PRELIMINARY FEASIBILITY STUDY
TECHNICAL REPORT

GRAPHITE ONE PROJECT

ALASKA, USA

EFFECTIVE DATE – AUGUST 29, 2022
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NOTICE

JDS Energy & Mining, Inc. prepared this National Instrument 43-101 Preliminary Feasibility Study Technical Report, in accordance with Form 43-101F1, for Graphite One Inc. The quality of information, conclusions and estimates contained herein is based on: (i) information available at the time of preparation; (ii) data supplied by outside sources, and (iii) the assumptions, conditions, and qualifications set forth in this report.

Graphite One Inc. filed this Technical Report with the Canadian Securities Regulatory Authorities pursuant to provincial securities legislation. Except for the purposes legislated under provincial securities law, any other use of this report by any third party is at that party's sole risk.

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1 EXECUTIVE SUMMARY

1.1 Introduction

This technical report (TR) has been prepared for Graphite One Inc. (GPH: TSX-V; GPHOF: OTCQX) (Graphite One or the Company) with its address at Suite 600, 777 Hornby St., Vancouver, BC for the purpose of disclosing the results of a Prefeasibility Study (PFS) for the Graphite One Project (the Project). It is the objective of the Company to become a vertically integrated 100% US-based manufacturer of graphite products with an operating mine near Nome, Alaska and an operating secondary treatment plant in Washington State, which are modeled in this report. This technical report was prepared by JDS Energy & Mining at the request of Graphite One Inc. The results of the PFS were disclosed to the public by Graphite One in a news release on 29 August 2022, the Effective date of the technical report.

The Project combines a mining operation located on state mining claims near Nome, Alaska (the Property) with a secondary treatment plant (the STP) located in Washington State.

In Alaska, the graphite will be mined from the company-owned deposit, then crushed, ground, and concentrated in a processing plant using flotation to enrich the graphite concentrate to approximately 95% purity for shipment. The bagged concentrate will then be loaded into 20 ft standard shipping containers and barged to the STP. The STP's specific location in Washington State has not been defined.

The city of Nome has a seasonal shipping window and, as such, stockpiling and bulk shipping of the concentrate will be required resulting in a considerable lag between the mining and processing of the graphite ore and the realization of revenue from the final product.

The Company intends on constructing the facilities on both the Property and the STP as quickly as possible. As the time required to develop the Property is longer than that required to construct the STP, the Company intends to commission the STP with graphite purchased on the open market (open market graphite or OMG) and operate it continuously while the Graphite Creek graphite (GCG) is mined, processed, and shipped.

1.1.1 The Property

The Graphite Creek Property (the Property) is on the Seward Peninsula, approximately 60 kilometre (km) north of Nome, Alaska. The Property comprises 23,680 acres and consists of 176 active State of Alaska 160-acre (1/4 section) mining claims with 28 of those claims overlying more senior claims within the claim block. The claims are on the Teller A2 and A1 quadrangles, and the plan projection of the deposit is centered on UTM coordinates 474,600 E and 7,212,200 N (NAD 83, Zone 3N). The corresponding geographic coordinates are -165.540990W, 65.038424N. The proposed mining footprint is well within the Property boundaries.

1.1.2 The Secondary Treatment Plant (STP)

The Secondary Treatment Plant (STP) is designed to produce lithium-ion battery anode materials on a commercial scale for the U.S. domestic market using natural graphite and other materials.

It would start operation and continue for an estimated period of up to four years by processing purchased graphite while the Graphite Creek mine is progressing through permitting and construction. Graphite Creek graphite would be phased in as soon as it is available. At full capacity, the STP requires about 34.5 hectares (ha) (85 acres) of land, consists of 17 buildings, and would annually produce about 77,000 tonnes (t) of manufactured graphite products. The products are grouped into battery anode materials, specialty purified graphite products, and traditional unpurified graphite products. The products are manufactured from natural graphite concentrate, artificial graphite precursors, coke and pitch. Key components of the manufacturing process are the purification of natural graphite and graphitization of artificial graphite precursors in high temperature, electrically heated furnaces. The STP's preferred location is in Washington State to access both its relatively lower power rates from hydro generated electricity and its skilled workforce.

1.2 Location, Access, and Ownership

The Graphite Creek Property (the Property) is on the Seward Peninsula, Alaska (Figure 1-1). Nome, a regional hub (population 3,699 in 2020) with a seaport and international airport, is approximately 60 km south of the Property. The communities of Brevig Mission and Teller (populations 397 and 235 in 2020) are about 45 km northwest of the Property. Mary's Igloo, with seasonal residents only, lies about 25 km northeast of the Property.

Access is by helicopter, or overland by foot or snowmobile, or by water and foot – the Property is separated from the intertidal Imuruk Basin by three kilometers of tundra.

The Property is 23 km from the seasonal Kougarok Road (Nome-Taylor Highway), on an undeveloped route through the Kigluaik Mts. via Mosquito Pass. It is 30 km from the Property to the Teller Highway, along the northern flank of the Kigluaik Mts.

Prior to 2021 drilling efforts used camps on the road system and helicopters to support remote drill pads. Camps were established at Salmon Lake about 40 km (30 miles) from Nome on the Kougarok Road in 2012 and 2013; and at the Tisuk camp on the Teller Highway about 80 km (50 miles) from Nome in 2014, 2018, and 2019. In 2021 a remote helicopter-access camp was established at Graphite Creek, about a kilometer north of the proposed pit.

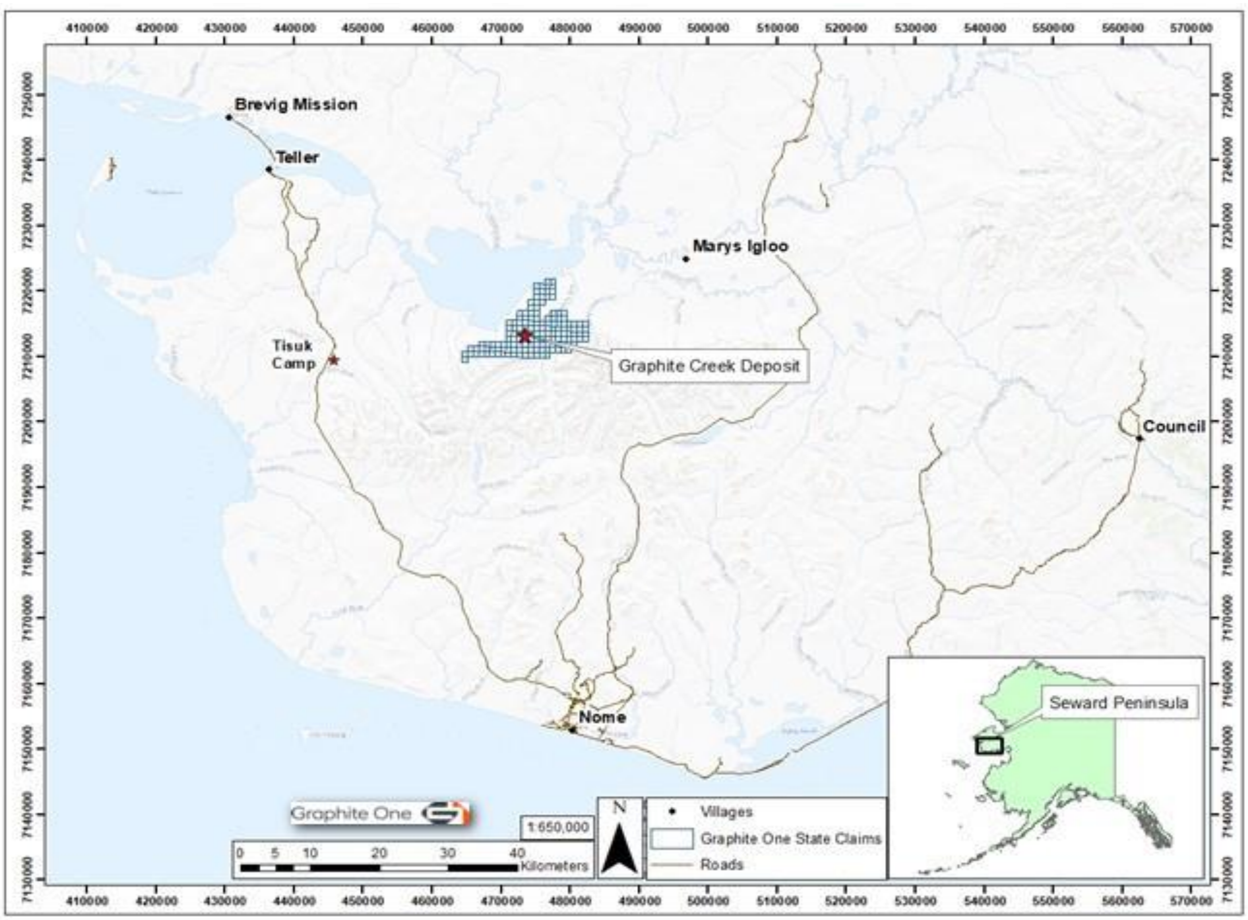
Graphite One gained control of senior federal claims on the Property, via a long-term lease with Kougarok LLC, executed in 2015 (Lease). Production royalties, timelines and buyouts were part of the Lease. Graphite One also staked 120 Alaska State mining claims, each a full 160 acres.

Graphite One purchased additional claims in two transactions each acquiring 28 Alaska state mining claims covering the same lands and representing the junior and senior state mining claims that overlap and surround the leased property. The first group of 28 claims was purchased in 2012 for $20,000 and a 2% production royalty on future production from the particular claims. In 2020, the Company acquired the 2% production royalty in return for 2,500,000 common shares and 2,500,000 warrants. The Warrants were exercised in 2021. The second group of 28 claims was purchased in 2015 for $50,000, the issuance of 3 million common shares of the Company and a royalty interest equal to 1% of the net smelter returns received on production from the particular claims. Graphite One has the right to purchase the royalty for $500,000 at any time within 36 months following the start of mine production.

In 2018 under the Lease terms, Kougarok converted its Federal mining claims to State of Alaska mining claims. Graphite One in turn transferred to Kougarok ownership of thirteen of its Alaska state mining claims that overlapped with the lands of 4 of Kougarok's former Federal claims and simultaneously leased them back from Kougarok. This conversion put the State of Alaska in the lead regulatory role for the mine development.

Graphitic bedrock was first documented on the north side of the Kigluaik Mountains in the early twentieth century (Moffit, 1913). The graphite showings outcrop in incised creek valleys on the north side of the Kigluaik Mountains. The showings are well described (e.g., Mertie, 1918; Coats, 1944; Cobb, 1972; Cobb and Sainsbury, 1972; Sainsbury, 1972; Weiss, 1973; Cobb, 1975; Hudson and Plafker, 1978; Hudson, 1981, 1998; Swainbank et al., 1995; Adler and Bundtzen, 2011; Nelson, 2011). From west to east these creek exposures include Christophosen Creek, Hot Springs Creek, Trail Creek, Glacier Canyon Creek, Ruby Creek and Graphite Creek. A general historical overview of each of the graphite showings is described in Duplessis et al., (2013).

Figure 1-1: Location of Graphite One Resources Inc. State Claims on the Seward Peninsula, Alaska



Source: AES (2022)

1.3 History

1.3.1 Historical Mining

During the early 1900s, at least two companies mined in the area. The first known claims were staked in 1900 by Uncle Sam Alaska Mining Syndicate (USAMS) near Graphite Bay, now known as Windy Cove (Harrington, 1919). In 1912, USAMS shipped 120 t of graphite to Seattle and the San Francisco Bay area, and by 1916 had stockpiled another 275 t (Mertie, 1918). The Alaska Graphite Mining Co. staked claims in 1905 and added additional claims in 1915 and 1916 (Mertie, 1918; Harrington, 1919). A total of 32 t of graphite was mined from talus in 1907 (Coats, 1944). Employing about seven people, 90 t of graphite was mined in 1916 (Mertie, 1918). This production was hauled a short distance overland to Windy Cove, from there to Teller by boat, and then shipped to Seattle and San Francisco (Harrington, 1919).

1.3.2 Early Exploration

After initial early 1900s production, the Graphite Creek deposits lay dormant until 1943 when USGS geologist Robert Coats visited the area. His field crew sampled material from several sorted piles of previously mined graphite, and from several high-grade graphitic lenses on the Property (Coats, 1944). Three specific areas underwent surface excavation work and were named by Coats as Christophosen Creek, Ruby Creek, and Graphite Creek. Coats (1944) reported that exposed high-grade lenses in these three areas varied from a few centimeters to a metre in thickness with lengths that are ten to fifteen times their width and contained up to 60% graphite.

The last known previous exploration interest in the area was in 1981 when a brief field examination of the showings was conducted by the Anaconda Copper Company when several samples were taken for analysis during a one-day visit (Hudson, 1981; Wolgemuth, 1982).

1.3.3 Graphite One Exploration

Exploration work done for Graphite One in 2011, commissioned by Graphite One and performed by APEX Geosciences during 2012 to 2014, and Alaska Earth Sciences in 2018 and 2019,and performed by Graphite One in 2021 consisted of a variety of programs, the details of which are reported in Nelson (2011), Adler and Bundtzen (2011), Duplessis et al., (2013), Eccles and Nicolls (2014), Eccles et al., (2015), Messler (2018), King, et al., (2019), and Gierymski and Flanigan (2022). The programs are summarized in this report in the Exploration and Drilling sections.

A series of resource estimations have been made as exploration progressed.

A maiden inferred resource estimate was calculated in 2013 using 17 diamond drill holes arrayed over 2.2 km (1.3 miles) strike length, (Duplessis, et al., 2013). Seven of those holes were in the southwestern 900 metre (m) of the 2012 drill pattern, which is within the current proposed pit footprint. Inferred Resource: 6,196,160 metric tons (mt) of in situ Cg @ 5.78% using 3% cut off, in 107.2 Mt.

After the 2013 drilling campaign (which extended the resource along strike about 400 m northeast and about 2.3 km southwest) a new inferred resource using 28 holes was calculated for the expanded 4.7 km strike length, (Eccles and Nicolls, 2014). Inferred Resource: 10,346,400 Mt of in situ Cg@5.54% using 3% cut-off, in 186.9 Mt.

After the 2014 drilling program an indicated resource estimate was prepared for a 730-m strike length segment of the drill-tested trend, as well as an inferred resource for the 4000 m of strike outside of the indicated resource area. Inferred Resource: 8,763,000 Mt of in situ Cg@~~6% using 3% cut-off, in 154.36 Mt. Indicated Resource: 1,132,000 Mt of in situ Cg@~~6.3% using 3% cut-off, in 17.93 Mt. (Eccles, et al, 2015).

A revised restatement of resources was done in a Preliminary Economic Assessment (PEA) in 2016 (Robinson et al., 2017).

Inferred Resource: 8,769,000 Mt of contained Cg@5.7% using 3% cut-off, in 154.44 Mt. Indicated Resource: 1,134,000 Mt of contained Cg@6.3% using 3% cut-off, in 17.97 Mt and Indicated Resource: 1,009,000 Mt of contained Cg@6.7% using 5% cut-off, in 15.10 Mt and the preferred, Inferred Resource: 4,969,000 Mt of contained Cg@7.0% using 6% cut-off in 71.24 Mt. Indicated Resource: 744,000 Mt of contained Cg@7.2% using 6% cut-off in 17.97 Mt.

A statement of resources in the 2017 NI 43-101 Preliminary Economic Analysis reported the same resource as the 2016 PEA (Robinson, et al, 2017).

After 2018 drilling a new inferred, indicated, and measured resource was calculated (King, et al., 2019). Inferred Resource: 7,342,883 Mt of contained Cg@8.0% using 5% cut-off, in 91.89 Mt. Indicated Resource: 715,363 Mt of contained Cg@7.7% using 5% cut-off, in 9.26 Mt. Measured Resource: 135,171 Mt of contained Cg@8.0% using 5% cut-off, in 1.69 Mt Cg@8.0% using 5% cut-off, in 1.69 Mt.

1.4 Geology and Mineralization

1.4.1 Regional Geology

The Kigluaik Mountains are a gneiss dome composed of Kigluaik Group amphibolite and granulite facies metamorphic rocks and are one of a group of Cretaceous gneiss domes on the southern Seward Peninsula and in eastern Chukotka, Russia. Nome Group Cambrian? to Devonian platform rocks recording blueschist metamorphism and retrograde greenschist metamorphism surround the Kigluaik Group. These are all parts of the Arctic Alaska Chukotka microplate. (Till, 2016).

The Kigluaik dome comprises a 15 km-thick structural section of metasedimentary rocks and orthogneisses, with an undeformed 90 ± 1 Ma granite core derived from mantle magmatism (Amato and Miler, 2004). A 91 ± 1 Ma upper-amphibolite-to-granulite facies metamorphic event that was syntectonic with gneiss dome fabrics overprints a pre–120 Ma blueschist-to-greenschist facies event. High-temperature, granulite-grade, metamorphism of the Kigluaik gneiss dome likely took place around 90 Ma. A protracted metamorphic history prior to that event is indicated by the structural complexity of garnet porphyroblasts but the timing and character are unknown (Case, et al., 2019).

Metamorphic isograds in the Kigluaik Group are unusually steep, transitioning from the biotite zone to the sillimanite + K-spar zone in less than 10 km.

The basal Kigluaik Group contains granulite grade schist and gneiss and is exposed on north flank of the mountains (Figure 1-2). These rocks have no direct counterparts in the adjacent mountain ranges and are believed to represent the deepest crustal rocks exposed in northwestern Alaska (Miller, 1994). The lower Kigluaik Group comprises coarse marble, quartzo-feldspathic gneiss, schist and gneiss of mafic and ultramafic composition, graphite-rich schist, and garnet lherzolite.

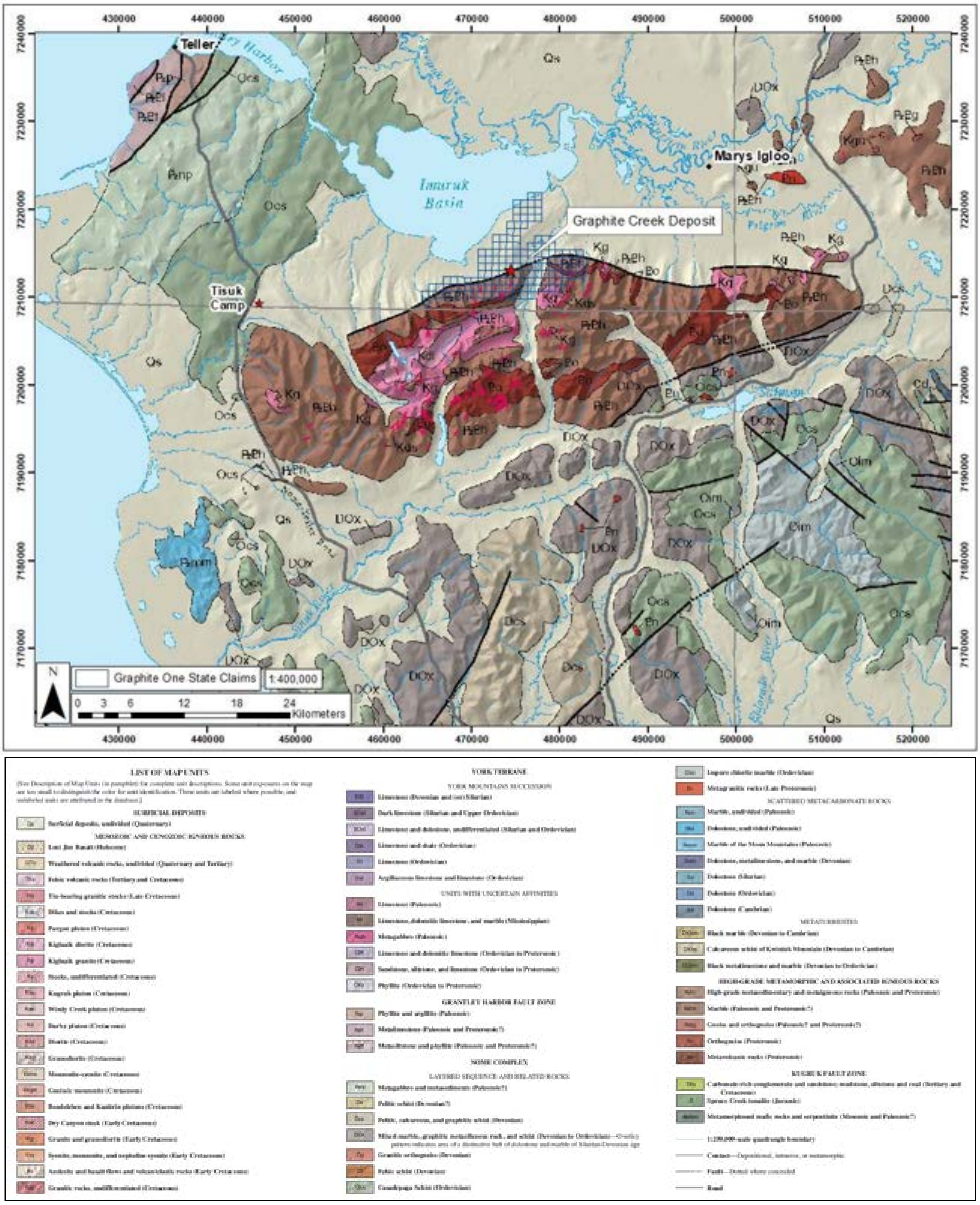
Amphibolite grade upper Kigluaik Group schist is exposed on the southern flanks of the Kigluaik Mountains. The Kigluaik Group is in fault contact with the lower metamorphic grade Nome Complex to the south and may correlate to those rocks, and to parts of the western Brooks Range. (Case, et al, 2019).

The metamorphic rocks of the Kigluaik Group are composed of continental crustal material of Proterozoic to middle Paleozoic age that were subjected to crustal imbrication and thickening in middle Mesozoic time and widespread plutonic activity in mid-Cretaceous to late Cretaceous time (Sainsbury, 1972, 1975; Bunker et al., 1979; Miller, 1994; Till and Dumoulin, 1994; Armstrong et al., 1986; Amato and Wright, 1998; Till et al., 2011). However, some authors have proposed that at least part, and perhaps a significant part, of high-grade metasedimentary and metaigneous rocks of the Kigluaik Group (unit PzPh on Figure 1-2) was originally blueschist-facies rocks of the Nome Complex subsequent to a high-grade metamorphic overprinting (Hannula and McWilliams, 1995; Till et al., 2011).

All the formations of the Kigluaik Group are cut by intrusive rocks, the most common of which is granite. These intrusions are more abundant in the lower part of the group. Besides granite intrusions, dykes and sills of diorite, diabase and pegmatite are present.

Peak metamorphic grade in the Kigluaik Group is thought to have occurred in the Cretaceous (91 Ma), immediately preceding or coincident with the intrusion of the Kigluaik Pluton, based on U-Pb analyses of monazite from orthogneiss and metapelite and from pegmatite derived from partial melting of metasedimentary rocks. Extensive detailed U-Pb dating of zircon from the mafic root of the Kigluaik pluton using conventional and step-wise HF dissolution techniques yielded a 90 ± 1 Ma intrusive age, suggesting that mantle-derived magmatism was the heat source for high-temperature metamorphism. (Amato and Wright, 1998). Other dating methods have yielded younger ages. K-Ar dates of biotite and hornblende from paragneiss, orthogneiss, and amphibolite reported by Turner and Swanson (1981) range from 81 ± 2 Ma to 87 ± 3 Ma. K-Ar analyses of “mafic gneiss” by Sturnick (1984) yielded 84-85 Ma dates. Calvert (1992) dated hornblende from an amphibolite within the Kigluaik Group using 40Ar/39Ar techniques. He obtained a plateau date of 86 ± 1 Ma (Calvert, 1992). Because the closure temperature of hornblende to Ar diffusion is thought to be 550°C and the peak metamorphic temperatures were about 700-800°C, this date must be a minimum for peak metamorphism (Amato and Wright, 1998). Dating of 40K/40Ar and 40Ar/39Ar dating have yielded ages of ~95-81 Ma. The younger ages likely date the onset of high-grade regional metamorphism of the Kigluaik Group (Adler and Bundtzen, 2011).

Figure 1-2: Geologic Map of the Seward Peninsula



Source: Till et al., (2011)

1.4.2 Property Geology

The Graphite Creek deposit is on the north slope of the Kigluaik Mountains gneiss dome in granulite facies metamorphic rocks. Graphite occurs as high-grade massive to semi-massive segregations and disseminations within amphibolite facies metasedimentary rocks, primarily quartz-biotite schist with zones of quartz-biotite-garnet-sillimanite schist (Sainsbury, 1972). The graphite-bearing schist units strike subparallel to the mountain front and dip north between 40º and 75º. Locally, the attitude of the Kigluaik fault and the geologic dip of the metasediments is coincident, or nearly so.

The deposit is on the footwall, south, side of the Kigluaik fault. The Kigluaik fault generally strikes at approximately azimuth 250º and dips from 35º to 75º to the north over a strike length of approximately 35 km. Contemporary movement on this fault has uplifted the rugged and youthful Kigluaik Mountains to the south and down thrown the lowlands of the Imuruk Basin to the north (Hudson and Plafker, 1978). The fault is a boundary between bedrock mineralization and overburden. Surficial Quaternary deposits cover the area to the north of the Kigluaik Fault on the Graphite One Property. The surficial deposits include glacially deposited sand, gravel, and boulders; fluvial gravel and sand; marine and fluvial terrace deposits; and wetlands (Till et al., 2011).

Bedrock is either exposed or covered minimally by surficial overburden material throughout most of the Property area south of the Kigluaik Fault, particularly in the incised creek valleys and/or relatively steep slopes adjacent to the Kigluaik Fault.

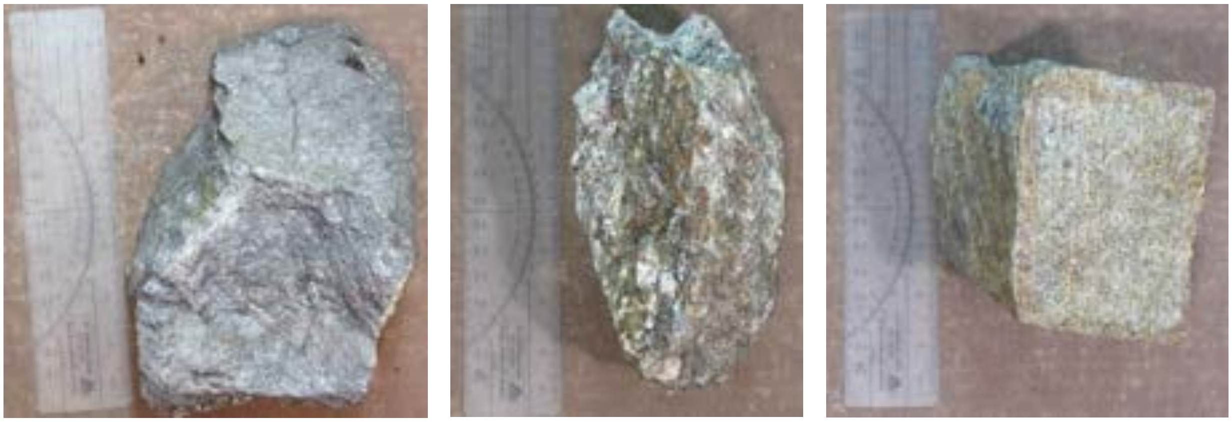
The 2012 geological mapping program confirmed historical observations of distinct geological layers comprising high-grade massive to semi-massive segregated and disseminated graphite in quartz-biotite-garnet-sillimanite schist and disseminated graphite in quartz-biotite schist (±garnet). Based on strike/dip measurements, the layers consistently dip northwards such that these layers appear to represent continuous geological units and are not overly distorted by complex regional or large-scale fold belts. Small, localized folding does exist on the <1 m scale but is more or less confined within the high-grade graphite schist layers.

The map pattern of the EM anomaly suggests a low angle northeast-plunging fold geometry. Interpretation of the oriented core data by Oriented Targeting Solutions (OTS) included suggestions of an F1 low angle NE plunging fold pattern (Burtner, et, al 2022).

1.4.3 Mineralization

Of the four shist lithologies logged at Graphite Creek, two main graphite-bearing lithologies are identified. One is quartz-biotite-garnet-sillimanite k-spar schist (QBGSS) that contains disseminations of graphite and very high-grade lenses (up to 60% graphite) of coarse grained, semi-massive and massive graphite segregations (Figure 1-3). The other is quartz-biotite schist (QBS) that typically contains disseminated, and occasionally massive, graphite. The QBGSS is the principal host to higher grade graphite and appears in outcrop as two distinctive layers in the metasedimentary sequence along the north flank of the Kigluaik Mountains. A third horizon observable in outcrop occurs as 'pods' of quartz-biotite-garnet-sillimanite schist. These layers are most likely structurally controlled, i.e., a folded unit with the third pod-like layer occurring as a remnant erosional feature (T. Hudson, personal communication, 2012). The quartz-biotite-garnet-sillimanite schist layers strike obliquely to the mountain front and dip northwards at 40° to 80°.

Figure 1-3: Examples of Graphite Mineralization in Different Schists



Source: AES (2022)

Photo on left is semi-massive graphite, center photo is quartz-biotite-garnet-sillimanite schist, far right photo is quartz-biotite schist.

The QBGSS typically is fine to coarse grained, weathers grey, has a wavy and crenulated schistosity, has garnet porphyroblasts (up to 2 cm across) and has augen-shaped quartz grains. Discontinuous segregations (lenses and streaks) of high-grade graphite, from centimeters to a few metres thick, are common. These high-grade graphite lenses in the QBGSS have up to 60% coarse crystalline graphite at 1 m scale sample lengths in drill core. Disseminated flakes of graphite, up to 1 mm or more across, make up several percent of the rock.

The QBS is fine-grained, weathers a rusty ochre color and has regular layering with individual layers commonly 3 to 10 cm thick. Graphite occurs as disseminated flakes up to about 1 mm across and can make up several percent of the rock. Higher grade graphite-rich layers, varying from 3 to 25 cm in width are present, but are not as common as in the QBGSS.

The other logged schist units at Graphite Creek, QBGS and QBSS, are usually not well mineralized. Graphite is observed in at least trace amounts in all lithologies other than QDIO (quartz diorite intrusive) and INM (mafic intrusive).

1.5 Metallurgical Testing and Mineral Processing

SGS Minerals Services conducted a series of metallurgical tests in support of a prefeasibility study for Graphite One Inc.'s Graphite One Project in Alaska. The samples, totaling 3,720 kilogram (kg), were grouped into five composites representing yearly periods in the expected mine life. They were received by SGS in February 2020, and the testing was completed by June 2021. The primary objective of the metallurgical testing was to develop a flowsheet that would produce a flotation concentrate grading of at least 95% C(t) with minimal flake degradation and maximum graphite recovery using conventional unit operations.

To that end, the following test were conducted:

- ICP analysis;
- Whole rock analysis;
- Comminution testwork;
- Heavy liquid separation;
- Flotation testwork, including rougher, cleaner, variance, and locked cycle tests;
- Solid / liquid separation for both tailings and concentrate; and
- A large scale pilot plant program was conducted using surface outcrop samples to generate approximately 400 kg of ~ 95% C graphite concentrate for market testing.

Plant design capacity is based on processing 1,000,000 tonnes per year (t/a) or 2,740 t/d of ROM material containing 6.18% Cg. An operating schedule of 365 days per year, 2 x 12-hour shifts per day was assumed for the grinding circuit and downstream operations. Crushing plant operation is based on 1 x 12-hour shift per day

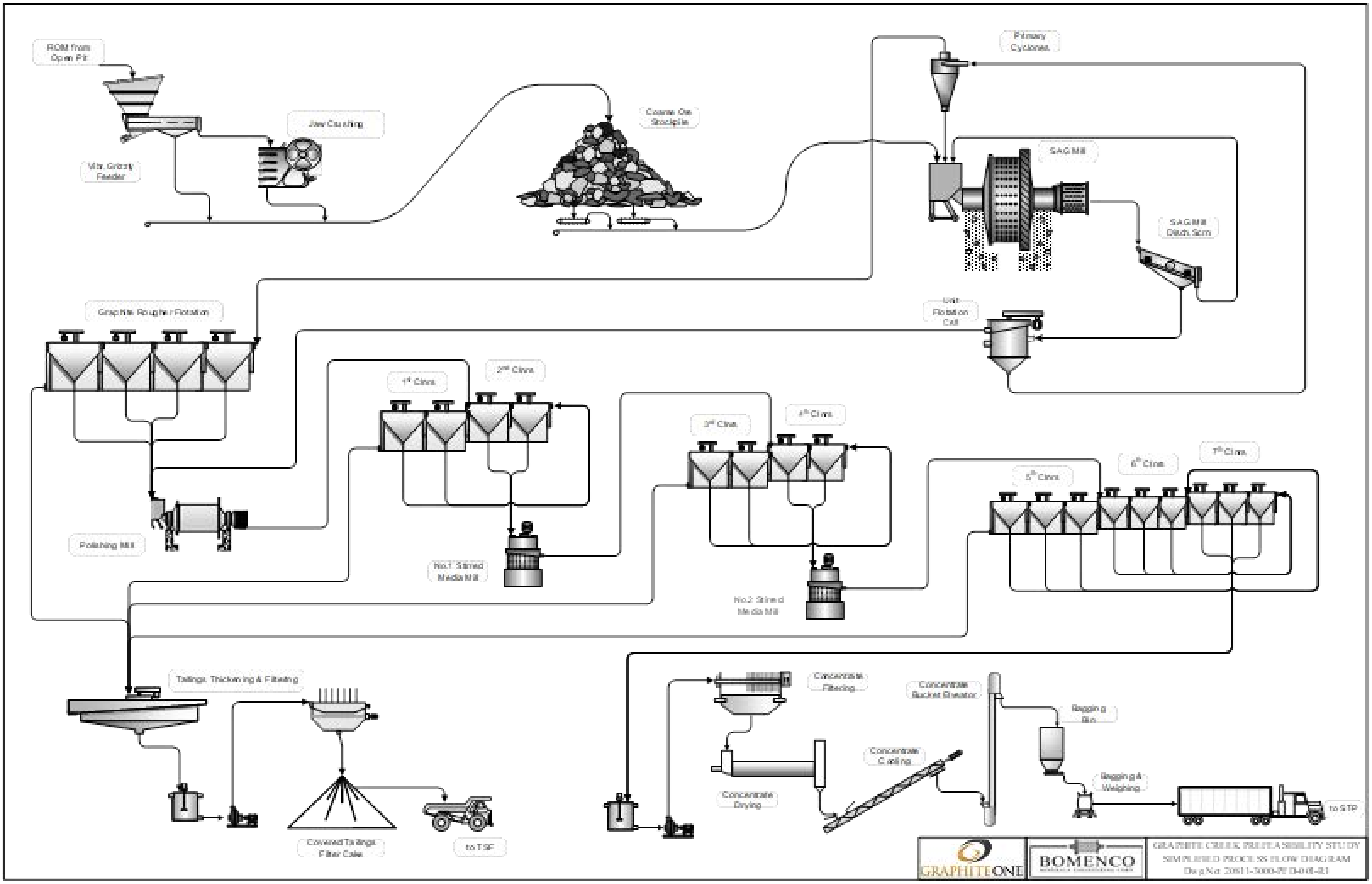
Plant design consists of the following major processing steps:

- The comminution circuit will include a single-stage crushing, coarse ore stockpiling and SAG milling in closed circuit with cyclones targeting 80% passing 320 µm grind;
- The grinding circuit will include a flash flotation step while the comminution circuit product will proceed to rougher flotation;
- Rougher and flash flotation concentrates will be combined for open circuit polishing grind and the subsequent seven stages of cleaning with stirred media milling after the second and fourth cleaner stages;
- The graphite concentrate will be dewatered with a filter press followed by drying through a diesel-fired indirect dryer before cooling and packing in 1 t bulk bags before shipment; and
- Overall plant tailings will be dewatered with a thickener and disc filter to produce sufficiently dry filter cake before haulage for storage to a surface Dry Stack Tailings Storage Facility.

Based on 900,000 t/a throughput at 6.18% C feed grade, 92% carbon recovery and 95% C concentrate grade were predicted.

A simplified flowsheet is shown as Figure 1-4.

Figure 1-4: Simplified Process Flow Diagram



Source: Bomenco (2022)

1.6 Mineral Resource Estimate

The Graphite Creek Resource estimate has been classified in accordance with guidelines established by the CIM "Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines" dated November 23rd, 2003 and CIM "Definition Standards for Mineral Resources and Mineral Reserves" dated November 27th, 2010.

The Graphite Creek Resource estimate has been classified as 'Indicated' and 'Inferred' according to the CIM definition standards. The classification was based on geological confidence, data quality and grade continuity. The most relevant factors used in the classification process were:

- Drill hole spacing; density;
- Level of confidence in the geological interpretation where the observed stratigraphic horizons are easily identifiable along strike and across the deposit, which provides confidence in the geological and mineralization continuity; and
- Estimation parameters (i.e., continuity of mineralization).

The parameters of each estimation pass were determined by the factors listed above and thus the classification of resources was guided by the estimation pass (Table 1-1). The single box search pass and pass 1 are considered to have a high level of confidence. Thus, they are unlikely to be drilled again and are placed within the 'Measured' category. Pass 2 used a range within 80% of the maximum sill variance, with at least two drill holes and are considered to be the next highest level of confidence, the 'Indicated' category. All remaining blocks estimated are considered within the 'Inferred' category which includes blocks estimated in passes 3-7. The updated Graphite Creek resource numbers for inferred, indicated and measured resources are summarized in Table 1-2.

Table 1-1: Classification Criteria

	Pass	Nominal Search Distance	Min. Number of Composites	Min. # of Drill Holes
Measured	BOX	1 x 1 x 1	1	1
	1	45 x 22 x 8	2	2
Indicated	2	100 x 50 x 20	2	2
Inferred	3	160 x 65 x 22	2	2
	4	80 x 32 x 11	1	1
	5	250 x 100 x 40	2	2
	6	125 x 50 x 20	1	1
	7	1500 x 500 x 500	1	1

Source: AES (2022)

Table 1-2: June 2022 Graphite Creek Updated Resource with Inferred, Indicated, and Measured Resources

Graphite Creek Resource Estimate Update: June 2022				
Mineral Resource Classification	Cut-Off Grade (% Cg)	Tonnage (Million Tonnes)	Graphite Grade (% Cg)	Contained Graphite (Tonnes)
Inferred	1	328.57	4.30%	14,116,795
	2	254.67	5.11%	13,004,017
	3	196.41	5.89%	11,566,233
	4	142.75	6.79%	9,686,980
	5	103.99	7.65%	7,950,965
Indicated	1	36.38	4.30%	1,562,806
	2	27.87	5.15%	1,435,135
	3	21.35	5.97%	1,273,779
	4	16.29	6.73%	1,096,952
	5	11.67	7.63%	889,914
Measured	1	5.43	5.22%	283,577
	2	4.67	5.83%	272,205
	3	3.99	6.40%	255,456
	4	3.22	7.08%	228,079
	5	2.44	7.92%	192,858
Measured + Indicated	1	41.81	4.42%	1,846,382
	2	32.54	5.25%	1,707,340
	3	25.34	6.03%	1,529,235
	4	19.51	6.79%	1,325,031
	5	14.10	7.68%	1,082,772

Source: AES (2022)

It should be noted the dip and location of the Kigluaik Fault that trends parallel and is adjacent to the mineralization of the deposit is a controlling factor of the graphite resource. The fault surface has been updated in 2019, 2020 and now in 2022. The updates in 2018 and 2019 resulted in resource truncated by the fault surface. New 2021 drilling indicated a shallow dip to the fault, resulting in minimal to no truncation of resource. Continued drilling is required to confirm the fault interpretation, particularly down dip. Outside of the central resource area (the area of 2018-2021 drilling), the fault has been interpreted as being vertical and thus will likely change significantly as additional drilling confirms the dip of the fault plane. Observed stratigraphic horizons continue to show remarkable consistency along strike with little deviation along strike which provides confidence in the geological and mineralization continuity.

Mineral resources are not mineral reserves and do not have demonstrated economic viability. There is no guarantee that all or any part of the mineral resource will be converted into a mineral reserve. Based on these early stages of exploration, the above resource analysis indicates that the Graphite Creek Property currently contains sufficient grade and tonnage to continue feasibility studies. The Property includes also includes excellent potential to increase the size of the resource.

1.7 Mineral Reserve Estimate

To convert mineral resources into a mineral reserve, estimates of commodity prices, mining dilution, process recovery, refining/transport costs, royalties, mining costs, processing, and general and administration costs were used to estimate cut-off grades (COG). These inputs parameters, along with geotechnical slope recommendations formed the basis for the selection of economic mining blocks.

The economic mining blocks were identified using the Lerchs-Grossmann algorithm in the NPVS software package which produced a series of optimized open pit shapes. The QP has selected one of these shapes for detailed design and then quantified the mineral reserves at the determined COG within the final pit design.

A summary of the Mineral Reserves for the project is shown in Table 1-3 within the designed final pit for the Graphite Creek deposit. In the detailed mine production schedule, the cut-off grade has been raised variably over the life of the project to 2.0% Cg for the first 12 years and then increased to 3.0% Cg beyond year 12 in order to maximize production at the STP. Any resources below the raised cut-off grades have been wasted. The effective date of the Mineral Reserve stated in this report is 29 August 2022.

The QPs have not identified any known legal, political, environmental, or other risks that would materially affect the potential development of the mineral reserves, except for the risk of not being able to secure the necessary permits from the government for development and operation of the project; however, the QPs are not aware of any unique characteristics of the project that would prevent permitting.

Table 1-3: Proven and Probable Mineral Reserve Estimate

Class	Diluted Tonnes (k tonnes)	Diluted Grade (% Cg)	Contained Graphite (k tonnes)
Proven	3,812	6.0	230
Probable	18.678	5.5	1,028
Total Proven and Probable	**22,490**	**5.6**	**1,258**

Notes:

1. Mineral Reserves follow CIM definitions and are effective as of 29 August 2022
2. Mineral Reserves are estimated using a raised variable cut-off of 2.0% Cg – 3.0% Cg which is required to maximize secondary treatment production. The economic cut-off grade is 0.7% Cg based on a net average Graphite Price of US$7,677/t (including transport & treatment charges) and a mill recovery of 90%.
3. The final pit design contains an additional 7.6 Mt of Measured and Indicated resources between the raised cut-off grade (2% Cg - 3% Cg) and the economic cut-off grade (0.7% Cg) at an average grade of 1.7% Cg. These resources have been treated as waste in the final mine production schedule.

4. The final pit design contains an additional 14.0 Mt of Inferred resources above the economic cut-off grade (0.7% Cg) at an average grade of 5.2% Cg. Inferred Mineral Resources are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorized as Mineral Reserves, and there is no certainty that any part of the Inferred Resources could be converted into Mineral Reserves.
5. Tonnages are rounded to the nearest 1,000 t, graphite grades are rounded to one decimal place. Tonnage measurements are in metric units.

1.8 Mining

The Graphite Creek Deposit is near surface containing several graphite zones which dip generally to the north at 40° to 78°. The strike length of the deposit is several kilometers long; however, the current defined resources of the deposit is approximately 1 km long. The thickness of the modeled graphite zones within the pit area varies widely from 4 m to 60 m and where mineralized zones run parallel to each other, the distance between the host rock hangingwall and footwall can exceed 180 m. The Kigluaik fault runs parallel to the strike of the deposit and the current assumption is that all material North of this fault is overburden or loose rock type material.

The Graphite Creek deposit has been planned to be developed as an open pit mine. Material will be drilled and blasted on 8 m benches and then excavated using 7 m^3 front-end loaders, and 55 t trucks. Ore will be processed at a nominal production rate of 1 Mt/a or 2,740 t/d. Over the life-of-mine (LOM), the mine will produce 22.5 Mt of ore at an average graphite grade of 5.6% Cg, along with 50 Mt of waste. Ore material is to be sent directly to the primary crusher or a temporary stockpile, located 2 km to the East of the pit. Waste material will be co-mingled with tailings in the Tailings Management Facility (TMF) located 1.5 km North of the pit.

The open pit was optimized in software using the Lerchs-Grossmann algorithm in combination with the input parameters shown Table 1-4. A pitshell was selected based on both mitigating risk (waste stripping requirements) and maximizing potential revenues. The selected shell formed the basis for detailed design, final reserves and production scheduling.

Table 1-4: Open Pit Optimization Parameters

Parameter	Unit	Value
Revenue, Smelting & Refining		
Average Final Product Price	US$/tonne	$7,250
Payable Adjustments	US$/tonne	+$3,221
TC/RC/Transport	US$/tonne	-$3,155
Royalties	US$/tonne	-$23
Net Graphite Price	US$/tonne Cg	$7,677
Operating Costs		
Mining	US$/t mined	7.4
Milling	US$/t processed	30.0
G&A	US$/t processed	16.4

Parameter	Unit	Value
Recovery and Dilution		
External Mining Dilution	%	0
Mining Recovery	%	95
Process Recovery	%	90
Cut-off Grades		
Mill Cut-off Grade	% Cg	0.7

1.9 Recovery Methods

1.9.1 Primary Processing Plant (Alaska)

Plant design capacity is based on processing 900,000 t/a or 2,465 t/d of ROM material containing 6.18% Cg. An operating schedule of 365 days per year, 2 x 12-hour shifts per day was assumed for the grinding circuit and downstream operations. Crushing plant operation is based on 1 x 12-hour shift per day.

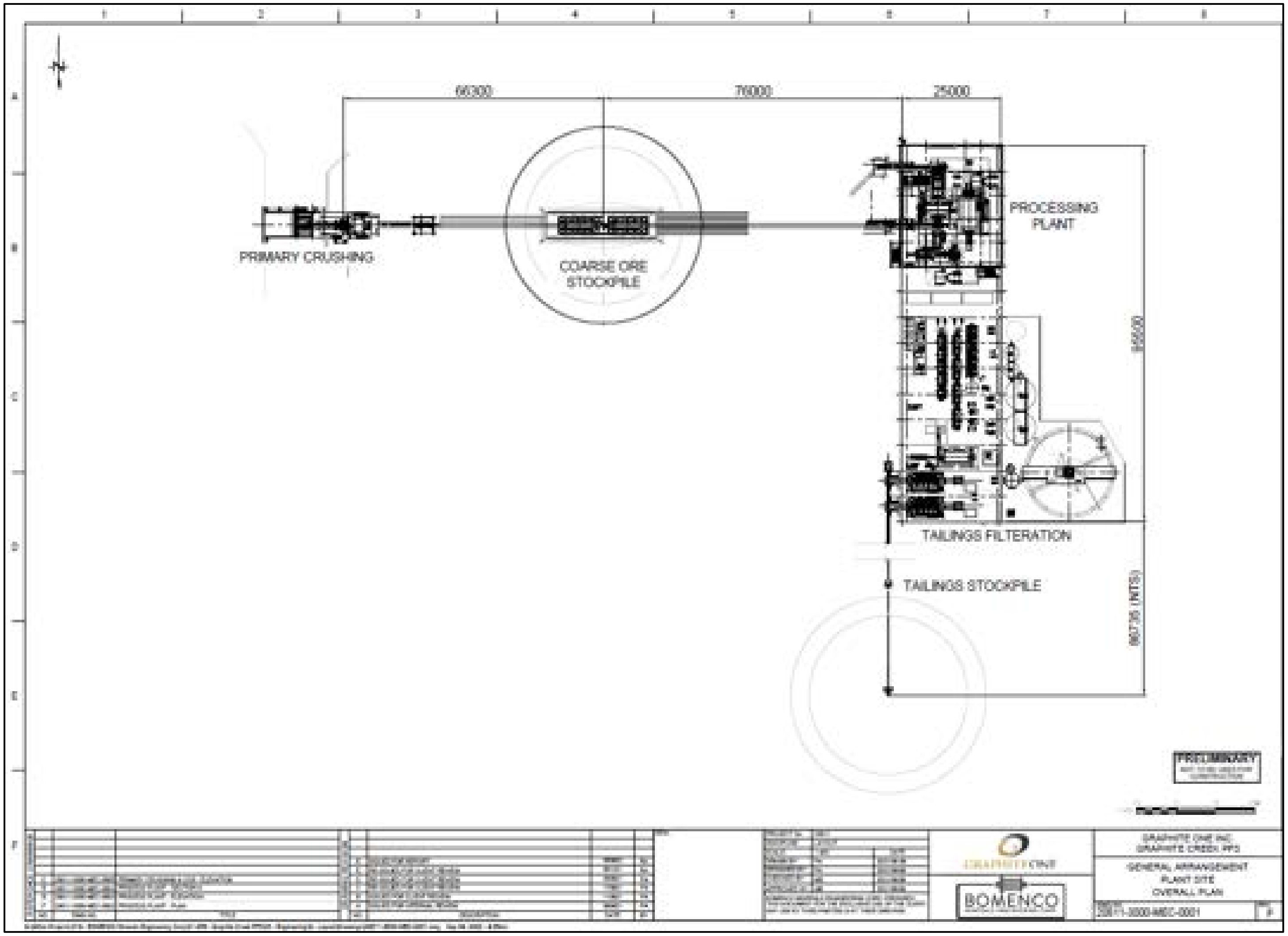
Plant design consists of the following major processing steps:

- The comminution circuit will include a single-stage crushing, coarse ore stockpiling and SAG milling in closed circuit with cyclones targeting 80% passing 320 µm grind;
- The grinding circuit will include a flash flotation step while the comminution circuit product will proceed to rougher flotation;
- Rougher and flash flotation concentrates will be combined for open circuit polishing grind and the subsequent seven stages of cleaning with stirred media milling after the second and fourth cleaner stages;
- The graphite concentrate will be dewatered with a filter press followed by drying through a diesel-fired indirect dryer before cooling and packing in 1 t bulk bags before shipment; and
- Overall plant tailings will be dewatered with a thickener and disc filter to produce sufficiently dry filter cake before haulage for storage to a surface Dry Stack Tailings Storage Facility.

Based on 900,000 t/a throughput at 6.18% C feed grade, 92% carbon recovery and 95% C concentrate grade were predicted.

A general arrangement of the primary processing plant is shown as Figure 1-5.

Figure 1-5: General Arrangement of Primary Processing Plant



1.9.2 Secondary Treatment Plant (Washington)

The STP is designed to produce lithium-ion battery anode materials on a commercial scale for the U.S. domestic market using natural graphite and other materials. It would start operation and continue for an estimated period of four years by processing purchased graphite while the Graphite Creek mine is progressing through permitting and construction. Alaska graphite would be phased in as soon as it is available.

The STP will be constructed in two Phases, with Phase 1 representing 50% construction and production capability. At full capacity (Phase 2), the STP requires about 34.5 ha (85 acres) of land, consists of 17 buildings, and would annually produce about 77,000 t of manufactured graphite products. The general arrangement drawings for Phase 1 and Phase 2 are shown as Figure 1-6 and Figure 1-7.

The products are grouped into battery anode materials, specialty purified graphite products, and traditional unpurified graphite products. The products are manufactured from natural graphite concentrate, artificial graphite precursors, coke and pitch. Key components of the manufacturing process are the purification of natural graphite and graphitization of artificial graphite precursors in high temperature, electrically heated furnaces. The STP's preferred location is in Washington State to access both its relatively lower power rates from hydro generated electricity and its skilled workforce.

Permitting and construction of the STP, once its design is finalized, is expected to take three years. The STP would be constructed in two phases, each with almost identical equipment and production capacity. An exception is that Phase 2 has three furnace lines, Phase 1 has two. Phase 1 is assumed to operate at 90% capacity for the first year to allow for startup adjustments. Thereafter it would operate at full capacity. Phase 2 would come on stream in Year 2 and the STP would operate at full capacity. Phase 1 requires a workforce of 123 and Phase 2, 155.

The STP, at full capacity, is designed to produce 51,167 t/a of anode materials for the electric vehicle and energy storage battery markets; 7,585 t/a of purified, sized material for the specialty graphite market; and 18,622 t/a for the unpurified, traditional graphite market (see Table 1-5). Total annual production would be 77,374 t based on the expected annual production capacity. The average annual production over 26 years in the PFS is 75,026 t.

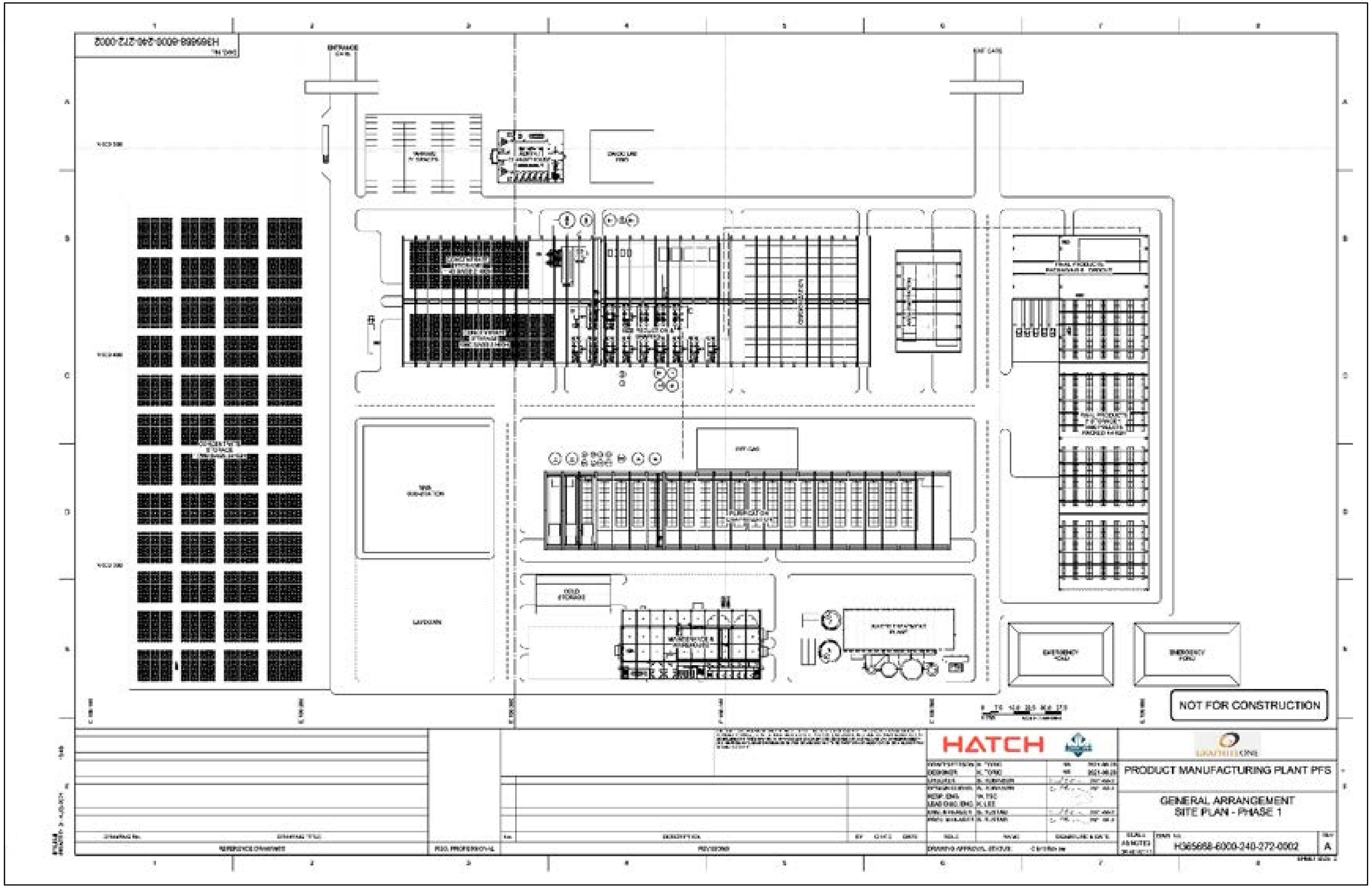
The STP product manufacturing process has been designed by Graphite One and provided to Hatch to produce process drawings, process mass balances and building designs. The process layout and buildings were engineered by Hatch Ltd. based on the process requirements provided by Andrew Tan of Graphite One.

Table 1-5: STP Products and Production Rates

No.	Category	Name	Description	Purity (%Cg)	Ph 1 (t/a)	Total (t/a)	Ph 2 (t/a)	Total (t/a)
1	**Anode Material**	CPN	Coated, spherical NG	99.95	6,015	**25,584**	12,030	**51,167**
2		BAN	Blended AG and NG	99.95	11,458		22,915	
3		SPN	Secondary Particle NG	99.95	1,829		3,658	
4		SPC	Secondary Particle Composite	99.95	6,282		12,565	
5	**Purified**	3299	+32 Mesh Purified	99+	59	**3,792**	117	**7,585**
6		599	+50 Mesh Purified	99+	527		1,055	
7		899	+80 Mesh Purified	99+	586		1,172	
8		199	+100 Mesh Purified	99+	977		1,953	
9		Battery Conductor	-320 Mesh Purified	99.9	692		1,386	
10		Synthetic Diamond Precursor	-320 Mesh Purified	99.99	951		1,902	
11	**Unpurified**	3295	+32 Mesh	95+	95	**9,311**	189	**18,622**
12		595	+50 Mesh	95+	851		1,701	
13		895	+80 Mesh	95+	945		1,890	
14		195	+100 Mesh	95+	1,575		3,150	
15		Carbon Raisers Lubricants	Carbon Raisers Lubricants	95+	4,640		9,279	
16		Coke Reject	Coke Reject	95+	1,207		2,413	
						38,687	**Total**	**77,374**

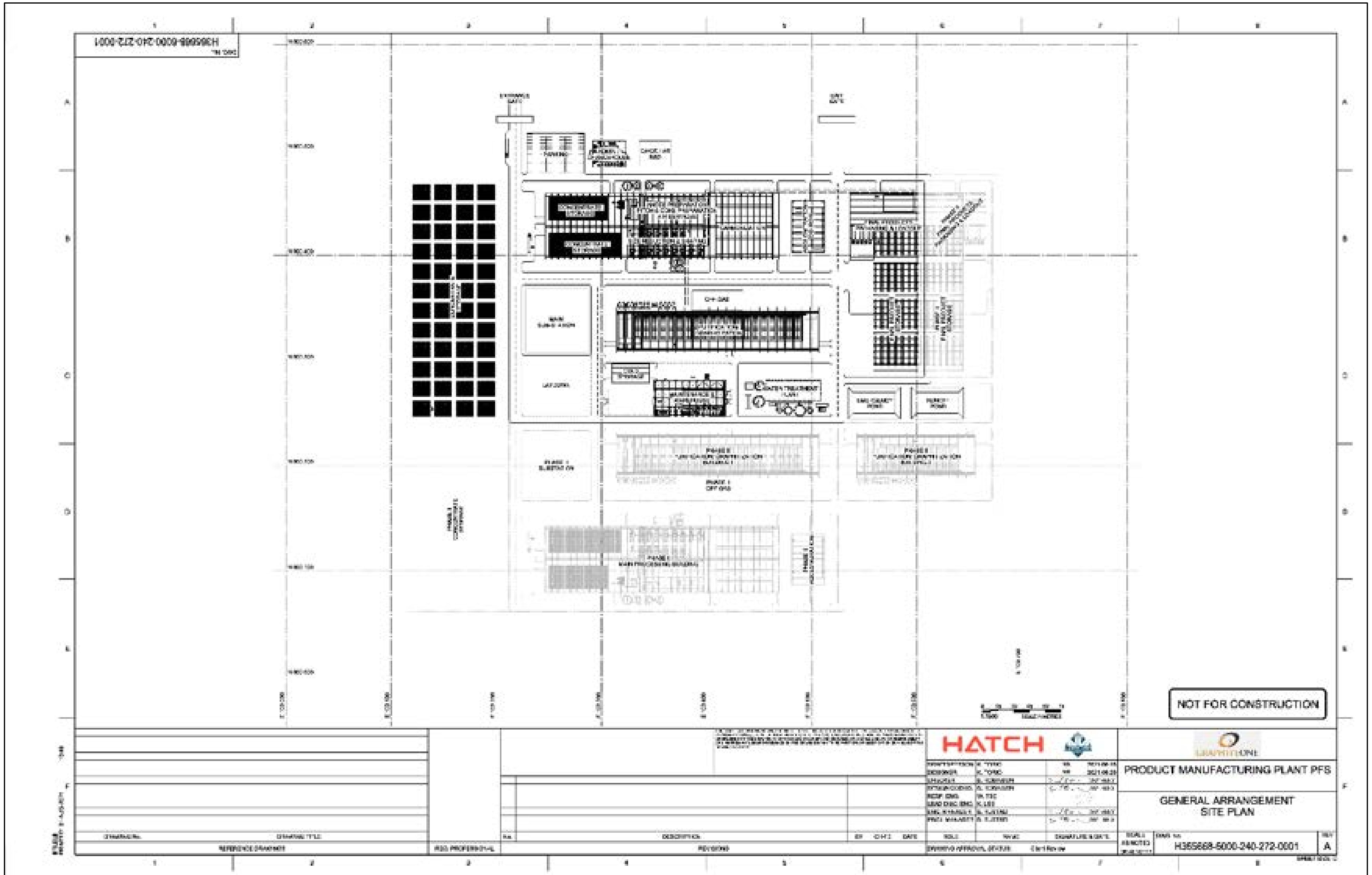
Note:
NG = Natural Graphite AG = Artificial or Synthetic Graphite
Source: Tan (2022)

Figure 1-6: Secondary Treatment Plant General Arrangement - Phase 1



Source: Hatch (2022)

Figure 1-7: Secondary Treatment Plant General Arrangement – Phase 2



Source: Hatch (2022)

1.10 Infrastructure

The Mine site is located approximately 60 km north of Nome, Alaska near the Imuruk Basin, on the Seward Peninsula. There is no current road access to the Property, with the Nome-Teller highway as the closest seasonal road to the southeast.

1.10.1 Site Facilities

Infrastructure Facilities located at the Alaska mine site include:

- Primary crusher, coarse ore stockpile, process plant site pad and buildings;
- Tailings and concentrate filtration;
- Tailings management facility for dry stack and mine waste rock storage;
- Covered tailings stockpile;
- Concentrate storage area;
- Water management facilities including diversion ditches, seepage collection pond, water management pond, overland piping, and pumping;
- Water treatment plant;
- Onsite haul and access roads and various laydowns;
- Explosive and cap magazines;
- Assay Lab;
- Truck shop;
- Cold storage and heated warehouse;
- Bulk fuel storage and distribution; and
- Camp buildings and supporting infrastructure.

1.10.2 General Site Arrangement

The site layout has been designed to minimize environmental and community impacts, provide security-controlled site access, minimize construction costs and optimize operational efficiency. Primary buildings have been located to allow easy access for construction and utilize existing topography to minimize bulk earthworks volumes. The Alaska site layout can be found in Figure 1-8. The Alaska plant site and main infrastructure facilities can be found in Figure 1-9.

Figure 1-8: Overall Site Layout

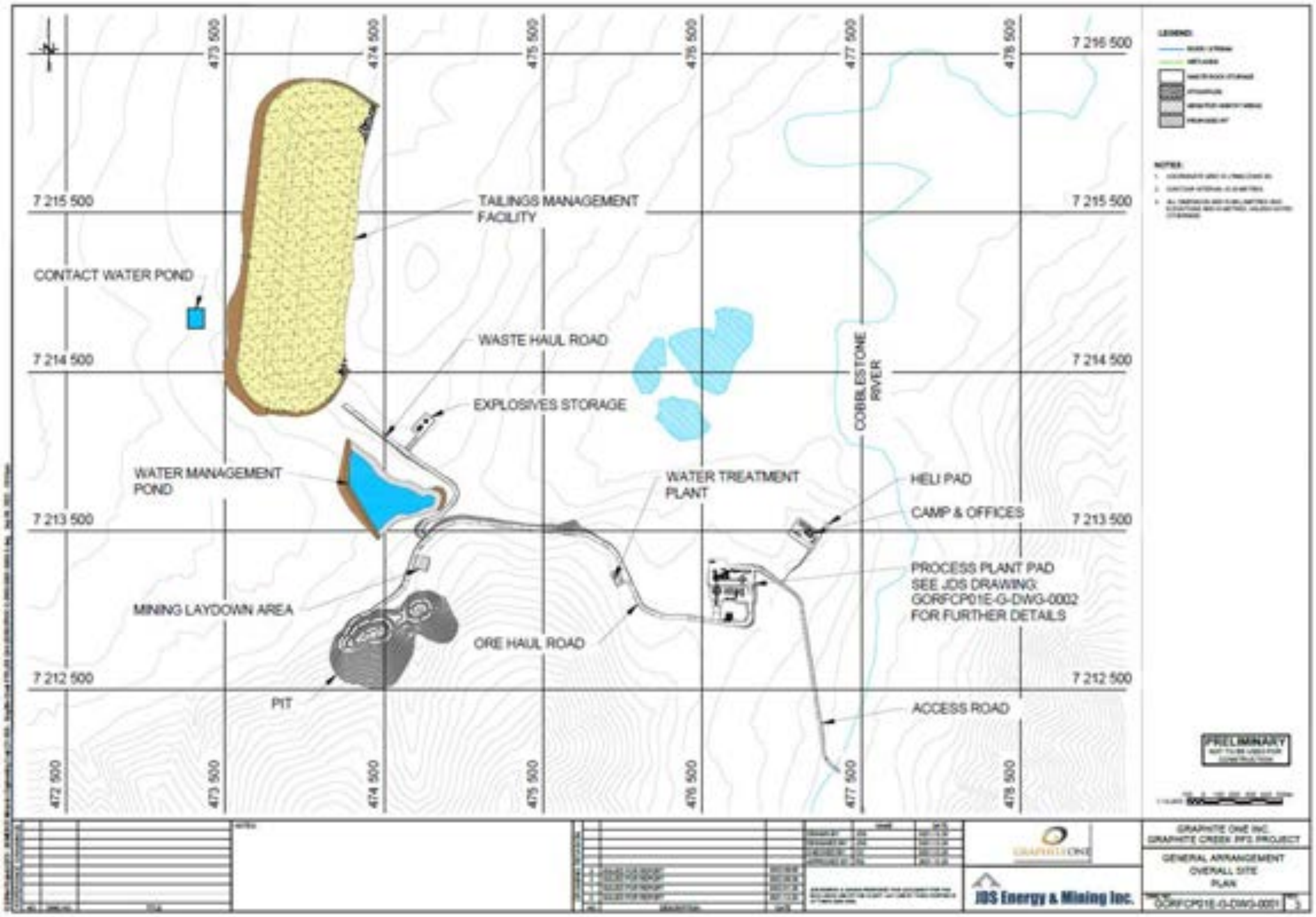
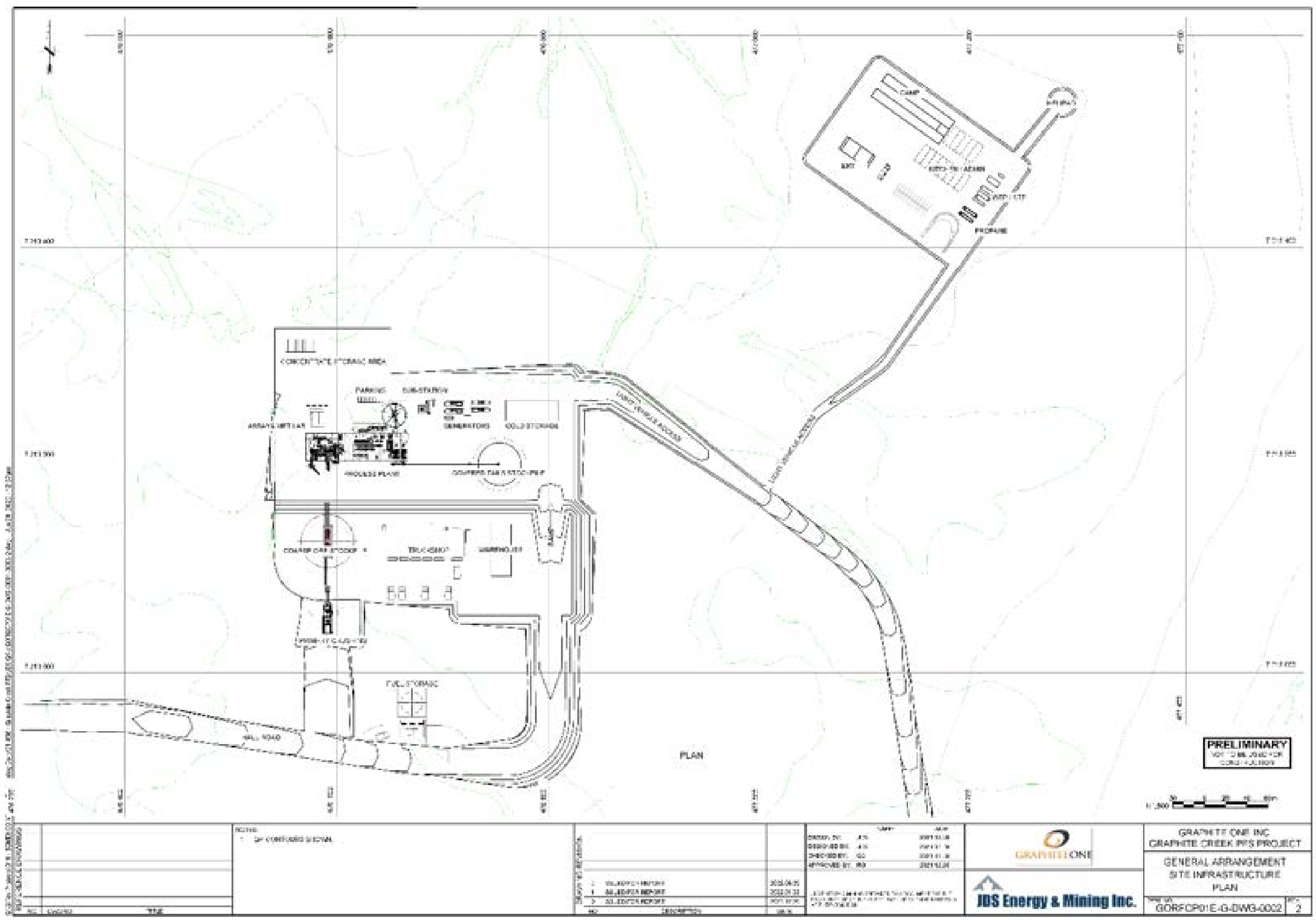


Figure 1-9: Plant Site & Main Infrastructure



1.10.3 Access to Site

A 27.8 km long, two lane, gravel site access road will connect the mine to the Kougarok Road, which will provide year-round road access to the city of Nome. The new 27.8 km section of road will include an 8 m driving width, and six bridge crossings designed for 80-ton capacity. The road will begin at Milepost 29.6 of the Kougarok Road. The road will immediately cross headwaters of Nome Creek before trending west along the north side of Buffalo Creek. Near Kilometer Post (KP) 1.5, the route will cross Buffalo Creek before cresting a low pass and descending to the Sinuk River crossing at KP 7. Around KP 9, the route will turn north along the east flank of Windy Creek valley before climbing up to Mosquito Pass (elev. 350 m). After cresting the pass at KP 15, the route will descend along the east flank of the Cobblestone River valley north to a crossing of the Cobblestone River just below its confluence with the Oro Grande Creek at KP 25. The proposed mill site and road terminus is located on a low ridge immediately east of Cobblestone River at the north flank of the Kigluaik Mountains.

1.10.4 Waste Storage

The principal objectives for the Waste Management Facility (WMF) and associated infrastructure are to provide safe and secure storage of tailings and waste rock, to protect regional groundwater and surface water during operations and in closure, and to achieve effective reclamation. The filtered tailings and waste rock are assumed to be Potentially Acid Generating (PAG) and will be co-disposed in a single facility. There is no storage of water at the WMF. The primary water storage facility on site is the Water Management Pond (WMP).

The WMF is located north of the open pit on a western facing slope. The facility is designed to store approximately 63 Mt of filtered tailings and waste rock and includes a HDPE basin liner and a stabilizing buttress constructed with non-PAG earthfill and rockfill materials. The tailings and waste rock will be co-mingled to create a blended, compacted, low permeability material. The WMF will be constructed in three stages, progressing further north with each stage. Contact water will be managed in the Contact Water Pond (CMP) located west of and downstream of the WMF, and the WMP located adjacent to the Open Pit. Overburden and topsoil removed during Open Pit stripping activities and the development of the WMF and the WMP will be stored to the west of the WMF with the materials used in construction throughout the Project life or reclamation activities.

The WMF will be constructed with slope graded at 4H:1V and a relatively flat crest surface (nominal 1% grade). The staging plan allows for progressive reclamation from the southern extent progressing towards the north as tailings and waste rock are placed within the facility.

The closure cover includes a 1.0 m thick layer of low permeability overburden material placed above the co-mingled tailings and waste rock material and an 80 mil HDPE geomembrane to form a composite liner. The top liner will be welded to the basin liner to completely encapsulate the tailings and waste rock. The facility will be capped with a nominal 2.0 m thick layer of non-PAG material to improve long-term geotechnical stability. The capping layer may be tapered at the base of the facility and increase in thickness towards the crest to optimize geotechnical stability. Overburden and topsoil will be spread above the capping material and the facility will be revegetated as part of reclamation activities.

1.10.5 Water Management

The water management plan includes separate management of non-contact and contact water. Non-contact water will be collected and diverted around facilities to the maximum extent practical. This includes diverting flows from Graphite Creek above the Open Pit around the Open Pit. Contact water will be managed via diversion ditches, spillways, ponds, sumps, pipes, and pumps and treated as required prior to release in a controlled manner to Graphite Creek and ultimately Imuruk Basin.

The site will be in a water surplus condition water balance due to increasing rates of groundwater inflows into the Open Pit as the mine expands. It is estimated the water treatment plant will need to treat up to approximately 8,000 m^3/day through the non-winter months.

The WMP will be the primary water storage facility on site and will collect all site contact water prior to being treated and discharged to the environment. Water will be pumped from the WMP to the Plant Site for use in the mill process, or to the WTP for treatment prior to discharge to the environment. Non-contact water will be diverted around the WMP to the maximum extent practical. The WMP will be a fully lined facility.

The closure and reclamation plan for the WMP includes breaching the dams and removing the HDPE geomembrane prior to reclaiming the basin footprint. The surface area of the pond footprint will be covered with topsoil and revegetated to resemble natural terrain at the Project site.

1.10.6 Water Treatment

A pit lake water quality model was developed to estimate closure water quality. The results of the pit lake model were used to inform the project treatment design and costing. The water model will continue to be refined as additional HCT test results are received.

Water treatment will be required to discharge excess water during operations and closure. During operations, excess water from the water management pond is anticipated to be acidic (pH ~4) and to have elevated metal concentrations (SRK 2022a). Contact water collected in the pit will also need to be treated during closure. The primary constituent of concern is iron. Other constituents predicted to exceed Alaska Freshwater Aquatic Life Standards include:

- Aluminum;
- Antimony;
- Arsenic;
- Cobalt;
- Copper;
- Manganese;
- Nickel;

- Selenium; and
- Zinc.

A high-density sludge water treatment plant will be constructed to treat excess WMP water for during operations. Water treatment will continue from construction through the demolition of the site infrastructure and closure of the mine waste facilities. After the mine closes, contact will be conveyed to the pit. The pit will fill with pit wall runoff, groundwater inflows, direct precipitation and other sources of contact water as needed. Flooding the pit will take approximately 10 years (SRK 2022b).

1.10.6.1 Operation Phase Water Treatment

KP (2022) describes the site water balance during operations. The water management system is anticipated to have sufficient storage capacity to attenuate seasonal variations in flow. The water treatment plant design flow rate is 1520 g/m. The water treatment plant will operate for seven months a year from April through October. The operational water treatment plant is anticipated to be decommissioned one year after the site is closed.

1.10.6.2 Closure Phase Water Treatment

A second water treatment plant will be constructed after the pit floods to manage the pit water level and treat the contact water that fills the pit. On average, approximately 277,350 m^3 of water will need to be treated annually and discharged from the pit. The design flow rate of the water treatment plant is 900 g/m. The water treatment plant will operate two months per year, likely during July and August. Operation of the water treatment plant during closure will require logistical support and planning for a remote camp on site. The costs to maintain the camp are not included in the closure water treatment cost estimate. Water treatment in perpetuity is expected because of the exposed pit high wall. The following needs to be evaluated in future studies to advance the understanding of water treatment for the Graphite One Project:

- Limnological and ecological characterization of Imuruk Basin;
- Water quality regulations for Imuruk Basin that affect the discharge of treated water; and
- Removal of antimony and arsenic by coprecipitation with iron concentrations in the influent to the water treatment plant.

1.11 Environment and Permitting

The Project has initiated a series of studies to characterize the major environmental resources in the project area which are necessary to collect the data necessary for permitting and *National Environmental Policy Act* (NEPA) analysis. The most critical studies are underway, and include the following:

- **Wetlands** - A complete delineation of the wetlands types in the project area is necessary to obtain the US Army Corps of Engineers (ACOE) permit under Section 404 of the *Clean Water Act* (wetlands permit). This is a critical authorization, as it is the only major federal authorization necessary for this project and will trigger the NEPA review. Field mapping was initiated in 2019 and was completed in 2021.This mapping is at a detail required for the Preliminary Jurisdictional Determination, which will be necessary for the ACOE to make its decisions on the Section 404 permit.

- **Water Quality** - Understanding the baseline hydrology and water quality, and the potential impacts of the proposed activity to water in the project area are fundamental parts of the NEPA analysis. Baseline water quality sampling of streams in the project area began in 2014.

  Groundwater studies (hydrogeology) quantify baseline conditions, predict impacts to surface water resources during mining and post-mining, and provide input to operational considerations such as water handling and treatment. A minimal program was accomplished in 2019 with more comprehensive ongoing studies. Hydrogeologic investigations, begun 2021, will lead to a hydrogeologic conceptual model.

- **Air Quality** - Most likely, the major issue with respect to air quality will be power plant emissions and control of fugitive dust. An air quality permit requires baseline data, and a meteorological tower was installed in the project area in October of 2019. The instrument package on the tower will continue to measure a number of parameters necessary for modelling.

- **Aquatic Resources** - In 2019, Graphite One initiated an aquatic baseline data collection program in anticipation of project planning and environmental evaluation. Data collection was designed to establish baseline conditions of aquatic communities and water quality while quantifying natural variability of both, and to evaluate the overall health and productivity of the drainage. The goal of the aquatic baseline study is to collect data to support the NEPA evaluation and ADFG Fish Habitat Permit review and issuance.

- **Marine Environment** - A characterization of Imuruk Basin will be necessary, and should include bathymetry, current flow analysis, water and sediment quality, and aquatic life. This characterization will be necessary for APDES permitting, should the project pursue discharge of treated water into the basin. All the rivers and streams proximal to the mine site flow into Imuruk Basin.

Additional baseline environmental studies which will be necessary, and will be initiated soon, include wildlife, cultural resources, visual resources, noise, and land use.

The major state and federal authorizations for this project include:

- Plan of Operations, Reclamation Plan & Bond, Millsite Lease (Alaska Department of Natural Resources);
- Air Quality Control Permit (Alaska Department of Environmental Conservation);
- Alaska Pollutant Discharge Elimination System Permit (Alaska Department of Environmental Conservation);
- Solid Waste Management Permit (Alaska Department of Environmental Conservation);
- Section 404 Wetlands Permit (U.S. Army Corps of Engineers);

- Right-of-Way Permit and Material Sites (Alaska Department of Natural Resources);
- Tidelands Lease (Alaska Department of Natural Resources);
- Temporary Water Use Authorizations (Alaska Department of Natural Resources);
- Stormwater Plan (Alaska Department of Environmental Conservation);
- Fish Passage Permits (Alaska Department of Fish and Game);
- Essential Fish Habitat Authorization (US Fish and Wildlife Service);
- Eagle, Migratory Bird, Threatened and Endangered Species clearance (National Oceanic and Atmospheric Administration);
- Cultural Clearance (U.S. Army Corps of Engineers & Alaska Department of Natural Resources); and
- Dam Safety Permit (Alaska Department of Natural Resources).

Federal requirements under the *National Environmental Policy Act* (NEPA) provide the structure for Alaska's Large Mine Permit Process. The NEPA requires federal agencies to incorporate environmental considerations into decision-making. All major federal actions require a NEPA analysis, and the wetlands permit from the U.S. Army Corps of Engineers (ACOE) constitutes a major federal action under the law. Consequently, Graphite Creek will require a NEPA analysis: either an Environmental Assessment (EA) or the longer, more expensive Environmental Impact Statement (EIS).

Alaska state agencies use the Alaska Large Mine Permitting Process (LMPP) to work with the federal agencies during NEPA and to issue state decisions on a mine.

The Project has an active consultation program with the communities of Brevig Mission, Mary's Igloo and Teller, which are closest to the project area. Project staff have also maintained communication with various regional entities and organizations and entities based in Nome such as: The City of Nome, Bering Straits Native Corporation, Nome Eskimo Community, Nome Chamber of Commerce, Kawerak, and the Norton Sound Economic Development Corporation. Graphite One staff have also conducted preliminary consultations with state, federal agencies.

1.11.1 Factors for Consideration

- **Subsistence** - One of the biggest concerns for the residents of the communities near the project is their ability to access fish, game, and other resources necessary for their subsistence way of life. The Project has developed a Subsistence Advisory Council, with representatives from the communities, to provide advice on how to avoid subsistence impacts.
- **Geochemistry, Acid-Rock Drainage, and Metals Leaching** - The permitting issue which takes up the most agency time, and which most influences mine design and costs is usually the mine's ability to control and discharge water. And water quality is, in turn, a function of the mine's water budget and geochemistry: specifically, the potential for acid-rock drainage

and metal leaching. Studies are ongoing to characterize the geochemistry of the waste rock and tailings.

- **Groundwater** - A substantial percentage of the water that must be controlled and discharged is a result of pit dewatering. The factors that may control water flow into the pit and consequently the geochemistry of the water to be treated are poorly understood and the subject of ongoing studies. Studies are ongoing to characterize the groundwater of the project area.

- **Closure** - At the end of mine life, the mine will be closed and reclaimed in accordance with state laws and regulations. The primary authorities that set closure requirements are 1) DNR Reclamation Plan Approval, 2) ADEC Waste Management Permit, and 3) DNR Dam Safety Certification for any jurisdictional dam structures. These authorizations are described in more detail in Section 20.3.

1.12 Operating and Capital Cost Estimates

The capital cost estimate was prepared using first principles, applying project experience and avoiding the use of general industry factors. The estimate is derived from engineers, contractors, and suppliers who have provided similar services to existing operations and have demonstrated success in executing the plans set forth in the study. Given that assumptions have been made due to a lack of available engineering information, the accuracy of the estimate and/or ultimate construction costs arising from the engineering work cannot be guaranteed. The estimate meets a AACE Class 4 (FEL4) estimate, with a target accuracy of -15 to -30% on the low side, and +20 to 50% on the high side.

Costs are expressed in US$ with no escalation unless stated otherwise.

The estimate is based on the assumption that contractors would mobilize only once to carry out their work and are not already mobilized on site performing other work.

LOM Project capital costs total $1,484.9M, consisting of the following distinct phases and sites.

1.12.1 Alaska Mine and Processing Plant

- Pre-production capital costs – Includes all costs to develop the Property to operations. Initial capital costs total $579.7M and are expended over a 36-month pre-production period on engineering, construction, and commissioning activities;

- Sustaining capital costs – includes all costs related to the acquisition, replacement, or major overhaul of assets during the mine life required to sustain operations. Sustaining capital costs total $244.4M and are expended in the first year of operations at the Alaska mine site and carry through 24 years of operations; and

- Closure Costs – includes all costs related to the closure, reclamation, and salvage value, post operations. Closure costs total $125M and are expected in Year 24 and 25. Closure costs which occur for an extended period in the post closure phase have been included at the current value in Year 25.

1.12.2 Secondary Treatment Plant

Pre-production capital costs – includes all costs to develop the Property to an operating treatment plant facility. Initial capital costs total $660.8M and are expended over a 24-month pre-production period for engineering, construction, and commissioning activities. Due to the lag between startup of the STP and production of concentrate from the mine site, the pre-production cost period for the STP ends one year in advance of the pre-production period at the mine site.

Table 1-6: Summary of Capital Cost Estimate

Capital Costs	Pre-Production (M$)	Sustaining / Closure (M$)	Total (M$)
Open Pit Mining	51.9	19.5	71.3
On-Site Development	112.4	60.9	173.2
Process Plant	119.6		119.6
Alaska Infrastructure	95.5		95.5
Alaska Indirect Costs	119.9		119.9
Secondary Treatment Plant (STP) WA	490.0		490
STP Indirect Costs - WA	81.1		81.1
Subtotal	**1,070.4**	**80.4**	**1,275.7**
Contingency	170.1	39.1	209.2
Closure		125.0	125.0
Total Capital Costs	**1,240.5**	**244.4**	**1,484.9**

The operating cost estimate was prepared using first principles, applying project experience and avoiding the use of general industry factors. Inputs are derived from engineers, contractors and suppliers who have provided similar services to other projects.

The operating cost estimate is broken into five major sections:

- Mining;
- Alaska Processing;
- Secondary Treatment Plant Processing;
- Transportation; and
- General & Administrative.

Certain items within the operating costs begin during the construction phase and continue through the life of the mine. Some of the costs incurred during the pre-production period relate to the costs to purchase items such as consumables required for the following year of production. The timing of these costs has been accounted for in the economic analysis.

Operating costs are presented in 2022 US dollars on a calendar year basis. No escalation or inflation is included.

The total operating unit cost is $71.07/t processed for the site in Alaska, and $3,908.7/t concentrate processed for the Secondary Treatment Plant, and exclusive of ocean transportation. Summaries of the operating costs are provided in Table 1-7 and Table 1-8.

Table 1-7: Breakdown of Estimated Operating Costs - Alaska

Operating Costs - Alaska	$/t Milled	LOM M$
Mining	23.08	519.1
Processing	29.97	674.1
G&A	18.01	405.1
Total	71.07	1,598.3

Table 1-8: Breakdown of Estimated Operating Costs – Transport & STP

Operating Costs	$/t Concentrate	LOM M$
Transport	314.4	374.7
Secondary Treatment Plant	3,308.7	3,942.9
Total	3,623.1	4,317.6

1.13 Economic Analysis

An engineering economic model was developed to estimate annual cash flows and sensitivities of the Project. Pre-tax estimates of Project values were prepared for comparative purposes, while after-tax estimates were developed and are likely to approximate the true investment value. It must be noted, however, that tax estimates involve many complex variables that can only be accurately calculated during operations and, as such, the after-tax results are only approximations.

Univariate sensitivity analyses were performed for variations in metal prices, head grades, operating costs, capital costs, and discount rates to determine their relative importance as Project value drivers.

This technical report contains forward-looking information regarding projected mine production rates, construction schedules and forecasts of resulting cash flows as part of this study. The mill head grades are based on sufficient sampling that is reasonably expected to be representative of the realized grades from actual mining operations. Factors such as the ability to obtain permits to construct and operate a mine, or to obtain major equipment or skilled labour on a timely basis, to achieve the assumed mine production rates at the assumed grades, may cause actual results to differ materially from those presented in this economic analysis.

The reader is cautioned that the refined product prices and exchange rates used in this study are only estimates based on recent historical performance and there is absolutely no guarantee that they will be realized if the Project is taken into production. The price of refined graphite products is based on many complex factors and there are no reliable methods of predicting the long-term price.

1.13.1 Main Assumptions

Table 1-9 provides the product pricing for the varied refined products that are used in the analysis.

Table 1-9: Product Pricing and Exchange Rates

Product	Sale Price (US$/t)
CPN: Coated, spherical Natural Graphite (NG)	8,030
BAN: Blended Artificial/Natural Graphite	10,585
SPN: Secondary Particle NG Anode	8,890
SPC: Secondary Particle Composite Anode	8,890
3295: + ’32 Mesh	1,820
595: + ’50 Mesh	1,820
895: + ’80 Mesh	1,515
195: + ’100 Mesh	1,325
3299: + ’32 Mesh Purified	10,230
599: + ’50 Mesh Purified	7,980
899: + ’80 Mesh Purified	6,800
199: + ’100 Mesh Purified	5,490
Carbon Raisers Lubricants	1,860
Battery Conductor, -320 Mesh	9,210
Synthetic Diamond RM, -320 Mesh	6,450
Rejected Coke Product	210
Weighted Average	7,301

Mine revenue is derived from the sale of refined graphite products into the international marketplace. No contractual arrangements for production currently exist. Table 1-10 indicates the NSR parameters that were used in the economic analysis.

Table 1-10: NSR Parameters

Parameter	Unit	Value
Graphite Recovery (Mine Site)	%	95
Graphite Products Payable	%	100
Royalties	%	1.0

The Project has been evaluated on an after-tax basis to provide a more indicative, but still approximate, value of the potential Project economics. A tax model was prepared by Mining Tax Planners, an independent tax consultant, and reviewed by JDS and Graphite One personnel. Current tax pools were used in the analysis. The tax model contains the following assumptions:

- Federal Income Tax: 21%;
- Alaska State Income Tax: 9.4%;
- Alaska Mining License Tax: 7.0%;
- Washington Business & Occupation Tax: 0.05%; and
- Advanced Manufacturing Production Tax Credit is available.

1.13.2 Results

The economic results for the Project, based on the assumptions outlined above are presented in Table 1-11.

Table 1-11: Summary of Results

Summary of Results	Unit	Value
Capital Costs		
Pre-Production Capital	M$	1,070.4
Pre-Production Contingency	M$	170.1
Total Pre-Production Capital	**M$**	**1,240.5**
Sustaining and Closure Capital	M$	205.3
Sustaining and Closure Contingency	M$	39.1
Total Sustaining and Closure Capital	M$	244.4
Total Capital Costs Incl. Contingency	**M$**	**1,484.9**
Working Capital	M$	18
Pre-Tax Cash Flow	LOM M$	6,812.4
Taxes	LOM M$	1,600.3
After-Tax Cash Flow	LOM M$	5,212.0

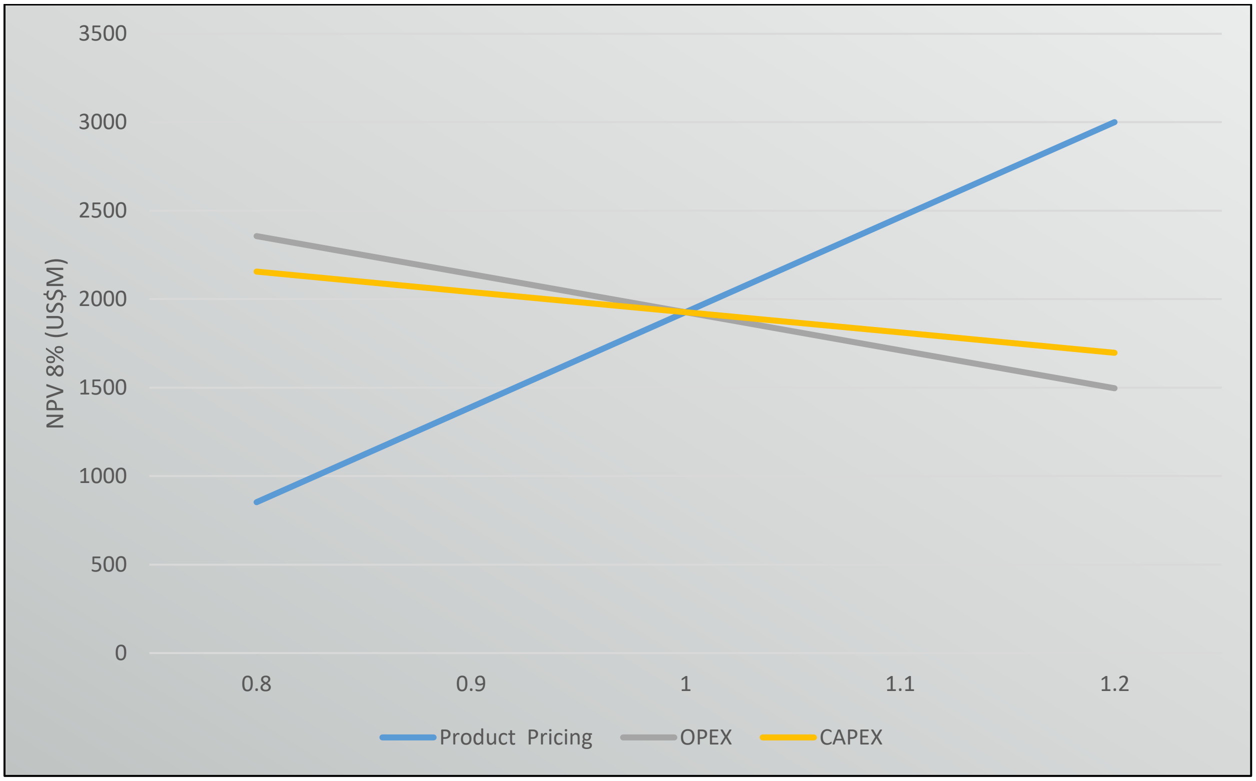
Summary of Results	Unit	Value
Economic Results		
Pre-Tax NPV8%	**M$**	**1,927**
Pre-Tax IRR	**%**	**26**
Pre-Tax Payback	**Years**	**4.6**
After-Tax NPV8%	**M$**	**1,398**
After-Tax IRR	**%**	**22.3**
After-Tax Payback	**Years**	**5.1**

1.13.3 Sensitivities

A univariate sensitivity analysis was performed to examine which factors most affect the Project economics when acting independently of all other cost and revenue factors. Each variable evaluated was tested using the same percentage range of variation, from -20% to +20%, although some variables may actually experience significantly larger or smaller percentage fluctuations over the LOM. For instance, the product prices were evaluated at a ± 20% range to the base case, while the CAPEX and all other variables remained constant. This may not be truly representative of market scenarios, as metal prices may not fluctuate in a similar trend. The variables examined in this analysis are those commonly considered in similar studies – their selection for examination does not reflect any particular uncertainty.

Notwithstanding the above noted limitations to the sensitivity analysis, which are common to studies of this sort, the analysis revealed that the Project is most sensitive to product prices and head grade. The Project showed the least sensitivity to capital costs. Figure 1-10 show the results of the sensitivity tests.

Figure 1-10: Project Sensitivities



1.14 Interpretation and Conclusions

1.14.1 Interpretations

The work performed for the PFS shows that the mineralogical data is sufficient to declare a resource for the Graphite One Project. The engineering work demonstrated that a reserve could be declared and that the Project should be advanced to a Feasibility Study with further field investigations and engineering. No fatal flaws were identified by the QPs during the course of this work.

1.14.2 Risks

1.14.2.1 General Risks

There are a number of generic risks that are applicable to most, if not all, mining projects. The main generic risks are shown in Table 1-12. Project-specific risks are discussed individually in the following sections.

Table 1-12: Generic Main Project Risks

Risk	Explanation/Potential Impact	Possible Risk Mitigation
Resource Modelling	All mineral resource estimates carry some risk and are one of the most common issues with project success.	Infill drilling may be recommended in order to provide a greater level of confidence in the resource.
Metallurgical Recoveries	Negative changes to metallurgical assumptions could lead to reduced metal recovery, increased processing costs, and/or changes to the processing circuit design. If LOM metal recovery is lower than assumed, the project economics would be negatively impacted.	Additional sampling and testwork is needed at the next level of study.
CAPEX and OPEX	The ability to achieve the estimated CAPEX and OPEX costs are important elements of project success. OPEX costs are primarily driven by a few high value items, and variation of these factors could have a significant impact on operating income.	Further cost estimation accuracy with the next level of study, as well as the active investigation of potential cost-reduction measures would assist in the support of reasonable cost estimates.
Permit Acquisition	The ability to secure all of the permits to build and operate the project is of paramount importance. Failure to secure the necessary permits could stop or delay the project.	The development of close relationships with the local communities and government along with a thorough Environmental and Social Impact Assessment and a project design that gives appropriate consideration to the environment and local people is required. Maintain direct control with a clear solution.
Development Schedule	The project development could be delayed for a number of reasons and could impact project economics. A change in schedule would alter the project economics.	If an aggressive schedule is to be followed, PFS or FS field work should begin as soon as possible.
Ability to Attract Experienced Professionals	The ability to attract and retain competent, experienced professionals is a key success factor for the project, especially in consideration of the remote location. High turnover or the lack of appropriate technical and management staff at the project could result in difficulties meeting project goals.	The early search for professionals as well as competitive salaries and benefits identify, attract and retain critical people.
Pit Slope Stability	Worse than anticipated ground conditions and/or existence of previously unidentified major geologic structure(s) resulting in reduced slope angles and sub-optimal project economics.	Additional geotechnical core drilling and development of a 3D geologic structural model.

1.14.2.2 Water and Waste Management

- No geotechnical information was available in the areas of the waste and water management facilities at the time of developing the PFS design. This may impact the assumptions considered for foundation preparations, facility design and configurations, and facility locations;
- The WMF buttress and the WMP embankments will be constructed using non-PAG construction materials. No borrow sources have been identified as part of the PFS design for construction of the site infrastructure;
- Baseline studies (climate and hydrology, hydrogeology, permafrost, vegetation and wildlife) are preliminary as they began in 2019 and are intended to be developed over the coming years. These studies may influence the design of the mine waste and water management facilities as they progress;
- The PFS water balance model was completed using preliminary data to evaluate whether the site was in a deficit or surplus condition, and to provide initial WMP size estimates. Quantities of water requiring management may be under or overestimated;
- The tailings and waste rock management strategy were developed based on the currently understood geochemistry of the material; the material is anticipated to be PAG;
- The physical properties of the tailings are based on the laboratory testing of one sample;
- A detailed seismic hazard assessment for the site has not been completed;
- Freezing temperatures could impede placement of comingled filtered tailings and waste to the WMF; and
- Graphite Creek runs through the middle of the pit. If the execution of re-routing the creek is delayed or extended over a long period of time, it could impact the mine plan resulting in increased mining costs or inhibit the ability of the mine to supply sufficient ore to the mill. The is mitigated by building up a stockpile of graphite concentrate early in the project life.

1.14.2.3 Construction Materials

A significant amount of construction rock and aggregate is required to support construction due to the ground conditions. A suitable source of NPAG material is required to support construction. If a suitable local source is not found, this could significantly increase project costs.

This could be mitigated by use of NPAG waste rock from the open pit, if PAG/NPAG delineation is possible. Optimization of facilities design to reduce the amount of NPAG required is also possible. Testing and quantification of materials from areas identified as potential quarry locations must be undertaken as a priority.

1.14.2.4 Secondary Treatment

There is risk specific to the plan to feed the STP with OMG purchased on the open market during the first four years of operations, including the following:

- There is no purchase agreement or arrangement in place for the purchase of OMG. As such, the availability and price can only be projected at this time;
- The STP will be designed to match the characteristics that have been defined and tested in GCG. Although the Company intends to match the characteristics of the GCG with OMG as closely as possible, an exact match will not be possible. Processing the OMG may result in a reduction of processing equipment performance, possible design modifications and retrofit(s), and reduced revenue for the period of OMG supply; and
- Multiple sources of OMG from multiple suppliers may be required, exacerbating these concerns with an inconsistent feed to the STP.

STP's advanced processing technologies: In April 2022, the Company announced its MOU with Sunrise (Guizhou) New Energy Material Co., Ltd. (Sunrise). The intent is for the parties to develop an agreement to share expertise and technology for the design, construction, and operation of the STP. There is no guarantee that the agreement will be finalized. The MOU's term was recently extended, and Sunrise is in the process of preparing anode materials for sample purposes from Graphite Creek concentrate produced from graphite recovered during exploration.

The STP's site has not been finalized. The Company, working with the Washington State Department of Commerce, identified several potential locations and cost and logistics assumptions used within the study are based on a potential site for the STP in Washington State, but this is yet to be secured. Failure to secure an appropriate site could impact project plans and economics. For the purposes of the PFS, a location in Lewis County was assumed. Site selection must be finalized as soon as possible.

1.14.2.5 Logistics

The project is very isolated, with road access to a small community that is serviced by barging on a seasonal basis. The limited annual shipping window means that large quantities of supplies must be brought to the mine and stored over the winter. As the concentrate must be barged out, it also means that concentrate will require storage both in Alaska and Washington. Storage will in AK will be in seacans and in covered facilities in WA. Any disruption to the shipping schedule could impact supply to WA and create logistical challenges at either site. A well-defined logistics plan to be developed in conjunction with shipping experts to ensure smooth transportation and storage planning.

1.14.2.6 Water Treatment

Source term water quality predictions have a high degree of uncertainty related to the limited surface and groundwater quality monitoring dataset. In particular, only one groundwater sample is available that is representative of pit inflow water quality. Since the pit inflow is estimated to be the highest flow that will have to be managed during operations (KP 2022b, pers. comm.), the model is sensitive to the source term input for this flow.

1.14.3 Opportunities

There are several opportunities that should be investigated in the next phase of engineering for the Project.

1.14.3.1 Mine Operations

The mine operates at a fairly low production rate and uses small equipment. There may be benefits to using larger equipment in combination with a different shift schedule or seasonal operations for the mine in order to reduce costs.

1.14.3.2 Geotechnical Considerations

While pit slope uncertainty is identified as a risk, it must also be considered as an opportunity – should actual ground conditions be found to be better than currently modelled, steeper slopes could be employed, improving project economics.

1.14.3.3 Delineation and Use of Mine Rock

Delineation of PAG/NPAG rock in mine waste could reduce the required storage capacity in the Waste rock storage facility and provide additional construction materials, reducing CAPEX and simplifying construction logistics.

1.14.3.4 Waste Rock Storage Facility Design

It may be possible to refine the existing design of the Waste Rock Storage Facility to reduce the amount of construction materials required, reducing CAPEX.

1.14.4 Conclusions

It is the conclusion of JDS that the vertically integrated business model for manufacturing and selling finished graphite products with 100% USA-based facilities is viable based on the data and analysis work that has been done and reported in this document, specifically:

- Additional diamond drilling was successful in upgrading the resources;
- Overall good rock mass conditions are anticipated for most of the pit with the west wall controlled by foliation joints, although the east wall is anticipated to be comprised of deep, soil overburden of unknown geotechnical characteristics;
- Metallurgical testwork indicates that the natural graphite located on the Graphite Creek Property is suitable to make a high-grade concentrate for shipment to the STP;
- The deposit is able to generate graphite ore in the quantities required to feed the primary processing plant and STP;

- A plan for disposal of all waste products is viable, despite the waste products being primarily comprised of PAG rock and tailings;
- Though a location for the STP has not been finalized, there appear to be several similar and suitable options in Washington State;
- The market projections support a positive economic outcome for the business model; and
- There do not appear to be any insurmountable obstacles to permitting the project, either in Alaska or Washington State.

The QPs did not find any fatal flaws in this evaluation. As such, Graphite One should continue to advance the project with a Feasibility Study to refine the current model and advance all permits for eventual construction and operations.

1.15 Recommendations

1.15.1 Water and Waste Management

Knight Piésold makes the following recommendations:

- Complete geotechnical investigations and geotechnical characterizations to support the design assumptions of the waste and water management facilities and associated site infrastructure;
- Optimize the WMF and associated buttress design based on geotechnical characterization of the site;
- Additional investigations to identify borrow sources for construction materials. This includes an evaluation of geotechnical and geochemical properties of the borrow site;
- Continue to advance baseline studies and incorporate results of baseline studies into future mine waste and water management facility designs. This includes an evaluation and characterization of the permafrost conditions at site. Permafrost conditions may govern the design and location of the WMF;
- A more detailed water balance model should be developed using GoldSim™ software. The model should be completed using variable climate conditions and conducted for a monthly timestep and include the updated groundwater inflow estimates to the pit. The updated water balance will be run through closure and post closure to assist with operational and closure/post closure water treatment requirements. This to be completed once additional site baseline information has been collected;
- Additional geochemistry testing and studies to confirm the metal leaching and acid generating potential of the materials that will be stored and/or used for construction;
- Complete additional lab testing on the tailings materials to confirm the results from the testwork completed in 2021. This may include additional testing to confirm the feasibility of filtration;

- Complete a site-specific Seismic Hazard Assessment. This information will inform future stability analyses; and
- Assess potential WMF design and operating modifications, including the tailings storage requirements at the mill, to manage temporary non-conforming tailings and waste rock materials.

1.15.2 Groundwater Quality Prediction

SRK makes the following recommendations:

- Collect additional groundwater samples and use of the results to evaluate if the current groundwater source term concentrations are valid;
- Collect additional surface water samples and use of the results to evaluate if the overburden source term is valid;
- Ongoing testing of HCTs to evaluate long-term release rates is required; and
- Periodic updates to source terms should be made as appropriate, as additional geochemistry, surface and groundwater quality monitoring data becomes available.

1.15.3 Water Treatment

The following needs to be evaluated in future studies to advance the understanding of water treatment for the Graphite One Project:

- Limnological and ecological characterization of Imuruk Basin;
- Water quality regulations for Imuruk Basin that affect the discharge of treated water; and
- Removal of antimony and arsenic by coprecipitation with iron concentrations in the influent to the water treatment plant.

1.15.4 Primary Processing

The following actions are recommended to refine the metallurgy for primary processing:

- Samples from mining areas of the current mine production schedule should be taken representing the mining sequence in increments less than one year for comminution and flotation tests to map the Geometallurgical characteristics of the deposit for a minimum of the first seven operating years;
- Where possible, regrind tests of representative samples should be conducted to establish power requirements with increased certainty for equipment sizing; and

- Concentrate and tailings dewatering tests on representative samples of should be carried out to optimize products dewatering engineering and design.

1.15.5 Secondary Treatment Plant

Following a review of the market demand and the STP plan, the following is recommended:

- Work to develop the STP in parallel with the development of the Graphite Creek Mine be accelerated including computer simulations of the process, continued process development work with associated consultants and institutions, and process engineering design;
- Move forward with a MOU or similar commitment for STP site location in Washington;
- Finalize electrical power supply;
- Procure the supply of purchased graphite and precursor materials; and
- Continue work on qualifying anode products.

1.15.6 Mine Geotechnical

Geotechnical drilling, logging and downhole televiewing of three additional holes are recommended to support a Feasibility Study.

1.15.7 Other/Mine

A trade-off study to assess optimum mining fleet and personnel shift schedule should be prepared for the mine.

1.15.8 Feasibility Study

It is recommended that Graphite One proceed to the feasibility study stage in line with its desire to advance the Project to the construction and operation of a vertically integrated 100% US based graphite manufacturing company. It is also recommended that environmental and permitting continue as needed to support the Project's development plans.

The FS and supporting field work are estimated to cost approximately $20.8M. Options for a bulk sample and product test program are estimated at $11M to $21M. A breakdown of the key components of the next study phase is as follows in Table 1-13.

Table 1-13: Estimated Feasibility Study Cost (US $M)

Area	Description	US $M
Mine	Mine Engineering	0.25
	Mine Geotechnical engineering	0.10
	Infrastructure	0.15
	Project Support & Report Editing	0.02
	Waste and Water Management	0.85
	Geotechnical & Hydrogeological Drilling Support	0.16
	Metallurgy & Processing	0.40
	Road and Site Infrastructure	1.40
	Geochemistry and Geochem testing	0.14
	Environmental and Permitting	2.00
	Metallurgical Testwork	0.30
	Mine Geotechnical Logging Lab Testing & Televiewer	0.20
	Drilling: Probable to Proven	10.00
	Stakeholder engagement	0.10
	Subtotal	**16.06**
STP	STP Detailed Engineering (Process, Buildings, etc.)	1.00
	STP Power Study	0.10
	Site Assessment (geotech, etc.)	0.50
	Logistics Study (materials handling, transportation)	0.10
	Environmental & Permitting	1.00
	Stakeholder Engagement & Workforce Study	0.15
	Market Report	0.15
	Product Development	1.00
	Subtotal	**4.00**
Project	Project Management	0.50
	Drafting	0.04
	Cost Compilation	0.15
	Economic Model	0.04
	Subtotal	**0.73**
Total, Feasibility Study		**20.79**
Test Program Options		
Material Preparation	Option 1: Bulk sample with toll processing	$10M to $20M
	Option 2: Bulk sample with onsite pilot plant	
Product Development	Product Preparation & Testing	$1M
Total		**$11M to $21M**

2 INTRODUCTION

2.1 Terms of Reference

This technical report (TR) has been prepared for Graphite One Inc. (GPH: TSX-V; GPHOF: OTCQX) (Graphite One or the Company) with its address at Suite 600, 777 Hornby St., Vancouver, BC for the purpose of disclosing the results of a Prefeasibility Study (PFS) for the Graphite One Project (the Project). It is the objective of the Company to become a vertically-integrated manufacturer of graphite products with an operating mine ins Alaska and operating secondary treatment plant in Washington State, which is modeled in this report. This technical report was prepared by JDS Energy & Mining at the request of Graphite One. The results of the PFS were disclosed to the public by Graphite One in a news release on 29 August 2022, the Effective date of the technical report.

The Graphite Creek Property (the Property) is on the Seward Peninsula, approximately 60 km north of Nome, Alaska. The Property comprises 23,680 acres of State of Alaska mining claims located approximately 59 km north of Nome. The claim block consists of 176 active 160-acre (1/4 section) claims, with 28 of those claims staked as duplicates over other claims within the claim block. Of the 176 total claims, 163 are wholly owned by Graphite One (Alaska) Inc. and 13 are leased to Graphite One (Alaska), Inc. by Kougarok, LLC.

The PFS is based on a new resource estimate based on the drill results from the 2021 field program that is conformable to the "Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Standards on Mineral Resources and Reserves – Definitions and Guidelines" (2019), as referred to in National Instrument (NI) 43-101 and Form 43-101F, Standards of Disclosure for Mineral Projects (2014). The results of the 2022 field program were reported in the 6 October 2022 news release "Graphite One Completes 2022 Field Program with 2,090 m of drilling for the Feasibility Study". These results have not been incorporated into the current resource estimate or PFS results.

The Property is a "greenfields" site with no road access or permanent facilities on site.

There has been no material change to the Project between the effective date and signature date of this technical report. JDS understands that this technical report will support the public disclosure requirements of Graphite One and will be filed on SEDAR as required under NI 43-101 disclosure regulations.

2.2 Qualified Persons

2.2.1 Scope of Work

This technical report summarizes the work of several consultants with the scope of work for each company listed below, which combined, comprises the total Project scope.

JDS Energy & Mining Inc. (JDS):

- Study management;

- Mine engineering including pit geotechnical engineering; and
- Preparation of all capital cost estimates, operating cost estimates, and the economic model.

Bomenco Inc. (Bomenco):

- Processing and primary processing plant design.

Hatch Ltd. (Hatch):

- STP plant design.

Alaska Earth Sciences (AES):

- Site geology, regional geology; and
- Resource estimation.

Knight Piésold (KP):

- Waste and water management.

Jade Environmental Consultants (Jade):

- Permitting and environmental.

SRK Consulting (SRK):

- Geochemical characterization; and
- Water quality predictions.

Recon LLC (Recon):

- Site access road design and cost estimation.

The Secondary Treatment Plant (STP) process design was supplied by Graphite One's specialist, Andrew Tan.

2.2.2 Qualifications and Responsibilities

The results of this PEA are not dependent upon any prior agreements concerning the conclusions to be reached, nor are there any undisclosed understandings concerning any future business dealings between Graphite One and the QPs. The QPs are being paid a fee for their work in accordance with normal professional consulting practice.

The following individuals, by virtue of their education, experience and professional association, are considered QPs as defined in the NI 43-101, and are members in good standing of appropriate professional institutions / associations. The QPs are responsible for the specific report sections as follows:

Table 2-1: QP Responsibilities

QP	Company	QP Responsibility / Role	Report Section(s)
Richard Goodwin, P.Eng.	JDS	Study Manager	1.1.1, 1.11, 1.14, 1.15, 2, 3, 19, 20, 25 to 29
Tysen Hantelmann, P.Eng.	JDS	Mineral Reserves, Mine Planning, Production Schedule and Open Pit CAPEX and OPEX	1.7, 1.8, 15, 16 (except 16.3)
Carly Church, P.Eng.	JDS	Infrastructure and Economic Modelling	1.10.1 to 1.10.3, 1.12, 1.13, 21, 22, 23, 18.1 to 18.4
Mike Levy, P.Eng.	JDS	OP Geotechnical	16.3
Matt Bolu, P.Eng.	Bomenco	Process and Plant Design	1.12, 1.5,1.9, 13, 17
Robert Retherford, CPG	AES	Geology and Resource Estimation	1.2 to 1.4, 1.6, 4 to 12, 14, 24
Les Galbraith, P.Eng.	KP	Waste and Water Management	1.10.4, 1.10.5, 18.5.1, 18.5.3, 18.6.1 to 18.6.6
Tom Sharp, P.Eng.	SRK	Geochemistry	18.5.2, 18.6.7

2.3 Sources of Information

This report is based on information collected by JDS and the subconsultants on various site visits, as described in Table 2-2 on additional information provided by Graphite One throughout the course of JDS's investigations. Other information was obtained from the public domain. JDS has no reason to doubt the reliability of the information provided by Graphite One. This technical report is based on the following sources of information:

- Discussions with Graphite One personnel;
- Inspection of the Graphite Creek area, including outcrop and drill core;
- Review of exploration data collected by Graphite One; and
- Additional information from public domain sources.

2.4 Site Visit

In accordance with National Instrument 43-101 guidelines, several QPs have visited the Graphite One Project, as detailed in Table 2-2.

Table 2-2: QP Site Visits

Qualified Person	Company	Date	Accompanied by	Description of Inspection
Richard Goodwin	JDS	Sep 2021	S. Foo	Inspection of pit location, outcrops, drill locations, access road route, AML facilities in Nome, active drill sites, prospective camp and plant site, camp site, Imuruk Basin, possible borrow site.
Carly Church	JDS			
Les Galbraith	KP			
Tysen Hantelmann	JDS	Sep 2019	S. Foo	Inspection of pit location, outcrops, drill locations, access road route, prospective camp and plant site, Imuruk Basin, possible borrow sites, Nome infrastructure, and core storage.
Mike Levy	JDS	Sep 2019	S. Foo	Inspection of pit location, outcrops, drill locations, access road route, prospective camp and plant site, Imuruk Basin, possible borrow sites, Nome infrastructure, and core storage.
Robert M. Retherford	AES	Sep 2022	B. Flanigan	Inspection of drilling in progress. Inspection of core logging procedures and facility. Review of QA/QC protocols.

2.5 List of Previous Relevant Technical Reports

The most recent technical report for the Property was “2019 NI 43-101 Mineral Resource Update for Graphite Creek, Seward Peninsula, Alaska, USA”, prepared by Natalie King and William Ellis of AES and Chris Valorose of Valorose Consulting, Inc. The report has an effective date of 26 March 2019 and report date of 2 May 2019.

The most recent economic evaluation of the Project was in the Technical Report “Graphite One Resources Inc. NI 43-101 Preliminary Economic Analysis on the Graphite One Project”, prepared by R.J. Robinson, I. Roumeliotis, and M. Paterson of TRU Group. The report has an effective date of 28 November 2016 and a report date of 2 February 2017.

2.6 Units, Currency and Rounding

The units of measure used in this report are as per the International System of Units (SI) or metric.

All dollar figures quoted in this report refer to United States dollars ($US or $) unless otherwise noted.

Frequently used abbreviations and acronyms can be found in Section 29. This report includes technical information that required subsequent calculations to derive subtotals, totals and weighted averages. Such calculations inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, the QPs do not consider them to be material.

This report may include technical information that requires subsequent calculations to derive sub-totals, totals and weighted averages. Such calculations inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, JDS does not consider them to be material.

