HEEMSKIRK
Announcement

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Reserves and Resources Update

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HEEMSKIRK CONSOLIDATED

KEY POINTS

- **Annual Statutory Update of Resources and Reserves**
- **Reported Silica Resources at Moberly Project and recoverable frac sand increased***

The Moberly plant in British Columbia has been operating for over 30 years. Product from this facility is to be used predominantly in the oil and gas drilling services industry. Major developments are underway in this industry which will require significant consumables during the forthcoming decades.

Due to exploitation of these resources and reserves, the major focus of the Company has been advancing the engineering and finance stages of the Moberly Silica operation for a redevelopment producing frac sand. Construction of the footings at the facility completed during 2015. The Company is now focused on completion of project financing with conditions precedent being addressed.

* Refer to Table 1 attached and the associated narrative

Moberly Silica Deposit (100% owned by Heemskirk)

The Moberly silica deposit occurs on the flank of Mount Moberly approximately 7km north of the regional centre of Golden, British Columbia and about 215km west of Calgary.

The material that is mined at Moberly is the Ordovician Mount Wilson Quartzite unit. Near Golden it reaches a maximum thickness of 480 metres at Horse Creek (less in the mine area) and Mount Moberly is the northern limit of the unit, where it is terminated by a thrust fault. The quartzite occupies a faulted syncline in the Beaverfoot Range and outcrops in parallel, structurally repeated layers. The quartzite is typically grey to buff coloured massive orthoquartzite with some evidence of crudely laminated and cross laminated beds near the base.

At the mine site the geology is simple. Bedding generally strikes around 118° magnetic and is vertical to steeply NE dipping. The rock consists of an orthoquartzite mostly but variably de-cemented (ie by removal of the silica 'cement' binding the grains) so that most of the area exposed consists of 'altered' quartzite, said to be friable or 'sandy' to varying degrees. Only a small percentage of the rock could be described as 'quartzite' in hand specimen; mostly there is a siliceous skeletal texture with beds, blebs and irregular masses of sand which flows freely when the rock is dug. There appears to be no systematic variation or control of the de-cementing. The composition of the rock is +99% SiO_2 as quartz, with the remainder being silicate clays and very rare other silicate minerals.

Petrological studies show that the sand grains within the rock vary between 0.841mm to 0.105mm in diameter (20 mesh to 100 mesh on the US scale).

The deposit was mined from the early 1980s to 2009 for silica processed to silica sand for glass making, golf course sand and similar products. Over these almost 25 years, the resource has been exposed and mined over 200m in vertical extent (along bedding), about 800m in strike (along bedding) and over 250m across strike (perpendicular to bedding) and for at least the last 10 years of full scale production, no portion of the pit varied from silica quality suitable for glass making, confirmed by customer analyses every shipment. The north-east margin of the quartzite unit has not been exposed in the mine area and the quartzite can be traced in air photos to the south-east for at least double the exposed length in the mine area.

Criteria for sand for glass making are SiO_2 +99.5% with Al_2O_3 <0.25%, Fe_2O_3 <0.1% and Cr_2O_3 <0.005%. The Moberly deposit and plant consistently delivered within spec during its operation.

During 2010 – 12 Heemskirk investigated, via an internal pre-feasibility and then a feasibility study (which was updated in early 2015) the possibility of treating the quartzite to produce a 'frac sand' suitable for use in the oil & gas sector as a proppant[1]. The studies found the project to be economically viable and the project moved to engineering design of a new frac sand plant on the existing plant site and an increased mining rate, within the same mine footprint, with at least a 35 year mine life. The plant engineering is now complete. Non frac sand residues are saleable either as silica flour (with additional treatment) or as additives for cement making.

Testing conducted while engineering design was being done found that a change in 'scrubber' equipment (used as the last stage of grain liberation and to 'polish' the sand grains to increase sphericity and roundness) would increase the yield of frac sands from the feedstock whilst still yielding ISO/API quality frac sands. This led to the incorporation of a commercial mixer unit in the process flow sheet. Recoveries in test work were up to 80% 30# -140# (64% 20# to 140# previously) but the Competent Person settled on 70% recovery of 30# to 140# for the estimation of Resources and Reserves to allow for uncertainties in applying the mixers at full scale. The cut-off for frac product was set at 30# due to the presence of a proportion of grain 'clusters' in the 20# to 30# fraction.

Frac sand is defined within a range of qualities (such as grain size, roundness, sphericity, acid solubility, turbidity, crush resistance and conductivity), each measured to ISO or API (American Petroleum Institute) specifications, rather than a single pass/fail specification, with customers defining the range of each quality that is acceptable for their particular use at a particular time (ie well depth, well location, availability of other product, well logistics).

In the past year Heemskirk continued to negotiate finance arrangements to build the new plant and other works to allow the expanded mining operation. These negotiations have been concluded on terms satisfactory to Heemskirk and the project remains financially robust.

Estimated Mineral Resources and Ore Reserves of silica at Moberly have changed from last year.

As noted above, the estimated recovery of frac sand from the silica ore has changed from 64% of 20#-140# frac sand, to 70% of 30#-140# frac sand as a result of test work leading to a design change to incorporate a pair of commercial mixers into the process design, replacing a 'scrubber' unit of different design.

Also, the strike extent of published Resources has been increased by 150m and consequently, published Reserves by 50m, resulting in increases of tonnages of silica for frac sand or, alternatively, glass making sand and a material increase in recoverable frac sand. The reason for

[1] Frac sand consists of silica sand which, having certain characteristic roundness, sphericity, strength and certain other properties is suitable to act as a proppant in oil and gas wells. Proppants are injected into such wells in order to keep fractures open, allowing the continued free flow of the gas or oil from the reservoir. Frac sand is usually used by customers in certain size brackets, e.g. 20 mesh to 40 mesh, 40 mesh to 70 mesh and 70 mesh to 140 mesh.

the increased strike extent in Resources is largely historical. When the Competent Person initially began estimating silica Resources and Reserves at Moberly, the future of the western 50m and eastern 100m extents of the resource was uncertain – vegetation regrowth was progressing and there were adequate resources in the smaller area given the production rates. With the increased tonnages required for the frac plant, and greater certainty of the most recent Mine Plan, the ends of the resource have been brought back into the published figures.

Resources of frac sand residues have decreased due to the increased recovery factor used for frac sands.

Resources and Reserves of silica at Moberly in 2015 are again reported separately for the traditional markets of Moberly silica – firstly for frac sand (with residues suitable for cement making or further processing into silica flour as an additional resource) and also for glass making. These estimates are largely for the same area of the deposit, but utilising different processing routes and end markets. Therefore the resource estimates are not additive, but rather alternatives to one another. Due to the simplicity of the geometry of the resource blocks, traditional cross-sectional techniques were able to be used, based on volumes estimated from AutoCad applied to a digital terrain model (DTM) of the deposit and a 35 year Mine Plan.

Further information is contained in the JORC defined 'Table 1' which is included as Appendix 1 here due to the increase in Resources and Reserves. Parts of Table 1 which have changed are labelled "UPDATE".

Ore Reserves and Mineral Resources this year are estimated as at 30 September, to align with Heemskirk's financial reporting date. The prior estimation was as at 30 June 2014. No changes in the estimations resulted from this date change.

A. *Silica for frac sand, frac sand residues and silica flour markets*

These Resources and Reserves are for an alternative processing route and market to the glass sand and other products reported in Section B. Resources and Reserves presented in this Section A are therefore not additive to those presented in Section B but rather are alternatives.

In-situ silica destined for the frac sand market has an estimated 70% yield to 30 mesh to 140 mesh sized sand[2], with the balance (frac sand residues) suitable for cement additives or further processing to silica flour for high temperature cement additives. Therefore the frac sand is

[2] Updated recovery and size range following test work using a mixer 'scrubber' unit and the adoption of this equipment in the circuit.

expressed as a tonnage and percent frac sand yield, with the frac sand residue Mineral Resource expressed as *in-situ* tonnage.

