



RESPEC

# MINE INFRASTRUCTURE AND RESPEC







# INDUSTRIAL DESIGN

RESPONSIBLY DEVELOPED,  
THOUGHTFULLY IMPLEMENTED.

From exploration to reclamation, RESPEC supports the mining industry in every phase of its life cycle. We have created solutions in remote and extreme environments throughout Alaska—from the North Slope to the Seward Peninsula and the rainforest of Southeast Alaska. Underground or surface mining and support facilities, we can handle any mining application. This range of technical and geographic experience allows RESPEC to understand the mining industry's needs, including site access, site infrastructure, and mine design. Our specialized skills—from geotechnical designs to ventilation and blasting optimization—ensure mining clients receive exactly what they are looking for.

RESPEC'S mining experience centers around five market sectors:

- » Metals
- » Construction Materials
- » Industrial Minerals
- » Energy
- » Mining Facilities and Infrastructure

Our geologists, mining engineers, civil engineers, mechanical engineers, electrical engineers, land surveyors, and environmental scientists support these market sectors. They reside in many RESPEC office locations, including Anchorage, Fairbanks, Juneau, Palmer, and Soldotna.

RESPEC is a unique consultant because we have the local workforce necessary to support a project beyond design and construction. When repairs or facility expansions and retrofits become necessary, we can respond quickly and continue to support a mine's operations. Our capabilities in infrastructure design and the mining industry provide our client partners with fit for purpose solutions to their most challenging problems.



# SERVING THE FULL MINE LIFE CYCLE



**EXPLORATION**  
FINDING & DEFINING DEPOSITS



**MINE DEVELOPMENT**  
PLANNING & BUILDING



**OPERATIONS**  
EXTRACTING & OPTIMIZING



**CLOSURE & RECLAMATION**  
RESTORING & MAINTAINING



# RESPEC

## BY THE NUMBERS

1969

Founded in 1969 in Rapid City, South Dakota

550+

Over 550 employees across the US and Canada

\$105M

Created over \$105M in revenue in 2023

400+  
REPORTS

for geology and engineering technical resources and reserves



**METALS INDUSTRY**

served for 33 years



29+

29+ offices in 14 US states with 1 Canadian location in Saskatoon, Saskatchewan



250,000+ HOURS | 20,000+ ACRES

spent on transportation projects in past decade

of abandoned mine lands reclaimed and restored



# SOLUTIONS

## TO YOUR MINING CHALLENGES:

Alaska Mine Infrastructure Planning & Design

Access Roads/Remote Highways

Natural Gas Utilities

Heat & Power Generation & Distribution

Industrial Facility Design & Maintenance

Remote Airports

Environmental Permitting & Regulatory Services

Reclamation

Geotechnical & Ground Support

Mineral Resource, Reserve Estimations, and Geological Services

Mine Planning & Engineering

Geotechnical Prefeasibility and Feasibility Studies



“We are more than consultants. We’re teammates—from start to finish and beyond.”

**TABETHA STIRRETT** | RESPEC Co-President, Canada

# CAPABILITIES

## ALASKA MINE INFRASTRUCTURE PLANNING AND DESIGN

RESPEC's commitment to our clients is to provide high-quality plans and contract specifications that meet their financial and construction requirements. We serve clients with all types of surface and underground operations across the full spectrum of commodities around the world, from stone and aggregate to industrial minerals to base and precious metals.

Our core capabilities in mine development include all facets of site and facility design, mine design and layout, equipment selection, production sequencing, grade controls and optimization (costs and operational), strategic plans, business plans, and operational plans. Our team of experienced engineers and geoscientists includes experts in multiple planning software platforms specializing in value creation for our clients.

## PROJECT EXAMPLES

### ➤ *Manh Choh Gold Mine – Infrastructure Planning, Design, and Construction Administration*

Southcentral/Interior, Alaska // Kinross Gold

Located on a remote hillside in the Alaska Range, this gold mine project anticipates moving more than 1.5 million cubic yards of overburden in the first year and producing 1 million ounces of gold and 4 million ounces of silver over 4 years. A unique aspect of the project is that raw ore will be transported via highway trucks to a processing facility located over 200 miles from the mine site. With this challenge, the client needed a plan for access and transport of the ore to the main highway. They selected RESPEC as the project consultant. RESPEC's engineers across its Infrastructure and Mining & Energy business units conducted scoping and feasibility studies along with the design for the site's development.

The client initially suggested using an existing road that was once used by hunters and locals and ran from the bottom of the hill to the mine site. When exploratory drilling started, this road became the primary access route to the mine; however, with steep grades (exceeding 20 percent) and tight horizontal curves, the road was not optimal for large, heavy vehicles.

RESPEC engineers proposed a new road, deviating from the original route to give it a proper geometry for heavy mine off-road haul trucks (maximum grade of 10 percent). Following client approval, RESPEC proceeded with this plan to 95 percent completion.





The client then tasked the RESPEC team to redesign the access road, maintaining grades less than 6 percent, enabling highway trucks to descend more than 1,500 vertical feet during all weather conditions. The road design extends for over 9 miles through very challenging terrain before reaching flatter lands. The RESPEC team met the challenge by designing this new route with minimal impact on the project schedule.

