4.4 CLIMATE CHANGE

4.4.1 Effects Analysis Indicators and Methodology of Analysis

4.4.1.1 Issues and Indicators

The analysis of effects of the Stibnite Gold Project (SGP) on climate change and the effects of climate change in combination with the SGP on the environment include the following issues and indicators:

Issue: The SGP activities could contribute to factors that influence climate change.

Indicators:

- Greenhouse Gas (GHG) emissions from SGP activities (construction, operations, and closure and reclamation), expressed as metric tons (MT) of carbon dioxide (CO_2) equivalent (CO_2eq) of GHGs.

Issue: Changing climatic conditions, in synergy with the SGP (including construction, operations, and closure and reclamation), could impact the physical, biological, and social resources.

Indicators:

- Changes in hydrologic patterns (drought, precipitation variability, and seasonality);
- Changes in temperature (extreme heat/cold, or overall change in annual or seasonal temperatures); and
- Changes in extreme weather events (flash flooding, wildfires, severe storms).

This section analyzes the expected climate change impacts in the SGP area by examining:

- **GHG Emissions** – an analysis of anticipated GHG emissions associated with each action alternative as an indicator of their potential impact on climate change trends. This includes both direct and indirect emissions attributable to the SGP.
- **Effects of Climate Change** – an analysis of how climate change, in synergy with the SGP, could impact the physical, social, and biological resources in the SGP area.

This analysis will review direct effects represented by the GHG emissions from the alternative components, and the combined (indirect) potential impacts to resources that could be impacted by climate change. The scope of analysis for the effects of climate change on resources in the SGP area is discussed in the context of each resource, except for noise.

The emission estimates were derived using published emission factors for the emission of GHG constituents for various fuel-combustion equipment (e.g., diesel-fueled engines, propane fired heaters). Based on the GHG emission levels for action alternative's emission inventories, the potential for climate change effects was assessed in the context of statewide GHG emissions, as reported by the Idaho Department of Environmental Quality. In addition, the potential for climate change effects, in tandem with SGP activities, on the physical, biological, and social resources in the analysis area, were evaluated using scientific literature reviews, and information and analysis documented in reports prepared for the SGP.

4.4.1.2 Relation of Greenhouse Gas Emissions to Climate Change

The most recent Council on Environmental Quality (CEQ) draft guidance for addressing GHG emissions in National Environmental Policy Act (NEPA) analyses suggests the quantification of the direct and indirect GHG emissions from SGP components may be used as a proxy for assessing potential climate effects (CEQ 2019). This guidance is used as the principal framework for evaluation of the direct and indirect effects of GHG emissions for the action alternatives. GHG emissions from a source or even a group of sources cannot be directly attributed to any specific climate change impact area.

In the assessment of environmental consequences, this analysis first quantifies potential GHG emissions associated with each action alternative (Alternatives 1 through 4) and then describes the context of the cumulative GHG emissions over the duration of any alternative using the current and projected GHG emissions for the state of Idaho. A discussion is provided of the features associated with each action alternative that would reduce its direct GHG emissions, as well as the qualitative potential for indirect climate change effects.

4.4.1.3 Mining and Gold Ore Processing GHG Sources

Surface mining activities release GHG to the atmosphere primarily due to the operation of engine-driven vehicles and equipment. For the action alternatives, the largest source category is operation of diesel-fueled vehicles and equipment engines. Gasoline-fueled vehicles also would be GHG emission sources, as would propane-fueled process heating and heating of buildings. However, these latter two fuels each account for less than 10 percent of fuel consumption, by volume, compared to the total use of diesel fuel.

GHG inventory data generally includes surface mines, other than coal, in the industrial sector. CO_2 accounts for over 99 percent of the industrial sector GHG emissions in Idaho (Idaho Department of Environmental Quality 2010). For the industrial sector, nationwide emissions in 1990 were about 841 million MT CO_2eq and have decreased to 771 million MT CO_2eq by 2020 (U.S. Environmental Protection Agency [EPA] 2017). Additional details regarding the historic trends in GHG emission inventory for Idaho and the United States are provided in Section 3.4.3.1, GHG Inventory Information.

4.4.1.4 GHG Emission Factors

An overall assessment of GHG emissions for the alternatives can be based on the total fuel consumption as estimated for non-road equipment and mobile sources. Under all action alternatives, the required equipment would be fueled with conventional, low-sulfur No. 2 distillate diesel fuel. In addition, there are gasoline vehicles, propane-fired heaters and, under Alternative 2, the operation of a propane-fired limestone kiln. The EPA provides generic GHG emissions factors that can be applied to the non-road vehicles and other fuel-combustion equipment (EPA 2015). The factors used for this analysis are listed in **Table 4.4-1**.

Table 4.4-1 Fuel-Combustion Source Emission Factors for SGP GHGs

Emission Source Category	Carbon Dioxide (CO_2)[1] (kg/gallon)	Methane (CH_4)[2] (g/gallon)	Nitrous Oxide (N_2O)[2] (g/gallon)
Mobile Combustion Engine Sources Distillate No. 2 Fuel [1]	10.21	0.57	0.26
Mobile Combustion Engine Sources - Motor Gasoline Fuel	8.78	0.50	0.22
Stationary Combustion Units - Propane Fuel	5.72	0.27	0.05

Table Source: EPA 2015

Table Notes:

1 For engines, from the Mobile Combustion CO_2, Diesel Fuel and Motor Gasoline categories. For propane-fueled equipment, from general stationary combustion factor category.

2 For engines, from the Mobile Combustion for Non-Road Vehicle category, Diesel Construction or Gasoline Construction categories. For propane-fueled equipment, from general stationary combustion factor category.

g/gallon = grams per gallon kg/gallon = kilograms per gallon

4.4.1.5 Emissions Monetization Policy

Qualitatively, the societal costs of GHG emissions and climate change generally encompass the financial, environmental, and societal costs resulting from sea level rise, diminishing water supplies, loss of plant and wildlife species, changes in ecosystems, increased wildfires, among other effects. As described in Section 3.4.2, Relevant Laws, Regulations, Policies, and Plans, no federal or state rules or regulations currently limit or curtail emissions of GHGs from sources in the State of Idaho. Therefore, no regulatory mechanism currently exists for quantifying a monetized costs and benefits assessment of the significance of the GHG emissions associated with the alternatives.

Draft CEQ 2019 guidance has not changed the policy established in 2016 CEQ guidance (since rescinded) with respect to monetizing climate benefits and costs of a specific project (CEQ 2019). Consequently, the current policy is that individual agencies have the discretion to disclose such an analysis if it would be relevant to the choice among alternatives. The social cost of carbon refers to a method to express in monetary terms the magnitude of the effects associated with an incremental increase in carbon emissions. It is intended to quantify climate change-induced effects, without attempting to determine potential meteorological and weather changes that are hypothetically related to those emissions. For purposes of this environmental impact statement (EIS), qualitative analysis is appropriate because quantifying the relative costs and benefits of the alternatives is not practically feasible and would be subject to high uncertainty. Consequently, a social cost of carbon calculation has not been conducted for this analysis.

4.4.1.6 Assumptions and Uncertainties

Assessment of current baseline climate conditions that, in theory, could be compared to future trends in regional climate is subject to uncertainty that these baseline conditions accurately represent the SGP area. Therefore, discussion of climate conditions in Idaho and surrounding states was generally qualitative in this analysis. Information regarding the recent climatological conditions for Idaho and the Northwest is summarized in Section 3.4.3.2, Climate Change Trends. In the same manner, this analysis will qualitatively describe the type and extent of potential climate change impacts on the physical, social, and biological resources in the analysis area, since information is not available to address such effects with quantitative certainty.

There is a degree of uncertainty in the GHG emission rate estimates developed using emission factor methodology. This type of uncertainty is discussed in Section 4.3.1.2, Air Emission Inventory Methodology, in relation to the nature of emission factors and emission models representing an average from a population of specific type of emission sources. However, there is no GHG emissions data that is specific to the conditions of the SGP area and the models and designs of the specific equipment that would be utilized for any action alternative. Although reasonable estimates for GHG emissions may be derived for a specific activity, there is uncertainty in evaluating longer-term emissions levels and the relationship between GHG sources and sinks over a lengthy and uncertain timeframe.

4.4.2 Direct and Indirect Effects

This section quantifies GHG emissions, qualitatively discusses potential climate change and SGP impacts to physical, social, and biological resources in the analysis area.

The following analysis of effects are considered in the overall context of regional and statewide GHG emissions and climate change trends. Several aspects of the context for this analysis include:

- GHGs emission inventory for the State of Idaho (represents a basis for comparison with action alternative GHG emission estimates);
- GHGs emitted from diesel-fueled and gasoline-fueled engines, and propane combustion for either process needs or heating of buildings, which can be estimated for the action alternatives;
- How GHG emissions may be mitigated for the action alternatives, given the lack of a regulatory framework for managing and permitting GHG sources; and

- Observable climate change trends in Idaho and the Northwest region of the U.S., such as increased annual average temperatures, precipitation variability, and decreased snowpack and streamflow (see Section 3.4.3.2, Climate Change Trends).

