In 2021, Piedmont engaged SGS Canada Inc. in Lakefield, Ontario to undertake testwork on nine variability samples. Samples were produced from drill core from the East and South pits and represented the early years of production (i.e., the first 10 years of operation). The samples generally contained elevated levels of host rock dilution (ranging from 9.4% to 17.3%) as compared to the mine plan average (10%). DMS and batch and locked-cycle flotation tests were undertaken. Based on the historical testwork and the 2021 variability program, the DFS assumes a spodumene recovery of 77.0% when targeting a 6.0% Li_2O spodumene concentrate product.

1.8.2 By-Product Metallurgy

The production of bulk quartz and feldspar concentrates as by-products from the spodumene locked-cycle flotation tailings was investigated. Six individual batch tests were conducted with the quartz and feldspar concentrates being composited.

Piedmont engaged North Carolina State University's Minerals Research Laboratory in 2018 to conduct bench-scale testwork on samples obtained from the Company's MRE within the Core Property for by-products quartz, feldspar, and mica. The objective of the testwork program was to develop optimized conditions for spodumene flotation and magnetic separation for both grade and recovery.

Mica quality is measured by its physical properties including bulk density, grit, color/brightness, and particle size. The bulk density of mica by-product generated from Piedmont composite samples was in the range of 0.680 - 0.682 g/cm^3.

The National Gypsum Grit test is used mostly for minus 100 mesh mica which issued as joint cement compound and textured mica paint. Piedmont sample grit results were in the range of 0.70 - 0.79%, well below the typical specification for total grit in mica of 1.0%. Color/brightness is usually determined on minus 100 mesh material. Several instruments are used for this determination including the Hunter meter, Technedyne and the Photovoltmeter. The green reflectance is often reported for micas and talcs. Piedmont Green Reflectance results were in the range of 11.2 - 11.6.

Quartz and feldspar concentrates were produced during the 2021 Variability program at SGS Canada Inc. Batch flotation tests were operated to produce feldspar concentrate with the flotation tailings were passed through wet high-intensity magnetic separation to produce quartz concentrate.

1.8.3 Conversion Metallurgy

In 2021, Piedmont engaged Metso:Outotec to undertake pilot plant testwork using their proprietary Lithium Hydroxide Process. The spodumene concentrate sample used was produced during concentrator pilot plant operation in 2020. The spodumene concentrate was calcined by Metso:Outotec at their laboratory in Oberursel, Germany. The calcined concentrate was then sent to Metso:Outotec Research Center in Pori, Finland for hydrometallurgical testing.

The pilot plant flowsheet tested included: soda leaching, cold conversion, secondary conversion, ion exchange, and lithium hydroxide crystallization. The pilot plant operated for approximately 10 days. Roughly 100 kg of calcined spodumene concentrate was fed to the pilot plant. The average total lithium extraction achieved in soda leaching and cold conversion was 89% during the first 136 h of operation. Process recycles were incorporated in the pilot plant with no significant accumulation of impurities in the process. First stage lithium hydroxide crystallization was operated continuously during the pilot plant. Second stage crystallization was operated in batches after the completion of the continuous pilot plant. Impurities levels in the final battery-quality lithium hydroxide monohydrate product were typically low with Al <10 ppm, Ca <10 ppm, Fe <20 ppm, K <10 ppm, and Si <40 ppm. All other metal impurities were below detection limits.

1.8.4 Process Design

The concentrator process design is based on historical testwork including the 2021 variability testwork program. Lithium hydroxide manufacturing process design is based on pilot plant results and Metso:Outotec experience. The simplified process flow diagram for the Project is shown in Figure 1-1.

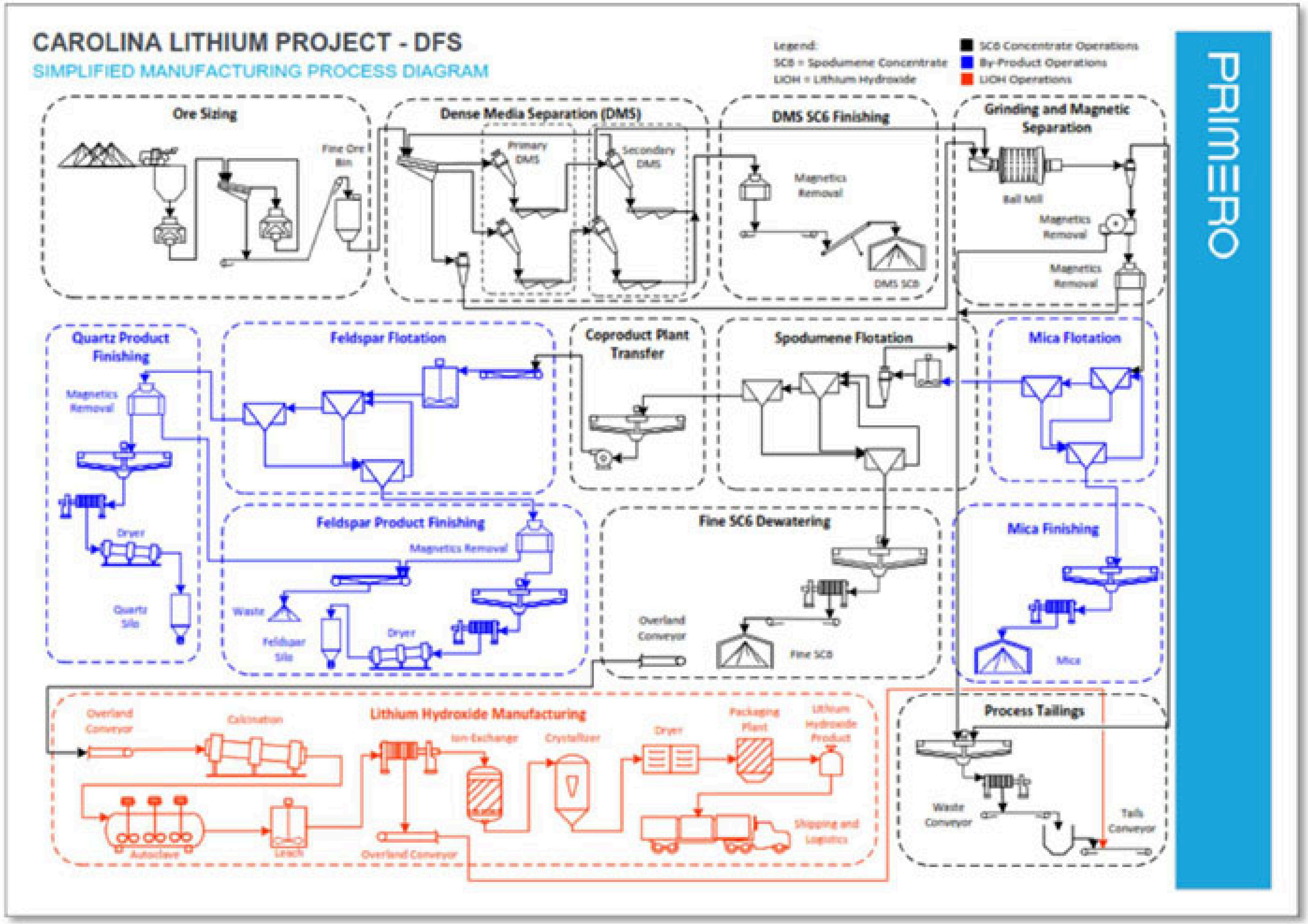


Figure 1-1 - Proposed Carolina Lithium Project block flow diagram

1.9 MINERAL RESOURCES ESTIMATES

MRE for the project, representing in-situ lithium-bearing pegmatites, are reported below in accordance with the U.S. Securities and Exchange Commission (SEC) Regulation S-K 1300 standards and are therefore suitable for public release. Global lithium MRE for the Project are reported by classification in Table 1-2.

Table 1-2 - Summary of Lithium Mineral Resources as of October 20, 2021 Based on US$15,239/t $LiOH{\cdot}H_2O$

Mineral Resource Category	Tonnes (Mt)	Grade (Li_2O%)	Li_2O (kt)	LCE (kt)	$LiOH{\cdot}H_2O$ (kt)	Cut-Off Grade (% Li_2O)	Metallurgical Recovery[1]
Indicated	28.2	1.11	313,000	774,000	879,000	0.4	71.2
Inferred	15.9	1.02	162,000	401,000	455,000		
Total	44.2	1.08	475,000	1,175,000	1,334,000		

Note 1 – Overall metallurgical recovery from spodumene ore to lithium hydroxide monohydrate

Lithium MRE include tonnage estimates for lithium oxide (Li_2O), Lithium Carbonate Equivalent (*LCE*) whereby one tonne of Li_2O is equivalent to 2.473 tonnes LCE, and lithium hydroxide mono-hydrate ($LiOH{\cdot}H_2O$) tonnage whereby one tonne of Li_2O is equivalent to 2.81 tonnes $LiOH{\cdot}H_2O$.

By-product MRE for the Project incorporates Indicated and Inferred category resources totaling 12.99 Mt of quartz, 20.00 Mt of feldspar and 1.82 Mt of mica. Lithium and by-product MRE are reported above a 0.4% Li_2O cut-off grade and are current to October 20, 2021. MRE are based on appropriate recovery factors and a lithium hydroxide price of US$15,239 per metric tonne and by-product mineral basket price of US$79.50 for calendar year 2021.

1.10 ORE RESERVE ESTIMATES

An estimate of Ore Reserves was made following detailed mine planning and based on the Indicated Mineral Resources contained within the Project's Core Property. The Ore Reserves have been estimated in accordance with the requirements of S-K 1300 and the JORC Code. Table 1-3 show the Ore Reserve Classification.

Table 1-3 - Estimate of Ore Reserves (undiluted)

Ore Reserves Category	Tonnes (Mt)	Grade (Li_2O%)	Li_2O (t)	LCE (t)	$LiOH{\cdot}H_2O$ (t)	Cut-Off Grade (% Li_2O)	Metallurgical Recovery (%)[1]
Proven	-	-	-	-	-	0.4	70.1
Probable	18.26	1.10	200,000	495,000	562,000		
Total	**18.26**	**1.10**	**200,000**	**495,000**	**562,000**		

Note 1 - The metallurgical recovery of ore reserves is based on 77% recovery of ore to spodumene concentrate, and 91% metallurgical recovery of SC6 to battery quality lithium hydroxide as reported in this announcement.

The Probable Ore Reserves have been estimated and based on the consideration of pertinent modifying factors, inclusive of geological, environmental, regulatory, and legal factors, in converting a portion of the Mineral Resources to Ore Reserves. All converted Mineral Resources were classified as Probable Ore Reserves. There were no Measured Mineral Resources defined that could be converted into Proven Ore Reserves and no Inferred Mineral Resources were included in the estimation of Ore Reserves. Cutoff grade of 0.4% Li_2O was used in creation of the block model.

An open pit mining method was selected due to the ore body outcropping in several places along the surface. No other mining method was evaluated as part of the Ore Reserves estimation. Mine design parameters include overburden batter angle in unconsolidated material of 27 degrees, face batter angle of 75 degrees, inter-ramp slope of 57 degrees, overall slope of 51 degrees, berm width of 9.5 meters, berm height working 12 meters, berm height final wall of 24 meters, ramp width of 30 meters, ramp grade of 10%, mine dilution of 10%, process recovery for spodumene concentrate of 77%, and minimum mining width of 50 meters.

Operating costs were established using budget pricing from mining contractors based on a request for proposal issued by Marshall Miller and Associates combined with first principles estimates for utilities including electrical service from Duke Energy. Royalties of $1.00 per ROM tonne are based on the average land option agreement.

1.11 MINING METHODS

Pit optimizations were completed by Marshall Miller & Associates in order to produce a production schedule on a quarterly basis for the first five years of operations and on an annual basis thereafter. This resulted in a total production target of approximately 2.56 Mt of 6.0% Li_2O spodumene concentrate (“SC6”), averaging approximately 242,000 t/y of SC6 over the 11-year ore reserve life. This equates to a steady state average of 1.90 Mt/y of ore processed, totaling approximately 20.1 Mt of run-of-mine (“ROM”) ore at an average fully diluted ROM grade of 1.0% Li_2O (diluted) over the 11-year ore reserve life.

The concentrate operations production life is 11 years (matching ore reserves) and chemical plant operations life is 30 years, commencing in year 1 of the Project. It is assumed that concentrate operations including by-products will commence about 90 days in advance of chemical plant start-up to build initial SC6 inventory. Produced SC6 which exceeds chemical plant capacities are assumed to be sold to third parties during the life of the Project. Of the total production target of 2.56 Mt of SC6, approximately 0.56 Mt will be sold to third parties during the operational life and approximately 2.0 Mt will be supplied to Piedmont’s chemical plant operations for conversion into lithium hydroxide.

The Study assumes production targets of 2.68 Mt of quartz concentrate, 4.17 Mt of feldspar concentrate, and 0.30 Mt of mica concentrate over the life of operations based on the potential recovery of these products from the concentrator flotation circuits and the Company’s analysis of domestic industrial minerals markets and engagement with prospective customers.

Two specialized programs, Maptek Vulcan and Evolution, were used to generate a series of economic pit shells using the updated Mineral Resource block model and input parameters as agreed by Piedmont. Overall slope angles in rock were estimated following a preliminary geotechnical analysis that utilized fracture orientation data from oriented core and downhole geophysics (Acoustic Televiewer), as well as laboratory analysis of intact rock strength. The preliminary geotechnical assessment involved both kinematic and overall slope analyses utilizing Rocscience™ modeling software.

Overall slope angles of 27 degrees were assumed for overburden and oxide material. Overall slope angles of 51 degrees were estimated for fresh material which includes a ramp width of 30 meters. Production schedules were prepared for the Project based on the following parameters:

- A targeted run-of-mine production of 1.9 Mt/y targeting concentrator output of about 242,000 t/y of SC6
- Mining dilution of 10%
- Mine recovery of 100%

- Concentrator processing recovery of 77%
- Mine sequence targets utilized Proven and Probable reserves for the schedule

The results reported are based upon a scenario which utilizes extraction of Probable reserves. Table 1-4 shows the production target of the mining plan.

Table 1-4 - Mining Plan Summary (diluted)

Property	ROM Tonnes Processed (Mt)	Waste Tonnes Mined (Mt)	Stripping Ratio (W:O t:t)	ROM Li_2O Undiluted Grade (%)	ROM Li_2O Diluted Grade (%)	Production Years	Tonnes of SC6 (Mt)
Core	20.09	232.52	11.58	1.10	0.996	1-11	2.57
Central	0	0	0	-	-	-	0
Huffstetler	0	0	0	-	-	-	0
Total	**20.09**	**232.52**	**11.58**	**1.10**	**0.996**	**1-11**	**2.57**

1.12 PROCESSING AND RECOVERY METHODS

The processing operations are designed to produce saleable spodumene concentrate by Dense Media Separation (DMS) and flotation, at a concentration plant, and then to further refine the spodumene concentrate to produce a battery and technical grade lithium hydroxide monohydrate at a conversion facility. Additional saleable by-products are produced at the concentrator in unison with the spodumene concentrate; they include quartz, feldspar, and mica concentrates.

The concentrator circuit is supplied from an in-pit primary crush circuit, with the material being conveyed and stockpiled at the ROM pad. The ore is then upgraded through a series of dense media separation units, magnetic separation units and a flotation circuit, to separate the material of value (concentrates) from the various gangue minerals. The key process areas of the concentrator are listed as the following:

- Secondary and tertiary crushing;
- Dense Media Separation (DMS) circuit and magnetic separation;
- Grinding and desliming;
- Mica flotation;
- Spodumene flotation;
- Spodumene flotation concentrate dewatering and handling;
- Flotation tailings dewatering and handling;
- Feldspar flotation;
- Spodumene concentrate dewatering and handling;
- By-products (mica, feldspar, and quartz) concentrate dewatering and handling;
- Process tailings dewatering and handling;

The lithium conversion plant, uses the Metso:Outotec proprietary technology, by converting the spodumene ($LiAl(SiO_3)_2$) into a lithium carbonate form and then into a soluble lithium hydroxide, to allow crystallization to the final lithium hydroxide monohydrate product. The solutions generated within the circuit are recirculated as much as possible to maintain lithium concentrations, recover as much lithium as possible, and reduce water requirements. The key process areas for the lithium conversion plant are listed as the following:

- Spodumene Concentrate storage and transfer;
- Calcination;
- Grinding and Pulping;
- Carbonate Leaching – High Pressure and Atmospheric;
- Conversion (carbonate to hydroxide);
- Lithium Hydroxide Crystallization and Product Drying;
- Product Bagging Facility;

1.13 INFRASTRUCTURE

A detailed site plan including mining operations, concentrate operations, lithium hydroxide manufacturing, overburden and waste rock disposal, by-product manufacturing and ancillary facilities was developed in connection with the Project’s mine permit application submitted in August 2021 (see Figure 1-2).

Navisworks models have been completed for the concentrate operations (see Figure 1-3) and conversion facility (see Figure 1-4) to a DFS level of detail.

Figure 1-2 - Site plan for the Carolina Lithium Operations

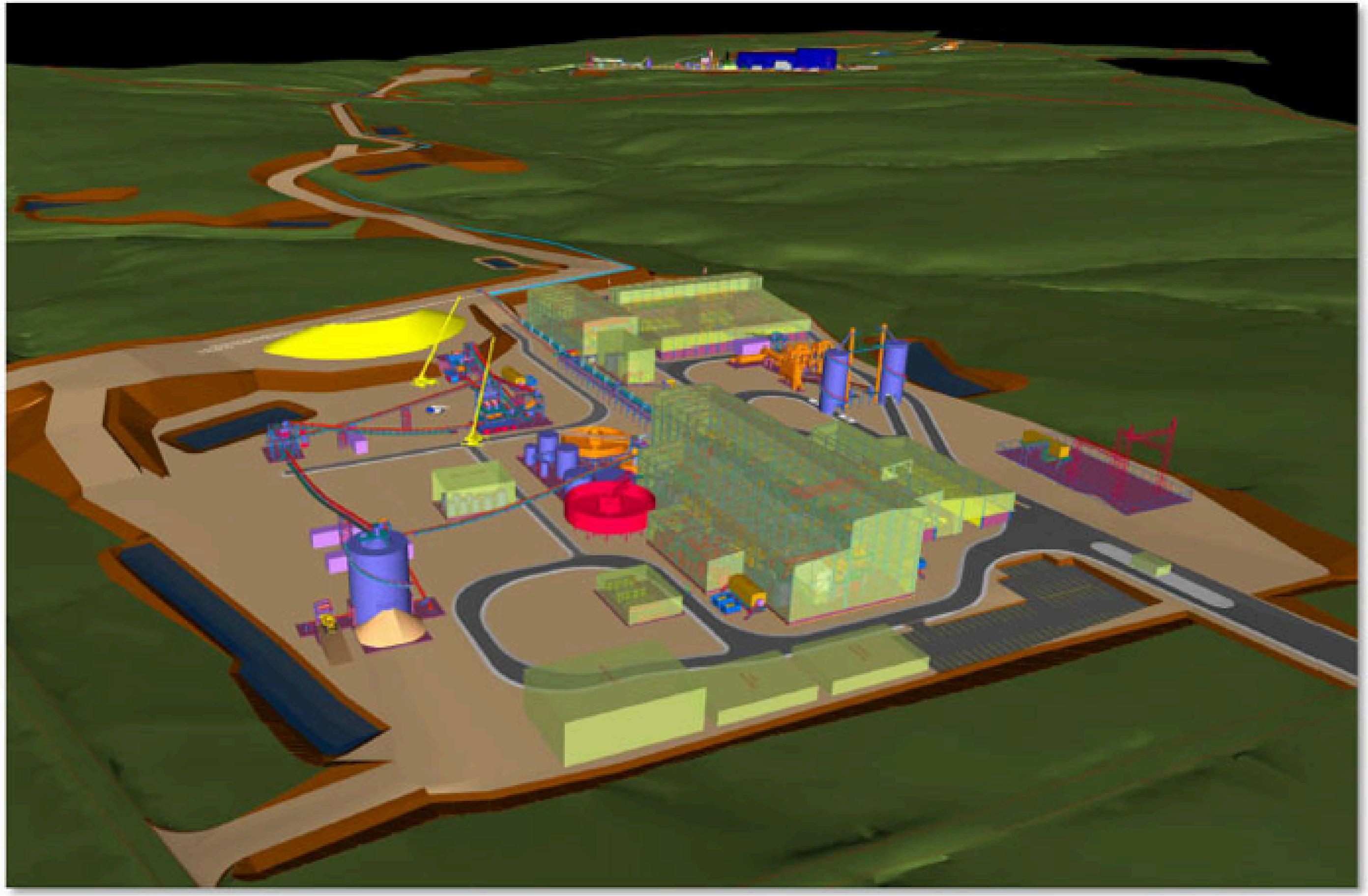


Figure 1-3 - Spodumene and Byproducts Concentrator (LiOH Conversion Plant in background)

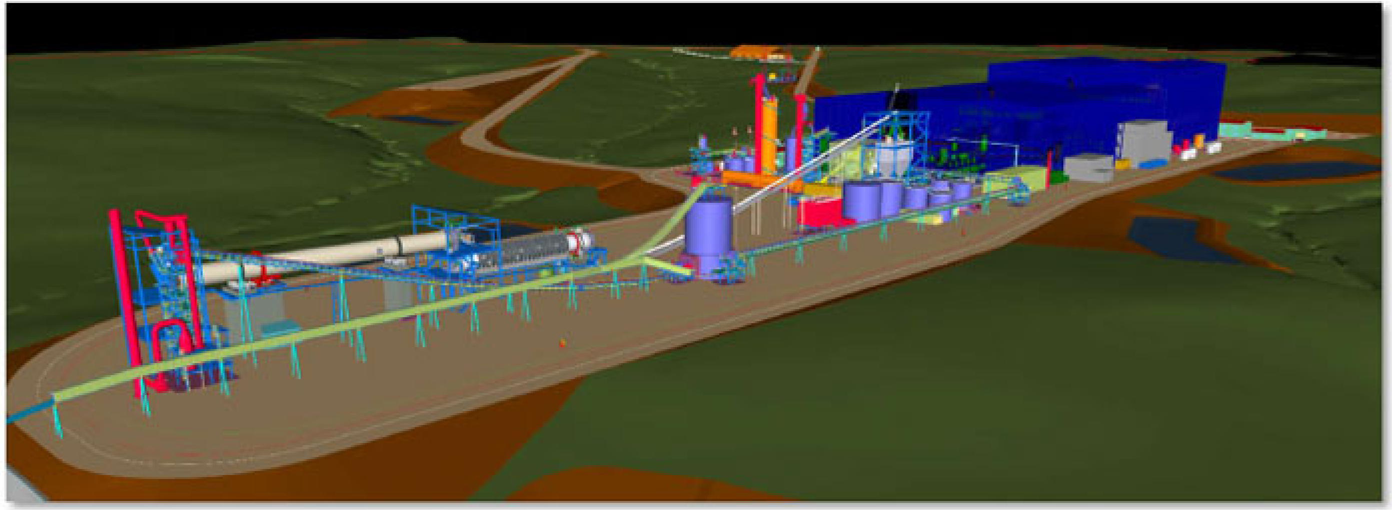


Figure 1-4 - 3D model of the Lithium Hydroxide Conversion Plant

1.14 MARKET ANALYSIS

Benchmark Mineral Intelligence ("Benchmark") reports that total battery demand will grow to 312 GWh in 2021 translating to 297kt of LCE demand in 2021, a growth of 41% over 2020 demand. Benchmark forecasts total demand in 2021 to be 430kt on an LCE basis.

Benchmark further expects the market to remain in a structural deficit or the foreseeable future as demand gets a head-start on supply. In the near impossible scenario that all projects come online on time as planned and without any issues, the first surplus will not occur until 2025. Benchmark believes that in this extreme case, a surplus could only be expected to last a few years before demand forces the market into a large deficit without further new projects yet undiscovered or developed.

The Company analyzed Q4 2021 battery-grade lithium hydroxide and SC6 price forecasts from Benchmark, JPMorgan and Macquarie for the period 2022-2025 as well as price forecasts recently announced by other lithium project developers. Based on these and other data this Study assumes long-term pricing of $18,000/t for battery quality lithium hydroxide and $900/t for spodumene concentrate for the life of the project (see Table 1-5).

Table 1-5 - Price Forecasts for Battery-Grade Lithium Hydroxide ($/tonne)

Forecast	2022	2023	2024	2025
Benchmark Minerals	$20,600	$26,200	$25,200	$20,900
JPMorgan	$26,625	$22,500	$19,737	$18,420
Macquarie	$21,275	$20,415	$18,545	$17,540

Piedmont is focused on establishing strategic partnerships with customers for battery grade lithium hydroxide with an emphasis on a customer base which is focused on EV demand growth in North America and Europe. Piedmont will concentrate this effort on these growing EV supply chains, particularly in light of the growing commitments of battery manufacturing by groups such as Ford, General Motors, Stellantis, Toyota, LGES, SK Innovation, Samsung SDI and others. Advanced discussions with prospective customers are ongoing.

1.15 ENVIRONMENTAL STUDIES AND PERMITTING

HDR Engineering has been retained by Piedmont to support permitting activities on the proposed Project.

In November 2019, the Company received a Clean Water Act Section 404 Standard Individual Permit from the US Army Corps of Engineers for the concentrate operations. The Company has also received a Section 401 Individual Water Quality Certification from the North Carolina Division of Water Resources. In connection with the 404 Permit an Environmental Assessment was completed for the Project which resulted in a Finding of No Significant Impact (“FONSI”).

The concentrate operations require a North Carolina State Mining Permit from the North Carolina Department of Environmental Quality (“NCDEQ”) Division of Energy, Mineral and Land Resources (“DEMLR”). The Company submitted a mine permit application to DEMLR on August 31, 2021. A public hearing in relation to the mine permit application was held on November 15, 2021. The Company has received additional information requests in connection with the mine permit application and responded to these information requests on December 15, 2021. The company expects to receive additional information requests in connection with its mine permit application and will respond to these requests in due course.

Piedmont previously received synthetic minor air permit from the NCDEQ Division of Air Quality (“DAQ”) for a proposed lithium hydroxide operation in Kings Mountain. The Company has held pre-application consultation meetings with Division of Air Quality in connection with the integrated Carolina Lithium Project. The Company plans to submit a determination letter to DAQ in January 2022 requesting concurrence with respect to the spodumene mining as the primary activity of the Carolina Lithium Project. The Company will proceed with an air permit application for the Carolina Lithium Project upon receipt of DAQ’s response to the determination letter request.

Carolina Lithium remains subject to local rezoning and permit requirements. Piedmont remains in pre-application consultation with Gaston County at this time. A rezoning application will follow receipt of a state mining permit. The Company will apply for a special use permit required under the Gaston County UDO upon completion of the rezoning process.

The list of background environmental studies undertaken in connection with the Project's permit applications is listed in Section 17.1 of this report.

This Study assumes that the operations will be progressively reclaimed in accordance with the Company's mine permit application submitted in August 2021. An estimate of $16.6 M in alkaline amendment costs and $19 M in closure costs have been included in the sustaining capital for mine reclamation expenses.

1.16 CAPITAL AND OPERATING COSTS

Table 1-6 highlights the total estimated capital expenditures for the Project. Variable contingency is included and has been applied to project costs based on the level of engineering definition completed and the confidence level of supplier and contractor quotations. The capital cost estimate has a ±15% accuracy and is based on Q4 2021 costs.

Table 1-6 – Project Capex Summary

Capex (mm $)		Direct	Indirect	Grand Total
Area	**Sub-Area**			
Concentrator Operations				
	1100 - Mining	99.5		99.5
	1200 - Processing Plant	220.3		220.3
	1300 - Site Infrastructure	14.8		14.8
	1400 - Waste Rock	6.0		6.0
	Sub Total - Concentrator Operations	***340.5***		***340.5***
Lithium Hydroxide Operations				
	2200 - Overland Network	19.4		19.4
	2400 - LiOH Plant	431.3		431.3
	2900 - Site Infrastructure - LiOH Plant	13.7		13.7
	Sub Total - Lithium Hydroxide Operations	***464.3***		***464.3***
Indirect Costs				
	6100 - Concentrator Indirects		44.0	44.0
	6200 - Lithium Hydroxide Indirects		65.1	65.1
	Sub-Total - Indirect Costs		***109.1***	***109.1***
Owners Cost, Pre-production & Working Capital				
	8100 - Owners Cost		73.6	73.6
	Sub-Total - Owners Cost, Pre-production & Working Capital		***73.6***	***73.6***
Grand Total				**987.6**

The deferred, working and sustaining capital is estimated at $351 M.

The operating cost estimate was prepared in detail for the Spodumene and By-Product processing plants. They are presented in Table 1-7 and Table 1-8 respectively. The conversion plant opex is based on producing 30,000 t/y of lithium hydroxide monohydrate. Table 1-9 summarizes the estimated average operating costs for lithium hydroxide production over the life of mining operations and when using third-party spodumene concentrate.

Table 1-7 – Spodumene Processing Plant Opex Summary

Cost Center	Total Cost		
	US$/year	US$/t ore	US$/t spod conc.
Labor (Process)	$8,657,990	$4.56	$35.68
Operating Consumables and Reagents	$8,951,905	$4.72	$36.89
Power	$3,938,852	$2.08	$16.23
Maintenance Supplies	$1,059,145	$0.56	$4.36
Mobile Equipment	$593,367	$0.31	$2.45
Concentrate transport	-	-	-
Laboratory	$164,679	$0.09	$0.68
Water Treatment	$790,986	$0.42	$3.26
General & Administration	$507,349	$0.27	$2.09
Total	**$24,664,273**	**$13.00**	**$101.64**

Table 1-8 – By-Products Processing Plant Opex Summary

Cost Center	Total Cost		
	US$/year	US$/t ore	US$/t spod conc.
Labor (Process)	$2,364,205	$1.25	$9.74
Operating Consumables and Reagents	$5,388,051	$2.84	$22.20
Power	$1,545,785	$0.81	$6.37
Maintenance Supplies	$274,716	$0.14	$1.13
Mobile Equipment	$249,718	$0.13	$1.03
Concentrate transport	-	-	-
Laboratory	$76,787	$0.04	$0.32
Water Treatment	$1,186,479	$0.63	$4.89
General & Administration	$206,837	$0.11	$0.85
Total	**$11,292,577**	**$5.95**	**$46.53**

Table 1-9 – Conversion Plant Opex Summary

Cost Center	Total Cost		
	US$/year	US$/t feed	US$/t final product
Labor (Process)	$10,006,330	$51.31	$333.54
Operating Consumables	$29,997,743	$153.83	$999.92
Power	$6,428,614	$32.97	$214.29
Maintenance Supplies	$3,211,137	$16.47	$107.04
Mobile Equipment	$304,276	$1.56	$10.14

Laboratory	$2,099,846	$10.77	$69.99
General & Administration	$762,865	$3.91	$25.43
Total	**$52,810,810**	**$270.82**	**$1,760.36**

1.17 ECONOMIC MODEL AND SENSITIVITY ANALYSIS

A detailed financial model and discounted monthly cash flow (DCF) has been developed to complete the economic assessment of the project and is based on current (Q4 2021) price projections and cost estimates in U.S. dollars. No provision was made for the effects of future inflation, but cost estimates incorporate recent 2021 inflationary price increases. The evaluation was carried out on a 100%-equity basis using an 8% discount factor. Current US federal and North Carolina state tax regulations were applied to assess the corporate tax liabilities.

The pricing information for battery-grade lithium hydroxide sales and spodumene concentrate supply were estimated in Q4 2021 and are based on a fixed price of $18,000/t for battery quality lithium hydroxide and $900/t for 6.0% Li_2O spodumene concentrate. The tax rates utilized in the financial model are based on current federal and state tax laws. The current federal tax rate is 21% and the current North Carolina Tax rate is 2.5% but it reduces to 0% between 2024-2028. A depletion allowance for tax purposes is applied across the Spodumene, Quartz, Feldspar and Mica sales with an amount of 22% applied to Spodumene and Mica and 14% applied to Feldspar and Quartz.

Table 1-10 show the summary of the project economics. The main project economic indicators are presented in Table 1-11. The economic study shows a net profit after tax (NPAT) of $7,317 M. The net present value of the 30-year based project is $2,041 M at an 8% discount rate and after applicable taxes. The after-tax internal rate of return (IRR) is 27.2%.

Table 1-10 - Project Economics Summary

Base Case Financial Results	Unit of Measure	Value
Pre-Tax NPV @ 8%	$ M	2,561
After-Tax NPV @ 8%	$ M	2,041
Pre-Tax IRR	%	29.7
After-Tax IRR	%	27.2
Pre-Tax Payback Period	Years	5.51
After-Tax Payback Period	Years	5.53

Table 1-11 – Economic Indicator Summary

Income Statement	Project $ million
Gross revenues (LiOH, SC6 and by-products)	16,905
Net revenues after royalties	16,884
Operating cost cash flow	(6,530)
EBITDA	10,375
Capital expenditure (pre-production)	(988)
Sustaining and deferred capital	(305)
Gross profit before tax (EBT)	9,109
Tax	(1,792)

Net Profit After Tax (NPAT)	7,317

Primero has studied the economical models' sensitivity of the NPV_8 and IRR regarding a variation of:

- Capital cost;
- Operating cost
- Spodumene Recovery;
- Lithium Hydroxide Recovery
- Product Pricing.

The results are summarized in Figure 1-5 and Figure 1-6 respectively.

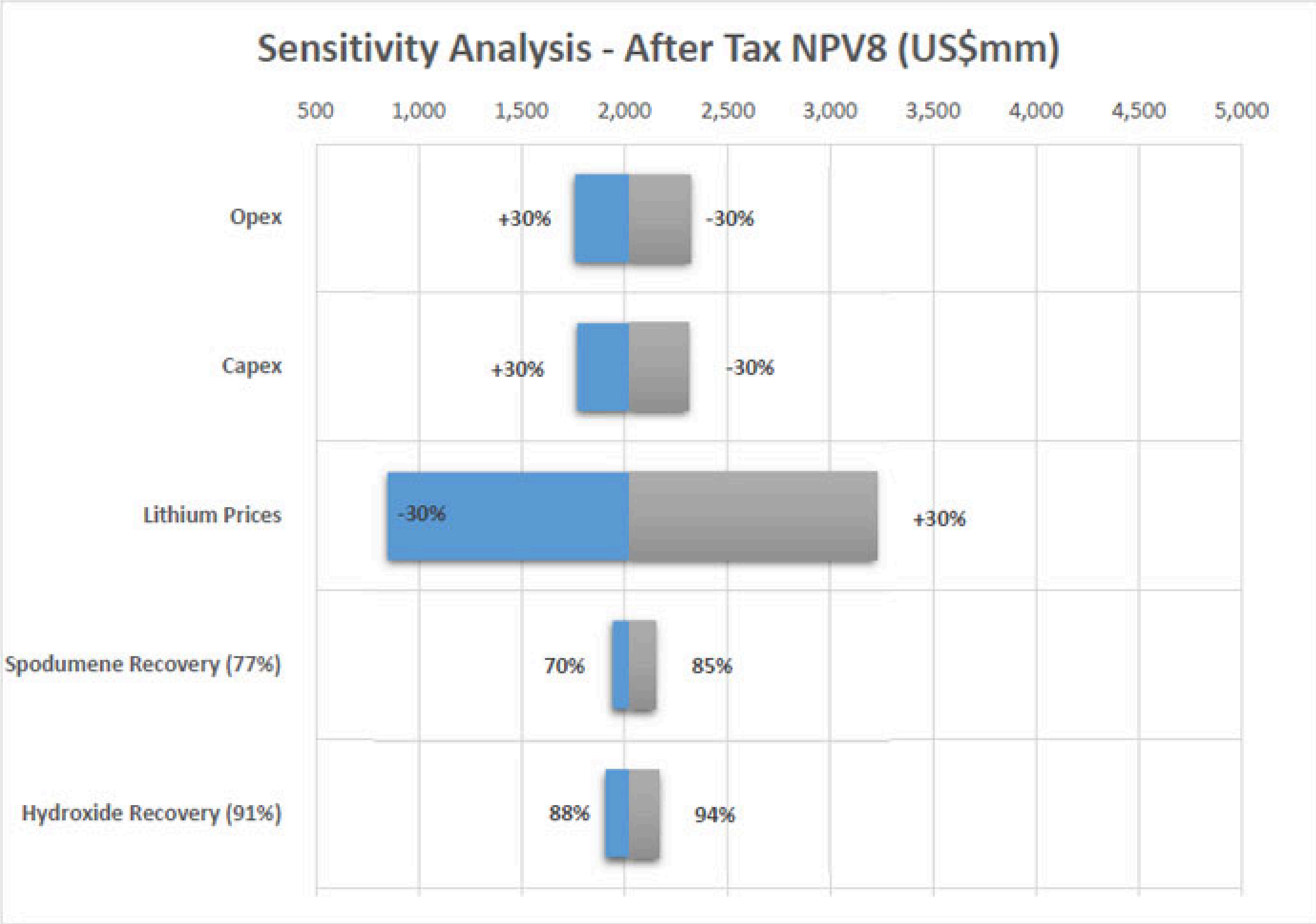


Figure 1-5 - Sensitivity Chart - After Tax NPV_8

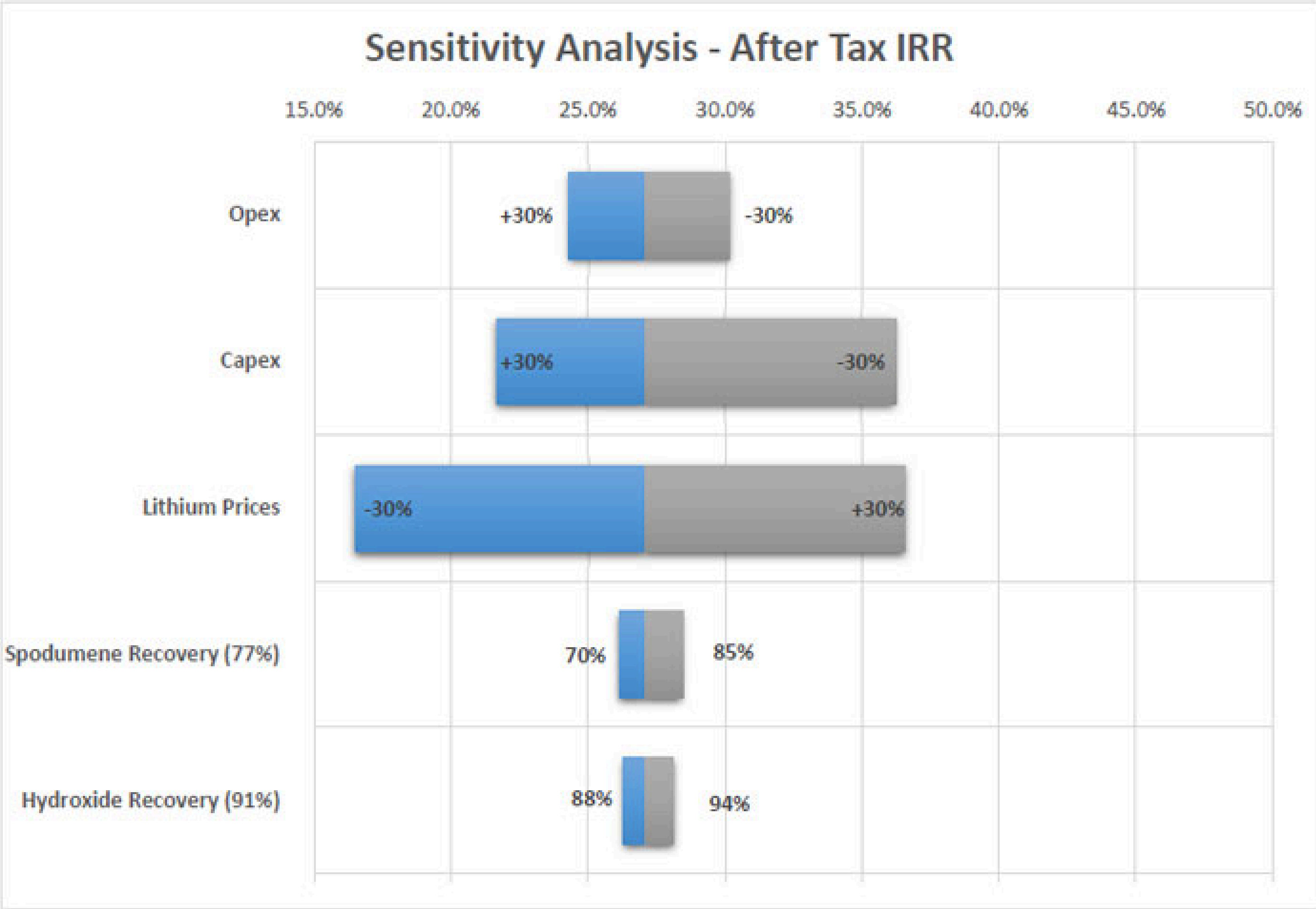


Figure 1-6 - Sensitivity Chart - After Tax IRR

The results are showing that the NPV and the IRR are:

- Sensitive to Lithium Hydroxide selling price and the IRR is sensitive to variability in CAPEX costs
- Less sensitive to variations in OPEX and process recovery

1.18 INTERPRETATION AND CONCLUSIONS

The following main interpretation and conclusions are summarized below:

- Sufficient data have been obtained through various exploration and sampling programs to support the geological interpretations of the lithium-bearing pegmatite deposit on the Property. The data are of sufficient quantity and reliability to reasonably support the resource estimates in this TRS.
- The Carolina Lithium project supports conventional and proven mining and spodumene concentration technology.
- The open pit, concentrator and converter plants have been designed and positioned to minimize the footprint.

- The concentrator includes a processing circuit to recover and stockpile as much as possible by-products (quartz, feldspar and mica) with the quality standards to be sold on the market. This also minimizes the amount of material to be placed in a waste disposal area.

- The spodumene bearing ore will be extracted from open pits with in-pit crushing and conveying. Similarly, the open pit waste rock and the concentrator rejects will be co-disposed in dry state (after filtering of the concentrator rejects) with the usage of crushing and conveying equipment.

- The spodumene conversion to lithium hydroxide finish product is based on the technology developed and proposed by M:O.

- PLL is committed to execute all phases of the project in a socially responsible and environmentally manner.

- The processing plants will recover water for re-use in processing to minimize the use of surface/underground water and reduce treated water discharge.

1.19 RECOMMENDATIONS

The following recommendations are summarized below by project areas:

Mineral Resources:

- Conduct infill drilling to increase data density and support the upgrading of Mineral Resources from Inferred to Indicated throughout the Project.
- Investigate shallow portions of Core Property deposits deemed amenable to early-stage mining through infill drilling and appropriate surface methods, at 20 m to 40 m spacings.
- Model the extent of major metavolcanic and metasedimentary host rock units to support mine planning at the Core property.
- Undertake a targeting study to identify new exploration targets and prioritize step-out drill targets that expand defined resource pegmatites.
- To support exploration targeting across its properties, and to direct future property acquisitions, Piedmont should continue to synthesize a mineral system model for spodumene bearing pegmatites along the Tin Spodumene Belt.

Ore Reserve and Mining Method:

- Additional property for waste storage should be considered with the capacity to hold approximately 79 million tonnes.
- Some adjoining properties will need to be purchased to remove regulated offsets to obtain the tonnages shown in this feasibility study. It is believed that this is achievable before operations starts and costs have been included in the Mining Cost Model of this study.
- Continue to develop markets and cost analyses for ballast production from waste material.
- Further examine the long-range possibilities of using waste material for off-site projects.
- Evaluate permitting requirements and costs associated with mining through the northwest stream to combine Central Pit and North Pit.
- Research acquisition possibilities along the northeast, east, and southwest project boundaries for additional resource development, as well as added waste disposal areas.

- Complete a drilling program to convert inferred and indicated classification of the current resource to measured, especially in shallower areas of the deposit. This additional exploration will help add measured and indicated resource in the early years of mine production.
- Develop Central and Huffstetler Properties to an expanded level project site. Initial indications are that the Central Property may contain higher grade Li_2O possibilities, as compared to Core Property.
- Finalize the mine permit and the rezoning permit for Core Property site.
- Refine cost estimates of contract mining services.
- Update project estimates and costs as drilling progresses and property acquisitions develop.

Metallurgical Testing and Recovery Methods:

It is recommended to complete on-going testwork programs which will be completed during 2022:

- By-products filtration testing.
- Flotation process water treatment testing.
- Ore sorting testwork.

It is also recommended to further explore:

- Alternate mica, spodumene, and feldspar flotation reagents (chemistries and suppliers).
- Potential for by-products production from DMS tailings.
- Optical measurements on mica concentrates.
- Calcination and leaching testwork on variability program concentrate samples.

PLL is continuing to work both internally and externally to continue to further define their selected process technologies.

- Flotation testwork to eliminate kerosene and hydrofluoric acid.
- Further evaluate the concentrate quality (i.e. contained hematite) on conversion plant recoveries.

Project Infrastructure & layout:

- Evaluate the relocation of the concentrator closer to the conversion facility.
- Given the concentrate and analcime are being conveyed via overland conveyor to minimize truck movement, then changes to the layout are considered necessary, predominantly at the concentrator.
- Further evaluation of overland technologies and transfer methods should be undertaken.
- Implementing an ore sorting circuit to reduce production quality risks, is recommended and would also lead to a layout re-evaluation.
- Continue to optimize cost of construction of the project buildings (sizing and construction specifications).

Environment and Permitting:

- Respond to additional requests for information from DEMLR and other state agencies and continue to advance mine permit approvals.
- Complete and submit a new air permit application for the proposed 30,000 t/y Carolina Lithium Project.
- Engage in further pre-application consultation with Gaston County in advance of rezoning and special use permit application submittals.

2 INTRODUCTION

Piedmont Lithium Inc. (Nasdaq: PLL; ASX: PLL) holds a 100% interest in the Carolina Lithium Project (the Project) located within the Carolina tin-spodumene belt (TSB) and along trend to the Hallman Beam and Kings Mountain mines, which historically provided most of the western world's lithium between the 1950s and the 1980s. The TSB, an area with easy access to infrastructure and power, has been described as one of the largest lithium regions in the world and is located approximately 25 miles (40 km) West of Charlotte, North Carolina. PLL is pursuing the goal of becoming a strategic domestic supplier of lithium to the increasing electric vehicle and battery storage markets in the USA.

PLL is currently in an advanced study phase of the development of the project, with a completed Phase 5 drilling at its flagship project site located North of Bessemer City, NC. This resulted in a mineral resource estimate updated (dated October 21st, 2021) performed by McGarry Geoconsulting which is integrated into this feasibility study.

Primero was requested by PLL to prepare a Definitive Feasibility Study (DFS) for the development of a mine operated with the in-pit crushing & conveying method, concentrator & by-product (quartz, feldspar & mica) plants along with a LiOH conversion plant to convert the spodumene concentrate (SC6) to lithium hydroxide (LiOH). The economics of the project was developed to an accuracy level of +/-15% with contingencies of less than 10%.

2.1 DECLARATION

DISCLAIMER

The following report was prepared for Piedmont Lithium Inc. (PLL) by Primero Group Americas Inc. (Primero) as an independent consultant and is part based on information provided by PLL and part on information not within the control of either PLL or Primero. While it is believed that the information, conclusions and recommendations will be reliable under the conditions and subject to the limitations set forth herein, Primero does not guarantee their accuracy. The use of this report and the information contained herein shall be at the user's sole risk, regardless of any fault or negligence of Primero.

USE OF THIS INFORMATION

This document summarizes the scope of works Primero was engaged to undertake as an independent consultant, appointed by PLL to investigate the requirements associated with establishing the mineral processing and lithium hydroxide conversion facilities at the mine site, along with associated infrastructure in accordance with Primero's proposals Doc No. 18605-PPL-BD-002.

Primero gives its permission to PLL to use the information if it reflects the findings and understanding that are presented in this report. Use of this document, for whatever purpose, by any third party must seek written prior approval by Primero.

Primero has relied on other experts for the study portions on mining (Marshall Miller & Associates), Resources (McGarry Geoconsulting), metallurgical testing (SGS), lithium hydroxide conversion (Metso:Outotec) and environmental (HDR).

2.2 STUDY PARTICIPANTS AND RESPONSIBILITIES

The following individuals and organizations have contributed to this document:

Table 2-1 - Report Contributors

Section	Description	Prepared By
1	Executive Summary	Primero
2	Introduction	Primero
3	Property Description	Primero
4	Accessibility, Climate, Local Resources, Infrastrucutre and Physiography	Primero and McGarry Geoconsulting
5	History	Primero
6	Geological Setting, Mineralization and Deposit	McGarry Geoconsulting
7	Exploration	McGarry Geoconsulting
8	Sample Preparation, Analyses, and Security	McGarry Geoconsulting
9	Data Verification	McGarry Geoconsulting
10	Mineral Processing and Metallurgical Testing	Primero
11	Mineral Resource Estimates	McGarry Geoconsulting
12	Mineral Reserve Estimates	MM&A
13	Mining Methods	MM&A
14	Processing and Recovery Methods	Primero
15	Infrastructure	Primero and MM&A
16	Market Studies	Roskill and PLL
17	Environmental Studies, Permitting, and Plans, Negotiations, or Agreements with Local Individuals or Groups	HDR
18	Capital and Operating Costs	Primero
19	Economic Model and Sensitivity Analysis	Primero
20	Adjacent Properties	Primero
21	Other Relevant Data and Information	Primero
22	Interpretation and Conclusions	Primero
23	Recommendations	Primero
24	References	Primero
25	Reliance on Information Provided by the Registrant	Primero

2.3 ABBREVIATIONS, ACRONYMS AND UNITS OF MEASURE

Table 2-2 – Abbreviations, Acronyms and Units of Measure

Symbol	Description
AREMA	American Railway Engineering and Maintenance of Way
B	Billion
BG	Battery Grade
CAPEX	Capital Expenditure
CSX	Railroad CSX
DMS	Dense Medium Separation
DMC	Dense Medium Cyclone
DFS	Definitive Feasibility Study
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
EBT	Earnings Before Taxes
IRR	Internal Rate of Return
LiOH	Lithium hydroxide monohydrate
ktpy	thousand tonnes (metric) per year
M	Million
MGG	McGarry Geoconsulting Corp.
MM&A	Marshall Miller & Associates, Inc.
MRE	Mineral Resource Estimate
MRL	North Carolina State University's Mineral Research Laboratory
Mtpy	Million tonnes (metric) per year
NCDEMLR	North Carolina Department of Energy, Mineral and Land Resources
NPAT	Net Profit After Tax
NPI	Non-Process Infrastructure
NPV	Net Present Value
OPEX	Operational Expenditure
PFDs	Process Flow Diagrams
PFS	Pre-feasibility Study
PLL	Piedmont Lithium Inc.

Primero	Primero Group
SC6	Spodumene concentrate 6% Li_2O
SMP	Structural Mechanical and Piping
TG	Total grade
tpy	tonnes (metric) per year

Symbol	Description
TSB	Tin Spodumene Belt
$	United States Dollars

2.4 BACKGROUND

The PLL Carolina Lithium Project is located in one of the premier regions in the world for lithium exploration, with favorable geology and ideal location with easy access to infrastructure, power, research and development centers for lithium and battery storage and major high-tech population centers.

The Carolina Lithium Project is in a rural area of Gaston County in North Carolina, USA (see Figure 3-1) approximately 44 km northwest of Charlotte, 16 km northeast of the town of Kings Mountain and 11 km southwest of the town of Lincolnton. The project is centered at approximately 35º 23' 20" N 81º 17' 20" W.

The property parcels are easily accessible through a paved secondary road bisecting the project area. Several small gravel roads traversable by truck allow further access into the properties. Interstate highway I-85 lies 13 km to the South and provides easy access to the city of Charlotte and the Charlotte Douglas international airport 30 km to the East. Charlotte is North Carolina’s largest city.

As of October 31, 2021, the Project comprised approximately 3,245 total acres, of which 1,526 acres are claims on private property through option or deferred purchase agreements, 113 acres are under a long-term mineral leased agreement, 79 acres are under lease to own agreements, and 1,527 acres are owned by Piedmont. For the properties hosting the Mineral Resources in this report, Piedmont controls 100% of the surface and mineral rights per one or more agreement scenarios.

2.5 SCOPE OF WORK

The scope of work for the study was to deliver a CAPEX and OPEX estimate of ±15% accuracy, including an economic assessment and risk assessment.

The study considers the technical, engineering and cost elements of the project for the mine, concentrator, by-products, and conversion plant production facilities.

The mine scope of work and description are covered in section 13 of this report.

For the concentrator including the by-products facilities, process circuits were developed to a feasibility study level in terms of engineering deliverables.

2.5.1 Concentrator and by-product plants

For the concentrator and by-product plants, the study evaluated the following aspects of the project:

- The recent metallurgy test results (described in Section 10.0)
- The concentrator including:
- Crushing (excluding the primary crusher) and screening;
- Primary and secondary DMCs, screening and magnetic separation – coarse;
- Primary and secondary DMCs, screening and magnetic separation – fines;

- Upflow and screw classifiers;
- DMC tailings thickener and filter;
- Grinding;
- Mica flotation including iron removal flotation;
- Mica stockpile;
- Spodumene flotation;
- Spodumene flotation concentrate thickener and filter;
- Spodumene concentrate stockpile;
- Flotation tails thickening and filter;
- Reject stockpile;
- Water (sources and distribution).
- Reagents;
- The by-product plant:
- Feldspar flotation;
- Feldspar stockpile;
- Quartz recovery;
- Quartz stockpile;
- Magnetic separation;
- Water (sources and distribution);
- Reagents.
- Infrastructure requirements consisting of:
- Reagent’s facilities including unloading, storage and distribution to process;
- Potable, fresh water and process water storage and distribution;
- Fire pump set and reticulation;
- Diesel storage and distribution;
- Plant air services (compressed air facility);
- 24 MVA connected power (for the concentrator and by-product plant) and reaching 30MVA including the mine area;
- Communications (assumed available, needs further studies to confirm).
- The concentrator, by-product and conversion plant infrastructure is inclusive of:
- All site preparation and earthworks including any construction laydown areas;
- Electrical rooms and control rooms;
- Non-process buildings;
- Site roads and drainage within the processing plant;
- Plant access and haul roads (by others);

The following inputs to the study have been provided by McGarry Geoconsulting group:

- Geology and MRE (Including Central, Core and Huffstetler).

The following inputs to the study have been provided by MM&A:

- Mining (including in-pit crushing, waste rock stockpiles, ROM pad and earthworks).

The following inputs to the study have been provided by PLL or its subconsultants:

- Environment and permitting;
- Metallurgical test work;
- Logistics;
- Manning;
- Marketing;

2.5.2 Lithium conversion plant

The conversion plant development assumes an EPC delivery model with a key technology partner providing the design and supply of the key process package. As such, Primero was provided with the estimated CAPEX and operational OPEX from Metso:Outotec for the key process -equipment package. Primero estimated the rest; earth works, foundation, SMP supply & installation, building and lab, power sub-station along with including owner's costs, working & sustaining capital, pre-production and contingencies.

2.5.3 Methodology

The feasibility study was undertaken by Primero, Metso:Outotec, MM&A, McGarry Geoconsulting and PLL and input for PLL's sub-consultants.

McGarry Geoconsulting were responsible for the geological development, update of the Core, Central and Huffstetler properties MRE and by-products MRE.

MM&A was responsible for the mining scope including the mine plan, optimization, mining CAPEX and OPEX.

SGS conducted the metallurgical test work program under guidance from PLL and assistance from Primero.

Metso:Outotec provided process design, capital, and operating cost figures for the lithium hydroxide conversion facilities.

Primero undertook the study management, process design and engineering, infrastructure requirements, capital and operating costs compilation, financial assessment, and report compilation.

2.5.4 Deliverables

The key deliverable is the DFS report that will enable the executive management of PLL to make decisions on advancing the project to the next level.

The definitive feasibility study update deliverables include:

- Updated Mineral Resource Estimate for Core, Central and Huffstetler properties and for by-products property per JORC 2012 and SK-1300 requirements;
- Mine plan and schedule;
- PFDs, process design criteria and mass balance;
- Mechanical equipment list;
- Plant layouts;
- Project schedule (preliminary plan and schedule of the execution phase);
- CAPEX and OPEX;

- Economic model;
- Feasibility study update report (this document).

2.5.5 Battery Limits

Primero's battery limits for the study scope are as follows:

Concentrator and by-products:

Feed	Coarse ore feed bin.
Tailings	Tailing's conveyor discharge.
SC6	Stockpiling and truck weighting.
Mica	Stockpiling.
Quartz and Feldspar byproduct	Drying, silo truck loading and weighting.
Raw water	Inlet to raw water tank (pit dewatering and bore water supply by others).
Potable water	Connection at process plant fence.
Power	Main substation near plant fence.
Reagents	Resin, sodium carbonate, phosphate, hydrated lime, acid area, sodium hydroxide.
Communications	Communication panel in the main control room.
Utilities	Air, nitrogen, CO_2, natural gas, steam.

Conversion plant:

SC6 Feed	Feed into bin (provided by Metso:Outotec).
Civil/structural	Underside of baseplate and building.
Solid residues	Filter cake, slurry, screen overs (storage bunker & transport to tailings).
Effluent, water and slurry	Liquid effluent (outlet pipe flange), cooling water and condensate returns (single flanged connections).
Gaseous emissions	Process gas off take (outlet pipe flange, top of stack).
Product (LiOH)	Bagging, storage and shipping.
Water	Potable, demineralized, fresh for process and colling. Single flanged connections).
Electrical energy	Motors connected to equipment and grounding connectors in equipment.
Reagents	Feed into preparation bins and distribution systems.
Instrumentation	Connectors.
Utilities	Steam (HP and MP) (single flanged connections). Plant air, air, CO_2 and sealing gas (single flange connections).

3 PROPERTY DESCRIPTION

3.1 LOCATION

The Carolina Lithium Project is located in a rural area of Gaston County, North Carolina, USA (Figure 3-1), approximately 40 km northwest of Charlotte, North Carolina; 15 km northeast of the town of Kings Mountain, North Carolina; and 10 km southwest of the town of Lincolnton, North Carolina.

The Property is centered at approximately 35°23’20”N 81°17”20”W. The Project is located on United States Geological Survey (*USGS*) Quadrangles: Bessemer City, Lincolnton West and Lincolnton East. The coordinate system and datum for the modeling is UTM-17N, NAD-83.

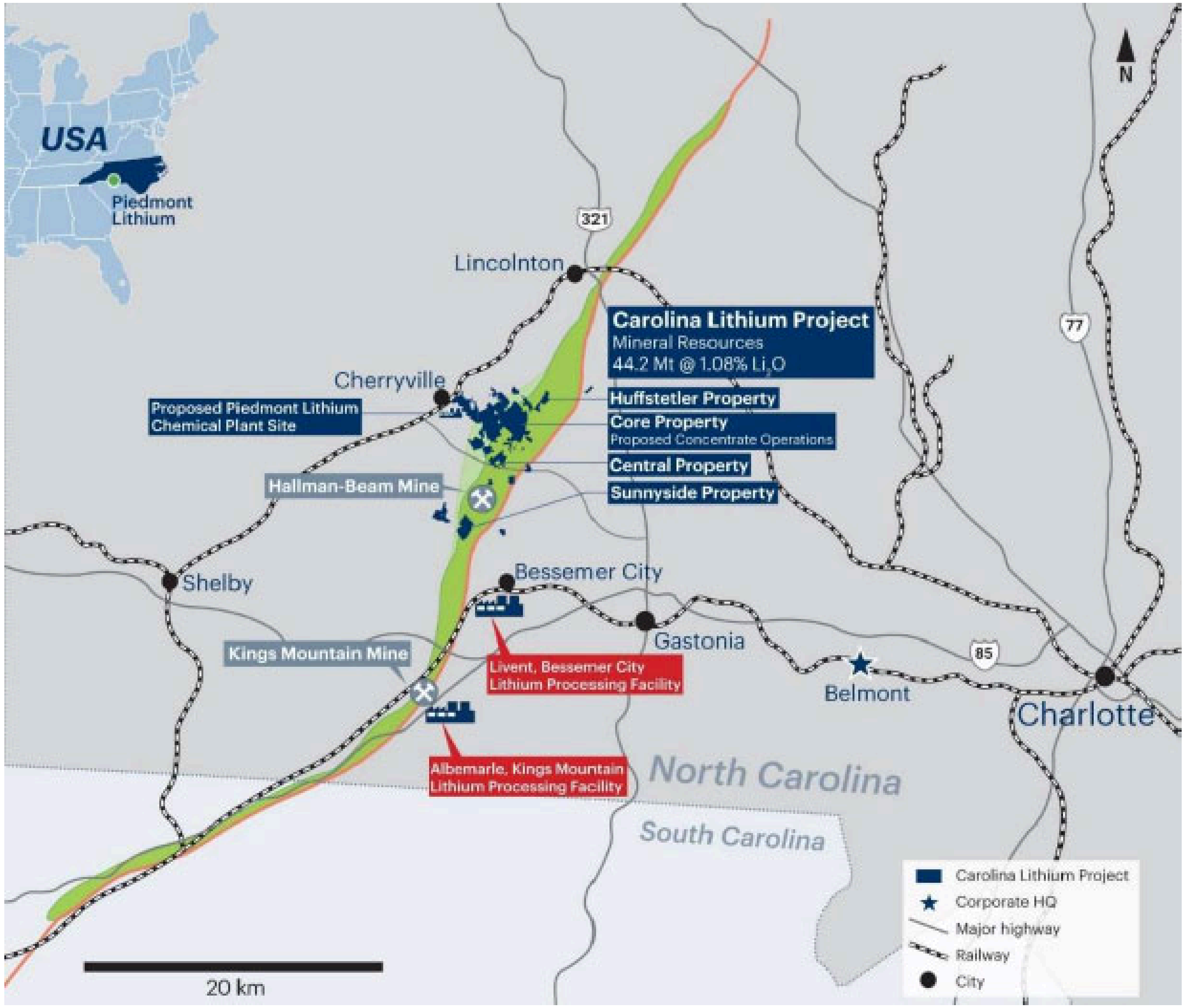


Figure 3-1 - Carolina Lithium Project Location

3.2 TITLES, CLAIMS OR LEASES

Piedmont Property that is the subject of this Report as of October 31, 2021 comprise approximately 3,245 total acres (Figure 3-2), of which: 1,526 acres are claims on private property through option or deferred purchase agreements, 113 acres are under a long-term mineral leased agreements, 79 acres are under lease to own agreements, and 1,527 acres are owned by PLL.

Private option agreements between PLL and its subsidiaries and the respective landowners grant PLL the exclusive and irrevocable right to access, enter and occupy each property for the purpose of mineral exploration and, upon exercise of the option, to either purchase each property or enter into a long-term mining lease.

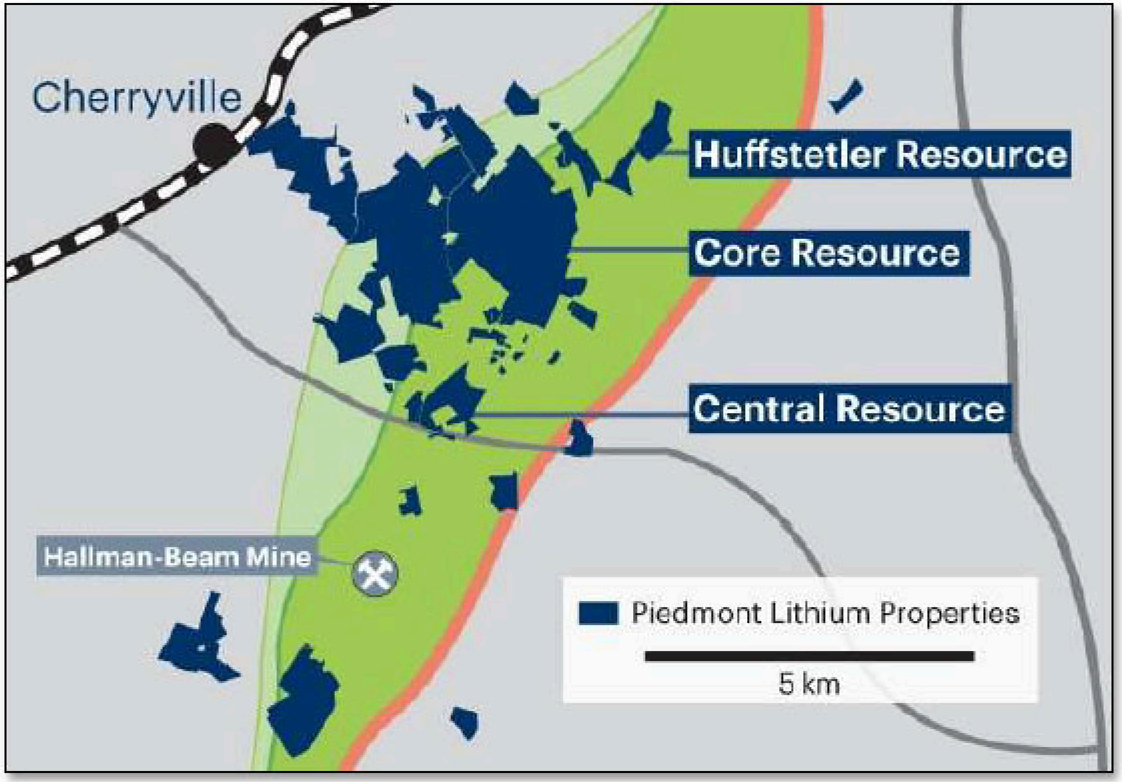


Figure 3-2 - PLL Total Land Package

For the properties hosting the MRE's in this report, PLL controls 100% of the surface and mineral rights per one or more of the agreement scenarios described above.

Table 3-1 below summarizes the surface and minerals rights per agreement type for all PLL properties.

Table 3-1 - Summary of land agreement type and acreage for all PLL properties

Agreement Type *	Total Acres	Surface Rights Acres	Mineral Rights Acres
Option or Deferred Option Agreements	1,526	1,526	1,473

Long Term Mineral Lease Agreements	113	113	113
Lease to Own Agreements	79	79	79
Owned Properties	1,527	1,527	1,393
Acres - Total	3,245	3,245	3,058

**As of October 2021*

Neither MGG nor MM&A has carried out a separate title verification for the property and neither company has verified leases, deeds, surveys, or other property control instruments pertinent to the subject resources. PLL has represented to MGG and MM&A that it controls the mining rights to the resources as shown on its property maps, and both MGG and MM&A have accepted these as being a true and accurate depiction of the mineral rights controlled by PLL. The TRS assumes the Property is developed under responsible and experienced management.

3.3 MINERAL RIGHTS

PLL supplied property control maps to MGG and MM&A related to properties for which mineral and/or surface property are controlled by PLL. While MGG and MM&A accepted these representations as being true and accurate, MGG and MM&A have no knowledge of past property boundary disputes or other concerns that would signal concern over future mining operations or development potential.

The concentrate operations and chemical plant are located entirely within private lands. Piedmont engaged Johnston, Allison & Hord P.A. ("JAH") to provide legal advice regarding the nature, scope and status of the Company's land tenure and mineral tenement rights for the Project in considering the results of the DFS.

As of this report date, the Company's properties comprised approximately 3,245 acres of surface property and associated mineral rights in North Carolina, of which approximately 1,527 acres (114 parcels) are owned by Gaston Land Company, LLC, a subsidiary of the Company. Approximately 113 acres are subject to long-term lease (1 parcel; 1 individual landowner), approximately 79 acres are subject to lease-to-own agreements (2 parcels; 2 landowners), and approximately 1,526 acres are subject to exclusive option agreements (79 landowners; 124 land parcels). These exclusive option agreements, upon exercise, allow us to purchase or, in some cases, enter into long-term leases for the surface property and associated mineral rights. The Company has made all required payments under each option agreement.

- Piedmont has received a Memorandum of Option or Memorandum of Contract signed by each landowner and each Memorandum is recorded in the Gaston County Register of Deeds. These Memoranda were recorded between September 2016 and October 2021.

- Title searches on all properties were completed prior to recording each Memorandum of Option.

- All title searches have confirmed that landowners hold fee simple ownership of all land and mineral rights related to the land with the exception of real estate taxes, certain utility access and easements which do not materially impact Piedmont's option or purchase rights or ability to extract minerals from the land, and mortgage liens to be paid by the private landowner or subordinated to Piedmont's rights to the land and the minerals upon acquisition or long-term lease by Piedmont.

Legal mining rights may reflect a combination of fee or mineral ownership and fee or mineral leases through various surface and mineral lease agreements.

3.4 ENCUMBRANCES

No Title Encumbrances are known. By assignment, MGG and MM&A did not complete a query related to Title Encumbrances.

On August 31, 2021 PLL subsidiary Piedmont Lithium Carolinas, Inc. submitted a mining permit application to North Carolina's Division of Energy, Mineral and Land Resources. The application is under review as of the publication date of this report.

In order to undertake mining activities within Gaston County, North Carolina, properties must be zoned I-3 under the Gaston County Unified Development Ordinances. Additionally, mining and quarrying operations within Gaston County require a Special Use Permit approved by the Gaston County Board of Commissioners. As of the date of this report PLL has not submitted applications for I-3 zoning or for a Special Use Permit.

3.5 OTHER RISKS

There is always risk involved in property control. PLL has had its legal teams examine the deeds and title control in order to minimize the risk.

4 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

4.1 TOPOGRAPHY, ELEVATION, AND VEGETATION

Topography of the area surrounding the Project is typical of the Piedmont Plateau characterized by relatively low, rolling hills. Several creeks bisect the property and are surrounded by flat, swampy floodplains that can extend up to 100 m away from the drainage channel. Surface elevations at the Project range from approximately 300 m above sea level in upland regions to approximately 220 m at stream level.

The area surrounding the Property is considered rural with a mixture of cleared farmland and forest in the temperate broadleaf category. Vegetation, where present, is a combination of large trees with smaller underbrush and is easily traversable by foot.

4.2 ACCESS AND TRANSPORT

General access to the Project is via a well-developed network of primary and secondary roads. Interstate highway I-85 lies 10 km to the south of the Project area and provides easy access to Charlotte Douglas International Airport 30 km to the east. A CSX-owned rail line borders the Property to the northwest (Figure 3-1).

4.3 PROXIMITY TO POPULATION CENTERS

Transport links provide access to Charlotte, North Carolina’s largest city, within an hour’s drive from the Project. The Charlotte metropolitan region has a 2020 population of 2.66 million people.

4.4 CLIMATE AND LENGTH OF OPERATING SEASON

North Carolina has a humid subtropical climate with short, mild winters and hot summers. The area around Lincolnton experiences summer temperatures ranging from approximately 20°C to 32°C, with July being the hottest month at an average maximum of 31.4°C. Winter temperatures tend to be close to freezing, with January being the coldest month at an average minimum temperature of –1.4°C. Average precipitation is around 120 cm and is evenly distributed throughout the year, with March being the wettest month with approximately 12 cm of rain. Average annual snowfall for the area totals less than 15 cm per year. The relatively mild climate allows for exploration year-round with little to no weather-related interruptions. Seasonal variations and weather events would be expected to have a small effect on the efficiency of surface mining and concentrator operations. Negative impacts would be on a limited basis and last less than a few days.

4.5 INFRASTRUCTURE

There is a significant potential human resource available from towns in the vicinity of the Project, including skilled heavy machinery operators. The Charlotte metropolitan area is home to multiple universities providing for a highly skilled pool of talent.

A rail line borders the Property to the northwest. An electrical power infrastructure is already in place feeding power to nearby residents and property owners. Water is also accessible with a shallow water table and two convergent creeks running through the middle of the property.

Major transmission lines run immediately south of the Project with 11.5 GW of large scale, low-cost power, within 50 km from the Project. The Transcontinental Gas Pipeline runs through Bessemer City.

5 HISTORY

5.1 PREVIOUS LITHIUM MINING IN THE REGION

The Project lies within the Carolina tin-spodumene belt. Mining in the belt began in the 1950's with the Kings Mountain Mine, currently owned by Albemarle Corporation, and the Hallman-Beam mine near Bessemer City, currently owned by Martin Marietta Corporation. Both former mines are located within approximately 20 km of the Project to the south, near Bessemer City and Kings Mountain, respectively (Figure 3-1). Portions of the Project area were explored and excavated to shallow depths in the 1950's as the Murphy-Houser mine, owned by the Lithium Corporation of America (predecessor to Livent) (Cooley, 2010).

5.2 PREVIOUS EXPLORATION

In 2009, Vancouver based North Arrow Minerals Inc. ("North Arrow") commenced exploration at the property. North Arrow collected a total of 16 rock grab samples in the Core Property area, of which 14 returned above 1% Li_2O (Cooley, 2010). Extensive geological mapping outlined over 37 spodumene-bearing pegmatite dikes at the Core Property and confirmed localized historical trenching of these dikes by Lithium Corporation of America (Cooley, 2010). Geological mapping, which captured the location and visual estimate for spodumene, were used for drill hole targeting. North Arrow completed 19 diamond drillholes in 2009/2010. North Arrow subsequently terminated all their property agreement soon thereafter.

In 2016, Piedmont (formerly WCP Resources Limited) began optioning surface and mineral rights at the property. Piedmont commenced a renewed exploration effort at the Project which is detailed in Section 7.0 of this report.

6 GEOLOGICAL SETTINGS, MINERALIZATION AND DEPOSIT

6.1 REGIONAL, LOCAL AND PROPERTY GEOLOGY

The Project is situated in the Inner Piedmont belt near the Kings Mountain shear zone (Figure 3-1). The Inner Piedmont belt is *characterized by Cambrian or Neoproterozoic gneisses, amphibolites, and schists of varying metamorphic grade. These rocks typically lack primary structures and the relationships amongst the rock types are generally undetermined. Several major intrusions occur in the Inner Piedmont, including the nearby Mississippian-aged Cherryville granite. Concurrent dike events extend from the granite, mainly to the east, with a strike that is sub-parallel to the northeast-trending Kings Mountain shear zone. As the dikes progress further from their sources, they become increasingly enriched in incompatible elements including lithium. The enriched pegmatitic dikes are located within a 3.5 km wide zone extending from the town of Kings Mountain through Lincolnton.* This zone is known as the Carolina Tin-Spodumene Belt (*TSB*). As shown in Figure 3-1, the Project lies within the TSB.

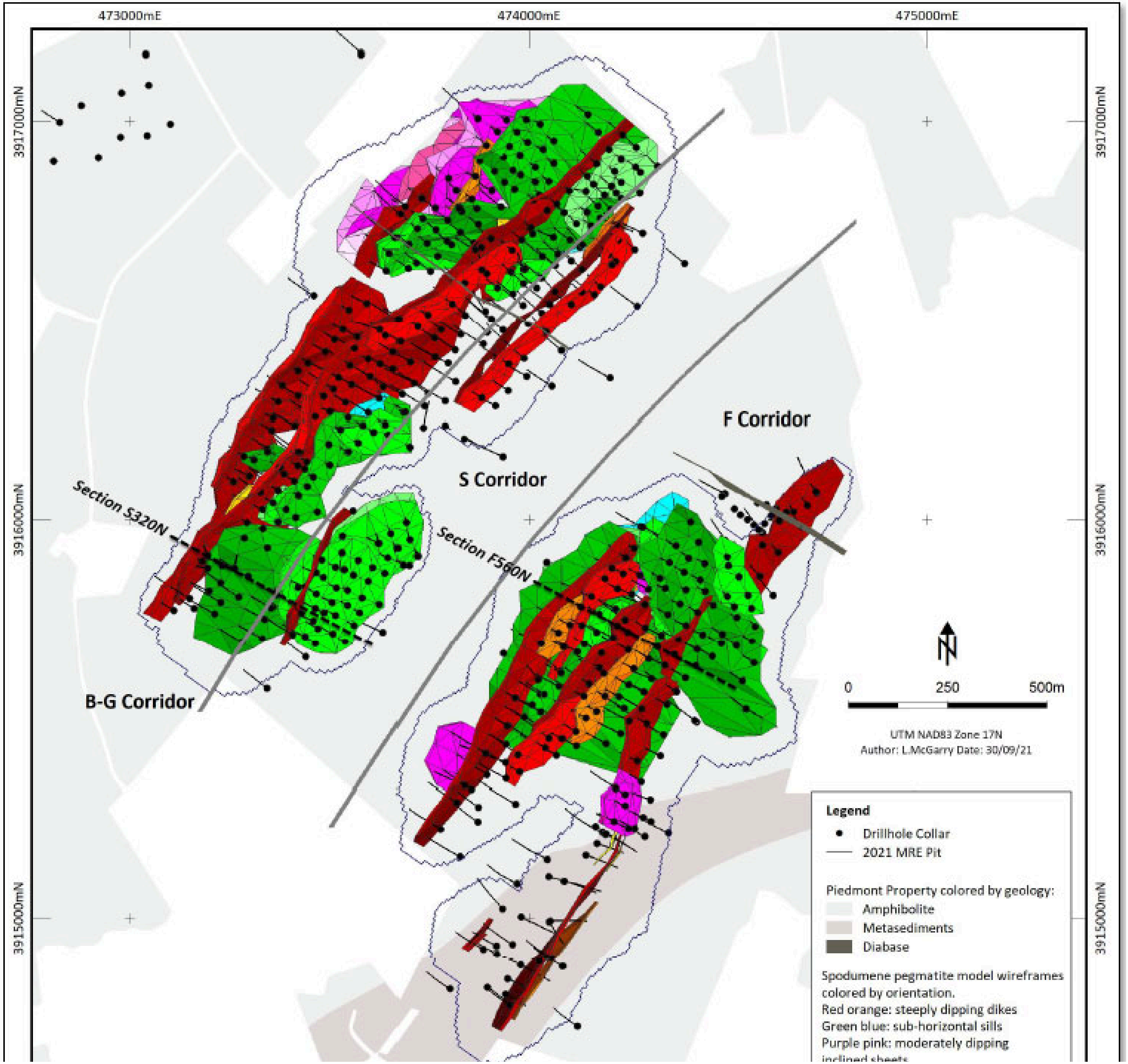
Spodumene pegmatites on the Property are hosted in a fine to medium grained, foliated biotite, hornblende, quartz feldspar gneiss commonly referred to as amphibolite, and metasedimentary rocks including shists and mudstones. The extent of major host rocks is shown in Figure 6-1. Massive to weakly foliated gabbro dikes are encountered over limited extents. Testing indicates that the metasedimentary rocks have the potential to generate acidic conditions.

Pegmatites at the Project include spodumene-bearing and spodumene-free dikes. Spodumene-bearing dikes host the lithium and by-product mineral deposits at the Project.

Spodumene-free pegmatite dikes have variable orientations. Some share the same trend as the spodumene-bearing dikes and in some instances, there is a gradational contact between them. Spodumene-free pegmatite dikes represent either: an early stage (pre-spodumene) fractionated magma; or a later barren pegmatite system. Intervals logged as barren pegmatite can also represent altered portions of the spodumene-bearing pegmatite.

On the Core Property, spodumene-bearing pegmatites are cut by steeply dipping west-northwest trending diabase dikes of 5 m to 10 m thickness at a coordinate northing of approximately 3,916,600 m (Figure 6-1).

A schematic stratigraphic column representing the geological setting of the Carolina Lithium Project is presented in Figure 6-2.



