EAGLE GOLD PROJECT

DUST CONTROL PLAN

Version 2017-02

JULY 2017

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DOCUMENT CONTROL

Submission History

Version Number	Version Date	Document Description and Revisions Made
2013-01	Sep 2013	Original submission to the Department of Energy, Mines and Resources in support of an application for a Quartz Mining Licence allowing for preliminary construction activities and submitted to the Yukon Water Board in support of the application to amend Type B Water Use License QZ11-013. The amendment application considered the use of water and deposit of waste associated with preliminary construction activities and included the construction and operation of the Dublin Gulch Diversion Channel. Version 2013-01 was re-submitted in support of an application to the Yukon Water Board and the Department of Energy, Mines and Resources for a Type A Water Use and a Quartz Mining Licence for the full Construction, Operation and Closure of the Project
2017-01	Mar 2017	Revisions made to address comments received during the adequacy review of the application to the Yukon Water Board for a Type A Water Use Licence and to address the conditions of the Quartz Mining Licence QML-0011. Version 2017-01 was submitted to the Department of Energy, Mines and Resources and the Yukon Water Board to satisfy SGC's annual reporting requirements.
2017-02	Jul 2017	Revisions made to reflect the current site general arrangement and submitted as part of a consolidated application for *Environment Act* permits.

Version 2017-02 of the Dust Control Plan (the Plan) for the Project has been revised in July 2017 to update Version 2017-01 submitted in March 2017. The table below is intended to identify modifications to the Plan and provide the rationale for such modifications

Version 2017-02 Revisions

Section	Revision/Rationale
Section 2.3.3 Ore Handling and Processing	▪ Updated ore handling and processing details for consistency with optimized general arrangement and mine plan. ▪ Removal of installation of additional sprinklers as this mitigation has been considered during the development of optimized facility designs.
Section 2.5 Contingency Measures	▪ Removal of contingency measures including: reduction of drop heights from conveyors; and installation of additional sprinklers as these measures have been considered during the development of optimized facility designs.
Appendix A Dust Control Design Criteria	▪ Updated design criteria for consistency with optimized general arrangement and mine plan.

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1 INTRODUCTION

1.1 PROJECT SUMMARY

StrataGold Corporation (SGC), a directly held wholly owned subsidiary of Victoria Gold Corp. has proposed to construct, operate, close and reclaim a gold mine in central Yukon. The Eagle Gold Project ('the' Project) is located 85 km from Mayo, Yukon using existing highway and access roads. The Project will involve open pit mining and gold extraction using a three stage crushing process, heap leaching, and a carbon adsorption, desorption, and recovery system over the mine life.

1.2 SCOPE AND OBJECTIVES

The objective of this Dust Control Plan is to describe the best management practices and mitigation measures that will be employed to minimize dust emissions from the Project. The scope of the plan includes dust control methods, ambient air quality monitoring procedures, and a description of existing meteorological conditions that may influence dust emissions and deposition.

This Dust Control Plan was informed by the guidelines provided by Government of Yukon's Department of Energy, Mines and Resources and the Yukon Water Board in the Plan Requirement Guidance for Quartz Mining Projects (August 2013), the Yukon Government Dust Management Plan Guidelines, the Terms and Conditions of Recommendation, Proponent Commitments and Proponent Mitigations specified in the Final Screening Report and Recommendation (Yukon Environmental and Socio-economic Assessment Board Project Assessment 2010-0267), and the regulatory approvals issued for the Project.

2 DUST CONTROL METHODS

The following sections provide a description of best management practices used throughout all Project phases and methods to control dust during construction and operations.

2.1 BEST MANAGEMENT PRACTICES

The following are Best Management Practices that will be implemented during all phases of the Project:

- Minimization of land clearing activities to the extent possible (e.g. do not disturb land beyond facility or road boundaries or areas required for construction).
- Construction of haul roads with low silt content material.
- Low speed limits for all mobile mine equipment.
- Trucks to maintain more than 15 seconds separation when possible to reduce respirable dust exposure to following truck.
- Site roads to be watered within 12 hours of previous wettings (e.g. rain or via water truck) on hot dry days and within 48 hours on cool humid days or as necessary.
- Orientation of material stockpiles so that the length is parallel with prevailing winds where possible.
- Establishment of waste rock storage area final surfaces early to enable re-vegetation.
- Delay blasting if conditions are unfavourable.
- Visual inspections to identify and address potential dust emissions.
- Timely response to dust complaints by adjacent land users.
- Record of dust suppression activities.

2.2 CONSTRUCTION PHASE

The primary sources of dust generated during the construction phase will be:

- Clearing and grubbing.
- Salvaging and stockpiling of overburden.
- Development of quarry and borrow areas.
- Traffic on existing and newly constructed site roads.

Project design includes the reduction of overall site road length to shorten haul distances to decrease maintenance and operations cost for the mine fleet. In turn, optimized road length will result in reduced dust emissions compared to roads of greater length. Similarly, cleared land will be minimized to the extent possible to reduce cost of material handling which will result in decreased vegetation and soil disturbance. Dust control options during mining, loading and dumping of topsoil and overburden are generally limited to dust suppression watering however; the construction plan includes the start of land clearing activities to occur as early in the spring as possible when soil moisture is optimal after break up.

Water will be used as a dust suppressant using a tank truck with spray bars for cleared surfaces, overburden stockpiles, borrow sites, and site roads as required during dry conditions. The water truck will be used as required to suppress visible dust emissions. The water truck capacity will be approximately 5,000 gallons (18,927 liters). The total estimated water use for dust suppression for site roads and cleared areas will be up to approximately 40 truckloads of water (200,000 gallons) per day during dry conditions. It is assumed that dust suppression will be required for up to approximately 20 days/month from June to September. During construction, the source of water for dust suppression will be an existing groundwater well located on the Dublin Gulch alluvial fan adjacent to Haggart Creek. This well was installed by previous land users to provide potable and drilling water for a mineral exploration camp at Dublin Gulch.

Chemical dust suppressants such as polymers or surfactants may be considered if raw water alone is not effective for dust control. Surfactant additives increase the ability of water to wet and suppress dust by reducing surface tension of water, which causes water to spread in smaller droplets. Water is better absorbed into the cleared area of roadbed rather than runoff or evaporation from road surfaces. Polymer additives function to seal surfaces so that fine particulate matter is not readily mobilized. SGC will notify Yukon Government if any chemical dust suppressant additives are considered prior to use.

Overburden stockpiles, borrow areas, and large cleared areas will be wetted as necessary to control dust by a water truck with spray bar. In the event the water truck application rate is not sufficient to control dust, additional measures such as construction of additional wind breaks or stationary misters will be considered.

2.3 OPERATIONS PHASE

The primary sources of dust generated during the operations phase of the Project will be:

- Open-pit mining including blasting, excavation, and ore/waste hauling and handling.
- Mining equipment, haul truck and other vehicle traffic.
- Ore processing including crushing, hauling, and conveying.

2.3.1 Blasting

Blasting is usually a relatively minor contributor to total dust emissions. The options for controlling dust from blasting are somewhat limited however Project planning includes delaying blasting under unfavourable wind and atmospheric conditions when possible to reduce dust.

Dust generated when processing mined materials, primarily occurs as a result of the mechanical handling of ore. At the crushing plants, the rock mined from the open pit undergoes particle size reduction to allow for the eventual extraction of gold through the heap leaching process.

2.3.2 Traffic

Water will be used as a dust suppressant using a tank truck with spray bars for cleared surfaces, stockpiles and site roads as required during dry conditions. The water truck capacity will be approximately 5,000 gallons (18,927 liters). The total estimated water use for dust suppression for site roads and cleared areas will be approximately 40 truckloads of water (200,000 gallons) per day during dry conditions. It is assumed that water will only be applied for dust suppression for approximately 20 days/month from June to September. During operations, the primary sources of water for dust suppression will be the Lower Dublin South Pond and an existing well adjacent to Haggart Creek.

Active site roads will be watered unless meteorological conditions (e.g., rain, frozen surfaces, etc.) are adequate to suppress dust to a degree that is equivalent to 3-hour periodic watering. Inactive roads will be watered if there is evidence of wind driven dust.

2.3.3 Ore Handling and Processing

The following is a description of the ore processing method and systems that includes a summary of dust control methods. Dust control design criteria is appended as Appendix A.

After blasting, ore from the open pit will be delivered by haul truck to the primary crusher, located north of the open pit. During regular operations, ore will be transported overland by covered conveyor from the primary crusher to the crushing and screening plants. During winter months the primary crushed ore will be conveyed to the 100 d ore storage pad. Once climatic conditions return to operational criteria for heap leach pad stacking the ore stockpiled on the 90 d storage pad will be fed back into the crushing system at the secondary/tertiary crushing plant. The crushing system will produce an average particle size P80 6.5 mm for delivery to the heap leach pad.

Crushed ore will be transported by covered conveyor to the heap leach pad for stacking. Belt agglomeration will occur using lime and cement before it is stacked on the heap leach pad. The cement and lime are added to the ore on the conveyor feeding the heap leach pad. Ore will be stacked on a composite liner system in 10 m lifts using a stacking conveyor system.