Table 1: *In situ* Estimated Mineral Resources of silica suitable for frac sand, at 30 September 2015

	Dry tonnes	
Resource Category	**2014 20 mesh to 140 mesh frac sand**	**2015 30 mesh to 140 mesh frac sand**
Measured*^	10.8 million tonnes @ 64% frac sand	12.5 million tonnes @ 70% frac sand
Indicated*^	21.6 million tonnes @ 64% frac sand	25.0 million tonnes @ 70% frac sand
Total Measured + Indicated*^	32.4 million tonnes @ 64% frac sand	37.5 million tonnes @ 70% frac sand

* *Mineral Resources for frac sand include that proportion modified to produce Ore Reserves of frac sand.*
^ *Frac sand Resources are not additive to Resources for glass making etc*
Columns may not add up due to rounding

The tonnage of Mineral Resources of silica to produce frac sand have increased due to a 150m increase in the strike extent of published Resources due to changed certainty of use of the east and west extents of the resource area. A change in designed processing equipment, following test work on bulk samples had led to an increase in expected recoveries to frac sand and a narrowing of the expected range of frac sand mesh size.

Residues from the production of frac sand (ie -140 mesh) are suitable for use as cement additives, or further processing to silica flour for high temperature cement additives, so the following Mineral Resources for frac sand residues are in addition to the Mineral Resources for frac sand.

Table 2: *In situ* Estimated Mineral Resources of silica as frac sand residues, at 30 September 2015

	Dry tonnes (millions)	
Resource Category	**2014**	**2015**
Measured*^	3.9	3.8
Indicated*^	7.8	7.5
Total Measured + Indicated*^	11.7	11.3

* *No proportion of these Resources are contained in the frac sand Ore Reserves below*
^ *Frac sand residue Resources are not additive to Resources for glass making etc*
Columns may not add up due to rounding

Expected recoveries to frac sand have increased from 64% to 70%, so silica reporting to frac sand residues will decrease proportionately. However the increase in strike extent of published

Resources has increased the total tonnage of Resources, offsetting most of the decrease in Resource of silica reporting to frac sand residues.

A Feasibility Study in 2012 found the Moberly frac sand project to be economically robust at 64% recoveries and other assumptions at the time. The Feasibility Study was updated in early 2015; incorporating the increased expected recoveries and updating capital and operating costs. A further update to the economic model late in 2015 demonstrates that the project still yields an attractive NPV and IRR.

All permits to produce frac sand are in place, except for an amendment to the one pertaining to dust emissions. This amendment application cannot be made until the precise dust filtration equipment specifications and locations of that equipment are known. The amended permit is not required until production commences. An Operating Permit to use treated on site bore water as potable supply is required, but the project is not dependent on that, as potable water could be trucked in. The mine haul road needs to be upgraded before production commences and engineering plans and costings are in place. The upgrade plan has been approved as part of the Mining Permit.

From the estimated Mineral Resources for frac sand were estimated the following Ore Reserves of frac sand. These are contained within a fully Permitted and engineered pit of 35 years duration at a mining rate of 400,000 tpa. Frac sand residue Resources have not been converted to Ore Reserve status.

Table 3: Estimate of Ore Reserves of silica suitable for frac sand, at 30 September 2015

Reserve Category	Dry tonnes	
	2014	2015
Proved^	8.9 million tonnes @ 64% frac sand#	9.3 million tonnes @ 70% frac sand##
Probable^	4.6 million tonnes @ 64% frac sand#	4.6 million tonnes @ 70% frac sand##
Total Proved + Probable^	13.5 million tonnes @ 64% frac sand#	13.9 million tonnes @ 70% frac sand##

^ *Frac sand Reserves are not additive to Reserves for glass making etc*
\# *20 mesh to 140 mesh*
\## *30 mesh to 140 mesh*
Columns may not add up due to rounding

Ore Reserve tonnages of silica for frac sand have increased due to the extension of the reported Resources envelope, as noted above, but the Mine Plan was only affected by this in a small way. Recoveries to frac sand have increased from 64% 20 mesh to 140 mesh to 70% 30 mesh to 140 mesh due to a change in equipment in the wet circuit following test work on bulk samples.

B. Silica for glass sand and silica flour markets

These Resources and Reserves are for an alternative processing route and market to the frac sand reported in Part A. Resources and Reserves presented in this Section B are therefore not additive to those presented in Section A but rather are alternatives.

In-situ silica for glass making sand and silica flour yields 100% saleable product and so is expressed as *in-situ* tonnes.

Table 4: Estimated Mineral Resources for silica for glass making and golf course sand, silica flour markets at 30 September 2015

Resource Category	Dry tonnes (millions) of silica product	
	2014	2015
Measured*	21.6	25.0
Indicated*	21.6	25.0
Total Measured + Indicated*	**43.2**	**50.0**

* *Mineral Resources include that proportion modified to produce Ore Reserves.*
Columns may not add up due to rounding

The tonnage of Mineral Resources of silica to produce sand for glass making etc have increased due to a 150m increase in the strike extent of published Resources due to changed certainty of use of the terminal extents of the resource area.

From the above *in-situ* Mineral Resources were estimated the Ore Reserves given in Table 5. These are contained within a fully Permitted and engineered pit of 35 years duration at a mining rate of 400,000 tpa.

Table 5: Estimated Ore Reserves for silica suitable for glass making sand and silica flour markets at 30 September 2015

Reserve Category	Dry tonnes (millions) of silica product	
	2014	2015
Proved	12.8	13.2
Probable	0.7	0.7
Total Proved + Probable	13.5	13.9

Columns may not add up due to rounding

Ore Reserve tonnages of silica for glass making have increased due to the extension of the reported Resources envelope, as noted above, but the Mine Plan was only affected by this in a small way.

The information in this report that relates to Mineral Resources or Ore Reserves is based upon information compiled by Malcolm Ward, BSc (Hons), MSc (Queen's), who is a Fellow of the Australasian Institute of Mining and Metallurgy.

Malcolm Ward is employed by and is Principal of Mining Advisory Pty Limited. Malcolm Ward and Mining Advisory Pty Ltd are retained under contract by Heemskirk to provide geological and other services, including the estimation of Ore Reserves and Mineral Resources. The work on Ore Reserves and Mineral Resources is undertaken independently. No remuneration is contingent on the outcome of that aspect of work and Heemskirk is not permitted to review or comment on the Ore Reserves and Mineral Resources estimate and accompanying technical documentation during preparation and afterwards may only comment on the estimate to correct errors of fact.

Malcolm Ward has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Malcolm Ward consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.

APPENDIX 1

JORC Code, 2012 Edition – 'Table 1'

Preamble: Please refer to the geological description of the Moberly silica deposit in the main body of this report. Sand for glass making and frac sand come from essentially the same areas of the deposit.

For the industrial mineral sand for glass making and frac sand, the concept of 'grade' as a percent or ppm of the material sought within the host rock is not applicable. Both these types of sand are bulk industrial products. Silica for glass making is required to be +99% SiO_2 with specified low levels of aluminium, iron and chrome. Silica for frac sand is defined by a number of qualities, measured by ISO and API specified techniques, including grain roundness, sphericity, acid solubility, turbidity, crush resistance and conductivity, with each quality determined for certain grain sizes such as 20/40, 30/50, 40/70 and 70/140 mesh. The range of acceptable values for each quality varies and the customer will define the requirements for each particular shipment. Thus, other than being in a size range between 30 mesh (0.595mm diameter) to 140 mesh (0.105mm diameter) there is no set 'hurdle' as to whether a sand is frac quality or not.

Sand produced for frac sand could be sold for glass making and tests have found that sand previously produced for glass making is largely frac quality.

Section 1 Sampling Techniques and Data

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

Changes in this section from June 2014 are prefaced '<u>UPDATE</u>'.

