Economic, Small Business and Consumer Impact Statement
Water Quality Standards for Surface Waters
Title 18, Chapter 11, Article 1

The Arizona Department of Environmental Quality [ADEQ] is required by A.R.S. §49-1055(B) to provide an economic, small business, and consumer impact statement for the adopted water quality standards rules.

In general, ADEQ believes that the water quality standards rules will have a little or no economic impact, with the exception of the adopted rule which classifies Buehman Canyon Creek as a unique water [See discussion below]. The majority of the proposed revisions to the rules are editorial changes. Substantive revisions to the water quality standards that may have a minimal economic impact include the following:

1. The revision of the waste treatment system exclusion language;
2. The adoption of the net ecological benefit rule;
3. The adoption of the *E. coli* water quality standards for the full body contact designated use;
4. The repeal of the water quality criteria for turbidity for the full-body contact and partial-body contact designated uses;
5. The adoption of diurnal standards for dissolved oxygen in effluent dependent waters.
6. The unique waters classifications, particularly the Buehman Canyon Creek nomination;
7. The adoption of the variance rule;
8. The revision to the numeric water quality criteria to protect the domestic water source, fish consumption, full body contact and partial body contact designated uses;
9. The addition of the fish consumption designated use to surface waters that are cold water or warm water fisheries which currently do not have the designated use.

Each of these potential economic impacts is discussed below. Probable economic impacts are characterized qualitatively, except for the discussion of the economic impact of the unique waters classification of Buehman Canyon Creek. The qualitative descriptions include a discussion of the persons who may be directly affected by the rule, the probable costs and benefits associated with adoption and implementation of the rule change, a description of the probable impact of the revision on private and public employment, and a description of the probable impact of the revisions on small businesses, private persons and consumers. None of the proposed rules to the water quality standards rules are expected to have an effect on state revenues, with the possible exception of the unique waters classification of Buehman Canyon Creek.

Persons who may be directly affected by, bear the costs of, or directly benefit from the adopted water quality standards rules include the following:

1. Owners of wastewater treatment plants and other point source discharges to surface waters in Arizona;
2. Municipalities serving populations of 100,000 or more and urbanized counties with populations in unincorporated areas with populations of 100,000 or more that are required to obtain NPDES permits for discharges from their separate storm sewer systems;
3. State agencies and political subdivisions which operate wastewater treatment plants which discharge to surface waters in Arizona;
4. Mines and mineral exploration companies; and
5. Members of the general public.

Effect on the Arizona Department of Environmental Quality

The adopted rules will have little or no impact on ADEQ. ADEQ anticipates no change in staff levels or payroll as a result of the adoption and implementation of the rules. Two of the adopted rules may result in additional costs for ADEQ. Two adopted rules create new procedures which permit: 1) the modification of a water quality standard on the ground of net ecological benefit; and 2) discharger-specific variances. Implementation of the adopted rule on variances may result in additional costs for the agency associated with technical and legal review of variance requests and public participation procedures. Implementation of the net ecological benefit rule may result in an increase in petitions for rulemaking. The adopted rule provides the authority to modify a water quality standard, by rule, on grounds of net ecological benefit. Owners of wastewater treatment plants may submit petitions for rulemaking to modify water quality standards on this ground. ADEQ cannot predict how many persons may take advantage of these two adopted rules and either request a variance or seek a modification of a water quality standard.

Effect on Other State Agencies and Political Subdivisions

The adopted rules may affect state agencies and political subdivisions as owners of NPDES-permitted facilities. Counties, municipalities, federal and state agencies, and sanitary districts operate wastewater treatment plants which discharge to surface waters in Arizona that are subject to water quality standards. The point source discharge of pollutants from wastewater treatment plants are regulated by NPDES permits. A NPDES permit may contain water quality-based discharge limitations which are designed to ensure that the discharge from the point source to the surface water complies with applicable water quality standards. Any revision to the applicable water quality standards may affect a point source through the NPDES permit which limits the

discharge of pollutants. New monitoring requirements or revised discharge limitations may be placed in a NPDES permit because the applicable water quality standards for the receiving surface water have been revised.

In general, ADEQ believes that the revisions to the water quality standards rules will have little or no economic impact on other state agencies and political subdivisions which own and operate point source discharges to surface waters. The only revisions to the water quality standards which may result in revisions to NPDES permits are the following: 1) the adoption of *E. coli* water quality criteria for surface waters with the full body contact designated use; 2) the adoption of more stringent water quality criteria for the domestic water source, fish consumption, full body contact and partial body contact designated uses to protect human health; and 3) the adoption of the fish consumption designated use for certain surface waters in Arizona. The economic impact of each of these revisions is discussed separately below.

It should be noted that a revision of state-adopted water quality standards may have an impact on municipalities with populations greater than 100,000 and counties with populations in unincorporated urbanized areas greater than 100,000 which operate separate storm sewer systems. In Arizona, this initially includes Pima County and the cities of Phoenix, Tucson, Mesa and Tempe. These political subdivisions are required to obtain NPDES permits for discharges of storm water from their municipal separate storm sewer systems [MS4] to surface waters. EPA is the NPDES MS4-permitting authority in Arizona. EPA has acknowledged that substantial costs are potentially associated with the control of the discharge of pollutants in storm water to achieve compliance with water quality standards. Initially, the NPDES MS4 program will focus on the implementation of best management practices or non-structural source controls to reduce the discharge of pollutants in storm water. Consequently, the draft NPDES MS4 permits do <u>not</u> include water quality-based discharge limitations and the revision of the state-adopted water quality standards in this triennial review has no short term economic impact. However, EPA has stated that additional discharge controls may be needed over the long term to achieve compliance with state-adopted water quality standards, depending upon the success of nonpoint source control efforts. ADEQ acknowledges that while the adopted rules will not have a short-term economic impact on political subdivisions, there is a possibility of a substantial, long-term economic impact for political subdivisions if numeric discharge limitations that are necessary to achieve compliance with state-adopted water quality standards are written into NPDES MS4 permits in future permit cycles.

Effect on Businesses

With the possible exception of the unique waters classification of Buehman Canyon Creek, the adopted rules will have no impact on businesses in the private sector. There are a small number of point source discharges to

surface waters that are owned by businesses in the private sector [e.g., electric utilities, point source discharges from mines]. NPDES-permitted facilities that are owned by businesses in the private sector may be affected in the same way that NPDES-permitted facilities owned by political subdivisions are affected. Again, the only revisions to the water quality standards in the which may result in revisions to NPDES permits for point sources that are owned by businesses in the private sector are the following: 1) the adoption of *E. coli* water quality criteria for surface waters with the full body contact designated use; 2) the adoption of more stringent water quality criteria for the domestic water source, fish consumption, full body contact and partial body contact designated uses to protect human health; and 3) the adoption of the fish consumption designated use for certain surface waters in Arizona. The economic impact of each of these revisions is discussed separately below.

It should be noted that the Clean Water Act requires that NPDES permits be issued for storm water discharges that are associated with industrial activity. Surface water quality may be adversely affected by stormwater discharges through contact with industrial areas. Again, EPA is the NPDES storm water permitting authority for industrial facilities in Arizona. By monitoring and regulating stormwater discharges from industrial facilities under the NPDES program, EPA hopes to control and reduce industrial stormwater pollution, and, in turn, reduce the loading of pollutants to receiving surface waters which are subject to state-adopted water quality standards. Achieving the long-term goal of protecting water quality requires a phased approach. EPA has developed a four-tier set of priorities for issuing NPDES storm water permits for industrial facilities, starting with general permits and over time addressing watershed permits, industrial category-specific permits, and facility-specific permits. Ultimately, some industrial facilities may be required to implement pollution control systems based on best available technology or water quality standards.

Initially, EPA has issued general permits which cover most industrial facilities in Arizona. The most important component of these general permits is the development of a pollution prevention plan. Basically, these pollution prevention plans require that industrial dischargers identify the source of pollutants in storm water runoff from their facilities and then develop and implement a plan to reduce the pollutants in the runoff. The key elements of the pollution prevention plan include preventive maintenance, good housekeeping, spill prevention and response, sediment and erosion prevention, employee training, inspection of facilities and recordkeeping. Permittees also must consider appropriate structural control measures such as storm water detention basins, oil and grit separators, infiltration devices, the use of vegetated swales, and storm water runoff diversion structures. In general, the general permits for industrial facilities require the implementation of best management practices thought to be appropriate for all industrial storm water dischargers.

The adopted rules will have no short-term economic impact on businesses which are required to control storm water runoff from their industrial facilities because EPA is initially requiring the implementation of best management practices in NPDES general permits. However, like the NPDES MS4 permits, there is a possibility that the baseline general permits may prove to be inadequate or inappropriate for all industrial facilities to achieve compliance with state-adopted water quality standards. There is the possibility of a substantial, long-term economic impact for businesses if numeric discharge limitations are deemed necessary to achieve compliance with state-adopted water quality standards and such permit conditions are written into individual NPDES permits for industrial facilities in future NPDES stormwater permit cycles.

Effect on Private and Public Employment

With the exception of the classification of Buehman Canyon Creek as a unique water, the adopted water quality standards should have no effect on private and public employment.

Effect on Small Businesses

With the exception of the classification of Buehman Canyon Creek as a unique water, the adopted rules will have no short term economic impact on small businesses. To the extent that small businesses own and operate point source discharges to surface waters, the adopted rules will affect them like political subdivisions and other state agencies that own and operate point source discharges. However, this impact is minimal. Small businesses that are required to control storm water discharges from industrial facilities are affected by NPDES stormwater permitting regulations. The state-adopted water quality standards may be used as a basis for NPDES permit conditions for industrial facilities that may be owned and operated by small businesses as defined by A.R.S. §41-1001(20). However, since most industrial facilities in Arizona will be regulated initially under general permits which focus on the implementation of best managment practices to achieve compliance with water quality standards, it is expected that the adopted rules will not have a short-term economic impact.

Effect on Consumers

The adopted rules will have no economic impact on consumers.

Probable Effect on State Revenues:

With the possible exception of the classification of Buehman Canyon Creek as a unique water, the adopted rules will have no effect on state revenues.

Economic Impact of the Revision of the Waste Treatment System Exclusion

The revision of the language of the waste treatment system exclusion will benefit persons who own or operate wastewater treatment plants. Counties, municipalities, sanitary districts which own and operate wastewater treatment plants are the primary beneficiaries of the proposed rule revision. The proposed revision also may benefit industrial facilities which utilize lagoons or impoundments for industrial wastewater treatment [e.g. utilities which utilize cooling ponds, fly ash ponds or blowdown ponds]. The adopted rule clarifies that waste treatment systems, including treatment ponds and lagoons that are a part of such treatment systems are not "surface waters" or "waters of the United States" and are not subject to water quality standards. The adopted rule repeals language which restricts the location of such wastewater treatment systems.

The adopted rule removes a regulatory barrier to the construction of in-channel waste treatment systems. In particular, the revision provides more flexibility under the water quality standards program for the construction of wetlands to provide "natural" wastewater treatment in dry watercourses. In many cases, constructed wetlands are a cost-effective method of wastewater treatment and disposal. The adopted rule will benefit the owners and operators of wastewater treatment plants by providing a cost-effective wastewater treatment and disposal option.

Economic Impact of the Proposed Adoption of the E. coli Water Quality Standards for Surface Waters With the Full Body Contact Designated Use

The adoption of *E. coli* water quality criteria for the full body contact [FBC] designated use will affect point source dischargers who discharge treated wastewater to surface waters with the FBC designated use. This revision will primarily affect wastewater treatment plants. If the new *E. coli* water quality criteria become effective, the standards will eventually be incorporated as water quality-based discharge limitations in the NPDES permits for wastewater treatment plants which discharge to surface waters with the FBC designated use.

The monitoring costs for those point source dischargers will increase because they will be required to monitor the discharge of effluent for the presence of *E. coli*. ADEQ expects that the increase in the cost of monitoring will be minimal. Information gathered from the Arizona Department of Health Services [ADHS] indicates that the increased cost of *E. coli* monitoring is minimal. The additional cost for samples submitted to ADHS laboratories is $2 - $3/sample. For smaller laboratories the increased cost may be greater, but no more than $10/sample. Assuming that a wastewater treatment plant is required to conduct monitoring for *E. coli* twice a month, the predicted increase in monitoring costs could be as little as $50/year to as much as $240/year.

It is not known how many point source dischargers will be affected by this increase in monitoring costs. As of June 30, 1995, there were only 157 NPDES permitted-facilities in Arizona. Of these, 14 are located on Indian lands and are not affected by the adoption of *E. coli* standards by the state. Not all of the remaining 143 NPDES-permitted facilities discharge to surface waters with the full body contact designated use. Approximately 30 wastewater treatment plants discharge to effluent dependent waters which do not have the FBC designated use. The remaining number of wastewater treatment plants is probably less than 100. ADEQ reviewed the NPDES permit files of approximately 25% of the point source discharges in Arizona. Of the NPDES permits reviewed, approximately 50% discharged to a surface water that was protected with the FBC designated use. If this proportion is applied to all potential NPDES-permitted facilities, then it is likely that 55 to 60 facilities may be affected by the increased cost of monitoring for *E. coli*. Assuming that 60 NPDES-permitted facilities are affected by the increase in monitoring costs for *E. coli*, then the estimated increase in the total annual cost of monitoring for all facilities in the state ranges from $3000/year to $14,400/year.

State or county agencies may conduct monitoring activities as part of their management of public swimming areas [e.g., Arizona State Parks or County Health Departments]. The amount of the increased cost of monitoring for *E. coli* depends upon the sampling frequency. However, because *E. coli* is a better indicator of swimming-associated gastrointestinal illness than fecal coliform, there are public health benefits associated with *E. coli* monitoring. Water quality managers can make better informed decisions about whether closures of public swimming areas in Arizona surface waters are necessary if *E. coli* monitoring is performed.

Economic Impact of the Adoption of the Net Ecological Benefit Rule

The net ecological benefit rule permits a modification of a water quality standard for an effluent dependent water. An effluent dependent water is a surface water whose flow consists primarily of treated wastewater. Thirty-five surface waters in Arizona have been classified as effluent dependent waters. Thus, the adopted rule may provide a benefit to the owners of 35 wastewater treatment plants in Arizona.

In many cases, the discharges of effluent from these 35 wastewater treatment plants create or support ecologically valuable aquatic, wildlife and riparian habitats along watercourses that would otherwise be dry or nearly dry. The adopted rule creates regulatory flexibility to allow the modification of a water quality standard which applies to an effluent dependent water when necessary to preserve and maintain the in-stream flow of effluent which creates or supports an ecologically valuable aquatic, wildlife or riparian habitat.

Because there is little or no dilution for a point source discharge of effluent which creates an effluent dependent water, the source wastewater treatment plant often has to meet applicable water quality standards at the "end-of-the-pipe." Where a water quality cannot be met or where the cost of meeting a water quality standard is very high, the owner of the wastewater treatment plant may consider alternatives to discharging effluent to the surface water. Examples of alternatives to discharging effluent include total reuse of the effluent or groundwater recharge. High treatment costs associated with achieving compliance with an applicable water quality standard may discourage the continued discharge of treated wastewater which supports an effluent dependent ecosystem. The elimination of the discharge of effluent may result in the complete destruction of the effluent dependent ecosystem.

Under the adopted rule, the owner of a wastewater treatment plant which creates an effluent dependent water may, under certain conditions, obtain a modification of a water quality standard. The adopted rule permits the modification of a water quality standard where the owner of a wastewater treatment plant demonstrates that a modification is justified because the value of providing treated wastewater to create or support an effluent dependent ecosystem [even under a modified water quality standard] outweighs the environmental cost associated with the elimination of the discharge of effluent and the complete destruction of the effluent dependent ecosystem.

