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TECHNICAL MEMORANDUM

DATE: August 27, 2020

Project No.: 704-60-20-14
SENT VIA: EMAIL

TO: Nick Pappani

CC: Rod Stinson

FROM: Kenneth Loy, PG #7008

REVIEWED BY: Jim Connell, PE, RCE #63052

SUBJECT: Peer Review of Groundwater Hydrology and Water Quality Analysis and Groundwater Model Reports for the Idaho-Maryland Mine Project, Nevada County, California

INTRODUCTION

This technical memorandum (TM) documents peer review of two technical reports that were prepared to assess potential impacts to groundwater hydrology and water quality associated with Rise Grass Valley, Inc.'s (Rise) proposed Idaho-Maryland Mine (Proposed Project) in unincorporated Nevada County (County). These reports are:

- Groundwater Hydrology and Water Quality Analysis Report for the Idaho-Maryland Mine Project, Nevada County, California (EMKO Report) (EMKO Environmental, Inc., March 2020)
- Predictions of Groundwater Inflows to the Underground Mine Workings at the Idaho- Maryland Mine (Itasca Report) (Itasca Denver, Inc., March 2020)

The EMKO Report provides an analysis of the environmental setting, baseline conditions and potential effects and impacts of the Proposed Project from the perspective of groundwater hydrology and water quality. The stated purpose of the EMKO Report is to provide the technical data and evaluations to support environmental review of the Proposed Project under the California Environmental Quality Act (CEQA). The Itasca Report provides documentation of numerical modeling of groundwater flow to predict groundwater inflow rates to the mine workings, the potential effects on mining on groundwater levels, and the potential for reductions in baseflow in Wolf Creek and the South Fork of Wolf Creek. The EMKO Report incorporates and provides analysis of the results and conclusions of the Itasca Report, and presents these in the context of providing technical data and evaluations necessary for environmental review under CEQA.

Summary of the Proposed Project

The Proposed Project is located on two properties owned by Rise, referred to as the Brunswick Industrial Site and the Centennial Industrial Site. According to the Project Description[1], most of the aboveground facilities, access to the underground mine workings, treated-water outfall structure, and a portion of the engineered fill would be located on the Brunswick Industrial Site. Engineered fill would also be placed on 56-acres of the Centennial Industrial Site. Of the approximately 175 total surface acres, approximately 104 acres is proposed to be disturbed as a result of the construction of the Proposed Project, including facilities proposed to support dewatering, mining activities and material processing at the Idaho-Maryland Mine. Furthermore, as proposed, the applicant retains the subsurface rights to approximately 2,585 acres that encompass the existing historic Idaho-Maryland Mine workings and the Proposed Project area. As proposed, upon completion of construction of the aboveground facilities, the applicant would begin dewatering the mine, performing advanced exploration, and mining the underground mine workings.

The primary purpose of the Proposed Project is operation of the Idaho-Maryland Mine. The Proposed Project consists of five primary elements:

1. Dewatering the existing underground mine workings;
2. Mining existing and new underground workings;
3. Processing gold mineralization and rock;
4. Placing engineered fill at the Brunswick and Centennial Industrial Sites; and
5. Exporting engineered fill from the Brunswick Industrial Site to support local construction projects.

Organization of the Peer Review TM

This TM is organized according to the CEQA Checklist Form for environment analysis of the Proposed Project.[2] The major headings of this TM are listed in Table 1 with reference to the corresponding section of the CEQA Checklist.

[1] Raney Planning and Management, *Draft Project Description*, July 2020.
[2] California Code of Regulations, Title 14, Division 6, Chapter 3, Appendix G, Section X.

Table 1. TM Sections and Applicable CEQA Appendix G Checklist Items

TM Section Heading	Corresponding CEQA Checklist Item: X. Hydrology and Water Quality
Water Quality	a. Would the project violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?
Groundwater Supplies and Recharge	b. Would the project substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?
Drainage Patterns	c. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would: i) result in substantial erosion or siltation on- or off-site; ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site; iii) create or contribute to runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or iv) impede or redirect flood flows?
Inundation Risks	d. Would the project [result] in flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?
Plan Conflicts	e. Would the project conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

Each of the sections listed in Table 1 provides an opinion of the adequacy of the assessment performed, including the data and information on which the assessment was based, regulatory requirements (as applicable) and analysis approach and techniques. Each section provides an opinion as to whether the conclusions of the analysis are supported.

The sections listed in Table 1 are followed by sections on the overall conclusions and recommendations of the peer review.

WATER QUALITY

a. Would the project violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?

