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Groundwater Resources Report

Empire Exploration Drilling Project

Konnex Resources, Inc.
Mackay, Idaho
September 2018

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1.0 INTRODUCTION

This report was prepared in support of the environmental analysis for the 2018 Empire Exploration Drilling Project proposed by Konnex Resources Inc (Konnex). Konnex is exploring a north-trending polymetallic skarn on the eastern flank of the White Knob Mountains. The Konnex mineral claim block is located in the Alder Mining District of central Idaho, at the historic Empire Mine in Custer County, Idaho approximately 3 miles west of Mackay, Idaho (Figure 1).

Drilling is proposed to collect samples for determining the northern and southern extents of mineralization, including condemnation of certain areas that may be suitable for siting ancillary mine facilities in the future. Konnex has proposed drilling 26 holes approximately 500 feet deep in 23 locations on some of their unpatented claims within the Salmon-Challis National Forest (SCNF). Drilling will be conducted using reverse circulation (RC) method.

The report is organized into three main topic areas: 1) geology and hydrogeology, 2) proposed drilling procedures, and 3) analysis of potential effects to groundwater resources.

2.0 PHYSIOGRAPHY

The Big Lost River Valley and adjacent mountains of the White Knob Mountains and the Lost River Range exemplify topography of the Basin and Range physiographic province. The project occupies the Lower Big Lost River Subbasin watershed between the White Knob Mountains and the Lost River Range. The watershed is approximately 15 miles wide with a topographic relief of approximately 6,000 feet, from the lowest point at the Beck and Evan Ditch diversion (approximately 5,650 feet above mean sea level (amsl)) to the peak of the Mount McCaleb (11,682 feet amsl).

On the east side of the watershed, coalescing alluvial fans emanate from the Lost River Range and stretch for two to five miles across into the Big Lost River floodplain. The west side of the watershed is a pediment developed mainly in Challis Volcanics between the White Knob Mountains range front and the Big Lost River.

The Big Lost River floodplain becomes broader from north to south, and has eroded the toes of the alluvial fans on the east side of the watershed. The floodplain is approximately 0.25 miles wide near the Mackay Dam, 1.25 miles wide in Mackay, and nearly 2.5 miles wide north of Leslie Butte. The Big Lost River has a sinuous channel with numerous abandoned meanders with an average gradient of 0.5 percent.

3.0 CLIMATE

The Big Lost River Valley has a semi-arid climate with a 30-year mean precipitation, between 1981 and 2010, of 9.79 inches in Mackay (Western Regional Climate Center (WRCC), 2017). Comparatively, the mean annual precipitation at the Site (elevation 8,500 feet amsl) is estimated to be 23.13 inches (PRISM, 2017). Precipitation is typically received on the valley floor as snow from November through March when monthly maximum air temperatures are sub-freezing. The annual average pan evaporation in Mackay from May through September from 1965 to 1988 was 40.55 inches (WRCC, 2017).

4.0 GEOLOGY

The geology of the project area and surrounding vicinity is summarized in this report from a geologic map of the Arco 30 x 60 Quadrangle published by the Idaho Geological Survey (IGS, 2009). The oldest rocks in the White Knob Mountains are the carbonate sedimentary rock units of the Mississipian (330 to 360 million years ago (Ma)) McGowan Limestone (Mm), White Knob Limestone (Mw), and undifferentiated units (Mcb). The Mm consists of interlayered mudstone, siltstone and limestone that is more than 4,000 feet thick. The Mw overlies the Mm, and consists of more than 5,500 feet of blue-gray to black, thick bedded, variably fossiliferous limestone with abundant chert nodules and lenses. The upper half of the Mw contains siliclastic interbeds (mudstone to conglomerate).

The Mississipian rocks in the project area occupy the footwall of the Copper Basin thrust, which is mapped approximately 9 miles west of the Empire Mine in Copper Basin. The Copper Basin thrust accommodated compression of the western North American continent during the Antler Orogeny (340 to 370Ma). In addition, the carbonate sedimentary rocks are tightly folded (some are overturned) with fold axes that typically trend northwest and plunge northward.

The Tertiary intrusives (Ti) includes Mackay Granite, quartz monzonite, leucogranite porphyry and dikes of quartz latite, rhyolite and phorphyritic latite. The skarn formed by intrusion of granite into the limestone, which metamorphosed the limestone into calcium silicate minerals, mainly diopside, garnet (andradite to grossularite), magnetite and hematite. The skarn formed along a discrete portion of the eastern contact of the Eocene Mackay stock (Ti; 47 to 49 Ma) with the Mw (Figure 2). The drill holes will target the skarn and Tertiary intrusives.

The highest peaks of the White Knob Mountains and surrounding areas, including the mineral claims, occupy the White Knob horst. The White Knob horst is an elevated block of bedrock approximately five miles wide that is bound by east-northeast trending normal faults. These faults were formed during emplacement of the Mackay granite and contemporaneous emplacement of Tertiary extrusives (Te) of the Challis Volcanic Group (44 to 51 Ma).

Challis Volcanic Group lithologies include rhyolite to andesite compositions emplaced as lava flows, welded tuffs and tuff breccias. The Challis Volcanic Group have distinctively darker coloration than the limestone and intrusive rocks, typically reddish to purplish brown, greenish gray to gray and light tan.

Normal faulting that produced the modern physiography of the Basin and Range began forming in the Miocene (approximately 17 Ma) due to extension of the continental crust. Extension is accommodated by northwest trending, range-bounding faults, including the active segment of the Lost River fault that cause the 1983 Borah Peak earthquake.

Unconsolidated sediment (Qs and QTs) has been shed from the Lost River Range to form coalescing alluvial fans that are two to five miles wide on the east side of the Big Lost River valley.