Manh Choh's owners and operators also trusted RESPEC to design and specify equipment for the mine's new Water Treatment Plant (WTP). A WTP is a critical piece of any mine's infrastructure because it removes naturally occurring metals and other potentially harmful particulates from surface runoff. Typically, any stormwater that touches a mine's ground surface must be treated before discharge. Manh Choh's WTP collection system was designed to handle 260 gallons per minute (gpm) of stormwater and be directed to an 8 million gallon pond. Based on the anticipated inflow rate of stormwater, RESPEC designed a treatment plant to handle 780 gpm. The WTP included systems for chemical treatment, de sedimentation, filtration, and reverse osmosis treatment methods. RESPEC

also designed stormwater outfalls for the final discharge of the treated water.

In addition to access road design consultation, RESPEC developed the water, wastewater, and facility pads for the mine site, produced overburden placement plans and ore load-out facilities, and constructed a mine personnel camp. RESPEC's water resource group was also involved, aiding in the runoff water management design, such as perimeter ditches, retention ditches (for storage), and the setup of the WTP.

During construction, RESPEC teamed with the client's construction administration group. RESPEC is currently on site monitoring progress and schedules, evaluating materials, analyzing costs, and ensuring the project is safe, efficient, and organized. Our construction engineers also provide direct feedback to the team when questions or unknown conditions arise, which greatly reduces the delay and expenses associated with standard request for information (RFI) procedures. During the summer and fall of the 2022 construction season, the team oversaw the completion of 9 miles of roadway, with more than a million tons of material excavation and borrow placement.

## ➤ ***Fort Knox Mill Repairs and Retrofits***

### **Fairbanks, Alaska // Kinross Gold**

RESPEC has conducted work at the Fort Knox Mine since the mine was in its original planning stages. Several projects include the structural design for maintenance of the Ball Mill (thunderbolt pickers), semi-autogenous grinding mill screen deck supports, monorails design,

fall protection tie-off upgrades, man-basket implementation designs, gravity pumps, floor remodels, and seismic anchorage design to accommodate new equipment installs and support existing equipment removal.



## ➤ *Pogo Mine Water and Wastewater Treatment and Utilities Expansion*

Near Delta Junction, Alaska // Northern Star Resources

The owners of Pogo Mine contacted RESPEC to increase the camp capacity and expand the water and wastewater utilities for mine personnel. The program was divided into three projects:

1) addition of modular personnel camps; 2) assessment/modifications to the sewer treatment plant (STP); and 3) assessment/modifications to the potable water plant (Potable 3). RESPEC engineers are working with the client to assess and perform code reviews on the existing out-of-state modular structures. They are also developing a full set of design documents to be used for Alaska State Plan and Alaska Department of Environmental Conservation reviews to increase camp capacity by 300 individuals. The STP assessment and modification project improved the membrane filter installation and reviewed the facility's

unit processes to reevaluate the STP's capacity. As a result of the assessment, RESPEC determined that the facility had the additional capacity required to accommodate the increased camp population and submitted a request to the ADEC to re-rate the facility. RESPEC is also expanding Potable 3 to increase the potable water output and developing a full set of design documents for ADEC review and construction to increase the facility output by approximately 60 percent. This project has an accelerated schedule because of the immediate need for expansion and is constrained by budget and equipment availability; however, RESPEC is working within these constraints to provide an innovative, efficient design for clean drinking water for the additional Pogo Mine camp population.

## ➤ *Pogo Mine Primary Haulage Conveyor Repairs*

Near Delta Junction, Alaska // Northern Star Resources

Pogo Mine hired RESPEC in 2021 to provide design documents for a structural repair to their "Blue Tube." The Blue Tube houses and structurally supports the primary conveyor, which transports underground ore to the mill. A portion of the conveyor's foundation had settled unexpectedly, which caused structural damage to the supports of the conveyor. RESPEC's design had three components: 1) a temporary shoring plan; 2) a permanent rehabilitation structural support design; 3) and a

geotechnical foundation design that addressed the cause of the settlement. The project was successfully completed through close coordination with on-site contractors, which minimized the downtime of the conveyor. The project was also accomplished by having previous knowledge of the infrastructure and personnel on site, and RESPEC's proximity to the site, which allowed for a site visit within hours after the incident that had shut down the conveyor.



## ➤ *Fort Knox Primary Crusher Maintenance*

Fairbanks, Alaska // Kinross Gold

For the past 12 years, RESPEC has performed emergency repairs on the mill primary crusher slab and breaker, designed equipment for preventive maintenance, designed an energy absorption system to protect the crusher

bed, and conducted structural inspections of the facility. Because of our institutional knowledge and close proximity to the client, RESPEC can provide solutions and immediate response to these critical infrastructure components of a site.

## ACCESS ROADS/REMOTE HIGHWAYS

Our team has designed and engineered roadways over some of the most challenging terrain in the United States. We excel at designing safe, sustainable, and constructible roadways through seemingly impassable landscapes.

To maintain reliable access, we apply proven strategies for slope stabilization and permafrost, aufeis, and snowdrift mitigation. We also design drainage improvements and fish-passage culverts.

Our environmental team evaluates the boundaries of sensitive environmental features so that avoidance or mitigation strategies can be rolled into the planning and permitting process from the start.

The RESPEC transportation team thrives on devising creative solutions within demanding parameters. We deliver on every aspect of roadway planning and design within time and budget constraints.

