RESOURCE AND RESERVE REPORT

Pre-Feasibility Study

Salar del Hombre Muerto

February 21, 2023

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

Allkem	Allkem Limited
amsl	above mean sea level
bgs	below ground surface
CAGR	compound annual growth rate
CFR	Code of Federal Regulations
CIM	Canadian Institute of Mining, Metallurgy and Petroleum
Contract of 1991	Exploration, Development and Operation Contract executed in 1991
CSR	Corporate Social Responsibility
CRIRSCO	Committee for Reserves and International Reporting Standards
DCF	discounted cash flow
DGFM	Dirección General de Fabricaciones Militares
DIPGAM	Direccion Provincial de Gestion Ambiental Minera
EIA	environmental impact assessment
EMA	Environmental Mining Agency
EPdA	Empresa Portuaria de Antofagasta
ESIA	Environmental and Social Impact Assessment
FMC	FMC Corporation
FOB	freight on board
FSB	finished salar brine
Galan	Galan Lithium Limited
HMW	Hombre Muerto West
ICP	inductively coupled plasma
Integral	Integral Consulting Inc.
ISO	International Organization for Standardization
LCE	lithium carbonate equivalent
Livent	Livent Corporation
L/s	liter(s) per second
MdA	Minera del Altiplano, S.A.

MIL	Federal Mining Code, Mining Investments Law. No. 24,196
Mt	metric ton(s)
NDVI	Normalized Difference Vegetation Index
OD	outer diameter
OES	optical emissions spectroscopy
OSC	Ontario Securities Commission
P_e	effective porosity
POSCO	POSCO Argentina
ppm	parts per million
psi	pounds per square inch
PVC	polyvinyl chloride
PWB	primary well battery
QA/QC	quality assurance and quality control
QP	Qualified Person
SA	selective adsorption
SdHM	Salar del Hombre Muerto (also referred to as “the Salar”)
SdHM Trust	Fund denominated Salar del Hombre Muerto Trust Fund
SEC	Securities and Exchange Commission
SEGEMAR	Servicio Geológico Minero Argentino
S_r	specific retention
SWB	secondary well battery
S_y	specific yield
TDS	total dissolved solids
U.S.	United States
WMC	Water Management Consultants

1 EXECUTIVE SUMMARY

This report discloses the lithium mineral resources and reserves at Livent Corporation's (Livent's) Project Fenix, an active lithium brine mining operation that began producing lithium in 1997. Project Fenix is the first lithium brine operation in Argentina to produce lithium from brine at a commercial scale.

Project Fenix is scheduled to undergo several phased expansions designed to increase nominal lithium carbonate production capacity to 100,000 metric tons (Mt) lithium carbonate per year. The First Expansion, designed to double lithium carbonate production capacity to 40,000 Mt, is currently underway in two phases (A and B). The remaining expansions will increase production capacity in the years that follow, culminating with 100,000 Mt lithium carbonate production capacity in 2030.

Future operating conditions at Project Fenix and operating expenses are known with greater certainty than other projects without a proven track record of lithium carbonate production. This report was developed to pre-feasibility standards to support the ongoing operations, and the announced expansions currently in progress. This report establishes the resource and reserves to support the ongoing operations, and the expansions currently in progress and announced.

Certain elements of Project Fenix—including site infrastructure, mine design and planning, processing plant(s), and environmental compliance and permitting, including near-term capital and operating costs—are established with enough rigor and confidence to meet feasibility standards. This study is classified as pre-feasibility primarily to acknowledge uncertainty in long-term capital and operating costs as projected to the life-of-mine over 40 years.

Resources and reserves reported herein are based on data collected prior to operations, during operations, and through the end of 2022. Some information contained in this report is forward-looking and should be used with caution. Forward-looking statements are based on assumptions the Qualified Persons (QPs) consider reasonable at the time this report was created. Forward-looking statements do not guarantee specific or implied results, performance, or outcomes. Instead, forward-looking statements involve risks, are inherently uncertain, and cannot be relied upon to provide assurance for a particular outcome.

1.1 PROPERTY DESCRIPTION AND OWNERSHIP

Salar del Hombre Muerto (SdHM or Salar) is located in northwest Argentina, in the northeastern portion of Catamarca Province on the border with Salta Province. SdHM is a hydrologically closed (endorheic) basin characterized by a dry former lake bed that evolved into a salt pan (salar), which covers an area of nearly 600 km^2. A bedrock saddle near the center of the Salar separates the basin into the Western and Eastern Subbasins, approximately 348 km^2 and 240 km^2, respectively.

Minera del Altiplano S.A. (MdA), Livent's Argentine operating subsidiary, owns and operates lithium brine production facilities and related chemical processing plants in the Western Subbasin of SdHM. The operation, referred to as Project Fenix, broadly encompasses the areas used for lithium brine production and processing, and is located exclusively within the Western Subbasin of SdHM.

MdA holds a title to mining concession rights to extract resources from SdHM. These mineral concession rights include a total of 143 contiguous mining concessions in the Western Subbasin (referred to as the Contiguous Lease Area) and one concession in the Eastern Subbasin, which when combined cover an area of approximately 327 km^2.

1.2 GEOLOGY AND MINERALIZATION

The geology in northwest Argentina covers two geologic provinces: the Puna plateau in the west and the Eastern Cordillera to the east. The Argentinean portion of the Puna is the southern extension of the Altiplano of southernmost Bolivia, southern Peru, and northern Chile. The Puna is located east of a modern volcanic arc and above a moderately dipping segment of the eastwardly subducting Nazca plate.

The principal lithium-bearing region of South America is located within the Puna plateau. The climate of the Puna varies from semiarid to hyperarid on the eastern border, to arid along the western volcanic arc. In the southern Puna, combinations of east-trending volcanic chains and north-trending, reverse fault–bounded structural blocks comprise several endorheic basins.

A salar is the hydrologic terminus of an endorheic basin. Lithium-rich brine deposits are common beneath the salar surface, within porous evaporite and clastic sedimentary deposits, because they are located in areas with the following characteristics: arid climate; igneous and/or hydrothermal activity; tectonically driven subsidence; lithium-bearing minerals or hydrothermal waters; and time required to evapoconcentrate lithium in brine.

The salar at SdHM consists of evaporite deposits formed within an endorheic basin, bounded by pre-Paleozoic, Paleozoic, and Cenozoic–age crystalline metamorphic basement rocks. Fault-bounded bedrock hills occur within and along the margins of the Salar basin subdividing the SdHM into two separate subbasins (eastern and western), each with different evaporite sediment compositions. The Eastern Subbasin is dominated by borate evaporites and clastic sediments (such as sand, silts, and clays), whereas the Western Subbasin is relatively free of clastic sediment and is dominated by halite (sodium chloride salt) evaporite deposits.

The lateral boundary of the evaporite sedimentary deposits of the Western Subbasin of SdHM is roughly circular in shape, coinciding with the contact between sediment and surrounding bedrock. The deposit is hydraulically unbounded at the saddle where the Eastern and Western Subbasins connect, which allows brine in the Eastern Subbasin and brackish water from the Rio de los Patos to enter the Western Subbasin. The deposit is open to the south where groundwater flow from the Trapiche Aquifer enters the Salar. At both locations, water or lithium-rich brine flows into the deposits of the Western Subbasin. The vertical extent (depth) of the lithium-rich brine deposit has not been determined. Based on surface geophysical surveys and several drilling locations greater than 100 m deep, the bedrock–halite contact is likely greater than 200 m in most of the Western Subbasin and may exceed 900 m in the northwestern portion of the subbasin.

1.3 STATUS OF EXPLORATION ACTIVITIES

Livent's mineral exploration activities at SdHM are classified according to when they occurred relative to operations. Pre-development exploration began with a comprehensive site characterization program initiated in the early 1990s, which consisted of two field investigations centered on collecting hydrogeologic information in the Western Subbasin.

Shortly after pre-development site characterization work was completed in 1997, brine extraction and lithium carbonate production began. Brine quality (chemical analysis), brine elevation levels, and brine pumping data collected during operations can be considered supplemental exploration data because they provide valuable information about the brine reservoir and lithium resources/reserves on a much broader scale than is possible during a conventional pre-development exploration program.

In 2020, Livent explored the lithium brine resources of the Western Subbasin of SdHM at depths greater than the depth of its operating lithium brine production wells. This supplemental exploration program, referred to as the Deep Characterization Program, involved core drilling using an HQ-diameter diamond drill to 102 m, 220 m, and 302 m below ground surface (bgs) at three locations near existing brine pumping well batteries, as well as in the area where the Eastern and Western Subbasins connect.

Exploration activities are ongoing to the extent Livent continues to collect operational data (brine elevation, pumping rates, and brine quality). Additional exploration activities focused on core drilling and sampling at depths greater than 40 m bgs are in the planning phase. Once completed, data generated from those activities may potentially allow for upgrading lithium resource estimates.

1.4 DEVELOPMENT AND OPERATIONS

Livent's process for extracting lithium from the brine resource is to pump the lithium-bearing brine from production wells into the Selective Adsorption (SA) Plant, or optionally into pre-concentrate ponds for solar concentration prior to going to the SA Plant. The SA Plant uses treated fresh water and a proprietary adsorption process to selectively remove the lithium from the brine. The polished stream leaves the SA Plant and is further concentrated in solar evaporation ponds called finished salar brine (FSB) ponds. The residual barren brine and freshwater mixture (generally referred to as spent brine) is sent to the artificial lagoon where it evaporates or infiltrates back into the Salar. Some of the finished brine is sent to the Carbonate Plant, where it is reacted with soda ash to produce battery- or technical-grade lithium carbonate. The remaining finished brine is sent offsite to the Güemes Plant where it is used to produce high-purity lithium chloride.

Livent continues to process lithium at SdHM essentially the same way it has since operations began in 1997. The only significant changes to operations occurred in 2012 when the pre-concentrate ponds and two additional lithium brine production wells were placed in service. Livent has begun expansion plans to increase lithium carbonate production. Plans for increased lithium carbonate production involve increasing brine and water extraction and throughput capabilities at the SA Plant, and increasing lithium carbonate production capacity. Considering Livent's successful track record and historical performance, its plans for expansion are fundamentally sound and have lower risk than a similar operation at an unproven location.

1.5 MINERAL RESOURCE ESTIMATES

This report includes the first resource and reserve estimate for Project Fenix that complies with Securities and Exchange Commission regulations S-K 601(b) (96). The current resource estimate provided in this report, as of December 31, 2022, does not rely on historical (pre-production) lithium grade information. Instead, it relies on data collected from an extensive monitoring well network installed in 2017, nearly 20 years after operations began, and data from deep characterization boreholes drilled in 2020. Historical data collected prior to development and data collected from deep exploration boreholes are used to estimate static reservoir properties that are not expected to change over time. Although historical resource estimates do not conform to current standards, they are included in this report for reference and to illustrate how well various resource estimates compare over time and across different estimation methods and data sets.

Kriging, a well-established method for interpolating data between measurements, was used to estimate *in situ* lithium resources in September 2022. Using this method, measured lithium concentrations from Livent's monitoring wells, publicly available lithium concentration data from the Eastern Subbasin, and lithium concentrations measured in deep characterization boreholes were the basis for interpolation. The availability, density, and reliability of brine and hydraulic data from lithium brine production and monitoring wells allows resources from ground surface to 40 m bgs to be classified as “measured.” The interval from 40 to 100 m bgs is classified as “indicated,” and from 100 to 200 m bgs, where data are sparse, is classified as “inferred.”

The current resource estimates (as of December 31, 2022) were calculated by deducting the amount of lithium produced from September 1, 2022, through the end of 2022 from the September 2022 estimate. Current resources are presented inclusive and exclusive of mineral reserves.

Resource estimates, inclusive of reserves, are as follows: 523,000 Mt lithium (measured); 805,000 Mt lithium (indicated); 1,328,000 Mt lithium (measured and indicated); and 892,000 Mt lithium (inferred). The total measured, indicated, and inferred resource, inclusive of reserves, is 2,220,000 Mt lithium.

To calculate resources exclusive of reserves, the proven reserves were deducted from measured resources and probable reserves were deducted from indicated resources. Resource estimates, exclusive of reserves, are as follows: 370,000 Mt lithium (measured); 228,000 Mt lithium (indicated); and 597,000 Mt lithium (measured and indicated). The total measured, indicated, and inferred resource, exclusive of reserves, is 1,489,000 Mt lithium.

1.6 MINERAL RESERVE ESTIMATES

Integral Consulting Inc. estimated lithium reserves using a numerical brine reservoir model (Salar Model) to predict changes in brine occurrence and grade in response to anticipated lithium brine production schedules. Numerical modeling is the best tool for estimating lithium brine reserves. It is essentially a physically based bookkeeping method for simulating fluid flow and for tracking dissolved solids and lithium concentration and movement.

The active model area of the Salar Model is 364 km^2, which covers the entire Western Subbasin. In the vertical dimension, the model is divided into nine horizontal layers from ground surface to bedrock. Model calibration involved changing input parameters until a satisfactory match between observed and model-simulated conditions were reached. The Salar Model was calibrated to brine elevations and brine chemistry (total dissolved solids and lithium concentrations) measured at brine monitoring wells distributed across the entire Western Subbasin, from proxy locations used to represent aggregate flows from the primary well battery and secondary well battery, and monitoring wells in the Trapiche Aquifer.

Once the Salar Model was calibrated, it was used to predict changes in brine levels and brine quality for a 40-year period through 2062. It should be noted that 40 years was the chosen time frame for the numerical simulation, based on the QPs’ understanding of the resource, operational history, and anticipated lithium carbonate production schedule, which in turn is the basis for establishing the life-of-mine. In the QPs' opinion, based on available resources, current mine plans, and pricing assumptions, the life-of-mine will remain profitable and above the cut-off grade beyond 40 years.

New lithium brine production wells are required to meet future target lithium brine production rates. Lithium grades are anticipated to gradually decrease over time as the rate of lithium removal exceeds the rate of natural replenishment. As this happens, brine becomes more dilute and more pumping is required to extract the required mass of lithium.

In the predictive simulations, all new wells were designed to draw exclusively from the measured resource depth interval (0–40 m bgs) in years 0–20. In later years (21–40), brine is extracted from both the measured and indicated resource (0–100 m bgs) depth intervals. It should be noted that future lithium brine production can be achieved with various well configurations, and actual future well configurations are subject to change.

Although Project Fenix is the only commercial lithium carbonate production operation at SdHM, other companies with mining claims adjacent to Livent's, mainly in the Eastern Subbasin, are known to be in the advanced exploration stage and could begin brine extraction on a commercial scale in the next few years. To evaluate the potential impact on reserves, model inflows from the Eastern Subbasin were deactivated for a 40-year predictive simulation beginning in January 2023. Key results from this simulation were that the flux from the Eastern Subbasin, as modeled for reserve estimation, is diluting resources in the Western Subbasin. Without flow from the Eastern Subbasin, lithium grade increases over time, and brine levels decrease, relative to the reserve simulation, but not enough to materially affect reserves in either case.

For this reserve assessment, a cut-off grade of 218 mg/L was calculated using a breakeven financial analysis for a 40-year life-of-mine. The breakeven analysis included reasonably foreseeable capital and operating expenses and cost of capital at 10%, and revenue generated assuming a long-term, forward-looking lithium carbonate price of $20,000 per Mt. This approach was considered a "worst-case scenario" to establish the minimum economically viable lithium concentration for Project Fenix to be marginally profitable and is appropriate to estimate a cut-off grade concentration.

Numerical model results indicate the lithium carbonate production schedule provided by Livent is feasible, and brine grade remains well above the economically viable cut-off grade of 218 mg/L throughout the 40-year simulation period. At the end of the 40-year simulation, flow-weighted, average lithium concentration is 523 mg/L.

Future brine extraction was simulated in the Salar Model with new wells screened in the "measured" resource interval for years 0–20. In years 21–40, additional brine is produced with new wells screened in both the "measured and indicated" resource interval. Considering anticipated pumping rate increases together with model predictions and 25 years of performance monitoring data, it is reasonable to classify brine produced in the first 10 years as "proven reserves." Brine produced in years 11–40 is classified as "probable" on the basis that new wells extract brine from the measured and indicated resource in later years.

Lithium reserves extracted in years 1–10 are classified as "proven" by reducing the lithium mass extracted by 23.4% to account for process inefficiencies. Proven reserves (153,000 Mt) represent approximately 12% of the current measured and indicated resource (1,328,000 Mt lithium). Lithium resources extracted in later years (11–40), also discounted for process inefficiencies, are classified as "probable." Probable lithium reserves (578,000 Mt) produced in years 11–40 represent 43% of the total measured and indicated resource. Reserves are classified as probable because a fraction of the brine produced in years 21–40 originated in the measured and indicated resource intervals and certain modifying factors (economic, legal, governmental, environmental, and social) necessarily introduce uncertainty in future operations. The total proven and probable reserves (731,000 Mt) make up approximately one-third of the total resource.

1.7 PERMITTING REQUIREMENTS

MdA entered into an agreement with the Argentine federal government and Catamarca Province to develop SdHM in 1991. After 1993, the Argentine federal government assigned its rights and obligations to Catamarca Province, which provides Catamarca Province jurisdiction and a minority ownership stake in MdA. MdA holds water rights to the Rio Trapiche and Trapiche Aquifer to support current operations. MdA currently holds temporary rights to the Los Patos Aquifer. Permeant concessions for the Los Patos Aquifer are expected to be granted in the coming months.

Project Fenix conducts operations under a variety of environmental and operating permits. Environmental baseline investigations were conducted for Project Fenix and the Los Patos Aqueduct projects. Environmental impact assessments are updated biannually with data collected from ongoing monitoring programs. Additional permits are obtained for facilities upgrades and expansion as required by governmental agencies.

1.8 SUMMARY

This lithium resource and reserve disclosure may differ from other disclosures for projects involving lithium-bearing brine extraction because Project Fenix is a mature project and is one of only a few long-term operating projects (25 years of continuous operation) of its kind in the world. Currently, most lithium brine projects are for sites still in the exploration phase, have only a few years of experience with commercial lithium production, or are not subject to disclosure requirements. Because of the 25 years of operational history, information collected during operations support the interpretations and conclusions made herein.

Although not considered in this reserve assessment, lower cut-off grades may become economically viable with advances in process technology or with changes in mine plans (e.g., additional pre-concentrate ponds or SA columns). The economic analysis indicated positive cash flow for the life-of-mine after an initial payback period of 3.6 years based on the anticipated lithium carbonate production schedule.

1.9 RECOMMENDATIONS

Future exploration should focus on depths greater than 40 m bgs to potentially upgrade resource estimates currently considered indicated and inferred. A supplemental deep exploration program work plan is currently in development. Incorporating new data collected following a future deep exploration program may have the added benefit of increasing reserves.

Livent should evaluate the mass balance at the artificial lagoon. A mass balance evaluation is aimed at quantifying flows into and out of the artificial lagoon and its storage capacity. A better understanding of the lagoon mass balance is necessary to manage future spent brine disposition as lithium brine production increases. Additionally, the evaluation should include future spent brine return options, including an adaptive management program for surface return, mechanical evaporators, recycle technologies, injection wells, or some combination thereof.

Further numerical modeling work is recommended to support expanded lithium brine production and optimize well configurations and pumping rates. Additional modeling work should include validation and/or extending the calibration period to simulate a future brine elevation and quality monitoring data set. Future numerical modeling work should incorporate relevant information collected during the other two recommended future work programs (deep exploration or spent brine return evaluation).

2 INTRODUCTION

In 2018, the Securities and Exchange Commission (SEC) adopted amendments to modernize the property disclosure requirements for mining registrants by requiring disclosures concerning mineral resources and reserves. The amendments more closely align the SEC's disclosure requirements and policies for mining properties with current industry and global regulatory practices and standards (i.e., Committee for Reserves and International Reporting Standards [CRIRSCO]).

This report was prepared in accordance with SEC regulations S-K 601(b) (96) by Integral Consulting Inc. (Integral) on behalf of Livent Corporation (Livent; the Registrant) for its lithium brine mining operation, Project Fenix, located in the Western Subbasin of the Salar del Hombre Muerto (SdHM or Salar), Catamarca Province, Argentina. This report was developed to meet or exceed pre-feasibility standards in support of ongoing operations and the announced expansions currently in progress. Of the relevant factors evaluated herein, site infrastructure, mine design and planning, processing plant(s), and environmental compliance and permitting, including near-term capital and operating costs, are established with enough rigor and confidence to meet feasibility standards. This study is classified as pre-feasibility primarily to acknowledge uncertainty in long-term capital and operating costs as projected to the life-of-mine over 40 years.

2.1 TERMS OF REFERENCE AND PURPOSE

Integral was retained by Livent to develop this report to comply with the mineral disclosure requirements set forth by the SEC. The mineral disclosures are specific to Livent's Project Fenix, an active lithium brine mining operation that began producing lithium in 1997. This report establishes the resource and reserves to support the ongoing operations, and the expansions currently in progress and announced.

Mineral resource and reserve estimates, reported herein, were developed in accordance with the following guidance:

- Australasian Code for Reporting Exploration Results, Mineral Resources and Ore Reserves (JORC 2012).
- Mineral resource and reserve definitions provided by the Canadian Institute of Mining, Metallurgy and Petroleum (CIM 2014).
- Ontario Securities Commission (OSC) staff notice 43-704 for guidance on the application of National Instrument 43-101 for mineral brine projects such as lithium (OSC 2011).

Although these guidance documents do not provide prescriptive mineral classification breakpoints, we adhere to their principles, which center on transparency, materiality, and competence, in developing the resource and reserve estimate for Project Fenix.

Some information contained in this report is forward-looking and should be used with caution. Forward-looking statements are based on assumptions the Qualified Persons (QPs) consider reasonable at the time this report was created. Forward-looking statements do not guarantee specific or implied results, performance, or outcomes. Instead, forward-looking statements involve risk, are inherently uncertain, and cannot be relied upon to provide assurance for a particular outcome.

Lithium brine production rates at the Selective Adsorption (SA) Plant have been remarkably consistent in recent years (2015 to 2022), averaging approximately 25,300 metric tons (Mt) lithium carbonate equivalent (LCE) per annum.

In 2022, Project Fenix produced 26,100 Mt LCE of concentrated lithium brine from the SA Plant, which feeds both the Lithium Carbonate Plant at Project Fenix and the Lithium Chloride Plant located in Güemes, Argentina (the Güemes Plant).

Project Fenix is scheduled to undergo several phased expansions designed to increase nominal lithium carbonate production capacity to 100,000 Mt lithium carbonate per year. The First Expansion, designed to double lithium carbonate production capacity to 40,000 Mt, is currently underway in two phases (A and B). The remaining expansions will increase lithium carbonate production capacity in the years that follow, culminating with 100,000 Mt lithium carbonate production capacity in 2030.

In this report, lithium mass is usually the preferred unit for expressing resources; however, a conversion factor of 5.323 is used when converting lithium mass to LCE. Metric units are used throughout this report, unless otherwise noted. Costs are expressed in United States (U.S.) dollars ($).

2.2 SOURCES OF INFORMATION

This report is based in part on site characterization data collected before mining operations began (pre-development); operational data in the period thereafter, including deep exploration data collected by Livent in 2020; information provided by Livent; government reports and publications; and reports, letters, information from reports and memoranda prepared by other third parties as cited in the report and listed in Section 24 (References).

2.3 DETAILS OF INSPECTION

Personal inspections of the SdHM and Livent operating facilities, as well as meetings in Argentina with local authorities have been conducted by QPs from Integral as outlined below:

- Sean Kosinski and William Cutler visited the Salar and Livent's Project Fenix facilities in April 2015. The site visit included inspection of geological and hydrological setting, review of brine and freshwater extractions systems, and review of manufacturing processes.
- Sean Kosinski and William Cutler met with local mining and water authorities in Catamarca in August 2015. They presented a freshwater management strategy for the Trapiche Aquifer during that visit.
- Sean Kosinski and William Cutler met with the federal Mining Ministry and technical leaders from the Argentine government in Buenos Aires in December 2016. They presented plans for the SdHM brine monitoring well network and provided an overview of numerical modeling work in support of Livent's management of the Salar.
- Sean Kosinski visited the SdHM in March 2017 to provide technical oversight, including drilling methods and inspecting core and drill cuttings during installation of brine monitoring wells and across Livent's concession in the Western Subbasin of the Salar.
- Sean Kosinski and William Cutler visited the SdHM and Livent's Project Fenix facilities in March 2018. During this site visit, the QPs inspected site facilities and freshwater resources at the Los Patos and Trapiche rivers at and in the vicinity of the Salar.
- Sean Kosinski visited the SdHM and Project Fenix facilities in March 2022. During this visit, he observed operations at the Salar, including the operation of lithium brine production wells and flows to the artificial lagoon; overseeing geophysical surveys; toured portions of the Eastern Subbasin, including Laguna Catal; observed surface water flows in Trapiche area streams, and construction activities related to the Project Fenix plant expansion.

2.4 REPORT VERSION UPDATE

This report marks the first mineral resource and reserve disclosure submitted by Livent for its lithium brine mining operation at SdHM in accordance with 17 Code of Federal Regulations (CFR) § SEC 229.1300. As this report may be updated later following acquisition of new and relevant data or information, the user should confirm that this is the latest filed version of the report.

2.5 QUALIFIED PERSONS

This report was prepared by Integral, a third-party consulting firm, in accordance with 17 CFR § 229.1302. The following personnel serve as the QPs for this report as defined in 17 CFR § 229.1302 (b)(1)(i):

- **Sean Kosinski, P.Hg.,** graduated from Eastern Connecticut State University with a Bachelor's degree in Environmental Earth Science, and from the University of Nevada, Reno, with a Master's degree in Hydrogeology. He is a Professional Hydrogeologist certified by the American Institute of Hydrology (No. 14-HG-6007) and he is a member of the Nevada Mining Association and National Groundwater Association. He is a Senior Consultant with Integral with more than 20 years of experience in mining hydrology.
- **William Cutler, Ph.D., P.G.,** graduated from the University of Michigan with a Bachelor's degree in Geological Sciences; from the University of Calgary with a Master's degree in Geology and Geophysics; and from the University of Hawaii with a Doctor of Philosophy (Ph.D.) in Geology and Geophysics. He is a Professional Geologist licensed in California (No. GEO 4667), and a Principal with Integral with 40 years of experience in geology, including oil and gas exploration and development, mining, and water resources.

Livent has determined that the QPs meet the qualifications specified under the definition of qualified person in 17 CFR § 229.1300.

3 PROPERTY DESCRIPTION

The SdHM is a salt pan (salar) in northwest Argentina, in the northeastern portion of Catamarca Province on the border with Salta Province (Figure 3-1).

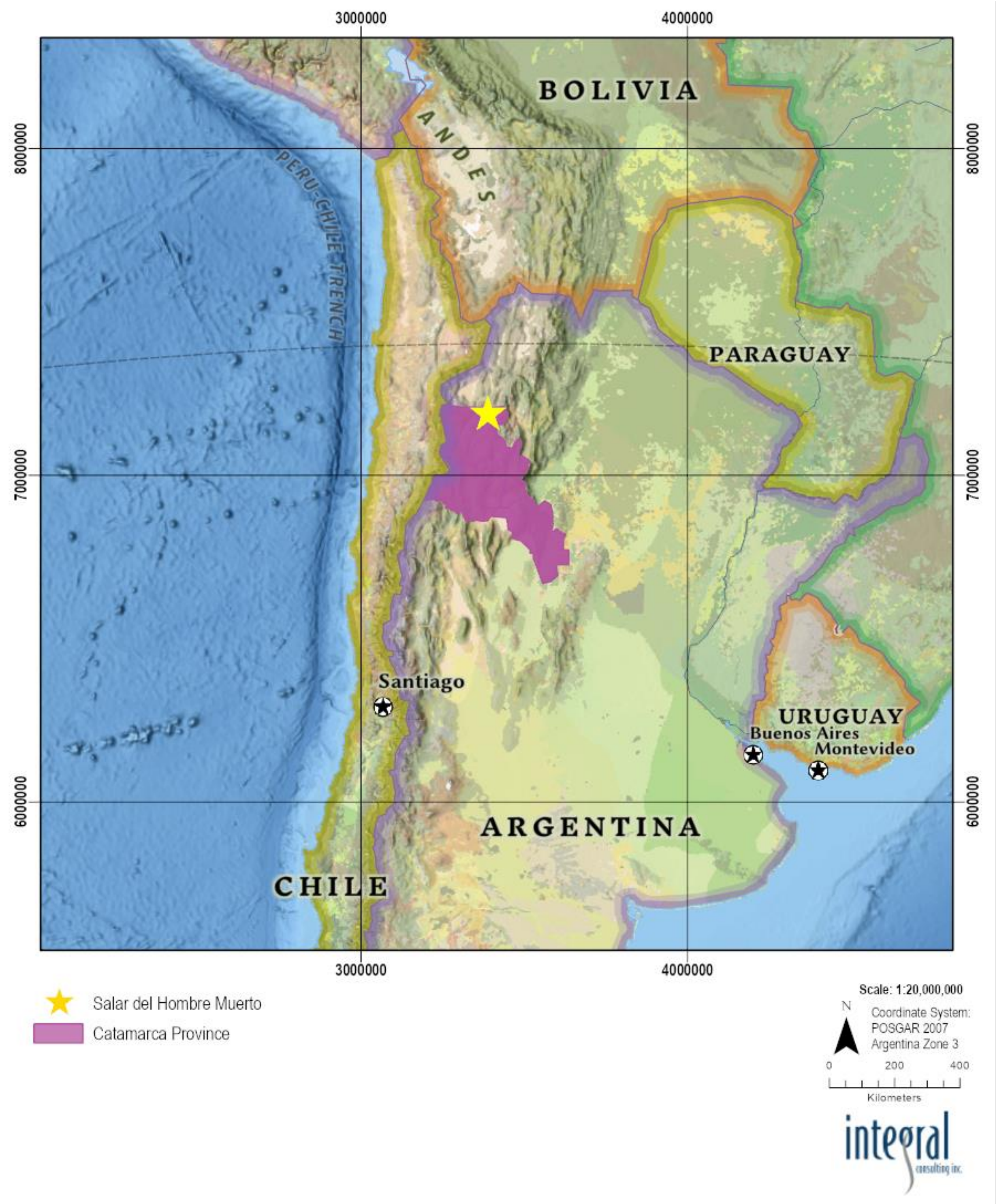


Figure 3-1. Location of Salar del Hombre Muerto

The entire SdHM covers an area of nearly 600 km². A bedrock saddle near the center of the Salar separates it into Western and Eastern Subbasins, approximately 348 km² and 240 km², respectively (Figure 3-2).

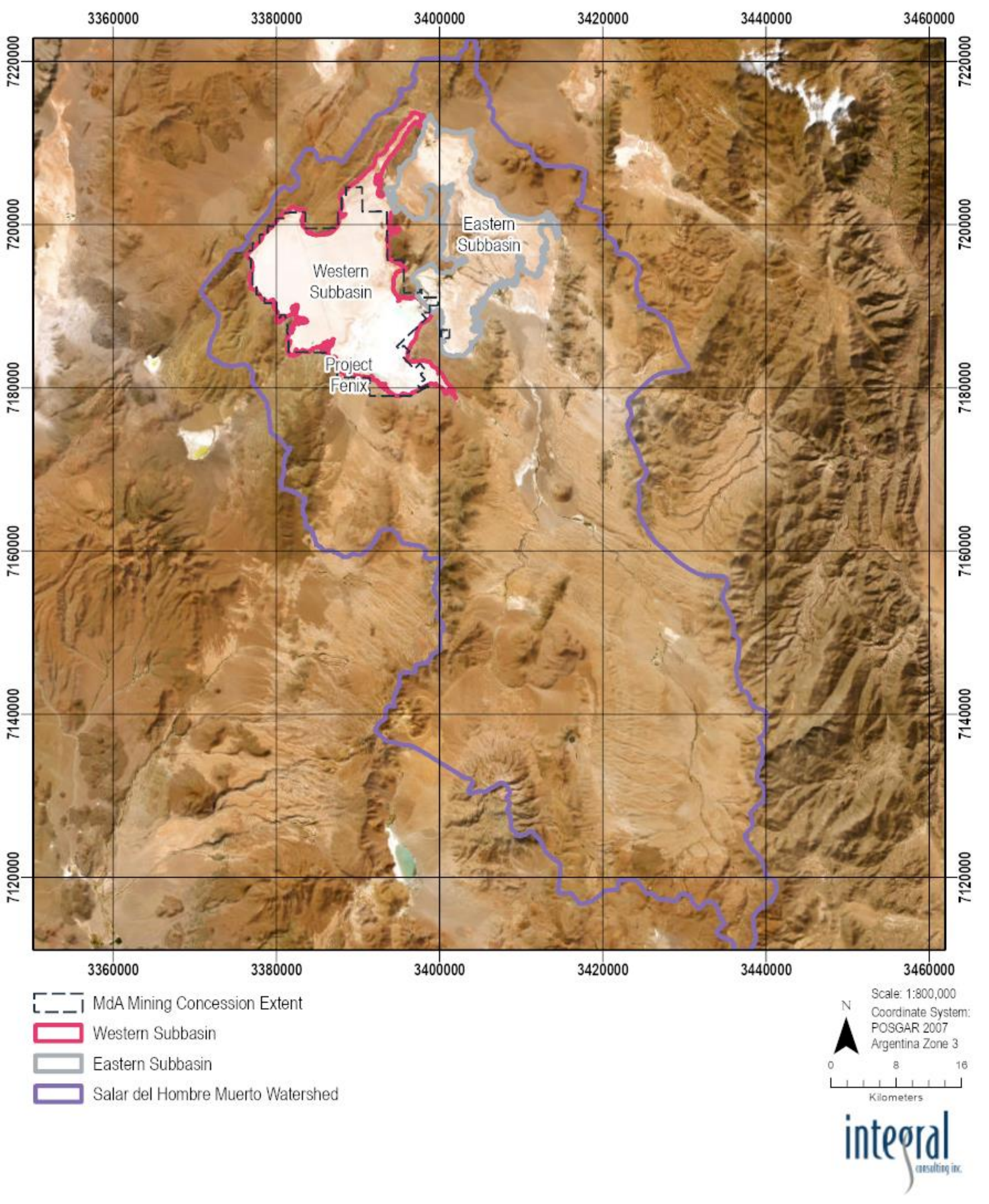


Figure 3-2. Project Fenix and Subbasins

Minera del Altiplano S.A. (MdA), Livent's Argentine operating subsidiary, owns and operates lithium brine production facilities and related chemical processing plants in the Western Subbasin of SdHM (S 25° 27', W 67 °05'), referred to hereafter as Project Fenix. Project Fenix broadly encompasses the areas used by Livent for lithium brine production and processing, and is located exclusively within the Western Subbasin of SdHM. Project Fenix is approximately 45 km from Ciénaga Redonda, 85 km from Los Nacimientos, 97 km from Antofalla, 100 km from Antofagasta de la Sierra, and 174 km from Peñon. The city of Salta has a population of approximately 700,000 and is 185 km east-northeast of Project Fenix.

3.1 PROPERTY AREA

MdA holds a title to mining concession rights to extract resources from SdHM. These mineral concession rights were granted to MdA pursuant to the Argentine Mining Code and include a total of 143 contiguous mining concessions in the Western Subbasin (referred to as the Contiguous Lease Area) and one concession in the Eastern Subbasin, which when combined, cover an area of approximately 327 km^2 (32,617 hectares). The extent of mining concession rights within the entire SdHM and party holding title to the concessions were provided to Integral by Livent on December 22, 2021, and are shown on Figure 3-3. Neighboring mining concessions are discussed in Section 20.

3.2 MINERAL CONCESSIONS TITLE AND RIGHTS

MdA owns 144 mining properties and holds concessions title and rights to mine lithium, magnesium, sodium, potassium, magnesium salts, borax, borate, and bentonite from SdHM (collectively, the Project Fenix). To date, however, MdA has only produced lithium and removes the other minerals during brine processing. MdA and Livent's predecessor, FMC Corporation (FMC), initially obtained mineral rights under the Contract of 1991 (as defined in Section 16.4.1) with Dirección General de Fabricaciones Militares (DGFM), an entity of the Ministry of Defense of the Argentine Republic and Catamarca Province. The agreement has since been amended several times, including under the Amendment of 1994 (as defined in Section 16.4.1), which, following legislative and constitutional reforms in 1993 and 1994, resulted in the Argentine federal government's transfer of eminent domain of mineral rights subject to MdA's concession to Catamarca; while the DGFM transferred title to the concessions to MdA. For additional information regarding the agreements governing MdA's concessions, see Section 16.4.1.

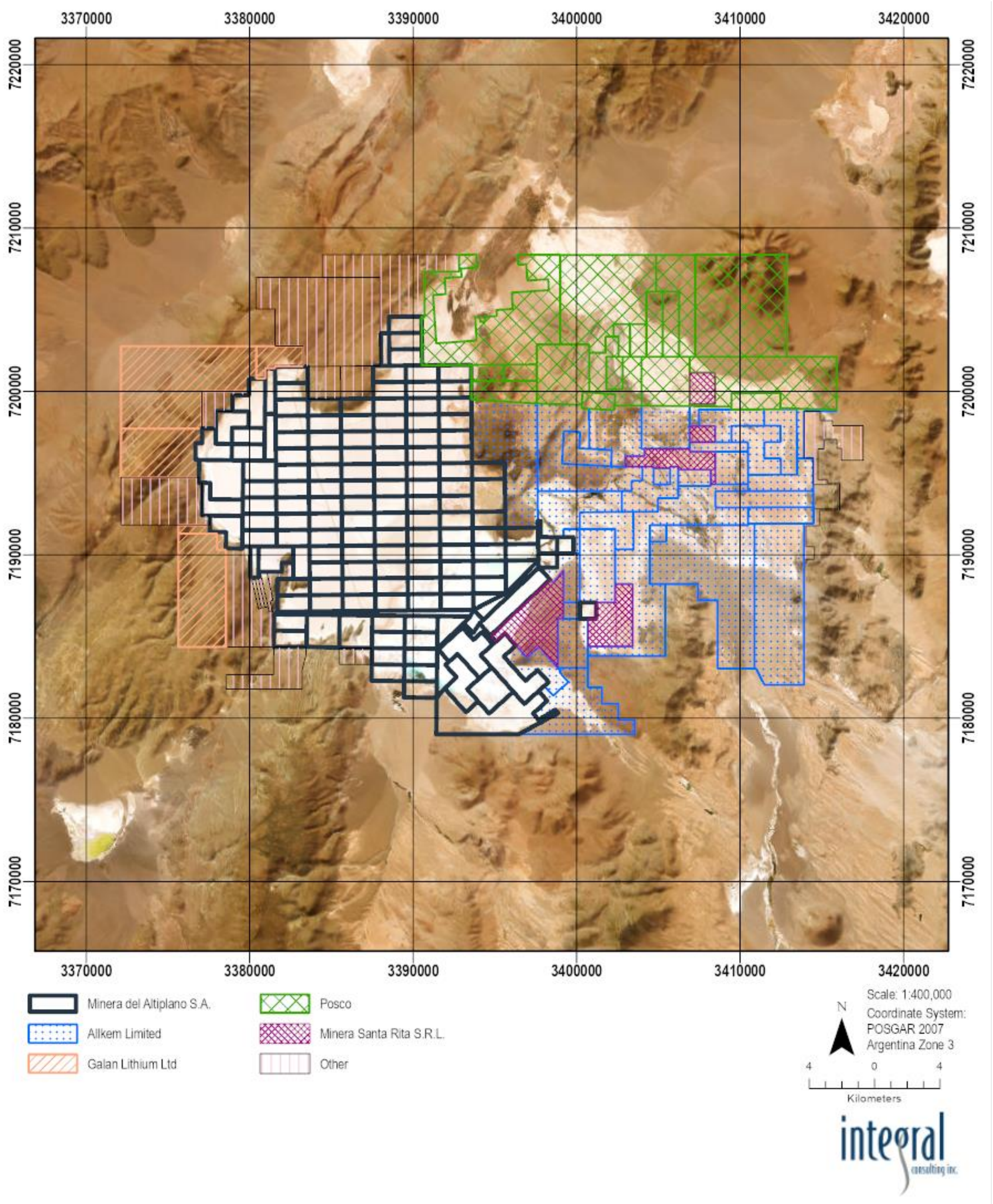


Figure 3-3. Mining Claims in the Salar del Hombre Muerto

3.2.1 Mineral Concessions Title and Mining Group

On December 29, 2021, the mining authority of Catamarca issued joint resolution No. RESFC-2021-90-E-CAT-AM, by virtue of which it approved the formation of the SdHM mining group (i.e., a new mining property constituted from multiple adjoining existing mines), including 141 mining properties in a single unified docket. Livent has access to 144 total mining properties. A list of these 144 mining concessions titles and rights is included as Table 3-1 (the three not included in the mining group are in ***Bold Italics).*** The locations of the 144 mining properties are shown on Figure 3-4.

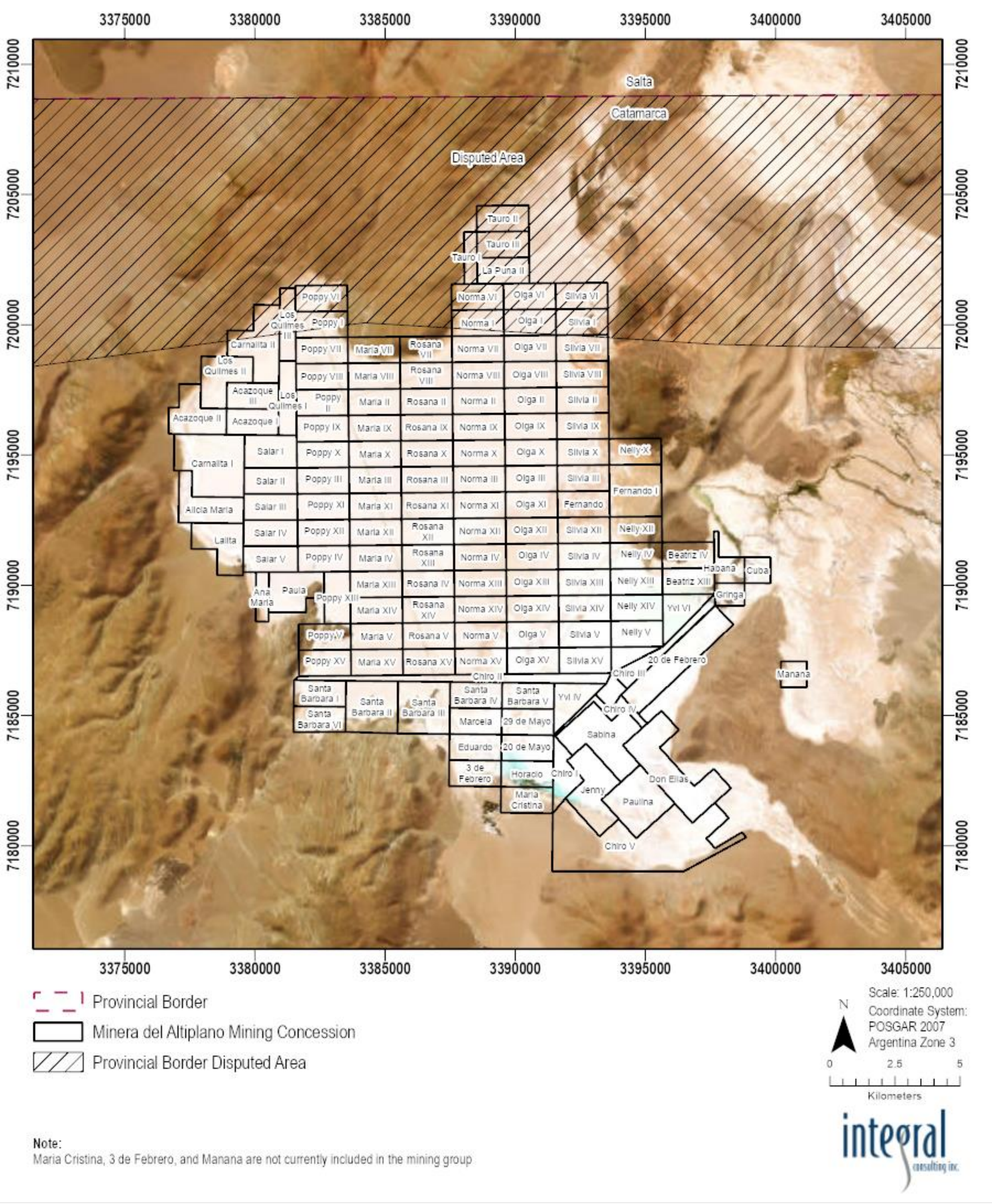
Table 3-1. MdA's Mineral Concessions Titles and Rights in the SdHM

Concession Name	Original File Number	Hectares	Unified File Number
20 de Febrero	165M1993	500	EX–2021-00466761
20 de Mayo	84M1991	200	EX–2021-00466761
29 de Mayo	86M1991	200	EX–2021-00466761
3 de Febrero	91M1991	200	
Acazoque I	92M1988	200	EX–2021-00466761
Acazoque II	93M1988	300	EX–2021-00466761
Acazoque III	94M1988	200	EX–2021-00466761
Alicia María	46M1993	300	EX–2021-00466761
Ana María	45M1993	95	EX–2021-00466761
Beatriz IV	108M1993	200	EX–2021-00466761
Beatriz XIII	51M1985	200	EX–2021-00466761
Carnalita I	142M1990	600	EX–2021-00466761
Carnalita II	143M1990	400	EX–2021-00466761
Chiro I	203M2003	178	EX–2021-00466761
Chiro II	204M2003	336	EX–2021-00466761
Chiro III	205M2003	194	EX–2021-00466761
Chiro IV	206M2003	105	EX–2021-00466761
Chiro V	565M2004	1270	EX–2021-00466761
Cuba	1953M1900	100	EX–2021-00466761
Don Elías	168M1993	600	EX–2021-00466761
Eduardo	85M1991	200	EX–2021-00466761
Fernando	70M1991	200	EX–2021-00466761
Fernando I	69M1991	399	EX–2021-00466761
Gringa	223M1995	100	EX–2021-00466761
Habana	17M1992	200	EX–2021-00466761
Horacio	222M1995	200	EX–2021-00466761
Jenny	167M1994	400	EX–2021-00466761
La Puna II	38M1991	200	EX–2021-00466761

Concession Name	Original File Number	Hectares	Unified File Number
Lalita	44M1993	300	EX–2021-00466761
Los Quilmes I	66M1991	200	EX–2021-00466761
Los Quilmes II	67M1991	300	EX–2021-00466761
Los Quilmes III	68M1991	172	EX–2021-00466761
Mañana	1951M1900	100	
Marcela	88M1991	200	EX–2021-00466761
María Cristina	92M1991	200	
María II	121M1983	200	EX–2021-00466761
María III	122M1983	200	EX–2021-00466761
María IV	123M1983	200	EX–2021-00466761
María IX	87M1985	200	EX–2021-00466761
María V	124M1983	200	EX–2021-00466761
María VII	85M1985	200	EX–2021-00466761
María VIII	86M1985	200	EX–2021-00466761
María X	88M1985	200	EX–2021-00466761
María XI	89M1985	200	EX–2021-00466761
María XII	90M1985	200	EX–2021-00466761
María XIII	91M1985	200	EX–2021-00466761
María XIV	92M1985	200	EX–2021-00466761
María XV	93M1985	200	EX–2021-00466761
Nelly IV	113M1983	200	EX–2021-00466761
Nelly V	114M1983	200	EX–2021-00466761
Nelly X	28M1985	200	EX–2021-00466761
Nelly XII	30M1985	100	EX–2021-00466761
Nelly XIII	31M1985	200	EX–2021-00466761
Nelly XIV	32M1985	200	EX–2021-00466761
Norma I	115M1983	200	EX–2021-00466761
Norma II	116M1983	200	EX–2021-00466761
Norma III	117M1983	200	EX–2021-00466761
Norma IV	118M1983	200	EX–2021-00466761
Norma IX	57M1985	200	EX–2021-00466761
Norma V	119M1983	200	EX–2021-00466761
Norma VI	54M1985	200	EX–2021-00466761
Norma VII	55M1985	200	EX–2021-00466761
Norma VIII	56M1985	200	EX–2021-00466761
Norma X	58M1985	200	EX–2021-00466761
Norma XI	59M1985	200	EX–2021-00466761
Norma XII	60M1985	200	EX–2021-00466761
Norma XIII	61M1985	200	EX–2021-00466761

Concession Name	Original File Number	Hectares	Unified File Number
Norma XIV	62M1985	200	EX–2021-00466761
Norma XV	63M1985	200	EX–2021-00466761
Olga I	100M1983	200	EX–2021-00466761
Olga II	101M1983	200	EX–2021-00466761
Olga III	102M1983	200	EX–2021-00466761
Olga IV	103M1983	200	EX–2021-00466761
Olga IX	37M1985	200	EX–2021-00466761
Olga V	104M1983	200	EX–2021-00466761
Olga VI	34M1985	200	EX–2021-00466761
Olga VII	35M1985	200	EX–2021-00466761
Olga VIII	36M1985	200	EX–2021-00466761
Olga X	38M1985	200	EX–2021-00466761
Olga XI	39M1985	200	EX–2021-00466761
Olga XII	40M1985	200	EX–2021-00466761
Olga XIII	41M1985	200	EX–2021-00466761
Olga XIV	42M1985	200	EX–2021-00466761
Olga XV	43M1985	200	EX–2021-00466761
Paula	26M1993	290	EX–2021-00466761
Paulina	169M1993	400	EX–2021-00466761
Poppy I	125M1983	200	EX–2021-00466761
Poppy II	126M1983	200	EX–2021-00466761
Poppy III	127M1983	200	EX–2021-00466761
Poppy IV	128M1983	200	EX–2021-00466761
Poppy IX	77M1985	200	EX–2021-00466761
Poppy V	129M1983	100	EX–2021-00466761
Poppy VI	74M1985	200	EX–2021-00466761
Poppy VII	75M1985	200	EX–2021-00466761
Poppy VIII	76M1985	200	EX–2021-00466761
Poppy X	78M1985	200	EX–2021-00466761
Poppy XI	79M1985	200	EX–2021-00466761
Poppy XII	80M1985	200	EX–2021-00466761
Poppy XIII	81M1985	200	EX–2021-00466761
Poppy XV	83M1985	100	EX–2021-00466761
Rosana II	131M1983	200	EX–2021-00466761
Rosana III	132M1983	200	EX–2021-00466761
Rosana IV	133M1983	200	EX–2021-00466761
Rosana IX	97M1985	200	EX–2021-00466761
Rosana V	134M1983	200	EX–2021-00466761
Rosana VII	95M1985	200	EX–2021-00466761

Concession Name	Original File Number	Hectares	Unified File Number
Rosana VIII	96M1985	200	EX–2021-00466761
Rosana X	98M1985	200	EX–2021-00466761
Rosana XI	99M1985	200	EX–2021-00466761
Rosana XII	100M1985	200	EX–2021-00466761
Rosana XIII	101M1985	200	EX–2021-00466761
Rosana XIV	102M1985	200	EX–2021-00466761
Rosana XV	103M1985	200	EX–2021-00466761
Sabina	164M1993	500	EX–2021-00466761
Salar I	18M1990	300	EX–2021-00466761
Salar II	19M1990	200	EX–2021-00466761
Salar III	17M1990	200	EX–2021-00466761
Salar IV	15M1990	208	EX–2021-00466761
Salar V	16M1990	200	EX–2021-00466761
Santa Barbara I	5M1991	200	EX–2021-00466761
Santa Barbara II	6M1991	370	EX–2021-00466761
Santa Barbara III	7M1991	400	EX–2021-00466761
Santa Barbara IV	8M1991	200	EX–2021-00466761
Santa Barbara V	9M1991	200	EX–2021-00466761
Santa Barbara VI	10M1991	200	EX–2021-00466761
Silvia I	95M1983	200	EX–2021-00466761
Silvia II	96M1983	200	EX–2021-00466761
Silvia III	97M1983	200	EX–2021-00466761
Silvia IV	98M1983	200	EX–2021-00466761
Silvia IX	67M1985	200	EX–2021-00466761
Silvia V	99M1983	200	EX–2021-00466761
Silvia VI	64M1985	200	EX–2021-00466761
Silvia VII	65M1985	200	EX–2021-00466761
Silvia VIII	66M1985	200	EX–2021-00466761
Silvia X	68M1985	200	EX–2021-00466761
Silvia XII	70M1985	200	EX–2021-00466761
Silvia XIII	71M1985	200	EX–2021-00466761
Silvia XIV	72M1985	200	EX–2021-00466761
Silvia XV	73M1985	200	EX–2021-00466761
Tauro I	33M1991	100	EX–2021-00466761
Tauro II	34M1991	200	EX–2021-00466761
Tauro III	31M1991	200	EX–2021-00466761
Yvi IV	46M1991	200	EX–2021-00466761
Yvi VI	48M1991	600	EX–2021-00466761



Note:
Maria Cristina, 3 de Febrero, and Manana are not currently included in the mining group

Figure 3-4. MdA Claims in the Salar del Hombre Muerto

3.3 ROYALTIES

Pursuant to Provincial Laws Nos. 4757, 4759, 5031, and 5128, related regulatory decrees and supplementary regulations, as well as the agreements with Catamarca (as described in more detail in Section 16.4.1), MdA is required to pay monthly royalties to Catamarca in consideration for the minerals extracted from its concessions.

MdA is required to pay the Catamarca province an immaterial semi-annual “canon” fee pursuant to the Argentine Mining Code and monthly royalties equal to 3% of the pithead value of the minerals extracted by MdA (the "Pithead Royalty") pursuant to the Argentine Mining Investment Law and Catamarca provincial law. Separately, under an amendment to its long-term agreement with Catamarca entered into on January 25, 2018, MdA agreed to pay the Catamarca province an additional monthly contribution (the "Additional Contribution") and to make Corporate Social Responsibility (CSR) expenditures. The Additional Contribution amount is equal to 2% of sales of products in a given month measured at the higher of MdA’s average invoice price or an average export price for similar products from Chile and Argentina, net of tax in either case (the "Contractual Price") less Pithead Royalty. The total amount MdA pays will not be above 2% of sales of products at the Contractual Price in a given month. The CSR amount each year is the equivalent of 0.3% of MdA's annual sales of products at the Contractual Price. Total payments including the "canon" fee, Pithead Royalty, Monthly Contribution, CSR expenditures and water trust payments equal to 1.2% of annual sales of products at the Contractual Price (as described below in the "Water" subsection to Item 1).

3.4 OTHER ENCUMBRANCES

The mining properties have been granted to MdA and comply with all legal requirements to maintain them (royalty payments, investment plan fulfilled). For further information, see Section 3.3, Royalties.