Soil characteristics affect potential for sediment contributions into surface water due to erosion. The following soil units are delineated east of the project area on public land managed by the US Bureau of Land Management (University of California - Davis, 2018):

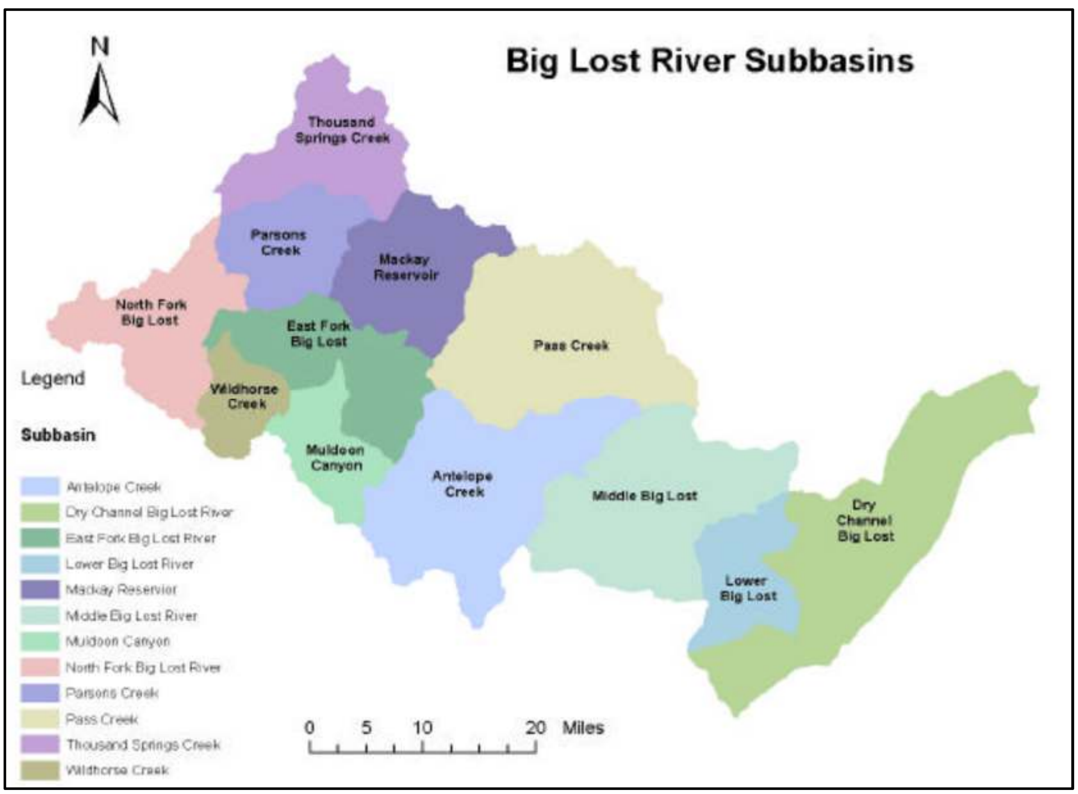
- 79, Gany Gravelly Loam, 30 to 60 percent slopes

- 95, Ike-Rock Outcrop-Jimbee Complex, 15 to 60 percent slopes
- 96, Inferno-Grouseville Association, 15 to 50 percent slopes
- 97, Jimbee-Rock Outcrop-Ike Association, 30 to 75 percent slopes
- 190, Simeroi gravelly loam, 6 to 15 percent slopes
- 244, Zeale-Meegero Complex, 20 to 40 percent slopes

Mollisols are one of the 12 soil orders in the U.S. soil taxonomy system. Mollisols form in semi-arid to semi-humid climates and are characterized as having a dark humus-rich surface layer that almost always forms under grassland vegetation. Soils examined by CES in June 2017 above the Cossack Tunnel along the intermittent streambed in Rio Grande Canyon are dark mollisols.

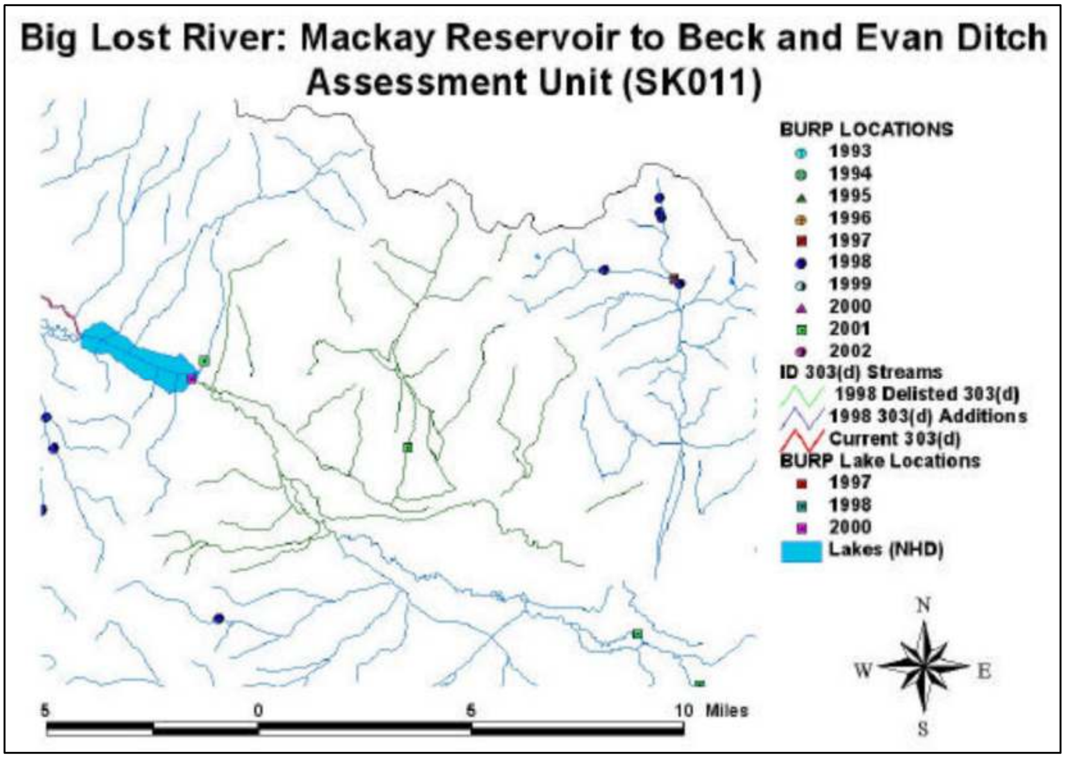
5.0 SURFACE HYDROLOGY

The Konnex project area lies on the west side of the Mackay Dam to Beck and Evan Ditch Assessment Unit (Assessment Unit 11), of the Lower Big Lost River watershed (Idaho Department of Environmental Quality (DEQ), 2004). The Lower Big Lost River watershed extends south for 22 miles from the Mackay Dam to the irrigation diversion structure at Moore, and continues further south for varying distances depending upon flow contributions and losses of the Big Lost River. The river flow contributions include discharges from the Mackay Dam, tributary contributions, irrigation diversions, and infiltration into gravel deposits and Snake River Plain Basalt.