473000mE
474000mE
475000mE
3917000mN
3916000mN
3915000mN
F Corridor
S Corridor
Section S320N
Section F560N
B-G Corridor
N
0
250
500m
UTM NAD83 Zone 17N
Author: L.McGarry Date: 30/09/21
Legend
Drillhole Collar
2021 MRE Pit
Piedmont Property colored by geology:
Amphibolite
Metasediments
Diabase
Spodumene pegmatite model wireframes colored by orientation.
Red orange: steeply dipping dikes
Green blue: sub-horizontal sills
Purple pink: moderately dipping inclined sheets

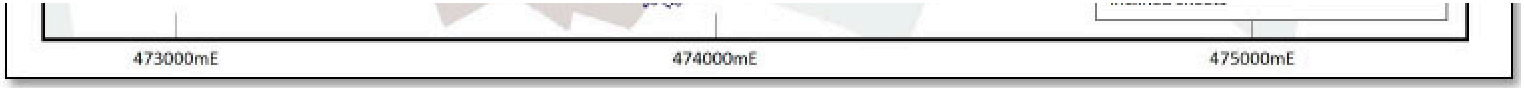


Figure 6-1 - Plan View of Core Property Lithology and Mineralized Pegmatite Dikes

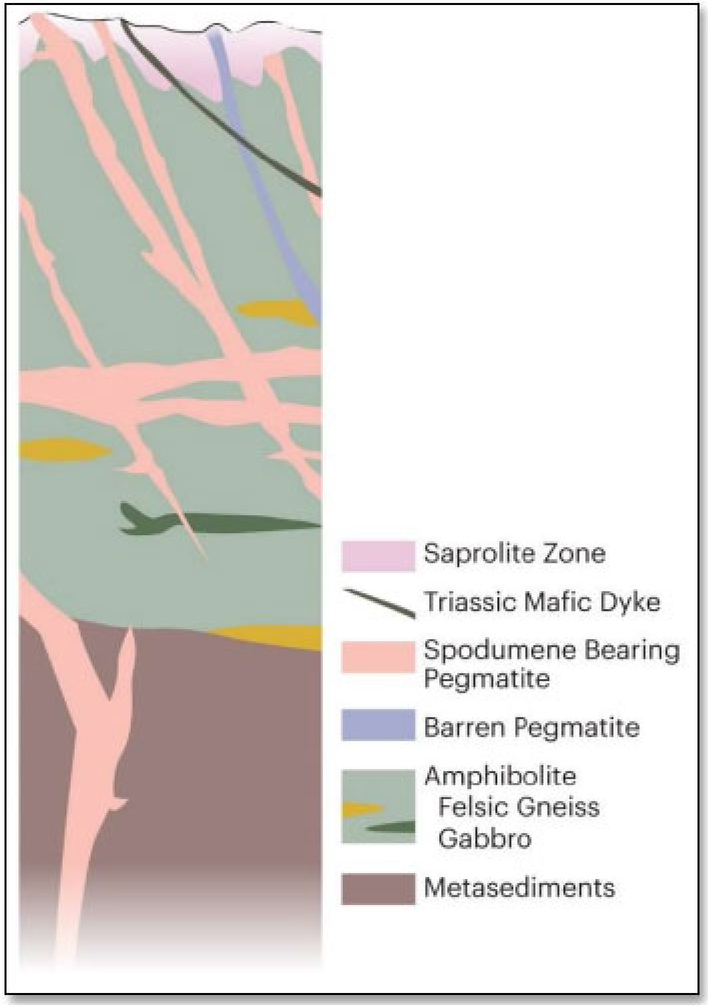


Figure 6-2 - Stratigraphic Column – Carolina Lithium Project

6.2 MINERALIZATION

The spodumene-bearing pegmatites are un-zoned having no apparent systematic variation in primary mineralogy and range from fine grained (aplite) to very coarse-grained. Primary mineralogy consists of spodumene, quartz, plagioclase, potassium-feldspar, and muscovite. Table 6-1 presents average compositional mineral proportions derived from normative minerology calculations on X-ray Fluorescence (*XRF*) drill core assay data.

Table 6-1 - Average Compositional Mineral Proportions for Spodumene-bearing Pegmatites

Mineral	Compositional Average (%)		
	Core	Central	Huffstetler
Spodumene	13.6	16.7	11.8
Quartz	29.4	29.4	28.8
Albite	35.7	35.6	36.4
K-spar	9.7	8.9	12.2
Muscovite	4.3	3.7	3.2
Biotite	1.9	1.6	3.4
Residual	5.5	4.1	4.1

6.3 ALTERATION

Several types of alteration are observed at the Project. Within the amphibolite and metasedimentary host rock, the most common types of alteration are chlorite, epidote, and potassic alteration.

Holmquistite alteration of the amphibolite occurs as a metasomatic replacement at the margins of lithium rich pegmatites. At the Project, holmquistite alteration is distinguished by a light blue color and acicular habit (Figure 6-3) and is observed as both small veinlets and massive zones that usually occur within 2 m of the contact between amphibolite and spodumene pegmatite (Piedmont Lithium, 2017).

Within the spodumene pegmatites, spodumene shows varying alteration intensity from fresh to complete replacement. Spodumene is typically altered to a greater degree than other compositional minerals. The most common types of spodumene alteration are clay, muscovite, and feldspar replacement (Piedmont Lithium, 2017). The distinguishing features of clay alteration of spodumene are the softness and lack of cleavage planes in the spodumene crystals. Muscovite alteration of spodumene results in pseudomorphs of muscovite after spodumene (Figure 6-4).

Left: Sample of massive holmquistite showing asbestiform habit (hole 17-BD-54, 94.73–94.90 m).

Right: Sample of amphibolite with vein of blue-colored holmquistite (hole 17-BD-82 94.49–94.59 m).

Figure 6-3 - Examples of Holmquistite

Note – Picture is from Hole 17-BD-121 72.24–72.44 m

Figure 6-4 - Pegmatite showing Pseudomorphs of Muscovite after Spodumene

6.4 DEPOSITS

6.4.1 Core

Spodumene-bearing pegmatites on the Core Property are assigned to three major corridors shown in Figure 6-1: the B-G corridor and S corridor (cross section view in Figure 6-5) and the F corridor (cross section view in Figure 6-6). Corridors extend over a strike length of up to 2 km and commonly have a set of thicker dikes of 10 m to 20 m true thickness at their core. These major dikes strike northeast and dip steep to moderately toward the southeast. Dikes are intersected by drilling to a depth of 300 m down dip. Dikes are curvi-planar in aspect.

At the Core property, dikes are commonly interconnected by flat to shallow-dipping sills and inclined sheets that are encountered over broad lateral extents but rarely outcrop at surface. These sills and sheets are tested by drilling over 600 m along strike and 500 m down dip where they remain open and can be projected between major corridors as shown in Figure 6-5 and Figure 6-6. The true thickness of individual sills and inclined sheets range from 1 m to 18 m. A representative closely spaced series of sills and inclined sheets typically has a cumulative thickness greater than 10 m.

Spodumene-bearing pegmatites, or a closely spaced series of such pegmatites, can be traced between drillhole intercepts and surface outcrops for over 1.7 km. Although individual units may pinch out, the deposit is open at depth. The Mineral Resource has a maximum vertical depth of 210 m from surface. Ninety-two (92) percent of the Mineral Resource is within 150 m of the topography surface.

6.4.2 Central

Spodumene-bearing pegmatites on the Central Property fall within a corridor that extends over a strike length of up to 0.6 km and contains a pair of 10 m to 20 m true thickness dikes (see inset plan map in Figure 6-7). These major dikes strike northeast and dip steeply to the southeast. Dikes are intersected by drilling to a depth of 225 m down dip (Figure 6-7). Although individual pegmatite bodies may pinch out, the deposit is open along strike and down dip and is primarily confined by the property boundary. The Central mineral resource has a maximum vertical depth of 275 m below surface. On average, the model extends to 200 m below surface. Seventy-five (75) percent of the Central Mineral Resource model is within 150 m of the topography surface.

6.4.3 Huffstetler

Spodumene-bearing pegmatites on the Huffstetler Property fall within a corridor that extends over a strike length of up to 0.4 km (see inset plan map in Figure 6-8) and form a stacked series of inclined sheets that range from 2 m to 18 m true thickness (Figure 6-8). Inclined sheets strike northeast and dip moderately to the northwest. Spodumene bearing pegmatites are intersected by drilling to a depth of 200 m down dip from surface; however, up-dip extents are limited by the southeastern edge of the permit boundary. Although individual units may pinch out, the deposit is open at depth and along strike. The Huffstetler Mineral Resource has a maximum vertical depth of 150 m below the ground surface.

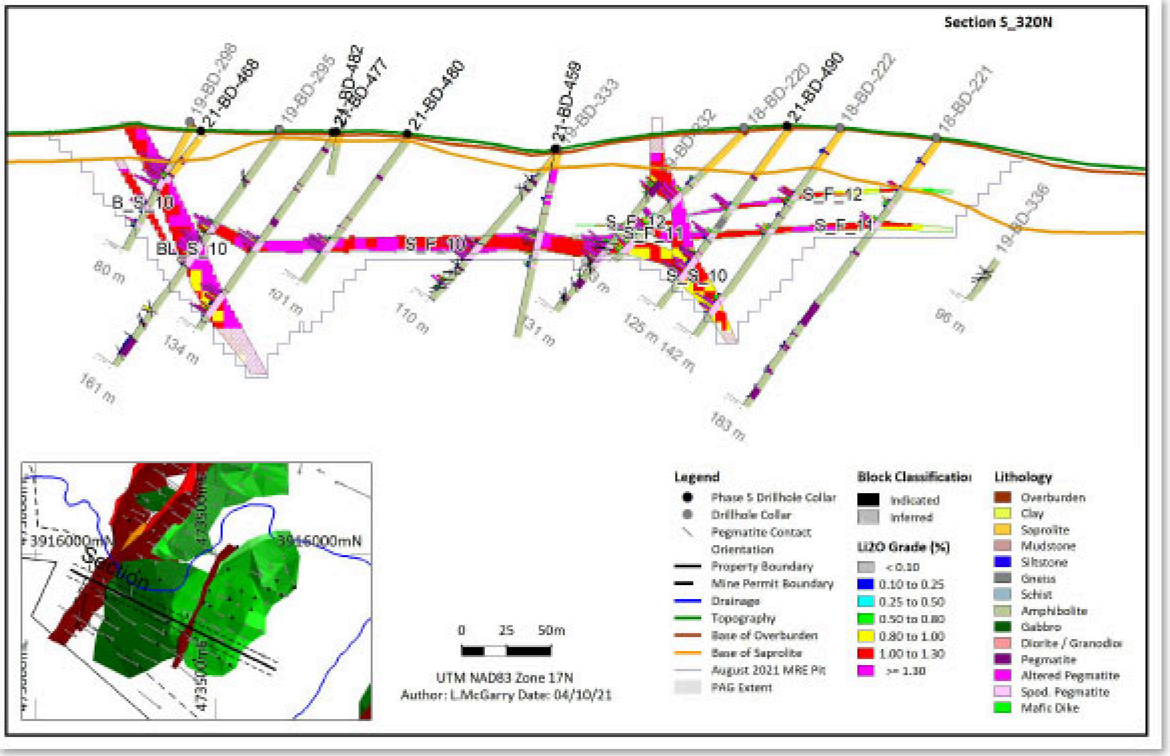


Figure 6-5 - Cross section of Steep Dikes at Core B-G Corridor and S Corridor Connected by a Sill

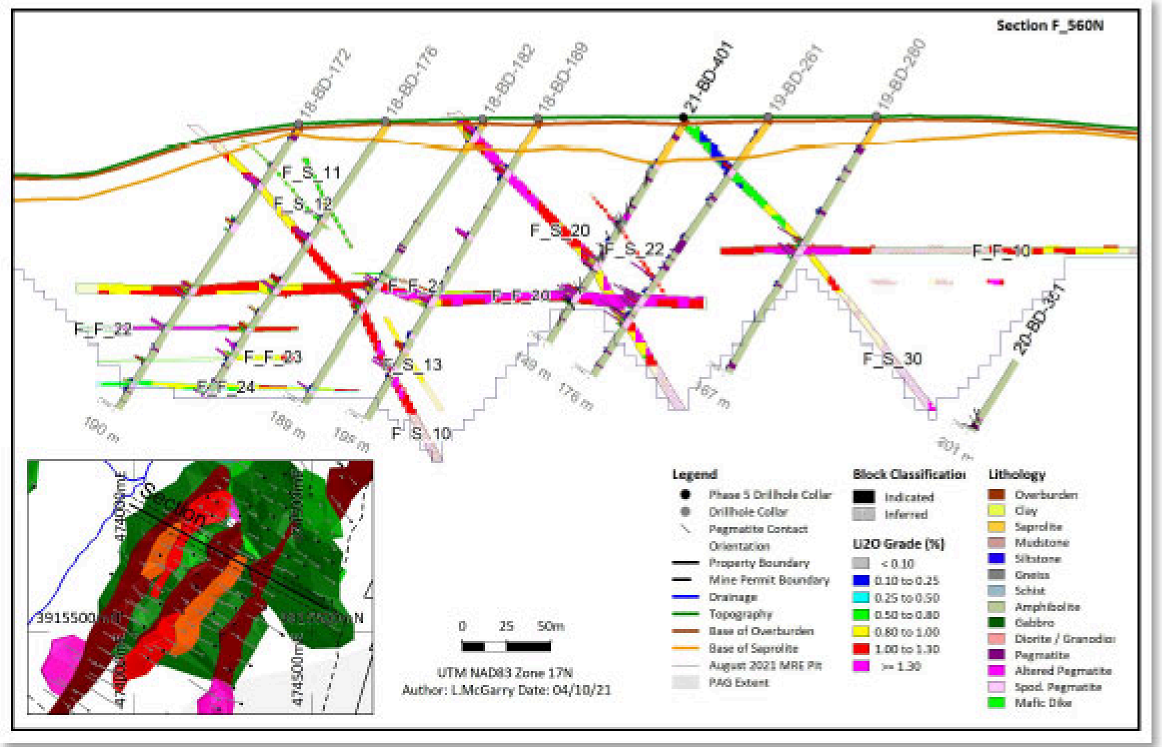


Figure 6-6 - Cross Section of Steep Dikes at Core F Corridor Interconnected by Sills

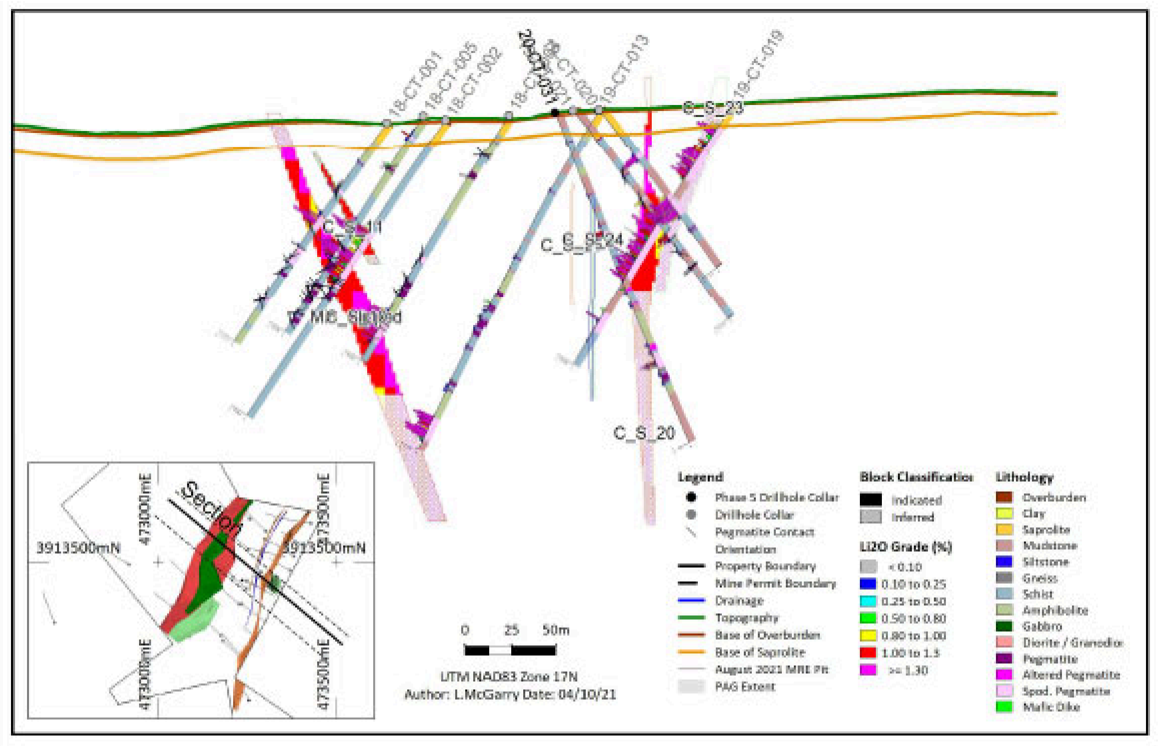


Figure 6-7 - Cross Section of Steep Dikes at the Central Property

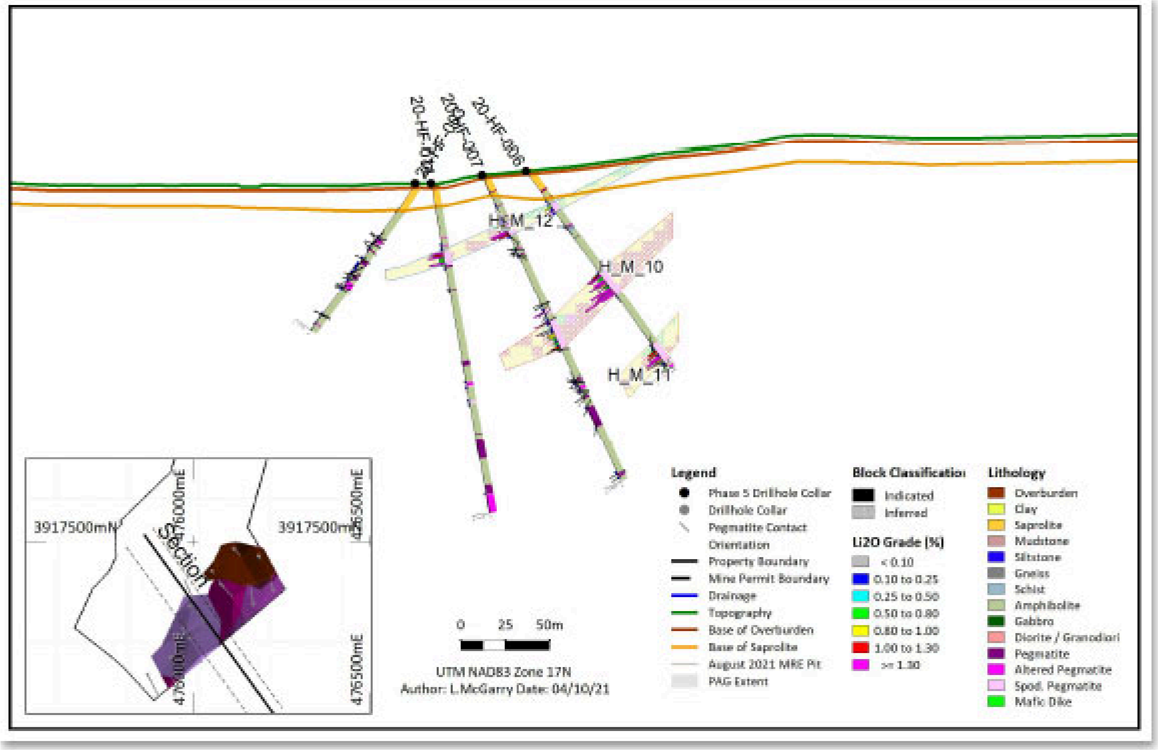


Figure 6-8 - Cross Section at the Huffstetler Property

7 EXPLORATION

7.1 NATURE AND EXTENT OF EXPLORATION

Extensive exploration supports this resource estimate and is comprised of surface mapping and extensive subsurface drilling carried out on the Property. Exploration has predominantly been carried out by PLL, with a small number of initial exploratory holes completed by North Arrow. PLL's exploration of the Property has been carried out by professional geologists in adherence to established operating procedures that have been verified by the QP. To date, exploration has been concentrated on the Core, Central and Huffstetler deposit areas detailed below.

7.1.1 Core Property

As of the 3 August 2021 cut-off date, 542 core holes totaling 80,029 m had been drilled at the Core Property. Table 7-1 shows the breakdown of drilling about the historical drilling completed by North Arrow and the subsequent drilling programs completed by PLL which include 505 diamond core holes and 18 sonically drilled holes. The extent of drilling at the Core property is shown in Figure 7-1.

Table 7-1: Core Drilling Campaigns and Historical Data Included in the Core Property MRE

Year(s)	Company	Phase	No. of holes	Hole size*	Meters	Hole ID (from)	Hole ID (to)
2009–2010	North Arrow	Historical	19	HQ/NQ	2,544	09-BD-01	10-BD-19
2017	Piedmont	Phase 1	12	HQ/NQ	1,667	17-BD-20	17-BD-31
2017	Piedmont	Phase 2	93	HQ/NQ	12,408	17-BD-32	17-BD-124
2017–2018	Piedmont	Phase 3	124	HQ/NQ	21,530	17-BD-125	18-BD-248
2018–2020	Piedmont	Phase 4	90	HQ/NQ	14,766	17-BD-249	19-BD-338
2020-2021	Piedmont	Phase 5	186	HQ/NQ	26,825	20-BD-339	21-BD-524
2020	Piedmont	Phase 5	18	Sonic	289	20-SBD-001	20-SBD-0018
ALL	Piedmont	Total	542	HQ/NQ	80,029	09-BD-01	21-BD-524

At the cut-off date, lithology data were available for all holes up to and including drillhole 21-BD-524. Assay results were available up to and including drill hole 21-BD-491, drill hole 21-BD-494, and drillholes 21-BD-496 to 21-BD-502.

7.1.2 Central Property

At the cut-off date, 36 diamond core holes totaling 5,563 m had been drilled at the Central property as detailed in Table 7-2. The extent of drilling at the Central property is shown in Figure 7-2.

Table 7-2 - Core drilling campaigns and historical data included in the Central Property MRE

Year(s)	Company	Phase	No. of holes	Hole size*	Meters	Hole ID (from)	Hole ID (to)
2018–2019	Piedmont	Phase 4	30	HQ/NQ	4,675	18-CT-001	19-CT-030
2020-2021	Piedmont	Phase 5	6	HQ/NQ	888	20-CT-031	20-CT-036
ALL	Piedmont	Total	36	HQ/NQ	5,563	18-CT-001	20-CT-036

7.1.3 Huffstetler Property

At the cut-off date, 14 diamond core holes totaling 2,151 m had been drilled at the Huffstetler Property as detailed Table 7-3. The extent of drilling at the Huffstetler Property is shown in Figure 7-3.

Table 7-3 - Core drilling campaigns and historical data included in the Huffstetler Property MRE

Year(s)	Company	Phase	No. of holes	Hole size	Meters	Hole ID (from)	Hole ID (to)
2020	Piedmont	Phase 5	14	HQ/NQ	2,151	20-HF-001	20-HF-0014

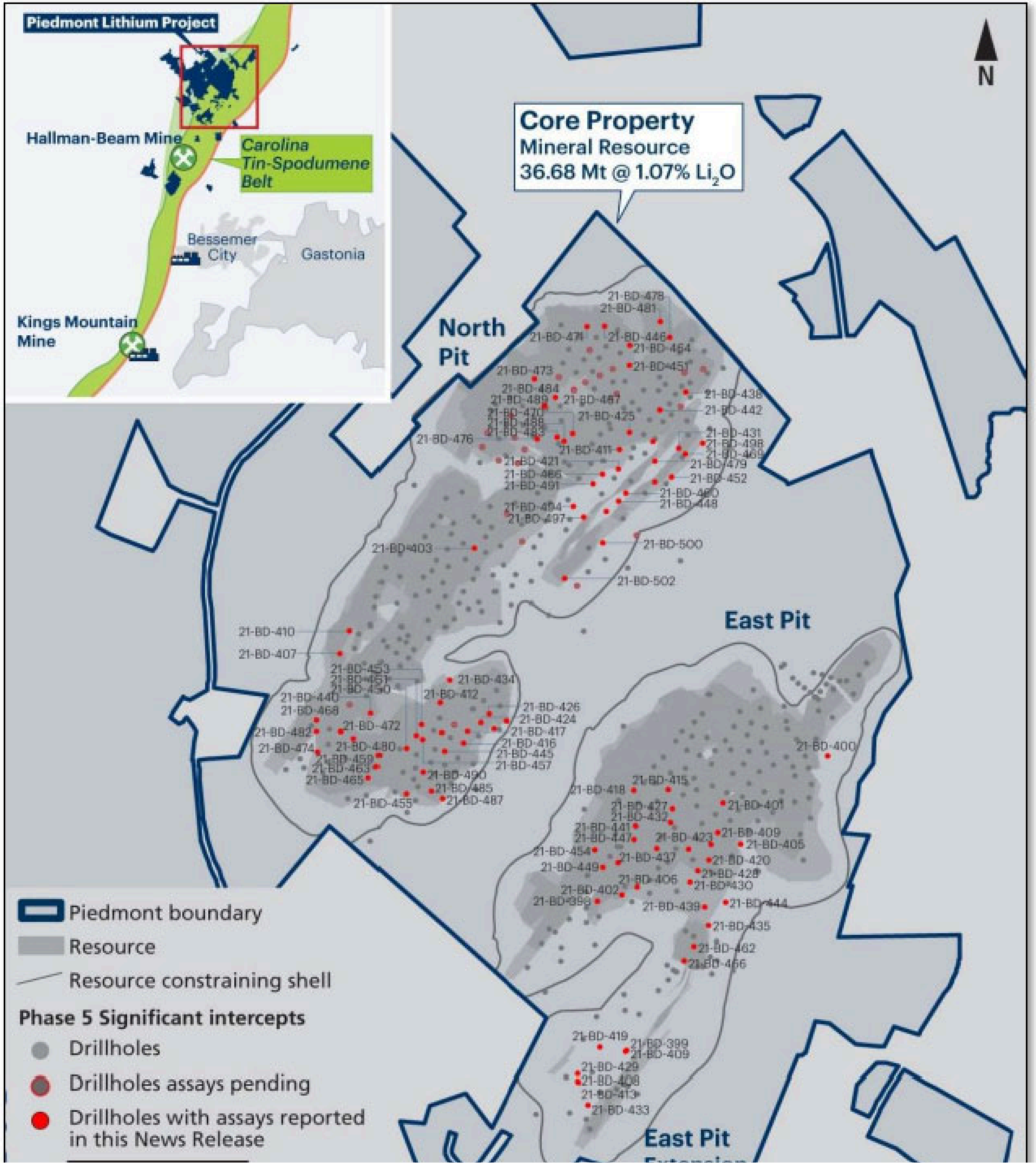

Piedmont Lithium Project
Hallman-Beam Mine
Carolina Tin-Spodumene Belt
Bessemer City
Gastonia
Kings Mountain Mine
N
Core Property
Mineral Resource
36.68 Mt @ 1.07% Li_2O
North Pit
East Pit
East Pit Extension
Piedmont boundary
Resource
Resource constraining shell
Phase 5 Significant intercepts
Drillholes
Drillholes assays pending
Drillholes with assays reported in this News Release

Figure 7-1 - Extent of drilling at the Core property

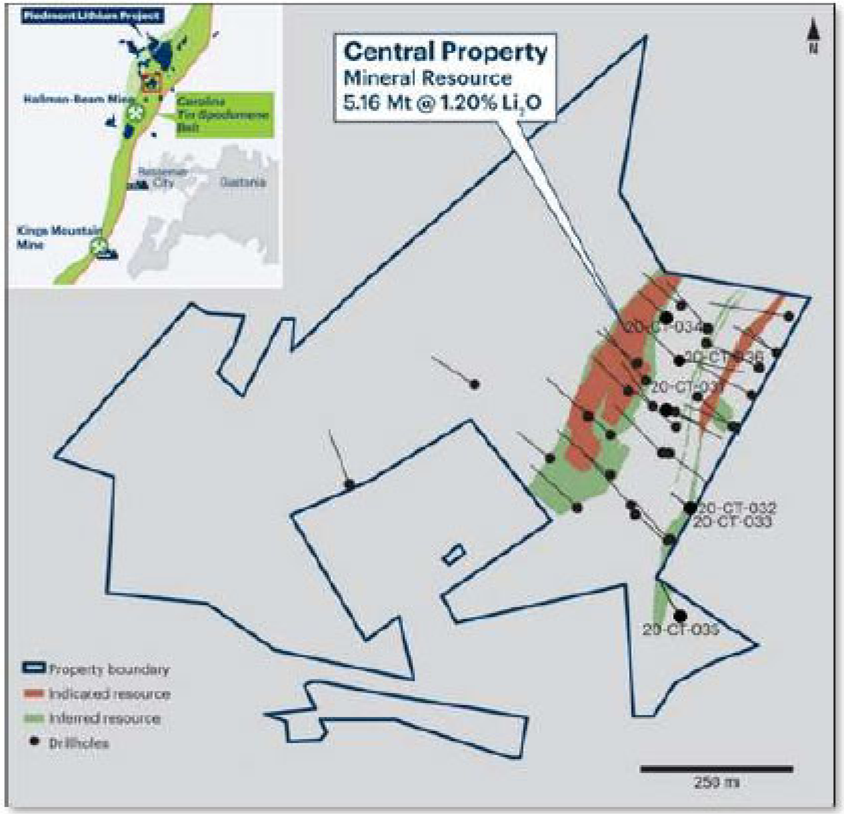


Figure 7-2 - Extent of drilling at the Central property

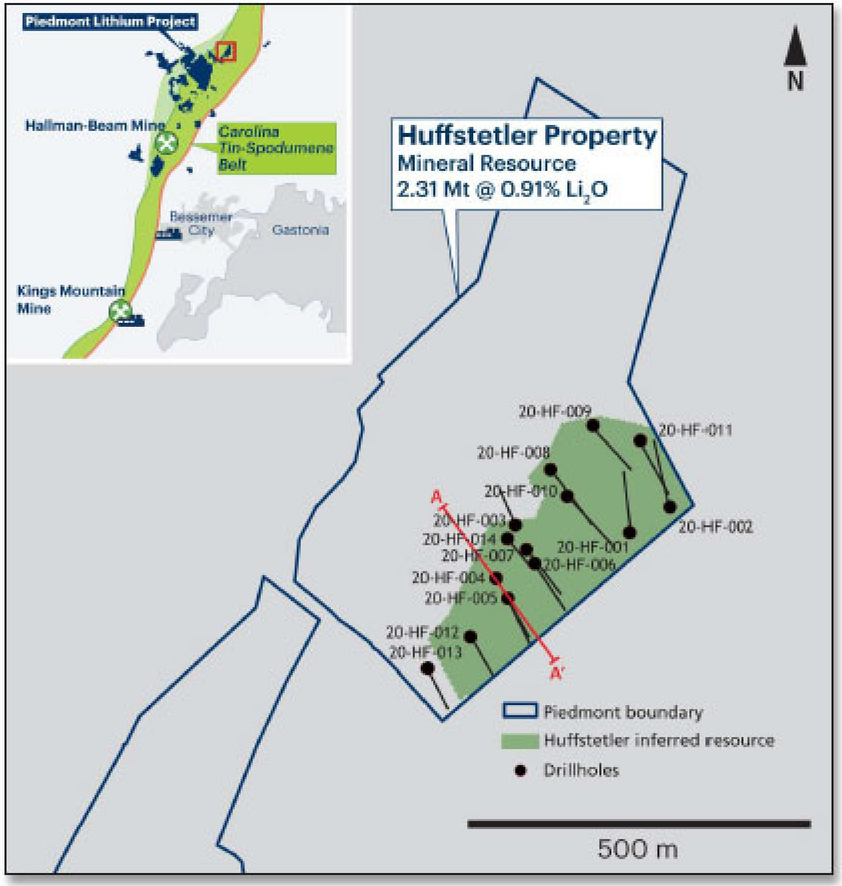


Figure 7-3 - Extent of drilling at the Huffstetler property

7.2 NON-DRILLING PROCEDURES AND PARAMETERS

Non-drilling exploration procedures included testing of soil samples and surface rock exposures, geologic mapping, and surface geophysics surveying. The soil sampling program, along with surface rock sampling and mapping, proved successful in identifying high priority drill targets for spodumene-bearing pegmatites. Soil and rock testing, as well as geologic mapping, results were only used as prospecting tools and are not included as data points for the resource estimate.

Soil testing to identify blind spodumene-bearing pegmatite dikes involved collection, documentation, and laboratory testing of 2,410 soil samples from numerous test lines across PLL's properties. The soil sampling was initially calibrated in areas known to contain spodumene-bearing pegmatites, and then subsequently used as a guide for planning core drilling locations as exploration progressed. Soil samples were collected using a hand-operated soil auger from depths ranging from six to 36 inches below top of ground. Lithium assays ranged from below detection limit (*BDL*) to 2,306 ppm.

Rock collected and tested included float, subcrop and outcrop samples. These occurrences ranged in size from fist-size float to meter-scale subcrop blocks. Lithium values from the samples ranged from 0.01% Li_2O to 4.37% Li_2O. Locations of the samples were recorded with a handheld GPS unit. Outcrop was observed to exist predominantly associated with moderately southeast-dipping pegmatites. The presence of spodumene in surface exposures was found to be indicative of spodumene down-dip. Mapping and testing of the surface exposures were only used as prospecting tools and are not included as data points for the mineral resource estimate.

Geophysics, in the form of a ground magnetic survey, totaling 43.05 line-km, was conducted over Core and Central properties with a minimum of 40 m line spacing. The ground magnetic survey was marginal, at best, in Identifying pegmatites.

7.3 DRILLING PROCEDURES

7.3.1 North Arrow

North Arrow completed a total of 2,544 m of core drilling in 19 drillholes in programs conducted in the fall of 2009 and spring of 2010. Drill cores were recovered as HQ for weathered bedrock (saprolite) with high clay content and as NQ for deeper un-weathered bedrock. The dip of the drill hole at depth was measured with up to four acid tests per hole.

Descriptions of the drill core were logged and are stored digitally. The drill logs include notes on the lithological units, alteration, estimated amount of spodumene mineralization in pegmatite units, textures, grain size, and magnetic susceptibility.

7.3.2 Piedmont

PLL has completed a total of 85,199 m of core drilling in 574 drillholes at the Core, Central and Huffstetler properties. Drilling was conducted in five phases from 2017 to 2021.

All diamond drillholes were collared with HQ and were transitioned to NQ once non-weathered and unoxidized bedrock was encountered. Oriented core was collected by a qualified geologist at the drill rig from 103 drillholes using the Reflex ACT III tool. Orientated core measurements were collected for lithology contact, foliation, vein, fault, shear, and fold plane angles. Downhole surveying was performed on each hole using a Reflex EZ-Trac multi-shot instrument. Readings were taken approximately every 15 m that recorded depth, azimuth, and inclination. Drill collars were located with the differential global positioning system (*GPS*) with the Trimble Geo 7 unit which resulted in accuracies of less than 1 m.

Geological data was collected in sufficient detail to aid in Mineral Resource estimation. Core logging consisted of marking the core, describing lithologies, geologic features, percentage of spodumene and structural features measured to core axis. The core was photographed wet before logging and again immediately before sampling with the sample numbers visible. All the core from the 574 holes reported was logged.

7.4 HYDROLOGY AND HYDROGEOLOGY

Hydrogeological assessment for the project was completed by **HDR, Inc. (*HDR*)**. The tasks involved included surface water and groundwater quality monitoring; streamflow monitoring; pump testing; groundwater level monitoring; and creation of a groundwater model using MODFLOW. MM&A has received and reviewed memorandums and data summaries from HDR. HDR reports on the hydrogeology of the project area include "T*echnical Memorandum: Aquifer Test, Piedmont Lithium – Gaston County, North Carolina*" (revised version submitted February 18, 2019) and "*Technical Memorandum: Groundwater Model, Piedmont Lithium – Gaston County, North Carolina*" (submitted June 28, 2019). An additional groundwater modeling report, titled "*Technical Memorandum: Groundwater Model – Piedmont Lithium, Gaston County, North Carolina*", was also completed by HDR in August 2021.

HDR's groundwater modeling results form a basis for selection of pit dewatering equipment and operating cost considerations. The project will involve pumping from two pits simultaneously at times throughout the mine life, with pumping rates varying depending on the stage of mining and pits being excavated. The predicted dewatering rates range from 575 gallons per minute (*gpm*) in the first year to maximum pumping rates of 2,300 gpm and 2,000 gpm in years 2 and 12, respectively. The estimated average for the mine life is on the order of 1,400 gpm.

7.5 GEOTECHNICAL DATA

MM&A has completed geotechnical characterization and pit slope stability assessment tasks including basic laboratory rock strength testing, discontinuity orientation data collection, kinematic bench-scale stability assessment, and overall pit slope stability assessment. The pit slope stability assessment, initially completed in 2019 and supplemented in 2021, provides guidance with regard to bench, inter-ramp, and overall pit slope for pit design. In January 2021, MM&A conducted additional geotechnical drilling and data collection for specific areas of the planned pits. Results of the geotechnical assessment yielded recommendations for an overall pit wall angle of 51 degrees assuming a bench angle of 75 degrees, a final bench height of 24 m, a final berm width of 9.5 m, and a single 30 m haul road ramp width.

8 SAMPLE PREPARATION, ANALYSIS AND SECURITY

8.1 SAMPLE COLLECTION AND SECURITY

Diamond drill core was cut in half with a diamond saw. Standard sample intervals were a minimum of 0.35 m and a maximum of 1.5 m for both HQ and NQ drill core, taking into account lithological boundaries (i.e., sampled to, and not across, major contacts). Core was cut in half with a diamond saw.

Samples were numbered sequentially with no duplicates and no missing numbers. Triple tag books using nine-digit numbers were used, with one tag inserted into the sample bag and one tag stapled or otherwise affixed into the core tray at the interval the sample was collected. Samples were placed inside pre-numbered sample bags with numbers coinciding to the sample tag.

Drill core samples and surface rock samples were shipped directly from the core shack by the project geologist in sealed rice bags or similar containers using a reputable transport company with shipment tracking capability to maintain chain of custody. Each bag was sealed with a security strap with a unique security number. The containers were locked in a shed if they were stored overnight at any point during transit, including at the drill site prior to shipping. The laboratory confirmed the integrity of the rice bag seals upon receipt.

8.2 SAMPLING TECHNIQUE AND SAMPLE PREPARATION

8.2.1 North Arrow

Historical samples (holes 09-BD-01 through 10-BD-19) were submitted to the commercial independent laboratory **Acme Analytical Laboratories (*AcmeLabs*)** in Vancouver for analysis. AcmeLabs was accredited with ISO/IEC 17025 by the Standards Council of Canada (*SCC*) for the methods employed. Each sample was subjected to: a four-acid digestion and analysis for 40 elements (including lithium) using a combination of ICP-ES (inductively coupled plasma emission spectrometry) and ICP-MS (inductively coupled plasma mass spectrometry) methods (Acme method 7TX); or sodium peroxide fusion and lithium analysis by ICP-ES (Acme method 7PF-Li).

8.2.2 Piedmont Phase I Exploration

Piedmont Phase 1 samples were shipped to the independent commercial laboratory **Bureau Veritas Minerals Laboratory (*BV*)** in Reno, Nevada. BV is accredited with ISL-certification for the methods employed.

- The preparation code was PRP70-250 (crush to 70% of sample <2 mm, pulverize 250 g to 85% <75 µm);
- The analysis code was MA270 (multi-acid digestion with either an ICP-ES or ICP-MS finish), which has a range for Li of 0.5% to 10,000 ppm (1%) Li. This digestion provides only partial analyses for many elements in refractory minerals, including Ta and Nb. It does not include analyses for Cs;
- The over-range method code for Li >10,000 ppm is PF370, which uses a peroxide fusion with an ICP-ES finish and has lower and upper detection limits of 0.001% and 50%, respectively. The laboratory was instructed to implement the over-range method in all samples that exceed 5,000 ppm Li to allow for poor data precision near the upper limit of detection using MA270.

8.2.3 Piedmont Phase 2 to Phase 5 Exploration

All surface and drill core rock samples were shipped to the independent commercial laboratory **SGS Minerals - Lakefield (*SGS*)**, Ontario, Canada. SGS is accredited with ISO/IEC 17025 certification and has a Quality Management System that conforms to ISO 9001:

- Prior to 2020, the preparation code was CRU21 (crush to 75% of sample <2mm). Starting in 2020 the code was changed to CRU16 (crush to 90% of sample <2 mm). The pulverization code remains PUL45 (pulverize 250g to 85% <75 µm);

- Prior to August 2017 the analysis code was GE ICM40B (multi-acid digestion with either an ICP-ES or ICP MS finish), which has a range for Li of 1 to 10,000 (1%) ppm Li;

- Starting in August 2017, samples were analyzed using GE ICP91A Li only. The over-range method code for Li >5,000 ppm is GE ICP90A, which uses a peroxide fusion with an ICP finish, and has lower and upper detection limits of 0.001% and 5% respectively;

- In 2020, the analysis code was changed to GE ICP92A50, which uses a peroxide fusion with an ICP finish, and has lower and upper detection limits of 0.001% and 5% respectively.

Soil samples

Soil samples were analyzed using GE_ICM40B (49 element ICP package) at SGS Laboratories in Lakefield, Ontario & Burnaby, British Columbia. Blanks and certified standard materials (*CRM's*) were inserted at the recommended rate.

Bulk Density

Bulk density measurements for Phase 2 drilling were made on each drillhole (one host rock and one mineralized rock) at SGS using the immersion method analyses code GPHY04V. Saturated and dry bulk densities for Phase 3, Phase 4 and Phase 5 drill programs were collected by Piedmont geologists using a triple beam scale and the immersion method.

X-Ray Fluorescence

Upon completion of Phase 3 drill sample lithium analysis, sample intervals falling within the Core Property deposit model were identified for subsequent whole rock analysis by SGS using borate fusion followed with XRF (SGS analysis code GO XRF76V). The same analytical procedure was used for whole rock analysis of all Phase 4 and Phase 5 drill core containing spodumene-bearing pegmatite at the Core, Central and Huffstetler properties.

Normative Minerology Calculations

Normative mineralogy was calculated from total fusion XRF major element data using a least squares method (MINSQ – Herrmann, W. and Berry, R.F., 2002, Geochemistry: Exploration, Environment, Analysis, volume 2, pp. 361-368). The normative calculations were validated against and corrected where necessary using x-ray diffraction (*XRD*) Rietveld semi-quantitative mineralogical data from 38 sample pulps selected to represent a range of chemical compositions and mineralogy, as well as three QEMSCAN analyses of composite samples prepared for metallurgical test work.

8.3 QA/QC CONTROLS

Examination of the QA/QC sample data obtained by PLL and North Arrow indicates satisfactory performance of field sampling protocols and assay laboratories providing acceptable levels of precision and accuracy.

Based on an assessment of the data, the Qualified Person considers the entire dataset to be acceptable for resource estimation with assaying posing minimal risk to the overall confidence level of the MRE.

8.3.1 North Arrow

Data quality was monitored through the submission of coarse blank (marble) material and two company Standard Reference Materials (*SRMs*) produced from spodumene concentrates from the Tanco Li-Cs-Ta (*LCT*) pegmatite mine, Manitoba, Canada (Arne, 2016). Marble was used as coarse blank material submitted with the core samples (Arne, 2016). No duplicate were collected during the program.

A review undertaken by independent consulting geochemist Dennis Arne in 2016 found that "*The standard reference materials used by North Arrow Minerals and AcmeLabs have returned acceptable results within their control limits. There is evidence for only slight possible cross contamination of Li between samples"* but that *"the cross-contamination has not been of a significant level*".

8.3.2 Piedmont

PLL has maintained QA/QC protocols and surveillance of CRM, blank and duplicate sample results during all exploration phases. PLL QA/QC data undergo regular independent review by consulting geochemist Dennis Arne. The following section contains a summary of information provided in Arne (2017, 2017a, 2018, 2018b, 2019, 2019b, 2021 and 2021a).

A CRM or coarse blank was included at the rate of one for every 20 drill core samples (i.e., 5%). The CRMs used for this program were supplied by Geostats Pty Ltd of Perth, Australia. A sequence of these CRMs covering a range in Li values and, including blanks, were submitted to the laboratory along with all dispatched samples so as to ensure each run of 100 samples contains the full range of control materials. The CRMs were submitted as "blind" control samples not identifiable by the laboratory. Marble was used as coarse blank material submitted with the core samples.

Sampling precision was monitored by selecting a sample interval likely to be mineralized and splitting the sample into two quarter-core duplicate samples over the same sample interval. These samples were consecutively numbered after the primary sample and recorded in the sample database as "field duplicates" and the primary sample number recorded. Field duplicates were collected at the rate of 1:20 samples when sampling mineralized drill core intervals.

Random sampling precision was monitored by splitting samples at the sample crushing stage (coarse crush duplicate) and at the final subsampling stage for analysis (pulp duplicates). The coarse jaw-crushed, reject material was split into two preparation duplicates, sometimes referred to as second cuts, crusher, or preparation duplicates, which were then pulverized and analyzed separately. These duplicate samples were selected randomly by the laboratory.

Analytical precision was also monitored using pulp duplicates, sometimes referred to as replicates or repeats. Data from all three types of duplicate analyses was used to constrain sampling variance at different stages of the sampling and preparation process.

9 DATA VERIFICATION

9.1 PROCEDURES OF QUALIFIED PERSON

MGG's QP Leon McGarry visited the site during 2017, 2018 and 2019 to review exploration sites, drill core and work practices. An initial site visit was made between 7 September and 8 September 2017. Visual validation of mineralization against assay results was undertaken for several holes. Verification core samples were collected by Leon McGarry.

9.1.1 Data Import and Validation

All drill hole data was imported into Micromine™ software version 15.08. Validation of the data was then completed which included checks for:

- Logical integrity checks of drillhole deviation rates;
- Presence of data beyond the hole depth maximum;
- Overlapping from-to errors within interval data.

Visual validation checks were also made for obviously spurious collar coordinates or downhole survey values.

9.2 LIMITATIONS

Travel to the site was curtailed during 2020 and 2021 due to the impact of the COVID-19 pandemic which limited the QP's ability to independently verify aspects of Phase 5 exploration that required personal inspection. This limitation was mitigated by remote monitoring of exploration activities via regular video conferencing and through review of core photography. The QP did undertake personal inspections from 2017 to 2019 to verify exploration phases 1 to 4.

As with any exploration program, localized anomalies cannot always be discovered. The greater the density of the samples taken, the less the risk. Once an area is identified as being of interest for inclusion in the mine plan, additional samples are taken to help reduce the risk in those specific areas.

9.3 OPINION OF QUALIFIED PERSON

Sufficient data have been obtained through various exploration and sampling programs to support the geological interpretations at the Property. The data are of sufficient quantity and reliability to reasonably support the lithium resource estimates in this TRS.

10 MINERAL PROCESSING AND METALLURGICAL TESTING

The following metallurgical testwork programs have been undertaken for the Carolina Lithium Project:

- Bench-scale beneficiation of spodumene and by-products (Minerals Research Laboratory (MRL), NC State University, 2018);
- Concentrator Variability Testwork (SGS Canada Inc., 2019);
- Concentrate Production (SGS Canada Inc., 2020);
- Conversion Testwork (SGS Canada Inc., 2020);
- Concentrator Pilot Plant (SGS Canada Inc., 2020);
- Concentrator Variability Testwork (SGS Canada Inc., 2021);
- Conversion Pilot Plant (Metso:Outotec 2021).

This report presents the details of the 2021 Metallurgical Testwork Program performed by SGS Canada Inc. and Metso:Outotec only. All previous testwork programs can be found in the Primero technical report entitled “Scoping Study Update Report – Ref 18605-REP-GE-001– Carolina Lithium Project” dated September 10, 2021.

10.1 SAMPLE SELECTION

A metallurgical testwork program was undertaken at SGS Canada Inc. in Lakefield, Ontario during 2021 on nine variability samples from the Piedmont Lithium Project. The testwork program included sample characterization, heavy liquid separation (HLS), Reflux classifier testing, dense media separation (DMS), and batch and locked-cycle flotation testing.

The samples were produced from drill core. The samples were taken from the South and East pits and represented material that would be mined in the early years of operation (i.e., years 1 to 10). Each sample contained both pegmatite and host rock (dilution). The samples typically contained elevated proportions of host rock relative to the anticipated levels of dilution (10%) in the mine plan. Table 10-1 gives a description of each sample and the abbreviated sample name (short name). The samples generally contained amphibolite host rock dilution. Two samples from the East pit extension included meta-sediments host rock.

Table 10-1 - Variability Sample Description

Name	Short Name	Description
East Pit Early Flat 1	E_EF1	Overall, it was estimated that the pegmatite portion of the sample contained 17% spodumene mineralization where 95% occurs as coarse grain, white to light green spodumene and 5% occurs as fine grain, white spodumene. Strong oxidized zones were present along with weak muscovite alteration at upper and lower contacts. The waste rock consisted of amphibolite that had moderate biotite alteration which locally hosts millimeter-scale holmquistite veinlets at or near the pegmatite contacts, and red-orange clay saprolite.
East Pit Early Flat 2	E_EF2	Overall, it was estimated that the pegmatite portion of the sample contained 15% spodumene mineralization where 90% occurs as coarse grain, white to light green spodumene and 10% occurs as fine grain, white spodumene. Moderate muscovite alteration was present at upper and lower contacts. The waste rock, amphibolite had moderate biotite alteration which locally hosts millimeter-scale holmquistite veinlets at or near the pegmatite contacts.

East Pit Early Steep	E_S	Overall, it was estimated that the pegmatite portion of the sample contained 18% spodumene mineralization where 60% occurs as coarse grain, light green spodumene and 40% occurs as fine grain, white to light green spodumene. Weak oxidized zones were present along with moderate muscovite alteration at upper and lower contacts. The waste rock, amphibolite had moderate biotite alteration.

Name	Short Name	Description
East Pit Late Flat	E_LF	Overall, it was estimated that the pegmatite portion of the sample contained 15% spodumene mineralization where 95% occurs as coarse grain, white to light green spodumene and 5% occurs as fine grain, white spodumene. Weak muscovite alteration was present at upper and lower contacts. The waste rock, amphibolite had weak biotite alteration which locally hosts millimeter-scale holmquistite veinlets at or near the pegmatite contacts.
East Pit Late Low Grade	E_LG	Overall, it was estimated that the pegmatite portion of the sample contained 14% spodumene mineralization where 80% occurs as coarse grain, light green to green spodumene, 5% occurs as medium grain, light green spodumene, and 15% occurs as fine grain, white spodumene. Weak muscovite alteration was present at upper and lower contacts and in patches throughout the pegmatite. The waste rock, amphibolite had moderate biotite alteration.
East Pit Extension High Grade	EE_HG	Overall, it was estimated that the pegmatite portion of the sample contained 20% spodumene mineralization where 30% occurs as coarse grain, white to light green spodumene, 20% occurs as medium grain, light green spodumene, and 50% occurs as fine grain, white spodumene. The waste rock consisted of meta-sediments (biotite schist).
East Pit Extension Low Grade	EE_LG	Overall, it was estimated that the pegmatite portion of the sample contained 12% spodumene mineralization where 40% occurs as coarse grain, light green to green spodumene, 15% occurs as medium grain, light green spodumene, and 45% occurs as fine grain, white spodumene. Weak oxidized zones were present along with weak muscovite alteration at upper and lower contacts. The waste rock consisted of amphibolite that had moderate biotite alteration which locally hosts millimeter-scale holmquistite veinlets at or near the pegmatite contacts, weathered amphibolite saprock, and meta-sediments (biotite schist and meta-mudstone).
South Pit Lower Flat	S_F	Overall, it was estimated that the pegmatite portion of the sample contained 25% spodumene mineralization where 90% occurs as coarse grain, white to light green spodumene, 10% occurs as fine grain, white spodumene, and <1% occurs as coarse grain light purple spodumene. Weak muscovite alteration was present at upper and lower contacts. The waste rock, amphibolite had moderate biotite alteration which locally hosts millimeter-scale holmquistite veinlets at or near the pegmatite contacts and local coarse grain tourmaline.
South Pit Upper Steep	S_S	Overall, it was estimated that the pegmatite portion of the sample contained 17% spodumene mineralization where 50% occurs as coarse grain, white to light green spodumene and 50% occurs as fine grain, white spodumene. Moderate oxidized zones were present along with weak muscovite alteration at upper and lower contacts. The waste rock, amphibolite had moderate biotite alteration.

Figure 10-1 shows the locations of the drill core samples used to produce the variability samples shown against the wireframes of the pegmatite dykes.

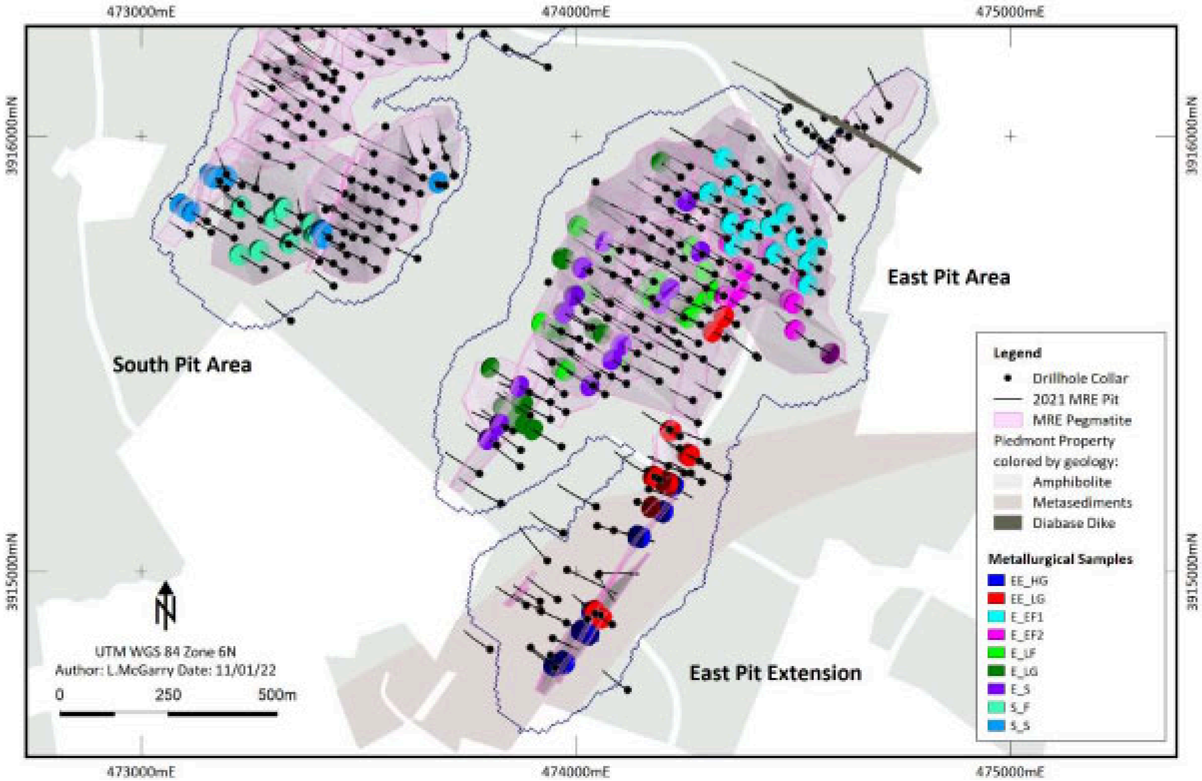


Figure 10-1 - Location of drill core sample from the East pit to produce Variability samples

10.2 SAMPLE CHARACTERIZATION

Each sample contained pegmatite and host rock which were delivered as separate samples to SGS. The pegmatite and host rock were each assayed individually and analyzed by X-ray diffraction. Table 10-2 and Table 10-3 show semi-quantitative mineralogy of the pegmatite and host rock, respectively, for each variability sample as determined using the Reference Intensity Ratio (RIR) method.

Spodumene content in the pegmatite samples ranged from 8.0% to 16.2%. Spodumene was the only lithium-bearing mineral identified in the pegmatite. Biotite and chamosite were the only iron-bearing minerals identified.

For the host rock, three lithium-bearing minerals were identified: spodumene, holmquistite and petalite. Four iron-bearing silicate minerals were identified: biotite, magnesiohornblende, holmquistite, and chamosite.

Table 10-2 - Semi-quantitative mineralogy of the variability pegmatite samples

Mineral	Pegmatite Sample								
	EE_HG	E_LG	S_F	EE_LG	E_S	E_EF2	E_LF	E_EF1	S_S
	(wt %)								
Plagioclase	30.9	37.3	32.7	33.0	33.4	35.9	33.7	34.4	33.3
Quartz	32.4	29.7	31.6	33.1	30.0	31.7	32.6	32.1	31.0
Muscovite	11.1	8.9	10.8	11.8	10.3	10.9	10.3	11.0	12.4
Biotite	2.4	2.1	2.0	2.7	2.8	2.1	2.3	2.1	2.5
Spodumene	16.2	8.9	14.4	8.0	15.0	12.0	13.8	13.4	13.2
Potassium-feldspar	6.4	11.2	7.8	9.0	7.6	6.2	5.9	6.3	6.1
Chamosite	-	0.8	-	-	-	0.3	0.8	-	-
Apatite	0.7	1.0	0.7	0.7	0.8	0.9	0.7	0.7	0.8
Kaolinite	-	-	-	1.7	-	-	-	-	-
Beryl	-	-	-	-	-	-	-	-	0.6
TOTAL	100	100	100	100	100	100	100	100	100

Table 10-3: Semi-quantitative mineralogy of the variability host rock samples

Mineral	Host Rock Sample								
	EE_HG	E_LG	S_F	EE_LG	E_S	E_EF2	E_LF	E_EF1	S_S
	(wt %)								
Plagioclase	25.8	34.1	26.2	19.8	35.3	28.8	28.4	33.9	35.8
Quartz	12.0	9.4	11.0	11.2	4.7	9.9	11.4	7.0	4.3
Muscovite	16.5	5.9	10.4	12.2	3.2	11.9	11.7	7.2	6.8
Biotite	11.8	7.7	1.0	4.2	4.2	3.1	4.6	5.6	3.6
Spodumene	0.8	0.5	0.4	0.8	0.3	0.3	0.3	0.1	0.7
Potassium-feldspar	3.1	4.7	2.8	3.5	4.5	2.8	1.2	1.0	2.8

Amphibole	7.4	17.5	17.1	13.9	23.1	18.3	12.3	19.2	20.0
Holmquistite	5.4	7.3	6.9	10.7	6.2	10.7	7.6	8.3	7.0
Chamosite	7.2	3.3	7.8	6.9	5.1	4.2	9.3	4.7	5.1
Pyroxene	4.6	4.9	5.8	6.8	4.1	3.0	5.2	6.6	4.4
Apatite	0.5	0.8	1.4	1.7	1.2	0.7	0.9	1.2	0.8
Maghemite	2.3	1.0	-	-	-	-	-	-	-
Rutile	0.5	0.9	1.2	0.6	1.4	0.7	0.9	0.7	1.1
Magnetite	-	-	0.4	0.5	0.7	1.0	0.6	0.9	0.6
Hematite	-	-	0.6	0.8	0.7	0.5	0.6	0.4	0.6
Ilmenite	-	-	1.1	0.5	0.9	1.0	0.5	0.9	0.8
Siderite	-	-	2.5	1.5	1.5	1.1	1.4	0.8	2.1
Calcite	-	-	1.4	3.0	1.8	1.1	1.7	1.0	0.8
TOTAL	100	100	100	100	100	100	100	100	100

Table 10-4 shows semi-quantitative mineralogy of the variability samples (i.e., combined pegmatite and host rock samples). The amount of host rock dilution present in each sample is shown in Table 10-5 and ranged from 9.4% to 17.3%. Also shown are estimates of the amount of lithium present as spodumene in each variability sample. Spodumene is the only lithium-bearing mineral that will be selectively recovered in the Piedmont Lithium concentrator flowsheet. Lithium present in spodumene ranged from 74.5% in variability sample E_LF to 95.2% in sample EE_HG.

Table 10-4: Semi-quantitative mineralogy of the variability (composite) samples

Mineral	Variability Sample								
	EE_HG	E_LG	S_F	EE_LG	E_S	E_EF2	E_LF	E_EF1	S_S
	(wt %)								
Albite	27.9	41.5	33.6	33.6	40.6	35.9	36.8	39.6	36.6
Quartz	30.7	23.6	24.7	30.9	26.7	26.5	23.8	22.6	23.3
Microcline	7.2	10.8	10.4	10.9	8.8	9.0	11.5	8.6	9.4
Spodumene	12.2	8.7	12.2	7.6	11.7	8.9	9.5	8.7	11.8
Muscovite	10.3	4.4	6.1	6.3	5.1	5.9	4	6.3	6.2
Biotite	5.4	4.5	2.7	3.5	1.7	3.9	4.6	5.3	4.4
Holmquistite	1.0	1.9	1.6	1.3	0.5	2.8	3.9	2.8	2.7
Magnesiohornblende	1.6	1.6	2.9	1.9	1.4	2.2	0.7	1.2	1.9
Diopside	1.4	1.4	1.5	1.8	1.2	1.9	1.2	2.0	1.9
Petalite	0.2	0.9	2.3	0.8	0.7	1.8	2.2	1.4	0.3
Chamosite	1.1	0.3	1.5	0.8	1.1	0.6	0.7	0.9	1.0
Calcite	1.0	0.5	0.6	0.5	0.4	0.5	1.1	0.6	0.6
TOTAL	100	100	100	100	100	100	100	100	100

Table 10-5: Dilution and estimated lithium content in spodumene for each variability samples

Item	Variability Sample								
	EE_HG	E_LG	S_F	EE_LG	E_S	E_EF2	E_LF	E_EF1	S_S
	(%)								
Dilution	16.4	15.5	15.0	12.1	9.4	14.3	16.1	17.3	17.3
Li in Spodumene (est.)	95.2	85.5	84.9	87.1	94.6	78.3	74.5	73.6	80.8

Table 10-6 shows the head assays for the nine variability samples. Lithia (Li_2O) concentration ranged from 0.69% to 1.12%. Iron assay ranged from 1.40% to 2.25% Fe_2O_3.

Table 10-6: Variability sample assays

Variability Sample	Assay, %									
	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	P_2O_5	MnO
E_EF1	0.49	1.05	69.9	16.6	2.01	0.68	1.26	3.70	2.49	0.33	0.13
E_EF2	0.46	0.99	70.0	16.4	1.80	0.63	1.53	3.97	2.34	0.33	0.12
EE_HG	0.52	1.12	70.2	16.5	1.92	0.72	0.95	3.46	2.51	0.30	0.11

E_LG	0.32	0.69	70.7	16.0	1.89	0.59	1.32	4.19	2.90	0.39	0.13
EE_LG	0.32	0.69	69.8	16.0	1.85	0.70	1.15	3.93	2.88	0.38	0.15
E_S	0.49	1.05	71.2	16.4	1.40	0.46	1.13	3.71	2.53	0.36	0.13
E_LF	0.47	1.01	70.3	16.3	1.81	0.61	1.29	3.93	2.46	0.32	0.13
S_F	0.47	1.01	70.1	16.1	2.00	0.75	1.48	3.75	2.44	0.34	0.12
S_S	0.51	1.10	69.8	16.4	2.25	0.76	1.54	3.58	2.41	0.40	0.14

10.3 GRINDABILITY

Table 10-7 presents results of the grindability tests. Bond rod mill work index (RWi) ranged from 9.7 kWh/t to 11.5 kWh/t. Bond ball mill work index ranged from 10.9 kWh/t to 12.8 kWh/t. Abrasion index ranged from 0.395 g to 0.486 g.

Table 10-7 -Variability grindability results

Variability Sample	RWi kWh/t	BWi kWh/t	Ai g
E_EF1	9.9	11.1	0.395
E_EF2	11.0	12.3	0.486
E_S	9.7	10.9	0.422
E_LF	10.7	12.0	0.409
E_LG	9.8	11.0	0.425
EE_HG	11.5	11.8	0.474
EE_LG	10.0	11.5	0.448
S_F	10.9	12.8	0.439
S_S	9.8	12.1	0.411

(Note: measurements are metric)

10.4 HEAVY LIQUID SEPARATION (HLS)

The HLS tests were undertaken on sub-samples of each variability sample. The ultrafine fraction (i.e., -1.0 mm) was screened out from each sub-sample and the oversize fraction the (-6.3 mm / +1 mm) was submitted for HLS testing with a heavy liquid comprised of methylene iodide diluted with acetone. Each HLS test included specific gravity (SG) cut points of 3.00, 2.95, 2.90, 2.85, 2.80, 2.70, 2.65, and 2.60. Products were screened at 3.3 mm and analyzed to produce coarse (-6.3 mm / +3.3 mm) and fine (-3.3 mm / + 1 mm) stage mass balances.

Figure 10-2 and Figure 10-3 present the HLS stage grade-recovery curves for the coarse and fines fractions, respectively. The coarse concentrates did not achieve 6% Li_2O. The fines fraction generally showed higher concentrate grades and recoveries, likely due to increased spodumene liberation. For the fines fraction, two of the nine samples achieved 6% Li_2O concentrate at a heavy liquid sg of 3.0. Low concentrate grades were due to significant quantities of host rock reporting to the sinks which resulted in high iron concentrations in the sinks streams.

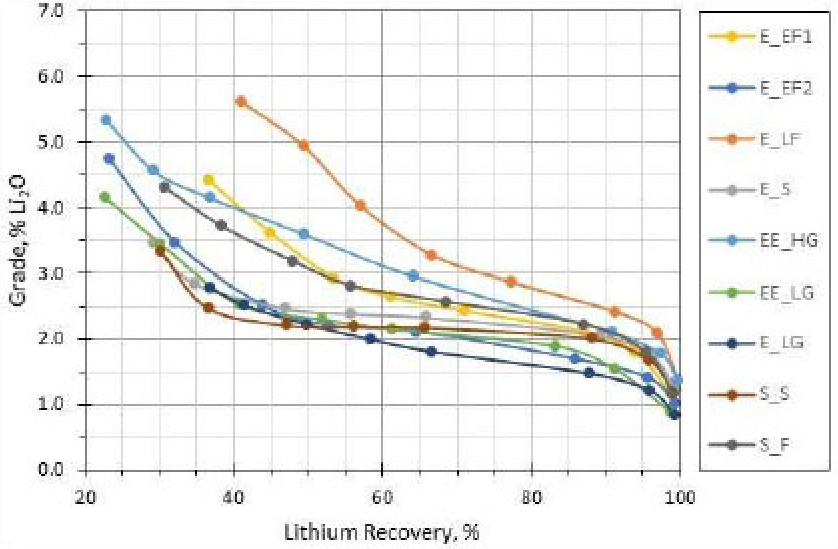


Figure 10-2 - Coarse fraction cumulative sinks grade – stage recovery curves

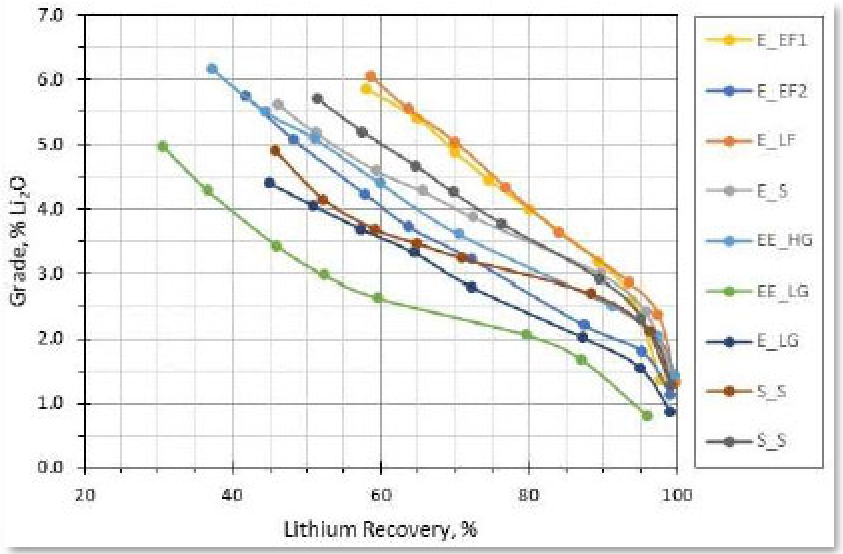


Figure 10-3 - Fines fraction cumulative sinks grade – stage recovery curves

Figure 10-4 and Figure 10-5 present the HLS stage grade-recovery curves for the coarse and fines fractions after dry magnetic separation, respectively. For both fractions, all the concentrates achieved 6% Li_2O. Again, the fines fraction generally showed higher concentrate grades and recoveries.

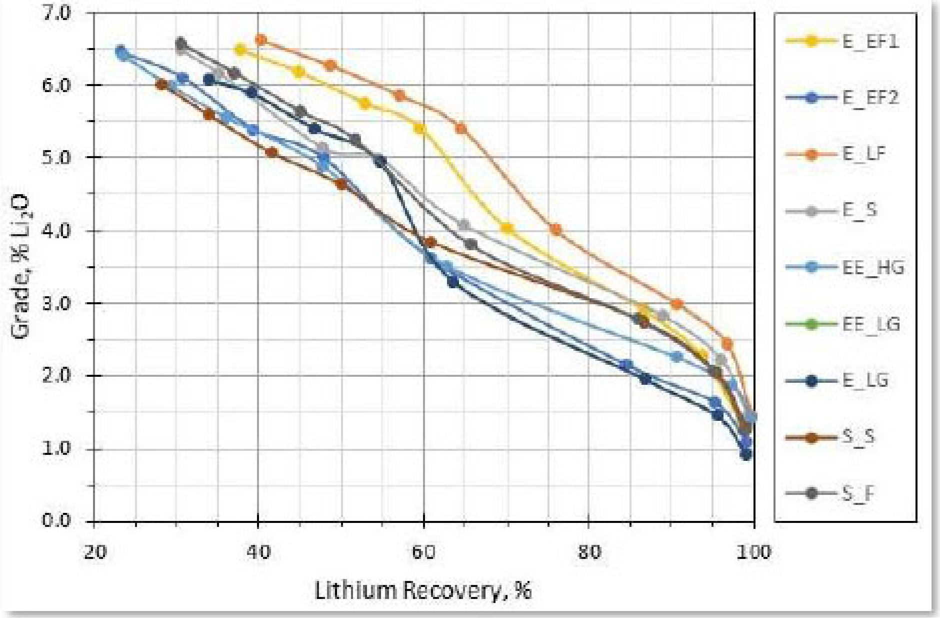


Figure 10-4 - Coarse fraction cumulative sinks - recovery curves with magnetic separation

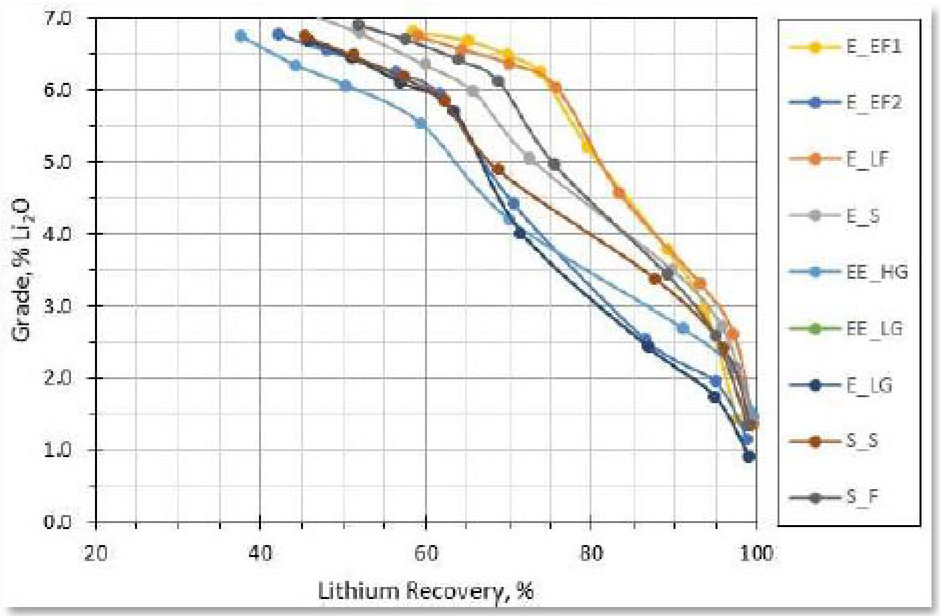


Figure 10-5 - Fines fraction HLS cumulative sinks grade - recovery curves with magnetic separation

Table 10-8 and Table 10-9 show the HLS stage and global, respectively, grades and recoveries interpolated to 6% Li_2O spodumene concentrate (post dry magnetic separation). Iron in the concentrate ranged from 0.75% to 1.35% Fe_2O_3. Stage lithium recoveries ranges from 40% to 68%. Global (including the fines fraction) lithium recoveries ranged from 21% to 48%. The heavy liquid sg values presented in the tables were used as target values for DMS testwork.

Table 10-8 - Combined Stage HLS results with magnetic separation – Grades and recoveries

Sample	HL SG g/cm^3	Weight %	Assays (%)										Distribution (%)								
			Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O	K_2O	P_2O_5
E_EF1	2.86	13.6	2.80	6.0	65.2	24.7	0.82	0.34	0.15	0.68	0.45	0.15	67.9	12.1	21.2	11.5	6.9	9.2	2.5	2.3	7.1
E_EF2	2.91	7.9	2.80	6.0	64.6	25.0	0.89	0.46	0.17	0.63	0.56	0.17	47.8	7.0	12.5	7.7	4.3	6.0	1.2	1.8	4.3
E_LF	2.88	13.9	2.79	6.0	65.6	24.7	0.75	0.26	0.07	0.63	0.51	0.15	67.4	12.5	21.4	10.1	12.2	1.4	2.2	2.9	8.0
E_LG	2.93	6.2	2.79	6.0	64.4	24.6	1.07	0.75	0.11	0.56	0.63	0.44	49.3	5.5	9.6	5.3	5.0	2.2	18.5	23.6	0.9
E_S	2.91	11.6	2.79	6.0	65.4	24.3	1.19	0.50	0.20	0.66	0.49	0.18	54.7	10.5	17.7	16.5	24.7	4.0	2.1	2.0	6.4
EE_HG	2.92	9.0	2.79	6.0	66.5	24.1	0.83	0.23	0.08	0.48	0.39	0.17	41.2	8.4	13.4	5.4	4.7	1.2	1.2	1.4	5.5
EE_LG	2.91	4.6	2.80	6.0	65.0	24.7	1.01	0.42	0.11	0.50	0.52	0.26	39.7	4.2	7.5	4.5	6.4	0.7	0.6	0.8	3.6
E_LG	2.93	6.2	2.79	6.0	64.4	24.6	1.07	0.75	0.11	0.56	0.63	0.44	49.3	5.5	9.6	5.3	5.0	2.2	18.5	23.6	0.9
S_F	2.88	10.8	2.79	6.0	64.8	24.7	1.00	0.47	0.18	0.73	0.51	0.18	59.0	9.7	16.8	10.7	14.1	2.4	2.0	2.0	7.0
S_S	2.93	9.2	2.79	6.0	64.2	24.8	1.35	0.63	0.29	0.55	0.41	0.19	47.1	8.1	14.4	11.9	7.1	10.3	1.4	1.4	4.9

Table 10-9 - Combined Global HLS results with magnetic separation – Grades and recoveries

Sample	HL SG g/cm^3	Weight %	Assays (%)										Distribution (%)								
			Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O	K_2O	P_2O_5
E_EF1	2.86	7.6	2.80	6.0	65.2	24.7	0.82	0.34	0.15	0.68	0.45	0.15	42.7	7.1	11.4	2.9	2.0	1.7	1.4	1.4	3.5
E_EF2	2.91	4.9	2.80	6.0	64.6	25.0	0.89	0.46	0.17	0.63	0.56	0.17	32.0	4.5	7.5	2.3	1.5	1.3	0.8	1.2	2.5
E_LF	2.88	9.0	2.79	6.0	65.6	24.7	0.75	0.26	0.07	0.63	0.51	0.15	47.9	8.4	13.7	3.4	2.8	0.6	1.5	1.9	4.2
E_LG	2.93	3.6	2.79	6.0	64.4	24.6	1.07	0.75	0.11	0.56	0.63	0.44	31.4	3.3	5.5	1.9	2.0	0.6	7.4	9.4	0.6
E_S	2.91	6.5	2.79	6.0	65.4	24.3	1.19	0.50	0.20	0.66	0.49	0.18	34.5	6.0	9.7	5.4	4.6	1.5	1.2	1.3	3.2
EE_HG	2.92	6.0	2.79	6.0	66.5	24.1	0.83	0.23	0.08	0.48	0.39	0.17	29.5	5.6	8.8	2.7	2.1	0.6	0.8	0.9	3.2
EE_LG	2.91	2.3	2.80	6.0	65.0	24.7	1.01	0.42	0.11	0.50	0.52	0.26	21.5	2.2	3.5	1.3	1.4	0.3	0.3	0.4	1.8
E_LG	2.93	3.6	2.79	6.0	64.4	24.6	1.07	0.75	0.11	0.56	0.63	0.44	31.4	3.3	5.5	1.9	2.0	0.6	7.4	9.4	0.6
S_F	2.88	6.2	2.79	6.0	64.8	24.7	1.00	0.47	0.18	0.73	0.51	0.18	35.9	5.8	9.5	3.1	3.3	0.9	1.2	1.3	3.2
S_S	2.93	5.0	2.79	6.0	64.2	24.8	1.35	0.63	0.29	0.55	0.41	0.19	28.9	4.6	7.6	2.7	1.8	1.7	0.8	0.9	2.3

10.5 REFLUX CLASSIFIER

Ten tests were undertaken using a pilot-scale Reflux Classifier (RC100) operating in semi-batch mode. Tests were undertaken on the fines fraction (-3.3 mm / +1.0 mm) of each of the nine variability samples. The size of the samples tested ranged from 41 kg to 78 kg. Each of the tests generated a concentrate, tailings, and slimes sample, and in some testwork, middlings samples were also produced. Fluidization water flowrate ranged from 55 L/min to 80 L/min.

Table 10-10 presents the Reflux Classifier testwork results. Mass pull to the overflow ranged from 0.9% to 7.1%. Based on potassium assays, there seemed to be minimal concentration to the overflow stream.