## ➤ *Eva Creek Wind Farm - Access Road and Infrastructure*

Ferry, Alaska // Golden Valley Electric Association

RESPEC performed the fast-tracked design to support the Michels/Brice design-build team that developed a wind farm on the ridges above Ferry, Alaska. This remote area of Alaskan wilderness was accessed by a single-lane mining road typically via all-terrain vehicles or helicopters. After 4 months, design and construction efforts turned the narrow, winding, steep 10-mile road into an access road capable of handling 380,000-pound loads, 150-foot-long wind turbine blades, and all the construction traffic to build twelve 410-foot-tall wind turbine generators.

The access road design minimized ongoing aufeis and wind-drifting maintenance of the road and impacts on wetlands, migratory birds, and the surrounding fragile alpine environment.

Support infrastructure included a 170-person temporary camp, two maintenance and operations (M&O) buildings, three communication towers, and associated water supply and wastewater treatment. Only 18 months after design began, all 12 wind turbines were producing power for this 24.6-megawatt (MW) plant for Golden Valley Electric Association.





## ➤ *Alaska Highway Rehabilitation*

### East of Tetlin, Alaska // AKDOT&PF

RESPEC took the partially completed design from the Alaska Department of Transportation and Public Facilities (DOT&PF) and developed solutions to rehabilitate the pavement structure over permafrost and soft-soil foundation failure areas, resurface the roadway, repair the settled embankment at a bridge abutment, and stabilize rock cuts. We integrated preliminary engineering, survey, right-of-way (ROW) limits, and hydrological data

provided by others into a cohesive Plans, Specifications, and Estimates (PS&E) set. A 0.5-mile, new material source access road was designed on a LiDAR surface. Under a separate contract, RESPEC prepared the construction engineering drawings and permits and worked closely with the DOT&PF and U.S. Fish and Wildlife Services to identify wetland mitigation strategies.

## NATURAL GAS UTILITIES

### ➤ *Interior Gas Utility*

#### North Pole, Alaska // Interior Gas Utility

The Fairbanks/North Pole, Alaska, area has some of the worst air quality and highest utility costs in the United States. The cities of North Pole and Fairbanks, along with the Fairbanks North Star Borough, created Interior Gas Utility (IGU) to facilitate the delivery of natural gas to Interior residents in an effort to alleviate economic constraints and poor air quality. In six phases, IGU plans to build a natural gas distribution system to distribute natural gas to as many as 15,000 residents, which would effectively lower energy costs and address public health concerns related to poor air quality.

Since the formation of IGU, the RESPEC team has provided surveying, engineering, permitting, and forecasting services. We designed the Phase I pipe network, developed the permits, performed a cursory analysis of liquefied natural gas storage options, and developed a robust GIS database that can produce accurate design drawings.

RESPEC's surveyors have met or exceeded the accelerated schedule of this huge, complex, fast-track effort since winning the project. The team developed survey procedures for subcontractors; conducted ROW and easement research on more than 130 subdivisions; and quickly mobilized multiple crews for cadastral surveys, subdivision and ROW ties, topographic surveys, and slough crossings. The property base map covered most of North Pole, from the Chena flood-control project to the intersection of the Old and New Richardson Highways.

Just 15 months after design started, IGU had 73 miles of high-density polyethylene (HDPE), gas- distribution piping in the ground that is ready to connect 2,000 homes and businesses as soon as a natural gas source is secured.

## HEAT & POWER GENERATION & DISTRIBUTION

The experts at RESPEC can assist with comprehensive planning and design for heat and power generation and distribution projects, including surveying, engineering, permitting, forecasting, and construction oversight.

Heat and power generation facilities are large capital assets and, therefore, require resilient and reliable systems that can operate at peak performance for decades. Our multidisciplinary team excels at reaching across disciplines and collaborating with project partners to clarify project needs and devise solutions that support our clients' objectives. We are adept at working with original equipment manufacturers to ensure that the systems we design will accommodate power generation equipment. RESPEC also accounts for elevated safety factors

in all of our design criteria to safeguard operations during major weather events or natural disasters.

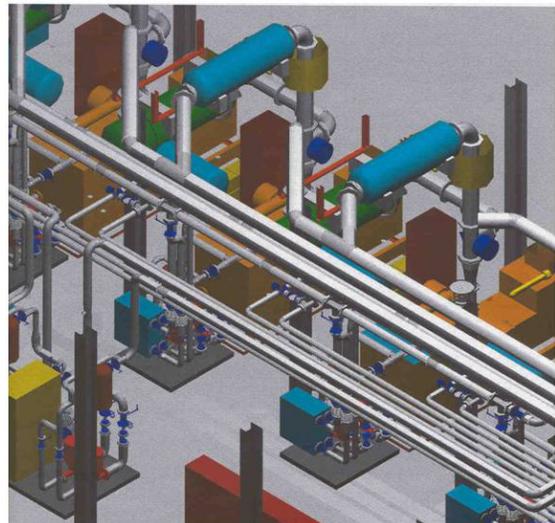
For utilidor vaults and direct-bury distribution lines, we develop accurate economic models to minimize energy loss and maximize distribution economics. We assess options to present our clients with the best, most cost-effective solutions that provide the greatest value for their investment.

RESPEC's team is highly skilled in multiagency permitting processes, as well as researching and obtaining easements and ROWs. Public safety considerations and maintenance ease are designed into all of our solutions.