Primary Crushing and Conveying

During regular operations, run-of-mine (ROM) ore will be delivered by haul trucks from the open pit to the primary gyratory crusher, located to the north of the open pit. ROM ore will be direct-dumped into the primary crusher dump hopper situated above the gyratory crusher, and will be discharged to the crusher with an open side setting of 152 mm. The primary crushed ore will be collected in the discharge pocket below the primary crusher. A belt feeder will regulate the discharge rate of the primary crushed ore. This crushed product will be conveyed to a stockpiles diverter chute which will convey to the coarse ore stockpile or the 90 day storage pad. The conveyors will be fitted with covers along their entire length to prevent additional moisture addition to the ore, block wind entrainment of dust and reduce overall dust emissions. The discharge of the primary crusher as well as the feeder discharge will be located inside the crusher building and as such will be shielded from the prevailing winds. All transfer points within the primary crusher building will incorporate dust collection extraction points and the dust will be conveyed to one or more dust collectors.

Secondary/Tertiary Crushing and Conveying

The primary crushing discharge conveyor will deliver the primary crushed ore to the coarse ore stockpile via the stockpiles diverter. The ore is reclaimed from the coarse ore stockpile through two vibrating feeders on to the secondary crushing feed conveyor. The two vibrating feeders will regulate the ore feed rate from the coarse ore stockpile to an inclined double deck vibrating screen (secondary screen) with apertures of 100 and 38 mm, respectively. The two separation decks produce a coarse and a fine product. The coarse product material will discharge to a Metso MP1250 (or equivalent) standard head cone crusher (secondary crusher), with a closed side setting of 35 mm. The undersize material from the secondary screen will be combined with crushed material and conveyed to the tertiary crushing feed bin and will be ready for further processing.

Ore from the tertiary crushing feed bin will be fed, in parallel, to three inclined double deck vibrating screens. The screen oversize material from the three screens will be fed to three Metso MP1250 (or equivalent) short head cone crushers (tertiary crushers). The tertiary crusher discharge will be fed back to the vibratory screens thereby completing the closed circuit. Screen undersize material will be conveyed directly to a series of conveyors and then to the heap leach pad. The tertiary crushers will each have a closed side setting of 14 mm and the vibrating screen apertures are 19 mm and 10 mm for the top and bottom decks, respectively. Various ancillary equipment will include a dust collection system, overhead cranes, weightometers, samplers, and lubrication units for the crushers. The secondary and tertiary crushing and screening devices will be enclosed within industrial buildings to control dust emissions.

Within each crushing section (secondary or tertiary) as ore is transferred from one conveyor to another the ore transfer point will be enclosed by a fabricated steel chute. Likewise, at points of ore loading onto conveyors from screens or crushers there are fabricated carbon steel chutes. These material transfer points (chutes) serve to enclose the ore stream thus confining any fine particulates. By use of an exhaust fan and duct work these hoods are linked to an emissions control device (bag house). The control device will have particulate removal of 95 – 99% efficiency for 10 micron particulate to meet National and Territorial ambient air quality guidelines. The secondary and tertiary crushing building will have two dedicated baghouses for dust control.

Dust Collection

The majority of dust will be generated by the truck unloading, material transfer points, screens, and crushers.

Mitigation for dust emissions from the crushing facility will be as follows:

- Truck Unloading Station
    - Shelter the dumping of ore from the wind by enclosing the truck dump to the maximum extent possible, if dust emissions are found to be a problem
    - Dust extraction with conveyance to and processing in dust collectors
- Material Transfer Points
    - The use of sleeves and proper chute design will prevent air entrainment of the dust.
    - Dust extraction with conveyance to and processing in dust collectors
    - Conveyors will be covered or enclosed in buildings.
- Vibrating screens
    - Screens will be equipped with dust covers
    - Screen feed and screen discharge transfer points will be handled similarly as all material transfer points as described above.

Cement - lime addition and heap stacking

The Heap Leach Facility (HLF) conveyor system will be operated using a conveyor stacking system that will include:

- overland conveyors
- grasshopper-type portable transfer conveyors
- horizontal mobile bridge conveyor mounted on a dozer crawler carriage
- radial stacking conveyor

The HLF feed conveyors will be installed adjacent to the heap leach pad, and then extended as needed around the pad. The grasshopper conveyors will transport the ore from the overland conveyors to the bridge conveyor. The ore will be placed in 10 m lifts using the radial stacker. The leach lifts will be constructed from east to west, retreating up the slope of the pad. As the stacker retreats, the grasshopper conveyors will be removed from the transfer train and relocated in an adjacent area so that the heap will be constructed from the toe upwards in a series of 60 m wide by 500 m long lifts.

As the crushed ore (final product material) is conveyed to the HLF from the final transfer station located immediately east of the HLF embankment, lime and Portland cement will be added to the material on the conveyor at a controlled rate by screw conveyor or rotary valve, together with water to facilitate agglomeration of the heap leach feed material. The agglomeration process will aid in binding small particles to larger particles and thereby assist in reducing dust emissions of small particles.

Dust is most easily entrained in the wind when the material is falling through the air at points of transfer. Therefore, final facility design will consider minimizing the drop heights of material transfer points wherever practical. The use of sleeves and proper chute design incorporating wind barriers will also be used to minimize dust entrainment. Fixed transfer points will be sheltered from the wind by the use of enclosures. All conveyor belts will be covered and incorporate belt cleaners in order to reduce material carry back on the return strand of the conveyor.

Refinery

Smelting will take place in an electric tilting crucible furnace. The furnace will be equipped with hydraulic control of the tilt mechanism for the pouring of the molten gold melt product. The filtered precipitate will be mixed with fluxes, typically a combination of borax, niter and possibly silica sand. A cascading mould system will be included. Off gases from the melting furnace will be extracted with a fan and then discharged into a bag house to remove particulate matter. A dry aspirated dust collection system will control fumes and dust emissions from the smelting furnace. A canopy hood will be located over the furnace and collected fines will be dropped via a rotary air lock into a drum for manual removal as required.

Assay Laboratory

The assay lab will be a will be a prefabricated modular structure located near the ADR facility. This facility will house all necessary laboratory equipment for metallurgical grade testing and control. The lab will be equipped with all appropriate HVAC and chemical disposal equipment as needed. A dry aspirated dust collection system equipped with a single dust collector and exhaust fan with pick up hoods will be located at crushers, pulverizers, and workstations. Collected fines will be discharged via a rotary air lock into a drum that will be manually emptied as required.

2.4 INSPECTIONS AND RECORDS

Dust emissions and mitigation measures will be monitored by regular inspections and corrective actions taken when appropriate. Potential dust sources that will be inspected will include but are not necessarily limited to the following:

- Active land clearing, excavation and site preparation areas
- Borrow material quarries and stockpiles
- Overburden stockpile and construction material screening area(s)
- Open pit
- Eagle pup waste rock storage area
- Platinum gulch waste rock storage area
- Primary crusher
- Crushing and screening plant (including all dump pockets, transfer points, feed bins, etc.)
- Overland conveyor system from Crushing and Screening Plant to HLF
- Heap leach pad (including grasshopper and radial conveyor transfer and drop points)
- Inactive site roads
- Active site roads including haul and secondary site access roads

2.5 CONTINGENCY MEASURES

Contingency measures may be implemented, as the result of a site or area inspection, in a timely manner and will be subject to additional inspection to confirm satisfactory performance. The following contingency measures will be used in the event inspections, monitoring and/or complaints require:

1) Additional dust suppression via more frequent watering of roads and exposed soils
2) Traffic and work reduction in areas where dust is generated
3) Rescheduling of revegetation activities for disturbed areas so that they may be seeded as early as possible
4) Wind barrier (windrow) construction such as crushed rock, soil berms or fences upwind of roads and exposed areas. The following methods will be considered when placing barriers to prevent dust emissions:
    a. Wind barriers are most effective when placed perpendicular to the direction of the prevailing wind, but will have little or no effect when the wind direction is parallel to the barrier.
    b. When choosing wind barriers it has been observed that solid barriers provide significant reductions in wind velocity for relatively short leeward distances, whereas porous barriers provide smaller reductions in velocity for more extended distances.
    c. Wind barriers should be at least 2 metres high.

   d. Screening material with a porosity of 50% is optimum for controlling dust.

5) Reconfiguration or covering of stockpiles. Limit work to the downwind side of stockpiles. Uncovered stockpiles may need re-orientation to offer minimal cross sectional area to prevailing winds.
6) Limit material transfer points
7) Pre-watering of areas prior to earthworks
8) Stoppage of work that generates dust
9) Immediate review of dust control equipment, control measures and overall management plan

Ongoing dust control concerns and corrective actions will be periodically reviewed by the Environmental Manager to determine if additional contingency measures and/or Project design, or operational changes are required.

2.6 RESPONSIBILITIES

The Mine Manager is responsible for the effective implementation of the Dust Control Plan, providing the resources needed for the implementation and continual improvement of the Plan and for participating in annual management review meetings.

