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Board of Public Utilities

Cheyenne Water and Sewer Departments

P.O. Box 1469 • Cheyenne, Wyoming 82003 • Phone (307) 637-6460
2100 Pioneer Avenue

October 9, 1995

Regulatory Reinvention Pilot Projects
XL Community Pilot Program
Water Docket, Mail Code 4101
U.S. EPA
401 M Street, S.W.
Washington, DC 20460

Re: Proposal for EPA's XL Community Pilot Program

Dear Sir/Madame:

On August 29, 1995, the Wyoming Department of Environmental Quality (DEQ) sent you a proposal whereby the environmental management of Crow Creek would become part of EPA's XL Community Pilot Program. That proposal focused primarily on pollution prevention and stormwater management concerns within that reach of the stream that runs through the City of Cheyenne. The purpose of this submittal is to expand the project scope to include watershed issues both above and below the City.

Since 1993, several State agencies and the Cheyenne Board of Public Utilities (BPU) have been collecting physical, chemical, and biological data in order to characterize the quality of Crow Creek. The primary purpose of the data collection effort is to determine if Crow Creek should be reclassified for aquatic life uses above and below the two secondary wastewater treatment plants (WWTPs) that serve 60,000 people in the greater Cheyenne area.

Below the WWTPs, Crow Creek is classified for agricultural uses such as irrigation and livestock watering (Wyoming Class 4). Typical low stream flows upstream of the WWTPs are on the order of 0.5 cfs or less. You can literally step across the stream during these periods. Downstream of the City, WWTP effluent comprises 90 to 95 percent of the total flow for much of the year. The stream is therefore an effluent dominated stream.

If Crow Creek is reclassified as a Class 3 stream below the WWTPs and treatment standards are changed accordingly, it is very questionable whether this classification will be achieved in reality for several reasons: (1) stream flows are marginal; (2) bottom substrate conditions are poor; and (3) non-regulated or unidentifiable sources of pollution are clearly present. Bottom line, use attainability is very marginal, if not in fact non-existent. In addition to not being able to achieve a "true" Class 3 stream, there will be no real public benefit. There is

essentially no public access to Crow Creek downstream of the WWTPs, the number, size and type of fish that can live in Crow Creek will be very limited. Thus, large sums of money will be spent in a futile effort which provide very little benefit to the environment or public.

The primary cost impact of stream reclassification is the potential imposition of extremely low effluent ammonia limits at the WWTPs. The capital cost of the preferred ammonia treatment alternatives ranges from $5 to $7 million. We want to move beyond the traditional regulatory compliance strategy that would call for construction of expensive ammonia removal facilities at the WWTPs. Instead, we suggest alternative environmental improvement on the upstream portions of Crow Creek which will timely benefit the environment and the public, all at a lower cost.

In anticipation that the State may propose the reclassification of Crow Creek, the BPU prepared a comprehensive EPA 201 Facility Planning Study during 1993-1995. This Facility Plan evaluated both conventional and nonconventional compliance options and the results of this study are summarized in the enclosed paper that was presented to the American Institute of Hydrology in May 1995.

Based on the Facility Plan and parallel stream study efforts, the BPU feels that Crow Creek should remain a Class 4 stream below the WWTPs. Reclassifying the stream in this reach to Class 2 (game fishery) or Class 3 (nongame fishery) will provide minimal public benefits at great capital and annual costs and, in our opinion, no benefit to the stream given nonpoint source and other unidentified sources of pollution.

The BPU did not want to engage the State or EPA in a protracted disagreement over the merits of reclassifying Crow Creek. Neither do we want to substantially increase our customer rates to install and operate ammonia removal facilities at the WWTPs. Our preferred approach is to not build ammonia removal facilities at the WWTPs and use $1,000,000 or more of the savings to improve fish habitat and public access in the Crow Creek watershed within and upstream of the City.

The BPU benthic consultants have proven that the benthic invertebrate population suffers the greatest destruction in the reach of the creek which flows through the City of Cheyenne. Without this destruction (26 taxa to 8 taxa) the lower reaches of the creek at the WWTPs would very likely show an adequate diversity index.