Project Fenix and its mining properties are required to maintain certain permits. An environmental impact statement is required to be updated and approved by Catamarca every 2 years. Certain water permits are also currently subject to renewal every 2 years. No additional material permits are required for MdA to freely operate these concessions.

3.5 PROVINCIAL BORDER DISPUTE

A portion of the territory governed by MdA’s concession rights is subject to a longstanding border dispute between Catamarca Province and adjacent Salta Province (Figure 3-4). The border dispute has never impacted MdA’s operations and it is not expected to impact operations going forward, because MdA’s lithium brine production well batteries and lithium carbonate production facilities are located south of the disputed areas. In disputed areas in the north of the Salar, MdA obtained mining concessions from the Salta Province (Litio I and Litio II) that overlap concessions granted by the Catamarca Province (Norma VI, Norma I, Tauro I, Tauro III, La Puna II, Olga VI, Olga I, Silvia VI, and Silvia I). The total area in dispute represents approximately 7.6% of MdA's concession (approximately 25 km^2). Further, the area in question is largely at the fringe of the mining property, where the deposits are not as thick, and the grade of lithium concentration is lower. However, due to this border dispute, the mining authority of Salta Province has granted mining concessions that overlap with mining concessions granted to MdA by the Catamarca Province mining authority.

MdA has filed an objection with the mining authority of Salta Province in two third-party applications for mining concessions (i.e., Tabahm, Eugenia I, Baltasar I and Arco Iris I mines), but the authority of Salta consistently rejects MdA's filings on the grounds that the territory under dispute belongs to Salta. So far, nine mining concessions granted by the Salta Province mining authority have been identified that would overlap (totally or partially) with MdA's mining concessions granted by the Catamarca Province mining authority.

Table 3-2 lists the mining concessions granted by Salta Province to third parties that overlap with MdA's concessions granted by Catamarca Province, and the purported ownership thereof. MdA wholly controls two concessions (La Puna II and Olga VI) within the dispute area between Salta and Catamarca.

Table 3-2. Mining Concessions Granted to Third Parties by Salta Province Overlapping with Catamarca Province

Mining Concession Granted by Salta Province to Third Parties	Title Owners of Salta Province Concessions	Mining Concessions Granted by Catamarca Province to MdA that Overlap with Salta Province's Concessions
Rodrigo II	Taballione Carlos Dante	Poppy VI; Poppy I; Los Quilmes III; Carnalita II
Baltasar Primero	Alpha Minerals S.A.	Tauro I; Tauro II; Tauro III
Arco Iris I	Alpha Minerals S.A.	Tauro I; Norma VI
Eugenia I	Surminera	Norma VI; Norma I
Tabahm	Posco Argentina	Olga I; Silvia I; Silvia VII
Norma Edith	Moreno Jorge Enrique, Salas Alba Silvia	Silvia VI; Silvia I
Virgen de Lourdes Segunda	Vacant	Silvia VI; Silvia I

4 ACCESSIBILITY, CLIMATE, AND INFRASTRUCTURE

4.1 ACCESSIBILITY

Project Fenix (the site) is located where the toe of the Trapiche alluvial fan and Salar meet in the Western Subbasin of SdHM. There are no navigable waterways or railways that connect Project Fenix to other population centers.

Vehicles and planes provide access to the site. When traveling from Salta, the site is accessed from the north by National Route 51 to Provincial Route 27, and then Provincial Route 17. The total drive distance from Salta to Project Fenix is approximately 400 km. From Catamarca, the site is accessed via National Route 40 through Belen, then Provincial Route 43 from Las Juntas through Antofagasta de la Sierra. The total drive distance from Catamarca to Project Fenix is approximately 650 km. From Project Fenix to the port city of Antofagasta, Chile, is approximately 675 km via Provincial Route 17 to Provincial Route 27, then National Route 51 to Route 23, and then Panamericana Norte Route 5 (Figure 4-1).

The Salta Airport is the nearest major commercial airport to Project Fenix.

Livent maintains a runway suitable for light-duty aircraft approximately 1 km east of Project Fenix. Departures from the runway occur several times per day, weather permitting, to regional airports in Catamarca and Salta (Figure 4-2).

4.2 PHYSIOGRAPHY

SdHM is located at high elevation (approximately 4,000 m above mean sea level [amsl]) within the Central Andean Plateau bounded on either side by the eastern and western Cordillera of the Andes Mountains. SdHM is located in the Puna region of the Altiplano—a high plateau with horst and graben topography characterized by north–south trending volcanic mountain ranges separated by sediment-filled basins. Elevations range from approximately 6,100 m amsl at Cerro Galan, a massive inactive volcanic caldera at the southern extent of SdHM, to approximately 3,970 m amsl at the surface of the Salar in the Western Subbasin. A topographic profile from Cerro Galan to the Western Subbasin of the Salar is shown in Figure 4-3.

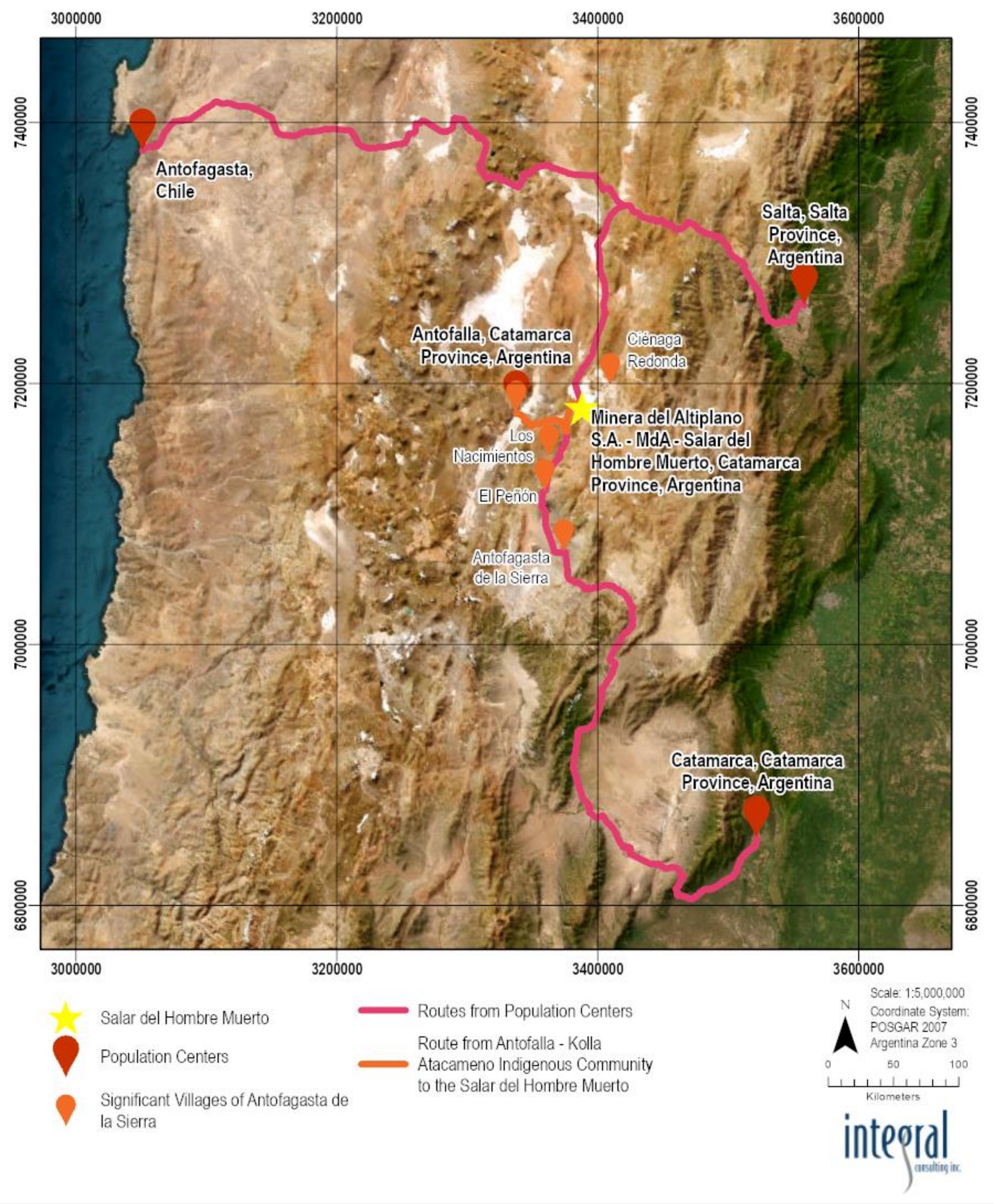


Figure 4-1. Location Map and Directions

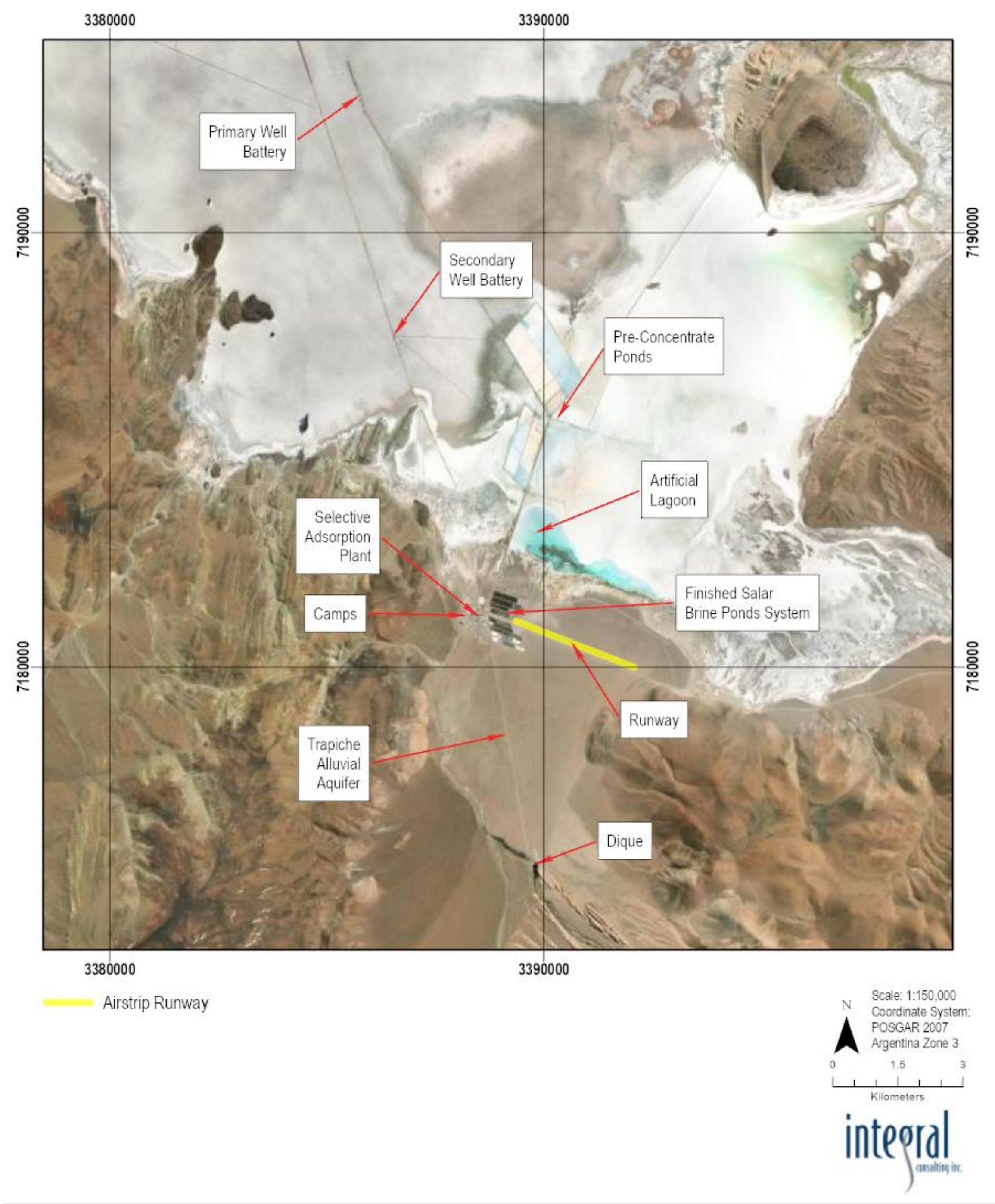


Figure 4-2. Project Fenix Process Area Layout

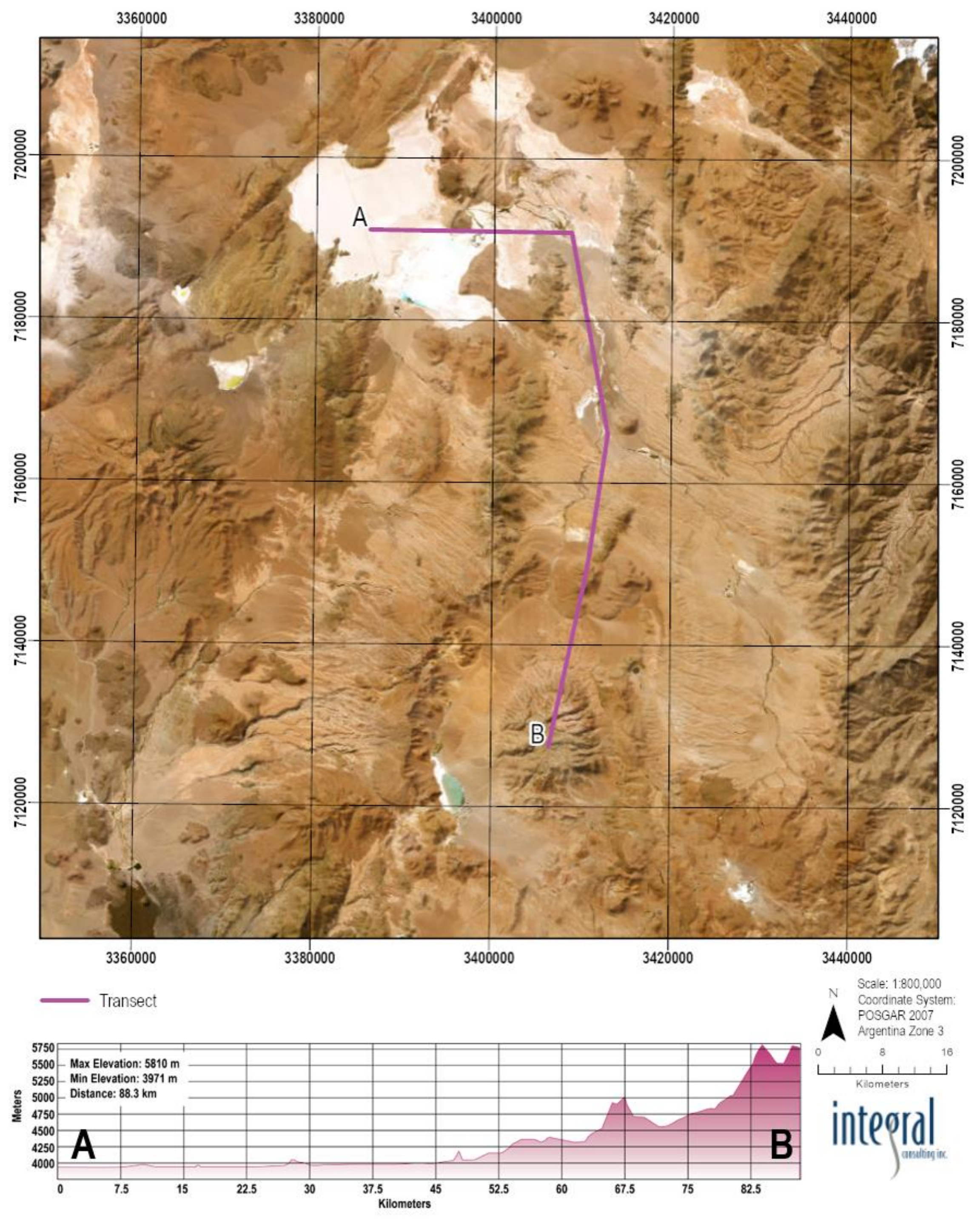


Figure 4-3. Elevation Profile

4.3 HYDROGRAPHY

The SdHM is an endorheic basin defined by the boundaries of its watershed, which is approximately 3,900 km^2 in area (Figure 4-4). The SdHM watershed consists of three subwatersheds: the Trapiche watershed, the Rio de Los Patos watershed, and the Salar watershed. The Rio Trapiche watershed (319 km^2) is characterized by the alluvial fan that gently slopes from the highlands in the south toward the Salar. Two perennial streams are located within the boundaries of Trapiche watershed: the Rio Peñas Blanca and Rio Trapiche. Infiltration from both streams into the alluvial fan provides groundwater recharge to the Trapiche Aquifer.

A dam (dique) was constructed in 1994 along the Rio Trapiche to impound surface water before it infiltrates into the Trapiche alluvial fan. Some of the impounded water is used to supply the Selective Adsorption (SA) Plant and for human consumption (Figure 4-2).

The Los Patos watershed is the largest (2,140 km^2) of the three subwatersheds and hosts the Rio de Los Patos and its tributary Rio Aguas Caliente. The headwaters of Rio de Los Patos are located at Cerro Galan. The Rio de Los Patos and Rio Aguas Caliente merge in the alluvial basin west of Cerro Amarillo, where it flows north toward the alluvial fan in the southern portion of the Eastern Subbasin. Here, the Rio de Los Patos becomes braided and spreads out across the alluvial fan and Salar. The braided segments flow north and west until they merge into a single surface water feature, the Laguna Catal, where the Eastern and Western Subbasins connect.

The Salar watershed (1,415 km^2) is characterized by the expansive Salar surface, which is the hydrologic terminus for both the Rio Trapiche and Rio de Los Patos watersheds. There are three large surface water features within the Salar watershed: Lagunas Catal and Verde, and an artificial lagoon north of Project Fenix. The Laguna Catal is the most prominent surface water body within the Salar watershed. The extent of each surface water feature varies seasonally and in response to precipitation and snowmelt events. In recent aerial photographs, Laguna Catal is approximately 9 km^2. Laguna Verde, located in the northern portion of the Eastern Subbasin, is approximately 3.7 km^2. The artificial lagoon north of Project Fenix, fed by discharge of lithium-barren (spent) brine to the Salar surface, is approximately 1.5 km^2.

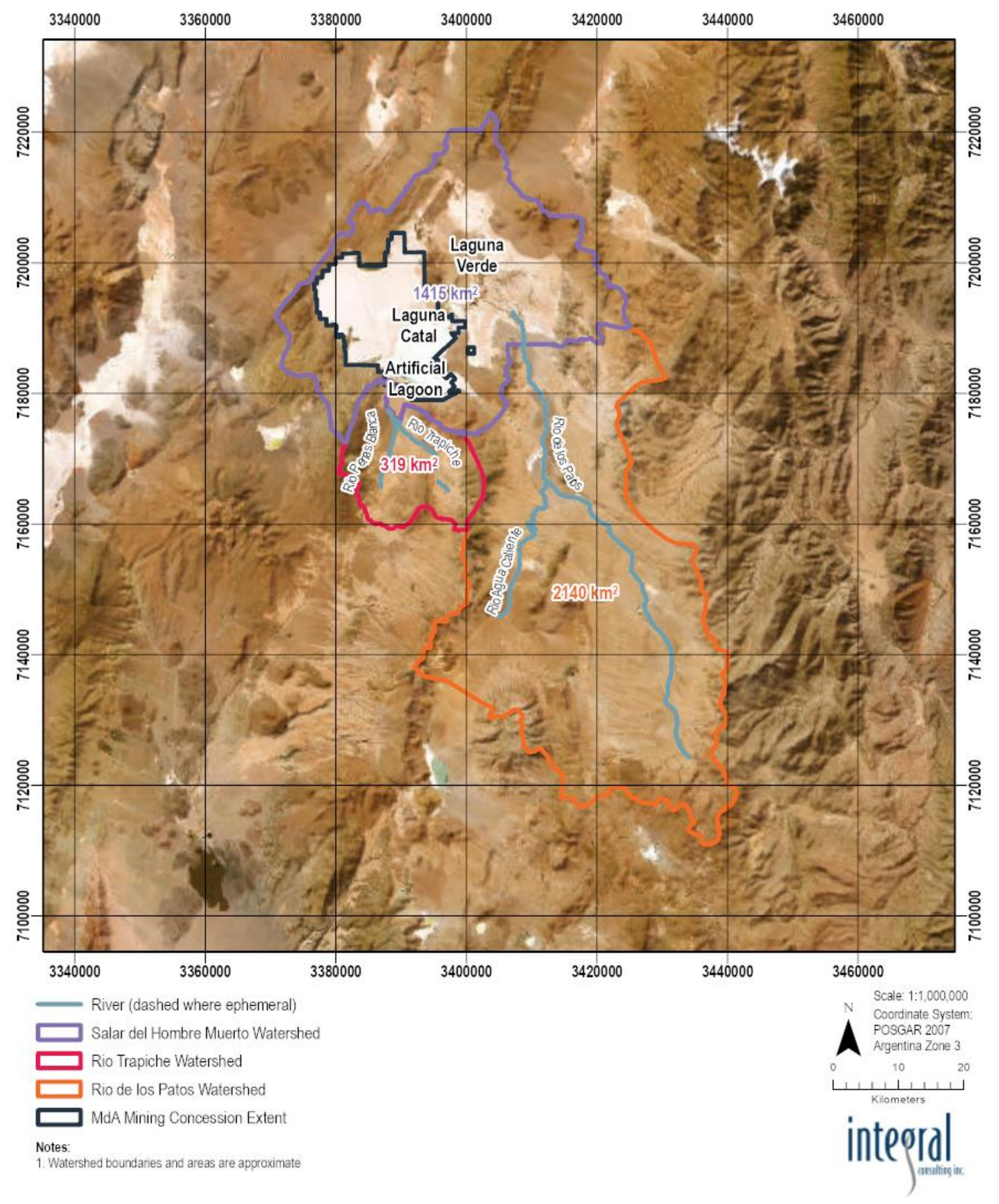


Figure 4-4. Salar del Hombre Muerto Watersheds

4.4 CLIMATE

The Puna region is an arid desert climate with temperate summers and cold winters. Summer temperatures range from freezing at night to 15–30°C during the day. Winter temperatures are cold, ranging from -30°C during the night to 15°C during the day, with strong steady winds gusting to more than 120 km/h.

Precipitation measured at Project Fenix, near the Salar surface, averages approximately 100 mm per year and falls mostly during summer thunderstorms. Precipitation rates roughly correlate with elevation. Higher elevations within the SdHM tend to receive greater amounts of precipitation than lower elevations. Light snow is common during the winter months, particularly at higher elevations.

4.5 VEGETATION

The plants at SdHM evolved in response to changes from a Neotropical origin toward the dry conditions that define the high Andean desert (EC & Asociados 2020). Vegetation is sparse in the Puna due to low precipitation rates. Vegetation tends to occur as grasses, or as phreatophytes located along narrow riparian corridors, vegas, or wetlands, supported by the presence of shallow fresh or brackish water.

4.6 INFRASTRUCTURE

The energy required for the operation of Project Fenix is generated at the Auxiliary Services Plant located onsite. This plant has eight generators: five dual-fuel generators, two generators that use natural gas, and one diesel generator used as backup through programmed or unscheduled interventions of the other generators. Current operations have a maximum generation capacity of 5.2 MW (including backup equipment), and deliver power for operating conditions with an average demand of 4.4 MW.

Natural gas is the primary power supply to the Auxiliary Services Plant. It is supplied to Project Fenix via pipeline operated by REMSA S.A., a public limited company responsible for managing the energy and mining resources of Salta Province. Diesel used to power lithium brine production wells and for backup power at the Auxiliary Services Plant is transported by vehicles with bulk tanks. A network of six underground tanks and two aboveground tanks provides 500,000 liters of standard, 777,000 maximum diesel storage capacity.

The railway network in Chile is operated by the company Ferronor; this network is made up of 2,300 km of rail with a line that runs from north to south of Chile, plus a set of branches that run east to west. The Augusta Victoria Station (Chile)–Socompa Station (Argentina), on the border with Argentina, allows cargo to be moved from the Antofagasta Port at the Pacific Ocean to the

Socompa Station, and from the Socompa Station through the Belgrano Railway to the Olacapato Station or Socompa Station–Güemes Station (611 km) in Argentina (Figure 4-5).

Figure 4-5. Railway Network

4.6.1 Other Factors Affecting Operations

MdA uses natural gas and diesel to generate electricity, which is the principal source of power at its facilities. From time to time, MdA experiences interruptions in the supply of electricity, but the interruptions have not materially impacted its operations to date.

5 HISTORY

Livent is a specialty chemical company focused on performance lithium compounds. Livent was formed and incorporated by FMC Corporation as FMC Lithium USA Holding Corp. in the state of Delaware on February 27, 2018, and was subsequently renamed Livent Corporation. Prior to this time, Livent's property was operated through various subsidiaries of FMC.

Livent conducts its operations in Argentina through MdA, its local operating subsidiary. MdA mines lithium via brine production in the Western Subbasin of the SdHM, in a region of the Andes Mountains of northwest Argentina known as the "lithium triangle." This area of the Central Andes is within an arid plateau with numerous volcanic peaks and salt flats known as "salars" and is the principal lithium-bearing region of South America.

Livent began its initial geological investigations of the SdHM in the early 1990s, prior to development (WMC 1992, 1994). An economic geologic reconnaissance report by Catalano (1964) is the only geologic investigation at SdHM known to predate Livent's. In 1991, MdA entered into an agreement with the Argentine federal government and the Catamarca Province in connection with the development of the SdHM exploration site. In 1993 and 1994, the Argentine federal government assigned all of its rights and obligations under the agreement to the Catamarca Province. Pilot lithium production began in 1997 and commercial lithium production operations began in 1998.

Even though the current lithium production process has undergone optimization and improvement since operations began, the fundamental technology remains largely unchanged. Lithium-rich brine is pumped from beneath the surface of the Salar, where it is directed to the SA Plant for processing. Surface water from the Rio Trapiche and groundwater from the Trapiche Aquifer are directed to the SA Plant for processing along with the brine. Once lithium is extracted from the brine, the mixture is directed to the artificial lagoon on the Salar surface where it infiltrates back into the Salar or evaporates. Concentrated lithium brine from the SA Plant is then further processed into lithium carbonate or lithium chloride products.

Livent is the only commercial lithium producer in SdHM. Several other companies are involved in various stages of exploration. Additional information on neighboring lithium projects is provided in Section 20.

6 GEOLOGIC SETTING AND MINERALIZATION

In order to better understand the SdHM lithium-containing brine reservoir, a comprehensive review of available geological data was conducted and is summarized herein. Understanding of Salar reservoir geology and hydrology is critical in designing and operating a brine extraction system to maximize recoverable reserves.

6.1 GEOLOGIC SETTING

This section describes the regional and local geology of the SdHM.

6.1.1 Regional Geology

The geology in northwest Argentina covers two geologic provinces: the Puna plateau in the west and the Eastern Cordillera to the east. The Argentinean portion of the Puna is the southern extension of the Altiplano of southernmost Bolivia, southern Peru, and northern Chile. The Puna is located east of a modern volcanic arc and above a moderately dipping segment of the eastwardly subducting Nazca plate. East of the modern volcanic arc, local volcanic edifices are present within the Puna, and both the volcanic arc and volcanoes within the Puna have been active from Miocene times to the present (e.g., Allmendinger et al. 1997; Kay et al. 2008; and references therein).

The principal lithium-bearing region of South America is located within the Puna plateau. The climate of the Puna varies from semiarid to hyperarid on the eastern border, to arid along the western volcanic arc. In the southern Puna, combinations of east-trending volcanic chains and north-trending, reverse fault–bounded structural blocks comprise several hydrologically closed (endorheic) basins (Alonso 1986, 1999; Vandervoort et al. 1995).

The hydrologic terminus of an endorheic basin is essentially a dry lake bed, referred to as a salar. In the Puna, where evaporation rates far exceed precipitation, salars are typically flat and expansive with little or no perennial water or vegetation. Lithium-rich brine deposits are common beneath the salar surface, within porous evaporite and clastic sedimentary deposits, because they are located in areas with the following characteristics: arid climate; igneous and/or hydrothermal activity; tectonically driven subsidence; lithium-bearing minerals or hydrothermal waters; and time required to evapoconcentrate lithium in brine (Munk et al. 2016).

SdHM is one of the most important evaporitic basins in the Argentinean Puna and encompasses nearly 600 km^2 (Figure 6-1). SdHM lies adjacent to the eastern margins of the Puna (late Tertiary, Neogene age) sedimentary units that are up to 7 km thick and largely infilled the modern depositional basins (Jordan et al. 1999; Alonso et al. 1991). Many of these basins contain thick sequences of evaporites (mainly halite, gypsum, borates, and carbonates) and alluvial clastic material (sands, silts, and clays) with minor volcanic tuff horizons (Alonso 1986). In the Puna, and especially in the central part of the Puna, Neogene strata outcrop as reverse fault–bounded “slices” along salar margins or as intrabasin uplifts within the salars (Vandervoort et al. 1995). Surface water drains into these closed basins and evaporation dominates the water balance, leaving behind brines enriched in various metals and salts, sometimes including economic levels of lithium, boron, and/or potassium.

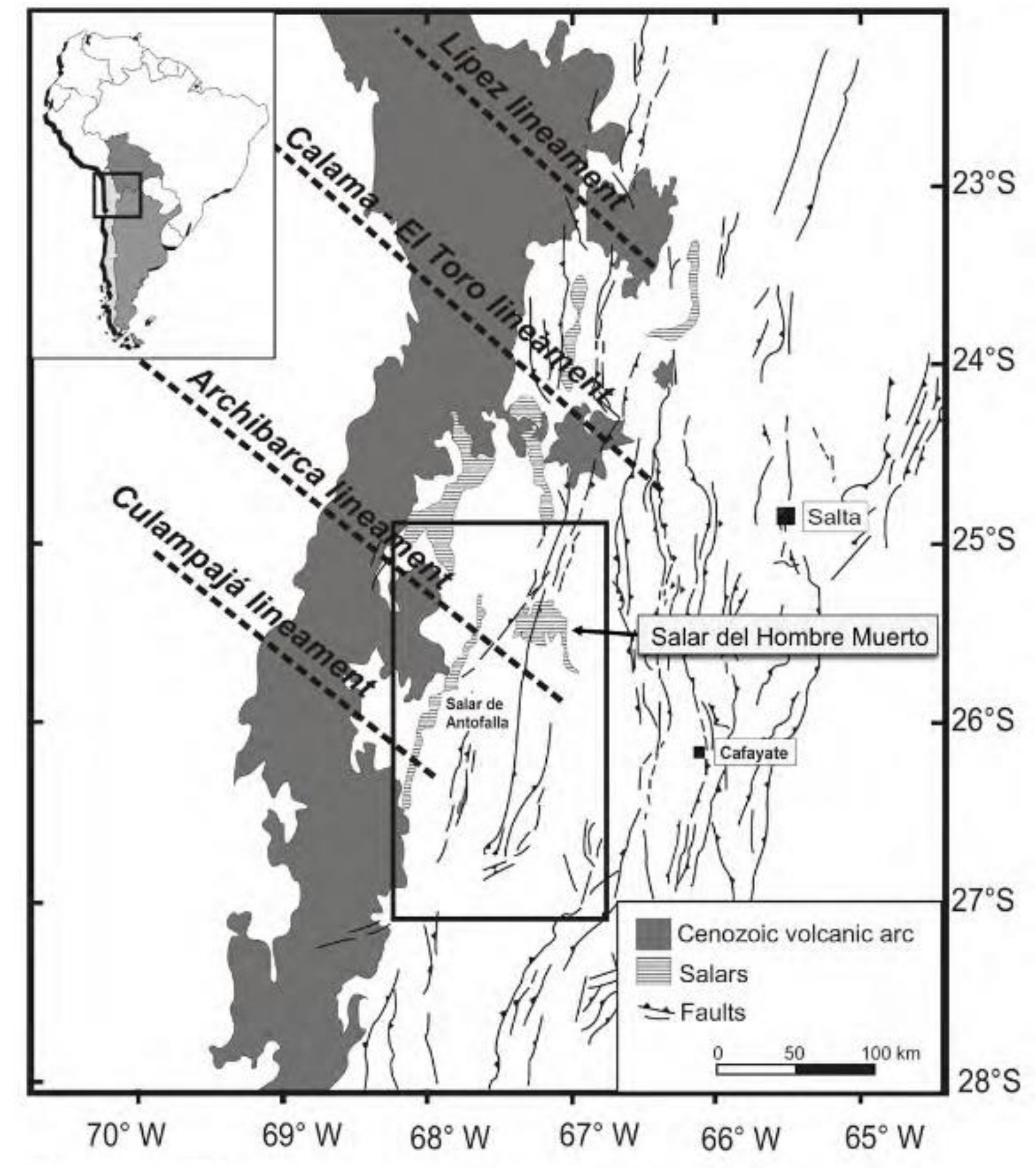
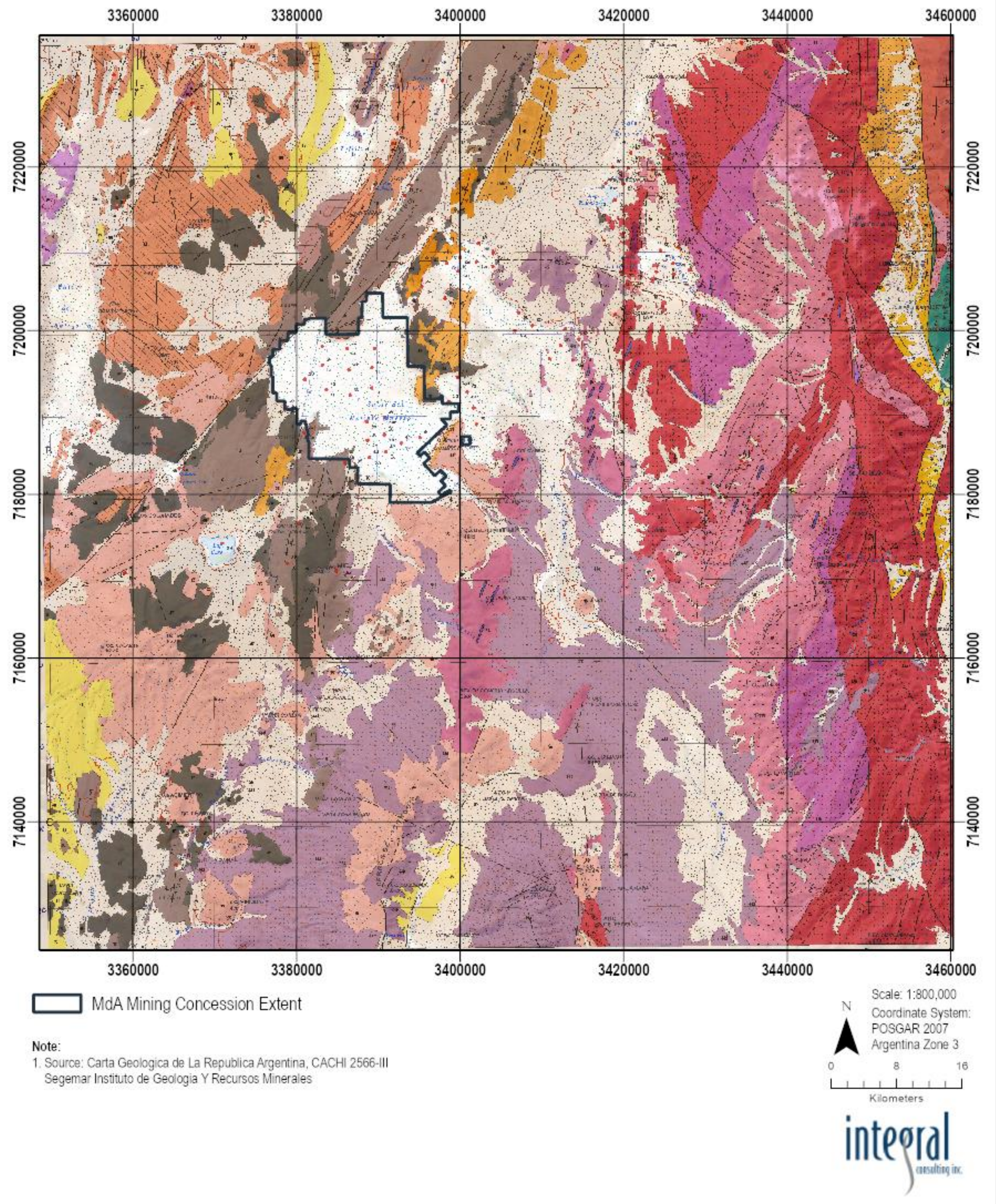


Figure 6-1. Location of Salar del Hombre Muerto, Puna Plateau

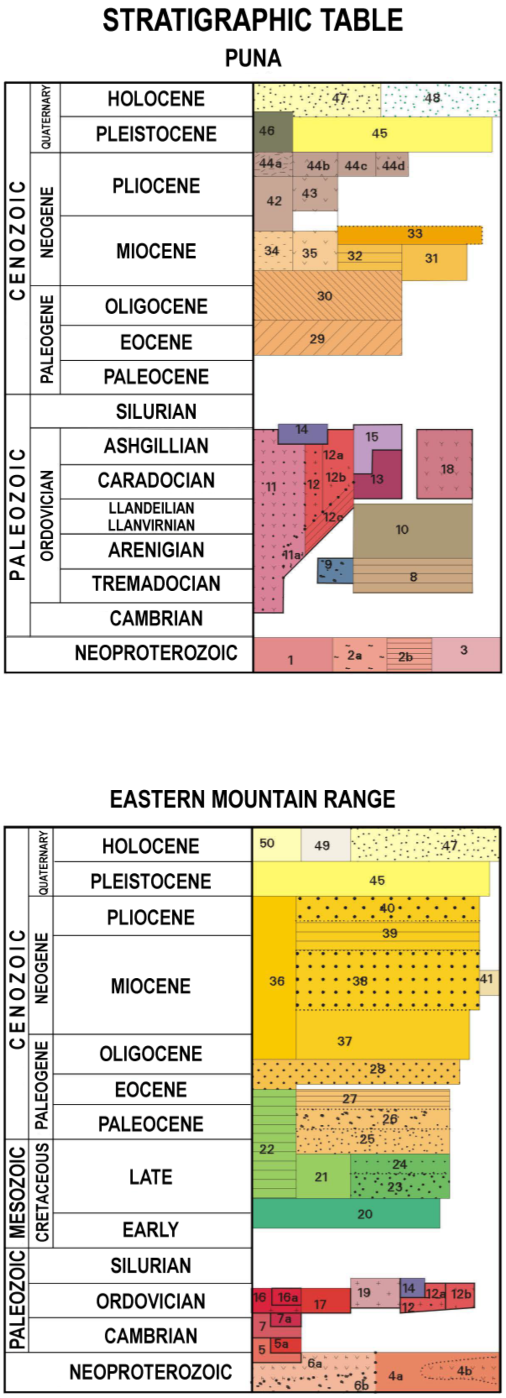
The origin of lithium in the brines of the Puna/Altiplano has not been established with certainty. Shallow magma chambers are known to underlie the Puna and could potentially be the source for mineral constituents being emplaced to the surface by volcanic activity (especially fumarolic and hydrothermal vents or leakage through many of the faults that traverse the Puna). Lithium is transported to the Salar in surface waters that enter the Salar and largely evaporate, depositing evaporite sediments along with concurrent clastics. Lithium is not a significant component of precipitated evaporite minerals and tends to concentrate in the residual brine within the sediment porosity. Evaporite deposits and their entrained brine are believed to be of Holocene age (within the last 12,000 years).

A regional geologic map of the area surrounding SdHM is provided as Figure 6-2, with accompanying stratigraphic columns provided as Figure 6-3. Holocene evaporite deposits and alluvial/colluvial clastic deposits (Units 48 and 47 of Figure 6-3, respectively) overlie older igneous, metamorphic, and clastic sedimentary rocks. A detailed description of the regional geology, tectonics, and evolution of the Puna is beyond the objectives of this report; the interested reader is referred to the works of Aceñolaza et al. (1975, 1976), Kay et al. (2008), Alonso et al. (1991), Vandervoort et al. (1995), and Warren (1999, 2010).



Note:
1. Source: Carta Geologica de La Republica Argentina, CACHI 2566-III
Segemar Instituto de Geologia Y Recursos Minerales

Figure 6-2. Regional Geologic Map

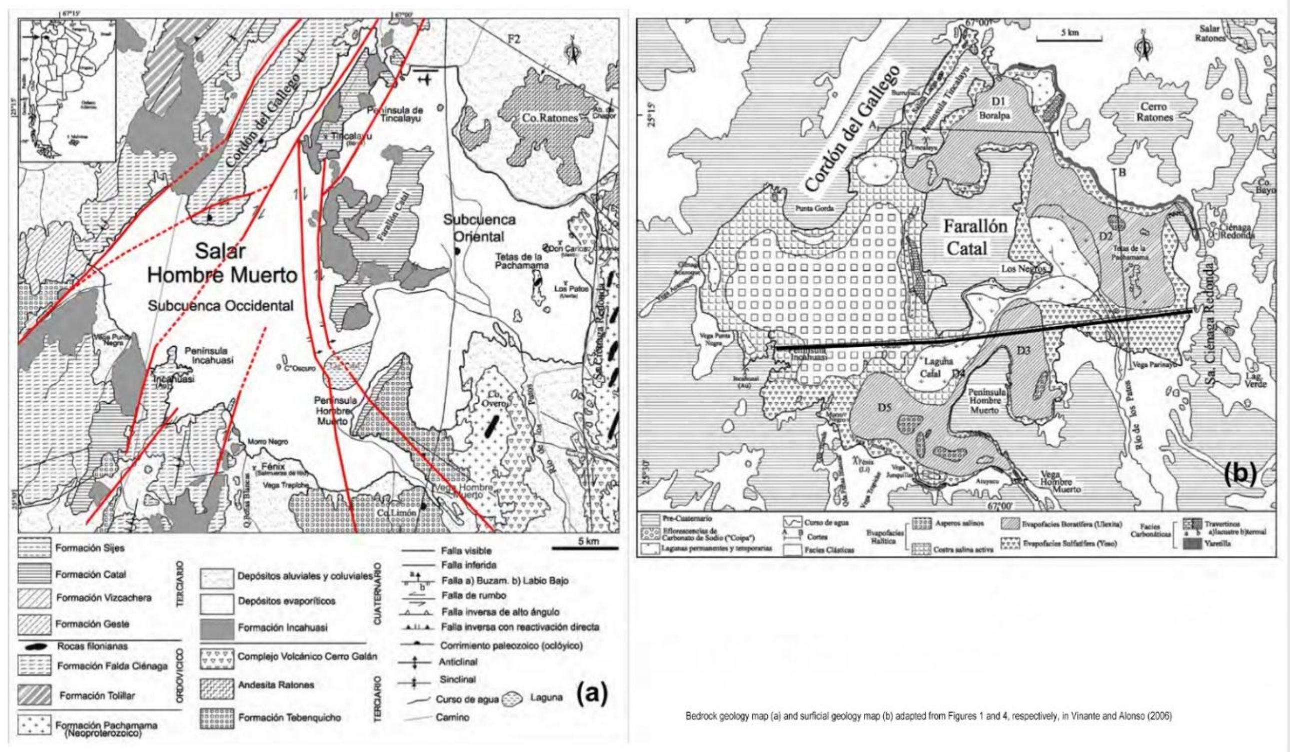


50. ALLUVIAL DEPOSITS. Gravel, sand and clays; barreales. Weakly developed soils.
49. SLIDE DEPOSITS. Blocks
48. EVAPORITIC DEPOSITS. Chlorides, borates, sulfates and carbonates.
47. ALLUVIAL AND COLUVIAL DEPOSITS. Gravel, sand and gravel. Barreales.
46. INCAHUASI FORMATION. Basalts.
45. TERRACE DEPOSITS. Conglomerates with interbeds of sandstones, claystone and tuffs
44. CERRO GALAN VOLCANIC COMPLEX. a) Ignimbrite of the resurgent center, b/c) Lavas and post-caldera domes. b) Lava, c) Aguas Calientes Dome, d) Dacitic ignimbrite.
43. LARGE ROYAL LAVA. Dacites
42. RATONES ANDESITE
41. PUCARILLA IGNIMBRITE. Dacitic ignimbrite. Lahars.
40. SAN FELIPE FORMAION. Conglomerates. Fluvial deposits and alluvial fans.
39. PALO PAINTADO FORMATION. Sandstones, claystone and gray conglomerates, green and reddish. Fluvial deposits.
38. ANGASTACO FORMATION. Conglomerates and gray and brown sandstones. Fluvial deposits.
37. LOS COLORADOS QUEBRADA FORMATION. Orange to red sandstones and conglomerates. Fluvial deposits.
36. UNDIFFERENTIATED PAYOGASTILLA GROUP.
35. TEBENQUICHO FORMATION. Dacites and andesites.
34. INCA VIEJO FORMATION. Porphyry rhyolitic-dacites.
33. SIJES FORMATION. Greenish-gray sandstones and pellets with volcaniclastic and evaporitic intercalations, mainly borates. Fluvial and saline lake deposits.
32. BATIN FORMATION. Continental conglomerates and sandstones with intercalations of tuff. Fluvial deposits.
31. CATAL FORMATION. Conglomerates and sandstones with intercalations of ignimbrite and volcaniclastics. Fluvial deposits.
30. VIZCACHERA SEDIMENTARY. Conglomerates, sandstones and claystone, mainly red with intercalations of gypsum and halite. Fluvial, eolian and saline lake deposits.
29. GESTE FORMATION. Fluvial red conglomerates and sandstones and alluvial fans.
28. LURACATAO FORMATION. Red and white sandstones and conglomerates. Fluvial deposits (includes sequences possibly belonging to edge facies of the Santa Barbara subgroup).
27. LUMBRERA FORMATION. Red sandstones and claystone. Fluvial deposits.
26. MAIZ GORDO FORMATION. Red and white fine sandstones and conglomerates. Deposits of alluvial and fluvial fans.
25. MEALLA FORMATION. Red fine and medium sandstones. Fluvial deposits.
24. YACORAITE FORMATION. Limestone and pink sandstone. Lacustrine and fluvial deposits.
23. LECHO FORMATION. Lightly colored sandstones. Fluvial and eolian deposits.
22. UNDIFFERENTIATED BALBUENA AND SANTA BARBARA SUBGROUPS.
21. UNDIFFERENTIATED BALBUENA SUBGROUP.
20. PIRGUA SUBGROUP. Red conglomerates and sandstones. Unrifted deposits. Alluvial fans.
19. ALTO DEL CAJON GRANITE. Pink and grey granites.
18. CORTADERAS FORMATION. Granites and granodiorites.
17. PUCARA GRANITE. Pink granites.
16. LA ANGOSTURA GRANITE. Gray granites. a) Pegmatites and zones with intense pegmatization.
15/11. OIRE ERUPTIVE COMPLEX.
15. Leucogranites.
14. Pegmatites, aplites and lamprophyres.
13. Gabbros and diorites.
12. Coarse grained granites and granodiorites with mega crystals a) hydrothermally altered - greisenized, b) with intense pegmatization, c) with metamorphism.
11. Fine to medium grained granites and granodiorites, equigranular to porphyric. a) with metamorphism.
10. FALDA CIENEGA FORMATION. Greywackes and claystone with intercalations of quartz sandstones, dacitic lavas and volcanic sandstones, with regional metamorphism. Marine deposits.
9. OJO DE COLORADOS BASIC COMPLEX. Gabbro and diorites.
8. TOLLILLAR FORMATION. Greywackes and claystone with regional metamorphism. Marine deposits.
7. VINEYARD TONALITE. Tonalites. a) Pegmatites.
6. LA PAYA FORMATION. a) Quartzites, schists and nodular schists, gneisses and migmatites. b) Phyllites, schists and gneisses, mottled.
5. CACHI FORMATION. Trondjemites, granites and granodiorites. a) Pegmatites.
4. PUNCOVISCAN FORMATION. a) Regional metamorphic greywackes, sandstone, and claystone. Turbidites. b) Dacites.
3. METAMORPHIC ANTOFALLITA. Quartz-micaceous schists, amphibole schists and amphiboles.
2. RIO BLANCO METAMORPHIC COMPLEX. a) Sillimanite schists. B) Metaquartzite, phyllites, slates, common schists.
1. PACHAMAMA FORMATION. Schists and gneisses (para and orthogneisses) with limestone and amphibole intercalations.

Figure 6-3. Regional Stratigraphic Columns

6.1.2 Local Geology

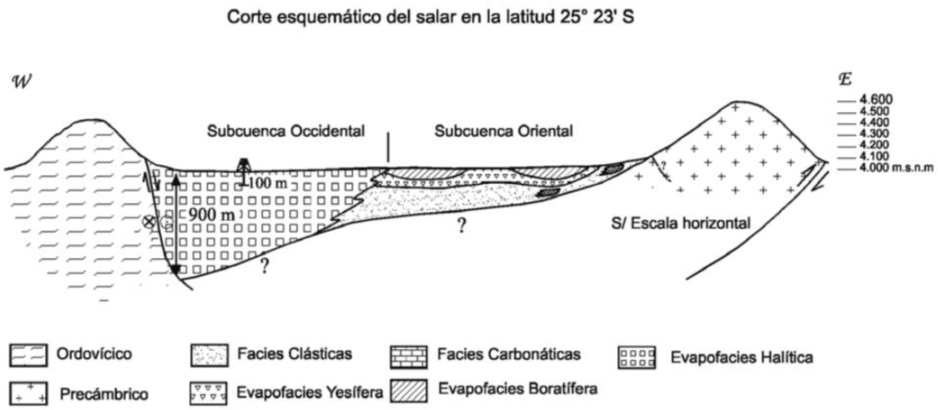
SdHM consists of evaporite deposits formed within an isolated endorheic basin, bounded by pre-Paleozoic, Paleozoic, and Cenozoic–age crystalline metamorphic basement rocks. Published geologic maps and cross sections of SdHM geology are provided in Figures 6-4 and 6-5, adapted from Vinante and Alonso (2006). Fault-bounded bedrock hills—for example the Península Tincalayu, Farallón Catal, and Península Hombre Muerto—occur within and along the margins of the Salar basin (Figure 6-4), further subdividing SdHM into two separate subbasins (eastern and western), each with different evaporite sediment compositions. The Eastern Subbasin is dominated by borate evaporites and clastic sediments (such as sand, silts, and clays), whereas the Western Subbasin is relatively free of clastic sediment and is dominated by halite (sodium chloride salt) evaporite deposits. Farallón Catal rises to an elevation of about 4,200 m and is a bedrock inlier within SdHM. The Eastern and Western Subbasins are connected by sediments deposited between Farallón Catal to the north and Península Hombre Muerto to the south. The margins of the sedimentary basins have lacustrine depositional terraces and ephemeral wetlands.



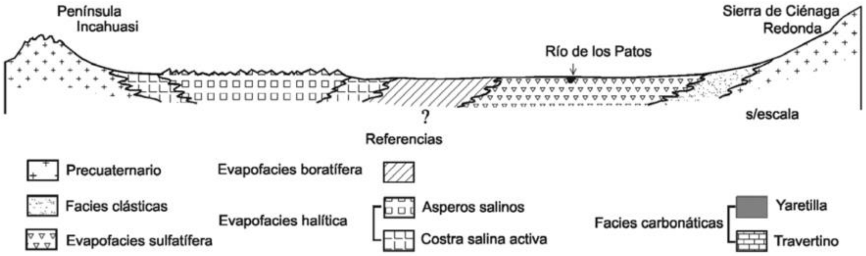
Bedrock geology map (a) and surficial geology map (b) adapted from Figures 1 and 4, respectively, in Vinante and Alonso (2006)

Figure 6-4. Bedrock and Surficial Geologic Maps

(a) Regional Section across Salar del Hombre Muerto[a]



(b) Surficial Geology East/West Section across Salar del Hombre Muerto[b]



[a] Taken from Figure 6, Vinante and Alonso (2006)
[b] Taken from Figure 5, Vinante and Alonso (2006)

Figure 6-5. Geologic Cross Sections

Neoproterozoic metasedimentary rocks are generally present in the Rio de Los Patos watershed to the southeast. Lower Paleozoic through Miocene shale, sandstone, conglomerates, and evaporites are present across the western portion of the watershed. These are overlain by late Miocene volcanic dacite, andesite, and ignimbrites. Quaternary alluvial deposits are present within valleys and as alluvial fans with evaporate deposits forming in the Salar.

Clastic sediments (sands, silts, and clays) are deposited along with evaporite minerals in the basins by stream inflows and by alluvial fans along bounding hills. The Eastern Subbasin is much more clastic-rich than the Western Subbasin, primarily because the predominant stream feeding the entire SdHM basin complex, Rio de Los Patos, enters the Eastern Subbasin at its southeastern margin and deposits stream-entrained clastics. The Western Subbasin is considered a “mature” salar, per the definitions provided by Houston et al. (2011). Mature salars are dominated by massive central cores of halite with salar-margin sheets of clastic deposits. Immature salars are dominated by basin-wide interbedded deposits of evaporites and clastics. The Western Subbasin maturity could have resulted from "moderately evolved brines decanting from the immature eastern sub-basin over a subsurface bedrock barrier" (Houston et al. 2011). Stratigraphic succession of halite beds with small amounts of terrigenous material indicates a lack of sediment feed during deposition with the presence of tuffaceous layers providing evidence of ash falls during volcanism.

The general configuration of sedimentary deposits in SdHM is presented in Vinante and Alonso (2006). A transition of primary evaporite minerals is observed from basin margins to basin centers, proceeding from carbonates at margins through borates, sulfates, and ultimately chlorides (halite) in basin centers. The Eastern Subbasin is highly asymmetric, with the deeper basin center in the western portion (Figure 6-5a). The Western Subbasin is more symmetrical but is believed to be deepest west of the geographical center. Clastic sediments (sands, silts, and clays) are deposited along with evaporites in the basins by stream inflows and by alluvial fans along bounding bedrock hills. A generalized geological model of the site is discussed in Section 11.7.

6.2 MINERAL DEPOSIT

There are several key characteristics that allow lithium-rich brines to develop over time within Salar sediments. The characteristics required are an endorheic basin, arid climate, tectonically driven subsidence, igneous or geothermal activity, lithium-bearing source rocks, adequate aquifer(s)/reservoir(s), and sufficient time to concentrate the brine (Bradley et al. 2013). SdHM, along with other lithium-rich salars in the lithium triangle, each bear these characteristics to varying degrees.

