Surface Water and Groundwater Quality

Current Conditions

- Midas Gold has conducted baseline monitoring of surface water and groundwater since 2012 for a broad set of constituents. A total of 32 stream stations and 31 monitoring wells were sampled regularly for more than four years (DEIS Section 3.9).
- While there were differing concentrations of constituents among the stream locations and wells, most monitored surface water constituents are not of concern (DEIS p 3.9-22).
- A few constituents are at elevated levels in some surface waters due to natural mineralization and legacy mining activities: arsenic, antimony, and mercury. Downstream of Meadow Creek, the main stem of East Fork of the South Fork of the Salmon River (EFSFSR) has levels of arsenic and antimony above Idaho's Human Health criteria. The main stem of Sugar Creek has arsenic above Idaho's Human Health criterion and mercury at concentrations above an Aquatic Life criterion for mercury. Tributaries to EFSFSR upstream of Sugar Creek are also impaired for arsenic (DEIS Section 3.9.3.1.1.2). As a result, these streams segments have been listed as "Impaired" for these constituents by the State of Idaho (DEIS Table 3.9-11).
- The Idaho Department of Environmental Quality temperature standards (Section 58.01.02) are evaluated for different species, life stages, seasons, and statistics. Table 4.9-11 provides the maximum and average temperatures for the warmest summer and fall conditions for baseline conditions. **All reaches** in the headwaters of the EFSFSR (upstream of and including Sugar Creek) are compliant with the maximum summer temperature protective of the Coldwater use (22°C). **All reaches** in the headwaters of the EFSFSR (upstream of and including Sugar Creek) are compliant with the average summer temperature protective of the Coldwater use (19°C). **Only Fiddle Creek** is compliant with the salmonid spawning and bull trout daily maximum summer temperature (13°C). **Only reaches in upper EFSFSR (above Meadow Creek) and Fiddle Creek** are compliant with the average fall temperature protective of the salmonid spawning and bull trout uses (9°C).
- Monitoring well results indicate several constituents that exceed Idaho groundwater criteria: arsenic, antimony, iron, manganese, and aluminum (DEIS p 3.9-53). These elevated levels result from both natural mineralization and legacy mining activity (DEIS p 3.9-57).

Mine Impacts/Protective Measures

- Alternative 1: Groundwater could be impacted via generation of new development rock and tailings. Most is non-acid-generating but has the potential to leach some metals (DEIS Section 4.9.2.1.1.4). The potential for seepage from the tailings storage facility (TSF) would be managed with an engineered liner system (DEIS p 4.9-58). Surface water quality could be impacted by discharge of mine contact water with elevated levels of some metals, and by runoff from roads and utility corridors. Constituents of primary concern are arsenic, antimony, and mercury. Changes to stream flow, groundwater-surface water interactions, open stream diversion channels, discharges from surfaces of pit lakes, removal of the Yellow Pine pit (YPP) lake, and loss of stream shading due to vegetation removal increase stream temperatures. Recovery of

vegetation following riparian planting at closure improves temperature over time, but not to baseline conditions in most of the project area.
  - Open diversion channels would be routed around new mining facilities to divert streams and prevent runoff outside the facilities from entering them and becoming contact water.
  - Contact water would be reused to the greatest extent possible, thus minimizing discharge.
  - Roads would be designed, constructed, and maintained with best management practices to minimize potential for water quality impacts.
  - Utility corridors would be designed, constructed, and maintained with best management practices to minimize potential for water quality impacts.
  - The Idaho Pollutant Discharge Elimination System (IPDES) permit and other regulatory tools would be in place to ensure discharges comply with Idaho criteria.
  - Removal of certain legacy materials (Spent Ore Disposal Area [SODA], Bradley tailings, and Hecla Heap) would reduce potential leaching of metals to surface water and groundwater, thus improving water quality.
  - The YPP lake would be removed; Hangar Flats pit lake, Midnight pit lake, and West End pit lake would remain following closure.
  - Meadow Creek would flow through Hangar Flats pit lake, cooling daily maximum temperatures but contacting pit lake water chemistry.
- Alternative 2: Groundwater quality would be similar to Alternative 1, but much of Hangar Flats and Fiddle development rock storage facilities (DRSF) would be covered with a geosynthetic liner to prevent percolation of runoff and snowmelt (DEIS p 4.9-93). Surface water quality would be similar to Alternative 1 but Alternative 2 includes treatment systems for contact water and sanitary wastewater for employee facilities, thus showing improved quality for discharge to EFSFSR. This alternative improves on Alternative 1 by diverting low flows in piped conveyances rather than open diversion channels during operations. This Alternative also routes Meadow Creek around Hangar Flats pit lake rather than through it to improve water quality (which results in warmer daily maximums because the stream has less temperature buffering capacity). Additional liner placed in lower Meadow Creek and peak flow shaving to fill Hangar Flats pit lake faster mitigates stream flow losses and improves temperature. Treating water at the contact water treatment plant sometimes reduces stream temperatures in the summer but could increase temperatures in the winter if not managed.
- Alternative 3: Groundwater quality would be similar to Alternative 1, but SODA and Bradley tailings would not be removed because the TSF would be in upper EFSFSR valley, and thus groundwater quality improvement would not be realized through removal of those materials. Surface water quality would be similar to Alternative 1, but SODA and Bradley tailings would not be removed because TSF would be in upper EFSFSR valley, so surface water quality improvement would not be realized in Meadow Creek and EFSFSR through removal of those materials (DEIS p 4.9-97. This Alternative results in stream temperatures that are warmer than Alternative 1, especially in upper EFSFSR (above Meadow Creek). Because Meadow Creek temperatures remain at baseline conditions and temperatures at the confluence with EFSFSR are higher than baseline, warmer temperatures propagate downstream.
- Alternative 4: Groundwater quality would be the same as Alternative 1. Surface water quality would be similar to Alternative 1, but with higher potential for surface water quality impacts from spills or other accidents on Johnson Creek Road or Stibnite Road because all mine traffic would

