



**NANO ONE MATERIALS CORP.**

**INTERIM MANAGEMENT DISCUSSION**

**AND**

**ANALYSIS – QUARTERLY HIGHLIGHTS**

**FOR THE PERIOD ENDED MARCH 31, 2018**

## **INTERIM MANAGEMENT DISCUSSION AND ANALYSIS – QUARTERLY HIGHLIGHTS**

The following Interim Management Discussion and Analysis – Quarterly Highlights (“Quarterly Highlights”) of Nano One Materials Corp. (“Nano One” or the “Company”) has been prepared to provide material updates to the business operations, liquidity and capital resources of the Company since its last management discussion & analysis, being the Management Discussion & Analysis (“Annual MD&A”) for the fiscal year ended December 31, 2017. This Quarterly Highlights does not provide a general update to the Annual MD&A, or reflect any non-material events since the date of the Annual MD&A.

This Quarterly Highlights has been prepared in compliance with the requirements of section 2.2.1 of Form 51-102F1, in accordance with National Instrument 51-102 – Continuous Disclosure Obligations. This Quarterly Highlights should be read in conjunction with the Annual MD&A, the audited financial statements of the Company for the years ended December 31, 2017 and 2016 and the unaudited condensed interim financial statements for the three months ended March 31, 2018, together with the notes thereto. In the opinion of management, all adjustments (which consist only of normal recurring adjustments) considered necessary for a fair presentation have been included. The results for the three months ended March 31, 2018 are not necessarily indicative of the results that may be expected for any future period. Information contained herein is presented as at May 25, 2018 (the “Report Date”), unless otherwise indicated.

The unaudited condensed interim financial statements for the three months ended March 31, 2018, including comparatives, have been prepared in accordance with International Accounts Standards (“IAS”) 34, “Interim Financial Reporting” using accounting policies consistent with International Financial Reporting Standards (“IFRS”) as issued by the International Accounting Standards Board (“IASB”) and Interpretations issued by the International Financial Reporting Interpretations Committee (“IFRIC”).

External auditors, appointed by the shareholders, have not audited or reviewed the financial statements for the three month period ended March 31, 2018 and did not perform the tests deemed necessary to enable them to express an opinion on these unaudited condensed interim financial statements.

For the purposes of preparing this Quarterly Highlights, management, in conjunction with the Board of Directors, considers the materiality of information. Information is considered material if: (i) such information results in, or would reasonably be expected to result in, a significant change in the market price or value of Nano One’s common shares; or (ii) there is a substantial likelihood that a reasonable investor would consider it important in making an investment decision; or (iii) it would significantly alter the total mix of information available to investors. Management, in conjunction with the Board of Directors, evaluates materiality with reference to all relevant circumstances, including potential market sensitivity.

Additional information relevant to the Company’s activities can be found on SEDAR at [www.sedar.com](http://www.sedar.com) and the Company’s website at [www.nanoone.ca](http://www.nanoone.ca). All dollar amounts included therein and in the following Quarterly Highlights are in Canadian dollars, the reporting and functional currency of the Company, except where noted.

## **FORWARD LOOKING STATEMENTS**

Certain statements contained in this Quarterly Highlights may constitute “forward-looking statements”. Such term is defined in applicable securities laws. The forward-looking information includes, without limitation, the success of research and development activities and other similar statements concerning anticipated future events, conditions or results that are not historical facts. These statements reflect management’s current estimates, beliefs, intentions and expectations; they are not guarantees of future performance. The Company cautions that all forward-looking information is inherently uncertain and that actual performance may be affected by a number of material factors, many of which are beyond the Company’s control. Such factors include, among others, risks relating to research and development; the Company’s intellectual property applications being approved, the Company’s ability to properly its proprietary rights from unauthorized use or disclosure, the ability of the Company to obtain additional financing; the Company’s limited operating history; the need to comply with environmental and governmental regulations; fluctuations in currency exchange rates; operating hazards and risks; competition; and other risks and uncertainties. Although the Company has attempted to identify important

factors that could cause actual actions, events or results to differ materially from those described in forward-looking information, there may be other factors that cause actions, events or results not to be as anticipated, estimated or intended. Accordingly, actual future events, conditions and results may differ materially from the estimates, beliefs, intentions and expectations expressed or implied in the forward-looking information. All statements are made as of the Report Date and, except as required by law, the Company is under no obligation to update or alter any forward-looking information.

