

**Compiled Responses to
Public Comments
Regarding the Permit Applications and
Related Regulatory and
Administrative Concerns About the Proposed
Kennecott Eagle Project**

Contents of this document

Public Participation Process.....	2
DEQ Air Quality Division Responses to Comments, 10/17/2007	4
DEQ Geological Survey Responses to Comments, 10/17/2007	24
DEQ Water Bureau Responses to Comments, 10/17/2007.....	60
Hydrogeology	60
Wastewater Treatment	82
Surface Water Quality.....	95
Permit Issues.....	96
Antidegradation, Best Technology in Process and Treatment.....	98
Compiled Responses to Comments, October 27, 2006	100
Compiled Responses to Comments, June 21, 2006.....	104
Terms and Abbreviations	125
Kennecott Eagle Project Internet Accessible Documents.....	136
Printed Copies of Materials are Available at the Following Locations:.....	138

Public Participation Process

Kennecott Eagle Minerals Company has proposed to construct and operate a nickel and copper ore mine with associated processing equipment in Michigamme Township, Marquette County, Michigan. The proposed mine and processing equipment requires several permits and leases from the Michigan Department of Environmental Quality (DEQ) and the Michigan Department of Natural Resources (DNR). Kennecott has applied to DEQ for:

- Air Use Permit to Install, application No. 50-06, under Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).
- Groundwater Discharge Permit, application No. GW1810162, under Part 31, Water Resources Protection, of the NREPA.
- Nonferrous Metallic Mineral Mining Permit, application No. MP 01 2007 under Part 632, Nonferrous Metallic Mineral Mining, of the NREPA.
- Kennecott has also applied to DNR for a State Land Lease Agreement, and a Mine Reclamation Plan. DNR responses to public comments are not included in this document.

DEQ and DNR held a joint public participation process on their proposed conditional approval of the permits, lease, and reclamation plan. The public participation process involved providing information for public review including an overarching document, fact sheets, proposed permit terms and conditions, a 28-day public comment period, four and a half days of public hearings, and the receipt of written and verbal public comments on analysis by DEQ staff of the applications, the proposed permits, the proposed lease, and the proposed reclamation plan.

On July 30, 2007, copies of the Notice of Consolidated Public Comment Period and Hearing, the overarching document, and the Fact Sheet and the draft terms and conditions for the Nonferrous Metallic Mineral Mining Permit were placed on the Internet on [DEQ web pages](#) (select the link to see a list of the various online files).

On August 6, 2007, copies of the updated Notice of Consolidated Public Comment Period and Hearing, the updated Fact Sheet and the draft terms and conditions for the Nonferrous Metallic Mineral Mining Permit, and Fact Sheets and the draft terms and conditions for the Air Use Permit to Install, the Groundwater Discharge Permit, and the State Land Lease Agreement were placed on the Internet at the same web address noted above.

On August 7, 2007, copies of the further updated Notice of Consolidated Public Comment Period and Hearing were placed on the Internet.

Notices announcing the Public Comment Period, and the Hearings were placed in the Marquette Mining Journal on July 31, 2007, August 9, 2007, and August 23, 2007. Each notice provided pertinent information regarding the proposed action; the locations of available information; a telephone number to request additional information; the date, time, and location of the Public Hearings; the closing date of the Public Comment Period; and the address where written comments were being received.

The first Public Hearing was held on September 10, 2007, at Northern Michigan University in Marquette, Michigan. The hearing began at 1:00 PM and ran until 11:30 PM with an hour and a half break for dinner. The next Public Hearings were held on September 11, 12, and 13, 2007 at the West Branch Community Center in Gwinn, Michigan. On September 11 and 12 the hearings

began at 1:00 PM and ran until 9:30 PM with an hour and a half break for dinner. On September 13 the hearing began at 1:00 PM and ran until 4:30 PM. The last Public Hearing was held on September 19, 2007 at the Lansing Center in Lansing, Michigan. It began at 1:00 PM and ran until 9:30 PM with an hour and a half break for dinner. The Hearings Officer for the hearings in Marquette and Gwinn was retired Judge James Collins. The Hearings Officer for the hearing in Lansing was Mr. John Skubinna of the DEQ Environmental Science and Services Division.

At each of the hearings, comments were received by a panel of representatives from the DEQ and DNR, consisting of the following persons:

Mr. Vinson Hellwig, Chief of Air Quality Division, DEQ, and decision maker for the Air Use Permit to Install.

Mr. James Janiczek, Supervisor of Groundwater Permits Unit, Water Bureau, DEQ, and decision maker for the Groundwater Discharge Permit.

Mr. James Sygo, Deputy Director of the DEQ and decision maker for the Nonferrous Metallic Mineral Mining Permit.

Mr. Harold Fitch, Director of the Office of Geological Survey, DEQ.

Ms. Lynne Boyd, Chief of the Forest, Mineral, and Fire Management Division, DNR, representing the DNR Director, decision maker for the Land Lease Agreement application and the Mine Reclamation Plan.

The purpose of the hearings was to receive comments on the proposed permits, lease, and reclamation plan. DEQ and DNR staff was available outside each of the hearing rooms to answer any questions. Approximately 700 people were in attendance at the Marquette Public Hearing with 150 making comments on the record. Approximately 200 people attended three days of Public Hearings in Gwinn with 75 making formal comments. Approximately 150 were in attendance at the Lansing Public Hearing with 62 making formal comments.

A total of approximately 3,500 written comments were received during the public comment period and the hearing.

DEQ Air Quality Division Responses to Comments, 10/17/2007

1. **Comment:** Commenters stated that the air permit has not been properly evaluated and will allow the proposed mining to exceed national air quality standards. Estimates of more than 50 tons per year of sulfide precipitate/particulate matter will be released into the air were provided. Commenters indicated that as a result, over the life of the mine, thousands of pounds of metallic copper and nickel, which is toxic to fish and other plants, will be deposited over the head waters of the Salmon Trout and Yellow Dog River, both of which flow into Lake Superior. Concern was expressed about the sulfide and trace metal in that particulate matter that are going to settle on the land all throughout the winter and in the spring snow melt are going to be washed into the waterways. Finally, it was requested that the Department evaluate specific nickel and copper dispersion maps (provided by the commenter) in light of seasonal climate conditions.

Response: The assertion that the facility as originally proposed will emit more than 50 tons per year of particulate matter is incorrect. Under the state and federal regulations, the draft air permit allowed Kennecott to emit up to a maximum of 23.25 tons of particulate matter per 12-month rolling time period.

In response to the many concerns raised throughout the public comment period concerning the emissions of particulate matter less than 10 microns (PM-10) from the mine ventilation air raise (MVAR) stack, Kennecott has amended their application to include particulate control of the MVAR stack using a fabric filter system. The AQD reviewed the information provided with the amendment and concurred that the control system will reduce the emissions from the MVAR by a minimum of 85 percent. The allowed PM-10 from the MVAR has been revised due to this voluntary control from 20.15 tons per 12-month rolling time period to 3.02 tons per 12-month rolling time period. This updated emission limit is included in the final permit issued to Kennecott. The following table identifies the allowed emissions of PM-10:

Process	Final Permit Limit (tons per 12 month rolling time period)
Crusher Building	0.13
2 Crushed Ore Storage Bins	0.35
Cement Silo	1.31
Fly Ash Silo	1.31
Fugitive Sources	2.5
Mine Ventilation Air Raise (MVAR)	3.02
Total Allowed PM-10 Emissions	8.62

In addition, the AQD evaluated the impact of the deposition from the air to the soil of several metals and sulfide (an ionic form of sulfur) emitted from the MVAR and the crusher building baghouse. These are the two largest sources of metals at the proposed mine. For the metals, the mass deposited to the soil was determined. This amount was assumed to mix in the top 1 centimeter (cm) of soil. The resulting soil concentration of each metal was compared to background levels in soil, as well as soil cleanup criteria established by the DEQ's Remediation and Redevelopment Division (RRD), specifically the Part 201 Soil Cleanup Criteria. The Part 201 Soil Cleanup Criteria were designed to be protective of human health for specific exposure situations. Additionally, soil metal impacts on wildlife were evaluated for arsenic and copper, using the Bureau of Land Management Risk Management Criteria.

For the sulfide emissions, a maximum deposition rate and its location were determined and compared to background levels of sulfate deposition for the region, as well as a standard developed by the State of Minnesota to protect sensitive aquatic and terrestrial ecosystems against the effects of sulfuric acid rain.

The metals analysis assumed that after ten years, the projected life of the mine, 100 percent of the deposited metals remained in the top 1 cm of soil. The incremental and background soil concentrations are listed in the table, Metal Impacts, below.

Metal Impacts

Metal	10-Year Maximum Incremental Soil Concentration 1 cm Soil Depth (ppm)	Site-Specific Background Soil Concentration.① (ppm)	Applicable Part 201② Soil Cleanup Criteria (ppm)	Risk Criteria for Metals in Soils at Bureau of Land Management (BLM) Mining Sites③ (ppm)
Arsenic (As)	0.001	8.6	4.6	4
Cobalt (Co)	0.019	9.5	5	n/a
Copper (Cu)	0.699	15.5	5800	7
Manganese (Mn)	0.046	726.3	136	n/a
Nickel (Ni)	0.715	19.4	100	n/a

① Recommended typical range (mean+2 standard deviation), calculated by David Slayton, Waste and Hazardous Material Division, MDEQ. Site-specific data from Eagle Project Mining Permit Application Volume II Environmental Impact Assessment, Appendix C, Surficial Geology, Table 3. Golder Associates Inc. (Sept., 2005) Kennecott Eagle Minerals, February 2006.

② Natural Resources and Environmental Protection Act (NREPA), PA 451 (324.20120a)

③ Based on lowest criteria of all species listed (American Robin) (US Dept of Interior, 2004) Risk Management Criteria of Metals at BLM Mining Sites. Karl L. Ford. Bureau of Land Management, National Science and Technology Center, Denver, CO. BLM/RS/ST-97/001+1703 (Technical Note 390 rev. Oct. 2004). n/a: Not Available

Maximum Metal Soil Impact as Percentage of Various Standards

Metal	10 Year Maximum Incremental Soil Concentration 1 cm Soil Depth (ppm)	Site-Specific Background Soil Concentration.①	Applicable Part 201 Soil Cleanup Criteria	Risk Criteria for Metals in Soils at BLM Mining Sites
As	0.001	0.017%	0.031%	0.036%
Co	0.019	0.2%	0.2%	
Cu	0.699	4.5%	0.012%	10.0%
Mn	0.046	0.006%	0.006%	
Ni	0.715	3.7%	0.71%	

This analysis showed that after 10 years, the maximum impact of metals deposited from the mine will have negligible effects on soil concentrations.

Minnesota is the only agency, state or federal, known to have set an acid rain standard to protect sensitive aquatic and terrestrial ecosystems from sulfur deposition. Minnesota’s standard of 11 kilograms of sulfate per hectare per year (kg/ha/yr) limits the total amount of sulfate in wet deposition (sometimes called acid rain). This standard is based on total wet deposition of sulfate and is the sum of liquid and frozen precipitation from both the source in question and background deposition. For AQD’s review, the background deposition rate of sulfate was determined from National Atmospheric Deposition Program (NADP), National Trends Network raw data. The NADP data showed that the 2006 annual average sulfate wet deposition rates for Houghton and Seney National Wildlife Refuge (Seney) were 4.4 and 6.4 kg/ha/yr, respectively. The AQD used the average (“midpoint”) of the two values or 5.4 kg /ha/yr for its analysis.

Both the background deposition rate and the Minnesota standard are based on sulfate ion (SO₄-2), and not sulfide (S-2), the form of sulfur expected to be deposited around the mine. Therefore, AQD converted the sulfate ion to sulfide ion by multiplying Minnesota’s standard deposition rate by the molecular weight ratio of sulfur to sulfate. Using this same method, the Minnesota sulfate deposition standard was adjusted to a sulfur-specific rate of 3.63 kg/ha/yr. A sulfur-specific background wet deposition rate of 1.8 kg/ha/yr was also calculated using this method. Air dispersion and deposition modeling indicated that the maximum annual sulfide wet deposition rate from the mine is 0.2 kg/ha/yr. The maximum impact of sulfide wet deposition (incremental + background) of 2.0 kg/ha/yr is below the Minnesota standard 3.6 kg/ha/yr. In addition, the impacts from Kennecott Eagle (0.2 kg/ha/yr) are roughly 11 percent of background sulfide deposition rates (0.2 vs. 1.8 kg/ha/yr); therefore, it was determined that sulfide impacts are not likely to result in adverse effects on the environment.

The AQD also reviewed particulate matter, copper, and nickel deposition modeling submitted as part of the comments received. A consultant hired by the commenter performed this modeling. Four major differences were found between the deposition modeling done by the consultant and that done by the AQD.

The consultant included all sources from the proposed mining operations, whereas AQD included only the MVAR and the crusher building baghouse. As the MVAR and crusher building baghouse are the two largest emission sources of copper and nickel at the proposed facility, these sources will have the greatest impact on the deposition. The differences in the modeling results would be slight.

The consultant did not take into account plume depletion whereas the modeling performed by AQD included depletion. Plume depletion accounts for particles falling out as the plume travels. With plume depletion, as the plume travels from the source, there is less material that can be deposited. Without accounting for plume depletion, the modeling presumes a constant deposition rate occurs throughout the modeled area. The AQD determined that the consultant's modeling may have overestimated the deposition of material by approximately 25 percent.

The emission rates used by the consultant are greater than those used by the AQD. As was stated above, in response to concerns and comments raised during the comment period about emissions from the MVAR, Kennecott amended their application to include control on the MVAR. This control will reduce the emissions from the MVAR by a minimum of 85 percent. The AQD modeling used the revised emission rates for the MVAR.

The meteorological data set used by the consultant was different than used by AQD. The data used by the consultant assumed a surface roughness for cultivated land, whereas the data used by AQD assumed a surface roughness for coniferous forests. The coniferous forests values used by AQD predict a higher maximum deposition flux than the cultivated land values used by the consultant. Thus AQD's analysis was more conservative.

After reviewing the modeling provided, the AQD determined that the modeling completed by the AQD is more representative of the proposed facility and resulting impacts.

The commenter provided nickel and copper dispersion maps; however, no additional information was included. Absent this background data, the AQD is unable to review or verify the maps.

2. **Comment:** Have you studied the surface winds and where this particulate matter will go and what will happen to the contaminants?

Response: The initial proposal estimated a maximum of 23.25 tons of PM-10 particulate matter per 12-month rolling time period. As a part of the review of the air permit application, AQD staff evaluated the proposed PM-10 particulate emissions of 23.25 tons per 12-month rolling time period against both the National Ambient Air Quality Standards (NAAQS) and the Prevention of Significant Deterioration (PSD) increment standards. These evaluations were done using computer models that simulate the emission impacts from the facility.

One of the components of the computer models is the use of representative local wind patterns. In its initial review, AQD staff used wind data from the airport in Marquette County. This data showed the prevailing winds to be north and south. The AQD staff also ran the computer modeling using wind data from the Hancock surface station located in the Copper Harbor area. The Hancock data showed the prevailing winds to be east and west. In both cases, the initially proposed emissions were found to be well below their respective allowed standards and acceptable.

The AQD later remodeled the emissions from the facility taking into account the changes in the silt content value and increased emissions from the storage piles (these were in response to comments raised) and the MVAR fabric filter control. This revised modeling also showed the projected PM-10 emissions met all applicable air standards.

3. **Comment:** The permits will allow particulate matter containing copper, nickel and other toxic chemicals to be spread by airborne emissions over a wide area, in one of Michigan's most unspoiled natural areas. Kennecott's air permit application shows that emissions of PM-10 will be slightly under Michigan's 80 percent maximum PSD increment limitation, and nickel emissions will also be within permissible limits.

Response: The commenter is correct. The AQD's initial evaluation of Kennecott's proposed PM-10 emissions of 23.25 tons per 12-month rolling time period showed that the emissions would not exceed 80 percent of the available 24-hour or annual PSD increments. The commenter is also correct that AQD's evaluation of Kennecott's proposed nickel emissions showed that they will not exceed AQD's allowed screening level.

With the addition of the MVAR fabric filter control system, the particulate emissions were reduced. The revised dispersion modeling again showed the PM-10 and nickel emissions to be within all applicable standards.

4. **Comment:** What are the parameters used in determining if the air will be safe to breathe?

Response: The AQD is determined to protect the health and welfare of all citizens of the State of Michigan by ensuring they have safe air to breathe. To accomplish this, the AQD utilizes the state and federal air quality rules and regulations that are in place to protect public health and the environment. The federal Clean Air Act includes the NAAQS to protect public health. These standards define the maximum concentration of certain air emissions in the breathing zone that would protect the health of the most sensitive individuals, including those with heart, respiratory, neurological and asthma problems. The emissions from the facility were evaluated and found to meet all applicable standards. (See Table 1 below).

In addition, chemicals that do not have an established NAAQS must meet the applicable AQD-established health-based screening levels. Screening levels are developed to protect from cancer and non-cancer effects based on toxicological research. The best available information is used to establish safe exposure levels and exposure times that are protective against cancer and non-cancer health effects. Harmful health effects are not anticipated to occur over a lifetime of exposure for any pollutant concentrations that are below these health criteria. The emissions from the facility were modeled to determine impacts and were then compared to the applicable screening levels. All emissions are well below the applicable health-based screening levels. Table 2 compares the toxic air contaminant impacts with the applicable AQD health-based screening levels.

Table 1. National Ambient Air Quality Standards (NAAQS)

Criteria Pollutant	Averaging Time	NAAQS (g/m3)	Facility Impact (g/m3)	Predicted Impact Including Monitored Background Sources (g/m3)	Pass or Fail?
Nitrogen Oxide (NOx)	Annual	100	13.1	26.5	Pass
Carbon Monoxide (CO)	8-Hour	10,000	22.3 [ⓐ]		Pass
CO	1-Hour	40,000	73.4 [ⓐ]		Pass
Particulate Matter less than 10 microns (PM-10)	Annual	50	4.1	20.1	Pass
PM-10	24-Hour	150	23.5	51.3	Pass
Sulfur Dioxide (SO2)	Annual	80	0.4	2.7	Pass
SO2	24-Hour	365	6.0	22.0	Pass
SO2	3-Hour	1300	15.4	68.6	Pass

[ⓐ] The CO emissions are below significance levels and therefore meet NAAQS per AQD guidance.

Table 2. Toxic Air Contaminant (TAC) Impacts

TAC	Averaging Time	Screening Level (g/m3)	Facility Impact (g/m3)	Percent of Screening Level	Pass or Fail?
Ammonia	24-Hour	100	2.8	2.8%	Pass
Arsenic	Annual	0.0002	0.00009	45.0%	Pass
Cobalt	8-Hour	0.2	0.003	1.5%	Pass
Copper	8-Hour	2.0	0.06	3.0%	Pass
Manganese	24-Hour	0.05	0.044	88.0%	Pass
Nickel	Annual	0.0042	0.00274	65.2%	Pass
Sulfuric Acid	8-Hour	10	4.44	44.4%	Pass

5. **Comment:** Kennecott will be taking up 75 percent of the maximum allowed amount of nitrogen oxides for that whole airshed, and 36 percent of manganese and 74 percent of the nickel.

Response: The commenter is incorrect in the assertion that the proposed nitrogen oxide emissions will consume 75 percent of the available PSD increment. Appendix A of the AQD Fact Sheet for the proposed permit shows that the proposed nitrogen oxide emissions will consume 31.2 percent of the available PSD increment. It is the AQD's policy to allow a facility to consume a maximum of 80 percent of the available PSD increment.

With the revisions to the silt content, storage pile emissions, and the MVAR emissions, the revised dispersion modeling shows the manganese emissions are at 88 percent of its allowed health-based screening level and the nickel emissions are at 65 percent of its allowed health-based screening level. Screening levels are developed to protect from cancer and non-cancer effects based on toxicological research. The best available information is used to establish safe exposure levels and exposure times that are protective against cancer and non-cancer health effects. Harmful health effects are not anticipated to occur over a lifetime of exposure for any pollutant concentrations that are below these health criteria. The 88 percent and 65 percent values are maximum values determined during the analysis and occur only at a single location. For all other locations, the values were determined to be less than the maximums of 88 percent and 65 percent. As the screening levels are designed to protect human health, any emissions determined to be less than 100 percent of their respective allowed screening level are approvable.

6. **Comment:** Air emissions and the distances from the site they will travel have been under-represented.

Response: The AQD does not believe that the distance air emissions will travel from the proposed mine have been under represented. The AQD used the U.S. Environmental Protection Agency (EPA)-accepted Industrial Source Complex Short Term 3 model (ISCST3) to predict the ambient impacts of the emissions from the proposed Kennecott mine. The EPA's models are the established regulatory models used by most state air pollution agencies to simulate emissions from a facility and to conduct ambient air quality evaluations.

The AQD placed a 3.1 square mile rectangular receptor grid around the proposed site to evaluate the projected emissions from the mine. Receptor grids are designed to extend far enough away from the facility in question to ensure that they include the point of maximum predicted impact. These points will vary for each pollutant evaluated. The modeling also takes into account representative meteorological data to simulate local conditions. The worst-case possible ambient air impacts are then compared against the health-based NAAQS and PSD standards for criteria pollutants and allowed screening levels established by the AQD for toxic air contaminants. These worst-case impacts must be below these standards before a facility is issued a permit by the AQD. As the worst-case possible impacts are used to make these comparisons, it is assured that the ambient air concentrations will be acceptable at all other locations and times as well, even those areas beyond the receptor grid. While emissions from the proposed mine will travel beyond the 3.1 square mile rectangular receptor grid evaluated by AQD, the worst-case impacts (all of which are below their respective standards and thus approvable) will occur within it.

7. **Comment:** This application uses unfounded assumptions such as 90 percent dust suppression but no watering plan.

Response: Special Condition No. 10.1 of the Draft air permits limits visible emissions from all wheel loaders and truck traffic to a maximum of 5 percent opacity. Opacity is the degree to which an emission reduces the transmission of light or obscures an observer's view. It is AQD's experience at other similar sources, including rock quarries and sand mines, that in order for the 5 percent opacity limit to be met, a minimum of 90 percent fugitive dust suppression must be obtained. In response to the comments received, the fugitive dust plan has been modified and now includes a minimum specified watering schedule.

8. **Comment:** Kennecott's calculations contain significant errors in the methods used to estimate the quantity of PM-10 to be emitted from the mining operation, and are inconsistent with the standards and methodologies required by EPA to comply with the Clean Air Act. The air permit application calculated the settling efficiency for PM-10 assuming all of the PM-10 material has a diameter equal to 10 microns. It is reasonable to assume that PM-10 material includes a distribution of particle size diameters. Since larger particles will settle out faster than smaller particles, assuming all PM-10 materials has a diameter of 10 microns will result in a higher settling efficiency. Using the correct calculation methods, the estimated emissions from the vent raise will be at least 1.6 times higher than those estimated in the air permit application. The PM-10 emissions from vehicular traffic have been under estimated because the applicant used an incorrect silt content in their calculations. The calculations contained in the air permit application were based upon a silt content of 1 percent, yet the application contained information showing the silt content of the facilities roads to be 3.01 percent. Using the correct silt content, the estimated vehicular traffic emissions will be 2.2 to 2.7 times higher than those estimated in the air permit application. Further, if the proper PM-10 emission rates are used in modeling the proposed facility, it will no longer meet the PSD increment standard. Rather it will exceed it by almost four times. As such, the air permit is not approvable.

Response: The particulate emissions questioned are the result of underground activities and are emitted out the MVAR. The expected particulate emissions from the MVAR were calculated based upon anticipated production rates and an assumed settling rate. It is correct that the settling rate assumed was that for particles with a diameter equal to 10 microns and an assumed settling efficiency of 97 percent. The allowed emissions stated in the draft permit were based on state requirements and the ability to demonstrate compliance with the NAAQS and the PSD increment standards.

In response to the many concerns raised throughout the public comment period regarding the PM-10 emissions from the MVAR stack, Kennecott amended their air permit application to include control of the MVAR stack using a fabric filter system. It is estimated that this control will reduce the emissions from the MVAR by a minimum of 85 percent. The addition of the fabric filter control will more than compensate for any underestimation of emissions due to the settling velocity. Further, particulate emissions from a fabric filter system will not exceed 10 microns in diameter. The final air permit requires that Kennecott not operate the MVAR unless the fabric filter system is also installed and operating. Malfunction abatement and preventative maintenance plans are required for the fabric filter system.

The AQD reran the dispersion modeling for PM-10 to verify compliance with applicable state and federal standards, including the NAAQS and the PSD increments. The revised modeling inputs included the PM-10 emissions from roadways based upon a 3 percent silt content value, increased PM-10 emissions from the storage piles, and decreased PM-10 emissions from the MVAR with fabric filter control. The updated modeling showed the PM-10 emissions continued to be within all applicable standards, including the NAAQS and PSD increment. The PM-10 PSD consumption will be 23.5 ug/m³, which is less than the 24ug/m³ allowed in the State of Michigan. The fugitive dust plan attached to the final air permit has been updated and now includes specific language for a silt content of greater than 1 percent

9. **Comment:** The same significant errors in the methods used to estimate the quantity of PM-10 to be emitted from the mining operation apply to the individual metal components of the PM-10. As such, the commenter believes that AQD's toxics modeling underestimates the impacts of each metal evaluated and needs to be redone.

Response: Based upon comments received questioning the projected PM-10 emissions from both vehicle traffic on roads and storage piles, the AQD recalculated the projected emissions of metals (arsenic, copper, manganese, and nickel) and remodeled them to check compliance against their respective health based screening levels. The AQD's updated modeling showed the projected metals emissions to still be within their respective allowed screening levels and thus approvable.

10. **Comment:** When the input data is used in the provided equation on page 31 of Appendix C – Emission Calculations and Stack Parameters, the calculated emission rates for PM and PM-10 are higher than the results shown in the table. The “assumed” value for item “f” (Percentage of time wind is greater than 12 mph at mean pile height of 15.3 meters) appears to be low. Applicable meteorological data should be used to determine the variable “f” instead of an “assumed” value as was done in the permit application. It is likely that the corrected calculations will result in a higher PM-10 emission rate for this source than what was used in the air dispersion modeling. The calculation needs to be revised and the results reevaluated.

Response: The commenter is correct in that the storage pile emissions calculations submitted by Kennecott contained an error. The commenter is also correct in that the 15.3 percent value for the amount of time the wind speed will exceed 12 mph used by the Kennecott in their calculation of fugitive emissions from storage piles is indeed low. Local meteorology data from the airport in Marquette County shows the correct value to be 28.9 percent. Accounting for Kennecott’s error, AQD staff recalculated the PM-10 emissions from the storage piles based upon the 28.9 percent value and remodeled them, along with the increased PM-10 emissions from vehicle traffic and the decreased PM-10 emissions from the MVAR, to check compliance against both the NAAQS and PSD increment standards. The AQD’s updated modeling showed the PM-10 emissions continue to be within all applicable requirements.

11. **Comment:** Pursuant to Section 324.5524 (5) of the NREPA, if the silt content is greater than 1 percent there are additional requirements for the Fugitive Dust Control Plan. The Fugitive Dust Control Plan was prepared based on a silt content of 1 percent. The Fugitive Dust Control Plan does not meet the regulatory requirements because the silt content is greater than 1 percent.

Response: The fugitive dust plan attached to the final air permit has been updated and now includes specific language for a silt content of greater than 1 percent.

12. **Comment:** The fugitive dust plan does not include critical items such as watering application rates or frequency.

Response: The fugitive dust plan attached to the final air permit has been updated and now includes a specified minimum watering schedule.

13. **Comment:** The application fails to assess the potential impact of the proposed air emissions on flora and fauna in the Huron Mountain Club land, the McCormick Tract, and the Salmon Trout and Yellow Dog River headwaters. Of particular concerns are the Coaster Brook Trout and the 23 rare and unusual species of fungi in the area. Literature indicates that the Coaster Brook Trout is threatened by serious physiological and behavioral damaged at very low concentrations of copper. Not performing such reviews is inconsistent with EPA requirements.

Response: Potential impacts on flora and fauna including physiological and behavioral effects on the Coaster Brook Trout and effects on fungi species are beyond the scope of an air permit. In response to this and other comments raised during the public comment period, the AQD did evaluate the proposed metal and sulfide emissions to determine their impacts on the land and waterways surrounding the proposed facility. These evaluations showed that the proposed emissions are not likely to result in any adverse impacts.

14. **Comment:** Existing baseline water quality data for the Salmon Trout and Yellow Dog River show that they presently contain virtually no sulfides or toxic metals. So, for at least 8 years, the levels of chemicals which are harmful to aquatic life in the waters downstream from the mine would be elevated above baseline conditions. It is also likely that elevated conditions would persist even after the mine closes, as material from those emissions remaining on the ground is eventually washed into the streams from runoff due to rain and snow melt.

Response: The 2004 DEQ water data does show that the Salmon Trout and Yellow Dog River currently contains only small amounts of some metals. For other metals, the amount contained in the rivers is below the detection level. While these levels may increase over the current levels, this does not mean that adverse impacts will occur. The AQD evaluated the potential effects of sulfide emissions from the proposed mine on nearby surface waters. This evaluation showed that the sulfide impacts are not likely to result in any adverse impacts.

15. **Comment:** Before the air permit is approved, it is recommended that the following four courses of action are taken: First, a better understanding of how the specific volume and composition of mine-related particles will affect species should be in hand before the project proceeds. Second, if the project proceeds, controls should be applied at the point of origin to prevent the discharge of potentially harmful mineral wastes, particularly mercury, cadmium, lead, nickel, and copper. Third, continued periodic monitoring of metals and other chemicals in fish and wildlife is needed for identification of potential problem areas, and for evaluation of ongoing activities that introduce harmful metals and other particulates into the environment. Finally, additional research is needed on mechanisms of mine byproduct accumulation and detoxification in comparatively pristine ecosystems.

Response: In response to the comments received, Kennecott amended their application to include particulate control from the MVAR stack using a fabric filter system. The remaining items outlined in this comment are beyond the scope of an air permit. The AQD has no legal authority to require the company to undertake the proposed monitoring and studies, nor does the AQD possess the resources or abilities to perform the proposed monitoring and studies ourselves. Finally, there are no regulatory standards against which to compare the result of the proposed studies if they were completed.

16. **Comment:** Page 10 of Appendix C – Emission Calculations and Stack Parameters contains an error in the magnesium data presented. The same magnesium value is listed in both columns; the values need to be different because they are different representations of the concentration. If the emissions are not calculated correctly one cannot determine if the emissions from the process will have an unacceptable impact on the air quality. The table needs to be corrected and any calculations using these concentrations need to be checked.

Response: The commenter is correct that Page 10 of Appendix C – Emission Calculations and Stack Parameters of the air permit application package does contain an error in the magnesium data presented. However, throughout the remainder of the application package the correct magnesium data was presented and evaluated. The proposed magnesium emissions were found to meet Michigan’s allowed health-based screening level and are thus approvable.

17. **Comment:** Page 14 of Appendix C – Emission Calculations and Stack Parameters lists an incorrect emission factor for propylene. The factor listed is 2.97E-04. From AP-42, Table 3.4-3, the correct factor is 2.97E-03. This will result in propylene emissions being 10 times larger than indicated (640 pounds per year and not 64 pounds per year). The correct value should be used and the results should be evaluated to ensure that there is not an unacceptable impact on air quality.

Response: The commenter is correct that the emission factor for propylene included on Page 14 of Appendix C – Emission Calculations and Stack Parameters of the air permit application package is off by a factor of 10. The AQD staff identified this error during their original review of the application and evaluated yearly propylene of 640 pounds. Those emissions were found to be approvable.

18. **Comment:** Kennecott’s application for the air permit contains no evaluation of the economic or technical feasibility of any other control technologies for the MVAR stack other than gravitational settling. For PM-10 generated by surface vehicular traffic, watering is the only control technology considered.

Response: As the Kennecott facility is a minor source under both state and federal PM-10 regulations, there are no provisions requiring Kennecott to evaluate the economic or technical feasibility of add-on PM-10 controls. For minor sources, the applicant is only required to demonstrate that the proposed facility will comply with both the NAAQS and the PSD increment standard for PM-10. Kennecott made that demonstration through dispersion modeling. Kennecott has amended their application to include control of the MVAR stack using a fabric filter system. As a result, the allowed emissions have been revised and are 3.02 tons per 12-month rolling time period.

The application of water and/or chemical dust suppressants are the only types of controls available to control fugitive dust emissions from surface vehicular traffic. It is the AQD’s experience at other similar sources, including rock quarries and sand mines, that the permitted opacity limits (and thus the assumed control values) can be met by watering alone if it is properly applied in terms of amount, frequency, and application method. The fugitive dust plan has been modified and now includes a specified minimum watering schedule.

19. **Comment:** The term “insignificant” has no relevant meaning for Michigan PTI purposes, nor is it defined in the Michigan Air Pollution Control Rules. As such, the terminology should not be used in the permit application as it has no meaning and is a misleading term.

Response: The commenter is correct, the term “insignificant” is not defined in the Michigan Air Pollution Control Rules. Many other terms used in the application are also not defined in the Michigan Air Pollution Control Rules. There is no regulatory requirement to limit the terms used in an air permit application to those defined in the Michigan Air Pollution Control Rules.

20. **Comment:** Page 16 of Appendix C – Emission Calculations and Stack Parameters presents an emission factor that is applicable for wet drilling, but it is not clear from the permit application if wet or dry drilling will be used. The emission calculations on this page are based upon anticipated production rates. If the actual production rates are greater than the values used in the permit application, the emissions will be proportionally higher. Since the emissions are based on anticipated production rates, the permit should include limits on production consistent with the anticipated production rates. The “final draft permit” has no production limits.

Response: While the permit does not include a direct production limit, it does contain a limit on the amount of ore that may be transported off site per 12-month rolling time period. That limit, along with the storage capacity of the facility, will in effect limit the total production of the facility. Also, while the expected emissions from the facility are calculated based upon anticipated production rates, the allowed emissions are based upon the capability of the add-on control equipment and the ability to demonstrate compliance with the NAAQS and the PSD increment standards. The allowed emissions are also based upon the control results achievable with the application of the best technically feasible, practical equipment available. For particulate emissions, it is assumed that the allowed emissions will occur continuously, even during times of decreased or no production. If the company chooses to exceed the anticipated production rates, they run the risk of exceeding their permitted emissions limits and being subject to enforcement action by the AQD.

21. **Comment:** Many of the PM and PM-10 control values used to calculate the allowed emissions from the proposed facility are based upon assumptions which are not supported with equipment design specifications and/or manufacturer’s guarantees. An example of this is baghouses assumed to have a control efficiency of 99 percent.

Response: The commenter is correct that some of the assumed control efficiencies included in the air permit application were not supported with equipment design specifications and/or manufacturer’s guarantees; however, the assumed control efficiencies were the minimum industry standard for the proposed equipment. It is the AQD’s experience that if the equipment is properly installed and operated that the minimum industry standards will be achieved.