Climate change effects occur over decades and on a global scale, such that the CEQ considers climate change to be inherently a cumulative issue (CEQ 2014). Guidance provided by the U.S. Forest Service (Forest Service) has indicated that, “it is not currently feasible to quantify the indirect effects of individual or multiple projects on global climate change and therefore determining significant effects of those projects or project alternatives on global climate change cannot be made at any scale” (Forest Service 2009). On a global scale, climate change is suspected to cause changes in regional temperature cycles, rainfall amounts, and seasonal distribution or precipitation that can result in flooding, droughts, or more frequent and severe heat waves.

4.4.2.1 Alternative 1

4.4.2.1.1 GHG Emissions

Implementation of Alternative 1 (**Figure 2.3-1** and **Figure 2.3-2**) would result in a total construction, operation, and closure cycle of approximately 20 years, which includes approximately 3 years of initial site treatment of previous disturbance from past mining and redevelopment and construction activities; an estimated 12 years for mining and ore processing activities with continued concurrent reclamation/mitigation; and 5 years for final closure and reclamation work. There also would likely be several years of follow-up monitoring to ensure the ultimate success of the reclamation work.

Additional potential direct sources of emissions have not been included in the analysis, because they are difficult to estimate and are expected to be minor. These are:

- CO_2 release from crushing and grinding carbonate rocks would be minor, and such releases typically only occur when the minerals are heated.
- Carbon concentrations in existing soils are relatively low, and Alternative 1 includes provisions for soil salvage, preservation, and re-use. Therefore, this limited source would not release much additional CO_2 to the environment.

4.4.2.1.1.1 Direct GHG Emissions

The direct GHG emissions associated with Alternative 1 would be CO_2, methane (CH_4), and nitrous oxide (N_2O) emitted from the exhaust of diesel engine-driven vehicles and, to a much smaller extent, from other fuel- fired equipment. Under this alternative, mining would be conducted in three open pits. Mining equipment would include blast-hole drills, shovels, front-end loaders, and non-road haul trucks. Mobile sources working at the mine site would include bulldozers, rubber-tired dozers, motor graders, water trucks, and other support equipment. These vehicles and mobile mining equipment would be almost entirely diesel fuel fired, and combustion emissions would contain GHG constituents, predominantly CO_2.

Additional GHG emissions related to vehicle fuel use at the mine site would contribute smaller amounts of GHGs to the overall direct effects. These activities may produce fuel combustion emissions from heaters, engines, boilers, etc. The petroleum fuels would be transported to the mine site by tanker trucks, estimated to require approximately 50 truck trips per month. Blasting explosives also are recognized as a source of limited GHG emissions, as their use is a form of combustion. The primary explosive would be a mixture of ammonium nitrate and fuel oil. The relatively minor contribution for blasting operations is described in the air quality modeling report prepared for Midas Gold Idaho, Inc. (Midas Gold) (Air Sciences 2018).

The estimated annual consumption of petroleum fuels for Alternative 1 is summarized in **Table 4.4-2**. Stationary fuel-combustion sources include water pumps, generators, and heaters that would be diesel engine or propane-fired units. Consumption of diesel fuel and gasoline represents use by highway and off-highway vehicles (OHVs), non-road construction and earthmoving equipment, and stationary engines. Combustion of propane from propane-fired heaters is represented by the total delivered and stored pressurized bulk liquid.

An overall estimate of GHG emissions (expressed in CO_2eq) for annual operations of Alternative 1 also is provided in **Table 4.4-2**. Based on estimated annual use of petroleum fuels for all uses, the total GHG emissions would be 67,400 MT CO_2eq/year. The combustion product CO_2 accounts for over 99 percent, even though CH_4 and N_2O have substantially higher global warming potential factors. The contributions for CH_4 and N_2O are 0.1 percent and 0.7 percent, respectively, in terms of MT CO_2eq per year. Most of this (95 percent) is from mobile sources. Only approximately 3,215 MT CO_2eq/year would be from stationary sources.

Development and related operations of Alternative 1 would result in an increase in regional GHG emissions compared to existing conditions, and therefore could be viewed to contribute, incrementally, to climate change. Between 2000 and 2010, statewide total GHG emissions averaged 29.6 million MT CO_2eq, as presented in **Table 3.4-1**. On this basis, Alternative 1 annual emissions represent approximately 0.23 percent of the statewide GHG emission inventory, and slightly over 5 percent of the industrial process category for Idaho, which includes mining. On a national scale, Alternative 1 emissions would represent 0.01 percent of the national GHG inventory. This fact precludes meaningful quantification of the indirect effects that operations may have on climate. The potential for incremental contribution to the global GHG inventory can be viewed qualitatively based on reported emissions compared to the current state inventory.

Table 4.4-2 Fuel-Combustion Source Annual GHG Emissions for Alternative 1

Emission Source Category	Fuel Consumption (gal/yr)	Carbon Dioxide (CO_2) [1] (MT/yr)	Methane (CH_4) [2] (MT/yr)	Methane (CH_4) [3] ($MTCO_2eq/yr$)	Nitrous Oxide (N_2O) [2] (MT/yr)	Nitrous Oxide (N_2O) [3] ($MTCO_2eq/yr$)	Emissions Totals ($MTCO_2eq/yr$)
Mobile Combustion Engine Sources Distillate No. 2 Fuel [1]	5,800,000	59,218	3.31	82.6	1.51	449.4	**59,755**
Mobile Combustion Engine Sources - Motor Gasoline Fuel	500,000	4,390	0.25	6.3	0.11	32.8	**4,430**
Stationary Combustion Units - Propane Fuel	560,000	3,203	0.15	3.8	0.03	8.3	**3,215**
Subtotals for MT Emissions and CO2eq MT/yr	N/A	**66,811**	**3.71**	**92.7**	**1.65**	**490.5**	**67,400**
Percent of Total Annual Emissions (MTCO2eq Basis)	N/A	99.2	--	0.1	--	0.7	N/A

Source: Midas Gold 2016

Table Notes:

1 CO_2 emissions are calculated from the annual fuel consumption in gallons/yr, multiplied by the EPA emission factors in **Table 4.4-1**.

2 For CH_4 and N_2O calculated from the annual fuel consumption in gallons/yr, multiplied by the EPA emission factors in **Table 4.4-1**.

3 CO_2eq results are MT emissions multiplied by the global warming potential for CH_4 and N_2O.

gal/yr = gallon per year; yr = year; N/A = not applicable; MT/yr = metric tons per year; $MTCO_2eq/yr$ = metric tons carbon dioxide equivalent per year

Overall, as shown in **Table 4.4-2**, implementation of Alternative 1 would be expected to generate a total of approximately 67,400 MT CO_2eq/year. There is no guidance for GHG significance levels considering mobile source emissions, which represent the majority of the emissions from Alternative 1. It also should be noted the stationary source emissions for Alternative 1 would not exceed the 25,000 MT CO_2eq reporting threshold for the 2009 Mandatory GHG Reporting Rule, which is to consider contributions from stationary sources only. The combined stationary and mobile source emissions of Alternative 1 would not exceed the EPA's threshold of 100,000 MT/year CO_2eq, at which major stationary source permitting would be required.

Alternative 1 includes several SGP design and operational features, such as implementing air emission controls on the oxidation and neutralization, gold and silver leaching and carbon adsorption, and gold and silver electrowinning and refining processes, which serve to limit GHG contributions. Additionally, revegetation of disturbance areas also would occur under Alternative 1.

Although reasonable estimates for GHG emissions may be derived for a specific activity, there is uncertainty in evaluating longer-term emissions levels and the relationship between GHG sources and sinks over a lengthy and uncertain timeframe. Because climate change effects resulting from GHG emissions are global in scale, there is no reliable way to quantify whether or to what extent local GHG emissions contribute to observed regional trends, or the larger global phenomenon. Therefore, meaningful connection of Alternative 1 GHG emissions to climate change effects at the state, regional, or global level cannot be provided.

4.4.2.1.1.2 Indirect GHG Emissions

Two indirect sources of GHG emissions associated with Alternative 1 are: 1) electrical power generated off-site but used on-site; and 2) energy costs for transport and refinement of antimony concentrate.

4.4.2.1.2 Off-Site Generated Power

Electricity for the mine site would be provided via a transmission line connected to the grid. The supplier of the electricity would be the Idaho Power Company (IPCo). IPCo obtains approximately half its energy from hydropower, which does not emit GHGs. The remaining power is derived from coal-fired power plants, as well as other sources. Between 2010 and 2019, IPCo generated electricity at an average CO_2 emission rate of 848 pounds per megawatt hour (MWh). This rate is 29 percent lower than it was in 2005, and IPCo plans to maintain an emissions intensity of at least 15 to 20 percent below 2005 levels through 2020. Emissions in 2019 were 543 pounds per MWh (IPCo 2019).

Alternative 1 is estimated to utilize approximately 40 to 50 MWs at full production, which would be equivalent to approximately 394,200 MWh annually. Therefore, Alternative 1 would be indirectly responsible for emissions of approximately 214 million MT of CO_2 annually, using current IPCo emission rates per MWh. However, it should be noted this existing utility source of electricity would not be considered a new source and would not trigger additional Clean Air Act permitting under the New Source Review or Title V operating permits.