Source: DEQ, 2004

Assessment Unit 11 is the upper portion (approximately 13 miles) of the watershed between the Mackay Dam and the Beck and Evan Ditch diversion. The diversion is located in the unincorporated community of Leslie. Tributaries that contribute flow to the Big Lost River on the west side of Assessment Unit 11, where the project area is located, include Cliff Creek, Willow Creek, and Alder Creek.



Source: DEQ, 2004

Stream flow in the Big Lost River is largely controlled by releases from the Mackay Dam to provide flood control and water supply for irrigation. Monthly mean discharges of the Big Lost River at a USGS gaging station located approximately 1.5 miles below the Mackay Dam from 1906 through 2017 are 102 to 159 cubic feet per second (cfs) over the winter from November through March, increase to 472 cfs in May, 924 cfs in June, and then recede to 655 cfs in July, 400 cfs in August, 231 cfs in September, and 165 cfs in October (USGS, 2018).

The USGS recently established a stream gaging station on Antelope Creek, which is approximately 12 miles south of the project area (USGS, 2018). The gaging station is located in a narrow canyon on the main stem of the creek above bifurcations and irrigation diversions, so it represents natural flows. The flow patterns at the gaging station should be generally representative of other tributaries in the watershed, such as Cliff Creek. Since the gaging station began operation on August 23, 2017, the peak streamflow of 544 cfs was observed on May 26, 2018, and has dissipated to 28.1 cfs on August 1, 2018. The high flow in May corresponds with observations of snowmelt in the mountains. The Snotel Station at Hilts Creek in the Lost River Range (approximately 10 miles northeast of Mackay) at 8,000 feet amsl reported snow depths of 52 inches on March 27, 2018 dissipating to 0 inches on May 21 (US Department of Agriculture National Water and Climate Center (USDA NWCC), 2018). Similarly, the

Snotel Station on Smiley Mountain (approximately 18 miles southwest of Mackay) at 9,520 feet amsl reported snow depths of 65 inches on May 13, 2018, and 0 inches on June 9 (USDA NWCC, 2018). Beneficial uses for the Big Lost River in Assessment Unit 11 include supporting cold water aquatic life, salmonid spawning, primary contact recreation, domestic water supply, and special resource water (IDAPA 58.01.02). However, water quality in this reach was found to be impaired due to elevated water temperatures and not supporting cold water aquatic life or salmonid spawning (DEQ, 2004).

All of the drill pads on the north side of the project area (17 pads for 20 drill holes; Unpat-1 through Unpat-16 and Con-1 through Con-4) are in the Rio Grande Canyon of the White Knob Mountains. Based on satellite imagery and several field visits conducted by CES during snowmelt periods in May 2017 and May 2018, there are no perennial streams that flow out of Rio Grande Canyon. There is a perennial stream fed by seeps in Horseshoe Canyon, which flows into Rio Grande Canyon for a few days to weeks in the spring due to snowmelt. The stream was observed to flow down the channel across the pediment along the south side Mine Hill Road until it dissipated at road crossing that is nearly one mile above the Big Lost River. At other times of the year, the stream in Horseshoe Canyon dissipates above Rio Grande Canyon at approximately 7,600 feet amsl, shortly after it flows through a culvert on Mine Hill Road. There is a spring-fed creek in the upper reaches of Rio Grande Canyon that percolates into the ground above the historic Taylor Sawmill. Flow past the sawmill has not been observed in satellite images or during field observations in May 2017 or May 2018. The Forest Service has a water right to divert water down the canyon through polyethylene pipe to stock watering tanks.

All of the drill pads on the south side of the project area (Unpat-17 through Unpat-22) are along the top of the Cliff Creek watershed. Cliff Creek is considered to be fully supporting cold water aquatic life and secondary contact recreation (DEQ, 2014). Cliff Creek is a perennial stream that flows into the Darlington Ditch, which is dry when the irrigation head gate is closed at the end of each irrigation season. The Darlington Ditch head gate is located on the Big Lost River approximately 0.6 miles south of Mine Hill Road and 0.3 miles south of the Mackay wastewater lagoons. The Darlington Ditch flows along the west side of the floodplain until it discharges into Antelope Creek west of the unincorporated community of Darlington.

6.0 EXISITING GROUNDWATER QUALITY AND QUANTITY

No groundwater wells or sampling data is available within the project area. As reported above, there are springs and seeps in the upper reaches of Horseshoe Canyon and Rio Grande Canyon. The Empire Mine has several miles of interconnected underground workings that stretch across the project area but the adit portals at the 700 level (Alberta Tunnel), 1100 level (Empire Mill) and 1600 level (Cossack tunnel) are dry. None of the published literature by the US Geological Survey or Idaho Geological Survey about the Empire Mine mention occurrence of groundwater or dewatering. The only known water supply to the project area is pipeline from a point of diversion with an authorized water right for 0.75 cubic feet per second on Cliff Creek.

The Idaho Department of Environmental Quality (DEQ) conducted an inspection of the Empire Mine in August 2005 and issued a preliminary assessment and site inspection (PA/SI) report in December 2005. The sites investigated included the Cossack Tunnel, Empire Mill, Alberta Tunnel, Tramway "Headhouse," Bullion Tunnel, and Blue Bird Workings. The report indicated that aquatic life is not supported by the ephemeral drainages within or near the site. Groundwater exposure pathways were identified as unlikely. The report indicated additional site characterization and analysis would be necessary to substantiate the findings of the preliminary assessment.

The nearest well to the project area is located approximately two miles east of the Cossack Tunnel on the south side of Mine Hill Road in the northeast quarter of the northeast quarter of Section 32 in Township 7 North Range 24 East (T7N R24 E). The well was drilled at a home as a domestic water supply in October 2010, according to a Well Driller's Report obtained from the Idaho Department of Water Resources (IDWR). The well boring was advanced with an air rotary drilling rig through large boulders and clay to 32 feet below the ground surface (bgs), cemented gravel and clay to 62 feet bgs, and brown or gray, broken or fractured rhyolite to the bottom of the hole at 410 feet bgs. Groundwater was encountered in fractured brown rhyolite at 105 feet bgs, with a static water level at 102 feet bgs. The well intake is a 6-inch diameter steel casing with manually (torch or saw) cut ¼-inch by 2-inch slots from 325 to 360 feet bgs. After two hours of groundwater discharge by air lifting at 15 gallons per minute, the groundwater drawdown was 200 feet.