Criteria	JORC Code explanation	
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,*	The Moberly silica sand deposit was drilled by four cored holes in 1982 with logging was largely done on a qualitative basis and indicates the homogeneity of the deposit at depth, although this would be essentially down-dip of the sandstone beds. Extensive exposure and mining in three dimensions by open cut mining in the subsequent 25 years, with processing through the former sand plant (producing silica sand for glass making) has attested to the purity and homogeneity of the silica in the deposit. During this time, every silica shipment to customers was analysed by the customer with very few quality issues. Forward mining will be in the same area as previous mining. Sampling for frac sand quality and feasibility comprised several phases. Firstly, five bulk (+300kg) samples were taken by excavator. The first was of 'random' run-of-mine ore from a stockpile, then four were taken from in situ representing various degrees of

Criteria	JORC Code explanation	
	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.	alteration/sand production within the pit and also spread over the extent of the existing pit. A second phase of sampling took 15 samples, each approx. 20kg from a 3D network across the mine area. From these samples, sub samples were taken for petrological description and some SEM work. Petrological studies show that the sand grains within the mine area vary entirely between 0.841mm to 0.105mm in diameter (20 mesh to 100 mesh on the US scale), that is, all within the range for frac sand. The sampling was done under geological supervision and control to cover variability in the critical component of the frac sand quality which is the degree of cementation of the grains (‘alteration’). The bulk samples were submitted to an independent metallurgical laboratory to produce sand under the proposed frac sand wet circuit conditions (essentially crush, then ‘scrub’ or attrition). After consideration of recoveries for the various bulk samples, an overall recovery factor of 64% of ‘frac sand’ (sized from 20 mesh to 140 mesh) was determined by the met laboratory. The 36% non-frac sand product (mostly <140 mesh) is saleable as cement additive, and/or silica flour, grouting products or other silica sand applications. The laboratory produced sand from the bulk samples (approximately 40kg each) was split and about 5kg sieved to the standard mesh size ranges of 20/40, 40/70 and 70/140 mesh and examined under the microscope, photographed and described. The various fractions were then sent to accredited laboratory StimLabs of Oklahoma, USA for thorough testing for frac sand quality according to ISO and American Petroleum Institute (API) standards for roundness, sphericity, bulk density, acid solubility, turbidity and crush resistance (‘K value’). A composite sample from several of the sands from the bulk samples was made to simulate the characteristics of ore to be mined in the early phases of the new operation, and similarly tested, with frac sand ‘conductivity’ also measured under ISO standard methodology for the various mesh sizes. This is a very exacting ‘stress’ test for frac sand material.

Criteria	JORC Code explanation	
		The Moberly sands satisfy all the ISO/API criteria for frac sands. A sample of the plain 'glass sand' from an existing stockpile, without any scrubbing or attrition ('polishing') also qualified as frac sand. A number of sand samples, including the above, were sent to customers for their in-house testing and assessment. All customers reported their satisfaction, although the results of their testing were not disclosed. <u>UPDATE:</u> A third phase of sampling occurred in late 2014, when ten +800kg bulk samples were taken from throughout the pit area via excavator under the supervision of the Mine Manager. The samples were subjected to jaw crushing, VSI crushing and then testing using a mixer unit at the mixer company's manufacturing and testing facility.
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).*	The deposit has not been drilled in recent times as the open cut area, on the side of a mountain, yields a 3 dimensional exposure and sampling opportunity much more effective than a drilling program would produce. Also, due to the orientation of the beds, drilling would sample along or across the bed planes only, which can be done on the 3D pit surface. Bulk samples via excavator under geological control were taken from the 3D pit area surface and placed in steel drums. <u>UPDATE:</u> The 2014 +800kg bulk samples were placed in industrial Super Sacks for transport.
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.*	As noted above, drilling has not been undertaken recently. Bulk samples were taken using an excavator under geological supervision to ensure representivity and sample recovery was 100% in these cases. Grade is not an appropriate concept in this situation however it is possible that sand which might have 'escaped' during bulk sampling could produce a biased sample overall. Care was taken to avoid this situation.

Criteria	JORC Code explanation	
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.* • *Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography* • *The total length and percentage of the relevant intersections logged.*	Although core / chip sampling has not been undertaken, the pit has been geologically mapped over a number of years, backed up by microscopic examination of a range of samples by a professional petrologist, including thin section micro photography and some SEM photography. Sample sites were photographed and described geologically. Bulk samples were taken and resultant processed sands also examined, described and photographed. This level of work is appropriate to support Mineral Resource estimation for both glass sand and frac sand. All of this work has confirmed the uniform nature of the deposit, in terms of silica content (or rather, near absence of non-silica grains) and the roundness and sphericity of the grains.
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 sampling specifically for glass sand production has been done recently, however the deposit has been processed successfully for 25 years by the former sand plant and each sand shipment for many years was sampled and analysed with little indication of off-spec product. As noted above, no coring has been done but five bulk samples were taken via excavator for treatment and then very exacting frac sand quality determination. Given the homogeneity of the deposit, and the fact that the samples were +300kg bulk samples, sample duplication was not considered necessary. The samples were taken in sealed steel drums to a metallurgical laboratory in Vancouver, where a sub-pilot scale circuit had been established. The samples were split, with portion crushed to -25mm for grinding in closed circuit with a 1.7mm screen in 10kg batches at 30% solids for 2 hours per batch. Screen oversize was returned to the grinder for treatment, -140 mesh material was discarded to tailings and the product was decanted for settling, drying and weighing. Both the yield of feed reporting to the product fraction

Criteria	JORC Code explanation	
		from each sample, as well as the size distribution of the product fraction retained was determined from the testing. The optimal scrubber configuration produced about 40kg of sand from each sample, which was then riffle split and sieved down into various mesh sizes for description, photography and laboratory testing for frac sand qualities. Bulk sand from each sample was sent to accredited frac sand testing laboratories in the USA. There, the samples were analysed for bulk mesh size, then the various size ranges such as 20-40 mesh, 40-70 mesh and 70-140 mesh for each sample were analysed for cluster presence, roundness, sphericity, bulk density, acid solubility, turbidity, crush resistance (‘K value’) according to ISO and API standards and methodologies. Two samples from the area to be mined initially were composited and again tested, this time including and long term conductivity and permeability. The size of the samples at all stages was appropriate to the grain size of the deposit and the proposed processing circuit. The samples were damp when collected, later dried but scrubbing was done with a wet circuit, therefore the moisture state is largely irrelevant. UPDATE: As noted above, in late 2014 ten +800kg bulk samples were taken from throughout the pit area, under supervision of the Mine Manager. They were jaw crushed, VSI crushed and then tested in the mixer unit. The samples were transported in industrial ‘Super Sacks’. At the jaw crush and VSI crush stages, the samples were re-homogenised using sheet rolling and/or riffle splitting. At the mixer testing facility, the tote bags were tumbled to re-homogenise, but some settling effect may still have been present. Sub samples of +50kg were taken by shovel from the Super Sacks for mixing (‘scrubbing’) tests. Minor contamination of two samples was found following the VSI crushing stage. The contamination was not sufficient to materially affect the results.

Criteria	JORC Code explanation	
		At each of the jaw crushing, VSI crushing and mixing stages, at least 2kg of sample was split off for size analysis at an accredited laboratory. Sand from -mixed (scrubbed) samples were further riffle split and sub-samples of +6kg sent to an accredited ISO laboratory to test for frac sand qualities. The sampling technique, location of samples and sample preparation were all appropriate for the grain size, type of deposit and analytical techniques being used.
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) and whether acceptable levels of accuracy (ie lack of bias) and precision have been established.*	Historically, sand for glass making was analysed for % SiO_2, and deleterious element oxides Al_2O_3, Fe_2O_3 and Cr_2O_3 each shipment and each month by broad spectrum ICP/AA (total analysis). This is considered appropriate. The analyses for frac sand quality conducted by StimLabs (an accredited frac sand testing laboratory) is a thorough test of frac sand quality and is one of two major laboratories that conducts these tests for the industry in North America. Test are conducted to exacting ISO 13503-2 and API RP19C standards and protocols, specifically Sections 6, 7, 8, 9, 10, 11; some included conductivity and permeability. Analytical procedures are given in the ISO standard: https://www.iso.org/obp/ui/#iso:std:iso:13503:-2:ed-1:v1:en (Subscription may be required; full text available from Heemskirk.) This testing is entirely industry standard and those including conductivity can be regarded as a total test. Whether or not conductivity is included, the testing regime is considered appropriate. No geophysical tools have been used. Measurements for frac sand properties are conducted under strict ISO/API procedures. Calibrations at the StimLabs facility are done weekly to annually depending on the piece of equipment; major equipment is calibrated by an independent contractor. Many tests are