The EMKO Report analyzes potential impacts to water quality in the following categories:

- Stormwater
- Dewatering and Surface Water
- Water within Underground Workings
- Fill Areas
- Post-Mining

Stormwater

The EMKO Report address potential impacts to storm water from "grading and construction activities at the New Brunswick Shaft, the Brunswick Industrial Site, the treated water discharge location along the South Fork of Wolf Creek, along East Bennett Road for installation of the potable water supply pipeline, and at the Centennial Industrial Site." Construction work at each of the sites would disturb more than 1 acre and would therefore require compliance with the State Water Resources Control Board (State Board) Construction General Permit.[3]

The EMKO Report also states that "ongoing operations at the New Brunswick shaft, the water treatment facility and the ore processing area would require compliance with the State Board Industrial General Permit.[4]"

The EMKO Report states that compliance with the Construction and Industrial General Permits would require Rise to prepare and comply with Construction and Industrial Storm Water Pollution Prevention Plans (SWPPPs), both of which would need to address water quality impacts to storm water, including implementation of Best Management Practices (BMPs) and monitoring. The SWPPPs would need to be in place prior to ground disturbance at the beginning of construction activities, dewatering and discharge of treated water, and placement of engineered fill.

Sections 4.6 and 4.7 of the EMKO Report provide detailed information on permitting requirements.

[3] National Pollutant Discharge Elimination System General Permit No. CAS000002, Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction Activity.
[4] National Pollutant Discharge Elimination System General Permit No. CAS000001, Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Industrial Activity.

In our opinion, the EMKO Report adequately describes the relevant storm water permitting requirements. We concur with the conclusion that development and implementation of the appropriate SWPPPs for the Proposed Project would address water quality impacts to storm water.

Dewatering and Surface Water

The EMKO Report identifies iron and manganese as the chief constituents of concern present in dewatering discharges. The report points out that other constituents, including arsenic, 1,2-dichloroethylene (1,2-DCE), ammonia, total dissolved solids (TDS) and pH could also be present in the dewatering discharges at levels requiring treatment.

The EMKO Report states that Proposed Project includes treatment prior to discharge to the South Fork of Wolf Creek[5]. This treatment would reduce the concentrations of constituents of concern to comply with applicable water quality requirements.

Section 3.4 of the EMKO Report provides discussion of the available water quality data and its interpretation. Section 4.6 provides documentation of the discharge limitations under the anticipated Central Valley Regional Water Quality Control Board (Regional Board) Order for Limited Threat Discharges to Surface Waters.[6] The Order includes Waste Discharge Requirements (WDRs) for discharges of wastewater from hard rock mines (Tier 3).

The EMKO Report makes the following recommendation,

> "The Conditional Use Permit, either as a mitigation measure or as a condition of approval, should require that the RoWD [Report of Waste Discharge] be submitted at least six months prior to construction of the water treatment system and that the WDR permit be received before dewatering can begin. Flexibility in design and operation of the water treatment system would be appropriate to ensure that elevated pH and TDS conditions could be addressed if encountered during dewatering."

In our opinion, the EMKO Report adequately describes and interprets the relevant discharge water quality data and identifies the likely permitting requirements. The recommendation above should be revised to state,

> "The Conditional Use Permit, either as a mitigation measure or as a condition of approval, should require that the RoWD [Report of Waste Discharge] or *Notice of Intent (NOI)* be submitted at least six months prior to construction of the water treatment system and that the WDR permit *or Notice of Applicability (NOA)* be received before dewatering can begin. Flexibility in design and operation of the water

[5] Linkan Engineering, 2019, Idaho Maryland Water Treatment Plant Design Report, Elko, NV.
[6] Central Valley Regional Water Quality Control Board Order No. R5-2016-0076 (NPDES No. CAG995002) for Limited Threat Discharges to Surface Waters.

> treatment system would be appropriate to ensure that ensure potential constituents of concern, including ammonia, arsenic, hexavalent chromium, iron, manganese, pH, TDS and 1,2-DCE could be addressed if encountered during dewatering."

We concur with the conclusion that an appropriately designed, constructed, and operated water treatment plant would achieve applicable water quality objectives for the discharge. The RoWD or NOI submitted to the Regional Board by the applicant would have to include comprehensive sampling results characterizing the water quality of the untreated dewatering discharge. This would include all the parameters that have water quality objectives/criteria that are enforced for surface water dischargers in the Central Valley, which include water quality objectives/criteria from the California Toxics Rule, the Basin Plan and other constituents and pollutants of concern. If the analytical test results show that constituent concentrations exceed the lowest applicable criteria, then treatment will be required for these constituents. The RoWD or NOI must also include:

- Description of the proposed treatment system, including the proven technology that will result in the discharge of wastewater that complies with effluent limitations.
- Plans for the proposed treatment system signed by an engineer licensed in the State of California.