22. **Comment:** The term “in a satisfactory manner” is used in many instances throughout the draft air permit for recordkeeping and monitoring. This term needs to be defined as to what is satisfactory for each occurrence it is used. “In a satisfactory manner” is a very subjective term open to a myriad of interpretation.

Response: The term “in a satisfactory manner” is standard language that is used in most permits issued by the AQD. It is the responsibility of the AQD district inspector to determine if the facility is achieving it. Questions from either the company or the public concerning the interpretation of that language in a specific condition should be directed to the district inspector.

23. **Comment:** The draft air permit states that they cannot crush asbestos tailings or waste materials containing asbestos. Apparently this is an issue of concern (which is not discussed in the air permit application), but there are no conditions to verify that this is not occurring.

Response: The condition prohibiting the crushing of asbestos tailings or waste materials containing asbestos is a standard condition that the AQD includes on all permits that involve a crusher.

24. **Comment:** The draft air permit provides emission limits for “inorganic PM” and “inorganic PM-10.” DEQ regulations do not address for “inorganic PM” and “inorganic PM-10.” The air permit application only addresses for PM and PM-10. The draft air permit should refer to PM and PM-10 only.

Response: In the draft air permit, limits for “inorganic PM” and “inorganic PM-10” were placed upon the MVAR. The MVAR is used to ventilate the working environment of the mine. Within the mine there will be certain activities (drilling, blasting, ore and development handling, and backfill material handling and mixing) subject to the requirements of an air permit. The particulate emissions given off by these activities only contain inorganic materials. Also within the mine there will be truck and loader traffic. The engines of the trucks and loaders are not subject to the requirements of an air permit. The particulate emissions given off by the engines only contain organic materials. As the emissions from both the activities subject to a permit and the engines not subject to a permit are exhausted via the same air stream, they need to be separated for permitting and compliance purposes. This is achieved by limiting the inorganic particulate emissions from the mine.

25. **Comment:** We are surprised by the idea that the mine operator is not proposing to install a scrubber to control sulfide emissions.

Response: The AQD staff reviewed the worst case sulfide emissions from the proposed facility, assuming that it would all become sulfuric acid. The projected maximum impact of the sulfuric acid emissions was less than 44.4 percent of Michigan’s health-based screening level for sulfuric acid. As such, there is no regulatory requirement that the wet scrubber be installed to control sulfide emissions.

26. **Comment:** The PM-10 emission rates used in the dispersion modeling do not reflect short-term emission rates, as required. Some of the short-term PM-10 emission rates for this facility are twice the average annual rates. The air dispersion model in this air permit application did not use the maximum emission concentrations and instead, used estimated average emission concentrations (represented by 95 percent UCLs). This is in direct contrast to DEQ's guidance. Examples of this include modeling a mine heater PM-10 emission rate of 0.0525 pounds per hour when the actual short term emission rate is 0.105 pounds per hour.

Response: The AQD's modeling analysis is based on the worst-case operation of the equipment at the site. In the case of the four mine heaters, the maximum pound-per-hour value was used in the modeling analysis for PM-10. The total emission rate from all four mine heaters is 0.105 pounds per hour (0.013 grams per second) which is what was modeled. For the annual average PM-10 air quality standard, the applicant is allowed to take into consideration the permit restriction on the amount of fuel that the heaters can use in a year. This equates to an emission rate of 0.0525 pound per hour. Although this is acceptable under state and federal modeling guidance, the AQD used the maximum value of 0.105 pound per hour for all PM-10 modeling, short-term and annual. The resulting PM-10 impacts are well below the applicable health-based standards and thus approvable.

27. **Comment:** The Best Available Control Technology analysis for toxics (T-BACT) does not meet all the requirements of Michigan Air Pollution Control Rules 336.224-232. Specifically, the air permit application does not provide the following information/evaluation even through it is required by the Rules: Selection of Alternative Control Strategies and Evaluation of Alternative Control Strategies.

Response: T-BACT is required for emissions of ammonia from the engine generators. The generators themselves do not actually emit ammonia. Ammonia is a result of the selective catalytic reduction (SCR) control used to reduce nitrogen oxide emissions. The SCR uses ammonia (urea) injection to react with nitrogen oxides and form nitrogen and water. Any unrelated ammonia is emitted to the atmosphere. The level emitted is typically low and results from the use of higher of amounts of ammonia when the SCR catalyst deteriorates. Proper maintenance of the SCR system and frequent stack testing will ensure that ammonia emissions will be minimal. The T-BACT analysis was based mostly on permit reviews for similar sources. There are no known sources that have looked at alternative control strategies. Based on the low level of ammonia emissions and the fact that it is a secondary pollutant that results from control equipment, it is assumed that additional control would not be economically feasible and therefore not an appropriate T-BACT choice.

28. **Comment:** The air permit application contains conflicts concerning the mine heaters. At one point in the application it states that the direct-fired heaters with no stacks, but another part of the application lists stacks for the heaters.

Response: The applicant is not certain at this time whether or not the heaters will have individual stacks or if they will route the exhaust to the main ventilation air raise stack. As such, both scenarios were evaluated and modeled by AQD staff and the impacts from each scenario were determined to be acceptable. Therefore, the permit allows the company the option of choosing how to vent the mine heaters at a later date.

29. **Comment:** Rule 336.1203(1) (a) of the Michigan Air Pollution Control Rules requires a complete description, in appropriate detail, of each emission unit or process covered by the application. The description shall include the size and type along with the make and model, if known, of the proposed process equipment, including any air pollution control equipment. Technical data provided in the air permit application for the Caterpillar generator is outdated. According to the supplier, Empire Power System, the specified generator set is no longer available new. The permit application states all equipment will be purchased new. Emission factors for the intended replacement generator set must be obtained to determine if any revisions to emission calculations and modeling are required.

Response: The AQD prefers to evaluate specific equipment when possible. It is understood, however, that for large projects which can take several years to plan and obtain the proper permits, many changes to equipment vendors and models may occur. The AQD is concerned with the air emissions from each piece of equipment and whether those emissions can meet the applicable regulations. Kennecott must comply with the terms and conditions of the approved Permit to Install and as such the final plans and specifications of the equipment must meet all of the applicable requirements of the permit. A new permit review is required if changes to the equipment result in an increase in emissions or alter the modeled impacts.

30. **Comment:** Appendix C – Emission Calculations and Stack Parameters portion of the air permit application contains some conflicts in the actual NO_x, SO_x, and CO emissions. The emissions for NO_x, SO_x, and CO exceed the stated potential to emit (PTE) in the table on Page 1; however, the numbers in the columns on Page 3 are incorrectly added. If the emissions are not calculated correctly one cannot determine if the emissions from the process will have an unacceptable impact on the air quality.

Response: The differences in Appendix C of the permit submittal are marginal. The AQD performs an independent review of the applicant's submittal, including emission calculations. Worst-case operating scenarios and emissions are modeled to determine compliance with state and federal health-based standards. All of Kennecott's proposed impacts are well below the standards and small differences in calculations will not impact those results.

31. **Comment:** Page 15 of Appendix C – Emission Calculations and Stack Parameters uses incorrect emission factors for calculating emissions from the mine heaters. The emission factors used are for industrial boilers (not mine heaters) with heat input rates between 10 and 100 MMBtu/hr. Each mine heater has a heat input rate of 4 MMBtu/hr. Direct-fired mine heaters have a completely different application than industrial boilers. The manufacturer should be consulted for emission factors/data. According to the manufacturer, this type of mine heater is checked against the emission rate limits in ANSI standard ANSI Z83.4-2003 using methane as the fuel. The manufacturer has not conducted any tests for comparison against the ANSI standard using propane as the fuel (propane is indicated as the fuel the will be used for the mine heaters in the permit application). It is likely that the CO emissions will be much larger than stated in the permit based on the allowable ANSI standard. The effect of using propane instead of methane and the impact on emissions is not addressed. Once more accurate emissions estimates can be obtained, the data should be should be evaluated to ensure that the emissions would not result in an unacceptable impact on air quality.

Response: The emissions were calculated based on a conservative approach. At the time the application was put together, more specific information was not available. The applicant has since provided vendor data for the heaters and the data show that carbon monoxide emissions are slightly higher than the emissions calculated in the permit. The carbon monoxide emissions from the heaters are still insignificant and well below the health-based standards.

32. **Comment:** The draft air permit fails to specify the type of “fuel oil” that my burned at the facility. As “No. 2 fuel oil” was used as the basis for the emissions calculations, the permit should only allow its use.

Response: The permit contains a limit on the amount of sulfur in the fuel of 0.1 percent. At this level, the fuel is considered “ultra low sulfur diesel” by definition. Residual fuel oils have a much higher sulfur content, so the sulfur content limit in the permit restricts the facility to using only distillate fuel oil (No. 2 fuel oil). Special conditions Nos. 1.2, 1.9 (previously 1.8), and 1.13 (previously 1.12) in the final permit has been modified to only allow No. 2 fuel oil to be burned.

33. **Comment:** The draft air permit requires only one of the three generators to be tested every five years. As the life of the proposed mine is projected to be only eight years, only two of the three generators will ever be tested. Each generator should be tested initially and then again over a five-year period.

Response: The three generators are identical and therefore it is not necessary to test each one. This is language that is typically used in other permits when a facility contains several identical units. In addition, only two generators are allowed to operate and the third is used as a backup.

34. **Comment:** NO_x emission rates are supposed to be calculated and recorded each month but there are no emission factors in the draft air permit to use until the testing is complete and that may not occur for 180 days. How will the emissions be calculated during the first 180 days?

Response: The emission limits table for FGGENERATORS in the final air permit was modified to require the use of the vendor emission factor (6.95g/bhp-hr) or the most recent test data to calculate the NOx emissions.

35. **Comment:** The draft air permit requires a plan to include a replacement schedule for the catalyst but does not address any intermittent testing of the catalyst between replacements to verify the integrity of the catalyst. Emissions testing should also be conducted near the end of the scheduled life of the catalyst to verify the emission limits are still being met with “used” catalyst.

Response: The permit requires that the preventative maintenance plan for the SCR system include the manufacturer’s recommended guidelines for catalyst replacement. The catalyst guidebook contains several methods for checking the catalyst, cleaning the catalyst or replacing it when necessary. A catalyst is usually replaced every three to five years depending on how much it is operated. The permit requires that ammonia testing be conducted every five years so the emissions should represent a “used” catalyst.

36. **Comment:** In response to the many concerns raised throughout the public comment period and at the public hearings concerning the PM-10 emissions from the MVAR stack, Kennecott has amended their air permit application to include control of the MVAR stack using a fabric filter system. It is estimated that this control will reduce the emissions from the MVAR by a minimum of 85 percent. Kennecott also indicated that they would increase the MVAR stack height from the originally proposed **49.2** feet to 65 feet.

Response: This change in design is reflected in Emission Unit Table included in the final air permit. Also, the allowed particulate emissions from MVAR have been reduced by 85 percent from those included in the draft air permit. This will reduce the original allowed PM-10 emissions of 20.15 tons per 12-month rolling time period from the MVAR to 3.02 tons per 12-month rolling time period. The final air permit also includes requirements that Kennecott not operate the MVAR unless the fabric filter system is also installed and operating and that Kennecott submit to the AQD for its approval a malfunction abatement plan and a preventative maintenance plan for the fabric filter system. Finally, the stack height requirement for the MVAR stack has been increased to 65 feet in the final air permit.

37. **Comment:** Kennecott commented that special condition No. 10.4 in the draft air permit which limited the number of ore trucks entering and leaving the facility per 12-month rolling time period contained an error. The limit included in the draft permit was a maximum equivalent of 1400 50-ton trucks. The correct value that should have been included in special condition No. 10.4 is 16,856 trucks entering and leaving the facility per 12-month rolling time period.

Response: The 1400 truck limit included in the draft air permit represented the average monthly number of trucks entering and leaving the facility, not the yearly amount. As AQD’s review of the application was based on the yearly value, special condition No. 10.4 in the final air permit has been changed to reflect the 16,856 trucks entering and leaving the facility per 12-month rolling time period value.

38. **Comment:** Emissions from the mine of tiny particles, so called PM-10, will far exceed permitted levels. We strongly urge the DEQ to obtain an independent evaluation of these airborne emissions.

Response: The AQD disagrees that the emissions from the facility will exceed the permitted levels and stands behind its review. The Michigan Air Pollution Control Rules prohibit the AQD from issuing a permit if it has any reason to believe that the applicant cannot meet the requirements of said permit. The AQD is the independent reviewer of the air emissions.

39. **Comment:** Kennecott claims that the emissions from the Main Ventilation Air Raise will meet both state and federal requirements. Finally, if the legal or safe limits are exceeded, what are the consequences? Will the mining operations be shut down until a cure is found?

Response: The AQD is responsible for assuring compliance with the Clean Air Act, the NREPA, and the rules and regulations promulgated under the NREPA. The AQD takes this responsibility very seriously and through its network of district air inspectors and administrative staff endeavors to ensure that every facility subject to these air regulations is in full compliance with them. This is carried out through an ongoing presence of diligent oversight that includes scheduled inspections, routine visits, response to citizen complaints, and office review of required company submittals. Any violation detected is followed up by a letter of violation (LOV). Part 55 of the NREPA does not provide for the immediate shut-down of a facility found in violation of that statute, unless there is an imminent and substantial threat to public health. Those violations that rise to the level of High Priority Violation are referred for enforcement. The lesser violations cited are handled within the district and resolved through cooperative actions between the district and the company cited. Section 5528 of the NREPA allows a violating company an opportunity to come back into compliance through the entry of a voluntary agreement or consent order. If a company refuses to enter into a voluntary settlement with the state, the DEQ can seek injunctive relief in court.

40. **Comment:** There is abundant documentation that metal and particulate deposition over forest is harmful to mycorrhizal fungi and the trees which with they are in symbiosis.

Response: A detailed and timely analysis would be required in order to properly evaluate the potential affects the emissions from the mine may have upon mycorrhizal fungi and the trees with which they are in symbiosis. The AQD does not possess the resources or abilities to perform the proposed evaluation. Such a review is beyond the scope of an air permit.

41. **Comment:** How will DEQ stop any new mercury that originates in the flyash being used to make the concrete backfill from being deposited onto the Yellow Dog Plains and into the local waterways. This is relevant because the Salmon Trout River is already listed on the State's 2006 303(d) list of impaired waters for mercury exceedances from the Northwestern Road upstream to the AAA Road, exactly in the immediate area that would be impacted from the air discharge.

Response: As the backfill operations will not begin for several years, neither Kennecott nor the AQD currently know the source of the flyash that will be used to make the concrete backfill. Total allowed PM-10 emissions from the proposed flyash silo are 1.31 tons per 12-month rolling time period. Assuming the flyash silo were to operate at maximum allowed emissions for 10 years, the total PM-10 emissions from it will be 13.1 tons (26,200 pounds). The mercury content of typical flyash is less than one part per million. At one part per million the projected total mercury emissions over 10 years (again assuming maximum allowed emissions) would be approximately 0.026 pounds.

DEQ Geological Survey Responses to Comments, 10/17/2007

42. **Comment:** Baseline hydrological and geological studies of this proposed sulfide mine should have been conducted by an independent third party and should have included a complete hydrological study of not only the nearby groundwater and streams, but also the potential for pollution making its way to our Great Lakes.

Response: The DEQ is charged with reviewing a mining application and making a determination whether or not it meets statutory and regulatory requirements. The DEQ is equipped with qualified staff to review the hydrologic and geologic analysis provided in the application. However, if the DEQ lacks necessary expertise, independent consultants are retained.

43. **Comment:** The Michigan DEQ should have provided a full environmental impact statement of the proposed sulfide mining paid for by the applicant.

Response: There are no provisions in Part 632 of the NREPA to require an Environmental Impact Statement. However, Part 632, Rule R425.202, requires the applicant to complete a very detailed and thorough Environmental Impact Assessment.

44. **Comment:** Commenters provided independent modeling, analysis and review of the geotechnical information provided in the application. Conclusions presented assert there is uncertainty regarding the structural integrity of the mine not only for the safety of the workers in the mine, but also the ecological danger to the Salmon Trout River.

Response: Two independent experts retained by the DEQ reviewed the applicant's analysis on structural integrity of the proposed mine, and both concluded in subsequent technical memorandums and reports submitted to the DEQ that Special Permit Condition E8 of the Mining Permit MP 01 2007 would adequately address safety and environmental issues. The modeling inputs used were very conservative and assumed the entire mine would be open, when in fact the mine would be backfilled as mining progresses upward. The backfilling would add stability and counter the possibility of fracturing and resultant hydraulic communication with overlying aquifers. Even in the worst case, the approximate eight inches of decline of the water table would have little effect on the surrounding wetlands or surface waters. However, as added assurance Kennecott would utilize a phased mining approach and would be required to closely monitor water levels in all aquifers and at all surface water bodies that could potentially be impacted. In addition, pumping volumes from within the mine would be closely monitored. With the required extensive monitoring, potential impacts would be identified early enough to initiate preventive measures. In addition, due to subtle uncertainties with modeling, the permittee is required to conduct rigorous monitoring and periodically recalibrate the model to verify validity. If modeling results indicate a problem, the permittee will be required to adjust mining to correct the problem or cease activities. Section L of the Mining Permit MP 01 2007 requires the permittee to conduct rigorous groundwater, surface water, and aquatic monitoring throughout mining operations and postclosure, which would allow for early detection of potential impacts.

45. **Comment:** Given the State of Michigan's budgetary situation, it's unclear whether the DEQ will have the resources and the personnel available to properly monitor this mine should it be approved, and to make sure that they are operating under the standards that they have been permitted to meet.

Response: If a mine is permitted, the company is required by Statute (Part 632 of the NREPA, Sec. 63215. (1)) to pay a surveillance fee to be used by the DEQ for staff to conduct regular inspections and monitoring of the mine facilities.

46. **Comment:** Does the DEQ have the appropriate expert on staff? If they do not, do they have the funds to hire additional inspection staff? The state should insist that Kennecott Company pay for the DEQ enforcement work, not the State taxpayers.

Response: If a mine is permitted, the company is required by Statute (Part 632 of the NREPA, Sec. 63215. (1)) to pay a surveillance fee to be used by the DEQ for staff to conduct regular inspections and monitoring of the mine facilities. In addition, if the DEQ lacks necessary expertise, independent consultants would be retained.

47. **Comment:** The company has also not provided any written bond or other financial assurance should there be any need to clean up the mine after closure. The company has only provided the State of Michigan verbal agreement that they will clean up any pollution that may occur after the mine is closed.

Response: Kennecott must maintain financial assurance sufficient to cover any necessary reclamation and remediation from the effective date of the permit through the end of postclosure monitoring. In the event of a violation of any Michigan permit, the DEQ may utilize the financial assurance instrument to mitigate if necessary. In addition, the DEQ may increase the amount of financial assurance at any time if necessary.

48. **Comment:** The DEQ has agreed to provide a partial release of any financial assurance provided as the site is being remediated. This allows the company to walk away from the project, neglecting any responsibility they may have should the closed mine become an environmental hazard in future years. The DEQ should not give any of this funding back to the company until the mine is completely remediated and it is obvious that no problems will occur. The Kennecott Company should remain accountable should any future contamination be discovered at this site.

Response: Financial assurance will remain in place until the DEQ is satisfied the reclamation is successful. The Permittee must apply to the DEQ for partial or complete release of financial assurance.

49. **Comment:** The infrastructure required by the mine will remain long after the minerals are gone. It will forever change the character of that area.

Response: The permittee is required to restore the mine site to a condition commensurate with the pre-mining landscape using native vegetation as outlined in Section P of the Permit Conditions for Mining Permit MP 01 2007.

50. **Comment:** The Lake Superior Watershed Partnership drafted a watershed plan for the Salmon Trout watershed and one of the most important recommendations in the plan is to prohibit any sulfide based mining in that sensitive watershed.

Response: The new mining law (Part 632 of the NREPA) is protective of the environment. The law allows mining in Michigan if the application meets all the requirements of the statute and rules. In addition, in a letter dated October 18, 2007, to the Superior Watershed Partnership from the Water Bureau, the Water Bureau states that they do not agree with the recommendations regarding sulfide mining.

51. **Comment:** We need to have contingency procedures in place so that the survival of the coaster brook trout population on the Salmon Trout River can be guaranteed.

Response: In its application, Kennecott proposed to monitor fish, aquatic macroinvertebrates, and aquatic habitat on an annual basis, utilizing the Great Lakes Environmental Assessment Section Procedure 51. The DEQ included appropriate conditions in the Mining Permit to assure that monitoring results would be utilized in conjunction with other environmental parameters to assess potential impacts. The permit contains a comprehensive monitoring plan for the proposed operation in order to detect problems early enough to initiate preventative measures.

52. **Comment:** Is there a true interdisciplinary approach to this?

Response: The DEQ established a multi-discipline and multi-agency Mining Team to review the application. This included not only several divisions of the DEQ but contributions from the DNR as well as consultants.

53. **Comment:** They don't know the size of the settling ponds.

Response: The size of the CWBs and NCWIBs are described in Section 4 of the Mine application.

54. **Comment:** There have been substantive changes in the mining application that haven't been accompanied by substantive changes in the environmental assessment.

Response: The only substantive changes in the application have been an increase in the thickness of the crown pillar pending further evaluation and approval, and the addition of a fabric filter system on the mine ventilation shaft stack; these do not constitute cause for changes to the environmental impact assessment. In addition, the DEQ has added several precautionary conditions on the permit to assure protection of the environment.

55. **Comment:** Commenters provided independent modeling, analysis and review of the geochemical information provided in the application. Conclusions presented assert that some of assumptions going into the modeling of contaminant generation in the re-flooded mine were flawed such as things like the quantity of waste rock being backfilled into the mine.

Response: An independent geochemist retained by the DEQ found the modeling to be satisfactory. In addition, due to subtle uncertainties with modeling, the permittee is required to conduct vigorous monitoring and periodically recalibrate the model to verify validity. If modeling results indicate a problem, the permittee will be required to adjust mining to correct the problem or cease activities.

56. **Comment:** Commenters provided independent modeling, analysis and review of the geochemical information provided in the application. They assert the following: mine drainage predictions are grossly underestimated by orders of magnitude; when calculating the AMD [acid mine drainage] predictions, only one massive sulfide sample from the ore body was used; data input into the models was not used as its peak AMD generating capacity; and according to the data available from the company to date, no one knows what the peak acid generating capacity even is because the tests were simply cut off while the levels of pollutants were still rising.

Response: An independent geochemist retained by the DEQ found the modeling to be satisfactory. In addition, due to subtle uncertainties with modeling, the permittee is required to conduct vigorous monitoring and periodically recalibrate the model to verify validity. If modeling results indicate a problem the permittee will be required to adjust mining to correct the problem or cease activities.

57. **Comment:** In response to criticism of the crown pillar stability and lack of information on its porosity, Kennecott thickened the crown pillar. One result of thickening the crown pillar is that more acid generating materials would be left in the underground workings post closure. This would increase the acidity and metals content of water in the re-flooded mine.

Response: The applicant proposes to mine up to level 383 meters mean sea level. However, the DEQ will require the permittee to conduct further field investigations and analysis on crown pillar stability before they proceed beyond Level 327.5 as outlined in Special Permit Condition E 8 of Mining Permit MP 01 2007. In addition, due to subtle uncertainties with modeling, the permittee is required to conduct vigorous monitoring and periodically recalibrate the model to verify validity. If modeling results indicate a problem, the permittee will be required to adjust mining to correct the problem or cease activities. To address acid mine drainage (AMD) the applicant provided a number of methods to reduce the potential for AMD by mixing limestone with backfill rock, grouting mine workings with cement, and rapidly backfilling the mine workings with water. In addition, the permit contains several precautionary conditions to assure protection of the environment. The mining plan acknowledges there will be some infiltration of water through the crown pillar during mining operations. When mining ceases, this infiltration will be curtailed by the effects of backfilling and reflooding. As a result, the effects of the remaining crown pillar on surrounding water quality will be no different than those existing before mining, irregardless of the crown pillar thickness.

58. **Comment:** Sulfide mining inevitably creates a risk of acid mine drainage (AMD) that could contaminate the Salmon Trout River and seep into Lake Superior. Even with the best plans in place, there has never been a metallic sulfide mine anywhere in the United States that has not polluted its watershed.

Response: Under Part 632 of the NREPA, a metallic sulfide mine cannot be permitted unless the applicant satisfactorily demonstrates the proposed mine will not cause pollution of the watershed or other adverse environmental impacts. In addition, the permit contains many precautionary conditions to assure protection of the environment.

59. **Comment:** Metallic sulfide mines generate sulfuric (battery) acid. This acid can seep through rock much the same way water seeps through coffee and then drain into the nearby Yellow Dog and Salmon Trout Rivers as well as groundwater, killing fish, plants and wildlife and contaminating local drinking water and eventually Lake Superior.

Response: The applicant provided a number of safeguards to prevent acid leaching (known as “acid rock drainage,” or ARD) by mixing limestone with backfill rock, grouting mine workings with cement, and rapidly backfilling the mine workings with water to exclude oxygen. In addition, the Temporary Development Rock Storage Area (TDRSA) will be covered to minimize development rock contact with precipitation, as well as have a liner system and contact water collection system designed to contain any water that may come in contact with the development rock. The permit contains a comprehensive monitoring plan for the proposed operation in order to detect problems early enough to initiate preventative measures. In addition, the permit contains several other precautionary conditions to assure protection of the environment.

60. **Comment:** The influence of heavy metals and low pH levels will place many organisms in a zone of intolerance.

Response: The permittee will be required to meet standards set in Part 632, Nonferrous Metallic Mineral Mining, and Part 31, Water Resources Protection, of the NREPA for water quality which are protective of the environment.

61. **Comment:** Kennecott has failed to provide adequate plans for monitoring groundwater and surface water contamination from on-site rock storage.

Response: The permit requires the permittee to monitor water quality in the TDRSA and in wells adjacent to the TDRSA as outlined in Section L of the permit conditions for Mining Permit MP 01 2007.

62. **Comment:** Spring snow melt would produce runoff that would carry mine pollution to the streams and rivers of the area.

Response: The permit requires the permittee to treat all contact water, including snow, before it is released into the environment. See additional responses to comments regarding air emissions (particularly comments 4, 13, 14, 16, 28, 32, 41, 54, 248, 249, and 250).

63. **Comment:** The consequences of violations of permit limits should be defined.
Response: Violation penalties are outlined in Part 632 of the NREPA, Sec. 63221. (1).
64. **Comment:** Time schedules for remediation of violations must be established.
Response: Action levels are outlined in Part 632 of the NREPA, Rule 425.406 (7).
65. **Comment:** The amount of water pumped out of the mine every day will be very large, and so may the amount of sulfuric acid.
Response: The permit requires mine dewatering water to be treated as outlined in Section H of the permit conditions for Mining Permit MP 01 2007.
66. **Comment:** Ore dust off the trucks can fall on the ground, then gets washed away by rain, creates sulfuric acid, and finds its way to the groundwater.
Response: The haul road from the portal to the crusher will be paved and curbed, and runoff will be collected and treated along with other contact water. The permit requires the permittee to collect and treat all contact water before releasing it into the environment. In addition, trucks are required to be washed before leaving the mine site as outlined in Sections G and H of the Mine Permit Conditions for Mining Permit MP 01 2007.
67. **Comment:** Kennecott has not put forward a watering plan to limit dust.
Response: The permittee is required to control fugitive dust as outlined in Special Permit Condition D 14 and D 15 of the permit conditions for Mining Permit MP 01 2007. Fugitive dust is addressed in the Air Quality Permit as well.
68. **Comment:** Contamination will not be detected in time to protect water resources.
Response: The permit contains a comprehensive monitoring plan for the proposed operation in order to detect problems early enough to initiate preventative measures.
69. **Comment:** The wastewater system should not be allowed to be bypassed to protect Kennecott's property.
Response: The water system is designed to route water back to the mine if a problem occurs.
70. **Comment:** It is important that the DEQ monitor the construction and operation of the mine in future years to assure that Kennecott complies with the permits.
Response: The DEQ is committed to closely monitoring all phases of Kennecott's operation.

71. **Comment:** I would strongly encourage a very detailed and thorough analysis of the geology of the area along with guaranteed reclamation plans that include performance guarantees (inflation adjusted, as it will cost more to reclaim a site in ten years than today).

Response: A detailed geologic analysis is provided in Section 4.2.5 and Appendix C of the permit application and Section 3.4 and Appendix B of the EIA. Reclamation costs are estimated in Section 7.6 of the application and inflation is accounted for. In addition, the DEQ may increase the amount of financial assurance at any time if necessary.

72. **Comment:** I would like to recommend that there be put in place a DEQ sub-office within the Kennecott Eagle Project on-site offices. This office would be staffed 24 hours a day with DEQ qualified staff that would provide daily communication between the DEQ, the public and the mining staff. In addition to constantly monitoring the mining and transporting activities, a web site could be developed to be kept updated by these on-site staff.

Response: The DEQ has a district office located in Marquette County and staff will conduct frequent inspection of the facilities. This approach is comparable to or exceeds the coverage for monitoring and enforcement for any DEQ program, and the DEQ is confident that it will be effective.

73. **Comment:** If approved, Kennecott should be required to remove all mining equipment, buildings, et cetera, after they are through.

Response: The permittee is required to restore the mine site to a condition commensurate with the pre-mining landscape using native vegetation as outlined in Section P of the permit conditions for Mining Permit MP 01 2007.

74. **Comment:** Is there some sort of mechanism, a fund or something that they have to pay into that, should they for some reason fail; either go out of business or not own up to their responsibilities at the end of this project?

Response: Part 632 of the NREPA requires the permittee to provide the DEQ with financial assurance “sufficient to cover the cost to administer, and to hire a third party to implement reclamation... as well as necessary environmental protection measures, including remediation of any contamination of the air, surface water, or groundwater that is in violation of the mining permit.”

75. **Comment:** There’s a 10 day reporting window for failures to their system, water or whatever. Ten days is too long. I would ask personally that that window of reporting be shortened. It should be at least down to 24 hours if they have overburden on the water system or whatever is run off there.

Response: The permittee is required to notify the DEQ as soon as concentrations of solute two standard deviations above the log-term average background level are detected for two consecutive sampling events (Rule 425.406). In addition, the permittee must notify the DEQ as soon as possible of any incident, act of nature, or exceedance of a permit standard or condition that creates, or may create, a threat to the environment, natural resources, or public health and safety. (Rule 425.503).

76. **Comment:** Shouldn't the resident have a right to decide?

Response: The DEQ is required to evaluate these permit applications based only on whether the proposed operation meets the standards of existing law.

77. **Comment:** The permit should be denied based upon the company's past record of compliance.

Response: With respect to compliance status as criteria for permit eligibility, Part 632 of the NREPA states only that the DEQ shall not issue a mining permit if the applicant has current, unresolved violations of Part 632 or of rules or orders under Part 632. Kennecott is not in violation of any provisions under Part 632, and thus cannot be denied a permit on that basis.

78. **Comment:** Can the DEQ and the people of the State of Michigan trust the company to follow regulations and do the required reporting?

Response: The DEQ cannot issue a permit if it is determined that the proposal cannot comply with all applicable state regulations. The applicable laws provide for strict penalties for failure to comply.

79. **Comment:** How can we trust a company to do self monitoring?

Response: The DEQ is committed to closely monitoring all phases of Kennecott's operation to assure compliance with all regulations.

80. **Comment:** Comments were received questioning the location of the Public Hearings. Specifically people questioned why all of the hearings were not held in Marquette at Northern Michigan University or at a location closer to the proposed site of the mine. Many felt the Gwinn location was too far to travel to.

Response: Given the known public concerns with the proposed mine and the large number of actions (three DEQ permits and a DNR State Land Lease Agreement and Mine Reclamation Plan), both Departments felt it was important to give the public ample opportunity to provide public comments. It was decided that three and a half days in the vicinity of the proposed mine followed by an additional day in Lansing would be sufficient. In setting up the local hearings, the Departments first investigated the availability of Northern Michigan University in Marquette. The University was unable to provide the Departments with a facility for four consecutive days. Given the Departments' mandate to process complete applications in a timely manner, it was decided that we could not wait for the University facilities to become available but rather needed to locate a different facility. The Departments then began looking for facilities closer to the proposed location. Again, no facilities were available for four consecutive days. After finding no facilities available in the Marquette area or to the north of it, the Departments began searching for facilities to the south of Marquette. Once it was determined that the West Branch Community Center in Gwinn was available, the Departments attempted to accommodate the public as much as possible by holding the first day of hearings in Marquette at Northern Michigan University.

81. **Comment:** Add language regarding a shut down of the mine if limits have been exceeded to the point that they threaten public health and the environment. Expected wastewater characteristics included in the permit application did not include copper.

Response: Under Part 632 of the NREPA, the DEQ may revoke the permit or suspend mining operations if the DEQ determines that Kennecott has violated Part 632, the rules, or the mining permit, and the violation is causing an imminent and substantial threat to public health or safety, the environment, or natural resources.

82. **Comment:** Critical data is missing, including a lack of actual data on horizontal stress. Instances of regional subsidence were ignored.

Response: The mining team found the analysis of subsidence to be satisfactory. Special Permit Condition E 8 of Mining Permit MP 01 2007 requires additional analysis of the crown pillar before the advancement of any mining above elevation 327.5 meters.

83. **Comment:** Commenters provided independent modeling, analysis and review of the geotechnical and hydrogeologic information provided in the application. Conclusions assert porosity of crown pillar was not assessed, so the amount of water flowing into the mine from the Salmon Trout River and wetlands is unknown.

Response: The mining team found the hydrogeologic analysis to be satisfactory. In addition, the permittee is required to conduct vigorous monitoring and periodically recalibrate the model to verify validity. If modeling results indicate a problem, the permittee will be required to adjust the mining operation to correct the problem or cease activities.

84. **Comment:** Kennecott has failed to consider how the mine's sulfuric acid and heavy metals will pollute the bedrock groundwater and how that will impact people who use it for drinking water. This is because Kennecott incorrectly assumes that the bedrock groundwater is not an aquifer.

Response: The mining team has determined that the analysis of the bedrock groundwater system is adequate. The existing water chemistry is above drinking water standards, and the permeability of the bedrock is consistent with the definition of an unusable aquifer.

85. **Comment:** They claim that they're going to be able to successfully identify, delineate and remove 100 percent of the reactive rock.

Response: The proposed mining method will allow the permittee to remove the majority of massive and semi-massive sulfide ore from the development rock. However, the mass balance for the TDRSA is conservative, as the permittee is proposing to add 40 percent more limestone as a safety factor (Appendix D-3 of Volume IC of the permit application), allowing for adequate neutralization of the development rock.