### ➤ *Amundsen-Scott South Pole Power Plant*

#### Amundsen-Scott South Pole Station // National Science Foundation

The New Power Plant at the Amundsen-Scott South Pole Station was part of a phased 10-year construction redevelopment effort for the National Science Foundation. RESPEC joined the project in early conceptual design efforts that defined solutions for long-term, 25- to 40-year power plant, fuel, communications, and grounding challenges. This project demonstrates RESPEC's specialized experience with multidisciplinary coordination and design of technically complex projects. The climate of the site dictated that the design of this 7,000-square-foot facility consider energy efficiency (fuel costs are approximately \$12 per gallon) and installation techniques that accommodate the extreme climatic conditions. These



considerations were paramount with winter design temperatures that can reach -20 degrees Fahrenheit at a barometric altitude of 12,000 feet. The power plant design included specific features that can be

applied to other remote Alaska or arctic locations including waste heat recovery systems for engine-generator exhaust (heat-recovery silencers) and jacket

water, lubrication oil purification/reuse system, panelized building construction, and systems to minimize floor space and maximize maintenance access.

## INDUSTRIAL FACILITY DESIGN AND MAINTENANCE

Many engineers can design M&O facilities, but RESPEC designs them to last. We know that building them is the easy part. Maintaining them, especially in remote locations, requires harder work. RESPEC creates designs that account for projects' lifespans. We ensure our clients can use, maintain, and repair their M&O facilities long after our contract is finished. RESPEC's M&O facilities often have similar designs that are always adapted to

specific sites. We start by asking, "Where do function and form overlap?" Then, we determine the M&O facilities' priorities, so the facilities work as needed for years to come. We also apply lessons learned using our quality control checklists, each developed uniquely for the type of facility. For instance, at an M&O shop in Interior Alaska, we modified our design to include a condenser that serves as both an active and passive freeze-back system.

### ➤ *Fort Knox Shop/Warehouse/Office Building*

Fairbanks, Alaska // Kinross Gold

The 64,000-square-foot Fort Knox shop/warehouse/office building is the primary M&O center for Fort Knox. RESPEC designed the building foundation, slabs, docks, below-slab pits, and truck wash

bay for a design-build project. To minimize structure cost, RESPEC found efficiencies by providing structural fixity from the foundation to the steelwork above.

### ➤ *Fort Knox Equipment Maintenance Shop*

Fairbanks, Alaska // Kinross Gold

The 5,000-square-foot equipment maintenance shop had a very short construction schedule. RESPEC designed the steel building using locally supplied materials, built by local erection crews, to save time and meet the aggressive schedule. The slabs were designed to

support the heavy wheel loads of the large rock trucks and accommodate large bulldozers. Special detailing was needed to accommodate slab abrasion and shrinkage, drainage, and thermal differential movement.



## ➤ *Crown Point Maintenance Facility*

Seward, Alaska // AKDOT&PF

RESPEC specified building requirements and mechanical components/layout for a prefabricated shop that services road maintenance vehicles near Seward, Alaska. The structure is an 8,400-square-foot premanufactured metal building with three maintenance bays, an accessory office, training rooms, and attached boiler and generator spaces. The shop area includes a pulldown and movable exhaust system for vehicles and welding, an overhead crane, a large vehicle lift, a heated floor slab, and a snowmelt system

for the concrete aprons outside each overhead door. The exterior skin of the building consists of low-maintenance insulated metal wall and roof panels over steel building frames. The project also included developing the surrounding parcel to include a sand storage pad, drainage pond, and parking area for the building users. The design for the project was based on a prototype design developed by RESPEC for a similar facility in Aniak, Alaska.



## REMOTE AIRPORTS

Airports can range from a simple system with a small runway and few hangars to a thriving, metropolis-like center with thousands of employees and passengers passing through daily. The modern-day airport fulfills several roles, and understanding the airport activities, stakeholder needs, and expectations is important in operating a successful facility.

We help our clients define their vision and see it through to completion. Whether the need is to expand, rethink, or completely reconstruct infrastructure, we work alongside our client's team to examine the details, understand goals, develop state-of-the-art strategies, and deliver an action

plan. Our clients can expect solutions that emphasize safety, reduce risk, and capitalize on restricted budgets.

RESPEC's team has a full spectrum of airport experience, from international gateway airports to backcountry airstrips in unforgiving terrain. We understand the demands of planning and designing for urban, rural, and environmentally and culturally sensitive environments. We are adept at coordinating with federal, state, and local agencies, as well as conducting public outreach. As a result, we can anticipate hurdles and streamline processes to deliver fast, cost-effective solutions.

## *Tetlin Airport Relocation*

### Tok, Alaska // AKDOT&PF

RESPEC developed a master plan and design for the Tetlin Airport Relocation project for the DOT&PF. The primary goal of this all-discipline project was to design a longer, safer runway that included a taxiway, apron, access roads, snow-removal equipment building,

automated weather observing system, wind cone, segmented circle, and signage. These improvements made aircraft emergency support available year round, which could benefit the safety of the Tetlin Mine staff.

## ENVIRONMENTAL PERMITTING AND REGULATORY SERVICES

With extensive knowledge in environmental studies, permitting processes, and the National Environmental Policy Act (NEPA), RESPEC offers a wide array of environmental services that are vital to protecting natural resources.

Performing environmental services for almost 50 years, our professionals provide management, consulting, inventory, investigation, design, and construction-

management services for several remediation, reclamation, and restoration projects throughout the US. For public and private clients in need of environmental permits, we identify and secure permits from appropriate agencies and required biological assessments, geologic/hydrogeologic investigations, and wetland delineations to ensure project compliance with permit conditions.