3 RELIANCE ON OTHER EXPERTS

In preparing this technical report, the authors have relied upon certain work, opinions and statements of two non-QP specialists: Andrew Tan and Ed Fogels. The authors consider the reliance on other experts, as described in this section, as being reasonable based on their knowledge, experience, and qualifications. The QPs have taken reasonable measures to confirm information provided by others and take responsibility for the information.

3.1 Secondary Treatment Processing

For Section 13.2 and Section 17.2 and their corresponding summaries in Section 1, Matt Bolu, P.Eng. has relied on the work and experience of Mr. Andrew Tan of Graphite One for the design of the secondary treatment processes required to convert the natural graphite supplied by the mine into saleable final products (Section 13.2). Mr. Bolu is a metallurgical engineer with over 40 years' experience in a broad range of minerals and metals processing including graphite.

While the processes of milling, grinding, sizing, and conveying natural graphite are common and understood by Mr. Bolu, the technologies and processes to purify natural graphite, graphitize synthetic graphite precursors and manufacture natural and synthetic graphite battery anode materials are held closely by a confined group of industry participants, the majority of which are in Chinese companies. These technologies and processes are considered proprietary and confidential. China's current share of global production is spherical graphite = 100%, synthetic graphite = 69%, and battery anodes = 91%.[1] Mr. Bolu is not an expert in this specialized and proprietary portion of the STP's production plan and relies on the expertise of Mr. Tan in these areas. With this reliance, he understands and relies upon the work provided by Mr. Tan to act as QP for the referenced sections of the report.

Mr. Tan manages the development of the STP for Graphite One. One aspect of this involves Graphite One's relationship with Sunrise (Guizhou) New Energy Material Co., Ltd. (Sunrise), an experienced Chinese anode producer. Graphite One has an MOU with Sunrise to develop an agreement to share expertise and technology for the design, construction, and operation of the STP. Sunrise is currently producing anode materials from Graphite Creek concentrate to be used as product samples with potential customers.

Mr. Tan has over 30 years' experience in the graphite industry and has applied for the professional engineer's designation from Engineers and Geoscientists BC since moving to BC in July 2022. The following summarizes Mr. Tan's qualifications and experience:

1. Education:
    a. Master's degree, Chemical Engineering, University of New Brunswick; and
    b. Bachelor's degree, Chemical Engineering, Hunan University, China.

[1] https://www.benchmarkminerals.com/membership/chinas-lithium-ion-battery-supply-chain-dominance/

2. Professional Experience:

   a. Graphite One Inc., Director of Graphite Manufacturing, April 2021-present;

   b. Consultant to numerous Canadian and Australian graphite companies, 2014 -2021;

   c. SGL Group, SGL Sinyuan Graphite Company (SSG), Ningbo, China, General Manager, expanded graphite plant, 2011-2013;

   d. Pamas & Company Inc. Exton, PA Technical Manager, Manager of China Operations, Graphitic & Graphitized Cathode, 2008 -2010;

   e. Norit American Inc. Marshall, TX, Developmental Engineer, Activated carbon, 2007-2008;

   f. Other:

      i. Graduate study & Research Engineer, nano-porous carbon, Canada; and

      ii. Senior Process Engineer, New Graphite Products Development Group Leader, China.

3. Related Expertise:

   a. Developed natural graphite thermal-chemical purification process now used in the Chinese Li-ion battery industry. Has successfully purified Canadian originated flake graphite in this process;

   b. For clients as a consultant, supervised using representative graphite samples, the preparation of spherical graphite, coated spherical graphite (CSG) and purified CSG at commercial plants in China;

   c. Industrial experience in natural graphite salting (intercalating), exfoliation, and expandable graphite product development;

   d. Experience with large scale processing equipment in carbon and graphite facilities;

   e. Process development and control experience with ultra-high purity natural graphite, ISO graphite, and graphite electrodes; and

   f. Worked with Li-ion battery anode materials (both synthetic and natural), spheronizing, purification, coating, and subsequent testing.

Mr. Bolu relied on the following documents provided to him from Mr. Tan to conduct his review of the secondary treatment processes involved in this PFS document:

- Owner Reports:
  - STP Process PPT;
  - STP Mass Balance Check dhs; and

- STP Products.

- Engineering Reports:
  - 01 General Site Plans;
  - 02 Project Design Criteria and Mass Balance;
  - 03 Process Flowsheet Drawings 00001 to 0030;
  - 04 Mechanical Equipment List;
  - Project Work Breakdown Structure;
  - Electric Design Criteria (5 x Docs);
  - Electric Equipment List;
  - Electric Load List (4 x Docs); and
  - Electrical Single Line Diagrams (7 x Docs).
- STP (Secondary Treatment Process) PFS Report.

Mr. Bolu used his experience to determine that the information provided to him was suitable for inclusion in this technical report.

3.2 Environmental and Permitting

For Section 20 and the corresponding summary in Section 1, Richard Goodwin, P.Eng. has relied upon the work and experience of Mr. Ed Fogels of Jade North (Anchorage, Alaska) to define the permitting status and requirements for Project, both in Alaska and Washington State.

Mr. Fogels has thirty-six years of experience in resource management and environmental analysis as a consultant and regulator for the Alaska Gasline Development Corporation and Alaska Department of Natural Resources. Mr. Fogels has a Bachelors degree in Environmental Sciences from the University of Virginia (1979).

Mr. Goodwin has extensive experience in permitting through overseeing permitting application processes as President of an Alaskan mining company operating an underground gold mine and as Vice President of Underground Operations while a permitting a greenfields underground zinc mine in Yukon. Both applications were successful. Mr. Goodwin has also provided closure cost estimates for multiple studies and projects and has adjudicated closure cost estimates for both the Yukon Department of Energy, Mines and Resources and the Yukon Water Board.

Mr. Goodwin relied on the following documents provided to him from Mr. Fogels to conduct his review of the environmental and permitting aspects of this report, contained in Section 20:

- Graphite One Permitting Analysis, January 2018 Jade North LLC;
- Multi-Year 2022-2026 Hardrock Exploration & Reclamation #2299, Hardrock Exploration - Graphite Creek - Nome & Port Clarence Mining District, KRM T5S R34W Sections 9-17, & 20-35, KRM T5S R35W Sections 25-27 & 34-36 (ADNR), June 24, 2022;
- Miscellaneous Land Use Permit for Hardrock Exploration & Reclamation Permit # 2299 (The State of Alaska Division of Mining, Land and Water), June 24, 2022;
- APMA F20222299 Graphite Creek Nome & Port Clarence Mining Districts Memorandum of Decision, (ADNR) June 24, 2022;
- Temporary Water Use Authorization (TWUA) TWUA F2022-077 to 80 (ADNR), Issued: June 30, 2022 Expires: December 31, 2026;
- 2019 Aquatic Baseline Program – Graphite One Project, Aquatic Resource Permit Study Plane, May 2019, prepared by Owl Ridge Natural Resource Consultants Inc.; and
- Wetland and Waterbody Delineation Report, Graphite One Project, Graphite One Inc., December 15, 2021, prepared by HDC Engineering Inc.

Mr. Goodwin used his experience to determine that the information provided to him was suitable for inclusion in this technical report.

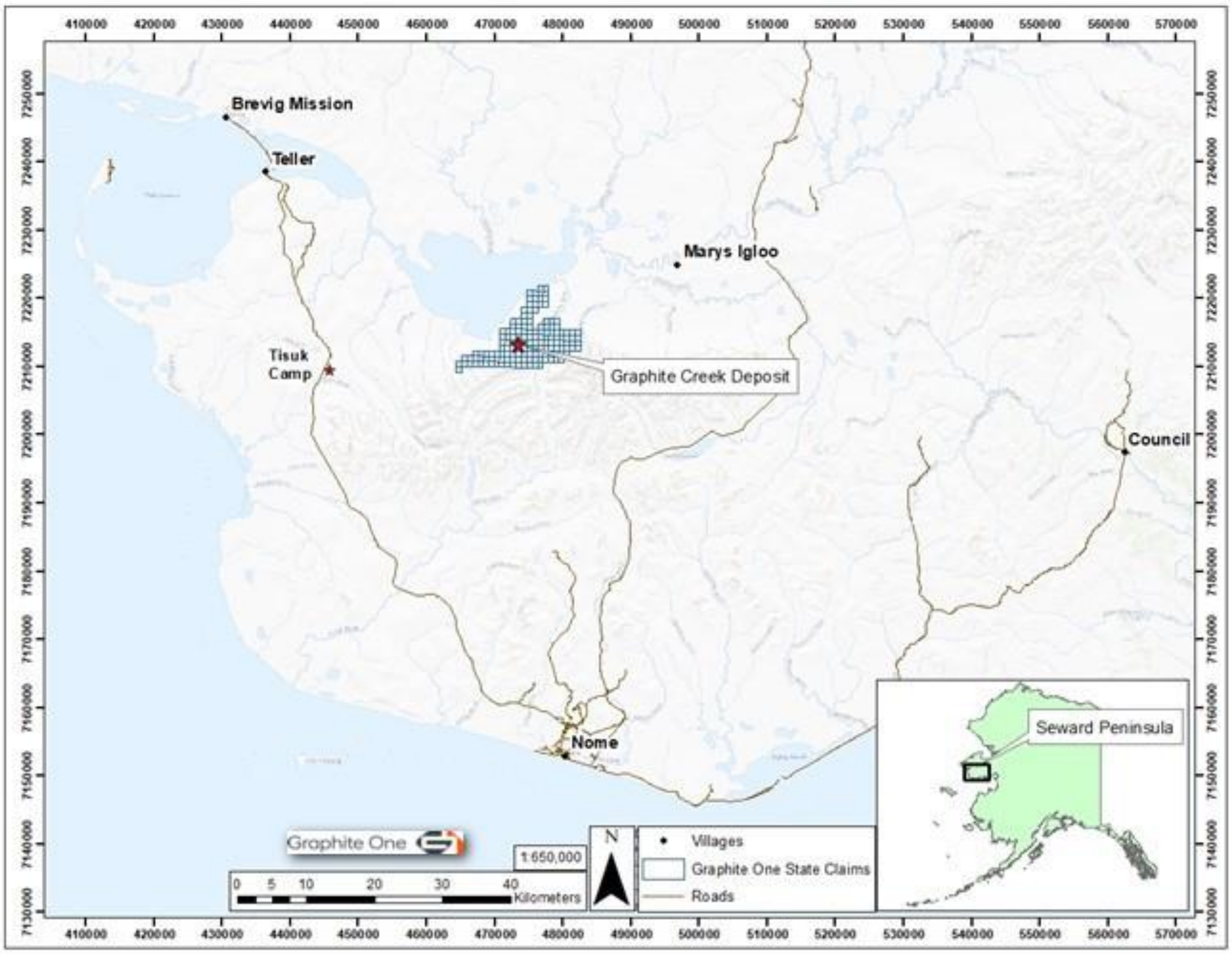
4 PROPERTY DESCRIPTION AND LOCATION

4.1 Graphite Creek Property Location

The Property comprises 23,680 acres of State of Alaska mining claims. The claim block consists of 176 active 160-acre (1/4 section) claims, with 28 of those claims staked as duplicates over other claims within the claim block. Of the 176 total claims, 163 are wholly owned by Graphite One (Alaska) Inc. and 13 are leased to Graphite One (Alaska), Inc. by Kougarok, LLC. The claims are on the Teller A2 and A1 quadrangles. The Property is located on the north flank of the Kigluaik Mountains and on the alluvial plain to the north. The northern end of the claim block abuts intertidal waters of the Imuruk Basin. The Kigluaiks are a rugged glacially carved mountain range with a maximum elevation at Mt. Osborne of 1437 m.

The closest significant port, industrial/population center is Nome, situated some 59 km to the south. There is no current road access to the Property; the closest seasonal road is 20 km to the Southeast (the Nome-Taylor Highway).

Figure 4-1: Location of Graphite One Resources Inc. State Claims on the Seward Peninsula, Alaska



Source: AES (2022)

4.2 Graphite Creek Mineral Tenure

The Project's mineral tenure consists of 176 state mining claims categorized as three groups based primarily upon the way the interests in the claims were acquired by Graphite One (Alaska) Inc. The three groups are nominally referred to as:

1. The GC Leased Property;
2. The GC Staked Property; and
3. The GC Purchased Property.

The claims constituting the three groups are depicted in Figure 4-1. The first group, the GC Leased Property, consists of 13 state mining claims, shaded yellow in Figure 4-1, which partially overlap the 24 former federal mining claims shaded red in Figure 4-1. Five of the claims in the GC Leased Property are duplicate claims such that the GC Leased Property appears in Figure 4-1 to consist of eight separate mining claims. The second group, the GC Staked Property consists of 117 state mining claims shaded blue in Figure 4-1. And the third group, the GC Purchased Property, consists of 46 state mining claims, including 23 duplicate claims, shaded green in Figure 4-1. The three groups form a contiguous block of Alaska state mining claims. Each group is further described in the following sections and summarized in Table 4-1, Table 4-2, and Table 4-3 respectively.

Readers are cautioned that the summaries do not constitute full disclosure, and that each agreement has not been referenced to confirm the status and application of any of the royalty or lease agreement payments. The QP did not establish the legal status of the mineral claims and has relied upon the guidance of Graphite One Inc. in describing the property groups and the agreements with involved parties. The QP has no knowledge of further encumbrances, beyond what has been described, that would impact the mining claims.

4.2.1 The GC Leased Property

Graphite One (Alaska) Inc. originally leased the former federal claims from Kougarok, LLC. When the federal claims were relinquished and the lands conveyed to the State of Alaska, the state mining claims that comprise the GC Leased Property were transferred to Kougarok, LLC and committed to the lease in place of the former federal claims via a quitclaim deed with confirmatory grant, recorded on May 8, 2015, in the Cape Nome Recording District. A restated version of the lease with Kougarok, LLC had been executed in 2015 with an initial term of twenty (20) years, commencing January 1, 2014, and may be extended for so long as the production of minerals continues from anywhere on the GC Leased Property. Three of the state mining claims making up the GC Leased Property were originally staked by Graphite One (Alaska) Inc. The remaining ten state mining claims that comprise the GC Leased Property were purchased by Graphite One (Alaska) Inc. Those ten claims consist of two sets of five duplicate state mining claims which completely overlap one another. The payments and production royalties due under the lease are as follows:

1. An advance royalty of $30,000 was paid to the Lessor (Kougarok, LLC) upon execution of the lease agreement;

2. Annual advance royalty payments of $30,000 paid on January 1 of each year through 2019, then increasing by $10,000 per year until production begins;

3. Production royalties:

    a. 5% from lands within the 4 former federal claims staked in 1943;

    b. 2.5% from lands within the other 20 former federal claims;

    c. Except as provided in 3b above, 5% from lands within the claims staked by Graphite One (Alaska) Inc.; and

    d. Except as provided in 3a above, 2.5% from lands within the claims purchased by Graphite One (Alaska) Inc.

4. Graphite One (Alaska) Inc. has the option to reduce all production royalties due under the lease by up to 2% by paying $2,000,000 for each 1% reduction of the royalties; and

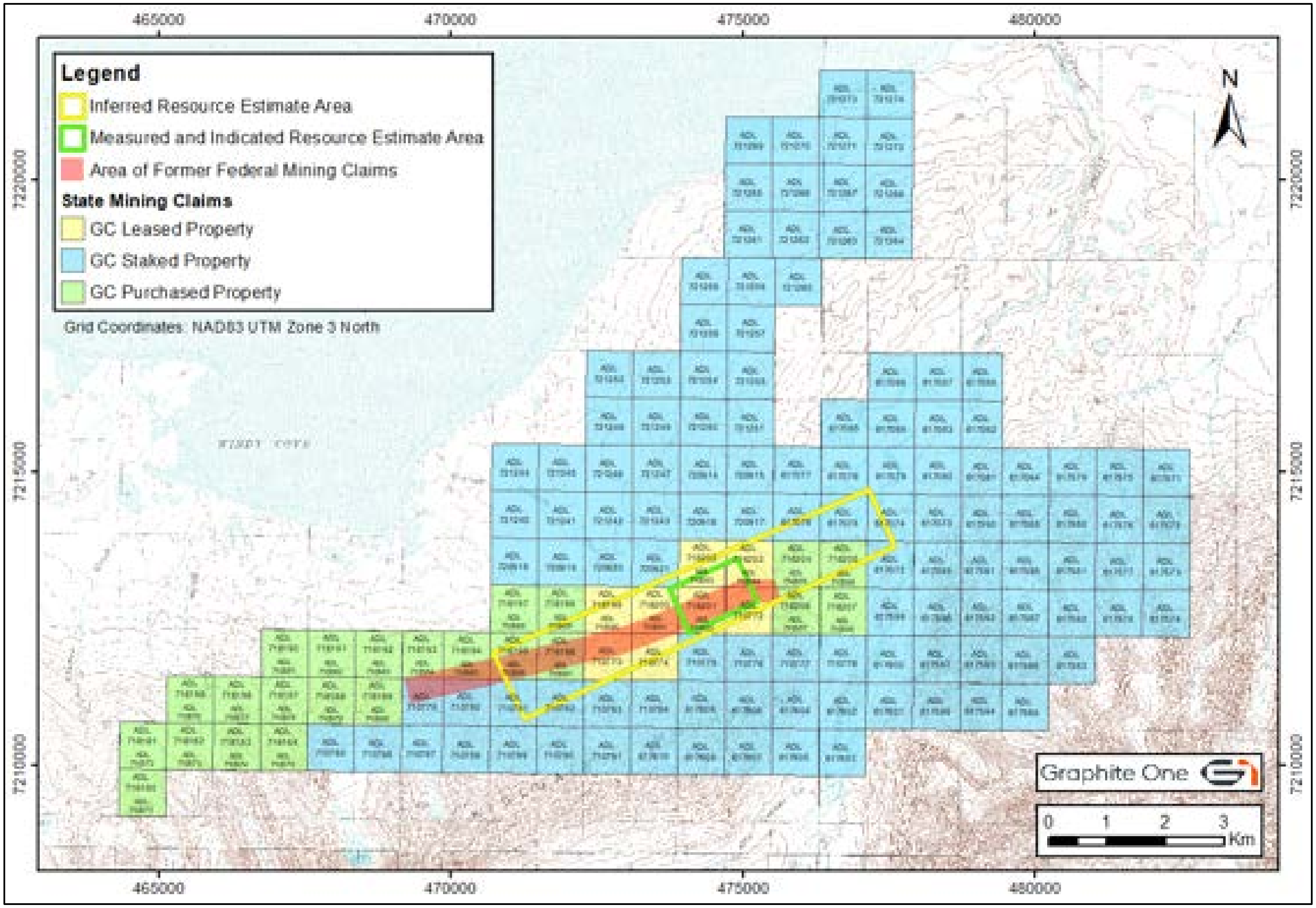
5. All advance royalties may be recouped from production royalties.

Table 4-1: GC Leased Property: Alaska State Mining Claims (all claims are a full ¼ Section (160 acres))

Claim Number	Claim Owner	Claim Name	Location Date	Township Location
ADL 710772	Kougarok LLC	GC 001	22-Nov-11	K 005S 034W 22SE
ADL 710773	Kougarok LLC	GC 002	22-Nov-11	K 005S 034W 28NW
ADL 710774	Kougarok LLC	GC 003	22-Nov-11	K 005S 034W 28NE
ADL 710590	Kougarok LLC	GRAPHITE CREEK 20	29-OCT-11	K 005S 034W 21SW
ADL 710591	Kougarok LLC	GRAPHITE CREEK 21	29-OCT-11	K 005S 034W 21SE
ADL 710592	Kougarok LLC	GRAPHITE CREEK 22	29-OCT-11	K 005S 034W 22SW
ADL 710593	Kougarok LLC	GRAPHITE CREEK 23	29-OCT-11	K 005S 034W 22NW
ADL 710594	Kougarok LLC	GRAPHITE CREEK 24	29-OCT-11	K 005S 034W 22NE
ADL 716199	Kougarok LLC	GPH 20	04-OCT-12	K 005S 034W 21SW
ADL 716200	Kougarok LLC	GPH 21	04-OCT-12	K 005S 034W 21SE
ADL 716201	Kougarok LLC	GPH 22	06-OCT-12	K 005S 034W 22SW
ADL 716202	Kougarok LLC	GPH 23	03-OCT-12	K 005S 034W 22NW
ADL 716203	Kougarok LLC	GPH 24	03-OCT-12	K 005S 034W 22NE

Source: AES (2022)

Figure 4-2: Claims Map of Graphite Creek Property ADL Numbers Shown



Source: AES (2022)

4.2.2 The GC Staked Property

The GC Staked Properties consist of 117 Alaska state mining claims located by Graphite One (Alaska) Inc., a wholly owned subsidiary of Graphite One Inc. (shown in blue in Figure 4-2).

Table 4-2: GC Staked Property: Alaska State Mining Claims (all claims are a full ¼ Section (160 acres))

Claim Number	Claim Owner	Claim Name	Location Date	Township Location
ADL 710775	Graphite One (Alaska) Inc.	GC 004	22-Nov-11	K 005S 034W 27NW
ADL 710776	Graphite One (Alaska) Inc.	GC 005	22-Nov-11	K 005S 034W 27NE
ADL 710777	Graphite One (Alaska) Inc.	GC 006	22-Nov-11	K 005S 034W 26NW
ADL 710778	Graphite One (Alaska) Inc.	GC 007	22-Nov-11	K 005S 034W 26NE
ADL 710779	Graphite One (Alaska) Inc.	GC 008	22-Nov-11	K 005S 034W 30SW
ADL 710780	Graphite One (Alaska) Inc.	GC 009	22-Nov-11	K 005S 034W 30SE
ADL 710781	Graphite One (Alaska) Inc.	GC 010	22-Nov-11	K 005S 034W 29SW
ADL 710782	Graphite One (Alaska) Inc.	GC 011	22-Nov-11	K 005S 034W 29SE
ADL 710783	Graphite One (Alaska) Inc.	GC 012	22-Nov-11	K 005S 034W 28SW
ADL 710784	Graphite One (Alaska) Inc.	GC 013	22-Nov-11	K 005S 034W 28SE
ADL 710785	Graphite One (Alaska) Inc.	GC 014	22-Nov-11	K 005S 035W 36NW
ADL 710786	Graphite One (Alaska) Inc.	GC 015	22-Nov-11	K 005S 035W 36NE
ADL 710787	Graphite One (Alaska) Inc.	GC 016	22-Nov-11	K 005S 034W 31NW
ADL 710788	Graphite One (Alaska) Inc.	GC 017	22-Nov-11	K 005S 034W 31NE
ADL 710789	Graphite One (Alaska) Inc.	GC 018	22-Nov-11	K 005S 034W 32NW
ADL 710790	Graphite One (Alaska) Inc.	GC 019	22-Nov-11	K 005S 034W 32NE
ADL 710791	Graphite One (Alaska) Inc.	GC 020	22-Nov-11	K 005S 034W 33NW
ADL 617072	Graphite One (Alaska) Inc.	GCX-01	04-Jun-12	K 005S 034W 24NW
ADL 617073	Graphite One (Alaska) Inc.	GCX-02	04-Jun-12	K 005S 034W 13SE
ADL 617074	Graphite One (Alaska) Inc.	GCX-03	04-Jun-12	K 005S 034W 13SW
ADL 617075	Graphite One (Alaska) Inc.	GCX-04	04-Jun-12	K 005S 034W 14SE
ADL 617076	Graphite One (Alaska) Inc.	GCX-05	04-Jun-12	K 005S 034W 14SW
ADL 617077	Graphite One (Alaska) Inc.	GCX-06	04-Jun-12	K 005S 034W 14NW
ADL 617078	Graphite One (Alaska) Inc.	GCX-07	04-Jun-12	K 005S 034W 14NE
ADL 617079	Graphite One (Alaska) Inc.	GCX-08	04-Jun-12	K 005S 034W 13NW
ADL 617080	Graphite One (Alaska) Inc.	GCX-09	04-Jun-12	K 005S 034W 13NE
ADL 617595	Graphite One (Alaska) Inc.	GCX-52	29-Aug-12	K 005S 034W 24NE
ADL 617596	Graphite One (Alaska) Inc.	GCX-53	29-Aug-12	K 005S 034W 24SE
ADL 617599	Graphite One (Alaska) Inc.	GCX-57	29-Aug-12	K 005S 034W 24SW
ADL 617602	Graphite One (Alaska) Inc.	GCX-61	29-Aug-12	K 005S 034W 26SE

Claim Number	Claim Owner	Claim Name	Location Date	Township Location
ADL 617604	Graphite One (Alaska) Inc.	GCX-63	29-Aug-12	K 005S 034W 26SW
ADL 617606	Graphite One (Alaska) Inc.	GCX-65	29-Aug-12	K 005S 034W 27SE
ADL 617608	Graphite One (Alaska) Inc.	GCX-67	29-Aug-12	K 005S 034W 27SW
ADL 617081	Graphite One (Alaska) Inc.	GCX-10	04-Jun-12	K 005S 033W 18NW
ADL 617082	Graphite One (Alaska) Inc.	GCX-11	04-Jun-12	K 005S 033W 07SW
ADL 617083	Graphite One (Alaska) Inc.	GCX-12	04-Jun-12	K 005S 034W 12SE
ADL 617084	Graphite One (Alaska) Inc.	GCX-13	04-Jun-12	K 005S 034W 12SW
ADL 617085	Graphite One (Alaska) Inc.	GCX-14	04-Jun-12	K 005S 034W 11SE
ADL 617086	Graphite One (Alaska) Inc.	GCX-15	04-Jun-12	K 005S 034W 12NW
ADL 617087	Graphite One (Alaska) Inc.	GCX-16	04-Jun-12	K 005S 034W 12NE
ADL 617088	Graphite One (Alaska) Inc.	GCX-17	04-Jun-12	K 005S 033W 07NW
ADL 617571	Graphite One (Alaska) Inc.	GCX-18	29-Aug-12	K 005S 033W 16NW
ADL 617572	Graphite One (Alaska) Inc.	GCX-19	29-Aug-12	K 005S 033W 16SW
ADL 617573	Graphite One (Alaska) Inc.	GCX-20	29-Aug-12	K 005S 033W 21NW
ADL 617574	Graphite One (Alaska) Inc.	GCX-21	08-Sep-12	K 005S 033W 21SW
ADL 617575	Graphite One (Alaska) Inc.	GCX-25	29-Aug-12	K 005S 033W 17NE
ADL 617576	Graphite One (Alaska) Inc.	GCX-26	29-Aug-12	K 005S 033W 17SE
ADL 617577	Graphite One (Alaska) Inc.	GCX-27	29-Aug-12	K 005S 033W 20NE
ADL 617578	Graphite One (Alaska) Inc.	GCX-28	08-Sep-12	K 005S 033W 20SE
ADL 617579	Graphite One (Alaska) Inc.	GCX-32	29-Aug-12	K 005S 033W 17NW
ADL 617580	Graphite One (Alaska) Inc.	GCX-33	29-Aug-12	K 005S 033W 17SW
ADL 617581	Graphite One (Alaska) Inc.	GCX-34	29-Aug-12	K 005S 033W 20NW
ADL 617582	Graphite One (Alaska) Inc.	GCX-35	08-Sep-12	K 005S 033W 20SW
ADL 617583	Graphite One (Alaska) Inc.	GCX-36	08-Sep-12	K 005S 033W 29NW
ADL 617584	Graphite One (Alaska) Inc.	GCX-39	29-Aug-12	K 005S 033W 18NE
ADL 617585	Graphite One (Alaska) Inc.	GCX-40	29-Aug-12	K 005S 033W 18SE
ADL 617586	Graphite One (Alaska) Inc.	GCX-41	29-Aug-12	K 005S 033W 19NE
ADL 617587	Graphite One (Alaska) Inc.	GCX-42	08-Sep-12	K 005S 033W 19SE
ADL 617588	Graphite One (Alaska) Inc.	GCX-43	08-Sep-12	K 005S 033W 30NE
ADL 617589	Graphite One (Alaska) Inc.	GCX-44	08-Sep-12	K 005S 033W 30SE
ADL 617590	Graphite One (Alaska) Inc.	GCX-46	29-Aug-12	K 005S 033W 18SW
ADL 617591	Graphite One (Alaska) Inc.	GCX-47	29-Aug-12	K 005S 033W 19NW
ADL 617592	Graphite One (Alaska) Inc.	GCX-48	08-Sep-12	K 005S 033W 19SW
ADL 617593	Graphite One (Alaska) Inc.	GCX-49	08-Sep-12	K 005S 033W 30NW
ADL 617594	Graphite One (Alaska) Inc.	GCX-50	08-Sep-12	K 005S 033W 30SW
ADL 617597	Graphite One (Alaska) Inc.	GCX-54	29-Aug-12	K 005S 034W 25NE
ADL 617598	Graphite One (Alaska) Inc.	GCX-55	29-Aug-12	K 005S 034W 25SE
ADL 617600	Graphite One (Alaska) Inc.	GCX-58	29-Aug-12	K 005S 034W 25NW

Claim Number	Claim Owner	Claim Name	Location Date	Township Location
ADL 617601	Graphite One (Alaska) Inc.	GCX-59	29-Aug-12	K 005S 034W 25SW
ADL 617603	Graphite One (Alaska) Inc.	GCX-62	29-Aug-12	K 005S 034W 35NE
ADL 617605	Graphite One (Alaska) Inc.	GCX-64	29-Aug-12	K 005S 034W 35NW
ADL 617607	Graphite One (Alaska) Inc.	GCX-66	29-Aug-12	K 005S 034W 34NE
ADL 617609	Graphite One (Alaska) Inc.	GCX-68	29-Aug-12	K 005S 034W 34NW
ADL 617610	Graphite One (Alaska) Inc.	GCX-69	29-Aug-12	K 005S 034W 33NE
ADL 720914	Graphite One (Alaska) Inc.	GCN 001	11-Jun-15	K 005S 034W 15NW
ADL 720915	Graphite One (Alaska) Inc.	GCN 002	11-Jun-15	K 005S 034W 15NE
ADL 720916	Graphite One (Alaska) Inc.	GCN 003	11-Jun-15	K 005S 034W 15SW
ADL 720917	Graphite One (Alaska) Inc.	GCN 004	11-Jun-15	K 005S 034W 15SE
ADL 720918	Graphite One (Alaska) Inc.	GCN 005	11-Jun-15	K 005S 034W 20NW
ADL 720919	Graphite One (Alaska) Inc.	GCN 006	11-Jun-15	K 005S 034W 20NE
ADL 720920	Graphite One (Alaska) Inc.	GCN 007	11-Jun-15	K 005S 034W 21NW
ADL 720921	Graphite One (Alaska) Inc.	GCN 008	11-Jun-15	K 005S 034W 21NE
ADL 721240	Graphite One (Alaska) Inc.	GCN 009	20-Nov-15	K 005S 034W 17SW
ADL 721241	Graphite One (Alaska) Inc.	GCN 010	20-Nov-15	K 005S 034W 17SE
ADL 721242	Graphite One (Alaska) Inc.	GCN 011	20-Nov-15	K 005S 034W 16SW
ADL 721243	Graphite One (Alaska) Inc.	GCN-012	20-Nov-15	K 005S 034W 16SE
ADL 721244	Graphite One (Alaska) Inc.	GCN 013	20-Nov-15	K 005S 034W 17NW
ADL 721245	Graphite One (Alaska) Inc.	GCN 014	20-Nov-15	K 005S 034W 17NE
ADL 721246	Graphite One (Alaska) Inc.	GCN 015	20-Nov-15	K 005S 034W 16NW
ADL 721247	Graphite One (Alaska) Inc.	GCN 016	20-Nov-15	K 005S 034W 16NE
ADL 721248	Graphite One (Alaska) Inc.	GCN 017	20-Nov-15	K 005S 034W 09SW
ADL 721249	Graphite One (Alaska) Inc.	GCN 018	20-Nov-15	K 005S 034W 09SE
ADL 721250	Graphite One (Alaska) Inc.	GCN 019	20-Nov-15	K 005S 034W 10SW
ADL 721251	Graphite One (Alaska) Inc.	GCN 020	20-Nov-15	K 005S 034W 10SE
ADL 721252	Graphite One (Alaska) Inc.	GCN 021	20-Nov-15	K 005S 034W 09NW
ADL 721253	Graphite One (Alaska) Inc.	GCN 022	20-Nov-15	K 005S 034W 09NE
ADL 721254	Graphite One (Alaska) Inc.	GCN 023	20-Nov-15	K 005S 034W 10NW
ADL 721255	Graphite One (Alaska) Inc.	GCN 024	20-Nov-15	K 005S 034W 10NE
ADL 721256	Graphite One (Alaska) Inc.	GCN 025	20-Nov-15	K 005S 034W 03SW
ADL 721257	Graphite One (Alaska) Inc.	GCN 026	20-Nov-15	K 005S 034W 03SE
ADL 721258	Graphite One (Alaska) Inc.	GCN 027	20-Nov-15	K 005S 034W 03NW
ADL 721259	Graphite One (Alaska) Inc.	GCN 028	20-Nov-15	K 005S 034W 03NE
ADL 721260	Graphite One (Alaska) Inc.	GCN 029	20-Nov-15	K 005S 034W 02NW
ADL 721261	Graphite One (Alaska) Inc.	GCN 030	20-Nov-15	K 004S 033W 31SW
ADL 721262	Graphite One (Alaska) Inc.	GCN 031	20-Nov-15	K 004S 033W 31SE
ADL 721263	Graphite One (Alaska) Inc.	GCN 032	20-Nov-15	K 004S 033W 32SW

Claim Number	Claim Owner	Claim Name	Location Date	Township Location
ADL 721264	Graphite One (Alaska) Inc.	GCN 033	20-Nov-15	K 004S 033W 32SE
ADL 721265	Graphite One (Alaska) Inc.	GCN 034	20-Nov-15	K 004S 033W 31NW
ADL 721266	Graphite One (Alaska) Inc.	GCN 035	20-Nov-15	K 004S 033W 31NE
ADL 721267	Graphite One (Alaska) Inc.	GCN 036	20-Nov-15	K 004S 033W 32NW
ADL 721268	Graphite One (Alaska) Inc.	GCN 037	20-Nov-15	K 004S 033W 32NE
ADL 721269	Graphite One (Alaska) Inc.	GCN 038	20-Nov-15	K 004S 033W 30SW
ADL 721270	Graphite One (Alaska) Inc.	GCN 039	20-Nov-15	K 004S 033W 30SE
ADL 721271	Graphite One (Alaska) Inc.	GCN 040	20-Nov-15	K 004S 033W 29SW
ADL 721272	Graphite One (Alaska) Inc.	GCN 041	20-Nov-15	K 004S 033W 29SE
ADL 721273	Graphite One (Alaska) Inc.	GCN 042	20-Nov-15	K 004S 033W 29NW
ADL 721274	Graphite One (Alaska) Inc.	GCN 043	20-Nov-15	K 004S 033W 29NE

Source: AES (2022)

4.2.3 The GC Purchased Properties

Graphite One (Alaska) Inc. purchased the GC Purchased Property in two transactions. In each transaction, Graphite One (Alaska) Inc. acquired 28 Alaska state mining claims. Each set of 28 claims is classified into two of the nominal groups, with 5 claims in each set included in GC Leased Properties and the other 23 claims in each set included in GC Purchased Properties. The two sets of 23 claims classified as GC Purchased Properties are duplicate claims which completely overlap one another and partially surround the GC Leased Property. The first group of 28 claims was purchased in 2012 for $20,000 and the seller was granted a 2% production royalty on future production from the particular claims. Graphite One (Alaska) Inc. purchased the 2% production royalty in 2020. The production royalty merged with Graphite One (Alaska) Inc.'s ownership of the claims such that the claims are no longer burdened by the 2% production royalty. The second group of 28 claims was purchased in 2015 for $50,000, the issuance of 3 million common shares of Graphite One Resources Inc. and a royalty interest equal to 1% of the Net Smelter Returns received by Graphite One (Alaska) Inc. on production from the acquired claims. Graphite One (Alaska) Inc. has the right to purchase the royalty for $500,000 on or before the earlier of (i) the third anniversary of the commencement of production of the particular claims or (ii) June 1, 2035. The royalty interest remains a burden on all 28 claims, 23 of which are part of the GC Purchased Property and 5 of which are part of the GC Leased Property. Graphite One (Alaska) Inc. later conveyed 10 claims, five from each of the two acquisitions, to Kougarok, LLC. As discussed above, those ten claims now comprise the GC Leased Property.

Table 4-3: GC Purchased Property: Alaska State Mining Claims (all claims are a full ¼ Section (160 acres))

Claim Number	Claim Owner	Claim Name	Location Date	Township Location
ADL 710571	Graphite One (Alaska) Inc.	GRAPHITE CREEK 1	29-OCT-11	K 005S 035W 34SW
ADL 710572	Graphite One (Alaska) Inc.	GRAPHITE CREEK 2	29-OCT-11	K 005S 035W 34NW
ADL 710573	Graphite One (Alaska) Inc.	GRAPHITE CREEK 3	29-OCT-11	K 005S 035W 34NE
ADL 710574	Graphite One (Alaska) Inc.	GRAPHITE CREEK 4	29-OCT-11	K 005S 035W 35NW
ADL 710575	Graphite One (Alaska) Inc.	GRAPHITE CREEK 5	29-OCT-11	K 005S 035W 35NE
ADL 710576	Graphite One (Alaska) Inc.	GRAPHITE CREEK 6	29-OCT-11	K 005S 035W 27SE
ADL 710577	Graphite One (Alaska) Inc.	GRAPHITE CREEK 7	29-OCT-11	K 005S 035W 26SW
ADL 710578	Graphite One (Alaska) Inc.	GRAPHITE CREEK 8	29-OCT-11	K 005S 035W 26SE
ADL 710579	Graphite One (Alaska) Inc.	GRAPHITE CREEK 9	29-OCT-11	K 005S 035W 25SW
ADL 710580	Graphite One (Alaska) Inc.	GRAPHITE CREEK 10	29-OCT-11	K 005S 035W 25SE
ADL 710581	Graphite One (Alaska) Inc.	GRAPHITE CREEK 11	29-OCT-11	K 005S 035W 26NE
ADL 710582	Graphite One (Alaska) Inc.	GRAPHITE CREEK 12	29-OCT-11	K 005S 035W 25NW
ADL 710583	Graphite One (Alaska) Inc.	GRAPHITE CREEK 13	29-OCT-11	K 005S 035W 25NE
ADL 710584	Graphite One (Alaska) Inc.	GRAPHITE CREEK 14	29-OCT-11	K 005S 034W 30NW
ADL 710585	Graphite One (Alaska) Inc.	GRAPHITE CREEK 15	29-OCT-11	K 005S 034W 30NE
ADL 710586	Graphite One (Alaska) Inc.	GRAPHITE CREEK 16	29-OCT-11	K 005S 034W 29NW
ADL 710587	Graphite One (Alaska) Inc.	GRAPHITE CREEK 17	29-OCT-11	K 005S 034W 29NE
ADL 710588	Graphite One (Alaska) Inc.	GRAPHITE CREEK 18	29-OCT-11	K 005S 034W 20SW
ADL 710589	Graphite One (Alaska) Inc.	GRAPHITE CREEK 19	29-OCT-11	K 005S 034W 20SE
ADL 710595	Graphite One (Alaska) Inc.	GRAPHITE CREEK 25	29-OCT-11	K 005S 034W 23NW
ADL 710596	Graphite One (Alaska) Inc.	GRAPHITE CREEK 26	29-OCT-11	K 005S 034W 23NE
ADL 710597	Graphite One (Alaska) Inc.	GRAPHITE CREEK 27	29-OCT-11	K 005S 034W 23SW
ADL 710598	Graphite One (Alaska) Inc.	GRAPHITE CREEK 28	29-OCT-11	K 005S 034W 23SE
ADL 716180	Graphite One (Alaska) Inc.	GPH 01	08-OCT-12	K 005S 035W 34SW
ADL 716181	Graphite One (Alaska) Inc.	GPH 02	07-OCT-12	K 005S 035W 34NW
ADL 716182	Graphite One (Alaska) Inc.	GPH 03	07-OCT-12	K 005S 035W 34NE
ADL 716183	Graphite One (Alaska) Inc.	GPH 04	08-OCT-12	K 005S 035W 35NW
ADL 716184	Graphite One (Alaska) Inc.	GPH 05	08-OCT-12	K 005S 035W 35NE
ADL 716185	Graphite One (Alaska) Inc.	GPH 06	06-OCT-12	K 005S 035W 27SE
ADL 716186	Graphite One (Alaska) Inc.	GPH 07	06-OCT-12	K 005S 035W 26SW
ADL 716187	Graphite One (Alaska) Inc.	GPH 08	06-OCT-12	K 005S 035W 26SE
ADL 716188	Graphite One (Alaska) Inc.	GPH 09	07-OCT-12	K 005S 035W 25SW
ADL 716189	Graphite One (Alaska) Inc.	GPH 10	06-OCT-12	K 005S 035W 25SE
ADL 716190	Graphite One (Alaska) Inc.	GPH 11	06-OCT-12	K 005S 035W 26NE
ADL 716191	Graphite One (Alaska) Inc.	GPH 12	06-OCT-12	K 005S 035W 25NW
ADL 716192	Graphite One (Alaska) Inc.	GPH 13	06-OCT-12	K 005S 035W 25NE

Claim Number	Claim Owner	Claim Name	Location Date	Township Location
ADL 716193	Graphite One (Alaska) Inc.	GPH 14	06-OCT-12	K 005S 034W 30NW
ADL 716194	Graphite One (Alaska) Inc.	GPH 15	06-OCT-12	K 005S 034W 30NE
ADL 716195	Graphite One (Alaska) Inc.	GPH 16	06-OCT-12	K 005S 034W 29NW
ADL 716196	Graphite One (Alaska) Inc.	GPH 17	06-OCT-12	K 005S 034W 29NE
ADL 716197	Graphite One (Alaska) Inc.	GPH 18	04-OCT-12	K 005S 034W 20SW
ADL 716198	Graphite One (Alaska) Inc.	GPH 19	04-OCT-12	K 005S 034W 20SE
ADL 716204	Graphite One (Alaska) Inc.	GPH 25	04-OCT-12	K 005S 034W 23NW
ADL 716205	Graphite One (Alaska) Inc.	GPH 26	04-OCT-12	K 005S 034W 23NE
ADL 716206	Graphite One (Alaska) Inc.	GPH 27	04-OCT-12	K 005S 034W 23SW
ADL 716207	Graphite One (Alaska) Inc.	GPH 28	03-OCT-12	K 005S 034W 23SE

Source: AES (2022)

4.2.4 Surface Rights and Permitting

For Alaska State mining claims, surface rights remain with the State, while surface uses that are necessary for the prospecting for, extraction of, or basic processing of minerals are allowed, subject to reasonable concurrent uses. The permits required for mining are more fully outlined in Section 20 of this Assessment, but as a minimum, the following are expected:

1. A Regional General Permit (RGP) 2006-1944 or an RGP 2007 or an Individual Permit; and
2. An Alaska Pollutant Discharge Elimination System (APDES) Permit.

To the knowledge of the QP, there are no outstanding environmental liabilities to which any portion of the project is subject.

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 Topography, Elevation, and Vegetation

The Property is in the Seward Peninsula in Alaska, and located approximately 59 km North from Nome, AK which is the closest major centre. On its northern edge, the Property borders onto the Imuruk Basin, a shallow tidal body of water that leads, via the Tuksuk Channel out to Grantley Harbor, and thus to Port Clarence and the Bering Sea. The elevation of the Property gently rises from the basin to the Kigluaik Mountains, which reach some 1190 m asl. The proposed mine site would be located between 100 and 500 m in elevation along the base of the Kigluaik mountain range front adjacent to Graphite Creek, a small drainage descending from the mountains west facing slopes.

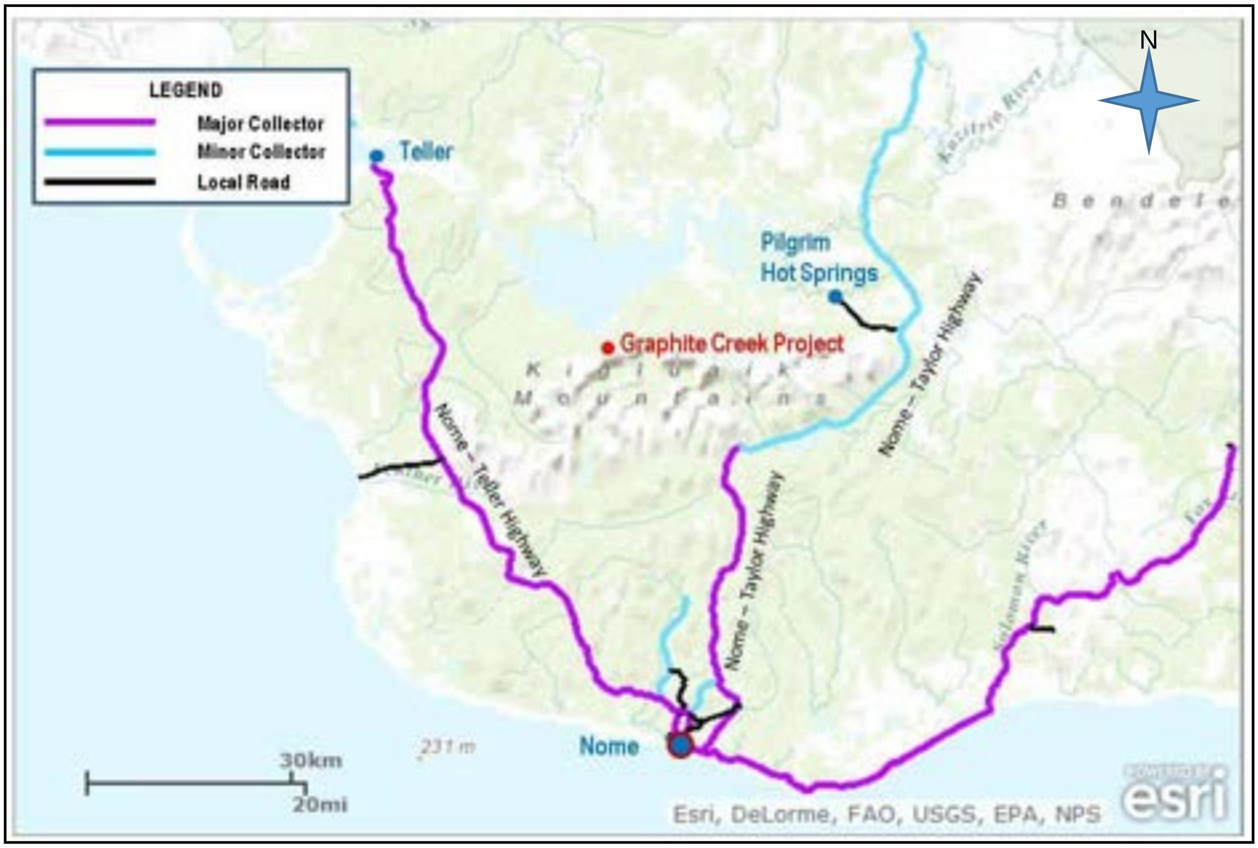
Permafrost is present, as this is an arctic tundra environment, with low vegetation composed primarily of shrubs, grasses and lichens.

5.2 Accessibility

With major urban center Nome to the South, the closest village to the Property is the Inupiat village of Teller (2020 population of 237 persons), located 42 km northwest. There is no road access to the Property at present. The roads closest to the site are marked in Figure 5-1. The Nome-Teller (Bob Blodgett Highway) Highway passes the western periphery of the Kigluaik Mountain chain approximately 30 km west of the Property and ends at Teller, Alaska. The Nome-Taylor (Kougarok Highway) Highway circumvents the eastern part of the Mountain range along its southern flank 20 km southeast of the Project area and ends at the Kougarok River Bridge. A (local) road spur leading off the Nome-Taylor highway leads to Pilgrim Hot Springs just north of the eastern flank of the Kigluaik Mountain Range. Both highways are well-maintained gravel roads but neither highway is entirely maintained during winter months (October to May) beyond certain mile posts, which for Nome-Taylor is mile post 13 and for Nome-Teller is mile post 8. The highways are typically closed after the first snowstorm.

During the 2021 and 202 field exploration programs, a temporary camp was used and access to the Property was achieved by helicopter. Future mining operations will be supported by a proposed overland route connecting the mine site to the Nome-Taylor highway.

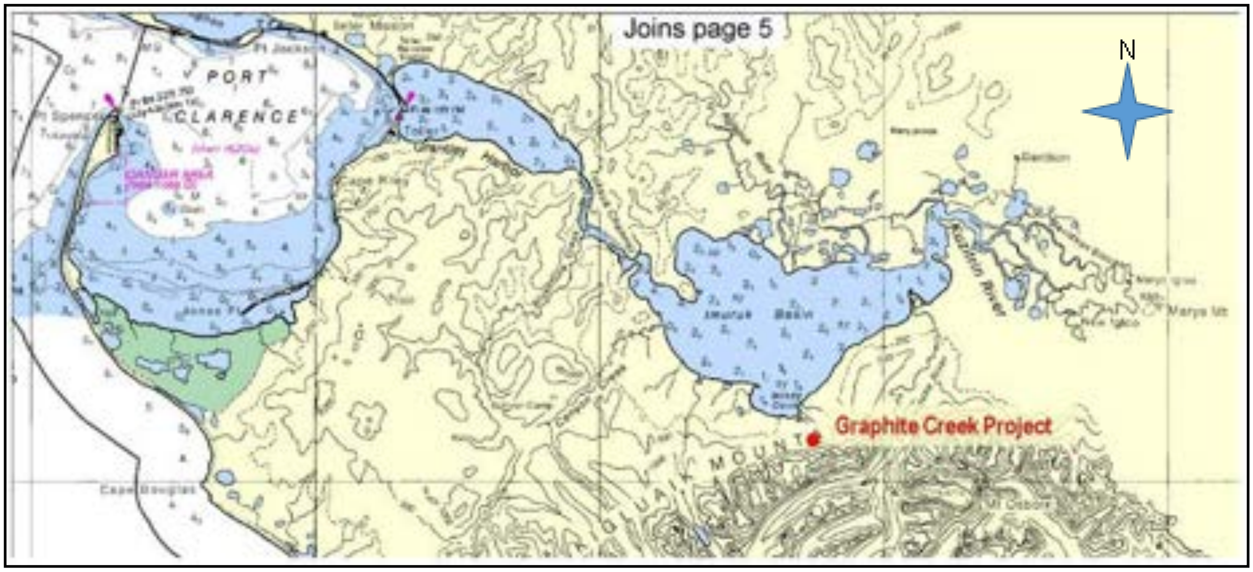
Figure 5-1: Main Highways and Roads from Nome Leading towards Project Area



Source: Esri (2022)

Seward Peninsula lacks rivers of adequate depth for commercial transport and navigation to be commonplace with the bodies of water of interest are shown in Figure 5-2. The navigational route from the Property on the Imuruk Basin at Windy Cove through the Tuksuk Channel to Grantley Harbor and on to Port Clarence would have to be assessed for larger bulk transport of material at the proposed scale of operation. Imuruk Basin is a shallow lagoon with recorded depths of 1.8 to 2.7 metres (1 to 2 fathoms). Employment of a port facility on the Imuruk Basin is not the primary focus for a transport option due to a combination of factors including difficult passage through Tuksuk channel; uncertainty of water depths; determining an appropriate/passable route; the presence of two threatened seal species, and concerns regarding potential Alaska Natives fishing and hunting sustenance constraints. As such, a year-round road connected to the Teller Highway is presently considered to be the most suitable and practical transport option. The proposed road length and location is discussed in more detail in Section 18 of this Report.

Figure 5-2: Soundings (in fathoms, 1 fathom = 1.8 metres) of Port Clarence, Grantley Harbor and Imuruk Basin



Source: Graphite One PEA (June 30, 2017)

5.3 Climate

The climate local to the Property is categorized as maritime in the months when the Bering Sea is ice-free and acting as a modifier. In winter (mid-November to mid-June), when the sea is ice-covered, the climate is categorized as continental, with drier, colder conditions. It is more generally described as a sub-arctic climate. Average temperatures for Nome range from -19 °C in the winter months to 15 °C in the summer months with an average freeze-free period of 81 days. Precipitation in Nome averages 421 mm rain and 1,453 mm snow on an annual basis.

5.4 Infrastructure

There is no permanent infrastructure at the site.

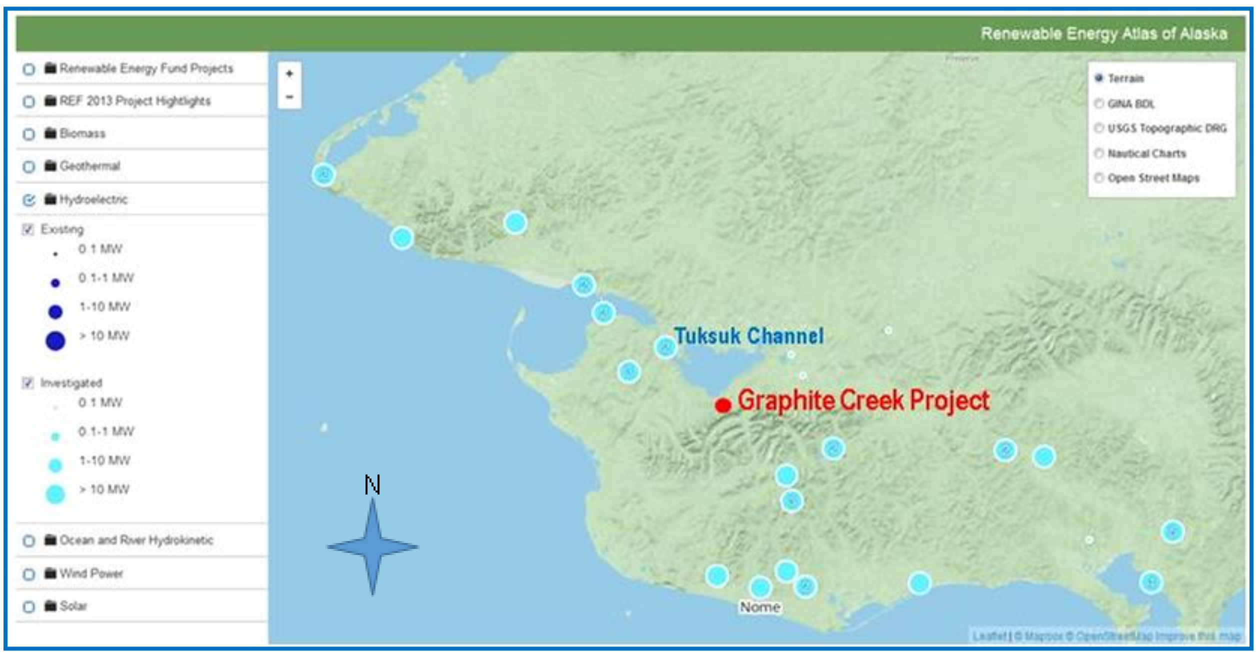
5.4.1 Energy Infrastructure

There are presently no large, interconnected grids of power transmission and distribution lines in the Seward Peninsula. The only intra-state grid network is found in the more populated areas of eastern Alaska running the corridor from Fairbanks to Anchorage.

Most power in the Seward Peninsula is generated by consumer-owned electric cooperatives near the serviced communities. Teller, Brevig Mission and Nome generate electricity via diesel-fuel power plants with respective electrical generating capacities of 1,050 kW (approximately 1 MW) and 20.4 MW. The project area and western Alaska in general are far from the eastern oil producing areas and the Alaska oil pipeline and access to the intra-state electrical grid. However, the Tuksuk Channel that links Imuruk Basin to Grantley Harbor has been identified as potential site for hydroelectric power generation on maps by the Alaska Energy Authority (Figure 5-3) and was evaluated in a 1980 study on Alaskan hydroelectric resource to have potential generating capacity of 66 MW.

There are various options for electric power generation on site, ranging from the more likely diesel generation to liquid natural gas (LNG), to wind (Nome has local experience in setting up arctic-grade wind generation systems), and even to some geothermal generation from Bering Straits Native Corporations Pilgrim Hot Springs project. These options are being explored through discussions between Graphite One and the Alaska Industrial Development and Import Authority and the University of Alaska at Anchorage, with a view to incorporate some renewable energy at a cost advantage to the project. Further discussion of this is included in Section 18.

Figure 5-3: Alaska Energy Authority Map Identifying Sites with Hydroelectric Potential in the Seward Peninsula



Source: Alaska Energy Authority. (June 2019). Renewable Energy Atlas of Alaska. Anchorage, Alaska

5.4.2 Water Source(s)

There is sufficient water source on or available at the Property to support mining operations, and a site for a tailings pond has been identified. Environmental considerations must be taken into account in the planning for water use and disposal. This review is in the beginning stages, as outlined in Section 20 of this Report.

The following description of the physiography of the Graphite Creek Property is paraphrased from Eccles et al., (2015).

The Property is located in the southwestern part of the Seward Peninsula, approximately 59 km north of Nome, and 3 km south of Windy Cove on the Imuruk Basin. The Imuruk Basin is a shallow intertidal basin that connects to the Bearing Sea at Grantley Harbor. A gently sloping alluvial plain extends inland from Windy Cove to the Kigluaik Mountains. Elevation on the property varies from approximately 77 m asl in the alluvial plains to 1190 m asl in the mountains.

Vegetation on the property is characteristic of the arctic tundra biome, where vegetation is low and dominated by shrubs, sedges, perennial forbs, grasses mosses and lichens. Additionally, a layer of discontinuous permafrost is present.

The operating season on the property is approximately from mid-June to the beginning of November. From early June until mid-November the Bering Sea is typically ice free and the area of the Property is considered a maritime climate zone. The climate changes to continental in the winter, with drier and colder conditions. Average annual precipitation in Nome is 421 mm precipitation and 1,453 mm of snow. Average temperatures range from 15°C in summer to -19°C during winter.

6 HISTORY

6.1 Overview

Historical graphite excavations and occurrences, and other mineral commodities around the Property are shown on Figure 6-1. The only areas of historic graphite mining in the region occur within the Property boundary. Other undeveloped occurrences of graphite are documented at Windy Creek and Christophosen Creek about 8-10 km southeast of the Property.

No work has been completed by the Company or any other Qualified Person on the historic mining or historic reported deposits or mineral inventory in the area. Therefore, those deposits and resources are not considered modern mineral resources or mineral reserves. The QP has solely relied on NI 43-101 resource estimates published by the Company in 2013, 2014, 2015 and 2019.

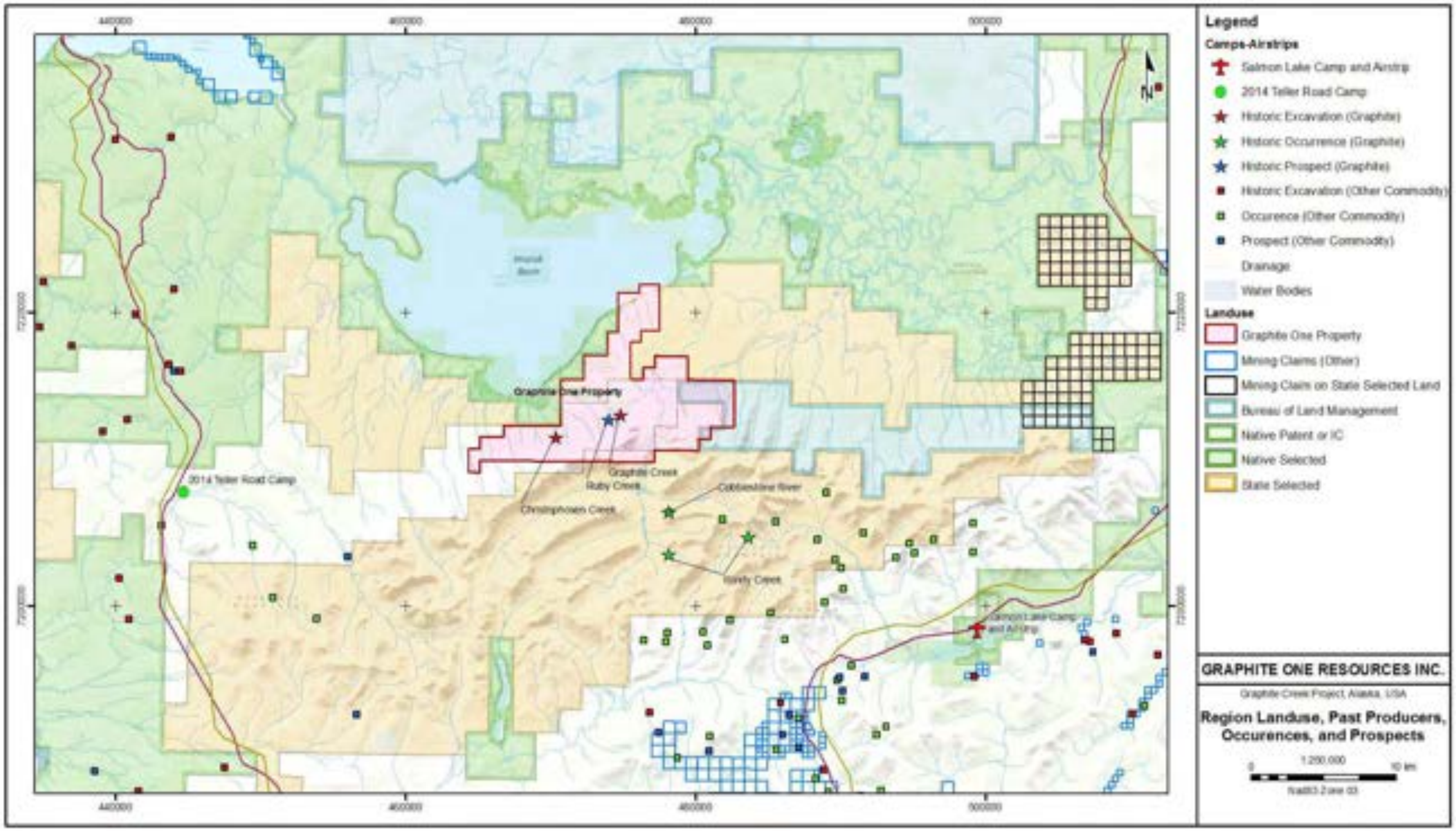
Graphitic bedrock was first documented on the north side of the Kigluaik Mountains in the early twentieth century (Moffit, 1913). The graphite showings are known to crop out in incised creek valleys on the north side of the Kigluaik Mountains and it is from these exposures that the graphite showings have been described by various authors (e.g., Mertie, 1918; Coats, 1944; Cobb, 1972; Cobb and Sainsbury, 1972; Sainsbury, 1972; Weiss, 1973; Cobb, 1975; Hudson and Plafker, 1978; Hudson, 1981, 1998; Swainbank et al., 1995; Adler and Bundtzen, 2011; Nelson, 2011). From west to east these creek exposures include Christophosen Creek, Hot Springs Creek, Trail Creek, Glacier Canyon Creek, Ruby Creek and Graphite Creek. A general historical overview of each of the historical graphite showings is described in Duplessis et al., (2013).

6.2 Historical Mining

Historic mining production and resource estimates were originally published in imperial units. All values have been converted to metric units for clarity and convenience.

During the early 1900s, at least two companies mined in the area. The first known claims were staked in 1900 by Uncle Sam Alaska Mining Syndicate (USAMS) in Graphite Bay, now known as Windy Cove (Harrington, 1919). In 1912, USAMS shipped 120 t of graphite to Seattle and the San Francisco Bay area, and by 1916 had stockpiled another 275 t (Mertie, 1918). The Alaska Graphite Mining Co. staked claims in 1905 and added additional claims in 1915 and 1916 (Mertie, 1918; Harrington, 1919). A total of 32 t of graphite was mined from talus in 1907 (Coats, 1944). Employing about seven people, 90 t of graphite was mined in 1916 (Mertie, 1918). This production was hauled a short distance overland to Windy Cove, from there to Teller by boat, and then shipped to Seattle and San Francisco (Harrington, 1919).

Figure 6-1: Property Location, Historic Deposits, Showings and Occurrences, and Land Disposition in the Property Area



Source: AES (2022

6.3 Prior Exploration

After initial early 1900s production, the properties lay dormant until 1943 when USGS geologist Robert Coats visited the area. His field crew sampled material from several sorted piles of previously mined graphite, and from several high-grade graphitic lenses on the Property (Coats, 1944). Three specific areas underwent surface excavation work and were named by Coats as Christophosen Creek, Ruby Creek, and Graphite Creek (Figure 6-1). Coats (1944) reported that exposed high-grade lenses in these three areas varied from a few centimetres to a metre in thickness with lengths that are ten to fifteen times their width and contained up to 59.7% graphite.

The last known exploration interest in the area was in 1981 when a brief field examination of the showings was conducted by the Anaconda Copper Company when several samples were taken for analysis during a one-day visit (Hudson, 1981; Wolgemuth, 1982).

The historical work, which includes inferences to middle 1910s 'mining' by way of hand-sorting high-grade graphite material from small (<10 m) excavations into outcrop, is superseded by recent investigations conducted by Graphite One.

Exploration work performed by Graphite One during 2011 to 2018 consisted of a variety of programs, the details of which are reported in Duplessis et al., (2013), Eccles and Nicolls (2014), and Eccles et al., (2015) and King et al (2018). Those programs can be summarized as follows:

1. In 2011, Mr. S. Nelson conducted a helicopter-supported mapping and sampling program on behalf of Graphite One. He identified and mapped the distribution of graphite bearing meta-sediments along the north-central slope of the Kigluaik Mountains (Nelson, 2011). Graphite-rich host rocks were reported across a continuous strike length in excess of five kilometres.

2. During the 2011 field season, three 15 kg composite samples were collected from outcrop (Hudson, 2011). The samples were characterized as high grade, mixed grade and mixed/disseminated grade. The samples were submitted for petrographic and laboratory screen analysis.

   The high-grade, mixed-grade and disseminated graphite samples contained 56.9, 14.5, and 8.2% graphite respectively. Screening analyses of the samples that were crushed to -10 mesh and it was determined that they contained 84.3%, 93.6% and 76.5% large flake graphite. Large flake being defined as flake size greater than 80 mesh in one dimension (Hudson, 2011). Graphite flakes varied between a few microns to about 1.5 mm in its longest direction with averages between 150-250 µm. The graphite was described as consisting of lath-shaped particles with deformed or foliated texture, liberated crystals and intergrowths with other constituents.

3. An ambitious exploration program was carried out over the Property during the summer of 2012. This program consisted of an airborne geophysical survey, detailed 1:5,000 scale mapping and sampling, bulk pit sampling, and a diamond drilling program consisting of 4,248 metres in 18 holes. The results of the helicopter-borne time domain electromagnetic (EM) survey are shown in Figure 6-2. Warm colors (red) represent high signal and cold colors (blue) represent low signal. The continuous northeast-trending, high electromagnetic anomaly is approximately 18 km in length. Interpretation of the geophysical survey results coupled with the mapping and sampling program led the researchers to believe that graphite mineralization was present along the 18 km corridor of metasediments on the flank of the Kigluaik Mountains.

A total of 591 rock samples were collected by Graphite One's consultants APEX Geoscience Ltd. across the Property. Graphite mineralization grading between 0.05% and 51% total carbon in graphite form (Cg) was found to occur within biotite-quartz schist and sillimanite-garnet-biotite-quartz schist units. The sillimanite-garnet-biotite-quartz schist is typically high-grade due to graphite concentrated as massive to semi-massive segregations that contain up to 80.9% Cg. Of the 591 grab samples collected in 2012, 11 samples yielded >45%Cg, 47 samples had >10% Cg and 137 samples had >3% Cg.

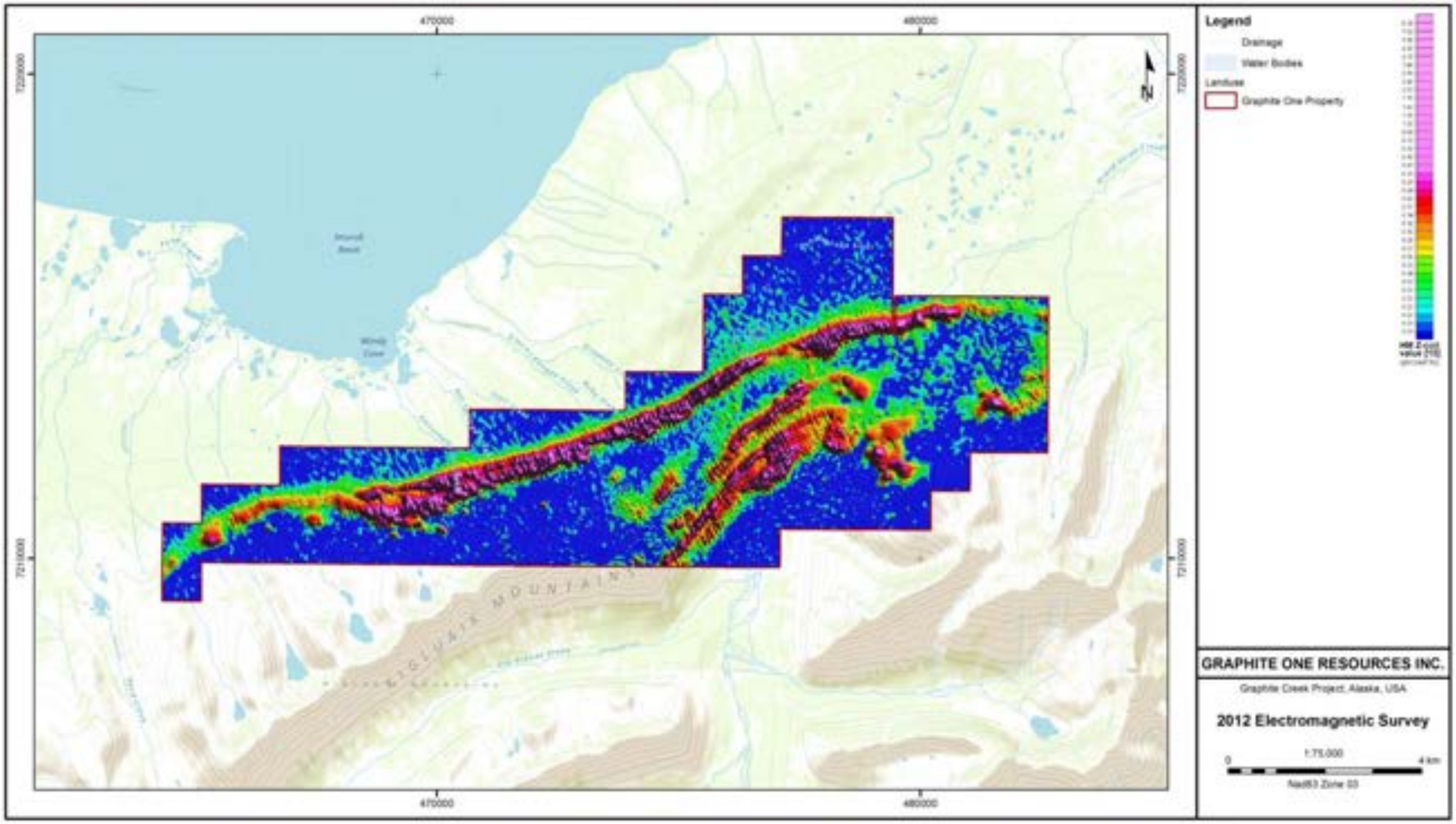
Fifteen bulk samples of between 558 kg and 739 kg totaling 9,916 kg were collected from three different areas including the Graphite Creek, Christophosen Creek and Child Drainages.

The initial drill hole spacing was approximately 200 m between holes along strike, but later in the program some infill drilling was carried out with hole spacings as close as 50 m. Graphite mineralization was encountered in all drill holes, including the last hole, 12GCH008 which was collared approximately 2.3 km to the west along strike to test the lateral extent of the mineralization.

Several composite samples were selected from drill core and submitted for laboratory analysis to characterize the graphite flake size and structure and the nature and abundance of the various gangue minerals. The graphite was described by Hazen Research of Golden, Colorado (Hazen) as occurring mostly as liberated flakes/crystals in the minus 40 mesh fractions and occurring together with less common intergrowths of graphite and other gangue schist components (quartz, mica and other siliceous materials and iron oxides. The samples supplied to Hazen were described as "…consist(ing) mainly of quartz, with minor amounts of mica, clay, magnetite, ilmenite, and titanium oxides. The graphite is present as: minute scales or flakes; fine, undulated stringers along schist planes; liberated lath- shaped or tabular-foliated crystals; or as blocky and irregular deformed particles." (Hazen Research Inc., 2012). One 5 kg composite sample was collected from drill core and sent to Activation Laboratories Ltd. in Thunder Bay, Ontario for x-ray diffraction analysis. Mineral 'mapping' on the Mineral Liberation Analyzer shows that most of the graphite flakes/crystals/particles occur as free (liberated) graphite with 50% of the graphite passing through 120 µm and 80% passing through 330 µm.

Based on the 2012 drilling and exploration results, APEX reported an inferred mineral resource of 107.2 Mt of graphite mineralization grading 5.78% Cg at a cut-off grade of 3.0% (Duplessis et al., 2013).

Figure 6-2: SkyTEM Helicopter-Borne Time-Domain Electromagnetic Image; High Moment Z-coil Channel 05



Source: Duplessis et al., (2013)

4. The 2013 exploration program consisted of a small diamond drilling program, calculation of a new resource estimate, and a bench-scale beneficiation test. The diamond drilling program consisted of 1,024 m of drilling in ten drill holes. Again, graphite mineralization was encountered in all of the drill holes. The holes were drilled with a collar spacing of approximately 250 m and increased the mineral resource to a zone approximately five kilometres in length, and at depths from surface or near surface to depths of 147 m below surface.

   The issuer's consultants calculated a new resource estimate based on the cumulative drill data from the 2012 and 2013 drill programs. The APEX geologists calculated that the deposit contained approximately 186.9 Mt of graphite-bearing mineralization at a grade of 5.5% Cg, using a cut-off grade of 3.0% Cg (Eccles and Nicholls, 2014). The model and resource estimate based on it was calculated by dividing the deposit into eight different domains or lodes, based on lateral continuity and statistical grade analysis of the assayed core samples.

   The bench-scale beneficiation study demonstrated that it was feasible to produce high-purity 99.2%Cg from a rough concentrate (Graphite One Resources Inc., 2013). The methods used included flotation cells and a leaching process to produce the high-purity graphite.

5. The 2014 program consisted of diamond drilling, collection of metallurgical samples, and the calculation of a new resource estimate. That program is described in detail in a technical report issued by Graphite One Resources in March, 2015 (Eccles et al., 2015).

   The drill program was designed to both increase the confidence level and the extent of the resource. The program consisted of 20 holes totaling approximately 2,221 m logged and assayed, and 2 holes totaling 91.6 m used for metallurgical testing. A total of 2,354 samples were collected in the 2014 program, of which 2,274 were submitted for assay, and 80 retained for metallurgical test-work. The 2014 drill holes were collared on sections approximately apart and at least two holes were drilled on each section, in an effort to confirm continuity of the mineralization, both vertically and laterally. Once again, all holes encountered significant Cg mineralization.

   The increased drill density in the central region of the deposit, combined with the demonstrated continuity of the mineralization allowed the resource in this section to be classified as Indicated. The Indicated Mineral Resource area is spatially constrained by the boundary of the 2014 drill program and defines an area measuring: approximately 730 m along the northeast-striking trend of the graphitic schist; approximately 185 m across the strike of the schist; and to a depth of approximately 200 m below surface. Using a preferred base cut-off of 3% Cg, the Indicated Mineral Resource estimation contains 17.95 Mt of mineralized graphite schist at a grade of 6.3% Cg. Based on this tonnage, grade and 3% Cg cut-off, the in-situ graphite contained within the Indicated Mineral Resource area is estimated to be 1.13 Mt.

   The Inferred Mineral Resource area is constrained by the drilled portions of the graphitic conductor that are not included within the Indicated Resource area. Accordingly, the Inferred Resource area is approximately 5.0 km along the northeast- striking trend of the graphitic schist (minus the 730 m portion of the Indicated Resource); approximately 200 m across the strike of the graphitic schist; and to a depth of approximately 320 m below surface. Using a preferred base cut-off of 3% Cg, the Inferred Mineral Resource estimates that 154.36 Mt of mineralized graphite schist at a graphite grade of 5.7% Cg are present at the Graphite Creek deposit. Based on this tonnage, grade and 3% Cg cut-off, the in-situ graphite of the Inferred Mineral Resource is 8.76 Mt.

6. The 2018 drill program increased the indicated resources to measured and gathered sufficient material for metallurgical testing. Drill holes were completed within the core area of the resource at 50 m spaced down-dip step-outs. A total of 800.87 m of drilling in six (6) drill holes were completed.

   The drilling continued to show that the upper zone of graphite mineralization is fairly consistent. The lower zone of mineralization is more variable in grade and thickness of higher-grade graphite mineralization (King et al., 2018). Four of the drill holes drilled were collared before the break in slope of the Kigluaik mountain front. Each of these drill holes encountered a large, fault gouge zone immediately below the abundant overburden before going into bedrock. This fault zone is interpreted to be part of the basin-bounding Kigluaik fault system (King et al., 2018).

The mineral resource estimate is discussed in more detail in Section 14.

7 GEOLOGICAL SETTING AND MINERALIZATION

7.1 Regional Geology

The following synopsis of the regional geology of the Property area is quoted from previous technical reports issued for the Property (Duplessis, et al., 2013, Eccles and Nicholls, 2014, Eccles et al., 2015, and King et al., 2018). Although new regional-scale research is being carried out in the area, the QP Robert M. Retherford considers this description to be still current and applicable.

*The Kigluaik Group consists of amphibolite and granulite facies metamorphic rocks and is therefore divided into two sub-groups, an upper and lower assemblage. Amphibolite grade upper Kigluaik Group schist is exposed on the southern flanks of the Kigluaik mountain range. Pelitic gneiss samples from the upper section of the Kigluaik group have been dated using Rb/Sr to ~735 Ma (Bunker et al., 1979). The basal Kigluaik Group contains granulite grade schist and gneiss and is exposed on north flank of the mountains (*Figure 7-1*). These rocks have no direct counterparts in the adjacent mountain ranges and are believed to represent the deepest crustal rocks exposed in northwestern Alaska (Miller, 1994). The lower Kigluaik Group comprises coarse marble, quartzo-feldspathic gneiss, schist and gneiss of mafic and ultramafic composition, graphite rich schist, and garnet lherzolite.*

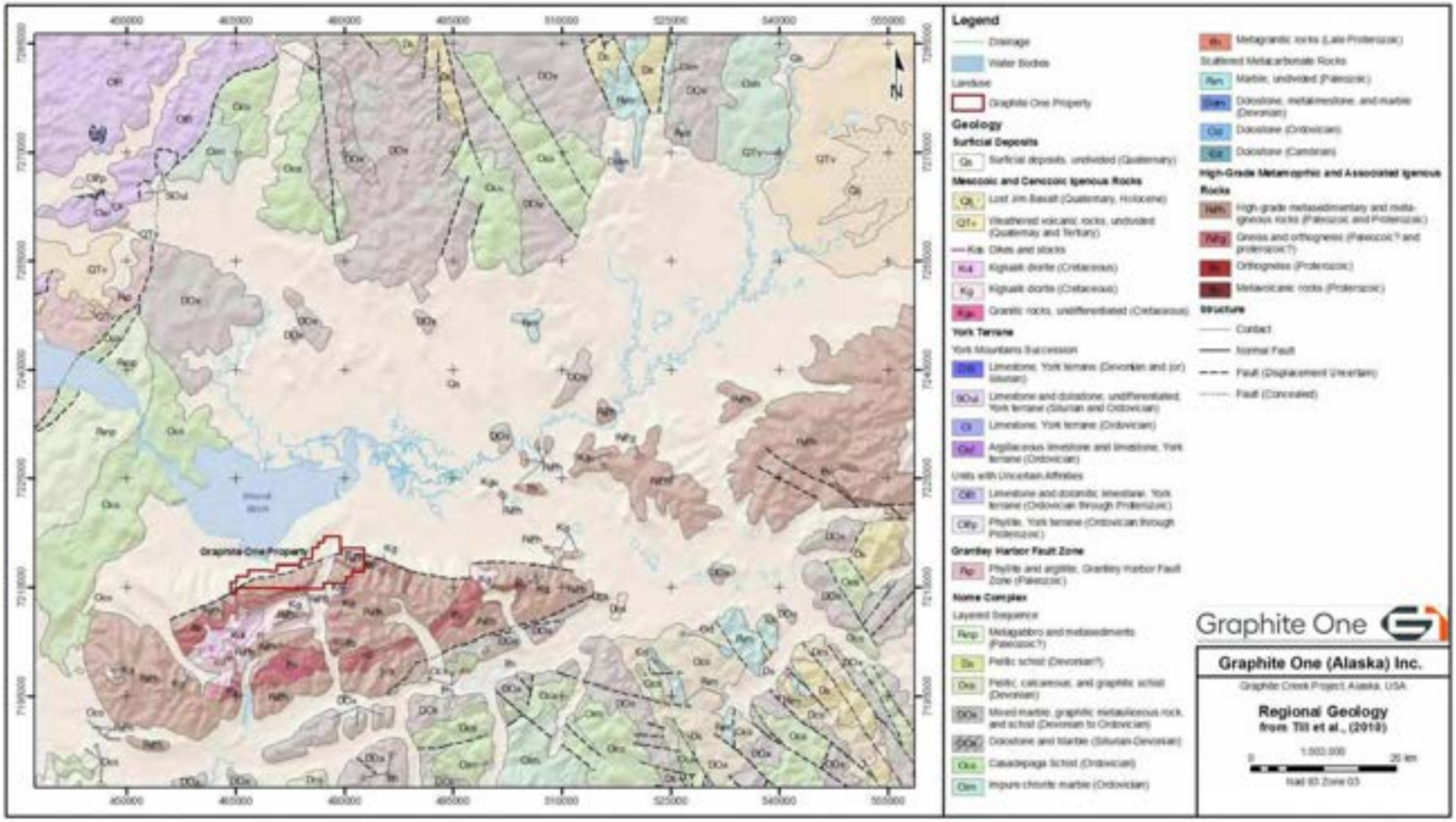
The Graphite One Property area is underlain by high-grade metamorphic rocks of the Kigluaik Group (Figure 7-1)*. These metamorphic rocks are composed of continental crustal material of Proterozoic to middle Paleozoic age that were subjected to crustal imbrication and thickening in middle Mesozoic time and widespread plutonic activity in mid-Cretaceous to Late Cretaceous time (Sainsbury, 1972, 1975; Bunker et al., 1979; Miller, 1994; Till and Dumoulin, 1994; Armstrong et al., 1986; Amato and Wright, 1998; Till et al., 2011). However, some authors have proposed that at least part, and perhaps a significant part, of high-grade metasedimentary and metaigneous rocks of the Kigluaik Group (unit PzPh on* Figure 7-1*) was originally blueschist-facies rocks of the Nome Complex subsequent to a high-grade metamorphic overprinting (Hannula and McWilliams, 1995; Till et al., 2011).*

All of the formations of the Kigluaik Group are cut by intrusive rocks, the most common of which is granite. These intrusions are more abundant in the lower part of the group. Besides granite intrusions, dykes and sills of diorite, diabase and pegmatite are present.

Peak metamorphic grade in the area is thought to have occurred in the Cretaceous (91 Ma), immediately preceding or coincident with the intrusion of the Kigluaik Pluton (Amato and Wright, 1998). Other dating methods have yielded younger ages. 40K/40Ar and 40Ar/39Ar dating have yielded ages of ~95-81 Ma. The younger ages likely dates the onset of high grade regional metamorphism of the Kigluaik Group (Adler and Bundtzen, 2011).

*Bedrock is either exposed or covered minimally by surficial overburden material throughout most of the Property area, particularly in the incised creek valleys and/or relatively steep slopes adjacent to the Kigluaik Fault. Surficial Quaternary deposits dominate the area to the north of the Graphite One Property (*Figure 7-1*). The surficial deposits include: glacially deposited sand, gravel, and boulders; fluvial gravel and sand; marine and fluvial terrace deposits; and wetlands (Till et al., 2011).*

Figure 7-1: Regional Geology of the Graphite Creek Property Area



Source: Till et al., (2010)

7.2 Property Geology

The property-scale geology in the Graphite One Project area has been described in previous technical reports issued for the Property. The following property-scale description of the Graphite Creek area geology is derived primarily from Eccles, et al., (2015) except where not in italics. No property-scale mapping has been completed on the Property since this synopsis was published, and the QP Robert M. Retherford considers this a fair and accurate description of the Property geology.

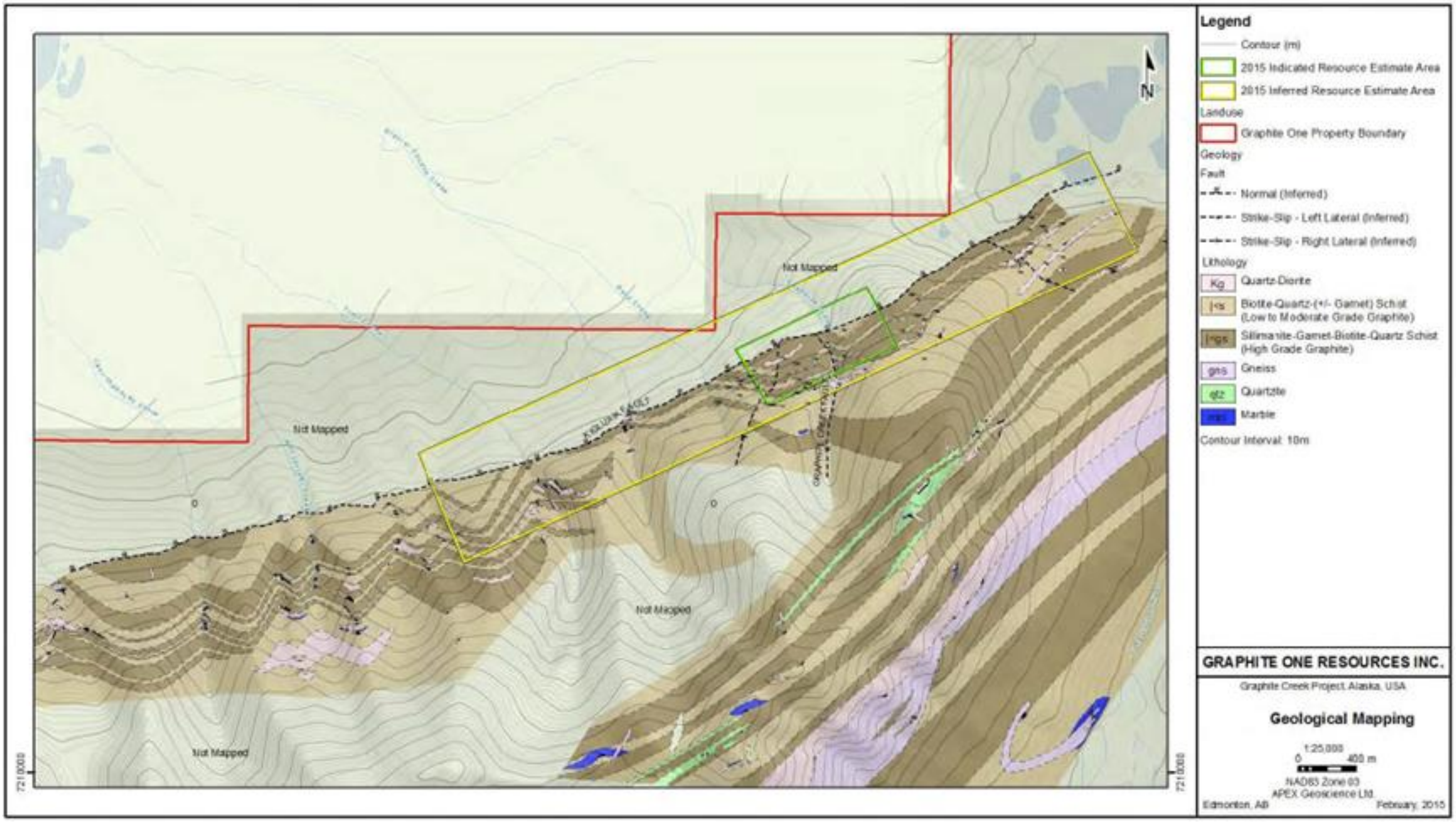
> *The Graphite Creek graphite deposit is located on the north side of the Kigluaik Mountains (at about 230 m elevation). More specifically, the graphitic schist occurs on the upslope and footwall surface trace of the reactivated Kigluaik normal fault. The Kigluaik Fault generally strikes at approximately azimuth 250º and dips 75º to the north over a distance of approximately 35 km. Contemporary movement on this fault has uplifted the rugged and youthful Kigluaik Mountains to the south and down thrown the lowlands of the Imuruk Basin to the north (Hudson and Plafker, 1978).*

The Kigluaik fault in the preliminary pit area is recognized as dipping at about 45º at an azimuth of 250º based on 11 drill intercepts, 7 of them in 2021. (Gierymski and Flanigan, 2022).

> *Graphite occurs as high-grade massive to semi-massive segregations and disseminations within amphibolite facies metasedimentary rocks, primarily biotite-quartz schist with zones of sillimanite-garnet-biotite-quartz schist (*Figure 7-2*; Sainsbury, 1972). Based on their apparent association with the Kigluaik Fault, the graphite-bearing schist units strike subparallel to the mountain front and dip north between 40° and 75°.*
>
> *The 2012 geological mapping program confirmed historical observations of distinct geological layers comprising high-grade massive to semi-massive segregated and disseminated graphite in sillimanite-garnet-biotite-quartz schist and disseminated graphite in biotite-quartz schist (±garnet). Based on strike/dip measurements, the layers consistently dip northwards such that these layers appear to represent continuous geological units and are not overly distorted by complex regional or large-scale fold belts. Small localized folding does exist on the <1 m scale, but it is more or less confined within the high-grade graphite schist layers.*
>
> *A total of 591 rock grab samples collected from throughout the Graphite Creek Property during 2012 include graphitic sillimanite-garnet-biotite-quartz and biotite-quartz (±garnet) schistose units plus localized intrusive diorite. All samples were analyzed for specific gravity and graphitic carbon. Of the 591 samples, 11 samples yielded >45% Cg (up to 80.9% Cg), 47 samples had >10% Cg and 137 samples had >3% Cg.*
>
> *A 1,523.5 line-kilometre time-domain, helicopter-borne magnetic and electromagnetic survey over the Graphite One Property shows that bands of continuous high-electromagnetic anomalies mimic historical and 2012 geological mapping of high grade graphitic schist in the Graphite Creek Property area. The high-electromagnetic bands also correlate well with 2012-2014 drill results. Subsequently, interpretation of the electromagnetic data provides preliminary*

evidence that the high-grade graphite layers observed in incised creek exposures are continuous along strike in a north-easterly direction for approximately 18 km.

Figure 7-2: Detailed Geologic Map of a Portion of the Graphite Creek Property



Source: Eccles et al., (2015)

7.3 Mineralization

The mineralization in the Property area has been described in previous technical reports issued for the Property. The following synopsis of the mineralization on the Graphite Creek property is quoted from Eccles, et al., (2015). New studies of the mineralization have begun since this synopsis was published, and the QP Robert M. Retherford considers this is still a fair and accurate description of the mineralization.

> *There are two distinctive graphite-bearing schist intervals at Graphite Creek. The first is sillimanite-garnet-biotite-quartz schist that contains coarse, semi-massive and massive graphite segregations and disseminated graphite (*Figure 7-2*. The other interval unit is biotite-quartz schist that typically contains disseminated graphite. The sillimanite-garnet- biotite-quartz schist is the principal host to higher grade graphite and makes up two distinctive layers in the metasedimentary sequence along the north flank of the Kigluaik Mountains. A third potential horizon is defined by 'pods' of sillimanite-garnet- biotite-quartz schist (*Figure 7-2*). The position of these layers is most likely structurally controlled; that is a folded unit with the third pod-like layer forming in this style as uppermost erosional features (T. Hudson, personal communication, 2012). Hence, shallow-dipping erosional remnants of the southern-most third layer makes up a few discontinuous perched masses at higher elevations. The sillimanite-garnet-biotite-quartz schist layers strike obliquely to the mountain front and dip northwards at 40° to 78°.*
>
> *The sillimanite-garnet-biotite-quartz schist typically is fine to coarse grained, weathers grey, has a wavy and crenulated schistosity, garnet porphyroblasts (up to 2 cm across), and augen-shaped quartz grains. Discontinuous segregations (lenses and streaks) of coarse high-grade graphite, from centimeters to a few meters thick, are common. These high-grade graphite lenses in the sillimanite-garnet-biotite-quartz-schist have up to 60% coarse, crystalline graphite and were no doubt the sources of hand sorted graphite produced in the early 1900's. Disseminated flakes of graphite, up to 1 mm or more across, make up several percent of the rock.*
>
> *The biotite-quartz schist is fine-grained, weathers a rusty ochre colour and has regular layering with individual layers commonly 3 to 10 cm thick. Graphite occurs as disseminated flakes up to about 1 mm across and can make up several percent of the rock. Higher grade graphite-rich layers, varying from 3 to 25 cm in width are present, but are not as common as in the sillimanite-garnet-biotite-quartz schist.*

8 DEPOSIT TYPES

Graphitic carbon deposit types have been described in previous technical reports issued for the Property. The following synopsis of graphitic carbon deposits is quoted from Eccles, et al., (2015). The QP Robert M. Retherford is not aware of any research published subsequent to the 2019 technical report which would render the observations and conclusions invalid. The QP Robert M. Retherford considers this a fair and accurate description of the various deposit types around the world.

Graphite deposits of commercial interest occur widely in regionally or thermally metamorphosed sedimentary rocks, and in hydrothermal and metasomatic deposits. Harben and Kužvart (1996) identified five deposit types:

1. Deposits formed by concentration and crystallization of carbon (from coal or carbonaceous sedimentary rocks) during regional or contact metamorphism (Cameron and Weiss, 1960; Graffin, 1975; Krauss et al., 1988; Sutphin et al., 1991; Weiss, 1973; Weiss and Salas, 1978);

2. Vein deposits, where graphite is thought to form epigenetically from carbon-rich hydrothermal or pneumatolytic solutions as interlocking aggregates of coarse graphite crystals in veins containing 75-100% carbon (Cameron and Weiss, 1960; Harben and Bates, 1984; Krauss et al., 1988; Rumble et al., 1986; Sutphin et al., 1991; Weiss, 1973);

3. Contact metasomatic (skarn) deposits resulting from a concentration of preexisting carbon in sediments (Bugge, 1978) that could include calc-silicate hornfelses or reaction skarns (Evans, 1993);

4. Residual Deposits that may be concentrated in deposits formed through weathering/leaching of graphitic gneiss and schist because of the unreactive nature of graphite (Dill, 2009; Murdoch, 1967; Fogg and Boyle, 1987); and

5. Early magmatic deposits (rare) such as peraluminous dacite and gabbro (Tsuchiya et al., 1991; Kanaris-Sotiriou, 1997), and alkaline pegmatite (Jaszczak et al., 2007; Satish-Kumar and Santosh, 1998).

Most economic deposits of graphite occur as flake graphite in high-grade metamorphic rock (i.e., granulite facies) forming under pressures of 1 GPa and 750ºC. Disseminated flake graphite deposits develop syngenetically from carbonaceous material in sedimentary rocks that have been subjected to garnet grade or higher regional metamorphism (Cameron and Weiss, 1960; Harben and Bates, 1984; Krauss et al., 1988; Sutphin et al., 1991). Since graphite is a form of carbon, and all carbon oxidizes at high temperature, graphite must have a reducing environment in order to be stable at high temperature.

Flake graphite deposits may be any age but are commonly Archean to late Proterozoic in age. Host rocks typically consist of metasedimentary rocks such as quartz-mica schist, gneiss, micaceous quartzite, micaceous-feldspathic quartzite and marble. Associated rocks are pegmatite, aplite, and granite intrusives. Gangue mineralogy may include quartz, calcite, biotite, muscovite, feldspars, garnet, and sometimes amphibole, pyrrhotite, pyrite and magnetite. A typical rock type where flake graphite may be found is sulphidic biotite-quartz-feldspar gneiss; such is the rock type of the Mesoproterozoic graphite deposits in the Highlands region of New Jersey, USA (Volkert et al., 2000).

Deposits are usually stratabound and consist of individual beds or lenses in gneiss, schist, and marble that are richer in graphite than associated beds. Deposits are typically up to 35 m thick and several kilometres or more long. Concurrent, intense large-scale folding of the metasedimentary sequences is common and graphite deposits commonly occur on the limbs of such folds. Deposits tend to occur in metamorphosed continental margin or intercratonic basinal sediments. Regional depositional environments include regional metamorphism and large-scale deformation of carbon rich sedimentary sequences. Rarely, graphite veins may be associated with disseminated flake graphite deposits.

Most of the world's production of flake graphite comes from deposits of disseminated graphite in areas characterized by regionally metamorphosed rocks. Large deposits of flake graphite are known and/or have been mined in the United States, Central America, South America, Canada, Africa, India, Germany, Ukraine, Russia, Madagascar and China. Small, localized deposits of flake or flake-like graphite are known from literally hundreds of other localities. Mined flake graphite deposits commonly have grades of 10% to 12% graphite. Mexico and South Korea are significant sources of amorphous, or microcrystalline, graphite. Sri Lanka is home to the largest known deposits of crystalline vein graphite. Contact metasomatic or hydrothermal graphite deposits were mined in Canada and the United States, but these deposits are generally small and of relatively low grade.

Landis (1971) tentatively concluded that graphite formation is primarily dependent on metamorphic temperature and forms above 400°C, with pressure and variation in starting material constituting secondary controls.

Since the Graphite One Project graphite deposit occurs in a quartz-granite-biotite-sillimanite schist, which is a high-grade metamorphic rock, the Graphite Creek mineralization is considered to be of a Flake Graphite Type Mineralization.

Characterization testwork executed by TRU Group, a graphite-graphene engineering consultant based in Tucson AZ, at an independent Graphite Laboratory confirmed graphite flake characteristics along with unique, naturally occurring morphologies in mineralized samples in drill core segments taken from seven drill holes.

9 EXPLORATION

A general summary of Graphite One's 2011 to 2021 exploration work at the Graphite Creek Property is presented in the Section 6 (History) of this Technical Report. The summary includes the general results of the 2012, 2013 2014, 2018, 2019, and 2021 exploration programs that involved:

- A time-domain, helicopter-borne electromagnetic survey;
- Geological mapping; surface grab, channel and bulk pit sampling;
- Diamond drilling programs in 2012, 2013, 2014, 2018, 2019, and 2021;
- Flake-size distribution analysis; and
- Graphite beneficiation tests.

For greater detail on the 2012, 2013 and 2014 exploration programs, the reader is referred to Duplessis et al., (2013), Eccles and Nicholls (2014), and Eccles et al., (2015). For greater detail on the 2018, 2019, and 2021 exploration programs, the reader is referred to King et.al., 2019, Messler, 2019, and Gierymski and Flanigan 2022.

10 DRILLING

10.1 Overview

A summary and results of all known previous drill campaigns have been described in Section 6 of this report.

10.2 Summary of Drill Collar Locations and Downhole Surveys

The 2012, 2013 and 2014 drill hole collars were surveyed using a Topcon static GPS system. Drill hole collar elevations were determined using a differential GPS and then cross-checked with the recently acquired IfSAR bare-earth DEM (DTM) data, which has a 5 m cell size resolution. Due to the vast topographic relief in places at Graphite Creek differences between the differential GPS and the IfSAR bare-earth DEM (DTM) data is to be expected. No major concerns were identified. (Robinson et al., 2017)

The 2018 and 2019 drill collars were surveyed using Topcon and Javad high precision GPS equipment using typical RTK (Real Time Kinematic) surveying methods to accurately locate 2018 collars in the same coordinate system used in previous exploration campaigns.

The 2021 drill hole collars were surveyed by Recon LLC (RECON) surveyors, with the exception of holes 21GCT070, 21GTW001, and 21GTW007; these three holes, with a total of zero samples, are so far located only with a Garmin64 handheld GPS. RECON utilized Leica GS16 multi-frequency Global Navigation Satellite System (GNSS) receivers to perform the 2021 drill hole collar survey by standard RTK GPS methods. Positions of all survey points were reported in UTM Zone 3 North metres, North American Datum of 1983 (NAD83) CORS 2011 (Epoch 2010.0000) datum. Elevations were reported on the North American Vertical Datum of 1988 (NAVD88) by applying the Geoid12B separation values to ellipsoid heights using Leica Infinity software version 3.3. Project control monuments as described in the RECON report “Graphite One; Graphite Creek Project Access Route; Survey Report” dated August 1-7, 2018 were used for all RTK base station set ups and checks.

Of the 50 drill holes completed during 2012-2014, 42 drill holes were drilled at an azimuth of approximately 160°, with the holes being drilled from the northwest to the southeast. The drill hole inclination of these holes varied from -49° to -78° with 40 drill holes (80%) having inclinations of between -49° to -65°. The remaining 8 drill holes were drilled vertically (-90°). Regular down hole easy shot surveys were routinely collected every 30 m down the drill hole while the drilling was in progress, after which a follow up multi-shot survey was completed for each hole at regular 1 to 10 m intervals. The exception to this was drill holes: 12GC001; 12GC004; 12GCH006; 13GCH009; 13GCH010 13GCH012; 13GCH013; 14GCH003; 14GCH010; 14GCH012; 14GCH013; 14GCH017 to 14GCH020, where only 5 to 30 m interval easy shot surveys were completed. All spurious surveys were removed from the database.

The down hole surveys for the 2018 drill holes used the Reflex EZ-Trac multi-shot survey collecting a reading every 30 m coming out of the hole. Survey results were evaluated for validity and results that were deemed not good were not imported into the drilling database. Drill holes 18GC021 and 18GC022 did not have downhole surveys completed due to complications with tooling in the hole. The survey for 18GC025 was not good due to a rock stuck in the drill bit preventing the survey tool from going out into the open hole for good readings.

Downhole surveys for the 2019 drill holes used the Reflex multi-shot tool collecting a shot every 25 m coming out of the hole.

Downhole surveys for the 2021 drill holes used the Reflex EZ-Trac multi-shot tool. Collar shots were collected 30 feet into bedrock to ensure the hole was progressing as planned. The completed drill holes were surveyed at 50-foot intervals while tripping out. All 2021 core holes were downhole surveyed. Survey results were evaluated for validity and results that were deemed not good were not imported into the drilling database.

10.3 Summary of 2012 Drilling

APEX Geoscience Ltd, on behalf of Graphite One, completed 18 core drill holes totaling 4,248 m. Drilling took place between June 12th and August 22nd. Drill tested graphite zone is 2.2 km long.

Table 10-1: 2012 Drill Hole Specifications

Drillhole ID	Easting (m) NAD83-Zone03	Northing (m) NAD83-Zone03	Elevation (m)	Total depth (m) [1]	Start date	End date	Drillhole azimuth (°)	Drillhole dip (°)	Drill rig type
12GC001	474716	7213034	222	428.85	29-Jun-12	05-Jul-12	161.2	-50.9	LF70
12GC002	474437	7212914	225	380.10	05-Jul-12	10-Jul-12	159.9	-49.0	LF70
12GC003	474252	7212838	219	291.70	11-Jul-12	15-Jul-12	158.2	-50.8	LF70
12GC004	475749	7213665	129	258.20	16-Jul-12	22-Jul-12	163.9	-49.9	LF70
12GC005	474917	7213118	257	252.10	25-Jul-12	27-Jul-12	160.8	-49.6	LF70
12GC006	475143	7213189	293	274.02	29-Jul-12	01-Aug-12	160.6	-50.2	LF70
12GC007	475365	7213461	193	275.85	01-Aug-12	08-Aug-12	169.7	-50.2	LF70
12GC008	475574	7213571	156	232.90	08-Aug-12	11-Aug-12	157.6	-50.0	LF70
12GC009	475935	7213747	119	233.20	12-Aug-12	15-Aug-12	157.4	-51.5	LF70
12GC010	476103	7213852	107	230.21	16-Aug-12	18-Aug-12	159.5	-49.9	LF70
12GCH001	474416	7212823	259	172.82	27-Jul-12	29-Jul-12	160.9	-49.3	Hydracore
12GCH002	474379	7212784	269	166.73	30-Jul-12	02-Aug-12	161.7	-49.5	Hydracore
12GCH003	474335	7212765	269	169.77	03-Aug-12	05-Aug-12	157.1	-49.0	Hydracore
12GCH004	474515	7212859	254	160.63	06-Aug-12	08-Aug-12	157.6	-48.8	Hydracore
12GCH005	474515	7212859	254	178.92	08-Aug-12	11-Aug-12	147.5	-87.2	Hydracore
12GCH006	474622	7212920	247	177.39	11-Aug-12	14-Aug-12	158.1	-49.2	Hydracore
12GCH007	474789	7213006	256	177.39	14-Aug-12	16-Aug-12	156.6	-49.7	Hydracore
12GCH008	472160	7211831	258	188.06	17-Aug-12	22-Aug-12	160.4	-49.9	Hydracore

[1] Total drillhole meterage is 4,248.84 m

Source: AES (2022)

10.4 Summary of 2013 Drilling

APEX Geoscience Ltd drilled ten core drill holes totaling 1023.84 m were drilled between September 13th and October 13th. Drill tested graphite zone is 5 km long.

Table 10-2: 2013 Drill Hole Specifications

Drillhole ID	Easting (m) NAD83-Zone03	Northing (m) NAD83-Zone03	Elevation (m)	Total depth (m) [1]	Start date	End date	Drillhole azimuth (°)	Drillhole dip (°)	Drill rig type
13GCH009	476212	7213904	92	115.52	17-Sep-13	20-Sep-13	162.8	-49.6	Hydracore
13GCH010	476428	7214009	88	114.00	20-Sep-13	23-Sep-13	160.3	-50.2	Hydracore
13GCH011	474016	7212736	202	95.71	23-Sep-13	23-Sep-13	158.2	-52.2	Hydracore
13GCH012	473704	7212604	189	101.80	26-Sep-13	28-Sep-13	159.2	-51.0	Hydracore
13GCH013	473496	7212494	188	92.66	28-Sep-13	29-Sep-13	161.2	-52.0	Hydracore
13GCH014A	473293	7212493	144	49.99	24-Sep-13	26-Sep-13	160.7	-52.2	Hydracore
13GCH014B	473301	7212441	150	110.95	29-Sep-13	01-Oct-13	161.2	-50.5	Hydracore
13GCH015	472919	7212105	240	114.00	01-Oct-13	04-Oct-13	158.5	-50.0	Hydracore
13GCH016	472583	7212085	146	81.99	04-Oct-13	05-Oct-13	159.5	-50.1	Hydracore
13GCH017	472323	7212013	191	147.22	05-Oct-13	08-Oct-13	160.4	-49.6	Hydracore

[1] Total drillhole meterage is 1,023.84 m

Source: AES (2022)

10.5 Summary of 2014 Drilling

APEX Geoscience Ltd drilled twenty core holes totaling about 2,221 m for resource assessment and two core holes totaling 91.6 m were drilled to obtain metallurgical samples. Drilling took place between September 18th and November 14th. Part of inferred resource is upgraded to indicated.

Table 10-3: 2014 Drill Hole Specifications

Drillhole ID	Easting (m) NAD83-Zone03	Northing (m) NAD83-Zone03	Elevation (m)	Total depth (m)	Start date	End date	Drillhole aziumuth (°)	Drillhole dip (°)	Drill rig type
14GCH001	474269	7212795	230	117.96	18-Sep-14	21-Sep-14	160.9	-50.1	Hydracore
14GCH002	474328	7212794	239	137.16	23-Sep-14	25-Sep-14	160.0	-78.7	Hydracore
14GCH003	474350	7212727	284	71.63	25-Sep-14	27-Sep-14	161.6	-49.9	Hydracore
14GCH004	474376	7212806	247	128.93	27-Sep-14	30-Sep-14	151.8	-64.7	Hydracore
14GCH005	474400	7212742	288	79.55	22-Sep-14	23-Sep-14	158.4	-50.1	Hydracore
14GCH006	474406	7212860	227	153.31	25-Sep-14	28-Sep-14	159.7	-61.2	Hydracore
14GCH007	474425	7212781	274	91.74	07-Oct-14	10-Oct-14	159.3	-49.9	Hydracore
14GCH008	474477	7212791	281	88.39	11-Oct-14	12-Oct-14	162.5	-50.6	Hydracore
14GCH009	474477	7212791	281	161.54	12-Oct-14	17-Oct-14	314.8	-89.8	Hydracore
14GCH010	474502	7212886	237	143.26	17-Oct-14	20-Oct-14	160.6	-89.2	Hydracore
14GCM010	474502	7212886	237	51.05	05-Oct-14	09-Oct-14	160.6	-89.2	LF70
14GCH011	474529	7212822	273	105.16	21-Oct-14	22-Oct-14	159.5	-49.5	Hydracore
14GCH012	474566	7212899	240	120.40	22-Oct-14	24-Oct-14	4.5	-89.5	Hydracore
14GCH013	474566	7212899	240	89.92	24-Oct-14	25-Oct-14	159.9	-50.3	Hydracore
14GC014	474616	7212938	227	136.55	26-Oct-14	28-Oct-14	252.4	-89.6	LF70
14GCH015	474646	7212878	258	61.87	10-Oct-14	11-Oct-14	158.8	-49.9	Hydracore
14GCH016	474684	7212994	212	138.99	29-Oct-14	30-Oct-14	51.6	-89.2	Hydracore
14GCH017	474684	7212993	212	91.44	31-Oct-14	31-Oct-14	160.0	-50.5	Hydracore
14GC018	474715	7213035	212	145.69	01-Nov-14	02-Nov-14	260.6	-89.4	LF70
14GCH019	474725	7212981	234	85.04	03-Nov-14	04-Nov-14	158.1	-49.8	Hydracore
14GCH020	474801	7212977	266	72.85	04-Nov-14	05-Nov-14	158.8	-49.7	Hydracore
14GCM020	474801	7212978	266	40.54	05-Nov-14	05-Nov-14	157.9	-68.9	Hydracore
	Metallurgical hole (shaded)								
	Total cored for standard assaying			2,221.38					
	Total cored for metallurgical work			91.59					
	Total cored			2,312.97					

Source: AES (2022)

10.6 Summary of 2018 Drilling

Six core holes totaling 800.87 m were drilled between August 2nd and October 5th. All of the 2018 drill holes were within the indicated resource area proposed pit.

The 2018 and 2019 drill collars were surveyed using Topcon and Javad high precision GPS equipment using typical RTK surveying methods to accurately locate 2018 collars in the same coordinate system used in previous exploration campaigns.

Table 10-4: 2018 Drill Hole Specifications

Hole ID	Easting	Northing	Elevation (m)	Coordinate System	Depth (m)	Azimuth	Dip	Hole Status	Drill Co.	Core Size
18GC021	474438.1	7212911	216.8	NAD83 Zone 3	67.06	160	-49	Abandoned	Yukuskokon	HQ3
18GC022	474351.3	7212853	219.23	NAD83 Zone 3	156.97	160	-62	Complete	Yukuskokon	BTW
18GC023	474421.5	7212960	210.41	NAD83 Zone 3	198.73	160	-58	Complete	Boart Longyear	HQ
18GC024	474394	7212900	211.46	NAD83 Zone 3	144.78	160	-59	Complete	Boart Longyear	HQ
18GC025	474482.6	7212941	213.92	NAD83 Zone 3	169.32	160	-66	Complete	Boart Longyear	HQ
18GC026	474523	7212961	214.66	NAD83 Zone 3	64.01	160	-52	Complete	Boart Longyear	HQ

Source: AES (2022)

10.7 Summary of 2019 Drilling

Three core holes for a total of 356 m were drilled in 2019, between Sept 19th and mid-November. Two were geotechnical/resource holes within the planned pit, 19GT001 was a geotechnical hole outside of the planned pit.

Table 10-5: 2019 Drill Hole Specifications

Hole ID	Easting	Northing	Elevation (m)	Coordinate System	Depth (m)	Azimuth	Dip	Hole Status	Drill Co.	Core Size
19GT001	437507	7212765	140	NAD83 UTM Zone 3	70.71	0	-90	Abandoned	BLY	HQ3
19GC027	474733	7212590	254	NAD83 UTM Zone 3	151.18	160	-50	Abandoned	BLY	HQ3
19GC028	474442	7212746	299	NAD83 UTM Zone 3	135.92	160	-50	Abandoned	BLY	HQ3

Source: AES (2022)

10.8 Summary of 2021 Drilling

Resource area core drilling began on July17th with a AR60 drill operated by T&J Drilling and concluded on October 7th. All resource area core drilled in 2021 was oriented using the Reflex ACT III oriented core system. Chris Brown of Oriented Targeting Solutions (OTS) trained drillers and geologists in the collection of oriented core at the start of the first 2021 core hole. A total of 10 HQ3-size core drill holes were drilled in the inferred resource area in 2021, comprising 5084 ft (1550 m) of drilling. One of those holes was lost at 171 ft (52 m) in overburden and fault material, before reaching bedrock; another is only 66 ft (20 m) deep, in overburden. An additional 476 ft (145 m) of DDH core was drilled in geotechnical and condemnation hole 21GT006 outside the resource area.