4.4.2.1.3 EMISSIONS FROM ANTIMONY TRANSPORT AND PROCESSING

Under Alternative 1, gold would be primarily purified on-site and poured into doré bars (an alloy of gold and silver). GHG emissions associated with this process are accounted for in the indirect electricity-related emission estimates. However, the antimony-bearing froth/slurry would be separated and processed off-site. The antimony concentrate would be transported from the mine site for off-site smelting and refining. It is unknown at this time where or how the concentrate from the mine would be processed, and depending on the buyer, it could be processed by any number of companies, in any number of states or foreign countries.

Transportation of the antimony concentrate for off-site processing also would result in indirect GHG emissions under Alternative 1. Because it is unknown at this time where the concentrate from the mine would be processed, GHG estimations associated with the transport of antimony concentrate are speculative and cannot be quantified. However, emissions per mile of transport can be estimated to quantify this indicator. Alternative 1 estimates one truck per day of antimony concentrate hauled from the mine site. About 22.5 pounds (10.2 kilograms) of CO_2 are produced from burning 1 gallon of diesel fuel (see **Table 4.4-1**), and at the fuel consumption rate of typical on-road haulage trucks, approximately 135 pounds of CO_2 would be generated per mile for each truck.

There is very little information on the energy usage, and GHG emissions, of smelting and refining antimony concentrate. None of the major countries that actively produce antimony (i.e., China, Russia, Bolivia, Tajikistan, Turkey, and Myanmar) report GHG emissions from the process; however, this specialized mining sector is not considered a substantial source of GHG emissions worldwide. GHG emissions from gold smelting have been shown to have electrolytic refining requirements of approximately 325 kilowatt hours per metric ton of gold (Norgate and Haque 2012). Assuming a similar electrolytic refining requirement for the estimated 44,015 metric tons of antimony concentrate that would be generated at the site (as described under Alternative 1), refining antimony would require approximately 14,304,875 kilowatt hours (14,304 MWh). Using IPCo's CO_2 current emission rate of 543 pounds per MWh, refining all the antimony concentrate would generate an additional 8,940,000 pounds (4,055 metric tons) of GHG emissions. While this calculation provides an estimate of GHG emissions from electrolytic refining of gold, rather than antimony, it can be used as part of the indicator for overall SGP GHG emissions.

4.4.2.1.4 CLIMATE CHANGE IMPACTS TO ANALYSIS AREA RESOURCES

Effects of ongoing climate change in the SGP area following implementation of Alternative 1 would be largely the same as those that would occur regionally and in Idaho without the SGP. Due to the nature of the resource, noise would not be impacted by climate change.

4.4.2.1.4.1 Geologic Resources and Geotechnical Hazards

Changes in landcover and slope stability (e.g., pit slopes or slopes adjacent to roadways) due to changing climate conditions and SGP activities could exacerbate certain geologic hazards in the analysis area under Alternative 1. Geotechnical design standards have been proposed to help minimize and mitigate the extent of stability impacts, but climate change could increase the severity of impacts to geologic characteristics over time. Changes in landcover and slope stability due to climate change could create conditions that cause more frequent landslides, damaging vegetation and other forest resources. Landslides also could potentially impact surface water resources through increased sedimentation and runoff.

4.4.2.1.4.2 Air Quality

Alternative 1 would require obtaining an air quality permit from Idaho Department of Environmental Quality and implementing various air quality controls that would likely have the associated benefit of reducing GHG emissions compared to uncontrolled conditions. The sources affected would include surface mining, fugitive dust from off-highway trucks, and process emissions. Additional SGP design measures would be adopted to reduce air quality impacts also would reduce GHG emissions. Busing and/or vanpooling would be provided to minimize traffic, which also would reduce dust emissions, sediment runoff, and GHGs from vehicle tailpipes.

These mitigation measures or design features would tend to reduce particulate matter emissions that otherwise would be higher as a result of climate change. One example is disposal of thickened tailings that would form a hardened crust at the tailings storage facility (TSF) at the mine site (Midas Gold 2016). This method would limit the potential for wind erosion and fugitive dust as climate change affects local winds, precipitation, and temperature. “Smart grid” technology also would be used to reduce energy consumption and emissions of GHGs due to lower power use at the mine site. Additionally, selection of road construction materials and application of natural and chemical dust suppressants would limit the potential for roadway dust emissions as climate change affects local precipitation and temperature. These processes and controls will help to minimize impacts to air quality as a result of climate change during construction and operation of Alternative 1; however, increased particulate matter and other criteria pollutants as a result of climate change (e.g., potential for increased wildfires and decreased groundcover resulting in more particulates in the air) could persist within the SGP area (Jacob and Winner 2009).

4.4.2.1.4.3 Soils and Reclamation Cover Materials

Alternative 1 would include reclamation of impacted soils in the SGP area. Much of this soil is currently poor quality (for example, old tailings piles), and would be unlikely to naturally revegetate at a normal rate. Proposed improvements to soil as part of preparing the soil for reclamation activities under Alternative 1, such as increasing fines and the addition of organic carbon, could allow the soil to retain more moisture during the summer, even as climate change is expected to reduce summer precipitation (Halofsky et al. 2018; Runkle et al. 2017).

Reclamation would help minimize the climate-induced impacts to soils in the short-term; however, changes in soil moisture and temperature could lead to changes in soil properties and functions, potentially diminishing the soil quality over time (Halofsky et al. 2018). Consequently, diminished soil quality could hinder reclamation efforts involving revegetation of disturbed areas in the SGP area.

4.4.2.1.4.4 Hazardous Materials

Under Alternative 1, various materials and chemical reagents, including fuel, explosives, and ore processing reagents, would be transported for use at the mine site. Aboveground tanks also would be used to store fuels, lubricants, coolants, hydraulic fluids, propane, explosive materials, and nitric and sulfuric acid. To minimize risk of spills, Midas Gold would comply with the EPA Toxic Release Inventory Program; develop a Spill Prevention, Control, and Countermeasure Plan; and develop a Hazardous Materials Handling and Emergency Response Plan. Although these procedures would minimize the risk and likelihood of a spill, climate change could potentially affect the severity of a spill. Climate-change related trends with respect to annual periods of frozen ground, variability in the groundwater tables, increased precipitation and flooding, and conditions affecting the ability of crews to quickly implement response measures would all factor into spill severity. These impacts would be experienced during construction, operation, and closure and reclamation, and should be considered in the development of the Spill Prevention, Control, and Countermeasure Plan and Hazardous Materials Handling and Emergency Response Plan.

4.4.2.1.4.5 Surface Water and Groundwater (Quality and Quantity)

Water would be required for ore processing, surface and underground exploration, dust control, and potable or domestic use under Alternative 1. It would be supplied from a combination of collected runoff water, water recycled from ore processing facilities, and water reclaimed from the TSF (Midas Gold 2016). Much of this water supply and the supporting infrastructure is dependent on streamflow, which is vulnerable to the physical factors of climate change.

Regional climate change could affect the ability of SGP area streams to maintain previous flow rates and recharge of water supply due to changes in Idaho snowpack and precipitation patterns (Halofsky et al. 2018). The ore processing facility would represent the primary consumer of water associated with mining operations and approximately 80 percent of this water would be continually recycled. This practice would improve resiliency of water availability and would help to minimize adverse effects from changes in regional streamflow by maintaining instream flows and protecting aquatic species and downstream uses.

Streams in the mine site could potentially be less impacted than nearby natural streams if water handling methods associated with Alternative 1 adjust with changing precipitation conditions. For example, it is predicted that winter flows would slightly increase while spring and summer flows would decrease (Halofsky et al. 2018); this means that structures that retain winter precipitation (such as the post-mining pit lakes) could help maintain adequate flow in the summer. Changes designed to increase infiltration of surface water may work to extend flow and recharge the water supply during drier periods. Without consideration of climate change impacts during construction and operation, Alternative 1 could exacerbate impacts such as diminished water quality from lower average streamflows.

Climate conditions causing decreased streamflow and warmer water temperatures could lead to diminished water quality for streams in the SGP area. Alternative 1 components such as diversions of the West End Creek, the East Fork South Fork Salmon River (EFSFSR) around the existing Yellow Pine pit, and the lower reaches of Midnight Creek and Hennessy Creek have been designed to help improve water quality in the SGP area (see Section 4.9, Surface Water Quality); however, the additional impacts to water quality from climate change may require supplementary measures to mitigate these impacts. There have been no additional, supplementary, mitigation measures developed at this time.

A portion of the water supply for Alternative 1 would come from fresh water pumped from groundwater dewatering wells around the Hangar Flats pit in the Meadow Creek drainage and around the Yellow Pine pit in the EFSFSR. Groundwater in central Idaho is recharged by precipitation and snowmelt, and reductions in the longevity of snowpack and variable precipitation may lead to faster runoff and less groundwater recharge (Halofsky et al. 2018). Climate change impacts to groundwater could decrease the availability of groundwater and the groundwater quality in the area, which could be exacerbated by construction and operation activities under Alternative 1.