Anderson Spring is displayed on the Mackay Reservoir 7.5 minute Topographic Quadrangle at a location that is approximately 100 yards south of the domestic well described above. However, satellite images do not show evidence of the spring, such as channel erosion, water flow or changes in vegetation. Previous investigators could not locate this spring during a field visit either, and surmised that the map was incorrect (University of Utah, 1984).

The City Spring, which is the primary source of water to the City of Mackay, is located 1.8 miles east-northeast of the Cossack Tunnel, approximately 0.2 miles north of Mine Hill Road in the northwest corner of the northeast quarter of Section 32 in T7N R24E. The Consumer Confidence Report issued on June 25, 2018 for 2017 indicates the City of Mackay drinking water met all drinking water standards, which are regulated by the State of Idaho under an agreement with the US Environmental Protection Agency. The spring was investigated as a potential geothermal source since the water temperature is between 64 and 72 degrees Fahrenheit (University of Utah, 1984). The investigation indicated that the water has a low salinity, with 150 milligrams per liter (mg/L) of total dissolved solids, calcium bicarbonate composition with an alkaline pH (7.7 standard units) (University of Utah, 1984). The calcium carbonate composition is indicative of spring water discharge from groundwater flowing through limestone. A Source Water Assessment prepared by the Idaho DEQ indicates that the project area is within the 3-year time of travel capture zone for the spring (DEQ, 2009). The spring water source was interpreted by DEQ based on regional topographic and geologic maps. Potential contaminant sources identified in the SWA include 18 historic mines and the Empire Mill. However, the report acknowledges that the City Spring water meets drinking water standards. The City Spring was developed in 1902 and improvements were made in 1995. Spring water discharges at 500 to 600 gallons per minute (gpm) into a concrete spring box with a 10-inch pipe that conveys water by gravity for approximately 0.25 miles to a 300,000 gallon storage tank. Water is supplied from the tank to the City water distribution system.

7.0 EXPLORATION DRILLING PROJECT DESCRIPTION

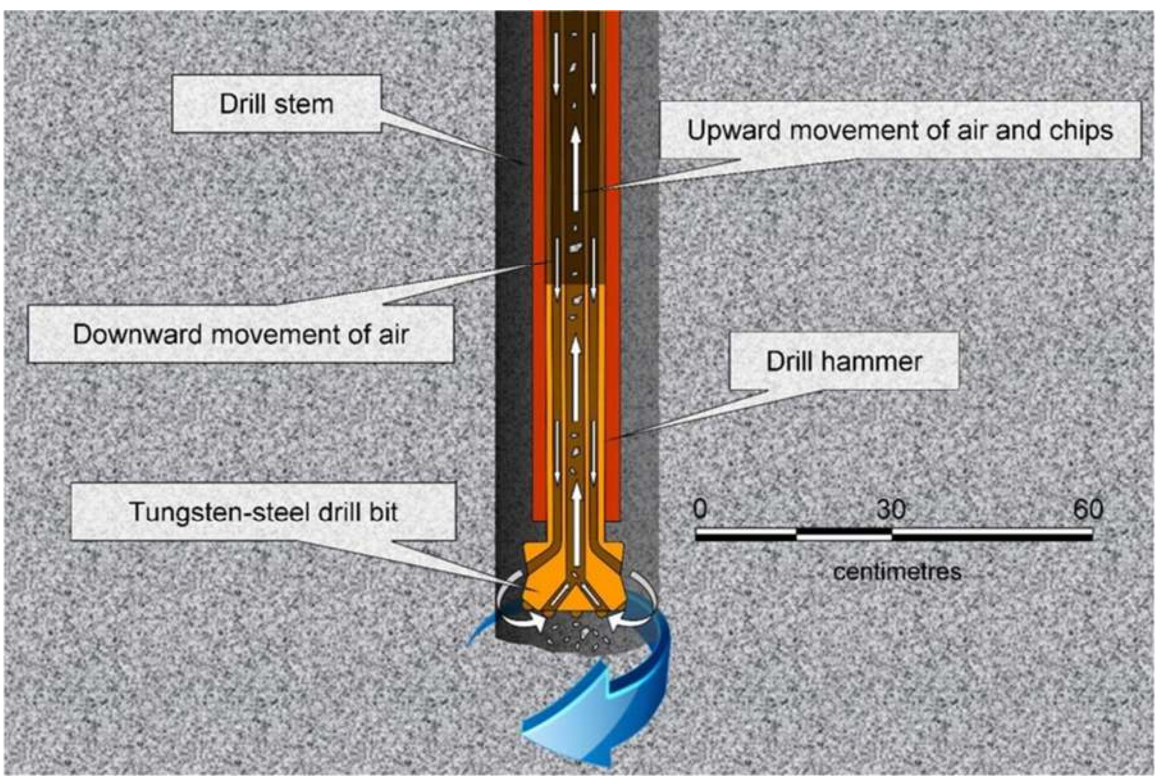
Konnex has proposed to drill up to 26, 5 to 8 inch diameter RC holes between 300 and 800 feet deep at 23 locations adjacent to their patented claim block at the Empire Mine.

The proposed holes north of the patented claims would be drilled at elevations of 7,200 to 8,400 feet amsl. The proposed holes south of the patented claims would be drilled at elevations of 8,000 to 8,600 feet amsl. The boreholes are expected to reach depths of 300 to 800 feet, and may encounter groundwater. The standard drilling procedures described below minimize the risk of groundwater.

7.1 Drilling Procedures

RC drilling is proposed for this project. RC drilling is used in the mining industry to collect pulverized rock chip samples for mine grade control and exploration projects where recovery of intact core for detailed observations of rock characteristics from diamond core drilling is not needed. RC drilling is much faster than core drilling, such that each hole would be drilled in one day.