Designated construction and operations personnel will conduct daily inspections for their assigned area(s) and will report any significant dust emission events/concerns to their Supervisor and the Environmental Manager.

Production Supervisors and Maintenance Supervisors (or designates) are responsible for addressing high priority corrective/maintenance actions within 24 hours; and for scheduling and following up on lower priority corrective/maintenance actions within one week.

3 AIR QUALITY OBJECTIVES AND MONITORING

The following sections provide a summary of the air quality monitoring objectives and methods that will be used to monitor dust emissions during construction and operations.

It is anticipated that atmospheric Criteria Air Contaminants (CAC) will be emitted during the construction and operations phases of the Project. The primary CACs will result from dust emissions from overburden excavation and handling, most notably clearing, grading, drilling, blasting, loading/unloading, unpaved road traffic and emissions from diesel combustion from heavy vehicles and machinery.

3.1 YUKON AMBIENT AIR QUALITY STANDARDS

Yukon Ambient Air Quality Standards define maximum allowable limits for particulate matter, nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2) and ground level ozone (O_3). These standards are presented in Table 3.1-1.

Table 3.1-1: Yukon Ambient Air Quality Standards[ab]

Parameter	Standard (µg/m3)[c]	Standard (ppm)[d]	Standard (ppbv)[e]
Total Suspended Particulate (TSP)			
24–hour average	120		
Annual geometric mean	60		
Fine Particulate Matter ($PM_{2.5}$)			
24–hour average	28		
Annual mean (calendar year)	10		
Coarse Particulate Matter (PM_{10})			
24-hour average	50		
Nitrogen Dioxide (NO_2)			
1-hour average			213
24–hour average			106
Annual arithmetic mean			32
Carbon Monoxide (CO)			
1-hour average		13	
8-hour average		5	
Sulphur Dioxide (SO_2)			
1-hour average			172
24–hour average			57
Annual arithmetic mean			11

Ground Level Ozone (O_3)			
8-hour running average			63

NOTES:
[a] The following standards are the maximum concentrations of pollutants acceptable in ambient air throughout the Yukon Territory. These standards will be used to determine the acceptability of emissions from proposed and existing developments.
[B] All ambient air quality measurements will be referenced to standard conditions of 25 degrees Celsius and 101.3 kiloPascals.
[C] ug/m^3 = micrograms per cubic meter
[D] ppm = parts per million
[E] ppbv = parts per billion by volume

3.2 AMBIENT AIR QUALITY MONITORING AND THRESHOLDS FOR ADDITIONAL MITIGATION MEASURES

The air quality baseline data collection program is planned to record baseline data prior to construction and operations. A Thermo Scientific Partisol 2025i Sequential Ambient Air Sampler has been installed near the Camp climate station, in an area away from active exploration activities. The unit is capable of sampling TSP over a continuous 24-hour period according to protocols established for the National Air Pollution Surveillance (NAPS) program.

SGC has established ambient air TSP thresholds for monitoring. If the TSP concentrations exceed 100 µg/m^3 24 hour average or 50 µg/m^3 as an annual geometric mean, additional dust control mitigation measures will be implemented and chemical analyses of TSP will be carried out to determine the chemical composition of dust deposition for potential effects to human and ecological health.

3.2.1 Methods

As the Project moves into the construction phase, air quality monitoring will consist of TSP monitoring using the existing Partisol Air Sampling unit near the lower camp climate station. The air quality sampler will sample on a 6-day cycle.

The 2025i Partisol holds a filter supply magazine containing 16 filter cassettes. Filters used include a Pallflex TX40 HI20-WW 47 mm filter specified for TSP and $PM_{2.5}$ and a 37 mm MCE (mixed cellulose ester) filter specified for metals. Each filter will be pre-weighed in triplicate according to procedures in U.S. EPA 2.12 Quality Assurance Handbook, Section 7. The filter weight will be recorded along with the filter cassette number and placed into the cassette. Sixteen cassettes are placed into a magazine and shipped to site to be installed in the Partisol.

During a programmed sampling date, the 2025i maintains a temperature- and pressure-compensated flow of 16.67 L/min (1 m^3/hr) through the filter. Following completion of the programmed sampling event (24 hours) the sample filter is automatically transferred into the storage magazine. After 16 sampling events have been completed the storage magazine will be shipped to an accredited laboratory for re-weighing.

The sampled concentration is determined as the net weight of the filter divided by the total flow volume over the sampling event. Chemical analysis of particulate samples will be performed on two samples every second magazine. Data management and record keeping will be an integral part of the monitoring program. Sampling, analysis and reporting will be performed in accordance with the industry standards (ASTM 2010).

In addition to air quality sampling, dust control inspections will be conducted for site roads and facilities to determine the need for additional mitigation measures. If threshold levels for TSP are exceeded, SGC will take the following actions:

1. Review all applicable air quality, meteorological data and metadata (e.g., records of Project activities during the exceedance period, inspection reports, field notes etc. and any other information that may be relevant) to determine reason for high TSP concentrations.
2. Apply contingency measures, and modify or add mitigation measures to reduce dust emissions.
3. Notify Government of Yukon of the exceedance and any changes to mitigation measures.

Annual reports will be produced which contain the recorded TSP concentrations with comparison to Yukon Ambient Air Quality Standards. The reports will also contain the sampling QA/QC data recorded in the Partisol Sampler interval file and the results of any chemical lab analyses (after mining begins during operations).

4 EXISTING ENVIRONMENT

The following sections have been excerpted from climate baseline data reports to provide a summary of existing conditions that may influence dust emissions and deposition.

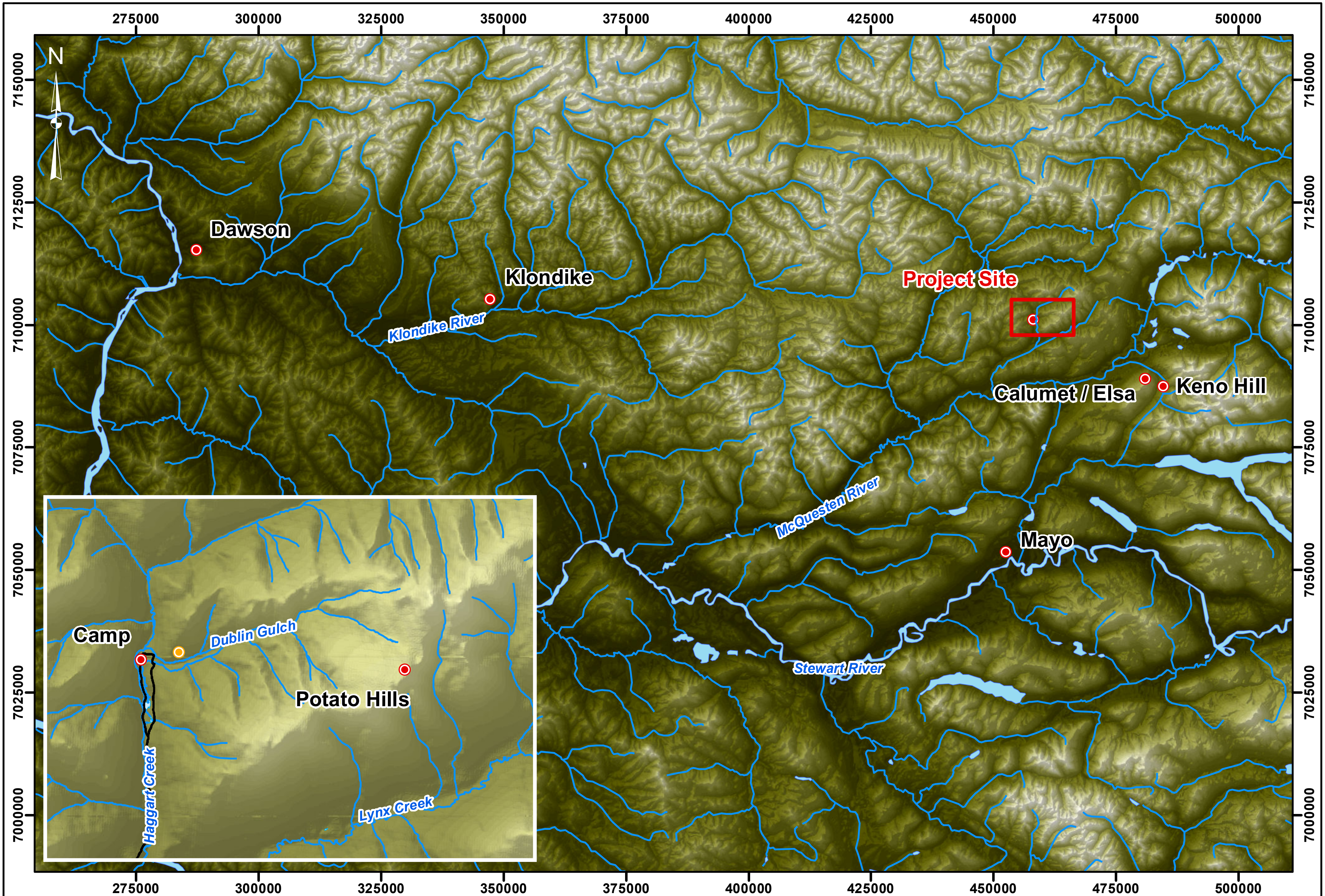
4.1 SITE METEOROLOGY

The Project area is characterized by a continental-type climate with moderate annual precipitation and a large temperature range. Summers are short and can be hot, while winters are long and cold with moderate snowfall. Rainstorm events can occur frequently during the summer and may contribute between 30 to 40% of the annual precipitation. Higher elevations are typically snow-free by mid-June. Frost may occur at any time during the summer or fall.