Table 10-6: 2021 Drill Hole Sampling Summary

2021 Drill Program, Diamond Drill Hole Sampling Summary													
Hole	Total Depth	Meters Sampled	# Core Samples	Total # Samples	# Blanks	# Dups	# Standards	CDN-GR-1	CDN-GR-2	CDN-GR-3	CDN-GR-4	Depth of OVB	Depth Samples Start
21GC060	150.88	150.88	149	177	10	9	9	1	3	2	3	40.54	0
21GC061	164.9	128.02	137	161	8	8	8	2	2	2	2	36.88	36.88
21GC062	140.82	127.82	143	173	12	9	9	1	1	1	6	13.14	13
21GC063	152.1	137.17	154	184	12	9	9	2	2	2	3	14.93	14.93
21GC064	167.64	125.16	137	166	13	8	8	2	2	2	2	42.28	42.48
21GC065	167.64	127.39	145	173	10	9	9	3	2	2	2	40.25	40.25
21GC066	325.53	325.53	364	428	22	21	21	6	5	5	5	0	0
21GC067	52.43	0	0	0	0	0	0	0	0	0	0	47.85	NA
21GC068	195.68	151.33	162	192	10	10	10	2	3	3	2	46.63	44.35
21GC069	20.12	0	0	0	0	0	0	0	0	0	0	20.12	NA
21GCT070	10.06	0	0	0	0	0	0	0	0	0	0	4.67	NA
21GT006	145.19	139.19	147	172	9	8	8	2	2	2	2	5.49	6
Totals:	**1692.99**	**1412.49**	**1538**	**1826**	**106**	**91**	**91**	**21**	**22**	**21**	**27**	**312.78**	

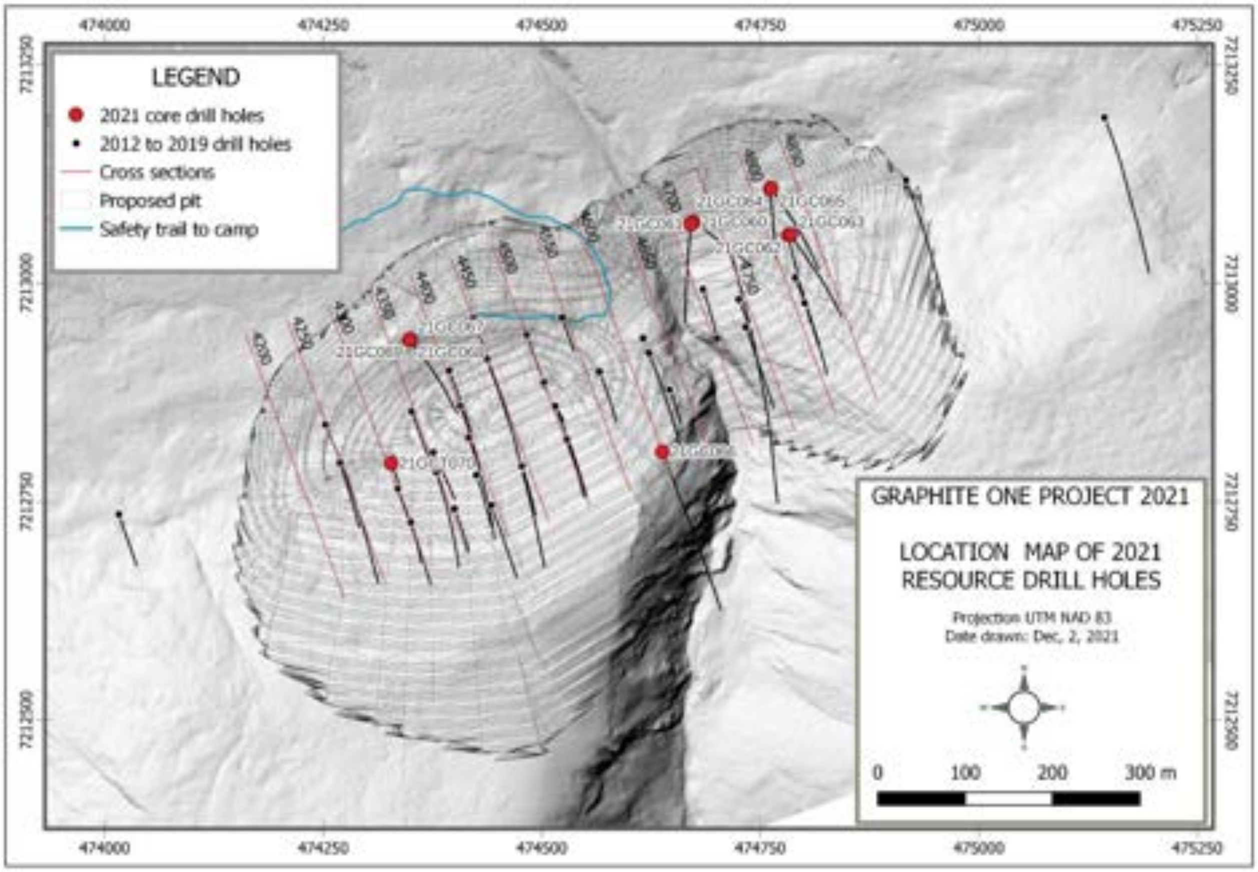
Source: AES (2022)

Table 10-7: 2021 Drill Hole Specifications

Hole ID	Easting	Northing	Elevation (m)	Coordinate System	Depth (m)	Azimuth	Dip	Hole Status	Drill Co.	Core Size
21GC060	474673.1	7213070	198.707	NAD83 UTM Zone 3	150.88	124	-55	Abandoned	T&J	HQ3
21GC061	474670.2	7213068	198.054	NAD83 UTM Zone 3	164.9	184	-45	Abandoned	T&J	HQ3
21GC062	474782.5	7213055	227.456	NAD83 UTM Zone 3	167.64	173	-52	Abandoned	T&J	HQ3
21GC063	474785	7213056	227.974	NAD83 UTM Zone 3	167.64	147	-46	Abandoned	T&J	HQ3
21GC064	474761.3	7213108	211.261	NAD83 UTM Zone 3	140.82	178	-57	Abandoned	T&J	HQ3
21GC065	474762.5	7213109	211.257	NAD83 UTM Zone 3	152.1	145	-45	Abandoned	T&J	HQ3
21GC066	474638.2	7212807	307.592	NAD83 UTM Zone 3	325.53	160	-50	Monitoring well installed	T&J	HQ3
21GC067	474349.7	7212936	206.979	NAD83 UTM Zone 3	52.43	144	-57	Abandoned	T&J	HQ3
21GC068	474349.5	7212936	206.993	NAD83 UTM Zone 3	195.68	144	-57	Monitoring well installed	T&J	HQ3
21GC069	474348.9	7212936	206.641	NAD83 UTM Zone 3	20.12	0	-90	Monitoring well installed		
21GCT070	474328	7212974		NAD83 UTM Zone 3	10.06	260	-55	Open	T&J	HQ3
21GT006	476596	7213039	193.125	NAD83 UTM Zone 3	145.19	0	-90	Abandoned, with DTC and VWPs	Mud Bay	HQ3

Source: AES (2022)

Figure 10-1: 2021 Resource Drill Hole Plan Map



Source: AES (2022)

The 2021 drill core was sampled on an approximate metre by metre basis but was not sampled across geological contacts; in such instances the sample start depth was reset, and one-metre increments were sampled to the next contact or geological feature. The minimum sample interval was 0.22 m and the average sample interval of 1391 drill core samples collected was 0.91 m.

In 2021, within the indicated resource area/proposed pit 1550 m were drilled, and 1,391 core samples were analyzed.

The 2021 drill core analytical results not including condemnation hole 21GT006 (n=1,391 total samples, not including duplicates and blanks) includes: 11 samples yielding >30% Cg; 57 samples with >10% Cg; 299 samples containing >3% Cg; and 874 samples > 0.5% Cg. Every drill hole intersected graphite mineralization and significant intersections of continuously mineralized core were observed. For example, drill hole 21GC064 contained 5.7 % Cg over 59 m (apparent thickness) between depths of 77.3 m and 131.25 m.

11 SAMPLE PREPARATION, ANALYSES AND SECURITY

The sample preparation, analysis and security procedures and protocols followed during the various exploration phases carried out on the Property are discussed in the previous technical reports issued by Graphite One. For detailed descriptions and analyses of the various protocols followed, reader is referred to Duplessis et al., (2013), Eccles and Nicholls (2014), Eccles et al., (2015), King, et.al., (2019), and Gierymski and Flanigan, (2022). The procedures and protocols employed are described in great detail and the results of all verification procedures and quality control protocols are discussed at length. All phases of the sample handling, preparation, and analysis were supervised by qualified personnel.

11.1 Sample Preparation

During all seasons of sample collection and analysis, Graphite One contracted Activation Laboratories Ltd. in Ancaster, ON, Canada (ActLabs) to maintain a sample preparation facility in Nome. This preparation laboratory was set up and crewed by employees of the main analytical laboratory used during the work programs ActLabs. The prep lab in Nome, Alaska was used to dry, crush and package all rock and drill core samples for shipping, via commercial carrier, from Nome to ActLabs for analysis.

The prep lab dried the split core at a nominal 60ºC, then crushed all half-core samples in a Rocklabs Boyd Jaw Crusher to 85% passing 2 mm (10 mesh). The crushed material was riffle split to obtain a 250 g subsample, which was pulverized in an ESSA LM2 miller ring and puck pulverizer to at least 95% passing 105µ (150 mesh). Cleaning sand was run in between every pulverized sample for about 20 seconds. Cleaning rock was run through the crusher in between suspected high-grade samples identified by the technician and compressed air was used between each sample on the crusher and pulverization stage. Crush rejects were stored in sealed polyurethane bags, placed into rice bags, palletized, and stored with the processed core.

11.2 Sample Analyses

The laboratory used for the majority of the Cg analyses, and all of the analyses used in the resource estimate, was ActLabs, which is ISO 17025 accredited and/or certified to 9001: 2008. The core samples were subjected to the following analytical procedure prior to determination of total graphitic carbon using a LECO CR-412 Carbon Analyzer. A 0.5 g pulp sample is either digested with hydrochloric and perchloric acids or subjected to a multistage furnace treatment to remove all forms of carbon with the exception of graphitic carbon. The residue is vacuum-filtered and dried. Accelerator material is added to the dried filter. The inductive elements of the sample and accelerator couple with the high frequency field of the induction furnace. The pure oxygen environment and the heat generated by this coupling cause the sample to combust.

During combustion, carbon-bearing elements are reduced, releasing the carbon, which immediately binds with the oxygen to form carbon monoxide (CO) and carbon dioxide (CO_2), the majority being CO_2. Carbon is measured as CO_2 in the infra-red (IR) cell as gases flow through the IR cells. CO_2 absorbs IR energy at a precise wavelength within the IR spectrum. Energy from the IR source is absorbed as the gas passes through the cell, preventing it from reaching the IR detector. All other IR energy is prevented from reaching the IR detector by a narrow bandpass filter. Because of the filter, the absorption of IR energy can be attributed only to CO_2. The concentration of CO_2 is detected as a reduction in the level of energy at the detector.

11.3 QA and QC Procedures

11.3.1 Summary of field Data Verification Procedures

Sample handling, preparation procedures and equipment, and analytical procedures have been fairly consistent for all drilling campaigns. A sample preparation lab in Nome, established by Graphite One but managed and operated by technicians and managers from Activation Labs, was used in all years. The prep lab crushed, and pulverized core samples provided by Graphite One. Prep lab procedures were consistent over the years, although the pulp aliquot prepared was a nominal 30 g in 2012 to 2014, unrecorded in 2018 and 2019, and a nominal 100 g in 2021.

Core splitting was by wheel-operated splitter in 2012 through 2014. All core from 2018, almost all core from 2019, and all core from 2021 was split with a saw.

Frequency and type of standards, blanks, and duplicates varied somewhat over the years. Details of the results of previous years QAQC programs can be seen in the referenced reports.

11.3.2 2012 Data Verification

In 2012 field blanks and field duplicates (1/4 core) were inserted into the sample stream by Graphite One. Blanks were inserted at a rate of one per ten core samples and were preferentially placed directly after highly mineralized core samples. Field duplicates were inserted at a rate of one per 20 samples. In 2012 no standards were inserted into the sample stream delivered to ActLabs, instead the program depended on ActLabs internal standards. (Duplessis, C., 2013)

11.3.3 2013 Data Verification

The overall 2013 drill core protocol and methodology including drill core collection, core geotechnical logging, geological logging, sampling, on-site sample preparation, quality control procedures, chain of custody, and shipping and analysis was almost identical to those that were reported for the 2012 drill program. However, in 2013 field blanks were inserted independent of mineralization. (Eccles and Nicholls, 2014.)

11.3.4 2014 Data Verification

After the first 3 2014 drill holes, four Certified Reference Materials (CRM) were added to the QAQC protocol. These are CDN Resource Laboratories Ltd.'s Certified Reference Materials CDN-GR-1, CDN-GR-2, CDN-GR-3 and CDN-GR-4. One control sample, either a blank or standard, was inserted at a rate of 1 for every 10 core samples. In 2014 the only duplicate samples inserted by Graphite One were field duplicates (1/4 split core); and were inserted at a rate of one per twenty samples. About 10% of core samples were duplicated and sent to two separate and independent laboratories as a check on Activation Labs. (Eccles, R., et al, 2015.)

11.3.5 2018 Data Verification

In 2018 the CRMs CDN-GR-1, CDN-GR-3, and CDN-GR-4 as well as field blanks, but no duplicates, were inserted into the sample stream by Graphite One. An alternating standard or field blank was inserted every 10th sample in sequence. A field blank was also inserted after a semi-massive to massive graphite sample. Unlike in previous years, a core saw was used to split the core, (King, N., 2018.)

11.3.6 2019 Data Verification

In 2019 the CRMs CDN-GR-1, CDN-GR-3, and CDN-GR-4 as well as BL-9, a commercial blank SRM, were inserted into the sample stream by Graphite One. An alternating standard or field blank was inserted every 20th sample in sequence. A blank was also inserted after a semi-massive to massive graphite sample. No field blanks or duplicates were inserted by Graphite One.

Plots of control samples used in 2019 are shown here, since they have not previously been presented in a report. All of the blank's values were below detection limit for graphitic carbon. All the standard sample assay values fell within the accepted two standard limits of deviation.

11.3.7 2021 Data Verification

In 2021 CRMs as well as field blanks and prep/crush duplicates (splits from the crush reject) were inserted into the sample stream by Graphite One.

Four graphite CRMs were used in 2021: CDN-GR1, CDN-GR2, CDN-GR3, and CDN-GR4. An alternating CRM was inserted at a rate of 5%. Duplicates and field blanks were also inserted at the same proportion, with field blanks placed preferentially after a semi-massive to massive graphite sample. Field blank material was composed of a metagranite from a quarry east of Nome. This is the same field blank material used in late 2012 through 2019 Graphite One drill programs.

A total of 1826 samples were submitted for graphite analyses by ActLabs in 2021, including 1,521 core samples. Also among those 1826 samples are 91 prep/crush duplicates, 106 field blanks, and 109 CRMs (28 CDN-GR-1, 22 CDN-GR-2, 21 CDN-GR-3, 37 CDN-GR-4).

Once assays were received from Activation Laboratories Ltd. the results of field blanks, Standard Reference Materials, and duplicate samples inserted by Graphite One, and ActLabs internal repeat assays and lab standards were checked to ensure results were within acceptable limits.

Assay results were plotted to see if values fell within the accepted limits.

Prep (crush) duplicate samples showed acceptable repeatability. Two field blanks fell outside acceptable limits. Three CRMs fell outside of acceptable limits, one each of CDN-GR-1, CDN-GR-3, and CDN-GR-4.

The failed CDN-GR-4, returning a value of 2.31 Cg%, is explained as a mistakenly inserted CDN-GR-3 with a certified value of 2.39 ± 0.11 Cg%.

To investigate the other failures Graphite One had ActLabs re-analyze for Cg a total of 84 samples, using the pulps stored by ActLabs.

Samples 1496161 to 1496181 from certificate A21-17605Rev were reanalyzed by ActLabs for Cg and reported on certificate A21-17605RevFinalReaasy, because of the failure of field blank 1496164.

Samples 1496731 to 1496751 from certificate A21-19377 were reanalyzed by ActLabs for Cg and reported on certificate A21-19377FinalReaasy, because of the failure of field blank 1496740.

Samples 1496401 to 1496421 from certificate A21-19389 were reanalyzed by ActLabs for Cg and reported on certificate A21-19389FinalReaasy, because of the failure of CDN-GR-1 as sample 1496407.

Samples 1496677 to 1496697 from certificate A21-19386Rev were reanalyzed by ActLabs for Cg and reported on certificate A21-19386FinalReaasy, because of the failure of CDN-GR-3 as sample 1496687.

Reruns of the pulps for the failed CRMs returned acceptable values. The rerun values for the CRMs and other samples on certificates A21-19389FinalReaasy and A21-19389FinalReaasy are used in the database and resource calculation.

The reruns of the failed blanks did not resolve the situation: the blanks are still outside accepted limits. The values from certificates A21-17605RevFinalReaasy and A21-19377FinalReaasy are not in the database and are not used in the resource calculation. The original values from certificate A21-17605Rev and certificate A21-19377 are still in the database and were used for the 2021 resource calculation.

Reconciliation of the failed blanks is a pending issue. The crush rejects stored in Nome will be used in 2022 to prepare new pulps of the sample series containing the failed blanks to be submitted for Cg analyses. It is thought that the failed blanks are due to contamination in the pulverizing stage of sample prep. If new pulps scientifically split from the crush rejects of the blanks fail, or if the surrounding samples change significantly in Cg content, ¼ core will be sampled and analyzed to resolve the issue.

11.4 Samples Security

In 2012, 2013, 2014, 2018, and 2019 core and rock samples were transported from the field to camp by helicopter, where they were palletized, loaded onto a flatbed truck, and driven to Graphite One's warehouse in Nome for processing. In 2021 core samples were transported from the field to the Nome core logging and processing facilities. Geotechnical logging, geological core logging, core photography, core splitting and core sampling were conducted at the Nome facility. All measurements and core logging observations were recorded directly into a digital format that included a predetermined set of codes to describe characteristics including rock type, lithology, mineralization, texture and competency over the entire length of the drill core. Digital photographs were taken of each individual core box by using a stationary camera and lighting.

Shipping of the pulp samples from Graphite One's sample preparation lab in Nome was conducted by ActLabs personnel. Security tags, which had bag identifiers other than drill hole names and/or sample coordinates, were used to seal the sample bags. To complete the chain of custody, individual samples with same sample numbers originally recorded in the field were continued all the way to ActLabs. Similarly, metallurgical samples for flake-size testing were sent to Hazen Golden, CO and/or ActLabs in Thunder Bay, ON, and/or SGS Mineral Services, Lakefield, ON. Once the samples arrived at the laboratories, they remained in the custody of the independent lab until final processing was completed. ActLabs has achieved the ultimate accreditation to international standards, the ISO 17025 standard. Hazen also holds several professional accreditations.

11.5 QP Opinion on QA/QC Procedures

It is the opinion of the QP Robert M. Retherford that the quality assurance/quality control QA/QC procedures and protocols followed by Graphite One's geological and geophysical consultants and contractors follow industry best practices. The sample data provided by previous exploration programs are suitable for the purposed for which they are used in this report.

12 DATA VERIFICATION

Site visits were conducted by several of the QPs, as detailed in Section 2.2. The purpose of the site visits was to fulfil the requirements specified under NI43 101 guidelines, become familiar with the Property and verify key data and information to be used as source inputs for this technical report and resulting resource estimates.

12.1 Field Verification

During the QPs Property visits in 2021 and 2022, he was able to locate many drill collars and sample sites. Past work was clearly carried out as described in the previous technical reports issued by Graphite One.

The author visited many collar locations and was able to verify the coordinates to within the accuracy of his hand-held GPS. He visited and sampled several historic sample locations and the analyses returned for his samples correlated well with historically recorded values. The author also inspected the core and sample storage areas, core logging facility and the sample preparation facility. All these facilities were observed to be exactly as described in the previously issued technical reports. Random sections of drill core were examined and compared to the descriptions recorded in the drill logs. The logs were judged to accurately reflect the observations made by the author. Several samples were collected from stored sample rejects and from stored drill core. These samples were kept in the custody of the author until they were shipped to the ALS Minerals sample preparation facility in Fairbanks. The samples were analyzed for graphitic carbon and the results were compared to the results reported by Graphite One in their previous technical reports. The results of the check assays were found to correlate very well with the previously-reported values as illustrated in Table 12-1.

Table 12-1: Comparison of Previously-Reported Assay Values to Check Assays

Type	Sample Location	Sample Description	Original Assay Cg (%)	Check Assay Cg (%)
ROCK	West side Graphite Creek, below adit	Quartz biotite schist in outcrop. Disseminated Graphite <0.5%	Low Grade	<0.02
ROCK	West wall, old Graphite Creek adit	Channel sample across 50cm band of quartz biotite garnet + sillimanite schist	15-20% (Est.)	18.1
ROCK	West wall, old Graphite Creek adit	Grab sample from pod of high-grade graphite	>50% (Est.)	>50
PULP	Sample P661772	Grain size varies from powder to 1.5 mm. Tan, some oxidization. Qz-Bi, minor graphite	0.91	1.17
PULP	Sample P661776	Grain size as above. Med grey. Graphitic streak overall. Qz, Bi, Garnet, Sillimanite, graphite	6.17	5.34

Type	Sample Location	Sample Description	Original Assay Cg (%)	Check Assay Cg (%)
CORE	Hole 14GCH016 63.67 - 64.67	Qz Bi Schist with minor garnet and minor sillimanite. 2-5% graphite. Minor Po? Brownish-red oxide, possibly iron carbonate	4.71	4.61
CORE	Hole 14GCH016 16 68.00 - 69.00	Nearly massive graphite schist with 5% pink garnets and minor Qz-Bi-Si	15.00	14.45
CORE	Hole 14GCH016 17 71.23 - 72.23	Qz Bi Garnet Sillimanite schist with ~10% graphite. Intermediate between low-grade below and high-grade above. Blob of MX graphite at 72.15 m	13.50	11.25
CORE	Hole 12GCH004 33.32 - 34.00	Qz Bi schist with some pink garnets. 2 cm garnet at 33.58 m	4.26	5.41
CORE	Hole 12GC005 180.00 - 181.00	Qz Bi Garnet schist with ~3% graphite. Wavy ba nds of biotite and graphite. Flakes to 1 mm	7.16	6.08

Source: AES (2022)

12.2 Database Verification

An unlocked version of the geological database was obtained by the author from Graphite One in Microsoft Excel format. The lithologic and structural descriptions were compared to field observations, and no discrepancies were observed. The assay results in the database were compared to original certificates of analysis and no errors or discrepancies were noted. Collar coordinates were compared to field observations made during the site visit, maps and original field observations. No discrepancies beyond normal GPS variations were discovered.

The data recorded in the Project database were found to be correct, verifiable, suitable and adequate for the purposes for which they were used.

12.3 Adequacy Statement

Retherford is confident that the data and results are valid based on the site visits and inspection of the project, including the methods and procedures used. It is the opinion of Retherford that all work, procedures, and results have adhered to best practices and industry standards as required by NI 43-101.

The datasets employed for use in the mineral resource estimates are a mix of historic data and recent data. There is always a concern regarding the validity of historic data. Extensive validation and verification must always be performed to ensure that the data may be relied upon.

Retherford reviewed extensive validation and verification studies to ensure the validity of the mineral resource estimates.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

SGS Minerals Services conducted a series of metallurgical tests in support of a prefeasibility study for Graphite One Inc.'s Graphite One Project in Alaska. The initial samples were received by SGS in February 2020, and the testing was completed by June 2021.

13.1 Metallurgy Testwork (Primary Treatment)

The metallurgical testwork was based on 3,720 kg samples shipped to SGS. The samples were grouped into five composites representing yearly periods in the expected life of mine from years 0 – 11 (Table 13-1). Each composite also had 20 pieces of 50 to 150 mm sized rocks randomly removed for future Low Energy Impact testing and the remainder was crushed to ¾" nominal, and further separated into subsamples for metallurgical testing.

Table 13-1: Master and Variability Composite Sub-samples

Sample ID	Master Composite (kg)	Variability Composite (kg)
Year 0-1	10	45
Year 1-3	20	45
Year 3-5	20	45
Year 5-7	20	45
Year 7-11	40	45

Source: Bomenco (2022)

Each variability composite was homogenized before 20 kg was split out for Bond Rod mill grindability and Bond abrasion testing. The remaining 25 kg was stage crushed to -6 mesh, blended, and 10 kg split out for a Bond Ball mill grindability test. A sub sample was cut for chemical analysis, and the remainder of each variability composite was rotary split to 2 kg test charges.

The five subsamples that comprise the master composite were combined and homogenized. A 10 kg sample was extracted for Heavy Liquid Separation (HLS) testing and the balance was stage crushed to -6 mesh. The -6 mesh master composite was then split into 2 kg and 10 kg sub-samples.

13.1.1 Sample Grades

Head samples were taken for each of the yearly composites and submitted for chemical analysis. The analysis for total carbon C(t), graphitic carbon C(g), total organic carbon (TOC), and sulphur (S), are listed in Table 13-2.

Table 13-2: Assays for Carbon Speciation

Sample ID	Assays %				Specific Gravity
	C(t)	C(g)	TOC (LECO)	S	
Year 0-1	4.56	4.4	<0.05	0.08	2.79
Year 1-3	4.68	4.38	<0.05	0.08	2.80
Year 3-5	6.46	5.72	<0.05	0.10	2.78
Year 5-7	4.48	4.27	<0.05	0.17	2.84
Year 7-11	4.64	4.44	<0.05	0.25	2.78

Source: Bomenco (2022)

Most of the carbon in the samples was associated with graphite grading between 4.28% C(g) and 5.72 C(g). The total organic carbon (TOC) analyzed by LECO Corporation, was below detection limit in each sample. The sulphur content was relatively low in each of the samples but did increase with each subsequent yearly period, from 0.08% to 0.25%.

13.1.2 Chemical Analysis

Whole rock analysis and ICP-OES scanning were done on the five composites. There were no elevated concentrations of typical deleterious elements. Silicates were the most abundant minerals and accounted for about 60% of the mass.

Table 13-3: ICP-OES Scan

Sample ID	Assays %									
	Ag	As	Ba	Be	Bi	Cd	Co	Cu	Li	Mo
Year 0-1	<2	<30	1000	1.00	<20	<2	25	30.2	35	<5
Year 1-3	<2	<30	976	1.14	<20	<2	28	26.6	39	<5
Year 3-5	<2	<30	937	1.16	<20	<2	26	32.3	41	<5
Year 5-7	<2	<30	908	1.10	<20	<2	40	28.3	41	<5
Year 7-11	<2	<30	977	1.39	<20	<2	27	29.9	42	<5

Sample ID	Assays %									
	Ni	Pb	Sb	Se	Sn	Sr	Tl	U	Y	Zn
Year 0-1	58	<20	<10	<30	<20	83.7	<30	<20	29.7	116
Year 1-3	60	<20	<10	<30	<20	105	<30	<20	28.6	130
Year 3-5	65	<20	<10	<30	<20	78.4	<30	<20	26.7	132
Year 5-7	68	<20	<10	<30	<20	74.5	<30	<20	28.9	122
Year 7-11	57	<20	<10	<30	<20	105	<30	<20	26.2	121

Source: Bomenco (2022)

Table 13-4: Whole Rock Analysis

Sample ID	Assays %						
	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O
Year 0-1	61.3	16.1	8.05	1.92	1.11	0.25	2.165
Year 1-3	60.9	16.2	7.99	1.9	0.96	0.58	2.34
Year 3-5	58	17.1	8.15	1.86	0.74	0.45	2.29
Year 5-7	59.3	17.5	8.38	2.21	1.05	0.45	2.22
Year7-11	62.1	15.4	7.52	2.13	1.52	0.51	2.22
Sample ID	**Assays %**						
	TiO_2	P_2O_5	MnO	CrO_3	V_2O_5	LOI	Sum
Year 0-1	1.02	0.15	0.12	0.03	0.03	7.47	99.7
Year 1-3	1.04	0.16	0.12	0.03	0.03	7.19	99.5
Year 3-5	1.08	0.15	0.11	0.03	0.03	9.74	99.7
Year 5-7	1.02	0.13	0.12	0.03	0.03	7.15	99.6
Year7-11	1.04	0.17	0.11	0.03	0.03	6.87	99.7

Source: Bomenco (2022)

13.1.3 Comminution Testing

Comminution testing was done by Bond rod mill, Bond ball mill, and an abrasion test.

The results from the Bond rod mill work index (RWi) test at a standard 14 mesh grind, indicate the samples tested are considered very soft ranging from 9.9 kWh/t – 10.7 kWh/t.

The Bond ball mill work index (BWi) samples were ground to 42 mesh to target a P_{80} of approximately 250 µm. The BWi tests produced by the composites ranged from 12.4 kWh/t – 13.7 kWh/t which places the mineralization in the soft - medium hardness category.

The Bond abrasion index (AI) test results indicated a medium abrasivity, with AI ranges between 0.248 - 0.337g/t.

The Work index and Abrasion index test results are shown in Table 13-5.

Table 13-5: Bond Work and Abrasion Indices

Sample ID	RWI (kWh/tonne)	BWI (kWh/tonne)	Abrasion Index
Year 0-1	9.9	12.4	0.259
Year 1-3	10.5	13.2	0.259
Year 3-5	10.7	13.7	0.252
Year 5-7	10.6	13.6	0.248
Year 7-11	10.2	13.5	0.337

Source: Bomenco (2022)

13.1.4 Heavy Liquid Separation

A 10 kg portion of the master composite was set aside for Heavy Liquid Separation (HLS) testing. The specific gravity (SG) of both the graphite and the host rock indicated that the samples could be good candidates for pre-concentration by means of dense media separation.

The - ¾" master composite samples were first screened at 850 µm to remove fines and subjected to HLS testing. The density cuts were at SG 2.81 g/cm^3, 2.73 g/cm^3, and 2.71 g/cm^3.

The HLS results show that gravity separation does not seem to be a suitable option for pre-concentrating the Graphite Creek mineralization. There was only slight upgrading from the HLS testwork combined with low recovery of 70% graphite to the HLS concentrate, while the heaviest fraction of 2.81 sinks contained 18.8% of the mass and 10.7% of the total carbon. Separating a "clean" sinks product with a reasonable rejection, i.e., 30-50% of the feed weight, was not possible.

A further analysis in the form of size fraction analysis (SFA) was performed on the three density cuts. The SFA showed that there was little difference in grades as a function of particle size. After these two results, further testing of HLS as a means of preconcentration was suspended.

13.1.5 Flotation Testing

13.1.5.1 Summary

The objective of flotation testing for the Graphite One Project was to develop a process that would achieve a 95% C(t) grade for the final concentrate with minimal carbon flake degradation at the highest economic recovery using conventional process unit operations.

Two rougher kinetics tests were carried out on the master composite to determine grind fineness for optimum rougher recoveries.

Sixteen cleaner flotation tests were carried out during the process development program. The initial focus was to establish suitable primary grinding and cleaner conditions to reject a large portion of the fed mass, then to establish a flowsheet needed to make 95% C(t) concentrate.

Four comparative flotation tests were carried out to quantify the difference in reagent selection between standard MIBC-Diesel scheme, and other proposed alternative reagents.

Two Locked Cycle Tests (LCT) were used to evaluate the circuit performance of the proposed flowsheet. The first LCT produced a final grade slightly below 95% C(t). A second LCT with slightly longer grind times resulted in a final concentrate of 95.7% at 92% recovery.

Variability tests for the five mine plan composites that comprise the master composite were conducted with the open circuit conditions of LCT-1 in order to assess the proposed flowsheet and conditions.

13.1.6 Rougher Tests

Two rougher kinetics tests were conducted on the master composite to compare a traditional single stage rougher with a mill-float-mill-float (MF2) approach. Primary grind sizes were P_{80} of 511 µm and P_{80} of 601 µm respectively. Tests were conducted using conventional MIBC-Diesel combination reagent scheme.

Theoretically the MF2 approach will benefit coarse flake preservation better than a traditional approach, therefore two rougher kinetics tests were carried out on the master composite to see if there was greater value in either approach. The traditional single stage rougher flotation test resulted in a concentrate grade of 32.1% at a recovery of 88.4%. The MF2 flotation test resulted in a grade of 38.2%, recovery of 86.0%. The significantly higher concentrate grade of the MF2 method outweighed the slightly lower recovery of a single stage rougher, and therefore a decision was made to use the MF2 flowsheet for other tests in the program.

Two additional rougher tests were used to compare a standard MIBC – Diesel reagent suite to alternative reagents provided by the client (Table 13-6). The client-provided reagent scheme gave 43.1% C(t) at 92.7% recovery. The standard MIBC-Diesel fuel yielded 42.2% C(t) at 94.9% recovery.

Table 13-6: Rougher Kinetics Test with AETC & Standard Reagents

Test	Product	Weight	Assays %	Distribution %
		%	C(t)	C(t)
F15 Rougher Test using alternative Reagents	Flash Conc 1	2.4	57.5	27.97
	Flash Conc 1 & 2	2.2	57.1	25.09
	Flash Conc 1 & 2 + Ro Conc 1	3.3	41.1	27.15
	Flash Conc 1 & 2 + Ro Conc 1 & 2	1.4	31.4	8.99
	Flash Conc 1 & 2 + Ro Conc 1 - 3	1.4	12.5	3.48
	Rougher Tails	89.3	0.4	7.33
	Head (calc.)	*100.0*	4.99	100.0
F18 Rougher Test using MIBC-Diesel	Flash Conc 1	3.0	58.9	35.0
	Flash Conc 1 & 2	5.1	55.5	55.6
	Flash Conc 1 & 2 + Ro Conc 1	8.6	49.1	83.6
	Flash Conc 1 & 2 + Ro Conc 1 & 2	10.4	44.7	92.0
	Flash Conc 1 & 2 + Ro Conc 1 - 3	11.4	42.2	94.9
	Rougher Tails	88.6	0.29	5.1
	Head (calc.)	100.0	5.07	100.0

Source: Bomenco (2022)

The results favor the use of MIBC-Diesel as it provided comparable grades to the alternative reagents but garnered a higher recovery. The MIBC-Diesel reagent scheme was selected and used throughout the rest of the program due to favourable results over the alternatives.

13.1.7 Cleaner Tests

Sixteen cleaner flotation tests were conducted during the program to determine a coarse primary grind and rejection of a large portion of the gangue minerals in the feed. Furthermore, cleaner tests were conducted to optimize following parameters: polishing grind times, number of cleaner stages, and order of flotation and polishing.

The first three cleaner tests started at 30 minutes polishing with three cleaners, The second test had 40 minutes polishing with three stages of cleaning. The third test used 20 minutes + 20 minutes polishing, and four stages of cleaning.

The third test with two-stage polishing produced the best results, and the following six cleaner tests focused on different combinations of polishing and Stirred Media Mill (SMM) grinding to improve graphite liberation while minimizing flake degradation.

The following six cleaner flotation tests evaluated different combinations of polishing and SMM grinding to improve graphite liberation while minimizing flake degradation. Of the six cleaner tests, test F10 proved to give the best results with a 7th cleaner concentrate grade of 97.3% and 90.8% recovery. The configuration of the circuit used one stage of polishing, two stages of SMM, and seven stages of cleaning. A summary of the mass balances of the six tests are presented in Table 13-7.

Table 13-7: Summary of Cleaner Flotation Tests F6-F11

Test	Product	Weight %	Assays, % C(t)	% Distribution C(t)
F6	Combined Concentrate	4.28	90.7	78.9
	Coarse Cleaning Circuit Feed	1.77	86.1	30.9
	Fine Cleaning Circuit Feed	3.21	79.7	52.0
Primary Polish, Secondary SMM	3rd Clnr Conc	4.98	82.0	83.0
	2nd Clnr Conc	5.18	79.5	83.6
Primary Polish - 40 min	1st Clnr Conc	5.92	70.1	84.3
Screen at 100 mesh	Rougher Conc	10.5	40.1	85.5
+100 mesh SMM - 3 min	Ro Tails	89.5	0.80	14.5
-100 mesh SMM - 7 min	Head (calc.)	100.0	4.92	100.0
	Head (direct)		4.96	
F7	Combined Concentrate	4.47	92.4	83.3
	Coarse Cleaning Circuit Feed	1.86	85.0	31.8
	Fine Cleaning Circuit Feed	3.49	78.8	55.5
Primary Polish, Secondary SMM	3rd Clnr Conc	5.35	80.9	87.3
	2nd Clnr Conc	5.54	78.8	88.0
Primary Polish - 40 min	1st Clnr Conc	6.35	69.5	89.0
Screen at 100 mesh	Rougher Conc	11.8	37.8	90.2
+100 mesh SMM - 6 min	Ro Tails	88.2	0.6	9.8
-100 mesh SMM - 15 min	Head (calc.)	100.0	4.96	100.0
	Head (direct)		4.96	
	7th Clnr Conc	4.95	87.6	91.9
F8	6th Clnr Conc	5.01	87.2	92.7
	5th Clnr Conc	5.12	85.4	92.7
Three Stages of Polishing	4th Clnr Conc	5.34	81.8	92.7
	3rd Clnr Conc	5.53	79.1	92.7
	2nd Clnr Conc	6.32	69.2	92.7
1st Polish - 20 min	1st Clnr Conc	7.17	61.8	94.0
2nd Polish - 20 min	Rougher Conc	13.0	34.7	95.4
3rd Polish - 20 min	Rougher Tails	87.0	0.25	4.6
	Head (calc.)	100.0	4.72	100.0
	Head (direct)		4.96	
	9th Clnr Conc	4.66	88.3	83.3
	8th Clnr Conc	4.70	88.1	83.9
F9	7th Clnr Conc	4.79	87.8	85.1
	6th Clnr Conc	4.92	86.5	86.2
Four Stages of Polishing	5th Clnr Conc	5.04	85.8	87.5
	4th Clnr Conc	5.23	83.4	88.4
1st Polish - 20 min	3rd Clnr Conc	5.42	81.7	89.6
2nd Polish - 20 min	2nd Clnr Conc	6.06	74.9	92.0
3rd Polish - 20 min	1st Clnr Conc	6.87	66.8	93.0
4th Polish - 20 min	Rougher Conc	12.7	37.0	94.9
	Rougher Tails	87.3	0.29	5.1
	Head (calc.)	100.0	4.94	100.0
	Head (direct)		4.96	
	7th Clnr Conc	4.32	97.3	90.8
F10	6th Clnr Conc	4.45	97.1	93.3
	5th Clnr Conc	4.58	94.3	93.3
1 Stage of Polish	4th Clnr Conc	4.80	90.0	93.3
2 Stages of SMM	3rd Clnr Conc	5.14	84.1	93.3
	2nd Clnr Conc	6.39	67.6	93.3
Primary Polish - 20 min	1st Clnr Conc	7.30	59.9	94.5
1st SMM - 12 min	Rougher Conc	13.6	33.0	96.6
2nd SMM - 12 min	Rougher Tails	86.4	0.18	3.4
	Head (calc.)	100.0	4.63	100.0
	Head (direct)		4.96	
F11	Combined Concentrate	4.05	95.1	78.3
	Coarse Cleaning Circuit Feed	1.80	84.8	31.1
Primary Polish	Fine Cleaning Circuit Feed	3.78	80.2	61.7
Two Stages of SMM	3rd Clnr Conc	5.58	81.7	92.8
	2nd Clnr Conc	5.92	78.1	94.1
Primary Polish - 40 min	1st Clnr Conc	7.09	66.0	95.2
Screen at 100 mesh	Rougher Conc	14.4	32.9	96.5
+100 mesh SMM - 6 + 6 min	Ro Tails	85.6	0.20	3.5
-100 mesh SMM - 15 + 15 min	Head (calc.)	100.0	4.92	100.0
	Head (direct)		4.96	

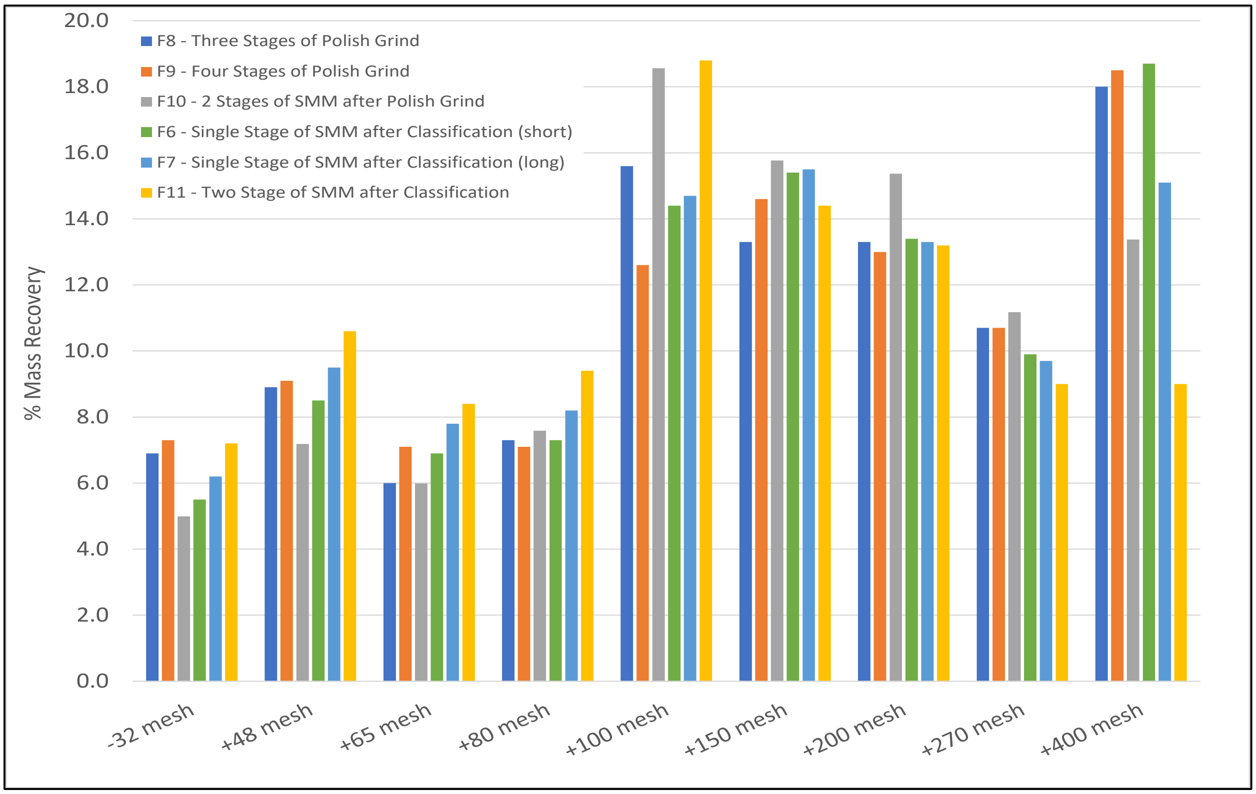
Source: Bomenco (2022)

Test F10 subjected the rougher concentrate to one stage of polish for 20 minutes and two stages of cleaning. The final grinding stage consisted of another 12 minutes of SMM grinding followed by three stages of cleaning. The 7th cleaner concentrate graded 97.3% C(t), which was the highest grade of the six cleaner tests. The total carbon recovery of 90.8% was the second highest of the tests.

Test F11 subjected the rougher concentrate to one stage of polish for 40 minutes followed by cleaner flotation and classification at 100 mesh. The resulting combined concentrate graded 95.1% C(t) at an open circuit recovery of 78.3%. Interestingly, most graphite losses occurred in the secondary cleaning circuit after SMM grinding.

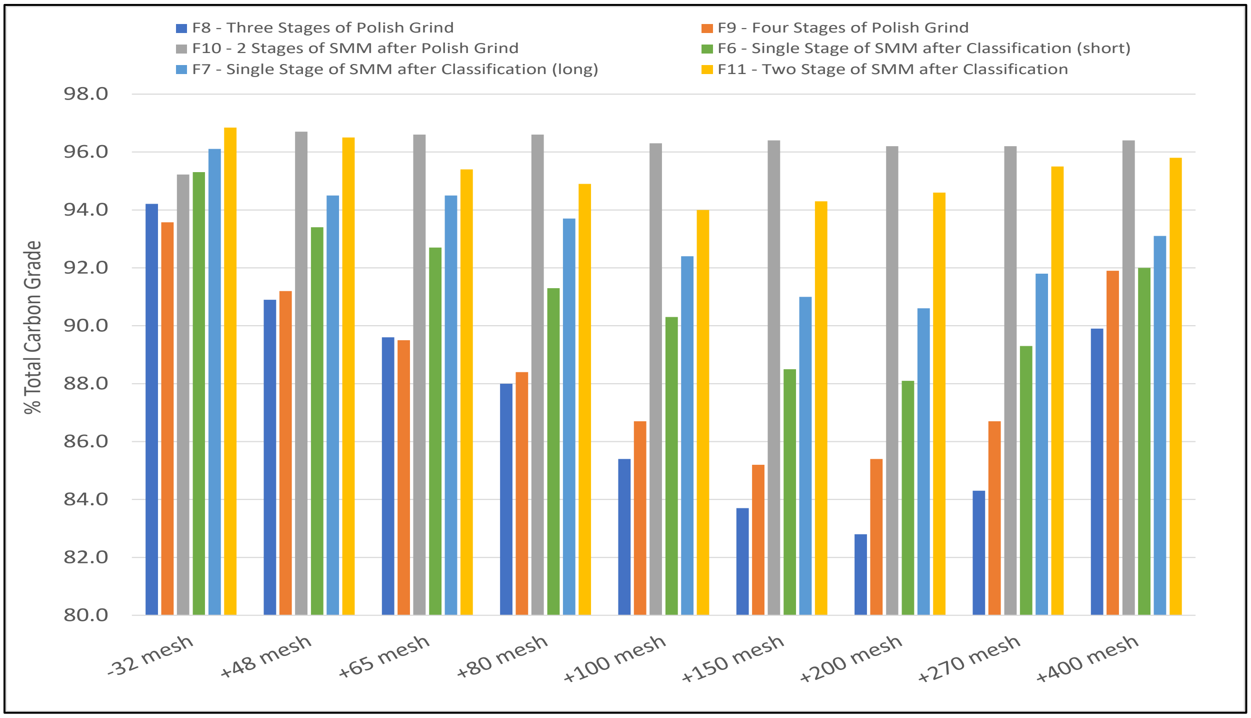
The final concentrates of the six cleaner tests were submitted for a size fraction analysis. The mass distribution and total carbon grade profiles are depicted in Figure 13-1 and Figure 13-2, respectively.

Figure 13-1: Mass Distribution of Final Concentrate (F6 to F11)



Source: Bomenco (2022)

Figure 13-2: Total Carbon Grades of Final Concentrate Size Fractions (F6 to F11)



Source: Bomenco (2022)

The two tests with only polishing produced the highest mass recovery into the +32 mesh size fraction. Test F10 with SMM grinding of the combined concentrate resulted in the highest degree of flake degradation but was only one of two tests that achieved a combined concentrate grade of at least 95% C(t). Test F11, which produced a concentrate grade of 95.1% C(t) consisted of a much more complex cleaning circuit with classification and two additional SMMs.

The graph depicting the total carbon grade of the different size fractions clearly illustrates the superior performance of test F10 followed closely by test F11, while the other four tests failed to produce acceptable grades.

13.1.8 Variance Tests

Four tests were carried out back-to-back to quantify the variance between two tests using the client supplied reagents (F16 and F17) and the standard MIBC-Diesel reagent regime (F19 and F20). Flotation selectivity of the client-supplied reagents was slightly better, but overall graphite recoveries into the third cleaner concentrate were noticeably lower.

A test-to-test variance of the full cleaner flowsheet was compared in tests F11 and F12. The combined concentrate grade of the two tests is within the analytical measurement uncertainties.

Table 13-8: Test-to-Test for Full Cleaner Test

Test	Product	Weight %	Assays, % C(t)	% Distribution C(t)
F11 Full Cleaner Test	Combined Concentrate	4.0	95.1	78.3
	Coarse Cleaning Circuit Feed	1.8	84.8	31.1
	Fine Cleaning Circuit Feed	3.8	80.2	61.7
	3rd Clnr Conc	5.6	81.7	92.8
	2nd Clnr Conc	5.9	78.1	94.1
	1st Clnr Conc	7.1	66.0	95.2
	Rougher Conc	14.4	32.9	96.5
	Ro Tails	85.6	0.20	3.5
	Head (calc.)	100.0	4.92	100.0
	Head (direct)		4.96	
F14 Full Cleaner Test Repeat of F11	Combined Concentrate	3.9	95.3	75.2
	Coarse Cleaning Circuit Feed	1.8	85.2	31.8
	Fine Cleaning Circuit Feed	3.6	81.3	60.3
	3rd Clnr Conc	5.4	82.6	92.1
	2nd Clnr Conc	5.7	79.8	93.1
	1st Clnr Conc	6.8	68.0	94.4
	Rougher Conc	12.5	37.4	96.1
	Ro Tails	87.5	0.22	3.9
	Head (calc.)	100.0	4.88	100.0
	Head (direct)		4.96	

Source: Bomenco (2022)

13.1.9 Locked Cycle Testing

Two Locked Cycle Tests (LCT) were conducted to evaluate the circuit performance of the proposed flowsheet. The first LCT produced a final grade of 94.8% C(t) with 89.8% recovery. This was below the target of 95% C(t). All four tailings streams had an equal distribution of graphite losses.

The second LCT increased the grind time in the primary grind, polish grind, and the two stages of SMM grinding. LCT-2 showed an improved grade and recovery: 95.7% C(t) and 92.0% respectively. The Mass Balance for LCT-2 is shown in Table 13-9 and the flake size distribution in Table 13-10.

Table 13-9: Mass Balance of LCT-2

Sample ID	Weight %	Assays (%) C(t)	% Distr. C(t)
7th Clnr Conc	4.8	**95.7**	**92.0**
5th Clnr Tails	0.4	20.8	1.6
3rd Clnr Tails	1.7	4.90	1.7
1st Clnr Tails	9.5	1.05	2.0
Ro Tails	83.7	0.16	2.7
Head (calc)	100.0	4.98	100.0

Source: Bomenco (2022)

Table 13-10: Flake Size Distribution of LCT-2 Combined Concentrate

Size		Mass	Grade	Distribution
Mesh	µm	%	% Ct	% Ct
32	500	0.4	93.5	0.4
48	300	4.3	93.1	4.2
65	212	8.2	94.3	8.2
80	180	5.8	95.0	5.8
100	150	8.1	95.3	8.1
150	106	16.3	95.3	16.3
200	75	13.2	95.1	13.2
270	53	14.3	95.3	14.3
400	38	11.0	95.4	11.0
Pan	-38	18.3	95.9	18.4
Total		100.0	95.2	100.0

Source: Bomenco (2022)

Variability tests for the five mine plan composites that comprise the master composite were conducted with the open circuit conditions of LCT-1 in order to assess the proposed flowsheet and conditions. The metallurgical and mass balance results from these tests are provided in Table 13-11.

Table 13-11: Summary of Variability Test Results

Test	Product	Weight %	Assays, % C(t)	% Distribution C(t)
VAR-1	7th Clnr Conc	4.2	95.9	95.0
	6th Clnr Conc	4.3	95.5	96.3
Years 0 - 1	5th Clnr Conc	4.4	93.1	96.3
	4th Clnr Conc	4.7	87.8	96.3
	3rd Clnr Conc	5.1	80.9	96.3
Rougher Tails	2nd Clnr Conc	7.2	57.4	96.3
P_{80} = 285 microns	1st Clnr Conc	8.2	50.5	97.2
	Rougher Conc	16.5	25.5	98.4
Comb. Conc	Rougher Tails	83.5	0.08	1.6
P_{80} = 185 microns	Head (calc.)	100.0	4.27	100.0
	Head (direct)		4.40	
VAR-2	7th Clnr Conc	4.1	96.3	92.6
	6th Clnr Conc	4.2	96.0	93.8
Years 1 - 3	5th Clnr Conc	4.3	93.9	93.8
	4th Clnr Conc	4.5	88.6	93.8
	3rd Clnr Conc	4.9	82.3	93.8
Rougher Tails	2nd Clnr Conc	6.2	64.6	93.8
P_{80} = 310 microns	1st Clnr Conc	7.0	57.6	94.9
	Rougher Conc	14.0	29.5	96.8
Comb. Conc	Rougher Tails	86.0	0.16	3.2
P_{80} = 176 microns	Head (calc.)	100.0	4.27	100.0
	Head (direct)		4.38	
VAR-3	7th Clnr Conc	5.2	95.6	87.9
	6th Clnr Conc	5.4	95.3	90.2
Years 3 - 5	5th Clnr Conc	5.6	91.8	90.2
	4th Clnr Conc	5.9	86.2	90.2
	3rd Clnr Conc	6.4	80.5	90.2
Rougher Tails	2nd Clnr Conc	7.8	65.3	90.2
P_{80} = 286 microns	1st Clnr Conc	8.9	58.9	91.9
	Rougher Conc	15.1	35.6	94.8
Comb. Conc	Rougher Tails	84.9	0.35	5.2
P_{80} = 179 microns	Head (calc.)	100.0	5.67	100.0
	Head (direct)		5.72	
VAR-4	7th Clnr Conc	3.9	96.0	90.0
	6th Clnr Conc	4.0	95.8	91.0
Years 5 - 7	5th Clnr Conc	4.1	93.4	91.0
	4th Clnr Conc	4.3	88.1	91.0
	3rd Clnr Conc	4.6	82.2	91.0
Rougher Tails	2nd Clnr Conc	5.9	64.8	91.0
P_{80} = 327 microns	1st Clnr Conc	6.7	58.0	92.3
	Rougher Conc	13.6	29.0	94.2
Comb. Conc	Rougher Tails	86.4	0.28	5.8
P_{80} = 192 microns	Head (calc.)	100.0	4.20	100.0
	Head (direct)		4.27	
VAR-5	7th Clnr Conc	3.8	96.1	85.3
	6th Clnr Conc	3.9	95.9	86.9
Years 7 - 11	5th Clnr Conc	4.0	93.5	86.9
	4th Clnr Conc	4.2	89.6	86.9
	3rd Clnr Conc	4.4	85.5	86.9
Rougher Tails	2nd Clnr Conc	5.2	72.4	86.9
P_{80} = 351 microns	1st Clnr Conc	5.8	66.5	88.7
	Rougher Conc	10.3	38.1	90.5
Comb. Conc	Rougher Tails	89.7	0.46	9.5
P_{80} = 174 microns	Head (calc.)	100.0	4.34	100.0
	Head (direct)		4.44	

Source: Bomenco (2022)

The consistent metallurgical results of the variability composites validate the proposed conditions and flowsheet for the Graphite Creek samples developed in this program.

13.1.10 Solid Liquid Separation Testing

A graphite concentrate sample was subjected to pressure filtration and a rougher tailings sample was tested for thickening and vacuum filtration (Table 13-12). No attempt was made to test the settling characteristics of graphite concentrate samples as the flakey nature and low specific gravity of graphite result in poor settling thickener underflow densities, usually not far from feed densities.

The rougher tailings responded well to BASF Magnafloc 10 flocculent. Static tests were successful in selecting a dosage for reasonable settling of the tailings. Dynamic thickening was attempted but the underflow discharge was problematic as a result of high settling and compaction rates due to the coarse particle size range of the tailings. Further testing is recommended.

Vacuum filtration was conducted on the rougher tailings at 65% w/w solids. The moisture in the cake ranged between 13.3% and 21.9%.

Table 13-12: Vacuum Filtration – Rougher Tailings

Filter Cloth	Operating Conditions					Filter Outputs				
	Feed Solids %w/w	Vacuum Level, Inches Hg	Form Time s	Dry Time s	Form/Dry Time Ratio	Cake Thickness mm	[1]Throughput, dry solid kg/m²•h	Cake Moisture % w/w	Filtrate TSS, mg/L	Cake Surface Texture
Testori P 4408 TC	65.0	20	178	18	9.90	52	1509	21.9	30	Wet
			188	516	0.36	52	422	16.5	26	Tacky
			109	22	4.92	37	1586	21.1	38	Wet
			106	53	2.01	36	1322	20.0	33	Tacky
			106	106	1.00	36	985	18.6	34	Tacky
			107	212	0.50	36	658	16.4	38	[2]DTT
			43	215	0.20	20	464	13.3	59	DTT

[1]Throughputs are calculated using cycle time which includes form and dry times only.

[2]Indicates that the cake surface was dry-to-touch.

Source: Bomenco (2022)

The graphite concentrate sample was tested at 25% w/w solids in a pressure filter. The discharge cake residual moisture ranged between 22.2% and 24.9%.

Table 13-13: Pressure Filtration Results – Graphite Concentrate

Filter Cloth	Operating Conditions			Filter Outputs					
	Feed Solids %w/w	Pressure Level bar	Filtration Time s	[1]Cake Thickness mm	[2]Filtration Time Cycle Throughput, dry solid $kg/m^2\cdot h$	[3]Estimated Full Cycle Throughput, dry solid $kg/m^2\cdot h$	Cake Moisture % w/w	Filtrate TSS mg/L	Cake Surface Texture
Testori P 4408 TC	25.0	4.1	243	48	519	150	24.6	7	Soft
			164	36	558	120	24.0	11	Soft
			108	24	561	86	23.1	27	Soft
			57	15	646	56	22.2	39	Soft
		5.5	195	45	615	151	24.7	13	Soft
			128	34	688	121	24.9	15	Soft
			84	25	744	91	24.2	21	Soft
			62	15	620	58	22.3	37	Soft

[1]Cake thickness represents half of the chamber thickness.

[2]Throughput calculated using cycle time which includes filtration time only.

[3]Estimated pressure filter throughput, calculated using a full cycle time which includes filtration time plus 10 minutes of miscellaneous cycle time which includes filter loading, cake discharge, cloth washing, and filter assembly.

[4]Indicates that the cake surface was dry-to-touch.

Source: Bomenco (2022)

13.2 Process Description (Secondary Treatment)

13.2.1 Process Summary

The STP processes are grouped into three streams by product categories as summarized below. The tonnages stated in this section are for annual input requirements at full capacity with both Phase 1 and 2 in operation.

13.2.1.1 Natural Graphite Stream

About 26% of the annual natural graphite feed is processed into the following products:

- Sized, unpurified 95% Cg flake (6,930 t/a);
- Sized, purified flake 99+% Cg (4,297 t/a); and

- 320 mesh, purified 99.99+% Cg, designated as synthetic diamond precursor (1,902 t/a). The remaining 74% is fed to the anode product lines.

13.2.1.2 Secondary Particle Coating Line

The Secondary Particle Coating Line produces the following products:

- SPN – secondary particle, agglomerated, purified natural graphite anode material (3,658 t/a); and
- SPC – secondary particle, composite anode material of agglomerated, purified graphites (12,565 t/a); and Rejects including sized, 95% Cg and sized, unpurified coke to the unpurified product portfolio (11,692 t/a).

13.2.1.3 Single Particle Coating Line

The Single Particle Coating Line produces the following products:

- CPN – single particle, shaped, purified, coated natural graphite anode material - CSG (12,030 t/a);
- BAN – blend of single particle, artificial and natural graphite anode materials (22,915 t/a); and
- Purified 320 mesh is added to the battery conductor product line market (along with purified, screened rejects from the Secondary Particle Coating Line. (1,386 t/a).

13.2.2 Purification/Graphitization

13.2.2.1 Purification

Natural graphite flake is transformed to anode grade material by first shaping it into spheres and then purifying the shaped material to remove impurities. The purification process uses high-temperature electric furnaces to volatize impurities. This involves raising the furnace temperature to the boiling points of the impurities. To accomplish this at a lower furnace operating temperature, and therefore requiring the use of less electricity, chlorine gas would be added to the furnace to react with the metallic oxides present as impurities. These oxides are converted to chlorides with lower boiling points allowing for a lower operating temperature.

13.2.2.2 Graphitization

Artificial graphite precursor is graphitized in the furnaces at temperatures up to 3,100°C to produce artificial graphite.

13.2.2.2.1 Off Gas Scrubbing

- The volatized impurities are transported away from the process in the furnace stack and then cleaned in four stages: cyclonic separation, venturi water scrubbing, packed bed tower caustic scrubbing and incineration;

- In the cyclonic separator, particulate matter is separated from the steam using centrifugal force, collected, bagged, and removed;

- The gas stream then flows to a venturi scrubber which uses water as its scrubbing solution. The water is recycled within the unit. Any water removed from the system is sent to the water treatment plant. The gas stream mixes with the water, the mixture reacts with the contaminates, and also cools the gas stream. The gas stream then moves to the caustic scrubber;

- A solution of sodium hydroxide is sprayed from the top of the caustic scrubber into its packed reactor and contacts with the gas stream. Any acidic gases are neutralized. Sulphur dioxide, chlorine gas and other acid gases are removed from the stream. Any solution removed from the system is sent to the water treatment plant. The cleaned gas stream moves through a mist eliminator to remove any entrained droplets. The gas moves to the stack and the droplets are recirculated back to the scrubber; and

- The gas stream passes through a natural gas flare to incinerate any carbon monoxide produced in the furnace and the cleaned steam is then discharged.

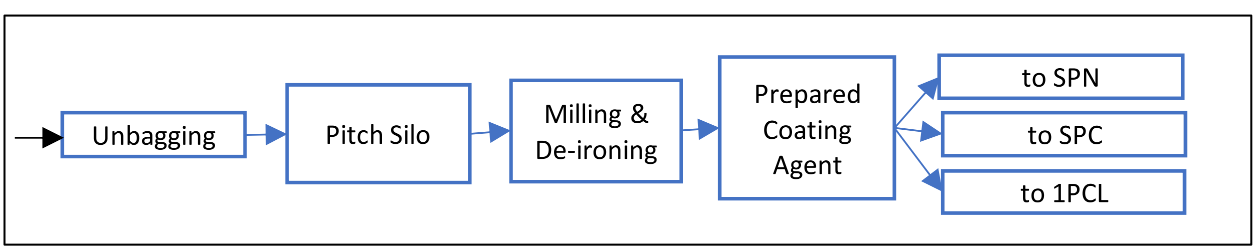
13.2.3 Precursor Preparation

Pitch, coke, and artificial graphite precursors are each processed prior to their input into the anode production process.

13.2.3.1 Pitch

Purchased pitch is milled and de-ironed. The resulting prepared coating agent is distributed to a series of 12 weigh hoppers in the Secondary Particle Coating Line and three weigh hoppers in the Single Particle Coating Line.

Figure 13-3: Processing Flowsheet for Pitch

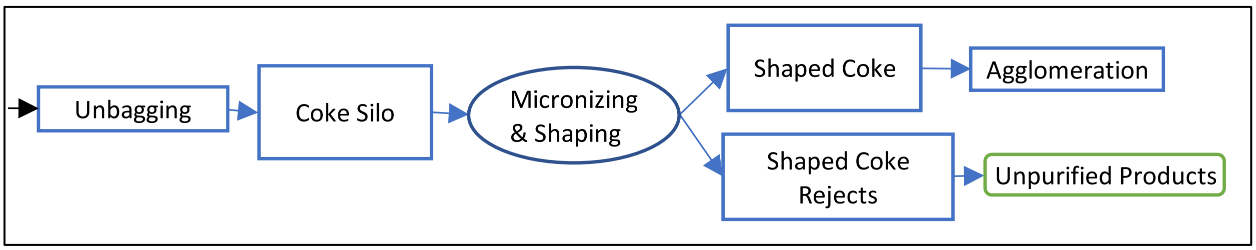


Source: Tan (2022)

13.2.3.2 Coke

Purchased coke precursor material is fed through three coke micronizers to six coke shaping mills. After rejects and losses, the resulting shaped coke is stored in its silo. Shaped coke rejects are accumulated in a storage bin, then conveyed to the product bagging system for coke fine products.

Figure 13-4: Processing Flowsheet for Coke

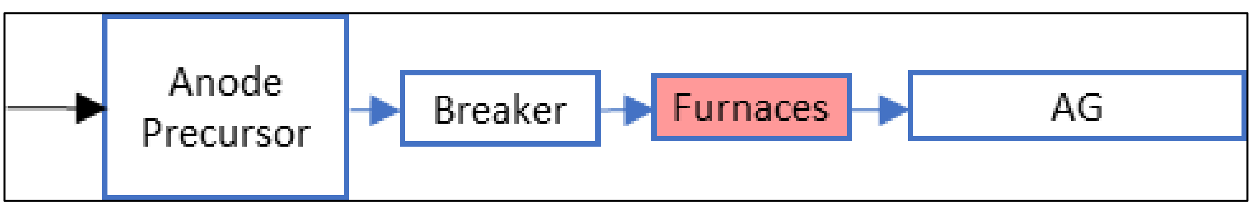


Source: Tan (2022)

13.2.3.3 Artificial Graphite

Purchased anode precursor material in bulk bags is discharged at the unloading station, processed through a lump breaker, and pneumatically conveyed to a surge bin. The material is then graphitized in the furnaces and the resulting artificial graphite after losses is pneumatically conveyed to a storage bin.

Figure 13-5: Processing Flowsheet for Anode Precursor



Source: Tan (2022)

13.2.4 Natural Graphite Processing

The tonnage and equipment quantities in the following descriptions are for the processes in Phase 1. The processes added for Phase 2, full capacity, duplicate those in Phase 1 and unless indicated otherwise, the total tonnage and equipment quantities for Phase 2 would be double those stated for Phase 1. Phase 2 represents the STP at full production capacity.

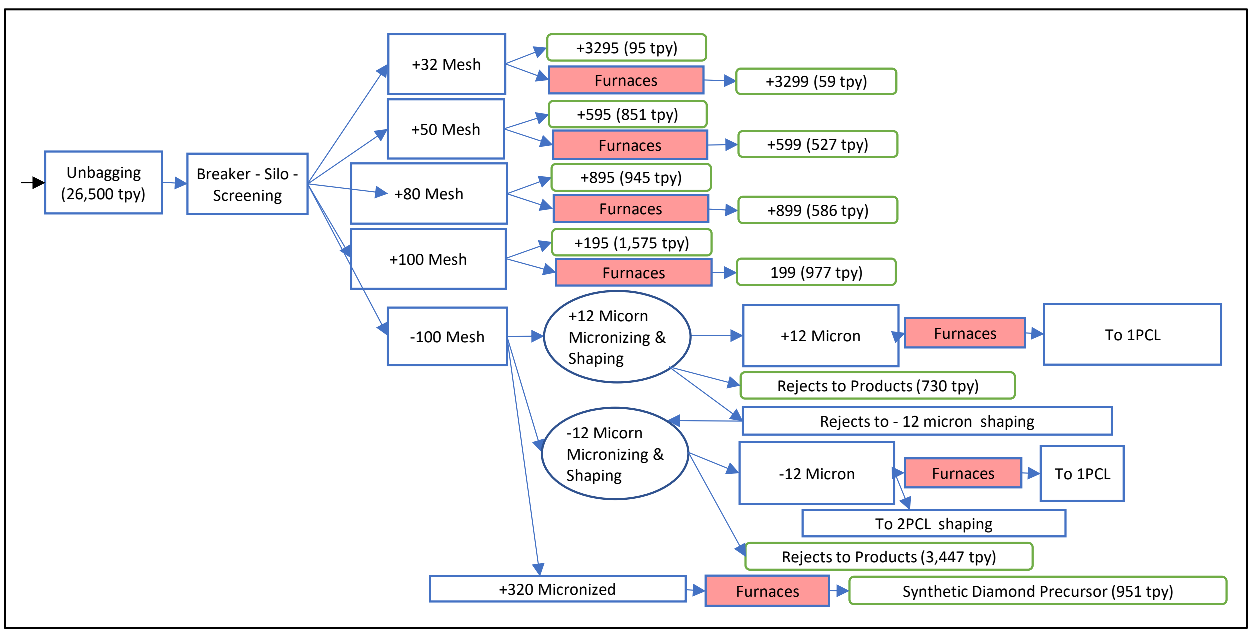
13.2.4.1 Graphite Concentrate

Graphite concentrate in bulk bags (26,250 t/a) is transferred from the storage warehouse to the bulk bag unloading station. There, graphite is discharged from the bags into a hopper, through a lump breaker and a discharge chute, and conveyed to a surge silo. From the surge silo, concentrate (26,250 t/a) is fed through two primary sorting screens and separated into sizes:

- +32 mesh;
- +50 mesh;
- +80 mesh;
- +100 mesh; and
- \- 100 mesh.

Each size fraction is next conveyed to its dedicated storage hopper.

Figure 13-6: Process Flowsheet for Natural Graphite



Source: Tan (2022)

13.2.4.2 Unpurified and Purified Flake

The +100, +80, +50 and +32 mesh sizes are pneumatically conveyed in metered quantities from their dedicated storage silos to two distinct process streams as follows:

13.2.4.2.1 95% Cg Unpurified Flake

The following fractions (4,671 t/a) are pneumatically conveyed from their respective storage bins to the product bagging system where respective products are bagged to customer specifications.

- +3295: +32 mesh (95 t/a);
- +595: +50 mesh (851 t/a);
- +895: +80 mesh (945 t/a);
- +195: +100 mesh (1,575 t/a); and
- Plus: Coke Rejects from Anode A Coke Shaping (1,206 t/a).

13.2.4.2.2 99+% Purified Flake

The following fractions (2,310 t/a) are pneumatically conveyed from their respective storage bins to the purification furnaces:

- +32 mesh;
- +50 mesh;
- +80 mesh; and
- +100 mesh.

Once purified in the furnaces to 99%+ Cg and after losses, the following fractions are pneumatically conveyed to the product bagging system where respective products are bagged to customer specifications.

- +3299: +32 mesh (59 t/a);
- +599: +50 mesh (527 t/a);
- +899: +80 mesh (586 t/a); and
- +199: +100 mesh (977 t/a).

13.2.4.3 -100 Mesh

The -100 mesh fraction is pneumatically conveyed from its silo and separated into three process streams: +12 µm, -12 µm, and 320 mesh.

13.2.4.3.1 +12 Micron

The + 12 µm feed is first loaded to its silo and then passes through +12 µm coarse micronizers (60), +12 µm fine micronizers (24) and +12 µm shaping machines (156). Discharged from this section are:

a. +12 µm unpurified shaped material which is pneumatically conveyed from its product storage silo to the purification furnaces where it is purified to 99.9%+Cg and the resulting purified shaped graphite less losses is sent to the Single Particle Coating Line for further processing; and

b. Two streams of +12 µm unpurified shaped rejects: one to the -12 µm shaping machines and one to the product bagging system for carbon raisers and lubricant products (730 t/a).

13.2.4.3.2 -12 Micron

The - 12 µm feed is first loaded to a silo and then passes through two -12 µm coarse micronizers (+1 for Phase 2). It is then fed along with the +12 µm rejects to -12 µm shaping mills (23). Discharged from this section's product storage silo are two steams of materials:

- -12 µm shaped, unpurified material; and
- -12 µm rejects, shaped unpurified.

A portion of the shaped, unpurified material is pneumatically conveyed to the purification furnaces. The resulting shaped, purified material is conveyed to the Single Particle Coating Line.

The balance of the shaped, unpurified material is sent to the Secondary Particle Coating Line.

The rejects (3,447 t/a) are sent to the product bagging system for carbon raisers and lubricant products.

13.2.4.3.3 320 Mesh

The 320 mesh feed is first loaded to a silo and then passed through one 320 mesh micronizer to a product storage silo. Material from the storage silo is pneumatically conveyed to the purification furnaces. Purified 320 mesh, micronized natural graphite (951 t/a) is discharged from the furnaces and conveyed to a storage silo. From the storage silo, it is sent to the product bagging system for synthetic diamond precursor products.

13.2.5 Secondary Particle Processing:

Prepared coating agent, -12 µm unpurified shaped material and shaped coke are each transferred to their respective sets of weigh hoppers (12 hoppers per set). Material from each hopper set is first fed into two streams:

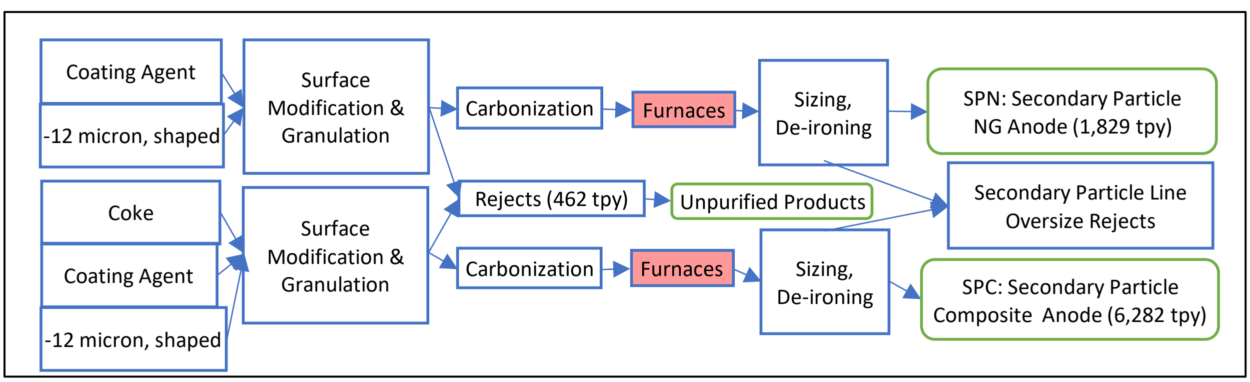
13.2.5.1 Secondary Particle Natural Graphite Anode (SPN)

Prepared coating agent and -12 µm, shaped graphite, are processed through the secondary particle coating line to the carbonization ovens. Following carbonization, the material is sent to the purification furnaces. After purifying, it is sized, de-ironed and conveyed to packaging as Secondary Particle Natural Graphite Anode (SPN) material (1, 829 t/a).

13.2.5.2 Secondary Particle Composite Anode (SPC)

Shaped coke, prepared coating agent and -12 µm, shaped graphite are processed through the secondary particle coating line to the carbonization ovens. Following carbonization, the material is sent to the purification furnaces. After purifying, it is sized, de-ironed and conveyed to packaging as Secondary Particle Composite Anode (SPC) material (6,282 t/a).

Figure 13-7: Process Flowsheet for Secondary Particle Processing



Source: Tan (2022)

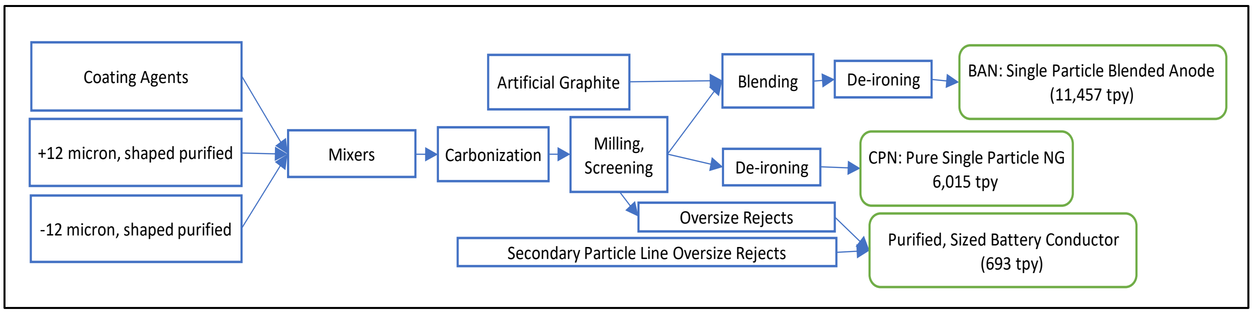
13.2.5.3 Process Rejects

Rejects from screening in both streams are conveyed to the product bagging system for carbon raisers and lubricant products. Oversize rejects from the final product screening are sent to combine with similar rejects from the Single Particle processing line.

13.2.6 Single Particle Processing:

Prepared coating agent is conveyed to three weigh hoppers, +12 µm purified shaped graphite is conveyed to a storage silo, and -12 µm purified shaped graphite is conveyed to a storage silo. Streams from the three storage groups are fed to three cone mixers which discharge to a carbonization storage silo. Its contents are conveyed to the carbonization ovens and associated saggar handling systems. The resulting purified carbonized output less losses are conveyed first to three discharge hoppers and then to a single particle carbonized product transfer hopper. From the transfer hopper, the purified carbonized products are milled and screened.

Figure 13-8: Process Flowsheet for Single Particle Processing



Source: Tan (2022)

13.2.6.1 Single Particle Blended Graphite (BAN)

Undersized material from screening is combined in a ribbon blender with artificial graphite from its storage bin. The blended product is processed through eleven de-ironing magnets and conveyed to the Single Particle Blended Anode (BAN) product storage silo (11,457 t/a) and then to the product bagging system for bagging and storage.

13.2.6.2 Single Particle Natural Graphite (CPN or CSG)

A second undersized material stream from the ultrasonic screens passes through the de-ironing units and is then conveyed to the CPN (Single Particle NG Anode) product storage silo. The CPN product (6,015 t/a) is conveyed to the product bagging system for bagging and storage.

13.2.6.3 Micronized Purified 320 Mesh

The purified oversize material from the Single Particle Line's ultrasonic screens is joined with the stream of purified oversize material from the Secondary Particle line's ultrasonic screens and conveyed (693 t/a) first to an impact mill and then to a storage silo. From there, it is sent to the purified 320 mesh Battery Conductor Product line.

14 MINERAL RESOURCE ESTIMATE

14.1 Introduction

Modelling, resource estimation and statistics were performed by Christopher Valorose under the supervision of QP Robert M. Retherford. The Measured, Indicated and Inferred Graphite Creek Resource estimate is reported in accordance with the Canadian Securities Administrators National Instrument 43-101 and has been estimated using the CIM “Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines” dated November 23rd, 2003 and CIM “Definition Standards for Mineral Resources and Mineral Reserves” dated November 27th, 2010. Mineral resources are not mineral reserves and do not have demonstrated economic viability. There is no guarantee that all or any part of the mineral resource will be converted into a mineral reserve.

> *A ‘Measured Mineral Resource’ is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, physical characteristics are so well established that they can be estimated with confidence sufficient to allow the appropriate application of technical and economic parameters, to support production planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough to confirm both geological and grade continuity.*

> *An ‘Indicated Mineral Resource’ is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics can be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters, to support mine planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough for geological and grade continuity to be reasonably assumed.*

> *An ‘Inferred Mineral Resource’ is that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity. The estimate is based on limited information and sampling gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes.*

The project area is based in the Universal Transverse Mercator (UTM) coordinate system, North American Datum (NAD) 1983 and UTM Zone 3. Multiple drill programs have been completed in 2012, 2013, 2014, 2018, 2019, and 2021. A total of 15 holes drilled in 2019 and 2021 provide the entirety of new data in the resource model since the March 2019 resource update. The drill data was provided in a single Microsoft ACCESS databases with original drill logs and assay certificates. A total of 71drill holes are included in the drill databases with 64 having assay data available (six holes were metallurgical, geotechnical, or abandoned holes with no associated assay results and one hole is outside the resource area). All collar coordinates, downhole surveys, assays, and geologic data were compared to original logs and assay certificates and no significant discrepancies were found.

Results from previous resource estimations and geologic modeling were provided and used as a basis for future modeling. Updates to lithologic units, overburden, and faulting using the new data were also provided. Mineral resource modelling, estimation and statistics was carried out using the commercial mine planning software Vulcan (version 2021).

14.2 Drill Hole Data

14.2.1 Drill Hole Database Validation

Previously, multiple databases were maintained by Graphite One. All data was consolidated and validated into a single Microsoft Access database for use going forward. Original logs in Microsoft Excel format for all drill holes were also provided, as were all assay certificates for all drill holes. A full comparison of the drill hole databases to the original logs and assay certificates was completed.

The 2012, 2013 and 2014 drill holes were surveyed using a Topcon static GPS system. Drill hole elevations were determined using a differential GPS and then cross-checked with the recently acquired IfSAR bare-earth DEM (DTM) data, which has a 5 m cell size resolution. Due to the vast topographic relief in places at Graphite Creek differences between the differential GPS and the IfSAR bare-earth DEM (DTM) data is to be expected. No major concerns were identified. (Robinson et al., 2017)

The 2018 drill collars were surveyed using Topcon and Javad high precision GPS equipment using typical RTK surveying methods to accurately locate 2018 collars in the same coordinate system used in previous exploration campaigns. The 2019 drill collars were provided as hand-held GPS coordinates. The 2021 drill hole collars were surveyed by Recon LLC (RECON) surveyors utilizing Leica GS16 multi-frequency Global Navigation Satellite System (GNSS) receivers by standard RTK GPS methods. Holes 21GCT070, 21GTW001, and 21GTW007 are located with a Garmin64 handheld GPS.

When compared to original logs, minor differences were found in the 2012-2014 collar coordinates within the database provided. One 2012 hole (12GCH008) had a 2 m difference in the Y coordinate and all 2014 drill holes had minor X and Y coordinates discrepancies of less than 0.72 m. Difference in elevation up to 5.4 m were also seen, primarily in 2012 drilling, with more minor difference seen in 2014 drilling. In all cases, the discrepancies are considered insignificant, and coordinates provided in the drill hole database were used in resource estimation as the database had been verified and used in previous estimates.

Of the 50 drill holes completed during 2012-2014, 42 drill holes were drilled at an azimuth of approximately 160°, with the holes being drilled from the northwest to the southeast. The drill hole inclination of these holes varied from -49° to -78° with 40 drill holes (80%) having inclinations of between -49° to -65°. The remaining 8 drill holes were drilled vertically (-90°). Regular down hole easy shot surveys were routinely collected every 30 m down the drill hole while the drilling was in progress, after which a follow up multi-shot survey was completed for each hole at regular 1 to 10 m intervals. The exception to this was drill holes: 12GC001; 12GC004; 12GCH006; 13GCH009; 13GCH010 13GCH012; 13GCH013; 14GCH003; 14GCH010; 14GCH012; 14GCH013; 14GCH017 to 14GCH020, where only 5 to 30 m interval easy shot surveys were completed. All spurious surveys were removed.

The down hole surveys for the 2018 and 2019 and 2021 drill holes used the Reflex EZ-Trac multi-shot survey collecting a reading every 50 feet coming out of the hole. Survey results were evaluated for validity and results that were deemed not good were not imported into the drilling database. Drill holes 18GC021 and 18GC022 did not have downhole surveys completed due to complications with tooling in the hole. The survey for 18GC025 was not good due to a rock stuck in the drill bit preventing the survey tool from going out into the open hole for good readings.

All EZ Shot downhole surveys were compared with original logs and one discrepancy in hole 13GCH013 was found and corrected. Remaining multi-shot surveys were reviewed visually when loaded in Vulcan and no significant issues were seen. The 2012-2014 survey results all used a standard declination correction of 12.016777. Due to the location of the project, declination can vary significantly year-to-year and thus it was determined to use new correction factors for 2012, 2013, and 2014 data. The declination was determined for each year using the magnetic field calculator on the National Oceanic and Atmospheric Administration website. The maximum difference in sample location (the bottom sample in all holes) when using the new declination correction factor was less than 1.7 m in all holes, and the average maximum distance is approximately 0.7 m (Table 14-1).

Table 14-1: Maximum Difference in Sample Location using Updated Declination in Downhole Surveys

HOLE ID	Max Difference (m)	HOLE ID	Max Difference (m)
12GC001	1.612	13GCH014B	0.761
12GC002	1.364	13GCH015	0.791
12GC003	0.965	13GCH016	0.572
12GC004	0.962	13GCH017	1.065
12GC005	0.895	14GC014	0.016
12GC006	1.020	14GC018	0.060
12GC007	1.002	14GCH001	0.959
12GC008	0.840	14GCH002	0.452
12GC009	0.798	14GCH003	0.755
12GC010	0.816	14GCH004	0.925
12GCH001	0.658	14GCH005	0.833
12GCH002	0.618	14GCH006	1.207
12GCH003	0.631	14GCH007	0.954
12GCH004	0.602	14GCH008	0.918
12GCH005	0.109	14GCH009	0.094
12GCH006	0.669	14GCH010	0.110
12GCH007	0.640	14GCH011	1.097
12GCH008	0.674	14GCH012	0.052
13GCH009	0.809	14GCH013	0.935
13GCH010	0.779	14GCH015	0.642
13GCH011	0.664	14GCH016	0.099
13GCH012	0.681	14GCH017	0.948

HOLE ID	Max Difference (m)	HOLE ID	Max Difference (m)
13GCH013	0.617	14GCH019	0.899
13GCH014A	0.319	14GCH020	0.769
AVERAGE	**0.722**		

Source: AES (2022)

Logged lithology in the drill database was compared to the original logs with no errors or omissions found.

All assay results for Cg (%) were compared to original certificates and 100% of the assay results in the provided database were verifiable with no errors or omissions found.

Density data was also provided but no comparisons back to original logs or certificates was undertaken. Rather, a visual and statistical validation was undertaken with no significant errors discovered.

After validation of the provided data, a Vulcan database was created for further modeling, statistics and resource estimation. No overlapping samples or geologic intervals were found. The Vulcan database used in resource modeling and estimation is considered reliable for mineral resource estimation purposes.

14.2.2 Data Summary

The final database is composed of 71 drill holes. Six holes are metallurgical, geotechnical, or abandoned holes with no assay data available and one hole is outside the resource area, leaving 64 drill holes with assay data available for resource estimation. A summary of the final assay data available is provided in Table 14-2.

Table 14-2: Summary Statistics for Unconstrained Graphite Samples

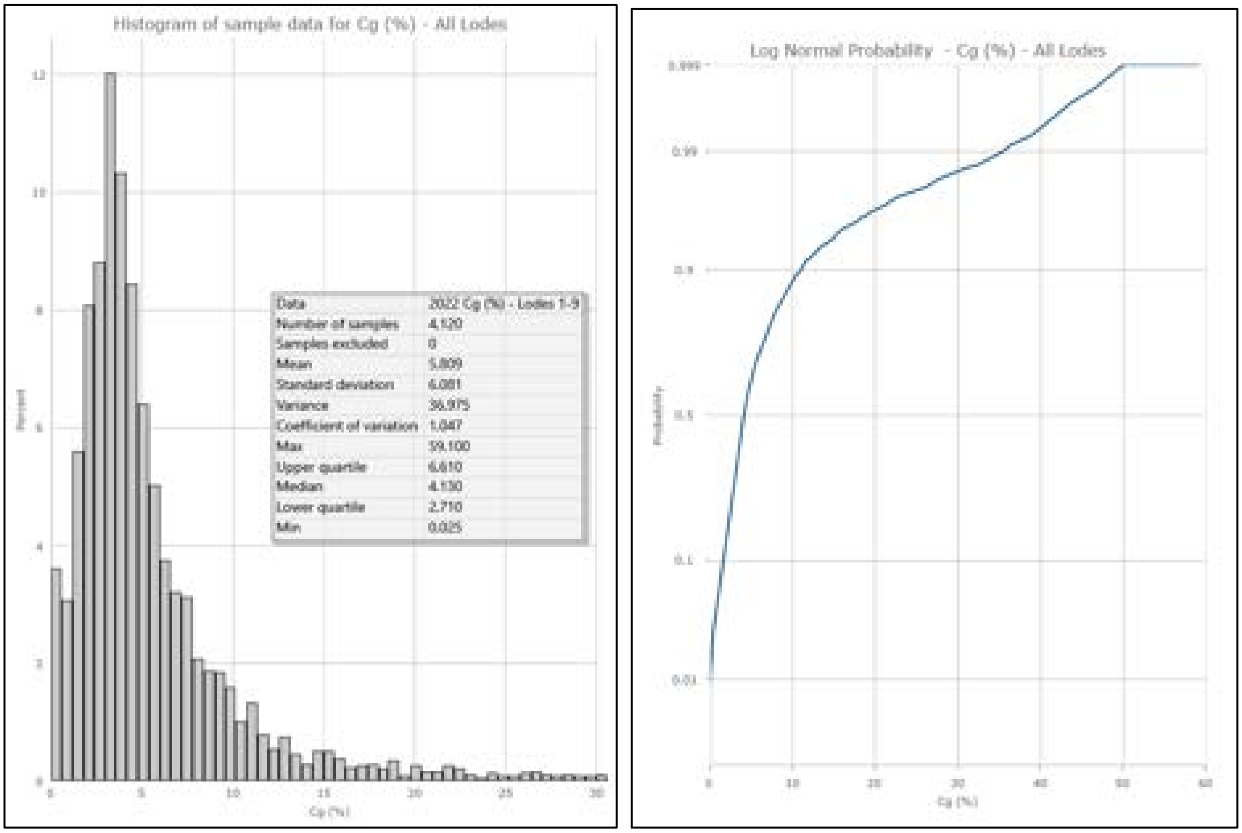
	All Graphite Samples – Cg (%)
Count	9902
Mean	3.07
Standard deviation	4.72
Maximum	59.10
Upper quartile	3.77
Median	1.80
Lower quartile	0.40
Minimum	0.02
Coeff. Of Variation	1.54
Variance	22.24

	All Graphite Samples – Cg (%)
Percentile 10	0.08
Percentile 20	0.28
Percentile 90	6.98
Percentile 99	25.20

Source: AES (2022)

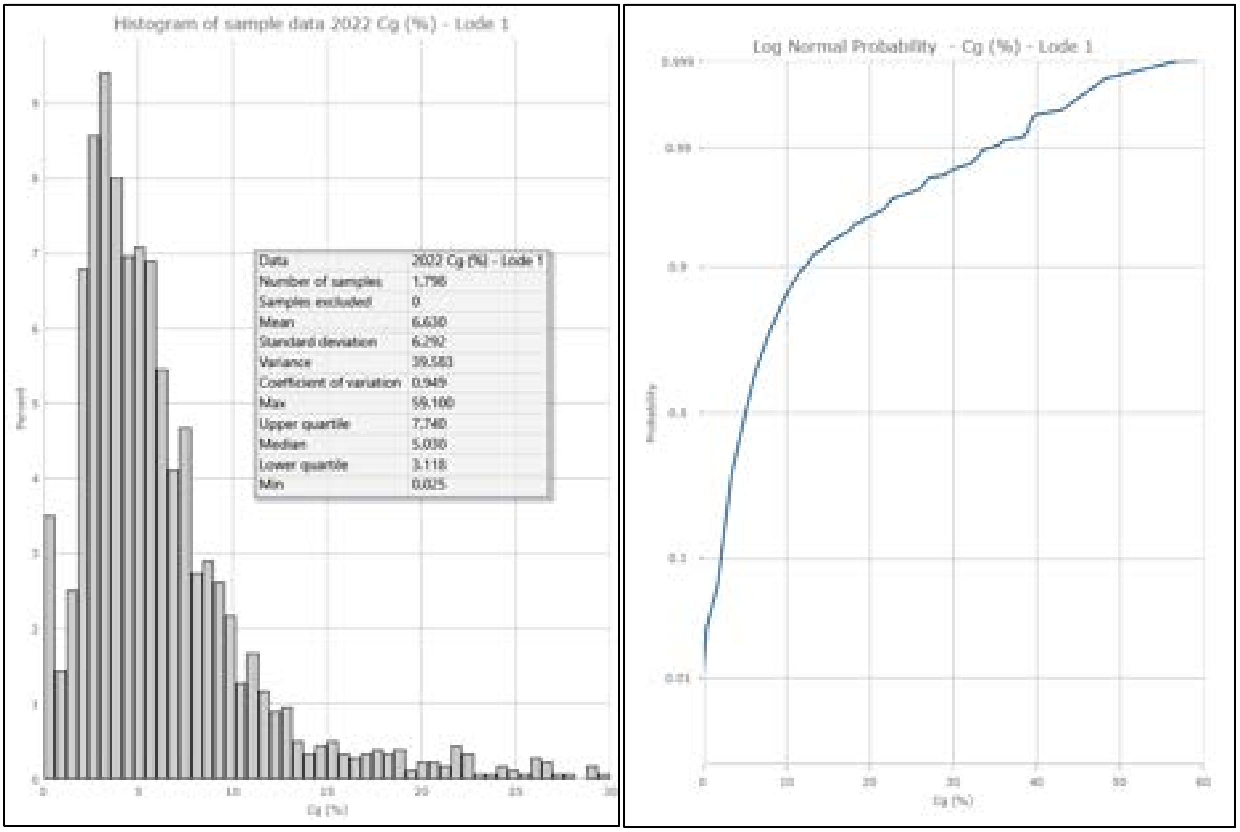
The Graphite Creek Resource estimate has been calculated utilizing the graphitic carbon (Cg) percent assay grade. Graphite is the only commodity at this stage that demonstrates potential for economic concentrations. Previous resource modeling interpreted nine mineralized lodes using an approximate 3% Cg cut-off. The interpretation was updated with the new 2019 and 2021 drill results and new downhole survey correction factors. All mineralized wireframes/solids were snapped directly to drilling to provide distinct contacts between mineralized and unmineralized zones (see Section 14.3.2). It should be noted that the more densely drilled lodes with abundant samples have an excellent single population and Log normal bell curve (Lodes 01 to 03); whereas when the number of drill holes intersecting the respective lode decrease, the number of samples within that lode are less and as such the data populations are more erratic (albeit still exhibiting single populations). Because the Graphite Creek samples exhibit a single population, linear estimation techniques were applied. Summary statistics, histograms, and log normal curves for each lode are provided in Figure 14-1 through Figure 14-11.

Figure 14-1: Histogram and Probability Plot of Cg (%) Sample Data in All Lodes



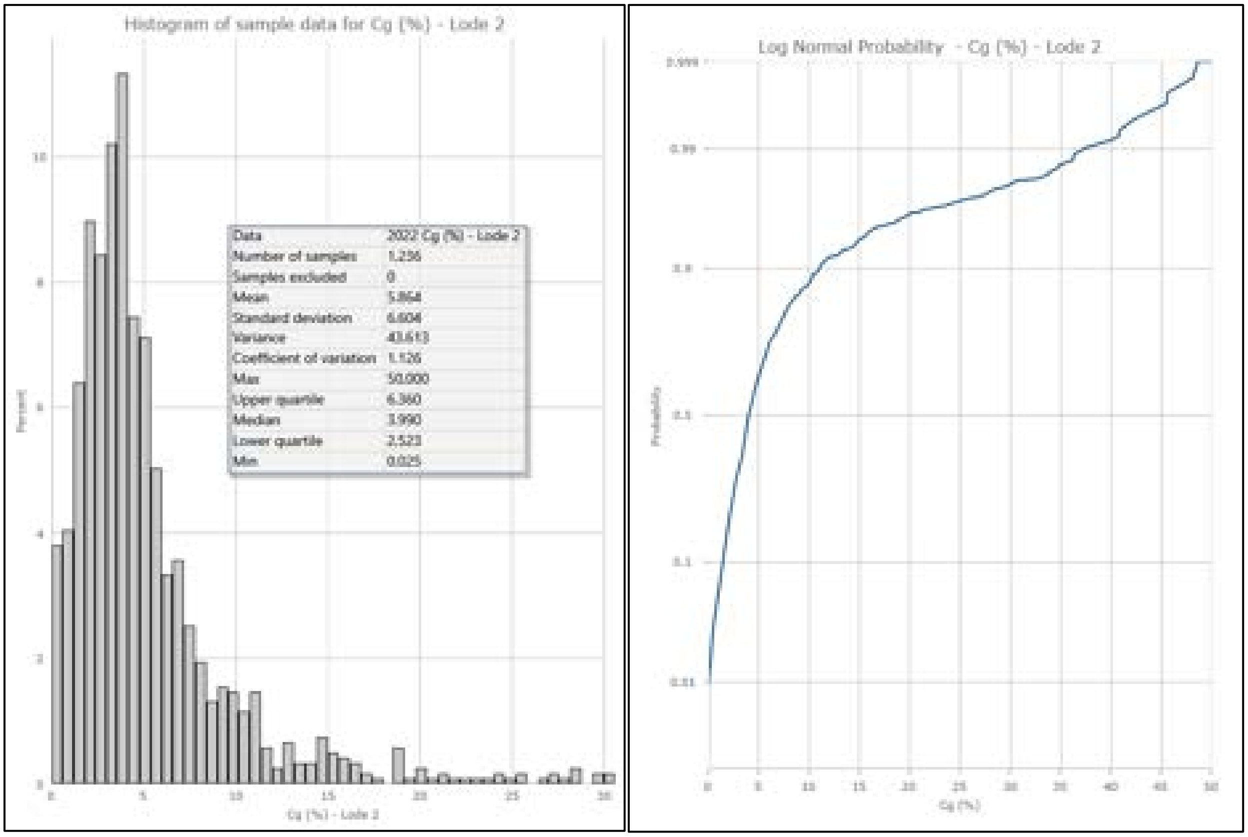
Source: AES (2022)

Figure 14-2: Histogram and Probability Plot of Cg (%) Sample Data in Lode 1



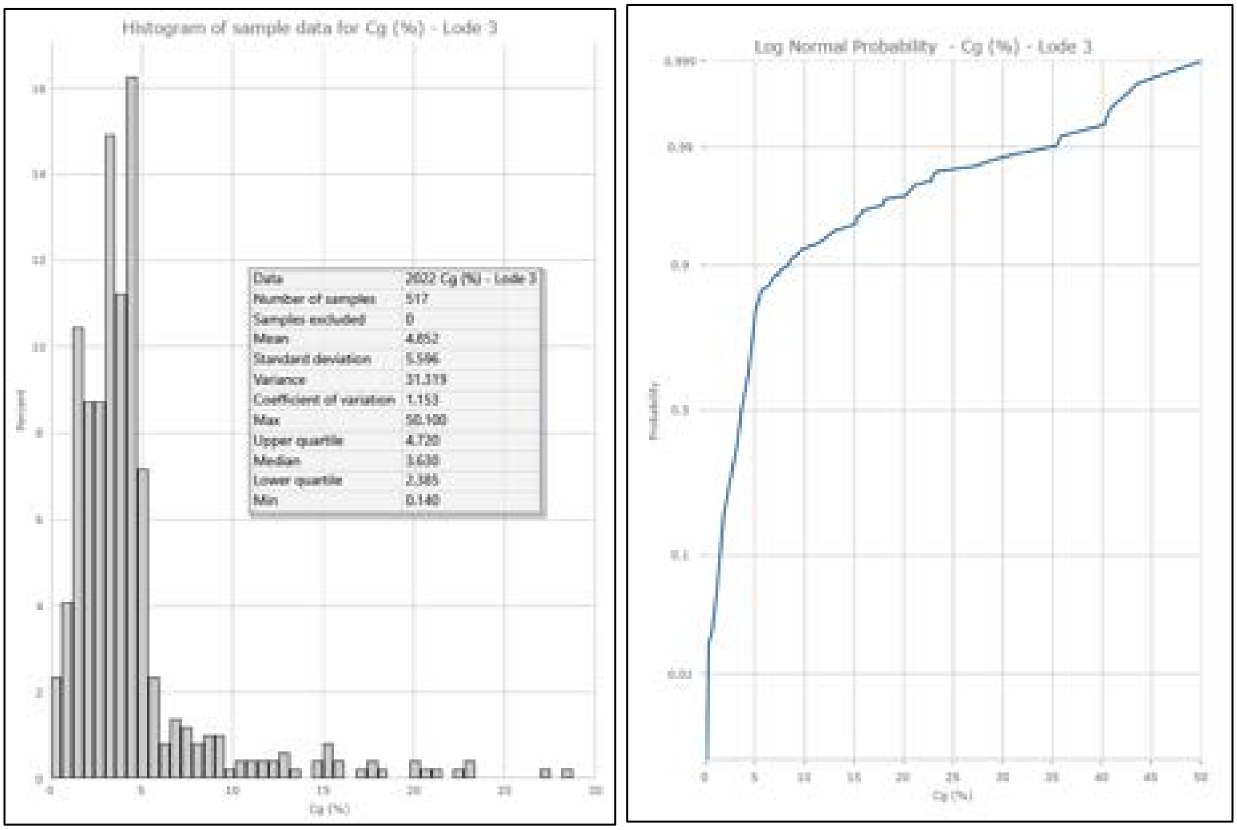
Source: AES (2022)

Figure 14-3: Histogram and Probability Plot of Cg (%) Sample Data in Lode 2



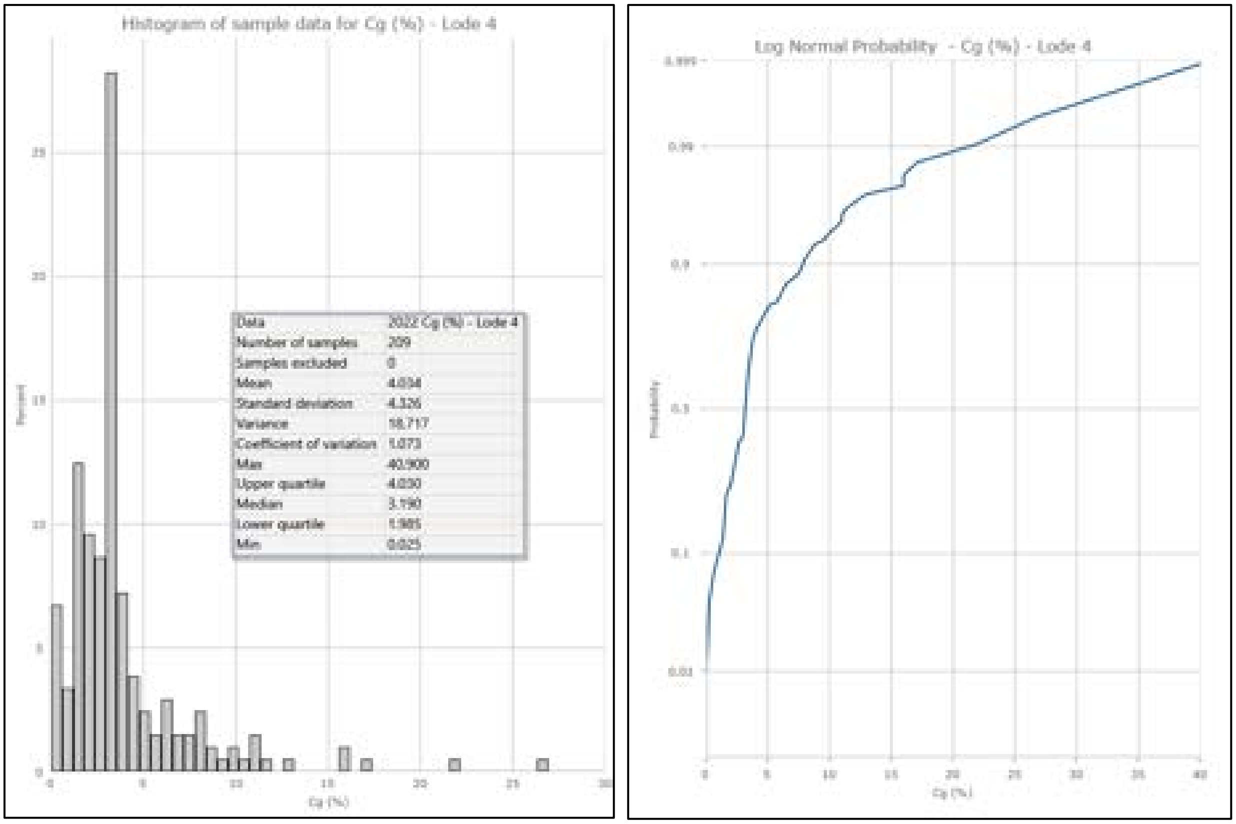
Source: AES (2022)

Figure 14-4: Histogram and Probability Plot of Cg (%) Sample Data in Lode 3



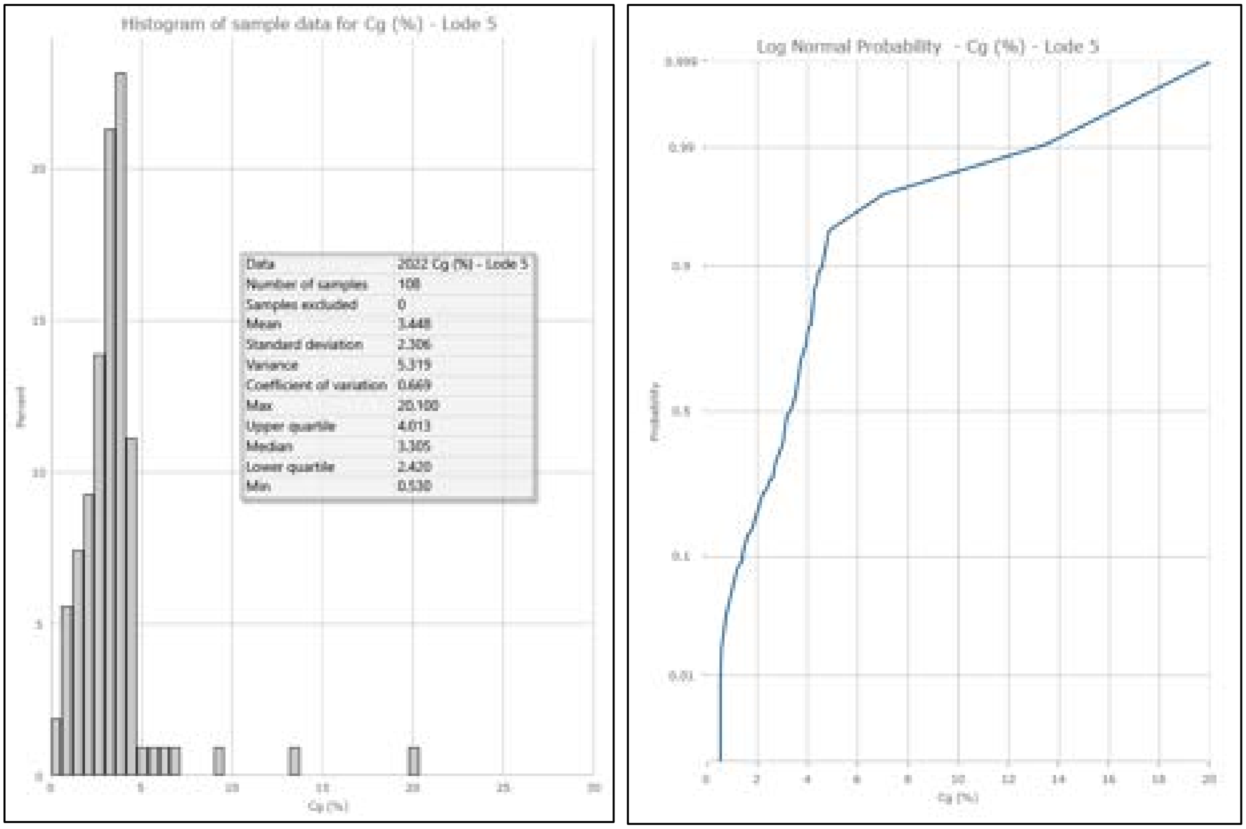
Source: AES (2022)

Figure 14-5: Histogram and Probability Plot of Cg (%) Sample Data in Lode 4



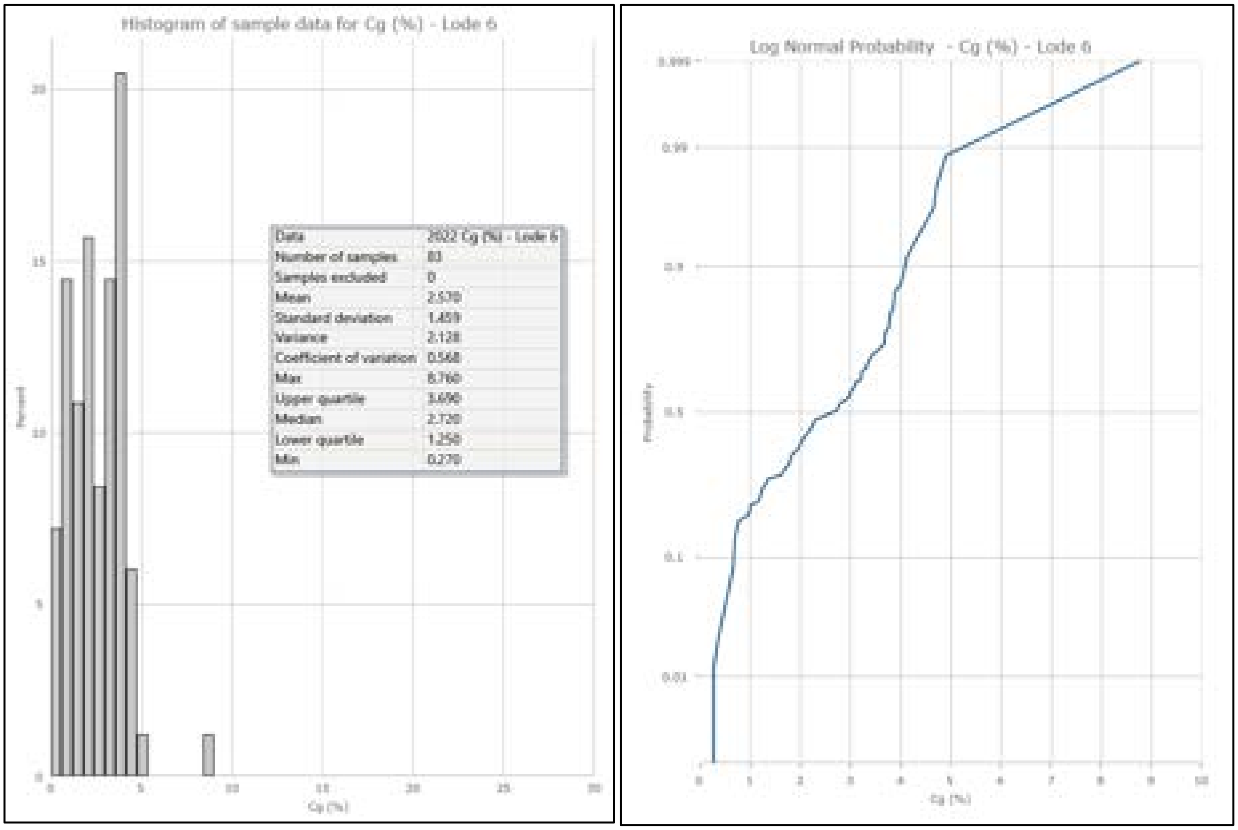
Source: AES (2022)

Figure 14-6: Histogram and Probability Plot of Cg (%) Sample Data in Lode 5



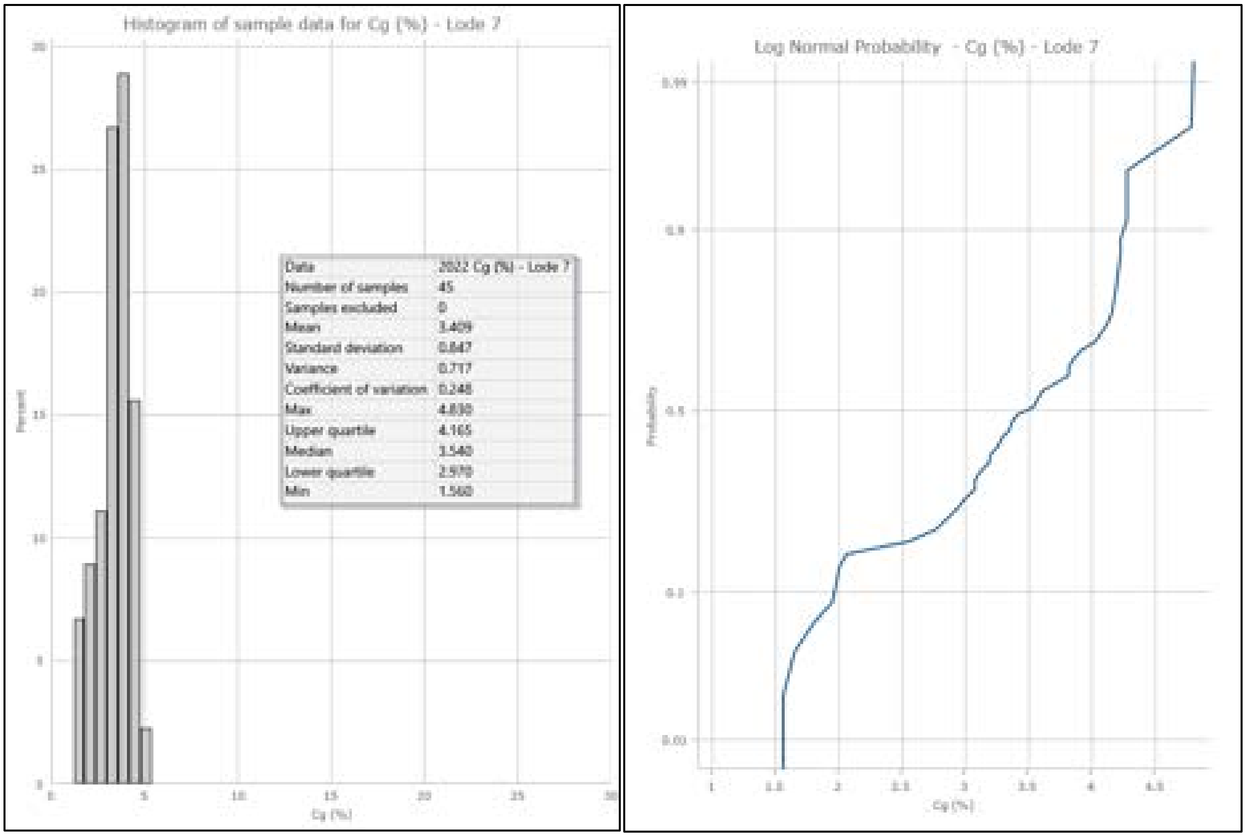
Source: AES (2022)

Figure 14-7: Histogram and Probability Plot of Cg (%) Sample Data in Lode 6



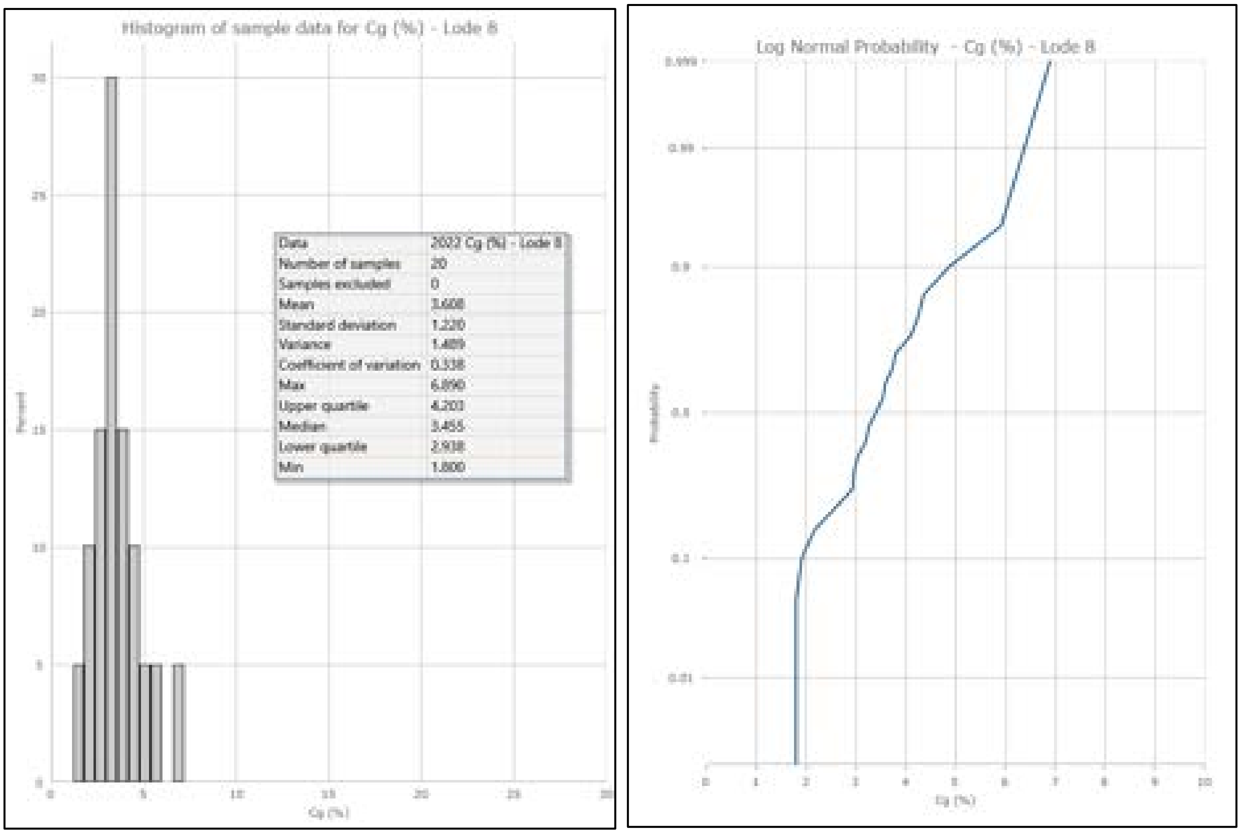
Source: AES (2022)

Figure 14-8: Histogram and Probability Plot of Cg (%) Sample Data in Lode 7



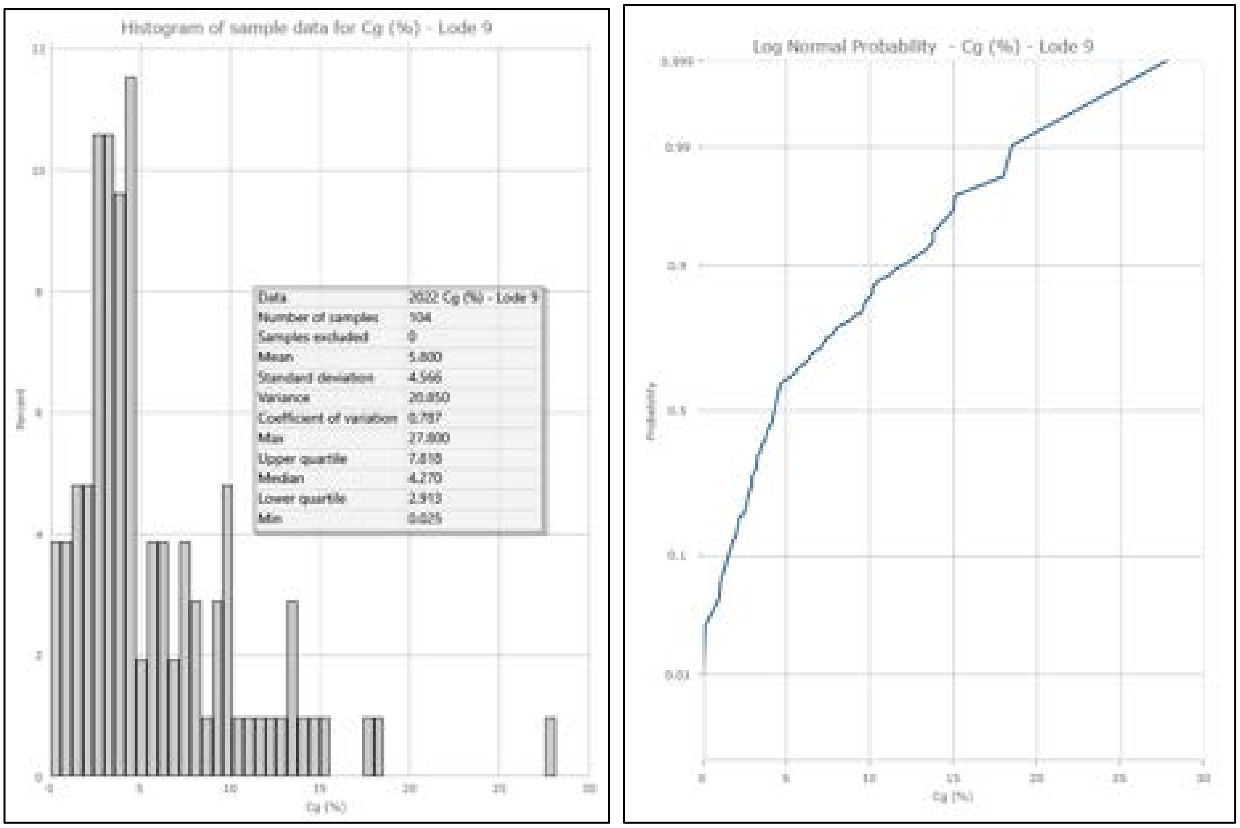
Source: AES (2022)

Figure 14-9: Histogram and Probability Plot of Cg (%) Sample Data in Lode 8



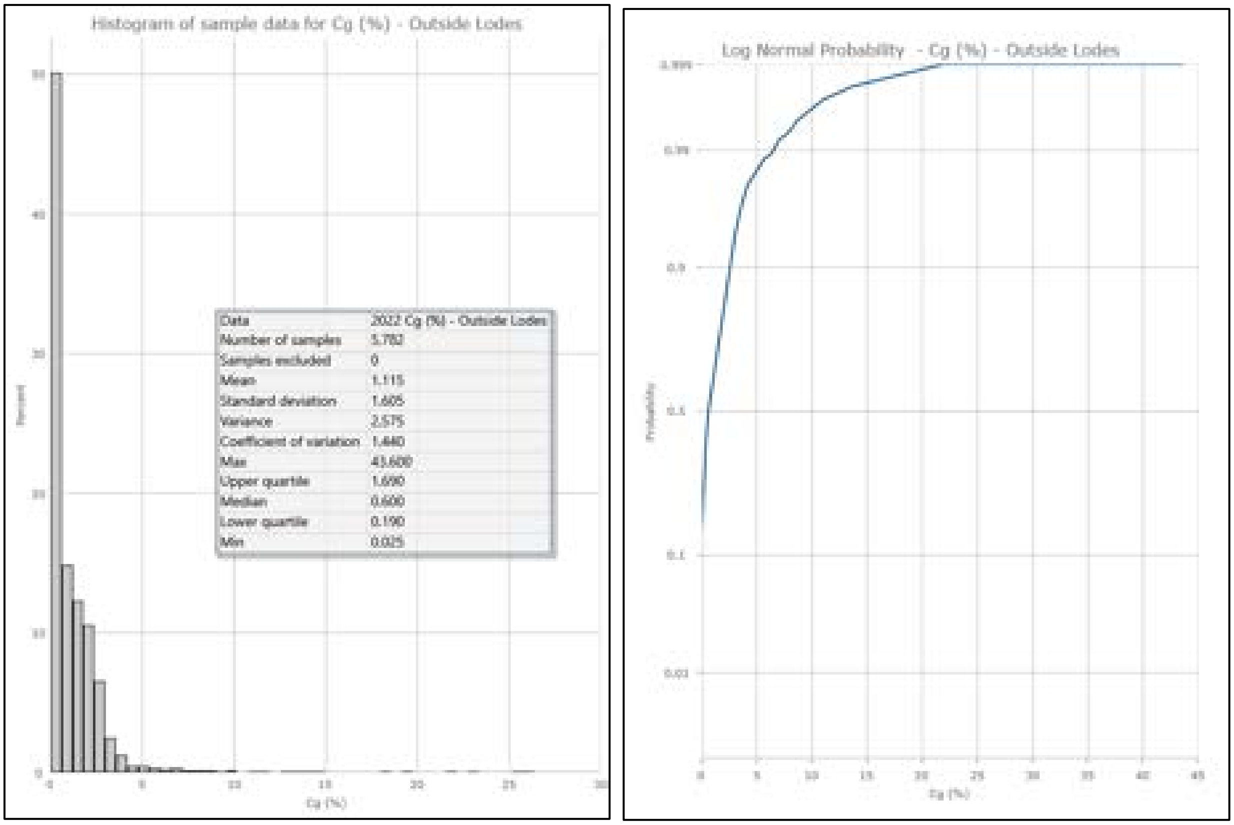
Source: AES (2022)

Figure 14-10: Histogram and Probability Plot of Cg (%) Sample Data in Lode 9



Source: AES (2022)

Figure 14-11: Histogram and Probability Plot of Cg (%) Sample Data Outside of Lodes



Source: AES (2022)

14.3 Geological Models

14.3.1 Topography

During the 2018 season, LiDAR was flown over the project area along with the two proposed access corridors. The full LiDAR dataset was provided, in addition to 2 m contour lines. The LiDAR data was used to create three topographic areas with varying resolution:

1) A 0.5 m grid topographic surface was created over a select core area of the resource area;

2) A 2 m grid topographic surface was created over the larger resource area; and

3) A topographic surface using 2 m contour lines was created over the entire deposit area.