## OVERVIEW

The Company was incorporated on November 5, 1987. The Company is engaged in developing novel, scalable and low-cost processing technology for the production of high performance nano-structured materials. Nano One's mission is to establish its patent pending technology as a leading platform for the global production of a new generation of nano-structured composite materials. Nano One is building a portfolio of intellectual property and technology "know-how" for applications in markets that include energy storage, specialty ceramics, pharmaceutical, semiconductors, aerospace, dental, catalysts and communications. The technology simplifies the assembly of complex formulations of organic and inorganic ceramic powders and is suited to growth markets where the commercialization of advanced materials is inhibited by costly and entrenched industrial fabrication methods. Nano One's first market is lithium-ion cathode materials in the energy storage sector, where its advantageous technology can bring sustainable differentiation and value to early adopters.

## OVERALL PERFORMANCE

The Company has no revenues, so its ability to ensure continuing operations is its ability to obtain necessary financing to complete the development of novel, scalable and low-cost processing technology for the production of high performance nano-structured materials.

Nano One's innovative processing technology can be used to produce materials used in a wide range of markets. Nano One's first addressable market is cathode materials for lithium ion rechargeable batteries for consumer electronics, electric vehicles (EV) and energy storage systems (ESS). There is growing demand in the lithium ion battery market for more cost effective and higher performance energy storage solutions. Nano One is well positioned to address these needs with its patented and patent pending technology and anticipates growth potential for the technology in many other materials markets beyond energy storage, including dental, catalysts, specialty ceramics, pharmaceutical, semiconductors, agriculture, aerospace and communications.

Nano One has developed a new process of producing high performance cathode materials, which uses standard equipment and simple methods that are known to scale in a wide range of industrial applications. The process can produce higher performance composite materials while using lower cost feedstock and simpler processing. Nano One's patented and patent pending technology is a flexible manufacturing platform that enables lithium carbonate (or hydroxide) to be used as feedstock alongside other raw materials such as nickel, manganese, cobalt, iron, phosphate and/or aluminum. It is a water based process operating at mild pH and temperature that forms the energy storing cathode materials used in lithium ion batteries. The process can be configured to produce a range of different nano-structured materials and has the flexibility to shift with emerging and future battery market trends and a diverse range of other growth opportunities.

The process consists of three stages, and the major innovations lie in the first stage where a special mode of combining reactants controls crystal nucleation and growth of particles. Nucleation is the self-assembly of molecules into an organized structure. The desired nano-scale or superfine structure is formed in the initial stage of the production cycle and eliminates many steps common to the incumbent industrial processes.

The underlying structure and morphology of the materials is preserved through a wide range of thermal processing steps, eliminating the need for long and repeated firings and indicative of a robust and more durable material. The process produces materials that are highly crystalline (high phase purity) which is critical for the storage and retrieval of lithium ions and for the performance metrics of other applications.

The presence of nano-structures early in the process and prior to calcination (i.e. heating to high temperature) simplifies processing and is advantageous for material performance, process throughput and scale-up.

Characterization of the materials by electron microscope and x-ray characterizes the size, the composition and the kind of structure, providing evidence of a robust structure that withstands the rigours of drying and calcination and maintains the integrity of its advantageous structure through thousands of charge cycles.

Typically, synthesis of nano-materials at the benchscale are performed in small quantities anywhere from milligrams to grams of material. Subsequent scale-up from these small quantities often leads to detrimental changes in thermodynamics (heat, temperature, energy, work) and reaction kinetics (reaction rates and chemical change). Nano One recognizes that synthesis of materials must begin at a larger scale where the properties of the system are much closer to production conditions. For this reason, Nano One designed a 6-litre bench scale reactor that is capable of producing up to 150 grams per hour (150 g/hr) or 3 kilograms per day (3 kg/day), with drying and firing stages easily scaled to match. At this scale, there is sufficient volume to emulate the thermodynamic and reaction kinetics expected in pilot and full-scale production.