RC drilling rigs for mineral exploration rotate a drill string while circulating air down the outer wall of dual wall drill pipe. As the drill bit breaks up the formation, the air circulates around the outside of the bit to remove the drill cuttings. The air pushes the cutting through another set of ports near the center of the bit into the center of the drill pipe to the surface. The cuttings flow through a hose on the rig into a cyclone splitter that slows the air flow down and divides the cuttings into manageable sample sizes. Rock cuttings, or chips, are collected and submitted to a laboratory for mineral assays.



A sketch of an RC drill stem. The direction of air flow is shown with white arrows. The blue arrow represents the rotation of the drill string. (www.geologyforinvestors.com)

If the bedrock is covered with sediment, the hole is collared once the drill bit reaches bedrock. A collar is PVC or steel pipe (casing) that is placed down the hole to prevent unconsolidated sediment from collapsing on the drill string.

Since RC drilling does not require the use of water to advance boreholes, drilling fluids will not be generated. Groundwater may be discharged with cuttings if the borehole intersects an aquifer, which is addressed below. If groundwater is not present, a small amount of water is used for dust suppression. Dust suppression is primarily needed as a safety measure to protect workers from dust inhalation.

7.2 Environmental Protection Measures for Groundwater Resources

Environmental protection measures (EPMs) for RC drilling are designed to assure compliance with relevant environmental regulatory standards, including the Idaho Ground Water Rule (IDAPA 58.01.11), Idaho Rules Governing Exploration, Surface Mining Closure of Cyanidation Facilities (IDAPA 20.03.02)' and Idaho Well Construction Standards Rule (IDAPA 37.03.09).

The Well Construction Standards Rule is only indirectly applicable in that mineral exploration boreholes are not considered to be wells and therefore are not subject to the standards of the rule. However the rule does require that the construction of such boreholes meets the intent of the regulations which is "to protect the ground water resources of the state against waste and contamination," implying that the exact letter of the rule need not be strictly followed as long as the intent is met. All of the SOPs meet the intent of the rule and, in almost every instance, meet or exceed the standards.

7.2.1 Drill Pad Locations and Construction

Planning for the drilling program involved identifying drill targets or zones by constructing a 3-dimensional geologic model of the Konnex claims through surface mapping and previous drilling. As more drilling is completed, the model is refined; model refinements are used to identify data gaps between drill holes for future infill drilling. The drill targets for this Plan of Operation are initial holes intended to expand the geologic model north and south of the patented claim block, so they are fairly widely spaced with some latitude applied for siting the drill pads. As such, the drill pads were sited along existing roads and at least 150 feet away from surface water.

The drill pads would be graded to drain surface runoff and any groundwater discharged from the borehole into a sump. Silt fencing, straw bales, and/or sediment traps will be used, as applicable, for water management and erosion control on the pad.

7.2.2 Secondary Containment and Disposal of Petroleum Products

Petroleum products will be kept in secondary containment and spill prevention kits will be kept on site to prevent contamination of water resources. Minor leaks from the drill rig will be contained by placement of a collection pan, buckets, or an impervious tarp or liner material under drip points. Spilled or leaked petroleum products will be containerized and properly disposed offsite. Only nontoxic compounds will be used downhole, such as vegetable-based drill pipe thread lubricant.

7.2.3 Drill Hole Interceptions with Groundwater

Groundwater may be encountered during drilling, which will be immediately noticeable when it is discharged from the borehole out of the cyclone. Groundwater is often detected initially as an increase in moisture of the cuttings. Discharge of groundwater often quickly dissipates from minor water bearing zones as the borehole is quickly advanced past them and cuttings tend to plug the zones. However, groundwater discharge rates will increase in significant aquifers as the borehole penetrates further into them. Groundwater discharge rates are self-regulating because more air pressure is required to overcome the hydrostatic pressure to discharge the groundwater and cuttings from the drill string. Eventually, groundwater influx can impede drilling if the air supply cannot keep up.

The total volume, duration, and rate at which groundwater flows into a borehole is governed by a number of hydraulic factors. For example, if the total water volume is small and the pressure differential is low, the water entry may be very short lived and not even noticeable. On the other hand, if there is a large volume and large pressure gradient, artesian flow could be observed at the surface.

EPMs taken to respond to groundwater discharge from the cyclone would commensurate with the severity and duration of the flow. Should there be enough flow to exceed the sump capacity, the airflow would be shut off after the cuttings are cleared from the drill string, and overflow would be discharged onto an area with the most available obstructions to flow (e.g. embedded logs, thick grass or brush). If groundwater is encountered in unconsolidated sediment or shallow bedrock, groundwater inflow would be prevented by collaring the hole, as described above. If groundwater inflow cannot be prevented by collaring and the discharge rate cannot be contained in the sump, then the hole would be immediately plugged as described below.

7.2.4 Collection Sump Reclamation

Once drilling is completed, the collection sumps would be allowed to dry out prior to capping with the native soil that was excavated to build them. The sump area along with the rest of the drill pad is then reclaimed as described in the CE. There are no Riparian Conservation Areas (RCAs) in the project area so sumps would not be located in RCAs or in areas where groundwater levels could rise above the bottom of the sump.

7.2.5 Borehole Plugging

Boreholes would be promptly plugged after reaching their total planned depth. Borehole abandonment would generally take place within hours of borehole completion to avoid the need to bring the drilling rig back to the site later. The hole collar (temporary surface casing) would be removed during hole abandonment.

Borehole abandonment entails plugging the holes from bottom to top with bentonite or neat cement grout and/or dry bentonite chips, which seals off all water transmission. Both bentonite and cement are highly effective sealants when prepared and placed correctly. The Nebraska Grout Task Force conducted an extensive study of grout performance by installing 63 grout observation wells with clear PVC casing, inspecting the grout condition with down-hole camera surveys for two years, and then injecting dye from the surface and monitoring the depth of dye penetration along the well casing (University of Nebraska, 2009). The major findings of the study were as follows:

- Bentonite chips performed well above and below the water table,

- Bentonite slurry grouts performed well below the water table but not in the unsaturated zone above the water table,
- Sand cement slurries performed better than other cement-based slurries,
- Cement slurries cracked above and below the water table

Plugging would be done immediately after reaching the total planned depth. If the hole contains less than about 20 feet of water at the bottom and is stable, dry bentonite chips would be used to fill the hole after the drill string is tripped out. If the hole is unstable or the water column is greater than about 20 feet thick, bentonite grout would be pumped down the hollow drill string starting at the bottom of the hole in order to ensure a continuous seal throughout the hole. In the case of abandonment of a flowing artesian drill hole, neat cement is used instead of bentonite grout. As the hole is filled with grout, the drill string would be withdrawn. The rise of grout in the borehole would be monitored and the bottom of the drill string would be kept submerged in the grout to make sure the grout completely fills the borehole. After the grout has risen to within five to ten feet of the ground surface and has set up, the surface casing is pulled, and the remainder of the hole is plugged with cement flush to the ground surface.

