JULIA CREEK PROJECT

Vanadium
Oil Shale

Registered Office
Level 8
216 St Georges Tce
Perth WA 6000
Australia
+61(0) 8 9481 0389

Head Office
Level 6
50 Appel St
Surfers Paradise Q 4217
Australia
+61(0) 7 5646 9553

www.qldem.com.au
info@qldem.com.au

Highest Vanadium Extraction Results to Date by GSA Environmental

Highlights

- **QEM achieves highest vanadium extraction results to date, reports GSA Environmental.**
- **Acid leaching yielded up to 98% extraction - highest rate to date.**
- **Alkali leaching routes also showed promising results with 92% vanadium extraction achieved.**
- **Both methods of extraction are currently being optimised to inform the Julia Creek Project's Flow Sheet.**

QEM Limited (ASX: QEM) **("QEM" or "Company")** is pleased to announce that GSA Environmental (**"GSAe")** has completed the first round of vanadium extraction testing which involved the roasting of samples provided, post shale oil extraction, followed by acid and alkaline leaching test work.

GSAe was engaged to conduct comprehensive testing into multiple processes for extracting vanadium from solids generated during shale oil recovery (ASX Announcement 10 Nov 2022). Samples of Julia Creek oil shale (post-oil extraction from QEM's pilot plant at HRL Melbourne) were subjected to leaching tests to extract vanadium using a variety of reagents and methods.

Vanadium extraction rates achieved by both acid and alkaline leaching methods exceeded previous acid extraction results (ASX Announcement 27 Sept 2022), whilst reagent consumption was improved significantly over previous test work with further optimisation work still progressing.

Optimisation Studies are now Underway.

The results obtained from GSAe's interim report provide important insights into the extraction of vanadium from QEM's Julia Creek Project (JCP). Further studies are now underway to optimise the extraction process and determine the most effective method for the recovery of vanadium and other metals. Final conclusions should be available in April 2023 and this information will inform our flow sheet development for the wider project.

QEM Managing Director Gavin Loyden said the partnership with GSAe is already producing excellent results.

"It is great to be working with Michael and the team again. Their skill in this space is world class and this is evidenced by the results being achieved already. The material that they are working with was produced from the QEM pilot, after the hydrocarbons were extracted. This is really important, as we are now working with material that is representative of what would be produced in any future operation".

JCP Update

Concurrently, QEM is working with the University of Queensland's Sustainable Minerals Institute on potential vanadium beneficiation routes to further improve V2O5 yields. The Company is currently updating the mining scoping study at the Julia Creek Project, which is expected to be completed in the second quarter of 2023 and is also undertaking additional processing optimisation work, and environmental and water studies at the Project.

ENDS

This announcement was authorised for release on the ASX by the Board of QEM Limited.

For further information, please contact:

Gavin Loyden
Managing Director
P: +61 7 5646 9553
E: gavin@qldem.com.au

Joanne Bergamin
Communications Director
P: +61 7 5646 9553
E: jbergamin@qldem.com.au

ABOUT QEM

QEM Limited (ASX: QEM) is a publicly listed company which is focussed on the exploration and development of its flagship Julia Creek Project, covering 250km² in the Julia Creek area of North Western Queensland.

The Julia Creek vanadium / oil shale project is a unique world class resource with the potential to utilise and deliver innovative and sustainable energy solutions, through the production of energy fuels and vanadium pentoxide. QEM strives to become a leading producer of liquid fuels and in response to a global vanadium deficit, also aims to become a global supplier of high-quality vanadium pentoxide, to both the nascent energy storage sector and the Australian steel industry.

This globally significant JORC (2012) Mineral Resource of 2,850 Mt @ 0.31% V2O5 is one of the single largest ASX listed vanadium resources and represents a significant opportunity for development.

The tenements form part of the vast Toolebuc Formation, which is recognised as one of the largest deposits of vanadium and oil shale in the world. The project is located 6km east of the township of Julia Creek, in close proximity to all major infrastructure and services, and intersected by the main infrastructure corridor of the Flinders Highway and Great Northern Railway, connecting Mt Isa to Townsville.

ABOUT GSA Environmental Ltd

GSA Environmental Ltd has been operating since 2003 initially as the owner/operator of a vanadium/nickel extraction plant in Harwich, UK; and grown into a globally recognised technology and engineering consultant based around their own technological know-how of metals extraction.

GSAe focus is on recovery from secondary sources from the titanium dioxide industry and wider oil refining industry such as power station ash cokes, spent catalysts and gasification residues. In doing so, they have successfully bridged the gap between hydrocarbon containing wastes and metals extraction.