Criteria	JORC Code explanation	
		repeated up to three times and if repeats vary by a certain fraction of SD, the test is repeated. An internal standard is run as a 'blind' sample three times per month.
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.*	The results obtained in the StimLabs testing were returned to Heemskirk Canada and separately analysed and interpreted by several people, including the Competent Person and their interpretations and conclusions were the same. This analysis and interpretation is equivalent to the calculation of 'significant intersections'. The results were also shown to potential clients and industry experts and no doubts were expressed that saleable frac quality sand had been produced. No twinning or duplicate sampling was undertaken, however the samples were bulks of ~330kg each. StimLabs reports were received in hard copy at the company office in Calgary and filed appropriately. The results did not require transferal into any digital database. No adjustments to the data were done. UPDATE: As noted above, the third round of sampling entailed +800kg bulk sampling.
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.*	Although a historical grid exists at the silica open pit, it is not currently used. The sample locations were recorded by GPS and transferred to Google Maps and aerial imagery. The scale of the sampling and homogeneity of the silica within the pit means that this location accuracy was sufficient. The hand held GPS uses WGS 84 datum and spheroid and displays latitude and longitude to one decimal point of seconds. The pit is surveyed periodically via GPS by licenced surveying contractors although the lack of mining in recent years has meant that

Criteria	JORC Code explanation	
		a full survey has not been conducted in the past year. The current survey control is adequate for the sampling exercise described above and for resource and reserve estimation.
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.*	The sampling was not undertaken for Exploration. As the silica content and grain sizes are totally and reasonably homogenous throughout the mine area respectively, data spacing and distribution was adequate for the purposes of establishing the continuity of frac sand and also glass sand quality for the Mineral Resource and Ore Reserve estimation procedures, using the recovery process(es) to be employed. Although the samples were not composted, the frac sand recovery factor determined by the metallurgical lab was a single figure, determined by the met lab to be appropriate across the deposit. Resources and Reserves are not estimated and reported to the level of the ISO testing described above, but to the recovery level of 20 mesh to 140 mesh frac sand. Sample compositing was applied in one round of ISO quality testing. Sands from two of the bulk samples representing the area to be first mined for frac sand were composited and tested for a full suite of frac sand characteristics, including conductivity and porosity, with good results. UPDATE: No compositing was applied to the 2014 bulk sampling exercise until the final frac quality analysis where two samples were combined. This was done both to achieve the quantity of sand required and to achieve a more representative sample across a wider area of the deposit.
Orientation of data in relation to	• *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*	Although the deposit is bedded, there is no discernible variation in silica composition or trends in grain size either across bedding or along strike. The samples taken did represent an unbiased sampling along and across structures.

Criteria	JORC Code explanation	
geological structure	*of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.*	The deposit was not sampled for frac sand quality by drilling. The bulk sampling took account of the bedding structures.
Sample security	• *The measures taken to ensure sample security.*	Samples were sealed in steel drums during transport to the metallurgical laboratory and the resultant sands sent by courier between the laboratory and Calgary office in sealed plastic drums and from there to the sand testing laboratory. These measures are adequate for the type and size of the samples in question. UPDATE: The +800kg bulk samples taken in late 2014 were collected into industrial 'Super Sacks' for transport. Some sand leakage may have occurred during transport but this would not be material to the results. These measures are adequate for the type and size of the samples in question.
Audits or reviews	• *The results of any audits or reviews of sampling techniques and data.*	The sampling program was reviewed by a consultant firm on behalf a second party investigating the deposit and the amount and locations of the samples were questioned (eg 'unknown' sample locations). However it became apparent that the reviewer was not given access to several critical documents, such as the geological report on the sampling program, which included sample locations and descriptions nor the last detailed Mineral Resources and Ore Reserves estimation report. Heemskirk and the Competent Person are confident that the sampling was well controlled and adequate and has rejected or addressed most of the reviewer's comments. UPDATE: The late 2014 bulk sampling and testing program, along with the rest of the frac sand project technical data and plans was reviewed by an independent engineering company and a frac sand expert engaged by a prospective financier. This review found no issues with the sampling and testing program.

Section 2 – not applicable

Section 3 Estimation and Reporting of Mineral Resources

(Criteria listed in section 1, and where relevant in section 2, also apply to this section.)

Changes in this section from 2014 are prefaced '<u>Update</u>'.

Criteria	JORC Code explanation	Commentary
Database integrity	• *Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes.* • *Data validation procedures used.*	The data relating to this silica / sand / frac sand deposit is relatively simple. Hardcopy reports were handled entirely by professional persons and figures produced in spreadsheets relating to averages etc were reviewed internally. There is no database involved. As no database is employed, no validation procedures were employed other than re-checking results received in hardcopy from the laboratory against sample numbers and descriptions sent.
Site visits	• *Comment on any site visits undertaken by the Competent Person and the outcome of those visits.* • *If no site visits have been undertaken indicate why this is the case.*	The site is visited several times a year by the Competent Person, including one visit annually specifically in relation to Mineral Resource and Ore Reserve Estimation. No unusual features or occurrences have been noted. The CP also visited the metallurgical laboratory in Vancouver at the time of initial frac sand recovery test work. <u>UPDATE:</u> The Competent Person attended the mixer plant in the USA for the testing of bulk samples using mixers. A visit to the Moberly mine and plant site was made in September 2015.
Geological interpretation	• *Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit.* • *Nature of the data used and of any assumptions made.* • *The effect, if any, of alternative interpretations on Mineral Resource estimation.*	The mineral deposit is a simple bedded sandstone/orthoquartzite deposit, broadly folded so bedding is near vertical throughout the mine area, with no hinge zone apparent, well exposed in the open cut. Variation in the de-cementing of the grains occurs on a mm to metre scale, but this does not affect the frac or glass making sand quality except to the degree that silica shards may remain on the

Criteria	JORC Code explanation	Commentary
	• *The use of geology in guiding and controlling Mineral Resource estimation.* • *The factors affecting continuity both of grade and geology.*	grains in the less altered rock (and which are removed in the scrubbing stage). Confidence in the geological interpretation of the deposit is high. Data used is geological mapping and petrological examination of samples taken across the mine area. The main assumption made is that the deposit continues in its present form for a further 100m or so at depth; note that this direction is along bedding and that more than this vertical extent is already exposed within the open cut workings. There is no other reasonable geological interpretation to the deposit; the entire deposit is exposed in three dimensions, over hundreds of metres in each direction. Geology controls the Mineral Resource estimation in that the resource lies entirely within a consistent bedded sandstone/quartzite unit. There are no other rock types involved. 'Grade' is not a quality associated with glass sand or frac sand deposits but various, separate, glass and frac sand qualities are determined. The factors affecting the continuity of these qualities and geology relate to primary sedimentary deposition processes. Any variations which are present are not material to the Mineral Resource estimation.
Dimensions	• *The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.*	Within the exposed and previously mined area of the altered orthoquartzite (800m plan length (along bedding), 250m plan width (perpendicular to bedding) and 200m in vertical extent below surface (along bedding), the frac sand resource has been estimated and reported for a length of 600m in plan length (along bedding), between 220 and 180m in plan width (perpendicular to bedding) and 25m for Measured then a further 50m for Indicated Resource below surface (along bedding). The glass making silica resource has been estimated and reported for a plan length of 700m (along bedding), between 220 and 180m plan width (perpendicular to bedding) and 50m for below surface for