Climatic parameters are measured at the Project site by two weather stations as shown in Figure 4.1-1. The Potato Hills station is situated at the highest elevation of the site (1420 m), and was installed in August 2007. The second station was originally installed near the camp at 823 m in August 2009, and subsequently moved to its current location in September 2010 at 782 m due to construction of new camp facilities.

The mean measured temperature at site is approximately -3.6°C at the Camp station (782 m) and -3.8°C at the Potato Hills station (1420 m) over the respective periods of record. Maximum temperatures range from -43.8°C to 22.0°C and from -36.6°C to 22.8°C at the Camp and Potato Hills stations respectively (Lorax 2016).

The measured annual rainfall at the site during the monitoring period has ranged from 187.2 mm to 248.8 mm and from 162.6 mm to 462.2 mm for the Camp and Potato Hills stations respectively. Snowpack surveys indicated that annual maximum snow water equivalent (SWE) values during the respective periods of record ranged from 93 mm to 160 mm at the Camp snow course, 98 mm to 117 (shorter record) at the Ann Gulch snow course, and vary from 190 mm to 410 mm at the Potato Hills snow course (Lorax 2016).



Legend:

- Climate Station
- Snow Course Only
- Watercourse
- Road

StrataGold Corporation

0 5 10 20 30
Kilometers

Projection: NAD83 UTM Zone 8N

Drawn By: HC

Date: 2017/03/28

Figure: 4.1-1

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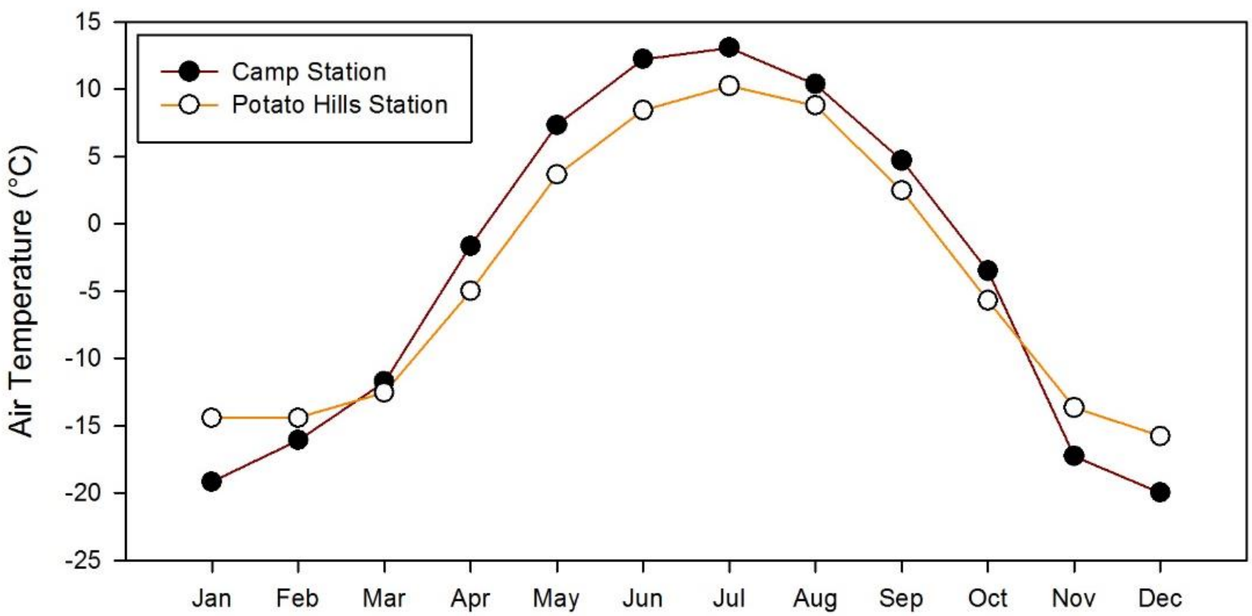
Climate Station Locations and Snow Courses

4.1.1 Temperature

Annually, spring thaw begins in April when daily maximum temperatures exceed 0°C, although daily mean temperatures may not rise above freezing until May. Annual maximums occur in July and daily mean temperatures begin to recede during late August and September. However, daily minimums may drop below freezing at night during August. Daily freezing conditions begin in October and annual minimums occur in January.

Mean, maximum and minimum monthly (based on the daily average) temperatures are presented in Table 4.1-1. At the camp station, monthly average temperature ranges from -20.2°C in January to 13.1°C in July and -16.1°C to 10.1°C at the Potato Hills station for the same months. The minimum (maximum) recorded daily average temperatures were -43.8°C (22.0°C) and -36.6°C (22.8°C) at the Camp and Potato Hills stations respectively. The minimum (maximum) recorded 15-minute temperatures were -46.4°C (31.6°C) and -37.6°C (28.5°C) at the Camp and Potato Hills stations, respectively. The monthly mean temperature signatures for both climate stations are shown in Figure 4.1-2 (Lorax 2016).



Source: Lorax 2016

Figure 4.1-2 Project Area Monthly Mean Temperatures

Table 4.1-1: Project Site Monthly Air Temperature Record

Climate Station	Elevation (m asl)	Temperature (°C)														
		Year		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Camp Station	782	2009	Mean	-	-	-	-	-	-	-	-	6.2	-2.6	-13.6	-17.3	-
			Maximum	-	-	-	-	-	-	-	-	11.2	2.3	-2.2	-2.8	-
			Minimum	-	-	-	-	-	-	-	-	-4.8	-9.7	-22.6	-31.3	-
		2010	Mean	-17.1	-10.8	-6.9	1.1	8.3	12.1	13.6	12.1	4.4	-3.4	-13.5	-24.1	-2.0
			Maximum	-6.7	1.0	1.4	9.4	16.9	15.7	18.0	20.5	11.8	7.1	4.0	-11.2	20.5
			Minimum	-33.4	-25.0	-17.7	-6.8	1.8	7.2	10.3	6.2	-6.1	-10.5	-28.4	-37.7	-37.7
		2011	Mean	-22.9	-21.3	-15.9	-3.2	7.7	11.5	12.8	9.2	5.1	-2.8	-20.7	M	-
			Maximum	-1.3	-1.4	2.1	2.7	16.1	16.1	18.2	14.3	9.7	0.3	-6.4	M	-
			Minimum	-38.5	-37.8	-30.3	-11.6	-2.2	7.0	9.5	5.7	0.9	-6.8	-39.1	M	-
		2012	Mean	-25.2	-12.2	-13.4	0.4	5.9	13.3	12.6	10.5	5.0	M	-24.1	-25.9	-4.8
			Maximum	-7.2	0.7	-1.4	4.4	12.6	19.4	16.7	15.6	13.6	M	-10.3	-8.5	19.4
			Minimum	-40.4	-24.2	-24.4	-7.6	-0.4	8.7	8.7	4.5	-0.6	M	-37.1	-41.0	-41.0
		2013	Mean	-21.6	-13.3	-15.5	-8.6	5.0	14.2	14.0	11.9	5.5	-2.5	-18.7	-26.7	-4.7
			Maximum	-9.3	-4.4	0.3	2.9	14.1	22.0	18.5	18.0	14.5	4.9	-4.0	-11.6	22.0
			Minimum	-43.8	-20.9	-26.8	-16.6	-2.6	6.0	9.5	4.9	0.9	-9.9	-39.5	-40.7	-43.8
		2014	Mean	-14.9	-23.4	-13.8	-1.8	7.0	11.0	13.4	10.6	3.7	-3.5	-15.8	-15.2	-3.6
			Maximum	-1.8	-6.4	-3.8	4.5	12.9	16.5	18.6	15.1	9.4	3.4	-3.3	-4.6	18.6
			Minimum	-34.1	-36.8	-24.4	-12.4	2.5	5.4	8.7	4.5	-3.8	-11.9	-33.8	-26.4	-36.8
		2015	Mean	-19.4	-18.1	-11.5	-0.1	10.1	11.2	12.2	9.0	2.9	-1.5	-15.1	-15.2	-3.0
			Maximum	-2.9	-1.7	-1.0	4.4	17.5	15.5	16.8	15.4	7.3	3.4	-4.4	-6.0	17.5
			Minimum	-39.1	-38.3	-26.8	-4.8	-0.9	5.6	7.9	1.6	-4.3	-9.3	-33.1	-34.3	-39.1
		All Years	Mean	-20.2	-16.5	-12.9	-2.0	7.3	12.2	13.1	10.6	4.7	-2.7	-17.4	-20.8	-3.6
			Maximum	-1.3	1.0	2.1	9.4	17.5	22.0	18.6	20.5	14.5	7.1	4.0	-2.8	22.0
			Minimum	-43.8	-38.3	-30.3	-16.6	-2.6	5.4	7.9	1.6	-6.1	-11.9	-39.5	-41.0	-43.8
Potato Hills Station	1420	2007	Mean	-	-	-	-	-	-	-	-	1.0	-6.9	-12.0	-15.2	-
			Maximum	-	-	-	-	-	-	-	-	8.0	-1.5	-5.5	-9.4	-
			Minimum	-	-	-	-	-	-	-	-	-6.2	-13.8	-27.7	-24.2	-
		2008	Mean	-17.7	-17.2	-11.3	-4.8	3.3	8.7	8.1	5.3	1.9	-7.7	-10.8	-18.6	-5.1
			Maximum	-9.2	-3.4	-2.8	2.7	12.5	14.3	13.4	9.2	6.7	2.4	-5.4	-8.4	14.3
			Minimum	-33.1	-31.9	-29.6	-16.8	-0.6	4.6	2.8	1.7	-7.7	-21.3	-19.6	-27.2	-33.1
		2009	Mean	-19.3	-17.2	-16.7	-4.4	M	M	12.6	7.4	3.3	-5.3	-12.8	-11.9	-
			Maximum	-0.5	-10.4	-7.0	9.4	M	M	22.8	16.2	10.4	-1.9	-4.9	-3.8	-

