

Date: 21 May 2024

ASX Code: MAN

Capital Structure

Ordinary Shares: 616,759,920
Current Share Price: 3.4c
Market Capitalisation: \$21.0M
Cash: \$15.0M (Mar. 2024)
EV: \$6.0M
Debt: Nil

Directors

Lloyd Flint
Non-Executive Chairman
Company Secretary

James Allchurch
Managing Director

Roger Fitzhardinge
Non-Executive Director

Contact Details

First Floor
10 Outram Street
West Perth WA 6005
Australia

Tel: +61 9200 3743

mandrakeresources.com.au

DLE provider Electroflow achieves 92% Lithium recovery and direct conversion to Lithium Hydroxide from MAN brine

Highlights

- US-based DLE provider Electroflow Technologies, Inc (Electroflow) has completed processing brine from Mandrake's Utah Lithium Project, achieving outstanding repeatable Lithium recoveries of 92% and conversion to Lithium Hydroxide with no chemical pre-treatment
- Electroflow's results validate the recently reported production of 99.9% pure battery grade Lithium Hydroxide by Australian-based DLE company ElectraLith (ASX Announcement 6 May 2024)
- The production of Lithium Hydroxide direct from brine revolutionises DLE by skipping the conventional interim step of producing lithium carbonate using costly, carbon intensive converters
- Following its site visit in late April 2024, Electroflow is planning to construct a pilot plant for the Utah Lithium Project
- Mandrake executed a Strategic Alliance Agreement with Electroflow in December 2023 (ASX Announcement 22 Dec 2023) and is now in the process of updating this document to facilitate the pilot plant processing of Utah Lithium Project brines
- The maiden JORC 2012 Mineral Resource Estimate for the Utah Lithium Project is in on target for delivery early in Q3 2024

Mandrake Resources Limited (ASX: MAN) (Mandrake or the Company) advises that Direct Lithium Extraction (DLE) provider Electroflow Technologies, Inc. (Electroflow) has achieved repeatable recoveries of 92% Lithium when producing Lithium Hydroxide directly from Mandrake's flagship Utah Lithium Project brines.

Mandrake's 100%-owned Utah Lithium Project covers 93,755 acres (~379km²) and hosts an Exploration Target of 1.7 to 5.6 million tonnes (Mt) of contained LCE (Lithium Carbonate Equivalent)¹.

The Exploration Target has been prepared and reported in accordance with the 2012 edition of the JORC Code. The potential quantity and grade of the Exploration Target is conceptual in nature. There has been insufficient exploration to estimate a Mineral Resource. It is uncertain if further exploration will result in the estimation of a Mineral Resource.

¹ Refer to ASX Announcement 13 March 2024 - Substantial Lithium Exploration Target defined at Utah Project

Mandrake executed a Strategic Alliance Agreement (SAA) with Electroflow in December 2023 (ASX Announcement 22 Dec 2023).

Managing Director James Allchurch commented:

'After a rigorous assessment of available technologies, next generation DLE providers Electroflow and ElectraLith were selected to process Mandrake brines based on their ability to convert brine directly to high quality battery-grade Lithium Hydroxide without using any significant water or chemicals.'

Both companies have produced compelling initial test results both in recovery and Lithium Hydroxide purity, with both DLE providers requesting Mandrake supply brine to independent pilot programmes designed to scale up Lithium Hydroxide production and further build out their respective technologies.'

The successful testing by two independent DLE providers and subsequent request to establish pilot plant facilities is a huge nod for the Utah Lithium Project as we work towards the publication of a maiden Mineral Resource Estimate.'

Electroflow CEO Eric McShane commented:

'Our breakthrough represents a crucial step towards onshoring a robust US Lithium supply chain using US-built Lithium processing technology. We're thankful for our partnership with Mandrake, which has made our vision for an energy abundant world a step closer to reality.'