Criteria	JORC Code explanation	Commentary
		Measured and a further 50m for Indicated Resource (again, along bedding). Both the Mineral Resource and Ore Reserves are estimated entirely within the quartzite unit; no country rocks or non-resource lithotypes are within the Mineral Resource or Ore Reserves envelopes. UPDATE: ‘600m’ in the first paragraph above should have read ‘700m’, the same as for glass making silica resources. This was a typographical error. The strike extent of the published Resources in 2015 has been increased by a total of 50m to the west and 100m to the east due to greater certainty that this resource will be able to be recovered, rather than the land left to re-vegetate.
Estimation and modelling techniques	• *The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used.* • *The availability of check estimates, previous estimates and/or mine production records and whether the Mineral Resource estimate takes appropriate account of such data.* • *The assumptions made regarding recovery of by-products.* • *Estimation of deleterious elements or other non-grade variables of economic significance (eg sulphur for acid mine drainage characterisation).* • *In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed.* • *Any assumptions behind modelling of selective mining units.* • *Any assumptions about correlation between variables.* • *Description of how the geological interpretation was used to control*	As the deposit is massive and largely homogenous, the cross section technique is employed for Mineral Resource estimation, with sections 100m apart and Mineral Resource outlines projected 50m either side of a section line. No domaining is used. This is considered appropriate to the type of deposit. No computer software is employed, other than Autocad, by the pit engineer to derive the pit shape. For silica for glass making, the resources were extended in the Measured category for 50m from the surface (ie along strike) and for Indicated category, a further 50m. For silica for frac sand the Mineral Resources were extrapolated 25m from the surface for Measured category and for Indicated category, a further 50m. Prior to the current phase and methodology of resource estimation, commencing in 2006, no resources were estimated at the deposit. Production and customer records before and subsequent to 2006 confirm the purity of the deposit with respect to silica and lack of significant deleterious elements. By products from both glass making and frac sand are silica ‘fines’ – variably defined depending on the use to which the silica sand is used. The recovery of -140 mesh proportion in the frac sand was determined by metallurgical testing and the equipment design. The

Criteria	JORC Code explanation	Commentary
	the resource estimates. • *Discussion of basis for using or not using grade cutting or capping.* • *The process of validation, the checking process used, the comparison of model data to drill hole data, and use of reconciliation data if available.*	fines from either processing route can be sold for cement additive, or made into silica flour. A silica flour circuit is in operation at the plant site. There are no deleterious elements in the deposit expected to impact product sales. Iron occurs occasionally as small pisolites but is eliminated in the initial magnetic scalping of the mill feed or in the washing process. Historically deleterious elements iron, aluminium and chrome have all been analysed routinely and have not been a customer issue in sand for glass making. Block modelling is not employed and no selective mining is employed (the pit lies entirely within 100% resource rock). No assumptions between variables are made. Geology is used to control resource estimates to the extent that the entire unit is homogenous and the resource is contained entirely within the geological unit. Grade cutting or capping is not applicable because the resource is based on +99% silica with a homogenous spread of sand grain sizes. Validation is not made to a computer model, but the assumption of +99% SiO_2 is validated against historic shipments of product as glass sand, with each shipment tested by customers.
Moisture	• *Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.*	Estimation is on a dry basis.
Cut-off parameters	• *The basis of the adopted cut-off grade(s) or quality parameters applied.*	The concept of cut-off grade is not applicable to this bulk sand deposit; see above. Quality parameters such as the amount of in-situ sand development is used in surface mapping, but is not used in Mineral Resource estimation.

Criteria	JORC Code explanation	Commentary
Mining factors or assumptions	• *Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made.*	The deposit has been mined by open cut mining since the early 1980s and it is reasonable to assume that this will continue to be the most appropriate method for a very long time. The margins of the geological unit being mined have not been fully exposed on the surface, so it is reasonable to expect that all the current resource will be accessible eventually. Mining occurs entirely within the resource geological unit, with no 'waste rock', so mining recovery factors do not come into play. The 35 year mine plan of 2012 which is still current, is the basis for current mining assumptions.
Metallurgical factors or assumptions	• *The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.*	The deposit has been processed and sold for glass making silica for about 25 years. It has a simple composition of +99% SiO_2 as sand grains and the silica variably cementing the grains. Most of the remainder is silicate clay minerals. It is easily produced into sand feed for glass plants by crushing, washing, drying and screening, which makes it ideal for this purpose. Residues are suitable for cement additives or silica flour. A metallurgical laboratory test program was initiated to look at the recovery of frac sand from the deposit. Across a number of bulk (+300kg) samples, this found a 64% recovery as frac sized sand (20 mesh to 140 mesh), the balance being silica fines, amenable to sale as concrete additive, or silica flour. ISO standard measurement of frac sand qualities of the sand produced gave good to very good results. <u>UPDATE:</u> Ten +800kg bulk samples were taken from throughout the pit and subjected to jaw crushing, VSI crushing (as already planned in the new plant) and despatched to the mixing facility in the USA. Nine of the ten samples were subjected to a variety of tests including varying the mixer settings and the length of time under mixing. Recovery to 30# to 140# sand was between 75% and 80% and sands tested in an ISO accredited laboratory confirmed that they were of frac quality. The Competent Person has decided that a recovery factor of 70% should be used for Resource and Reserve estimation,

Criteria	JORC Code explanation	Commentary
		to allow for variations between the test facility and the new plant, notwithstanding that an independent review concluded that a recovery figure of 75% was permissible.
Environmen-tal factors or assumptions	• *Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfields project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.*	The mine site, in operation since the early 1980s, is fully permitted for planned operations. The plant site also began operation for sand processing in the early 1980s. It is currently fully permitted for glass making sand and frac sand production, except a permit amendment relating to dust emissions, which regulators advise will not be an issue with the dust collection measures planned to be employed. All of the material trucked to the plant site is ultimately saleable, including the fines/residues. Any lag in sales of the latter can be accommodated by stockpiling on site (which has been done previously), for which there is ample room. Permission has been given by agricultural authorities for that part of the site not zoned industrial to be used for 'non-farm use' including stockpiling and rail sidings. No environmental permitting for this is required, other than dust suppression.
Bulk density	• *Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples.* • *The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vugs, porosity, etc), moisture and differences between rock and alteration zones within the deposit.* • *Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.*	Bulk density of the feedstock for both glass making and frac sand silica has been determined by several phases of laboratory determination. A number of approximately 10kg samples were submitted in 2006 and in 2008 to a certified laboratory, representing varying degrees of silica de-cementing ("% sand") across the deposit. Each sample was sawn in half. One half was dried in an oven (ie removing adsorbed water), coated in wax and had its bulk density measured by the water displacement method. The other half was placed uncoated in water and then had its bulk density measured by the same water displacement method. A computation of the bulk density of the samples if the pores and voids were removed was also made. Thus a matrix of bulk densities was determined from wet, dry

Criteria	JORC Code explanation	Commentary
		and voids excluded, and for the range of almost no to almost complete silica de-cementing. The dry bulk densities ranged from 2.26 to 2.64 and the bulk density without voids ranged from 2.39 to 2.65. Given the non-systematic nature of the de-cementing across the deposit a, uniform bulk density of 2.50 was adopted.
Classification	• *The basis for the classification of the Mineral Resources into varying confidence categories.* • *Whether appropriate account has been taken of all relevant factors (ie relative confidence in tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data).* • *Whether the result appropriately reflects the Competent Person's view of the deposit.*	The basis of classification into Measured and Indicated categories is based on the depth below current pit surface. The current pit surface (on the slopes of a mountain) is well exposed in 3 dimensions and is the product of open cut mining for over 25 years, all of which has yielded the same quality silica. Bedding is vertical or very close to it. For sand for glass making, Measured category is taken from surface to 50m below surface, and Indicated category for a further 50m below that. For frac sand, the Measured category is taken only 25m below surface, with Indicated category a further 50m. This takes appropriate account of the historic homogeneity of the deposit in respect of silica content and grain sizes, the location of bulk samples used to determine recoveries for frac sand and the vertical attitude of bedding. Appropriate account has been taken of the various factors, continuity and the distribution of data, and reflects the view of the Competent Person.
Audits or reviews	• *The results of any audits or reviews of Mineral Resource estimates.*	The 2012 Mineral Resource estimate, which remains unchanged to date, was reviewed by an independent geologist for a third party company undertaking due diligence. Although the report of the geologist has not been sighted, another independent reviewing report states that the independent geologist 'agreed with the methodology and result' of the Heemskirk Competent Person's estimations. Further, discussions with the independent geologist at the mine site by the Competent Person revealed no material issues of contention.