The volcanic arc of the western Cordillera, eastern volcanic centers, and Altiplano-Puna magma body, which have been active from the Miocene to present day, are the origin of boron-rich fluids—the source of borate in SdHM (Alonso 1999). The presence of arsenic, antimony, and lithium in modern boron-rich hot springs and buried deposits favors a common origin model for lithium in the SdHM (Alonso 1999). The current chemistry of SdHM resulted from the dissolution of constituents by infiltrating surface water or hydrothermal fluids rich in boron or sodium chloride that flowed into SdHM, were concentrated in solution, and precipitated due to evaporation or supersaturation (Alonso 1999; Houston et al. 2011; Munk et al. 2016). Lithium continues to concentrate in brine after halite saturation is reached (Houston et al. 2011). These mechanisms result in brines that increase in lithium concentration from relatively dilute in fresh water entering the Salar to lithium-rich brine in the Western Subbasin's halite nucleus (farthest from entering surface waters).

The lateral boundary of the evaporite sedimentary deposits of the Western Subbasin of SdHM is roughly circular in shape, coinciding with the contact between sediment and surrounding bedrock, consisting mainly of Paleozoic metamorphic graywackes and shales. The Incahuasi Formation, consisting of Quaternary-aged clastics, evaporites, basalts, and andesites, forms the northern boundary. Neogene volcanic dacites and andesites form the eastern and southeastern boundary of the depositional basin.

The deposit is hydraulically unbounded at the saddle where the Eastern and Western Subbasins connect, which allows brine in the Eastern Subbasin and brackish water from the Rio de los Patos to enter the Western Subbasin. The deposit is open to the south where the groundwater flow from the Trapiche Aquifer enters the Salar. At both locations, water or lithium-rich brine flows into the deposits of the Western Subbasin. The vertical extent (depth) of the lithium-rich brine deposit has not been determined. Based on surface geophysical surveys (Section 7.1.3), and several deep (>200 m) drilling locations, the bedrock–halite contact is likely greater than 200 m in most of the Western Subbasin and may exceed 900 m in the northwestern portion of the subbasin (WMC 1994).

7 EXPLORATION

Livent's mineral exploration activities at SdHM are classified according to when they occurred relative to operations (i.e., pre-development or during operations). Pre-development exploration began with a comprehensive site characterization program initiated in the early 1990s, conducted by Water Management Consultants (WMC) on behalf of FMC (now Livent). The program consisted of two field investigations centered on collecting the site characterization information in the Western Subbasin (WMC 1992, 1994). The site characterization work involved core drilling boreholes, surface and downhole geophysical surveys, hydraulic testing, water quality sampling from surface holes and catas (shallow excavated trenches), and other tests to evaluate site-specific baseline geological, hydrogeological, chemical, and meteorological conditions.

Shortly after pre-development site characterization work was completed in 1997, lithium production began. Brine quality (chemical analysis), brine elevation levels, and brine pumping data collected during operations can be considered supplemental exploration data because they provide valuable information about the brine reservoir and lithium resources/reserves on a much broader scale than is possible during a conventional pre-development exploration program.

In 2020, Livent explored the lithium brine resources of the Western Subbasin of SdHM at depths greater than the depth of its operating lithium brine production wells. This supplemental exploration program, referred to as the Deep Characterization Program, involved core drilling three locations using an HQ-diameter diamond drill to 102 m, 220 m, and 302 m below ground surface (bgs). The drill hole locations were selected to collect data near existing brine pumping well batteries, as well as in the area where the Eastern and Western Subbasins connect. Pre-development and operational exploration activities are discussed in the following subsections. Exploration activities are summarized in Table 7-1.

Table 7-1. Summary of Exploration Work

Year Completed	Exploration Type	Number	Depth Range (m bgs)	Length/Depth (m)
1992	Surface Holes	74	Shallow	Unknown
	Boreholes (HQ Core)	17	8 - 92.5	742.3
	Boreholes (NQ Core)	1	70	70
	Core Samples	892	0.1 - 63.54	89.2
	Discrete Brine Samples	78	0.02 - 89	NA
	Downhole Geophysics	15	16.8 - 70.2	540.6
	Packer Testing	24	0 - 46	NA
1993	Gravity Survey	6 lines/217 total stations	0 - 930	36,000
	Pumping Wells	3	0 - 54	154
	Observation Wells	6	0 - 54	308
2017	Exploration Boreholes	11	29.5 - 30.5	333.5
	Exploration/Monitoring Wells	35	10.5 - 31	709
	Brine Samples	35	0 - 31	--
2020	Deep Characterization Boreholes	3	101.5 - 302	623.5
	Discrete Brine Samples	36	37 - 302	--
	Downhole Geophysics	3	0 - 302	623.5

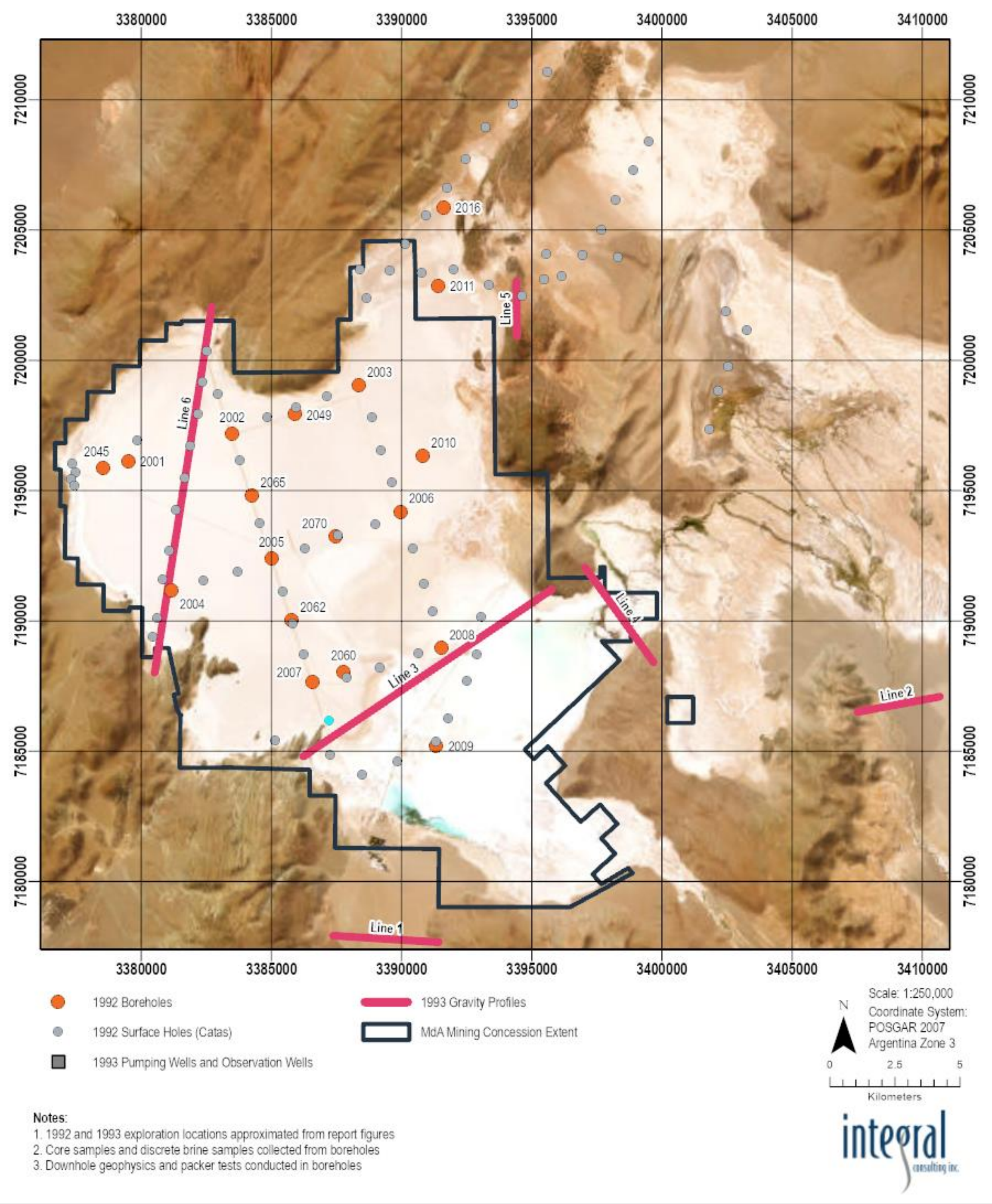
Notes:
bgs = below ground surface
HQ = H-size Q-group
m = meter(s)
NA = not applicable
NQ = N-size Q-group

7.1 PRE-DEVELOPMENT TESTING CAMPAIGN (1992–1994)

The following provides a brief summary of the field investigations performed in the early 1990s prior to development of the lithium-bearing brine resource (key features of the pre-development exploration program are shown on Figure 7-1):

- A total of 18 boreholes (2000-series) were core drilled to evaluate the basin deposits in a broad pattern across the Salar.
- Lithologic logs (sediment and rock type) were prepared for 17 boreholes.
- All but two of the boreholes were installed to relatively shallow depths (<55 m bgs). The two deeper boreholes (Numbers 2002 and 2011) were drilled to 65 and 92.5 m bgs, respectively.
- The core drilling program averaged 90% core recovery for a total of 743 m of HQ core and 70 m of NQ core.

- Core samples were collected every 50 cm (or otherwise as practicable) to evaluate effective porosity in a field laboratory, resulting in 892 porosity data values. Select core samples were shipped to the Corelabs laboratory in Denver, Colorado, for verification of the field methodology.
- Quality assurance was provided through additional gas porosimetry and petrographic mineralogic analysis of selected core samples (total of nine) and analysis of two selected samples by scanning electron microscopy.
- A suite of downhole geophysical logging tools was run in 15 of the open boreholes, including natural gamma ray, gamma-gamma, temperature, caliper, and neutron density tools.
- Straddle packer tests were conducted across multiple intervals in 16 boreholes for a total of 24 tests (including two injection tests), to obtain specific formation permeability and to collect brine samples for chemical analysis.
- A total of 74 shallow holes (or "catas") were excavated in the surface of the Salar to collect additional brine samples. All samples were analyzed for lithium and other relevant solutes, as well as the determination of brine density.
- A meteorological station was installed to collect weather-related data. It included the placement of lysimeters (total of six) and pan evaporation systems to measure evaporation rates.
- Two surface water stations, adjacent to the largest streams, Rio de Los Patos and Rio Trapiche, were also established to provide monthly freshwater inflows to the Salar.
- Six surface geophysical (gravity) surveys were conducted to evaluate the bedrock topography and thickness of overlying evaporite and alluvial sediment deposits.
- Three pumping tests were conducted to calculate hydraulic properties of Salar sediments.
- Seven specific capacity tests were conducted to estimate hydraulic properties of alluvial aquifers.



Notes:
1. 1992 and 1993 exploration locations approximated from report figures
2. Core samples and discrete brine samples collected from boreholes
3. Downhole geophysics and packer tests conducted in boreholes

Figure 7-1. Pre-Development Exploration at Salar del Hombre Muerto

7.1.1 Drilling Type and Extent

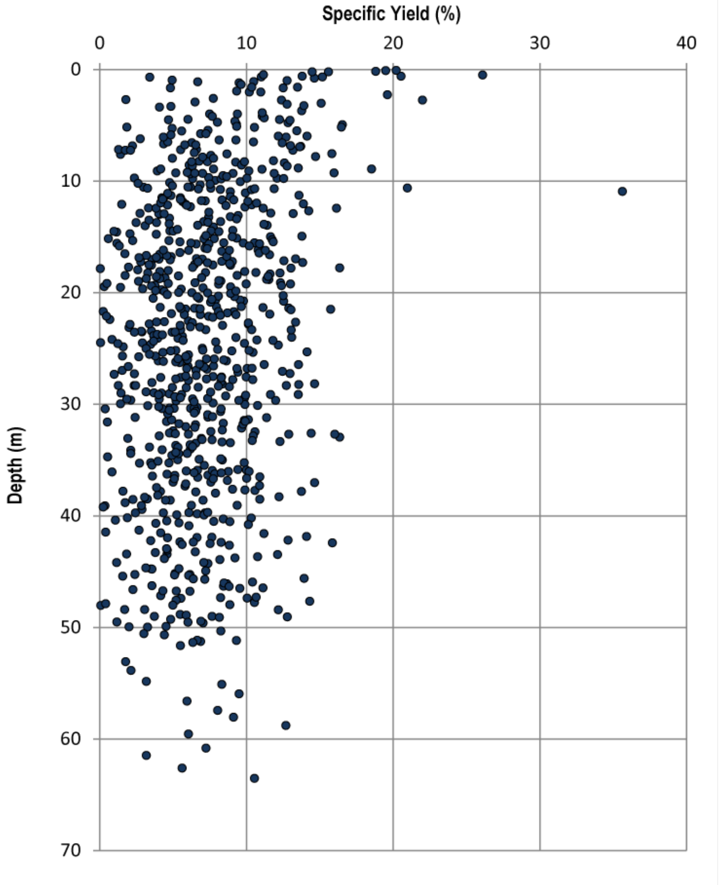
A total of 18 boreholes were drilled and cored to depths between 8.0 m and 92.5 m bgs during the 1992 investigation to provide information on SdHM geology, hydrogeology, and brine chemistry. An HQ core (96-mm outer diameter [OD]) was used for 17 cored boreholes for a total of 743 m of coring, whereas an NQ core (76-mm OD) was used for an additional 70 m of coring; however, information for this NQ cored borehole was not reported by WMC (1992). Core recovery was excellent, averaging 90% or higher. Each 1-m interval of core was logged with descriptions of "mineralogy, crystal size, texture, clastic content, matrix mineralogy, effervescence with HCl, and porosity indicators such as large voids or fractures" for a total of 17 logs from the HQ cores (WMC 1992). An exploration drilling summary is provided in Table 7-2.

Table 7-2. Summary of Exploration Drilling

Borehole Type	Year	Method	Drilling Depth (m)	Core Length (m)	Recovery (%)
Exploration Borehole	1992	DDH HQ Core	743	743	> 90
Exploration Borehole	1992	DDH NQ Core	70	70	> 90
Pumping Wells	1993	Direct Rotary	154	NA	NA
Observation Wells	1993	Direct Rotary	308	NA	NA
PS core	2017	DDH HQ Core	333.5	333.5	74
PS wells	2017	Direct Rotary	709	NA	NA
Deep Characterization Boreholes	2020	DDH HQ Core	623.5	552	> 80

Notes:
DDH = wireline diamond drilling
HQ = H-size Q-group
NQ = N-size Q-group
PS = Salar Piezometer

A total of 892 core samples of approximately 10 cm in length were collected at discrete intervals from 679 m of HQ core from 16 boreholes. WMC measured total interconnected porosity for the 892 select core samples in the field using an Archimedes method. Cores were 10 cm in length and 96 mm in diameter. Specific retention (S_r) of brine was measured in each core sample after 5 seconds of drainage, and for 44 select cores after 5 days of drainage (considered complete brine gravity drainage, a measure of effective porosity). Using the ratio of 5 seconds/5 day S_r in the 44 core subset, which was 0.59, effective porosity was estimated where not directly measured using the 5 second/5-day S_r ratio for each core sample. In its report, WMC (1992) used the terms effective porosity (P_e) and specific yield (S_y) interchangeably, stating: "The effective porosity value used in volume calculations is, in this report, equivalent to the specific yield of the interconnected pore spaces." Figure 7-2 is a cross plot of all S_y values versus depth for all data reconstructed by Integral from data provided in the WMC report.



Source:
Data from WMC (1992)

Figure 7-2. Cross Plot of Specific Yield vs. Depth

Results of the field program were used to select 28 cores with a range of low, medium, and high specific yield. These cores were submitted to the Corelabs laboratory in Denver, Colorado, for analysis of gas porosimetry, petrography, and scanning electron microscopy to provide additional information on porosity, crystallization, and mineralogy. Laboratory results showed good correlation with field results and confirmed field results were of appropriate quality for the resource estimate.

Downhole geophysical surveys were conducted using Logmaster tools for temperature, caliper, natural gamma, gamma-gamma density, and neutron logs in 15 of the boreholes drilled during the 1992 investigation to provide supplemental lithologic information and relative porosity estimates. A calibrated neutron porosity log was generated from the neutron density log and used to develop continuous vertical porosity estimate profiles.

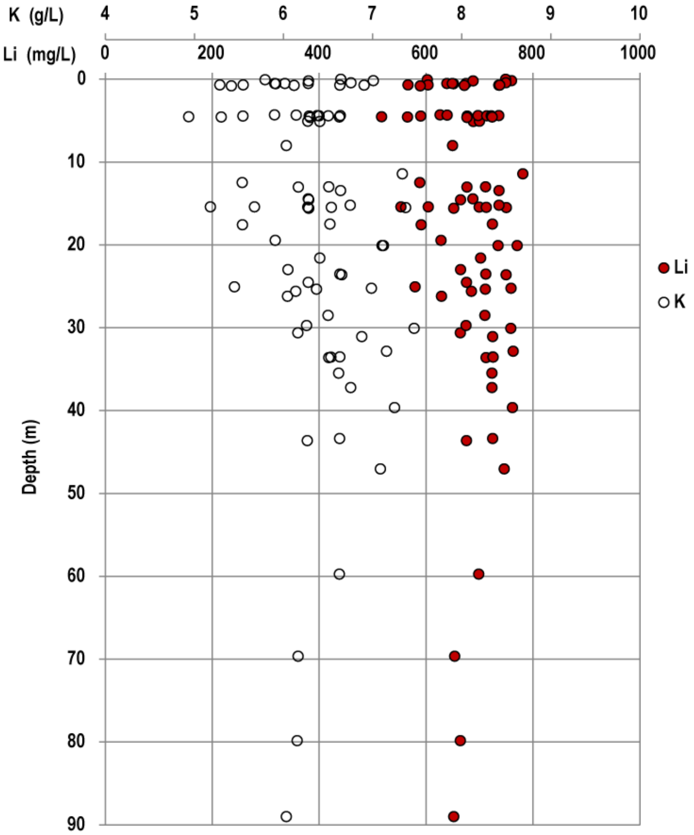
In 1993, pumping wells and associated observation wells were installed at three separate locations adjacent to existing boreholes 2001, 2011, and 2007 to provide hydraulic information on the recoverability of the lithium resource. The pumping wells were labeled as well 3010 (adjacent to borehole 2001), well 3020 (adjacent to borehole 2011), and well 3030 (adjacent to borehole 2007). Locations were selected to provide control over the northwestern portion of the central halite nucleus (well 3010), the northern arm of the Salar (well 3020), and the southern portion of the resource (well 3030). Pumping wells were constructed with 300-mm slotted casing in a 400-mm borehole and gravel packed if required to maintain borehole integrity. Observation wells were constructed 5 and 10 m from the pumping wells and 90° from each other to depths between approximately 40 and 50 m bgs. Observation wells were constructed with 1-mm slotted, 100-mm-diameter casing within a 200-mm-diameter borehole.

Eight groundwater monitoring wells (alluvial wells 4001 through 4008) were installed in alluvial freshwater aquifers in 1993 around the perimeter of the Salar to evaluate the hydrogeology and chemistry of groundwater within the Trapiche Aquifer and the Los Patos Aquifer. These monitoring wells were installed using the mud-rotary method to a depth of 30 m bgs and completed with 0.5- to 1-mm slotted 100-mm polyvinyl chloride (PVC) screens.

7.1.2 Brine Sampling

A total of 78 brine samples were collected at approximate 10-m intervals within 16 boreholes using an inflatable packer system, 95 brine samples were collected from surface holes, and 65 fresh and brackish samples were collected from surface water. Typically, two samples were collected in the upper 10 m of each borehole, and about one sample for each subsequently deeper 10-m interval. Additionally, 86 samples (including duplicates at a frequency of 1 per 10 samples) were collected for quality assurance and quality control (QA/QC). Brine samples were submitted to FMC’s (now Livent’s) Bessemer City, North Carolina, facility for chemical analysis of sodium, potassium, calcium, magnesium, lithium, sulfate, and borate using inductively coupled plasma (ICP) spectroscopy and chloride using a titration method. Fresh and brackish surface water samples were also analyzed for copper, lead, arsenic, carbonate, bicarbonate, fluoride, and nitrate. As a quality assurance check, ion balance for shallow excavation and borehole brine samples was conducted and deemed acceptable. Spatial and temporal changes were not apparent due to the time or location at which samples were collected, and chemical concentration with depth did not demonstrate any systematic change. QA/QC results were not included in the WMC (1992) report.

Concentrations of lithium, potassium, and borate were provided by WMC (1992, Appendix G) as cross plots (concentration versus depth). Figure 7-3 is a cross plot of all lithium and potassium concentration data versus depth reconstructed by Integral from WMC (1992) reported data.



Source:
Data from WMC (1992)

Figure 7-3. Cross Plot of Lithium and Potassium Concentration vs. Depth

7.1.3 Borehole Geophysics

Geophysical logging was conducted by WMC (1992) in a suite of boreholes. Tools included caliper, natural gamma, single-detector neutron, gamma-gamma density, and fluid-column temperature. Integral reviewed the geological logs, provided as Appendix A of the WMC (1992) report. Eighteen boreholes were initially drilled from July through August 1992, and 15 of them were geophysically logged. Due to borehole instability and collapse, geophysical logs did not extend to drilled total depth in all boreholes.

The types of geophysical logs acquired are described in the following paragraphs. Because few details were provided by WMC with respect to the interpretation of the downhole geophysical logs, these descriptions are provided herein only to illustrate the capabilities and limitations of each borehole log system. We will not describe the gamma-gamma logging tool, as it was determined by WMC to be operating in error. Additional background on geophysical logging is available readily in the published domain and is not discussed any further.

Caliper. Caliper logs provide a continuous record of the borehole diameter and can provide information on stability of rock/sediment encountered. Caliper logs can be important in interpreting other logs that are affected by changes in borehole diameter.

Natural Gamma. Natural gamma (hereafter referred to as "gamma") logs measure the gamma activity (radiation) produced by the naturally occurring isotopes of uranium, potassium, and thorium. The gamma response indicates variations in the lithologies, typically related to the proportion of clay minerals or unweathered mineral grains.

Neutron. These logs use a neutron source to generate a flux of neutrons and measure the rate at which neutrons are returned to a detector. Log interpretation assumes that the neutrons are absorbed by the geologic materials through the collision of neutrons with hydrogen atoms. On that basis, the neutron log signal is assumed to be inversely proportional to the total amount of water around the probe in the region surrounding the detector, which can be used to interpret the amount of total water-filled porosity.

Temperature. Temperature logs (or fluid-temperature logs) provide a continuous record of vertical variations in the water temperature in a borehole, and are useful in identifying water-producing and water-receiving zones and in determining zones of vertical borehole flow. Typically, isolated fractures (or flow zones) when penetrated by a borehole will show a "spike" or thermal anomaly on the temperature log.

We determined that the available borehole geophysical logs were highly useful in confirming lithologic interpretations and in allowing correlation of geologic strata between boreholes—allowing us to develop a 3-dimensional understanding of the Salar aquifer framework. Lithology was primarily determined using a combination of gamma, neutron, and caliper logs in conjunction with core logging lithological descriptions. WMC (1992) faced significant challenges in attempting to use neutron log data to estimate porosity. Neutron logs, in addition to providing important keys to lithology, provide a qualitative measure of rock/sediment porosity, where high count rates represent low porosity and vice versa.

7.1.4 Gravity Profiles

Six gravity geophysical profiles were undertaken by WMC in June 1993 for additional geologic/hydrologic investigation at SdHM. The gravity method was selected to be the most cost effective to accomplish the objectives for the geophysical program (i.e., to estimate the depth to bedrock beneath evaporite and clastic sediments, and to determine the subsurface geometry of alluvial fans). Electrical methods were considered but rejected because of the significant amount of salt present along lines 3 to 6. Seismic reflection and refraction methods were not selected because of difficulties and expenses involved with mobilizing the necessary equipment to the remote site. As stated above, the work was performed to estimate the subsurface geometry of alluvial fans and contacts between the Salar and surrounding bedrock.

The results from the profiling of alluvial fans (specifically those at Rio Trapiche and Rio de Los Patos) were used in developing the groundwater input to the hydrologic balance of the Salar. The combined total survey length was approximately 36 km (217 stations). Figure 7-4 shows an example output from the gravity survey.

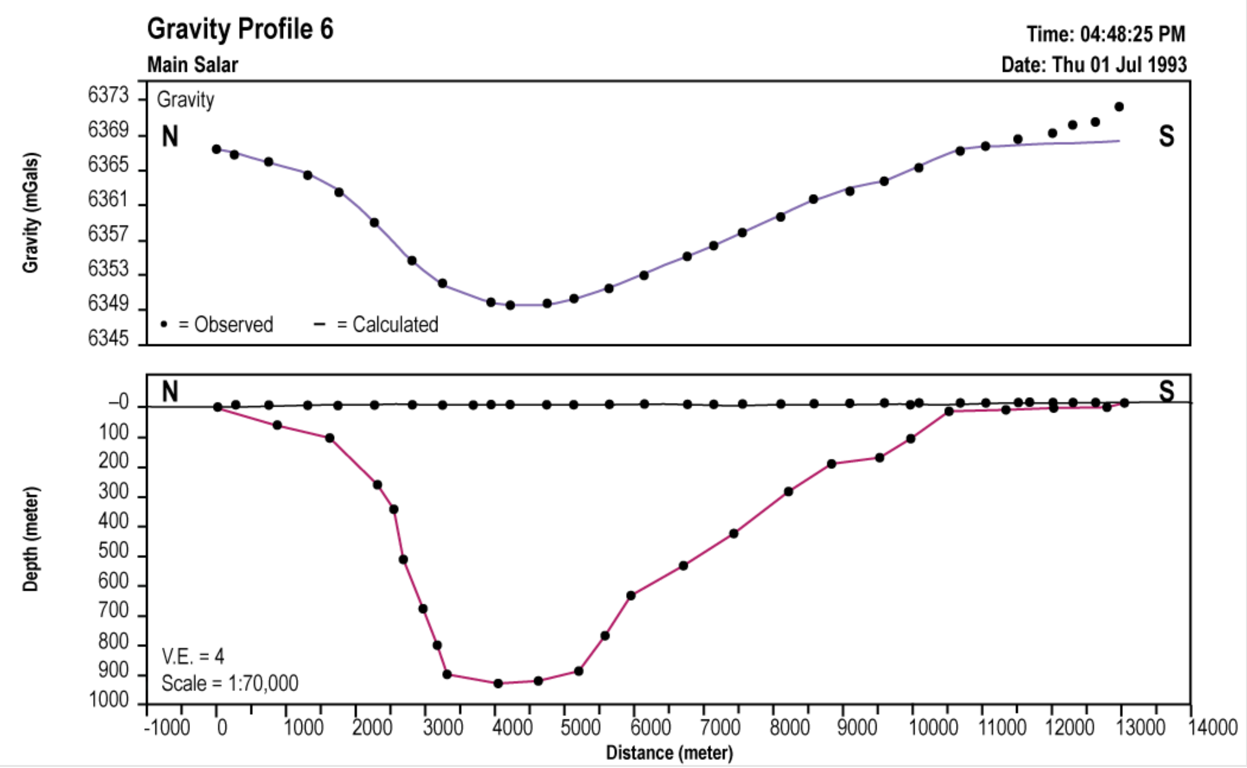


Figure 7-4. Example Surface Gravity Profile

The main objectives of the gravity profiling were to map bedrock topography, obtain combined thickness estimates of the salt and any underlying alluvial sediments, and obtain thickness estimates of alluvial sediments across Rio Trapiche and Rio de Los Patos alluvial fans. .

Gravity data were collected using a Lacoste & Romberg G Meter. Profiles extended onto areas of outcrop at each end. Station spacing along Profiles 1 to 5 varied from 50 m near outcrop to 100–150 m near the center of each line where greater depths to bedrock were anticipated. Station spacing for Profile 6 varied from 250 m near the outcrop to 500 m along the remainder of the line.

All gravity data were corrected for instrument drift, tide, and latitude. Free air and simple Bouguer corrections were applied. Terrain corrections were applied after limited available topographic data were digitized from the Cachi 1 x 1.5° topographic map. Geosoft gravity reduction software was used to process the data. Regional effects were removed by graphical methods assuming linear relationships between the regional gravity trend and distance. After removal of regional trends, the remaining residual complete Bouguer anomalies were used to perform depth to bedrock modeling along each of the profiles. Northwest Geophysical Associates GM-SYS software was used to perform the forward modeling of depth to bedrock.

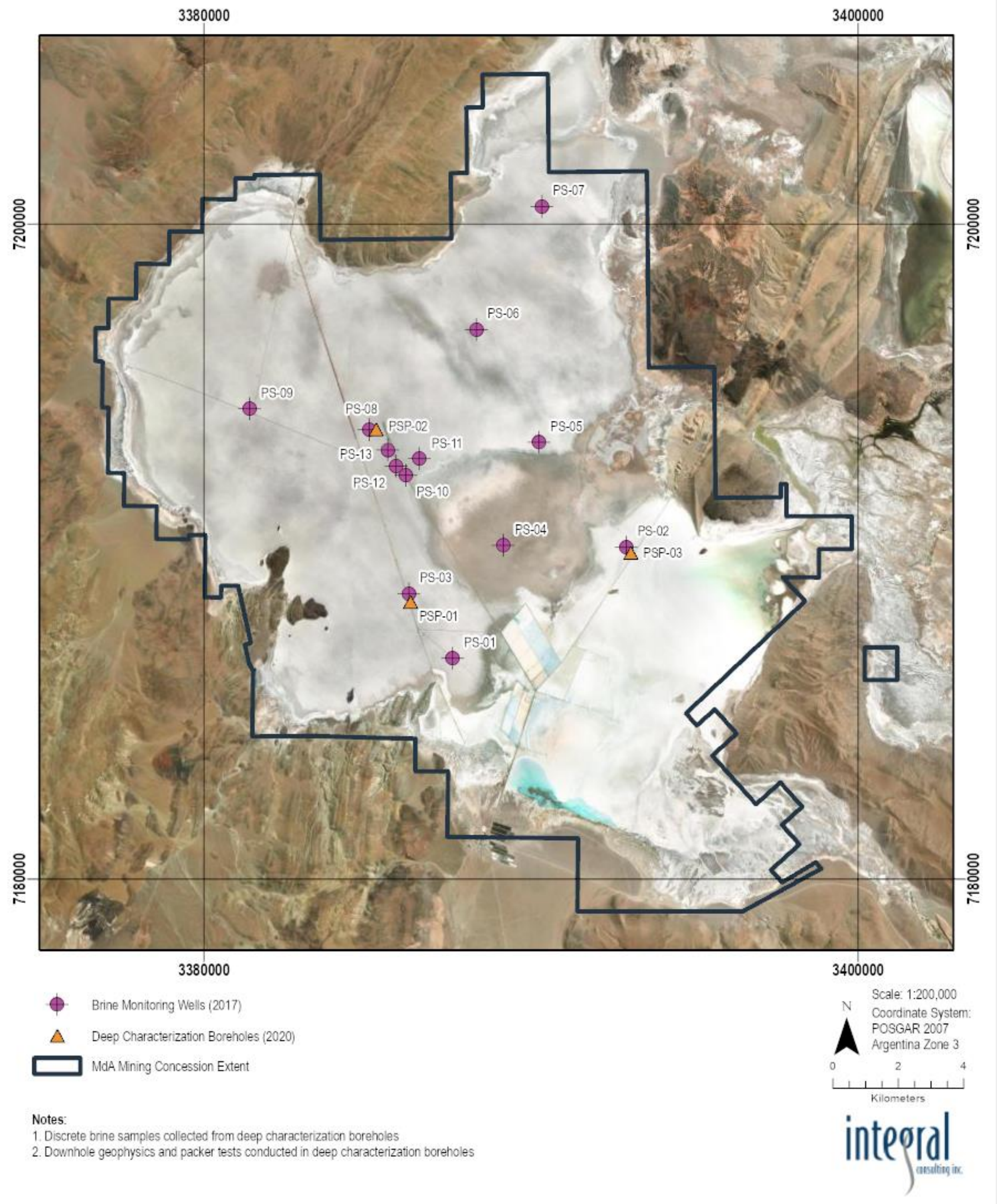
A total of 24 samples were collected at the ends of the profiles for laboratory density measurements. These measurements helped to determine density contrasts between salt, alluvium, and various volcanic bedrock types.

7.1.5 Supplemental Testing and Reporting by WMC in 1994

In 1994, FMC hired WMC to investigate the recoverable reserves for SdHM by field investigation, data interpretation, and computer modeling. As part of this investigation, extended pumping tests were done from three wells (3010, 3020, and 3030) used in the 1992 study (boreholes 2001, 2011, and 2007). Samples taken over 2-week intervals through the month of June 1993 were packaged and shipped to the Bessemer City, North Carolina, QA/QC labs for analysis by inductively coupled plasma optical emissions spectroscopy (ICP-OES). The results showed no significant variation of constituent concentrations and correlated well with the 1992 packer testing results, thus supporting the conclusions of the 1992 test and demonstrating that the brine is more or less homogeneous over an extended pumping period.

7.2 CHARACTERIZATION DURING OPERATIONS

Nearly 25 years of data collected during Project Fenix operations, including flow rates and lithium concentrations from lithium brine production wells, provide an excellent source of site characterization data. Additional, targeted site characterization activities were also completed after operations began. Those activities included installation and sampling of a brine monitoring well network in 2017 and the Deep Characterization Program in 2020. Locations of brine monitoring wells and deep boreholes are shown on Figure 7-5.



Notes:
1. Discrete brine samples collected from deep characterization boreholes
2. Downhole geophysics and packer tests conducted in deep characterization boreholes

Figure 7-5. Brine Monitoring Well Network and Deep Characterization Boreholes

7.2.1 Brine Monitoring Well Network Installation (2017)

In 2017, Livent designed and installed a brine monitoring well network across the Western Subbasin of SdHM to support periodic monitoring of brine chemistry and elevations of top of brine. At each of 11 locations, a set of 3 clustered monitoring wells was constructed with depths of 10 m, 20 m, and 30 m bgs, and a single well to 10 m bgs was installed at 2 locations, for a total of 35 individual monitoring wells. Wells were constructed of 4-inch-diameter PVC pipe with 5-m-long slotted screen intervals at the bottom of each well pipe. Each of the 30-m-deep boreholes was drill cored and encountered lithologies were documented prior to well construction in that borehole. Brine monitoring wells were installed predominantly in halite, except for the two easternmost stations (PS-1 and PS-2), which were installed in clastic material with trace halite. Details of monitoring well construction, lithologic logs, and field chemical parameters are provided in a report prepared by Livent's contractor, Conhidro S.R.L. (2017).

Following installation of brine monitoring wells in 2017, brine samples were collected for laboratory analysis at Livent's laboratory at Project Fenix. Additional rounds of brine monitoring were also conducted several times from 2020 through 2022.

7.2.2 Deep Characterization Program (2020)

Livent conducted a deep brine reservoir characterization program below 40 m depth in 2020 within the Western Subbasin of SdHM. The primary goals of the program were to measure the quantity and quality of the brine, and reservoir characteristics below 40 m to depths of at least 200 m by installation of targeted boreholes near the primary well battery (PWB) and secondary well battery (SWB). Specifically, the two primary objectives were:

1. Determine the brine quality (e.g., lithium, potassium, and magnesium concentrations) at depths greater than 40 m bgs
2. Characterize the deep brine reservoir hydraulic properties (relative permeability).

Data collected from boreholes during the program provide evidence of lithium concentrations and reservoir properties at depths below any existing pumping wells. Boreholes were cored and logged for lithology, after which downhole geophysical logging was conducted. The logging suite included natural gamma, spontaneous potential, and resistivity logs. Packer tests were employed to collect brine samples and determine relative permeability (flow rates) at various depth intervals within boreholes. Brine samples were collected and analyzed for lithium content at SGS Laboratories in Orlando, Florida. Each borehole was converted into a monitoring well after completion of geophysical logging and packer test sampling. Findings from each of the three deep boreholes follows.

<u>PSP1-20</u> is located near the SWB (Figure 7-5). The boring was advanced to a total depth of 220 m bgs through dominantly halite with some clastics. Undifferentiated metamorphic bedrock was encountered at 202 m bgs. The geophysical logs and lithology for PSP1-20 are provided in Figure 7-6. Once the borehole was finished to total depth, inflatable packers were used to isolate intervals within the borehole for brine sample collection and to measure flow rates (Figure 7-7).

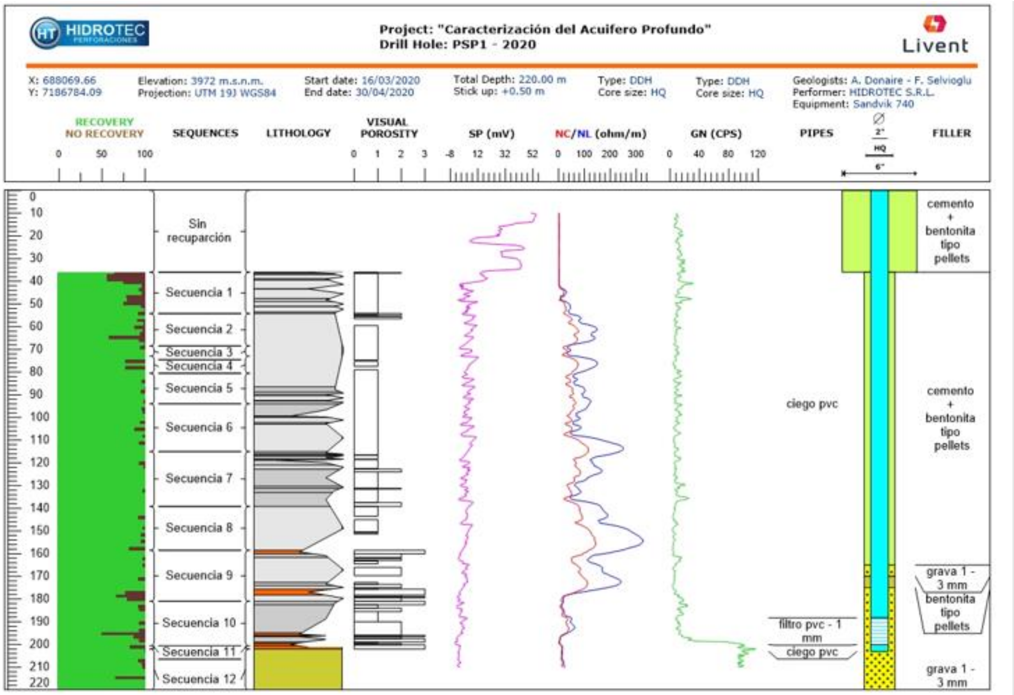


Figure 7-6. Geophysical Logs and Lithology for Deep Exploratory Borehole PSP1-20

Flow rates were measured, and brine samples were collected at 14 depth intervals within the borehole (Figure 7-7). Lithium concentrations ranged from 691 to 773 mg/L. The highest concentration of lithium (773 mg/L) was collected from 65–76 m bgs. Flow rates measured in each interval during sample collection were relatively consistent with depth, averaging approximately 12 L/min, indicating favorable hydraulic characteristics with depth. Graphical results (Figure 7-7) show a modest negative (declining) trend of lithium concentrations with depth. Cores obtained during drilling indicate a lithologic sequence of fractured evaporites (mostly halite) with some clastics (fine sand, silt and clay) from ground surface to 202 m bgs. Bedrock was encountered at 202 m bgs. This borehole provides a control point for the reservoir basement, which had not been established by drilling in prior investigations.

PSP2-20 is located near the PWB. The boring was advanced to a total depth of 302 m bgs; bedrock was not encountered. Cores obtained during drilling indicate the dominant lithology is crystalline halite, exhibiting fractures and interbedded fine sand and silt lenses. From ground surface to about 170 m bgs the halite is highly fractured, below which halite is more massive. The geophysical logs and lithology for this boring are provided in Figure 7-8.

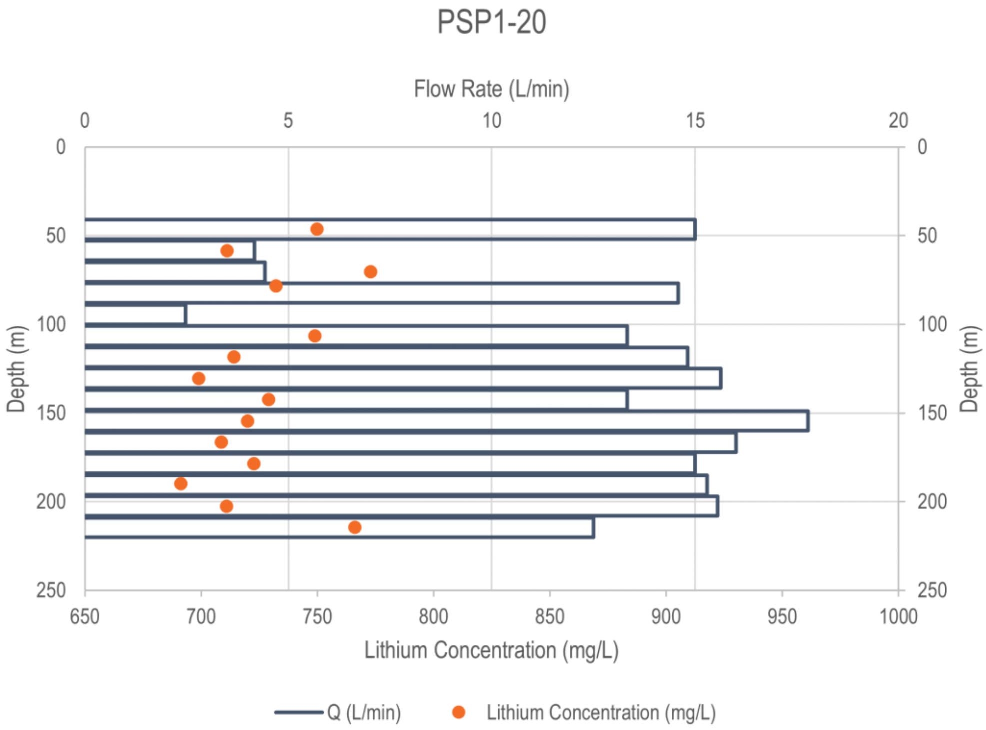


Figure 7-7. Packer Test Results for Deep Characterization Borehole PSP1-20

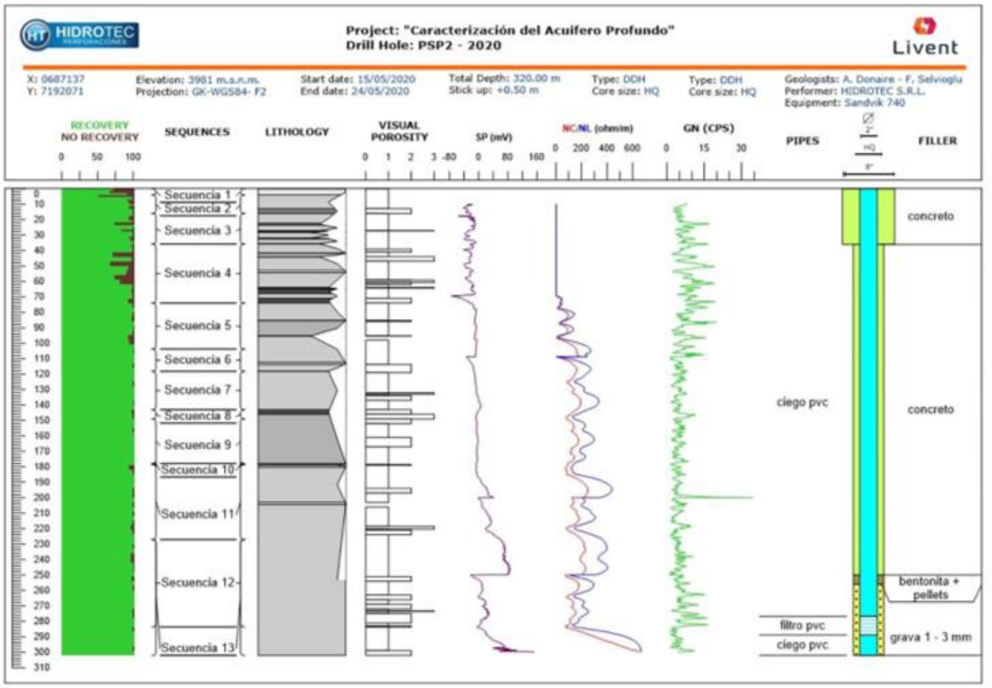


Figure 7-8. Geophysical Logs and Lithology for Deep Exploratory Borehole PSP2-20

Once the borehole was finished to total depth, inflatable packers were used to isolate intervals within the borehole, for sample collection and to measure flow rates. The deepest test interval was 243–302 m bgs. A total of 17 brine samples were collected at various depth intervals throughout the boring. Lithium concentrations ranged from 725 to 848 mg/L. The highest concentration of lithium (848 mg/L) was detected in a sample collected from 207–218 m bgs. Graphical results (Figure 7-9) show a modest positive (increasing) trend of lithium concentrations with depth in boring PSP2-20. Flow rates were more variable and generally lower than PSP1-20, averaging approximately 5 L/min. The highest flow rate (20 L/min) was observed in the shallow portion of the borehole.

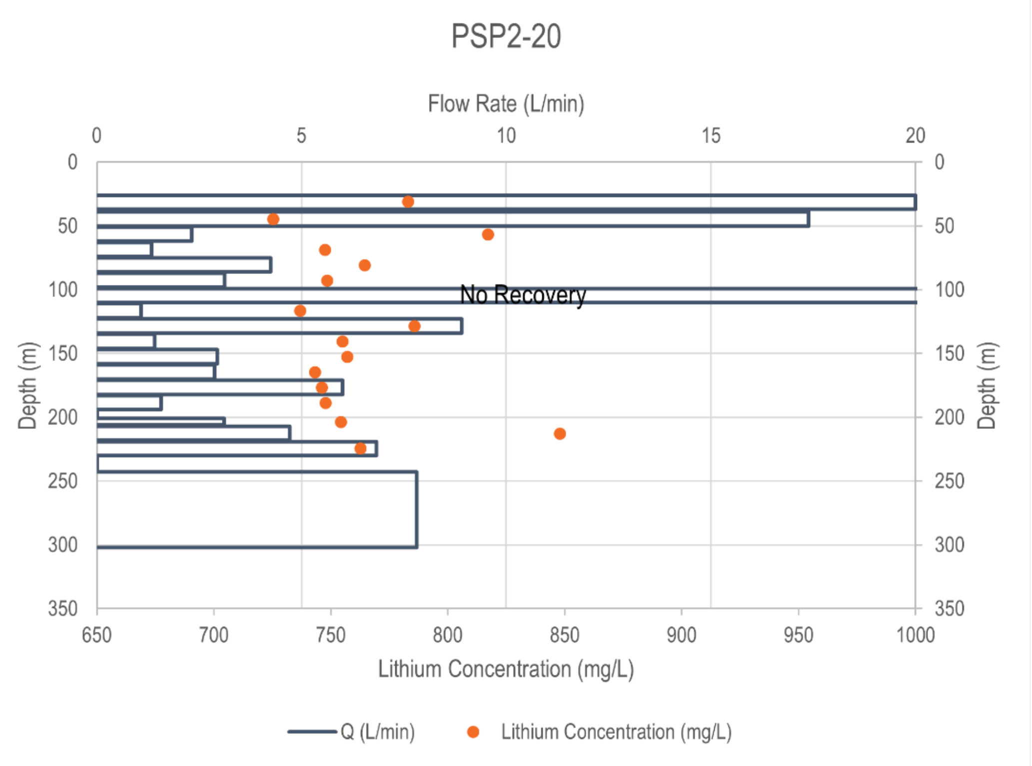


Figure 7-9. Packer Test Results for Deep Characterization Borehole PSP2-20

PSP3-20 is located in the eastern portion of the Western Subbasin. The borehole was advanced to a total depth of 101.5 m bgs; bedrock was not encountered. The lithology here is primarily clastic and markedly different from either PSP1-20 or PSP2-20. Massive fine-grained silts and clays, becoming progressively dense and compact, are present from ground surface to total depth. Isolated factures filled with gypsum occur below 70 m, and halite is notably absent. Unconsolidated clastic sediments with gypsum and iron oxide, and organics, were noted in the upper 98 m. Lithified sands and clays, resembling conglomerate, were noted in the deepest interval (98–101.5 m bgs). The geophysical logs and lithology for this boring are provided in Figure 7-10.

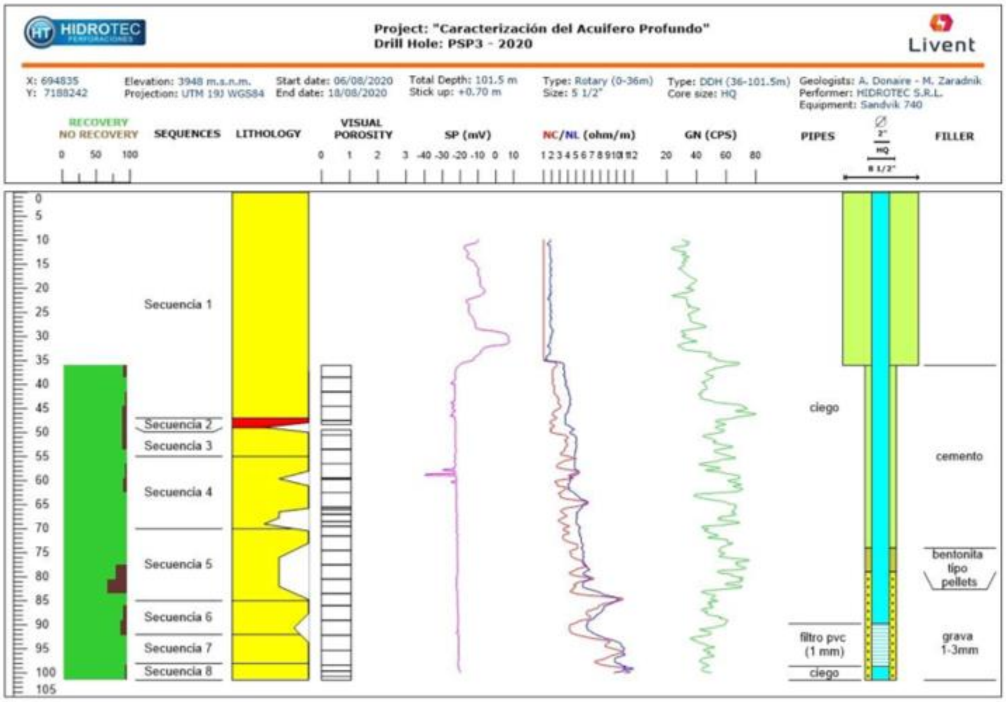


Figure 7-10. Geophysical Logs and Lithology for Deep Exploratory Borehole PSP3-20

Once the borehole was finished to total depth, inflatable packers were used to isolate intervals within the borehole for sample collection and to measure flow rates. The first interval was 8 m in length and the following three intervals were 11 m, whereas the deepest interval was 17 m in length. A total of nine brine samples (including duplicates) were collected at various depth intervals throughout the borehole. Lithium concentrations ranged from 919 to 979 mg/L. The highest concentration of lithium (979 mg/L) was detected in the sample collected from 84.5–101.5 m bgs. Graphical results (Figure 7-11) show a positive trend of lithium concentrations with depth.

Measured flow rates were lower at PSP3-20 than either of the other two boreholes, averaging approximately 2.3 L/min per interval. The higher apparent flow rate in the deepest interval is consistent with shallower intervals after taking into consideration the longer packer interval.

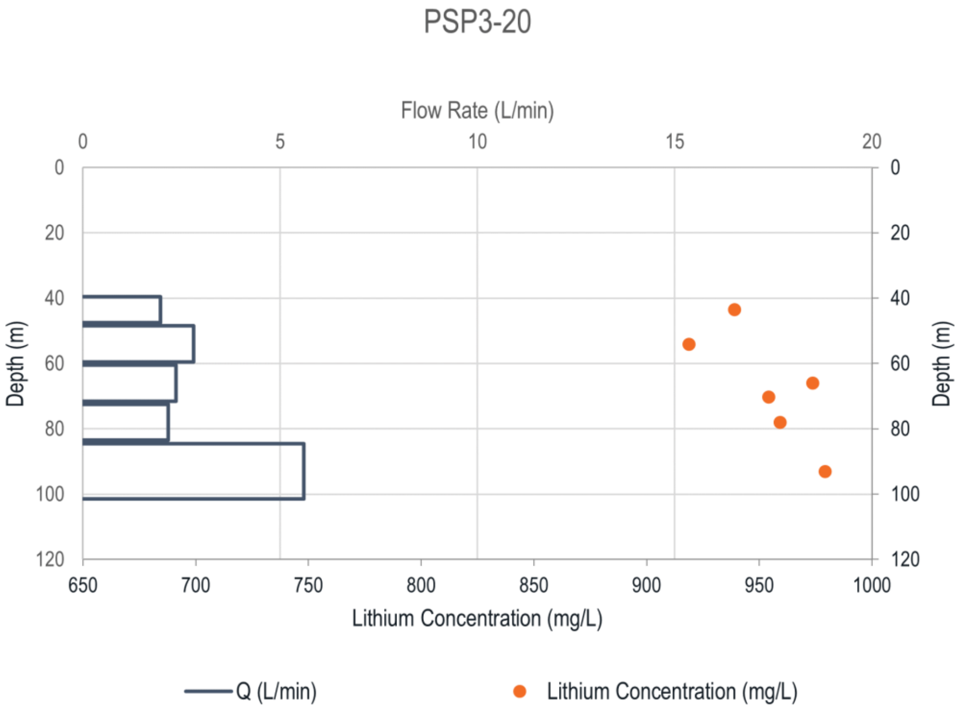


Figure 7-11. Packer Test Results for Deep Characterization Borehole PSP3-20

7.2.3 Lithium Brine Production During Operations

As previously described, Livent operates two lithium brine production well batteries: 1) the PWB located in the approximate center of the Western Subbasin, and 2) the SWB located south of the PWB near the southwest margin of the basin (Figure 7-12). The PWB pumping has been operating at essentially a constant rate of 1,000 m^3/h since 1997, and the SWB has been operating at roughly 600 m^3/h since pumping began in 2013. In June 2021, the average depth to brine in the five active PWB lithium brine production wells and two active SWB wells was 1.94 and 1.88 m bgs, respectively. High volumetric flow rates and minimal drawdown in the lithium brine production wells confirms the reservoir is suitable for brine extraction.