### **Pilot Plant Project**

In 2016, Nano One, NORAM Engineering and Constructors Ltd. (“NORAM”) and B.C. Research Inc. (“BCRI”) entered into a collaboration agreement whereby the parties would design, procure, construct, optimize and operate a pilot production plant. The purpose of the pilot plant is to: (i) simulate full scale production of lithium ion cathode materials; (ii) showcase Nano One’s patented technology; and (iii) demonstrate the cost, scalability, performance and novelty of Nano One’s technology to strategic industry players. The pilot plant is capable of producing hundreds (100’s) of kilograms batches of various lithium mixed metal cathode materials that are strategically critical to electric vehicle, grid storage and consumer electronic batteries. The procurement and construction phase of the pilot project began on June 1, 2016. The construction and commissioning of the pilot plant was completed in June 2017.

The scaled-up production of lithium ion cathode materials that meet Nano One’s processing and battery capacity targets has been demonstrated. Preliminary analysis of the pilot scale process is consistent with the chemistry and operating parameters developed in the laboratory. Evaluations of the pilot plant produced cathode materials shows crystallinity, elemental composition and battery capacity in line with Nano One’s laboratory scale process and materials.

The pilot plant project is being supported by the Government of Canada through grants of up to \$2.08M from Sustainable Development Technology Canada (“SDTC”) and up to \$1.9M from the Automotive Supplier Innovation Program (“ASIP”), a program of Innovation, Science and Economic Development Canada (“ISED”).

SDTC funds will be payable in installments over the three (3) phases of the project, namely: “commission”, “optimization” and “validation” with a 10% holdback awarded upon completion of the project in late-2018. The funds are dispersed at the beginning of each phase, and are subject to Nano One meeting milestones and having matching funds in place. To date, the Company has received two instalments totaling \$1,113,022 (2017 – one instalment of \$488,994) for the first and second phase of the project.

ASIP funds will be applied to the three project phases described above with an additional phase 4 involving the validation of materials specific to the electric vehicle market. To date, a total of \$995,221 has been claimed.

During the period ended March 31, 2018, the Company received additional government grants for training and employment grants totaling \$15,394 (2017 - \$Nil).

### **Technology**

The electric vehicle industry is demanding higher energy density lithium ion cathode materials at a lower cost. This is being achieved with increasing proportions of nickel relative to cobalt, manganese or aluminum. Current industrial methods require higher cost lithium hydroxide as feedstock for these nickel-rich cathode materials. The flexibility of Nano One’s process enables the use of lithium feedstock in form of either carbonate or hydroxide for the production of high performance cathode materials which could reduce constraints on the supply of battery grade lithium by enabling new sources. Nano One has begun working with a range of lithium sources from various producers to demonstrate the flexibility of its processing technology.

Nickel rich cathode materials include nickel cobalt aluminate (NCA) and nickel manganese cobaltate (NMC-532, 622 and 811). [Note: “NMC-xyz”, where x, y and z refers to ratios of nickel, manganese and cobalt, respectively.] These materials are expected to play an increasingly dominant role in the lithium ion batteries used by major electric vehicle manufacturers.

During the period ended December 31, 2017, Nano One demonstrated the synthesis of high energy cathode material for electrical vehicles using lithium carbonate feedstock with energy densities on par with industry standards. This demonstration underlines the opportunity of Nano One’s technology to enable a wider range of lithium sources for the rapidly growing electric vehicle market and supplements Nano One’s other opportunities in the space including improved cathode material durability, power, energy and processing cost.

Nano One has successfully piloted NMC111 and NMC622 with nickel content at 33% and 60% respectively. The material yield from these pilot tests were approximately 100 times that of typical lab scale and the results provide confidence that these nickel rich materials can be manufactured at commercial scale. Electrochemical testing of battery cells made with these pilot plant produced materials is showing initial energy capacity measurements in line with that achieved in the laboratory.