Environmental improvements in the upper creek are therefore more scientifically sound than those in the lower creek. The

prospects of spending $5 million on ammonia removal at one WWTP which shows a benefit/cost ratio of approximately 0.15 portends a waste of dollars that could provide greatly increased environmental benefits and a better benefit/cost ratio in the upper reaches of the stream. Clearly, a trade-off through the XL program would be environmentally and financially beneficial.

The following cover sheet summarizes the issues noted herein and the anticipated results of the project. Note that our XL Program would be combined with the pollution prevention and stormwater management initiatives suggested by the Wyoming DEQ. This will result in a comprehensive approach to improving environmental quality in the Crow Creek watershed.

We appreciate your interest and leadership in changing the way EPA "gets the job done." We hope you select Cheyenne as a case study in how the exercise of regulatory flexibility will benefit not only the local environment, but also the people who live, work, and play in it. Thank you for considering our proposal and we look forward to your response.

Sincerely,

Jerome M. Mark

Jerome M. Mark, P.E. & L.S.
Director

JMM/ljs
Enclosures
cc: Mr. Bruce Zander, Region VIII EPA
Mr. Mark Maxwell, Black & Veatch

XL COMMUNITY PILOT PLANT PROGRAM
FOR THE CHEYENNE BOARD OF PUBLIC UTILITIES

APPLICANT Cheyenne Board of Public Utilities
Attn: Jerome M. Mark, P.E., Director
P. O. Box 1469.
2100 Pioneer Avenue
Cheyenne, WY 82003

ENVIRONMENTAL RESULTS

The Cheyenne XL Project will improve water quality, aquatic habitat, stream flow, and public access to Crow Creek. The XL Project will consist of the following components:

- Community-based pollution prevention programs.
- Phased installation of best management practices (BMPs) on major storm drainages in the greater Cheyenne area.
- Investment of $1,000,000 by the Cheyenne BPU for habitat, public access, and open space improvements along Crow Creek both within and upstream of the City.
- Implementation of a potable water demand management system by the Cheyenne BPU. This system will substitute non-potable surface water for potable water currently used to irrigate major greenbelt areas in the City. The BPU may also study the feasibility of using reclaimed wastewater to further reduce potable water irrigation requirements.
- Environmental improvements in the upper (Cheyenne) sections of Crow Creek should help the Cheyenne Environs as well as aid in clean up of the entire creek.

STAKEHOLDER INVOLVEMENT AND SUPPORT

The constituency for the XL Project are the 60,000 residents who would have daily access to the improved segments of Crow Creek. Stakeholders range from Trout Unlimited to the Wyoming Department of Game and Fish to the local businesses that would be generated or expanded due to the enhanced recreational opportunities along Crow Creek.

FEASIBILITY

Through the 201 Facility Planning Process, the Cheyenne BPU has already determined the XL Project to be technically and financially feasible.

TRANSFERABILITY

The concepts promoted in this XL Project can be applied throughout the semi-arid west where many streams are "effluent dominated" and there is limited benefit to providing more than secondary wastewater treatment.

MONITORING, REPORTING, AND EVALUATION

The City of Cheyenne will be accountable for project results. The Crow Creek data collected during 1993-1995 can be used as a baseline for evaluating project performance. The aquatic habitat, public access, open space, and pollution prevention initiatives can be initiated in 1996. The schedule for financing and implementation of stormwater BMP improvements will be negotiated between the City, State, and EPA.

SHIFTING OF ENVIRONMENTAL RISK BURDEN

No one will be subject to unjust environmental consequences. The two WWTPs that discharge to Crow Creek will continue to meet secondary treatment requirements, as they have for many years. There will be no cross media transfer of pollution to the air or land.

ECONOMIC OPPORTUNITY

The XL Project will enhance economic and recreational opportunities along Crow Creek, both within and upstream of the City. It also means that for each single family home, wastewater rates can be at least $45.00 per year less compared to the installation of conventional ammonia removal facilities at the WWTPs.