The full list of constituents to be treated would be identified through sampling of the untreated water and documented in a RoWD or NOI prepared and stamped by an engineer licensed in the State of California. The Regional Board would require monitoring and reporting of the discharge per the terms of the WDR permit or NOA, could conduct inspections of the facility and its records, and would levy minimum mandatory penalties for violations per the State Board Water Quality Enforcement Policy.

We concur with the recommendation for the requirements to be included in the Conditional Use Permit with respect to the water treatment plant and its permitting with the addition of the language pertaining to filing a NOI and receiving a NOA from the Regional Board.

The RoWD or NOI submitted by Rise to attain coverage under the Regional Board Order for Limited Threat Discharges to Surface Waters should include evaluation of all required potential constituents of concern in the dewatering discharge, including arsenic, iron, manganese, hexavalent chromium TDS (see following discussion), 1,2-DCE, and ammonia.

Water within Underground Workings

The EMKO Report identified two potential impacts to surface water quality associated with the underground workings. The first of these was the potential for release of hexavalent chromium from the Cement Paste Backfill (CPB) that is proposed to be used to backfill the underground workings. The report makes a statement to the effect that use of CPB is an "environmentally

favorable" method for tailings disposal because it minimizes the release of metals and minimizes the impacts caused by surface disposal of tailings.

The report noted that the Portland cement used in the CPB should have a low chromium concentration to, "prevent the potential for leaching of hexavalent chromium into the surrounding water" and that the CPB's minimum cure time should be evaluated to determine when inundation with groundwater can occur after dewatering ceases.

The second potential impact to surface water quality was from TDS potentially generated by sulfide oxidation and the subsequent neutralization of the resulting acidic water by carbonate rock formations during mining operations. The report noted, "If elevated TDS levels are generated during dewatering, the treatment system would need to be adjusted to meet applicable discharge standards and antidegradation standards."

The EMKO Report makes the following recommendation,

> "Prior to the use of CPB, additional documentation would be needed to verify that Cr^{+6} [hexavalent chromium] levels in Portland cement used for the mixture are minimal and will not leach. The Conditional Use Permit, either as a mitigation measure or as a condition of approval, should require that the source of Portland cement to be used for the CPB be specified and that testing data showing the Cr^{+6} levels do not leach above water quality standards must be provided to the County prior to the use of CPB. In addition, the County should require the RoWD for use of CPB be submitted to the RWQCB [Regional Board] at least six months prior to the proposed initial use of CPB and that the WDR permit be received prior to initiating any mine backfilling using CPB."

Additional research should be conducted to determine the availability of low-chromium Portland cement products, and this should be documented in the applicant technical studies to support the CEQA analysis.

We concur with the EMKO Report findings on the potential for hexavalent chromium and TDS in the dewatering discharge, and add that Rise should include evaluation of all required potential constituents of concern in the dewatering discharge, including arsenic, iron, manganese, hexavalent chromium, TDS, 1,2-DCE, and ammonia in the RoWD submitted to the Regional Board as part of the process for attaining coverage under the Regional Board Order for Limited Threat Discharges to Surface Waters.

Fill Areas

Per the EMKO Report, the Proposed Project would create engineered fill areas at the Brunswick and Centennial Industrial Sites. Acid-base accounting test results documented in the report demonstrate that the engineered fill areas would not result in acid mine drainage.

Also, per Section 4.4 of the report, DI-WET leaching test results indicated that the bulk composition of the fill material would not leach metals in concentrations in excess of applicable water quality standards. TDS and conductivity were noted as being "relatively low". The leaching results suggested the pH of the engineered fill could be above 9.0. The report noted that this finding was inconsistent with observed water quality data from the New Brunswick Shaft, the drain and surface water, which ranged from 5.78 to 7.8.

The EMKO Report noted that the RoWD submitted to the Regional Board by Rise to attain a WDR Order for the engineered fill areas will need to evaluate these issues.

We concur with the findings of the EMKO Report about the potential surface water quality impacts caused by leaching from engineered fill areas.

Post-Mining

The EMKO Report states that after mining is completed, water would begin to seep from the mine drains or from bedrock fractures if the drains are sealed. The water quality would be like the current discharges from the drains and would contain iron and manganese. The report documents that some of the drains also contain elevated levels of arsenic, but the reported concentrations of all metals in Wolf Creek are below the National Pollutant Discharge Elimination System (NPDES) water quality standards. The report states this re-activation of the seeps would not be a potentially significant impact under CEQA, as it would be a return to existing (baseline) conditions.

