Atrum Coal
COAL FOR STEEL

ASX Release

4 February 2019

Initial Coal Quality Results Confirm Premium Hard Coking Coal At Elan South

HIGHLIGHTS

- **Excellent results from coal quality and carbonisation test work on the first two large diameter holes cored at Elan South in 2018.**
- **Supports previous coal quality testing and prediction work, indicating high-quality hard coking coal parameters at Elan South.**
- **High yields of clean coal samples with low ash (5-9%) and high CSN/FSI (4-8.5).**
- **High CSR values (62-70) from two small scale carbonisation tests, with low total sulphur (0.60-0.68%) in the coking test samples.**
- **Confirms Elan South possesses Tier 1 hard coking coal properties similar to those from Teck's nearby Elk Valley complex and Australian HCC products.**
- **Final results from the remaining samples expected in March.**
- **Expanded drilling and coal quality testing planned for the 2019 field program.**

Atrum Coal Ltd ("**Atrum**" or the "**Company**") (**ASX: ATU**) is pleased to provide a coal quality update for the flagship Elan South area of its 100%-owned Elan Hard Coking Coal Project in southwest Alberta, Canada ("**Elan Project**" or "**Elan**").

Managing Director, Max Wang, commented: *"We are highly encouraged by the initial coal quality results from the first two large diameter cored holes. With small scale carbonisation testing returning CSR numbers as high as 70, along with favourable clean coal parameters from the first batch of samples, we are further convinced that Elan South is capable of producing a high-quality, medium-volatile hard coking coal for the global steel industry."*

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Confidence in the coking quality of Elan South coal is reinforced by Atrum's VP of Marketing, Ty Zehir, who has spent more than 30 years in coal quality testing oversight and global marketing of Western Canadian coking coals. It is echoed by Atrum Non-Executive Director, George Edwards, who has more than 40 years of experience in researching and marketing Australian coking coals to global steel mills, and who commented:

"*Based on the initial results of the current large diameter testing program, the coking properties of Elan South appear readily comparable with coal specifications of other mines in the region, such as Teck Resources' Elk Valley complex, as well as globally traded hard coking coals from Australia.*"

Detailed Clean Coal Analysis and Coking Property Testing

Results from the initial clean coal composite samples subjected to coking coal characterisation tests by CoalTech evidenced:

- Medium-volatile hard coking coal as indicated by a mean maximum vitrinite reflectance (R_oMax) ranging from 1.14% to 1.21%.
- Low product ash content (5 - 9% at CF1.45) that fits well with all coke makers.
- Low to moderate total sulphur (0.60 - 0.70%) and phosphorus levels (generally below 0.080% on composited samples), with no deleterious elements detected.
- Volatile matter (24-26% ad) compares well with North American and Australian premium medium-volatile products.
- Variable fluidity with samples returning values from 28 to 1,700 ddpm, to achieve a probable average fluidity of approximately 300 ddpm.
- Typical Western Canadian reactive maceral content ranging from 51% to 75% (including 50% of semi-fusinite as a reactive maceral).
- Favourable ash chemistry indicated by basicity index (base acid ratio) values ranging from 0.10 to 0.19.

Detailed results of all coking coal characterisation tests conducted by CoalTech are contained in the Appendix to this release.

Carbonisation Testing

In order to assess the coke making potential, and obtain more representative coking properties of the proposed coal deposit and future clean coal products, composites were further grouped for coal carbonisation test work in order to delineate any variations within and among the seams, and provide factual data for final clean coal product design.

Two blended samples, Sample 1 and Sample 2, were manually combined and shipped to INCAR (Spain) and DMT (Germany) laboratories. Results from this testing are presented in Table 1 below.

Table 1. Initial clean coal and coke quality results from the first batch of composite samples (from cored holes 1 & 2) (a.d.b)

RoMax	CSR (1)	JIS Drum Index (2)	HGI	Yield	ASH (3)	VM	TS (4)	P (5)	Max DDPM	FSI/CSN
1.16	62-70	93-94	75-85	>65%	6-7%	23.3-25.3%	0.60-0.68%	0.060-0.085%	64-332	4-6

Notes: (1) CSR values for Elan South obtained from actual coal carbonisation tests samples.
(2) JIS DI 30/15 Index.
(3) Ash content of individual composites varied from 5.0% to 9.4% at CF1.45.
(4) Test on 2014 core samples further north of the 2018 exploration areas showed 0.47-0.71% sulphur.
(5) 2014 core samples further north of the 2018 exploration areas showed 0.010–0.020% phosphorous.

The 62-63 lower CSR range was obtained using a small retort on a sample that was produced with at least 50% of the lower acidity samples from Comps 4 - 6 and is therefore not believed to be a typical CSR value for a likely Elan South hard coking coal product.