Integrated Watershed Planning Yields Creative Permit Compliance Alternatives at Cheyenne, Wyoming

by
Mark Maxwell, Project Manager, Black & Veatch
Dan Buhrmaster, Project Engineer, Black & Veatch
Jack Young, Wastewater Operations Manager, Cheyenne Board of Public Utilities
Jerry Mark, Director, Cheyenne Board of Public Utilities

Mr. Maxwell and Mr. Buhrmaster are at the Rocky Mountain Regional Office of Black & Veatch, 11900 East Cornell Avenue, Suite 300, Aurora, Colorado 80014. Requests for reprints should be directed to Mr. Maxwell.

Mr. Young and Mr. Mark are part of the management team for the Cheyenne Board of Public Utilities, P. O. Box 1469, 2100 Pioneer Avenue, Cheyenne, Wyoming 82003.

ABSTRACT

The Cheyenne Board of Public Utilities (BPU) is faced with the possible reclassification of its receiving stream, Crow Creek. The Wyoming Department of Game and Fish (DGF) may recommend that Crow Creek be reclassified from Class 4 designation (agricultural uses and wildlife) to either Class 2 (game fishery) or Class 3 (nongame fishery).

The primary impact of reclassification is the potential imposition of extremely low ammonia limits on wastewater treatment plants (WWTPs). The cost of ammonia treatment alternatives ranges from $5 to $25 million. Because of the hugh investment required for sophisticated treatment facilities, the BPU is pursuing creative (nonconventional) permit compliance alternatives that integrate watershed planning for the Cheyenne area.

Nonconventional alternatives identified to-date are as follows:

- **Transbasin Diversion.** Transbasin diversion of secondary effluent in lieu of additional treatment facilities.
- **Fisheries Habitat Enhancement.** Habitat and public access improvements to Crow Creek.
- **Wetlands Treatment.** Constructed wetlands to provide additional treatment of secondary effluent and collateral benefits such as wildlife habitat enhancement and aquatic life propagation.

The BPU's wastewater master plan will identify institutional and noneconomic factors that should be weighed by the State when it considers the possible reclassification of Crow Creek.

BACKGROUND

The Cheyenne BPU operates two WWTPs which, for many years, have discharged secondary effluent into Crow Creek several miles east of the City. The Crow Creek WWTP is a 4 million gallon per day (mgd) trickling filter facility and the Dry Creek WWTP is a newer, 7 mgd activated sludge plant. In general, the Crow Creek plant operates as a baseloaded facility and excess flows are conveyed to the Dry Creek WWTP. Typically, waste

sludges from the Crow Creek plant are also discharged into the interceptor sewer and all solids handling operations occur at the Dry Creek WWTP. Primary and centrifuge-thickened waste activated sludges are anaerobically digested prior to air drying on paved beds at the Dry Creek WWTP.

The Cheyenne BPU has senior water rights on Crow Creek and virtually all of the flow in this stream, plus groundwater from 44 wells and imported surface water from the Little Snake/Douglas Creek projects, is used to meet potable requirements in the BPU's service area. Consequently, native stream flows are very low during dry weather periods. For example, it is estimated that during dry weather periods, the WWTP effluent comprises 90 to 95 percent of the flow in Crow Creek. Below the WWTPs, Crow Creek is a small, yet continuously flowing stream which does not have an aquatic life designation. The stream meanders through primarily private agricultural lands, with limited public access, and much of the water is used for stock watering and irrigated agriculture. The BPU must provide approximately 3 to 4 mgd of return flow to satisfy downstream agricultural water rights.

REGULATORY FRAMEWORK

Since 1990, the DGF conducted several cursory studies which suggest to them that portions of Crow Creek could support either game or nongame fish. Based on these preliminary assessments, the Wyoming Department of Environmental Quality (DEQ), with support from the BPU and DGF, initiated a more formal study to determine if Crow Creek should be reclassified for aquatic life propagation.

This aquatic life study is currently ongoing but preliminary indications are that the DGF will recommend to the Wyoming Environmental Quality Council that portions of Crow Creek downstream of the WWTPs be reclassified as a nongame fishery. If so, extremely stringent effluent ammonia limits may be established for the WWTPs.