Criteria	JORC Code explanation	Commentary
		UPDATE: A second independent review of the 2014 Mineral Resource estimates was undertaken in early 2015 during due diligence by a proposed financier. No significant issues in the technique or estimations were brought forward. The Mineral Resource estimate has been amended in 2015, as noted above (this announcement). This has not been reviewed by an independent person.
Discussion of relative accuracy/ confidence	• *Where appropriate a statement of the relative accuracy and confidence level in the Mineral Resource estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate.* • *The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used.* • *These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.*	The deposit is one of a massive, bedded quartzite/sandstone unit with no waste rock within the pit. No geostatistical manipulation has been used in the Mineral Resource estimates. The estimate is accurate as there is no waste rock within the geological unit and all rock is suitable for saleable products. The Resource estimate is for a single body of rock hosting a single pit, so the estimate is considered global.

Section 4 Estimation and Reporting of Ore Reserves

(Criteria listed in section 1, and where relevant in sections 2 and 3, also apply to this section.)

Criteria	JORC Code explanation	Commentary
Mineral Resource estimate for conversion to Ore Reserves	• *Description of the Mineral Resource estimate used as a basis for the conversion to an Ore Reserve.* • *Clear statement as to whether the Mineral Resources are reported additional to, or inclusive of, the Ore Reserves.*	The Mineral Resource estimate for the massive silica deposit was via simple cross sectional method, from surface to a reasonable depth based on geological and continuity factors. The conversion to Ore Reserves was by application of the Mining Plan, other Modifying Factors and the frac sand Feasibility Study.

Criteria	JORC Code explanation	Commentary
		The Mineral Resources for silica for glass making etc and for frac sand are inclusive of the Ore Reserves for each respective type of use.
Site visits	• *Comment on any site visits undertaken by the Competent Person and the outcome of those visits.* • *If no site visits have been undertaken indicate why this is the case.*	The Competent Person visited the site on a number of occasions in the past year, most recently in September 2014. As no mining has taken place in the past year, nor any change to mining or processing options, no different conclusions or observations in respect of Mineral Resources and Ore Reserves were drawn. UPDATE: The Competent Person attended the mixer plant in the USA for the testing of bulk samples using mixers. A visit to the Moberly mine and plant site was made in September 2015.
Study status	• *The type and level of study undertaken to enable Mineral Resources to be converted to Ore Reserves.* • *The Code requires that a study to at least Pre-Feasibility Study level has been undertaken to convert Mineral Resources to Ore Reserves. Such studies will have been carried out and will have determined a mine plan that is technically achievable and economically viable, and that material Modifying Factors have been considered.*	A Feasibility Study was undertaken in 2011 to determine the economics and feasibility of producing frac sand from the silica resource, which had previously been mined for decades for glass making sand. The outcome of the study was economically positive and robust. The most recent Mine Plan was an update to that in the Feasibility Study, and takes account the planned, permitted increase in mining rate. UPDATE: The Feasibility Study was revised and updated in early 2015, incorporating updated capital and operating costs and incorporating the mixer (‘scrubber’) in the treatment process. Cost figures have been revised again late in 2015 and the economics of the project remained robust.
Cut-off parameters	• *The basis of the cut-off grade(s) or quality parameters applied.*	For bulk mining of this massive silica deposit, there are no cut-off parameters applied as the deposit and all material is ultimately saleable, irrespective of grain size.

Criteria	JORC Code explanation	Commentary
Mining factors or assumptions	• *The method and assumptions used as reported in the Pre-Feasibility or Feasibility Study to convert the Mineral Resource to an Ore Reserve (i.e. either by application of appropriate factors by optimisation or by preliminary or detailed design).* • *The choice, nature and appropriateness of the selected mining method(s) and other mining parameters including associated design issues such as pre-strip, access, etc.* • *The assumptions made regarding geotechnical parameters (eg pit slopes, stope sizes, etc), grade control and pre-production drilling.* • *The major assumptions made and Mineral Resource model used for pit and stope optimisation (if appropriate).* • *The mining dilution factors used.* • *The mining recovery factors used.* • *Any minimum mining widths used.* • *The manner in which Inferred Mineral Resources are utilised in mining studies and the sensitivity of the outcome to their inclusion.* • *The infrastructure requirements of the selected mining methods.*	A 25 year Mine Plan (open pit) was completed with detailed designs in July 2009 by Clifford Lusby P.Eng, a licensed professional engineer in British Columbia. Although this was a mine plan for mining silica for glass sand, it was adopted in the FS for frac sand as the material mined, and the mining technique was no different, because the deposit is massive and all material in the pit is ultimately saleable via either processing route. The Mine Plan was revised in 2012 as a 35 year plan, mining 400,000 tpa silica ore for frac sand (which is also saleable as glass making sand). Permits are in place to accommodate the increased mining rate. This is an appropriate mining technique, as the open cut mine plan occurs entirely within the known boundaries of the silica resource; there is no waste rock within the pit. There is no pre strip required (although some soil will need to be removed) and access will be via the existing access and haul road, which will be up-graded along its full length. The Mine Plan contains detailed consideration of geotechnical aspects, including a detailed separate, earlier, geotechnical report. Benches: 12m high; 78 degree face angle, 48.7 degree inter-ramp angle, 8m wide catchment berms, 15m wide ramps and 12 percent ramp grade. There will be no pre-production drilling, as there is abundant pre-existing exposure. Mining dilution factor is 0%, as all material excavated and trucked is ultimately saleable. Mining recovery factor is 100% as the pit lies entirely within the silica resource. There is no minimum mining width. The Mine Plan is insensitive to the inclusion of Inferred Resources. The open cut will require only the infrastructure already in place, namely the haul road, which will be upgraded (and engineering and permits are in place for this work).

Criteria	JORC Code explanation	Commentary
Metallurgical factors or assumptions	• *The metallurgical process proposed and the appropriateness of that process to the style of mineralisation.* • *Whether the metallurgical process is well-tested technology or novel in nature.* • *The nature, amount and representativeness of metallurgical test work undertaken, the nature of the metallurgical domaining applied and the corresponding metallurgical recovery factors applied.* • *Any assumptions or allowances made for deleterious elements.* • *The existence of any bulk sample or pilot scale test work and the degree to which such samples are considered representative of the orebody as a whole.* • *For minerals that are defined by a specification, has the ore reserve estimation been based on the appropriate mineralogy to meet the specifications?*	It is proposed to utilise VSI crushing to liberate the sand grains from the sandstone/quartzite (which is already de-cemented in large part), then scrub or 'polish' the grains to remove adhering silica cement/over-growths, dry the sand and screen it into appropriate size categories. This type of processing is appropriate to the type of ore feed, and product required. Overall the process is conventional and well tested however it includes a VSI in combination with a mill or scrubber stage which is not conventionally used in frac sand plants which are usually based around less consolidated feedstock mainly in Wisconsin and nearby states in the USA. It is included in the Moberly circuit at the recommendation of the met lab testing. For frac sand testing, in addition to a random 'ROM' sample, four 'variability' samples of about 330 kg each from various silica de-cementing and geographic areas were taken from the deposit, representing variations of characteristics spread over the resource. The samples were supplied to an independent met testing laboratory in Vancouver who derived the 'VSI and mill/scrubber' component of the flow sheet and reported on frac sand recoveries, arriving at a single recovery figure across the deposit (as the de-cementing is not systematic). The sand samples derived from this testing were supplied to specialized laboratories for ISO standard testing for frac sand qualities, and all produced satisfactory results for all sand size fractions. Due to the irregular nature of the 'de-cementing' (natural in-situ 'sand' production), processing domaining has not been possible and it is recognized that commissioning will need to be cognisant of the source of the early feedstock and plant settings adjusted accordingly. Deleterious elements are generally absent from the deposit, although there are ferruginous zones, mainly along the footwall contact of the sedimentary unit. In past processing of these zones for glass making silica, the ferruginous particles (nodules up to 5mm) were eliminated in the magnetic scalping or the washing stage. Mining for frac sand will not occur in this area for many years. No allowances have been