8.0 EXPLORATION DRILLING EFFECTS ON GROUNDWATER RESOURCES

Exploration boreholes that encounter groundwater would likely have negligible effects on groundwater resources due to the short duration (typically one day) for drilling each borehole, the use of air instead of drilling mud for RC drilling, and the small scale of the project.

8.1 Effects on Groundwater Quantity

The scale of aquifer disturbance is an important consideration. The maximum subsurface volume disturbed by an 8-inch borehole drilled to 800 feet would be 279 cubic feet. By comparison, the volume of a hypothetical aquifer (including groundwater and aquifer matrix) that is 10 feet thick under one acre of land would be 435,560 cubic feet, and more than 1500 times the volume of the borehole. As such, the volumetric fraction of aquifer(s) potentially affected by drilling would be very small.

The second relevant factor to consider is the duration that the boreholes are open. The average hole would be open for one day, immediately after which it would be abandoned following the procedures described above. The plugged borehole would essentially become a relatively small impermeable column (with various short dendritic branches) of clay within the aquifer. The long-term effects of these columns of clay are negligible; groundwater would continue to flow around them. There would be an insignificant reduction in bulk permeability and total water storage capacity of the aquifer.

During drilling, it is possible that there could be very minor pressure increases or decreases in the aquifer as a result of air loss into the aquifer. If there were springs or seeps nearby, this could result in very brief (on the order of hours at most) fluctuations in flow if there happened to be a direct hydraulic connection between the borehole and the discharge point. However, there are no known springs or seeps near the proposed drill sites.

8.2 Effects on Groundwater Quality

Drilling holes without proper EPMs has the potential to alter the chemical composition of surface water and groundwater through the mixing of waters from different sources. The drilling EPMs described above serve to minimize or eliminate the mixing of groundwater between aquifers or with surface water.

For the small quantities of water that are likely to mix as a result of drilling, the effects can be analyzed with respect to the composition of substances which have the potential to degrade water quality, the mechanisms by which degradation could occur, and why the EPMs serve to limit such effects to the degree that they become negligible, temporary, and thus insignificant.

8.2.1 Effects of Drilling Through Multiple Aquifers

Drill holes can act as conduits for mixing groundwater between different aquifers. The concern with aquifer mixing is that any contamination in one aquifer can be spread into other aquifers via the boreholes.

The risk of groundwater mixing due to cross-flow during the active drilling phase is minimized by the short duration for each hole to be drilled before it is plugged with bentonite. In order for mixing to occur, a zone of inflow and a zone of outflow (a net pressure differential between zones) would have to be encountered in the same hole.

The holes would be plugged immediately after drilling to minimize the risk of aquifer mixing. Since these values are much lower than the permeability of any aquifer there will be no vertical flow paths through the annular space or the borehole itself that could interconnect aquifers.

8.2.2 Effects of Surface Water Mixing with Groundwater

There are two mixing situations that will be considered; when the surface water is the contributing source and the groundwater is the receiving water and vice-versa.

Flow of surface water down the borehole would not occur during active drilling because the surrounding drill pad surface would be graded to drain water away from the borehole. Flow of surface water into an aquifer via the annular space would be prevented by proper sealing of the casing with the approved materials described above. In addition, the various material handling measures noted in the drilling procedures section would prevent spills of hazardous materials stored on the drill site that could then infiltrate into shallow alluvial aquifers.

If a significant water entry results in an artesian flow of poor quality groundwater (e.g. elevated metals) at the ground surface, this water could flow into and mix with nearby surface water.
This possibility is minimized by the SOPs described for dealing with artesian flow in the Fluid Gain section, the location of mud sumps outside of RCAs, and the prompt abandonment of flowing artesian drill holes.

Another route by which groundwater could affect surface water is when it becomes surface water by discharging from a seep or spring. The low probability of groundwater quality being affected aquifer mixing described above becomes even lower by the time it reaches a discharge point (assuming a hydraulic connection between the borehole and a discharge point exists).

8.2.3 Effects of Groundwater Infiltration and Drill Cuttings Disposal

Some of the groundwater collected in a sump will infiltrate into the soil, which has the potential to return into the uppermost aquifer. The amount of groundwater that infiltrates will be limited by the size of the sump, the soil infiltration rate, and the duration of drilling. Since the sumps would be small (typically less than 500 gallons with an area less than 10 square feet), sumps would be dug into soil that would limit the infiltration rate, and the drilling duration would be short (approximately one day), the amount of groundwater infiltration will be negligible.

Concerns have been expressed regarding the potential for sulfidic drill cuttings left in the boreholes to generate acid rock drainage and/or leach metals which might then migrate into shallow groundwater. This possibility is unlikely primarily because the cuttings would be enclosed within bentonite used to plug the hole, which would limit exposure of the cuttings to air and water.

9.0 MONITORING AND REPORTING

Since the effective protection of groundwater resources is strongly dependent upon the proper implementation of EPMs, monitoring of these EPMs will be carried out by Forest Service personnel on a regular basis.

Forest Service regulations for locatable mineral operations require regular compliance inspections by the Forest Service administrator (36 CFR 228.7) and this project also includes provision for additional Forest Service monitoring. Because the project will have negligible to no impacts on groundwater, no extraordinary monitoring measures (e.g. monitoring wells, pulling drill string to test or collect water samples) are deemed necessary.

10.0 CONCLUSIONS

The proposed mineral exploration drilling plan is not expected to impact groundwater resources.

10.1 Direct and Indirect Effects

This report considered five main issues with respect to potential impacts to groundwater related resources:

- Uncontrolled artesian flow to the ground surface causing depressurization of aquifers and run-off of contaminants and sediment into nearby surface water systems.
- Aquifers containing high-quality water may be connected by drill holes to aquifers with inferior-quality water. Groundwater mixing between aquifers may be induced by natural pressure differences.
- Significant loss of fluids from drill holes, and migration of water or drilling fluids via large faults, fractures, or solution cavities to a receptor (stream, spring, wetland, or water well).
- Groundwater contamination from spills at the surface or from run-off water entering into open drill holes from the surface.