4.4.2.1.4.6 Vegetation: General Vegetation Communities, Botanical Resources, and Non-Native Plants

Construction activities under Alternative 1 would require removal of vegetation, including whitebark pine individuals, which is a potential candidate plant species and can be at risk to the spread of insects and disease in a changing climate (Keane et al. 2017). As an ongoing component of the operational phase, and later closure and reclamation, Alternative 1 would involve revegetating areas disturbed by historic mining, construction, and operation activities in the SGP area. Seed mixtures would consist of certified weed-free native herb and grass species, adjusted to fit elevation and aspect ranges in the area, and would be approved by the Forest Service. Native trees and shrubs also would be planted, as well as disease-resistant whitebark pine seedlings.

Revegetation efforts would likely represent an improvement over areas of existing poor-quality soils; however, revegetation of the disturbed mine site and legacy impacted areas would likely be difficult due to current trends for climate change. Adaptive management strategies, such as noxious weed-free seed mixes, could provide opportunities for more successful revegetation efforts. Longer periods of precipitation deficit in the summer paired with decreasing snowpack could create new challenges for vegetation ecosystems (Halofsky et al. 2018). Reclamation of heavily degraded ecosystems usually requires intensive management techniques, which may include soil enrichment, weed treatment, and seeding and/or planting of desirable species. Reclamation efforts in heavily degraded systems usually require repeated efforts, and successful revegetation may not be achieved for decades (Stanturf et al. 2014). Additionally, long-term reclamation may require adaptive revegetation strategies and a focus on ecosystem function rather than species composition, as initial revegetation plans may become infeasible due to changing climate conditions and land use requirements (Stanturf et al. 2014). It will be important to consider possible future changes in weather patterns, precipitation amounts and seasonality, and resilience of species to fire and drought when identifying reclamation methods and goals.

4.4.2.1.4.7 Wetlands and Riparian Resources

Final closure and reclamation of the mine site, conducted under an agency-approved Reclamation and Closure Plan, would reestablish wetlands impacted by Alternative 1 during construction and operation where feasible and practical. Depending on the type of wetland and adjacent environmental conditions, certain wetlands in the SGP area may be able to recover rapidly from construction and operation-related impacts and would likely be the least affected by longer-term climate change. However, some wetlands with narrower environmental tolerances, or those that take longer to reestablish and stabilize, would be vulnerable to additional impacts from climate change trends such as lower streamflows and less groundwater recharge (Halofsky et al. 2018). Alternative 1 would involve constructing features on the East Fork of Meadow Creek (Blowout Creek) to raise groundwater levels and address ongoing erosion, which would help to stabilize the existing wetlands in the valley and reclaim the pre-reservoir conditions that support wetlands and riparian features. Implementing these types of features in other areas would help to minimize climate change impacts by supporting wetland reestablishment.

4.4.2.1.4.8 Fish Resources and Fish Habitat

Under Alternative 1 fish habitat would be reconstructed as part of the reclamation phase, which may mitigate some expected climate change impacts, such as warmer water temperatures and reduced stream flows. However, the structure and function of fish habitats would need to be fully reclaimed to minimize species vulnerability. Additionally, if stream habitat is restricted by these changing conditions, the Hangar Flats pit lake (the only body of water in the SGP area that would be accessible to fish) could potentially act as a refuge for aquatic species. However, this may have adverse consequences; for example, juvenile Chinook salmon would be at higher risk of predation from bull trout in the Hangar Flats pit lake (see Section 4.12, Fish Resources and Fish Habitat). Habitat connectivity also is an important consideration during operations and reclamation because sensitive species like the bull trout and other migratory species would be the most vulnerable to climate change impacts and loss of habitat connectivity.

4.4.2.1.4.9 Wildlife and Wildlife Habitat

Climate change impacts to wildlife and wildlife habitat in the SGP area would include habitat loss and fragmentation, physiological sensitivities, and alterations in the timing of seasonal life cycles. Habitat loss and fragmentation may occur in the region and analysis area due to the increased potential for wildfire that is anticipated from changing climatic conditions (Halofsky et al. 2018). Under Alternative 1, construction and operation of the mine site, access roads, utilities, and off-site facilities would further exacerbate wildlife impacts from habitat loss and fragmentation. Reclamation activities are intended to achieve post-mining land use for wildlife habitat, which would help to reclaim habitat connectivity. However, the post-closure reclamation activities were developed to help offset Alternative 1 wildlife impacts, and were not designed to offset wildlife impacts due to climate change impacts.

4.4.2.1.4.10 Timber Resources

Timber resources in the SGP area are vulnerable to climate change impacts such as changing temperatures and precipitation patterns, increased wildfire frequency and intensity, and insects and disease. Direct effects of climate change on timber (e.g., temperature and precipitation) are likely to be minor, but indirect effects from various disturbances (e.g., increased temperatures and warmer winters causing insect and disease outbreaks) may be significant for the timber industry (Halofsky et al. 2018).

Alternative 1 would result in ground disturbance in locations currently covered by forested vegetation, and constructing facilities associated with the mine site, access roads, utilities, and off-site facilities would require the removal of timber resources in the SGP area. Post-closure, all disturbed areas would be revegetated under Alternative 1. This would be achieved through a combination of infrastructure removal, soil preparation, direct seeding, and tree planting. To address losses of vegetation from disturbance associated with Alternative 1, the Reclamation and Closure Plan proposes to replant 472 acres with conifer and other tree species, which will be located completely within the mine site (see Section 4.14, Timber Resources). Some reclamation efforts would be concurrent with operations, but the success of the reclamation cannot be predicted due to the increased risk of wildfire and tree decay from insects and disease (American Forests 2017; Halofsky et al. 2018). Therefore, these reclamation efforts cannot be relied upon to offset the GHG emissions from Alternative 1.

4.4.2.1.4.11 Land Use and Land Management

Alternative 1 would alter land use in areas of new or expanded right-of-way and easements to accommodate access roads, utilities, and off-site facilities. Climate change could impact how lands in the SGP area are used, altering the surrounding environment (e.g., decreasing ground cover, larger burn areas, decreased stream flows impacting how the area is used for recreational or designated tribal purposes) and impacting accessibility. Alternative 1 would maintain public access in recreational areas surrounding the SGP area, but would restrict activities at the mine site during construction, operation, and closure and reclamation, which minimize climate change impacts to land use be helping help to support current recreational land uses within the SGP area. Land management is not expected to be impacted by Alternative 1.

4.4.2.1.4.12 Access and Transportation

Access to and through the SGP area would be maintained under Alternative 1 during construction, operation, and closure and reclamation, except there would be no public access through the mine site during construction and operations. Climatic changes causing an increase in catastrophic events, such as floods, landslides, and avalanches, can add stress to roadways and other infrastructure, which may result in more frequent maintenance and repairs. Roads and infrastructure near their design life are more susceptible to climate change impacts. Additionally, the magnitude of impacts may vary for infrastructure and access roads located in the valley versus ridgetop locations. Road maintenance during construction, operation, and reclamation would involve repair to deteriorated roadway segments or for emergency road repairs, which would help to minimize climate change impacts. Continual attention to road conditions would help to address damage or other issues that may occur due to climate change; however, catastrophic damages due to flash floods, avalanches, or landslides could impact access roads and other transportation infrastructure in the SGP area.

4.4.2.1.4.13 Cultural Resources and Tribal Rights and Interests

Alternative 1 would impact ten historic properties, due to extensive ground and visual disturbance in the SGP area. Changing climatic conditions are expected to exacerbate the damage and loss of cultural resources and natural areas designated for tribal uses such as hunting, fishing, and gathering in the SGP area through increased soil erosion, more frequent and intense wildfires, flooding, degraded water quality, and wildlife and fish habitat impacts. There are mitigation measures to avoid and minimize impacts to cultural resources and tribal rights and interests under Alternative 1 in the SGP area, which also may help to minimize potential effects from climate change.

4.4.2.1.4.14 Public Health and Safety

Climate change impacts to public health and safety would be experienced through impacts to air, soil, and water quality. Alternative 1 has the potential to impact public health and safety through the release of chemicals to the environment, natural environmental hazards, economic impacts, changes to public services and infrastructure, and impacts to the local population.

Climate change could exacerbate some Alternative 1 impacts to public health and safety by affecting the way spills are handled or enter the environment. It also could increase the frequency and amplify the impacts of natural hazards such as avalanches and landslides, flash floods, and wildfires (Halofsky et al. 2018). More frequent heat waves could increase employee health risks due to extreme heat exposure, especially for employees with pre-existing health conditions or who work outdoors. More extreme heat days and higher temperatures over time could increase air quality and health risks over both the short and long term, impacting the public and the employees' abilities to work (Runkle et al. 2017).

4.4.2.1.4.15 Recreation

Much of the SGP area is used for recreation year-round, which would be both directly and indirectly impacted by climate change. Alternative 1 has the potential to impact recreational access, recreation facilities, dispersed recreation areas, special use permits, recreational motorized travel, and recreation use affected by changes in recreation facilities, opportunities and setting. Direct impacts from climate change would include variable precipitation and rising temperatures, which could affect individual decisions to recreate in a certain area. Indirect impacts from climate change would be experienced through the changing conditions that may alter the recreation facilities, opportunities, and setting.