The final topographic surface for resource estimation purposes used a merged surface of all 3 resolutions to cover the entire deposit area.

14.3.2 Lode Models

Nine different mineralized lodes have previously been recognized in the project area. Previous estimations have used a 3.0% Cg lower cut-off for lode interpretation and this practice was continued with allowances of lower grade to allow for continuity of individual lodes. The mineralized lodes were updated using the following process:

- Wireframe solids of previous estimation lodes were provided;
- The wireframe points were extracted, and relevant points were snapped to drill holes at sample locations accounting for a 3% Cg lower cut-off;
- A hanging wall surface and footwall surface for each Lode was created. The standard smoothing and filtering process in Vulcan were used to create a smoother, more geologically reasonable interpretation. Care was taken to honor all drill hole snapping; and
- The resulting hanging wall and footwall surfaces were combined into a 3D wireframe solid. All Lodes were extended beyond overburden, topography, Graphite Creek Fault, and the Kigluaik Fault.

From previous reports, the mineralization was extrapolated down dip approximately 150 m from the drill hole and extrapolated up dip to surface. Rock chip samples collected during the 2012 field season confirmed mineralization at surface. The lodes were extrapolated halfway to the next drill section or 90 to 120 m along strike from the last drill hole.

The top of the lodes was either cut by one of the overburden surfaces (see Section 14.3.3) or the topographic surface described (see Section 14.3.1). The down dip mineralization was either extended 150 m down dip from the nearest drill hole or was cut in instances where the extension of mineralization intersected one of the two interpreted Kigluaik Fault surfaces (see Section 14.3.5). Lodes 1-5 intersected the Graphite Creek Fault and are cut into an East and West Lode.

14.3.3 Lithological Models

The quartz-biotite-garnet-sillimanite schist was modelled snapping to the tops and bottoms of intervals in the drill holes. Two main horizons were modelled. All of the high-grade graphite mineralization is found within this unit. Lower grade zones (1-3% Cg) were occasionally found outside the modelled lithology in the quartz-biotite schist. The two horizons were fairly linear across the deposit with no major folding within the bounds of the pit and only one major offset (less than 30 m) at the interpreted Graphite Creek fault. The quartz diorite sill was also modelled which lies mostly in the western part of the deposit above the upper quartz-biotite-garnet-sillimanite schist.

The lithology models were not used during resource estimation.

14.3.4 Overburden Model

Using all related drill intercepts of overburden, and previous overburden models as a guide, an overburden model was created in a similar detailed manner as the lithology models described in Section 14.3.2. Additional points were added beyond the drilling area in order to extend the surface in an appropriate manner. Care was taken to ensure the surface was snapped to drill intercepts and the surface correlated well to previous models.

All samples above the wireframe surfaces were flagged and not included in the resource estimation.

14.3.5 Fault Models

Two major faults are present in the project area:

- The Graphite Creek Fault is interpreted as a NW-SE trending fault and is a bounding surface for the mineralized lodes. The lodes that intersect the fault are split at the fault surface into an East and West Lode. There are no definitive drill intercepts of this fault; and
- The Kigluaik Fault is a major range-bounding fault trending NE-SW throughout the resource area. North of the fault is deep overburden.

Previous interpretations included a West Fault, which was modeled in a N-S orientation on the western edge of the main resource area. However, the fault has not been updated and is no longer considered a main fault in the deposit.

Within the area of new drilling and the previously recognized Measured and Indicated Resource, the Kigluaik Fault was modeled as part of Lithology as described in Section 14.3.2. The 2021 drill results included six holes drilled downdip of the fault surface, intersecting the Kigluaik Fault at approximately 40 m in depth. These intersections, plus structural information obtained from oriented core indicate the Fault has a dip of approximately 45° to the Northwest as opposed to a more vertical dip. The Kigluaik Fault surface was updated in the main Resource area where the 2018-2021 drilling was focused. The shallower dip allows mineralization to extend downdip without being truncated. The Kigluaik Fault surface outside of the main Resource area has not been updated with new drilling and still extends at a near-vertical dip.

The Graphite Creek Fault was intersected during the 2019 drill season by hole 19GC027. The Graphite Creek fault was adjusted to account for the new intersection point and accounted for offsets of Lodes 1-4 seen in new 2019-2021 drill results.

It should be noted that the Kigluaik Fault continues to be a driving factor in the global resource. Additional clarification of the fault orientation is needed, particularly outside the main Resource area. In addition, additional drilling is needed to further define the Graphite Creek fault and its effect on the East and West Lodes.

14.4 Drill Hole Flagging and Compositing

Drill hole samples situated within the mineralized lodes were selected and flagged with the wireframe name/code. The flagged samples were checked visually next to the drill hole to check that the automatic flagging process worked correctly and that wireframes were snapped to drill holes correctly. All samples were correctly flagged and there was no need to manually flag or remove any samples.

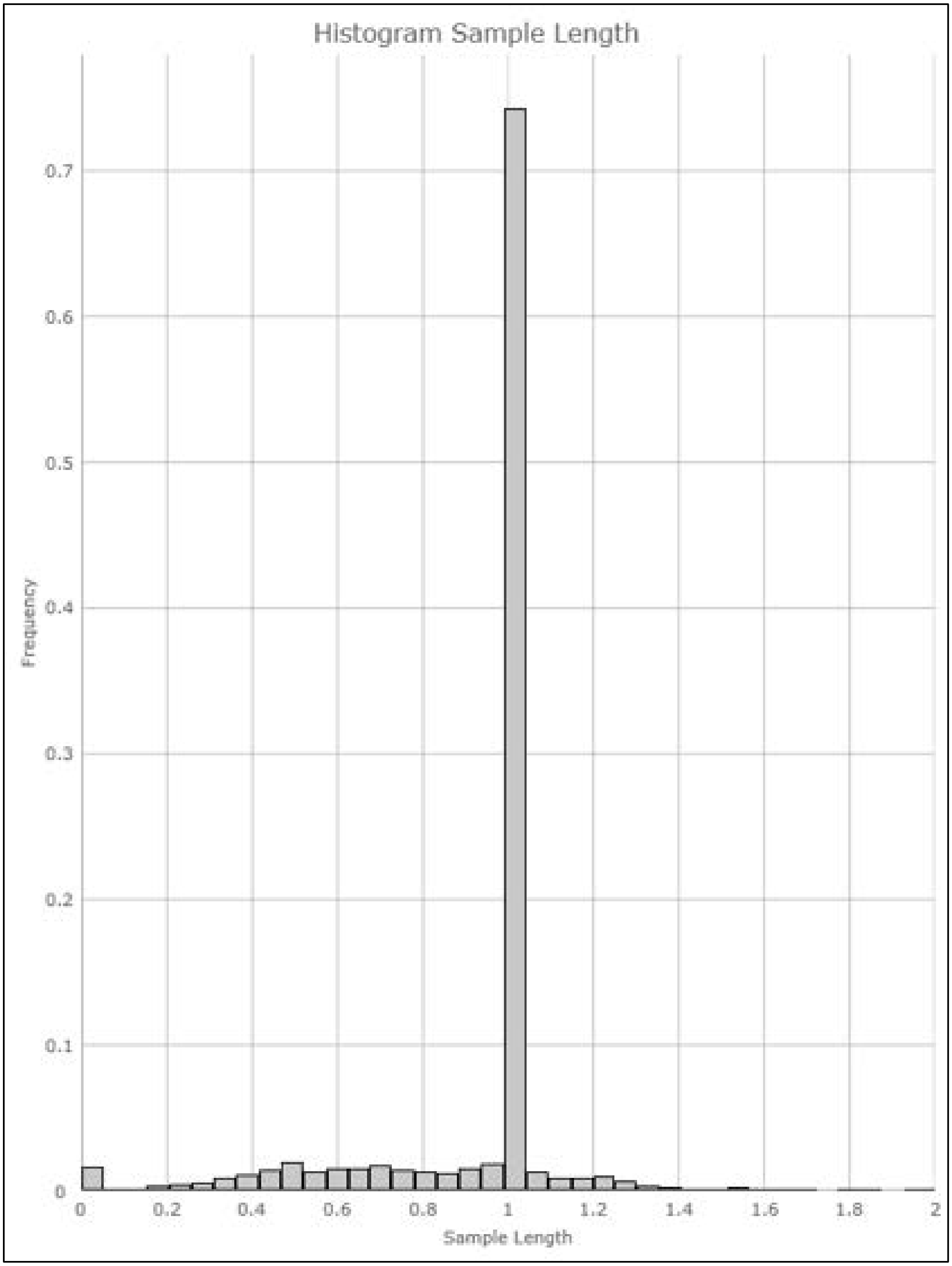
The drill hole sample width analysis showed a variable sample length from 0.1 m to 5.13 m with a dominant sample length population at 1.0 m (Table 14-3 and Figure 14-12). Previous estimations selected a composite size of 3.0 m. The current estimation selected a composite size of 2.0 m because it portrays a more realistic interval equivalent to the anticipated mining unit, provides more detail within mineralized lodes, and compares well with potential mining equipment size. The majority of the samples are a nominal 1.0 m. Within the mineralized lodes, only 12 samples are above 2.0 m in length, (0.35%).

Table 14-3: General Statistics for Sample Length (m)

	ALL	Outside Lode	Lode 1	Lode 2	Lode 3	Lode 4	Lode 5	Lode 6	Lode 7	Lode 8	Lode 9
Count	9902	5782	1798	1236	517	209	108	83	45	20	104
Mean	0.93	0.94	0.94	0.92	0.92	0.86	0.94	0.94	1.05	0.95	0.94
Standard deviation	0.25	0.23	0.31	0.22	0.22	0.30	0.22	0.24	0.47	0.22	0.19
Maximum	5.13	3.43	5.13	2.20	1.28	1.44	1.00	1.31	4.00	1.00	1.19
Upper quartile	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Median	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lower quartile	1.00	1.00	1.00	1.00	1.00	0.83	1.00	1.00	1.00	1.00	1.00
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
Coeff. Of Variation	0.27	0.25	0.33	0.24	0.24	0.35	0.24	0.26	0.45	0.23	0.20
Variance	0.06	0.05	0.09	0.05	0.05	0.09	0.05	0.06	0.22	0.05	0.04
Percentile 10	0.61	0.62	0.60	0.59	0.61	0.42	0.96	1.00	1.00	0.99	0.58
Percentile 20	0.98	0.99	0.93	0.94	1.00	0.73	1.00	1.00	1.00	1.00	1.00
Percentile 90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percentile 99	1.32	1.35	1.46	1.28	1.17	1.28	1.00	1.05	2.71	1.00	1.16

Source: AES (2022)

Figure 14-12: Histogram of Sample Lengths for Drill Core Assay Data



Source: AES (2022)

Length weighted composites were calculated for all of the graphite assay samples. The compositing process starts from the first point of intersection between the drill hole and the mineralized wireframe and is stopped upon the end of the mineralized wireframe. Small (orphan) composites were distributed evenly amongst intervals of the same mineralized wireframe. Un-assayed intervals were ignored in the composite process.

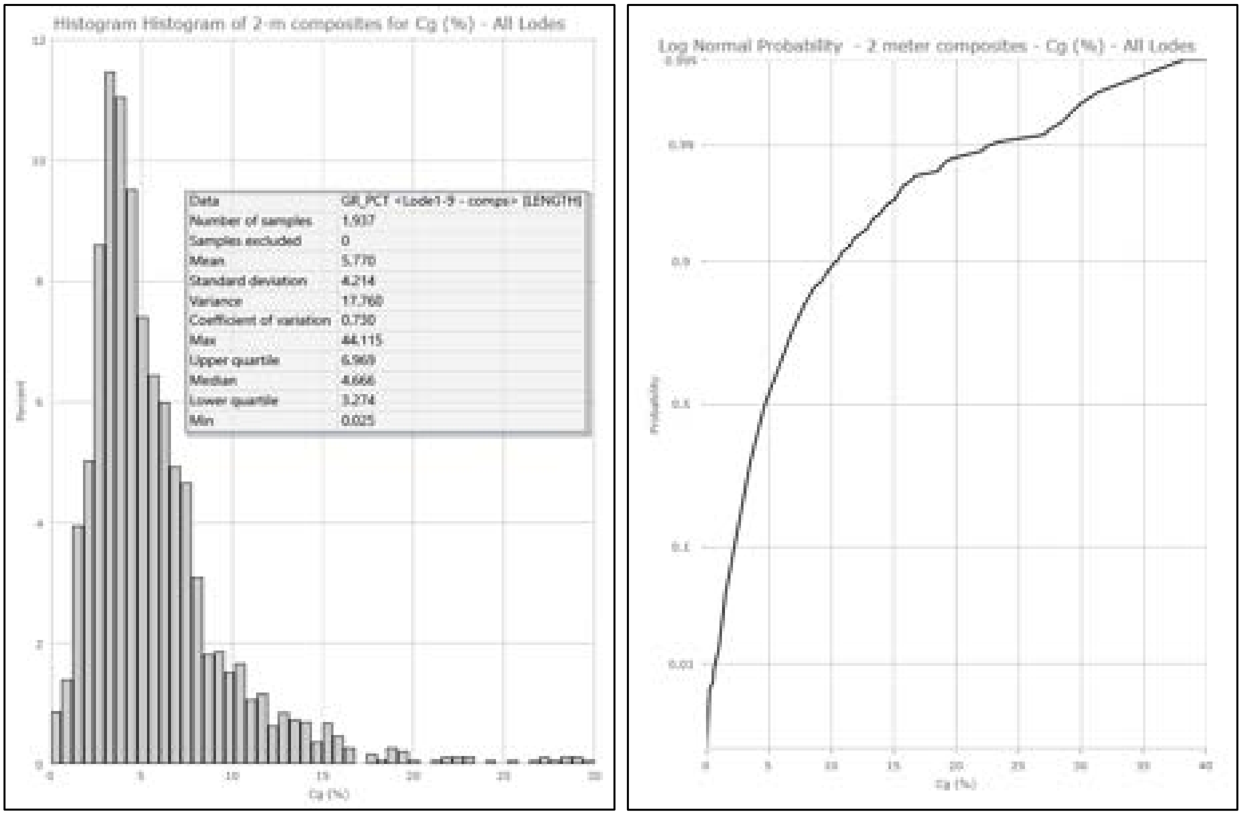
Upon completion of the 2.0 m compositing process, the composites were examined to determine if there were any noticeable bias' applied to the grades during the compositing process. There was little to no change in the grade for the Graphite Creek sample file. The composited samples were used for sample statistics, capping, estimation input file and validation comparisons.

14.5 Data Analysis/Grade Capping/Outlier Restrictions

Composites within the nine lodes were examined for capping analysis. Log probability plots and histograms of the composites for each of the nine lodes are seen in Figure 14-13 through Figure 14-24. The figures show the graphite values (% Cg) belong to a consistent population within each lode and do not require capping of the data. There is the appearance of a higher-grade population as seen at the tailing end of the histograms above approximately 10%. However, the end of the histogram is showing continuity of grade, rather than anomalous grade or outlier data. Such high-grade is supported by field visits and observations in the core during all drill seasons. Due to the low co-efficient of variation and lack of clear high-grade outliers, it was decided not to apply any capping to the estimation.

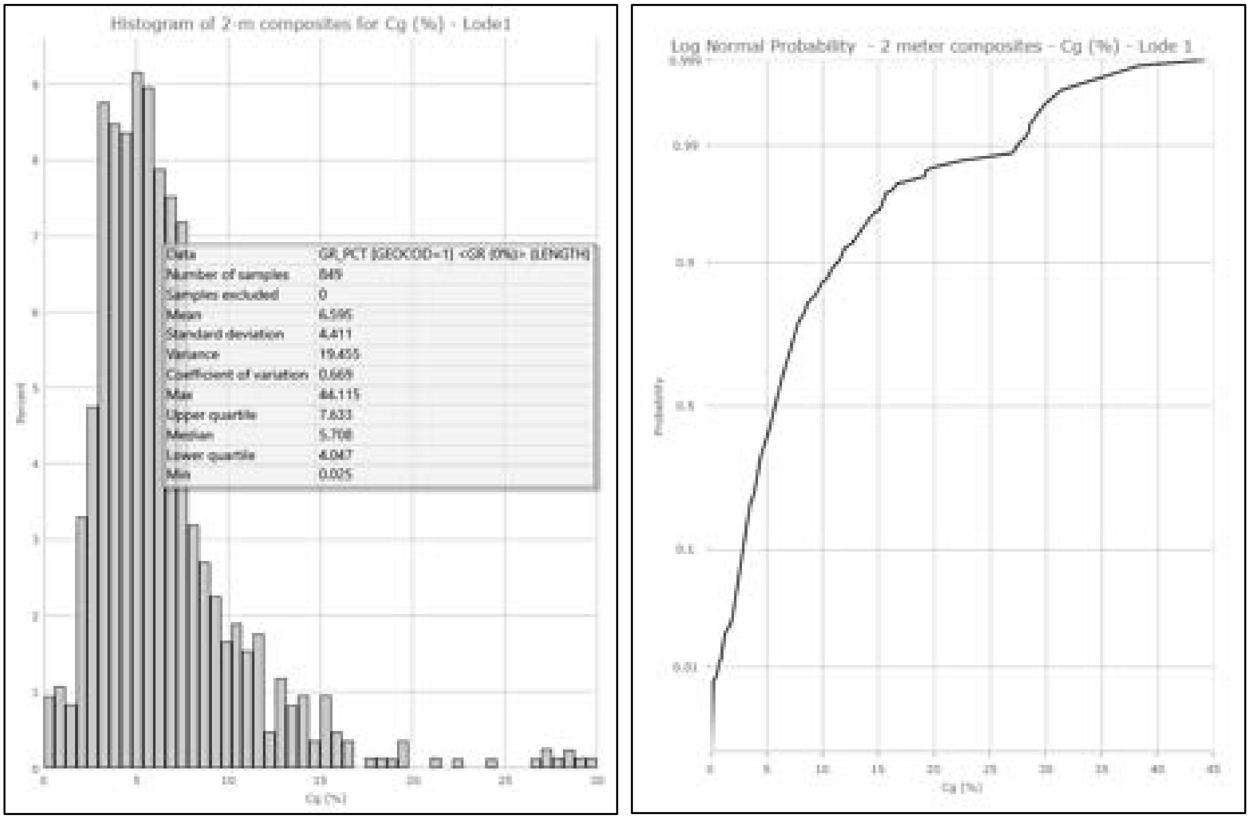
It should be noted that a graphite value of 25% is the approximate 99th percentile and capping composites would only affect 14 composites, indicating the lack of capping would likely have limited effect on the estimation.

Figure 14-13: Histogram and Probability Plot of 2 m Composites for All Lodes



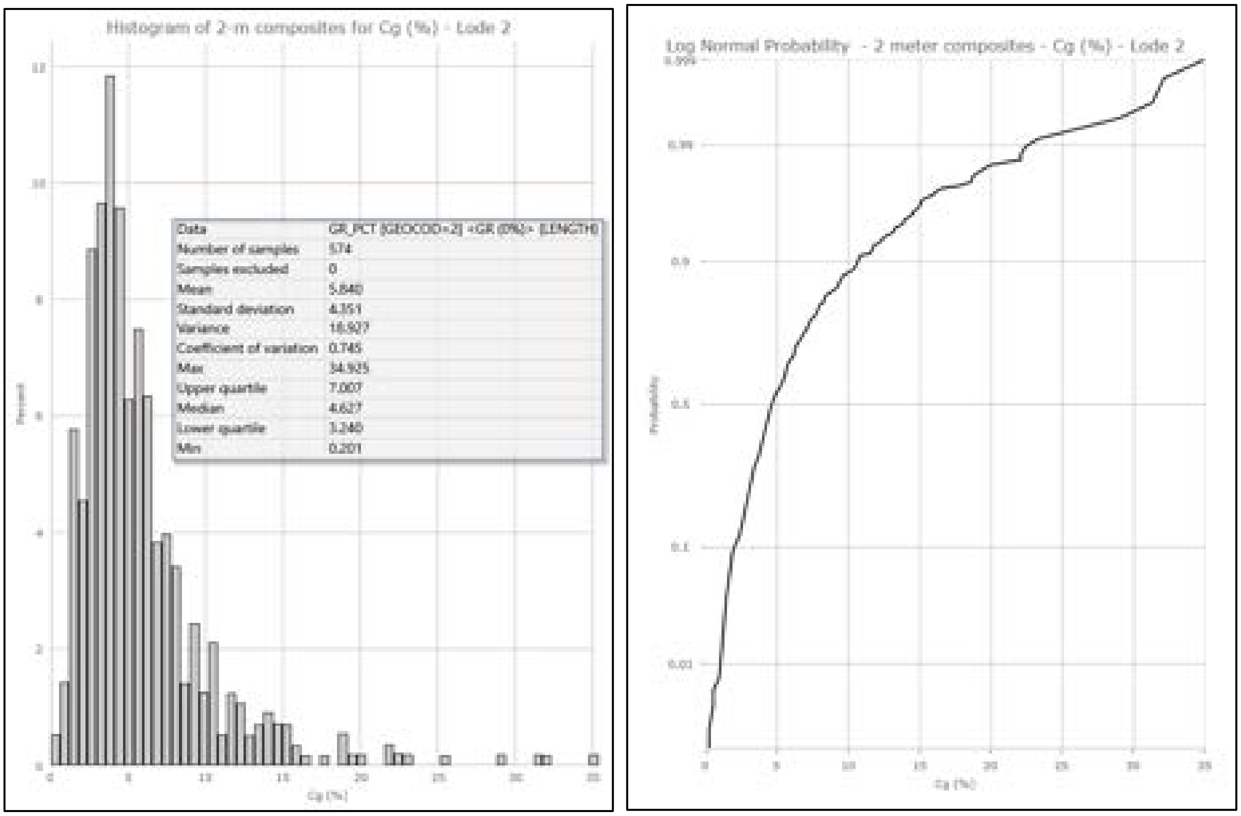
Source: AES (2022)

Figure 14-14: Histogram and Probability Plot of 2 m Composites for Lode 1



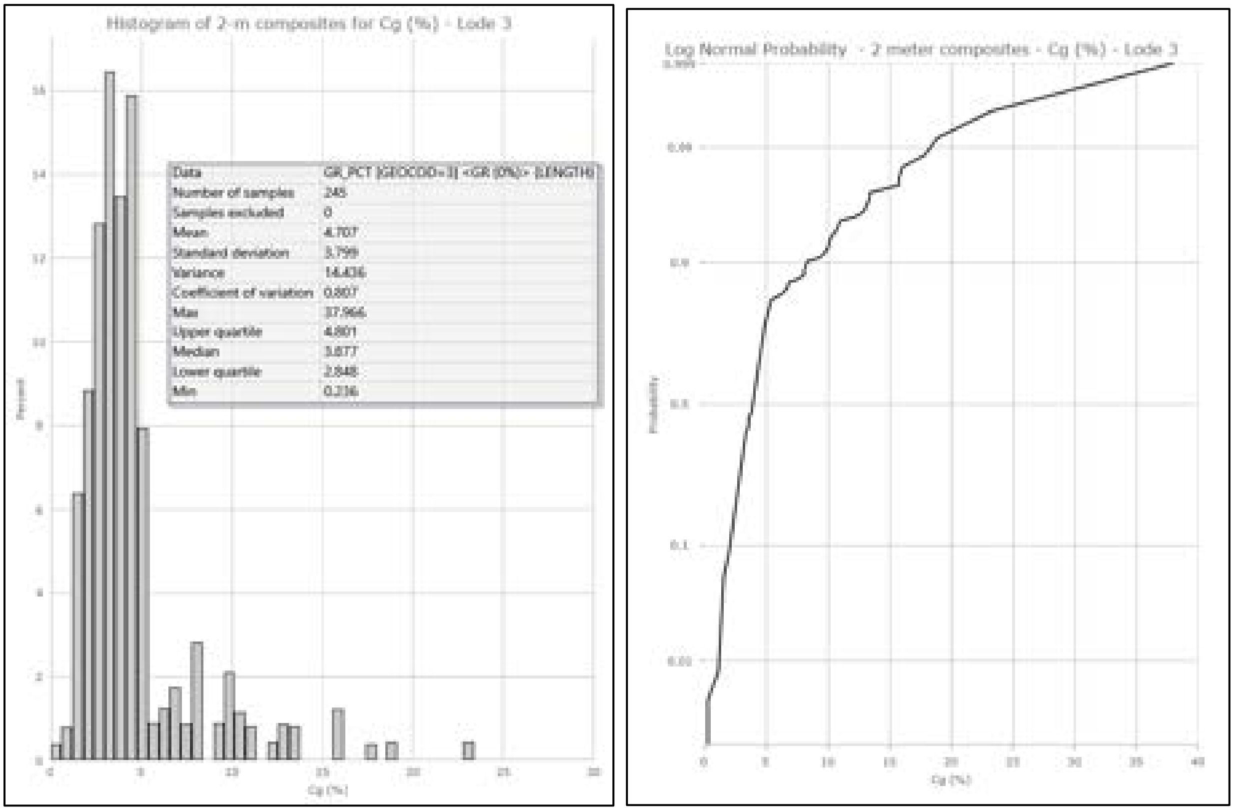
Source: AES (2022)

Figure 14-15: Histogram and Probability Plot of 2 m Composites for Lode 2



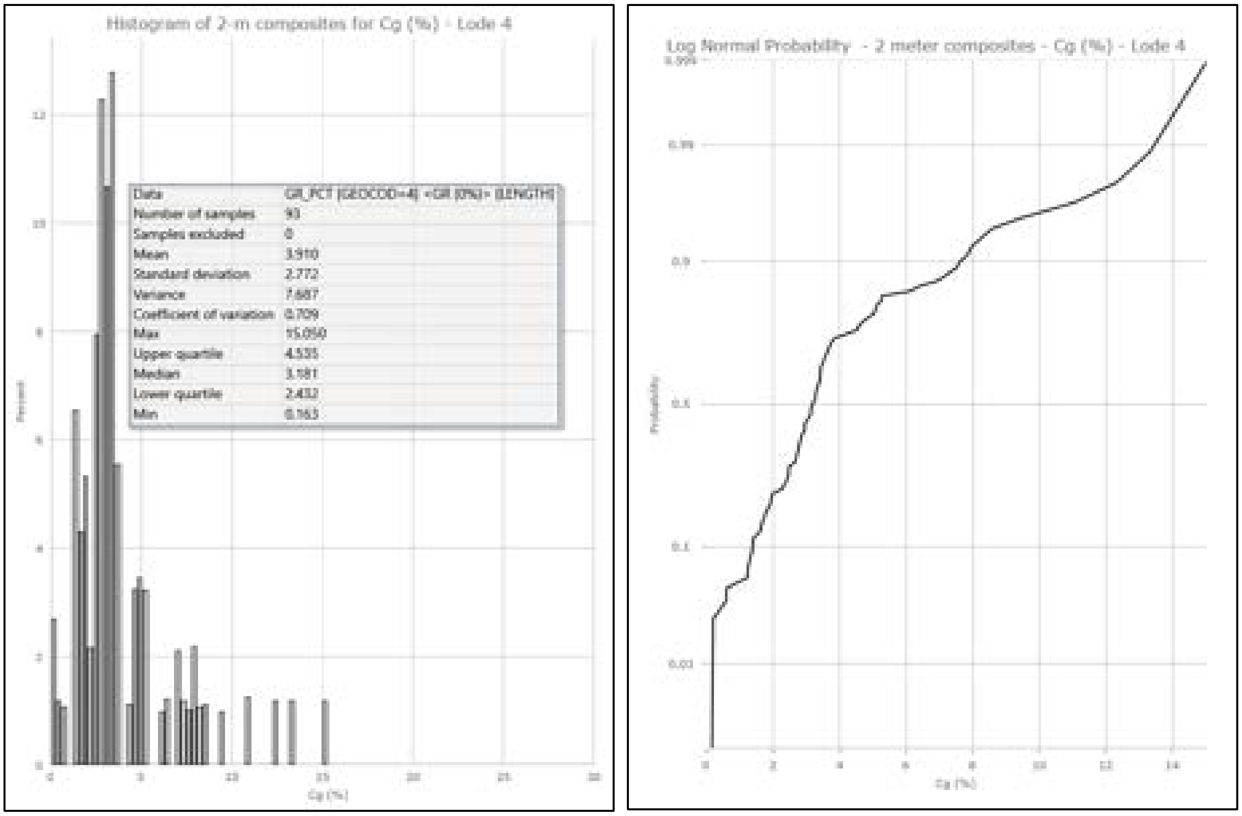
Source: AES (2022)

Figure 14-16: Histogram and Probability Plot of 2 m Composites for Lode 3



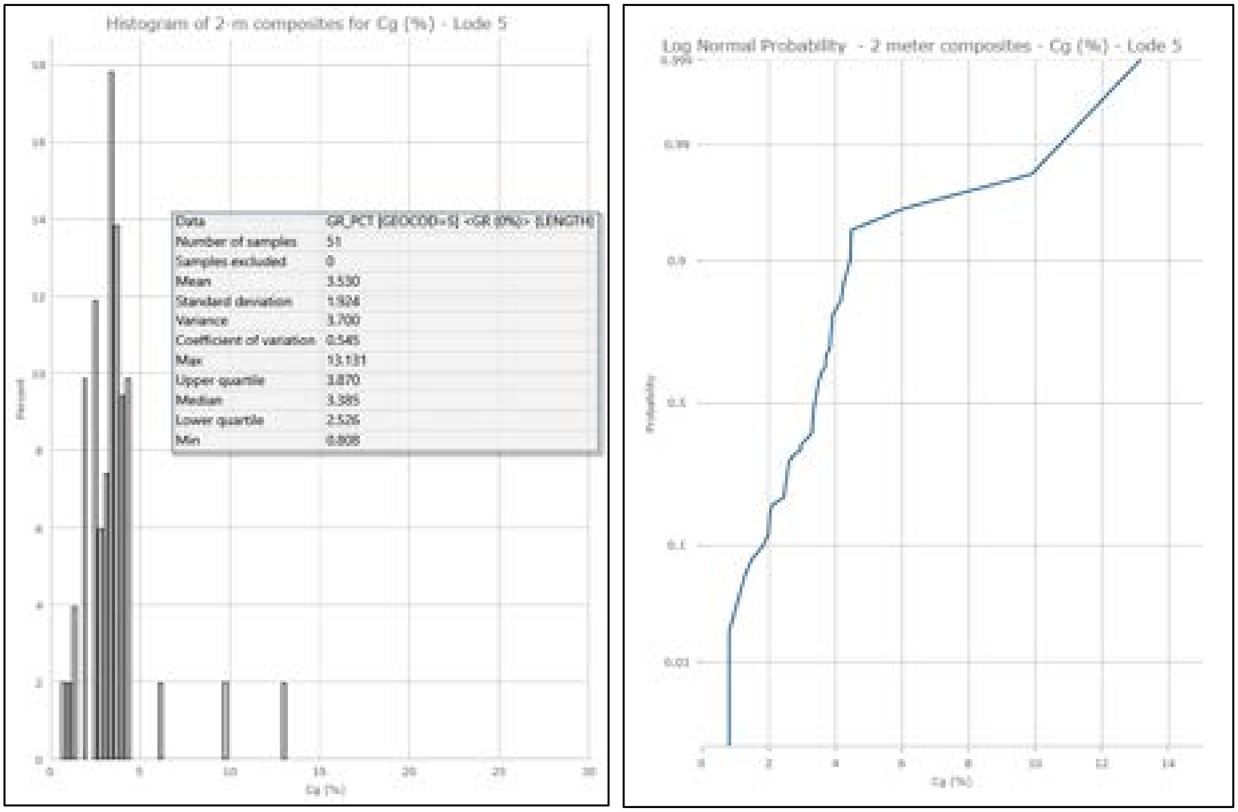
Source: AES (2022)

Figure 14-17: Histogram and Probability Plot of 2 m Composites for Lode 4



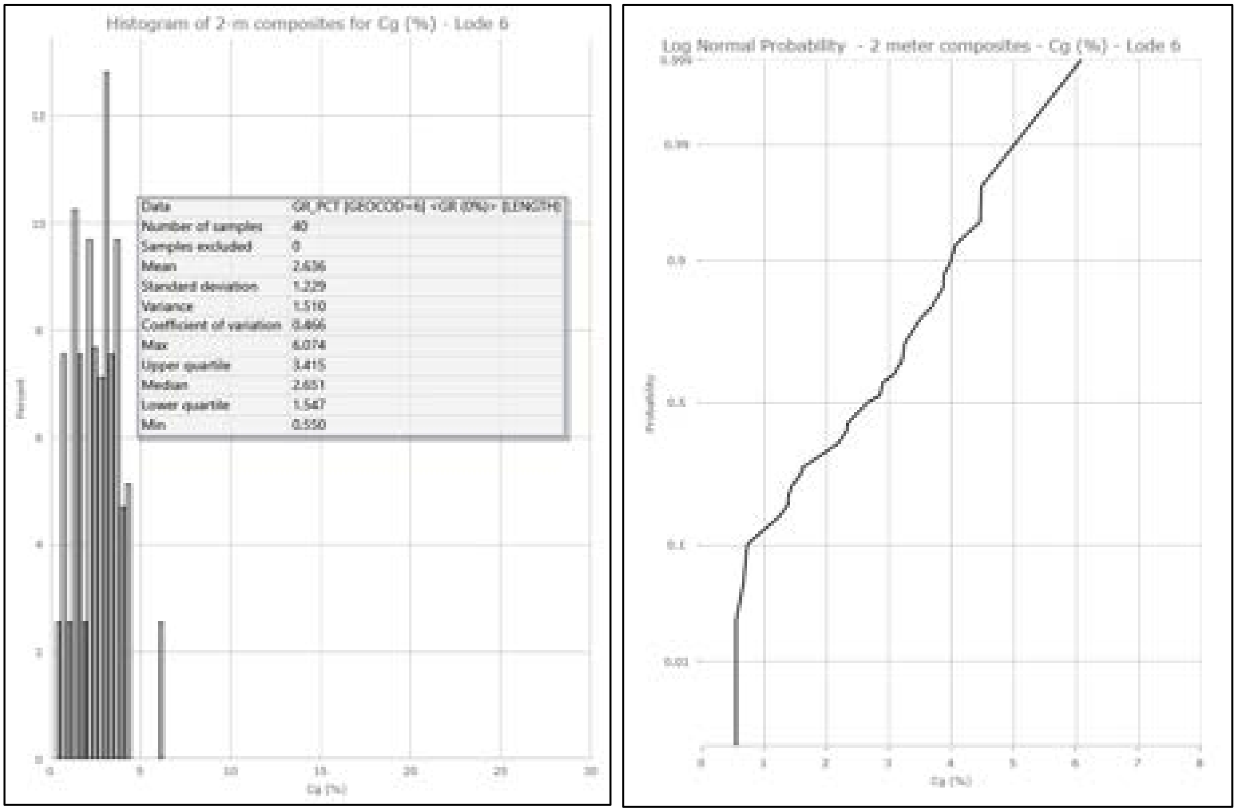
Source: AES (2022)

Figure 14-18: Histogram and Probability Plot of 2 m Composites for Lode 5



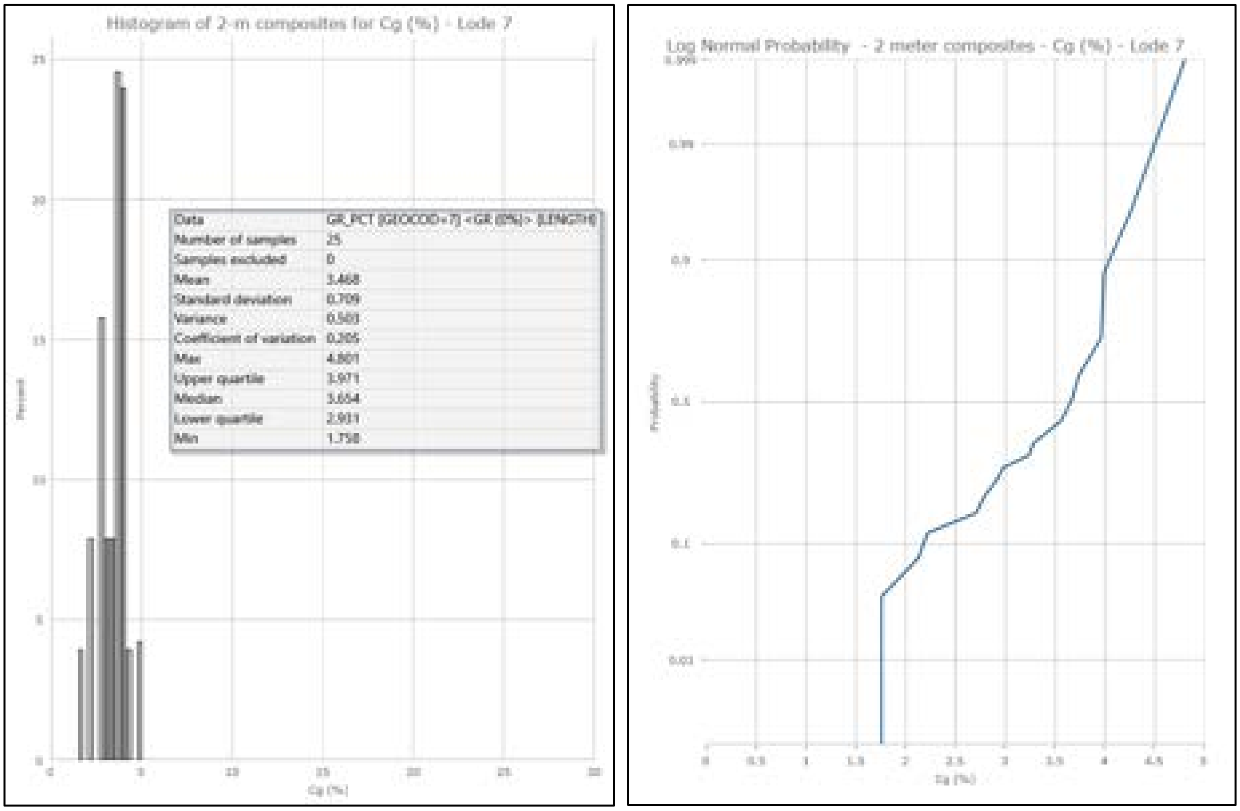
Source: AES (2022)

Figure 14-19: Histogram and Probability Plot of 2 m Composites for Lode 6



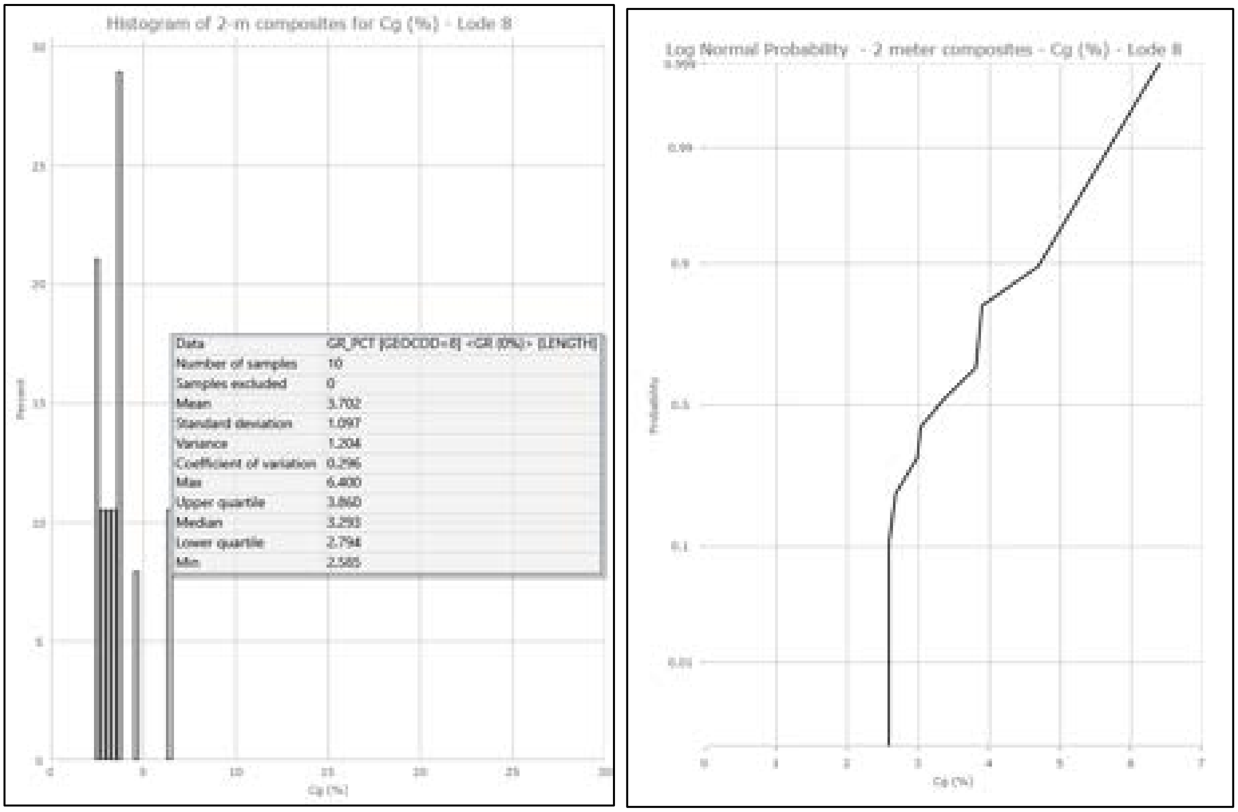
Source: AES (2022)

Figure 14-20: Histogram and Probability Plot of 2 m Composites for Lode 7



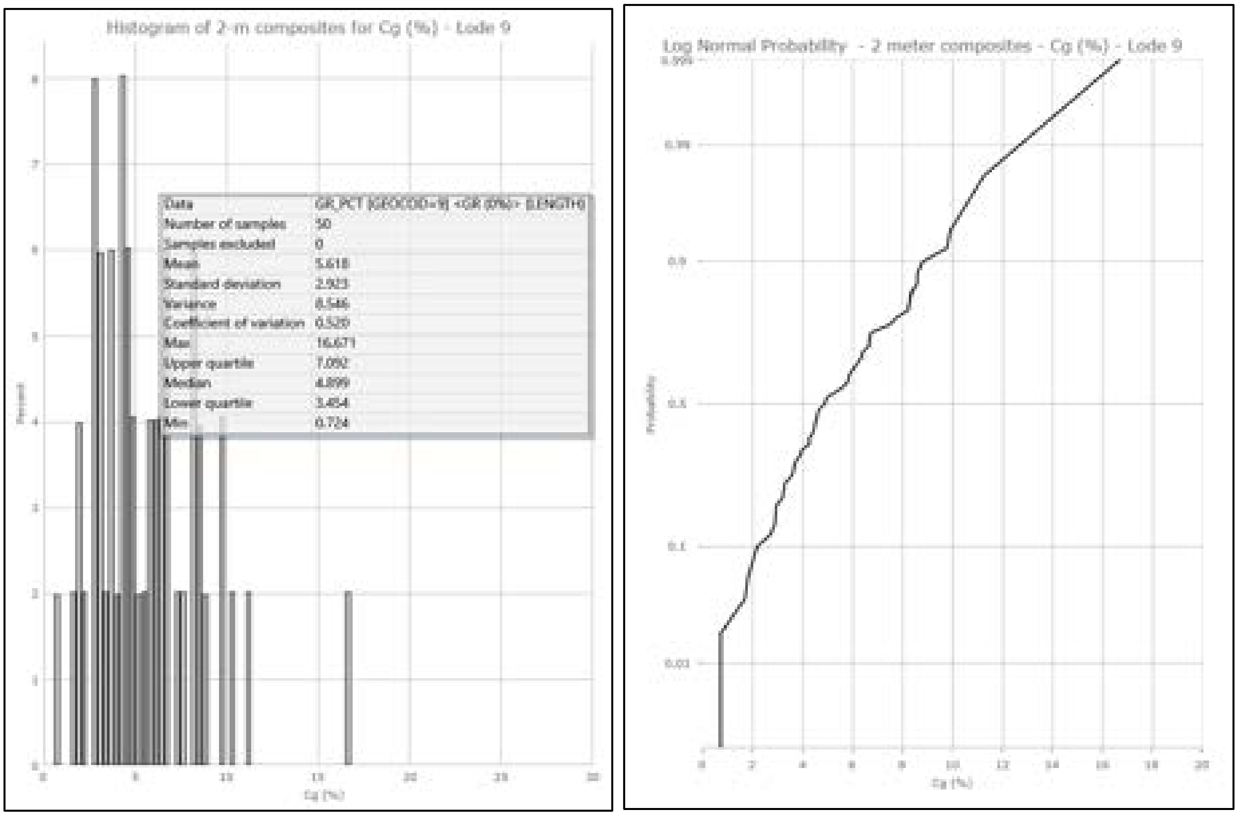
Source: AES (2022)

Figure 14-21: Histogram and Probability Plot of 2 m Composites for Lode 8



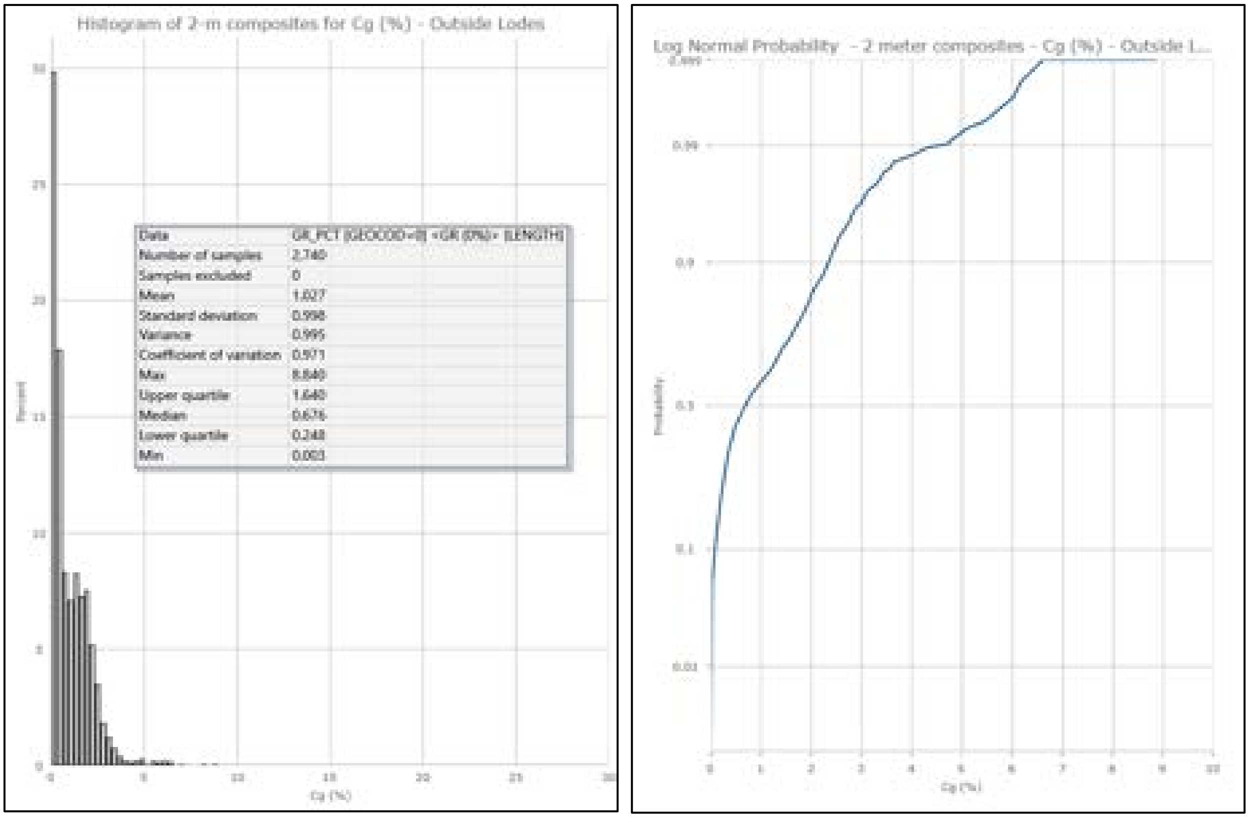
Source: AES (2022)

Figure 14-22: Histogram and Probability Plot of 2 m Composites for Lode 9



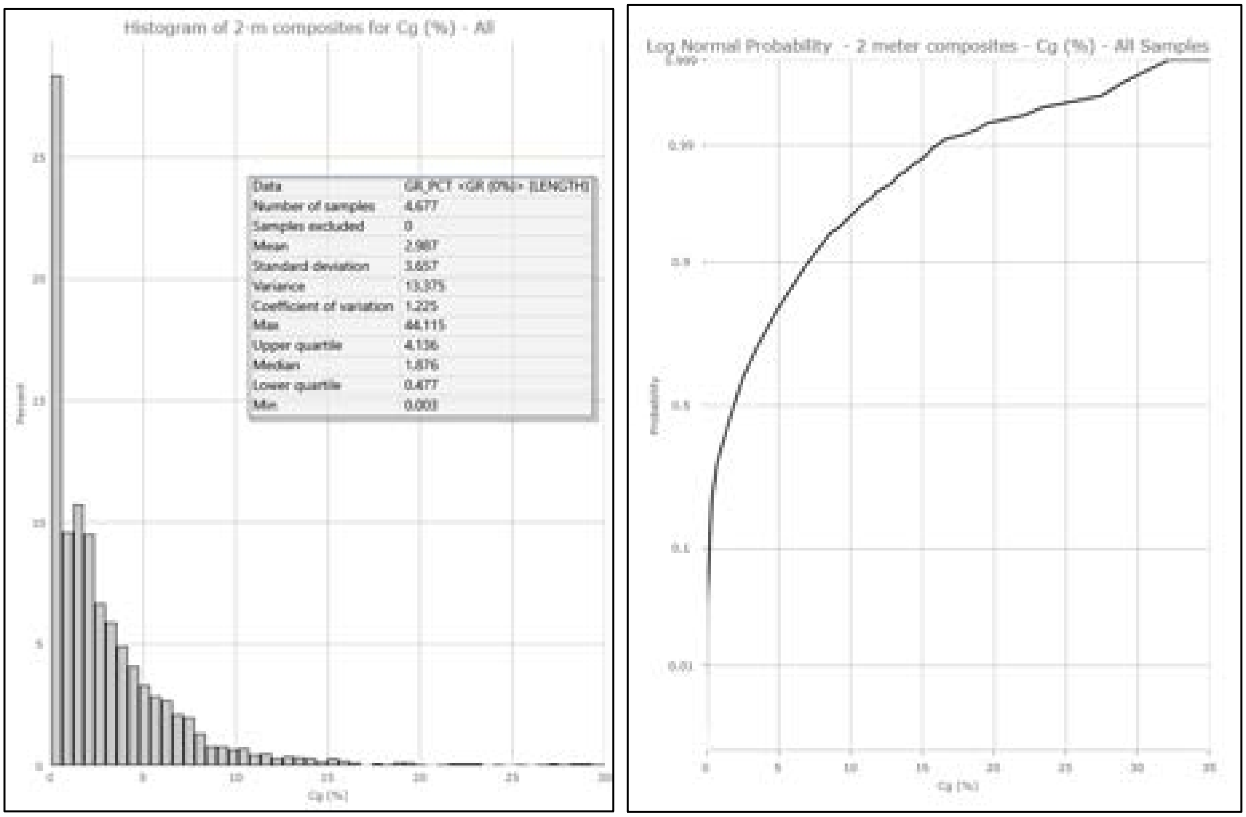
Source: AES (2022)

Figure 14-23: Histogram and Probability Plot of 2 m Composites for Outside Lodes



Source: AES (2022)

Figure 14-24: Histogram and Probability Plot of 2 m All Composites



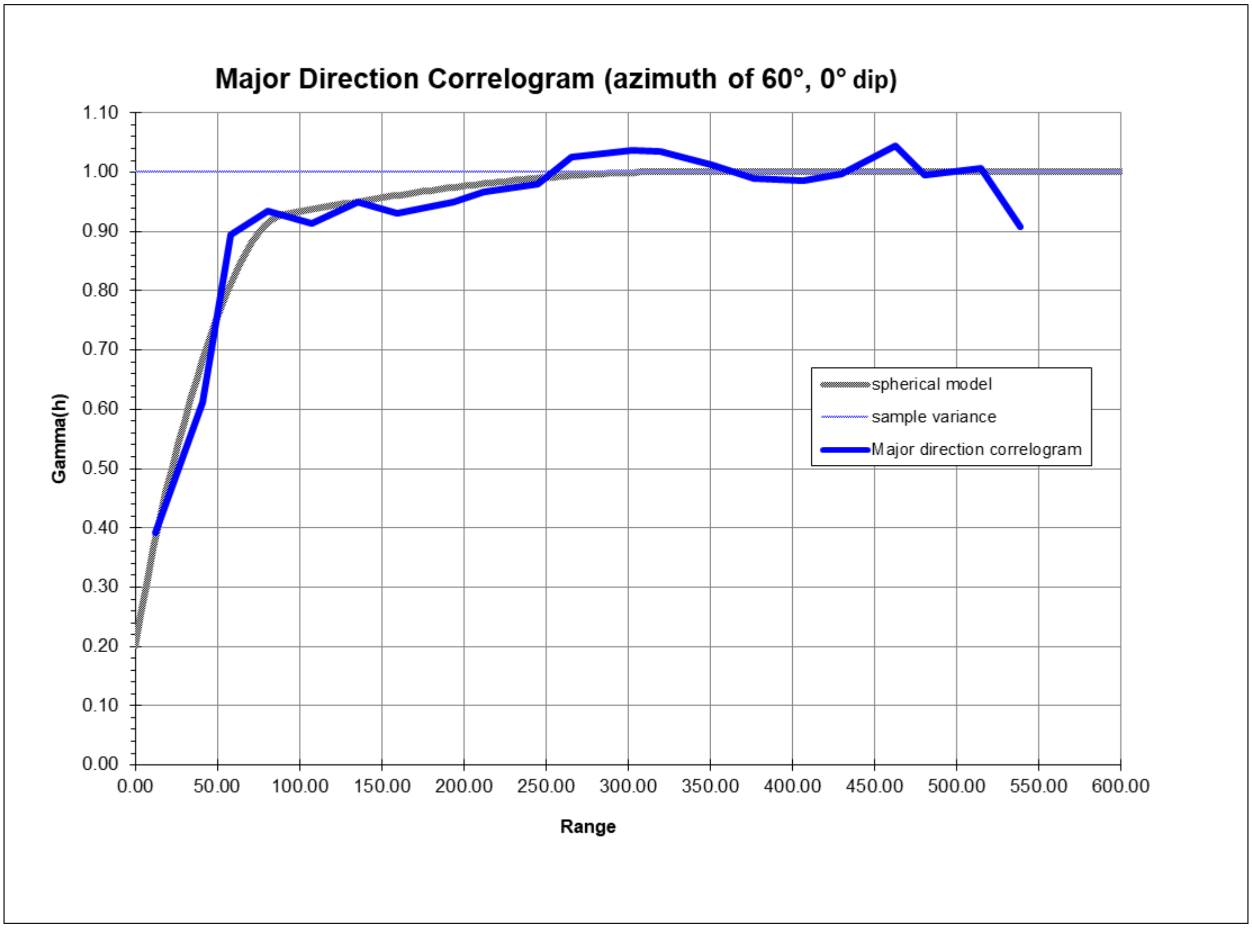
Source: AES (2022)

14.6 Grade Continuity/Variography

Variography on the composited data was used to produce spherical correlograms. As all nine lodes have similar orientations and grade characteristics, it was deemed appropriate to treat them all as one domain. The variograms were created along a 060° strike orientation, similar to the previous variography and similar to the strike of graphite mineralization. Orthogonal variograms were created to determine appropriate ranges for estimation along the major, semi-major, and minor directions.

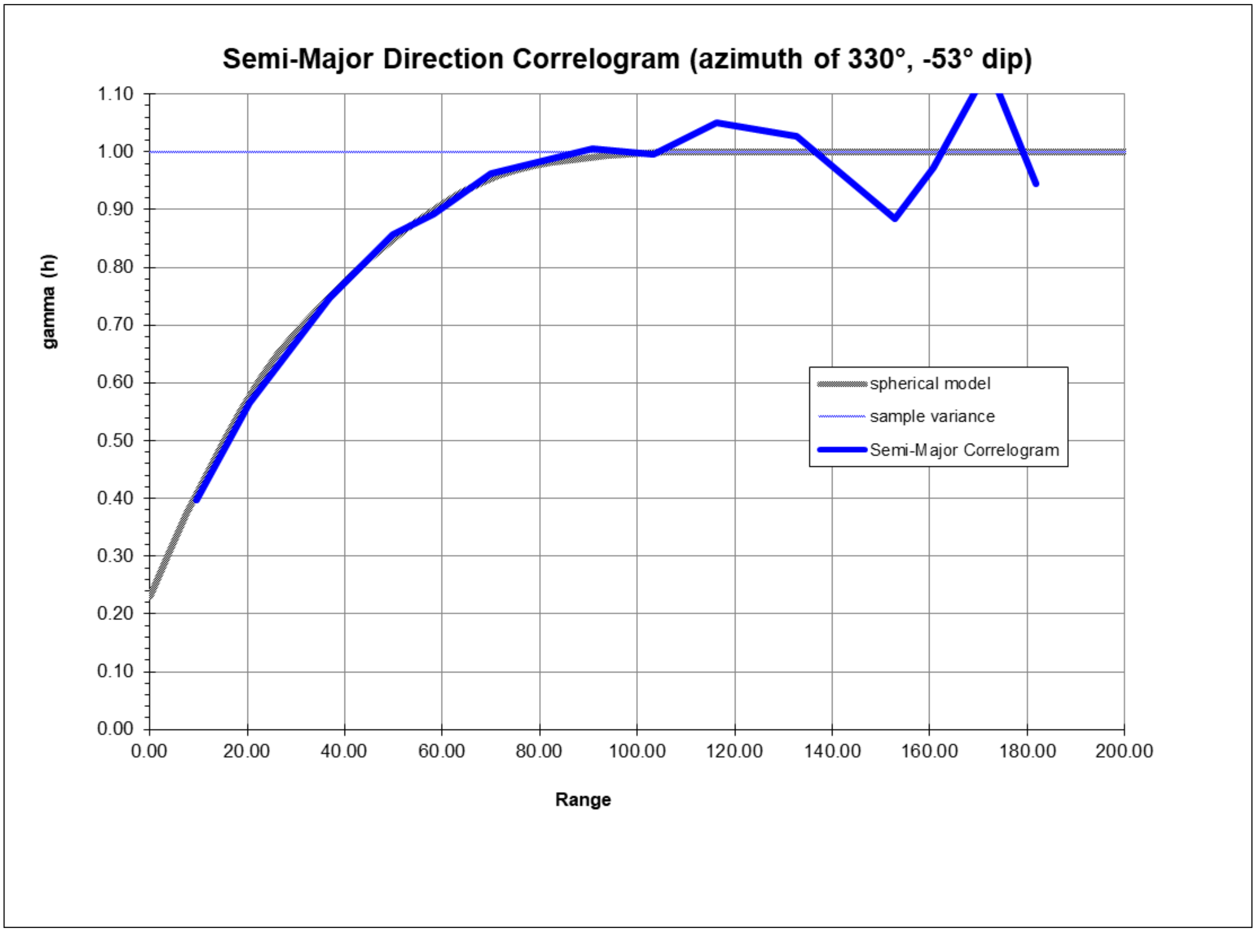
The maximum range of the variogram in the major axis direction was approximately 300 m, and approximately 100 m in the semi-major direction, which is comparable to previous estimations.

Figure 14-25: Major Direction Correlogram



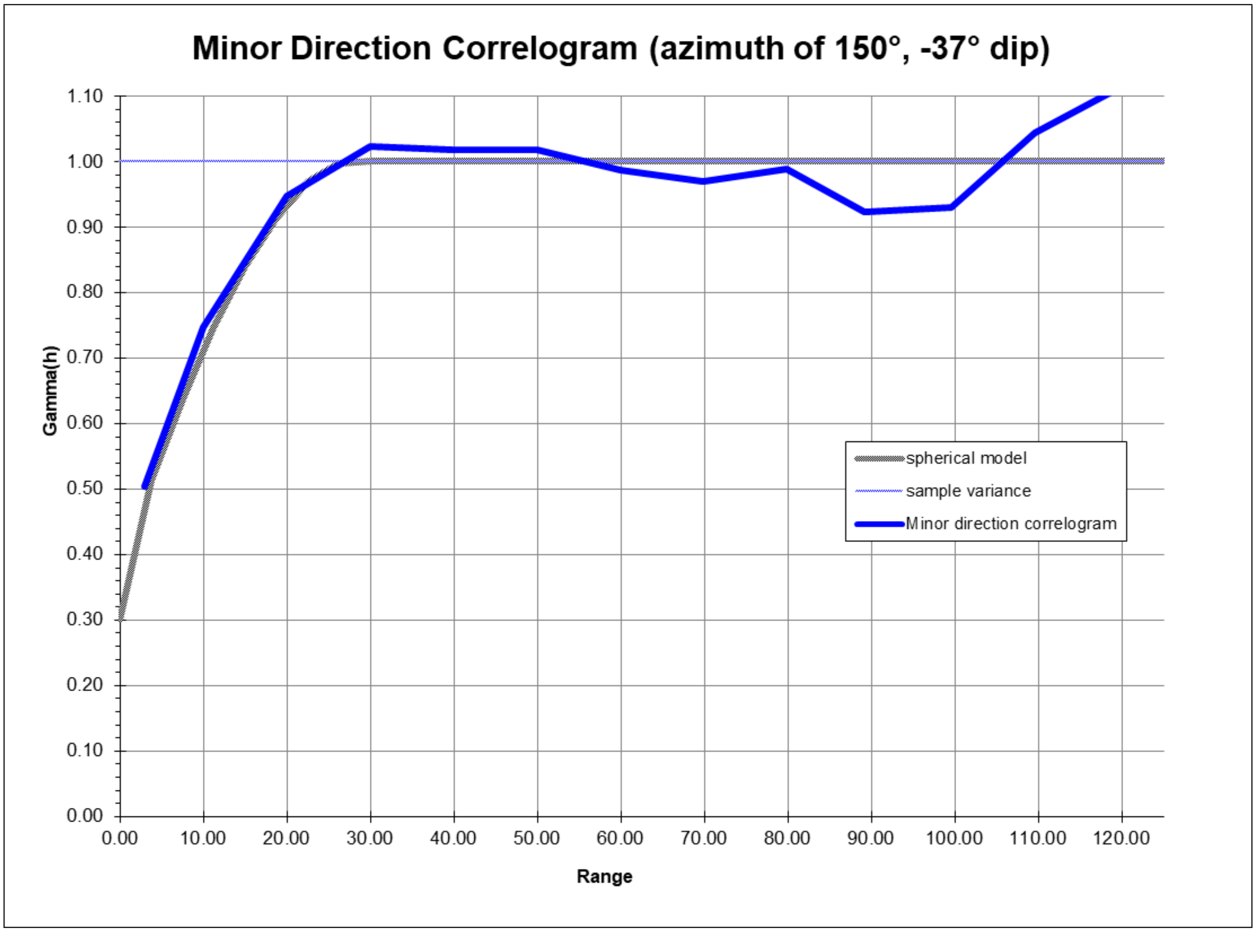
Source: AES (2022)

Figure 14-26: Semi-Major Direction Correlogram



Source: AES (2022)

Figure 14-27: Minor Direction Correlogram



Source: AES (2022)

14.7 Block Model Extents and Block Size

A parent block size of 2 m (X) x 2 m (Y) x 2 m (Z) was chosen for the resource estimate. This was chosen to provide more detail of mineralized lodes and represent equipment size in future mining scenarios. The block model was rotated to an absolute bearing of 067 to be parallel to the strike of graphite mineralization. The block model extents were extended past mineralized wireframes to encompass potential for grade.

Table 14-4 presents the coordinate ranges and block size dimensions that were used to build the 3D block models from the mineralization wireframes. A comparison of wireframe volume versus block model volume was performed to ensure there was no overstating of tonnages. Each block was coded with the lode number to ensure the mineralized lodes were treated as hard boundaries.

Table 14-4: Block Model Extents and Offset (Offset are Distance from Origin)

	Easting	Northing	Elevation
Minimum	472,160	7,211,350	-170
Offset	5,100	850	620
Cell Size	2	2	2
Rotation (Absolute Bearing)	067	067	067

Source: AES (2022)

14.8 Validation of Grade Estimates

14.8.1 Estimation Methods

The resource estimation of graphite (% Cg) was calculated using inverse-distance weighted squared (IDW2) for each of the nine lodes. A block discretization of 4 x 4 x 4 was applied to all blocks during estimation. Each lode was estimated as a hard boundary which means that only composites located within that lode were used to estimate the grade of the blocks within that lode. Blocks not within a mineralized lode were estimated with graphite in a similar manner. After estimation, blocks above the topography surface, above the overburden surface, and north of the Kigluaik Fault were assigned a graphite value of 0.

14.8.2 Sample Selection

A multi-pass approach was used in grade estimation with variable sample selection criteria depending on the estimation pass (Table 14-5). Identical selection criteria were used for each mineralized lode. Prior to estimation of each individual lode, a single block search for all blocks was completed to allow any block pierced by a drill hole to be estimated. For each of the nine mineralized lodes, a total of seven passes were completed. Passes 1,2,3, and 5 required at least 2 drill holes. Passes 4 and 6 are considered 'donut hole' passes and require only one drill hole at smaller distances in to fill in blocks that may have been missed in previous passes. Pass 7 was a final estimation requiring only one drill hole and closely followed the previous estimations final pass to fill in all remaining blocks within mineralized lodes. Blocks outside of mineralized lodes were estimated using only passes 1-6 as pass 7 was considered too wide without a wireframe constraint.

Table 14-5: Summary Table of Estimation Criteria for Graphite Estimation

Pass	Note	Approximate Factor of Max. Sill Variance Range	Minimum # of Samples	Maximum # of Samples	Max. # per Drill Hole	Ellipse Range			Corresponding Category
						Major	Semi-Major	Minor	
BOX	Box search	N/A	1	99	1	1	1	1	Measured
1		50%	2	5	1	45	22	8	Measured
2		85%	2	5	1	100	50	8	Indicated
3		95%	2	5	1	160	65	8	Inferred
4	"donut hole"		1	5	1	80	32	8	Inferred
5		100%	2	5	1	250	100	8	Inferred
6	"donut hole"		1	5	1	125	50	8	Inferred
7	fill remaining blocks	300%	1	5	1	1500	500	8	Inferred

Source: AES (2022)

14.8.3 Search Ellipsoid

The directions of the search ellipse were defined in previous estimations and the same directions were used in the current estimation (Table 14-6).

Table 14-6: Search Ellipsoid Orientation for the Graphite Estimation

Lode	Search Ellipsoid	Strike (°)	Dip (°)	Plunge (°)
Lode 01	Lode 01 E	60	53	0
	Lode 01 W	68	39	0
Lode 02	Lode 02 E	61	53	0
	Lode 02 W	70	44	0
Lode 03	Lode 03 E	61	57	0
	Lode 03 W	71	51	0
Lode 04	Lode 04 E	58	61	0
	Lode 04 W	67	55	0
Lode 05	Lode 05 E	60	62	0
	Lode 05 W	72	55	0
Lode 06	Lode 06	61	61	0

Lode	Search Ellipsoid	Strike (°)	Dip (°)	Plunge (°)
Lode 07	Lode 07	64	51	0
Lode 08	Lode 08	66	55	0
Lode 09	Lode 09	59	51	0
Outside	Outside	59	51	0

Source: AES (2022)

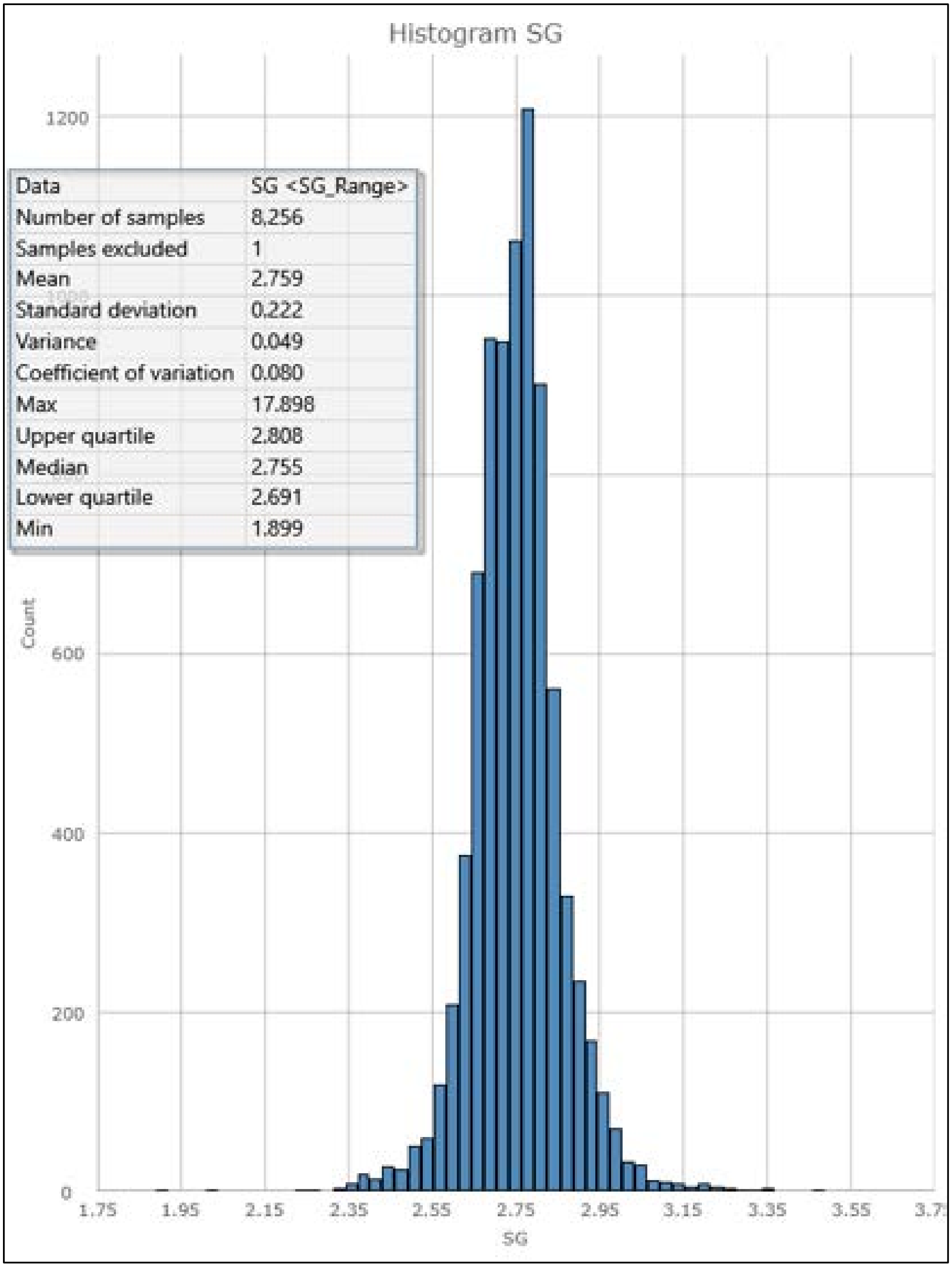
The multi-pass approach used increasing sizes of search ellipsoids based on the variogram ranges in each direction (see Section 14.6). The ranges and passes were also used in defining the classification of resources (see Section 14.11). After the initial box search, the search ellipsoid ranges were approximated to be equal to variable factors of the maximum sill variance range. Pass 1, 2, 3, 5, and 7 used approximately 50%, 85%, 95%, 100%, and 300% of the maximum sill variance range, respectively. Passes 4 and 6, with their less selective sample searches, used ranges equal to half of passes 5 and 7, respectively.

After reviewing the ranges and comparing to previous estimate, adjustments were made to the ranges to provide continuity with previous estimates. The ranges in the major direction of passes 1,2, and 3 were increased from 30, 65, and 130 m to 45, 100, and 160 m, respectively. The major direction is along strike of the graphite mineralization and its continuity is observed in the field and thus the increase in range is considered acceptable.

14.9 Bulk Density (Specific Gravity)

A total of 8,256 bulk density measurements were collected from the 2012, 2013, 2014, 2018, 2019, 2021 drill core within the resource area. These were collected at regular intervals, averaging 1.0 m, down each of the 56 drill holes (excluding the three metallurgical and geotechnical drill holes). The density measurements were calculated on site by Activation Laboratories Ltd. staff in 2012-2014 and by Graphite One staff in 2018 - 2021 using the weight in air/weight in water methodology. Of the 8,256 bulk density samples collected only 3,454 bulk density samples were situated within the mineralized wireframes. A histogram and summary statistics of the density samples is shown in Figure 14-28 and Table 14-7.

Figure 14-28: Histogram of Bulk Density (Specific Gravity) Data



Source: AES (2022)

Table 14-7: General Statistics of Bulk Density Data

	Outside Lodes	Lode 1	Lode 2	Lode 3	Lode 4	Lode 5	Lode 6	Lode 7	Lode 8	Lode 9
Count	4766	1442	1078	412	184	87	82	45	20	104
Mean	2.77	2.74	2.75	2.74	2.72	2.71	2.71	2.66	2.86	2.70
Standard deviation	0.26	0.17	0.11	0.10	0.09	0.10	0.07	0.07	0.60	0.09
Maximum	17.90	6.58	3.22	3.19	3.07	3.05	2.91	2.91	5.44	2.91
Upper quartile	2.81	2.81	2.81	2.79	2.77	2.75	2.74	2.69	2.79	2.76
Median	2.77	2.74	2.75	2.72	2.71	2.68	2.70	2.67	2.70	2.71
Lower quartile	2.71	2.68	2.69	2.68	2.66	2.66	2.67	2.62	2.67	2.65
Minimum	1.90	2.36	2.33	2.40	2.34	2.25	2.58	2.52	2.63	2.45
Coeff. Of Variation	0.07	0.03	0.01	0.01	0.01	0.01	0.00	0.01	0.36	0.01
Variance	0.10	0.06	0.04	0.04	0.03	0.04	0.03	0.03	0.21	0.04
Percentile 10	2.66	2.60	2.63	2.64	2.64	2.64	2.62	2.57	2.64	2.55
Percentile 20	2.69	2.66	2.67	2.66	2.65	2.65	2.66	2.60	2.66	2.62
Percentile 90	2.88	2.88	2.87	2.87	2.84	2.80	2.80	2.74	2.83	2.81
Percentile 99	3.05	3.05	3.03	3.01	2.98	2.97	2.89	2.86	4.93	2.86

Source: AES (2022)

The 2012 Maiden Inferred Resource estimate of the Graphite Creek Property used a conservative density value of 2.7 kg/m^3 (Duplessis et al., 2013). In 2013, the Expanded Graphite Creek Inferred resource estimate for Graphite Creek estimated the density value for each block using the density dataset collected (Eccles and Nicholls, 2014). The high level of detailed density collection (i.e., one density measurement per every metre and in every drill hole) has been maintained during 2014 and 2018-2021 drill seasons, and accordingly, it was decided to estimate the value of density for each individual block within the block model (as was done for graphite assay data).

The estimation technique used to calculate the density value for each block was inverse-distance squared. The density was calculated using the mineralized lodes as hard boundaries, where all blocks within the lodes were estimated as one unit and all blocks outside the lodes estimated as another unit. For future use in mine planning, it was thought this would provide accurate density measurement for areas outside of mineralization.

A separate set of 2 m composites was created for the bulk density measurements using an identical method as for the graphite composites. During estimation, only composites between 1.5 and 3.2 were selected as this was considered a valid range, effectively providing a top cut of 3.2 and removing 9 composites from estimation. Search ellipsoids were oriented along the average orientation of mineralization with a bearing of 064° and dip of 54° to the NW. A multi-pass approach was used to estimate the bulk density with identical sample selection criteria and search ellipsoid ranges as the graphite estimation. Blocks above topography were assigned a density value of 0. Blocks above the overburden surface and north of the Kigluaik Fault were assigned a density value of 2.6 as were any remaining blocks without an estimation.

A comparison of estimated density to 2 m composite density can be seen in Table 14-8. In the primary lodes (Lodes 1-3), the difference is less than 1%, and the maximum difference is Lodes 1-6 and Lode 9 is 1.12%. Lode 8 has a 4.78 difference but consists of only 19 samples and is a more conservative lower value in the blocks compared to composites. Thus, the effect for overestimation of density in the mineralized lodes is considered minimal.

Table 14-8: Comparison of Mean Specific Gravity Values Between Raw Samples, 2-m Composites and Estimated Blocks by Lode

	Lode 1	Lode 2	Lode 3	Lode 4	Lode 5	Lode 6	Lode 7	Lode 8	Lode 9	Outside Lodes
Raw	2.74	2.75	2.74	2.72	2.71	2.71	2.66	2.86	2.70	2.77
2 m Composites	2.75	2.75	2.74	2.72	2.70	2.71	2.66	2.91	2.70	2.78
Blocks - ALL	2.74	2.75	2.74	2.73	2.72	2.71	2.71	2.73	2.70	2.76
Blocks - M+I	2.74	2.75	2.73	2.74	2.72	2.68	2.65	2.74	2.70	2.76
% Diff ALL vs 2 m	-0.29%	0.00%	0.22%	0.29%	0.70%	0.07%	1.84%	-6.06%	-0.22%	-0.50%
% Diff M+I vs 2 m	-0.44%	-0.15%	-0.18%	0.51%	0.63%	-0.81%	-0.11%	-5.61%	0.07%	-0.54%

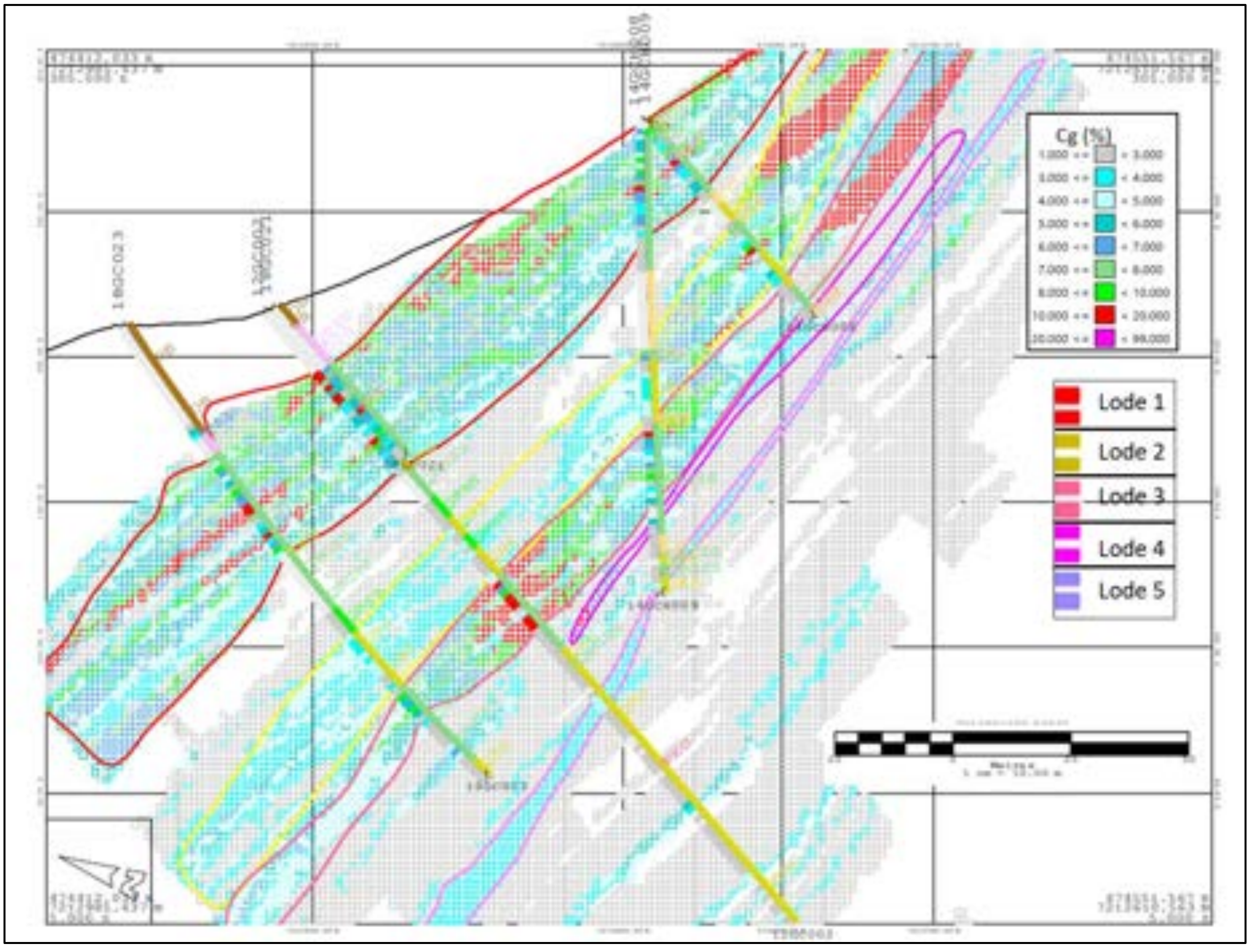
Source: AES (2022)

14.10 Block Model

14.10.1 Visual Validation

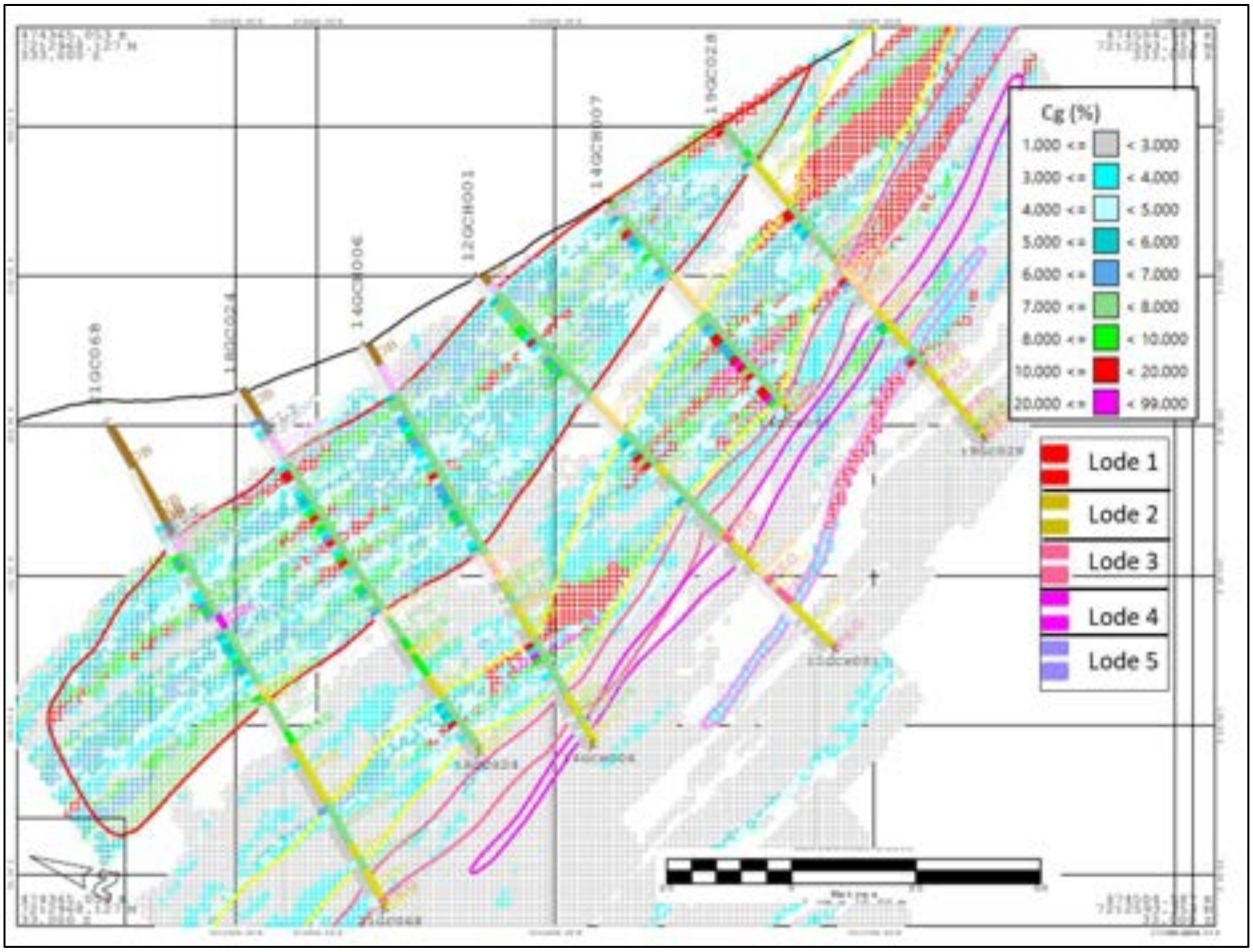
The blocks were visually validated on cross sections and plan view comparing block grades versus the composite sample grades for all sections and drill holes (Figure 14-29 through Figure 14-31). The estimated graphite showed good correlation to the composite values. Reasonable variation and orientation of the grade was also observed.

Figure 14-29: Section 4350E Showing Block Model Cg (%) Grades within Mineralized Lodes



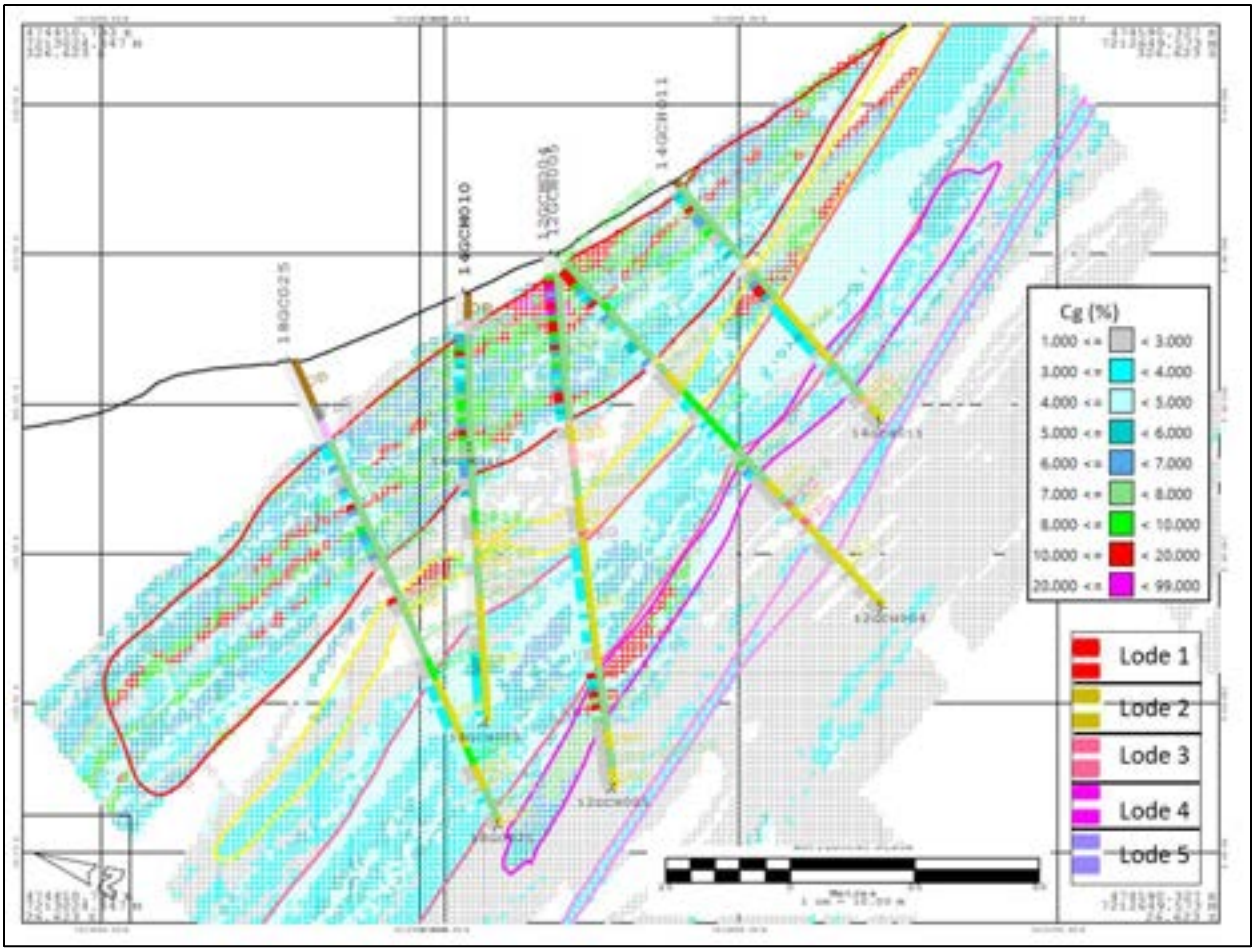
Source: AES (2022)

Figure 14-30: Section 4400E Showing Block Model Cg (%) Grades within Mineralized Lodes



Source: AES (2022)

Figure 14-31: Section 4500E Showing Block Model Cg (%) Grades within Mineralized Lodes



Source: AES (2022)

14.10.2 Statistical Validation

A statistical comparison of the raw data, 2 m composite data, and the resulting block data for each mineralized lode is provided in Table 14-9. The block data is also broken down into the Measured and Indicated category (see Section 14.11). The comparison shows good statistical comparison between the estimated blocks and the 2 m composite within the closer spaced areas of the resource (i.e., the Measured and Indicated resource). The comparison of all estimated blocks, including the wider spaced areas with less data show more variation in the average grade including instance of higher average grade in specific lodes. This would be expected and can be attributed to the lack of data to further define the estimation and is not considered unreasonable. Similar statistical comparisons of the density (specific gravity) estimation are provided in Table 14-10.

Table 14-9: Representative Statistics of Sample Data, 2 m Composites and Estimated Cg (%) By Mineralized Lode

	Lode 1	Lode 2	Lode 3	Lode 4	Lode 5	Lode 6	Lode 7	Lode 8	Lode 9	Outside
2 m Length-Weighted Composite Statistics by Lode - Cg (%)										
Count	849	574	245	93	51	40	25	10	50	2740
Mean	6.59	5.84	4.71	3.91	3.53	2.64	3.47	3.70	5.62	1.03
Standard deviation	4.41	4.35	3.80	2.77	1.92	1.23	0.71	1.10	2.92	1.00
Maximum	44.12	34.92	37.97	15.05	13.13	6.07	4.80	6.40	16.67	8.84
Upper quartile	7.63	7.01	4.80	4.53	3.87	3.42	3.97	3.86	7.09	1.64
Median	5.71	4.63	3.88	3.18	3.38	2.65	3.65	3.29	4.90	0.68
Lower quartile	4.05	3.24	2.85	2.43	2.53	1.55	2.93	2.79	3.45	0.25
Minimum	0.03	0.20	0.24	0.16	0.81	0.55	1.76	2.59	0.72	0.00
Coeff. Of Variation	4.41	4.35	3.81	2.79	1.94	1.24	0.72	1.16	2.95	1.00
Variance	19.48	18.96	14.49	7.77	3.77	1.55	0.52	1.34	8.72	1.00
Percentile 10	2.85	2.01	2.00	1.38	1.83	0.72	2.18	2.59	2.19	0.08
Percentile 20	3.63	2.94	2.59	1.94	2.45	1.39	2.80	2.67	3.20	0.19
Percentile 90	11.27	10.68	8.25	7.62	4.43	3.98	4.05	4.78	8.80	2.33
Percentile 99	27.42	22.57	18.33	13.57	11.48	5.45	4.67	6.24	13.96	4.54
Raw (Uncomposited) Statistics by Lode - Cg (%)										
Count	1798	1236	517	209	108	83	45	20	104	5782
Mean	6.63	5.86	4.85	4.03	3.45	2.57	3.41	3.61	5.80	1.11
Standard deviation	6.29	6.60	5.60	4.33	2.31	1.46	0.85	1.22	4.57	1.60
Maximum	59.10	50.00	50.10	40.90	20.10	8.76	4.83	6.89	27.80	43.60
Upper quartile	7.74	6.36	4.72	4.03	4.01	3.69	4.17	4.20	7.82	1.69
Median	5.03	3.99	3.63	3.19	3.31	2.72	3.54	3.46	4.27	0.60
Lower quartile	3.12	2.52	2.39	1.99	2.42	1.25	2.97	2.94	2.91	0.19
Minimum	0.03	0.03	0.14	0.03	0.53	0.27	1.56	1.80	0.03	0.03
Coeff. Of Variation	6.29	6.61	5.60	4.34	2.32	1.47	0.86	1.25	4.59	1.60
Variance	39.61	43.65	31.38	18.81	5.37	2.15	0.73	1.57	21.05	2.58
Percentile 10	2.06	1.44	1.46	1.04	1.40	0.67	1.97	1.91	1.53	0.03
Percentile 20	2.79	2.23	2.02	1.62	2.07	1.00	2.76	2.55	2.54	0.12
Percentile 90	12.20	11.04	8.26	7.83	4.58	4.08	4.26	4.86	11.92	2.62
Percentile 99	33.73	37.32	34.74	21.38	13.18	5.54	4.81	6.69	18.48	6.56

Source: AES (2022)

Table 14-10: Representative Statistics of Sample Data Measured and Indicated Estimated Block Statistics by Lode - Cg (%)

	Lode 1	Lode 2	Lode 3	Lode 4	Lode 5	Lode 6	Lode 7	Lode 8	Lode 9	Outside
Measured and Indicated Estimated Block Statistics by Lode - Cg (%)										
Count	547743	296049	135043	17721	5490	243	23	7	49	1374935
Mean	6.51	5.83	4.68	3.43	3.01	3.75	3.37	3.85	5.65	1.94
Standard deviation	3.09	3.21	2.36	2.11	0.59	0.72	0.64	1.21	2.95	1.83
Maximum	44.12	34.92	37.97	15.05	13.13	6.07	4.11	6.40	16.67	26.25
Upper quartile	7.60	6.80	5.25	4.55	3.39	4.24	3.96	4.69	7.11	2.54
Median	5.93	5.06	4.13	3.08	3.08	3.78	3.62	3.38	5.21	1.55
Lower quartile	4.63	3.81	3.22	2.08	2.57	3.52	2.91	2.98	3.64	0.72
Minimum	0.00	0.20	0.24	0.16	0.70	0.55	2.00	2.68	0.72	0.00
Coeff. Of Variation	3.09	3.21	2.36	2.11	0.59	0.73	0.65	1.30	2.98	1.83
Variance	9.52	10.31	5.58	4.46	0.34	0.53	0.42	1.70	8.87	3.35
Percentile 10	3.61	2.94	2.66	0.85	2.21	3.21	2.15	2.68	2.00	0.23
Percentile 20	4.32	3.58	3.00	1.70	2.45	3.49	2.76	2.80	3.24	0.54
Percentile 90	9.92	9.65	7.68	5.79	3.73	4.25	3.98	5.20	8.58	4.02
Percentile 99	18.60	17.69	13.91	10.61	4.03	4.37	4.08	6.28	14.01	8.71
ALL Estimated Block Statistics by Lode - Cg (%)										
Count	2360770	4134847	977058	620486	327064	763413	306079	228467	651595	173883151
Mean	6.20	5.66	6.02	4.23	3.27	2.92	3.25	1.92	5.28	0.11
Standard deviation	2.98	3.36	5.24	1.82	1.38	1.01	1.00	1.95	2.67	0.64
Maximum	44.12	34.92	37.97	15.05	13.13	6.07	4.80	6.40	16.67	37.97
Upper quartile	6.99	7.12	6.89	5.30	3.77	3.52	3.70	3.81	7.03	0.00
Median	5.79	5.35	4.49	3.81	3.33	3.19	3.51	2.59	4.93	0.00
Lower quartile	4.58	3.79	3.39	3.02	2.86	2.47	3.26	0.00	3.58	0.00
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coeff. Of Variation	2.98	3.36	5.24	1.82	1.38	1.01	1.00	1.95	2.67	0.64
Variance	8.88	11.31	27.46	3.31	1.89	1.01	1.00	3.82	7.11	0.40
Percentile 10	3.66	1.94	2.61	2.31	2.28	1.37	2.15	0.00	2.18	0.00
Percentile 20	4.31	3.26	3.14	2.85	2.59	2.23	3.10	0.00	3.20	0.00
Percentile 90	9.12	9.25	10.24	6.84	4.03	4.07	3.99	4.69	8.33	0.00
Percentile 99	18.67	17.29	33.81	10.12	9.86	4.47	4.80	6.40	12.86	2.94

Source: AES (2022)

Table 14-11: Representative Statistics of Sample Data, 2 m Length-Weighted Composite Statistics by Lode -SG

	Lode 1	Lode 2	Lode 3	Lode 4	Lode 5	Lode 6	Lode 7	Lode 8	Lode 9	Outside
2 m Length-Weighted Composite Statistics by Lode -SG										
Count	772	543	208	86	46	40	25	10	50	2489
Mean	2.75	2.75	2.74	2.72	2.70	2.71	2.66	2.91	2.70	2.78
Standard deviation	0.19	0.08	0.08	0.09	0.11	0.06	0.06	0.35	0.08	0.32
Max	6.58	3.07	3.02	2.95	3.05	2.86	2.81	3.60	2.84	17.90
Upper quartile	2.80	2.80	2.78	2.76	2.74	2.72	2.69	2.99	2.75	2.81
Median	2.74	2.75	2.73	2.71	2.69	2.69	2.67	2.77	2.71	2.77
Lower quartile	2.69	2.70	2.68	2.67	2.66	2.67	2.61	2.69	2.65	2.72
Min	2.37	2.44	2.43	2.34	2.25	2.61	2.55	2.65	2.53	2.32
Coeff. Of Variation	0.04	0.01	0.01	0.01	0.01	0.00	0.00	0.12	0.01	0.10
Variance	0.07	0.03	0.03	0.03	0.04	0.02	0.02	0.12	0.03	0.12
Percentile 10	2.62	2.66	2.66	2.65	2.65	2.64	2.57	2.65	2.60	2.68
Percentile 20	2.67	2.69	2.68	2.67	2.66	2.67	2.60	2.69	2.63	2.71
Percentile 90	2.85	2.84	2.84	2.82	2.80	2.77	2.72	3.59	2.79	2.86
Percentile 99	2.99	2.94	2.95	2.91	2.96	2.86	2.79	3.60	2.83	2.99
Raw (Uncomposited) Statistics by Lode - SG										
Count	1442	1078	412	184	87	82	45	20	104	4766
Mean	2.74	2.75	2.74	2.72	2.71	2.71	2.66	2.86	2.70	2.77
Standard deviation	0.17	0.11	0.10	0.09	0.10	0.07	0.07	0.60	0.10	0.27
Max	6.58	3.22	3.19	3.07	3.05	2.91	2.91	5.44	2.91	17.90
Upper quartile	2.81	2.81	2.79	2.77	2.75	2.74	2.69	2.79	2.76	2.81
Median	2.74	2.75	2.72	2.71	2.68	2.70	2.67	2.70	2.71	2.77
Lower quartile	2.68	2.69	2.68	2.66	2.66	2.67	2.62	2.67	2.65	2.71
Min	2.36	2.33	2.40	2.34	2.25	2.58	2.52	2.63	2.45	1.90
Coeff. Of Variation	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.36	0.01	0.07
Variance	0.06	0.04	0.04	0.03	0.04	0.03	0.03	0.21	0.04	0.10
Percentile 10	2.61	2.64	2.64	2.64	2.64	2.63	2.57	2.64	2.55	2.66
Percentile 20	2.66	2.67	2.66	2.65	2.65	2.66	2.60	2.66	2.62	2.69
Percentile 90	2.88	2.87	2.87	2.84	2.81	2.80	2.74	2.83	2.81	2.88
Percentile 99	3.05	3.03	3.01	2.98	2.97	2.90	2.86	4.93	2.86	3.05

Source: AES (2022)

Table 14-12: Representative Statistics of Ample Data, 2 m Composites and Estimated Density (Specific Gravity) by Mineralized Lode

	Lode 1	Lode 2	Lode 3	Lode 4	Lode 5	Lode 6	Lode 7	Lode 8	Lode 9	Outside
Measured and Indicated Estimated Block Statistics by Lode - SG										
Count	547743	296049	135043	17721	5490	243	23	7	49	1374935
Mean	2.737	2.75	2.73	2.74	2.72	2.68	2.65	2.74	2.70	2.76
Standard deviation	0.071	0.06	0.054	0.06	0.04	0.02	0.06	0.05	0.08	0.065
Max	3.032	3.06	3.018	2.95	3.05	2.86	2.81	2.79	2.84	3.176
Upper quartile	2.781	2.78	2.764	2.77	2.75	2.68	2.69	2.79	2.76	2.8
Median	2.74	2.74	2.72	2.74	2.72	2.68	2.66	2.76	2.72	2.76
Lower quartile	2.699	2.71	2.692	2.70	2.68	2.68	2.62	2.71	2.65	2.718
Min	2.366	2.44	2.539	2.34	2.25	2.63	2.55	2.65	2.53	2.249
Coeff. Of Variation	0.005	0.00	0.003	0.00	0.00	0.00	0.00	0.00	0.01	0.004
Variance	0.026	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.03	0.023
Percentile 10	2.658	2.68	2.672	2.65	2.67	2.68	2.57	2.65	2.57	2.682
Percentile 20	2.688	2.70	2.686	2.68	2.68	2.68	2.60	2.68	2.63	2.707
Percentile 90	2.822	2.81	2.807	2.80	2.77	2.68	2.71	2.79	2.79	2.839
Percentile 99	2.895	2.92	2.868	2.88	2.82	2.77	2.79	2.79	2.83	2.926
ALL Estimated Block Statistics by Lode - SG										
Count	2360770	4045161	977058	620486	327064	763413	306079	228467	651595	173883151
Mean	2.74	2.75	2.741	2.729	2.719	2.707	2.706	2.729	2.696	2.761
Standard deviation	0.07	0.06	0.061	0.055	0.074	0.036	0.048	0.05	0.056	0.049
Max	3.03	3.07	3.018	3.045	3.045	2.861	2.922	2.889	2.839	3.176
Upper quartile	2.79	2.78	2.772	2.76	2.75	2.721	2.731	2.757	2.729	2.775
Median	2.74	2.75	2.74	2.726	2.712	2.699	2.706	2.737	2.7	2.75
Lower quartile	2.70	2.72	2.705	2.7	2.69	2.685	2.678	2.707	2.668	2.75
Min	2.37	2.44	2.337	2.249	2.249	2.609	2.553	2.324	2.529	2.249
Coeff. Of Variation	0.01	0.02	0.004	0.003	0.005	0.001	0.002	0.003	0.003	0.002
Variance	0.03	0.00	0.022	0.02	0.027	0.013	0.018	0.018	0.021	0.018
Percentile 10	2.65	2.69	2.672	2.672	2.67	2.674	2.653	2.662	2.624	2.715
Percentile 20	2.69	2.71	2.697	2.694	2.685	2.681	2.671	2.699	2.653	2.744
Percentile 90	2.83	2.82	2.817	2.792	2.789	2.747	2.768	2.785	2.766	2.819
Percentile 99	2.91	2.92	2.905	2.873	2.883	2.834	2.826	2.827	2.823	2.936

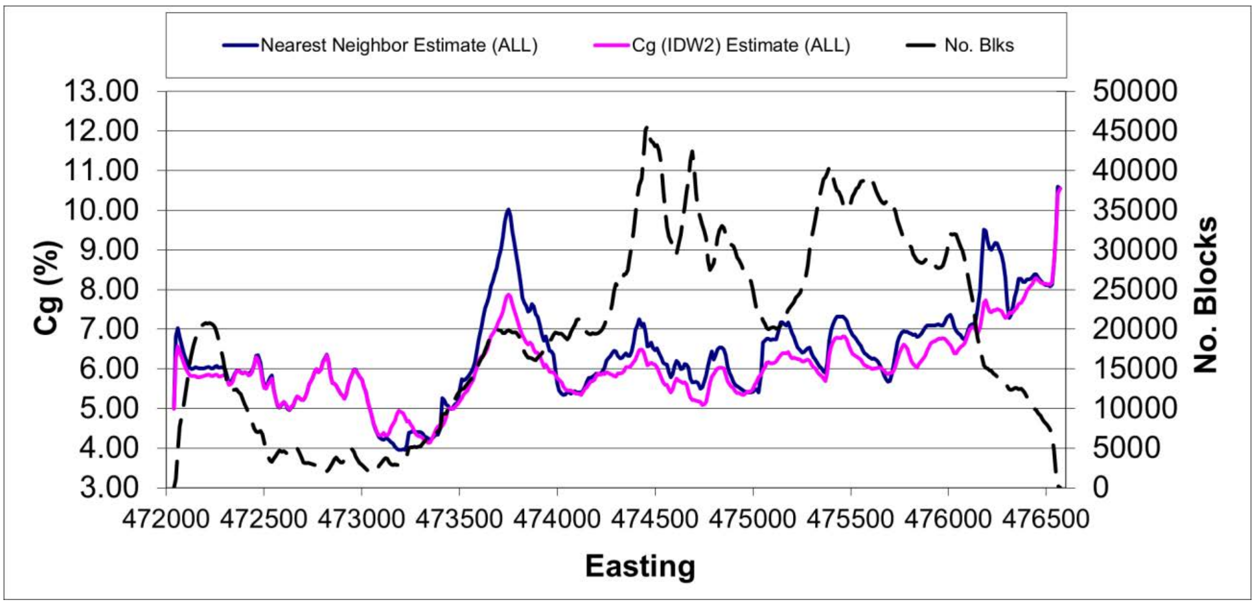
Source: AES (2022)

14.10.3 Swath Plots

During each pass in the graphite estimation process, a nearest neighbor value was calculated into the block model. Swath plots along the Easting, Northing and Elevation were created comparing the estimated graphite and the nearest neighbor value (Figure 14-32 through Figure 14-37). The swath plots were created in 10 m wide sections along each orientation and with a 3% (Cg) cut-off. The resulting swath plots showed limited over and under estimation, especially within the Measured and Indicated blocks. When comparing all estimated blocks, the variation is larger, particularly when the number of blocks is small. This is expected with the lack of data in certain areas.

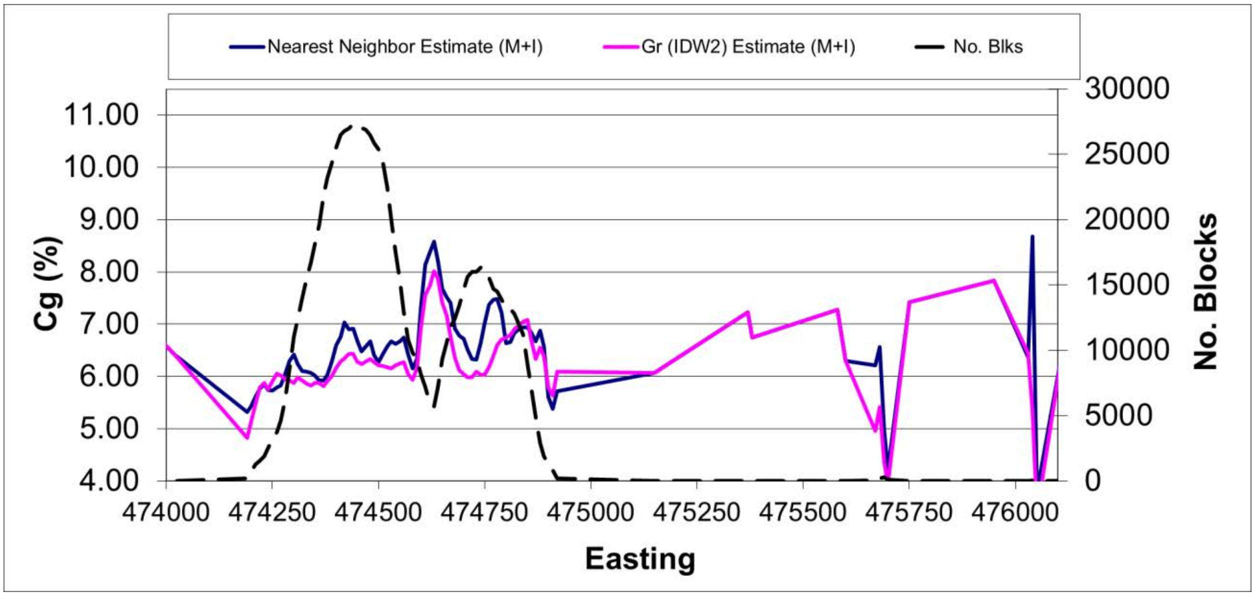
Similar swath plots were created for the density estimation with no significant issues seen.