use the route immediately adjacent to Johnson Creek and EFSFSR to access the mine site. Temperatures would be similar to Alternative 1.

- Alternative 5: There would be no change in groundwater quality relative to current conditions, which would be a missed opportunity to improve groundwater quality through removal of legacy materials in lower Meadow Creek basin. There would be no change in surface water quality relative to current conditions and no change in simulated temperature regime relative to current conditions. This would be a missed opportunity to improve surface water quality through removal of legacy materials in the lower Meadow Creek basin.

Reclamation/Restoration/Mitigation

- Alternative 1: For groundwater, several metals could leach to groundwater from the TSF embankment, Hangar Flats DRSF, Fiddle DRSF, West End DRSF, and YPP backfill after closure at levels exceeding Idaho groundwater standards. For surface water, in the absence of adequate treatment, several parameters could cause or contribute to exceedances of surface water criteria in Meadow Creek and EFSFSR (DEIS Section 4.9.2.1.2). Temperature mitigation measures include planting seven-foot riparian buffers along stream channels with wetland plantings extending out to the floodplain. Stream restoration designs provide habitat and accessibility but can result in warmer stream temperatures until vegetation is fully established. Liners placed five feet below the stream bed and out to the edge of the floodplain provide interactions with the shallow groundwater zone, but this cooling effect is not accounted for in the temperature modeling. Vegetation planted beyond the seven-foot riparian planting zone and growth of vegetation along other reaches are not accounted for the temperature modeling.
- Alternative 2: Improved groundwater and surface water quality post-closure through removal of some legacy features and ongoing passive water treatment as needed. During operations, low flows are transported in pipes along diversion channels, improving temperatures to baseline, or better, conditions. Additional potential mitigation measures include pulling water from deeper layers of Hangar Flats pit lake and contact water treatment ponds to lower effluent temperatures in the summer. In the winter, passive methods leveraging cold air temperatures could be used to lower the temperature of the contact water treatment plant effluent to near-ambient conditions.
- Alternative 3: Similar to Alternative 1 for groundwater and surface water quality and stream temperature, but disturbance extends up the EFSFSR above Meadow Creek.
- Alternative 4: Same as Alternative 1 for groundwater and surface water quality and stream temperature.
- Alternative 5: No change in groundwater or surface water quality relative to current conditions. No change in simulated temperature regime relative to current conditions. This is a missed opportunity to improve surface water and groundwater quality through removal of legacy materials in lower Meadow Creek basin.

Net Change

- Alternative 1: For groundwater, there would be a reduction of arsenic and antimony concentrations in the lower Meadow Creek valley aquifer and downgradient area. Localized increases in some metals in surficial aquifer near DRSFs. For surface water, there would be reduced concentrations of arsenic and antimony in EFSFSR as a result of removal of SODA and Bradley tailings. Anticipated instream concentrations would be lower than baseline values at some prediction nodes. Temperatures increase relative to baseline but are within 0.3°C of the coldwater summer maximum and warmest summer average criterion by end-of-year (EOY) 22, and within 0.2°C of the salmonid spawning and bull trout warmest fall average criterion by EOY 52 in the two areas that are compliant under baseline (EFSFSR above Meadow Creek and Fiddle Creek). Fiddle Creek was the only stream complying with the salmonid spawning and bull trout summer maximum criterion, and it would no longer comply under Alternative 1.
- Alternative 2: Groundwater quality would be the same as Alternative 1, but with reduced potential for metals in groundwater from DRSFs due to covers after closure. Surface water quality would be similar to Alternative 1, but with improved conditions in the EFSFSR due to water treatment prior to discharge. Temperatures are similar to Alternative 1, except in Meadow Creek where daily maximums are higher due to the routing of the creek around Hangar Flats pit lake. Simulated maximum summer temperatures are within 0.5°C of the coldwater criterion by EOY52 in Meadow Creek.
- Alternative 3: Less opportunity for groundwater and surface water improvement because SODA and Bradley tailings would not be removed from the lower Meadow Creek drainage area. Temperatures would improve in Meadow Creek but increase in EFSFSR from its headwaters to Sugar Creek.
- Alternative 4: Same as Alternative 1 for groundwater and surface water quality and stream temperature at the mine site. There would be a higher potential for surface water quality impacts from spills or other accidents on Johnson Creek Road or Stibnite Road since all mine traffic would use the route immediately adjacent to Johnson Creek and EFSFSR to access the site, although such risks can be managed well.
- Alternative 5: No change in groundwater or surface water quality relative to current conditions. No change in simulated temperature regime relative to current conditions. Missed opportunity to improve surface water and groundwater quality through removal of legacy materials in lower Meadow Creek basin.