The adopted rule provides a benefit to the owners of wastewater treatment plants that support or create effluent dependent waters because it provides a mechanism for relief from a water quality standard that otherwise might force costly treatment plant upgrades. The adopted rule also provides ecosystem benefits in that it provides a regulatory incentive to maintain and preserve in-stream flows in areas where riparian and aquatic resources are limited. The continued discharge of effluent may provide net ecological benefits, even though an applicable water quality standard is not being met. Examples of possible ecological benefits include:

1. Enhancement, expansion or restoration of aquatic and riparian habitat for native, threatened or endangered aquatic species, or for migratory waterfowl;
2. Provision or enhancement of habitat or food sources for native, threatened and endangered species that are terrestial;
3. Enhancement of species diversity; and
4. Enhancement or restoration of riparian values [e.g., cottonwood/willow habitat, improved bird and wildlife habitat];

ADEQ cannot predict how many owners of wastewater treatment plants may request a modification of a water quality standard on the ground of net ecological benefit. However, it is expected that there will be few such requests. Currently, there are only 35 effluent dependent waters in the state and the wastewater treatment plants

which create these effluent dependent waters are not encountering difficulty in complying with applicable water quality standards. ADEQ is aware of only two municipalities in the state, the Cities of Phoenix and Nogales, that have considered zero discharge options for their wastewater treatment plants because of the potential high cost of treatment upgrades necessary to achieve compliance with applicable water quality standards.

Economic Impact of the Proposed Repeal of the Water Quality Criteria Turbidity for the Full Body Contact and Partial Body Contact Designated Uses

ADEQ repealed the water quality criteria for turbidity for the full-body contact and partial-body contact designated uses. The repeal of the turbidity criteria will affect ephemeral waters and land use activities which occur around them. The practical result of the repeal of the turbidity criteria for the partial-body contact designated use is that turbidity standards will not apply to ephemeral waters in Arizona.

The repeal of water quality criteria for turbidity in ephemeral waters may benefit urbanized counties and municipalities that are regulated under NPDES stormwater permits. The repeal of the water quality criteria for turbidity for the partial-body contact and full-body contact designated uses eliminates the possibility that NPDES permits for stormwater discharges to ephemeral waters may include water quality-based discharge limitations for turbidity. It should be noted that the draft NPDES stormwater permits for municipal storm sewer systems do <u>not</u> include any water quality-based discharge limitations. Thus, the repeal of the water quality criteria for turbidity will have no short-term effect on NPDES-permitted stormwater discharges in the short term [i.e., in the first NPDES permit cycle of 5 years]. The repeal may provide a benefit if water quality-based discharge limitations are incorporated into reissued NPDES stormwater permits in future permit cycles.

Economic Impact of the Proposed Diurnal Standard for Dissolved Oxygen in Effluent Dependent Waters

ADEQ adopted a more stringent, diurnal dissolved oxygen standard for effluent dependent waters. The adopted daytime standard for dissolved oxygen in an effluent dependent water is 3.0 mg/L. The currently effective dissolved oxygen standard is 1.0 mg/L. The adopted standard may affect approximately 35 wastewater treatment plants which create effluent dependent waters in Arizona. While the dissolved oxygen standard which applies during the daytime is more stringent, it should have no impact on wastewater treatment plants. Data collected by ADEQ shows that effluent dependent waters currently meet or exceed the more stringent daytime dissolved oxygen standard. Dissolved oxygen concentrations in effluent dependent waters range from 1.0 mg/L during the night to 12 mg/L during the daytime hours. Effluent dependent waters may become super-saturated with oxygen during the daytime because of the amount of photosynthetic production of oxygen by aquatic plants. Thus, the adopted dissolved oxygen standard will not force any wastewater treatment plant to upgrade treatment.

Economic Impact of the Proposed Variance Provision

The proposed rule provides a mechanism for obtaining a variance from water quality standards. The proposed variance is discharger-specific. Thus, the only persons who may be directly affected by the proposed rule are point source dischargers to surface waters. The proposed rule provides a benefit to dischargers because it provides a way for the discharger to obtain short-term relief from compliance with a water quality standard if compliance is not technically or economically feasible. The adopted rule allows a specific discharger to avoid the high cost of upgrading treatment where it can be demonstrated that imposing such cost would have a substantial and widespread economic and social impact.

Economic Impact of Proposed Revisions to Numeric Water Quality Criteria

ADEQ adopted revisions to the numeric water quality criteria for the domestic water source, fish consumption, full body contact and partial body contact designated uses. These revisions may affect point source dischargers that discharge pollutants to surface waters with those designated uses. For example, revisions to the water quality criteria for the domestic water source designated use will affect only those point source dischargers that discharge to a surface water with that designated use. In most cases, the point source dischargers who are affected are domestic and municipal wastewater treatment plants. The revision to an applicable water quality standard may result in a change in a discharge limitation in a NPDES permit for the wastewater treatment plant or a new monitoring requirement.

The majority of the revisions to the numeric water quality criteria result in less stringent criteria. The adoption of a less stringent water quality criterion will have no economic impact on any point source discharger. However, in some cases, the revision results in a more stringent water quality criterion. In such cases, there is a possibility that a point source discharger may be required to upgrade treatment to ensure compliance with the more stringent water quality standard. A treatment upgrade would be required only if a discharge contains the pollutant in a concentration that would result in a violation of the more stringent water quality standard. Again, it is unlikely that more stringent water quality standards adopted by ADEQ will affect point source dischargers because, in most cases, the more stringent water quality standards are for pollutants that are not typically found in effluents and point source dischargers are not required to conduct routine monitoring for them.

A number of the changes in the water quality criteria, especially for the PBC designated use, resulted in a change from a water quality criterion of "no numeric standard [NNS]" to a numeric standard. If it is determined that a permitted facility should monitor for one of these parameters, then the result could be additional monitoring costs.

For the domestic water source designated use, ADEQ revised the water quality criteria for eight pollutants to be more stringent. These pollutants are: Boron, 1,3-dichloropropene, manganese, mercury, nickel, pentachlorophenol, 1,2,4-trichlorobenzene and zinc.

For the fish consumption designated use, ADEQ revised the water quality criteria for six pollutants to be more stringent. These pollutants are: Cadmium, 1,3-dichloropropene, pentachlorophenol, thallium, 1,2,4-trichlorobenzene and zinc.

For the full body contact designated use, ADEQ revised the water quality criteria for twenty-one pollutants to be more stringent. These pollutants are: Boron, carbofuran, total residual chlorine, cyanide, 1,2-dibromomethane, 2,4-dichlorophenoxyacetic acid, 1,3-dichloropropene, 2,4-dimethylphenol, dimethyl phthalate, 2-methyl-4,6-dinitrophenol, ethylbenzene, manganese, nitrate, nitrite, pentachlorophenol, styrene, thallium, toluene, 1,2,4-trichlorobenzene, 2-(2,4,5-trichlorophenoxy) propionic acid and xylenes.

For the partial body contact designated use, ADEQ revised the water quality criteria for thirty-seven pollutants to be more stringent: Alachlor, anthracene, arsenic, atrazine, barium, BHC-gamma, bis (2-ethylhexyl) phthalate, boron, carbofuran, carbon tetrachloride, chlordane, chlorine, cyanide, DDT, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dichlorophenoxyacetic acid, 1,3-dichloropropene, 2,4-dimethylphenol, dimethyl phthalate, 2-methyl-4,6-dinitrophenol, 2,4-dinitrotoluene, endosulfan sulfate, endrin aldehyde, ethylbenzene, fluoride, manganese, methoxychlor, methylene chloride, nitrate, nitrite, tetrachloroethylene, thallium, toluene, 1,2,4-trichlorobenzene, 2,4,5-TP, xylenes.

It should be noted that all surface waters in Arizona have multiple designated uses. Where there is more than one designated use and multiple water quality criteria apply to a surface water, the most stringent water quality criterion applies. For example, the water quality criteria for the full body contact designated use may be less stringent than the water quality criteria that have been established to maintain and protect water quality for other designated uses. Thus, even where ADEQ revised the full body contact criterion to be more stringent, it may have no economic impact because other applicable water quality criteria are more stringent. In general, the water quality criteria for the full body contact and partial body contact designated uses are less stringent than the water quality criteria that have been established for the domestic water source, fish consumption, and aquatic and wildlife designated uses. Consequently, the revision of the full body contact and partial body contact water quality criteria will have no economic impact in terms of a facility requiring upgrades in treatment capabilities to meet the water quality criteria. However, because many of the changes to the partial body contact criteria result in the establishment of a water quality standard rather than NNS, there is the potential for increased monitoring costs for facilities that may be required to monitor for new criteria.

The majority of large NPDES permitted facilities are required to monitor for a routine set of sixteen chemicals (See following Table 1). Small facilities will have an even more limited set of chemicals to monitor. Only in special cases where there is a reasonable potential for a chemical to be present in the waste stream will a facility have discharge limitations in their permit for chemicals other than the sixteen routine chemicals.

Two approaches were undertaken to evaluate the impact of changes in the water quality criteria for these sixteen chemicals listed in Table 1 on existing NPDES permitted facilities. The first approach was to look at a subset of existing NPDES permits. Thirty-two of 143 NPDES or ca. 23% of the existing NPDES permits were reviewed. Six facilities were found that could be required to have more stringent discharge limitations put into their permit. However, for all six facilities a review of their discharge monitoring reports showed that the facility was already discharging water that met the new standard. A review, then, of almost one quarter of existing permits showed that the changes in water quality criteria for routinely monitored chemicals would have no impact on the facilities.

The second approach used to evaluate the impact of changes to the numeric water quality criteria was to look at the effect of a change in the water quality standard in the context of all other designated uses. This approach is useful since the discharge limitations placed in NPDES permits are based on the most stringent designated use that is applied to the water body receiving the discharge. This review showed that of the sixteen chemicals routinely monitored, modifications in the numeric criteria for seven of them (antimony, beryllium, cadmium, cyanide, mercury, selenium, and zinc) have no impact on NPDES permits as other designated uses (usually aquatic and wildlife criteria) are protected by more stringent criteria. Of the remaining nine chemicals, changes in the water quality criteria for six chemicals (barium, boron, chlorine, manganese, nitrate and nitrite) could result in increased monitoring costs as these chemicals previously had no numeric standard, but now with a numeric standard could be placed in permits with a discharge limitation. Because the requirement to monitor for any of these six chemicals depends on the nature of the facility, the waste stream and the designated uses of the receiving water body, it was not possible to evaluate an average additional cost per facility. However, in no case is it believed that any of the new discharge limitations would be difficult for a NPDES permitted facility to meet. The three remaining chemicals (arsenic, nickel, and thallium) are more stringent in specific ways (see following Table 1). However, in the review of almost one quarter of existing NPDES permits no compliance problems were identified as a result of these changes.

With regards to arsenic, it should be noted that the adopted rules include a change of the fish consumption arsenic standard from 3.1 μg/L to 1450 μg/L. In parts of the state the 3.1 μg/L standard was below natural background levels for arsenic, especially in the Verde and Lower Salt River basins. The result was the potential for significant compliance problems for dischargers. The considerably less stringent adopted standard results

from the reclassification of arsenic in fish tissue from a carcinogen to a non-carcinogen. This change is expected to benefit many point source dischargers. In addition to changes in the water quality criteria for routinely monitored chemicals, many changes (both more and less stringent) also occurred for chemicals for which NPDES permitted facilities do not have to routinely monitor. Table 2 summarizes the effect of these changes in the water quality criteria in terms of the most stringent use. In the review of the subset of NPDES permits (23% of the total), no compliance problems were identified by the changes in these water quality criteria.

Table 1. Summary of Proposed Changes to Human Health Criteria Routinely Monitored by NPDES-Permitted Facilities

Parameter	Uses with Modified Standards (all values in μg/L)	Cost/Benefit of Proposed Change	
Antimony	DWS (2.8 to 6)	**Benefit -** No Effect -	For waters with the DWS use, the most stringent use, the new DWS standard is less stringent. If the water does not have the DWS use, then no change.
Arsenic	FC (3.1 to 1450) PBC (2800 to 50)	**Benefit -** *Cost -*	Any water with the FBC or DWS use, the most stringent standard has changed from 3.1 μg/L to 50 μg/L. For any water with PBC, the standard is more stringent (2800 μg/L to 50 μg/L).
Barium	DWS (1000 D to 2000 T) FBC (1000 D to 9800 D) PBC (NNS to 9800 D)	**Benefit -** *Cost -*	For waters with the DWS use, the new standard is less stringent. For waters without the DWS use (except listed canals), there is now a numeric standard; resulting in a new parameter to measure.
Beryllium	DWS (0.008 to 4) FBC (0.33 to 4)	**Benefit -** No Effect -	For canals that have the DWS use, the standard is now less stringent. For waters with an FBC or DWS use, the FC criteria remain more stringent.
Boron	DWS (NNS to 630) FBC (NNS to 12600) PBC (NNS to 12600)	*Cost -*	For waters with the DWS use, new standard established that is now the most stringent for all uses. For waters without the DWS or AgI uses, but with FBC or PBC uses, there is a new numeric standard to measure.
Cadmium	FC (83 to 41)	No Effect -	All A&W and DWS criteria remain more stringent.
Chlorine	FBC (NNS to 14000) PBC (NNS to 14000)	*Cost -* No Effect -	Because A&We has no numeric standard, new PBC standard results in a new parameter to be measured for ephemeral waters. For waters with A&Wc, A&Ww or A&Wedw, these A&W criteria remain the most stringent.
Cyanide	DWS (140 to 200) FBC (3100 to 2800) PBC (3100 to 2800)	No Effect -	All A&W criteria remain the most stringent.

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Parameter	Uses with Modified Standards (all values in $\mu g/L$)	Cost/Benefit of Proposed Change
Manganese	DWS (NNS to 4900 T) FBC (NNS to 19600 T) PBC (NNS to 19600 T)	*Cost* - For waters that do not have an AgI use, there is a new parameter to be measured. For waters with DWS, the new standard is more stringent than the AgI criteria.
Mercury	DWS (2.1 to 2)	No Effect - The associated A&W criteria remain the most stringent.
Nickel	DWS (140 to 100) FC (400 to 730)	*Cost* - For waters with the DWS use and low hardness (ca. < 90 mg/L $CaCO_3$), the new DWS standard is more stringent. No Effect - For waters without the DWS use, the A&W standards are typically more stringent.
Nitrate	FBC (NNS to 224000) PBC (NNS to 224000)	*Cost* - For waters without the DWS use (except listed canals), there is a new parameter to measure. No Effect - For waters with DWS, the DWS standard remains the most stringent.
Nitrite	FBC (NNS to 14000) PBC (NNS to 14000)	*Cost* - For waters without the DWS use (except listed canals), there is a new parameter to measure. No Effect - For waters with the DWS use, the DWS standard remains the most stringent.
Selenium	FBC (420 to 700) PBC (420 to 700)	No Effect - All A&W criteria remain the most stringent.
Thallium	DWS (0.63 to 2) FBC (3700 to 12) FC (44 to 41) PBC (3700 to 12)	**Benefit** - For waters with the DWS use, the most stringent use, the new DWS standard is less stringent. *Cost* - For waters without the DWS use, the new FBC, PBC and FC criteria are all more stringent.
Zinc	DWS (5000 to 2100) FBC (28000 to 42000 T) FC (NNS to 22000) PBC (28000 to 42000 T)	No Effect - All A&W criteria remain the most stringent.