Climate Station	Elevation (m asl)	Temperature (°C)														
		Year		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
			Minimum	-34.8	-30.3	-25.2	-13.0	M	M	6.6	3.1	-6.3	-14.2	-19.1	-21.2	-
		2010	Mean	-14.5	-9.7	-9.4	-1.8	5.2	8.8	10.5	9.7	2.3	-5.3	-11.7	-18.2	-2.9
			Maximum	-5.1	-1.8	-2.9	6.3	15.1	13.4	15.2	19.5	8.8	3.1	-1.4	-8.8	19.5
			Minimum	-30.9	-26.4	-16.5	-8.3	-4.0	2.7	6.2	3.4	-9.3	-10.4	-23.1	-25.6	-30.9
		2011	Mean	-15.5	-18.3	-13.9	-5.6	4.8	8.8	10.3	7.0	4.1	-5.7	-18.0	-13.0	-4.6
			Maximum	-5.6	-3.6	-1.4	1.3	15.3	13.9	15.7	11.4	20.4	-1.2	-9.1	-8.8	20.4
			Minimum	-28.0	-30.2	-23.2	-13.0	-7.2	2.2	5.9	5.3	-5.5	-12.1	-29.0	-20.0	-30.2
		2012	Mean	-19.8	-11.1	-13.4	-1.9	3.1	11.3	10.9	M	M	-8.4	-18.8	-19.4	-
			Maximum	-6.8	-5.1	-1.7	1.8	9.5	18.5	17.9	M	M	3.3	-8.0	-6.5	-
			Minimum	-30.3	-19.5	-22.6	-8.0	-2.5	5.5	5.5	M	M	-16.8	-24.0	-29.2	-
		2013	Mean	*-17.6*	*-11.3*	-14.2	*-10.4*	*2.8*	12.1	11.6	11.0	3.0	-2.9	-16.0	-19.5	-4.3
			Maximum	-5.5	-4.9	-5.1	*-2.5*	*13.5*	22.2	17.4	19.9	10.2	1.3	-4.7	-3.4	22.2
			Minimum	-36.6	-15.5	-24.8	*-18.4*	*-6.2*	2.0	5.3	1.7	-1.8	-8.5	-28.9	-29.1	-36.6
		2014	Mean	-10.0	-15.9	-11.5	-3.4	*5.6*	8.7	11.8	8.7	2.1	-5.6	-11.6	-11.4	-2.7
			Maximum	0.6	-7.8	-5.1	3.2	*11.5*	17.6	15.6	13.9	8.5	0.9	-5.0	-5.4	17.6
			Minimum	-27.3	-26.3	-19.9	-13.5	*0.4*	1.7	7.4	1.7	-5.2	-12.1	-22.5	-19.2	-27.3
		2015	Mean	-14.4	-13.8	-9.6	*-2.3*	*8.6*	*8.6*	*9.5*	7.1	0.1	-3.7	-13.5	-13.6	-3.1
			Maximum	-3.9	-2.3	-0.5	*1.4*	*16.5*	*13.6*	*14.9*	17.0	4.9	2.0	-4.3	-5.6	17.0
			Minimum	-31.7	-32.7	-24.3	*-6.5*	*-3.2*	*1.9*	*4.4*	-2.0	-6.1	-10.7	-28.3	-25.3	-32.7
		All Years	Mean	-16.1	-14.3	-12.5	-4.4	4.8	9.6	10.7	8.0	2.2	-5.7	-13.9	-15.6	-3.8
			Maximum	0.6	-1.8	-0.5	9.4	16.5	22.2	22.8	19.9	20.4	3.3	-1.4	-3.4	22.8
			Minimum	-36.6	-32.7	-29.6	-18.4	-7.2	1.7	2.8	-2.0	-9.3	-21.3	-29.0	-29.2	-36.6

Source: Lorax 2016

NOTES:
1. Values are calculated from average daily temperatures.
2. Data is considered missing for a month if less than 25 days of data are available for that month.
3. Monthly values in italics for the Potato Hills station, for the period of 2013 through 2015 have been infilled using monthly regression relationships with temperature data from the Camp station.
4. Monthly values in gray for the period of June 2014 to March 2015 were recorded by a standalone HOBO temperature sensor.
5. ‘M’ denotes data missing due to a sensor malfunction.
6. Monthly temperature lapse rates presented in Section 3.1 are based on a comparison of monthly average temperature data from the Camp and Potato Hills stations.

During the months of March to October inclusive, the standard lapse rate applies, with temperatures decreasing with rising elevation, and are approximately 3°C cooler at the upper station, on average. However, during the winter months of November to February, temperature inversions are common at the Project site, with temperatures roughly 2.5°C cooler on average in the valley bottom than at the height of land (Lorax 2016).

The spring/summer lapse rate of -4°C/1000 is consistent with the saturated adiabatic lapse rate of -5.0°C/1000 m. This is likely due to increased frequency of precipitation during the summer months, when the majority of annual precipitation falls, resulting in warmer and wetter air masses at the Project site. The winter lapse rate of +4°C/1000 m is consistent with that reported by Wahl *et al*. (1987), which states that during a temperature inversion, lapse rates can range from 3-5°C/1000 m of elevation gain (Lorax 2016).

Long-term temperature data from Mayo demonstrate there has not been any long-term warming or cooling trend in the region over the last 80 years. Over the period of record, the mean annual temperature at Mayo has fluctuated approximately 4°C. Over this period, there has been a larger variability in annual minimum temperatures, while annual maximum temperatures have stayed relatively constant.

4.1.2 Precipitation

Long-term estimates of precipitation for the area have been based on analyses of regional climate data from stations in Mayo, Dawson, Klondike, Elsa, and Keno Hill. Comparison of Project site data to Mayo data demonstrated that the Potato Hills station received approximately 1.3 times more monthly precipitation. This reflects the orographic effect common to mountainous regions and is evident in the Project site precipitation estimates. Rainfall, snowfall, and surface lying moisture and snow are natural dust suppressants. As such, the area is not prone to prolonged dusty periods. Based on the regional and local data, monthly precipitation totals are highest in July and lowest in February.

4.1.2.1 Rainfall

The precipitation data is collected at the Project site using tipping bucket rain gauges, which have not been adapted to measure snowfall. Therefore, the precipitation data presented in Table 4.1-2 is for rainfall only, collected between the months of March and October, inclusive. Generally precipitation falls as snow from November through March, with precipitation falling as a mix of rain and snow in April and October. Rainfall data for March is included in the table below, where the temperature record indicates that precipitation would have fallen as rain (i.e., daily average air temperature was above zero).

Maximum annual monthly rainfall is realized in the month of July (53.2 mm and 65.6 mm at the Camp and Potato Hills stations, respectively). On an annual basis, rainfall at the Camp station averages 222.6 mm, and 254.7 mm at the Potato Hills station (Lorax 2016).