Recreation access and other facilities could be negatively impacted by road or structural damage caused by flooding, landslides, or avalanches. Changing climatic conditions could alter the ecological conditions that affect the quality of the recreation experience, including warmer water temperatures, decreased streamflow, and habitat loss and fragmentation. In the Rocky Mountain region, it is expected that snow-based activities (skiing, snowmobiling) would be impacted negatively by climate change due to warmer futures (Halofsky et al. 2018). Primitive area use, horseback riding on trails, motorized water activities, birding, hunting, and fishing in the region also are expected to be negatively influenced by climate change; however, longer periods of warmer temperatures are expected to increase participation in warm-weather activities such as swimming and hiking (Askew and Bowker 2018).

4.4.2.1.4.16 Scenic Resources

Alternative 1 would impact scenic resources in the SGP area through construction and operation of new facilities and roads. Because much of the SGP area vegetation has been characteristically burned by past wildfires, the visual impacts of these new facilities would be amplified as there are less trees to block views. Under Alternative 1, the Forest Service would be consulted for concurrence with visual quality objectives to reduce visual contrast of structures and surfaces; however, if changing climate conditions continue to increase the frequency and intensity of wildfires, more vegetation in the SGP area could be lost, creating greater visibility of the mine site and associated facilities and infrastructure.

4.4.2.1.4.17 Social and Economic Conditions

Socioeconomic impacts from Alternative 1 are predominantly associated with the development and operations at the mine site and off-site facilities. Alternative 1 would create more efficient recreation access to support tourism and employ both local and non-local residents in the trade industry that would commute in and out of the area and purchase local goods and services. Although warmer temperatures could increase participation in some warm-weather activities, many other recreation activities could be negatively impacted by climate change. Mine site construction and operations could help to support the viability of local communities and offset potential adverse climate change impacts.

4.4.2.1.4.18 Environmental Justice

Alternative 1 has the potential to impact Native American communities by restricting their access to traditional hunting and fishing lands. Changing climate conditions could exacerbate the impacts felt by these communities as warmer water temperatures, decreased streamflow, and habitat loss and fragmentation continue to impact the natural resources in the SGP area.

4.4.2.1.4.19 Special Designations

Climate change impacts would not directly impact the special designations of areas under Alternative 1 but could impact the environmental conditions in these areas and cause indirect effects to these designations. Variable precipitation, decreased streamflow, and more precipitation falling as rain instead of snow could impact the characteristics and quality of these areas. The Burntlog Route and other alternative components would be constructed adjacent to or within wilderness areas, eligible wild and scenic rivers, Inventoried Roadless Areas (IRAs), and Research Natural Areas (RNAs) under Alternative 1. This would impact wildlife, wildlife habitat, and wilderness characteristics by fragmenting habitat, bringing noise and light disturbance to previously undisturbed areas, and increasing the potential for non-native invasive plant species, pathogens, or insects to spread to these areas. Climate change may further intensify impacts to special designation areas by contributing to habitat fragmentation, magnifying the potential for insects and disease to spread, or hindering the ability for native vegetation to reestablish as disturbed areas are revegetated during reclamation efforts.

4.4.2.2 Alternative 2

Alternative 2 includes modifications to component alternatives that are anticipated to result in relatively small increases in GHG emissions (**Figure 2.4-1** and **Figure 2.4-2**). Although there are no modifications designed to specifically reduce GHG emissions or address climate change impacts, some of the Alterative 2 design features may help to minimize various resource impacts. Alternative 2 includes a limestone kiln, which would increase GHG emissions through propane fuel combustion and release of CO_2 by reactions during the limestone calcining process (i.e., heating to a high temperature). The added GHG emissions for the limestone kiln operation are quantified for Alternative 2 below. The on-site generation of lime would reduce the number of lime delivery truck trips annually to the mine site by more than 2,900, but would require an average of 133 additional propane deliveries per year (Midas Gold 2016).

Alternative 2 also would include the addition of a Centralized Water Treatment Plant (WTP) near the Ore Processing Facility as part of a Water Quality Management Plan. The Centralized WTP would require approximately 40 additional annual truck trips during operations for water treatment-related chemical deliveries. Post-closure, the Centralized WTP would continue to operate in perpetuity (with approximately 34 annual truck trips for chemical deliveries and removal of residuals). Operation of the Centralized WTP in perpetuity also would require continued operation of the new transmission line.

Although the Centralized WTP would require additional truck trips, there would be an overall net reduction of operational truck activity under Alternative 2 due to the on-site generation of lime. However, the reduced GHG emissions for the net reduction in delivery truck activity would largely be offset by off-highway mining haul truck traffic bringing limestone to the lime generation process, at approximately two trucks per day. These trucks are much larger, and while they travel a short distance, they carry much larger volumes of materiel (400 tons per load) and burn 100 gallons of fuel per hour of operation. Assuming each truck operates one hour per day, five days per week, that is 200 gallons of diesel per day. At 19.4 pounds/gallon CO_2 emissions, over 260 days per year, that is approximately 500 tons of CO_2 per year from limestone hauling.

Alternative 2 also includes several changes to access roads in the SGP area, to surface water management, and the construction of a public access road through the mine site. Since the overall construction activity for the SGP would not be significantly affected by these roadway changes, it can be assumed the GHG emissions related to the road construction and operation under Alternative 2 would not differ substantially from those described under Alternative 1.

4.4.2.2.1 GHG EMISSIONS

The GHG emissions increases from operation of the lime generation process on an annual basis are shown in **Table 4.4-3**. In Section 4.3, Air Quality, the relative annual emission rates were quantified for pollutants related to fuel combustion (carbon monoxide and nitrogen oxides) compared to Alternative 1. These sources were estimated to have between a 4 or 5 percent higher emission rate for Alternative 2, primarily due to the higher propane consumption required for the on-site limestone kiln. These incremental increases also consider the reduction in truck delivery traffic that would average eight delivery trips per day over the Burntlog Route (basis: 2,900 trips per 365 days). It is reasonable to assume that GHG emissions due to more vehicle travel at the mine site (lime haul) under Alternative 2 would have comparable increases in annual emission rates. Additionally, no measurable increase in GHG emissions is expected from the 40 annual truck trips associated with the Centralized WTP.

Overall, the net GHG emissions related to the lime generation process and related mining and material handling represents a small portion of air emissions from the action alternative sources. For the limestone kiln, GHG emissions would occur due to propane combustion and loss of CO_2 by reactions in the kiln. Details of the emissions estimates for Alternative 2 are provided in **Appendix F-1** (Lime Generation Option), which were reproduced from Appendix A of the report entitled Air Quality Analysis prepared for Midas Gold (Air Sciences 2018).

Table 4.4-3 Fuel-Combustion Source Annual GHG Emissions for Alternative 2

Emission Source Category	Alternative 2 Fuel Consumption or Limestone Feed	Carbon Dioxide (CO_2)[1] (MT/yr)	Methane (CH_4)[2] (MT/yr)	Methane (CH_4)[3] ($MTCO_2eq$/yr)	Nitrous Oxide (N_2O)[2] (MT/yr)	Nitrous Oxide (N_2O)[3] ($MTCO_2eq$/yr)	Emissions Totals ($MTCO_2eq$/yr)
Lime Kiln Operation – Propane Combustion	152,629 MMBtu/yr.	10,580	12.5	313	30.0	8,940	19,876
Lime Kiln Operation – Loss by Reaction	83,000 ton/yr.	30,311	No Emissions	No Emissions	No Emissions	No Emissions	30,311
Mobile Combustion Engine Sources Distillate No. 2 Fuel [1]	5,800,000	59,218	3.31	82.6	1.51	449.4	59,755
Mobile Combustion Engine Sources - Motor Gasoline Fuel	500,000	4,390	0.25	6.3	0.11	32.8	4,430
Stationary Combustion Units - Propane Fuel	560,000	3,203	0.15	3.8	0.03	8.3	3,215
Subtotals for MT Emissions and CO_2eq MT/yr	N/A	107,702	16.2	405.7	31.7	89,430.5	117,587

Table Source: Midas Gold 2016

Table Notes:

1 CO_2 emissions are calculated from the annual fuel consumption, multiplied by the EPA emission factors in **Table 4.4-1**.

2 For CH_4 and N_2O calculated from the annual fuel consumption, multiplied by the EPA emission factors in **Table 4.4-1**.

3 CO_2eq results are MT emissions multiplied by the global warming potential for CH_4 and N_2O.

gal/yr = gallon per year; MMBtu/yr = Million British Thermal Units per year; MT/yr = metric tons per year; $MTCO_2eq$/yr = metric tons carbon dioxide equivalent per year; N/A = not applicable; yr = year

4.4.2.2.2 CLIMATE CHANGE IMPACTS TO SGP AREA RESOURCES

The anticipated climate change impacts in synergy with the SGP for Alternative 2 would be the same as those discussed under Alternative 1 for the following resources of this EIS: geologic resources and geotechnical hazards, air quality, soils and reclamation cover materials, hazardous materials, vegetation (including general vegetation communities, botanical resources, and non-native plants), wetlands and riparian resources, timber resources, land use and land management, access and transportation, cultural resources, recreation, scenic resources, social and economic conditions, environmental justice, special designations, and tribal rights and interests. Surface water and groundwater (quality and quantity), fish resources and fish habitat, wildlife and wildlife habitat, and public health and safety impacts under Alternative 2 are described below.