Table 2. Summary of Proposed Changes to Human Health Criteria Not Routinely Monitored by NPDES Permitted Facilities

Parameter	Uses with Modified Standards (all values in $\mu g/L$)	Cost/Benefit of Proposed Change
Acenaphthylene	DWS (0.003 to NNS) FBC (0.12 to NNS) FC (0.002 to NNS)	**Benefit -** All uses now have no numeric standard.
Acrolein	FBC (1300 to 2200) PBC (1300 to 2200)	No Effect - All A&W criteria remain the most stringent.
Acrylonitrile	PBC (1400 to NNS)	No Effect - All A&W criteria remain the most stringent.
Alachlor	FBC (NNS to 1400) PBC (NNS to 1400)	*Cost* - For waters without the DWS use (except listed canals), now have a numeric standard; resulting in a new parameter to measure. No Effect - For waters with the DWS use, there is no effect as the DWS standard remains the most stringent.
Anthracene	FBC (420000 to 42000) PBC (NNS to 42000)	*Cost* - For waters without the DWS use (except listed canals), now have a numeric standard; resulting in a new parameter to measure. No Effect - For waters with the DWS or FC uses, there is no effect as these uses have more stringent standards.
Atrazine	FBC (NNS to 4900) PBC (NNS to 4900)	*Cost* - For waters without the DWS use (except listed canals), now have numeric standard; resulting in a new parameter to measure. No Effect - For waters with the DWS use, there is no effect as the DWS standard remains the most stringent.
Benzene	PBC (470 to NNS)	**Benefit -** For ephemeral waters, there is no longer a standard to measure. No Effect - For waters with PBC and other A&W uses, the A&W criteria remain more stringent.
Benzidine	FC (0.0007 to 0.002)	**Benefit -** For waters without the DWS use (except canals), the criteria are less stringent. No Effect - For waters with the DWS use, the DWS criteria remain more stringent than the FC criteria.

Table 2. Summary of Proposed Changes to Human Health Criteria Not Routinely Monitored by NPDES Permitted Facilities

Parameter	Uses with Modified Standards (all values in $\mu g/L$)	Cost/Benefit of Proposed Change	
Benzo (a) pyrene	DWS (0.003 to 0.2) FBC ((0.12 to 0.2)	**Benefit -** No Effect -	For canals that have the DWS use, the standard is now less stringent. For waters with an FBC or DWS use, the FC criteria remain more stringent.
Benzo (ghi) pyrelene	DWS (0.003 to NNS) FBC (0.12 to NNS) FC (0.00001 to NNS)	**Benefit -**	All uses now have no numeric standard; no longer a standard to measure.
BHC - gamma (lindane) (Hexachlorocyclohexane gamma)	PBC (2500 to 42)	No Effect -	All A&W criteria remain the most stringent.
Bis (2-ethylhexyl) phthalate (Di(2-ethylhexyl) phthalate)	DWS (2.5 to 6) PBC (28000 to 2800)	**Benefit -** No Effect -	For waters with the DWS use, which is the most stringent use, the standard is now less stringent. For waters without the DWS use (except listed canals), no change as A&W criteria are more stringent.
Carbofuran	FBC (NNS to 700) PBC (NNS to 700)	*Cost -* No Effect -	For waters without the DWS use (except listed canals), new numeric standard to be measured. For waters with the DWS use, no change as the DWS standard remains the most stringent.
Carbon tetrachloride	PBC (8000 to 98)	*Cost -*	PBC standard now more stringent than all A&W criteria; because A&We has no numeric standard, new PBC standard results in new parameter to be measured for ephemeral waters.
Chlordane	PBC (110 to 8.4)	No Effect -	All associated A&W uses have more stringent standards.
DDT	PBC (700 to 70)	No Effect -	All A&W criteria remain the most stringent.
1,2-Dibromoethane	FBC (NNS to 1.6)	*Cost -* No Effect -	For waters without the DWS use (except listed canals), there is a new parameter to measure. For waters with the DWS use, the DWS standard remains the most stringent.

Table 2. Summary of Proposed Changes to Human Health Criteria Not Routinely Monitored by NPDES Permitted Facilities

Parameter	Uses with Modified Standards (all values in $\mu g/L$)	Cost/Benefit of Proposed Change
1,3-Dichlorobenzene	FBC (13000 to 1880) FC (1200 to 2000) PBC (13000 to 1880)	*Cost* - For waters with A&We, new PBC standard is more stringent. No Effect - For waters without A&We and canals, no change as the DWS and other A&W criteria remain more stringent.
1,4-Dichlorobenzene	FBC (13000 to 1880) PBC (13000 to 1880)	*Cost* - For waters with A&We, new PBC standard is now more stringent than A&We. No Effect - For waters without A&We and canals, no change as the DWS and A&W criteria remain more stringent.
Dichlorobromomethane (Bromodichloromethane)	FBC (11 to 100) FC (10 to 22)	**Benefit** - For waters with the FC use, the most stringent use, the new FC standard is less stringent.
1,1-Dichloroethane	FBC (14000 to NNS) PBC (14000 to NNS)	**Benefit** - All uses now have no numeric standard; no longer a standard to be measured.
1,2-Dichloroethane	PBC (10000 to NNS)	**Benefit** - Ephemeral waters no longer have a numeric standard; A&Ww and A&Wedw criteria are less stringent than withdrawn PBC standard.
2,4-Dichlorophenoxyacetic acid	FBC (NNS to 1400) PBC (NNS to 1400)	*Cost* - For waters without the DWS use (except listed canals), there is a new parameter to be measured. No Effect - For waters with the DWS use, the DWS standard remains the most stringent.
1,2-Dichloropropane	FBC (200 to NNS) PBC (200 to NNS)	**Benefit** - Ephemeral waters no longer have a numeric standard; A&Ww and A&Wedw criteria are less stringent than withdrawn PBC standard. No Effect - For waters with DWS use, the DWS standard remains the most stringent.
1,3-Dichloropropene	DWS (2.1 to 0.2) FBC (60 to 7.8) FC (360 to 6.6) PBC (60 to 42)	*Cost* - All waters with these now have more stringent standard.

Table 2. Summary of Proposed Changes to Human Health Criteria Not Routinely Monitored by NPDES Permitted Facilities

Parameter	Uses with Modified Standards (all values in $\mu g/L$)	Cost/Benefit of Proposed Change	
2,4-Dimethylphenol	FBC (28000 to 2800) PBC (NNS to 2800)	*Cost* - No Effect -	For ephemeral waters, new PBC standard results in new parameter to be measured. For waters with PBC and A&Ww or A&Wedw, these A&W criteria remain more stringent; waters with FBC, the FC and/or DWS criteria remain the most stringent.
Dimethyl phthalate	FBC (14000000 to 1400000) PBC (NNS to 1400000)	*Cost* - No Effect -	For ephemeral waters, new PBC standard results in new parameter to be measured. For waters that are not ephemeral (except listed canals), the A&W criteria remain the most stringent.
2-methyl-4,6-Dinitrophenol (4,6-Dinitro-o-cresol)	FBC (550 to 55) PBC (NNS to 55)	*Cost* - No Effect -	For ephemeral waters, new PBC standard results in new parameter to be measured. For waters that are not ephemeral and without the DWS use (except listed canals), the A&W criteria remain the most stringent. For waters that are not ephemeral but with the DWS use, the DWS standard remains the most stringent.
2,4-Dinitrotoluene	DWS (0.009 to 14) FBC (0.38 to 280) FC (0.02 to 163) PBC (NNS to 280)	**Benefit** - *Cost* -	For waters that are not ephemeral, the DWS, FBC and FC criteria are now less stringent. For ephemeral waters, new PBC standard results in new parameter to be measured.
Endosulfan sulfate	PBC (NNS to 7)	No Effect -	All A&W criteria remain the most stringent.
Endosulfan-alpha,beta (Endosulfan-Total)	All Uses	**Benefit** -	Two parameters combined resulting into only one parameter to be measured.
Endrin aldehyde	PBC (NNS to 420)	No Effect -	All A&W criteria remain the most stringent.
Ethylbenzene	FBC (64000 to 14000) PBC (64000 to 14000)	*Cost* - No Effect -	For ephemeral waters, new PBC standard more stringent. For waters that are not ephemeral, the DWS and A&W criteria remain the most stringent.
Fluoride (Fluorine)	PBC (NNS to 8400)	*Cost* -	For ephemeral and effluent-dependent waters, the new PBC standard is more stringent.

Table 2. Summary of Proposed Changes to Human Health Criteria Not Routinely Monitored by NPDES Permitted Facilities

Parameter	Uses with Modified Standards (all values in μg/L)	Cost/Benefit of Proposed Change
Heptachlor	FBC (0.31 to 0.4) PBC (20 to 70)	No Effect - All A&W criteria remain the most stringent.
Heptachlor epoxide	FBC (0.15 to 0.2)	No Effect - All A&W criteria remain the most stringent.
Hexachlorobenzene	DWS (0.02 to 1) FBC (0.83 to 1) PBC (100 to 280)	**Benefit -** For waters with the PBC use, the new PBC standard is now less stringent. No Effect - For waters with the FBC or DWS use, the FC standard remains more stringent.
Hexachlorobutadiene	PBC (280 to NNS)	**Benefit -** For ephemeral waters, there is no longer a standard to be measured.
Hexachlorocyclopentadiene	DWS (49 to 50)	No Effect - All A&W criteria remain the most stringent.
Isophorone	DWS (8.5 to 36.8) FBC (340 to 1500) FC (520 to 2300)	**Benefit -** For waters that are not ephemeral, the DWS, FBC, and FC standards are now less stringent.
Methoxychlor	FBC (NNS to 700) PBC (NNS to 700)	*Cost -* For waters without the DWS use (except listed canals), there is a new parameter to be measured. No Effect - For waters with DWS, the DWS standard remains more stringent.
Methyl Chloride (Chloromethane)	DWS (5.7 to NNS) FC (1800 to NNS) FBC (230 to NNS) PBC (2800 to NNS)	No Effect - All A&W criteria remain the most stringent.
Methylene chloride (Dichloromethane)	DWS (4.7 to 5) PBC (27000 to 13000)	**Benefit -** For waters with the DWS use, the most stringent use, the new DWS standard is less stringent. *Cost -* For ephemeral waters, the new PBC standard is more stringent.
Naphthalene	FBC (560 to NNS) PBC (560 to NNS)	**Benefit -** For ephemeral waters, the withdrawal of the PBC standard results in no numeric standard for these waters and a parameter that no longer needs to be measured. No Effect - For waters that are not ephemeral, the A&W uses remain more stringent.

Table 2. Summary of Proposed Changes to Human Health Criteria Not Routinely Monitored by NPDES Permitted Facilities

Parameter	Uses with Modified Standards (all values in μg/L)	Cost/Benefit of Proposed Change	
N-nitrosodiphenylamine	FC (12 to 14)	**Benefit -** No Effect -	For waters without the DWS use but with A&Wc or A&Ww uses, the FC use, the most stringent use, is now less stringent. For waters with the DWS use, the DWS standard remains the most stringent.
Pentachlorophenol	DWS (210 to 1) FBC (2000 to 11.7) FC (29000 to 8.2)	*Cost* -	For waters with the DWS use, the DWS standard is now typically more stringent than the A&W chronic standards. For waters that are not ephemeral, have the FC use, do not have the DWS use and have a pH of > 7.4, the new FC standard is more stringent.
Phenanthrene	DWS (0.003 to NNS) FBC (0.12 to NNS) FC (0.0005 to NNS)	No Effect -	All A&W criteria remain the most stringent.
Polychlorinatedbiphenyls	FBC ((0.18 to 0.5)	No Effect -	The FC standard remains the most stringent.
Styrene	FBC (NNS to 28000) PBC (NNS to 28000)	*Cost* -	New parameter to measure for waters with FBC or PBC use.
1,1,2,2-Tetrachloroethane	PBC (450 to NNS)	**Benefit -**	For ephemeral waters, no longer a parameter to be measured.
Tetrachloroethylene	PBC (4000 to 1400)	*Cost* -	For ephemeral waters, the new PBC standard is more stringent.
Toluene	FBC (42000 to 28000) PBC (42000 to 28000)	*Cost* - No Effect -	For ephemeral waters, the new PBC standard results is more stringent. For waters that are not ephemeral or listed canals, the A&W criteria remain the most stringent.
Toxaphene	PBC (1000 to NNS)	No Effect -	All A&W criteria remain the most stringent.
1,2,4-Trichlorobenzene	DWS (NNS to 70) FBC (2800 to 1400) FC (NNS to 155) PBC (2800 to 1400)	*Cost* -	For waters with the DWS use, the most stringent use, the new DWS standard is more stringent. For waters without the DWS use that have the FC use, the new FC standard is more stringent. For ephemeral waters, the new PBC standard is more stringent.

Table 2. Summary of Proposed Changes to Human Health Criteria Not Routinely Monitored by NPDES Permitted Facilities

Parameter	Uses with Modified Standards (all values in $\mu g/L$)	Cost/Benefit of Proposed Change	
1,1,1-Trichloroethane	FC (160000 to NNS) FBC (13000 to NNS) PBC (13000 to NNS)	No Effect -	All A&W criteria remain the most stringent.
1,1,2-Trichloroethane	DWS (0.61 to 5)	**Benefit -**	For waters with the DWS use, the most stringent use, the new DWS standard is more stringent.
Trichloroethylene	FC (78 to NNS) FBC (110 to NNS)	No Effect -	All A&W criteria remain the most stringent.
2,4,5-TP	FBC (NNS to 1120) PBC (NNS to 1120)	*Cost* -	For waters without the DWS use (except listed canals), the new FBC and PBC standards result in a new parameter to be measured.
Xylenes	FBC (NNS to 280000) PBC (NNS to 280000)	*Cost* -	For waters without the DWS use (excepted listed canals), the new FBC and PBC standards result in a new parameter to be measured.

Economic Impact of Proposed Addition of Fish Consumption Designated Uses

The addition of the fish consumption designated use to surface waters that are identified as cold water or warm water fisheries had the potential to result in new discharge limitations or monitoring requirements for point source dischargers who discharge to surface waters with the added use. ADEQ has determined that only one existing NPDES-permitted facility discharges to a water body that had the fish consumption use added. A review of the discharge limitations in this facility's NPDES permit showed that the additional use would result in no additional monitoring cost or more stringent discharge limitations.

Economic Impact of Proposed Unique Waters Designations

Three surface waters are classified as unique waters in the adopted rules. The classification of a surface water as a unique water results in a high level of water quality protection for that surface water. In general, the water quality standards rules require that existing water quality in a unique water be maintained and protected. No degradation of existing water quality in a unique water is allowed.

Two of the new unique waters are located in federal wilderness areas that will remain undeveloped. For this reason, the unique waters classifications for Aravaipa Creek and the Cave Creek watershed are expected to have no economic impact. The third unique water, Buehman Canyon Creek, is located on public lands managed by U.S. Forest Service and on private lands. The classification of Buehman Canyon Creek as a unique water may have a significant economic impact. Because ADEQ classified Buehman Canyon Creek as a unique water, any land use activities within the Buehman Creek Canyon watershed are given strict scrutiny under the antidegradation provisions of the water quality standards rules. Any land use activity in the watershed which will degrade water quality in Buehman Canyon Creek is prohibited.

This portion of the EIS focuses on the economic impact associated with the classification of Buehman Canyon Creek as a unique water. It illustrates an increasingly common decision problem that governments with environmental laws face: the problem that focuses on the tension between the need of private companies with mining claims to mine non-renewable resources and the need of society as a whole to keep undeveloped the increasingly rare riparian and ecologically significant areas of the State.

The classification of Buehman Canyon Creek as a unique water was intended by ADEQ to prevent the discharge of pollutants into the surface water and groundwater. The Department does not intend to prohibit mining or any other economic activity from occurring in the area. However, Keystone Minerals, Inc., a Tucson based mining company with unpatented rights to minerals in the Canyon, claims that the unique waters designation will

effectively preclude it from developing the property.

Mining the property is only one of the activities for which the area has economic potential. Comments submitted by interested parties and members of the public were overwhelmingly in favor of granting the unique waters designation for a variety of reasons including ecosystem preservation, aesthetic/recreational, and tourism activities.

Using a variety of research methods and analytical techniques, ADEQ staff, in conjunction with Thomas, Warren and Associates, developed revenue projection models for two scenarios to arrive at economic impact estimates from the competing land uses: 1) Model A made the assumption that Keystone Minerals, Inc. goes ahead with its plan to mine copper in Buehman Canyon; and 2) Model B makes the assumption that mining does not occur in the area, and that tourism and recreational activities become the principal tools for economic development.