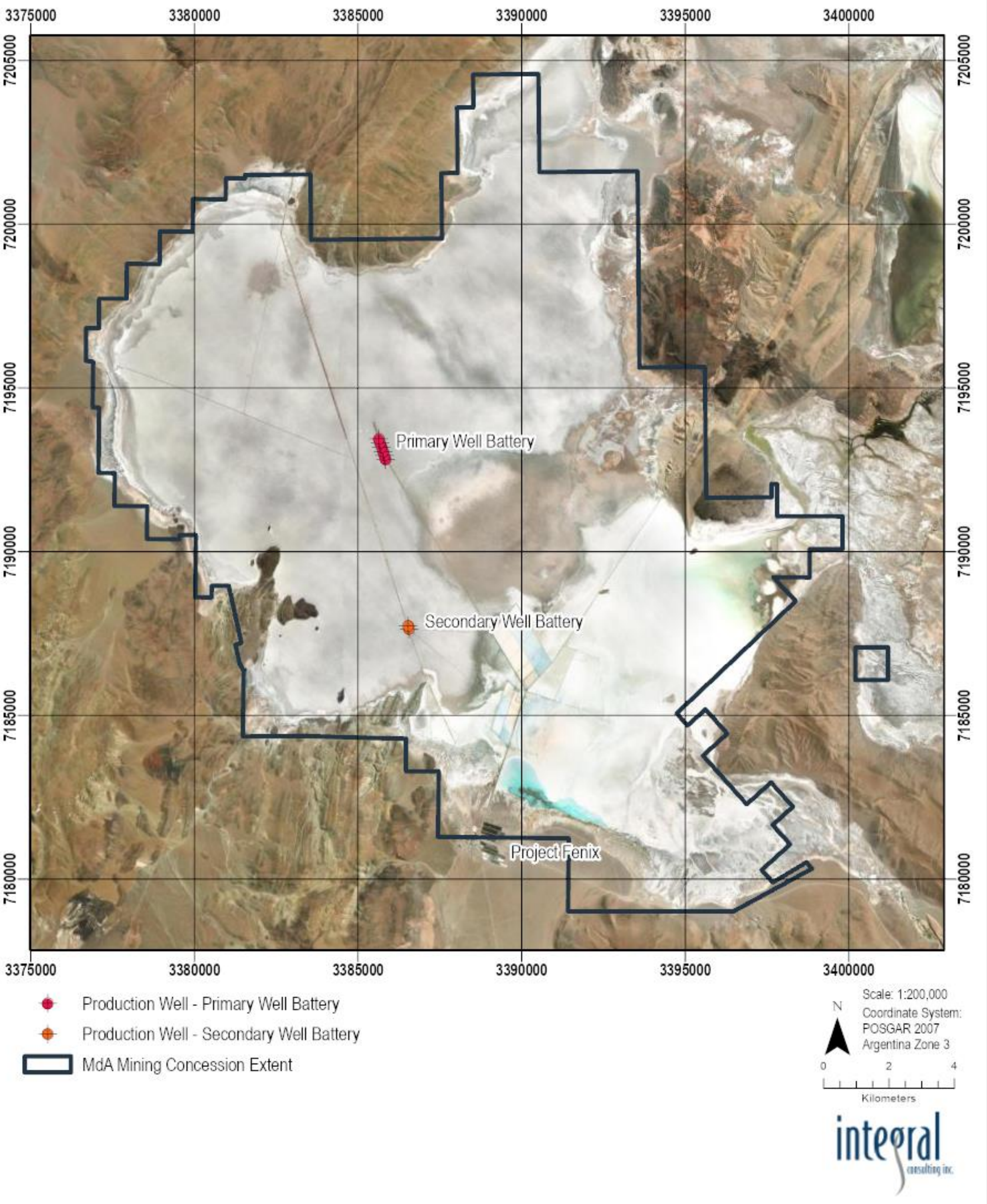


Figure 7-12. Primary and Secondary Lithium Brine Production Well Batteries

The concentration of lithium in brine produced from the PWB and SWB over the past 20 years is shown graphically in Figure 7-13. The PWB has consistently produced brine with lithium concentrations between 700 and 800 mg/L. At startup in 2013, the SWB produced brine with lithium at lower concentrations than the PWB. However, in recent years, the SWB has produced brine with nearly identical lithium content as the PWB. This pattern of increasing concentrations followed by a period of relatively stable concentrations occurs shortly after pumping begins when localized lower grade brine is removed and is replaced with higher grade brine, which is consistent with the broader resource.

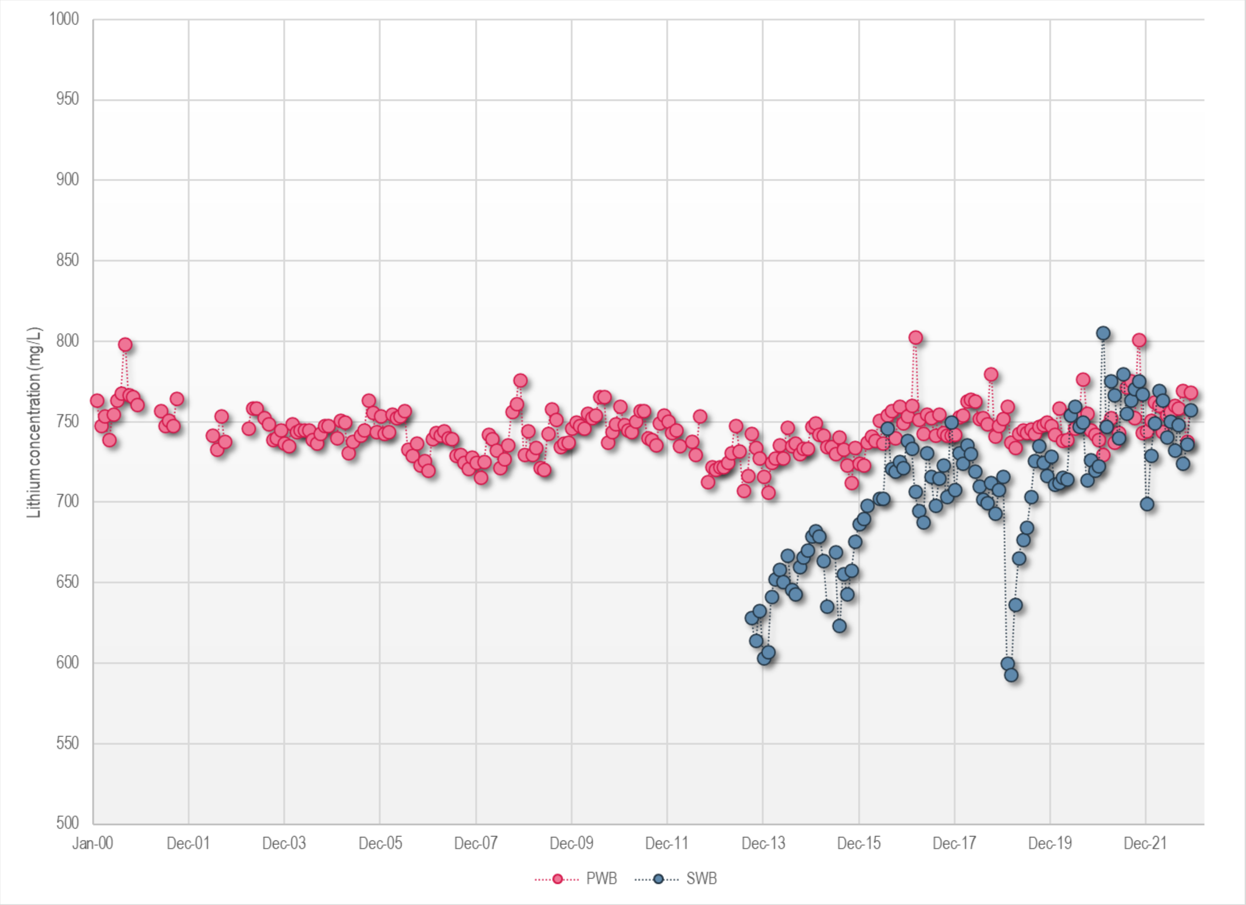


Figure 7-13. Lithium Concentration in Brine Produced by the Primary and Secondary Well Batteries

7.3 HYDROGEOLOGY

Fresh water primarily enters the SdHM brine reservoir from both streams and groundwater discharges from basin-bounding alluvial aquifers (and potentially from adjacent rock formations). Characterization of the hydrogeology of SdHM was initiated for the brine reservoir during site characterization in 1992, and for the alluvial aquifers during the 1993 site investigation. Hydraulic testing—including slug tests, packer tests, step-drawdown, and constant-rate pumping tests, and core sampling—has been conducted in boreholes and wells drilled in the brine reservoir to evaluate the lithium reserve. Constant rate pumping tests were also completed in the Rio Trapiche and Rio de Los Patos alluvial aquifers before reservoir development to evaluate the water balance and freshwater supply. Hydraulic testing results are summarized in Table 7-3. Estimates of hydraulic conductivity from results of previous investigations were not reevaluated or reanalyzed during preparation of this report and are presented as is; however, 25 years of operational data exist to support the conclusions made from pre-development data.

Table 7-3. Hydraulic Conductivity Measured During Exploration

Unit	Test Type	K (m/day)				
		Number Results	Minimum	Average	Maximum	Geometric Mean
Halite	Slug Injection Test	2	0.1	0.12	0.13	0.11
Halite	Packer Test	21	0.35	31.3	120	18.5
Halite	Constant Rate Pumping Test	5	340	2,156	6,120	1,046
Transition	Packer Test	1	NA	0.36	NA	NA
Alluvium	Specific Capacity Test	7	2.9	10.4	25	8.46

Notes:
Only tests with reported results included in summary.
m/day = meters per day
Constant rate pumping test hydraulic conductivity approximated from transmissivity using thickness of 50 m.

7.3.1 1992 Brine Reservoir Evaluation

A total of 22 packer tests were conducted in 11 of the 2000-series boreholes/wells between 0 and 46 m bgs during the 1992 site investigation. Packer tests were conducted by isolating a 5-m interval using a nitrogen-inflated packer, pumping three borehole volumes at a measured flow rate using a suction pump, and recording drawdown in the sample interval. For the two intervals in which the permeability was too low for pumping, water was injected and water levels measured during a falling-head slug test. Results were evaluated using the Hvorslev method and ranged from 0.1 to 120 m/day, with a geometric mean of 10 m/day. Specific yield was also calculated from cores as discussed in Section 7.1.

7.3.2 1993 Brine Reservoir Evaluation

Step-drawdown tests were first conducted at each of the 3000-series pumping wells using electrical submersible pumps. Tests were completed to estimate well yield and efficiency and to determine the optimal rate for constant-rate tests. Discharge was pumped at least 500 m from the site through 15-cm PVC pipe with flow controlled using a gate valve at the wellhead, and brine levels were monitored in the pumping well to the nearest ±1 mm using a 25-mm access tube. A weir tank was used to record flow.

Simultaneous constant rate pumping tests were then conducted in the 3000-series pumping wells and observation wells for a period greater than 20 days. Electrical submersible pumps were used in two wells, and a surface turbine pump was used in one well. Wells were pumped at rates between 31 and 37 L/s. Water levels were monitored in the pumping well, three adjacent observation wells, and next closest 2000-series well installed in 1992 (WMC 1994) to the nearest ±1 mm using a water level probe with measurement intervals increasing geometrically. Results of the tests are summarized in Table 7-3. Transmissivity ranged from 17,000 m^2/day to 306,000 m^2/day in wells 3020 and 3030, respectively. High transmissivity values are attributed to presence of fractures, with lower values representative of the aquifer at a semi-regional scale (WMC 1994).

Dispersion tests were conducted during the constant discharge tests to support reserve modeling by introducing a sodium fluoride solution of known concentration at the observation well 10 m from the pumping well and then collecting samples from the pumping well for onsite fluoride analysis using a benchtop pH/ISE meter and fluoride electrode (WMC 1994).

7.3.3 1993 Alluvial Aquifer Evaluation

Specific capacity tests were run on seven of the eight wells installed in the alluvium (alluvial wells 4001 through 4008) surrounding SdHM (WMC 1994). Wells were pumped at rates between 79.5 and 142.5 m^3/day for a total of approximately 5 hours and drawdown was measured in the well. Results were used to calculate hydraulic conductivity of the alluvial aquifers, assuming 60% well efficiency, and ranged from 6.6 to 25 m/day for the Rio de Los Patos alluvial aquifer and 5.3 to 14.3 m/day for the Trapiche alluvial aquifer (WMC 1994). Additional discussion of the alluvial aquifers is provided in Section 15.3.

7.4 SIGNIFICANT RESULTS AND INTERPRETATION

In the QPs’ opinion, the geologic and hydrologic framework necessary for understanding the fundamental processes governing fluid movement (i.e., groundwater and brine) at SdHM are well understood. Data collected by Livent prior to development laid the foundation for 25 years of reliable lithium production. Additional data collected during operations and deep exploration both support and refine the initial conceptual site model.

Pre-development exploration work utilized proven technology and protocols to define the geology, hydrogeology, and chemistry of the lithium-bearing brines of SdHM, with particular focus on Livent’s mining concession in the Western Subbasin. Borehole drilling, coring, packer test sampling, surface and downhole geophysics, pump testing, and laboratory analytical chemistry all contributed to a solid understanding of the lithium brine reservoir.

Exploratory work in 2017 and 2020, subsequent to the start of operations in 1997, further contributed to the understanding of the lithium resource. Operational data, in particular flow and chemistry data of produced brine over a period of 25 years, demonstrate the adequacy of the resource.

8 SAMPLE PREPARATION, ANALYSIS, AND SECURITY

Core and brine samples have been collected from boreholes and wells drilled in SdHM since site characterization was initiated in 1992, as discussed in Section 7. Core samples were collected during the 1992 site investigation and analyzed for S_y. Brine samples have been collected from discrete intervals of packer-isolated boreholes, from operating well batteries, and from monitoring wells constructed in SdHM. Sampling methods, preparation, and analysis vary by sampling event and type. Samples are considered to varying degrees in evaluating the resources and reserves, based on the collection method and time, but holistically provide multiple lines of evidence and confidence in the estimates.

8.1 SAMPLING EVENTS

Samples have been collected from SdHM in several campaigns since 1992 to evaluate the pre-development and current *in situ* resources and reserves. Core and brine samples were collected from boreholes during the original investigations (WMC 1992, 1994), brine samples have been collected from the active operating well batteries since operations were initiated in 1997, brine samples have been collected from the brine monitoring wells installed in the SdHM in 2017, and several times in 2020 through 2022. Additionally, brine and core samples were collected during the 2020 Deep Characterization Program.

8.1.1 Pre-Development Sampling

WMC prepared core laboratory and hydrological monitoring procedures documents for the 1992 site investigation and provided supervision for MdA personnel completing the work as summarized in the 1992 report (WMC 1992). The proposed sampling frequency of 20% (0.1-m sample per 0.5 m of core) was reduced to 13% due to sample quality or recovery; however, a total of 892 core samples (89.2 m of core) were collected and analyzed in the field during the 1992 site investigation to calculate S_y as discussed in Section 7.1.1. Total interconnected porosity was calculated using Archimedes method, whereby an object is weighed in two different media of known density and the weights are used to calculate its volume. S_r was also calculated in the field and used to calculate S_y. All samples were fully saturated and then weighed after 5 seconds with a subset of 44 core samples (approximately 5%), then weighed again after 5 days of gravity drainage. This subset of samples was used to develop a ratio of 5-second/5-day S_r of 0.59 and used to calculate S_y for all 892 samples by subtracting 5-day S_r from the total interconnected porosity.

A subset of 28 of these samples was selected to represent a range of low, medium, and high yields and minimize bias, and submitted to Corelabs in Denver, Colorado, an independent geotechnical laboratory, for confirmation laboratory analysis. Samples submitted measured approximately 6.35 cm in diameter and were assigned unique eight-digit IDs where the first four numbers represented the borehole ID and last four numbers represented the sample depth. Each core sample was weighed to the nearest 0.0001 g after drying at 55°C to a constant weight and dimensions measured to the nearest 0.001 mm using digital calipers in accordance with ASTM D4543-85. Bulk volumes were calculated by multiplying core length and area. Each core was then placed into a matrix cup and pore volume measured using the CORELAB AutoPorosimeter™. A quantified volume of helium at known pressure was injected and pore volume calculated using Boyle's law. This in turn was used to calculate the matrix volume, total interconnected porosity, and density of cores. Laboratory tests showed good correlation with the field measurements and confirmed they were accurate and unbiased. Results of the 1992 field program are the primary source of S_y data used to prepare the resource estimates.

Brine samples were collected from surface holes and packer-isolated discrete borehole intervals using procedures outlined in the *Manual on Hydrological Monitoring Program and Cata Drilling* prepared by WMC. This document was not available to the QPs, and pre-development sample collection procedures cannot be discussed. A total of 95 samples were collected from surface holes and 78 samples were collected during packer testing. Brine samples were submitted for analysis of sodium, potassium, calcium, magnesium, lithium, sulfate, and borate using ICP spectroscopy and analysis of chloride using titration at the Livent (formerly FMC) laboratory in Bessemer City, North Carolina.

Concentrations of lithium, potassium, and borate were provided by WMC (1992) as cross plots (concentration versus depth), but raw data were not provided to Integral to allow for an independent evaluation of the *in situ* resource. Cross plots were digitized independently by two different Integral personnel and then averaged to generate a concentration dataset. Figure 7-3 shows the cross plot of all lithium and potassium concentration data versus depth reconstructed by Integral from WMC (1992) reported data.

Additional samples were collected and submitted for QA/QC at the laboratory, but it is not clear from the report how many of those samples were collected from brine. In addition to the internal QA/QC presumed to have been completed at the laboratory, the analytical procedures and laboratory results were screened using the cation-anion balance. More than 88% of the brine samples had errors of less than 1% difference and the remainder were below 1.5%; therefore, all parent brine samples are included in the pre-development resource analysis. Results of pre-development sampling and their inclusion in the analysis is supported by samples collected after brine extraction began.

8.1.2 Operational Sampling

Aggregate samples have been collected on a daily basis from the PWB plant feed since 2000 and from the SWB plant feed since 2013. Spent brine sampling occurs on a weekly basis. Samples collected from other mine components (pre-concentrate ponds, FSB ponds, and from control points within the processing plants) are not within the scope of this report. Samples collected are analyzed at the onsite MdA laboratory for lithium, boron, calcium, potassium, magnesium, sodium, and sulfur by ICP-OES. Aggregate PWB and SWB sample results were averaged for each month of active operations and provided to Integral. A total of 358 average monthly results, representing a much larger daily data set, are shown in the box and whisker plot of lithium concentrations in Figure 8-1. The greatest variability in brine concentrations occurred in the period when the SWB began producing brine (2013). Brine variability remained higher through 2019 than prior to SWB operations, but decreased in recent years as the lithium concentrations from the SWB begin to equilibrate toward concentrations representative of the broader resource.

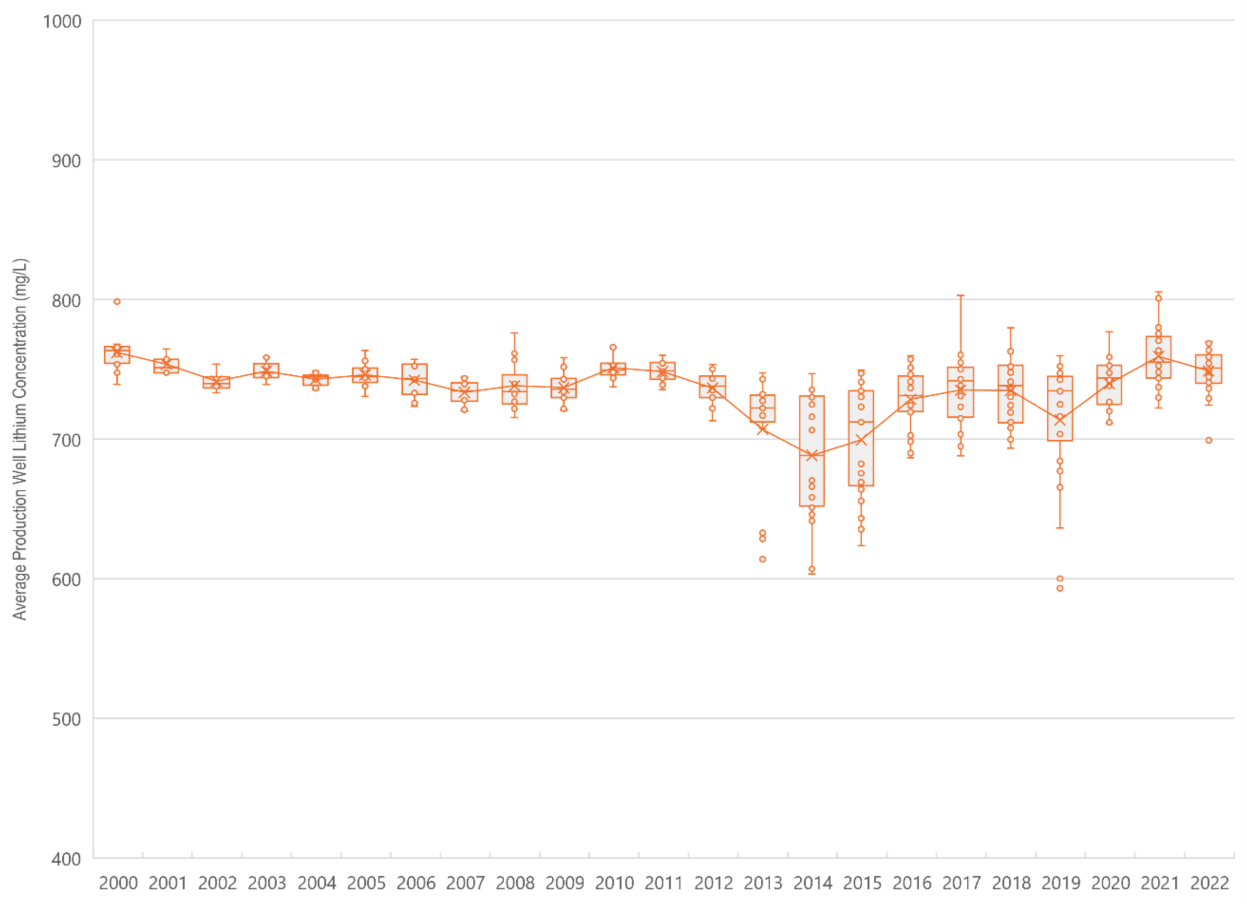


Figure 8-1. Variability in Average Lithium Brine Production Well Lithium Concentrations (2000–2022)

8.1.3 Brine Monitoring Well Sampling

In 2017, Livent installed 35 lithium brine monitoring wells at 10, 20, and 30 m depths in the Western Subbasin of SdHM. Monitoring wells were sampled by lowering a submersible pump and extracting 3 times the volume of the well before sample collection. Samples were sent to

Livent's onsite quality control laboratory for compositional analysis by ICP-OES. Depths to brine measurements and samples were collected in 2017 and several times from 2020 through 2022.

8.1.4 Deep Characterization Sampling (2020)

In 2020, three boreholes were cored and packer tests were employed to collect brine samples at various discrete depth intervals during drilling. In general, boreholes were advanced at 12-m increments, rods were then raised to expose the newly drilled interval, and a simple packer system lowered into the open borehole. The packer system included two packers inflated using nitrogen gas to approximately 50–90 pounds per square inch (psi) and used to isolate the upper portion of the borehole from the sample interval. Brine was evacuated from the borehole using a 7-bar air compressor and downpipe airline. A total of three borehole volumes of the target sample interval were purged prior to sampling. Parameters including electrical conductivity, temperature, pH, and density were measured and recorded for samples, which were collected in bottles during purging. Brine samples were collected by Hidrotec Drilling personnel and delivered to MdA personnel.

Samples from PSP-01 through PSP-03 were submitted to MdA's onsite laboratory and analyzed for aluminum, arsenic, boron, barium, calcium, density, iron, potassium, lithium, magnesium, sodium, sulfur, silica, zinc, pH, conductivity, chloride, and alkalinity. Duplicate samples collected from deep characterization boreholes were sent to SGS Laboratories in Salta, Argentina, for analysis of density using ASTM Method D7777-13 and lithium using SGS Method 113. Samples were also analyzed by SGS Laboratories for alkalinity, chloride, conductivity, barium, boron, calcium, strontium, iron, magnesium, manganese, sodium, potassium, zinc, nitrate, pH, total suspended solids, total dissolved solids (TDS), and sulfate using standard analytical methods.

8.2 QUALITY CONTROL/QUALITY ASSURANCE PROCEDURES

Samples from the initial reserve estimates in 1992 and 1994 were analyzed in the field for density, pH, and temperature. They were then packaged and shipped to the FMC QA/QC labs in Bessemer City, North Carolina, for compositional analysis by ICP-OES using a validated instrument and a proprietary analytical method already established by FMC. Each sample was analyzed 10 times. Prior to analysis of each batch of samples, a synthetic standard of known and similar composition was analyzed as a calibration check.

Once lithium brine production had commenced, regular samples taken from the primary wells and the secondary wells installed in 2013 were analyzed onsite by the MdA laboratory using the same analytical method and techniques developed in the Bessemer City QA/QC Labs. Prior to analyses, the ICP is calibrated with a 10,000 parts per million (ppm) lithium standard.

8.2.1 Control Laboratories

Livent routinely sends split samples to both its onsite laboratory and external laboratories including Servicio Geológico Minero Argentino (SEGEMAR), SGS, and Alex Stewart laboratory for quality assurance purposes. In 2017, a subset of samples collected from monitoring wells PS-03 through PS-13 was analyzed at both the onsite laboratory and SEGEMAR Laboratory. In 2020 during the Deep Characterization Program, samples were submitted to SGS in Salta. More recently in 2022, 52 samples were collected from onsite wells and analyzed at both the MdA laboratory and Alex Stewart laboratory in Jujuy.

8.2.2 Correlation between Lithium Grades Measured at MdA and External Laboratories

Figures 8-2, 8-3, and 8-4 show the correlation between analysis at an external laboratory and the MdA internal laboratory. In the 2017 data, analytical results from MdA internal laboratory were consistently higher than results from the SEGEMAR laboratory (Figure 8-2). MdA laboratory protocol included sodium chloride addition to the calibration standard matrix because MdA learned over many years that calibration standards should have dissolved solids (salt) chemistry mimicking brine to accurately quantify lithium content. Lower values provided by the SEGEMAR laboratory are likely due to the use of a calibration standard that did not include TDS (sodium chloride addition) to simulate a brine solution matrix. Analytical results for the 2020 samples sent to SGS and MdA, and 2022 samples sent to Alex Stewart and MdA are well correlated with R^2 values of 0.91 and 0.99, respectively (Figure 8-3 and Figure 8-4).

The QPs' opinion is the data reported by MdA's internal laboratory are accurate and acceptable for estimating resources at SdHM.

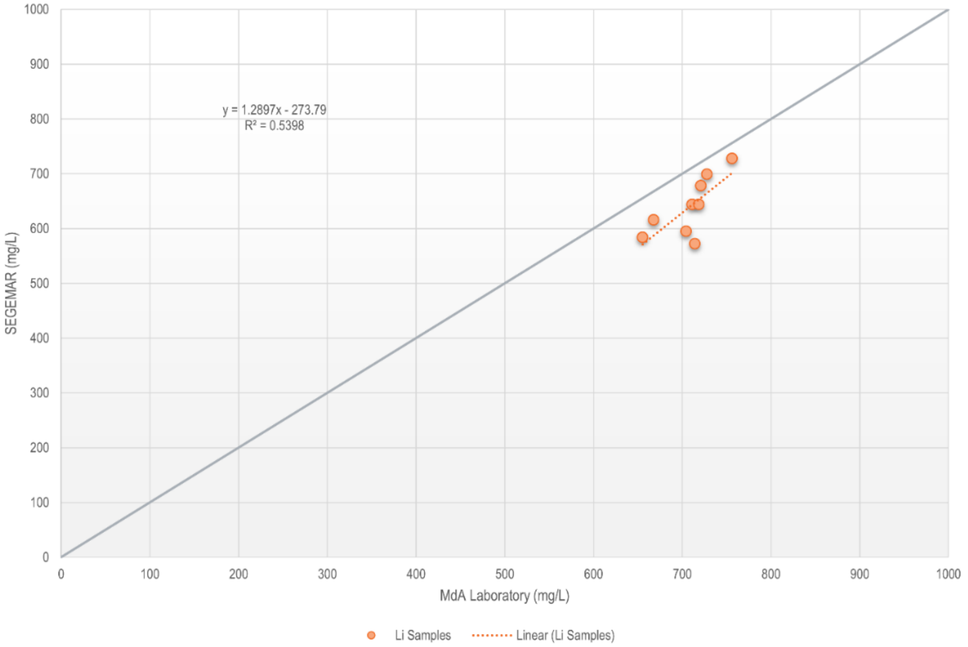


Figure 8-2. Comparison of Lithium Concentrations between MdA's Laboratory and SEGEMAR Laboratory

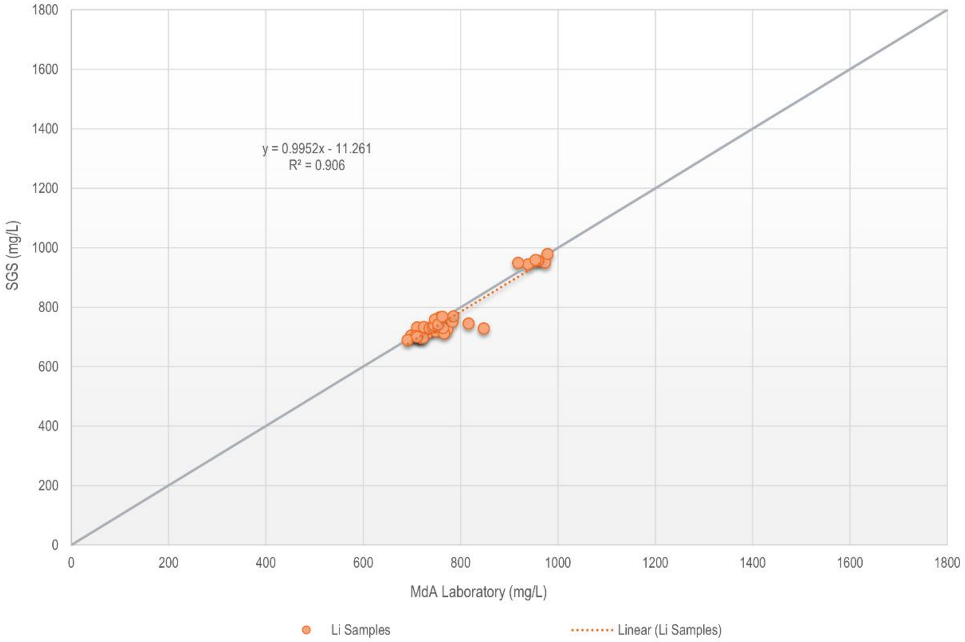


Figure 8-3. Comparison of Lithium Concentrations between MdA's Laboratory and SGS Laboratory

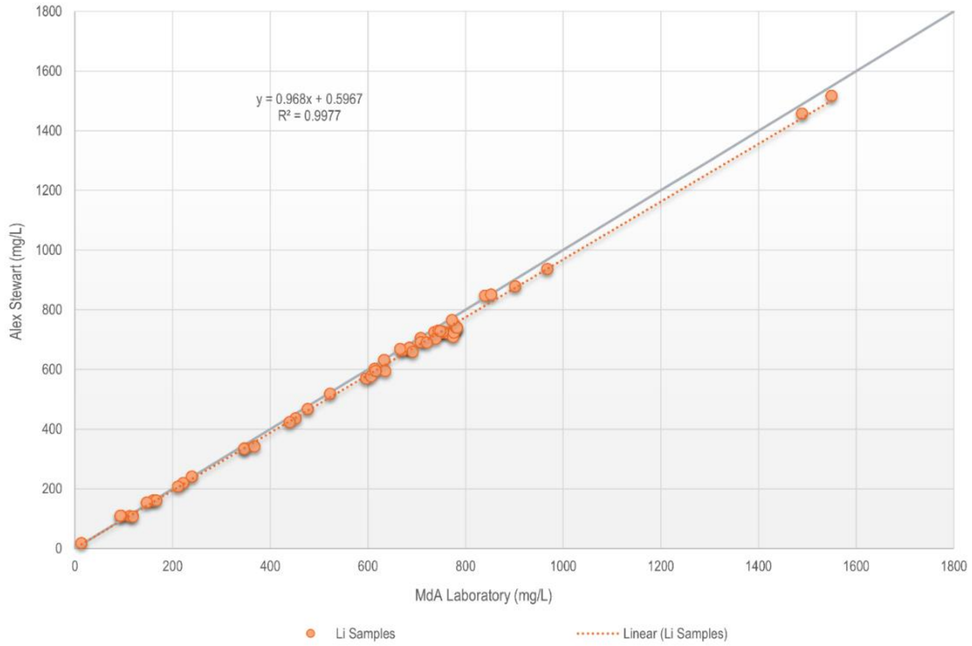


Figure 8-4. Comparison of Lithium Concentrations between MdA's Laboratory and Alex Stewart Laboratory

8.3 OPINION ON DATA ADEQUACY

Pre-development sampling and quality assurance programs (WMC 1992, 1994) were conducted in accordance with industry standard practices at the time of the investigations.

Duplicate samples for chemical analysis have been collected from various locations across SdHM, including from brine and freshwater monitoring wells, ponds, lithium brine production wells, and process components. These duplicate samples have been concurrently analyzed by Livent's onsite laboratory, the Alex Stewart laboratory in Jujuy, Argentina, and the SGS laboratory in Salta, Argentina, and are in good agreement across the continuum from fresh water to saturated brine.

The agreement between quality assurance samples collected in duplicate during the installation of the brine monitoring wells, split between Livent's laboratory and a commercial laboratory, were less favorable—likely due to differences in brine sampling and analysis techniques. However, the QPs maintain that Livent's onsite laboratory has years of experience with lithium analytical techniques for brine samples, and it is our opinion that Livent's laboratory results are reliable and accurate.

The historical data previously used to estimate resources (WMC 1992; Integral 2016) were not reevaluated in a comprehensive QA/QC program for this report. However, the QPs do not view this as a deficiency in developing a resource estimate for SdHM. Instead, the QPs take a holistic view toward all data collected prior to and during operations to support resource estimates discussed in later sections. The QPs' opinion is the sample preparation, security, and analytical procedures are adequate.

9 DATA VERIFICATION

9.1 DATA VERIFICATION PROCEDURES

Integral developed and continues to maintain an environmental monitoring database including select operational data (e.g., spent brine and PWB and SWB flow rates and brine quality). Ongoing database maintenance includes steps for data verification in keeping with industry standard practices.

Integral prepared estimates of the original (1992) lithium and potassium resource using aquifer volumes determined from aerial photographs and maps of the concession boundary provided by FMC. Aquifer parameters (S_y) determined from drill cores and lithium/potassium grades (concentrations) in brine from packer tests were obtained from the 1992 WMC report. FMC was not able to locate the underlying tabulated data for S_y and lithium/potassium concentrations generated by WMC. Therefore, Integral reconstructed the data by digitizing data points on cross plots available in WMC (1992, Appendix G). Data were digitized twice, by two separate Integral staff, and compared to allow for identification and correction of digitizing errors.

9.2 LIMITATIONS

The QPs inspected the site on multiple occasions. During site visits, the QPs inspected facilities during operations and key features outside the boundaries of the facility. The QPs monitored freshwater stream conditions (Rio Trapiche and Rio de los Patos), inspected core boxes, observed monitoring well installations, toured the Project Fenix laboratory, and interpreted site geophysical data.

The QPs cannot verify data collected prior to development or reported by third parties. Unless expressly mentioned, it should be assumed that the QPs did not verify data provided by Livent. However, Livent's QA/QC practices typically include verification by independent laboratories.

9.3 OPINION ON DATA ADEQUACY

In the QPs' opinion, the data are wholly adequate to support the analyses and interpretations of lithium resources and reserves as described herein. Livent has been continuously operating Project Fenix since 1997. Its track record of historical operations provides valuable supplemental information to support our opinions.

The approach, methods, and procedures described in reports the QPs reviewed in preparation of this report appear to conform to industry standard practices. The QPs consider data provided by Livent and its subcontractors reliable and have the opinion that potential errors or omissions in those reports would not significantly affect the resource or reserve estimates presented herein. The QPs' opinion is the data upon which resources and reserves are estimated are sufficient and reliable.

10 MINERAL PROCESSING AND METALLURGICAL TESTING

Livent's process for extracting lithium from the brine resource is to pump the lithium-bearing brine from the lithium brine production wells into the SA Plant or, optionally, into pre-concentrate ponds, for solar concentration prior to going to the SA Plant. The SA Plant includes the lithium production facilities and related chemical processing plants in the Western Subbasin of the SdHM property owned and operated by MdA. It uses treated fresh water and a proprietary adsorption process to selectively remove the lithium from the brine. At the SA Plant, the process stream is further concentrated and polished to remove multivalent ions. The polished stream leaves the SA Plant as concentrated lithium brine and is further concentrated in solar evaporation ponds called FSB ponds. The residual barren brine and freshwater mixture (generally referred to as spent brine) is sent to the artificial lagoon where it evaporates or infiltrates back into the Salar. Some of the FSB is sent to the Carbonate Plant, where it is reacted with soda ash to produce battery- or technical-grade lithium carbonate. The remaining FSB is sent offsite to the Güemes Plant where it is used to produce high-purity lithium chloride. A mineral processing diagram is provided in Figure 10-1.

Livent continues to process lithium at SdHM essentially the same way it has been since operations began in 1997. The only significant changes to operations occurred in 2012 when the pre-concentrate ponds and two additional lithium brine production wells went into service. Livent has begun expansion plans to increase lithium carbonate production. Plans for increased lithium carbonate production involve increasing brine and water extraction and throughput capabilities at the SA Plant, and increasing lithium carbonate production capacity. Considering its successful track record and historical performance, its plans for expansion are fundamentally sound and have lower risk than a similar operation at an unproven location.

Livent has its own analytical laboratory for testing of process streams and manufactured products, and also relies on third-party laboratories for certain analyses and data verification.

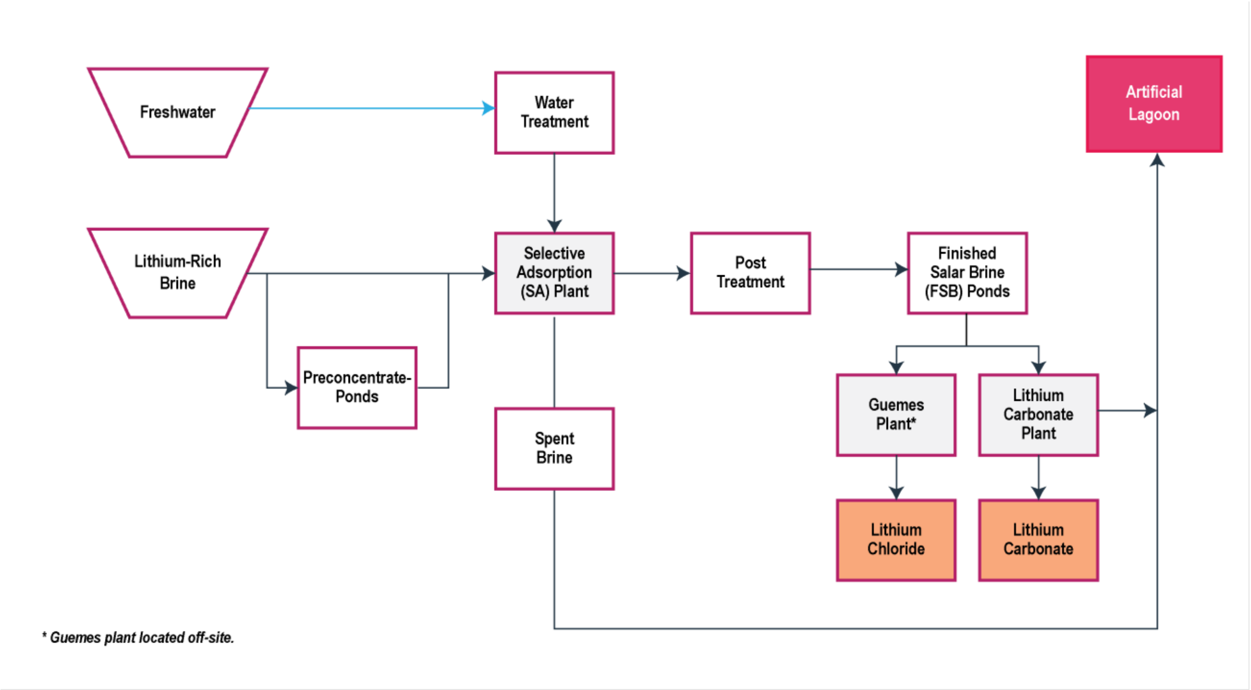


Figure 10-1. Mineral Process Diagram

11 MINERAL RESOURCE ESTIMATES

Mineral resource estimates for *in situ* lithium in the Western Subbasin of SdHM are presented in this section. We adopt the definition of a mineral resource from CIM (2014), which states:

> A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.

11.1 BACKGROUND

In the period prior to commencement of operations (1997) to the present, Livent's consultants have prepared several, independent preliminary mineral resource estimates using various methods and data sets. Those prior estimates do not conform to current industry standards for classifying resources. This report includes the first resource and reserve estimate for Project Fenix that complies with SEC regulations S-K 601(b) (96).

The current resource and reserve estimates provided in this report, as of December 31, 2022, do not rely on historical (pre-production) lithium grade information. Instead, they rely on data collected from an extensive monitoring well network, consisting of 35 wells across the Western Subbasin, installed in 2017, nearly 20 years after operations began. Historical data collected prior to development and data collected from deep exploration boreholes are used to estimate static reservoir properties that are assumed not to change. Historical resource estimates are presented for reference and to illustrate how well various resource estimates compare over time and across different estimation methods and data sets.

Prior to operations, WMC (1994) calculated pre-production lithium resources within the Contiguous Lease Area (Figure 3-3) using three different methods: classical (Thiessen polygons), and two different forms of kriging (block and panel). These prior resource estimates were not classified according to current industry standards (measured, indicated, or inferred), but were instead presented for 0–30 m bgs and 0–70 m bgs depth intervals based on the number of boreholes within those depth intervals.

In 2016, Integral performed an independent estimate of original (pre-production) lithium resources based on a re-analysis of the pre-development data (Integral 2016). Integral's estimates were performed blind—with access to all input data, but without access to the final resource estimates produced by WMC (1994). Integral estimated resources using four methods:

a single polygon across Livent's Contiguous Lease Area, two different methods involving Thiessen polygons around exploratory boreholes, and a lithology-based approach.

We used ordinary kriging techniques to estimate lithium resources pre-development and for September 2022. The pre-development resource estimate using kriging differed from prior methods in that it incorporated brine chemistry data from publicly available, third-party data sets for the Eastern Subbasin of SdHM (Montgomery & Associates 2011). The same approach was used for a resource estimate for September 2022, where lithium grade measured in brine monitoring network wells was used instead of lithium grade from pre-development boreholes. In addition, brine chemistry data from the Deep Characterization Program were used to inform lithium grade below the brine monitoring wells, at depths where lithium resources are assumed similar to pre-development conditions.

11.2 KEY ASSUMPTIONS, PARAMETERS, AND METHODS

Lithium resources in Livent's Contiguous Lease Area of SdHM have been calculated as described in the following discussion. A resource estimate represents the lithium mass in brine, at a specific point in time, that may be extracted by pumping or some other extraction method. The basic calculation of resource mass for compounds dissolved in brines is simply the product of the control (reservoir) volume, the brine-saturated S_y, and the concentration of a specific compound (e.g., lithium) in the brine.

The pre-production mineral resource for lithium was calculated for an area consisting of the Livent Contiguous Lease Area, using several related methods. For all methods, the area of analysis (i.e., the resource extent) included nearly all portions of the SdHM sedimentary basin within (not extending beyond) the Livent concession boundary. The only portion of the sedimentary basin within the concession boundary that was not included in the resource extent was the southeastern area that includes the alluvial fan of Rio Trapiche. That area was excluded because no borings had been conducted in the vicinity, and the potential for low-permeability sediments (silt and clay) and freshwater influx were high. However, we do not discount that future exploration could prove that this portion of the basin contains economic lithium resources.

All calculation methods used defined reservoir volumes consisting of polygons of nominal 10 m thickness (0–10 m, 10–20 m, etc.). For each reservoir volume, a S_y and concentration of lithium were applied to determine the mass of lithium resource within each volume. The calculated mass of lithium was then summed for multiple volumes to generate the resource estimate for the entire Livent concession. A brief summary of the methods used to estimate lithium resources is provided below. Additional detail on each method is provided in WMC (1992) and Integral (2016).

11.2.1 Method 1—Single Polygon Using Resource Extent within Livent Concession

Method 1 is the simplest of the resource calculation methods. Reservoir volumes were constructed using the entire resource extent within Livent's concession and nominal 10-m depth intervals, or slices. By this method, lateral variations in S_y and lithium concentration are not considered, and data from all boreholes for each 10-m slice (to 40 m depth) within the Contiguous Lease Area boundary were averaged and applied to that reservoir volume.

11.2.2 Method 2—Thiessen Polygons Defined by Boreholes

Lateral variability in S_y and lithium concentration can be captured by several techniques. One of the simplest techniques is to define a series of Thiessen polygons, subareas of the resource extent that are each defined by a single borehole.[1] Thiessen polygon boundaries are drawn as lines of equal distance between boreholes, such that any location within a given polygon is closer to its associated point (borehole) than to the point of any other polygon. By this method, the resource area is subdivided into a series of polygons, each of which is associated with its representative borehole. The S_y and lithium concentration data for a particular borehole are assigned to the reservoir volume defined by its associated Thiessen polygon and the depth interval of interest. The borings installed in SdHM in 1992 were of variable depth. Nearly all of the boreholes were drilled to depths of 30–40 m below grade. Sufficient spatially distributed S_y and lithium concentration data are available for 10-m intervals from 0–40 m. Figure 11-1 shows the Thiessen polygon approach using 1992 boreholes, with the most boreholes available for shallow intervals, and fewer boreholes available for deeper intervals. Below 40 m depth, only three boreholes were deep enough to provide data for resource calculations.

For each Thiessen polygon volume (polygon area multiplied by the 10-m depth interval), S_y and lithium concentrations from the polygon's borehole were averaged (if more than one data value was available for that 10-m interval). Mass of lithium for that polygon volume was determined by multiplying S_y by lithium concentration and by polygon volume. Resource estimates for each 10-m interval were determined by summing the mass of lithium for all polygons within that interval.

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[1] Other methods of handling lateral variability include extrapolation techniques such as kriging or triangulation of borehole data. Because of the limited data density, Integral used the simpler technique of defining Thiessen polygons for each borehole.

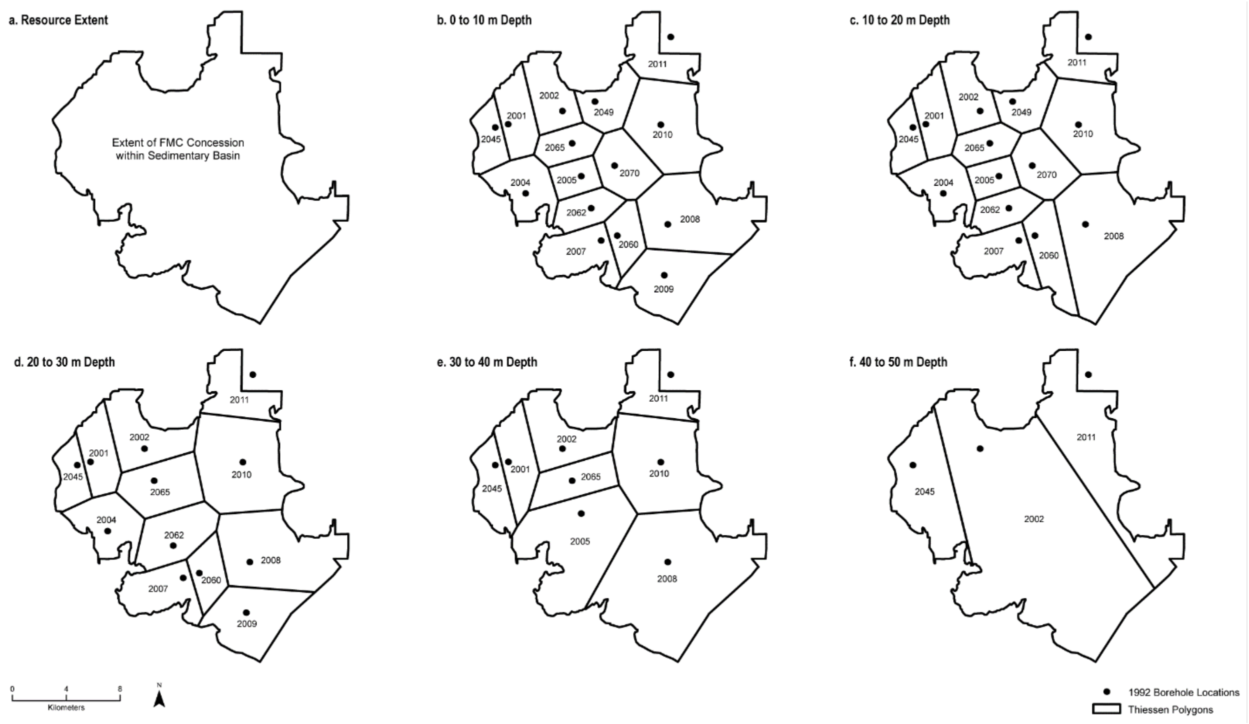


Figure 11-1. Thiessen Polygon Approach to Resource Assessment Using 1992 Exploratory Boreholes

11.2.3 Method 3—Thiessen Polygons with Lithologically Defined Specific Yield

A third method for calculating lithium resources was developed to represent lithologic controls on S_y. Geophysical and geological logs of the 1992 boreholes show significant intercalation of lithologies. For many boreholes, lithologies vary in vertical profile within nominal 10-m intervals. Consistent with the lithologic nomenclature presented by WMC (1992) on borehole geologic logs, Integral assigned one of five lithologies to each borehole interval:

1. Halite (pure)
2. Halite with sand
3. Halite with sand and clay
4. Clay with halite
5. Sand.

Each value for S_y was assigned its representative lithology, and an average S_y was determined for each lithology (with the exception of sand, which had no associated S_y values). Pure halite and halite with sand showed the highest S_y values, averaging 8.3%. Halite with sand and clay showed lower S_y, at 7.4%, whereas clay with halite showed the lowest value at 6.4%. Table 11-1 summarizes S_y values by lithology.

Table 11-1. Specific Yield by Lithology

Lithology	N	Specific Yield (S_y)	
		Mean (%)	Standard Deviation (%)
Halite (pure)	198	8.3	4.0
Halite with sand	63	8.3	5.0
Halite with sand and clay	270	7.4	3.9
Clay with halite	106	6.4	3.6

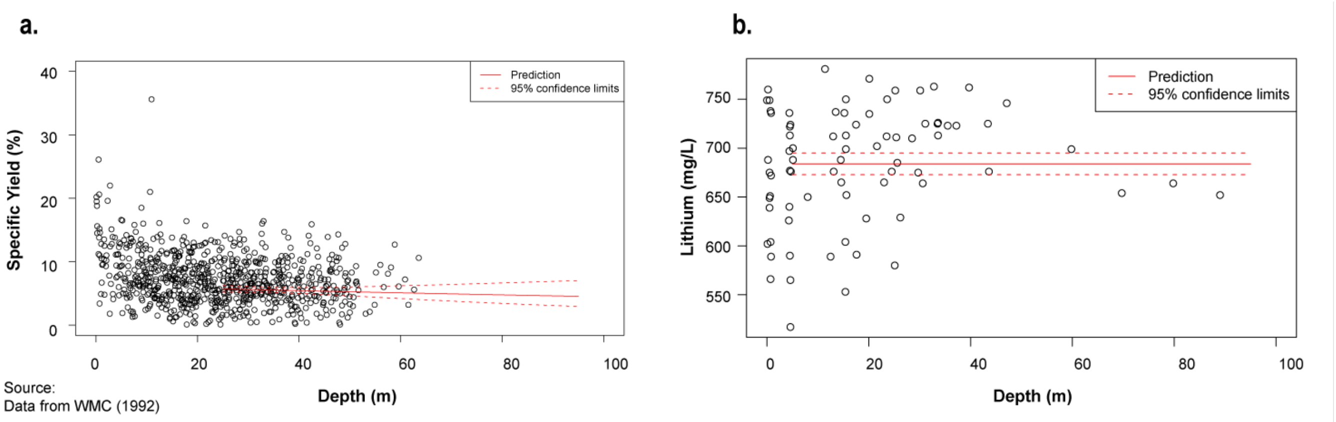
Note:
Sand (pure) was identified on geologic logs; however, no S_y values were available.
N = number of samples with both lithology and S_y

By review of geological/geophysical logs (WMC 1992), the vertical thickness of lithologies within each 10-m depth interval in each borehole was tabulated. A S_y was assigned to that interval based on the proportions of various lithologies present and their associated average S_y values. Lithium mass was calculated per Method 2 for each polygon volume, however, using lithologically defined S_y values.

11.2.4 Method 4—Single Polygon with Statistical Predictions of Specific Yield and Lithium Concentration at Depth

Because of the deficiency in spatial distribution of the S_y and lithium concentration data below 40 m depth collected during pre-development exploration activities, traditional calculation methods using data from deeper intervals were not possible. In this fourth method, we statistically evaluated all available S_y and lithium concentration data by way of linear regression analysis to develop predictive equations for these variables with depth. Statistics were performed using R software, Version 2.10.1 (R Development Core Team 2009).

Log-transformed S_y data were found to have a statistically significant correlation with respect to depth. A pattern of decreasing S_y with depth was revealed (Figure 11-2a), and a regression equation was developed to describe and predict S_y values versus depth. Uncertainties in the mean estimated values of S_y, as expressed by the 95 percent confidence interval about the regression predictions, were determined to support the uncertainty analysis in overall resource calculations.



Source:
Data from WMC (1992)

Figure 11-2. Prediction of Specific Yield and Lithium Concentration with Depth

We concluded that the arithmetic average of all observed lithium concentrations, irrespective of depth, was the most representative quantity for resource calculations under this method. The arithmetic average concentration for lithium was 684 mg/L, as no statistically significant change with depth was observed (Figure 11-2b). A 95 percent confidence interval on the mean was calculated using the Student's *t* statistic. To account for propagation of error in lithium mass calculations, we used the 95 percent confidence intervals for both S_y and lithium concentration to estimate the 95 percent confidence limits for the calculated mass values. This approach was chosen as a conservative method, which may slightly overestimate the true variance of calculated mass values. Average S_y and lithium concentrations were determined for each 10-m nominal depth interval from 40 to 100 m.