Figure 14-32: Easting Swath Plot of nearest Neighbor Cg (%) vs. IDW2 Estimate Using 3% Cut-off and 10 m Increments with all Estimated Blocks



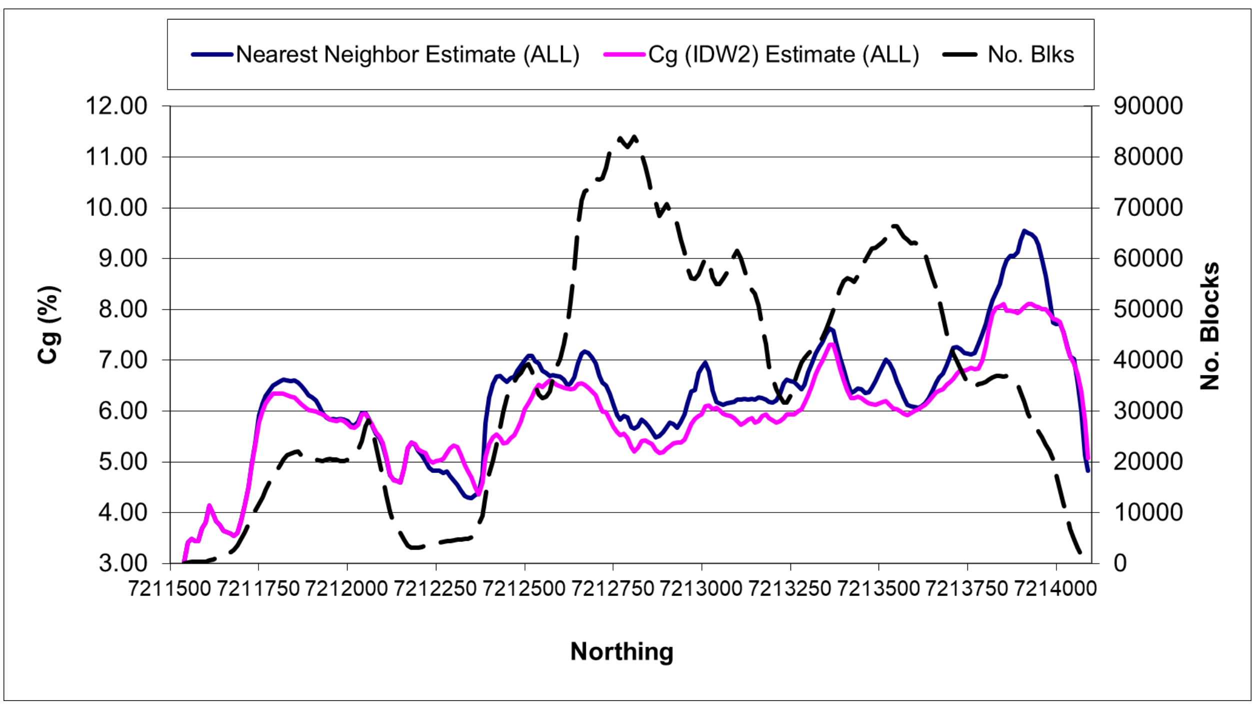
Source: AES (2022)

Figure 14-33: Easting Swath Plot of nearest Neighbor Cg (%) vs. IDW2 Estimate Using 3% Cut-off and 10 m Increments with Measured and Indicated Blocks



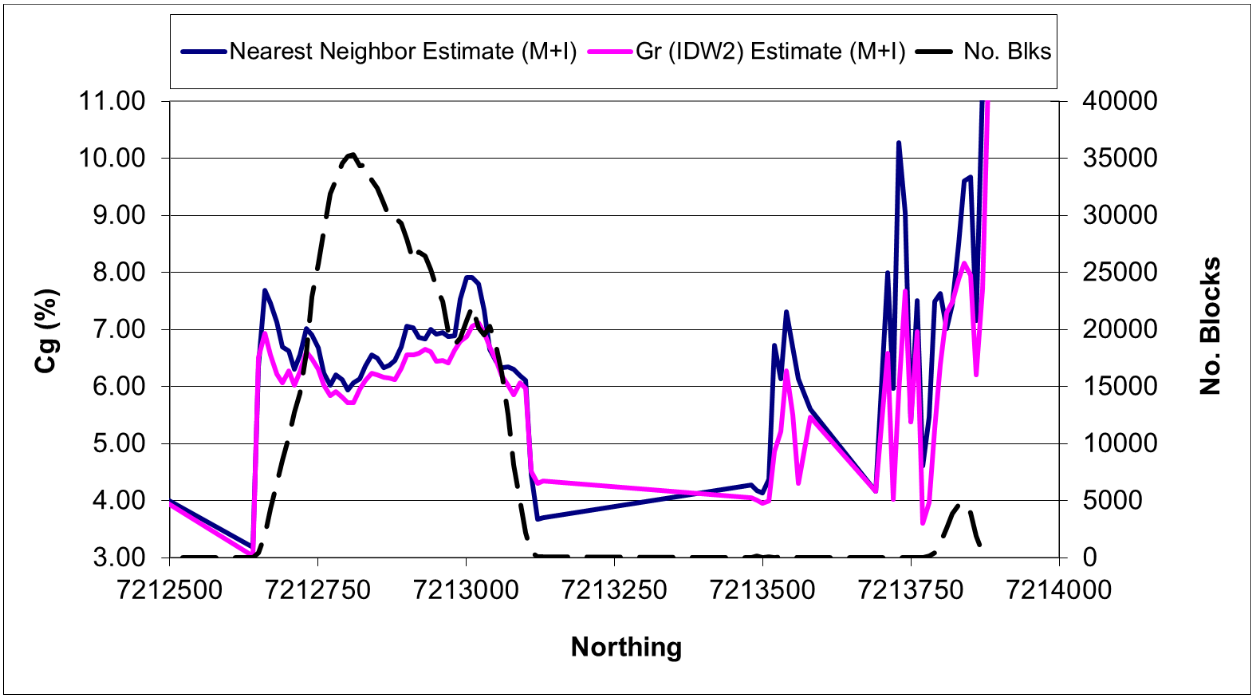
Source: AES (2022)

Figure 14-34: Northing Swath Plot of nearest Neighbor Cg (%) vs. IDW2 Estimate Using 3% Cut-off and 10 m Increments with All Estimated Blocks



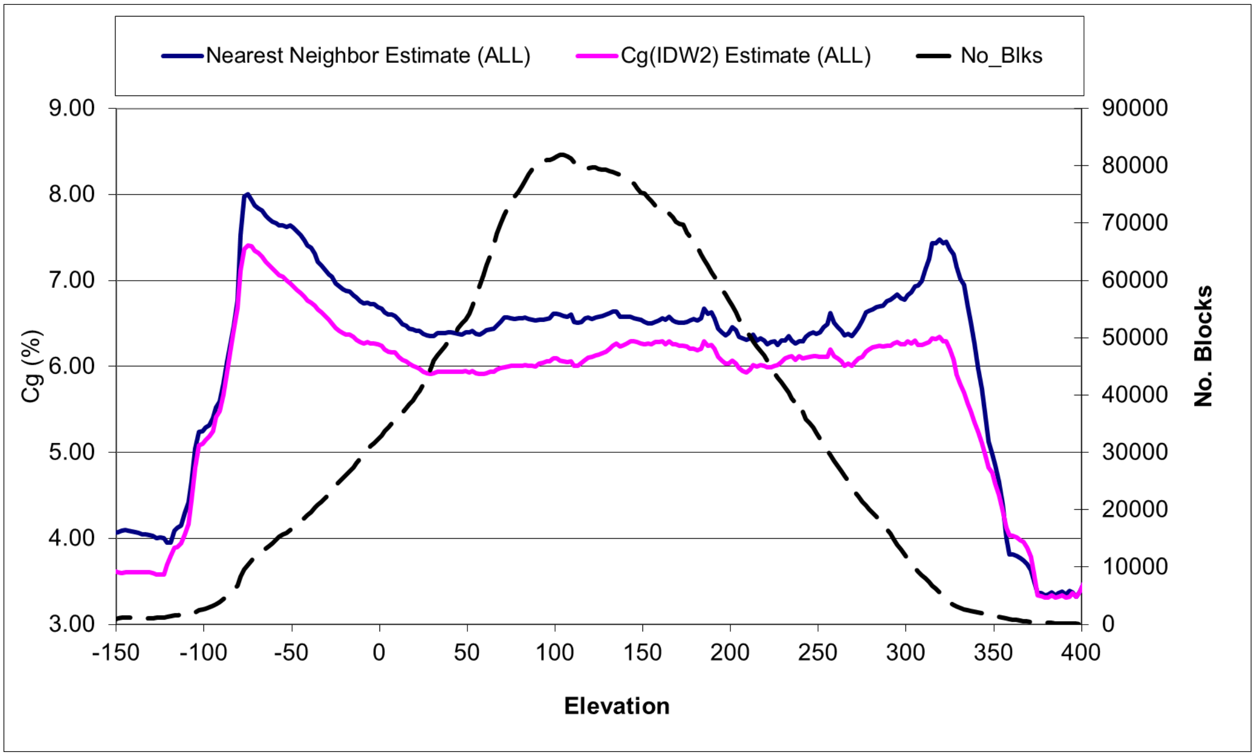
Source: AES (2022)

Figure 14-35: Northing Swath Plot of nearest Neighbor Cg vs. IDW2 Estimate Using 3% Cut-off and 10 m Increments with Measured and Indicated Blocks



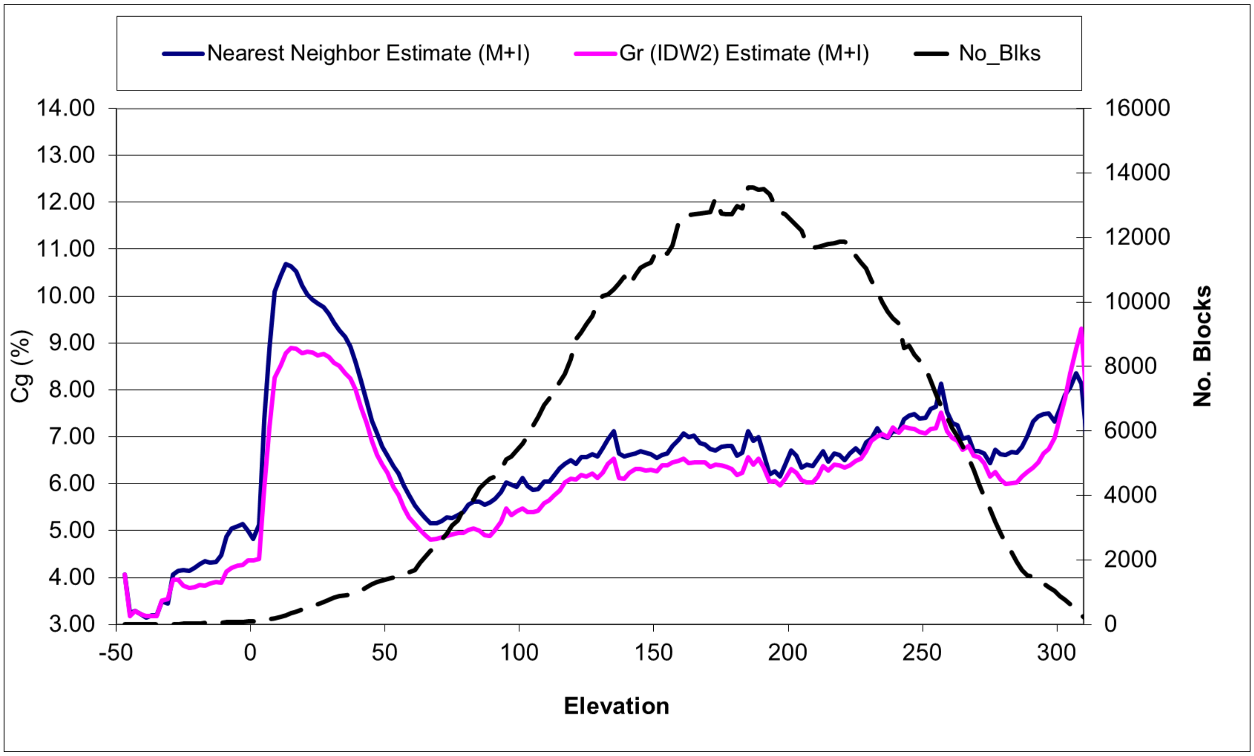
Source: AES (2022)

Figure 14-36: Elevation Swath Plot of nearest Neighbor Cg vs. IDW2 Estimate Using 3% Cut-off and 10 m Increments with All Estimated Blocks



Source: AES (2022)

Figure 14-37: Elevation swath plot of nearest neighbor Cg vs. IDW2 estimate using 3% cut-off and 10 m increments. All estimated blocks on top graph, Measured and Indicated blocks on bottom graph



Source: AES (2022)

14.11 Mineral Resource Classification

The Graphite Creek Resource estimate has been classified in accordance with guidelines established by the CIM "Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines" dated November 23rd, 2003 and CIM "Definition Standards for Mineral Resources and Mineral Reserves" dated November 27th, 2010.

The Graphite Creek Resource estimate has been classified as 'Indicated' and 'Inferred' according to the CIM definition standards. The classification was based on geological confidence, data quality and grade continuity. The most relevant factors used in the classification process were:

- Drill hole spacing; density;
- Level of confidence in the geological interpretation where the observed stratigraphic horizons are easily identifiable along strike and across the deposit, which provides confidence in the geological and mineralization continuity; and
- Estimation parameters (i.e., continuity of mineralization).

The parameters of each estimation pass were determined by the factors listed above and thus the classification of resources was guided by the estimation pass (Table 14-13). The single box search pass and pass 1 are considered to have a high level of confidence. Thus, they are unlikely to be drilled again and are placed within the 'Measured' category. Pass 2 used a range within 80% of the maximum sill variance, with at least two drill holes and are considered to be the next highest level of confidence, the 'Indicated' category. All remaining blocks estimated are considered within the 'Inferred' category which includes blocks estimated in passes 3-7. The updated Graphite Creek resource numbers for inferred, indicated and measured resources are summarized in Table 14-14.

Table 14-13: Classification Criteria

	Pass	Nominal Search Distance	Min. Number of Composites	Min. # of Drill Holes
Measured	BOX	1 x 1 x 1	1	1
	1	45 x 22 x 8	2	2
Indicated	2	100 x 50 x 20	2	2
Inferred	3	160 x 65 x 22	2	2
	4	80 x 32 x 11	1	1
	5	250 x 100 x 40	2	2
	6	125 x 50 x 20	1	1
	7	1500 x 500 x 500	1	1

Source: AES (2022)

Table 14-14: June 2022 Graphite Creek Updated Resource with Inferred, Indicated, and Measured Resources

Graphite Creek Resource Estimate Update: June 2022				
Mineral Resource Classification	**Cut-Off Grade (% Cg)**	**Tonnage (Million Tonnes)**	**Graphite Grade (% Cg)**	**Contained Graphite (Tonnes)**
Inferred	1	328.57	4.30%	14,116,795
	2	254.67	5.11%	13,004,017
	3	196.41	5.89%	11,566,233
	4	142.75	6.79%	9,686,980
	5	103.99	7.65%	7,950,965
Indicated	1	36.38	4.30%	1,562,806
	2	27.87	5.15%	1,435,135
	3	21.35	5.97%	1,273,779
	4	16.29	6.73%	1,096,952
	5	11.67	7.63%	889,914

Graphite Creek Resource Estimate Update: June 2022				
Mineral Resource Classification	**Cut-Off Grade (% Cg)**	**Tonnage (Million Tonnes)**	**Graphite Grade (% Cg)**	**Contained Graphite (Tonnes)**
Measured	1	5.43	5.22%	283,577
	2	4.67	5.83%	272,205
	3	3.99	6.40%	255,456
	4	3.22	7.08%	228,079
	5	2.44	7.92%	192,858
Measured + Indicated	1	41.81	4.42%	1,846,382
	2	32.54	5.25%	1,707,340
	3	25.34	6.03%	1,529,235
	4	19.51	6.79%	1,325,031
	5	14.10	7.68%	1,082,772

Source: AES (2022)

It should be noted the dip and location of the Kigluaik Fault that trends parallel and is adjacent to the mineralization of the deposit is a controlling factor of the graphite resource. The fault surface has been updated in 2019, 2020 and now in 2022. The updates in 2018 and 2019 resulted in resource truncated by the fault surface. New 2021 drilling indicated a shallow dip to the fault, resulting in minimal to no truncation of resource. Continued drilling is required to confirm the fault interpretation, particularly down dip. Outside of the central resource area (the area of 2018-2021 drilling), the fault has been interpreted as being vertical and thus will likely change significantly as additional drilling confirms the dip of the fault plane. Observed stratigraphic horizons continue to show remarkable consistency along strike with little deviation along strike which provides confidence in the geological and mineralization continuity.

Mineral resources are not mineral reserves and do not have demonstrated economic viability. There is no guarantee that all or any part of the mineral resource will be converted into a mineral reserve. Based on these early stages of exploration, the above resource analysis indicates that the Graphite Creek Property currently contains sufficient grade and tonnage to continue feasibility studies. The Property includes also includes excellent potential to increase the size of the resource.

15 MINERAL RESERVE ESTIMATE

A Mineral Reserve is the economically mineable part of a Measured and/or Indicated Mineral Resource and is defined by studies at a Pre-Feasibility or Feasibility level that include application of Modifying Factors. This Pre-Feasibility Study includes adequate information and considerations on mining, processing, metallurgical, infrastructure, economic, marketing, environmental and other relevant factors that demonstrate, at the time of reporting, that economic extraction could reasonably be justified.

Mineral Reserves are those parts of Mineral Resources which, after the application of all mining factors, result in an estimated tonnage, and grade which, in the opinion of the Qualified Person(s) making the estimates, is the basis of an economically viable project. Mineral Reserves are inclusive of diluting material that will be mined in conjunction with the Mineral Reserves and delivered to the treatment plant or equivalent facility. The term “Mineral Reserve” need not necessarily signify that extraction facilities are in place or operative or that all governmental approvals have been received. It does signify that there are reasonable expectations of such approvals.

Mineral Reserves are subdivided in order of increasing confidence into Probable Mineral Reserves and Proven Mineral Reserves. The reserve classifications used in this report conform to the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) classification of NI 43-101 resource and reserve definitions and Companion Policy 43-101CP. These are listed below.

A “Proven Mineral Reserve” is the economically mineable part of a Measured Mineral Resource. Application of the Proven Mineral Reserve category implies that the Qualified Person has the highest degree of confidence in the estimate with the consequent expectation in the minds of the readers of the report. The term should be restricted to that part of the deposit where production planning is taking place and for which any variation in the estimate would not significantly affect potential economic viability of the deposit.

A “Probable Mineral Reserve” is the economically mineable part of an Indicated Mineral Resource, and in some circumstances a Measured Mineral Resource. The confidence in the Modifying Factors applying to a Probable Mineral Reserve is lower than that applying to a Proven Mineral Reserve. The Qualified Person(s) may elect, to convert Measured Mineral Resources to Probable Mineral Reserves if the confidence in the Modifying Factors is lower than that applied to a Proven Mineral Reserve.

To convert Mineral Resources into a Mineral Reserve, estimates of commodity prices, mining dilution, process recovery, refining/transport costs, royalties, mining costs, processing, and general and administration costs were used to estimate cut-off grades (COG). These inputs parameters, along with geotechnical slope recommendations formed the basis for the selection of economic mining blocks.

The economic mining blocks were identified using the Lerchs-Grossmann algorithm in the NPVS software package which produced a series of optimized open pit shapes. The QP has selected one of these shapes for detailed design and then quantified the Mineral Reserves at the determined COG within the final pit design.

15.1 Open Pit Optimization

The open pit optimization process generates a series of nested pit shell surfaces for the purpose of approximating potentially mineable resource of a given deposit. The Lerchs-Grossmann algorithm in the NPVS software package was used for the optimization and associated analysis. The resulting nested pit shells were generated by varying the profit by applying a factor to the base case value.

15.1.1 Basis of Estimate

15.1.1.1 Resource Model

The mineable resource for the Property is based on the June 2022 mineral resource estimate described in Section 14. The models comprise parameters that describe in-situ density, resource classification, rock type, and graphite grade. Mineral resources that were classified as Inferred were excluded in the optimization as obligatory for a PFS level of study.

15.1.1.2 Commodity Pricing

The average graphite price used in the pit optimization analyses was set at US$7,677/t. This is based on the weighted average of sixteen different final products ranging from US$200/t to US$10,250/t and includes an adjustment for an overall net mass increase of 44% in the secondary treatment facility (STP) due to the addition of other materials. Further details on commodity pricing can be found in Section 19.

15.1.1.3 Royalties and Selling Costs

The graphite resources are currently subject to a number of royalties. It has been assumed that some of the royalties will be bought-out, leaving the majority of the resources with an average 2.8% royalty. Royalty payments are based on the concentrate transfer price, which has been assumed to be $802/wmt.

15.1.1.4 Mining Method and Operating Costs

A conventional truck/shovel open pit mining method was selected for the various deposits. Mining costs used in the pit optimization were based on first-principles mine cost build-ups using a preliminary production schedule as guidance.

15.1.1.5 Processing and General & Administrative Costs

Processing and General & Administrative (G&A) operating costs were developed for the treatment of mineralized material. The battery limits for the determination of the process operating costs commence from the crushing facilities and continue through to the placement of tailings. G&A costs cover items such as site services, transportation and camp costs. The operating costs are based on a mill production rate of 1.0 Mt/a.

15.1.1.6 Mining Dilution & Losses

Dilution for the deposit was included as part of the resource block model. The resource block model was originally created with 2 m x 2 m x 2 m blocks but was re-blocked to 4 m x 4 m x 4 m blocks which is a better match for the expected mining method and equipment selectivity. Grade estimates are for whole blocks and so by re-blocking the model, individual blocks could have seen up to a maximum 87.5% dilution on the edges of the resource. It is expected that the overall dilution estimates are conservative.

Mining losses were assumed to be 5% to account for various operational items such as blasting, carry-back, and misdirected loads.

15.1.1.7 Mill Recovery

Graphite Mill recovery was provided by Bomenco Minerals Engineering Corp. based on testwork performed at SGS Canada’s Lakefield laboratory in 2020/2021.

15.1.1.8 Overall Pit Slope Angles

Overall pit slope angles for each deposit were estimated by adjusting the recommended Inter-ramp angles that are described in Section 15.1.2 below to include an allowance for access ramps. To determine the potential location of pit access ramps, a preliminary pitshell was developed followed by locating a potential 10% ramp that would allow access to every bench. The ramp width is expected to be approximately 18 m. The overall slopes were then calculated for various elevation ranges based on the number of times the ramp passes through the final pit walls.

The overall slopes are expected to range from 38 degrees to 47 degrees in rock and 29 degrees in overburden. Due to the hill side mining, the benches above the 196 m elevation will not require any ramps to be left in the final pit wall. Below 196 m elevation, pit walls are expected to have 1-3 ramp passes.

15.1.2 Open Pit Optimization Input Parameters

A summary of the open pit optimization input parameters is shown in Table 15-1 below. Pit shell generation was not constrained by any existing infrastructure as the only existing features are exploration access roads. All of the major infrastructure facilities planned for the project will be external to the ultimate pit designs and their area of influence.

Table 15-1: Open Pit Optimization Input Parameters

Parameter	Unit	Value
Revenue, Smelting & Refining		
Average Final Product Price	US$/tonne	7,250
Payable Adjustments	US$/tonne	+3,221

Parameter	Unit	Value
TC/RC/Transport	US$/tonne	-3,155
Royalties	US$/tonne	-23
Net Graphite Price	US$/tonne Cg	7,677
Operating Costs		
Mining	US$/t mined	7.4
Milling	US$/t processed	30.0
G&A	US$/t processed	16.4
Recovery and Dilution		
External Mining Dilution	%	0
Mining Recovery	%	95
Process Recovery	%	90
Cut-off Grades		
Mill Cut-off Grade	% Cg	0.7

Note:

These parameters differ slightly from those used in the economic model due to subsequent, more detailed estimation work but the differences are not considered material.

15.1.3 Open Pit Optimization Results

A series of optimized shells were generated for the deposit based on varying revenue factors to produce the series of nested shells and their respective Net Present Value (NPV) results. The results were analyzed with shells chosen as the basis for ultimate limits and phase selection.

The optimization software produces both best case and a worst-case scenarios. These two scenarios provide a bracket for the range of possible outcomes to help guide final pit selection. The best case is typically an optimistic evaluation while the worst case is considered to be conservative.

The results of the pit optimization evaluation for varying revenue factor values are summarized in Table 15-2, Figure 15-1 and Figure 15-2. Note that the NPV in this optimization summary does not consider capital expenditures and is used only as a guide in shell selection and determination of the mining shapes. The ultimate pit shell was selected not only based on maximizing NPV, but also minimizing the addition of increasingly lower grade and higher strip ratio mineralized material (i.e., higher incremental strip ratios) that generate only a minimal improvement on the overall NPV. Pit Shell #6 (revenue factor of 0.12) was selected for as the basis for detailed mine design. The selected shell contains the majority of the defined Mineral Resources.

Table 15-2: Overall Results of the Graphite Creek Open Pit Optimization

Pit Shell	Revenue	ORE-d	WST-d	TOTAL	SR-d	Cg-d	Cg-d	NPVbest	NPVavg	NPVworst
	Factor	Mt	Mt	Mt	w:o	kt	%	US$M	US$M	US$M
1	2%	8.7	5.1	13.8	0.6	505	5.8	$2,098	$2,098	$2,098
2	4%	13.3	11.0	24.3	0.8	731	5.5	$2,590	$2,519	$2,555
3	6%	25.7	30.9	56.5	1.2	1,237	4.8	$3,126	$2,850	$2,988
4	8%	28.0	36.8	64.8	1.3	1,339	4.8	$3,181	$2,869	$3,025
5	10%	29.2	40.6	69.9	1.4	1,389	4.8	$3,204	$2,871	$3,037
6	12%	30.3	44.0	74.3	1.5	1,427	4.7	$3,218	$2,865	$3,042
7	14%	31.0	46.7	77.8	1.5	1,453	4.7	$3,228	$2,857	$3,042
8	16%	31.5	48.4	79.9	1.5	1,469	4.7	$3,232	$2,854	$3,043
9	18%	32.1	51.0	83.1	1.6	1,487	4.6	$3,238	$2,844	$3,041
10	20%	32.5	52.6	85.1	1.6	1,500	4.6	$3,241	$2,838	$3,040
12	24%	33.1	55.8	88.9	1.7	1,521	4.6	$3,246	$2,824	$3,035
14	28%	36.1	68.8	104.8	1.9	1,593	4.4	$3,259	$2,761	$3,010
16	32%	37.0	73.9	110.9	2.0	1,619	4.4	$3,263	$2,740	$3,001
18	36%	37.4	76.2	113.5	2.0	1,626	4.4	$3,264	$2,733	$2,998
20	40%	37.7	78.3	116.0	2.1	1,637	4.3	$3,265	$2,724	$2,995
22	44%	38.4	82.3	120.6	2.1	1,650	4.3	$3,267	$2,703	$2,985
24	48%	38.7	84.9	123.6	2.2	1,661	4.3	$3,268	$2,689	$2,978
26	52%	38.9	86.0	124.9	2.2	1,661	4.3	$3,268	$2,683	$2,975
28	56%	39.1	88.2	127.3	2.3	1,669	4.3	$3,268	$2,675	$2,972
30	60%	39.1	88.6	127.7	2.3	1,671	4.3	$3,269	$2,673	$2,971
32	66%	39.4	91.2	130.6	2.3	1,675	4.3	$3,269	$2,659	$2,964
34	70%	39.7	93.3	133.0	2.3	1,680	4.2	$3,269	$2,649	$2,959
36	74%	39.8	94.0	133.8	2.4	1,683	4.2	$3,269	$2,645	$2,957
39	80%	40.2	97.9	138.1	2.4	1,690	4.2	$3,270	$2,627	$2,948
41	84%	40.4	100.5	140.9	2.5	1,697	4.2	$3,270	$2,614	$2,942
44	90%	40.5	101.9	142.5	2.5	1,701	4.2	$3,270	$2,606	$2,938
46	94%	40.7	105.6	146.3	2.6	1,706	4.2	$3,270	$2,588	$2,929
48	100%	40.7	106.1	146.8	2.6	1,707	4.2	$3,270	$2,586	$2,928

Figure 15-1: Graphite Creek Open Pit Optimization - Overall Pit Shell Results

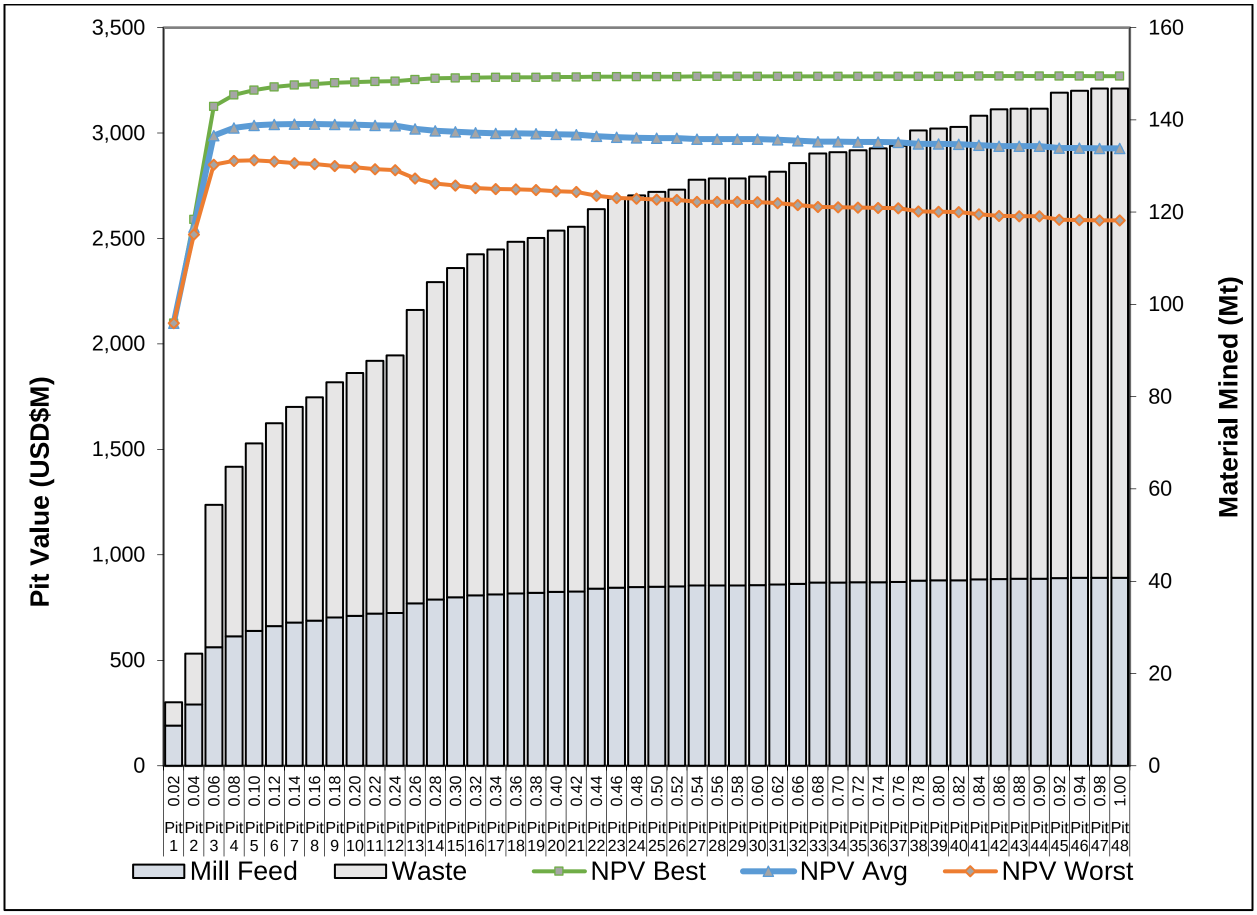
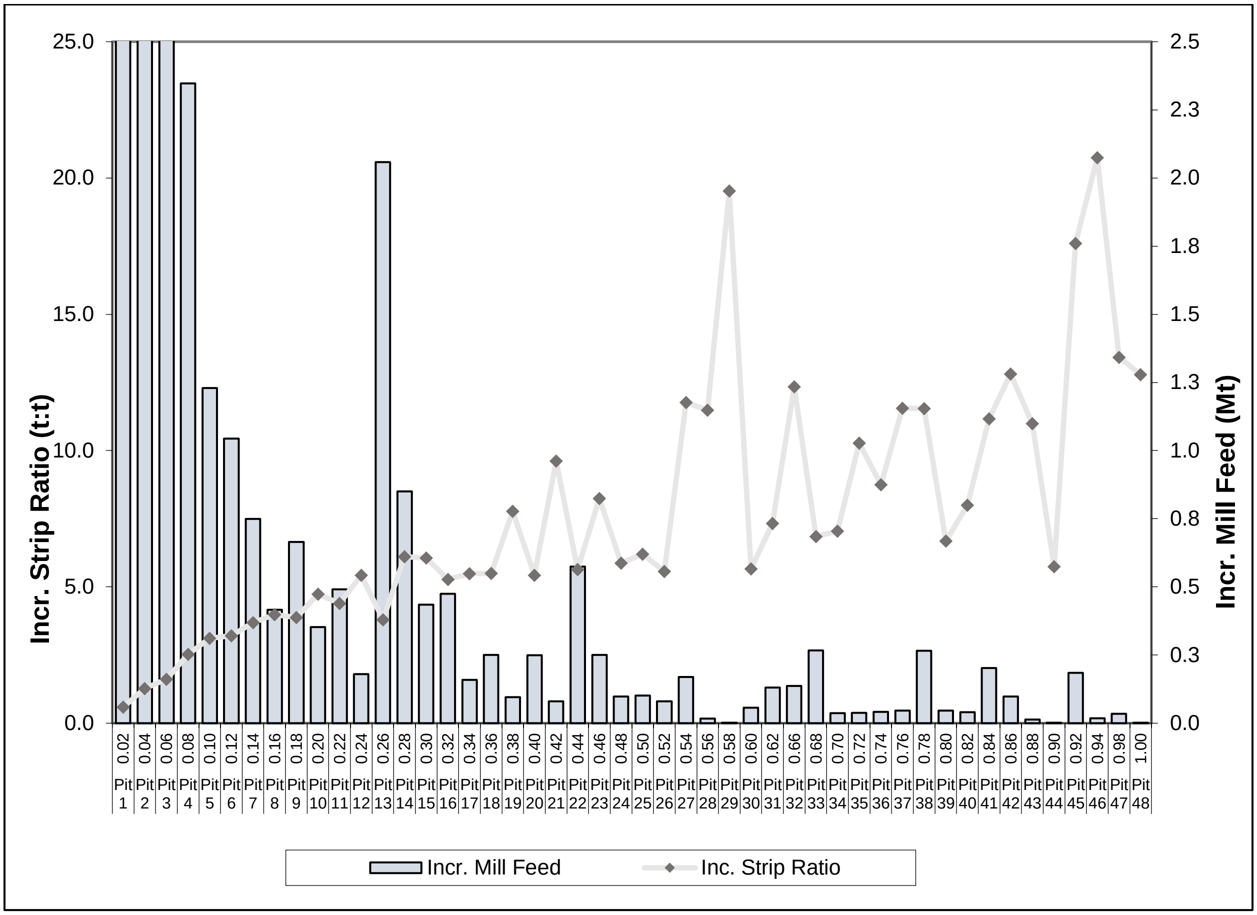


Figure 15-2: Graphite Creek Open Pit Optimization - Incremental Pit Shell Results



15.2 Open Pit Design

The selected optimized pit shell was converted into a detailed open pit mine design that formed the basis of the Mineral Reserve estimate and production scheduling. The pit wall slope angles, bench heights and access ramp details are discussed in further detail below. The final pit design is located along the northern flank of the Kigluaik mountain range, is approximately 900 m long with a maximum elevation of 412 masl and a pit bottom elevation of 52 masl. The interior pit ramp is planned to exit at an elevation of 196 masl. The final pit design is shown in Figure 15-3. Measured and Indicated resources above the economic cut-off grade (0.7% Cg) are shown relative to the final pit design in Figure 15-4, Figure 15-5 and Figure 15-6.

Figure 15-3: Final Open Pit Design

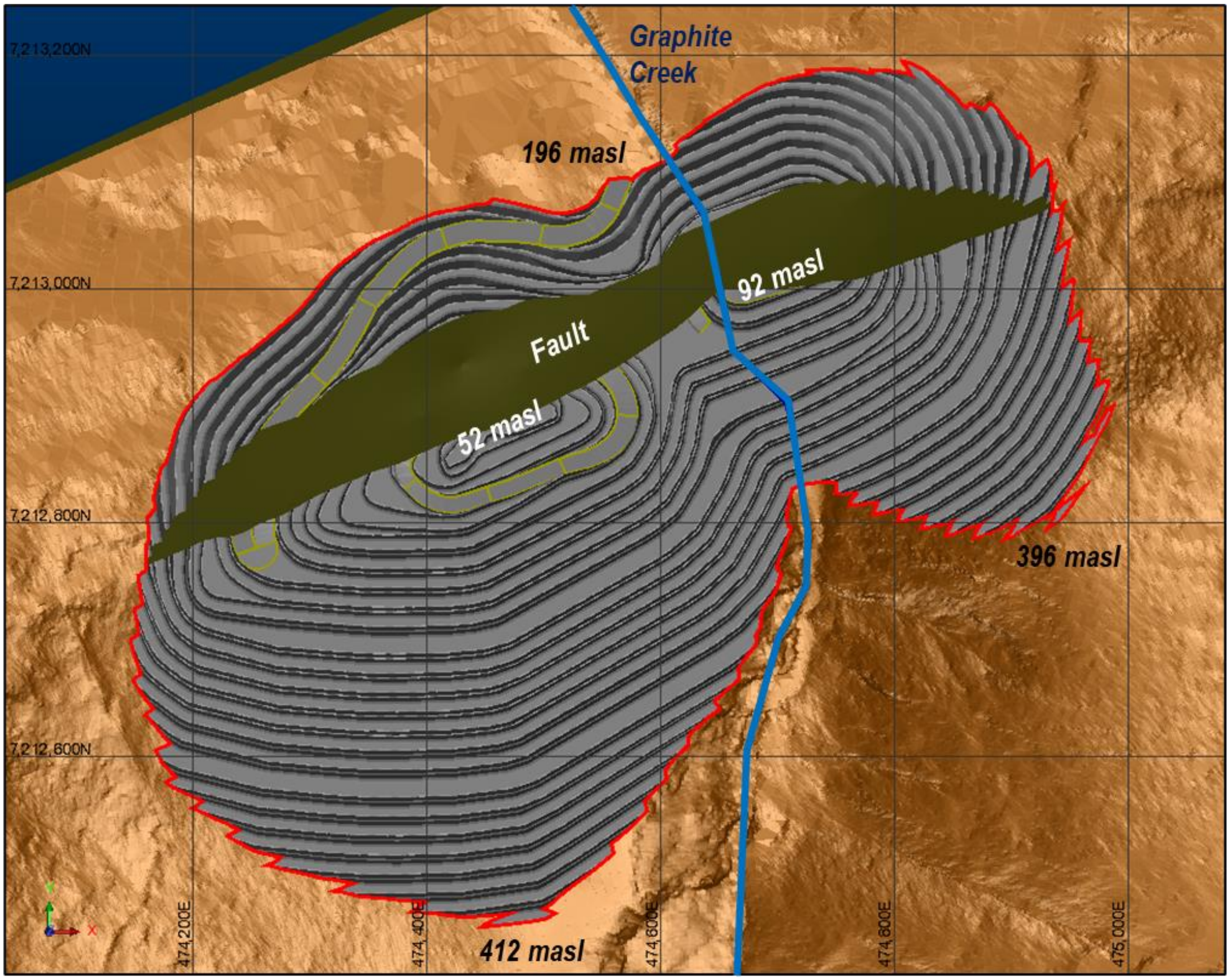


Figure 15-4: Measured and Indicated Resources Relative to the Final Pit Design

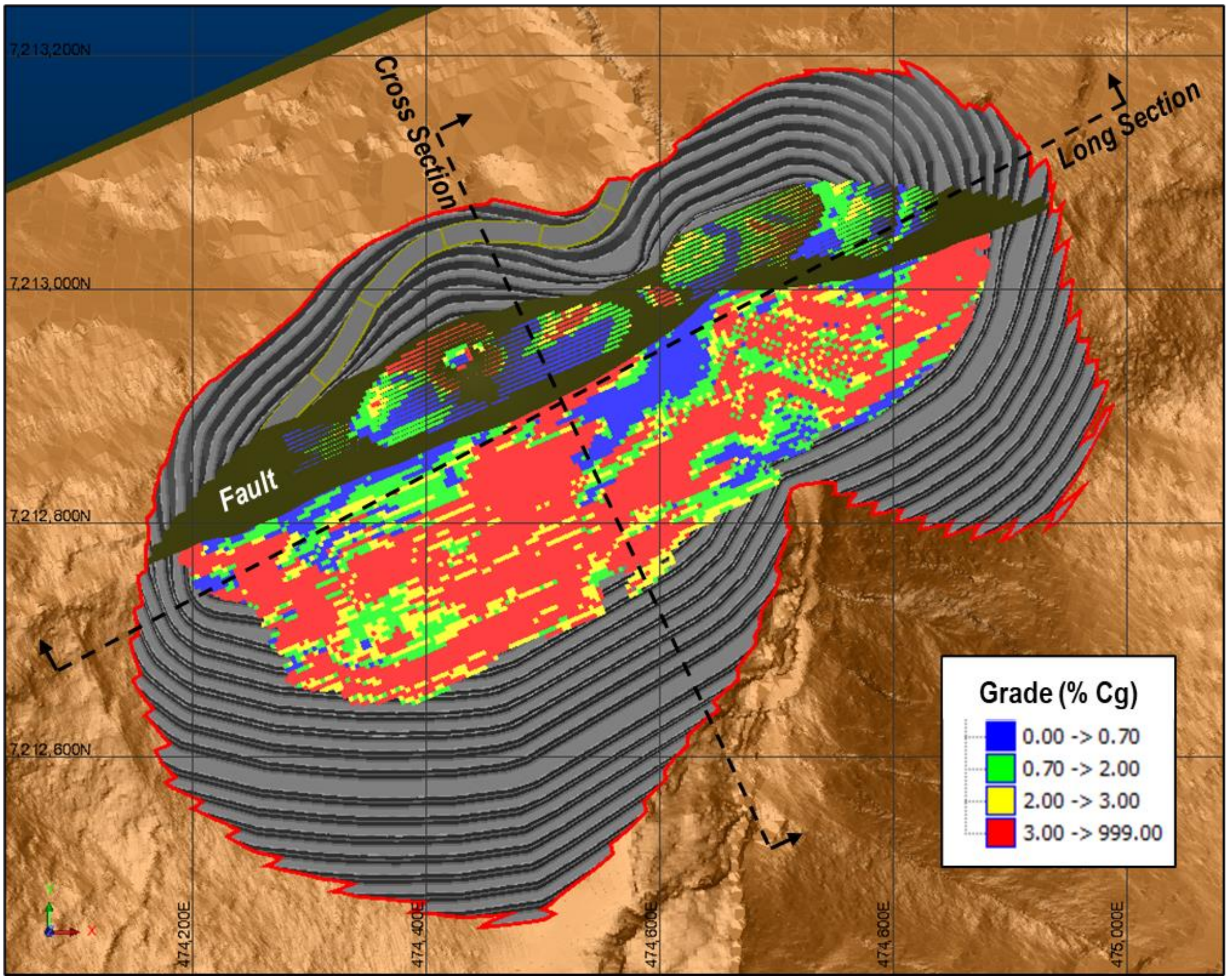


Figure 15-5: Cross Section of Final Pit Showing Measured and Indicated Resources

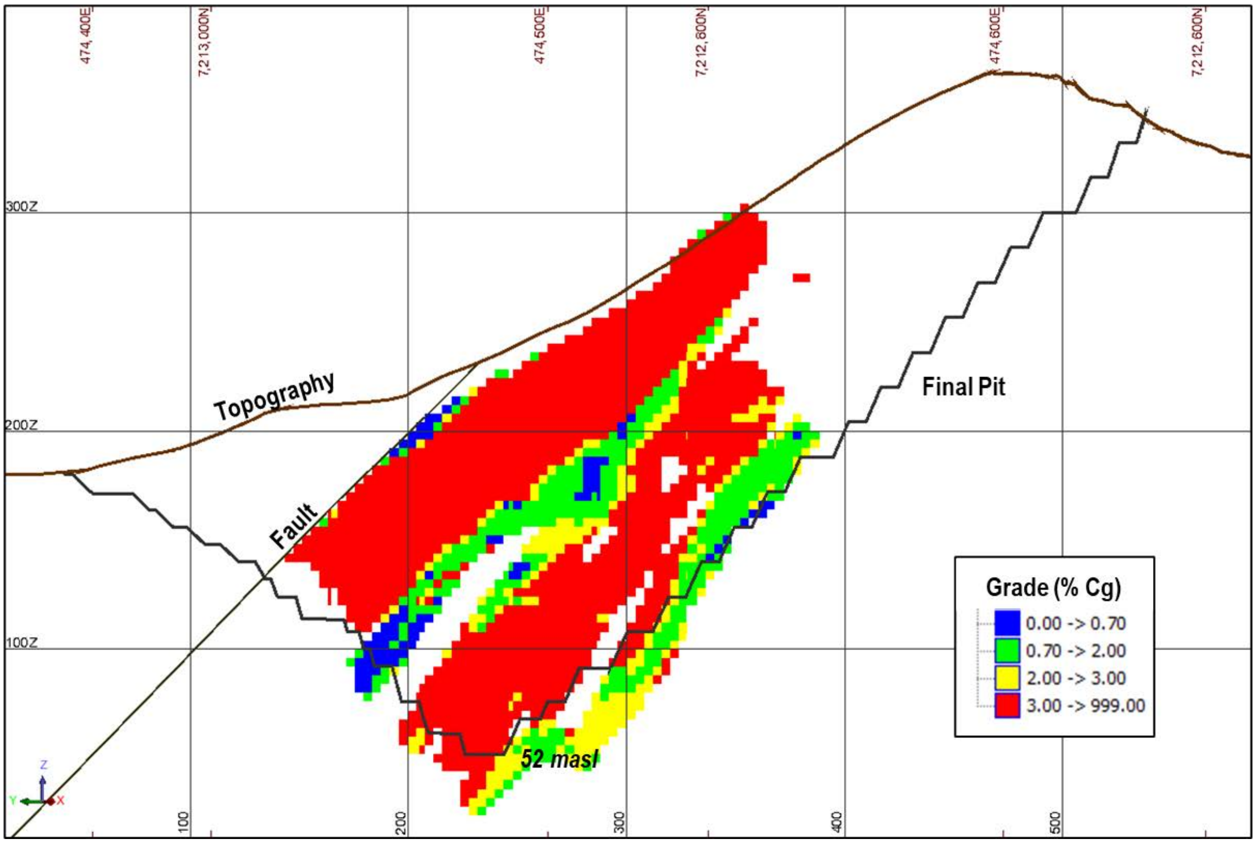
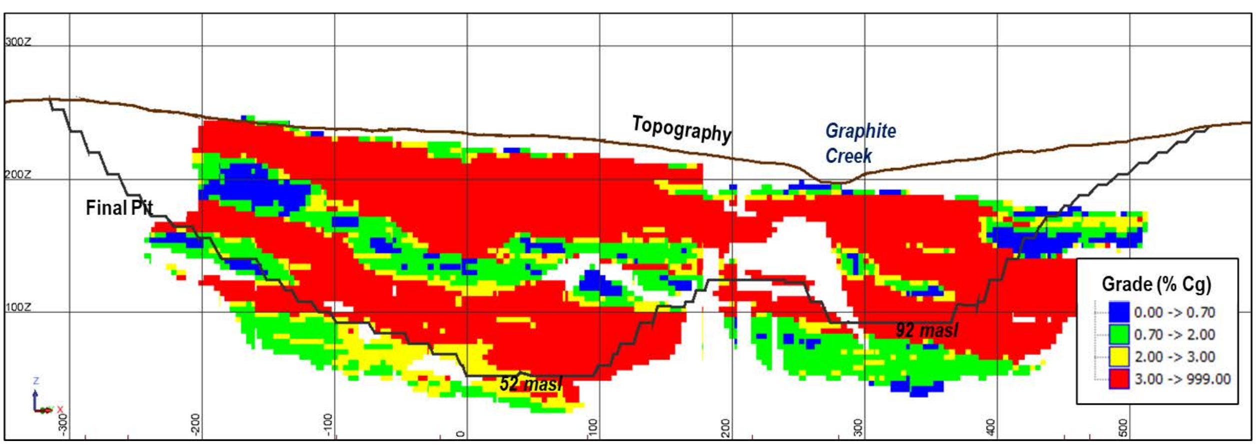


Figure 15-6: Long Section of Final Pit showing Measured and Indicated Resources



15.2.1 Geotechnical Pit Slope Recommendations

The slopes of the final pit design were divided into separate design sectors where structural characteristics and pit slope orientations were similar. Recommended pit slope design parameters are summarized in Table 15-3 including bench face angle (BFA) and inter-ramp angle (IRA). For high, continuous inter-ramp slopes that are not broken up by a ramp, a 15 m wide geotechnical berm was incorporated into the design spaced at vertical intervals no greater than 150 m. Further details of the Geotechnical analysis can be found in Section 16.3.

Table 15-3: Open Pit Slope Design Recommendations

Material Type	Pit Slope Design Sector				Design Recommendations			
	Sector ID	Wall Dip Direction (°)		Max. Slope Height (m)	Bench Face Angle (°)	Bench Height (m)	Bench Width (m)	Max. IRA (°)
		From	To					
Soil/Ovb.	**Soil/Ovb.**	115	200	40	45	8	6.5	28.9
Rock	**A1/A2**	0	20	350	62	16	8	44.1
	E1/E2	20	40	250	67	16	8	47.2
	D	40	290	150	75	16	8	52.5
	C1/C2	290	320	325	70	16	8	49.2
	B1/B2	320	345	250	67	16	8	47.2
	A1/A2	345	360	350	62	16	8	44.1

15.2.2 Road/Ramp Width

The main in-pit haul roads and ramps are designed to have an overall road width allowance of 18 m. The selected road allowance is adequate for accommodating three times the width of the largest haul truck (55 t), with additional room for drainage ditches and safety berms as summarized in Table 15-4. The majority of the internal pit ramps are designed with a maximum gradient of 10%; however, they were steepened to 12% for final access to the lower portions of the open pit (i.e., below 124 masl).

Table 15-4: In-Pit Haulage Road Design Parameters

Item	Metres
Truck (55 t) operating width	4.2
Running surface - 3x truck width	12.6
Berm height (3/4 tire height)	1.6
Berm width	3.3

Item	Metres
Ditch width	2.1
Total Road Allowance	**18.0**

15.3 Mineral Reserve Estimate

A summary of the Mineral Reserves for the project is shown in Table 15-5 within the designed final pit for the Graphite Creek deposit. In the detailed mine production schedule, the cut-off grade has been raised variably over the life of the Project to 2.0% Cg for the first 12 years and then increased to 3.0% Cg beyond year 12 in order to maximize production at the STP. Any resources below the raised cut-off grades have been wasted. The effective date of the Mineral Reserve stated in this report is 29 August 2022.

The QPs have not identified any known legal, political, environmental, or other risks that would materially affect the potential development of the Mineral Reserves, except for the risk of not being able to secure the necessary permits from the government for development and operation of the project; however, the QPs are not aware of any unique characteristics of the project that would prevent permitting.

Table 15-5: Proven and Probable Mineral Reserve Estimate

Class	Diluted Tonnes (k tonnes)	Diluted Grade (% Cg)	Contained Graphite (k tonnes)
Proven	3,812	6.0	230
Probable	18.678	5.5	1,028
Total Proven and Probable	**22,490**	**5.6**	**1,258**

Notes:

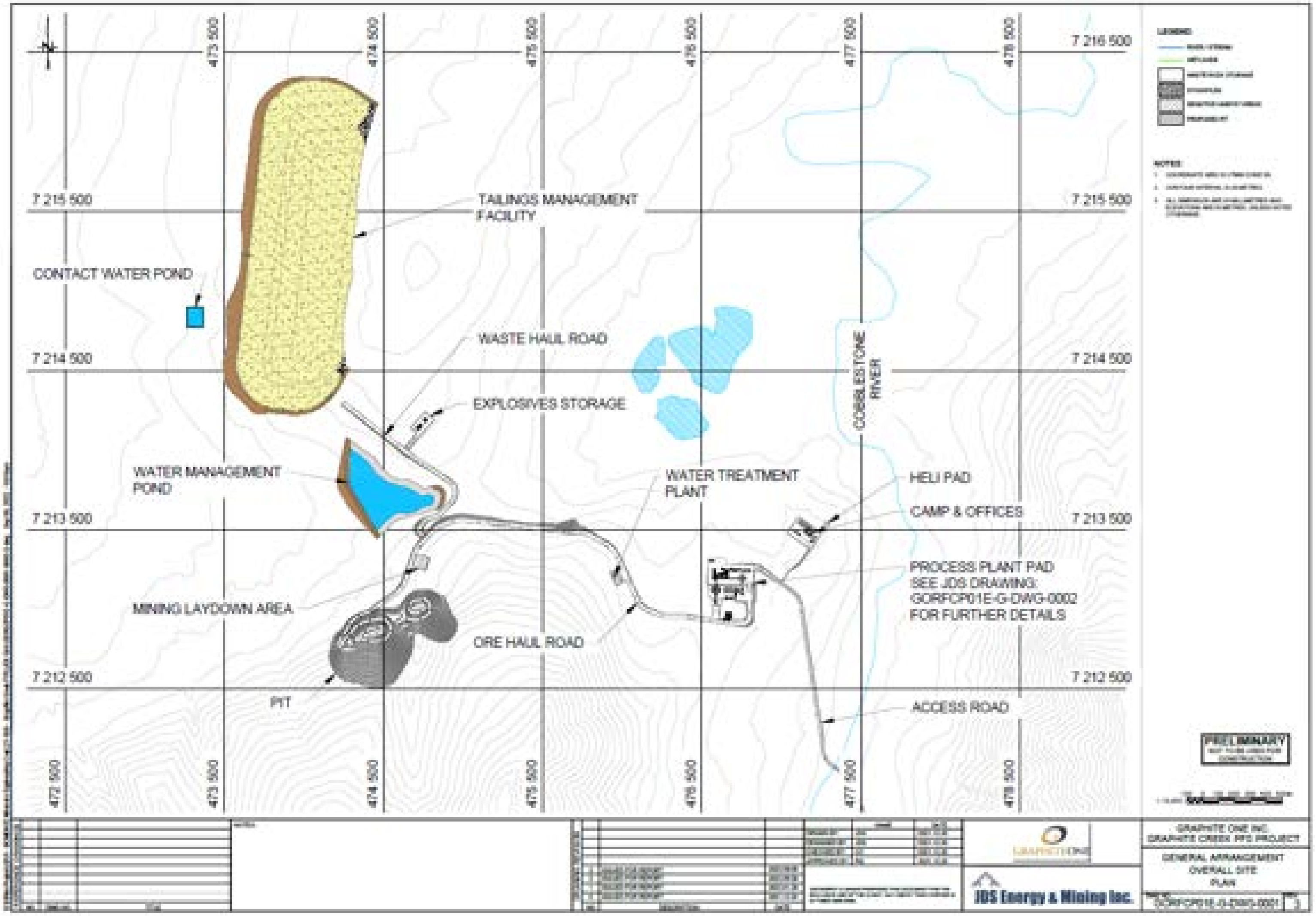
1. Mineral Reserves follow CIM definitions and are effective as of 29 August 2022.
2. Mineral Reserves are estimated using a raised variable cut-off of 2.0% Cg – 3.0% Cg which is required to maximize secondary treatment production. The economic cut-off grade is 0.7% Cg based on a net average Graphite Price of US$7,677/t (including transport & treatment charges) and a mill recovery of 90%.
3. The final pit design contains an additional 7.6 Mt of Measured and Indicated resources between the raised cut-off grade (2% Cg - 3% Cg) and the economic cut-off grade (0.7% Cg) at an average grade of 1.7% Cg. These resources have been treated as waste in the final mine production schedule.
4. The final pit design contains an additional 14.0 Mt of Inferred resources above the economic cut-off grade (0.7% Cg) at an average grade of 5.2% Cg. Inferred Mineral Resources are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorized as Mineral Reserves, and there is no certainty that any part of the Inferred Resources could be converted into Mineral Reserves.
5. Tonnages are rounded to the nearest 1,000 t, graphite grades are rounded to two decimal places. Tonnage measurements are in metric units.

16 MINING METHODS

16.1 Introduction

The Graphite Creek deposit has been planned to be developed as an open pit mine. Material will be drilled and blasted on 8 m benches and then excavated using 7 m^3 front-end loaders, and 55 t trucks. Ore will be processed at a nominal production rate of 1 Mt/a or 2,740 t/d. Over the life-of-mine (LOM), the mine will produce 22.5 Mt of ore at an average graphite grade of 5.6% Cg, along with 50 Mt of waste. Ore material is to be sent directly to the primary crusher or a temporary stockpile, located 2 km to the East of the pit. Waste material will be co-mingled with tailings in the Tailings Management Facility (TMF) located 1.5 km North of the pit. The overall site layout is shown in Figure 16-1.

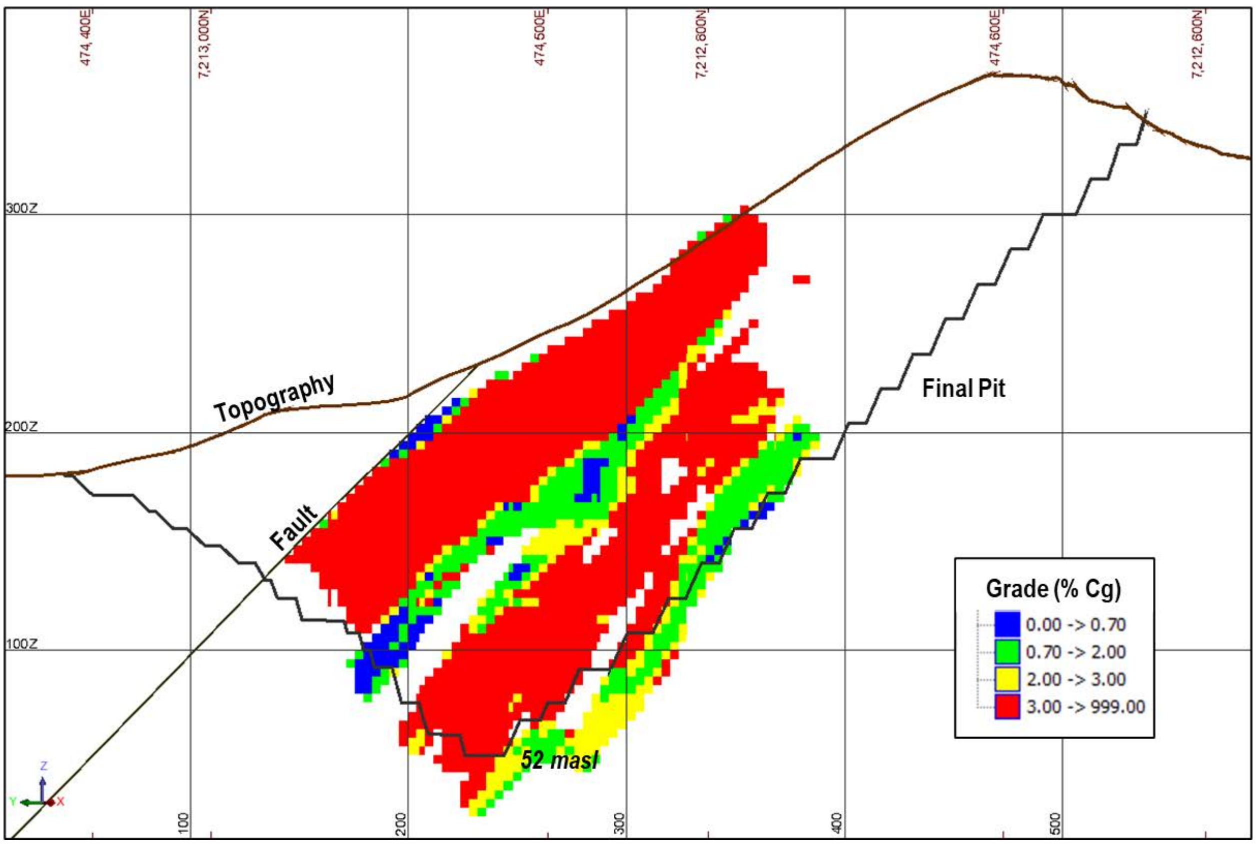
Figure 16-1: Overall Site Layout



16.2 Deposit Characteristics

The Graphite Creek Deposit contains several graphite zones which dip generally to the north at 40° to 78°. The strike length of the deposit is several kilometers long; however, the current defined resources of the deposit is approximately 1 km long. The thickness of the modeled graphite zones within the pit area varies widely from 4 m to 60 m and where mineralized zones run parallel to each other, the distance between the host rock hanging wall and footwall can exceed 180 m. The Kigluaik fault runs parallel to the strike of the deposit and the current assumption is that all material North of this fault is overburden or loose rock type material. A typical cross section of the deposit is shown in Figure 16-2.

Figure 16-2: Section View of the Graphite Creek Deposit (looking East)



16.3 Geotechnical Analysis and Recommendations

16.3.1 Geotechnical Characterization

The current open pit slope designs are based on previous work by others that included detailed geotechnical core logging, fracture orientation and laboratory strength testing of core retrieved from two holes drilled during the 2019 exploration program. The two drill holes (19GC027 and 19GC028) were drilled at an inclination of approximately -60º towards southeast to intersect the central portion of the proposed pit highwall. A 20-bead thermistor string and a vibrating wire piezometer were installed in each of the two geotechnical drill holes to better understand potential pore water pressures and ground temperature profiles. Each thermistor string was 200 m in length while the vibrating wire piezometers were placed at a depth of approximately 100 m below ground surface (bgs).

The previous geotechnical logging was carried out at the time by Knight Piésold (KP) on a 24-hour basis at the drill rig with the primary purpose of characterizing the rock mass for engineering purposes using the Bieniawski rock mass rating (RMR89) and Barton Q (Grimstad & Barton, 1993) classification systems. Core photographs, rock quality designation (RQD) and core recovery data for an additional 38 resource drill holes from within the pit area and considered as part of the investigation.

Select core samples were shipped to the Norman B Keevil Institute of Mining Engineering, Rock Mechanics Facility at the University of British Columbia for laboratory strength testing. A total of 14 samples were tested for uniaxial compressive strength (UCS), Brazilian Indirect Tensile Strength (BTS) and measurements of elastic properties.

Lithology, alteration and geologic structure of the two geotechnical drill holes were logged in detail by Alaska Earth Sciences (AES). This information along with preliminary 3D lithology and fault models for the project were also incorporated into the assessment.

16.3.2 Geotechnical Conditions

The previous KP (2019) geotechnical logging and laboratory testing data were used to characterize rock mass conditions based primarily on the RMR89 classification system. With the exception of the upper weathered materials, rock mass characteristics are anticipated to be similar over much of the pit. The depth of weathering typically extends from a few metres up to approximately 20 m in local areas.

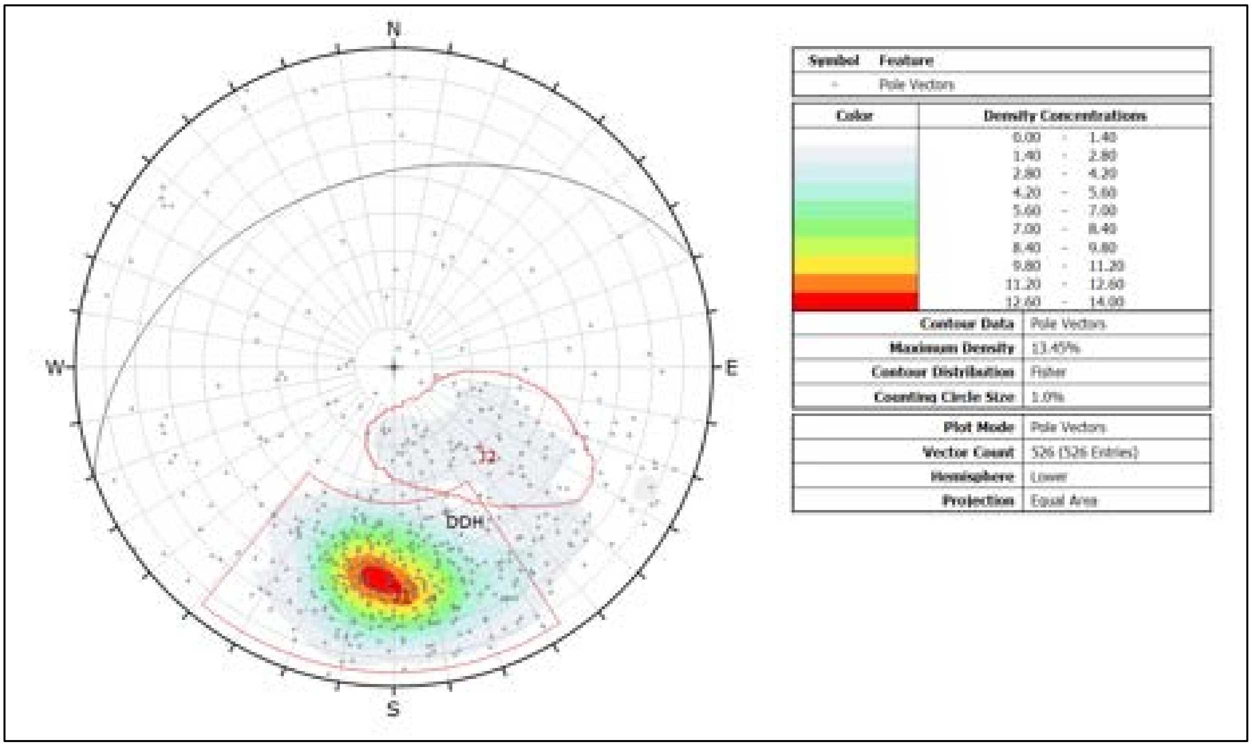
Below the weathered zone, the fresh rock is generally quite competent with relatively few faults or fracture zones. RMR values typically range between 55 and 75 classifying as ‘Fair’ to ‘Good’ rock mass quality, according to the Bieniawski (1989) system. The average RMR logged for the fresh rock was 66, classifying as ‘Good’ rock mass quality. RQD values are typically greater than 80 with the frequency of fractures typically decreasing with depth.

Two dominant discontinuity sets were identified from the oriented core data. The most dominant discontinuities are the foliation joints which dip north typically between 50° and 70° with a 59° average dip angle. The second discontinuity set is a shallow to moderately northwest dipping joint set with an average dip and dip direction of 30° and 313°, respectively. Figure 16-3 contains a stereonet of all discontinuities oriented in drill holes 19GC027 and 19GC028.

UCS test results of the fresh rock ranged from 39 to 161 MPa with an average of 92 MPa. A number of the UCS test results were impacted by pre-existing discontinuities or foliation suggesting that the true intact rock strength is more likely in the 75 to 160 MPa range or Strong to Very Strong, according to the ISRM (1978) qualitative indices.

The oriented core dataset appears to be of good quality and is considered a good representation of southerly dipping discontinuities located within the southeast highwall at least. However, due to the directional bias caused by both 19GC027 and 19GC028 both being drilled towards southeast, it is likely that additional discontinuity sets exist that are not represented in Figure 16-3. Additional oriented core drilling in other directions will be required to identify these potential sets as the project advances.

Figure 16-3: Stereonet of Discontinuities Oriented from 19GC027 and 19GC028



A deep soil overburden deposit exists at the base of the Kigluaik mountain range, immediately to the north of the deposit. Based on the final pit design and current 3D model of the soil overburden, the upper section of the ramp and up to approximately 60 m of the pit will be comprised of this soil material.

Currently very little information exists regarding the extents and characteristics of these soils, but one hole drilled as part of the previous KP (2019) investigation revealed mostly sands with silt and gravel in this area. Thermoskarst features are apparent nearby which suggests that the soils in this area of the site may contain a significant amount of permafrost.

The sub-vertical, northeast trending Kigluaik Fault is currently interpreted to daylight along the crest of the northwest pit wall. It is possible that these deep soils are related to downward movement of the north side of the fault relative to the south. It is not anticipated that the Kigluaik Fault will have a significant impact on pit wall stability at this time however this will need to be confirmed in later stages of project development.

16.3.3 Pit Wall Stability Considerations

Given the overall good quality rock mass anticipated to comprise the pit slopes, the orientation of the dominant discontinuity sets relative to pit wall orientations will likely control maximum achievable bench face and inter-ramp slope angles for much of the pit. In particular, the foliation joint set is expected to be a very strong control on the stability of north facing slopes due to its pervasiveness, steep dip angles (50° and 70°) and relatively weak shear strengths. Geotechnical logging to date suggests that foliation joints are commonly undulating or planar with smooth graphitic coatings.

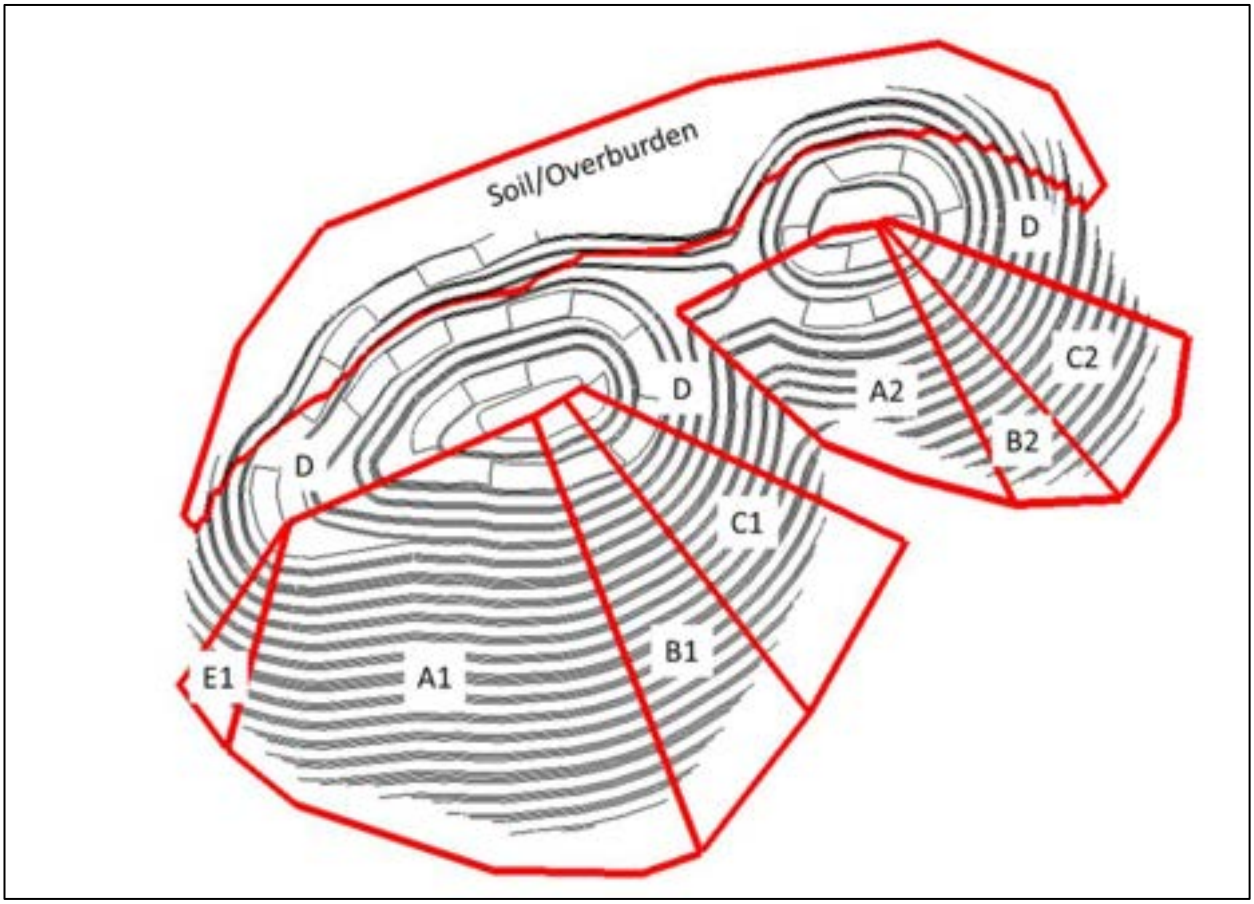
Based on the proposed pit design, up to ~55 m of the upper northwest pit wall is expected to be comprised of overburden soils. The nature and extent of the soils are currently not well understood but the limited data available suggests the soils to be coarse grained and potentially with permafrost. Given the low height of pit wall that would be composed of the sands and that the pit access ramp will also enter on the northwest side reducing the overall slope angle, the presence of the deep soils is not expected to have a major impact on pit economics or overall pit wall stability. Single benches with relatively shallow bench face angles will be required along with a wider bench at the bedrock contact to allow cleanup of potential sloughing.

In addition to the Kigluaik Fault previously discussed, a second major fault structure is believed to exist within the deposit. This fault, called the Graphite Creek Fault, is interpreted as being sub-vertical and south-southeast trending. Likely due to the poor rock quality associated with the fault or fault zone, an erosional valley has formed along the apparent intersection with the fault and the ground surface. This erosional feature bisects the deposit near the northeast end but is not expected to significantly impact pit stability at this time.

16.3.4 Pit Slope Design Criteria

The slopes of the final pit design were divided into separate design sectors where structural characteristics and pit slope orientations were similar. The pit slope design sectors are shown on Figure 16-4. Maximum achievable bench face angles were then determined for each sector based on analysis of the dominant discontinuity sets anticipated within the sector.

Figure 16-4: Pit Slope Design Sectors



Recommended pit slope design parameters are summarized in Table 16-1 by pit design sector. Due to the pit geometry and the resulting slope dip directions relative to the dominant discontinuity sets, Sectors E1 and B2 have relatively narrow widths that may not be practical for mining. These sectors may be used to transition the different bench face angles (BFAs) between the neighboring sectors. For example, Sector E1 can be used to transition from the 62° BFA from Sector A1 to the 70° BFA recommended for Sector C1. Similarly, Sector B2 can be used to transition between the Sectors A2 and C2 BFAs. Bench width and bench height recommendations are consistent between all sectors except the overburden soils in the upper northwest wall.

For high, continuous inter-ramp slopes that are not broken up by a ramp or some type of wide step-out for infrastructure, a 15 m wide geotechnical berm is recommended to be incorporated into the design. The geotechnical berms should be spaced at vertical intervals of preferably 100 m to 125 m, but no greater than 150 m.

Table 16-1: Pit Slope Design Recommendations

Material Type	Pit Slope Design Sector				Design Recommendations			
	Sector ID	Wall Dip Direction (°)		Max. Slope Height (m)	Bench Face Angle (°)	Bench Height (m)	Bench Width (m)	Max. IRA (°)
		From	To					
Soil/Ovb.	**Soil/Ovb.**	115	200	40	45	8	6.5	28.9
Rock	**A1/A2**	0	20	350	62	16	8	44.1
	E1/E2	20	40	250	67	16	8	47.2
	D	40	290	150	75	16	8	52.5
	C1/C2	290	320	325	70	16	8	49.2
	B1/B2	320	345	250	67	16	8	47.2
	A1/A2	345	360	350	62	16	8	44.1

16.4 Hydrogeology Analysis and Recommendations

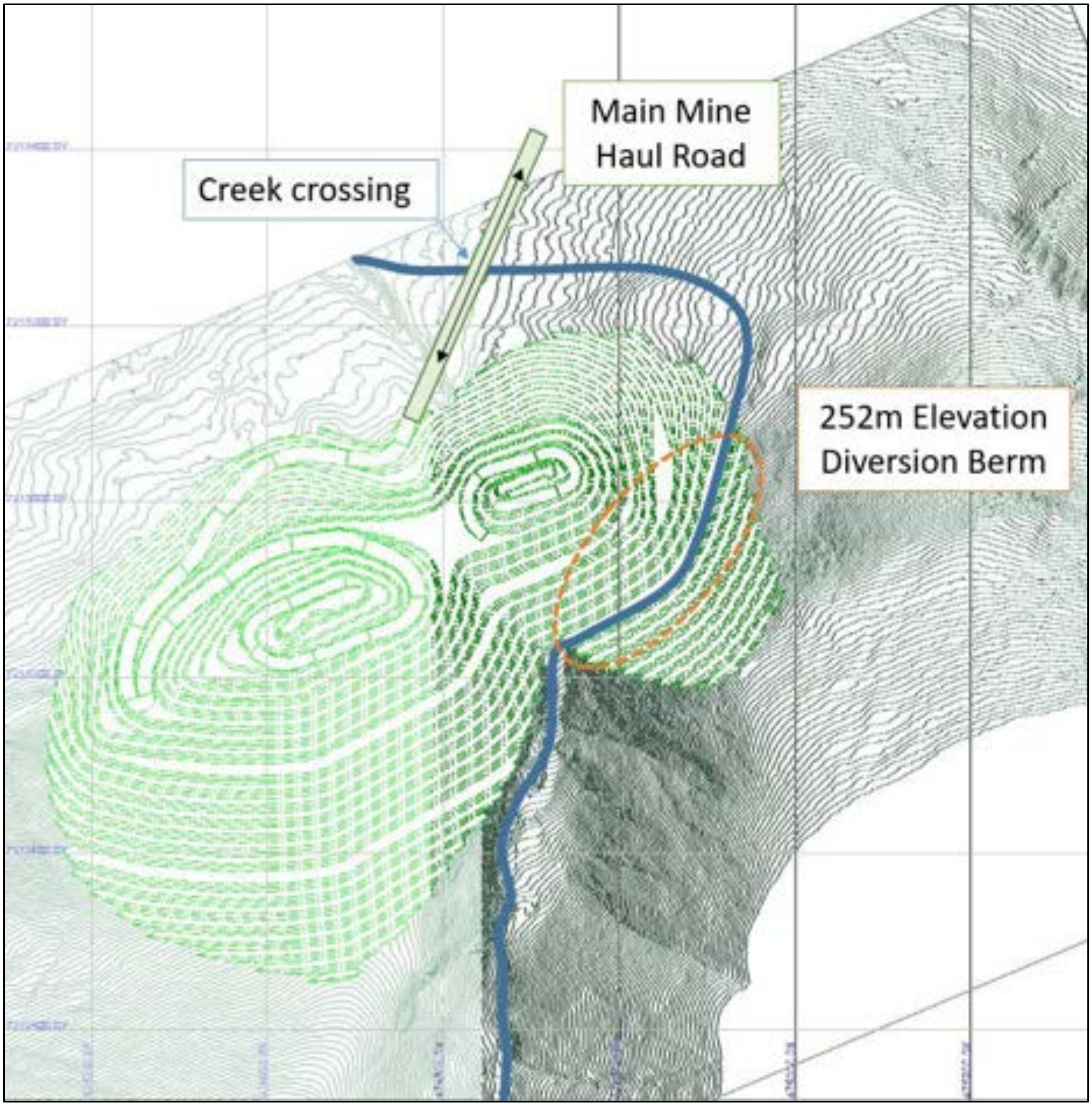
The Kigluaik Fault, located at the base of the mountain slope, may have a major influence on groundwater flow. It separates two hydrogeologic regimes and may be a barrier to groundwater flow. On the southside of the fault (where the deposit is located), the rock likely has very low permeability due to the very high metamorphic grade. Groundwater flow in these rocks is likely confined to faults and fractures. Poorly understood, unconsolidated sediments of large but unknown depth, are found on the north side of the fault. The fault will cross the planned pit part way up the north pit wall for the entire length of the pit.

Further work will partially focus on determining the hydraulic conductivity of the rock north of the Kigluaik Fault. There may be a “damage zone” adjacent to the Kigluaik Fault that has increased faulting and fracturing and, therefore, may have increased hydraulic conductivity. Groundwater flow in this area may be influenced by the permeability of the Kigluaik Fault, fracture/fault density, and the presence/absence of permafrost.

Further work will also focus on understanding the sediment and associated hydrogeologic regime on the north side of the Kigluaik Fault. This may have a substantial influence on the rate of groundwater inflow to the pit during mining and on the post mining pit lake water level.

During production, the open pit will also require the Graphite Creek to be diverted as it currently runs through the middle of the pit. The current plan is to divert the creek water to the East of the pit within drainage pipes that are placed along one of the wider geotechnical safety berms. The geotechnical berm will be designed with sufficient width such that the drainage pipes can be buried to protect them from any rock falls, as well as maintaining access for equipment. The mining schedule anticipates that the diversion will be required near the end of Year 3 of production. Figure 16-5 shows the proposed graphite creek diversion.

Figure 16-5: Graphite Creek Diversion



16.5 Mining Methods

Open pit mining has been selected as the mining method for the Graphite Creek deposit due to its relatively low cost (versus underground mining methods) and the near-surface nature of the deposit. Ore production has been restricted based on the secondary treatment processing capacity of 53,600 dmt per year which results in an on-site Mill throughput of 1.0 Mt/a. At these processing rates, relatively small surface mining equipment will be required.

Material will be drilled and blasted on 8 m bench heights with final pit walls being double-benched to 16 m heights. The selected excavators are capable of mining 8 m benches, but mining could be excavated in 4 m flitches for greater selectivity in ore zones.

Ore will be sent directly to a crusher located by the proposed processing facilities ~ 2 km East of the pit. The waste material from the pit will be co-disposed with the tailings in a facility located approximately 1.5 km North of the proposed pit.

16.6 Mine Design

Industry-standard methodologies for pit limit analysis, mining sequence, cut-off grade optimization, and detailed design were adopted.

The main steps in the planning process were:

- Assignment of economic criteria to the geological resource model;
- Definition of optimization parameters such as commodity prices, preliminary operating cost estimates, pit wall angles, dilution and metallurgical recovery estimates for each material type;
- Calculation of economic ultimate pit limits for the deposit using open pit optimization software (applies the Lerchs-Grossmann algorithm to define optimal mining shells); and
- Development of detailed ultimate pit designs and mining phases (incorporating pit accesses and appropriate bench heights and pit geometry).

Details of the open pit optimization was discussed in Section 15.1.

16.6.1 Final Pit Design and Pushbacks

The ultimate pit design was split into six pushbacks to aid in construction activities and to help smooth production rates during operations. The approximate pushback shapes were selected from the generated pit shells as part of the pit optimization process which provide a sequence based on overall value.

Graphite creek intersects the proposed pit area from the South at an elevation of approximately 252 masl. The planned creek diversion has been taken into account in designing the individual pushbacks and production schedule.

The initial pit phase (Figure 16-6) is strictly in Overburden (non-acid potential) materials for use in construction activities. Pushback 1, on the West side of the creek accesses ore quickly at a low strip ration and is shown in Figure 16-7. Pushback 2 (Figure 16-8) is designed on the East side of the creek and will be used to divert graphite creek in a drainage pipe along one of its geotechnical berms around the pit to the East. Pushback 3 (Figure 16-9) is a continuation of the first pushback on the West side of Graphite Creek which is initially partially inaccessible without the creek diversion. Pushback 4 (Figure 16-10) and Pushback 5 (Figure 16-11) mine to final limits on the East and West sides of the pit respectively.

Figure 16-6: Pushback 0 Design (Overburden)

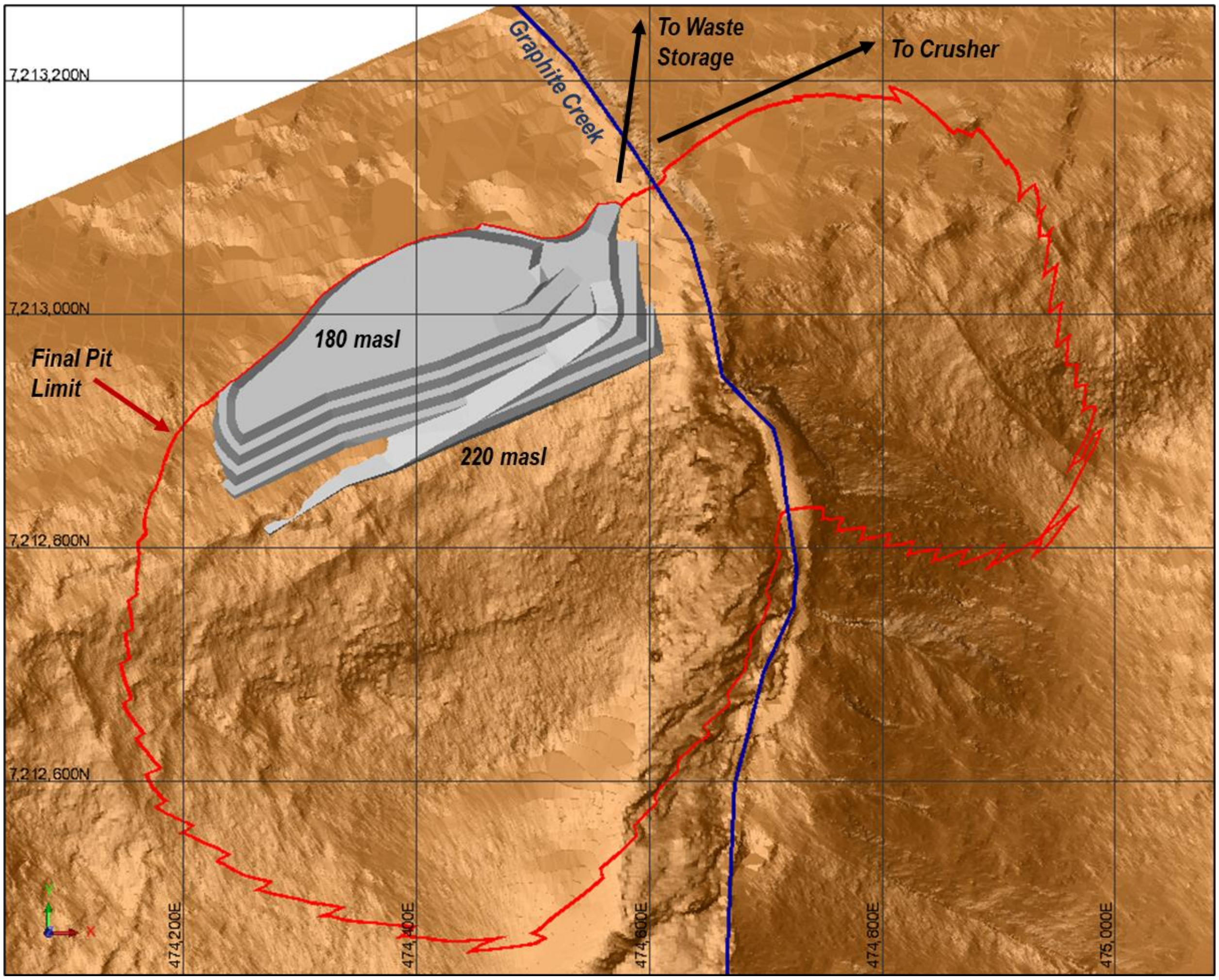


Figure 16-7: Pushback 1 Design

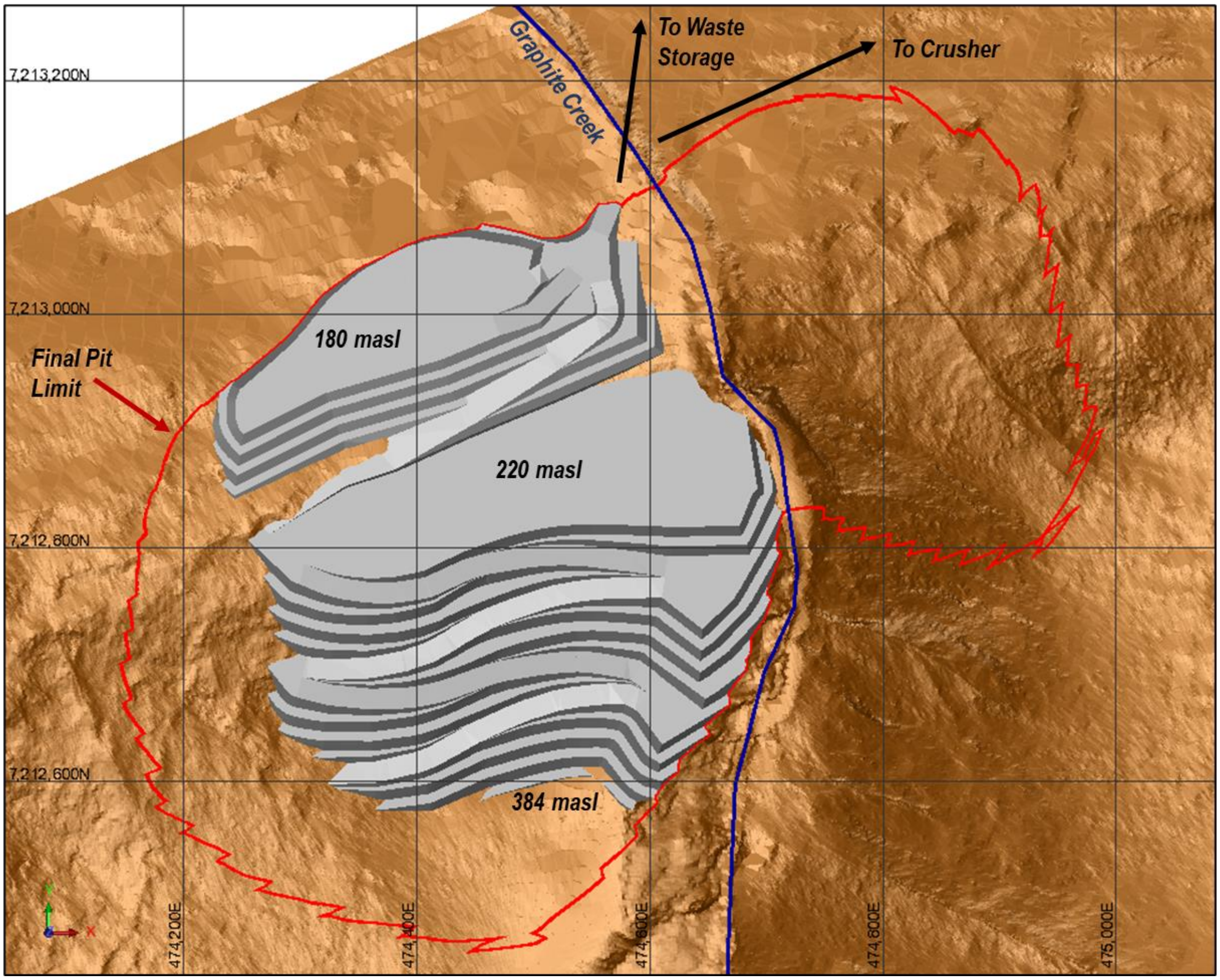


Figure 16-8: Pushback 2 Design

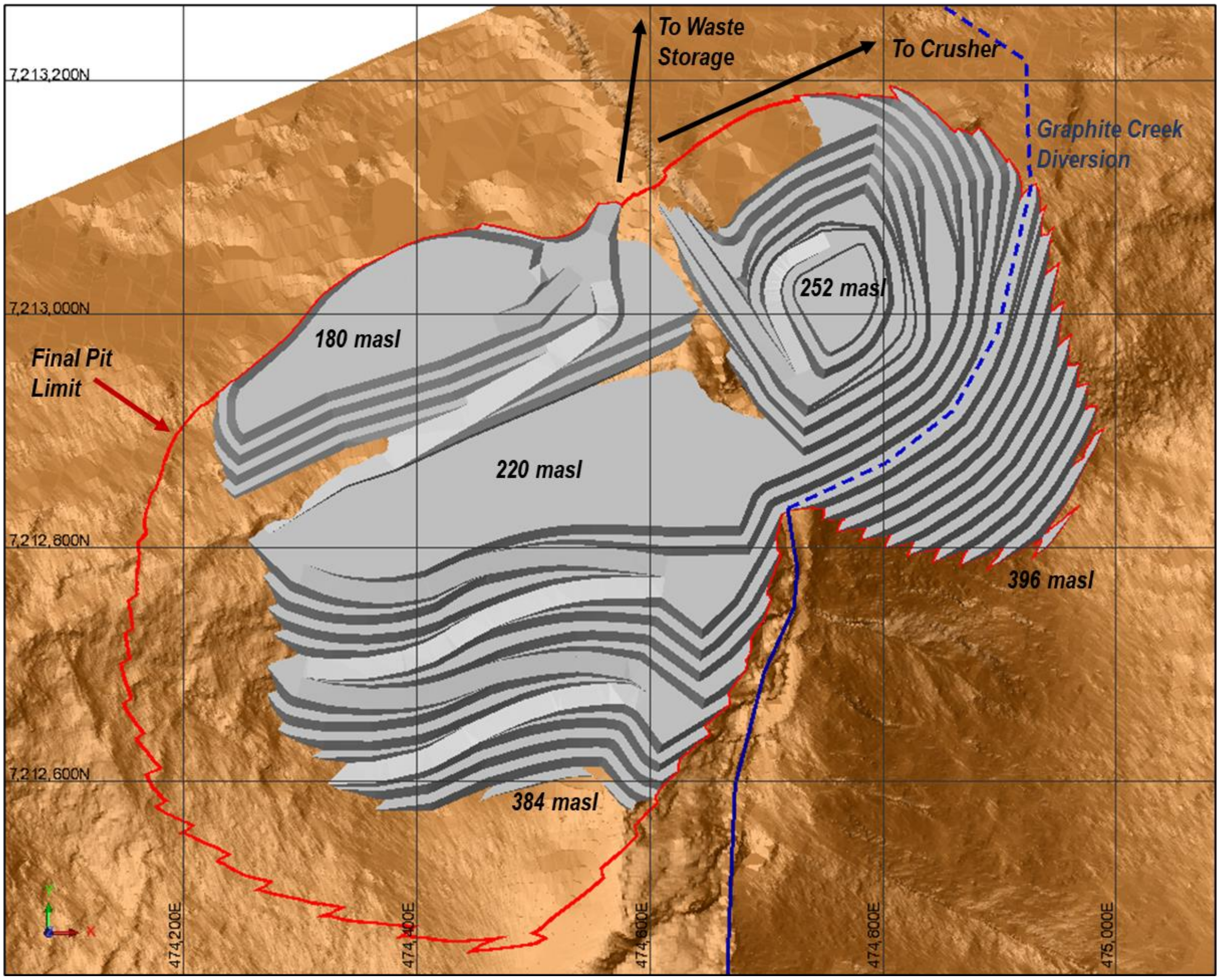


Figure 16-9: Pushback 3 Design

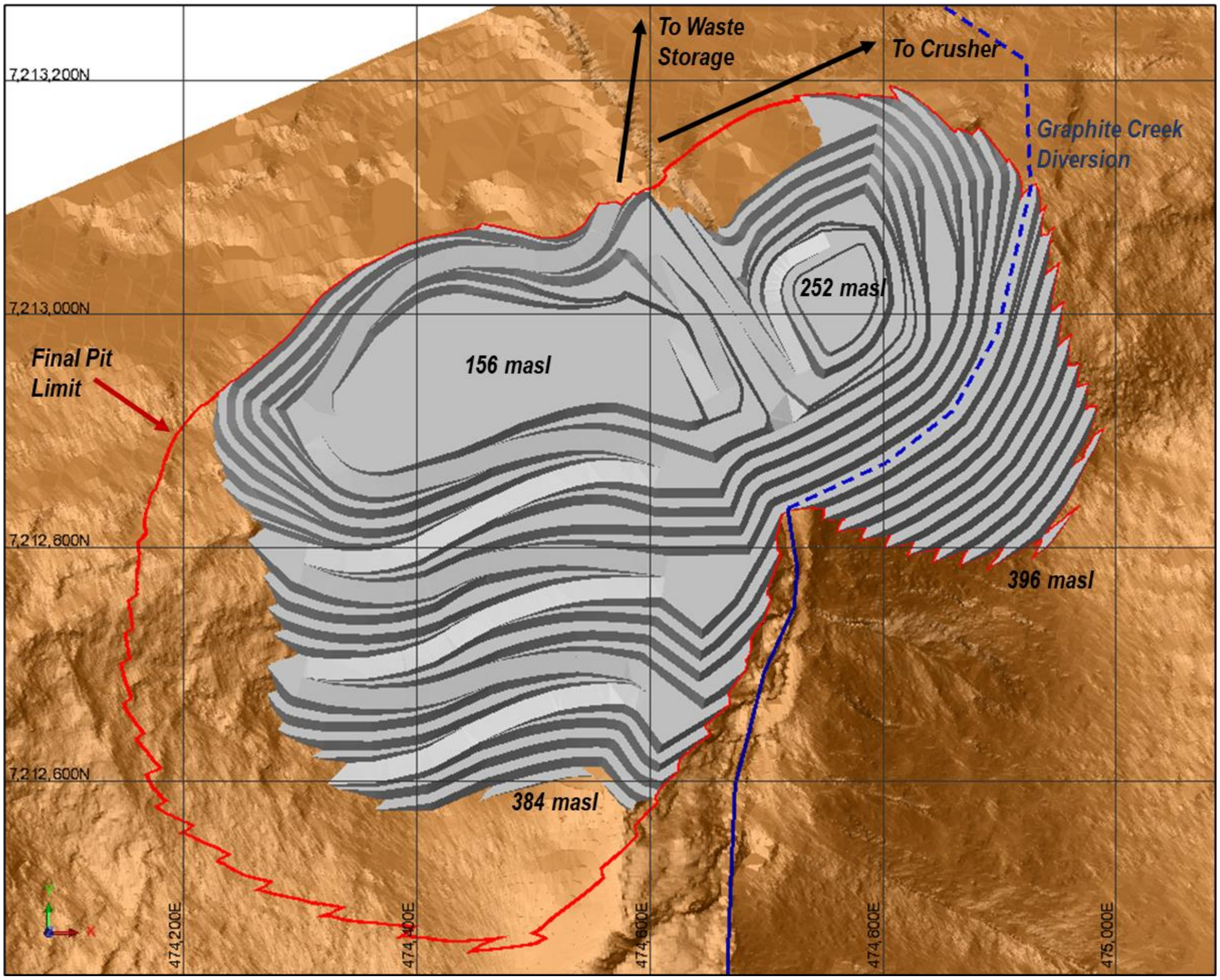


Figure 16-10: Pushback 4 Design

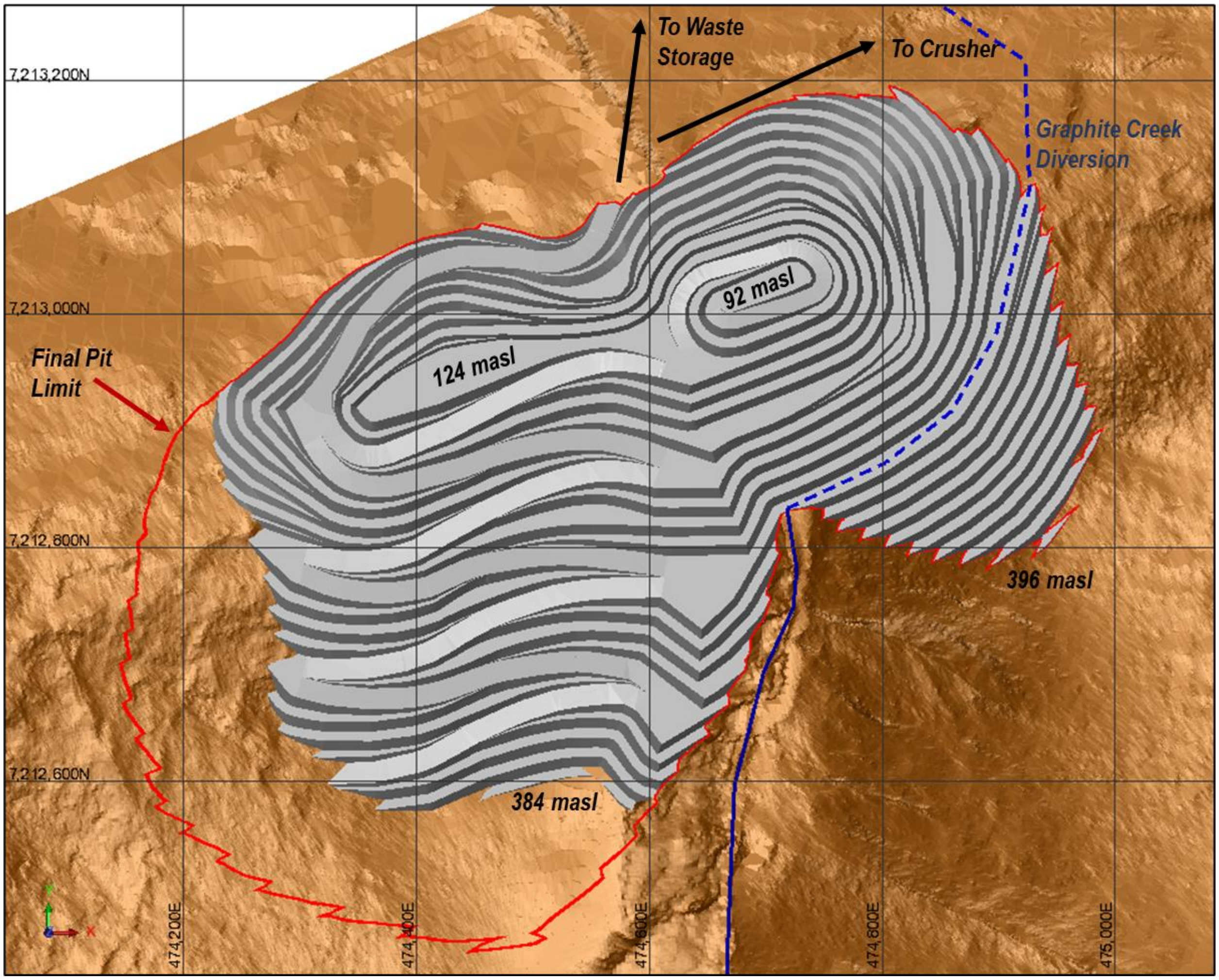
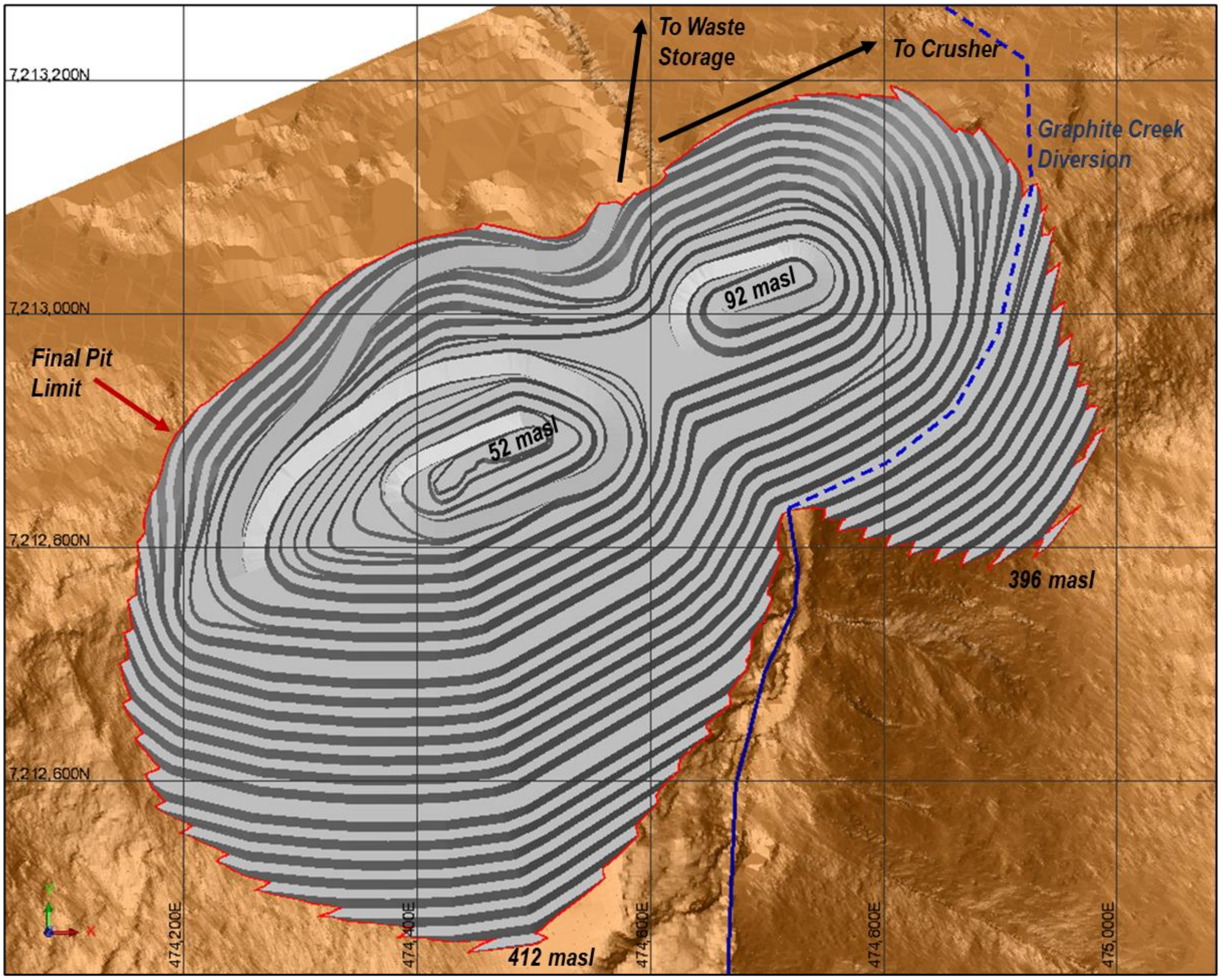
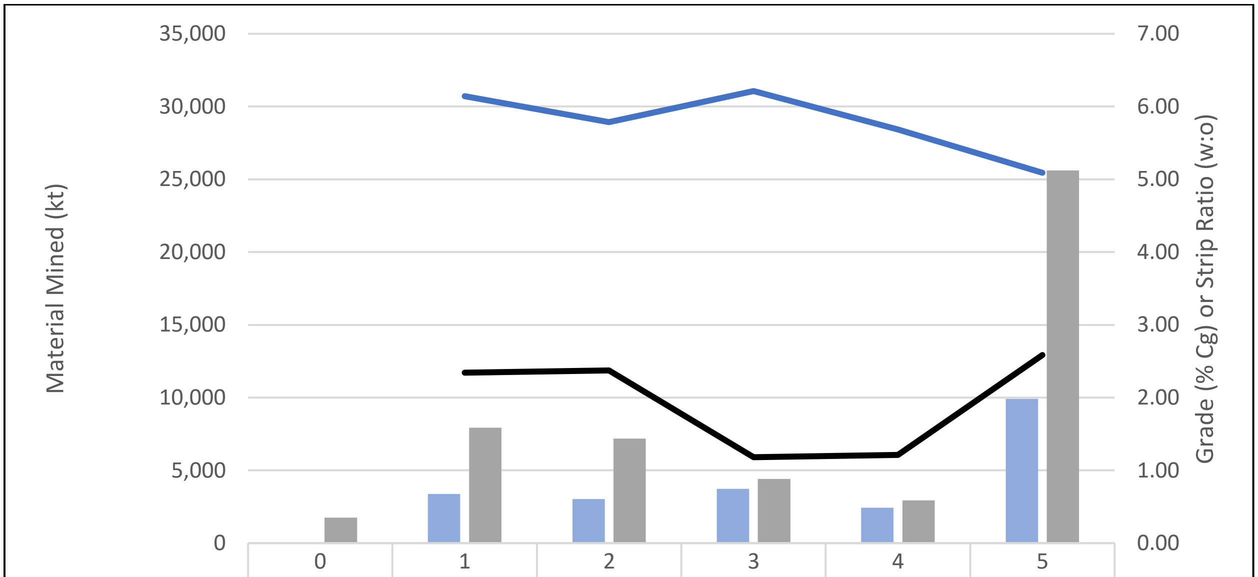


Figure 16-11: Pushback 5 Design



The ultimate pit design contains a total of 22.5 Mt of ore with an average grade of 5.6% Cg and 50 Mt of waste for a strip ratio of 2.2:1 (waste:ore). Figure 16-12 further summarizes the pushback designs, illustrating ore and waste mined tonnages, grade, strip ratio and contained value. The contained value, which drives the optimized mining sequence, is based on the mine design criteria taking into account net commodity prices, operating costs and recoveries. Ore is based on a variable cut-off grade (2% Cg to 3% Cg) as discussed in Section 16.7.

Figure 16-12: Mining Pushback Summary

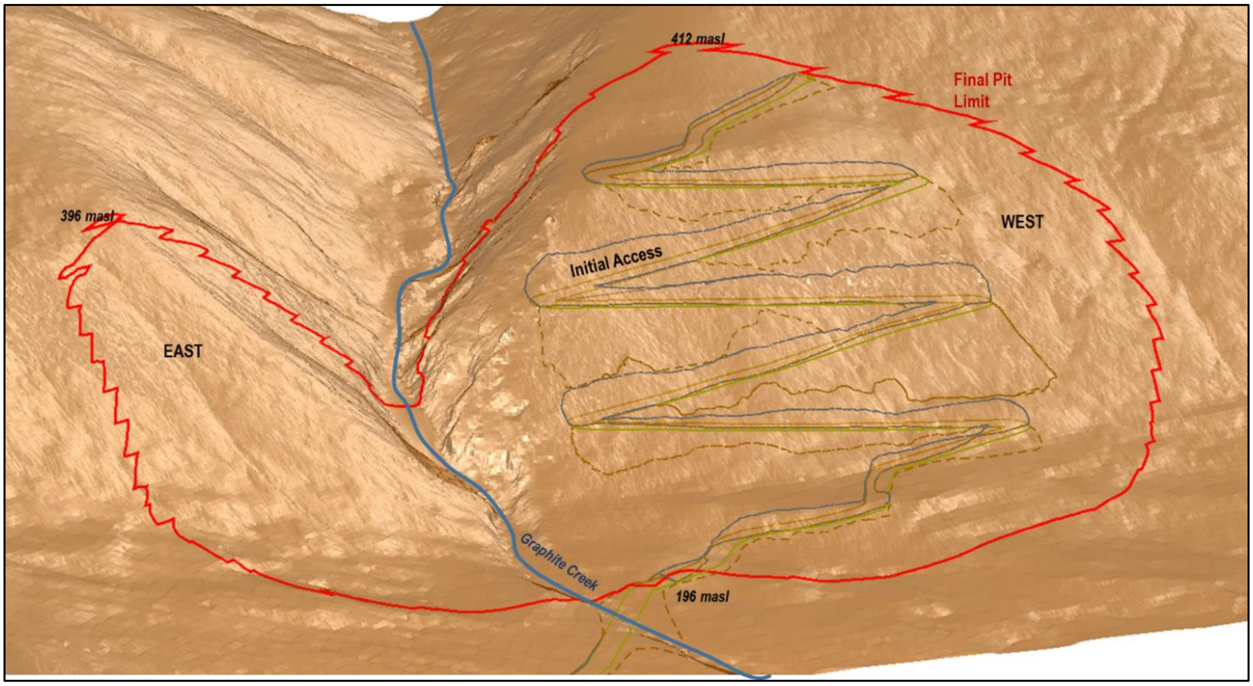


	0	1	2	3	4	5
Ore (kt)		3,386	3,028	3,742	2,429	9,904
Wst (kt)	1,748	7,937	7,181	4,420	2,942	25,606
SR (w:o)		2.34	2.37	1.18	1.21	2.59
Grade (Cg %)		6.14	5.79	6.21	5.68	5.09
Value ($/t)	-$7	$106	$97	$168	$149	$78

16.6.2 Access/Development

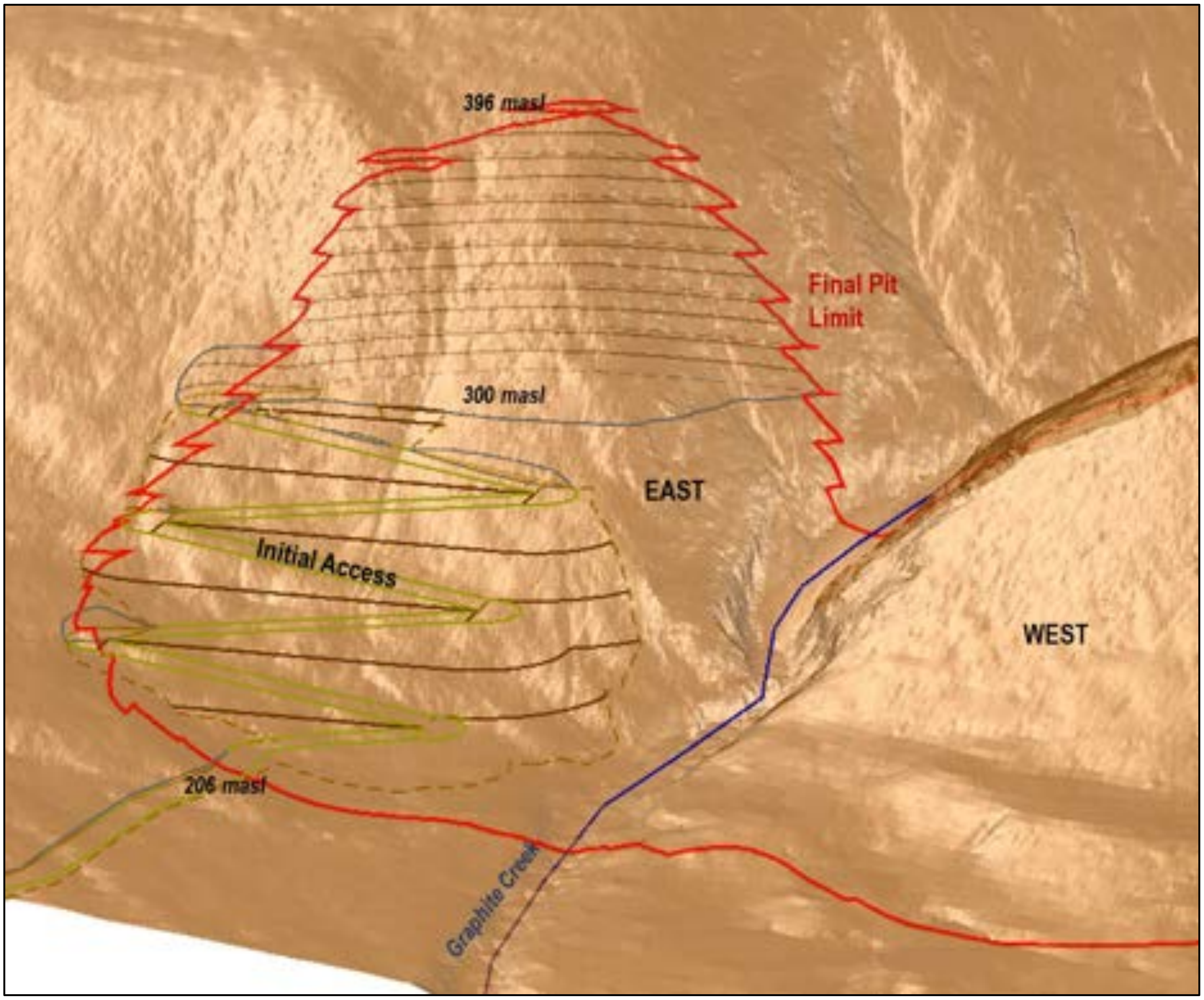
Mining activities are expected to start on the West side of the pit. In order to develop haulage access to the top of the initial phase of the pit, it is estimated that 400 kt of material will require to be mined (cut and fill). The existing mining fleet is well sized for this type of pit development work so no additional equipment will be required. Figure 16-13 illustrates the initial mine access design.

Figure 16-13: Initial Mine Access (Looking South)



Access up to the top of the East side of the pit (Pushback 2) is quite steep and narrow, and so developing a haul road for truck haulage will not be practical. Instead, the upper waste benches (1,000 kt) will be drill and blasted and material will be pushed down the slope down to approximately 312 masl at which point truck haulage can commence. The East haulage access is scheduled to be developed during the second year of production. Figure 16-14 illustrates the initial stages of mining in Pushback 2.