Revenue modeling for copper mining yielded direct impacts of between $20 to 24 million annually or a conservative estimate of $200 over ten years (the life expectancy of Korn Kob, Keystone's copper project). In contrast, recreational and tourism activities will generate between $59 and $64 million annually, or a conservative estimate of $590 million over a decade. ADEQ concludes, therefore, that the probable benefits of designating Buehman Canyon Creek "unique waters" outweigh the probable costs.

Economic impacts of copper mining versus recreational and tourism activities in Buehman Canyon

Among the costs for designating Buehman Canyon Creek as a unique water are those which revolve around the economic concept of opportunity costs. The mining company, Keystone Minerals, Inc. [1] (which had contracted with two Canadian mining companies to develop the property) will forego the opportunity to develop the ore reserves which it claims exists in sufficient enough quantities to make the project economically feasible at the current world market price of copper.

The company has projected gross revenues of about $200 million over a period of 10 years -- the expected economic life of the mine. The foregone opportunity would be a cost not only to the company in question, but also to various private and public sector entities which are in the multiplier "chain". These are private companies that would supply Keystone with goods and services it needs to operate, as well as government entities that would become the recipient of tax and fee revenues if Korn Kob becomes fully operational.

Copper mining has, for a long time, been a mainstay of the Arizona economy. A study prepared by the Western Economic Analysis Center (WEAC) on the copper industry's impact on the Arizona economy stated that in 1992, the copper industry had a total direct impact of $1.7 billion, and a combined (including indirect) impact of $6.5 billion. In the same year, a total of 12,100 people were directly employed in copper exploration and production, with industry payroll expenditures amounting to over $450 million. [2]

On the other hand, designating Buehman Canyon Creek as a unique water and keeping the area undeveloped will carry socio-economic benefits for the entire population of the State. These benefits may be grouped under three broad headings:

1. Ecological Benefits: These derive from the argument that there are intrinsic values to maintaining ecosystems, including preservation of wildlife, especially endangered species of flora and fauna which are known to exist in the Canyon. Existing riparian ecosystems occupy less than one-half of 1% of Arizona's land area, and over 90% of Arizona's riparian areas have already been destroyed, according to the Southwest Center for Biological Diversity and the Arizona Riparian Council. [3] (See, also, Appendix B.)

2. Aesthetic/Recreational Benefits: The preservation of scenic beauty carries economic value for local citizens and tourists. Comments made during the public hearings for this rule (and in the form of letters) were overwhelmingly in favor of keeping the canyon pristine for hikers, birdwatchers, nature lovers, conservation groups, land stewards, photographers, etc..

Tourism is also a mainstay of the Arizona economy. And it has been growing at a robust rate, in tandem with the State's rapid population growth. According to data issued by the Northern Arizona University Hospitality Research and Resource Center (NAU AHRRC), the number of visitors increased from 16.2 million in 1984 to 26.3 million in 1994, an increase of 62% over the decade. The visitors in 1994 consisted of domestic (87%) and international (13%) travelers, who together were responsible for the expenditure of $9.7 billion.

According to the 1994 Arizona Statewide Comprehensive Outdoor Recreation Plan, there were 11.5 million visitor use days spent in exclusively wildlife related activities, and a total of almost $400 million in expenditures by these recreators, mostly in Arizona rural communities. And a 1994 poll conducted by the Arizona State Parks Board ascertained that 50% of Arizonans polled, engaged in back country recreational activities. [4] The beauty of the natural areas, and the continued influx of tourism dollars cannot be maintained in the Canyon if mining were to occur in the area.

Coronado National Forest, of which Buehman Canyon is a part, hosts 1.7 million visitors annually. It would be expected that as riparian areas become evermore scarce and the demand for outdoor recreational activities continues to increase, the value of areas such as Buehman Canyon will increase (see Appendix B).

Using the above mentioned State Parks Board study, it is estimated that an average of $34.78 per visitor per day is spent in wildlife related activities in Arizona. On this basis, an estimated annual total of $59 million is spent by visitors to this area. Over a period of ten years, therefore, a conservative $590 million is projected. This is a conservative estimate because it does not take into account the growth trends in tourist and resident expenditures, and no inflationary factor was built into the projections.

3. Intergenerational Equity Benefits -- The benefits of maintaining the area pristine would accrue not only to the existing populations in the State with competing interests, but also to future generations who would derive a variety of utility values from an undeveloped site. Among these are ranchers and other landowners, people residing in the vicinity and downstream of Buehman Canyon Creek (including American Indian tribes) with water rights, and property owners whose property values would be affected by land use.

The protection of the natural environment is not merely an aesthetic or moral issue which is dependent on the subjective evaluation of the "beholder." Thomas M. Power, University of Montana Economics Dept. Chairman, writes: "High quality living environments, including both the natural and social environments, are very important economic resources. -- Because people care about where they live and because people and economic activity are attracted to the West [due to] its high quality natural landscapes, protecting that landscape also protects one of the primary sources of the West's economic vitality. -- Businesses also care about where the population is located because the cost and quality of employees is a dominant determinant of business profitability."

Power analyzes the demographic shift in this country toward the Sun Belt and refers to environmental factors as a draw in Americans' pursuit of preferred climate and other natural amenities. He asserts that enhanced environmental protection forms a necessary part of the "new" economic base. By contrast, he points to the mining towns of the West which have become run down and depressed communities due to the price volatility of non-renewable resources, and the uncertainty associated with the mining industry. Despite "high wages", the result has been unstable employment and unstable incomes, not to mention the lack of long-term investments that would sustain continued economic development. And for further proof, he notes, one need only look at many Third World countries which have been exporting minerals for many decades, but continue to remain trapped in poverty. [5]

ARS §41-1055 Requirements for the EIS

Persons directly affected by the rule:

1. Keystone Minerals Inc. (on the assumption that the company becomes operational), its employees, investors, contractors and sub-contractors, other suppliers, and federal, State and local governments that would be the recipients of copper mining-generated income, as well as tax and fee revenues, and possibly royalties.
2. Ranchers and other landowners in Buehman Canyon and in the San Pedro River below the Canyon, parties with water rights in the area, and others who have an economic interest in ranching and maintaining the area undeveloped.
3. Citizens of Arizona who have expressed the desire to keep Buehman Canyon pristine for ecological and aesthetic reasons, and to preserve the area for future generations.
4. Businesses in the recreational and tourist and travel/ hospitality industries would be affected. Among them are owners/operators of hotels, motels, restaurants, service stations and other transportation and retail trade establishments.
5. Consumers of tourism services, both from in- and out-of-state, who would take advantage of Buehman Canyon's scenic beauty if it remains undeveloped.

Cost-benefit analysis

B(3)a1. Costs to ADEQ, the implementing agency: There will be no incremental costs to ADEQ as a result of designating Buehman Canyon Creek as a unique water other than the minimal administrative costs of carrying this out, which the ADEQ budget can absorb.

Benefits to ADEQ -- No economic (dollar) benefits will accrue to ADEQ as a result of this rule. The "unique waters" designation would increase the chances of ADEQ fulfilling its mission of protecting public health and the environment. Since mining operations carry certain risks, not the least of which is the degradation of Creek water, it is the position of ADEQ that the designation would be a pollution prevention strategy.

B(3)a2. Costs to other state agencies: The designation would keep the Arizona Department of Revenue and possibly other taxing authorities (political subdivisions) of the state from receiving tax revenues associated with the mining operations of Keystone Minerals. Keystone Minerals has projected up to 25% of its net revenues as payable to all levels of government -- federal, state and local, including royalty payments in the event that the 1872 Mining Law is changed (See Appendix A).

Benefits to other state agencies: No direct benefits to other state agencies are anticipated. However, if more tourists come to Arizona as a result of Buehman Canyon being left undeveloped, revenues in the form of sales taxes, hotel industry bed taxes, as well as excise taxes from gasoline consumption and other travel-oriented activities is bound to increase. NAU AHRRC data show that state taxes generated by tourism increased from $252 million in 1991 to $312 million in 1994, an increase of 24% in only three years. [6]

B(3)b. Benefits and costs to political subdivisions: The tax and fee revenues accruing to counties and municipalities from mining operations would be lost. School districts and a variety of other local jurisdictions would also be recipients of this revenue. The tax and fee revenues accruing to counties and municipalities from increased tourism activity would be gained.

B(3)c. Costs to businesses: The largest cost would be borne by Keystone Minerals (see Appendix A). Annual cash flows would be distributed to employees, contractors, other suppliers and public sector taxing authorities. In addition, there could be balance of payments and international trade implications because the company plans to export some of its production to other countries.

A fundamental issue, however, is whether Korn Kob (Keystone's copper oxide project) is viable as a business. Among the material submitted by interested parties during the public comment period is a press release issued by two Canadian companies, Gold Giant Minerals of Vancouver and Corner Bay Minerals of Toronto on Feb. 20, 1996, indicating that they are withdrawing from their agreement with Keystone to mine the property because the copper grade of the ore reserves "do not meet the economic criteria" of the companies. [7]
While ADEQ is not in a position to verify the accuracy of Keystone's or other parties' claims concerning the economic viability of Korn Kob without conducting its own third party feasibility study, the withdrawal of partners may not necessarily prevent Keystone from finding others whose "economic criteria" are less stringent. Profitability of the project is a function of many factors, including the supply and demand for copper (as reflected in the world market price for the commodity), the quality of the ore reserves, the project's existing technology which influences its break-even price and the investors' required rate of return.

Benefits to businesses and to the citizens of Arizona: Benefits to private sector businesses (including small businesses) would take the form of increased sales associated with recreational and tourist activities directly attributable to Buehman Canyon Creek and Coronado National Forest. Many of the local businesses, especially in Pima County, would be the direct recipients of the estimated $59 million tourist and wildlife recreation dollars given above. To the extent that foreign tourists could be involved (especially from Mexico, Canada and Europe), there would also be balance of payments ripple effects.

B(3)c1. Benefit estimates derived from contingent valuation studies: Several Arizona studies of preservation value have employed contingent valuation techniques (see Appendix B). Survey results of willingness to pay for the preservation of Ramsay Canyon Preserve and the San Pedro River National Conservation Area (RNCA) yielded an average willingness to pay of $101.67 by visitors. With an annual visitation of 23,628 non-resident visitors in 1992, the annual preservation value of Ramsay Canyon was estimated to be $2.4 million; for the San Pedro RNCA (preservation of a perennial stream flow and riparian habitat), the annual preservation value is about $657,000.

B(3)c2. Ecological service value estimates: Ecological service values refer to the value of ecological functions. Some services, for example, provided by riparian ecosystems include provision of habitat for fish and other wildlife, water supply, amelioration of flooding events and promotion of groundwater recharge, and pollution mitigation. It is not known if any studies exist of ecological service values for riparian areas in the arid southwest. However, given protection, areas such as Buehman Canyon can be expected to provide ecological services for a very long time horizon. For example, with a time horizon of 10 years and one million visitors annually (similar to Sabino Canyon), a preservation value of $4 per person results in a value of $40 million.

Another component of the ecological service value is the benefits of species preservation, which derive from their potential pharmaceutical value. Biotechnology, both as a science and an industry, is experiencing dramatic growth in the US and depends on biodiversity for new sources of genetic material and ideas. Companies in the pharmaceutical industry are reputed to have generated several hundreds of millions of dollars in revenue made possible by research from biodiversity. It is believed that the Desert Pupfish, an AZ native and inhabitant of Buehman Canyon Creek will be important in providing a cure for skin cancer.

B(4) Impacts on public and private employment

B(4)a. Public Employment: No employment impacts on the public sector are anticipated as a result of the "unique waters" designation of Beuhman Canyon Creek.

B(4)b. Private Employment -- If Korn Kob becomes operational, the company will employ between 20 and 26 people with an annual estimated payroll of $895,000. The mining operations would be contracted out to an Arizona mining company which will employ 64 people in Korn Kob. In addition, an undetermined number of people in the construction industry would find short-term employment, mainly during the building of the solvent extraction and electrowinning plant. Other employment opportunities would exist for mining engineering consultants, legal, marketing and tax specialists and others like property appraisers.

If Korn Kob does not become operational, employment in the recreational and tourist/hospitality industries could increase. Identifying the number of employees that would be hired specifically because of the increased activities at Buehman Canyon is not possible at this time. However, NAU AHRRC data show that in 1994, the tourism industry was responsible for a total of 283,647 jobs in Arizona, 38% of which were directly related industry jobs.

B(5) Impacts on small businesses

B(5)a. Small businesses subject to the rule: The principal businesses that would be impacted by the "unique waters" designation is Keystone Minerals and its mining contractor. It is difficult to ascertain whether Keystone fits the statutory definition of a small business or not because it will have fewer than 100 employees, is not a leader in its field (i.e., is not in the same league as Phelps Dodge or Asarco), but is expected to generate $20 million annually, considerably more than the $4 million a year in gross revenue that defines the upper limit of small businesses.

If Beuhman Canyon remains undeveloped, the economic impacts will be mainly on businesses in the recreational and tourism/travel industries, the vast majority of which are categorized as small businesses. According to the County Business Patterns, Arizona 1992 (published by the US Bureau of the Census), 93% of all hotels and lodging places and 97% of all businesses in the State which are classified under amusement and recreation services, have fewer than 100 employees, and are therefore small businesses.

B(5)b. Administrative costs: There are no administrative costs to small businesses as a result of the "unique waters" designation.

B(5)c. Reduction of impact on small businesses: ADEQ did not deem it necessary to undertake measures specifically in aid of reducing any potential unfavorable impacts on small business. The "unique waters" designation will either be granted or not.

B(5)d. Costs and benefits to private persons: If Buehman Canyon Creek is granted "unique waters" status and the designation effectively precludes Keystone Minerals from mining the property, the persons who will be directly impacted will be the employees of Korn Kob as well as employees of other businesses affected by the project's cash flows. (See details in Appendix A.) They will bear the brunt of employment opportunity costs.

If the unique water classification is granted, a far bigger group of private persons will stand to benefit, to the extent that their expressed needs for recreational opportunities related to the use and enjoyment of an undeveloped Buehman Canyon will be met. (Please refer to the analysis of public comments and Appendix B.)

B(6) Probable effect on state revenues: If Korn Kob becomes operational, it will pay taxes and fee revenues to the state as well as local governments. The actual figure cannot be calculated, (the mine plan is not yet complete), although an annual amount representing about 25% of net revenues is projected by Keystone as payable to all levels of government, including federal. In 1992, the entire copper industry in Arizona contributed $396 million in direct ($117 million) and indirect impacts to state and local government revenues, according to the WEAC study.

If Buehman Canyon remains undeveloped, the sales tax and other revenues associated with recreational and tourism activities will accrue to state and local governments. Dollar figures specific to Buehman Canyon cannot be calculated. However, if the ratio of state tax revenue to total tourist expenditures reported by NAU AHRRC for 1994 holds true for Buehman Canyon, annual state taxes could be $1.8 million.

B(7) Less intrusive or less costly alternatives -- ADEQ did not explore less intrusive or less costly alternatives to the "unique waters" designation. The designation will either be granted or not.

Appendix A - Costs and benefits of designating Buehman Canyon Creek as a unique water

In a letter to ADEQ dated Feb. 2, 1996, Keystone Minerals Inc. objected to the nomination of Buehman Canyon Creek as a unique water because this "... may effectively preclude the further development and production from our mine." The company has been drilling and prospecting in the area during the last 25 years, and identified mineable ore reserves of about 20 million tons of soluble copper ore and an additional 50 million tons of "in situ" leachable ore. The company had an agreement with two Canadian mining companies to bring the property into production. The mining claims coincide with portions of Buehman Canyon Creek, and Keystone would consider the "unique waters" designation as a "regulatory taking by the State of Arizona."