11.2.5 Method 5—Kriging

Kriging is an industry standard approach for estimating mineral grades among other physically based environmental variables. Kriging is an interpolation method based on geostatistical principles. There are different forms of kriging. However, at its core, the method relies on prior information (e.g., lithium concentration or specific yield measurements sampled from boreholes), and the basic assumption that two measurements closer together are more likely similar than two measurements at distance, to estimate values at previously unsampled locations. Two of the three methods from WMC (1992) relied on kriging (block and panel methods).

Recently, Integral applied the ordinary kriging method to historical, pre-development lithium concentration measurements to estimate lithium resources within Livent's concession. In this method, we used average lithium concentrations from pre-development boreholes and deep characterization boreholes located within 10-m intervals from ground surface to 60 m bgs. For each uniform thickness slice of control volume, we applied a constant value for S_y representative of halite from the corresponding depth intervals, by the same regression described in Method 4 above. We chose to use S_y measured in halite as a conservative measure (lower lithium mass) because the western subbasin is predominantly halite which has lower measured S_y than other, neighboring geologic materials present within Livent's concession (e.g., clastics or transitional halite-clastics). We also used publicly available lithium concentration data published by a third-party from the Eastern Subbasin (Montgomery & Associates 2011). Data from the Eastern Subbasin constrain the kriging interpolation at the eastern margin of the Western Subbasin. This approach created 10-m-thick layers of interpolated lithium resources. The lateral extent of each layer was clipped to the interior of Livent's concession and again to the perimeter of the Salar. The Western Subbasin brine reservoir is roughly bowl shaped. Thus, we assume the control volume decreases by 1% for each 10-m interval below 30 m as the lateral extent of the reservoir decreased with depth. Lithium resources by depth using the kriging method are summarized in Table 11-2.

Table 11-2. Pre-development and September 2022 Kriged Resource Estimates

Depth Interval (m bgs)	Area (m^2)	S_y	b (m)	Pre-Development				September 2022		
				Average Li Concentration (mg/L)	Li Resource (K Mt)	Type		Average Li Concentration (mg/L)	Li Resource (K Mt)	Type
0 - 10	3.00E+08	0.097	9/8.1	666	174	Measured		414	97	Measured
10 - 20	3.00E+08	0.072	10	674	145	Measured		645	139	Measured
20 - 30	3.00E+08	0.068	10	686	140	Measured		668	136	Measured
30 - 40	2.97E+08	0.066	10	702	138	Measured		773	152	Measured
40 - 50	2.94E+08	0.064	10	763	144	Indicated		763	144	Indicated
50 - 60	2.91E+08	0.065	10	786	149	Indicated		786	149	Indicated
60 - 100	2.82E+08	0.058	40	781	512	Indicated		781	512	Indicated
100 - 200	2.64E+08	0.046	100	735	892	Inferred		735	892	Inferred
Pre-Development Measured Resource (0–40 m)					***597***		--			
September 2022 Measured Resource (0–40 m)									*525*	
Indicated Resource (40–100 m)									*805*	
Total September 2022 Measured and Indicated Resource (0–100 m)									***1,330***	
Inferred Resource (100–200 m)									*892*	
Total September 2022 Measured, Indicated, and Inferred Resource (0–200 m)									***2,222***	

Notes:
Data from deep characterization boreholes PSP-01, PSP-02, and PSP-03 drilled in 2020 used to estimate indicated and inferred resource.
Area reduced by 1% of total for each 10-m interval deeper than 30 m bgs.
m = meters
m^2 = square meters
b = thickness of depth interval – reduced from 9 m pre-development to 8.1 m in 2022 due to observed drawdown
mg/L = milligram per liter
K Mt = thousand metric tons
-- = not available

We also applied the same kriging technique described above to estimate the resource in September 2022. However, this evaluation used lithium concentrations measured in brine monitoring wells, rather than lithium concentrations measured in pre-development boreholes as the basis for lithium grade interpolation in the 0–30 m interval. Below 30 m, we incorporated lithium concentration data measured in 2020, during the Deep Characterization Program. Pre-development and September 2022 resources estimated using kriging are summarized in Table 11-2.

11.3 HISTORICAL RESOURCE ESTIMATE SUMMARY

A summary of the preliminary pre-development resource estimates from WMC (1992) and Integral (2016) -utilizing pre-development data but without access to WMC's resource estimates- is provided in Table 11-3. Although these resource estimates rely on the same underlying pre-development data sets, they were calculated independently using multiple methods. The consistency between estimates is noteworthy and provides confidence in the general amount of pre-development lithium resource in Livent's concession within the Western Subbasin of SdHM.

Table 11-3. Historical Pre-Development Resource Estimate Summary

Depth (m)	WMC 1992 (K Mt Li)			Integral 2016 (K Mt Li)				
	Classical	Block Kriging[a]	Panel Kriging[a]	Method 1	Method 2	Method 3	Method 4	Average[b]
Interval Sums								
Sum 0–30[c]	408	403	411	412	404	410		409
Sum 0–40				542	541	560		548
Sum 0–50				640	639	658		646
Sum 0–70	851	870	880	826	826	845		832
Sum 50–100							444	

Note:
[a] Mean value presented in WMC (1992)
[b] Average of Methods 1–4
[c] Polygon volume for 0–10 m interval uses 9 m thickness, assuming depth to brine is 1 m bgs.
K Mt = thousand metric tons

11.4 HISTORICAL BRINE PRODUCTION

A summary of historical lithium brine production at the SA Plant, from 1997 through 2022, is provided in Table 11-4. By deducting the amount produced from the lithium resource from pre-development resource estimates, the resource remaining can be estimated. By comparison, we estimate the measured (0–40 m bgs) pre-production resource at 597,000 Mt using kriging (Method 5) of pre-production borehole data. We estimated the resource after approximately 25 years of lithium brine production (in September 2022) at 525,000 Mt, using the same kriging method, the same 0–40 m bgs "measured resource" interval, and a new lithium concentration data set (from brine monitoring network wells sampled in September 2022).

The amount of concentrated lithium brine produced through September 2022 was approximately 84,000 Mt, which is approximately 16% of the measured (0–40 m bgs) resource estimated as of September 2022. As a check, the pre-development lithium resource estimate, less 25 years of concentrated lithium brine production, is about equal to the September 2022 lithium resource estimate of 525,000 Mt (597,000 Mt – 84,000 Mt = 513,000 Mt, which is within approximately 2% of 525,000 Mt, c.f. Table 11-2). The difference between extracted and produced lithium mass is inherently returned to the Salar. The current resource estimate (December 31, 2022) was calculated in a similar manner, by discounting the amount of lithium produced after September 1, 2022 from the September 2022 lithium resource estimate.

Table 11-4. Historical Production from Selective Adsorption Plant

Year	Concentrated Lithium Brine (Mt Li)	
	Annual	Cumulative
1997	500	500
1998	2,254	2,755
1999	1,244	3,998
2000	2,394	6,392
2001	1,208	7,601
2002	842	8,443
2003	1,693	10,137
2004	2,770	12,907
2005	3,199	16,106
2006	3,237	19,342
2007	3,515	22,857
2008	3,788	26,645
2009	3,352	29,997
2010	3,383	33,380
2011	3,283	36,664
2012	3,455	40,118
2013	3,819	43,937
2014	4,302	48,239
2015	4,273	52,512
2016	4,545	57,057
2017	4,792	61,849
2018	4,406	66,255
2019	4,753	71,008
2020	4,708	75,716
2021	4,932	80,648
2022	4,903	85,551

11.5 CURRENT RESOURCE ESTIMATE INCLUSIVE OF RESERVES

In situ lithium resources, inclusive of mineral reserves, for SdHM at the end of 2022 are summarized in Table 11-5. This resource estimate assumes that brine produced from September 2022 through December 2022 originated from brine in the measured resource (0–40 m bgs) interval, as the PWB and SWB lithium brine production wells are constructed to a depth up to 40 m bgs. Because flow to lithium brine production wells is predominantly horizontal, and the existing well batteries do not extend below 40 m, it is unlikely lithium produced to-date originated from indicated (40–100 m bgs) or inferred (100–200 m bgs) resource intervals. A cut-off grade was not applied to this resource estimate (inclusive of lithium reserves) because economic viability is not a factor that affects the amount of resource in place. A cut-off grade of 218 mg/L, and the assumptions inherent, are tied to the resource estimate (exclusive of lithium reserves) because the cut-off grade was applied to the reserve estimate.

Table 11-5. Lithium Resource Estimate (inclusive of lithium reserves), as of December 31, 2022

Category	Lithium (K Mt)	Lithium Carbonate Equivalent (LCE) (K Mt)
Measured	523	2,783
Indicated	805	4,288
Total Measured & Indicated	**1,328**	**7,071**
Inferred	892	4,749
Total Measured, Indicated & Inferred	**2,220**	**11,820**

Notes:
K Mt = thousand metric tons
Values rounded to nearest thousand

11.6 CURRENT RESOURCE ESTIMATE EXCLUSIVE OF RESERVES

In accordance with SEC regulations 229.601 (b)(iii)(B)(11) and 229.1304, mineral resources must be reported exclusive of reserves. Lithium brine is a fluid resource that is not static and may migrate over time in response to various pumping stresses or environmental factors. Lithium resources, exclusive of reserves, were estimated by subtracting proven and probable reserves (discussed in Section 12) from the total (including reserve) *in situ* measured resource and indicated resource (Table 11-5). The assumptions, including process efficiencies, cut-off grades, and future operational conditions used to estimate mineral resources and mineral reserves, are discussed in Sections 12.2 and 13.3, respectively. Mineral resources (exclusive of reserves) on December 31, 2022, are presented in Table 11-6.

Table 11-6. Lithium Resource Estimate (exclusive of lithium reserves), as of December 31, 2022

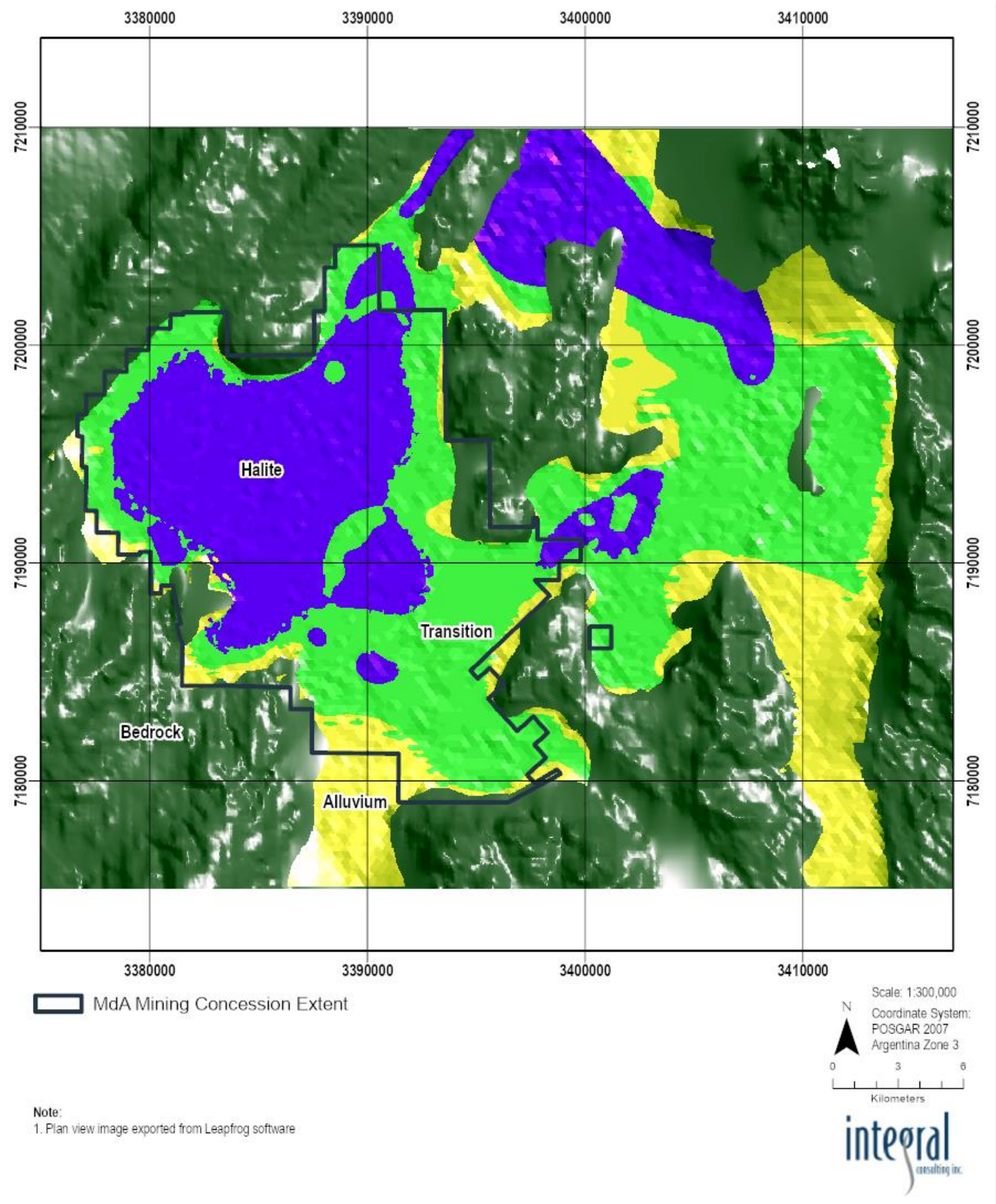
Category	Lithium (K Mt)	Lithium Carbonate Equivalent (LCE) (K Mt)
Measured	370	1,968
Indicated	228	1,212
Total Measured & Indicated	**597**	**3,180**
Inferred	892	4,749
Total Measured, Indicated & Inferred	**1,489**	**7,928**

Notes:
K Mt = thousand metric tons
Values rounded to the nearest thousand

11.7 GEOLOGICAL MODEL

A 3-dimensional geological model was prepared for SdHM using Leapfrog Works software (Version 2021.2). The model was developed to support parameterization of the variable-density flow and transport model used to estimate the lithium reserves. Borehole logs for the 1000-series (primary well battery), 2000- and 3000-series (pre-development exploration boreholes and pumping wells), brine monitoring wells, and deep characterization boreholes in the Western Subbasin were compiled along with borehole logs for the Trapiche alluvial aquifer and publicly available third-party boreholes and cross sections in the Eastern Subbasin of the SdHM.

Borehole logs and cross sections were generalized and grouped based on litho/hydrostratigraphic properties into four major units: 1) halite; 2) transition (mixed clastics and evaporites); 3) alluvium (coarse-grained clastics); and 4) bedrock. A plan view of the geologic model is shown in Figure 11-3 and vertical cross-section through the model (roughly aligned with the gravity profile in Figure 7-4) is shown in Figure 11-4. Areal extents of halite, transition, and alluvium were evaluated and digitized, and used to bound each of these units laterally. Pre-development gravity profiles and publicly available third-party cross sections were used to create a bedrock surface and bound the model vertically. This surface was also informed by the slope of bedrock outcrops surrounding the Salar and structural features. In the Western Subbasin, the bedrock surface is largely inferred from the aboveground topographic slope and gravity surveys and is estimated to extend as deep as 900 m in the northwest portion of the basin containing the halite core.



Note:
1. Plan view image exported from Leapfrog software

Figure 11-3. Generalized Local Geology

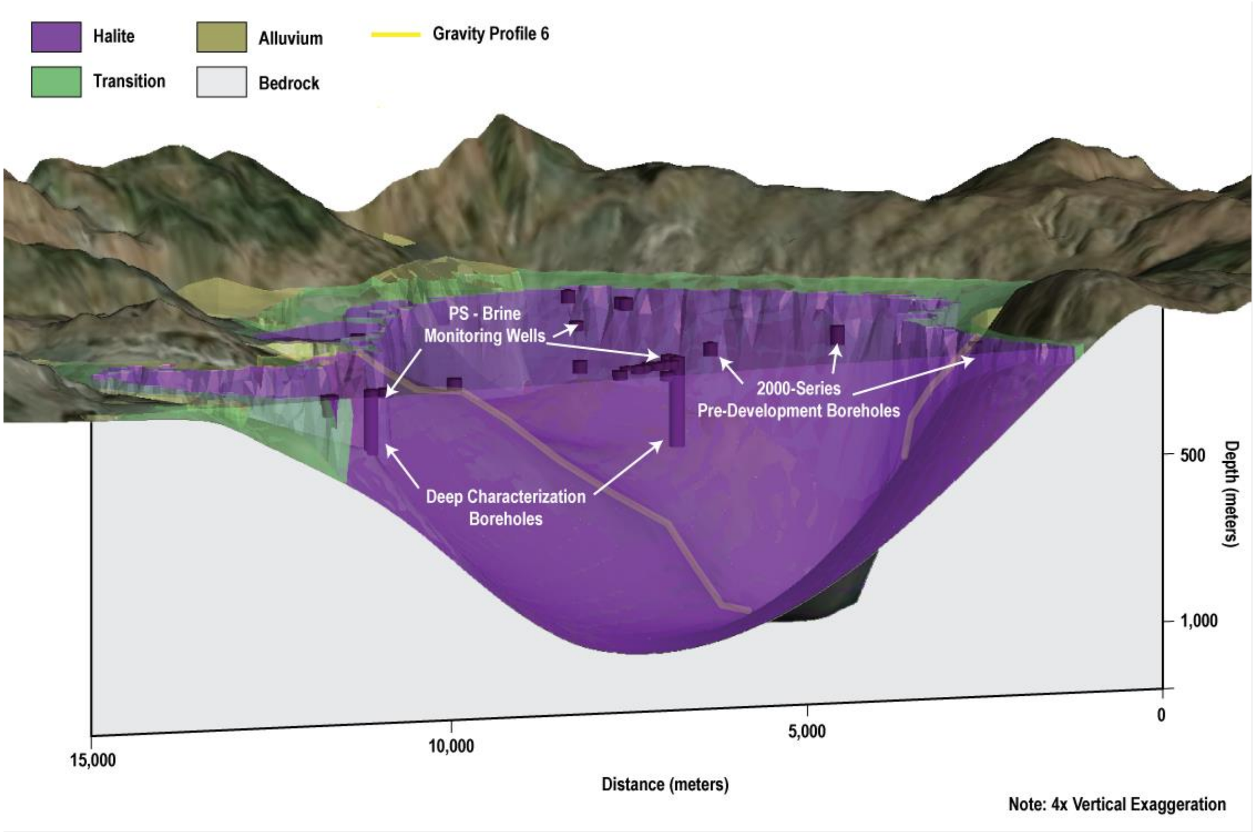


Figure 11-4. Vertical Cross Section through the Geologic Model

11.8 SUMMARY

Regardless of the calculation method employed, lithium resource estimates were similar for various depth intervals (thickness). Integral's (2016) independent estimates of pre-development reserves confirmed WMC's 1994 estimates. Since operations began 25 years ago, Livent's Project Fenix has and continues to produce high-grade (>740 mg/L) lithium brine with remarkably low variability in brine grade (Figure 8-1). When considering the consistency between independent resource estimates together with 25 years of operational data, the QPs have a high degree of confidence in the resource estimates.

The current resource estimates incorporate lithium concentration data measured at 35 monitoring well locations across the Salar and lithium concentrations measured from deep exploration holes, installed in 2020, at depths greater than 30 m. In the QPs' opinion, the current resource estimates (as of December 31, 2022) are appropriate because they were estimated by deducting lithium produced from September 2022 through December 2022 from the September 2022 resource estimate. The same approach of deducting lithium produced through 2022 from pre-development resources, produced nearly the same mass absent from the

2022 resource estimate (relative to pre-development resources) from within the measured interval.

Although lithium concentration data from depths below 100 m in the Western Subbasin are sparse, available data from below 100 m indicate the presence of high-grade brine. Furthermore, lithium grades appear to increase with depth, whereas S_y within halite is likely to decrease with depth due to increasing lithostatic loading. The anticipated decrease in S_y was modeled using a regression to project S_y at depth. The depth of the resource in the Western Subbasin (assumed to coincide with depth to bedrock) has been estimated using geophysical methods to be up to 900 m in the western lobe of the Western Subbasin (WMC 1992). Deep exploration holes installed in 2020 indicate resource depths greater than 300 m near the PWB. With limited deep borehole data, our understanding of reservoir properties, in particular effective porosity and permeability at depth, are uncertain. In the absence of borehole data below 300 m bgs, we set the depth of our resource evaluation to 200 m. Future exploration below 40 m bgs is recommended to improve confidence in resources, particularly lithium grade and reservoir properties in the intervals currently classified as indicated and inferred.

12 MINERAL RESERVES ESTIMATES

Mineral reserves are the economically mineable part of a resource. Reserves are always a fraction of the resource because the reserve estimate accounts for dilution and process-related losses before the resource becomes a viable product (CIM 2014).

Integral estimated lithium reserves using a numerical brine reservoir model to predict changes in brine occurrence and grade in response to anticipated lithium brine production schedules. Numerical modeling is essentially a physically based bookkeeping method for simulating fluid flow and for tracking dissolved solids and lithium concentration and movement. Our approach for estimating lithium reserves, including a description of the method, key assumptions, and parameters, is provided in this section.

12.1 NUMERICAL BRINE RESERVOIR MODEL

Integral created a 3-dimensional numerical groundwater flow and transport model (Salar Model) to predict lithium reserves for a 40-year period beginning in 2023. Groundwater Vistas software (Environmental Simulations Incorporated) was used to create model input files and to post-process model results.

The Salar Model is based on the U.S. Geological Survey's program, SEAWAT Version 4 (Langevin et al. 2007), for simulating variable density groundwater flow and multi-species transport. SEAWAT is a coupled version of two other, industry-standard programs for simulating groundwater flow, MODFLOW (Harbaugh et al. 2000), and transport of dissolved species in groundwater, MT3DMS (Zheng 2006). SEAWAT is designed to simulate variable-density brine migration in continental aquifers by coupling the two programs.

12.1.1 Model Domain and Grid

The Salar Model domain covers the entire Western Subbasin (Figure 12-1). At ground surface, the active model area is 364 km^2. The model area is divided into 123 rows and 113 columns, and model cell lengths vary in size from 200 m at the halite nucleus to 500 m at the margins of the model. In the vertical dimension, from ground surface to the bedrock contact, the model is divided into nine horizontal layers. A vertical slice through the numerical model along row 50 (north to south) is shown in Figure 12-2.

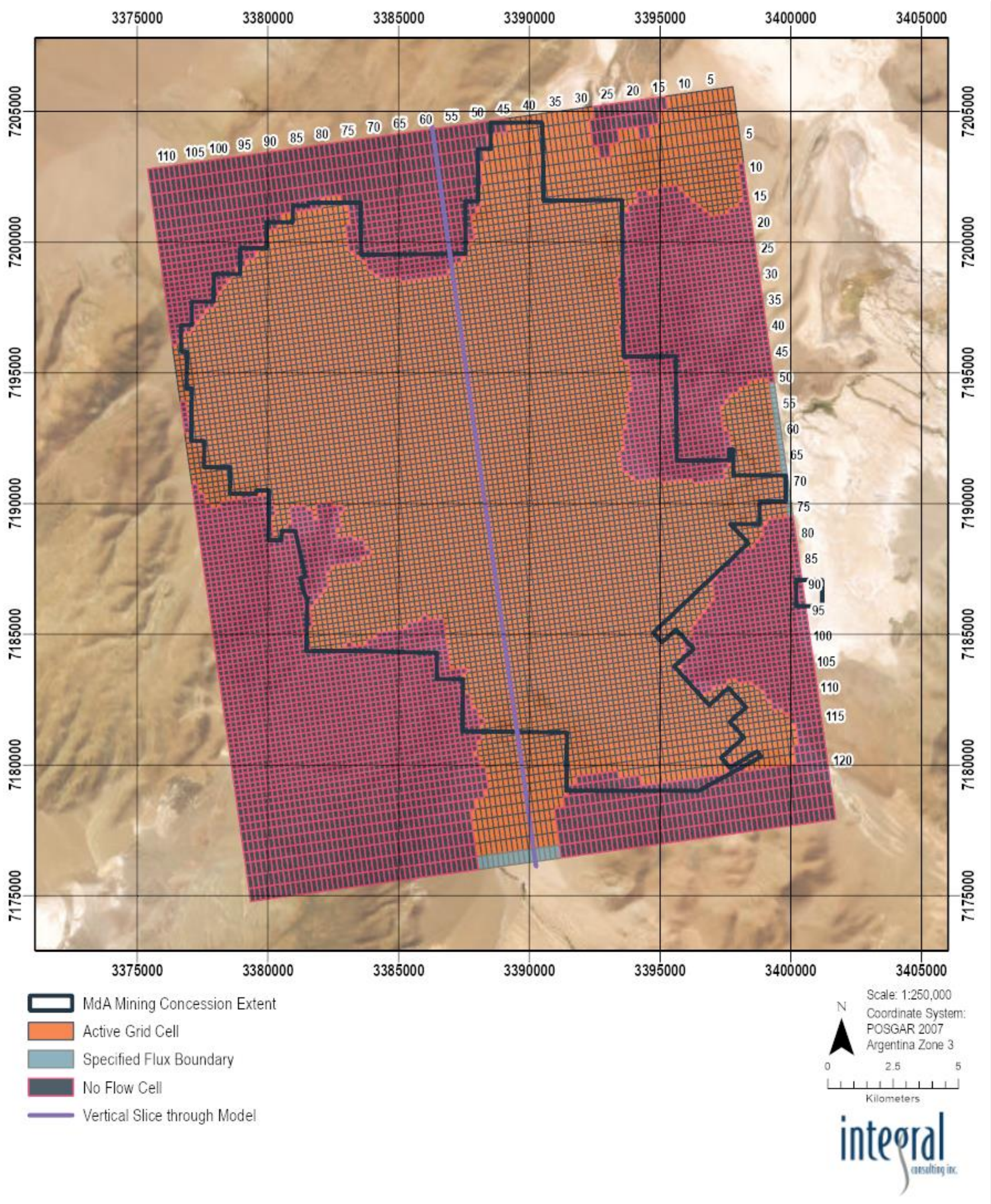


Figure 12-1. Model Plan View

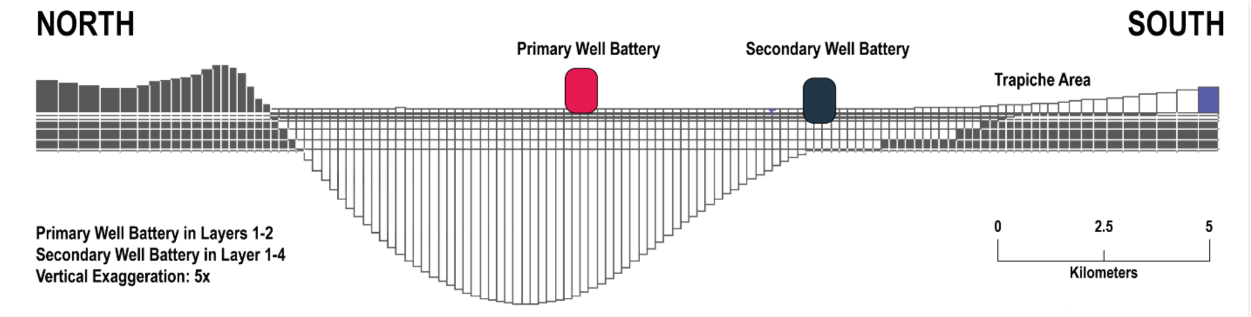


Figure 12-2. Vertical Slice through Salar Model

12.1.2 Flow and Transport Boundary Conditions

All of the relevant processes affecting fluid movement are simulated in the model, including naturally occurring inflows from river leakage and from groundwater, and outflow by evapotranspiration. Operational conditions are simulated in the model by outflow of fluids by extraction well pumping, and inflow of spent brine. Together, naturally occurring and operational inflows/outflows are used as inputs to the numerical model, which allows for accounting of fluid flow and dissolved lithium.

Most of the groundwater inflow to the Western Subbasin occurs as Rio de Los Patos leakage and groundwater inflows at the saddle between the Eastern and Western Subbasins, followed by groundwater inflows from the Trapiche Aquifer. Shallow brackish groundwater inflow from the Eastern Subbasin was simulated using specified flux boundary conditions. Shallow inflows from the Rio de Los Patos were assumed to have brackish water quality devoid of lithium, which was simulated using specified concentration boundary conditions at 200 g/L TDS. Deeper brine inflows from the Eastern Subbasin were simulated using specified flux and specified concentration boundary conditions at 330 g/L TDS and 500 mg/L lithium. Although lithium-rich brine likely flows into the Western Subbasin at higher concentration, relatively low lithium concentrations in brine flowing from the Eastern to Western Subbasins were used in model simulations to be conservative. The total simulated inflow from the Eastern Subbasin is 0.3 m^3/s, consistent with estimates made by WMC (1994). In the model, shallow inflows constitute approximately 80% of the total inflow from the Eastern Subbasin with the remainder of inflows occurring at depth.

Fresh groundwater inflow to the Salar from the Trapiche Aquifer was simulated using specified flux (well) boundary conditions. The freshwater quality was simulated with constant concentration boundary conditions, with TDS set to 2 g/L, and without lithium, based on water quality data from Trapiche Aquifer monitoring wells. Total simulated inflow from the Trapiche Aquifer is 0.1 m^3/s, which is approximately 25% lower than WMC's estimate (WMC 1994) to account for diversions and evaporation from the Trapiche Dique.

Groundwater/brine is assumed to flow primarily within porous evaporite and clastic sediments. Thus, no flow boundary conditions are assigned to model cells that represent bedrock along the margins of the Salar and at depth beneath the Salar sediments. This is a conservative approach, as bedrock adjacent and beneath the Salar may have some porosity and permeability containing lithium-rich brines; however, without definitive information we assume bedrock is not part of the brine reservoir system.

Recharge from the infiltration of precipitation onto the Salar surface is not simulated because it rarely occurs with sufficient volume to affect the water balance in a material way. When recharge does occur, it does not significantly dilute shallow brine enough to affect average lithium concentrations in well batteries, as indicated in Figure 7-13.

Evapotranspiration is applied to the top layer of the model. The maximum evaporation rate and extinction depth, depth below ground surface where evaporation is 0, is specified in the model according to surface characteristics. Applied evapotranspiration rates range from 2×10^{-4} to 5×10^{-3} m/d with higher rates of evaporation occurring at open water bodies and lower rates in areas of barren (sparse vegetation) alluvium.

12.1.3 Hydraulic and Solute Transport Properties

SEAWAT simulates density-driven flow based on the assumption that there is a linear relationship between solute concentrations and fluid density, in this case TDS and density (Figure 12-3). Lithium is tracked in the model but is not part of the density equation because it, along with the other dissolved solutes, is represented by TDS.

Model hydraulic properties were assigned based on the lithology mapped to the model grid from the Geological Model (Section 11.7). The QPs developed the Salar Model on the principle of parsimony, by grouping lithologies observed in boreholes into as few modeled lithologic units as practical. This approach avoids overparameterization, which is often used to force a model to appear calibrated and is usually unjustified. In general, shallow halite and shallow transition zone lithologies (mixed evaporites and clastics), present at the saddle between the Eastern and Western Subbasins, were assigned the highest hydraulic conductivity values (approximately 500 m/d). Hydraulic conductivities (a term we use interchangeably with permeability) were assumed isotropic in the horizontal plane. The vertical anisotropy (ratio of horizontal to vertical hydraulic conductivity) generally varies (from 10 to 2) based on depositional characteristics (i.e., the vertical anisotropy is highest in alluvium, while lower in transitional material and evaporites).

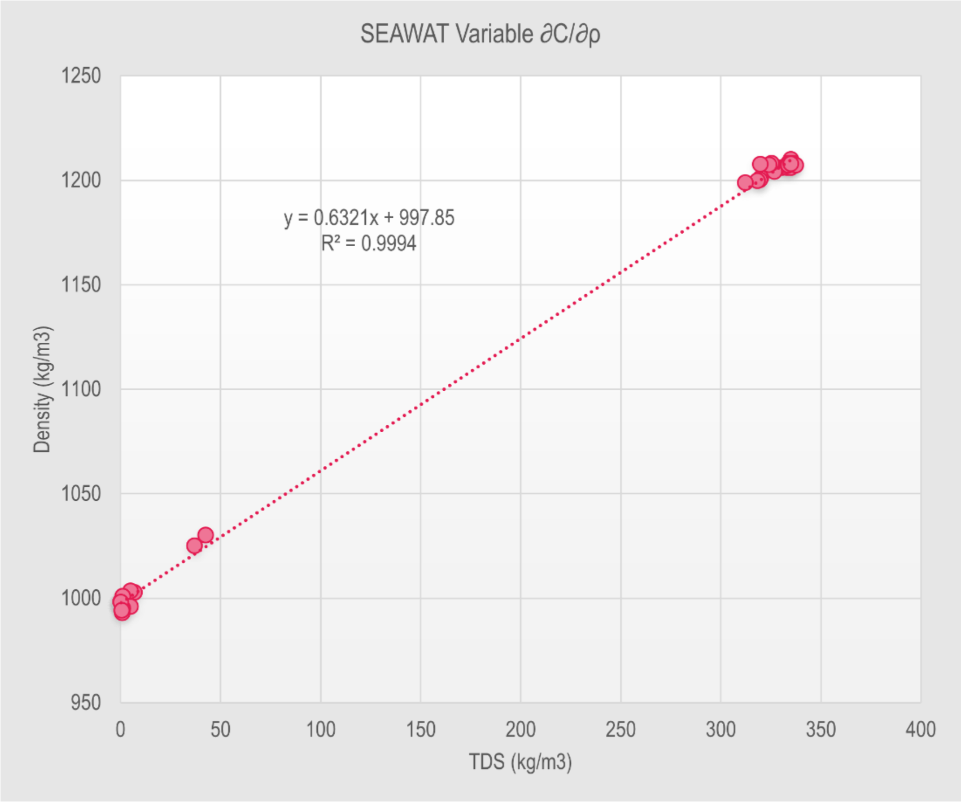


Figure 12-3. Relationship between TDS and Density Used in Salar Model

Reductions in hydraulic conductivity with depth are commonly noted in deep (>100 m) flow systems due to compaction of sediment by overburden materials (Belcher et al. 2001; D'Agnese et al. 1997). This behavior was noted in one of three deep characterization holes (PSP-02); however, the other two (PSP-01 and PSP-03) did not show an obvious reduction in conductivity with depth. In the absence of additional information and to be conservative (less yield for a given pumping condition), we reduced hydraulic conductivity with depth in the model.

In a transport model, effective porosity, the ratio of interconnected drainable pore space to total porosity, is inversely proportional to solute velocity. Effective porosity is assumed to be similar to S_y and the two properties are set equal to each other in the model. Dispersivity is a parameter used to account for the compounding effect that small-scale changes in velocity have on solute transport. As such, dispersivity is a scale-dependent parameter that tends to increase with the size of the flow system. Longitudinal dispersivity was set to one-tenth the length of a nominal grid cell (20 m), with an order-of-magnitude reduction in the lateral and vertical dimensions (2 and 0.2 m, respectively). Considering groundwater/brine velocities at SdHM are quite high, and dissolved lithium salts tend to act as conservative tracers in groundwater, diffusion and sorption kinetics were not simulated in the model.

12.1.4 Model Calibration

Model calibration involved changing input parameters until a satisfactory match between observed and model-simulated conditions are reached. Industry standard practices and guidelines (Zheng and Bennett 1995; Anderson et al. 2015; Reilly and Harbaugh 2004) were followed throughout the calibration process. The Salar Model was calibrated to brine elevations and brine chemistry (TDS and lithium concentrations) measured at brine monitoring wells distributed across the entire Western Subbasin, from proxy locations used to represent aggregate flows from the PWB and SWB, and monitoring wells in the Trapiche Aquifer.

The Salar Model was calibrated to observed brine elevation measurements and concentrations of TDS and lithium, using a combination of trial-and-error techniques and using an automated inverse calibration program, PEST (Watermark Computing 2016).

The model calibration process was iterative, whereby a pseudo steady-state model was constructed to establish the initial hydraulic conditions. The pseudo steady-state model, developed to estimate water/brine balance and elevations prior to development, was run in transient mode for a long period of time until near-equilibrium conditions were met and changes in storage were negligible. Using this model as a starting point, a transient calibration was performed by simulating historical operations.

12.1.5 Simulated Historical Operations

Transient calibration involved grouping operational data (brine and freshwater extraction and spent brine discharge) into periods of relative uniformity called stress periods. The transient calibration period spans 9,300 days, from July 1997 through the end of 2022. Model calibration statistics and visual goodness-of-fit were evaluated at the end of each transient calibration simulation, and parameters were adjusted in the pseudo steady-state, and in turn the transient calibration model, until the model was deemed calibrated. Historical operations are simulated using the transient Salar Model. The transient Salar Model divides the period from July 1997 through the end of 2022 into 31 stress periods. During a given stress period, brine and freshwater pumping rates, as well as the rate and quality (TDS and lithium) of spent brine discharge and leakage from pre-concentrate ponds, occur at a constant rate equal to the average historical rate (taken as the average over the stress period). Inflows from the Eastern Subbasin and Trapiche Aquifer were assumed constant for the entire simulation.

Brine monitoring of the PWB and SWB occurs after discharge from the individual wells comprising the battery are manifolded together in a single pipe. For example, the brine quality reported at the PWB is the aggregate brine quality from the five wells that are operating at any given time. In the Salar Model, an artificial monitoring location was placed in the center of each well battery as a surrogate for evaluating the TDS/lithium concentration at each battery. A comparison between actual measured and model-simulated lithium concentrations at those locations is provided in Figure 12-4.

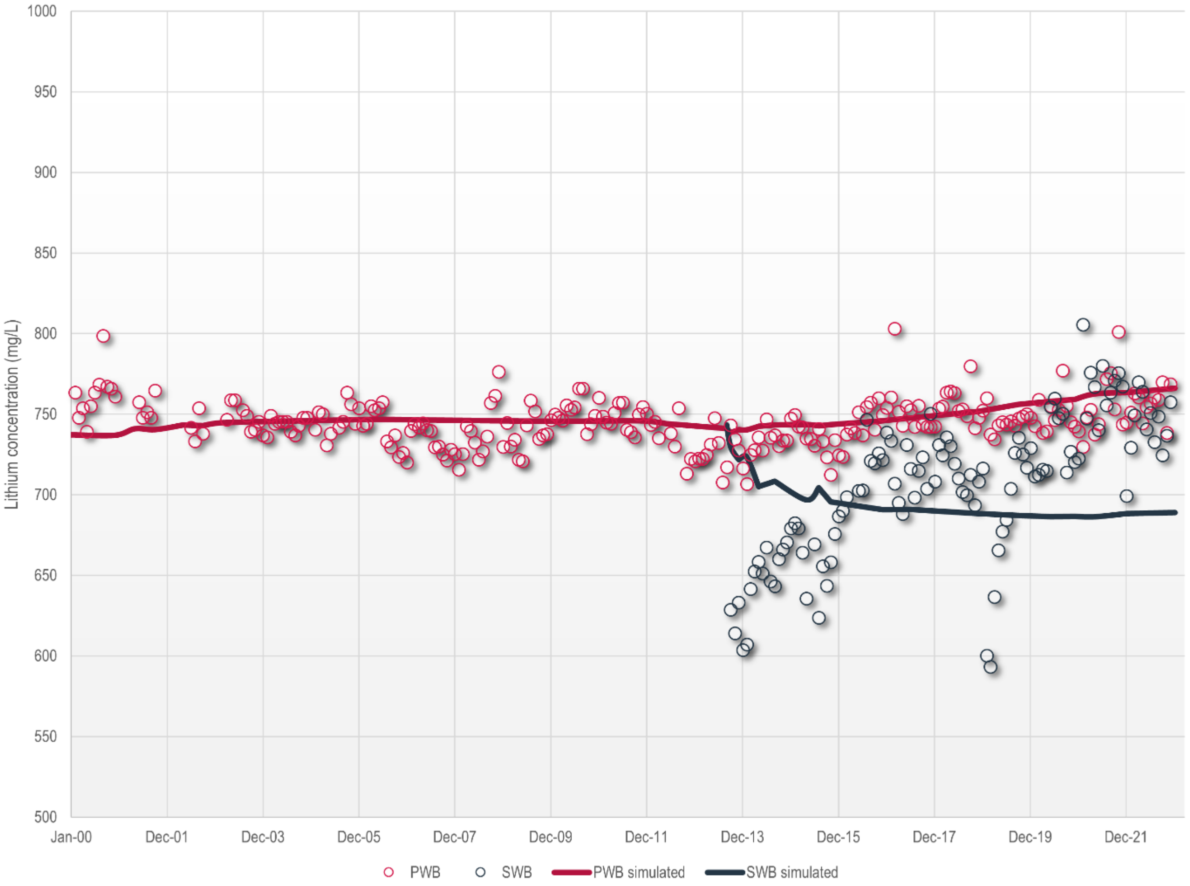


Figure 12-4. Measured and Simulated Lithium Concentrations at Primary and Secondary Well Batteries (2000–2022)

The model was deemed calibrated when the residuals, or differences between measured and simulated values (e.g., head or concentration), were sufficiently small. At the end of the transient calibration period, the model was deemed acceptably calibrated using two commonly referenced calibration statistics—the average head residual and the scaled residual mean (the residual sum of squares divided by the range in observed head)—which were -0.05 m and 8%, respectively. Average model residuals for lithium concentration in lithium brine production wells were 4.5 mg/L (Figure 12-4). The model mass balance error at the end of calibration was 0%, which is another indication the model is acceptable (0.5% or less is a common benchmark [Reilly and Harbaugh 2004]).

12.1.6 Predictive Simulations

Once the Salar Model was calibrated, it was used to predict changes in brine levels and brine quality for a 40-year period through 2062. Inflows from the Eastern Subbasin and Trapiche Aquifer were assumed constant for the entire predictive simulation. Inflows of spent brine increased in response to increased plant throughput following anticipated future expansions, until year 2030, at which point the flows were held constant. Future spent brine management was assumed for the model to involve cycling discharge to other areas, including the existing artificial lagoon and an undeveloped area east of the artificial lagoon. Leakage from the pre-concentrate ponds was assumed equal to leakage in 2022 until year 2026, when the ponds are planned to be repurposed as part of the Third Expansion (see Section 14.7.3).

New lithium brine production wells are required to meet future target lithium carbonate production rates. Lithium grades are anticipated to gradually decrease over time as the rate of lithium removal exceeds the rate of natural replenishment. As this happens, brine becomes more dilute, and more pumping is required to extract the required mass of lithium. Thus, a series of model simulations was performed by adjusting new well pumping rates and locations until the simulated lithium extraction exceeded targeted lithium brine production. Simulated lithium extraction should exceed targeted lithium brine production because the manufacturing process efficiency is less than 100%, indicating there is some lithium loss between raw brine entry to the SA Plant and the production of final manufactured product. Inherent in the model predictions is the assumption that process efficiency will be similar to current efficiency in years before the pre-concentrate ponds were used for spent brine return, with increasing efficiency in later years.

In the predictive simulations, all new wells were designed to draw exclusively from the measured resource depth interval (0–40 m bgs) in years 0–20. In later years (21–40), brine is extracted from both the measured and indicated resource (0–100 m bgs) depth intervals. Target lithium brine production rates were achieved with the well configuration shown in Figure 12-5. It should be noted that this future production well configuration is only one of many potential well configurations capable of meeting target lithium production rates. Actual future well configurations are subject to change.

To meet Livent's anticipated near-term lithium carbonate production targets, four new wells were added to the Salar Model to the northwest of the PWB. Additional wells were added in the northwestern and northeastern quadrants of the Western Subbasin, within Livent's Contiguous Lease Area, to meet longer-term demands. A pumping schedule containing model-simulated lithium brine production rates by well battery and individual new wells is provided in Table 12-1. The pumping plan described is one of many potential configurations to achieve the target lithium carbonate production schedule.

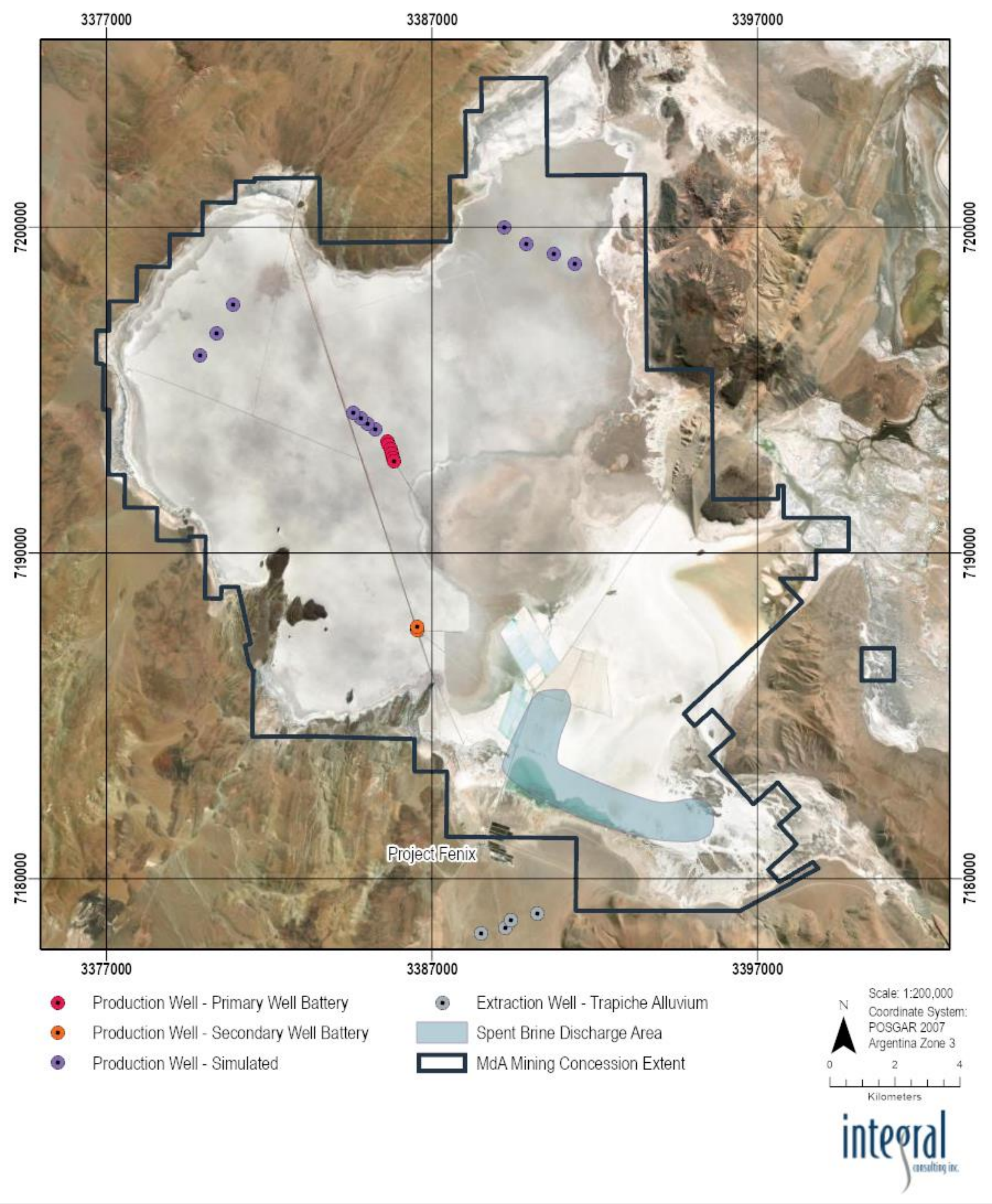


Figure 12-5. Simulated Lithium Brine Production Wells, Freshwater Extraction Wells, and Spent Brine Discharge Area

Table 12-1. Simulated Future Brine Pumping Schedule (m³/d)

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032–2041	2042–2051	2052–2062
Total Simulated Flow Rate by Well Battery												
Primary Well Battery	24,800	24,800	24,800	24,800	24,800	24,800	24,800	24,800	24,800	24,800	24,800	24,800
Secondary Well Battery	20,200	20,200	20,200	20,200	20,200	20,200	20,200	20,200	20,200	20,200	20,200	20,200
New Wells	4,000	7,000	12,000	29,000	36,000	36,000	44,000	44,000	44,000	52,000	70,500	77,500
Total	***49,000***	***52,000***	***57,000***	***74,000***	***81,000***	***81,000***	***89,000***	***89,000***	***89,000***	***97,000***	***115,500***	***122,500***
Simulated Flow Rate by Individual New Wells												
New well No. 1	2,000	2,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,500	6,500	7,500
New well No. 2	2,000	3,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,500	6,500	7,500
New well No. 3		1,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,500	6,500	7,500
New well No. 4		1,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,500	6,000	7,500
New well No. 5			3,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	7,500	7,500
New well No. 6			3,000	4,000	4,000	4,000	4,000	4,000	4,000	4,500	7,500	7,500
New well No. 7			3,000	4,000	4,000	4,000	4,000	4,000	4,000	7,500	7,500	7,500
New well No. 8			4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
New well No. 9					4,000	4,000	4,000	4,000	4,000	6,000	6,000	7,000
New well No. 10							4,000	4,000	4,000	4,000	6,000	7,000
New well No. 11							4,000	4,000	4,000	4,000	6,000	7,000

12.1.7 Sensitivity to Potential Operations in the Eastern Subbasin

Project Fenix is the only commercial lithium carbonate production operation at SdHM. Other companies with mining claims adjacent to Livent's, mainly in the Eastern Subbasin, are known to be in the advanced exploration stage and could begin brine extraction on a commercial scale in the next few years. To evaluate the potential impact on reserves, model inflows from the Eastern Subbasin were deactivated for a 40-year predictive simulation beginning in January 2023. This simulation was identical to the predictive simulation described above in every aspect except the model cells used to simulate inflows at the Eastern Subbasin were converted from constant flux boundary conditions to no-flow boundary conditions. Inherent in this simulation is the potential for neighboring operations to capture all of the water and lithium-rich brine that flows naturally from the Eastern to Western Subbasin.

There were three key results of this simulation. The first key result was that lithium brine concentrations at the end of 40 years were higher when the flux from the Eastern Subbasin was set to zero. This occurs because most of the flux from the Eastern Subbasin was modeled as fresh water without much lithium, which had the effect of diluting lithium concentrations in later years.

The second key result was total lithium mass extracted as reserves between the two predictive simulations at the end of the 40-year simulation were within 3% of each other. This suggests the reserve estimates are not sensitive to assumptions on inflows at the Eastern Subbasin.

Lastly, the model-simulated drawdown, expressed as the difference between brine elevation at the start and end of the model prediction, was greater when the flux from the Eastern Subbasin was set to zero, with brine elevations approximately 5 m lower after 40 years. Thus, the primary risk to future operations, if brine extraction in the Eastern Subbasin were to effectively eliminate flux into the Western Subbasin, is lower brine elevations, which in turn may require future wells to be screened at correspondingly lower elevations.

12.2 CUT-OFF GRADES ESTIMATES

A cut-off grade is a concentration threshold below which mining is no longer economic. Establishing a cut-off grade for lithium brine resources is not straightforward because the concentration typically increases in the manufacturing process after it is extracted (i.e., uneconomic raw brine may become economically viable after further concentration by evaporation).

For this reserve assessment, a cut-off grade of 218 mg/L was calculated using a breakeven financial analysis for a 40-year life-of-mine. The breakeven analysis included reasonably foreseeable capital and operating expenses; cost of capital at 10%; and revenue generated assuming a long-term, forward-looking lithium carbonate price of $20,000 per Mt. This approach was considered a “worst-case scenario” to establish the minimum economically viable lithium concentration for Project Fenix to be marginally profitable and is appropriate to estimate a cut-off grade concentration. Although future lithium carbonate prices have the potential to be volatile, $20,000 per Mt is reasonable considering analysts’ current projections (Section 16).

The cut-off grade was calculated by adjusting lithium concentration to meet the demand schedule (Section 13) within the financial constraints described above until project revenue exceeded total capital and operating expenses by 10% (equal to cost of capital). Future process efficiency (assumed at 76.6%) was accounted for in establishing the cut-off grade. Financials are valued in current terms (dollars). Operating expenses captured depreciation, royalties and corporate taxes, and all normal expenses (e.g., labor and raw materials) required to operate Project Fenix now and in the future, following expansions. Financials do not include (de)escalators related to currency volatility or inflation. In the QPs’ opinion, it is conservative to omit such (de)escalators from the cut-off evaluation as revenue is projected to exceed expenses and inflation is likely to affect both cost expenditures and revenue. In a similar manner, omitting depreciation from the breakeven analysis effectively reduces expenses and increases project profitability.

Although not considered in this reserve assessment, lower cut-off grades may become economically viable with advances in process technology or with changes in mine plans (e.g., additional pre-concentrate ponds or SA columns). The economic analysis (Section 19) indicated positive cash flow for the life-of-mine after an initial payback period of 3.6 years based on the anticipated lithium carbonate production schedule. Numerical model results indicate the lithium carbonate production schedule provided by Livent is feasible, and brine grade remains well above the economically viable cut-off grade of 218 mg/L throughout the 40-year simulation period when the model-simulated flow-weighted average lithium concentration in year 40 is 523 mg/L.

12.3 RESERVES CLASSIFICATION AND CRITERIA

The Salar Model simulates fluid (brine) movement within its domain. Brine is a fluid resource that moves within and between resource units (measured, indicated, and inferred) in response to changes in pressure (pumping) and other environmental variables, which are generally less influential. Predictive simulations using the Salar Model assume production from the PWB and SWB remains constant during the 40-year simulation. Additional lithium brine production required to meet the anticipated lithium carbonate production schedule is made up with 11 additional wells. Flow to lithium brine production wells is believed to be predominantly horizontal in stratified evaporite/clastic sediments; and, it is likely lithium produced to-date originated primarily from the measured resource interval (0–40 m bgs) rather than deeper indicated (40–100 m bgs) or inferred (100–200 m bgs) resource intervals because existing lithium brine production wells are not screened deeper than 40 m bgs.

SA Plant efficiency is expressed as the ratio of lithium mass in concentrated lithium brine exiting the SA Plant (effluent) divided by lithium brine production. Figure 12-6 shows the SA Plant efficiency from 2012 through 2022, indicating improved efficiency from 2012 through 2017, and stable efficiency thereafter. Although historical SA Plant efficiency is not a perfect indicator of process recovery, because it does not account for throughput delays at the plant or sample variability within a given sampling event, it provides a good estimate of future performance over extended periods. The SA Plant efficiency in the most recent 5 years (2018–2022) averaged 93%. For future lithium brine production and estimating reserves, the lithium processed at the SA Plant is assumed to be 95% efficient.