Sections 3.3 and 3.4 of the EMKO Report document the locations, flows and water quality of the mine drains. Section 4.5 provides an analysis of the potential post-mining effects of seepage from the mine drains.

Section 5.2 of the EMKO Report points out alternatives for managing post-mining discharges from the mine drains, including applying to the Regional Board for an individual NPDES discharge permit, which would allow for dilution in the receiving waters, treatment prior to discharge, and sealing of areas of the underground workings or drains contributing to exceedances of water quality standards. The report notes that additional investigation and planning should be undertaken prior to sealing areas of the underground workings or drains to prevent new discharge from the workings or bedrock fractures.

In our opinion and based on the data and analysis presented in the Itasca Report and EMKO Report, it is possible that mining activities, including blasting, backfilling with CPB, and sealing of drains or areas of the underground workings, could activate leaching and groundwater flow in new subsurface areas, potentially resulting in impacts to neighboring wells, and discharges to surface water of groundwater with water quality exceeding applicable standards. These impacts could potentially occur during the mining or post-mining periods. Because of the uncertainty inherent in the bedrock fracture flow system, monitoring will be needed, as mining activities progress, to assess potential impacts, design appropriate solutions and attain necessary permits

to mitigate these potential impacts. These efforts should be addressed in the monitoring and mitigation requirements for the mining and post-mining phases of the Proposed Project.

GROUNDWATER SUPPLIES AND RECHARGE

b. Would the project substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

Our peer review comments on groundwater supplies and recharge are organized in the following subsections:

- Groundwater Occurrence and Management
- Groundwater Pumping
- Groundwater Levels
- Groundwater Recharge
- Groundwater Discharges to Surface Water

Groundwater Occurrence and Management

The EMKO Report states that the Proposed Project is in bedrock terrain, and groundwater occurs in bedrock fractures rather than in a groundwater basin. The closest groundwater basin is more than 15 miles west of the Proposed Project. The Sustainable Groundwater Management Act of 2014 (SGMA) applies to groundwater basins that the California Department of Water Resources (DWR) has designated as medium or high priority.

In our opinion, the information and analysis in the EMKO Report adequately documents these findings.

The EMKO Report concludes that the Proposed Project would not impede sustainable groundwater management because it overlies a fractured bedrock groundwater system separated from the nearest groundwater basin by a significant distance. We concur with this conclusion.

Groundwater Pumping

The EMKO Report and the Itasca Report conceptualize the mine shafts as passive groundwater wells under existing and post-project conditions and as an actively pumped well (the New Brunswick Shaft) during dewatering for the Proposed Project.

Groundwater flows to the shafts because the groundwater levels in the fractured bedrock groundwater system are higher than most of the mine workings, as are most of the open fractures. The fractures close with depth due to the weight of the overburden, and only minimal flow occurs in fractures below a depth of approximately 500 feet below ground surface. Most of the mine workings are at greater depths. The elevations of open bedrock fractures follow the terrain so that groundwater flows from areas of higher to lower land surface elevation; i.e., from areas underlain by ridges to areas underlain by stream channels. The mine shafts pass from the land surface at relatively high elevations through the relatively shallow bedrock fracture flow system to the mine workings. The mine workings are in turn connected to mine drains and near surface fractures underlying areas with lower land surface elevations. The mine shafts and workings act as conduits for flow between the bedrock fracture flow system and mine drains and open bedrock fractures at lower land surface elevations, such as near stream channels.

Under existing and post-project conditions, flow is induced by the difference in groundwater elevation in open bedrock fractures intersecting the upper parts of the shafts and the elevations of the mine drains and open fractures connecting the mine workings to stream channels.

During the Proposed Project, pumping for mine dewatering will remove water from the workings and induce additional groundwater inflows from the bedrock fracture flow system and would likely cause drain discharges to cease.

As documented in the EMKO Report, approximately 60 to 70 gallons per minute (gpm) flows into the shafts from shallow bedrock fractures and out of the mine workings under existing conditions.

In the Itasca Report[7], the initial pumping rate for dewatering is estimated to be approximately 2,500 gpm. This estimate is the total of at least 1,600 gpm for removal of water from the workings and an average of approximately 850 gpm from increased groundwater seepage into the New Brunswick Shaft from open bedrock fractures. After the initial dewatering of the workings, maintenance dewatering could reach a maximum of 1,500 gpm during the rainy season after 65 years of pumping.