ADEQ staff solicited economic data for the project, known as Korn Kob, and perused the comment letters submitted by the general public for information relevant to the economics of the project. Keystone had commissioned a number of engineering studies of the mine and submitted data based on a feasibility study conducted by Roberts & Schaefer, an engineering consulting company based in Utah. Information for the following factors were submitted:

1. Mineable ore reserves: 23,562,000 tons with a soluble copper grade of 0.42%. Below the two open pits are additional ore reserves, with an estimated "in situ" ore reserves of 50 million tons. Engineering studies are underway to verify the additional deposits.

2. Expected time frame of development: The company expects delays of between three to four years in the permitting process, approval of mine plans and other factors. However, it expects to be fully operational and generating an income stream about 15 months after breaking ground. Extraction of the known ore reserves is estimated to take about 8.63 years; hence, the projected mine life of about ten years is given as a reasonable assumption.
3. Initial capital requirements: $15 million for building the solvent extraction and electrowinning plant, heap pad construction and land acquisition. Keystone owns the mineral rights to the ore reserves found in about 1,000 acres of land in the area. Ranchers in Beuhman Canyon, however, own the grazing patents and surface rights to the land.
4. Keystone executives report that they are now negotiating with rancher/landowners to purchase between 800 to 1,000 acres which will include rights-of-way. Keystone is also negotiating to exchange land with the US Forest Service in order to acquire access to about half a section (320 acres) which contain ore reserves.
5. Employment impacts: Keystone as the operating company will employ between 20 and 26 people with managerial and professional skills and skilled labor. In addition, the company intends to contract with an Arizona mining company with a payroll of 64 people to mine the ore and place it on leaching pads. The number of people to be hired for land development and construction of the electrowinning plant is unknown at this point. The company intends to hire the majority of its employees from Arizona.
6. Expected annual operating costs: $11.3 million, based on the feasibility study's "optimum" case scenario. The mining of about 2.7 million tons of ore per year, and the generation of 4.1 million tons of waste per year is projected to yield an annual production estimate of 16.7 million lbs. of marketable copper. Based on data submitted by the company and other information sources, ADEQ staff constructed a cost-benefit flow analysis of the project. Some of the costs to the mining company are uncertain at this stage, but are analyzed to enable a clearer picture of where the project's cash flows would go.
7. Expected annual gross revenues: ADEQ calculated a range of between $20 and $24 million a year, depending on the world market price of copper. Over a ten-year period comprising the expected life of the mine, a total of $200 million is therefore projected. The low and high ends of the range were based on the average monthly prices of copper as published in Platt's Metals Week covering the period January 1995 to January 1996.

COSTS to Keystone Minerals which constitute benefits to other entities are indicated as annual average project cash flows:

1. Korn Kob Employees -- $895,000 in the form of salaries, wages and fringe benefits. Salaries and benefits range from $25,000 annually for helpers to $39,000 for mine geologists and $52,000 for mine engineers. The General Manager would be paid $75,000.
2. Mining Contractor: $6.7 million which includes the cost of mining, crushing, heap leaching, solvent extraction, electrowinning general facility operations and salaries and wages for 64 employees.
3. Payments to Utilities: $1.7 million based on an annual usage of 22.3 million kilowatt hours per year.
4. Other suppliers: $2 million for equipment and supplies required for operations, maintenance and miscellaneous expenditures (e.g., metal liners, sulfuric acid, reagent, cobalt, etc.).
5. Interest payments to financial institutions: An annual average of $786,000 is projected, assuming the company is able to borrow its initial capital requirements at the current prime lending rate of 8.5%. If normal amortization procedures are utilized, the company would pay interest of $1.275 million in year one and $179,000 in year 10.
6. Taxes: Payments to all levels of government could be between $1.5 and $2 million. The company did not want to project its tax burden, however it surmised that payments to federal, state and local governments (as well as royalty payments to the US in the event of changes to the federal mining law) could approach 25% of net proceeds. It was not possible to disaggregate the tax payments to State and local governments exclusively, however, payments would be in the form of corporate income, property, severance, payroll and sales taxes on Arizona purchases as well as a variety of other taxes and fees.
7. Investors' Rate of Return on Investment: The company declined to give an expected rate of return percentage, except to state that it is "favorable at current and anticipated world market prices for copper." According to Dr. Michael Rieber, Prof. of Mineral Economics with the University of AZ (interview of 3/18/96), Arizona mining companies in the past have indicated a break-even price of $0.65 to $0.75 cents per pound of copper using old technologies. Under the new heap leaching and solvent extraction methods, a production cost of $0.50 per pound makes it economic to mine copper oxide ores. [8]
8. Other costs to Keystone -- These costs cannot be calculated at this stage because the mine plan is not complete, and a lot of uncertainty about the project still exists. But if Korn Kob becomes operational, the following costs will inevitably be borne by the company. It has to be pointed out, however, that these costs are not required by the "unique waters" rule but by other statutes and rules:
   A. Preparing permit applications, which often involve the services of engineering and other mining consultants, can cost large sums, sometimes in the millions. The company will also need to obtain an Aquifer Protection Permit (APP) from ADEQ and other statutory requirements. These are costs that the company will likely incur before it can commence operations. Under

the proposed Water Quality Fee rules, ADEQ will be able to charge cost recovery fees for the issuance of an APP permit, and for the review of construction plans and compliance inspections. The statutory limit for an APP is the lesser of $16,000 per permit or $25,000 per individual site. Maximum compliance inspection fees range from $3,200 to $4,000. Actual fees will be based on the number of hours it takes to issue the permits, and will vary with the type of facility and type of discharge.

B. Costs are also likely to be incurred for the use of land and water. Rent (in the case of leases) or purchase payments would be made to ranchers who own the surface rights to the land on which the ore reserves are found. Wildly differing dollar values for the land in Buehman Canyon have been reported by various parties from $400 to $600 per acre for flat grazing land [9], all the way to $20,000 per acre for land intended to be used as a resort [10]. These cannot be used for estimate purposes because fair market values for the land are established at the time appraisals are conducted, and property valuation techniques can vary according to the actual designated land use.

Costs for the use of water could also vary greatly according to several factors. Among these are: which parties own the water rights in the area, whether surface or groundwater is to be used for mining operations, whether the use of groundwater will affect in-stream supply, and whether any changes to the quantity and quality of the water supply will affect the property owners downstream who have grandfathered water rights. Legal and technical (hydrologic) studies may be required to determine these. Again, several values were submitted during the public comment period ranging from $20 per acre foot per year (Bellota Ranch letter of 3/7/96) to $1,200 per acre foot which is imputed from water leases that are part of settlements with American Indian tribes, and ratified by Congress in 1988. [11]

Keystone has rights to a registered well which could produce groundwater at the rate of 150 gallons per minute and intends to acquire two other wells that could produce between 350 to 400 gallons per minute or about 605 acre feet per year. Keystone estimates that its mining operations will consume anywhere from 600 to 650 acre feet per year.

C. Legislation has been passed in recent years requiring the reclamation and rehabilitation of mine-damaged lands. Mine owners are required to post reclamation performance bonds for mining activities on federal lands to restore an ecosystem to its previous state. In Arizona, beginning July 1, 1996, an owner/operator of a new mine will need to prepare a reclamation plan and financial assurance mechanism for its operation if it creates a surface disturbance of more than

five acres (§ ARS 27-921). Reclamation costs will be highly dependent on the amount of damage caused and other features of the individual site.

In an attempt to estimate these costs, ADEQ staff contacted a mining company that has submitted a reclamation and closure plan to ADEQ. Carlota Mining Co. in Miami, AZ has similar features to the proposed Korn Kob operations. It is located on about 1,500 acres (1,412 of which are projected disturbance areas), has heap leaching and electrowinning operations, has a creek running through the property and a mine life expectancy of 18 years. A telephone interview with Carlota's General Manager, Mr. Bob Walish indicated that the reclamation and closure costs will be about $10 million, half of which will be spent after cessation of operations.

Reclamation activities are designed to return the project site to the pre-mining land uses of recreation, mineral exploration, livestock grazing; and wildlife habitat as well as provide for environmental protection and public safety. The $10 million estimate does not include other environmental mitigation costs such as those for the relocation of endangered cacti and creek diversion. Environmental monitoring costs are about half a million dollars a year and permitting costs with the US Forest Service under the National Environmental Policy Act (NEPA) came to $5 million. [12]

ADEQ contracted with economists from Thomas, Warren and Associates to provide an economic analysis of the classification of Buehman Canyon Creek as a unique water. This economic analysis is attached as an appendix to this economic impact statement [See Attachment 2]. The report provides an analysis of the recreational, nature-based or ecotourism, preservation, and ecological service values associated with classifying Buehman Canyon Creek as a unique water. This report is supplemented by a summary of economic costs and benefits of the Buehman Canyon Creek nomination by Dr. Bonnie G. Colby [See Attachment 3]; a report entitled "Rural Arizona...The Economic Benefits of Recreation," Arizona State Parks Board, Statewide Planning Section [February, 1989] [See Attachment 3]; and a the final report of a study entitled "Nature-Based Tourism and the Economy of Southeastern Arizona: Economic Impacts of Visitation to Ramsey Canyon Preserve and the San Pedro Riparian Conservation Area," by Kristine Crandall, et.al, Department of Agricultural and Resource Economics, University of Arizona, Tucson, Arizona [October 30, 1992] [Attachment 4]. Together these documents provide a compelling economic argument for the classification of Buehman Canyon Creek as a unique water. ADEQ concludes, therefore, that the probable benefits of designating Buehman Canyon Creek as a unique water outweigh the probable costs.

The unique waters classification of Buehman Canyon Creek does not necessarily preclude mining in Buehman Canyon. However, it would preclude the development of any mine in a manner which would degrade water quality in Buehman Canyon Creek. Also, the classification of Buehman Canyon Creek as a unique water may make the development of any mine more expensive because more stringent pollution control measures may need to be taken to maintain existing water quality in Buehman Canyon Creek.

Alternatives

ADEQ does not believe there are any less costly or less intrusive alternative methods of achieving the purpose of the adopted rules.

List of Sources and References

Information and data for this EIS were derived from a wide variety of sources, many of them from interested parties directly impacted by this rule and members of the public who participated in the public hearings and wrote comment letters. They are documented in the section on public comments and footnoted in this report.

1. Keystone Minerals, Inc., Tucson, AZ. Letters to ADEQ dated Feb. 2 and Feb. 19, 1996 and signed by Elmo Nelson, Pres. and Dirk Den-Baars, Vice Pres.
2. George F. Leaming, Ph.D. The Copper Industry's Impact on the AZ Economy, 1992. Western Economic Analysis Center, Marana AZ, April,1993.
3. Southwest Center for Biological Diversity, Tucson, AZ. Letter to ADEQ dated Feb. 22, 1996 and signed by Shane Jimmerfield, Asst. Director; and Arizona Riparian Council, ASU, Tempe, AZ. Letter to ADEQ dated Feb. 23, 1996 and signed by Kris Randall, Pres..
4. Arizona State Parks Board. 1994 AZ Statewide Comprehensive Outdoor Recreation Plan. Phoenix, AZ.
5. Thomas Michael Power, Ph.D., Not All that Glitters: An Evaluation of the Impact of Reform of the 1872 Mining Law on the Economy of the American West. University of Montana, Missoula, Montana; and "The Crown Jewel Project and the Economies of Okanogan and Ferry Counties, Washington", Prepared for the Okanogan Highlands Alliance, August, 1995.
6. Steven Boswell, Research Technician, NAU AHRRC, "Key Tourism Indicators, Arizona 1994." School of Hotel and Restaurant Management, Northern Arizona University, Flagstaff AZ, 1995.
7. News Release published by Canada Stockwatch. "Korn Kob drilling completed; partners to drop interest." Issued Feb. 20, 1996.
8. Telephone interview with Michael Rieber, Ph.D., Prof. of Mineral Economics, University of Arizona on 3/18/96.
9. Telephone interview with Mr. Dirk Den-Baars, Vice Pres. of Keystone Minerals, Inc. on 3/7/96.
10. Bellota Ranch, Tucson AZ. Letter to ADEQ dated 3/11/96 and signed by W.S. McGinniss, Pres.
11. Bonnie G. Colby, Ph.D., Assoc. Prof. of Natural Resource and Agricultural Economics, University of Arizona, Tucson, AZ. Memo to Linda McNulty of Mendelsohn, Oseran & Eisner, P.C. entitled "Buehman Canyon -- Economic Benefits of Unique Water Designation" and dated 3/11/96.
12. Carlota Mining Co., Miami, AZ. Reclamation and Closure Plan prepared for US Forest Service, Tonto National Forest, June 3, 1994; and telephone interview with Mr. Bob Walish, General Manager, Carlota Mining Co on 3/14/96.

AN ECONOMIC IMPACT ANALYSIS OF THE PROPOSED UNIQUE WATER STATUS OF BUEHMAN CANYON CREEK

Prepared for the
Arizona Department of Environmental Quality
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OUTLINE OF

AN ECONOMIC IMPACT ANALYSIS OF THE PROPOSED UNIQUE WATER STATUS FOR BUEHMAN CANYON CREEK

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AN ECONOMIC IMPACT ANALYSIS OF THE PROPOSED UNIQUE WATER STATUS FOR BUEHMAN CANYON CREEK

I. Unique Waters Status of Buehman Canyon Creek

Buehman Canyon was identified as a Class I riparian habitat by Pima County's Critical and Sensitive Wildlife Habitat Map (Shaw, 1988).

The proposed unique water status would prevent deterioration of the surface water in Buehman Canyon Creek. Protecting the water quality in Buehman Canyon Creek would promote the continued existence of diverse riparian flora and fauna along the creek (Malusa and Porter, 1990) and would ensure that the contribution of Buehman Canyon Creek to the San Pedro River is not degraded.

Work done by the University of Arizona, the Arizona-Sonora Desert Museum, and Saguaro National Park has shown that Buehman Canyon provides a continuous wildlife migration corridor between upper elevations in the Santa Catalina Mountains, the San Pedro River valley, and the Gailluro Mountains and provides valuable habitat for numerous rare, threatened, or endangered species.

Buehman Canyon Creek and its tributaries also constitute one of the largest watersheds, 51.3 square miles, contributing to the flow of the San Pedro River in the Lower San Pedro Basin. Buehman Canyon Creek empties into a perennial portion of the San Pedro River. However, exactly how much of Buehman Canyon Creek itself is perennial is currently under consideration by the Arizona Riparian Mapping Project (Wennerlund, Personal Communication, 1996).

Granting unique water status to Buehman Canyon Creek would also protect the integrity of several springs in the Santa Catalinas which feed it. Cienegas and other habitat types surrounding springs are famous in Arizona for their unique, relict, and endemic organisms (Arizona Comparative Environmental

Risk Project, 1995). Cienegas, spring fed marshes, are by far the rarest type of wetland in the state.

Bingham Cienega, which is owned by the Pima County Flood Control district and managed by the Arizona Nature Conservancy on a 24 year lease, is approximately one mile downstream from the confluence of Buehman Canyon Creek and the San Pedro River. Recent investigations into the origin of waters which feed the springs supporting Bingham Cienega, carried out by the U.S. Geological Survey, the Pima County Flood Control District, and the Department of Geosciences at University of Arizona, indicate Buehman Canyon waters are a likely source (Phillips *et al.*, 1993).

The 1994 Arizona Wetlands Priority Plan (Arizona State Parks Board, 1994) recommended that priority consideration for preservation should be given to wetland sites that are contiguous to protected areas or public land, or provide wildlife corridors, or enhance the functions and values of adjacent wetlands. Buehman Canyon satisfies these three criteria.

Preservation of water quality in Buehman Canyon Creek should also be considered in the context of the overall condition of riparian areas in Arizona. Riparian ecosystems are highly limited in Arizona. The riparian habitat in Buehman Canyon includes sycamore, cottonwood, and willow which are some of the rarest habitat types in the state. Sycamore accounts for only 1%, and cottonwood/willow 4% of the riparian vegetation statewide (Arizona Comparative Environmental Risk Project, 1995). Cottonwood/willow habitat is reported to be the rarest forest type in North America and supports higher breeding bird densities than any other forest type in the continental United States (Arizona Comparative Environmental Risk Project, 1995).