Introducing pre-concentrate ponds to the process reduces efficiency because some brine in the ponds is lost to leakage or is entrained in solid residuals. Livent has not undertaken pilot testing to estimate pond process efficiency. However, others have reported efficiencies near 70% (Galaxy Resources Ltd. 2021). The pre-concentrate and proposed evaporation ponds are assumed to be 65% efficient (35% of the lithium leaks back into the Salar or is entrained). Based on the weighted average of flow through the various processes and efficiencies for the planned expansions discussed in Section 14.7, the time-weighted average process efficiency (from the brine resource to final product) is expected to be 76.6%. Thus, lithium reserves based on future anticipated lithium brine production are calculated by applying time-weighted efficiency to the mass of lithium in feedstock lithium brine produced from the Salar. In essence, the mass of lithium in feedstock brine is reduced by 23.4% for reserve estimation purposes.

The Salar Model was used to predict lithium concentrations 40 years into the future, which is an acceptable prediction period considering guidance set forth in Anderson and Woessner (1992) that suggests predictive simulations not be extended into the future more than twice the period for which calibration data are available. Future brine extraction was simulated in the Salar Model with new wells screened in the "measured" resource interval for years 0–20. In years 21–40, additional brine is produced with new wells screened in both the "measured and indicated" resource interval. Considering anticipated pumping rate increases together with model predictions and 25 years of performance monitoring data, it is reasonable to classify brine produced in the first 10 years as "proven reserves." Brine produced in years 11–40 is classified as "probable" on the basis that new wells extract brine from the measured and indicated resource in later years.

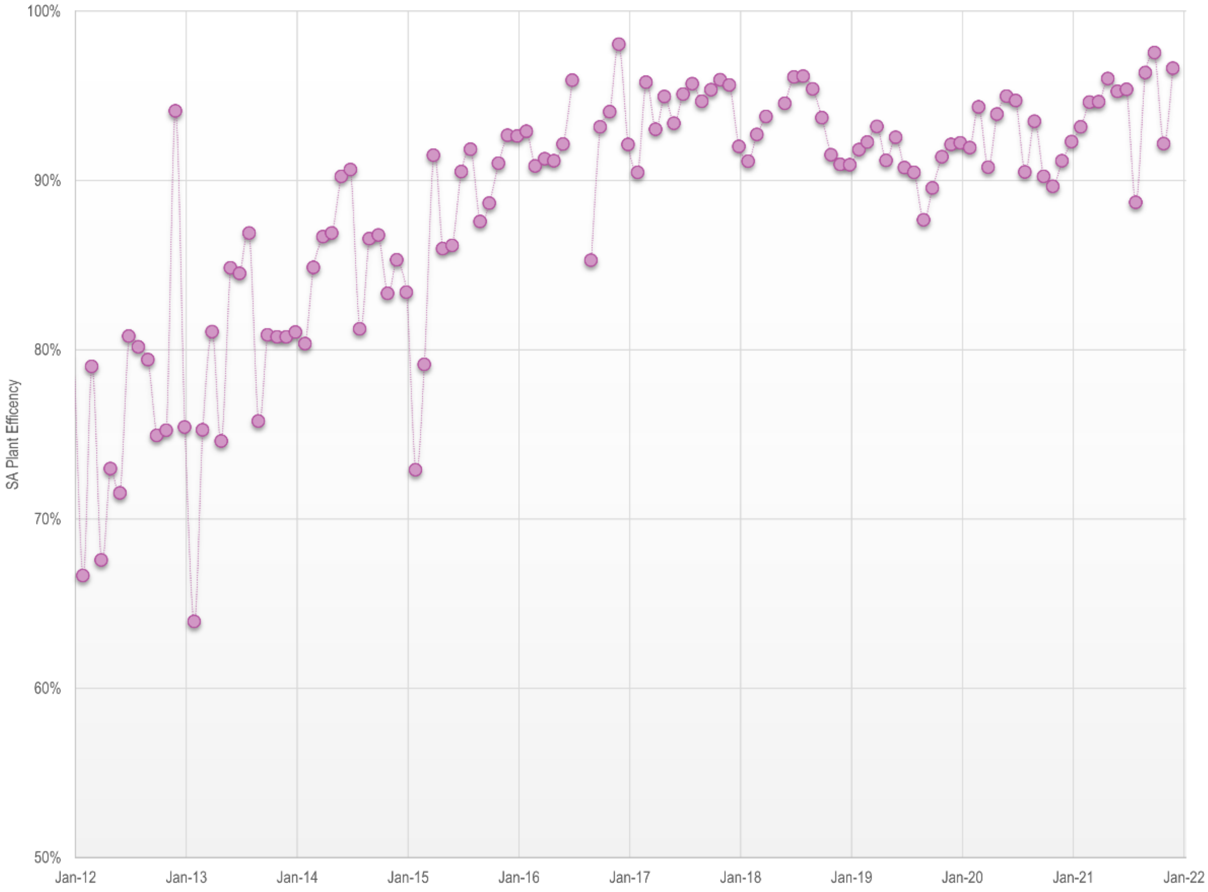


Figure 12-6. SA Plant Process Efficiency (2012–2022)

12.4 MINERAL RESERVES ESTIMATE

Mineral reserve estimates for the 40-year period from January 1, 2023, through 2062 are presented in Table 12-2. The reserve estimates are based on the anticipated lithium production schedule following planned project expansions (Section 13.3). Mineral reserves are based on an economic cut-off grade of 218 mg/L lithium, 76.6% time-weighted average process efficiency, and assuming a future lithium carbonate price of $20,000 per Mt.

Table 12-2. Proven and Probable Lithium Reserves (starting January 1, 2023)

Reserve Category	Years	Total Lithium (K Mt)	Total LCE (K Mt)
Proven	0–10	153	815
Probable	11–40	578	3,076
Total Proven + Probable		**731**	**3,891**

Notes:
Assumes 76.6% time-weighted average process efficiency
K Mt = thousand metric tons
Values rounded to the nearest thousand

12.5 DISCUSSION

The Salar Model was used to predict changes in brine levels and brine quality for a 40-year period through 2062. It should be noted that 40 years was the chosen time frame for the numerical simulation, based on the QPs' understanding of the resource, 25-year operational history, and anticipated lithium brine production schedule, which in turn is the basis for establishing the life-of-mine. In the QPs' opinion, based on available resources, current mine plans, and pricing assumptions, the life-of-mine will remain profitable and above the cut-off grade beyond 40 years.

All of the brine produced to-date by Project Fenix is believed to have originated from measured resources. The anticipated lithium production schedule is feasible and may be achieved by the pumping well configuration shown in Figure 12-5, according to the pumping rate schedule in Table 12-1. Model predictions do not indicate excessive drawdown in the future, which is consistent with expectations for a mature salar and brine level observations made since operations began in 1997. Model-predicted lithium concentrations remain above the cut-off grade (218 mg/L) throughout the life-of-mine.

Lithium-rich brine is a fluid resource and its grade is subject to change in response to pumping and numerous other environmental factors. Factors other than brine grade and pumping may affect reserve estimates, including the acquisition of new hydrogeologic and environmental data, changes in mine plans, or mining operations at neighboring locations. This reserve estimate is based on the data and assumptions described in this report and is sufficient for disclosure and mining planning purposes.

Lithium reserves extracted in years 1–10 are classified as “proven” by reducing the lithium mass extracted by 23.4% to account for process inefficiencies. Proven reserves (153,000 Mt) represent approximately 12% of the current measured and indicated resource (Table 11-5). Lithium resources extracted in later years (11–40), also discounted for process inefficiencies, are classified as “probable.” Reserves are classified as probable because a fraction of the brine produced in years 21–40 originated in the measured and indicated resource intervals and certain modifying factors (economic, legal, governmental, environmental, and social) necessarily introduce uncertainty in future operations. The total proven and probable reserves (731,000 Mt) make up approximately one-third of the total resource.

13 MINING METHODS

Lithium mining at Project Fenix begins by pumping lithium-rich brine from beneath the surface of the Salar. When operations began, brine was pumped from a network of six wells (referred to as the PWB) located near the geographic center of the Western Subbasin of SdHM. In 2012, two additional wells (referred to as the SWB), located approximately 5 km south-southeast of the PWB, were brought into service to increase lithium brine production. The location of key mining features including the PWB and SWB is shown in Figure 4-2.

13.1 CURRENT WELLFIELD DESIGN

Existing lithium brine production wells are approximately 30–40 m deep. Each production well is fitted with a submersible pump powered by a diesel generator installed at the wellhead. Typical equipment used to operate a lithium brine production well is shown in the schematic in Figure 13-1. Historically, five wells from the PWB produce brine, with one well in standby to maintain target lithium brine production rates during well maintenance periods. In 2022, the average lithium brine production rates for the PWB and SWB were 1,031 and 735 m^3/h, respectively. Historical brine pumping rates are provided in Figure 13-2.

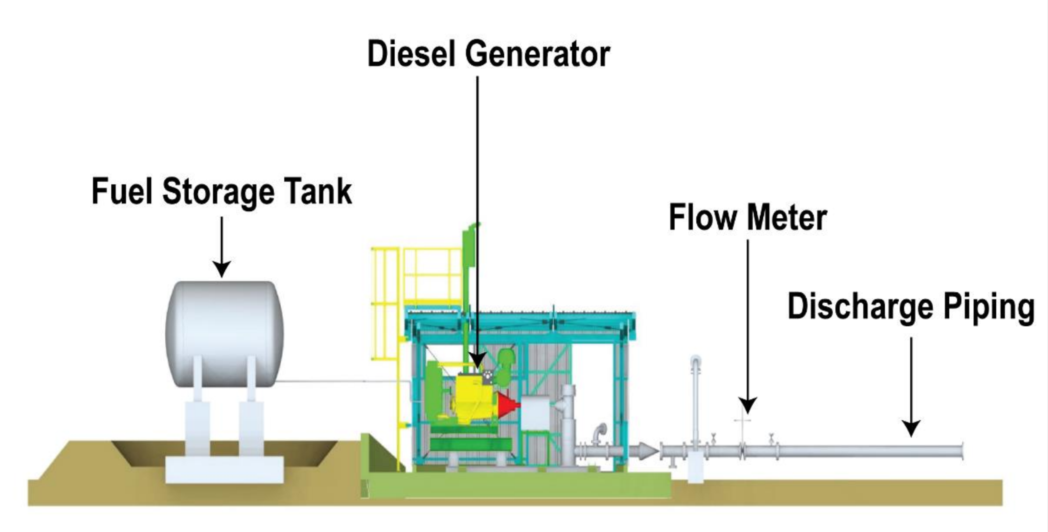


Figure 13-1. Surface Pumping Equipment

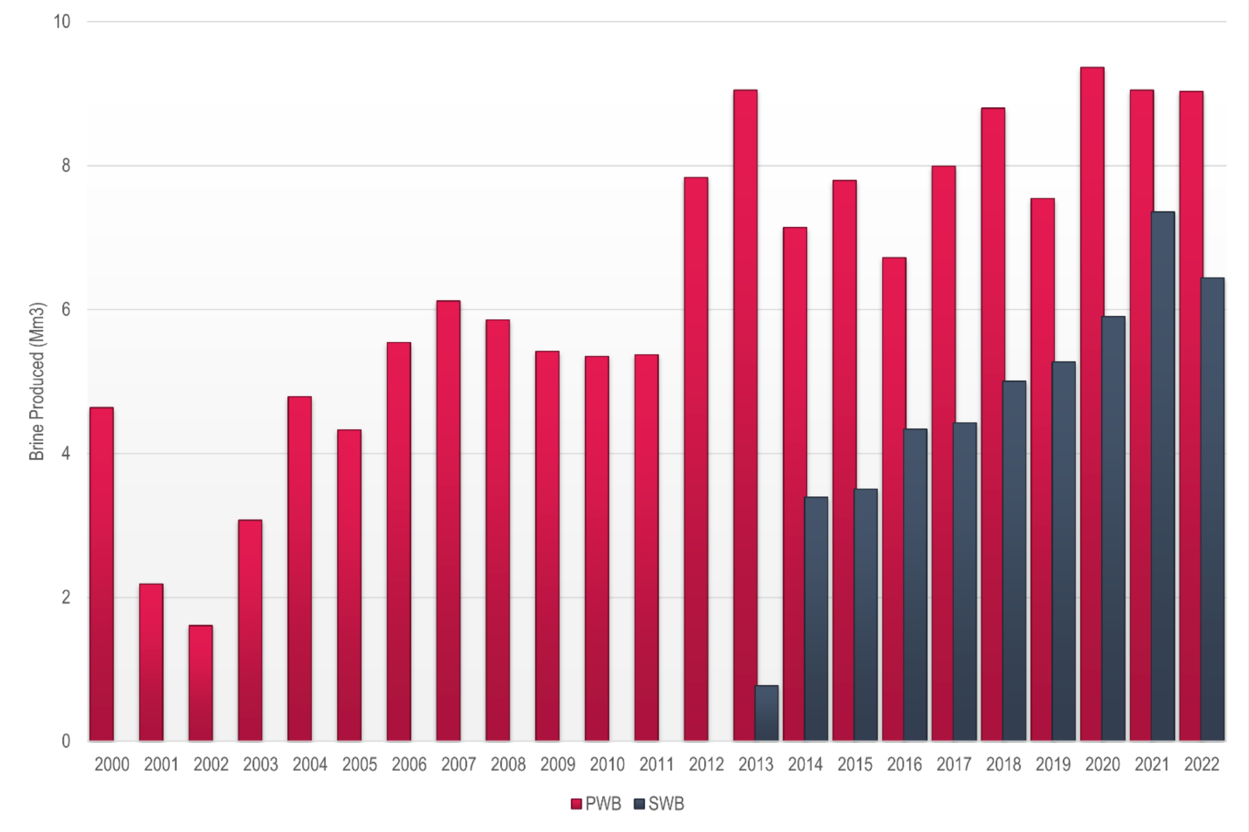


Figure 13-2. Historical Lithium Brine Production from the Primary and Secondary Well Batteries (2000–2022)

Brine produced by the PWB and SWB is conveyed to two locations with a 24-inch pipeline: to pre-concentrate ponds or to the SA Plant as direct feed for processing. The SA Plant is capable of processing native brine feed directly from the well batteries, from concentrated brine feed from the pre-concentrate ponds, or a combination of native and pre-concentrated brine.

13.2 ANTICIPATED WELLFIELD DESIGN

Additional lithium brine production wells are necessary to meet future lithium carbonate production demands. Lithium brine is a fluid resource and its behavior (grade) changes in response to environmental variables and pumping stresses. Thus, the Salar Model was used in an iterative process to estimate the location of new wells and the pumping schedule necessary to meet those demands by adjusting the number, location, and screened interval of new pumping wells until the simulated produced lithium closely matched the anticipated lithium carbonate production schedule.

The locations of new (future) wells simulated in the Salar Model to meet the anticipated lithium brine production schedule, and additional future mining features, are shown in Figure 12-5. This future well configuration is only one of many potentially viable well configurations that will be evaluated/modeled in the future based on observed conditions at that time.

13.3 ANTICIPATED LITHIUM BRINE PRODUCTION SCHEDULES

The anticipated lithium brine production schedule is provided in Figure 13-3. For 2 years leading up to the Third Expansion (discussed in Section 14.7), additional brine is extracted to fill ponds. Lithium brine production beyond 2030 is assumed to remain constant at approximately 24,160 Mt lithium per year.

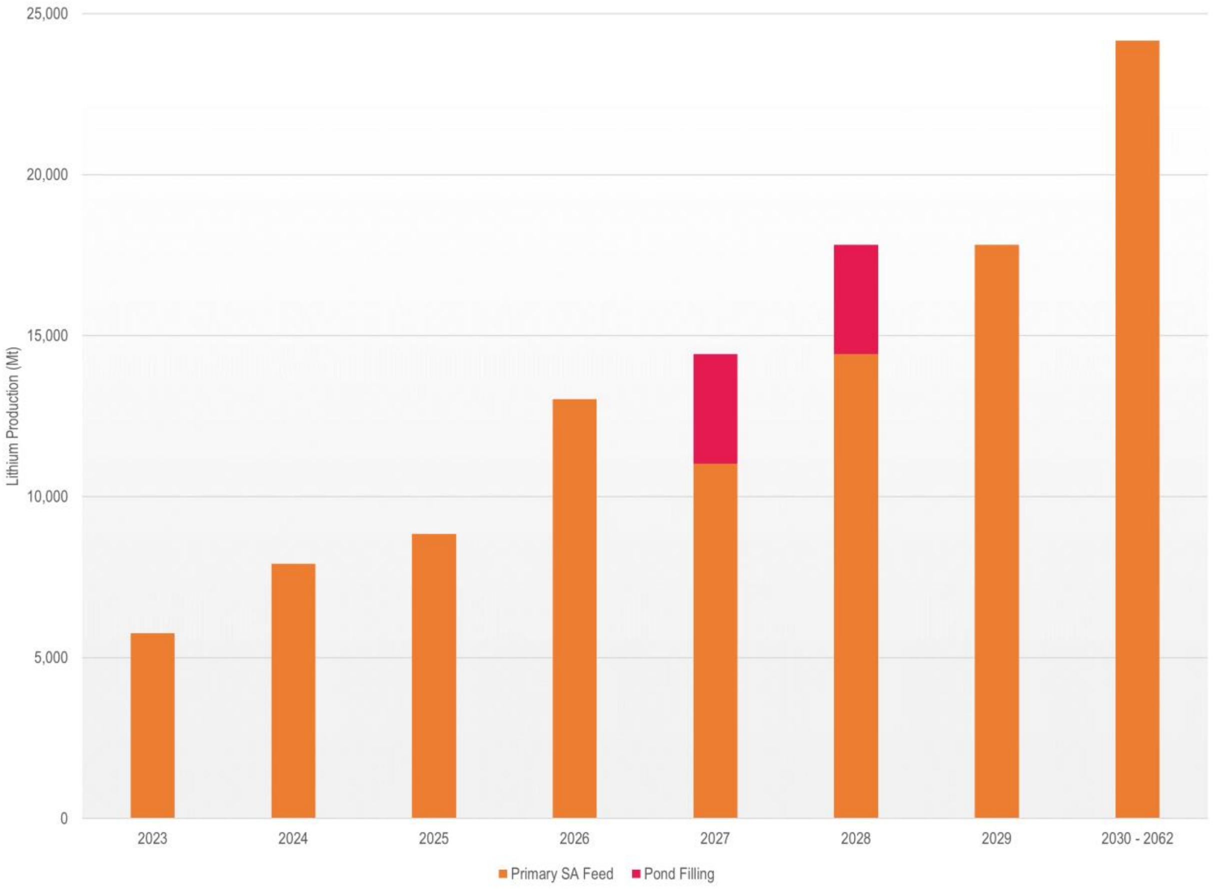


Figure 13-3. Anticipated Lithium Brine Production Schedule

The lithium carbonate production schedule is summarized in Table 13-1. Average annual lithium carbonate production is anticipated to be 98,000 Mt by 2030, and this rate can be sustained for the next 40 years through 2062. The lithium brine production schedule exceeds the lithium carbonate production schedule to account for process inefficiencies and a portion of the brine feed directed to the Güemes Plant for lithium chloride production. As a conservative measure, intended to bias revenue lower than anticipated, lithium chloride production is not currently modeled in the Economic Analysis (Section 19).

Table 13-1. Anticipated Lithium Carbonate Production Schedule (2023–2030)

Year	2023	2024	2025	2026	2027	2028	2029	2030
Total Carbonate Production (Mt)	***24,000***	***34,000***	***38,000***	***56,000***	***68,000***	***68,000***	***77,000***	***98,000***

Notes:
Lithium carbonate production expressed in metric tons (Mt)
Production in years 2031–2062 is expected to continue at the rate of 98,000 Mt per annum.

14 PROCESSING AND RECOVERY METHODS

Mineral processing at Project Fenix requires lithium-rich brine and fresh water. The process involves three primary steps: raw brine and freshwater extraction (lithium brine production), lithium removal via SA (concentrated lithium brine production), and concentration and conversion to lithium carbonate (lithium carbonate production). In 2022, the process extracted 1,770 m^3/h of raw brine and 355 m^3/h of fresh water to produce 4,903 Mt of concentrated lithium at the SA Plant. During the same period, approximately 43% of the brine and fresh water used in the process was returned to the Salar at the artificial lagoon. Brine extraction is described in Section 13 (Mining Methods).

This section focuses on lithium removal and recovery processes after brine extraction. The main processing facilities at Project Fenix include the SA Plant, pre-concentrate ponds, FSB ponds, a Carbonate Plant, and Auxiliary Services Plant. All of Livent's plants are certified by the International Organization for Standardization (ISO) standards for Environment (14001), Occupational Health and Safety (45001), and Quality (9001). Additionally, Livent's lithium carbonate production plan is certified for lithium battery manufacturing (16949) by the International Standard for Automotive Quality Management Systems' International Automotive Task Force.

A photograph of the Project Fenix facility is provided in Figure 14-1 and a general flow diagram is depicted in Figure 10-1.

Figure 14-1. Project Fenix Facilities

14.1 SELECTIVE ADSORPTION (SA) PLANT

Feedstock brine is directed to the SA Plant where lithium chloride is removed from the raw brine using a trade secret SA process. At the SA Plant, the brine is loaded into a column where the lithium is adsorbed onto media. The medium is then stripped of the lithium-rich brine where it proceeds to the next step that removes water for recycle and further concentrates the lithium chloride brine. The brine is polished to remove other elements. The SA process is shown in Figure 14-2.

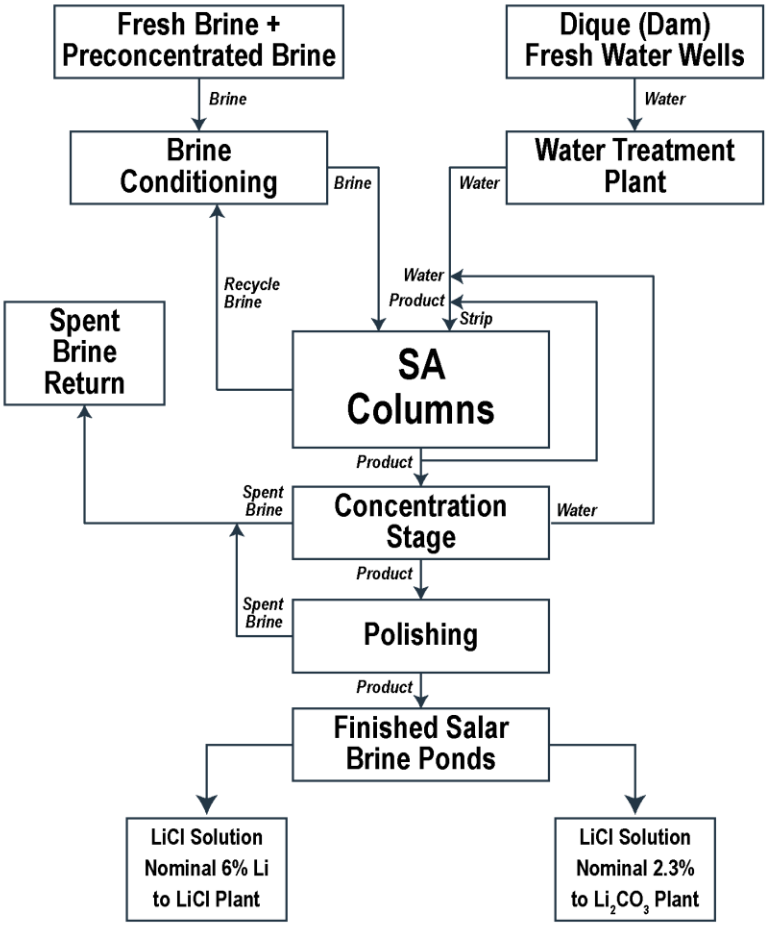


Figure 14-2. Project Fenix Selective Adsorption Plant Process

14.2 PRE-CONCENTRATE PONDS

In 2012, the facility began operating a series of evaporation basins (“pre-concentrate” ponds), whereby some of the flow from the PWB was directed into these ponds located approximately 3 km north of the SA Plant on the Salar surface. These shallow ponds cover a large surface area (approximately 330 hectares) and promote evaporation and lithium concentration of the brine. An aerial image showing the pre-concentrate ponds is provided in Figure 4-2.

The SA Plant can be fed with either fresh brine only, or with concentrated brine from the pre-concentrate ponds. Raw brine is diverted into these ponds, which act like the sodium chloride ponds of a conventional lithium removal pond series, dropping out sodium chloride and raising the concentration of lithium (and other elements) through solar evaporation. The value of using higher concentration brine as feedstock is an increase in lithium brine production capacity at the SA Plant.

14.3 FINISHED SALAR BRINE (FSB) PONDS

After passing through the SA Plant, concentrated lithium brine is directed to a series of small evaporation ponds (called FSB ponds) used to further raise the concentration of the brine. The FSB ponds are much smaller (42 acres) than the pre-concentrate ponds, are located on the alluvial terrain adjacent to the SA Plant, and are lined to prevent leakage. An aerial image showing the FSB ponds is provided in Figure 4-2.

14.4 CARBONATE PLANT

A concentrated brine stream is directed from the FSB ponds to the Carbonate Plant (Figure 14-3) as feed for finished lithium carbonate, or the concentrated brine is transported to the lithium chloride processing facility in Güemes. At the Carbonate Plant, concentrated brine is conditioned and reacted with sodium carbonate to produce lithium carbonate and sodium chloride. The slurry is filtered, repulped, centrifuged, and dried before packaging. Finished lithium carbonate is packaged into 0.5- or 1-cubic-yard woven polyethylene super sacks and stored onsite until they are shipped. Livent also has the capability to micronize lithium carbonate to meet specific customer requirements.

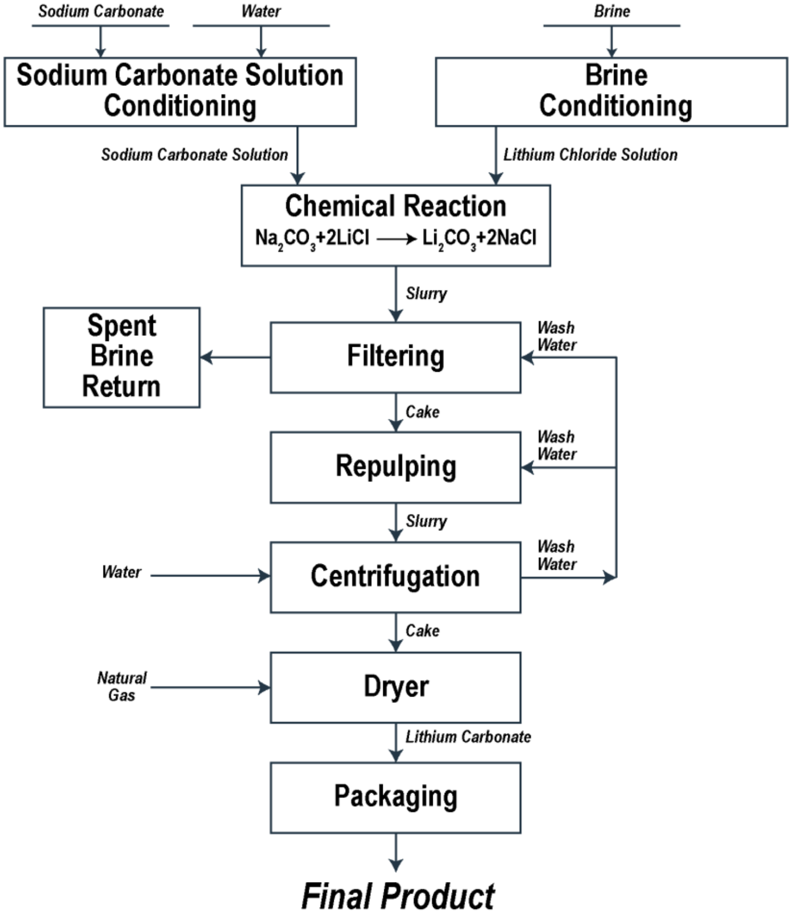


Figure 14-3. Project Fenix Carbonate Processing Plant

14.5 AUXILIARY SERVICES PLANT

The Auxiliary Services Plant is responsible for generating electricity, steam, and compressed air for the operating plants and for the rest of the service buildings.

Electrical power is generated from liquid fuel (diesel) or natural gas. Steam is generated using demineralized water (osmosis) and condensate recovered from the plants as secondary inputs to the system. Corrosion-inhibiting chemicals are sometimes added to the water injected to the boilers, which improve function and reduce chemical attack on the internal structures of the equipment. A process flow diagram for the Auxiliary Services Plant is provided in Figure 14-4.

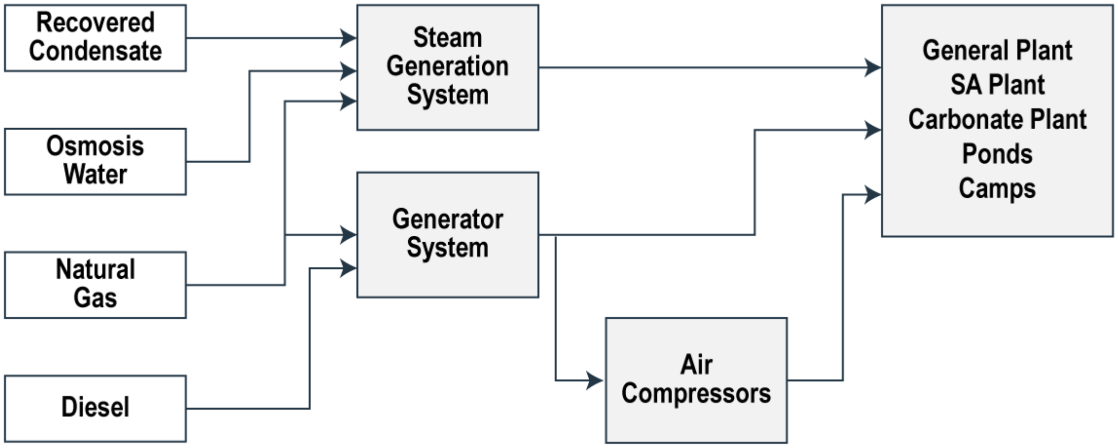


Figure 14-4. General Flowchart of Auxiliary Services Plant

14.6 ARTIFICIAL (SPENT BRINE) LAGOON

Livent's operations at SdHM are unique because no other active mining operation uses the same methods to process lithium from brine. Brine extraction does not create "tailings" like a hard rock mine. Livent manages the return of produced water to the salar via infiltration following land application. Thus, the best management practices employed at Project Fenix are not directly comparable to other lithium brine mining operations.

According to the U.S. Department of the Interior (Guerra et al. 2011), returning produced water to the aquifer as storage for future use is beneficial. Other beneficial uses of produced water include crop irrigation, livestock watering, streamflow augmentation, and municipal and industrial uses. The type of beneficial use most appropriate for a produced water application depends on the geographical location of the produced water generation, the location of the beneficial use, and the constituent concentrations in the produced water.

At Project Fenix, returning produced water back to the aquifer is the most beneficial use because the quality of produced water is not suitable for agricultural or livestock use or for stream augmentation. The quality of produced water at Project Fenix is essentially identical to fresh brine. Thus, infiltration of produced water is a viable beneficial use at SdHM.

Effluent from the SA Plant, referred to as spent brine, is a mixture of brine that has been stripped of lithium and fresh water. Spent brine is directed north of the SA Plant to equalization ponds before being discharged to the artificial lagoon (Figure 4-2). At the artificial lagoon, spent brine provides recharge to the Salar through infiltration or is evaporated. Average annual flow to the artificial lagoon is shown in Figure 14-5.

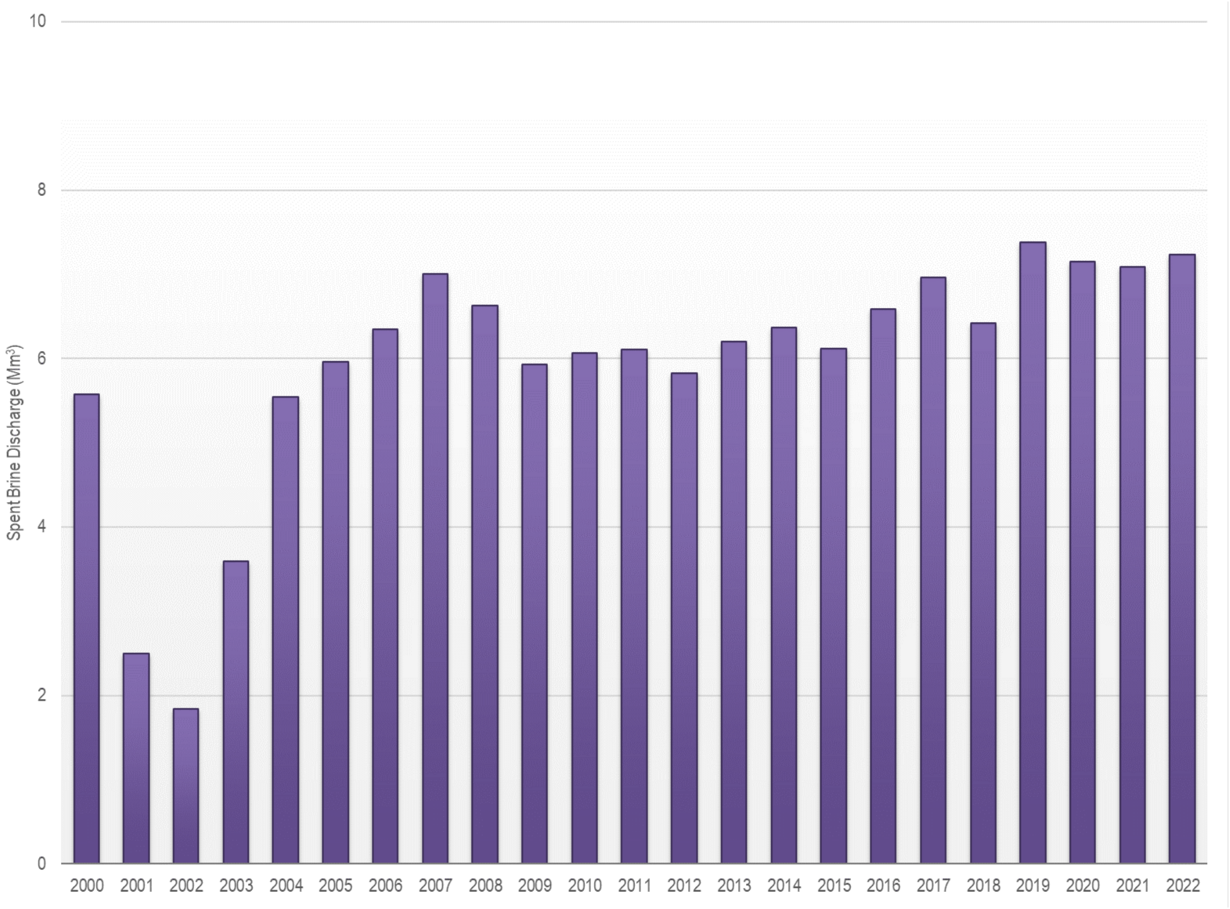


Figure 14-5. Annual Flow to Artificial Lagoon

14.7 PROJECT FENIX EXPANSIONS

Mineral processing capacity at Project Fenix is scheduled to expand in future years. The First Expansion is currently underway. A Second and Third expansion are both in the early development (Capital Deployment Process Front End Load) stage. Brine demands are expected to increase with increased lithium carbonate production. New lithium brine production wells within the Western Subbasin will supply additional brine feedstock, and additional fresh water will be obtained from the Los Patos Aquifer and from engineered conservation and recycling technologies. Following each expansion, the ratio of spent brine return to lithium brine production is expected to decrease as recovery technologies are introduced into the process. Within these expansions, no new or novel processes will be introduced that have not already been proven to be effective in lithium extraction. Livent's SA process and later use of evaporation ponds are established extraction processes, and water recovery methodologies being applied to auxiliary streams are utilized in multiple industries. Future expansions will focus efforts on reducing the intensity of freshwater use. Descriptions of each expansion, including the technologies considered to increase production efficiency and to conserve and recycle fresh water, are provided in the sections that follow.

14.7.1 First Expansion

In 2016, the first in a series of planned expansions was initiated. The project scope was split into two phases to achieve an ultimate increase in lithium carbonate production capacity of 20,000 Mt of lithium carbonate per year. Phase A includes scope to support lithium carbonate production of the first 10,000 Mt per year of lithium carbonate and is expected to be mechanically complete in 2023. Phase B (a replica of Phase A) is expected to begin production in 2024. The final design of the first full expansion of the Fenix facility, currently under construction, is shown in Figure 14-6.

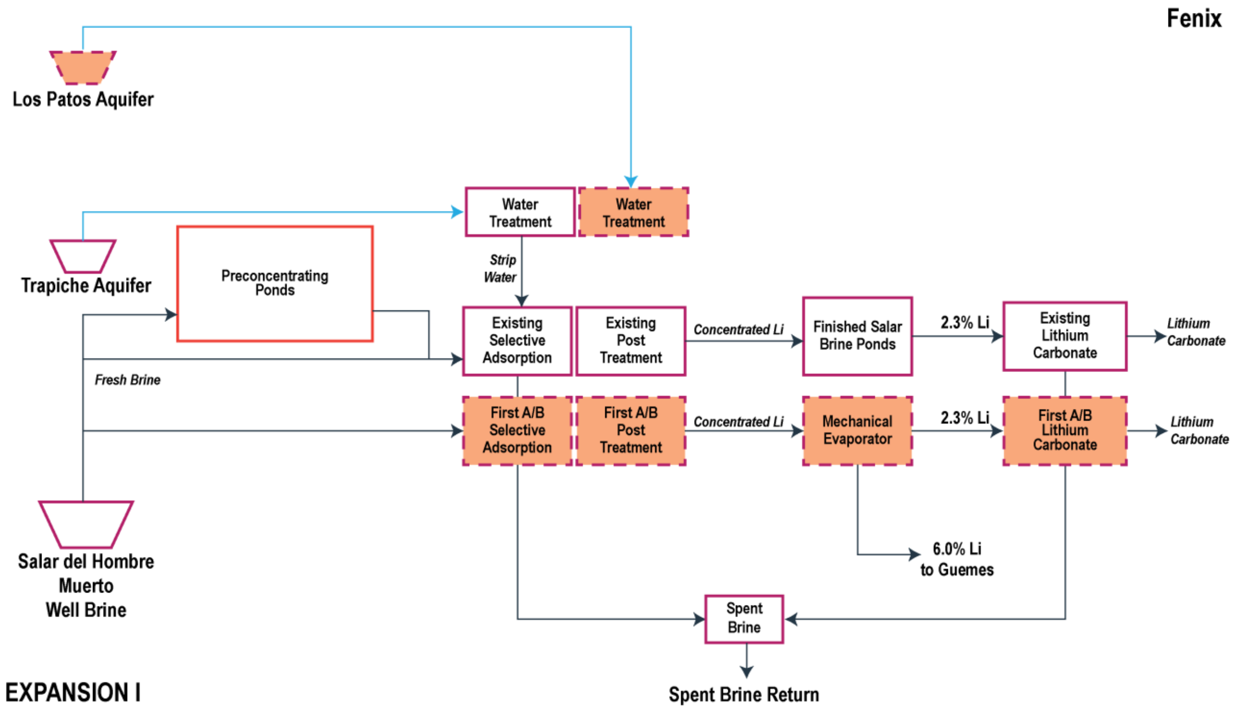


Figure 14-6. Project Fenix Facility First Expansion Process Flow Diagram

The First Expansion involves constructing a new SA Plant, a small section of interim FSB ponds, a new mechanical evaporation system designed to replace the finishing ponds, and a new Carbonate Plant. The expansion will include additional brine wells, ponds, piping, utilities, and buildings to support increased lithium carbonate production and administration. In addition, a new raw water pipeline and water treatment plant will be installed to deliver additional fresh water to the SA Plant from the Rio de Los Patos Aquifer (Section 15, Infrastructure).

As part of this expansion, a change will be made to allow recovery of water in the finished brine, as well as reduce contamination and seasonal changes in brine grade introduced by the FSB ponds. A mechanical evaporation process utilizes vapor recompression technology as a fully contained concentration process for lithium chloride brines, which displaces water and removes impurities. Water recovered by this process can be used in the same or other parts of the process. This project addition minimizes equipment footprint when compared to the existing process technology. A future independent project will add a second train of mechanical evaporators to allow for closure and reuse or removal of the FSB pond system. Construction of the First Expansion is shown in a photograph from January 2023 (Figure 14-7).

Figure 14-7. Photograph of Project Fenix Current Facility First Expansion, January 2023

Significant brine testing was conducted with potential equipment providers before the final technology was chosen. The first unit is under construction for delivery and installation in 2023.

14.7.2 Second Expansion

Expansions beyond the First Expansion have been included in modeling of the resource and financials, but are presented here in concept only.

The Second Expansion is currently in early design phase, with the announced intent to increase capacity by another 30,000 Mt of lithium carbonate in total per year. Similar to the First Expansion, the Second Expansion will include another SA Plant, mechanical evaporation system, Carbonate Plant, additional brine wells, ponds, piping, utilities, and buildings. Additional water recovery is part of the design considerations of the Second Expansion to allow for a reduced intensity of the demand on freshwater resources.

The Second Expansion will also include a process technology designed to reduce the volume of a lithium-rich liquid effluent stream from the lithium carbonate process by recovering the lithium and a fraction of the free water in the stream and to produce a crude primary lithium carbonate suitable for use as a feedstock to lithium hydroxide facilities. It is expected that approximately one-third of the expanded capacity will be made available by this unit and is intended to be targeted for use in lithium hydroxide production.

The Second Expansion project is in early development; it is expected to be completed in a single construction phase and mechanically complete in late 2025. A conceptual flow diagram for Project Fenix after the Second Expansion is depicted in Figure 14-8.

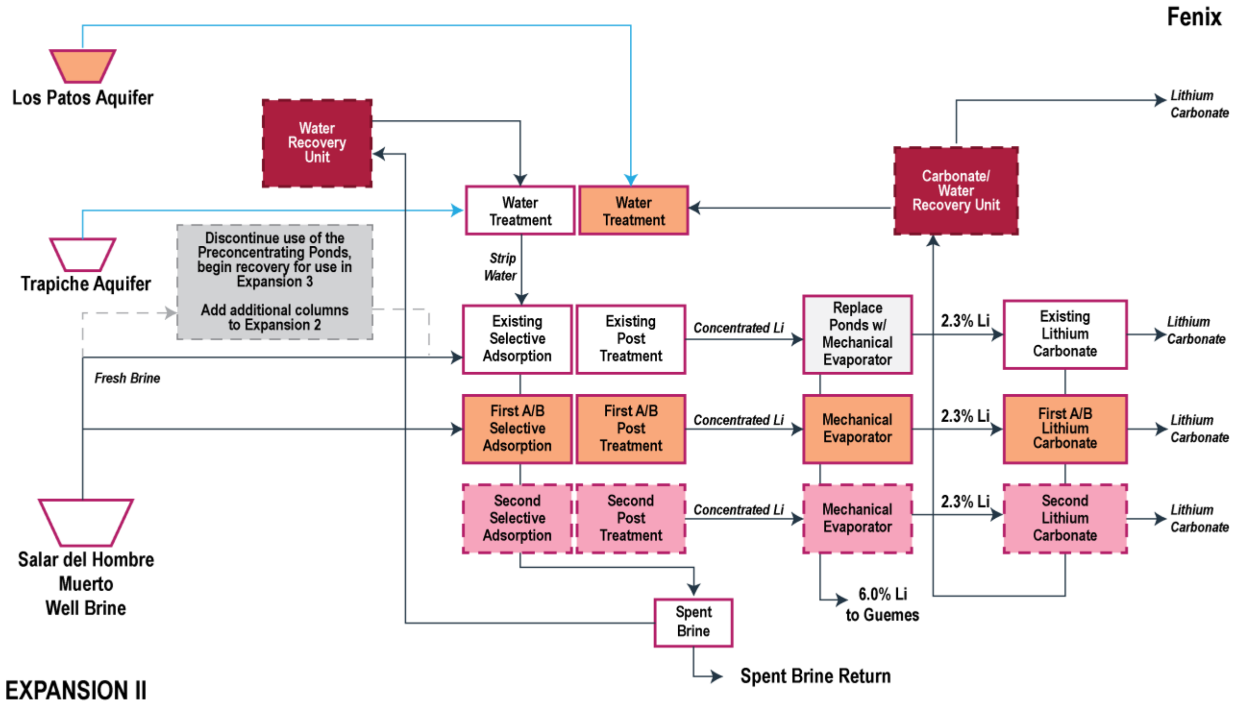


Figure 14-8. Project Fenix Facility Second Expansion Conceptual Process Flow Diagram

14.7.3 Third Expansion

The Third Expansion will increase capacity by another 30,000 Mt of lithium carbonate per year. The Third Expansion is in early conceptual design and will consider a wider set of options including the re-use and expansion of the pre-concentrate ponds used for existing operations as the basis for a conventional brine pond evaporation technology with enough feed for a 30,000-Mt Carbonate Plant. A flow diagram of Project Fenix after the Third Expansion is provided in Figure 14-9.

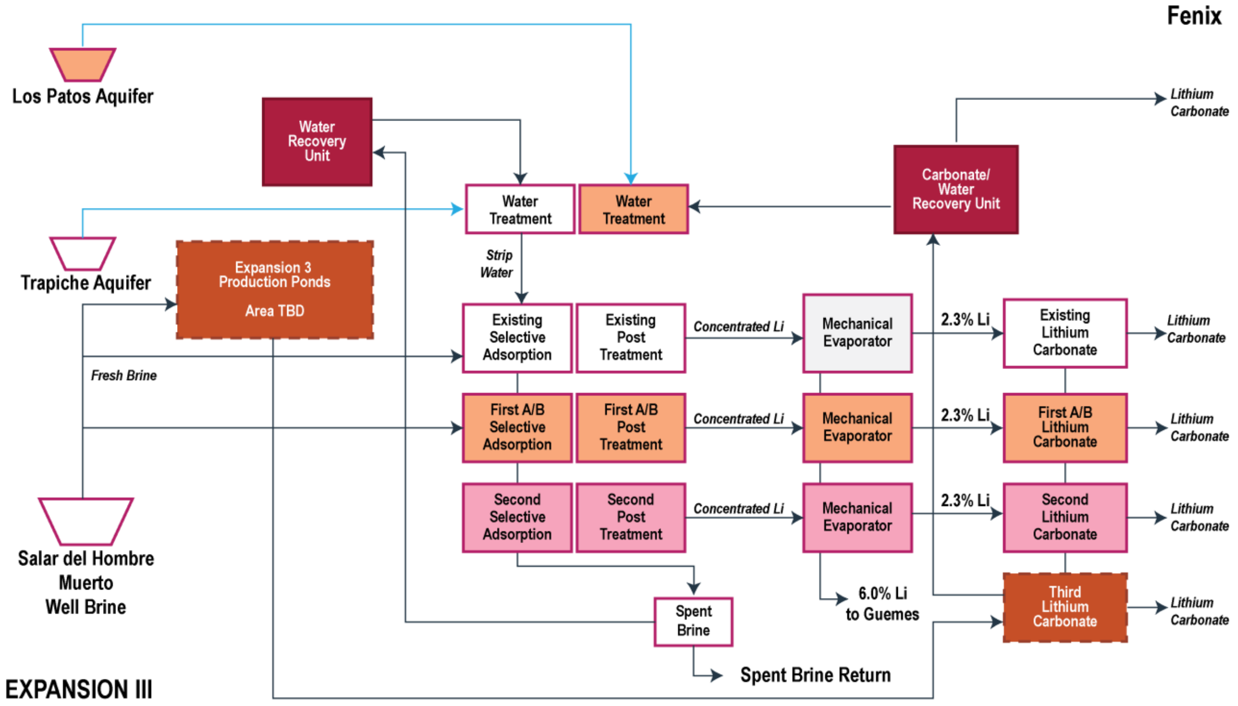


Figure 14-9. Project Fenix Facility Third Expansion Conceptual Process Flow Diagram

15 INFRASTRUCTURE

The infrastructure to support Project Fenix is well established and reliable. Access to the site by road and aircraft is described in Section 4. Infrastructure to support mineral processing and recovery is discussed in Section 14.

This section focuses on site infrastructure including the utilities and support facilities necessary to support operations at Project Fenix.

15.1 SITE FACILITIES

Project Fenix includes an operations camp with two facilities to house personnel, and related infrastructure for water supply and distribution, shop and warehouse facilities, and administrative offices. Construction to expand the operations camp ahead of planned manufacturing plant expansions is nearing completion. Piped natural gas provides the energy for heating and steam needs at the facilities. Site facilities are shown in Figure 15-1. Dedicated security personnel secure the site, which has a full communications system installed.

A description of the ponds used at various stages during mineral processing to store and concentrate brine is provided in Section 14. Maintenance on the site's ponds involves the management of solid precipitates, including treating or recycling solids into the process.

Raw water, coming from the Rio Trapiche surface impoundment and Trapiche Aquifer groundwater wells, is filtered, preheated, and conditioned at the water treatment plant. A recovery reverse osmosis rejection plant is available to improve water quality and increase yield.

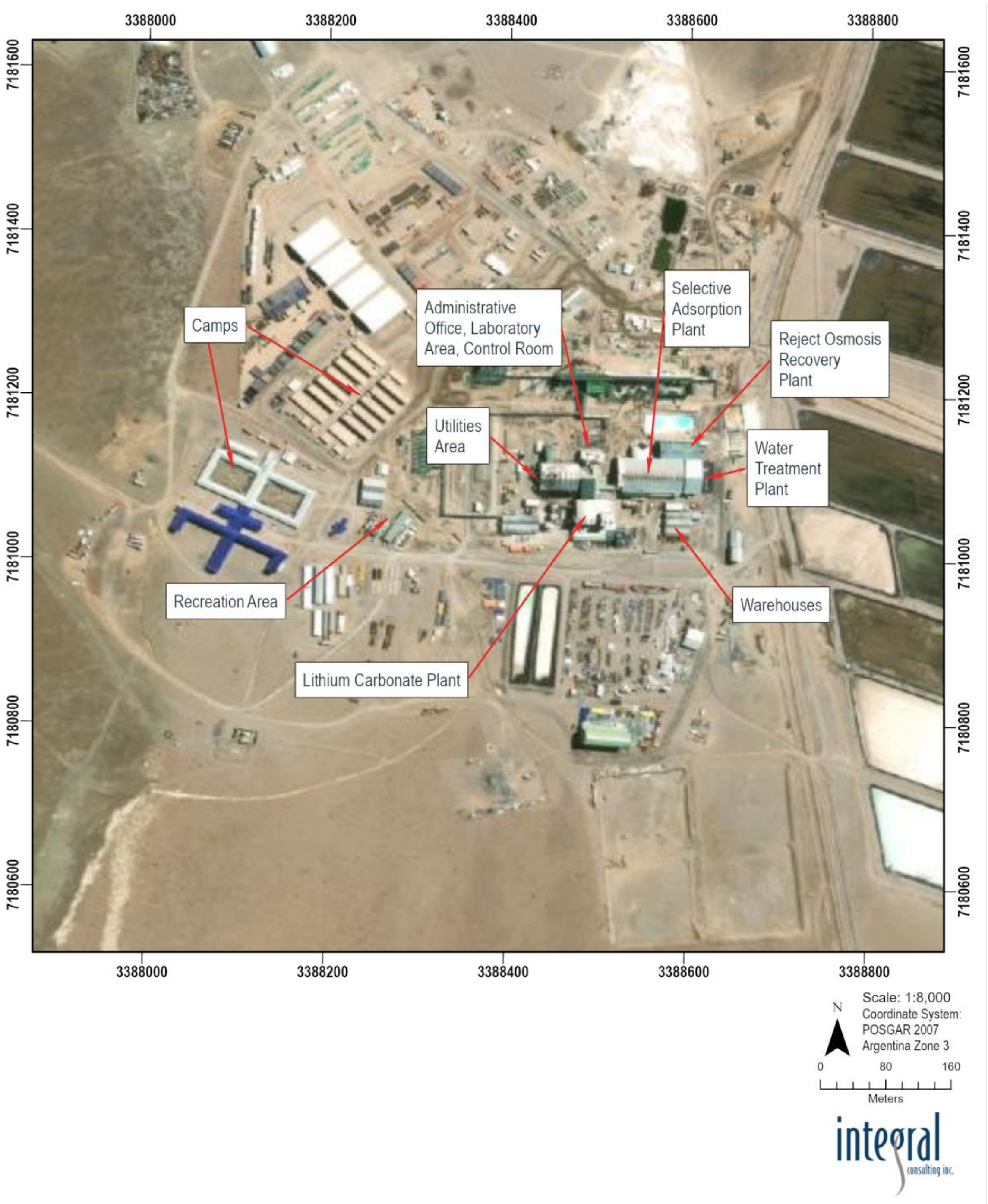


Figure 15-1. Project Fenix Site Facilities

15.2 ENERGY

Power for Project Fenix is generated onsite at the Auxiliary Services Plant. Natural gas conveyed via pipeline is the primary fuel source to the Auxiliary Services Plant. Natural gas delivered by pipeline arrives at 50 kg/cm^2 of pressure at a rate of 3,800 m^3/h (normal).

The industrial and household supply facilities (camps) of the site are fed from the main regulation and measurement station, where it goes from 50 kg/cm^2 to a distribution of 7 kg/cm^2; this being an internal distribution to the other regulation substations that feed the different operation plants.

General loads of consumption and associated energies for the Fenix plant are provided in Table 15-1.

Table 15-1. General Load Consumption and Associated Energies for Fenix Plant

Position	Equipment	Energy			Natural Gas Consumption			
		Min	Max	Units	Units	Min	Max	Units
LiCa	D-7600	2686	3171	MBTU/h	Kg/cm2	72	85	Nm3/h
Utilities	Gen X-9202	4351	4351	MBTU/h	Kg/cm2	117	117	Nm3/h
	Gen X-9203	4351	4351	MBTU/h	Kg/cm2	117	117	Nm3/h
	Gen X-9204	4495	5394	MBTU/h	Kg/cm2	121	145	Nm3/h
	Gen X-9205	4495	5394	MBTU/h	Kg/cm2	121	145	Nm3/h
	Gen X-9208	12434	12434	MBTU/h	Kg/cm2	333	333	Nm3/h
	Gen X-9209	4351	4351	MBTU/h	Kg/cm2	117	117	Nm3/h
	Gen X-9210	4351	4351	MBTU/h	Kg/cm2	117	117	Nm3/h
	Cald BO-8810	30215	35064	MBTU/h	Kg/cm2	810	940	Nm3/h
	Cald BO-8820	30215	35064	MBTU/h	Kg/cm2	810	940	Nm3/h
	Cald BO-8830 bkup	29469	30961	MBTU/h	Kg/cm2	790	830	Nm3/h
Camp	System	1492	1492	MBTU/h	Kg/cm2	40	40	Nm3/h
Total		**132,903**	**146,377**			**3,563**	**3,924**	**Nm3/h**

Diesel is used for fuel generators at lithium brine production wells, and in bi-fuel generators and as backup for the Auxiliary Services Plant. Six underground and two aboveground tanks provide 500,700 liters standard capacity with the ability to store up to 777,000 liters. Tank characteristics and their capacities are provided in Table 15-2.