Nano One is also developing other important cathode materials at the laboratory scale in preparation for piloting including: NMC811; NCA; LMNO (high voltage spinel); LFP (lithium iron phosphate); LMO (lithium manganese oxide); and NCM325 (lithium manganese rich).

Nano One’s laboratory batches of NCA and NMC811 made with lithium carbonate have energy densities of 710 and 750 Wh/kg, respectively. This is comparable to the same materials made with higher cost lithium hydroxide and thereby demonstrates a cost effective lithium alternative.

Nano One successfully completed an 18 month project developing cobalt free LMNO cathode material for lithium ion batteries referred to as High Voltage Spinel (HVS), with the support NRC-IRAP. HVS is suited to fast charging and high power applications and is a candidate cathode material in next generation solid state lithium ion batteries for automotive, consumer electronics and energy storage applications. HVS differs from other cathodes because it is made from lithium, manganese and nickel, without the high cost and supply chain risk of cobalt.

Nano One met its initial objectives in the HVS project and made a number of significant breakthroughs. Battery performance is excellent when HVS is tested with lithium, graphite and LTO (lithium titanium oxide) anodes. The process can control particle size and output voltage; and stabilizes HVS for high temperature applications which are important advances for battery manufacturers.

Nano One can control HVS particle size to tailor it for energy storage or power applications and its higher voltage enables simpler energy management systems and delivers increased power at high rates of discharge. HVS production is now ready for demonstration at pilot scale.

Operating the pilot plant has also enabled Nano One to complete preliminary engineering plans for a modular 3,300 tonne/year cathode production unit that could supply materials for roughly 24,000 electric vehicle batteries averaging 60kWh each. Nano One has also begun efforts on detailed plant engineering in support of technology licensing proposals to global industrial interests.

## **LIQUIDITY AND FINANCIAL CONDITION**

The Company has not yet realized profitable operations and has relied on non-operational sources of financing to fund operations. The ability of the Company to achieve its objectives, meet its ongoing obligations and recover its investments in granted and pending patents, and other assets will depend on management’s ability to successfully execute its business plan, achieve profitable operations and obtain additional financing, if or when required. There is no assurance that these initiatives will be successful.

Loss and comprehensive loss for the period ended March 31, 2018 increased by \$400,468. The change was primarily due to the following:

- General and administrative costs of \$957,552 (2017 - \$612,555) increased as follows:
  - Research and development increased by \$338,551 primarily due to work performed in connection with the pilot plant. Total government assistance recognized for the period ended March 31, 2018 was \$30,802 (2017 - \$156,478). The amount is offset against research and development expense on the statement of loss and comprehensive loss.
  - Consulting increased by \$9,299 primarily due to consulting fee paid to for corporate development consulting services and IT consulting services.
  - Professional fees decreased by \$21,846 primarily due to patent legal fees decreasing.
  - Salary and benefits increased by \$18,355 due to the hiring of employees.
  - Office and general increased by \$4,457 due to an overall increase in activity.
- The Company recorded a non-cash share-based payments of \$127,554 (2016 – \$64,786) relating to the fair value to the current period.

**Research and Development Expense For The Fiscal Period Ended March 31, 2018 Compared To March 31, 2017:**

	Period Ended March 31, 2018 \$	Period Ended March 31, 2017 \$
Analytical services	1,373	1,714
Consulting	26,111	160,659
Depreciation	169,059	16,342
Government grant recovery	(30,802)	(156,478)
Lab rent	14,802	15,703
Office and lab expense	130,039	20,736
Salaries and benefits related to R&D	292,163	157,584
Travel	1,296	49,230
	604,041	265,490

Liquidity risk is the risk that the Company will not be able to meet its obligations associated with its financial liabilities. The Company has historically relied upon equity financings to satisfy its capital requirements and will continue to depend heavily upon equity capital to finance its activities. The Company's approach to managing liquidity risk is to ensure that it will have sufficient liquidity to meet liabilities when due. The Company started 2018 with a working capital of \$4,643,789, and as at March 31, 2018, the Company had working capital of \$4,293,923. The decrease in the working capital of \$349,866 was primarily due to:

- 293,825 warrants with an exercise price of \$1.25 were exercised for gross proceeds of \$367,281;
- 400,000 stock options with an exercise price of \$0.35 were exercised for gross proceeds of \$140,000;
- total government assistance recognized \$30,802; and
- general and administrative costs of \$957,552.