Wyoming uses standard Environmental Protection Agency (EPA) values for allowable instream unionized ammonia concentrations. Accordingly, there is some difference in the allowable unionized ammonia concentration whether the stream segments below the WWTPs are classified for game or nongame fish species. However, the potential range of effluent ammonia concentrations will primarily be based on critical downstream conditions for low flow, temperature, and pH. Such data for Crow Creek are scarce and more are currently being collected.

To evaluate the range of potential ammonia standards for Crow Creek, critical late summer conditions of low dilution flow and elevated pH and temperature were reviewed to assess their impact on allowable effluent ammonia for both game and nongame fisheries. Assuming a "more favorable" set of conditions where the blended effluent/stream pH is 7.3 units and temperature is 19 degrees Centigrade, values which are similar to those for the BPU's secondary effluent, the total ammonia standard for the WWTPs would be set at approximately 1.9 mg/L for a nongame fishery. If the situation is "less favorable" and the blended pH and temperature increase downstream of the WWTP to respective values of 8.5 units and 23 degrees Centigrade, the total ammonia standard for the WWTPs could be set as low as 0.2 mg/L for a game fishery. The relationship between the effluent total ammonia limit and the blended instream conditions for pH, temperature, and fishery class are graphically depicted on Figure I.

WATERSHED PLANNING CONCEPTS

Early in the planning process, it became apparent that the BPU may be forced to make a huge investment to provide for ammonia removal down to "stringent" (1.9 mg/L) or even "extreme" (0.2 mg/L) levels. In addition, there is little full scale experience to document that the BPU can meet a 0.2 mg/L limit on a continuous basis, even using advanced multi-stage ammonia removal technology. At best, the return on the financial investment would be very small since there is almost no public access to Crow Creek downstream of the WWTPs. There would be many people to pay, and few to benefit.

EPA and Congressional officials responsible for reauthorization of the Clean Water Act (CWA) have talked about the need to develop solutions that provide the greatest benefit and lowest cost on a watershed basis. But what really is *integrated watershed planning* and how can it be applied in a site-specific situation? While the Wyoming DEQ did not have any pat answers, they made some suggestions and agreed to listen to several ideas that were put forth by the BPU and the consultant it retained to prepare a Wastewater Master Plan (Master Plan).

COMPLIANCE ALTERNATIVES

Table I lists all of the Dry Creek WWTP alternatives which are being carried forward for detailed economic and noneconomic evaluation. As shown in Table I, the potential regulatory scenarios include (1) no reclassification of Crow Creek, (2) nonconventional reclassification of Crow Creek, (3) nongame fishery reclassification with stringent ammonia removal, and (4) game fishery reclassification with extreme ammonia removal. The "nonconventional" alternatives of transbasin diversion, secondary effluent, or wetlands treatment are applicable whether "stringent" or "extreme" levels of ammonia removal are required.

For this analysis, it is assumed that the Crow Creek WWTP would be upgraded to create nonpotable reuse water rather than meeting stringent or extreme ammonia removal requirements. This was done because (1) it is less likely that the stream segment immediately below the Crow Creek WWTP will be reclassified and (2) the BPU is establishing a nonpotable water system to reduce treated water demands.

The success of the transbasin diversion option is contingent upon the Wyoming DEQ making a commitment that it will not, in the future, reclassify the dry stream to which the secondary effluent would be discharged. The DEQ indicated a willingness to provide such a commitment if a suitable intermittent water course was selected by the BPU. This option also requires that the BPU make arrangements to satisfy any downstream appropriators who may be injured by the lack of return wastewater flow in Crow Creek.