Table 4.1-2: Project Site Monthly Rainfall Data

Climate Station	Elevation (m asl)	Precipitation (mm)														
		Year		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Camp Station	782	2009		-	-	-	-	-	-	-	-	35.0	*8.0*	S	S	-
		2010		-	-	5.0	9.0	20.0	62.0	34.0	28.0	25.0	*12.0*	S	S	195.0
		2011		-	-	11.0	10.0	16.0	31.0	75.0	44.0	40.0	*9.0*	S	S	236.0
		2012		-	-	13.0	1.0	22.0	18.0	74.6	29.8	24.0	*4.8*	S	S	187.2
		2013		-	-	8.6	10.4	34.6	25.6	28.4	35.2	58.6	*25.2*	S	S	226.6
		2014		-	-	5.4	8.8	9.2	52.8	43.2	70.4	28.8	*23.2*	S	S	241.8
		2015		-	-	20.8	13.0	8.2	28.8	64.0	62.0	38.6	*13.4*	S	S	248.8
		All Years	Mean	-	-	10.6	8.7	18.3	36.4	53.2	44.9	35.7	*13.7*	S	S	222.6
			Maximum	-	-	20.8	13.0	34.6	62.0	75.0	70.4	58.6	*25.2*	S	S	248.8
			Minimum	-	-	5.0	1.0	8.2	18.0	28.4	28.0	24.0	*4.8*	S	S	187.2
Potato Hills Station	1420	2007		-	-	-	-	-	-	-	24.0	100.8	*2.0*	S	S	-
		2008		S	S	3.4	4.8	58.4	52.0	201.2	130.0	11.2	*1.2*	S	S	462.2
		2009		S	S	S	3.0	-	50.8	12.6	75.4	44.4	*1.2*	S	S	-
		2010		S	S	1.0	6.2	16.4	77.2	45.8	39.4	4.2	*5.4*	S	S	195.6
		2011		S	S	0.2	7.2	21.2	38.0	92.8	83.8	34.4	*0.4*	S	S	278.0
		2012		S	S	S	0.6	9.6	24.2	64.8	37.8	21.0	*4.6*	S	S	162.6
		2013		S	S	2.2	0.2	29.6	33.2	18.0	18.2	63.8	*10.0*	S	S	175.2
		2014		S	S	S	M	M	M	M	M	M	*M*	S	S	-
		2015		S	S	M	M	M	M	M	48.5	27.1	*10.0*	S	S	-
		All Years	Mean	S	S	S	3.7	27.0	45.9	72.5	57.1	38.4	*4.4*	S	S	254.7
			Maximum	S	S	S	7.2	58.4	77.2	201.2	130.0	100.8	*10.0*	S	S	462.2
			Minimum	S	S	S	0.2	9.6	24.2	12.6	18.2	4.2	*0.4*	S	S	162.6

Source: Lorax 2016

NOTES:

1. Winter precipitation data (October through April in many years) are unreliable due to the majority falling as snow. The months where no rainfall was recorded due to freezing conditions are denoted by an 'S'.
2. Data for the month of October are in italics, as rainfall is not measured for the entire month.
3. 'M' denotes data missing due to a sensor malfunction.

4.1.2.2 Snow Data

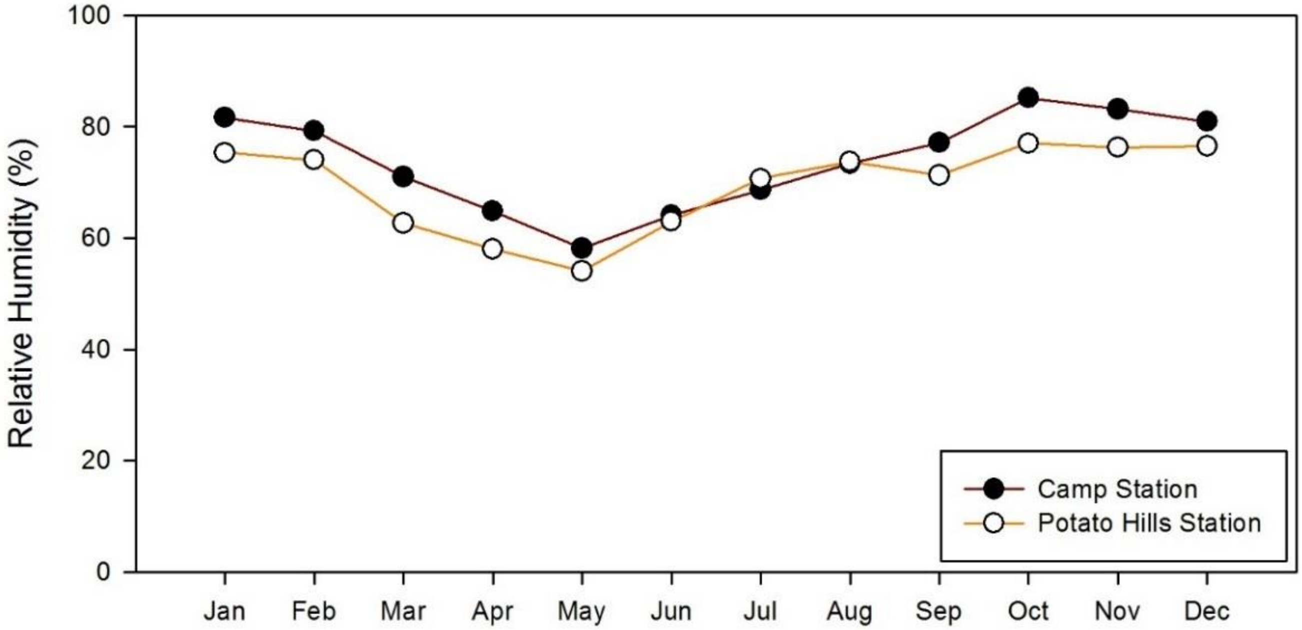
Snow data is being collected at three snow courses at the Project site. The annual maximum snow water equivalent (SWE) value generally occurs in late-March or early-April. Field measurements from site show that snow density is generally lower earlier in the season, corresponding to colder temperatures, but increases through winter as the snow pack deepens, weathers and as snow melt progresses (Lorax 2016).

Overall, these data shown that annual maximum SWE values at the Camp snow course range from 93 mm to 160 mm, range from 117 mm to 237 mm (shorter record) at the Ann Gulch snow course, and vary from 190 mm to 410 mm at the Potato Hills snow course (Lorax 2016).

4.1.3 Relative Humidity

Relative humidity is a measure of the water vapour content of an air parcel, expressed as a percentage of the total water vapour required for the air to be fully saturated at a given temperature. Therefore, at colder temperatures, less water vapour is required to achieve a high relative humidity, and conversely at higher temperatures, more water vapour is required to obtain the same relative humidity value (Lorax 2016).

Given that air temperatures are well below zero during the winter, relative humidity values are elevated throughout the winter, and lower during the summer. With respect to monthly patterns for relative humidity, the annual minima is expected to occur in the month of May. All monthly average relative humidity values from both climate stations are provided in Figure 4.1-3 (Lorax 2016).



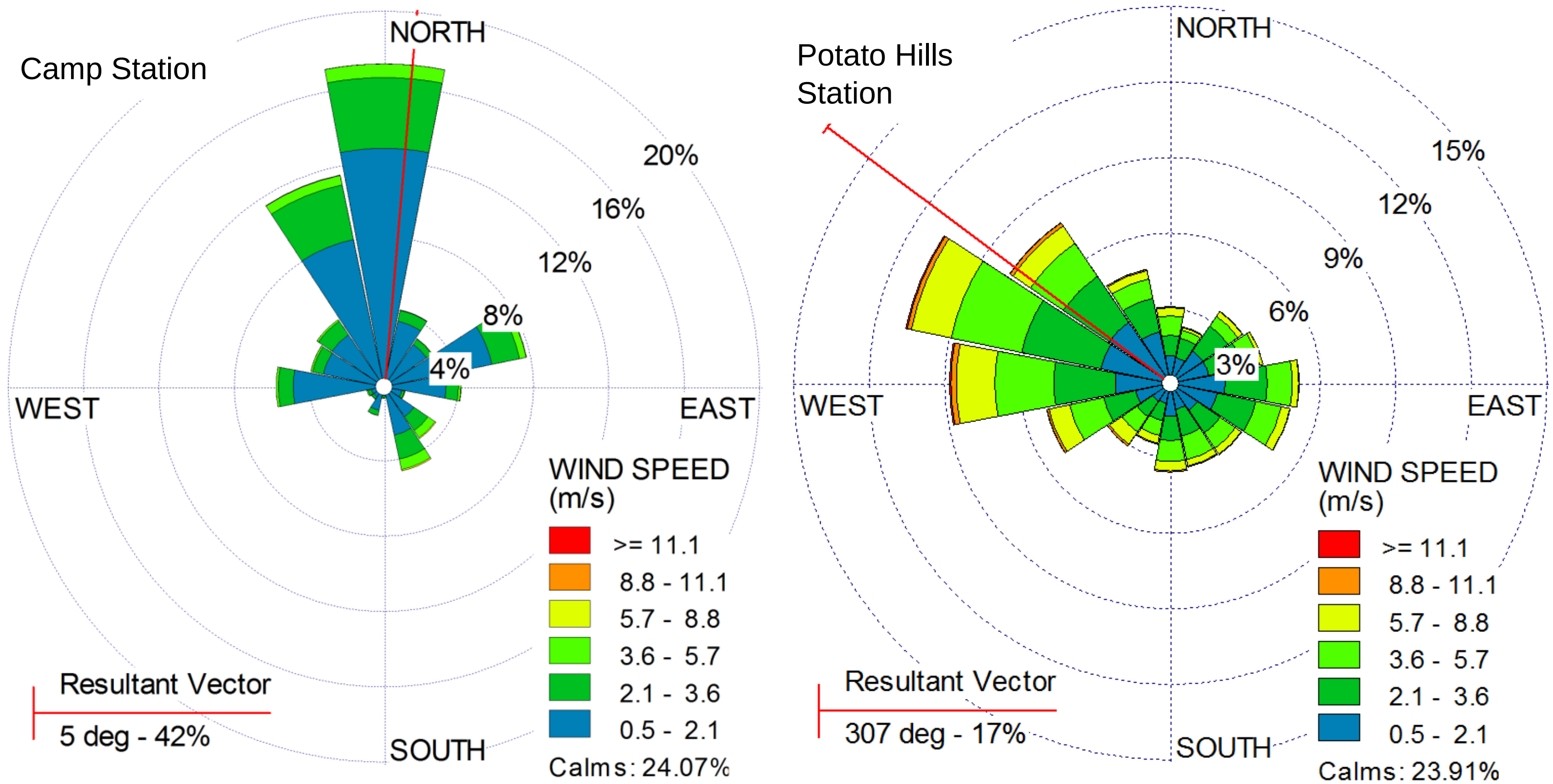
Source: Lorax 2016

Figure 4.1-3 Project Site Average Monthly Relative Humidity

4.1.4 Wind Speed and Direction

Wind roses have been produced to illustrate wind vector trends at each station (Figure 4.1-4).