- Properly implementing appropriate drill hole abandonment procedures for a given hydrogeologic setting.

Each of the above risks was determined to be minimal due to the inherent nature of the local subsurface environment and the nature, scale, and timing of the project. Standard industry practices for RC drilling, including contingencies for unanticipated conditions, further reduce the likelihood that any of the above impacts would occur in such a manner as to be detectable in the short or long term. Therefore, like most drilling operations, direct or indirect effects of the Konnex Exploration Drilling project on groundwater or the subsurface environment are expected to be negligible and temporary.

The limited potential for interaction between aquifers having differing water quality poses little risk of aquifer degradation. If minor transient aquifer cross-flow does result in the mixing of small volumes of groundwater, the consequences would be minimal.

10.2 Cumulative Effects

There are no connected actions occurring on adjacent private lands that are not administered by the Forest Service.

The present project should have no effect on groundwater hydraulics or water quality since the potential area of effect is proximal to the drill holes. The cumulative effects area would be the 23 drill sites and the subsurface extent that the RC holes would penetrate. Therefore, like most drilling operations, it is anticipated that the Konnex Exploration Drilling project will result in no detectable cumulative effects to groundwater or the subsurface environment.

10.3 Regulatory Compliance

The Challis LRMP contains no specific standard(s) for subsurface resources, in general, or groundwater, in particular. Forest Plan standards that indirectly address these resources and with which the project complies include:

- *Ensure that activities meet State water quality standards.*

  State standards for ground water quality include narrative standards and numerical standards for primary and secondary constituents in relation to natural background levels (IDAPA 58.01.02.11.200), require activities with the potential to degrade aquifers to be managed in a manner which maintains or improves existing ground water quality through the use of best management practices and best practical methods to the maximum extent practical (IDAPA 58.01.02.11.301), enumerate measures for the prevention of ground water quality degradation, and provide for investigation, evaluation, and enforcement action by the Idaho Department of Environmental Protection (IDAPA 58.01.02.11.400). State well construction standards that may apply to the project include requirements to prevent aquifer cross-contamination (IDAPA 37.03.09.035), to use drilling additives in accordance with manufacturer specifications (IDAPA 37.03.09.030), and to use impermeable materials to seal borings (IDAPA 37.03.09.010). As described in the previous sections, the project meets or exceeds these State standards.

- *Maintain or improve water quality.*

  Surface water and ground water quality are expected to be maintained.

- *Monitor exploration activities to ensure that stated plans and mitigation measures are accomplished.*

  Because the project is not anticipated to have major impacts on other resources, there are no mitigation measures, but the project design and operating plan include EPMs with contingency provisions. The project design also includes multiple Forest Service and operator monitoring protocols that will document how the project complies with the operating plan, EPMs, etc.