## ➤ ***Barrick Golden Sunlight Mine EIS***

Montana // Montana Department of Environmental Quality (DEQ)

Golden Sunlight Mines, Inc., proposed an amendment to its Golden Sunlight Mine in Jefferson County, Montana (Amendment 017 to Permit 00065). The amendment would allow the mine to excavate and reprocess tailings from the previously reclaimed TSF-1, construct a new repulping plant, reprocess the tailings to separate sulfur and gold, and dispose of the remaining tailings by partially backfilling the pit. The Montana Department of Environmental Quality (MDEQ) retained RESPEC to perform scoping activities, prepare the Draft Environmental Impact Statement (EIS), respond to public comment, and prepare the Final EIS for the MDEQ and Bureau of Land Management.

RESPEC staff were responsible for all aspects of the EIS—managing the

project, developing the purpose and need, developing and refining the alternatives, conducting public scoping activities, preparing technical memoranda, compiling and indexing the Administrative Record, writing and assembling the EIS text, collecting and reporting public comments, and analyzing impacts related to three alternatives. Three key issues of concern were addressed: 1) geotechnical stability of the shared embankment between TSF-1 and TSF-2; 2) geochemical implications of using reprocessed tailings as pit backfill, soils, and vegetation; and 3) overall groundwater and surface water quality and water management. RESPEC also evaluated alternative reclamation designs for enhanced reclamation of TSF-1 and the pit.



## RECLAMATION

### ➤ ***CERCLA reclamation in Alaska – the Ross Adams Uranium Mine***

Prince of Wales Island, Alaska // Newmont

Once Alaska's only producing uranium mine, the former Ross-Adams Mine shuttered operations in the 1970s. The abandoned mine, now an open pit

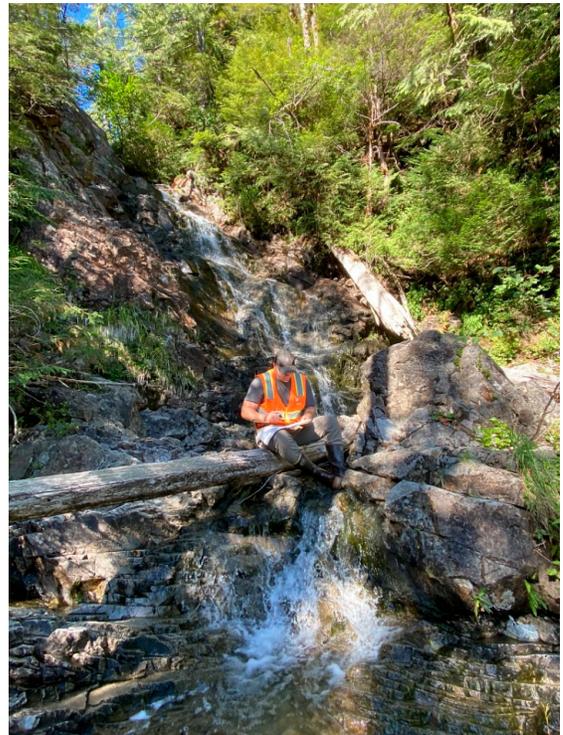
with accessible portals and stockpiled radioactive ore, has become a source of safety hazards and environmental concerns in the Tongass National Forest.



The U.S. Forest Service declared the Ross-Adams site a Superfund site and enacted the Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA). CERCLA mandates that the current site owner develop plans and allocate funds for cleanup. To accomplish this, Newmont contracted RESPEC to provide multiple concrete bulkhead designs for eliminating access to three mine portals and an air vent shaft.

RESPEC visited the mine site in August 2022 and performed a Light Detection and Ranging (LiDAR) scan to develop three-dimensional (3D) models of the mine portals, capturing incredible detail. These data were crucial for identifying potential stability issues and understanding the exact dimensions and contours of the mine portals, which was essential for safe and effective closure designs. RESPEC also conducted a stability analysis of the rock mass at each portal.

In addition to the LiDAR scan, flow estimations of a nearby creek were combined with flume data collected at the 300-foot level portal, which helped designers determine the design flow



capacity for piping that will allow water to flow from the 300-foot level portal once it is closed.

With the project moving into the design phase, RESPEC remains active, primarily focused on upgrading the rough mine roads to facilitate haul trucks during reclamation. RESPEC's mining engineering team is also developing plans for a mine waste rock repository. Construction is set to occur in 2024 and 2025.

## GEOTECHNICAL AND GROUND SUPPORT

Geotechnical services are usually required and critical for the success of an infrastructure project or active mine site. The point at which geotechnical services are necessary could be during the early stages of design and construction or in the later stages of operations, maintenance, or repurposing. Overlooking the geotechnical aspects of projects can result in difficult and costly

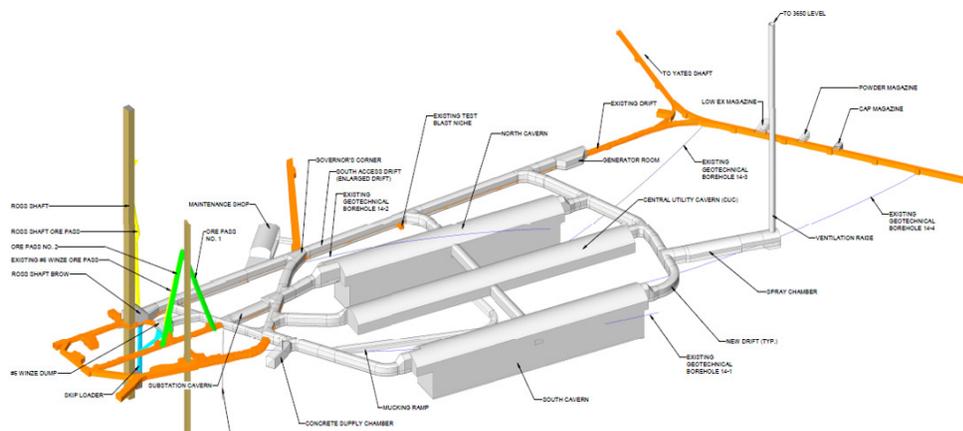
corrections, especially in the arctic and subarctic, permafrost, and seasonal frost-prevalent regions. RESPEC offers in-house geotechnical consulting services to support the needs of our clients. Our primary goal is to provide clients with the information they need to make reliable, informed decisions about the geotechnical elements of their projects.

