

**EPA Superfund  
Record of Decision:**

**SILVER BOW CREEK/BUTTE AREA  
EPA ID: MTD980502777  
OU 04  
BUTTE, MT  
09/28/1990**

- THE SURFACE WATERS OF ALL THREE CREEKS (MILL, WILLOW, AND SILVER BOW) THAT ENTER THE OPERABLE UNIT ARE CONTAMINATED WITH DISSOLVED METALS. THE SURFACE WATER QUALITY STANDARDS ADOPTED UNDER THE MONTANA WATER QUALITY ACT ARE FREQUENTLY EXCEEDED FOR COPPER AND ZINC WITHIN THE AREA.
- LARGE AREAS OF SURFACE CONTAMINATION, COMPRISED OF TAILINGS AND CONTAMINATED SOILS, ARE PRESENT WITHIN THE BOUNDARIES OF THE WARM SPRINGS PONDS OPERABLE UNIT. THE TAILINGS AND CONTAMINATED SOILS, WHICH INCLUDE PREVIOUSLY SUBMERGED POND BOTTOM SEDIMENTS THAT ARE NOW EXPOSED, CONTAIN ELEVATED LEVELS OF SEVERAL METALS AND ARE EITHER VOID OF VEGETATION OR SPARSELY VEGETATED. THESE TAILINGS AND CONTAMINATED SOILS SUBJECT HUMANS TO RISKS FROM EXPOSURE. COPPER AND ZINC, WHICH ARE SIGNIFICANT CONTAMINANTS IN THE TAILINGS, ARE ALSO SUSPECTED OF CAUSING SEVERAL FISHKILLS OBSERVED IN THE MILL-WILLOW BYPASS AND THE CLARK FORK RIVER.

#### **ENFORCEMENT ACTIVITIES**

IN AUGUST 1967, THE ANACONDA MINERALS COMPANY RECEIVED AN ORDER FROM THE MONTANA WATER QUALITY BOARD, REQUIRING STEPS TO BE TAKEN TO PREVENT THE INTRODUCTION OF HEAVY METAL SALTS INTO THE CLARK PORK RIVER FROM THE WARM SPRINGS PONDS. IN RESPONSE TO THIS ORDER, WATER FROM BELOW POND 1 WAS PUMPED BACK INTO POND 1 FOR FURTHER TREATMENT. ADDITIONALLY, IN RESPONSE TO A FISHKILL IN JULY 1989, ARCO (ANACONDA MINERAL COMPANY'S SUCCESSOR) AGREED TO ISOLATE STREAMSIDE TAILINGS DEPOSITS BY CONSTRUCTING BERMS BETWEEN THE TAILINGS AND THE CLARK FORK RIVER. FINALLY, THE EPA, IN JULY 1990, ORDERED ARCO TO REMOVE ALL TAILINGS AND SOILS CONTAMINATED WITH HEAVY METALS FROM THE MILL-WILLOW BYPASS. THIS WORK IS ONGOING AND IS EXPECTED TO BE COMPLETED BY LATE 1990.

THE PHASE I REMEDIAL INVESTIGATION REPORT OF THE ENTIRE SILVER BOW CREEK SITE WAS RELEASED IN 1987(1). THE PHASE II REMEDIAL INVESTIGATION REPORT, WHICH CONCENTRATED SOLELY ON THE WARM SPRINGS PONDS OPERABLE UNIT, WAS COMPLETED IN MAY 1989(2). THE REMEDIAL INVESTIGATIONS FOCUSED ON THE NATURE AND EXTENT OF CONTAMINATION WITHIN THE OPERABLE UNIT. THE FEASIBILITY STUDY INCORPORATING THE INFORMATION OBTAINED DURING THE REMEDIAL INVESTIGATIONS, WAS RELEASED FOR PUBLIC COMMENT ON OCTOBER 26, 1989(3). THE FEASIBILITY STUDY DEVELOPED AND EVALUATED A RANGE OF REMEDIAL ALTERNATIVES FOR CLEANUP OF THE OPERABLE UNIT.

- (1) MILTITECH, 1987. PHASE I REMEDIAL INVESTIGATION REPORT.
- (2) CH2M HILL, 1989. PHASE II REMEDIAL INVESTIGATION REPORT.
- (3) MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES, 1989. FEASIBILITY STUDY FOR THE WARM SPRINGS PONDS OPERABLE UNIT. VOLUME I, REPORT; VOLUME II, APPENDIXES.

#### **#HCP**

#### **HIGHLIGHTS OF COMMUNITY PARTICIPATION**

#### **BACKGROUND**

COMMUNITY INVOLVEMENT IN THE SILVER BOW CREEK SUPERFUND SITE ACTIVITIES BEGAN EARLY IN THE PROJECT. THE INITIAL COMMUNITY RELATIONS PLAN, IN 1983, DESIGNATED THE BUTTE-SILVER BOW COUNTY HEALTH DEPARTMENT AS THE FOCAL POINT FOR COMMUNITY RELATIONS AND INCLUDED THE FORMATION OF A CITIZENS ADVISORY COMMITTEE. THAT COMMITTEE WAS ACTIVE IN THE SELECTION OF A CONTRACTOR FOR THE INITIAL PHASE I REMEDIAL INVESTIGATIONS OF SILVER BOW CREEK.

LATE IN 1985, EPA CONDUCTED AN ASSESSMENT OF THE SITE COMMUNITY RELATIONS PLAN. THE ASSESSMENT RECOMMENDED SEVERAL IMPROVEMENTS TO THE PLAN, INCLUDING INSTALLATION OF A TOLL-FREE TELEPHONE NUMBER, PREPARATION OF FACT SHEETS AND UPDATES, AND AN INCREASE IN THE NUMBER OF INFORMAL PUBLIC MEETINGS OR BRIEFINGS. MOST OF THESE IMPROVEMENTS WERE IN PLACE BY 1987.

INFORMATION REPOSITORIES, CONTAINING KEY SITE STUDIES, INDEXES AND REPORTS, ARE PRESENTLY MAINTAINED AT THE FOLLOWING LOCATIONS: MONTANA STATE LIBRARY IN HELENA, MONTANA HISTORICAL SOCIETY IN HELENA, UNIVERSITY OF MONTANA LIBRARY IN MISSOULA, MISSOULA PUBLIC LIBRARY, NATIONAL PARK SERVICE MAIN OFFICE IN DEER LODGE, HEARST FREE LIBRARY IN ANACONDA, MONTANA TECH LIBRARY IN BUTTE, BUTTE PUBLIC LIBRARY, AND MONTANA STATE UNIVERSITY LIBRARY IN BOZEMAN. THE COMPLETE ADMINISTRATIVE RECORD IS MAINTAINED AT THE EPA'S OFFICES IN HELENA.

THE PHASE II REMEDIAL INVESTIGATION, FOLLOWED BY A FEASIBILITY STUDY, BEGAN AT THE WARM SPRINGS PONDS OPERABLE UNIT IN 1986 AND CONTINUED THROUGH 1989. DURING THAT TIME MDHES AND EPA STAFF PROVIDED INFORMATION ABOUT THE WARM SPRINGS PONDS ACTIVITIES AT PUBLIC MEETINGS AND THROUGH FACT SHEETS AND PROGRESS REPORTS. THESE REPORTS WERE DISTRIBUTED TO PEOPLE ON A MAILING LIST (271 INDIVIDUALS IN 1987 AND 800 INDIVIDUALS IN 1990) IN NOVEMBER 1986, NOVEMBER 1987, MAY 1988, JULY 1988, AUGUST 1988, OCTOBER 1988, JUNE 1989, SEPTEMBER 1989, AND MAY 1990. SPECIAL INTEREST GROUPS THAT INDICATED CONCERN ABOUT THE SITE INCLUDED THE CLARK FORK COALITION, BUTTE CHAPTER OF TROUT UNLIMITED, SKYLINE SPORTSMEN OF ANACONDA, THE DEER LODGE CHAPTER OF TROUT UNLIMITED, GEORGE GRANT CHAPTER OF TROUT UNLIMITED, ANACONDA SPORTSMEN'S CLUB, PINTLAR AUDUBON, AND UPPER CLARK FORK CHAPTER OF TROUT UNLIMITED.

THE WARM SPRINGS PONDS FEASIBILITY STUDY AND PROPOSED PLAN WERE RELEASED FOR PUBLIC REVIEW IN OCTOBER 1989. THE MDHES HELD PUBLIC INFORMATIONAL MEETINGS IN BUTTE, ANACONDA, AND MISSOULA DURING OCTOBER AND FORMAL PUBLIC HEARINGS IN THE SAME CITIES IN DECEMBER. THE PUBLIC COMMENT PERIOD FOR THE FEASIBILITY STUDY AND PROPOSED PLAN WAS OPEN FROM OCTOBER 1989 UNTIL THE END OF JANUARY 1990.

#### **PUBLIC PERCEPTION OF ITS INVOLVEMENT AT WARM SPRINGS PONDS**

THE EPA AND MDHES RECEIVED 162 COMMENT LETTERS AND 40 PEOPLE PRESENTED TESTIMONY AT THE PUBLIC HEARINGS. MOST COMMENTS INDICATED DISSATISFACTION WITH THE LEVEL OF PUBLIC INVOLVEMENT IN THE SUPERFUND PROCESS AT THE WARM SPRINGS PONDS. THE EPA AND MDHES ARE STRIVING TO INVOLVE MORE FULLY ALL INTERESTED PARTIES AND OTHER AGENCIES IN FUTURE ACTIVITIES AT THE WARM SPRINGS PONDS AND AT OTHER SITES IN THE CLARK FORK BASIN.

PUBLIC INVOLVEMENT IN THE MILL-WILLOW BYPASS REMOVAL ACTION IS AN EXAMPLE OF THE EFFORT TO INVOLVE THE PUBLIC EARLY IN SUPERFUND ACTIVITIES. A PUBLIC SCOPING MEETING ON THE MILL-WILLOW BYPASS REMOVAL ACTION WAS HELD IN FEBRUARY OF 1990. THE AGENCIES HELD FIVE PUBLIC MEETINGS IN FEBRUARY AND MAY OF 1990 TO GATHER INPUT FROM THE GENERAL PUBLIC ON THE REMOVAL ACTIVITIES AND OTHER ACTIONS PLANNED BY THE AGENCIES AND ARCO. COORDINATION MEETINGS INVOLVING LOCAL GOVERNMENT OFFICIALS, REPRESENTATIVES OF INTERESTED STATE AGENCIES, AND PUBLIC INTEREST GROUPS WERE HELD IN PREPARATION FOR THE SUMMER'S REMOVAL ACTION. THE AGENCIES WILL CONTINUE SIMILAR EFFORTS TO INVOLVE THE PUBLIC IN THE SUPERFUND PROCESS.

#### **PUBLIC INPUT REGARDING PROPOSED REMEDIAL ACTION**

THE REMEDY SELECTED IN THIS RECORD OF DECISION WAS DEVELOPED, TO A LARGE EXTENT, TO ADDRESS COMMENTS AND RECOMMENDATIONS PROVIDED BY ARCO AND THE GENERAL PUBLIC DURING THE PUBLIC COMMENT PERIOD. SEVERAL KEY REVISIONS WERE MADE TO THE ORIGINAL PREFERRED ALTERNATIVE:

THERE WAS CONSIDERABLE PUBLIC OPPOSITION TO THE CONSTRUCTION AND USE OF AN UPSTREAM SETTLING BASIN TO CATCH AND CONTROL FLOOD FLOWS ON SILVER BOW CREEK. THIS ELEMENT HAS BEEN DROPPED IN FAVOR OF A MAJOR UPGRADE OF PONDS 2 AND 3 TO STORE AND TREAT FLOOD FLOWS. THIS UPGRADE INCLUDES SUBSTANTIAL CHANGES TO THE BERMS, AS WELL AS NEW INTAKE STRUCTURES AND A NEW LIME ADDITION FACILITY.

THERE WAS OVERWHELMING SUPPORT FOR EXPEDITING THE REMOVAL OF TAILINGS FROM THE MILL-WILLOW BYPASS IN AN EFFORT TO PREVENT ANY FUTURE FISHKILLS IN THE UPPER CLARK FORK RIVER. THIS WORK HAS ALREADY BEEN STARTED AS PART OF THE MILL-WILLOW BYPASS REMOVAL ORDER SIGNED IN JULY 1990. THE MAJORITY OF THE REMOVAL IS EXPECTED TO BE COMPLETED BY THE END OF 1990.

THERE WAS CONSIDERABLE SUPPORT FOR THE PROTECTION OF THE POND BERMS TO THE FULL MAXIMUM CREDIBLE EARTHQUAKE AND AT LEAST HALF OF THE PROBABLE MAXIMUM FLOOD. THE ORIGINAL PREFERRED REMEDY WOULD HAVE USED FULL EARTHQUAKE PROTECTION, BUT LESS THAN 0.5 PROBABLE MAXIMUM FLOOD PROTECTION FOR BERMS ON PONDS 1 AND 2. THE AGENCIES HAVE AGREED THAT 0.5 PROTECTION FOR ALL THE PONDS IS APPROPRIATE, SO THE SELECTED REMEDY NOW PROVIDES FOR FULL MAXIMUM CREDIBLE EARTHQUAKE AND 0.5 PROBABLE MAXIMUM FLOOD PROTECTION FOR ALL PONDS.

## #SSC

### SUMMARY OF SITE CHARACTERISTICS

#### SURFACE HYDROLOGY

THE WARM SPRINGS PONDS INCLUDE THE PRIMARY HYDROLOGIC FEATURES WITHIN THE OPERABLE UNIT. THEY COVER AN AREA OF APPROXIMATELY 2,500 ACRES (ABOUT 4 SQUARE MILES). THREE CREEKS FROM THE SOUTH AND THE WEST FLOW THROUGH THE OPERABLE UNIT (SEE FIGURE 2). SILVER BOW CREEK, THE LONGEST OF THE THREE CREEKS, FLOWS FROM THE SOUTH AND ENTERS POND 3 NEAR THE SOUTHERN END OF THE OPERABLE UNIT. MILL AND WILLOW CREEKS FROM THE WEST AND SOUTH FLOW INTO THE MILL-WILLOW BYPASS, A DIVERSION DITCH, WHICH ROUTES THE COMPARATIVELY LESS CONTAMINATED WATER IN THESE TWO CREEKS AROUND THE PONDS AND TO THE CLARK FORK RIVER.

WATER FLOWING OUT OF POND 3 GOES PRIMARILY INTO POND 2, WITH A SMALLER VOLUME BEING USED TO MAINTAIN SEVERAL WILDLIFE PONDS LOCATED BETWEEN PONDS 2 AND 3 (SEE FIGURE 1). THE EFFLUENT FROM POND 2 FLOWS INTO THE MILL-WILLOW BYPASS, AS A REGULATED POINT-SOURCE DISCHARGE, AND THEN DOWN THE BYPASS TO THE CLARK FORK RIVER. THE AVERAGE FLOWS IN THE THREE CREEKS ARE 73 CUBIC FEET PER SECOND (CFS) FOR SILVER BOW CREEK, AND 27 CFS FOR COMBINED MILL AND WILLOW CREEKS.

THE AVERAGE FLOW OF 100 CFS IN THE LOWER PORTION OF THE MILL-WILLOW BYPASS IS JOINED BY THE AVERAGE FLOW OF APPROXIMATELY 47 CFS IN WARM SPRINGS CREEK AT THE NORTHERN END OF THE OPERABLE UNIT TO FORM THE CLARK FORK RIVER. WARM SPRINGS CREEK IS ALSO CONTAMINATED, POSSIBLY DUE TO MILLING AND SMELTING ACTIVITIES IN THE ANACONDA AREA, WEST OF THE OPERABLE UNIT.

#### GROUNDWATER HYDROLOGY

THE SHALLOW GROUND WATER SYSTEM IN THE WARM SPRINGS OPERABLE UNIT IS COMPLEX, OWING TO THE HETEROGENEITY OF THE NEAR SURFACE GEOLOGY IN THE AREA. THE SITE IS IN A GROUND WATER DISCHARGE AREA FOR THE UPPER DEER LODGE VALLEY, TYPIFIED BY SHALLOW GROUND WATER TABLES AND SWAMPS. THE PRESENCE OF THE POND SYSTEM AFFECTS SHALLOW GROUND WATER ELEVATIONS AND GROUND WATER MOVEMENT WITHIN THE SITE.

SHALLOW AQUIFERS OCCUR ALONG PRESENT-DAY STREAM CHANNELS BUT DO NOT EXTEND Laterally THROUGHOUT THE SITE. DEEPER AQUIFERS ARE ASSOCIATED WITH TERTIARY-AGE VALLEY FILL AND THICK DEPOSITS OF GLACIOFLUVIAL MATERIAL. THESE AQUIFERS GENERALLY EXHIBIT MODERATE TO LOW PERMEABILITIES AND ARE PROBABLY CONNECTED ON A REGIONAL SCALE, ALTHOUGH FINE-GRAINED INTERBEDS TEND TO CONFINE THE DEEPER AQUIFERS LOCALLY.

THE UPPERMOST AQUIFER AT THE SITE IS A 10- TO 15- FEET-THICK SAND AND GRAVEL UNIT, WHICH IS TYPICALLY PRESENT APPROXIMATELY 10 FEET BELOW GROUND SURFACE. THIS SAND AND GRAVEL AQUIFER APPEARS TO BE PRESENT THROUGHOUT MOST OF THE SITE. GROUND WATER MOVEMENT THROUGH THE SITE IS GENERALLY SOUTH TO NORTH, ALTHOUGH A SIGNIFICANT COMPONENT OF GROUND WATER ENTERS FROM THE OPPORTUNITY PONDS AREA TO THE SOUTHWEST. (SEE FIGURE 2).

NO DOMESTIC WELL IS LOCATED WITHIN THE WARM SPRINGS PONDS OPERABLE UNIT. SEVERAL ARE LOCATED EAST OF THE POND SYSTEM WITHIN A MILE OF THE OPERABLE UNIT, BUT THESE WELLS ARE COMPLETED IN BEDROCK AQUIFERS THAT DO NOT APPEAR TO BE AFFECTED BY THE POND SYSTEM. THE TOWN OF WARM SPRINGS DERIVES ITS WATER FROM SUPPLY WELLS CONSTRUCTED IN UNCONSOLIDATED TERTIARY DEPOSITS, FROM DEPTHS OF APPROXIMATELY 200 FEET. THESE WELLS APPEAR TO BE SUPPLIED WITH WATER DERIVED FROM GROUND WATER RESOURCES WEST OF AND HYDRAULICALLY ISOLATED FROM THE WARM SPRINGS PONDS.

#### NATURE AND EXTENT OF CONTAMINATION

SEDIMENTS, SURFACE WATER, SOILS, AND GROUND WATER ARE ALL AFFECTED BY CONTAMINANTS IN THE WARM SPRINGS PONDS OPERABLE UNIT. A SCHEMATIC THAT SHOWS THE CONTAMINATED AREAS AND THE MIGRATION PATHWAYS IS PRESENTED AS FIGURE 3. FOUR CONTAMINATED MEDIA HAVE BEEN IDENTIFIED FOR THE OPERABLE UNIT: POND BOTTOM SEDIMENTS, SURFACE WATER, TAILINGS DEPOSITS AND CONTAMINATED SOILS, AND GROUND WATER. THE MEDIA ARE DISCUSSED IN THE FOLLOWING SECTIONS. TABLE 1 PRESENTS A BREAKDOWN OF THE AREAS AND VOLUMES FOR EACH OF THE FOUR MEDIA.

## SEDIMENTS, TAILINGS, AND CONTAMINATED SOILS

TWO OF THE MEDIA--THE POND BOTTOM SEDIMENTS, AND THE TAILINGS DEPOSITS AND CONTAMINATED SOILS--CONTAIN THE MAJORITY OF THE CONTAMINANTS IN THE WARM SPRINGS PONDS OPERABLE UNIT. THESE MATERIALS ARE TYPICALLY FINE TO COARSE SAND AND GENERALLY CONTAIN METALS ASSOCIATED WITH THE SULFIDE ORE BODY PRESENT NEAR BUTTE. POND BOTTOM SEDIMENTS ARE ALSO COMPRISED OF PRECIPITATED HYDROXIDES AND OXYHYDROXIDES RESULTING PRINCIPALLY FROM THE ADDITION OF LIME TO TREAT THE WATER ENTERING THE POND SYSTEM AND FROM BIOLOGICALLY MEDIATED PRECIPITATION.

THE EXPOSED (UNSUBMERGED) SEDIMENTS, TAILINGS DEPOSITS AND CONTAMINATED SOILS COVER AN AREA OF APPROXIMATELY 634 ACRES WITHIN THE WARM SPRINGS PONDS OPERABLE UNIT. THICKNESSES OF THESE DEPOSITS RANGE FROM LESS THAN 1 INCH TO SEVERAL FEET. THE SUBMERGED SEDIMENTS IN PONDS 1, 2, 3, AND THE WILDLIFE PONDS COVER AN AREA OF APPROXIMATELY 1,227 ACRES AND RANGE IN THICKNESS FROM LESS THAN 1 FOOT TO OVER 20 FEET. (SEE TABLE 1.)

## SURFACE WATER

THE DATA OBTAINED DURING THE REMEDIAL INVESTIGATION CHARACTERIZE THE SURFACE WATER FOR NEAR-AVERAGE FLOW RATES. FEW DATA ARE AVAILABLE TO CHARACTERIZE THE SURFACE WATER QUALITY DURING HIGHER FLOWS BECAUSE OF DRIER-THAN-NORMAL CONDITIONS IN THE AREA EXPERIENCED DURING THE REMEDIAL INVESTIGATION. NO OPPORTUNITY WAS AVAILABLE DURING THE SAMPLING PERIOD TO COLLECT FLOW AND CONTAMINATION DATA DURING ONE OF THE HIGH RUNOFF EVENTS THAT CAUSE INFLOWS TO BE DIVERTED AROUND THE POND SYSTEM.

SURFACE WATER SAMPLES WERE COLLECTED AT 25 SAMPLING POINTS IN AND ADJACENT TO THE WARM SPRINGS PONDS OPERABLE UNIT DURING PHASE I AND PHASE II REMEDIAL INVESTIGATIONS. THE PHASE I REMEDIAL INVESTIGATION SHOWED THAT METALS ARE BEING REMOVED FROM THE SILVER BOW CREEK FLOW BY THE CURRENT POND TREATMENT SYSTEM. INFLOW LOADS OF TOTAL COPPER AND TOTAL ZINC WERE REDUCED BY OVER 90 PERCENT BY THE TIME THE WATER LEFT THE POND SYSTEM DURING THE SUMMER MONTHS AND BY 50 TO 70 PERCENT DURING WINTER MONTHS. ALTHOUGH METALS CONCENTRATIONS ARE REDUCED IN THE POND SYSTEM, MONTANA'S CHRONIC AMBIENT WATER QUALITY STANDARDS FOR COPPER, LEAD, AND ZINC WERE OCCASIONALLY EXCEEDED IN THE WATER LEAVING THE POND SYSTEM, PARTICULARLY IN WINTER MONTHS. AMBIENT STANDARDS FOR CADMIUM AND IRON WERE ALSO FREQUENTLY EXCEEDED DURING THE SAMPLING EVENTS.

FOUR 24-HOUR, OR DIURNAL, SAMPLING EPISODES WERE COMPLETED WITHIN THE WARM SPRINGS PONDS SYSTEM DURING THE PHASE II REMEDIAL INVESTIGATION TO GAIN A BETTER UNDERSTANDING OF CHANGES IN WATER QUALITY OVER 1-DAY PERIODS AND ON A SEASONAL BASIS. THESE SAMPLING EPISODES WERE COMPLETED IN SEPTEMBER 1987 AND IN JANUARY, APRIL, AND JULY 1988.

HOURLY DATA FROM THE DIURNAL SAMPLING STUDIES HAVE BEEN COMPILED. (4)

THE DATA FOR THE 24-HOUR SAMPLING EPISODES INDICATE THE FOLLOWING:

- PH VARIED BY UP TO 2.2 UNITS THROUGHOUT THE DAY AT ALL STATIONS SAMPLED.
- TOTAL METALS CONCENTRATIONS DECREASED 50 TO 90 PERCENT BETWEEN POND SYSTEM INFLOW AND OUTFLOWS.
- DISSOLVED METALS CONCENTRATIONS FOR COPPER AND ZINC WERE GENERALLY 20 TO 50 PERCENT HIGHER IN THE WINTER AT ALL SAMPLING STATIONS IN THE POND SYSTEM. HIGHER DISSOLVED METALS CONCENTRATIONS IN THE WINTER CORRELATE DIRECTLY WITH LOWER PH VALUES MEASURED DURING WINTER SAMPLING EVENTS.

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(4)CH2M HILL, 1989. PHASE II REMEDIAL INVESTIGATION DATA SUMMARY. THE POND SYSTEM REDUCED METALS CONCENTRATIONS AT THE OUTFLOWS FROM THE SYSTEM DURING THE FOUR DIURNAL SAMPLING EVENTS, FREQUENTLY TO LEVELS BELOW BOTH CHRONIC AND ACUTE AQUATIC STANDARDS. FIGURE 4 SHOWS AN EXAMPLE OF THIS PHENOMENON RECORDED DURING ONE OF THE DIURNAL SAMPLING EVENTS.