Based on the initial two small retort carbonisation tests, as a single coking coal or in properly formulated coking blends, the Elan South coal would be expected to result in:

- Excellent contribution to coke cold and hot strength.
- High coke hot strength (CSR up to 70), high coke cold strength (JIS (DI 30/15 = 94–95% and DI 150/15 = 83–85%).
- High coke yield (78%).
- Very favourable expansion and contraction (Carbonisation contraction: -18%).
- Very low Carbonisation Internal Gas and Wall Pressures (< 1.0 psi).
- Low Total Sulphur content (mostly Organic).
- Low ash content.
- Favourable ash chemistry (very low Total Alkali).

Coke strength, coke chemical parameters and coke carbon forms will be tested again in the coming weeks in a 500 kg pilot-scale coke oven at operating conditions that closely reflect actual coke plant operations.

A Tier One Hard Coking Coal

Western Canadian coking coals are some of the highest quality coking coals on the global market, including low sulphur and phosphorous. Mist Mountain Formation coking coals typically have high coke strength after reaction (CSR) values. Aside from the favourable coal rank of many Canadian coking coals, one of the key reasons for the high CSR is the favourable base-acid ratio (basicity index) which is typically low in Mist Mountain Formation coals.

Full test results on all 2018 samples and groupings are yet to be completed. More sampling and testing are also needed in order to design a preliminary product specification. However, the initial results detailed in this release confirm the potential of Elan South to produce a high quality, medium-volatile hard coking coal product.

Table 2 shows the initial sample results of coking properties tested on cores extracted from the first two Elan South cored holes, as compared with typical hard coking coal properties from the region, namely Riversdale's Grassy Mountain Project and Teck Resource's "Teck Premium" product, and from globally traded Australian hard coking coals.

Table 2. Indicative coal specifications relative to Canadian and Australian comparables

Mine / Project	Operator/ Index	VM % ad	Ash % ad	TS %	CSN	RoMax %	Fluidity ddpm	Phos %	CSR	Reactives
Elan South	**Atrum Coal**	**23 - 25**	**7 - 8**	**0.60**	**5 - 8**	**1.16**	**300**	**0.070**	**62 - 70**	**60 – 75**
Teck Premium	Teck	25.5	9	0.50	7.5	1.14	350	0.090	72	71
Grassy Mountain	Riversdale	23.5	9	0.50	-	1.19	150	0.040	65	-
Peak Downs HCC benchmark	Platts	20.7	10.5	0.60	8.5	1.42	400	0.030	74	71
QLD Premium Low Vol	TSI / Platts	21.0	10	0.45	8	1.35	600	0.050	71	68
HCC 64 Mid Vol Benchmark	Platts	25.5	8	0.60	-	-	100	0.050	64	55
Moranbah North	AAMC	24.0	8.5	0.60	8	1.20	1200	0.040	65	60
Goonyella C	BMA	22.8	9	0.55	8	1.20	500	0.040	70	58
Hail Creek	Glencore	20.4	10	0.31	8	1.35	160	0.070	68	50
Illawarra	South 32	23.2	9.5	0.45	7.5	1.25	1200	0.060	73	53

Notes: (1) Initial CSR numbers on Elan South are obtained from small scale coal carbonisation samples.
(2) Grassy Mountain specification sourced from Nov 2015 company presentation.
(3) Platts index specifications source from:
https://www.spglobal.com/platts/plattscontent/_assets/_files/en/our-methodology/methodology-specifications/metcoalmethod.pdf
(4) Other comparable HCC specifications sourced from:
https://www.platts.com/im.platts.content/productsservices/products/coaltraderintl.pdf.
(5) Test on 2014 core samples further north of the 2018 exploration areas showed 0.01–0.02% phosphorous.

Figure 1 illustrates where Elan South hard coking coal and other Canadian hard coking coals sit relative to globally traded coking coals with respect to CSR and drum index.