86. **Comment:** You'll start the formation of acid mine drainage right then and there while it is sitting on the surface so that, if you use it for back fill, once you put it back in the mine we've already got the reaction starting and therefore potentially putting rock that is going to be reactive back in the mine itself.

Response: Based on the geochemical analysis, 80 percent of the development rock has the potential to generate acid. However, the reaction time is in the order of decades (Appendix D-2 of Volume IC of the permit application). In addition, the rock will be adequately amended with limestone to neutralize acidity if it forms.

87. **Comment:** When calculating the AMD predictions, only one massive sulfide sample from the ore body was used. Data input into the models was not used at its peak AMD generating capacity. Commenters provided independent modeling, analysis and review of the geochemical information provided in the application.

Response: An independent geochemist retained by the DEQ reviewed the modeling and the number and locations of samples used in the analysis and found it to be adequate.

88. **Comment:** I would like to see at least two more prudent and reasonable alternatives that might have been considered for anything that's been done here, and I do not see that in any of the permit, and it's called for by the regulation.

Response: The Mining Team has found that the application meets the requirements of Part 632 of the NREPA with respect to feasible and prudent alternatives described in Section 4 in the EIA. In many instances, there may not be any feasible and prudent alternative.

89. **Comment:** We don't know where the water divide is between the Yellow Dog and the Salmon Trout River.

Response: The surface water divide is well defined in the applicant's EIA.

90. **Comment:** It is clear that if this mine is approved, that DEQ had this predetermined for a long time, and simply went through the steps of including public input.

Response: The DEQ established a multi-discipline/multi-agency mining team to review the application. The entire team was committed to conducting a thorough review of the application and make recommendations based on the technical validity of the application.

91. **Comment:** It is not clear how the backfill will be uniformly distributed and compacted. Will this be accomplished using vibrators as normally used for concrete forms? How will this be accomplished and verified when filling the underground cavities?

Response: The backfill method proposed is the cemented rock fill (CRF) method. This method is considered an industry standard method and has been used successfully around the world.

92. **Comment:** Since the porosity of the crown has not been measured, the required capacity of the treatment plant cannot be determined.

Response: The mining team concluded the hydrogeologic analysis of the crown pillar is satisfactory. In addition, the permit contains several precautionary conditions to assure protection of the environment.

93. **Comment:** In their proposal, Kennecott describes road watering 20 hours per day to reduce fugitive dust. Where will they draw this water from? The Salmon Trout River? Treated wastewater? Untreated wastewater?

Response: Treated water will be used for surface dust control.

94. **Comment:** I feel that the mining application fee paid by Kennecott is completely inadequate. This process should be modified such that many costs related to evaluating these applications are passed on to the applicant.

Response: The application fees are prescribed by statute and cannot be changed through the process of a permit application review.

95. **Comment:** A specific question would be what Kennecott proposes to do with the considerable amount of reject water that results from the proposed double reverse osmosis water treatment system.

Response: The applicant proposes to use a microfiltration process for dewatering the reject water (MPA Section 4.3.12.3). The resulting waste material will be handled according to all applicable regulations.

96. **Comment:** Groundwater sampling methods inadequate.

Response: The analytical methods used to establish background water quality in both the groundwater and surface water at the Eagle Project site are EPA-approved methods and meet accepted environmental analysis industry standards.

97. **Comment:** Response to groundwater exceedances unspecified.

Response: The permittee is required to notify the DEQ as soon as concentrations of solute two standard deviations above the log-term average background level are detected for two consecutive sampling events (Rule 425.406). When concentrations reach a defined action level, the permittee must increase monitoring, investigate the source, and provide a report to the DEQ. If the change in water quality is found to be caused by mining activity, the permittee must implement remedial actions.

98. **Comment:** Bedrock head data inadequate.

Response: The bedrock hydrogeologic investigation report found in Volume IIA, Appendix B-2 clearly shows in the text that six bedrock wells and one overburden well were used to establish the hydraulic properties of the bedrock horizons. The Mining Team found the analysis to be adequate.

99. **Comment:** Commenters provided independent modeling, analysis and review of the hydrogeological information provided in the application. Conclusions assert packer data must be scaled up to regional scale.

Response: The DEQ agrees packer tests under estimate bedrock hydraulic conductivity. However, the applicant performed enough bedrock tests within the mining activity area to adequately define the hydraulic conductivity. The applicant modeled the inflow of water to the mine workings and the expected impact to shallower aquifer horizons based on the bedrock hydraulic conductivity derived from their packer tests. Then the applicant re-modeled the inflow of water into the mine workings and the expected impact to other aquifer horizons based on a worst-case scenario whereby the bedrock hydraulic conductivity was much higher than their in-situ tests indicated. The re-modeling effort takes into account the possibility of the packer tests under estimating the bedrock hydraulic conductivity. The applicant provided enough data and adequately modeled the area hydrologic environment to provide the DEQ with the tools to assess the viability of the assumptions. Since there is some subtle uncertainty with modeling, the DEQ imposed rigid permit conditions that will require additional monitoring as mining activity proceeds. If the additional ongoing monitoring indicates any change from the predictive model conditions, the applicant will be required to re-model the hydrologic environment with regard to the influx of water into the mine workings and what possible impact the withdrawal of that water will have on upper aquifer horizons. The imposed conditions will require the applicant to resolve any potential impacts to upper aquifer horizons indicated by future data and/or modeling before mining activity can continue.

100. **Comment:** Postclosure pump and treat program is of unlimited duration.
- Response:** The applicant identified a maximum of five years for pumping and treating water from the upper bedrock layers in the mine. This plan is a contingency provided to address the potential of sealing methods not performing as proposed required by rules under Part 632 of the NREPA.
101. **Comment:** Tritium data indicate exchange between glacial and deep bedrock aquifers.
- Response:** There is more than one way to interpret the tritium levels detected in the bedrock boreholes. However, the interpretation that elevated tritium levels are due to deep fracture flow of relatively young water seems to contradict the evidence of an upward vertical gradient in the deeper bedrock. The DEQ believes the mining and reclamation plan along with the rigid permit conditions will adequately protect the upper aquifer horizons from inundation by mineral enriched deep water.
102. **Comment:** Draft stormwater permits must be developed.
- Response:** The permittee must have a Stormwater Permit prior to operating the facility. In addition, the Mining Permit is not effective until all NREPA permits are approved.
103. **Comment:** Fish sampling should include population estimates and basic age and growth analysis at each of the sampling sites to allow for detection of population changes.
- Response:** Permit conditions (L 12 and L 43) of Mining Permit MP 01 2007 have been established to address these concerns.
104. **Comment:** We also believe that aquatic macroinvertebrate sampling should include analysis of the species compositions and abundances present, including the identification of those species present that are known to be sensitive to particular water quality impairments.
- Response:** Permit conditions (L12 and L43) of Mining Permit MP 01 2007 have been established to address these concerns.
105. **Comment:** The criteria for interpreting the fish and aquatic macroinvertebrate monitoring data are ambiguous. It is not clear what guidelines will be used to resolve discrepancies in the interpretation of this monitoring data. Likewise, it is not apparent what set points or parameters will trigger a contingency action.
- Response:** Permit conditions (L12 and L43) of Mining Permit MP 01 2007 have been established to address these concerns.
106. **Comment:** We would like to see provisions for quarterly sampling of water and sediment in the non-contact water infiltration basins to help with early detection of any unforeseen contamination issues.
- Response:** Special Permit Condition M1 of Mining Permit MP 01 2007 requires that monitoring wells be installed down gradient of the NCWIBs.

107. **Comment:** Flora and fauna baseline data collection activities were completed for insufficient lengths of time to establish actual baseline conditions. Baseline data collection activities were not completed during all seasons to determine all species present or using this area.

Response: The mining team found methods used were satisfactory to determine the presence and abundance of species in the affected area. Flora and fauna baseline data collection met the requirements of the statute and rules.

108. **Comment:** Baseline heavy metal content of area plants, animals, and aquatic ecosystems has not been determined.

Response: Rules under Part 632 of the NREPA require the applicant to identify species and abundance of species to determine the potential impact from mining. The Mining Team concluded the analysis to be satisfactory, as soil and water samples were analyzed for heavy metals.

109. **Comment:** It is also my understanding that Kennecott plans on filling the mine workings with water following completion of mining. A permit is required for this discharge.

Response: The proposed rapid mine backfill with water is a common reclamation method. Both the DEQ and the USEPA have concluded the applicant is not required to acquire a permit for this activity.

110. **Comment:** It is my understanding that Kennecott plans on disposing of a significant amount of facility waste into the mine working after completion of mining. To complete this activity Kennecott is required to obtain permits for operation of a solid waste facility.

Response: The applicant will be required to recycle or dispose of any material that is designated as a solid waste in a licensed land fill.

111. **Comment:** It is my understanding that some of the waste material that Kennecott will be disposing into the mine workings after completion of mining will likely be hazardous by composition, specifically liner materials and water treatment plant sludge. This will require hazardous waste disposal and storage facility permitting to be completed.

Response: The applicant will be required to recycle or dispose of any material that is designated as a solid or hazardous waste in a licensed disposal facility.

112. **Comment:** Kennecott's baseline water quality data lists a number of parameters as non-detect. This is inadequate. Kennecott needs to establish the actual concentrations of analytes. Non-detect is not baseline.

Response: The analytical methods used to establish background water quality in both the groundwater and surface water at the Eagle Project site were EPA-approved methods and were within accepted environmental analysis industry standards.

113. **Comment:** In addition, the ore load out facilities need to be included in the environmental assessment.

Response: The railhead is part of the transportation network; and therefore, its construction and operation are outside the purview of Part 632 of the NREPA. However, other regulations may apply at this location. In addition, the applicant has indicated that the railhead facility will be designed to incorporate an enclosed bulk ore storage building and enclosed conveyor and rail car loading equipment, and that all ore handling processes will be contained within enclosed structures.

114. **Comment:** The level of bonding proposed is insufficient to cover the worst case scenario, which is that subsidence occurs beneath the headwaters of the Salmon Trout and the river is destroyed. A bond in an amount to pay for reconstruction of the Salmon Trout river should be included in the proposal.

Response: The Mining Team reviewed the applicant's proposed financial assurance and required the applicant to increase the financial assurance to \$17,000,000. In addition, the DEQ may require the permittee to increase the amount at any time if found to be necessary.

115. **Comment:** Weather data from the airport is included in the environmental assessment. This data is not applicable to the locality proposed for mining and should not be used for modeling and predictions.

Response: The applicant collected on site weather data as required by Part 632 of the NREPA and incorporated it into the application. However, data was used from the Marquette County Airport to establish long term trends. This is a very common approach since there are not many weather stations that have long term data.

116. **Comment:** The distinction between contact and non-contact water is unrealistic. All water should be treated as contact water.

Response: The applicant provided methods in the application to segregate contact and non-contact water. The Mining Team found the methods to be satisfactory.

117. **Comment:** It is my understanding that not all stormwater will be sampled. Additional sampling of stormwater is needed.

Response: All contact storm water will be monitored and analyzed.

118. **Comment:** After 8-10 years what will it look like there? Will we still be able to swim and fish (and eat the fish we catch)?

Response: The reclamation requirements outlined in rules under Part 632 of the NREPA require the applicant to restore the site to a self sustaining ecosystem. The Mining Team concluded the plan meets the requirements of the rules.

119. **Comment:** (Special Permit Condition A-2) The permit should require Kennecott to support the presence of an archaeologist designated by the state to oversee excavation and building activities related to development of the surface facilities. The permit should also specify the powers of the designee to call a halt to operations, and specify the consequences for non-compliance with this permit condition. If such requirements are already contained in other permits, laws or rules, this permit should reference those explicitly.

Response: The permittee will be required to follow the requirements of the Michigan State Historic Preservation Office (SHPO) regarding archaeological findings.

120. **Comment:** (Special Permit Condition C-6) Any documents on which the final permit is based should be published as inseparable attachments to it.

Response: Part 632 of the NREPA, Section 63205(13) states: “Terms and conditions that are set forth in the permit application and the mining, reclamation, and environmental protection plan and that are approved by the department shall be incorporated in and become a part of the mining permit.” All documents pertaining to the application and permits are available on the DEQ web page or by request.

121. **Comment:** (Special Permit Condition F-19) There is no indication, though, of the extent to which the head would have to exceed one foot to be considered an exceedance, nor is there an indication of the length of time a head greater than one foot would have to prevail to be considered an exceedance. Finally, there are no specific reporting requirements or contingency procedures. The permit should specify conditions that require specific actions in response to specific conditions. Otherwise it should refer to another document that does so.

Response: The permittee is required by rules under Part 632 of the NREPA to not exceed more than one foot of head on the TDRSA, except in the sump. The DEQ is committed to closely monitor all operations of the facility to assure compliance.

122. **Comment:** (Special Permit Condition F-23) There are no specific reporting requirements, however, and no indication of which state agency/office would review the corrective action plan. Further, no time limits within which corrective action must be undertaken are set. The permit should specify to whom the leak must be reported and a time frame for reporting a leak and completing corrective action. If requirements such as these are specified in another document, that document should be referenced in this section.

Response: Details of reporting and time frames for actions are provided in Rule 506 under Part 632 of the NREPA.

123. **Comment:** (Special Permit Condition H-3, 4) The permit conditions should specify record keeping and reporting requirements or refer to a separate document that does so.

Response: The permit conditions and Rules under Part 632 of the NREPA outline reporting and corrective action procedures.

124. **Comment:** (Special Permit Condition H-7) The nature of the contingency that would be acceptable to DEQ should be described and requirement for submitting the contingency plans for review should be specified. If such requirements have already been set forth in other documents, this section should reference them.

Response: Condition H 22 of Mining Permit MP 01 2007 specifies the contingency.

125. **Comment:** (Special Permit Condition H-18) The standards that are considered applicable are not specified. It is unclear whether the term applicable standards includes such standards as EPA maximum contaminant levels for drinking water, national recommended water quality criteria to protect aquatic life, and/or national recommended water quality criteria to protect human health or whether it simply refers to the short list of contaminants with concentration limits present in the groundwater discharge permit. The specific sets of standards considered applicable here should be named. Further, the approach to setting limits for those contaminants of concern that have no standards should be described.

Response: The permittee will be required to meet water quality standards in Part 632, Nonferrous Metallic Mineral Mining, and Part 31, Water Resources Protection, of the NREPA.

126. **Comment:** (Special Permit Condition L-1) It is unclear from the wording whether only one monitoring well is being required for all NCWIBs or whether one is required immediately down gradient of each. This should be clarified. In any case, considering that stormwater in industrial areas often becomes contaminated and that there is a significant possibility that any one of these basins could become a source of groundwater contamination, it would be prudent to place several wells down gradient from each basin.

Response: Monitoring will be required at all NCWIBs.

127. **Comment:** (Special Permit Condition L 3, 5, 6) The number of proposed wells does not appear to be adequate. To ensure that any groundwater contamination is detected and the source is eliminated in a timely manner, monitoring wells should be placed around the perimeter of the surface facility and several wells should be placed in close proximity to each potential source of groundwater contamination, for example, each contact water basin, each non-contact water infiltration basin, the treated water infiltration system, the TDRSA and so on.

Response: The Mining Team concluded the number of monitoring wells for the TDRSA is satisfactory.

128. **Comment:** (Special Permit Condition L-12) In my opinion, this requirement as it stands is too vague to be effective. The metrics to be used for monitoring fish, macroinvertebrates and aquatic habitats should be describe in the permit and the concentrations that would trigger reporting and initiation of response activities should be specified for each metric. If this information is contained in other documents, specific references should be provided.

Response: Permit conditions L 12 and L 43 of Mining Permit MP 01 2007 are appropriate to assure that monitoring results would be utilized in conjunction with other environmental parameters to assess potential impacts.

129. **Comment:** (Special Permit Condition L-29) The number of stations proposed, however, does not appear to be adequate for the size and setting of this project. In particular, one monitoring station in the Yellow Dog River is not sufficient to observe any spatial patterns or trends, or to identify the source areas for any anomalously high concentrations that might be detected. The number of surface water monitoring stations should be increased.

Response: The Mining Team identified additional monitoring locations as permit conditions. With these additions, the mining team concluded the number of monitoring stations is satisfactory.

130. **Comment:** (Special Permit Condition N-2) It is difficult to see, though, how meaningful statistical analysis to evaluate distributional changes can be done with so few sampling locations. EPA statistical guidance is listed, but it does not appear to have been used to design a sampling plan in consideration of data quality objectives. The adequacy of the sampling plan for meeting the goals of the monitoring program should be re-evaluated. Related to the question of data quality objectives, it should be noted that in the list of parameters under the heading of Groundwater Monitoring and Limitations in the Groundwater Discharge permits, two of the listed maximum daily limits are lower than the quantification levels listed in the same document.

Response: The Mining Team found the procedures to be satisfactory.

131. **Comment:** Since the initial installation of the piezometers QAL-015 thru QAL 21 there have been other installations which can improve the data quantity/quality curve, however, those recently installed piezometers time for collect data could certainly be used as corroborating previously collected information, but in the spirit of the two year study criteria, it seems credible to use as two year study from time of their installation.

Response: Rules under Part 632 of the NREPA require the applicant to define baseline conditions using two years of on-site data. The Mining Team concluded the evaluation is satisfactory.

132. **Comment:** The permit application does not address potential health risks of heavy metals to people picking blueberries on the Yellow Dog Plains, which is one of the most heavily used blueberry picking areas in Marquette County.

Response: The application indicates there will be no impact to blueberries outside of the area that will be utilized for mining activities.

133. **Comment:** In Section 3.9.1.1 Kennecott does not list the most serious exotic species: *Centaurea maculate* (spotted knapweed), which is widespread along roads near the mine site.

Response: Spotted knapweed was not identified in the mining area or the affected area.

134. **Comment:** Kennecott's statement that linear-leaved gentian is not susceptible to fluctuating water levels is unsubstantiated and directly contradicts the Michigan Natural Inventory (2007), which states that this species is sensitive to hydrological alterations and requires protection from both extreme flooding and excessive drainage.
- Response:** The narrow-leaf gentian was identified in areas that were both wet and dry; therefore, it was determined to be facultative. In addition, no impacts to any species have been identified for the proposed operations.
135. **Comment:** The information and analysis, or more properly, lack of analysis presented in the Mine Permit Application (MPA) and project Environmental Impact Analysis (EIA) are an inadequate description of the impacts of the proposed project due to noise and vibrations.
- Response:** In its supplemental response, Kennecott defined the affected areas for noise and light; identified noise suppressant measures and addressed the issue of noise-sensitive features; and described light sources and measures to minimize impacts. The Review Team found the descriptions and proposed mitigation measures to be satisfactory.
136. **Comment:** The information and analysis presented in the Mine Permit Application (MPA) and project Environmental Impact Analysis (EIA) inadequately describe the visual impacts of the proposed project.
- Response:** The mining team found the visual impact analysis and mitigation measures to be satisfactory.
137. **Comment:** Commenters provided independent modeling, analysis and review of the hydrogeologic information provided in the application. Conclusions assert Kennecott has not sufficiently characterized hydrogeologic conditions.
- Response:** The Mining Team concluded the hydrogeologic analysis is satisfactory.
138. **Comment:** Commenters provided independent modeling, analysis and review of the geotechnical and hydrogeological information provided in the application. Conclusions assert insufficient data is provided to assess outflow from the mine adjacent bedrock.
- Response:** The Mining Team found data provided assessing bedrock flow to be satisfactory. In addition, the permittee is required to conduct vigorous monitoring and periodically recalibrate the model to verify validity. If modeling results indicate a problem, the permittee will be required to adjust mining to correct the problem or cease activities.
139. **Comment:** Commenters provided independent modeling, analysis and review of the hydrogeological information provided in the application. Conclusions assert insufficient fracturing data is provided to provide reasonable level of certainty regarding the project's hydrological features and impacts.

Response: The Mining Team found the modeling to be satisfactory. In addition, the permittee is required to conduct vigorous monitoring and periodically recalibrate the model to verify validity. If modeling results indicate a problem, the permittee will be required to adjust mining to correct the problem or cease activities.

140. **Comment:** The application does not provide a complete list of other permits needed.

Response: The rules under Part 632 of the NREPA only require applications to list all expected necessary NREPA permits. A list of all necessary NREPA permits was provided in the application.

141. **Comment:** The application's discussion of historic and cultural sites is incomplete.

Response: The SHPO concluded the applicant's analysis of historic and cultural resources is satisfactory.

142. **Comment:** The water balance analysis is inadequate.

Response: The Mining Team concluded the water balance analysis is satisfactory.

143. **Comment:** The groundwater quality monitoring network is inadequate.

Response: The Mining Team identified additional groundwater monitoring wells in the Permit Conditions and believes the monitoring requirements with these additions are satisfactory.

144. **Comment:** More surface water monitoring sampling locations are needed.

Response: The Mining Team identified additional surface water monitoring locations in the Permit Conditions and believes the monitoring requirements with these additions are satisfactory.

145. **Comment:** Groundwater elevation monitoring is inadequate.

Response: The Mining Team believes the monitoring requirements in the Permit are satisfactory.

146. **Comment:** Monitoring of water in the NCWIBs should be required.

Response: The applicant will be required to follow the requirements of the Storm Water Permit.

147. **Comment:** Mitigation must be identified for the narrow-leaved gentian.

Response: The application does not propose any measurable impacts to the narrow-leaved gentian

148. **Comment:** Reclamation plans for the underground workings are inadequate.
- Response:** The Mining Team concluded reclamation plans outlined in the application are satisfactory and meet the requirements of Part 632 of the NREPA.
149. **Comment:** The postclosure monitoring plan is inadequate.
- Response:** The Mining Team concluded the postclosure monitoring plan is satisfactory and meets the requirements of Part 632 of the NREPA.
150. **Comment:** Reclamation costs do not have an adequate basis.
- Response:** The Mining Team conducted a thorough review of the financial assurance proposed in the application and required the permittee to increase their financial assurance to \$17,000,000. The Mining Team found the new financial assurance amount to be satisfactory.
151. **Comment:** The Environmental Impact Assessment does not meet the requirements of the Natural Resources and Environmental Protection Act.
- Response:** The Mining Team concluded the EIA meets the requirements of NREPA.
152. **Comment:** Ore trucks should be washed after unloading at the ore terminal facility, and ore trucks should be required to have a hard cover, not just a secured cap as is proposed in the Draft Permit Conditions.
- Response:** The railhead is part of the transportation network, and therefore outside the purview of Part 632 of the NREPA. Part 201, Environmental Remediation, of the NREPA, air quality provisions, and other regulations may apply at this location. In addition, the applicant has indicated that the railhead facility will be designed to incorporate an enclosed bulk ore storage building and enclosed conveyor and rail car loading equipment, and that all ore handling processes will be contained within enclosed structures. Ore trucks will be covered with a rigid cover to prevent release of ore.
153. **Comment:** Zinc should be sampled quarterly, not annually, as proposed in the Draft Permit Conditions.
- Response:** Permit Condition L 23 of Mining Permit MP 01 2007 has been amended to require monitoring zinc quarterly.
154. **Comment:** Including local officials and agencies in tests of the Contingency Plan should be made a requirement of the Part 632 conditions.
- Response:** Permit Condition M 19 of Mining Permit MP 01 2007 has been amended to include local officials and agencies in the contingency plan tests.
155. **Comment:** Clear procedures should be defined about who will have access to the data from the further geotechnical field investigations and analysis.

Response: Special Permit Condition E 8 has been amended to specify that the DEQ will review the pertinent data. In addition, if the DEQ lacks necessary expertise, independent consultants will be retained.

156. **Comment:** The application does not realistically consider the impact that brines could have on the post-mining gradients between the mine and the shallow aquifer.

Response: The upward vertical gradient is very small and the relative hydraulic conductivity of the lower bedrock is so small that high quality non-saline water will flow into the mine workings as fast, if not faster, than the low-quality saline water. In addition, the reclamation plan describes rapid backfill of the mine with fresh water to prevent any saline water from migrating up into the unconsolidated aquifer. Therefore, it is expected that the post-mine aquifer density layering will be similar to the present pre-mining aquifer layering.

157. **Comment:** Commenters provided independent modeling, analysis and review of the geochemical information provided in the application. Conclusions assert the inputs to the model for predicting backfilled mine water quality are factually incorrect.

Response: An independent geochemist retained by the DEQ found the modeling inputs to be satisfactory. In addition, the permittee is required to conduct vigorous monitoring and periodically recalibrate the model to verify validity. If modeling results indicate a problem, the permittee will be required to adjust mining to correct the problem or cease activities.

158. **Comment:** Commenters provided independent modeling, analysis and review of the geochemical information provided in the application. Conclusions assert the surface area of crushed ore in stope floors and in roadbeds and ore dust on mine walls is not accounted for.

Response: An independent geochemist retained by the DEQ has determined the geochemical modeling to be adequate. All development rock backfill will be amended with limestone and primary stopes will be backfilled with cement.

159. **Comment:** A trigger of 25 gallons/acre/day to indicate composite liner leakage is contrary to the intent of the Nonferrous Metallic Mineral Mining rules and far exceeds the leakage that should be expected of a composite liner.

Response: Permit Condition F-22 specifies an average daily flow rate that would be indicative of leakage from the TDRSA composite liner. Rule 425.509(D) of Part 632 of the NREPA requires that a stockpile or storage facility have a leak detection system. It does not describe the elements of a leak detection system, or describe any performance standard for the leak detection system. Therefore, the DEQ has chosen to adopt the standards for leak detection systems for monitorable landfill units as specified in Rule 299.4437 of Part 115, Solid Waste Management, of the NREPA, and apply those standards to the leak detection system of the TDRSA. Rule 437 provides for a value of response flow rate of 25 gallons per acre per day for a landfill design which has a primary liner without two or more feet of compacted clay. This flow rate has proven to be a reliable indicator of liner leakage, as even very small or pinpoint leaks generally result in higher flow rates.

160. **Comment:** The application does not describe how Kennecott will prevent leaching of contaminants into groundwater and surface water.

Response: The permit adequately identifies measures to prevent leaching of contaminants into groundwater and surface water in Section 5 of the permit application. In addition, the DEQ added a condition in the permit (F 1) that requires the permittee to install a synthetic liner under the entire TDRSA for leak detection. The application also identifies measures to control leaching in the back filled mine in Section 7. The permittee will be required to monitor the effectiveness of the methods described throughout the life of the mine and for at least 20 years post closure.

161. **Comment:** There is a concern regarding disposal of solids collected from the CWB in the mine.

Response: The permittee will be required to recycle or dispose of any sediments collected from the facility, that are determined to be a solid waste, in a licensed disposal facility as outlined in Permit condition L 34 of Mining Permit MP 01 2007.

162. **Comment:** There is no accounting for contaminant generated during the 7 years of above ground storage.

Response: The Mining Team concluded the mass-balance for the development rock is satisfactory.

163. **Comment:** The permit application review process to date has been largely opaque to the public and leaves key provisions of the law in question.

Response: The DEQ provided an unprecedented number of opportunities for the public to participate in the process.

164. **Comment:** Commenters provided independent modeling, analysis and review of the geochemical information provided in the application. Conclusions assert concentrations of sulfate, nickel, total dissolved solids, aluminum, beryllium, cadmium, cobalt, copper, iron, lead, and manganese exceeding relevant water quality standards in the underground mine.

Response: An independent geochemist retained by the DEQ reviewed the modeling and found it to be adequate. In addition, the applicant proposes to leave the Wastewater Treatment Plant (WWTP) in operation for five years into the postclosure period, after re-flooding is complete. If monitoring indicates there is potential for upward migration of mine related constituents into the quaternary aquifer, water will be pumped out of the upper bedrock workings, treated at the WWTP, then the treated water will be recirculated back into the upper bedrock workings until water quality conditions are protective of the groundwater in the quaternary aquifer.

165. **Comment:** The MPA does not meet the requirements of Michigan's Natural resources and Environmental Protection Act and federal laws.

Response: The Mining Team concluded the application meets the requirements of NREPA.

166. **Comment:** KEMC has not provided the required copy to each emergency management coordinator.

Response: KEMC provided a copy of the emergency management plan to all applicable emergency management coordinators.

167. **Comment:** The MPA and activities it proposes do not meet Part 632 reclamation standard.

Response: The Mining Team found the application to meet the reclamation requirements outlined in Part 632 of the NREPA.

168. **Comment:** The MPA does not meet Part 632 financial assurance requirements.

Response: The Mining Team conducted a thorough review of the financial assurance proposed in the application and required the permittee to increase their financial assurance to \$17,000,000. The Mining Team found the new financial assurance amount to be satisfactory.

169. **Comment:** Mining activities proposed in the MPA violate the inland lakes and streams act and require a permit.

Response: The application does not propose any activities that would reasonably be expected to have measurable impacts to any inland lakes or streams that would require a permit.

170. **Comment:** Commenters provided independent modeling, analysis and review of the hydrogeological information provided in the application. Conclusions assert mining activities proposed in the MPA violate the wetlands protection act and require a permit.

Response: The application does not propose any activities that would reasonably be expected to have measurable impacts to wetlands that would require a permit. However, the DEQ imposed rigid permit conditions that will require additional monitoring as mining activity proceeds. If the additional ongoing monitoring indicates any change from the predictive model conditions, the applicant will be required to re-model the hydrologic environment as regards to the influx of water into the mine workings and what possible impact the withdrawal of that water will have on upper aquifer horizons. The imposed conditions will require the applicant to resolve any potential impacts to upper aquifer horizons indicated by future data and/or modeling before mining activity can continue.

171. **Comment:** Commenters provided independent modeling, analysis and review of the geochemical information provided in the application. Conclusions assert the mass-balance model for the post-re-flooded mine water chemistry does not take into account the generation of soluble forms of contaminants that are not fully rinsed from the stockpile during the 7 years of above ground storage.

Response: An independent geochemist reviewed the application and concluded the mass balance model is satisfactory. However, the mass balance for the TDRSA is conservative, as the permittee is proposing to add 40 percent more limestone as a safety factor (Appendix D-3 of Volume I C of the permit application), allowing for adequate neutralization of the development rock.

172. **Comment:** Concern regarding mine fires not adequately addressed.

Response: Although the DEQ is concerned about potential mine fires, it is the role of the Mine Safety and Health Administration to ensure a mine has necessary fire suppression and safety plans.

173. **Comment:** In the time period of 20 months since KEMC submitted the original MPA, the prices of metals present in the Eagle East have risen to the point that KEMC may wish to consider what was previously considered waste rock as feasible ore.

Response: The permittee identified a total tonnage to be removed for mining purposes in their application. If the permittee identifies additional reserves, they will be required to either request a permit amendment or may be required to apply for a new Mining Permit.

174. **Comment:** The EIA's assessment of exposure pathways and sensitive receptors is insufficient.

Response: The Mining Team concluded the EIA presented in the application is satisfactory.

175. **Comment:** The DEQ should include a provision in the Permit asserting its right to enforce any and all laws within its authority regardless of the MPA.

Response: Issuing a mining permit does not reduce the DEQ's enforcement abilities regardless of what is presented in the application.

176. **Comment:** The DEQ intends to accept KEMC's proposed conditions for release of significant portions of the financial assurance.
- Response:** The permittee is required to apply to the DEQ for release from their financial assurance obligation as outlined in Part 632 of the NREPA, Rule 425.309.
177. **Comment:** Draft Permit does not delineate any particular compliance well or other compliance measurement tools.
- Response:** Permit Conditions L 1, 4, 5, 6 and 7 of Mining Permit MP 01 2007 describe monitoring wells that will be used for compliance. In addition, the ground water discharge permit describes additional compliance monitoring locations.
178. **Comment:** KEMC should be required to submit a copy of the SPCC plan to the MMU Supervisor along with any updates prior to mining activities.
- Response:** Special Permit Condition B 3 of Mining Permit MP 01 2007 describes the requirements for submitting the SPCC plan. The permittee must adhere to all applicable state and federal regulations with regard to the SPCC, and the SPCC must be maintained at the mine facility.
179. **Comment:** All stopes should be cemented to prevent vertical movement within the workings and lateral cross connections within fractures that have been documented to intersect the proposed mine.
- Response:** The hydrogeologic data collected in the bedrock indicate little vertical hydraulic conductivity. In addition, the reclamation plan requires the permittee to install a concrete plug in the mine workings on level 383 meters and 353 meters to prevent vertical movement.
180. **Comment:** Special condition F19 allows the 1 foot head to be exceeded as needed for the CWB contingency plan.
- Response:** The applicant will be required to limit the hydraulic head to no more than one foot in the TDRSA liner, except in the sump. Special Permit Condition F 19 of Mining Permit MP 01 2007 has been amended so that it is consistent with this requirement.
181. **Comment:** The limestone and development rock ratio in the TDRSA has not been demonstrated that it will be effective in neutralizing the acidity produced in the development rock.
- Response:** The mining team concluded the applicant adequately demonstrated the neutralization of the development rock to be effective.
182. **Comment:** Special condition F9 needs to be more specific as to when the cover is to be placed and how long the cover is to remain over the rock in the TDRSA.

Response: The applicant will cover the areas of the TDRSA that are filled to grade. The TDRSA covering sequence is shown in Figure 5-7 of the application. The cover will remain until the development rock is needed for backfill in the mine.

183. **Comment:** The impacts associated with NCWIB releases have not been evaluated in the permit application.

Response: The application describes the operation of the NCWIBs in Section 8.1.5.2. The Mining Team concluded the operation is satisfactory.

184. **Comment:** The monitoring well cluster in Special Condition L 5 should include a well screened within the upper fracture zone of the bedrock aquifer.

Response: Bedrock monitoring locations are described in Figure 7-3 of the MPA. The Mining Team found the monitoring locations to be satisfactory.

185. **Comment:** In Special Condition L 16 “indicator parameters” should be defined.

Response: The groundwater Discharge Permit outlines water quality parameters.

186. **Comment:** In Special Condition L 26 “local and regional monitoring” locations should be defined.

Response: Special Permit Condition L 29 of Mining Permit MP 01 2007 identifies all surface monitoring locations.

187. **Comment:** In Special Condition L 31 the timing of “annual” monitoring event should be defined so that all “annual” samples are taken during the same event.

Response: The condition has been changed to add language to clarify monitoring to be conducted during the same event.

188. **Comment:** Parameters with a high percentage of non-detects must not be ignored and must be evaluated with appropriate parametric or nonparametric method.

Response: The analytical methods used to establish background water quality in both the groundwater and surface water at the Eagle Project site were EPA-approved methods and were within accepted environmental analysis industry standards.

189. **Comment:** Allowing the use of the buildings for civic uses does not comply with returning the site to “pre-mining” conditions.

Response: The permittee will be required to restore the property to a condition commensurate with the pre-mining landscape as outlined in Special Permit Condition P 9 of Mining Permit MP 01 2007. Special Permit Condition P 18 is inconsistent with condition P 9 and has been deleted.