REMOVAL OF METALS IN THE PONDS IS ACCOMPLISHED BY PHYSICAL, BIOLOGICAL, AND CHEMICAL PROCESSES. PHYSICAL REDUCTION OF METAL-BEARING SOLIDS OCCURS THROUGH SIMPLE SEDIMENTATION. INCREASES IN PH, WHICH ARE PARTLY DUE TO THE ADDITION OF LIME AND PARTLY DUE TO PHOTOSYNTHESIS, CAN PRECIPITATE METALS AS A RESULT OF CHANGING METALS SOLUBILITIES. YET ANOTHER IMPORTANT METALS REMOVAL MECHANISM MAY BE THE PRECIPITATION OF CALCITE AND COPRECIPITATION OF METALS AND PHOSPHORUS, WHICH FOLLOW THE PHOTOSYNTHETIC REMOVAL OF CARBON DIOXIDE AND A COMPENSATING SHIFT IN THE BICARBONATE BUFFERING SYSTEM (5). DIRECT UPTAKE OR ABSORPTION OF METALS BY ALGAE AND AQUATIC MACROPHYTES IS ALSO PROBABLE. ADDITION OF LIME TO THE SILVER BOW CREEK INFLOW DURING THE WINTER MONTHS ALSO CONTRIBUTES TO PRECIPITATING METAL CONTAMINANTS WHEN THE AMOUNT OF SUNLIGHT TO SUPPORT PHOTOSYNTHESIS IS REDUCED.

SEVERAL FISHKILLS HAVE OCCURRED IN THE MILL-WILLOW BYPASS AND IN THE UPPER CLARK FORK RIVER, WITH THE MOST RECENT KNOWN EPISODE BEING IN JULY 1989. ANALYSIS OF FISH TISSUE BY MONTANA DEPARTMENT OF FISH, WILDLIFE, AND PARKS FROM ONE EVENT IN THE SUMMER OF 1986 REVEALED ACUTE COPPER POISONING AS THE CAUSE OF THE FISH MORTALITY. ALTHOUGH MDFWP DID NOT DETERMINE THE SOURCE OF METALS RESPONSIBLE FOR THE KILLINGS, THAT SOURCE MOST LIKELY CONSISTS OF TAILINGS MATERIAL ALONG THE MILL-WILLOW BYPASS.

#### **GROUND WATER**

GROUND WATER QUALITY DATA WERE GENERATED THROUGH SAMPLING OF 19 MONITORING WELLS ON TWO OCCASIONS (JANUARY AND MAY, 1988) FIGURE 5 SHOWS THE LOCATIONS OF THE MONITORING WELLS AT THE SITE. TABLE 2 SUMMARIZES GROUND WATER QUALITY DATA FOR THESE MONITORING WELLS. GROUND WATER BENEATH PONDS 2 AND 3 MAY BE CONTAMINATED ALSO. WELLS WERE NOT INSTALLED TO DETERMINE THE QUALITY OF THE GROUND WATER BENEATH THOSE TWO PONDS. GIVEN THE HYDROGEOLOGY OF THE SITE, CONTAMINATED GROUND WATER UNDER THE PONDS WOULD FLOW NORTH AND BE DETECTED AT THE NORTHERN END OF THE POND SYSTEM.

WITH ONE EXCEPTION, ALL DETECTED EXCEEDENCES OF THE PRIMARY MAXIMUM CONTAMINANT LEVELS FOR METALS (ARSENIC AND CADMIUM) WERE NORTH OF THE POND 1 BERM. GROUND WATER QUALITY DOWNGRAIENT OF POND 1 IS GENERALLY OF POOREST QUALITY IMMEDIATELY NORTH OF THE BERM; MOST METAL CONTAMINANTS DECREASE TO THE NORTH, OR DOWNGRAIENT OF THE POND SYSTEM. CONCENTRATIONS OF MOST METALS ALSO DECREASE WITH DEPTH.

HIGHEST CONCENTRATIONS OF METALS ARE GENERALLY ASSOCIATED WITH THE SHALLOW SAND AND GRAVEL AQUIFER IN THE AREA IMMEDIATELY BELOW THE POND 1 BERM. CALCULATIONS OF GROUND WATER DISCHARGE FROM THE AREA BELOW POND 1 INTO THE CLARK FORK RIVER INDICATE THAT THE GROUND WATER SYSTEM CONTRIBUTES VERY LITTLE FLOW TO THE RIVER BECAUSE OF THE RELATIVELY LOW PERMEABILITY AND LOW GRADIENT OF THE SHALLOW AQUIFER. UNDER AVERAGE CONDITIONS, THE FLOW IN THE CLARK FORK RIVER IS APPROXIMATELY 137 CFS, WHILE THE GROUND WATER DISCHARGE TO THE RIVER IS APPROXIMATELY 1.0 CFS. NEVERTHELESS, THE EXCEEDENCES OF THE MAXIMUM CONTAMINANT LEVELS FOR ARSENIC AND CADMIUM IN THE GROUND WATER CONSTITUTE A VIOLATION OF THE DRINKING WATER STANDARDS.

#### **APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS**

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) ARE A BASIC STANDARD BY WHICH ALL ASPECTS OF CONTAMINANT CLEANUP ARE MEASURED. COMPLIANCE WITH ARARS OR INVOCATION OF AN APPROPRIATE ARAR WAIVER, IS REQUIRED BY SECTION 121(D) OF CERCLA. THE FEASIBILITY STUDY EVALUATED POTENTIAL COMPLIANCE OF THE DEVELOPED REMEDIAL ALTERNATIVES WITH FEDERAL AND MONTANA ARARS. COMPLIANCE WITH ARARS IS A THRESHOLD DETERMINATION FOR SELECTION OF A REMEDY. 40 CFR 300,430(F)(I)(A).

THE DISCUSSION OF ARARS IN THIS SECTION IS A GENERAL DISCUSSION, WHICH HIGHLIGHTS THE MAJOR ARARS FOR THE REMEDIAL ACTION. A FULL LIST OF ALL ARARS AND COMPLIANCE POINTS, AS WELL AS INFORMATION TO BE CONSIDERED ("TBCS"), AND OTHER RELEVANT LEGAL REQUIREMENTS, IS CONTAINED IN THE ATTACHMENT TO PART II: THE DECISION SUMMARY. THE BASIS FOR EPA'S SELECTION OF THE ARARS IS GIVEN IN THE FEASIBILITY STUDY AND PART III, RESPONSIVENESS SUMMARY.

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(5)WETZEL, R.G., 1975. LIMNOLOGY. PHILADELPHIA: W.B. SAUNDERS COMPANY.

ARARS ARE DIVIDED INTO THREE CATEGORIES: CHEMICAL-SPECIFIC, LOCATION-SPECIFIC, AND ACTION-SPECIFIC. CHEMICAL-SPECIFIC ARARS INCLUDE LAWS AND REGULATIONS THAT SET HUMAN HEALTH- OR ENVIRONMENTALLY-BASED NUMERICAL VALUES GOVERNING MATERIALS HAVING CERTAIN CHEMICAL OR PHYSICAL CHARACTERISTICS. THESE VALUES SET THE ACCEPTABLE CONCENTRATIONS OF CHEMICALS THAT MAY BE FOUND IN, OR RELEASED TO, THE ENVIRONMENT. LOCATION-SPECIFIC ARARS RESTRICT CONTAMINANT CONCENTRATIONS OR CLEANUP ACTIVITIES DUE TO THE SITE'S GEOGRAPHIC OR PHYSICAL LOCATION. ACTION-SPECIFIC ARARS ARE BASED ON ACTIONS TAKEN DURING CONTAMINANT CLEANUP.

SECTION 121(D)(4) OF CERCLA, 42 USC S9621(D)(4), PROVIDES FOR THE WAIVER OF ARARS IF CERTAIN CRITERIA ARE MET. THIS RECORD OF DECISION WAIVES TWO ARARS FOR SURFACE WATER-- ARSENIC AND MERCURY--AND ESTABLISHES REPLACEMENT NUMERIC LIMITATIONS FOR THOSE STANDARDS WAIVED. THE WAIVERS ARE BASED ON TECHNICAL IMPRACTICABILITY FROM AN ENGINEERING PERSPECTIVE, AS PERMITTED UNDER SECTION 121(D)(4)(C) OF CERCLA, 42 USC S9621(D)(4)(C). THE REPLACEMENT CRITERIA WILL REMAIN FULLY PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. THE REPLACEMENT CRITERIA ARE:

MERCURY: 0.0002 MG/L  
ARSENIC: 0.02 MG/L

THERE IS UNCERTAINTY OVER WHETHER CREATION OF PERMANENT DISPOSAL FACILITIES WITHIN PONDS 1 AND 3 AND THE POND 2 AND 3 IMPOUNDMENTS IN PLACE IS IN COMPLIANCE WITH A RELEVANT AND APPROPRIATE REQUIREMENT FROM THE STATE'S SOLID WASTE DISPOSAL REGULATIONS, WHICH PROHIBITS DISPOSAL OF SOLID WASTE WITHIN THE 100-YEAR FLOODPLAIN. EPA BELIEVES THAT THE WASTE UNITS WILL BE OUTSIDE OF THE FLOODPLAIN WHEN THE POND BERMS ARE RAISED AND STRENGTHENED TO SPECIFIED STANDARDS. EVEN IF THE WATER WITHIN THE PONDS IS CONSIDERED PART OF THE FLOODPLAIN, THE DISPOSAL UNITS ARE PROBABLY OUTSIDE OF THE 100-YEAR FLOOD POOL OF THE WATER WITHIN THE PONDS. TO THE EXTENT THE AREAS WITHIN THE POND BERMS ARE CONSIDERED TO BE WITHIN THE 100-YEAR FLOOD PLAIN, EPA WAIVES THE SOLID WASTE DISPOSAL ALAR PURSUANT TO SECTION 121(D)(4)(C), AS TECHNOLOGICALLY INFEASIBLE FROM AN ENGINEERING PERSPECTIVE AND PURSUANT TO SECTION 121(D)(4)(A), AS AN INTERIM ACTION.

ADDITIONALLY, IF IT IS LATER DETERMINED THAT THE AREA WITHIN THE POND BERMS IS WITHIN THE 100-YEAR FLOODPLAIN, THEN A WAIVER OF THE STATE'S SOLID WASTE DISPOSAL REGULATIONS, PROHIBITING DISPOSAL WITHIN THE 100-YEAR FLOODPLAIN, IS INVOKED, ON THE SAME BASES AS ABOVE.

#### CHEMICAL-SPECIFIC ARARS

THE MOST SIGNIFICANT STATE AND FEDERAL CHEMICAL-SPECIFIC ARARS CONSIST OF STANDARDS PROTECTING THE QUALITY OF SURFACE AND GROUND WATER RESOURCES FOR HUMAN HEALTH AND ENVIRONMENTAL PURPOSES. SURFACE WATER ARARS INCLUDE AMBIENT WATER CONCENTRATION LIMITS TO PROTECT BOTH AQUATIC LIFE AND PUBLIC HEALTH, POINT SOURCE DISCHARGE STANDARDS FOR DISCHARGES FROM THE POND SYSTEM, AND DRINKING WATER STANDARDS. GROUND WATER ARARS INCLUDE ONLY DRINKING WATER STANDARDS. THE CONTAMINANTS OF CONCERN AT THE SITE ARE ARSENIC, CADMIUM, COPPER, IRON, LEAD, SILVER, SELENIUM, MERCURY, ALUMINUM, AND ZINC.

#### LOCATION-SPECIFIC ARARS

IMPORTANT LOCATION SPECIFIC ARARS INCLUDE CLEANUP ACTIVITY RESTRICTIONS TO PROTECT AND MINIMIZE IMPACTS ON HISTORICALLY SIGNIFICANT FEATURES AND ENDANGERED SPECIES.

#### ACTION-SPECIFIC ARARS

ACTION-SPECIFIC ARARS PERTINENT TO THE WARM SPRINGS PONDS OPERABLE UNIT INCLUDE REGULATIONS CONCERNING DAM SAFETY IN EVENT OF FLOODS AND EARTHQUAKES, HAZARDOUS WASTE MANAGEMENT AND LAND RECLAMATION FOR MINING AREAS.

DAM SAFETY REGULATIONS ADDRESS BERM DESIGN AND MODIFICATION FOR THE EXISTING TREATMENT SYSTEM. HAZARDOUS WASTE MANAGEMENT ARARS INCLUDE REQUIREMENTS FOR CONTAMINANT DISPOSAL. RECLAMATION ARARS REQUIRE PROPER GRADING, BACKFILLING, SUBSIDENCE STABILIZATION, WATER CONTROL, REVEGETATION AND OTHER MEASURES NEEDED IN SURFACE MINING AREAS TO ELIMINATE DAMAGE FROM SOIL EROSION, SUBSIDENCE, LANDSLIDES, WATER POLLUTION, AND HAZARDS DANGEROUS TO LIFE AND PROPERTY.

## **SUMMARY OF HUMAN HEALTH AND ENVIRONMENTAL RISKS**

A PUBLIC HEALTH AND ENVIRONMENTAL RISK ASSESSMENT WAS CONDUCTED BY THE MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES TO IDENTIFY AND CHARACTERIZE THE ACTUAL AND POTENTIAL THREATS TO HUMAN HEALTH AND THE ENVIRONMENT POSED BY CONTAMINANTS PRESENT AT THE WARM SPRINGS PONDS OPERABLE UNIT. CARCINOGENIC AND NONCARCIN AND THE ENVIRONMENT, ENDANGERMENT WAS ESTABLISHED.

### HUMAN HEALTH RISKS

THE EPA HAS DETERMINED THAT THE WARM SPRINGS PONDS OPERABLE UNIT POSES THE FOLLOWING ACTUAL OR POTENTIAL ENDANGERMENT TO HUMAN HEALTH:

- WORKERS AT THE PONDS FACE AN INCREASED RISK OF CANCER ESTIMATED TO BE 2 X (10<sup>-4</sup>), OR TWO EXCESS CANCERS IN 10,000 INDIVIDUALS EXPOSED FOR A LIFETIME, DUE TO INCIDENTAL INGESTION OF ARSENIC IN THE CONTAMINATED SOILS, SEDIMENTS AND TAILINGS. RECREATIONISTS (HUNTERS, FISHERMEN, BIRD WATCHERS) ALSO FACE INCREASED CANCER RISK FROM EXPOSURE TO ARSENIC.
- WORKERS AND RECREATIONISTS FACE ADDITIONAL CANCER AND NONCANCER HEALTH RISKS DUE TO INGESTION OF LEAD AND OTHER HAZARDOUS SUBSTANCES IN THE CONTAMINATED SOILS, SEDIMENTS, AND TAILINGS.
- CURRENT RESIDENTS ADJACENT TO THE PONDS FACE ACTUAL OR POTENTIAL RISKS FROM CONTAMINATED SOILS, SEDIMENTS, AND TAILINGS BECOMING WIND-BORNE. IF HOMES WERE TO BE BUILT WITHIN THE OPERABLE UNIT BOUNDARIES, RESIDENTS WOULD ALSO FACE RISKS GREATER THAN THE LEVELS NOTED ABOVE.
- THE CONTAMINATED GROUND WATER BELOW POND 1 POSES A POTENTIAL THREAT TO USERS OF THE GROUND WATER.
- THE BERMS PROTECTING THE PONDS FAIL TO MEET CURRENT DAM SAFETY STANDARDS. THEIR FAILURE DUE TO A FLOOD OR EARTHQUAKE COULD RESULT IN CATASTROPHIC CONSEQUENCES, INCLUDING LOSS OF LIFE.

THE BASELINE RISK ASSESSMENT ESTABLISHES CURRENT AND POTENTIAL THREATS TO HUMAN HEALTH. 40 CFR 300.430(D)(4).

THE NCP STATES THAT THE GOAL OF A SUPERFUND CLEANUP SHOULD BE REDUCTION OF RISK TO ACCEPTABLE RANGES, IF ARARS DO NOT EXIST OR ARE NOT SUFFICIENTLY PROTECTIVE. THE POINT OF DEPARTURE, OR TARGET RISK RANGE, IS 1 X (10<sup>-6</sup>) FOR CANCER RISK AND LEVELS THAT DO NOT CREATE ADVERSE EFFECT, INCORPORATING A MARGIN OF SAFETY, FOR SYSTEMIC TOXICANTS. 40 CFR 300.430(E)(2)(I)(A)(2).

THE PREAMBLE TO THE NCP STATES THAT THE 1 X (10<sup>-6</sup>) RISK RANGE SHOULD BE THE GOAL OF ANY CLEANUP, UNLESS REVISION TO A LESSER PROTECTIVE LEVEL IS APPROPRIATE FOR SITE SPECIFIC REASONS. 55 FR 8715-8717. RISKS SHOULD NOT EXCEED 1 X (10<sup>-4</sup>).

### **SUMMARY OF TOXICITY ASSESSMENT**

ARSENIC, A KNOWN CARCINOGEN IS PRESENT AT THIS OPERABLE UNIT. SAMPLES OF EXPOSED TAILINGS AND CONTAMINATED SOILS CONTAINED A MAXIMUM ARSENIC CONCENTRATION OF 597 MG/KG AND AN AVERAGE OF 349 MG/KG ARSENIC. LEAD, A HAZARDOUS SUBSTANCE THAT IS BOTH A SUSPECTED CARCINOGEN AND TOXIC NONCARCINOGEN, IS ALSO PRESENT AT ELEVATED CONCENTRATIONS (MAXIMUM OF 1000 MG/KG AND AVERAGE OF APPROXIMATELY 490 MG/KG). RISKS FROM LEAD WERE NOT QUANTIFIED IN THE RISK ASSESSMENT, BUT THE PRESENCE OF LEAD RISKS IS NOTED. IN ADDITION TO ITS SUSPECTED CARCINOGENIC EFFECTS, LEAD IS KNOWN TO DAMAGE THE CENTRAL NERVOUS SYSTEM AND CAUSE OTHER SERIOUS HEALTH EFFECTS. THE EPA BELIEVES THERE IS NO SAFE THRESHOLD FOR LEAD INTAKE. OTHER HAZARDOUS SUBSTANCES, SUCH AS CADMIUM, ARE ALSO PRESENT AT ELEVATED CONCENTRATIONS.

### **SUMMARY OF EXPOSURE ASSESSMENT**

IN ADDITION TO SERVING AS AN ACTIVE WATER TREATMENT SYSTEM FOR CONTAMINANTS TRANSPORTED BY SILVER BOW CREEK, THE WARM SPRINGS PONDS AND SURROUNDING AREA ALSO FUNCTION AS A WILDLIFE MANAGEMENT AREA. SINCE TWO EMPLOYEES OF THE MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS WORK

WITHIN THE OPERABLE UNIT, MANAGING THE WILDLIFE AREA, THEIR OCCUPATIONAL EXPOSURE WAS EVALUATED. A RECREATIONAL EXPOSURE SCENARIO WAS ALSO EVALUATED BECAUSE HUNTERS AND FISHERMEN ARE OFTEN PRESENT AT THE PONDS. THE RISK TO CURRENT RESIDENTS WAS EVALUATED BECAUSE SEVERAL HOMES ARE LOCATED NEAR THE OPERABLE UNIT BOUNDARY.

AS REQUIRED BY EPA POLICY, THE RISK ASSESSMENT ALSO EXAMINED RISKS UNDER A FUTURE RESIDENTIAL SCENARIO. BECAUSE THE OPERABLE UNIT IS COMPRISED ALMOST ENTIRELY OF THE PONDS AND ASSOCIATED WETLANDS, EPA CONSIDERS IT UNLIKELY THAT HOMES WILL BE BUILT WITHIN ITS BOUNDARIES. TO ENSURE THAT FUTURE RESIDENTIAL DEVELOPMENT DOES NOT OCCUR, THE RECORD OF DECISION REQUIRES IMPLEMENTATION OF INSTITUTIONAL CONTROLS. THE REMEDY THEN FOCUSES ON ACTIVE MEASURES TO ADDRESS THE OCCUPATIONAL, RECREATIONAL, AND ENVIRONMENTAL THREATS.

THE CURRENT HUMAN EXPOSURE ROUTES ARE SUMMARIZED ON FIGURE 6 FOR EACH EXPOSURE SCENARIO. THE PRINCIPAL COMPONENT OF HUMAN HEALTH RISK COMES FROM INCIDENTAL INGESTION OF ARSENIC DURING OCCUPATIONAL ACTIVITY.

#### **RISK CHARACTERIZATION**

THE RISK ASSESSMENT EVALUATED RISKS FROM CARCINOGENIC ELEMENTS SUCH AS ARSENIC, LEAD, AND CADMIUM, AND RISKS FROM NUMEROUS NONCARCINOGENIC ELEMENTS SUCH AS COPPER, IRON, LEAD, AND ZINC. THE HUMAN HEALTH RISKS FROM NONCARCINOGENS ARE EVALUATED BASED ON THEIR HAZARD INDEX. IF THE COMBINED CHEMICAL HAZARD INDEX IS GREATER THAN ONE (BASED ON A DETAILED CALCULATION PRESENTED IN THE RISK ASSESSMENT), THEN AN UNACCEPTABLE RISK IS PRESENT. ALTHOUGH SOME RISKS DUE TO NONCARCINOGENS WERE FOUND, THE HAZARD INDEX WAS IN ALL CASES LESS THAN ONE. AS INDICATED PREVIOUSLY, LEAD WAS NOT QUANTITATIVELY EVALUATED IN THE RISK ASSESSMENT. HOWEVER, THE EPA BELIEVES THERE IS NO SAFE THRESHOLD FOR LEAD INTAKE. ALTHOUGH COPPER AND ZINC DO NOT PRESENT A RISK TO HUMAN HEALTH, THEY DO POSE SIGNIFICANT RISKS TO THE ENVIRONMENT, ESPECIALLY TO AQUATIC ORGANISMS.

THE MAXIMUM EXCESS LIFETIME CANCER RISK DUE TO ARSENIC EXPOSURE (ARSENIC IS THE CONTAMINANT OF PRIMARY CONCERN) FOR WORKERS AT THE PONDS IS ESTIMATED TO BE  $2 \times (10^{-4})$ , OR TWO EXCESS CANCERS IN EVERY 10,000 EXPOSED INDIVIDUALS. THIS ESTIMATED RISK IS BASED ON EXPOSURE TO MAXIMUM MEASURED CONCENTRATIONS OF ARSENIC IN EXPOSED TAILINGS AND CONTAMINATED SOILS PRESENT AT THE WARM SPRINGS PONDS, BUT EXCLUDING THE MILL-WILLOW BYPASS.

BECAUSE OF DIFFICULTIES IN DEVELOPING RISK-BASED CLEANUP LEVELS FOR THE OCCUPATIONAL AND RECREATIONAL SCENARIOS, EPA HAS ELECTED TO DELAY SELECTION OF A SPECIFIC HEALTH-BASED SOIL CLEANUP ACTION LEVEL. THE EPA WILL CONTINUE TO EXAMINE APPROPRIATE METHODS FOR CALCULATING SPECIFIC SOIL CLEANUP LEVELS FOR THIS OPERABLE UNIT. NEVERTHELESS, EPA IS CONFIDENT THAT THE RISK ASSESSMENT HAS DEMONSTRATED ACTUAL AND POTENTIAL RISKS POSED BY CONDITIONS AT THIS OPERABLE UNIT TO JUSTIFY THE RECORD OF DECISION REQUIREMENTS. THE NEXT SECTION, CONCERNING ENVIRONMENTAL RISKS, EXPLAINS HOW THE HUMAN HEALTH RISKS WILL BE REDUCED BY MITIGATION OF THE ENVIRONMENTAL RISKS.

#### **ENVIRONMENTAL RISKS**

THE EPA HAS DETERMINED THAT THE WARM SPRINGS PONDS POSE THE FOLLOWING ACTUAL OR POTENTIAL ENDANGERMENT TO THE ENVIRONMENT.

- PERIODIC FISHKILLS HAVE OCCURRED DUE TO SALTS OF COPPER AND ZINC WASHING FROM TAILINGS DEPOSITS INTO THE CLARK FORK RIVER DURING THUNDERSTORMS. CONTAMINATED SOILS, SEDIMENTS, AND TAILINGS ALSO POSE AN UNQUANTIFIABLE CHRONIC RISK TO AQUATIC LIFE AND WILDLIFE, BOTH WITHIN THE BOUNDARIES OF THE OPERABLE UNIT AND IN THE RIVER DOWNSTREAM.
- WATER QUALITY CRITERIA FOR THE PROTECTION OF AQUATIC LIFE HAVE BEEN EXCEEDED BY WATER DISCHARGED FROM THE PONDS, AND BY WATER ROUTED AROUND THE PONDS WITHOUT TREATMENT.
- THE BERMS PROTECTING THE CONTAMINATED POND WATER AND SEDIMENTS FAIL TO MEET CURRENT DAM SAFETY STANDARDS. THEIR FAILURE DUE TO FLOODS OR EARTHQUAKES COULD RESULT IN CATASTROPHIC ENVIRONMENTAL CONSEQUENCES IN THE CLARK FORK RIVER.

ALTHOUGH THIS RECORD OF DECISION DOES NOT REQUIRE A SPECIFIC SOIL CLEANUP ACTION LEVEL, EPA IS CONFIDENT THAT THE RISK ASSESSMENT HAS SUFFICIENTLY DEMONSTRATED THE ACTUAL AND POTENTIAL ENVIRONMENTAL RISKS POSED BY CONDITIONS AT THE WARM SPRINGS PONDS TO JUSTIFY THE CLEANUP REQUIREMENTS.