Furthermore, the State of Arizona contains approximately 150,000 stream miles of which it is estimated that only 3% (4,500 stream miles) are currently perennially flowing (Valencia, 1993). This perennial figure includes streams which remain permanent due only to wastewater discharges.

Riparian areas have declined by 95% in many areas (Arizona Comparative

Environmental Risk Project, 1995) and now comprise only 0.1% to 0.5% of the Arizona landscape, while sustaining 95% (approximately 80% in the obligative, and additional 15% in the facultative sense) of all animal species in Arizona (Ohmart, Personal Communication, 1996).

II. Impacted Parties

Those parties impacted by granting Buehman Canyon Creek unique water status include Arizona citizens, Keystone Minerals, ranching operations along Buehman Canyon and recreationists.

III. Probable Costs and Benefits

A. Probable Costs to the Implementing Agency and Other Affected Agencies

Costs of monitoring to determine compliance with the unique waters standard are best determined by the Arizona Department of Environmental Quality.

B. Probable Costs to Political Subdivisions of the State

The citizens of Arizona are the primary political subdivision of the state which would be impacted by assigning unique water status to Buehman Canyon Creek. The benefits provided by areas such as the Buehman Canyon include use values (recreation, now and in the future, and ecological service value, now and in the future) and existence values. Although it is not possible to value existence precisely, society does place a value beyond direct use values, including option value, bequest, and nonuse values. (See the Appendix for a discussion of the valuation of ecosystems).

1. Recreational Value

Buehman Canyon is adjacent to the expanding Tucson population area (approximately 1.5 hours drive). It is possible to hike into Buehman Canyon from Mt. Lemmon, and 0.7 million visit Mt. Lemmon annually. Preservation of water quality in Buehman Canyon Creek has potentially significant recreational value given its associations with Coronado National Forest, Bingham Cienega, and the San Pedro River, and its importance in maintaining wildlife on the eastern slopes of the Santa Catalina Mountains.

According to the *1994 Arizona Statewide Comprehensive Outdoor Recreation Plan,* there were 11.5 million visitor use days spent in exclusively wildlife related activities and a total of almost $400 million in expenditures by these recreators mostly in rural Arizona communities. A 1994 poll, conducted by the Arizona State Parks Board, ascertained that 50% of Arizonans polled engaged in back country recreational activities.

Coronado National Forest, of which Buehman Canyon is a part, hosts 1.7 million visitors annually. It would be expected that as riparian areas become evermore scarce and the demand for outdoor activities continues to increase, the value of areas such as Buehman Canyon will increase.

It should be emphasized that outdoor recreation is of immense importance to Arizonans and to the Arizona economy. According to the *1994 Arizona Statewide Comprehensive Outdoor Recreation Plan* more than 110 million official visitor days to the state parks, National Park Service areas, Bureau of Land Management (BLM) lands, and U. S. Forest Service areas were recorded in 1991. However, the 110 million visitor days is an underestimate of recreation days; this figure ignores the huge number of unofficial visitor days spent in national forests and wilderness areas across the state each year. It should also be noted that Arizona hosts 22 million out of state visitors annually, bringing an estimated 8 billion dollars in revenue into the state, and of these 22 million visitors, 63% participate in outdoor recreation activities (Arizona State Parks Board, 1994).

2. Nature-based Tourism Value

Nature-based tourism or eco-tourism is growing as an industry in Arizona as well as both nationally and internationally. Nature-based tourism is specific to remote areas, such as Ramsey Canyon, which possess significant biological diversity. Strategies cited for increasing returns from nature-based tourism include the preservation of existing natural sites in the area and expansion of sites attractive to birders.

Because of the sensitivity of birds and other wildlife to changes in water quality, without protection of the water quality in Buehman Canyon Creek, the potential value of Buehman Canyon for nature-based tourism could be degraded.

Visitors to the San Pedro River National Conservation Area (managed by the BLM) and to the Ramsey Canyon Preserve (managed by the Arizona Nature Conservancy) contribute $3 million annually to the Sierra Vista economy according to a study conducted by the Department of Agricultural Economics at University of Arizona (Crandall, Leones, Colby, 1992). Expenditures were mainly by nonresidents, since two thirds of the visitors are from out of state and 5-6% were from outside the U. S. Nearly all visitors coming from outside the local area also visited other areas in southeastern Arizona and purchased goods and services at these sites as well.

The expenditure in Sierra Vista, however, is only a part of the value of nature-based tourism in southeastern Arizona; visitors to the area spent approximately $12 million per year on trips that included these two sites.

3. Preservation Value

Kirchoff (1994) reports survey results of willingness to pay for the preservation of Ramsey Canyon Preserve and the San Pedro National Conservation Area. These areas are near the Buehman Canyon Creek - San Pedro River confluence so preservation estimates could be expected to be similar. The average willingness to pay by Ramsey Canyon visitors was

$101.67. With an annual visitation of 23,628 non-resident visitors in 1992, the annual preservation value of Ramsey Canyon was thus estimated to be $2.4 million.

The average willingness to pay of visitors to the San Pedro River National Conservation Area for preservation of a perennial stream flow and riparian habitat was estimated to be $69.03 for non-residents and $45.54 for local residents. Given an estimated visitation of 5,271 non-resident and 6,441 local visitors, the annual preservation value is approximately $657,000.

Crandall (1991) reported an average willingness to pay of $65 per visitor to restore the Hassayampa riparian area from intermittent streamflow to perennial streamflow. This implies a preservation value of $520,000, based on an estimated 8,000 visitors annually.

Carmichael (1995) estimated an average annual willingness to pay of $2.70 per person for visitors to Sabino Canyon to prevent degradation of the Canyon from its current condition. Multiplying this figure by 1.3 million visitors annually implies an annual preservation value of $3.5 million.

Given protection, areas such as Buehman Canyon can be expected to provide ecological services for a very long time horizon. For example, for a time horizon of 50 years and one million visitors annually (similar to Sabino Canyon), a preservation value of $4 per person results in a value of $200 million.

4. Ecological Service Value

Ecological service values refer to the value of ecological functions. Some services, for example, provided by riparian ecosystems include provision of habitat for fish and other wildlife, water supply, amelioration of flooding events and promotion of groundwater recharge, and pollution mitigation.

To our knowledge there have been no studies of ecological service values for riparian areas in the arid southwest. However, the results of several studies

performed in other parts of the country can be useful for comparison purposes and order of magnitude estimates.

The present ecological service value per acre of the Charles River area in Massachusetts has been estimated at $3,700 for recreation and $89,000 per acre (in 1993 dollars discounted at 8%) for water supply (Thibodeau and Ostro, 1981). The present ecological service value of storm control services provided by wetlands in Louisiana were estimated to be $2834 per acre (in 1993 dollars) (Constanza *et al.*, 1989).

Another component of the ecological service value is the benefits of species preservation from its potential pharmaceutical value.

Biotechnology, both as a science and an industry, is experiencing dramatic growth in the U. S. and depends on biodiversity for new sources of genetic material and ideas. In the U. S. today, more than 40% of all prescriptions depend on natural sources (Kane and Stark, 1992). For example, Tac Polymerase is an enzyme developed by the Hoffman-La Roche Pharmaceutical Company from a unique bacteria indigenous to one of the springs in Yellowstone National Park; it is widely used in DNA finger printing and other processes and has reportedly generated several hundred million dollars in revenue for Hoffman La-Roche (Charles, 1996).

It is believed that the Desert Pupfish, an Arizona native and inhabitant of Buehman Canyon Creek (U.S. Fish and Game, 1996), will be important in providing a cure for skin cancer. An hypothesis currently being tested postulates that organisms indigenous to arid lands, because of the environmental stress they experience, contain more bioactive compounds than organisms native to less stressful environments (Timmerman, 1994).

5. <u>Water Quality</u>

Buehman Canyon Creek deposits significant amounts of sediment into the San Pedro River in this region. This sediment could become contaminated if the quality of water in the canyon is not protected (Fonsecca, Personal

Communication, 1996).

Water samples collected in May/June of 1991 at three sites near the Coronado National Forest boundary indicated good water quality in Buehman Canyon Creek with no water quality violations. In November of 1995 water samples taken on the perennial reach located downstream of the Forest Service boundary indicated good water quality, with mostly non-detects of total recoverable metals. Detectable metals were well below water quality standard limits according to the Arizona Department of Environmental Quality. The dissolved portion of metals is the only portion that is biologically available to organisms, and is the primary source of concern when protecting water quality.

Heavy metals such as copper and zinc are toxic to fish in very low levels. Mixtures of these metals can be more toxic. Mining waters discharged into streams have been observed to alter chemical quality and reduce biotic diversity and density. In Arizona the situation is aggravated because the receiving streams are often intermittent due to low annual rainfall (Lewis and Burraychak, 1979).

Mining impacts on riparian systems are long term. These systems have little resistance. For example, the expansion of the Ray Mine throughout Mineral Creek eliminated the existing riparian zone. Collapse of, or spill from tailing ponds may greatly alter downstream riparian areas. Mining can pollute streams through releases of suspended sediments, toxic heavy metals, and acids. However, rehabilitation after mining activities are completed is not equivalent to restoration to the previous ecosystem state (Arizona Comparative Environmental Risk Project, 1995).

C. Businesses Directly Affected

1. <u>Keystone Minerals</u>

Granting unique water status for Buehman Canyon Creek does not prohibit mining. It may, however, require that the mining operation incur additional

costs to ensure that contamination does not occur.

The unique waters designation requirements for a surface water discharging facility would prohibit direct point source discharges to unique waters. Indirect discharges would also not be permitted to degrade the water quality of a unique water.

The cost to Keystone Minerals of assigning Buehman Canyon Creek unique water status is the marginal (extra) cost of maintaining water quality. The return to a mining investment is net revenues (price times quantity of extracted metal minus extraction and other costs). In this instance, the net revenues of Keystone Minerals will be reduced by the extra costs of maintaining water quality both during the actual operation of the Korn Kob mine and afterwards as part of the reclamation process.

Keystone Minerals plans to use a solvent extraction-electrowinnowing (SX-EW) process at the Korn Kob mine. This process does not require grinding and carries fewer environmental risks than the conventional flotation and smelting process. In theory, this process could be employed without discharge or seepage (Paul Stewart, Tonto National Forest, Personal Communication, 1996; also see the Environmental Impact Statement for the Carlotta Mine). This would mean that the additional cost imposed by the rule during the operation of the mine may be negligible.

Given the very short projected life of the mine, 8.63 years, reclamation costs faced by Keystone Minerals are immediate and would have a significant impact on their projected net revenues. Reclamation costs incurred due the unique water rule would be reclamation costs in addition to those required to satisfy the National Forest Service requirements and Aquifer Protection Program requirements. In 1997, reclamation requirements for mining on private land will also become effective.

The Carlotta Mine, located on Pinto Creek in Tonto National Forest, for which an Environmental Impact Statement is currently being finalized, has reclamation costs of $10 million (approximately $2.5 million to comply with Tonto National Forest standards and the remaining $7.5 million to comply

with the requirements of the Aquifer Protection Program). While reclamation costs vary from site to site, Carlotta Mine and Korn Kob Mine have several important attributes in common: SX-EW technology; inclusion of stream areas; location partially on U. S. Forest Service land; and size of disturbed area.

It should be noted that the majority of the reclamation costs are due to Aquifer Protection Program (APP) requirements. How much reclamation beyond this APP level would be required to satisfy the unique water status is unclear.

Whether or not increased reclamation costs will cause Keystone Minerals operations to become unprofitable largely depends on copper prices. Copper prices have been strong since the early 1980's (over a dollar per pound). It is believed that this phenomenon may be due to a worldwide shortage of smelters. This situation is expected to be remedied in the next 5-6 years and the price of copper would be expected to decline (Rieber, Personal Communication, 1996).

2. Ranches Along Buehman Canyon Creek

Buehman Canyon Creek provides water for ranching operations. Maintaining the water quality in the stream would protect these ranching operations. Water use for mining may negatively impact these operations.

IV. Impact on Employment

A. Impact on Public Employment

The immediate impact on public employment would be negligible. In the future, however, there could be a small expansion in public employment if preservation of water quality promotes the recreational development of this area.

B. Impact on Private Employment

Even should assigning Buehman Canyon Creek unique water status preclude Keystone Minerals from mining at the Korn Kob mine site, we anticipate that there would be no net effect on employment in the mining sector because of the availability of substitute ore deposits (see Part IX, below).

Keystone Minerals, in a letter to Arizona Department of Environmental Quality dated February 19, 1996, stated that their planned mining operation at the Korn Kob site would last approximately 8.63 years. A mining contractor would mine and place the ore on leaching pads with a payroll of 64 people. The operating company would then run the plant with an additional 20 to 26 people. They assume that the majority of the professional and skilled labor will be hired from the Arizona labor pool.

V. Probable Impact on Small Business

See Part III, Sections C (i) and C (ii).

VI. Methods to Reduce Impact on Small Businesses

None are apparent.

VII. Probable Costs and Benefits to Consumers

The proposed rule will not affect the price of copper, and so there is no impact on copper consumers.

VIII. Less Intrusive or Less Costly Ways of Achieving Unique Water Status

The alternative to preservation of water quality is reclamation. As noted in

Part III Section B. 5., mining impacts on riparian and aquatic systems are long term and these systems have little resistance. Rehabilitation after mining activities is not equivalent to restoration to the previous ecosystem state. As mentioned in Part IV, Section B, reclamation costs can be significant.

IX. Comparison of Social and Private Costs and Benefits

Comparison of benefits and costs of the unique waters designation of Buehman Canyon Creek involves comparing public benefits and private costs. Public benefits of the rule are associated with recreation and ecological values. Private costs have to do with reduced potential mining profits of Keystone Minerals.

Arizona is abundantly endowed with copper ore deposits. The AzMILS database lists over 3,000 deposits statewide. Porphyry type deposits are particularly ubiquitous in Pima, Santa Cruz, Pinal, and southern Gila counties. Strong copper prices averaging more than a dollar a pound since the late 1980's combined with the advent of solvent extraction-electrowinnowing technology (SX-EW) with its lower capital costs and low labor and operating costs has lead to some increased interest in the development of smaller lower grade ore deposits (Arizona Department of Mines and Mineral Resources, Open File # 92-10).

There are many undeveloped reserves of equal or greater size and quality yet to be developed in Arizona (Arizona Department of Mines and Mineral Resources, Open-Open-File #92-11). When prices are sufficient to make mining attractive, these reserves will be developed. Because of the existence of these other undeveloped comparable deposits in areas not affected by the proposed rule, there should be no loss of potential jobs or production in the mining industry should this rule effectively preclude Keystone Minerals from developing the Korn Kob mine.

Therefore, should the proposed rule indeed prevent Keystone from mining at current prices, this could represent a private loss to Keystone minerals, but not a social cost to Arizona citizens. There would be no loss in potential copper output in Arizona, and the benefits of maintaining Buehman Canyon

would be preserved. At what level Keystone Minerals should be compensated for their private loss is purely a question of equity, not economic efficiency.

Appendix. Economic Valuation of Ecosystems: Categories of Benefit

Generally, the total economic benefits provided by functioning and healthy ecosystems may be divided into three basic categories: use values, non-use values, and ecological service values. Use values derive from actual use of a given resource. Ecosystem use values may include: market benefits such as water provision, forage, fishing, provision of biological material for pharmaceutical development; non-market use values include the value of recreational activities, and option value, which is the value of preserving the option of enjoying the use of a resource at a future date.

Non-use values often refer to existence or "passive" use values, unrelated to current use or option values. Non-use values derive from the fact that many individuals find that the existence of certain assets has intrinsic value. Non-use values have been studied extensively and been found to be significant in many cases (Organization for Economic Cooperation and Development, 1989). Bequest value, the value a resource derives from the knowledge that future generations might benefit from its continued existence, is also an example of a non-use value.