190. **Comment:** Special Condition L 34 does not address how and where sediment that is cleaned from the CWB will be dewatered prior to reuse or disposal.
- Response:** The application describes using a microfiltration process for dewatering the sediments (MPA Section 4.3.12.3).
191. **Comment:** The flora and fauna monitoring should be used for compliance purposes.
- Response:** The permittee is required in Special Permit Condition L 36 of Mining Permit MP 01 2007 to conduct monitoring of flora and fauna. If conditions change as result of mining operations, the permittee will be required to correct the problem.
192. **Comment:** The wetland monitoring should be used for compliance purposes.
- Response:** Special Permit Condition L 4 of Mining Permit MP 01 2007 requires the permittee to collect daily measurements and report the data to the MMU Supervisor quarterly for compliance purposes.
193. **Comment:** If the impacts of dewatering at such rates (exceeding 300,000 gpd for more than 2 days in any 10-day period or for more than 5-days in any 30-day period) are unknown then dewatering at that level should not be allowed until the impacts are demonstrated by the applicant.
- Response:** Even though the application concludes this is unlikely, the DEQ added this compliance standard as one indicator of potential impact to the overburden aquifer.
194. **Comment:** Special Permit Condition G 1 doesn't state that the vehicles would have to be washed while passing through the truck wash. The permit should require that all surfaces of trucks and equipment leaving the contact area of the mining facility must be thoroughly washed.
- Response:** Special Permit Condition G 1 of Mining Permit MP 01 2007 has been amended to require that all vehicles will have to be washed before leaving the mining facility.
195. **Comment:** The application indicates that water going to the truck wash would come from the wastewater clarifier and filter but it would not go through the WWTP. The trucks would then be washed with contaminated water, which could lead to contaminates washing off the trucks into the environment on the way to the railhead.
- Response:** Special Permit Condition H 18 of Mining Permit MP 01 2007 has been amended to require that only treated or potable water be used to supply water at the truck wash.

196. **Comment:** General Permit Condition C 1. The last sentence in this section addressing permit transfers should be modified to delete the words “Eagle Project” and simply reference the “mine” or “mining activities authorized by this permit” since this provision is probably intended as a boilerplate permit provision not specifically directed at the Eagle Project, as opposed to the project specific conditions in the special permit conditions section. This comment applies to other sections in the General Conditions.
- Response:** Since the permit would apply to the Eagle Project, it is appropriate to reference the specific mine name.
197. **Comment:** General Permit Condition F 7. The word “possible” in the last sentence of this condition should be changed to “practicable.”
- Response:** General Permit Condition F 7 of Mining Permit MP 01 2007 incorporates language from Rule 503 (1) and (1)(a) of Part 632 of NREPA.
198. **Comment:** General Permit Condition F 10. The amended Organization reports should be included in the annual report required under General Condition F 2.
- Response:** Rule 425.501 under Part 632 of the NREPA requires a permittee to file an updated organization report as part of the Annual Mining and Reclamation Report. General Permit Condition F 10 of Mining Permit MP 01 2007 imposes an additional requirement for filing an amended Organization Report when changes occur.
199. **Comment:** Special Permit Condition B 1. It is recommended that the word “only” be deleted from the first sentence.
- Response:** Special Permit Condition B 1 of Mining Permit MP 01 2007 has been amended as recommended.
200. **Comment:** Special Permit Condition B 3. This condition should be reworded such that the SPCC Plan shall be prepared prior to use of any fuel storage tank at the site as required under 40 CFR 112.
- Response:** Special Permit Condition B 3 of Mining Permit MP 01 2007 will reference Part 5 rules promulgated pursuant to Part 31, Water Resources Protection, of the NREPA.
201. **Comment:** Special Permit Condition B 5. It is recommended that the last part of this condition that reads “...in addition to federal SPCC requirements...” be deleted as it is redundant with Special Permit Condition B3.
- Response:** Special Permit Condition B 5 of Mining Permit MP 01 2007 has been amended as recommended.
202. **Comment:** Special Permit Condition C 1. The permit condition should make it clear, as a matter of law, that to the extent that any remediation that may be required is governed by Part 201 and Part 213 of the NREPA.

Response: Special Permit Condition C 1 of Mining Permit MP 01 2007 has been amended to generally reference other applicable standards for any necessary remediation.

203. **Comment:** Special Permit Condition C 6. The first sentence of this condition should read as follows: “Unless approved by the DEQ, the permittee shall conduct mining activities in accordance with the approved ...”

Response: Special Permit Condition C 6 of Mining Permit MP 01 2007 has been amended as recommended.

204. **Comment:** Special Permit Condition D 8. These requirements are redundant in that they are covered in the SPCC and PIPP requirements. Therefore, this condition should be deleted.

Response: The SPCC and PIPP requirements are referenced in the revised Special Permit Condition D 8 of Mining Permit MP 01 2007.

205. **Comment:** Special Permit Condition D 11. This condition should be revised to read as follows: “The Permittee shall maintain the perimeter fence and gates.”

Response: Special Permit Condition D11 of Mining Permit MP 01 2007 has been amended to address this concern.

206. **Comment:** Special Permit Condition D 15. This permit condition is redundant in that it is already covered in the Air Permit. Therefore, it should be deleted.

Response: Fugitive dust measures were included in the MPA, so it is not inappropriate to include them in the Mining Permit Conditions even though they may be redundant.

207. **Comment:** Special Permit Condition F 2. The provision should be revised to specify that construction of the TDRSA cannot begin until the plans have been submitted and approved.

Response: Special Permit Condition F 2 of Mining Permit MP 01 2007 has been amended to specify that the TDRSA will not be constructed until plans have been submitted and approved.

208. **Comment:** Special Permit Condition F 9a should be stricken from this condition and reworded so that the liner system is required for the containment of contact water, not the control of oxidation.

Response: The TDRSA cover is intended to limit oxidation as well as infiltration.

209. **Comment:** Special Permit Conditions G 4, 5, and 6. These conditions are redundant because they are covered in the Air Permit.

Response: Air quality measures for the crusher and conveyor were included in the MPA, so it is not inappropriate to include them in the Mining Permit Conditions even though they may be redundant. The Air Use Permit has been referenced in Special Permit Conditions G 5 and 6 of Mining Permit MP 01 2007.

210. **Comment:** Special Permit Condition H 2e. If it is DEQ's intention to limit plant discharge to 350 gpm then the condition should be revised to correctly note the maximum discharge rate as specified in the draft groundwater discharge permit conditions.

Response: Special Permit Condition H 2e of Mining Permit MP 01 2007 has been amended so that the size of the pump is not restricted.

211. **Comment:** Special Permit Condition H 7. This condition is not needed because the overflow contingency is specified in the permit application and is approved under condition H 22.

Response: Special Permit Condition H 22 of Mining Permit MP01 2007 describes the overflow contingency, therefore Special Permit Condition H 7 has been deleted.

212. **Comment:** Special Permit Conditions H 10, 11, and 12. These conditions are not needed as they will be covered under the Storm Water Pollution Prevention Plan prepared as a requirement of the Industrial Storm Water Permit that is referenced in Condition H 9.

Response: The Industrial Storm Water Permit has been referenced in Special Conditions H 10, 11, and 12 of Mining Permit MP 01 2007.

213. **Comment:** Special Permit Condition H 18. The purpose of this condition is unclear. Utility water will never be released into the environment.

Response: Special Permit Condition H 18 of Mining Permit MP 01 2007 has been amended to apply to the truck wash only.

214. **Comment:** Special Permit Condition H 25. This provision should be revised to read that Kennecott shall not operate the CWBs or NCWBs until DEQ has approved the plan.

Response: Special Permit Condition H 25 of Mining Permit MP 01 2007 has been amended to require that CWBs and NCWIBs shall not operate until plans have been approved.

215. **Comment:** Special Permit Condition K 6. The first two sentences of this condition are covered under the Industrial Storm Water Permit and do not need to be duplicated in the Mine Permit.

Response: The Industrial Storm Water Permit has been referenced in Special Permit Condition K 6 of Mining Permit MP 01 2007.

216. **Comment:** Special Permit Conditions L 9 and 10. The flow periods in this condition should be changed so that simple drainage of stored water does not trip this condition. It is recommended that 2 days be changed to 5 days and 5 days be changed to 10 days.
- Response:** Special Permit Conditions L 9 and 10 of Mining Permit MP 01 2007 were revised to exclude the effects of increased pumping that is due solely to accelerated removal of stored water.
217. **Comment:** Special Permit Condition L 12. Part 632 of the NREPA does not specify any compliance standards for biological assessments. Nor do the results of such assessments readily lend themselves to establishing a basis for applying Rule 425.406. This condition should be revised to impose a general obligation to continue the biological assessments as set forth in the MPA and report the results to DEQ.
- Response:** Special Conditions L 35, 36, and 41 require ongoing monitoring of flora and fauna, and reporting of the results during the life of the mine. The results of the biological assessments shall be used in conjunction with other environmental parameters to assess potential impacts.
218. **Comment:** Special Permit Condition L 14. The condition should be revised to state that construction of these structures shall not occur until the monitoring plan has been submitted and approved.
- Response:** Special Permit Condition L 14 of Mining Permit MP 01 2007 has been amended to require that impermeable surfaces that will be exposed to contact storm water shall not be put into operation until a monitoring plan has been submitted and approved.
219. **Comment:** Special Permit Condition. L 15, 16, 21, and 22. These conditions are not needed since they are already covered in the ground water discharge permit.
- Response:** The Groundwater Discharge Permit has been referenced in Special Permit Conditions L 15, 16, 21, and 22 of Mining Permit MP 01 2007.
220. **Comment:** Special Permit Condition L 26. This permit condition is redundant with conditions L 27 and L 29 and should be deleted.
- Response:** Special Permit Condition L 26 of Mining Permit MP 01 2007 has been deleted since regional monitoring requirements are specified in Special Permit Conditions L 27 and 29 and in the rules under Part 632 of the NREPA.
221. **Comment:** Special Permit Condition L 32a. Sediment removed from ditches conveying non contact storm water does not need to go to a landfill.
- Response:** All sediment removed from ditches and culvert pipes shall be managed in accordance with applicable requirements.
222. **Comment:** Special Permit Condition L 34. This sediment does not need to go into a landfill. It should be disposed of in the TDRSA.

Response: All sediment removed from ditches and culvert pipes shall be managed in accordance with applicable requirements.

223. **Comment:** Special Permit Condition L 35. This permit condition is not needed since it will be covered in the Industrial Stormwater Permit.

Response: Special Permit Condition L 35 of Mining Permit MP 01 2007 has been deleted since Special Permit Condition L 1 specifies additional monitoring for the NCWIBs.

224. **Comment:** Special Permit Condition L 43. This permit condition should be modified to require sampling of macroinvertebrates and sediments as the brook trout population is limited in numbers and size.

Response: Special Permit Condition L 43 of Mining Permit MP 01 2007 has been amended to provide for the DEQ and DNR to accompany the permittee during sampling to confirm whether adjustments are needed due to brook trout population.

225. **Comment:** Special Permit Condition L 48. This condition should be modified such that it is clear that the sampling procedures and statistical methods employed cannot be changed unless specifically approved by the DEQ.

Response: Special Permit Condition L 48 of Mining Permit MP 01 2007 has been amended to require approval by the DEQ of any changes in sampling procedures and statistical methods.

226. **Comment:** Special Permit Condition L 50. The buildings in which this requirement applies should be specified.

Response: The building identified in Special Permit Condition L 50 of Mining Permit MP 01 2007 is the COSA, as referenced in the first sentence of the Condition.

227. **Comment:** Special Permit Condition M 1. The second full sentence of this condition should be modified to read as follows: "If monitoring indicates there is the potential for upward migration of fluids associated with the underground openings such that there could be an impact on the quaternary aquifer, the permittee shall pump water out of the upper bedrock workings, treat it at the WWTP and recirculate the treated water back into the upper bedrock workings."

Response: Special Permit Condition M 1 of Mining Permit MP 01 2007 has been amended to include reference to indications of impact on the quaternary aquifer.

228. **Comment:** Special Permit Condition O1. The language in this condition should be modified such that the entire permit's effectiveness isn't contingent upon posting the bond, but that the bond must be posted within 30 days of issuance of the permit.

Response: Rule 425.301 under Part 632 of the NREPA states that a mining permit shall not be effective until the permittee establishes financial assurance in an amount in accordance with the mining permit.

229. **Comment:** Special Permit Conditions P 2 and 3. The word “prevent” should be changed to “minimize” to more closely match the permit application.

Response: Special Permit Conditions P 2 and P 3 of Mining Permit MP 01 2007 has been amended to clarify its intent.

230. **Comment:** Special Permit Condition P 16. The language in this condition should be changed so that the materials in question are disposed in accordance with Part 115 of NREPA or used as mine backfill.

Response: Special Permit Condition P 16 of Mining Permit MP01 2007 has been amended to require that material shall be managed in accordance with applicable regulations.

231. **Comment:** Special Permit Condition P 18. Please modify this condition to allow KEMC to enter into agreements with Non Governmental Organizations.

Response: Special Permit Condition P 18 of Mining Permit MP01 2007 has been amended to allow alternatives for subsequent use of buildings.

232. **Comment:** Special Permit Condition P 22. Please modify this condition so that it specifies that the material should be disposed in accordance with Part 115 of the NREPA.

Response: Special Permit Condition P 22 of Mining Permit MP 01 2007 has been amended to require that all materials will be handled in accordance with applicable regulations.

233. **Comment:** Special Permit Condition P 24. In KEMC’s response to Comment 46 of the 91 DEQ comments, it was noted that KEMC may elect at the time of reclamation to keep one or two cells of the TWIS open until reclamation of the WWTP. This is for contingency purposes only to discharge a small volume of treated water in the need arose. This condition should reflect KEMC’s response.

Response: Special Permit Condition P 24 of Mining Permit MP 01 2007 specifies that the TWIS will be decommissioned when the WWTP is no longer necessary and has been amended to reference the contingency specified in Special Permit Condition P 26.

234. **Comment:** The RMR values used in the geotechnical studies to characterize the rock mass in the Eagle Project Mine were incorrect and overstated.

Response: Rock mass classification systems, including RQD and RMR, were developed primarily to provide a means of determining ground support requirements for underground openings. Initial use of these parameters was in civil applications where little geological information was available and expected ground conditions and support requirements had to be determined for contract excavation purposes.

Cores from diamond drill holes for geological exploration of the Eagle ore body, as well as some additional holes for geotechnical purposes, were logged by KEMC geologists and put into a data base. These data were utilized by Golder and Associates to develop a geotechnical data base. Crown pillar stability evaluations were based on data from boreholes that intersected the crown pillar. Eight holes were identified as containing 'major structures'. Photos of core boxes for these holes and their EXCEL spreadsheet were utilized by Vitton and Parker.

Discrepancies are due to the different derived values and assigned to the model. Kennecott had access to more data with greater detail which is more reliable.

Both David Sainsbury and Wilson Blake agree that an 87.5 millimeter crown pillar will be stable based on the data presented.

It has been observed that the geological model of a deposit based on widely spaced diamond drill core data seldom accurately delineates the ore body or the continuity of the ore within it. In addition, the rock surrounding underground openings, judged to be fair to good by rock mass classification or just visual evaluation of drill core data, is almost always found to be better than predicted. Further, the exploration and geotechnical holes for the proposed Eagle Mine were not ideally positioned on surface due to access and environmental restrictions.

235. **Comment:** The proposed stope backfilling will not achieve a 'tight fill' status, hence not provide support to the crown pillar.

Response: Panel mining using cemented rock backfill has been successfully used at other mines around the world. It is an operational problem to cement the backfill sufficiently so that it stands up during mining. The backfill can be compacted by subsequent mining activities.

Panel mining is routinely done in a large number of mines.

236. **Comment:** The permit did not take into account a "plug" type failure such as occurred at the Athens Mine some 23 miles away.

Response: Because of failure to the surface over at the Athens Mine in Negaunee, Michigan, a great deal of concern has been expressed regarding a similar type failure occurring at the proposed Eagle Mine, located only 23 miles away. While there may be some similarities there are also substantial differences.

The geology of the Marquette Iron Range is quite different from the geology at the Eagle Mine site. The Eagle Mine deposit is a massive sulfide type ore body that occurs more or less conformably in a subvertical intrusive body that is oriented about east-west.

Major structures were not identified during surface mapping and have not been identified from diamond drilling.

Based on a review of the photos for the eight cores, Vitton and Parker reported that there were fractured zones along intrusive boundaries which could possibly act as a failure plane for the crown pillar. There is little hard data to suggest that a “plug” type failure at the Eagle Mine is likely to occur.

237. **Comment:** In situ stress measurements were not carried out in the exploration boreholes drilled at the site to determine the horizontal stress.

Response: In situ stress measurements utilizing existing surface boreholes is not a technique that is routinely used by the mining industry.

It is agreed by everyone that in situ stress measurements need to be carried out at the Eagle Mine site for input into both mine and crown pillar stability analyses.

DEQ Water Bureau Responses to Comments, 10/17/2007

Hydrogeology

238. **Comment:** Aggressive Nature of Final Effluent.

The treated effluent will be discharged to a treated water infiltration system (TWIS). Although the treated water may have a high level of purity, it will also be very aggressive (i.e., in general, the greater the purity of water the greater its tendency to dissolve materials it comes in contact with), and therefore, will likely leach contaminants such as calcium, silica, metals and others out of the infiltration bed or subsurface, which in turn, may lead to a violation of the applicable groundwater standards. It does not appear that the applicant even considered the aggressive nature of the final effluent in its design. The applicant should be instructed to propose measures to prevent or neutralize such leaching of contaminants.

Response: The greater purity of the water may cause some leaching of natural constituents from the soils much in the same way rainwater (which has a greater purity than groundwater) leaches metals. The groundwater discharge is expected to leach soil materials to a point that causes the groundwater to approach the concentrations of constituents found in natural groundwater in the area. Leaching of constituents above any applicable groundwater standard is not anticipated because no mechanism or plausible theory for such an occurrence has been identified.

239. **Comment:** Some of the significant flaws in the GDPA are generally summarized below: The groundwater model used by the Applicant in the GDPA is inadequate to achieve its intended purpose of estimating the effects of infiltration at the Treated Water Infiltration System (TWIS) discharge location. The groundwater flow model simulates the hydrogeologic conditions of the project site in a way that ignores the effects of the Salmon Trout River and other significant hydrologic features as boundary conditions in the model. The Applicant's modeling analysis does not account for the observed range of parameter values that were measured in the field and does not assess uncertainty in model predictions based on parameter values beyond the observed range of values. Due to the deficiencies in the Applicant's groundwater model, the influence of the TWIS on groundwater flow at the proposed mine site is not understood, and the Applicant's estimate of this influence cannot be used for designing a monitoring network or determining the area that will be affected by the discharge from the TWIS.

Response: The MDEQ acknowledges the limitations of the model provided in the GDPA. The Part 22 Rules of Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451) require a demonstration of mounding and characterization of impacts specifically in the area of the groundwater discharge, and the MDEQ believes those potential impacts were adequately addressed. Permit limits are established in the effluent prior to discharge, and the groundwater is not being used to provide treatment through mixing, dispersion, adsorption, etc. Therefore, as long as compliance is maintained in the effluent and groundwater monitor wells, required pursuant to Rule 2224(1), modeling of groundwater movement past the compliance points was not considered a necessary part of the groundwater discharge permit application review.

240. **Comment:** The GDPA utilizes an insufficient monitoring period, number of samples, and statistical methods to formulate background water quality. As a result, the character and quality of the background data provided by the Applicant is not adequate to assess impacts of the proposed discharge.

Response: The background groundwater quality documentation and methodology is considered acceptable pursuant to Rule 2221(4)(c)(i) for adequately determining existing groundwater quality for the Groundwater Discharge (GD).

241. **Comment:** The receptor survey (well inventory) included in the GDPA is misleading because of the systematic spatial bias in the search area and failure to acknowledge bedrock as an aquifer. A slightly enlarged search area would have identified several more wells as potential receptors. Consequently, the GDPA does not address the problem of discharges to the bedrock aquifer that is used as a domestic supply in the vicinity of the proposed mine.

Response: The HSR has evaluated human receptors per the requirements of Rule 323.2221. The proposed GD will require Kennecott to treat effluent wastewater to below all applicable criteria prior to discharge to groundwater, including residential drinking water standards.

242. **Comment:** The Applicant has not shown in the GDPA that mounding at the discharge site will not cause venting along shorter flowpaths to the main branch of the Salmon Trout River. The Applicant concludes that the groundwater discharges to the TWIS would, like the ambient groundwater in the area, move to the springs and seep North of the site. However, the groundwater mound created by the infiltrating water from the TWIS will move to the North where seeps and springs drain the shallow aquifer at the headwaters of the Salmon Trout River. The Applicant should be required to provide additional hydrogeologic characterization, specifically, additional geologic and water elevation data for the area south and west of the site, to better evaluate the potential for the proposed discharge to vent to the Salmon Trout River. Shorter flowpaths and shorter residence times in the aquifer, as would result if such venting occurred, would mean less dispersion and contaminant attenuation within the aquifer than has been assumed by the Applicant. This, in turn, would create concentrated contaminant discharge to the perennial seeps and springs that feed the headwaters of the East Branch of the Salmon Trout River.

Response: The site data provided in the GDPA indicates that TWIS effluent will vent to the tributaries of the Salmon Trout River located northeast of the site. Additional wells will be installed between the TWIS and the main branch of the Salmon Trout as part of the GDP. However, if groundwater were shown to vent to the main branch Salmon Trout River it would not cause a GDP violation because the Salmon Trout River would be less restrictive in regards to groundwater standards compared to the eastern tributaries due to increased mixing. The decreased travel time would not cause a violation because the permit limits are low enough that little if any dispersion or attenuation is needed for discharge constituents to meet permit limits.

243. **Comment:** Water quality samples are taken only after the well has been "purged" by removing water in the well so that it can be replaced by water from the formation. The amount of purging can significantly affect the conclusions reached about water chemistry because of mixing with atmospheric conditions in the monitoring well. There were serious inconsistencies in the purge volumes for wells 05EA-107 and 04EA-084. This adds a confounding variable in the two samples, making the Applicant's interpretation even more suspect. There was no information provided on the purging of the wells or whether the groundwater had equilibrated within the wells. The amount of purging before a well is sampled affects water quality. If it did not, the USEPA and the USGS would not have very tight standards on groundwater samples for purge volumes. Given the importance of such information to the understanding of the background groundwater quality, the Applicant should be required to provide it.

SEE: U.S. Environmental Protection Agency Region I Low Stress (low flora Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells, July 30, 1996, Revision 2 and U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. AI-A9, available online at <http://pubs.water.usgs.gov/twri9A>.

The applicant did not provide a well log that describes the rock formations in the sampled well. Without this information it is not possible to interpret the water quality data that was reported from that location. For example, if the sample came from a well with extensive fractured zones, different conclusions would be reached about how this information could be used relative to a well drilled into rock with few fractures, in assessing groundwater quality that would flow into the mine.

The Applicant did not specify the depth of the samples that were compiled in its analysis. Again, without this information, few conclusions can be reached about the vertical distribution of groundwater quality and the potential for different waters to be encountered at different depths.

The Applicant failed to present procedures from either EPA or ASTM to demonstrate that accepted methods were utilized. As examples, EPA/540/S-95/504 April 1996 ("Low-Flow (Minimal Drawdown) Groundwater-Water Sampling Procedures") should have been followed for regulatory guidance and/or acceptance. An alternative guidance document would be ASTM D6452-99 ("Standard Guide for Purging Methods for Wells Used for Ground-Water Quality Investigations"). Without such references, it is not clear whether any standard procedures were used and consequently, it is not possible to determine the

extent to which variation in the data is a reflection of variation in methods as opposed to variation in water quality in the formation. This fundamental technical flaw makes it impossible to distinguish any signal in the variables of interest (spatial or temporal variation in water chemistry) from variation caused by the sampling techniques,

Response: The methods utilized by Kennecott's consultants were reviewed and considered in compliance with Rule 2223(3) dealing with the collection of groundwater samples.

244. **Comment:** Deficiencies Hydrogeologic Report

Rule 323.2221 requires the Applicant to provide a hydrogeologic report that complies with specific standards set forth in the rule. The Applicant's hydrogeologic reports ignore available data where it exists, draw conclusions favorable to the Applicant where there is little supporting evidence, and systematically underestimate the potential risk posed by the proposed discharges.

1. Rule 323.2221(2)(a) requires the Applicant to "[describe the regional hydrogeologic conditions, including regional and local geology and surface and groundwater conditions, over an area sufficient to allow the department to determine the acceptability of discharging at the site...." The Applicant's description of regional conditions is deficient in several ways:

The Applicant's analysis omits several water bodies that will have significant impacts on the acceptability of the TWIS location. Other than one measurement from STRM002 that is presented in a figure, stage data from the Salmon Trout River (STR), tributaries, and the Yellow Dog River are not included in the report. These data are necessary to assess boundary conditions for groundwater flow and the potential effects of the proposed discharge.

Response: Data from nearby surface water bodies were included in the GDPA. Stage data from both the STR and Yellow Dog River is provided in the GDPA. Extensive temporal and spatial surface water data was not provided in the GDPA but is not considered necessary for the HSR or issuance of a GDP.

245. **Comment:** Groundwater flow patterns are misrepresented in most of the related hydrogeologic report figures. It appears that "convergent flow," flow that is not spreading but converging at a spring or seep, is apparent in the water level data (Table 4). The consequence of this omission is that conclusions reached about the attenuation of any contaminants will be systematically overestimated. The sparse data in the area between the proposed site and the STR suggest that the potentiometric surface in this area is very flat and that there is likely a groundwater divide between the proposed site and the STR. In this area groundwater flow seems to be converging south and west to the STR instead of to the north and east as assumed by the Applicant. Water level data for Zones A and D are represented in Cross-section D (Appendix B Figure 23) for monitoring well QAL0012. However, this well is not shown on the location maps. In addition, data collected from this well are not included in Table 4. Collection of water level data is necessary between QAL008A/D and the STR in the zone A and D. Water level measurements in the STR between WLD022 and WLD023 is also necessary. The use of selective data again illustrates how the Applicant is attempting to create the impression of limited risk of release when their own data argues otherwise.

Response: It appears groundwater flow patterns were drawn using only actual data without consideration for known geologic features such as seeps. Because the seeps do not represent actual data points in the data set being contoured they were likely omitted. Although this method of depicting groundwater flow patterns may lead to some inaccuracies around certain features it reduces the influence of subjective interpretations by the consultant. Depicting groundwater flow patterns in this manner is within standard geologic convention. The MDEQ believes there is a groundwater divide between the TWIS and the STR. QAL12 is not shown on Figure 23. This appears to be an oversight by Kennecott. The location of QAL12 can be seen on Figure 15. The MDEQ believes the water level data provided in the GDPA is sufficient to meet the HSR requirements.

246. **Comment:** Rule 323.2221(2)(c) requires the determination of groundwater properties in the aquifer to which the discharge will occur. The Applicant's analysis of the regional groundwater properties understate the discharge to shallow groundwater and the risks posed by those releases when contaminated water emerges into streams.

Groundwater flow at the scale of the site and small watershed are determined by the local boundary conditions. The groundwater flow analysis provided by the Applicant in the GDPA is based on a geographically sparse and statistically unreliable data set that is inconsistent with the Applicant's conceptual model. The groundwater modeling that was done by the Applicant was entirely qualitative and was not calibrated, tested or even reviewed prior to making predictions. This approach is contrary to the professional standards in the industry and in no way complies with the ASTM standards for regulatory groundwater modeling (ASTM, Standard Guide for Developing Conceptual Site Models for Contaminated Sites. ASTM Standard E 1689-95, 8 p.; American Society for Testing and Materials (ASTM), Standard Guide for Defining Boundary Conditions in Ground-Water Flow Modeling. ASTM Standard D 5609-94, 4 p. ASTM, Standard Guide for Application of a Ground-Water Flow Model to a Site-Specific Problem.; ASTM Standard D 5447-93, 6 p.; ASTM Standard Guide for Subsurface Flow and Transport Modeling. ASTM Standard D 5880-95, 6 p.). In every case where these standards are not used, the conclusion reached is the site and the mine will not cause problems. None of these claims

are supported by the work presented in the permit applications.

Response: Modeling may be used to demonstrate the effects of localized stresses on the groundwater flow system without accurately simulating all of the sources and sinks to the regional flow system. The GDPA only requires a demonstration of mounding and characterization of adverse impacts in the area of the groundwater discharge, and limits are set in the permit accordingly.

247. **Comment:** Limited additional drilling and on site work would have been required to properly characterize the site but that was not done. Instead, the Applicant draws general (favorable) conclusions that are based, not on data, but on a conceptual model that can not be shown to comport to the actual condition at the site. For example, more wells screened in Zones A and D and more surface water elevation measurements are needed to determine the interconnection of Zones A and D near the proposed site and to predict groundwater flow directions under present and proposed conditions. This additional characterization is required to determine the direction of groundwater flow and the streams and springs where contaminants will emerge.

Response: The MDEQ has determined that the data provided in the GDPA adequately characterizes hydrogeologic conditions at the site and meets the requirements of Rule 2221. The limits in the permit are protective of surface water, regardless of whether venting is to the main branch or tributaries of the STR.

248. **Comment:** Several aspects of the project site hydrogeology that together could determine impacts have not been adequately characterized for use in the GDPA groundwater flow modeling and impact analysis. A 3-dimensional flow path of the proposed discharge within the aquifer, as required by R 323.2221(2)(c), is not presented in the GDPA,

Response: A three dimensional flow path is indicated through various data sources within the HSR. Variations to the requirements of the HSR may be considered acceptable by the MDEQ in accordance with Rule 323.2221(6).

249. **Comment:** 3. Rule 323.2221(4) requires the Applicant's hydrogeologic study to contain several specific elements. The Applicant failed to provide some of that information. Moreover, the required elements that were provided are inaccurate, misleading, and contradict statements and conclusions made elsewhere in the GDPA.

a) Rule 323.2221 (4)(g)(i) requires the Applicant to evaluate the potential impact on human receptors. The Applicant's characterization of this element seems to have been artificially limited in order to avoid detecting wells, and thus, to avoid the need to evaluate potential impacts on human receptors. In connection with its review of the GDPA, WHPA conducted an independent expanded water well search in northern Marquette County. The purpose of the independent search was to verify that the data presented in the well survey was complete, accurate, and evaluate the extent of the search area for possible spatial bias or selectivity. The well survey was also conducted to search for bedrock wells, because drinking water wells with an open bedrock interval may be at risk as a result of the proposed mine operations. Based on the difference in groundwater elevation between the Eagle mine location and Lake Superior, groundwater flow in the bedrock is likely toward

Lake Superior, in a roughly northeasterly direction.

The databases listed in Appendix B-10 of the EIA and Appendix C of the GDPA were used for this well search. In addition to these databases, the Water Well Viewer tool on the MDEQ website was also used to obtain well logs. All of the logs included in WHPA's well search were also available to the Applicant. The search boundary used by the Applicant appears to be of an arbitrary distance from the mine site, as it is a roughly rectangular area measuring 12 mi to 14 1/4 mi east-to-west and 6 mi north-to-south. Our search radius included the same area as presented by the Applicant, but was further expanded by 1 mile in the downgradient direction of flow to incorporate a larger area of potential receptors of contaminated drinking water.

In addition to the wells listed by the Applicant, the independent well search identified 11 bedrock wells downgradient of the proposed mine and in the presumed downgradient flow direction, near Lake Independence in the town of Big Bay. Eight of these bedrock wells are located a short distance outside the search area in Sections 19 and 21 of T51N, R28W. A total of 28 wells were identified outside the search area shown in the GDPA. The wells are described below and are grouped together based on their location in the township and range coordinate system.

T51N, R28W: Two additional wells were found; one in section 3 and one in section 4. Both of these wells are screened in unconsolidated sand and clay.

T51N, R27W: Twenty-six additional wells exist in the western half of T51N, R27W, with the greatest concentrations in Section 9 (7 wells) and Section 21 (12 wells). Wells in Sections 8, 9, 16, 19 are completed in sandstone bedrock and are unscreened. Wells in Section 21, including Powell Township public wells 1 and 2, are completed and screened in unconsolidated sand and clay.

The independent well inventory, including a figure showing well locations, is attached as Appendix A to this document.

The existence of those wells clearly indicates that the TWIS discharge will have potential impact on human receptors. For example, bedrock wells in the area are typically constructed with relatively long open-rock sections that intercept multiple fractures. For that reason, any wells in the bedrock in a region between the proposed mine site and Lake Superior are, in fact, at risk. Unlike flow in the unconsolidated shallow aquifer, flow in the deep aquifer is through fractures and may move more rapidly within the system.

Moreover, the location of the homeowner wells near Lake Independence and Lake Superior does not necessarily mean that water withdrawn from them originates from either of those water bodies. As the Applicant's work regarding the TWIS indicates (see Appendix E-3 of the GDPA), the Applicant is aware that a well withdrawing from an aquifer with a sloping potentiometric surface will not necessarily capture water from any significant distance downgradient from the well.

Response: The HSR has evaluated human receptors per the requirements of Rule 323.2221. The proposed GDP will require Kennecott to treat effluent wastewater to below all applicable criteria, including residential drinking water standards, prior to discharge.

250. **Comment:** The bedrock hydrogeology for the site was inadequately characterized by the Applicant. Rule 323.2221(4)(g)(i) requires the Applicant to characterize the aquifer system sufficient to make estimates of impact of the proposed activity. The Applicant failed to estimate groundwater velocities in the bedrock and, for the most part, the Applicant denies that bedrock is an aquifer. (See comment about bedrock being treated as an aquifer above.) The presence of bedrock wells in the area (see comment above and Appendix A to this document) contradicts the Applicant's claim. This omission is the only way that the Applicant could ignore the potential impact that the mine could have on down-gradient water users for the next several decades. The contaminants that are going to be moving from the mined formation through the bedrock will be high in metals (including Mercury) and could cause problems for future land owners and the environment when this water discharges.

Response: The proposed GDP will require Kennecott to treat effluent wastewater to below all applicable criteria, including residential drinking water standards prior to discharge, regardless of whether the wells are set in bedrock or the glacial overburden.

251. **Comment:** The Applicant improperly excluded a water body that will likely be affected by the discharge. Rule 323.2221(4)(g)(v) requires the Applicant to identify wetlands in the area. The GDPA mentions a wetland located within ½ mile of the TWIS, but improperly concludes that the wetland "will not be affected by the discharge." See Section 3.1.1. This conclusion is not supported by the data and analysis presented in the GDPA. The groundwater flow modeling provided in the GDPA is not adequate to determine that the flow from the TWIS will not affect the wetlands.

Response: The groundwater flow modeling along with geologic data collected from the site indicate that there will be no adverse impact from the GD to any wetland.

252. **Comment:** Rule 323.2221(4)(g)(iv) requires that the hydrogeologic study must include "a map of the site...which has a groundwater contour overlay that indicates groundwater flow direction with a maximum contour interval of 1 foot" Contour interval shown on the figures in this report are much greater than 1 foot, contrary to the rule.