Criteria	JORC Code explanation	Commentary
		made for deleterious elements, except for the inclusion of scalping magnets after the crush stage. The met testing of the ~330kg 'variability' samples could probably not be characterised as pilot scale testing but the samples were bulk samples covering the spectrum of differences in de-cementing. The 'variability' samples were representative of the extremes of the variation in the deposit (which is the amount of de-cementing or alteration, not of inherent composition), as well as surface geographic extremes of the deposit and combined with the 'ROM" bulk sample is regarded as representative of the deposit as a whole. The Ore Reserve has been based on the appropriate mineralogy, as well as the qualities of that mineralogy. <u>UPDATE:</u> In late 2014, ten +800kg bulk samples were taken from throughout the pit area and subjected to jaw crushing, VSI crushing and then testing using a 'mixer' at the company's manufacturing and testing facility in the USA. The samples were subject to a range of tests, including same mixer settings across nine of the samples and then varying the mixer parameters on repeated aliquots of four of the samples. Recoveries to 30# to 140# sand varied between 75% and 80% and testing via an ISO certified laboratory verified that the sands were of frac quality. The Competent Person had decided that for the estimation of Resources and Reserves, a recovery factor of 70% should be used, to allow for possible scaling-up effects to the 2.5 tonne capacity mixers that will be used in the plant. The frac range 30# to 140# will replace the former range of 20# to 140# due to the presence of clusters in the 20# to 30# product from the mixers. It is possible that tuning of the VSI crushers and the mixers when in production will de-cluster the 20# to 30# range and allow it to be sold. An independent review in early 2015 noted mixer recoveries in the range of 70% to 75% were possible, and settled on a figure of 75%.

Criteria	JORC Code explanation	Commentary
Environmen-tal	• *The status of studies of potential environmental impacts of the mining and processing operation. Details of waste rock characterisation and the consideration of potential sites, status of design options considered and, where applicable, the status of approvals for process residue storage and waste dumps should be reported.*	An independent 'Phase 1' environmental report (carried out to ISO and British Columbia Ministry standards) was carried out in 2011 and was incorporated into the Feasibility Study. It covered both the existing open cut and the processing plant site, which hosted the de-commissioned glass sand processing plant. Several relatively minor issues at the plant site were identified, most of which were rectified before a follow-up visit in March 2013. Any remaining issues will be rectified as the site is redeveloped for frac sand. As the open cut is entirely within silica sandstone/quartzite, no 'acid' type drainage issues are present either at the open cut or at the processing plant. Both sites have porous silica sand substrates and most run-off drains naturally into the ground. All material taken to the processing plant is ultimately saleable and no waste stockpile is planned. Fines generated in the frac sand process are saleable for cement manufacture, or can be consumed in the existing silica flour plant on site. A stockpile of fines may grow if sales lag production but no permit is required for this. A stockpile of fines from the old glass making process already exists on site and is being slowly consumed in the silica flour plant. Approval from the Agricultural Land Commission has been granted to store fines etc on the portion of the plant site not already classified for industrial use. All permits required for frac sand production by the planned process circuit are in place, except for an amendment to that relating to dust emission. The amendment cannot be sought until the final equipment specifications and locations are known; discussions with regulators indicate that it will be a minor amendment, and is not required until the new plant is commissioned.
Infrastructure	• *The existence of appropriate infrastructure: availability of land for plant development, power, water, transportation (particularly for bulk commodities), labour, accommodation; or the ease with which the infrastructure can be provided, or accessed.*	The plant site was in operation for over 25 years to 2009 for glass sand production and remains in operation producing silica flour. It is fully serviced by grid electricity and a 300m access road to the Trans-Canada Highway. It has its own rail spur off the main line Canadian Pacific Railway which also runs by the plant. Water can be drawn

Criteria	JORC Code explanation	Commentary
		under an existing Permit from the Blaeberry River which runs by the plant, and two new water bores have been sunk and pump tested demonstrating an adequate availability of process water for 24/7 operation. The current plant site, owned under freehold, is easily large enough to accommodate the new frac sand plant, ROM stockpiles, the existing fines pile, a proposed extended rail spur and any new temporary stockpiles. The plant is about 16km north-west via the Trans-Canada Highway of the regional centre of Golden, a town of about 4,000 people and a focus for skiing, lumber and rail industries. All except technical specialists and senior management are expected to be sourced from Golden.
Costs	• *The derivation of, or assumptions made, regarding projected capital costs in the study.* • *The methodology used to estimate operating costs.* • *Allowances made for the content of deleterious elements.* • *The source of exchange rates used in the study.* • *Derivation of transportation charges.* • *The basis for forecasting or source of treatment and refining charges, penalties for failure to meet specification, etc.* • *The allowances made for royalties payable, both Government and private.*	Capital costs have been established by a combination of a) detailed quotes from suppliers based on engineering drawings and specifications for specific equipment items, b) engineering cost specialists for items such as concrete and steel and c) contractor quotes for labour and project management (checked by engineering cost specialists). Operating costs were estimated via a combination of quotes from contractors and suppliers (mining, electricity, gas, labour) and historical and current operating costs from the plant and mine already in place. Allowance for deleterious elements is not appropriate as the ore is processed to final product on site and deleterious 'elements' are not present. The study was costed in Canadian dollars. Costs quoted in US dollars were converted at spot at the date of their receipt. Transport charges were derived from contractor quotes and historic and current contract costs. TC/RCs are not applicable as the ore is processed on site to final product. Off spec material would be returned to the plant but for frac

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		sand it is likely to have been used by the purchaser in an application requiring the lower spec. No royalties are payable. UPDATE: Capital costs are in the process of being refined by the likely contractor to construct the plant, for a fixed price quote for construction; operating costs are continuously reviewed. As previously announced, a gross sales royalty of 2% of sales will be payable to a financing party if the agreed financing package is fulfilled.
Revenue factors	• *The derivation of, or assumptions made regarding revenue factors including head grade, metal or commodity price(s) exchange rates, transportation and treatment charges, penalties, net smelter returns, etc.* • *The derivation of assumptions made of metal or commodity price(s), for the principal metals, minerals and co-products.*	Frac sand is not subject to long term supply contracts and prices are struck as prevailing rates for the quality and size fraction of the sand being purchased, the market availability for a particular spec of sand derived from a particular source and its intended use (including location). The finished product is produced on site at Moberly so TC/RCs or ‘smelter penalties’, and ‘net smelter returns’ are not applicable. The finished product is mainly defined in terms of US mesh size (eg 20-40 mesh, 30-50 mesh, 40-70 mesh, 70-140 mesh) with acceptable frac qualities, although the benchmark of these qualities can vary depending on the location (oil/gas field) that the customer is operating in, and the availability of alternatives. Prices used for frac sand in the FS model were based on extensive personal consultations with potential customers, who had been supplied with examples of the sand product from the met testing. No revenue has been assumed in the Feasibility Study for the fines by-product, which would either be sold to the cement industry or consumed in the existing silica flour plant and then sold as a high value product. No revenue has been assumed for the silica flour product, although the flour plant is currently operational and sales are being made.

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Market assessment	• *The demand, supply and stock situation for the particular commodity, consumption trends and factors likely to affect supply and demand into the future.* • *A customer and competitor analysis along with the identification of likely market windows for the product.* • *Price and volume forecasts and the basis for these forecasts.* • *For industrial minerals the customer specification, testing and acceptance requirements prior to a supply contract.*	Currently the demand for frac sand in North America is rising every year as horizontal drilling and completion techniques are yielding higher production rates compared to vertical wells and each well is using more frac stages, on average. Frac sand consumption in 2013 was estimated to be about 37 million tonnes, up from 15 million tonnes in 2010 and 5 million tonnes in 2007. In Canada, emphasis is now on the export of liquefied gas from planned new export facilities on the coast of British Columbia, underpinning the increase in exploration for gas (drilling of wells requiring frac sand) in western Canada. Supply of frac sand from the traditional USA suppliers to Canada is often squeezed by USA demand; shortages are not unknown. Heemskirk is targeting the Western Canadian Sedimentary Basin oil and gas fields (Yukon, northern British Columbia and Alberta). Although there are local competitors in western Canada, Heemskirk will have the better quality frac sand according customer technical reviews. The sands from the United States are of superior quality but location and logistical advantages of Heemskirk to service the western Canadian drilling market are significant. Heemskirk has direct access to the Canadian Pacific Railway via its own siding and frontage to the Trans-Canada Highway. These are logistical advantages unmatched by competitors in Canada. The price for sand is currently reported at $55-85 per ton in the US. HCA plans on being competitive with pricing using the transportation differential to provide value to its customers. There is no specific specification for frac sand, but customer requirements on a general or per-shipment basis are dictated by a matrix of sand qualities, including grain size (eg 20-40 mesh, 30-50 mesh, 40-70 mesh, 70-140 mesh), roundness, sphericity, acid solubility, turbidity, crush resistance and conductivity. These qualities are defined in the ISO 13503 and API RP19C standards but the