The conceptual model for groundwater flow and discharge is based on evaluation of regional and site-specific geologic and hydrogeologic data, including above and below ground geologic mapping, rock coring, well completion reports, hydraulic property data, groundwater elevation data and historical records of pumping for mine dewatering. This information and analysis are documented in Section 2.0 of the Itasca Report and Section 3.0 of the EMKO Report. The data, information and analysis presented in the reports provides adequate support for the conceptual model of groundwater flow associated with the Proposed Project.

[7] Also reported in the EMKO Report.

The estimates of historical dewatering rates and existing groundwater flows under existing conditions are based on historical records of mine operations and direct measurements under existing conditions, as documented in both reports. In our opinion, the data, information and analysis presented in the reports provides adequate support for the estimated flow rates under historical, and existing conditions.

The estimated flow rates for dewatering during the Proposed Project were developed using the data and information described above and a groundwater flow model assessment, which was conducted by Itasca.

As documented in the Itasca Report, Itasca developed a numerical groundwater flow model with regional extent and site-specific detail in the area of the Proposed Project. The numerical model was developed based on a sound hydrogeologic conceptual model for flow in the Proposed Project area using specialized finite element numerical code (MINEDW), which is generally accepted in the mining industry. The Itasca Report documents that the model was developed using the available data and information listed above for the Proposed Project area. The model was calibrated to pre-mining and historical mining groundwater levels, and post-mining recovery of groundwater levels. The model is acceptably calibrated per industry practices. Itasca conducted a sensitivity analysis, which included separate model runs with increased hydraulic conductivity, adjusted fault structure, increased groundwater recharge rate and increased duration of planned mining operations by 40 years. In our opinion, the numerical model development, calibration and sensitivity analysis are adequate for the purpose of estimating the range of dewatering flow rates listed above.

We concur with the estimated flow rates used to evaluate the effects of dewatering conducted as part of the proposed Project.

Groundwater Levels

As documented in the Itasca Report, the numerical model discussed in the preceding section was used to assess potential impacts to groundwater levels due to mine dewatering. The EMKO Report discusses the Itasca findings and provides additional assessment of potential groundwater level impacts due to mine dewatering based on analytical modeling.

Both reports concluded that drawdown in groundwater levels would be mostly restricted to the mineral rights boundary associated with the Proposed Project parcels, and the primary impacts to groundwater levels would be in East Bennet Road area, where groundwater levels were predicted to decrease by 5 to 10 feet. Rise would mitigate these potential impacts by installing a water pipeline along East Bennet Road and offering to connect affected well owners to the pipeline at no cost. Nevada Irrigation District would provide potable water supply through the pipeline.

The EMKO Report states,

> "To prevent any potentially significant impacts to water supplies in the East Bennett Road area, the Conditional Use Permit should specify, either as a mitigation measure or as a condition of approval, that the potable water supply line be installed prior to the initiation of mine dewatering."

The reports projected less than 2 feet of groundwater level decline in other areas around the periphery of the mine. Based on review of the available well completion reports for these areas, the EMKO Report concluded that these declines would constitute less than 10 percent of the available water column height in the affected wells and would be substantially less than the typical seasonal fluctuations in the wells, which range from 10 feet to more than 30 feet. Also, EMKO included a 100 percent safety factor in their approach to assessing the potential groundwater level declines in wells on the periphery of the Proposed Project. Based on these considerations, the EMKO Report concluded that drawdown in the peripheral areas would not have a significant impact on groundwater supplies.

Based on our commentary in the preceding section and this section, we generally concur with the assessment of potential groundwater level impacts from the Proposed Project as documented in the EMKO and Itasca Reports. However, we have two concerns with the reports:

1. Section 5.4 of the Itasca Report documents the sensitivity analysis for the numerical model. The sensitivity analysis included increasing recharge by 50 percent, which was found to have limited effect on the simulated pumping rates for dewatering but did reduce the extent of simulated groundwater level drawdown. Decreasing the simulated recharge rate, for example by 50 percent, could have the corresponding effect of increasing the extent of simulated drawdown, because less recharge would be entering the fracture flow system, which would still be draining to the New Brunswick Shaft. Additional discussion of the model's sensitivity to decreasing recharge should be provided.
2. Section 4.2.2 of the EMKO Report describes a three-step procedure used to assess potential drawdown effects in perimeter areas. Steps 1 and 2 apportion the dewatering rate at the New Brunswick Shaft to specific mine workings in the vicinity of the perimeter wells. Step 3 then uses the pumping rate determined in Steps 1 and 2 to simulate the drawdown at potentially affected perimeter wells using the Theis analytical solution. As documented in the EMKO Report, the approach is based on multiple conservative assumptions, and the results are consistent with the results in the Itasca Report. A major assumption is that flow contributions from the workings are distributed uniformly across the mining areas after correcting for depth. However, the subsurface distribution and orientation of bedrock fractures is not uniform and is subject to uncertainty. Discussion of this uncertainty and the overall uncertainty of the model predictions with respect to groundwater level impacts on individual wells should be provided.