Response: The HSR contains groundwater flow maps with a contour interval greater than 1 foot. However, due to the hydraulic gradient, scale of the site, and nature of the proposed discharge, this is considered acceptable. Variations to the requirements of the HSR may be considered acceptable by the MDEQ in accordance with Rule 323.2221(6).

253. **Comment:** Appendix C of Appendix B of the GDPA addresses aquifer hydraulic testing data (pumping test reports). These reports contain technical inadequacies that cast doubt upon both the Applicant's conclusions and its qualifications to characterize the properties of the aquifer that will receive the discharge. Based on our review of the approach, it is clear that the analysis of the aquifer test was not understood. The analysis shown on Figure 2, is described as the Cooper-Jacob method, is actually the Theis method of analysis of recovery test data (Theis, 1935) and its application in this case is inadequate for use in characterizing aquifer properties. The Theis method only accounts for water that moves from the aquifer to the well from storage, not from boundary conditions like streams, lakes and surface water. Note that the residual drawdown includes negative values, indicating the water level in the well temporarily went higher than level prior to this short pumping test. This was likely caused by an unknown volume water discharging down the pump column back into the well and should have been a clue that the data were flawed for this application. Reference is made to other pumping test data, but the analyses could not be located. Use of these inappropriate techniques and conceptual models for evaluating aquifer properties suggests that the Applicant did not understand the site or the methods used to draw conclusions about impact.

Response: The Cooper-Jacob method is based on the Theis equation. It is common practice to assume all water is from storage when using these types of analytical methods. Although this assumption may not be absolutely true it is necessary to approximate a hydraulic conductivity for the aquifer materials. Often these types of analysis are only considered accurate within an order of magnitude. This is considered acceptable due to the mathematical limitations of analytical methods. The goal is to produce a relatively accurate estimate of hydraulic conductivity based on the comprehensive data set collected at the site. The estimated hydraulic conductivities at the site are considered valid and usable for the HSR.

254. **Comment:** The Applicant's calculations of background groundwater quality (see Section 3.2.4 of the GDPA, p. 12), required under R 323.2221(4)(d), are poorly documented, utilize improper methodology, and tend to overstate the concentrations of background constituents present in the groundwater. If those inaccurate numbers are accepted as true "background" levels, the effluent limits set for the TWIS will not be reflective of the actual background water quality and the impact of the TWIS discharge on the groundwater quality will be underestimated.

Response: The background groundwater quality documentation and methodology is considered acceptable pursuant to Rule 2221(4)(c)(i) for evaluating existing groundwater quality for the GD and is within the standard expectations for a GDPA.

255. **Comment:** The Applicant does not specify which methods were used to produce the statistical analysis presented in Appendix D to the GDPA. Several guidance documents are referenced generally, but the application does not state whether any of the documents were actually applied or what parts were used. Again, standard practice in the field is to use ATSM techniques to estimate aquifer properties and document the results.

Response: The methods used for the statistical analysis have been reviewed and determined to comply with the requirements of Rule 2221. ASTM methods are not specifically required in the Part 22 Rules.

256. **Comment:** Many of the methods used in Appendix D contradict the recommendations in one or more of the guidance documents, or are only applicable under strict criteria that have not been justified. For example, several assumptions are made about the range of values used for hydraulic conductivity when more than one data point was available in the database. Rather than plot that information and explain why one range of values would be more representative than another (standard scientific methods), the Applicant simply declares the value and continues with the analysis. This casts serious doubt upon the validity of the Applicant's statistical analysis and of the conclusions reached in the GDPA.

Response: The statistical analysis of hydraulic conductivity is considered acceptable for the evaluation being performed. Any variations to the requirements of the HSR are considered acceptable by the MDEQ in accordance with Rule 323.2221(6). The estimated hydraulic conductivities at the site are considered valid and usable for the HSR.

257. **Comment:** The Applicant's analysis is inconsistent with accepted standards for groundwater quality analysis. The Applicant established background as the arithmetic mean plus one standard deviation contrary to Part 201 requirements. The Part 201 guidance also recommends a minimum of nine events over a full two-year period to determine background. The Applicant's sampling does not come close to meeting that recommendation, having been conducted from April of 2004 to August of 2005. Moreover, while the USGS and the USEPA have developed standards for evaluating these data sets, no confidence limit is provided for non-detect or low frequency detection parameters. A limit should be established for these parameters based on the detection limit or other statistically valid treatment. Without some explicit, technical approach, the conclusions reached can only be described as unbounded and essentially arbitrary.

Response: The site is not a Part 201 Facility and therefore should not be evaluated using methods identified in Part 201 guidance documents. The existing groundwater quality documentation and methodology is in compliance with Rule 2221(4)(c) and is within the standard expectations for a GDPA.

258. **Comment:** The MDEQ has identified water quality standards for hazardous substances developed under Part 31 of NREPA that constitute generic GSI criteria consistent with R 299.5716(6). Water quality standards include chronic chemical specific values that represent the most restrictive the water quality values protective for aquatic life, human health, or wildlife. The chronic chemical-specific GSI criteria are listed in the criteria table of R 299.5744 and the associated footnotes of R 299.5750 RRD Operational Memorandum No. I. Note that the Part 201 water quality criteria R299.5744 are updated periodically. The most recent update (RRD Op Memo No. 1, Attachment 1, dated January 23, 2006) shows that drinking water criteria referenced in Table 3 of the GDPA are incorrect for aluminum, arsenic, copper, iron and manganese. In addition, the GDPA should state that wells used to determine compliance with respect to the Groundwater Surface water Interface (GSI) pathway criteria will meet MDEQ construction and location requirements.

Response: The MDEQ has identified the above noted inaccuracies in the GDPA. The MDEQ will set permit limits independent of the values listed in Table 3 of the GDPA. The MDEQ must approve all locations and installation methods for any wells required by the permit.

259. **Comment:** Part 201 guidance requires tests of independence to avoid dependent temporal variability (e.g. that samples collected less than 90 days apart may be part of the same sample). As stated in the Part 201 guidance, the use of distributional statistics requires that the samples be independent. The Applicant uses distributional statistics, without demonstrating that the data are independent.

Response: The site is not a Part 201 Facility and therefore would not be evaluated using methods identified in Part 201 guidance documents. The methods used for data evaluation have been evaluated and approved by the MDEQ pursuant to Rule 2221.

260. **Comment:** The MDEQ Part 201 Guidance (2002) requires statistical tests of normality and distribution to determine appropriate statistical methods for data. The Applicant, however, has apparently assumed normal distributions for all data. The Applicant also used the regression method where more than 50% of the values are non-detect. This is explicitly not recommended by the MDEQ Part 201 guidance.

Response: The site is not a Part 201 Facility and therefore was not evaluated using methods identified in Part 201 guidance documents.

261. **Comment:** Part of the references included in Appendix D are either outdated or are only marginally relevant to groundwater data included in the GDPA. Recent guidelines that are specific to groundwater data and more appropriate for the Applicant's analysis were not used by the Applicant (e.g. EPA 2000, EPA 2002, Gibbons 2001, and ASTM 6312-98, 2005). Those documents contain relatively straight-forward approaches that do not require the manipulation of data due to non-detects and allow for real-time updating of background data to continuously incorporate natural variation and seasonal extremes. The failure to use the current, state-of-the art approaches is not explained in the GDPA.

Response: The methods used for data evaluation have been evaluated and approved by the MDEQ pursuant to Rule 2221.

262. **Comment:** Deficiencies In Discharge Monitoring

Rule 323.2223 requires the Applicant to monitor the discharge to assess compliance with the groundwater discharge rules. The Applicant's proposed groundwater monitoring network is inadequate to measure compliance with the groundwater discharge rules.

Rule 323.2223(2) requires the design of the monitoring system to be based on the hydrogeologic report, the local geology, groundwater conditions specific to the site, and the type of discharge. As explained above, there are serious deficiencies in the Applicant's hydrogeologic study, analyses of groundwater conditions, and characterization of the WWTP influent and effluent. Therefore, this information is inadequate for designing a monitoring network.

Response: The MDEQ disagrees, the HSR is sufficient at fulfilling the requirements of Rule 2221 to describe the hydrogeology in the area of the discharge.

263. **Comment:** The Applicant does not demonstrate that the selected monitoring location will be outside the zone of influence of the mining operation and TWIS discharge. Proposed background monitoring of the infiltration system consists of existing well QAL026A and a proposed nested well QAL026D (Section 9.2.1.2 of GDPA, page 56). Data presented in the mounding analyses in Appendix E-2 do not indicate that this location will be upgradient of the proposed discharge site. According to ASTM 6313, an effective groundwater monitoring system needs to be able to distinguish between affected water and some background water quality. These background wells must be located at a site not affected by site operations or the proposed discharge system. It is critical that the flow system is understood before the monitoring system is implemented.

Response: The background monitoring locations for the TWIS are expected to remain upgradient as demonstrated by the HSR. In the event that they are shown to no longer be upgradient, additional wells would be required.

264. **Comment:** Deficiencies Groundwater Flow Characterization and Modeling of the Site and the Proposed Discharge

In Appendix E to the GDPA, the Applicant attempts to model the proposed infiltration. However, due to deficiencies in the Applicant's modeling analysis, the information contained in the GDPA is insufficient for determining the impact of the TWIS discharge on groundwater and surface water resources.

The boundary conditions used for this modeling ignore the actual conditions in the area the model covers. The Applicant must construct a more appropriate model that takes into account interaction between the alluvial aquifer and area streams and wetlands. The hydraulic conductivity field does not reflect what is known about the materials in the area. For example, the peridotite outcrop and subcrop are not included. The conceptual model of this groundwater flow model should be based on other information presented in the application,

Response: The model provided in the HSR is sufficient to demonstrate the effects of mounding and hydrogeologic characterization in the area of the groundwater discharge, thereby fulfilling the requirements of Rule 2221. The more detailed site wide model and its interaction with features such as the crown pillar is covered by the mining permit and not the GDPA.

265. **Comment:** The particle traces do not accurately reflect groundwater flow paths in this idealized model. After a more appropriate model is constructed, more particles are needed and should be started southwest of the TWIS in order to evaluate the effects of the mounding.

Response: The model provided in the HSR is sufficient to demonstrate the effects of mounding and hydrogeologic characterization in the area of the groundwater discharge. Compliance with groundwater limitations is focused in the area within 150 feet of the discharge, it is unclear what benefit additional particle flowpaths beyond that distance would provide.

266. **Comment:** There is no explanation of why this oversimplified model was used instead of the more refined and preferred MODFLOW model presented in the MPA which includes the boundary conditions created by the Salmon Trout River and the Yellow Dog River.

Response: The model provided in the HSR is sufficient to demonstrate the effects of mounding and hydrogeologic characterization in the area of the groundwater discharge, thereby fulfilling the requirements of Rule 2221. The more detailed site wide model and its interaction with features such as the crown pillar is covered by the mining permit and not the GDPA.

267. **Comment:** The model is inadequate to achieve its intended purpose of estimating the effects of infiltration at the TWIS. The far-field boundary conditions are contrived, and their justification using field measurements is not documented:

Uniform flow in a direction that is inconsistent with the regional models.

Upgradient far-field specified head boundary is above land surface in some places.

The land surface intersects the potentiometric surface, but no internal boundary conditions are available to receive the water.

Response: The model provided in the HSR is sufficient to demonstrate the effects of mounding and hydrogeologic characterization in the vicinity of the groundwater discharge, thereby fulfilling the requirements of Rule 2221. A more detailed site wide model characterizing all aspects of the groundwater flow system is not required by the HSR or the GDPA.

268. **Comment:** Numerous streams and springs present in the model domain are not included in the model. As a result, none of the predictions of the model are useful.

Response: The model provided in the HSR is sufficient to demonstrate the effects of mounding and hydrogeologic characterization in the area of the groundwater discharge thereby fulfilling the requirements of Rule 2221. Compliance with groundwater limitations is focused in the area within 150 feet of the discharge. Unless the discharger violates the conditions of the permit, additional specificity in defining venting locations is not warranted at this time.

269. **Comment:** The headwaters of the Salmon Trout River East Branch on the northern slope is identified as the venting point of groundwater in the vicinity of the proposed discharge. Data presented in the Hydrogeologic Report (Appendix B) and the mounding analyses (Appendix E) do not present conclusive determination of the venting point(s). The MODFLOW model used to determine the potential height of mounding and potential groundwater flowpaths from the site was not ever calibrated (according to ASTM standard 6313) and little consideration was given to the uncertainty in model input parameters. Based on the data presented in this section, important regional and local boundary conditions are excluded from the model.

Response: The model provided in the HSR is sufficient to demonstrate the effects of mounding and hydrogeologic characterization in the vicinity of the groundwater discharge, thereby fulfilling the requirements of Rule 2221. If groundwater vents elsewhere in the area, the permit limitations are still protective of surface water because the MDEQ evaluation was conducted on the lowest flow tributary.

270. **Comment:** The bedrock elevations used by the Applicant in the GDPA are incorrect. The Applicant's bedrock elevations are approximately 25 feet above the ground elevation. The topographic maps of the area show that the stream elevation is approximately 1415 feet above mean sea level. The Applicant's bedrock elevations in the same area are 1440 feet above mean sea level.

Response: It is unclear what "stream elevation" is being referred to. However, if an error exists the map will be corrected.

271. **Comment:** If a more detailed flow model was prepared as part of the MPA ETA, then why isn't that model used to support the Applicant's assertions regarding flow directions? A "more complex" model included boundary conditions that were set outside the domain of this demonstration model, would be far more useful in assessing changes in flow directions that are at issue.

Response: The Applicant is required to meet the requirements of the HSR and Rule 2221, which may or may not include modeling. If models are incorporated into the HSR, there is no requirement to use the same model for both the mining permit and the GDP.

272. **Comment:** The MDEQ recognized many of the modeling deficiencies discussed above in its May 10, 2006 Comments on the GDPA (MDEQ Comment 6), explaining that "The model... has not been calibrated, does not use realistic boundary conditions, has an excessively large cell size, and has not modeled relevant surface features such as rivers, seeps, or bedrock outcrops. The current model may be able to provide mounding estimates but cannot accurately predict changes to the local groundwater flow regime."

Response: The MDEQ's May 10th comment identified an overreaching statement previously made by Kennecott regarding their model results. Although the MDEQ disagreed with Kennecott's claims regarding model results, the model was sufficient to demonstrate the effects of mounding and hydrogeologic characterization in the area of the groundwater discharge, thereby fulfilling the requirements of Rule 2221.

273. **Comment:** As the MDEQ also recognized in its May 10 Comments (Comment 5), the Applicant's groundwater model sensitivity analysis should be rerun to include a three order of magnitude increase in flux that may result from the hydrologic instability of the crown pillar described in the May 22, 2006, Itasca Consulting memo to the MDEQ.

Response: The MDEQ's May 10th comment identified an overreaching statement previously made by Kennecott regarding their model results. Although the MDEQ disagreed with Kennecott's claims regarding model results, the model was sufficient to demonstrate the effects of mounding and hydrogeologic characterization in the area of the groundwater discharge, thereby fulfilling the requirements of Rule 2221.

274. **Comment:** In addition to the numerous modeling deficiencies discussed above, the Applicant's modeling is simply not an appropriate basis upon which to base conclusions about groundwater flow. The Applicant inappropriately used a quotation from Anderson and Woessner (1992, p. 28) to justify the use of the model for predicting groundwater flow directions. The next sentence from that same reference, however, says: "It is critical that the conceptual model be a valid representation of the important hydrologic conditions; failure of numerical models to make accurate predictions can often be attributed to errors in the conceptual model." A central theme of this textbook is that modeled outcomes must be dictated by geology and physics of the flow system, not pre-determined by the modeler. In other words, the Applicant's "conclusions" are, in fact, pure speculation by the Applicant. This is because the flow characteristics have been largely determined in advance by the modeler using specified head boundaries and excluding the upper portion of the bedrock. Drawing conclusions regarding flow characteristics based on a "hard wired" feature of the model is circular reasoning from which no valid conclusions can be drawn.

MDEQ recognized as much in its May 10, 2006 Comments on the GDPA (Comment 7), explaining that the Applicant's conclusion that none of the water will migrate to the main branch of the Salmon Trout River is "illogical" because "By design the model could not possibly allow water to flow anywhere but to the northeast regardless of discharge quantity. Groundwater not flowing to the Salmon Trout River is a function of how the model was built and not a conclusion of the modeling effort." MDEQ again reiterated, in additional comments dated June 19, 2006, that "the model in its current design and implementation is not able to accurately predict discharge points for groundwater discharged at the TWIS nor is it able to accurately characterize any groundwater flow beyond a generalized northeast direction."

Faced with this obvious point, the Applicant inexplicably refused to alter its conclusions (Applicant's June 2, 2006 Response to MDEQ's May 10 Comments). A permit should not be issued until the Applicant properly determines groundwater flow, using adequate data and all relevant data, and incorporates those conclusions into its analysis.

Response: The MDEQ believes the comments made in the May 10th letter regarding the model are accurate and correct. The May 10th comment identified an overreaching statement made by Kennecott regarding their model results. The MDEQ required Kennecott to retract the claims regarding their model. However, the overreaching claims were the focus of the comment and not the model itself. The model was sufficient to demonstrate the effects of mounding and hydrogeologic characterization in the area of the groundwater discharge thereby fulfilling the requirements of Rule 2221.

275. **Comment:** The Groundwater sampling methods inadequate:

The groundwater monitoring program proposes to establish background and to monitor changes in constituents using techniques that are unable to detect existing concentration of many constituents. The inadequacy of the methods proposed to detect background levels of constituents has been repeatedly demonstrated by Kennecott in its previous sampling (EIA Appendix B-1 and Groundwater Permit Application Appendix J) with the majority of their results being non-detects.

The sample and analysis methods used to establish background groundwater quality must be sensitive enough to produce at least some detections. The methodology used by Kennecott for calculating background water quality is based on almost totally non-existent data. Kennecott must collect valid samples for groundwater quality using methods that can actually detect the existing levels.

Response: The detection limits used for establishing background groundwater quality meet the requirements of the Part 22 groundwater discharge permit.

276. **Comment:** Need for discharge limits on Chloride, Sodium, and Sulfate and groundwater limits for all regulated parameters:

Kennecott has claims that moderately briny waters will occur at depth in the mine. Other mines in the western U.P. have demonstrated brine inflows as high as 170,000 mg/l of chloride. While Kennecott currently predicts effluent to the TWIS with 44 mg/l of chloride as well as relatively high sodium and sulfate, those predictions are based on assumptions of only moderately saline water in the mine and little generation of Acid Rock Drainage (ARD). Should the mine project encounter brine seeps similar to those found at other U.P. mines, the chloride and sodium content of the discharge water may be much higher than that which Kennecott currently predicts. Such levels of chloride could easily exceed Part 201 drinking water standards. Because the actual levels of these constituents will depend on what brine waters are encountered during mining, it is currently impossible to accurately predict what the levels of these constituents will be in the effluent. The level of sulfate in the effluent will depend substantially on the rate of generation of ARD at the development rock storage area and in the mine. Both these rates of generation are currently poorly known. Because of these uncertainties, there should be limits on the allowable level of chloride, sodium and sulfate in the discharge to the TWIS.

Part I, Section 4 (Groundwater Monitoring and Limitations) of the groundwater permit inadequately describes the applicable limits for groundwater. In Section 4 there are many parameters listed as having no maximum daily limit, yet for many of these there are applicable Part 201 standards. Discharge by Kennecott that renders the groundwater unfit for use does not comply with the intent or the fact of state regulations. Either the

Groundwater Permit should state the limits for all parameters for which there are applicable limits or else the Mine Permit should provide limits where the Groundwater Permit falls short.

Response: The groundwater discharge permit requires that the discharge be in compliance with Part 31 of Act 451. Rule 2204(f) of the Part 22 Rules of Part 31, states that the discharge cannot create a facility as defined in Part 201. The standards for chloride, sodium, and sulfate are the same in Part 201 as they are in Part 22, so by default those parameters are limited. However, specific limitations will be added to the permit.

277. **Comment:** Kennecott's Hydrogeologic Report Is Seriously Deficient

The hydrogeologic report incorporated into the GDPA provides an inaccurate representation of regional conditions. For example, regional groundwater flow is based on a sparse data set, and Kennecott appears to misrepresent the actual direction of flow (WHPA pp. 13-14). Kennecott fails to provide information that is required under applicable regulations, including a three-dimensional flow path of groundwater within the aquifer, and a groundwater contour overlay indicating flow direction with a maximum interval of one foot (WHPA pp. 15 and 17). Kennecott also misrepresents its method of analysis of aquifer properties, and instead uses a method that is wholly inappropriate for analyzing such properties (WHPA p. 17). More data and proper analysis are necessary before any conclusions can be made about groundwater flow.

Response: Relative to the GDPA, the HSR contains groundwater flow maps with a contour interval greater than one foot. However, due to the hydraulic gradient, scale of the site, and nature of the proposed discharge this is considered acceptable. A three dimensional flow path is indicated through various data sources within the HSR. The statistical analysis of aquifer properties as provided in the HSR is considered acceptable for adequately characterizing aquifer properties and is within the standard expectations for a GDPA. Variations to the requirements of the HSR may be considered acceptable by the MDEQ in accordance with Rule 323.2221(6).

278. **Comment:** Even more troublesome is the fact that Kennecott appears to have purposely excluded possible human receptors from its analysis. An independent well survey performed by WHPA, which expanded Kennecott's search area by only one additional mile downgradient of the proposed discharge, detected 28 additional wells, 11 of which are located downgradient and within the presumed groundwater flow path from the mining site toward Lake Superior. Many of those wells are in the bedrock aquifer, through which contaminants may move from the underground mine (WHPA pp. 15-17). In short, human receptors may be impacted by the proposed mining operations and discharge, and Kennecott should be required to analyze that potential impact.

Response: The HSR has evaluated human receptors per the requirements of Rule 323.2221. The proposed GD will require Kennecott to treat effluent wastewater to below all applicable criteria prior to discharge to the groundwater, including residential drinking water standards.

279. **Comment:** Kennecott's background groundwater quality calculations are also doubtful in light of the lack of documentation of the methods that were used. The GDPA may consequently overstate the concentrations of background constituents in the groundwater and underestimate the actual impact of the TWIS discharge on groundwater quality. For example, no documentation is provided to show whether any of the guidance documents that were referenced by Kennecott were complied with, and if so, which ones. Many of the methods that were used, moreover, are inconsistent with standard scientific methods and relevant guidance, including the referenced guidance documents. More recent methods that are more appropriate for Kennecott's analysis and allow for more realistic estimates were not referenced (and presumably, not used) by Kennecott, and Kennecott does not explain its failure to incorporate those relevant and widely accepted approaches (WHPA pp. 17-19).

Response: The background groundwater quality documentation and methodology is considered acceptable for evaluating background groundwater quality for the GD pursuant to Rules 2221(4)(c)(i) and is within the standard expectations for a GDPA.

280. **Comment:** Significant errors in Kennecott's hydrogeologic modeling further undermine Kennecott's conclusions. MDEQ recognized the inadequacy of the model in its May 10, 2006 Comments on the GDPA, explaining that:

The model... has not been calibrated, does not use realistic boundary conditions, has an excessively large cell size, and has not modeled relevant surface features such as rivers, seeps, or bedrock outcrops. The current model... cannot accurately predict changes to the local groundwater flow regime.

(WHPA p. 21). As MDEQ also recognized in those comments, Kennecott's calculations must be rerun to account for a vastly larger maximum inflow to the mine resulting from the hydrologic instability of the crown pillar. (WHPA p. 21). In addition, the conceptual model was not implemented in accordance with professional standards, and incorporates several faulty assumptions that are inconsistent with Kennecott's data (WHPA p. 14). For example, Kennecott assumes that groundwater flow in the bedrock is negligible, when its own drilling data indicate fracture flow (WHPA p. 15). Kennecott also asserts that wetland drawdown will be prevented by a continuous clay layer; however, its own data show that the clay layer is not present in some samples (WHPA p. 15). As was noted by MDEQ, Kennecott fails to consider numerous springs and streams present in the model domain, and also excludes other features such as the peridotite outcrop and subcrop, all of which should serve as important factors and boundary conditions in the model (WHPA p. 13 and p. 20). Moreover, Kennecott's modeling analysis suffers from a number of deficiencies, including an oversimplified model, idealized and unrealistic flow paths, additional unsupported assumptions that contradict available data, and inaccurate bedrock groundwater elevations (WHPA pp. 20-21).

Response: The MDEQ's May 10th comment identified an overreaching statement previously made by Kennecott regarding their model results. Although the MDEQ disagreed with Kennecott's claims regarding model results, the model was sufficient to demonstrate the effects of mounding and hydrogeologic characterization in the vicinity of the groundwater discharge, thereby fulfilling the GDPA requirements. The more detailed sitewide model and its interaction with features such as the crown pillar is covered by the mining permit and not the GDPA.

281. **Comment:** Perhaps to avoid being required to augment the limited and dubious hydrogeologic data it chose to collect, Kennecott even asserts that its flawed modeling can be used as substantive evidence of groundwater flow directions. MDEQ recognized the absurdity of that claim in its May 10 and June 19, 2006 comments on the GDPA, observing that no valid conclusions about groundwater flow can be based on a model that is specifically designed to depict groundwater flow in a particular direction (WHPA pp. 21-22). This is even more true where, as here, many significant features and boundary conditions in the model domain have been ignored. Inexplicably, Kennecott refused to change its conclusions on this point despite MDEQ's disagreement (WHPA p. 22). Kennecott should not be allowed to substitute such absurd logic for actual data collection and analysis.

It is not clear why the serious deficiencies in Kennecott's data collection, modeling, and conclusions, which have been expressly identified by MDEQ and remain uncorrected by Kennecott, are now being ignored. The modeling must be corrected and performed again, using an appropriate amount of new data as discussed above, before any valid predictions can be made about the impacts of the proposed discharge on groundwater and surface water.

Response: The MDEQ acknowledges the limitations of Kennecott's model in regard to the concerns stated by the MDEQ's May 10th letter. Kennecott was asked to remove the disputed statements, which they did. The claims made by Kennecott's consultant were overreaching and not necessary for the GDPA. The GDPA requires a demonstration of mounding and characterization of impacts specifically in the area of the groundwater discharge.

282. **Comment:** Alternative modeling of the effect of the proposed discharge on the Quaternary glacial aquifer and the East Branch Salmon Trout River, utilizing the same model as utilized in the GDPA but with more reasonable boundary conditions and volumetric assumptions, demonstrates that Kennecott's predictions in both the GDPA and the mining permit application ("MPA") are flawed (Stratus pp. 24-25). Kennecott's GDPA prediction is wholly invalid due to its oversimplification and failure to account for relevant boundary conditions (Stratus p. 25). In comparison with Kennecott's MPA prediction, the alternative modeling predicted shorter travel time for the discharge to reach the East Branch Salmon Trout River, resulting in more surface water impacts than predicted by Kennecott (Stratus p. 25). Moreover, when an increased discharge volume accounting for more mine water from infiltration through the crown pillar is accounted for – an approach explicitly recommended by MDEQ but not implemented by Kennecott – the results are, unsurprisingly, dramatically different (Stratus pp. 24-25). Kennecott must account for that likely inflow and adjust its conclusions accordingly before any conclusions can be made about the impact of the discharge.

Alternative modeling was also conducted and compared with Kennecott's predictions of drawdown impacts from mine dewatering (Stratus pp. 30-31). That modeling predicts vastly higher drawdown and wetland area affected than was predicted by Kennecott. Moreover, as with the TWIS discharge impact, Kennecott's predictions failed to account for the larger volume of inflow through the crown pillar. These differences highlight the severe environmental consequences that are masked by the errors in Kennecott's modeling, and underscore the fact that Kennecott must be required to reevaluate its predictions before any valid conclusions can be made about the effect of the proposed mine and discharge.

Response: Variability does exist regarding the results of the modeling efforts including estimates of travel time from the TWIS to the venting location. Each model attempts to approximate and/or predict a real world situation. By design a model never provides a conclusive answer when simulating what is a very complex groundwater system.

Variability exists between models in regards to travel times. Actual travel times that will be realized will likely fall within the ranges given for the various models. However, neither the upper nor the lower limits for the estimated travel times if realized would create a condition that would constitute a violation of the proposed GD.

283. **Comment:** The Aggressive Nature Of The Proposed Discharge May Lead To Water Quality Violations And Adverse Impacts

Even if Kennecott's predictions about the purity of the WWTP effluent are taken at face value, the discharged water will also be very aggressive (in general, the greater the purity of water, the greater its tendency to dissolve materials it comes in contact with), and, therefore, will likely leach contaminants such as calcium, silica, metals and others out of the infiltration bed or subsurface (see Attachment 3 to these Comments, p. 4). That, in turn, may lead to a violation of the applicable groundwater standards. Kennecott did not consider the possibility of such leaching or potential impacts on water quality that would result from such leaching. The discharge cannot be allowed to occur until those potential impacts are understood.

Response: The greater purity of the water may cause some leaching of natural constituents from the soils much in the same way rainwater (which has a greater purity than groundwater) leaches metals. The groundwater discharge is expected to leach soil materials to a point that causes the groundwater to approach the concentrations of constituents found in natural groundwater in the area. Leaching of constituents above any applicable groundwater standards is not anticipated because no mechanism or plausible theory for such an occurrence has been identified.

284. **Comment:** The Proposed Construction of Compliance Monitoring Wells Is Inadequate To Detect Adverse Impacts And Groundwater and Surface Water Permit Limits Are Inadequate To Protect Drinking Water Use And Aquatic Biota

Exacerbating the problems caused by Kennecott's inaccurate prediction of discharge impacts, Kennecott's discharge monitoring system, as designed, will not adequately detect adverse impacts. For example, the groundwater compliance wells for the TWIS are planned to be screened at a depth that is unlikely to capture much, if any, of the discharged TWIS water; rather, those wells should be screened at two levels (Stratus p. 25). Moreover, daily and monthly permit limits have not been set for all contaminants that are expected to occur and may adversely affect water quality for human health and aquatic life (Stratus p. 27). The stream surface water monitoring system is also inadequate, because the stream compliance points are not located appropriately and do not include numeric compliance limits for any contaminants (Stratus pp. 27-28).

Response: Compliance wells for the TWIS are located in a manner that will detect any groundwater permit violations pursuant to Rule 2223(2). In addition, multiple compliance wells for the TWIS do include nested wells (wells screened at two levels). Due to the rate at which groundwater flows, it is not considered necessary to monitor TWIS compliance wells on a daily basis. Permit limits for several previously "report only" constituents will be set in the final permit.

285. **Comment:** Part I, section 4 (Groundwater Monitoring and Limitations) of the groundwater permit inadequately describes the applicable limits for groundwater. In section 4 there are many parameters listed as having no maximum daily limit, yet for many of these there are applicable Part 201 standards. Discharge by Kennecott that renders the groundwater unfit for use does not comply with the intent or the fact of state regulations. Either the Groundwater Permit should state the limits for all parameters for which there are applicable limits or else the Mine Permit should provide limits where the Groundwater Permit falls short.

Response: The Part 22 Rules of Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451) do not allow the discharge to create a "Facility" as defined by Part 201. However, the Part 22 groundwater standards are not identical to the Part 201 Generic Residential Criteria, they are generally more conservative. Permit limits for several previously "report only" constituents will be set in the final permit.

286. **Comment:** Kennecott's proposed construction for groundwater compliance wells that monitor TWIS discharge is flawed because it will not allow direct measurement of groundwater levels after TWIS discharge. Additional wells at each location should be screened from the current water table to the elevation of the highest expected water table to allow for direct measurement of groundwater mounding over time.

Response: The groundwater mound will be detected from wells screened below the current water table. The basic principles of hydrogeology dictate that the water will rise in the well to a level equivalent to the mound height regardless of the depth of the well screen.

287. **Comment:** Proposed stream surface water monitoring locations for TWIS discharge are not located close enough to the predicted discharge locations in the East Branch Salmon Trout River to provide an early warning system for potential water quality impacts. In addition, no numeric limits are established for surface water compliance points. For the glacial outwash well, daily and monthly permit limits should be required that use groundwater-surface water interface standards pursuant to Part 201 Cleanup Criteria. Also, permit limits should also be established for the stream compliance locations based on aquatic life criteria.

Response: The Part 201 groundwater –surface water interface standards, which are also contained in Part 4 of Act 451, were used as the basis to establish limits that are in the permit. The limits are placed in groundwater monitor wells that are far enough hydraulically upgradient of the venting location to adequately address compliance problems long before they adversely impact surface water.

288. **Comment:** In the case of the Golder model submitted in the KEMC groundwater discharge permit application, WHPA's simulation makes a more realistic picture of the hydraulics of the site. Golder's model makes no attempt to account for local boundary conditions, seeps, streams, or other features of interest. As such, we do not endorse the Golder results. Because the Golder model does not represent local boundary conditions, its predictions cannot be justified,

On the other hand, WHPA's model is generally consistent with the Fletcher Driscoll model presented in the EIA of the mining permit application, both in its conceptualization of the flow system and its results, at least for the portion of the aquifer system south of the seeps. Because water leaving the seeps probably moves quickly into nearby surface streams, the Fletcher Driscoll model's predictions for flows north of the seeps probably overestimates the travel times for waters reaching the Salmon Trout River and underestimates the impacts of the TWIS on the river.

The analysis described here used a simple conceptual model of the shallow aquifer and several simplifying assumptions about separating layers in the unconsolidated section. While we are comfortable that this approach provides substantial new insights into the system, it is clearly not detailed enough to make an assessment of local impacts. If more detail is desired regarding local impacts, it would be necessary to modify the current model to explicitly include vertical flow in the layered aquifer system at the site.

Response: The MDEQ acknowledges that variability does exist regarding the results of the modeling efforts including estimates of mound height and travel time from the TWIS to the venting location. Each model attempts to approximate and/or predict a real world situation. By design a model never provides a conclusive answer when simulating what is a very complex groundwater system. A significant range of estimated values is provided for both travel time and mound height. The reality is that the actual mound height and travel times that will be realized will likely fall within the ranges given for the various models. However, neither the upper nor the lower limits for either the mound height or the travel time would create a condition that would constitute a violation of the proposed groundwater discharge permit.

Wastewater Treatment

289. **Comment:** (Special Permit Condition L-15) the table of Final Effluent Limitations in the Groundwater Discharge Permit gives concentration limitations of only seven parameters. Considering the size of the facility and the fairly complex nature of operations, this list seems unreasonable brief. It is not clear how the list of limits for seven parameters corresponds with applicable water quality standards.

Response: The draft permit includes a total of 35 parameters that will be monitored and reported. The results of the monitoring will provide an excellent indication of the degree of treatment provided. Of the 35 parameters to be monitored, pH and the six metals have effluent limits, and are related to the Part 4 surface water quality review. Changes will be made to the permit to include limitations in Part I, Section 4, Groundwater Monitoring and Limitations, to address those concerns.