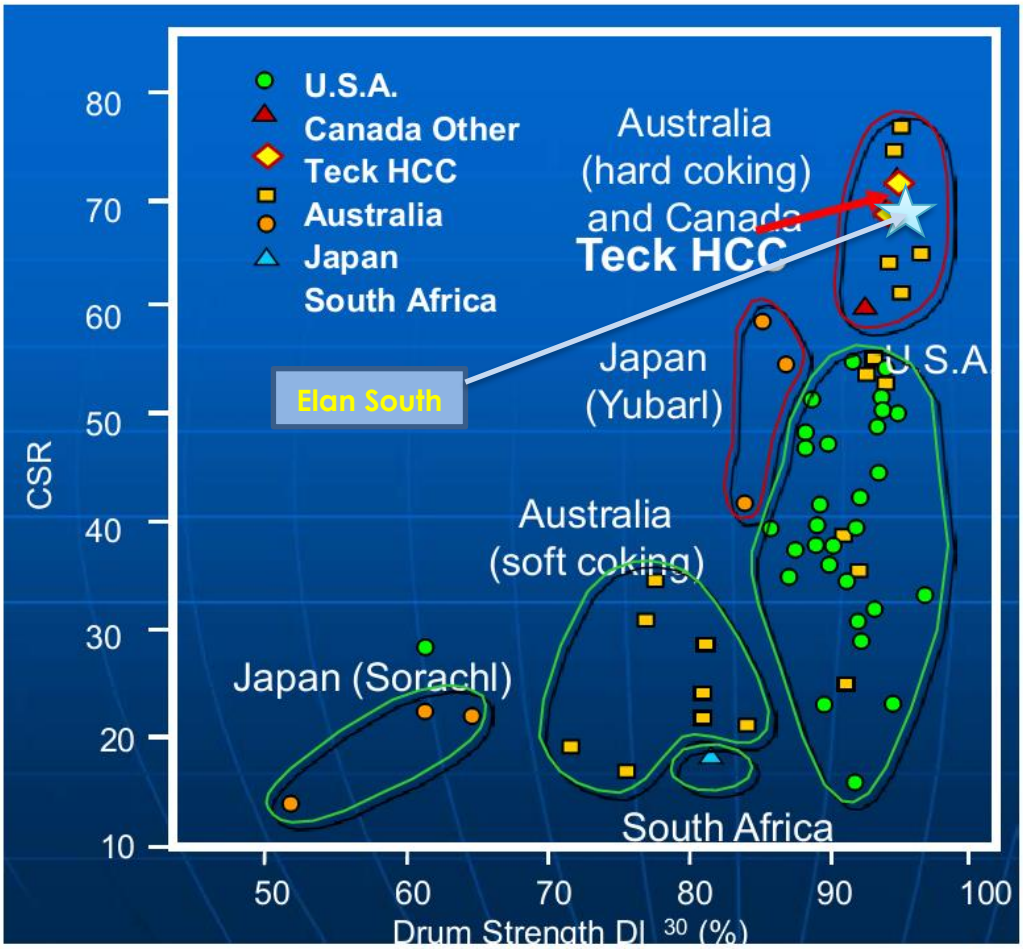

Figure 1. Elan South HCC quality position among other seaborne coking coals (based on initial results)

(Figure adapted from Teck Resources, Investors Presentation, January 2019)

Appendix

About the Elan Hard Coking Coal Project and Elan South Area

The Elan Hard Coking Coal Project is located in the Crowsnest Pass area of Alberta, Canada. It consists of several different project areas which are known to contain shallow emplacements of high quality hard coking coal of the Mist Mountain Formation (Kootenay Group). The Elan Project has a significant areal footprint comprising 27 coal exploration tenements spread over a 50 x 20 km zone and totalling approximately 22,951 ha (229.5 square kilometres).

Approximately 40km to the west of the Elan Project, Teck Resources Ltd operates five mines, also in the same Mist Mountain Formation, producing approximately 25 Mt per annum of predominantly hard coking coal for the global steel industry. The coal seams at Elan correspond directly to those horizons of the same Mist Mountain Formation found in the Teck Resources' hard coking coal mines, and have similar rank ranges.

The Elan South Area forms the southern part of the broader Elan Project tenement holding. Elan South is approximately 13 km north of Coleman and Blairmore where an existing rail line operated by Canadian Pacific Railway is located, providing direct rail access to export terminals in Vancouver and Prince Rupert.

Elan South shares its southern boundary with Riversdale Resources' flagship Grassy Mountain Project, which is in the final permitting stage for a 4.5 Mtpa open cut operation producing hard coking coal. The current Grassy Mountain resource estimate is 195 Mt, with 85 Mt in Measured and 110 Mt in Indicated classification (see Riversdale Resources' Annual Report 2018).

Private Australian company, Hancock Prospecting, acquired 19.99% of Riversdale Resources in August 2018 for A$68.9 million cash. In September 2018 it then maintained that percentage equity holding by investing another A$30.4 million cash via anti-dilution rights. This total investment of A$99.3 million (for a 19.99% equity interest) effectively values Riversdale Resources at approximately A$500 million.

Large Diameter Coring and Sampling Program at Elan South

After the completion of the open hole drilling program at Elan South last year, Atrum mobilised a coring rig to obtain fresh cores from previously selected drill hole locations, with the rig operating from late October to early November 2018. The coring operation targeted shallow, thick coal intersections that were drilled during Phase 1 and Phase 2 of the 2018 program (refer Figure 2 for drill hole locations).