THE ACTIONS REQUIRED BY THIS RECORD OF DECISION ARE NECESSARY AND APPROPRIATE TO ADDRESS THE RISKS DESCRIBED ABOVE, EVEN THOUGH AN EXACT QUANTIFICATION OF ACCEPTABLE RISK LEVELS WAS NOT DETERMINED. THE ACTIONS REQUIRED WILL REDUCE OR ELIMINATE THE PRINCIPAL RISKS. THIS STATEMENT IS BASED ON THE KNOWLEDGE THAT SEVERAL COMPONENTS OF THE SELECTED REMEDY REQUIRE EXCAVATION OR COVERING OF EXPOSED TAILINGS, SEDIMENTS, AND CONTAMINATED SOILS. FOR EXAMPLE, DRYING AND COVERING POND 1 WILL RETARD OR STOP THE GROUND WATER CONTAMINATION WHICH CURRENTLY EXISTS, AND INCREASING THE OPERATIONAL LEVEL OF POND 2 WILL FLOOD AREAS OF CONTAMINATED SOILS, SEDIMENTS, AND TAILINGS, THEREBY REDUCING EXPOSURE BY DIRECT CONTACT TO THOSE AREAS.

#### **FUTURE RISK ASSESSMENT ACTIONS**

THE DETERMINATION OF A FINAL SOIL CLEANUP ACTION LEVEL, WHICH WILL BE NECESSARY FOR CONTAMINATED AREAS DEFERRED BY THIS ACTION, AND APPROPRIATE MEASURES TO REMEDIATE THOSE AREAS, WILL BE MADE WITHIN ONE YEAR OF THE EFFECTIVE DATE OF THIS DOCUMENT.

#### PROBLEM DEFINITION

EIGHT ENVIRONMENTAL AND HUMAN HEALTH CONCERNS WERE IDENTIFIED FOR WHICH THE FEASIBILITY STUDY DEVELOPED REMEDIAL OBJECTIVES AND ALTERNATIVES FOR REMEDIAL ACTION. THE EIGHT PROBLEMS ARE BASED ON THE RESULTS OF THE REMEDIAL INVESTIGATIONS, THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) ANALYSIS, AND THE PUBLIC HEALTH AND ENVIRONMENTAL RISK ASSESSMENT.

THE EIGHT HUMAN HEALTH AND ENVIRONMENTAL PROBLEMS ARE DESCRIBED IN TERMS OF FOUR CONTAMINATED MEDIA: (A) POND BOTTOM SEDIMENTS, (B) SURFACE WATER, (C) TAILINGS DEPOSITS AND CONTAMINATED SOILS, AND (D) GROUNDWATER. THE CONTAMINATED MEDIA ARE DISCUSSED BELOW IN TERMS OF THE PROBLEMS EACH MEDIUM PRESENTS TO THE WARM SPRINGS PONDS OPERABLE UNIT.

#### POND BOTTOM SEDIMENTS

DAM STABILITY DURING FLOODS. MONTANA'S DAM SAFETY RULES CONTROL THE MINIMUM LEVEL OF FLOOD PROTECTION FOR THE DESIGN OF DAMS WITHIN THE STATE OF MONTANA. THE DAMS AT WARM SPRINGS PONDS ARE CLASSIFIED AS HIGH HAZARD DAMS FOR WHICH THE STATE'S DAM SAFETY RULES REQUIRE THE PONDS' OUTLET STRUCTURES TO PASS VARYING FRACTIONS OF A PROBABLE MAXIMUM FLOOD. AS THE VOLUME OF WATER STORED INCREASES, THE FRACTION BECOMES GREATER, TO A MAXIMUM OF ONE-HALF. THE POND BERMS, AS CURRENTLY CONSTRUCTED, WOULD LIKELY FAIL DURING A MODERATE TO MAJOR FLOOD. IN THE EVENT OF PARTIAL OR CATASTROPHIC DAM FAILURE DURING SUCH A FLOOD, THE CONTAMINATED POND BOTTOM SEDIMENTS COULD CAUSE INCALCULABLE DAMAGE TO THE CLARK FORK RIVER.

DAM STABILITY DURING EARTHQUAKES. THE WARM SPRINGS PONDS ARE LOCATED WITHIN OR VERY NEAR THE NORTHERN SECTION OF THE INTERMOUNTAIN SEISMIC BELT, WHICH IS A ZONE OF MAJOR EARTHQUAKE ACTIVITY WITHIN THE NORTH AMERICAN TECTONIC PLATE (6). AT LEAST 230 EARTHQUAKES WITH MAGNITUDES GREATER THAN 4.0 HAVE OCCURRED AT EPICENTERS WITHIN 187 MILES OF THE WARM SPRINGS-BUTTE AREA DURING THE LAST 107 YEARS OF RECORDED EARTHQUAKES. (7)

THE GROUND-SHAKING THAT OCCURS DURING AN EARTHQUAKE CAN CAUSE BERMS THAT ARE NOT ADEQUATELY DESIGNED OR CONSTRUCTED TO FLOW SOMEWHAT LIKE A LIQUID, CAUSING THEM TO SLUMP AND RELEASE THE WATER AND SEMISOLIDS BEHIND THEM. EARTHQUAKES CAN ALSO CAUSE SLOSHING OF THE WATER IN A POND, CREATING GREAT WAVES THAT OVERFLOW AND ERODE BERMS, OFTEN CAUSING BERM FAILURE. A REVIEW OF THE LIMITED INFORMATION AVAILABLE ON THE CONSTRUCTION OF THE WARM SPRINGS PONDS BERMS SHOWS THAT THEY ARE NOT STRONG ENOUGH TO WITHSTAND EVEN MODERATE EARTHQUAKES.

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(6) INTERNATIONAL ENGINEERING COMPANY (IECO), 1981. GEOTECHNICAL AND HYDROLOGIC STUDIES, WARM SPRINGS TAILINGS PONDS, ANACONDA, MONTANA. PREPARED FOR ANACONDA COPPER COMPANY, DENVER, COLORADO.

(7) IBID.

THE MONTANA DAM SAFETY RULES REQUIRE THAT IF A DAM IS IN A REGION SUBJECT TO EARTHQUAKES, THE DAM MUST BE DESIGNED TO WITHSTAND THE MOST SEVERE EARTHQUAKE THAT CAN BE REASONABLY ANTICIPATED. THIS DESIGN EARTHQUAKE IS KNOWN AS THE MAXIMUM CREDIBLE EARTHQUAKE.

A REVIEW OF AVAILABLE INFORMATION REGARDING THE EMBANKMENT MATERIALS CONFIRMS THAT THE EAST-WEST AND NORTH-SOUTH BERMS ARE LIKELY TO FAIL IN A MODERATE-TO-SEVERE EARTHQUAKE. THE LIKELIHOOD OF FAILURE APPEARS TO BE GREATER THAN PREVIOUSLY REPORTED. THIS WAS DETERMINED BY A PRELIMINARY STABILITY EVALUATION PERFORMED FOR THIS STUDY, WHICH INDICATED THAT THE DOWNSTREAM SLOPES OF THE BERMS HAVE POTENTIAL TO FAIL AT ACCELERATIONS FROM 0.05 TO 0.07 G (G IS THE STANDARD SYMBOL FOR THE ACCELERATION OF GRAVITY). FOR COMPARISON, IN 1981, THE INTERNATIONAL ENGINEERING COMPANY DETERMINED THAT THE ACCELERATION AT WARM SPRINGS PONDS DURING A MAXIMUM CREDIBLE EARTHQUAKE COULD BE AS HIGH AS 0.23 G. THESE PRELIMINARY CONCLUSIONS WILL BE INVESTIGATED FURTHER AND CONFIRMED DURING THE REMEDIAL DESIGN PHASE.

FAILURE OF THE UPSTREAM SLOPES (FACES) OF THE BERMS WAS NOT EXAMINED IN THIS STUDY BECAUSE INFORMATION ON THE MATERIALS AND CONSTRUCTION OF THE UPSTREAM SLOPES WAS NOT AVAILABLE. DURING THE REMEDIAL DESIGN INVESTIGATION, THE POTENTIAL FOR UPSTREAM SLOPE FAILURE ALSO WILL BE INVESTIGATED.

FAILURE OF THE BERMS DURING AN EARTHQUAKE COULD RESULT IN AT LEAST PARTIAL RELEASE OF THE CONTENTS OF THE PONDS. THE SLUDGES AND TAILINGS IN THE PONDS ARE SUFFICIENTLY LIQUID THAT THEY COULD MIGRATE A CONSIDERABLE DISTANCE IF RELEASED FROM THE PONDS. ALTHOUGH IT HAS NOT BEEN DETERMINED THAT THE TAILINGS IN WARM SPRINGS PONDS COULD ALSO EXPERIENCE SPONTANEOUS LIQUEFACTION, THIS IS A PROCESS THAT HAS BEEN OBSERVED IN SEISMICALLY INDUCED FAILURES OF OTHER TAILINGS PONDS. IF THIS PROCESS DID OCCUR, THE TAILINGS AND SLUDGES COULD FLOW FOR MILES, CONTAMINATING THE CLARK FORK RIVER DOWNSTREAM.

#### SURFACE WATER

FISHKILLS IN THE MILL-WILLOW BYPASS. THERE HAVE BEEN FIVE DOCUMENTED FISHKILLS ASSOCIATED WITH THE MILL-WILLOW BYPASS SINCE 1983. THEY OCCURRED ON AUGUST 9, 1983; AUGUST 2, 1984; JULY 3, 1987; MAY 27, 1988; AND JULY 13, 1989, AND ARE DOCUMENTED IN MONTANA DEPARTMENT OF FISH, WILDLIFE, AND PARKS MEMORANDA FOR THESE YEARS.

ALL FIVE FISHKILLS FOLLOWED A SIMILAR PATTERN. THEY WERE ASSOCIATED WITH LOCALLY INTENSE THUNDERSTORMS IN THE WARM SPRINGS PONDS AREA, USUALLY AFTER EXTENDED DRY PERIODS. THE FISHKILLS STARTED IN THE MILL-WILLOW BYPASS AND EXTENDED DOWN THE CLARK FORK RIVER FOR VARIOUS DISTANCES. IN THE 1984 EVENT, OVER A THOUSAND DEAD FISH WERE OBSERVED IN A 15-TO 20-MILE STRETCH OF THE CLARK FORK RIVER. IN JULY 1989, OVER 5,000 DEAD FISH WERE REPORTED. THE FISHKILLS HAVE BEEN LINKED TO HIGH CONCENTRATIONS OF COPPER IN THE WATER; ZINC CONCENTRATIONS AND LOW PH LEVELS MAY ALSO BE FACTORS IN FISH MORTALITY.

THE AVAILABLE DATA INDICATE RAPID ELEVATION AND DISSIPATION OF THE METALS CONCENTRATIONS DURING STORM EVENTS, WHICH IMPLIES THAT THEY ARE DERIVED FROM A READILY AVAILABLE SOURCE OF HIGHLY SOLUBLE COMPOUNDS, I.E., METAL SALTS. A SOURCE OF SUCH SALTS HAS BEEN IDENTIFIED ALONG THE MILL-WILLOW BYPASS. DURING EXTENDED DRY PERIODS, SALTS OF COPPER AND ZINC FORM BY SURFACE OXIDATION OR THE EVAPORATION OF SOIL MOISTURE ON THE TAILINGS DEPOSITS THAT EXIST ALONG THE BYPASS. THERE ARE APPROXIMATELY 21 ACRES OF TAILINGS DEPOSITS ALONG THE BYPASS. THE COPPER SALTS ARE CLEARLY VISIBLE ON THE TAILINGS DEPOSITS DURING WARMER MONTHS AS GREEN- AND BLUE-COLORED SURFACE DEPOSITS.

THE POSTULATED MECHANISM FOR THE FISHKILLS IS THAT THE RAIN WATER DISSOLVES THE METAL SALTS AND WASHES THEM INTO THE BYPASS, RESULTING IN METAL CONCENTRATIONS HIGH ENOUGH TO CAUSE MORTALITY. ELEVATED LEVELS OF METALS DETECTED IN THE GILLS OF DEAD FISH SUGGEST THAT THE FISH WERE EXPOSED TO ACUTE LEVELS OF METALS.

WHILE TRANSIENT PHENOMENA SUCH AS THE OBSERVED FISHKILLS ARE DIFFICULT TO STUDY AND EVEN MORE DIFFICULT TO MODEL, THE EVIDENCE AVAILABLE AT THIS TIME POINTS TO THE VISIBLE SALTS ON THE TAILINGS DEPOSITS AS THE PRIMARY CAUSE OF THE FISHKILLS.

METAL LOADS IN THE STREAM FLOWS. SILVER BOW CREEK, AND TO A LESSER DEGREE MILL AND WILLOW CREEKS, ARE ALL CONTAMINATED WITH DETECTABLE LEVELS OF HEAVY METALS; PRIMARILY COPPER, ARSENIC, LEAD, AND ZINC. FOR EXAMPLE, IN THE PHASE I REMEDIAL INVESTIGATION, ON THE AVERAGE, THE INFLOW

TO THE PONDS, THE DISCHARGE FROM POND 2, AND THE COMBINED FLOWS OF MILL AND WILLOW CREEKS EXCEEDED MONTANA'S CHRONIC WATER QUALITY STANDARD FOR COPPER IN EFFECT DURING THE PHASE I REMEDIAL INVESTIGATION. THE STANDARD WAS EXCEEDED IN 100, 70, AND 60 PERCENT OF THE SAMPLES FOR THOSE THREE SAMPLING POINTS, RESPECTIVELY.

THE MILL-WILLOW BYPASS WAS CONSTRUCTED TO ROUTE THE COMPARATIVELY CLEANER MILL AND WILLOW CREEKS FLOWS AROUND THE PONDS AND TO THE CLARK FORK RIVER WITHOUT MIXING WITH THE COMPARATIVELY MORE CONTAMINATED SILVER BOW CREEK FLOW. HOWEVER, RECENT DATA INDICATE THAT, ALTHOUGH MILL AND WILLOW CREEKS ARE CLEANER THAN SILVER BOW CREEK, THEY STILL CONTRIBUTE A PORTION OF THE TOTAL AMOUNT OF METALS REACHING THE OPERABLE UNIT (ARSENIC -- 34 PERCENT, COPPER -- 6 PERCENT, CADMIUM -- 3 PERCENT, LEAD -- 3 PERCENT, ZINC -- 4 PERCENT).

THE POND SYSTEM TREATS CONTAMINATED WATER BY COMBINATIONS OF PHYSICAL, CHEMICAL AND BIOLOGICAL PROCESS. PHYSICAL SETTLING OF SUSPENDED SOLIDS OCCURS SIMPLY BECAUSE THE FLOW VELOCITIES IN THE PONDS ARE VERY LOW COMPARED TO THE VELOCITIES IN THE CREEK CHANNEL. THE REMOVAL OF DISSOLVED METALS OCCURS IN PART BECAUSE OF PHOTOSYNTHETICALLY-INDUCED CHEMICAL PRECIPITATION, AND UPTAKE OF METALS BY, AND SUBSEQUENT SETTLING OF, AQUATIC PLANTS. THE EFFECTIVENESS OF THE PONDS IS ENHANCED BY THE ADDITION OF LIME TO PRECIPITATE METALS DURING COLDER MONTHS WHEN THE AMOUNT OF LIGHT AVAILABLE FOR PHOTOSYNTHESIS AND BIOLOGICAL ACTIVITY IS DIMINISHED.

WITHOUT THE TREATMENT IN THE POND SYSTEM, THE MONTANA CHRONIC WATER QUALITY STANDARDS FOR THE PROTECTION OF AQUATIC LIFE WOULD BE FAR MORE FREQUENTLY EXCEEDED AT THE POND 2 OUTLET IMMEDIATELY UPSTREAM OF THE BEGINNING OF THE CLARK FORK RIVER. FOR EXAMPLE, AVAILABLE INFORMATION INDICATES THE STANDARD FOR COPPER (12 UG/L FOR A CALCIUM CARBONATE HARDNESS OF 100 MG/L), WOULD BE EXCEEDED MORE THAN 75 PERCENT OF THE TIME. EVEN THOUGH THE POND SYSTEM CURRENTLY TREATS SILVER BOW, MILL, AND WILLOW CREEKS, THE WATER QUALITY STANDARDS FOR SEVERAL CONTAMINANTS ARE OFTEN EXCEEDED, PARTICULARLY IN WINTER MONTHS. THE DISSOLVED METALS IN THE THREE CREEKS ULTIMATELY CONTRIBUTE TO THE CHRONIC EXPOSURE BY FISH DOWNSTREAM.

TAILINGS IN THE MILL-WILLOW BYPASS. THE TOTAL AMOUNT OF IDENTIFIABLE SURFICIAL TAILINGS IN THE MILL-WILLOW BYPASS HAS BEEN ESTIMATED AT 79,000 CUBIC YARDS. THIS INCLUDES 76,000 CUBIC YARDS OF EXPOSED TAILINGS DEPOSITS AND 3,000 CUBIC YARDS OF TAILINGS WITH VEGETATION COVER. THE PRIMARY SOURCE OF THESE TAILINGS IS SILVER BOW CREEK. ON NUMEROUS OCCASIONS OVER THE PAST 20 YEARS, THE INLET STRUCTURE OF POND 3 HAS BEEN PLUGGED BY FLOOD DEBRIS. THIS HAS CAUSED SILVER BOW CREEK TO ENTER THE MILL-WILLOW BYPASS AND DEPOSIT ITS SEDIMENT LOAD -- MUCH OF IT IN THE FORM OF TAILINGS -- ALONG THE BANKS OF THE BYPASS CHANNEL.

THESE TAILINGS HAVE BEEN FURTHER ERODED AND TRANSPORTED OUT OF THE BYPASS AND INTO THE CLARK FORK RIVER PARTICULARLY DURING HIGH FLOW CONDITIONS. ONCE DEPOSITED IN AND ALONE THE BANKS OF THE CLARK FORK RIVER, THESE CONTAMINATED TAILINGS ADD TO THE PROBLEMS THAT ALREADY EXIST THERE AND THUS CONTRIBUTE TO ADVERSE EFFECTS ON AQUATIC ORGANISMS.

THE MILL-WILLOW BYPASS REMOVAL ACTION, BEING CONDUCTED UNDER AN ADMINISTRATIVE ORDER ON CONSENT AND SCHEDULED FOR COMPLETION DURING LATE FALL OF 1990, WILL REMOVE TAILINGS AND CONTAMINATED SOILS FROM THE UPPERMOST FOUR MILES OF THE BYPASS CHANNEL. THE REMAINING PORTION OF THE BYPASS CHANNEL (APPROXIMATELY ONE-HALF MILE), TO ITS CONFLUENCE WITH WARM SPRINGS CREEK, WILL BE CLEANED UP AS PART OF THE OVERALL REMEDIAL ACTION FOR WARM SPRINGS PONDS. ALL WORK REQUIRED BY THE REMOVAL ORDER IS PART OF THE OVERALL REMEDY DESCRIBED HEREIN AND THUS ENFORCEABLE UNDER THIS RECORD OF DECISION.

TRANSPORT OF UPSTREAM TAILINGS TO THE CLARK FORK RIVER. THE WARM SPRINGS PONDS ARE 27 RIVER MILES FROM BUTTE, WHERE MOST OF THE MINING-RELATED ACTIVITIES OCCURRED THAT LED TO THE CONTAMINATION AT THE WARM SPRINGS PONDS. SILVER BOW CREEK IS CONTAMINATED ALONG MOST OF THOSE 27 MILES, WITH SEVERAL LARGE DEPOSITS OF TAILINGS INTERSPERSED WITH MANY SMALLER DEPOSITS. THERE ARE ALSO MUCH SMALLER DEPOSITS OF TAILINGS ALONG MILL AND WILLOW CREEKS.

ALTOGETHER, SOME 3 MILLION CUBIC YARDS OF STREAMSIDE TAILINGS ARE ESTIMATED TO EXIST UPSTREAM OF THE WARM SPRINGS PONDS. (8) THESE TAILINGS ARE ERODED BY NORMAL AND ABOVE NORMAL FLOWS IN THE CREEKS; HOWEVER, HIGH FLOWS MOVE LARGER QUANTITIES OF THESE TAILINGS. A RECENT FLOOD STUDY ESTIMATED THAT A 100-YEAR FLOOD ON SILVER BOW CREEK WOULD DELIVER 100,000 CUBIC YARDS (ONE FOOTBALL FIELD 47 FEET DEEP) OF SEDIMENTS TO THE WARM SPRINGS PONDS. (9) THESE SEDIMENTS WOULD CONSIST OF BOTH NATURAL SEDIMENTS AND TAILINGS.

(8) HYDROMETRICS, 1983. SUMMIT AND DEER LODGE VALLEYS LONG-TERM ENVIRONMENTAL REHABILITATION STUDY, BUTTE-ANACONDA, MONTANA, VOLUME VII, WARM SPRINGS PONDS. PREPARED FOR THE ANACONDA MINERALS COMPANY, BUTTE, MONTANA.

(9) CH2M HILL, 1986. SILVER BOW CREEK FLOOD MODELING STUDY. PREPARED FOR STATE OF MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES, HELENA, MONTANA

#### TAILINGS DEPOSITS AND CONTAMINATED SOILS

IN ADDITION TO THE AREAS OF TAILINGS DEPOSITS AROUND THE POND SYSTEM, THERE ARE SOILS THAT CONTAIN VARYING CONCENTRATIONS OF METALS OR ARE MIXED WITH TAILINGS. IN ADDITION, THERE ARE AREAS OF POND BOTTOM SEDIMENTS THAT WERE HISTORICALLY SUBMERGED IN PONDS 1 AND 2, BUT WHICH ARE NOW EXPOSED. THE TOTAL AREA OF TAILINGS DEPOSITS AND CONTAMINATED SOILS IS ESTIMATED TO BE APPROXIMATELY 420 ACRES WITH A CORRESPONDING VOLUME OF 1.9 MILLION CUBIC YARDS. (SEE TABLE 1)

THE PRIMARY PATHWAYS IDENTIFIED FOR POTENTIAL HUMAN EXPOSURE TO THESE CONTAMINANTS ARE DIRECT (SKIN) CONTACT, INHALATION OF DUST FROM THE SURFACE, AND INCIDENTAL INGESTION OF CONTAMINATED SOIL AND SEDIMENT. IN ADDITION, THESE CONTAMINANTS MAY PRESENT ENVIRONMENTAL THREATS, THROUGH ADVERSE EFFECTS ON FISH AND WILDLIFE WITHIN THE POND SYSTEM.

#### GROUND WATER

EXCEEDENCES OF PRIMARY MAXIMUM CONTAMINANT LEVELS FOR CADMIUM AND ARSENIC WERE DETECTED IN ONE WELL LOCATED WITHIN POND 1 AND IN SEVERAL WELLS DOWNGRADIENT OF POND 1. THE AFFECTED WELLS DOWNGRADIENT OF POND 1 ARE COMPLETED IN THE SHALLOW SAND AND GRAVEL AQUIFER. THESE EXCEEDENCES COULD POSE A THREAT TO USERS OF THE AQUIFER, EITHER CURRENTLY OR IN THE FUTURE, AND TO AQUATIC ORGANISMS IN THE CLARK FORK RIVER.

THE KNOWN AREA OF PRIMARY MAXIMUM CONTAMINANT LEVEL EXCEEDENCES IN GROUNDWATER CAUSED BY THE POND SYSTEM IS IN AND BELOW POND 1 AND IS ESTIMATED TO COVER 180 ACRES. THERE ARE LIKELY NO PRIMARY REASONS WHY THE AREA OF CONTAMINATION IS NOT MORE EXTENSIVE. MOST SIGNIFICANTLY, THE POND BOTTOM SEDIMENTS (TAILINGS AND SLUDGES) FORM A LOW PERMEABILITY LAYER ON THE BOTTOMS OF THE PONDS, PARTICULARLY IN PONDS 2 AND 3. THUS, THE CONTAMINATED WATER IN THE PONDS AND IN THE SEDIMENTS DOES NOT READILY LEAK INTO AND CONTAMINATE THE GROUNDWATER TO THE DEGREE THAT IT OTHERWISE WOULD. ADDITIONALLY, UPWARD GRADIENTS IN THE AQUIFER NORTH OF POND 1, AND THE INTERCEPTION OF THE GROUNDWATER IN THAT AREA BY THE CLARK FORK RIVER, HAVE KEPT THE GROUNDWATER CONTAMINATION IN THE AREA OF THE PONDS FROM SPREADING VERY FAR NORTH.

#### PROBLEMS UPSTREAM

IN ADDITION TO THE EIGHT HUMAN HEALTH AND ENVIRONMENTAL PROBLEMS DESCRIBED ABOVE, THE RELATIONSHIPS AMONG THOSE PROBLEMS AND THE REMAINDER OF THE SILVER BOW CREEK/BUTTE AREA NPL SITE PROBLEMS UPSTREAM OF THE WARM SPRINGS PONDS ARE ALSO IMPORTANT. MOST SIGNIFICANTLY, THE UPSTREAM AREAS ARE THE SOURCES OF THE VERY LARGE VOLUME OF CONTAMINATED WATER FLOWING INTO AND THROUGH THE OPERABLE UNIT. THE PONDS, WHILE NOT CURRENTLY CAPABLE OF PROVIDING TOTALLY ADEQUATE TREATMENT OF THE CONTAMINATED FLOWS IN MILL, WILLOW, AND SILVER BOW CREEKS, ARE NONETHELESS AN IMPORTANT TREATMENT SYSTEM. THEY PROVIDE SIGNIFICANT PROTECTION OF THE CLARK FORK RIVER FROM THE CONTINUOUS FLOW OF CONTAMINATION CURRENTLY COMING FROM UPSTREAM AREAS.