290. **Comment:** MDEQ should consider adding perchlorate and/or other explosive-related chemicals to the list of groundwater monitoring parameters.

Response: The OGS permit application indicates that ammonium nitrate will be the explosive uses at the mine. Part I Section 4 will include limitations of 10 mg/l for both nitrate and ammonia.

291. **Comment:** The treatment and containment plan is inadequate.

Response: With the information submitted in the application including the components and sizing of the treatment system, the amount of water to be treated, the expected concentrations of contaminants, the estimated degree of treatment, and the supporting manufacturer's pollutant removal information, the MDEQ concluded that the proposed treatment system should provide adequate treatment to meet the proposed effluent limitations.

Also, the containment for contact precipitation was designed for a once in 50 years storm occurrence plus snow melt. This resulted in 7.8 million gallons capacity in the contact water basins, which is equal to 8 ½ inches of standing water on the 32.72 acre contact area. If additional storage is needed above the 7.8 million gallon contact holding basin capacity, water can be pumped and stored in the temporary development rock storage area. Thus, KEMC provides a substantial volume of capacity upstream of the treatment system, and the MDEQ concluded that the proposed containment capacity is sufficient.

292. Comment: .Volume of Water Inflow From Other Sources

The GDPA omits necessary data and contains clear errors in calculating the volume of inflows from non-mine sources, casting further doubt upon the sufficiency of the proposed WWTP capacity. For example, inflow rates for stormwater runoff from the main operations area and temporary development rock storage area ("TDRSA") inflows are not documented with any calculations (WHPA p. 6). Moreover, the stormwater design calculations do not account for at least 12.2 acres, nearly 40%, of the main operations area (WI-EPA p. 12). Furthermore, the WWTP was not designed to accommodate extreme precipitation events followed by normal/average precipitation events (WI-IPA pp. 6-7). No flow estimates were given for drainage from either the coarse ore storage area or the fine ore bins, both of which will contribute highly contaminated water to the WWTP (Stratus p. 21). The GDPA must be revised to properly document and consider all potential flows into the WWTP.

Response: KEMC did provide their assumptions for stormwater runoff and snowmelt in Appendix H of the application. Calculations in determining the runoff do not necessarily mean the estimated runoff amounts are not accurate. Also, the pollutant removals from proposed treatment system are more controlled by solubility rather than influent pollutant concentration. Higher pollutant concentrations may require some increase in treatment chemical dosages and would cause more solids to be removed from the waste stream, but any reduction in effluent quality will be very small compared to the increase in pollutant loading. Further, it is not in KEMC's best interest to underestimate the amount of wastewater or the pollutant concentrations. If the wastewater flows, rates, and pollutant concentrations were severely underestimated it could significantly impact mining operations. KEMC will be strictly held to their discharge permit limitations.

293. Comment: The WWTP May Be Incapable Of Meeting The WWTP Effluent Limits Established In The Proposed Permit

From an operational standpoint, the proposed reverse osmosis system will have difficulty removing boron due to boron's small molecular size, and Kennecott's estimated removal efficiency is extremely optimistic. Even under that optimistic assumption, the projected boron concentrations in the effluent are very close to the maximum allowable level. If removal is less effective than estimated by Kennecott (which is highly likely), an exceedance will probably occur (Stratus p. 23). Such exceedances will be a violation of Part 31 and the Part 22 Rules including, but not limited to, R. 323.2222(5)(a). The WWTP design is also overly complex and appears to be an untested and unconventional system. Both the complexity and the lack of precedent and experience with this kind of system suggest that start-up and initial performance problems will probably occur (Stratus p. 23).

Response: The application included a thorough discussion on removal of boron. The process proposed for boron removal is a high pH second pass RO system with removal of boron via ion exchange in the concentrate reduction process. The application also says that ion exchange may be evaluated during treatment system design in lieu of the second pass high pH RO system. KEMC will be held to their discharge permit limitations.

294. **Comment:** Effectiveness of the WWTP

A number of water quality characteristics were not considered or included in Kennecott's predictions of WWTP influent data, including the temperature and concentrations of total organic carbon, total dissolved solids (TDS), total suspended solids, alkalinity, and silica. Not considering these critical influent data may cause significant system design deficiencies that could result in the treatment system not being able to meet its effluent requirements or having excessive downtime for maintenance or system modifications. Moreover, incorrect values were used for influent nitrate concentrations. The design must be revised to account for the correct numbers.

Response: With the information submitted in the application including the components and sizing of the treatment system, the amount of water to be treated, the expected concentrations of contaminants, the estimated degree of treatment, and the supporting manufacturer's pollutant removal information, the MDEQ concluded that the proposed treatment system should provide adequate treatment to meet the proposed effluent limitations.

295. **Comment:** The limiting or critical factor with the overall treatment system is its ability to remove boron. Kennecott's boron removal efficiency estimate is overly optimistic, and even under that optimistic view, the effluent boron concentration is close to the maximum daily limit. A less than expected removal efficiency by the proposed double pass reverse osmosis treatment system or an increase in the influent boron levels could very easily result in an effluent boron concentration that is higher than allowable permit limits.

Response: The application included a thorough discussion on removal of boron. The process proposed for boron removal is a high pH second pass RO system with removal of boron via ion exchange in the concentrate reduction process. The application also says that ion exchange may be evaluated during treatment system design in lieu of the second pass high pH RO system. KEMC will be held to their discharge permit limitations.

296. **Comment:** The WWTP design is overly complex, and is an untested and unconventional system in the industry. Untested systems are usually fraught with start-up problems and do not initially perform to meet expectations, which would inevitably result in permit violations. In addition, treatability or pilot tests on potential WWTP discharge were not conducted and crucial aspects of the treatment system process are still not finalized. Kennecott should finalize all aspects of the treatment system, and a revised groundwater discharge permit should be submitted for a second round of public review.

Response: We do not agree with the untested and unconventional statement. The treatment components were selected for their ability to remove pollutants. All selected treatment components and processes have a long history of use in physical/chemical treatment facilities.

297. **Comment:** If our higher WWTP influent concentrations are realized, the amount of sludge produced from the treatment would increase, and the type of pretreatment would need to be reconsidered

Response: True – if influent concentrations are higher more sludge will be produced. KEMC will have to handle all sludge produced by the treatment process.

298. **Comment:** The range of possible background concentrations in bedrock groundwater is an important parameter for water treatment because there are constituents in the bedrock groundwater that are poorly treated by the proposed system, most notably boron. Boron concentrations are higher in the one lower bedrock sample than in the upper bedrock groundwater samples (Table 1), and concentrations in well 05EA-107 increased from 0.94 to 4.1 mg/L from the 18.2-43.9 m depth to the 97.5-114 m depth (GDPA, Appendix F). Kennecott should be required to collect and analyze more groundwater samples, especially in the lower bedrock aquifer, to characterize more completely the background concentrations of boron and to evaluate whether the treatment system will be able to remove boron and other solutes that derive from this source. Based on the variability of concentrations in "upper" bedrock groundwater, at least as many samples should be collected from the "lower" bedrock to assess its compositional variability.

Response: The application included a thorough discussion on removal of boron. The process proposed for boron removal is a high pH second pass RO system with removal of boron via ion exchange in the concentrate reduction process. The application also says that ion exchange may be evaluated during treatment system design in lieu of the second pass high pH RO system. KEMC will be held to their discharge permit limitations.2.3.6 Concentrations of nitrate in mine drainage.

299. **Comment:** Kennecott uses a nitrate concentration of 0.050 mg/l (50 ug/L) for its composite mine drainage water (GDPA, Table 4-1). This value is unrealistically low for drainage from an active underground mine **that uses blasting to extract ore**. Kennecott based its nitrate concentration on "information supplied by Kennecott from other representative mines" (GDPA, p. 17). However, no information is included in the GDPA to substantiate these concentrations, and the predicted nitrate concentration value of 0.050 mg/L is an underestimate of what the true nitrate concentrations will be. Use of such low nitrate values will underestimate concentrations reporting to the WWTP. More reasonable, higher values of nitrate should be used in Kennecott's mine drainage calculations, and the effectiveness of the WWTP in treating those higher concentrations should be reevaluated.

Response: Influent nitrate is not considered to be of major concern. Any nitrate not removed through the WWTP will be monitored in the effluent. Part I Section 4 will include limitations of 10 mg/l for both nitrate and ammonia in groundwater.

300. Comment: 4. WWTP Operation and Expected Effluent Quality Page 23

Conestoga-Rover and Associates (CRA, 2007) evaluated the proposed WWTP for the Eagle Project and found a number of deficiencies that raise questions about the validity of predicted outflow concentrations from the plant. Their most important points are summarized below. For a more detailed discussion, see the full report.

A number of water quality characteristics were not considered or included in the WWTP influent data, including the temperature and concentrations of total organic carbon, total dissolved solids, total suspended solids, alkalinity, and silica. Not considering these critical influent data may cause significant system design deficiencies that could result in the treatment system not being able to meet its permit limits or having excessive downtime for maintenance or system modifications. Moreover, incorrect values were used for influent nitrate and ammonia concentrations. The design must be revised to account for the correct numbers.

Response: Many of these are indicators or groupings of pollutants. KEMC provided individual pollutant estimates, and therefore, the generalized indicators are not necessary. We do not consider these parameters to be significant in the design of the WWTP. The discharge permit as drafted requires monitoring of 35 parameters which have been selected as the best indicators of the effectiveness of the treatment system. We offer the following:

Temperature: The wastewater will be from mine infiltration, processing, and runoff. Little or no heat is added to any of the wastewater. The WWTP is a physical chemical treatment plant. Temperature variations of the wastewater will not significantly change the capabilities of the treatment system.

Total Organic Carbon (TOC): The pollutants of concern are inorganic in nature. The initial TOC in the wastewater is of little significance to effective treatment of the wastewater.

Total Dissolved Solids (TDS): TDS is a general indicator of inorganic pollutants. The draft permit requires specific monitoring of the pollutants of concern

Total Suspended Solids (TSS): TSS indicates the amount of solids not dissolved. All TSS will be removed by the sedimentation basins, sand filters and reverse osmosis (RO).

Alkalinity: Alkalinity indicates the amount of acid a solution can absorb before the pH is significantly reduced. Part of the WWTP process includes increasing the pH for metals precipitation, then neutralization with acid. The initial alkalinity of the wastewater is of little significance since the treatment requires raising then lowering the pH.

Silica: Silica is effectively removed by RO. The initial silica concentration in the wastewater is of little significance to effective treatment of the wastewater.

Nitrate: Any nitrate not removed through the WWTP will be monitored in the effluent. Part I Section 4 will include limitations of 10 mg/l for both nitrate and ammonia in groundwater.

301. **Comment:** The limiting or critical factor with the overall treatment system is its ability to remove boron. Kennecott's boron removal efficiency estimate is overly optimistic, and even under that optimistic view, the effluent boron concentration is close to the maximum daily limit. A less than expected removal efficiency by the proposed double pass RO treatment system or an increase in the influent boron levels could very easily result in an effluent boron concentration that is higher than the Groundwater Discharge Permit limits.

Response: The application included a thorough discussion on removal of boron. The process proposed for boron removal is a high pH second pass RO system with removal of boron via ion exchange in the concentrate reduction process. The application also says that ion exchange may be evaluated during treatment system design in lieu of the second pass high pH RO system. KEMC will be held to their discharge permit limitations.

302. **Comment:** The WWTP design is overly complex, and CRA considers it an untested and unconventional system in the industry. The lack of treatability or pilot tests to demonstrate that the Groundwater Discharge Permit limits can be met raises additional concern. Untested systems are usually fraught with start-up problems and do not initially perform to meet expectations, which would inevitably result in permit violations. In addition, crucial aspects of the treatment system process are still not finalized. Kennecott should finalize all aspects of the treatment system, and a revised Groundwater Discharge Permit should be submitted for a second round of public review,

Response: Yes, the system is complex but we do not agree that the technology is untested or unconventional. The treatment components were selected for their ability to remove pollutants. All selected treatment components and processes have a long history of effective treatment.

303. **Comment:** If WWTP influent concentrations predicted by us in Table 5 are realized, the amount of sludge produced from the treatment would increase, and the type of pretreatment would need to be reconsidered.

Response: True – if influent concentrations are higher more sludge will be produced. KEMC will have to handle all sludge produced by the treatment process. However, an increase in sludge production does not mean that the technology is inappropriate. If additional capacity or technology is necessary to meet the permit, KEMC will have to provide it. KEMC will be held to their permit requirements.

304. **Comment:** Attachment 3 CONESTOGA-ROVERS & ASSOCIATES

Certain vital characterization data for the influent wastewater were not considered by the applicant during the design of the wastewater treatment system. Not considering this critical data may cause significant system design deficiencies that, in turn, result in the treatment system not being able to meet its Groundwater Discharge Permit requirements and/or having excessive downtime for maintenance or system modifications;

Response: See previous response to same question.

305. Comment: The limiting or critical factor with the overall treatment system is its ability to remove boron. A less than expected removal by the proposed double pass Reverse Osmosis (RO) treatment system or an increase in the influent boron levels could very easily result in an effluent boron concentration that is higher than the Groundwater Discharge Permit limits;

Response: See previous response to same question.

306. **Comment:** The proposed treatment system is overly complex. Based on the reviewers' extensive experience with membrane processes, it would appear that the proposed system is a "first-of-a-kind." The facts that the wastewater to be treated does not currently exist, and that no treatability or pilot tests will be done to demonstrate that the Groundwater Discharge Permit limits can be met, raise a further significant concern.

Response: The treatment components were selected for their ability to remove pollutants. This may be the first time all of the components are used in one treatment facility, but the individual components have a long history of effective treatment. It will be up to KEMC to operate the system to comply with the discharge permit. Substantial capacity is provided to hold wastewater that does not meet permit requirements.

307. Comment: Experience has shown that "first-of-a-kind" systems are usually fraught with start-up problems and do not initially perform to meet expectations, which would inevitably result in Groundwater Discharge Permit violations; and the proposed system is very conceptual with Foth and Van Dyke indicating that many changes could still be made during the detailed design phase. As a result, crucial aspects of the treatment system process are still not finalized. The applicant should be instructed to finalize those aspects of the treatment system, and the Michigan Department of Environmental Quality (MDEQ) should issue a new proposed Groundwater Discharge Permit for public review that accounts for the finalized treatment process.

Response: If KEMC determines that different processes are necessary to provide treatment, any modifications to the treatment system will need to be provided to the MDEQ for technical evaluation. The treatment components were selected for their ability to remove pollutants.

308. Comment: EVALUATION OF THE WASTEWATER TREATMENT PROCESS AS PROPOSED IN THE GROUNDWATER DISCHARGE PERMIT APPLICATION

Significant concerns with respect to the proposed wastewater treatment process as proposed in the Groundwater Discharge Permit Application are discussed below. Each issue raised below may cause the proposed wastewater treatment system to be inoperable for significant periods of time or may lead to a violation of the Groundwater Discharge Permit (Permit No. GW1810162), or both.

Metals Precipitation and Solids Contact Clarification

Only one metal precipitation tank and one solids contact clarifier are proposed. If the units are out of service for repairs or maintenance, it is proposed to either temporarily store wastewater in the Contact Water Basins (CWBs) or bypass around the system to the gravity filters. The bypass option will not only tend to foul the gravity filters, it will also

foul the downstream primary Reverse Osmosis (RO) unit. The scaling that will occur could happen in minutes and may result in a permanent membrane flux (i.e., capacity) reduction even after cleaning. This would likely result in significant system downtime for cleaning and reduced system capacity. Bypassing is, therefore, not an acceptable option, and the applicant should be instructed to propose an alternative.

Response: Substantial capacity is provided to hold wastewater during times when any of the treatment processes are down. Also, KEMC may need to suspend certain mining operations. If KEMC determines that additional treatment units are necessary, or additional storage is required, they will have to provide them. Also, it is not in KEMC's best interest to under design the treatment system. In any event, KEMC will be held to their discharge permit limitations.

309. **Comment:** Influent Wastewater Characterization

In the design of any wastewater treatment system, it is very important to have complete characterization data for the subject wastewater. Lack of key data can lead to system design deficiencies that, in turn, result in the treatment system not being able to meet its Groundwater Discharge Permit requirements and/or having excessive downtime for maintenance or system modifications. The significant wastewater characterization deficiencies for the proposed system include: No data are provided for organic content [e.g., Total Organic Carbon (TOC)] in the influent feed water: Any colloidal organics that are smaller than the protection provided by the gravity filter or dissolved organics will likely foul the downstream NO system.

The biocide will provide some protection, but will not be able to adjust for seasonal variations without extensive monitoring. This type of membrane fouling could result in unexpected down time of the treatment system;

No influent feed water data are provided for temperature. A fairly wide range would be expected for this location, which will seasonally impact membrane flux and ion removal efficiency. Not accounting for temperature variations may result in significant down time of the treatment system or Groundwater Discharge Permit violations, or both;

No influent feed water data are provided for total dissolved solids (TDS), total suspended solids (TSS), alkalinity, or silica. These are all critical parameters required for the conceptual sizing of the membrane pretreatment system and for the downstream RO processes. Without having data for these critical parameters, the membrane pretreatment system and downstream RO process cannot be sized correctly;

It is anticipated that the influent feed water nitrate would be much higher than the 50 ug/L value indicated in Table 4.2 and used in treatment system calculations, based on CRA experience at similar sites. The applicant should use more appropriate nitrate values in its design and evaluate the implications of the increased nitrate on the wastewater treatment process; and the influent feed water ammonia value indicated in Table 4.2 should be 10,163 ug/L rather than 163 ug/L. This appears to be an error in transposition of data from Table 4.1 to Table 4.2, US Filter (Appendix G-2) in its membrane performance prediction used an influent ammonia concentration of 148 ug/L rather than 10,163 ug/L. It is apparent in Appendix G that Foth and Van Dyke have attempted to make adjustments to account for this error, but it is not clear how these adjustments were performed. Was another membrane performance projection made that has not been provided or was some

other correction used? This uncertainty calls into question the adequacy of the treatment process design. The applicant should clarify what values were used for ammonia and how this impacted the treatment system design.

Response: It is KEMC's responsibility to meet the conditions of the discharge permit. If additional treatment is necessary, or additional storage is required, KEMC will have to provide these as necessary. Also, it is not in KEMC's best interest to under design the treatment system. In any event, KEMC will be held to their discharge permit limitations. Also, previous response to same questions.

We agree the influent feed water ammonia value in Table 4.2 should be 10,163 ug/l.

310. **Comment:** Boron Removal

Boron is notoriously difficult to remove via RO because of its small size (i.e., boron atomic weight = 10.8); therefore, the limiting or critical factor with the overall treatment system is its ability to remove boron. The boron removal efficiency of 90%+ in the 2 pass RO system predicted by the applicant is overly optimistic. The effluent boron for the overall system predicted by the applicant, based on the overly optimistic removal efficiency estimate, is 71% of the Groundwater Discharge Permit Initial Effluent Limitations, Maximum Daily Limit Value (i.e., 172 gg/L predicted effluent versus the Maximum Daily Limit value of 250 tig/L). A less than expected removal by the double pass NO system or an increase in the influent boron levels could very easily result in an effluent that does not meet the Groundwater Discharge Permit limits for boron. Considering that one of the most critical objectives of the treatment system is boron removal, and that boron discharges above the Groundwater Discharge Permit limits are likely, the applicant should be instructed to propose more appropriate treatment alternatives,

Response: See previous response to same question.

311. **Comment:** Break Point Chlorination (BPC)

BPC is proposed as the primary mechanism for reducing the ammonia content in the water. In BPC, chlorine is added to the wastewater to oxidize ammonia via a progression of oxidation products leading to eventual production of nitrogen gas. As with any chemical treatment-based process, its success will depend on the consistency of the feed water and the appropriate proportions of feed chemicals. In the reviewers' experience, these systems are very difficult to optimize and operate and thus, there is a high risk of compromising the downstream membrane integrity. The applicant should be required to propose alternatives that do not involve such a high risk of compromising critical downstream treatment processes.

Response: Break Point Chlorination is a conventional technology for ammonia removal. KEMC will need to provide appropriate operating parameters to insure the process operates properly. It is not in KEMC's best interest to propose a process that won't provide the necessary treatment. Ultimately, KEMC will be held to their permit limitations.

312. **Comment:** System Complexity

The proposed treatment system is overly complex. For example, there are ten separate unit operations, including clarification/softening, sand filtration, three RO trains, break point chlorination, microfiltration, two separate ion-exchange systems, a residual solids management train and an evaporation/crystallization process, seven pH adjustments, use of at least 12 different chemicals including lime, polymer, sulphuric acid, caustic, RO cleaning chemicals, anti-scalant, biocide, hydrochloric acid, sodium hypochlorite, magnesium chloride, ferric chloride, and sodium bisulphite. Such a complex system could inherently have a high degree of down-time, particularly during start-up, and will certainly have high on-going maintenance requirements. A high level of instrumentation and control will be necessary, and the skill and training level for the system operators will need to be exceptional. In addition, a great deal of system monitoring and analysis will need to be conducted on a daily basis to assure that the numerous interdependent processes are performing to design.

Response: Yes, the system is complex and it will require a high degree of oversight, operation, and control. The treatment components were selected for their ability to remove pollutants. All selected treatment components and processes have a long history of effective treatment.

313. **Comment:** Based on the reviewers' extensive experience with membrane processes, it would appear the proposed system is a "first-of-a-kind." The facts that the wastewater to be treated does not currently exist, and that no treatability or pilot tests will be done to demonstrate that the Groundwater Discharge Permit limits can be met; raise a further significant concern. Experience has shown that "first-of-a-kind" systems are usually fraught with start-up problems and do not initially perform to meet expectations, which would inevitably result in Groundwater Discharge Permit violations. Due to the high degree of uncertainty that this system will function properly, the applicant should be instructed to propose a demonstrably more reliable system using a proven combination of processes.

Response: If KEMC determines that different processes are necessary to provide treatment, any modifications to the treatment system will need to be provided to the MDEQ for technical evaluation. The treatment components were selected for their ability to remove pollutants.

314. **Comment:** Concentrate Recovery Process (CRP)

The first steps in the proposed CRP train involve addition of several chemicals two in-series reactors to address numerous potential contaminants issues. For example, sodium hypochlorite is being added for break point chlorination, magnesium chloride is being added for silica removal, ferric chloride is being added as a coagulant, and hydrochloric acid and caustic are being used for pH control. All of these removal processes may have different optimum set point conditions and in the reviewers' opinion, this system as currently proposed will be very difficult if not impossible to operate. The consequence of any failures would be inoperability of the downstream treatment process and/ or potential violations of the Groundwater Discharge Permit,

Conceptual Nature of System

The proposed system is very conceptual with Foth and Van Dyke indicating that changes could still be made during the detailed design phase. For example, Foth and Van Dyke suggest that alternate processes may be considered for boron removal (Page 36), microfiltration sludge could be incorporated with the underground cemented mine backfill (Page 28), an alternate CRP may be considered (Page 38), and reverse osmosis (RO) concentrate from the CRP will be either discharged to the evaporation/ crystallizer process or will be incorporated into the cemented mine backfill (Page 43) (all referenced page numbers refer to the Groundwater Discharge Permit Application). As a result, crucial aspects of the treatment system process are still not finalized. Therefore, the applicant should be instructed to finalize those aspects of the treatment system, and the MDEQ should issue a new proposed Groundwater Discharge Permit for public review that accounts for the finalized treatment process.

Response: If KEMC determines that different processes are necessary to provide treatment, any modifications to the treatment system will need to be provided to MDEQ for technical evaluation. The treatment components were selected for their ability to remove pollutants. The limitations in the permit would not change even if an alternate treatment system were proposed, as they were developed to be protective of groundwater and surface water pursuant to Part 22 and Part 4 of Part 31.

315. **Comment:** The description, documentation, and assumptions used in the mine water balance calculations and the storm water runoff designs and plans indicate that the Contact Water Basin (CWB) may not be capable of handling routine runoff events and the proposed design of the WWTP capacity is not sufficient to accommodate these very likely inflows.

Response: We have reviewed the basis for runoff designs. Appendix H describes how containment for contact precipitation was designed for a once in 50 year storm occurrence. Also, the containment for contact precipitation was designed for a once in 50 years storm occurrence plus snow melt. This resulted in 7.8 million gallons capacity in the contact water basins, which is equal to 8 ½ inches of standing water on the 32.72 acre contact area. If additional storage is needed above the 7.8 million gallon contact holding basin capacity, water can be pumped and stored in the temporary development rock storage area. Thus, KEMC provides a substantial volume of capacity upstream of the treatment system, and the MDEQ concluded that the proposed containment capacity is sufficient.

316. **Comment:** Rule 323.2218(2) requires the Applicant to provide a basis of design of the proposed treatment system containing specified information and showing that the treatment system will have "sufficient hydraulic capacity and detention time to adequately treat the anticipated organic and inorganic pollutant loading" in the wastewater, The Applicant's design is inadequate in several respects.

Response: the applicant did provide a basis of design for the proposed treatment system including hydraulic capacity, etc. There is no information provided that the applicant's information is not appropriate.

317. **Comment:** Several other inputs to the CWB are not documented or described, including the 61 gpm input for stormwater runoff from the main operations area or the 22 gpm input from the TDRSA. Those rates are not documented with any calculations.

The Applicant also fails to adequately evaluate the impact of normal Spring snowmelt and summer storms in the area, and consequently fails to provide adequate capacity for the WWTP to accommodate such events in order to preserve the capacity of the CWBs. The capacity of the WWTP is stated to be 350 gpm. Of this capacity, a 250 gpm rate is designated for mine dewatering, leaving 100 gpm of treatment capacity for stormwater and other inputs. Storage capacity for stormwater surge is provided in the CWBs. This surge capacity would logically be used to buffer the required input rate to the WWTP; however, the GDPA does not explain how the WWTP will accommodate average annual precipitation or extreme design events (snowmelt and storms) that increase inflow into the CWBs. For example, the Applicant describes an extreme event (50-year rainfall coupled with 26-day snowmelt) that produces 7.8 million gallons of net input to the CWBs (assumes a 100 gpm discharge from the CWBs to the WWTP during the 26-day period), which matches the design capacity of the CWBs. It would take nearly 70 days to pump out the CWBs at the 100-gpm rate for which the WWTP is designed. Under this scenario, there will not be enough capacity in the CWB for stormwater runoff from smaller events during the pump-out period. These pulses of rainfall and snowmelt will also increase water levels in the upper aquifer and further increase mine inflows

Response: Figure 4-2 from the application shows the water balances at average precipitation. Figure 4-2 indicates 76 gpm rate to the WWTP which allows about 275 gpm for treatment of the equalized runoff. It will take about 20 days to pump the excess runoff from the containment basins at average flows. It is not reasonable to expect that the maximum precipitation flows would last for very long. Also, additional storage is available in the TDRSA should precipitation higher than the design storm and snow melt occur.

318. **Comment:** The water balance flowchart in Figure 4-18A indicates a 428 gpm input to the clarifier/filter portion of the WWTP, which is inconsistent with the 350 gpm stated WWTP capacity.

Response: Figure 4-1 does indicate 428 gpm at maximum flow. However, the same Figure indicates 279 gpm to the rest of the WWTP. KEMC will need to document that the clarifier/filter portion of the WWTP will be capable of treating 428 gpm.

319. **Comment:** 2. Rule 323.2218(2)(b) requires the Applicant to provide an analysis of the chemistry of the influent to the WWTP. The Applicant's estimates of influent chemistry utilize insufficient and selectively presented data, unsupported and inappropriate assumptions, and are not properly documented. As a result, the influent chemistry will likely be significantly different from the Applicant's estimates. The Applicant should be required to correct these errors and redesign the WWTP to account for a more realistic estimate of influent chemistry.

The water chemistry of the TDRSA that will form the influent to the WWTP is estimated in Appendix F. This analysis is deficient in several respects:

The Applicant's analysis most likely underestimates the sulfide content of TDRSA water. On page 2, TECHNICAL APPROACH, last paragraph, the Applicant sets forth its assumption that "20% of average annual precipitation infiltrates through the pile on a steady-state basis ... Leach rates for weighted average country-rock and intrusives are calculated in terms of mass per unit surface area per unit time from the kinetic column tests are incorporated with the annual precipitation on a steady state basis into the model." The Applicant, however, does not indicate where the country rock samples came from. Country rock removed from near the ore body would likely have higher sulfide content than country rock in general. Therefore, unless the Applicant used country rock samples representative of the area surrounding the ore body, the sulfide content of the TDRSA water will be much higher than that estimated by the Applicant.

The Applicant overestimates the neutralization of acidity in the TDRSA water, and consequently underestimates the acidity of the TDRSA water, by failing to account for the inevitable armouring of limestone that is added to the TDRSA rock. On page 11, ESTIMATING LIMESTONE ADDITION, the Applicant gives the suggested dosage of a high grade limestone to the stockpiled development rock for purposes of neutralizing acidity. These calculations were derived from the acid potential (AP) data from extractions of S as sulfide from pyrite (Phase I and Phase II geochemistry studies, part 1 of 3). Neutralization potentials (NP) were then calculated for the various massive and semi massive ores, and the materials referred to as the development rock. This value is reported in tCaCO₃/1,000 t. However, these calculations were not carried out using actual CaCO₃ limestone characteristics, but rather, by using the REACT model limestone of 98% CaCO₃. The model does not take into consideration the flaws of CaCO₃ as a neutralization material. As explained in EPA-903-K-97-0003, "allowing the limestone treatment process to occur in the presence of oxygen causes a buildup of metallic hydroxide compounds on the surface of the limestone (armoring) .. , which halts the treatment process." In addition, it is common knowledge that sulfates released into solution can combine with the calcium (Ca) to form gypsum (CaSO₄) and coat the rocks of the limestone, rendering it ineffective. Moreover, iron (Fe) released under these conditions will also "armor" the coating of limestone by forming iron carbonate (Fe(CO)₃) and iron hydroxide (Fe(OH)₃) produced by the neutralization process. This also reduces the effectiveness of limestone in reducing the acidity. The Applicant does not mention, much less account for, these facts.

The Applicant's acidity neutralization estimates are also rendered wholly speculative by the Applicant's failure to define the particle size of the limestone to be used, or where the limestone would come from. From a technical perspective, the larger the particle or mesh size (or grain size) of limestone, the less effective its neutralizing capacity is. Consequently, a larger mesh size results in less reliable calculations regarding the amount of CaCO₃ required to neutralize the acid producing ores. Larger mesh size limestone obviously has a stronger propensity for increased hydraulic flow, thereby minimizing contact time. An ASTM procedure, C110-05a ("Standard Test Methods for Physical Testing of Quicklime, Hydrated Lime and Limestone"), or equivalent, should be implemented to gauge the reactivity and size of the actual limestone being used. The applicant should also have indicated the source of the stone used to confirm the chemistry of the rock as well as the particle size anticipated for the fill.

Response: This comment seems to promote an idea that acid production in the TDRSA is a fatal flaw in the design. It is not. The first process in the WWTP is metal precipitation with lime. Any acid from the TDRSA will be neutralized by the lime before the pH can be elevated for metals precipitation. Such acid will require an incremental amount of lime for neutralization. However, the presence of acid in the WWTP is of no major concern for proper operation of the WWTP or treatment of the wastewater.

Surface Water Quality

320. **Comment:** An independent evaluation of the effect of TWIS discharge on downgradient groundwater levels and travel time found that travel times to the East Branch Salmon Trout River would range from three to 10 years. Kennecott's models did not account for local boundary conditions, seeps, streams, or other features of interest and did not apply appropriate boundary conditions for groundwater flow at the site and thus likely overestimated travel times for TWIS discharge to reach the Salmon Trout River and underestimated the impacts of the discharge on the river.

Response: The MDEQ acknowledges the limitations of the model provided in the GDPA. However, the Part 22 Rules of Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451) require a demonstration of mounding and characterization of impacts specifically in the area of the groundwater discharge, and the MDEQ believes those potential impacts were adequately addressed.

The ground water effluent limits are designed to meet surface water quality standards at the seeps that form headwaters of the East Branch of the Salmon Trout River. These perennial and ephemeral seeps are surface waters of the state; therefore, they were considered for protection in MDEQ's evaluation.

321. **Comment:** Based on Kennecott's estimate of TWIS effluent concentrations, the discharge will dilute hardness in the East Branch. Hardness values in the East Branch are already low; further dilution of hardness increases the vulnerability of aquatic life to metals discharge. Kennecott should evaluate the impact of TWIS discharge on the East Branch Salmon Trout River, Stratus Executive Summary (October 16, 2007) Page S-4SC11271 under relevant stream flow and water quality scenarios using a redesigned WWTP.

Response: The ground water discharge limits are designed to meet surface water quality standards at the seeps that form headwaters of the East Branch of the Salmon Trout River. A hardness value of 50 mg/L was used to calculate limits for the ground water surface water interface. Water samples collected from the seeps during September to November 2005, indicated background hardness values ranging from 50 mg/L to 70 mg/L.

The existing hardness in groundwater, from wells in the vicinity of the proposed discharge, is approximately 50 mg/l. Advection/dispersion calculations indicate that the expected hardness concentration in groundwater as a result of mixing from the discharge will be approximately 40-46 mg/l. It is reasonable to expect that 5-10 mg/l of hardness will be mineralized from the previously unsaturated soils beneath the discharge basins, thus returning the groundwater to the current hardness concentration of 50 mg/l. The advection/dispersion calculations did not indicate that there would be enough of a change in the groundwater hardness concentrations to reduce the effluent limitations that are protective of surface water.

322. **Comment:** Will the temperature of the wastewater entering the groundwater and venting to the Salmon Trout River raise the temperature of the river water, thus impacting the Brook Trout?

Response: Baseline data collected during fall 2005 from ground water seeps, which are the headwaters of the Salmon Trout River, indicate that venting groundwater temperature is approximately 6.1 to 8.3 degrees C. The proposed discharge would mix with groundwater and would take several to many years to reach the groundwater seeps. Because of the duration of time it will take for the proposed discharge to mix with ground water and travel to the headwaters of the Salmon Trout River, it is the MDEQ's position that temperature in the Salmon Trout River will not be significantly affected.

323. **Comment:** Will the groundwater discharge impact the Salmon Trout River?

Response: Michigan's water quality standards are designed to protect several designated uses including cold water fisheries and other indigenous aquatic life and wildlife. These standards include numeric criteria for toxic substances that are developed to protect sensitive species. The draft groundwater discharge permit is designed so that surface water quality standards will be met in the effluent, prior to discharging to groundwater. Although the location where the groundwater vents to surface water is approximately 5,000 feet from the point of discharge, compliance with those standards will also be measured in groundwater within 150 feet of the discharge.

Permit Issues

324. **Comment:** So basically the application needs to contain some sort of cost benefit analysis in order to comply with that Clean Water Act 303.