Groundwater Recharge

The EMKO Report provides data, information and analysis to substantiate the report's conclusion that the Proposed Project will not result in a reduction of groundwater recharge, because the Proposed Project will be undertaken in previously developed areas that have undergone compaction or paving.

We concur with this conclusion.

Groundwater Discharges to Surface Water

The EMKO Report documents that baseflows in the South Fork of Wolf Creek would be reduced by up to 0.1 cubic foot per second (cfs) from the current conditions baseflow of 0.94 cfs, based on the numerical modeling conducted by Itasca. Per the report, measured base flows in the South Fork of Wolf Creek range from 0.17 cfs in summer to 6.5 cfs between winter storm events. According to the EMKO Report, the reduction in base flow would be offset by discharge of 1.9 to 5.6 cfs of treated water pumped from the mine. The EMKO Report concluded that the Proposed Project would not cause a reduction in base flow in the South Fork of Wolf Creek.

The EMKO Report notes that the dewatering for the Proposed Project would reduce baseflow in Wolf Creek and eliminate seepage from drains to Wolf Creek. Per the results of the Itasca numerical model, the total reduction would be slightly more than 1 cfs. The EMKO Report concludes that this flow reduction would be minimal in comparison to the base flow rates ranging from 25 cfs to 30 cfs, and NID releases averaging 35 cfs.

We concur with these conclusions with two qualifications regarding the underlying uncertainties in assessing the potential impacts of mine dewatering on stream flow.

First, the observations of baseflow are limited. Because of this, discussion of the uncertainty in the observed values of baseflow cited in the report should be provided to support the conclusions above and the selection of baseflows used in the numerical model.

Second, the additional discussion of the numerical model's sensitivity and uncertainty with respect to assessing the potential effects of mine dewatering on stream flow should be provided.

The sensitivity of the numerical model was assessed using five scenarios in which input parameters were varied individually to assess how these changes affected model outputs. The focus of the sensitivity analysis was on how the changes in parameter values affected simulated groundwater levels. The sensitivity analysis should be expanded to include discussion of how the changes in parameter values affected simulated stream flow in the South Fork of Wolf Creek and Wolf Creek.

Baseflow in the South Fork of Wolf Creek and Wolf Creek is from bedrock fractures. The reported hydrogeologic conceptual model for groundwater flow acknowledges this, but the numerical model necessarily assumes a relatively uniform distribution of hydraulic properties in the subsurface. The subsurface distribution and orientation of bedrock fractures is not uniform and is subject to uncertainty. Discussion of this uncertainty and its impact on the model's predicted impacts of mine dewatering on stream flow should be provided.

DRAINAGE PATTERNS

c. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

> *i) result in substantial erosion or siltation on- or off-site;*
>
> *ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;*
>
> *iii) create or contribute to runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or*
>
> *iv) impede or redirect flood flows?*

The EMKO Report states that the Proposed Project would not, "alter drainage patterns at the project site, would not alter the course of a stream or river and would not add impervious surfaces."

This conclusion appears to be consistent with the July 2020 Project Description, which designates Wolf Creek as open space with a 100-foot setback for the riparian corridor. Per the Project Description, "an aboveground pipe would convey treated water from the water treatment facility along an existing road to the planned discharge point at South Fork Wolf Creek." The outfall would be constructed outside of the mapped flood hazard zone for the South Fork of Wolf Creek. The report documents that the permit requirements[8] for the outfall would require construction of the outfall in such a way as to not reduce the capacity of the stream channel or flood plain of the South Fork of Wolf Creek. Based on this, the EMKO Report concluded that the Proposed Project would not impede or redirect flood flows.

[8] Clean Water Act Section 404 permit from the U.S. Army Corp of Engineers and California Fish and Game Code Section 1600 Streambed Alteration Agreement from California Department of Fish and Wildlife.

Per the EMKO Report, the engineered fill at the Centennial Industrial Site and the Brunswick Industrial Site would be graded to minimize runoff, and stormwater conveyance would be constructed in accordance with County standards to handle up to a 100-year storm without causing erosion or siltation.