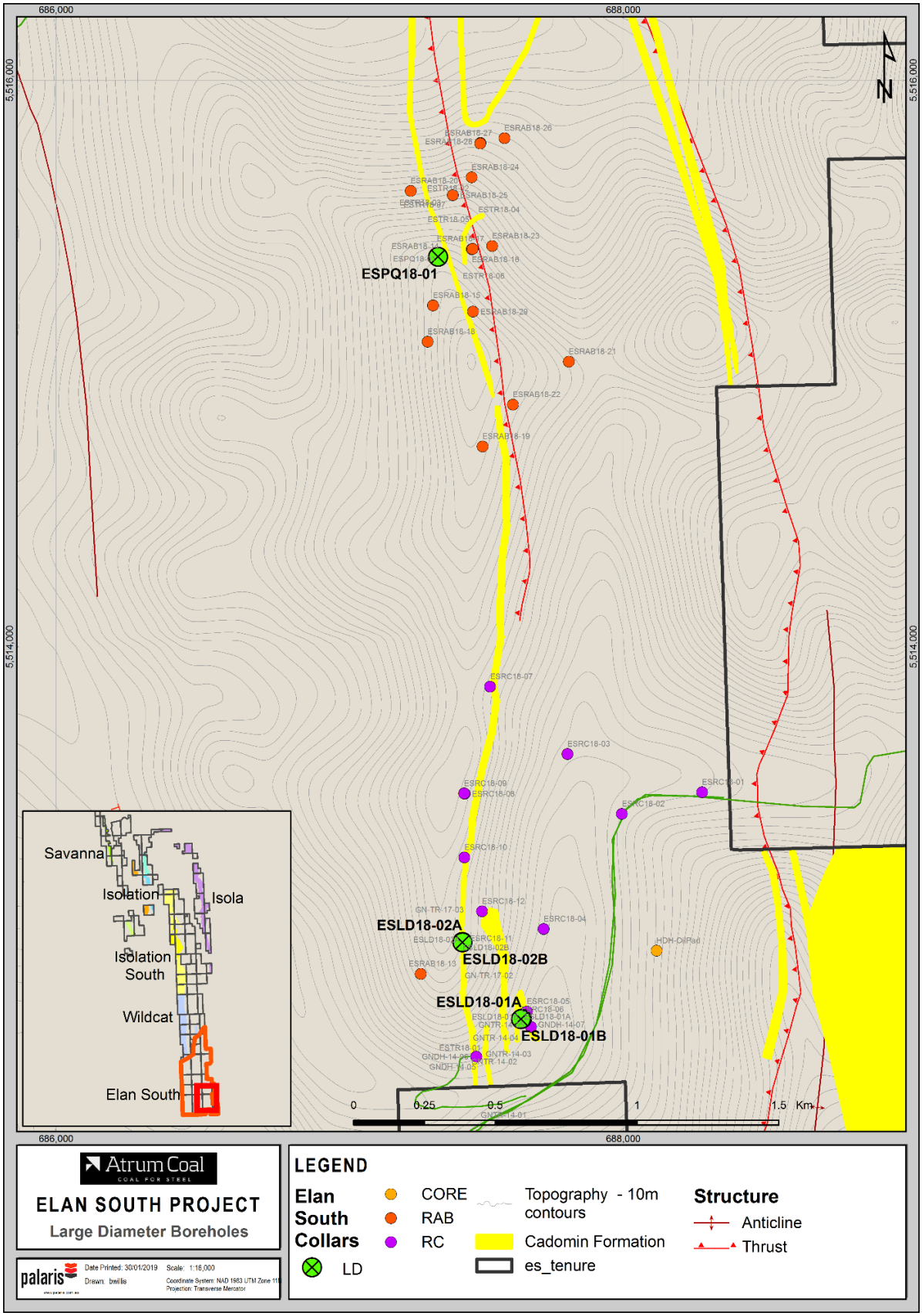

Figure 2. Elan South large diameter borehole locations

A total of five cored holes were completed: four large diameter (~150mm) and one PQ3 (~83mm) for a total 371.5m of drilling. Approximately 128m of core was recovered in order to provide sufficient coal sample mass for the planned coal quality testing program (refer Table 3).

Table 3: Summary of the core diameter, total drill depth, and coal recovered from Phase 3 drilling operations

Borehole ID	Core Diameter (mm)	Total Depth (m)	Coal Recovered (m)	Core Recovery
ESLD18-01A	150	35.24	14.87	98.9%
ESLD18-01B	150	35.95	14.44	97.7%
ESLD18-02A	150	66.64	30.01	98.7%
ESLD18-02B	150	72.86	42.90	98.5%
ESPQ18-01	83	160.80	25.82	51.7%
TOTAL		**371.49**	**128.04**	

Core recoveries, as recorded by Atrum's geologists who supervised the program, were very high (>95%) in the first four large diameter holes. Unfortunately, the core recovery in PQ hole ESPQ18-01 was much lower, and will limit the level of reliability of coal quality testing of core samples from this hole. The total length of coal cores recovered from each hole was also compared with the geophysical test logs to confirm the core recovery rates.

Sample Compositing and the Analytical Testing Program

Australian metallurgical consultants, A&B Mylec, assisted the Company and the GWIL Birtley Coal & Minerals Testing labs with guidance on laboratory sample preparation techniques, sub-sampling and the raw coal and washability testing programs. This ensured that the best sampling and testing practices were employed to obtain information on raw coal, sizing and washability, as well as clean coal characteristics.