Figure 1: April 2024 Mandrake/Electroflow Utah Lithium Project Site Visit (from L to R) – Ricardo Garzon (MAN COO), Jake Cammack (MAN Expl Manager), Dr Eric McShane (Electroflow CEO), Dr Evan Gardner (Electroflow CTO), Sabina Kraushaar (MAN geologist), James Allchurch (MAN MD)

During sampling activities undertaken in December 2023, Mandrake dispatched bulk brine samples to DLE providers Electroflow and ElectraLith (see Table 1).

Rio-Tinto-backed ElectraLith successfully produced 99.9% pure battery-grade Lithium Hydroxide from Mandrake's brines (ASX Announcement 6 May 2024).

Electroflow's proprietary electrochemical process uses lithium-selective electrodes to convert saltwater brines into lithium chemicals for batteries. Their process eliminates the need for excessive chemical reagents for purification and offers high scalability with a modular cell stack design.

Table 1: Bulk Brine Sampling for DLE Processing

Well	Long/Lat	Sample Depth (ft)	Head Li grade (mg/L)	DLE provider	Status
Big Indian #1	38.239428/ 109.275236	6,150	147	Electroflow (USA)	Planning of pilot plant
Lisbon B-912	38.186416/ 109.240868	8,480	65.6	ElectraLith (Aust)	Planning of pilot plant

Electroflow is backed by Bill Gates' Breakthrough Energy Fellows programme. The BE group has a stated aim of "accelerating the energy transformation by supporting cutting-edge research and development, investing in companies that turn green ideas into clean products, and advocating for policies that speed innovation from lab to market. Through investment vehicles, philanthropic programs, policy and advocacy efforts, and other initiatives, BE works with a global network of partners to accelerate the technologies needed to build a carbon-free economy."

The ability of Electroflow's technology to produce Lithium Hydroxide directly from brine revolutionises DLE by completely circumventing the conventional interim steps of lithium processing, being the production of lithium chloride and lithium carbonate, which often involves the use of costly, carbon intensive converters.

The relationship between Mandrake and its DLE providers are non-exclusive, enabling Mandrake to assess the best-fit technology for its brines.

Electroflow has requested Mandrake supply brines for a pilot plant facility which will exclusively process Mandrake brines and will be operated at Electroflow's cost. Mandrake and Electroflow will update the existing Strategic Alliance Agreement to govern the relationship between pilot plant operator and brine supplier.

Direct Lithium Extraction

Direct Lithium Extraction (DLE) is a cutting-edge development in the realm of renewable energy. It offers an alternative approach to meeting the growing demand for Lithium, which is essential for battery production in electric vehicles and energy storage systems.

Unlike traditional methods such as open-pit mining or evaporation ponds, DLE extracts Lithium from brine sources more efficiently and with less environmental impact. This method is particularly advantageous because it uses less water and can tap into lower concentration Lithium sources, making it a more sustainable option.

This technology is an important step forward in the energy transition, helping to facilitate the shift towards cleaner energy and transportation solutions.

This announcement has been authorised for release by the Board of Mandrake Resources.

Competent Persons Statement

The information related in this announcement has been compiled and assessed under the supervision of Mr James Allchurch, Managing Director of Mandrake Resources. Mr Allchurch is a Member of the Australian Institute of Geoscientists. He has sufficient experience that is relevant to the information under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the JORC Code. Mr Allchurch consents to the inclusion in this announcement of the matters based on his information in the form and context in which it appears.

- **JORC Code, 2012 Edition – Table 1 report template**
- **Section 1 Sampling Techniques and Data**

(Criteria in this section apply to all succeeding sections.)