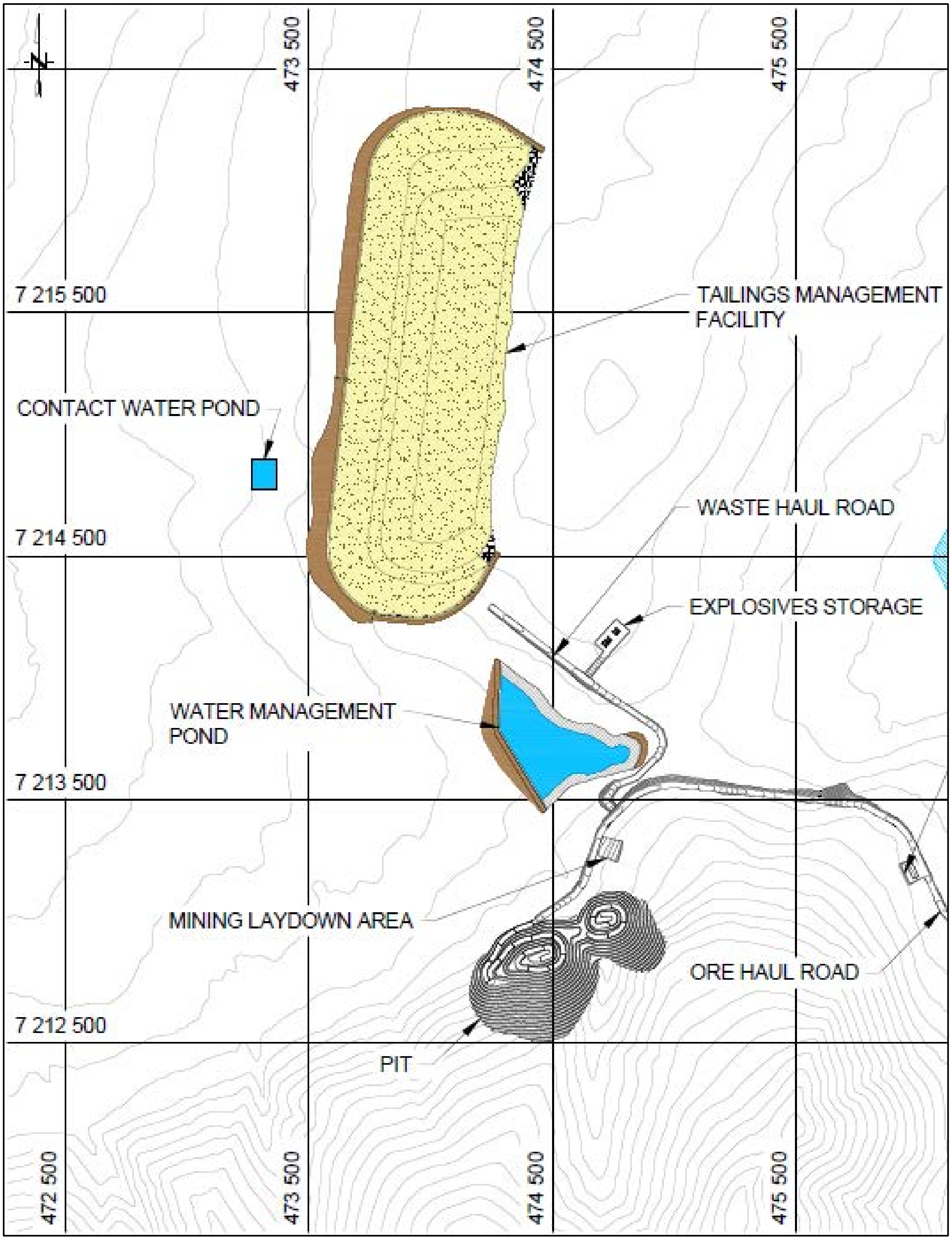
Figure 16-14: Initial Access on the East Side (Looking South- East)



16.6.3 Waste Storage

A total of 50 Mt of waste material will be mined over the mine life. It has been assumed that all non-overburden waste materials will be potentially acid generating (PAG) and will be contained in a common storage facility with the tailings material. The TMF is located approximately 1.5 km North of the pit. Additional details on the design of the TMF can be found in Section 18. The TMF design is shown in Figure 16-15.

Figure 16-15: Tailings and Waste Management Facility



16.7 Mine Production Schedule

The basic criteria used for the development of the life-of-mine (LOM) production schedule are to:

- Ensure a graphite concentrate production of 53,600 dry metric tonnes (dmt) per year;
- Do not exceed a graphite concentrate stockpile of more than 1 year of production; and
- Plan on operating the open pit mine 365 days per year, allowing for 10 non-operating days per year due to weather delays.

The mining sequence focuses on achieving the required concentrated production, mining of higher value material early in the mine life, while balancing grade and strip ratios.

Ore production was determined based on a secondary treatment processing capacity of 53,600 dmt/a. To achieve this, the Mill production was fixed at 1,000 kt/a over the life of mine and the mine cut-off grade was raised to a minimum of 2%. Beyond Year 12, the cut-off grade was raised to 3% mine to ensure the STP remained at full production. Due to these raised cut-off grades, approximately 7.6 Mt of low-grade resources end up being wasted.

The mine will require approximately 1.5 years of pre-production for construction activities, developing the initial pit access and waste stripping to expose ore for the first year of production (570 kt). After the pre-strip period, mining is expected to be able to maintain a relatively constant strip ratio of 3:1 (W:O) for the first 7 years. Stripping requirements will decline after this as the waste haulage distances increase which allow for a relatively smooth equipment requirement profile. The current expected mine life is 23 years.

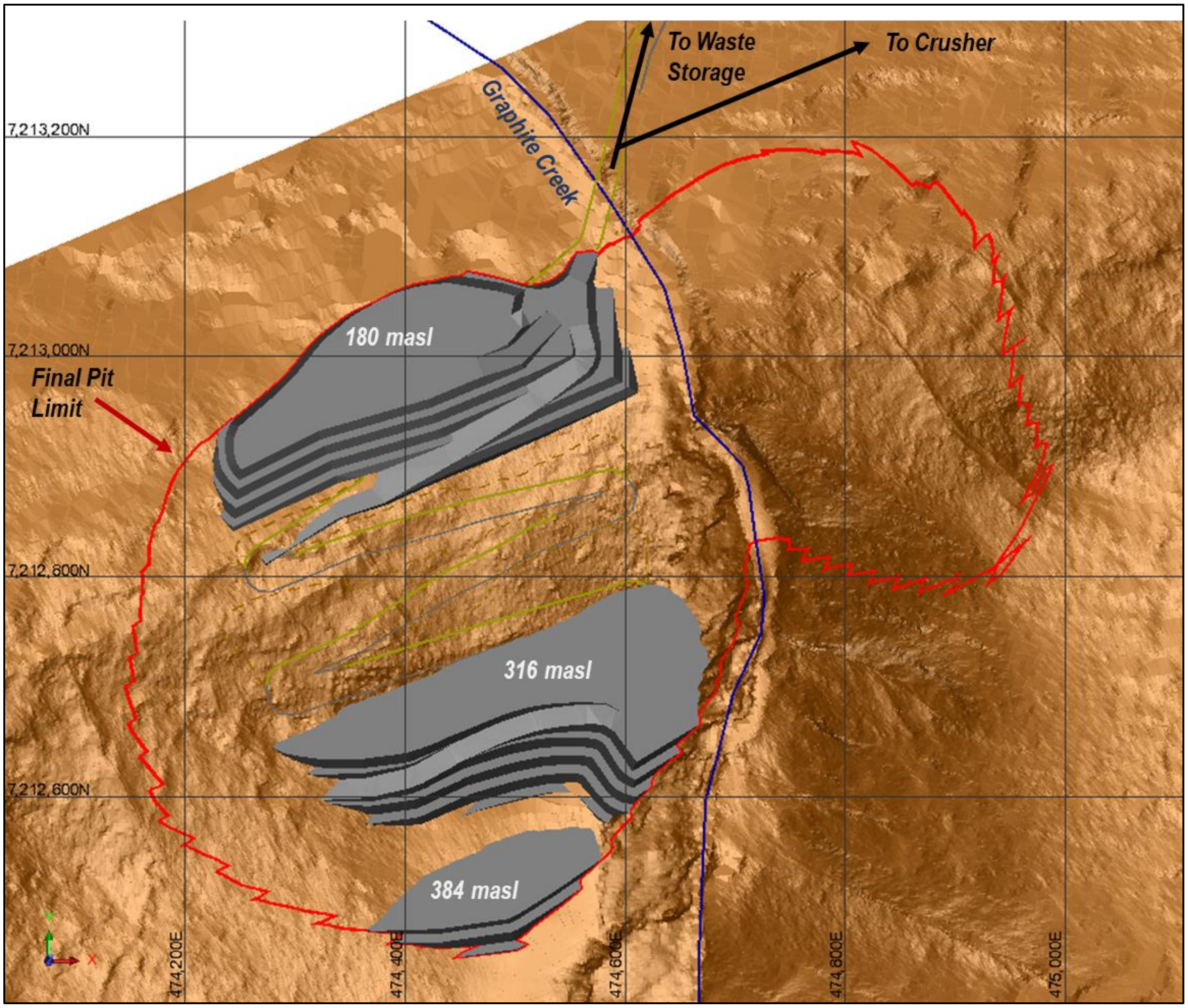
Dilution has been accounted for within the block model through re-blocking of the original resource model. As part of the reserve estimate, ore quantities include a 5% loss to account for various operational inefficiencies. Table 16-2 summarizes the material movement and mill schedule by year over the LOM.

Table 16-2: Annual Mine and Mill Schedule

	Unit	Total	Y-2	Y-1	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23
Mine Production																											
Ore	tonnes	22,489,774	-	9	570,850	950,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	968,914
Cg Grade	Cg %	5.67	-	3.21	4.75	6.19	6.53	6.48	6.01	5.28	5.72	6.02	6.38	6.29	5.90	5.94	5.19	5.32	5.31	5.07	5.18	5.21	4.89	5.07	5.61	5.40	4.54
Cg Contained	Cg t	1,257,898	-	0	27,097	58,834	65,340	64,767	60,089	52,777	57,240	60,185	63,786	62,925	58,981	59,411	51,889	53,241	53,057	50,740	51,755	52,096	48,890	50,695	56,073	54,026	44,002
Waste	tonnes	49,834,896	808,536	3,704,357	3,352,028	2,926,885	2,876,236	2,871,503	2,864,029	2,806,908	2,706,073	2,284,894	2,121,480	2,095,095	2,050,718	1,905,500	1,831,314	1,423,553	1,348,722	1,358,659	1,373,804	1,348,995	1,376,632	1,273,581	1,201,249	1,192,157	731,989
Strip Ratio	w:o	2.2			5.9	3.1	2.9	2.9	2.9	2.8	2.7	2.3	2.1	2.1	2.1	1.9	1.8	1.4	1.3	1.4	1.4	1.3	1.4	1.3	1.2	1.2	0.8
Total Mined	tonnes	72,324,670	808,536	3,704,366	3,922,878	3,876,885	3,876,236	3,871,503	3,864,029	3,806,908	3,706,073	3,284,894	3,121,480	3,095,095	3,050,718	2,905,500	2,831,314	2,423,553	2,348,722	2,358,659	2,373,804	2,348,995	2,376,632	2,273,581	2,201,249	2,192,157	1,700,903
Mining Rate	t/d	8,088	1,108	10,149	10,748	10,622	10,620	10,607	10,586	10,430	10,154	9,000	8,552	8,480	8,358	7,960	7,757	6,640	6,435	6,462	6,504	6,436	6,511	6,229	6,031	6,006	4,660
Mill & Concentrate Production																											
Total Feed	tonnes	22,489,774			570,860	950,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	968,914
	Cg %	5.67			4.75	6.19	6.53	6.48	6.01	5.28	5.72	6.02	6.38	6.29	5.90	5.94	5.19	5.32	5.31	5.07	5.18	5.21	4.89	5.07	5.61	5.40	4.54
	Cg tonnes	1,257,898			27,097	58,834	65,340	64,767	60,089	52,777	57,240	60,185	63,786	62,925	58,981	59,411	51,889	53,241	53,057	50,740	51,755	52,096	48,890	50,695	56,073	54,026	44,002
Cg Recovered	tonnes Cg	1,132,108			24,387	52,950	58,806	58,290	54,080	47,499	51,516	54,167	57,408	56,632	53,083	53,470	46,700	47,917	47,752	45,666	46,580	46,887	44,001	45,626	50,466	48,624	39,602
Concentrate Produced	dmt	1,191,692			25,671	55,737	61,901	61,358	56,927	49,999	54,228	57,018	60,429	59,613	55,877	56,284	49,158	50,439	50,265	48,070	49,031	49,354	46,317	48,027	53,122	51,183	41,686
Concentrate Shipped	dmt	1,191,692			25,671	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	53,571	52,916	41,686
Concentrate Stockpiled	dmt				-	2,166	10,496	18,283	21,639	18,067	18,724	22,170	29,028	35,070	37,376	40,090	35,676	32,544	29,238	23,737	19,197	14,980	7,726	2,182	1,733	-	-

Pre-production activities will focus on creating access to ore and providing fill materials for construction activities. During the 1.5 years of pre-production, approximately 4.5 Mt of waste will be mined, most of which is overburden materials which will used to build the TMF containment. The initial ore material is located part-way up the West side of the pit. The mine status at the end of pre-production is shown in Figure 16-16.

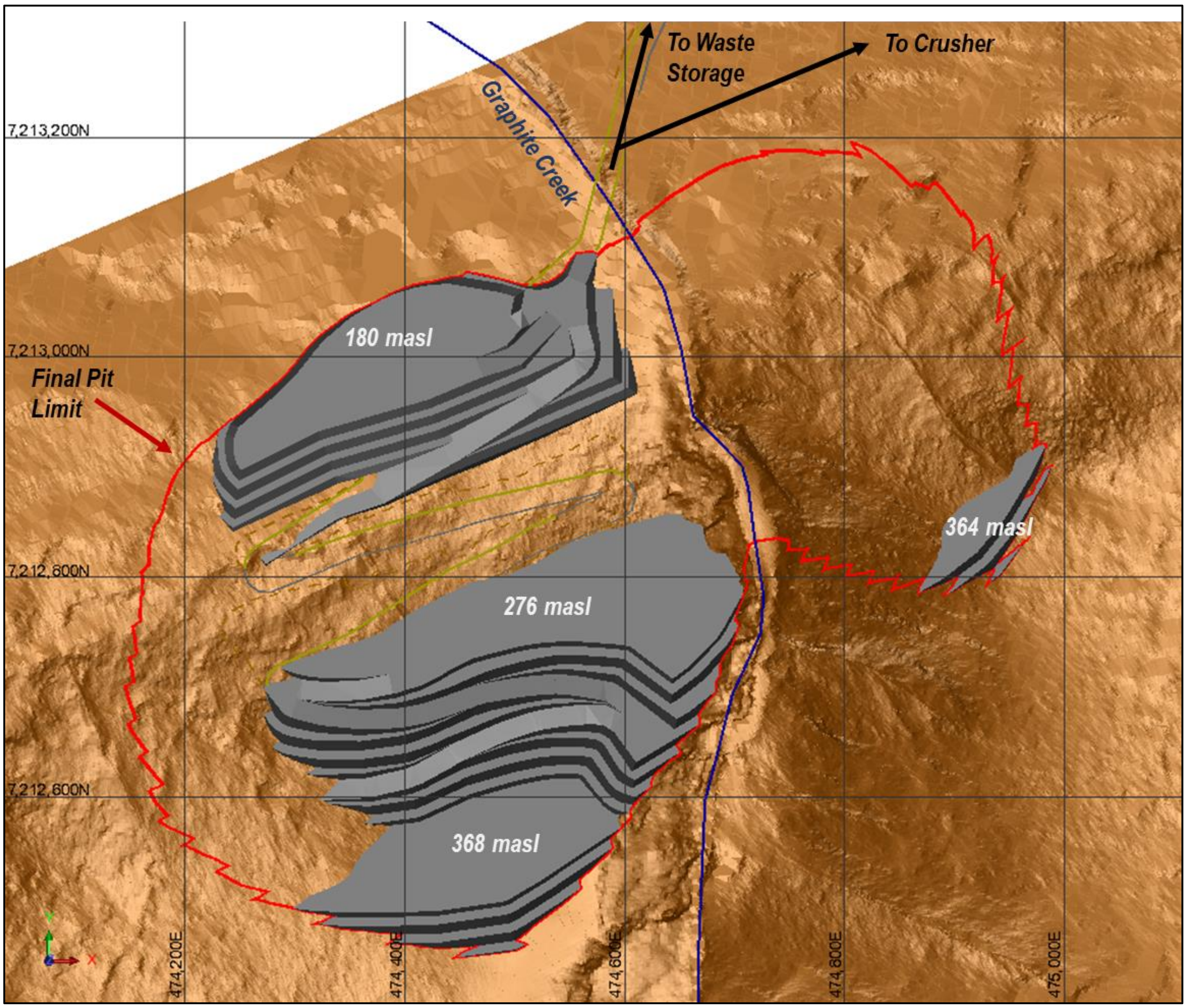
Figure 16-16: Mine Status at End of Pre-production



Year 1 of mine operations will start feeding ore to the Mill. A total of 570 kt of ore and 3.9 Mt of waste will be mined (10,700 t/d). Mining in Pushbacks 2 and 5 is all waste and needed to help smooth future equipment requirements. Due to the steep terrain on the East side of the pit, the material at the top of Pushback 2 will be pushed down the slope to the North with dozers to develop a fill road for future haul truck access. The mine status at the end of Year 1 is shown in Figure 16-17.

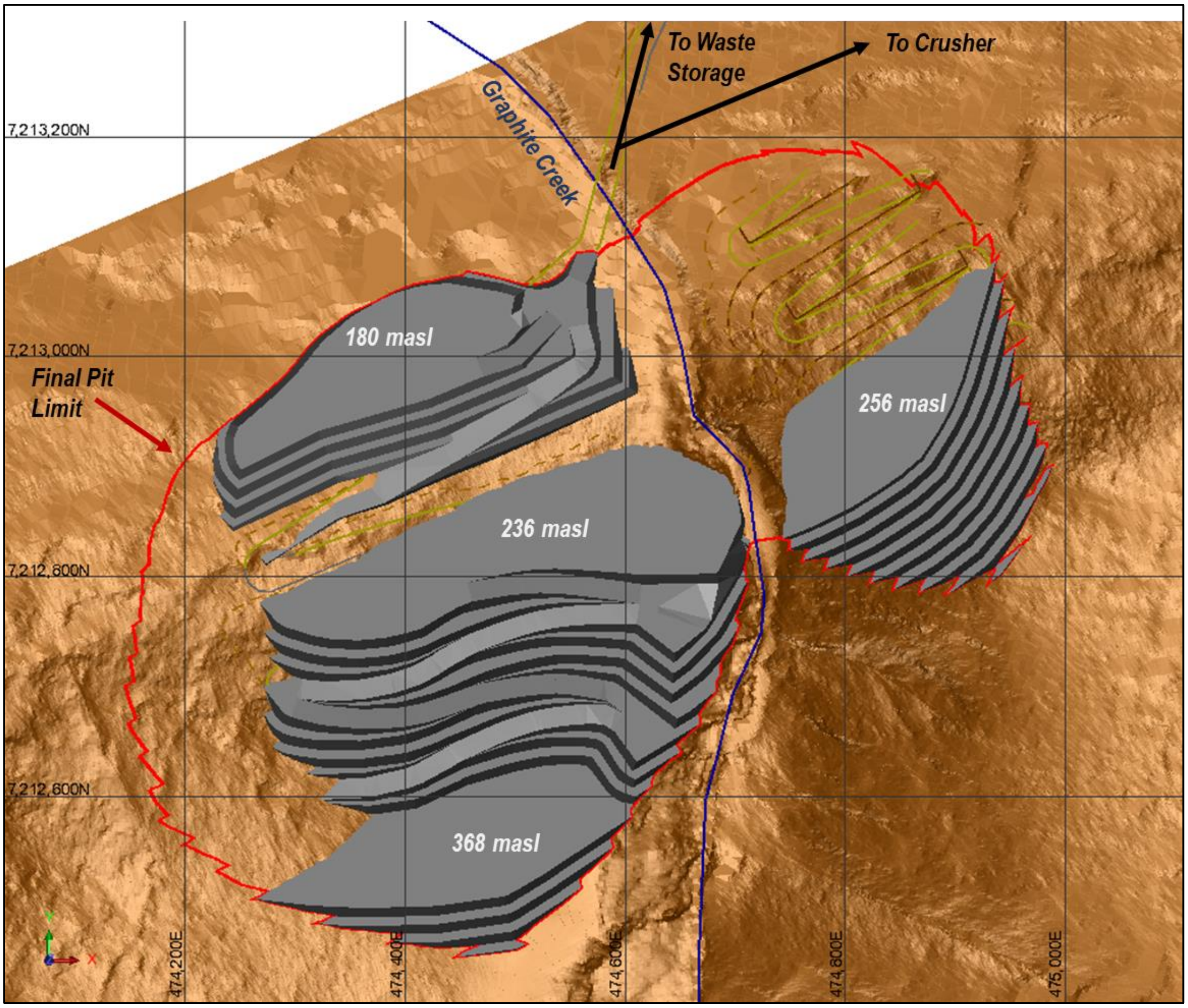
Year 1 of mine operations will start feeding ore to the Mill. A total of 570 kt of ore and 3.9 Mt of waste will be mined (10,700 t/d). Mining in Pushbacks 2 and 5 is all waste and needed to help smooth future equipment requirements. Due to the steep terrain on the East side of the pit, the material at the top of Pushback 2 will be pushed down the slope to the North with dozers to develop a fill road for future haul truck access. The mine status at the end of Year 1 is shown in Figure 16-17.

Figure 16-17: Mine Status at End of Year 1



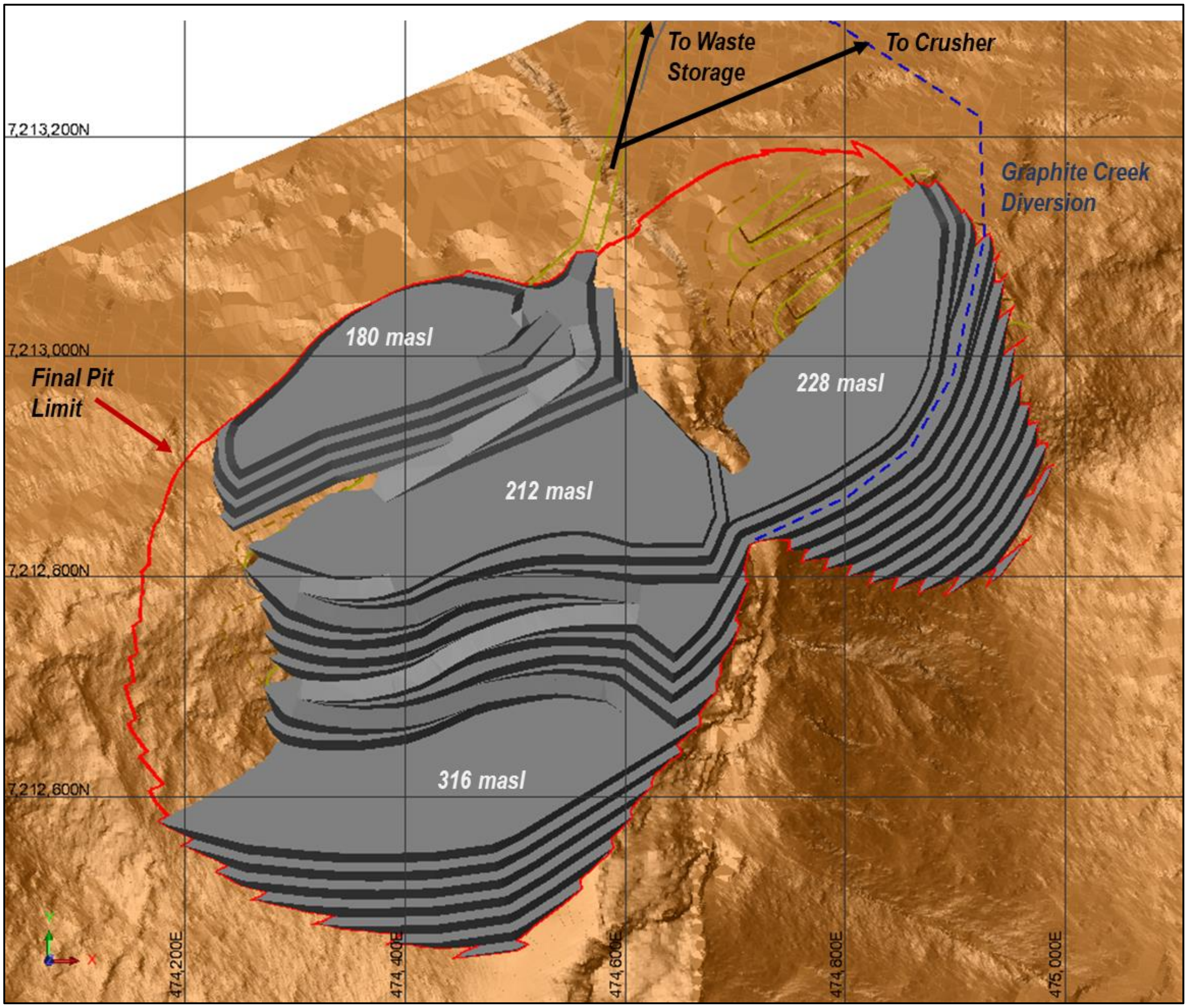
In Year 2 to 3 of operations, the mill is now running at full capacity (1.0 Mt/a) and the total mine production rate remains around 10,600 t/d. Mining activities continue in Pushbacks 1 and 2 on both sides of Graphite Creek. The fill access road on the East side was completed by the end of Year 2, allowing for truck access. By the end of Year 3, the East side is now at the point where the Graphite creek diversion can be constructed which will then allow the creek area running through the pit to be mined out. The mine status at the end of Year 3 is shown in Figure 16-18.

Figure 16-18: Mine Status at End of Year 3



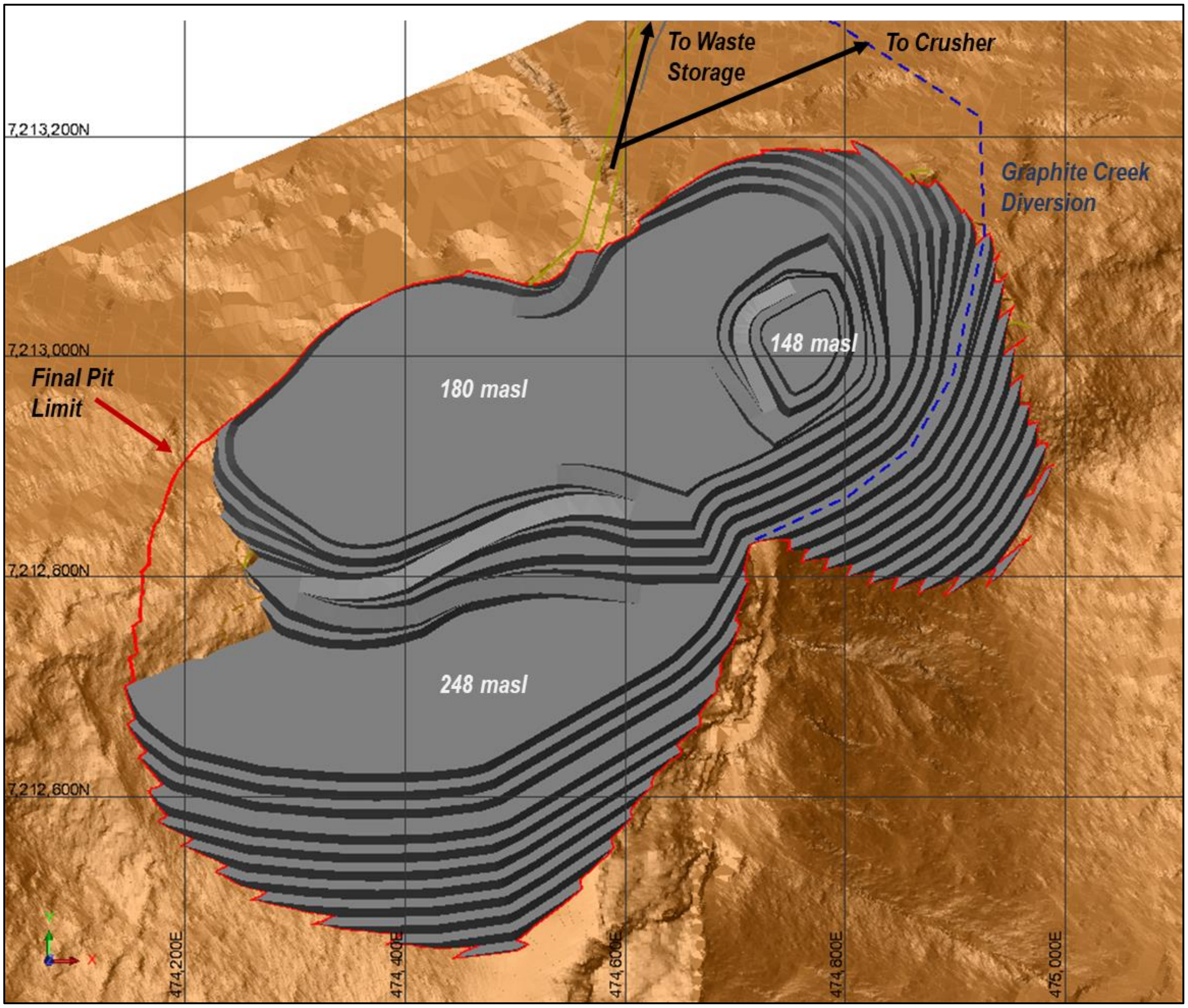
The Graphite Creek diversion is installed early in Year 4 along the 256 masl berm. For Years 4 and 5, Mining activities continue on both sides of the pit and the total mine production rate remains around 10,600 t/d. The mine status at the end of Year 5 is shown in Figure 16-19.

Figure 16-19: Mine Status at End of Year 5



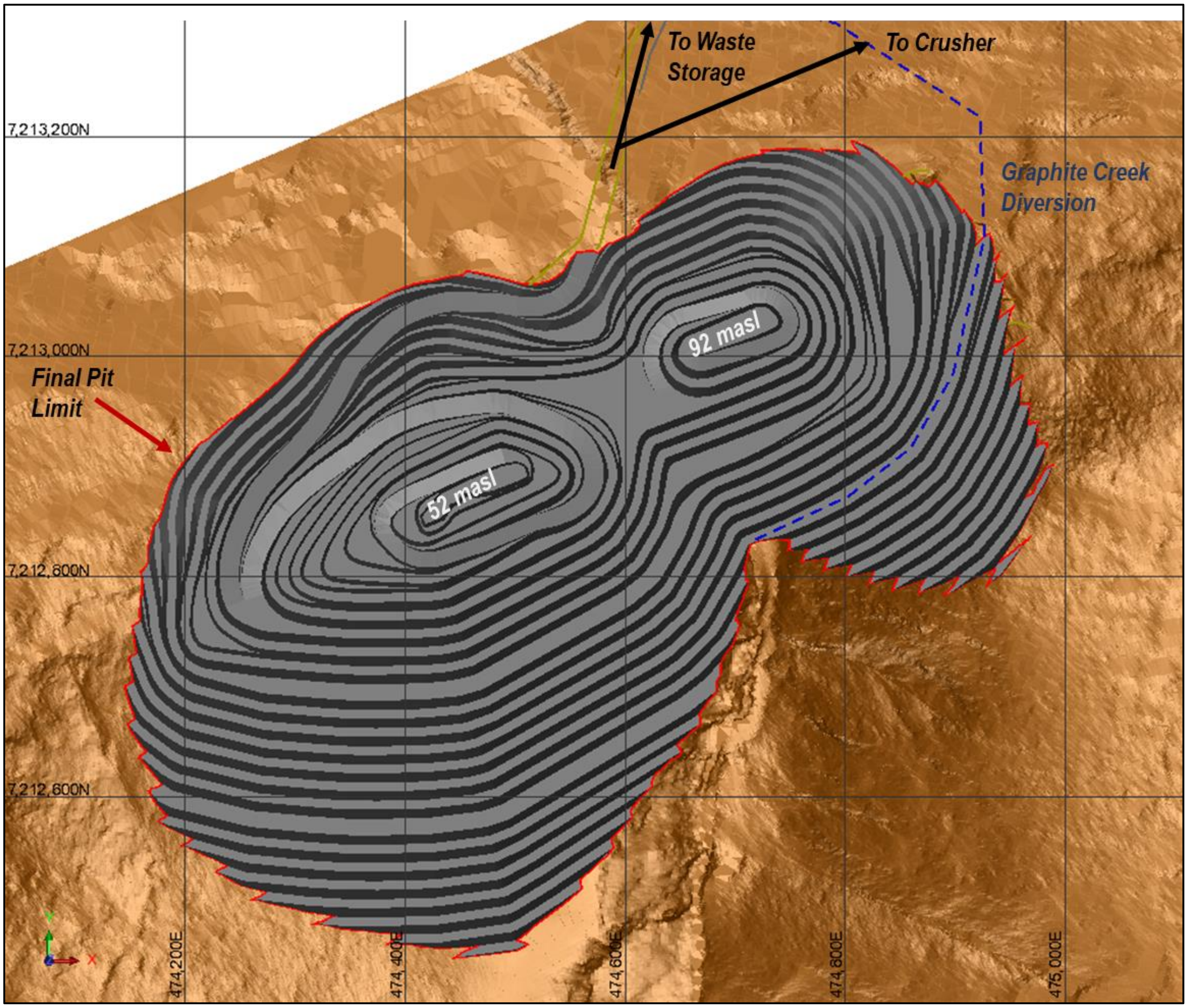
During Years 6 to 10, the total mine production rates slowly start to reduce (from 10,600 t/d to 8,500 t/d) as much of the waste stripping has been completed. The interior part of Graphite Creek is now mined out and the two sides of the pit are fully connected. The mine status at the end of Year 10 is shown in Figure 16-20.

Figure 16-20: Mine Status at End of Year 10



During the last half of the mine life from Year 11 to 23 the pit is mined to final limits as shown in Figure 16-21. Total mine production rates slowly reduce to 6,500 t/d.

Figure 16-21: Mine Status and End of Mine Life (Year 23)



16.8 Mine Operations

The open pit mining activities are assumed to be undertaken by the owner with conventional drill, blast, load and haul activities. The mining fleet will consist of 7 m^3 front-end loaders (FEL), 55 t haul trucks and 114 mm diameter drills. Given the overall scale of operations and equipment requirements, the fleet will be all diesel-powered.

The open pits are designed with 8 m benches in both waste and ore with adequate phase geometry to achieve a maximum production rate of 3.9 Mt/year (11 kt/d). Mining is scheduled to advance sequentially through the pit pushbacks, typically with 2 Pushback mining areas active at any given time providing options for ore and waste headings. Given the required production rates and pit geometries, vertical advance rates are typically only 2 benches per year, with the exception of the initial development of pushbacks 1 and 2 where the vertical advance rate reach a maximum of 10 benches per year.

16.8.1 Drilling

Production drilling will be with a 114 mm diameter drill on 8 m benches. Final walls will double-benched to a height of 16 m and will be pre-sheared. Drilling productivity for each material type is shown in Table 16-3 below.

Table 16-3: Drilling Productivity

Parameter	Unit	Ore	Wst-Rock	Wst-Ovb	Wall Control
Hole Diameter	mm	114	114	114	76
Material UCS	Mpa	100.0	120.0	50.0	120.0
RPM	RPM	86	81	103	81
Pen. Rate	m / hr	33.4	29.0	42.6	29.0
Hole Length	m	9.20	9.05	9.35	16.00
Drilling Time per Hole	min / hl	16.5	18.7	13.2	33.1
Non-Drilling Time per Hole	min / hl	5.8	5.8	5.8	8.0
Total Time per Hole	min / hl	22.3	24.5	18.9	41.1
Drilling Productivity	**m / NOH**	**24.8**	**22.2**	**29.6**	**23.3**

16.8.2 Blasting

Blasting will be done primarily using a blend of ANFO and emulsion explosives. The production and delivery of the explosive blend will be by a contractor, while the loading of the holes and blasting will be done by the owner. It is common for material in permafrost to require a 10% higher powder factor than non-frozen materials. The blasting patterns and powder factors for each material are shown in Table 16-4 below.

Table 16-4: Blasting Patterns and Powder Factors

Parameter	Unit	Ore	Wst-Rock	Wst-Ovb	Wall Control
Bench Height	m	8.0	8.0	8.0	16.0
Sub Drill	m	1.2	1.1	1.4	0
Hole Length	m	9.2	9.1	9.4	16

Parameter	Unit	Ore	Wst-Rock	Wst-Ovb	Wall Control
Hole Diameter	mm	114	114	114	114
Burden	m	4.00	3.50	4.50	2.00
Spacing	m	4.80	4.20	5.40	1.40
Powder/hole	kg	85.1	83.2	88.8	30.7
Powder Factor	kg / m^3	0.55	0.70	0.46	0.70

16.8.3 Loading

7 m^3 front-end loaders will be the primary loading equipment which will offer flexibility in moving between active mining areas. The loading equipment is able to effectively load trucks with payloads of 55 t and can mine either the full bench height (8 m) or mine in smaller flitches (4 m) when greater selectivity is required. The number of passes and fill factors are summarized in Table 16-5. In addition to the loading time, the loading unit productivities include waiting, maneuver and unproductive time estimates.

Table 16-5: Loading Parameters

Parameter	Unit	FEL
Dry density (in situ)	t/m^3	2.73
Material swell factor	%	30
Production Delays	min/op hr	10
Bucket Size	m^3	7.0
Bucket Fill Factor	%	95
Size of truck to load	t	55
Avg. buckets to load	#	4
Avg. bucket cycle time	sec	60
Avg. spot time	sec	30
Total time to load	**Minutes/Load**	**4.5**

16.8.4 Hauling

A fleet of 55 t trucks will be used for ore and waste haulage. Haulage profiles were created for several benches of each mining pushback to each potential destination. The haul profiles were run through simulation software to estimate individual cycle times for each bench in each mining pushback. The simulation software adjusts the speed of the truck based on the truck rim pull curve and safe downhill speeds. Manual inputs were made to each haul profile to account for locations where the trucks would slow-down or stop such as switch-backs and intersections.

Table 16-6 summarizes the haul cycle parameters used in calculating truck productivities. Truck performance was calculated for every loading unit and period of the mine plan. It reflects travel time and other fixed times of the load / haul / dump cycle.

Table 16-6: Haulage Cycle Parameters

Parameter	Unit	Value
Rated payload	tonnes	55.0
Travel time (loaded/empty)	minutes/load	simulated
Maximum Speed	km/h	50
Dump time at crusher / stockpile	minutes/load	1.5
Dump time at waste dump	minutes/load	1.0
Production inefficiencies (non-hauling)	% of Net operating hour	10

16.8.5 Support

The support and auxiliary equipment selection was made considering the size and type of the primary loading and hauling fleet, the geometries of the various open pits, and the number of roads and waste material destinations that would be in operation at any given time.

The following items were also included in the list of owner's support equipment:

- Track dozers, primarily used for maintenance of waste storage locations, road construction, stockpile maintenance, highwall cleaning and other activities as needed;
- Graders to be used primarily for road maintenance and pit and dump floor maintenance, road construction;
- Fuel trucks for the supply of diesel fuel to all the hydraulic diesel excavators, dozers;
- Low-boy transporter trailer for transportation of dozers, drills, small backhoe and major equipment components;
- Skid Steer for stemming loading;
- Water truck for dust suppression;
- Light vehicles for supervisors/technical personnel; and
- Mobile lights for lighting of pits, waste dumps and construction areas.

16.9 Mine Equipment

Based on the productivity parameters discussed in Section 16.7, operating hours for the various equipment were estimated accounting for the amount of material that is planned to be moved within a specified period. The fleet size was then calculated using total operating hours for the period and the maximum available operating hours per unit within the period. The assumptions of mechanical availability, and overall utilization of the different equipment types are listed in Table 16-7.

Table 16-7: Equipment Utilization Assumptions

Parameter	Units	Drills	FEL	Trucks	Support
Non-Operating Days	days / year	30	10	10	10
Use of Availability	%	92%	97%	97%	97%
Availability (Initial)	%	85%	85%	88%	75%
Availability (Y5-LOM)	%	75%	80%	82%	65%
Operating Delays per Day	hrs / day	3.5	3.8	4.4	4.4
Operating Hours per Day	hrs / day	20.5	20.2	19.6	19.6
Operating Efficiency	%	85%	84%	82%	82%
Overall Utilization	%	58%	67%	66%	53%

A summary of the main open pit fleet requirements is shown in Table 16-8. The fleet reaches its full size by Year 1 and remains relatively constant for 7 years and then decreases slightly for the remaining LOM. Equipment suppliers provided estimates for equipment life and given the 23-year mine life, replacements for all equipment will be necessary and the costs for these are carried under sustaining capital.

Table 16-8: Main Mining Equipment Fleet (average number of units)

Mining Equipment	Year -2	Year -1	Year 1-7	Year 8-LOM
114 mm Drill	1	1	1	1
7 m^3 Front-End Loader	1	2	2	2
55 t Truck	3	6	7	5
310 hp Track Dozer	2	2	2	2
4.3 m Grader	1	1	1	1

16.10 Mine Personnel

The work schedule assumes a 24-hour/day, 7-days/week and 365-days/year mining operation. Operations and maintenance personnel who support the 24-hour operation will work two 12-hour shifts per day. The roster for this group will rotate with 4 operating shifts. Due to the remote location, Technical Services and Management will also follow the same shift rotation as the production crews.

Equipment operator labour requirements are based on the number of equipment units, operating requirements and shift rotations. Maintenance labour requirements are based on the number of equipment units to be maintained, estimates of mechanical availability, and estimates on the ratio of maintenance labour requirements to the number of units for each open pit fleet type.

The mine operations department will be responsible for the mining operation, including drilling, blasting, loading, and hauling of ore and waste, spreading of waste materials at the TMF, haul road construction and maintenance, and mine dewatering. Each crew will be led by a mine shift foreman. The delivery of explosives to the blast holes will be done by a contractor.

Annual personnel requirements (all crews) excluding contractors are summarized in Table 16-9. Mining personnel includes mine supervision, mine operations, mine maintenance and technical services. Personnel requirements peak around 145 people during the first year of production and remains relatively constant for 7 years and then decreases slightly for the remainder of the LOM.

Table 16-9: Mining Personnel Requirements

Area	Year -2	Year -1	Year 1-7	Year 8-LOM
Mine General	4	8	7	7
Mine Operations	14	46	49	41
Mine Maintenance	11	38	40	36
Technical Services	4	12	12	12
Total (all crews)	**33**	**104**	**108**	**96**

17 PROCESS DESCRIPTION / RECOVERY METHODS

17.1 Primary Processing (Alaska)

17.1.1 Overall Process Design

Graphite Creek process design was based on the metallurgical testwork described in Section 13 above. The primary objective of the metallurgical testing was to develop a flowsheet that would produce a flotation concentrate grading of at least 95% C(t) with minimal flake degradation and maximum graphite recovery using conventional unit operations.

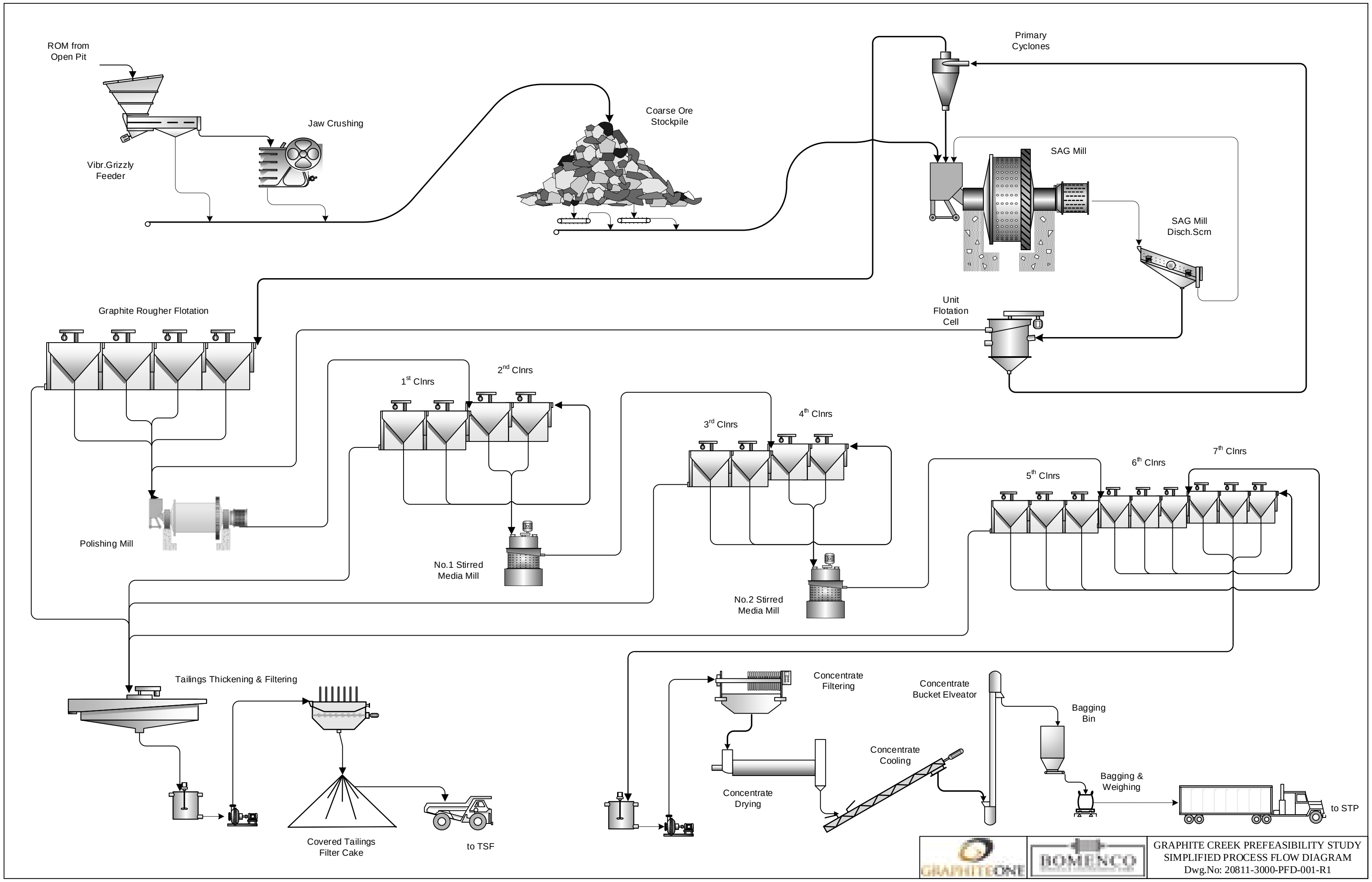
Plant design capacity is based on processing 1,000,000 tonnes per year (t/a) or 2,740 t/d of ROM material containing 6.18% Cg. An operating schedule of 365 days per year, 2 x 12 hour shifts per day was assumed for the grinding circuit and downstream operations. Crushing plant operation is based on 1 x 12-hour shift per day

Plant design consists of the following major processing steps:

The comminution circuit comprises single-stage crushing, coarse ore stockpiling and SAG milling in closed circuit with cyclones targeting 80% passing 320 µm grind. The grinding circuit will include a flash flotation step while the comminution circuit product will proceed to rougher flotation. Rougher and flash flotation concentrates will be combined for open circuit polishing grind and the subsequent seven stages of cleaning with stirred media milling after the second and fourth cleaner stages. The graphite concentrate will be dewatered with a filter press followed by drying through a diesel-fired indirect dryer before cooling and packing in 1 t bulk bags before shipment. Overall plant tailings will be dewatered with a thickener and disc filter to produce sufficiently dry filter cake before haulage for storage to a surface Dry Stack Tailings Storage Facility.

A simplified overall process flow diagram is shown as Figure 17-1.

Figure 17-1: Simplified Process Flow Diagram



Source: Bomenco (2022)

17.1.2 Plant Design Criteria

Key process design criteria for the process plant are listed in Table 17-1.

Table 17-1: Key Process Design Criteria

Design Parameter	Units	Value
Plant Throughput	t/a	900,000
Plant Throughput (nominal)	t/d	2,466
Carbon Head Grade	%	6.18
Crushing Plant Operating Availability	%	75
Mill Operating Availability	%	92
Bond Rod Mill Index (RWI)	kWh/t	10.4
Bond Ball Mill Index (BWI)	kWh/t	13.3
Abrasion Index (AI)	g/t	0.271
ROM Material Specific Gravity	t/m^3	2.74
Concentrate Grade	% C_t	95.0
Carbon Recovery	%	91.5
ROM F_{100}	mm	750
Grinding Product Size, P_{80}	µm	320
Concentrate Filter Stock Tank capacity	h	16
Tailings Filter Stock Tank capacity	h	12
Dried Concentrate moisture content	%	3
Filtered tailings moisture content	%	16

Source: Bomenco (2022)

Plant major equipment is summarized in Table 17-2.

Table 17-2: Summary of Major Equipment

Description	Specification
Vibrating Grizzly Feeder	52' X 20' L
Primary Jaw Crusher	920 x 1200 mm; 250 HP
Primary Cyclones	2 x 570 mm dia
Sag Mill	20' x 10'L; 1,500 hp

Description	Specification
Flotation Unit Cell (Flash Flotation)	23 m^3
ROUGHER FLOTATION Cells 1to 5	10 m^3 each
#1 Polishing Mill	3.7 m x 8 m L
1ST CLEANER FLOTATION Cells 1-2	3 m^3 each
2ND CLEANER FLOTATION Cells 1-2	3 m^3 each
#1 Stirred Media Mill	1,475 hp
3RD CLEANER FLOTATION Cells 1-2	3 m^3 each
4TH CLEANER FLOTATION Cells 1-2	3 m^3 each
#2 Stirred Media Mill	1,000 hp
5TH CLEANER FLOTATION Cells 1-3	3 m^3 each
6TH CLEANER FLOTATION Cells 1-3	3 m^3 each
7TH CLEANER FLOTATION Cells 1-3	3 m^3 each
Concentrate Filter Press	1.5 m x 1.5 m x 34; 128 m^2
Tailings Thickener	17 m dia HRT
TAILINGS DISC Filters 1-2	2.7 m dia. x 12 Disks-each
Concentrate Dryer	TBD

Source: Bomenco (2022)

17.1.3 Process Plant Description

The run of mine (ROM) material will be fed to the processing plant with 75 t mine trucks. A 5,360 t emergency ROM stockpile will be maintained near the crusher station to mitigate interruptions in ROM material deliveries from the mine.

The crushing circuit is designed for a nominal 2,465 t/d feed rate, 1x12-hour shift per day, with 75% availability. The crusher rate will be 223 t/h nominal and 297.8 t/h design. The beneficiation plant is designed to run 365 days per year with 92% operating availability. The ROM material was estimated to have an SG of 2.74 t/m^3 and is projected to contain an average of 4% moisture.

The plant is designed to produce a 95% C(t) graphite concentrate, from an average ROM feed grade of 6.18% C(g) for years 1 – 8.

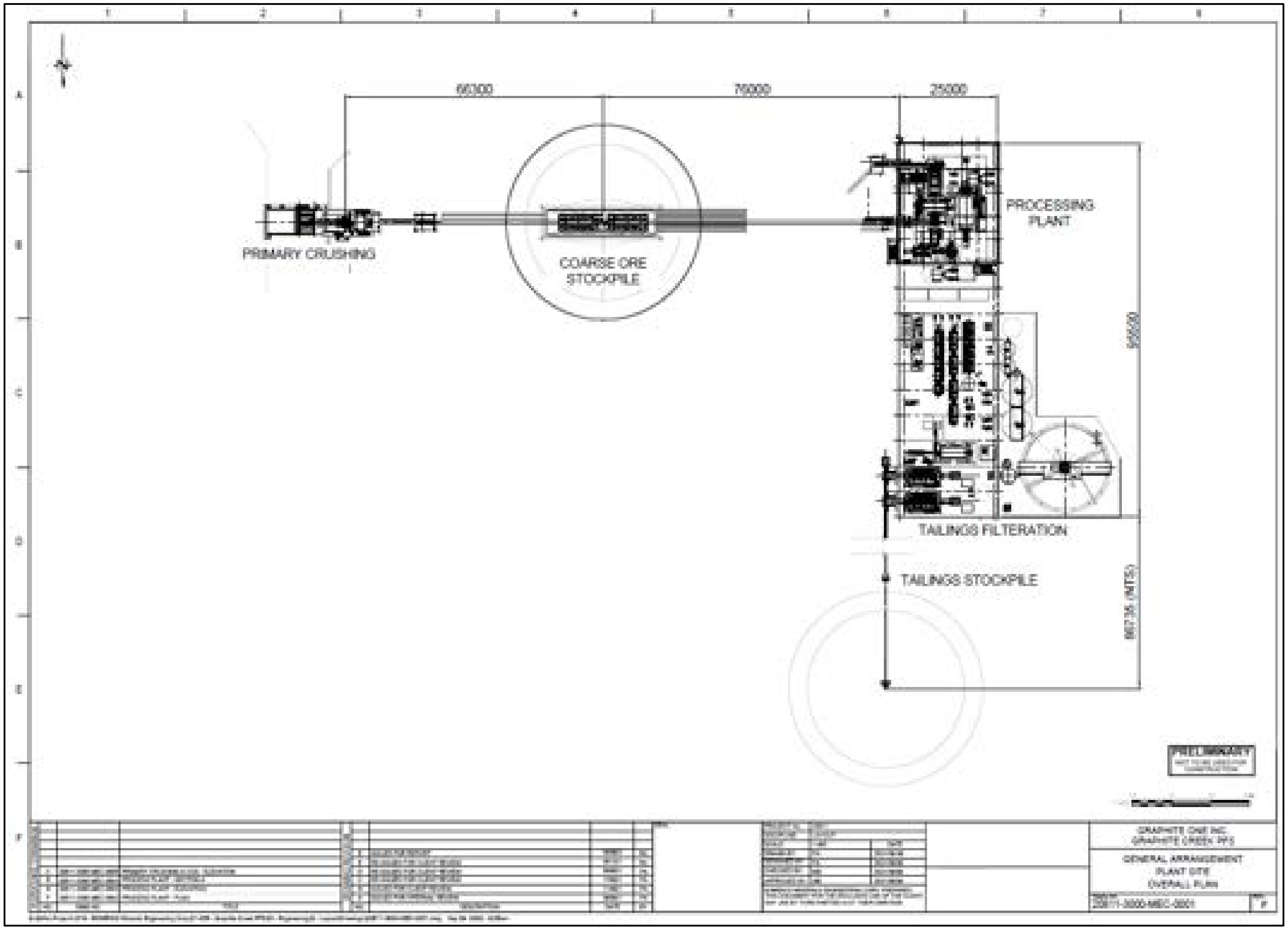
The processing methodology selected consists of the following process circuits:

- Emergency ROM stockpile - 5,360 t live; two days;
- Crushing plant – single jaw crusher;
- Coarse Ore stockpile – 2,680 t live; one day;
- Primary grinding – Single-stage SAG milling closed with cyclones;

- Flash Flotation;
- Rougher flotation;
- Polishing mill;
- First and second cleaners;
- Stirred media mill;
- Third and fourth cleaners;
- Stirred media mill;
- Fifth, sixth, and seventh cleaners;
- Final concentrate filtering, drying and packing;
- Tailings thickening and filtration;
- Dry stack tailings management facility (DSTMF); and
- Reclaim and freshwater systems.

The overall plant layout is shown as Figure 17-2.

Figure 17-2: Plant Layout



Source: Bomenco (2022)

17.1.3.1 Crushing and Stockpile

The crushing circuit will comprise a 180 t dump pocket equipped with a stationary grizzly with 750 mm x 750 mm openings. Oversize boulders will be broken with a hydraulic rock breaker. The dump hopper will discharge to vibrating grizzly, the oversize will report to the jaw crusher, and the -100 mm undersize to the primary crusher discharge conveyor where it will be joined by the jaw crusher product. Combined material will report to the coarse ore stockpile conveyor and be transported to the coarse ore stockpile (COS) with 2,680 t live capacity, equivalent to one day of capacity. Two apron feeders will reclaim material from the coarse ore stockpile and feed the SAG mill via a conveyor. The crushing circuit will have a weigh scale and self-cleaning magnet for tramp iron removal on the COS feed conveyor. Dry dust collection systems will provide dust control at strategic locations.

17.1.3.2 Grinding Circuit & Unit Cell Flotation

Grinding will be provided by a SAG mill operating in closed circuit with a SAG mill discharge screen, a flash flotation cell, and the primary cyclones. SAG mill discharge screen oversize, pebbles, will be recycled to the SAG mill feed chute via scissor conveyors and the undersize will gravitate to the flash flotation pump box for furtherance to the flotation unit cell for flash flotation of liberated graphite.

Flash flotation tailings are pumped to the primary cyclones for primary classification. Cyclone underflow will return to the SAG mill and the cyclone overflow will gravitate to rougher flotation.

17.1.3.3 Flotation and Regrind

Rougher flotation consists of four 10 m^3 flotation cells. The rougher tails will be sent to final tailings pumpbox, and then to the tailings thickener. Rougher concentrate will be joined by flash flotation concentrate in #1 polishing mill feed chute to provide further separation of gangue from graphite flakes in a low-density environment. The Polishing mill will operate in open circuit to help minimize overgrinding. Mill discharge will feed 1st stage of cleaners.

The 1st cleaner tailings will be sent to the final tailings pumpbox for disposal. The 1st cleaner concentrate will feed the 2nd cleaners operating in counter current cleaner circuit with the 1st cleaners. The 2nd cleaner concentrate will feed the #1 stirred media mill.

The #1 stirred media mill, also operating in open circuit, will feed the 3rd cleaners. The 3rd cleaners and 4th cleaners will operate in a counter-current cleaning circuit where the 3rd cleaner concentrate will feed the 4th cleaner, and the 3rd cleaner tailings will report to final tailings. The 4th cleaner concentrate will be sent to the #2 stirred media mill, in an open circuit, for a final polishing of the graphite.

The #2 stirred media mill discharge will be pumped to the next and 5th cleaner flotation. The 5th, 6th, and 7th stages of cleaners will also operate in counter-current cleaning configuration, with each stage feeding the next stage of cleaning. The 5th cleaner tailings will report to final tailings, while the concentrate will move progressively through the 6th and 7th cleaners as previously described.

17.1.4 Dewatering

17.1.4.1 Concentrate

The 7th cleaner concentrate will report to filter stock tanks directly as thickening of graphite was not considered practical due to its relatively low specific gravity and flakey physical nature. Two stock tanks will supply feed to a filter press for dewatering. Filter cake moisture was tested to be approximately 25%.

A trade off study concluded that drying of the concentrates at the mine site before shipping would be more economic than drying after shipping at destination in Washington, USA. Therefore, an indirect drying system using diesel as fuel is proposed for the graphite concentrates. Concentrates, after being dried to approximately 3% moisture, will be cooled through a double jacketed screw cooler and bucket elevated to a day bin for sampling and bagging into 1 t bulk bags for shipment.

17.1.4.2 Tailings

Tailings from rougher flotation will combined with tailings from the 1st, 3rd and 5th cleaners in final tailings pump box and pumped to tailings thickener. The tailings thickener underflow at approximately 60% solids density will be reclaimed and pumped to two filter stock tanks, which in turn will feed two tailings vacuum disc filters. The disc filters will provide final dewatering for the tailings product. The disc filter cake will be discharged to a covered stockpile and from there be hauled to the Dry Stack Tailings Storage Facility for placing.

17.1.4.3 Reagent Handling and Storage

The reagent regime for the process plant consists of a collector, frother and a flocculant. The frother (MIBC) and collector (Fuel Oil/Diesel) will each be stored in a separate double walled envirotanks. The envirotanks will fill holding tanks. Metering pumps will draw from the holding tanks and supply the process with at pre-determined addition rates. MIBC will be supplied at 20 g/t plant feed to the Unit Cell, 30 g/t to roughers and scavengers and 70 g/t Feed to the cleaners. The fuel oil will be supplied at similar rates; 20 g/t feed to the Unit Cell, 30 g/t feed to roughers and scavengers and 70 g/t feed to the cleaners.

The flocculant will be delivered in bags. The bags will be manually added to a flocculant mixing system which will allow for mixing and maturing before being fed to the tailings thickener and concentrate stock tanks.

17.1.5 Power Requirements

The power requirements for the Graphite One Project will be supplied by gensets at site using diesel fuel. The power will be split into 480v load, and 4160v load. See the Table 17-3 for a total load overview.

Table 17-3: Total Electrical Load Overview

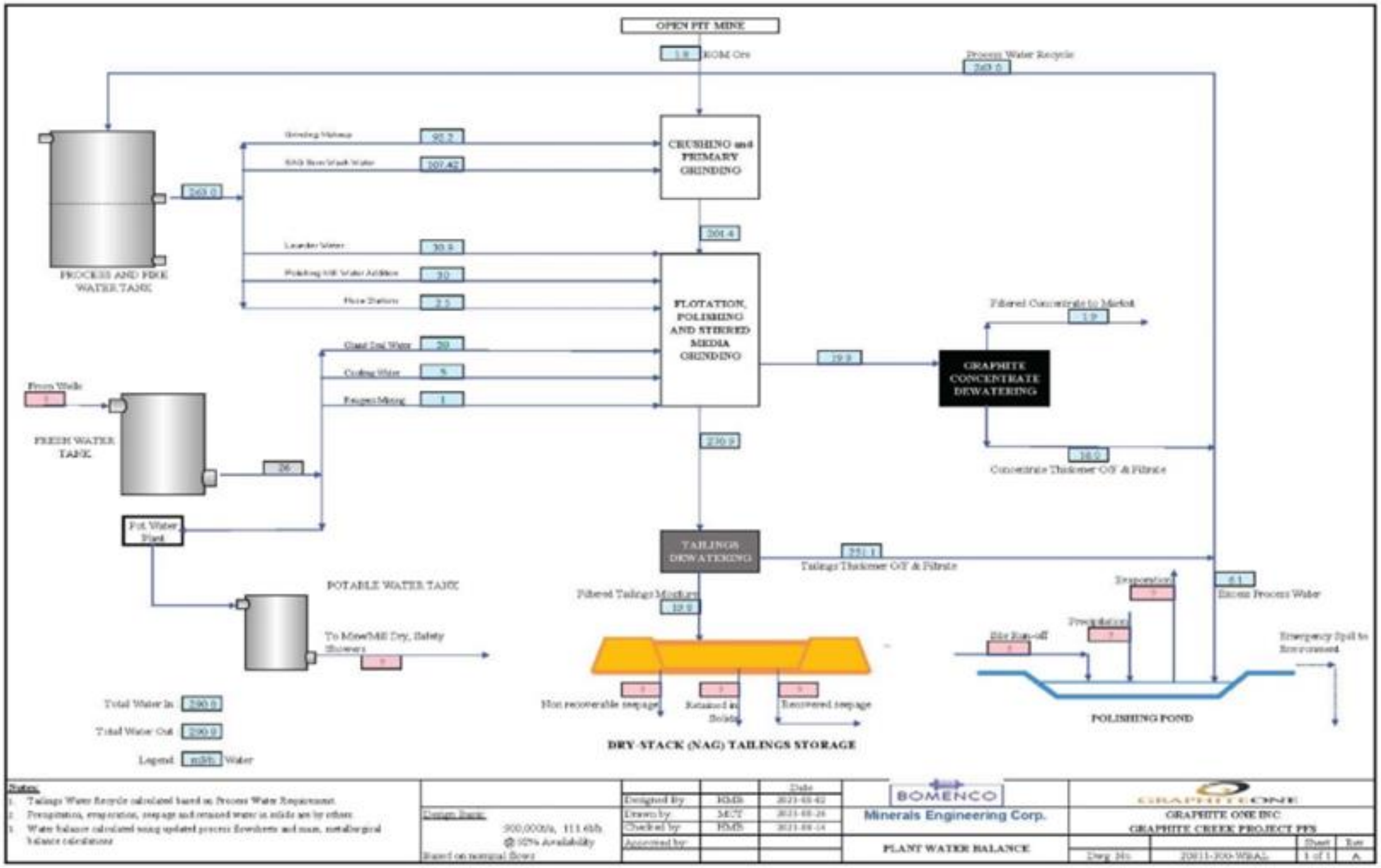
GRAPHITE ONE Inc. GRAPHITE CREEK PFS TOTALLOADOVERVIEW	BOMENCO MINERALS ENGINEERING CORP. Rev 1.02 PROJECT:21811
480V CONCENTRATOR TOTAL LOAD	
Connected hp	**5,469**
Connected kW	**4,080**
kW-Hrs/Yr	**18,870**
Load Factor	**0.85**
4160V CONCENTRATOR TOTAL LOAD	
Connected hp	**6,498**
Connected kW	**4,848**
kW-Hrs/Yr	**28,502**
Load Factor	**0.89**
CONCENTRATOR TOTAL LOAD	
Connected hp	**11,967**
Connected kW	**8,927**
kW-Hrs/Yr	**47,373**
Load Factor	**0.87**

Source: Bomenco (2022)

17.1.6 Water Requirements

The process plant will be provided with water from two sources: raw/fresh water supplied by wells and recycled water from the tailings and concentrate dewatering processes. Well water will supply about 26 m^3/h for the gland seal water and cooling water. The potable water plant will also be fed from well water. Water supply to grinding, flotation, and hose stations will come from the process water tank. The process water tank will receive 100% recycled water, at approximately 263 m^3/h. This water will come from thickener overflow and filtrate water from the tailings and concentrate filters. Any excess water from the system will report to the polishing pond. A water balance for the process plant is provided in Figure 17-3.

Figure 17-3: Process Plant Water Balance



Source: Bomenco (2022)

17.2 Secondary Treatment (Washington)

17.2.1 General Description

The Secondary Treatment Plant (STP) is designed to produce lithium-ion battery anode materials on a commercial scale for the U.S. domestic market using natural graphite from the Graphite Creek Mine in Alaska and other materials. Four anode products are proposed, each with different specifications to fit the requirements of automakers. The process also unavoidably produces by-products which would be sold to the traditional natural graphite markets. The projected demand for anode materials in the U.S. supports the business case to design, permit and construct the STP in parallel with the development, permitting and construction of the Graphite Creek Mine in Alaska. It is assumed that the STP would take 3 years to permit and construct once design is finalized. It would start operation and continue for an estimated period of four years by processing purchased graphite while the Graphite Creek mine is progressing through permitting and construction. Alaska graphite would be phased in in the fourth year and completely replace purchased graphite in the fifth year of operation.

It should be noted that although the Company believes this operational plan is achievable on the basis of industry forecasts and preliminary inquiries, this business plan has an element of risk associated with it, as there is no certainty that the Company will be successful in purchasing graphite prior to receiving production from the Graphite Creek Mine in the quantities and pricing projected in this Report. It is recommended that the Company begin contracting for this supply as soon as possible.

The STP, as designed at full capacity, sits on about 34.5 ha (85 acres) of land, consists of 17 buildings, and annually produces about 77,000 t of manufactured graphite products. The products are grouped into battery anode materials, specialty purified graphite products, and traditional unpurified graphite products. The products are manufactured from natural graphite concentrate, artificial graphite precursors and coke and pitch. The purification of natural graphite and graphitization of artificial graphite precursors in high temperature, electrically heated furnaces are key components of the manufacturing process. The STP's preferred location is in Washington State to access both its relatively lower power rates from hydro generated electricity and its skilled workforce. The Company's intention is to develop an American supply chain of critical graphite anode materials for electric vehicle and energy storage batteries on a commercial scale.

17.2.2 Location

Key components of the manufacturing process are the purification of natural graphite and graphitization of artificial graphite precursors in high temperature, electrically heated furnaces. The STP's preferred location is in Washington State to access both its relatively lower power rates from hydro generated electricity and its skilled workforce. The Company, working with the Washington State Department of Commerce, identified several potential locations for the STP in Washington State. A final location has yet to be chosen. For the purposes of the PFS, a location in Lewis County has been assumed.

17.2.3 Phasing

Permitting and construction of the STP, once its design is finalized, is expected to take three years. The STP would be constructed in two phases, each with almost identical equipment and production capacity. An exception is that Phase 2 has three furnace lines, Phase 1 has two. Phase 1 is assumed to operate at 90% capacity for the first year to allow for startup adjustments. Thereafter it would operate at full capacity. Phase 2 would come on stream in Year 2 and the STP would operate at full capacity. Phase 1 requires a workforce of 123 and Phase 2, 155.

The STP product manufacturing process has been designed by Graphite One and provided to Hatch to produce process drawings, process mass balances and building designs. The process layout and buildings were engineered by Hatch based on the process requirements provided by Andrew Tan of Graphite One.

Permitting and construction of the STP, once its design is finalized, is expected to take 3 years. The STP would be constructed in two phases, each with almost identical equipment and production capacity. An exception is that Phase 2 has three furnace lines, Phase 1 has two. Phase 1 would operate at 90% capacity for the first half of Year 1 to allow for startup adjustments. Thereafter it would operate at full capacity. Phase 2 would come on stream in Year 2 and the STP would operate at full capacity.

During the first four years of operation, the STP would be fed with graphite concentrate sourced on the open market. Alaska graphite from the Graphite Creek Mine would begin replacing purchased graphite in Year 4 and completely replace it in Year 5. Graphite would arrive at the Port of Seattle in containers in one tonne bags and be trucked to the STP.

17.2.4 Products

The STP, at full capacity (Table 17-4), is designed to produce about 51,000 t/a of anode materials for the electric vehicle and energy storage battery markets; 7,600 t/a of purified, sized material for the specialty graphite market; and 18,600 t/a for the unpurified, traditional graphite market. Total annual production would be about 77,000 t.

Table 17-4: STP Products and Production

No.	Category	Name	Description	Purity (%Cg)	Ph 1 (t/a)	Total (t/a)	Ph 2 (t/a)	Total (t/a)
1	**Anode Material**	CPN	Coated, spherical NG	99.95	6,015	**25,584**	12,030	**51,167**
2		BAN	Blended AG and NG	99.95	11,458		22,915	
3		SPN	Secondary Particle NG	99.95	1,829		3,658	
4		SPC	Secondary Particle Composite	99.95	6,282		12,565	
5	**Purified**	3299	+32 Mesh Purified	99+	59	**3,792**	117	**7,585**
6		599	+50 Mesh Purified	99+	527		1,055	

No.	Category	Name	Description	Purity (%Cg)	Ph 1 (t/a)	Total (t/a)	Ph 2 (t/a)	Total (t/a)
7		899	+80 Mesh Purified	99+	586		1,172	
8		199	+100 Mesh Purified	99+	977		1,953	
9		Battery Conductor	-320 Mesh Purified	99.9	692		1,386	
10		Synthetic Diamond Precursor	-320 Mesh Purified	99.99	951		1,902	
11	**Unpurified**	3295	+32 Mesh	95+	95	**9,311**	189	**18,622**
12		595	+50 Mesh	95+	851		1,701	
13		895	+80 Mesh	95+	945		1,890	
14		195	+100 Mesh	95+	1,575		3,150	
15		Carbon Raisers Lubricants	Carbon Raisers Lubricants	95+	4,640		9,279	
16		Coke Reject	Coke Reject	95+	1,207		2,413	
						38,687	**Total**	**77,374**

Source: Graphite One (2022)

17.2.4.1 Anode Materials

The anode materials produced would be comprised of:

- From the Single Particle Coating Line (1PCL):
  - CPN: shaped, coated, purified, single particle natural graphite – also known as coated spherical graphite; and
  - BAN: blend of single particle artificial and purified natural graphites.
- From the Secondary Particle Coating Line (2PCL):
  - SPN: secondary particle, agglomerated, purified natural graphite; and
  - SPC: composite of secondary particle, agglomerated, purified and graphitized materials.

Based on ongoing work that began in 2022, the Company projects that its anode products would be qualified with battery makers by the time the STP begins production, three years after STP permitting begins.

17.2.4.2 Purified, Sized Graphite Products.

Purified, sized graphite products are mainly for the traditional non-lithium-ion battery anode industry. This industry requires tailored combinations of different sizes and purities. The STP is designed to provide the most cost-effective array of products to meet the requirements of this market.

17.2.4.3 Unpurified, Sized Graphite Products.

Unpurified, sized graphite products are delivered to the traditional graphite markets such as refractory materials, lubricants, etc.

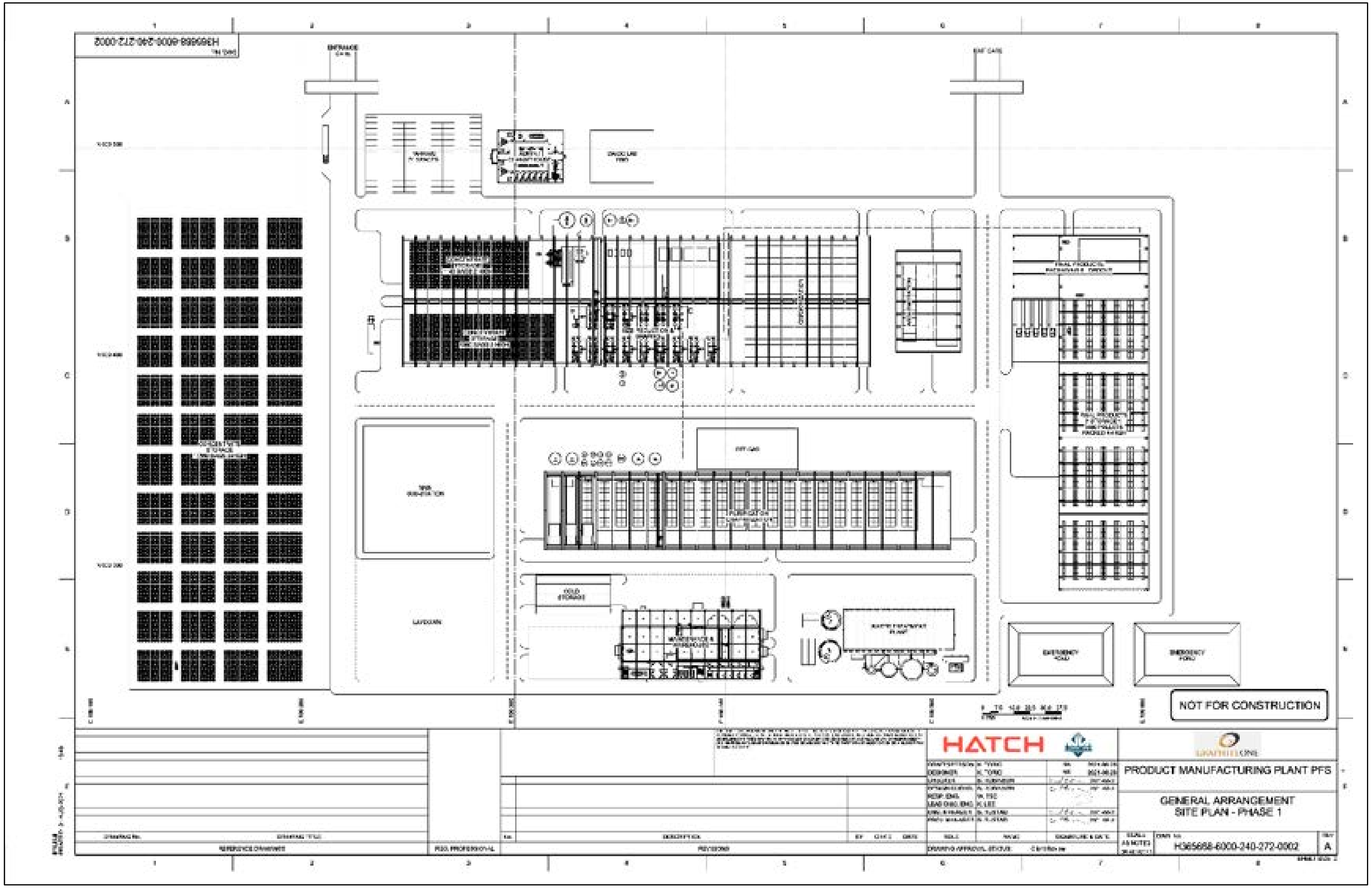
Following a review of the market demand and the STP plan, the following is recommended:

- Work to develop the STP in parallel with the development of the Graphite Creek Mine be accelerated including computer simulations of the process, continued process development work with associated consultants and institutions, and process engineering design;
- Finalize site selection and electrical power supply;
- Procure the supply of purchased graphite and precursor materials; and
- Continue work on qualifying anode products.

17.2.5 Secondary Treatment Plant General Layout

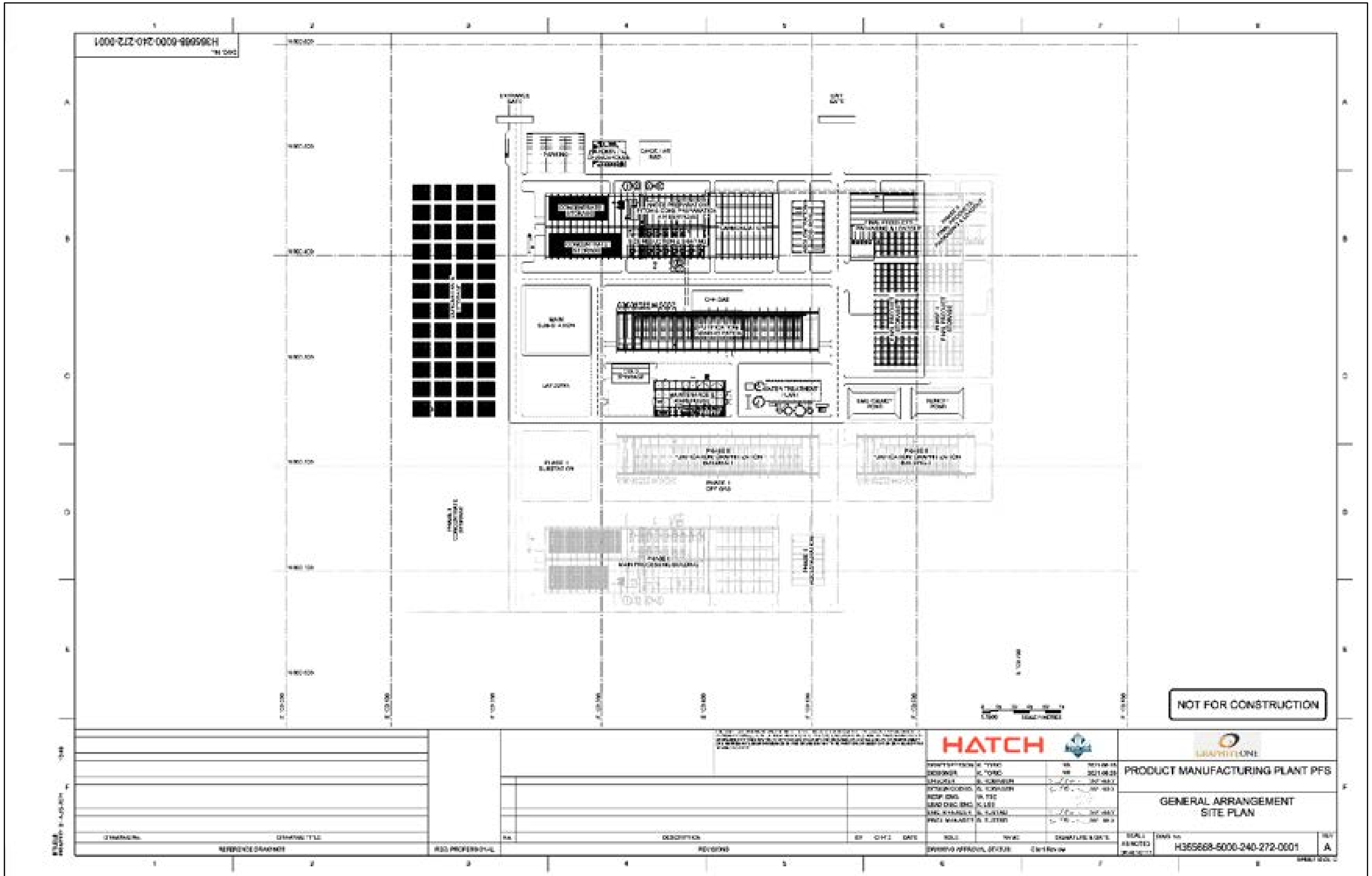
The STP's General Arrangement and Site Plan is shown in Figure 17-4 for Phase 1 and its complete configuration, constructed as Phase 2 is shown in Figure 17-5. The complex, as designed at full capacity, covers a minimum of 34.5 ha (85 acres) with ten buildings constructed in Phase 1 and an additional seven in Phase 2. A larger land base would allow for expansion.

Figure 17-4: Secondary Treatment Plant General Arrangement - Phase 1



Source: Hatch (2022)

Figure 17-5: Secondary Treatment Plant General Arrangement – Phase 2



Source: Hatch (2022)

17.2.6 Description of Major Buildings

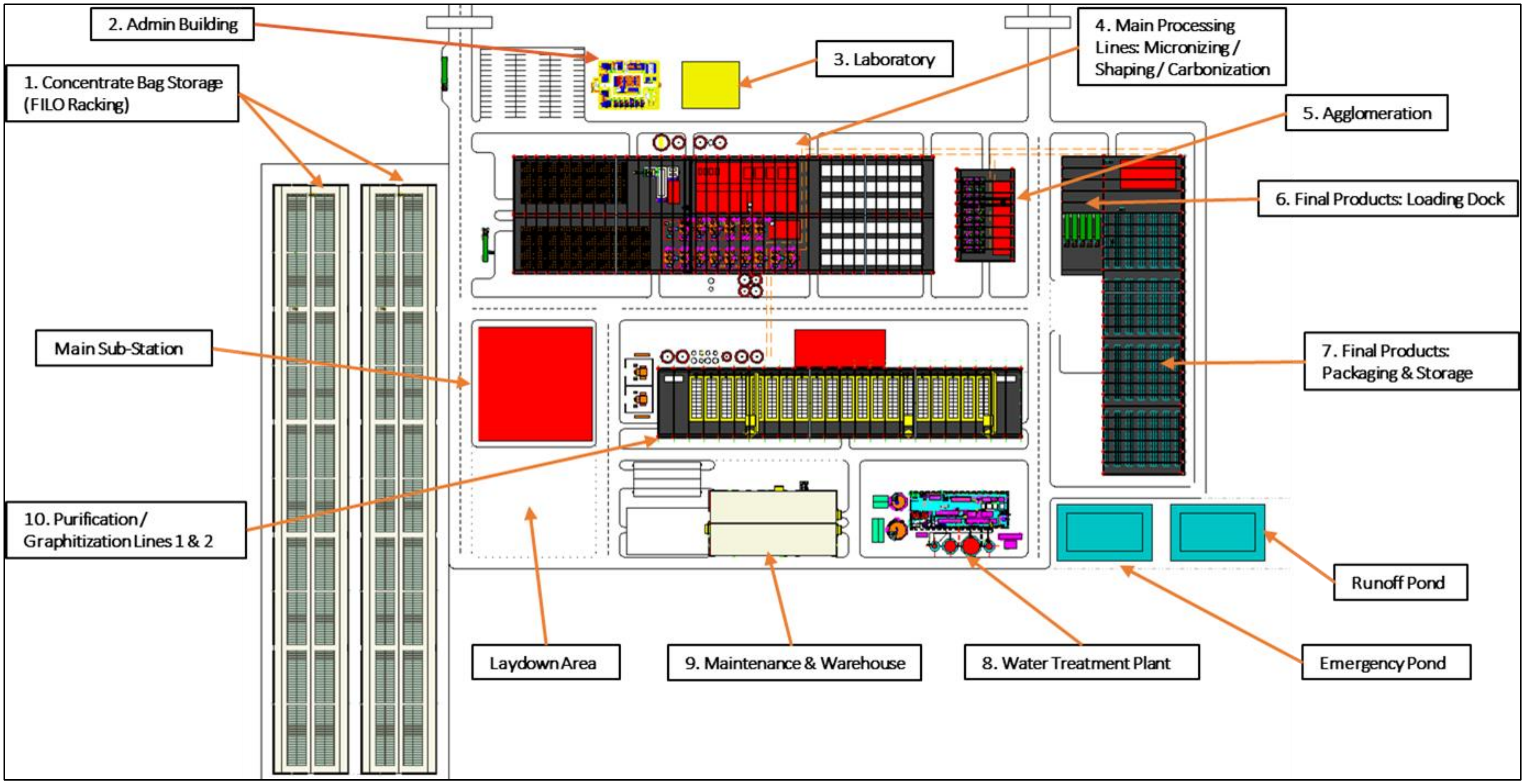
The buildings constructed for each phase are listed in Table 17-5. Figure 17-6 and Figure 17-7 show their respective positions on the Property.

Table 17-5: STP Buildings - Phases 1 & 2

Phase	No.	Description	Dimensions (m)		
			Width	Length	Height
1	1	Concentrate Bag Storage	40	310	14.9
	2	Admin, Offices and Change Room	28	32.5	7.4
	3	Laboratory: QA/QC & R&D	18.3	40.2	2.6
	4	Main Processing Lines	60	222	13
	5	Agglomeration	30	48	21
	6	Final Products: Loading Dock	22	30	6.7
	7	Final Products: Packaging, Storage	42	168	6.7
	8	Water Treatment Plant	18.4	51.8	8.6
	9	Maintenance and Warehouse	32	65	8.9
	10	Purification/Graphitization Lines 1 & 2	35	192	17
2	11	Concentrate Bag Storage	40	310	14.9
	12	Final Products: Loading Dock	22	30	6.7
	13	Final Products: Packaging, Storage	42	168	6.7
	14	Purification/Graphitization Lines 3&4	35	192	17
	15	Purification/Graphitization Line 5	35	112	17
	16	Agglomeration	30	48	21
	17	Main Processing Lines	60	222	13

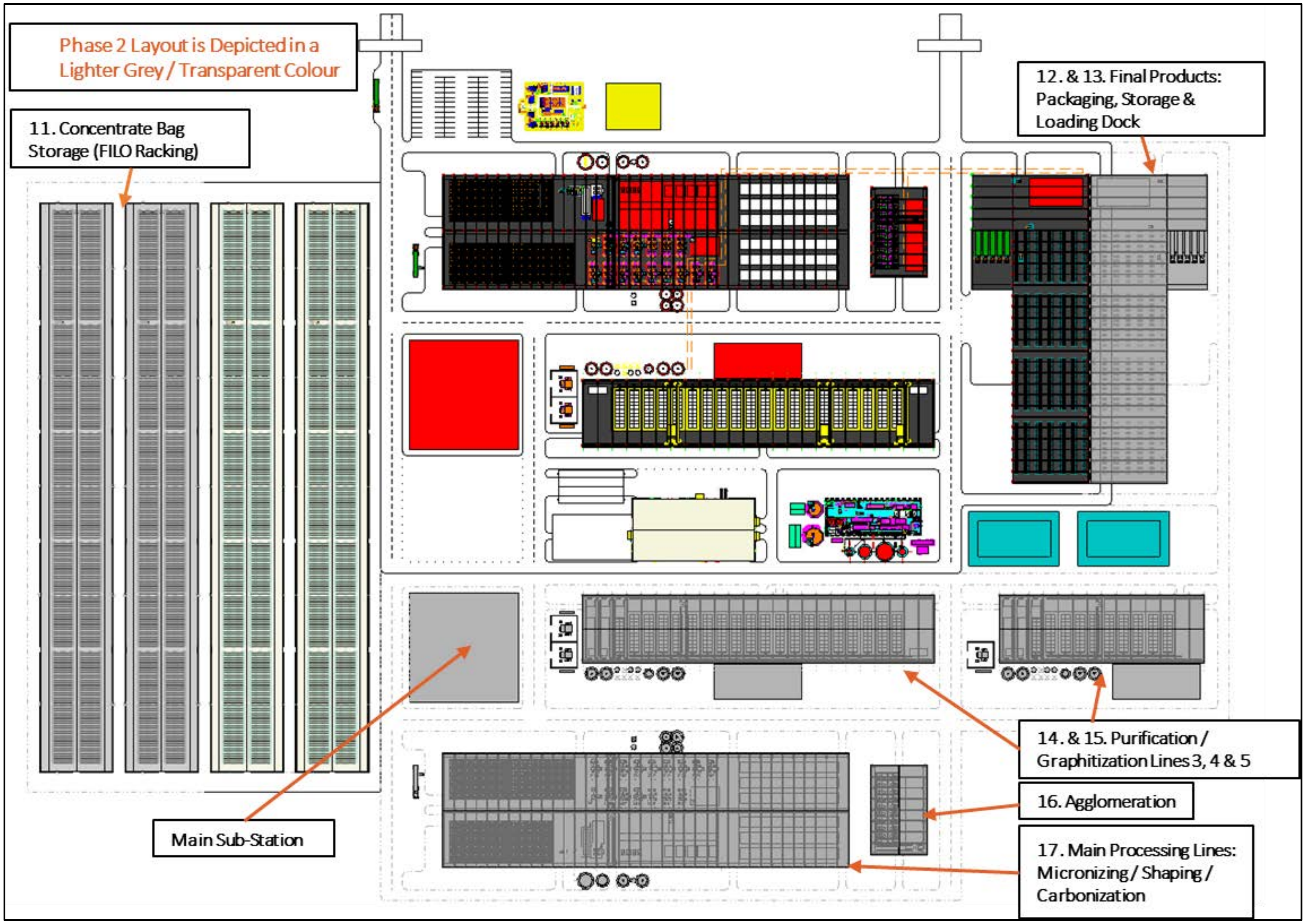
Source: Hatch (2022)

Figure 17-6: STP Layout - Phase 1



Source: Hatch (2022)

Figure 17-7: STP Layout - Phase 2

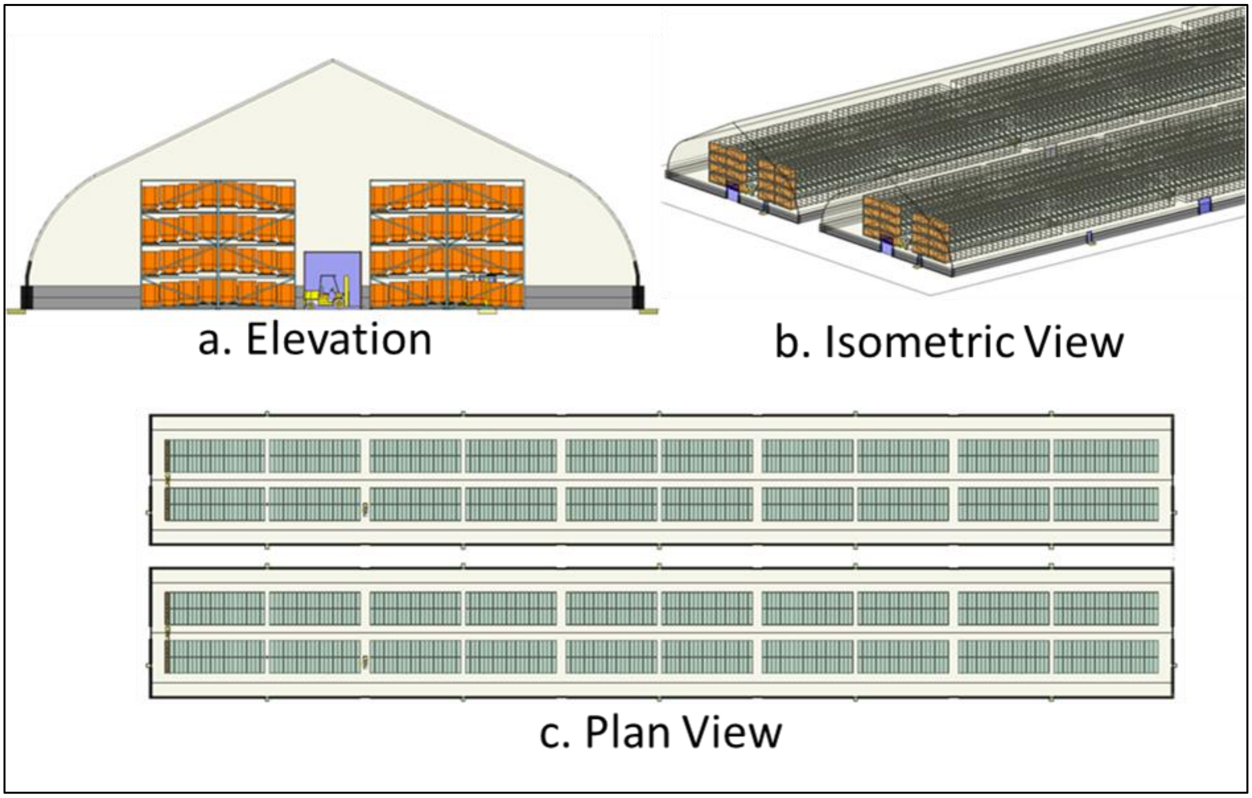


Source: Hatch (2022)

17.2.6.1 Concentrate Bag Storage Building

Graphite concentrate in one tonne bulk bags is delivered to and stored in a modular, tensioned fabric structure on lock blocks (Figure 17-8). One building is constructed for each of Phases 1 and 2. Bulk bags are stored in stacked racks until required. The storage capacity of each building is 27,500 t. Precursor materials delivered in one tonne bulk bags can also be stored as required.

Figure 17-8: Concentrate Bag Storage



Source: Hatch (2022)

17.2.6.2 Administration Offices and Change Room

The administration building is a two-story, steel frame and metal clad structure constructed on concrete slabs. It includes offices and change room facilities for the work force.

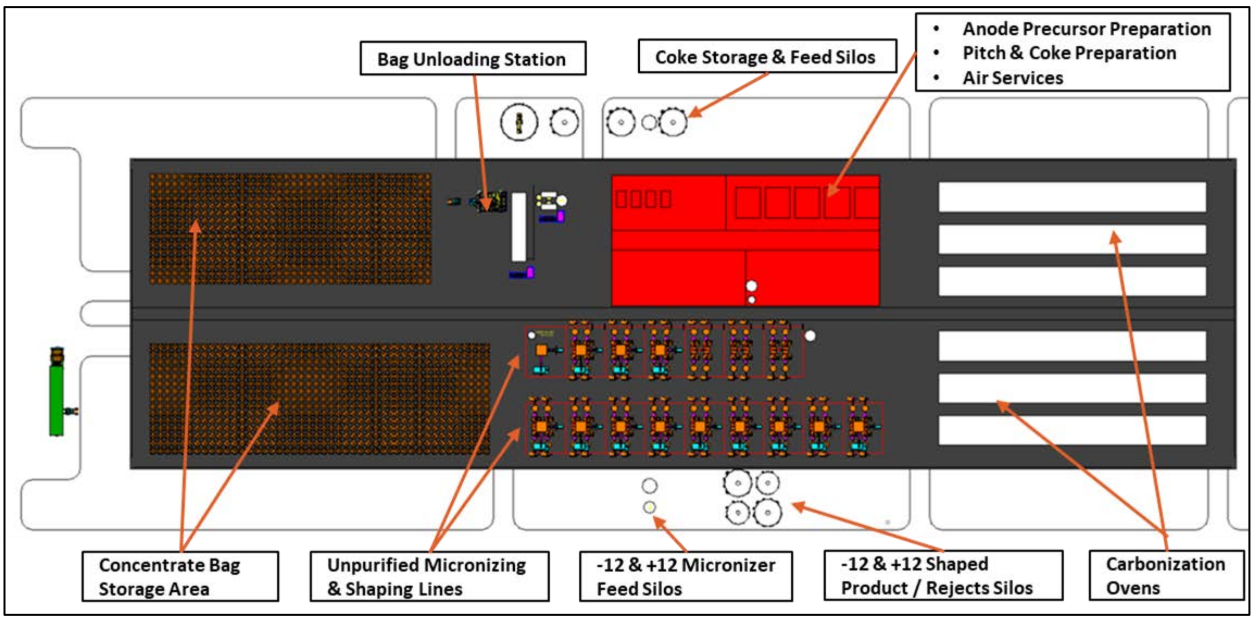
17.2.6.3 Laboratory: QA/QC & R&D

The laboratory is a single story, modular structure housing the staff and equipment to conduct product quality assurance, product quality control and research and development work.

17.2.6.4 Main Processing Building

The main processing building (Figure 17-9) is a steel frame, metal clad structure constructed on concrete pads.

Figure 17-9: Main Processing Building



Source: Hatch (2022)

One processing building is constructed for each of Phases 1 and 2 and each contains the processing lines summarized below.

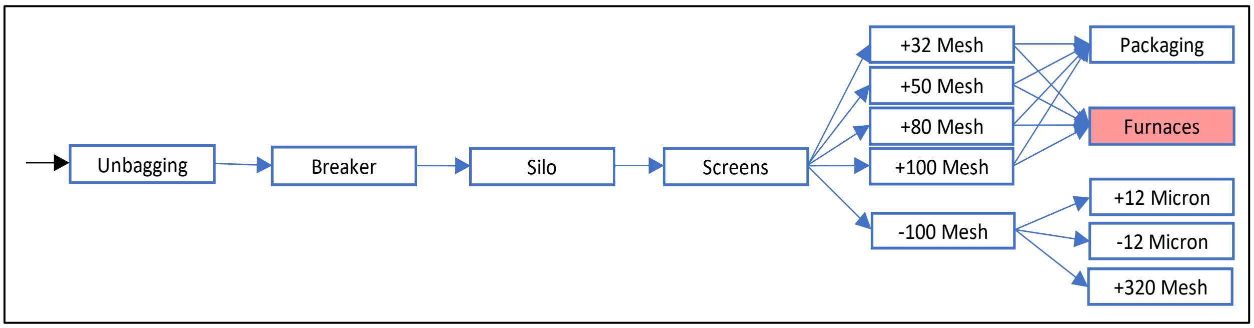
17.2.6.4.1 Material Receiving Line

Bulk bags of concentrate are transferred from the storage building to the storage area and then as required to a dedicated bag unloading station. There, bags are discharged to a hopper, progress through a lump breaker and are then conveyed to a concentrate surge silo. Concentrate is fed from the silo via a screw conveyor to two sorting screens arranged in series.

17.2.6.4.2 Screening Line

The two sorting screens separate the concentrate into +32, +50, +80, +100 and -100 mesh sizes. Each size is pneumatically conveyed to a dedicated collection hopper.

Figure 17-10: Process Flow Diagram for Receiving and Screening



Source: Tan (2022)

From their respective collection hoppers, the +32, +50, +80, +100 and -100 mesh materials are metered into two distinct streams. One is pneumatically conveyed to the final products building for packaging, storage, and eventual sale as unpurified, 95% Cg in the segregated mesh sizes. The other stream is pneumatically conveyed to the furnace building for purification.

The -100 mesh material is directed from its collection hopper to the micronizing and shaping lines.

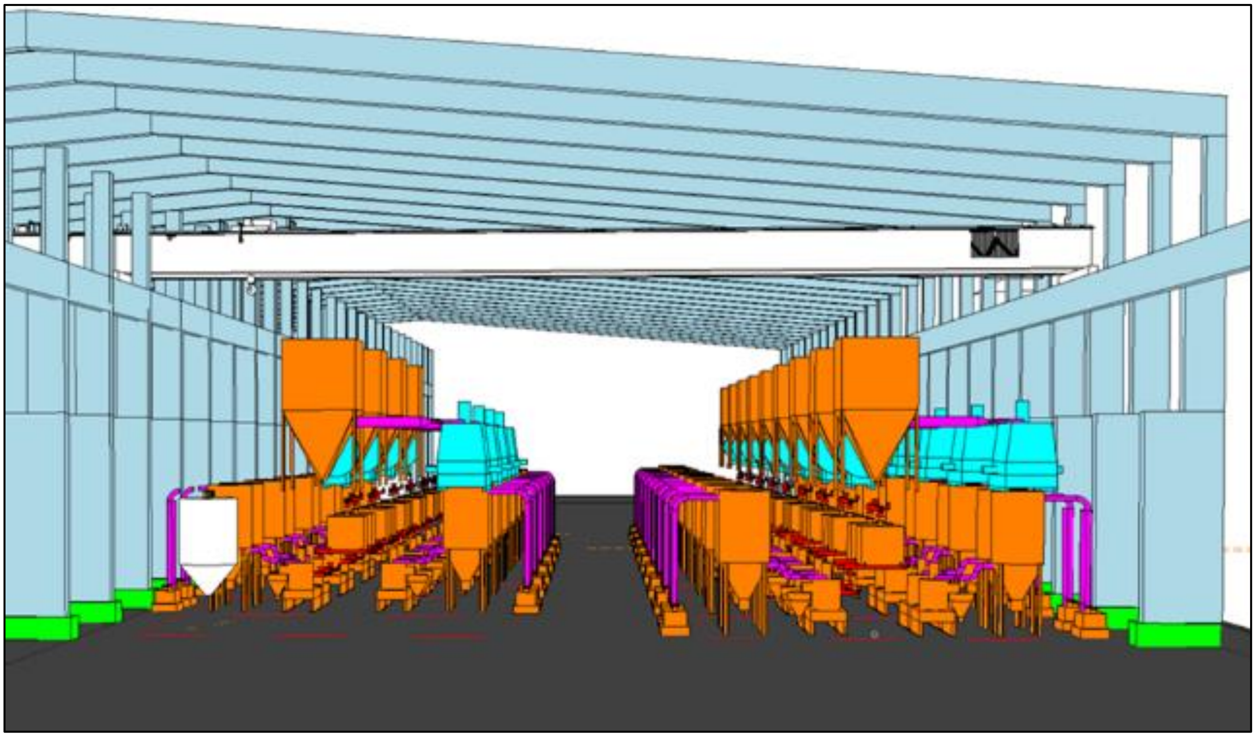
17.2.6.4.3 Micronizing and Shaping Line

The -100 mesh material is separated into +12 µm, -12 µm and 320 mesh sizes and stored in dedicated micronizing feed silos. The material from each silo is fed to their respective micronizer lines (Figure 17-11).

The +12 mesh material progresses through 12 equipment lines. Each line consists of 5 coarse micronizers (total 60), 2 fine micronizers (total 24) and 13 shaping machines (total 156). These sets also include their associated classifiers, cyclones, and baghouses. From these process lines, +12 µm shaped material is conveyed to a +12 µm shaped storage silo and a +12 µm shaped rejects silo.

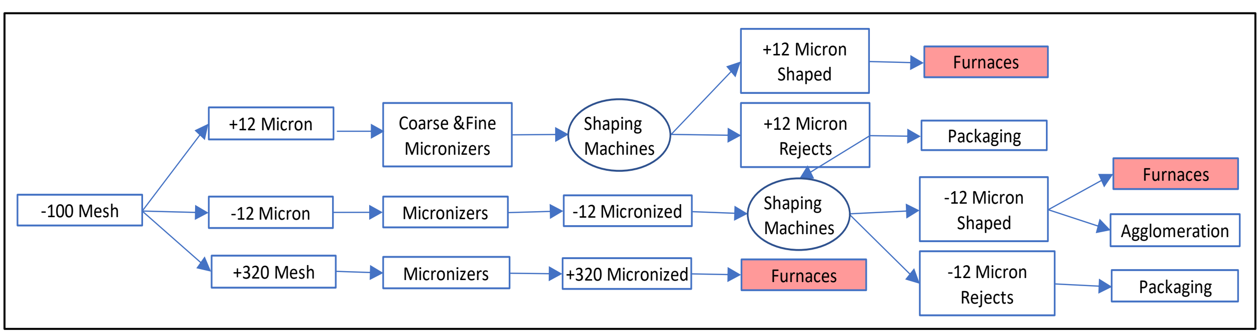
Material from the +12 shaped silo is conveyed to the furnace building. Material from the +12 rejects silo is metered into two streams. One is conveyed to the -12 µm shaping mills for further processing, and the other to the final products building for packaging, storage, and eventual sale in the unpurified, 95% Cg portfolio.

Figure 17-11: Micronizers & Shapers



Source: Hatch (2022)

Figure 17-12: Process Flow Diagram for Micronizing and Shaping



Source: Tan (2022)

The -12 µm material from its silo is processed through 2 micronizers (Phase 2 adds 1 more) and is distributed into 23 feed hoppers along with a portion of the +12 shaped rejects. The hoppers feed 23 shapers. The resulting shaped material is separated into a -12 shaped material silo and a -12 rejects silo.

Material from the -12 shaped silo is metered into two streams. One is conveyed to the furnace building, and the other to the agglomeration building's Secondary Particle Coating Line. Material from the -12 shaped rejects silo is conveyed to the final products building for packaging, storage, and eventual sale in the unpurified, 95% Cg portfolio.

Material from the 320 mesh micronizing feed silo is fed to a micronizer and then to a micronized 320 mesh storage silo. From there it is conveyed to the furnace building.

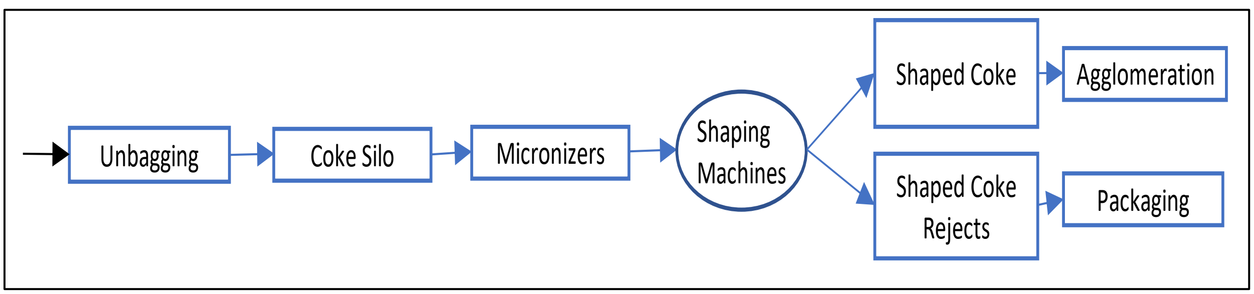
17.2.6.4.4 Precursor Preparation Lines

a. Coke

Bulk bags of coke are delivered to the storage area and then as required to a dedicated bag unloading system. There, bags are discharged to a storage hopper and then conveyed to 3 micronizers. The micronizers feed two equipment sets, each containing 3 feed hoppers, 3 shaping mills and 3 discharge hoppers. The discharge from each of these hoppers is conveyed to a shaped coke storage silo. Shaped coke is conveyed to 12 weigh hoppers in the agglomeration building.

Rejects from the coke shaping mills are conveyed to the final products building for packaging, storage, and eventual sale in the unpurified, 95% Cg portfolio.

Figure 17-13: Process Flow Diagram for Coke

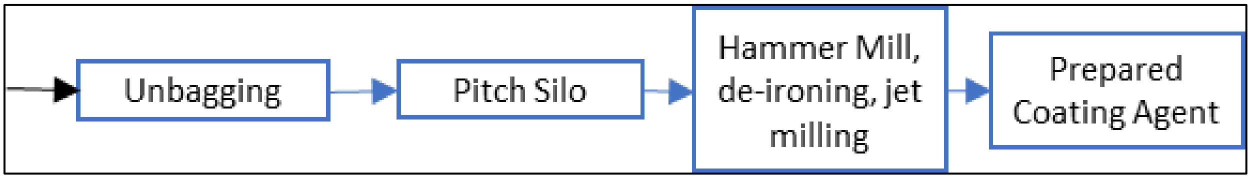


Source: Tan (2022)

b. Pitch

Bulk bags of pitch are transferred from the storage area to a dedicated bag unloading system. Once discharged, the pitch is processed through a hammer mill, a de-iron machine, and a jet mill. The resulting prepared coating agent is conveyed to two prepared coating agent bins in the agglomeration building.

Figure 17-14: Process Flow Diagram for Pitch

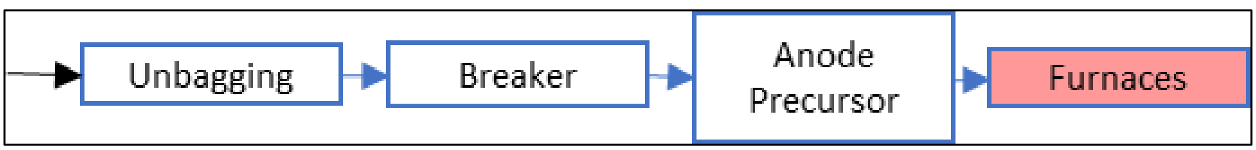


Source: Tan (2022)

c. Anode Precursor

Bulk bags of anode precursor material are transferred to the storage area and then as required to a dedicated bag unloading system. There bags are discharged to a hopper, through a lump breaker and conveyed to an anode precursor surge bin. The material is then pneumatically conveyed to the furnace building. It discharges from the furnaces as artificial graphite.

Figure 17-15: Process Flow Diagram for Anode Precursor



Source: Tan (2022)

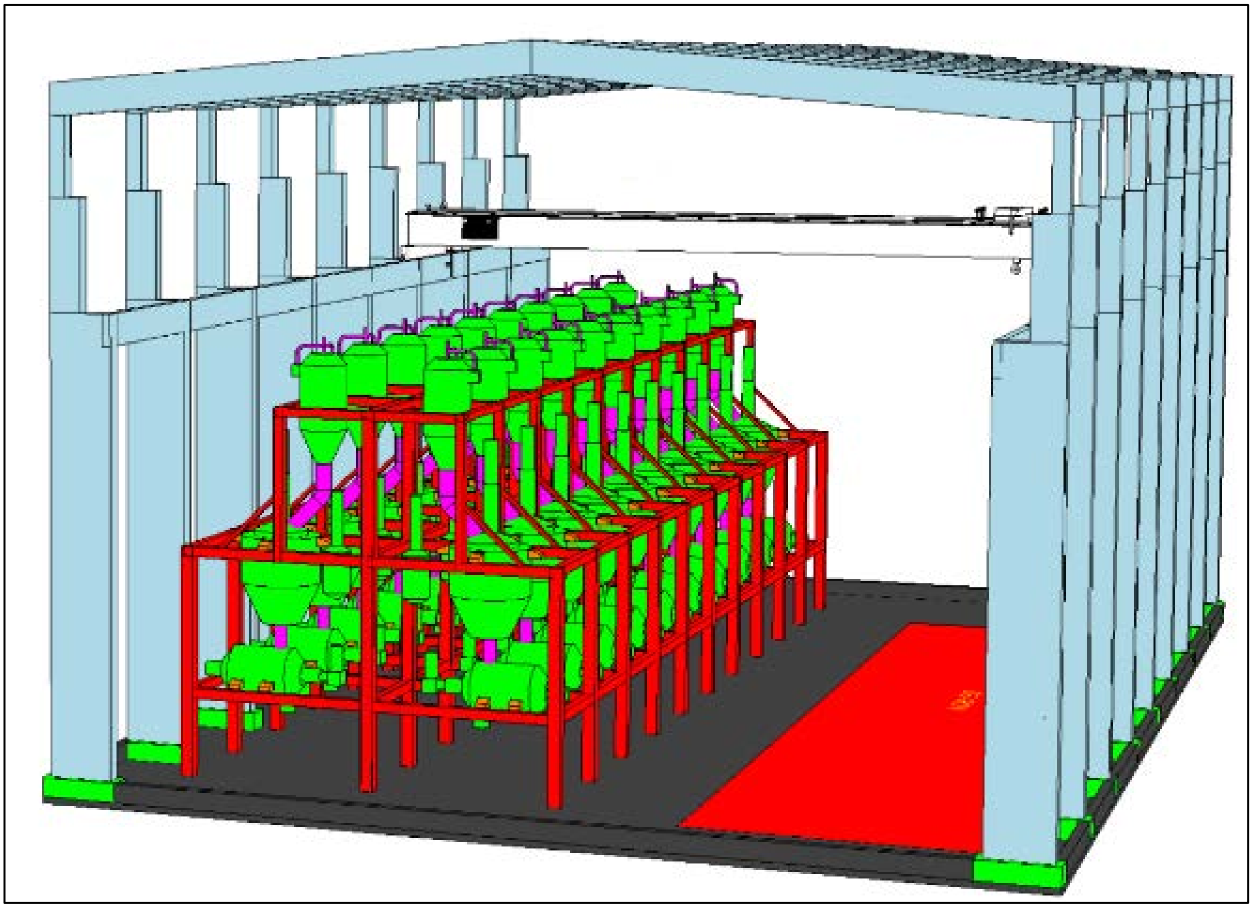
17.2.6.4.5 Carbonization Line

The carbonization unit consists of 3 feed silos, feeding 6 carbonization ovens, via 3 sagger handling systems. The resulting carbonized material is discharged to two storage sets, each with 3 hoppers. Each set of 3 hoppers conveys to 2 dedicated carbonized product storage silos.

17.2.6.5 Agglomeration Building

There is an agglomeration building for each of Phases 1 and 2. In the Secondary Particle Coating Line for each Phase, prepared coating agent, shaped coke and -12 µm unpurified shaped graphite are conveyed from the main processing building into three dedicated sets of weigh hoppers in the agglomeration building (Figure 17-16).

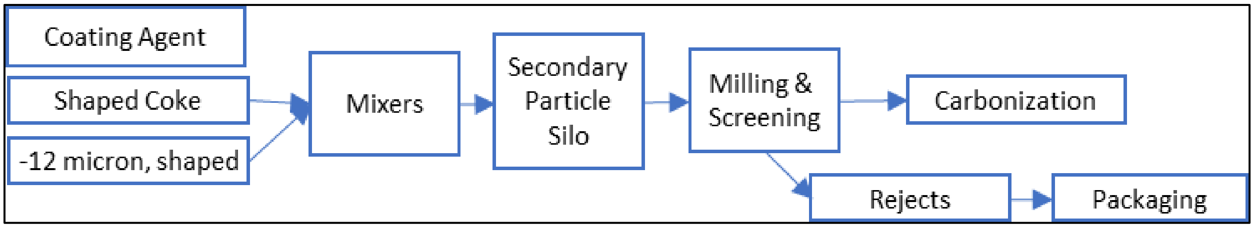
Figure 17-16: Vertical Agglomeration



Source: Hatch (2022)

Each set has twelve hoppers. Material from one hopper in each set is conveyed into one of twelve vertical cone mixers. The mixed material from the twelve mixers is conveyed to the agglomeration line which consists of twelve vertical agglomeration units. The processed material is collected in a storage silo and then fed to a bank of eight mills, followed by nine ultrasonic screens. The resulting material is collected in a transfer hopper, then conveyed to the carbonization ovens in the main processing building. Oversize rejects from the ultrasonic screeners are collected in a storage silo. The reject stream is split in two and conveyed to the carbon raisers/lubricant and unpurified graphite product lines.