4.4.2.2.2.1 Surface Water and Groundwater (Quality and Quantity)

Alternative 2 includes changes in surface water management in response to potential effects on streamflow, water temperatures, and water quality. Alternative 2 also would include process and design modifications in response to potential issues related to surface water and groundwater. Although the anticipated impacts from climate change would be the same as Alternative 1, it is expected that the proposed modifications under Alternative 2 would help to minimize the severity of climate change impacts to surface water and groundwater quality and quantity. This would occur through changes in water management that are designed to improve streamflow and water quality in the SGP area, such as rerouting Hennessy Creek during mining, lining the Meadow Creek diversion channel further down the drainage, piping low flows in stream diversions to prevent water warming, and continuing to use the rapid infiltration basins during seasonal low flows.

4.4.2.2.2.2 Fish Resources and Fish Habitat

The anticipated impacts from climate change would be the same as Alternative 1 for fish resources and fish habitat; however, the Alternative 2 changes in surface water management also would help to minimize the severity of climate change impacts to fish resources and fish habitat. Lower streamflows, increased water temperatures, and decreased water quality would adversely impact aquatic species and habitat. Process and design modifications, such as rerouting Hennessy Creek, Lining the Meadow Creek diversion channel, piping low flows, and continued use of rapid infiltration basins would help to minimize these impacts.

4.4.2.2.2.3 Wildlife and Wildlife Habitat

Alternative 2 includes process and design modifications that were developed in response to potential issues related to wildlife habitat. Although the impacts from climate change would be the same as Alternative 1, some of the modifications would help to mitigate impacts to wildlife and wildlife habitat by minimizing habitat loss and fragmentation. This would occur through shortening the Burntlog Route, decreased truck traffic on access roads due to on-site lime generation, and surface water management changes that would benefit wildlife species that prey on fish or otherwise use the mine site streams.

4.4.2.2.2.4 Public Health and Safety

Alternative 2 includes changes in surface water management in response to potential effects on streamflow, water temperatures, and water quality (see Section 4.4.2.2.2.1, Surface Water and Groundwater [Quality and Quantity]) under Alternative 1. Although the anticipated impacts from climate change would be the same as Alternative 1, these additional water management measures could help to minimize impacts to public health and safety by improving water quality issues resulting from climate change.

4.4.2.3 Alternative 3

The components under Alternative 3 were developed to reduce adverse impacts to federally listed fish species, and surface water primarily related to water quality and temperature by moving the TSF location. (**Figure 2.5-1** and **Figure 2.5-2**). Although there are no modifications designed to specifically reduce GHG emissions or address climate change impacts, some of the changes may help to minimize various resource impacts. Meadow Creek TSF and Hangar Flats Development Rock Storage Facility (DRSF) would be relocated under Alternative 3 to the EFSFSR valley. This also would require realigning several mine site facilities and rerouting approximately 2.5 miles of new transmission line from the Johnson Creek substation to the mine site. Surface water management would be the same as Alternative 1, except channels would divert the EFSFSR and runoff around the TSF (the diversion of Meadow Creek would not be needed). An approximately 3.2-mile segment of the Burntlog Route would be rerouted through Blowout Creek valley, and there would be no public access through the mine site during mine operations. Additionally, the OHV connector would not be constructed under Alternative 3.

4.4.2.3.1 GHG Emissions

In general, the GHG emissions for Alternative 3 will be the same as Alternative 1. Possible differences between these two alternatives would not be greater than the uncertainty in the GHG emission estimates derived by generalized emission factors for fuel combustion.

Relatively small changes in roadway routes would be involved under Alternative 3, which are not substantive enough to affect GHG emissions overall. The Burntlog Route would be designed and constructed the same as Alternative 1. Due to the TSF and DRSF location, a 3.2-mile segment of Burntlog Route and the main gate entrance would be relocated to the Blowout Creek drainage. Based on relative roadway length and areas affected, these changes in alignment would represent a small increase in overall construction phase GHG emissions. However, the magnitude of the emissions difference would be small compared to total construction GHG emissions.

4.4.2.3.2 Climate Change Impacts To SGP Area Resources

The anticipated climate change impacts for Alternative 3 would be the same as those discussed under Alternative 1 for the following resources of this EIS: geologic resources and geotechnical hazards, air quality, soils and reclamation cover materials, hazardous materials, surface water (quantity) and groundwater (quality and quantity), vegetation (including general vegetation communities, botanical resources, and non-native plants), wetlands and riparian resources, timber resources, land use and land management, access and transportation, cultural resources, public health and safety, scenic resources, social and economic conditions, recreation, environmental justice, and tribal rights and interests. Impacts to surface water (quality), fish resources and fish habitat, wildlife and wildlife habitat, and special designations under Alternative 3 are described below.

4.4.2.3.2.1 Surface Water (Quality)

Although surface water management under Alternative 3 would be the same as Alternative 1, the Meadow Creek TSF and Hangar Flats DSRF would be relocated to the EFSFSR valley. Relocating the TSF would serve to reduce adverse impacts to water quality and temperature in Meadow Creek. These measures are expected to minimize the severity of climate change impacts resulting in degraded water quality and warmer surface water temperatures.

4.4.2.3.2.2 Fish Resources and Fish Habitat, and Wildlife and Wildlife Habitat

Alternative 3 would relocate the Meadow Creek TSF and Hangar Flats DSRF to the EFSFSR valley to potentially address issues related to Endangered Species Act-listed candidate species habitat and communities, as well as IRAs in the SGP area. Although the impacts from climate change would be the same as Alternative 1, there would be somewhat less fragmentation of the terrestrial and fish habitat for the altered features in Alternative 3. The OHV connector would not be constructed, which would minimize terrestrial habitat fragmentation, and the TSF would be relocated to avoid fish and fish habitat impacts in Meadow Creek. These design features could assist wildlife and fish and aquatic species to tolerate future climate change because of less fragmentation from SGP.

4.4.2.3.2.3 Special Designations

Alternative 3 would relocate the Meadow Creek TSF and Hangar Flats DSRF to the EFSFSR valley drainage to potentially address issues related to IRAs in the SGP area. Although the impacts from climate change impacts would be the same as Alternative 1, it is expected that the improvements to avoid fragmentation would help to minimize impacts to IRAs.

4.4.2.4 Alternative 4

Under Alternative 4 the Yellow Pine Route would be used for access to the mine site during mine construction, operations, and closure and reclamation (**Figure 2.6-1** and **Figure 2.6-2**). The Burntlog Route would not be constructed under this alternative, which avoids the construction GHG emissions for this activity; however there would be construction activities required to improve the Yellow Pine Route specifically along Johnson Creek Road (County Road [CR] 10-413) and the Stibnite portion of the McCall-Stibnite Road (CR 50-412). Controlled public access through the mine site during mining operations for Alternative 4 would be provided by a road connecting Stibnite Road (CR 50-412) to Thunder Mountain Road (National Forest System Road 50375), in a similar manner as Alternative 2.

There are no modifications designed to specifically reduce GHG emissions or address climate change impacts; however, several other design features under Alternative 4 also would provide opportunities to minimize the severity of GHG and climate change impacts than the other action alternatives. The Johnson Creek temporary groomed over-snow vehicle trail would be kept open during construction and operations for winter public access, step pools would be created in Blowout Creek to reduce water velocity and sediment in its lower reaches and restore the eroded channel, Meadow Creek and Blowout Creek would be routed in a pipeline instead of a surface diversion channel, and cell tower construction within IRAs would be via helicopter.

4.4.2.4.1 GHG Emissions

The Burntlog Route, which serves as the main mine access for Alternatives 1 through 3, would not be constructed. This would have the effect of decreasing overall construction phase GHG emissions; however, the construction activities to complete major improvements on the Yellow Pine Route would likely offset the decrease and would likely end up very similar to Alternative 1. The Stibnite Road (CR 50-412) portion of Yellow Pine Route would be improved by widening curves to accommodate 55-foot long semi-truck trailers. Approximately 1 mile of road through the village of Yellow Pine would be paved. Using Yellow Pine Route for mine access would avoid some construction-related GHG emissions that would otherwise occur under other alternatives. Based on relative roadway length affected, these changes in roadway construction would represent a slight decrease of overall construction phase GHG emissions. However, the magnitude of the emissions difference would be small compared to total construction emissions during the construction phase.

To the extent that construction of the step pools represents an increase in overall construction phase emissions, there would be a temporary increase in GHG emissions during this activity. Reclamation of disturbed areas outside of the step pools would be the same as described for Alternative 1, so there would be no net GHG emission difference for this phase resulting from construction of step pools.