Recent developments in the capital markets have restricted access to debt and equity financing for many companies. As the Company has no significant income, cash balances will continue to decline as the Company utilizes these funds to conduct its operations, unless replenished by capital fundraising.

	March 31, 2018	December 31, 2017
Working capital	\$ 4,293,923	\$ 4,643,789
Deficit	(13,719,518)	(12,644,499)

Subsequent to March 31, 2018, The Company issued 62,500 common shares pursuant to the exercise of warrants at \$1.25 for gross proceeds of \$78,125.

**FUTURE PLANS**

Nano One will continue to develop, optimize and demonstrate the benefits of producing various cathode materials using its processing technology, for use in lithium ion batteries including the development of high voltage cobalt free cathode materials.

Nano One will continue to collaborate with NORAM and BCRI on the design of its the pilot plant to demonstrate the production of lithium ion battery cathode powders and to demonstrate technology improvements as they arise. Nano One will continue to provide test samples and will continue to optimize cathode materials for third party evaluation purposes. Nano One is continuing to ramp up its internal testing, cell assembly and electrochemical characterization capabilities.

Nano One has collaborated with Simon Fraser University to advance the understanding of the physical and chemical characteristics of lithium ion batteries as they charge and discharge. The two-year collaboration with SFU will be supervised by Associate Professor Dr. Byron Gates and Dr. Stephen Campbell, Nano One’s Principal Scientist, with financial support from the Mitacs Elevate Postdoctoral Fellowship Program.

As the lithium ion battery market evolves, Nano One believes its key opportunities lie in: (i) manufacturing of value added and differentiable cathode materials; (ii) enabling lithium feedstocks that others cannot use; and (iii) customizing materials for solid state, fast charging and next generation batteries. Nano One is adjusting financial models and development programs to pursue these opportunities.

Nano One intends to leverage progress on these key opportunities and continues to develop relationships with potential strategic interests and key market pull players to collaborate as partners in the demonstration pilot and in the development of materials for next generation lithium ion batteries.

**RELATED PARTY DISCLOSURES**

Key management personnel are the persons responsible for the planning, directing and controlling the activities of the Company and includes both executive and non-executive directors, and entities controlled by such persons. The Company considers all Directors and Officers of the Company to be key management personnel.

**(a) Purchases of services**

	<b>March 31, 2018</b>	<b>March 31, 2017</b>
	\$	\$
Bedrock Capital Corp., an entity controlled by Paul Matysek, an executive director is an officer, for consulting fees	15,000	15,000
Sterling Pacific Capital, an entity controlled by John Lando, an executive director is an officer, for miscellaneous operating expenses and employee benefits	4,321	12,909
Patent Filing Specialists Inc, an entity where a Joseph Guy, a director, is a director, for legal fees	14,332	-
	<b>33,653</b>	<b>27,909</b>

**(b) Key management compensation**

Key management includes directors (executive and non-executive), the, Chief Executive Officer President and Chief Financial Officer. The compensation paid or payable to key management for employee services is shown below:

	<b>March 31, 2018</b>	<b>March 31, 2017</b>
	\$	\$
Salary and benefits to the CFO	26,788	18,161
Salary and benefits to the President and Director	20,084	18,897
Salary and benefits to CEO and Director	33,493	31,733
	<b>80,365</b>	<b>68,791</b>

**RISK AND UNCERTAINTIES**

Risk is inherent in all business activities and cannot be entirely eliminated. Our goal is to enable the Company's business processes and opportunities by ensuring that the risks arising from our business activities, the markets and political environments in which we operate is mitigated. The risks and uncertainties described in the Annual MD&A for the year ended December 31, 2017 are considered by management to be the most important in the context of the Company's business and are substantially unchanged as of the Report Date. Those risks and uncertainties are not inclusive of all the risks and uncertainties the Company may be subject to and other risks may apply.