FIGURE I - Projected Total Ammonia Discharge Limit

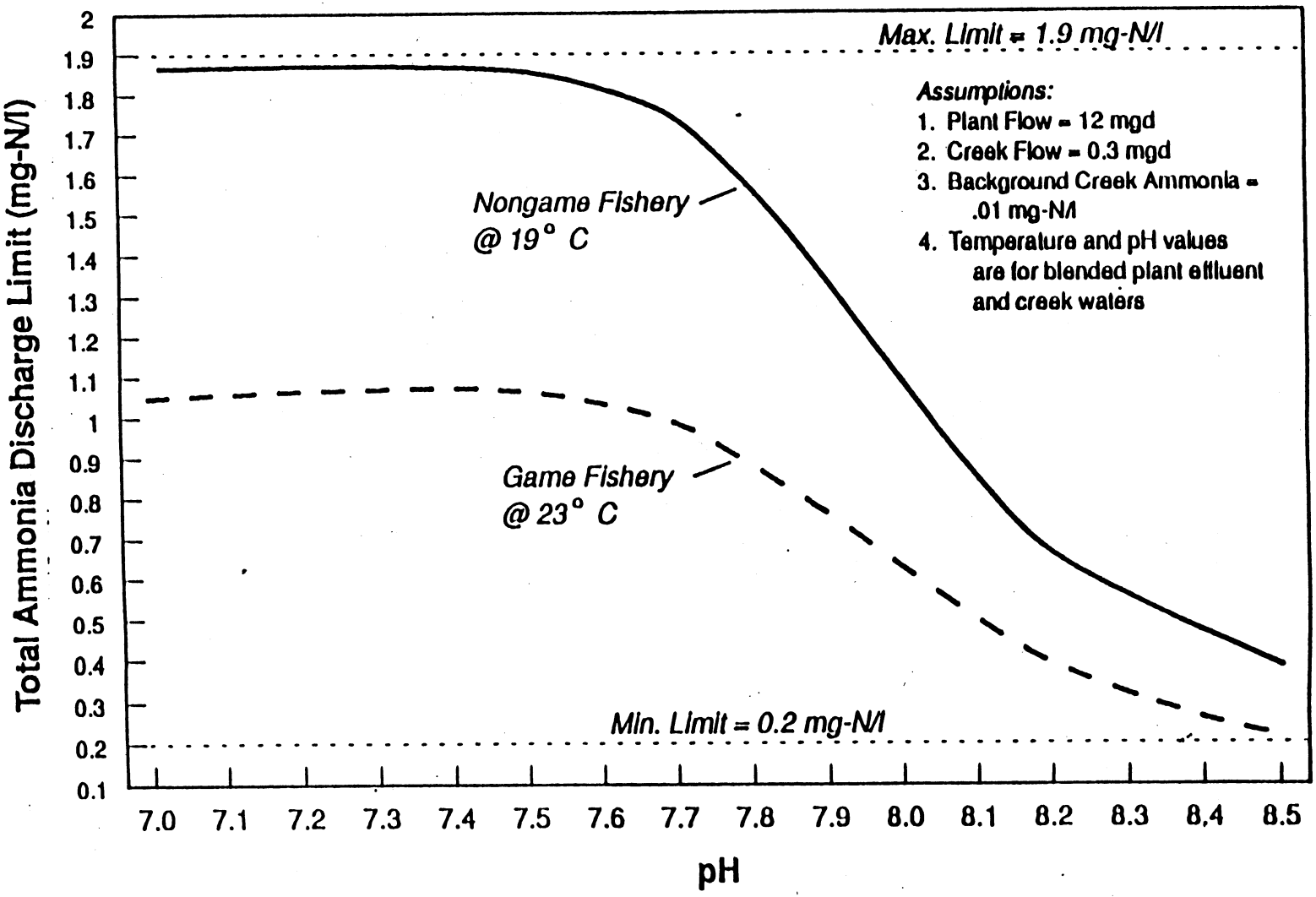

TABLE I Summary of Dry Creek WWTP compliance alternatives carried forward for detailed evaluation	
Future scenario	**Possible compliance alternatives**
No reclassification of Crow Creek	**Alternative 1.** Secondary treatment and discharge to Crow Creek.
Nonconventional reclassification	**Alternative 2.** Secondary treatment and discharge to Crow Creek with upstream fisheries improvements within the Crow Creek drainage.
	Alternative 3. Constructed wetlands for treatment beyond secondary and wildlife propagation.
Nongame fishery with critical temperature of 19 C and pH of 7.3 (effluent ammonia of 1.9 mg-N/L)	**Alternative 4.** Transbasin diversion of secondary effluent and pipe 3 mgd of effluent directly to the Herford Ranch.
	Alternative 5. Single-stage biological nitrification and discharge to Crow Creek.
	Alternative 6. Second-stage biological nitrification and discharge to Crow Creek.
Game fishery with critical temperature of 23 C and pH of 8.5 (effluent ammonia of 0.2 mg-N/L)	**Alternative 4.** Transbasin diversion of secondary effluent and pipe 3 mgd of effluent directly to the Herford Ranch.
	Alternative 7. Biological nitrification with subsurface discharge via rapid infiltration basins.
	Alternative 8. Biological nitrification followed by breakpoint chlorination and discharge to Crow Creek.
	Alternative 9. Biological nitrification followed by ion exchange and discharge to Crow Creek.

One other innovative and nonconventional compliance approach is for the BPU to pay for fishery improvements upstream of Cheyenne in exchange for not having to put in ammonia removal facilities at the WWTPs (Alternative No. 2). This exchange is comparable to the "no net loss" of wetlands policy where an equivalent amount and quality of wetlands are created for those that may be damaged by construction activities. Based on aquatic biology surveys that the BPU performed separate from the DGF's study, the habitat and water quality is already much better in the mountains west of Cheyenne compared to the segments of Crow Creek that lie within the City and downstream. A moderate amount of money spent on these upstream areas would benefit more people, and may provide a more aesthetically pleasing experience, than the substantial sums that will be needed to upgrade and operate the WWTPs for ammonia removal.

Another nonconventional option is to create a large amount of wetlands, perhaps up to 500 acres, using secondary effluents from the WWTPs. This would serve both as (1) a demonstration project to determine how well wetlands remove ammonia on a year-round basis at a location that is 6,000 feet in elevation and has a non-temperate climate and (2) for wildlife propagation. It is suspected that the latter function will be the primary benefit since it is unlikely that created wetlands will meet even the stringent (1.9 mg-N/L) standard, particularly during winter.