THE LEVELS OF CONTAMINATION IN MILL, WILLOW, AND SILVER BOW CREEKS WILL LIKELY BE REDUCED BY FUTURE CLEANUP ACTIONS TAKEN UPSTREAM OF THE WARM SPRINGS PONDS. BUT, UNTIL THAT TIME, THE POND SYSTEM WILL BE NEEDED TO TREAT THE FLOWS AND THEREBY IMPROVE THE WATER QUALITY IN THE THREE CREEKS. THIS IS AN IMPORTANT FACTOR IN DETERMINING THE TYPES OF ALTERNATIVES THAT CAN BE DEVELOPED FOR THE WARM SPRINGS PONDS OPERABLE UNIT. ALTERNATIVES THAT WOULD ELIMINATE OR SUBSTANTIALLY ALTER THE EXISTING POND TREATMENT WOULD HAVE TO INCLUDE ALTERNATIVE TREATMENT

CAPACITY FOR THE CONTAMINATED SURFACE WATER IF AN EQUIVALENT LEVEL OF AQUATIC PROTECTION IS DESIRED.

IN SPITE OF THE ENVIRONMENTAL PROBLEMS, THE WARM SPRINGS PONDS HAVE BECOME A MAJOR NESTING AND RESTING PLACE FOR ABUNDANT WATERFOWL IN THE UPPER CLARK FORK RIVER. BROWN AND RAINBOW TROUT ALSO INHABIT THE WILDLIFE PONDS AND PONDS 2 AND 3. THE PONDS ARE AN IMPORTANT SPORT FISHING AND HUNTING SPOT, ATTRACTING SPORTSMEN FROM ALL PARTS OF THE UNITED STATES. TROUT ARE CAUGHT FREQUENTLY IN THE RANGE OF 8-12 POUNDS. THESE POINTS ARE NOTEWORTHY IN LIGHT OF THE LONG TERM PLANS FOR IMPROVING THE PONDS' ABILITY TO SUPPORT FISH AND WILDLIFE. THE SELECTED REMEDY, WHICH INCLUDES PROVISIONS FOR IMPROVING WATER QUALITY, INCREASING WETLANDS AREAS, ELIMINATING EXPOSED TAILINGS, AND IMPROVING THE CONFIGURATION OF THE BYPASS CHANNEL, IS NOT ONLY A SUPERFUND CLEANUP PROPOSAL BUT IT IS ALSO A MAJOR FISH AND WILDLIFE HABITAT ENHANCEMENT PROPOSAL.

## #DOA

### DESCRIPTION OF ALTERNATIVES

OBJECTIVES FOR REMEDIATION OF THE WARM SPRINGS PONDS OPERABLE UNIT WERE IDENTIFIED AS PART OF THE FEASIBILITY STUDY. THESE OBJECTIVES WERE DEVELOPED FROM THE IDENTIFICATION OF ENVIRONMENTAL AND HUMAN HEALTH PROBLEMS, UTILIZING ARARS AND SITE-SPECIFIC HUMAN HEALTH AND ENVIRONMENTAL PROTECTIVENESS STANDARDS IDENTIFIED THROUGH THE PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT. THE REMEDIAL ACTION OBJECTIVES ARE LISTED IN TABLE 3.

FOLLOWING THE IDENTIFICATION OF THE REMEDIATION OBJECTIVES, POTENTIAL REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS WERE IDENTIFIED AND EVALUATED FOR USE AT THE SITE. ALL OF THE TECHNOLOGIES AND PROCESS OPTIONS WERE INITIALLY SCREENED TO ELIMINATE THOSE THAT WERE UNRELATED TO THE PROBLEMS AT THE SITE OR THAT WERE TECHNICALLY INFEASIBLE FOR USE AT THE SITE. THE RETAINED TECHNOLOGIES AND PROCESS OPTIONS WERE EVALUATED A SECOND TIME BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST TO FURTHER REDUCE THE LIST OF POTENTIAL TECHNOLOGIES.

THE TECHNOLOGIES REMAINING FOLLOWING THE SECOND SCREENING WERE COMBINED TO FORM MEDIA-SPECIFIC ACTIONS ADDRESSING THE REMEDIAL OBJECTIVES IDENTIFIED FOR EACH OF THE MEDIA. THE MEDIA-SPECIFIC ACTIONS WERE DEVELOPED TO THE CONCEPTUAL DESIGN LEVEL IN THE FEASIBILITY STUDY.

SIX COMPREHENSIVE REMEDIAL ACTION ALTERNATIVES WERE ASSEMBLED IN THE FEASIBILITY STUDY BY COMBINING ONE OR MORE MEDIA-SPECIFIC ACTIONS FOR EACH OF THE AFFECTED MEDIA INTO AN OVERALL REMEDIATION PACKAGE. THE ACTION ALTERNATIVES WERE ASSEMBLED FROM THE 16 MEDIA-SPECIFIC ACTIONS DEVELOPED IN THE FEASIBILITY STUDY. IN ADDITION, A "NO-ACTION" ALTERNATIVE WAS ADDED TO THE RANGE OF ALTERNATIVES AND EVALUATED WITH THE ACTION ALTERNATIVES AS REQUIRED BY THE NATIONAL CONTINGENCY PLAN. THE SEVEN ALTERNATIVES DEVELOPED IN THE FEASIBILITY STUDY FOR EVALUATION COVER A RANGE OF POSSIBLE COMBINATIONS (TABLE 4). ALSO INCLUDED IN TABLE FOR COMPARISON IS ALTERNATIVE 3+3A, THE SELECTED REMEDY.

DURING THE DEVELOPMENT OF THE FEASIBILITY STUDY REPORT, ARCO DEVELOPED ITS OWN PROPOSED PLAN (CALLED ALTERNATIVE 3A). IT INCORPORATED MANY OF THE FEATURES OF THE AGENCIES' ALTERNATIVE 3, BUT WAS SIGNIFICANTLY DIFFERENT IN TWO MAJOR RESPECTS. BECAUSE THE ARCO ALTERNATIVE HAD CERTAIN USEFUL FEATURES, AND IT WAS CLEAR THAT A COMBINATION OF THE FEATURES OF THE AGENCIES' ALTERNATIVE 3 AND ARCO'S ALTERNATIVE 3A COULD BE DEVELOPED AS AN EFFECTIVE ALTERNATIVE FOR REMEDIATION OF THE SITE, A COMBINED ALTERNATIVE, CALLED ALTERNATIVE 3+3A IN THIS RECORD OF DECISION, HAS BEEN DEVELOPED. IT IS THE SELECTED REMEDY FOR THE OPERABLE UNIT. TABLE 4 LISTS THE ALTERNATIVES AND DESCRIBES THE SPECIFIC ACTIONS THAT EACH INCLUDES. EACH OF THE ALTERNATIVES, INCLUDING 3+3A, IS DESCRIBED SEPARATELY BELOW.

#### ALTERNATIVE 1 (\$1,191,500,000)

THE COMPONENTS OF ALTERNATIVE 1 INCLUDE SOLIDIFYING ALL ONSITE CONTAMINATED SOILS, TAILINGS, SEDIMENTS, AND SLUDGES TO PROTECT AGAINST A PROBABLE MAXIMUM FLOOD (PMF) AND A MAXIMUM CREDIBLE EARTHQUAKE (MCE); CONSTRUCTING A NEW TREATMENT POND FOR SURFACE WATER TREATMENT AND AN UPSTREAM FLOOD IMPOUNDMENT TO CAPTURE FLOOD FLOWS FOR ADDITIONAL TREATMENT; AND INSTALLING A GROUNDWATER INTERCEPTION TRENCH TO CAPTURE AND THEN TREAT CONTAMINATED GROUNDWATER AS IT MIGRATES FROM THE PONDS.

THE CURRENT INABILITY OF THE THREE EXISTING PONDS TO WITHSTAND FLOODS AND EARTHQUAKES WOULD BE ADDRESSED BY USING AN IN SITU SOLIDIFICATION PROCESS TO STABILIZE THE POND BOTTOM SLUDGES AND

SEDIMENTS. THIS WOULD MINIMIZE THE RISK OF POND FAILURE DUE TO AN EARTHQUAKE OR FLOOD EVENT. IN ADDITION, CONTAMINATED SOILS AND EXPOSED TAILINGS THAT EXCEED AN ACTION LEVEL OF 250 PPM FOR ARSENIC AND 750 PPM FOR LEAD WOULD BE EXCAVATED AND DISPOSED OF IN THE EXISTING PONDS PRIOR TO SOLIDIFICATION.

THIS ALTERNATIVE WOULD EFFECTIVELY LIMIT THE TOXICITY AND MOBILITY OF TAILINGS TO ACCEPTABLE CONCENTRATION LEVELS AND GREATLY REDUCE THE POTENTIAL FOR FUTURE HUMAN OR ANIMAL CONTACT WITH HARMFUL CONTAMINANTS.

ALTERNATIVE 1 WOULD ALSO IMPROVE SURFACE WATER QUALITY WITH THE CONSTRUCTION OF A NEW POND TREATMENT SYSTEM. A NEW TREATMENT POND WOULD BE CONSTRUCTED TO REPLACE THE EXISTING, NOW SOLIDIFIED, POND SYSTEM. THE NEW POND WOULD BE CAPABLE OF CAPTURING AND TREATING FLOWS UP TO 600 CFS. THIS IS THE FLOW THE CURRENT POND SYSTEM IS CAPABLE OF TREATING.

IN ADDITION, AN UPSTREAM FLOOD IMPOUNDMENT (8,000 ACRE-FEET) WOULD BE CONSTRUCTED TO PROVIDE SETTLING AND TREATMENT OF FLOWS ON SILVER BOW CREEK UP TO THE VOLUME OF A 100-YEAR FLOOD OR THE MAXIMUM FLOW RATE OF THE MAXIMUM FLOOD OF 4,000 CFS. CURRENTLY, FLOOD FLOWS ON SILVER BOW CREEK THAT EXCEED 600 CFS (THE DESIGN LIMIT OF THE POND 3 INLET STRUCTURE) ARE ROUTED AROUND THE PONDS, UNTREATED. A FLOW OF 600 CFS ON SILVER BOW CREEK REPRESENTS A 2- TO 3-YEAR RETURN FLOOD.

THE GOAL OF THE UPSTREAM IMPOUNDMENT IS TO PREVENT LARGE QUANTITIES OF SEDIMENTS AND DISSOLVED METALS FROM BYPASSING THE POND SYSTEM AND FLOWING INTO THE CLARK FORK RIVER. THE IMPOUNDMENT WOULD SERVE TWO FUNCTIONS. FIRST, IT WOULD SERVE AS A CONVENTIONAL SEDIMENTATION BASIN; AS THE INFLUENT VELOCITY SLOWED IN THE IMPOUNDMENT, THE SEDIMENT BEING TRANSPORTED BY THE FLOW WOULD SETTLE OUT. SECOND, THE IMPOUNDMENT WOULD HAVE THE STORAGE CAPACITY TO CONTAIN FLOWS UP TO THE 100-YEAR FLOOD. THE WATER COULD THEN BE METERED TO THE PONDS FOR TREATMENT OF DISSOLVED METALS. FLOODS EXCEEDING 4,000 CFS WOULD BE ROUTED AROUND THE IMPOUNDMENT TO PROTECT IT FROM DAMAGE CAUSED BY SCOURING.

CONTAMINATED GROUNDWATER MOVING FROM THE OPERABLE UNIT WOULD BE COLLECTED FROM IN AND BELOW POND 1 THROUGH THE INSTALLATION OF AN OPEN GROUNDWATER TRENCH. THE COLLECTED GROUNDWATER WOULD THEN BE PUMPED TO THE INLET OF THE NEW POND FOR TREATMENT. THIS WOULD REDUCE THE DISCHARGE OF CONTAMINATED GROUNDWATER INTO THE CLARK FORK RIVER AND ENABLE THE AQUIFER TO BE USED FOR DRINKING WATER AND OTHER BENEFICIAL USES.

ALTERNATIVE 1 IS ONE OF TWO ALTERNATIVES EXPECTED TO EXCEED AT LEAST ONE ARAR. WHEREAS MONTANA'S DAM SAFETY STANDARDS REQUIRE PROTECTION OF THE EXISTING PONDS 1,2, AND 3 TO 0.2, 0.3, AND 0.5 PMF, RESPECTIVELY, THE IN SITU STABILIZATION PROCESS WOULD PROVIDE PROTECTION OF ALL THREE PONDS AGAINST THE FULL PMF. ALTERNATIVE 1 IS EXPECTED TO MEET ALL OTHER AID WITH ONE EXCEPTION; SURFACE WATER STANDARDS FOR ARSENIC AND MERCURY FOR PROTECTION OF PUBLIC HEALTH FROM INGESTION OF CONTAMINATED WATER AND FISH ARE TECHNICALLY IMPRACTICABLE TO MEET USING THIS OR ANY OTHER REMEDIAL ALTERNATIVE.

THE ACTIONS PROPOSED IN ALTERNATIVE 1, HOWEVER, WOULD HAVE A SUBSTANTIAL ADVERSE AFFECT ON EXISTING WETLANDS. OVER 1,200 ACRES OF WETLANDS AND OPEN HABITAT FOR BIRDS, FISH, AND MAMMALS WOULD BE DESTROYED.

A POTENTIAL ADVERSE AFFECT ON AN IDENTIFIED CULTURAL RESOURCE WITHIN THE AREA ALSO EXISTS. A CONCRETE ARCH BRIDGE LOCATED WITHIN THE DRY PORTION OF POND 2 HAS BEEN DETERMINED TO BE ELIGIBLE FOR INCLUSION IN THE NATIONAL REGISTER OF HISTORIC PLACES. CONSULTATION WITH THE STATE HISTORIC PRESERVATION OFFICE WOULD BE NECESSARY TO MINIMIZE POTENTIAL IMPACTS TO THE BRIDGE PRIOR TO COMMENCING ANY REMEDIATION ACTIVITIES. CONSULTATION WITH THAT OFFICE WILL BE NECESSARY WITH THE REMAINING ALTERNATIVES AS WELL.

CERTAIN INSTITUTIONAL CONTROLS WOULD BE REQUIRED FOR ALTERNATIVE 1 AND ALL THE OTHER REMEDIAL ALTERNATIVES, AS WELL. INSTITUTIONAL CONTROLS ARE GENERALLY DEFINED AS LEGAL MECHANISMS THAT PREVENT OR LIMIT HUMAN ACCESS AND EXPOSURE TO THE CONTAMINATION AND ARE USED TO ENHANCE THE EFFECTIVENESS OF A GIVEN REMEDIAL ALTERNATIVE. UPON SOLIDIFICATION AND CLOSURE OF THE PONDS, THE LOCAL ZONING OR LAND USE AUTHORITY AND THE EPA REGIONAL ADMINISTRATOR MUST BE NOTIFIED OF THE TYPE, LOCATION, AND QUANTITY OF WASTE DISPOSED OF IN EACH POND. A NOTATION OR DEED TO THE FACILITY PROPERTY MUST BE RECORDED IN ACCORDANCE WITH STATE LAW TO NOTIFY ANY POTENTIAL PURCHASER THAT THE LAND HAS BEEN USED TO MANAGE HAZARDOUS WASTE. FINALLY, THE PROHIBITION AGAINST CONSUMPTION OF ANY FISH CAUGHT WITHIN THE POND SYSTEM MUST BE CONTINUED.

WITH THE APPROPRIATE DESIGN, CONSTRUCTION, AND MAINTENANCE, ALTERNATIVE 1 SHOULD RELIABLY REDUCE HUMAN HEALTH AND ENVIRONMENTAL RISKS. BECAUSE OF THE ENORMOUS VOLUME OF POND SLUDGES (19 MILLION CUBIC YARDS), ALTERNATIVE 1 WOULD TAKE APPROXIMATELY 17 YEARS TO COMPLETE. FULL RISK REDUCTION WOULD NOT OCCUR UNTIL THAT POINT. THE ESTIMATED PRESENT WORTH COST FOR THIS ALTERNATIVE IS \$1,191,500,000. THIS PRESENT WORTH COST INCLUDES BOTH CAPITAL COSTS AND ANNUAL OPERATIONS AND MAINTENANCE COSTS. ALL FUTURE COSTS ARE REDUCED TO PRESENT WORTH COSTS TO ALLOW REMEDIAL ACTION ALTERNATIVES TO BE COMPARED ON A RELATIVELY EQUIVALENT BASIS.

**ALTERNATIVE 2 (\$241,500,000)**

ALTERNATIVE 2 IS THE MOST COMPREHENSIVE OF THE ALTERNATIVES THAT RETAIN THE CURRENT POND TREATMENT SYSTEM. ITS COMPONENTS INCLUDE PROTECTING THE POND SYSTEM AGAINST A PROBABLE MAXIMUM FLOOD AND THE MAXIMUM CREDIBLE EARTHQUAKE; EXCAVATING AND DISPOSING OFFSITE ALL CONTAMINATED SOILS AND TAILINGS WITHIN THE MILL-WILLOW BYPASS, POND 3, AND BELOW POND 1; CAPPING POND 1; FLOODING EXPOSED TAILINGS AND CONTAMINATED SOILS WITHIN POND 2; AND UPGRADING THE TREATMENT SYSTEM IN POND 3. IT ALSO INCLUDES TWO OF THE COMPONENTS OF ALTERNATIVE 1: CONSTRUCTING AN UPSTREAM FLOOD IMPOUNDMENT AND INSTALLING GROUNDWATER INTERCEPTION TRENCHES.

POND STABILITY WOULD BE ACHIEVED BY PROTECTING ALL THREE PONDS AGAINST BOTH A FULL PROBABLE MAXIMUM FLOOD (PMF) AND MAXIMUM CREDIBLE EARTHQUAKE (MCE). THUS, MAXIMUM PROTECTION IS PROVIDED AGAINST RELEASE OF THE POND BOTTOM SEDIMENTS. WHILE SOME DAMAGE TO THE POND BERMS COULD STILL OCCUR UNDER EXTREME CONDITIONS, THERE WOULD BE MINIMAL RISK OF LOSING THE POND BOTTOM SEDIMENTS DURING AN EARTHQUAKE OR FLOOD EVENT.

ALL EXPOSED TAILINGS AND CONTAMINATED SOILS ALONG THE MILL-WILLOW BYPASS, AND ALL EXPOSED TAILINGS AND CONTAMINATED SOILS WITHIN POND 3 AND BELOW POND 1 THAT EXCEED AN ACTION LEVEL OF 250 PPM ARSENIC AND 750 PPM LEAD, WOULD BE REMOVED AND DISPOSED OF AT AN OFFSITE RCRA DISPOSAL FACILITY. THE CLOSEST TREATMENT, STORAGE, AND DISPOSAL FACILITY ABLE TO ACCEPT THE WASTE IS NEAR BOISE, IDAHO, APPROXIMATELY 480 MILES FROM THE SITE. EXPOSED TAILINGS AND CONTAMINATED SOILS WITHIN POND 2 WOULD BE FLOODED, AND POND 1 WOULD BE CAPPED WITH A RCA-COMPLIANT CAP. ALL EXCAVATED AREAS AND POND 1 WOULD SUBSEQUENTLY BE REVEGETATED.

ALTERNATIVE 2 WOULD IMPROVE SURFACE WATER QUALITY BY COMPLETELY UPGRADING THE CURRENT POND TREATMENT SYSTEM. THE IMPROVEMENTS WOULD INCLUDE THE FOLLOWING SEVEN MEASURES:

1. DIVERTING MILL AND WILLOW CREEKS INTO POND 3 FOR TREATMENT
2. MODIFYING THE INLET STRUCTURE TO POND 3 BY ADDING A TRASH RACK AND OVERFLOW WEIR, AND RELOCATING THE FUSE PLUG
3. CHANNELIZING SILVER BOW CREEK WITHIN THE DRY AREAS OF POND 3 TO MINIMIZE THE INTERACTION OF SILVER BOW CREEK WITH EXPOSED TAILINGS AND CONTROLLING THE DIRECTION OF FLOW
4. IMPROVING THE LIME ADDITION SYSTEM TO ENHANCE METALS PRECIPITATION
5. ADDING A BERM ACROSS POND 3 TO HELP PREVENT SHORT-CIRCUITING OF FLOW AND THEREBY INCREASE SETTLEMENT OF SOLIDS
6. CONSTRUCTING A NEW EFFLUENT STRUCTURE IN POND 3 TO MINIMIZE SCOURING AND RESUSPENSION OF POND SEDIMENTS
7. WET CLOSING POND 2 SINCE THE SLUDGE STORAGE CAPACITY OF THE POND HAS BEEN EXHAUSTED

AS IN ALTERNATIVE 1, AN UPSTREAM FLOOD IMPOUNDMENT (8,000 ACRE-FEET) WOULD BE CONSTRUCTED TO PROVIDE SETTLING AND TREATMENT OF FLOWS ON SILVER BOW CREEK UP TO THE 100-YEAR FLOOD (4,000 CFS).

CONTAMINATED GROUNDWATER WOULD BE COLLECTED THROUGH INTERCEPTION TRENCHES BELOW BOTH POND 1 AND POND 2 BERMS. THE GROUNDWATER WOULD THEN BE PUMPED TO THE INLET OF POND 3 FOR TREATMENT.

ALTERNATIVE 2 IS ONE OF TWO ALTERNATIVES EXPECTED TO EXCEED AT LEAST ONE ARAR. WHEREAS MONTANA'S DAM SAFETY STANDARDS REQUIRE PROTECTION OF THE EXISTING PONDS 1, 2, AND 3 TO 0.2, 0.3,

AND 0.5 PMF, RESPECTIVELY, ALTERNATIVE 2 STABILIZES ALL POND BERMS AGAINST A FULL PMF. THIS ALTERNATIVE IS EXPECTED TO ATTAIN AQUATIC WATER QUALITY STANDARDS FOR SURFACE WATER (EXCEPT FOR ARSENIC AND MERCURY, AS DESCRIBED IN ALTERNATIVE 1), MAXIMUM CONTAMINANT LEVELS FOR GROUNDWATER, AND SELECTED RCRA CLOSURE REQUIREMENTS FOR POND 1.

ALL OF THE COMPONENTS OF ALTERNATIVE 2 SHOULD RELIABLY REDUCE THE HUMAN HEALTH AND ENVIRONMENTAL RISKS AT THE SITE, IF PROPERLY DESIGNED, OPERATED, AND MAINTAINED. THE ACTIONS PROPOSED MAY RESULT IN ADVERSE EFFECTS TO WETLANDS, ENDANGERED SPECIES, OR HISTORICAL RESOURCES. THE ESTIMATED PRESENT WORTH COST FOR THIS ALTERNATIVE IS \$241,500,000. IT IS ESTIMATED THAT THE REMEDIATION MEASURES WILL TAKE 5 YEARS TO COMPLETE.

### **ALTERNATIVE 3 (\$71,100,000)**

ALTERNATIVE 3, IDENTIFIED BY MDHES AND EPA IN THE FEASIBILITY STUDY AND THE PROPOSED PLAN AS THE PREFERRED ALTERNATIVE, IS SIMILAR TO ALTERNATIVE 2 IN THAT IT INCLUDES PROTECTING THE PONDS AGAINST AN MAXIMUM CREDIBLE EARTHQUAKE COMPLETELY UPGRADING THE POND TREATMENT SYSTEM, CAPPING POND 1 AND FLOODING POND 2, AND INSTALLING GROUND WATER INTERCEPTION TRENCHES. IT IS DIFFERENT FROM ALTERNATIVE 2 IN THAT IT REQUIRES PROTECTION OF THE PONDS TO A FRACTION OF THE PROBABLE MAXIMUM FLOOD INSTEAD OF THE FULL PROBABLE MAXIMUM FLOOD; IT INCLUDES EXCAVATION OF EXPOSED TAILINGS AND CONTAMINATED SOILS WITH SUBSEQUENT DISPOSAL IN POND 1 INSTEAD OF OFFSITE DISPOSAL; AND IT INCLUDES THE SMALLER UPSTREAM SETTLING BASIN IN LIEU OF A LARGE UPSTREAM IMPOUNDMENT. ONLY THE NEW COMPONENTS ARE DISCUSSED BELOW.

POND STABILITY IN THIS ALTERNATIVE IS ACHIEVED BY PROTECTING POND 1 AGAINST A 0.2 PMF, POND 2 AGAINST A 0.3 PMF, AND POND 3 AGAINST A 0.5 PMF. THESE ARE THE STANDARDS THAT ARE REQUIRED BY MONTANA'S DARN SAFETY REGULATIONS FOR HIGH HAZARD DARNS SUCH AS THOSE AT THE WARM SPRING PONDS.

IN ALTERNATIVE 3, ALL EXPOSED TAILINGS AND CONTAMINATED SOILS IN THE MILL-WILLOW BYPASS, WITHIN POND 3, AND BELOW POND 1 THAT EXCEED AN ACTION LEVEL OF 250 PPM ARSENIC AND 750 PPM LEAD WOULD BE EXCAVATED AND DISPOSED OF IN POND 1. POND 1 WOULD BE CLOSED WITH A RCRA-COMPLIANT CAP AS DESCRIBED IN ALTERNATIVE 1.

CONSOLIDATING EXCAVATED MATERIAL INTO POND 1 UNDER A RCRA-COMPLIANT CAP WOULD EFFECTIVELY ISOLATE THE MATERIAL FROM DIRECT CONTACT AND EFFECTIVELY LIMIT THE MOBILITY OF THE MATERIAL. IT WOULD ALSO EFFECTIVELY CONSOLIDATE ALL MATERIAL WHICH EXCEEDS THE CLEANUP CRITERIA WITHIN A SMALLER AREA. AS LONG AS THE CAP IS PROPERLY MAINTAINED, THE MATERIAL WOULD BE SAFE FROM RELEASE BECAUSE OF EROSION OF THE CAP.