GSAe technology employs a sequence of hydrometallurgical and pyrometallurgical processes to extract metals such as vanadium and nickel from a variety of feedstocks. The core of the technology is acidic and alkaline leaching of feedstocks, followed by selective metal precipitation, filtration of the precipitates and roasting stages as required. The technology can be run in either batch or continuous configurations.

Over many years we have optimised this technology, adapting the chemistry for different qualities of feed-stock to isolate and extract a variety of metals as high purity saleable products and leaving non-hazardous wastes

In general, GSAe techniques result in limited emissions to atmosphere and drain, as the hydrometallurgy is carried out at 'low' temperatures and aqueous wastes would be treated to recover useful ions and reduce the project's possibility of eventual landfill.

*The information in this announcement that relates to the mineral resource and contingent resource estimates for the Company's Julia Creek Project was first reported by the Company in its IPO prospectus dated 20 August 2018 and supplementary prospectus dated 12 September 2018 (together, the "Prospectus") and the subsequent resource upgrade announcements ("Resource Upgrade") dated 14 October 2019 and 7 April 2022. The Company confirms that it is not aware of any new information or data that materially affects the information included in the Prospectus and Resource Upgrade, and in the case of estimates of Mineral Resources and Contingent Resources, that all material assumptions and technical parameters underpinning the estimates in the Prospectus and Resource Upgrade continue to apply and have not materially changed.

Competent Person

The information in this report that relates to Exploration Results for the Julia Creek Project is based on and fairly represents information complied and reviewed by Mr. Lyon Barrett, who is a Member of the Australasian Institute of Mining and Metallurgy and is a Principal Geologist employed by Measured Group Pty Ltd, independent consultants to QEM. Lyon Barrett has more than 20 years' experience in the estimation of Mineral Resources both in Australia and overseas. This expertise has been acquired principally through exploration and evaluation assignments at operating mines and exploration areas. This experience is more than adequate to qualify him as a Competent Person for the purpose of Mineral Resource Reporting as defined in the 2012 edition of the JORC Code. Mr Barrett consents to inclusion of the resource estimate and supporting information in the form and context in which they are presented in the announcement. *The information in this announcement that relates to the mineral resource and contingent resource estimates for the Company's Julia Creek Project was first reported by the Company in its IPO prospectus dated 20 August 2018 and supplementary prospectus dated 12 September 2018 (together, the "Prospectus") and the subsequent resource upgrade announcements ("Resource Upgrade") dated 14 October 2019 and 7 April 2022. The Company confirms that it is not aware of any new information or data that materially affects the information included in the Prospectus and Resource Upgrade, and in the case of estimates of Mineral Resources and Contingent Resources, that all material assumptions and technical parameters underpinning the estimates in the Prospectus and Resource Upgrade continue to apply and have not materially changed.

Appendix A: JORC Code, 2012 Edition – Table 1

Section 1 - Sampling Techniques and Data

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

Criteria	Details
Sampling techniques	Samples used in the extraction test work were taken from shale ash material produced from the pilot scale extraction test work described in QEM's announcement to the ASX dated 27th September 2022. The material used was initially taken from selected samples of QEM019 and QEM020 (part of the 2021 drilling programme) to form a composite bulk sample. Additional JORC Table 1 information in relation to the drill programme is contained in QEM's ASX announcement dated 7 April 2022. Approximately 5.5 kg of toluene-washed and unwashed shale ash (approx.. 2.5kg each) was supplied from the QEM piloting laboratories. Six random samples of as received ash were collected using the coning and quartering sampling technique, ground using a mortar and pestle, and leached in aqua regia for ICP OES analysis. It was clear that the as-received ash is hydrophobic therefore composition of ash was determined using roasted ash. Ash samples were subjected to a series of leaching experiments to extract vanadium. The ash samples were roasted at either 900 °C or 1000 °C prior to leaching. The leaching experiments were carried out using different leaching agents and methods.
Drilling techniques	The 2021 drilling programme involved the drilling of 6 drill holes across the tenements (plus one redrill). These varied in depth from 41.5 m (drillhole QEM023R) to the deepest hole at 83.5 m (QEM018), drilled during November 2021. The drilling was completed by rotary core drilling, using 4C (100mm) core. The drill diameter for the chipped section of the hole was 124 mm where PCD bit was used for chipping. All drill holes of the 2021 programme were geologically logged on site, photographed, geophysically logged and surveyed. Cores were labelled and boxed before dispatch to the laboratory for analysis.
Drill sample recovery	Not applicable – this announcement refers to metallurgical test work only. For specific information relating to drill sampling please refer to individual ASX drilling result announcement dated 7 April 2022.
Logging	Not applicable – this announcement refers to metallurgical test work only. For specific information relating to drill sampling please refer to individual ASX drilling result announcement dated 7 April 2022.
Sub-sampling techniques and sample preparation	Not applicable – this announcement refers to metallurgical test work only. For specific information relating to drill sampling please refer to individual ASX drilling result announcement dated 7 April 2022.
Quality of assay data and laboratory tests	Not applicable – this announcement refers to metallurgical test work only. For specific information relating to drill sampling please refer to individual ASX drilling result announcement dated 7 April 2022.
Verification of sampling	Not applicable – this announcement refers to metallurgical test work only. For specific information relating to drill sampling please refer to individual ASX drilling result announcement dated 7 April 2022.
Location of data points	Not applicable – this announcement refers to metallurgical test work only. For specific information relating to drill sampling please refer to individual ASX drilling result announcement dated 7 April 2022.