ALTERNATIVES EVALUATION

Initial reclassification hearings will be held during summer 1995 and the State will make a final decision regarding stream reclassification and effluent ammonia limits in 1996. Whichever decision is made, the Master Plan will meet EPA 201 Facility Planning requirements so that a State Revolving Fund (SRF) loan can be used to finance the improvements that emerge from this complex process.

Tables II through IV present capital cost opinions for the Dry Creek WWTP alternatives presented in Table I. As shown, capital costs range from $5.16 million for expansion of secondary treatment to $23.8 million for extreme ammonia removal and discharge to Crow Creek. The wetlands alternative provides for the construction of 500 acres of free water surface wetlands. Compared to the biological nitrification and breakpoint chlorination option, it is not cost effective to provide more than 500 acres of wetlands and it is extremely unlikely that additional acreage will enable the BPU to meet stringent numeric ammonia limits on a year round basis.

Operation and maintenance costs were estimated and the options were then compared on a present worth basis. The evaluation is also presented in Tables II through IV. The cost figures clearly show a strong economic incentive to avoid costly, approaches such as biological nitrification followed by chemical addition, filtration, and ion exchange treatment prior to discharge to Crow Creek. For a typical residential household, wastewater bills are projected to increase by $2.30 per month for a basic secondary treatment expansion to $10.40 per month for ion exchange ammonia removal technology at the Dry Creek WWTP.

TABLE II Present worth cost for no reclassification of Crow Creek or nonconventional reclassification[1]				
Present worth cost component	Project component	No reclassification of Crow Creek	Nonconventional reclassification	
		Alternative 1 - expanded secondary treatment	Alternative 2 - fishery improvements	Alternative 3 - wetlands treatment
Probable project cost	Secondary treatment	2,249	2,249	2,249
	Facility upgrades	2,907	2,907	2,907
	Additional improvements	-	1,000	6,771
	TOTAL	5,156	6,156	11,927
	PRESENT WORTH	5,156	6,156	11,927
Remaining value of facilities	TOTAL	<1,467>	<1,467>	<1,717>
	PRESENT WORTH	<107>	<107>	<125>
Additional annual O&M costs	TOTAL (per year)	163	163	178
	PRESENT WORTH	1,740	1,740	1,900
TOTAL PRESENT WORTH		6,789	7,789	13,702

[1]All costs are expressed in $1,000. All costs are referenced to December 1994 (ENR-BCI = 3110).