All cores were logged, photographed, bagged and transported, according to well-established company protocols, to GWIL Birtley labs in Calgary, Alberta where the samples were refrigerated prior to analysis.

Individual large diameter core samples were taken on smaller increments, generally in close to one metre length per sample. Each individual sample was tested for apparent relative density (ARD) to enable Atrum to determine how the samples should be composited. Directions on compositing were then provided to GWIL Birtley who manually combined the individual samples into seam / ply composites.

GWIL Birtley conducted a comprehensive analytical testing program on raw coal, washability testing on various size fractions, and clean coal analysis on each composite sample. Clean coal composites were compiled at cumulative floats ('CF') at separation density 1.45 while further clean coal and coking test work was carried out at three specialised labs; CoalTech in the USA, INCAR in Spain and DMT in Germany.

Clean Coal and Coking Property Testing

Clean coal composite samples (2.0kg each) were dispatched from Birtley to CoalTech for all important coking coal characterisation tests and assessment of coke making potential including proximate analysis, sulphur, oxidation test, ash composition, free swelling index, Gieseler plasticity, Arnu dilatation, Hardgrove Grindability Index (HGI), ash fusion temperature (reducing), and petrographic analysis. Results of all coal characterisation tests by CoalTech are shown in Table 6.

Additionally, samples from clean coal composites were also sent to INCAR and DMT for small-scale carbonisation testing including coke physical strength tests such as; coke strength after reaction (CSR), coke cold strength (JIS Drum Indices) and internal gas and wall pressures generated during carbonisation. The composite combinations for testing were created to represent certain plies of a coal seam or inter-seam blends in order to delineate the coking properties of the Elan South samples.

A larger quantity (~500 kg) of clean coal sample will subsequently be shipped to DMT for movable-wall pilot oven carbonisation testing. This oven produces coke of suitable size and quantity for coke physical tests such as ASTM Stability and Hardness, ISO M40 and I40, and CRI / CSR. Wall and Internal gas pressures generated during the test along with coke mass Expansion / Contraction are also measured.

Figure 3. Large Diameter Core (LDC) samples from the first cored hole

Raw Coal Quality Results

LD core samples have been subjected to a detailed coal quality, washability and subsequently coal carbonisation testing programs. Initial raw coal quality results from GWIL Birtley's testing of composites is summarised in Table 4 below.

The Cretaceous Age coal seams of the Mist Mountain Formation (Kootenay Group) at Elan South are generally low to moderate in raw ash, with low total sulphur and phosphorus levels. FSI (CSN) swelling values are generally variable on raw coal testing, ranging from 1.5 to 7.5.

Table 4. Raw coal quality results of all large diameter core samples (air dried basis)

BORE ID	LAB #	From m	To m	IM %	ASH %	VM %	TS %	CV kcal/kg	FSI
ESLD18-01A	COMP-01	21.95	23.11	0.6	11.8	22.2	0.63	7,449	4
ESLD18-01A	COMP-02	23.11	29.19	0.5	7.5	23.3	0.60	7,901	3
ESLD18-01A	COMP-03	29.19	34.21	0.5	8.0	24.3	0.67	7,877	6
ESLD18-01B	COMP-04	19.46	22.52	0.7	22.3	20.6	0.60	6,468	4
ESLD18-01B	COMP-05	22.52	26.73	0.7	5.6	25.6	0.73	8,151	6
ESLD18-01B	COMP-06	26.83	32.84	0.8	10.8	24.0	0.71	7,573	5
ESLD18-02A	COMP-08	28.0	32.0	0.7	13.6	25.0	0.71	7,242	7.5
ESLD18-02A	COMP-09	32.0	38.0	0.7	9.5	25.9	0.69	7,698	7.5
ESLD18-02A	COMP-10	38.0	43.73	0.8	10.9	24.9	0.96	7,480	6.5
ESLD18-02A	COMP-11	43.88	48.9	0.7	11.8	24.6	0.87	7,457	6
ESLD18-02A	COMP-12	48.9	52.56	0.8	19.6	23.4	1.08	6,664	5.5
ESLD18-02B	COMP-15	28.35	32.35	1.0	11.7	24.8	0.76	7,437	6.5
ESLD18-02B	COMP-16	32.35	38.34	1.2	16.7	24.0	0.71	6,905	5.5
ESLD18-02B	COMP-17	38.46	42.25	1.3	16.8	24.0	0.54	6,863	5.5
ESLD18-02B	COMP-18	42.35	46.5	1.2	18.6	23.8	0.78	6,740	4.5
ESLD18-02B	COMP-19	46.5	53.7	1.4	12.2	23.8	0.73	7,315	5.5
ESLD18-02B	COMP-20	53.7	60.18	1.5	15.6	23.7	0.66	6,924	4.5
ESLD18-02B	COMP-21	60.18	61.8	0.9	25.1	20.1	0.65	6,096	1.5

Clean Coal Quality Testing Results

Initial clean coal composite testing results at CF1.45 from the GWIL Birtley laboratory are summarised in Table 5 below. These results indicate that the coal will wash to 5 – 10% product ash, with consistently low total sulphur (typically <0.70%) and moderate to high swell (FSI) of 4 to 8.5. Full results from the current program will be reported following expected completion in several weeks.