For Alternative 4, controlled public access through the mine site would be provided similar to Alternative 2. The public access road would be constructed during the first year of mine operation, with resultant slight increase in GHG emissions for that aspect of the construction phase. Accommodating public access through the mine site would reduce the miles of motorized trails open to all vehicles within the Meadow Creek IRA by not constructing the OHV connector; this is expected to reduce net GHG emissions inside of, and in the vicinity of, the SGP area.

4.4.2.4.2 Climate Change Impacts To SGP Area Resources

The anticipated climate change impacts for Alternative 4 would be the same as those discussed under Alternative 1 for the following resources of this EIS: geologic resources and geotechnical hazards, air quality, soils and reclamation cover materials, hazardous materials, groundwater (quality and quantity), timber resources, land use and land management, access and transportation, cultural resources, public health and safety, scenic resources, social and economic conditions, recreation, environmental justice, and tribal rights and interests. Impacts to surface water (quality and quantity), wetlands and riparian resources, vegetation (including general vegetation communities, botanical resources, and non-native plants), fish resources and fish habitat, wildlife and wildlife habitat, and special designations under Alternative 4 are described below.

4.4.2.4.2.1 Surface Water (Quality and Quantity)

Alternative 4 would include the construction of step pools in Blowout Creek to reduce water velocity and sediment in lower reaches of Blowout Creek, and to restore the eroded channel. Climate change is expected to create more extreme precipitation events, leading to increases in flash flooding, sedimentation, and erosion in waterways (Halofsky et al. 2018). Although the impacts of climate change would be the same as Alternative 1, it is expected these design improvements would help to minimize the severity of impacts by more efficiently managing surface water after extreme precipitation events.

4.4.2.4.2.2 Wetlands and Riparian Resources

Not constructing the Burntlog Route under Alternative 4, as well as routing Meadow Creek and Blowout Creek in a pipeline instead of a surface diversion channel, would avoid impacts to wetlands and riparian areas. Although the impacts of climate change would be the same as Alternative 1, these Alternative 4 design features would minimize the severity of impacts to wetlands and riparian resources.

4.4.2.4.2.3 Vegetation: General Vegetation Communities, Botanical Resources, and Non-Native Plants; Fish Resources and Fish Habitat; Wildlife and Wildlife Habitat; and Special Designations

The Burntlog Route would not be constructed under Alternative 4, avoiding the construction of approximately 20 miles of roadway by using the Yellow Pine Route for mine access. Although the impacts of climate change would be the same as Alternative 1, it is expected that not constructing the Burntlog Route would help to minimize the severity of impacts to sensitive plant species (whitebark pine), federally listed fish species, wildlife and wildlife habitat, and IRAs. There would be less fragmentation of habitat without construction of the Burntlog Route, and there would be fewer opportunities for insects and disease to spread to special designation areas. Additionally, cell tower construction via helicopter would further reduce fragmentation in IRAs and minimize climate change impacts to IRAs and sensitive plant species (whitebark pine) within the IRAs.

4.4.2.5 Alternative 5

Under Alternative 5, the analysis area would continue to be impacted by current climate change trends. As the no action alternative, Alternative 5 represents the baseline condition against which potential GHG emission and climate change effects are evaluated for the analysis area. The Forest Service would not approve the mining plan that would allow development of the mine site, ore processing, and related activities. For example, the earth-moving and vehicle traffic that would represent direct GHG emission effects associated with the action alternatives would not occur. The use of petroleum fuels for existing generators, water pumps, vehicles and other approved exploration-related operations would be ongoing, as well as other Forest Service and local activities such as prescribed fire and road construction and use. Mineral exploration would continue to occur as part of the Golden Meadows Exploration Project, creating emissions from fuel consumption and fugitive dust emissions associated with exploration activities; however, the magnitude of impacts from these activities would be very low compared to the action alternatives. Consequently, on a regional level the effects of GHG emissions from activities within the analysis area would be unchanged from current conditions.

Areas of the mine site disturbed by previous mining activities would remain as they are and (without targeted revegetation efforts tied to required mine reclamation) would be anticipated to recover at a natural, although very slow, rate as new soil forms and plants are established.

4.4.2.5.1 GHG Emissions

If the SGP does not proceed, it can be assumed that current uses by Midas Gold and other users on patented mine/mill site claims and on the Payette National Forest and Boise National Forest would continue to comply with all existing applicable air quality regulations. Uses of National Forest System lands that may result in GHG emissions include mineral exploration, dispersed OHV use, snowmobiling, recreational driving, and other forms of recreation.

No long-term direct effects on GHG emissions or climate change are anticipated for Alternative 5. The removal of existing vegetation that would be necessary to develop the action alternatives would not occur, and the disturbed areas due to historic mining would not be reclaimed or actively reforested. Emissions of GHGs associated with the continuation of approved exploration activities at the mine site and associated reclamation and monitoring commitments would be small and intermittent across a limited area within the SGP area boundary. Given these characteristics of Alternative 5, GHG emissions would not be expected to change compared to current conditions, and an emissions analysis has not been performed.

4.4.2.5.2 Climate Change Impacts To SGP Area Resources

Potential incremental contributions to GHG emissions and climate change effects discussed in preceding sections for the action alternatives would not occur under Alternative 5. Any of the action alternative components that would potentially represent net climate change impacts to various resources in the SGP area would not be constructed. The existing climate change trends and indirect effects that are being observed on a regional level, as described in Section 3.4.3.2, Climate Change Trends, would continue to affect the SGP area under Alternative 5.

4.4.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the

Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.4.4 Cumulative Effects

In accordance with NEPA and the CEQ guidelines, cumulative effects are to be analyzed as a component of any project undergoing a NEPA analysis. Cumulative effects are additive or interactive effects that would result from the incremental impact of the proposed action [or alternatives] when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 Code of Federal Regulations 1508.7). Past and present actions and reasonably foreseeable future actions include activities, developments, or events that have the potential to change the physical, social, economic, and/or biological nature of a specified area. By this definition, GHG emission sources directly associated with the alternatives, and reasonably foreseeable future actions having emissions that may or may not overlap with the alternatives in time, could result in cumulative climate change impacts, even though it is not possible to quantify such incremental effects.

Regional levels of GHG emissions will change due to many factors, the primary ones being trends in industrial activity, pace of energy resource development, transportation fuel consumption rate, and population growth. But within this generalized framework, it cannot be predicted with certainty the extent to which the mix of all these activities will collectively contribute to the global phenomenon of climate change. Therefore, defining a specific cumulative impact on climate change cannot be related to emissions from the SGP or sources that would contribute to overall cumulative GHG emissions.

As described in Section 3.4.2, Climate Change, Relevant Laws, Regulations, Policies, and Plans, no federal or state rules or regulations currently limit or curtail emissions of GHGs from sources in the State of Idaho. Therefore, at present no regulatory mechanism exists for assessing in a quantitative manner the significance of GHG emissions or cumulative effects. Draft guidance on climate change analysis published by the CEQ (CEQ 2019) has indicated that a quantitative analysis of GHG emissions and the relationship to climate change is not required in every project-level NEPA analysis. Based on this guidance, this analysis has adopted a qualitative approach.

4.4.4.1 Action Alternatives

Cumulative effects analysis for GHG emissions as an indicator of climate change effects considers the geographic range and timeframe of emissions from current and foreseeable activities. In theory, GHG emissions from past projects have already contributed to current climate conditions, even if the mechanisms creating those conditions are global in scale. Transport of GHGs from far more distant urban regions, even overseas, may contribute to regional climate changes, but are not within the scope of a cumulative effects analysis. Based on these considerations, past operations by Midas Gold in the analysis area, such as exploratory drilling, monitoring wells, roadway construction and maintenance, are not contributors to future GHG-related cumulative effects. Similarly, past activities within the cumulative analysis area, such as prior roadway and infrastructure construction projects, and vegetation management have both contributed to and offset some of the cumulative GHG emissions in the SGP area.

While the magnitude and location of air emission sources associated with the SGP are different for the action alternatives, the differences are not sufficiently large enough to significantly affect GHG emission and climate change. The extent and magnitude of potential cumulative GHG emission and climate change effects due to foreseeable projects in the analysis area when added to the GHG emissions and climate effects (**Table 4.4-4**) would be the same for all action alternatives.

4.4.4.2 Alternative 5

Under Alternative 5, the SGP would not be implemented and therefore would not contribute to cumulative effects. The same cumulative effects contributions from potential development in the surrounding area would be the same as described above.

Past and ongoing activities in the region surrounding the SGP area include forest management (e.g., prescribed burns), motorized use of roads for land management and recreation, and fire suppression. These activities would continue as relatively small GHG contributors in the context of the total GHG inventory for Idaho, and would not be expected to add to substantial cumulative GHG-related effects in the region or to climate change in general.