Table 15-2. Fuel Storage Tank Capacity

Position	TAG Internal	Standard	Max	Units	Type
Utilities	**T-9001**	60,000	94,000	Liters	Underground
	T-9002	60,000	94,000	Liters	Underground
	T-9003/4	120,000	188,000	Liters	Underground
	T-9005/6	120,000	188,000	Liters	Underground
	T-9007/8	120,000	188,000	Liters	Underground
Others	**T-9227A**	10,000	12,000	Liters	Underground
	T-9227B	10,000	12,000	Liters	Aerial
	T-9035	700	1,000	Liters	Aerial
Total		**500,700**	**777,000**	**Liters**	

15.3 WATER AND PIPELINES

In addition to brine extracted from the Salar, the SA Plant also requires fresh water, which is used in its SA process to extract lithium. From 1997 to the present, fresh water has been withdrawn from a small dammed surface water impoundment (dique) located at the terminus of the Rio Trapiche, and from a series of groundwater pumping wells installed in the Trapiche alluvial aquifer. Additional pumping wells in the Trapiche Aquifer have been added over time to increase freshwater extraction rates. Groundwater conveyed from the Los Patos Aquifer will accommodate anticipated future freshwater demands following plant expansions.

15.3.1 Trapiche Aquifer

Surface water from the Rio Trapiche and groundwater from the Trapiche Aquifer are directed to the SA Plant for processing along with the brine. A network of pumping wells provides fresh groundwater extraction, with four to five wells operating at any given time. Groundwater levels and quality are measured in pumping and monitoring wells installed in the alluvial fan downstream from the dique. The locations of freshwater extraction wells and monitoring wells are shown in Figure 15-2. Average annual withdrawals and diversions from the Trapiche Aquifer system are shown in Figure 15-3.

Since 1997, fresh groundwater from the Trapiche Aquifer has been used to supply operations at Project Fenix. Livent manages groundwater resources to prevent groundwater overdraft (excessive drawdown) and minimize the potential for brine upwelling, by monitoring and using numerical modeling tools. Livent monitors and reports aquifer conditions (water levels and water quality) to local authorities in accordance with its Environmental Control Program (Section 17.2).

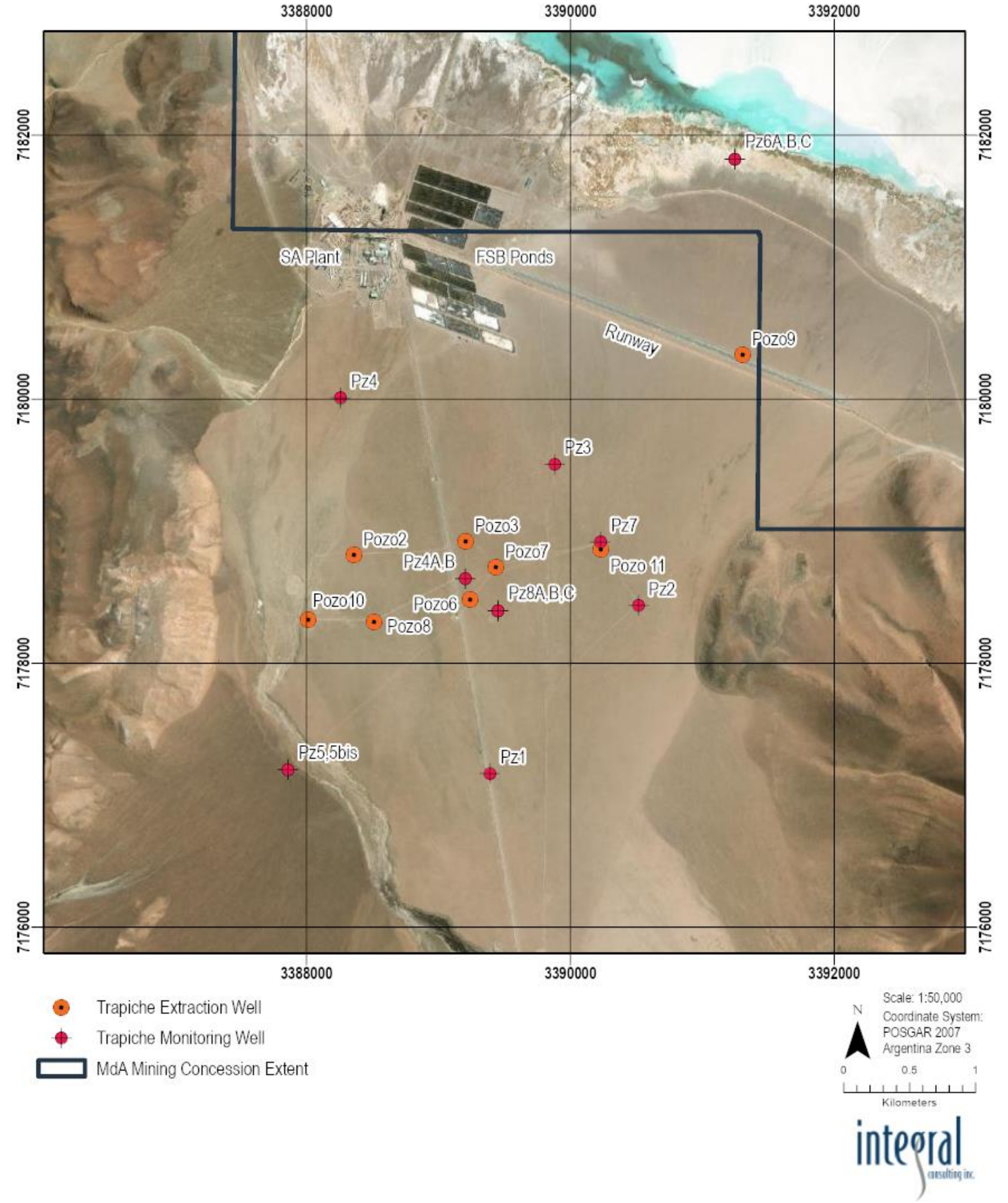


Figure 15-2. Trapiche Aquifer Well Locations

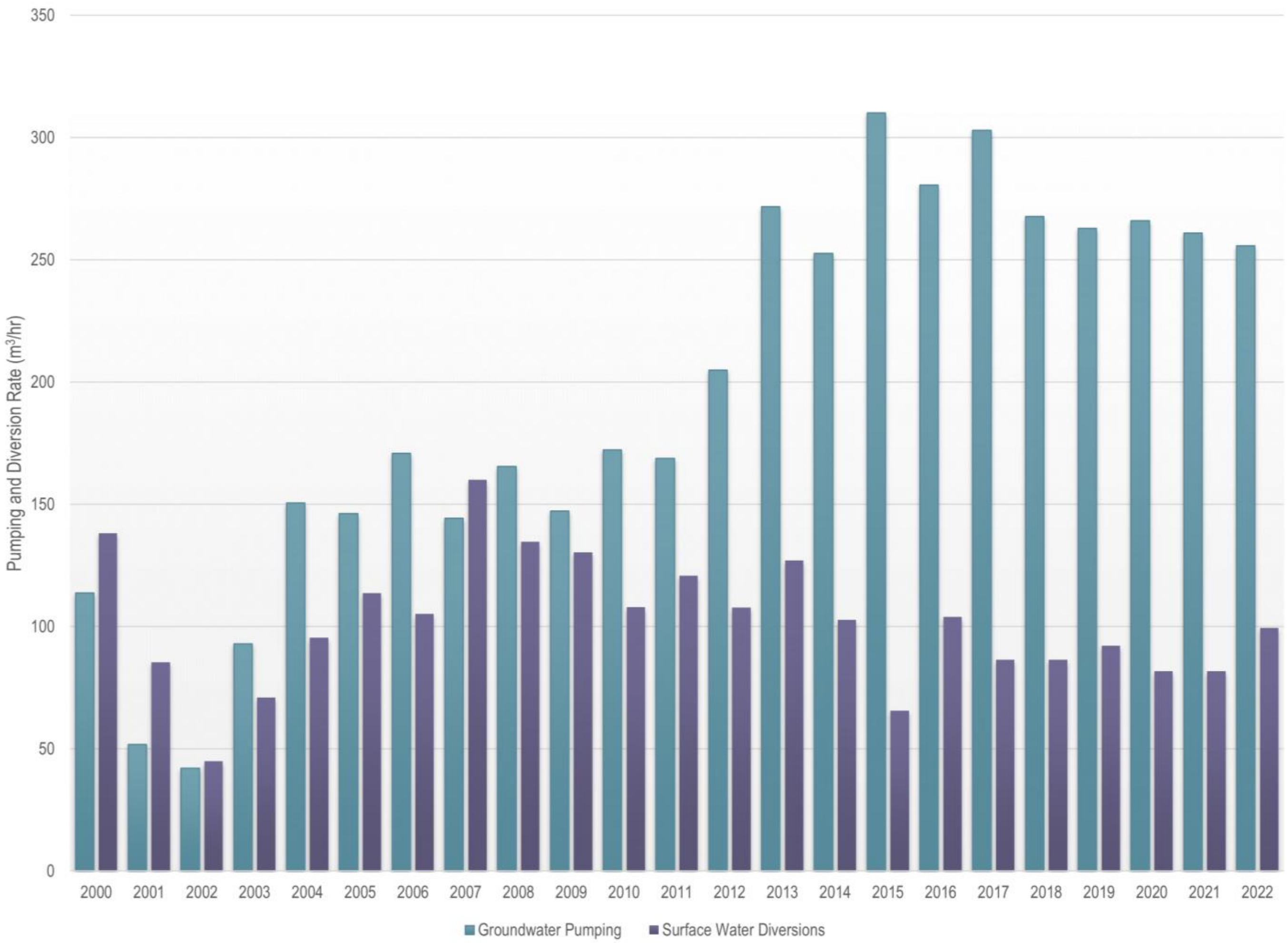


Figure 15-3. Average Annual Extraction Rates, Trapiche Aquifer

In 2015, a numerical groundwater flow and transport model (Trapiche Model) was developed to quantify groundwater flow within the Trapiche Aquifer and to evaluate future pumping scenarios. The Trapiche Model was updated in 2018 and recalibrated in 2022 (Integral 2022). Following each update and recalibration, predictive simulations were conducted to optimize the use of freshwater resources. The optimization process involves adjusting groundwater extraction rates and the locations of freshwater extraction wells based on monitoring data and modeling predictions.

15.3.2 Los Patos Aquifer

Freshwater supply from the Trapiche Aquifer is not sufficient to meet the projected demands following plant expansions. Starting in 2016, Livent began a freshwater reconnaissance program to identify locations suitable for freshwater development (Conhidro 2012). In the years that followed, additional investigations were carried out with progressively increasing rigor (Conhidro 2016; Integral 2018).

During its freshwater resource reconnaissance program, Livent installed a network of six freshwater extraction wells and 10 monitoring wells (Figure 15-4). Step-tests and aquifer tests with 72 hours of constant pumping were performed in three of the freshwater extraction wells (PBLP-01 through PBLP-03). Analytical and numerical methods were used to estimate aquifer properties from test data and optimal well spacing. Results of the comprehensive aquifer testing program and associated numerical modeling indicate the Los Patos Aquifer is a suitable freshwater resource and is capable of providing the amount of fresh water required to meet future demand for Project Fenix.

Construction of a 31-km aqueduct to convey fresh water from the Rio de Los Patos Aquifer to Project Fenix is currently underway (Figure 15-5). Once fresh water from the Los Patos Raw Water Aqueduct is available to Project Fenix, freshwater demand from the Trapiche Aquifer will be reduced.

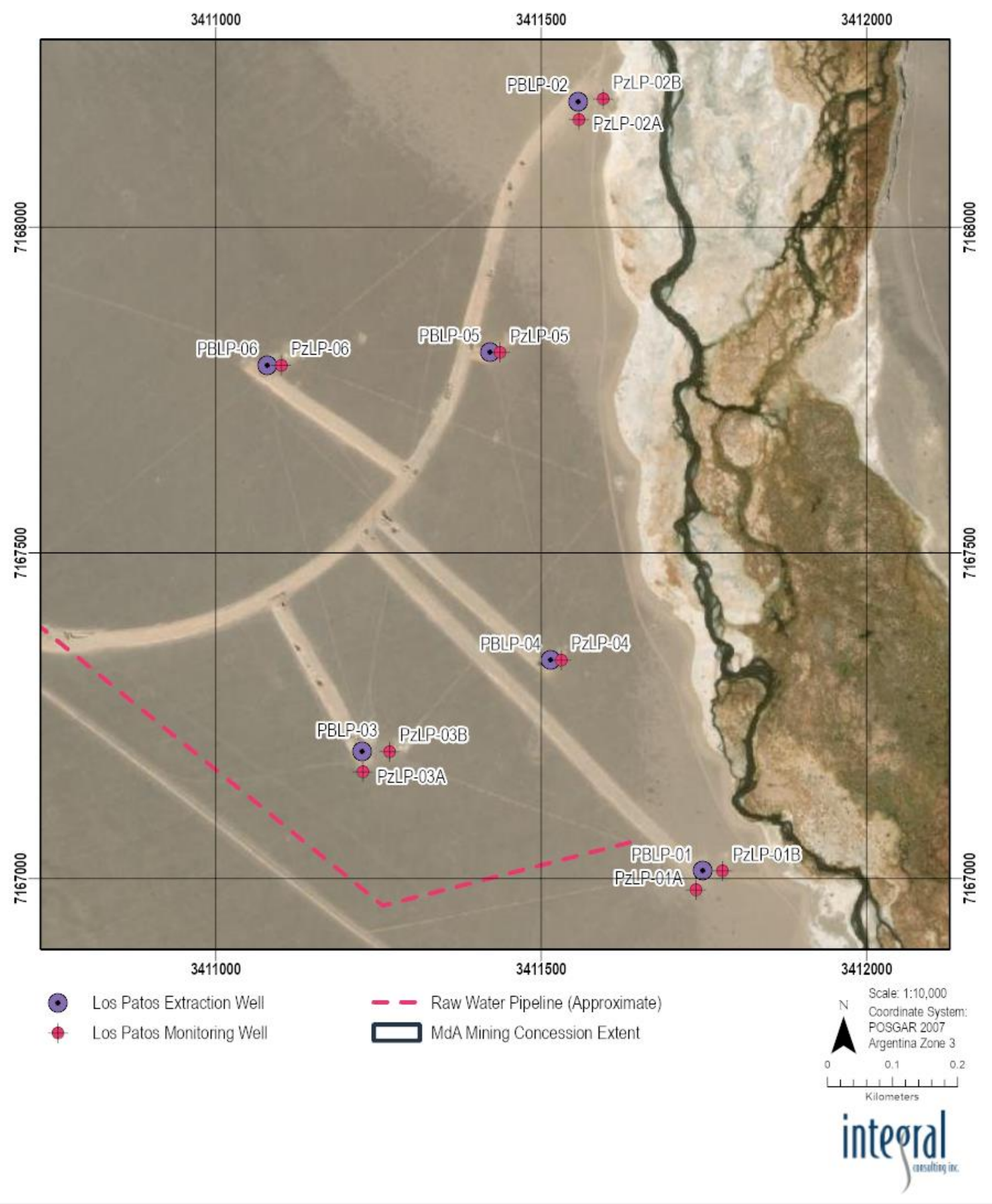


Figure 15-4. Rio de Los Patos Aquifer Infrastructure

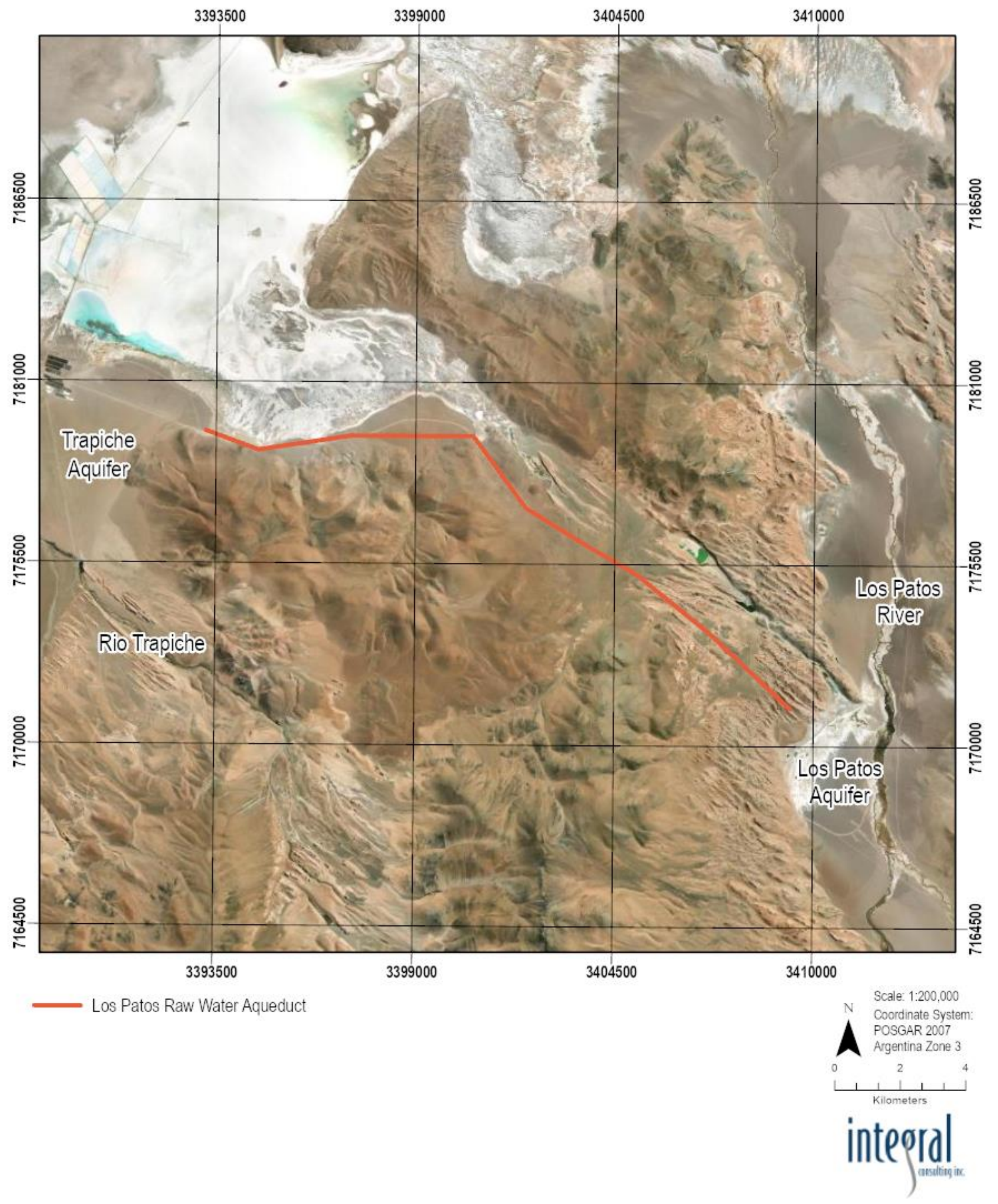


Figure 15-5. Los Patos Aquifer Raw Water Aqueduct

15.4 WASTE DISPOSAL

Industrial effluents (sorbents used at the SA Plant or water treatment plant rejectate water) are returned to the Salar onsite.

Hazardous solid wastes are contained in temporary storage onsite before shipment offsite to an authorized disposal facility. Non-hazardous, non-recyclable waste is disposed of in an approved onsite landfill. Recyclable waste streams including plastics, metal, wood, and paper products are separated and shipped offsite to an authorized recycling facility.

Sanitary wastes are conveyed from facilities to a central treatment facility where effluents undergo aerobic treatment before being discharged to leach fields.

15.5 TRANSPORTATION

Access to Project Fenix by vehicle and aircraft is discussed in Section 4. Transportation infrastructure used to ship lithium products by rail and ship is described below.

15.5.1 Rail

The railway network in Chile is operated by the company Ferronor; this network is made up of 2,300 km of rail with a line that runs from north to south of Chile, plus a set of branches that run crosswise (Figure 4-5). One of the most important is the Augusta Victoria Station (Chile)–Socompa Station (Argentina), on the border with Argentina. This network allows cargo to be moved from the Antofagasta Port to the Socompa Station (300 km) and from the Socompa Station, through the Belgrano Railway-C14, to the Salar de Pocitos Station (250 km) or Socompa Station–Güemes Station (611 km) in Argentina (shown in a photograph on Figure 15-6).

Figure 15-6. Livent Salar de Pocitos Railway Station

Figure 15-7. Super Sacks at the Antofagasta Port Railway Station

15.5.2 Port Facilities

Empresa Portuaria de Antofagasta (EPdA) is located in South America, specifically in the Antofagasta Region, Chile (shown in photographs on Figures 15-7 and 15-8). The port is located in a strategic area that borders northwestern Argentina, a part of Bolivia, and the Pacific Ocean.

It is located 676 km from Project Fenix, Livent, SdHM, in Catamarca; and 734 km from the Lithium Chloride Plant, Livent, located in Güemes, Salta.

EPdA manages the terminal in accordance with the standards of ISO 9001 certification, under the multi-operated modality with ship and wharfage agencies. It has three docking sites with a total length of 600 m and a maximum draft of 9.14 m. The terminal has 11 hectares of esplanades for the collection and operation of cargo, and three warehouses with a total capacity of 18,000 m^2 for storage.

Figure 15-8. Empresa Portuaria de Antofagasta

15.6 LOCAL COMMUNITIES

SdHM has very low population density, with approximately 40 inhabitants. The population centers with more than a few families are located in villages outside the boundaries of SdHM, including the villages of Antofagasta de la Sierra and el Peñón, and very small population settlements such as Ciénaga Redonda, Los Nacimientos, and Antofalla (Figure 4-1).

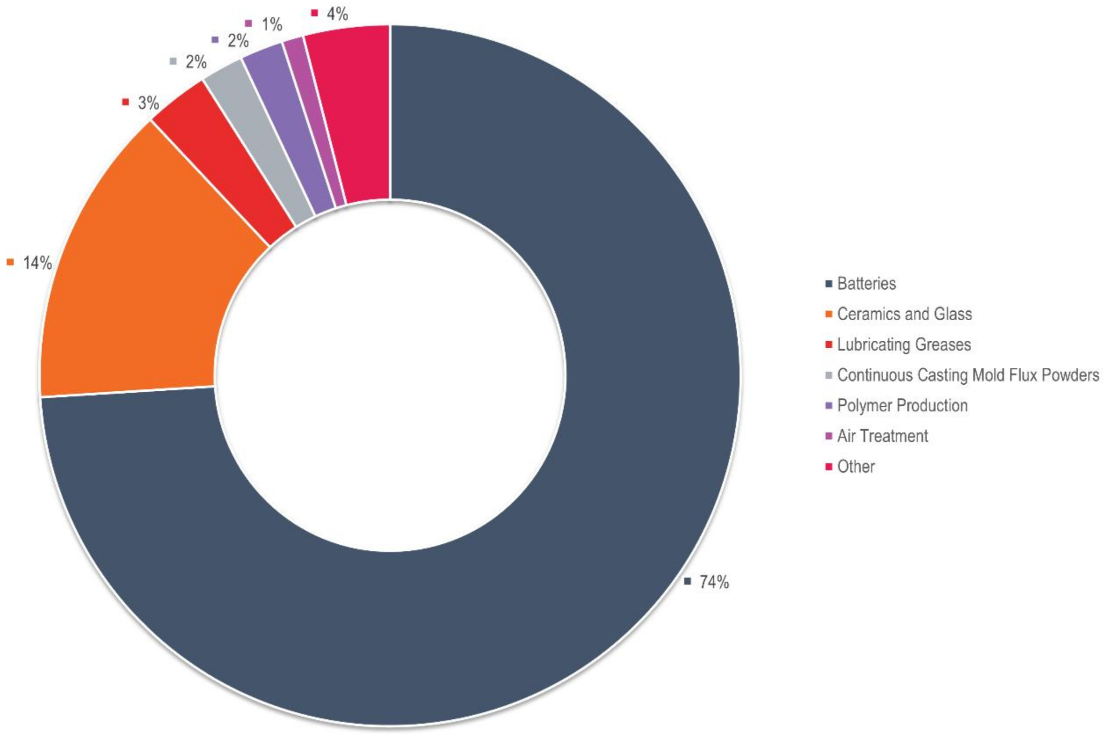
Following applicable provincial regulations currently in effect, the Province of Catamarca has established that the area of direct and indirect influence of Project Fenix is County (*Departamento*) of Antofagasta de la Sierra. Under applicable regulations, the only indigenous community currently recognized within the County (*Departamento*) of Antofagasta de la Sierra, is the indigenous community of Antofalla - Kolla Atacameño (the "Indigenous Community").

As a result of these circumstances and as evidenced in Project Fenix's approved environmental impact assessments (EIAs), Project Fenix's mining-related activities do not affect rights or interests of the Indigenous Community. Those rights or interests include, but are not limited to, impacts on lands, territories, and resources; requirements for the physical relocation of people; disruption to traditional livelihoods; impacts on critical cultural heritage; or involve the use of cultural heritage for commercial purposes.

16 MARKET STUDIES

Lithium is a soft, naturally occurring, silvery-white metal that, due to its unique chemical and physical properties, is widely used in a range of energy storage and industrial applications. Its high specific heat capacity and charge density, as well as its low thermal expansion, enable high-performance characteristics that could not otherwise be achieved in end use applications.

Most markets for lithium compounds are global, with significant growth occurring in Asia, eventually expected to follow in Europe, and then the U.S. Although lithium markets vary by location, global end-use markets are dominated by batteries and ceramics and glass. The distribution of end-use by market is provided in Figure 16-1.



Source: USGS 2022

Figure 16-1. Distribution of End-Use Market

Market supply and demand information in this section was obtained from industry consulting experts Wood Mackenzie (woodmac.com) [2], Benchmark Mineral Intelligence (benchmarkminerals.com), and EV Volumes (ev-volumes.com) through subscription or pay-for-service fees.

16.1 DEMAND

Demand for lithium batteries has increased significantly in recent years because rechargeable lithium batteries are used extensively in the growing market for portable electronic devices and increasingly are used in electric tools, electric vehicles, and grid storage applications (USGS 2022). Besides electrification of transportation, electricity generation continued its decarbonization trend, with solar and wind installations crossing new milestones; many of these installations are coupled with lithium-ion battery-based energy storage systems.

Due to its highly reactive nature, lithium is rarely consumed in its pure form, and instead, is consumed as a compound created through a chemical process.

16.1.1 Base Lithium Compounds

Base lithium compounds are produced through the extraction and processing of lithium-bearing resources, which are either brine or hard rock minerals. After extraction, the source materials are further processed into higher concentration compounds that are typically used to produce lithium carbonate and lithium chloride and, in the case of hard rock, lithium hydroxide. Base lithium compounds are typically produced to standard specifications, such as minimum lithium content or maximum impurity levels, depending on the end use application. Base lithium compounds are primarily used in energy storage, glass, ceramics, and general industrial applications. Lithium carbonate and lithium chloride are also used as feedstock in the production of performance lithium compounds.

Global consumption of lithium carbonate in 2021, according to Wood Mackenzie's Global Lithium Investment Horizon Outlook – Q4 2022 (published in December 2022), was approximately 288,700 Mt LCE. Wood Mackenzie forecasts lithium carbonate consumption is expected to grow to approximately 958,500 Mt LCE by 2031, representing a 3.3x increase. Demand from energy storage and some industrial applications is expected to be the primary driver of this growth.

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[2] Livent obtained this information from the Lithium Market Service™ a product of Wood Mackenzie. The data and information provided by Wood Mackenzie should not be interpreted as advice and you should not rely on it for any purpose. You may not copy or use this data and information except as expressly permitted by Wood Mackenzie in writing. To the fullest extent permitted by law, Wood Mackenzie accepts no responsibility for your use of this data and information except as specified in a written agreement you have entered into with Wood Mackenzie for the provision of such of such data and information.

In their Global Plug-in Passenger Cars and Light Commercial Vehicles Forecast published in January 2023, EV Volumes expects global sales of fully electric light- and medium-duty electric vehicles to grow about 10 times from approximately 5 million units in 2021 to approximately 47 million units in 2031. China and Europe accounted for approximately 58% and 27%, respectively, of global fully electric light- and medium-duty electric vehicle sales in 2021. In 2031, China and Europe are expected to account for approximately 39% and 27%, respectively, of global fully electric light- and medium-duty electric vehicle sales. Based on strong demand growth expectations from electric transportation segments, particularly the light- and medium-duty electric vehicles segment, numerous major automakers have been investing in capacity and capability in key regional markets followed by lithium-ion cells manufacturers' investments. Asia, particularly China, has been a leader in installed and plant capacities of electric vehicle assembly, cell manufacturing, and cathode active material production. Within the lithium-ion cell, cathode active material is the largest consumer of lithium compounds; lithium compounds are also used in electrolytes and anode material. Producers of cathode active material and electrolyte salts are starting to build capacity in North America and Europe. Provisions of the U.S. Inflation Reduction Act are driving demand growth as well as investments in the supply chain.

16.1.2 Performance Lithium Compounds

Performance lithium compounds are produced through chemical processes that utilize base lithium compounds, primarily lithium carbonate and lithium chloride, as inputs, and lithium sulfate intermediates. The production of performance lithium compounds requires extensive manufacturing process technology and application know-how as products are required to meet specific performance requirements in each customer's manufacturing application. As a result, performance lithium compounds are often developed in collaboration with customers and undergo rigorous qualification processes to ensure they can meet these requirements. Customer qualification processes take approximately 12 months and may be longer depending on the product, customer, and application. Performance lithium compounds are priced based on product performance and the technical support producers can offer customers. Performance compounds are primarily used in lithium-ion batteries for electric vehicles, polymer, pharmaceutical, aerospace, and niche industrial applications.

Advancements in lithium-ion battery technology have resulted in increased adoption of lithium-ion batteries for use in powering electric vehicles. Accelerating electric vehicle sales, particularly all-battery electric vehicles sales, are expected to be the dominant driver of the growth in demand for performance lithium compounds. Within performance compounds, in their Global Lithium Investment Horizon Outlook – Q4 2022 (published in December 2022), Wood Mackenzie forecasts that consumption of lithium hydroxide is expected to grow from approximately 160,200 Mt LCE in 2021 to approximately 1,063,200 Mt LCE in 2031, representing a 6.6x increase. Lithium carbonate, for some demanding lithium-ion battery applications, could also fall in this category.

16.2 SUPPLY

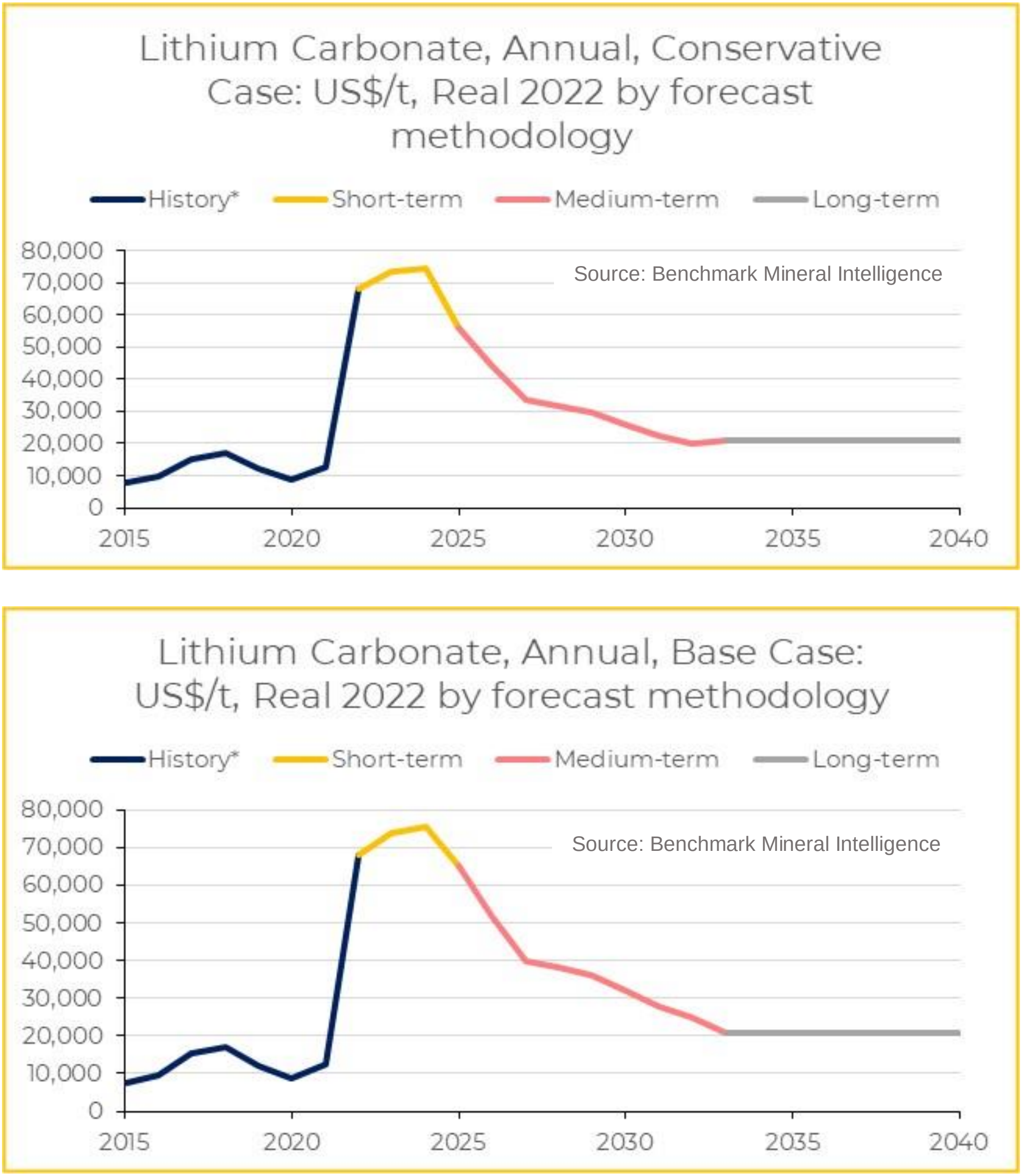
Wood Mackenzie expects growth in refined lithium capacity largely from mineral conversion capacity, as well as new and expanding brine capacity in South America. The production of refined lithium compounds is derived from output from mineral conversion, lithium brine production, low-grade compound upgrading/reprocessing, and recycling refineries. Mineral resources—spodumene and lepidolite—are predominantly mined in Australia, followed by China and Brazil. Canada and some countries in Africa have been witnessing new mine and project development activities. China leads the world in refined lithium production. Countries having brine-based refined lithium capacity and output include Chile, Argentina, China, and the U.S. The refined lithium capacity and output across the industry can also be classified between integrated and non-integrated producers. China has a large concentration of non-integrated converters, who have been constrained in the recent past on feedstock.

According to Wood Mackenzie's base case in their Global Lithium Investment Horizon Outlook—Q4 2022, the global supply of refined lithium compounds was 557,000 Mt LCE in 2021 and is expected to increase to 2,000,000 Mt LCE in 2031 with an additional 475,000 Mt LCE approximately from new projects. Demand growth was higher than supply was able to meet throughout most of 2021 and 2022.

In response to this significant supply/demand gap, several producers, including both existing and new entrants, have announced projects to build additional base and performance lithium compound supply. However, the industry has historically been challenged in bringing supply online within the announced time frame and at full nameplate capacity. The wide range of recent challenges, including energy curtailments, geopolitics, pandemic-related restrictions, and logistics difficulties, has been hampering industry supply. Wood Mackenzie estimates that the historical capacity utilization for the industry has rarely exceeded 75%. This is likely a reflection of the significant challenges at each stage of the project development and production process, which are commonly underestimated in projected supply figures and pose a risk to the effectiveness of new supply to meet demand.

16.3 PRICING

A supply deficit across the refined lithium market in 2021 caused China spot market prices to set new records through Q4 2022. A large part of the refined lithium demand is tied to long-term contracts, in which prices are either fixed or they move with a floor and ceiling depending on spot price movements. Benchmark Mineral Intelligence's historical and forecast prices for battery-grade lithium carbonate under their conservative- and base-cases (from their Lithium Price Forecast Q4 2022 (published in January 2023) are provided in Figure 16-2.


Lithium Carbonate, Annual, Conservative Case: US$/t, Real 2022 by forecast methodology

Source: Benchmark Mineral Intelligence

Lithium Carbonate, Annual, Base Case: US$/t, Real 2022 by forecast methodology

Source: Benchmark Mineral Intelligence

Figure 16-2. Conservative and Base Case Forecast Prices for Lithium Carbonate

16.4 MATERIAL AGREEMENTS

16.4.1 Argentina Agreements

MdA's mineral rights were obtained under, and the relationship between MdA, Livent (as successor of FMC), and Catamarca Province is governed by, the Exploration, Development and Operation Contract executed in 1991 (the Contract of 1991). Most of the provisions of this contract are no longer operative because they regulated the phases of exploration and construction that concluded more than 20 years ago and therefore are no longer applicable. Other provisions were amended in 1994 to conform the text of the Contract of 1991 to the Federal Constitutional Reform of 1994 and the Federal Mining Code, Mining Investments Law No. 24,196 (MIL) enacted in 1993 (the Amendment of 1994); and others have been recently been amended or terminated in connection with the expansion of Project Fenix (e.g., the Amendment of 2018).

16.4.1.1 Contract of 1991

The Contract of 1991 was entered into by and among MdA, FMC, DGFM, and Catamarca Province. The Contract of 1991 regulated in general terms the relationship between the parties and the three phases of the project containing specific rights and obligations: 1) exploration phase, 2) project construction phase, and 3) exploitation/operation of the plant phase. The exploitation/operation phase lasts for the life of the project and only the provisions of the Contract of 1991 related to this phase continue to apply.

The material surviving the Contract of 1991 includes the following provisions:

- Catamarca Province is bound to indemnify MdA for any claim from third parties related to the property, interprovincial limit conflicts, exploration, development, exploitation, or other claims that may affect MdA’s existing mining concessions.
- Exempts MdA from any fees for the use of water or rights-of-way to any Catamarca Province public agencies or governmental entities.
- Requires MdA, with respect to its mining operations in the SdHM, to maintain a workforce that is at least 50% composed of residents of Catamarca Province at professional, technical, and operating levels, to the extent they are available and sufficiently qualified for their respective jobs. It also requires MdA to provide relevant supplemental technical training and specialized know-how to qualified Argentine employees.
- Catamarca Province retains two shares of one class that entitle Catamarca Province to appoint two of MdA’s board members and one audit committee member. MdA’s board of directors is composed of 10 members and an audit committee is composed of three members and three alternates. All dividends corresponding to the shares are deducted from royalty payments.
- Permits MdA to abandon the exploitation of its mining properties without any responsibility to the other parties, provided that MdA delivers, free of charge, to Catamarca Province all the assets affixed to the land of the mining concessions and the agreement shall be terminated.
- Requires MdA to engage at least in the processing and commercialization of lithium from the mining concessions. If MdA presents a plan for industrialization and

commercialization of a mineral other than lithium and MdA harvests the minerals but does not exploit them commercially, those minerals shall be made available ex-factory, free of charge to Catamarca Province, which may exploit these harvested minerals either by itself or through another enterprise. In the event the exploitation of other harvested minerals was carried out by Catamarca Province and/or another enterprise, they must not interfere with MdA's operations.

- Establishes tax stability through 2026 for MdA and Livent (as FMC's successor) at the provincial and municipal level for the lifetime of the concessions.
- Requires MdA to supply the needs of the Argentine domestic market for the consumption of all the products it manufactures. As of the date of this report, MdA does not have any lithium supply agreements in place with Argentine federal, provincial, or local government entities, and all production is sold under contract to Livent's other affiliates.

16.4.1.2 Amendment of 1994

The Contract of 1991 was amended in 1994, mainly to conform the terms of the Contract of 1991 to the MIL that was enacted in 1993, and to the Federal Constitutional Reform of 1994 that recognized the eminent domain of the provinces over the natural resources located in their jurisdictions. Prior to the constitutional reform of 1994, the Argentine federal government had the eminent domain over the natural resources, and, accordingly, DGFM assigned all of its rights and obligations under the Contract of 1991 in favor of Catamarca Province; title to the mining concessions was simultaneously transferred by DGFM to MdA by way of Notary Deed No. 117 entered into on March 9, 1994.

The royalty payments agreed under the Contract of 1991 were replaced by the provisions of the MIL and its regulatory decrees. Under the MIL, MdA was required to pay royalties to Catamarca Province equivalent to 3% of the pithead value of the minerals extracted by MdA, which allows for certain cost deductions (the "Pithead Royalty"). This royalty provision continues to apply, but was complemented by the Amendment of 2018, as described below.

16.4.1.3 Amendment of 2018

The purpose of the Amendment of 2018 was to revise and adapt the Contract of 1991 and the Amendment of 1994 to enable MdA and FMC (as Livent's predecessor) to expand the production of lithium carbonate. Certain provisions of the Contract of 1991 and the Amendment of 1994 were also terminated, including the restriction on the change of control of MdA and the prohibition on MdA's grant of certain encumbrances on the concessions transferred to it under the Amendment of 1994. In addition, MdA agreed to pay the Catamarca province an additional monthly contribution (the "Additional Contribution") and to make CSR expenditures.

The following is a summary of the relevant material provisions of the Amendment of 2018.

MdA agreed to pay an Additional Contribution to Catamarca Province, in addition to the Royalty payable on a monthly basis to the Argentine federal government under the MIL. The Additional Contribution amount is equal to 2% of sales of products in a given month measured at the higher of MdA’s average invoice price or an average export price for similar products from Chile and Argentina, net of tax in either case (the "Contractual Price") less Pithead Royalty. The total amount MdA pays will not be above 2% of sales of products at the Contractual Price in a given month.

In October 2015, MdA entered into the SdHM Trust Agreement with the Catamarca province, which created a trust denominated SdHM Trust Fund (sometimes referred to as the Water Trust) dedicated to financing the development of physical infrastructure works within the territory of Catamarca Province. The SdHM Trust Fund, or the SdHM Trust, is aimed at meeting the needs of the communities involved in the area of direct or indirect influence of the mining activities in SdHM. MdA agreed to make certain contributions to the SdHM Trust as part of its CSR activity. Under the Amendment of 2018, the parties agreed that MdA would increase its contributions to the SdHM Trust to 1.2% of its annual sales (calculated using the annual Contractual Price described in the above paragraph).

MdA agreed that the aggregate amount of the CSR Budget to be spent in each calendar year would equal 0.3% of MdA's annual sales of products at the Contractual Price. CSR Budget means MdA’s calendar year budget for CSR programs and/or gratuities of any nature, including, without limitation, any and all cost and expenses incurred by MdA in connection with: 1) the Three Pillars Program; 2) any local employee and supplier development programs; 3) CSR or infrastructure trusts or schemes of similar characteristics, existing or future, at national, provincial, or any municipal levels (other than the SdHM Trust); and 4) any other charitable contributions or donations made by MdA associated with Project Fenix.

Since the entry into the Amendment of 2018, the maximum annual amount of royalties, additional contribution, CSR and trust expenditures by Livent has amounted to 3.5% of its annual sales (as defined above).

MdA committed not to mortgage its mining concessions.

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17 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL FACTORS

The following section summarizes environmental, permitting, and social or community considerations related to Project Fenix in the SdHM. These sections rely on information and data collected through a desktop review of available documents for Project Fenix made available to Integral by Livent. Recommendations for additional data collection, including baseline data and/or management actions, are provided where needed.

Brine extraction does not specifically create "tailings" like a hard rock mine. Livent manages the return of spent brine to the Salar through the artificial lagoon (noted in Figure 14-4). Excess salt harvested from facility ponds is stockpiled or spread on the ground surface as a land application.

17.1 ENVIRONMENTAL STUDIES

An initial EIA focusing on the proposed dam to create the surface water impoundment on the Rio Trapiche was conducted in 1993. The original version was submitted to MdA in January 1997. Since that time, several additional EIAs have been conducted for various portions of the site.

17.1.1 General Background

SdHM is located on a high plateau in the Central Andes in Argentina Puna at an elevation of approximately 4,000 m above sea level. It is mostly located in Catamarca Province, between the provinces of Salta (Department Los Andes) and Catamarca (Department Antofagasta de la Sierra). The Salar occupies about 600 km^2 of an approximately 4,000-km^2 watershed.

The brines are processed at two manufacturing facilities: one located within SdHM at Project Fenix, and the second located in Güemes, Argentina.

SdHM is Puneño Phytogeographic Domain, which is characterized by poor vegetation, xerophytic grasses, and dicotyledons. The vegetation in these environments combines the herbaceous steppe with vegas, lichen deserts (typical of the High Andean region), and shrub Yepa (characteristic of the Puna region).

17.1.2 Salar del Hombre Muerto (Project Fenix)

As mentioned above, a preliminary EIA was conducted by Parsons Engineering, and its subsidiary Engineering Sciences, consisting of preliminary environmental impact studies for FMC–MdA. The original EIA focused on the proposed dam and surface water impoundment on the Rio Trapiche. The final version of the EIA was submitted to MdA in January 1997. Biannual environmental assessments were completed in 2002 and 2004 Biannual Renewal of the Environmental and Social Impact Assessments (ESIAs). The following environmental studies were reviewed and relied on in this section:

- 2002 Environmental and Social Impact Assessment of the Fenix Project, Salar Del Hombre Muerto, Catamarca Province, Consultora Ambiental, July 2002.
- 2007 Biannual Renewal of the Environmental and Social Impact Study, Vector Argentina S.A., February 2007.

The 2007 Biannual EIA for Project Fenix calculated the total environmental impact, and indicated that there were no measurable environmental impacts during the reporting period.

17.1.2.1 Hydrogeology and Water Quality

Groundwater

The 2002 EIA evaluated surface and groundwater resources, soil, and risk of contamination of aquifers near SdHM. Three large hydrogeological systems were identified during the evaluation: the Salar del Hombre Muerto Aquifer System, the Los Patos River Aquifer System, and the Trapiche River Aquifer System. The results of the evaluation assigned a high, moderate, or low vulnerability index for a universal pollutant load and risk of contamination of lithium salts to the Trapiche River Aquifer System based on the presence of a high water table and connection of the alluvial fan and the major river beds. The High Vulnerability zones (0.54) are associated with the beds of river courses and the distal part of the alluvial cone, the Moderate Vulnerability zone (0.38) extends between the middle and distal sectors of the alluvial cone, and the Low Vulnerability zone (0.27) is located between the middle and apical part of the aquifer.

The 2007 Biannual Renewal (Vector Argentina S.A. 2007) noted an increase in production of lithium since 2002, and an increase in water consumption from 60 to 340 m^3/h.

Surface Water

In the 2007 Biannual Renewal, no significant modifications were observed that could affect the surface runoff of water in the area of the Trapiche dam and alluvial fan of the same name. The only changes observed between 2002 and 2007 were the addition of 4 hectares of evaporation ponds in the distal part of the Trapiche alluvial fan, adjacent to those already built before 2002. The new ponds were located in the area where there was no surface runoff from the river and far from the dry stream bed on the alluvial fan.

17.1.2.2 Social Issues and Communities

Archaeological

The Puna Catamarqueña presents an important and varied archaeological record, not only in temporal depth with respect to significant sites for Argentine and South American archaeology in general, but also a diversity of evidence resulting from human processes linked to different economic and social activities over time. Monitoring tasks in the area have been concentrated on the findings that are located in the sectors of Planta/Campamento, Rio Trapiche, Rio Peñas Blancas, Poppy VI Quarry, and Rio de Los Patos, which are the result of a series of previous surveys carried out within the framework of different environmental studies over the span of the development of the project (e.g., FMC 1997, 2000; Ambasch and Andueza 2010, 2013, 2015, 2016, 2017). An archaeological record was formed that includes a total of 116 sites of archaeological significance. In reference to the monitoring tasks carried out on the set of previously recorded findings, and the main objective of this study, it is concluded that in general no significant modifications and/or alterations were detected on the registry.

Objectives of the Program

The evaluation of the patrimonial status of the archaeological record is within the framework of the biannual environmental assessment required by National Law No. 24,585 and Provincial Law 4218 on the Protection of Archaeological and Cultural Heritage of Catamarca Province.

The objective is to generate predictions about the possible impacts related to the activities involved in this project, recommending the prevention and mitigation measures necessary to achieve a correct interaction between the archaeological heritage and the current mining work.

This Environmental Control Program of Social Action is framed under Resolution No. 119/2010 (“Presentation Guide for technical or environmental risk control programs for mining industry in the province of Catamarca”) and is approved by Resolution No. 243/2017.

Results of the Period

From the archaeological point of view, Project Fenix has an important accumulation of information resulting almost exclusively from the development of environmental studies in all its variants, including RABArq (bi-annual updates required following an EIA), MoArq (annual monitoring events) and, EIArq (project-specific EIAs).

Through them, an archaeological record was generated that currently has a total of 57 archaeological discoveries (e.g., FMC 2002; Ambasch and Andueza 2010, 2015).

17.1.2.3 Biodiversity

Flora and Fauna

Mitigation measures for impacts to vegetation by the construction of the water collection system in the Rio Trapiche are included in the Mine Closure Plan.

Currently the restoration of the Vega de Trapiche is being carried out with a biologist specialized in wetlands. There is a specific environmental control program for all the activities regarding the redevelopment activities. A summary the following activities were carried out since the beginning of the program:

- February 2020: Start of continuous irrigation in Vega
- August 2020: Construction of a test plot (0.25 hectares) with closure and planting of species
- August 2021: Development of institutional controls for the Vega to protect the restoration area (9 hectares)
- October 2021: Start of initial revegetation (2 hectares), using a scattered methodology with 1 species every 2 m
- January 2022: Dense revegetation with plots of the same species, 1 species every 2 cm
- November 2022: Dense revegetation with mixed species plots, 1 species every 2 cm.

After the revegetation campaigns, good growth of the transplanted species was observed. In addition, birds were observed, which shows that the Vega is being productive and offers food. The specialist concludes that "This fact is extremely important because the elements of wetland fauna are being reinstated again." The activities and the monitoring studies will continue until full redevelopment of the area.

Livent's Project Fenix production facility is located approximately 4,000 m amsl and requires a unique approach to biodiversity management. To protect the Andean Mountain ecosystem that is home to diverse flora and fauna adapted to extreme environmental conditions, Livent regularly commissions third-party specialists to monitor the variety and abundance of local plant and animal species, watershed properties, and limnology.

A 2017 study found that plant species variety and abundance were consistent with previous years and the number of animal species had increased compared to a 2009 baseline, including nine additional bird species. A 2021 study identified 23 additional plant species, and in a more recent study from January 2022, 30 more plant species were identified. The increase in species is most likely due to the seasonal changes, as individual species become easier to identify when they bloom. The January 2022 report also noted the presence of halophytic plant species, which are plants that have adapted to living in areas with high soil salinity, and a number of additional animal species, including 20 different birds, 7 mammals, 1 reptile, and 1 amphibian.

Flora was evaluated for diversity and cover, and fauna were identified and categorized as part of the 2002 EIA and in the biannual renewals. In the 2002 EIA, 30 plants were identified and species richness was almost constant in all areas.

The 2007 Biannual Renewal reviewed the following documents describing the plant communities in the project area and detailed the flora monitoring in the following areas: active plain, Dry Valley, landing strip perimeter community, and community near the evaporation ponds:

- Qualitative Study of the Flora of the Project, 1997
- Diagnosis and Environmental Monitoring of the Trapiche River, 2000
- Flora Monitoring Plan, 2001
- ESIAs of the Fénix Project – Salar del Hombre Muerto, 2002
- Trapiche River Flora Monitoring Plan, 2003
- Biannual Renewal of ESIAs-Fénix Project, 2004
- Trapiche River Flora Monitoring Plan, 2005.

The 2007 Biannual Renewal concluded that all vegetation communities were stable and total vegetation coverage ranged from 75% to 100%.

Similarly, the 2007 Biannual Renewal reviewed the following fauna surveys near Project Fenix and completed a detailed fauna survey in the same areas of the flora survey. The 2007 fauna surveys identified aquatic amphibians, at least 2 reptile species, 31 bird species, and 9 mammals:

- Qualitative Study of the Fauna of the Project, 1997
- Diagnosis and Environmental Monitoring of the Trapiche River, 2000
- Fauna Monitoring Plan, 2001
- ESIAs Phoenix Project – Salar del Hombre Muerto, 2002
- Biannual Renewal of ESIAs-Fénix Project, 2004
- Survey of Fauna, November 2005.

Flora, fauna and limnology are monitored every 6 months to ensure that there are no changes or impacts on the biodiversity within the project's areas of influence.

In the 2022 biannual report, it is observed that among all the groups studied, avian species turned out to be the best indicators of existing conditions and potential impacts due to their quantity and diversity.

The samplings carried out were useful to make consistent comparisons. For the period considered, there are no significant changes, so it can be inferred that the conservation situation of the area involved in the project is the same as in previous years regarding to the species numbers, coverage, and distribution

17.1.3 Los Patos Aqueduct Environmental Baseline

In August 2018, EC & Asociados completed an environmental and social baseline prior to the construction of the Los Patos Aqueduct. The EC & Asociados report describes the environmental system in the Los Patos Aqueduct study area systematically, adequately documenting the primary environmental information, which can be used moving forward to accurately evaluate environmental impacts of the work.

17.1.4 Known Environmental Issues

At this time there are no known environmental issues as a result of brine extraction from the SdHM. Environmental control programs described in the following section will continue to monitor environmental impacts.

17.2 ENVIRONMENTAL CONTROL PROGRAM

There are 15 different environmental control programs developed for the SdHM, which include an exhaustive regular data collection that monitors for environmental impacts (Table 17-1). The results of these monitoring programs are reported to the enforcement authorities as required.