Table 10-10 - Reflux Classifier testwork results

Sample	Product	Weight	Assays, %					% Distribution				
		%	Li	SiO_2	Al_2O_3	Na_2O	K_2O	Li	SiO_2	Al_2O_3	Na_2O	K_2O
S_S (T1)	Overflow	0.9	0.36	63.5	18.5	4.12	2.63	0.6	0.8	1.0	1.0	1.0
	Middlings	10.1	0.51	71.8	15.9	3.63	2.51	9.4	10.2	9.9	10.1	11.0
	Underflow	89.0	0.55	71.1	16.1	3.60	2.27	90.0	89.0	89.0	88.8	88.0
	Feed (calc.)	100.0	0.54	71.1	16.1	3.61	2.30	100.0	100.0	100.0	100.0	100.0
S_S (T2)	Overflow	2.3	0.33	69.3	17.0	4.28	2.67	1.4	2.3	2.5	2.9	2.5
	Underflow	97.7	0.55	70.8	15.8	3.41	2.46	98.6	97.7	97.5	97.1	97.5
	Feed (calc.)	100.0	0.54	70.8	15.8	3.43	2.46	100.0	100.0	100.0	100.0	100.0
EE_LG	Overflow	1.1	0.17	68.3	18.3	3.52	3.85	0.5	1.0	1.2	1.0	1.4
	Underflow	98.8	0.36	71.6	15.6	3.74	2.95	99.4	98.9	98.6	98.9	98.5
	Slimes	0.1	0.23	59.1	21.9	3.06	2.18	0.1	0.1	0.2	0.1	0.1
	Feed (calc.)	100.0	0.36	71.5	15.6	3.74	2.96	100.0	100.0	100.0	100.0	100.0
E_EF2	Overflow	6.2	0.30	72.3	15.4	4.28	2.76	4.0	6.4	5.9	6.5	7.0
	Underflow	93.7	0.48	70.9	16.2	4.08	2.45	95.9	93.6	94.0	93.4	92.9
	Slimes	0.1	0.33	60.7	18.1	3.82	2.32	0.1	0.1	0.1	0.1	0.1
	Feed (calc.)	100.0	0.47	71.0	16.2	4.09	2.47	100.0	100.0	100.0	100.0	100.0
E_S	Overflow	7.1	0.37	73.2	15.7	3.76	3.31	4.3	7.2	6.8	7.5	8.6
	Underflow	92.9	0.63	71.6	16.5	3.53	2.66	95.7	92.7	93.2	92.4	91.3
	Slimes	0.1	0.30	63.7	17.9	4.38	2.49	0.0	0.1	0.1	0.1	0.1
	Feed (calc.)	100.0	0.61	71.7	16.4	3.55	2.71	100.0	100.0	100.0	100.0	100.0
S_F	Overflow	6.1	0.31	73.2	15.1	4.07	3.14	3.7	6.2	5.8	6.5	7.2
	Underflow	93.8	0.53	72.0	15.8	3.80	2.62	96.3	93.8	94.1	93.4	92.7
	Slimes	0.1	0.29	55.1	16.5	3.18	2.08	0.0	0.1	0.1	0.1	0.1
	Feed (calc.)	100.0	0.52	72.1	15.8	3.82	2.65	100.0	100.0	100.0	100.0	100.0

E_LF	Overflow Underflow Slimes	1.7 98.2 0.1	0.17 0.55 0.29	72.7 71.4 53.8	15.5 16.2 14.5	4.32 3.86 3.30	3.58 2.39 2.05	0.5 99.4 0.0	1.7 98.2 0.1	1.6 98.3 0.1	1.9 98.1 0.1	2.5 97.4 0.1
	Feed (calc.)	100.0	0.54	71.4	16.2	3.87	2.41	100.0	100.0	100.0	100.0	100.0
EE_HG	Overflow Middlings Underflow Slimes	0.3 1.8 97.9 0.1	0.20 0.32 0.61 0.31	71.4 72.2 71.6 55.5	16.1 15.8 16.4 15.4	3.94 3.87 3.57 3.19	4.08 3.36 2.52 2.49	0.1 0.9 98.9 0.0	0.3 1.8 97.9 0.1	0.3 1.7 97.9 0.1	0.3 1.9 97.7 0.1	0.4 2.3 97.1 0.1
	Feed (calc.)	100.0	0.60	71.6	16.4	3.58	2.54	100.0	100.0	100.0	100.0	100.0

Sample	Product	Weight	Assays, %					% Distribution				
		%	Li	SiO_2	Al_2O_3	Na_2O	K_2O	Li	SiO_2	Al_2O_3	Na_2O	K_2O
E_EF1	Overflow	0.6	0.26	70.6	16.5	4.07	3.44	0.3	0.5	0.6	0.6	0.8
	Middlings	1.9	0.24	70.2	16.7	4.20	3.12	0.8	1.8	2.0	2.1	2.4
	Underflow	97.3	0.55	72.1	15.9	3.69	2.46	98.7	97.4	97.1	97.0	96.7
	Slimes	0.3	0.30	53.1	18.5	2.61	1.60	0.2	0.2	0.4	0.2	0.2
	Feed (calc.)	100.0	0.54	72.0	15.9	3.70	2.47	100.0	100.0	100.0	100.0	100.0
E_LG	Overflow	0.5	0.14	69.8	17.1	3.97	4.52	0.2	0.5	0.6	0.5	0.8
	Middlings	2.9	0.19	70.3	16.9	4.24	3.91	1.6	2.9	3.1	3.0	3.8
	Underflow	96.4	0.35	71.7	15.6	4.14	3.00	98.1	96.5	96.1	96.4	95.3
	Slimes	0.1	0.19	62.7	15.8	4.63	2.50	0.1	0.1	0.1	0.1	0.1
	Feed (calc.)	100.0	0.34	71.6	15.6	4.14	3.03	100.0	100.0	100.0	100.0	100.0

Table 10-11 shows mineralogy of the overflow and underflow products for sample EE_LG. Muscovite content in the overflow was 16.6% as compared to 5.5% in the underflow.

Table 10-11: Example mineralogy from Reflux Classifier testing (EE_LG)

Mineral	Overflow	Underflow
	(wt %)	
Albite	32.6	35.2
Quartz	24.8	28.6
Muscovite	16.6	5.5
Microcline	12.1	13.6
Spodumene	2.9	8.9
Diopside	2.9	2.6
Kaolinite	3.0	-
Biotite	1.2	1.0
Halloysite	2.0	-
Petalite	1.5	0.4
Holmquistite	-	1.6
Chamosite	-	1.5
Calcite	0.0	0.7
Magnetite	0.4	0.3
Total	100.0	100.0

10.6 DENSE MEDIA SEPARATION (DMS)

The DMS testwork was performed on each of the variability samples on the coarse (-6.3 mm / +3.3 mm), and fines (-3.3 mm / +1.0 mm) size fractions separately. Each size fraction underwent two DMS passes for: 1) gangue rejection and, 2) concentrate production. The first pass was operated at a lower media density to reject silicate gangue minerals (sg of 2.65). The first pass sink product was repassed through the DMS at a higher density cut-point to produce spodumene concentrate. The cut-points for the second pass were based on interpolated HLS data for the production of 6% Li_2O spodumene concentrate. Dry magnetic separation was performed on the concentrate to reject iron-bearing minerals.

Table 10-12, Table 10-13, and Table 10-14 present the combined global DMS mass balance results for the nine variability samples. DMS concentrate grades, after magnetic separation ranged from 5.96% to 6.63% Li_2O. Iron in the final concentrates ranged from 0.79% to 1.37% Fe_2O_3. Mass recoveries (global) to the concentrate ranged from 2.8% to 7.5%. Combined global lithium recovery ranged from 23.0% to 42.4

Table 10-12 - Combined global DMS mass and elemental balances (E_EF1, E_EF2, E_S, E_LF)

Sample	Product	Wt.	Assays (%)									Distribution (%)							
		%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
E_EF1	Conc. Non-Mag	6.1	2.94	6.32	65.9	25.0	0.84	0.19	0.65	0.41	0.11	37.3	5.7	9.2	2.4	0.9	1.0	1.0	2.3
	Conc. Mag	3.1	0.36	0.77	48.7	18.0	11.78	7.81	1.66	1.46	0.65	2.3	2.1	3.4	17.5	20.0	1.3	1.9	6.7
	Middling	25.0	0.46	0.98	71.8	15.4	2.45	1.77	3.65	1.62	0.33	23.8	25.6	23.4	29.3	36.6	23.7	16.7	27.1
	Tailings	29.2	0.07	0.15	74.5	14.6	0.43	0.30	4.76	3.90	0.26	4.3	30.9	25.8	6.0	7.1	36.1	46.8	25.1
	Ultrafines wet	1.1	0.51	1.10	66.8	17.8	4.28	1.16	3.63	2.47	0.35	1.1	1.0	1.1	2.2	1.0	1.0	1.1	1.2
	Ultrafines dry	35.5	0.42	0.90	68.6	17.2	2.51	1.17	3.99	2.22	0.32	31.1	34.7	37.1	42.6	34.3	36.8	32.5	37.6
	Head (Calc.)	100	0.48	1.03	70.3	16.5	2.09	1.21	3.85	2.43	0.30	100	100	100	100	100	100	100	100
	Head (Dir.)		0.49	1.05	69.9	16.6	2.01	1.26	3.70	2.49	0.33								
	Flotation Feed	61.6	0.44	0.94	69.9	16.5	2.52	1.41	3.85	1.98	0.32	56.1	61.2	61.6	74.1	71.9	61.5	50.3	65.9
E_EF2	Conc. Non-Mag	4.1	3.00	6.45	65.2	25.1	0.79	0.30	0.60	0.54	0.17	27.2	3.8	6.3	1.7	0.8	0.6	0.9	2.1
	Conc. Mag	2.7	0.37	0.79	48.5	17.4	12.51	7.89	1.96	1.13	0.67	2.2	1.9	2.9	18.5	14.8	1.3	1.3	5.5
	Middling	30.6	0.51	1.09	69.3	16.2	2.46	2.03	3.65	1.69	0.35	34.7	30.2	30.6	40.7	42.6	27.0	22.2	32.2
	Tailings	30.5	0.07	0.14	74.1	14.7	0.40	0.50	5.27	3.35	0.29	4.6	32.2	27.7	6.6	10.5	38.9	43.9	26.4
	Ultrafines wet	0.8	0.61	1.31	65.3	18.0	4.63	1.40	3.22	2.62	0.36	1.0	0.7	0.8	1.9	0.7	0.6	0.9	0.8
	Ultrafines dry	31.4	0.43	0.92	69.6	16.3	1.80	1.41	4.16	2.27	0.35	30.3	31.2	31.6	30.6	30.5	31.7	30.7	33.0
	Head (Calc.)	100	0.45	0.96	70.1	16.2	1.85	1.45	4.13	2.32	0.33	100	100	100	100	100	100	100	100
	Head (Dir.)		0.46	0.99	70.0	16.4	1.80	1.53	3.97	2.34	0.33								
	Flotation Feed	62.8	0.47	1.01	69.4	16.3	2.16	1.71	3.90	1.99	0.35	66.0	62.2	63.1	73.3	73.9	59.3	53.8	66.0
E_S	Conc. Non-Mag	5.3	2.95	6.33	65.7	24.7	1.15	0.24	0.57	0.41	0.13	29.9	4.8	8.0	4.0	1.2	0.8	0.9	1.9
	Conc. Mag	3.3	0.41	0.87	47.5	18.8	11.52	9.01	1.69	0.95	0.45	2.5	2.2	3.8	25.0	26.9	1.4	1.2	4.0
	Middling	27.2	0.64	1.38	72.5	15.8	1.57	1.21	3.43	1.73	0.41	33.6	27.6	26.4	28.6	30.2	23.6	19.0	30.0
	Tailings	27.4	0.07	0.16	74.7	14.4	0.41	0.34	4.72	4.10	0.30	3.9	28.7	24.3	7.6	8.5	32.7	45.3	22.5
	Ultrafines wet	0.8	0.65	1.40	66.0	18.2	4.86	1.15	3.15	2.62	0.37	1.0	0.7	0.9	2.5	0.8	0.6	0.8	0.8
	Ultrafines dry	36.1	0.42	0.90	71.3	16.5	1.34	0.98	4.49	2.25	0.42	29.1	36.0	36.6	32.2	32.4	40.9	32.8	40.8
	Head (Calc.)	100	0.52	1.12	71.4	16.2	1.50	1.09	3.96	2.48	0.37	100	100	100	100	100	100	100	100
	Head (Dir.)		0.49	1.05	71.2	16.4	1.40	1.13	3.71	2.53	0.36								
	Flotation Feed	60.1	0.58	1.25	71.2	16.6	1.59	1.12	3.96	1.98	0.41	67.4	59.9	61.3	63.7	61.9	60.2	48.0	66.1
E_LF	Conc. Non-Mag	7.5	3.05	6.56	65.6	24.8	0.84	0.18	0.59	0.47	0.12	42.4	6.9	11.4	3.3	1.1	1.1	1.4	2.8
	Conc. Mag	2.3	0.57	1.24	48.2	18.3	11.70	7.11	1.51	1.56	0.99	2.5	1.6	2.6	14.1	13.7	0.9	1.5	7.1
	Middling	30.9	0.46	1.00	70.1	15.7	2.69	1.74	3.64	1.72	0.37	26.7	30.7	29.8	43.1	44.5	28.8	21.9	35.1
	Tailings	30.4	0.05	0.11	75.0	14.4	0.36	0.36	5.19	3.76	0.26	2.8	32.2	26.9	5.6	9.0	40.3	46.9	24.5
	Ultrafines wet	0.8	0.62	1.33	65.9	18.3	4.10	1.32	3.07	2.78	0.34	0.9	0.8	0.9	1.7	0.9	0.6	0.9	0.9
	Ultrafines dry	28.1	0.47	1.01	69.7	16.4	2.21	1.33	3.94	2.38	0.34	24.6	27.7	28.3	32.2	30.9	28.3	27.4	29.6
	Head (Calc.)	100	0.54	1.15	70.6	16.3	1.93	1.21	3.91	2.44	0.32	100	100	100	100	100	100	100	100
	Head (Dir.)		0.47	1.01	70.3	16.3	1.81	1.29	3.93	2.46	0.32								
	Flotation Feed	59.9	0.47	1.01	69.9	16.1	2.48	1.54	3.77	2.05	0.35	52.3	59.2	59.1	77.0	76.3	57.7	50.2	65.6

Table 10-13: Combined global combined DMS mass and elemental balances (E_LG, EE_HG, EE_LG, S_F)

Sample	Product	Wt.	Assays (%)									Distribution (%)							
		%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
E_LG	Conc. Non-Mag	2.9	2.98	6.42	65.1	24.7	1.11	0.55	0.57	0.58	0.37	27.0	2.7	4.6	1.7	1.3	0.4	0.6	2.7
	Conc. Mag	2.2	0.47	1.01	48.2	16.9	13.18	7.77	1.69	1.30	0.85	3.2	1.5	2.4	15.1	13.6	0.9	1.0	4.7
	Middling	30.4	0.40	0.85	70.2	15.7	2.63	1.84	3.65	2.02	0.44	37.2	30.2	30.0	41.2	44.2	26.2	21.4	33.7
	Tailings	32.9	0.05	0.10	73.6	15.0	0.46	0.37	5.14	4.14	0.30	4.7	34.3	31.0	7.8	9.7	39.8	47.2	24.3
	Ultrafines wet	0.9	0.53	1.14	66.2	18.2	3.99	1.30	3.35	3.00	0.39	1.4	0.8	1.0	1.8	0.9	0.7	0.9	0.8
	Ultrafines dry	30.6	0.28	0.60	70.5	16.1	2.06	1.26	4.45	2.73	0.44	26.4	30.5	31.0	32.4	30.4	32.0	29.0	33.7
	Head (Calc.)	100	0.32	0.70	70.7	15.9	1.95	1.27	4.25	2.89	0.40	100	100	100	100	100	100	100	100
	Head (Dir.)		0.32	0.69	70.7	16.0	1.89	1.32	4.19	2.90	0.39								
	Flotation Feed	61.9	0.34	0.73	70.3	15.9	2.37	1.55	4.04	2.39	0.44	65.0	61.5	62.0	75.4	75.4	58.9	51.2	68.2
EE_HG	Conc. Non-Mag	5.0	2.85	6.12	66.9	23.9	0.91	0.22	0.54	0.43	0.16	24.2	4.7	7.3	2.5	1.4	0.7	0.9	2.6
	Conc. Mag	1.3	0.57	1.24	49.0	17.5	11.13	6.43	1.03	1.51	0.59	1.3	0.9	1.4	8.2	10.4	0.4	0.8	2.5
	Middling	35.8	0.67	1.45	71.2	16.1	2.30	1.00	3.12	1.88	0.28	41.1	35.8	35.3	45.7	43.6	31.3	27.5	31.8
	Tailings	23.8	0.09	0.18	74.4	14.7	0.48	0.33	5.10	3.60	0.31	3.5	24.9	21.4	6.3	9.6	34.0	34.9	23.3
	Ultrafines wet	1.0	0.64	1.38	68.5	17.4	2.87	1.05	3.08	2.42	0.32	1.1	1.0	1.1	1.7	1.3	0.9	1.0	1.1
	Ultrafines dry	33.0	0.51	1.10	70.6	16.6	1.94	0.84	3.54	2.59	0.37	28.7	32.8	33.5	35.6	33.7	32.7	34.9	38.8
	Head (Calc.)	100	0.59	1.26	71.2	16.3	1.80	0.82	3.57	2.45	0.32	100	100	100	100	100	100	100	100
	Head (Dir.)		0.52	1.12	70.2	16.5	1.92	0.95	3.46	2.51	0.30								
	Flotation Feed	69.9	0.60	1.28	70.9	16.4	2.14	0.93	3.32	2.23	0.32	71.0	69.5	69.9	83.0	78.6	64.9	63.4	71.6
EE_LG	Conc. Non-Mag	2.8	2.78	5.98	65.2	24.2	1.37	0.57	0.60	0.57	0.37	23.0	2.6	4.3	2.3	1.6	0.4	0.6	2.9
	Conc. Mag	1.9	0.42	0.90	48.3	15.4	12.35	7.69	1.62	1.42	0.50	2.3	1.3	1.8	14.0	14.6	0.8	1.0	2.6
	Middling	29.4	0.43	0.92	71.2	15.4	2.18	1.36	3.57	2.13	0.39	36.7	29.5	28.3	38.1	40.1	27.2	22.1	32.1
	Tailings	32.2	0.07	0.16	74.1	14.8	0.50	0.34	4.60	3.87	0.32	6.8	33.7	29.8	9.6	11.0	38.5	44.2	28.7
	Ultrafines wet	1.0	0.59	1.27	66.5	18.3	3.47	1.24	3.22	2.73	0.33	1.8	1.0	1.2	2.1	1.3	0.9	1.0	0.9
	Ultrafines dry	32.6	0.31	0.67	69.4	17.0	1.74	0.96	3.80	2.69	0.36	29.5	31.9	34.6	33.8	31.4	32.2	31.1	32.7
	Head (Calc.)	100	0.34	0.74	70.9	16.0	1.68	1.00	3.85	2.82	0.36	100	100	100	100	100	100	100	100
	Head (Dir.)		0.32	0.69	69.8	16.0	1.85	1.15	3.93	2.88	0.38								
	Flotation Feed	63.0	0.37	0.80	70.2	16.3	1.97	1.15	3.68	2.43	0.37	67.9	62.4	64.1	74.1	72.8	60.3	54.3	65.7
S_F	Conc. Non-Mag	6.0	2.77	5.96	65.4	24.5	0.97	0.37	0.84	0.54	0.18	34.9	5.5	9.2	3.3	1.8	1.3	1.3	3.2
	Conc. Mag	3.6	0.37	0.80	47.9	16.7	12.69	7.72	1.98	1.17	1.12	2.8	2.4	3.8	25.7	22.4	1.8	1.6	12.0
	Middling	28.9	0.50	1.08	72.0	15.4	2.09	1.51	3.63	1.59	0.33	30.7	29.4	27.8	33.9	35.3	26.9	17.9	27.8
	Tailings	33.4	0.06	0.12	74.1	14.6	0.34	0.38	4.92	4.04	0.28	3.9	34.9	30.4	6.3	10.3	42.1	52.4	27.2
	Ultrafines wet	0.7	0.50	1.08	66.9	17.5	4.13	1.24	3.46	2.64	0.36	0.8	0.7	0.8	1.7	0.7	0.6	0.7	0.8
	Ultrafines dry	27.4	0.47	1.01	70.0	16.4	1.90	1.34	3.88	2.45	0.36	27.0	27.0	28.0	29.2	29.5	27.2	26.1	29.1
	Head (Calc.)	100	0.48	1.02	70.8	16.0	1.78	1.24	3.90	2.57	0.34	100	100	100	100	100	100	100	100
	Head (Dir.)		0.47	1.01	70.1	16.1	2.00	1.48	3.75	2.44	0.34								
	Flotation Feed	57.0	0.49	1.05	71.0	15.9	2.02	1.43	3.75	2.02	0.34	58.4	57.1	56.7	64.8	65.5	54.8	44.7	57.7

Table 10-14: Global combined DMS Mass and elemental balances (Variability samples S_S)

Sample	Product	Wt.	Assays (%)									Distribution (%)							
		%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
S_S	Conc. Non-Mag	4.1	3.10	6.67	64.6	25.3	1.05	0.24	0.46	0.33	0.13	25.3	3.8	6.5	1.9	0.7	0.5	0.6	1.3
	Conc. Mag	3.6	0.44	0.96	48.2	16.5	13.00	8.02	1.79	0.84	0.90	3.1	2.5	3.7	20.0	19.0	1.7	1.3	8.0
	Middling	30.5	0.58	1.25	70.5	15.7	2.70	1.85	3.28	1.59	0.42	34.9	30.9	29.7	35.5	37.4	26.4	21.1	31.8
	Tailings	26.7	0.08	0.17	73.9	14.4	0.47	0.43	4.74	3.70	0.32	4.2	28.3	23.8	5.4	7.6	33.4	42.9	20.9
	Ultrafines wet	1.1	0.51	1.10	66.6	17.7	4.58	1.14	3.46	2.65	0.35	1.1	1.0	1.2	2.1	0.8	1.0	1.2	0.9
	Ultrafines dry	34.0	0.47	1.01	68.8	16.7	2.40	1.54	4.13	2.23	0.44	31.4	33.6	35.2	35.1	34.6	37.1	33.0	37.0
	Head (Calc.)	100	0.51	1.09	69.7	16.2	2.33	1.51	3.79	2.30	0.40	100	100	100	100	100	100	100	100
	Head (Dir.)		0.51	1.10	69.8	16.4	2.25	1.54	3.58	2.41	0.40								
	Flotation Feed	64.1	0.58	1.25	68.9	16.5	2.73	1.74	3.65	1.89	0.43	73.2	63.3	65.6	75.2	73.7	61.7	52.7	68.4

10.7 MICA AND SPODUMENE FLOTATION

10.7.1 Batch Tests

Batch flotation tests were undertaken on samples from each variability sample (see Table 10-15). The feed to the flotation tests comprised the DMS middlings and tailings streams. Samples were stage-ground to -300 micron and underwent: magnetic separation, mica flotation, scrubbing and de-sliming, high-density conditioning and spodumene flotation.

Table 10-16 to Table 10-18 present results of optimized batch flotation tests (mica and spodumene) for each of the nine variability samples. Spodumene flotation concentrate grades ranged from 5.21% to 5.96% Li_2O. Iron in the final concentrates ranged from 0.91% to 1.70% Fe_2O_3. Stage mass recoveries to the final concentrate ranged from 7.0% to 15.9%. Stage lithium recovery ranged from 53.3% to 71.3%. Figure 10-6 shows the batch flotation test lithium grade and stage recovery curves for the optimized conditions.

Calculated iron concentrations in the flotation feed were relatively high and ranged from 1.21% to 2.61% Fe_2O_3. Multiple stages of medium- and high-intensity magnetic separation were employed prior to flotation to reject iron-bearing minerals. Mass pulls to the magnetic concentrates ranged from 6.2% to 12.0% with lithium losses ranging from 7.1% to 20.3%.

Stage mass pull to the mica rougher and scavenger concentrates ranged from 7.9% to 22.3% with grades ranging from 8.1% to 9.0% K_2O + Na_2O.

Table 10-15 - Batch flotation test reagent dosages

Sample	Reagent Dosage, g/t						
	EDA	Armac C/T	NaOH	Na_2CO_3	MIBC	F220	FA2
E_EF1	-	110	400	114	23	250	620
E_EF2	-	110	300	120	23	250	620
E_S	-	110	400	114	23	250	620
E_LF	-	110	300	100	23	250	620
E_LG	-	110	300	120	23	250	620
EE_HG	-	110	375	114	23	250	520
EE_LG	25	60	500	145	28	250	525
S_F	-	110	325	120	23	250	620
S_S	-	110	325	113	23	250	620

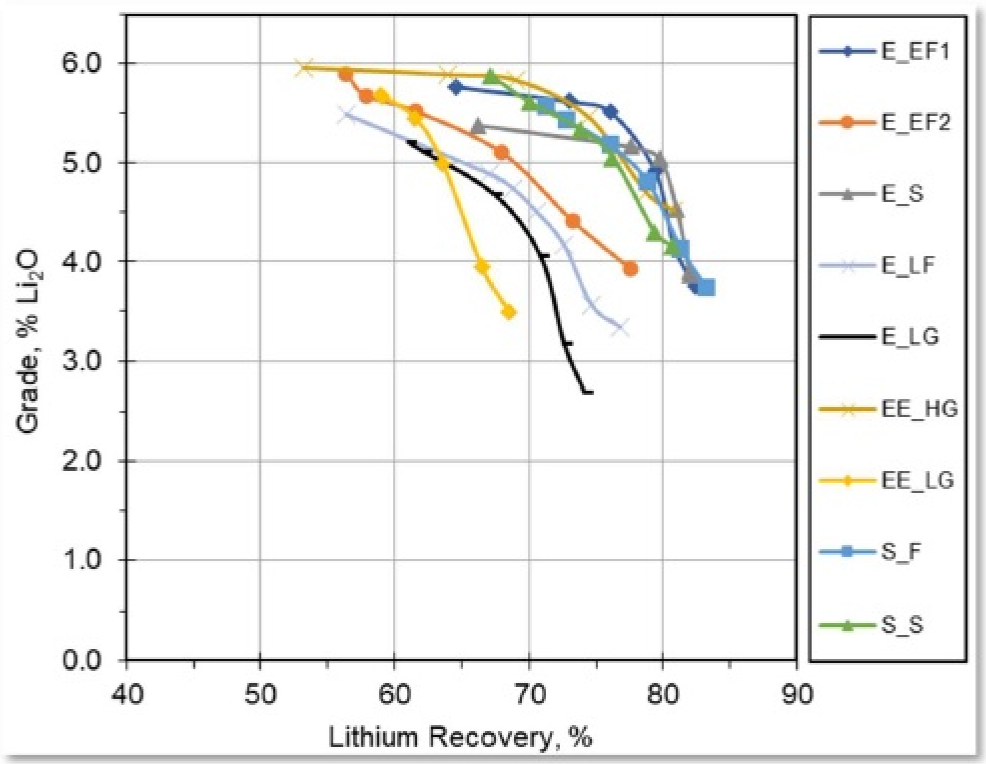


Figure 10-6 - Batch flotation test grade-recovery curves

Table 10-16 - Batch flotation test results (Variability samples E_EF1, E_EF2, E_S, and E_LF)

Test	Product	Wt.	Assays,%											Distribution,%									
		%	Li	Li_2O	SiO_2	Al_2O_3	K_2O	Na_2O	CaO	MgO	MnO	P_2O_5	Fe_2O_3	Li	SiO_2	Al_2O_3	K_2O	Na_2O	CaO	MgO	MnO	P_2O_5	Fe_2O_3
E_EF1	2nd Cl Conc. 1	10.4	2.68	5.77	61.9	23.7	0.49	0.79	2.09	0.22	0.14	0.74	0.99	64.6	9.0	15.7	2.8	2.0	15.7	4.6	16.7	28.8	6.3
	2nd Cl Conc. 1-2	12.0	2.61	5.62	62.2	23.5	0.53	0.86	2.06	0.22	0.14	0.72	1.04	73.0	10.4	18.1	3.5	2.6	17.9	5.4	19.3	32.5	7.6
	2nd Cl Conc.	12.7	2.56	5.51	62.3	23.4	0.55	0.92	2.04	0.22	0.14	0.70	1.05	76.1	11.1	19.1	3.9	2.9	18.9	5.7	20.4	33.8	8.2
	1st Cl Conc.	14.9	2.29	4.92	63.7	22.5	0.68	1.32	1.99	0.22	0.13	0.63	1.04	79.4	13.3	21.4	5.6	4.9	21.5	6.6	22.1	35.5	9.6
	Ro Conc	18.0	1.92	4.14	65.6	21.2	0.83	1.91	1.87	0.20	0.11	0.55	0.96	80.9	16.6	24.4	8.2	8.6	24.5	7.4	23.6	37.2	10.6
	Sc Conc.	20.3	1.74	3.75	66.3	20.6	0.95	2.19	1.81	0.20	0.11	0.50	0.94	82.4	18.8	26.8	10.6	11.1	26.7	8.1	24.6	38.5	11.7
	Ro Tail	60.5	0.02	0.04	79.0	12.2	1.39	5.24	0.64	0.03	0.01	0.10	0.33	2.8	66.9	47.1	46.3	79.0	28.0	3.1	7.7	23.2	12.2
	Sc Tail	58.2	0.01	0.02	79.3	12.0	1.37	5.27	0.61	0.02	0.01	0.10	0.31	1.2	64.6	44.7	43.8	76.5	25.8	2.4	6.7	21.9	11.1
	Mica Ro Conc.	2.4	0.23	0.50	58.8	24.6	5.52	2.65	1.00	0.41	0.07	0.32	1.68	1.3	2.0	3.8	7.2	1.6	1.7	2.0	1.9	2.9	2.5
	Mica Ro-Sc Conc.	7.9	0.20	0.42	55.3	27.4	6.61	2.17	0.80	0.40	0.07	0.26	1.78	3.6	6.1	13.9	28.7	4.3	4.6	6.5	6.4	7.9	8.7
	Mag Conc.	8.2	0.48	1.03	50.7	17.2	2.57	1.54	3.66	4.51	0.57	0.76	12.31	9.1	5.8	9.0	11.5	3.1	21.7	74.8	54.0	23.5	61.8
	Total Slimes	5.4	0.29	0.62	61.7	16.4	1.78	3.70	5.41	0.75	0.13	0.41	2.02	3.6	4.7	5.7	5.3	5.0	21.2	8.2	8.3	8.2	6.7
	Head (calc.)	100	0.43	0.92	71.5	15.6	1.82	4.01	1.38	0.49	0.09	0.27	1.63	100	100	100	100	100	100	100	100	100	100
E_EF2	3rd Cl Conc. Non Mag	8.4	2.74	5.90	61.0	24.2	0.55	0.74	2.61	0.17	0.18	0.82	1.05	56.4	7.0	13.0	2.6	1.5	13.7	3.1	17.0	24.0	6.6
	3rd Cl Conc	8.9	2.64	5.67	60.3	23.8	0.57	0.75	2.96	0.39	0.20	0.87	1.52	57.9	7.4	13.6	2.8	1.6	16.5	7.5	20.0	27.2	10.2
	2nd Cl Conc.	9.8	2.56	5.52	60.7	23.7	0.62	0.87	2.87	0.39	0.19	0.82	1.51	61.5	8.1	14.8	3.4	2.0	17.6	8.1	21.3	28.1	11.1
	1st Cl Conc.	11.6	2.37	5.11	61.6	23.2	0.73	1.18	2.75	0.38	0.18	0.73	1.46	67.9	9.9	17.3	4.7	3.3	20.1	9.4	23.8	29.9	12.8
	Li Ro Conc.	14.5	2.05	4.41	63.3	22.1	0.85	1.77	2.60	0.35	0.16	0.63	1.33	73.3	12.7	20.6	6.9	6.1	23.7	10.8	26.5	32.2	14.5
	Li Ro-Sc Conc.	17.2	1.83	3.93	64.3	21.5	0.95	2.17	2.52	0.33	0.15	0.57	1.25	77.6	15.3	23.8	9.1	8.9	27.2	12.4	28.9	34.1	16.2
	Li Ro Tail	63.0	0.05	0.11	80.4	12.2	1.21	5.30	0.72	0.05	0.02	0.10	0.25	8.0	69.7	49.1	42.7	79.2	28.4	6.7	16.1	23.0	11.7
	Li Sc Tail	60.2	0.03	0.05	80.9	11.9	1.20	5.34	0.66	0.04	0.02	0.10	0.22	3.7	67.1	46.0	40.4	76.4	24.9	5.2	13.6	21.1	10.0
	Mica Ro Conc.	6.9	0.25	0.54	55.3	27.4	6.59	2.33	1.26	0.36	0.08	0.51	1.65	4.3	5.3	12.2	25.5	3.8	5.5	5.4	6.3	12.4	8.6
	Mica Ro-1st Sc Conc.	9.9	0.26	0.56	56.7	26.4	6.16	2.55	1.25	0.39	0.08	0.46	1.65	6.4	7.7	16.8	34.2	6.0	7.8	8.4	9.3	15.8	12.4
	Mica Ro-Sc Conc.	12.0	0.28	0.60	58.4	25.2	5.66	2.82	1.27	0.44	0.08	0.44	1.65	8.2	9.7	19.4	38.1	8.1	9.6	11.3	11.0	18.3	15.0
	Mag Conc.	6.5	0.52	1.12	50.8	16.5	2.16	1.69	4.98	4.84	0.57	0.99	11.53	8.3	4.5	6.8	7.8	2.6	20.2	67.6	42.0	22.5	56.4
	Total Slimes	4.5	0.33	0.70	60.0	15.9	1.90	3.83	7.32	0.82	0.14	0.45	1.7	3.7	3.8	4.6	4.8	4.1	20.9	8.0	7.4	7.1	5.9
	Head (calc.)	100	0.41	0.87	72.6	15.6	1.79	4.21	1.59	0.46	0.09	0.29	1.33	100	100	100	100	100	100	100	100	100	100
E_S	3rd Cl Conc. Non-Mag	15.9	2.50	5.38	65.1	23.0	0.47	1.11	1.34	0.11	0.16	0.55	0.93	66.2	14.5	22.2	3.8	4.6	17.4	4.1	20.5	24.2	10.1
	3rd Cl Conc.	19.4	2.40	5.16	65.6	22.6	0.51	1.26	1.33	0.11	0.15	0.52	0.94	77.6	17.9	26.7	5.0	6.4	21.1	5.1	24.1	28.2	12.5
	2nd Cl Conc.	20.4	2.35	5.05	65.9	22.4	0.53	1.33	1.33	0.11	0.15	0.51	0.95	79.8	18.9	27.8	5.5	7.1	22.2	5.4	24.9	29.1	13.2
	1st Cl Conc.	23.0	2.11	4.54	67.2	21.4	0.63	1.69	1.31	0.11	0.14	0.47	0.89	81.0	21.8	30.0	7.3	10.2	24.6	5.8	25.6	30.1	14.1
	Ro Conc	27.0	1.82	3.91	68.9	20.1	0.74	2.16	1.25	0.10	0.12	0.41	0.80	82.0	26.2	33.1	10.1	15.3	27.7	6.2	26.2	31.2	14.9
	Scav. Conc.	27.4	1.80	3.87	68.9	20.0	0.75	2.19	1.25	0.10	0.12	0.41	0.80	82.1	26.6	33.4	10.4	15.7	27.9	6.3	26.4	31.3	15.1
	Ro Tail	48.8	0.01	0.03	79.8	11.7	1.44	5.50	0.36	0.01	0.01	0.07	0.27	1.2	54.8	34.9	35.5	70.4	14.5	1.2	4.1	9.6	9.2
	Scav. Tail	48.5	0.01	0.03	79.8	11.7	1.44	5.51	0.36	0.01	0.01	0.07	0.27	1.1	54.5	34.6	35.3	70.0	14.3	1.1	3.9	9.4	9.0
	Mica Ro Conc.	3.1	0.32	0.69	59.9	24.8	5.73	2.68	0.65	0.22	0.07	0.24	1.44	1.7	2.6	4.7	9.0	2.2	1.6	1.6	1.7	2.1	3.1
	Mica Ro & 1st Sc Conc.	12.8	0.30	0.66	56.9	26.7	6.51	2.24	0.71	0.23	0.09	0.32	1.57	6.5	10.3	20.8	42.0	7.5	7.4	6.9	8.8	11.5	13.8
	Mag Conc.	7.0	0.60	1.30	48.3	16.4	2.05	1.45	5.61	4.82	0.98	2.16	12.04	7.1	4.8	7.0	7.3	2.7	32.2	80.1	55.6	42.1	57.9
	Total Slimes	4.4	0.44	0.95	63.8	16.0	2.28	3.66	5.06	0.54	0.15	0.46	1.42	3.2	3.9	4.3	5.1	4.2	18.2	5.6	5.4	5.6	4.3
	Head (calc.)	100	0.60	1.29	71.0	16.4	1.98	3.82	1.22	0.42	0.12	0.36	1.46	100	100	100	100	100	100	100	100	100	100
E_LF	4th Cl Conc. Non Mag	9.6	2.55	5.49	61.6	23.7	0.57	0.97	2.49	0.25	0.15	0.67	1.02	56.4	8.4	14.4	2.6	2.5	13.6	3.0	10.8	20.4	4.2
	4th Cl Conc.	12.7	2.27	4.89	59.3	22.7	0.70	0.95	3.23	0.98	0.20	0.77	2.69	67.0	10.8	18.3	4.3	3.3	23.6	15.7	19.5	31.2	14.6
	3rd Cl Conc.	13.5	2.20	4.74	59.6	22.5	0.76	1.07	3.19	0.98	0.20	0.74	2.69	68.8	11.5	19.3	4.9	3.9	24.6	16.5	20.2	31.9	15.5
	2nd Cl Conc.	14.5	2.10	4.51	60.1	22.2	0.85	1.24	3.14	0.97	0.19	0.70	2.67	70.5	12.5	20.5	5.9	4.9	26.1	17.6	21.0	32.5	16.5
	1st Cl Conc.	16.2	1.94	4.18	61.1	21.8	0.93	1.51	3.06	0.94	0.18	0.65	2.58	72.6	14.1	22.3	7.3	6.6	28.3	18.9	22.0	33.6	17.8
	Ro Conc.	19.5	1.66	3.57	63.2	20.7	1.05	2.04	2.85	0.84	0.16	0.57	2.33	74.6	17.6	25.5	9.8	10.7	31.8	20.5	23.2	35.3	19.4
	Ro & Sc Conc.	21.4	1.55	3.34	64.1	20.2	1.09	2.24	2.76	0.81	0.15	0.53	2.25	76.8	19.5	27.5	11.2	13.0	33.8	21.7	24.2	36.4	20.6
	Ro Tail	54.8	0.03	0.07	80.8	11.4	1.30	5.06	0.57	0.06	0.01	0.09	0.37	4.3	63.2	39.5	34.2	75.1	17.8	3.8	5.0	16.3	8.7
	Sc Tail	52.9	0.02	0.04	81.1	11.2	1.29	5.09	0.52	0.04	0.01	0.09	0.33	2.2	61.2	37.6	32.8	72.8	15.7	2.6	4.0	15.2	7.4
	Mica Ro Conc.	8.2	0.21	0.45	51.4	29.6	7.73	1.61	0.77	0.79	0.08	0.20	2.71	4.0	6.0	15.5	30.6	3.6	3.6	8.1	5.0	5.2	9.5
	Mica Ro & 1st Sc Conc.	11.6	0.23	0.49	53.2	27.9	7.11	1.86	0.91	0.89	0.09	0.24	2.85	6.1	8.8	20.5	39.6	5.8	6.0	12.9	7.5	8.9	14.1
	Mag Conc.	10.8	0.81	1.74	47.4	17.7	2.23	1.06	4.09	4.87	0.80	1.22	13.24	20.3	7.3	12.1	11.6	3.1	25.3	66.0	65.9	42.0	61.2
	Total Slimes	6.5	0.35	0.75	59.6	15.1	2.10	3.42	7.80	1.17	0.14	0.40	2.56	5.3	5.5	6.2	6.6	6.0	29.1	9.5	7.0	8.4	7.1
	Head (calc.)	100	0.43	0.93	70.1	15.8	2.08	3.70	1.75	0.80	0.13	0.31	2.34	100	100	100	100	100	100	100	100	100	100

Table 10-17: Batch flotation test results (Variability samples E_LG, E_HG, and EE_LG)

Test	Product	Wt.	Assays,%											Distribution,%									
		%	Li	Li_2O	SiO_2	Al_2O_3	K_2O	Na_2O	CaO	MgO	MnO	P_2O_5	Fe_2O_3	Li	SiO_2	Al_2O_3	K_2O	Na_2O	CaO	MgO	MnO	P_2O_5	Fe_2O_3
E_LG	3rd Cl Conc. Non Mag.	8.5	2.42	5.21	62.8	23.3	0.67	1.07	2.37	0.12	0.17	1.07	1.03	61.0	7.5	12.7	2.6	2.2	14.0	2.1	12.3	24.9	5.2
	3rd Cl Conc.	8.8	2.38	5.11	62.4	23.1	0.69	1.08	2.54	0.21	0.18	1.11	1.25	62.2	7.7	13.1	2.8	2.3	15.6	3.9	13.6	26.8	6.6
	2nd Cl Conc.	10.4	2.18	4.69	63.5	22.4	0.78	1.38	2.50	0.22	0.17	0.99	1.25	67.4	9.2	15.0	3.7	3.5	18.1	4.7	15.0	28.3	7.8
	1st Cl Conc.	12.7	1.88	4.06	65.2	21.3	0.89	1.84	2.45	0.22	0.15	0.85	1.19	70.8	11.5	17.4	5.1	5.7	21.6	5.7	16.1	29.6	9.0
	Ro Conc.	16.6	1.47	3.17	68.0	19.5	0.99	2.51	2.27	0.19	0.12	0.68	1.02	72.6	15.8	20.8	7.5	10.2	26.3	6.6	17.1	31.0	10.1
	Ro-Sc Conc.	20.0	1.25	2.69	69.6	18.4	1.03	2.86	2.17	0.17	0.10	0.59	0.92	74.1	19.4	23.7	9.4	14.1	30.2	7.3	17.7	32.1	10.9
	Ro Tail	52.1	0.02	0.05	79.6	11.9	1.33	5.26	0.70	0.03	0.01	0.08	0.27	3.5	57.8	39.8	31.7	67.3	25.5	3.7	4.7	11.8	8.3
	Sc Tail	48.7	0.01	0.03	79.7	11.8	1.34	5.31	0.64	0.03	0.01	0.08	0.26	2.0	54.2	36.9	29.7	63.4	21.7	3.0	4.1	10.7	7.5
	Mica Ro Conc.	13.4	0.19	0.41	57.1	25.9	6.61	2.39	0.94	0.38	0.06	0.41	1.98	7.6	10.7	22.4	40.5	7.9	8.8	10.6	6.8	15.1	15.8
	Mica Ro & 1st Sc Conc.	22.3	0.19	0.40	64.8	21.2	4.77	3.35	0.96	0.30	0.05	0.35	1.47	12.3	20.2	30.4	48.5	18.3	14.9	13.8	9.1	21.4	19.4
	Mag Conc.	7.0	0.52	1.12	46.2	15.9	3.14	1.29	4.65	5.00	1.16	1.85	14.81	10.8	4.5	7.1	10.0	2.2	22.6	72.8	68.5	35.3	61.4
	Total Slimes	2.3	0.28	0.60	60.5	15.1	2.42	3.61	7.58	1.01	0.10	0.39	1.55	1.9	2.0	2.2	2.6	2.1	12.2	4.9	1.9	2.5	2.1
	Head (calc.)	100	0.34	0.73	71.7	15.6	2.20	4.08	1.44	0.48	0.12	0.37	1.68	100	100	100	100	100	100	100	100	100	100
EE_HG	2nd Cl Conc. 1	11.6	2.77	5.96	62.6	24.4	0.32	0.72	1.57	0.32	0.14	0.48	1.19	53.3	10.2	17.5	1.7	2.5	17.9	5.8	15.3	18.3	7.7
	2nd Cl Conc. 1-2	14.1	2.74	5.89	62.8	24.3	0.34	0.76	1.55	0.32	0.14	0.47	1.22	64.0	12.4	21.2	2.2	3.2	21.5	7.1	18.8	21.8	9.5
	2nd Cl Conc.	15.4	2.71	5.84	63.1	24.2	0.36	0.82	1.53	0.32	0.14	0.46	1.24	69.0	13.6	23.0	2.6	3.8	23.2	7.7	20.2	23.2	10.5
	1st Cl Conc.	17.7	2.54	5.47	63.9	23.6	0.45	1.11	1.49	0.32	0.13	0.43	1.24	74.4	15.9	25.8	3.7	5.9	25.9	9.0	21.9	25.1	12.2
	Ro Conc.	21.8	2.18	4.70	65.9	22.1	0.59	1.70	1.41	0.31	0.12	0.38	1.15	78.7	20.1	29.8	5.9	11.1	30.2	10.4	24.3	27.3	13.9
	Ro-Sc Conc.	23.3	2.10	4.52	66.3	21.8	0.63	1.82	1.40	0.31	0.11	0.37	1.15	80.7	21.6	31.2	6.8	12.6	32.0	11.1	25.1	28.2	14.8
	Ro Tail	49.9	0.05	0.10	82.8	10.3	1.32	4.77	0.30	0.05	0.01	0.09	0.31	3.8	57.8	31.7	30.3	71.1	14.6	3.8	5.3	15.1	8.4
	Sc Tail	48.5	0.02	0.05	83.1	10.1	1.32	4.80	0.27	0.04	0.01	0.09	0.28	1.8	56.4	30.2	29.5	69.6	12.9	3.0	4.5	14.3	7.5
	Mica Ro Conc.	13.3	0.23	0.50	55.9	27.3	6.96	1.91	0.64	0.56	0.06	0.26	2.08	5.1	10.4	22.5	42.8	7.6	8.4	11.7	7.5	11.3	15.3
	Mica Ro & 1st Sc Conc.	16.2	0.25	0.54	58.7	25.4	6.25	2.21	0.67	0.54	0.06	0.26	1.95	6.7	13.3	25.4	46.7	10.7	10.7	13.7	8.8	13.7	17.5
	WHIMS Mag Conc.	7.9	0.61	1.31	46.1	18.4	3.47	1.20	2.86	5.37	0.77	1.45	12.80	7.9	5.1	8.9	12.6	2.8	22.1	65.8	56.7	37.2	55.6
	Total Slimes	4.2	0.41	0.89	62.3	16.1	2.35	3.44	5.49	0.97	0.12	0.49	2.00	2.8	3.6	4.1	4.5	4.3	22.4	6.3	4.8	6.6	4.6
	Head (calc.)	100	0.61	1.30	71.4	16.2	2.17	3.35	1.02	0.64	0.11	0.31	1.81	100	100	100	100	100	100	100	100	100	100
EE_LG	3rd Cl Conc. Non-Mag	7.0	2.64	5.68	63.1	24.2	0.55	0.91	1.63	0.10	0.16	0.74	0.90	59.0	6.1	11.1	1.7	1.6	10.6	1.6	11.4	17.8	5.2
	3rd Cl Conc.	7.0	2.64	5.67	63.1	24.2	0.55	0.91	1.65	0.11	0.16	0.74	0.92	59.1	6.1	11.1	1.7	1.6	10.8	1.7	11.6	18.0	5.3
	2nd Cl Conc.	7.6	2.54	5.45	63.4	23.9	0.63	1.04	1.63	0.12	0.16	0.72	0.94	61.6	6.6	11.9	2.1	2.0	11.6	2.1	12.4	18.8	5.9
	1st Cl Conc.	8.6	2.32	4.99	64.2	23.2	0.77	1.34	1.59	0.13	0.15	0.67	0.95	63.6	7.6	13.1	2.9	2.9	12.8	2.5	13.5	19.9	6.7
	Ro. Conc.	11.3	1.84	3.95	66.5	21.5	1.05	2.09	1.45	0.13	0.13	0.56	0.87	66.5	10.4	15.9	5.3	6.0	15.4	3.3	15.2	22.1	8.1
	Ro-Sc Conc.	13.2	1.63	3.50	67.4	20.8	1.22	2.39	1.38	0.13	0.12	0.51	0.84	68.5	12.2	17.9	7.1	8.0	17.0	3.9	16.5	23.3	9.0
	Ro Tail	59.8	0.03	0.06	81.0	11.5	1.65	5.00	0.22	0.03	0.02	0.09	0.17	4.9	66.6	44.9	43.7	75.4	12.5	4.5	13.2	19.3	8.6
	Sc Tail	58.0	0.02	0.03	81.2	11.3	1.63	5.02	0.20	0.03	0.02	0.09	0.16	3.0	64.8	42.9	41.8	73.4	10.8	4.0	11.9	18.0	7.6
	Pho Ro Conc	2.4	0.71	1.53	69.0	15.7	1.41	3.55	3.36	0.28	0.12	1.23	0.88	5.5	2.3	2.5	1.5	2.2	7.7	1.6	3.0	10.4	1.8
	Mica Ro Conc.	6.3	0.24	0.52	61.7	22.0	4.55	2.98	1.37	0.39	0.10	0.45	1.61	4.8	5.3	9.0	12.6	4.7	8.0	5.6	6.4	9.7	8.3
	Mica Ro-Sc Conc.	15.6	0.22	0.46	59.6	24.1	5.49	2.65	0.93	0.40	0.09	0.29	1.64	10.8	12.8	24.7	38.0	10.5	13.6	14.2	15.1	15.9	21.0
	Mag Conc.	6.2	0.46	1.00	50.1	17.1	2.78	1.50	4.14	4.74	0.73	1.19	10.67	9.2	4.3	7.0	7.7	2.4	24.1	67.5	46.3	25.6	54.5
	Total Slimes	4.5	0.20	0.44	57.2	16.6	1.92	3.20	6.29	0.85	0.15	0.43	1.62	3.0	3.6	5.0	3.9	3.7	26.8	8.8	7.2	6.8	6.1
	Head (calc.)	100	0.31	0.67	72.7	15.3	2.26	3.97	1.07	0.44	0.10	0.29	1.22	100	100	100	100	100	100	100	100	100	100

Table 10-18: Batch flotation test results (Variability samples S_F, and S_S)

Test	Product	Wt.	Assays,%											Distribution,%									
		%	Li	Li_2O	SiO_2	Al_2O_3	K_2O	Na_2O	CaO	MgO	MnO	P_2O_5	Fe_2O_3	Li	SiO_2	Al_2O_3	K_2O	Na_2O	CaO	MgO	MnO	P_2O_5	Fe_2O_3
S_F	3rd Cl Conc. Non Mag.	13.6	2.59	5.58	62.2	24.4	0.66	1.03	2.01	0.20	0.16	0.71	0.93	71.3	11.8	21.4	4.6	3.7	20.0	4.6	20.8	28.5	7.6
	3rd Cl Conc.	14.3	2.52	5.43	61.7	24.2	0.68	1.04	2.18	0.35	0.17	0.74	1.27	72.8	12.2	22.2	5.0	3.9	22.7	8.4	23.5	30.9	10.9
	2nd Cl Conc.	15.6	2.41	5.18	62.1	23.8	0.77	1.22	2.16	0.35	0.17	0.69	1.28	76.0	13.5	24.0	6.2	5.1	24.6	9.3	24.9	31.8	12.0
	1st Cl Conc.	17.4	2.24	4.82	62.8	23.3	0.87	1.49	2.14	0.34	0.16	0.64	1.25	78.8	15.2	26.1	7.8	6.9	27.2	10.1	26.5	32.9	13.1
	Ro Conc.	21.0	1.92	4.13	64.6	22.0	1.02	2.02	2.05	0.31	0.14	0.56	1.13	81.3	18.8	29.7	10.9	11.3	31.4	11.2	28.2	34.6	14.3
	Ro & Scav. Conc.	23.7	1.74	3.74	65.7	21.3	1.10	2.32	1.99	0.29	0.13	0.51	1.07	83.2	21.6	32.4	13.3	14.7	34.4	11.9	29.5	35.9	15.3
	Ro Tail	55.2	0.03	0.06	81.4	11.0	1.48	4.97	0.45	0.04	0.01	0.12	0.26	3.0	62.4	39.2	41.9	73.1	18.0	3.4	6.3	19.9	8.6
	Sc Tail	52.5	0.01	0.02	81.8	10.8	1.47	4.99	0.39	0.03	0.01	0.12	0.24	1.2	59.6	36.5	39.5	69.7	14.9	2.7	5.0	18.5	7.6
	Mica Ro Conc.	9.2	0.23	0.50	55.7	27.0	6.56	2.29	1.11	0.31	0.09	0.51	1.46	4.3	7.1	16.0	30.9	5.6	7.4	4.8	7.9	13.8	8.1
	Mica Ro & 1st Sc Conc.	13.7	0.25	0.53	61.0	23.5	5.33	2.87	1.08	0.28	0.08	0.44	1.22	6.8	11.6	20.7	37.3	10.4	10.8	6.4	10.0	17.6	10.0
	Mag Conc.	8.3	0.51	1.09	47.1	16.2	1.78	1.27	5.28	5.63	0.70	1.13	13.74	8.5	5.4	8.6	7.5	2.8	31.9	79.1	55.3	27.4	68.3
	Total Slimes	2.6	0.37	0.79	62.8	15.6	2.07	3.72	5.79	0.85	0.12	0.39	1.41	1.9	2.2	2.6	2.7	2.5	10.8	3.7	3.0	3.0	2.2
	Head (calc.)	100	0.49	1.06	72.0	15.5	1.95	3.75	1.37	0.59	0.10	0.34	1.66	100	100	100	100	100	100	100	100	100	100
S_S	3rd Cl Conc. Non Mag.	15.0	2.73	5.88	62.0	24.4	0.37	0.66	1.90	0.45	0.17	0.79	1.70	67.1	13.5	22.5	3.1	2.8	15.2	7.5	17.3	29.0	9.8
	3rd Cl Conc.	16.4	2.61	5.61	61.0	23.9	0.40	0.67	2.26	0.78	0.20	0.84	2.49	70.0	14.5	24.0	3.6	3.2	19.7	14.3	21.8	33.5	15.7
	2nd Cl Conc.	18.2	2.48	5.34	61.5	23.6	0.51	0.87	2.24	0.77	0.19	0.78	2.46	73.8	16.2	26.3	5.1	4.5	21.7	15.6	23.4	34.5	17.1
	1st Cl Conc.	19.9	2.35	5.05	62.0	23.2	0.60	1.08	2.23	0.75	0.18	0.73	2.40	76.2	17.8	28.2	6.6	6.1	23.6	16.6	24.5	35.3	18.2
	Ro Conc.	24.3	2.00	4.30	63.7	22.0	0.82	1.67	2.16	0.67	0.16	0.63	2.15	79.3	22.3	32.8	11.0	11.6	28.0	18.1	26.3	37.1	20.0
	Ro-Sc Conc.	25.5	1.93	4.16	64.0	21.8	0.88	1.78	2.14	0.66	0.16	0.61	2.11	80.6	23.6	34.1	12.3	13.0	29.2	18.7	27.0	37.7	20.7
	Ro Tail	51.9	0.05	0.10	79.5	12.2	1.62	5.06	0.61	0.06	0.02	0.09	0.25	4.0	59.6	39.0	46.0	75.0	16.8	3.4	7.5	11.8	5.0
	Sc. Tail	50.7	0.03	0.07	79.7	12.1	1.61	5.09	0.58	0.05	0.02	0.09	0.22	2.7	58.3	37.6	44.7	73.6	15.7	2.8	6.8	11.1	4.3
	Mica Ro Conc.	5.6	0.30	0.65	53.7	27.4	6.79	1.88	1.56	0.52	0.11	0.75	2.29	2.7	4.3	9.4	20.8	3.0	4.7	3.2	4.2	10.2	4.9
	Mica Ro & 1st Sc Conc.	8.8	0.33	0.71	57.0	25.4	5.94	2.28	1.45	0.52	0.11	0.60	2.14	4.7	7.2	13.7	28.7	5.7	6.8	5.1	6.3	13.0	7.2
	Mag Conc.	12.0	0.59	1.28	46.8	15.8	1.49	1.18	6.09	5.58	0.72	1.25	15.01	11.7	8.1	11.6	9.8	4.0	39.1	74.5	58.5	36.5	69.1
	Total Slimes	4.3	0.44	0.95	59.8	16.7	2.16	3.21	6.00	1.19	0.20	0.58	2.79	3.1	3.7	4.4	5.1	4.0	13.8	5.7	5.9	6.1	4.6
	Head (calc.)	100	0.61	1.32	69.3	16.3	1.82	3.50	1.88	0.90	0.15	0.41	2.61	100	100	100	100	100	100	100	100	100	100

10.7.2 Locked-Cycle Flotation Tests

Three flotation locked-cycle tests (LCT) were undertaken on variability samples E_EF1, E_S, and EE_HG. The LCT flowsheet is shown in Figure 10-7. Reagent dosages for the tests are shown in Table 10-19. Test conditions were the same for the three tests. Table 10-20 - Projected LCT mass balances shows the projected mass balances based on the final cycles of each LCT. Concentrate grade ranged from 5.67% to 6.37% Li_2O with stage lithium recovery ranging from 63.8% to 81.2%. Iron in the concentrate ranged from 1.07% to 1.39% Fe_2O_3.

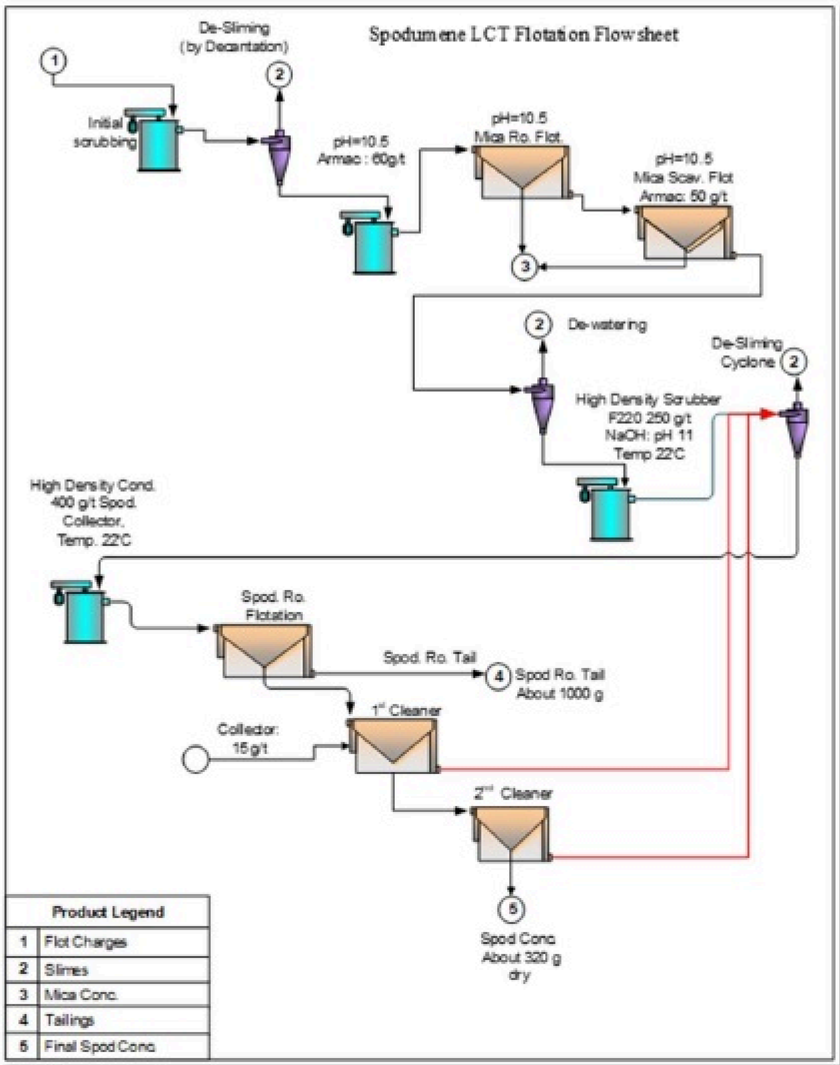


Figure 10-7 - Locked-cycle flotation flowsheet

Table 10-19 - LCT reagent dosages

Test	Reagent Dosage, g/t		
	Armac C/T	F220	FA-2
LCT	110	250	415

Table 10-20 - Projected LCT mass balances

Sample	Combined Product	Wt. %	Assays %											Global Distribution %									
			Li	Li_2O	SiO_2	Al_2O_3	K_2O	Na_2O	CaO	P_2O_5	MgO	MnO	Fe_2O_3	Li	SiO_2	Al_2O_3	K_2O	Na_2O	CaO	P_2O_5	MgO	MnO	Fe_2O_3
E_EF1	Li Cl Conc	9.9	2.63	5.67	59.9	25.0	0.88	0.51	2.51	1.00	0.35	0.17	1.39	63.8	8.2	15.8	4.7	1.3	17.7	36.2	6.7	20.1	8.7
	Li Ro Tail	72.2	0.12	0.25	77.7	13.6	1.73	4.89	0.69	0.11	0.08	0.01	0.37	20.6	77.9	62.6	66.8	87.6	35.4	28.0	10.6	12.0	16.8
	2nd Slime	2.66	0.35	0.75	63.0	15.9	1.58	3.81	5.63	0.39	0.69	0.12	1.66	2.3	2.3	2.7	2.2	2.5	10.7	3.8	3.5	3.7	2.8
	Mica Ro Conc.	2.45	0.21	0.45	57.2	24.8	5.26	2.66	1.24	0.32	0.61	0.12	2.36	1.2	1.9	3.9	6.9	1.6	2.2	2.9	2.9	3.4	3.7
	Mica Sc Conc.	2.15	0.22	0.46	59.3	23.7	4.88	2.87	1.28	0.33	0.60	0.10	2.22	1.1	1.8	3.2	5.6	1.5	1.9	2.6	2.5	2.6	3.0
	1st Slime	3.7	0.30	0.64	62.0	17.2	1.94	3.69	4.82	0.44	0.81	0.14	2.39	2.7	3.2	4.1	3.8	3.4	12.7	6.0	5.8	6.4	5.6
	WHIMS Mag	6.9	0.49	1.06	47.9	17.6	2.71	1.22	3.97	0.82	5.09	0.64	13.63	8.2	4.6	7.7	10.0	2.1	19.4	20.6	67.9	51.9	59.4
	Head (Calc.)	100	0.41	0.88	72.0	15.7	1.87	4.03	1.41	0.27	0.52	0.08	1.58	100	100	100	100	100	100	100	100	100	100
E_S	Li Cl Conc	17.4	2.96	6.37	63.4	24.5	0.37	0.74	1.35	0.65	0.14	0.17	1.07	81.2	15.4	26.1	3.3	3.4	17.7	30.3	5.4	22.8	11.8
	Li Ro Tail	63.6	0.06	0.13	79.3	12.4	1.60	5.22	0.47	0.09	0.03	0.02	0.43	6.0	70.7	48.4	52.6	87.2	22.7	14.9	4.7	8.1	17.4
	2nd Slime	1.70	0.49	1.06	62.2	14.2	1.63	3.61	7.81	0.44	0.64	0.15	1.04	1.3	1.5	1.5	1.4	1.6	10.0	2.0	2.4	1.9	1.1
	Mica Ro Conc.	4.80	0.20	0.44	51.8	30.0	7.99	1.65	0.54	0.22	0.31	0.09	2.01	1.5	3.5	8.8	19.8	2.1	2.0	2.8	3.3	3.5	6.1
	Mica Sc Conc.	3.21	0.23	0.50	53.5	29.0	7.55	1.85	0.63	0.25	0.33	0.10	2.01	1.2	2.4	5.7	12.5	1.6	1.5	2.1	2.3	2.5	4.1
	1st Slime	2.0	0.39	0.85	56.2	16.0	2.47	3.13	9.83	0.59	0.87	0.21	2.09	1.2	1.5	1.9	2.5	1.6	14.5	3.1	3.8	3.2	2.6
	WHIMS Mag	7.4	0.65	1.39	47.8	16.8	2.06	1.36	5.68	2.24	4.78	1.02	12.16	7.5	4.9	7.6	7.8	2.6	31.6	44.7	78.0	58.1	56.9
	Head (Calc.)	100	0.63	1.36	71.3	16.3	1.94	3.81	1.33	0.37	0.45	0.13	1.58	100	100	100	100	100	100	100	100	100	100
EE_HG	Li Cl Conc	17.5	2.69	5.80	62.8	24.3	0.39	0.80	1.61	0.54	0.33	0.15	1.21	77.5	15.3	26.2	3.2	4.2	29.9	31.2	9.6	25.1	12.6
	Li Ro Tail	59.7	0.09	0.19	80.9	11.3	1.53	4.59	0.35	0.09	0.08	0.01	0.30	8.9	67.6	41.7	42.3	82.4	22.5	17.7	7.9	5.7	10.5
	2nd Slime	0.98	0.50	1.07	63.9	13.1	1.32	3.63	7.77	0.36	0.65	0.08	0.92	0.8	0.9	0.8	0.6	1.1	8.1	1.2	1.0	0.8	0.5
	Mica Ro Conc.	7.93	0.20	0.44	52.1	29.3	7.69	1.59	0.60	0.19	0.61	0.06	2.29	2.7	5.8	14.3	28.2	3.8	5.1	5.1	8.0	4.9	10.8
	Mica Sc Conc.	4.21	0.25	0.54	58.3	25.2	6.11	2.23	0.80	0.24	0.61	0.07	2.01	1.7	3.4	6.5	11.9	2.8	3.6	3.3	4.2	2.8	5.0
	1st Slime	1.6	0.39	0.83	60.0	16.5	2.56	3.26	5.99	0.57	1.09	0.15	2.48	1.0	1.3	1.6	1.9	1.5	10.1	3.0	2.8	2.3	2.3
	WHIMS Mag	8.1	0.56	1.20	47.4	18.2	3.31	1.30	2.87	1.50	4.98	0.77	12.14	7.4	5.4	9.1	12.5	3.2	24.8	40.1	66.7	59.4	58.7
	Head (Calc.)	100	0.61	1.31	71.3	16.2	2.17	3.30	0.98	0.31	0.61	0.11	1.69	100	100	100	100	99	104	102	100	101	101

10.8 OVERALL SPODUMENE MASS BALANCES (DMS AND FLOTATION)

Overall (DMS and flotation) spodumene mass balances are presented in Table 10-21. Mass pull to the combined concentrates ranged from 6.6% to 16.7%. Combined concentrate grades ranged from 5.67% to 6.36% Li_2O with lithium recovery from 54.2% to 77.4%. Iron in the combined concentrates ranged from 0.92% to 1.59% Fe_2O_3.

Table 10-21 - Overall spodumene mass balances (DMS and flotation) for each variability sample

Sample	Stage	Combined Products	Wt.	Assays (%)									Distribution (%)							
			%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
E_EF1	DMS	Conc. Non-Mag	6.1	2.94	6.32	65.9	25.0	0.84	0.19	0.65	0.41	0.11	37.2	5.70	9.30	2.51	0.87	1.04	1.01	2.33
		Conc. Mag	3.1	0.36	0.77	48.7	18.0	11.8	7.81	1.66	1.46	0.65	2.31	2.15	3.42	18.05	18.81	1.35	1.86	6.82
		Tailings	29.2	0.07	0.15	74.5	14.6	0.43	0.30	4.76	3.90	0.26	4.24	30.9	26.0	6.20	6.69	36.6	46.6	25.4
	Mag Sep (Flotation)	MIMS Mag	5.7	0.38	0.82	65.8	17.2	4.52	1.73	3.61	2.19	0.39	4.46	5.29	5.94	12.6	7.58	5.37	5.07	7.39
		LONGi Mag.	4.1	0.77	1.66	54.5	20.7	7.57	2.84	1.61	2.91	0.65	6.53	3.16	5.16	15.24	8.98	1.73	4.87	8.89
		LONGi Midds	1.2	0.67	1.44	51.2	20.3	9.76	2.99	1.41	3.06	0.65	1.65	0.86	1.47	5.70	2.75	0.44	1.49	2.58
		WHIMS Mag	3.4	0.48	1.04	47.5	17.5	13.9	4.02	1.19	2.71	0.82	3.42	2.30	3.65	23.4	10.6	1.06	3.78	9.4
	Flotation LCT	Li Cl Conc.	4.9	2.61	5.60	59.6	25.0	1.46	2.60	0.51	0.94	1.03	26.6	4.2	7.5	3.53	9.9	0.66	1.90	17.0
		Li Ro Tail	36.9	0.14	0.29	77.5	13.7	0.38	0.70	4.84	1.73	0.11	10.5	40.7	30.9	6.98	19.9	47.0	26.2	13.2
		2nd Slime	1.1	0.36	0.78	63.5	16.1	1.71	5.10	3.82	1.59	0.40	0.83	0.99	1.08	0.93	4.34	1.10	0.72	1.46
		Mica Ro Conc.	1.3	0.21	0.45	57.8	24.4	2.32	1.26	2.75	5.12	0.32	0.57	1.09	1.98	1.51	1.29	0.96	2.78	1.44
		Mica Scav. Conc.	1.1	0.21	0.46	59.8	23.4	2.17	1.26	2.93	4.80	0.32	0.49	0.95	1.60	1.19	1.09	0.86	2.19	1.20
		1st Slime	1.9	0.30	0.65	62.3	17.0	2.33	4.81	3.71	1.88	0.44	1.20	1.69	1.98	2.18	7.09	1.86	1.47	2.84
	Combined	Head (Calc.)	100	0.48	1.04	70.3	16.4	2.03	1.29	3.80	2.44	0.30	100	100	100	100	100	100	100	100
		Head (Dir.)		0.49	1.05	69.9	16.6	2.01	1.26	3.70	2.49	0.33								
		Combined Conc.	11.0	2.79	6.00	63.1	25.0	1.11	1.27	0.59	0.65	0.53	63.8	9.9	16.8	6.0	10.8	1.7	2.9	19.4

Sample	Stage	Product	Wt.	Assays (%)									Distribution (%)							
			%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
E_EF2	DMS	Conc. Non-Mag	4.05	3.00	6.45	65.2	25.1	0.79	0.30	0.60	0.54	0.17	28.4	3.73	6.33	1.79	0.81	0.58	0.96	2.15
		Conc. Mag	2.72	0.37	0.79	48.5	17.4	12.5	7.89	1.96	1.13	0.67	2.33	1.87	2.95	19.2	14.1	1.28	1.36	5.58
		Tailings	30.5	0.07	0.14	74.1	14.7	0.40	0.50	5.27	3.35	0.29	4.74	31.9	27.9	6.81	9.97	38.5	44.9	27.0
	Mag Sep (Flotation)	MIMS Mag	3.5	0.36	0.77	65.3	16.4	4.72	2.14	3.8	2.14	0.4	2.91	3.19	3.53	9.2	4.85	3.16	3.26	4.23
		LONGi Mag	6.2	0.78	1.68	55.4	20.3	6.72	3.65	1.86	2.79	0.78	11.4	4.88	7.87	23.5	14.9	2.79	7.66	14.8
		WHIMS Mag	3.4	0.52	1.12	50.8	16.5	11.5	4.98	1.69	2.16	0.99	4.18	2.47	3.52	22.3	11.2	1.40	3.28	10.4
	Batch Flotation	3rd Cl Conc. Non-Mag	4.4	2.74	5.89	61.0	24.2	1.05	2.61	0.74	0.55	0.82	28.4	3.8	6.7	2.62	7.6	0.79	1.08	11.1
		Cl Tail	3.0	1.11	2.40	68.0	19.5	1.02	2.04	3.38	1.29	0.25	7.76	2.9	3.6	1.71	4.0	2.4	1.7	2.3
		Ro Tail	33.4	0.05	0.11	80.4	12.2	0.25	0.72	5.30	1.21	0.10	4.02	38.0	25.3	4.63	15.8	42.5	17.9	10.6
		Mica Ro & Sc Conc.	6.4	0.28	0.60	58.4	25.2	1.65	1.27	2.82	5.66	0.44	4.14	5.27	10.0	5.93	5.30	4.32	15.9	8.49
		Total Slimes	2.4	0.33	0.70	60.0	15.9	1.73	7.32	3.83	1.90	0.45	1.84	2.04	2.38	2.35	11.6	2.22	2.02	3.29
	Combined	Head (Calc.)	100	0.43	0.92	70.8	16.1	1.78	1.53	4.16	2.27	0.33	100	100	100	100	100	100	100	100
		Head (Dir.)		0.46	0.99	70.0	16.4	1.80	1.53	3.97	2.34	0.33								
		Combined Conc.	8.5	2.86	6.16	63.0	24.6	0.92	1.51	0.67	0.55	0.51	56.7	7.6	13.0	4.4	8.4	1.4	2.0	13.3

Sample	Stage	Combined Products	Wt	Assays (%)									Distribution (%)							
			%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
E_S	DMS	Conc. Non-Mag	2.8	2.96	6.36	66.1	24.3	1.23	0.29	0.57	0.44	0.13	15.1	2.6	4.0	2.1	0.8	0.4	0.5	1.1
		Conc. Mag	2.2	0.28	0.61	47.0	60.4	17.91	0.22	0.10	0.09	0.03	1.1	1.5	7.8	23.7	0.5	0.1	0.1	0.2
		Middlings (-3.3 +1 mm)	7.5	0.80	1.72	70.8	16.8	1.79	1.39	3.01	1.77	0.43	11.0	7.5	7.4	8.1	10.4	5.9	5.5	9.4
		Tailings	27.4	0.07	0.16	74.7	14.4	0.41	0.34	4.72	4.10	0.30	3.7	28.6	23.2	6.8	9.1	33.8	46.0	24.2
	Mag Sep (Flotation)	MIMS Mag	1.6	0.48	1.03	67.6	16.7	4.16	1.38	3.80	2.23	0.48	1.4	1.5	1.6	4.0	2.2	1.6	1.5	2.3
		WHIMS Mag	4.3	0.65	1.39	47.8	16.8	12.16	5.68	1.36	2.06	2.24	5.1	2.9	4.2	31.5	24.3	1.5	3.6	28.1
	Flotation LCT	Li Cl Conc	10.2	2.96	6.36	63.4	24.5	1.07	1.35	0.74	0.37	0.65	54.9	9.0	14.6	6.5	13.6	2.0	1.5	19.0
		Li Ro Tail	37.2	0.06	0.13	79.3	12.4	0.43	0.47	5.22	1.60	0.09	4.0	41.2	27.1	9.6	17.5	50.7	24.4	9.4
		2nd Slime	1.0	0.49	1.06	62.2	14.2	1.04	7.81	3.61	1.63	0.44	0.9	0.9	0.8	0.6	7.7	0.9	0.7	1.3
		Mica Ro Conc.	2.8	0.20	0.44	51.8	30.0	2.01	0.54	1.65	7.99	0.22	1.0	2.0	4.9	3.4	1.5	1.2	9.2	1.8
		Mica Sc. Conc.	1.9	0.23	0.49	53.5	29.0	2.01	0.63	1.85	7.55	0.25	0.8	1.4	3.2	2.3	1.2	0.9	5.8	1.3
		1st Slime	1.1	0.39	0.85	56.2	16.0	2.09	9.83	3.13	2.47	0.59	0.8	0.9	1.1	1.4	11.2	0.9	1.2	2.0
	Combined	Head (Calc.)	100	0.55	1.18	71.5	17.0	1.67	1.01	3.83	2.44	0.34	100	100	100	100	100	100	100	100
		Head (Dir.)		0.48	1.03	67.6	16.7	4.16	1.38	3.80	2.23	0.48								
		Combined Conc.	12.9	2.96	6.36	64.0	24.5	1.11	1.12	0.70	0.38	0.53	70.0	11.6	18.6	8.6	14.4	2.4	2.0	20.1

Sample	Stage	Product	Wt.	Assays (%)									Distribution (%)							
			%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
E_LF	DMS	Conc. Non-Mag	7.45	3.05	6.56	65.6	24.8	0.84	0.18	0.59	0.47	0.12	44.0	6.89	11.4	3.24	0.97	1.13	1.42	2.95
		Conc. Mag	2.33	0.57	1.24	48.2	18.3	11.7	7.11	1.51	1.56	0.99	2.59	1.58	2.63	14.0	12.28	0.90	1.47	7.64
		Tailings	30.4	0.05	0.11	75.0	14.4	0.36	0.36	5.19	3.76	0.26	2.90	32.1	27.1	5.56	8.08	40.6	46.2	26.2
	Mag Sep (Flotation)	MIMS Mag	2.2	0.42	0.90	64.9	16.2	6.21	1.94	3.48	2.28	0.41	1.79	2.02	2.21	7.1	3.18	1.98	2.03	3.00
		WHIMS Mag	6.2	0.81	1.74	47.4	17.7	13.2	4.09	1.06	2.23	1.22	9.78	4.17	6.81	42.6	18.9	1.70	5.63	25.2
	Batch Flotation	4th Cl Conc. Non Mag	5.5	2.55	5.48	61.6	23.7	1.02	2.49	0.97	0.57	0.67	27.2	4.8	8.1	2.90	10.2	1.38	1.27	12.2
		Cl Tail	3.9	0.55	1.19	79.8	19.0	1.86	2.40	4.62	1.92	0.22	4.13	4.4	4.5	3.71	6.9	4.6	3.0	2.8
		Ro Tail	31.6	0.03	0.07	80.8	11.4	0.37	0.57	5.06	1.30	0.09	2.10	36.0	22.2	6.04	13.3	41.2	16.6	9.75
		Mica Ro & Sc Conc.	6.7	0.23	0.49	53.2	27.9	2.85	0.91	1.86	7.11	0.24	2.94	5.01	11.5	9.83	4.52	3.20	19.2	5.32
		Total Slimes	3.8	0.35	0.75	59.6	15.1	2.56	7.80	3.42	2.10	0.40	2.54	3.15	3.50	4.96	21.7	3.31	3.19	5.04
	Combined	Head (Calc.)	100	0.52	1.11	71.0	16.2	1.94	1.35	3.88	2.47	0.30	100	100	100	100	100	100	100	100
		Head (Dir.)		0.47	1.01	70.3	16.3	1.81	1.29	3.93	2.46	0.32								
		Combined Conc.	13.0	2.84	6.10	63.9	24.4	0.92	1.16	0.75	0.51	0.35	71.2	11.7	19.5	6.1	11.2	2.5	2.7	15.2

Sample	Stage	Product	Wt.	Assays (%)									Distribution (%)							
			%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
E_LG	DMS	Conc. Non-Mag	2.94	2.98	6.42	65.1	24.7	1.11	0.55	0.57	0.58	0.37	27.4	2.68	4.62	1.98	1.33	0.40	0.61	3.04
		Conc. Mag	2.23	0.47	1.01	48.2	16.9	13.2	7.77	1.69	1.30	0.85	3.28	1.50	2.40	17.8	14.4	0.88	1.03	5.33
		Tailings	32.9	0.05	0.10	73.6	15.0	0.46	0.37	5.14	4.14	0.30	4.79	33.9	31.3	9.22	10.2	39.7	48.6	27.3
	Mag Sep (Flotation)	MIMS Mag Conc.	5.8	0.3	0.65	67.2	16.6	4.2	1.75	3.78	2.83	0.45	5.42	5.43	6.09	14.7	8.37	5.12	5.83	7.29
		WHIMS Mag Conc.	3.9	0.52	1.12	46.2	15.9	14.8	4.65	1.29	3.14	1.85	6.39	2.54	3.96	35.2	15.1	1.19	4.39	20.4
	Batch Flotation	3rd Cl Conc. Non-Mag.	4.8	2.42	5.20	62.8	23.3	1.03	2.37	1.07	0.67	1.07	36.2	4.2	7.1	2.99	9.4	1.20	1.14	14.4
		Cl Tail	4.4	0.44	0.94	76.1	15.4	0.32	1.67	4.33	1.28	0.14	5.99	4.7	4.3	0.86	6.1	4.5	2.0	1.7
		Ro Tail	29.3	0.02	0.05	79.6	11.9	0.27	0.70	5.26	1.33	0.08	2.09	32.6	22.1	4.79	17.1	36.1	13.9	6.79
		Mica Ro & Sc Conc.	12.5	0.19	0.40	64.8	21.2	1.47	0.96	3.35	4.77	0.35	7.29	11.4	16.9	11.2	9.97	9.83	21.3	12.3
		Total Slimes	1.3	0.28	0.60	60.5	15.1	1.55	7.58	3.61	2.42	0.39	1.14	1.10	1.25	1.22	8.18	1.10	1.12	1.44
	Combined	Head (Calc.)	100	0.32	0.69	71.4	15.7	1.65	1.21	4.26	2.80	0.36	100	100	100	100	100	100	100	100
		Head (Dir.)		0.32	0.69	70.7	16.0	1.89	1.32	4.19	2.90	0.39								
		Combined Conc.	7.7	2.63	5.67	63.7	23.8	1.06	1.67	0.88	0.64	0.80	63.6	6.9	11.7	5.0	10.7	1.6	1.8	17.4

Sample	Stage	Product	Wt.	Assays (%)									Distribution (%)							
			%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
EE_HG	DMS	Conc. Non-Mag	5.0	2.85	6.12	66.9	23.9	0.91	0.22	0.54	0.43	0.16	24.3	4.68	7.35	2.72	1.30	0.75	0.89	2.62
		Conc. Mag	1.3	0.57	1.24	49.0	17.5	11.1	6.43	1.03	1.51	0.59	1.30	0.91	1.43	8.87	9.93	0.38	0.83	2.54
		Tailings	23.8	0.09	0.18	74.4	14.7	0.48	0.33	5.10	3.60	0.31	3.47	24.8	21.5	6.88	9.25	34.0	35.4	23.8
	Mag Sep (Flotation)	MIMS Mag	3.6	0.46	0.99	63.9	16.6	6.53	1.33	3.21	2.58	0.43	2.81	3.19	3.65	14.0	5.53	3.21	3.81	4.97
		WHIMS Mag	5.5	0.55	1.18	48.0	18.2	11.9	2.79	1.36	3.33	1.42	5.17	3.70	6.18	39.2	17.9	2.09	7.58	25.4
	Flotation LCT	Cl Conc	11.7	2.66	5.72	62.7	24.2	1.24	1.61	0.82	0.41	0.54	53.1	10.3	17.4	8.73	21.8	2.69	1.99	20.5
		Ro Tail	38.9	0.08	0.17	81.3	11.1	0.28	0.35	4.63	1.49	0.09	5.40	44.3	26.6	6.57	15.9	50.5	23.9	11.7
		2nd Slime	0.6	0.51	1.10	64.3	13.2	0.92	7.56	3.63	1.30	0.38	0.49	0.51	0.46	0.31	4.96	0.57	0.30	0.70
		Mica Ro Conc.	5.6	0.20	0.44	52.9	28.8	2.24	0.59	1.69	7.51	0.19	1.95	4.17	9.98	7.58	3.86	2.67	17.5	3.45
		Mica Sc Conc.	3.0	0.26	0.55	61.2	23.1	1.95	0.80	2.56	5.36	0.24	1.33	2.59	4.30	3.54	2.82	2.17	6.70	2.35
		1st Slime	1.1	0.39	0.83	60.8	16.7	2.45	5.50	3.30	2.59	0.57	0.70	0.90	1.08	1.55	6.74	0.97	1.13	1.93
	Combined	Head (Calc.)	100	0.58	1.26	71.4	16.2	1.66	0.86	3.57	2.42	0.31	100	100	100	100	100	100	100	100
		Head (Dir.)		0.60	1.28	70.9	16.4	2.14	0.93	3.32	2.23	0.32								
		Combined Conc.	16.7	2.71	5.84	64.0	24.1	1.14	1.19	0.74	0.42	0.43	77.4	15.0	24.8	11.5	23.1	3.4	2.9	23.1

Sample	Stage	Product	Wt.	Assays (%)									Distribution (%)							
			%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
EE_LG	DMS	Conc. Non-Mag	2.84	2.78	5.98	65.2	24.2	1.37	0.57	0.60	0.57	0.37	24.1	2.60	4.35	2.43	1.51	0.44	0.58	3.03
		Conc. Mag	1.90	0.42	0.90	48.3	15.4	12.4	7.69	1.62	1.42	0.50	2.42	1.29	1.86	14.6	13.6	0.79	0.97	2.72
		Tailings	32.2	0.07	0.16	74.1	14.8	0.50	0.34	4.60	3.87	0.32	7.13	33.6	30.3	10.0	10.2	38.2	44.8	29.9
	Mag Sep (Flotation)	MIMS Mag	4.0	0.35	0.75	65.5	17.2	4.09	1.56	3.4	2.49	0.45	4.29	3.69	4.38	10.2	5.85	3.51	3.58	5.22
		LONGi Mag and Midds	5.6	0.64	1.37	54.4	20.8	6.33	2.94	1.72	3.35	0.88	10.97	4.29	7.40	22.1	15.4	2.49	6.75	14.3
		WHIMS Mag	3.3	0.46	1.00	50.1	17.1	10.7	4.14	1.50	2.78	1.19	4.72	2.34	3.61	22.1	12.9	1.29	3.32	11.5
	Batch Flotation	3rd Cl Conc Non-Mag	3.7	2.64	5.68	63.1	24.2	0.90	1.63	0.91	0.55	0.74	30.1	3.3	5.7	2.09	5.7	0.87	0.74	8.0
		Cl Tail	2.3	0.54	1.16	72.0	17.1	0.78	1.13	3.99	1.86	0.27	3.79	2.3	2.5	1.13	2.4	2.4	1.5	1.8
		Ro Tail	31.9	0.03	0.06	81.0	11.5	0.17	0.22	5.00	1.65	0.09	2.51	36.3	23.2	3.48	6.64	41.1	18.9	8.64
		Pho Ro Conc	1.3	0.71	1.53	69.0	15.7	0.88	3.36	3.55	1.41	1.23	2.83	1.27	1.30	0.71	4.10	1.19	0.66	4.65
		Mica Ro & Sc Conc.	8.4	0.22	0.46	59.6	24.1	1.64	0.93	2.65	5.49	0.29	5.52	7.00	12.8	8.54	7.23	5.71	16.5	7.11
		Total Slimes	2.4	0.20	0.44	57.2	16.6	1.62	6.29	3.20	1.92	0.43	1.52	1.96	2.56	2.45	14.3	2.00	1.68	3.04
		3rd Cl Conc Mag	0.01	1.42	3.06	53.5	19.7	5.50	6.12	1.14	1.07	1.88	0.07	0.01	0.02	0.05	0.08	0.00	0.01	0.07
	Combined	Head (Calc.)	100	0.33	0.70	71.1	15.8	1.61	1.07	3.88	2.79	0.35	100	100	100	100	100	100	100	100
		Head (Dir.)		0.32	0.69	69.8	16.0	1.85	1.15	3.93	2.88	0.38								
		Combined Conc.	6.6	2.70	5.81	64.0	24.2	1.10	1.17	0.78	0.56	0.58	54.2	5.9	10.1	4.5	7.2	1.3	1.3	11.0

Sample	Stage	Product	Wt.	Assays (%)									Distribution (%)							
			%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
S_F	DMS	Conc. Non-Mag	5.99	2.77	5.96	65.4	24.5	0.97	0.37	0.84	0.54	0.18	34.8	5.50	9.27	3.48	1.81	1.30	1.27	3.20
		Conc. Mag	3.60	0.37	0.80	47.9	16.7	12.7	7.72	1.98	1.17	1.12	2.79	2.42	3.80	27.25	22.6	1.83	1.66	11.9
		Tailings	33.4	0.06	0.12	74.1	14.6	0.34	0.38	4.92	4.04	0.28	3.88	34.7	30.8	6.70	10.4	42.1	53.0	27.1
	Mag Sep (Flotation)	MIMS Mag	3.1	0.42	0.90	66.3	16.1	4.87	1.94	3.59	2.19	0.40	2.76	2.92	3.20	9.1	4.96	2.89	2.70	3.71
		WHIMS Mag	4.5	0.51	1.09	47.1	16.2	13.7	5.28	1.27	1.78	1.13	4.72	2.94	4.58	36.5	19.2	1.45	3.12	14.8
	Batch Flotation	3rd Cl Conc. Non-Mag.	7.3	2.59	5.57	62.2	24.4	0.93	2.01	1.03	0.66	0.71	39.8	6.4	11.3	4.07	12.0	1.94	1.90	15.4
		Cl Tail	3.6	0.63	1.35	70.8	17.5	0.83	1.77	4.13	1.73	0.18	4.73	3.6	4.0	1.79	5.2	3.8	2.5	1.9
		Ro Tail	29.7	0.03	0.06	81.4	11.0	0.26	0.45	4.97	1.48	0.12	1.70	34.0	20.7	4.57	10.8	37.9	17.3	10.7
		Mica Ro & Sc Conc.	7.4	0.25	0.53	61.0	23.5	1.22	1.08	2.87	5.33	0.44	3.80	6.30	10.9	5.35	6.48	5.41	15.4	9.52
		Total Slimes	1.4	0.37	0.79	62.8	15.6	1.41	5.79	3.72	2.07	0.39	1.07	1.22	1.36	1.17	6.52	1.32	1.13	1.61
	Combined	Head (Calc.)	100	0.48	1.03	71.2	15.8	1.68	1.23	3.90	2.54	0.34	100	100	100	100	100	100	100	100
		Head (Dir.)		0.47	1.01	70.1	16.1	2.00	1.48	3.75	2.44	0.34								
		Combined Conc.	13.3	2.67	5.74	63.6	24.4	0.95	1.27	0.95	0.60	0.47	74.6	11.9	20.6	7.5	13.8	3.2	3.2	18.6

Sample	Stage	Combined Products	Wt.	Assays (%)									Distribution (%)							
			%	Li	Li_2O	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5	Li	SiO_2	Al_2O_3	Fe_2O_3	CaO	Na_2O	K_2O	P_2O_5
S_S	DMS	Conc. Non-Mag	2.2	3.17	6.82	64.9	25.3	1.12	0.27	0.43	0.33	0.13	13.3	2.0	3.4	1.0	0.4	0.3	0.3	0.8
		Conc. Mag	2.4	0.41	0.87	48.2	41.0	15.40	0.20	0.13	0.08	0.13	1.8	1.6	5.8	15.3	0.3	0.1	0.1	0.8
		Middlings (-3.3+1 mm)	4.7	0.76	1.63	70.6	16.4	2.44	1.82	2.87	1.64	0.43	6.8	4.7	4.6	4.8	6.0	3.7	3.4	5.4
		Tailings	26.7	0.08	0.17	73.9	14.4	0.47	0.43	4.74	3.70	0.32	4.1	28.2	23.1	5.3	8.0	34.6	43.8	22.4
	Mag Sep (Flotation)	MIMS Mag	2.1	0.47	1.01	63.0	17.2	6.22	2.48	3.24	2.29	0.56	1.9	1.9	2.2	5.5	3.7	1.9	2.1	3.1
		WHIMS Mag	7.4	0.59	1.28	46.8	15.8	15.0	6.09	1.18	1.49	1.25	8.4	5.0	7.1	47.0	31.9	2.4	4.9	24.7
	Batch Flotation	3rd Cl Conc. Non-Mag.	9.3	2.73	5.87	62.0	24.4	1.70	1.90	0.66	0.37	0.79	48.4	8.3	13.7	6.7	12.4	1.7	1.5	19.6
		Cl Tail	4.9	0.73	1.56	69.3	18.1	1.44	1.97	3.74	1.71	0.19	6.7	4.8	5.3	2.9	6.8	5.0	3.7	2.4
		Ro Tail	32.2	0.05	0.10	79.5	12.2	0.25	0.61	5.06	1.62	0.09	2.9	36.6	23.7	3.4	13.7	44.6	23.1	8.0
		Mica Ro & 1st Sc Conc.	5.5	0.33	0.71	57.0	25.4	2.14	1.45	2.28	5.94	0.60	3.4	4.5	8.3	4.9	5.5	3.4	14.4	8.8
		Total Slimes	2.7	0.44	0.95	59.8	16.7	2.79	6.00	3.21	2.16	0.58	2.2	2.3	2.7	3.1	11.3	2.4	2.6	4.1
	Combined	Head (Calc.)	100	0.53	1.13	69.8	16.6	2.38	1.42	3.65	2.25	0.38	100	100	100	100	100	100	100	100
		Head (Dir.)		0.47	1.01	63.0	17.2	6.22	2.48	3.24	2.29	0.56								
		Combined Conc.	11.5	2.81	6.05	62.6	24.6	1.59	1.59	0.62	0.36	0.66	61.7	10.3	17.1	7.7	12.8	1.9	1.9	20.3

10.9 FELDSPAR AND QUARTZ CONCENTRATION TESTWORK

Batch flotation tests were undertaken to produce feldspar concentrate. The feldspar tailings stream was passed through WHIMS to remove iron-bearing minerals and produce a quartz concentrate.