Criteria	JORC Code explanation	Commentary
Sampling techniques	• Nature and quality of sampling (eg cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling. • Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used. • Aspects of the determination of mineralisation that are Material to the Public Report. • In cases where 'industry standard' work has been done this would be relatively simple (eg 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30 g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (eg submarine nodules) may warrant disclosure of detailed information.	• A ball-valve bailer, capable of storing up to 3.4 L of liquid, attached to a wireline truck was used to retrieve samples from the formations of interest using existing perforations in historical shut-in oil and gas wells. • A mixture of brine and minor volumes of hydrocarbon liquids retrieved from the bailer were poured into a clean bucket and then into a 2,000 mL separator funnel to separate hydrocarbons from water. After 5-10 minutes of allowing for hydrocarbon/brine separation, a 200-300 mL aliquot of the brine was captured from the separation funnels to be analysed with an AquaTroll 500 water multimeter. The Aqua Troll was factory calibrated upon shipment and re-calibrated upon arrival for high conductivity brines (~100,000 µs/cm). After 30-40 minutes of allowing for hydrocarbon/brine separation, the brine separated was collected in a HDPE sampling bottle with minimal headspace and transported in a cooler on ice. • Sampling equipment (e.g. bucket, beakers, separation funnels, etc.) was thoroughly cleaned with soap and water and rinsed 3x - 4x with distilled water between sample points. • The sample retrieval method used only samples accumulated fluids in the immediate wellbore and is not always an accurate representation of the native brines in the adjacent targeted geological formations. In this case, it is possible that Mandrake will carry out a future brine sampling campaign that improves sample confidence by using a swabbing rig that allows for larger

Criteria	JORC Code explanation	Commentary
		volumes of liquid to be obtained from the stratigraphic formations. Historical wells may not be optimally perforated to target fluids associated with the highest lithium-brine units. In this case, it is possible that Mandrake will carry out a future brine sampling program that isolates stratigraphic zones of interest using packers and establishes new perforations to enhance the pumping of lithium-enriched brine to the surface.
Drilling techniques	Drill type (eg core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (eg core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).	- Mandrake has yet to conduct any drilling at the Utah Lithium Project. - The historical oil and gas company owned wells were drilled using conventional oil and gas drill rigs that drill vertical well bores.
Drill sample recovery	- Method of recording and assessing core and chip sample recoveries and results assessed. - Measures taken to maximise sample recovery and ensure representative nature of the samples. - Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.	- Sample size is constrained by the capacity of the bailer and reduced by its oil/water saturation. - Measurements of the original liquids recovered from the bailer, oil saturation and final sample collected were recorded. - Actions were taken to extract brine from each sample and separate-out any minor liquid hydrocarbons that were retrieved from the original mixed-liquids in the bailer. - To the best of Mandrake's knowledge, no relationship exists between the oil saturation and the concentrations of other elements in the brines.
Logging	Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.	- Electric Conductivity, Temperature and pH were recorded in the field using an AquaTroll 500 instrument. - Petrophysical well logs associated with the historical wells include gamma-ray, neutron density, resistivity, sonic, and mud logs.

Criteria	JORC Code explanation	Commentary
	- Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography. - The total length and percentage of the relevant intersections logged.	The petrophysical logs provide information such that geologists can make stratigraphic formation picks to define the down-well lithology of each well. These interpreted lithological logs are used to prepare cross-sections to map the reservoir and to target future well locations.
Sub-sampling techniques and sample preparation	- If core, whether cut or sawn and whether quarter, half or all core taken. - If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry. - For all sample types, the nature, quality and appropriateness of the sample preparation technique. - Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples. - Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/second-half sampling. - Whether sample sizes are appropriate to the grain size of the material being sampled.	- No sub-sampling techniques were applied. - Sample collection and preparation followed the protocols of the NELAC accredited laboratories used. - A blind synthetic standard was provided every 20-30 samples or at the beginning and end of a set of samples. Blind blanks (distilled water) are provided every 50-60 samples or at the beginning of each set of samples and a check lab was used for every second sample. - The contracted labs reported the following methodologies for sample analysis: - Sample Digestion: EPA 200.2 - Anions: EPA M300.0, EPA 300.0, SM2320B, SM4500S2-D, SM2310BSM, SM D516 - Cations: EPA M200.7 & EPA 200.7 - Volatile Organic Compounds (Hydrocarbons): EPA M8015D, EPA M8260C/D, and EPA M3520C
Quality of assay data and laboratory tests	- The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total. - For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc. - Nature of quality control procedures adopted (eg standards, blanks, duplicates, external laboratory checks)	- Reported analytes typically include, for example, cation and anion data along with a limited number of trace elements. - Assay procedures are considered appropriate. - Quality control procedures included the inclusion of standards and duplicates and the use of external laboratory checks. - Often the laboratory names are not reported, and hence there is no way to evaluate laboratory certificates or make statements on the independence and