Response: The groundwater permit is regulated by the Part 22 Groundwater Quality Rules of Part 31, Water Resources Protection, of Michigan's Natural Resources and Environmental Protection Act of 1994, PA 451, as amended, which is a state law. The Clean Water Act applies to direct discharges to surface water pursuant to the federal National Pollutant Discharge Elimination System (NPDES). The Part 22 Rules require that limitations in the groundwater discharge permit are protective of surface water, but do not require an NPDES permit.

325. **Comment:** There is no NPDES permit which would be required for any surface discharge, as a discharge to surface waters may not be avoided.
- Response:** The proposed discharge from KEMC is to the groundwater through land application. The Part 22 Rules require that limitations in the groundwater discharge permit are protective of surface water. The Michigan Attorney General's Office concurred with the MDEQ position that an NPDES permit is not needed.
326. **Comment:** The MDEQ should not make a decision on the groundwater discharge permit until the EPA permitting process for an underground injection control permit is complete.
- Response:** These are separate permitting programs, one state and the other federal. The limitations in the groundwater discharge permit meet the Part 22 Rules standards, which are more conservative than limitations that would be developed pursuant to the Clean Water Act. The issuance of a groundwater discharge permit does not preclude the applicant from obtaining all other necessary permits, including those for which the federal government is responsible.
327. **Comment:** Kennecott's application admits that it will discharge polluted water into aquifers.
- Response:** The groundwater discharge permit requires KEMC to meet all applicable groundwater and surface water standards required pursuant to the Part 22 Rules.
328. **Comment:** Add language regarding a shut down of the mine if limits have been exceeded to the point that they threaten public health and the environment. Expected wastewater characteristics included in the permit application did not include copper.
- Response:** The Part 22 Rules, specifically Rule 2227(2)(j), give the MDEQ that authority regardless of whether the language appears in the permit or not. However, language has been added to Section 12.d) of the draft groundwater discharge permit that reiterates the MDEQ's authority to close the facility or end the discharge if a standard is exceeded. The omission of copper in the table listing expected effluent quality in Attachment II of the draft permit was an error. That parameter is now listed in the table.
329. **Comment:** Nor has Kennecott shown that the area chosen for discharge of the groundwater will not cause venting of contamination to the Salmon Trout River.
- Response:** The groundwater that vents to the Salmon Trout River is required to meet the Part 22 standards, which require venting groundwater to be protective of surface water.
330. **Comment:** The permitting of effluent chemical levels above MDEQ's groundwater standards Part 22 Rule along with proof of Kennecott's past track record leads us to strongly discourage the approval of the permit.
- Response:** KEMC will be required to meet effluent and groundwater limits based upon the Part 22 Groundwater standards, which are required to be protective of surface water; or groundwater levels calculated from existing groundwater quality.

331. **Comment:** Need for discharge limits on Chloride, Sodium, and Sulfate and groundwater limits for all regulated parameters.

The table of Final Effluent Limitations in the Groundwater Discharge Permit gives concentration limitations of only seven parameters. Considering the size of the facility and the fairly complex nature of operations, this list seems unreasonable brief. It is not clear how the list of limits for seven parameters corresponds with applicable water quality standards. MDEQ should consider adding perchlorate and/or other explosive-related chemicals to the list of groundwater monitoring parameters.

Response: The parameter list is based upon expected wastewater characteristics for the proposed mine operation. Effluent limitations were assigned to “indicator parameters” that were identified as being indicative of the wastewater treatment system operating properly and others that were critical to protection of surface water. While the remaining parameters are report only, Rule 2204(2)(f) prohibits the discharge from creating a facility as defined under Part 201, and these levels will be closely monitored. Additional limits have been added to Section 4, Groundwater Monitoring and Limitations, for downgradient monitor wells.

Antidegradation, Best Technology in Process and Treatment

332. **Comment:** Kennecott's plans do not follow the rules for non-degradation. Non-degradation permitting should be followed.

Response: The Department agrees that this activity is subject to the antidegradation requirements specified in Rule 323.1098. The application submitted on February 22, 2006, contained information relative to Rule 323.1098 such as alternatives considered and best technology in process and treatment. However, the application was determined to be incomplete relative to other requirements of Rule 323.1098. The Department requested more information to address antidegradation requirements regarding social and economic development and the benefits that would be forgone if the new or increased loading is not allowed. This information was provided by Kennecott to complete the application. The department believes antidegradation requirements were appropriately applied to this situation and the applicant met the requirements of this rule.

333. **Comment:** I don't feel that the BTPT (best technology in process and treatment) that would eliminate or reduce the new or increased loading of the Lake Superior Basin-Bioaccumulative Substance of International Concern is an acceptable standard.

Response: The limit that was placed in the permit for mercury, which is the only Bioaccumulative Substance of International Concern in the discharge, was developed pursuant to the Part 4 water quality standards to be protective of surface water. Section 4.b.iii of Rule 1098 requires the discharger to use the best technology in process and treatment (BTPT). It further requires that the BTPT be the most advanced treatment techniques which have been adequately demonstrated to provide appropriate treatment and which are reasonably available to the discharger. The proposed treatment system is a full scale, advanced wastewater treatment system (WWTS) capable of producing an effluent that is protective of surface water for mercury, and therefore meets the requirements of the BTPT under Rule 1098 and water quality standards.

Compiled Responses to Comments, October 27, 2006

Response to Public Comments on Supplemental Information Submitted by Kennecott. Following is a list of additional issues raised in public comments on the additional information provided by Kennecott on October 27, 2006, and the responses by the DEQ.

334. **Comment:** Kennecott's responses did not answer the DEQ's questions, or answered them inadequately.

Response: Some of Kennecott's responses did not follow the format of the questions. However, the Review Team evaluated the responses in the context of the original application, the requirements of Part 632 and the rules promulgated thereunder, and independent information, and determined that Kennecott had satisfied the pertinent requirements.

335. **Comment:** Kennecott has not proven there would be no damage resulting from subsidence.

Response: Kennecott provided additional information on calculation of the crown pillar stability. Kennecott further clarified that mining would proceed in a phased manner, with additional exploratory testing and evaluation of stability being conducted as mining progresses upward. The DEQ will take a precautionary approach with regard to this issue. The DEQ would include a condition in the Mining Permit prohibiting Kennecott from continuing upward expansion beyond an elevation of 3275 meters (leaving a crown pillar thickness of 87 meters) unless and until additional data and modeling assure that it is safe for both the miners and the environment.

336. **Comment:** Kennecott's plans do not prevent potential adverse impacts to surface water, groundwater, and wetlands from leakage through the Crown Pillar.

Response: Hydrologic modeling results presented in Kennecott's application present two scenarios: base (expected) case and upper-bound (worst) case. The base case model predictions indicate no measurable hydrologic impact to surface water, groundwater, or wetlands. The upper-bound case model predictions indicate a potential localized decline of groundwater water levels of approximately eight inches in the uppermost aquifer directly over the crown pillar. The modeling inputs used were very conservative and assumed the entire mine would be open, when in fact the mine would be backfilled as mining progresses upward. The backfilling would add stability and counter the possibility of fracturing and resultant hydraulic communication with overlying aquifers. Even in the worst case, the approximate eight inches of decline of the water table would have little effect on the surrounding wetlands or surface waters. However, as added assurance Kennecott would utilize a phased mining approach and would be required to closely monitor water levels in all aquifers and at all surface water bodies that could potentially be impacted. In addition, pumping volumes from within the mine would be closely monitored. With the required extensive monitoring, potential impacts would be identified early enough to initiate preventive measures.

337. **Comment:** Kennecott has not adequately defined the proposed transportation route for hauling ore and supplies and has not taken into account seasonal load restrictions.

Response: Kennecott identified the intended haul route in the permit application, and confirmed it in the supplemental response Starting at the proposed plant site the route would follow (1) CR AAA east to CR 510 (2) north on CR 510 to CR 550 (3) CR 550 to Wright Street in Marquette (4) Wright Street to U S 41 (5) West on U S 41 to CR FN at Humbolt (6) and then 0.4 miles north on CR FN to the proposed railhead. In the permit application, Kennecott states that during seasonal weight restrictions loads would be reduced to 65 percent of the normal load to meet County requirements.

338. **Comment:** Spills and dust at the ore loadout, along the transportation route, and at the railhead storage facility could cause unacceptable environmental damage.

Response: Kennecott's plan incorporates effective measures to curtail losses of potential contaminants. At the mine, the ore would be stored in an enclosed facility. The loaded ore trailers would be covered with solid box covers. Before trucks leave the site they would be washed. In addition, haul trucks would be required to follow all applicable transportation regulations including seasonal weight restrictions. The haul trucks would deposit the ore in an enclosed facility at the railhead. In the event of a spill at a stream crossing, appropriate cleanup procedures would be implemented Due to the size and density of the crushed ore, it would be unlikely to be transported down stream; therefore, the spill would remain localized and could be readily recovered. While the ore would be reactive (i.e., it has the potential to generate acidic leachate), the reaction rate is slow enough to allow for effective cleanup measures before any measurable reaction occurs.

339. **Comment:** The proposed mining activities could impact the Kirtland's Warbler.

Response: Subsequent to the receipt of Kennecott's mining application by the DEQ, a Kirtland's Warbler was identified approximately two miles from the proposed mine site. In response to the reported sighting, the DEQ requested in the June 21, 2006 letter to Kennecott, that they provide information on the potential impact the Eagle Project could have on the Kirtland's Warbler. In Kennecott's response, a study was provided that was conducted during known breeding times and encompassed 465 acres including the footprint of the proposed mine site. The study was conducted in accordance with DNR guidelines for threatened and endangered species. Based on the study there is no evidence Kirtland's are utilizing the study area for breeding. The study concludes the project would not have an impact on the Kirtland's Warbler.

340. **Comment:** Air and groundwater impacts are not adequately addressed.

Response: The Mining Permit application and supplemental response does contain information addressing these areas of concern. However, the separate Air Use and Groundwater Discharge permit applications contain not only the information in the Mining Permit application but additional information as well. In that both of these permits are also being proposed for approval the corresponding Part 632 issues are satisfactorily addressed.

341. **Comment:** A recent report by James Kuipers and Ann Maest indicates that hardrock mines located near both surface water and ground water have commonly exceeded water quality standards. The DEQ should independently review Kennecott's predictions.

Response: The DEQ has done an initial review of the Kuipers and Maest report. The Review Team has conducted an independent review of Kennecott's water quality predictions and found them to be satisfactory, even assuming the potential for a relatively large error in predictive modeling. At the proposed Eagle Project, there would be several factors that would provide a margin of safety: ore and waste rock would be stored for relatively short periods; ore would be in an enclosed building, and waste rock under an impervious cover; and all waste rock would be emplaced into mined-out areas surrounded by very low-permeability rock, in an environment that would be anaerobic after the mine is closed.

342. **Comment:** Kennecott did not adequately delineate the Affected Area, and did not provide a satisfactory basis for its delineation.

Response: Kennecott provided a description of the affected area for each feature required under Part 632: topography and drainage, soils, geology, hydrology, water supply wells, part 201 facilities, wetlands and floodplains, terrestrial biology and invasive species, threatened and endangered species and species of special concern, natural and wild and scenic river and wilderness research and recreational areas, public and private buildings, public roads, pipelines and power lines, land use, aquatic resources, cultural historical and archaeological resources, air quality, and esthetic resources. The Review Team found the delineation to be satisfactory.

343. **Comment:** Kennecott has not addressed monitoring of groundwater near chemical storage facilities.

Response: Groundwater monitoring proposed by Kennecott will include analysis of parameters that are appropriate indicators for the chemicals proposed to be stored. In addition, the federal SPCC plan will incorporate necessary monitoring.

344. **Comment:** Kennecott did not adequately address potential impacts from noise and light, and control measures.

Response: In its supplemental response, Kennecott defined the affected areas for noise and light; identified noise suppressant measures and addressed the issue of noise-sensitive features; and described light sources and measures to minimize impacts. The Review Team found the descriptions and proposed mitigation measures to be satisfactory.

345. **Comment:** Kennecott did not adequately address cumulative and additive impacts.

Response: In its supplemental response, Kennecott satisfactorily identified how cumulative and additive impacts were addressed, primarily in assessing potential impacts on surface water flow, groundwater elevations, groundwater quality, surface water quality, aquatic biota, and wetlands. The Review Team found Kennecott's information to satisfy the requirements of Part 632.

346. **Comment:** Kennecott predicts that iron and nickel concentrations will be elevated in mine water; the DEQ should require a detailed pump and treat plan. Also, the predicted concentrations would be a violation of Part 632.

Response: Kennecott's application includes detailed plans for mine pumping and water treatment. Elevated metal concentrations would not contravene the provisions of Part 632 unless they are not properly dealt with.

347. **Comment:** Kennecott did not adequately address monitoring of fish, fish habitat, and aquatic macroinvertebrate populations.

Response: In its application, Kennecott proposes to monitor fish, aquatic macroinvertebrates, and aquatic habitat on an annual basis, utilizing the Great Lakes Environmental Assessment Section Procedure 51. The DEQ would include appropriate conditions in the Mining Permit to assure that the monitoring results would be utilized in conjunction with other environmental parameters to assess potential impacts.

348. **Comment:** Kennecott did not adequately address water quality downgradient from the non-contact water infiltration basins.

Response: The DEQ has determined that Kennecott's plans provide for effective surface water and groundwater monitoring downgradient of the non-contact water infiltration basins.

Compiled Responses to Comments, June 21, 2006

Compiled Comments and Responses made regarding the Application for Mining Permit by
Kennecott Eagle Minerals Company

Department of Environmental Quality, Office of Geological Survey, June 21, 2006.

The following is a summary of comments collected during the public meeting held on April 18, 2006, and received by the DEQ in writing, regarding the content of the Eagle Mine Application submitted to the DEQ on February 22, 2006.

349. **Comment:** Insufficient time to review the document.

Response: Section 63205 in Part 632 outlines a very prescriptive time line to follow for reviewing an application.

350. **Comment:** A description of the basis for determining the affected area was not included.

Response: The DEQ requested the applicant to clarify methods used to define the affected area for the conditions or features outlined in the Environmental Impact Assessment (EIA).

351. **Comment:** No visual or noise analyses are presented to support the conclusions in the EIA.

Response: The DEQ requested the applicant to provide a description of the basis for determining the sensitive receptors in section 318 of the EIA.

352. **Comment:** The application fails to provide any information with regard to the railhead.

Response: The DEQ requested the applicant to provide a description of the transportation route and load out facility.

353. **Comment:** The application does not contain monitoring along the route to detect any tracking, dusting, or other release of sulfide material during transportation.

Response: The applicant will be required to adhere to appropriate Department of Transportation (MDOT) and State Police motor carrier standards.

354. **Comment:** Cumulative impacts are not sufficiently addressed in the application.

Response: The DEQ requested the applicant to clarify the rationale for determining cumulative and additive impacts.

355. **Comment:** Each of the proposals for monitoring at the site should contain an action limit and a plan to respond to changes in baseline conditions.

Response: The applicant will be required to follow the standards set in Rule 406 (6) through (9).

356. **Comment:** The application contains no analyses of the effectiveness of reducing or minimizing impacts of non-native or invasive species.
- Response:** The applicant identifies, in section 3.9.2 of the EIA, potential impacts and mitigation measures and will implement an invasive species control plan prior to construction.
357. **Comment:** More details are needed about what alterations need to be made to the AAA Road.
- Response:** The applicant will be required to comply with Marquette County Road Commission (MCRC) standards for road improvements and maintenance.
358. **Comment:** The application does not identify potential impacts to the McCormick Wilderness Area by noise and aesthetics.
- Response:** The DEQ requested the applicant to provide a description of the basis for determining the sensitive receptors in section 3.1.8 of the EIA.
359. **Comment:** The flora surveys performed by the applicant do not identify all of the species that should be expected to occur at the site.
- Response:** The DEQ requested the applicant to clarify methods used to define the affected area for the conditions or features outlined in the EIA. The above information will assist in making a determination if the surveys accomplished the objective.
360. **Comment:** The conclusion in the application states no threatened or endangered mammal species or species of concern were identified; however, the moose and spruce grouse are listed as species of special concern on the current Michigan list.
- Response:** The applicant observed species of special concern outside the proposed project area. However, the DEQ requested the applicant to clarify methods used to define the affected area for the conditions or features outlined in the EIA.
361. **Comment:** A more descriptive management scheme for handling dewatered sludge and brine solids should be defined in the application.
- Response:** The DEQ requested the applicant to provide a plan for disposal and handling of solid waste not exempt from the definition solid waste.
362. **Comment:** The Temporary Development Rock Storage Area (TDRSA) must be adequately sized to hold all development rock and added limestone, and space should not be used for snowmelt storage.
- Response:** The referenced use is for emergencies only and would be temporary. The DEQ requested the applicant to provide a plan for maintaining the requirement of less than one foot of head on the liner system.

363. **Comment:** Analysis of bentonite displacement in construction of the TDRSA must be conducted before equivalency with three feet of clay can be determined.
- Response:** The DEQ requested the applicant to clarify what standards will be used for testing liner materials.
364. **Comment:** The analysis for the TDRSA does not account for stored snow within the basin.
- Response:** The DEQ requested the applicant to provide a plan for maintaining the requirement of less than one foot of head on the liner system.
365. **Comment:** Monitoring of groundwater under the TDRSA will be combined by flow from the Treated Water Infiltration System (TWIS).
- Response:** The DEQ requested the applicant to provide a plan to prevent masking of water quality samples by discharge from the TWIS.
366. **Comment:** The groundwater monitoring proposes to monitor changes in constituents using techniques that are unable to detect background concentrations of many constituents.
- Response:** The applicant proposes EPA and DEQ approved analysis methods for water quality.
367. **Comment:** While the relatively low conductivity of the bedrock currently limits upward movement of deep groundwater, post mining conditions will do little to impede upward movement.
- Response:** The DEQ requested the applicant to provide analysis of potential upward migration of groundwater.
368. **Comment:** Packer test data should be scaled up one or more orders of magnitude to be more inline with the pump test results.
- Response:** The DEQ requested the applicant to provide analysis and results of model sensitivity.
369. **Comment:** No justification is given for the assumption that only five years of water treatment will be needed to clean up the contaminated upper mine.
- Response:** The DEQ requested the applicant to clarify how water will be managed if the TWIS is removed 5 years prior to removal of the WWTP.
370. **Comment:** The applicant must make predictions of near term contaminant concentrations from within the mine.
- Response:** The applicant identifies predicted water quality in the mine at end of mining in Appendix D-5 of the Mine Application.

371. **Comment:** The EIA should contain a detailed description of potential impacts for unplanned subsidence.
- Response:** The applicant provides an adequate contingency plan for unplanned subsidence; however, the DEQ requested the applicant to provide additional analysis to confirm predicted stability of the crown pillar.
372. **Comment:** There is no description of the response that will be made should any groundwater samples be found to exceed the criteria set in R425406.
- Response:** The applicant will be required to follow the standards set in Rule 406 (6) through (9).
373. **Comment:** The Gentic surveys were incomplete.
- Response:** The DEQ determined the surveys conducted by the applicant are adequate; however, the DEQ requested the applicant to clarify methods used to define the affected area for the conditions or features outlined in the EIA.
374. **Comment:** To collect the only specimen of potentially endangered species (yellow- pond lily) is irresponsible and potentially a violation of the Consultant's Michigan Rare Species Collection permits.
- Response:** The DEQ requested the applicant to clarify the procedures followed for identification of the Yellow-pond Lily.
375. **Comment:** Application fails to demonstrate that proposed methods and techniques are capable of preventing leaching.
- Response:** The DEQ requested the applicant to provide clarification on methods that would satisfy the requirements of Part 632.
376. **Comment:** Characterization of rock reactivity is unreliable.
- Response:** The application outlines approved methods in Section 23 of Volume IB.
377. **Comment:** Claims regarding ability to identify and control 100 percent of massive and semi-massive sulfides are unsubstantiated.
- Response:** The DEQ requested the applicant to provide results from calculated time to consumption of the neutralization capacity using long term column leaching data.
378. **Comment:** Potential impacts of the mine on the adjacent forests of the Huron Mountains are not addressed in the application.
- Response:** The DEQ requested the applicant to clarify methods used to define the affected area for the conditions or features outlined in the EIA.

379. **Comment:** The applicant fails to ensure protection from Acid Rock Drainage (ARD) in backfilled underground mine workings.
- Response:** The applicant provides a number of methods to reduce the potential for ARD by mixing limestone with backfill rock, grouting mine workings with cement, and rapidly backfilling the mine workings with water; however, the DEQ requested the applicant to provide results from calculated time to consumption of the neutralization capacity using long term column leaching data.
380. **Comment:** There is no discussion or demonstration of the method described as sealing of the deeper mine levels to prevent upward mixing, including methods, materials, testing, or documented applications in similar settings.
- Response:** The DEQ requested the applicant provide information or analysis that demonstrates that sealing will accomplish the proposed objective.
381. **Comment:** The applicant fails to provide information regarding alternatives explored and explanation of the rationale used to select the chosen alternative.
- Response:** The application outlines alternatives analysis in Section 4 in the EIA.
382. **Comment:** Dust clouds associated with heavy trucks and with cement manufacturing will severely damage fragile terrestrial and aquatic ecosystems.
- Response:** Measures to control fugitive dust will be required in accordance with the Air Quality permit to install, and cement mixing will occur underground.
383. **Comment:** The applicant fails to demonstrate that financial assurance will cover all required costs.
- Response:** DEQ requested the applicant to provide additional clarification on several aspects of the Financial Assurance calculations.
384. **Comment:** The application does not contain and evaluate all required site specific data.
- Response:** The DEQ requested the applicant to provide all information required by Rule 202(3).
385. **Comment:** The application fails to provide the required confidence interval.
- Response:** The DEQ requested the applicant to clarify where statistical analysis methods were used and provide the analysis and results.
386. **Comment:** The application does not evaluate the potential impacts of blasting on the condition of the bedrock and unconsolidated materials overlying the bedrock.
- Response:** The DEQ requested additional modeling on the affects from blasting.
387. **Comment:** The application does not provide a complete transportation plan.

Response: The DEQ requested the applicant to clarify the transportation route and load out facility.

388. **Comment:** The incompleteness of Kennecott's Groundwater Discharge Permit application renders the application incomplete.

Response: While the requirements for the Groundwater Discharge Permit and the Mining Permit overlap, they are not identical. The Mining Permit, if granted, would not be effective until all other permits required under 1994 PA 451 for the proposed mining operation are obtained.

389. **Comment:** The application does not include the required chemical and physical testing and modeling to predict the potential generation of acid, dissolved metals, and other related substances.

Response: Appendix D-1 through D-5 outlines the methods and results of all chemical testing of the ore, development rock, and peripheral rock. The DEQ has determined that this information satisfies the pertinent requirements under Part 632.

390. **Comment:** Some application materials were submitted in an electronic format that is not text searchable.

Response: The applicant submitted the documents in an electronic format that was approved by the DEQ. Neither Part 632 nor DEQ policy requires application documents to be text searchable.

391. **Comment:** Nothing is mentioned in the application about the maintenance and improvements of County Road 550.

Response: The Part 632 Rules require description of roads to be used, and of provisions to prevent contamination from ore or waste rock transportation; however, road maintenance and improvements are subject to other jurisdictions—in this case, the MCRC and MDOT.

392. **Comment:** The DEQ should permit this project with the stipulation that the trucking route be moved to the western end of Marquette County coming south from the mining project to the railhead somewhere in Champion or Humboldt Townships.

Response: There is no evidence that the proposed alternative route would result in less potential for environmental impact.

393. **Comment:** The application does not include a plan to protect threatened or endangered species that were detected within the area of the proposed mine.

Response: The only threatened or endangered species identified is the narrow-leafed gentian, and the application demonstrates there will be no adverse impact on the species.

394. **Comment:** The DEQ should require Kennecott to submit an administratively complete application and should render the public's right to review and comment meaningful by providing sufficient time to analyze and comment upon that complete application.
- Response:** The Eagle Project Mining Application was determined to be administratively complete by the DEQ. The time for public comment is dictated by the time line in the Statute and Rules.
395. **Comment:** The application does not contain and evaluate all required site specific groundwater occurrence data.
- Response:** The DEQ requested the applicant to provide all information required by Rule 202(3).
396. **Comment:** The application does not contain and evaluate all required site-specific surface water quality, level, and discharge rate data.
- Response:** The applicant provides the necessary surface water flow and quality analysis in Section 3.1.4.3 in Volume II of the EIA.
397. **Comment:** The application does not contain and evaluate all required meteorological data.
- Response:** The DEQ requested the applicant to provide all required information that fulfills the requirements of rule 202(3).
398. **Comment:** The leak detection system for the TDRSA does not extend under the whole rock storage area.
- Response:** The DEQ requested the applicant to provide a plan for leak detection under the entire TDRSA.
399. **Comment:** Kennecott has not sufficiently characterized hydrogeologic conditions.
- Response:** The applicant provides a detailed analysis of the hydrogeological conditions in Appendix B- 1 through B-10 in the EIA.
400. **Comment:** The application does not provide a complete list of other permits needed.
- Response:** The applicant provided a list of all state and federal permits anticipated to be required.
401. **Comment:** The application's discussion of historic and cultural sites is incomplete.
- Response:** The State Historic Preservation Office concluded the applicant completed a thorough review of the site.
402. **Comment:** Surface facilities should not be located on State land.

Response: This concern will be addressed by the DNR in its review of surface leasing issues.

403. **Comment:** Eagle Rock should not be used as the mine portal.

Response: There is no basis under Part 632 to preclude Eagle Rock as a mine portal. The DNR has authority over mine development on state land.

404. **Comment:** Stormwater management plans are incomplete and inadequate.

Response: The application contains a detailed storm water management plan in Section 4.3.10 – 4.3.10.2 and the applicant has been advised they will need an industrial storm water permit.

405. **Comment:** The water balance analysis is inadequate.

Response: The application provides extensive information on the water balance for the proposed project; in addition, the modeling results incorporate very conservative assumptions.

406. **Comment:** The mine design and layout presented does not ensure that no subsidence will occur.

Response: The DEQ requested that the applicant provide additional analysis of subsidence.

407. **Comment:** The treatment and containment plan is inadequate because it does not protect water in the upper bedrock aquifer.

Response: The application presents information on methods to prevent contamination to the aquifer.

408. **Comment:** Impacts to hydrology from predicted plastic deformation must be disclosed.

Response: The DEQ requested the applicant to provide additional modeling for plastic deformation.

409. **Comment:** The Groundwater quality monitoring network is inadequate.

Response: A description of the groundwater monitoring network is presented in Section 62 of Volume I. The Water Bureau (WB) and Office of Geological Survey (OGS) will coordinate monitoring requirements to assure adequate monitoring at the facility if a permit is issued.

410. **Comment:** All monitoring wells should remain in place to continue to provide monitoring as needed.

Response: The WB and OGS will coordinate monitoring requirements to assure adequate monitoring at the facility if a permit is issued. Specific monitoring wells will be required to remain during the post closure monitoring period as appropriate.

411. **Comment:** More surface water monitoring sampling locations are needed.

Response: The DEQ requested the applicant to provide a surface water monitoring plan that includes the seeps located on the north terrace.

412. **Comment:** Monitoring data must be easily accessible to the public.

Response: Data and information provided to the DEQ is provided to the public upon request.

413. **Comment:** Monitoring in the Non-Contact Water Infiltration Basins (NCWIBs) should be required.

Response: The DEQ requested the applicant to provide a plan for monitoring the NCWIBs.

414. **Comment:** Air emissions monitoring should be required.

Response: The OGS is coordinating with the Air Quality Division to assure necessary monitoring.

415. **Comment:** Mitigation must be identified for the narrow-leaved gentian.

Response: The application provides a worst-case analysis and indicates no impact to wetland species. If a permit is issued, monitoring will be required for water levels and quality in wetlands, and if impacts are detected from mining, then mitigation will be required by the applicant.

416. **Comment:** Monitoring results showing impacts on flora, fauna, and habitat must be available to assess compliance.

Response: The OGS, WB, and DNR will coordinate monitoring requirements as permit conditions to assure adequate monitoring at the facility if a permit is issued.

417. **Comment:** Reclamation plan for the treatment plant is missing crucial information.

Response: The application provides information on the reclamation for the treatment in Section 7.4 of Volume I.

418. **Comment:** Reclamation plans for the underground workings are inadequate.

Response: The application provides adequate information on the reclamation of the underground workings in Section 7.4.2 in Volume I.

419. **Comment:** The post closure monitoring plan is inadequate.
Response: The DEQ has found that the post closure monitoring plan meets the requirements of Part 632.
420. **Comment:** Reclamation costs do not have an adequate basis. The costs need to be recalculated to account for an unplanned necessity for a third party to conduct reclamation.
Response: The DEQ requested the applicant to provide clarification on reclamation costs.
421. **Comment:** The contingency plans are inadequate; spills and leaks are highly probable, and the plan does not provide for berm failure, containment system failure, unforeseen movement of water from the mine into the alluvial aquifer, and potential contamination of the upper bedrock aquifer.
Response: The DEQ has found that the contingency plans, in Section 8 of Volume I meet the requirements of Part 632.
422. **Comment:** More detail is needed regarding potential movement of Contact Water Basin (CWB) water into the TDRSA or mine workings.
Response: The DEQ requested the applicant to provide a plan for leak prevention for conveyance systems.
423. **Comment:** The EIA does not meet the requirements of the Natural Resources and Environmental Protection Act.
Response: The DEQ requested the applicant to provide clarification or additional information for several portions of the application.
424. **Comment:** The application is confusing to readers.
Response: Due to the complex and technical nature of this type of operation the application is written for technical readers.
425. **Comment:** The application does not adequately address feasible and prudent alternatives.
Response: The DEQ has found that the application meets the requirements of Part 632 with respect to feasible and prudent alternatives in Section 4.0 in the EIA.
426. **Comment:** The application discusses a leakage rate of 0.000511 inches/acre/day. This does not meet the standard set in the law to "prevent leakage".
Response: The application provides analysis of the hydraulic conductivity of the liner system that meets Rule 409 (a)(i)(A).

427. **Comment:** The stability of the natural bedrock below the stream would be weakened and compromised as a result of mining. The concrete backfill will settle over time allowing plastic deformation to exceed 2 centimeters.
- Response:** The DEQ requested the applicant to provide sensitivity analysis on the crown pillar.
428. **Comment:** The Company has no research to explain the effects of the sulfide mining dust that will be carried into Lake Superior by the rain, or the chemicals that will leach from the cement used to fill the ground shafts and be carried by the groundwater into Superior.
- Response:** The application provides a plan in Sections 8.1.7.1 through 8.1.7.3 in Volume I for minimizing impacts from fugitive dust.
429. **Comment:** The application provides no information on impacts within the mining area.
- Response:** The DEQ has found that the application meets the requirements of Part 632 in terms of information on impacts within the mining area.
430. **Comment:** The EIA should reveal whether any increase in metals or sulfides will be allowed to remain without remediation.
- Response:** The applicant will be required to meet water quality standards in Rule 406 (6), (7), and (8).
431. **Comment:** The application fails to disclose potential impacts that would occur if any of its mitigation or contingency measures fail.
- Response:** The application provides adequate analysis and information addressing contingency measures in Section 8 of Volume I.
432. **Comment:** The mineral rights acquisition process in Michigan is in need of serious redress.
- Response:** The acquisition of mineral rights is governed by long-established common law (i.e., law established by court precedent) that cannot be changed though the process of a permit application review.
433. **Comment:** There has been no determination on how thick the crown pillar needs to be to prevent subsidence.
- Response:** The DEQ requested the applicant to provide analysis on crown pillar stability.
434. **Comment:** There is no information about how Kennecott might prevent spilling ore on its transportation route.

Response: The application provides a plan for reducing potential impacts from ore hauling in Section 8.1.7.2 in Volume I; however, the DEQ requested the applicant to clarify what measures will be taken to control fugitive dust from haul trucks in their return route to the mine.

435. **Comment:** There is a lack of response plans protective of human health and the environment.

Response: The application provides adequate plans for the protection of human health and the environment in Section 4.3.1.8 and Section 8 in Volume I.

436. **Comment:** Incomplete and missing contingency plans are not reflected in financial assurance calculations.

Response: DEQ requested the applicant to provide additional clarification on several aspects of the Financial Assurance calculations.

437. **Comment:** The plans for erosion and erosion control are not sufficient.

Response: The application provides plans for soil erosion and sediment control in Sections 4.2.1 through 4.2.3 and Sections 4.3.10.3 through 4.3.10.5 in Volume I.

438. **Comment:** The placement of such a mine under the headwaters of one of the area's major rivers should be postponed until the hydrology of the area is much better understood.

Response: The application provides a hydrologic analysis in Appendix B in the EIA. However; the DEQ has requested the applicant to provide additional information.

439. **Comment:** The DEQ should halt their review of the application until it meets all of the legislated requirements.

Response: It is typical for the DEQ to perform an initial review of an application and identify a need for clarification or additional information.

440. **Comment:** On site as well as off site impacts to surface runoff need to be disclosed.

Response: The DEQ requested the applicant to provide information on the affected area.

441. **Comment:** The groundwater divide is not adequately defined south and east of the mine surface facilities.

Response: The DEQ requested the applicant to provide figures with more detail including the groundwater divide in the ore body and surface facility area.

442. **Comment:** A sulfide mine has never been operated anywhere in the world without creating sulfuric acid run-off over long periods of time.

Response: The Statute and Administrative Rules are designed to protect human health and the environment.

443. **Comment:** A description and analysis of the entire bedrock groundwater regime is required by the regulations and is missing from the EIA.

Response: The application provides a hydrologic analysis in Appendix B in the EIA. However, the DEQ has requested the applicant to provide additional information.

444. **Comment:** The EIA should disclose the impacts on hydrology if Kennecott's assumptions prove wrong.

Response: The application provides a description of contingency measures in Section 8 of Volume I.

445. **Comment:** The EIA does not provide sufficient information on drawdown around the mine.

Response: The DEQ requested the applicant to provide additional information on the modeled effects of the upper bound case.

446. **Comment:** Kennecott must provide the necessary demonstration that proposed technology, not widely accepted, is effective and will work in this circumstance 63205(2)(c)(ii).

Response: The application provides detailed information on widely accepted systems and methods to prevent adverse environmental impacts.

447. **Comment:** The amount indicated for remediation to air, surface water, or groundwater in the financial assurance section is inadequate.

Response: The DEQ has requested the applicant to provide clarification on some aspects of the Financial Assurance calculations.

448. **Comment:** The EIA should provide information on the full distance that measurable drawdown of the water table will extend.

Response: The DEQ has requested the applicant to provide tables and maps clearly describing the impacts to hydrology (base case and upper-bound case) in the area around the ore body.

449. **Comment:** The permit application should address the important issue of coaster brook trout.

Response: The application presents information referencing the coaster brook trout in Section 3.15 in the EIA.