WHIMS was performed on the spodumene flotation tailings sample followed by mica pre-flotation. The slurry underwent high-density scrubbing and de-sliming followed by conditioning with sulfuric acid, hydrofluoric acid or fluoride solution, and kerosene. Rougher and scavenger flotation stages were undertaken. Rougher concentrate was upgraded in three- to five-stages of cleaning. The scavenger tailings underwent wet high-intensity magnetic separation to produce quartz concentrate

Table 10-22 shows the feed sample tested and the reagent additions for selected tests. Tests BF1 through BF-4 employed a mica pre-flotation stage employing Armac T as collector. Test BF-4 utilized a fluoride solution (mixture of NaF and HCl) to replace HF during feldspar flotation.

Table 10-23 shows mass balances for feldspar flotation and quartz production tests. Mass pull to the feldspar concentrate ranged from 30% to 50%. Feldspar concentrate grade ranged from 10.4% to 11.2% Na_2O+K_2O. The concentrates appear to be primarily sodium feldspar with assays ranging from 8.1% to 8.9% Na_2O. Iron concentration in the concentrate was roughly 0.1% Fe_2O_3. Mass pull to the quartz concentrate ranged from 30% to 35%. Quartz concentrate grades ranged from 99.4% to 99.7% SiO_2 and did not exceed 0.02% Fe_2O_3.

Table 10-22 - Batch feldspar flotation and quartz concentrate production test conditions

Test	Spod. Flot. Tailings Sample	Reagent Dosage, g/t					
		H_2SO_4	HF	F Sol'n	Armac C	Kerosene	Armac T
BF-1	EE_HG	2250	2200	0	440	185	50
BF-2	E_EF1	2250	2200	0	440	185	50
BF-3	E_S	2250	2200	0	440	185	50
BF-4	EE_HG	2200	0	2250	455	185	50
BF-10	EE_HG	2250	2200	0	440	185	0

Table 10-23: Batch feldspar flotation and quartz concentrate production testwork results

Test	Combined Product	Wt.	Assays %								Distribution %							
		%	SiO_2	Al_2O_3	K_2O	Na_2O	CaO	MgO	P_2O_5	Fe_2O_3	SiO_2	Al_2O_3	K_2O	Na_2O	CaO	MgO	P_2O_5	Fe_2O_3
	Fld 4th Cl Conc (Non-mag)	41.1	69.3	18.5	2.32	8.15	0.51	0.06	0.13	0.1	34.7	70.9	65.4	78.7	66.4	26.2	73.5	17.5
	Fld 4th Cl Conc	41.2	69.4	18.4	2.31	8.12	0.51	0.06	0.13	0.1	34.9	70.9	65.4	78.7	66.4	26.2	73.5	18.3
	Fld 3rd Cl Conc	43.6	69.9	18.1	2.27	7.97	0.50	0.06	0.13	0.1	37.1	73.6	67.8	81.6	69.5	27.7	76.4	20.4
	Fld 2nd Cl Conc	45.6	70.4	17.8	2.23	7.82	0.50	0.06	0.12	0.1	39.1	75.6	69.6	83.7	71.6	28.7	78.3	22.2
	Fld 1st Cl Conc	48.0	71.3	17.3	2.16	7.58	0.48	0.06	0.12	0.1	41.8	77.3	71.1	85.5	73.4	29.5	80.0	24.6
	Fld Ro Conc	52.4	73.6	15.9	1.99	6.97	0.45	0.05	0.11	0.1	47.0	77.6	71.4	85.8	73.9	30.0	80.6	27.2
BF-1	Fld Ro & Scav Conc	59.6	76.6	14.1	1.76	6.15	0.40	0.05	0.10	0.2	55.7	78.2	71.8	86.1	74.6	30.7	81.6	34.2
	Qtz Conc. (NonMag)	29.6	99.6	0.11	0.01	0.03	0.01	0.01	0.01	0.01	35.9	0.3	0.2	0.2	0.9	3.1	4.1	1.1
	Qtz Conc.	30.4	98.7	0.63	0.07	0.22	0.04	0.02	0.01	0.04	36.6	1.8	1.5	1.6	4.1	6.7	5.3	4.4
	Total Mag Conc	3.6	67.4	16.9	2.68	4.01	1.33	1.42	0.11	3.6	3.0	5.7	6.7	3.4	15.4	54.9	5.3	46.4
	Mica Conc.	7.0	62.1	23.8	4.38	6.06	0.39	0.15	0.09	0.76	5.3	15.5	21.0	10.0	8.7	11.2	8.7	18.9
	Slime	0.3	82.5	10.3	1.40	4.35	0.51	0.04	0.11	0.21	0.2	0.2	0.2	0.3	0.4	0.1	0.4	0.2
	Head (calc.)	100	82.1	10.7	1.46	4.26	0.32	0.09	0.07	0.28	100	100	100	100	100	100	100	100
	Fld 4th Cl Conc (Non-mag)	30.0	65.6	20.8	2.25	8.92	1.08	0.05	0.13	0.1	25.1	48.0	39.4	56.2	51.4	21.0	45.9	11.7
	Fld 4th Cl Conc	30.4	65.5	20.8	2.27	8.88	1.08	0.05	0.13	0.1	25.4	48.7	40.3	56.7	52.1	22.3	46.4	13.4
	Fld 3rd Cl Conc	34.2	65.6	20.8	2.28	8.80	1.09	0.05	0.13	0.1	28.6	54.6	45.5	63.2	59.0	24.4	53.1	15.9
	Fld 2nd Cl Conc	37.9	65.8	20.7	2.29	8.72	1.08	0.05	0.13	0.1	31.8	60.2	50.6	69.4	64.9	27.0	59.1	18.3
	Fld 1st Cl Conc	42.0	66.1	20.5	2.28	8.61	1.06	0.05	0.13	0.1	35.4	66.2	56.0	76.0	70.6	29.9	66.0	21.3
	Fld Ro Conc	54.6	68.1	19.3	2.20	8.04	1.02	0.05	0.13	0.1	47.4	81.0	70.1	92.1	88.3	36.9	83.7	30.6
BF-2	Fld Ro & Sc Conc	62.3	71.0	17.6	2.01	7.21	0.94	0.04	0.12	0.2	56.4	84.1	72.9	94.4	92.4	39.1	88.2	37.8
	Qtz Conc. (NonMag)	29.9	99.7	0.13	0.01	0.04	0.01	0.01	0.01	0.02	37.9	0.3	0.2	0.3	0.5	4.2	3.5	2.3
	Qtz Conc.	30.1	99.7	0.14	0.01	0.04	0.01	0.01	0.01	0.02	38.2	0.3	0.2	0.3	0.5	4.2	3.5	2.6
	Total Mag Conc	2.4	61.3	20.9	4.11	2.43	1.31	1.43	0.10	4.0	1.9	3.9	5.8	1.2	5.0	48.5	2.8	38.4
	Mica Conc.	5.4	55.1	29.0	6.83	3.75	0.28	0.12	0.08	1.07	3.8	12.1	21.7	4.3	2.4	9.1	5.1	22.7
	Slime	0.3	75.8	14.2	1.66	4.80	0.94	0.09	0.22	0.40	0.3	0.3	0.3	0.3	0.4	0.4	0.8	0.5
	Head (calc.)	100	78.5	13.0	1.71	4.77	0.63	0.07	0.09	0.26	100	100	100	100	100	100	100	100
	Fld 4th Cl Conc (Non-mag)	39.4	67.8	18.8	2.28	8.14	0.95	0.04	0.11	0.1	34.0	57.5	51.0	65.1	79.8	31.6	64.2	14.8
	Fld 4th Cl Conc	40.5	67.8	18.9	2.28	8.12	0.96	0.04	0.11	0.1	34.9	59.3	52.4	66.8	83.2	35.7	66.2	18.0
	Fld 3rd Cl Conc	41.5	68.3	18.5	2.24	7.97	0.95	0.04	0.11	0.1	36.1	59.8	52.8	67.3	84.4	36.1	66.8	19.1
	Fld 2nd Cl Conc	42.6	68.8	18.2	2.20	7.84	0.94	0.04	0.11	0.1	37.3	60.4	53.3	67.8	85.2	36.3	67.4	20.1
	Fld 1st Cl Conc	43.7	69.5	17.8	2.16	7.66	0.92	0.04	0.10	0.1	38.7	60.6	53.5	68.0	85.6	36.5	67.7	20.7
	Fld Ro Conc	48.6	72.5	16.1	1.95	6.92	0.83	0.04	0.10	0.1	44.8	60.9	53.7	68.3	86.2	37.5	68.4	22.6
BF-3	Fld Ro & Scav Conc	57.3	71.1	17.2	2.21	7.00	0.73	0.04	0.09	0.2	51.9	76.6	71.9	81.5	89.8	51.5	78.7	48.2
	Qtz Conc. (NonMag)	29.8	99.7	0.14	0.02	0.03	0.01	0.01	0.01	0.01	37.8	0.3	0.3	0.2	0.6	6.0	4.4	1.4
	Qtz Conc.	30.0	99.5	0.27	0.03	0.08	0.02	0.01	0.01	0.01	37.9	0.6	0.6	0.5	1.2	6.0	4.7	1.9
	Total Mag Conc	2.3	63.8	21.7	3.28	5.47	1.59	0.56	0.14	1.7	1.9	3.9	4.3	2.6	7.8	25.7	4.8	18.2
	Mica Conc.	11.5	62.9	23.3	3.79	7.40	0.20	0.09	0.08	0.65	9.2	20.8	24.7	17.3	4.9	20.8	13.6	35.1
	Head (calc.)	100	78.6	12.9	1.76	4.93	0.47	0.05	0.07	0.21	100	100	100	100	100	100	100	100
	Fld 5th Cl Conc (Non-mag)	35.0	69.0	18.8	2.46	8.46	0.48	0.05	0.13	0.1	28.9	66.6	66.9	71.0	57.2	20.9	66.8	12.8
	Fld 5th Cl Conc	36.5	68.9	18.8	2.45	8.41	0.51	0.06	0.13	0.1	30.2	69.7	69.8	73.8	62.9	25.8	69.1	18.1
	Fld 4th Cl Conc	39.7	69.4	18.5	2.40	8.27	0.50	0.06	0.13	0.1	33.1	74.6	74.1	78.9	67.9	28.1	73.8	20.9
	Fld 3rd Cl Conc	42.0	69.9	18.2	2.35	8.13	0.49	0.06	0.12	0.1	35.2	77.4	76.6	81.9	70.7	29.7	76.4	23.6
	Fld 2nd Cl Conc	44.3	70.4	17.9	2.30	7.98	0.49	0.06	0.12	0.1	37.4	80.3	79.2	84.9	73.5	31.4	79.2	25.8
	Fld 1st Cl Conc	45.5	71.0	17.6	2.25	7.82	0.48	0.06	0.12	0.2	38.7	80.9	79.7	85.4	74.1	31.7	79.7	28.4
BF-4	Fld Ro Conc	49.8	73.1	16.3	2.08	7.24	0.45	0.05	0.11	0.2	43.6	82.1	80.6	86.5	75.6	32.2	80.9	31.2
	Fld Ro & Scav Conc	56.8	76.1	14.5	1.85	6.42	0.40	0.05	0.10	0.17	51.8	83.3	81.5	87.6	76.8	33.0	82.0	39.8
	Qtz Conc. Non Mag	35.2	99.4	0.13	0.01	0.04	0.01	0.01	0.01	0.02	42.0	0.5	0.3	0.3	1.2	4.2	5.2	2.9
	Total Mag Conc	3.7	65.7	18.1	2.66	4.96	1.44	1.35	0.11	3.4	2.9	6.8	7.7	4.4	18.2	60.0	5.8	51.5
	Mica Conc.	5.8	65.6	21.2	2.96	7.48	0.48	0.11	0.11	0.47	4.6	12.5	13.4	10.4	9.5	7.6	9.4	11.2
	Head (calc.)	100	83.4	9.87	1.29	4.16	0.29	0.08	0.07	0.24	100	100	100	100	100	100	100	100
BF-10	Fld 3rd Cl Conc (Non-Mag)	49.9	69.3	18.5	2.53	8.56	0.36	0.05	0.13	0.1	41.6	91.1	91.1	92.6	80.6	53.9	87.7	33.4
	Fld 3rd Cl Conc	49.9	69.3	18.5	2.53	8.56	0.36	0.05	0.13	0.1	41.6	91.1	91.1	92.6	80.6	53.9	87.7	33.4
	Fld 2nd Cl Conc	52.0	69.2	18.5	2.53	8.54	0.37	0.05	0.13	0.1	43.4	95.2	95.2	96.3	87.0	60.9	90.9	42.9
	Fld 1st Cl Conc	53.8	69.8	18.2	2.49	8.38	0.37	0.05	0.13	0.1	45.2	96.6	96.6	97.8	88.6	62.2	92.2	48.5
	Fld Ro Conc	54.7	70.2	17.9	2.45	8.26	0.36	0.05	0.12	0.1	46.2	96.8	96.7	97.9	88.9	62.4	92.4	51.4
	Fld Ro & Scav Conc	58.6	72.1	16.8	2.29	7.72	0.34	0.05	0.12	0.1	50.9	97.1	97.0	98.2	89.8	63.3	92.9	56.4

	Qtz Conc. No- Mag	34.8	99.7	0.12	0.01	0.04	0.01	0.01	0.01	0.0	41.7	0.4	0.3	0.3	1.6	7.5	4.7	3.3
	Qtz Conc.	35.0	99.7	0.12	0.01	0.04	0.01	0.01	0.01	0.0	42.0	0.4	0.3	0.3	1.6	7.6	4.7	4.4
	Total Mag Conc	3.58	70.9	16.6	2.38	6.11	0.86	0.45	0.09	1.2	3.1	5.9	6.2	4.7	13.9	34.8	4.6	42.3
	Mica Conc.	0.12	78.3	11.9	1.67	5.07	0.57	0.10	0.21	0.6	0.1	0.1	0.1	0.1	0.3	0.3	0.4	0.7
	Fld Sc Conc	5.05	97.6	1.02	0.13	0.31	0.04	0.01	0.01	0.1	5.9	0.5	0.5	0.3	0.9	1.1	0.7	6.8
	Head (calc.)	100.0	83.1	10.1	1.38	4.61	0.22	0.05	0.07	0.10	100	100	100	100	100	100	100	100

10.10 OVERVIEW – LITHIUM HYDROXYDE PILOT PLANT

In 2021, Piedmont engaged Metso:Outotec to undertake pilot plant testwork using their proprietary Lithium Hydroxide Process. The spodumene concentrate sample used for the testwork was produced during concentrator pilot plant operation in 2020 at SGS Canada Inc. The spodumene concentrate was calcined by Metso:Outotec at their laboratory in Oberursel, Germany. The calcined concentrate was sent to Metso:Outotec Research Center in Pori, Finland for hydrometallurgical pilot plant testing.

The pilot plant flowsheet (Figure 10-8: Pilot plant flowsheet) tested included: soda leaching, cold conversion, secondary conversion, ion exchange, lithium hydroxide crystallization, and carbonation.

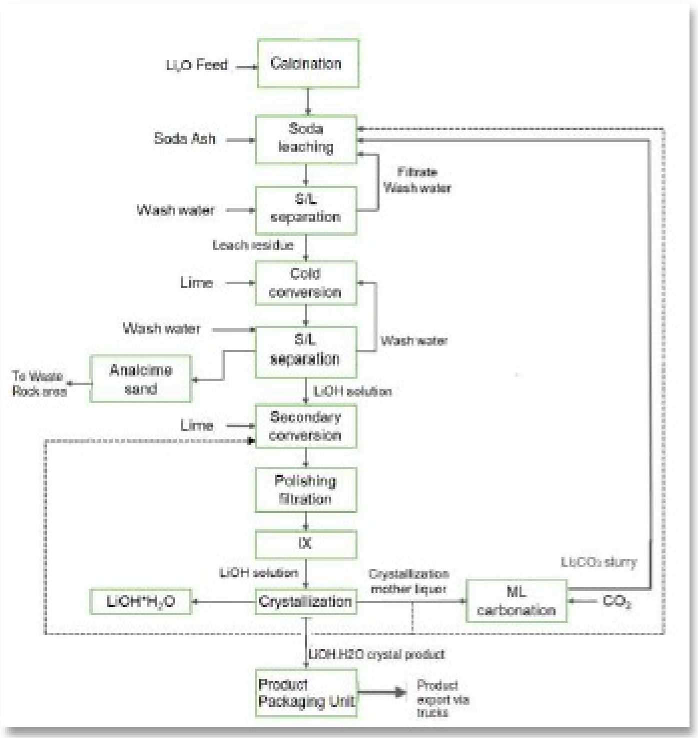


Figure 10-8: Pilot plant flowsheet

The pilot plant operated for approximately 10 days. Roughly 100 kg of calcined spodumene concentrate was fed to the pilot plant. The average total lithium extraction achieved in soda leaching and cold conversion was 89% during the first 136 h of operation. Process recycles were incorporated in the pilot plant with no significant accumulation of impurities in the process. First stage lithium hydroxide crystallization was operated continuously during the pilot plant. Second stage crystallization was operated in batches after the completion of the continuous pilot plant. Impurities levels in the final battery-quality lithium hydroxide monohydrate product were typically low with Al <10 ppm, Ca <10 ppm, Fe <20 ppm, K <10 ppm, and Si <40 ppm. All other metal impurities were below detection limits.

10.11 CONCENTRATE CALCINATION

The spodumene concentrate sample tested was a combined DMS and flotation concentrate produced during pilot plant operation at SGS Canada Inc. in 2020. The spodumene concentrate was calcined in a continuous fluidized bed furnace at the Metso:Outotec laboratory in Oberursel, Germany. Calcined spodumene concentrate assays are shown in Table 10-24: Calcined spodumene concentrate assays.

Calcined samples were submitted for X-ray diffraction analysis which showed the presence of three spodumene phases (α, β, and γ). Semi-quantitative mineral analysis using the Rietveld refinement method was undertaken on the samples. Results showed 98% of the spodumene was converted to the leachable β- and γ-spodumene phases.

Table 10-24: Calcined spodumene concentrate assays

Element	Method		Piedmont calcine barrel 2
Li	ICP	%	2.94
Li_2O	Calc.	%	6.33
Be	ICP	%	0.034
B	ICP	%	0.028
Na	ICP	%	0.52
Mg	ICP	%	<0.01
Al	ICP	%	12.3
P	ICP	%	0.082
K	ICP	%	0.35
Ca	ICP	%	0.29
Ti	ICP	%	0.007
Mn	ICP	%	0.087
Fe	ICP	%	0.46
Zn	ICP	%	<0.05
As	ICP	%	<0.02
Ta	ICP	%	<0.01
Bi	ICP	%	<0.02
SiO_2	Colorimetry	%	64.5

10.12 SODA ASH LEACHING

Slurry preparation entailed pulping the calcined spodumene concentrate with water, soda ash, and recycle solutions prior to leaching. Leaching was carried out in a six-compartment electrically heated (jacketed) 65-L titanium autoclave. Soda ash used for piloting was sourced by PLL from Genesis Alkali. Soda ash dosage to slurry preparation was adjusted based on the residual sodium concentration in the leach filtrates. Crystallization mother liquor was recycled to soda leaching.

The total amount of calcine processed was approximately 90 kg to 100 kg of calcine. Approximately 160 kg of wet filter cakes were collected from the soda leach residue filtration. In total, approximately 250 L of filtrates and 68 L of wash filtrates were collected from the soda leach residue filtration and washing. Most of the soda leach filtrates were recycled to soda leach slurry preparation.

Solution analyses of the soda leaching filtrate are shown in Figure 10-9. The concentrations of aluminum (<3 mg/L), calcium (<6 mg/L), and potassium (<400 mg/L) were relatively low throughout piloting. Silicon concentrations ranged from roughly 500 mg/L to 120 mg/L. Lithium concentration was generally in the range of lithium carbonate solubility (ca. 2000 mg/L). The sodium concentration in the filtrate was mostly at a suitable level of roughly 4 g/L.

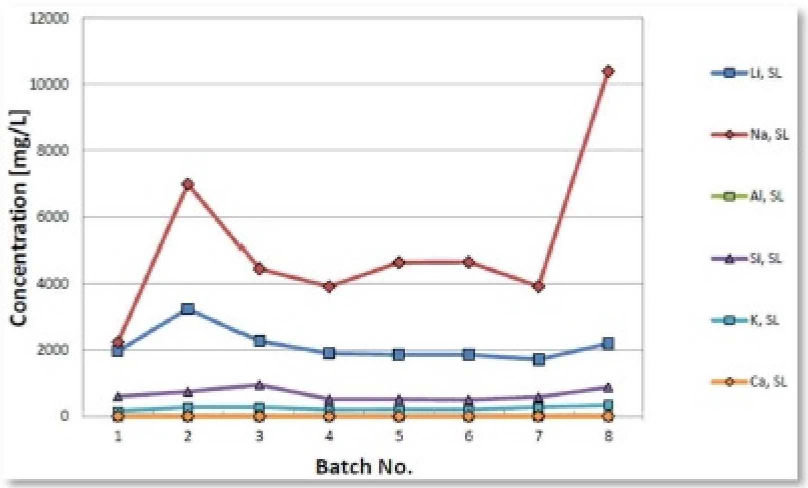


Figure 10-9: Soda leaching filtrate solution assays

The total lithium and acid soluble lithium concentrations in the soda leach filter cakes varied, but in the individual samples, the total and acid soluble lithium concentrations were similar suggesting that the soda leaching reaction was complete and most of the lithium in the feed material had been converted to lithium carbonate. During the pilot, the Li concentration increased as was expected primarily due to process recycles.

10.13 COLD CONVERSION

Cold conversion was undertaken in two OKTOP stainless steel reactors in series. The soda leach residue was pulped with wash solution during slurry preparation. Filtrate was pumped to a buffer tank and fed secondary conversion. Solids were removed from the filter as required and washed with deionized water. Roughly 150 kg of soda leaching residue was fed to cold conversion during piloting.

In total ~185 kg of wet analcime filter cakes were produced during the pilot.

The results of solution analyses from cold conversion filtrates are presented in Figure 10-10. During the first 50 hours of operation, the lithium concentration in solution increased from roughly 4 g/L to 7.5 g/L. Sodium concentration was relatively stable at roughly 1 g/L. The average Potassium, Calcium, Aluminium and Silicon concentrations were 50 mg/L, 25 mg/L, 30 mg/L and 50 mg/L, respectively.

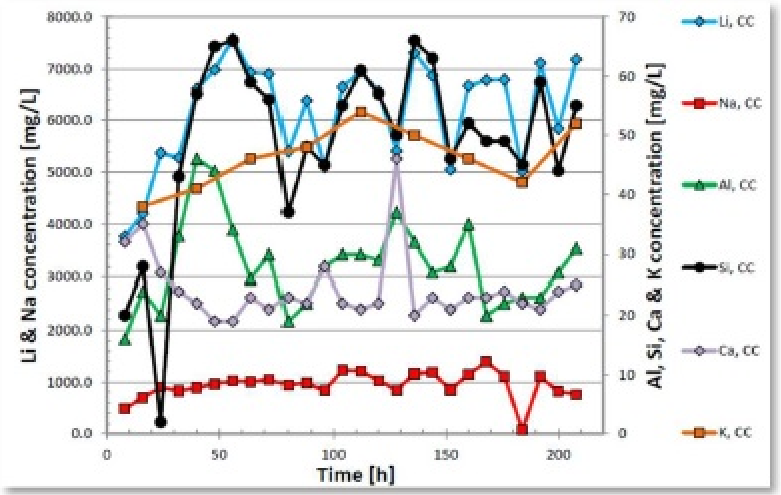


Figure 10-10: Cold conversion (CC) filtrate analysis

The lithium concentration in the cold conversion residue generally ranged from 0.17% to 0.25%. The acid soluble lithium concentrations of the cake samples followed the same trends as total lithium concentration.

Average lithium extraction was 89% for the first 136 h of operation. Lithium extraction was typically between 85% and 91%.

10.14 SECONDARY CONVERSION

Secondary conversion was carried out in two OKTOP stainless steel reactors in series. Cold conversion filtrate and lime milk were pumped continuously to the first reactor. Slurry was dewatered by vacuum filtration. In total, roughly 8 kg of wet polishing filter cakes were produced during piloting. Filtrate was continuously pumped to a buffer tank which fed ion exchange.

The results of solution analyses from the secondary conversion filtrates are presented in Figure 10-11. The lithium concentration increased to greater than 6 g/L during the first 50 hours of operation, after which the concentration generally fluctuated between 6 g/L and 7 g/L. Sodium concentrations were similar to levels in cold conversion. Potassium and calcium concentrations were reasonably stable with average concentrations 50 mg/L and 30 mg/L, respectively. Average silicon concentration was roughly 50 mg/L in cold conversion and decreased to roughly 20 mg/L in secondary conversion.

Crystallization mother liquor was recycled to secondary conversion.

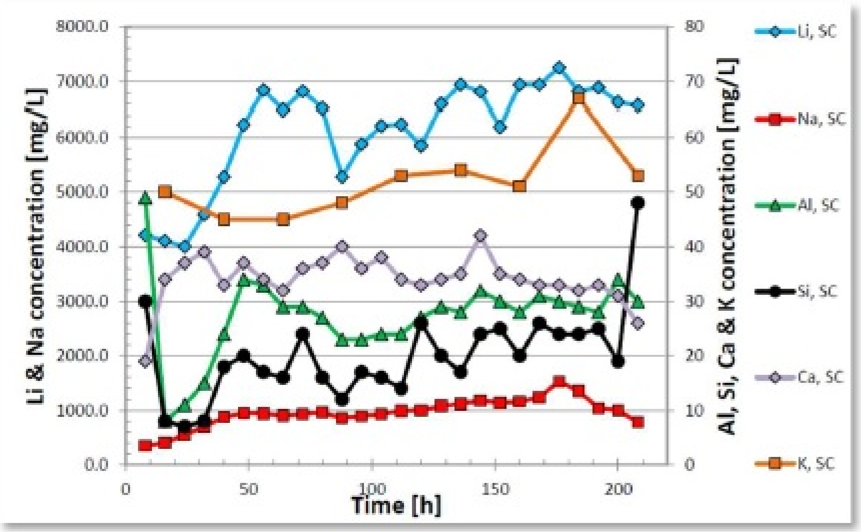


Figure 10-11: Secondary conversion filtrate assays

10.15 ION EXCHANGE

Polished solution from secondary conversion fed ion exchange (IX) which was operated continuously. IX consisted of two columns in series, packed with weakly acidic chelating cation exchange resin Lewatit MDS TP 208 with total bed volume of 500 mL. One additional 250 mL column was available as a backup to be changed into operation when resin regeneration was necessary. IX product solution fed the Pre-Evaporation stage. All the filtrate from the polishing filter was fed through IX during piloting. Roughly 220 L of solution was processed through IX during piloting. At certain times during the piloting, the first column was taken off-line for regeneration.

The results of IX product solution analyses are shown in Figure 10-12. Lithium concentration increased to roughly 7 g/L during the first 60 hours of operation. Aluminum, sodium and silicon concentrations were relatively stable. The main function of the ion exchange stage was to remove calcium ions from the solution, along with any other divalent metal cations. Calcium removal was generally efficient with the concentration decreasing from an average of 34 mg/L in secondary conversion to less than 1 mg/L in the IX product solution. IX product solution fed pre-evaporation and LiOH crystallization stages.

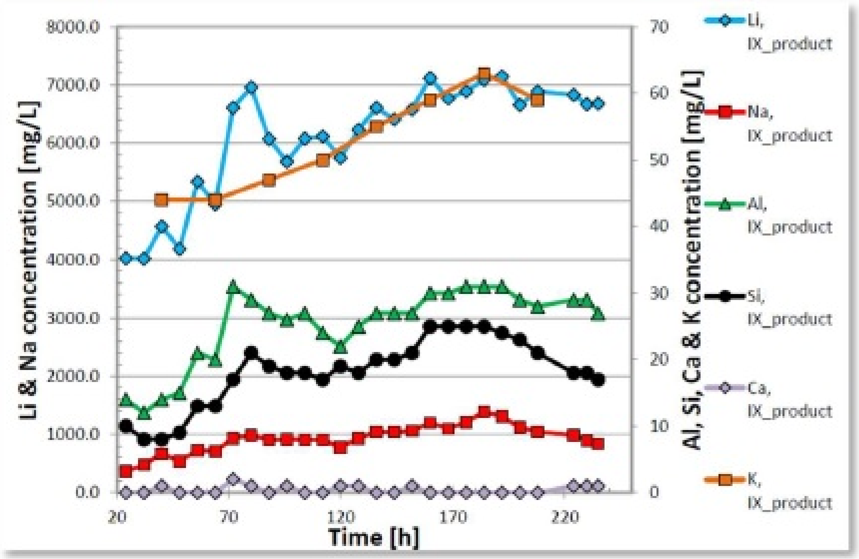


Figure 10-12: IX product solution assays

10.16 PRE-EVAPORATION AND FIRST-STAGE LITHIUM HYDROXIDE CRYSTALLIZATION

IX product solution was continuously fed to the pre-evaporator. The vapor head of the pre-evaporator was a 5-liter reactor with a heated jacket. Vacuum was produced inside the pre-evaporator using a vacuum pump. Solution was heated to evaporate water and concentrate the lithium hydroxide solution.

The first-stage Lithium hydroxide crystallization was carried out with a laboratory forced circulation crystallizer consisting of a vertical cylindrical vessel or vapor head with volume of about 2 L, circulation pump, heater, circulating oil bath, condenser, and a vacuum pump with pressure control.

Crystal slurry was extracted from the crystallizer once a desired amount of solution was fed, and the desired solids concentration achieved. Samples were dewatered and washed with a laboratory centrifuge. Most of the filtrates (mother liquor) from the centrifuge were fed back to the crystallizer and some were recycled upstream in the pilot process. Crystal masses were weighed.

Based on lithium hydroxide content, the moisture content in the first-stage $LiOH*H_2O$ samples was roughly 2% to 6%. Main impurities in the samples included aluminum, sodium, potassium and silicon. Most other impurities were below the detection limit.

10.17 MOTHER LIQUOR CARBONATION

Mother liquor carbonation was undertaken as a batch test in a heated stainless steel reactor equipped with impeller, temperature measurement and carbon dioxide gas feed to the slurry. Based on the analysis results, the carbonation was successful with solution lithium concentration reduced to approximately 2 g/L (i.e., lithium carbonate solubility). The most significant impurities in the carbonation solids were sodium and aluminum. The filter cake was not washed as the aim was to recycle the solids to soda leaching.

10.18 SECOND-STAGE LITHIUM HYDROXIDE CRYSTALLIZATION

Second-stage lithium hydroxide crystallization was carried out in batches after continuous pilot plant operation. Crystallization equipment consisted of a vacuum pump, a heating bath, a distillation column and feed solution and distillate bottles.

Feed solution was prepared by dissolving the crude crystals in deionized water to approximately 20 g/L lithium concentration. Crystallization was carried out by evaporating water from the feed solution with a vacuum distiller. After crystallization, the slurry was filtered, and crystals were washed on the lab centrifuge.

The second stage crystallization samples showed aluminum <10 ppm, calcium <10 ppm, sodium <20 ppm, potassium <10 ppm and silicon <40 ppm. All other metallic impurities were below detection limits. Results showed carbon dioxide concentrations below 0.20%.

Based on the impurity concentrations, it is expected that when corrected for moisture that the pilot plant samples would be equal to or greater than 56.5% LiOH.

11 MINERAL RESOURCE ESTIMATES

11.1 ASSUMPTIONS, PARAMETERS AND METHODS

11.1.1 Geological Modelling

MGG Qualified Person Leon McGarry created a geologic model to define the lithium and by-product Mineral Resources for the Project. Geological modeling was undertaken by MGG using Micromine™ geological modelling software version 15.08. Lithological and structural features were defined based upon geological knowledge of the deposit derived from drill core logs and geological observations on surface. The following features were wireframed:

Spodumene Dikes

At the Carolina Lithium project, lithium mineralization is present within spodumene-bearing pegmatite dikes which are hosted in altered amphibolite and metasediments. The lithium bearing mineral holmquistite occurs as a metasomatic replacement alteration that locally occurs within the host rocks adjacent to the mineralized pegmatites. Lithium cannot be economically recovered from holmquistite, and intervals of wall rock are excluded from the model where possible. Resource modeling is based on logged spodumene pegmatite lithology (coded “SBPEG” or “SPEG” in Piedmont logging), not Li_2O mineralization grade alone.

In discreet areas of limited extent, spodumene is altered with clay, muscovite, and feldspar replacement of varying intensity. A nominal low-grade limit of 0.25% Li_2O for pegmatite interpretation was developed to approximate the boundary between less and more intensely altered pegmatite seen in the histogram of Li_2O grades for spodumene bearing pegmatite samples (Figure 11-1). Pegmatite intervals below 0.25% Li_2O were reviewed on a case-by-case basis. Where low-grade intervals occur at the periphery of the deposit, they are excluded from the mineralization model.

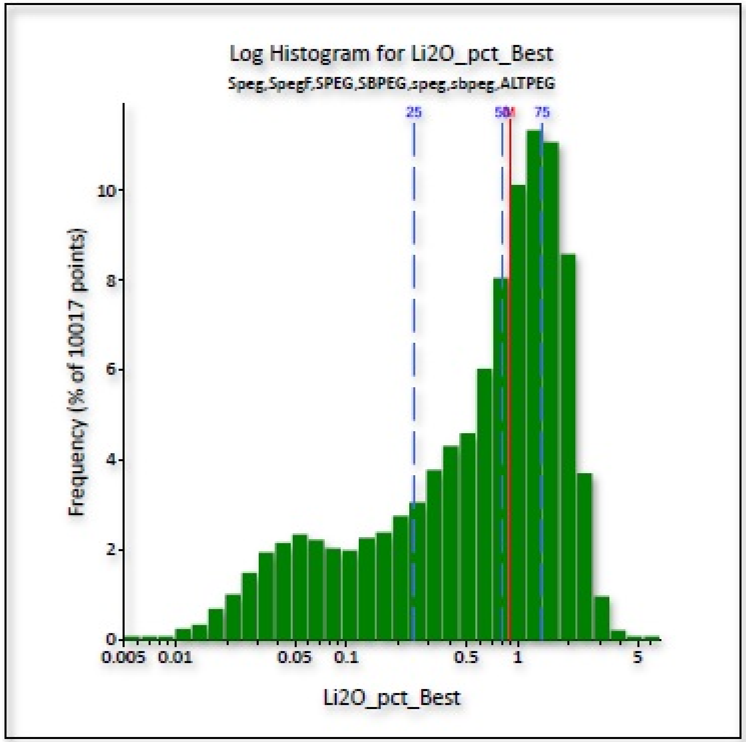


Figure 11-1 - Li_2O % Grades in Spodumene-bearing Pegmatites

Pegmatite orientations are interpreted to be controlled by their emplacement within hydro-fractures propagated along preferential structural pathways within the amphibolite and metasedimentary facies host rocks. Pegmatites are classified as either steep dikes, moderately dipping inclined sheets, or shallow dipping sills.

At the Core and Central properties, dikes and inclined sheets strike northeast and dip to the southeast at between 40° and 90°. At the Core and Huffstetler Properties, numerous flatter pegmatite sheets dip at between 0° and 45° in directions ranging from the north-northeast to south-southeast, and less frequently to the northwest as at the Huffstetler property.

String polygons are interpreted on sections spaced at 40 m in well drilled areas, with section spacings of up to 80 m in sparsely drilled areas. Each cross section was displayed with drillhole traces color-coded according to lithology code and with Li_2O values.

The following techniques were employed whilst interpreting the mineralization:

- Each cross section was displayed on screen with a clipping window equal to a half distance from the adjacent sections;

- Polygon nodes were snapped to drillhole intervals of spodumene pegmatite. Additional nodes were inserted to strings and snapped to regular 40 mRL intervals to aid wireframe modeling and modeling tie lines in plan view;
- Entire intervals of spodumene pegmatite were typically selected for modeling, regardless of the presence of low-grade material associated with partial alteration. Occasionally interstitial waste of up 2 m may be included for the sake of continuity. However, if there is a gap of more than 2 m, or the interval is likely to be a separate feature, it was not included in the modeled interval. These rules were applied on a case-by-case basis;

- No minimum thickness criteria are used for modeling, but a pegmatite must be present in at least two drillholes and on at least two sections;
- If a mineralized envelope did not extend to the adjacent drill hole section, it was projected halfway to the next section and terminated. The general direction and dip of the envelopes was maintained, although the dike thickness was reduced from the last known intersection;
- Polygon interpretations are extended a typical distance of 40 m to 60 m from the nearest SPEG interval, dependent on the local continuity of dikes.

The interpreted strings were used to generate three-dimensional (*3D*) solid wireframes for the mineralized envelopes. Every section was displayed on-screen along with the closest interpreted section. If the corresponding envelope did not appear on the next cross section, the former was projected halfway to the next section, where it was terminated.

- On the Core Property, 76 spodumene-bearing pegmatite dike portions are modeled that are considered sufficient for use as MRE domains;
- On the Central Property, 11 spodumene-bearing pegmatite dike portions are modeled that are considered sufficient for use as MRE domains;
- On the Huffstetler Property, six spodumene-bearing pegmatite dike portions are modeled that are considered sufficient for use as MRE domains.

Topography

Modelling utilized a topographic digital terrain model (*DTM*) that incorporates LiDAR and photogrammetry data with high accuracy RTN-GPS survey control. The LiDAR data has an accuracy class of +/- 0.1 m. Relative to the topography, surveyed collar coordinates have an average difference of 2 m ranging from -6 m to 26 m. Obvious differences are noted where tree cover and vegetation is dense often associated with gullies and ridges. To account for these differences drill collars are projected on to the DTM surface.

Weathering

At the Carolina Lithium Project properties, weathering profiles were modeled for the following features:

- Base of overburden surface, extending to a maximum depth of approximately 12 m with an average depth of approximately 2 m;
- Base of saprolite surface, extending to a maximum depth of approximately 48 m with an average depth of approximately 15 m.

For each feature, 3D points representing the base overburden interval and saprolite depth are extracted from each drillhole log. Points are filtered to remove inconsistent and possibly mis-logged intervals. Depths are contoured at a 10 m^2 resolution. Overburden and saprolite wireframes are generated from gridded overburden depths offset from the topography surface.

Example cross sections through the base of overburden model and base of saprolite model are shown in Figure 6-5 to Figure 6-7.

11.1.2 Statistical and Geostatistical Analysis

Before undertaking the resource estimate, statistical assessment of the data was completed to understand how the estimate should be accomplished. Exploration sample data were statistically reviewed, and variograms were calculated to determine spatial continuity for Li_2O grades and quartz, feldspar, and mica grades. Statistical analysis was carried out using Snowden Supervisor™ software version 8.6.

Data Coding and Composite Length Selection

Samples were selected for individual mineralized envelopes and flagged for each mineralization zone and geological domain. A summary of the codes used to distinguish the data during geostatistical analysis and estimation is shown below.

Wireframes are first classified by deposit, or Core deposit corridor from west to east:

Core			
	Ballard	=	1000
	B Corridor	=	2000
	G Corridor	=	3000
	Star	=	4000
	F Corridor	=	5000
Central		=	6000
Huffstetler		=	7000

Wireframes receive an additional code if they have a shallow, steep or moderate dip:

Flat	=	100
Steep	=	200
Moderate	=	300

Domains receive an additional qualifier to distinguish between multiple stacked dikes (10, 20, 30, etc.). Using this system, alpha numeric codes that uniquely describe all dikes and dike segments are generated.

Compositing is undertaken whereby the maximum composite length is defined by the dominant sample length (1 m) and the minimum composite length is set to 0.3 m.

Unsampled Intervals

At the Core Property there are eight intervals present within the spodumene pegmatite model that were not sampled and do not have an assayed lithium grade. These intervals include zones of poor recovery and very thin dikes that were not sampled. At the Central Property there are two unsampled intervals within the spodumene pegmatite model that do not have an assayed lithium grade. These intervals include a zone of poor recovery and an unsampled waste parting. Unsampled intervals are assigned a null grade rather than a zero grade and are ignored during resource estimation. There are no unsampled intervals at the Huffstetler deposit.

There are several intervals that do not have XRF analyses or calculated normative minerology values derived from them. Historical holes completed prior to drillhole 17-BD-47 did not have material available for XRF analysis and normative minerology could not be calculated for those samples. Given that intervals from these holes will contain by-product minerals, albeit at unknown grades, they are assigned a null grade rather than a zero grade and are ignored during resource estimation.

11.1.3 Statistical Analysis

Samples were assigned to the specific spodumene-bearing pegmatite domains. Samples that fell outside of these domains were excluded from further analysis.

Univariate statistical assessments of composited Li_2O grade data and normative minerology calculations were undertaken. Histograms and summary statistics for composited Li_2O, quartz, albite, potassium-feldspar (*K-spar*) and muscovite values for each property are presented below. Results of the statistical analysis indicate that a single estimation approach is appropriate for all properties.

Li_2O

At all properties, Li_2O grades have broadly comparable asymmetric distributions with moderate positive skew (Table 11-1). At Core and Central, most samples are above 1% Li_2O with median grades of 1.02% and 1.33%, respectively. Li_2O grades are slightly lower at the Huffstetler property which has a median grade of 0.71% Li_2O. At all properties Li_2O analyses have a low coefficient of variation (*CV* - i.e., the ratio of the standard deviation to the mean) ranging from 0.50 at Central and 0.73 at Huffstetler. Within modeled mineral resource wireframes, Li_2O grade distributions are comparable for fresh and weathered rock. Weathered pegmatite samples have slightly lower grade on average.

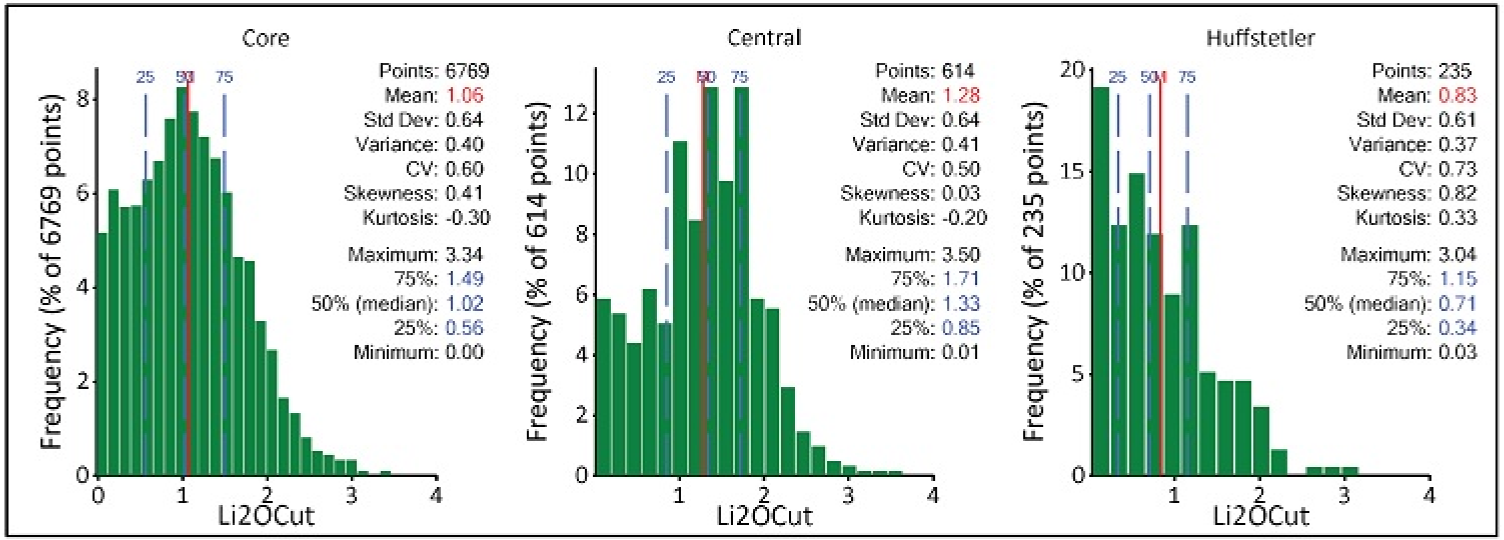


Table 11-1 - Li2O Histograms and Statistics by Property Area

Filters	Area	Count	Min.	Median	Max.	Average	Std. Dev.	CV
Li_2O %	Core	6769.0	0.00	1.02	3.34	1.06	0.64	0.60
	Central	614.0	0.01	1.33	4.10	1.28	0.65	0.50
	Huffstetler	235.0	0.03	0.71	3.04	0.83	0.61	0.73

Quartz

At all properties quartz has a tight symmetrical distribution with very similar average grades ranging from 28.83% at Huffstetler to 29.59% at Core (Table 11-2). All properties have low CVs less than 0.2. Low quartz grade variability is reflected by an interquartile range of 6% or less. There is no significant difference between quartz grade distributions or average grades for fresh and weathered rock.

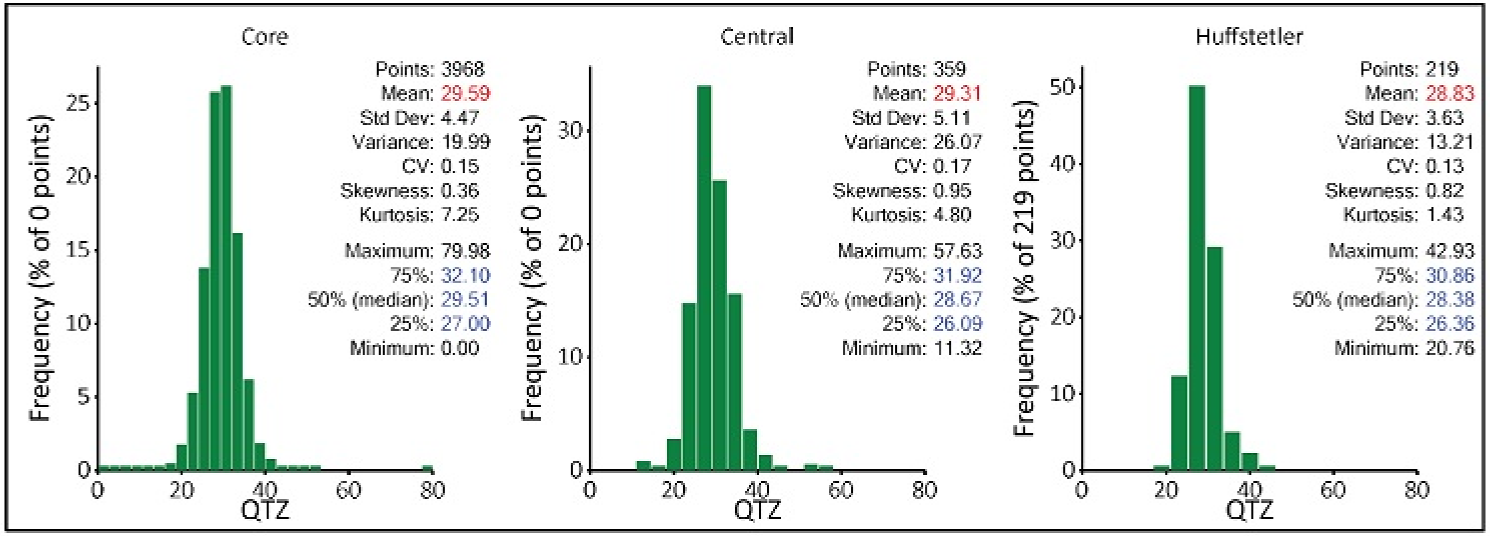


Table 11-2 - Quartz Histograms and Statistics by Property Area

Filters	Area	Count	Min.	Median	Max.	Average	Std. Dev.	CV
Quartz %	Core	3,968.0	0.00	29.51	79.98	29.59	4.47	0.15
	Central	359.0	11.32	28.67	57.63	29.31	5.11	0.17
	Huffstetler	219.0	20.76	28.38	42.93	28.83	3.63	0.13

Albite

At all properties Albite grades have a symmetrical distribution (Table 11-3) and have very similar average grades ranging from 33.39% at Central (where Li grades are highest) to 36.90% at Huffstetler (where Li grades are lowest). All properties have a low CV of 0.3 or less. The average calculated grades show very good agreement with the average logged minerology grades. There is no significant difference between albite grade distributions or average grades for fresh and weathered rock.

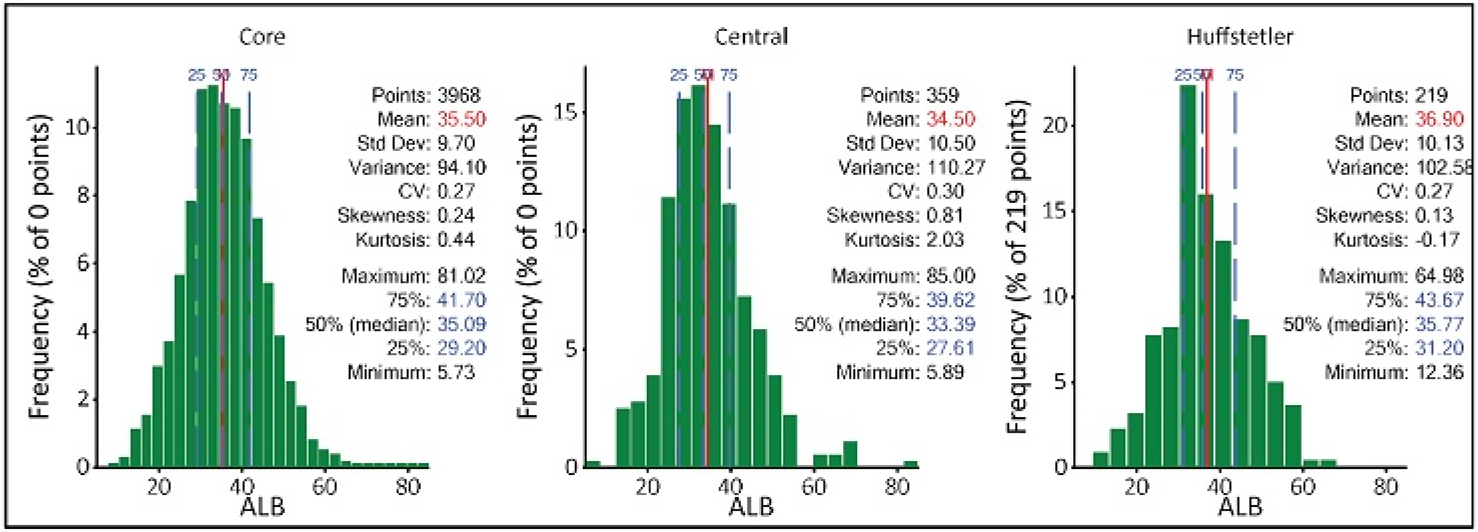

Core
Points: 3968
Mean: 35.50
Std Dev: 9.70
Variance: 94.10
CV: 0.27
Skewness: 0.24
Kurtosis: 0.44
Maximum: 81.02
75%: 41.70
50% (median): 35.09
25%: 29.20
Minimum: 5.73
Frequency (% of 0 points)
ALB
Central
Points: 359
Mean: 34.50
Std Dev: 10.50
Variance: 110.27
CV: 0.30
Skewness: 0.81
Kurtosis: 2.03
Maximum: 85.00
75%: 39.62
50% (median): 33.39
25%: 27.61
Minimum: 5.89
Frequency (% of 0 points)
ALB
Huffstetler
Points: 219
Mean: 36.90
Std Dev: 10.13
Variance: 102.58
CV: 0.27
Skewness: 0.13
Kurtosis: -0.17
Maximum: 64.98
75%: 43.67
50% (median): 35.77
25%: 31.20
Minimum: 12.36
Frequency (% of 219 points)
ALB

Table 11-3 - Albite histograms and statistics by property area

Filters	Area	Count	Minimum	Median	Maximum	Average	Std. Dev.	CV
Albite %	Core	3,968.0	5.73	35.09	81.02	35.50	9.70	0.27
	Central	359.0	5.89	33.39	85.00	34.50	10.50	0.30
	Huffstetler	219.0	12.36	35.77	64.98	36.90	10.13	0.27

K-Spar

At Core and Central properties, K-spar grades have asymmetric distributions with a moderate to strong positive skew (Table 11-4). At Core and Central, most grades (75%) are below 13% with mean grade of 9.54% and a CV of approximately 0.62. At Huffstetler, the distribution is less skewed with a higher average K-Spar grade of 12.16% and lower CV of 0.39. The average calculated grade is comparable to the average logged minerology grade of 12% K-spar. Weathered pegmatites have lower K-spar values across all grade ranges.

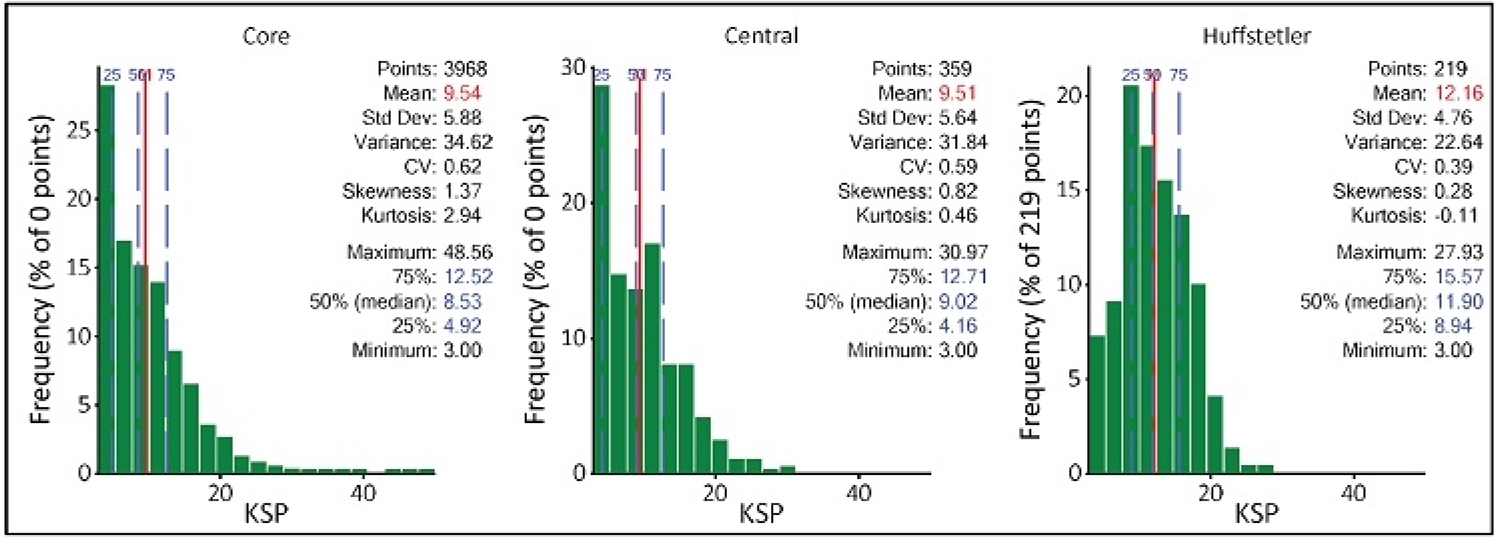


Table 11-4 - K-spar Histograms and Statistics by Property Area

Filters	Area	Count	Min.	Median	Max.	Average	Std. Dev.	CV
K-spar %	Core	3,968.0	3.00	8.53	48.56	9.54	5.88	0.62
	Central	359.0	3.00	9.02	30.97	9.51	5.64	0.59
	Huffstetler	219.0	3.00	11.90	27.93	12.16	4.76	0.39

Muscovite

At all properties Muscovite grades have a positively skewed distribution (Table 11-5) with a long tail of high grades. At all properties, 90% percent of samples have a muscovite grade of 7% or less, while the remaining 10% have grades ranging up to 19.41% at Core and 11.66% at Huffstetler. The Core property has an average grade of 4.29% and a CV of 0.46. Central and Huffstetler have an average muscovite grade of 3.3%, lower than at Core. The average calculated grades show very good agreement with the average logged minerology grades. Pegmatites above the base of saprolite surface have higher muscovite values across all grade ranges. This is in accordance with observed weathering of K-spar to muscovite.

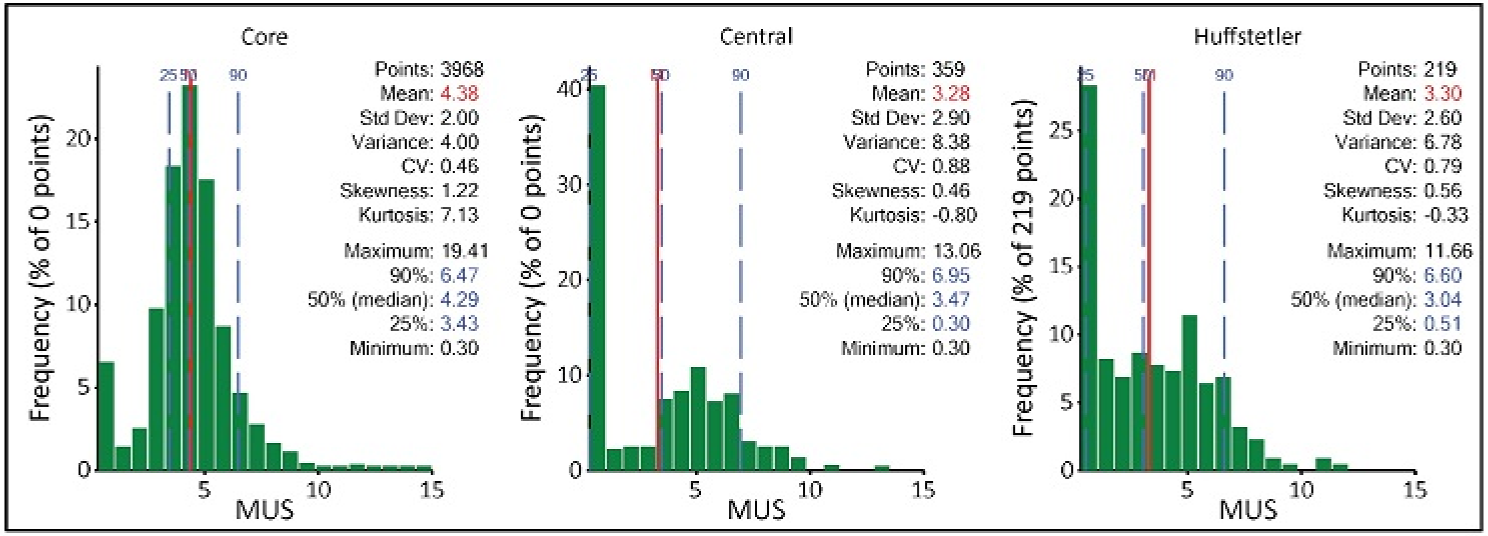


Table 11-5 - Muscovite histograms and statistics by property area

Filters	Area	Count	Min.	Median	Max.	Average	Std. Dev.	CV
Muscovite %	Core	3,968.0	0.30	4.29	19.41	4.38	2.00	0.46
	Central	359.0	0.30	3.47	13.06	3.28	2.90	0.88
	Huffstetler	219.0	0.30	3.04	11.66	3.30	2.60	0.79

11.1.4 Treatment of Outliers

A review of grade outliers was undertaken to ensure that extreme grades are treated appropriately during grade interpolation. Although extreme grade outliers within the grade populations of variables are real, they are potentially not representative of the volume they inform during estimation. If these values are not cut, they have the potential to result in significant grade over-estimation on a local basis.

Lithium

At Core a review of composite statistics did not present a compelling case for the application of top cuts. The CV of all domained composites is close to one (see statistics and histograms in Table 11-1). For individual domains, CVs are less than one. An inflection at the 99.8 percentile grade of 2.8% Li_2O is seen in the probability plot for composite Li_2O grades. This value was used to identify “extreme grades” samples that are compared to surrounding sample grades. The majority of extreme grades are encountered in high-grade portions of the deposit, and they are well constrained by surrounding drillholes. In domains 1220, 3311, 4210, 5210 and 5220 twelve extreme grades ranging from 3.02% to 4.30% Li_2O were unusually high relative to surrounding samples and were capped at 3.0% Li_2O.

At Central, a sample with an extreme grade of 4.10% Li_2O was identified in hole 19-CT-014 within domain 6220 which was particularly high relative to surrounding samples and was capped at 3.5% Li_2O.

At Huffstetler, no extreme grade samples were identified, and none were capped.

By-Product Minerals

In general, domained mineral grade data show distributions that are not heavily skewed and do not contain extreme values. The CVs for these grade data are less than one. On this basis, it is not necessary to cap by-product mineral grades.

11.1.5 Geostatistical Analysis

Modeled spodumene-bearing pegmatites were grouped into orientation domains. For each orientation domain a representative pegmatite, or set of pegmatites, with a sufficient number of samples was selected to generate meaningful lithium grade variation models that could support block model estimation.

Lithium

Composite Li_2O values underwent a normal score transform prior to being assessed for anisotropy, or directional dependence. Maps of Li_2O value continuity were used to investigate the strike, dip, and pitch direction axis of spodumene mineralization trends within the domains. For all domains, semi-variogram charts for Li_2O were modeled using two spherical functions. Normal score variograms were back-transformed to give the semi-variogram parameters used for estimation.

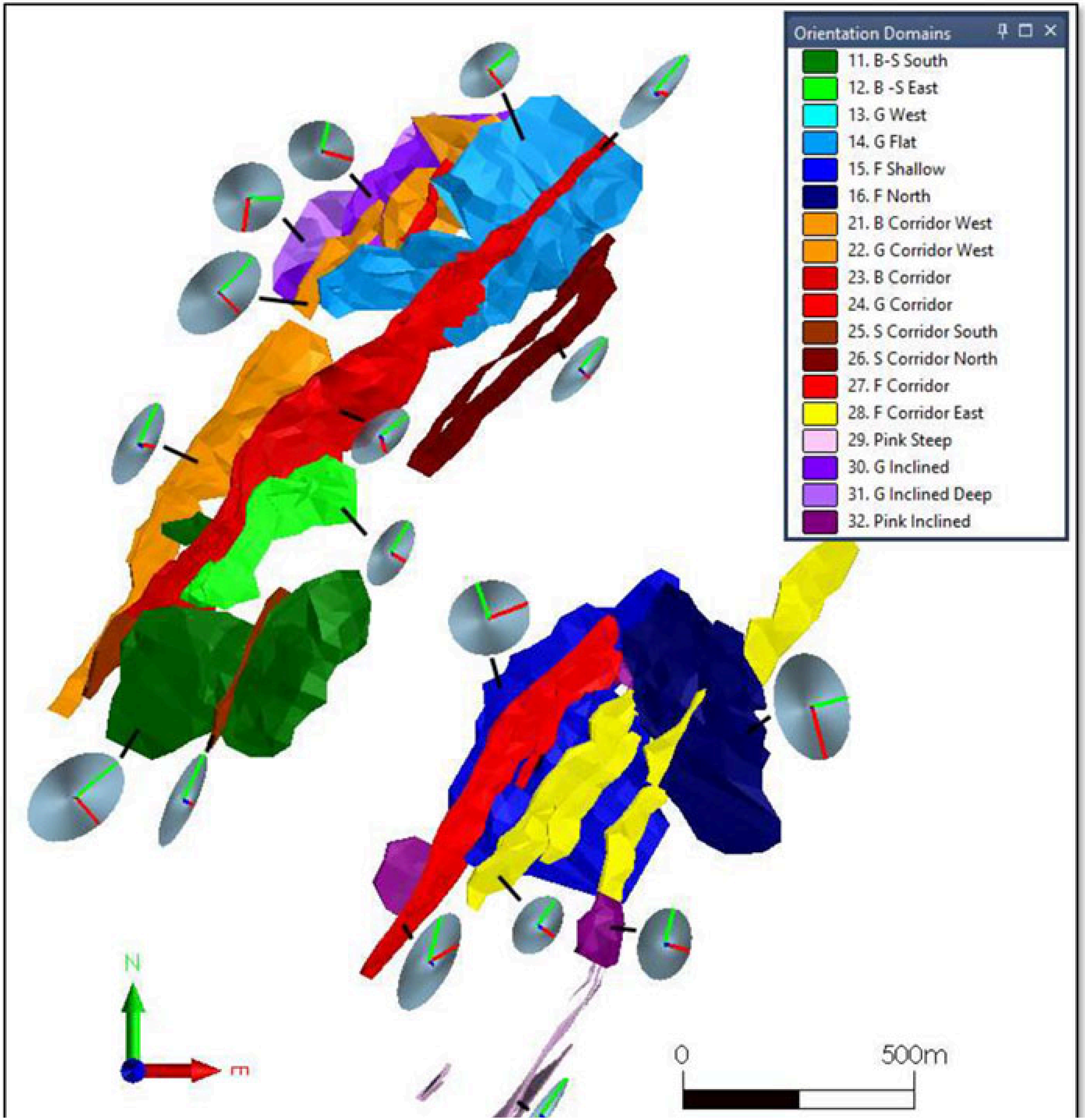
Core Property: Fourteen (14) orientation domains were identified, wireframes colored by orientation domain are shown in Figure 11-2 with corresponding mineralization trends. Along strike and down dip Li_2O grade continuity typically ranges from 80 m to 110 m with shorter ranges in more thin, variable or discontinuous domains. Across strike and down hole variograms indicate short grade continuity across pegmatites with ranges typically less than 15 m. Nugget effect (i.e., short range grade variability) at the Core deposit is low with domain nugget values averaging 25%, indicative of the Li_2O low-grade variability.

Central Property: Three (3) orientation domains were identified. Wireframes colored by orientation domain are shown in Figure 11-3 with corresponding mineralization trends. Central mineralization trends are broadly comparable to those at Core.

Huffstetler Property: Two (2) orientation domains were identified, and wireframes colored by orientation domain are shown in Figure 11-3 with corresponding mineralization trends. Huffstetler mineralization trends are broadly comparable to those at Core.

By-Product Minerals

Semi-variogram models for Li_2O are appropriate for modeling of by-product minerals.


Orientation Domains
11. B-S South
12. B -S East
13. G West
14. G Flat
15. F Shallow
16. F North
21. B Corridor West
22. G Corridor West
23. B Corridor
24. G Corridor
25. S Corridor South
26. S Corridor North
27. F Corridor
28. F Corridor East
29. Pink Steep
30. G Inclined
31. G Inclined Deep
32. Pink Inclined
N
E
0
500m

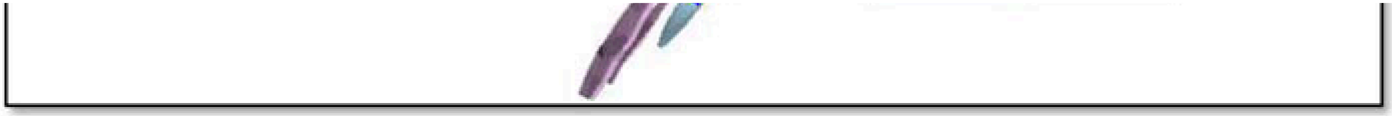


Figure 11-2 - Piedmont Orientation Domains with Associated Search Ellipse for Core Resource

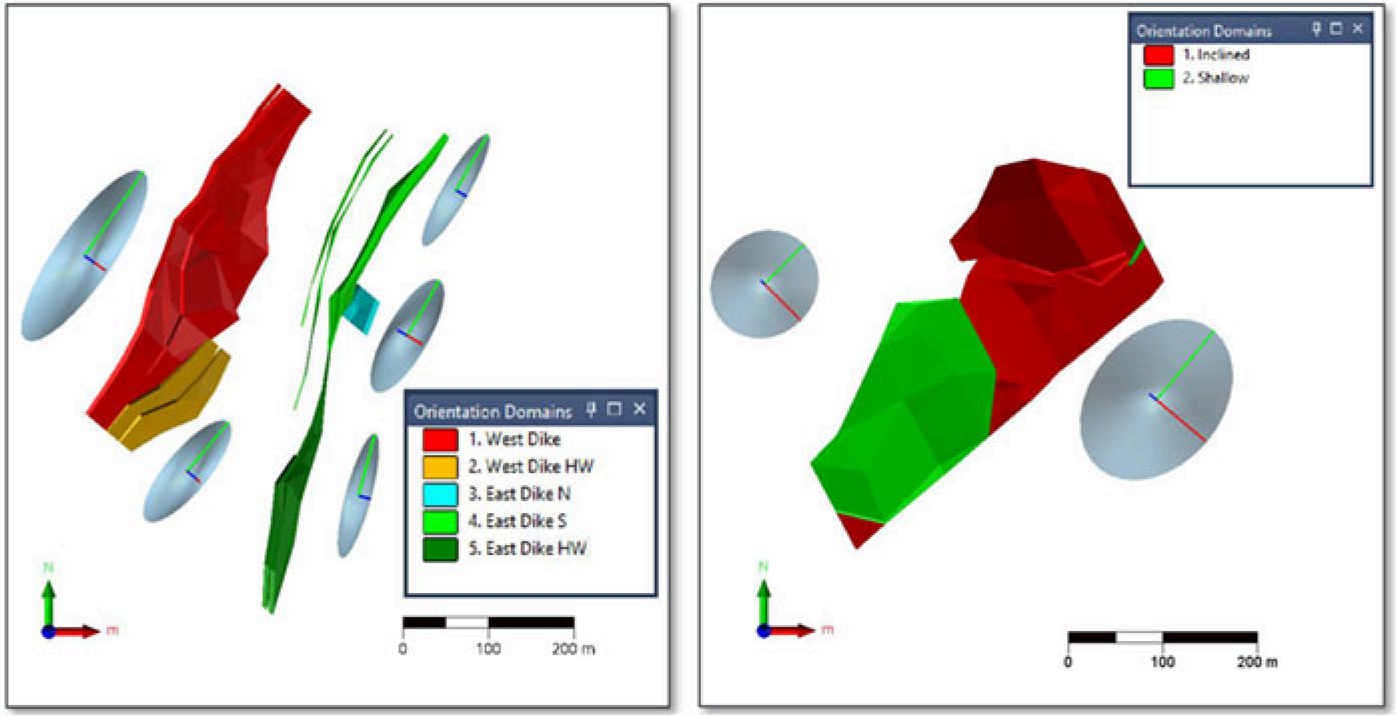


Figure 11-3 - Domains with Search Ellipse for Central Resource (left) and Huffstetler Resource (right).