Figure 17-17: Process Flow Diagram for Agglomeration

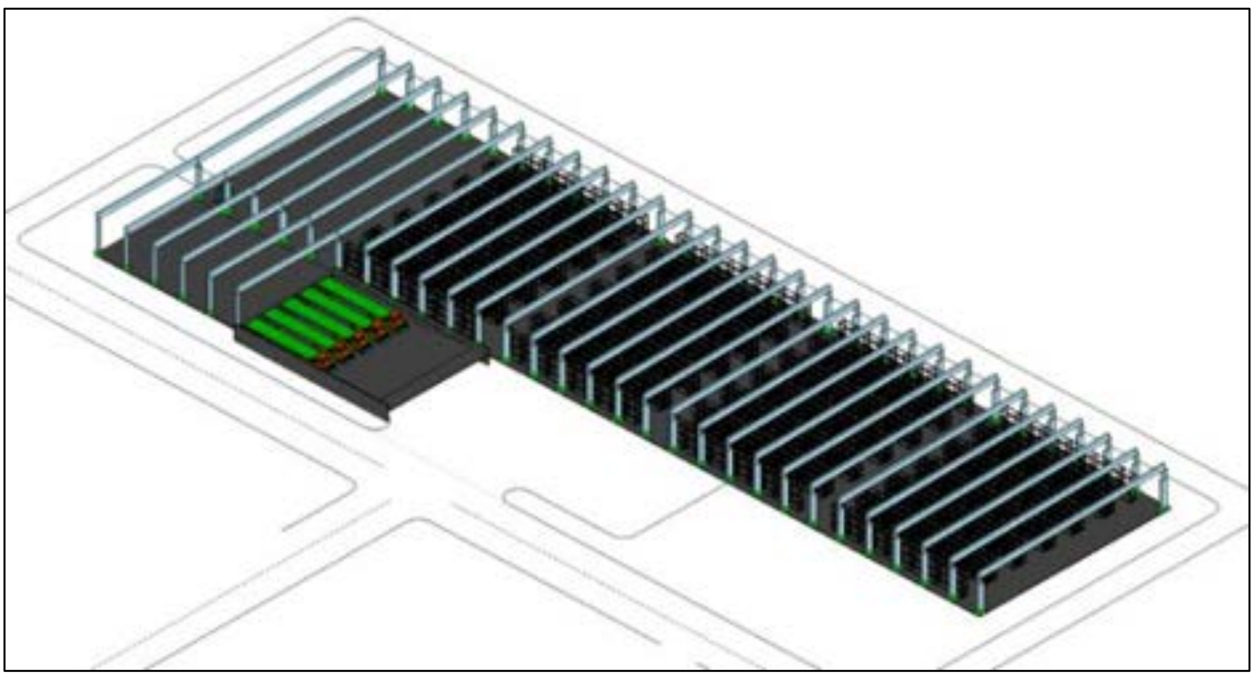


Source: Tan (2022)

17.2.6.6 Final Products Line: Packaging & Storage Building

The packaging and storage building (Figure 17-18) is a steel frame, metal clad building containing a bag packing machine, a bag placing machine, and a bag palletizing machine. There is storage space for inventorying the packed product bags on pallets, unused bags, and unused pallets. Each product bag contains about 23 kg (50 lb). One tonne bags are common for large customers.

Figure 17-18: Final Products: Packaging, Storage & Loading Dock



Source: Hatch (2022)

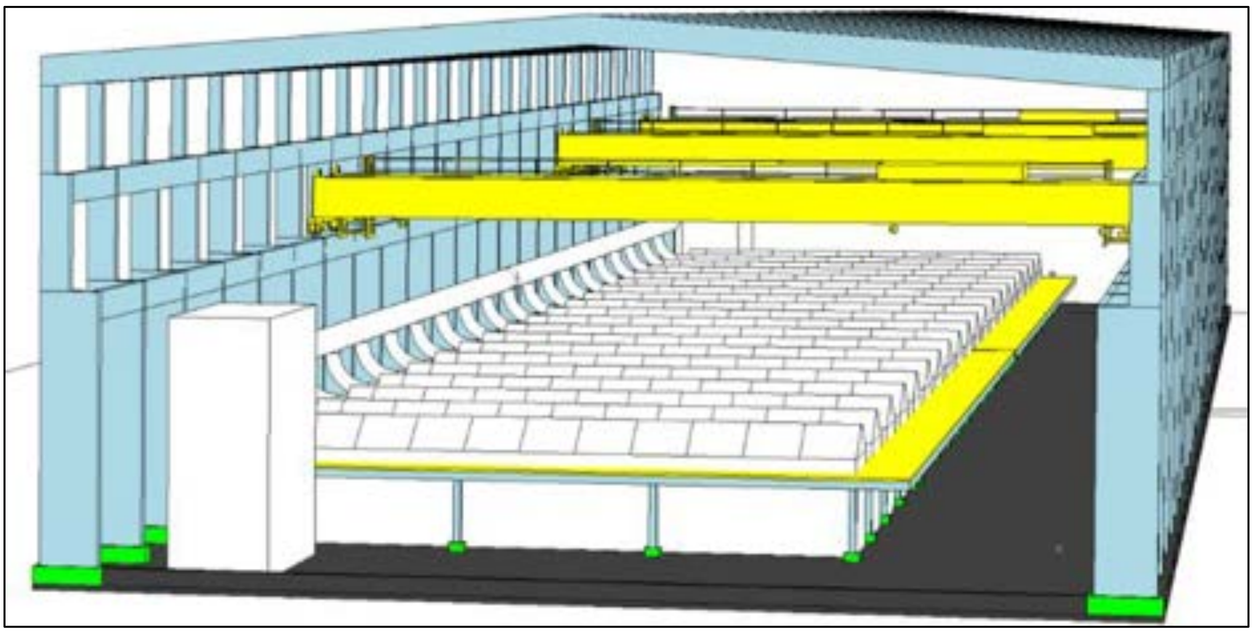
17.2.6.7 Final Products Line: Loading Dock

There is a final product packaging and storage building and loading dock for each Phase. The loading dock is a steel frame, metal clad building on concrete slabs constructed adjacent to the packaging and storage building (Figure 17-18).

17.2.6.8 Purification/Graphitization Furnace Building

The furnace building (Figure 17-19) is steel framed, metal clad and constructed on concrete slabs. Phases 1 and 2 each have a building containing two furnace lines (Figure 17-20). Phase 2 also has a third building containing one furnace line. In addition to the furnace lines, each building has a service crane, 3 multifunction cranes, unpurified material storage silos, purified material storage silos, an off-gas scrubbing system, a chlorine gas handling station, and a nitrogen distribution system.

Figure 17-19: Furnace Building - Two Lines

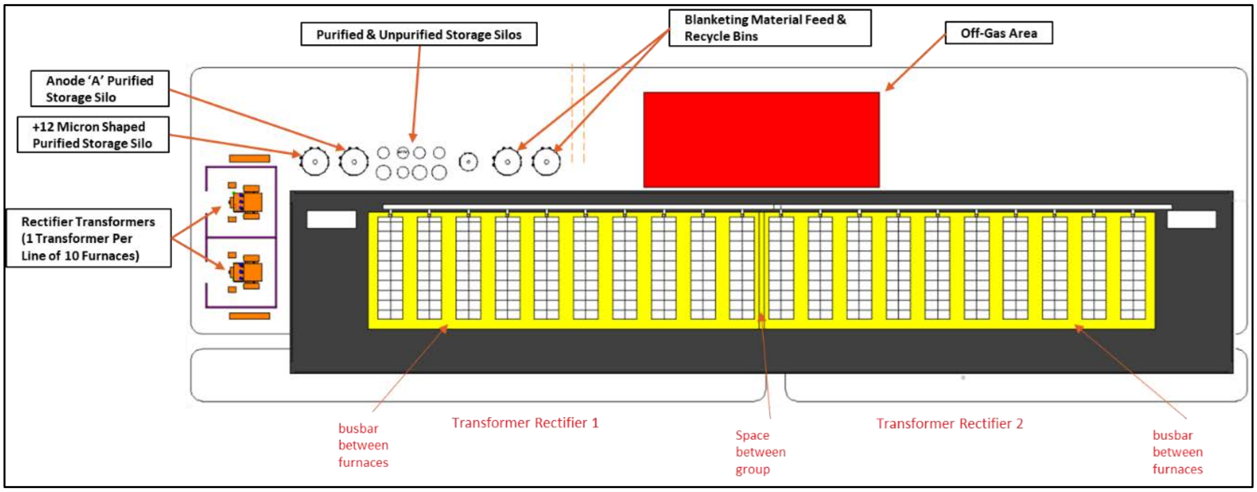


Source: Hatch (2022)

Each furnace line consists of 10 furnaces, 1 rectifier and a blanketing material handling system. The furnaces operate with a chlorine atmosphere, purged with nitrogen. Material is conveyed pneumatically and loaded and unloaded automatically. The furnaces are heated by electric resistance and designed to purify or graphitize material in 110 t maximum batches at design temperatures of up to 3,1000C.

Each furnace building has an off-gas scrubbing system to which its furnace gases discharge. Associated with this is a sodium hydroxide package which provides sodium hydroxide to the system's wet scrubber.

Figure 17-20: Purification/Graphitization Furnaces - Two Lines

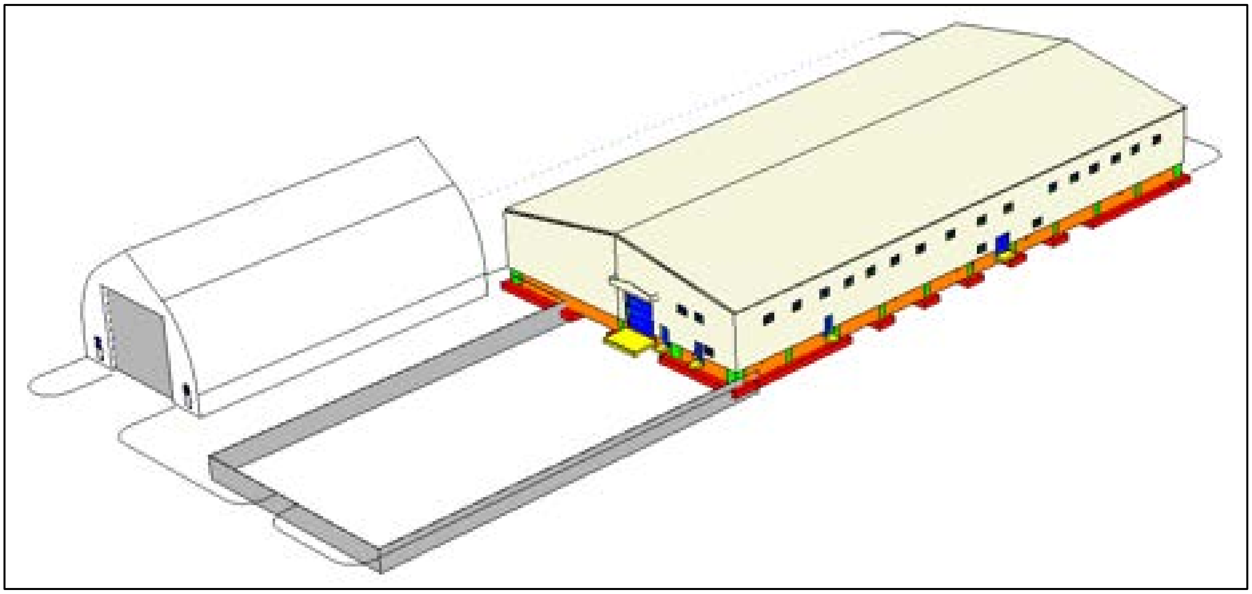


Source: Hatch (2022)

17.2.6.9 Maintenance & Warehouse Buildings

The maintenance and warehouse facility (Figure 17-21) is steel framed, metal clad and constructed on concrete slabs. It is designed to house the maintenance function requirements for the complex and warehouse the associated spare parts and materials.

Figure 17-21: Maintenance Facility & Warehouse



Source: Hatch (2022)

17.2.6.10 Water Treatment Plant

The water treatment plant is a purchased package, installed on a concrete pad and housed in a fabric building. A freshwater tank and a process water tank are associated with it. The freshwater tank receives fresh water from municipal sources and distributes it for regular and firefighting use as well as topping up the process water systems. It has a pump for each of Phases 1 and 2.

The process water tank collects water from the site water runoff pond, the off-gas scrubber system and, as necessary, from the freshwater tank. It has a pump for each of Phases 1 and 2. Collected process water is returned to the process water distribution system to maintain it at capacity. Any overflow is directed to the water treatment plant.

The water treatment plant treats all water from the Property prior to it being discharged into the local sanitary sewer system.

17.2.6.11 Other

A packaged nitrogen generation system is installed for each of Phases 1 and 2. Nitrogen is distributed to the purification/graphitization furnaces, the carbonization ovens, and the agglomeration processes.

Materials are primarily conveyed throughout the STP via pneumatic conveyance. This requires an extensive conveyance system throughout the STP and three air compressor packages for each phase. All discharge air is filtered to eliminate dust emissions.

17.2.7 Secondary Treatment Plant Infrastructure

17.2.7.1 General Description

Infrastructure located at the STP includes the following facilities:

- Concentrate Storage facilities;
- Material receiving, drying, sorting and micronizing building and equipment;
- Graphite purification and carbonization building and equipment;
- Agglomeration building and equipment;
- Final product storage building;
- 115 kV Substation;
- Maintenance and warehouse building;
- QA/QC lab;
- Cold storage;
- Admin offices and change house; and
- Site Water Management facilities.

17.2.7.2 Power Supply & Distribution

The secondary treatment plant will be connected to the Washington state power grid. The STP will have an onsite substation with a 115 kV switchgear for onsite distribution. The power will be distributed across the plant site, reduced using localized switchgear.

17.2.7.3 Maintenance/Warehouse

The maintenance/warehouse build is a multipurpose building that will be used for:

- Upkeep and operations of the STP;
- Heated/unheated storage areas for reagents and consumable; and
- Maintenance (it will be equipped with a workshop, machine shop, and welding shop).

There will also be offices, washrooms, and storage areas for the local workforce.

17.2.7.4 Process Plant Buildings

The buildings will be a steel structure with metal cladding and concrete slab on-grade. Roofing and cladding will be installed for operations, equipment, or materials for weather protection. The building design will all be provided by the pre-engineered building supplier. The building will be complete with snow sheds, fire protection, doors, and HVAC equipment.

17.2.7.5 Admin Building and Lab

There will be an admin/change house building that will be used for all workers to arrive and change for their daily activities.

There will be a QA/QC lab for sampling material at all stages of the secondary treatment process. The QA/QC lab will be also used to test potential improvements to the circuit.

17.2.7.6 Waste & Water Management

The secondary treatment plant will be connected to the municipality water source. Water will be purchased and used as required. There will be an onsite water treatment plant for treatment, monitoring and discharge to the environment, if required.

17.2.8 Staffing

Total employment in Phase 1 is 123 and 155 in Phase 2 as summarized in Table 17-6. The STP would operate about 300 days per year. The furnaces would operate 24 hours per day, 7 days per week. Most of the other processes would operate 16 hours per day, 5 days per week.

Table 17-6: STP Workforce - Phases 1 & 2

Departments	Phase 1			Phase 2		
	Staff	Hourly	Total	Staff	Hourly	Total
Technical Services	8	58	66	8	90	98
Maintenance	6	23	29	6	23	29
Administration	10	18	28	10	18	28
			123			**155**

Source: Tan (2022)

18 PROJECT INFRASTRUCTURE AND SERVICES

The project infrastructure is designed to support the operation of the mine and processing plant in Alaska and the Secondary Treatment Plant in Washington. All sections will be split by the two sites for clear understanding of each area.

18.1 Alaska Site Infrastructure

The Mine site is located approximately 60 km north of Nome, Alaska near the Imuruk Basin, on the Seward Peninsula. There is no current road access to the Property, with the Nome-Teller highway as the closest seasonal road to the southeast.

Infrastructure Facilities located at the Alaska mine site include:

- Primary crusher, coarse ore stockpile, process plant site pad and buildings;
- Tailings and concentrate filtration;
- Tailings management facility for dry stack and mine waste rock storage;
- Covered tailings stockpile;
- Concentrate storage area;
- Water management facilities including diversion ditches, seepage collection pond, water management pond, overland piping, and pumping;
- Water treatment plant;
- Onsite haul and access roads and various laydowns;
- Explosive and cap magazines;
- Assay Lab;
- Truck shop;
- Cold storage and heated warehouse;
- Bulk fuel storage and distribution; and
- Camp buildings and supporting infrastructure.

The site layout has been designed to minimize environmental and community impacts, provide security-controlled site access, minimize construction costs and optimize operational efficiency. Primary buildings have been located to allow easy access for construction and utilize existing topography to minimize bulk earthworks volumes. The Alaska site layout can be found in Figure 18-1. The Alaska plant site and main infrastructure facilities can be found in Figure 18-2.

Figure 18-1: Overall Site Layout

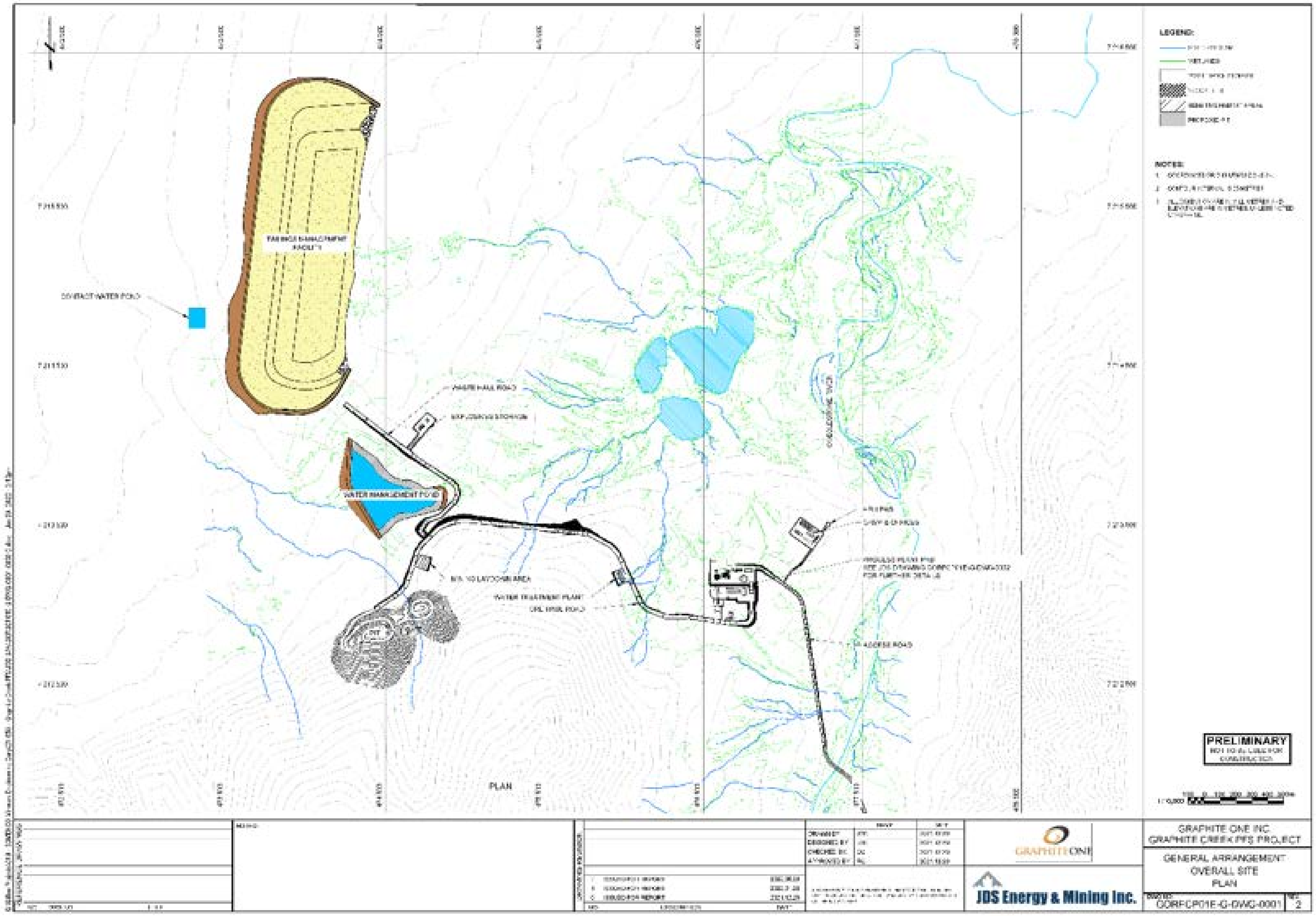
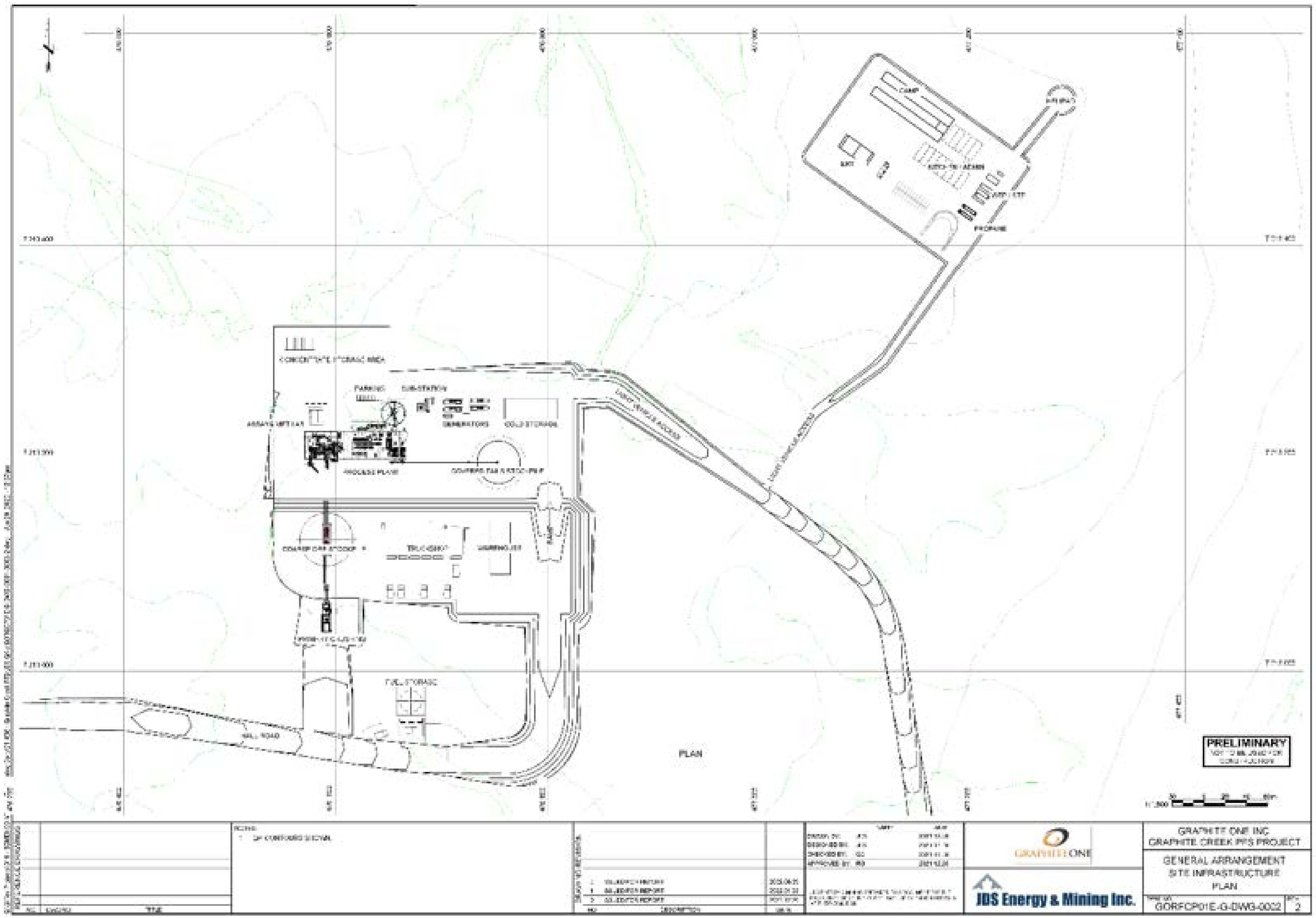


Figure 18-2: Plant Site & Main Infrastructure



18.2 Project Roads

18.2.1 Site Access Road

A 27.8 km long, two lane, gravel site access road will connect the mine to the Kougarok Road, which will provide year-round road access to the city of Nome. The new 27.8 km section of road will include an 8 m driving width, and six bridge crossings designed for 80-ton capacity. The road will begin at Milepost 29.6 of the Kougarok Road. The road will immediately cross headwaters of Nome Creek before trending west along the north side of Buffalo Creek. Near Kilometer Post (KP) 1.5, the route will cross Buffalo Creek before cresting a low pass and descending to the Sinuk River crossing at KP 7. Around KP 9, the route will turn north along the east flank of Windy Creek valley before climbing up to Mosquito Pass (elev. 350 m). After cresting the pass at KP 15, the route will descend along the east flank of the Cobblestone River valley north to a crossing of the Cobblestone River just below its confluence with the Oro Grande Creek at KP 25. The proposed mill site and road terminus is located on a low ridge immediately east of Cobblestone River at the north flank of the Kigluaik Mountains.

The road will be constructed entirely of locally sources material extracted from several proposed borrow sites along the route. The road will typically utilize fill construction over native soils with side cut to fill construction on side slope sections where subgrade conditions allow. The following design criteria was used for the design of the Access Road

- Design life of 50 years;
- Typical transport design vehicle: WB-62, typical tractor-trailer used on resource roads;
- Construction phase vehicle: 40 t articulating truck;
- Design speed of 60 kph (45 mph);
- Clearing width: Extend 1.5 m beyond the cut/fill toe;
- The driving surface of the two-lane road is 8 m (26.2 ft) in width;
- The embankment fill is a minimum of 1 to 1.8 m, depending on quality of subgrade;
- The surface course 0.2 m in depth and grading B; to consist of 75 mm minus, well-graded, durable, granular material with 6 to 10% passing the 200 sieve;
- Road grades: 7% preferred, 8% maximum;
- Cut slope: 0.25:1 to 3:1 depending on rock or soil type;
- Fill slope: 1.5:1 to 3:1 depending on rock or soil type;
- Horizontal curve: 130 m minimum with 244 m preferred;

- Vertical curve: American Society of Highway Traffic Officials (ASHTO) standard for design speed or specialized carrier requirements for oversize loads, K=20 typical and K=15 minimum;
- Minor culverts: corrugated metal pipe (CMP) with minimum diameter of 0.6 m (24 inches); and
- Guardrail or berms per criteria for industrial and resource roads.

18.2.2 Site Roads

The main site roads will be developed after completion of the access road. The site access road will fork towards the camp and the remainder of the mine site. The site road will continue west towards beyond the plant the water treatment plant, open pit mining, water management pond and the tailings management facility.

The site will also have designated haul roads. From the open pit, there will be access for ore hauling towards the process plant and primary crusher. Additionally, there will be a waste rock haul road towards the tailing management facility.

Various temporary construction access roads will be made or modified from existing roads for temporary construction laydown facilities, the staged TMF construction, and for construction access, where required.

18.3 Power

18.3.1 Power Supply

Power will be generated by 7 x 1.83 MW diesel generators operating in a N+2 arrangement. The total rating will be 12.81 MW. The generators will be located next to the process plant and beside the main sub-station.

18.3.2 Power Distribution

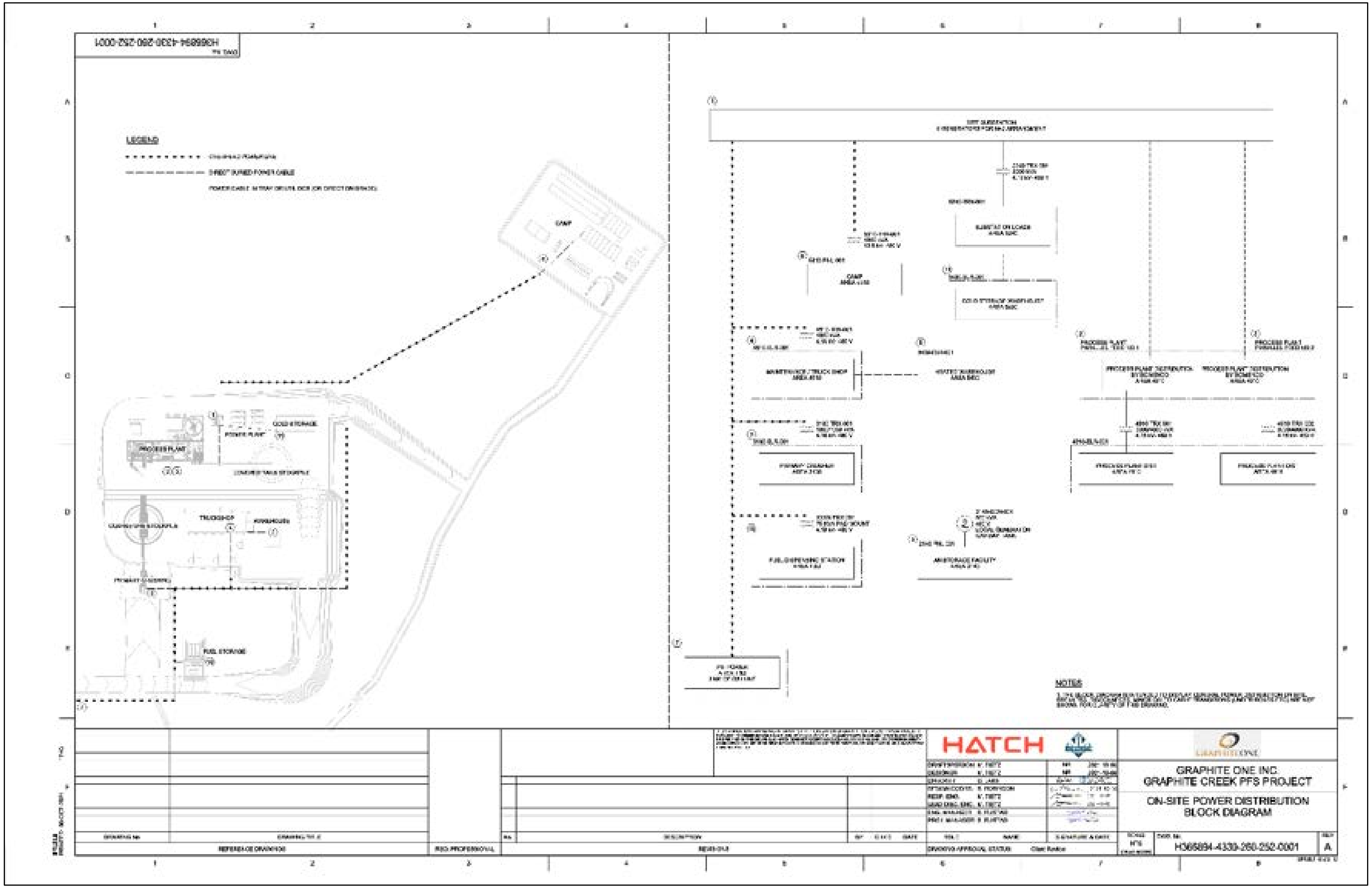
Onsite distribution will be operating as a 4160 V distribution system with localized transformers at each area of the plant. Cables will be both buried underground and overhead line to areas along the plant.

The selected distribution will be 4.16 kV for large drives and 480 V for smaller drives within the processing plant. The distribution system will have area substations and will distribute power to each individual user.

Heat from the diesel generators will be recovered using a glycol system, which will be pumped into the processing plant for supplemental heating requirements.

The block diagram for onsite distribution can be found in Figure 18-3.

Figure 18-3: Alaska Site Power Block Diagram



18.3.3 Construction Power

Generators will be rented during the construction phase for the camp and the processing facilities. They will be used and relocated as required while the construction of the main power supply is being constructed.

18.4 Support Infrastructure

18.4.1 Fuel Storage and Distribution

Bulk fuel will be delivered to site for the power generation and fueling of equipment onsite. Existing bulk storage facilities near the port of Nome, will be used store fuel deliveries received during the 5-month shipping window to Nome. A bulk fuel diesel storage tank consisting of a 4 ML capacity with a concrete containment area and fuel dispensing equipment will be constructed at site. This facility will service the open pit mining equipment, the site surface fleet, the powerplant, and is sized to provide sufficient storage for several weeks in the case of closures to the site access due to inclement weather.

The Powerplant fuel storage would consist of one double walled 75,000 L capacity reservoir for diesel. A mine service fuel truck would deliver fuel from the bulk fuel storage to the mobile mining fleet at the pit.

18.4.2 Explosives Storage

An explosive storage facility will be located off the haul road leading from the Open Pit towards the tailings and waste management facility. The explosives storage facility is sized to accommodate sufficient storage to supply the mine during the winter period where there is no barge access to the port of Nome.

18.4.3 Warehouse/Cold Storage

The site will include a heated warehouse along with a cold storage facility. They will both be sprung structures that have concrete slab and footings. The warehouse will be heated and insulated. The cold storage will be covered, but not heated.

18.4.4 ERT

An emergency response and first aid facility will be located near the camp and will include space for training, storage and parking for the ambulance and fire truck.

18.4.5 Truckshop

The mine truck shop will be located near the processing plant, easily accessible from the mine and the plant site. The truck shop will be used for maintenance and general upkeep of the mining fleet and surface equipment. Multiple bays will be allocated for general maintenance. A dedicated wash bay will also be included for the cleaning of vehicles. The maintenance facility will include a warehouse for parts and spares. An office area within the truck shop will house the maintenance supervisor and planner. A mobile equipment parts and spares warehouse will also be included within this facility. The building will be a steel-frame and metal clad build with approximate dimensions of 24 x 47 M, serviced by a 10 t crane.

18.4.6 Assay and Met Lab

An assay lab and met lab will be located next the main process plant to service the metallurgical and geological assay requirements of the operation.

18.4.7 Camp Facilities

The camp will consist of 152 beds, with four x 38 bed wings. All facilities will be connected via arctic corridors. There will also be a 9-unit kitchen and dining facility. The camp facilities will also be equipped with mudroom, mine dry, offices and washrooms. All heating will be provided by propane furnaces, supplied by propane storage tanks.

There will be potable water treatment and wastewater treatment at the camp site for water requirements and disposal. There will also be waste bins, incinerator, and allowances for general waste removal from site.

There will be a temporary camp rented for the months when the permanent camp is being constructed and the peak construction period. The rental period will last 12 months.

18.4.7.1 Admin Facilities

Offices and meeting rooms to support the operation will be located adjacent to the Camp facility. Site orientations and specialty staff training sessions will also be held at this location.

18.4.7.2 Process Plant Buildings

The building will be a steel structure with metal cladding and concrete slab on-grade. Roofing and cladding will be installed for operations, equipment, or materials for weather protection. The building design will be provided by the pre-engineered building supplier. The building will be complete with snow sheds, fire protection, doors, and HVAC equipment.

18.4.8 Concentrate Storage & Shipping

Concentrate will be stored on site during the 7-month period each year where the Port of Nome is inaccessible by barge due to ice buildup at the Port of Nome. Concentrate will be loaded into

1t tote bags, which will then be stored in 20t shipping containers that will be stored on laydowns at the mine site. The shipping containers will provide secondary containment and protection from the elements during the winter months. Once the annual shipping window opens in the spring, the containers will be transported to Nome and loaded directly onto a barge for shipment to the Secondary Treatment Facility. Empty containers will be backhauled from Washington to Nome, once the concentrate has been offloaded, and will be stockpiled at the site at the end of the shipping season to be filled over the course of the next winter.

18.4.9 Mobile Equipment

A list of mobile equipment has been estimated for the site services is shown in Table 18-1. This service equipment is planned to be purchased by the Owner during the construction period and used for operations.

Table 18-1: Site Service Mobile Equipment

Equipment Required	Operating Description	Qty
1 T Diesel Crew Cab Pick-Up - Ford F350	Site Services	10
44 Passenger Bus - Freightliner	Transportation	2
4x4 Bus	Transportation	2
Container Handler	Site Services	2
Tool Carrier - Cat 966 k (C/W Attachments)	Site Services	1
5 T Forklift Zoom-Boom - Caterpillar	Site Services	1
Tractor (Winch/Semi, Truck)	Site Services	1
20t Picker Truck - Western Star 4900 Xd	Site Services	2
2 T Diesel Pick-Up C/W Heated Van - Ford F550	Site Services	2
3 T Forklift - Warehouse - Cat 2dp6000	Site Services	1
CAT 980 - Inc. Forks And Buckets	Site Services	1
Mobile Equipment Operator - Grader	Site Services	2
Vacuum Truck	Site Services	1
Ambulance / Rescue - Ford F450	ERT/Emergencies	1
Firetruck (Used)	ERT/Emergencies	1
Portable Light Plants (Diesel) - 15 KW	Site Services	6
Portable Diesel Heaters (Including Ducting)	Site Services	20

18.5 Waste Management Facility

18.5.1 Introduction

The principal objectives for the Waste Management Facility (WMF) and associated infrastructure are to provide safe and secure storage of tailings and waste rock, to protect regional groundwater and surface water during operations and in closure, and to achieve effective reclamation. The design basis and operating criteria for the WMF and water management facilities are based on the latest available project information and studies, mine production schedule, and relevant design standards. The filtered tailings and waste rock are assumed to be Potentially Acid Generating (PAG) and will be co-disposed in a single facility. There is no storage of water at the WMF. The primary water storage facility on site is the Water Management Pond (WMP). The end of mine general arrangement is shown on Figure 18-4.

18.5.2 Geochemistry

Based on 48 samples collected as part of the geochemical sampling program, 73% of the waste rock samples were characterized as PAG, 4% as uncertain and 23% as non-PAG. The following parameters were elevated in the solid-phase relative to 10x the average crustal abundances Price (2009): arsenic, cadmium, molybdenum and selenium. Although these constituents were elevated in the solid-phase, aluminum was the only element elevated in the SFE testing when compared to the Alaska water quality criteria for toxic and other deleterious organic and inorganic substances (State of Alaska 2008). It is important to note that these criteria apply to receiving environment standards and SFE results were only compared to them as a mechanism to identify potential constituents of interest (COIs).

The total inorganic carbon (TIC) content in the majority of the samples is low and humidity cell testing indicates that acid generation can occur within weeks. Three of the six waste rock HCTs became acidic during the testing program with the pH decreasing to less than 4.5 after 22 weeks. Samples with higher carbonate content have longer lag times and depletion times can range from several years to decades in these samples. Release rates of several constituents increased as the pH decreased. These included: sulphate, aluminum, beryllium, cadmium, cobalt, copper, iron, lithium, manganese, nickel, selenium, uranium and zinc. The complete evaluation of elemental leaching potential suggests trace elements will be mobile in potentially high concentrations when conditions are acidic. Site drainage quality is evaluated in the site water quality model.

Graphite One produced one rougher tailings sample and five variability samples. The static results of the rougher tailings sample and variability tests indicate that tailings contain limited carbonate minerals but also have low sulphide concentrations (0.02 w.t.% to 0.18 w.t.%). Based on the sulphide cut-off, four of the samples were classified as non-PAG and two of the samples were classified as PAG.

The following constituents were elevated relative to the average crustal abundances in the tailings samples: antimony, arsenic, barium, cadmium, chromium, lead, lithium, molybdenum, selenium, silver and zinc. No constituents were measured above the Alaskan water quality criteria in the tailings SFE test, but the following constituents were greater than this criteria in the process water sample produced with the rougher tailings composite: dissolved concentrations of manganese and zinc and total concentrations of aluminum, copper, iron, lead, selenium and silver. Similar to the waste rock SFE tests, the comparison to the Alaskan water quality criteria is only completed to screen for potential COIs and exceedances in these tests do not imply an exceedance will occur during operations or closure. Site water quality is evaluated in the site water quality model.

The rougher tailings composite was submitted for humidity cell testing. This sample had no detectable TIC (i.e., TIC <0.02 w.t.%) and low sulphide concentration (0.09 w.t.%) and was classified as non-PAG. The HCT indicated that this sample does have a small amount of carbonate content and the pH was initially buffered at 7 during the first 16 weeks of the test (SRK 2022a). The pH decreased and remained stable between 5.3 and 5.6 for the remaining weeks of the test indicating that aluminosilicate buffering can maintain the pH at these values for low sulphide samples with low acidity production rates. Depletion calculations indicate that the sulphide will oxidize prior to the modified-NP (which includes aluminosilicate-NP) being depleted. This will be confirmed through ongoing testing. Release rates of several metals increased as a function of the pH decreasing in the HCT. These include: aluminum, cadmium, cobalt, copper, lithium, manganese, nickel and zinc.

18.5.3 Waste Management Facility

The WMF is located north of the open pit on a western facing slope. The facility is designed to store approximately 63 Mt of filtered tailings and waste rock, equivalent to a storage volume of approximately 33 Mm^3. The WMF includes a HDPE basin liner and a stabilizing buttress. The buttress will be constructed with non-PAG earthfill and rockfill materials. The tailings and waste rock will be co-mingled and placed and compacted in thin lifts to reduce void spaces in the facility, improving geotechnical and geochemical stability. The objective of the co-mingling strategy is to create a blended, compacted, low permeability material. Waste rock or processed quarried material may also be placed in select locations in the WMF to promote internal drainage of the filtered tailings. The WMF will be constructed in three stages, progressing further north with each stage. Contact water will be managed in the Contact Water Pond (CMP) located west of and downstream of the WMF, and the WMP located adjacent to the Open Pit. Overburden and topsoil removed during Open Pit stripping activities and the development of the WMF and the WMP will be stored to the west of the WMF with the materials used in construction throughout the Project life or reclamation activities.

The design of the WMF includes the following key design functions:

- Confinement of co-mingled filtered tailings and waste rock within an engineered facility;
- Diversion of clean water around the facilities with use of berms and diversion channels;
- Collection of contact water from the facilities with the use of collection ditches;
- Progressive advancement of the low permeability composite HDPE geomembrane liner system;
- Conveyance of groundwater flows beneath the facility;
- Facility seepage and runoff collection and management during operations and active closure;
- Inclusion of monitoring features to confirm performance goals are achieved and design criteria and assumptions are met;

- Staged construction of the WMF to defer construction costs; and
- Progressive closure cover of the facility, where possible.

18.5.3.1 Waste Management Facility Design

The PFS design assumes the footprint of the WMF will be cleared of vegetation and stripped of topsoil, exposing the underlying overburden materials. The PFS assumed 50% of material within the WMF footprint will be unsuitable and will be excavated and removed from the footprint during construction. The percentage of unsuitable material will need to be confirmed in future site investigation programs. The remaining 50% of the material would be reworked in-situ to form a relatively low-permeability, smooth layer for the overlying geomembrane liner.

Foundation drains will be constructed in the basin of the WMF to route groundwater and potential seepage beneath the facility to seepage collection sumps west of and downstream of the facility. Seepage collected in the seepage collection sumps will be pumped to the CWP located downstream of the WMF, and depending on water quality, may either be pumped to the WMP or discharged into the adjacent Graphite Creek.

A stabilizing buttress will be constructed for confinement at the downstream slope of the WMF to improve the overall geotechnical stability. The buttress will be constructed with selectively sourced, non-PAG material. The buttress will be constructed with 2.5H:1V upstream and downstream slopes to facilitate lining and suitable reclamation of the downstream slope at closure. Foundation preparation below the WMF stabilizing buttress assumed the removal of 5 m of overburden material. This will need to be confirmed following site investigations in this area. The minimum buttress crest width is 13 m to allow a working space for liner anchoring and haul traffic. The buttress crest elevation is 160 masl. The maximum elevation difference between the buttress crest and the lowest ground elevation at the downstream toe is approximately 35 m.

Two spillways are located along the southern and western extents of the buttress to provide controlled discharge of runoff from the WMF to the CWP.

The WMF is to be developed in three stages. Stage 1 commences at the south and will extend approximately 700 m north. Stage 2 will tie-in with Stage 1 and extend an additional 400 m north. Stage 3 is the final stage and extends approximately 1,100 m north of Stage 2. The Stage 1 WMF will store tailings and waste rock material up to end Year 2. The Stage 2 WMF will provide storage up to the end Year 8. The Stage 3 (final) WMF will provide storage capacity for the life of mine (Year 23). The buttresses have approximate fill volumes of 1.1 Mm^3 for Stage 1, 0.2 Mm^3 for Stage 2, and 1.0 Mm^3 for Stage 3. WMF construction may be divided into shorter construction portions based on updates to the mine plan and subsequent design studies. The ultimate WMF is approximately 2 km long and 0.8 km wide. The maximum vertical height of the co-mingled tailings and waste rock is approximately 50 m. The layout and ultimate height of the WMF will be optimized in future studies as geotechnical information is collected and analyzed for the site.

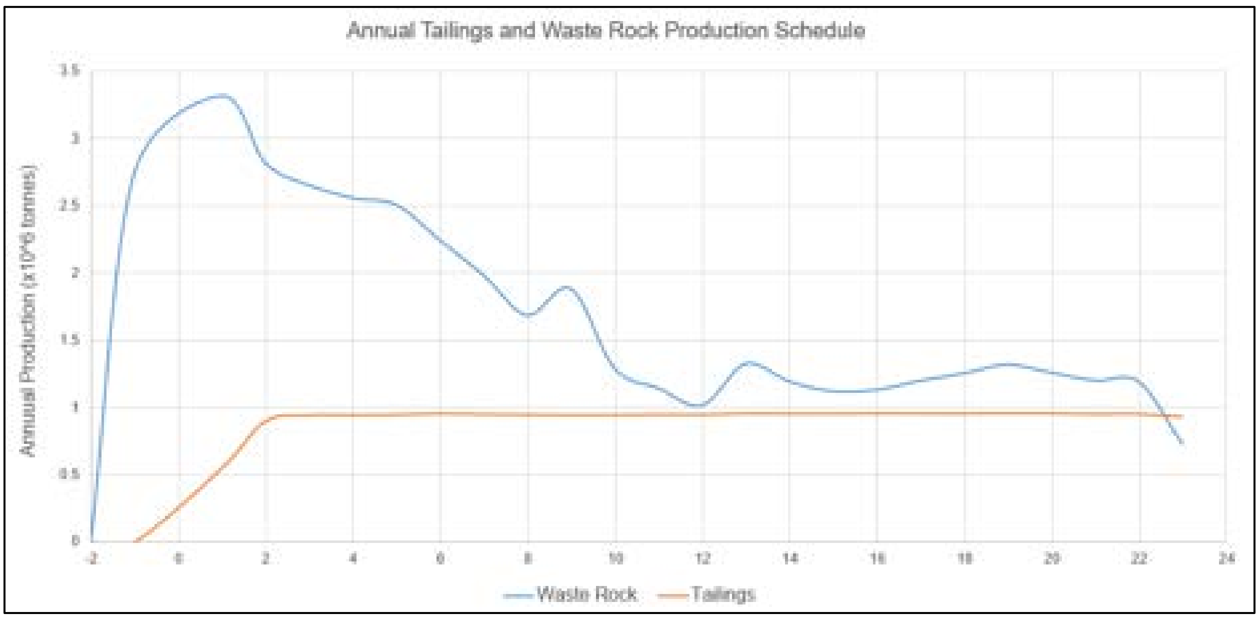
18.5.3.2 Low Permeability Liner System

A continuous 1.0 m thick layer of lower permeability material will be placed and compacted across the facility basin. An 80 mil HDPE geomembrane liner will be installed above the compacted material to form a composite liner to provide a low permeability seepage barrier beneath the facility. Sand and gravel will be placed above the liner for protection from construction vehicle traffic and to collect and convey infiltrated water through the tailings and waste rock to the dewatering sumps at the upstream toe of the buttress.

18.5.3.3 Tailings and Waste Rock Co-Disposal Strategy

Tailings and waste rock will be co-mingled in the WMF. Mixing of the tailings and waste rock will reduce void spaces in the facility and improve the geotechnical and geochemical stability. An objective of the co-mingling strategy is to create a blended, compacted, low permeability material. Waste rock without tailings filling the void spaces could function as preferential infiltration pathways, therefore the objective is to place the material in co-mingled lifts. Deposition planning will be required to ensure the co-mingled objectives are achieved, particularly in earlier years where waste rock production is significantly higher than tailings production as shown on Figure 18-4.

Figure 18-4: Annual Tailings and Waste Rock Production Schedule



Source: KP (2022)

It may be necessary to place the tailings and waste rock rapidly and in small areas during freezing conditions, reducing the exposed surfaces and risk of freezing prior to compaction.

Geotechnical testing was completed on one tailings sample in 2021. The program included specific gravity (ASTM D854), particle size distribution (ASTM D7928/D7928), hydraulic conductivity testing (falling head) (ASTM D5084) and consolidated undrained (CU) triaxial compression testing. The laboratory test results are summarized in Table 18-2. The tailings material is a non-plastic silty sand, with a United Soil Classification System classification of SM.

Note, the results of hydraulic conductivity testing are potentially at the lower bounds as the flow rates may have exceed the capacity of the equipment.

Table 18-2: Tailings Geotechnical Test Results

Test Method	RoTail Composite
Hydraulic conductivity testing	5.6 $x10^{-4}$ to 6.9 $x10^{-4}$ cm/s
CU Triaxial Testing	Effective friction angle 34 °
Particle Size Distribution	30.7% Passing 0.075 mm sieve (fines)
Specific Gravity	2.85

Source: KP (2022)

18.5.3.4 Infiltration Collection System

A continuous 0.5 m drainage layer placed above the HDPE geomembrane liner will route runoff and infiltration through the co-mingled tailings and waste rock to the dewatering sumps. The drainage material, consisting of sand and gravel, will be sourced from local borrow sources.

The facility will be graded to collect and convey infiltration flows to the dewatering sumps at the upstream toe of the buttress. A minimum grade of 1% has been adopted in the PFS design along the upstream toe of the buttress. The remaining footprint area of the WMF will follow existing surface grades which generally slope down at 12% towards the west. Collected infiltration water will be pumped from the sumps to the CMP and then to the WMP.

18.5.3.5 Cover Design and Progressive Reclamation

The WMF will be constructed with the western slope graded at 4H:1V and a relatively flat crest surface (nominal 1% grade) and an eastern slope also graded at 4H:1V that will tie-in with surrounding ground at an elevation of approximately EL. 220 masl. One bench has been included in the design to provide slope break and reduce the height of the tailings. The staging plan allows for progressive reclamation from the southern extent progressing towards the north as tailings and waste rock are placed within the facility.

The design of the closure cover includes a 1.0 m thick layer of low permeability overburden material placed in thin compacted lifts above the co-mingled tailings and waste rock material, covered by an 80 mil HDPE geomembrane to form a composite liner. The top liner will be welded to the basin liner to completely encapsulate the tailings and waste rock. A 0.5 m thick layer of drainage material will be placed above the liner for protection from vehicle traffic. The facility will be capped with a nominal 2.0 m thick layer of non-PAG material to improve long-term geotechnical stability. The capping layer may be tapered at the base of the facility and increase in thickness towards the crest to optimize geotechnical stability. Overburden and topsoil will be spread above the capping material and the facility will be revegetated as part of reclamation activities.

18.5.3.6 WMF Instrumentation

The following types of instrumentation may be installed:

- Survey monuments to evaluate the performance of the buttress with respect to movement, settling, etc.;
- VWPs to monitor pore pressures within the WMF foundations, buttress, and the tailings and waste rock materials to evaluate performance of the facility;
- Slope inclinometers to monitor potential movement of the WMF Facility; and
- Flow metres to monitor effectiveness and performance of the foundation seepage collection systems.

These will be monitored during construction and ongoing operations to assess performance of the facility and to identify any conditions that differ from those assumed during design and analysis. Amendments to the ongoing designs, operating strategies and/or remediation work can be implemented to respond to changing conditions as necessary.

18.6 Water Management

18.6.1 Introduction

The site water management plan describes strategies and provides guidance for the control of water in the Project area during construction and operations. All water in contact with the mine facilities (contact water) and non-contact water will be segregated.

Non-contact water will be collected and diverted around facilities to the maximum extent practical.

Contact water will be managed via diversion ditches, spillways, ponds, sumps, pipes, and pumps and treated as required prior to release in a controlled manner to Graphite Creek and ultimately Imuruk Basin.

All water will be managed to minimize erosion in areas disturbed by construction activities and the release of sediment laden water to the receiving environment.

18.6.2 Water Balance

A preliminary life of mine water balance was developed for the Project using GoldSim® software. Climate inputs to the model were based on historic climate records from Nome that extend between 1918 and 2020. The model suggests the system is a gaining system due to increasing rates of groundwater inflows into the Open Pit as the mine expands. It is estimated the water treatment plant will need to treat an average of approximately 8,000 m^3/day through the non-winter months to maintain the WMP below the maximum operating level in the 95th percentile conditions.

18.6.3 Water Management Pond

The Water Management Pond (WMP) will be the primary water storage facility on site and will collect all site contact water prior to being treated and discharged to the environment. Water will be pumped from the WMP to the Plant Site for use in the mill process, or to the WTP for treatment prior to discharge to the environment. Non-contact water will be diverted around the WMP to the maximum extent practical.

The pond embankment is approximately 700 m long, with a crest elevation of 163 masl, and have side slopes graded at 2.5H:1V. The crest will be 20 m wide to allow maintenance vehicles to access the crest, as required. The upstream (eastern) end of the pond terminates at a local saddle where a small embankment is required to provide pond containment. The small embankment will have a crest elevation of 163 masl, be approximately 2.0 m high and have side slopes graded at 2.5H:1V. The pond storage capacity is approximately 1.0 Mm^3 including 1.0 m freeboard and has been sized based on the results of the preliminary water balance assuming treatment and discharge over a seven-month period. The operating months of the WTP will need to be confirmed in future studies and the storage requirements adjusted as required. An emergency spillway will be formed in natural ground at the southern end of the pond.

The footprint of the WMP will be cleared of vegetation and stripped of topsoil, exposing the underlying overburden material. Any unsuitable overburden material will be removed, and suitable overburden material will be reworked in-situ to form a minimum 1.0 m thick foundation layer. As per the WMF, it was assumed that 50% of material within the WMP basin footprint will be unsuitable and the remaining 50% could be reworked in-situ. Foundation drains will be excavated and constructed with a nominal herringbone configuration to suit existing surface topography and to route groundwater underneath and downstream of the facility. The foundation drains will be formed using drain rock or higher permeability aggregate material. The foundation drains will discharge to the downstream WMP Seepage Collection Sump. Depending on the water quality in the sump, the water may be discharged directly to Graphite Creek or pumped back into the pond forming a closed-loop circuit. The sump will provide the monitoring point for the performance of the liner and seepage collection system.

The WMP will be a fully lined facility. A continuous 1.0 m thick layer of low permeability material will be placed and compacted in thin lifts to provide a lower permeability seepage barrier beneath the facility. An 80 mil HDPE geomembrane liner will be placed above the compacted material to form a composite liner system.

The closure and reclamation plan for the WMP includes breaching the dams and removing the HDPE geomembrane prior to reclaiming the basin footprint. The surface area of the pond footprint will be covered with topsoil and revegetated to resemble natural terrain at the Project site.

18.6.4 Open Pit Diversion

The footprint of the Open Pit extends across the existing flow path of Graphite Creek. The creek will be diverted around the Open Pit during the early stages of site development to reduce the risk of flooding the pit and to reduce the operational dewatering requirements. Graphite Creek will be diverted via twin pipelines with a headwall located at the southern edge of the pit rim. Diversion pipes will extend around the Open Pit cut slope benches at a minimum grade of 1%.

The diversion will discharge into the undisturbed portion of Graphite Creek downstream of the pit and will be outfitted with energy dissipators to reduce flow velocities and prevent erosion at the discharge point.

A localized diversion berm will form the main water diversion structure. A concrete headwall for the pipes will be cast into the diversion berm and the downstream face of the berm will be covered with a layer of riprap to protect it in the event of berm overtopping. The design of the concrete headwall is subject to further studies including an assessment of subgrade conditions and the development of expected loading conditions. The pipeline and diversion berm are sized to convey flows associated with the 1 in 10-year design event while maintaining freeboard and the 1 in 200-year design event with no freeboard. The design of the berm and pipeline shall be subject to design analyses in subsequent studies to confirm the operational and maintenance requirements including snow loading, avalanche risk, and potential for snow and ice blockage, as well as refining estimated flow rates associated with the 1 in 10-year and 1 in 200-year design events.

18.6.5 Diversion Channels and Collection Ditches

Non-contact water will be managed via a series of diversion channels that will divert runoff around the site facilities. Contact water will be managed via collection ditches that divert collected runoff towards the nominated sumps and ponds for water quality testing and treatment prior to discharge to the environment.

Diversion channels and collection ditches will be required, as follows:

- WMF diversion channels: These channels will be formed upslope of the WMF and graded at a minimum 1% towards the north and south to divert upslope non-contact water around the WMF. A diversion channel will also be located adjacent to and upslope of the WMF access road;
- WMP diversion channels: This pair of channels will divert runoff from the small catchment area upslope of the WMP around the WMP footprint. The southern diversion will discharge into Graphite Creek near the outlet of the Open Pit Diversion. The northern diversion channel will tie-in with the WMF diversion channel before discharging to the environment; and
- Collection ditches will be used for disturbed areas to collect runoff and convey it to collection points. A collection ditch will be located downslope of the WMF along the buttress toe to collect runoff from the WMF and direct it to the CWP, from where it will be pumped to the WMP.

18.6.6 Erosion Management and Sediment Control Strategies

Erosion management and sediment control includes establishing diversion and collection ditches to manage surface water runoff, stabilizing disturbed land surfaces to minimize erosion, establishing temporary vegetative cover, and re-establishing vegetation that is similar in structure to natural vegetation where final slopes are created.

Activities that have the potential to require sediment and erosion control include clearing vegetation and stripping topsoil, stockpiling overburden and topsoil, and constructing roads and infrastructure. Potential consequences from these activities, in the absence of planned mitigation measures, include increased surface erosion from disturbed areas, increased sediment load to downstream receiving environments, and siltation or erosion of downstream watercourses or waterbodies.

Sediment mobilization and erosion will be managed throughout the site by:

- Installing sediment control measures prior to construction activities;
- Limiting disturbances to the minimum practicable extent;
- Reducing water velocities across the ground, particularly on exposed surfaces and in areas where water concentrates;
- Progressively rehabilitating disturbed land and constructing drainage controls to improve the stability of rehabilitated land;
- Ripping of rehabilitation areas to promote infiltration;
- Protecting natural drainages and watercourses by constructing appropriate sediment control devices such as collection and diversion ditches and sediment traps;
- Restricting access to rehabilitated areas; and
- Constructing surface drainage controls to intercept surface runoff.

Installation of temporary erosion and sediment control features will be the first step towards controlling sediment and erosion during construction. All temporary sediment and erosion control features will require regular maintenance. The temporary erosion and sediment control features will be reclaimed after achieving soil and sediment stabilization.

18.6.7 Water Treatment and Discharge

A pit lake water quality model was developed to estimate closure water quality. The results of the pit lake model were used to inform the project treatment design and costing. The water model will continue to be refined as additional HCT test results are received.

Water treatment will be required to discharge excess water during operations and closure. During operations, excess water from the water management pond is anticipated to be acidic (pH ~4) and to have elevated metal concentrations (SRK 2022a). Contact water collected in the pit will also need to be treated during closure. The primary constituent of concern is iron. Other constituents predicted to exceed Alaska Freshwater Aquatic Life Standards include:

- Aluminum;
- Antimony;
- Arsenic;
- Cobalt;

- Copper;
- Manganese;
- Nickel;
- Selenium; and
- Zinc.

A high-density sludge water treatment plant will be constructed to treat excess WMP water for during operations. Water treatment will continue from construction through the demolition of the site infrastructure and closure of the mine waste facilities. After the mine closes, contact will be conveyed to the pit. The pit will fill with pit wall runoff, groundwater inflows, direct precipitation and other sources of contact water as needed. Flooding the pit will take approximately 10 years (SRK 2022b).

Operation Phase Water Treatment

KP (2022) describes the site water balance during operations. The water management system is anticipated to have sufficient storage capacity to attenuate seasonal variations in flow. The water treatment plant design flow rate is 1520 g/m. The water treatment plant will operate for seven months a year from April through October. The operational water treatment plant is anticipated to be decommissioned one year after the site is closed.

Closure Phase Water Treatment

A second water treatment plant will be constructed after the pit floods to manage the pit water level and treat the contact water that fills the pit. On average, approximately 277,350 m^3 of water will need to be treated annually and discharged from the pit. The design flow rate of the water treatment plant is 900 g/m. The water treatment plant will operate two months per year, likely during July and August. Operation of the water treatment plant during closure will require logistical support and planning for a remote camp on site. The costs to maintain the camp are not included in the closure water treatment cost estimate. Water treatment in perpetuity is expected because of the exposed pit high wall.

18.6.7.1 Process Description

A high-density sludge lime-based neutralization and precipitation process is proposed to treat effluent from the contact water in operations and closure. This process will consist of neutralization and precipitation with lime, flocculation, clarification, and pH adjustment (if required). The neutralization and precipitation process will include aeration to oxidize iron and manganese and lime addition to neutralize acidity and increase pH to precipitate metal hydroxides and gypsum. Arsenic and antimony are assumed to co-precipitate with the iron hydroxide. Bench scale testing of the process during subsequent studies are recommended to verify metal removal efficiencies and removal of arsenic and antimony by co-precipitation.

The water treatment systems for operation and closure will include the following:

- Lime storage silo, lime slurry preparation, and lime slurry distribution systems;

- Flocculant storage, preparation, and dosing systems;
- Hydrochloric acid (HCl) storage and dosing systems;
- Agitated lime-sludge mix tank;
- Agitated reactor tanks;
- Aeration blowers;
- Clarifier;
- Clarifier underflow recycle and waste pump systems;
- Agitated overflow tank, flush water and dilution water pump systems;
- Flocculant preparation area, reactor area, clarifier area, and reagent storage area sump and sump pump systems;
- Instrumentation and controls;
- Instrument air system;
- Eye wash stations and safety showers;
- Reagent storage area;
- Control room; and
- Motor control center.

During operations, sludge will be pumped to a drop box in the mill tailings line and will be co-disposed with the tailings. Sludge from water treatment after closure will be disposed of in the pit.

Treated water will be conveyed to a final agitated tank. A pumping and pipeline system will convey treated water to an underwater diffuser in Imuruk Basin.

18.6.7.2 Receiving Water Quality Limits

Water quality objectives in Imuruk Basin have been defined. The hydrodynamics, water quality and designated use of Imuruk Basin need to be characterized to advance the project study. Depending on the influence and balance of tidal driven currents and freshwater flows, the basin maybe classified as marine or freshwater. These hydrodynamic factors and Alaska regulations will determine the designated use and in-stream water quality standards for Imuruk Basin.

If the Imuruk Basin is classified as a freshwater body, a mixing zone will be needed to meet standards for:

- Selenium (Water Quality Standard for the protection of aquatic life);
- Total Dissolved Solids (Water Quality Standards for water supply - drinking, culinary and food processing); and
- Sulfate (Water Quality Standards for water supply - drinking, culinary and food processing).

Future studies characterizing Imuruk Basin are needed to evaluate permitting options and requirements and if selenium, sulfate and/or total dissolved solids require treatment.

19 MARKET STUDIES AND CONTRACTS

19.1 Introduction

Natural and synthetic graphites are used to make products for many applications that can generally be grouped into the following categories:

- Energy storage: anode materials for lithium-ion (Li-ion) batteries for electric vehicles and electrical grid storage applications; and li-ion and other batteries for consumer, communications, aerospace, medical and military applications;

- Thermal management – applications requiring graphite's properties as a thermal conductor or insulator including refractories, crucibles, steel and foundry additives, hot metal toppings, and geothermal grouting systems;

- Engineering products – products manufactured using graphite powder additives such as fire retardants, powder metallurgy, foils, friction materials (brake linings, clutch facings), carbon brushes, and synthetic diamonds;

- Lubricants -applications relying on graphite's natural lubricity such as lubricants (wet, dry, rail, nuclear grade, aerospace, agriculture, MIL-SPEC, food grade), drilling fluids, coatings, and dispersions; and

- Plastics and polymers – applications using graphite's properties in plastics and polymers to make gaskets, seals, anti-static materials, and coatings.

In some cases, only synthetic (also known as artificial) or only natural graphite can be used to make a particular product. In others, the two are used as a blend or processed together, depending on the product's goals.

19.2 Market Reports

The information in this section is based on the following studies either commissioned or purchased by Graphite One and augmented by information from Graphite One's direct contacts (the Market Reports):

1. Graphite One – Pre-Feasibility Study Market Report by Benchmark Mineral Intelligence (BMI) dated August 2021;

2. Graphite One Inc. Commercial/Technical PFS Market Report by Lone Star Tech Minerals, LLC-USA dated August 2021, updated July 2022;

3. Anode Market Report by a confidential industry source dated August 2021;

4. Flake Graphite Forecast, Q4 2021 by BMI; and

5. Global Graphite Market Strategic Planning Outlook – Q1 2022 by Wood Mackenzie Limited's Graphite Market Service™. The graphite demand and supply forecast summary that follows is from this report. [2]

19.3 Market Review Conclusions

- China is and will continue to be, the dominant global producer of advanced graphite products. It has abundant natural graphite resources, synthetic graphite production capacity, coated spherical graphite production capacity, advanced anode production capacity, the related technology and experience, and the capital to expand;
- Graphite use, all types in all applications, is forecast to increase to 9.2 Mt/a in 2050 from about 2.85 Mt/a in 2020. Of this, synthetic increases to 5.9 Mt/a from about 1.8 Mt/a and natural to 3.35 Mt/a from about 1 Mt/a;
- Flake graphite in battery use is forecast to peak at 2.41 Mt/a in 2043, increasing from 0.28 Mt/a in 2020, and gradually drop to 2.17 Mt/a in 2050; and
- An increase in demand for natural flake graphite for batteries of over 2 Mt/a by 2043 requires existing operations to reach their maximum capacities and new projects to commence production.

19.4 Summary of Graphite Products

A wide range of products depend on the use of natural graphite to take advantage of graphite's unique properties. These properties include:

- Low density;
- Low hardness;
- Chemically inert;
- High lubricity;
- High electrical conductivity;
- High thermal conductivity;
- Magnetic permeability;

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- High sublimation temperature; and
- Low thermal expansion.

Characteristics of a particular flake graphite such as types and quantities of its impurities, flake size and thickness, and particle size distribution are also important in its selection for applications.

19.4.1 Energy Storage Products

The energy storage product category has become the most important market sector for graphite, taking advantage of its property of high electrical conductivity and ability to store energy. In lithium-ion battery anodes, high purity and particle size are critical. This can avoid side reactions in the batteries and ensure the lithium ions shuttle quickly. It is also used in rechargeable and non-rechargeable batteries, fuel cells and capacitors designed for many energy storage applications. This report mainly focuses on its use in Li-ion battery anode materials.

19.4.2 Thermal Management Products

Natural flake's high thermal conductivity is critical in this category, and particle size (typically greater than 20 µm) is a more important parameter than higher purity.

19.4.2.1 High Thermal Conductivity Graphite Blocks

High thermal conductivity graphite blocks are used to dissipate heat in the electronics industry by taking advantage of graphite's high thermal conductivity in the plane direction.

19.4.2.2 High Thermal Conductivity Graphite Film

High thermal conductivity graphite film is also used to dissipate heat in electronic devices where space is limited. Films made with natural graphite have an advantage over those made with synthetic graphite because natural graphite film has a greater continuous hexagonal crystal structure and resulting in greater thermal conduction.

19.4.2.3 Porous Graphite Composites with Phase Changing Materials

Natural flake graphite that is made into a porous composite material and combined with a phase changing material is used to drive a variety of heat transfer applications. The system absorbs or releases heat as it changes phases (e.g., paraffin solid ⇔ liquid).

19.4.2.4 Graphite Modified Insulation Material

Using polystyrene infused with 1-50 µm graphite powder in the manufacture of rigid foam insulation results in an improved insulation, the resin coated with expandable graphite results in an improved flame retardancy, dimensional stability and R-value. BASF manufactures BASF Neopor® GPS, a polystyrene graphite foam, which it markets to the foam insulation industry.

19.4.2.5 Thermally Conductive Gypsum Board

Natural graphite powders are added to traditional gypsum wall board to improve its thermal conductivity and enhance the effectiveness of radiant cooling and heating technologies.

19.4.3 Engineered Products

The engineered products group encompasses a wide range of applications that use graphite powder additives. These applications include expandable graphite, friction products, powder metallurgy, ceramics, and carbon brushes.

19.4.3.1 Expandable Graphite

Expandable graphite (also known as graphite salt) is manufactured by treating flake graphite with specific compounds that are intercalated between the layers of the flake graphite crystals. When the compounds are exposed to high degrees of heat, the graphite layers expand several hundred times their original flake size and thickness thereby creating expanded or exfoliated graphite, a critical parameter for fire stop applications.

Expandable graphite flake is an additive used in materials requiring improved fire-protection characteristics. Some of the many applications include residential, commercial and industrial building materials, automotive seating, aircraft seating, firestop expandable seals, expandable foams for commercial and industrial building, and industrial and consumer fire retardant fabrics. Each application has specific parameters, chemical limits, performance metrics, and mesh size requirements.

Currently, almost all expandable graphite is produced in China from Chinese natural flake mines creating a domestic manufacturing opportunity. Fire retardants are one of the fastest growing segments in the in the graphite industry. The U.S. Department of Defense is actively looking for solutions to eliminate polyfluoroalkyl substances from the common aqueous film-forming foams now used to extinguish petroleum-based fires and this is an opportunity for expandable graphite.

19.4.3.2 Friction Products

The use of graphite in friction materials such as brake linings and clutch facings has grown, partly as a replacement for asbestos. While amorphous graphite is the preferred type, finely sized flake graphite (minus 200 mesh) is also used as a heat dissipater and a friction modifier.

19.4.3.3 Powder Metallurgy

Both natural and synthetic graphites are used in powder metallurgy with the grade choices being made based on price and availability. Natural graphite accounts for around 65% and synthetic graphite 35% of the total used. High purity (minimum 99.0%) and small particle size is required.

19.4.3.4 Ceramics

Ceramics is an industry segment with a wide range of applications including silicon carbide parts (optics and body armour), high wear seals, and solid oxide fuel cell components. Graphite's use in the ceramics market focuses on thermal management, friction management, or in the manufacturing of SiC optics for NASA, other aerospace or scientific applications. Ceramic applications also include consumer goods for BBQ grill lighters, industrial bearings, medical devices, and MIL-SPEC products.

19.4.3.5 Carbon Brushes

A carbon brush conducts electrical current between the stationary wires (stator) and the rotating wires (rotor) of an electric motor, alternator or generator. It is typically made up of one or more carbon blocks which can be made with both synthetic and natural graphite. Key parameters include electrical and thermal conductivity, lubricity and hardness, mechanical strength, wear protection, and corrosion resistance.

19.4.3.6 Graphite Foils

Natural flake graphite is the main component of graphite foils. Expandable graphite is heated to produce expanded or exfoliated graphite. The results, referred to as "worms", can be pressed, calendared, or rolled into sheets. These sheets or foils are then cut to various shapes, sizes, and configurations.

Graphite foils are primarily used in gaskets, valve packings and seals, which can withstand high temperatures and pressures. It is also used as a heat dissipator in electronic applications and importantly for this purpose by the automotive industry.

The ability of graphite foil to remain flexible under high temperatures and pressures, as well as its resistance to chemical attack, makes it useful in the petrochemical, chemical and nuclear industries where corrosive or radioactive fluids are common. Natural flake graphite used in foil applications can be either standard flake or high purity flake (97% to 99.9% LOI) and +100, +80, +50, and +32 mesh sizes.

19.4.3.7 High-Tech & Emerging Markets

There are many emerging high-technology applications beyond lithium-ion batteries and the uses for natural graphite. Some of these include: its use in pebble bed nuclear reactors, ceramic armour tiles, silicon carbide optics and bearings, non-slip paving and production of a wide range of graphene products for various applications (medical devices, sporting goods, aerospace, low friction paints, conductive coatings, conductive inks, and home security.

19.4.4 Lubricants

This category includes any application that requires reducing or limiting frictional contact between surfaces and graphite's natural lubricity enables it to be used as a lubricant additive. Graphite powder is added to greases, dry films and dispersions to improve or manage the coefficient of friction in high or low-temperature applications. Graphite, acting as a solid lubricant film, retains its properties under conditions of high temperature and pressure and applications cover almost every industry.

Colloidal graphite is another product in which one-micron particles of graphite are suspended in oils and greases and used in general lubrication applications and packings.

Dispersions are products where graphite powder is dispersed in liquids with other additives that act to improve the dispersion of the graphite powder in the liquid medium. These applications require a fine distribution of graphite on the carrier material surface. The critical properties of an industrial dispersion include its crystal structure, the dispersion’s surface tension, drying time, pH-value, ionic polarity, viscosity, adhesion and wetting behaviour on different surfaces, and sedimentation stability.

19.4.5 Polymers and Plastics

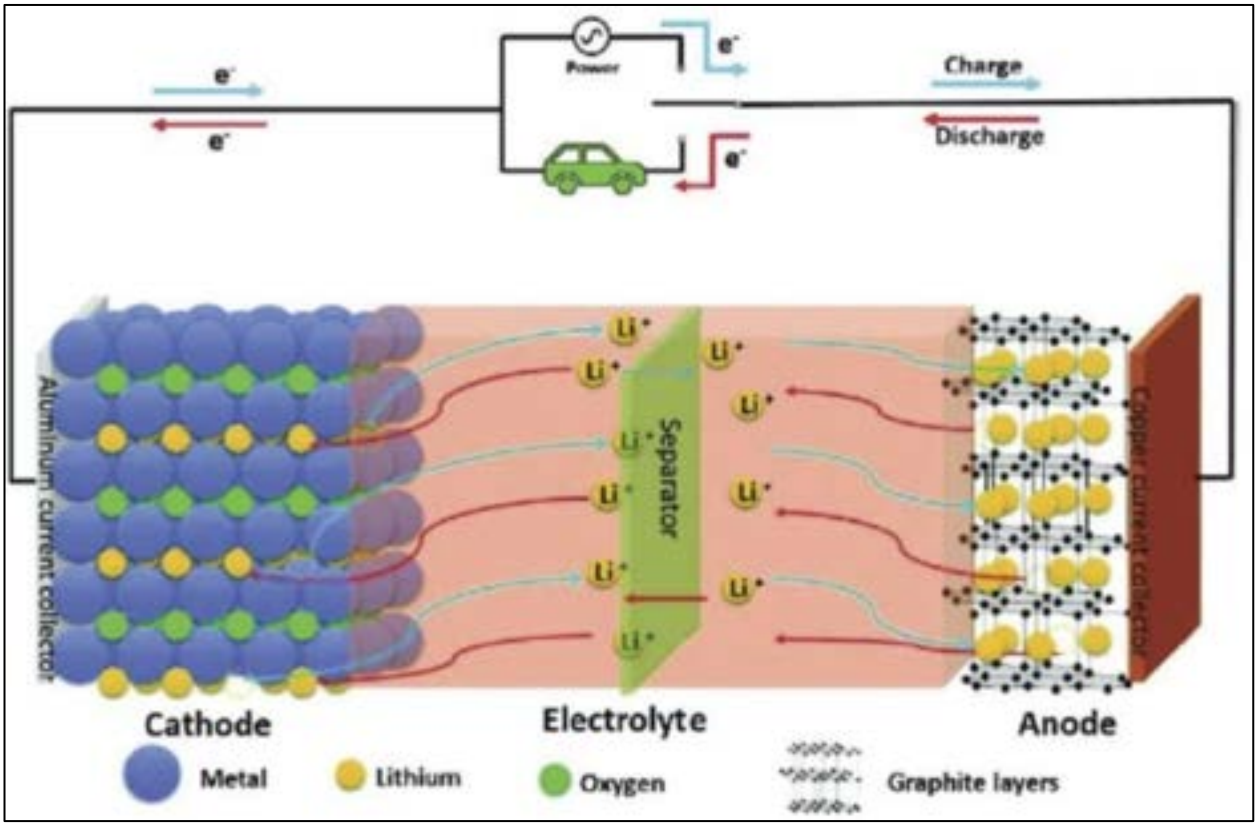
Polymers are lightweight, easy-to-process, and low-cost basic materials. Their uses increase when their thermal conductivity is enhanced by introducing graphite powders into the polymer matrix. Graphite is chemically inert and does not affect the other properties of the polymer matrix. Additional applications include chemical heat exchange pipes, LED lamp housings, and heating pipes. Graphite’s high electrical conductivity also allow applications where polymers and plastics can be used in areas where static electricity must be minimized.

19.5 Lithium-Ion Batteries

19.5.1 Introduction

Figure 19-1 illustrates the components of a Li-ion battery - an anode, cathode, separator, electrolyte, and two current collectors (positive and negative). The anode and cathode store the lithium ions. On charging, positively charged lithium ions move from the positive cathode, through the electrolyte and separator, to the negatively charged anode where they are intercalated in the graphite layers. At the same time, electrons move externally from the cathode, around the load, to the anode. The separator blocks this flow from occurring inside the battery. The battery is fully charged when the anode reaches its finite capacity to store the ions. On discharging, the reverse occurs. The Li-ions move to the cathode through the electrolyte and separator. The electrons move from the anode, through the load thereby powering it, and to the cathode.

Figure 19-1: Lithium-Ion Battery Schematics



Source: Benchmark Mineral Intelligence (2021)

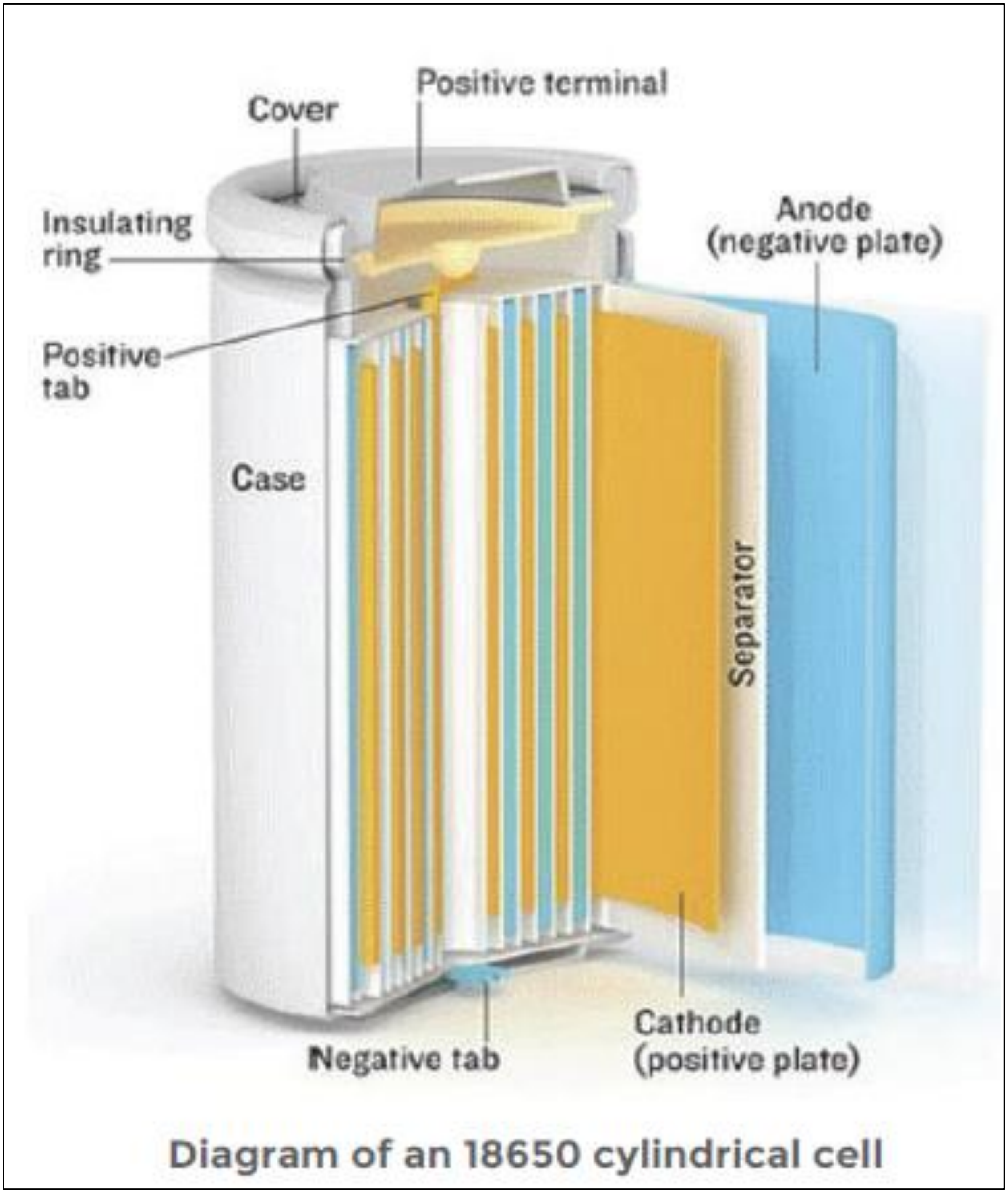
19.5.2 Cell Types

There are three main Li-ion battery cell formats: cylindrical, prismatic and pouch. Each format offers various performance characteristics.

19.5.2.1 Cylindrical

The cylindrical cell (Figure 19-2) offers good cycling ability, longevity and is economical to produce. For EV use, two common sizes are 18650 and 21701 (diameters = 18 & 21 mm; heights = 65 and 70 mm). As there are thousands of cells in an electric vehicle (EV), individual cell failure does not affect vehicle performance. The cell is heavy leading to lower specific energy density than other cell formats and has low packaging density due to space cavities. Common applications include power tools, laptops, e-bikes and EVs.

Figure 19-2: Cylindrical Cell



Source: Benchmark Mineral Intelligence (2021)

19.5.2.2 Prismatic

Prismatic cells (Figure 19-3) are encased in aluminum or steel for stability. Their rectangular shape provides good space utilization within an EV battery module, allowing for multiple module configurations within a battery pack. The design also allows for some swelling during performance. However, prismatic cells can be relatively expensive to manufacture, less efficient in thermal management and have potentially a shorter cycle life than the cylindrical design. Key applications of prismatic cells are for EVs and energy storage systems.

Figure 19-3: Prismatic Cell

Source: Benchmark Mineral Intelligence (2021)

19.5.2.3 Pouch

Pouch cells (Figure 19-4) employ a laminated battery configuration in a bag. The cells are very space efficient (90–95% packaging efficiency) and relatively light weight compared to cylindrical and prismatic cells. The cell needs allowance to expand in the battery compartment. Pouch cells are commonly used in portable electronics and EVs.

Figure 19-4: Pouch Cell

Source: Benchmark Mineral Intelligence (2021)

19.5.3 Graphite Anode Properties and Metrics:

- **Unit of Energy**: 1 Joule (J) = force of one Newton acting through one metre;
- **Unit of Power**: 1 Watt (W) = power of one Joule of energy per second and power from a current of 1 Ampere flowing through 1 Volt;
- **1 kilowatt-hour (kWh)** = energy from one kilowatt of power flowing for one hour or 3.6 x 10^6J;
- **Energy Density (kWh/m^3)** = amount of energy stored per unit volume;
- **Specific Energy (kWh/kg)** = energy stored per unit mass;
- **Power Density (kW/m^3)** = amount of power per unit volume;
- **Specific Power (kW/kg)** = power per unit mass;
- **Specific Surface Area (m^2/g)** = surface area per gram of solid material. The specific surface area of the anode material influences the dynamic performance of the battery and the formation of the solid electrolyte interface (SEI);

- **Elemental Content of Anode Material (ppm)** = Graphite's components are fixed carbon, impurities, and volatile matter. Fixed carbon is the electrochemically active component. The fixed carbon content specified for natural graphite anodes is ≥ 99.95% and this is achieved by subjecting the graphite concentrate to a purifying process. The small quantities of remaining impurities, and any introduced by any coating process, need to be identified to make sure they are not elements that could affect the electrochemical performance of the battery;

- **Initial Coulombic Efficiency or ICE (%)** = The ratio of a battery's capacity at a fixed voltage on its first charge to that on its first discharge and is a measure of the electrochemical performance of the electrode material; and

- **Density (g/m^3)** = Powder materials, including graphite, are porous. Density (mass per unit volume) therefore has variations. "True density" excludes the pores in its volume (true volume). "Apparent or bulk density" includes the volume of pores and water (apparent volume). "Effective density" is the density of the individual components of typically a mixture.

19.6 Graphite

19.6.1 Natural Graphite

Natural graphite occurs in mineral deposits of three types: microcrystalline (amorphous), macrocrystalline (flake) and vein (crystalline vein or lump).

Natural flake graphite is mined; crushed, ground, milled and screened; and then separated from non-graphitic material in a froth flotation process. The resulting graphite concentrate, depending on its source, is about 95% graphitic carbon and has a characteristic particle size distribution. The concentrate is used as is in many traditional applications (refractories, etc.), or further purified and processed into higher value products for use in advanced applications (fire retardants, battery anode materials, etc.).

Over the last decade, flake graphite has become increasingly important as a substitute for, or an additive with, synthetic graphite in Li-ion battery anodes. Anode producers look to optimize costs and battery performance with various blends of materials. To be used in a Li-ion battery anode, flake of the correct sizing (typically minus 100 mesh), is spheronized, purified (to at least 99.95% graphitic carbon), then coated with a carbon coating and carbonized to ensure consistent quality and optimal conductive properties. The resulting coated spherical graphite (CSPG) is an ingredient in a battery anode. A cell producer will combine the anode material with the other battery components in the casing of choice to produce a battery cell. The cell can be in either a cylindrical, prismatic or pouch configuration. The OEM will then purchase the cells from the battery producer for use in its various powered applications.

19.6.2 Synthetic Graphite

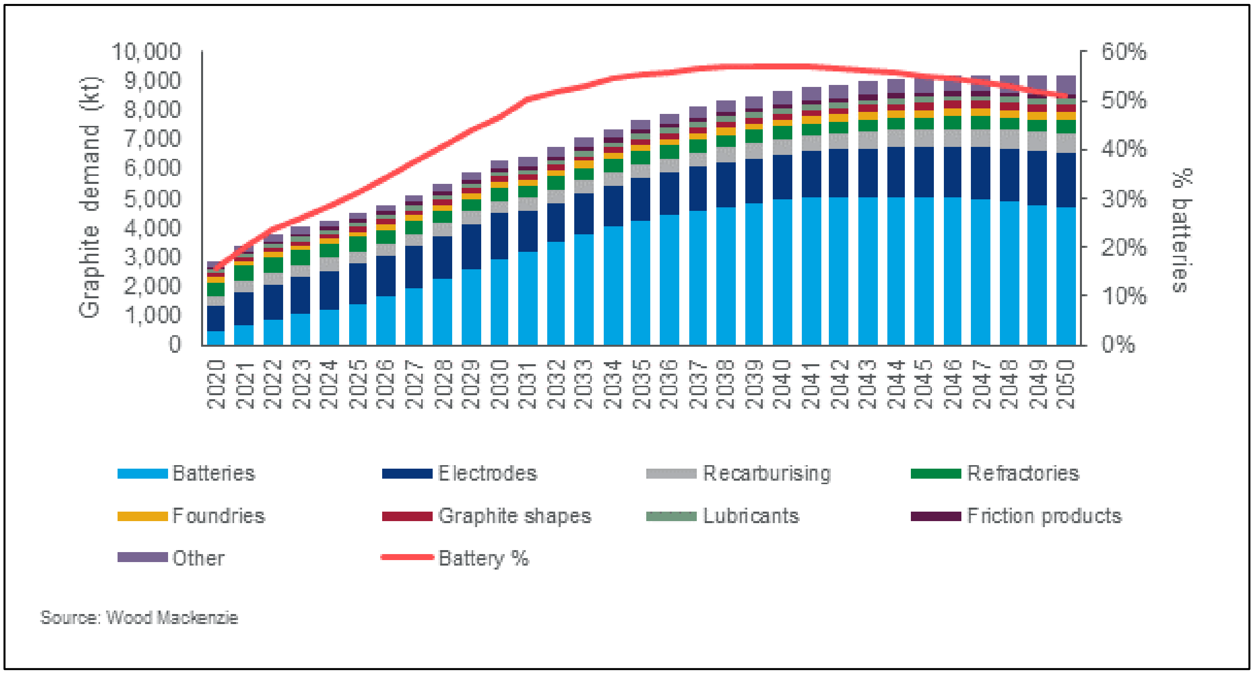
Synthetic graphite is produced by graphitizing a precursor material in high temperature furnaces (2,800 to 3,000^{0}C). The precursor is made from needle coke and pitches that are first milled and mixed and then carbonized. Synthetic graphite powders are used in various applications including making Li-ion battery anode materials.

19.7 Graphite Demand and Supply

19.7.1 By Application

In Figure 19-5, graphite demand is forecast by application to 2050.

Figure 19-5: Graphite Demand by Application[3]



Source: Wood Mackenzie (2022)

Total global graphite demand in 2020 was about 2.9 Mt of which 62% (1.78 Mt) was supplied by synthetic graphite and 38% (1.08 Mt) by natural graphite. Electrodes made up 31% (all synthetic) of the total demand, refractories 17%, batteries 16%, recarburising 12% and other applications averaged about 5% each. China supplied 62% of the total demand, other Asia 18%, Europe 9%, and North America 6%. South America and the rest of the world averaged about 2.5% each.

[3] The foregoing graph was obtained from the Graphite Market Service™, a product of Wood Mackenzie. The data and information provided by Wood Mackenzie should not be interpreted as advice and should not be relied on for any purpose. The graph may not be copied except as expressly permitted by Wood Mackenzie in writing. To the fullest extent permitted by law, Wood Mackenzie accepts no responsibility for the use of this data and information unless otherwise specified in a written agreement entered into with Wood Mackenzie for the provision of such data and information. Wood Mackenzie does not undertake any duty of care to any third party in respect of the Information and disclaims all liability to the fullest extent permitted by law for any consequence whatsoever should any third-party use or rely on the Information.

In 2025, total graphite demand is forecast to grow to 4.53 Mt, a 59% increase from 2020. Batteries now become the biggest graphite user at 31% (1.42 Mt). Electrodes follow at 30%, then refractories at 10% and recarburising at 9%. The other categories average about 4% each. In percentage terms, the supply split between synthetic and natural graphite remains about the same as in 2020 at 63% (2.8 Mt, +57%) and 37% (1.7 Mt, +60%) respectively but the quantities increased by over 50%. The global sources of supply are also forecast to maintain their relative positions with China at 60%, rest of Asia 21%, Europe 8%, North America 7%, and South America and the rest of the world averaging about 2.5% each.

By 2043, total graphite demand is forecast to reach almost 9 Mt, a 215% increase from 2020. Batteries account for 56% (5.1 Mt) of the demand with electrodes at 18%, recarburising at 6% and refractories at 5%. The rest of the categories average about 3% each. The supply split between synthetic and natural graphite persists at 62% (5.5 Mt) and 37% (3.5 Mt) respectively. The quantities of synthetic and natural graphite, 5.5 Mt and 3.5 Mt respectively, each increased by over 200% from 2020. The global sources of supply are forecast as China at 58%, rest of Asia 30%, Europe 5%, North America 4%, and South America and the rest of the world averaging about 2% each.

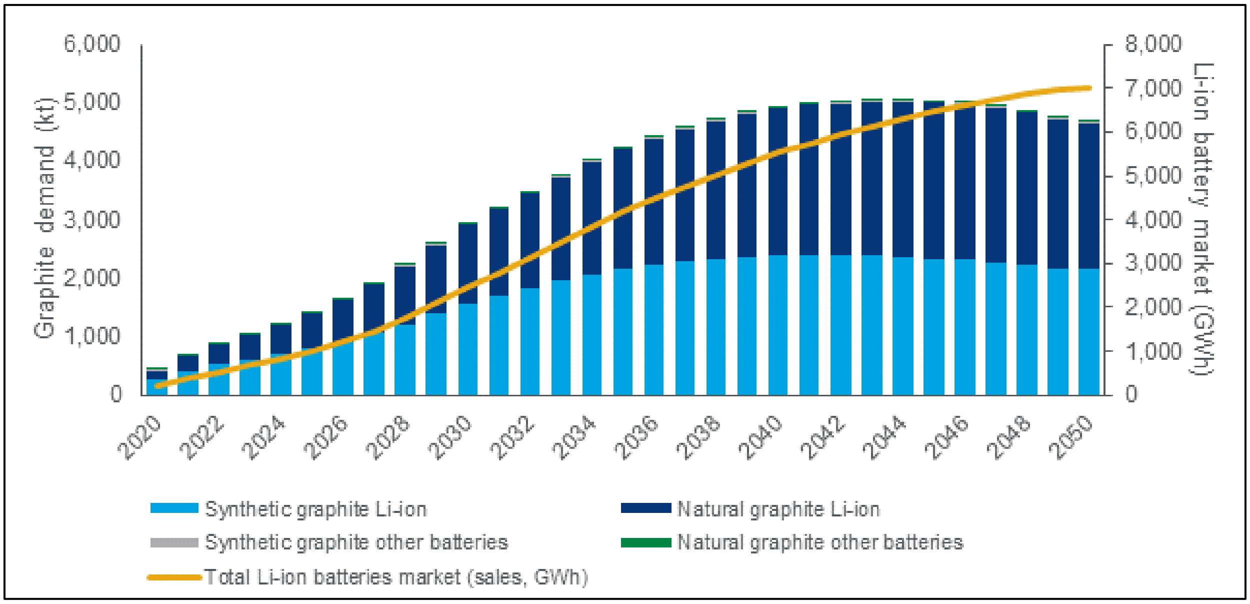
The forecast predicts a slowing of total graphite demand to a total of 9.2 Mt by 2050. Batteries' share drops to 51% (4.69 Mt). Electrodes and recarburising rise to 21% and 7% respectively. The percentages of the other categories remain unchanged from their positions forecast for 2043. The global supply sourcing also remains about the same as it was in 2043. Natural graphite's share of the supply is expected to decline to 36% (3.35 Mt) and synthetic's share to increase to 64% (5.85 Mt). The forecast predicts that solid-state anode technology begins to impact the use of graphite-based anodes around this time.

The increase in total demand from 2020 to 2043 is 6.1 Mt of which about 3.8 Mt is synthetic, and 2.4 Mt is flake. Almost a 3-fold increase in demand for flake.

19.7.2 The Battery Market

Figure 19-6 shows the forecast of graphite demand to 2050 from the total battery market. Almost all of this demand comes from the Li-ion battery sector which amounted to about 200 GWh in 2020 and is projected to grow to almost 7,000 GWh by 2050. This sector is dominated by electric vehicles, accounting for about 84% of the demand over the forecast period. The forecast estimates the yield of coated spherical graphite from a given quantity of natural graphite concentrate to currently be between 30 and 40% and predicts this to gradually improve over the forecast period. The yield of synthetic graphite to finished anode material is 1:1.

Figure 19-6: Battery Market Graphite Growth and Associated Graphite Demand[4]



Source: Wood Mackenzie (2022)

In 2020 about 0.5 Mt of graphite materials were used in the battery industry, 63% (about 0.3 Mt) from natural graphite and 37% (about 0.2 Mt) synthetic graphite. Natural graphite demand from batteries is forecast to peak in 2043 at 2.41 Mt (synthetic is then 2.65 Mt for a total demand of 5 Mt). Synthetic graphite demand is forecast to peak in 2045 at 2.68 Mt (natural is then 2.37 Mt for a total demand of 5.1 M). The forecast predicts by 2050 synthetic demand for batteries will be 2.52 Mt and natural 2.17 Mt for a total of 4.7 Mt. This gradual decline is from the projected impact of solid-state anodes entering the supply chain.

The additional annual quantities of all types of graphite for batteries that are required to meet the forecast demand in 2043 is 4.6 Mt/a of which about 2.5 Mt/a is synthetic, and 2.1 Mt/a is flake. Annual flake quantities increase over 7-fold from 2020 to 2043 (0.3 Mt/a to 2.4 Mt/a).

19.7.3 Natural Graphite Supply

Figure 19-7 summarizes the forecast of natural graphite supply to 2050 for all types of natural graphite in relation to its forecast of natural graphite demand for batteries.

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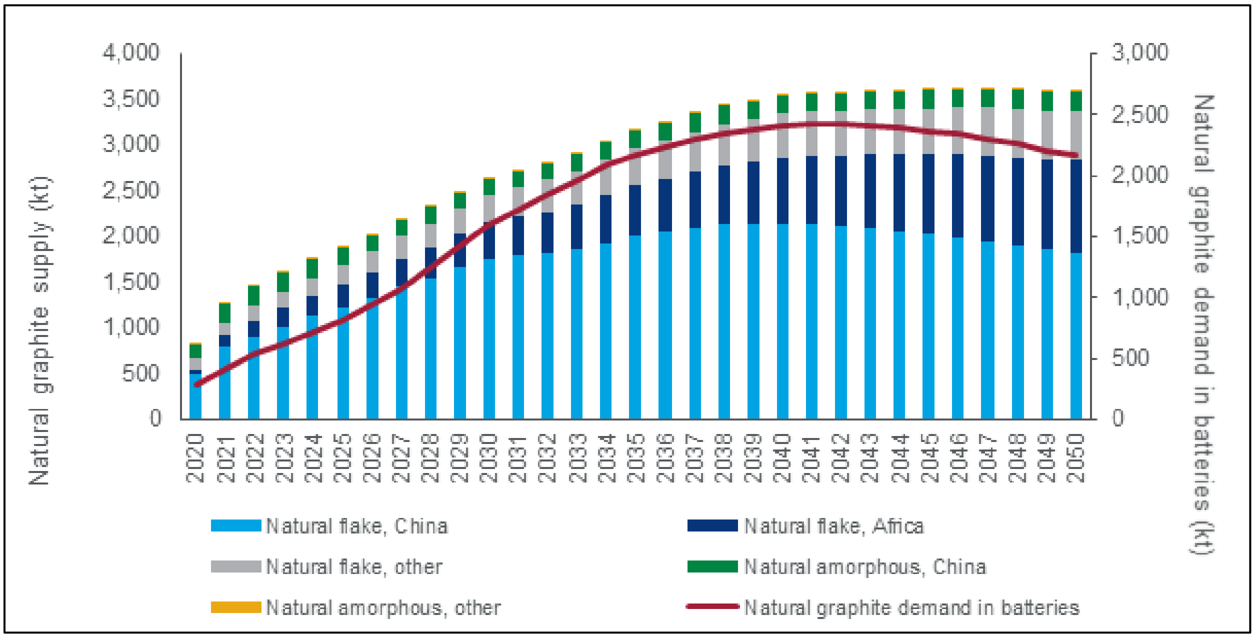
The demand for all types of natural graphite for batteries ranged from about 0.29 Mt in 2020 to the forecasts of 0.82 Mt in 2025, 2.41 Mt in 2043 and 2.17 Mt in 2050. Total supply of natural graphite, all types and applications, ranged from 0.8 Mt in 2020 to the forecasts of 1.92 Mt. in 2025, 3.61 Mt in 2043 and 3.6 Mt in 2050.

Figure 19-7: Natural Graphite Supply by Region[5]



Source: Wood Mackenzie (2022)

Table 19-1 summarizes the supply quantities by source forecast for selected years from Figure 19-7. China continues to dominate the supply throughout the forecast period. African projects are forecast to collectively become the second largest supplier. Other supply areas include Brazil, Canada, India, Australia, and Russia. Supply is forecast to meet or exceed demand by projecting that existing producers reach their maximum capacities and new natural graphite projects come on stream in time to meet the forecast demand. The forecast sees periods of tightened supply, followed by increased prices that stimulate new projects in the pipeline to come online.

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Table 19-1: Natural Graphite Supply by Region (Mt) [6]

Natural Graphite	2020	2025	2043	2050
Total Battery Demand	0.29	0.82	2.41	2.17
Total Supply	0.83	1.90	3.61	3.60
Flake Supply	0.66	1.68	3.39	3.38
China	0.50	1.23	2.09	1.83
Africa	0.03	0.25	0.78	0.99
Other Areas	0.13	0.21	0.51	0.56

Source: Wood Mackenzie (2022)

19.7.4 Synthetic Graphite Supply

Figure 19-8 presents the global supply of synthetic graphite. China is expected to continue its dominance of the industry. Japan is the second largest producer and India's production is expected to grow, replacing some of China's.

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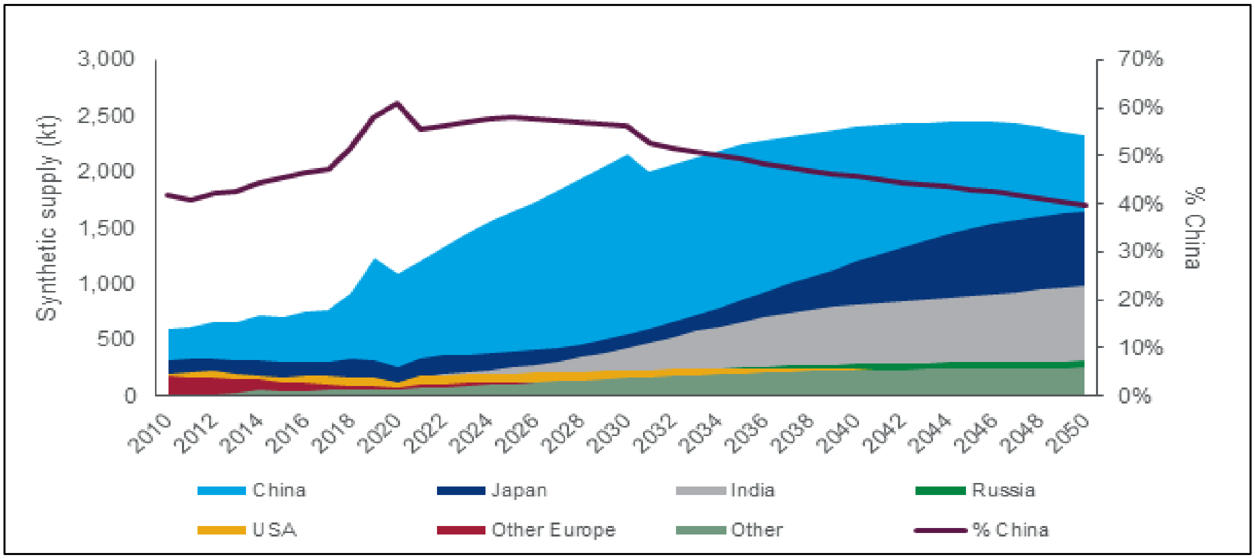
Figure 19-8: Global Synthetic Graphite Supply[7]



Source: Wood Mackenzie (2022)

19.8 Products, Prices, and Contracts

19.8.1 Products and Prices

Table 19-2 summarizes the Project's planned products and their respective prices as of the first half of 2022. U.S. based customers are the target market and prices are derived from price information in the Market Reports and assessed against competitive imported products, some of which may attract United States import duties. The prices are considered "Ex Works"

Prices in the graphite industry are tightly held, particularly for advanced graphite products. This is a result of the proprietary nature of some of the products and manufacturing processes, the fact that the industry is concentrated amongst relatively few players and the associated high capital costs, particularly in the anode sector. Graphite One has used the industry forecasts of Benchmark Mineral Intelligence and Wood Mackenzie Limited to provide category pricing at representative qualities. Other consultants with direct industry marketing experience have been used to get an understanding of the potential variations within product categories due to quality parameters, potential contract quantities, and shipping and packaging requirements for commercial scale production.

[7] The foregoing graph was obtained from the Graphite Market Service™, a product of Wood Mackenzie. The data and information provided by Wood Mackenzie should not be interpreted as advice and should not be relied on for any purpose. The graph may not be copied except as expressly permitted by Wood Mackenzie in writing. To the fullest extent permitted by law, Wood Mackenzie accepts no responsibility for the use of this data and information unless otherwise specified in a written agreement entered into with Wood Mackenzie for the provision of such data and information. Wood Mackenzie does not undertake any duty of care to any third party in respect of the Information and disclaims all liability to the fullest extent permitted by law for any consequence whatsoever should any third-party use or rely on the Information.

Table 19-2: Graphite One Project Products, Annual Quantities and Product Pricing

No.	Category	Name & Description	Mesh Size	Purity (% Cg)	Phases 1&2 (t/a)	Total (t/a)	Price (US$/t)
1	**Anode Material**	CPN: Coated, spherical NG		99.95	12,030	**51,167**	$8,030
2		BAN: Blended AG and NG		99.95	22,915		$10,585
3		SPN: Secondary Particle NG		99.95	3,658		$8,890
4		SPC: Secondary Particle Composite		99.95	12,565		$8,890
5	**Purified**	3299	+32	99+	117	**7,585**	$10,230
6		599	+50	99+	1,055		$7,980
7		899:	+80	99+	1,172		$6,800
8		199	+100	99+	1,953		$5,490
9		Battery Conductor	-320	99.9	1,386		$9,210
10		Synthetic Diamond Precursor	-320	99.99	1,902		$6,450
11	**Unpurified**	3295	+32	95+	189	**18,622**	$1,820
12		595	+50	95+	1,701		$1,820
13		895	+80	95+	1,890		$1,515
14		195	+100	95+	3,150		$1,325
15		Carbon Raisers Lubricants		95+	9,279		$1,860
16		Coke Reject		95+	2,413		$210
Total Annual Production and Average Annual Price per Tonne						**77,374**	**$7,301**

Source: Graphite One (2022)

19.8.2 Contracts

While Graphite One has had preliminary discussions with several potential customers under confidentiality agreements, no commercial contracts are currently in place. Unlike most mined commodities, there is no open market for graphite products and such contracts will be required to sell all products generated by the STP.

Graphite One has a memorandum of understanding with Sunrise (Guizhou) New Energy Material Co., Ltd. (Sunrise), a Chinese anode producer, to develop an agreement to share expertise and technology for the design, construction, and operation of the STP. Sunrise is currently developing anode materials from Graphite Creek concentrate to be used as product samples with potential customers.

19.9 QP Confirmation

Mr. Goodwin has reviewed the market reports and the analyses contained in this section, which have been used to provide revenue assumptions for this study. Mr. Goodwin considers that the projections deriving from these analyses adequately support the economic results projected in this study.

20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACTS

20.1 Introduction

This section outlines the environmental permitting requirements that apply to the Graphite One Project including the mine and mine road. It also describes the baseline environmental studies necessary to address the permitting requirements. Finally, it assesses some of the potential social or community issues involving the project.

20.2 Environmental Assessment

This section outlines the major environmental resources in the project area and gives a summary of any environmental baseline data collection done to date and describes the work necessary to collect the remaining data necessary for permitting and *National Environmental Policy Act* (NEPA) analysis.

20.2.1 Wetlands

A complete delineation of the wetlands types in the project area will be necessary to obtain the US Army Corps of Engineers (ACOE) permit under Section 404 of the *Clean Water Act* (wetlands permit). This is a critical authorization, as it is the only major federal authorization necessary for this project and will trigger the NEPA review.

A desktop wetlands analysis was completed in 2015 for the mine site area and the corridor for the Teller access option. In 2019, the field mapping program was initiated, and was completed during the 2021 field season. This mapping is at a detail required for the Preliminary Jurisdictional Determination, which will be necessary for the ACOE to make its decisions on the Section 404 permit.

Preliminary results from the mapping and analysis completed to date show that approximately 14 percent of the 9,947-acre project area is identified as a wetland or waterbody. Table 20-1 below summarizes the acreages (approximately 6 percent of the project area was not included in the 2018 imagery and will need to be field mapped).

Table 20-1: Project Area Description

Wetland/Upland Status	Acres	Percent of Study Area
Wetlands	1,098	11
Waterbodies	343	3
Uplands	7,862	79
Area not covered by 2018 imagery	644	6

Wetland/Upland Status	Acres	Percent of Study Area
Total Study Area	**9,947**	**100**

Source: Fogels (2022)

Interpretation of the aerial imagery suggests that most of the wetlands in the study areas have a seasonally flooded water regime. This water regime is common in floodplains, and as the Mosquito Pass Study Area parallels multiple streams and rivers, floodplain hydrology is expected to dominate in these areas. Most of the wetlands in the mapping area appear to be co-dominated by broad-leaved deciduous shrub species and sedges or grasses (persistent emergent vegetation; PSS1/EM1 Cowardin types). Collection of vegetation data in the study areas may allow for more precise photointerpretation of the wetland communities present in the area; truly co-dominant communities are also common in Alaska.

20.2.2 Hydrology and Water Quality

Understanding the baseline hydrology and water quality, and the potential impacts of the proposed activity to water in the project area are fundamental parts of the NEPA analysis.

20.2.2.1 Surface Water

Baseline water quality sampling of streams in the project area began in 2014. Nine monitoring sites in six streams in the project area are sampled with one seep site added in 2019. This program will continue into the foreseeable future. Water quality sampling indicates that streams in the project area have elevated contents of sulphates and some metals, including aluminum, iron, and manganese. Some streams, including Graphite Creek have naturally occurring aluminum sulphate precipitate in their upper reaches, iron oxide/hydroxide precipitate in their mid-reach, giving way to no precipitate in their lower reach as they traverse the lowlands to the Imuruk Basin.

The Imuruk Basin is the receiving water body of streams traversing the project area and potentially of treated water from the project area. The Imuruk basin is potential aquatic, wildlife, and subsistence resource and will be part of a NEPA analysis. Studies of the bathymetry, circulation, water flux, and water quality are planned.

20.2.2.2 Ground Water

Groundwater studies (hydrogeology) quantify baseline conditions, predict impacts to surface water resources during mining and post-mining, and provide input to operational considerations such as water handling and treatment. A minimal program was accomplished in 2019 with more comprehensive ongoing studies.

Perennially frozen ground (permafrost) often affects groundwater behavior in northern regions. Preliminary data suggest that permafrost in the project area is warm and discontinuous. Studies are underway to further understand permafrost distribution and the impact on groundwater distribution and flow.

A limited number of monitoring wells were first installed in 2021 with further installations planned. These wells will enable hydraulic testing, baseline water quality sampling, water table level gauging, and estimation of groundwater gradients.

Hydrogeologic investigations, begun 2021, will lead to a hydrogeologic conceptual model. The model and associated data will be used to develop a three-dimensional numerical groundwater model. This model will enable an understanding of baseline conditions and will be used to predict the impacts of mine dewatering during active mining, post-mining effects as the groundwater returns to equilibrium conditions, and long-term equilibrium conditions.

20.2.3 Air Quality

Most likely, the major issue with respect to air quality will be power plant emissions and control of fugitive dust. The Alaska Department of Environmental Conservation (DEC) requires a year of baseline meteorological data before applying for a minor air permit or a Prevention of Significant Deterioration (PSD) permit. A PSD permit also requires data on background air pollutants in the area. In addition to the year of baseline data collection, modelling and permit preparation can require another six months, and DEC can require roughly a year to process a PSD application. The air quality information required for DEC should be adequate for NEPA.

A meteorological tower was installed in the project area in October of 2019. The instrument package on the tower will continue to measure a number of parameters necessary for modelling. The location of the tower, and the instrument package was approved by DEC.

20.2.4 Aquatic Resources

In 2019, Graphite One initiated an aquatic baseline data collection program in anticipation of project planning and environmental evaluation. Data collection was designed to establish baseline conditions of aquatic communities and water quality while quantifying natural variability of both, and to evaluate the overall health and productivity of the drainage. The sampling program included the establishment of long-term biomonitoring sites and conducting aerial and ground-based fish surveys. The goal of the aquatic baseline study is to collect data to support the NEPA evaluation and ADFG Fish Habitat Permit review and issuance.

Seven long-term biomonitoring sites were established from July 13–17, 2019. Biomonitoring sites were sampled for water quality, periphyton standing crop, aquatic macroinvertebrates (invertebrates), and juvenile fish for abundance and whole-body elemental analysis. Five of the seven sites are within areas potentially impacted by project related activities, while two sites, one in Fall Creek to the west and one in Oro Grande Creek to the south, are located outside the project boundary and serve as control sites. Three additional sites were sampled to further describe fish distribution and habitat use in the project area.

In-situ water quality parameters and aquatic invertebrate sampling results indicate most systems surveyed had relatively good water quality and little evidence of disturbance. Glacier Canyon Creek, flowing directly out of the potential ore body, however, had highly mineralized water, poor water quality and most aquatic life was absent. Other highly mineralized streams and seeps, like Glacier Canyon Creek, exist in the area and in the headwaters of the Nome River. Glacier Canyon Creek will continue to be monitored, along with all other sites.

A total of 398 fish representing nine species were captured during a sampling effort that totaled approximately 256 hours of minnow trapping, 112 hours of fyke netting and 1,992 m of stream electrofished. Anadromous fish were found at all sites except for the two sites in Glacier Canyon Creek. Juvenile coho salmon were the most abundant fish captured, representing 34.7% of total capture, followed by Dolly Varden at 31.7%, three spine stickleback at 11.8%, and slimy sculpin and ninespine stickleback 8.8% each. Arctic grayling, Alaska blackfish, burbot and longnose sucker comprised less than 3% of the total catch combined. The majority of fish captured were juvenile fish, except for Arctic grayling and longnose sucker.

Aerial surveys were conducted during August and September to describe the extent and distribution of adult Pacific salmon within and near the project area. Pacific salmon were observed in 11 of the 22 streams surveyed and all five species were counted. No Pacific salmon were observed in Glacier Canyon Creek, while the highest concentrations occurred in the Cobblestone River. Pink salmon were the most abundant and widely distributed species, followed by chum salmon. In comparison to pink salmon, relatively few coho, sockeye, and Chinook salmon were observed in the study area.

20.2.5 Marine Environment

The project area is within 5 miles of Imuruk Basin, a body of tidally influenced water. Imuruk Basin is connected to Grantley Harbor to the west, by the narrow 10-mile long Tuksuk Channel. Numerous freshwater rivers flow into Imuruk Basin, including the Kusitrin, Kaviruk, Aqiapuk and Cobblestone rivers.

The DNR land-use plan for the Imuruk Basin describes the resources in the basin: “Shoreline consists of intertidal wetlands with extensive salt and brackish-water marshes of fine sands and organic muds to moderately sloping mixed sand and gravel beaches. Eel grass is present along the shores. High value habitat for waterfowl, shorebirds, and seabirds. Anadromous and resident fish, bivalves and crab are present. There are known or a high probability of heritage resources. Hunting, fishing, camping, bird watching, and boating occur in this unit.” (Subunit ST-02, Northwest Area Plan, classified for Habitat and Harvest).

A characterization of Imuruk Basin will be necessary, and should include bathymetry, current flow analysis, water and sediment quality, and aquatic life. This characterization will be necessary for APDES permitting, should the project pursue discharge of treated water into the basin. All the rivers and streams proximal to the mine site flow into Imuruk Basin.

20.2.6 Wildlife

Though the Graphite One Project may not be located in a particularly sensitive area for wildlife, the impact of the project on wildlife may be an important issue because of the reliance on subsistence resources by the local residents. In addition, according to USFWS maps, the project is theoretically within the range, but not the critical habitat, of Polar Bears, which are an endangered species. Wildlife information could document the use (or lack thereof) of the mine area by Polar Bears.

Avian, large mammal, subsistence, and threatened and endangered species surveys should be conducted for the Graphite One Project area and adjacent migratory locations. This information will be necessary for the required consultations with the USFWS and will be critical to ensure that the project complies with the Endangered Species Act, Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act. Project construction activities will be required to comply with timing restrictions for vegetation clearing during migration and nesting activities.

20.2.7 Cultural Resources

There is only one documented known cultural site in the project area, which consists of debris from an old cabin site, likely dating back to the historic graphite mining activity. However, this area has been used by the local Native residents for thousands of years, and there is a likelihood of additional cultural sites in the area. A cultural resource survey of the project area, in particular within areas to be disturbed by the project, will need to be conducted.

The extent of cultural resources analysis will depend on the state and federal determination of whether there is a high potential for on-the-ground archaeological resources within the project footprint. Sometimes the agencies require an on-the-ground-survey, and detailed report; sometimes they do not. If a detailed report is required, a consultant will describe the cultural resources of the area; locate known sites on or eligible for listing on the National Register of Historic Places and determine areas locations where there is significant probability of finding an archaeological site. In these locations, the consultant may be required to complete an on-the-ground survey to locate the resources. The consultant may recommend measures to protect the site. In some instances, other mitigation may be recommended by the consultant or required by the agencies. Information from the analysis and survey should be adequate to satisfy the information needs for the ACOE, State Historic Preservation Office (SHPO), and the NEPA analysis.