Ecological service values refer to the value of ecological functions. For example, some services provided by riparian ecosystems include provision of habitat for fish and other wildlife, amelioration of flooding and promotion of groundwater recharge, and pollution mitigation.

Clearly, many of these categories of benefits cannot be quantified or can only be partially quantified, either due to the existence of only incomplete scientific knowledge or to lack of economic technique. It is also true that many people object on moral grounds to attempts to quantify certain of these benefits such as for example intrinsic value of preserving a species.

A variety of techniques for evaluating the benefits of preserving riparian environments in Arizona have been investigated. Efforts to place dollar values on preservation of riparian systems in Arizona have focused on several different aspects of preservation value. It must be emphasized that the benefit estimates are <u>partial</u> benefit, only reflecting certain aspects of the

total benefits provided by functioning and healthy ecosystems. Thus, these estimates should only be considered as lower bounds on total value.

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ATTACHMENT 2

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Project: *Buehman Canyon – Economic Benefits of Unique Water Designation*

The purpose of this memorandum is to summarize economic considerations in support of ADEQ's proposed unique water designation for Buehman Canyon Creek. My work on this matter is authorized in your memorandum to me of March 5, 1996, and constitutes only a brief outline of relevant economic factors given the short time line for my work. I have reviewed the Arizona Revised Statutes addressing review of proposed rule makings by the Governor's Regulatory Review Council and the specific requirements of economic impact statements to be submitted to the Council for their consideration. This memo is not intended to provide the full information required in an economic impact statement. However, it addresses some of the probable costs and benefits of a unique water designation for Buehman Canyon Creek and comments on the adequacy of reasonably available data for quantifying benefits and costs. In particular, the information summarized here provides guidance on what factors need to be considered in a comprehensive examination of probable costs and benefits in the economic impact statement on the proposed unique water designation to be submitted to the Governor's Council.

Economic rationale in support of the proposed unique water designation are outlined below. To the extent that data is available to discuss probable benefits and costs, some economic factors are discussed in more detail than others.

1. **A unique water designation is consistent with the State of Arizona's commitment to cost-effective resolution of tribal water claims in the Gila River Basin,** and in particular the large (approximately 1.5 million acre feet) and unresolved claims of the Gila River Indian Community. There have been six Congressionally ratified negotiated settlements of tribal claims involving central Arizona tribes, and these have relied upon a combination of surface water, groundwater and Central Arizona Project water to satisfy tribal water needs (Checchio and Colby, 1993). Surface water has been particularly critical as a component of water supplies for settlements due to the relative scarcity of surface flows in central Arizona and to the emphasis that many tribes place on obtaining surface water to restore stream flows and riparian areas.

The waters of Buehman Canyon Creek are tributary to the San Pedro River, which joins the Gila River less than 50 miles downstream from where Buehman Canyon Creek enters the San Pedro. The Gila River Indian Reservation is located a short distance below this confluence. In adjudication proceedings on the San Pedro River in 1995, the Special Master found that the average annual outflow of the San Pedro at its mouth (confluence with the Gila) is only 18,094 acre feet per year (order of the Special Master in the Gila River Adjudication, filed February 23, 1995, Arizona Supreme Court). Marsett and Associates has estimated the annual water production of the Buehman Canyon watershed at 62,828 acre feet per year (Marsett and

Associates finding cited in March 5 memo from L. McNulty to Colby). Buehman Canyon Creek contributes a substantial amount of flows to the lower San Pedro River system.

To the extent that a unique water designation protects both water quality in Buehman Canyon and constrains new consumptive uses of Buehman Canyon Creek, surface water supplies for resolution of tribal claims are enhanced. An economic value of $1,200 per acre foot of water available for tribal claims can be imputed from the water leases that are part of the Salt River Pima Maricopa Settlement ratified by Congress in 1988 and the Fort McDowell settlement ratified in 1990 (P.L. 100-512, 102 Stat 2549 (1988) and P.L. 101-628, 104 Stat 4480 (1990)). Were the water yields of Buehman Canyon to be reduced in quality or quantity so as to be less available for tribal water settlements, substitute surface water would have to be acquired elsewhere at significant cost to federal and state taxpayers. For illustrative purposes, assume that the unique water designation preserves the quality and availability of 20,733 acre feet per year (one-third of the watershed yield estimated by Marsett and Associates) from Buehman Canyon Creek for tribal water settlements. The economic benefit of the unique water designation for this purpose alone would be $24.8 million at a value per acre foot of $1,200. The unique water designation would also, simultaneously, provide other benefits outlined below

2. In addition to tribal water settlements, there are other competing demands for water supplies in central Arizona. Diminished water flows or water quality from Buehman Canyon Creek, occurring due to the absence of a unique water designation, would cause downstream water users to incur costs to replace impaired supplies. Evidence regarding the economic value of preserving the water yields of the canyon so that they are available for downstream uses comes from recent water transactions in central Arizona. For instance, the Scottsdale City Council recently approved seven negotiated acquisitions of CAP water allocations at prices per acre foot ranging from $1,080 to $1,188 per acre foot (Water Intelligence Monthly, October, 1995). Del Webb, the largest developer in Arizona, negotiated an option to lease water from the Ak-Chin Indian Community at a price of $1,200 per acre foot in late 1994 (Water Strategist, April, 1995). These figures are consistent with the economic benefits cited above related to water supplies for tribal settlements.

3. Preserving the quality and volumes of flows out of Buehman Canyon Creek reduces costs to downstream dischargers of complying with surface water quality standards. As noted above, flows out of Buehman Canyon Creek are a non-trivial portion of the flows of the San Pedro River prior to its confluence with the Gila River. Small towns, mines and other point source dischargers into the San Pedro River along this reach incur costs to meet water quality standards. Flows from Buehman Canyon Creek provide economic benefits to these dischargers related to their costs of providing additional treatment (and upgrading treatment facilities) to remain in compliance with surface water standards, in the event that flows or water quality from Buehman Canyon Creek were impaired. With such impairment, downstream pollutant loads become more concentrated and the probability of surface water quality standard violations increases (Colby, 1994). While a specific dollar estimate of water quality benefits from the unique water designation is not possible within the limited scope of this memo, such benefits should be considered under the specific requirements of economic impact statements submitted to the Governor's Regulatory Review Council.

4. Riparian recreation areas in southern Arizona are heavily used and generate increased economic benefits as population and demand for outdoor recreation grows in the region. Buehman Canyon is particularly well situated for the rapid population growth occurring on the north side of the Tucson metropolitan area near San Manuel and Oracle and for the rapidly growing east side of Tucson, with access over Reddington Road. A comprehensive survey of economic benefits to recreationists at streamside sites in the western United States indicates recreation benefits of $18 to $27 *per visitor day* for general hiking and wildlife viewing (Walsh et al, 1992). Data collected for southern and central Arizona riparian areas indicates values *per visitor* of $65 to $102 to maintain the quality of the Hassyampa River Preserve, and $65 to $97 to protect the riparian ecosystems of the San Pedro Riparian National Conservation Area and The Nature Conservancy's Ramsey Canyon Preserve (Kirchoff, 1994, Crandall, Colby and Rait, 1992).

Visitation data is not collected for Buehman Canyon. However, it is known to be heavily visited for

birding and hiking, and for javelina hunting during the spring season. For comparative purposes, Aravaipa Canyon Wilderness (another canyon riparian area located within 25 miles of Buehman Canyon) has approximately 8,600 visitor days per year, even though visitors require a permit to enter Aravaipa Canyon. The San Pedro Riparian National Conservation Area and The Nature Conservancy's Ramsey Canyon Preserve (both located within two hours of Tucson) have annual visitation of approximately 12,000 and 26,000 visitor days, respectively. Assuming a relatively low use rate of 6,000 visitor days per year for Buehman Canyon and economic benefits to recreationists of $25 per visitor day, current recreation benefits may be in the range of $150,000 per year and will increase steadily with population growth. Visitor studies in Aravaipa Canyon establish that visitors are aware of even small reductions in stream flow levels or water quality and that these variables affect the value of the riparian area recreational experience (Moore, Wilkosz and Brickler, 1990).

A unique water designation for Buehman Canyon Creek also supports recreation benefits downstream. Pima County recently acquired the Bingham Cienega (located just below the confluence of Buehman Canyon Creek and the San Pedro River) for flood control, open space and recreation purposes. Buehman Canyon Creek appears to be an important source of flows for maintaining the integrity of the Cienega (letter from Fonseca, Principal Hydrologist, Pima County Flood Control District to ADEQ staff, dated January 26, 1996).

5. **In addition to economic benefits to recreationists themselves, small businesses and outlying communities depend economically on spending by outdoor recreationists.** Tourism linked to outdoor recreation is an important component of the economy of southern Arizona. Restaurants, retail stores, motels, bed and breakfasts, gas stations and other businesses benefit from preservation of attractive outdoor recreation sites. In the Sierra Vista area alone, expenditures by visitors to riparian areas stimulate $3 million per year in local economic activity (Crandall, Leones and Colby, 1992).

6. **There are substantial economic benefits associated with special status species and habitat preservation,** in addition to the economic benefits to recreationists described above. These preservation values (also termed "nonuse or passive use" values) have been affirmed by the courts as a valid component of economic costs and benefits (State of Ohio v U.S.Department of Interior, 880 F.2d 432 (D.C. Circ. 1989)), and are incorporated into assessments of proposed federal regulatory actions as well as in assessing liability for environmental damages under CERCLA. Examples of the application of these values in Arizona include the Environmental Impact Statement for Operations of Glen Canyon Dam (1995) and assessments of changes in air quality and visibility in the Four Corners region. Recent studies of preservation values associated with streamside and riparian areas in the western United States indicate economic benefits of $15 to $80 annually per household located in the general region of the site (Sanders, Walsh and Loomis, 1990 and Brown, 1991). Using the lower figure of $15 per household, for approximately 370,000 households in the greater Tucson Metropolitan area, preservation values associated with Buehman Canyon are on the order of $5.5 million per year.

7. **The value of private property located adjacent to or near streams and riparian areas is enhanced when water quality, flow levels and riparian habitat are protected.** Studies elsewhere in the U.S. indicate a twenty percent increase in private property values due to water quality protection in nearby water bodies (Young, 1984). In the Tucson area, economic studies document an increase in property values associated with proximity to wildlife habitat, such as washes and riparian areas (King, White and Shaw, 1991). A unique water designation for Buehman Canyon Creek will preserve private property values near the canyon and along the San Pedro River where Buehman Canyon Creek flows enhance the riparian corridor.

8. Documentation provided by Keystone Minerals, Inc. to which I have had access (consisting of letters addressed to ADEQ staff dated February 2 and February 19, absent four attachments which were appended to the February 19 letter) does not provide sufficient information for determining probable net losses (if any) to Keystone Minerals, Inc. as a consequence of the proposed unique water designation. Full data to document probable social costs and benefits with respect to mining operations should include (but are not limited to) the following:

1) full costs to undertake an adequate EIS process for proposed mining operations (including not only costs to Keystone Minerals and their partners, but also probable costs to participating public agencies and citizen groups)

2) start up costs to develop the site as necessary for proposed operations, including the costs of obtaining capital for site development

3) costs of obtaining an adequate and reliable water supply for proposed mining and processing operations, including an estimate of legal fees that will be incurred to secure such supplies in a basin that already faces severe water allocation shortages and competing claims. If the anticipated water supply is to be extracted from wells located in the canyon, then hydrologic studies likely will be necessary to be necessary to establish the extent of linkages between pumping for mining operations and surface flows. Such pumping could be determined to be "subflow", as defined under Arizona case law, and thus subject to the Gila River Adjudication and the priority of senior water rights in the Gila River Basin. In any case, substantial expenditures for legal and technical analyses would be incurred, in addition to the direct costs to obtain and transport water supplies for proposed mining activities.

4) all usual and customary costs associated with the proposed mining operations and sales of copper, including but not limited to: annual operations costs projected for the life of the mine, processing and transportation costs, environmental compliance costs, taxes and royalties and marketing costs for minerals produced.

5) a projection of annual revenues from copper sales over the life of the mine that accounts for business risks associated with volatility in the world price of copper.

6) end of mining costs, such as site reclamation and cleanup.

7) estimation of losses in recreation value, wildlife habitat values and water quality values as a consequence of mining operations. These effects are termed "externalities" and standard economic practice requires that they be incorporated in any assessment of the proposed mining operations so as to ensure a comprehensive examination of probable social costs and benefits of a unique water designation, as it may affect mining operations.

8) Economic evaluation by private mining interests based on exploratory drilling in 1995 appears to have determined that the economic viability of the proposed mining operations is marginal due to the prominence of relatively low grade ore. Canada Stockwatch reported on February 7, 1996 that the copper grade does not meet the economic criteria of two companies who were partners in the drilling campaign (Canada Stockwatch report provided to Colby by L. McNulty).

To conclude, there are a number of economic benefits associated with a unique water designation for Buehman Canyon Creek. Such benefits are substantial and widespread, even based on the limited data available for preparation of this memorandum. With regard to costs associated with possible impacts of a unique water designation on proposed mining operations, available evidence suggests that the proposed operations may be unprofitable from the mining company perspective, especially given substantive uncertainties regarding the feasibility and costs of obtaining water supplies for the proposed operations. Arguably, the proposed mining operations could generate net social losses (not gains) when externalities are taken into

account. Such externalities are included in standard cost-benefit assessments and should be considered in the economic impact statement on the proposed Buehman Canyon Creek unique water designation to be submitted to the Governor's Regulatory Review Council.

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ATTACHMENT 3

Rural Arizona...
The Economic Benefits of Recreation

A Summary Analysis of Tourism and Recreation
as Factors Influencing State and Local Economies

Arizona State Parks Board
Statewide Planning Section
February, 1989

RURAL ARIZONA...THE ECONOMIC BENEFITS OF RECREATION

SUMMARY

- Arizonans spent $2.6 billion on outdoor recreation in Arizona in 1987.
- Visitors to Arizona state parks spent a total of $94 million within 50 miles of the parks in 1987, benefitting over 30 rural communities.
- Outdoor recreation provides economic benefits to our state in two major ways: participant spending and as an attraction to new businesses.
- 98% of Arizonans participate in outdoor recreation activities.
- Colorado, Utah, and New Mexico enjoy between 3 1/2 and 6 times as many visitors to their state parks, with a corresponding increase in revenues to those states—as Arizona does.
- Only 51 % of Arizona state park visitors are Arizona residents. Three percent are from foreign countries, the remainder are from other states. Almost 60% of those Arizona visitors are from Phoenix and Tucson.
- State and Federal recreation facility demand is booming, while financial commitment is static and supply falls further and further behind demand.
- Arizonans' only current choices for outdoor recreation are overcrowded developed recreation facilities, undeveloped facilities, or travel out-of-state.
- Arizona's rural communities are losing a tremendous potential economic benefit that is leaking to other states due to our lack of investment in outdoor recreation.

Those natural and cultural elements that make a state a special place to live are quietly contributing more to economic growth than is generally understood. Maintaining high standards for quality of life is a critical factor in state economic development strategies.

- Council of State Planning Agencies, 1985

Recreation Attracts Business To Arizona

Tourism brings in substantial economic gain to our state. Total tourism expenditures in 1987 were estimated at over $5 billion by the Office of Tourism. Our ability to attract visitors and tourism spending has propelled us to a ranking of 11th in the nation in spending by tourists on a per capita basis. Arizonans spent almost $2.6 billion to participate in outdoor recreational activities in Arizona in 1987 as determined in the 1988 Participation Survey. (Arizona 1989 SCORP) Using a 7% average tax rate, $182 million is generated by taxing Arizonans' recreation spending.

Outdoor recreation plays a significat role in the travel choices made by many Americans. Opportunities to view, experience, or just relax against the backdrop of the scenic West are highly desired, especially among Midwesterners and Eastern urbanites. An estimated 16 million travelers visited Arizona in 1987. The attractions most sought by these tourists were natural attractions: the Grand Canyon, Lake Powell and Canyon de Chelly. (Office of Tourism statistics)

The Tucson visitor industry is critically important to all of us. Much of what we take for granted in Tucson, its' cultural attractions, performing arts, fine restaurants, city services, all the things that make our city an exciting cosmopolitan place to live and work depend directly on the continued vitality of our largest industry, tourism.