Table 5. Clean coal quality results from Birtley at CF1.45 (air dried basis)

BORE ID	LAB #	Cut Point	YIELD%	IM %	ASH %	VM %	FC %	TS %	FSI	Max Fluidity (ddpm)
ESLD18-01A	COMP-01	CF1.45	82.1	0.5	7.6	23.4	68.6	0.65	5	17
ESLD18-01A	COMP-02	CF1.45	93.4	0.6	5.9	23.8	69.8	0.63	5.5	21
ESLD18-01A	COMP-03	CF1.45	92.7	0.5	5.4	24.9	69.1	0.7	7	1,587
ESLD18-01B	COMP-04	CF1.45	54.2	0.6	9.5	24.5	65.5	0.7	5.5	555
ESLD18-01B	COMP-05	CF1.45	96.4	0.6	5.0	26.3	68.2	0.73	7.5	1,453
ESLD18-01B	COMP-06	CF1.45	85.4	0.6	6.2	25.1	68.1	0.71	7	1,770
ESLD18-02A	COMP-08	CF1.45	80.3	0.6	6.4	25.9	67.1	0.68	8.5	142
ESLD18-02A	COMP-09	CF1.45	88.0	0.7	5.1	26.6	67.6	0.65	8	416
ESLD18-02A	COMP-10	CF1.45	85.5	0.7	6.4	26.1	66.7	0.77	7.5	308
ESLD18-02A	COMP-11	CF1.45	85.1	0.7	6.9	25.7	66.7	0.73	7.5	171
ESLD18-02A	COMP-12	CF1.45	71.7	0.6	8.7	25.8	65.0	0.86	7	214
ESLD18-02B	COMP-15	CF1.45	82.9	1.0	7.6	25.9	65.5	0.63	7	149
ESLD18-02B	COMP-16	CF1.45	73.8	1.0	7.8	25.8	65.4	0.57	7.5	145
ESLD18-02B	COMP-17	CF1.45	72.7	1.2	6.9	26.1	65.9	0.5	7	155
ESLD18-02B	COMP-18	CF1.45	63.6	0.9	7.4	26.1	65.6	0.61	7.5	NA
ESLD18-02B	COMP-19	CF1.45	75.9	1.1	7.5	25.4	65.9	0.62	6	NA
ESLD18-02B	COMP-20	CF1.45	66.1	1.4	6.5	25.6	66.5	0.58	7.5	NA
ESLD18-02B	COMP-21	CF1.45	43.9	0.8	11.2	24.0	64.0	0.65	4	NA
ESLD18-02B	COMP-22	CF1.45	62.4	11.1	6.7	22.8	59.4	0.91	2.5	NA

Detailed Clean Coal Analysis and Coking Property Testing

Clean coal composite samples were dispatched from Birtley to CoalTech USA for all important metallurgical coal characterisation tests and assessment of coke making potential including;: proximate analysis, sulphur, oxidation test, ash composition, free swelling index, Gieseler plasticity, Arnu dilatation, Hardgrove Ggrindability Index, ash fusion temperature (reducing), and petrographic analysis. Results of all coal characterisation tests by CoalTech are shown in Table 6 below.

Table 6. Initial clean coal analysis results and coking properties at CF1.45 from CoalTech

CF1.45 Parameters	COMP-01	COMP-02	COMP-03	COMP-04	COMP-05	COMP-06
Ash % (db)	7.5	5.8	5.4	9.5	4.9	6.1
Volatile Matter % (ad)	24.1	24.2	25.3	25.3	26.9	26.0
Fixed Carbon % (db)	68.4	70.0	69.3	65.2	68.2	67.9
LT Oxidation Test %	99.2	98.9	99.1	98.4	97.5	98.1
Calorific Value kcal/kg (db)	7,967	8,136	8,208	7,721	8,277	8,111
Chlorine % (db)	0.01	0.01	0.01	0.02	0.02	0.02
Total Sulphur % (db)	0.68	0.65	0.74	0.70	0.75	0.73
Phosphorous %	0.056	0.063	0.139	0.009	0.126	0.087
Gieseler Fluidity (max ddpm)	31	28	1,560	581	1,700	1,550
FSI (CSN)	4.5	5	5.5	4.5	8	7
Hardgrove Grindability Index	80.9	76.7	74.1	82.8	82.8	81.3
Basicity Index (base acid ratio)	0.11	0.10	0.17	0.18	0.19	0.16
Maceral Analysis						
Vitrinite	29.8	28.4	40.9	44.8	54.2	52.1
Reactive Semifusinite	23.4	21.4	16.3	16.4	15.1	14.6
Total Reactives	54.2	50.6	57.7	62	69.7	67.2
Inert Semifusinite	23.3	21.4	16.3	16.6	15.2	14.6
Micrinite	17.5	23.7	21.8	14.5	11.8	13.5
Fusinite	0.7	1.0	1.1	1.5	0.5	1.2
Mineral Matter	4.3	3.3	3.1	5.4	2.8	3.5
Total Inerts	45.8	49.4	42.3	38	30.3	32.8
Mean Max. Vitrinite Reflectance %	1.21	1.16	1.17	1.17	1.14	1.16