TABLE III Present worth cost for reclassification of Crow Creek for stringent ammonia removal[1]

Present worth cost component	Project component	Stringent ammonia removal			
		Alternative 4 - transbasin diversion	Alternative 5 - secondary treatment/ infiltration basins	Alternative 6 - single-stage nitrification	Alternative 7 - second-stage nitrification
Probable project cost	Secondary treatment	2,249	2,249	2,249	2,249
	Facility upgrades	2,907	2,907	2,165	2,907
	Pipeline/pump station	8,892	-	-	-
	Infiltration basins	-	6,373	-	-
	Nitrification	-	-	5,482	12,143
	TOTAL	14,048	11,529	9,896	17,299
	PRESENT WORTH	14,048	11,529	9,896	17,299
Remaining value of facilities	TOTAL	<7,173>	<5,293>	<2,492>	<3,249>
	PRESENT WORTH	<524>	<386>	<182>	<237>
Additional annual O&M costs	TOTAL (per year)	310	517	400	489
	PRESENT WORTH	3,309	5,519	4,270	5,220
TOTAL PRESENT WORTH		16,833	16,662	13,984	22,282

[1]All costs are expressed in $1,000. All costs are referenced to December 1994 (ENR-BCI = 3110).

TABLE IV Present worth cost for reclassification of Crow Creek for extreme ammonia removal[1]

Present worth cost component	Project component	Extreme ammonia removal			
		Alternative 4 - transbasin diversion	Alternative 5 - secondary treatment/ infiltration basins	Alternative 8 - nitrification/ breakpoint chlorination	Alternative 9 - nitrification/ion exchange
Probable project cost	Secondary treatment	2,249	2,249	2,249	2,249
	Facility upgrades	2,907	2,907	1,865	2,165
	Pipeline/pump station	8,892	-	-	-
	Infiltration basins	-	6,373	-	-
	Nitrification	-	-	5,301	5,482
	Breakpoint chlorination	-	-	943	-
	Ion exchange	-	-	-	13,927
	TOTAL	14,048	11,529	10,358	23,823
	PRESENT WORTH	14,048	11,529	10,358	23,823
Remaining value of facilities	TOTAL	<7,173>	<5,293>	<2,618>	<3,526>
	PRESENT WORTH	<524>	<386>	<191>	<257>
Additional annual O&M costs	TOTAL (per year)	310	517	518	696
	PRESENT WORTH	3,309	5,519	5,530	7,430
TOTAL PRESENT WORTH		16,833	16,662	15,697	30,996

[1]All costs are expressed in $1,000. All costs are referenced to December 1994 (ENR-BCI = 3110).

REGULATORY CONSTRAINTS

While the habitat enhancement alternatives such as upstream fishery improvements and constructed wetlands appear to be an environmentally and economically attractive "middle ground," there is a major regulatory hurdle to their implementation. Specifically, Region VIII EPA representatives indicate that the current Clean Water Act (CWA) does not provide a regulatory framework for "trading off" ecosystem enhancement in exchange for not meeting numeric standards in a stream that may or may not support a very limited fishery. Although such a tradeoff may make economic sense and provide the greatest environmental gain for the least amount of money, the CWA currently does not give the EPA and States much decision making flexibility.

Under present law, "watershed management" techniques are limited to those which result in the attainment of the specific numeric limits for which a stream is classified. While this is a conservative and appropriate approach in States with abundant precipitation and stream flows, in the arid west, it may result in the expenditure of significant funds that benefit only a small amount of aquatic life and even fewer people.

Can we inject some common sense into the mutually compatible objectives of preserving environmental quality at a price society can afford to pay? While we cannot sacrifice the environment simply to keep utility rates low, decision makers need flexibility so they can do the best job of balancing these goals in each site-specific situation.