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FIGURES

Figure 1. **Site Location Map**
Figure 2. **General Geologic Map**

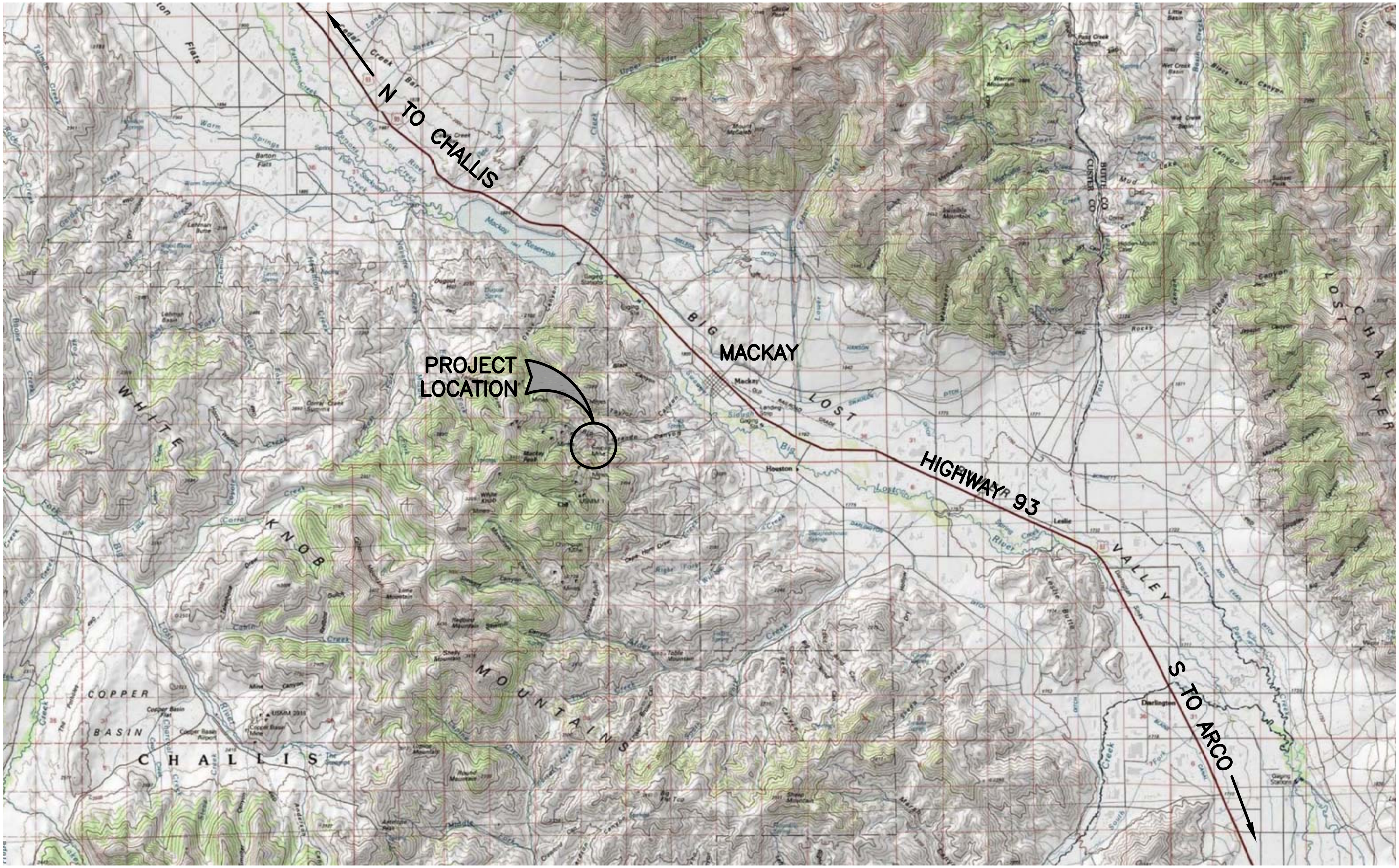


Figure 1. Site Location Map

0 3 mi

1"=3 mi

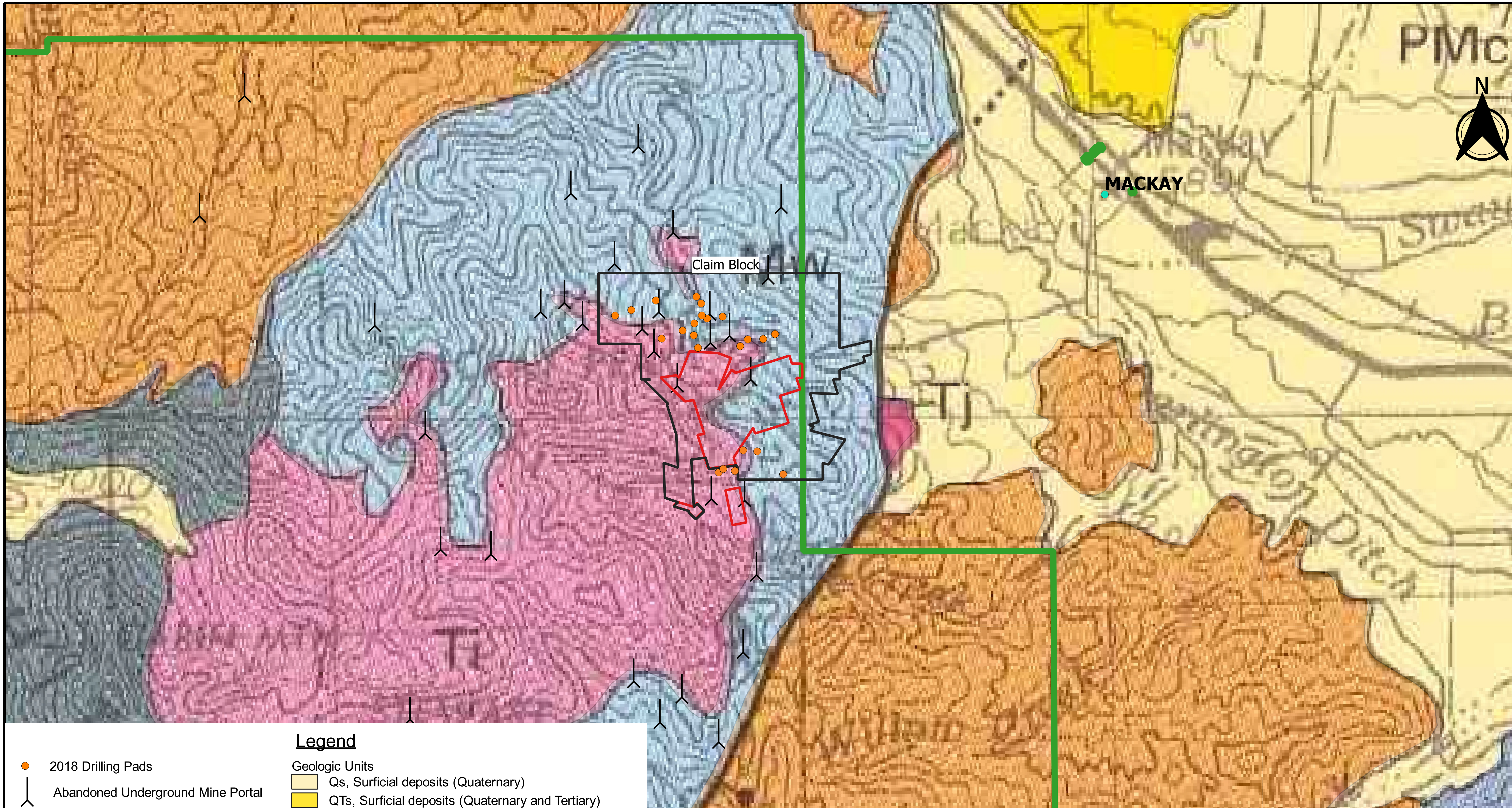
(LOCATIONS AND SCALE ARE APPROXIMATE)

N

PROJECT NUMBER: 2017220014	2018 Exploration Plan of Operations
DATE: 8/8/2017	
DWG NO: 2017220015 FIGURE 1.DWG	Konnex Resources Inc. Mackay, Idaho
DWG BY: 6DJR / PROJECT MANAGER: 5DJB	
REVISED:	CES CASCADE EARTH SCIENCES

(SOURCE: ©2013 National Geographic Society, i-cubed)

2017220015 Figure 1.dwg August 11, 2017 BD701479



Legend

- 2018 Drilling Pads
- Abandoned Underground Mine Portal
- Patented Claim Block
- Salmon-Challis National Forest Boundary

Geologic Units

- Qs, Surficial deposits (Quaternary)
- QTs, Surficial deposits (Quaternary and Tertiary)
- Tj, Jasperiod (Tertiary)
- Te, Extrusive rocks (Tertiary)
- Ti, Intrusive rocks (Tertiary)
- Mw, White Knob Limestone (Upper Mississippian)
- Mcb, Carbonate bank units (Upper Mississippian)
- Mm, McGowan Creek Formation (Lower Mississippian)

0 0.5 1 miles

Projection: NAD 83 Idaho State Plane Central (Feet)
Sources: US Geological Survey, 1994. Geologic map of the eastern part of the Challis National Forest and vicinity, Idaho.

Figure 2. General Geologic Map

PROJECT NUMBER: 2017220015	2018 Exploration Plan Review
DATE: 6/5/2018	
FILE: 2017220015 202 F2.qgs	Konnex Resources Inc Mackay, Idaho
PREP BY: DJB / REVIEWED BY:	
REVISIONS:	CASCADE EARTH SCIENCES A Valmont Industries Company