Further Coal Quality Testing

The core samples were taken from three drill sites at Elan South and provide critical information relating to coal quality and potential product specification. However, the results are preliminary and are based on the current drill spacing of LD holes. The current spacing of cored holes does not yet account for all spatial variability in coal quality that may exist in the deposit. The results should be taken as a potential representation of likely coal quality attributes and are a step forward in Atrum's exploration effort, with further work required.

More drilling, sampling and testing are needed in order to fully confirm the coal quality and coking properties from a wider range of locations and taking into consideration of processing design, before a final product specification can be established for Elan

South coal. Atrum is planning an expanded drilling and coal quality testing program for 2019 as part of its strategy to rapidly advance Elan South as the Company's flagship development.

Meanwhile, the next phase of the coal quality and coke characterization test work on the 2018 cored samples, including testing on coke produced from a pilot movable wall oven, is expected to be completed and the detailed results reported over the next couple of months.

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Competent Persons Statement

The information in this document that relates to Exploration Results of the Elan South project is based on, and fairly represents, information and supporting documentation prepared by Mr Brad Willis, who is a Member of the Australasian Institute of Mining and Metallurgy (#205328) and is a full-time employee of Palaris Australia Pty Ltd.

Mr Willis has read and understands the requirements of the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Exploration Targets, Mineral Resources and Ore Reserves (JORC Code, 2012 Edition). Mr. Willis is a Competent Person as defined by the JORC Code, 2012 Edition, having twenty years' experience that is relevant to the style of mineralisation and type of deposit described in this document.

Neither Mr. Willis nor Palaris Australia Pty Ltd has any material interest or entitlement, direct or indirect, in the securities of Atrum or any companies associated with Atrum. Fees for the preparation of this report are on a time and materials basis. Mr. Willis has visited the Elan project site with Atrum coal personnel during September, 2018 during the current exploration program.

The JORC Code (2012) Table 1 – Reporting of Exploration Results

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	▪ *Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings.* ▪ *The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.*	▪ The Elan South Project consists of 4 coal exploration permits encompassing an area of approximately 6,574 ha. The A13 coal agreements that contain the resources for this report are held by Elan Coal. ▪ The coal leases were acquired on January 20, 2012 and are held by Elan Coal Ltd. Coal Lease Applications provide the right to exclusively explore the land within the boundaries of the Lease and are granted for a term of 15 years (with an option to extend at expiry). ▪ A coal lease does not grant surface rights; a surface lease or grant is required. ▪ The Property falls within the Rocky Mountain Forest Reserve, which is managed by the Alberta Government. As such, no road use agreements with private companies are required for access to the Property. ▪ The project is located in an area that has been classified as Category 2 in accordance with the Coal Development Policy for Alberta. Surface mining is not traditionally considered in Category 2 areas either because it is an area where infrastructure is inadequate to support mining activities or it is an area associated with high environmental sensitivity
Exploration by other parties in Elan South Area	▪ *Acknowledgment and appraisal of exploration by other parties.*	▪ During the late 1940s and early 1950s, Western Canadian Collieries undertook dozer assisted surface geological mapping of the Elan South area which resulted in 16 recorded outcrop sections. ▪ NorthStar Energy Corporation drilled four HQ (63.5mm core) Coal Bed Methane gas wells within the Project boundaries in 2001. These holes targeted the deeper coal seam occurrences and are useful in establishing the regional structural interpretation at depth. All holes were geophysically logged and some limited coal quality data is also available. ▪ In 2014, Elan Coal in partnership with Kuro Coal completed 4 PQ/HQ boreholes, 3 RC open holes and 7 costean trenches. The exploration was principally conducted in two Elan South areas proximal to prospective areas identified by the earlier Western Canadian Colliers Mapping. The 2014 PQ/HQ Drilling program completed a total of 454 meters in four holes. Thirty three coal samples were collected and later composited into logical seam units in accordance with the geophysical logs for each hole. Coal recovery was poor ranging from a low of 7% to