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		customer determines the actual values required for any particular shipment. Potential customers have been supplied with sands from Heemskirk's test work and have been satisfied with the quality. On-going customers will generally test sand product periodically and form a view about the general acceptability of the producer's sand for specific, or general usages by them. UPDATE: Demand for frac sand has decreased slightly in the past year as gas prices have fallen and well completion numbers have fallen. However sand demand has held up relatively well, due to the trend to longer wells, and an increasing number of 'frac stages' per well. Canadian suppliers are well placed due to a drop in the value of the Canadian dollar against the US dollar – Canadian product is now much cheaper in the US and US product much more costly in Canada, leading to an attractive situation for Canadian producers. For these reasons, pricing for quality Canadian sands remains virtually unchanged. UPDATE: Revenue from silica flour, with production at the same rate from the 'fine grind' plant prior to its suspension, is now included in the project economic model, with marginal effect overall.
Economic	• *The inputs to the economic analysis to produce the net present value (NPV) in the study, the source and confidence of these economic inputs including estimated inflation, discount rate, etc.* • *NPV ranges and sensitivity to variations in the significant assumptions and inputs.*	General Project Parameters: capital cost estimate is C$26m$_{2013;}$ initial design production rate is 300,000 tonnes of saleable frac sand per annum at full production (year 2 onwards); project is readily expandable to double the initial production capacity once all initial operational and product sales milestones have been met; estimated Project $NPV_{7.5}$ C$66m, NPV_{10} C$48m; total net assets of project valued at $8.0m as at 31 March 2014; estimated Internal Rate of Return of 30%; the Payback Period from start of production is approximately 3 years; construction time estimate 9 - 12 months from a development decision. Product pricing used is commercial in confidence.

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		UPDATE: The capital cost estimate has increased due to rising electrical and other component prices, compounded by some equipment being sourced from the United States of America and to be purchased in US dollars. This cost estimate is also subject to fluctuations in the US/Canadian currency exchange rates. Estimated Project $NPV_{7.5}$ is now C$78m due to increased recoveries (announced to ASX on 23 February 2015) and refined capital numbers (announced to ASX on 15 December 2015). NPV_{10} is now C$58m. Total net assets of the project increased to C$10.6m due to completed foundations footings and detailed engineering. Estimated IRR has increased to 33**%** and Project Payback for Stage 1 from start of production is 2.9 years (also announced to ASX on 15 December 2015). Construction time estimate from a development decision is 12-14 months. This time has been increased due to refined engineering.
Social	• *The status of agreements with key stakeholders and matters leading to social licence to operate.*	The Moberly mine and plant has been operating from the early 1980s, although the scale of both has been substantially reduced since 2009. Local people and townspeople are aware of the proposed new development and are generally welcoming of it, as it will bring welcome economic activity and employment opportunities. No formal agreements exist with 'stakeholders' (including First Nations).
Other	• *To the extent relevant, the impact of the following on the project and/or on the estimation and classification of the Ore Reserves:* • *Any identified material naturally occurring risks.* • *The status of material legal agreements and marketing arrangements.* • *The status of governmental agreements and approvals critical to the viability of the project, such as mineral tenement status, and government and statutory approvals. There must be reasonable grounds to expect that all necessary Government approvals will be received within the timeframes anticipated in the Pre-Feasibility or*	There are no material naturally occurring risks; the area is not seismically active and the slopes of Mt Moberly around the pit are heavily vegetated and have proved stable during the over 25 years of prior operation. The Blaeberry River could flood the plant site under very exceptional circumstances however this has not occurred in the memory of the operators and flood bunding is planned for the new plant. There are no sand supply contracts in place, as frac sand is supplied on short term, as needed basis. However customers have been supplied with sand product and are satisfied with the quality, and the

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	Feasibility study. Highlight and discuss the materiality of any unresolved matter that is dependent on a third party on which extraction of the reserve is contingent.	Moberly project occupies a niche to supply the northern British Columbia/Alberta market, with excellent infrastructure, both highway and rail. Letters of Intent to buy have been received from likely customers. No change to material legal or marketing arrangements, to the extent that they exist, is likely to impact the Ore Reserves. All Permits required to operate the new frac sand plant and the expanded mining operation at the open pit / quarry are in place, except for an amendment to the dust emission permit which is necessary as several aspects of the operation will change. Discussions with the regulators indicates that the amendment will be processed as a relatively easy 'minor amendment', which will be submitted once final specifications for the dust collection equipment are known. The new Permit is not required until the new plant is operational. The mine haul road must be upgraded before mining/hauling is re-commenced (engineering and approvals are complete) and negotiations with a contractor are on-going. There is nothing to indicate that a satisfactory price won't be arrived at. The mining contract for the new operation has yet to be struck but is expected to be with the former, long term operator, who may also upgrade the haul road and no difficulty in renewing the mining contract at a satisfactory price is expected.
Classification	• *The basis for the classification of the Ore Reserves into varying confidence categories.* • *Whether the result appropriately reflects the Competent Person's view of the deposit.* • *The proportion of Probable Ore Reserves that have been derived from Measured Mineral Resources (if any).*	Proved Ore Reserves are derived from that portion of Measured Resources that lie within the 35 year, open cut Mine Plan after consideration of Modifying Factors. Probable Ore Reserves are derived from that part of the Indicated Resources that lie within the 35 year, open cut Mine Plan after consideration of Modifying Factors. The classifications accurately reflect the Competent Person's view of the deposit. No Probable Ore Reserve has been derived from Measured Resources.

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Audits or reviews	• *The results of any audits or reviews of Ore Reserve estimates.*	The 2012 Ore Reserve estimate, which remains unchanged to date, was reviewed by an independent geologist for a third party company. Although the report of the geologist has not been sighted, another independent reviewing report states that the independent geologist 'concurred with' the Heemskirk Competent Person's estimates. Further, discussions with the independent geologist at the mine site by the Competent Person revealed no material issues of contention. UPDATE: A second independent review of the Ore Reserve estimates was undertaken by an engineering firm and a frac sand expert in early 2015 during due diligence by a proposed financier. No significant issues in the technique or estimations were brought forward. The Ore Reserve estimate has been amended in 2015, as noted above (this announcement). This has not been reviewed by an independent person.
Discussion of relative accuracy/ confidence	• *Where appropriate a statement of the relative accuracy and confidence level in the Ore Reserve estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the reserve within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors which could affect the relative accuracy and confidence of the estimate.* • *The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used.* • *Accuracy and confidence discussions should extend to specific discussions of any applied Modifying Factors that may have a material impact on Ore Reserve viability, or for which there are remaining areas of uncertainty at the current study stage.* • *It is recognised that this may not be possible or appropriate in all*	The Ore Reserve is based on and is entirely contained within a large, massive silica resource with is relatively homogenous in respect of silica / sand grain content, but varies in respect of de-cementing of the silica grains ('alteration'). As such, confidence is high that silica for both glass making and frac sand Ore Reserves have been adequately, appropriately and accurately assessed via application of the 35 year Mine Plan and other Modifying Factors to the Mineral Resources estimated by the relatively simple cross sectional method. No geostatistical manipulation has been used. The estimation is considered to be a global one. Modifying Factors which could affect the relative accuracy and confidence of the method would be hitherto un recognized zones of, say, variable mechanical strength of the silica grains, as this may affect the quality of the frac sand product. There is no indication that such zones exist at the moment and if such zones did exist, on the basis of current sampling, it would be unlikely to account for such a large proportion of the deposit so as to make the deposit unviable.

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	circumstances. These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	Furthermore the weak grains would probably report to 70-140 mesh, which still constitutes saleable frac sand. Historically, no material unsuitable for silica for glass sand has been mined at the site. Silica for glass sand was tested and found to be of frac sand quality.