THE FINAL DIFFERENCE BETWEEN ALTERNATIVES 2 AND 3 IS THAT ALTERNATIVE 3 INCLUDES THE CONSTRUCTION OF A SMALLER UPSTREAM SETTLING BASIN (2,000 ACRE-Feet). DURING FLOOD FLOWS ON SILVER BOW CREEK GREATER THAN 600 CFS, SURFACE WATER WOULD PASS THROUGH THE UPSTREAM SETTLING BASIN. THE SETTLING BASIN WOULD BE SIMILAR TO THE UPSTREAM IMPOUNDMENT WITH TWO EXCEPTIONS. FIRST, THE STORAGE CAPACITY WOULD BE MUCH LOWER (2,000 ACRE-Feet VERSUS 8,000 ACRE-Feet). SECOND, THE AMOUNT OF WATER THAT WOULD RECEIVE FULL TREATMENT FOR BOTH SUSPENDED SOLIDS AND DISSOLVED METALS WOULD BE LESS.

DURING FLOOD FLOWS BETWEEN 600 AND 4,000 CFS, ALL SURFACE WATER FROM SILVER BOW CREEK WOULD PASS THROUGH THE UPSTREAM SETTLING BASIN. FULL TREATMENT WOULD BE PROVIDED FOR FLOODS THAT DO NOT COMPLETELY FILL AND THEN OVERFLOW THE 2,000 ACRE-FOOT SETTLING BASIN. SUSPENDED SOLIDS WOULD SETTLE WITHIN THE BASIN AND THE CAPTURED WATER WOULD THEN BE RELEASED SLOWLY FROM THE BASIN FOR TREATMENT OF DISSOLVED METALS IN POND 3. FLOODS THAT EXCEED THE STORING CAPACITY OF THE SETTLING BASIN, HOWEVER, WOULD BE ONLY PARTIALLY TREATED.

UP TO 80 PERCENT OF THE SUSPENDED SOLIDS WOULD CONTINUE TO BE SETTLED OUT WITHIN THE BASIN, BUT ONLY FLOWS UP TO 600 CFS (THE INLET CAPACITY OF POND 3) WOULD THEN BE TREATED IN THE PONDS FOR DISSOLVED METALS. THE REMAINDER OF THE FLOWS DISCHARGED OVER THE SPILLWAY OF THE SETTLING BASIN WOULD BE ROUTED AROUND POND 3 AND FLOW DOWN THE BYPASS WITHOUT TREATMENT OF DISSOLVED METALS.

THE ACTIONS PROPOSED IN ALTERNATIVE 3 ARE EXPECTED TO RESULT IN COMPLIANCE WITH ALL STATE AND FEDERAL ARARS. THESE INCLUDE MONTANA'S DAM SAFETY STANDARDS, AQUATIC WATER QUALITY STANDARDS (WITH THE EXCEPTION OF ARSENIC AND MERCURY, AS PREVIOUSLY DESCRIBED), MAXIMUM CONTAMINANT LEVELS, AND SELECTED RCRA CLOSURE REQUIREMENTS.

THE ACTIONS PROPOSED FOR ALTERNATIVE 3 ARE TECHNICALLY FEASIBLE AND ARE EXPECTED TO RELIABLY REDUCE THE ENVIRONMENTAL AND HUMAN HEALTH RISKS AT THE SITE. THE ACTIONS PROPOSED MAY RESULT IN ADVERSE EFFECTS TO WETLANDS, ENDANGERED SPECIES, OR HISTORICAL RESOURCES. THE ESTIMATED PRESENT WORTH COST IS \$71,100,000. IT IS ESTIMATED THAT THE REMEDIATION MEASURE IDENTIFIED WILL TAKE 5 YEARS TO COMPLETE.

**ALTERNATIVE 3+3A \$(57,416,000)**

ALTERNATIVE 3+3A, IDENTIFIED BY THE EPA AND MDHES AS THE SELECTED REMEDY, IS A SYNTHESIS OF ALTERNATIVE 3 AND ARCO'S ALTERNATIVE 3A. ALTERNATIVE 3+3A WAS DEVELOPED FOLLOWING CONSULTATION WITH THE PUBLIC AND ARCO TO ADDRESS CONCERNS ABOUT SOME OF THE ASPECTS OF ALTERNATIVE 3 AS PRESENTED IN THE FEASIBILITY STUDY. ALTERNATIVE 3+3A INCLUDES MANY OF THE FEATURES OF ALTERNATIVE 3, INCLUDING PROTECTING THE POND BERMS AGAINST THE MAXIMUM CREDIBLE EARTHQUAKE AND FRACTIONS OF THE PROBABLE MAXIMUM FLOOD, UPGRADING THE TREATMENT SYSTEM, REMOVING MILL-WILLOW TAILINGS, COVERING AND REVEGETATING POND 1, AND INSTALLING GROUND WATER INTERCEPTION TRENCHES. IT IS DIFFERENT FROM ALTERNATIVE 3 IN THAT STORAGE OF FLOOD FLOWS WOULD BE WITHIN POND 3 RATHER THAN IN AN UPSTREAM IMPOUNDMENT; THE BYPASS CHANNEL WOULD BE REALIGNED IN PLACES; POND 2 WOULD BE IMPROVED AND RETAINED AS A TREATMENT UNIT; AND DISPOSAL OF CONTAMINATED SOILS WOULD BE WITHIN THE DRY AREAS OF EITHER PONDS 1 OR 3. THE PRIMARY FEATURES OF ALTERNATIVE 3+3A ARE DISCUSSED BELOW.

POND STABILITY WOULD BE ACHIEVED BY ALTERING ALL POND BERMS SO THAT THEY WOULD BE STABLE DURING THE MAXIMUM CREDIBLE EARTHQUAKE. THIS WOULD BE ACCOMPLISHED BY FLATTENING THE DOWNSTREAM SLOPES OR ADDING TOE BERMS FOR STABILITY. ADDITIONALLY, THE UPSTREAM FACES OF THE BERMS WOULD BE ANALYZED DURING THE REMEDIAL DESIGN PHASE TO INSURE THEIR STABILITY DURING THE MAXIMUM CREDIBLE EARTHQUAKE. ALL NORTH-SOUTH BERMS ALONG THE MILL-WILLOW BYPASS WOULD BE RAISED AND STRENGTHENED TO PROTECT AGAINST FAILURE DURING FLOOD FLOWS UP TO 70,000 CFS, WHICH IS ONE-HALF THE PEAK FLOW RATE OF A PROBABLE MAXIMUM FLOOD. THE SLOPES OF THE BERMS ALONG THE BYPASS WOULD BE PROTECTED AGAINST SCOUR BY CONSTRUCTING SOIL-CEMENT ARMORING FOR THE ENTIRE LENGTH OF THE BYPASS.

THE TAILINGS AND CONTAMINATED SOILS ALONG THE MILL-WILLOW BYPASS WOULD BE EXCAVATED AND DISPOSED OF AT TWO LOCATIONS: WITHIN POND 1 PRIOR TO COVERING AND WITHIN A DRY AREA OF POND 3 NEAR THE POND 3 BERM (SEE FIGURE 1). THIS EXCAVATION AND DISPOSAL WAS BEGUN DURING THE SUMMER OF 1990 AS PART OF THE REMOVAL ACTION. THE REMAINDER OF THE EXCAVATION AND DISPOSAL WILL BE PERFORMED AS PART OF THE REMEDIAL ACTION COVERED BY THIS RECORD OF DECISION. THE DISPOSAL AREAS IN POND 1 AND IN POND 3 WILL ULTIMATELY BE COVERED WITH LIME AND SOIL BARRIERS, THEN REVEGETATED WITH NATIVE SPECIES. THE AMOUNT OF CONTAINED MATERIALS TO BE DISPOSED OF AT EACH LOCATION WILL BE DETERMINED BASED UPON THE ECONOMICS OF HAUL

DISTANCES.

THE MEASURES TO UPGRADE PONDS 2 AND 3 FOR THIS ALTERNATIVE WOULD SERVE TWO PRIMARY PURPOSES: 1) STORAGE OF FLOOD FLOWS UP TO THE 100-YEAR EVENT AND 2) IMPROVEMENT OF THE TREATMENT PROCESSES TO ACHIEVE THE WATER QUALITY STANDARDS AT THE POINT OF DISCHARGE. THE MAIN FEATURES INCLUDE:

- RAISE POND 2 AND 3 EMBANKMENTS TO INCREASE STORAGE CAPACITIES WITHIN THOSE PONDS AND ENABLE STORAGE AND TREATMENT OF THE 100-YEAR FLOOD EVENT IN POND 3. THE TOTAL STORAGE CAPACITY OF POND 3 WOULD BE INCREASED TO 13,000 ACRE-FEET. THE OPERATING VOLUME OF POND 2 WOULD BE INCREASED TO 2,200 ACRE-FEET TO INCREASE RETENTION TIME AND IMPROVE TREATMENT.
- MODIFY AND REPLACE HYDRAULIC STRUCTURES. THE INTAKE STRUCTURE TO POND 3 WOULD BE COMPLETELY REPLACED WITH A LARGER, MORE EFFICIENT STRUCTURE CAPABLE OF PASSING FLOWS UP TO 3,300 CFS (THE ESTIMATED PEAK FLOW OF THE 100-YEAR FLOOD EVENT). FLOWS EXCEEDING THAT AMOUNT WOULD BE ROUTED TO THE MILL-WILLOW BYPASS CHANNEL USING A COMBINATION OF AN OVERFLOW SPILLWAY AND A FUSE PLUG DIKE. THE INTAKE STRUCTURE WOULD BE DESIGNED TO MINIMIZE PLUGGING THROUGH USE OF A TRASH RACK. AT THE MAXIMUM WATER SURFACE ELEVATIONS ANTICIPATED DURING A MAJOR FLOOD, THE INTAKE STRUCTURE WOULD BE CAPABLE OF PASSING NO MORE THAN 4,000 CFS INTO THE PONDS.

THE TWO DECANT OUTLETS ON POND 3 WOULD BE RAISED AND MODIFIED TO PROVIDE CONTROLLED RELEASES INTO POND 2, NOT TO EXCEED 200 CFS. ADDITIONAL OUTFLOWS ARE REQUIRED TO AVOID EXCEEDING THE ALLOWABLE STORAGE VOLUME IN POND 3 DURING THE 100-YEAR FLOOD. OUTFLOWS IN EXCESS OF 200 CFS WOULD BE ROUTED DIRECTLY INTO THE MILL-WILLOW BYPASS CHANNEL VIA A PIPE FROM THE WEST DECANT

TOWER. THE OUTLET PIPE TO THE BYPASS WOULD BE CAPABLE OF DISCHARGES UP TO 500 CFS. THE DISCHARGE TO THE BYPASS WOULD BE THROUGH AN ENERGY-DISSIPATION STRUCTURE TO AVOID EXCESSIVE EROSION. THE OUTLET STRUCTURE IN POND 2 WOULD BE RAISED AND MODIFIED TO ACCOMMODATE THE WATER LEVEL INCREASE.

- CONSTRUCT EMERGENCY SPILLWAYS IN THE POND 2 AND POND 3 BERMS. IN POND 2, THE SPILLWAY WOULD BE DESIGNED TO ALLOW PASSING UP TO 12,500 CFS FROM A FLOOD IN THE EASTERN HILLS, WHICH IS ONE-HALF THE PROBABLE MAXIMUM FLOOD OF THAT DRAINAGE AREA ABOVE POND 2. IN POND 3, THE ENTIRE VOLUME EXPECTED DURING A FLOOD OF ONE-HALF THE PROBABLE MAXIMUM FLOOD, FROM THE EASTERN HILLS, CAN BE CONTAINED WITHIN THE UPGRADED STORAGE CAPACITY OF POND 3. HOWEVER, AS NOTED ABOVE, THE INLET STRUCTURE TO POND 3 CAN PASS AS MUCH AS 4,000 CFS DURING A MAJOR FLOOD IN SILVER BOW CREEK. THUS, THE SPILLWAY IN POND 3 MUST BE CAPABLE OF PASSING 4,000 CFS DIRECTLY INTO THE BYPASS CHANNEL TO AVOID OVERTOPPING THE BERMS DURING, A MAJOR FLOOD IN SILVER BOW CREEK. THE EMERGENCY SPILLWAYS WOULD BE CONSTRUCTED IN THE WESTERN EMBANKMENTS OF PONDS 2 AND 3 AND WOULD BE CONSTRUCTED USING SOIL-CEMENT SIMILAR TO THE SOIL-CEMENT USED TO ARMOR THE EMBANKMENTS SLOPES.
- UPGRADE LIME TREATMENT FACILITIES AND WATER QUALITY CONTROLS. A NEW LIME ADDITION FACILITY WOULD BE INSTALLED AT THE INTAKE STRUCTURE TO POND 3. THE NEW FACILITY WOULD ADD HYDRATED LIME TO THE SILVER BOW CREEK INFLUENT AT A RATE SUFFICIENT TO RAISE AND MAINTAIN PH LEVELS AT A MINIMUM OF 9.0. THE TREATMENT FACILITY WOULD BE DESIGNED TO HANDLE BOTH NORMAL FLOWS AND FLOOD FLOWS UP TO THE 100-YEAR EVENT. POND 3 WOULD PROVIDE SUFFICIENT RETENTION TIME TO ALLOW METALS TO REACT AND FORM INSOLUBLE HYDROXIDE PRECIPITATES. POND 2 WOULD PROVIDE GREATER VOLUME AND RETENTION TIME FOR FINAL SETTLING AND CLARIFYING OF THE POND 3 EFFLUENT BEFORE DISCHARGING.

THE CONTAMINATED GROUND WATER WOULD BE ADDRESSED USING THE SAME FACILITIES AS DESCRIBED FOR ALTERNATIVES 2 AND 3. THE GROUND WATER WOULD BE COLLECTED IN INTERCEPTION DRAINS BELOW AND WITHIN OR ADJACENT TO POND 1. THE GROUND WATER WOULD THEN BE PUMPED BACK TO THE INLET OF POND 3 FOR TREATMENT.

BOTH SURFACE AND GROUND WATER QUALITY MONITORING WOULD BE NEEDED. THE EXISTING PONDED WATER IN THE EASTERN PORTION OF POND 1 WOULD BE PUMPED OUT AND POND 1 WOULD THEN BE DRY-CLOSED. THE TAILINGS AND CONTAMINATED SOILS IN POND 1 WOULD BE PROTECTED FROM DIRECT EXPOSURE BY COVERING WITH LIME AND SOIL BARRIERS, FOLLOWED BY REVEGETATION WITH NATIVE SPECIES. THE DRY-CLOSED POND 1 WOULD BE PROTECTED FROM FLOODS IN THE EASTERN HILLS THROUGH CONSTRUCTION OF A CHANNEL AROUND THE EAST SIDE OF THE POND, DISCHARGING BELOW POND 1 TO THE CLARK FORK RIVER. THE CHANNEL WOULD BE DESIGNED TO SAFELY PASS A FLOOD FROM THE EASTERN HILLS OF 8,500 CFS, WHICH IS ONE-HALF THE PROBABLE MAXIMUM FLOOD OF THAT DRAINAGE AREA ABOVE POND 1.

THE EXPOSED TAILINGS ABOVE POND 2 WOULD BE FLOODED AS A RESULT OF THE INCREASED WATER ELEVATION AND VOLUME OF THIS POND. THE EXPOSED TAILINGS DEPOSITS ABOVE POND 3 WILL NOT BE ADDRESSED AS PART OF THIS ALTERNATIVE. THE AREA ABOVE POND 3 WILL BE PART OF THE ACTIVE RECEIVING POND, WITH FLOODS UP TO THE 100-YEAR FLOOD BEING ROUTED INTO THE POND. DURING THESE EVENTS, ADDITIONAL TAILINGS AND SEDIMENTS WILL BE DEPOSITED IN POND 3. HENCE, THE REMOVAL OR CAPPING OF THE EXPOSED TAILINGS IN THIS AREA WILL BE ADDRESSED AT THE 5-YEAR REVIEW AND AT THE TIME OF THE FINAL CLOSURE OF THE POND SYSTEM.

INSTITUTIONAL CONTROLS TO PREVENT FUTURE RESIDENTIAL DEVELOPMENT WOULD BE IMPLEMENTED. DEED NOTICES AND RECORDING THE LOCATIONS OF PONDS 1, 2 AND 3 AND ALL DISPOSAL AREAS WOULD BE REQUIRED. SPECIFIC CONTRACTUAL PROVISIONS WITH THE STATE MAY BE REQUIRED. FURTHER DEVELOPMENT OF DEER LODGE COUNTY'S ZONING SCHEME WILL BE REQUIRED. INSTITUTIONAL CONTROLS TO PREVENT SWIMMING AND CONSUMPTION OF FISH BY HUMANS IS NECESSARY. ALL OTHER ACTIVITIES NEEDED TO COMPLY WITH THE FINAL ARARS, ATTACHMENT TO PART 2 WOULD ALSO BE REQUIRED.

THE ACTIONS PROPOSED IN ALTERNATIVE 3+3A ARE EXPECTED TO RESULT IN COMPLIANCE WITH STATE AND FEDERAL ARARS. THESE INCLUDE MONTANA'S DAM SAFETY STANDARDS, AQUATIC WATER QUALITY STANDARDS (WITH THE EXCEPTION OF THE STANDARDS FOR ARSENIC AND MERCURY, WHICH WILL BE WAIVED AS PREVIOUSLY DESCRIBED), AND MAXIMUM CONTAMINANT LEVELS.

THE ACTIONS PROPOSED FOR ALTERNATIVE 3+3A ARE TECHNICALLY FEASIBLE AND ARE EXPECTED TO RELIABLY REDUCE THE ENVIRONMENTAL AND HUMAN HEALTH RISKS AT THE SITE. THE ACTIONS PROPOSED MAY RESULT IN

ADVERSE EFFECTS TO WETLANDS, ENDANGERED SPECIES, OR HISTORICAL RESOURCES. THE ESTIMATED PRESENT WORTH COST IS \$ 57,416,000. IT IS ESTIMATED THAT REMEDIATION WILL TAKE 3 TO 5 YEARS TO COMPLETE.

#### COMPONENT UPGRADE

A COMPONENT UPGRADE OF THE TREATMENT SYSTEM IN POND 3 MAY BE NECESSARY IN THE EVENT THAT THE REMEDIES PROPOSED IN ALTERNATIVE 3+3A FOR HANDLING FLOOD FLOWS ARE NOT AS EFFECTIVE AS CURRENTLY ANTICIPATED. THE PURPOSE OF THE COMPONENT UPGRADE WOULD BE TO ADDRESS THE POTENTIAL FOR RESUSPENSION OF BOTTOM SEDIMENTS IN POND 3.

THE POND BOTTOM SEDIMENTS OF CONCERN ARE THE VERY FINE GRAINED SETTLED MATERIALS THAT ARE ESSENTIALLY COMPOSED OF FLOWS AND SLUDGES RESULTING FROM THE EXISTING (AND PROPOSED) TREATMENT PROCESSES. THESE FLOWS AND SLUDGES EXIST AS A SLUDGE BLANKET ON THE BOTTOM OF POND 3. THEY MAY BE SUBJECT TO RESUSPENSION DURING HIGH WINDS OR HIGH FLOWS. THE AMOUNT AND THE EFFECTS OF RESUSPENSION CANNOT BE DETERMINED USING EXISTING MODELING TECHNIQUES.

ACCORDINGLY, TESTS WILL BE PERFORMED ON THE POND BOTTOM SEDIMENTS TO DETERMINE THEIR IMPACT ON AQUATIC LIFE. THE TESTS WOULD BE PERFORMED IN TWO PHASES:

- PHASE 1 WILL INCLUDE A BIOASSAY SURVEY OF THE POND BOTTOM SEDIMENTS. A MODEL WILL BE CONSTRUCTED ASSUMING VARIOUS LEVELS OF RESUSPENSION OF THESE MATERIALS. WATERS CONTAINING THESE LEVELS OF RESUSPENDED MATERIALS WILL THEN BE USED IN A SERIES OF BIOASSAYS. STANDARD EPA-APPROVED TEST SPECIES OF BIOTA (INCLUDING FISH AND MACROINVERTEBRATES), OR NATIVE BIOTA IF POSSIBLE, WILL BE SUBJECTED TO ACUTE AND CHRONIC BIOASSAYS USING WATERS CONTAINING THE MATERIALS TO DETERMINE THE EFFECTS ON THEIR ABILITY TO SURVIVE. IN CONJUNCTION WITH THE BIOASSAYS, A FULL SPECTRUM OF CHEMICAL ANALYSES WILL BE PERFORMED ON THE WATERS CONTAINING THE RESUSPENDED MATERIALS. THE BIOASSAY SURVEY WILL BE COMPLETED PRIOR TO SEPTEMBER 30, 1991.
- PHASE 2 WILL BE PERFORMED ONLY IF BIOASSAY RESULTS INDICATE THAT THERE ARE ADVERSE AFFECTS ON THE BIOTA AS A RESULT OF POND BOTTOM MATERIAL RELEASES. PHASE, WOULD INCORPORATE FIELD SCALE RESUSPENSION TESTING USING IN SITU TECHNIQUES TO DETERMINE THE PARAMETERS NECESSARY TO DEVELOP RESUSPENSION MODELING. ONCE THESE PARAMETERS HAVE BEEN DEFINED, THE POND 3 SYSTEM WOULD BE MODELED TO DETERMINE THE EXTENT OF RESUSPENSION DURING HIGH FLOWS OR HIGH WINDS.

IF THE PHASE 1 OR PHASE 2 INVESTIGATIONS INDICATE THAT RESUSPENSION OF POND BOTTOM SEDIMENTS WILL RESULT IN ADVERSE EFFECTS TO HUMAN HEALTH OR THE ENVIRONMENT, ADDITIONAL MEASURES WOULD BE REQUIRED AS PART OF THE SELECTED REMEDY. THESE MEASURES WOULD INCLUDE:

- A SEPARATE STUDY AMENDMENT TO IDENTIFY AND ANALYZE ADDITIONAL REMEDIAL MEASURES TO ADDRESS THE RESUSPENSION OF POND BOTTOM SEDIMENTS.
- CONSTRUCTION OF THE SELECTED ADDITIONAL REMEDIAL MEASURES.

#### **ALTERNATIVE 4 (\$77,000,000)**

ALTERNATIVE 4 CONTAINS MANY OF THE SAME COMPONENTS AS ALTERNATIVE 3. THESE INCLUDE PROTECTING THE POND SYSTEM AGAINST A FULL MAXIMUM CREDIBLE EARTHQUAKE AND A FRACTION OF THE PROBABLE MAXIMUM FLOOD, CAPPING POND 1, COMPLETELY UPGRADING THE POND TREATMENT SYSTEM, CONSTRUCTING AN UPSTREAM SETTLING BASIN, AND INSTALLING GROUND WATER INTERCEPTION TRENCHES. THE ONLY DIFFERENCE BETWEEN THIS ALTERNATIVE AND ALTERNATIVE 3 IS THAT THIS ALTERNATIVE PROVIDES FOR CAPPING EXPOSED TAILINGS AND CONTAMINATED SOILS IN PLACE INSTEAD OF EXCAVATING AND CONSOLIDATING THEM IN POND 1 PRIOR TO CAPPING.

IN ALTERNATIVE 4, THE ONLY AREAS OF EXPOSED TAILINGS AND CONTAMINATED SOILS THAT WOULD NOT BE CAPPED IN PLACE WOULD BE THOSE ALONG THE MILL-WILLOW BYPASS AND WITHIN POND 2 MATERIAL FROM THE BYPASS WOULD BE EXCAVATED AND PLACED INTO POND 1 PRIOR TO CAPPING. THE AREAS OF EXPOSED TAILINGS AND DECONTAMINATED SOILS WITHIN POND 2 WOULD BE FLOODED. ALL OTHER AREAS THAT EXCEED AN ACTION LEVEL OF 250 PPM FOR ARSENIC AND 750 PPM FOR LEAD WOULD BE CAPPED IN PLACE. THE CAPPING WOULD INVOLVE COVERING THESE AREAS WITH A 6-INCH LAYER OF AGRICULTURAL LIME TO HELP PREVENT METALS MIGRATION AND THEN COVERING THE AREA WITH 18 INCHES OF TOPSOIL. CAPPING THE

CONTAMINATED SOILS AND EXPOSED TAILINGS IN PLACE WITH AN 18-INCH CAP WOULD EFFECTIVELY REDUCE THE MOBILITY OF THE MATERIAL BUT WOULD NOT BE AS EFFECTIVE OR PERMANENT IN CONTAINING THE WASTES AND MINIMIZING THE EXPOSURES AS REMOVAL, CONSOLIDATION, AND PLACEMENT UNDER A RCRA-COMPLIANT CAP AS SPECIFIED IN ALTERNATIVE 3. FERTILIZER, SOIL AMENDMENTS, AND SEED WOULD BE SPREAD AS NECESSARY OVER THE AREA TO ESTABLISH STABLE VEGETATIVE COVER IN ACCORDANCE WITH STATE RECLAMATION REQUIREMENTS.

THE ACTIONS PROPOSED IN ALTERNATIVE 4 ARE EXPECTED TO RESULT IN COMPLIANCE WITH ALL STATE AND FEDERAL ARARS. THESE INCLUDE MONTANA DNRC DAM SAFETY REQUIREMENTS, AQUATIC WATER QUALITY STANDARDS (WITH THE EXCEPTION OF ARSENIC AND MERCURY, AS PREVIOUSLY DESCRIBED), MAXIMUM CONTAMINANT LEVELS. RCRA COMPLIANT CLOSURE REQUIREMENTS (POND 1), AND STATE RECLAMATION STANDARD (EXPOSED TAILINGS AND CONTAMINATED SOILS).