Table 4.4-4 Current and Reasonably Foreseeable Activities Considered Regarding Cumulative GHG Emissions

Project Type	Project Names/Description	Nature of Air Emissions and Contribution to Cumulative Effects
Exploratory Drilling for Mineral Resources	• **Morgan Ridge Exploratory Drilling** Project involves exploratory drilling for locatable minerals from remote drill pads approximately 10 miles north of the mine site. Project is reportedly on hold.	Local GHG emissions from drilling equipment (e.g., compressor engines), and vehicle tailpipe emissions. Expected to have GHG emissions that are a very small portion of the Idaho inventory.
Forest Maintenance and Fire Risk Reduction	• **Big Creek Fuels Reduction Project,** approximately 10 miles north of mine site • **South Fork Restoration and Access Management,** 25 miles southwest of mine site • **East Fork Salmon River Restoration and Access Management,** approximately 5 miles northwest of mine site	Local GHG emissions from portable generators equipment (e.g., compressor engines, and vehicle tailpipe emissions. Expected to have GHG emissions that are temporary and a very small portion of the Idaho inventory.

Project Type	Project Names/Description	Nature of Air Emissions and Contribution to Cumulative Effects
	Projects to reduce wildfire risk and fire severity/intensity on National Forest System lands and private property using commercial timber harvest, understory treatment, and prescribed burning.	
Construction Projects	• **Creek restoration** • **Trail construction and maintenance** • **Bridge and culvert replacement projects,** generally located more than 10 miles north of SGP area • **Hydroelectric projects: small residential projects for power generation** • **Road maintenance**	Short-term GHG emissions during construction with no long-term emission impacts that would overlap with impacts related to the SGP.
Natural Emission Events	**Wildland fires** • Between 2005 and 2015, over 88,000 acres of the Big Creek watershed have been burned. Between 1990 and 2013 over 330,000 acres have burned within the headwaters of East Fork South Fork Salmon River and Sugar Creek.	Future fires may add additional GHG to the atmosphere.
Mining Activities	**Ongoing mining activities on patented land** • Mineral exploration and mining have occurred in several locations around the SGP area. Exploration activities area ongoing for potential future mining development.	Local emissions from drilling equipment (e.g., compressor engines), and tailpipe GHG emissions. Known mining operations are of small size (50 tons per day or less) or are inactive. Expected to have GHG emissions that are temporary and a very small portion of the Idaho inventory.
Recreation and tourism	**Recreation and Tourist activities:** • Sport hunting, fishing, trapping • Snowmobile trails • Fugitive dust and tailpipe emissions from traffic on unpaved roads • Boating and river recreation • Camping, hiking, backpacking • Outfitter/Guide Operations • Tourist Services – Big Creek Lodge • OHV use • Tourist Services – e.g., Big Creek Lodge	Collectively substantial GHG emissions from vehicles on unpaved roads and trails, boats, and stationary fuel combustion sources. These sources are already included in the Idaho inventory.

4.4.5 Irreversible and Irretrievable Commitments of Public Resources

4.4.5.1 Action Alternatives

Alternative 1 would result in an increase in the use of fuels and other resources (40 to 50 MWs of electrical power) in the region. There would be use of public resources to support this effort, such as using public roads to access construction areas or infrastructure in the area; this would result in additional indirect GHG emissions related to all action alternatives. However, this use of fuels and other resources could have a compensating benefit of improving economic conditions in the area by offsetting some of the public resource expenditures. In addition, all action alternatives would result in a minor use of public resources for permitting and compliance assurance activities.

4.4.5.2 Alternative 5

Under Alternative 5, the resources associated the SGP would not be expended. As such, there would be no irreversible and irretrievable commitment of public resources.

4.4.6 Short-term Uses versus Long-term Productivity

4.4.6.1 Action Alternatives

The operation of the action alternatives generate short-term emissions of GHG for the duration of construction, operation, and closure and reclamation of the SGP. The long-term productivity of the SGP area would be an economic benefit to Idaho. Elements of the action alternatives, including reclamation of some historically disturbed areas, also may be a long-term benefit. These improvements in the long-term productivity of the mine site may help to minimize the severity of climate change impacts resulting from warmer temperatures, variable precipitation, decreased snowpack, lower stream flows, warmer stream temperatures, and changes in wildfire patterns.

4.4.6.2 Alternative 5

Under Alternative 5, the SGP would not be implemented. The long-term productivity of the analysis area would not be impacted by short-term uses, and current climate change trends would continue to persist in the analysis area.

4.4.7 Summary

Alternative 1 would create a total of 67,400 MT CO_2eq annual GHG emissions, approximately 0.23 percent of the annual Idaho statewide total GHG emissions. Indirect GHG emission sources associated with Alternative 1 include electrical power generated off-site (but used on-site), and emissions from antimony transport and processing. Changes in hydrologic patterns, temperature, and extreme weather events would contribute to a varying level and degree of impacts between resources.

Changes in hydrologic patterns and overall increasing temperatures are expected to result in decreased or degraded soil moisture and quality, air quality, annual streamflows, groundwater recharge, and water quality. Increased surface water temperatures; increased spread of insects and diseases; changes in the timing, duration, and severity of fire seasons; as well as habitat loss and fragmentation also are expected to occur. Closure and reclamation activities under Alternative 1 could reduce climate change impacts by improving soil quality and implementing best management practices during all phases of the SGP would help to reduce air quality impacts and GHG emissions.

Although geotechnical design standards have been developed to help minimize and mitigate the extent of potential stability impacts under Alternative 1, extreme precipitation events and flash flooding, could lead to more frequent and severe landslides and avalanches. Roads and other infrastructure near their design life also are more susceptible to extreme weather events. Road maintenance during all SGP phases could improve resilience of the access roads and transportation infrastructure against climate change impacts.

The addition of the lime kiln under Alternative 2 would increase direct GHG emissions from Alternative 1 by approximately 74 percent 117,587 MT CO_2eq annual GHG emissions. Indirect GHG emissions would be the same as those discussed under Alternative 1.

Direct and indirect GHG emissions and their associated impacts would be the same under Alternative 3 as those discussed under Alternative 1. Direct climate change impacts to SGP area resources under Alternative 3 would be the same as those discussed under Alternative 1; however, Alternative 3 would relocate the Meadow Creek TSF and Hangar Flats DSRF and the OHV connector would not be constructed, leading to less fragmentation in the SGP area. There would be fewer direct impacts to IRAs and wildlife habitat helping to indirectly minimize climate change impacts and assist sensitive species to tolerate future climate change.

Direct and indirect GHG emissions and their associated impacts would be the same under Alternative 4 as those discussed under Alternative 1. Direct impacts from climate change under Alternative 4 would be the same as those discussed under Alternative 1; however, the Burntlog Route would not be constructed under Alternative 4, leading to less habitat fragmentation in the SGP area. This would help to indirectly minimize climate change impacts experienced by wildlife, wildlife habitat, wilderness areas, IRAs, and Research Natural Areas.

Exploration activities associated with the Golden Meadows Exploration Project would continue under Alternative 5. Therefore, baseline conditions would continue and direct and indirect GHG emissions in the vicinity of the SGP area would not change. Current climate trends are expected to continue under Alternative 5, such as increased average annual temperatures, variable precipitation, decreased snowpack, reductions in stream flows, warmer stream temperatures, and changes to wildfire patterns. No additional impacts beyond current trends are expected to occur to the physical, social, and biological resources in the area.

Table 4.4-5 provides a summary comparison of climate change impacts by issues and indicators for the baseline condition and each alternative.

Table 4.4-5 Comparison of Climate Change Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP activities could contribute to factors that influence climate change.	GHG emissions from SGP activities (construction, operations, and closure and reclamation), expressed as MT of CO_2eq of GHGs.	No emissions.	67,400 MT of CO_2eq of total annual GHG emissions.	117,587 MT of CO_2eq of total annual GHG emissions.	Same as Alternative 1.	Small incremental differences from Alternative 1. GHG emissions would be reduced because the Burntlog Route would not be constructed; however, the construction activities required on the Yellow Pine Route would likely offset the decrease and would likely end up very similar to Alternative 1.	Same as baseline emissions
Changing climatic conditions, in synergy with the SGP (including construction, operations, and closure and reclamation), could impact the physical, biological, and social resources.	• Changes in hydrologic patterns (drought, precipitation variability and seasonality). • Changes in temperature (extreme heat/cold, or overall change in annual or seasonal temperatures). • Changes in extreme weather events (flash flooding, wildfires, severe storms).	• Current trends show variable annual average precipitation and drought patterns, decreases in snowpack, and decreases in streamflow. • Current trends show increases in annual average temperature and more frequent temperature extremes. • Current trends show increased frequency and intensity of extreme weather events.	Changing climatic conditions are expected to result in decreased soil moisture and quality; air quality; annual streamflow; groundwater recharge; water quality; increased surface water temperatures; increased spread of insects and diseases; changes in the timing, duration, and severity of fire seasons; and habitat loss and fragmentation.	Same as Alternative 1, except the severity of climate change impacts may be reduced for surface water and groundwater (quality and quantity), fish resources and fish habitat, wildlife and wildlife habitat, and public health and safety.	Same as Alternative 1, except the severity of climate change impacts may be reduced for surface water (quality), fish resources and fish habitat, wildlife and wildlife habitat, and special designations (IRAs).	Same as Alternative 1, except the severity of climate change impacts may be reduced for surface water (quality and quantity), wetlands and riparian resources, vegetation (including general vegetation communities, botanical resources, and non-native plants), fish resources and fish habitat, wildlife and wildlife habitat, and special designations.	Same as baseline.

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