11.1.6 Density

In situ dry bulk densities for the Core, Central and Huffstetler Mineral Resource were assigned on a lithological basis using representative averages.

Methodology

Dry bulk density measurements for Phase 2 drilling were made on half-core fragments sent for geochemical analysis at SGS using the immersion method (code GPHY04V). One host rock and one spodumene-bearing pegmatite measurement was taken for each drillhole.

Saturated and dry bulk densities for Phase 3, Phase 4 and Phase 5 drill programs were collected by Piedmont geologists using a triple beam scale and the immersion method. Core fragments are typically 6 cm to 10 cm in length and 90 cm^3 to 120 cm^3 in volume. Porosity was considered and porous samples were coated with cling film prior to immersion. During Phase 3 and Phase 4 measurements were primarily collected from the saprolite zone and amphibolite and metasediment host rocks. During Phase 5 measurements were made on all lithologies at regular 10 m intervals with closer spacings in spodumene pegmatites and weathered zones.

The two methods of density measurement are considered appropriate and determinations from each appear reasonable and can be grouped together for subsequent analysis.

Analysis and Results

Sampled intervals were tagged as being above or below the saprolite surface. Density estimates are generated for spodumene-bearing dike, waste, and overburden lithologies within fresh and saprolite weathering domains.

The number of density determinations for individual pegmatite domains is variable, but there is a sufficient number to estimate a representative density for spodumene-bearing dikes. This approach is also used for the other material units in the block model listed above. At all properties, units have low bulk density standard deviations (Table 11-6) which supports the use of representative averages for each material unit.

11.1.6.1.1 Core Property

There is a broad spread of density determinations throughout the Core deposit. Average bulk densities for spodumene bearing pegmatite and waste rock were derived from 3,434 determinations on selected drill core from the Property made by Piedmont geologists in the field and 139 by SGS Labs. Using an updated base of saprolite model generated in August 2021, simple averages presented in Table 11-6 were generated.

Five density determinations made on overburden waste rock material returned spurious values ranging from 0.75 t/m^3 to 0.79 t/m^3 and 2.85 t/m^3 to 5 t/m^3. Four density determinations made on saprolite waste rock material returned spurious values ranging from 3.36 t/m^3 to 9.52 t/m^3. Nine determinations made on saprolite returned spurious low dry bulk density values ranging from 0.21 t/m^3 to 0.79 t/m^3. Two density determinations made on fresh rock had spurious low-density values of 0.99 t/m^3 and 1.22 t/m^3. Four had erroneous high values ranging from 8.27 t/m^3 to 58.61 t/m^3. These results were not used to calculate rock density.

11.1.6.1.2 Central Property

At Central, average bulk densities for spodumene-bearing pegmatite and waste rock were derived from 197 determinations made by Piedmont geologists in the field on selected drill core from the Property. Density of weathered spodumene-bearing pegmatite is taken from available data at Core property as of January 8, 2021. For the Central Property, simple averages presented in Table 11-6 were generated.

11.1.6.1.3 Huffstetler Property

At Huffstetler, average bulk densities for fresh spodumene-bearing pegmatite and waste rock were derived from 55 determinations made by Piedmont geologists in the field on selected drill core from the Property. Densities of weathered spodumene-bearing pegmatite and waste rock are taken from available data at Core property as of February 15, 2021. For the Huffstetler Property, simple averages presented in Table 11-6 were generated.

Table 11-6: MRE Dry Bulk Density Values (t/m^3)

Material		Count	Minimum	Maximum	Average	Standard deviation
Core						
Overburden		165	0.81	2.44	1.31	0.25
Saprolite	Waste	730	0.81	3.35	1.41	0.46
	SPEG	60	1.17	2.71	1.90	0.53
Fresh	Waste	1876	1.05	7.14	2.88	0.18
	SPEG	436	2.15	3.03	2.70	0.09

Material		Count	Minimum	Maximum	Average	Standard deviation
Central						
Overburden		9	0.92	1.59	1.23	0.20
Saprolite	Waste	37	0.84	2.19	1.36	0.30
	SPEG	10	1.22	2.52	1.86	0.45
Fresh	Waste	131	1.68	7.91	2.95	0.50
	SPEG	29	2.55	3.73	2.85	0.24
Huffstetler						
Overburden*		141	0.75	2.85	1.30	0.27
Saprolite	Waste*	602	0.66	3.16	1.36	0.43
	SPEG*	52	1.2	2.93	1.86	0.52
Fresh	Waste	41	2.53	3.02	2.84	0.13
	SPEG	14	2.64	2.81	2.70	0.06

**Includes data from Core as of 15th February 2021.*

11.1.7 Block Modeling

Block Model Construction

Block models created to encompass the full extent of the Core, Central and Huffstetler Properties were constrained by the interpreted pegmatite wireframe model and by DTMs representing weathering and topography boundary surfaces. Block model parameters for each property are shown in Table 11-7.

Block models were rotated to align with pegmatite deposit trends at an azimuth orientation of 35° for the Core deposit and 40° for the Central and Huffstetler deposits. To honor the variable orientation and thinness of the pegmatite domains, parent cell sizes of 6 m (E) by 12 m to 18 m (N) by 6 m to 18 m (Z) were selected. Sub-celling to a minimum block size of 4 m to 6 m along strike, 2 m across strike and 1 m elevation was selected to maintain an appropriate model resolution.

Table 11-7: Block Model Parameters

Deposit	Coordinate	Origin (min)	Range (m)	Parent cell (m)	Sub-cell (m)	No. of sub cells
Core	X	472,503.344	1,854	6	2	284
	Y	3,915,510.429	2,352	12	4	167
	Z	23.5	252	6	1	43
Central	X	472,756.08	550	6	2	275
	Y	3,913,338.51	800	18	6	133
	Z	-29	330	18	1	330

Deposit	Coordinate	Origin (min)	Range (m)	Parent cell (m)	Sub-cell (m)	No. of sub cells
Huffstetler	X	475,594.824	546	6	2	160
	Y	3917221.438	684	12	4	40
	Z	50.50	202	6	1	15

Grade Interpolation

Pegmatite domain shell contacts are interpreted as hard boundaries for grade interpolation, such that Li_2O, quartz, feldspar, and muscovite grades in one domain cannot inform blocks in another domain.

The Kriging interpolation method uses measured mineralization trends to weight composite assay values when estimating block grades. The Ordinary Kriging (*OK*) estimation process also incorporates a locally varying average sample grade and is therefore an appropriate method for estimating block grades at the Piedmont deposits where mineralization has a locally variable nature.

For validation purposes, an IDW interpolation was also undertaken. The IDW technique weights sample grades proportionally to the inverse of their distance from the block raised by a power of three (IDW^3).

For the Core, Central and Huffstetler Property deposit models, blocks were estimated in multiple passes with at least three drillholes informing the block, minimum of 10 samples, maximum of 12 samples and a maximum of four samples per drillhole. A maximum of four samples per hole and a minimum of eight resulted in at least two drillholes being used. Search parameters are presented in Table 11-8.

Table 11-8: Search parameters

	Pass 1	Pass 2	Pass 3	Pass 4*
Search volume multiple	× 1	× 2	× 4	× 6
Minimum samples	8	8	8	4
Maximum samples	16	16	16	16
Maximum per hole	4	4	4	3
Discretization	3 x 3 x 3			
Boundaries	Hard			
Ellipse Segments	1			

**Applied to a small number of blocks.*

Up to four search passes were used if block was not estimated in the first pass. The first search distance was equal to approximately 50% of the variogram range; subsequent searches were undertaken using two and four times this distance. A small number of blocks did not receive an estimate in passes one to three. For these domains, an additional “filler” search run was used that allowed a minimum of four samples and a maximum of three samples per hole.

For a given block, the closest composite sample grades are the best indicators of the likely block grade. De-clustering via an octant search method was not necessary. The estimation performed using a 3 × 3 × 3 discretization of the parent block.

11.1.7.1.1 Lithium

The search ellipses detailed in Table 11-9 were used for both OK and IDW^3 estimates.

11.1.7.1.2 By-Product Minerals

Grades for by-product minerals were estimated independently using OK in a univariate sense, using the same search ellipses and parameters utilized for the lithium resource. This was done with the goal of ensuring block grade proportions and grade correlations honor input samples, and that mineral grade estimates approach 100%.

Table 11-9: Search Ellipse Parameters

ORIENTATION DOMAIN	ORIENTATION			RANGE		
	Strike	Dip	Plunge	Major	Semi-major	Minor
Core Property						
11. B-S South	50.0	-5.0	9.0	120.0	80.0	15.0
12. B -S East	30.0	0.0	15.0	80.0	40.0	15.0
13. G West	45.0	0.0	15.0	40.0	40.0	15.0
14. G Flat	50.0	0.0	15.0	75.0	50.0	15.0
15. F Deep	-20.0	-4.0	3.0	80.0	90.0	15.0
16. F Shallow	75.0	0.0	10.0	80.0	120.0	15.0
21. B Corridor West	26.0	-12.0	54.0	100.0	60.0	15.0
22. G Corridor West	45.0	0.0	35.0	110.0	80.0	15.0
23. B Corridor	53.2	15.2	48.2	80.0	60.0	15.0
24. G Corridor	39.7	-17.2	58.4	110.0	50.0	15.0
25. S Corridor South	25.0	0.0	65.0	110.0	60.0	15.0
26. S Corridor North	40.0	0.0	70.0	90.0	80.0	15.0
27. F Corridor	14.3	-31.8	47.6	120.0	110.0	15.0
28. F Corridor East	35.0	0.0	65.0	70.0	90.0	15.0
29. Pink Steep	35.0	0.0	85.0	100.0	100.0	15.0
30. G Moderate	92.2	18.9	16.7	80.0	80.0	15.0
31. G Moderate East	50.0	0.0	25.0	65.0	80.0	15.0
32. Pink Steep	15.0	0.0	45.0	80.0	80.0	15.0
Central Property						

1. West Dike	35	0	70	120	90	15
2. West Dike HW	40	0	70	75	60	15
3. East Dike N	30	0	90	75	60	15

ORIENTATION DOMAIN	ORIENTATION			RANGE		
	Strike	Dip	Plunge	Major	Semi-major	Minor
4. East Dike S	15	0	90	75	60	15
5. East Dike HW	30	0	-70	75	60	15
Huffstetler						
1. Inclined	40.0	0.0	-40.0	95	90	10
2. Shallow	45.0	0.0	-25.0	60	60	10

11.2 BLOCK MODEL VALIDATION

Validation of the Core Property and Central Property block model grade estimates was completed by:

- Visual checks on screen in cross-section and plan view to ensure that block model grades honor the grade of sample composites;
- Statistical comparison of composite and block grades;
- Generation of swath plots to compare input and output grades in a semi-local sense, by easting, northing, and elevation.

11.2.1 Visual Validation

For all properties, block grades correlate very well with input sample grades. The distribution and tenor of grades in the composites are well honored by the block model and are appropriate considering known levels of grade continuity and the variogram.

- Core: Poorly informed deposit areas with widely spaced samples are more smoothed which is expected. Example cross-section views of block models colored by Li_2O are shown in Figure 6-5 and Figure 6-6;
- Central: As in the Core Property block model, poorly informed deposit areas with widely spaced samples are more smoothed. An example cross-section views of block models colored by Li_2O are shown in Figure 6-7;
- Huffstetler: As in the Core Property block model, poorly informed deposit areas with widely spaced samples are more smoothed. An example cross-section views of block models colored by Li_2O are shown in Figure 6-8.

11.2.2 Comparison of Means

A comparison of the average Li_2O, quartz, albite, K-spar and muscovite grade of input composites and estimated block grades was undertaken for each resource estimate domain. For major domains that account for the majority of the resource model volumes at each property, a further comparison was made between de-clustered composite Li_2O grades and estimated block grades.

Core

The mean input composite grade and both the OK and IDW block model grades are comparable. The volume weighted average of Li_2O grades estimated by OK is equal to input samples. For 72 of 76 domains, differences are within ±10% for Li_2O grade estimates. Larger differences are seen for domains with greater grade variance, and/or fewer samples. Comparable results are seen for by-product minerals.

For 14 major domains, accounting for 55% of the Core resource model volume, both the OK and IDW method are within ±3% of de-clustered input composite mean grades and have an average difference of 0.72% and 2.68% respectively (Table 11-10).

Table 11-10: Comparison of Means for Major Core Property MRE Domains

Domain	Sample Count	Li_2O Mean	Declus Mean	Block Count	Li_2O OK	Diff. OK	Li_2O ID^3	Diff. ID^3
B Corridor South (1220)	125	1.36	1.40	6,901	1.44	2.56	1.44	2.74
B Corridor (2210)	298	0.92	0.95	30,769	0.95	-0.32	0.97	1.87
B Corridor (2220)	512	1.11	1.10	38,394	1.13	3.12	1.13	2.78
B Corridor (2221)	200	0.82	0.82	10,951	0.84	2.96	0.85	3.47
G Corridor (3230)	443	1.16	1.14	32,096	1.12	-1.43	1.13	-0.46
G Inclined (3321)	111	0.92	0.90	16,641	0.93	3.61	0.94	4.62
G Flat (3321)	251	1.25	1.25	20,211	1.24	-0.71	1.27	1.52
S Corridor (4110)	225	1.25	1.23	12,386	1.19	-3.53	1.24	0.80
F Flat (5110)	235	1.08	1.09	13,289	1.13	3.73	1.18	7.52
F Flat (5120)	372	1.20	1.14	19,341	1.15	0.97	1.19	4.19
F Corridor (5210)	447	1.13	1.14	33,657	1.12	-1.89	1.14	-0.35
F Corridor (5220)	208	1.08	1.10	14,153	1.13	2.84	1.13	2.22
F Corridor (5230)	179	0.89	0.87	17,135	0.89	1.59	0.91	4.39
F Corridor (5250)	172	1.33	1.24	17,670	1.25	0.99	1.35	9.05
All						0.72%		2.68%

Central

The volume weighted average of Li_2O grades estimated by OK are 5% lower than input samples. For 8 of 10 domains, differences are within ±10% for Li_2O grade estimates. Larger differences are seen for domains with greater grade variance, and/or fewer samples. Comparable results are seen for by-product minerals. For two major domains, accounting for 70% of the Central resource model volume, both the OK and IDW method differences are within ±5% of de-clustered input composite mean grades and have an average difference of 0.45% and 2.48% respectively (Table 11-11).

Table 11-11: Comparison of means for Central Property MRE domains

Domain	Sample Count	Li_2O Mean	Declus Mean	Block Count	Li_2O OK	Diff. OK	Li_2O ID^3	Diff. ID^3
West Dike (6210)	173	1.21	1.17	55,650	1.17	-0.18	1.20	3.05
East Dike (6220)	230	1.47	1.42	29,016	1.44	1.66	1.45	2.54
All						0.45%		2.48%

Huffstetler

The volume-weighted average of Li_2O grades estimated by OK are 5% higher than input samples. For 6 of 8 domains, differences are within ±10% for Li_2O grade estimates. For two major domains, accounting for 69% of the Huffstetler resource model volume, both the OK and IDW method differences are within ±5% of de-clustered input composite mean grades and have an average difference of 3.51% and 0.62% respectively.

Table 11-12: Comparison of means for Huffstetler Property MRE domains

Domain	Sample Count	Li_2O Mean	Declus Mean	Block Count	Li_2O OK	Diff. OK	Li_2O ID^3	Diff. ID^3
Inclined (7310)	116	0.92	0.97	57,223	1.01	5.07	0.97	0.73
Shallow (7311)	41	0.65	0.58	21,254	0.57	-0.69	0.58	1.39
All						3.51%		0.62%

11.2.3 Swath Plots

Swath plots were generated for the for major domains that account for the majority of resources each property. Swath plots compare the grades of composites and grade estimates that fall within regular slices along strike and depth slices. Plots identify slices that contain high-grade samples and low-grade blocks, or vice versa, which might indicate a problem with the estimation technique.

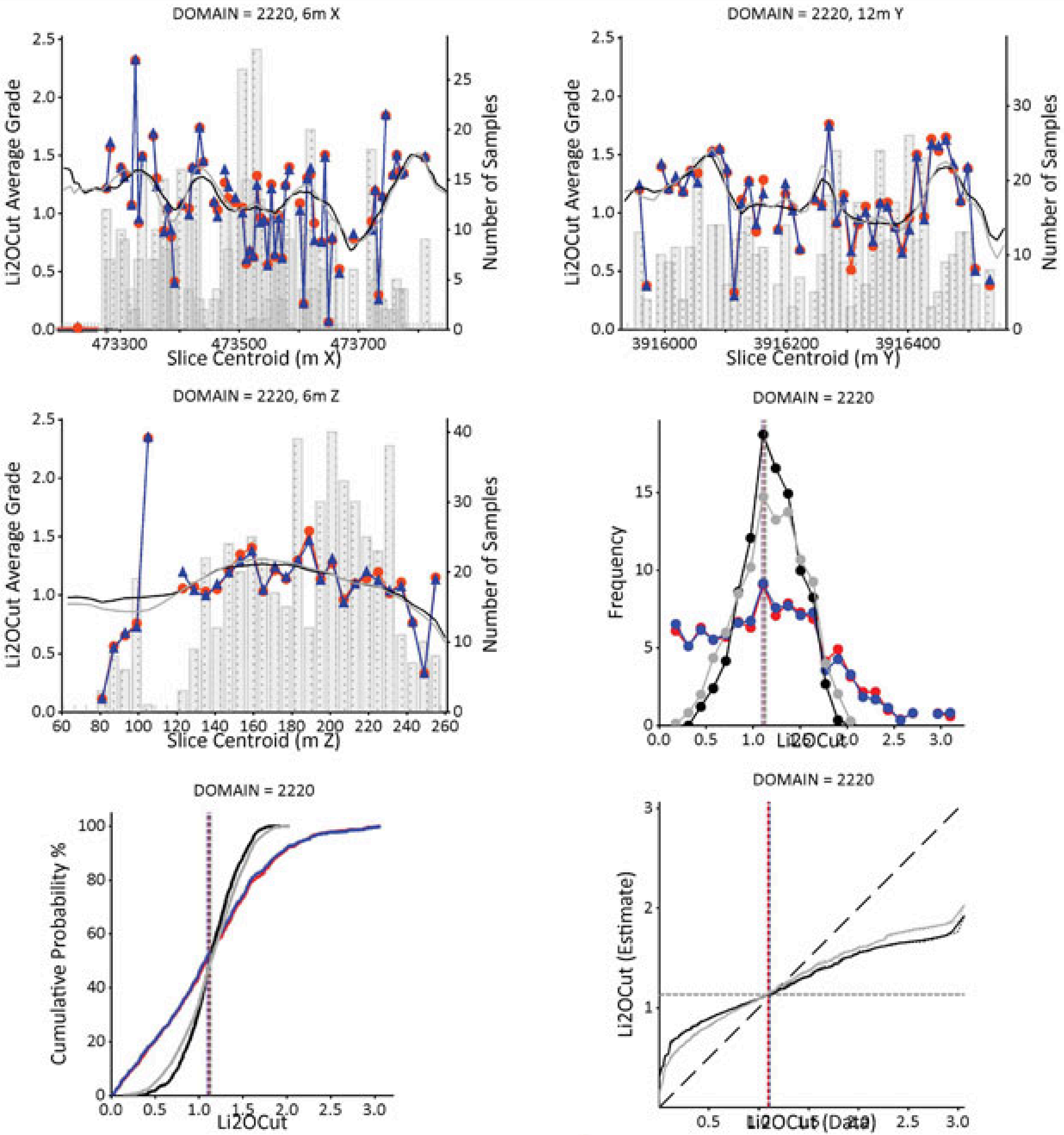
For all domains, block grades estimated by OK and IDW^3 have a smoother profile relative to input samples. Where there are more samples, good agreement is seen between the trends of input composites and block grades estimated by each technique. The OK profile is slightly smoother than IDW. Both models reflect drillhole data on a local basis.

Core

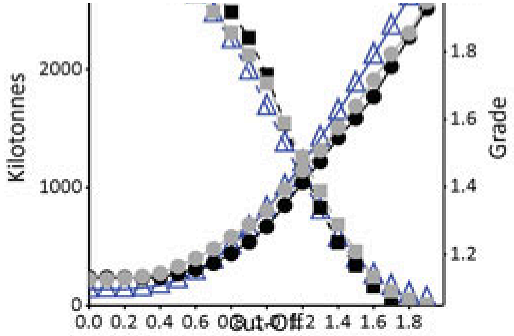
Swath plots were generated for the 14 major domains which compare the grades of composites and grade estimates that fall within 12 m northing slices and 4 m easting and elevation slices. Example swath plots for Li_2O in the B_S_20 domain are shown in Figure 11-4.

Central

Swath plots were generated for the two major domains which compare the grades of composites and grade estimates that fall within 20 m northing slices and 5 m easting and elevation slices. The OK profile is slightly smoother than IDW. Both models reflect drillhole data on a local basis.



Validation plots include swath plots, histograms, CDF plots, Q-Q plots and GCOS plots (generated using the Li2O variogram used for estimation)



Li_2O variogram used for estimation).

Sample data:

Red – composite data,

Blue – de-clustered data (based on de-clustering weights for Li_2O grades).

Model data:

Black – OK block estimates,

Grey – IDW3 block estimates.

Figure 11-4 - Validation Plots for the B_S_20 Domain

11.2.4 Correlation Coefficients

The correlation coefficient between modeled variables was compared with input data derived from lithium assays and normative calculations.

Both positive and negative correlations between variables are present in input composites and the block model. Although regularized weight percent grades are modeled independently in a univariate sense, the selected search parameters result in block model grade estimates that broadly honor mineral grade correlations in input composites.

Table 11-13: Comparison of correlation coefficients for Core assay and block data

	Li_2O comp	Li_2O blocks	QTZ comp	QTZ blocks	ALB comp	ALB blocks	KSP comp	KSP blocks	MUS comp	MUS blocks
Li_2O	1.00	1.00								
QTZ	0.15	0.04	1.00	1.00						
ALB	-0.56	-0.31	-0.46	-0.51	1.00	1.00				
KSP	-0.02	-0.12	-0.28	-0.24	-0.30	-0.37	1.00	1.00		
MUS	-0.22	-0.25	0.30	0.45	-0.18	-0.16	-0.27	-0.27	1.00	1.00

Table 11-14: Comparison of correlation coefficients for Central assay and block data

	Li_2O comp	Li_2O blocks	QTZ comp	QTZ blocks	ALB comp	ALB blocks	KSP comp	KSP blocks	MUS comp	MUS blocks
Li_2O	1.00	1.00								
QTZ	0.15	0.11	1.00	1.00						
ALB	-0.59	-0.46	-0.47	-0.45	1.00	1.00				
KSP	-0.06	-0.13	-0.31	-0.27	-0.32	-0.39	1.00	1.00		
MUS	-0.20	-0.25	0.32	0.38	-0.13	-0.11	-0.26	-0.28	1.00	1.00

Table 11-15: Comparison of correlation coefficients for Huffstetler assay and block data

	Li_2O comp	Li_2O blocks	QTZ comp	QTZ blocks	ALB comp	ALB blocks	KSP comp	KSP blocks	MUS comp	MUS blocks
Li_2O	1.00	1.00								
QTZ	-0.22	-0.27	1.00	1.00						
ALB	-0.63	-0.45	-0.39	-0.22	1.00	1.00				
KSP	0.24	0.27	-0.35	-0.55	-0.36	-0.40	1.00	1.00		
MUS	-0.43	-0.62	0.46	0.60	-0.04	0.16	-0.48	-0.57	1.00	1.00

11.3 CLASSIFICATION

The Mineral Resource has been classified in accordance with guidelines specified in the JORC Code and with definitions specified in SEC Regulation S-K 1300. The classification level is primarily based upon an assessment of the validity and robustness of input data and the estimator's judgment with respect to the proximity of resource blocks to sample locations and confidence with respect to the geological continuity of the pegmatite interpretations and grade estimates. Significant sources of uncertainly presented in Table 11-16 are considered when classifying resources at the Property.

Table 11-16: Sources of Uncertainty

Uncertainty Source	Discussion
Drilling techniques, drill sample recovery.	Majority of drilling utilizes NQ or larger core diameters that provide representative sample volumes. High core recoveries provide confidence that core samples, and the assay values derived from them, are representative of the material drilled and suitable for inclusion in resource estimation studies.
Logging	Digital lithology files have sufficient information to enable interpretations of pegmatite continuity and orientation. Core logging practices and lithology codes are consistent across exploration phases.
Sampling techniques, assay quality	Comprehensive and documented sampling, security and QA/QC measures were employed for all Piedmont exploration drill programs accounting for 97% of the drill holes in the resource database. Examination of the QA/QC sample data indicates satisfactory performance of field sampling protocols and assay laboratories providing acceptable levels of precision and accuracy.
Location of data points	Reliable collar surveys are available for all drilling. Reliable downhole surveys are available for recent drilling. Survey data allow modeling of pegmatite intercepts with high degree of spatial accuracy.
Data processing and handling,	Geological and geotechnical observations are recorded digitally using the Geospark® Database System directly into a central relational database using standardized logging codes developed for the project. To minimize risk of transcription errors sample data and analytical results are imported directly into the central database from the independent laboratory. An extract of the Core database was validated for internal integrity via Micromine® validation functions.
Data spacing and distribution	Deposits are well understood based on surface pegmatite outcrops and extensive drilling at spacings sufficient to provide multiple points of observation for modeled geological features. Lithology domain and grade continuity are well established where drill density is greater than 40 m x 40 m; however, there remain portions of the Core, Central and Huffstetler Properties where sample density is insufficient to establish continuity beyond an Inferred level. On the Core Property: ● Thin, sub 2 m true thickness, dikes and inclined sheets throughout the B-G, S and F corridors. ● Dikes informed by widely spaced drilling at the north-western end of the B-G Corridor and S Corridor and the Pink Dike in the East Pit Extension area of the F Corridor. ● Inclined sheets and sills informed by widely spaced drilling at S Corridor south of Beaverdam Creek and eastern and northern parts of the upper sill at F corridor. On the Central Property: ● At the periphery of major dikes to the south and at depth, ● Thin, sub 2 m true thickness, dikes and inclined sheets throughout the Property. On the Huffstetler Property: ● The entire deposit is Inferred.
Geological Modelling	Geological models are underpinned by a good understanding of the deposit geology. Mineral resources are controlled by the presence of spodumene pegmatite, and the intensity of spodumene alteration to muscovite and amount of weathering. Spodumene pegmatite dikes were modeled based on input drillhole data at nominal 40 m spacings, including orientated core measurements, and surface mapping. Where drill data is sparse alternative interpretations of the continuity of individual pegmatites between holes could be made. Alternate interpretations would adjust tonnage estimates locally but would not likely yield a more geologically reasonable result. Pegmatites are un-zoned Albite – Spodumene type with unproblematic minerology. Within resource pegmatites, discrete zones of intense spodumene to muscovite alteration result locally lower Li_2O grades. A small portion of resource pegmatite (i.e. <5%) extends into weathered rock and has a variable clay content (<25%) that may be associated with locally lower Li_2O grades.

Uncertainty Source	Discussion
Estimation	Lithium and by-product grade estimation and modeling techniques are classified as robust after consideration of the validation exercises undertaken as part of this study. Grade data have distributions with limited skew, and few extreme values, allowing established linear estimation techniques to be used. Estimated block grades reflect input samples, are not sensitive to cut-off grade choice, and are comparable when calculated by OK or IDW^3 methods. At the current typical data spacing (i.e., 40 m x 40 m), pegmatites appeared curvi-planner and were estimated using domain scale anisotropy models with appropriately large parent block sizes. Where data is closer spaced, local undulations in pegmatite morphology could be resolved better using dynamic (i.e., locally adjusting) anisotropy models with smaller block sizes. Estimated in situ dry bulk densities were assigned to resource pegmatites and waste rocks on a weathering domain basis using representative averages obtained from an extensive database of bulk density determinations. No correlation was modeled between density and pegmatite Li_2O grade, or individual waste rock units.
Deleterious Elements	Within the Core resource model, deleterious elements, such as iron are reported to be at acceptably to low levels. Metallurgical test work demonstrates that deleterious elements will not impede the economic extraction of the modeled spodumene hosted lithium and by-product minerals. Core Property pegmatites have comparable mineralogical and physical properties to pegmatites at the Central and Huffstetler properties.

Resource classification was undertaken using classification boundary strings assigned to the block model in a “cookie-cutter” fashion. Strings define a region of blocks that, on average, met criteria set out in Table 11-17.

Table 11-17: Classification Criteria and Justification

Classification	Criteria and Justification
Inferred	Criteria: All blocks captured in pegmatite dike interpretation wireframes below the topography surface are classified as Inferred. Intensely weathered near surface pegmatite segments, or zones of intensely altered pegmatite are classified as Inferred, irrespective of local drill spacing. Justification: As detailed in *Table 11-16,* spodumene pegmatite is modelled where supported by at least limited data of sufficient certainty and spacings (i.e., 80 m) to enable a reasonable estimate of Mineral Resource quantity and grade.
Indicated	Criteria: Indicated Resources are defined within major pegmatite dikes that have an along strike and down dip continuity greater than 200 m and 50 m respectively and are informed by at least two drillholes and eight samples within a range of approximately 30 m to the nearest drillhole in the along strike or strike and down dip directions. Justification: As detailed in *Table 11-16*, multiple drill holes at a nominal spacing of 40 m can provide adequate data to resolve major spodumene pegmatites with a certainty to support broad estimates of Mineral Resource quantity and grade adequate for long-term mine planning.
Measured	Criteria: No Measured Resources are estimated. Justification: Data density does not allow conclusive spodumene pegmatite, weathering domain, and waste rock resolution that can support local estimates of Mineral Resource quantity and grade that are adequate for detailed mine planning.

Distance between drill holes and Indicated and Inferred resource blocks is shown in Figure 11-5, 75% of Indicated resource blocks are within 27 m to the nearest drill hole. The resource classification applied at the Core and Central properties is illustrated in Figure 11-6.

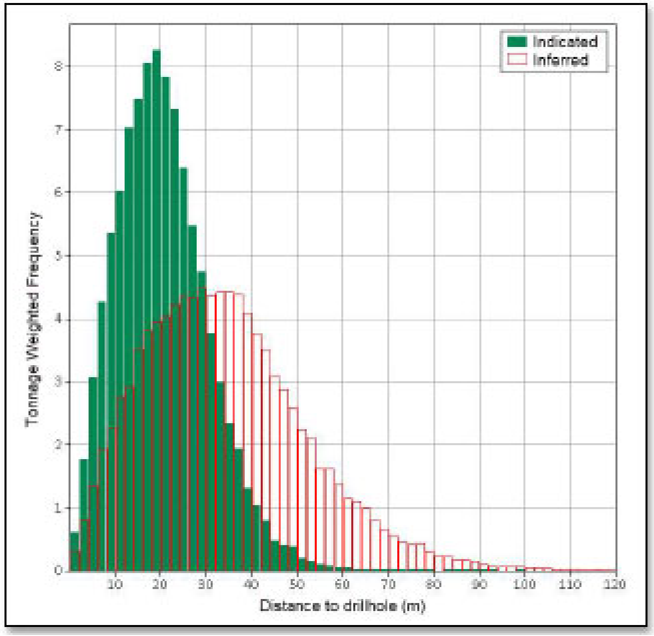


Figure 11-5 - Classified Block Distances from Drill Hole

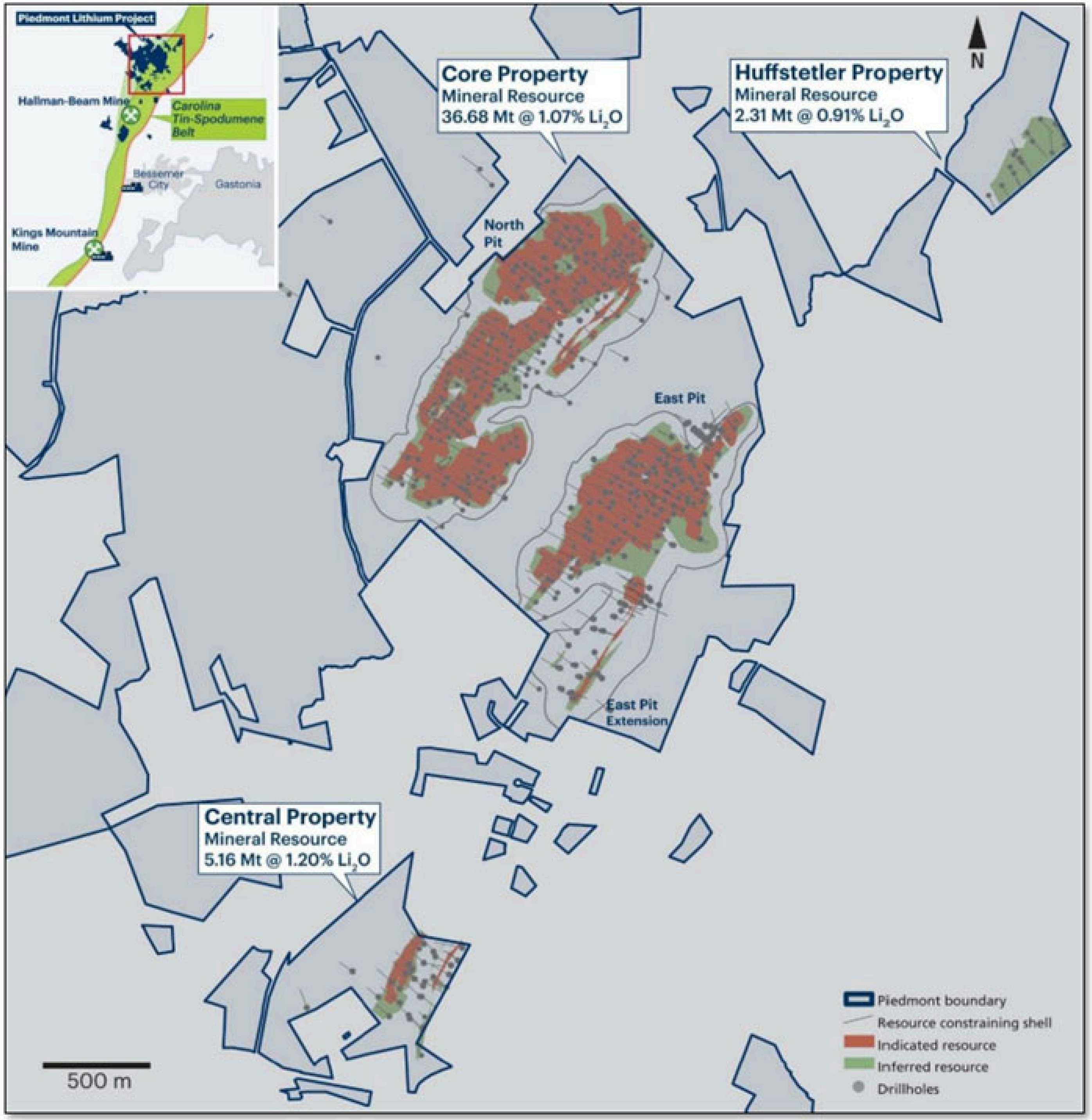

Piedmont Lithium Project
Hallman-Beam Mine
Carolina Tin-Spodumene Belt
Bessemer City
Gastonia
Kings Mountain Mine
Core Property
Mineral Resource
36.68 Mt @ 1.07% Li2O
Huffstetler Property
Mineral Resource
2.31 Mt @ 0.91% Li2O
N
North Pit
East Pit
East Pit Extension
Central Property
Mineral Resource
5.16 Mt @ 1.20% Li2O
Piedmont boundary
Resource constraining shell
Indicated resource
Inferred resource
Drillholes
500 m

Figure 11-6 - Carolina Lithium Property Mineral Resource Classification

11.4 REASONABLE PROSPECTS FOR ECONOMIC EXTRACTION

SEC Regulations S-K 1300 require that all reports of Mineral Resources must have reasonable prospects for eventual economic extraction regardless of the classification of the resource.

The depth, geometry, and grade of pegmatites at the Piedmont Project make them amenable to exploitation by open cut mining methods. Inspection of drill core from the Carolina Lithium Project properties and the close proximity of open pit mines in similar rock formations indicate that ground conditions are suitable for this mining method.

11.4.1 Lithium

The lithium Mineral Resource has been reported above a cut-off of 0.4% Li_2O cut-off which approximates cut-off grades used at comparable spodumene-bearing pegmatite deposits exploited by open pit mining.

As detailed in the 2021 Scoping Study, Mineral Resources are amenable to exploitation by an integrated operation with an open pit mine and concentrator supplying spodumene concentrate to a lithium hydroxide chemical plant. The Scoping Study envisioned a multi-decade mine life and the application of conventional mining and processing technology. PLL has used Roskill's long term lithium hydroxide price average of US$15,239/t $LiOH{\cdot}H_2O$ as the basis determining reasonable prospects for eventual economic extraction. $LiOH{\cdot}H_2O$ recovery parameters include a spodumene concentration recovery of 80% and a $LiOH{\cdot}H_2O$ processing recovery of 89% which together result in an overall metallurgical recovery of 71.2%.

11.4.2 By-Products

Quartz, feldspar, and muscovite mica occur as essential rock-forming minerals of the Carolina Lithium Project pegmatites and comprise approximately 80% of the mineral assemblage and estimated Mineral Resources that are reported in Table 6-1.

Feldspar and mica have been historically mined and produced from North Carolina where spodumene -bearing pegmatite deposits located northwest of Kings Mountain were mined until 1998. The historically mined pegmatite feed grade is quoted to be *"20% spodumene, 32% quartz, 27% albite, 14% microcline, 6% muscovite, and 1% trace minerals*", and that the "*fairly uniform grade of the crude ore allowed recovery of feldspar and mica by-products*" (Kestler, 1961).

Bulk samples of the quartz, feldspar and mica by-products from the Piedmont deposits have been evaluated for attributes such as product size distribution, chemical composition, purity, and color. Piedmont lithium announced the results of by-product test work programs undertaken at SGS Lakefield on May 13, 2020, and at North Carolina State University's Mineral Research Laboratory on September 4, 2018. Test work results demonstrate that by-products have specifications that are marketable to prospective regional customers in the solar glass, engineered quartz, ceramic tile, and other industries.

On 17 July 2021, the company announced an evaluation of by-product metallurgical testwork results, planned production volumes, and potential market applications. Independent consultant John Walker, working together with Piedmont joint-venture partner- Pronto Minerals and the Company, have estimated the market opportunities for Piedmont by-products as shown in Table 11-18. Quartz and feldspar recoveries are assumed to be 50.8% and 51.1% respectively. Mica recovery is assumed to be 35.5%. An updated study of by-product recovery is underway but has not been concluded as part of this Initial Assessment. The Qualified Person has assumed that recovery concerns will not pose any significant impediment the eventual economic extraction of by-products.

Table 11-18 Market Forecasts and Basket Pricing for By-Products - US$/t (Piedmont, 2021a)

Quartz (t/y)	Feldspar (t/y)	Mica(t/y)	Average Realized Price ($/t) Mine Gate
252,000	392,000	69,700	$79.50

Pegmatites at the Central and Huffstetler properties have comparable physical properties to those at the Core Property and have similar mineralogical proportions. Central and Huffstetler pegmatites are therefore concluded to have comparable co-product specifications.

The economic extraction by-product Mineral Resources is contingent on the economic extraction of lithium minerals. Therefore, the by-product Mineral Resource is also reported using 0.4% Li_2O cut-off grade. By-product mineral value is not used for pit optimization or for cut-off grade calculation.

11.4.3 Core Property

The Core resource model is constrained by a conceptual pit shell derived from a Whittle optimization using estimated block value and mining parameters appropriate for determining reasonable prospects of economic extraction (Table 11-19). These include: maximum pit slope of 50° and strip ratio of 12, mining cost of US$2.90/t, spodumene concentration cost of US$25/t, a processing cost of US$2,616/t $LiOH{\cdot}H_2O$, a commodity price equivalent to US$15,239/t $LiOH{\cdot}H_2O$ and with appropriate recovery and dilution factors. Material falling outside of this shell is considered to not meet reasonable prospects for eventual economic extraction.

Table 11-19. Piedmont Whittle Resource Constraining Pit Shell Parameters

Item	Value
$LiOH{\cdot}H_2O$ price	US$15,239/t
Mineralization mining cost	US$2.90/t
Waste mining cost	US$2.90/t
Mining recovery	100%
Mining dilution	10%
SC6 concentration cost	US$25/t
Spodumene recovery	80%
$LiOH{\cdot}H_2O$ processing cost	US$2,616/t
$LiOH{\cdot}H_2O$ processing recovery	89%
Pit slope angle	50°

Out of a total tonnage of 37.90 Mt, 36.68 Mt falls within the conceptual shell. Areas excluded include speculative blocks at depth and at the periphery of the deposit. The surface extent of the resource constraining shell is shown in Table 11-19. A cross-section view of the resource constraining shell at the south of B-G and S corridors is shown in Figure 6-5 and at the F corridor is shown in Figure 6-6.

11.4.4 Central and Huffstetler Properties

Conceptual shells for Central and Huffstetler resource models, developed using the above parameters, extended to the base of the resource model where the deposit is open, and beyond the modeled strike extent of the resource model where the deposit is open. Accordingly, the entire Central and Huffstetler resource models are considered to have reasonable prospects of eventual economic extraction.

11.5 QUALIFIED PERSON'S MINERAL RESOURCE ESTIMATES

Mineral Resources for the project, representing in-situ lithium-bearing pegmatites, are reported below in accordance with (*SEC*) Regulation S-K 1300 standards and are therefore suitable for public release. Based on the work described, detailed modelling of the deposits, and after considering all the parameters defined, MRE were prepared as of October 20, 2021 for property controlled by PLL.

Lithium MRE include tonnage estimates for lithium oxide (Li_2O), Lithium Carbonate Equivalent (*LCE*) whereby one tonne of Li_2O is equivalent to 2.473 tonnes LCE, and lithium hydroxide mono-hydrate ($LiOH{\cdot}H_2O$) tonnage whereby one tonne of Li_2O is equivalent to 2.81 tonnes $LiOH{\cdot}H_2O$.

The current global lithium MRE is reported above a cut-off of 0.4% Li_2O by classification in Table 11-20. The current by-product MRE is reported globally and for each property by classification in Table 11-21. The economic extraction of by-product minerals is contingent on the economic extraction of lithium minerals. Therefore, by-product Mineral Resources are also reported above a cut-off of 0.4% Li_2O.

The pricing data assumes a long-term lithium hydroxide price of US$15,239 per metric tonne and by-product mineral basket price of US$79.5 per metric tonne for calendar year 2021.

Table 11-20: Summary of Lithium Mineral Resources at October 20, 2021
Based on US$15,239 /t $LiOH{\cdot}H_2O$

	Tonnes (Mt)	Grade (Li_2O%)	Li_2O (kt)	LCE (kt)	$LiOH{\cdot}H_2O$ (kt)	Cut-Off Grade (% Li_2O)	Metallurgical Recovery[1]
Indicated	28.2	1.11	313,000	774,000	879,000	0.4	71.2
Inferred	15.9	1.02	162,000	401,000	455,000		
Total	44.2	1.08	475,000	1,175,000	1,334,000		

Note 1 – Overall metallurgical recovery from spodumene ore to lithium hydroxide monohydrate

Table 11-21: Summary of Quartz, Feldspar, and Mica Mineral Resources as of October 20, 2021

			Li_2O		Quartz		Feldspar		Mica	
Cut-Off Grade (Li_2O %)			0.4		0.4		0.4		0.4	
Metallurgical Recovery (%)			71.2[1]		50.8		51.1		35.5	
Category	**Deposit**	**Tonnes (Mt)**	**Grade (%)**	**Tonnes (Mt)**	**Grade (%)**	**Tonnes (Mt)**	**Grade (%)**	**Tonnes (Mt)**	**Grade (%)**	**Tonnes (Mt)**
Indicated	Core	25.75	1.10	0.282	29.59	7.62	45.06	11.60	4.29	1.10
	Central	2.47	1.30	0.031	28.79	0.71	45.16	1.12	3.24	0.08
	Huffstetler	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
	Total	28.22	1.11	0.313	29.52	8.33	45.07	12.72	4.20	1.18
Inferred	Core	10.93	1.02	0.111	29.13	3.18	45.52	4.97	4.18	0.46
	Central	2.69	1.10	0.030	29.99	0.81	43.88	1.18	4.08	0.11
	Huffstetler	2.31	0.91	0.021	28.82	0.67	48.60	1.12	3.24	0.08
	Total	15.93	1.02	0.162	29.22	4.66	45.67	7.28	4.03	0.64
Total		44.15	1.08	0.475	29.42	12.99	45.30	20.00	4.12	1.82

Note 1 - Overall metallurgical recovery from spodumene ore to lithium hydroxide monohydrate.
Note 2 – Based on long-term pricing of US$ 15,239/t $LiOH·H_2O$, Average By-Product Pricing of US$ 79.50/t.

11.6 QUALIFIED PERSON'S OPINION

Based on the data review, the attendant work done to verify the data integrity and the creation of an independent geologic model, McGarry Geoconsulting and MM&A believe this is a fair and accurate representation of PLL's lithium resources.

12 ORE RESERVE ESTIMATES

12.1 ASSUMPTIONS, PARAMETERS AND METHODOLOGY

All Ore Reserves on the subject properties are classified as *probable*, and consider relevant "modifying factors" including mining, processing, economic, marketing, legal, environmental, social, and governmental factors. Mineral resources which serve as the basis of reserve delineation only consider classifications of inferred and indicated. As such, by definitions, all ore reserves are limited to a probable category, as no measured resources currently exist on the property.

> **Proven Ore Reserves** are the economically mineable part of a measured mineral resource, adjusted for diluting materials and allowances for losses when the material is mined. It is based on appropriate assessment and studies in consideration of and adjusted for reasonably assumed modifying factors. These assessments demonstrate that extraction could be reasonably justified at the time of reporting.

> **Probable Ore Reserves** are the economically mineable part of an indicated mineral resource, and in some circumstances a measured resource, adjusted for diluting materials and allowances for losses when the material is mined. It is based on appropriate assessment and studies in consideration of and adjusted for reasonably assumed modifying factors. These assessments demonstrate that extraction could be reasonably justified at the time of reporting.

An estimate of Ore Reserves was made following detailed mine planning completed during the Feasibility Study and is based on the Indicated Mineral Resources contained within the Project's Core Property. The Ore Reserves have been estimated in accordance the requirements of S-K 1300 and the JORC Code. In order to derive various mining limits, an optimization routine completed to produce a production schedule of 1.9 Mt/year ROM feed to the concentrator. The optimization resulted in a total product tonnage of 20.1 Mt, at an average diluted grade of 1.00 percent Li_2O.

The mine plan was generated based on PLL's current mine permit application. All ore reserves estimated herein are contained on properties currently controlled by PLL. Due to regulatory permitting requirements, some adjoining properties will need to be purchased to remove regulated offsets to obtain the tonnages shown in this feasibility study. It is believed this is achievable before operations start and appropriate costs for property acquisitions have been included in capital cost section of the TRS.

12.1.1 Optimization Methodology

A revised block models for the Core Property was received from MGG in August 2021 and used for optimizations of resource for this feasibility study report using Maptek's Vulcan and Evolution programs. All floodplain restrictions were observed for the optimization process and West Pit was combined with North Pit through the north creek channel above the floodplain restrictions. Production requirements for Core Property were based on the concentrator capacity of 1,900,000 tonnes per year (1.096-percent undiluted Li_2O) with Year 1 being reduced by 40 to 50-percent for startup and continuing through the life of the Core Property mining. Results of the Optimization for Core Properties yielded 20.1 Mt of process ore at a 10-percent diluted grade of 0.996-percent (see Table 12-1). Figure 12-2 show the Core Property optimized pits mining through the north channel and maintaining the floodplain, wetland and permit restrictions. All production tonnes were classified as Probable Ore Reserves.

Table 12-1: Optimization Results-Annual Production Schedule

Period	Year	Quarter	Process (Mt)	Metal Li2O pct Kt	Diluted Li2O %	Tonnes (Mt)			Strip Ratio	Dump (Mt)	Total (Mt)
						Proven	Probable	Pvn + Pro			
1	1	1	0.24	2.11	1.11	0	0.24	0.22	20.63	4.90	5.13
2	1	2	0.24	1.78	0.97	0	0.24	0.22	14.16	3.40	3.64
3	1	3	0.24	2.10	1.09	0	0.24	0.22	5.05	1.22	1.47
4	1	4	0.24	2.10	1.09	0	0.24	0.22	9.33	2.26	2.50
5	2	1	0.47	4.29	1.14	0	0.47	0.43	7.55	3.53	4.00
6	2	2	0.47	4.07	1.09	0	0.47	0.43	7.24	3.42	3.90
7	2	3	0.48	3.72	1.01	0	0.48	0.43	18.25	8.73	9.20
8	2	4	0.48	3.28	0.91	0	0.48	0.43	22.82	10.92	11.39
9	3	1	0.47	3.29	0.93	0	0.47	0.43	17.83	8.41	8.88
10	3	2	0.47	3.80	1.03	0	0.47	0.43	10.11	4.77	5.24
11	3	3	0.48	3.14	0.89	0	0.48	0.43	16.66	7.95	8.42
12	3	4	0.48	3.83	1.03	0	0.48	0.43	4.91	2.34	2.82
13	4	1	0.47	3.47	0.97	0	0.47	0.43	11.77	5.51	5.97
14	4	2	0.47	3.23	0.91	0	0.47	0.43	10.33	4.88	5.36
15	4	3	0.48	3.54	0.97	0	0.48	0.43	14.36	6.87	7.35
16	4	4	0.48	3.28	0.92	0	0.48	0.43	10.93	5.23	5.70
17	5	1	0.47	3.40	0.96	0	0.47	0.43	15.15	7.09	7.56
18	5	2	0.47	3.50	0.97	0	0.47	0.43	13.21	6.25	6.72
19	5	3	0.48	3.98	1.06	0	0.48	0.43	10.11	4.84	5.31
20	5	4	0.48	4.22	1.11	0	0.48	0.43	9.36	4.48	4.95
21	6	1-4	1.90	15.02	1.02	0	1.90	1.73	6.35	12.04	13.94
22	7	1-4	1.90	13.50	0.94	0	1.90	1.73	13.59	25.78	27.68
23	8	1-4	1.90	14.00	0.97	0	1.90	1.73	14.27	27.08	28.98
24	9	1-4	1.90	14.14	0.97	0	1.90	1.73	11.35	21.54	23.44
25	10	1-4	1.90	15.09	1.02	0	1.90	1.73	10.74	20.38	22.28
26	11	1-4	1.90	15.28	1.03	0	1.90	1.73	8.90	16.89	18.79
27	12	1	0.15	1.10	0.97	0	0.15	0.14	12.23	1.82	1.97
Total			**20.09**	**154.29**	**1.00**	**0**	**20.09**	**20.09**	**11.58**	**232.52**	**252.61**

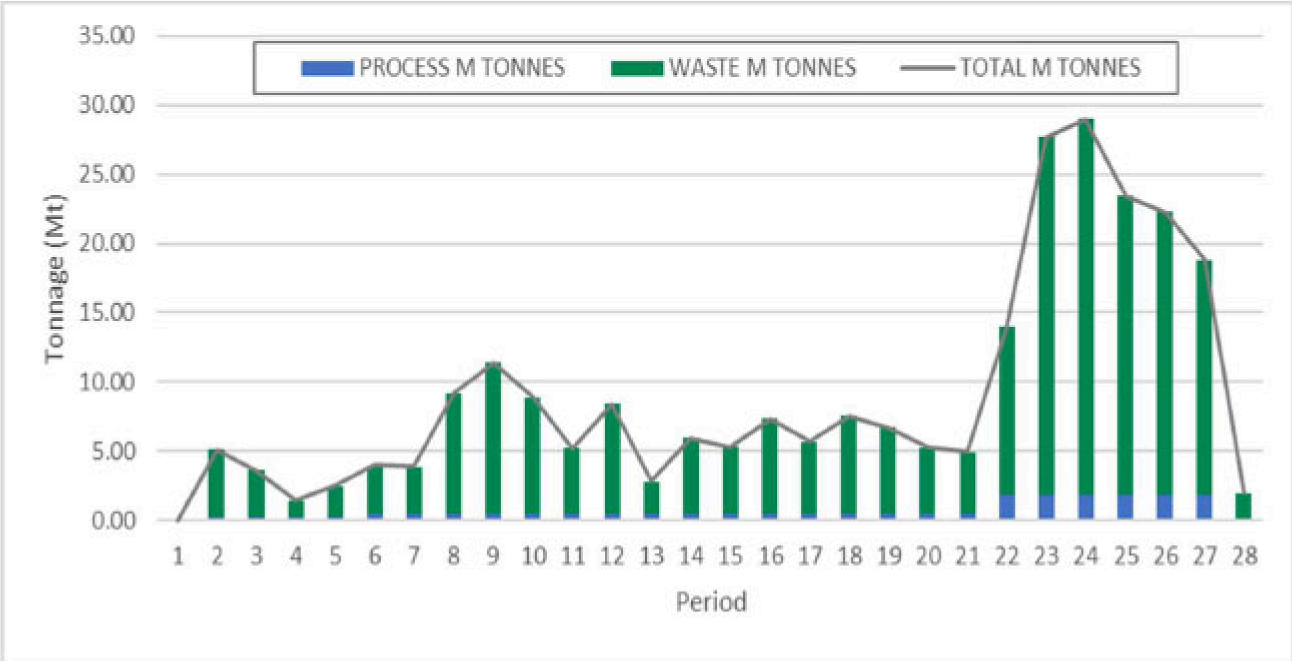


Figure 12-1 - Optimization Scenario Total Process and Dump Production Tonnes

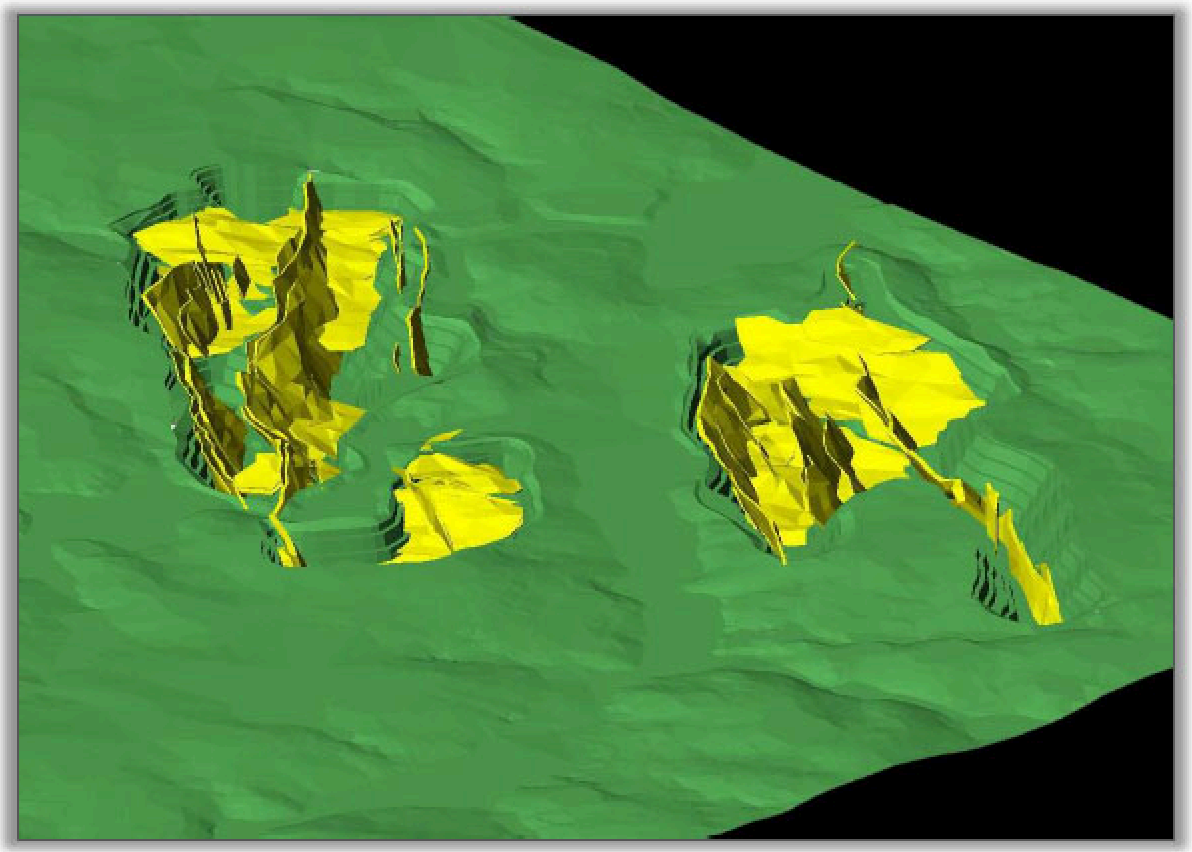


Figure 12-2 - Core Property Optimized Pits (orebody shown in yellow)

12.1.2 Optimization Parameters

Optimization parameters for the project were compiled using input from PLL, MGG, HDR, and MM&A and are shown in Table 12-2, with the pit geometry shown in Figure 12-3. Geotechnical review by MM&A resulted in a final wall berm (batter) height of 24 meters while the working berm (batter) height should be 12 meters for ore control. This indicates two working faces can be combined when the final wall is reached through the mining cycle with a berm width of 9.5 meters maintained every 24 meters of wall (batter) height.

Table 12-2: Optimization Parameters by Input Group

Group / Item	Unit	Value	Source
Geometry			
Overburden Slope	°	27	MM&A
Rock Slopes	°	75	MM&A
Interramp Slope	°	57	MM&A
Overall Slope	°	51	MM&A
Berm Width	m	9.5	MM&A
Batter Angle	°	75	MM&A
Berm (Batter) Height (working)	m	12	MM&A
Berm (Batter) Height (final wall)	m	24	MM&A
Minimum Mining Width	m	20	MM&A
Ramp Width	m	30	MM&A
Total Depth	m	192	MM&A
Block Dimension X	m	2	MGG
Block Dimension Y	m	4	MGG
Block Dimension Z	m	1	MGG
Mining			
Production Rate	Tonne/year	1,900,000	PLL
Ramp Grade	%	10	MM&A
Recovery	%	Varies (77.01 avg)	PRIMERO, PLL
Dilution	%	10	MM&A, PLL
Specific Gravity (ore)		2.72	MGG
Specific Gravity (waste rock)		2.81	MGG
Specific Gravity (weathered)		1.34	MGG

Specific Gravity (soil)		1.32	MGG
Restrictions		flood & wetlands	HDR
Vertical Rate of Advance	m	96	MM&A
Financial			
Mining Cost	US$	$2.25	PLL
Stockpile Cost	US$	$1.25	MM&A, PLL
Rate of Return	%	10	MM&A

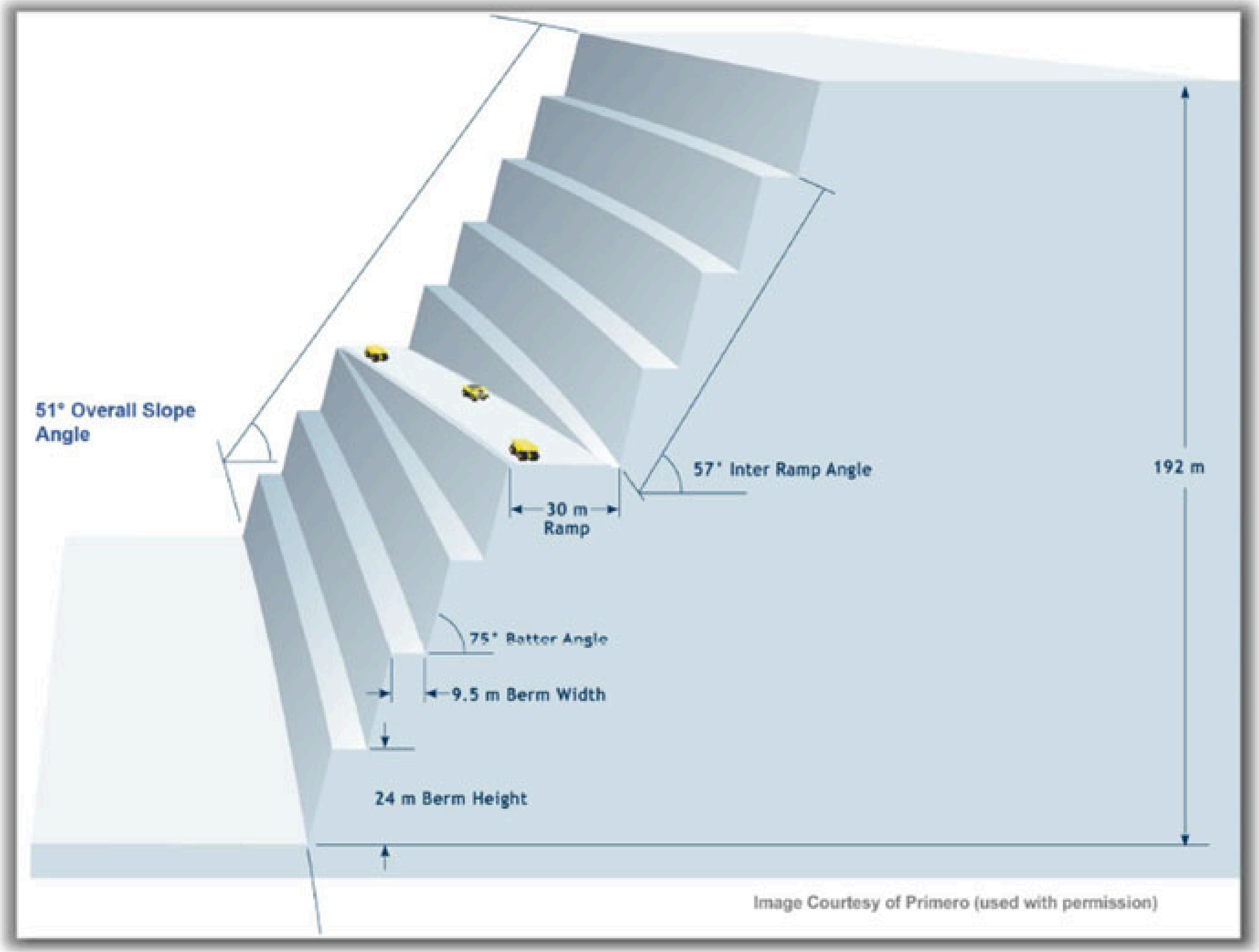


Figure 12-3 - Optimization Geometric Parameters

Diluted and undiluted data outputs from LOM plan sequencing were processed into Microsoft® Excel spreadsheets and summarized on a quarterly and annual basis for processing into the economic model.

The pricing data assumes a sales realization (FOB-mine) of $18,000 per ton for Lithium Hydroxide and $900 per ton for spodumene concentrate. Sale prices for spodumene concentrate and lithium hydroxide are fixed throughout the project's life in the economic model.

Resource modeling and mine optimization as described in the report was used as a basis for the reserve estimate. Probable mineral reserves were derived from the defined resource considering relevant processing, economic (including technical estimates of capital, revenue, and cost), marketing, legal, environmental, socio-economic, and regulatory factors.

12.2 QUALIFIED PERSON'S ESTIMATES

Reserve tonnage estimates provided herein report reserves derived from in-situ resource tons presented in Section 11, and not in addition to mineral resources. Probable reserves were derived from the defined resource considering relevant mining, processing, infrastructure, economic (including estimates of capital, revenue, and cost), marketing, legal, environmental, socio-economic and regulatory factors. The mineral reserves, as shown in Table 12-3, are based on a technical evaluation of the geology and a feasibility study of the deposits. The extent to which the reserves may be affected by any known environmental, permitting, legal, title, socio-economic, marketing, political, or other relevant issues has been reviewed rigorously. Similarly, the extent to which the estimates of reserves may be materially affected by mining, metallurgical, infrastructure and other relevant factors has also been considered.

Table 12-3: Carolina Lithium Project – Estimate of Ore Reserves (undiluted)

Ore Reserves Category	Tonnes (Mt)	Grade (Li_2O%)	Li_2O (t)	LCE (t)	$LiOH\cdot H_2O$ (t)	Cut-Off Grade (% Li_2O)	Metallurgical Recovery (%)
Proven	-	-	-	-	-	0.4	70.1
Probable	18.26	1.10	200,000	495,000	562,000		
Total	**18.26**	**1.10**	**200,000**	**495,000**	562,000		

The results of the feasibility study as summarized in this TRS define an estimated 18.26 tonnes of probable spodumene reserves (undiluted basis). Reserves estimated have an average grade of 1.10% Li_2O, and have been cutoff at modeled grades of 0.4% Li_2O.

12.3 QUALIFIED PERSON'S OPINION

The estimate of mineral reserves was determined in accordance with the SEC S-K1300 and JORC standards. The Qualified and Competent Persons responsible for the derivation of Probable Ore Reserves have considered pertinent modifying factors, inclusive of geological, environmental, regulatory, and legal factors, in converting a portion of the Mineral Resource to Mineral Reserve. Probable Ore Reserves, derived from previously stated Indicated Mineral Resources, incorporate reasonable expectations of costs and performance. Historic mining ventures in the TSB yield additional confidence in the likelihood of a successful mining project. The Qualified and Competent Persons have considered the rules and regulations promogulated by the Joint Ore Reserve Committee and US Securities and Exchange Commission in estimating Ore Reserves. The Qualified and Competent Persons find the assumptions and modifying factors utilized the DFS to be sufficient and satisfactory in the delineation of Probable Ore Reserves based upon JORC and S-K 1300 regulations.

13 MINING METHODS

13.1 PIT SLOPE GEOTECHNICAL ASSESSMENT

During previous work on the project, MM&A completed a preliminary pit slope geotechnical characterization and assessment including basic laboratory rock strength testing, discontinuity orientation data collection, kinematic bench-scale stability assessment, and overall pit slope stability assessment. The pit slope stability assessment provides general guidance with regard to bench, inter-ramp, and overall pit slope for pit design. Subsequent pit slope geotechnical work completed in 2021 included drilling of two holes along the west side of East Pit to refine the recommended offset distance between the pit and floodplain areas.

Rock samples for basic intact rock strength testing were collected by MM&A geologists from rock core available in PLL's core storage facility. The samples were shipped to the University of Kentucky (*UK*) for testing in their Rock Mechanics Laboratory facilities. Geotechnical test results are summarized in the table below.

Table 13-1: Geotechnical Rock Lab Test Results

Sample	Lab	Uniaxial Compressive Strength		Bulk Density		Indirect Tensile Strength		Bulk Density	
ID	No.	(psi)	(MPa)	lbs/ft^3	kg/m^3	(psi)	(MPa)	lbs/ft^3	kg/m^3
17-BD-112-GT1	1a	24,930	171.9	193.25	3,095.50	1,332.3	9.2	194.79	3,120.25
	1b					1,294.9	8.9	205.14	3,286.04
	1c					1,326.1	9.1	206.19	3,302.79
17-BD-112-GT2	2a	8,634	59.5	187.11	2,997.16	1,036.1	7.1	204.68	3,278.68
	2b					1,059.2	7.3	199.09	3,189.14
	2c					1,686.8	11.6	216.67	3,470.71
17-BD-112-GT3	3a	13,411	92.5	171.71	2,750.45	1,411.1	9.7	224.66	3,598.78
	3b					1,006.7	6.9	215.04	3,444.65
17-BD-112-GT4	4a	8,205	56.6	175.88	2,817.30	996.6	6.9	220.47	3,531.57
	4b					1,353.9	9.3	219.83	3,521.30
	4c					1,321.4	9.1	213.90	3,426.28
17-BD-112-GT5	5a	13,372	92.2	172.35	2,760.75	704.5	4.9	226.52	3,628.48
	5b					793.6	5.5	212.84	3,409.34
	5c					774.2	5.3	214.12	3,429.92

The rock strength test results indicate that intact host rock is strong, with some variability in strength due to failure along existing features such as veins and other smaller discontinuities. The intact rock strength test results are generally consistent with other tests conducted on the waste rock, such as standard railroad ballast testing which also indicated that the waste rock is expected to be strong and durable.

The orientations of highwalls in the proposed mine pit shells are key inputs for the stability assessment, as potential instability is often caused by the interaction of existing discontinuities (fractures) in the rock with the pit wall orientations. The general pit wall orientations are indicated in the following figure and summarized in the table below.

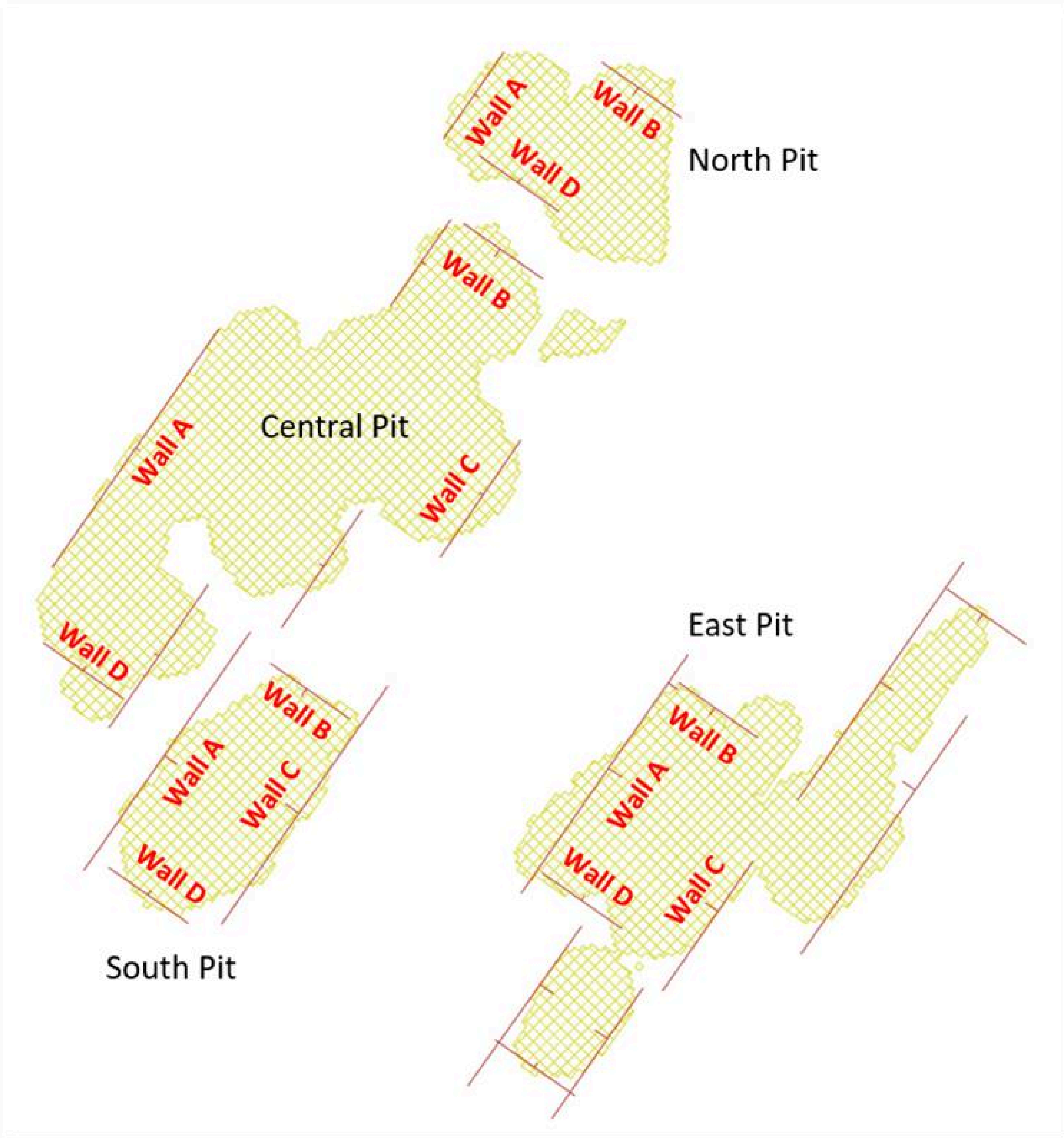


Figure 13-1 - General Pit Wall Orientations

Table 13-2: General Pit Wall Orientations for Proposed Pits

Wall	General Wall Name	Wall Dip Direction (Degrees Azimuth)
A	SE-Dipping	125
B	SW-Dipping	215
C	NW-Dipping	305
D	NE-Dipping	35

The assessment utilized discontinuity data extracted from oriented exploration core holes and from two Acoustic Televiewer (*ATV*) downhole geophysical logs run in exploration holes. The stereonet projection below is a bottom hemisphere pole plot summarizing the sets of discontinuities identified from the available data. The sources of the data points are identified in the legend. Nine discontinuity sets are identified and labeled on the stereonet. The dip direction of a discontinuity set is represented in degrees azimuth (North = 0 degrees, East = 90 degrees, South = 180 degrees, West = 270 degrees) and the dip angle (from horizontal) of a set is represented as values between 0 and 90 degrees as labelled in the figure. For example, Set 1 dips northwest at an angle of approximately 76 degrees, Set 3 dips southeast at an average angle of approximately 65 degrees, and the orientation for all other sets are represented in a similar manner.

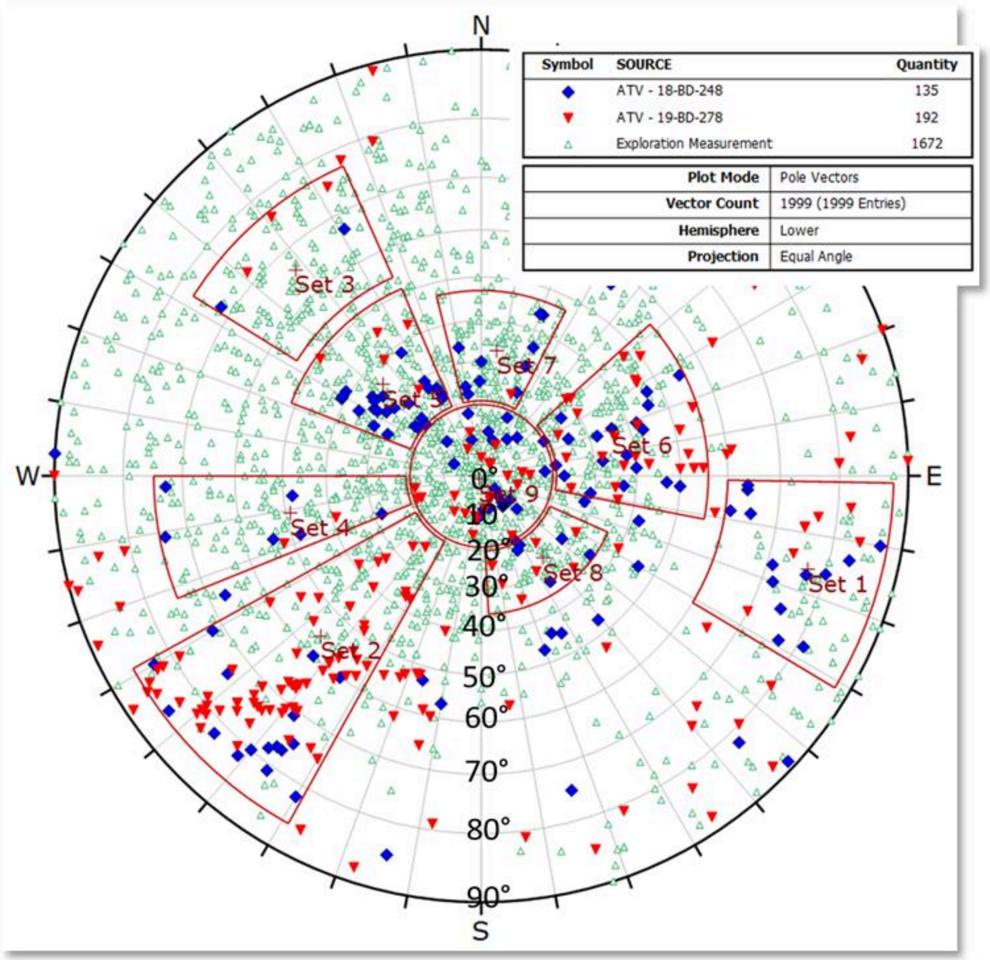


Figure 13-2 - Stereonet Representing Discontinuity Patterns Identified in Project Area

The stereonet data and discontinuity sets were utilized to complete a preliminary kinematic assessment to determine the potential for wedge and plane rock failures in the proposed pit wall slopes. The kinematic assessment utilized Rocscience, Inc. (*Rocscience*) programs including DIPS, RocPlane, and SWedge. The assessment utilized a Probabilistic Approach to determine, for any given bench angle, the probability of each potential failure in each wall of the proposed pits and a suggested minimum bench width based on the estimated size of potential failures. The results of the kinematic assessment were utilized to define bench dimensions that were combined with haul road ramp dimensions and pit wall heights to subsequently determine reasonable overall pit wall angles.

The expected stability of the overall proposed pit wall slopes was assessed using the computer program SLIDE3 by Rocscience, using the Spencer analysis method. Inputs to the modeling exercise include the expected pit wall surface (including bench angle, bench width, bench height, inter-ramp angle, ramp width, and overall pit wall height), estimated strength of the pit wall rock mass, and an assumed groundwater level. The strength of the wall rock for the proposed pits was estimated based on available information using the Rock Mass Rating (*RMR*) System.[2] The RMR score for the amphibolite wall rock is 65-70, suggesting it is Class II – Good Rock. The RMR scoring methodology accounts for the uniaxial compressive strength of the rock, Rock Quality Designation (*RQD*)/fracture frequency data, and the condition of the observed discontinuities in the rock. The overall pit wall stability assessment considered a water table at depth of 20 meters below the pit walls.

Results of the assessment indicate that an overall pit wall angle of 51 degrees is expected to have a factor of safety of ~1.4, given the assumptions discussed above. The overall angle of 51 degrees assumes a bench angle of 75 degrees, a final bench height of 24 meters, a final berm width of 9.5 meters, and a single 30-meter haul road ramp width. The results of the pit slope stability assessment summarized above were used to design the pits for the current iterations of pit slope optimization.

13.2 HYDROGEOLOGICAL ASSESSMENT

Hydrogeological assessment for the project was completed by HDR, Inc. (*HDR*). The tasks involved included surface water and groundwater quality monitoring; streamflow monitoring; pump testing; groundwater level monitoring; and creation of a groundwater model using MODFLOW. MM&A has received and reviewed memorandums and data summaries from HDR. HDR reports on the hydrogeology of the project area include "T*echnical Memorandum: Aquifer Test, Piedmont Lithium – Gaston County, North Carolina*" (revised version submitted February 18, 2019) and "*Technical Memorandum: Groundwater Model, Piedmont Lithium – Gaston County, North Carolina*" (submitted June 28, 2019). An additional groundwater modeling report, titled "*Technical Memorandum: Groundwater Model – Piedmont Lithium, Gaston County, North Carolina*", was also completed by HDR in August 2021.

HDR's groundwater modeling results form a basis for selection of pit dewatering equipment and operating cost considerations. The project will involve pumping from two pits simultaneously at times throughout the mine life, with pumping rates varying depending on the stage of mining and pits being excavated. The predicted dewatering rates range from 575 gallons per minute (*gpm*) in the first year to maximum pumping rates of 2,300 gpm and 2,000 gpm in years 2 and 12, respectively. The estimated average for the mine life is on the order of 1,400 gpm.

13.3 PRODUCTION RATES

Production scheduling for the PLL project site is based on providing 1,900,000 tonnes per year of ROM ore to the concentrator from the Core property. The following parameters are used for production scheduling:

- Concentrator ROM feed of 1,900,000 tonnes per year;
- Probable reserves only for all years of operations;
- Target output of 230,000 tonnes per year of 6-percent Li_2O concentrate;
- Mine dilution of ore at 10 percent;
- 50-percent production for first year of start-up;
- Processing recovery varies by year (average 77.01 percent spodumene concentrate recovery);
- First five years scheduled by quarter, yearly schedule from year six to end of life;
- Marketing of by-products for additional cost offset.

Production scheduling was performed using Maptek Evolution software and shown in Table 13-3.