ALL OF THE COMPONENTS OF ALTERNATIVE 4 ARE TECHNICALLY FEASIBLE, AND WITH APPROPRIATE DESIGN, CONSTRUCTION, OPERATION AND MAINTENANCE, WOULD RELIABLY REDUCE THE HUMAN HEALTH AND ENVIRONMENTAL RISKS AT THE SITE. THE ACTIONS PROPOSED IN ALTERNATIVE 4 MAY HAVE AN ADVERSE EFFECT ON WETLANDS, ENDANGERED SPECIES, OR HISTORICAL RESOURCES. IT IS ESTIMATED THAT IMPLEMENTATION OF THIS ALTERNATIVE WILL TAKE 5 YEARS AT A TOTAL PRESENT WORTH COST OF \$77,000,000.

#### **ALTERNATIVE 5 (\$66,300,000)**

ALTERNATIVE 5 IS SIMILAR TO ALTERNATIVE 4 IN ALL ASPECTS EXCEPT TWO. FIRST, ALTERNATIVE 5 INCLUDES A PARTIAL UPGRADE TO THE TREATMENT SYSTEM INSTEAD OF THE COMPLETE UPGRADE PROVIDED IN ALTERNATIVES 2, 3, AND 4. SECOND, ALTERNATIVE 5 PROVIDES FOR TREATMENT OF CONTAMINATED GROUND WATER IN AN ONSITE WETLAND TREATMENT SYSTEM INSTEAD OF IN POND 3.

THE PARTIAL UPGRADE OF THE POND TREATMENT SYSTEM WOULD INCLUDE THE FOLLOWING FOUR MEASURES:

1. DIVERTING MILL AND WILLOW CREEKS INTO POND 3 FOR TREATMENT
2. MODIFYING THE INLET TO POND 3 BY ADDING A TRASH RACK AND AN OVERFLOW WEIR AND RELOCATING THE FUSE PLUG
3. IMPROVING THE LIME TREATMENT SYSTEM
4. RETAINING THE EXISTING EFFLUENT STRUCTURES IN POND 3 AND KEEPING POND 2 IN SERVICE

THIS LESS COMPREHENSIVE UPGRADE TO THE POND SYSTEM WOULD PROVIDE SOME IMPROVED TREATMENT TO SURFACE WATERS, BUT NOT TO THE EXTENT NECESSARY TO EFFECTIVELY TREAT FLOWS UP TO 600 CFS AS PROVIDED IN ALTERNATIVES 2, 3, AND 4. CONSISTENT TREATMENT WOULD BE PROVIDED FOR FLOWS ONLY UP TO APPROXIMATELY 210 CFS. THIS FLOW RATE IS BASED UPON CALCULATIONS THAT DETERMINE THE MAXIMUM FLOW RATE THAT COULD BE DIRECTED FROM POND 3 TO POND 2 WHILE STILL PROVIDING ACCEPTABLE METALS REMOVAL IN POND 2 AND PREVENTING THE RESUSPENSION OF POND BOTTOM SEDIMENTS. SINCE THE EFFLUENT STRUCTURE THAT DIRECTS THE FLOW FROM POND 3 TO POND 2 WILL NOT BE MODIFIED, POND 2 REMAINS AS AN ACTIVE TREATMENT CELL IN THE POND SYSTEM AND BECOMES A LIMITING FACTOR WITH REGARD TO THE VOLUME OF FLOW THAT CAN BE TREATED IN THE PONDS.

BECAUSE OF THE LIMITED CAPACITY OF POND 2, FLOWS GREATER THAN 210 CFS WOULD BE DIRECTED AROUND THE POND SYSTEM WITHOUT TREATMENT FOR DISSOLVED METALS. THIS WILL RESULT IN VIOLATIONS OF AQUATIC WATER QUALITY STANDARDS DURING ABOVE AVERAGE FLOWS. (THE AVERAGE FLOW OF SURFACE WATERS THROUGH THE OPERABLE UNIT IS APPROXIMATELY 90 CFS). ALSO, BECAUSE THE EFFECTIVE TREATMENT CAPACITY OF POND 2 IS NEARLY EXHAUSTED DUE TO THE VOLUME TO SEDIMENTS ACCUMULATED IN THE POND, KEEPING POND 2 IN THE TREATMENT SYSTEM PROVIDES AN OPPORTUNITY FOR SEDIMENTS TO BE RESUSPENDED DURING PERIODS OF HIGH WINDS. THE FUTURE LIFE OF POND 2, AND THEREFORE THE FUTURE LIFE OF THE TREATMENT SYSTEM, WOULD BE LIMITED TO AN ESTIMATED 15 YEARS.

THE GROUND WATER CONTAMINATION PROBLEM WOULD BE ADDRESSED BY CONSTRUCTING A WETLANDS TREATMENT SYSTEM BELOW POND 1. CONTAMINATED GROUND WATER WOULD BE COLLECTED BY AN OPEN GROUND WATER TRENCH AND PUMPED UP TO THE ENTRANCE OF THE WETLANDS FOR TREATMENT. THE AREA AVAILABLE FOR THE ESTABLISHMENT OF A WETLANDS TREATMENT SYSTEM IS APPROXIMATELY 100 ACRES.

TWO SEPARATE TREATMENT CELLS WOULD BE CONSTRUCTED WITHIN THE WETLANDS TO ENHANCE THE METALS REMOVAL EFFICIENCIES. THE CELLS WOULD OPERATE IN SERIES, WITH EFFLUENT WATER FROM THE FIRST CELL DISCHARGING INTO THE SECOND CELL. TREATED WATER FROM THE SECOND CELL WOULD BE DISCHARGED TO THE CLARK FORK RIVER.

DUE TO PLANT UPTAKE OF TOXIC METALS AND VEGETATION DIE-OFF, PERIODIC REMOVAL OF ORGANIC MATTER FROM THE WETLANDS AREA WOULD BE NECESSARY. HOWEVER, WITH PERIODIC CLEANING AND PROPER MAINTENANCE, THE WETLANDS COULD BE EXPECTED TO REMAIN VIABLE FOR AT LEAST THE LIFE OF THE TREATMENT SYSTEM. TREATING CONTAMINATED GROUND WATER IN AN ONSITE WETLANDS SHOULD RESULT IN COMPLIANCE WITH GROUNDWATER STANDARDS. HOWEVER, WETLANDS TREATMENT IS NOT EXPECTED TO BE AS CONSISTENTLY RELIABLE AS THE POND TREATMENT SYSTEM PROPOSED IN ALTERNATIVES 2, 3, AND 4.

ALTERNATIVE 5 IS EXPECTED TO RESULT IN COMPLIANCE WITH MOST BUT NOT ALL ARARS. BY PROVIDING ONLY A PARTIAL UPGRADE TO THE POND TREATMENT SYSTEM, EXCEEDENCES OF AQUATIC WATER QUALITY STANDARDS CAN BE EXPECTED. COMPLIANCE WITH MAXIMUM CONTAMINANT LEVELS FOR GROUND WATER IS EXPECTED TO BE ACHIEVED, BUT NOT WITH THE CONSISTENCY EXPECTED WITH ALTERNATIVES 1 THROUGH 4. CERTAIN RCRA CLOSURE REQUIREMENTS FOR POND 1 AND RECLAMATION STANDARDS ARE EXPECTED TO BE ACHIEVED.

THE ACTIONS PROPOSED IN ALTERNATIVE 5 MAY HAVE AN ADVERSE EFFECT ON WETLANDS, ENDANGERED SPECIES, OR CULTURAL RESOURCES. IT IS ESTIMATED THAT THIS ALTERNATIVE WILL TAKE 5 YEARS TO IMPLEMENT AT A PRESENT WORTH COST OF \$66,300,000.

#### **ALTERNATIVE 6 (\$55,100,000)**

THE COMPONENTS OF ALTERNATIVE 6 ARE A COMBINATION OF MANY OF THE COMPONENTS FOUND IN ALTERNATIVES 1 THROUGH 5. ALTERNATIVE 6 INCLUDES PROTECTING THE POND SYSTEM AGAINST A FULL MAXIMUM CREDIBLE EARTHQUAKE AND A FRACTION OF THE PROBABLE MAXIMUM FLOOD, EXCAVATING TAILINGS AND DECONTAMINATED SOILS WITHIN THE MILL-WILLOW BYPASS AND DISPOSING OF THEM IN POND 1, PARTIALLY UPGRADING THE POND TREATMENT SYSTEM, AND COLLECTING AND TREATING CONTAMINATED GROUND WATER IN AN ONSITE WETLANDS TREATMENT SYSTEM.

THE UNIQUE FEATURES OF ALTERNATIVE 6 ARE THAT: 1) IT DOES NOT INCLUDE THE INSTALLATION OF AN UPSTREAM IMPOUNDMENT OR SETTLING BASIN; AND 2) THE ACTION PROPOSED FOR ISOLATING THE CONTAMINATED SOILS AND TAILINGS WITHIN THE SITE INCLUDES FLOODING WHEREVER POSSIBLE. ONLY THE TWO UNIQUE FEATURES ARE DISCUSSED BELOW.

THIS ALTERNATIVE DOES NOT ADDRESS THE TRANSPORTATION OF CONTAMINATED SOILS AND TAILINGS FROM UPSTREAM SOURCES EXPECT FOR FLOWS LESS THAN 210 CFS. AS DISCUSSED IN ALTERNATIVE 5, THIS FLOW RATE IS A LIMITATION OF POND 2 AND THE PARTIAL UPGRADE OF THE POND TREATMENT SYSTEM. THEREFORE, FLOWS GREATER THAN 210 CFS ON SILVER BOW CREEK WOULD BYPASS THE POND SYSTEM SINCE NO UPSTREAM IMPOUNDMENT OR SETTLING BASIN WOULD BE PRESENT TO DETAIN LARGER FLOWS AND THUS ENHANCE SETTLEMENT OF SOLIDS AND TREATMENT OF METALS. IN ADDITION, OVER THE LONG TERM, DEPOSITION OF UPSTREAM SOURCES MAY LEAD TO RECONTAMINATION OF THE MILL-WILLOW BYPASS.

IN ALTERNATIVE 6, EXPOSED TAILINGS AND CONTAMINATED SOILS BELOW POND 1 AND WITHIN PONDS 2 AND 3 WOULD BE ISOLATED BY FLOODING THE AREAS AND MAINTAINING A CONSTANT WATER LEVEL. THE FLOODING OF TAILINGS AND CONTAMINATED SOILS BELOW POND 1 WOULD BE ACCOMPLISHED THROUGH THE CONSTRUCTION OF THE WETLANDS TREATMENT SYSTEM.

THE EXPOSED TAILINGS AND CONTAMINATED SOILS WITHIN POND 2 WOULD BE FLOODED. A SMALL BERM WOULD BE DESIGNED TO CROSS POND 2, RUNNING EAST TO WEST IN ORDER TO FACILITATE THE FLOODING OF THE HIGHER SOUTHERN END OF THE POND. A SMALL AMOUNT OF WATER WOULD BE DISCHARGED FROM POND 3 TO POND 2 IN ORDER TO KEEP THE NEWLY BERMED AREA WET. DISCHARGE FROM POND 2 WOULD FLOW DIRECTLY INTO THE MILL-WILLOW BYPASS.

THE ACTIONS PROPOSED FOR ALTERNATIVE 6 SHOULD RESULT IN COMPLIANCE FOR MOST BUT NOT ALL ARARS IDENTIFIED. BECAUSE ONLY A PARTIAL UPGRADE TO THE POND TREATMENT SYSTEM WILL BE REALIZED, AND AN UPSTREAM IMPOUNDMENT OR SETTLING BASIN WILL NOT BE CONSTRUCTED, COMPLIANCE WITH AQUATIC WATER QUALITY STANDARDS WILL ONLY BE MET AT FLOWS LESS THAN 210 CFS ON SILVER BOW CREEK. COMPLIANCE WITH MAXIMUM CONTAMINANT LEVELS FOR GROUND WATER IS EXPECTED TO BE ACHIEVED BUT NOT WITH THE CONSISTENCY EXPECTED WITH ALTERNATIVES 1 THROUGH 4, CERTAIN RCRA CLOSURE STANDARDS AND STATE RECLAMATION STANDARDS ARE EXPECTED TO BE MET.

THE ACTIONS PROPOSED IN ALTERNATIVE 6 MAY RESULT IN ADVERSE EFFECTS TO WETLANDS, ENDANGERED SPECIES, OR CULTURAL RESOURCES AT THE SITE. IT IS ESTIMATED THAT ALTERNATIVE 6 WILL TAKE 5 YEARS TO IMPLEMENT AT A TOTAL PRESENT WORTH COST OF \$55,100,000.

#### **ALTERNATIVE 7**

ALTERNATIVE 7 IS THE NO-ACTION ALTERNATIVE REQUIRED BY THE NATIONAL CONTINGENCY PLAN. IT IS USED AS A BASELINE ALTERNATIVE AGAINST WHICH TO JUDGE THE OTHER ALTERNATIVES. AS THE NAME IMPLIES, THIS ALTERNATIVE DOES NOT INCLUDE ANY REMEDIATION ACTIVITIES. CURRENT ACTIVITIES AT THE SITE BEING CARRIED OUT BY THE AGENCIES WOULD DIMINISH SUBSTANTIALLY. THE ONLY ACTIVITIES ASSUMED TO CONTINUE ARE THOSE BEING CARRIED OUT BY THE OWNER (E.G., LIME ADDITION TO THE INFLUENT DURING WINTER MONTHS AND GENERAL MAINTENANCE OF THE SITE). ACCORDINGLY, THERE WOULD BE NO REDUCTION IN RISK OF INCREASE IN PROTECTIVENESS OF HUMAN HEALTH AND THE ENVIRONMENT. AS A RESULT OF THE CONTINUED OCCURRENCE OF A NUMBER OF PROCESSES ONSITE, THE RISKS TO HUMAN HEALTH AND THE ENVIRONMENT WOULD INCREASE OVER TIME IF LEFT UNMITIGATED. MAJOR FISHKILLS WILL CONTINUE TO OCCUR ON A PERIODIC BASIS. CATASTROPHIC FAILURE OF THE PONDS COULD OCCUR IN A MODERATE EARTHQUAKE OR A MODERATE FLOOD (PROBABLY LESS THAN A 100-YEAR EVENT).

#### **#CAA**

#### **COMPARATIVE ANALYSIS OF ALTERNATIVES**

THE ALTERNATIVES DESCRIBED IN THE PREVIOUS SECTION, WITH THE EXCEPTION OF ALTERNATIVE 3+3A, WERE BASED ON CERTAIN STANDARDS AND CRITERIA WHICH HAVE SINCE BEEN REEVALUATED. THOSE STANDARDS ARE THE PROBABLE MAXIMUM FLOOD STANDARD FOR POND BERMS (NOW 0.5 FOR ALL BERMS), THE RCRA STANDARDS FOR AN IMPERMEABLE CAP (NO LONGER REQUIRED), AND THE ACTION LEVELS FOR LEAD AND ARSENIC DEFERRED AND SUBSTITUTED BY OTHER CRITERIA. THESE CHANGES REQUIRE ONLY MINOR ADJUSTMENTS IN THE ACTUAL CLEANUP ACTIONS. IN PERFORMING THE COMPARATIVE ANALYSIS OF THEIR VARIOUS ALTERNATIVES, EPA AND MDHES ASSESSED THE ALTERNATIVES WITH THE REVISIONS AS DESCRIBED. THE COMPARATIVE ANALYSIS WHICH FOLLOWS ASSUMES THESE CHANGES WOULD BE INCORPORATED INTO THE ALTERNATIVES. COST ESTIMATES GIVEN WOULD NOT CHANGE SIGNIFICANTLY DUE TO THESE CHANGES.

CERCLA REQUIRES EPA TO EXAMINE SEVERAL FACTORS WHEN SELECTING A REMEDY. EPA HAS IDENTIFIED NINE EVALUATION CRITERIA TO BE EXAMINED. 40 CFR S300.5 15(E)(9)(III): S300.515(F)(1)(I).

TWO OF THE CRITERIA ARE THRESHOLD CRITERIA -- THE REMEDY MUST BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AND MUST COMPLY OR RESULT IN COMPLIANCE WITH ARARS, UNLESS A SPECIFIC ARAR IS WAIVED.

FIVE OF THE CRITERIA ARE PRIMARY BALANCING CRITERIA -- LONG-TERM EFFECTIVENESS AND PERMANENCE; REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT; SHORT-TERM EFFECTIVENESS; IMPLEMENTABILITY; AND COST.

THE TWO REMAINING CRITERIA ARE MODIFYING CRITERIA -- STATE AND COMMUNITY ACCEPTANCE.

THIS SECTION OF THE ROD ANALYZES THE VARIOUS ALTERNATIVES AGAINST EACH OF THESE CRITERIA AND WEIGHS THE ADVANTAGES AND DISADVANTAGES OF EACH ALTERNATIVE RELATIVE TO THE OTHER ALTERNATIVES.

THE EVALUATION IS PRESENTED USING THE NINE EVALUATION CRITERIA AS HEADINGS. UNDER EACH HEADING THE ALTERNATIVES ARE DISCUSSED APPROXIMATELY IN ORDER OF DECREASING PERFORMANCE FOR THAT CRITERION.

#### **OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT**

AS PREVIOUSLY EXPLAINED, TWO ELEMENTS OF THE OPERABLE UNIT CLEANUP ARE DEFERRED TO A LATER DATE, AS PERMITTED BY 40 CFR S300.5 15(F)(5)(III)(D). FINAL ACTION LEVELS FOR CONTAMINANTS IN SOILS, SEDIMENTS, AND TAILINGS WILL BE SELECTED WITHIN ONE YEAR. THIS WILL DETERMINE ADDITIONAL CLEANUP REQUIREMENTS, ESPECIALLY FOR THE AREA BELOW POND 1. FINAL CLEANUP DECISIONS FOR THE FINAL DISPOSITION OF PONDS 2 AND 3, AFTER THE NEED FOR TREATMENT OF THE INCOMING WATER IS NO LONGER NECESSARY, CANNOT BE MADE UNTIL AFTER THE EFFECTIVENESS OF UPSTREAM CLEANUP ACTIONS IS KNOWN. THEREFORE, THIS ANALYSIS ADDRESSES PROTECTIVENESS WITHIN THE SCOPE OF THIS INTERIM REMEDY ONLY, AND DOES NOT ADDRESS THE DEFERRED ACTIONS DESCRIBED ABOVE.

EACH OF THE FIRST SIX ALTERNATIVES (INCLUDING ALTERNATIVE 3 AND 3A) ADDRESSES THE EIGHT HUMAN HEALTH AND ENVIRONMENTAL CONCERNS IDENTIFIED AT THE SITE TO VARYING DEGREES OF PROTECTIVENESS. ALTERNATIVE 6 LEAVES ONE OF THE CONCERNS UNADDRESSED--THE TRANSPORT OF TAILINGS DOWN THE BYPASS DURING FLOOD FLOWS IN EXCESS OF 210 CFS. OTHER ALTERNATIVES DO NOT CONSIDER CONTAINMENT AND TREATMENT OF THE 100-YEAR FLOOD FLOWS. ALTERNATIVE 7 IS THE NO-ACTION ALTERNATIVE; IT WOULD NOT ALTER THE SITE, AND IT DOES NOT ADDRESS ANY OF THE IDENTIFIED CONCERNS.

OVERALL, ALTERNATIVE 1 IS THE MOST PROTECTIVE OF THE ALTERNATIVES, BECAUSE IT ALONE CONTAINS MEASURES TO TREAT THE POND BOTTOM SEDIMENTS, TAILINGS DEPOSITS, AND CONTAMINATED SOILS TO PERMANENTLY REDUCE THEIR MOBILITY. HOWEVER, BECAUSE IN SITU SOLIDIFICATION IS STILL A DEVELOPING TECHNOLOGY, ITS FEASIBILITY WOULD HAVE TO BE FURTHER EXPLORED DURING THE PREDESIGN OR DESIGN STAGE. IT WOULD DESTROY IMPORTANT FISH AND WILDLIFE HABITAT AND NECESSITATE TREATMENT PONDS ELSEWHERE IN THE CLARK FORK RIVER BASIN. THE REMAINING ACTION ALTERNATIVES (ALTERNATIVES 2-6) INCLUDE MEASURES TO STABILIZE THE POND BERMS TO LIMIT THE MOBILITY OF THE SEDIMENTS AND SLUDGES BY IMPROVING THEIR EXISTING CONTAINMENT. ALTERNATIVES 2 THROUGH 6 ALSO INCLUDE MEASURES TO CONTAIN THE TAILINGS AND CONTAMINATED SOILS EXPOSED AT THE SURFACE THROUGHOUT THE OPERABLE UNIT EITHER ONSITE (ALTERNATIVES 3-6) OR OFFSITE (ALTERNATIVE 2).

OF THE ALTERNATIVES THAT DO NOT ELIMINATE THE EXISTING POND SYSTEM (ALTERNATIVES 2-7), ALTERNATIVE 2 OFFERS THE MOST PROTECTION AGAINST POND FAILURE BY PROTECTING THE POND BERMS AGAINST THE MAXIMUM EXPECTABLE FORCES -- A PROBABLE MAXIMUM FLOOD OR A MAXIMUM CREDIBLE EARTHQUAKE. ALTERNATIVES 3 THROUGH 6 PROTECT THE POND BERMS AGAINST AN MAXIMUM CREDIBLE EARTHQUAKE AND FRACTIONS OF A PROBABLE MAXIMUM FLOOD. OF THESE, ALTERNATIVE 3+3A WOULD BE THE MOST PROTECTIVE BECAUSE IT WOULD UPGRADE ALL THE PONDS TO WITHSTAND A 0.5 PMF, WHEREAS THE OTHER ALTERNATIVES WOULD UPGRADE PONDS 1, 2 AND 3 TO WITHSTAND A 0.2, 0.3, AND 0.5 PMF, RESPECTIVELY. IN ADDITION, ALTERNATIVE 3+3A IS MOST EFFECTIVE IN PRESERVING AND ENHANCING WETLANDS, AND CONTAINING THE 100-YEAR FLOOD WITHOUT CREATING NEW CONTAMINATED AREAS.

THE NO-ACTION ALTERNATIVE WOULD BE THE LEAST PROTECTIVE BY LEAVING THE BERMS IN THEIR PRESENT UNSTABLE STATE.

CONTAINMENT MEASURES FOR TAILINGS DEPOSITS AND CONTAMINATED SOILS ARE PROPOSED FOR ALTERNATIVES 2 THROUGH 6. IN GENERAL, THE CONTAINMENT MEASURES ARE NOT EXPECTED TO BE AS PROTECTIVE OR AS PERMANENT AS THE SOLIDIFICATION ACTION PROPOSED FOR ALTERNATIVE 1. THIS IS BECAUSE THE TAILINGS AND SOILS WOULD STILL EXIST IN A FORM THAT COULD, IN THEORY, BE DISTURBED BY SEVERE WEATHER OR OTHER FORCES, THOUGH THE PROBABILITY OF DISPERSAL OF THE CONTAMINANTS WOULD BE VERY LOW FOR MOST OF THESE ALTERNATIVES. ALTERNATIVE 2 INCLUDES OFFSITE DISPOSAL OF THE CONTAMINATED MATERIAL. THIS WOULD REMOVE THE DIRECT THREAT FROM THE SITE, BUT IT WOULD ALSO INTRODUCE NEW RISKS AND THE LIABILITY ASSOCIATED WITH THE OFFSITE DISPOSAL OF UNTREATED MATERIAL. ALTERNATIVE 3 WOULD CONSOLIDATE THE MATERIAL ONSITE UNDER A RCRA-COMPLIANT CAP. THIS COULD EFFECTIVELY CONTAIN THE MATERIAL WITHOUT INTRODUCING THE ADDITIONAL LIABILITIES AND RISKS OF OFFSITE DISPOSAL. ALTERNATIVES 3+3A WOULD CAP CONTAMINANTS WITHIN POND 1 AND DRY PORTIONS OF POND 3; IT WOULD ALSO FLOOD THE TAILINGS DEPOSITS AND CONTAMINATED SOILS IN POND 2. ALL OF THE CONTAMINATED MATERIALS WOULD BE IN FLOOD PROTECTED AREAS. THE EXPOSED TAILINGS WITHIN POND 3 WOULD NOT BE REMEDIATED AT THE PRESENT TIME BECAUSE THIS WILL BE AN ACTIVE AREA OF THE POND. FLOODS UP TO THE 100-YEAR FLOOD WILL BE ROUTED INTO POND 3 RESULTING IN OCCASIONAL FLOODING OF SOME OF THESE TAILINGS. ALTERNATIVES 4 AND 5 WOULD CAP IN PLACE ALL OF THE MATERIAL POSSIBLE. LESS PROTECTIVE CAPS WOULD BE USED, AND THE LACK OF CONSOLIDATION WOULD INCREASE MAINTENANCE COSTS AND THE POTENTIAL FOR CAP FAILURE. ALTERNATIVE 6, FLOODING, IS THE LEAST PROTECTIVE OF THE ACTION ALTERNATIVES. FLOODING THESE MATERIALS WOULD LIMIT DIRECT CONTACT BUT MAY INCREASE MOBILITY. ALTERNATIVE 7 DOES NOT ADDRESS THE RISKS ASSOCIATED WITH THE TAILINGS DEPOSITS AND CONTAMINATED SOILS.