The detention basins constructed as part of the Proposed Project would reduce peak discharge to Wolf Creek by 25 cfs to 60 cfs and peak discharges to the South Fork of Wolf Creek by 25 cfs to 60 cfs.[9] The reduction in peak flows would result in lower potential for erosion and make capacity available downstream in existing drainage facilities beneath Grass Valley.

The EMKO Report documents direct observations that storm flows less than 23 cfs in the South Fork of Wolf Creek do not result in erosion, and studies found that storm flows in the range of 20 cfs to 90 cfs are required to mobilize sediment in the South Fork of Wolf Creek.[10] The report documents that base flows in the South Fork (0.17 cfs to 6.5 cfs) plus discharge from the proposed water treatment plant (5.6 cfs at maximum) are less than the discharge rates that may cause erosion and less than the 23 cfs threshold defined in the geomorphic assessment.

In our opinion, the EMKO Report conclusions with regards to drainage patterns are supported by EMKO's analysis of the available data and reports. The EMKO Report documents the relevant permit requirements and standards.

We concur with EMKO's analysis and conclusions on drainage patterns.

INUNDATION RISKS

d. Would the project [result] in flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?

The EMKO Report documents that the Proposed Project is not subject to tsunamis or seiches because of its location, and cites the Federal Emergency Management Agency flood hazard maps showing that, with the exception of northern edge of the Centennial Industrial site, the Proposed Project is not located in a flood hazard zone. The report notes that the Proposed Project work at the Centennial Industrial site is not in the flood hazard zone. It is also noted that the water treatment outfall to the South Fork of Wolf Creek would need to be constructed per the applicable permits discussed in the preceding section, and the storm water retention basins would be designed with sufficient freeboard to prevent substantial overtopping in the event of an earthquake during a design storm event.

[9] The listed peak storm flow reductions to the South Fork of Wolf Creek are the result of the proposed detention basin and outlet structure at the Brunswick site.
[10] Balance Hydrologics, Inc., 2020, Geomorphic Assessment, South Fork Wolf Creek, Near Grass Valley, California.

With respect to recommended repairs[11] to the clay-lined sediment control pond at the Brunswick Industrial Site, the EMKO report recommends,

> "The Conditional Use Permit should specify, either as a mitigation measure or as a condition of approval, that the recommended repairs be completed and verified by the County (e.g., through a grading permit or building permit) prior to initiating dewatering of the mine."

We concur with the EMKO Report's conclusions and recommendations with regards to inundation risks.

PLAN CONFLICTS

e. Would the project conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

The EMKO Report notes that the applicable water quality control plan for the Proposed Project is the Regional Board Water Quality Control Plan for the Sacramento and San Joaquin River Basins. The report states the Proposed Project would need to comply with required WDR Orders and NPDES permits, as discussed above. The report concludes that compliance with the WDR Orders and NPDES permits would prevent the Proposed Project from conflicting with or obstructing the Water Quality Control Plan.

The report documents that the Proposed Project is not in a DWR designated groundwater basin, is not subject to SGMA and would therefore not conflict with a sustainable groundwater management plan.

We concur with EMKO's analysis and conclusions with regards to plan conflicts.

CONCLUSIONS

Based on our review, the EMKO Report achieves its stated purpose of providing the technical data and evaluations to support environmental review of the Proposed Project under the CEQA.

The Itasca Report provides documentation of numerical modeling of groundwater flow to predict groundwater inflow rates to the mine workings, the potential effects of mining on groundwater levels, and the potential for reductions in baseflow in Wolf Creek and the South Fork of Wolf Creek. Based on our review of the Itasca Report, the numerical model was appropriately designed with regional extent and site-specific detail in the area of the Proposed Project, based on a sound conceptual model for fracture flow in bedrock. The model code is generally accepted in the

[11] NV5, 2019, 1999 Geotechnical Report Idaho-Maryland Mine Project – Brunswick Industrial Site.

mining industry. The model was adequately calibrated to pre-mining and historical mining groundwater levels, and post-mining recovery of groundwater levels. The sensitivity of the model was adequately evaluated and documented, but additional information on the model's sensitivity to variations in recharge rate would be beneficial as discussed below. Overall, the numerical model development, calibration and sensitivity analysis are adequate for the intended purpose.

The EMKO Report effectively incorporated and provided analysis of the results and conclusions of the Itasca Report, and presented these in the context of providing technical data and evaluations necessary for environmental review under CEQA. We concur with findings and conclusions of the EMKO Report as they relate to the CEQA Guidelines.

As discussed below, additional information on the model sensitivity, model uncertainty and uncertainty caused by limitations in the observed data would be beneficial and should be considered in developing appropriate monitoring and mitigation measures.