Table 13-3 - Production Schedule

Year	Quarter	Property Location	Process (Mt)	Waste (Mt)	Diluted Li_2O %	% Proven	Strip Ratio	6% Conc. (Kt)
1	1	South	0.24	4.90	1.11	0%	20.63	35.16
1	2	South	0.24	3.40	0.97	0%	14.16	29.73
1	3	South	0.24	1.22	1.09	0%	5.05	35.00
1	4	South	0.24	2.26	1.09	0%	9.33	35.00
2	1	South	0.47	3.53	1.14	0%	7.55	71.54
2	2	South	0.47	3.42	1.09	0%	7.24	67.87
2	3	South/East	0.48	8.73	1.01	0%	18.25	62.05
2	4	East	0.48	10.92	0.91	0%	22.82	54.67
3	1	East	0.47	8.41	0.93	0%	17.83	54.83
3	2	East	0.47	4.77	1.03	0%	10.11	63.26
3	3	East	0.48	7.95	0.89	0%	16.66	52.42
3	4	East	0.48	2.34	1.03	0%	4.91	63.81
4	1	East	0.47	5.51	0.97	0%	11.77	57.90
4	2	East	0.47	4.88	0.91	0%	10.33	53.79
4	3	East	0.48	6.87	0.97	0%	14.36	58.97
4	4	East	0.48	5.23	0.92	0%	10.93	54.74
5	1	East	0.47	7.09	0.96	0%	15.15	56.62
5	2	East	0.47	6.25	0.97	0%	13.21	58.40
5	3	East	0.48	4.84	1.06	0%	10.11	66.40
5	4	East	0.48	4.48	1.11	0%	9.36	70.31
6	1-4	East	1.90	12.04	1.02	0%	6.35	250.30
7	1-4	East/West	1.90	25.78	0.94	0%	13.59	225.07
8	1-4	West	1.90	27.08	0.97	0%	14.27	233.37
9	1-4	West	1.90	21.54	0.97	0%	11.35	235.68
10	1-4	West	1.90	20.38	1.02	0%	10.74	251.48
11	1-4	West	1.90	16.89	1.03	0%	8.90	254.74
12	1	West	0.15	1.82	0.97	0%	12.23	18.32

Total			**20.09**	**232.52**	**1.00**	**0%**	**11.58**	**2,571.43**

13.4 MINING RELATED REQUIREMENTS

Mining operations for the PLL project site are based on providing 1,900,000 tonnes of ROM ore to the concentrator from the three pits within the project boundary and disposing of waste material (non-ore rock, saprolite, and soils) in the Waste Rock Storage Area, Future Waste Rock Storage Area, Topsoil Storage Area, East Pit backfill and South Pit backfill. Final estimates for fleet and mine costs were generated from the production schedule.

13.5 REQUIRED EQUIPMENT AND PERSONNEL

Mine plans with ROM production tonnages, waste rock tonnages and roadway profiles were supplied by MM&A to Metso, Continental Conveyor, Komatsu, Deere/Hitachi, Cat®, Furukawa Rock Drills, Contract Mine Service Companies, Nelson Brothers, LLC, and Austin Powder Company, for evaluation of fleet sizing and utilization. Fleet recommendations were very similar amongst the independent vendors, providing good confidence in the estimates. Based on the recommendations, mine scheduling and cost modelling assumes the following basic fleet: four 12.3-m^3 (16-yd^3) front-end loaders for waste; two 6.1-m^3 (8-yd^3) front-end loader for ore; four Metso LT150E mobile jaw crushers for waste and two Metso LT130E mobile jaw crushers for ore and fixed and mobile conveyors. Support equipment includes two waste dozers, a water truck, a motor grader, light plants, 6 mobile rock breakers and other utility equipment (see Table 13-4).

Komatsu, Deere/Hitachi and Cat® provided recommendations for loaders, trucks, dozers, rock breakers, and support equipment. Komatsu and Cat® provided prices for various options for fleet acquisition, including options to purchase, finance through manufacturer, and lease through independent leasing companies. Contract mine services contractor prices were used for mobile equipment cost estimates, labor costs, and equipment operating costs for this study.

Drilling and Blasting estimates were provided by Austin Powder Company, Nelson Brothers, LLC, Contract Mine Services Contractors and Tri-State Drilling and Blasting. Austin Powder Company and Nelson Brothers, LLC supplied estimates and prices per ton of shot services and unit prices of blasting products for internal blaster use. Tri-State Drilling and Blasting provided prices for contract drilling services. Contract Mine Service Companies supplied a variety of pricing from individual components to complete drilling and blasting inclusive prices. Contract mine services contractor pricing was used for drilling and blasting estimates for this feasibility study.

MM&A solicited Request for Prices for Mine Contractor Services from seven independent contractors and received prices back from four contractors for this feasibility level layout of the pits, dumps, and haul roads. Ultimate pits and fills are designed with ramps incorporated and tonnage estimates for the yearly breakdowns. The purpose of this project is to obtain prices for mine contractor services for moving process material from the pits to feed the concentrate plant and waste material from the pits to the disposal areas and all associated work. This work must be performed in accordance with United Stated Mine Safety and Health Administration policy and Piedmont Lithium Carolinas, Inc. safety rules.

Requirements for the Mine Services Contractors included:

- No haul trucks can be used for transportation of process material or waste material from the pits to either the concentrate plant ROM pile nor the waste rock storage areas. In pit crushing and conveying must be used for material movements;
- In pit crushers and conveyors shall be mobile and powered by electric motors;
- Loaders feeding the crushers are preferably battery or electric but can be diesel powered;

- Drills must be down hole hammer type and can be diesel powered;
- Dozers can be diesel powered;
- Loader feeding the concentrate plant can be diesel powered;
- Rockbreakers can be diesel powered.

Included are support equipment in contract mine services costs that may include a water truck, dozer capable of maintaining the waste disposal volumes, motor grader, utility loader backhoe for water lines and plant cleanup, fixed or portable lights, two pumps with 2000 gpm at 800 feet vertical head, and a utility articulated haul truck (for shot stemming, erosion control measures cleaning, etc.).

Table 13-4: Mobile Equipment Fleet

No.	Category	Size	Description
2	LT130E Crusher	39x51	Ore (14")
4	LT150E Crusher	47x55	Waste (14")
18	Lokolinik conveyor	22.8 m (75 Ft)	Mobile Conveyor
3	Front Wheel Loader	6.1 m³ (8 yd³)	2 Ore Loaders 1 ROM Loader
4	Front Wheel Loader	12.3 m³ (16 yd³)	Waste Loader
1	Articulated Haul Truck	36 tonne (40 ton)	Blast stemming / Utility
2	Dozer	150,000 lb Class	Waste
6	Mobile Rock Breaker	12,000 lb Class	Ore / Waste
1	Motor Grader	4.3 m (14 Ft)	Utility
1	Water Truck	8,000 Gallon	Utility
1	Fuel Truck	2,000 Gallon	Utility
2	Dewatering Pump	800 gpm @ 700' Head	Pit Dewatering
1	Dewatering Lines, Fittings	10" HDPE IPS SDR-11	Pit Dewatering
8	Light Plants	4 Head Each	Ore/Waste
1	Mechanic Truck	1.8 tonne (2 Ton)	Autocrane, Compressor
1	Welding Truck	0.91 tonne (1 Ton)	Welder, Compressor
2	Pickup	0.45 tonne (1/2 Ton)	Foreman, Electrician
1	Backhoe/Loader	0.75 m³ (1cyd)	Utility
3	Magazine	7 X 7 X 30 Ft	Utility
6	DHD Drills	5-1/2 inch	Ore/Waste

MM&A solicited bid prices for Initial Site Development from seventeen independent contractors and received prices back from four contractors for this feasibility study (see Table 13-5). The purpose of this solicitation is to collect pricing for construction of initial site development erosion control measures and grading according to the NC DEMLR mine permit. This work will include clearing and grubbing, construction of screening berms, construction of sound walls, E&S for the Waste Rock Pile, E&S for the Topsoil Storage Pile, E&S for the pit areas, E&S and grading for the plant area, E&S and grading for the magazine area, E&S for the maintenance area, E&S and grading for the emulsion storage and bulk truck parking area, E&S and grading for the internal roads and vegetation for stabilized areas.

Table 13-5: Initial Site Development Cost Summary

Group	Totals
Mobilization	$1,870,000.00
Main Haul Road Construction	$21,402,300.00
Topsoil Storage Pile Erosion Control	$372,205.00
East Pit Haul Road Construction	$89,077.00
East Pit Overburden Removal	$33,524,812.95
Waste Rock Pile E&S	$4,608,150.00
Plant Area Grading	$10,073,641.00
South Pit Haul Road	$4,550,128.00
South Pit Conveyor access	$202,472.00
South Pit Overburden removal	$8,855,307.55
Magazine Construction	$462,067.00
North Pit Haul Road Construction	$2,158,537.00
North Pit Conveyor access	$159,956.00
Emulsion plant grading	$1,487,566.00
Fencing	$2,242,930.00
50 feet vegetation buffer planting	$39,000.00
Demobilization	$1,655,000.00
Total	**$93,753,149.50**

13.6 MINE INFRASTRUCTURE

MM&A prepared a site plan which includes property boundaries supplied by PLL; offset boundaries for intended use as required by North Carolina Department of Energy, Mineral, and Land Resources (*NCDEMLR*) and Gaston County; floodplains, wetlands, and streams as delineated by HDR; concentrator facilities designed by Primero; waste rock disposal areas; and planned pit areas.

13.6.1 Concentrator Pad Design

The concentrator layout was provided by Primero. The plant pad design contains both the concentrator and a ROM storage pad, while conforming to Gaston County setback distances and NCDEMLR erosion control requirements (Figure 13-4).

13.6.2 Internal Roads

MM&A completed design of internal roads capable of handling ore conveyors, waste conveyors, maintenance access roads, as well as the associated erosion control structures. Mine roads provide access to the various pits and waste disposal areas within the project site and provide connection to off-site transportation routes (Figure 13-4). Roadways were designed to be 30 meters wide, including runoff ditches and safety berms where required by MSHA.

Figure 13-3 - Plant Pad Design Including Concentrator and ROM pad

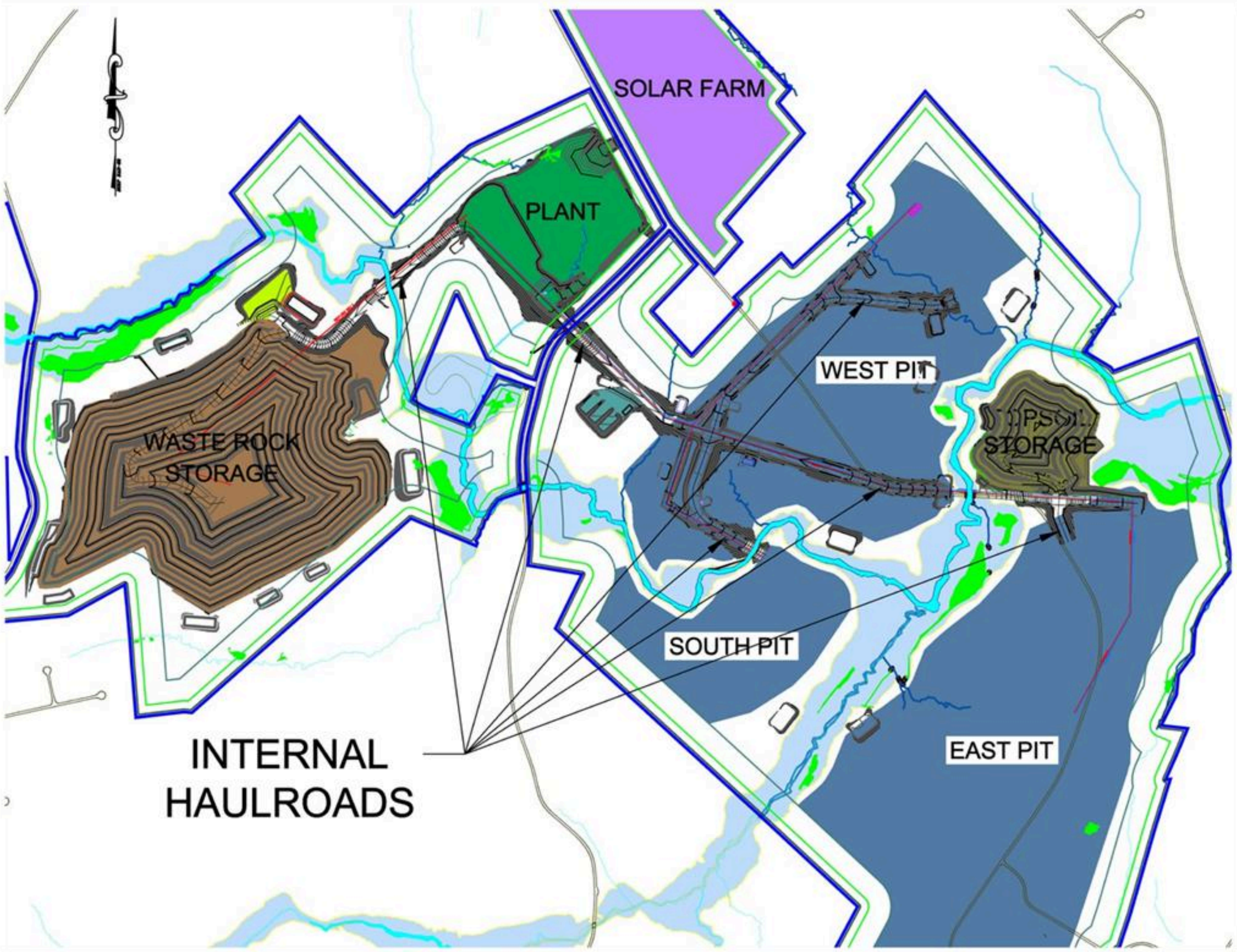


Figure 13-4 - Internal Haulage Road Network

13.6.3 Magazine Grading Plan

Magazine supply and pricing for the project was supplied by Ideal Blasting Supply Company in Asheville, North Carolina. Grading for the magazine pad and surrounding berms with associated erosion control structures are illustrated in Figure 13-5.

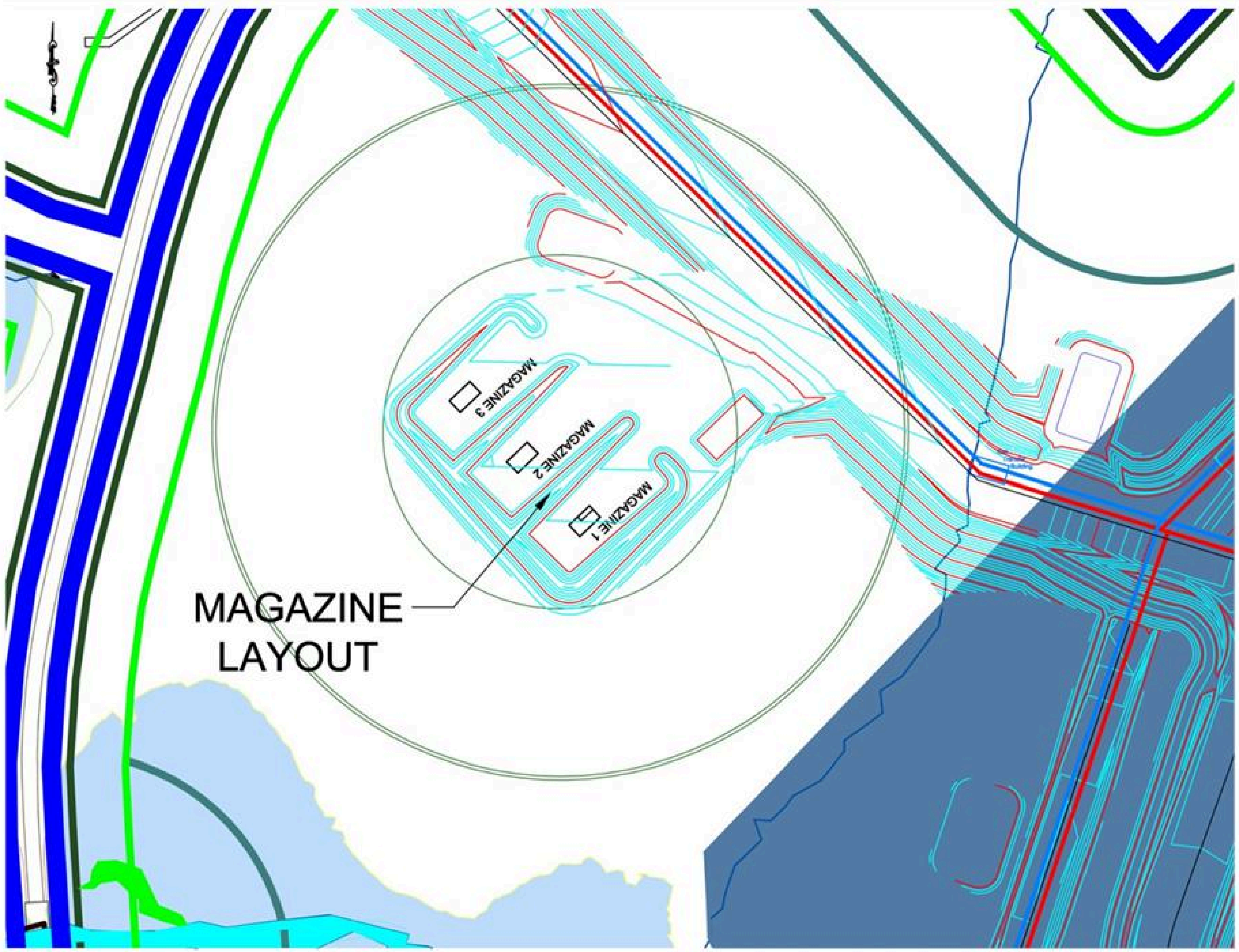


Figure 13-5 - Explosives Magazine Grading Plan

13.7 MINE PLAN

Mine plans were created for multiple years based on nested pits created from initial optimizations in order to create route profiles for equipment sizing and scheduling. These plans were used by MM&A to match production requirements by year to front end loaders, mobile crushers and fixed and mobile conveyors which ultimately resulted in preparing cost analysis data used in mining cost modeling.

Yearly plans incorporated ore production to the concentrator, waste production to on-site waste dumps, and the associated conveyor lines for each destination. Ore production was primarily dictated by plant rom feed requirements and secondarily dictated by pit size and scheduling of exhausted pits for waste backfill. Some scheduling of extracting ore simultaneously from multiple pits was necessary due to smaller pits not being capable of ramp widths and vertical advancement rates to adequately supply the full plant feed requirements. An example conveyor profile is represented in Figure 13-6.

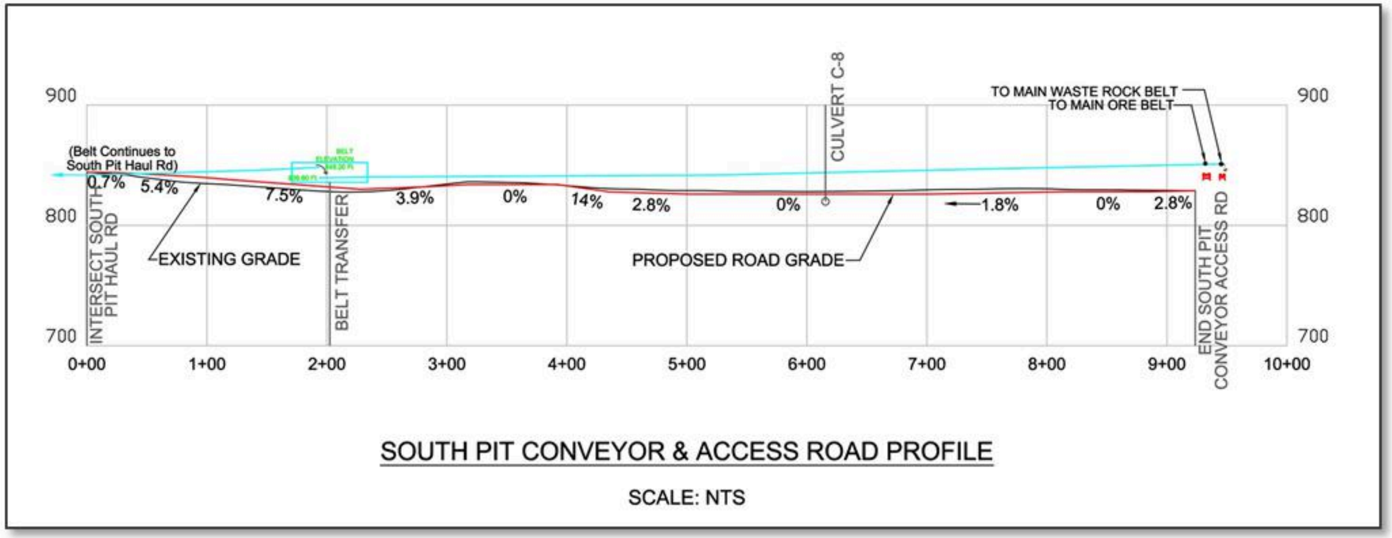


Figure 13-6 - Mine Conveyor Profile

14 PROCESSING AND RECOVERY METHODS

The concentrator is designed to produce saleable spodumene concentrate via Dense Media Separation (DMS) and flotation. The spodumene concentrate produced is then transported to the lithium hydroxide conversion facility to produce battery and technical grade lithium hydroxide monohydrate. Additional saleable by-products are produced in unison with the spodumene concentrate, which are mica, feldspar, and high purity quartz concentrates.

Figure 14-1 is a simplified process flow sheet which summarizes the process flow routings within the major circuits of the processing plant.

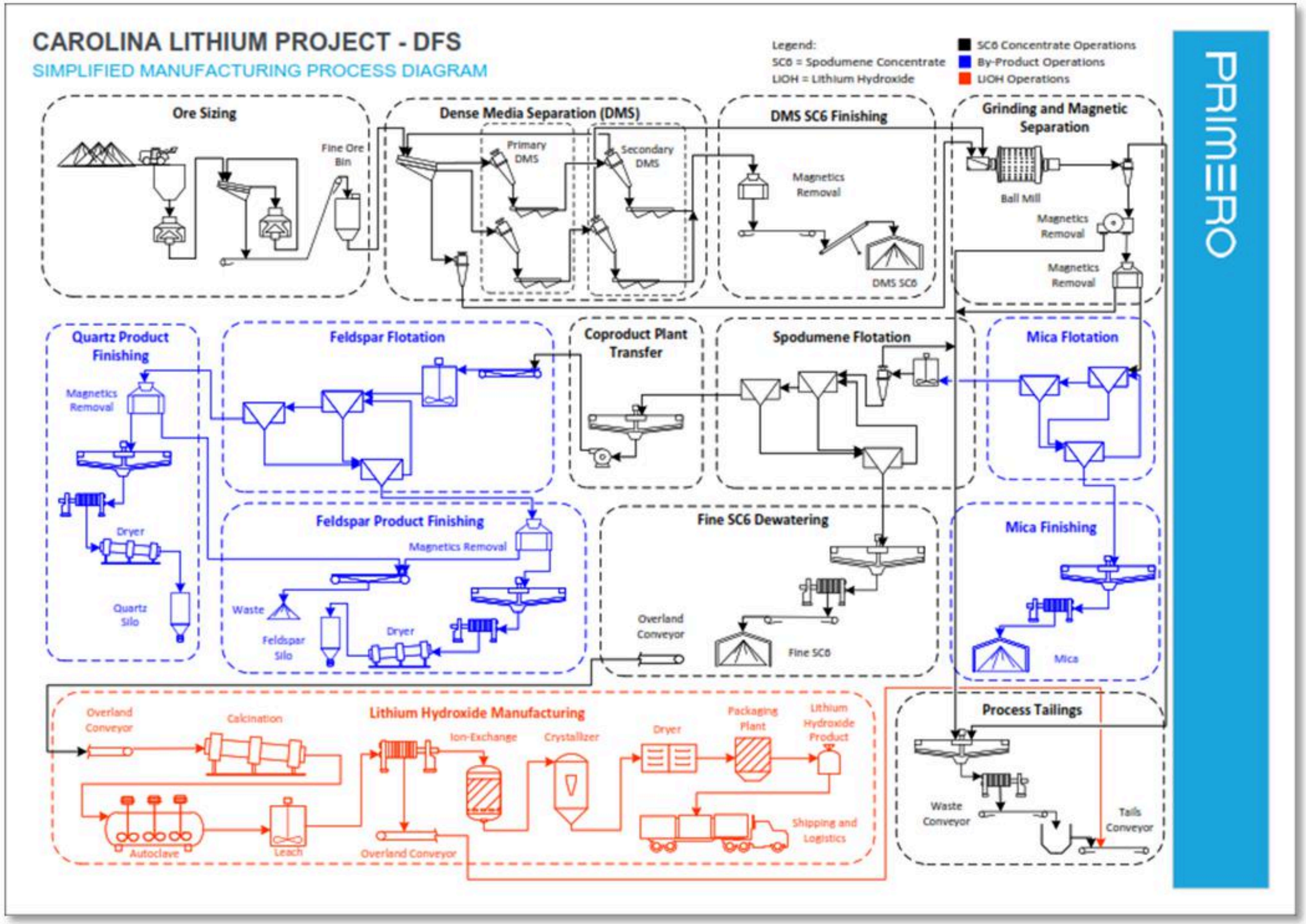


Figure 14-1 - Simplified Flow Sheet for Piedmont Carolinas Inc. (prepared by Primero, 2021)

14.1 CONCENTRATOR

The concentrator consists of two process plants due to layout and location: spodumene and by-products plant. The key process areas of the concentrator are listed as the following:

- Secondary and tertiary crushing
- Spodumene processing plant - Dense Media Separation (DMS) circuit

- Spodumene processing plant - Spodumene DMS concentrate magnetic separation, dewatering, and handling
- Spodumene processing plant - Grinding and desliming
- Spodumene processing plant - Mica flotation
- Spodumene processing plant - Spodumene flotation
- Spodumene processing plant - Spodumene flotation concentrate dewatering and handling
- Spodumene processing plant - Flotation tailings dewatering and handling
- By-Products processing plant - Feldspar flotation
- By-Products processing plant - By-products (mica, feldspar, and quartz) concentrate dewatering and handling
- Spodumene processing plant - Process tailings dewatering and handling
- Overland conveying

14.1.1 Coarse Ore Crushing

Run-of-mine (ROM) ore from the open pit mine is crushed by in-pit jaw crushers and is then conveyed to the concentrator site. A front-end loader (FEL) feeds the coarse ore with the top size of < 180 millimeter (mm) to the coarse ore sizing screen, which operates in an open circuit with the secondary cone crusher. The resulting – 60 mm ore is conveyed to tertiary crushing, which consists of a sizing screen in closed circuit with two (2) cone crushers. The resulting fine ore has a top size of < 6.3 mm. A 3,150 metric tonnes (t) live capacity fine ore bin is designed to provide an operating buffer between the crushing and the downstream wet plant.

14.1.2 Spodumene Processing Plant - Dense Media Separation

The DMS plant consists of a two-stage circuit (primary and secondary) for each of the two size fractions (coarse and fine). Four streams are produced: DMS fine by-pass, DMS spodumene concentrate, DMS middlings, and DMS tailings. The density target of the primary and secondary stage is 2.65 and 2.90, respectively.

The fine ore is conveyed from the fine ore bin to the DMS sizing screen to remove – 1 mm fines. The – 1 mm stream by-passes the DMS and is sent to the grinding circuit. The oversize (-6.3 +1 mm) is fed to the coarse DMS preparation screen to remove the – 2.5 mm portion. The -6.3 +2.5 mm material is fed to the primary coarse DMS circuit. Meanwhile, the -2.5 +1mm materials is sent to a reflux classifier for mica removal. The classifier overflow reports to tailings, and the underflow reports to fine DMS preparation screen. Screen oversize of the fine DMS prep screen is fed to primary fine DMS circuit and screen undersize is recycled as dilution water for the DMS sizing screen.

The oversize of the coarse preparation screen is mixed with ferrosilicon (FeSi) slurry prior to being pumped to the coarse DMS cyclone. The stream is split into sinks (ore specific gravity > 2.65) via the cyclone underflow and floats (ore specific gravity < 2.65) via the cyclone overflow. The resulting slurry is drained and rinsed on linear vibrating screens for FeSi recovery. The coarse primary sinks are then pumped to the secondary stage DMS to be further upgraded. At the same time, the coarse floats are sent to the tailings conveyor for dry waste disposal. The secondary stage DMS follows the same principal; however, the floats of the coarse second stage DMS is re-crushed by a rolls crusher for further liberation and is then recycled back to the DMS sizing screen to recover the liberated spodumene.

The fine DMS circuit is operates the same way as the coarse DMS circuit, but the secondary fine floats is considered DMS middlings. The middling stream is conveyed directed to the ball mill. A provision of a 30-minute middling surge bin between the DMS and ball mill has been made to absorb some mass fluctuations during operation.

The secondary DMS sinks (coarse and fine) are considered spodumene DMS concentrate. This material is transported to magnetic separators for iron removal to produce a 6.0% Li_2O spodumene concentrate. The concentrate is stockpiled in the concentrate shed and is reclaimed by a FEL onto a pocket-style overland conveyor routed to the integrated lithium hydroxide conversion plant for further refining.

14.1.3 Spodumene Processing Plant - Grinding

The grinding circuit consists of a ball mill working in closed circuit with classification cyclones to produce a product stream with 80% passing (P_{80}) 185 microns (µm). The circuit is fed by the DMS fine by-pass (-1 mm) and the DMS middlings.

The resulting stream is deslimed by cyclones to remove – 20 µm material (slimes) and is then pumped to a low intensity magnetic separator (LIMS) followed by a wet high intensity magnetic separator (WHIMS). The magnetics extracted by both stages are combined and pumped to the process tailing thickener. Meanwhile, the non-magnetic stream is pumped to mica flotation.

14.1.4 Spodumene Processing Plant - Mica Flotation

The non-magnetic stream from grinding is pumped to a flotation feed tank, which serves as surge capacity to absorb some operation instabilities. The slurry is then pumped to the mica flotation conditioning to be conditioned with Armac T/C mixture (mica collector). Sodium hydroxide (NaOH – pH modifier) is also added to maintain the pH at 10. Methyl isobutyl carbinol (MIBC - frother) is used to modify froth properties. The conditioned slurry overflows to a bank of rougher flotation cells. The rougher tailings stream flows by gravity to the scavenger cells to allow additional flotation time to recover the mica. The scavenger tailings stream is pumped to the spodumene flotation circuit. The rougher and scavenger concentrate is pumped to a two (2) staged cleaning circuit for further upgrading. Each cleaner tailings stream is recycled to the previous stage. The final mica concentrate is sent to mica concentrate dewatering and handling.

14.1.5 Spodumene Processing Plant - Spodumene Flotation

The mica scavenger tailings stream is first dewatered by cyclones to reach the percent solids of 67 weight percent (% w/w) prior to high intensity scrubbing. NaOH and F220 (dispersant) are added as attritioning aids. The slurry is subjected to a high-shear environment at the pH of 11 for 10 minutes to clean the spodumene surface before flotation. The scrubbed stream is then pumped to desliming cyclones to remove – 20 µm slimes and the underflow is sent to the spodumene flotation conditioning tanks. The slurry undergoes high intensity conditioning at 67% (w/w) solids with a fatty acid collector (FA-2). Sodium carbonate (Na_2CO_3) is added as a pH modifier to maintain the pH at 8.5. The conditioned slurry overflows to a bank of rougher flotation cells. The rougher tailings flow by gravity to the scavenger cells to allow additional flotation time to recover the spodumene. The scavenger tailings to pumped to the flotation tailings thickener. The rougher and scavenger concentrate is pumped to a three (3) staged cleaning circuit for further upgrading. Each cleaner tailings stream is recycled to the previous stage. The first cleaner tailing streams has an option to bypass to the flotation tailings thickener. The final spodumene concentrate is sent to spodumene concentrate dewatering and handling.

14.1.6 Spodumene Processing Plant - Spodumene Flotation Concentrate Dewatering and Handling

The spodumene flotation concentrate is thickened to 55% (w/w) solids in a high-rate thickener with the aid of an anionic flocculant. The underflow is then pumped to the filter feed tank. The purpose of the feed tank is to serve as a buffer between the upstream process and the downstream filtration. A plate and frame filter is used to form concentrate filter cakes with 12% (w/w) moisture. The cake is the stored in the concentrate shed prior to being reclaimed by a FEL onto a pocket-style overland conveyor routed to the integrated lithium hydroxide conversion plant for further refining.

14.1.7 Spodumene Processing Plant - Flotation Tailings Dewatering and Handling

The spodumene flotation tailings is thickened to 55% (w/w) solids in a high-rate thickener with the aid of an anionic flocculant. The underflow is then pumped to the filter feed tank. The purpose of the feed tank is to serve as a buffer between the upstream process and the downstream filtration. A belt filter produces the tailings filter cake with 15% (w/w) moisture. The cake is discharged onto a reversible conveyor with options to be fed to the by-products plant or directly to the tailings conveyor for disposal.

14.1.8 By-Products Processing Plant - Feldspar Flotation

The spodumene flotation tailings filter cake discharges into an agitated repulping tank. By-product process water is added to the cake to achieve 35% (w/w) solids prior to feldspar flotation. The slurry is then conditioned with hydrofluoric acid (HF – collector), Armac C (collector), and kerosene (promoter). Sulfuric acid (H_2SO_4) is also added as a pH modifier to maintain the pH at 2.5. The conditioned slurry overflows to a bank of rougher flotation cells. The rougher tailings flow by gravity to the scavenger cells to allow additional flotation time to recover spodumene. The scavenger tailings stream produces a high purity quartz stream and is pumped to a WHIMS unit to remove any residual iron. The rougher and scavenger concentrate is pumped to a two (2) staged cleaning circuit for further upgrading. Each cleaner tailings stream is recycled to the previous stage. The final feldspar concentrate is sent to a WHIMS unit to remove any residual iron.

The magnetic tailings of the two (2) WHIMS units are sent to a belt filter for filtration and cake washing with fresh water to minimize reagent contamination, specifically HF. The resulting filter cake discharges directly onto the tailings conveyor.

14.1.9 By-Products Processing Plant - By-Products Thickening and Filtration

The mica flotation concentrate is thickened to 50% (w/w) solids in a high-rate thickener with the aid of an anionic flocculant. The underflow is then pumped to the filter feed tank. The purpose of the feed tank is to serve as a buffer between the upstream and the downstream filtration. A plate and frame filter press is used to form concentrate filter cakes with 12% (w/w) moisture. The cake is the stored in the concentrate shed prior to being reclaimed via a FEL onto trucks for concentrate sales.

The feldspar flotation concentrate is thickened to 55% (w/w) solids in a high-rate thickener with the aid of an anionic flocculant. The underflow is then pumped to the filter feed tank. The purpose of the feed tank is to serve as a buffer between the upstream and the downstream filtration. A plate and frame filter press is used to form concentrate filter cake with 12% (w/w) moisture. Filter cake wash cycles with fresh water are used to minimize HF contamination and is also considered in the filter sizing. The cake is the stored in the by-product concentrate shed prior to being reclaimed onto the feldspar concentrate rotary dryer to reduce the moisture to < 1% (w/w). A caustic venturi scrubber is used to capture and clean the dryer off-gas. The dried concentrate is then conveyed to storage silos for truck load-out.

The quartz flotation concentrate is thickened to 55% (w/w) solids in a high-rate thickener with the aid of an anionic flocculant. The underflow is then pumped to the filter feed tank. The purpose of the feed tank is to serve as a buffer between the upstream and the downstream filtration. A plate and frame filter press is used to form concentrate filter cake with 12% (w/w) moisture. Filter cake wash cycles with fresh water are used to minimize HF contamination and is also considered in the filter sizing. The cake is the stored in the by-product concentrate shed prior to being reclaimed onto the quartz concentrate rotary dryer to reduce the moisture to < 1% (w/w). A caustic venturi scrubber is used to capture and clean the dryer off-gas. The dried concentrate is then conveyed to storage silos for truck load-out.

14.1.10 Spodumene Processing Plant - Tailings Dewatering and Handling

The DMS effluent clarifier receives and thickens the streams from the up-flow classifier, slimes, and DMS grits to 40% (w/w) solids with the aid of the anionic flocculant. The underflow is then pumped to the process tailings thickener for further thickening.

The process tailings thickener receives streams from desliming cyclones, magnetics, and DMS clarifier underflow stream. The slurry is thickened to 55% (w/w) solids. The underflow is then pumped to the filter feed tank. The purpose of the feed tank is to serve as a buffer between the upstream and the downstream filtration. A plate and frame filter press is used to form concentrate filter cakes with 15% (w/w) moisture. The filtered tailings is deposited on to the tailings conveyor along with the coarse DMS tailings.

The chemical plant produces a filter cake tailings stream consisting of analcime material with 20% (w/w) moisture, which is transported to the tailings conveyor at the concentrator via a pocket-style overland conveyor.

14.1.11 Overland Conveying

A bi-directional pocket-style overland conveyor connects the concentrator and the chemical plant. The overland conveyor carries the chemical plant tailings, mentioned previously, to the concentrator. A series of pulleys are used to unravel of the pocket conveyor and allow the unloading of the tailings material onto the tailings conveyor for disposal. A FEL then reclaims the spodumene concentrates (DMS and flotation), stored in the concentrate shed, into a bin. A belt feeder is used to control the feed rate into the unravelled overland conveyor. The conveyor folds back into a pocket-style using pulleys and transports the concentrate to the chemical plant for further processing.

14.2 LITHIUM HYDROXIDE CONVERSION PLANT DESCRIPTION

The lithium chemical conversion plant, uses the Metso:Outotec proprietary technology, by converting the spodumene ($LiAl(SiO_3)_2$) into a lithium carbonate form and then into a soluble lithium hydroxide, to allow crystallization to the final lithium hydroxide monohydrate product. The solutions generated within the circuit are recirculated as much as possible to maintain lithium concentrations, recover as much lithium as possible, and reduce water requirements.

The key process areas for the lithium conversion plant are listed as the following:

- Spodumene Concentrate Storage and Transfer;

- Calcination;
- Grinding and Pulping;
- Carbonate Leaching – High Pressure and Atmospheric;
- Conversion (carbonate to hydroxide);
- Lithium Hydroxide Crystallization and Product Drier;
- Product Bagging Facility.

The high-level process flow in summarized in Figure 14-2.

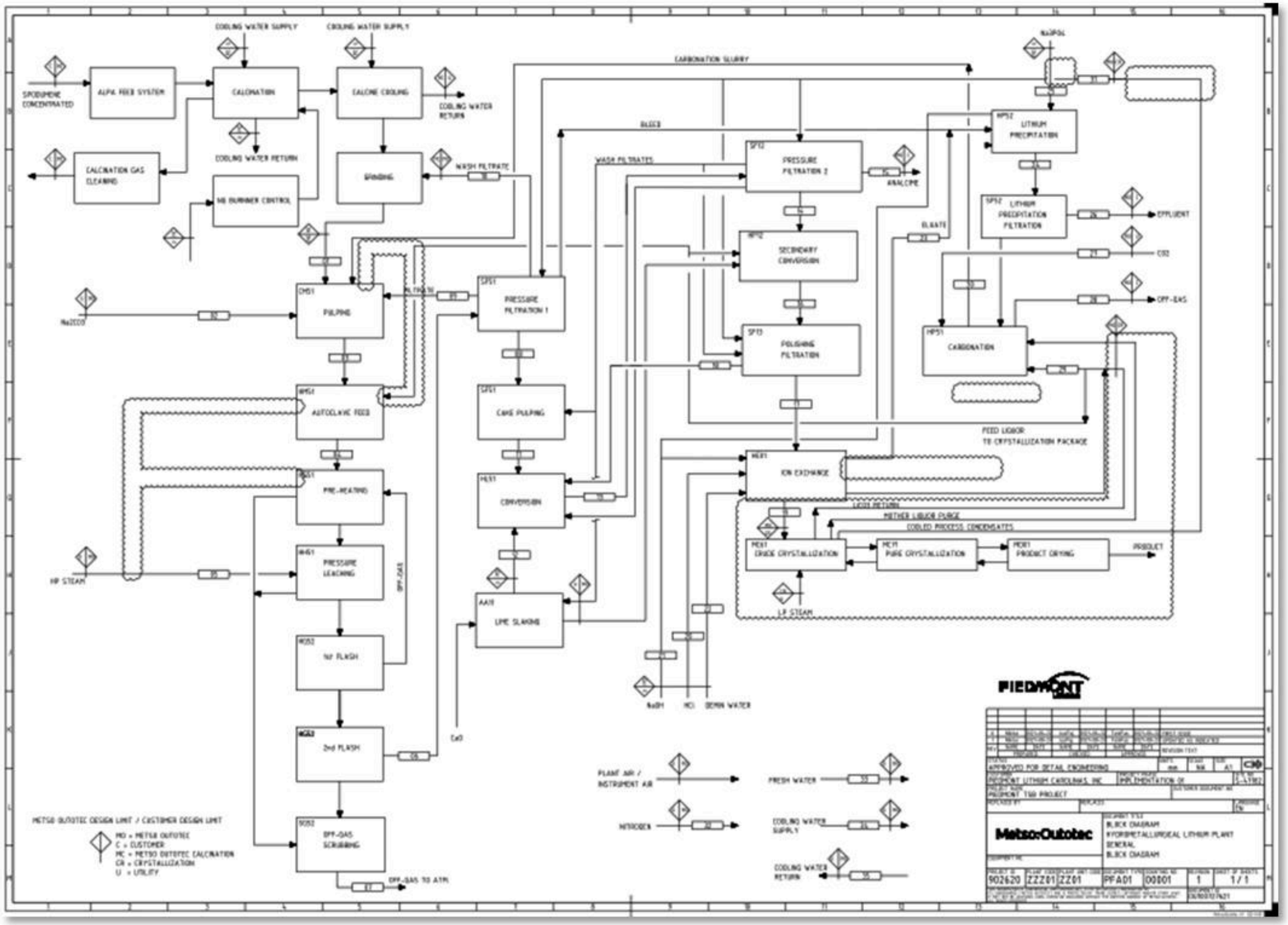


Figure 14-2 - Chemical Conversion Plant - High Level (M:O) Summary

14.2.1 Spodumene Concentrate Storage and Transfer

The stockpiled spodumene concentrate is transported from the concentrate plant to the conversion plant, where it is fed directly into the convertor feed system, or in emergency, to ground. A front-end loader (FEL) compliments the feed requirements to reclaim stockpiled concentrate. The material is then conveyed to the calciner.

The transportation options are primarily via an overland conveyor system nominally 8,000 ft long, or via trucks if the overland conveyor is down for extended periods.

14.2.2 Calcination and Pulping circuit

The material is then calcined at 1,050°C, via a direct fired horizontal rotating kiln, with the calcined material being cooled using an indirect rotating kiln. This converts the spodumene from an alpha form to a beta form, which improves the ores leachability. The cooled calcine is then wet ground in a conventional ball mill circuit and pulped in a sodium carbonate rich liquor. A storage bin (for calcine product) provides a buffer between circuits for a couple of hours, to maintain circuit stability.

Circulating streams; filtrate and wash filtrate from the 1st stage slurry filtration circuit are combined with the calcined solids to generate a slurry of nominally 50-70% solids. Additional solution is added, at the grinding product screen as necessary to achieve a 25-30% (w/w) slurry for feeding the autoclaves.

Solid sodium carbonate feed rate into the circuit is adjusted to maintain a mass ratio with the beta-spodumene mass flow from the grinding circuit, as determined by the operations team.

The slurry is stored in a surge tank where it is then pumped into the pressure autoclave circuit.

14.2.3 Carbonate Leaching – High Pressure and Atmospheric

The lithium leaching occurs concurrently with excess Na_2CO_3 forming a Li_2CO_3 precipitate. This is achieved by heating the slurry to >200°C (>392°F) via a pressure autoclave. A heat recovery system to reduce energy demand and manage the off-gas scrubbing is included in the design.

The slurry from the pulping circuit is fed through the heat recovery circuit where the high pressure flashed steam contacts with the feed to heat the slurry to >150°C. The heated slurry is pumped to the autoclave using positive displacement pumps.

Circulating streams; in addition to the filtrate liquors, the other circulating stream is the mother liquor (ML) from the LiOH crystallization circuit. The B-spodumene leaching in the autoclave, occurs using the 5-chamber unit, which are mechanically agitated with a weir arrangement in place to allow slurry to flow either under or over the weirs. The circuit operates at a >392°F >200°C with an operating pressure of >290PSI >20 barg. The temperature is controlled by direct injection of high-pressure steam.

The autoclave discharge is released via a series of pressure reduction steps; the flashing system (heat recovery system) recovers a large portion of the heat used to maintain temperature at >200°C (292F) and drops the pressure down to atmospheric nominally 14 PSI, which achieves a nominal temperature of 100°C (212°F).

The slurry is then pumped to the filter feed cooling reactor where air and cooling water is utilized to reduce the slurry temperature to a nominal 176°F (80°C).

14.2.4 Off Gas Scrubbing

The gas/vapor from the slurry depressurization stages are collected and treated via a venturi gas scrubber. The venturi scrubber recovers any solids carry-over that occurs in the off gas, by spray water contact. The spray is generated via nozzle sprays and a circulating pump. The spray water reports to the internal water reservoir, where the “slurry” is bled to the filter area and used for cake washing which helps maintain solids load, and salt content. The scrubbed gas/vapor is released to the atmosphere.

14.2.5 Soda Leach Residue Filtration

The cooled autoclave discharge slurry is then filtered to recover the solution, which is circulated back to the mill circuit, to reduce the water demand and recycle the excess Na_2CO_3.

The filtration circuit with a horizontal plate and frame units include filtration, cake wash, pressing and air drying, cake release, and cloth washing stages, which takes a nominal 15-minute cycle. To ensure good washing efficiency and to minimize lithium carbonate solubility, the wash is undertaken at 176°F (80°C). Fresh water, if used, will be heated to the target temperature. Wash filtrate is distributed back into the circuit, primarily to the calcine grinding and pulping process steps.

A bleed to effluent is applied to maintain soluble chloride concentrations and impurity levels in the process streams.

The washed filter cake which is predominantly $NaAlSi_2O_6 \cdot H_2O$ (analcime), Li_2CO_3 (lithium carbonate), SiO_2 (quartz), and gangue minerals, is typically 80% (w/w) solids.

14.2.6 Conversion (Carbonate to Hydroxide)

The filter cake generated is then repulped with recirculated lean LiOH solution, leach residue filtrate, wash waters, and added calcium hydroxide ($Ca(OH)_2$) to convert the lithium carbonate (Li_2CO_3) to soluble lithium hydroxide (LiOH), summarized as the Conversion Stage. The calcium hydroxide is fed at a ratio correlated to the filter cake mass, with the reaction taking place at a nominal 104°F (40°C). The slurry is then filtered, using pressure plate frame filters, with the various filtrates and wash filtrates being separately captured and pumped to the appropriate process steps.

The Li rich hydroxide mother liquor recovered is pumped to the secondary conversion circuit, under a nitrogen rich blanket. The wash filtratesare split between the conversion circuit and calcium hydroxide slurry (milk of lime) preparation respectively. The washed solids (analcime) report to the tailings discharge conveyor, at a nominal moisture of <20% (w/w).

The ML is purified through a series of filters and ion exchange units as detailed in the next section.

A circulating stream from the crystallization circuit is fed back into the conversion circuit to maintain the water balance and provide an impurity bleed for the crystallizer. If the crystallization ML bleed impacts solution chemistry of the conversion circuit, then the effluent bleed is increased to maintain the solution chemistry.

The final discharge from the conversion plant includes the filtered washed solid residue which contains nominally 20-30% water, which is referred to as analcime. This solid is conveyed and transferred onto an overland conveyor, with the option to divert to tailings stockpile where it is then loaded onto a truck and backhauled to the concentrator.

14.2.7 Polishing Filtration and Ion Exchange

The LiOH ML is fed through a polishing filtration (2-stage) process where suspended solids are removed from the lithium hydroxide solution prior to ion exchange processing. The polishing filtration units operate in series with a plate frame filter in the first filtration step and a LSF filter; with a filtering cycle consisting for each stage of:

- Filling and filtration;

- 1st pressing;
- Cake wash;
- 2nd pressing;
- Air dry, cake release;
- Cloth washing.

The nominal circuit cycle time is 105 minutes, with the filter cake being discharged into a pulper unit, which uses cloth and cake wash process water. The solution is then fed to the second filtration unit, which operates for a nominal 30-35 h depending on contained solids concentration in the feed.

The LSF filter circuit operates with the feed being run in recirculation until sufficient filtrate clarity is achieved. Once clear, the filtrate is diverted to the IX feed tank, for batch processing through the IX circuit. The cake formed in the filter unit is then removed via a wash sequence cycle with the sludge and cloth wash solution being fed back to the conversion reactors.

The filtrate in the IX feed tank is pumped through a series of fixed bed columns, run in a load, wash and regeneration cycle. The resin used is selective for multivalent cations.

14.2.8 Lithium Hydroxide Crystallization and Product Drying

The “clean ML” is then crystallized to produce a 99.0% lithium hydroxide monohydrate ($LiOH \cdot H_2O$) product, and dried in a CO_2 lean environment, refer to Figure 14-3. The crystallizing circuit includes an evaporator, with a two-stage crystallization process. Separation between each stage is achieved via a centrifuge prior to repulping or feeding to the drier unit for the consecutive crystallization stages respectively.

During the process, controlling the solution chemistry in the various liquor streams by using saturation limits of the various constituents, allows impurities to be precipitated. These solids are then removed via a series of filters and sent back to the conversion circuit where any associated lithium is recovered.

The final crystallization product is centrifuged and then fed into a drier unit, which includes a cooling stage to bring the product to a temperature of nominally 40°C, prior to pneumatic transport to the bagging plant storage facility.

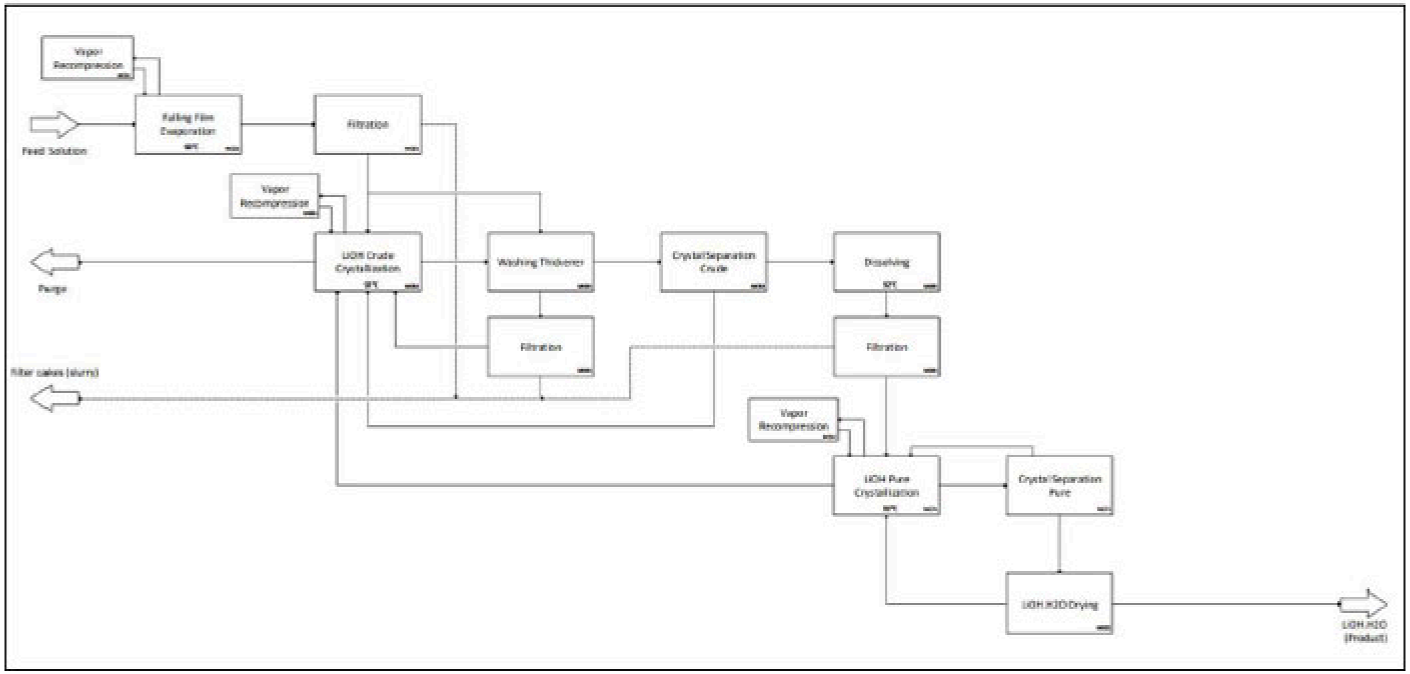


Figure 14-3 – Crystallizer Circuit Summary Flowsheet

14.2.9 Product Bagging Facility

The product is stored in a series of silos under an inert atmosphere (N_2 or CO_2 free air, heated). The bagging facility is proposed to operate during dayshift only. The silos are filled with screened material which is pneumatically transferred after discharged from the drier units. The screening unit separates the coarse and ultra-fines which are pulped and returned to the crystallization circuit for reprocessing.

The screened mid-range material is then pneumatic transferred to the storage silos. During packing, the at size material is run through a magnetic field to remove any magnetic impurities, and subsamples are taken prior to being bagged at a predetermined weight for sale. The bags are then sealed, wrapped in plastic, and then stored. The bag(s) are allocated a Lot number and identifier, so that analysis of subsamples can be issued with each Lot/bag, to meet the QAQC requirements.

14.3 CONCENTRATOR

14.3.1 Key Process Design Criteria

The concentrator is designed to nominally process 1,897,500 metric tonnes per year (tpy). The plant feed is based on MM&A's mine block model with 10% dilution. It is important to note that the feed grade considers only the lithia found in recoverable pegmatite. An average of 77% lithium recovery (based on recoverable lithia units) is used for this design.

By-products production such as mica, feldspar, and quartz are based on mass recoveries and average Life-of-Mine (LoM).

These figures are based on the applicable results of the test work completed to date. The design criteria will progress as the new test work data becomes available. The key design criteria are given in Table 14-1.

Table 14-1 – Concentrate Key Design Criteria

Parameter	Units	Nominal	Design
Plant throughput	dry t/y	1,897,500	2,340,000
Spodumene ore grade (no dilution)	% Li_2O	1.1	
Spodumene ore grade (incl. dilution)	% Li_2O	1.0	
Ore moisture	% w/w	6.0	
Mine dilution	% w/w	10.0	
Life-of-Mine	years	10.6	
Operating days per year	days	365	
Operating days per week	days	7	
Operating shifts per day	#	2	
Operating hours per shift	h	12	
Total operating hours	h/y	8,760	
Processing Plant Production Summary			
Spodumene concentrate Li_2O grade	% Li_2O	6.0	
Spodumene concentrate Fe_2O_3 grade	% Fe_2O_3	1.0	
Estimated spodumene recovery	%	77.0	
Mica concentrate mass recovery	%	1.5	
Feldspar concentrate mass recovery	%	23.0	
Quartz concentrate mass recovery	%	15.0	
Spodumene concentrate production	dry t/y	242,669	299,260
Mica concentrate production	dry t/y	28,301	34,900
Feldspar concentrate production	dry t/y	437,199	539,154
Quartz concentrate production	dry t/y	284,607	350,978
Availability			
Crushing plant availability	%	75	
Crusher operating hours	h/y	6,570	
DMS plant availability	%	85	
DMS operating hours	h/y	7,446	
Flotation plant availability	%	85	

Parameter	Units	Nominal	Design
Flotation operating hours	h/y	7,446	
Ore Characteristic			
Benchmarked crushing work index (CWi)	kWh/t	16.50	18.00
Abrasion index (Ai)	kWh/t	0.47	0.51
Bond ball mill work index (BBWi)	kWh/t	12.00	13.20
Crushing Plant			
Crushing plant throughput	dry t/d	5,199	6,411
Feed size F100	mm	179.0	
Feed size F80	mm	82.0	
Product size F100	mm	6.4	
Product size F80	mm	3.9	
Dense Media Separation (DMS)			
Fine ore storage bin residence time	hours	12	10
DMS plant throughput	dry t/d	5,199	6,411
Feed coarse fraction (-6.3 +2.5 mm) (% of wet plant feed)	%	42.3	
Feed fine fraction (-2.5 +1mm) (% of wet plant feed)	%	27.5	
Feed fine by-pass (- 1 mm) (% of wet plant feed)	%	30.3	
Up-flow classifier mass rejection (% of DMS plant feed)	%	0.7	
Primary DMS target SG	-	2.65	
Primary DMS minimum medium to ore ratio	-	7.50	
Secondary DMS target SG	-	2.90	
Secondary DMS minimum medium to ore ratio	-	15.00	
Magnetic separation - magnetic field intensity	gauss	8,000	
Estimated DMS spodumene recovery (including losses to by-pass)	%	34.2	
Total DMS spodumene concentrate production	dry t/d	295	364
Grinding			
Grinding circuit fresh feed	dry t/d	2,869	3,538
Circulating load (% of fresh feed)	%	250	
Feed size F_{100}	µm	2,500	

Parameter	Units	Nominal	Design
Feed size F_{80}	µm	1,820	
Product size F_{100}	µm	300	
Product size F_{80}	µm	185	
LIMS magnetic field intensity	gauss	5,000	
WHIMS magnetic field intensity	gauss	10,000	
Mica Flotation			
Mica flotation feed	dry t/d	2,524	3,112
Mica flotation conditioning time	min	10	
Mica flotation circuit configuration	-	Rougher and Scavenger + 2 stages of cleaning	
Mica concentrate mass recovery (% of wet plant feed)	%	1.5	
Mica concentrate production	dry t/d	78	96
Spodumene Flotation			
Spodumene flotation feed	dry t/d	2,359	2,909
Spodumene flotation conditioning time	min	20	
Spodumene flotation circuit configuration	-	Rougher and Scavenger + 3 stages of cleaning	
Spodumene flot. concentrate mass recovery (% of wet plant feed)	%	7.1	
Estimated flotation spodumene recovery	%	42.8	
Spodumene concentrate production	dry t/d	370	456
Feldspar Flotation			
Feldspar flotation feed	dry t/d	1,989	2,453
Feldspar flotation conditioning time	min	15 + 10 + 10	
Feldspar flotation circuit configuration	-	Rougher and Scavenger + 2 stages of cleaning	
Feldspar flot. concentrate mass recovery (% of wet plant feed)	%	23.0	
WHIMS magnetic field intensity	gauss	10,000	
Feldspar concentrate production	dry t/d	1,198	1,477

Parameter	Units	Nominal	Design
Quartz Production			
Quartz production circuit feed	dry t/d	782	965
Quartz concentrate mass recovery (% of wet plant feed)	%	15.0	
WHIMS magnetic field intensity	gauss	10,000	
Quartz concentrate production	dry t/d	780	962

14.3.2 Tonnage Basis

All tonnages quoted are metric units and are for dry solid materials unless otherwise noted.

14.3.3 Mass Balance

The process plant mass balance is summarized in Figure 14-4 and is based on the key design criteria above and the process flow sheet. Throughput in Figure 14-4 are shown in metric tonnes per day (t/d).

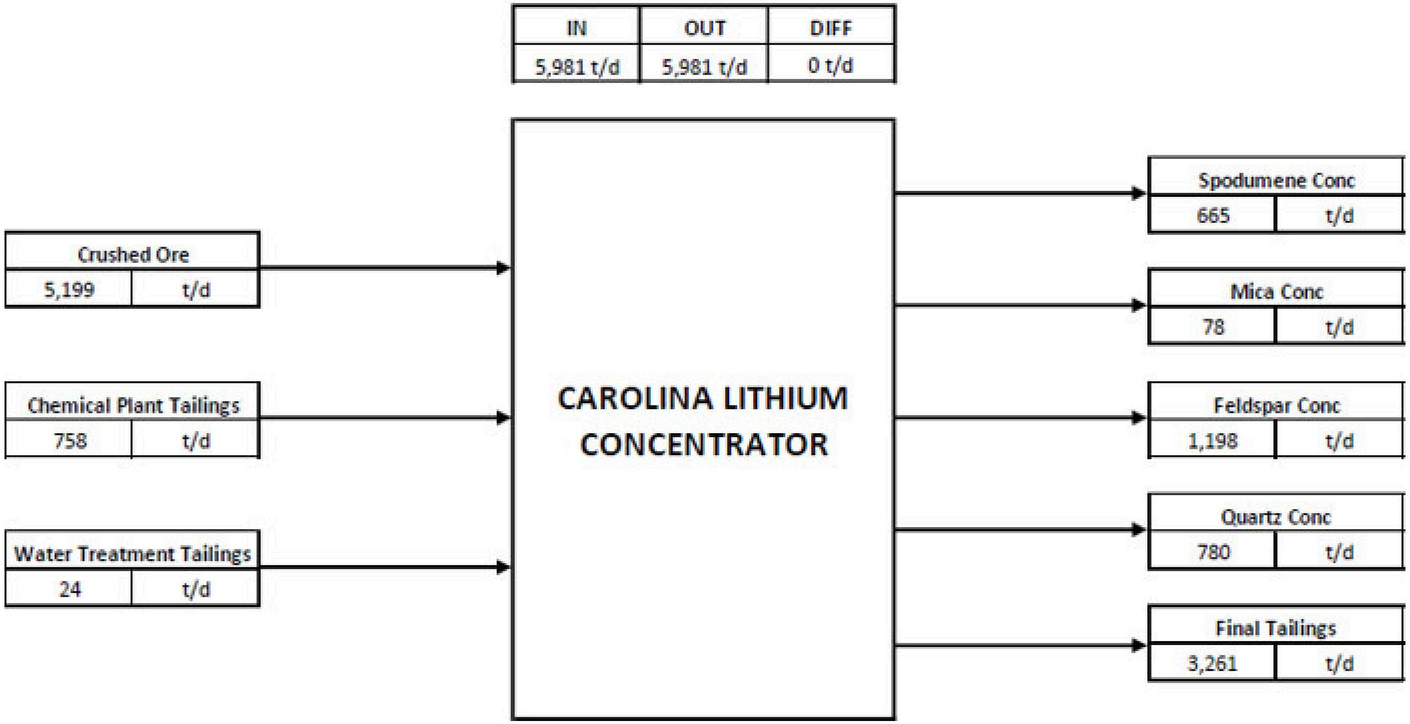
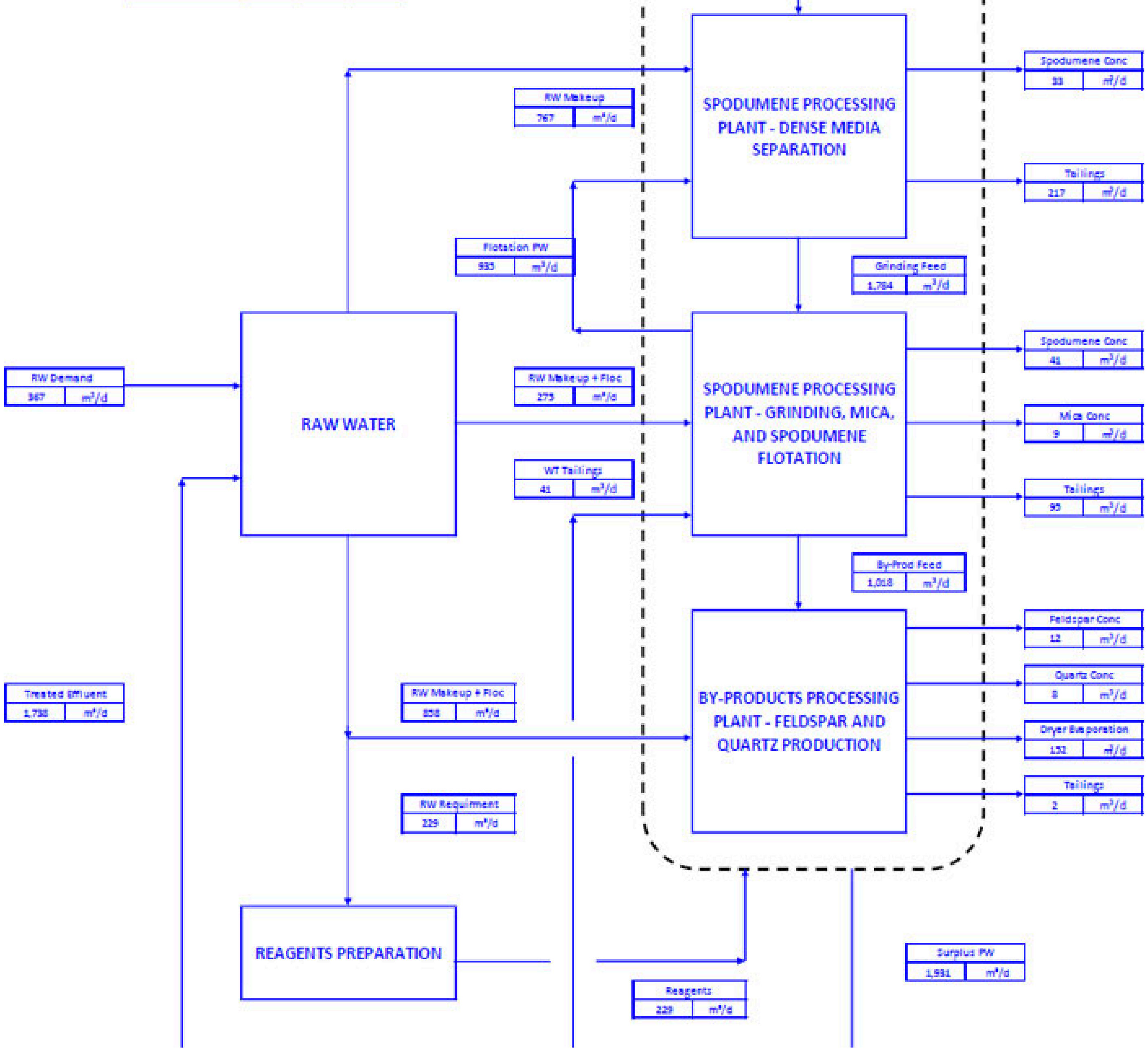


Figure 14-4 – Concentrator Global Mass Balance

14.3.4 Water Balance

The process plant water balance is summarized in Figure 14-5 and is based on the key design criteria above and the process flow sheet. Flowrates in Figure 14-5 are shown in meters cubed per day (m³/d).

Circuit	IN	OUT	DIFF
DMS	2,034	2,034	0
Grinding and Flotation	2,098	2,098	0
By-Products Flotation	1,875	1,875	0
Total	720	720	0



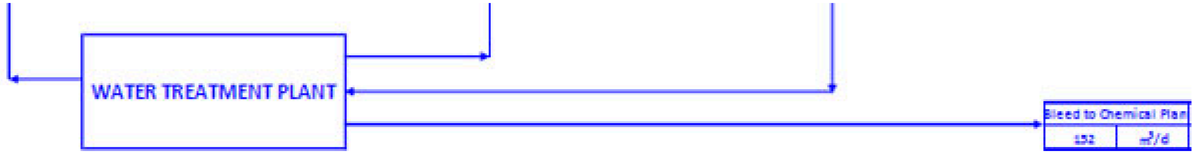


Figure 14-5 – Concentrator Global Water Balance

14.3.5 Reagents and Consumables

Table 14-2 presents the reagents and consumables required by the concentrator.

Table 14-2 – Reagent and Consumables Summary

Operation	Consumable	Usage	Delivery Form	Distribution Method
DMS	Ferrosilicon (FeSi)	Dense media	Super sac	Bag breaker and mixing hopper
Grinding	Ball media	Grinding media	Drum or super sac	Overhead crane and ball mill kibble feeder
Mica Flotation	Tallow alkyl amine Acetate (Armac T) and Coco amine Acetate (Armac C)	Mica collector	Bulk delivery	Dilute with raw water and distribute
	Methyl Isobutyl Carbinol (MIBC)	Frother	Drum - delivered at strength	Direct dosage
	Sodium Hydroxide (NaOH)	pH modifier	Bulk - delivered at strength	Direct dosage
High Intensity Scrubbing and Desliming	F220	Dispersant	Bulk delivery	Dilute with raw water and distribute
	Sodium Hydroxide (NaOH)	pH modifier	Bulk - delivered at strength	Direct dosage
Spodumene Flotation	FA-2	Spodumene collector	Bulk delivery	Direct dosage
	Sodium Carbonate (Na2CO3)	pH modifier	Super sac	Dilute with raw water and distribute
By-Product Flotation	Hydrofluoric acid (HF)	Feldspar collector	Bulk - delivered at strength	Direct dosage
	Coco amine Acetate (Armac C)	Feldspar collector	Tote	Dilute with raw water and distribute
	Kerosene	Promoter	Bulk - delivered at strength	Direct dosage
	Sulfuric acid (H2SO4)	pH modifier	Bulk delivery	Dilute with raw water and distribute
Thickening and Dewatering	Magnafloc 10	Anionic flocculant	Super sac	Dilute with raw and process water
Water Treatment Plant	Lime (Milk of Lime)	Precipitation reagent	Bulk delivery from chemical plant at strength	Direct dosage
	Coconut shell carbon	Adsorption media	Super sac	Hoist and bag breaker for each change out

Reagent mixing will be completed in a designated area within the plant. The design of this area includes features such as bunding, with dedicated sump pumps. The layout and general arrangement of the reagent area account for the need to prevent contact of incompatible reagent types. Separate onsite long-term reagent supply storage is provided a safe distance away from the process plant.

14.3.6 Utilities

Raw Water

Raw water is sourced from well drilled on site or pit dewatering. This is also supplemented by treated water from the water treatment plant.

The raw water system includes a raw water tank and distribution pumps to deliver an estimated nominal flowrate of 2,106 m³/d to the concentrator. Raw water is used for process makeup, gland seal water, reagent preparation, filter cake wash, and fire protection.

Process Water

The concentrator process water distribution consists of three (3) independent circuits to minimize reagent cross contamination, mainly fatty acid (FA-2) and hydrofluoric acid (HF). The process water circuits are as the following:

- DMS Process Water - Provides process water to the DMS circuit. Water is recovered from thickener overflows with raw water as makeup, the estimated nominal flowrate is 29,758 m³/d.
- Flotation Process Water Tank – Provides process water to grinding, mica, and spodumene flotation. Water is recovered from thickener overflows, the estimated nominal flowrate is 26,720 m³/d with a surplus of water at 1,645m³/d, which is filtered and then recycled as flotation gland seal water. Any additional grey water discharge is directed to the water treatment plant and to be recycled as “raw” water post treatment.
- By-products Process Water Tank - Provides process water to by-products flotation. Water is recovered from thickener overflows, the estimated nominal flowrate is 10,161 m³/d with a surplus of water at 1,517 m³/d, which is directed to the water treatment plant and to be recycled as “raw” water post treatment.

Water Treatment

A water treatment facility receives the surplus process water from the flotation and by-products process water circuits. The grey water is treated via a series of precipitation tanks, dissolved air flotation (DAF), and carbon adsorption to reduce impurities. The treated effluent to recycled to the concentrator as “raw” water. Water treatment sludge is thickened, filtered, and the disposed onto the tailings conveyor. A process water bleed post treatment of 152 m³/d is estimated to prevent impurity build up. The bleed stream is pumped to the chemical plant and serves as raw water makeup.

The spodumene concentrate produced from the concentrator is delivered via truck to the integrated conversion plant for battery grade lithium hydroxide production.

The lithium hydroxide plant is based on Metso:Outotec’s proprietary technologies to produce 30,000 tpy of battery grade lithium hydroxide monohydrate.

14.4 LITHIUM HYDROXYDE CONVERSION PLANT

14.4.1 Key Process Design Criteria

The chemical plant is designed to nominally process 195,000 metric tonnes per year of spodumene feed from the concentrator. The key design criteria of the lithium hydroxide conversion plant are presented in Table 14-3. These figures are based on information provided by Metso:Outotec to date.

Table 14-3 – Chemical Plant Basis of Design

Parameter	**Units**	**Value**
Plant throughput	dry tpy	195,000
Operating days per year	days	365
Operating days per week	days	7
Operating shifts per day	#	2
Operating hours per shift	h	12
Total operating hours	h/y	8,760
Project life	years	20
Availability		
Calcination plant availability	%	85.6
Calciner operating hours	h/y	7,500
Hydrometallurgical & crystallization plant availability	%	85.6
Hydrometallurgical & crystallization operating hours	h/y	7,500
Chemical Conversion Plant Production Summary		
Feed Li_2O grade	% Li_2O	6.0
Feed Fe_2O_3 grade	% Fe_2O_3	1.0
Lithium recovery	%	91.0
$LiOH \cdot H_2O$ production	tpy	30,000
Final Product LiOH grade	% LiOH	56.5
Final Product $LiOH \cdot H_2O$ grade	% $LiOH \cdot H_2O$	99.0
Spodumene Calcination		
Calciner feed	dry t/d	534
Feed moisture	% w/w	7 - 12
Feed particle size P_{80}	µm	2,023

Parameter	Units	Value
Calcination temperature	°C	1,050 - 1,100
Calciner residence time	min	110
Concentrate particle size distribution (P_{80})	µm	3,000
Required calcination temperature	°C	1,050
Lithium Hydroxide (LiOH) Conversion		
Total LiOH conversion feed	dry t/d	534
Number of circuits in parallel	-	2
Analcime tailings	dry t/d	758
Analcime tailing % moisture	% w/w	20
Nominal liquid effluent discharge	m^3/d	261
Bagging Plant		
Final production rate	tpy	30,000
Bagging plant operating hours	h/day	10
Bagging plant throughput	t/op h	8.2

14.4.2 Mass Balance

The chemical plant mass balance is summarized in Figure 14-6 and is based on the key design criteria above and the process flow sheet. Throughput in Figure 14-6 are shown in in metric tonnes per day (t/d).

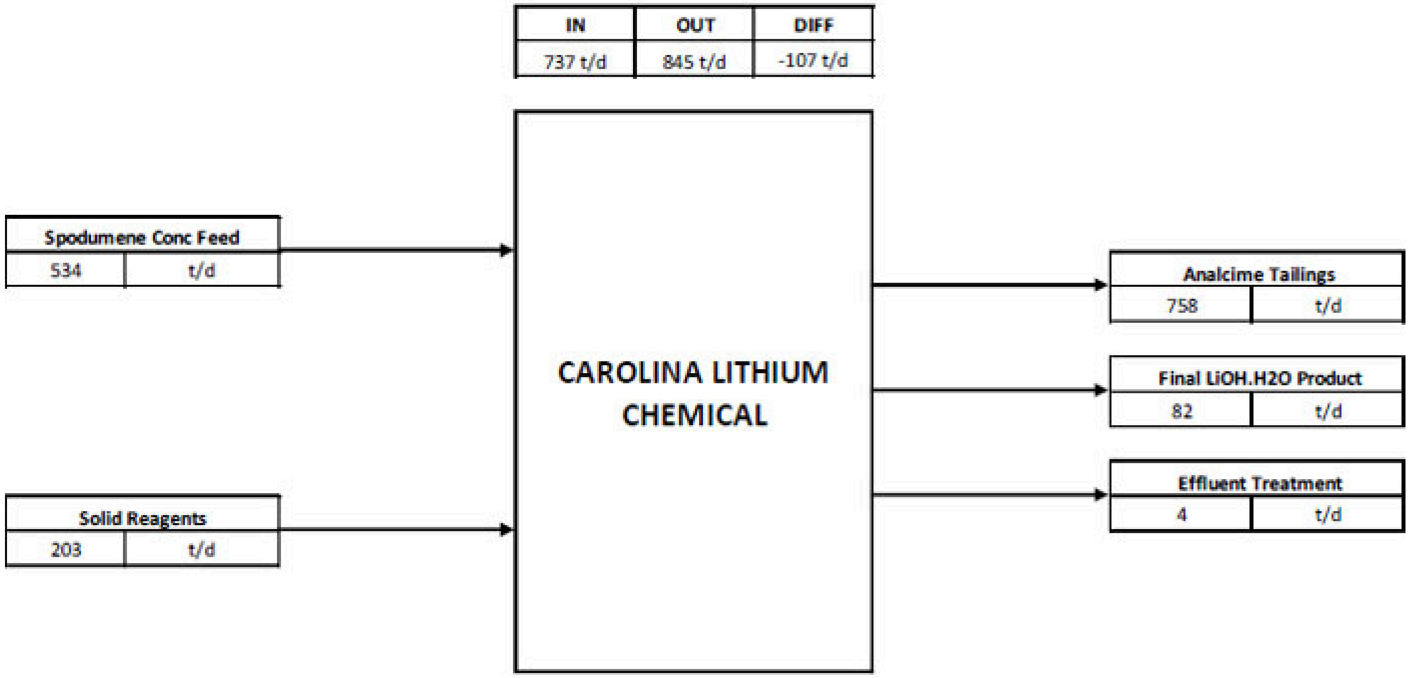


Figure 14-6 - Conversion Plant Global Mass Balance

14.4.3 Water Balance

The chemical plant mass balance is summarized in Figure 14-7 and is based on the key design criteria above and the process flow sheet. Throughput in Figure 14-7 are shown in meters cubed per day (m^3/d).

There is significant internal water recirculation to minimize water makeup requirements and lithium losses. An effluent treatment is designed to the treat the circulated water with sodium phosphate (Na_2PO_4) to reduce soluble lithium concentrations.

Additional evaporative losses from cooling towers are estimated at 740 m^3/d. Further refinement is required in detailed design to determine seasonal evaporative losses and plant water demand.

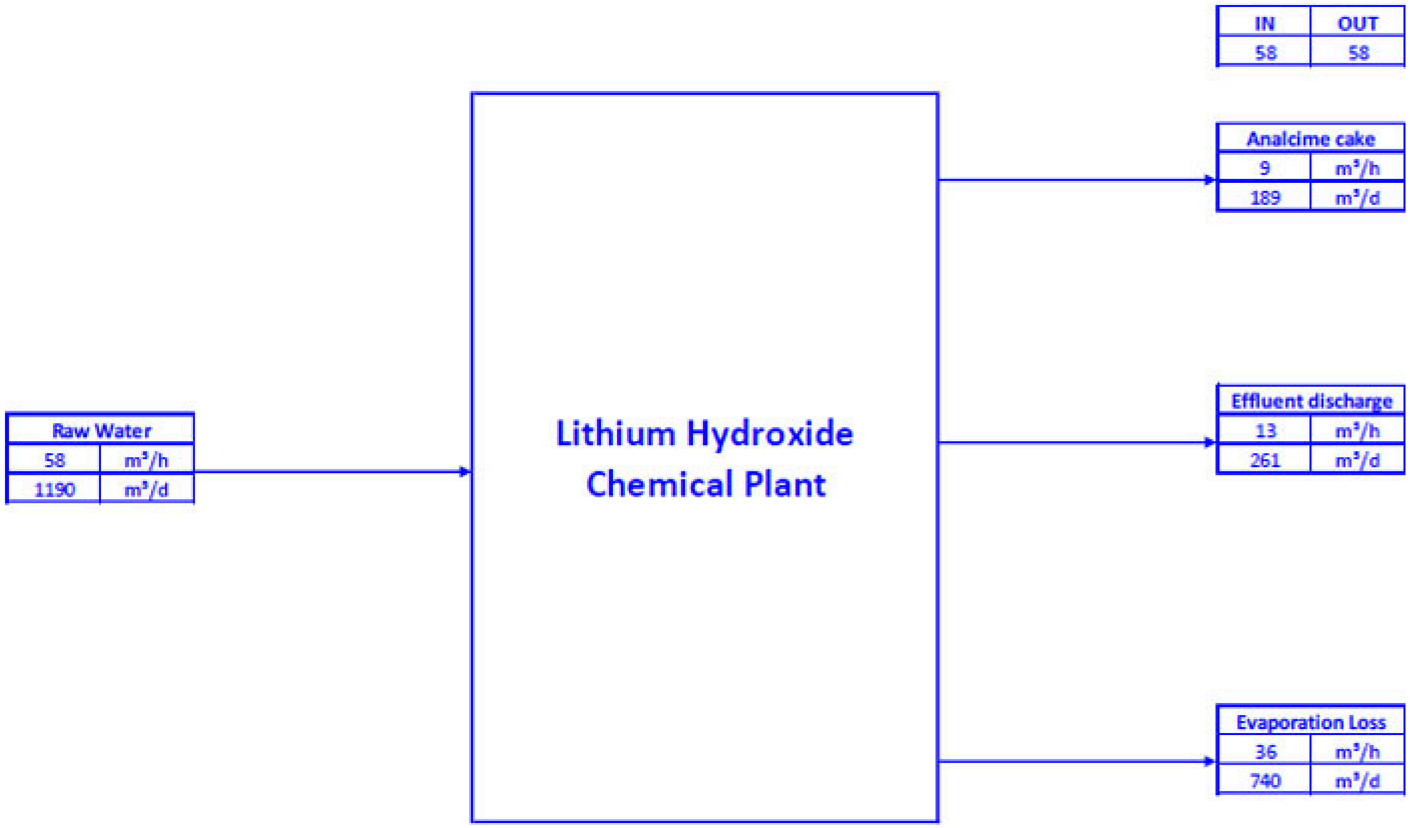


Figure 14-7 – Conversion Plant Global Water Balance

14.4.4 Reagents and Consumables

14.4.4.1.1 Calcium Hydroxide

The bulk delivery will be via truck during phase 1, and rail during phase 2. For rail delivery, a spur arrangement will be in place to store the loaded and empty carriages with offloading being undertaken on a daily to triweekly frequency. The operations team will shunt the necessary carriages to the respective offloading area.