The predominant wind direction at the site climate stations is from the north, and west-northwest, for the Camp and Potato Hills stations, respectively. Wind speeds average 1.2 m/s at the Camp station, and 2.3 m/s at the Potato Hills station, on an annual basis (Table 4.1-6; Figure 4.1-4). The maximum recorded gust speed at the Camp station was 15.1 m/s, and 23.9 m/s at the Potato Hills station. As shown in Table 4.1-6, the mean monthly wind speeds for both stations are higher in the spring, summer, and autumn months, and lower in the winter, with annual minima occurring in December, and annual maxima in May (Lorax 2016).



Source: Lorax 2016

NOTES:
Wind roses are based on hourly averages of 15-minute readings of wind speed and direction

Figure 4.1-4 Project Site Wind Roses

Table 4.1-3: Project Site Monthly Average Wind Speeds

Climate Station	Elevation (m asl)	Wind Speed (m/s)													
		Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Camp Station	782	2009	-	-	-	-	-	-	-	1.4	1.2	1.2	1.1	0.7	-
		2010	1.2	1.1	2.2	2.0	1.9	1.5	1.4	1.3	1.5	1.2	0.7	1.0	1.4
		2011	0.6	1.2	1.3	1.8	1.7	1.5	1.3	1.2	1.4	0.9	0.9	0.2	1.2
		2012	0.9	1.2	1.6	1.4	1.9	1.3	1.4	1.3	1.5	1.1	1.3	0.7	1.3
		2013	0.8	0.9	1.2	2.2	1.5	1.7	1.5	1.3	1.6	0.8	0.7	0.7	1.2
		2014	0.1	0.8	1.3	1.5	1.8	1.6	1.5	1.2	1.2	1.3	0.9	0.5	1.2
		2015	0.2	0.3	1.1	1.4	1.6	1.6	1.2	1.2	1.3	1.1	0.7	0.0	1.0
		2016	0.7	0.7	1.4	1.2	-	-	-	-	-	-	-	-	1.0
		Average	0.7	0.9	1.5	1.6	1.7	1.5	1.4	1.3	1.4	1.1	0.9	0.5	1.2
Potato Hills Station	1420	2007	-	-	-	-	-	-	-	2.3	2.3	3.0	3.0	0.8	-
		2008	2.8	3.7	3.6	3.6	3.6	3.1	3.1	2.8	1.7	1.3	2.6	3.1	2.9
		2009	3.2	2.5	3.2	3.0	3.1	2.7	2.9	2.0	2.0	3.4	2.3	2.1	2.7
		2010	2.1	2.1	3.9	3.6	2.7	2.0	2.6	2.7	3.0	2.8	1.5	1.0	2.5
		2011	2.0	3.2	3.4	3.2	3.4	2.0	1.8	2.3	1.2	0.4	2.0	1.4	2.2
		2012	0.0	0.2	1.4	2.0	2.9	1.8	1.9	2.0	2.9	2.5	2.6	0.7	-
		2013	1.7	0.7	2.9	4.8	2.6	2.3	2.5	1.8	2.9	2.2	2.1	2.2	2.4
		2014	1.6	2.6	2.5	3.0	2.7	-	-	-	-	-	-	-	-
		2015	-	-	-	-	-	-	0.9	1.8	2.5	1.4	0.0	0.0	-
		2016	1.3	2.7	2.8	2.9	-	-	-	-	-	-	-	-	-
		Average	1.8	2.2	3.0	3.3	3.0	2.3	2.2	2.2	2.3	2.1	2.0	1.4	2.3

Source: Lorax 2016

4.1.5 Solar Radiation

Solar radiation (or solar irradiance) is a measure of the power per unit area provided by the Sun, in watts per square meter (W/m^2). Given the high-latitude location of the Project site, day length, and therefore solar radiation, fluctuate greatly on a seasonal basis. Average annual minima of 1 W/m^2 (Camp station) and 3 W/m^2 (Potato Hills station) occur in the month of December, while the average annual maxima of 221 W/m^2 and 230 W/m^2 occur in May at the Camp and Potato Hills stations, respectively. The Camp stations location in the valley bottom results in slightly lower incident solar radiation, presumably due to the shading effect of the surrounding terrain.

4.1.6 Potential Evaporation

15-minute potential evaporation rates were computed for the Camp station using available climate and the Ref-ET calculator - a compiled, stand-alone computer program that calculates reference evapotranspiration (ASCE, 2005). For the period of available record (Jan 2013 to Apr 2016), a 15-minute climate input file was prepared for the Eagle Gold site. The input variables required by Ref-ET are: maximum air temperature, minimum air temperature, relative humidity, incoming solar radiation, atmospheric pressure and wind speed (Lorax 2016).

From the assembled climate inputs, Ref-ET returned potential evaporation (PE) computations at daily time-step based on an array of evaporation models (e.g., Penman-Monteith model, Priestley-Taylor formulation). May to end-September PE for the Camp station is estimated to be 380 mm, with highest monthly rates of PE expected in May, June, July and August of each year.

5 REFERENCES

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Wahl, H.E., Fraser, D.B., Harvey, R.C. and Maxwell, J.B. 1987. *Climate of Yukon*. Atmospheric Environment Service, Environment Canada, Ottawa, Ontario.

Yukon Environment. 2014. Dust Management Plan Guidelines. June 2014.

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APPENDIX A

Dust control design criteria

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TABLE OF CONTENTS

1.0 GENERAL

1.1 SCOPE

.1 This design criteria shall form the basis of all dust control systems for the project site, and shall be read in conjunction with the referenced Codes and Standards.

.2 The scope of project areas that are governed by this design criteria will be:

- Primary Crushing
- Secondary Crushing
- Tertiary Crushing
- Refinery
- Laboratory.

.3 This design criteria will govern the production and contents of the following documents:

- Design Calculations
- Equipment performance specifications
- General arrangement drawings
- Detailed drawings
- Standard detail drawings.

1.2 CODES AND STANDARDS

.1 All design material, equipment manufacturing, fabrication, testing, installation and construction shall be in accordance with the latest edition of the applicable codes and standards of the following organizations. The organizations include, but are not limited to, the following:

Institution	Description
ABMA	American Bearing Manufacturers' Association
ACI	American Concrete Institute
AGMA	American Gear Manufacturers' Association
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
API	American Petroleum Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers

Institution	Description
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CEC	Canadian Electrical Code
CEMA	Conveyor Equipment Manufacturers' Association
CISC	Canadian Institute of Steel Construction
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
EEMAC	Electrical Equipment Manufacturers Association
FM	Factory Mutual
HI	Hydraulic Institute
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
IFE	Industrial Fasteners Institute
ISA	Instrument Society of America
ISMA	Industrial Silencer Manufacturers' Association
ISO	International Organization for Standardization
JIC	Joint Industrial Council
MHIA	Material Handling Industry of America
MHEA	Material Handling Engineers Association
MPTA	Mechanical Power Transmission Association
YWCHSB	Yukon Worker's Compensation Health and Safety Board
MSS	Manufacturers' Standardization Society
NACE	National Association of Corrosion Engineers
NBC	National Building Code of Canada
NEC	National Electrical Code (US)
NEMA	National Electrical Manufacturers' Association
NESC	National Electrical Safety Code
NFC	National Fire Code
NFPA	National Fire Protection Association
NFPI	National Fluid Power Institute
OSHA	Occupational Safety and Health Act
PFI	Pipe Fabrication Institute
PPI	Plastics Pipe Institute
RMA	Rubber Manufacturers' Association
SNT	Society of Non-Destructive Testing
SAE	Society of Automotive Engineers
SSPC	Steel Structure Painting Council
TEMA	Tubular Exchanger Manufacturers' Association
UL	Underwriters Laboratories
CUL	Underwriters Laboratories of Canada

Institution	Description
WHMIS	Workplace Hazardous Materials Information System
WCB	Worker's Compensation Board, British Columbia

.2 The codes and laws of Yukon, municipality or jurisdiction may take precedence over the aforementioned codes.