20.2.8 Visual Resources

The project is located in a remote part of the state, with few anthropogenic visual features other than the two communities and related infrastructure (such as roads and transmission lines). Portions of the operating mine may be visible from the two communities, especially during dark periods of the day.

A visual resource assessment, including visual simulations from key observation points, is recommended, and will provide detail on potential visual impacts and potential mitigation measures.

20.2.9 Noise

The project is located in a remote part of the state, characterized by relatively low ambient sound levels. Noise impacts from the operating mine are not anticipated for the community of Nome, as it is too far away. The two nearby communities, Teller and Brevig Mission, could experience some level of noise impact from the operating mine.

A desktop analysis of projected noise levels from the operating mine is recommended. Federal agencies may require baseline acoustic measurements to characterize the existing environment at important locations. It is not clear that these would be required for the Graphite One Project, especially for an EA. Impacts are estimated through a variety of existing models.

20.2.10 Land Use and Recreation

The mine area and the Teller access alternative are primarily on lands owned by the State of Alaska and managed by the Alaska Department of Natural Resources (DNR). There are no Federal lands within the project area.

The mine-area itself is classified for mineral development in DNR's land-use plan for the area. Subunit S-05 in the Northwest Area plan has the primary designation of Minerals and Dispersed Public Recreation. This designation indicates that DNR expects mineral development but indicates it should be managed in a manner that minimizes harm to dispersed public recreation. This is a helpful designation for the project.

In Alaska, new access is always a controversial issue. Access was the major issue at the True North Mine, and at the Pogo Mine, and is usually a state, rather than a federal issue. And the major discussion often revolves around Alaskans' access for hunting, and fishing. It is unknown whether either road option to the mine would be viewed by hunters as a way to get to previously inaccessible areas. But new roads can bring in out-of-area hunters which may compete with local subsistence hunting. The major area of controversy is whether the road to the mine becomes a public road open to the public, and whether it is reclaimed at the end of mine life. A desktop study of recreation and other land uses should be conducted.

Given the remote location of the project, recreational use of this area is limited. There is some limited recreational use of the Mosquito Pass area by Nome residents, and occasional use by sport fishermen flying to the Cobblestone River.

20.3 Environmental Authorizations and Permits

This section provides a list of the authorizations that will be required for the construction and operation of the Graphite Creek Mine.

20.3.1 Existing Permits and Authorizations

The project currently holds the following authorizations and permits:

- Miscellaneous Land use Permit # APMA 2299, which authorizes hardrock exploration activities on the project site. This permit is issued by the Alaska Department of Natural Resources (DNR) Mining Section and is valid through 12/31/2021;

- Temporary Water Use Authorization F2017-030, which authorizes water removal from surface waterbodies for exploration activities. This authorization is issued by DNR's Water Section and is valid through 12/31/2021;

- Fish Habitat Permit FH17-III-0130, which authorizes activities in fish-bearing waters, primarily for water withdrawal structures. This authorization is issued by ADFG's Habitat Division and expires on 12/31/2021; and

- Camp Permit #8625, which authorizes the exploration camp. This permit is issued by DEC's Division of Environmental Health, Food Safety and Sanitation Program, and is valid through 12/31/2020.

20.3.2 DNR Plan of Operations, Reclamation Plan Approval, and Millsite Lease

These three authorizations are DNR's major authorizations for operation of the mine. The authorizations have considerable overlap.

The Plan of Operations approval balances the applicant's right to extract the minerals with the mine's effect on public resources. DNR has the authority under the plan of operations to stipulate changes in the design and operation of the mine to protect public resources. In this balancing, it is useful that the mine-area itself is classified for mineral development in DNR's land-use plan for the area. Subunit S-05 in the Northwest Area plan has the primary designation of Minerals and Dispersed Public Recreation. This designation indicates that DNR expects mineral development but indicates it should be managed in a manner that minimizes harm to dispersed public recreation. This is a helpful designation for the project.

The Reclamation Plan provides DNR authority to review operations to ensure that they comply with state's law, AS 27.19.20: "A mining operation shall be conducted in a manner that prevents unnecessary and undue degradation of land and water resources and the mining operation shall be reclaimed as contemporaneously as practical with the mining operation to leave the site in a stable condition." For hard rock mines, implementing DNR's authority under the law typically requires them to review the mine's plan of operations.

The law, AS 27.19.040, directs DNR to require a Reclamation Bond: "an individual financial assurance in an amount not to exceed an amount reasonably necessary to ensure the faithful performance of the requirements of the approved reclamation plan." The bonding requirement overlaps DEC's authority to require financial assurance under their waste management plan. DNR and DEC typically figure the bond jointly, and the bond is administered by DNR (DNR's Dam Safety Program may also require a bond for any dam within its jurisdiction).

A Millsite Lease provides a surface authorization for mine facilities that are not located on the upland mining lease or mining claim. In the Graphite One Project, like other mines in the state, the mine facilities will be located on mining claims. Therefore, a millsite lease is not required. Nevertheless, most similarly situated hard rock mines in Alaska have opted to request a millsite lease. The reason is that the lease solidifies the legal authorization for facilities. A mining claim is only valid if the claimant has a valid discovery. Most facilities are located specifically to avoid being over a mineable ore body. This location could theoretically provide a legal loophole where the facilities are not authorized by the mining claim. For that reason, most mines have opted for a millsite lease to confirm their legal right to the use of the surface. The Department has the authority to include stipulations in the lease to protect public resources. The Department's authority to impose these stipulations is no different than its authority under the plan of operations approval, so requesting a millsite lease does not cede additional authorities to DNR. A millsite lease requires an annual lease payment equal to the fair market value of the land.

As all three of these authorizations give DNR authority to stipulate mining operations to protect public resources (or the very similar prevention of "undue degradation of land and water resources"). While neither the plan of operation nor the reclamation plan have statutorily required public notice, draft authorization and public comment period is always provided for an operation the size of the Graphite One Project. For these reasons, the authorizations are typically considered together, concurrent with the EA/EIS.

The authorizations may consider the breadth of issues presented by a hard rock mine, but the major issue is almost always water quality during and after mining; specifically, the extent of acid rock drainage and metals leaching. These authorizations also consider the related issue of whether post-mining water quality treatment will be required and for how long.

Summary:

- Agency: DNR Division of Mining, Land and Water;
- Likely Major Issue: Extent of Acid rock drainage, metals leaching, and extent to which these might continue after mine reclamation; extent of water quality treatment necessary after mining closure; and
- Background Information Required: A variety of studies may be required. However, the most important studies are the geochemistry and hydrologic studies.

20.3.3 Reclamation Bond

The Reclamation Bond is not a separate authorization. It is required by DNR under their Reclamation Plan and Dam Safety authorities, and by DEC under the authority of the solid waste permit. However, it is processed on a different schedule from the other authorizations, and so it is considered separately.

DNR and DEC jointly calculate the financial assurance necessary to reclaim the site and to complete post-mining water quality treatment, water quality monitoring, and site maintenance. DNR typically administers the bond for both agencies. The size of the bond is usually driven by any required water quality treatment. If post-mining water quality treatment is required, the issue will be the annual cost and the length of time such treatment will need to be continued. While environmental groups have disputed the size of reclamation bonds in Alaska, the issue driving most of the disagreement is the need for post-closure water treatment. Environmental groups typically advocate that the bond include more treatment for a longer period than the applicant believes necessary.

Summary:

- Agency: DNR Division of Mining, Land and Water; DEC divisions of Environmental Health and Water;
- Likely Major Issue: Adequacy of the size of the bond, especially with respect to post-mining water quality treatment; and
- Background Information Required: None.

20.3.4 DEC Air Quality Permit

The construction, modification, and operation of mining facilities that produce air contaminant emissions require a state Air Quality Control Permit to Construct, and a separate Air Quality Control Permit to Operate. Generally, air quality must be maintained at the lowest practical concentrations of contaminants specified in the Ambient Air Quality Standards of 18 AAC 50.020(a).

DEC requires a minor air permit for ambient air emissions above certain thresholds. To apply for a minor air permit, the applicant must add up the air emissions based on mine emission factors that are standard to particular emission sources planned for the mine. Air quality modeling, using on-site meteorological data and emission factors from proposed sources, predicts the resulting air quality changes. If the modeling shows that the total emissions and changes in air quality are above the threshold that requires a permit but below certain other standards, the minor air permit will require best management practices for equipment, and facilities (such as maintenance of the road and methods to minimize dust from operations). If emissions are above these standards, a much more complicated Prevention of Significant Deterioration (PSD) permit is required.

One of the minimum thresholds for a minor air quality permit is the presence of a crusher with the rated capacity of more than 5 tons/hr. Graphite Creek will almost certainly include a crusher with a capacity greater than this throughput; therefore, an air quality permit of some type is inevitable. The progression from a minor air permit to the more significant PSD permit is dependent on mine specifics that are not yet known, but the major driver is usually electric power generation. A PSD permit requires more modelling and more background data collection than does a minor air permit and is correspondingly more expensive. The PEA indicates that the mill will have a generating capacity of 6 MW. A back of the envelope calculation indicates that Tier 4 diesel engines rated for a total of 6 MW burning ultra-low-sulphur diesel would result in potential NOx of slightly greater than the 250 tons per year limit which creates the need for a PSD permit. However, diesel combustion turbines of the same capacity using the same fuel would release emissions below the PSD threshold. At this point in mine planning, we can predict that an air quality permit will be required, but we cannot predict whether it would be a minor air permit or a PSD determination.

Air permit processing is typically independent of the NEPA schedule and other permits. Sometimes it occurs first, sometimes later. However, DEC will not allow construction of the mill to begin before the air permit is issued (though construction can usually continue during an appeal or lawsuit). Therefore, it is important to assure enough time to get the air permit before the expected time of construction.

The air permit requires roughly a year for acquiring the baseline data, and roughly 18 months to two years to prepare the permit application and for DEC to process the permit.

Summary:

- Agency: DEC Division of Air Quality;
- Likely Major Issue: Air emissions from power generation, and fugitive dust; and
- Background Information Required: Meteorological station with one-year's record and air quality modeling.

20.3.5 DEC APDES Permit

DEC authorizes effluent discharges under its Alaska Pollutant Discharge Elimination System Permit (commonly called APDES Permit). DEC requires characterization of the discharge and receiving water. The characterization requires water quality and flowrate information.

The APDES permit is often the focus of agency discussion during mine permitting. It can be a complex and difficult permit to obtain. However, the nearby presence of marine waters – the Imuruk Basin – could significantly simplify the discussion. Marine waters have less stringent water quality standards[8], no fish spawning issues, and opportunities for a mixing zone. Marine discharge could greatly simplify the permit and possibly the baseline information requirements. [9]

Mine discharges typically do not meet water quality standards and require a mixing zone. Even without a mixing zone, DEC will likely require an identification of the fisheries in any APDES receiving water. However, a mixing zone makes the identification mandatory. Alaska's mixing zone regulations (18 AAC 70.240) prohibit mixing zones in salmon spawning streams. The nearby Imuruk Basin provides an opportunity to discharge at the much less stringent marine water quality standards. Marine outfall could be a significant advantage for the project.

To comply with regulations, the baseline environmental studies will include hydrologic studies, and presence and identification of fish in the receiving waters.

Summary:

- Agency: DEC Division of Water;
- Likely Major Issue: Whether runoff from the mine, waste rock, and tailings facility will meet Alaska water quality standards during mining or after closure;
- Background Information Required: At least one year's hydrologic data. More data is useful. Presence and identification of fish will be required. However, determining the quality of mine effluent will also be a product of the baseline geochemistry studies; and
- Other: Mine water discharge will likely require authorization of a mixing zone.

20.3.6 DEC Solid Waste Management Permit

The major issue with respect to the tailings and waste rock is the potential for acid rock drainage and metals leaching. Geochemistry and hydrologic investigations will be required before DEC issues these permits.

A solid waste permit is required for the tailings facility whether it is a dry-stack tailings facility or a wet tailings management facility. DEC has the authority under the Solid Waste Permit to require financial assurance from the company. This requirement overlaps DNR's authority to require a reclamation bond under its reclamation authorities, and a dam maintenance bond under its Dam

[8] For example, there is no Al, Fe, or Mn standard for marine waters.

[9] Technically, marine discharge only simplifies the water-quality based standards. It does not affect the technology-based standards. EPA promulgated specific Best Practicable Control Technology Standards for graphite Mines. These federal standards are adopted by reference by DEC (40 CFR Part 436 Subpart AL). However, the standards only regulate total iron, pH, and total suspended solids (40 CFR 436.382). None are difficult to meet, especially with a mixing zone.

Safety Program. DNR and DEC jointly determine the bond and DNR typically administers the bond.

DEC also has the authority but not the mandate to require a solid waste permit for the placement of waste rock. DEC typically only requires a solid waste permit for waste rock if the rock has the potential to generate acid rock drainage or significant metals leaching. If these do not occur, DEC may determine that DNR's Plan of Authorization approval provides adequate oversight for the waste rock placement. For the True North Gold Mine and the much smaller Lucky Shot Gold Mine, DEC declined to require a solid waste permit for these reasons. For other mines, they have required it.

DEC also requires a solid waste permit for the disposal of inert wastes from construction, ash from incineration, etc. This is likely to be a separate permit from the tailings, and waste rock permits and is typically neither controversial nor is compliance difficult.

Summary:

- Agency: DEC Division of Environmental Health;
- Likely Major Issue: Quality of effluent discharge from the tailings facility and waste rock pile; especially with respect to acid rock drainage and metals leaching;
- Background Information Required: Geochemical characterization of the tailings and waster rock and hydrology; and
- Other: The permit will require that runoff meet water quality standards (potentially after a mixing zone is authorized). Monitoring will be required.

20.3.7 U.S. Army Corps of Engineers Wetlands Permit

The U.S. Army Corps of Engineers (ACOE) permit under Section 404 of the *Clean Water Act* requires an authorization (wetlands permit) before allowing discharge of fill into waters of the United States, including wetlands. The wetlands permit is likely the only major federal permit for the Graphite One Project.[10] Activities that may require a wetlands permit include road or bridge construction, construction of dams for tailings or water storage, and stream diversion structures. The ACOE is responsible for determining consistency of the proposed action with Clean Water Act, Section 404 guidelines. Under Section 404(c), the EPA has review authority over the ACOE 404 permit decisions.

The ACOE provides detailed methodology for identification of wetlands under federal jurisdiction. DEC must certify that the ACOE permit meets state water quality standards. DEC typically does not get involved in the wetlands mapping methodology.

Over the last decade, the ACOE also requires expensive mitigation for wetlands affected during mine development, even if the reclamation plan will restore the wetlands after mining. Mitigation is proportional to the wetland disturbance area and can be expensive. The ACOE uses a hierarchy of mitigation strategies, beginning with restoring affected wetlands, then on to repairing nearby wetland impacts or enhancing low-functioning wetlands, then to monetary compensation. Unfortunately, the ACOE has required mitigation be a multiple of the affected acreage. Unlike

[10] This assumes that the state-selected land in the road right-of-way is conveyed to the state.

projects in the lower 48 states, projects in relatively untouched Alaska rarely have damaged wetlands nearby that can restored or enhanced. Therefore, the ACOE has required expensive monetary compensation. While this system may make sense for the lower 48 states, monetary compensation makes no sense for Alaska where 43% of the state is wetlands. Fortunately, the ACOE is re-evaluating its mitigation/compensation strategy. However, because of the potential expense, it's important to allow adequate time during the permitting process for discussion/negotiation with the ACOE over this issue. The identification of wetlands and methods to minimize impacts are rarely the time-consuming wetlands issue. The issue is more likely to be the extent of off-site mitigation and compensation.

Summary:

- Agency: U.S. Army Corps of Engineers;
- Likely Major Issue: Compensatory Mitigation; and
- Background Information Required: Identification of jurisdictional wetlands, including function of the wetlands. (The information may require vegetation and soils analysis.)

20.3.8 Right-of-way

A right-of-way will be required for the road to the site. Both conceptual road routes identified by Graphite Creek are entirely on state-owned and state-selected lands, and assuming that the state receives ownership of the state-selected lands soon, only a DNR right-of-way will be required. If the state does not receive ownership of the state-selected lands, then a federal right-of-way from the US Bureau of Land Management will be required for that portion of the road. There is also a short alternative start to one of the conceptual road routes as it leaves the Nome-Teller Highway that is on Native Village Corporation land, and a right of access will be needed if this alternative is chosen. A state right-of-way requires an annual payment equal to the fair market rent for the land.

In Alaska, the major issue with a right-of-way is almost always the extent of public access. There is often tension between those who want more public access for hunting, subsistence, or recreation and those who prefer to limit access for these uses. The question for the project is twofold: Will the road be open to the public or be closed except for mine use? Will the road be reclaimed after the project? The right-of-way should not be difficult to obtain but will likely require a 2-year process. DNR must make a best interest finding and the authorization requires public notice.

Summary:

- Agency: DNR Division of Mining, Land and Water, and potentially the BLM and the Native corporation;
- Likely Major Issue: extent of public access;
- Environmental Information Required: None (other than that required for other authorizations); and

- Other: payment of fair market value rent, and possibly other reimbursements to a Native Corporation.

20.3.9 DNR Tidelands Lease

Graphite Creek will need a tidelands lease from DNR if it uses a pipeline for a discharge outfall into the Imuruk Basin. A tidelands lease is a lease for the use of land beneath the marine waters of Imuruk Basin. The issue will be the pipeline's effect on marine habitat. The DNR land-use plan for the Imuruk Basin provides: "Authorizations within this unit may be appropriate but must consider the impacts of the proposed use on the resources that occur within this unit." Given the lack of impact that a pipeline should have on the resources of the area, the tidelands lease should be obtainable, but DNR's process will require approximately two years. Like the right-of-way, DNR must make a public interest finding and the authorization requires public notice. A tidelands lease also requires payment of fair market value, though the market value of submerged land may not be great.

Summary:

- Agency: DNR Division of Mining, Land and Water;
- Likely Major Issue: Effect of the pipeline on fish and wildlife habitat;
- Environmental Information Required: None (other than that required for other authorizations); and
- Other: payment of fair market value rent.

20.3.10 DNR Water Right or Temporary Water Use Authorization

A water right or temporary water use authorization from DNR is required before taking a significant amount of water. DNR conditions those permits to protect other water right holders (not likely to be a problem for the Graphite One Project); other water users (not likely to be a problem), or the presence of fish habitat (also not likely to be a problem). A water right is a long-term or permanent property right to the water. A temporary water use authorization is for a use of less than 5 years. Typically, a mine will require water rights for their permanent use of water, such as for processing, and temporary authorizations for some other uses, such as road building or other construction uses.

A significant amount of water is defined in regulation (11 AAC 93.970) as more than 5,000 gallons per day from a single source; recurring use of more than 500 gallons per day for more than 10 days per year from a single source, or the non-consumptive use of more than 30,000 gallons of water per day from a single source, or any water use that might adversely affect the water rights of other appropriators or the public interest.

A water right requires public notice, but a temporary water use authorization does not. If the water use is likely to be controversial, it should be processed concurrent with the EIS. Otherwise, it may be processed afterwards. Detailed hydrologic information is not typically required unless the surface use is a significant percentage of a surface source. Unless some specific issue is raised, or a very large amount of water use is proposed, groundwater wells typically do not require significant prior investigation. The hydrologic investigation required for the APDES permit and Plan of Operation will typically be adequate for any water use authorizations in the area of the mine site.

Given the lack of other water users, and the fact that ADFG only lists one stream near the project in its Catalogue of Anadromous Fish Waters (Cobblestone River), the volume of water used in the project is unlikely to be a significant issue.

Summary:

- Agency: DNR Division of Mining, Land and Water;
- Likely Major Issue: Impact of water withdrawal on aquatic resources; and
- Environmental Information Required: None (other than that required for other authorizations).

20.3.11 DNR Materials Sale

Most sand and gravel for building the road will presumably be taken from the nearby state land. Some could be from Native Corporation land. Material from the road right-of-way and from the mining claims may be used on the within the mining claims or road without a sale without payment. Material from outside mining claims and outside the right-of-way require a materials sale and payment to DNR. Sand and gravel from Native Lands will likely require payment as well. A material sale on state land requires public notice.

Summary:

- Agency: DNR Division of Mining, Land and Water;
- Likely Major Issue: surface disturbance, stormwater control, and reclamation; and
- Other: payment materials removed from site.

20.3.12 DNR Mining Lease

A mining lease consolidates mining claims into a single lease. It is not a permit or authorization; it differs from the authorizations in this report in that it only consolidates the private property rights of the multiple mining claims into a single legal vehicle – the mining lease. It does not change the underlying property right. The reason companies use a mining lease is two-fold. First, it cleans the chain of title. That is, once a mining lease is issued, no one can protest that there was an error in the title of mining claim in previous years (staking error, missing statement of annual of labor, etc.). Second, if there is an error in payment for the lease – a late payment, or similar issues – the lessor gets a notice of the problem and an opportunity to cure it. Claim owners do not get a notice and can lose their claim to an intervening claimant if they've made an error. A mining lease requires public notice.

Summary:

- Agency: DNR Division of Mining, Land and Water;

- Likely Major Issue: None; and
- Environmental Information Required: None (other than that required for other authorizations).

20.3.13 DEC Stormwater Plan

The *Clean Water Act* requires control of stormwater. A mine (or exploration site) is required to have a stormwater plan to control the discharge of stormwater. Stormwater includes runoff from roads, and other locations within the mine that are not a part of the active mine area and should not have mine leachate or other chemicals. Water from adits, tailings piles, mine areas, etc. is classified as process water and may only be discharged under the APDES discharge program (described in Section 20.3.5). Stormwater plan has less stringent requirements than does an APDES permit. DEC administers the program under the supervision of the US Environmental Protection Agency (EPA). These plans are not public noticed, but DEC may review the proposed stormwater plan and may inspect the facility for compliance with an approved plan.

Summary:

- Agency: DEC;
- Likely Major Issue: None; and
- Environmental Information Required: None (other than that required for other authorizations).

20.3.14 ADFG Fish Passage Permits

The ADFG issues fish passage permits under AS 16.05.841 for work within the ordinary high-water mark of fish streams that are not listed in ADFG's Anadromous Fish Stream Catalogue. The criterion for the permit is to ensure that the work does not block fish passage. For road crossings the agency will require some basic hydrologic information to assure that a bridge or culvert is appropriately sized.

ADFG also requires a fish habitat permit for any activity in waters that are listed in the Anadromous Fish Stream Catalogue (AS 16.05.871). The only water close to the project is currently listed in the Catalogue is the Cobblestone River, although our aquatic baseline program may result in additional waterbodies being listed in the Catalogue. A fish habitat permit will be required for any activity, such as a water withdrawal, in the Cobblestone River, or any other waterbodies where anadromous fish are discovered.

For most mines, these have not been significant permits. An application is not typically made until the centerline of a potential road is actually staked. ADFG maintains a quick turn-around on these permits, and an application is often made during the construction process.

Summary:

- Agency: ADFG Habitat Division;
- Likely Major Issue: Effect of construction and operations on fish; and

- Environmental Information Required: Fish surveys, fish tissue analysis, aquatic habitat surveys.

20.3.15 NOAA Fisheries Essential Fish Habitat

The National Oceanic and Atmospheric Administration Fisheries agency (NOAA Fisheries), under authority of the Magnuson-Stevens Act, may require that federal agencies condition their permits to protect essential fish habitat. The *Act* requires cooperation among NOAA Fisheries and other federal agencies to protect, conserve, and enhance "essential fish habitat". Congress defined essential fish habitat for federally managed fish species as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NOAA Fisheries does the essential fish habitat consultation as a part of a federal permit evaluation. Thus, NOAA-recommended stipulations would be applied to the ACOE wetland permit.

Summary:

- Agency: NOAA Fisheries;
- Likely Major Issue: Effect of the project on salmon habitat; and
- Environmental Information Required: None (other than that required for other authorizations).

20.3.16 FWS Bald Eagle Protection Act; Migratory Bird Treaty; and Threatened and Endangered Species Act

The US Fish and Wildlife Service (FWS), under authority of the federal *Bald Eagle Protection Act*, will require identification of eagle nest, roost and perch trees. This *Act* should not have significant effect on the mine site because the site is above tree line.

Under authority of various migratory bird treaties, the FWS may advise federal agencies to condition their permits to ensure that a project is consistent with various treaties concerning migratory birds. As with bald eagles, however, the fact that the area is above tree line limits the likelihood of significant changes due to the treaty.

Finally, the FWS has authority over certain threatened and endangered species. FWS mapping shows that the Graphite Creek is within the range of the Polar Bears, which is a threatened species. It is within the Polar Bears theoretical range, which includes most of Northern and much of western Alaska. It is not within the Polar Bear critical habitat area. The DNR land use plan that includes the Graphite One Project area is more accurate than the more general FWS mapping and does not list Polar Bear as species that uses the area. Baseline information for the NEPA will likely be adequate for this authorization and may show that Polar Bears do not use the area.[11]

Like the NOAA Fisheries Essential Fish Habitat, a separate authorization is not required. However, the federal agencies have the authority to require conditions on the ACOE wetlands permit. These consultations occur as a part of the NEPA process, and the information generated for the NEPA analysis should be adequate.

[11] The Port Clarence area is also within the range, but not the critical habitat of the threatened Spectacled Eider and the Steller's Eider. FWS mapping indicates that the Eiders' range does not extend inland to the Imuruk Basin.

Summary:

- Agency: US Fish and Wildlife Service;
- Likely Major Issue: Effect of the project on threatened and endangered species, migratory birds; and
- Environmental Information Required: None (other than that required for other authorizations).

20.3.17 U.S. Army Corps or DNR Cultural Resources

The cultural resource analysis will be required for ground disturbance that could damage archaeological artifacts. The state and federal governments have overlapping jurisdiction over protection of cultural resources. For activities authorized by the state, it is the State Historic Preservation Office (SHPO) within DNR's Division of Parks and Outdoor Recreation. Because a wetlands permit will be required, the lead federal agency is the ACOE. The ACOE will coordinate evaluation of cultural resources with SHPO. The agencies will require a cultural resources analysis and possibly an on-the-ground survey if they determine there is a likelihood of historic or pre-historic cultural resources affected by the project. These have not usually been controversial for many Alaskan mines.

U.S. Army Corps of Engineers; National Historic Preservation Act

Section 106 of the *National Historic Preservation Act* requires review of any project funded, licensed, permitted, or assisted by the federal government for impact on significant historic properties. The agencies must allow the SHPO and the Advisory Council on Historic Preservation, a federal agency, to comment on a project. Following that review, the ACOE has the authority to require stipulations on federal permits, generally the Wetlands Permit, to protect cultural resources. The stipulation may require that an applicant protect the physical integrity of the cultural resource, or that the applicant ensure that the information from the cultural resources is gathered before an effect takes place, or that another means is used for protection. If there were no wetlands permit, there would be no ACOE jurisdiction over this issue and the cultural resources would be regulated by the state.

State Historic Preservation Act

The Alaska Historic Preservation Act, AS 41.35, contains a provision similar to Section 106, which mandates that any project with state involvement be reviewed in a similar manner. It gives the SHPO similar jurisdiction to the ACOE for state permits.

Through the permit review process, SHPO staff work with federal and state agencies during the early stages of project planning to protect cultural resources. They do this by providing information on the location of known sites and information from cultural resources surveys previously done in an area. If the potential to discover unknown sites is high, an on-the-ground survey may be required. If so, the applicant must contract and pay for the survey. When there are sites in a project area, SHPO staff determines National Register eligibility, how the project will affect sites, and methods to minimize or mitigate unavoidable damage.

The state mitigation required under the Cultural Resources authorizations will most likely be applied to the DNR Plan of Operations. The state mitigation should satisfy both state and federal governments. However, it is possible that some mitigation may be applied to the Corps of Engineers Wetlands Permit.

Summary:

- Agency: ACOE, DNR/SHPO;
- Likely Major Issue: Project impacts on existing or undiscovered cultural resources; and
- Environmental Information Required: Cultural resource survey.

20.3.18 Other DEC Wastewater Permits

DEC must authorize the discharge of wastewater into or upon all waters and land surfaces of the state. Any discharge for which an APDES permit is not required (such as a land application of mine wastewater) will require a separate permit from DEC.

- Agency: Alaska Department of Environmental Conservation;
- Likely Major Issue: Chemistry of discharged water; and
- Environmental Information Required: None (other than that required for other authorizations).

20.3.19 DNR Dam Safety Permit

Dam safety permits can be technically complex, and will be required for a tailings storage dam, and a water supply dam.

DNR's Division of Mining, Land and Water must issue a "Certificate of Approval to Construct" and a separate "Certificate of Approval to Operate" a dam. These authorizations are required for dams that are greater than 10 feet higher and hold back more 50 acre-feet of water; any dam more than 20 feet high; or any dam that the department determines may pose a threat to lives or property. The certificates are typically required for tailings facilities or a water supply dam. These certifications involve a detailed engineering review of the dam's design an operation.

The background information is the same needed for a competent dam design: relevant hydrology and geotechnical information. Public notice is not required. Application for this authorization may be made during the EIS processing period or after the major permits are signed, but typically the dam designs are reviewed concurrently with DEC's waste management permit and DNR's Plan of Operations Approval.

Summary:

- Agency: DNR/Dam Safety Unit;
- Likely Major Issue: Structural integrity of dams; and
- Environmental Information Required: Geotechnical conditions at site.

20.3.20 Alaska's Large Mine Permitting Process

Federal requirements under the *National Environmental Policy Act* (NEPA) provide the structure for Alaska's Large Mine Permit Process. This section outlines the NEPA procedures and expected schedule as they likely apply to the Graphite One Project.

NEPA Overview: EA or EIS?

The NEPA requires federal agencies to incorporate environmental considerations into decision-making. All major federal actions require a NEPA analysis, and the wetlands permit from the U.S. Army Corps of Engineers (ACOE) constitutes a major federal action under the law. Consequently, Graphite Creek will require a NEPA analysis: either an Environmental Assessment (EA) or the longer, more expensive Environmental Impact Statement (EIS).[12]

An EA must determine whether the project, the mine, road, and mill, would significantly affect the environment. If the answer is no, the agency issues a "Finding of No Significant Impact (FONSI). The FONSI may address measures that an agency will take to mitigate potentially significant impacts. If, on the other hand, the EA determines that the environmental consequences of a proposed federal undertaking may be significant, an EIS is prepared. Thus, to avoid an EIS, the federal agency must conclude that the mine, as mitigated, would have no significant impact on the environment.

Most hard-rock mines in Alaska have required an EIS: Red Dog Mine, Greens Creek Mine, Pogo Mine, and Kensington Mine. The Fort Knox Mine was authorized under EA in 1996, though a mine of that size would be unlikely to be authorized without an EIS today. The Nixon Fork, and Rock Creek mines were authorized under an EA. The Illinois Creek Gold Mine and the True North Gold Mine did not require any significant federal permit, (no wetlands) and consequently there was no major federal action and no NEPA analysis.

The Graphite One Project is roughly similar in size to the Nixon Fork and Rock Creek Mines that were authorized under an EA. The ideal permitting pathway for the Graphite One Project would involve the preparation of an EA, leading to a FONSI, without the need to prepare an EIS. The Project should have early discussions with the ACOE to gauge their willingness to take this pathway. If the ACOE believes that the EA is unlikely to lead to a FONSI, then it would be beneficial for the project to start with the EIS process, without spending the extra time preparing the EA.

There is a large difference in time and cost between an EA and an EIS. Both will require public notice, typically two rounds of public notice. The first round is for scoping (identifying issues specific to that project for analysis by the EA/EIS), and the second on the draft document.

Lead Agency. The lead federal agency prepares the NEPA analysis, EA or EIS, usually using a 3rd-party NEPA contractor, paid for by the applicant. Since the ACOE is the only federal agency with permit authority in the Graphite One Project, it will be the lead federal agency – the agency that supervises the NEPA analysis and makes the decision about whether an EA or EIS is required.

[12] Technically, there is a third category of environmental analysis in addition to an EA or EIS. There are small-scale activities which qualify for a categorical exclusion from NEPA analysis. Graphite Creek will not qualify for a categorical exclusion, and so this category is ignored in this report.

Cooperating Agencies. A federal, state, tribal or local agency having special expertise with respect to an environmental issue or jurisdiction by law may be a "cooperating agency" in the NEPA process. A cooperating agency has the responsibility to assist the lead agency by participating in the NEPA process at the earliest possible time; by participating in the scoping process; in developing information and preparing environmental analyses including portions of the environmental impact statement concerning which the cooperating agency has special expertise; and in making available staff support at the lead agency's request to enhance the lead agency's interdisciplinary capabilities.

The EPA and the State of Alaska are usually cooperating agencies in hard-rock mine project EISs and would likely serve in this role for the Graphite Creek NEPA process. More and more, the FWS has been a cooperating agency in Alaska EISs, and there is a high likelihood that they will be cooperators here as well.

In recent years, the lead federal agency has typically invited potentially affected tribal governments to be cooperating agencies. Recent efforts indicate that the ACOE may instead consult with the tribes separately, but not integrate them into the process as cooperating agencies.

The State of Alaska is particularly critical cooperating agency. The State's participation is coordinated by DNR's Office of Project Management and Permitting (OPMP), who will represent all the relevant state agencies during the process.

State Agency Process. Alaska state agencies use the Alaska Large Mine Permitting Process (LMPP) to work with the federal agencies and to issue state decisions on a mine. LMPP is voluntary process, paid for by the applicant, and is run by DNR's OPMP. The process has significant advantages, and every hard-rock mine project in Alaska has used it. Using the LMPP for mine permitting, rather than relying solely individual permit staff will ultimately decrease permitting costs by making the overall permitting process more efficient.

Once the applicant begins the process, OPMP assigns a project coordinator and creates a permitting team with members from all of the pertinent state agencies. Frequently, federal agencies use the LMPP to coordinate their involvement as well. The ACOE is familiar and supportive of the state process. Other federal agencies that may use the process include the FWS, NOAA Fisheries, and EPA. Also, the project coordinator works with the applicant to coordinate the public process, and so the public can go to one point-of-contact for the project.

The advantage of Alaska's LMPP is that it is more efficient for the agencies, the public, and the applicant. This is especially true for a project with a significant public process component, with significant technical issues, and one involving an EIS. The advantages for a company are:

- There is a lead state official who is responsible to the company for an efficient process. If there is a problem, this official is responsible to see that it is solved;
- The team approach should minimize contradictory direction from different agencies;
- The team approach should minimize overlapping data requirements — one data program should satisfy all team members;
- By using the team to work through mine design questions, it minimizes negative interactions between mine design and permitting; and

- The public has a single point-of-contact: the project coordinator.

For projects involving an EIS, there is often another advantage as well. The federal EIS team frequently involves people who do not know Alaska. A LMPP project team has enough respected expertise to help ensure that odd or impractical ideas are eliminated quickly without derailing the process. The LMPP project team provides an avenue to help control rumors that can otherwise become “officially sanctioned” by repetition from un-knowledgeable agencies.

In the state’s LMPP, the project bears the cost of state agency participation. The applicant must agree to pay for agency personnel time.

It is not always obvious when to start the LMPP ¬– that is, when to begin to pay for a coordinator which also means the company will begin to pay for agencies’ personnel time. In most cases, the process needs a coordinator in the year leading up to permitting, when the project expects coordinated state input on final company decisions about mine design. In any case, it does not appear that Graphite Creek is ready to start the process yet because baseline and mine design are net yet ready for detailed, coordinated agency scrutiny.

NEPA Schedule. With a good quality application based on adequate environmental baseline data, an EA can frequently be completed within a year. Hard-rock mine EIS processes in Alaska have taken significantly longer than that. Pogo required 3-1/2 years from the time of application (i.e., excluding the time to collect baseline environmental information); the Kensington Supplemental EIS required just more than three years from the time of the application to the Record of Decision.

Permitting Schedule. The ACOE must complete the EA or EIS before it can issue its Section 404 wetlands permit (the only major federal authorization necessary for the Graphite One Project). The ACOE must wait at least 30 days after finalizing the EA or EIS before it can first issue its Record of Decision, and then issue the wetlands permit. For planning purposes, 120 days should be budgeted for issuance of the wetlands permit after the EA or EIS is finalized.

A major focus of Alaska’s LMPP is to coordinate the processes for all the state permits so that they can be issued concurrently with, or as soon as possible after, the completion of either the EA or the EIS. It is expected that all state authorizations should be issued prior to, or concurrently with, the federal wetlands permit.

20.4 Consultation

20.4.1 Local Consultation

The communities of Brevig Mission, Mary’s Igloo and Teller are closest to the project area. Brevig Mission has a population of 462 residents, and Teller has a population of 237 residents. Both communities have high unemployment and poverty rates. Most work is seasonal, and the majority of the residents depend on subsistence harvests each year. The primary employers in remote rural villages are the school and the local government entities such as the tribe and city. There is also no running water in Teller. Mary’s Igloo residents have mostly relocated to Teller and other nearby communities. There is currently no active town site for Mary’s Igloo, but they have maintained their private land ownership, which was established through *the Alaska Native Claims Settlement Act* (1971) and their federally recognized tribal government status. Mary’s Igloo shareholder and tribal members have been included in Teller outreach meetings. Nome has also been included in community outreach because it is the hub in the Seward Peninsula region of Alaska, and this project would certainly have an economic and social impact in Nome as well as the nearby villages.

The first round of meetings with the communities of Nome, Brevig Mission, Mary's Igloo and Teller was in the fall of 2014. Since then, project staff have met every year for six consecutive years with these communities and have met twice with residents of Nome. Staff also held "community leadership roundtables" in the communities during the first two years, with elected leaders in one collective meeting. These meetings were helpful in establishing the main questions and issues from the local leadership directly with project leadership. The community leaders have been receptive to these meetings, and each meeting has been well attended.

Project staff have also maintained communication with various regional entities and organizations and entities based in Nome such as: The City of Nome, Bering Straits Native Corporation, Nome Eskimo Community, Nome Chamber of Commerce, Kawerak, and the Norton Sound Economic Development Corporation.

The following is a list of issues of concern brought up by community members during the outreach meetings since 2014:

- Critical subsistence areas need to be protected for anadromous fish, reindeer, moose, caribou, berries, Canadian geese, pike, walrus, and whitefish;
- There is concern about increasing algae in Imuruk Basin;
- Residents want to know about the project's waste water discharge, and if the graphite floatation agent is harmful;
- Some residents say they have seen black trout in Tisuk River;
- Residents want to know if there are smelts in Graphite Creek;
- Imuruk Basin is a key subsistence area, and needs to be protected;
- Training and workforce development, employment opportunities, and local benefits;
- How will the project be accessed?;
- What will be the water sources for the project during exploration and production?;
- What will be the project by-products and waste materials?;
- Will there be any airborne contaminants?;
- What will noise levels be during construction and operation?;
- Can work be avoided during hunting seasons?;
- Are there any naturally occurring toxins?;
- Need to describe how the graphite will be processed;

- Heavy snowfall and water drainage is a concern;
- Need to prevent trespass on Native Corporation lands;
- Can the project provide assistance with local programs and projects – like seawall in Teller?;
- Will the project have carbon pollution standards?;
- Employees will need hazmat training;
- Need water quality monitoring; and
- Dust control is a concern, and the toxicity of graphite dust.

20.4.2 Agency Consultation

Graphite One staff have conducted preliminary consultations with state, federal agencies. These consultations have included meetings with ADFG on fisheries issues, with ADEC on water and air quality issues, BLM on land use issues, DNR on mine permitting and land use issues, and the ACOE on wetlands permitting and NEPA issues. We intend to initiate full discussions with these agencies to brief them on baseline data collection efforts, and to prepare for permitting and NEPA.

20.5 Factors for Consideration

20.5.1 Subsistence

One of the biggest concerns for the residents of the communities near the project is their ability to access fish, game, and other resources necessary for their subsistence way of life. These small communities of Teller, Brevig Mission, and Mary's Igloo, are similar to all other small rural Alaskan communities, where the importation of food and other commodities can be extremely expensive, and consequently residents rely heavily on the harvest of local food. This project is taking all the necessary steps to ensure that the community subsistence resources will be protected.

In addition to gathering baseline data on water and air quality, and fish and wildlife abundance, the project is also gathering data on what subsistence resources are used by the local residents, and where they gather those resources. To assist in this effort, the project created a Subsistence Advisory Council (SAC), composed of leaders from each of the communities who are familiar with the subsistence use patterns of the communities.

In 2018, the SAC was initiated with a site-visit to the project site in August and a meeting in Nome in October. The purpose of the SAC is to provide guidance and advise the project team through recommendations on the following issues: helicopter activities, wildlife interactions, and creating a subsistence resource database. The SAC's additional roles are to participate in an annual meeting, site-visits as needed, and to serve as liaison between the project team and the community members when appropriate.

The community entities appoint their own representatives to the SAC. The following entities have appointed a primary and alternate representative:

- City of Brevig Mission;
- Brevig Mission Traditional Council;
- Brevig Mission Native Corporation;
- Mary's Igloo Traditional Council;
- Mary's Igloo Native Corporation;
- City of Teller;
- Teller Traditional Council; and
- Teller Native Corporation.

The Subsistence Director of the regional Native non-profit organization Kawerak has also been asked to serve as an honorary member of the SAC, due to his extensive knowledge of subsistence related issues in the entire region.

20.5.2 Geochemistry, Acid-Rock Drainage, and Metals Leaching

The permitting issue which takes up the most agency time, and which most influences mine design and costs is usually the mine's ability to control and discharge water. The way in which the agencies require the mine to control water, and its ability to obtain an authorization to discharge water is usually an issue of the water quality of the mine runoff. And water quality is, in turn, a function of the mine's water budget and geochemistry: specifically, the potential for acid-rock drainage and metal leaching.

The difficulty in resolving these issues varies significantly from mine to mine. For example, when permitting the Illinois Creek Mine, there was little concern about the quality of the waste rock leachate, and the waste rock pile was placed so that it did not collect water. The lack of water and lack of geochemical problems made this a non-issue and decreased the time for permitting. However, for the Rock Creek Mine, discussions of the post-closure water quality that will discharge from the pit held up the permits for some time.

There are some design factors for Graphite Creek which could help resolve water discharge issues. Using a dry stack instead of a wet-tailings disposal facility would decrease the effluent volume, which provides more permitting options. Storing waste rock within the pit could also help. Finally, the fact that the mine is close to the Imuruk Basin may allow the mine to discharge to marine water quality standards. These are significantly less stringent than fresh water standards, and discharge to the Imuruk Basin could be a significant advantage.

Groundwater quality in the mine area is indicated by Tetra Tech's 2014 water quality report from two bore holes, and by surface water quality measurements from streams draining the deposit. Bore hole 12GC001, shows an acidic pH of 5.0, and that concentration of five metals exceed

Alaska's water quality standards: Al, Fe, Mn, Ni, and Zn. The second borehole shows neutral pH and only Fe and Mn exceed water quality standards.

Streams draining the ore body also indicate potential water quality issues. The stations closest to the orebody[13] were acidic in the 2015 report (pH from 4.6 to 5.7), but two of the three stations yielded neutral pH in the 2014 report. The streams also show natural water quality exceedances for similar metals as the bore holes.

The results from ongoing geochemical testing indicate that much of the waste rock appears to be PAG, with potential for some metals leaching. One tailings sample was classified as non-PAG, with some potential for metals leaching (see Section 18.5.2). Testing is ongoing and will be used to develop a water model.

For efficient permitting it is critical that the Graphite One Project enter into permitting discussions with an adequate baseline of hydrologic and geochemical information, and with a defensible plan for discharge.

20.5.3 Groundwater

As stated in the previous section, the permitting issue which takes up the most agency time, and which most influences mine design and costs is usually the mine's ability to control and discharge water. A substantial percentage of the water that must be controlled and discharged is a result of pit dewatering. The factors that may control water flow into the pit and consequently the geochemistry of the water to be treated are poorly understood and the subject of ongoing studies.

The Kigluaik Fault, located at the base of the mountain slope, may have a major influence on groundwater flow. It separates two hydrogeologic regimes and may be a barrier to groundwater flow. On the southside of the fault (where the deposit is located), the rock likely has very low permeability due to the very high metamorphic grade. Groundwater flow in these rocks is likely confined to faults and fractures. Poorly understood, unconsolidated sediments of large but unknown depth, are found on the north side of the fault. The fault will cross the planned pit part way up the north pit wall for the entire length of the pit.

Further work will partially focus on determining the hydraulic conductivity of the rock north of the Kigluaik Fault. There may be a "damage zone" adjacent to the Kigluaik Fault that has increased faulting and fracturing and therefore may have increased hydraulic conductivity. Groundwater flow in this area may be influenced by the permeability of the Kigluaik Fault, fracture/fault density, and the presence/absence of permafrost.

Further work will also focus on understanding the sediment and associated hydrogeologic regime on the north side of the Kigluaik Fault. This may have a substantial influence on the rate of groundwater inflow to the pit during mining and on the post mining pit lake water level.

The relative amount of water entering the proposed pit from each side of the fault may affect water quality during mining (pit dewatering) and post-mining. The water on the north (sediment) side of the fault may have lower baseline constituent concentrations and source term derived loading than the water derived from the northern (bedrock) side of the fault. This will affect water treatment plans for the mining and post-mining periods.

[13] Graphite Creek Upstream - GR1; Ptarmigan Creek Upstream – Pt1; and Ruby Creek – RB1

20.6 Closure

At the end of mine life, the mine will be closed and reclaimed in accordance with state laws and regulations. The primary authorities that set closure requirements are 1) DNR Reclamation Plan Approval, 2) ADEC Waste Management Permit, and 3) DNR Dam Safety Certification for any jurisdictional dam structures. These authorizations are described in more detail in Section 20.3.

20.6.1 Reclamation Plan Approval

The Reclamation Plan Approval provides DNR authority to review operations to ensure that they comply with state's law: "A mining operation shall be conducted in a manner that prevents unnecessary and undue degradation of land and water resources and the mining operation shall be reclaimed as contemporaneously as practical with the mining operation to leave the site in a stable condition." DNR's Reclamation Plan Approval will include reclamation stipulations that ensure appropriate re-contouring, soil stability, and revegetation. DNR also has the authority to require financial assurance sufficient to complete the terms of the Reclamation Plan should the miner not be able to do so.

20.6.2 Solid Waste Management Permit

A Solid Waste Permit from DEC is required for the tailings facility whether it is a dry-stack tailings facility or a wet tailings facility and may be required for the placement of waste rock. This permit will have closure requirements, primarily focused on ensuring long-term water quality meets state and federal standards. If necessary, this permit will require long-term water treatment and monitoring. DEC has the authority under the Solid Waste Permit to require financial assurance from the company.

20.6.3 Dam Safety Certification

DNR will require a Dam Safety Certification for any jurisdictional dams necessary for this project, which in this case would include dams for a wet tailings management facility, or dams necessary for a water supply reservoir. The Dam Safety Certification would include requirements for closure, either complete decommissioning, or provisions for care and maintenance. The Certification would include requirements for bonding/financial assurance to cover the costs of closure for the dams.

21 CAPITAL COST ESTIMATE

21.1 Capital Cost Summary

The capital cost estimate was prepared using first principles, applying project experience and avoiding the use of general industry factors. The estimate is derived from engineers, contractors, and suppliers who have provided similar services to existing operations and have demonstrated success in executing the plans set forth in the study. Given that assumptions have been made due to a lack of available engineering information, the accuracy of the estimate and/or ultimate construction costs arising from the engineering work cannot be guaranteed. The estimate meets a AACE Class 4 (FEL4) estimate, with a target accuracy of -15 to -30% on the low side, and +20 to 50% on the high side.

Costs are expressed in US$ with no escalation unless stated otherwise.

The estimate is based on the assumption that contractors would mobilize only once to carry out their work and are not already mobilized on site performing other work.

LOM Project capital costs total $ 1,484.9 M, consisting of the following distinct phases and sites:

Alaska Mine and Processing Plant

- Pre-production capital costs – Includes all costs to develop the Property to operations. Initial capital costs total $579.7M and are expended over a 36-month pre-production period on engineering, construction, and commissioning activities.

- Sustaining capital costs – includes all costs related to the acquisition, replacement, or major overhaul of assets during the mine life required to sustain operations. Sustaining capital costs total $244.4M and are expended in the first year of operations at the Alaska mine site and carry through 24 years of operations; and

- Closure Costs – includes all costs related to the closure, reclamation, and salvage value, post operations. Closure costs total $125M and are expected in Year 24 and 25. Closure costs which occur for an extended period in the post closure phase have been included at the current value in Year 25.

Secondary Treatment Plant

- Pre-production capital costs – includes all costs to develop the Property to an operating treatment plant facility. Initial capital costs total $660.8 M and are expended over a 24-month pre-production period for engineering, construction, and commissioning activities. Due to the lag between startup of the STP and production of concentrate from the mine site, the pre-production cost period for the STP ends one year in advance of the pre-production period at the mine site.

The capital cost estimate was compiled using a combination of quotations, database costs, and judgment factors; the overall cost estimate was benchmarked against similar operations. Table 21-1 presents the capital estimate summary for initial and sustaining capital costs in Q4 2021 dollars.

Table 21-1: Capital Cost Summary

Capital Costs	Pre-Production (M$)	Sustaining / Closure (M$)	Total (M$)
Open Pit Mining	51.9	19.5	71.3
On-Site Development	112.4	60.9	173.2
Process Plant	119.6		119.6
Alaska Infrastructure	95.5		95.5
Alaska Indirect Costs	119.9		119.9
Secondary Treatment Plant (STP) WA	490.0		490
STP Indirect Costs - WA	81.1		81.1
Subtotal	**1,070.4**	**80.4**	**1275.7**
Contingency	170.1	39.1	209.2
Closure		125.0	125.0
Total Capital Costs	**1,240.5**	**244.4**	**1484.9**

21.2 Basis of Estimate

The Project capital estimates include all costs to develop and sustain the project at a commercially operable status. The capital costs do not include the costs related to operating consumables inventory purchased before commercial production.

The following key parameters apply to the capital estimates:

- Estimate Class: The estimate is a Class 4 Estimate, deemed to have an accuracy of -15% to -30% on the low side, and +20% to +50% on the high side, based on the amount of design, engineering and procurement completed;
- Estimate Base Date: The base date of the capital estimate is Q1 2022. No escalation has been applied to the capital estimate for future costs; and
- Currency: All capital costs are expressed in USD$. Table 21-2 presents the exchange rates used for costs estimated in foreign currencies and the portions of the capital costs estimated in those currencies.

Table 21-2: Foreign Currency Exchange Rates

Country	Currency	Code	Per US$
USA	Dollar	US$	1.000
Canada	Dollar	CAD$	1.282
China	Renminbi	RMD	6.36

21.3 Mine Capital Cost Estimate

Mining costs were derived from the JDS mining cost model which used a first principles approach in building up development costs. All equipment has been assumed to be new purchases. The equipment supply cost have been quoted by Vendors to create a database. Allowances as a percentage of equipment have been made for freight, spare parts, and assembly for the equipment. Table 21-3 provides a summary of the mining costs.

Table 21-3: Mine Capital Cost Estimate

	Initial $	Sustaining $	Total $
Pre-Stripping	32.4	-	32.4
Production Equipment	11.1	9.0	20.1
Support Equipment	2.9	7.4	10.3
Ancillary Equipment	3.6	2.0	5.5
Miscellaneous	1.9	1.1	3.0
Total	51.9	19.5	71.3

21.4 Site Development and On-Site Infrastructure Direct Cost Estimate

21.4.1 Direct Pre-Production Capital

Site construction costs include site development, mineral processing plant, tailings management facility, secondary treatment plant and on-site infrastructure. These cost estimates are primarily based on material and equipment costs from material take-offs (MTOs) and detailed mechanical equipment lists (MEL). Pricing for main equipment and bulk materials was primarily determined from quoted sources or database pricing, with some judgment factors applied for minor cost elements.

Table 21-4 presents a summary basis of estimate for the various commodity types within the surface construction estimates. Growth factors were included above neat material take-off quantities for all areas.

Table 21-4: Quantity Estimate Basis

Scope	Quantity Basis	Description
Site Preparation and Bulk Earthworks	MTOs	Quantities of Site Prep and Earthworks have been developed from the preliminary 3D model and sketches.
Concrete	MTOs	Quantities of Concrete have been developed from the preliminary 3D model.
Buildings	MTOs	Quantities developed based on sketches.
Structural Steelwork	MTOs Allowance	Quantities have been developed from the preliminary 3D layout model or allowance, depending on area.
Mechanical Equipment	MEL	Equipment was identified in the MEL.
Mechanical Platework/ Tanks	MTOs	Quantities have been developed based on the preliminary 3D model.
Process Piping	MTOs Allowance	Piping has been either developed from MTOs or allowances provided as a percentage of mechanical equipment. Differences of development depend on location and area
Electrical Bulks	MTOs	MTOs were developed based on Single Line Diagrams and Site General Arrangement Layouts and mining 3D model.
Instrumentation	Allowance	Allowances provided as a percentage of mechanical equipment

21.4.2 On-Site Development Costs

On-Site Development costs represent the costs for general site prep, onsite roads and laydowns and pads, along with the Tailings management area. These cost estimates are primarily based on MTOs from design drawings. Pricing earthwork activities were determined from quotes sources with some database pricing for minor activities and some factors applied for minor cost elements.

A summary of the surface infrastructure costs is outlined in Table 21-5.

Table 21-5: Site Development CAPEX

On-Site Development CAPEX	Pre-Production (M$)	Sustaining / Closure (M$)	Total
Onsite Development			
Earthworks	6.2	0	6.2
On-Site Roads	7.0	0	7.0
Site Water Management	38.7	1.1	39.8
Tailings Management Area	46.2	134.5	180.6
Quarry Operations	8.7	14.6	23.3
Total	**106.7**	**150.2**	256.9

21.4.3 Alaska Processing Capital Costs

Processing Capital costs represent the costs to construct the process plant and tailings filtration facilities at the site in Alaska. These cost estimates are primarily based on material and equipment costs from MTOs and detailed equipment lists. Pricing for main equipment and bulk materials was primarily determined from quoted sources, with some factors applied for minor cost elements.

A summary of the surface infrastructure costs is outlined in Table 21-6.

Table 21-6: Process CAPEX

Process CAPEX	Pre-Production (M$)	Sustaining / Closure (M$)	Total
Process Plant			
Primary Crushing	19.8		19.8
Grinding & unit cell flotation	22.4		22.4
Flotation	28.4		28.4
Concentrate Dewatering & packaging	12.5		12.5
Tailings Dewatering	8.1		8.1
Reagents	2.7		2.7
Process Plant Utilities	7.8		7.8
Process Plant Building	17.9		17.9
Total	**119.6**		**119.6**

21.4.4 Alaska Infrastructure Capital Costs

Surface construction costs include site the ancillary buildings, utilities and on-site infrastructure. These cost estimates are primarily based on material and equipment costs from MTOs and detailed equipment lists. Pricing for main equipment and bulk materials was primarily determined from quoted sources, with some factors applied for minor cost elements.

A summary of the Alaska site infrastructure costs is outlined in Table 21-7.

Table 21-7: Infrastructure CAPEX

Infrastructure CAPEX	Pre-Production (M$)	Sustaining / Closure (M$)	Total
Onsite Infrastructure			
Site Access Road	37.3		37.3
On-Site Electrical Supply & Distribution	21.9		21.9
Accommodations & Ancillary Buildings	15.5		15.5
Mine Area Ancillary Facilities	10.4		10.4
Utilities	4.7		4.7
IT & Communications	1.2		1.2
Surface Mobile Equipment	4.6		4.6
Total	**95.5**		**95.5**

21.4.5 Secondary Treatment Plant CAPEX

Secondary Treatment Plant (STP) Capital costs represent the costs to construct the facility in Washington state, which upgrades the graphite concentrate into final products for distribution. These cost estimates are primarily based on material and equipment costs from MTOs and detailed equipment lists. Pricing for main equipment and bulk materials was primarily determined from quoted sources, with some factors applied for minor cost elements. The STP will be constructed in two phases; however, both phases are included in pre-production capital due to the timing of the development of the mine site in Alaska.

A summary of the STP costs is outlined in Table 21-8.

Table 21-8: STP CAPEX

Secondary Treatment Plant CAPEX	Pre-Production (M$)	Sustaining / Closure (M$)	Total
STP			
Material Received, Drying, Sorting & Micronizing	125.9		125.9
Graphite Purification & Carbonization	167.7		167.7
Agglomeration	45.6		45.6
STP Ancillary Facilities	80.5		80.5
STP Infrastructure	19.8		19.8
Reagents	17.2		17.2
Off-Gas Handling & Scrubbing	3.7		3.7
Plant Services	29.5		29.5
Total	**490.0**		**490.0**

21.4.6 Indirect Capital Costs

Indirect costs are classified as costs not directly accountable to a specific cost object. Table 21-9 presents the subjects and basis for the indirect costs within the capital estimate.

Table 21-9: Indirect Cost Basis of Estimate

Commodity	Basis
Contractor Field Indirects (may vary depending on contractor or facility)	Estimated by first principles, and including the following items:
	Time based cost allowance for general construction site services (temporary power, heating and hoarding, contractor support, etc.) applied against the surface construction schedule
	Construction offices and wash car facilities
	Safety training, tools and equipment
	Site Maintenance and Temporary Services
	On-site/Off-site Overhead and Indirects
	Mobilization/Demobilization/Re-Occurring Cost
	Contractor facilities and related cost
	Construction team facilities, fuel
Indirect Labour (incl survey, site services, QA/QC, scaffolding, security, safety)	Built up based on hours and rotations to complete the work
Diesel/Fuel	Built up based on contractor hour and fuel burn rates
Flights and Travel	Built up based on rotations from the EPCM, G&A and Owners travel schedule

Commodity	Basis
Pre-Production Labour	Based on requirements determined by engineering from the operating usages
Freight and Logistics	Historical data base rates for major equipment and infrastructure or included in the quoted price. Preliminary quotes received for bulk shipping to each mine site
Vendor Representatives	Based on % of mechanical equipment for similar locations and applications
Capital Spares	Based on % of mechanical equipment for similar locations and applications
Start-up and Commissioning	Included under EPCM (personnel), Owner's team costs (material and consumables), and first principles build-up of estimated contractor labour requirements
First Fills/Consumables	Based on requirements determined by engineering from the operating usages

Table 21-10: Indirects CAPEX

Indirects CAPEX	Pre-Production (M$)	Sustaining / Closure (M$)	Total
Alaska Indirects			
Construction Support Contracts	35.8		35.8
Construction Equipment	3.3		3.3
Construction Indirects	16.1		16.1
Temporary Facilities	1.6		1.6
Freight & Logistics	15.3		15.3
Start-up & Commissioning	6.8		6.8
EPCM	28.1		28.1
Owners Costs	13.0		13.0
Total – Alaska Indirects	**119.9**		**119.9**
STP Indirects			
Construction Support Contracts	14.7		14.7
Construction Equipment	**2.1**		**2.1**
Construction Indirects	**14.1**		**14.1**
Temporary Facilities	**1.9**		**1.9**
Freight & Logistics	8.6		8.6
Start-up & Commissioning	3.6		3.6
EPCM	31.1		31.1
Owners Costs	5.0		5.0
Total – STP Indirects	**81.1**		**81.1**

21.4.6.1 EPCM Cost Estimate

21.4.6.1.1 Detailed Engineering and Procurement

The estimate was based on deliverables for engineering and drafting, and time based on project management services required to oversee project development. Engineering and procurement services and costs are based on judgment factors derived from previous projects.

21.4.6.1.2 Project and Construction Management

The staffing plan was built up against the development schedule for project management, health and safety, construction management, field engineering, project controls, and contract administration. Costs are based on an EPCM execution strategy.

21.4.6.2 Owner Cost Estimate

21.4.6.2.1 Pre-Production G&A – Labour

Costs for general and administrative labour are included for the following sectors:

- General management;
- Finance and accounting;
- Health and Safety;
- Environmental management;
- Human resources;
- Procurement & logistics;
- Security; and
- Owners Project Team

21.4.6.2.2 Pre-Production G&A – Expenses and Services

Costs for general and administrative expenses and fees are included for the following sectors:

- Health, safety and medical supplies;
- New hire orientations;
- Staff safety equipment (surface staff PPE);

- Surface support equipment operation fuel and maintenance;
- Surface facilities electrical power consumption;
- Site facilities maintenance supplies and consumables;
- Environmental services, fees, and outside laboratory costs;
- Construction insurance;
- Legal and regulatory, including property tax;
- External consulting;
- IT and communications;
- Site office costs;
- Office equipment lease and services;
- Waste disposal; and
- Senior staff travel allowance.

21.5 Contingency

Contingency has been applied to the estimate determined by the estimate class of the sub-categories. Where additional contingency was deemed necessary, based on the level of design confidence for that sub-category, a growth allowance was added to those specific items. The overall contingency is applied after the growth allowance has been added. Individual contingency rates ranged from 10-20% for individual cost categories, depending on level of design detail. Overall contingency totals $200.9M over the LOM and has been calculated to be 16% of the overall direct/indirect costs and 14% of the overall costs.

21.6 Closure Capital

Closure costs in Alaska include the cost to reclaim the various facilities on site, and to support ongoing monitoring and water treatment costs as required. No Closure costs have been considered for the STP, as it’s assumed that the plant can operate as a stand-alone facility, purchasing graphite concentrate, after the Mine site in Alaska has been closed. Overall Closure costs have been estimated at $125M.

21.7 Capital Estimate Exclusions

The following items have been excluded from the capital cost estimate:

- Working capital (which is included in the financial model);
- Financing costs;
- Currency fluctuations;
- Lost time due to severe weather conditions beyond those expected in the region;
- Lost time due to force majeure;
- Additional costs for accelerated or decelerated deliveries of equipment, materials or services resultant from a change in Project schedule;
- Warehouse inventories, other than those supplied in initial fills, capital spares, or commissioning spares;
- Any Project sunk costs (studies, exploration programs, etc.);
- Closure bonding (which is included in the financial model); and
- Escalation cost.

22 OPERATING COST ESTIMATE

22.1 Operating Cost Summary

The operating cost estimate was prepared using first principles, applying project experience and avoiding the use of general industry factors. Inputs are derived from engineers, contractors and suppliers who have provided similar services to other projects.

The operating cost estimate is broken into five major sections:

- Mining;
- Alaska Processing;
- Secondary Treatment Plant Processing;
- Transportation; and
- General & Administrative.

Certain items within the operating costs begin during the construction phase and continue through the life of the mine. Some of the costs incurred during the pre-production period relate to the costs to purchase items such as consumables required for the following year of production. The timing of these costs has been accounted for in the economic analysis.

Operating costs are presented in 2022 US dollars on a calendar year basis. No escalation or inflation is included.

The total operating unit cost is $71.07/t processed for the site in Alaska, and $3,908.7/t concentrate processed for the Secondary Treatment Plant, and exclusive of ocean transportation. Average annual operating costs and total unit costs are summarized in Table 22-1 and Table 22-2.

Table 22-1: Breakdown of Estimated Operating Costs - Alaska

Operating Costs - Alaska	$/t milled	LOM M$
Mining	23.08	519.1
Processing	29.97	674.1
G&A	18.01	405.1
Total	71.07	1,598.3

Table 22-2: Breakdown of Estimated Operating Costs – Transport & STP

Operating Costs	$/t concentrate	LOM M$
Transport	314.4	374.7
Secondary Treatment Plant	3,308.7	3,942.9
Total	3,623.1	4,317.6

A breakdown of the operating costs by area is shown in Figure 22-1.

Figure 22-1: Operating Costs Distribution

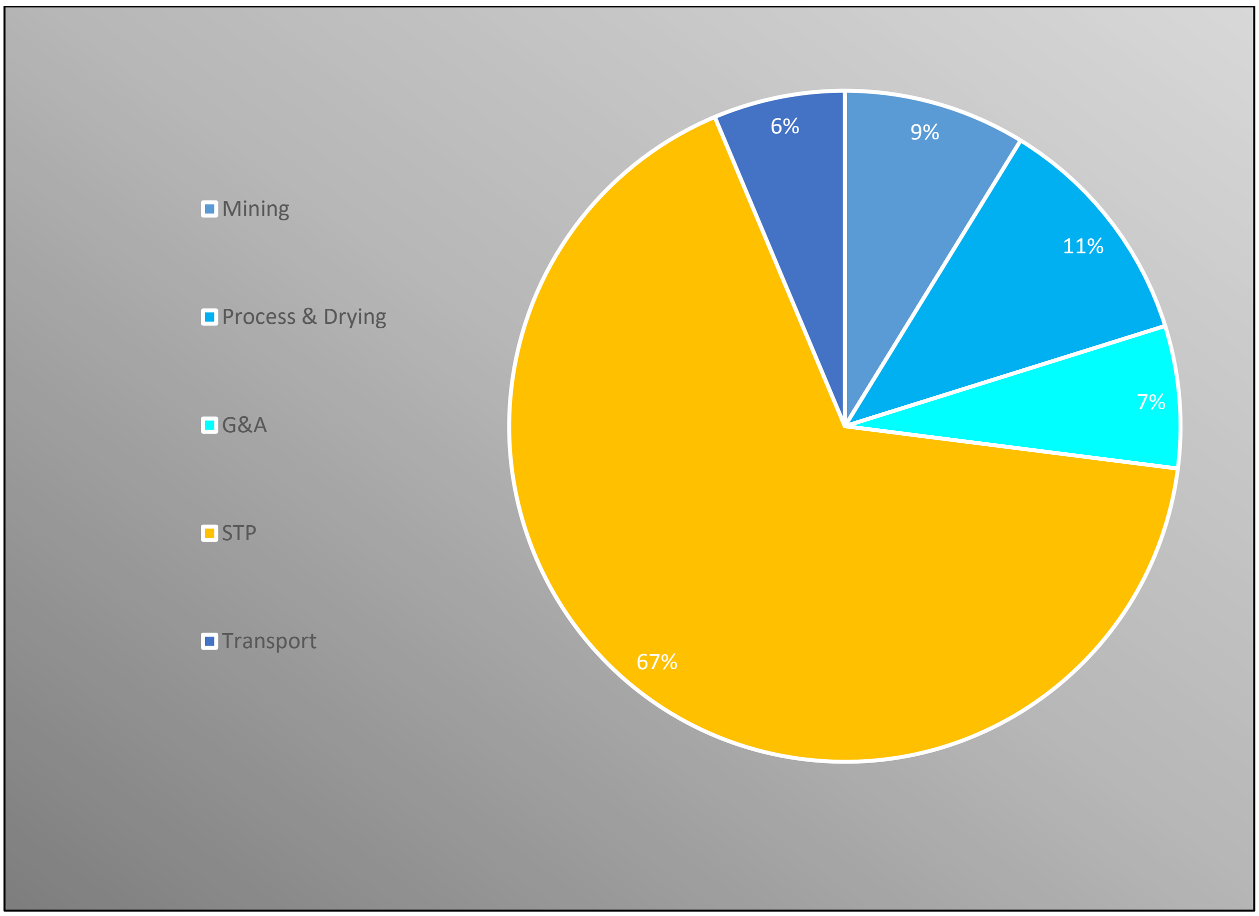


Table 22-3: Summary of Personnel – Peak Requirement

Position	Quantity
Mining	
Mine General	7
Mine Operations	49
Mine Maintenance	40
Technical Services	12
Subtotal - Mining	108
Process Plant	
Technical Services	12
Mill Operations	30
Mill Maintenance	18
Total Process Plant Personnel	60
Secondary Treatment Plant	
Administration	28
STP Tech Services	66
STP Maintenance	29
Total STP Personnel	123
G&A	
Management & Administration	2
Accounting	4
Human Resources	4
Community Relations & Environment	4
Health & Safety	5
IT & Communications	1
Procurement, Logistics & Warehousing	11
Security	4
Facilities & Maintenance	12
Camp & Transportation	28
Total General & Administration	**75**
Total Personnel - All Areas	**367**

22.2 Basis of Estimate

The operating cost estimate was developed from a number of sources, including quoted costs, benchmarks against similar projects in the USA and Northern Climates, and database information as required. Process cost determinations were based on fixed and variable components relating to mill throughput and plant flow sheet. G&A costs were based on a first principles build up from information based on similar projects in similar locations.

22.3 Mine Operating Cost Estimate

Mine Operating costs were developed using first-principle calculations to estimate equipment hours required to meet the mine material movement schedule. Equipment productivity assumptions are discussed in Section 16.8. Hourly equipment and fuel consumption costs supplied by vendors or taken from various equipment databases were applied to the estimate equipment hours. For truck haulage requirements, cycle times were simulated in Talpac software to provide accurate haulage hours. Explosives quantities were derived from the drill hole spacing and powder factors discussed in Section 16.8.

Mining labour costs include supervision and administration, equipment operators, maintenance, and technical services.

Due to the remote location and relatively low throughput, labour costs are the major component of the operating cost. A breakdown of the LOM mining operating costs is shown in Table 22-4.

Table 22-4: Mine Operating Cost Estimate

Cost Area	US$/t mined	US$/t milled	%
Labour	5.37	16.20	70%
Fuel / Power / Oil / Lube	1.11	3.35	14%
Parts & Consumables	0.45	1.36	6%
Explosives	0.23	0.69	3%
Services, Rentals & Lease Payments	0.50	1.49	6%
Mining Grand Total by Area	**7.65**	**23.08**	**100%**

Table 22-5: Mine Personnel Requirement

Area	Year -2	Year -1	Year 1-7	Year 8-LOM
Mine General	4	8	7	7
Mine Operations	14	46	49	41
Mine Maintenance	11	38	40	36
Technical Services	4	12	12	12
Total (all crews)	**33**	**104**	**108**	**96**

22.4 Processing Operating Cost Estimate

Based on 900,000 t/a throughput at 6.18% C feed grade, 92% carbon recovery and 95% C concentrate grade, total process operating cost was estimated to be US$29.97/t of ore or US$565.66/t concentrate produced.

This process plant operating cost estimate was prepared using metallurgical test data for consumable consumption, in-house experience for personnel requirements, and supplier information on spares and comminution consumables.

Processing costs include the costs of direct process operations, labour, consumables and reagents, and maintenance and operating supplies. A summary of operating costs by main cost centers is provided in Table 22-6.

Table 22-6: Process OPEX

Description	Unit	Annual Cost (US$)	Unit Cost (US$ /t Ore)
Labour	**Personnel**		
Technical Services	12	1.7	1.85
Mill Operations Labour	30	4.4	4.82
Maintenance Labour	18	3.3	3.65
Sub-Total	**60**	**9.3**	**10.32**
Utility	**MWh/a**		
Power	47.373	12.3	$13.69
Sub-Total		**12.3**	**$13.69**
Consumables			
Crushing/Grinding Wear Parts		1.0	1.06
Grinding Media		2.2	2.49
Reagents & Dryer Fuel		0.8	0.85
Assay And Quality Control Supplies		0.1	0.14
Others-Vehicles		0.1	0.13
Maintenance Supplies		1.2	1.29
Sub-Total		**5.4**	**5.97**
Total Mill Operating Cost		**27.0**	**29.97**

Source: Bomenco (2022)

The largest cost item in the plant is power, estimated at US$13.69/ t processed. The cost is based on 47.373 MWh/a consumption at a unit cost of US$0.26/kWh.

Labour costs, estimated at US$10.32/t processed, constitute the second largest share operating cost. It is estimated that a total of 60 personnel will be required to cover technical services (12), operational labour (30) and maintenance labour (18) requirements.

Total consumables are estimated to cost US$5.97/t processed and include comminution wear parts and media, reagents, maintenance supplies, and dryer fuel (diesel).

Process operating supply costs are based on test results and budgetary prices from vendors of consumables and reagents. Process maintenance supply costs are factored from equipment supply costs.

Labour wage rates were based on 2021 Alaska wage schedule, using the 75th percentile, with additions for overtime, and additional corporate benefits as applicable. assuming two weeks on/two weeks off crew schedules with 12-hour shifts.

22.5 General and Administration Operating Cost Estimate

On-site items as such as, overall management and administration, health and safety, environmental, human resources, insurance, legal, external consulting, IT, communications and office supplies, site service equipment operation and maintenance, and procurement and warehousing are covered under site G&A costs.

General and administrative costs comprise the following categories:

- Labour;
- Expenses;
- Vehicle & Equipment Operations;
- Camp Operations;
- Travel;
- General Facilities Maintenance;
- Power; and
- Supplies.

Table 22-7: G&A Personnel Requirement

Position	Quantity
Management & Administration	2
Accounting	4
Human Resources	4
Community Relations & Environment	4
Health & Safety	5
IT & Communications	1
Procurement, Logistics & Warehousing	11
Security	4
Facilities & Maintenance	12
Camp & Transportation	28
Total General & Administration	**75**

Table 22-8 summarizes the Life of Mine G&A operating costs.

Table 22-8: G&A Costs

Operating Costs	Production ($M)
Labour	128.9
Expenses	50.4
Vehicle Operations	6.4
Power	66.6
Accommodation	64.9
Personnel Transportation	9.2
Supplies	70.9

22.6 Transportation/Haulage Operating Cost Estimate

The transportation cost represents the cost of hauling concentrate from the site in Alaska to the Secondary Treatment Plant in Washington State. This includes the cost of hauling from the mine site in Alaska to the port of Nome, shipping from Nome to Washington State, and trucking to the STP site in Lewis County. Quotes from local shipping companies were received. Total haulage costs over the LOM are $374.7M.

22.7 Secondary Treatment Plant Operating Cost Estimate

STP Operating costs were developed using first-principle calculations, supplier quotations and in house database costs to estimate the Power, Reagents, and Labour requirements. Maintenance was factored from the Overall plant CAPEX. Separate OPEX build-ups were generated for Phase 1 and Phase 2 of the Secondary Treatment Plant Operations. The primary cost driver for the STP OPEX is the Artificial Graphite, which is blended with the Anode to produce a blended product. The Artificial Graphite makes up 76% of the Consumables cost, and 42% of the overall STP OPEX in Phase 2.

Table 22-9 summarizes the annual STP operating costs for Phase 1 and Table 22-10 summarizes the annual costs for Phase 2.

Table 22-9: STP Phase 1 Costs

Operating Costs	Phase 1 Annual OPEX ($M)	$/dmt Processed	%
Labour	12.2	456.1	15.5
Power	18.5	691.5	23.5
Consumables	44.1	1645.0	55.9
Maintenance	4.1	150.2	5.1
Total	78.8	2942.8	100

Table 22-10: STP Phase 2 Costs

Operating Costs	Phase 2 Annual OPEX ($M)	$/dmt Processed	%
Labour	15.1	282.4	10.2
Power	41.4	772.0	27.8
Consumables	83.9	1566.6	56.4
Maintenance	8.4	157.3	5.7
Total	148.8	2778.3	100

23 ECONOMIC ANALYSIS

An engineering economic model was developed to estimate annual cash flows and sensitivities of the Project. Pre-tax estimates of Project values were prepared for comparative purposes, while after-tax estimates were developed and are likely to approximate the true investment value. It must be noted, however, that tax estimates involve many complex variables that can only be accurately calculated during operations and, as such, the after-tax results are only approximations.

Univariate sensitivity analyses were performed for variations in metal prices, head grades, operating costs, capital costs, and discount rates to determine their relative importance as Project value drivers.

This technical report contains forward-looking information regarding projected mine production rates, construction schedules and forecasts of resulting cash flows as part of this study. The mill head grades are based on sufficient sampling that is reasonably expected to be representative of the realized grades from actual mining operations. Factors such as the ability to obtain permits to construct and operate a mine, or to obtain major equipment or skilled labour on a timely basis, to achieve the assumed mine production rates at the assumed grades, may cause actual results to differ materially from those presented in this economic analysis.

The estimates of capital and operating costs have been developed specifically for this Project and are summarized in Section 21 and Section 22 of this report (presented in 2022 dollars). The economic analysis has been run with no inflation (constant dollar basis).

The reader is cautioned that the refined product prices and exchange rates used in this study are only estimates based on recent historical performance and there is absolutely no guarantee that they will be realized if the Project is taken into production. The price of refined graphite products is based on many complex factors and there are no reliable methods of predicting the long-term price.

23.1 Summary of Results

The summary of the mine plan and payable metals produced is outlined in Table 23-1. A summary of total products produced can be found in Table 23-2.

Table 23-1: Life of Mine (LOM) Summary

Parameter	Unit	Value
Alaska Mine		
Mine Life	Years	24
Resource Mined	kt	22,490
Graphite Grade	%	5.6
Processing Rate	t/d	2,800

Parameter	Unit	Value
Concentrate Produced	dmkt	1,191.7
Concentrate Graphite Grade	%	95.0
Secondary Treatment Plant		
Operating Life	Years	26
Concentrate Processed	dmkt	1,353.5
Phase 2 Process Rate	t/a	53,571
Products Produced	kt	1,951

Table 23-2: Final Product Production

Product	Total Production (kt)	%
CPN: Coated Spherical NG	303.3	15.5
BAN: Blended AG/NG	577.8	29.6
SPN: Secondary Particle NG Anode	92.2	4.7
SPC: Secondary Particle Composite Anode	316.8	16.2
3295: + '32 Mesh	4.8	0.2
5095: + '50 Mesh	42.9	2.2
8095: + '80 Mesh	47.7	2.4
195: + '100 Mesh	79.4	4.1
3299: + '32 Mesh Purified	2.6	0.2
5099: + '50 Mesh Purified	26.6	1.4
8099: + '80 Mesh Purified	29.5	1.5
199: + '100 Mesh Purified	49.2	2.5
Carbon Raisers Lubricants	234.0	12.0
Battery Conductor, -320 Mesh	34.9	1.8
Synthetic Diamond RM, -320 Mesh	48.0	2.5
Rejected Coke Product	60.8	3.1
Total	1,950.7	100

Note:
NG = Natural Graphite AG = Artificial or Synthetic Graphite

23.2 Basis of Analysis

The economic analysis was based on the following factors:

- Discount rate of 8%;

- Nominal 2022 dollars;
- Revenues, costs, taxes are calculated for each period in which they occur rather than actual outgoing / incoming payment;
- Results are based on 100% ownership;
- No management fees or financing costs (equity fund-raising was assumed); and
- The model excludes all pre-development and sunk costs up to the start of detailed engineering (i.e., exploration and resource definition costs, engineering fieldwork and studies costs, environmental baseline studies costs, financing costs, etc.).

Table 23-3 outlines the product prices and exchange rate assumptions used in the economic analysis. The development and basis of the product pricing is outlined in Section 19.

The reader is cautioned that the product prices and exchange rates used in this study are only estimates based on recent available information and there is absolutely no guarantee that they will be realized if the Project is taken into production. The product prices are based on many complex factors and there are no reliable long-term predictive tools.

Table 23-3: Product Pricing and Exchange Rates

Product	Sale Price (US$/t)
CPN: Coated Spherical NG	8,030
BAN: Blended AG/NG	10,585
SPN: Secondary Particle NG Anode	8,890
SPC: Secondary Particle Composite Anode	8,890
3295: + ’32 Mesh	1,820
5095: + ’50 Mesh	1,820
8095: + ’80 Mesh	1,515
195: + ’100 Mesh	1,325
3299: + ’32 Mesh Purified	10,230
5099: + ’50 Mesh Purified	7,980
8099: + ’80 Mesh Purified	6,800
199: + ’100 Mesh Purified	5,490
Carbon Raisers Lubricants	1,860
Battery Conductor, -320 Mesh	9,210
Synthetic Diamond RM, -320 Mesh	6,450
Rejected Coke Product	210
Weighted Average	7,301

Note:
NG = Natural Graphite AG = Artificial or Synthetic Graphite

23.3 Assumptions

Mine revenue is derived from the sale of refined graphite products into the international marketplace. No contractual arrangements for production currently exist. Table 23-4 indicates the NSR parameters that were used in the economic analysis.

Table 23-4: NSR Parameters

Parameter	Unit	Value
Graphite Recovery (Mine Site)	%	95
Graphite Products Payable	%	100
Royalties	%	1.0

23.4 Taxes

The Project has been evaluated on an after-tax basis to provide a more indicative, but still approximate, value of the potential Project economics. A tax model was prepared by Mining Tax Planners, an independent tax consultant, and reviewed by JDS and Graphite One personnel. Current tax pools were used in the analysis. The tax model contains the following assumptions:

- Federal Income Tax: 21%;
- Alaska State Income Tax: 9.4%;
- Alaska Mining License Tax: 7.0%;
- Washington Business & Occupation Tax: 0.05%; and
- Advanced Manufacturing Production Tax Credit is available.

Total taxes for the Project amount to $1,600.3M of the Project life.

23.5 Results

The Graphite One Project is economically viable with a post-tax IRR of 22.3% and a net present value using an 8% discount rate (NPV8%) of $1,398 M using the product prices described in Section 23.2. Figure 23-1 and Figure 23-2 shows the projected pre- and post-tax cash flows, and Table 23-5 summarizes the economic results of the Project.

Figure 23-1: Annual Pre-Tax Cash Flow

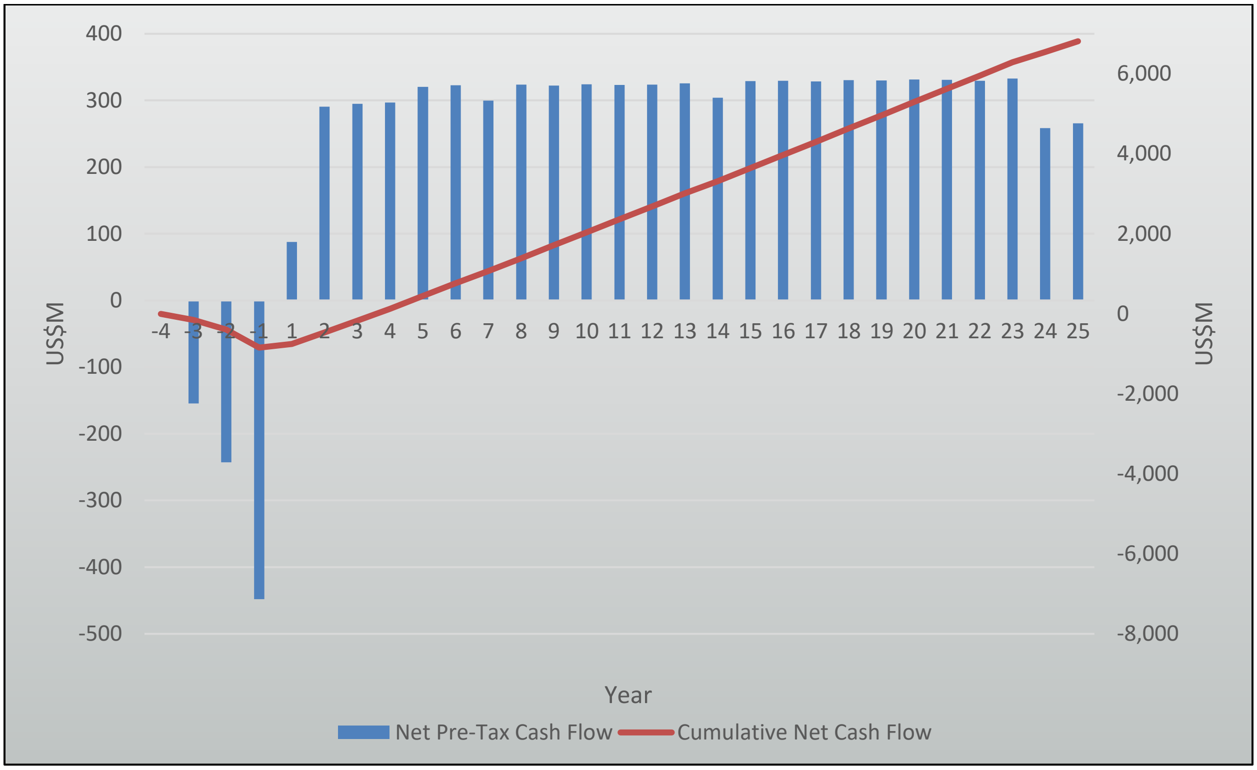


Figure 23-2: Annual Post-Tax Cash Flow

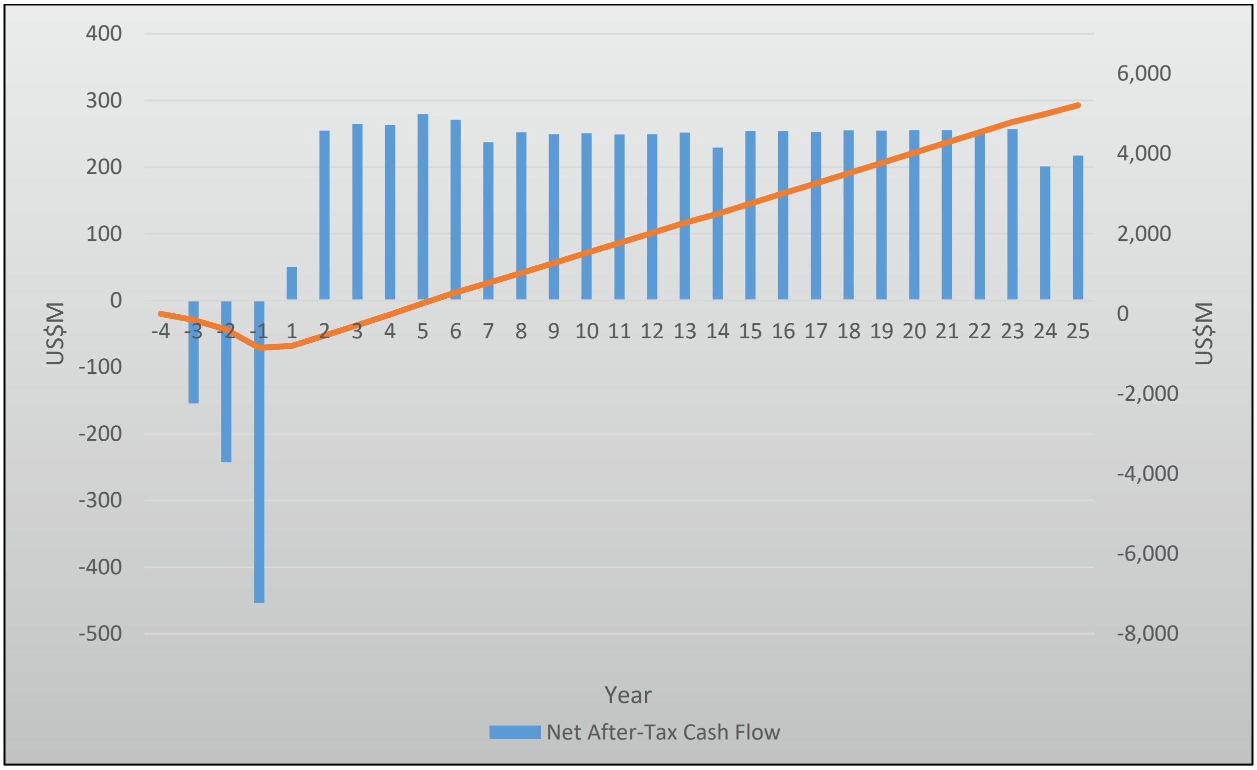


Table 23-5: Summary of Results

Summary of Results	Unit	Value
Capital Costs		
Pre-Production Capital	M$	1,070.4
Pre-Production Contingency	M$	170.1
Total Pre-Production Capital	**M$**	**1,240.5**
Sustaining and Closure Capital	M$	205.3
Sustaining and Closure Contingency	M$	39.1
Total Sustaining and Closure Capital	M$	244.4
Total Capital Costs Incl. Contingency	**M$**	**1,484.9**
Working Capital	M$	18
Pre-Tax Cash Flow	LOM M$	6,812.4
Taxes	LOM M$	1,600.3
After-Tax Cash Flow	LOM M$	5,212.0

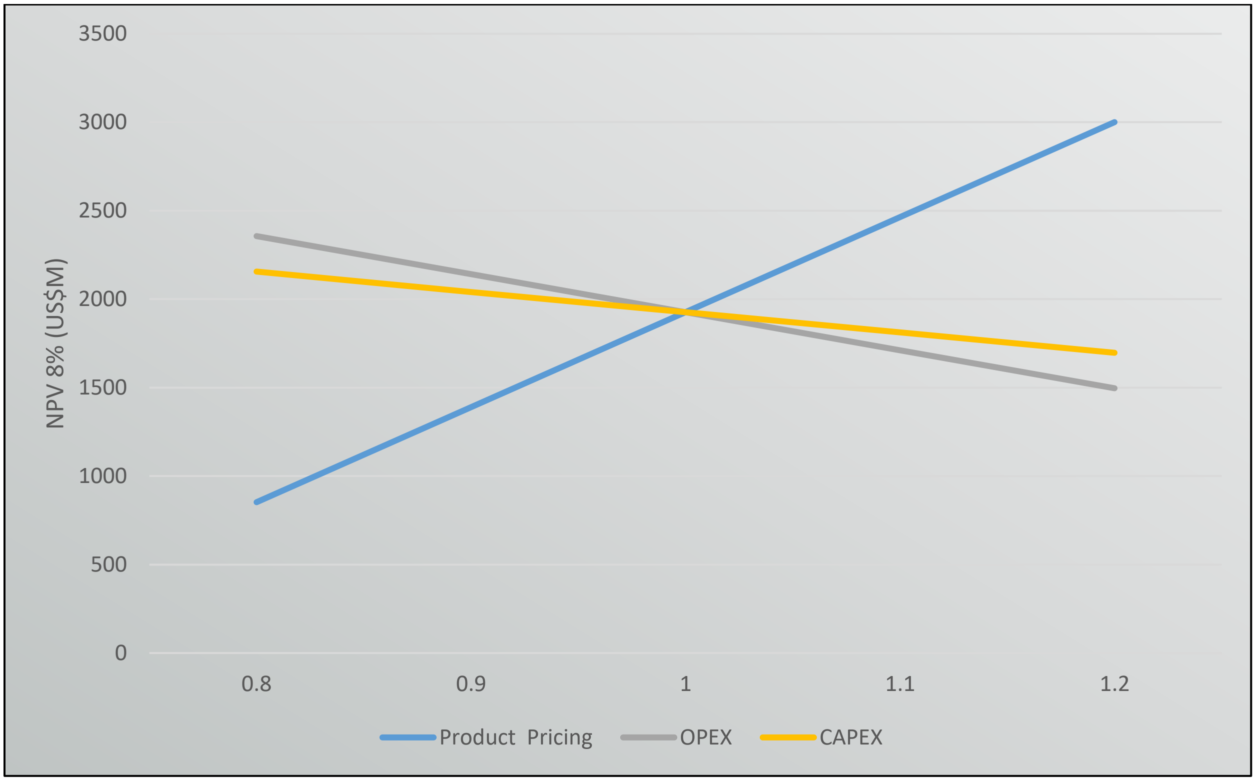
Summary of Results	Unit	Value
Economic Results		
Pre-Tax NPV8%	**M$**	**1,927**
Pre-Tax IRR	**%**	**26**
Pre-Tax Payback	**Years**	**4.6**
After-Tax NPV8%	**M$**	**1,398**
After-Tax IRR	**%**	**22.3**
After-Tax Payback	**Years**	**5.1**

23.6 Sensitivities

A univariate sensitivity analysis was performed to examine which factors most affect the Project economics when acting independently of all other cost and revenue factors. Each variable evaluated was tested using the same percentage range of variation, from -20% to +20%, although some variables may actually experience significantly larger or smaller percentage fluctuations over the LOM. For instance, the product prices were evaluated at a ± 20% range to the base case, while the CAPEX and all other variables remained constant. This may not be truly representative of market scenarios, as metal prices may not fluctuate in a similar trend. The variables examined in this analysis are those commonly considered in similar studies – their selection for examination does not reflect any particular uncertainty.

Notwithstanding the above noted limitations to the sensitivity analysis, which are common to studies of this sort, the analysis revealed that the Project is most sensitive to metal prices and head grade. The Project showed the least sensitivity to capital costs. Figure 23-3 show the results of the sensitivity tests.

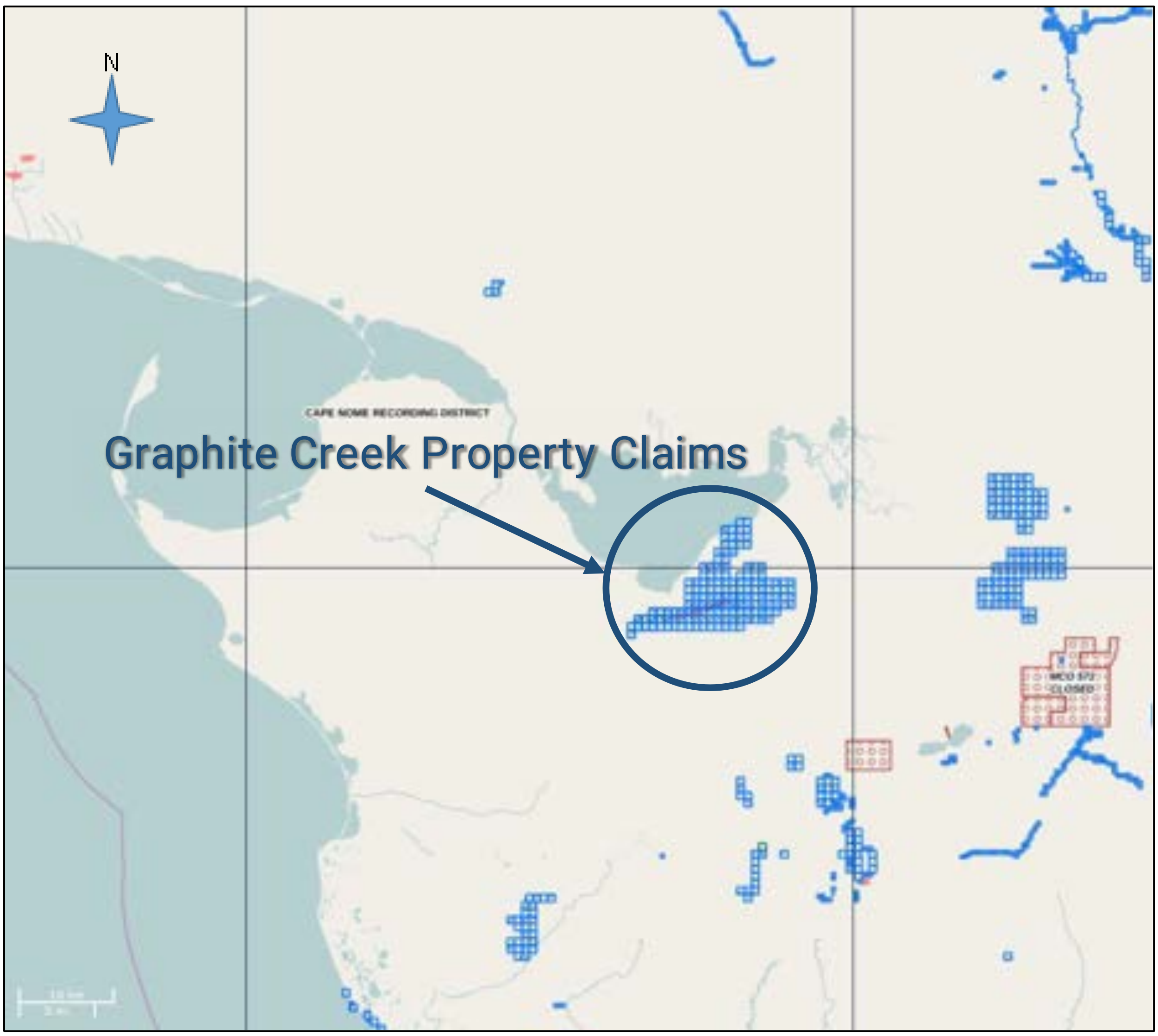
Figure 23-3: Project Sensitivities



24 ADJACENT PROPERTIES

The Property location map appearing in Figure 24-1 shows the current mineral claims in the Graphite One Project Property. The nearest claims of other projects relative to the Property are some 20 km or more to the east-southeast with other claims further distant. These claims are focused on commodities other than graphite, primarily gold and gold placer deposits. The Property is the only graphite specific exploration property and/or exploration company that is currently exploring in the region.

Figure 24-1: Graphite One Project Property Claims Relative to Other Mineral Claims[14]



Source: AES (2022)

[14] Alaska Mining Claims Mapper – Alaska Department of Natural Resources 11/2016 (http://akmining.info/).

25 OTHER RELEVANT DATA AND INFORMATION

The QPs are not aware of any additional information or further explanation not disclosed in this technical report that is necessary to make the technical report understandable and not misleading.

26 INTERPRETATIONS AND CONCLUSIONS

26.1 Interpretations

The work performed for the PFS shows that the n=mineralogical data is sufficient to declare a resource for the Graphite One Project. The engineering work demonstrates that a reserve can be declared and that the Project should be advanced to a Feasibility Study with further field investigations and engineering. No fatal flaws were identified by the QPs during the course of this work.

26.2 Risks

26.2.1 General Risks

There are a number of generic risks that are applicable to most, if not all, mining projects. The main generic risks are shown in Table 26-1. Project-specific risks are discussed individually int the following sections.

Table 26-1: Generic Main Project Risks

Risk	Explanation/Potential Impact	Possible Risk Mitigation
Resource Modelling	All mineral resource estimates carry some risk and are one of the most common issues with project success.	Infill drilling may be recommended in order to provide a greater level of confidence in the resource.
Metallurgical Recoveries	Negative changes to metallurgical assumptions could lead to reduced metal recovery, increased processing costs, and/or changes to the processing circuit design. If LOM metal recovery is lower than assumed, the project economics would be negatively impacted.	Additional sampling and testwork is needed at the next level of study.
CAPEX and OPEX	The ability to achieve the estimated CAPEX and OPEX costs are important elements of project success. OPEX costs are primarily driven by a few high value items, and variation of these factors could have a significant impact on operating income.	Further cost estimation accuracy with the next level of study, as well as the active investigation of potential cost-reduction measures would assist in the support of reasonable cost estimates.
Permit Acquisition	The ability to secure all of the permits to build and operate the project is of paramount importance. Failure to secure the necessary permits could stop or delay the project.	The development of close relationships with the local communities and government along with a thorough Environmental and Social Impact Assessment and a project design that gives appropriate consideration to the environment and local people is required. Maintain direct control with a clear solution.
Development Schedule	The project development could be delayed for a number of reasons and could impact project economics. A change in schedule would alter the project economics.	If an aggressive schedule is to be followed, PFS or FS field work should begin as soon as possible.
Ability to Attract Experienced Professionals	The ability to attract and retain competent, experienced professionals is a key success factor for the project, especially in consideration of the remote location. High turnover or the lack of appropriate technical and management staff at the project could result in difficulties meeting project goals.	The early search for professionals as well as competitive salaries and benefits identify, attract and retain critical people.
Pit Slope Stability	Worse than anticipated ground conditions and/or existence of previously unidentified major geologic structure(s) resulting in reduced slope angles and sub-optimal project economics.	Additional geotechnical core drilling and development of a 3D geologic structural model.

26.2.2 Water and Waste Management

- No geotechnical information was available in the areas of the waste and water management facilities at the time of developing the PFS design. This may impact the assumptions considered for foundation preparations, facility design and configurations, and facility locations;
- The WMF buttress and the WMP embankments will be constructed using non-PAG construction materials. No borrow sources have been identified as part of the PFS design for construction of the site infrastructure;
- Baseline studies (climate and hydrology, hydrogeology, permafrost, vegetation and wildlife) are preliminary as they began in 2019 and are intended to be developed over the coming years. These studies may influence the design of the mine waste and water management facilities as they progress;
- The PFS water balance model was completed using preliminary data to evaluate whether the site was in a deficit or surplus condition, and to provide initial WMP size estimates. Quantities of water requiring management may be under or overestimated;
- The tailings and waste rock management strategy were developed based on the currently understood geochemistry of the material; the material is anticipated to be PAG;
- The physical properties of the tailings are based on the laboratory testing of one sample;
- A detailed seismic hazard assessment for the site has not been completed;
- Freezing temperatures could impede placement of comingled filtered tailings and waste to the WMF; and
- Graphite Creek runs through the middle of the pit. If the execution of re-routing the creek is delayed or extended over a long period of time, it could impact the mine plan resulting in increased mining costs or inhibit the ability of the mine to supply sufficient ore to the mill. The is mitigated by building up a stockpile of graphite concentrate early in the project life.

26.2.3 Construction Materials

A significant amount of construction rock and aggregate is required to support construction due to the ground conditions. A suitable source of NPAG material is required to support construction. If a suitable local source is not found, this could significantly increase project costs.

This could be mitigated by use of NPAG waste rock from the open pit, if PAG/NPAG delineation is possible. Optimization of facilities design to reduce the amount of NPAG required is also possible. Testing and quantification of materials from areas identified as potential quarry locations must be undertaken as a priority.

26.2.4 Secondary Treatment

There is risk specific to the plan to feed the STP with OMG purchased on the open market during the first four years of operations, including the following:

- There is no purchase agreement or arrangement in place for the purchase of OMG. As such, the availability and price can only be projected at this time;
- The STP will be designed to match the characteristics that have been defined and tested in GCG. Although the Company intends to match the characteristics of the GCG with OMG as closely as possible, an exact match will not be possible. Processing the OMG may result in a reduction of processing equipment performance, possible design modifications and retrofit(s), and reduced revenue for the period of OMG supply; and
- Multiple sources of OMG from multiple suppliers may be required, exacerbating these concerns with an inconsistent feed to the STP.

STP's advanced processing technologies: In April 2022, the Company announced its MOU with Sunrise (Guizhou) New Energy Material Co., Ltd. (Sunrise). The intent is for the parties to develop an agreement to share expertise and technology for the design, construction, and operation of the STP. There is no guarantee that the agreement will be finalized. The MOU's term was recently extended and Sunrise is in the process of preparing anode materials for sample purposes from Graphite Creek concentrate produced from graphite recovered during exploration.

The STP's site has not been finalized. The Company, working with the Washington State Department of Commerce, identified several potential locations and cost and logistics assumptions used within the study are based on a potential site for the STP in Washington State, but this is yet to be secured. Failure to secure an appropriate site could impact project plans and economics. For the purposes of the PFS, a location in Lewis County was assumed. Site selection must be finalized as soon as possible.

26.2.5 Logistics

The project is very isolated, with road access to a small community that is serviced by barging on a seasonal basis. The limited annual shipping window means that large quantities of supplies must be brought to the mine and stored over the winter. As the concentrate must be barged out, it also means that concentrate will require storage both in Alaska and Washington. Storage will in AK will be in seacans and in covered facilities in WA. Any disruption to the shipping schedule could impact supply to WA and create logistical challenges at either site. A well-defined logistics plan to be developed in conjunction with shipping experts to ensure smooth transportation and storage planning.

26.2.6 Water Treatment

Source term water quality predictions have a high degree of uncertainty related to the limited surface and groundwater quality monitoring dataset. In particular, only one groundwater sample is available that is representative of pit inflow water quality. Since the pit inflow is estimated to be the highest flow that will have to be managed during operations (KP 2022b, pers. comm.), the model is sensitive to the source term input for this flow.

26.3 Opportunities

There are several opportunities that should be investigated in the next phase of engineering for the Project.

26.3.1 Mine Operations

The mine operates at a fairly low production rate and uses small equipment. There may be benefits to using larger equipment in combination with a different shift schedule or seasonal operations for the mine in order to reduce costs.

26.3.2 Geotechnical Considerations

While pit slope uncertainty is identified as a risk, it must also be considered as an opportunity – should actual ground conditions be found to be better than currently modelled, steeper slopes could be employed, improving project economics.

26.3.3 Delineation and Use of Mine Rock

Delineation of PAG/NPAG rock in mine waste could reduce the required storage capacity in the Waste rock storage facility and provide additional construction materials, reducing CAPEX and simplifying construction logistics.

26.3.4 Waste Rock Storage Facility Design

It may be possible to refine the existing design of the Waste Rock Storage Facility to reduce the amount of construction materials required, reducing CAPEX.

26.4 Conclusions

It is the conclusion of JDS that the vertically integrated business model for manufacturing and selling finished graphite products with 100% USA-based facilities is viable based on the data and analysis work that has been done and reported in this document, specifically:

- Additional diamond drilling was successful in upgrading the resources;
- Overall good rock mass conditions are anticipated for most of the pit with the west wall controlled by foliation joints, although the east wall is anticipated to be comprised of deep, soil overburden of unknown geotechnical characteristics;
- Metallurgical testwork indicates that the natural graphite located on the Graphite Creek Property is suitable to make a high-grade concentrate for shipment to the STP;
- The deposit is able to generate graphite ore in the quantities required to feed the primary processing plant and STP;

- A plan for disposal of all waste products is viable, despite the waste products being primarily comprised of PAG rock and tailings;
- Though a location for the STP has not been finalized, there appear to be several similar and suitable options in Washington State;
- The market projections support a positive economic outcome for the business model; and
- There do not appear to be any insurmountable obstacles to permitting the project, either in Alaska or Washington State.

The QPs did not find any fatal flaws in this evaluation. As such, Graphite One should continue to advance the project with a Feasibility Study to refine the current model and advance all permits for eventual construction and operations.

27 RECOMMENDATIONS

27.1 Water and Waste Management

Knight Piésold makes the following recommendations:

- Complete geotechnical investigations and geotechnical characterizations to support the design assumptions of the waste and water management facilities and associated site infrastructure;

- Optimize the WMF and associated buttress design based on geotechnical characterization of the site;

- Additional investigations to identify borrow sources for construction materials. This includes an evaluation of geotechnical and geochemical properties of the borrow site;

- Continue to advance baseline studies and incorporate results of baseline studies into future mine waste and water management facility designs. This includes an evaluation and characterization of the permafrost conditions at site. Permafrost conditions may govern the design and location of the WMF;

- A more detailed water balance model should be developed using GoldSim™ software. The model should be completed using variable climate conditions and conducted for a monthly timestep and include the updated groundwater inflow estimates to the pit. The updated water balance will be run through closure and post closure to assist with operational and closure/post closure water treatment requirements. This to be completed once additional site baseline information has been collected;

- Additional geochemistry testing and studies to confirm the metal leaching and acid generating potential of the materials that will be stored and/or used for construction;

- Complete additional lab testing on the tailings materials to confirm the results from the testwork completed in 2021. This may include additional testing to confirm the feasibility of filtration;

- Complete a site-specific Seismic Hazard Assessment. This information will inform future stability analyses; and

- Assess potential WMF design and operating modifications, including the tailings storage requirements at the mill, to manage temporary non-conforming tailings and waste rock materials.

27.2 Groundwater Quality Predictions

SRK makes the following recommendations:

- Collect additional groundwater samples and use of the results to evaluate if the current groundwater source term concentrations are valid;
- Collect additional surface water samples and use of the results to evaluate if the overburden source term is valid;
- Ongoing testing of HCTs to evaluate long-term release rates is required; and
- Periodic updates to source terms should be made as appropriate, as additional geochemistry, surface and groundwater quality monitoring data becomes available.

27.3 Water Treatment

The following needs to be evaluated in future studies to advance the understanding of water treatment for the Graphite One Project:

- Limnological and ecological characterization of Imuruk Basin;
- Water quality regulations for Imuruk Basin that affect the discharge of treated water; and
- Removal of antimony and arsenic by coprecipitation with iron concentrations in the influent to the water treatment plant.

27.4 Primary Processing

The following actions are recommended to refine the metallurgy for primary processing:

- Samples from mining areas of the current mine production schedule should be taken representing the mining sequence in increments less than one year for comminution and flotation tests to map the Geometallurgical characteristics of the deposit for a minimum of the first seven operating years;
- Where possible, regrind tests of representative samples should be conducted to establish power requirements with increased certainty for equipment sizing; and
- Concentrate and tailings dewatering tests on representative samples of should be carried out to optimize products dewatering engineering and design.

27.5 Secondary Treatment Plant

Following a review of the market demand and the STP plan, the following is recommended:

- Work to develop the STP in parallel with the development of the Graphite Creek Mine be accelerated including computer simulations of the process, continued process development work with associated consultants and institutions, and process engineering design;
- Move forward with a MOU or similar commitment for STP site location in Washington;
- Finalize electrical power supply;
- Procure the supply of purchased graphite and precursor materials; and
- Continue work on qualifying anode products.

27.6 Mine Geotechnical

Geotechnical drilling, logging and downhole televiewing of three additional holes are recommended to support a Feasibility Study.

27.7 Other/Mine

A trade-off study to assess optimum mining fleet and personnel shift schedule should be prepared for the mine.

27.8 Feasibility Study

It is recommended that Graphite One proceed to the feasibility study stage in line with its desire to advance the Project to the construction and operation of a vertically integrated 100% US based graphite manufacturing company. It is also recommended that environmental and permitting continue as needed to support the Project's development plans.

The FS and supporting field work are estimated to cost approximately $20.8M. Options for a bulk sample and product test program are estimated at $11M to $21M. A breakdown of the key components of the next study phase is as follows in Table 27-1.

Table 27-1: Estimated Feasibility Study Cost (US $M)

Area	Description	US $M
Mine	Mine Engineering	0.25
	Mine Geotechnical engineering	0.10
	Infrastructure	0.15
	Project Support & Report Editing	0.02
	Waste and Water Management	0.85
	Geotechnical & Hydrogeological Drilling Support	0.16
	Metallurgy & Processing	0.40
	Road and Site Infrastructure	1.40
	Geochemistry and Geochem testing	0.14
	Environmental and Permitting	2.00
	Metallurgical Testwork	0.30
	Mine Geotechnical Logging Lab Testing & Televiewer	0.20
	Drilling: Probable to Proven	10.00
	Stakeholder engagement	0.10
	Subtotal	**16.06**
STP	STP Detailed Engineering (Process, Buildings, etc.)	1.00
	STP Power Study	0.10
	Site Assessment (geotech, etc.)	0.50
	Logistics Study (materials handling, transportation)	0.10
	Environmental & Permitting	1.00
	Stakeholder Engagement & Workforce Study	0.15
	Market Report	0.15
	Product Development	1.00
	Subtotal	**4.00**
Project	Project Management	0.50
	Drafting	0.04
	Cost Compilation	0.15
	Economic Model	0.04
	Subtotal	**0.73**
Total, Feasibility Study		**20.79**
Test Program Options		
Material Preparation	Option 1: Bulk sample with toll processing	$10M to $20M
	Option 2: Bulk sample with onsite pilot plant	
Product Development	Product Preparation & Testing	$1M
Total		**$11M to $21M**

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29 UNITS OF MEASURE, ABBREVIATIONS AND ACRONYMS

Symbol / Abbreviation	Description
'	minute (plane angle)
"	second (plane angle) or inches
°	degree
°C	degrees Celsius
3D	three-dimensions
A	ampere
a	annum (year)
ac	acre
Acfm	actual cubic feet per minute
Ag	silver
amsl	above mean sea level
AN	ammonium nitrate
ARD	acid rock drainage
Au	gold
AWR	all-weather road
B	billion
BD	bulk density
Bt	billion tonnes
BTU	British thermal unit
BV/h	bed volumes per hour
bWi	bond work index
bya	billion years ago
C$	dollar (Canadian)
Ca	calcium
cfm	cubic feet per minute
CHP	combined heat and power plant
CIM	Canadian institute of mining and metallurgy
cm	centimetre
cm^2	square centimetre
cm^3	cubic centimetre
cP	centipoise
Cr	chromium
Cu	copper
d	day

Symbol / Abbreviation	Description
d/a	days per year (annum)
d/wk	days per week
dB	decibel
dBa	decibel adjusted
DGPS	differential global positioning system
DMS	dense media separation
dmt	dry metric ton
DSTMF	dry stack tailings management facility
DWT	dead weight tonnes
EA	environmental assessment
EIS	environmental impact statement
ELC	ecological land classification
Fe	iron
FEL	front-end loader
ft	foot
ft^2	square foot
ft^3	cubic foot
ft^3/s	cubic feet per second
g	gram
G&A	general and administrative
g/cm^3	grams per cubic metre
g/L	grams per litre
g/t	grams per tonne
Ga	billion years
gal	gallon (us)
GJ	gigajoule
GPa	gigapascal
gpm	gallons per minute (us)
GW	gigawatt
h	hour
h/a	hours per year
h/d	hours per day
h/wk	hours per week
ha	hectare (10,000 m^2)
HG	high grade
HLEM	horizontal loop electro-magnetic
hp	horsepower
HPGR	high-pressure grinding rolls
HQ	drill core diameter of 63.5 mm

Symbol / Abbreviation	Description
Hz	hertz
ICP-MS	inductively coupled plasma mass spectrometry
in	inch
in^2	square inch
in^3	cubic inch
IRR	internal rate of return
JDS	JDS Energy & Mining Inc.
K	hydraulic conductivity
k	kilo (thousand)
kg	kilogram
kg	kilogram
kg/h	kilograms per hour
kg/m^2	kilograms per square metre
kg/m^3	kilograms per cubic metre
km	kilometre
km/h	kilometres per hour
km^2	square kilometre
kPa	kilopascal
kt	kilotonne
kV	kilovolt
kVA	kilovolt-ampere
kW	kilowatt
kWh	kilowatt hour
kWh/a	kilowatt hours per year
kWh/t	kilowatt hours per tonne
L	litre
L/min	litres per minute
L/s	litres per second
LG	low grade
LOM	life of mine
m	metre
M	million
m/min	metres per minute
m/s	metres per second
m^2	square metre
m^3	cubic metre
m^3/h	cubic metres per hour
m^3/s	cubic metres per second
Ma	million years

Symbol / Abbreviation	Description
MAAT	mean annual air temperature
MAE	mean annual evaporation
MAGT	mean annual ground temperature
mamsl	metres above mean sea level
MAP	mean annual precipitation
masl	metres above mean sea level
Mb/s	megabytes per second
mbgs	metres below ground surface
Mbm^3	million bank cubic metres
Mbm^3/a	million bank cubic metres per annum
mbs	metres below surface
mbsl	metres below sea level
mg	milligram
mg/L	milligrams per litre
min	minute (time)
mL	millilitre
mm	millimetre
Mm^3	million cubic metres
MMER	metal mining effluent regulations
mo	month
MPa	megapascal
Mt	million metric tonnes
MVA	megavolt-ampere
MW	megawatt
NAD	North American datum
NG	normal grade
Ni	nickel
NI 43-101	National Instrument 43-101
Nm^3/h	normal cubic metres per hour
NQ	drill core diameter of 47.6 mm
OP	open pit
OSA	overall slope angles
oz	troy ounce
P.Geo.	professional geoscientist
Pa	Pascal
PAG	potentially acid generating
PEA	preliminary economic assessment
PFS	preliminary feasibility study
PGE	platinum group elements

Symbol / Abbreviation	Description
PMF	probable maximum flood
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
QA/QC	quality assurance/quality control
QP	qualified person
RC	reverse circulation
RMR	rock mass rating
ROM	run of mine
rpm	revolutions per minute
RQD	rock quality designation
s	second (time)
S.G.	specific gravity
Scfm	standard cubic feet per minute
SFD	size frequency distribution
SG	specific gravity
t	tonne (1,000 kg) (metric ton)
t	metric tonne
t/a	tonnes per year
t/d	tonnes per day
t/h	tonnes per hour
TCR	total core recovery
TFFE	target for further exploration
TMF	tailings management facility
tph	tonnes per hour
ts/hm^3	tonnes seconds per hour metre cubed
US	united states
US$	dollar (American)
UTM	universal transverse mercator
V	volt
VEC	valued ecosystem components
VSEC	valued socio-economic components
w/w	weight/weight
wk	week
wmt	wet metric ton
WRSF	waste rock storage facility
µm	microns
µm	micrometre

Scientific Notation	Number Equivalent
1.0E+00	1
1.0E+01	10
1.0E+02	100
1.0E+03	1,000
1.0E+04	10,000
1.0E+05	100,000
1.0E+06	1,000,000
1.0E+07	10,000,000
1.0E+09	1,000,000,000
1.0E+10	10,000,000,000