Table 17-1. Environmental Control Program

Environmental Component	Environmental Variable	Parameters	Frequency	Legal Requirements	Control Entity	Reporting Requirement
Water	Chemical Quality	pH Electrical Conductivity TDS Majority anion and cations	Weekly: pH and EC *in situ* Monthly: Sampling and chemical analysis of all parameters	MSR 042/12	EMA	BM: EMA (reports) BA: EMA (trends) A: WRA (consumption
	Consumption	Flows (m^3/h)	Continuous	MSR 269/12 Res. 012/2016 Res. 011/2016	EMA, PWRA	BM: EMA (reports) BA: EMA (trends)
	Piezometer levels	Dynamic and static piezometer levels	Monthly	MSR 041/12	EMA	BM: EMA (reports) BA: EMA (trends)
Supplies	Brine flow	Flows (m^3/h)	Continuous	MSR 040/12	EMA	BM: EMA (reports) BA: EMA (trends)
	Hazardous substances	Number of env. incidents related to discharge or transport of haz-mats. Compliance audit planning of secondary containment and transport units. Maintenance of transport units.	Continuous	MSR 043/12	EMA, PMS	BM: EMA (reports) BA: EMA (trends) BA: EIR
Waste	Sewage	pH Temperature D.B.O 5 D.Q.O Total sulfide Settleable solids Total phosphorous Ammonia-nitrogen Oils and fats Detergent	Weekly: Control of pH and temperature of TP Bimonthly: Sampling and analysis in external lab	MSR 274/12 EAR 011/01 EAR 065/05	EMA, PMS	BA: EMA (reports) A: EMA (trends) BA: EIR
	Industrial effluents	pH % solids Lithium concentration	Daily: pH control in exit of EQ pond Weekly: Sampling in the artificial lagoon	MSR 272/12	EMA, PMS	BA: EMA (reports) A: EMA (trends) BA: EIR
	Solids waste	Domestic, industrial, hazardous waste	Daily: Inspection at generation points Weekly: Inspection at disposals Quarterly: Audits to hazardous waste disposal	MSR 096/12 National Act 24,075	EMA, PEA, NEA	BA: EMA (reports) A: EMA (trends) BA: EIR

Environmental Component	Environmental Variable	Parameters	Frequency	Legal Requirements	Control Entity	Reporting Requirement
Physical	Climate	Temperature Wind speed Wind Direction Humidity Air pressure Rain	Continuous	MSR 277/12	EMA, PMS	Q: EMA (reports) BA: EMA (trends) BA: EIR
	Air quality	O2 NOx CO CO2 SO2 H2S Temperature Wind speed	Monthly: Gas emissions at Fenix Bimonthly: Gas emissions at Guemes and Pocitos Annual: air quality at Fenix	MSR 273/12 National Law 20284	EMA, PMS	Q: EMA (reports) BA: EMA (trends) BA: EIR
Biological	Flora	Diversity indices: wealth, abundance, dominance, Simpson_1-D, Shannon_H, Margalef Equitatividad_J	Annual	MSR 278/12	EMA	A: EMA (report)
	Fauna	Diversity and abundance	Annual	MSR 279/12	EMA	A: EMA (report)
	Limnology	Composite of microorganisms: phytoplankton, zooplankton, bacteria	Annual	None	None	None
Social	Archaeology	Archaeological findings	Annual	MSR 095/12	EMA	A: EMA (report)
	Responsible care	Community satisfaction	Annual	MSR 907/15	EMA	A: EMA (report)

Notes:
A = annually
BA = biannually
BM = bimonthly
EAR = Environmental Agency Resolution
EIR = Environmental Impact Report
EMA = Environmental Mining Agency (e.g., DIPGAM; Direccion Provincial de Gestion Ambiental Minera)
MSR = Mining Secretariat Resolution
NEA = National Environmental Agency
PEA = Provincial Environmental Agency
PMS = Provincial Mining Secretary
PWRA = Provincial Water Resources Agency

17.2.1 Water Programs

Water control programs include monitoring of the water wells and Trapiche dam flows, water quality monitoring in the Rio Trapiche, and piezometer level monitoring in Trapiche wells. These programs are described below.

17.2.1.1 Water Extraction Well and Trapiche Dam Flows

The flow in cubic meters per hour is continuously measured at the Rio Trapiche and Trapiche Aquifer groundwater extraction wells. Data are reported bimonthly to the Environmental Mining Agency (EMA) (e.g., Direccion Provincial de Gestion Ambiental Minera [DIPGAM]). Trend analyses are reported biannually to DIPGAM, and an annual consumption report is submitted to the Catamarca Water Resources Agency of Catamarca Province.

17.2.1.2 Water Quality of Trapiche System

Electrical conductivity, TDS, pH, and anions and cations are monitored in the Rio Trapiche, groundwater extraction wells, and monitoring wells (piezometers) to evaluate water quality in the Rio Trapiche system. pH and electrical conductivity are monitored weekly *in situ* using a Hach multiparametric meter, and monthly samples are collected for parameters listed above and analyzed at both Livent's Güemes Laboratory and an external laboratory. Data are submitted bimonthly, and trend analyses are submitted biannually to the DIPGAM.

17.2.1.3 Piezometer Levels of Trapiche Wells

Water levels are monitored monthly in monitoring wells (piezometers) and groundwater extraction wells with a water level meter. Data are submitted bimonthly and trend analyses are submitted biannually to the DIPGAM.

17.2.2 Supply Programs

17.2.2.1 Brine Control

Incoming brine is continuously measured with a flowmeter at the SA Plant to control the brine flow and check the quantities of brine consumed. Data are submitted bimonthly and trend analyses are submitted biannually to the DIPGAM.

17.2.2.2 Hazardous Substance Storage and Transport

Hazardous substance storage and transportation is monitored by tracking the number of environmental incidents related to discharges and transport of hazardous substances. Compliance audits are completed for secondary containment and transport units. Hazardous substance storage and transport are monitored at both the Project Fenix and the Güemes Plant. Every environmental incident related to discharge and transport of hazardous substances is immediately reported to authorities. Additionally, biannual reports of data and annual reports of trend analyses are submitted to DIPGAM–Catamarca Province for Project Fenix and environmental impact reports are submitted to the mining Secretary of Salta Province every 2 years for the Güemes Plant.

17.2.3 Waste Management Program

17.2.3.1 Sewage

Temperature and pH are monitored weekly, and bimonthly samples are collected for laboratory analysis at an external laboratory in both sewage effluent from Project Fenix and at the Soakaway pit at the Güemes Plant. Data for Project Fenix are submitted biannually, and trend analyses are submitted annually to DIPGAM. Data for the Güemes Plant are included in environmental impact reports submitted to the mining secretary of Salta Province every 2 years.

17.2.3.2 Industrial Effluents

The equalizing ponds are monitored daily for pH, and the artificial lagoon is monitored weekly for pH, percent solids, and lithium concentration. Data for the Project Fenix are submitted biannually and trend analyses are submitted annually to DIPGAM. Data for the Güemes Plant are included in environmental impact reports submitted to the mining secretary of Salta Province every 2 years.

17.2.3.3 Solid Waste

Solid waste is monitored at the Project Fenix, Güemes Plant, MdA Hanger, Pocitos, and the Salta office. Monitoring includes daily inspection at generation points, weekly inspection at disposals, and quarterly audits of hazardous waste disposal. Data for Project Fenix are submitted biannually and trend analyses are submitted annually to DIPGAM. Data for the Güemes Plant and Pocitos Plant are included in environmental impact reports submitted to the mining secretary of Salta Province every 2 years.

17.2.4 Physical Components Programs

17.2.4.1 Meteorology

Meteorologic and climatic variables, including temperature, wind speed, wind direction, humidity, air pressure, and precipitation are monitored continuously. Results for Project Fenix are submitted quarterly and trend analyses are submitted biannually to DIPGAM. Results for the Güemes Plant are included in environmental impact reports submitted to the mining secretary of Salta Province every 2 years.

17.2.4.2 Air Quality and Gas Emissions

Air quality and gas emissions, including oxygen, nitrogen oxide, carbon monoxide, carbon dioxide, sulfur dioxide, hydrogen sulfide, temperature, and speed are monitored at the following points:

- Project Fenix—Brine pumps, boilers, generators and monitoring points throughout the field
- Güemes Plant—Dryer and emergency generator
- Pocitos Plant—Generators.

Data for Project Fenix are submitted quarterly and trend analyses are submitted biannually to DIPGAM. Data for the Güemes Plant and Pocitos Plant are included in environmental impact reports submitted to the mining secretary of Salta Province every 2 years.

17.2.5 Biological Component Program

17.2.5.1 Flora and Fauna

Flora and fauna are monitored biannually at Project Fenix by evaluating diversity indices and by trapping and watching surrounding areas to evaluate diversity and abundance. Final reports from flora and fauna monitoring are submitted to DIPGAM annually.

As previously mentioned, the expansion of the productive capacity of Project Fenix implies the decrease in the supply of fresh water from the Rio Trapiche basin, while Phase 1 lasts, waiting for the beginning of the recovery process of the inactive wetland. The following is the proposal for this protection measure and its consequent follow-up.

The mitigation process for the wetland complex (set of the units of vega vegetation, riparian environment, and water grass) is facilitated by the increase of a constant supply of water and by transplanting vegetation from the surrounding areas. To track the progress of these mitigation measures, Livent will implement a monitoring program that covers the following aspects.

Related to the Wetland

- Coverage: Through vegetation plots, established both in the sector with and without signs of recovery, the measurements will be carried out and the degrees of coverage will be established. This monitoring will be seasonal (spring, summer, autumn, and winter).
- Composition and floristic abundance: In general, the floristic diversity of the Andean plains is low when compared to the hillside vegetation (Squeo et al. 1994). There are strong changes in the composition of species, structure of dominances, and physiognomy within and between Andean plains. Usually, the edges of the vegas are drier and saline. This determines a floristic composition different from flooded places, probably due to differences in the temporal availability and chemical quality of water. To differentiate the recovery method per unit of vegetation, the monitoring of composition and floristic abundance must be carried out, for which the established plots

(the same where coverage is measured) of the repopulating species will be identified. This follow-up will be seasonal (spring, summer, autumn, and winter).

- Productivity and biomass: During the vegetative period, the plains and bofedales produce large amounts of plant matter per unit area, a variable that is known as net primary productivity. The immediate consequence of wetland inactivity is the decline in plant production and reduction of the surface and fragmentation of the forage patches or paddocks. It is expected that the recovery of the wetland will reactivate the primary net productivity of the inactive wetland (currently it is almost zero). The monitoring of this indicator will be carried out on a seasonal basis.
- Surface: Satellite images and drone images track the progress on the surface of the wetland. We will work with spectral indicators such as Normalized Difference Vegetation Index (NDVI) and NDVI of change.

Related to Water Supply and Environmental Conditions

In the early stages of recovery, processes of colonization and plant establishment occur. Established plants can provide organic matter, promote soil formation processes, cause irregular water distribution, expand their wetting area, and produce seeds or retain other seeds dispersed by wind or water. Therefore, the first colonizing plants facilitate the establishment of other plants and thus increase green cover, productivity, and habitat availability and quality. In this sense, the monitoring of the aspects listed below becomes relevant:

- General characteristics of the soil and water flows in the plains: Assessing the hydrological dynamics and the real demand for water of the wetland (ecological flow); inferred from the active wetland upstream of the dam. Daily measurements of the water tables and surface flows contributed to the wetland will be carried out.
- Soil moisture level: Soil samples will be taken so that the parameters of organic matter and humidity can be determined in the laboratory. These samples will be collected at least once per year. Additionally, field capacity tests will be performed on a monthly basis.
- Physico-chemical composition of the water: The physical and chemical parameters of the water will be monitored from a multiparameter meter and the monthly data will be taken. Likewise, samples will be taken so that the physical and chemical parameters of the water are determined in the laboratory: percentage of dissolved oxygen saturation, concentration of suspended solids, pH, nitrate concentration, total phosphorus concentration, chemical oxygen demand, electrical conductivity, and temperature. This monitoring will be carried out quarterly.

This proposal must be incorporated into a new control program is generated.

Regarding the measures related to the fauna component, it should be noted that the decrease in the frequency of vehicles (due to the beginning of the operation of the gas pipeline) minimized the risks of disturbing wild fauna.

However, the scenario that is analyzed with the expansion of productive capacity implies an increase in vehicular movement and machinery that will require the application of the following measures in Table 17-2, which are aimed at preventing the possible effects on fauna.

Table 17-2. Measures to Prevent or Mitigate the Impacts to Wildlife from Transport

Proposed action	Enforcement of traffic rules	Information and training for staff
Character	Mitigation	Prevention
Nature	Complementary	Complementary
Duration	Permanent	Permanent
Application Opportunity	Operation	Operation
Spatial location	Routes to the Project Fenix from Salar de Pocitos (Pcia. Salta) and Antofagasta de la Sierra (Pcia. Catamarca)	Routes to the Project Fenix from Salar de Pocitos (Pcia. Salta) and Antofagasta de la Sierra (Pcia. Catamarca)
Measurement Description / Specifications Additional	- Speed control on roads - Placement of informative posters - Training of own staff and contractors.	- Prohibition of hunting, capture and trade of wild animals, specifying the penalties for its contravention.

17.2.5.2 Limnology

Limnology is monitored annually in the Rio Trapiche, artificial lagoon, and Catal lagoon by sampling water for phytoplankton and zooplankton bacteria. There is no regulatory or reporting requirement for monitoring limnology.

17.2.6 Argentina Community Relations Program

Livent maintains a community relations program in Argentina aimed at improving the community where they operate. Key elements of the social program include:

1. **Local Development & Employment**
   - "La Puna" Entrepreneurs Program
   - Agro-Livestock Sustainable Development Program
   - Local Hiring & Training
   - Supplier Community Engagement

2. **Quality of Life**
   - Good Neighbors Program
   - Health & Nutrition programs
   - Donations
   - Education Scholarships
   - Community Dialogue Roundtable Meetings
3. **Environmental Action**
   - Environmental & Climate Education
   - Recycling
   - Ecosystem Protection & Revitalization
4. **Volunteering**

17.3 PROJECT PERMITTING

MdA entered into an agreement with the Argentine federal government and the Catamarca Province to develop SdHM in 1991. After 1993, the Argentine federal government assigned its rights and obligations to Catamarca Province, which provides Catamarca Province jurisdiction and a minority ownership stake in MdA. This allows Catamarca to receive defined dividends and to appoint two of MdA's board of directors. The relevant permits are summarized below.

17.3.1 Environmental and Operating Permits

The environmental and operating permits are included in Table 17-3

Table 17-3. Environmental Permit Summary

No.	Location	Permit Name	Authority
1	Fenix, AR	Registration of aboveground fuel storage tanks (Aboveground Installations Certificate) Res.1102/04- FENIX	National Ministry of Energy and Mining.
2	Fenix, AR	Registration of underground fuel storage tanks (Underground Installations Certificate)	National Ministry of Energy and Mining;
3	Fenix, AR	SEDRONAR Registration Certificate for the National Register of Chemical Precursors	Secretariat of Planning for the Prevention of Drug Addiction and Action against Drug Trafficking.
4	Fenix, AR	Wastewater Discharge Permit	Provincial Directorate of Environmental Management
5	Fenix, AR	Pathogenic Waste Generator Registration	Provincial Directorate of Environmental Management
6	Fenix, AR	Pathogenic Waste Operator Registration	Provincial Directorate of Environmental Management
7	Fenix, AR	Hazardous Waste Generator Registration	Provincial Directorate of Environmental Management
8	Fenix, AR	Hazardous Waste Operator Registration	Provincial Directorate of Environmental Management
9	Fenix, AR	National Hazardous Waste Generators Certificate	Ministry of Environment and Sustainable Development.
10	Fenix, AR	Environmental Impact Declaration (DIA)	Mining Ministry of Catamarca
11	Fenix, AR	Municipal Permit	Municipality of Antofagasta de la Sierra
12	Fenix, AR	Environmental insurance	Provincial Directorate of Environmental Management
13	Fenix, AR	Water Concession	Water Secretariat of Catamarca

17.3.2 Water Rights

MdA holds water rights to the Rio Trapiche and Trapiche Aquifer to support current operations. Water levels and salinity are regularly monitored as described above in Section 17.2.1. MdA currently holds temporary rights to the Los Patos Aquifer. Permeant concessions for groundwater from the Los Patos Aquifer to support planned expansion are expected to be granted in the coming months.

17.4 MINE RECLAMATION AND CLOSURE

This section includes closure and reclamation planning as described below.

17.4.1 Closure Planning

The Project Fenix Closure Plan is a document that consolidates and synthesizes the company's strategy and vision regarding the closure of the activity, and also presents a sufficiently detailed description of the measures or programs to be implemented so that closure objectives are achieved. Descriptions of each component of the mining complex must be sufficient to support the design and cost estimation of the closure measures. With the closure of the mine as a perspective, the baseline should generate data and information that allow formulating future scenarios and understanding the environmental and social dynamics of the region in which the project is located. The mining activity constitutes a temporary form of land use. When the activity ceases, new forms of use of the areas occupied by the mine must be viable, considering the restrictions resulting from the permanent modifications, as well as the skills and opportunities associated with the period of operation of the mine. Closure is a process in which actions such as monitoring, maintenance, and social programs are executed after the full implementation of the closure measures. Accordingly, the Closure Plan provides a cost estimate of the rehabilitation activities, which may be adjusted in each instance of its renewal. Closure costs for current are accounted for in Section 19 (Economic Analysis).

17.4.2 Mine Closure Process in Argentina

Livent will submit revised closure plans following plant expansions. Mine closure costs for existing operations and future expansion are included in Section 19.

Resolution 396/16 establishes that:

> The owner of the mining activity will constitute guarantees of sufficient amount and timely realization for the fulfillment of the Mine Closure Plan, based on the estimated amounts, in the form, value and opportunities approved by the Competent Authority based on what is established in this resolution and in other specific ones that may be issued for this purpose. The owner of the mining activity must constitute the guarantee, after the approval of the Mine Closure Plan in accordance with the procedure established in this standard.

Consequently, the company will make the corresponding closure plan calculations and adjust guarantees after the approval of this plan.

17.4.3 Closure Cost Estimate

A closure plan has been submitted to Catamarca per Resolution 396/16. The final cost of closure for existing facilities (prior to planned expansions), based on present-day costs to mobilize, deconstruct, and rehabilitate Project Fenix, is summarized below in Table 17-4.

Table 17-4. Final Closure Cost Estimate

Description	Cost (Million $USD)
Construction of Closure Works – Fenix Complex	$ 14.5
Supplementary Closing Costs	$ 3.8
Subtotal	**$ 18.3**
Contingency: 10%	$ 1.8
Total	**$ 20.1**

17.4.4 Limitations on the Cost Estimate

Closure of the site is not expected before the cessation of the life of the mine, which is projected to 40 years (through 2062) for practical, cost-forecasting purposes rather than technical or resource constraints. Due to future expansion plans, site conditions at closure will be different than currently expected and, therefore, the current estimate of closure costs is unlikely to reflect the actual closure cost that will be incurred that far into the future. Closure costs at the end of mine life, including all expansion, were included in the economic analysis discussed in Section 19.

17.5 LOCAL PROCUREMENT

The SdHM watershed is extensive (approximately 3,900 km^2) and has a very low population density per the 2010 census. The majority of its inhabitants are concentrated in the towns of Antofagasta de la Sierra and el Peñón, and very small population settlements such as Ciénaga Redonda, Los Nacimientos, and Antofalla (EC & Asociados 2020).

Livent fosters development of a local workforce in Catamarca and Salta Provinces through a resolution with the Catamarca Mining Authority (Res SEM 526/19). In 2022, Livent Argentina employed 538 people, mostly from the northwest region of the country, particularly in Catamarca Province and from the town of Antofagasta de la Sierra. For employment of its contractors, Livent complies with other resolutions (Res SEM 278/13, Res SEM 520/14, and Res SEM 498/14), which establish 70% local procurement criteria for goods and services. The number of Livent employees from neighboring communities from 2016 through early 2022 is shown in Figure 17-1.

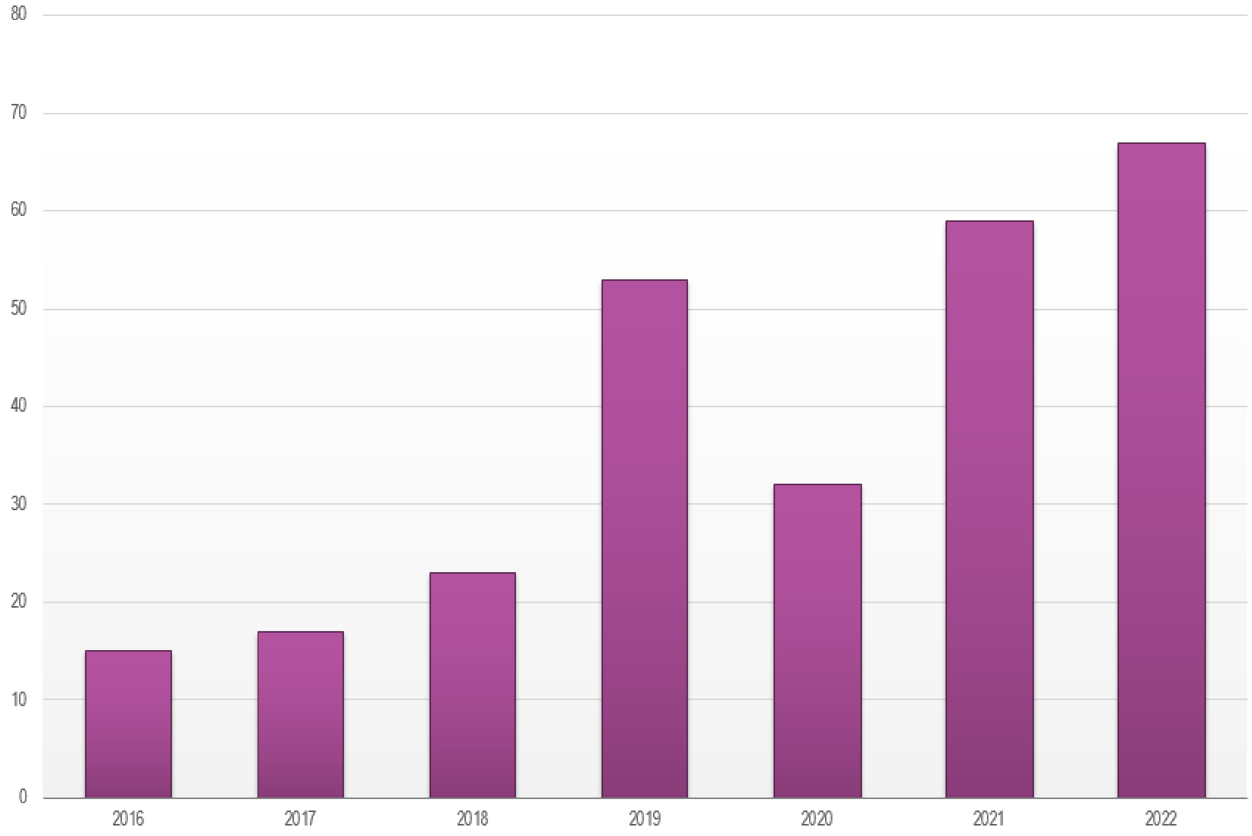

Figure 17-1. Number of Employees from Neighboring Communities

17.6 SDHM TRUST

In October 2015, MdA, Catamarca Province, and Bapro Mandatos entered into the SdHM Trust Agreement, which created the Water Trust, which is dedicated to financing the development of physical infrastructure works within the territory of Catamarca Province, aimed at meeting the needs of the communities involved in the area of direct or indirect influence of Project Fenix. MdA agreed to make certain contributions to the SdHM Trust as part of its CSR activity. A summary description of Livent's contributions to projects funded by the SdHM Trust are provided in Table 17-5.

Table 17-5. SdHM Trust Activities

Project Description	Status
Provided financing for purchases of equipment required for road maintenance works at Antofagasta de la Sierra.	Complete
Provided financing for the purchase of asphaltic materials required for road building and paving of Provincial Route No. 43 which connects Antofagasta de la Sierra with El Peñón	Complete
Installation of a waste treatment trench for the proper disposal of urban solid waste in the town of Antofagasta de la Sierra (La Villa)	Complete
Construction of a cistern intended to ensure the continuous supply and distribution of water for the population at Antofagasta de la Sierra.	Complete
Installation of a solar park in Antofagasta de la Sierra to meet the energy demand of the local population.	Complete
Construction of a sanitary waste landfill in order to stop waste disposal in open spaces.	Complete
Construction of a Park Ranger Station in the natural reserve Campo Piedra Pomez to provide shelter to Park Rangers from the extreme weather conditions.	Complete
Construction of recovery of the reservoir of Las Pitas River and water supply cistern for drinking water in Antofagasta de la Sierra in order to ensure the provision of drinking water to the entire local population´s needs.	Complete
Improved sanitation by construction of a modern sewer network in Antofagasta de la Sierra provided the deficiency of the existing network.	Complete
Construction of public utility improvements including a photovoltaic solar park in El Peñon to extend the daily electricity provision.	Complete
Construction of a drinking water intake and network located in Antofalla, located in the Department of Antofagasta de la Sierra.	Complete
Construction of a bridge over "El Bolson" river in order to improve communications between the local population with the rest of the province.	Complete
Construction of a bridge over "Cura Quebrada" river to improve communications between Antofagasta de la Sierra and the rest of the Province of Catamarca.	Complete
Purchase of flatbed trailers, two dump trailer units and a cart for transporting and carrying firewood, maize and other materials to the inhabitants of the posts and places surrounding the town of Antofagasta de la Sierra.	Complete
Purchase of two new vehicles in order to better the communications between Antofagasta de la Sierra and the rest of the Province.	In Progress
Road improvements, including the pavement of the Villa of Antofagasta de la Sierra.	In Progress
Local building improvements, including the extension of the west wing of the municipal hostelry.	In Progress

17.6.1 Archaeology

Archaeology in the surrounding Project Fenix areas is monitored annually by an outside consulting group and is reported to DIPGAM annually.

17.6.2 Responsible Care

An external consulting company also monitors socially responsible care around the Project Fenix area to verify the activities of responsible care and the satisfaction of the community. Results of these surveys are submitted to DIPGAM annually.

18 CAPITAL AND OPERATING COSTS

Project Fenix is currently in operation and producing lithium carbonate and lithium chloride. Capital and operating costs are forecasted as a normal course of operational planning with a primary focus on short-term budgets, then mid-term (5-year plans), and lastly long-term time frames.

Estimation of capital and operating costs is inherently a forward-looking exercise. These estimates rely upon a range of assumptions and forecasts that are subject to change depending upon macroeconomic conditions, operating strategy, and new data collected through future operations.

Production expansion projects are complex undertakings; assumptions into the current plans can change and therefore there could be no assurance that they will be completed within the projected budget and schedule or that the anticipated benefits from them will be fully achieved. Unforeseen technical or construction difficulties, lack of adequate water or energy, regulatory requirements (including permits), labor or civil/political unrest, community relations or logistical issues, or local hiring and procurement policies and requirements could change our assumptions on cost, scope, and schedule.

18.1 CAPITAL COST ESTIMATES

Capital cost forecasts are estimated based on 1) a baseline level of sustaining capital expenditures, in-line with historical expenditure levels and adjusted for changing production rates; and 2) strategic planning for major capital expenditures. Future capital expenditure estimates, including sustainable expenses are presented in Table 18-1.

Table 18-1. Capital Expenditure Estimate (2023–2031) in Million $USD

Lithium Carbonate	Year								
	2023	2024	2025	2026	2027	2028	2029	2030	2031
Total Carbonate CAPEX	$271	$315	$215	$45	$210	$135	$0	$0	$0
Sustaining CAPEX	$11	$12	$14	$17	$18	$18	$21	$23	$25
Total Expansion and Sustaining Capital	$282	$327	$229	$62	$228	$153	$21	$23	$25

Notes:
USD in millions
For fiscal year ending December 31st

There are planned expansions at the Salar to increase lithium carbonate capacity from 20,000 Mt to 100,000 Mt through the rest of the decade, which requires substantial capital. The First Expansion has been engineered and executed in two back-to-back phases (Phase A and B). Phase A implemented a strategy of modular construction to mitigate potential equipment delivery issues and to reduce construction activities onsite. Engineering for Phase A is complete, modules have been fabricated and are onsite, and the expansion is scheduled to be mechanically complete in 2023.

The capital estimate for Phase A was prepared using AACE International guidelines and is classified as a Class 3 estimate (accuracy level of ±10%). The impact of delays associated with an earlier suspension period as well as additional costs incurred due to recent circumstances (e.g., COVID-19) are included in the current capital estimate. Considering the advanced level of progress in capital commitments made and construction activities completed, estimation of costs for Phase A can be viewed with high confidence and are also well within the capital parameters used in the economics sensitivity analysis performed by Livent.

Phase B of the First Expansion is expected to begin production in 2024, with a similar execution strategy as for Phase A. Modular fabrication has been completed, shipments are being delivered and onsite construction activities have begun for Phase B development. Capital costs with an accuracy level of a Class 3 estimate have been compiled. Capital cost estimates for both Phases A and B were completed within the range used in the sensitivity analysis.

Livent has started the engineering development phase on the Second Expansion (increasing annual lithium carbonate capacity from 40,000 Mt to 70,000 Mt). This expansion will also have a modular construction strategy and similar process technology, and an additional water recovery unit to recycle fresh water from the SA Plant effluent. This expansion is in the pre-feasibility design; capital cost estimates are based on a combination of available data from the First Expansion for the process plant and scoping level costs derived from past experience and benchmarking against facilities of similar scope constructed in the region.

The Third Expansion will utilize conventional pond-based evaporation technology and the existing infrastructure Livent has in place. This expansion is also in pre-feasibility design, and capital costs were developed at scoping level based on past experience and benchmarking methodologies. After the expansions are complete, future capital expenditures are primarily sustaining capital and fall to lower levels. The amount of sustaining capital in future years increases with the size of the asset.

18.2 OPERATING COST ESTIMATES

Historically, operating costs in Argentina have not changed significantly. Approximately 60% of total operating cost in Argentina are U.S. dollar denominated and less subject to local economic factors. For the remaining balance of operating cost, denominated in Argentinian pesos, we assume inflation will be offset by increased devaluation over time.

Table 18-2 summarizes current key lithium carbonate cost components, including variable and fixed costs. Estimated carbonate cost throughout the forecast period assumes similar operations as the existing facility with efficiency on fixed cost from higher production volume, but no changes or efficiencies were assumed for variable consumption rates.

Table 18-2. Unit Cost Estimates in $USD

Carbonate Unit Costs/kg	Estimate $USD
Utilities	$1.13
Soda Ash	$1.73
Other Raw Materials	$0.36
Packaging	$0.11
Labor/Overhead	$1.37
Unit Cost	**$4.70**

Currently, operating costs in Argentina are not impacted by any corporate or headquarter cost outside of Argentina, but exclusively by labor and overhead costs incurred in Argentina for local operations and supporting functions.

Operating unit cost estimates in Table 18-2 do not include Catamarca Royalties, CSR, Fund Trust, and depreciation. Catamarca Royalties, CSR, and Fund Trust represent a combined unit cost impact of 3.5% based on the higher of average invoice price or an average of Argentina and Chile exports price for similar products, net of tax. Depreciation is calculated based on asset useful life, usually varying from 40 years for buildings to 15 years for equipment and machinery.

19 ECONOMIC ANALYSIS

The purpose of this section is to present an economic analysis of the project to determine its financial viability. The financial evaluation is based on a discounted cash flow (DCF) approach. The modeled cash flows include all production costs; general and administrative, maintenance, initial and sustaining capital costs; taxes; government and commercial royalties/payments; and community engagement contributions. The resulting cash flows are then discounted at an after-tax discount rate of 10% to produce a net present value. Financial metrics such as internal rates of return and payback period were also calculated using the projections. A sensitivity analysis then follows by varying key assumptions to projections to understand how the financial viability of the project changes under different scenarios.

19.1 BASIC MODEL PARAMETERS

The following criteria have been used to develop the economic projections:

- Annual cash flow forecasts based on pricing for battery-grade lithium carbonate are assumed to be constant at $20,000 per Mt LCE throughout the life of asset.
- Operating costs include all raw materials, packaging, labor, utilities, maintenance, and overhead.
- Catamarca Royalties, CSR, and Fund Trust represent a combined unit impact of 3.5% of forecast pricing.
- Expected asset operating life of 40 years is supported by sustaining capital as well as end of asset life closure costs.
- Costs prior to January 1, 2022, are not included in the DCF analysis.
- Effective corporate tax rate is assumed to be 22%.
- DCF was carried out on a constant money basis, so there is no provision for escalation or inflation on costs or revenue.
- For project DCF evaluation purposes, it has been assumed that 100% of capital expenditures, including pre-production expenses, are financed with owners' equity.

The lithium carbonate production schedule is summarized in Table 13-1. Average annual lithium carbonate production is anticipated to be 98,000 Mt by 2030, and this lithium carbonate production rate can be sustained through 2062. Additional LCEs produced will be allocated to lithium chloride production, but economic value is excluded from this analysis.

19.2 RESULTS

Results of the economic analysis, including annual cash flow forecasts based on an annual lithium carbonate production schedule for the 40-year life-of-mine, and measures of economic viability such as net present value, internal rate of return, and payback period of capital are provided in Table 19-1.

Table 19-1. Key Financial Results

Post-Tax Net Present Value (USD)	Post-Tax Internal Rate of Return	Payback Period (Years)	Life-of-Mine (Years)	Total Initial Capital (USD)
$6,346M	85%	3.6	40	$1,518M

19.3 SENSITIVITY ANALYSIS

Financial viability of the project was evaluated under a range of different scenarios to understand how resilient financial returns were under different favorable and unfavorable changes to key assumptions across lithium chemical prices, capital, operating costs, and production volumes. A pre-feasibility level sensitivity analysis (without contingency) is summarized in Table 19-2.

Table 19-2. Economic Model Sensitivity Analysis Million $USD

Cost Variable	Sensitivity Factor				
	-25%	-10%	0%	10%	25%
Lithium Carbonate Price $ / Mt	$3,772	$5,316	$6,346	$7,375	$8,919
Initial Capital	$6,627	$6,458	$6,346	$6,233	$6,065
Operating Expense	$7,041	$6,624	$6,346	$6,068	$5,650
Production Volume	$4,468	$5,595	$6,346	$7,097	$8,224

20 ADJACENT PROPERTIES

Information on adjacent properties was obtained from third-party websites operated by the companies with claims in SdHM. The QPs have not verified the accuracy of this information and make no claims or warranties about the information contained in this section.

The Salar at SdHM is subdivided into two major subbasins: Eastern and Western. Livent's Contiguous Lease Area covers approximately 327 km^2, or 94% of the Western Subbasin. The properties that surround Livent's Contiguous Lease Area are located along the margins of the Western Subbasin, where the Salar meets bedrock to form the basin boundary. These properties are generally less favorable for lithium brine operations for a number of reasons. First, there is relatively limited access for equipment and level ground for facilities (i.e., ponds) than areas internal to the Salar margins. Second, brine grade along the margins of the Salar can become dilute from freshwater inflows from higher elevations, or brine may be enriched in an isolated area in the absence of freshwater inflows. Either situation could pose mine-planning problems if the grade measured during exploration differs significantly from the grade after operations begin and lithium concentrations begin to equilibrate towards concentrations reflective of the broader resource. The process where lower-grade brine increased towards near equilibrium concentrations reflective of the broader resource was observed in the SWB several years after startup (Section 12.4). The opposite behavior could also occur. In this situation, concentrations in high-grade brine extracted early on decrease over time until the grade reaches near equilibrium with the broader resource at lower concentration than observed during exploration or after a few years of pumping.

Currently, Livent is the only commercial lithium producer at SdHM. Adjacent properties have the potential to affect Livent's operations to various degrees and in limited ways. Considering lithium brine is a fluid resource, hydraulic capture of brine across concession boundaries from pumping or dilution of brine from a neighbor's pond operation pose the most significant potential physical risks to Project Fenix. Other risk factors adjacent properties have on Project Fenix include competition for human and natural resources. Based on Livent's future mine plans, and the plans described by others and reviewed by the QPs at the time of this report, it is the QPs' opinion that risks posed by potential future operations at neighboring properties are relatively small and should not significantly impact lithium carbonate production at Project Fenix over the 40-year life of mine.

The three largest properties within SdHM that have stated ambitions to produce commercial quantities of lithium are Allkem Limited (Allkem), POSCO Argentina (POSCO), and Galan Lithium Limited (Galan) (Figure 20-1). A summary of mining claims for by adjacent property owners is provided in Table 20-1.

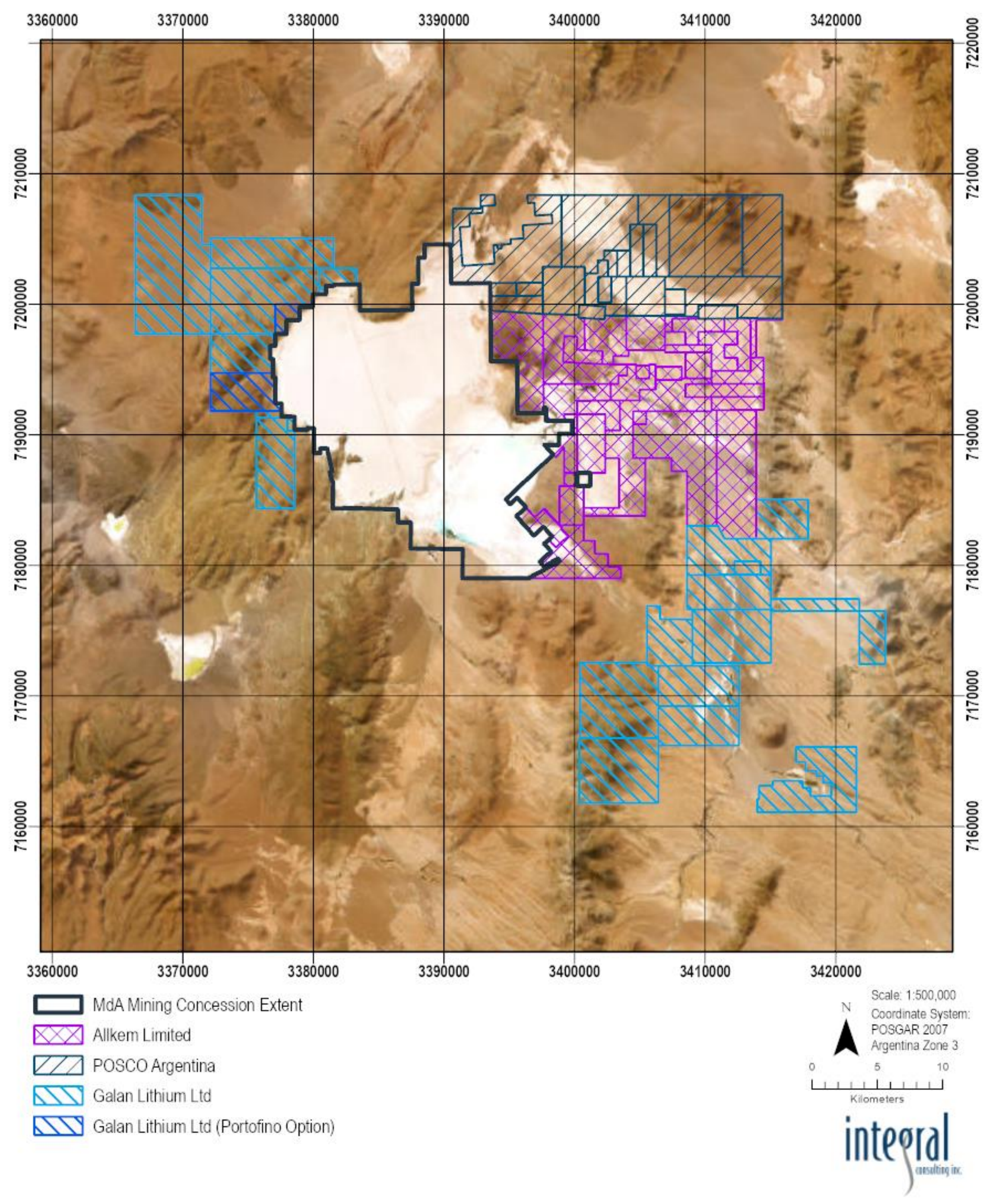

Figure 20-1. Adjacent Properties

Table 20-1. Mineral Concessions Adjacent to Project Fenix

Concession Owner and Description	Concession Name	Original File Number	Hectares	Unified File Number
Allkem Limited	Agostina	0168G2002	19	EX-2021-00233273
	Agustin	1279G2006	263	EX-2021-00233273
	Aurelio	0054G2000	37	EX-2021-00233273
	Barreal 1	0077G1999	56	EX-2021-00233273
	Centerario	0261G1997	8	EX-2021-00233273
	Chachita	0185G2002	51	EX-2021-00233273
	Delia	0398G2003	9	EX-2021-00233273
	Don Carlos	0056G2000	46	EX-2021-00233273
	Don Pepe	0162G2002	46	EX-2021-00233273
	El Tordo	1178G2006	173	EX-2021-00191729
	Fidel	1281G2006	38	EX-2021-00191729
	Juan Luis	0787G2005	19	EX-2021-00191729
	La Redonda 4	0078G1986	56	EX-2021-00191729
	La Redonda 5	0161G2002	56	EX-2021-00191729
	La Redonda I	0055G2000	56	EX-2021-00191729
	Los Patos	0210G1994	46	EX-2021-00191729
	Luna Blanca	1280G2006	15	EX-2021-00191842
	Luna Blanca II	0709G2009	142	EX-2021-00275916
	Luna Blanca Oeste	0045G2020	10	EX-2021-00275916
	Luna Blanca VI	0814G2009	37	EX-2021-00275916
	Maktub XXIII	0027G2000	90	EX-2021-00275916
	Maria Clara	0913G2005	45	EX-2021-00275916
	Maria Clara I	0914G2005	55	EX-2021-00275916
	Maria Lucia	0788G2005	9	EX-2021-00275916
	Meme	1430G2006	214	EX-2021-00275916
	Monsterrat	0254G2011	325	EX-2021-00275916
	Montserrat I	0065G2016	325	EX-2021-00275916
	Quiero Retruco	1198G2006	72	EX-2021-00275916
	Rodolfo	0657G2009	9	EX-2021-00275916
	Sonqo	0754G2009	92	EX-2021-00275916
	Truco	1197G2006	89	EX-2021-00275916
POSCO			1,000,000	
Galan Explorations S.A.	El Deceo III	0308G2010	15	EX-2021-00958201
	Rana de Sal I	0040G2018	132	EX-2021-00958201
	Rana de Sal II	0041G2018	314	EX-2021-00958201

20.1 ALLKEM LIMITED

Orocobre and Galaxy Resources Ltd merged in August 2021, and created Allkem. Sal de Vida, the company's brine project located in the Eastern Subbasin at SdHM, borders Livent's Contiguous Lease Area at the saddle that separates the two subbasins. Sal de Vida is designed to produce predominantly battery-grade lithium carbonate through an evaporation and processing operation at the SdHM site.

Allkem's numerical model projects that its wellfields, once constructed, will sustain operations for 44 years at an average projected lithium grade of 770 mg/L. Allkem estimated proven reserves (years 1–10) at 36,600 Mt lithium and 205,800 Mt lithium probable reserves (years 7–44). Its reserve estimate is based on a 500 mg/L cut-off and assumes 68.7% process efficiency (Galaxy Resources Ltd. 2021).

20.2 POSCO ARGENTINA

POSCO was constituted in 2018 following the sale of mineral rights by Galaxy of its claims located in the northern portion of the Eastern Subbasin. The claims sold by Galaxy were located in the area where the provincial boundary is disputed between Salta and Catamarca. POSCO manufactured a pilot plant in South Korea, which it transported and installed at SdHM in 2018. It is currently in the advanced exploration stage and expects to have its lithium brine commercialization facilities in Argentina completed by the end of 2023 (POSCO Argentina 2022).

20.3 GALAN LITHIUM LIMITED

Galan has two projects in SdHM: Hombre Muerto West (HMW) and Candelas. HMW is located west of Project Fenix. Galan reports conflicting information on its website on the number of concessions included in HMW (Galan 2022). One webpage states HMW consists of four concessions and an additional two concessions under an option agreement from Portofino Resources Inc. Another webpage states HMW comprises six concessions (Pata Pila, Rana de Sal, Deceo III, Del Condor, Pucara, and Santa Barbara). Most of these concessions are located atop outcropping shallow bedrock, which is generally considered unfavorable for brine extraction. Small portions of the easternmost claims extend over alluvium and salar sediments, where brine extraction is feasible.

Galan's Candelas project is located south of the Eastern Subbasin, in the alluvial sediments beneath the Los Patos River. Galan reports that recent drilling and geophysical results indicate the potential for substantial brine at depth.

20.4 WATER RIGHTS OF OTHER COMPANIES

The Contract of 1991 provides that FMC (as Livent's predecessor) and MdA are not obligated to pay fees for use of water or rights-of-way to Catamarca Province's public agencies or government. This is one of the surviving material provisions that has not been amended given that the use of water is an essential resource for the execution of the contract.

The aforementioned exemption was challenged by Catamarca Province, resulting in litigation. The litigation was settled through an agreement endorsed by the Supreme Court of Catamarca, whereby Catamarca Province agreed to accept the validity of the exemption and, in turn, MdA agreed to expand its CSR activities by making monetary contributions to the SdHM Trust and making money contributions to such trust as long as Project Fenix lasts.

The purpose of the SdHM Trust is to allocate and apply the trust funds exclusively to finance the development of physical infrastructure works within the territory of Catamarca Province, mainly and preferentially works focused on the needs of the communities involved in the areas of direct or indirect influence of Project Fenix, located in Antofagasta de la Sierra, Catamarca.

On January 14, 2016, the Ministry of Public Works of the Catamarca Province granted MdA a concession for the use of public underground water on a permanent basis and under the conditions of the settlement agreement regarding the volume of water to be used by MdA. The current volume of the concession amounts up to 4.1 Hm^3/year for the exploitation and use of water extracted from six boreholes located within MdA's concessions. Granted water use rights correspond to mining use in compliance with the provisions of Catamarca Water Law No. 2577.

21 OTHER RELEVANT DATA AND INFORMATION

All data and information relevant to this resource and reserve disclosure are referenced in this report.

22 INTERPRETATION AND CONCLUSIONS

This lithium resource and reserve disclosure may differ from other disclosures for projects involving lithium-bearing brine extraction because Project Fenix is one of only a few long-term operating projects (25 years of continuous operation) of its kind in the world. To the extent known by the QPs, operations in Salar de Atacama, Chile, and Clayton Valley, Nevada, are the only other lithium brine projects with a similar history of consistent long-term operation. Currently, most lithium brine projects are for sites still in the exploration phase, have only a few years of experience with commercial lithium production, or are not subject to disclosure requirements. Because of the 25 years of operational history, information collected during operations support the interpretations and conclusions made herein.

22.1 GEOLOGY AND RESOURCES

The sedimentary evaporite and associated clastic deposits of the Western Subbasin of SdHM, which host lithium-rich brine, are characteristic of a mature salar with a halite core. Mature salars have unique hydrogeologic characteristics (high transmissivity and high degree of reservoir homogeneity) favorable to lithium brine extraction. Additionally, the Western Subbasin contains brine with a low ratio of magnesium to lithium, which is preferrable for mineral processing. The shallow (0–40 m bgs) geology at SdHM, where the measured lithium resources occur, was thoroughly characterized prior to development. Pre-development characterization in the early 1990s has been further supported by 25 years of operations at Project Fenix, installation of a brine monitoring well network in 2017, and deep characterization (up to 200 m depth) exploratory boreholes in 2000.

22.2 MINING AND MINERAL PROCESSING

At SdHM, lithium mining is performed by production well pumping of lithium-rich brine. Pumping wells are a proven and reliable method for extraction of brine that has been used successfully at Project Fenix since operations began in 1997.

Livent uses a unique, proprietary, mineral processing technology (selective adsorption) to extract lithium from brine and return spent brine back to the Salar. The SA process is proven and more efficient than any other commercial lithium-brine process currently in operation.

22.3 MINERAL RESOURCES AND RESERVES

Current in-place lithium resources as of December 31, 2022, have been estimated for the Livent Contiguous Lease Area. A cut-off grade was not applied to this resource estimate because economic viability is not a factor that affects the amount of resource in place. Lithium reserves are the economically mineable part of the lithium resource. Reserves are always a fraction of the resource because the reserve estimate accounts for dilution and process-related losses before the resource becomes a viable product (CIM 2014).

Total measured (0–40 m bgs) and indicated (40–100 m bgs) resources, inclusive of reserves, are 1,328,000 Mt lithium (7,071,000 Mt LCE) (Table 11-5). The total lithium resource (0–200 m bgs), inclusive of reserves is 2,289,000 Mt lithium (12,183,000 Mt LCE).

Total measured (0–40 m bgs) and indicated (40–100 m bgs) resources, exclusive of reserves, are 597,000 Mt lithium (3,180,000 Mt LCE) (Table 12-3). In addition, an inferred lithium resource (100–200 m bgs) consists of 892,000 Mt lithium (4,928,000 Mt LCE).

Lithium reserves were estimated using a numerical brine reservoir model to predict future lithium grade (concentration) in produced brine using Livent's anticipated future lithium carbonate production rates. An economic lithium grade cut-off of 218 mg/L was applied. Modeling indicates that lithium concentrations in brine produced over the next 40 years will not degrade to below 218 mg/L. As such, proven reserves are calculated to be the total lithium produced in brine feedstock provided to the SA Plant, less any process-related lithium losses (23.4%) during years 1–10. Proven reserves during years 1–10 total 153,000 Mt lithium (815,000 Mt LCE).

Probable reserves, assigned to lithium resources produced in years 11–40, deducted by 23.4% for process inefficiency, are estimated at 578,000 Mt lithium (3,076,000 Mt LCE) (Table 12-2). Probable reserves account for 43% of the total measured and indicated resource and 25% of the total measured, indicated, and inferred resource. Total proven and probable reserves (731,000 Mt lithium or 3,891,000 Mt LCE) make up approximately 32% of the total resource.

22.4 INFRASTRUCTURE

Project Fenix consists of various infrastructure components including roadways, an airfield, natural gas pipeline, camp facilities, brine and freshwater extraction wells and conveyance pipelines, lithium processing facilities, surface impoundments, and product packaging and storage facilities. Facility expansion projects are ongoing, and further expansion projects are in preliminary assessment phases.

22.5 ENVIRONMENTAL, PERMITTING, AND SOCIAL ISSUES

Environmental baseline investigations were conducted for Project Fenix and the Los Patos Aqueduct projects. EIAs are updated biannually with data collected from ongoing monitoring programs.

SdHM is located in a remote, sparsely populated and hyper-arid region of the world. Freshwater resources are scarce, and flora and fauna that inhabit the region have adapted to the harsh conditions that characterize the region.

Project Fenix operates under a variety of environmental and operating permits as described in detail in Section 17.3. Additional permits are obtained for facilities upgrades and expansion as required by governmental agencies.

22.5.1 Closure

Facility closure is outlined in a Project Fenix Mine Closure Plan as described in Section 17.4. Current closure costs for Project Fenix based on existing infrastructure (prior to planned expansion) are estimated at $20.1 million (including contingency). Closure costs estimated at the end of mine, including all planned expansions, were incorporated into the economic analysis (Section 19). Modified closure plans to address plant expansions will be submitted in future years.

22.6 CAPITAL AND OPERATING COSTS

Project Fenix is in operation and producing lithium carbonate and lithium chloride. Capital and operating costs are forecasted as a normal course of operational planning with a primary focus on short-term budgets, then mid-term (5-year plans), and lastly long-term time frames. Details on Project Fenix capital and operating costs are provided in Section 18.

22.7 ECONOMIC ANALYSIS

Livent has performed financial evaluation based on a DCF approach. The modeled cash flows include all production costs; general and administrative, maintenance, initial and sustaining capital costs; taxes; government and commercial royalties/payments; and community engagement contributions. The resulting cash flows are then discounted at an after-tax discount rate of 10% to produce a net present value. Financial metrics such as internal rates of return and payback period were also calculated using the projections. A sensitivity analysis then follows by varying key assumptions to projections to understand how the financial viability of the project changes under different scenarios.

In summary, financial analysis results include post-tax net present value of $6,346 million, 85% post-tax internal rate of return, payback period of 3.6 years, 40-year life-of-mine, and total initial capital expenditure of $1,518 million. See Section 19 for details on economic analysis.

23 RECOMMENDATIONS

This section includes recommendations for future work and analysis in order to improve understanding of lithium resources and reserves. Recommendations are aimed at further developing lithium resources at the Salar, supporting project expansion projects, and improving site operations and efficiency.

23.1 RECOMMENDED WORK PROGRAMS

23.1.1 Deep Exploration

Future exploration below 40 m bgs is recommended to improve confidence in deep resources. The brine reservoir must be permeable at depth for the production of lithium-bearing brine to be economically favorable. Packer testing in deep exploration boreholes indicates lithium brine production at depth is feasible, albeit at lower yields than at shallow depths for the lithologies encountered. Recommended future work at SdHM includes an exploration program to improve understanding about reservoir depth, lithium grade, and reservoir hydraulic characteristics. Future exploration should focus on at depths greater than 40 and 100 m bgs to potentially upgrade resources currently considered indicated and inferred, respectively. A deep exploration program work plan is currently in development.

23.1.2 Spent Brine Return Evaluation

Since 1997, spent brine has been directed to the artificial lagoon, which has grown over the years to its current extent, which is approximately 1.5 km^2. A mass balance evaluation is aimed at quantifying flows into and from the artificial lagoon and its storage capacity. To the extent known to the QPs, a detailed mass balance for the artificial lagoon has not been completed. A better understanding of the lagoon mass balance is necessary to manage future spent brine disposition.

A detailed mass balance is one element of a broader evaluation into spent brine return options. An evaluation of future return options may include an adaptive management program for surface return of spent brine, mechanical evaporators, recycle technologies, injection wells, or some combination thereof.

23.1.3 Numerical Modeling

Further numerical modeling work is recommended to support expanded lithium brine production and optimize well configurations and pumping rates. Additional modeling work should include validation and/or extending the calibration period to simulate a future brine elevation and quality monitoring data set. Future numerical modeling work should incorporate relevant information collected during the other two recommended future work programs (deep exploration or spent brine return evaluation).

Incorporating new data collected following a future deep exploration program may have the added benefit of increasing reserves.

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25 RELIANCE ON INFORMATION PROVIDED BY THE REGISTRANT

Integral's opinions contained within this report are based in part upon information provided by registrant (Livent) which was deemed appropriate for use. The QPs relied on information provided by Livent the for subject matters outside their areas of expertise. Such information, including the report sections upon which the QPs relied on, provided by Livent includes:

- Mineral rights, ownership, and royalty status of Livent's and its neighbors' claims at SdHM (Section 3)
- Legal and governmental factors related to operations at Project Fenix (Section 17)
- Operating and capital costs (Section 18)
- Forward-looking economic analyses (Section 19).

In preparation of this report, Integral relied upon third-party information, including but not limited to published literature, technical reports prepared by other parties (including Livent's prior consultants and contractors), laboratory analyses performed by Livent and commercial laboratories, and operational data supplied by Livent.

26 SIGNATURE PAGE

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