## ➤ *Geotechnical Monitoring, Structural Reviews, and Third-Party Testing in Support of the Long Baseline Neutrino Facility at SURF*

Lead, South Dakota // Sanford Underground Research Facility (SURF)

As a trusted partner of the Homestake Mining Company and the South Dakota Science and Technology Authority, RESPEC has performed multiple underground excavation design, ground support, instrumentation and monitoring, and other projects at the Sanford Underground Research Facility (SURF) located in the historic Homestake Underground Mine in Lead, South Dakota.

The largest recent project included multiple aspects of ground support, underground facilities, and instrumentation engineering for the very large Long Baseline Neutrino Facility excavations (more than 300 feet long, 90 feet tall, and 80 feet wide). More than 530,000 cubic yards of rock will have been excavated to make room for the newest equipment available for the Deep Underground Neutrino Experiment (DUNE).



## MINERAL RESOURCE, RESERVE ESTIMATIONS, AND GEOLOGICAL SERVICES

RESPEC assists clients in exploration management, underground and open-pit resource development, and continued advancement in understanding the geological and geotechnical data of current operations.

RESPEC's team of qualified engineers and geologists work closely with our clients to create 3D geological models and resource

estimations for numerous deposit types. Using database validation, geostatistical analysis, block modeling, and interactive geological modeling, our professionals are adept at resource estimation, appraisal, and regulatory compliance.

Our 3D modeling services include solid, grid, and hybrid models. We also offer block modeling with geostatistical

analyses, including variography, kriging, and simulation. Outcomes include resource estimation and classification, uncertainty quantification, and other geostatistically derived results. Our team uses multiple software platforms to complete geological and resource modeling, including GEOVIA Surpac, Maptek Vulcan, Hexagon Minesight3D, and Carlson software packages. RESPEC works with national and international clients to design and manage exploration programs that range from grassroots exploration assessment to operating mine settings. Our team has more than 35 years of experience in exploration

management, target delineation, and project development. We assist our clients with deposit modeling, identifying and correcting sampling problems, conducting geological and statistical evaluations, and performing model resource and block-model reconciliations. Our experts understand reporting guidelines from Canadian National Instrument (NI) 43-101 to U.S. Securities and Exchange Commission (SEC) S-K 1300. We ensure that the data we collect meet or exceed the industry standards, such as Canadian Institute of Mining or Committee for Mineral Reserves International Reporting Standards.

## ➤ *DeLamar and Florida Mountain Prefeasibility Study*

Owyhee County, Idaho // Integra Resources Corp.

RESPEC has been working with Integra Resources Corp. since 2017 and has completed a Preliminary Economic Assessment (PEA) and Prefeasibility Study (PFS) for the DeLamar and Florida Mountain deposits. We are currently working on the Mine Plan of Operations. For the PFS, RESPEC completed the resource modeling, geotechnical

evaluation, mine optimization and designs, production scheduling, mining and general and administrative cost estimates, and economic analysis, including tax treatment inputs from the corporate CFO. A summary of this work was reported in an NI 43-101 Technical Report made public on March 28, 2022. The feasibility study is scheduled to begin in 2024.



# MINE PLANNING AND ENGINEERING

RESPEC serves clients with all types of surface and underground operations across the full spectrum of commodities around the world, from stone and aggregate to industrial minerals to base and precious metals. Our core capabilities in mine development include a range of mine plans, mine design and layout, equipment selection, production sequencing/

scheduling, grade controls and optimization (costs and operational), trade off studies, strategic plans, business plans, and operational plans. Our team of experienced engineers and geoscientists includes experts in multiple planning software platforms (such as Deswik, GEOVIA Surpac, and Vulcan) that specialize in value creation for our clients.

## ➤ *Copperstone Mine Planning Services*

Arizona // Sabre Gold Mines Corp.

RESPEC provided long-range planning and strategic planning services, including an updated mine plan and production schedule, for a fully permitted underground project in northwest Arizona. Much of the surface infrastructure and basic underground infrastructure, including portals and a previously mined pit, were in place and incorporated

into the mine plan and cost estimate. The cost estimate was updated to reflect production in the near term, with an updated cost model to reflect a contractor-mined operation. Potential longer term plans were considered and tied into nearer term planned mining activities.

## ➤ *Homestake District Planning Services*

Lead, South Dakota // Dakota Gold Corp. (DGC)

RESPEC has teamed with Dakota Gold Corp. (DGC) for strategic planning services to advance numerous potential gold projects within their land holdings in the Homestake District of South Dakota. Since 2020, RESPEC has provided DGC with exploration drilling permitting support, seismic and vibration monitoring and modeling, mine planning and mine design, mineral processing evaluation (through a subcontractor), tailings management

design, infrastructure review and design, capital and operating cost estimation, and general strategic planning services.