Throughout Phase 1, the lime will be pneumatically transferred to the storage silo. For phase 2, the bulk delivery will be dropped into a train unloading hopper, where the lime is fed from a screw feeder to a belt conveyor situated in an underground bunker. The belt conveyor distributes the off-loaded lime to a bucket elevator which then feeds directly into a silo. The dry powder is then screw fed to the attrition mill/mixer. Water and lime are mixed in ratio to maintain operating temperatures and to produce a 20% (w/w) product, which then gravitates to the lime storage tank. During bucket elevator maintenance and downtime, the hydrated lime is pneumatically transferred to the storage silo.

The storage silo has level monitoring so that delivery schedules can be managed, by providing feedback to the logistics team/suppliers so they can manage their delivery sequences. The lime silo has a storage residence time of four days. The four days of storage allows for train shunting and offloading during weekdays to minimize noise emission on weekends.

The storage tank level is maintained by monitoring the tank level and when the level is low enough to hold a mixing batch then a mix will be automatically initiated and managed by the vendor unit. The storage tank has a 36-hour storage capacity, to account for slaker downtime and ensure a consistent mixing schedule. The increased storage capacity enables the 10-hour batch mix to be done during the dayshift only.

The hydrated lime slurry (Milk of Lime - MOL) is distributed by a centrifugal pump via a ring main within the process facility. The MOL dosing rate is managed at the addition location by a flow distribution control valve which is regulated based on an addition ratio to the respective circuit feed.

14.4.4.1.2 Sodium Carbonate

The bulk delivery will be via rail, with trains delivering the material once or twice per week, as necessary. A spur arrangement will be in place to store the loaded and empty carriages with offloading being undertaken on a daily to triweekly frequency. The operations team will shunt the necessary carriages to the respective offloading area.

The bulk delivery will be dropped into a train unloading hopper, where the lime is fed from a screw feeder to a belt conveyor situated in an underground bunker. The belt conveyor distributes the off-loaded soda ash to a bucket elevator which then feeds the diverter chute. The dry powder is either belt conveyed to the pulping tank, via a variable speed unit, for mixing prior to pressure leaching, or fed to the storage silo. A screw feeder recirculates the soda ash from the silo to the bucket elevator to feed the pulping tank.

The storage silo has level monitoring so that delivery schedules can be managed, by providing feedback to the logistics team/suppliers so they can manage their delivery sequences. The four days of storage enables train shunting and offloading during weekdays only to minimize noise emission on weekends.

The storage tank level is maintained by monitoring the tank level and when the level is low enough to hold a mixing batch then a mix will be automatically initiated and managed by the vendor unit.

The soda ash dosing rate is managed at the addition location by a mass distribution screw feeder which is regulated based on an addition ratio to the respective circuit feed.

14.4.4.1.3 Trisodium Phosphate

The bulk solid delivery will be via biweekly truck shipments. The delivery truck’s pump will pneumatically transfer the solid sodium phosphate shipment into the storage silo. The phosphate is contacted with water to achieve the desired phosphate solution concentration for precipitating Li in solution.

The phosphate storage silo has level monitoring so that delivery schedules can be managed, by providing feedback to the logistics team/suppliers so they can manage their delivery sequences.

14.4.4.1.4 Hydrochloric Acid

The hydrochloric acid is delivered in bulk and stored on site in a tank with 3.5 days of storage capacity. The 28 m^3 tank stores the 33% HCl (2 M) shipped liquid acid. Hydrochloric acid transfer pumps transfer the acid to an inline mixer, where the acid concentration is diluted with fresh water. Dilution of the acid is undertaken to achieve the necessary 7% (2 M) HCl concentration. The diluted acid is stored in a separate tank, which is filled with a 1 hour mix every 12-hour shift.

The hydrochloric acid storage tank has level monitoring so that delivery schedules can be managed, by providing feedback to the logistics team/suppliers so they can manage their delivery sequences. The diluted acid tank level is maintained by monitoring the tank level and when the level is low enough to hold a mixing batch then a mix will be automatically initiated.

14.4.4.1.5 Sulfuric Acid

The sulfuric acid is delivered as a 92% concentration sulfuric acid in a tote which is stored in the acid area. A drum pump attached to the tote pumped the acid into the sulfuric acid tank, where it is mixed with fresh water to a 10% concentration.

The hydrochloric acid storage tank has level monitoring so that delivery schedules can be managed, by providing feedback to the logistics team/suppliers so they can manage their delivery sequences.

14.4.4.1.6 Caustic (NaOH) circuit

The solution delivery will be via truck shipments. The delivery truck's pump will transfer the solution sodium hydroxide into the storage container, and will be diluted to <30%, to reduce circuit crystallization due to saturation.

The phosphate storage silo has level monitoring so that delivery schedules can be managed, by providing feedback to the logistics team/suppliers so they can manage their delivery sequences.

14.4.5 Utilities

14.4.5.1.1 Nitrogen

The nitrogen supply will be provided by an onsite pressure swing adsorption (PSA) system. The PSA system utilizes gas phase adsorption to separate and recover nitrogen from the air. The PSA has two adsorber vessels, piping and valves to allow for continuous product flow and automatic switching between the carbon molecular sieve beds. Switching is controlled by a proprietary electronic control system.

14.4.5.1.2 Carbon Dioxide

The carbon dioxide is supplied as a liquid via truck shipments. The equipment, maintenance, monitoring, and supply are provided by the vendor of the CO_2 liquid. A remote, solar powered telemetry unit mounted on the storage tank provides the vendor with monitoring capabilities. The vendors continuous, real-time monitoring of product supply will enable optimal refill scheduling and further guarantee a reliable source of supply.

14.4.5.1.3 Natural Gas

Natural gas shall be used as the fuel source for calciner and steam boilers. Natural gas is supplied from the service provider network (Dominion).

14.4.5.1.4 Boiler

The multiple boiler unit(s) will supply the steam necessary to maintain the operating temperatures within the conversion plant. The boiler is fed via a combination of both demineralized water and fresh water to maintain the water feed quality as detailed in the design criteria. The purge, blowdown stream is returned to the water surge tanks for use in the circuit as grinding water make-up water, or for lime slurry make-up.

The plant steam demand is as the following:

- High pressure – 9.8 t/h @ 28 barg (405 PSI);
- Medium pressure – 12.5 t/h @ 10 barg (145 PSI);
- Low pressure – TBC t/h @ 2 barg (30 PSI).

14.4.5.1.5 Potable Water

Potable water will predominantly come from municipal supply, 2-day site storage, with a UV and bacterial treatment occurring onsite to mitigate any water contamination. The potable water is distributed via dedicated pumps located at the potable water storage tanks. Water is distributed to the following areas:

- Safety shower will be distributed on a ring main to minimize water temperature excursions for use across the whole plant specifically; the laboratory area, reagents – acid area, soda ash, hydrated lime, and within the process facility the grinding, autoclave, conversion and IX circuit, crystallization and bagging circuits;
- To all laboratory, ablutions, and administration buildings;
- Heat tracing will be applied where necessary to minimize line freeze.

14.4.5.1.6 Fresh Water

The fresh water is from the municipal supply. The storage tank will be sufficient to hold 48 hours of demand. The tank is filled from the excess water that gravity flows from the fire water tank. Fresh water is distributed as needed to the:

- evaporative cooling system, supplemented with demineralized water to maintain the salt content to <50ppm Cl;
- demineralized circuit;
- reagent/grinding circuit make-up.

14.4.5.1.7 Fire Water

The fire water is from the municipal supply. The storage tank will be sufficient to hold 90 minutes of instantaneous demand, with a 90k gallon capacity. Municipal water supply ensures the fire water tank is constantly filled, where the excess water will gravity flow to the freshwater tank. Due to the stand-alone nature and remoteness of the lithium conversion plant, the following fire provisions are utilized:

- A site wide practical automatic fire detection and alarm system that can convey critical and definitive information to a central location/control room point to allow for rapid emergency response by plant personnel/emergency response team;

- Automatic fire detection/protection systems for critical assets, such as the substations, infrastructure, control facilities, and process equipment;

- Site-wide fire water pumping and reticulation system. The fire main is installed in a ring configuration complete with take-off points to critical areas and sectionalizing valves to allow for part isolation of the fire water main while maintaining coverage to other areas of the site;

- First attack/first aid fire fighting equipment that can be used by the majority of staff to control a fire even in the early stages;

- Safety shower will be distributed on a ring main to minimize water temperature excursions for use across the whole plant specifically; the laboratory area, reagents – acid area, soda ash, hydrated lime, and within the process facility the grinding, autoclave, conversion and IX circuit, crystallization and bagging circuits;

- To all laboratory, ablutions and administration buildings.

Heat tracing will be applied where necessary to minimize line freeze.

14.4.5.1.8 Demineralized Water

The demineralized water will be fed from the fresh water surge tanks, with supply being provided by the Municipal system. The system is on dedicated standalone skids which are pre-piped and pre-wired containerized systems which includes:

- Multi-media filters (3 units);
- Sodium Bisulfite contact tank;
- Caustic injection system;
- RO – double pass system;
- IX Units.

The final product (Permeate) is transferred to the demineralized water storage tank. The demineralized water is fed to the boiler units for steam production. The solute solution along with any cleaning effluent is transferred to the Grinding / Repulping Surge Tank.

14.4.5.1.9 Gland Water

The gland water is distributed from the freshwater tank, further evaluation during the FEED will be undertaken to confirm if a booster unit is required for the single pump unit that requires gland water.

Gland water flow management at each pump is via a solenoid valve which opens when the request for pump start has been initiated and closes after a set period of time when a pump stop is initiated. Flow to the gland relies on a pre-set maric valve, with an inline strainer installed to minimize suspended solids carry through. A flow switch provides feedback that the system / water flow is functioning within design limits.

14.4.5.1.10Ablutions

Ablution facilities are in the following areas:

- Laboratory;
- Control Room;
- Shared Plant Area;
- Boiler Room;
- Administration Building;
- Maintenance Building;
- Gatehouse;
- Concentrator (disposal line).

The ablutions are all combined to have one connection for disposal to the municipal sewage treatment system, from the concentrator and conversion sites.

14.5 PLANT LAYOUT

14.5.1 Overall Site Arrangement

The complete processing of spodumene ore to lithium hydroxide occurs at two separate processing facilities, located at two separate sites. These facilities are the Concentrator Site and the Conversion Plant Site. Both sites are within the overall site permit boundary, however the sites are not connected by private road, rather the passage between the sites is on public road, including the transport of spodumene concentrate and conversion plant tails between the two sites. The two sites are approximately 2.5 km apart.

The concentrator site contains the processing facilities for the beneficiation of spodumene ore to spodumene concentrate (SC6) and the associated processing facilities used to produce quartz, feldspar and mica concentrate products.

A bi-directional pocket-style overland conveyor connects the concentrator and chemical plant sites. The conveyor consists of pulley systems, at both sites, for belt raveling and unraveling as well as booster stations at locations of high conveyor tension. The routing of the pocket conveyor is shown in green on the overall site arrangement drawing in Figure 14-8. SC6 is transported from the concentrator site to the chemical plant facility via the overland conveyor. Meanwhile, the chemical plant tailings stream (~ 37 t/h) is backloaded onto the returning section and is conveyed to the concentrator. A dedicated conveyor system is installed at the concentrator site to collect all dry tailings streams and transport them for disposal to the waste rock and tailings storage facility (WRTSF).

The concentrator location has been selected based on its proximity to both the mining operations and the waste rock and tailings storage facility. Concentrator feed shall be by overland conveyor and dry tailings disposal shall be by belt conveyor to the WRTSF in the early years (estimated year 4) and by belt conveyor to exhausted mining pits once available for backfilling.

The conversion plant layout has been selected based on its proximity to the CSX Transportation rail line, which lies north of the site. A rail spur from that line shall be built to service the facility and will be used to import bulk consumables (reagents) and export LiOH product.

Both the concentrator site and the conversion plant site layouts have been developed with the flow of bulk materials as the primary consideration in the arrangement of facilities. The flow of bulk material has been considered both from a processing route and a road transportation of bulk materials perspective.

In addition, the following factors have been considered in developing the site layout:

- Site topography and geotechnical ground conditions;
- Minimize visual impact for surrounding residents;
- Avoidance of existing natural water courses (where possible);
- Site stormwater and run-off capture and management;
- A single site entry point and security gate to control access on and off the plant site;
- Traffic management associated with reagent deliveries and light vehicles;
- HV electrical feed location from utility provider;
- Administration and other facilities located with minimum intrusion into the processing area.

The overall site general arrangement, including the locations of processing plant and the conversion plant is presented in Figure 14-8.

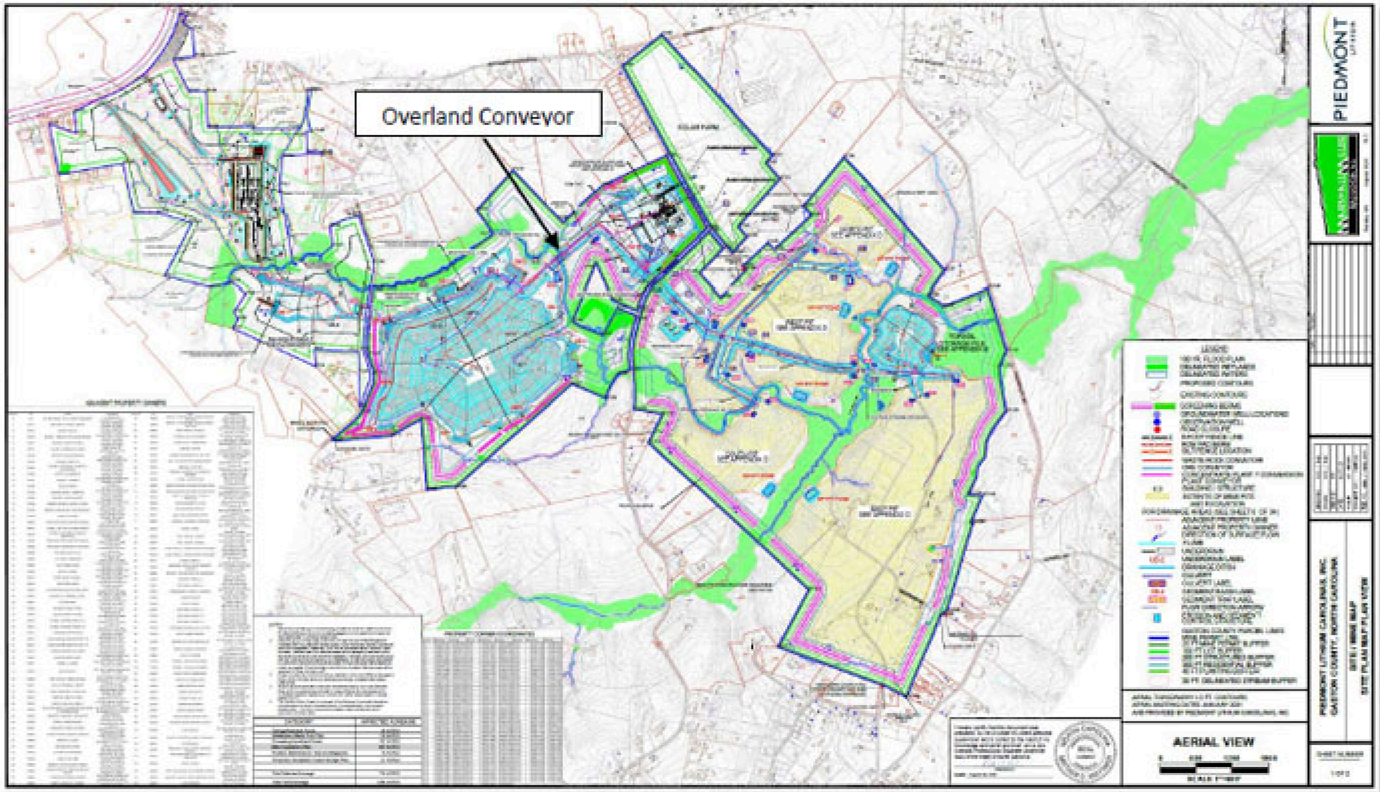


Figure 14-8 – Integrated Manufacturing Campus Site Plan

14.5.2 Processing Plant Site

The concentrator site has been located immediately to the north-east of the mining operation.

Waste rock from the mining operation is crushed at the mine and transported by belt conveyor to the WRTSF at approximately 4,700 t/h. This conveyor route has been optimized to reduce conveying costs.

Ore from the mining operation is primary crushed at the mine and transported by belt conveyor concentrator site at approximately 300 t/h. This conveyor route has been aligned with much larger waste rock conveyor, and as such the ore storage and reclaim for process plant feed has been positioned along this alignment, at the southwest edge of the concentrator site.

Dry processing facilities (ore crushing circuit and by-products drying circuits) are located outside. Crushed ore is stored in a closed bin to minimize fugitive dust emissions. Wet processing facilities are located within processing buildings.

There are four main processing buildings on the site, these are:

- Spodumene and mica processing;
- Spodumene and mica product filtration, storage, and loadout;
- By-products (quartz and feldspar) processing;
- By-products (quartz and feldspar) product filtration and storage.

The SC6 conveyor loadout is positioned west of the spodumene and mica concentrate shed for ease of materials handling.

The concentrator site has been arranged such that there is a common loop road for the transport by truck of bulk materials. This loop road accommodates the following bulk material transfer requirements:

- Emergency SC6 loadout (to open truck by front end loader);
- Mica concentrate loadout (to open truck by front end loader);
- Quartz concentrate (dried) loadout (to closed truck direct from silo);
- Feldspar concentrate (dried) loadout (to closed truck direct from silo).

A weigh bridge has been positioned to weigh incoming and outgoing trucks.

The crushing plant, complete with fine ore storage, has been positioned to optimize belt conveyor transfer distances and to minimize its interaction with bulk transport vehicles.

The spodumene and mica processing building has been arranged such that all products streams can be readily conveyed to the loadout facility positioned on the loop road. Consideration has also been given to the various independent water circuits within the building, and equipment has been arranged to avoid cross contamination of water circuits and to minimize the need for separate bunds.

The by-products processing plant has located in an independent building due to the use of hydrofluoric acid in the circuit as a flotation reagent, which is toxic and therefore processing areas utilizing hydrogen fluoride are segregated from the remainder of the plant. The by-products processing plant has been positioned adjacent to the tailings conveyor such that the by-products plant feed can be redirected readily to the WRTSF if the by-products plant is offline.

Reagent storage, preparation and distribution facilities are located in close proximity to their consumption locations, and as such the reagent areas have been separated as follows:

- Spodumene and mica reagents;
- By-products (quartz and feldspar) reagents.

A water treatment plant (WTP) is located in the southwest of the spodumene processing plant, below the main water services area, to minimize pipe runs to the raw water tank.

The electrical power factor correction and HV switchyard has been positioned on the south side of the process plant such that:

- It is in close proximity to the incoming power line, which is anticipated to approach the site from the south along Whitesides Road;

- It is central between the Concentrator site and the mining operations, as it provides an HV feed for both of these operations.

Electrical transformers and LV switch rooms have been located in various locations around the plant to minimize low voltage cable runs, with particular consideration to high power loads.

Other non-processing buildings on the site are:

- Administration facility;
- Processing laboratory;
- Workshop and warehouse;
- Plant access security gatehouse.

These facilities have been located on the eastern side of the concentrator site, adjacent to the site entry point to minimize interaction between administrative personnel and processing operations. The workshop and laboratory have been positioned to allow ease of equipment and metallurgical samples between the process areas and these facilities.

The guard house will be located at the entrance of the property to monitor pedestrian and all vehicle traffic to the site.

Provision has been made in the site layout for an ore sorting circuit should it be deemed necessary in the future. The layout of the processing plant is presented in Figure 14-9.

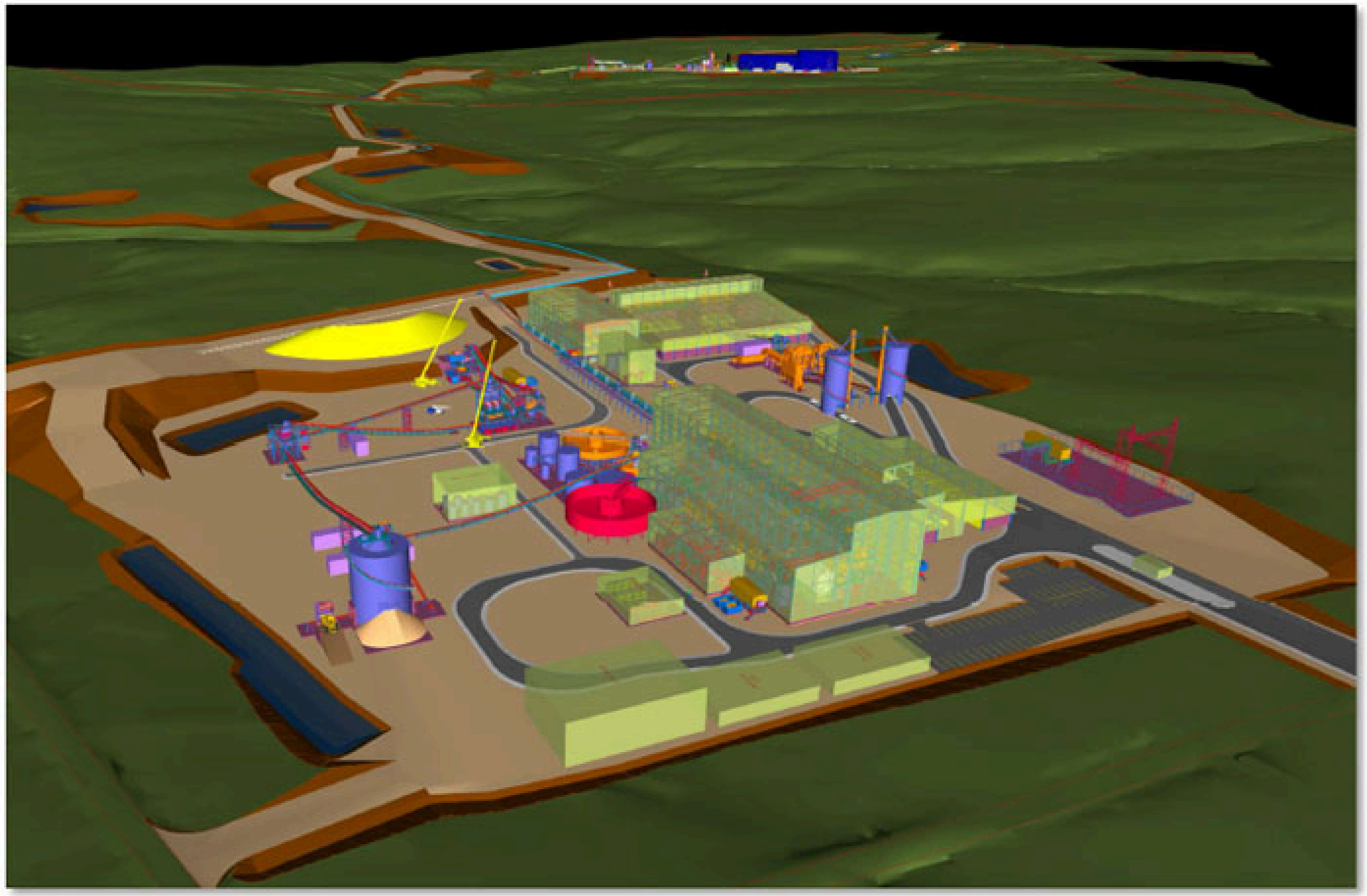


Figure 14-9 - Process Plant Layout

14.5.3 Lithium Hydroxide Conversion Site

The conversion plant site has been located in the north-west area of the overall site permit boundary, just south of the CSX Transportation rail line. The layout of the processing plant is presented in Figure 14-10.

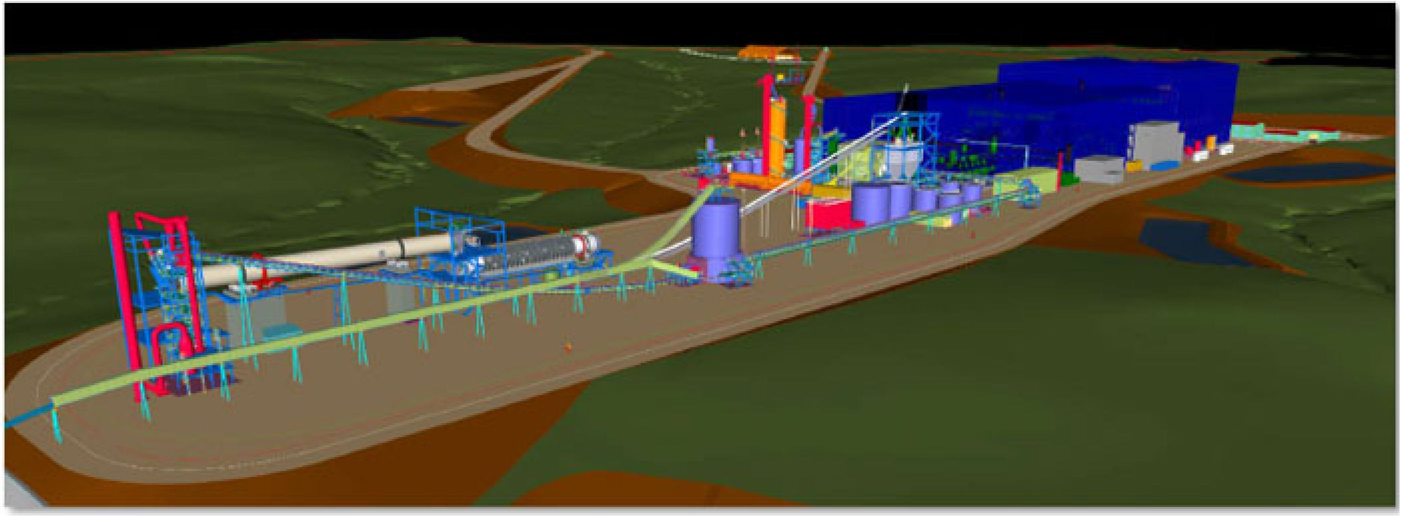


Figure 14-10 - Lithium Converter Plant Layout

15 INFRASTRUCTURE

15.1 SPODUMENE CONCENTRATOR

15.1.1 Potable Water

Potable water is provided to the plant by a connection to the municipal water supply. Potable water is distributed to following areas:

- Administration facility;
- Processing laboratory;
- Workshop and warehouse;
- Plant access security gatehouse;
- Spodumene and mica processing;
- By-products (quartz and feldspar) processing.

Where potable water is used for the supply of emergency shower and eyewash circuits, a dedicated pump and in-line heater is provided.

15.1.2 Sewage

Ablution facilities are located in following areas:

- Administration facility;
- Processing laboratory;
- Workshop and warehouse;
- Spodumene and mica processing;
- By-products (quartz and feldspar) processing.

Sewage from these facilities report by gravity to sewage pump stations and is pumped to the chemical plant site for discharge into the municipal sewer system.

15.1.3 Fire Services

The concentrator site is protected by a fire water system in accordance with NFPA standards. This system comprises of a dedicated fire water storage stank, electrical and diesel fire water pumps, fire water hose reels, standpipes, and sprinkler systems as required.

Automated fire detection and suppression systems are included in high-risk areas such as electrical switch rooms and hydraulic rooms.

15.1.4 Natural Gas

Natural gas shall be used as the fuel source for the rotary dryers for quartz and feldspar, and for various heating duties associated with the HVAC systems around the site.

Natural gas is supplied from the service provider network (Dominion).

15.1.5 Roads

Site roads shall be provided for all operations and maintenance activities. Roads shall be asphalt in high traffic areas only.

15.1.6 Diesel

A diesel storage and distribution facility shall be provided at the concentrator site to supply mobile equipment at the site.

Diesel shall be supplied by road tanker.

The facility shall provide sufficient diesel storage, provision for tanker unloading and for refueling of mobile equipment.

All other fuel and lubricants on site will be stored and dispensed from a dedicated storage area.

15.1.7 Compressed Air

Compressed air is provided by rotary screw compressors. The following compressed air circuits are included:

- Crushing circuit plant air;
- Spodumene and mica processing plant air;
- Spodumene and mica processing instrument air (from plant air circuit);
- By-products (quartz and feldspar) processing plant air;
- By-products (quartz and feldspar) instrument air (from plant air circuit);
- Spodumene concentrate filter air;
- Mica concentrate filter air;
- Quartz concentrate filter air;
- Feldspar concentrate filter air;
- Process tailings filter air.

Each compressed air circuit is complete with air dryers and filters to provide the required air quality, and with air receivers sized to accommodate the maximum instantaneous flow rate required.

Duty/standby compressors are provided for plant air services. Plant air circuits shall be used to feed instrument air circuits with additional filtration, drying and storage as required.

Flotation cell low pressure air is provided by centrifugal blowers. The following low pressure flotation air circuits are included:

- Spodumene and Mica flotation blowers;
- By-products flotation blowers.

Duty/standby blowers are provided for each circuit.

15.1.8 Electrical Power Supply and Distribution

The Concentrator and pit crusher will be supplied by one main electrical entrance of 3 phases 13.8 KV line from local utility provider. The size of this line is around 33 MVA including

- 24 MVA for Concentrator and by-product Plant;
- 9 MVA for mining pit-crushing.

The main low voltage power distribution throughout the plant will be 277/480V, 60 Hz, 3 phases. Medium voltage will be 4,160V, 60Hz, 3 phases.

In the concentrator, a 13.8 KV substation including switchboard and 12 feeders will supply 8 E-Rooms located in different areas near to motors to reduce cable cost and drop voltage. To optimize maintenance cost and spare parts, the electrical distribution will be based on 8 standards 2.5 MVA transformers 13.8KV/480V with MCCs sized at 1600A and 1 standard 2.5MVA transformers 13.8KV/4.16KV for ball mill.

In the concentrator, the largest motors will be:

- Ball mill with 2,000 HP (1,500KW). It will be started with 4.16 KV VFD;
- Secondary and tertiary crushers 400 HP (300KW). It will be started by 480V VFD;
- Water pumps 350 HP (260KW). It will be started by 480V VFD.

For pit-crushing, we will install a main 13.8 KV substation with switchboard including 2 feeders supplying :

- 7.5 MVA mobile 13.8 KV substation and pit crushing equipment;
- 3 conveyors in pit crusher with 500KVA each.

15.1.9 Control and Communication

PLC to Remote Input/Output (RIO) communications will be Ethernet over multimode fiber, copper and / or wireless. Communications within the plant area will be hardwired.

The operator control stations (OCS) located in the control rooms allow processes to be started, controlled, monitored, and shut down through the PCS (Plant Control System).

The concentrator PLC processor racks will be in switch rooms except for vendor package PLCs that may be in field control panels. The PLC hardware and associated code will be divided according to the process areas in a logical manner.

Ethernet communications within the plant to locations outside of the Switchrooms / control room building/s shall be interconnected with a multimode fiber optic self-healing ring/mesh. Communications within buildings and panels shall be radial (star) copper CAT5E communications with RJ45 connections. Connections to distant equipment will be by single mode fiber optic cable.

Communications to EOLs and VFDs will generally be Ethernet communications dependent on the hardware, where communications are Ethernet, they may be combined with RIO networks. EOL and VFD communications networks may be a combination of self-healing ring, star, or daisy chain configurations.

15.1.10 Administration Facilities

Administration offices and facilities will be provided for all operations and maintenance personnel. Buildings shall be of prefabricated modular construction.

All buildings will be plumbed, powered and contain HVAC as required. The following buildings shall be included:

- Plant offices including toilets, training room and first aid facilities;
- Change-house complete with locker rooms, showers and toilet facilities;
- Security gate house.

15.1.11 Control Room

The control rooms will be modular, air-conditioned and designed to be quiet and with less vibration from around equipment. It will be located inside the process near to equipment. It will include:

- 2 OWS: Operation Workstation;
- 1 EWS: Engineering Workstation;
- 2 Mains redundant PLCs;
- Servers;
- UPS;
- Ergonomic furniture.

15.1.12 Laboratory

A site laboratory facility will be provided. The laboratory will be of a prefabricated modular construction and connected to all services.

15.1.13 Workshop/Warehouse

A combined maintenance workshop/warehousing facility shall be provided. This building will be of steel frame construction on a concrete slab and include racking, lighting, power, ventilation and plumbing as required. It shall be fitted with an overhead crane for maintenance activities.

An exterior lay-down area with area lighting shall be provided for the storage of larger parts, equipment and materials.

15.2 LITHIUM HYDROXYDE CONVERSION PLANT

15.2.1 Non-Process Facilities

The facility includes the non-process buildings listed in Table 15-1. All buildings (with the exception of the maintenance shop/warehouse) are insulated and equipped with heating and air conditioning systems.

Table 15-1 - Non-Process Buildings

Building Name	Size & Description
Administration	• 50 ft x 50 ft • Men's & women's locker and showers
Lunchroom	• 45 ft x 50 ft • 25-person capacity
Entrance Guard House	• 15 ft x 20 ft • 25-person capacity
Laboratory	• 50 ft x 50 ft • Parking lot
Maintenance shop/warehouse	• 65 ft x 100 ft • 5 t overhead crane

The Entrance Guard House, Administration Building and the Lunchroom are located at the north end of the facility, adjacent to Hephzibah Church Road. The laboratory is located between the Lithium Product Storage building and the reagents area. The maintenance shop/warehouse is located north of the reagents area.

15.2.2 External Pipe/Cable Racks

Pipe/cable racks will be used for the distribution of utilities (such as electricity, compressed air, water, etc.) as well as for the transfer of process fluids and slurries.

The locations and sizes of major pipe/cable racks, located outside of process areas/buildings, are shown in the site plan and isometric drawings. Two types of pipe/cable tray are included:

- A heavy pipe/cable rack;
- A light pipe/cable rack.

The site plan includes a total of 3011 feet of pipe/cable rack. 1535 feet of heavy rack and 1476 feet of light rack.

15.2.3 Electric Power distribution

The power distribution for conversion plant is based on 13.8 KV in main entrance delivered by local utility power provider. At the upstream we have a main substation sized at 2000A/13.8KV with 12 feeders that supply 6 Switchrooms. The plant will include 12 transformers of 2.5 MVA each located in different areas. All MCCs will be standardized to 480V/1600A. To optimize cable length and reducing voltage drop, Switchrooms will be located near to major equipment when it's possible.

Major equipment will be:

- Falling Film Evaporator (FFE) with Mechanical vapor recompression (MVR) 700 HP (520KW);
- Crude LiOH MVR 500HP (370KW);
- Drying air compressor 450 HP (335KW).

15.2.4 Process Control and Site Communications Systems

A budget allowance has been included for a distributed process control system (DCS) hardware and associated programming, site communications and for CCTV for process areas.

The control system of Lithium Conversion plant will be based on Metso's PROSCON process control system. It will supervise and control the following areas:

- Calcining;
- Grinding;
- Leaching;
- Filtration;
- Polishing and conversion.

PROSCON will take care of critical control tasks and will offer 5 control levels:

- Field level: it concerns all the field devices such as control valves, transducers, transmitters etc., are at this level. Input (transmitters, transducers…) /output as units. Input devices (transmitters etc.) and output devices (control valves, etc.) are connected to input/output units (I/O units) that convert the 4-20mA or digital signals to specially coded signals for the Fieldbus. And also converts the coded signal to 4-20mA.

- Local Plc controller: It takes data from the Fieldbus to control individual control loops. At a time more than one can be controlled. The data on the Fieldbus contains all the information for each loop input and output. The local process controller, using only milliseconds of time, controls each in turn. The PID of each is separately programmed. To the operator, it looks as if all the loops are controlled at the same time.

- Overview and supervision: This is the plant supervisory unit. All the information about the control loop is displayed in this unit using Video display unit (VDU). It will have 5 workstations which display the distributed control units around the plant. From this unit, an operator can adjust the setpoint or he can change from manual to automatic etc.

- Production Control: At this level, advanced control functions will allow various crucial management systems in the plant like inventory control, billing and quality control, historian.

- Production scheduling: report and data will be generated at this level and sent to upper management to schedule production and to define strategic enterprise decisions.

15.3 WASTE DISPOSAL AREA

15.3.1 Disposal Area Design

MM&A designed a waste rock disposal area for the Project. MM&A prepared construction drawings and design assumptions for the disposal area, as well as Guideline Technical Specifications providing sufficient detail and technical guidance for construction. The waste rock disposal site will consist of waste rock generated from pit excavation operations, overburden stripping soil, and tailings (i.e., fine waste rock). In general, the waste rock disposal area is designed with 2 (horizontal) to 1 vertical slopes (2H:1V). Design drawings and specifications are included in the mine permit package prepared for PLI.

Mine planning indicated the waste rock disposal area would contain 22.5 Mt of waste, south pit backfill would contain 14.8 Mt of waste, and east pit backfill would contain 132.5 Mt of waste. Additional 79.4 Mt of waste storage would be stored in the future waste storage area on currently controlled property which will require a mine permit modification for use.

15.3.2 Waste Disposal Preliminary Stability Assessment

MM&A completed a preliminary stability assessment to aid the design of the waste disposal areas. The stability analyses for the disposal areas were performed using the computer program REAME (Rotational Equilibrium Analysis of Multilayered Earthworks). The required minimum factor of safety against slope failure is 1.5 for static loading. The stability assessment meets or exceeds the required minimum factor of safety requirements. Strength parameters used for the assessment are summarized in the Table 15-2.

Table 15-2: Parameters Utilized for Waste Disposal Stability Analysis

Material	**Cohesion (psf)**	**Angle of Internal Friction (Degrees)**	**Unit Weight (pcf)**
Waste Rock	0	40°	130

15.3.3 Waste Rock and Tailings Geochemical Assessment

MM&A designed and implemented geochemical sampling and analysis programs to include both waste rock (overburden) and process tailings. The assessments examined the potential for the waste rock and tailings generated from the proposed Piedmont Lithium Project (*the Project*) to have adverse effects on the environment. With regard to the waste rock, the work included sampling and testing of over 100 composited rock core samples from 16 different core holes distributed throughout the four main pit areas. Sampled hole locations and depth intervals in the holes were designed to provide an evenly distributed assessment of the proposed mine area. The core samples were collected by both MM&A and PLI geologists. The program also included 10 process tailings samples collected from pilot testing activities, as well as tailings from pilot testing of chemical plant activities.

Analyses conducted on the waste rock and tailings samples included Acid Base Accounting (*ABA*), “whole rock” elemental determination, and Toxicity Characteristic Leaching Procedure (*TCLP*). Where applicable, the ABA analyses results were supplemented with sulfur fractionation (sulfur forms) analyses to better determine the distribution of sulfidic (pyritic) sulfur in selected samples. In addition, selected waste rock and tailings samples are currently being analyzed for leachability via humidity cell testing.

The results of the waste rock analyses indicate no significant potential for the material to produce acidic conditions in approximately 90% of the waste rock, the possible exception being a portion of the southeastern side of the East Pit where the host rock changes from amphibolite to metasediment. Details of the waste rock and tailings analyses are included in the reports titled “Summary of Waste Rock and Process Tailings Geochemical Assessment Piedmont Lithium Project – August 2019” and “Addendum Report: Results of Humidity Cell Leaching Tests, Piedmont Lithium Project – December 2019” completed by MM&A.

For the majority of the Project area, the amphibolite waste rock paste pH values for the samples are typically between 9 and 10, with only shallower samples of saprolitic rock exhibiting lower paste pH values in the 5 to 6 range. Total Sulfur for the amphibolite waste rock samples is generally in the range of 0.01 to 0.3 percent, with only three of the 101 samples having a total sulfur content greater than 0.5 percent. Amphibolite samples exhibiting a sulfur content greater than 0.2 percent were further analyzed using a sulfur fractionation procedure. Results of the sulfur fractionation analyses indicate that the total pyritic sulfur (acid-producing) present in the amphibolite samples is very low. With consideration of the sulfur forms, results show that amphibolite waste rock samples exhibit an excess alkalinity condition.

In the southeastern area of the East Pit, ABA testing of the metasediment host rock indicates that some of the samples contain sulfide concentrations high enough to potentially produce acid. The affected area is estimated to include approximately 34 million tonnes of waste rock, including ~25% overburden and saprolite, ~19% mudstone, ~13% amphibolite, and ~43% schist. The schist, and to a lesser degree the mudstone, display the greatest potential to generate ARD if not properly managed. In particular, most of the schist samples exhibit significant sulfidic sulfur and very little neutralization potential (NP). The overburden and saprolite samples appear to be thoroughly leached and are expected to be essentially inert. A mitigation plan for the potentially acid producing material has been created. The proposed mitigation plan, which includes selective handling, alkaline amendment addition, at least partial encapsulation, and final burial in a sub-aqueous environment will greatly reduce any risk associated with excavation of the potentially acidic waste material. The final amount of material which will be subject to such practices is unknown. Additional testing is ongoing to better estimate volumes of such material for mine planning purposes. The results of testing specific to the waste rock in the southern-most portion of the East Pit are presented and further discussed in an August 27, 2021 memorandum titled “Acid Base Account (ABA) and Toxicity Characteristic Leaching Procedure (TCLP) Test Results Summary and Proposed Mitigation Plan Associated with Potentially Acid Producing Waste Rock in the Southern Portion of East Pit”. Mine planning as part of the feasibility study assumes that potentially 16.8 million tonnes of material would need to be treated and encapsulated. Costs of $16.6 million were included in the financial model for alkaline amendments at a rate of 2%.

ABA analyses for both the concentrator and the chemical plant tailings samples indicate very low Total Sulfur content, high paste pH values, and excess neutralization potential for all tailings samples. In particular, the chemical plant tailings have significant excess neutralization potential and may be utilized as a key component of the mitigation plan.

Waste rock and tailings samples were also analyzed to determine their overall elemental constituents, as a means for better understanding the “whole rock” components of the materials. The elemental analyses results were compared against relevant regulatory guidelines to screen for potentially problematic components.

The ABA and elemental analyses results were used as a guide for selection of a representative set of waste rock and tailings samples for further testing via TCLP analysis. The TCLP procedure is a short-term but aggressive test for detecting contaminants that may leach from the samples. Results of the TCLP testing were compared against the Environmental Protection Agency’s (*EPA*) “D” list, a list of regulatory levels for the “toxicity” characteristic as determined specifically from the TCLP test. The TCLP results indicate that all of the samples, including the metasediment from the East Pit, yielded results well below “D” list toxicity threshold levels.

Overall, results of this assessment indicate that acidic drainage is not expected to be released from either the waste rock (overburden) or the process tailings, with the possible exception of the southeastern portion of the East Pit (for which a mitigation plan has been established). In addition, consideration of whole rock elemental and TCLP test results does not indicate the potential for leaching hazardous levels of contaminants, as defined by EPA’s “D” list.

16 MARKET STUDIES

16.1 MARKETING

16.1.1 Lithium Demand and Supply Outlook

Benchmark Mineral Intelligence ("Benchmark") reports that total battery demand will grow to 312 GWh in 2021 translating to 297 kt of LCE demand in 2021, a growth of 41% over 2020 demand. Benchmark forecasts total demand in 2021 to be 430 kt on an LCE basis.

Benchmark further expects the market to remain in a structural deficit for the foreseeable future as demand gets a head-start on supply. In the near impossible scenario that all projects come online on time as planned and without any issues, the first surplus will not occur until 2025. Benchmark believes that in this extreme case, a surplus could only be expected to last a few years before demand forces the market into a large deficit without further new projects yet undiscovered or developed (see Figure 16-1).

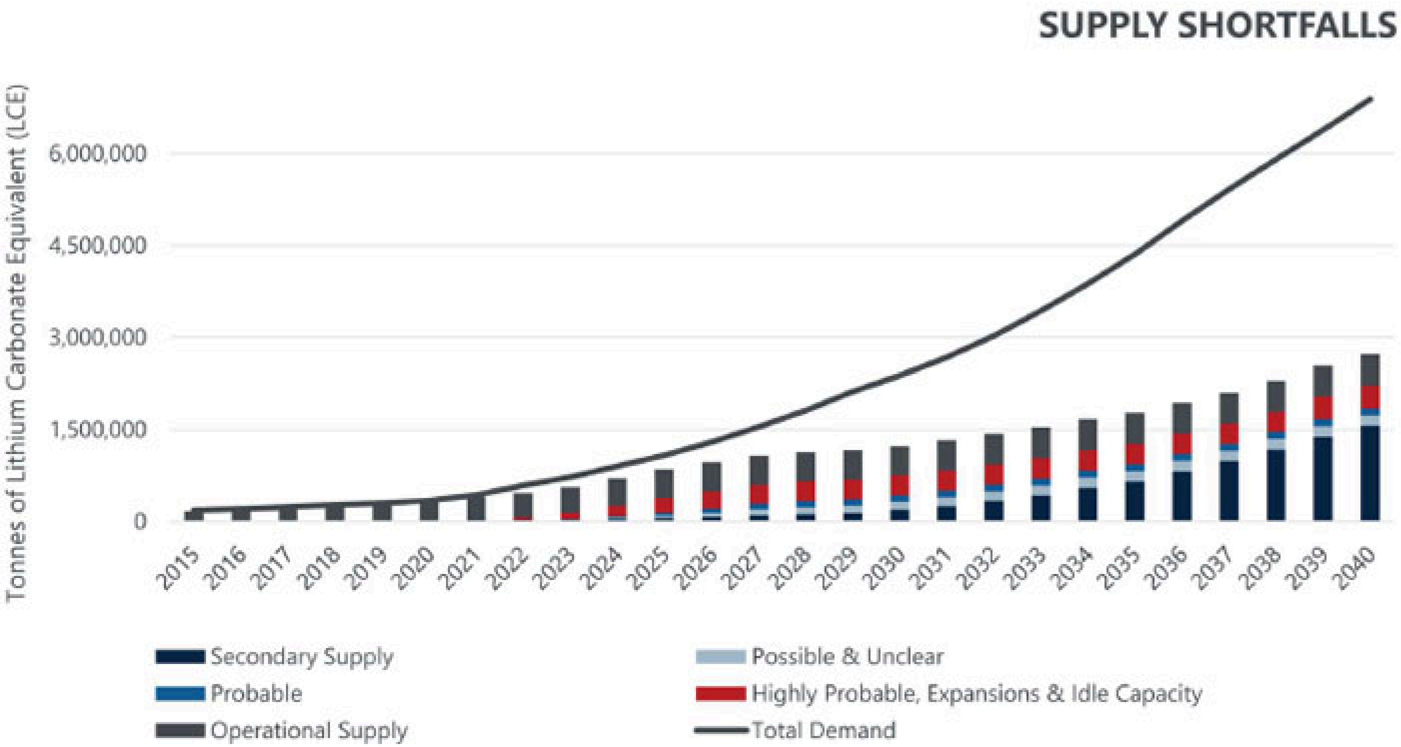


Figure 16-1 - Lithium hydroxide supply demand forecast

16.2 MARKETING STRATEGY

Piedmont is focused on establishing strategic partnerships with customers for battery grade lithium hydroxide with an emphasis on a customer base which is focused on EV demand growth in North America and Europe. Piedmont will concentrate this effort on these growing EV supply chains, particularly in light of the growing commitments of battery manufacturing by groups such as Ford, General Motors, LGES, Northvolt, SK Innovation, Volkswagen and others. Advanced discussions with prospective customers are ongoing.

16.3 PRODUCT PRICING

This Study assumes long-term pricing of $18,000/t for battery quality lithium hydroxide and $900/t for spodumene concentrate from 2025 onwards (see Figure 16-2).

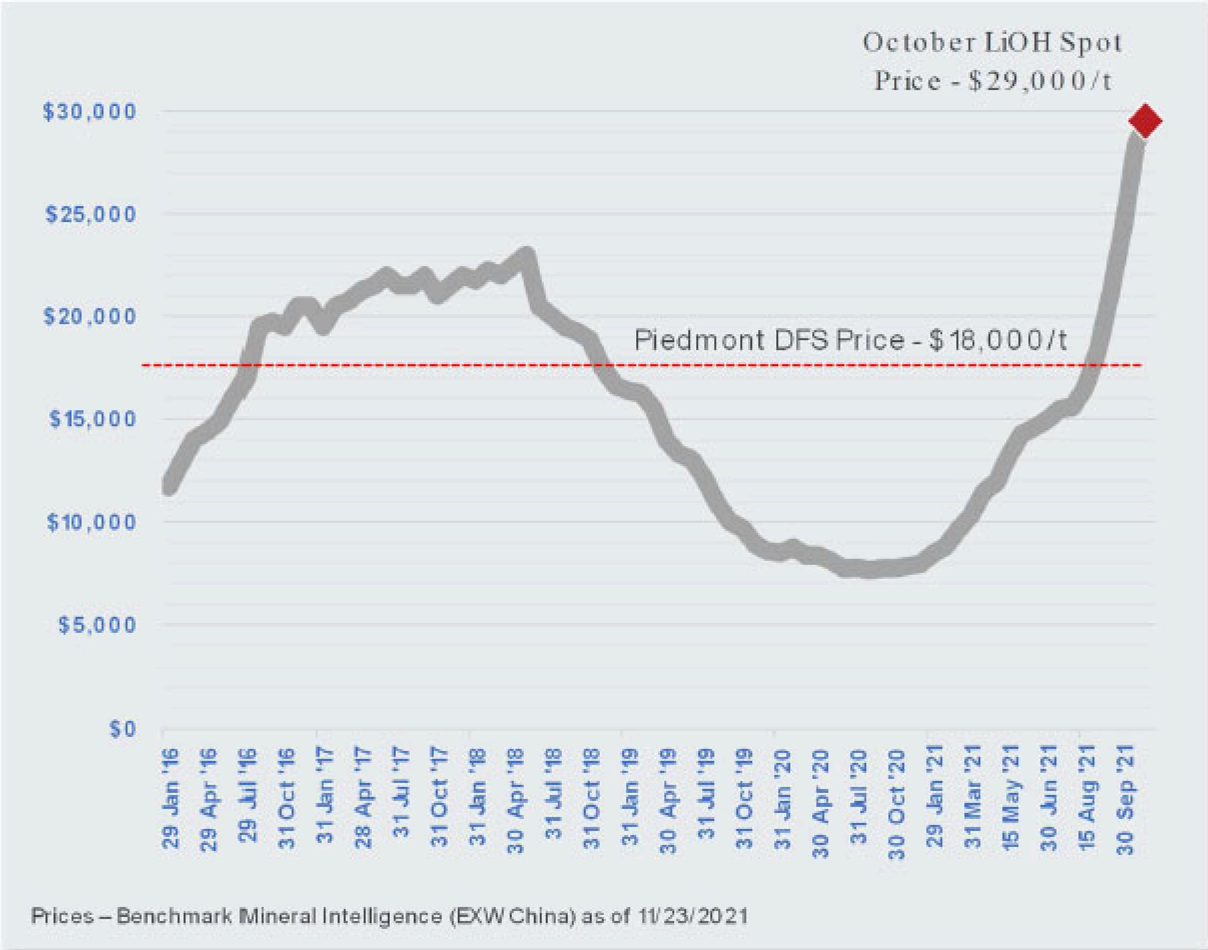


Figure 16-2 - Battery Grade ("BG") lithium hydroxide pricing

As shown in Figure 16-3 below North America is seeing considerable growth in battery plant capacity. Figure 16-4 below shows the corresponding lithium hydroxide demand for the announced U.S. battery plant capacity at full production.

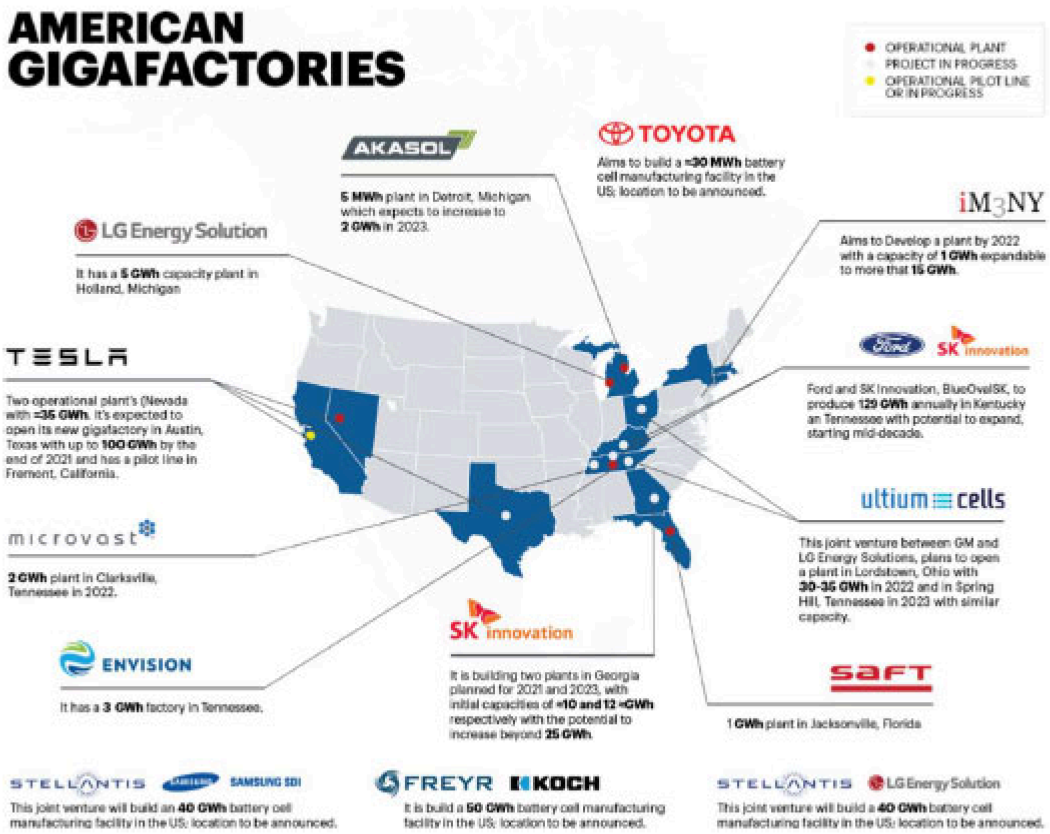


Figure 16-3 - Current Battery Plants Operating, Under Construction or Announced in the USA

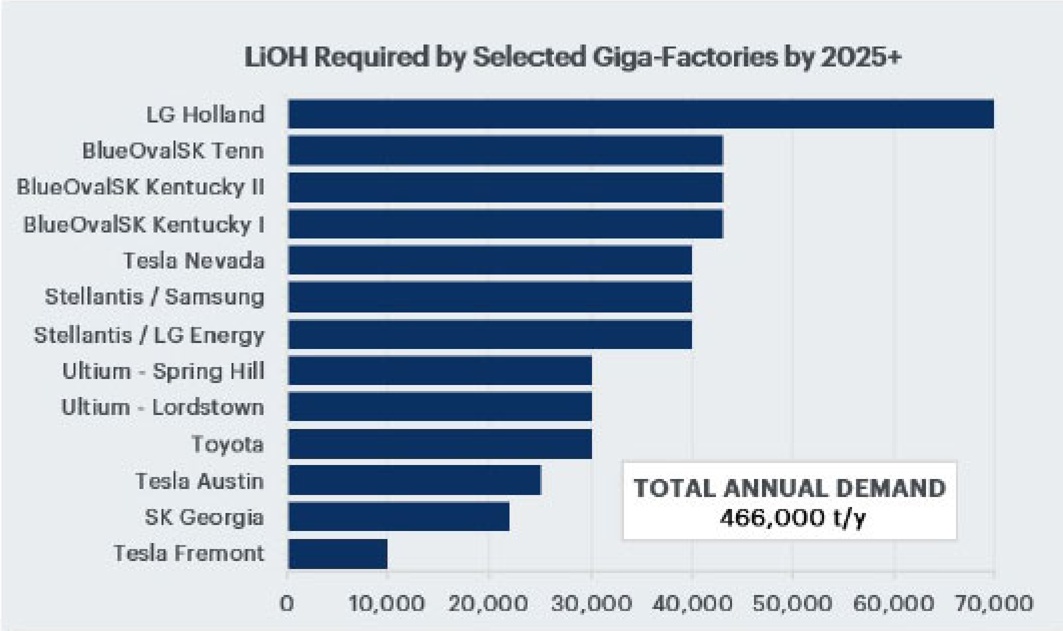


Figure 16-4 - LiOH Demand for Select USA Giga-Factories

16.4 BY-PRODUCTS

Piedmont proposes to produce quartz, feldspar and mica as by-products of spodumene concentrate operations. The Company engaged John Walker, an independent consultant, and Pronto Minerals, a joint venture between the Company and Ion Carbon & Materials, to assist the Company in estimating market opportunities for its by-products as shown in Table 16-1.

Table 16-1 – Market forecasts and basket pricing for by-products (US$/t)

Quartz (t/y)	Feldspar (t/y)	Mica(t/y)	Average Realized Price ($/t) Mine Gate
252,000	392,000	30,000	$79.50

17 ENVIRONMENTAL STUDIES AND PERMITTING

17.1 ENVIRONMENTAL, SUSTAINABILITY AND GOVERNANCE

Over the last year, and in view of the planned manufacturing of lithium hydroxide monohydrate, Piedmont commissioned Minviro, an industry-leading practitioner of LCA (Life Cycle Assessment) impacts of manufacturing battery materials to perform a prospective LCS of the site. As a result, Piedmont decided to enhance the sustainability footprint by implementing the following aspects in the current project study:

- Include a solar farm on the property with the objective of producing and supplying the Piedmont industrial complex electricity needs;
- Replacing the conventional fossil-energy fuel used by haulers with electric equipment for ore transportation between pits, disposal areas and concentrator;
- Co-locating operations on the same Gaston County site to minimize transit and allowing unused by-products streams to be repurposed for site redevelopment;
- Expanding the by-products operations to serve valuable markets for quartz, feldspar and mica.

HDR Engineering, Inc. of the Carolinas (HDR) has been retained by Piedmont to support permitting activities on the project. The following environmental studies have been completed in connection with the Project (Table 17-1).

Table 17-1 – List of Completed Environmental Background Studies for the Project

Study Description	Author	Date of completion
Jurisdictional Delineation	HDR Engineering	June 2018, December 2018, and April 2019;
Jurisdictional Delineation	HDR Engineering	Expanded area report complete November 2021
Threatened and Endangered Species Survey	HDR Engineering	December 2018; expanded area field work report completed November 2021
Cultural Resources Survey for the Piedmont Lithium Mine Project, Gaston County, North Carolina	HDR Engineering	April 2019
Summary of Waste Rock and Process Tailings Geochemical Assessment, Piedmont Lithium Project	Marshall Miller & Associates	August 2019
Addendum Report: Results of Humidity Cell Leaching Tests, Piedmont Lithium Project	Marshall Miller & Associates	December 2019
Roadway Abandonment Technical Memo	HDR Engineering	March 2019
Technical Memorandum: Groundwater Model Piedmont Lithium, Gaston County, NC	HDR Engineering	June 2019
Technical Memorandum: Groundwater Model Piedmont Lithium, Gaston County, NC	HDR Engineering	August 2021

Study Description	Author	Date of completion
Technical Memorandum: Toxicity Testing of the Lithium Hydroxide Conversion Plant Tailings, Piedmont Lithium Carolinas, Inc., Gaston County, NC	HDR Engineering	August 2021
Acid Base Account and Toxicity Characteristics Leaching Procedure Test Results Summary, and Proposed Mitigation Plan Associated with Potentially Acid Producing Waste Rock in the Southern East Pit	Marshall Miller & Associates	August 2021
Technical Memo: Water Quality Testing, Piedmont Lithium, Gaston County, NC	HDR Engineering	March 2020

17.2 PERMITTING

HDR Engineering has been retained by Piedmont to support permitting activities on the proposed Project.

In November 2019, the Company received a Clean Water Act Section 404 Standard Individual Permit from the US Army Corps of Engineers for the concentrate operations. The Company has also received a Section 401 Individual Water Quality Certification from the North Carolina Division of Water Resources. In connection with the 404 Permit an Environmental Assessment was completed for the Project which resulted in a Finding of No Significant Impact (“FONSI”).

The concentrate operations require a North Carolina State Mining Permit from the North Carolina Department of Environmental Quality (“NCDEQ”) Division of Energy, Mineral and Land Resources (“DEMLR”). The Company submitted a mine permit application to DEMLR on August 31, 2021. A public hearing in relation to the mine permit application was held on November 15, 2021. The Company has received additional information requests in connection with the mine permit application and responded to these information requests on December 15, 2021. The company expects to receive additional information requests in connection with its mine permit application and will respond to these requests in due course.

Piedmont previously received synthetic minor air permit from the NCDEQ Division of Air Quality (“DAQ”) for a proposed lithium hydroxide operation in Kings Mountain. The Company has held pre-application consultation meetings with Division of Air Quality in connection with the integrated Carolina Lithium Project. The Company plans to submit a determination letter to DAQ in January 2022 requesting concurrence with respect to the primary activity of the Carolina Lithium Project. The Company will proceed with an air permit application for the Carolina Lithium Project upon receipt of DAQ’s response to the determination letter request.

Carolina Lithium remains subject to local rezoning and permit requirements. Piedmont remains in pre-application consultation with Gaston County at this time. A rezoning application will follow receipt of a state mining permit. The Company will apply for a special use permit required under the Gaston County UDO upon completion of the rezoning process.

18 CAPITAL AND OPERATING COSTS

The objective of developing the capital and operating cost estimates is to provide substantiated costs feeding into the definitive feasibility study (DFS) pertaining to the Carolina Lithium Project – DFS (Project).

The parameters for the estimate used are as follows:

- Estimate Target Accuracy Initial Capital Costs +15% / -15%;
- Estimate Target Accuracy Sustaining Capital Costs +15% / -15%;
- Estimate Target Accuracy Operating Costs +15% / -15%;
- Estimate Base Date Q4 2021;
- Estimate Base Currency United States Dollars.

The target estimate accuracy is in accordance with AACE Class 3 estimate as pet AACE standard 18R-87.

18.1 CAPEX BASIS OF ESTIMATES

The initial CAPEX estimate includes all Projects' direct and indirect costs to be expended during the implementation phase of the Project. It is deemed to cover the period starting from the approval date by PLL of this DFS report and finishing at the successful completion of the commissioning phase. Any cost to be expended beyond the commissioning phase, i.e., transfer to operations, performance tests, start-up/ramp-up and operations of the PLL facilities will be included with sustaining CAPEX or OPEX.

Table 18-1 is proving the definitions of terms used in the capex estimation.

Table 18-1 - Capex Estimate Definition of Terms

Term	Definition
Initial CAPEX	Refers to capital expenditures incurred prior to the start-up of operations of a mineral plant
Sustaining Capital	Refers to capital expenditures incurred during the LOM, beginning at the start-up of operations of a mineral plant, necessary to maintain the plant's throughput capacity
Working Capital	Working capital is the cost associated with the operation of the plant prior to the first shipment or sale taking place.
Deferred Capital	Deferred Capital are capital expenditures deferred from the initial start-up of the Project.
Material Take Offs (MTO's)	These are theoretical quantities directly taken off 3D models or 2D drawings; theoretical quantities don't account for construction growth. It should be noted that no growth is applied against quantities generated through factors, estimates, allowances or conceptual design.
Construction growth	Construction growth, as identified by the estimating group, consist of additional quantities necessary to compensate for swelling, losses, theft, wastage, overlap, compaction factor, cut factors, etc.
Allowances	Allowances are necessary to ensure that the scope of work is covered in its entirety; it is the estimator's responsibility to validate quantities obtained by Engineering and allow for quantities that cannot be expressly defined, that are missing or, ultimately, when it is not economically viable to perform detailed take-offs.

Term	Definition
Level of confidence	For the purpose of evaluating the accuracy and, ultimately, the contingency (as defined below), an objective assessment of the level of confidence will be made. Typically, this assessment is made on a per package basis. The intent is to identify the level of definition and make an assessment of the possible variations from the estimated costs during the implementation phase.
Accuracy	Per AACE, estimate accuracy is an indication of the degree to which the final cost outcome of a project may vary from the estimated cost. It is traditionally represented as a +/- percentage range around the estimated cost.
Contingency	Contingency is a provision added to an estimate to cover uncertainties inherent to project execution. Estimating is an inexact science and recognizes that unknown uncertainties should be considered in a project estimate. A contingency is added to reduce the probability of overrunning the estimated budget. Contingency does not account for any change to the baseline scope of work, work stoppages (strikes or lock-out), natural disasters, excessive/unexpected inflation (i.e. beyond that estimated), excessive/unexpected currency fluctuation or any other unpredictable event that may occur. By its nature, the contingency fund is expected to be expended during the Project and should be considered an integral part of the project CAPEX.
Escalation	Escalation is an amount added to an estimate to cover for the future value of an element of cost due to inflation.
Risk	Risk is an amount resulting from a Risk assessment session carried out to identify, in the planning stage of a project, potential threats or cost opportunities that could adversely or positively affect the estimated cost. Since the risk (threat or opportunity) may in fact never materialize, the risk monies are typically shown as a reserve, below the total installed cost; unlike the contingency, the risk monies may never be expended.

18.1.1 Direct Estimate Preparation

The following approach will be used to estimate the direct costs for the Project.

Mine and Concentrator

Mining

The mine plan served as the basis for the MTO preparation pertaining to the following:

- Mine fleet, complete with major and support mining equipment as well as services equipment;
- In pit crushing and conveyors;
- Costs for freight, assembly, training, spare parts and consumables will be identified separately;
- Site preparation for Waste Storage Disposal Area.
- Operations and maintenance costs for pre-production operations (i.e. up to year 0)
- All above will also apply to sustaining capital covering, namely, additions and replacements, to be presented per year.

Bulk Earthworks

A detailed design and MTO's were used to estimate the following:

- Bulk Earthworks;
- Site Roads;
- Site Drainage and water catchment.

Concrete / Structural / Platework

Design was done and used to estimate the quantities for concrete, structural steel and platework. The MTO list was sent to local contractors for prices. The received information of the unit rates for the commodities was used in the project Capex estimates.

Mechanical Equipment (Primero)

A mechanical equipment list has been developed together with equipment datasheets for major equipment. The datasheets were sent for budget quotation to a list of recommended vendors. Proposals obtained were technically and commercially evaluated before a recommended vendor and price was selected.

The installation hours for mechanical equipment were obtained from local contractors and compared against Primero's internal database.

Piping

Piping procurement and installation pricing has been factored based on the installed mechanical equipment list and price. The factor has been broken down by WBS line and has been based on Primero's internal database of similar projects.

Electrical

Electrical design has been completed to produce major equipment datasheets, cable schedule and bulk material take-offs. The list has been sent to local suppliers to obtain budget quotations which will be evaluated and normalized.

Installation hours has been developed in conjunction with Primero's local sub-consultant Raw Electric.

Architectural Buildings

Sketches and a design criteria of the proposed plant buildings have been developed and sent to local suppliers for budget quotations.

Conversion Facility

Bulk Earthworks

HDR has completed a design and MTO list to estimate the following:

- Bulk Earthworks;
- Site Roads;
- Site Drainage and water catchment.

Rail

HDR has completed a design for the rail spur and provide pricing for the spur and tie into existing rail line.

Concrete

Primero completed a design to estimate the quantities for all concrete and detailed civil works. Primero used the unit rates obtained from local contractors for the concentrator to estimate the conversion plant price.

Structural and Platework

Primero completed a design to estimate the quantities for all balance of plant structural fabrication works. Primero used the unit rates obtained from local contractors for the concentrator to estimate the conversion plant price.

MO completed a design and provided the supply price for in battery limit works. Primero has estimated MO in battery limit price for installation based on internal databases.

Mechanical Equipment

A mechanical equipment list for the balance of plant has been developed by Primero together with equipment datasheets for major equipment. The datasheets have been sent for budget quotation to a list of recommended vendors. Proposals obtained have been technically and commercially evaluated before a recommended vendor and price was selected.

Mechanical equipment within MO battery limits will be provided as a supply price by MO.

The installation hours for all mechanical equipment will be obtained estimated from Primero’s internal database.

Piping

Piping within the MO battery limits has be priced as supply only by MO. Piping cost for balance of plant have been estimated based on a line and valve list produced by Primero. Small bore piping outside of MO battery limits has been factored as a percentage of mechanical equipment.

Installation of piping has been priced based on Primero’s internal database.

Electrical

An electrical design has been completed to produce the major equipment datasheets, cable schedule and bulk materials take-offs. This design has been sent to local suppliers to obtain budget quotations which have been evaluated and normalized.

Installation hours have been developed in conjunction with Primero’s local sub-consultant Raw Electric.

Architectural Buildings

Sketches and design criteria of the proposed plant buildings have been produced and sent to local suppliers for budget quotations.

18.1.2 In-Direct Estimate Preparation

Contractors' Temporary Facilities

It was assumed that the contractors will be responsible for their own construction trailers, tool crib, kitchen, storage, workshops, maintenance shop.

Contractors' Temporary Utilities

It was assumed that the contractors will be responsible for their own supply, delivery, storage, distribution and dispensing for:

- Water (domestic, potable and construction);
- Telecommunications;
- Fuel and gasoline.

For the execution phase, Piedmont Lithium may elect to be responsible for all utilities to avoid unnecessary storage and handling.

It should be noted that for Contractors' temporary facilities and utilities, the following will be included:

- Mobilization and transport to site;
- Rental charges;
- Insurance;
- Field assembly and erection;
- Set-up / hook-up;
- Maintenance and operations, including preservation;
- Dismantling, disassembly;
- Demobilization and transport from site;
- Restoration to original site condition.

Construction Equipment, including heavy lifts

Equipment to be supplied by the discipline contractor has been included in the unit rates solicited for the estimate.

Temporary Power

Temporary power will be under Contractors' responsibility; hence, the fuel powered generators will be used.

Scaffolding

As it is anticipated that a vertical contracting approach will prevail, scaffolding will be under contractors' responsibility.

Temporary Heating and Sheltering

Temporary heating and sheltering is falling under contractors' responsibility.

Labor Costs

Labor costs are a direct function of base unit man-hours, productivity factor for specific site conditions as well as of the all-inclusive labor crew mix wage rates; as such, the accuracy of labor costs can exponentially be affected by errors made to any one of these three (3) elements.

In order to ascertain the accuracy of the labor costs, base unit man-hours and productivity factors have been developed internally and then benchmarked against man-hours obtained through historical projects and contractor quotes.

Productivity factors have been estimated based on known local historical data, such as climate, as well as on established industry norms, such as time loss due to safety, in-plant movement, workweek, rotations schedule, height, confined space, repetitiveness, access restriction, congestion, etc. The resulting productivity factors have then been applied against base unit man-hours, which are assessed as having a PF of 1.0.

A Productivity Factor (PF) of 1.0 can be best described as favorable working conditions, i.e.:

- 40-hour workweek;
- No rotation schedule;
- Typical traveling distance for workers;
- Regular sized plant, limiting in-plant movement;
- Repeat technology, no complexity;
- Ambient weather of approximately +20° C, with little to no wind.

18.1.3 Engineering and Management

The engineering, project management and site management costs associated with the EPC packages have been estimated based on previous norms and projects. An organization chart will be developed to show the key positions required for the project. The costs have been reviewed as a percentage of direct and total project costs.

18.1.4 Owners Costs

All owners cost has been provided by PLL and integrated into the estimate by Primero.

18.1.5 Contingency

The purpose of contingency is to make specific provision for uncertain elements of cost within the Project scope and thereby reduce the risk of cost over-run to a predetermined acceptable level. Contingencies do not include allowances for scope changes, escalation, or exchange rate fluctuations.

Contingency reflects the measure of the level of uncertainties related to the scope of work. It is an integral part of an estimate and will be applied following a thorough analysis to all parts of the estimate, i.e. direct costs, indirect costs, services costs, etc.

Any defined item, no matter how preliminary the information, data or design, has been covered by specific allowances to complete the scope and not by contingency.

In addition to the calculated amounts for direct and indirect costs, allowances are incorporated for contingencies based on an assessment of the degree of definition available for each main cost center.

The analysis is made by assessing the level of confidence in each of the defining inputs to the item cost basis, be it engineering, estimate basis and vendor or contractor information. The weighted average of these inputs is used to define the contingency for that item. The analysis is undertaken for each discipline within each area.

Contingency is assigned to each estimate line item and is based on Table 18-2.

Table 18-2 - Contingency Requirements

Category	Contingency
SCOPE CATEGORY – Contingent sum attributed to quantities and scale	
Detailed take-off from detailed design drawings, detailed model and lists	7.5%
General take off from sketches, plot plans, general model, GAs, P&IDs and SLDs	10%
Estimated from plot plans, GA's and previous experience	12.5%
Factored from previous projects / ratios	20%
Allowance	25%
SUPPLY COST – Contingent sum attributed to supply and freight costs	
Awarded contract, purchase order and fixed price quotation	5%
Budget quotation	10%
In-house database	12.5%
Estimated value	15%
Factored value	20%
Allowance	25%
INSTALLATION COST – Contingent sum attributed to installation costs	
Awarded contract, purchase order and fixed price quotation	5%
Budget quotation	10%
In-house database	12.5%
Estimated value	15%
Factored value	20%
Allowance	25%

Contingency is calculated for each estimate line item according to the above categorization based on the following formula:

[A] = [0.4B + 0.4C + 0.2D]

Where:

- [A] = Contingency %
- [B] = Scope Category %
- [C] = Supply Cost Category %
- [D] = Installation Cost Category%

18.1.6 Escalation

Escalation factors has not been allowed in the estimate.

18.1.7 Currency

The base currency of the estimate is in United States Dollars. The following conversions (see Table 18-3) have been used for both the OPEX and CAPEX estimates.

Table 18-3 - Currency Conversion

Base	Conversion
1 USD	1.26 CAD
1 USD	0.85 EUR
1 USD	1.38 AUD

18.2 PROJECT INTEGRATED CAPEX

The integrated project capital investment (CAPEX) has been performed for the mining, spodumene concentration, by-products (quartz, feldspar, and mica), lithium hydroxide conversion plant and project infrastructure. Table 18-4 show the breakdown of the capex estimation based on the estimate plan described in the previous section.

Table 18-4 – Integrated Project Capex

	Capex (mm $)	Direct	Indirect	Grand Total
Area	**Sub-Area**			
Concentrator Operations				
	1100 - Mining	99.5		99.5
	1200 - Processing Plant	220.3		220.3
	1300 - Site Infrastructure	14.8		14.8
	1400 - Waste Rock	6.0		6.0
	Sub Total - Concentrator Operations	***340.5***		***340.5***
Lithium Hydroxide Operations				
	2200 - Overland Network	19.4		19.4
	2400 - LiOH Plant	431.3		431.3
	2900 - Site Infrastructure - LiOH Plant	13.7		13.7
	Sub Total - Lithium Hydroxide Operations	***464.3***		***464.3***
Indirect Costs				
	6100 - Concentrator Indirects		44.0	44.0
	6200 - Lithium Hydroxide Indirects		65.1	65.1
	Sub-Total - Indirect Costs		***109.1***	***109.1***
Owners Cost, Pre-production & Working Capital				
	8100 - Owners Cost		73.6	73.6
	Sub-Total - Owners Cost, Pre-production & Working Capital		***73.6***	***73.6***
Grand Total				**987.6**

The deferred, working and sustaining capital is estimated at $351 M. Sustaining and deferred capital includes:

- Capital recovery costs for in-pit crushing and overland conveyor system construction and maintenance of $0.60 per ROM tonne for a total of $152 M life of ore reserves;

- Other sustaining mining capital including:
    - $0.3 M of site preparation;
    - $54.4 M of future pre-strip expenses;
    - $3.3 M of future land acquisition expenses to support the current estimated ore reserves.
- Mine closure and reclamation costs of $19 M;

- Concentrator sustaining capital of $10 M;
- Chemical Plant sustaining capital of $67 M;

The working capital is estimated to be $45 M.

18.3 OPEX BASIS OF ESTIMATE

The operating cost estimate (OPEX) has been performed for the mining, spodumene concentration, by-products (quartz, feldspar, and mica) and lithium hydroxide conversion plant. The following list of cost centers have been used for the estimation: Salaries; G&A; reagents; consumables; utilities (electricity, fuel, water, etc.); maintenance; treatment and disposal.

The parameters for the estimate used are as follows:

- Estimate Target Accuracy Initial Capital Costs +15% / -15%;
- Estimate Target Accuracy Sustaining Capital Costs +15% / -15%;
- Estimate Target Accuracy Operating Costs +15% / -15%;
- Estimate Base Date Q4 2021;
- Estimate Base Currency United States Dollars.

The target estimate accuracy is in accordance with AACE Class 3 estimate as pet AACE standard 18R-87.

18.4 MINING OPEX

In addition to contract mining, a cost allowance of $1.2 M per year has also been made for internal managerial and technical staff to support mining operations. Table 18-5 presents of a detailed labor breakdown.

Table 18-5 – Mining and Geology Labor

Description	Number of Employees	Total Annual Labor Cost
Mining and Geology		
Mine Manager	1	$189,280
Mining Engineer	3	$463,008
Geology Supervisor	1	$116,480
Field Geologist	4	$349,440
Surveyor	1	$89,360
Mining and Geology Total	**10**	**$1,207,568**

18.5 CONCENTRATOR OPEX

The overall cost per year of operation, per metric tonne of ore, and per metric tonne of spodumene concentrate is described for the main parameters of the plant.

Table 18-6 presents a summary of the operating costs for the spodumene processing plant.

Table 18-6 – Spodumene Processing Plant OPEX Summary

Cost Center	Total Cost		
	US$/year	**US$/t ore**	**US$/t spod conc.**
Labor (Process)	$8,657,990	$4.56	$35.68
Operating Consumables and Reagents	$8,951,905	$4.72	$36.89
Power	$3,938,852	$2.08	$16.23
Maintenance Supplies	$1,059,145	$0.56	$4.36
Mobile Equipment	$593,367	$0.31	$2.45
Concentrate transport	-	-	-
Laboratory	$164,679	$0.09	$0.68
Water Treatment	$790,986	$0.42	$3.26
General & Administration	$507,349	$0.27	$2.09
Total	**$24,664,273**	**$13.00**	**$101.64**

The by-products processing plant operating costs summary is tabulated in Table 18-7.

Table 18-7 – By-Products Processing Plant OPEX Summary

Cost Center	Total Cost		
	US$/year	**US$/t ore**	**US$/t spod conc.**
Labor (Process)	$2,364,205	$1.25	$9.74
Operating Consumables and Reagents	$5,388,051	$2.84	$22.20
Power	$1,545,785	$0.81	$6.37
Maintenance Supplies	$274,716	$0.14	$1.13
Mobile Equipment	$249,718	$0.13	$1.03
Concentrate transport	-	-	-
Laboratory	$76,787	$0.04	$0.32
Water Treatment	$1,186,479	$0.63	$4.89
General & Administration	$206,837	$0.11	$0.85
Total	**$11,292,577**	**$5.95**	**$46.53**

The basis of the data sources, assumptions, cost inclusions and exclusions for the process operating costs are as follows.