THE SURFACE WATER AND GROUND WATER ACTIONS INCLUDED AS PARTS OF ALTERNATIVES 1 AND 2 AND 3+3A WOULD PROVIDE THE MOST EFFECTIVE AND MOST COMPREHENSIVE TREATMENT FOR SURFACE WATER AND GROUND WATER OF THE SEVEN ALTERNATIVES. SURFACE WATER TREATMENT IN AN UPGRADED POND SYSTEM WOULD BE PROVIDED FOR ALL FLOWS UP TO THE VOLUME OF A 100-YEAR FLOOD (13,000 ACRE-FEET) OR UNTIL THE MAXIMUM FLOW OF 3,300 CFS HAD BEEN REACHED. WITH APPROPRIATE DESIGN AND OPERATION, WATER QUALITY AMBIENT AND POINT SOURCE DISCHARGE STANDARDS SHOULD BE MET FOR NEARLY ALL FLOWS UP TO THE 100-YEAR FLOOD EVENT. ALTERNATIVES 3, 4, 5, AND 6 INCLUDE VARIOUS LEVELS OF POND TREATMENT, DECREASING IN THE DEGREE OF EFFECTIVENESS. ALTERNATIVES 3 AND 4 WOULD PROVIDE SUSPENDED SOLIDS TREATMENT FOR FLOOD FLOWS BETWEEN 600 AND 4,000 CFS. EXCEPT FOR 2,000 ACRE-FEET STORED IN THE SETTLING BASIN, FLOWS ABOVE 600 CFS WOULD NOT BE TREATED FOR DISSOLVED METALS. ALTERNATIVE 5 WOULD UPGRADE THE POND SYSTEM, BUT IT WOULD ONLY ACCEPT FLOWS UP TO 210 CFS FOR DISSOLVED METALS

TREATMENT. AGAIN, EXCEPT FOR 2,000 ACRE-FEET STORED IN THE SETTLING BASIN, FLOWS BETWEEN 210 AND 4,000 CFS WOULD RECEIVE TREATMENT FOR SUSPENDED SOLIDS ONLY. THE LACK OF DISSOLVED METALS TREATMENT FOR ABOVE-AVERAGE FLOWS WOULD LEAD TO INCREASED VIOLATIONS OF WATER QUALITY STANDARDS FOR FLOWS OUT OF THE OPERABLE UNIT. BECAUSE OF THE DECREASES IN LEVELS OR VOLUME OF TREATMENT, WATER QUALITY STANDARDS WOULD BE VIOLATED WITH GREATER FREQUENCY FOR EACH DECREASE IN THE UPGRADE OF THE TREATMENT SYSTEM. ALTERNATIVES 6 AND 7 WOULD LIKELY EXPERIENCE REGULAR VIOLATIONS DURING ABOVE AVERAGE FLOWS.

TRENCH DRAINS FOR GROUND WATER COLLECTION AND TREATMENT ARE INCLUDED AS PART OF ALL SEVEN ACTION ALTERNATIVES. ALTERNATIVES 1, 2, 3, AND 4 INCLUDE TRENCH DRAINS BOTH IN AND BELOW POND 1. ALTERNATIVE 3+3A INCLUDES AN INTERCEPTION TRENCH BELOW POND 1 AND FURTHER EXAMINATION OF THE NEED FOR ADDITIONAL TRENCHES, SUCH AS IN POND 1. ALTERNATIVES 5 AND 6 ONLY CALL FOR A SINGLE DRAIN BELOW POND 1. A SINGLE DRAIN WOULD EFFECTIVELY LIMIT THE OFFSITE MIGRATION OF CONTAMINATED GROUNDWATER BUT WOULD NOT AID ATTEMPTS TO DEWATER POND 1. ALTERNATIVES 1 THROUGH 4 WOULD TREAT THE GROUNDWATER IN THE POND SYSTEM. ALTERNATIVES 5 AND 6 INCLUDE THE ADDITION OF ONSITE WETLANDS FOR TREATMENT. THE WETLANDS SYSTEM WOULD DECREASE PUMPING REQUIREMENTS BUT COULD INCREASE TREATMENT OPERATION AND MAINTENANCE REQUIREMENTS AND LEAD TO FURTHER CONTAMINATION OF THE SOIL AND GROUND WATER AT THE LOWER END OF THE SITE.

IN GENERAL, PERMANENCE OF THE REMEDIAL ACTIONS IS GREATEST FOR THE MORE COMPREHENSIVE ALTERNATIVES. THE SOLIDIFICATION OF POND BOTTOM SEDIMENTS IS THE ONLY ALTERNATIVE THAT WOULD PERMANENTLY LIMIT THE MOBILITY OF THE POND BOTTOM SEDIMENTS. ACTIONS TO STABILIZE THE POND BERMS (ALTERNATIVES 2 THROUGH 6) WOULD PROTECT THE SEDIMENTS AS LONG AS THEY ARE MAINTAINED BUT WOULD NOT PERMANENTLY AFFECT THE SEDIMENTS THEMSELVES.

SURFACE WATER TREATMENT WOULD CONTINUE FOR AS LONG AS THE PONDS ARE FUNCTIONAL. UNDER CURRENT CONDITIONS, THE ESTIMATED LIFE OF POND 3 IS APPROXIMATELY 10 TO 25 YEARS. THE NEW TREATMENT POND (ALTERNATIVE 1) COULD BE CONSTRUCTED WITH AN ESTIMATED LIFE OF UP TO 100 YEARS. THE INCREASED POND VOLUMES ESTABLISHED WITH ALTERNATIVE 3+3A WOULD SIGNIFICANTLY INCREASE THE ESTIMATED LIFE POND 3. HOWEVER, ANY INCREASE IN ESTIMATED LIFE WOULD RESULT IN DECREASED STORAGE CAPACITY FOR FLOOD FLOWS.

THE PERMANENCE OF EFFORTS TO CLEANUP THE BYPASS WOULD DEPEND ON EFFORTS TO KEEP THE BYPASS FREE OF FUTURE DEPOSITION. ALTERNATIVES 1 AND 2, AND 3+3A OFFER THE GREATEST EFFECTIVENESS, CONTAINING AND TREATING ALL FLOWS UP TO THE 100-YEAR EVENT. FOR ALTERNATIVES 3, 4, AND 5, FLOWS UP TO THE 100-YEAR EVENT WOULD HAVE UP TO 80 PERCENT OF THE SUSPENDED SOLIDS LOAD REMOVED.

THE PERMANENCE OF SOILS AND TAILINGS REMEDIATION IS GREATEST FOR ALTERNATIVE 1 BECAUSE ALL CONTAMINATED MATERIAL WOULD BE SOLIDIFIED IN THE PONDS. ALTERNATIVES 2 AND 3 WOULD CONTAIN THE MATERIAL IN SEVERAL CONSOLIDATED UNITS THAT WOULD REDUCE MAINTENANCE REQUIREMENTS AND AID PERMANENCE. THE PERMANENCE OF CAPPING IN-PLACE OR FLOODING (ALTERNATIVES 4 THROUGH 6) IS MUCH MORE DEPENDENT ON THE CONTINUED MAINTENANCE OF THE CAP OR COVER.

#### **COMPLIANCE WITH ARARS**

ALL OF THE ALTERNATIVES WOULD COMPLY WITH MOST OF THE ARARS AND REPLACEMENT STANDARDS, EXCEPT FOR SURFACE WATER ARARS. ALL OF THE ALTERNATIVES WOULD CONTROL NON-POINT SOURCE CONTAMINATION FROM THE BYPASS, AND CONTRIBUTE TO OVERALL SURFACE WATER ARAR COMPLIANCE. ALTERNATIVE 1, 2, AND 3+3A WOULD RESULT IN COMPLIANCE WITH POINT SOURCE DISCHARGE ARARS FOR SURFACE WATER IN NORMAL CONDITIONS, AND WOULD ENSURE COMPLIANCE UP TO 100 YEAR FLOOD FLOWS, BY TRAPPING THOSE FLOWS IN FULL TREATMENT SYSTEMS. ALTERNATIVES 3 AND 4 WOULD RESULT IN COMPLIANCE WITH POINT SOURCE DISCHARGE ARARS, BUT WOULD FULLY CAPTURE ONLY LIMITED FLOOD EVENTS, AND WOULD NOT ACHIEVE ARARS COMPLIANCE FOR SURFACE WATER DURING OTHER FLOOD EVENTS. ALTERNATIVES 5 AND 6 WOULD NOT ACHIEVE COMPLIANCE WITH POINT SOURCE DISCHARGE ARARS DURING CERTAIN TIMES, AND WOULD NOT ACHIEVE COMPLIANCE WITH SURFACE WATER ARARS DURING CERTAIN FLOOD EVENTS. (ALTERNATIVE 7, THE NO ACTION ALTERNATIVE, WOULD NOT ACHIEVE COMPLIANCE WITH ANY OF THE IDENTIFIED ARARS.)

ALTERNATIVES 5 AND 6 WOULD NOT ACHIEVE COMPLIANCE WITH FLOODPLAIN MANAGEMENT REQUIREMENTS. ALTERNATIVES 1, 2, 3+3A, AND 4 WOULD COMPLY WITH THESE ARARS.

TABLE 5 SUMMARIZES EACH ALTERNATIVE'S COMPLIANCE WITH FEDERAL AND MONTANA ARARS. A COMPLETE LIST OF ARARS IS FOUND IN ATTACHMENT 1.

## LONG-TERM EFFECTIVENESS AND PERMANENCE

THE RESIDUAL RISKS THAT WOULD REMAIN AFTER IMPLEMENTATION OF EACH OF THE ALTERNATIVES INCREASE FROM ALTERNATIVE 1 THROUGH THE NO-ACTION ALTERNATIVE (ALTERNATIVE 7), WHICH INVOLVES THE GREATEST RESIDUAL RISK. ALTERNATIVE 1 WOULD RESULT IN THE LEAST RESIDUAL RISK BECAUSE THE MEASURES IT INCLUDES TO ELIMINATE OR CONTAIN THE RISKS ARE MORE COMPREHENSIVE THAN ANY OF THE OTHER ALTERNATIVES. THIS IS PRIMARILY THE CASE IN REGARDS TO THE POND BOTTOM SEDIMENTS AND THE TAILINGS AND CONTAMINATED SOILS. ALTERNATIVE 1 IS THE ONLY ALTERNATIVE TO INCLUDE TREATMENT (SOLIDIFICATION) OF THESE MATERIALS.

ALTHOUGH ALTERNATIVE 2 WOULD NOT REDUCE THE RESIDUAL RISK TO THE SAME RISK LEVEL AS ALTERNATIVE 1, IT WOULD PROTECT THE PONDS FROM THE THREAT OF FAILURE TO A GREATER EXTENT THAN THE REMAINING ALTERNATIVES, AND IT WOULD REMOVE THE MAJORITY OF THE CONTAMINATED SOILS AND TAILINGS FROM THE SITE. THE RESIDUAL RISK IN ALTERNATIVE 2 RESULTS FROM THE PRESENCE OF THE UNTREATED POND BOTTOM SEDIMENTS ONSITE.

ALTERNATIVES 3 THROUGH 6, IN TURN, CONTAIN A SLIGHTLY HIGHER LEVEL OF RESIDUAL RISK FROM THE POND BOTTOM SEDIMENTS BECAUSE THE POND BERMS WOULD BE PROTECTED AGAINST ONLY A FRACTION OF A PMF, RATHER THAN A FULL PMF (ALTERNATIVE 2). HOWEVER, THE PROBABILITY OF A CATASTROPHIC FAILURE OF THE POND BERMS DURING A FLOOD WOULD STILL BE SMALL BECAUSE THE LIKELIHOOD OF EVEN A 0.2 PMF IS QUITE SMALL. (NO SPECIFIC RETURN INTERVALS ARE ASSOCIATED WITH PROBABLE MAXIMUM FLOODS, THOUGH THEIR PROBABILITY OF OCCURRENCE IS ONLY ONCE IN SEVERAL THOUSAND YEARS.) ALTERNATIVE 7, WHICH WOULD NOT FURTHER STABILIZE THE POND BERMS, WOULD CARRY THE GREATEST RESIDUAL RISK OF FLOOD DAMAGE TO THE PONDS. THE EXTENT AT ENVIRONMENTAL DAME THAT WOULD RESULT FROM A POND FAILURE WOULD ALSO INCREASE OVER TIME WITH ALTERNATIVE 7 BECAUSE OF THE CONTINUED DEPOSITION OF SEDIMENTS WITHIN THE POND.

ALTERNATIVES 1 AND 2, AND 3+3A WOULD CARRY THE LEAST RESIDUAL RISK RESULTING FROM SURFACE WATER AND GROUNDWATER CONTAMINATION. BOTH ALTERNATIVES INCLUDE MEASURES TO TREAT BASICALLY ALL FLOWS LESS THAN A 100-YEAR FLOOD PASSING THROUGH OR FROM THE SYSTEM. SURFACE WATER FLOWS UP TO A 100-YEAR FLOOD FLOW WOULD BE DETAINED AND TREATED FOR SUSPENDED SOLIDS AND DISSOLVED METALS. ONLY FLOWS GREATER THAN 100-YEAR FLOOD FLOW WOULD PASS THROUGH THE SYSTEM UNTREATED.

THE RESIDUAL RISKS ASSOCIATED WITH CONTAMINATED SURFACE WATER INCREASE WITH EACH OF THE REMAINING ALTERNATIVES. ALTERNATIVES 3 AND 4, ALTHOUGH TREATING MOST FLOWS IN AN UPGRADED TREATMENT SYSTEM, INCLUDE ONLY SUSPENDED SOLIDS TREATMENT FOR FLOWS BETWEEN 600 AND 4,000 CFS THAT EXCEED 2,000 ACRE-FEET. ALTERNATIVES 5 AND 6 RETAIN THE CURRENT POND SYSTEM WITH A FEW MODIFICATIONS AND WOULD ONLY ALLOW DISSOLVED METALS TREATMENT IN THE PONDS FOR FLOWS UP TO 210 CFS BECAUSE OF THE CAPACITY LIMITATIONS OF POND 2. FOR ALTERNATIVE 5, FLOWS BETWEEN 210 AND 4,000 CFS WOULD BE TREATED FOR SUSPENDED SOLIDS IN THE UPSTREAM SETTLING BASIN. UP TO 2,000 ACRE-FEET OF THE FLOW WOULD BE RETAINED AND COULD BE METERED SLOWLY INTO THE PONDS FOR DISSOLVED METALS TREATMENT, IF REQUIRED. THE MODIFICATION OF THE CURRENT POND SYSTEM IN ALTERNATIVES 5 AND 6 ALSO WOULD NOT ADDRESS THE PROBLEM OF POTENTIAL SHORT-CIRCUITING IN THE PONDS. SHORT-CIRCUITING DECREASES THE EFFECTIVENESS OF THE PONDS. ALTERNATIVE 6, WHICH DOES NOT INCLUDE ANY TREATMENT FOR FLOWS GREATER THAN THE CURRENT CAPACITY OF THE TREATMENT SYSTEM (210 CFS), MAY EVENTUALLY RESULT IN THE RECONTAMINATION OF THE BYPASS AND THE AREA BELOW POND 1.

WATER QUALITY STANDARDS FOR AMBIENT AND POINT SOURCE DISCHARGES SHOULD BE MET FOR ALL FLOWS UP TO AT LEAST 1-YEAR FLOOD FOR ALTERNATIVES 1,2, AND 3+3A. ALTERNATIVES 3 AND 4 MAY EXCEED THESE WATER QUALITY STANDARDS DURING FLOWS ABOVE 600 CFS. ALTERNATIVES 5, 6, AND 7 WOULD EXPERIENCE MORE FREQUENT VIOLATIONS AND VIOLATIONS AT LOWER FLOWS THAN ALTERNATIVES 1 THROUGH 4.

BOTH OF THE GROUNDWATER TREATMENT ACTIONS SHOULD BE ABLE TO MEET THE APPROPRIATE TREATMENT STANDARDS IN THE LONG TERM. HOWEVER, PUMPING THE COLLECTED GROUNDWATER TO POND 3 FOR TREATMENT (ALTERNATIVES 1 THROUGH 4) WOULD REQUIRE LESS STARTUP EFFORT AND LESS LONG-TERM OPERATION AND MAINTENANCE. THE WETLAND SYSTEM (ALTERNATIVES 5 AND 6) WOULD REQUIRE PERIODIC MAINTENANCE AND/OR REPLACEMENT OF VEGETATION, AND MORE INTENSIVE CARE DURING WINTER MONTHS THAN THE PUMPING OPTION. THE ADDITION OF THE WETLANDS WOULD ALSO RESULT IN THE EVENTUAL RECONTAMINATION OF SOILS, SEDIMENTS, AND GROUNDWATER IN THE TREATMENT AREA, WHICH MAY REQUIRE FUTURE REMEDIATION DURING SYSTEM CLOSURE.

THE OPERATION AND MAINTENANCE REQUIREMENTS FOR ALL OF THE ACTION ALTERNATIVES WOULD BE FAIRLY CONSTANT, BECAUSE MOST OF THE REQUIREMENTS WOULD BE RELATED TO THE WATER TREATMENT SYSTEMS.

ALTERNATIVES 1 AND 2 WOULD REQUIRE SOMEWHAT GREATER OPERATION AND MAINTENANCE THAN ALTERNATIVES 3, 4, 5, AND 6 WITH RESPECT TO THE REQUIREMENTS OF THE UPSTREAM FLOOD IMPOUNDMENT. ALTERNATIVES 3, 4, AND 5 WOULD HAVE LESS SUBSTANTIAL OPERATION AND MAINTENANCE REQUIREMENTS ASSOCIATED WITH THE UPSTREAM SETTLING BASIN. ALTERNATIVE 3+3A WOULD NOT INVOLVE OPERATION AND MAINTENANCE OF A SEPARATE FLOOD DETENTION BASIN. ALTERNATIVE 6 WOULD REQUIRE THE PERIODIC REMOVAL OF TAILINGS FROM THE BYPASS. ALTERNATIVES 5 AND 6 INCLUDE A WETLANDS TREATMENT SYSTEM THAT WOULD REQUIRE SOME OPERATION AND MAINTENANCE. ALTERNATIVES 3 THROUGH 5 INCLUDE ONSITE CAPPING OF CONTAMINATED MATERIAL. MAINTENANCE OF THE CAP(S) WILL ALSO INCREASE THE OPERATION AND MAINTENANCE REQUIREMENTS. ALTERNATIVE 3, WHICH WOULD CONSOLIDATE THE CONTAMINATED MATERIAL UNDER A SINGLE RCRA-COMPLIANT CAP, WOULD HAVE LESS MAINTENANCE REQUIREMENTS THAN THE ALTERNATIVES THAT WOULD CAP THE MATERIAL IN PLACE. FLOODING THE CONTAMINANTS (ALTERNATIVE 6) WOULD POTENTIALLY HAVE THE GREATEST MAINTENANCE COSTS WHILE OFFERING THE LEAST PROTECTION.

MONITORING REQUIREMENTS WOULD BASICALLY BE THE SAME FOR ALL ALTERNATIVES, LIMITED TO ENSURING CONFORMANCE WITH SURFACE AND GROUNDWATER STANDARDS. NO MONITORING ABOVE THE CURRENT MPDES MONITORING REQUIREMENTS WOULD BE ADDED WITH ALTERNATIVE 7, NO-ACTION.

#### **REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT**

ALTERNATIVE 1 IS THE ONLY ALTERNATIVE TO USE TREATMENT IN THE REMEDIATION OF POND BOTTOM SEDIMENTS AND CONTAMINATED SOILS AND TAILINGS. THIS TREATMENT WOULD REDUCE THE MOBILITY OF THESE MATERIALS BY SOLIDIFYING THE SEDIMENTS IN PLACE. IT WOULD ALSO DECREASE THE POTENTIAL FOR LEACHING METALS FROM THE SEDIMENT. A DRAWBACK TO THE IN SITU SOLIDIFICATION PROCESS IS THAT IT WOULD SUBSTANTIALLY INCREASE THE TOTAL VOLUME OF THE POND BOTTOM MATERIAL. APPROXIMATELY 2 CUBIC YARDS OF SOLIDIFICATION AGENTS WOULD HAVE TO BE ADDED TO EVERY 1 YARD OF SEDIMENTS TREATED IN THE WET PORTIONS OF THE PONDS, THUS TRIPLING THE VOLUME OF THE SEDIMENTS IN THESE AREAS.

THE REMAINING ACTION ALTERNATIVES WOULD CONTAIN BUT WOULD NOT TREAT THE POND BOTTOM SEDIMENTS. THE CONTAINMENT ACTIONS WOULD REDUCE THE SEDIMENTS' MOBILITY TO A LESSER EXTENT THAN ALTERNATIVE 1 BECAUSE THEY STABILIZE THE CONTAINMENT STRUCTURES BUT NOT THE MATERIAL ITSELF. THE CONTAINMENT ACTIONS WOULD NOT AFFECT THE TOXICITY OR VOLUME OF THE MATERIAL. ALTERNATIVE 2 INCLUDES THE MOST STRINGENT OF THE CONTAINMENT ACTIONS, STABILIZING THE EXISTING POND BERMS AGAINST THE LARGEST EXPECTABLE FORCES, A PROBABLE MAXIMUM FLOOD AND AN MAXIMUM CREDIBLE EARTHQUAKE. THE REMAINING ACTION ALTERNATIVES WOULD LIMIT THE MOBILITY OF THE POND BOTTOM MATERIAL DURING EVENTS UP TO A FULL MAXIMUM CREDIBLE EARTHQUAKE AND A FRACTION OF A PROBABLE MAXIMUM FLOOD. THE NO-ACTION ALTERNATIVE WOULD NOT AFFECT THE TOXICITY, MOBILITY, OR VOLUME OF THE POND BOTTOM MATERIAL.

REMEDICATION OPTIONS PROPOSED FOR THE TAILINGS AND CONTAMINATED SOILS ALSO VARY IN THEIR EFFECTIVENESS IN LIMITING THE FUTURE MOBILITY OF THE MATERIAL. THROUGH OFFSITE DISPOSAL OF A MAJORITY OF THESE MATERIALS, ALTERNATIVE 2 REMOVES THE THREAT OF REMOBILIZATION AT THE SITE, ALTHOUGH THE MATERIAL WOULD CONTINUE TO EXIST IN AN UNTREATED STATE AT A SEPARATE SITE. ALTERNATIVE 3 OFFERS THE BEST ONSITE REDUCTION IN MOBILITY THROUGH CONSOLIDATION FOLLOWED BY CONTAINMENT UNDER A RCRA-EQUIVALENT CAP. ALTERNATIVE 3+3A INCORPORATES TAILINGS AND CONTAMINATED SOILS DISPOSAL IN PONDS 1 AND 3 UNDER A PROTECTIVE SOIL COVER, REVEGETATED WITH NATIVE GRASSES. ALTERNATIVES 4 AND 5 WOULD ALSO REDUCE THE MOBILITY OF THE MATERIAL, ALTHOUGH NOT TO THE SAME EXTENT AS ALTERNATIVE 3. ALTERNATIVE 3+3A AND 6 WOULD NOT GREATLY REDUCE THE MOBILITY OF THE CONTAMINATED TAILINGS AND SOILS THAT WOULD BE FLOODED, ALTHOUGH THEY WOULD REDUCE THE THREAT OF DIRECT CONTACT.

ALL OF THE ACTION ALTERNATIVES INCLUDE TREATMENT TO REDUCE THE TOXICITY OF THE SURFACE WATER TO SOME DEGREE. THE ALTERNATIVES DIFFER IN THE AMOUNT AND LEVEL OF TREATMENT. ALTERNATIVES 1 AND 2, AND 3+3A INCLUDE TREATMENT TO REDUCE THE TOXICITY OF CONTAMINATED WATER FOR ALL FLOW CONDITIONS UP TO A 100-YEAR FLOOD. FLOWS ABOVE THE 100-YEAR FLOOD FLOW WOULD BYPASS THE SYSTEM UNTREATED.

THE REMAINING ALTERNATIVES REDUCE THE TOXICITY OF THE SURFACE WATER TO A LESSER EXTENT. FOR ALTERNATIVES 3 AND 4, ONLY FLOWS BELOW 600 CFS AND 2,000 ACRE-FEET OF FLOWS ABOVE 600 CFS WOULD BE TREATED IN THE POND SYSTEM FOR SUSPENDED SOLIDS AND DISSOLVED METALS. FLOWS BETWEEN 600 AND 4,000 CFS WOULD BE TREATED FOR SUSPENDED SOLIDS ONLY IN THE UPSTREAM IMPOUNDMENT. ALTERNATIVES 5 AND 6 RETAIN THE PRESENT POND SYSTEM WITH A FEW MODIFICATIONS TO IMPROVE TREATMENT. ALTERNATIVE 5 INCLUDES A SETTLING BASIN TO CONTAIN UP TO 2,000 ACRE-FEET AND TREAT FLOWS BETWEEN 210 AND 4,000 CFS FOR SUSPENDED SOLIDS. FLOWS ABOVE 210 CFS WOULD NOT BE TREATED FOR DISSOLVED

METALS. ALTERNATIVE 6 DOES NOT INCLUDE ANY TREATMENT FOR FLOWS GREATER THAN THE CAPACITY OF THE CURRENT POND TREATMENT, 210 SYSTEM.

#### **SHORT-TERM EFFECTIVENESS**

MOST OF THE COMPONENTS OF THE ACTION ALTERNATIVES WOULD TAKE 2 TO 3 YEARS TO COMPLETE. THE COMPONENTS ARE SIMILAR FOR THE MOST PART, VARYING PRIMARILY IN SIZE OR LAYOUT. THE SOLIDIFICATION OF THE POND BOTTOM SEDIMENTS IS AN EXCEPTION TO THIS. ALTERNATIVE 1 WOULD REQUIRE APPROXIMATELY 17 YEARS TO COMPLETE BECAUSE OF THE LARGE VOLUME OF SOILS AND SEDIMENTS TO BE SOLIDIFIED. ALTHOUGH THE STABILITY OF THE SEDIMENTS WOULD INCREASE DURING THE SOLIDIFICATION PROCESS, IT WOULD STILL TAKE A SUBSTANTIALLY LONGER TIME TO REACH COMPLETE PROTECTION FROM ALTERNATIVE 1 THAN FROM ANY OF THE OTHER ALTERNATIVES.