# GEOTECHNICAL PREFEASIBILITY AND FEASIBILITY STUDIES

## ➤ *Integra Prefeasibility and Feasibility Studies*

Southwestern Idaho // Integra Resources, Corp.

RESPEC performed a geotechnical PFS for Integra Resource Corp.'s DeLamar and Florida Mountain gold-silver project in 2021 and 2022 and is currently working on the FS. RESPEC's Nevada-based resource development team (formerly Mine Development Associates [MDA]) completed the PEA for Integra, and the synergy between RESPEC's geotechnical, resource geology, and mine engineering teams streamlined the project and reduced costs. Because the project site has complex geology and a long history of surface and underground mining, historical geotechnical data and recent exploration core had to be carefully examined. Rock-mass and soil material properties were developed using laboratory tests performed at RESPEC's rock mechanics laboratory and a third-party soils testing facility, historical laboratory test data, geotechnical core logging and down-hole geophysical

logging. Soil and rock properties and structural data were incorporated in 2D and 3D stability models for evaluating overall and interramp stability and to design the pit slopes. Historical joint set, fault, and other structural data were combined with recent measurements from point-cloud data and down-hole geophysical surveys to perform kinematic stability analyses and evaluate the bench face angles. Prefeasibility-level pit slope design recommendations were delivered to the client and used by MDA to design the prefeasibility pits. RESPEC's design recommendations were largely consistent with historical recommendations and mining practices but also identified opportunities for slope steepening and potential increased ore recoveries. Optimization of the pit slope designs is currently being performed for the feasibility-level study.



# STAFF HIGHLIGHTS



## ALEC VENECHUK, PE

BS in Geological Engineering // Senior Mining Engineer

Alec is a versatile mining engineer with extensive experience in project management, mining operations and development, land surveying, and utility construction. His experience working for operating mines as a utility construction inspector and as a construction project manager gives him a unique perspective of the client-consultant relationship that will enhance projects from concept to completion. Alec has performed job titles of chief engineer, mine laborer, and everything in between. His professional mission is the responsible development of natural resources and construction projects throughout Alaska.

### PROJECT EXPERIENCE

- » Ross-Adams Mine Reclamation Design, Kendrick Bay, AK
- » Kensington Mine Tailings Dam and Infrastructure Construction, Juneau, AK
- » Hecla Greens Creek Mine Surveyor/Short-Range Planning/Geotechnical Engineer, Juneau, AK



## LUKE RUBALCAVA, PE

BS in Mechanical Engineering // Project Engineer

Luke's experience is focused on water/wastewater process mechanical engineering, facility design, and construction/operation services. He is involved in the design and construction phases of new facilities, assessment and retrofitting of existing facilities, and inspection and startup of finished projects. He can design and troubleshoot hydraulic systems and wide-ranging process/treatment systems that are typically used in water and wastewater treatment.

### PROJECT EXPERIENCE

- » Pogo Mine Man Camp Addition-Kitchen, Dining, and Recreation, Interior, AK
- » Pogo Mine Sewer Collection Treatment Systems Interior, AK
- » Pogo Mine Potable Water Treatment and Distribution System Interior, AK





## HEATHER ESTABROOK, PE

BS in Civil Engineering // Senior Civil Engineer

With 20 years of experience in performing engineering field investigations for highway projects and preparing Design Study Reports and PS&E assemblies for 135 miles of the Elliott, Parks, Steese, and Alaska Highways, Heather has intimate knowledge in all aspects of rural highway and road design and the process to develop a project from preliminary engineering through PS&E. She produces tightly coordinated plans, estimates, and design notebooks that are easy for the construction section to use to administer the project.

### PROJECT EXPERIENCE

- » Manh Choh Gold Mine Access Road, Eastern Interior, AK
- » University Avenue Rehabilitation and Widening, Fairbanks, AK
- » Elliott Highway MP 107.7-120.5 Reconstruction, Northern Alaska
- » Nome Bypass Road, Nome, AK,
- » Steese Highway MP 44-81 Rehabilitation, Interior, AK
- » Parks Highway MP 262 North 3R Update, Interior, AK





## KAREN BRADY, PE

BS in Civil Engineering // Principal Civil Engineer

Karen manages the utility group at RESPEC and remains involved in planning, design, and construction administration. Over the years, she has added site design work and expanded her capabilities as a well-rounded civil/environmental engineer. She has a solid, practical understanding of how technical drawings and specifications relate to the construction process in the field. Karen's utility experience includes hydraulic modeling, fire flow capacity analysis, thermal modeling, alignment and profile development, and storm drains. Her site design experience includes parking lots, access, grading, and drainage.

### PROJECT EXPERIENCE

- » Liquefied Natural Gas Storage Improvements, IGU, North Pole, AK
- » Three Million-Gallon Fuel Storage Concept, Golden Valley Electric Association, North Pole, AK
- » Ligu Street and Laura Madison Street Gas/Electric, North Slope Borough, Utqiagvik, AK
- » Utility System Characterization Studies, Doyon Utilities, Fort Greely Military Base, AK
- » Piped Sewer and Regional Septage Facility, Anderson, AK



## DANNY RAUCHTENSTEIN, PE

BS in Mechanical Engineering // Principal Mechanical Engineer

Born and raised in Alaska, Danny brings firsthand experience in cold Alaskan climates to all of his designs. His expansive HVAC design experience includes ventilation, heating, plumbing, controls, fire protection, and fuel systems, as well as utilidor and plant design. He also has broad experience in the energy field, including waste heat recovery, oil and gas development, and energy studies. Danny uses the industry's newest tools, including 3D CAD, flow modeling, building energy modeling, and economic analysis software.