18.5.1 Manpower

An allowance has been made for production, maintenance and management personnel associated with running the processing plant.

Roster is mainly based on a 12 hours per shift, 2 shifts per day, and 4 rotating crews. Once steady operation has been achieved, the manning levels will reflect previous experience at similar lithium operations.

Further rationalization and operational numbers during ramp-up should be reviewed in the DFS. A detailed labor breakdown is described in Table 18-8.

Table 18-8 – Concentrator Labor Breakdown

Plant	Description	Number of Employees	Total Annual Labor Cost
Plant Operations			
Spodumene	Plant Manager	1	$189,280
Spodumene	Process Engineer	1	$154,336
Spodumene	Plant Supervisor	4	$616,608
Spodumene	Control Room Operator	4	$465,184
Spodumene	Crushing Operator	4	$404,614
Spodumene	DMS and Grinding Operator	4	$434,899
Spodumene	Flotation Operator	8	$869,798
Spodumene	Dewatering / Loadout Operator	8	$809,229
Spodumene	Utility Operator	2	$120,480
Spodumene	Plant Laborer	8	$718,374
By-Products	By-Products Flotation Operator	4	$434,899
By-Products	By-Products Dewatering / Loadout Operator	4	$434,899
By-Products	By-Products Plant Laborer	4	$389,472
Spodumene	Mobile Equipment Operator	8	$869,798
By-Products	By-Products Mobile Equipment Operator	4	$434,899
Spodumene	Safety / Training Supervisor	2	$190,368
Spodumene	Receiving Warehouse Lead	1	$107,997
Spodumene	Receiving Warehouse Worker	1	$96,640
By-Products	Shipping Workers	2	$137,952
Maintenance			
Spodumene	Maintenance/Reliability Manager	1	$189,280
Spodumene	Maintenance Supervisor	1	$153,424
Spodumene	Maintenance Planner	1	$123,139
Spodumene	Millwright / Mechanic	2	$155,424
By-Products	By-products Millwright / Mechanic	1	$77,712
Spodumene	Millwright / Mechanic	2	$161,248

Spodumene	Electrical / Instrumentation Supervisor	1	$153,424
Spodumene	Electrical / Instrumentation Technician	2	$190,368
By-Products	By-Products Electrical / Instrumentation Technician	1	$95,184
Spodumene	Electrical / Instrumentation Technician	2	$196,192
Spodumene	Electrical / Instrumentation Planner	1	$123,139

Plant	Description	Number of Employees	Total Annual Labor Cost
Chemical Laboratory			
Spodumene	QC Supervisor	1	$110,656
Spodumene	QC/R&D Lead	4	$404,614
Spodumene	QC Technician	4	$359,187
By-Products	By-products QC Technician	4	$359,187
Spodumene	Dayshift QC Technician	1	$68,976
Metallurgy			
Spodumene	Metallurgist	2	$221,312
Spodumene Processing Plant		*81*	*$8,657,990*
By-Products Processing Plant		*24*	*$2,364,205*
Concentrator Total		**105**	**$11,022,195**

The total concentrator manpower cost per year is $11.0 M which consists of dedicated and share personnel between the spodumene and by-products plant.

18.5.2 Operating Spares and Consumables

Costing for crushers liners, screen panels, mill liners, grinding balls, filter press parts, and reagents have been included in operating consumables. Assumptions are based upon Primero's recent lithium experience at a similar processing facility and vendor operating spares quotes.

Costs for conveyor and chute work maintenance are included in maintenance supply cost estimates. An allowance has been incorporated for first fills and opening stocks under capital costs associated with pre-production.

Operating consumables cost is estimated as $6.3 M per year for the spodumene processing plant and $1.9 M per year for the by-products processing plant.

18.5.3 Reagents

The reagents costs are included in the operating consumables expense. The breakdown of the reagent quantities, unit price, and total cost is described in Table 18-9.

Table 18-9 – Concentrator Reagent Consumption and Annual Cost

Plant	Operation	Reagent	Consumption Rate	Total Cost Per Year
Spodumene Processing Plant	DMS	FeSi - 270D	500 g/t ore	$1,629,422
	Mica Flotation	Collector - Armac Mix	110 g/t ball mill feed	$430,918
		Frother - MIBC	20 g/t ball mill feed	$50,691

		pH Modifier - NaOH	235 g/t ball mill feed	$259,906
		Dispersant - F220	250 g/t ball mill feed	$230,413

Plant	Operation	Reagent	Consumption Rate	Total Cost Per Year
	High Intensity Scrubbing and Desliming	pH Modifier - NaOH	219 g/t ball mill feed	$242,211
	Spodumene Flotation	Collector - FA-2	625 g/t ball mill feed	$1,281,674
		pH Modifier - Na2CO3	142 g/t ball mill feed	$93,444
	Thickening and Dewatering	Flocculant - Magnafloc 10	20 - 60 g/t thickened feed	$55,777
By-Products Processing Plant	Feldspar Flotation	Collector - HF	2,000 g/t by-products feed	$1,988,487
		Collector - Armac C	440 g/t by-products feed	$1,222,660
		Promoter - Kerosene	185 g/t by-products feed	$127,308
		pH Modifier - H2SO4	350 g/t by-products feed	$62,871
	Thickening and Dewatering	Flocculant - Magnafloc 10	20 g/t thickened feed	$54,104
Water Treatment Plant	Precipitation	Lime - CaCO3	259 t/annum	$412,370
	Carbon Adsorption	Coconut shell carbon	1,704 t/annum	$1,038,342
Spodumene Processing Plant				*$4,274,456*
By-Products Processing Plant				*$3,455,430*
Water Treatment Plant				*$1,450,712*
Concentrator Total				**$9,180,599**

18.5.4 Power Cost

The power OPEX calculation utilized a value of 5.7 cents per kWh based upon an estimate provided by PLL and a load factor of 0.8.

Power consumption and costs are determined based on calculated plant utilization and the mechanical equipment list. The estimated total installed power for the spodumene and by-products processing plant is 12.8 MW (including water treatment plant) and 4.0 MW, respectively. An allowance of 640 kW has also been made for lighting, heating, and ancillary buildings.

Overall, power consumption for the concentrator is expected to be 70.0 GWh per year for a total power cost of $4.0 M per year. For the by-product plant, power consumption is expected to be 27.2 GWh per year for a total power cost of $1.5 M.

18.5.5 Plant Maintenance

Maintenance costs are estimated at $1.1 M and $0.3 M per year to account for conveyor and chute work maintenance for the spodumene and by-products processing plant, respectively.

18.5.6 Mobile Equipment

The mobile equipment cost summary is split between fuel cost and maintenance and repair costs. The yearly mobile equipment costs for the spodumene and by-products processing plant have been estimated as $593,367 and $249,718, respectively.

An additional allowance of $16,745 per year has been made for vehicles for the administration department, which is included in site-wide general and administration operating costs.

18.5.7 Concentrate Transport

An overland conveyor is included in the project CAPEX to transport spodumene concentrate to the downstream chemical plant. The OPEX associated with the operation on the overland conveyor is included in the chemical plant operating costs and thus is not included in the concentrator operating cost estimate.

Based on PLL's estimate, the concentrator transport of by-products (quartz, feldspar, and mica) is accounted for in the concentrate sell price and is not included in the concentrator operating cost estimate.

18.5.8 Laboratory

Laboratory sample and general analysis operating expenses are priced at $164,787 per year for the spodumene processing plant and $76,787 for the by-products processing plant. Additional allowance for third party testing of $61,440 and $92,160 per year has been made under the administration cost for the spodumene and by-products processing plant, respectively.

18.5.9 Concentrator General and Administration

The concentrator general and administration costs include first aid, medicals, personal protective equipment (PPE), recruitment, third-party metallurgical testing, and training.

The yearly general and administration costs for spodumene and by-products processing plant is $507,349 and $206,837, respectively.

18.5.10 Water Treatment

The water treatment facility yearly operating costs is estimated at $2.0 M. The basis of the water treatment plant is vendor provided quotes (operating spares and DAF reagents), estimated reagents for precipitation and carbon adsorption, and power consumption.

18.5.11 Site-Wide General and Administration

A cost allowance of $2.7 M per year has been made to account for site-wide general administration costs. The items including manpower for departments such as health, safety, and environment (HSE), management, logistics, and human resources.

Additionally, cost items for the site, such as telecommunications, third-party environmental testing / consultants, security, and office cleaning contracts, are included under general G&A.

Table 18-10 – Site-Wide General and Administration Costs

Cost Center	Total Cost		
	US$/year	US$/t ore	US$/t spod conc.
G&A - Labor HSE	$530,160	$0.28	$2.18

G&A - Labor Management	$316,496	$0.17	$1.30

Cost Center	Total Cost		
	US$/year	US$/t ore	US$/t spod conc.
G&A - Labor Shipping & Logistics	$656,288	$0.35	$2.70
G&A - Labor HR	$297,024	$0.16	$1.22
General G&A	$904,425	$0.48	$3.73
Total	**$2,704,393**	**$1.43**	**$11.14**

18.6 CONVERSION PLANT OPEX

The overall cost per year of operation, per metric tonne of feed, and per metric tonne of final lithium hydroxide monohydrate product is described for the main parameters of the plant.

Table 18-11 presents a summary of the operating costs for the chemical conversion plant.

Table 18-11 – Chemical Conversion Plant OPEX Summary

Cost Center	Total Cost		
	US$/year	US$/t feed	US$/t final product
Labor (Process)	$10,006,330	$51.31	$333.54
Operating Consumables	$29,997,743	$153.83	$999.92
Power	$6,428,614	$32.97	$214.29
Maintenance Supplies	$3,211,137	$16.47	$107.04
Mobile Equipment	$304,276	$1.56	$10.14
Laboratory	$2,099,846	$10.77	$69.99
General & Administration	$762,865	$3.91	$25.43
Total	**$52,810,810**	**$270.82**	**$1,760.36**

The basis of the data sources, assumptions, cost inclusions and exclusions for the process operating costs are as follows.

18.6.1 Manpower

An allowance has been made for production, maintenance and management personnel associated with running the processing plant.

Roster is mainly based on a 12 hours per shift, 2 shifts per day, and 4 rotating crews. Once steady operation has been achieved, the manning levels will reflect previous experience at similar lithium operations.

Further rationalization and operational numbers during ramp-up should be reviewed in the DFS. A detailed labor breakdown is described in Table 18-12.

Table 18-12 – Chemical Labor Breakdown

Description	Number of Employees	Total Annual Labor Cost
Management		
Plant Manager	1	$189,280
Plant Operations		
Production Supervisor	4	$465,920
Safety/Training Supervisor	1	$116,480
Process Engineer	1	$154,336
Control-room Operator	8	$930,368
Relief Operator	8	$869,798
Packer/Production Helper	20	$1,947,360
Shipping Workers	2	$137,952
Receiving Warehouse Lead	1	$96,640
Receiving Warehouse Worker	1	$89,069
Material Lead	1	$96,640
Material Handlers	3	$267,206
Maintenance		
Maintenance Supervisor	1	$116,480
Mechanical Maintenance Lead	1	$134,496
Millwright / Mechanic	6	$466,272
Millwright / Mechanic Night Shift Only	4	$322,496
Maintenance / Planner	1	$123,139
Electrical / Instrumentation Supervisor	1	$153,424
Electrical / Instrumentation lead	1	$134,496
Electrical / Instrumentation Technician	6	$571,104
Electrical / Instrumentation Technician Night Shift Only	2	$196,192
Electrical / Instrumentation Planner	1	$123,139
QC Laboratory		
QC Supervisor	1	$110,656
QC Lead	4	$404,614

QC Technician	8	$718,374
R&D Technician (special Projects)	1	$81,536
Utilities		
Utilities Supervisor	1	$101,920
Wastewater Treatment	4	$389,472
Boiler room Operator	4	$389,472
Relief Operator	1	$107,997

Description	Number of Employees	Total Annual Labor Cost
Chemical Total	**99**	**$10,006,330**

The total chemical manpower cost per year is $10.0 M for the 99 employees.

18.6.2 Operating Spares and Consumables

Costing for Metso:Outotec equipment spares, mill liners, filter cloths, and reagents have been included in operating consumables. Assumptions are based upon Primero's recent lithium experience, Metso:Outotec proprietary knowledge, and vendor operating spares quotes.

Costs for conveyor and chute work maintenance are included in maintenance supply cost estimates. An allowance has been incorporated for first fills and opening stocks under capital costs associated with pre-production.

Operating consumables cost is estimated as $30.0 M per year for the chemical conversion plant.

18.6.3 Reagents

The reagents costs are included in the operating consumables expense. The breakdown of the reagent quantities, unit price, and total cost is described in Table 18-13.

Table 18-13 Chemical Reagent Consumption and Annual Cost

Operation	Reagent	Consumption Rate	Total Cost Per Year
Carbonate Leaching	Sodium Carbonate	5.68 t/h	$11,723,684
Conversion	Calcium Hydroxide	4.47 t/h	$6,458,882
Ion Exchange	Hydrochloric Acid	0.40 t/h	$594,000
	Sodium Hydroxide	0.09 t/h	$352,309
	Resin	30 t/change	$159,000
Crystallization	Sulfuric Acid	5 t/annum	$1,213
	Carbon Dioxide	0.26 t/h	$516,750
Lithium Phosphate Precipitation	Trisodium Phosphate	0.22 t/h	$1,650,000
Chemical Total			**$21,455,837**

18.6.4 Power Cost

The power OPEX calculation utilized a value of 5.7 cents per kWh based upon an estimate provided by PLL and a load factor of 0.8.

Power consumption and costs are determined based on calculated plant utilization and the mechanical equipment list. The estimated installed power is 3.1 MW for the chemical balance of plant, 1.2 MW for the calcination circuit, and 13.7 for the hydrometallurgical and crystallization circuits. An allowance of 900 kW has also been made for lighting, heating, and ancillary buildings.

Overall, power consumption for the chemical plant is expected to be 113.0 GWh per year for a total power cost of $6.4 M per year.

18.6.5 Plant Maintenance

Maintenance costs are estimated at $3.2 M per year to account for the overland conveyor, chute work, piping, and valving maintenance for chemical plant.

18.6.6 Mobile Equipment

The mobile equipment cost summary is split between fuel cost and maintenance and repair costs. The yearly mobile equipment costs for the chemical conversion plant have been estimated as $304,276.

18.6.7 Laboratory

Laboratory sample and general analysis operating expenses are priced at $2.1 M per year. Additional allowance for third party testing of $57,910 per year has been made under the administration cost for the chemical plant.

18.6.8 Chemical General and Administration

The chemical general and administration costs include first aid, medicals, personal protective equipment (PPE), recruitment, third-party metallurgical testing, and training.

The yearly general and administration costs for spodumene and by-products processing plant is $762,865.

The site-wide general administration items including manpower for departments such as health, safety, and environment (HSE), management, logistics, and human resources is included in the concentrator OPEX.

19 ECONOMIC MODEL AND SENSITIVITY ANALYSIS

19.1 ECONOMIC MODEL

A detailed financial model and discounted monthly cash flow (DCF) has been developed to complete the economic assessment of the project and is based on current (Q4 2021) price projections and cost estimates in U.S. dollars. No provision was made for the effects of inflation, but cost estimates incorporate recent inflationary price increases. The evaluation was carried out on a 100%-equity basis using an 8% discount factor. Current US federal and North Carolina state tax regulations were applied to assess the corporate tax liabilities.

The key project production values are presented in Table 19-1.

Table 19-1 Project Economics Summary

Base Case Financial Results	Unit of Measure	Value
Pre-Tax NPV @ 8%	$ M	2,561
After-Tax NPV @ 8%	$ M	2,041
Pre-Tax IRR	%	29.7
After-Tax IRR	%	27.2
Pre-Tax Payback Period	Years	5.51
After-Tax Payback Period	Years	5.53

The main project economic indicators are presented in Table 19-2. The economic study shows a net profit after tax (NPAT) of $7,317 M. The net present value of the 30-year based project is $2,041 M at an 8% discount rate and after applicable taxes. The after-tax internal rate of return (IRR) is 27.2%

Table 19-2 Project Cash Flow and Profitability Summary

Income Statement	Project
	$ million
Gross revenues (LiOH, SC6 and by-products)	16,905
Net revenues after royalties	16,884
Operating cost cash flow	(6,530)
EBITDA	10,375
Capital expenditure (pre-production)	(988)
Sustaining and deferred capital	(305)
Gross profit before tax (EBT)	9,109

Tax	(1,792)
Net Profit After Tax (NPAT)	7,317

19.2 SENSITIVITY ANALYSIS

The major financial assumptions used in the base case are given in Table 19-3. The project forecasts are based on a sale price for the 6 % Li_2O Spodumene Concentrate product of $900/t and Battery Grade Lithium Hydroxide product of $18,000/t. Various Sales forecasts (Table 19-3) were examined to decide the final sale prices utilized in the base case and the rates chosen represent a 42% and 61% discount to the currents spot prices (December 2021) of Lithium Hydroxide and Spodumene Concentrate respectively. Details on the derivation of this price forecast are given in section 19.3 below. The sensitivity analysis examines a range of prices 30% above and below this base case forecast.

Table 19-3 – LiOH Price Forecasts

Price Forecasts for Battery Grade LiOH US$/t	2022	2023	2024	2025
Benchmark Minerals	20,600	26,200	25,200	20,900
J.P. Morgan	26,625	22,500	19,737	18,420
Macquarie	21,275	20,415	18,545	17,540

The base case was carried out on a 100 % equity basis regardless of how the project will be financed. A discount factor of 8 % was chosen as a reflection of the cost of equity and this is the most widely used discount factor for comparative project analysis.

The tax rates utilized in the financial model are based on current federal and state tax laws. The current federal tax rate is 21 % and the current North Carolina Tax rate is 2.5 % but it reduces to 0 % between 2024-2028. A depletion allowance for tax purposes is applied across the Spodumene, Quartz, Feldspar and Mica sales with an amount of 22 % applied to Spodumene and Mica and 14% applied to Feldspar and Quartz.

There has been an allowance for a bonus depreciation deduction based on the bonus depreciation allowance in the Tax Cuts and Jobs Act of 2017, which is 100 % in 2022 and reduces to 0 % by 2027. Depreciation in the concentrate operations is based on Asset Class 10.0 - Mining in IRS Table B-1 using the general depreciation system (“GDS”) over 7 years with the double declining balance method. Depreciation in the chemical plant is based on Asset Class 28.0 – Mfg. of Chemical and Allied Products in Table B-1 using GDS of 5 years with the double declining balance method.

There is an allowance of $1.00 per ROM Ore tonne for royalties based on Piedmont’s direction based on the average land option agreement. No other government royalty payments are expected at this time.

Table 19-4 – Financial Assumptions

Item	Unit of Measure	Value
Lithium Hydroxide Sale Price	$/t	18,000
Spodumene Concentrate Sale Price	$/t	900
Spodumene Concentrate Purchase Price (inc transport)	$/t	935
Discount Factor	%	8

Applicable Tax Rate	%	22.98-21.00

Item	Unit of Measure	Value
Mica Sale Price	$/t	104
Feldspar Sale Price	$/t	54
Quartz Sale Price	$/t	90
Royalties	$/t	1
Spodumene Depletion	%	22
Mica Depletion	%	22
Feldspar Depletion	%	14
Quartz Depletion	%	14
Mine / Concentrator Depreciation		7 Year Double Declining Method
Conversion Plant Depreciation		5 Year Double Declining Method

19.3 TECHNICAL ASSUMPTIONS

The main technical assumptions in the model are outlined in table 19-5 below.

The total mine life in the model is 11 years and 1 month with the first 5 years of the mine plan scheduled quarterly before reverting to annually for the remaining 6 years. The concentrator commences operations at the same time as mining commences and has a ramp up period of 8 months before it reaches nameplate production. The Chemical Plant commences 3 months after mining operations commence with a ramp up period of 12 months before reaching nameplate production. The chemical plant is assumed to have a life of 30 years and once the ore is depleted it is assumed spodumene is purchased from a 3rd party at the market rate assumed for Spodumene sales ($900/t) feed the chemical plant for the remaining project life and an amount of $35/t for transport is allowed for in the model.

Table 19-5 – Project Production Summary

Production Summary	Value	Units
Mill feed mined	20.1	Mt
Waste mined	232.5	Mt
Total material mined	252.6	Mt
Mine life	11.1	years
Average strip ratio (waste:ore)	11.6	(w:o)
Spodumene Concentrate Produced	2.56	Mt
Quartz Production	2.7	Mt
Feldspar Production	4.2	Mt

Mica Production	0.3	Mt

Production Summary	**Value**	**Units**
LOM Average Li_2O grade (diluted)	1.00	% Li_2O
Average Li_2O recovery	77	%
LOM average annual ore production	1.81	Mtpa
Spodumene Purchases	3.8	Mt
$LiOH:H_2O$ Recovery	91	%
Lithium Hydroxide (LiOH) Total Production	883	kt

19.4 FINANCIAL MODEL AND CASHFLOW

Real project yearly and cumulative cashflows can be seen in Figure 19-1. Total cash generated by project at the end of project life of $7.32 B and the after-tax payback period including construction phase equates to 5.53 years

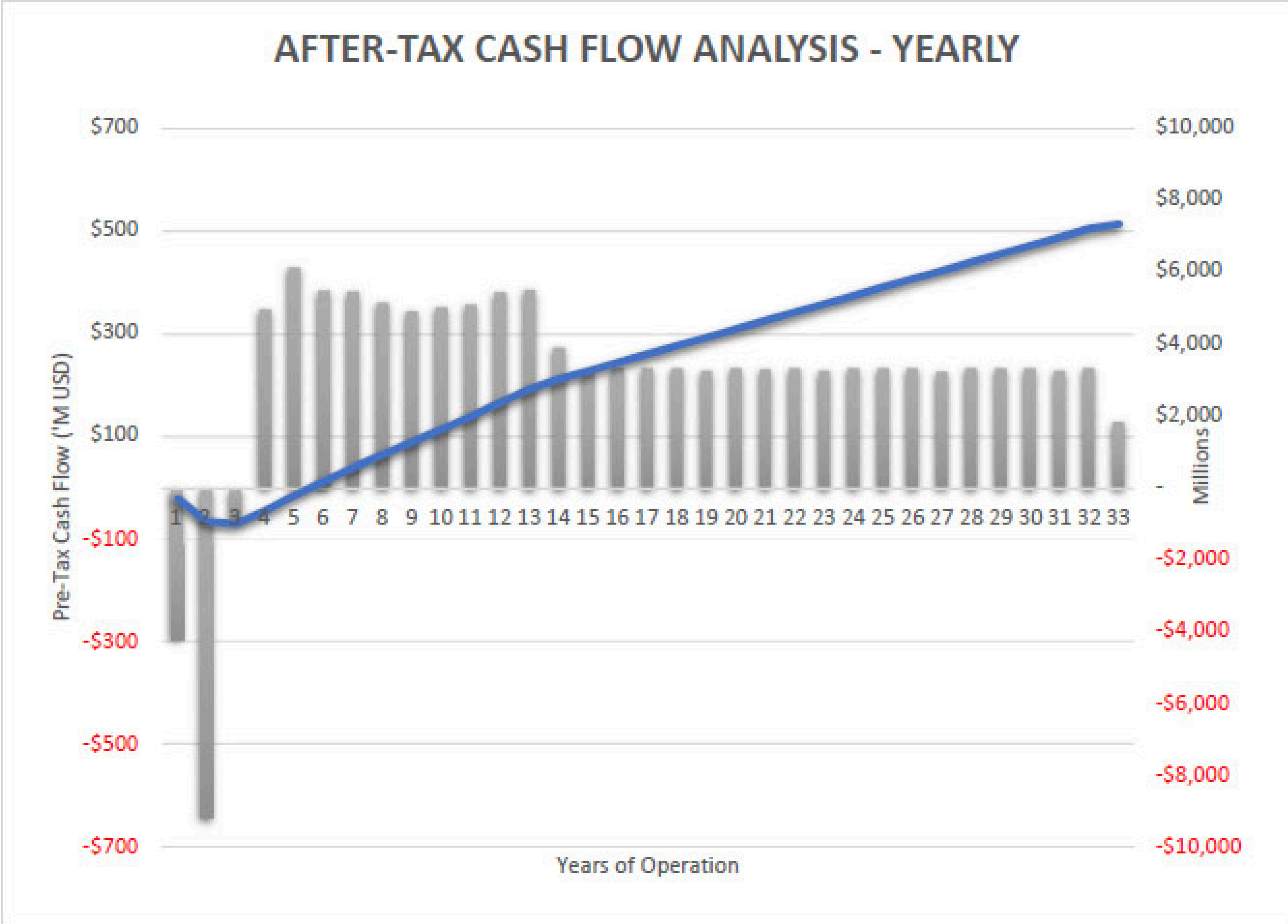


Figure 19-1 - After Tax Cash Flow Analysis

19.5 SENSITIVITY ANALYSIS

Primero has studied the economical models' sensitivity regarding a variation of:

- Capital cost;
- Operating cost;
- Spodumene Recovery;
- Lithium Hydroxide Recovery;
- Product Pricing.

The results are summarized in Figure 19-2 & Figure 19-3.

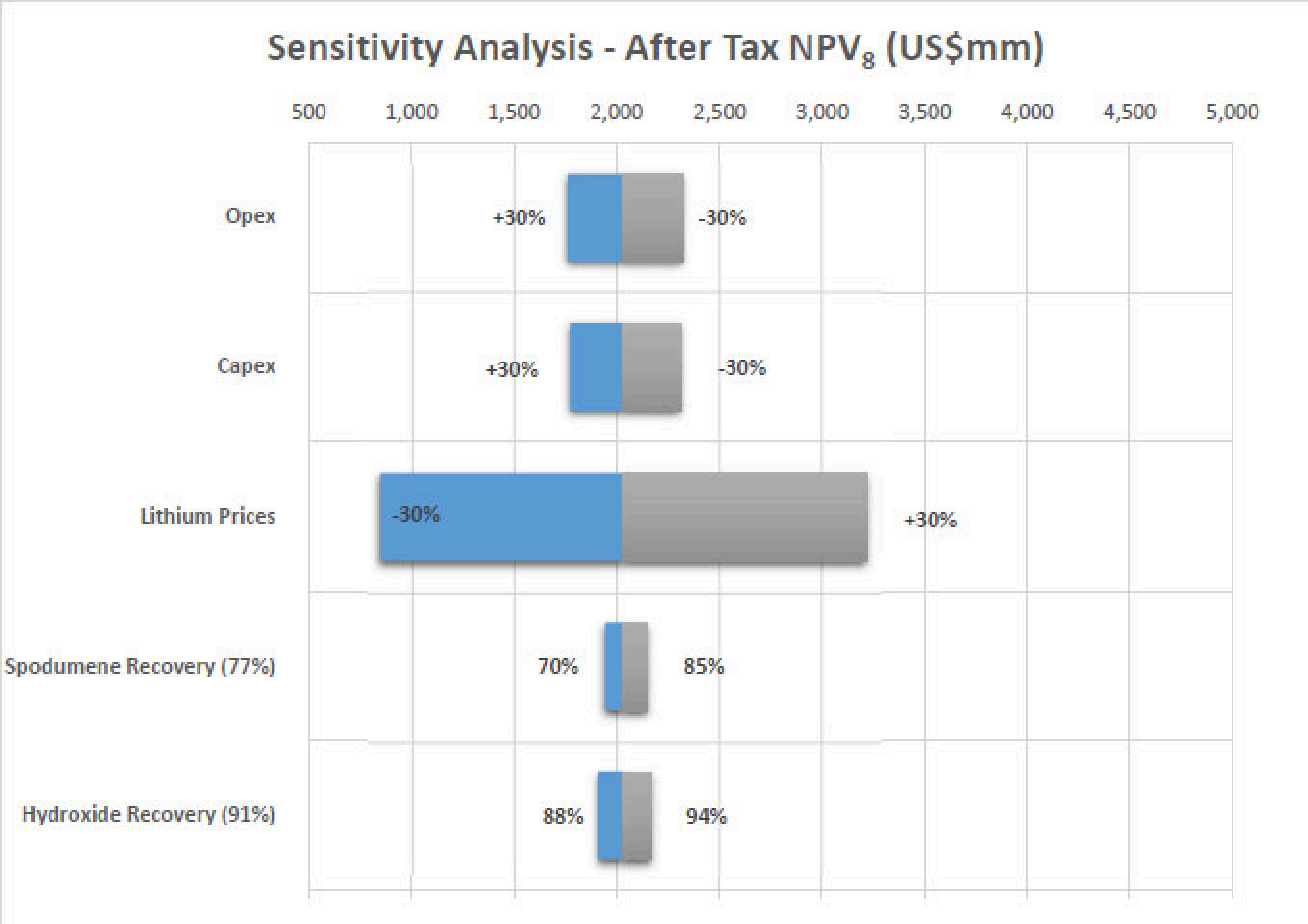


Figure 19-2 - Sensitivity Analysis After-Tax NPV_8

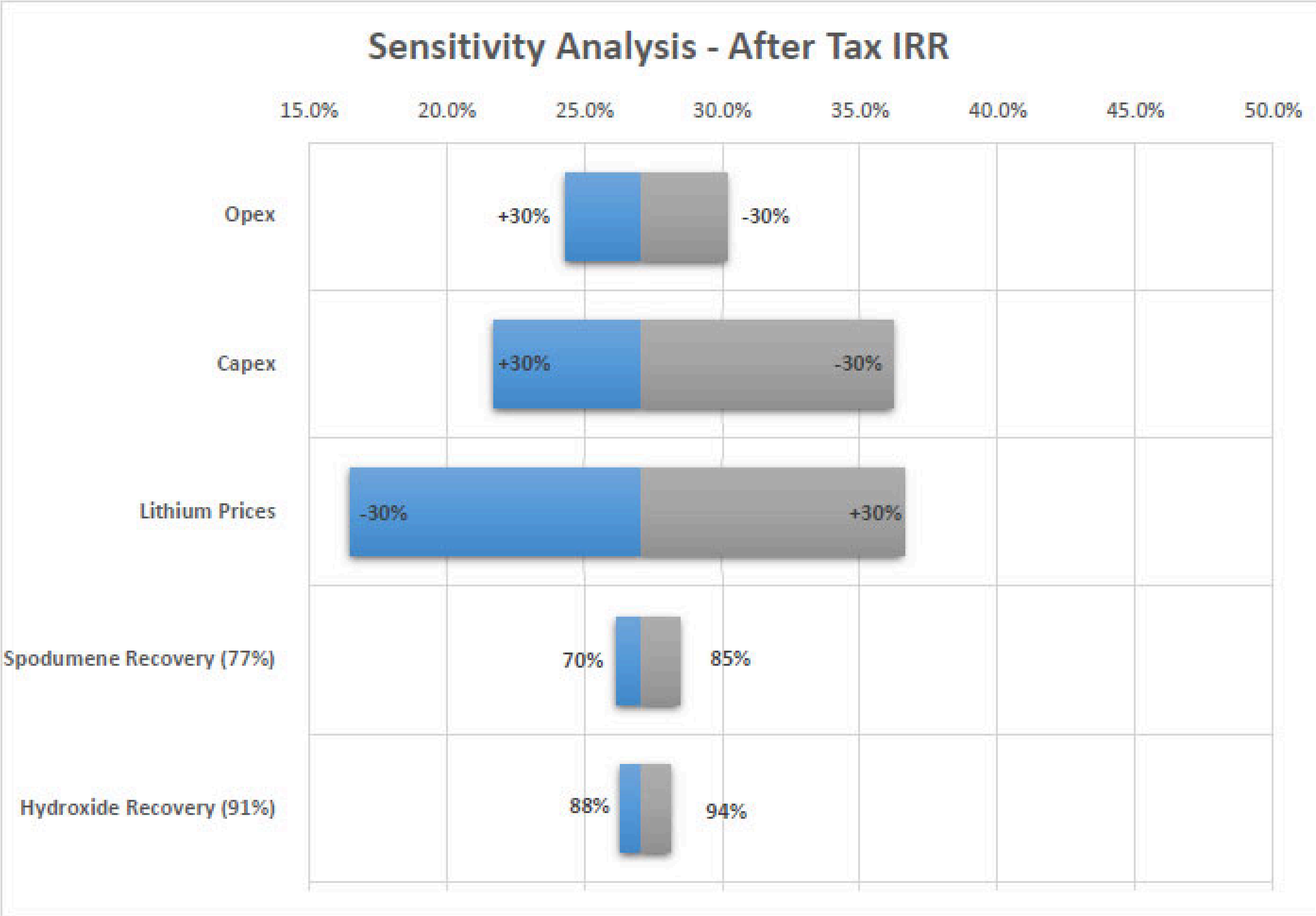


Figure 19-3 - Sensitivity Analysis After-Tax IRR

The results are showing that the NPV and the IRR are:

- Sensitive to Lithium Hydroxide selling price and the IRR is sensitive to variability in CAPEX costs
- Less sensitive to variations in OPEX and process recovery

20 ADJACENT PROPERTIES

The adjacent properties are generally privately held parcels of land. From a geological perspective, these properties all fall within the Inner Piedmont Belt (e.g. Gair, J.E., 1989. “Mineral resources of the Charlotte 1ºx2º quadrangle, North Carolina and South Carolina. U.S. Geological Survey professional paper 1462).

No specific mineral resource related information was found.

21 OTHER RELEVANT DATA AND INFORMATION

This section describes the project implementation and the organization of the operations.

21.1 PROJECT IMPLEMENTATION

The Project consists of the following major areas:

- Mine development, including haul roads, magazine, pit dewatering, in-pit crushing and ore overland conveyor;
- Lithium Spodumene concentrate process facility including by-product quartz, feldspar and mica processing;
- Lithium Spodumene Conversion Plant;
- Infrastructure to support construction, mining, processing and conversion operations.

For the project implementation, PLL would form an Integrated Project Management Team (IPMT) which would provide overall project management. The key management requirements are to:

- Define and document organization structure and individual positions, including responsibility for establishing and reporting, in accordance with the project management system;
- Ensure sufficient and appropriate resources are applied on the Project;
- Provide clear and mutually compatible position descriptions with authority and responsibilities levels detailed including expenditure and correspondence limits.

The IPMT would be comprised of PLL's employees and consultants as required. Figure 21-1 represents the planned organizational structure of the IPMT.

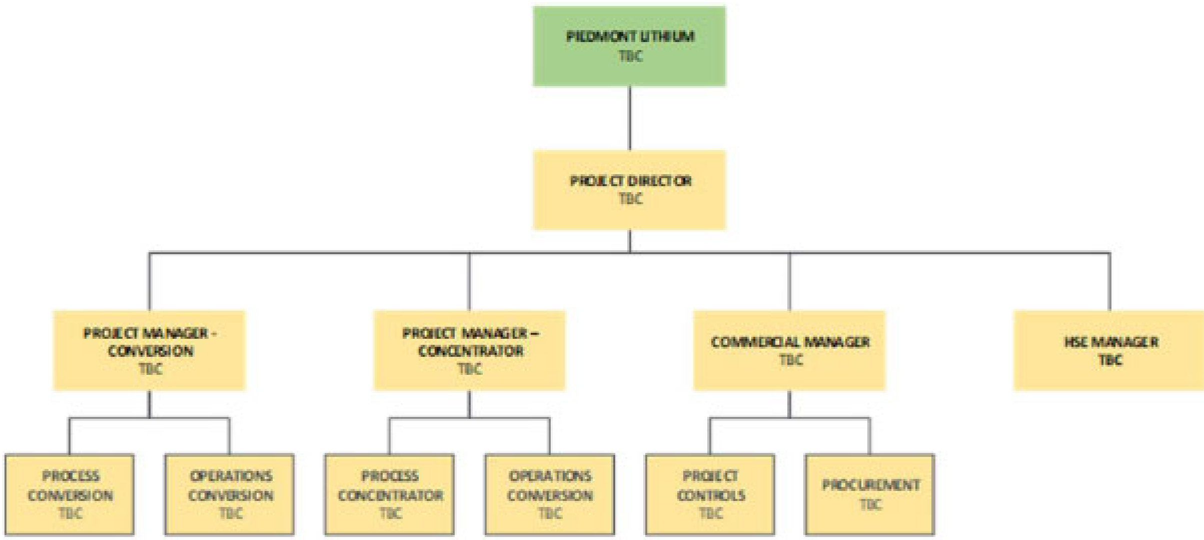


Figure 21-1 - The IPMT organizational structure chart

PLL would be responsible for the overall project management. PLL's key areas of responsibilities would be as follows:

- Managing large EPC contracts;
- Obtaining and management of necessary permits and approvals for the Project;
- Preparation of overarching standards and procedures;
- Scope preparation, tendering, award, contract administration and closeout of large EPC contracts;
- Technical review of engineering for compliance with PLL requirements;
- Interface management between contractors;
- Establishment of the operations and mining teams;
- Procurement of spare parts based on spare parts list provided by the suppliers;
- Operational readiness.

Primero would be assigned to be responsible for the following activities:

- FEED management and execution;
- Project controls;
- Planning and scheduling;
- Engineering and design;
- Procurement activities;
- Finalizing estimating (CAPEX and OPEX) during FEED;
- Constructability planning activities;
- Risk management;
- Supervision of installation contractors;
- QA/QC;
- Commissioning;
- Handover to operations.

Other contractors to be engaged by PLL would be responsible for engineering & design, testing, permitting activities and design & supply of the following project areas:

- Mining, waste, tailings and civil.
- Geotechnical and environmental.
- Conversion technology partner (Metso:Outotec)
- Infrastructure utilities (electric power, natural gas, municipal water supply; sewage).

21.1.1 Engineering and Design

All engineering and design works should be conducted as per contractors' own design procedures and in accordance with the relevant legislation and standards noted in Scope of Works document. The design should be performed to deliver the Project in accordance with the Process Design Criteria and Basis of Design.

The project execution would commence with the contractors carrying out Front End Engineering & Design (FEED). The FEED would allow time for various trade-off studies, optimizations and further investigations required prior to detailed engineering.

The Final Investment Decision (FID) would be the trigger for detailed engineering and design. Each contractor should prepare a detailed Engineering Management Plan covering their scope prior to commencement which would outline all responsibilities, design processes, performance requirements and design inputs. The plan should ensure that the products of the design process meet all PLL, legislative, contractor's own and other requirements.

Procurement Plan

The IPMT would be responsible for establishing the overarching procurement and contracts requirements for the Project including the development and maintenance of a detailed procurement and contracts register (PCR) for the items procured directly by PLL.

Each contractor would be responsible for preparing a Procurement and Contracting Plan which would outline procurement strategies and processes to be used to comply with project requirements and to achieve project goals. Contractors would also prepare and maintain a PCR for the procurement items within their scope. A list of suitable tenderers for each package in the contractors' PCRs should be vetted and approved by the IPMT prior to issuing of tenders in accordance with applicable procurement procedures and requirements and contract provisions.

Each contractor would be responsible for the following procurement and subcontract activities:

- Development and maintenance of the PCR;
- Development and maintenance of a procurement and contracts status report to track procurement progress and to provide input for the progress schedule;
- Preparation of all tender documentation including request for quotations (RFQ's), pro-forma contracts and associated tender schedules (pricing, manning, equipment, variation rates, etc.);
- Carrying out tender evaluations on all packages including clarification meetings as required;
- Preparation of formal RFAs for PLL review and approval as required by their contract;
- Contract negotiations;
- Issuing Purchase Orders.

Once purchase orders have been placed with selected suppliers, contractors would be responsible for expediting and management of all vendor documentation, QA/QC, RFI's, variation requests, progress claims and final delivery of equipment to site. Contractors' project manager along with the on-site construction management team would manage and expedite all site installation subcontracts.

Ongoing gap analysis would be carried out during the procurement phase to ensure that battery limits between packages are clearly defined and that there no gaps in scope.

US, local and women, minorities and veteran owned vendors would be prioritized when feasible and no significant risks regarding quality, cost or schedule impacts on the Project are present. Vendors based in areas where it would be harder to perform inspections or may lead to freight forwarding issues would be avoided when possible.

Procurement packages would be structured to minimize commitments and payments without the realization of tangible progress with milestone payments linked to submission of general arrangement drawings and vendor documents and data critical to design and engineering, material and equipment purchase orders, final inspections, or factory acceptance testing (FAT), delivery and finally submission of closeout documentation (MDR's and O&M's), as applicable.

To facilitate FEED and detailed design and engineering progress and to reduce schedule risk, the IPMT with cooperation from the contractors would identify and evaluate major equipment packages with expected long lead times and of critical importance to the project schedule. Where feasible and appropriate, early orders would be placed to secure vendor design data required to advance FEED and detailed design and to secure critical equipment delivery dates.

Formal technical and commercial evaluations would be completed for these packages and should be issued to the IPMT with a recommendation for final approval if such approval is required. Justification should be provided in the evaluations for any sole sourced packages.

21.1.2 Planning and Scheduling

A summary level integrated Level III logic-driven schedule would be developed covering all major areas of the Project. The integrated project schedule would be supported and based on contractors' Level IV logic-driven schedules developed for their respective scopes. The scheduling software would be Primavera P6 or similar. The IPMT would provide initial Level I key PLL deliverable dates to be included into the integrated project schedule as relevant to contractors' execution schedules.

21.1.3 Project Master Schedule

Figure 21-2 - Project Schedule illustrates the project schedule.

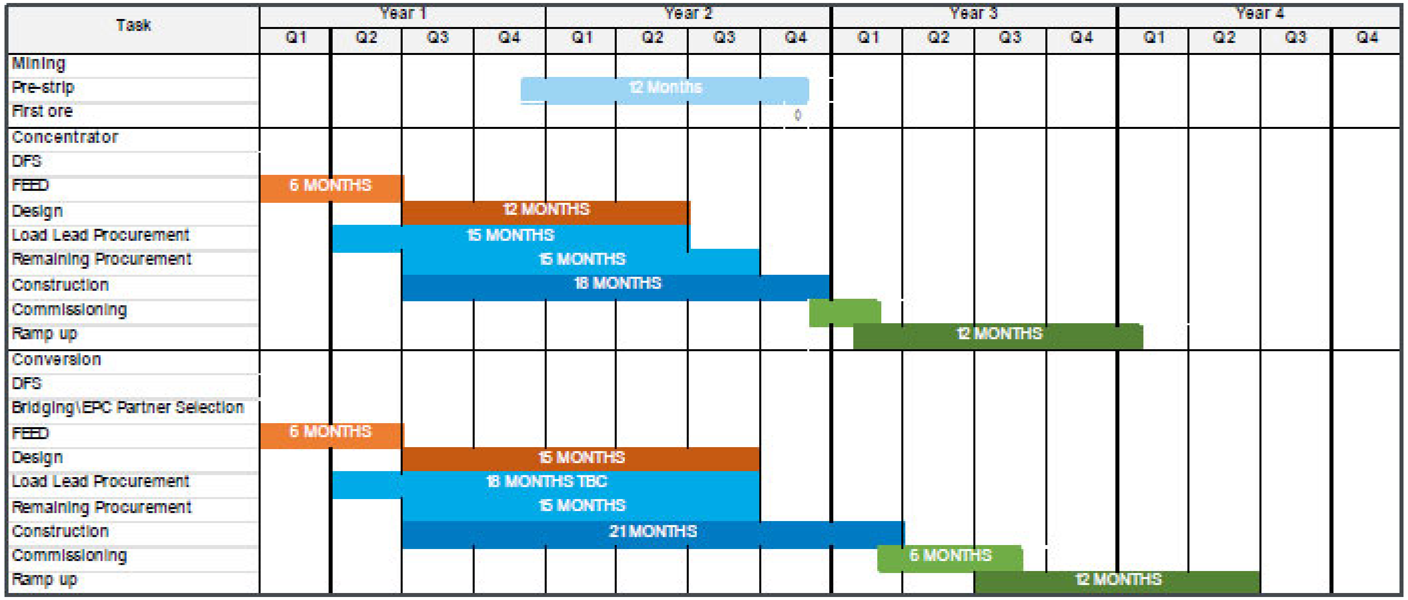


Figure 21-2 - Project Schedule

21.1.4 Critical Path

The anticipated longest path through the schedule starts with the financial approval and the notice to proceed with design works. Critical to the progress of design works is the receipt of engineering drawings and data for critical process equipment and placement of orders for the equipment with the longest lead times. The critical path then flows through detailed design by discipline (civil, structural, mechanical, piping, electrical and controls) followed by construction, pre-operational verification (POV) and commissioning activities for the Conversion Plant.

Contractors' Level IV schedules would identify critical path for the individual scopes of each contractor. Integrated project summary Level III schedule would show the overall project critical path.

21.1.5 Construction

Contractors' construction management teams, led by the construction managers, would be based at the Project site and would be responsible for the overall management of each contractor's respective sites and ensure that all construction activities are carried out safely and efficiently in line with project requirements.

The IPMT would also include site-based team members to provide overarching management and support for contractors.

Clear and detailed construction planning would be critical in ensuring that the construction phase is executed safely and on time, facilitating a smooth and definite transition into full operations. A Construction Management Plan would be prepared by each contractor for their scope of work and submitted to the IPMT for review, comment and approval. The Construction Management Plan would address in detail the means and methods by which construction phases would be carried out, managed, and controlled. In addition to the Construction Management Plan a constructability review would be carried out to optimize sequencing of construction activities as the design work progresses.

Communications on-site would be paramount for safe and successful construction management and to ensure that all relevant parties are informed of any site activities that may affect the safety or efficiency of their works.

Site kick-off meeting would cover site rules, safety and emergency procedures, contractor's work area(s) and interface points with other parties as well as identify contact persons for PLL and other contractors.

Contractors would hold weekly contractor meetings as well as interface meetings (as frequently as required) where each construction superintendent from all the contractors would meet and discuss safety, progress and interface issues or concerns.

21.1.6 Commissioning and Start Up

The Project commissioning process would be broken down into the following stages.

- Factory acceptance testing (FAT);
- Commissioning preparation;
- Construction verification;
- No-Load (Dry) commissioning;
- Load (Wet) commissioning;
- Process (Ore) commissioning.

21.1.7 Occupational Health, Safety and Environment

A primary focus for the IPMT is to promote a positive HSE culture at all levels of the Project and to ensure that a safe system of work is established and maintained for the protection of personnel, environment and the public during the execution of the Project.

Project Health, Safety and Environmental Management Plan (HSE Plan) would be strictly followed to ensure that all PLL employees, contractors and sub-contractors understand and adhere to all HSE expectations as well as federal, state and local health, safety and environmental regulations. Every contractor should develop a project specific HSE plan which would align with PLL's Project HSE Plan and would meet or exceed PLL's and legislative health, safety and environmental performance standards. All contractors and sub-contractors would be required to sign on to and comply with the Project HSE Plan prior to mobilizing to site.

- The HSE plan should include specific details to the following:
- Governing codes, standards, etc;
- Objectives, metrics and performance standards;
- Organization structure and responsibilities;
- Hazard and risk management planning;
- Implementation of policies, plans and procedures;
- Monitoring, evaluation, audits and review.

21.2 ORGANIZATION

Organization charts would be developed later by PLL for the mine, concentrator & by-product plants and the lithium conversion plants.

21.2.1 General Management

The types of activities considered for operations are as follows:

- General management;
- Administration;
- Human resources;
- Health, safety and environment;
- Security and emergency response;
- Process plant operations;
- Mining operations;
- Exploration and geology;
- Mine planning;
- Supply management;
- Transport and logistics;
- Maintenance and surface services (process equipment, mobile equipment, infrastructure, housekeeping);
- Laboratory testing;
- Storage (spare parts in warehouse and various bulk materials in stockpiles).

The entire operations workforce would be under the control of a general manager who would be supported by six main departments each headed by a manager.

- Conversion plants manager;
- Process plant manager;
- Mine manager;

- Exploration, geology and mine planning manager;

- Admin, store and supply manager;
- HR and HSE manager.

21.2.2 Lithium Hydroxide Conversion Plant Department

The lithium hydroxide plant department is responsible for the day-to-day operation of the plant to ensure budgeted tonnage and lithium hydroxide production are achieved. The process plant manager would be responsible for the department and would be assisted operationally by the operation superintendent and metallurgist, who would coordinate the activities of the plant.

In addition to production duties, the lithium hydroxide plant manager would be responsible for the maintenance of all fixed equipment. The maintenance superintendent would report to the process manager. The senior metallurgist would oversee the on-site laboratory.

The role of the maintenance section would be to maintain the fixed equipment in safe and good working order. This would incorporate maintenance planning including preventative maintenance and would require close liaison with the production department.

The maintenance department staffing levels would be adequate to handle most repairs and rebuild tasks; for major tasks, additional resources such as suitable contractors or additional temporary labor may be required to work under the direction of the maintenance supervisors.

21.2.3 Concentrator Department

The concentrator department is responsible for the day-to-day operation of the plant to ensure budgeted tonnage and concentrate production are achieved. The process plant manager would be responsible for the department and would be assisted operationally by the operation superintendent and metallurgist, who would coordinate the activities of the plant.

In addition to production duties, the process plant manager would be responsible for the maintenance of all fixed equipment. The maintenance superintendent would report to the process manager. The senior metallurgist would oversee the on-site laboratory.

The role of the maintenance section would be to maintain the fixed equipment in safe and good working order. This would incorporate maintenance planning including preventative maintenance and would require close liaison with the production department.

The maintenance department staffing levels would be adequate to handle most repairs and rebuild tasks; for major tasks, additional resources such as suitable contractors or additional temporary labor may be required to work under the direction of the maintenance supervisors.

21.2.4 Mining Department

The mining department responsible for all mining activities, with the structure of the department developed. This includes mine operations and mobile equipment maintenance.

The mine operations group would also maintain haul roads and feed ore to the process plant. Emphasis would be placed on safety and training, with dedicated is trainers for the mining equipment.

The mining manager would be responsible for the department and would be assisted by the mine operation superintendent and the mine maintenance superintendent.

21.2.5 Exploration, Geology and Mine Planning Department

This department is responsible for mine planning, geotechnical and geology activities, including exploration drilling.

The technical services manager would be responsible for the department and would be assisted by the senior mining engineer, the senior geotechnical engineer, and the senior geologist.

21.2.6 Administration and Supply Management Department

This department includes all administration, accounting, warehouse and purchasing functions as well as catering, contract administration, and secretarial. The administration, stores and supply manager would report to the general manager.

21.2.7 HR and HSE Department

The HR and HSE manager would be assisted by an HR officer and HSE officer.

The HR officer would oversee all human resources related issues.

The HSE officer with be responsible for health, industrial hygiene, safety, security, emergency response and environment, and would be in close contact with the medical services, prevention team, guardhouse, process plant manager and the environment specialist. The HS advisor would control all aspects of safety on site and industrial hygiene matters. The environmental officer would control all matters relating to the permitting, environment control and reporting requirements.

22 INTERPRETATION AND CONCLUSIONS

The Carolina Lithium Project is in a rural area of Gaston County in North Carolina, USA, approximately 44 km northwest of Charlotte, 16 km northeast of the town of Kings Mountain and 11 km southwest of the town of Lincolnton. The property parcels are easily accessible through a paved secondary road bisecting the project area. Several small gravel roads traversable by truck allow further access into the properties. Interstate highway I-85 lies 13 km to the South and provides easy access to the city of Charlotte and the Charlotte Douglas international airport 30 km to the East. Charlotte is North Carolina's largest city.

The Carolina Lithium project supports conventional and proven mining and spodumene concentration technology. The spodumene bearing ore will be extracted from open pits with in-pit crushing and conveying. Similarly, the open pit waste rock and the concentrator rejects will be co-disposed in dry state (after filtering of the concentrator rejects) with the usage of crushing and conveying equipment. This will minimize usage of trucking and fossil fuel consumption. The spodumene conversion to lithium hydroxide finish product is based on the technology developed and proposed by MO. PLL is committed to execute all phases of the project in a socially responsible and environmentally manner. The open pit, concentrator and converter plants have been designed and positioned to minimize the footprint. The concentrator includes a processing circuit to recover and stockpile as much as possible by-products (quartz, feldspar and mica) with the quality standards to be sold on the market. This also minimizes the amount of material to be placed in a waste disposal area. The processing plants will recover water for re-use in processing to minimize the use of surface/underground water and reduce treated water discharge.

Project investment will provide positive social, economic and material supply strategic impacts locally and nationally, including job creations, training, procurement and business opportunity throughout the region, from construction through operations.

22.1 MINERAL RESOURCE

Sufficient data have been obtained through various exploration and sampling programs to support the geological interpretations of the lithium-bearing pegmatite deposit on the Property. The data are of sufficient quantity and reliability to reasonably support the resource estimates in this TRS.

The geology of the Project area and controls to mineralization are well-understood. Exploration techniques employed on the Project are appropriate and data derived from them are of sufficient quality to support the modelling of Mineral Resources in accordance with the JORC Code.

Based on an assessment of available QA/QC data, the entire lithium and whole-rock drill core assay dataset is acceptable for resource estimation with assaying posing minimal risk to the overall confidence level of the MRE.

On the Core Property, 76 spodumene-bearing pegmatite dike portions are modeled within three major corridors that extend over a strike length of up to 2 km and commonly have a set of thicker spodumene-bearing pegmatite dikes of 10 m to 20 m true thickness at their core. Major dikes strike northeast and dip moderately to the southeast and can be traced between drillhole intercepts and surface outcrops for over 1.7 km. Dikes are intersected by drilling to a depth of 300 m down dip. Although individual units may pinch out, the deposit is open at depth and along strike. The Mineral Resource model has a maximum vertical depth of 210 m from surface. On average, the deposit extends to 150 m below surface.

On the Central Property, 11 spodumene-bearing pegmatite dikes fall within a corridor that extends over a strike length of up to 350 m and contains a pair of thicker spodumene-bearing pegmatite dikes of 10 m to 20 m true thickness. These major dikes strike northeast and dip steeply to the southeast dipping. Dikes are intersected by drilling to a depth of 200 m down dip. Although individual units may pinch out, the deposit is open at depth and along strike. The Central Mineral Resource has a maximum vertical depth of 250 m from surface. On average, the model extends to 200 m below surface.

On the Huffstetler Property, six spodumene bearing pegmatites fall within a corridor that extends over a strike length of up to 0.4 km and form a stacked series of inclined sheets that range from 2 m to 18 m true thickness. Inclined sheets strike northeast and dip moderately to the northwest. Spodumene bearing pegmatites are intersected by drilling to a depth of 200 m down dip from surface however up-dip extents are limited by the southeastern edge of the permit boundary. Although individual units may pinch out, the deposit is open at depth and along strike. The Huffstetler Mineral Resource has a maximum vertical depth of 150 m below the topography surface.

Spodumene, quartz, feldspar and muscovite mica and occur as essential rock-forming minerals of the modeled pegmatites and together comprise approximately 90% of the mineral assemblage. Sufficient data are available to generate reliable mineral grade estimates using the ordinary kriging method for the Piedmont properties.

Metallurgical test work on composite bulk samples of spodumene-bearing pegmatite from the property was conducted at bench scale at MRL in 2018, and at pilot-plant scale at SGS Lakefield in 2019. Flotation results showed that that lithium occurs almost exclusively within spodumene and that concentrates of greater than 6.0% Li_2O were achievable with an iron content to less than 1.0% Fe_2O_3. Quartz, feldspar, and mica concentrates were produced as by-products of the spodumene concentrate. Initial results demonstrate commercial potential for each by-product.

The depth, geometry, and grade of pegmatites on the properties make them amenable to exploitation by open cut mining methods. At the Core Property, reasonable prospects for economic extraction are specified for 97% of the resource model (36.68 Mt) that falls within a resource constraining conceptual pit shell. Reasonable prospects for economic extraction are specified for the entire Central resource model (5.16 Mt) and for the entire Huffstetler resource model (2.31 Mt).

For the Carolina Lithium Project, this study has defined (at a 0.4% Li_2O reporting cut-off) a global Inferred and Indicated MRE of 44.15 Mt at 1.08% Li_2O, containing 475,000 tonnes of lithium oxide with an effective date of October 20, 2021. Within the reported resource model, global by-product Mineral Resources are 12.99 Mt of quartz, 20.00 Mt of feldspar and 1.82 Mt of mica and have an effective date of October 20, 2021.

The global total incorporates: An Indicated Mineral Resource of 21.55 Mt at 1.121% Li_2O with 6.34 Mt of quartz, 9.69 Mt of feldspar and 0.90 Mt of mica; and An Inferred Mineral Resource of 17.61 Mt at 1.03% Li_2O with 5.16 Mt of quartz, 8.08 Mt of feldspar and 0.73 Mt of mica.

The completed Phase 5 drill program has partially tested previous Exploration Targets reported by the Company on 25 June 2019 and has successfully delineated new lithium and by-product Mineral Resources for the Project. Currently, the Company is conducting geological mapping, and exploration targeting study at the Project. No new exploration targets are presented for the Project.

22.2 MINING

The following summaries of interpretation and conclusion associated with the PLI project are primarily focused on the mine plan and mining-specific issues.

- Inferred resources extracted in early years can be converted to indicated resources with infill drilling in the upper portions of the deposit;
- Acquisition of additional property tracts northeast of North Pit, southwest of South Pit, and east and south of East Pit could add additional mineral resources;
- Additional recoverable tonnes may be achieved via stream relocations allowing for combining of certain pits;
- Off-site construction projects with a balance of fill could be utilized to offset waste handling costs;
- Continued evaluation of ballast sales may be helpful in recouping waste rock costs;
- Property acquisitions are required to execute the mine plan as summarized in this TRS. Although capital costs scheduling has accounted for such acquisitions, risk exists with regards to cooperation from current property controllers;
- The final amount of potentially acid producing material which will be subject to mitigation requirements is unknown. Additional testing is ongoing to better estimate volumes of such material. Risk exists based on the amount of potentially acid producing material defined;
- Mine scheduling as summarized in this TRS is predicated upon reasonable expectations of permit approval. As with any mining venture, risk exists with regards to permit approvals;
- Pit slope wall angles along southwest walls (northeast-dipping) have a potential to require lower overall slope angles and possibly would reduce available resources. Geotechnical analysis has resulted in implementation of an offset to reduce the opportunity for adverse conditions;
- All parcel data within the project boundary was taken from county tax information. Surveys should be undertaken before final site maps are completed. Non-surveyed parcels may result in minor variations to the overall project acreage and permits;
- Some parcels included in the study are pending an option agreement. Parcels not controlled by PLI present substantial risk to the project layout, permitting, resource estimates, and cost modelling;
- Initial site development costs and equipment costs are based on late-2021 estimates. Estimates should be updated as the project progresses.

22.3 METALLURGY TESTING

In 2019, Piedmont engaged SGS Canada Inc. in Lakefield, Ontario to undertake testwork on variability and composite samples. Dense Medium Separation (“DMS”) and locked-cycle flotation tests produced high-quality spodumene concentrate with a grade above 6.0% Li_2O, iron oxide below 1.0%, and low impurities from composite samples. The feed grade of the composite sample was 1.11% Li_2O.

In 2020, a pilot plant testwork program was undertaken at SGS SGS Canada Inc. A 54-t bulk outcrop sample from the Carolina Lithium Project was processed through a DMS and flotation pilot plant. Using the optimized results from the flotation pilot plant, the combined DMS and flotation concentrates graded >6% Li_2O and <1% Fe_2O_3 with lithium recoveries > 70%. Optimized testing on the master composite sample resulted in lithium recovery of 82% and concentrate grading 6.13% Li_2O.

In 2021, Piedmont engaged SGS Canada Inc. in Lakefield, Ontario to undertake testwork on nine variability samples. Samples were produced from drill core from the East and South pits and represented the early years of production (i.e., the first 10 years of operation). The samples generally contained elevated levels of host rock dilution (ranging from 9.4% to 17.3%) as compared to the mine plan average (10%). DMS and batch and locked-cycle flotation tests were undertaken. Based on the historical testwork and the 2021 variability program, the DFS assumes a spodumene recovery of 77.0% when targeting a 6.0% Li_2O spodumene concentrate product.

22.3.1 By-Product Metallurgy

The production of bulk quartz and feldspar concentrates as by-products from the spodumene locked-cycle flotation tailings was investigated. Six individual batch tests were conducted with the quartz and feldspar concentrates being composited.

Piedmont engaged North Carolina State University's Minerals Research Laboratory in 2018 to conduct bench-scale testwork on samples obtained from the Company's MRE within the Core Property for by-products quartz, feldspar, and mica. The objective of the testwork program was to develop optimized conditions for spodumene flotation and magnetic separation for both grade and recovery.

Mica quality is measured by its physical properties including bulk density, grit, color/brightness, and particle size. The bulk density of mica by-product generated from Piedmont composite samples was in the range of 0.680 - 0.682 g/cm^3.

The National Gypsum Grit test is used mostly for minus 100 mesh mica which issued as joint cement compound and textured mica paint. Piedmont sample grit results were in the range of 0.70 - 0.79%, well below the typical specification for total grit in mica of 1.0%. Color/brightness is usually determined on minus 100 mesh material. Several instruments are used for this determination including the Hunter meter, Technedyne and the Photovoltmeter. The green reflectance is often reported for micas and talcs. Piedmont Green Reflectance results were in the range of 11.2 - 11.6.

Quartz and feldspar concentrates were produced during the 2021 Variability program at SGS Canada Inc. Batch flotation tests were operated to produce feldspar concentrate with the flotation tailings were passed through wet high-intensity magnetic separation to produce quartz concentrate.

22.3.2 Conversion Metallurgy

In 2021, Piedmont engaged Metso Outotec to undertake pilot plant testwork using their proprietary Lithium Hydroxide Process. The spodumene concentrate sample used was produced during concentrator pilot plant operation in 2020. The spodumene concentrate was calcined by Metso Outotec at their laboratory in Oberursel, Germany. The calcined concentrate was then sent to Metso Outotec Research Center in Pori, Finland for hydrometallurgical testing.

The pilot plant flowsheet tested included: soda leaching, cold conversion, secondary conversion, ion exchange, and lithium hydroxide crystallization. The pilot plant operated for approximately 10 days. Roughly 100 kg of calcined spodumene concentrate was fed to the pilot plant. The average total lithium extraction achieved in soda leaching and cold conversion was 89% during the first 136 h of operation. Process recycles were incorporated in the pilot plant with no significant accumulation of impurities in the process. First stage lithium hydroxide crystallization was operated continuously during the pilot plant. Second stage crystallization was operated in batches after the completion of the continuous pilot plant. Impurities levels in the final battery-quality lithium hydroxide monohydrate product were typically low with Al <10 ppm, Ca <10 ppm, Fe <20 ppm, K <10 ppm, and Si <40 ppm. All other metal impurities were below detection limits.

22.4 RECOVERY METHODS

- The recovery of lithium from ore to final product has been achieved through a concentration stage, with the concentrate then being converted to a saleable lithium hydroxide monohydrate product.
- The DMS and Flotation technologies for the recovery of spodumene is a widely used technology for beneficiation of spodumene so both are considered a very low risk technology.
- Testwork confirming the technologies applicability was undertaken across samples considered representative of the ore zones.
- A concentrate grade that is in line with expectations of 6 % Lithia, with a nominal 1.0 % contained haematite grade was achieved, making the product very saleable.
- The averaged spodumene recovery from the DMS test program was nominally 34.2%, with a further 42.8% from the flotation circuit.
- The conversion of the contained lithium in the concentrate to a final lithium hydroxide monohydrate was tested using the Metso:Outotec (MO) patented carbonate process, and not the sulfation process which is a known commercialized process. This does make the technology a process risk given there are no known existing commercial operations.
- The results from the pilot program have confirmed that lithium conversion can be achieved, with >87% recovery, with a proposed recovery of 91% being applied (from technology provider). Provided correct solution management occurs then the process production targets can be achieved.
- Production schedule for the project is based on processing 2.1M tons per annum of ROM ore to produce a nominal 215k ton per annum of concentrate (6 % Li_2O) which is processed to produce 33k ton per annum of lithium hydroxide monohydrate.
- Tailings residue from the convertor is returned to the “waste” ore dry stack via overland conveyor, a nominal 382k ton of wet residue (20% (w/w)).
- An effluent stream to bleed a chloride rich solution of nominally 56gpm is to be disposed to a municipal treatment facility.

22.5 RISK & OPPORTUNY EVALUATION

A risk assessment (including the gathering of the risks highlighted by the other consultants responsible for their specific disciplines) was conducted by Primero. An internal workshop session including the key Primero managers and engineers was held on September 16th, 2021. Another session including the PLL staff was held on October 06, 2021 to complete the risk and opportunity register.

Risks and opportunities were listed into the following six categories:

- Technical risks and opportunities;
- Operation risks and opportunities;
- Mineral Resources risks and opportunities;
- Mining risks and opportunities;
- Environmental & permitting risks and opportunities;
- Project risks and opportunities.

Each of the risk and opportunity items of the lists were ranked with the use of a standard two-axis matrix. The first evaluation criteria is the Frequency (Five levels defined as Certain (A) to Rare (E)) whereas the second criteria is the Consequence (Five levels defined as Insignificant (1) to Catastrophic (5)). The combination of the Frequency and Consequences criterions results the Risk or Opportunity ranking of 4 categories (Low; Medium; High and Extreme).

They were a grand total of 129 risks identified for which 14 were ranked at a high level; 41 were ranked at a Medium level and 74 were Ranked at a Low level. Table 22-1 to Table 22-6 presents the summary of the number of risks and ranking and per project areas.

Table 22-1 - Technical Risks – Number of risk items and ranking proportions

Technical Risks	**Extreme Rated Items**		**High Rated Items**		**Medium Rated Items**		**Low Rated Items**	
Number of Risk Items	Number	%	Number	%	Number	%	Number	%
89	0	0	2	2	34	38	53	60

Table 22-2 - Project Risks – Number of risk items and ranking proportions

Project Risks	**Extreme Rated Items**		**High Rated Items**		**Medium Rated Items**		**Low Rated Items**	
Number of Risk Items	Number	%	Number	%	Number	%	Number	%
14	0	0	0	0	4	29	10	71

Table 22-3 - Operation Risks – Number of risk items and ranking proportions

OPERATION RISKS	**EXTREME RATED ITEMS**		**HIGH RATED ITEMS**		**MEDIUM RATED ITEMS**		**LOW RATED ITEMS**	
Number of Risk Items	Number	%	Number	%	Number	%	Number	%
3	0	0	2	67	1	33	0	0

Table 22-4 - Geology Risks – Number of risk items and ranking proportions

Geology Risks	**Extreme Rated Items**		**High Rated Items**		**Medium Rated Items**		**Low Rated Items**	
Number of Risk Items	Number	%	Number	%	Number	%	Number	%
5	0	0	1	20	1	20	3	60

Table 22-5 - Geology Risks – Number of risk items and ranking proportions

Mining Risks	**Extreme Rated Items**		**High Rated Items**		**Medium Rated Items**		**Low Rated Items**	
Number of Risk Items	Number	%	Number	%	Number	%	Number	%
8	0	0	2	25	0	0	6	75

Table 22-6 - Environmental Risks – Number of risk items and ranking proportions

Environmental Risks	**Extreme Rated Items**		**High Rated Items**		**Medium Rated Items**		**Low Rated Items**	
Number of Risk Items	Number	%	Number	%	Number	%	Number	%
10	0	0	7	70	1	10	2	20

All project element having a ranked Higher risk have been reviewed with more attention. They were all addressed with specific safeguards and recommendations that are highlighted in Table 22-7. PLL is integrating into action plans and project.

Table 22-7 – Summary of safeguards and recommendations for the risk elements ranked High

Area	**Category**	**Risk & Opportunity Event**
2400 / LiOH Plant	Engineering	Uncommercialized technology
2400 / LiOH Plant	Financial	LiOH lower than expected sales price
GEN / Project	Health, Safety & Community	Non-compliance with actual dust model - Gaston County approved level - construction
GEN / Operations	Health, Safety & Community	Non-complience with the actual noise plan approved by Gaston County
GEN / Operations	Plant Operations	Quantiy and quality of labour, employees, availability for the operations.
GEN / Geology	Engineering	Mining is complicated by resource dikes that are thinner, less continuous, or more complicated than modelled.
GEN / Environment	Permitting and environmental	Permit not delivered: Mining Permit / North Carolina Mining Act of 1971
GEN / Environment	Permitting and environmental	Delayed permit delivery: I3 Rezoning
GEN / Environment	Permitting and environmental	Permit not delivered: I3 Rezoning
GEN / Environment	Permitting and environmental	Delayed permit delivery: Gaston County Special Use Permit Permit
GEN / Environment	Permitting and environmental	Permit not delivered: Gaston County Special Use Permit Permit

GEN / Environment	Permitting and environmental	Delayed permit delivery: Road Abandonment
GEN / Environment	Permitting and environmental	Permit not delivered: Road Abandonment

23 RECOMMENDATIONS

Specific recommendations for the Carolina Lithium project are summarized below for the project areas.

23.1 MINERAL RESOURCE

PLL is continuing to work both internally and with outside assistance to continue to further define their Resource Base and to Optimize the proposed LOM Plan.

MGG recommends the following actions are completed to support the ongoing Mineral Resource development effort at the Carolina Lithium Project:

- Investigate shallow portions of Core Property deposits deemed amenable to early-stage mining through infill drilling and appropriate surface methods, at 20 m to 40m spacings. An understanding of the short-range variability of mineralization, pegmatite dike orientations, and weathering should be developed, and Measured resource classification criteria established.

- Model the extent of major metavolcanic and metasedimentary host rock units to support mine planning at the Core property. Models will improve bulk density estimation and support environmental and geotechnical characterization of waste rock.

- Conduct infill drilling to increase data density and support the upgrading of Mineral Resources from Inferred to Indicated throughout the Project.

- Undertake a targeting study to identify new exploration targets and prioritize step-out drill targets that expand defined resource pegmatites.

- To support exploration targeting across its properties, and to direct future property acquisitions, Piedmont should continue to synthesize a mineral system model for spodumene bearing pegmatites along the TSB.

23.2 MINING

- Additional property for waste storage should be considered with the capacity to hold approximately 79 million tonnes.

- Some adjoining properties will need to be purchased to remove regulated offsets to obtain the tonnages shown in this feasibility study. It is believed that this is achievable before operations starts and costs have been included in the Mining Cost Model of this study.

- Continue to develop markets and cost analyses for ballast production from waste material.

- Further examine the long-range possibilities of using waste material for off-site projects.

- Evaluate permitting requirements and costs associated with mining through the northwest stream to combine Central Pit and North Pit.

- Research acquisition possibilities along the northeast, east, and southwest project boundaries for additional resource development, as well as added waste disposal areas.

- Complete a drilling program to convert inferred and indicated classification of the current resource to measured, especially in shallower areas of the deposit. This additional exploration will help add measured and indicated resource in the early years of mine production.

- Develop Central and Huffstetler Properties to an expanded level project site. Initial indications are that the Central Property may contain higher grade Li_2O possibilities, as compared to Core Property.

- Finalize the mine permit and the rezoning permit for Core Property site.

- Refine cost estimates of contract mining services.

- Update project estimates and costs as drilling progresses and property acquisitions develop.

23.3 METALLURGY TESTING / RECOVERY METHODS

It is recommended to complete on-going testwork programs which will be completed during 2022:

- By-products filtration testing.
- Flotation process water treatment testing.
- Ore sorting testwork.

It is also recommended to further explore:

- Alternate mica, spodumene, and feldspar flotation reagents (chemistries and suppliers).
- Potential for by-products production from DMS tailings.
- Optical measurements on mica concentrates.
- Calcination and leaching testwork on variability program concentrate samples.

PLL is continuing to work both internally and externally to continue to further define their selected process technologies.

- Flotation testwork to eliminate kerosene, hydrofluoric acid.
- Further evaluate the concentrate quality (ie contained hematite) on conversion plant recoveries.

23.4 PROJECT INFRASTRUCTURE / LAYOUT

During the DFS reporting it was identified that improvements to the layout of the project site could improve operational challenges, economics and minimize social impacts. The recommendations are:

- Evaluate the relocation of the concentrator closer to the conversion facility.

- Given the concentrate and analcime are being conveyed via overland conveyor to minimize truck movement, then changes to the layout are considered necessary, predominantly at the concentrator.

- Further evaluation of overland technologies and transfer methods should be undertaken.
- Implementing an ore sorting circuit to reduce production quality risks, is recommended and would also lead to a layout re-evaluation.

24 REFERENCES

24.1 GEOLOGY

Arne, D., 2016, Review of Historical QAQC Data for the Beaverdam Li Pegmatite Project, North Carolina. CSA Global Report R376.2016_PDLGCD01_QAQCreview_V1.2, 7 p.

Arne, D., 2017, Review of 2017 QAQC data for the Beaverdam Li pegmatite project Phase 1 drilling program, North Carolina. CSA Global Report R197.2017_PDLGCD01_2017_QAQCreview_V1, 7 p.

Arne, D., 2017a, Review of 2017 QAQC data for the Beaverdam Li pegmatite project Phase 2 drilling program, North Carolina. CSA Global Report R457.2017_PDLGCD01V2_2017_QAQCreview_V1, 9 p.

Arne, D., 2018, Review of 2018 QAQC data for the Beaverdam Li pegmatite project Phase 3 drilling program, North Carolina. CSA Global Report R359.2018_PDLGCD01V3_2018_QAQCreview_V1, 9 p.

Arne, D., 2018b, Review of QAQC data for XRF and normative mineral calculations for the Beaverdam Li Pegmatite Project, North Carolina. CSA Global Report R407.2018_ DLGCD01V3_2018_QAQCreview_V1.2, 10 p.

Arne, D., 2018, Review of 2018 QAQC data for the Beaverdam Li pegmatite project Phase 3 drilling program, North Carolina. CSA Global Report R359.2018_PDLGCD01V3_2018_QAQCreview_V1, 9 p.

Arne, D., 2019, Review of 2018 and 2019 QAQC Data for the Beaverdam Li Pegmatite Project Phase 4 Drilling Program, North Carolina. CSA Global Report R220.2019 (revised), 9 p.

Arne, D., 2019b, Review of XRF QAQC data from the Beaverdam Li Pegmatite Project, North Carolina Phase 4 drill program. CSA Global Report R335.2019, 2 p.

Cooley, M., 2010, “Technical Report on The Beaverdam Project, North Carolina, USA” Prepared for North Arrow Minerals Inc. by Cooley Consulting Ltd.

Cooley, M., 2019, “Notes on the 3D structures of the spodumene pegmatites of the Piedmont Lithium project.” Prepared for Piedmont Lithium Inc. by Cooley Consulting Ltd.

Gair, J.E., 1989. “Mineral resources of the Charlotte 1ºx2º quadrangle, North Carolina and South Carolina. U.S. Geological Survey professional paper 1462, 171pp.

Joint Ore Reserves Committee (2012). “Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. The JORC Code, 2012 Edition”. Prepared by: The Joint Ore Reserves Committee of The Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia (JORC).

Piedmont Lithium, 2017, “Core Logging Procedures for Piedmont Lithium Beaverdam Project”, December 02, 2017, Core Logging Manual.docx, 16 p.

VALMIN Committee (2015), “Code for the Technical Assessment and Valuation of Mineral and Petroleum Assets and Securities for Independent Expert Reports”, 2015 edition.

Potter, 2007, Industrial minerals & rocks: commodities, markets, and uses, 7th ed. ISBN-13 978-0-87335-233-8.

Kestler, 1961, Exploration of the Kings Mountain pegmatites; Mining Eng., v. 13, p. 1062-1068.

Harben, P.W., 2002. “The industrial minerals handybook: a guide to markets, specifications, & prices.” Metal Bulletin. ISBN 1 904333 044

Herrmann, W., and Berry, R.F., 2002, MINSQ – a least squares spreadsheet method for calculating mineral proportions from whole rock major element analyses. Geochemistry: Exploration, Environment, Analysis, volume 2, pp. 361-368

Scogings, A., 2014. “Public reporting of industrial minerals resources according to JORC 2012.” AusIMM Bulletin, (3), p.34.

Scogings, A., Porter, R., and Jeffress, G., 2016. “Reporting exploration results and Mineral Resources for lithium mineralized pegmatites.” AIG News Issue, 125, pp.32-36.

Swanson, S.E., 2012. “Mineralogy of spodumene pegmatites and related rocks in the tin–spodumene belt of North Carolina and South Carolina, USA.”, The Canadian Mineralogist, 50(6), pp.1589-1608.

Company Reports

Piedmont Lithium, 2018, “Piedmont Announces Positive Initial Metallurgical Results and Sets Development Timeline”, April 9, 2018, available: **HTTPS://IR.PIEDMONTLITHIUM.COM/ASX-ANNOUNCEMENTS**.

Piedmont Lithium, 2018a, “Piedmont Lithium Announces Maiden Mineral Resource”, June 14, 2018, available: **HTTPS://IR.PIEDMONTLITHIUM.COM/ASX-ANNOUNCEMENTS**.

Piedmont Lithium, 2018b, “Piedmont Completes Bench-Scale Testwork Program to Produce Spodumene Concentrate”, July 17, 2018, available: **HTTPS://IR.PIEDMONTLITHIUM.COM/ASX-ANNOUNCEMENTS.**

Piedmont Lithium, 2018c, “Scoping Study Delivers Outstanding Results”, July 19, 2018, available: **HTTPS://IR.PIEDMONTLITHIUM.COM/ASX-ANNOUNCEMENTS**.

Piedmont Lithium, 2018d, “Piedmont Produces Quartz, Feldspar and Mica in Benchscale as By-Products of Spodumene Concentrate”, September 4, 2018, available: **HTTPS://IR.PIEDMONTLITHIUM.COM/ASX-ANNOUNCEMENTS**.

Piedmont Lithium, 2019, “Initial Central Mineral Resource Estimate Boosts Total Project Resources”, April 24, 2019, available: **HTTPS://IR.PIEDMONTLITHIUM.COM/ASX-ANNOUNCEMENTS**.

Piedmont Lithium, 2019a, “Piedmont Increases Lithium Resource by 47% to 27.9 Million Tonnes”, June 25, 2019, available: **HTTPS://IR.PIEDMONTLITHIUM.COM/ASX-ANNOUNCEMENTS**.

Piedmont Lithium, 2019b, “Outstanding PFS-Level Metallurgical Results”, July 17, 2019, available: **HTTPS://IR.PIEDMONTLITHIUM.COM/ASX-ANNOUNCEMENTS**.

Piedmont Lithium, 2019c, “Significant Increase in By-Product Mineral Resources”, August 1, 2019, available: **HTTPS://IR.PIEDMONTLITHIUM.COM/ASX-ANNOUNCEMENTS**.

Piedmont Lithium, 2019d, “Updated Scoping Study Extends Project Life and Enhances Exceptional Economics”, August 7, 2019, available: **HTTPS://IR.PIEDMONTLITHIUM.COM/ASX-ANNOUNCEMENTS**.

24.2 MINING AND GEOTECHNICAL

MM&A Technical Report. Summary of Waste Rock and Process Tailings Geochemical Assessment, Piedmont Lithium Project – August 2019.

MM&A Addendum Technical Report: Results of Humidity Cell Leaching Tests, Piedmont Lithium Project – December 2019.

MM&A Memorandum, Acid Base Account (ABA) and Toxicity Characteristic Leaching Procedure (TCLP) Test Results Summary and Proposed Mitigation Plan Associated with Potentially Acid Producing Waste Rock in the Southern Portion of East Pit – August 27, 2021.

24.3 METALLURGICAL TESTWORK

Primero. Scoping Study Update Report – Ref 18605-REP-GE-001– Carolina Lithium Project– September 10, 2021.

25 RELIANCE ON INFORMATION PROVIDED BY THE REGISTRANT

Primero has relied upon the information supplied by PLL management for the description of the transaction related to the Carolina Lithium Project as well as for guidance on the royalties, other agreements or encumbrances related to the project.

A draft copy of this Definitive Feasibility Study was reviewed by PLL. Any changes made as a result of these reviews did not involve any alteration to the conclusions made. Hence, the statement and opinions expressed in this document are given in good faith and in the belief that such statements and opinions are neither false nor misleading at the date of this Definitive Feasibility Study.

The information provided by PLL that was used to describe the different transactions involving the Carolina Lithium property under the following sections of the report.

- Section 5.0 – History. Property history;
- Section 8.0 – Historical Drilling & Assays;
- Section 9.0 – Data Verification. Historical data;
- Section 16.0 - Market Studies. This was performed by Roskill;
- Section 18.0 – Capital and Operating Costs. The Owners costs that form part of the project Capex estimation calculations.