Criteria	Details
Data spacing and distribution	Not applicable – this announcement refers to metallurgical test work only. For specific information relating to drill sampling please refer to individual ASX drilling result announcement dated 7 April 2022.
Orientation of data in relation to geological structure	Not applicable – this announcement refers to metallurgical test work only. For specific information relating to drill sampling please refer to individual ASX drilling result announcement dated 7 April 2022.
Sample security	Not applicable – this announcement refers to metallurgical test work only. For specific information relating to drill sampling please refer to individual ASX drilling result announcement dated 7 April 2022.
Audits or reviews	No audits of sampling etc. done however a comprehensive set of internal company procedures exist and have been adhered to.

Section 2 - Reporting of Exploration Results

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

Criteria	Commentary
Mineral tenement and land tenure status	Julia Creek Project covers EPM 25662, EPM 25681 EPM 26429 and EPM 27057. When combined, these leases cover a total area 249.6 km². A digital version of these concession boundaries was downloaded by Measured from the Queensland Government Department of Natural Resources and Mines website.
Exploration done by other parties	- In 1981 CSR Ltd. drilled a series of exploration holes within the current QEM's Julia Creek project for the measurement of oil yield and Vanadium content from the Toolebuc Formation. The drillholes reached a total depth of between 46m and 161m m, intersecting the Toolebuc Formation between 35 m to 142 m.
Geology	- The Julia Creek Oil Shale deposit was deposited as the basal layer to the Early Cretaceous Toolebuc Formation. The Oil Shale is described as consisting of fine-grained carbonate-clay-Oil Shale (Coxhell and Fehlberg, 2000). The top part of the Toolebuc Formation consists of coarse limestone rich clay-oil-shale termed as the Coquina Limestone (Coxhell and Fehlberg, 2000). The Toolebuc Formation forms part of the greater Eromanga Basin, which covers a wide structural depression within central and northern Queensland. Up to 100m of Late Cretaceous age Allaru mudstones overlie the Coquina Limestone (also part of the Eromanga Basin). Weathered mudstones and topsoil overly the fresh Allaru mudstones.
Drill hole Information	- Refer to the Company's IPO prospectus dated 20 August 2018 and supplementary prospectus dated 12 September 2018 (together, the "Prospectus") and the subsequent resource upgrade announcements ("Resource Upgrade") dated 14 October 2019 and 7 April 2022
Data aggregation methods	- Sample results have been composited over full sedimentary unit thickness using length and density weighting. No metal equivalents have been used.
Relationship between mineralisation widths and intercept length	- The orientation of drilling/sampling (sub-vertical) is not seen to introduce any bias as all drilling is vertical and sediments mostly gently dipping.
Diagrams	- Appropriate diagrams are shown in the IPO prospectus dated 20 August 2018 and supplementary prospectus dated 12 September 2018 (together, the "Prospectus") and the subsequent resource upgrade announcements ("Resource Upgrade") dated 14 October 2019 and 7 April 2022.
Balanced reporting	- All exploration results pertaining to holes drilled at Julia Creek Project have been fully documented in in the IPO prospectus dated 20 August 2018 and supplementary prospectus dated 12 September 2018 (together, the "Prospectus") and the subsequent resource upgrade announcements ("Resource Upgrade") dated 14 October 2019 and 7 April 2022.

Criteria	Commentary
Other substantive exploration data	- Lithological logging, sampling and assay testing of the Toolebuc Formation, downhole geophysics where available in historic holes and for all QEM drilled holes.
Further work	- Additional detailed exploration work inclusive of additional drilling will be required to increase confidence in local estimates of tonnes and grade. Drilling will need to define the LOX line and drill the oxidised material for testing. Updated Higher resolution topography data will be required.