RECOMMENDATIONS

The recommendation in the EMKO Report regarding requirements to be included in the Conditional Use Permit for submission of a RoWD or NOI to the Regional Board should be revised as follows:

> "The Conditional Use Permit, either as a mitigation measure or as a condition of approval, should require that the RoWD [Report of Waste Discharge] or *Notice of Intent (NOI)* be submitted at least six months prior to construction of the water treatment system and that the WDR permit *or Notice of Applicability (NOA)* be received before dewatering can begin. Flexibility in design and operation of the water treatment system would be appropriate to ensure potential constituents of concern, including ammonia, arsenic, hexavalent chromium, iron, manganese, pH, TDS and 1,2-DCE could be addressed if encountered during dewatering."

The RoWD or NOI submitted by Rise to attain coverage under the Regional Board Order for Limited Threat Discharges to Surface Waters (or other permit coverage) for the water treatment plant discharges to the South Fork of Wolf Creek should include evaluation of the required potential constituents of concern, including ammonia, arsenic, hexavalent chromium, iron, manganese, pH, TDS and 1,2-DCE.

Additional research should be conducted to determine the availability and feasibility of using low-chromium Portland cement products, and this should be documented in the applicant's technical studies to support the CEQA analysis.

Additional discussion of the numerical model's sensitivity to decreasing recharge rates should be provided. The Itasca Report documents the sensitivity analysis for the numerical model. The sensitivity analysis included increasing recharge by 50 percent relative to the 12 inches per year

assigned across the model domain. This was found to have limited effect on the simulated pumping rates for dewatering but did reduce the extent of simulated groundwater level drawdown. Decreasing the simulated recharge rate may increase the extent of simulated drawdown.

Discussion of the numerical model's sensitivity with respect to assessing the potential effects of mine dewatering on stream flow should be provided. The sensitivity of the numerical model was assessed using five scenarios in which input parameters were varied individually to assess how these changes affected model outputs. The focus of the sensitivity analysis was on how the changes in parameter values affected simulated groundwater levels. The sensitivity analysis should be expanded to include discussion of how the changes in parameter values affect simulated stream flow in the South Fork of Wolf Creek and Wolf Creek.

Additional discussion of the impact of uncertainty on the model predictions for groundwater level drawdown and stream flow depletions should be provided. The EMKO Report describes a three-step procedure used to assess potential drawdown effects in perimeter areas. A major assumption underlying the procedure is that flow contributions from the workings are distributed uniformly across the mining areas after correcting for depth. However, the subsurface distribution and orientation of bedrock fractures is not uniform and is subject to uncertainty. Discussion of this uncertainty and the overall uncertainty of the analytical and numerical model predictions with respect to groundwater level impacts on individual wells should be provided. This discussion should be expanded to include an assessment of the uncertainty in the conclusions developed by Todd Engineers[12] in their 2007 analysis of drawdown and impacts to domestic wells, which had similarities to EMKO's analysis.

Because baseflow observations are limited, discussion of the uncertainty of the observed values of baseflow cited should be provided to support the conclusions of the EMKO Report and the baseflow values selected for use in the numerical model.

Baseflow in the South Fork of Wolf Creek and Wolf Creek is from bedrock fractures. The reported hydrogeologic conceptual model for groundwater flow acknowledges this, but the numerical model necessarily assumes a relatively uniform distribution of hydraulic properties in the subsurface. The subsurface distribution and orientation of bedrock fractures is not uniform and is subject to uncertainty. Discussion of this uncertainty and its impact on the model's predicted impacts of mine dewatering on stream flow should be provided.

Based on the data and analysis presented in the Itasca Report and EMKO Report, it is possible that mining activities, including blasting, backfilling with CPB, and sealing of drains or areas of the underground workings, could activate leaching and groundwater flow in new subsurface areas, potentially resulting in impacts to neighboring wells, and discharges to surface water of groundwater with water quality exceeding applicable standards. These impacts could potentially

[12] Todd Engineers, 2007, Final Report Hydrogeologic Assessment Idaho-Maryland Mine, prepared for Idaho-Maryland Mining Corporation, August.

occur during the mining or post-mining periods. Because of the uncertainty inherent in the bedrock fracture flow system, monitoring will be needed, as mining activities progress, to assess potential impacts, design appropriate solutions and attain necessary permits to mitigate these potential impacts. These efforts should be addressed in the monitoring and mitigation requirements for the mining and post-mining phases of the Proposed Project.

The recommendations in the Itasca Report should be implemented.

Rise should evaluate whether the time frame evaluated in the numerical model adequately addresses the proposed 80-year duration of permitted activities.