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		a high of 90% for the identified seam groups.
Geology	▪ *Deposit type, geological setting and style of mineralisation.*	▪ The Mist Mountain Formation at Elan South contains a multi-seam resource consisting of a cyclic succession of carbonaceous sandstone, mudstone, siltstone, coal, and some conglomerate. This formation is directly overlain by the massive Cadomin Conglomerate which is a readily recognizable marker horizon throughout the area. The Cadomin Formation, a resistant, chert-pebble conglomerate up to about 100 m thick (although generally much thinner). The Cadomin Formation is overlain by continental deposits consisting of interbedded dark mudstone, siltstone and sandstone of the Gladstone Formation (Blairmore Group). ▪ There are at least three major coal horizons in the Mist Mountain formation at Elan South. The uppermost No. 1 Seam occurs immediately below the Cadomin and ranges in thickness from 1 m to 4 m. The No. 1 Seam may be eroded by the overlying conglomerate in some places. The thick No. 2 Seam is typically 35 m below the No. 1 and the ranges in thickness from 5 m to 15m. The lower No. 4 Seam is typically 30 m below the No. 2 and consists of multiple coal plies up to 1m thick with in rock parting material. These seams were mined on the Grassy Mountain open pit mine which 5km to the south of the Project. ▪ Tectonic deformation of coal measures is the major factor that controls the present areal extent, thickness variability, lateral continuity, and geometry of coal beds at Elan South. The strata is characterized by broad upright to overturned concentric folds, cut and repeated by major to minor thrust and tear faults, and late extensional faults. Extensive shearing and structural thickening and thinning of coal beds in the cores of flexures are common in highly deformed regions.
Drill hole Information	▪ *A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes:* o *easting and northing of the drill hole collar* o *elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar* o *dip and azimuth of the hole* o *down hole length and interception depth* o *hole length.*	▪ This information is provided for the five large diameter boreholes completed in 2018 at Elan South, the locations are shown in Figure 1, and details as follows:

BOREID	X	Y	Z	FINALD	AZI	DIP	DIAM
ESLD18-01A	687,642	5,512,687	1803	35.25	0	-90	150
ESLD18-01B	687,640	5,512,686	1803	35.95	0	-90	150
ESLD18-02A	687,433	5,512,958	1948	66.64	0	-90	150
ESLD18-02B	687,433	5,512,957	1948	72.86	0	-90	150
ESPQ18-01	687,347	5,515,377	2005	160.8	0	-90	83

Data aggregation methods	▪ *In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off grades are usually Material and should be stated.* ▪ *Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail.* ▪ *The assumptions used for any reporting of metal equivalent values should be clearly stated.*	▪ Individual samples were taken on large diameter core samples that consisted of coal, or coaly shale intervals ▪ For most of the core samples taken, individual samples were taken at (or close to) 1m sample increments ▪ Each individual sample was tested for apparent relative density to determine whether the density was reflective of coal, so that composites could be made in the lab ▪ Individual samples were combined into seam / ply composite samples for raw, washability and clean coal analytical testing at GWIL Birtley coal laboratory ▪ Carbonisation testing was undertaken using various blend proportions of the individual composites from each hole ▪ No compositing of coal quality test results has been undertaken against drill holes at this stage
Relationship between	▪ *These relationships are*	▪ Discrepancies between apparent and true seam thickness are an important consideration for interpretation of the drilling results

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mineralisation widths and intercept lengths	*particularly important in the reporting of Exploration Results.* ▪ *If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported.* ▪ *If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').*	▪ The results tabulated in this announcement are apparent thicknesses as recorded in drill holes, and may be significantly different to the true thickness of the seams. ▪ True thicknesses are addressed through use of borehole deviation survey data, and structural interpretation / fault modelling, and have been reported to the ASX on 8th January, 2019 ▪ Reported seam intersections in boreholes and as evidenced by seam outcrops (road cuttings) show evidence of fault thickening, and / or thickening through folded zones
Diagrams	▪ *Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.*	▪ Borehole locations plans are provided along with drill hole locations, cross sections and seam intersects from the 2018 program in previous ASX announcements (8th January, 2019)
Balanced reporting	▪ *Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.*	▪ To ensure balance reporting of Exploration Results, all samples that were tested have been reported, with no omission of what may be perceived as lower or less desirable quality variables ▪ Ranges of values have been reported for some variables
Other substantive exploration data	▪ *Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.*	▪ The 2018 large diameter cored holes were drilled and logged in detail, with core photography ▪ The holes were also geophysically logged with the normal suite of wireline logs. Sample depths used were drillers depths, later adjusted to geophysical log depths
Further work	▪ *The nature and scale of planned further work (e.g. tests for lateral extensions or depth extensions or large-scale step-out drilling).* ▪ *Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.*	▪ The remaining LD cores will be subjected to detailed raw quality sizing and washability test work, including comprehensive testing of clean coal composites and coke strength testing ▪ Atrum is currently planning an exploration program for 2019