450. **Comment:** The permit application should include a discussion of the uncertainty associated with the modeling studies so the public and the State of Michigan can understand the future uncertainty of preventing ARD.
- Response:** The application provides contingency plans to address such uncertainties.
451. **Comment:** The mine application does not provide any details on where the cement and the Class C fly ash that are used in backfilling the mine will be obtained from.
- Response:** The applicant is required by others regulations to obtain fly ash from a producer that meets Class C requirements. In addition, the DEQ has requested the applicant to clarify how the ash will be transported and transferred.
452. **Comment:** The EIA needs to reveal the current quality of groundwater and the level to which groundwater quality will be allowed to deteriorate before any remedial action is taken.
- Response:** Section 3.4 of the EIA identifies baseline groundwater quality and levels, and for water quality during operations and post mining the applicant will be required to address the standards in Rule 406.
453. **Comment:** The geochemical modeling studies should include an analysis of the metals content of the fly ash that will be used in backfilling.
- Response:** The producers of fly ash must provide adequate chemical data to the DEQ to qualify them as a Class C provider.
454. **Comment:** The application should include a contingency plan to ensure the hydraulic loading of the treatment system is not exceeded by employees' wastewater.
- Response:** The application provides plans for regular testing of contingency plans.
455. **Comment:** The EIA needs to disclose the potential impacts of groundwater discharges on surface water quality.
- Response:** The OGS will work closely with the WB to assure proper modeling will be conducted by the applicant to predict water quality at venting locations.
456. **Comment:** A longer-term hydrogeologic survey of the Salmon Trout River and surrounding areas should be completed or overseen by an impartial party.
- Response:** The Rule 202 dictates that an applicant provide the DEQ a comprehensive hydrologic study for the proposed operation.
457. **Comment:** The EIA should provide information on the potential impacts especially to the Salmon Trout and Yellow Dog rivers if various safeguards fail.
- Response:** The application provides a description of contingency plans for each media.

458. **Comment:** The EIA does not address how upwellings in streams and rivers rather than total stream flow might be affected by mine dewatering.
- Response:** The DEQ has requested the applicant to provide tables and maps clearly describing the impacts to hydrology (base case and upper-bound case) in the area around the ore body.
459. **Comment:** The EIA tells little or nothing about what area of wetlands can be expected to be impacted due to groundwater drawdown.
- Response:** The application indicates there will be no significant impacts on wetlands. However, the DEQ has requested the applicant to provide tables and maps clearly describing the impacts to hydrology (base case and upper-bound case) in the area around the ore body.
460. **Comment:** No convincing evidence is presented that this mine site is qualitatively different from sites where fuel spills have occurred in the past.
- Response:** The applicant will be required to submit and follow a Spill Prevention Control and Countermeasures Plan (SPCC) as per 40 CFR 112 and Pollution Incident Prevention Plan (PIP) prior to construction.
461. **Comment:** The EIA should include possible impacts on terrestrial invertebrates, amphibian, and reptiles.
- Response:** The DEQ has requested the applicant to provide a plan describing how fish, fish habitat, and aquatic macroinvertebrate populations will be monitored from the time of mine construction through reclamation. This plan should include information on methods and frequency of monitoring events.
462. **Comment:** The information presented in the EIA is not sufficient to determine what invasive species might be introduced by mining activities.
- Response:** The application provides methods to prevent invasive species and presents revegetation methods that reduce potential introduction of invasive species in Section 3.9 of the EIA.
463. **Comment:** Further clarification of the type of native vegetation to be used during reclamation is needed.
- Response:** The application provides details on the types of vegetation that will be used for reclamation in Section 7.4.1.10 in Volume I.
464. **Comment:** Increased traffic and road crossings could increase sediment load in rivers and streams.
- Response:** The applicant will be required to conform to all MCRC and MDOT road improvements and maintenance standards.

465. **Comment:** The EIA should disclose the potential impacts on the coaster brook trout if its efforts to contain acid mine drainage and/or direct discharges of pollutants to the Salmon Trout River fail.

Response: The application outlines methods to prevent discharge of pollutants and OGS and WB will work closely to require a monitoring program to prevent pollutants from affecting the Salmon Trout River.

466. **Comment:** The EIA needs to discuss the impacts of the mine on habitat for moose and wolves and other wildlife species.

Response: The application addresses the occurrence of moose, wolves, and other wildlife species, and concludes that impacts on these species would be minimal. However, the DEQ requested the applicant to clarify methods used to define the affected area for the conditions or features outlined in the EIA, to help evaluate potential impacts.

467. **Comment:** The potential impact of vaccinium (blueberries) in, around, and along AAA needs to be addressed.

Response: The application indicates there will be no impact to the blueberries outside of the area that would be utilized for mine facilities.

468. **Comment:** A series of modeling simulations should be required that will account for at least the standard deviation of heterogeneity and the anisotropic conditions found within all the overburden units.

Response: The DEQ has requested the applicant to provide sensitivity analysis for a number of model input parameters, including hydraulic conductivity, conductance through river beds, porosity, select boundary conditions, and recharge rates.

469. **Comment:** A series of fracture bedrock simulations should be required to address the fracture frequency and range in apertures found in the field studies.

Response: The applicant has accounted for a range of fracture frequencies and widths in their models that is significantly larger than indicated by their field tests. The base case model was calibrated against their field test results. The upper bound case model assumes a 285% increase in the flow of groundwater through bedrock fractures, which adequately models the possibility of extreme flow conditions.

470. **Comment:** The road from the crushed ore bins to the truck wash is not covered with bituminous concrete and is not surrounded by drainage ditches.

Response: The DEQ requested the applicant to provide clarification on road material that will be used from the crushed ore bins to the truck wash.

471. **Comment:** Consideration should be given to alternative tracers such as cfc's to further substantiate the age of the bedrock waters.

Response: The application provides adequate analysis and information on identifying the sources of water within the Quaternary and bedrock systems.

472. **Comment:** Nothing is said about how the contaminated sludge washed off the trucks at the truck wash would be handled.

Response: The DEQ requested the applicant to clarify what measures will be used to prevent/control leaks in the conveyance systems to the WWTP.

473. **Comment:** It is recommended that a state and federally approved conservative tracer be added to the TWIS during the first and last years of operation and continually monitored for the 20 year monitoring period.

Response: The OGS will work closely with the WB to identify a suitable tracer.

474. **Comment:** More detail is needed on the construction and operation of the wastewater treatment plant.

Response: Additional detail is provided in the Part 22 permit application, which addresses the details of the wastewater treatment design and operations.

475. **Comment:** Borehole, monitoring, and exploratory holes all should be decommissioned immediately upon the end of their project use and in a fashion as to eliminate the potential for future hydraulic and contamination connections between the various units.

Response: The application describes methods for plugging wells that comply with Part 625, Mineral Wells, of the NREPA.

476. **Comment:** All of the mining plan requirements should be applied to the aggregate removal site or sites.

Response: Part 632 jurisdiction does not extend to off-site sources of materials.

477. **Comment:** Monitoring wells should be included in the area of the coarse ore storage area (COSA), the crusher, and the truck wash.

Response: The monitoring plan proposed by the applicant adequately monitors the COSA, crusher, and truck wash.

478. **Comment:** Event hydrographic sampling should be undertaken on the neighboring streams downstream of the expected flow fields originating from the operation sites.

Response: The applicant provides an adequate plan for surface water flow monitoring; however, the DEQ will request the applicant to provide data from relevant hydrologic events.

479. **Comment:** Stream macroinvertebrates should be sampled and assessed to circumvent some of the limitations associated with containment monitoring programs based solely on quarterly or semi-annual surface water sampling.

Response: The applicant's water quality monitoring plan meets the requirements of Part 632 and Part 31.

480. **Comment:** Adaptive management plans should be outlined that include actions to unexpected conditions.

Response: The application describes contingency plans in Section 8 of Volume I.

481. **Comment:** A variably saturated, dual porosity, dual permeability should be employed to evaluate existing conditions on surface water impacts due to dewatering.

Response: The OGS will work closely with the WB to assure proper modeling will be conducted by the applicant to predict water quality at venting locations.

482. **Comment:** The application does not include the required chemical and physical testing and modeling to predict the potential generation of acid, dissolved metals, and other related substances.

Response: The application provides detailed geochemical testing in Appendix D of Volume IB and IC; however, the DEQ requested the applicant to provide clarification for several aspects of the geochemical analysis.

483. **Comment:** Lack of information demonstrating that proposed mining methods will protect the environment and public health.

Response: The application provides in several sections how proposed mining methods will be protective of the environment and public health; however, the DEQ requested the applicant provide and clarify several aspects of the application.

484. **Comment:** The applicant's geochemical tests rely on methodologies whose effectiveness and applicability in the critical task of predicting rock leachability are all under debate and do not constitute proven methodology.

Response: The applicant followed the Mine Environment Neutral Drainage (MEND) Program developed by Natural Resources Canada that contains methodologies that are considered standard practice for geochemical characterization.

485. **Comment:** The application fails to ensure protection from ARD in backfilled under ground mine workings.

Response: The DEQ requested the applicant to provide analysis of the effects wash-off of acidic salts will have on groundwater composition during mine reflooding.

486. **Comment:** The application fails to account for water movement in backfilled mine workings.
- Response:** The DEQ requested the applicant to provide analysis for potential changes in upward vertical hydraulic gradients due to the removal of the ore body and subsequent backfill partially using uncemented rock.
487. **Comment:** The possibility of uranium in the ore could put radioactive tailings into the open storage ponds and pits.
- Response:** The applicant has not proposed to generate tailings in the project, and ore will be stored in an enclosed area, not in open ponds or pits.
488. **Comment:** The DEQ should not allow the mining company to revise the permit application received February 22, 2006.
- Response:** It is a long-established practice of the DEQ to perform an initial review of the application and provide the applicant with a request for clarification and/or additional information. Part 632 states: "A determination that an application is administratively complete does not preclude the department from requiring additional information from the applicant".
489. **Comment:** The DEQ should approve Kennecott's application in a timely manner.
- Response:** The DEQ is bound by statutory timelines for review and a decision.
490. **Comment:** The public and the mining company should know what the taxes will be before starting the mine.
- Response:** The OGS is charged with determining the true cash value of nonferrous metallic mining properties for property tax assessment, and will follow the required procedures.
491. **Comment:** More monitoring wells should be installed to the northeast of Kennecott's surface facility.
- Response:** The OGS, WB, and DNR will coordinate monitoring requirements as permit conditions to assure adequate monitoring at the facility if a permit is issued.
492. **Comment:** The public needs to know the deadline for when the application is actually complete.
- Response:** The statement is clear on deadlines for the process.
493. **Comment:** Had section 106 of the National Preservation Act been followed, all tribes within historic homeland in the UP would have been contacted regarding the historic, cultural, and archeological sites.
- Response:** The applicant followed the requirements outlined in Rule 202 (2) (ee).

494. **Comment:** The exhaust fan should go underground and be muffled to the fullest extent possible.
- Response:** The DEQ requested the applicant to provide clarification on why the exhaust fan could not be constructed underground.
495. **Comment:** Generators and on-site stationary engines should be enclosed or muffled to the fullest extent possible.
- Response:** The DEQ requested the applicant to provide a plan for reducing noise from the power generators.
496. **Comment:** External lights should be shielded on top and on the sides.
- Response:** The DEQ requested the applicant to provide a plan for reducing light from the main surface facilities.
497. **Comment:** The application should include more information about the power generation.
- Response:** The application provides information on power generation in Section 4.3.11.1 in Volume I; in addition, the DEQ requested the applicant to provide a plan for reducing noise from the power generators.
498. **Comment:** Two years worth of data from recently installed piezometers should be collected prior to being included in the application.
- Response:** The DEQ requested the applicant to provide all required information that full fills the requirements of Rule 202(3) applicant provided.
499. **Comment:** Hydraulic testing is insufficient to characterize bedrock hydraulic properties.
- Response:** The application provides modeling results that are conservative; however, the DEQ has requested the applicant provide or clarify portions of the hydrologic modeling.
500. **Comment:** Modeling analyses are poorly documented.
- Response:** The DEQ has requested clarification of modeling analyses.
501. **Comment:** The application does not meet the requirements of Rule 203 for 24-hour 100-year precipitation event.
- Response:** The application provides analysis for precipitation that is more conservative than required in Rule 203.
502. **Comment:** The applicant needs to clarify the difference between selenium values identified in the application.
- Response:** The DEQ requested the applicant provide clarification on reported selenium values.

503. **Comment:** General comments requesting that the DEQ deny the permit based on company reputation.

Response: The decision to grant or deny the permit will be based on the applicable statute and rules.

504. **Comment:** General comments requesting that the DEQ grant the permit based on company reputation.

Response: The decision to grant or deny the permit will be based on the applicable statute and rules.

505. **Comment:** General comments requesting that the DEQ deny the permit based on economics and property values.

Response: The decision to grant or deny the permit will be based on the applicable statute and rules.

506. **Comment:** General comments requesting that the DEQ grant the permit based on economics and job creation.

Response: The decision to grant or deny the permit will be based on the applicable statute and rules.

Terms and Abbreviations

Term	Definition
%	Percent, 1/100
°C	degrees Celsius
administratively complete	<p>means an application for a mining permit under this part that is determined by the Department to contain all of the documents and information required under this part and any rules promulgated under this part. (Part 632)</p> <p>means an application for a permit to install that includes information required by the Department on the application form or by written notice. This information may include, as necessary, any of the information listed in R 336.1203(1). (AOD)</p>
affected area	means an area outside of the mining area where the land surface, surface water, groundwater, or air resources are determined through an environmental impact assessment to be potentially affected by mining operations within the proposed mining area. (Part 632)
Air Permit Application	Submittal by a person who plans to install, construct, reconstruct, relocate, or modify any such process or process equipment that requires a permit to install. Person shall apply to the Department for a permit to install on an application form approved by the Department and shall provide the information required in R 336.1203.
Air Pollution Control	“Air pollution control equipment” means any method, process, or equipment that removes, reduces, or renders less noxious air contaminants discharged into the atmosphere.
Air Use Permit to Install.	An air use permit to install authorizes a person to install, construct, reconstruct, relocate, or modify any process or process equipment, including control equipment pertaining thereto, which may emit any air pollutant regulated by title I of the clean air act and its associated rules, or any air contaminant.
Applicant	A person who applies to the department for a state or national permit to operate a mine, or to discharge wastewaters into the waters of the state; or to use the air.
AOD	Air Quality Division, Michigan Department of Environmental Quality
aquifer	means a geological formation, group of formations, or part of a formation capable of yielding significant quantities of groundwater to wells or springs. (Part 632)
ARD	acid rock drainage

Term	Definition
assurance instrument	A surety bond executed by a surety company authorized to do business in the state of Michigan, ♦ A certificate of deposit or time deposit account held by a financial institution regulated and examined by a state or federal agency, the value of which is insured by an agency of the United States government, ♦ A cash bond, ♦ An irrevocable letter of credit issued by a financial institution which has the authority to issue letters of credit and whose letter of credit operations are regulated and examined by a federal or state agency, ♦ A trust fund managed by a financial institution which has the authority to act as a trustee and whose trust operations are subject to federal or state oversight, ♦ An escrow account managed by a bank or other financial institution whose account operations are regulated and examined by a federal or state agency.
ASTM	American Society for Testing and Materials.
backfill surface facility	The approximate 4-acre area located at the east side of the ore body containing various mine backfill and ventilation related facilities.
beneficiation	means the primary treatment of ore to separate or remove a metallic product or products from ore using a process including, but not limited to, any of the following: ♦ crushing, ♦ grinding, ♦ washing, ♦ dissolution, ♦ crystallization, ♦ filtration, ♦ sorting, ♦ sizing, ♦ drying, ♦ sintering, ♦ pelletizing, ♦ briquetting, ♦ calcining to remove water and/or carbon dioxide, ♦ roasting, ♦ autoclaving, ♦ and/or chlorination in preparation for leaching (except where this process produces a final or intermediate product that does not undergo further beneficiation or processing), ♦ gravity concentration, ♦ magnetic separation, ♦ electrostatic separation, ♦ flotation, ♦ ion exchange, ♦ ex situ solvent extraction, ♦ electrowinning, ♦ precipitation, ♦ amalgamation, ♦ heap, dump, vat and tank leaching. (Part 632)
Carbon Monoxide (CO)	See below (CO)
Cement Silo	A 120 ton capacity cement silo equipped with a bin vent fabric filter. The silo is loaded via pneumatic conveyors. (from AQD draft permit)
CFR	Code of Federal Regulations
chalcopyrite	Chalcopyrite is a copper iron sulfide mineral. It has the chemical composition CuFeS ₂ .
cm	centimeter
CO	carbon monoxide
contact water basin	A lined lagoon, meeting the requirements of Rule 2237 of the Part 22 Rules, for the containment of wastewater.

Term	Definition
contaminated or contamination	means having substances in concentrations that are above natural background and that are, or may be, harmful to the environment or to human health and safety as determined by the department under other applicable parts of the act. (Part 632)
COSA	coarse ore storage area
CR	county road
crown pillar	The bedrock that is left in place at the top of the underground mine
CRP	concentrate reduction process
cumulative impact	means the environmental impact that results from the proposed mining activities when added to other past, present, and reasonably foreseeable future activities. (Part 632)
CWB	contact water basin
Department	means the DEQ Department of Environmental Quality. (Part 632)
DEQ	Department of Environmental Quality, see also MDEQ
DNR	Department of Natural Resources, see also MDNR
Draft Permit	A preliminary or prospective permit document that is yet to be approved or denied by the MDEQ, and is provided for public review and input prior to a final permit decision.
EIA	Environmental Impact Assessment
EPA	U.S. Environmental Protection Agency
fauna	Animals in a particular region or locality.
final reclamation	means reclamation performed after final cessation of mining with the intent not to resume mining. (Part 632)
financial assurance	means an assurance instrument or statement of financial responsibility provided by an operator to ensure compliance with the act, these rules, permit conditions, instructions, or orders of the department. (Part 632)
floodplain	means an area of land adjoining a river or stream that will be inundated by a flood with a magnitude that has a 1% chance of occurring or being exceeded in any given year. (Part 632)
flora	Plants in a particular region or locality.

Term	Definition
Fugitive Dust Control Plan	Written plan for control of particulate matter which is generated from indoor processes, activities, or operations and which is emitted into the outer air through building openings and general exhaust ventilation, except stacks. Fugitive dust can also be particulate matter which is emitted into the outer air from outdoor processes, activities, or operation due to the forces of the wind or human activity. The plan is attached to the final Air Use Permit.
g/bhp-hr	grams per brake horsepower hour
GDPA	Groundwater Discharge Permit Application
glacial	Relating to materials deposited by a glacier
glacial outwash	A glacial deposit that is formed in the meltwater from a glacier. The deposits are typically sandy in nature and generally flat topographically. The Yellow Dog plains are outwash deposits
gpd	gallons per day
gpm	gallons per minute
groundwater (also, ground water)	Water below the land surface in a zone of saturation.
groundwater discharge (GD)	any discharge into the groundwater or ground of any waste, waste effluent, wastewater, pollutant, cooling water or combination of the items.
groundwater model	a computer model of a groundwater flow system. Groundwater models are used by hydrogeologists to simulate and predict aquifer conditions.
groundwater quality	Means the concentration or level of a substance in the groundwater within an aquifer at the site receiving the discharge.
Groundwater Surface water Interface (GSI)	the location at which groundwater vents to a surface water body.
HSR	Hydrogeologic Study Report
Inspection	Different per division. May include physical inspection of operating equipment to ensure correct parameters, inspection of control equipment for proper operation, visible emission determinations, odor detection or verification, record review, or other verification of permit compliance.
intrusive	A body of igneous rock formed by the consolidation of magma intruded into other rocks, in contrast to lavas, which are extruded upon the surface.
ISCST3	Industrial Source Complex Short Term 3 Model

Term	Definition
KEMC	Kennecott Eagle Minerals Company
Level	The horizontal openings on a working horizon in a mine.
life of the mine	means the period from issuance of a mining permit through the completion of reclamation. (Part 632)
m	meter
m ² , m2	square meter
m ³ , m3	cubic meter
main operations area	That portion of the main surface facility area where ore and development rock will be handled or where some contact with those materials may occur.
massive sulfide	An ore type containing greater than 50% sulfide and more typically close to 100%. Minerals species are pyrrhotite, pentlandite and chalcopyrite.
MCL	Michigan Compiled Laws
MCRC	Marquette County Road Commission
MDEQ	Michigan Department of Environmental Quality, see also DEQ
MDNR	Michigan Department of Natural Resources, see also DNR
MDOT	Michigan Department of Transportation
metallic product	means a commercially salable mineral produced primarily for its nonferrous metallic mineral content in its final marketable form or state. (Part 632)
Meteorology	The natural dynamics of the atmosphere which cause air pollutants to travel and disperse. (as used in AQD modeling)
mg/l	milligrams per liter
mining activity	means any of the following activities for the purpose of, or associated with, mining: ♦ Clearing of land, ♦ Drilling and blasting, ♦ Excavation of earth materials to access or remove ore, ♦ Beneficiation, ♦ Reclamation, ♦ Transportation of overburden, ♦ waste rock, ♦ ore, ♦ and tailings, ♦ Storage, ♦ relocation, ♦ and disposal of overburden, ♦ waste rock, ♦ ore, ♦ and tailings within a mining area, ♦ including backfilling of mined areas, ♦ Storage and transportation of chemical reagents, ♦ Construction of water impoundment and drainage features, ♦ Construction of haul roads, ♦ Construction of utilities or extension of existing utilities, ♦ Withdrawal, ♦ transportation, ♦ and discharge of water. (Part 632)

Term	Definition
mining area	means an area of land from which earth material is removed in connection with nonferrous metallic mineral mining, the lands on which material from that mining is stored or deposited, the lands on which beneficiating or treatment plants and auxiliary facilities are located, the lands on which the water reservoirs used in the nonferrous metallic mineral mining process are located, and auxiliary lands that are used in connection with the mining. (Part 632)
mining permit	means a permit issued under this part for conducting nonferrous metallic mineral mining and reclamation operations. (Part 632)
Mining Team	A concept developed Part 632 applications. A team of specialists who evaluate the Permit Application. Each team member reviews the application with emphasis on their area of expertise. Members are typically from the DEQ, DNR and outside consultants.
MMBtu/hr	Million british thermal units per hour
MODFLOW	The U.S. Geological Survey modular finite-difference flow model, which is a computer code that solves the groundwater flow equation. The program is used by hydrogeologists to simulate the flow of groundwater through aquifers.
MPA	Mining Permit Application
MVAR	Mine ventilation air raise
NAAQS	National Ambient Air Quality Standards
National Ambient Air Quality Standards (NAAQS)	Federal maximum allowable pollutant concentrations in the ambient air, used for air modeling comparison. The United States Environmental Protection Agency has set maximum permissible levels for seven pollutants. These National Ambient Air Quality Standards (NAAQS) are designed to protect the public health of everyone, including the most susceptible individuals, children, the elderly, and those with chronic respiratory ailments. The seven pollutants, called the criteria pollutants, are carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), and sulfur dioxide.
NCWIB	Non-contact water infiltration basin
Nitrogen Oxide (NOx)	NOX is the term used to describe the sum of NO, NO2, and other nitrogen oxides. NOX is formed by reaction between nitrogen and oxygen in the air used for high temperature combustion. NOX is also formed by reactions between oxygen and organic nitrogen in a fuel.
non-contact area	The backfill surface facility area and the portion of the main surface facility where there is no ore or development rock handling or contact with those materials.

Term	Definition
nonferrous metallic mineral	means any ore or material to be excavated from the natural deposits on or in the earth for its metallic content, but not primarily for its iron or iron mineral content, to be used for commercial or industrial purposes. (Part 632)
nonferrous metallic mineral operator or permittee	means a permittee or other person who is engaged in, or who is preparing to engage in, mining operations for nonferrous metallic minerals, whether individually or jointly, or through agents, employees, or contractors. (Part 632)
NREPA	Natural Resources and Environmental Protection Act, Act No. 451 of the Public Acts of 1994
OGS	Office of Geological Survey, Michigan Department of Environmental Quality
operator	means a permittee or other person who is engaged in, or who is preparing to engage in, mining operations for nonferrous metallic minerals, whether individually or jointly, or through agents, employees, or contractors. (Part 632)
ore body	Mineralized rock having defined economic value.
ore reserves	The calculated tonnage and grade of mineralization which can be economically extracted; classified as possible, probable and proven according to the level of confidence that can be placed in the data.
organization report	means a certified statement, on a form prescribed by the department, giving the name, address, and plan of the business organization, and listing the following: All corporate officers, directors, incorporators, and limited liability company managers, All other partners, shareholders, limited liability company members, or other persons who have the authority to make, or are responsible for making, operational decisions, including the construction, operation, closure, postclosure monitoring, reclamation, and remediation of a mine. (Part 632)
Outcrop	An exposure of rock or mineral deposit that can be seen on surface, that is not covered by soil or water.
Overburden	means unconsolidated earth material that overlies bedrock and that is or will be excavated by open pit mining methods to access ore. (Part 632)
Part 201 NREPA	Part 201, Environmental Remediation of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended.
Part 22 Rules Part 31	The Part 22 Groundwater Quality Rules of Part 31 (Water Resources Protection) of the Natural Resources and Environmental Protection Act of 1994, PA 451 as amended,
Part 5 NREPA	provides authority for the DNR to lease lands for mining mineral products

Term	Definition
Part 55 NREPA	Air Pollution Control portion of Act 451
Part 632 NREPA	Nonferrous Metallic Mineral Mining of Act 451
peridotite	An ultramafic intrusive rock with less than 10% feldspar.
peripheral rock	means rock that is or will be left in place after the completion of mining and within 3 feet of either of the following: The walls and floor of an open pit, The walls, floor, and roof of adits, portals, and underground mine workings. (Part 632)
Permittee	means a person who holds a mining permit (Part 632). Other regulations may use the term in a manner consistent with the permit for which it is being applied.
PIPP	Pollution Incident Prevention Plan
PM-10	Particulate matter less than 10 microns in diameter
Pollutant	"Air pollution" means the presence in the outdoor atmosphere of air contaminants in quantities, of characteristics, under conditions and circumstances, and of a duration that are or can become injurious to human health or welfare, to animal life, to plant life, or to property, or that interfere with the enjoyment of life and property in this state, and excludes all aspects of employer-employee relationships as to health and safety hazards. (for AQD)
Portal	The surface entrance to the mine.
Postclosure	means the period following completion of final reclamation in compliance with the approved reclamation plan. (Part 632)
postclosure monitoring period	means a period following closure of a nonferrous metallic mineral mine during which the permittee is required to conduct monitoring of groundwater and surface water. (Part 632)
ppm	parts per million
PSD	Prevention of significant deterioration - Federal permitting regulations. The Prevention of Significant Deterioration (PSD) regulations allow the installation and operation of large, new sources and the modification of existing large sources in areas that are meeting the NAAQS. The regulations define what is considered a large or significant source, or modification.
PSD increment standards	Federal ambient air quality concentration standards used for air modeling comparison.
Psig	pounds per square inch gauge
PTE	potential to emit
Public Act 451	Natural Resources and Environmental Protection Act

Term	Definition
reactive	means susceptible to reacting, dissolving, or otherwise forming a leachate that is or may be harmful to the environment or to human health and safety as determined by the department under conditions that exist, or may exist, at a mining operation. (Part 632)
reclamation	means that reconditioning or rehabilitation of the mining area or portions thereof for useful purposes and the protection of the natural resources, including the control of erosion and the prevention of land or rock slides, collapses and subsidence, and air and water pollution. (Part 632)
remediation	means the taking of actions that are necessary to prevent, minimize, or mitigate injury to the public health, safety, or welfare, or to the environment, including cleanup, removal, containment, isolation, destruction, or treatment of a hazardous substance released or threatened to be released into the environment; and associated monitoring and maintenance. (Part 632)
RRD	Remediation and Redevelopment Division
SCR	selective catalytic reduction - Process in which NOx emissions are controlled with the injection of ammonia into the exhaust gas stream in the presence of a catalyst. The ammonia with the catalyst converts NO to nitrogen.
semi-massive sulfide	An ore type containing between 30 and 50% total sulfide by volume. Sulfide minerals species are pyrrhotite, pentlandite and chalcopyrite.
SESC	Soil Erosion and Sediment Control
SOx	sulfur dioxide - Sulfur dioxide is formed by the combustion of sulfur containing materials such as coal and fuel oil. When sulfur-bearing fuel is combusted, the sulfur is oxidized to form SO2.
SPCC	Plan Spill Prevention Control and Countermeasures Plan
Special Permit Condition	Same as "Special Condition". See "Condition".
stockpile	means material, including, but not limited to, surface overburden, rock, or lean ore, that in the process of mining and beneficiation or treatment has been removed from the earth and stored on the surface. Stockpile does not include materials that are being treated in the production of metallic products and the metallic product that has been produced by that operation. (Part 632)
stope	An excavation in a mine from which ore is, or has been removed.
storage facility	means a facility or a part of a facility where ore, waste rock, overburden, or tailings is held for a temporary period, at the end of which the ore, waste rock, overburden, or tailings is treated, disposed of, or stored elsewhere. (Part 632)

Term	Definition
Stormwater	means storm water runoff, snow melt runoff and surface runoff and drainage.
sump	An underground excavation where water accumulates before being pumped to surface.
surface water	Surface waters of the state include all of the following, but does not include drainage ways and ponds used solely for wastewater conveyance, treatment, or control: ♦ The Great Lakes and their connecting waters. ♦ All inland lakes. ♦ Rivers. ♦ Streams. ♦ Impoundments. ♦ Open drains. ♦ Wetlands. ♦ Other surface bodies of water within the confines of the state.
TAC	toxic air contaminant - Any air contaminant for which there is no national ambient air quality standard and which is or may become harmful to public health or the environment when present in the outdoor atmosphere in sufficient quantities and duration. Specific exceptions are listed in R 336.1120(f).
tailings	means material that is separated from the metallic product in the beneficiation or treatment of minerals. (Part 632)
T-BACT	best available control technology for toxics - The maximum degree of emission reduction which the Department determines is reasonably achievable for each process that emits toxic air contaminants, taking into account energy, environmental, and economic impacts and other costs.
TDRSA	temporary development rock storage area
TDS	total dissolved solids
TWIS	Treated water infiltration system
ug/l	micrograms per liter
USEPA	United States Environmental Protection Agency
Violation	The act or an instance of breaking or disregarding a law, rule, or permit condition.
Waste and Hazardous Material Division	A DEQ division that administers programs that regulate: solid, liquid, medical, hazardous waste and radioactive materials.
Watershed	A geographic region within which water drains into a particular river, stream, or body of water
WB	Water Bureau, Michigan Department of Environmental Quality
wetland	means that term as defined in part 303 of the act. (Part 632)
WWTP	Wastewater treatment plant

Term	Definition
Yd ³ , Yd3	cubic yard
Yr	year

Kennecott Eagle Project Internet Accessible Documents

The following information is available at the web page:

http://www.michigan.gov/deq/0,1607,7-135-3311_4111_18442-130551--,00.html

August 7, 2007

[revised Hearing Notice](#)

Monday August 6, 2007

[updated Part 632 Nonferrous Metallic Minerals Permit Conditions](#)

[Updated Air Quality Permit documents](#)

[Updated Groundwater Discharge Permit](#)

[Updated MDNR Metallic Mineral Lease](#)

Monday July 30, 2007

[Overview of Kennecott Eagle Project Hearing](#)

[Proposed Decision to Grant Kennecott Eagle Project Permit Dated July 30 2007](#)

Monday July 2, 2007

[Report from Dr. Wilson Blake](#) geotechnical review

Tuesday May 15, 2007

[Report from Dr. Donald Inman of EcoLogic Ltd](#)

[Summary of Review](#)

[Appendix to EcoLogic Report](#)

Monday March 19, 2007

[Reports and Technical Communications submitted by Arcadis](#)

[Reports and Technical Communications submitted by MFG](#)

Friday March 1, 2007

[Technical Report - Crown Pillar Subsidence ... Eagle Mine](#)

[Technical Memorandum - May 22, 2006 - David Sainsbury, Itasca Consulting Group, Inc.](#)

Friday February 23, 2007

[General and Special Permit Conditions](#)

Monday February 05, 2007

DEQ Draft Air Quality Permit Documents:

1) [50-06 Draft Permit Conditions](#),

2) [50-06 Fact Sheet](#),

3) [50-06 Notice of Hearing](#) and

4) [50-06 the Overarching Document](#).

Tuesday, January 9, 2007

[Proposed Decision Document](#)

[Press Release regarding the Proposed Decision](#)

Tuesday, November 14, 2006

[Kennecott Permit Review Update](#)

Friday, October 27, 2006

[Waiver of permit processing time](#)
[reply to the June 21, 2006 request for additional information.](#)

Wednesday, June 21, 2006

[Letter to Applicant requesting additional information](#) and
[Compilation of comments and responses.](#)

Monday, April 25, 2006

[Technical Memorandum 04 25 2006](#)

Tuesday, April 18, 2006

[Permit Application](#)

Friday, March 17, 2006

[Permit Application](#)

Friday, March 10, 2006

the Eagle Project is administratively complete. [More information](#)

Monday, February 27, 2006

[Permit Application files](#) revised to include Groundwater Discharge Permit files

Wednesday, February 22, 2006 - The Michigan Department of Environmental Quality, Office of Geological Survey, has received a Part 632, Nonferrous Metallic Mineral Mining, Permit Application, from the Kennecott Exploration Company, for the Eagle mine.

[Meet the Application Review Team.](#) A team of specialists will evaluate the Permit Application submitted for the Eagle Mine. Each team member will review the application with emphasis on their area of expertise.

Description of the [Part 632 Permit Application Review Process.](#)

[Part 632](#), Nonferrous Metallic Minerals statute and rules.

Additional information available from sites listed below

[DEQ Home Page](#)

[DEQ Events Calendar](#)

[DEQ Air Quality Division](#)

[DEQ Water Bureau](#)

[DEQ Office of Geological Survey](#)

[DNR Home Page](#)

[DNR Minerals Lease](#)

[DNR Business Calendar](#)

Printed Copies of Materials are Available at the Following Locations:

The following is a list of locations where people can review the permit application. It is suggested that you call to make sure the files will be available.

1. Peter White Library, 217 N Front Street, Marquette, MI 49855,
contact the Resource Desk, 906 228-9510
2. Michigamme Township Hall, 202 W Main, Michigamme Township, MI 49861,
contact John Olsen, 906 323-6608
3. Powell Township Hall, County Road 550, Big Bay, MI 49808,
contact Township Clerk, 906 345-9345
4. Michigan DEQ, Upper Peninsula District Office, 420 5th Street, Gwinn, MI 49841,
contact Tina Mitchell, 906 346-8520
5. Michigan DEQ, Office of Geological Survey, 525 West Allegan, Lansing, MI 48933
contact Ms. Sharon Carter, 517-241-1515