### PROJECT EXPERIENCE

- » Airport Rescue & Firefighting Facility/Snow Removal Equipment Building/Flight Service Station, Deadhorse, AK
- » Chena Flood Project Office and Visitor's Center Modernization, North Pole, AK
- » Energy Technology Facility, Fairbanks, AK
- » Eklutna Water Treatment Facility Generator Replacement, Anchorage, AK
- » Alaska Railroad Passenger Terminal, Fairbanks, AK



## PATRICK WIECK, PE

BS in Mining Engineering // Principal Consultant

Patrick is a professional engineer, principal consultant, and metals market lead within RESPEC's Mining & Energy business unit. Patrick has a diverse consulting, operations, construction, and project management background. Patrick is a Qualified Person/Competent Person for economic analysis and reserve reporting as defined by SEC S-K 1300 and NI 43-101. Patrick has experience in both surface and underground mines for metals, industrial minerals, and coal. He has international operational experience as a Senior Production Engineer and Operations Manager for Cliffs Natural Resources Koolyanobbing operations near Southern Cross, Western Australia. Patrick also worked as a project engineer and owner's representative during the Collom pit expansion construction at the Colowyo Coal Mine near Craig, Colorado. Patrick's expertise lies in project management, strategic mine planning, and capital and operating cost estimation.

### PROJECT EXPERIENCE

- » Dakota Gold Corp., Black Hills, SD
- » Manh Choh Mine, Tok, AK
- » Selwyn Resources Ltd., Yukon Territory, Canada
- » Coalspur Mines Ltd., Hinton, Alberta, Canada
- » Cliffs Natural Resources, Koolyanobbing Operations, Western Australia
- » Colowyo Coal Mine, CO
- » AngloGold Ashanti, Cripple Creek, CO
- » Gold Reserve Inc., Venezuela



## ELLIOT WILSON, PE

BS in Civil Engineering // Civil Engineer

Elliot Wilson likes solving problems to make people's lives better. He spends his days offering structural solutions to people who know they need a building and want to ensure that it withstands an Alaskan earthquake but do not have the technical expertise to meet their needs. Elliot gives options that are rooted in real-life application, industry standards, and hands-on experience. His background in construction influences the computer-simulated models that he creates, so clients can rest assured that his ideas will translate to practical, long-lasting structures.

### PROJECT EXPERIENCE

- » Yukon River Bridge Pier 2 Landslide Structural Assessment, Alyeska Pipeline Service Company, Milepost 56, Dalton Highway, AK
- » Structural Evaluation of Maintenance and Operation Stations, DOT&PF—Northern Region, Alaska
- » Liquefied Natural Gas Storage Improvements, IGU, North Pole, AK
- » Combined Heat and Power Plant Special Inspections, UAF, Fairbanks, AK
- » Moose Creek Water Expansion, City of North Pole, North Pole, AK



## TOM DYER, PE

BS in Mining Engineering // Principal Mining Engineer

Tom has more than 23 years of experience as a practicing mining engineer and has performed tasks associated with an operating mine, including the Cortez Gold Mine in Beowawe, Nevada, and other Placer Dome Inc. properties. His various duties have included updating reserve and resource models, pit optimization projects, pit design, short- and long-term planning, cost tracking, supervising surface and underground mine personnel, and participating in mine feasibility studies. Tom also has nearly 15 years of experience working as a miner in various underground and surface operations, including operating a range of equipment in gold, limestone, and coal mines.

### PROJECT EXPERIENCE

- » DeLamar Project, DeLamar Mining (Gold), Owahee County, ID
- » Long Valley Project (Gold), Vista Gold Corp., Mono County, CA
- » South Railroad Project, Gold Standard Ventures (Gold/Silver), Elko County, Nevada
- » Mt. Todd Project, Vista Gold Corp. (Gold), Northern Territory, Australia
- » Hasbrouck Project, West Kirkland Mining (Gold), Nye County, NV
- » Lindero (Gold), Goldrock Mines Corp., Salta Province, Argentina
- » Shahuindo Project (Gold), Sulliden Gold Corporation Ltd., Cajabamba, Peru



## KIERSTEN BRIGGS

BS in Geology/AS in Geology // Project Geologist

Kiersten has 20 years of experience working in geologic modeling, exploration, environmental compliance, and geotechnical projects in the western U.S. Kiersten's mining experience includes three-dimensional (3D) modeling of precious-metal deposits, surface and underground exploration drilling and geologic mapping, and mine operations supervisory duties. Additionally, she has experience in geotechnical investigations for open-pit mines, railroads, bridges, and streets and in environmental investigations for sites with impacted soil and groundwater. Kiersten has also worked as a geographic information system (GIS) professional in support of mining, environmental, and geotechnical projects.

### PROJECT EXPERIENCE

- » Comstock Lode Geology Modeling, Tonogold Resources, Inc., VA
- » Geologic Evaluation, Ida Consolidated Mines, Art Wilson Co., Silver City, NV
- » Surface Exploration, Dayton Property, Comstock Mining Inc., Silver City, NV
- » Petroleum Inventory GIS Database, Carson City Redevelopment District, Carson City, NV

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