Criteria	JORC Code explanation	Commentary
	and whether acceptable levels of accuracy (ie lack of bias) and precision have been established.	accreditation of the individual laboratories used in the historical brine analytical work.
Verification of sampling and assaying	- The verification of significant intersections by either independent or alternative company personnel. - The use of twinned holes. - Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols. - Discuss any adjustment to assay data.	- Lithological intersections not assessed as bailed sampling was performed on formation brines. - Documentation of primary field data detailed above was conducted under standard operating procedures.
Location of data points	- Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation. - Specification of the grid system used. - Quality and adequacy of topographic control.	- Well locations are identifiable in the field. - The longitude and latitude locations of the oil and gas wells provided by the oil and gas companies are recorded in government databases.
Data spacing and distribution	- Data spacing for reporting of Exploration Results. - Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied. - Whether sample compositing has been applied.	- Data spacing and distribution is insufficient to establish the degree of geological and grade continuity appropriate for a potential future Mineral Resource or Ore Reserve. - No compositing was applied to the brine data.
Orientation of data in relation to geological structure	- Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type. - If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.	- The effect of structures in the concentration of different elements in the brines is not fully understood. - Seismic interpretation has been undertaken by Mandrake to evaluate geological structures but further work is still required. - The location of the historical oil and gas wells sampled is presented with reference to the main known structures in the images in the body of the announcement.
Sample security	The measures taken to ensure sample security.	Samples were kept and safely stored by Mandrake's personnel while at the field and shipped by registered courier to the laboratories and DLE providers.

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Audits or reviews	The results of any audits or reviews of sampling techniques and data.	No audits/reviews of the data have been undertaken at this stage.

Section 2 Reporting of Exploration Results

(Criteria listed in the preceding section also apply to this section.)

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	- Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings. - The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.	- The Utah Lithium Project is located approx. 60km SSE of the City of Moab, in the State of Utah in the United States. - The total land position is 93,755 acres and includes: 34,670 acres within an Other Business Agreement (OBA) with the Utah State Government's School and Institutional Trust Lands Administration (SITLA). - The remaining land position of approximately 59,085 acres is comprised of over 2,950 staked Bureau of Land Management (BLM) placer claims. - Mandrake has lithium rights over 100% of both SITLA and BLM tenure. - Mandrake has potash rights over SITLA tenure only. - All the leases / BLM claims are 100% owned by Mandrake's US subsidiary, Mandrake Lithium USA Inc.
Exploration done by other parties	Acknowledgment and appraisal of exploration by other parties.	- Historical exploration work has been performed by oil and gas companies who have completed hydrocarbon-specific exploration and production activities over the last 80 years across the lease and claim areas. - Individual wells within oilfields continue to produce in the Paradox Basin and within the boundaries of the Utah Lithium Project.
Geology	Deposit type, geological setting and style of mineralisation.	- The Project is in the north-central portion of the Paradox Basin. - Structurally, Mandrake's Project occurs on the southern margin of the "Paradox fold and fault belt", which consists of a series of roughly parallel, northwest-trending faults,