1.3 REFERENCE SPECIFICATIONS

.1 For equipment general specification, weather and all site data refer "02 10 00 TS – Site Conditions" unless otherwise noted in the equipment Criteria.

.2 For all piping data and information (pipe velocity, pipe material, and buried pipe) see "40 00 00 DC Piping Design Criteria".

.3 For all structural data and information see "05 00 00 DC Structural Design Criteria".

.4 For all electrical data and information see "26 00 00 DC Electrical Design Criteria".

.5 For all instrumentation data and control information see "40 90 00 DC Instrumentation Design Criteria".

.6 For all building services data and information see "24 00 00 DC HVAC Design Criteria".

1.4 DESIGN PARAMETERS

.1 The basic requirements of dust control systems shall be to:

- Minimize emissions to atmosphere
- Minimize loss of product from the process
- Maintain stack emissions below established criteria
- Maintain air quality standards.

.2 The dust control systems shall be designed based on the premise that the material handling equipment, such as screens, conveyors, chutes, and skirting, are designed and maintained to prevent spillage and loss of material, and that the skirting lengths and heights are suitable for the intended dust control systems.

.3 Aspirated systems shall be dedicated to individual process circuits as much as possible, in order to provide flexibility with operations.

.4 Fogging systems shall be capable of reducing the fugitive dust emissions from transfer points, to 97.5% of those levels documented in USEPA –AP42 emission factors.

.5 The velocity of air entering exhaust hoods shall be such that it does not remove excess material from the process flow.

.6 Hoods shall be provided at all material transfer points within the crushing buildings.

.7 All dust conveying ducting shall be round.

.8 All ducting shall be flanged in lengths that will enable ease of installation and future removal.

.9 Duct diameters shall be sized to ensure complete conveyance of all collected dust, from the point of collection, to the dust collection equipment.

.10 In no case shall the duct velocity, in dust conveying ducting, be less than 20 m/s.

.11 The duct velocity in "clean" air ducting, on the downstream side of dust collection equipment, shall not be less than 15.3 m/s.

.12 Duct cleanouts shall be provided such that the internals of all sections of dust conveying ducting can be inspected and cleaned out. Cleanouts shall be located on the top, or side of the duct, not on the bottom.

.13 Air flow measuring ports shall be provided in all branch ducts and all main ducts, to enable each section of the system to be tested and balanced.

.14 Air flow test ports shall not be located within six duct diameters upstream of any turbulence and not less than two duct diameters downstream of any turbulence.

.15 Dampers shall be provided in all branch ducts for air flow balancing. The dampers shall only be low leakage blast gate type, with means to lock the gates in the final balanced position.

.16 Branch entries into a main duct shall preferably enter at an angle of 30 degrees, but in no case shall the angle exceed 45 degrees.

.17 Branch entries shall enter a main such that the duct velocities are maintained throughout the fitting.

.18 The included angle for duct contractions and expansions shall not exceed 15 degrees.

.19 No two branch entries shall enter the main duct opposite each other in the same plane.

.20 90 degree bends shall be constructed of seven segments of straight ducting, and have a centreline radius of two and a half times the duct diameter.

.21 Bends of less than 90 degrees shall be constructed of a pro-rated number of segments of straight duct, and have a centreline radius of two and a half times the duct diameter.

.22 Exhaust stacks shall not have any impediment to straight through flow. The only allowable arrangement of weather protection is the stack head configuration, where the head is at least four times the duct diameter and the head diameter is 25 mm larger than the stack diameter.

.23 Exhaust stack discharge velocities shall be at least 15.3 m/s.

.24 Fan inlet ducts shall be configured to prevent uneven loading of the fan wheel.

.25 Fan discharge ducts shall remain straight for at least one fan inlet diameter before any bend, and that bend shall only be turned in the direction of fan rotation.

.26 All exterior surfaces of ducts shall be prepared to SSPC-3 prior to application of paint.

.27 Paint shall be applied to all exterior duct surfaces.

.28 Ducts shall be supported at the following intervals: 3 m spacing for 200 mm diameter and smaller: 4.5 m for 210 mm diameter through 480 mm and 6 m spacing for ducts larger than 480 mm diameter.

.29 Duct supports shall be designed for the weight of the ducting and fittings, plus the following allowance for material:

1.0	Mains Dust Load	% Full:	33 Vertical & 33 Horizontal
2.0	Sub mains Dust Load	% Full:	50 Vertical & 50 Horizontal
3.0	Branches Dust Load	% Full:	100 Vertical & 100 Horizontal

.30 Vertical ducts shall be supported at the base of the riser.

.31 Emissions to atmosphere, through dust collector exhaust stacks are limited to 32 mg/dsm^3 and an opacity of less than 7%.

1.5 SPECIFIC DUST CONTROL SYSTEMS

Dust control shall be provided in the following areas of the project:

.1 Primary Crusher Dump Pocket

Dump Pocket: No fixed system for dust control.

.2 Primary Crusher - Below the crusher

A dry aspirated dust collection system handled by a single dust collector and exhaust fan, with pick up hoods located at the following points:

- Head chute of Primary crusher Belt Feeder
- Primary crusher discharge onto conveyor
- Tail of Primary crusher discharge conveyor

The collected fines will be discharged back to the process via a rotary air lock onto the primary crusher discharge conveyor.

.3 Secondary/Tertiary Crushing

A dry aspirated dust collection system handled by two dust collectors and exhaust fans, with pick up hoods located at the following points:

- Head chute of secondary crushing feed conveyor
- Secondary crushing screen
- Secondary crusher discharge onto conveyor
- Secondary crusher feed chute
- Screen undersize discharge onto Tertiary crushing feed conveyor
- Tail of tertiary crushing feed conveyor
- Head chutes of tertiary crushing belt feeders
- Tertiary crushing screens
- Tertiary crushing feed chutes
- Tertiary crusher discharges onto conveyor
- Screen undersize discharges onto Tertiary crushing feed conveyor No 1.
- Tail of secondary/tertiary crushing fines conveyor

- The collected fines from both dust collectors will be discharged back to the process via a rotary air lock onto the secondary/tertiary crushing fines conveyor.

.4 Tertiary Crushing Feed Bin

Two dry aspirated bin vents, located on the top of the tertiary crushing feed bin will negate dust that is produced by the feed from the tertiary crushing feed conveyor into the bin.

The collected fines will be discharged back to the tertiary crushing feed bin.

.5 Cement and Lime Addition

- Dry aspirated bin vents will be located on top of each of the cement and lime silos to negate dust emissions when the silos are being filled.

.6 Refinery

- A dry aspirated dust collection system will control fumes and dust emissions from the smelting furnace.
- A canopy hood will be located over the furnace, and the temperature of the air enterning the dust collector will b e maintained below 200 degrees Celsius.
- The collected fines will be dropped, via a rotary air lock, into a drum for manual removal when needed.

.7 Laboratory - Sample Prep

- Dry aspirated dust collection system handled by a single dust collector and exhaust fan, with pick up hoods located at the following points:

.a Crushers

.b Pulverizers

.c Dust hood workstations

.d The collected fines will be discharged via a rotary air lock into a drum, that will be manually emptied on an as needed basis.

.8 Laboratory - Fire Assay

- Dry aspirated dust collection system handled by a single dust collector and exhaust fan, with pick up hoods located at the following points:

.a Flux mixing

.b Pulverizers

.c Parting hood

.d Furnace hoods

.e The collected fines will be discharged via a rotary air lock into a drum, that will be manually emptied on an as needed basis.

2.0 EQUIPMENT

2.1 DUST COLLECTORS

.1 Materials and equipment shall be standard products of established manufacturers who have continuously produced the type of equipment suitable for the conditions specified.

.2 All like-equipment shall be manufactured by a single source, to minimize spare parts.

.3 Dust collectors shall be of the reverse pulse type, utilising dry compressed air for purging the filters, whilst remaining on-line during the purge.

.4 Dust collectors shall be designed and manufactured for heavy duty mining applications.

.5 Filter materials shall be selected by the dust collector supplier to suit the properties of the anticipated materials including the moisture content, temperature and size.

.6 Cartridge filters shall not be used.

2.2 DUST COLLECTOR EXHAUST FANS

.1 Fans shall be located on the clean side of the dust collector.

.2 Fans shall be heavy duty single inlet single width centrifugal fans, utilising radial impellers or single thickness, backward-inclined blade design.

.3 Fans shall be belt driven and be mounted on a sub frame for mounting directly onto concrete or steel structures.

.4 Fans shall be complete with guards designed to fit around all rotating machinery including drive shafts and V-belts. All such guards shall be designed for easy removal and accessibility to equipment.

2.3 ROTARY VALVES

.1 Rotary valves shall be gear driven, cast iron or abrasion resistant steel, flanged units.

.2 Rotary valves shall be directly connected to the discharge flange of the dust collector hopper.

.3 The vanes of the rotary valve shall be adjustable and shall be fabricated of abrasion resistant steel.

END OF DESIGN CRITERIA