—Lew Murphy, former Mayor of Tucson

Outdoor recreation availability is an important lifestyle factor for Arizonans. Ninety-eight percent of our population participate in some type of outdoor recreational activity. (Maricopa County Department of Human Services, 1988) The second largest employer in Pima County, Hughes Aircraft Company, considers the availability of outdoor recreation facilities as one of the most important quality of life factors for its employees.

The tourism dollar has a significant effect on the cost of living in Tucson and in general contributes to the overall lifestyle so attractive to our employees and prospective employees.
— Ed Spaulding, Manager, Community Affairs
Hughes Tucson Plant Site

Rural Benefits

Our urban dwellers are spending money and recreating locally and in our rural areas. Our three most popular tourist attractions are located in rural northern Arizona. The majority of Arizona state parks are located in rural areas of the state.

Visitors to our state parks were asked how much money their group spent during their trip within 50 miles of the state park they were visiting. Results show average expenditures of $203 per visitor group per trip. (1987-1988 Use Study of Arizona State Parks Visitors) When these spending figures are multiplied by park attendance, it was found that over $94 million was spent within 50 miles of a state park by park visitors in 1987.

The $94 million spent by State Park visitors within 50 miles of the parks provides a substantial injection of money into local economies. At least thirty rural communities benefit economically from their proximity to state parks. Lake Havasu City benefits from three state parks, with visitors spending a total of $18,158,866 within 50 miles of those parks. These numbers demonstrate the potential economic benefit that a state park can have on a rural community.

Current Investment

While some recreation needs are met at home, people want and need a diversity of places to recreate. Recreation facilities and opportunities are provided by city, county, state and federal governments throughout the state in response to these demands. Our 25 State Parks alone hosted 1,394,653 visitors in 1987. Federal recreation facilities provided by the National Park

> While Arizona population increased by 70% from 1970 to 1985, Arizona state park acreage increased by less than 43%. (Arizona 1989 SCORP)

Service, Forest Service, and Bureau of Land Management have all experienced explosions in user demand in the last 10 years. (Arizona 1989 SCORP) Managers of many popular remote areas, such as the Grand Canyon, Aravaipa Canyon and Paria Canyon, now have been forced to control user participation through permitting systems.

Investment in our State Park System has been dismal at best. While Arizona population increased by 70% from 1970 to 1985, Arizona state park acreage increased by less than 43%. (Arizona 1989 SCORP) Over the last three years the State has demonstrated a commitment to developing new parks, however, *no* state funds were spent on acquisition of new parks from 1981 to 1985.

We cannot rely on federal agencies to provide recreation services for our residents and visitors. While the Forest Service is trying to respond to recreation demand with a new Recreation Initiative Strategy, it has been unable to increase its recreation budget accordingly. In fact, the proposed Federal Executive Budget for FY 1990 has a 20% decrease in recreation spending including a 67% reduction in facility construction dollars.

Our lack of commitment has resulted in our residents having to choose between overcrowded developed sites, undeveloped sites or traveling out-of-state to enjoy outdoor recreation.

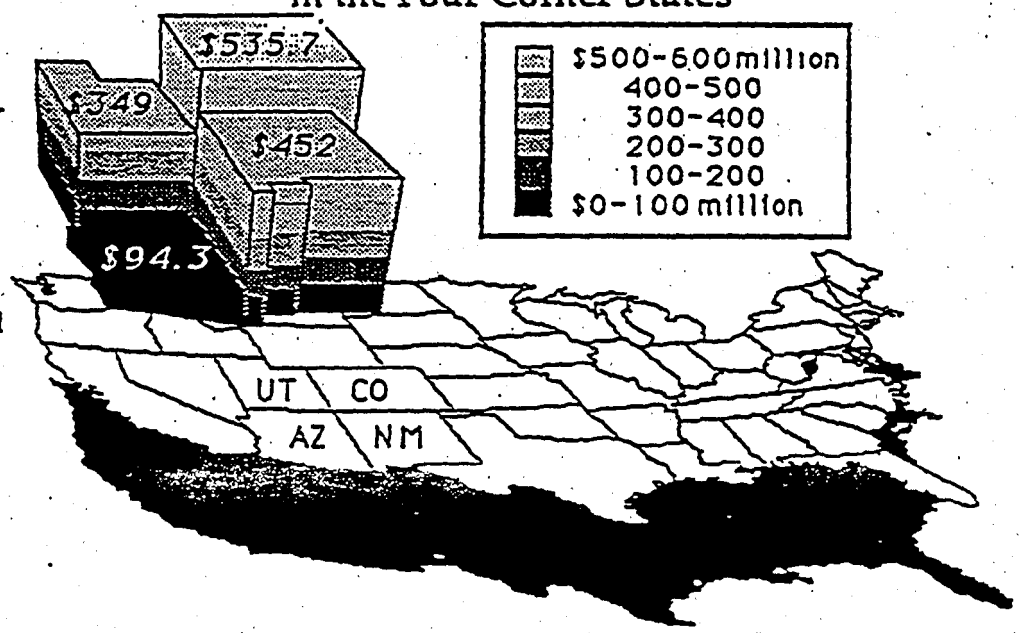
Southwestern States Visitors And Spending

To compare Arizona state park usage to others in the Southwest, the park visitation and resulting visitor expenditures were calculated for Arizona, New Mexico, Colorado and Utah. An average visitor expenditure of $203 was used to estimate visitor expenditures in the four states. Results show spending by visitors to state

parks in three adjacent states is 3 1/2 to almost 6 times higher than spending by their counterparts in Arizona. Colorado enjoys the highest state park visitation and visitor spending of the four states considered with nearly 8 million visitors who spend almost $536 million annually, compared to Arizona's 1.4 million visitors and $94 million annual expenditures.

In the next ten years, New Mexico will receive over $3 *billion* more from its state park visitors than Arizona will. The difference in annual visitor spending between the two states is over $312 million. Taking into account the greater number of parks in New Mexico than Arizona, this tremendous difference points out the huge economic cost of our lack of investment in Arizona's state parks.

Expenditures of State Park Visitors in the Four Corner States



Arizona's Economic Loss

Arizona has a vast and unique land base for our residents and visitors to enjoy. However, substantial opportunities for rural economic benefits are leaking out of the state. It is clear that the unmet demand in Arizona for outdoor recreation activities results in lost economic benefits to state and local economies. Outdoor recreation and accessibility to the natural environment are such strong quality of life values in our society that they are a major consideration in both personal and business location/relocation decisions.

The state parks system needs an immediate revitalization and investment to meet the needs of our residents and visitors. Many residents are forced to go out-of-state to enjoy a reasonable summer climate for recreational activities due to a shortage of facilities in Arizona's mountains. Investment in state recreation lands and facilities has tremendous economic benefits and should be an integral part of our state economic development program.

References

"The Contribution of Outdoor Recreation to State Economic Development", Suellen T. Keiner, Council of State Planning Agencies, 1985.

Arizona Office of Tourism, "Arizona Tourism Statistics."

"The 1987-1988 Use Study of Arizona State Parks Visitors", Arizona State Parks Board, 1989.

"Arizona Statewide Comprehensive Outdoor Recreation Plan", Arizona State Parks Board, 1989.

"1986 State Park Visitors," Arizona State Parks Board.

"1986 Visitation," Utah State Parks and Recreation Department.

"Visitation Count for 1986," New Mexico Park and Recreation Division.

"FY 86-87 Park Managers Visitation Report with Regional Subtotals," Colorado Division of Parks and Outdoor Recreation.

ATTACHMENT 4

NATURE-BASED TOURISM AND THE ECONOMY OF SOUTHEASTERN ARIZONA:

Economic Impacts of Visitation to Ramsey Canyon Preserve and the San Pedro Riparian National Conservation Area

Final Report
October 30, 1992

Kristine Crandall, M.S.
Julie Leones, Ph.D.
Bonnie G. Colby, Ph.D.

Department of Agricultural and Resource Economics
The University of Arizona
Tucson, Arizona 85721

Questions and comments can be directed to Professor Leones (621-6255) or Professor Colby (621-4775). Ms. Crandall is now working on international projects and can no longer be contacted at The University of Arizona.

Executive Summary

This study documents expenditures in the Sierra Vista area by visitors to the San Pedro Riparian National Conservation Area (RNCA) and by bird watchers at Ramsey Canyon Preserve. Information on visitor expenditures, characteristics and preferences is reported, along with implications for nature-based tourism in southeastern Arizona. This study examined visitation to only two natural areas and so economic impacts reported here represent only a portion of the impacts of visitor spending associated with all nature preserves located in southeastern Arizona. The study indicates that 95% of visitors to Ramsey Canyon and the San Pedro RNCA go to at least one other site in southern Arizona on a typical visit to the area, and make expenditures in communities located near these sites.

Ramsey Canyon Preserve and the San Pedro RNCA attract significant numbers of visitors from outside of the local area. Approximately two-thirds of the visitors to these sites are from outside of Arizona and 5-6% are from outside the U.S. These visitors bring new economic activity not only to southeastern Arizona, but to the state as a whole. The typical non-resident visitor to Ramsey Canyon spends $55 per day in Sierra Vista, while the typical non-resident visitor to the San Pedro RNCA spends $51 per day in Sierra Vista. The economic impact on total industry output in the Sierra Vista area associated with nature-based visitors to Ramsey Canyon and the San Pedro RNCA is nearly 3 million dollars per year.

This report focuses on only one economic aspect of nature-based tourism and is not intended to discuss the range of benefits and costs that communities experience as a result of increased tourism. However, the information provided here is an important component in considering these benefits and costs. The economic impact figures reported are very conservative because great care was taken to include only those portions of Ramsey Canyon and San Pedro visitor expenditures which were directly linked to time spent by visitors at these two study sites. Our study indicates that nearly all visitors coming from outside of the local area visited other sites in southeastern Arizona and purchased goods and services near those sites. Consequently, the numbers reported here are a conservative "lower bound" indication of the importance of nature-based tourism in southeastern Arizona.

Protected natural areas attract relatively high income and well-educated visitors, many of whom are retired or close to retirement. This type of visitor is highly desirable not only because they have discretionary time and income, but also because they may be seeking a location for retirement. The expenditures by nature-based visitors provide significant stimulation for the economy of Sierra Vista and Cochise County. Study results also demonstrate the importance of the study sites to local residents. Fifty-five percent of visitors contacted at the San Pedro RNCA were local residents or non-residents on day trips and most of these visit the RNCA regularly.

Visitation to Ramsey Canyon Preserve is spread fairly evenly through the year with the lowest visitation during the peak winter visitor months of October to February, and the highest visitation during March to August. Roughly 42.5% of all visitation occurred during the February through May season in 1992. Consequently, visitation to Ramsey Canyon is complementary to other types of visitation to Sierra Vista. Nature-based tourists help smooth visitation over the year, rather than making visitation during peak winter visitor months more pronounced. Given the large fluctuations in visitation to other parts of southern Arizona between the winter and summer months, this is an attractive attribute of nature-based tourism. Although visitor records are not available for San Pedro RNCA, results from the visitor survey indicate that 35 percent of visitors to Ramsey Canyon Preserve also visit the San Pedro RNCA. It is likely that seasonal visitation patterns are similar for the two sites.

The expenditure analysis indicates the importance of an overnight stay for communities to experience significant economic benefits from visitors. While overnight visitors spent an average of $51 to $55 per person per day in the Sierra Vista area, day trip visitors spent less than $7 per person per day in Sierra Vista. This makes the availability of accommodations in Sierra Vista a key factor affecting the magnitude of economic inflows from nature-based tourism. Potential opportunities exist not only for additional lodging but also for tour services originating in Cochise County. Nature-based visitors spent more than $654,000 on tour fees in fiscal 1991-1992. Only $16,000 of that amount was spent in the Sierra Vista area.

The potential for increased economic inflows from nature-based tourism is apparent from this study. Visitors spent about $12 million per year on trips that included a visit to Ramsey Canyon or the

San Pedro RNCA, but only a portion of the overall trip expenditures occurred in southeastern Arizona. While southeastern Arizona communities are unlikely to capture a portion of visitors' airfare and rental car expenditures, they could take steps to increase local expenditures by nature-oriented visitors on lodging, restaurants, tour services and miscellaneous retail purchases. Other important strategies for increasing returns from nature-based tourism include preservation of existing natural sites and possible expansion of sites attractive to birders (particularly for hummingbird viewing).

ATTACHMENT 5

Keystone Minerals, Incorporated

6318 East Hayne St. Tucson, Az 85710
Phone 520-747-9551 FAX 520-750-9563

FEB 1996 RECEIVED

Tucson, Feb.19th, 1996

Mrs. Mila H. Hill, Economist
Ariz. Dept. of Environmental Quality.
3033 North Central Ave.
Phoenix, Az 85012

Dear Mrs. Hill,

Thank you for your letter of Feb. 13th, regarding our Korn Kob mine in Buehman canyon, Pima County. I will attempt to answer your questions from present information and from Pre-Feasibility studies on the economics of our anticipated mining operation.

1: Our minable ore reserves have been calculated by a number of Engineering Companies. Any calculation of ore reserves depends on a number of variable factors as, the price of copper on the world market, the waste to ore ratio of the open pits and the average grade of ore mined. We are presently using the following figures, which we deem conservative. Minable ore reserves in the two adjacent pits are 23,562,000 Tons with a soluble copper grade of 0.42% (8.4 Lbs. per Ton.) Below the two open pits are additional ore reserves, including ore below Buehman Canyon, which will be considered for "in situ" leaching as a last phase. Engineering studies have not been completed on the "in situ" ore reserves but we would estimate some 50,000,000 Tons of such deposits.

2: Expected time frame depends on the permitting process, approval of our mine plans, our EIS and other factors which might delay our start up date by 3 to 4 years. With present mine plans, our ore reserves will last 8.63 years from starting date. After breaking ground, we expect to be in full production in 15 months, producing 16,717,000 Lbs.of marketable Cathode copper per year. (See note on Attachment 1.)

3: A mining Contractor will be used to mine and place the ore on the leaching pads with a payroll of 64 people. The operating company will run the plant with an additional 20 to 26 people as is shown on the "Cost of Labor" attachment 2. We assume that by far the majority of professional and skilled labor will be hired fron the Arizona Labor pool.

4: Initial capital requirements for the project are $ 15 Million, including land aquisition and Heap pad construction, but mostly for the Solvent Extraction and Electrowinning plant. Annual operating cost has been summarized on the "Summary of Annual Operating Cost" Attachment 1. Royalties to be paid to the US are still an uncertain factor, while the cost of borrowing money is not yet known at this time. Gross income from the sales of Cathode copper is expected to exceed $ 20 million per year.

5: Expected rate of return is favorable at current and anticipated world market prices for Cathode copper. The demand for copper has been increasing at a high rate and is expected to continue.

6: Primary customers will be mostly manufacturers of copper wire, brass and finished products.These customers will be mostly from out of State or in other countries in Europe and Asia.

6: At this time we hesitate to estimate the Tax burdens on our fully operational mine and plant. We assume however that Federal, State and local Taxes, together with possible royalties to the United States (in the event of changes in the Federal mining law.) may approach 25% of Net proceeds.

In order to get this information to you before the requested date of Feb. 23rd,'96 we may not have fully answered all your questions. Please feel free to call us or send a Fax at our office numbers provided on Page 1 if we can be of further assistance. Finally we request that the four pages of Confidential data attached to this letter remain Confidential.

Sincerely yours,
Keystone Minerals, Inc.

Dirk Den-Baars

Dirk Den-Baars, Vice Pres.

Attachements:
1. Summary of Annual Operating Cost.
2. Cost of Labor in 6 catagories.
3. Cost of Operating Supplies
4. Cost of Utilities.

DDB/bj