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		northwest striking diapiric salt-cored anticlines and synclines in the northern part of the Paradox Basin. - Currently, Mandrake's lithium-brine geological target units are defined by the Devonian McCracken sandstone, the Mississippian Leadville-Ouray Limestone Formation (Leadville Limestone) and the Pennsylvanian Paradox Member of the Hermosa Formation. - The Leadville Limestone comprises massive to thinly laminated, gray, buff, and yellow limestone that were deposited in intertidal to subtidal environments. - The Paradox Basin can be defined by the maximum extent of halite and potash salts in the Middle Pennsylvanian Paradox Formation and is composed of halite interbedded with gypsum, shale, sandstone, and dolomite deposited intermittently in a closed marine depositional environment.																												
Drill hole Information	- A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes: - easting and northing of the drill hole collar - elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar - dip and azimuth of the hole - down hole length and interception depth - hole length. - If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the Competent Person should clearly explain why this is the case.	- Mandrake has yet to conduct drilling at the Utah Lithium Project. - The historical oil and gas wells were drilled vertically. <table><tr><th>Well</th><th>Long/Lat</th><th>Sample Depth (ft)</th><th>Li (mg/L)</th></tr><tr><td>Big Indian #1</td><td>38.239428/109.275236</td><td>6,150</td><td>147</td></tr><tr><td>Big Indian #1</td><td>38.239428/109.275236</td><td>7,560</td><td>140</td></tr><tr><td>Lisbon B-912</td><td>38.186416/109.240868</td><td>8,480</td><td>65.6</td></tr><tr><td>Lisbon D-89</td><td>38.189514/109.288069</td><td>7,680</td><td>38.4</td></tr><tr><td>Lisbon D-84</td><td>38.204969/109.286034</td><td>8,560</td><td>59</td></tr><tr><td>Hook n Ladder Fed 15-25</td><td>38.245936/109.336416</td><td>6,800</td><td>18.5</td></tr></table>	Well	Long/Lat	Sample Depth (ft)	Li (mg/L)	Big Indian #1	38.239428/109.275236	6,150	147	Big Indian #1	38.239428/109.275236	7,560	140	Lisbon B-912	38.186416/109.240868	8,480	65.6	Lisbon D-89	38.189514/109.288069	7,680	38.4	Lisbon D-84	38.204969/109.286034	8,560	59	Hook n Ladder Fed 15-25	38.245936/109.336416	6,800	18.5
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Data aggregation methods	- In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off grades are usually Material and should be stated. - Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail. - The assumptions used for any reporting of metal equivalent values should be clearly stated.	- No weighting or cut-off grades have been applied. - No metal equivalent values have been reported.
Relationship between mineralisation widths and intercept lengths	- These relationships are particularly important in the reporting of Exploration Results. - If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported. - If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').	- Mandrake has yet to conduct drilling at the Utah Lithium Project. - The oil and gas fluids (hydrocarbons and brine) are produced from large, confined aquifer/reservoir deposits; hence, the brine samples – as fluid media – represent samples from a larger pool of fluids. Accordingly, it is accurate to state that brine data do not have common solid mineral deposit sample intervals or intercepts. Hence downhole lengths and true widths are not applicable to this type of deposit.
Diagrams	Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.	Historical well collar locations and appropriate lithium-brine information are presented within the figures, tables, and text contents of this announcement.
Balanced reporting	Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.	All results are reported in Table 1. The dataset is too sparse to evaluate grade variations.
Other substantive exploration data	Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment;	Based on the Mandrake's current knowledge of the project, all meaningful information has been provided.

Criteria	JORC Code explanation	Commentary
	<i>metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.</i>	
Further work	<i>The nature and scale of planned further work (eg tests for lateral extensions or depth extensions or large-scale step-out drilling).</i> <i>Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.</i>	- Planning of a swabbing campaign to allow for the sampling of more representative native and uncompromised brines further away from the historical oil and gas well bores is currently underway. - Permitting has been received which allows Mandrake to make new perforations in the historical oil and gas wells that target the lithological units most prospective to host lithium rich brines - Direct Lithium Extraction (DLE) test work to verify that lithium can be extracted from deep-seated brine underlying the Utah Lithium Project, is currently being undertaken by two independent DLE providers. - Work is underway to produce a lithium brine Mineral Resource in accordance with JORC (2012).