THE WETLANDS TREATMENT SYSTEM INCLUDED AS PART OF ALTERNATIVES 5 AND 6 MAY NEED UP TO 5 YEARS STARTUP TIME TO REACH THE DESIGN OBJECTIVES OF THE SYSTEM. THIS TIME IS NEEDED TO ESTABLISH PLANT SPECIES IN THE SYSTEM IN ORDER TO REALIZE EFFECTIVE TREATMENT. NONE OF THE OTHER TREATMENT COMPONENTS INCLUDED WITH THE ALTERNATIVES WOULD REQUIRE AN EXTENDED STARTUP PERIOD, THOUGH OPTIMIZING OPERATION OF A MODIFIED OR NEW POND TREATMENT SYSTEM MAY REQUIRE A FULL YEAR OR MORE OF OPERATIONAL EXPERIENCE.

ALTERNATIVE 2 WOULD HAVE SUBSTANTIAL IMPACTS ON THE AREA, BY CAUSING TRUCKS CARRYING CONTAMINATED SOILS TO TRAVEL ON PUBLIC ROADS.

NONE OF THE ACTION ALTERNATIVES ARE EXPECTED TO SUBSTANTIALLY AFFECT THE COMMUNITY OF WARM SPRINGS DURING REMEDIATION. LOCAL RELEASES OF METAL-CONTAMINATED TAILINGS OR DUST WOULD LIKELY OCCUR DURING CONSTRUCTION WORK CARRIED OUT IN CONTAMINATED AREAS, BUT SUCH RELEASES WOULD BE MINIMIZED BY DUST CONTROL TECHNIQUES AND WOULD NOT BE EXPECTED TO AFFECT THE COMMUNITY. THERE IS ALSO THE POTENTIAL FOR SHORT-TERM VIOLATIONS OF THE WATER QUALITY STANDARDS AT THE COMPLIANCE POINT AS A RESULT OF REMEDIATION WORK IN OR ADJACENT TO THE BYPASS AND STREAM BEDS. THOSE VIOLATIONS WOULD DIFFER SOMEWHAT BETWEEN ALTERNATIVES AND COULD BE MINIMIZED THROUGH USE OF SEDIMENTATION BARRIERS AND SEDIMENTATION PONDS.

CONSTRUCTION CONTRACTORS WOULD NEED PROTECTION AGAINST DERMAL AND RESPIRATORY EXPOSURE TO THE TAILINGS WHILE WORKING IN CONTAMINATED AREAS. DERMAL THREATS COULD BE CONTROLLED USING LONG-SLEEVE PROTECTIVE CLOTHING, AND INHALATION THREATS COULD BE CONTROLLED USING APPROPRIATE DUST OR FACE MASKS. HEALTH RISKS TO OPERATION AND MAINTENANCE WORKERS WOULD BE SUBSTANTIALLY LESS THAN FOR SUCH WORKERS UNDER THE EXISTING CONDITIONS (SEE THE PHEA, APPENDIX A OF THE WARM SPRINGS PONDS OPERABLE UNIT FEASIBILITY STUDY). THESE RISKS WOULD BE SIMILAR FOR ALL ALTERNATIVES.

PLANNING FOR ALL REMEDIATION ACTIVITIES WOULD HAVE TO CONSIDER POTENTIAL IMPACTS TO A PAIR OF BALD EAGLES, WHICH ARE PROTECTED UNDER THE ENDANGERED SPECIES ACT, THAT HAVE PREVIOUSLY NESTED WITHIN THE OPERABLE UNIT. THE EAGLES ARE NOT CURRENTLY NESTING WITHIN THE OPERABLE UNIT BUT THEY CONTINUE TO USE THE PONDS AS A FOOD SOURCE DURING THE SUMMER MONTHS. ONLY ALTERNATIVE 1 WOULD SUBSTANTIALLY AFFECT THIS FOOD SOURCE. IF THE EAGLES RETURN TO NESTING IN THE AREA SURROUNDING THE PONDS, STEPS WOULD BE REQUIRED TO MINIMIZE ANY IMPACT RESULTING FROM CONSTRUCTION. THIS WOULD BE DONE DURING PROJECT PLANNING IN THE DESIGN AND CONSTRUCTION PHASE OF REMEDIATION. WITH ATTENTION TO THE NECESSARY CONTROLS, ADVERSE IMPACTS TO THE EAGLES CAN LIKELY BE AVOIDED. THIS WOULD BE TRUE FOR ALL SEVEN OF THE ACTION ALTERNATIVES.

ENVIRONMENTAL IMPACTS TO THE OPERABLE UNIT WOULD BE GREATEST FOR ALTERNATIVE 1 BECAUSE OF THE IN SITU SOLIDIFICATION PROCESS PROPOSED FOR THE EXISTING PONDS. SOLIDIFICATION OF THE EXISTING PONDS WOULD ALTER SEVERAL HUNDRED ACRES OF LAND THAT IS CURRENTLY WETLAND WILDLIFE HABITAT. PRIOR TO SOLIDIFICATION, THE PONDS WOULD BE DRAINED; ABOUT 17 YEARS LATER, FOLLOWING SOLIDIFICATION AND COVERING WITH SOIL AND VEGETATION, THEY WOULD BE LEFT AS DRY, VEGETATED TERRESTRIAL HABITAT. SOME OF THE LOST OPEN-WATER HABITAT WOULD BE REPLACED BY THE NEW TREATMENT POND, WHICH WOULD BE CONSTRUCTED UPSTREAM OF THE PRESENT PONDS. THE NEW FLOOD IMPOUNDMENT POND, ALTHOUGH NOT TYPICALLY CONTAINING WATER, WOULD PERMANENTLY REMOVE APPROXIMATELY 1,000 ACRES OF RANGELAND FROM USE, BRINGING THE TOTAL ACREAGE AFFECTED BY THIS ALTERNATIVE TO APPROXIMATELY 2,250 ACRES.

THE REMAINDER OF THE ALTERNATIVES WOULD NOT SIGNIFICANTLY AFFECT THE ENVIRONMENT IN AND AROUND THE POND SYSTEM ON A LONG-TERM BASIS, EXCEPT FOR THE LOSS OF WETLANDS IN POND 1 AND THE EFFECTS

OF THE UPSTREAM IMPOUNDMENTS. THE FLOOD IMPOUNDMENT, AS DISCUSSED ABOVE, WOULD AFFECT APPROXIMATELY 1,000 ACRES. THE SMALLER SETTLING BASIN (ALTERNATIVES 3 THROUGH 5) WOULD AFFECT APPROXIMATELY 500 ACRES. ALTERNATIVES 2 THROUGH 6 (EXCEPT 3+3A) WOULD AFFECT THE LOCAL ENVIRONMENT DURING IMPLEMENTATION AS A RESULT OF CONSTRUCTION ACTIVITIES. THESE ALTERNATIVES WOULD AFFECT THE SURROUNDING WILDLIFE HABITAT WITH INCREASED NOISE AND DUST LEVELS. SOME HABITAT WOULD ALSO BE TEMPORARILY DESTROYED AS A RESULT OF NECESSARY EARTHWORK. THESE IMPACTS WOULD LIKELY BE SHORT-LIVED AND THE AREAS RETURNED TO THEIR PRECONSTRUCTION CONDITION FAIRLY QUICKLY.

#### **IMPLEMENTABILITY**

FOR THE MOST PART, THERE IS NOT A GREAT DEAL OF DIFFERENCE IN THE IMPLEMENTABILITY OF THE SEVEN ACTION ALTERNATIVES. MOST OF THE COMPONENTS PROPOSED AS PART OF THE ALTERNATIVES ARE WELL-DEVELOPED TECHNOLOGIES, USED TO SOME EXTENT IN EITHER THE HAZARDOUS WASTE, WATER, OR STANDARD CIVIL ENGINEERING DISCIPLINES. THE TECHNICAL FEASIBILITY OF THESE COMPONENTS APPEARS TO BE GOOD. THE EXCEPTIONS ARE THE TWO INNOVATIVE COMPONENTS INCLUDED AS PART OF A NUMBER OF THE ALTERNATIVES: IN SITU SOLIDIFICATION, AND WETLANDS TREATMENT FOR METALS REMOVAL.

THE TECHNICAL FEASIBILITY OF IN SITU POND BOTTOM SOLIDIFICATION (ALTERNATIVE 1) IS NOT KNOWN FOR CERTAIN AT THIS TIME. IT HAS BEEN USED WITH SUCCESS TO SOLIDIFY MARSHLANDS FOR FOUNDATION STABILIZATION IN JAPAN, BUT IT HAS NOT BEEN USED EXTENSIVELY ON HAZARDOUS WASTE SITES. CONSEQUENTLY, IT HAS A GREATER RISK OF IMPLEMENTATION DIFFICULTIES AND FAILURE THAN ANY OF THE OTHER MEDIA-SPECIFIC ACTIONS PROPOSED FOR THE POND BOTTOM SEDIMENTS. IF IT FAILS TO ADEQUATELY SOLIDIFY THE POND BOTTOMS, FOR WHATEVER REASON, ADDITIONAL STABILIZATION OF THE POND BERMS (AS IN ALTERNATIVES 2 THROUGH 6) WOULD BE NECESSARY.

WETLANDS TREATMENT (ALTERNATIVES 5 AND 6) HAS BEEN USED WITH SOME SUCCESS FOR REMOVING METALS LOADINGS FROM ACID MINE DRAINAGE, AND ITS TECHNICAL FEASIBILITY IS SOMEWHAT MORE DEFINED THAN IN SITU SOLIDIFICATION. HOWEVER, BECAUSE EFFECTIVE TREATMENT RELIES ON THE DEVELOPMENT OF A RESILIENT LIVING ECOSYSTEM IN THE WETLAND, THE IMPLEMENTATION OF AN EFFECTIVE WETLAND COULD PROVE DIFFICULT AND/OR TIME CONSUMING. THE EFFECTIVENESS OF THE WETLANDS SYSTEM ALSO DEPENDS TO SOME EXTENT ON THE WEATHER. A LARGE WINTER BUILDUP OF ICE COULD RESULT IN SEVERE SHORT-CIRCUITING IN THE WETLAND, DECREASING THE OBSERVED REMOVAL EFFECTIVENESS. THE TECHNICAL FEASIBILITY OF THE OTHER GROUNDWATER TREATMENT COMPONENT. WHICH RELIES ON TREATMENT IN THE POND SYSTEM (ALTERNATIVES 1-4), IS GREATER.

THE TECHNICAL FEASIBILITY OF THE REMAINDER OF THE COMPONENTS WOULD BE ABOUT EQUAL. PROTECTING THE POND BERMS AGAINST A FRACTION OF A PMF (ALTERNATIVES 3-6) WOULD BE MORE FEASIBLE THAN PROTECTING THE BERMS FROM A FULL PMF (ALTERNATIVE 2) SIMPLY BECAUSE OF THE MAGNITUDE OF THE PROJECT. THE SAME HOLDS TRUE FOR THE UPSTREAM SETTLING BASIN (ALTERNATIVES 3, 4 AND 5) VERSUS THE UPSTREAM FLOOD IMPOUNDMENT (ALTERNATIVES 1 AND 2). BECAUSE THE SETTLING BASIN WOULD BE SMALLER AND WOULD REQUIRE FEWER MATERIALS, ITS OVERALL FEASIBILITY WOULD BE GREATER.

FROM AN ADMINISTRATIVE FEASIBILITY STANDPOINT, ALL OF THE ALTERNATIVES ARE ABOUT EQUAL. ALL EIGHT ALTERNATIVES (NO-ACTION ALTERNATIVE INCLUDED) WOULD REQUIRE COMPLIANCE WITH DISCHARGE STANDARDS FOR WATER FROM THE TREATMENT SYSTEM INTO THE CLARK FORK RIVER. THE DISCHARGE STANDARDS ARE MORE LIKELY TO BE MET FOR ALTERNATIVES 1 THROUGH 4 BECAUSE THEY INCLUDE A MORE COMPREHENSIVE UPGRADING OF THE TREATMENT SYSTEM. THEY ARE NOT LIKELY TO BE MET WITH SUFFICIENT REGULARITY UNDER ALTERNATIVES 5 THROUGH 7. ALTERNATIVE 2 WOULD REQUIRE OBTAINING PERMITS FOR OFF-SITE DISPOSAL.

ALTERNATIVES 1 THROUGH 5 (EXCEPT ALTERNATIVE 3+3A) WOULD REQUIRE THE ACQUISITION OF 500 TO 1,000 ACRES OF RANGELAND FOR CONSTRUCTION OF THE SETTLING BASIN OR THE UPSTREAM FLOOD IMPOUNDMENT. BECAUSE LESS LAND IS NEEDED FOR THE SMALLER SETTLING BASIN, ALTERNATIVES 3, 4 AND 5 MIGHT BE EASIER TO IMPLEMENT.

THE OFFSITE DISPOSAL OPTION, PROPOSED FOR THE MAJORITY OF THE TAILINGS DEPOSITS AND CONTAMINATED SOILS AS PART OF ALTERNATIVE 2, WOULD BE MORE DIFFICULT TO IMPLEMENT THAN THE REMAINDER OF THE CONTAMINATED SOILS OPTIONS. REQUIRED PERMITS FOR OFF-SITE DISPOSAL WOULD HAVE TO BE OBTAINED. THE INTERSTATE TRANSPORT OF UP TO 1.5 MILLION CUBIC YARDS OF UNTREATED WASTE WOULD BE ADMINISTRATIVELY UNDESIRABLE FROM BOTH A TRANSPORTATION AND DISPOSAL POINT OF VIEW. THE ONSITE DISPOSAL OPTIONS (ALTERNATIVES 1 AND 3-6) WOULD LIKELY BE EASIER TO IMPLEMENT.

AN APPARENT LACK OF LOCALLY AVAILABLE RIPRAP WOULD FAVOR THE ALTERNATIVES THAT REQUIRE SMALLER AMOUNTS OF THAT MATERIAL (E.G., ALTERNATIVES 3-6 OVER ALTERNATIVES 1 AND 2). HOWEVER, ALTERNATIVE 3+3A UTILIZES SOILS CEMENT WHICH INCORPORATES ON-SITE MATERIALS. THIS WOULD BE SIGNIFICANT ESPECIALLY IF THE MATERIAL WOULD NEED TO BE QUARRIED SPECIFICALLY FOR IMPLEMENTATION. OTHER MATERIALS AND EQUIPMENT WOULD BE READILY AVAILABLE FOR CONSTRUCTION. THE IN SITU SOLIDIFICATION UNITS FOR ALTERNATIVE 1 WOULD REQUIRE UP TO 9 MONTHS FOR FABRICATION, BUT THIS COULD BE INCORPORATED INTO THE SCHEDULED IMPLEMENTATION WITHOUT CAUSING UNFORESEEN DELAY.

#### **COST**

THE COST COMPARISONS ARE STRAIGHTFORWARD. COMPARING PRESENT WORTH COSTS, ALTERNATIVE 1 IS MOST EXPENSIVE AND ALTERNATIVE 6 IS THE LEAST EXPENSIVE OF THE ACTION ALTERNATIVES. THE LONG IMPLEMENTATION SCHEDULE MORE STRONGLY AFFECTS THE PRESENT WORTH COST FOR ALTERNATIVE 1 THAN DO THE IMPLEMENTATION SCHEDULES OF THE OTHER ALTERNATIVES, WHICH ARE SHORTER. THE COSTS OF THE ACTION ALTERNATIVES ARE LISTED IN TABLE 6, BOTH WITH AND WITHOUT PRESENT WORTH CONSIDERATIONS.

#### **STATE ACCEPTANCE**

THE STATE OF MONTANA, ACTING THROUGH THE DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES, GENERALLY AGREES WITH THIS RECORD OF DECISION. THE STATE HAS WITHHELD CONCURRENCE ON THIS RECORD OF DECISION UNTIL EPA SELECTS CLEANUP ACTION LEVELS AND DETERMINES APPROPRIATE MEASURES FOR THE CONTROL OF SOILS, SEDIMENTS AND TAILINGS ABOVE THOSE LEVELS WHICH ARE NOT ADDRESSED BY THIS ACTION.

THE STATE AGREES WITH THE FINAL ARARS LIST. THE STATE IS PARTICULARLY CONCERNED THAT THE POINT SOURCE DISCHARGE FROM THE WARM SPRINGS PONDS REMAIN AS A REGULATED DISCHARGE SUBJECT TO THE MPDES PERMIT REQUIREMENT.

#### **COMMUNITY ACCEPTANCE**

COMMUNITY REACTION TO THE PROPOSED PLAN WAS VIGOROUS AND WIDESPREAD ACROSS COMMUNITIES IN THE CLARK FORK RIVER BASIN. A FULL RESPONSE TO COMMENTS FROM THE COMMUNITY AND FROM ARCO IS CONTAINED IN THE RESPONSIVENESS SUMMARY ATTACHED TO THIS RECORD OF DECISION.

GENERALLY, THE COMMENTS FROM THE COMMUNITY FELL INTO THESE CATEGORIES:

- THE PROCESS FOR SELECTING A REMEDY SHOULD PROVIDE FOR ADDITIONAL AND EARLIER COMMUNITY INVOLVEMENT. IN RESPONSE EPA EXTENDED THE PUBLIC COMMENT PERIOD FOR THE PROPOSED PLAN TO 90 DAYS, AND HAS HELD SEVERAL PUBLIC MEETINGS, AND MEETINGS WITH INTERESTED GROUPS OVER THE LAST YEAR. EPA HAS INITIATED SEVERAL ACTIVITIES AT OTHER OPERABLE UNITS WITHIN THE CLARK FORK RIVER BASIN TO INCREASE COMMUNITY INVOLVEMENT IN THE SUPERFUND PROCESS AT EARLIER STAGES.

EPA WILL ALSO INCLUDE COMMUNITY INVOLVEMENT IN THE PROCESS WHICH WILL ADDRESS FURTHER REMEDY ACTION SELECTION AT THE WARM SPRINGS PONDS.

- THERE WAS WIDESPREAD OPPOSITION TO THE CREATION OF AN ADDITIONAL UPSTREAM SETTLING BASIN, PARTICULARLY BY RESIDENTS OF OPPORTUNITY AND ANACONDA. IN RESPONSE, EPA HAS REEVALUATED THE PREFERRED ALTERNATIVE DESCRIBED IN THE PROPOSED PLAN, AND HAS SELECTED ALTERNATIVE 3+3A, WHICH PROVIDES FOR FLOOD STORAGE WITHIN EXISTING POND 3.
- MANY COMMENTS STRESSED THE NEED FOR FLOOD PROTECTION AND TREATMENT OF FLOOD FLOWS BEFORE WATER FROM THE OPERABLE UNIT ENTERS THE CLARK FORK RIVER. IN RESPONSE, EPA HAS REEXAMINED THE BERM-STRENGTHENING ARAR, AND DETERMINED THAT A STANDARD OF ONE-HALF OF THE PROBABLE MAXIMUM FLOOD IS NECESSARY FOR ALL BERMS WITHIN THE OPERABLE UNIT. IN ADDITION, EPA HAS SELECTED A REMEDY WHICH WILL FULLY TREAT FLOWS ENTERING THE SYSTEM UP TO THE 100-YEAR FLOOD FLOWS BEFORE THAT WATER IS RELEASED INTO THE CLARK FORK RIVER.
- MANY COMMENTS STRESSED THE NEED FOR PERMANENT REMEDIES WHICH UTILIZED TREATMENT OF HAZARDOUS SUBSTANCES FOUND AT THE SITE. IN RESPONSE, EPA CAREFULLY EXAMINED THE ISSUE AND CONCLUDED THAT THE EXTENSIVE BERM STRENGTHENING AND CONTAMINANT COVER REQUIREMENTS OF THE SELECTED REMEDY PROVIDE A PERMANENT REMEDY FOR THE SITE. THE

EPA NOTES THAT FLOODS OF MILL AND WILLOW CREEKS MAY NOT BE ALLOWED DO ENTER THE PONDS AFTER THE BERMS ARE STRENGTHENED, AND THAT SILVER BOW CREEK FLOODS WILL ENTER THE PONDS IN A SECURE AND CONTROLLED MANNER WHICH WILL PREVENT RELEASES OF CONTAMINANTS.

TREATMENT OPTIONS AND OFF-SITE DISPOSAL OPTIONS ARE NOT TECHNICALLY FEASIBLE AT THIS TIME, OR PRESENT NEGATIVE ASPECTS SUCH AS DESTRUCTION OF WETLANDS OR EXCESSIVE TRAFFIC, AND ARE EXTREMELY EXPENSIVE IN RELATION TO THE BENEFITS GAINED. SUPERFUND REMEDIES ARE REQUIRED TO BE COST EFFECTIVE.

THE EPA WILL CONTINUE TO EXAMINE TREATMENT OPTIONS CAREFULLY AT OTHER OPERABLE UNITS IN THE CLARK FORK RIVER BASIN. THE EPA ALSO NOTES THAT THE FINAL DETERMINATION FOR PONDS 2 AND 3 WILL BE MADE AT A LATER DATE, WHEN SOURCES OF CONTAMINATION FROM UPSTREAM HAVE BEEN CLEANED UP AND THE PONDS ARE NO LONGER NEEDED AS TREATMENT FACILITIES.

#### **#TSR**

#### **THE SELECTED REMEDY**

AFTER EVALUATING ALTERNATIVES WITH RESPECT TO EACH OTHER AND THE NINE REQUIRED CRITERIA, THE EPA AND MDHES HAVE IDENTIFIED ALTERNATIVE 3+3A AS THE SELECTED REMEDY FOR THIS WARM SPRINGS PONDS OPERABLE UNIT RECORD OF DECISION. THE AGENCIES HAVE DETERMINED THAT ALTERNATIVE 3+3A IS THE MOST EFFECTIVE OF THE ALTERNATIVES EVALUATED, OFFERS THE GREATEST POTENTIAL FOR BEING A PERMANENT REMEDY, IS SUPPORTED BY THE PUBLIC AND IS COST EFFECTIVE. THE SELECTED REMEDY IS AN INTERIM CLEANUP MEASURE THAT PROVIDES THE HIGHEST DEGREE OF CERTAINTY THAT IT WILL BE SUCCESSFUL AND PERMANENT. THE FINAL MEASURE OF THESE QUALITIES AWAITS ADDITIONAL ACTIONS AT THIS OPERABLE UNIT AND CLEANUP DECISIONS UPSTREAM. THE COMPONENTS OF ALTERNATIVE 3+3A ARE AS FOLLOWS:

- ALLOW THE PONDS TO REMAIN IN PLACE; PONDS 2 AND 3 WILL CONTINUE TO FUNCTION AS TREATMENT PONDS UNTIL UPSTREAM SOURCES OF CONTAMINATION ARE CLEANED UP;
- RAISE AND STRENGTHEN ALL POND BERMS ACCORDING TO SPECIFIED CRITERIA, WHICH WILL PROTECT AGAINST DAM FAILURE IN THE EVENT OF MAJOR EARTHQUAKES OR FLOODS, AND INCREASE STORAGE CAPACITY OF POND 3 TO RECEIVE AND TREAT FLOWS UP TO THE 100-YEAR FLOOD;
- CONSTRUCT NEW INLET AND HYDRAULIC STRUCTURES TO PREVENT DEBRIS FROM PLUGGING THE POND 3 INLET AND TO SAFELY ROUTE FLOWS IN EXCESS OF THE 100-YEAR FLOOD AROUND THE PONDS;
- COMPREHENSIVELY UPGRADE THE TREATMENT CAPABILITY OF PONDS 2 AND 3 TO FULLY TREAT ALL FLOWS UP TO 3,300 CUBIC FEET PER SECOND (100-YEAR PEAK DISCHARGE) AND CONSTRUCT SPILLWAYS FOR ROUTING EXCESS FLOOD WATER INTO THE BYPASS CHANNEL;
- REMOVE ALL REMAINING TAILINGS AND CONTAMINATED SOILS FROM THE MILL-WILLOW BYPASS, CONSOLIDATE THEM OVER EXISTING DRY TAILINGS AND CONTAMINATED SOILS WITHIN THE POND 1 AND POND 3 BERMS, AND PROVIDE ADEQUATE COVER MATERIAL WHICH WILL BE REVEGETATED.
- RECONSTRUCT THE MILL-WILLOW BYPASS CHANNEL AND ARMOR THE NORTH-SOUTH BERMS OF ALL PONDS TO SAFELY ROUTE FLOWS UP TO 70,000 CUBIC FEET PER SECOND (ONE-HALF OF THE ESTIMATED PROBABLE MAXIMUM FLOOD);
- FLOOD (WET-CLOSE) ALL DRY PORTIONS OF POND 2;
- CONSTRUCT INTERCEPTION TRENCHES TO COLLECT CONTAMINATED GROUND WATER IN AND BELOW POND 1 AND PUMP THE WATER TO POND 3 FOR TREATMENT;
- DEWATER WET PORTIONS OF POND 1 AND COVER AND REVEGETATE (DRY-CLOSE) ALL AREAS WITHIN THE POND 1 BERMS;
- ESTABLISH SURFACE AND GROUND WATER QUALITY MONITORING SYSTEMS AND PERFORM ALL OTHER ACTIVITIES NECESSARY TO ASSURE COMPLIANCE WITH ALL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS;

- IMPLEMENT INSTITUTIONAL CONTROLS TO PREVENT FUTURE RESIDENTIAL DEVELOPMENT, TO PREVENT SWIMMING, AND TO PREVENT CONSUMPTION OF FISH BY HUMANS; AND
- DEFER, FOR NOT MORE THAN ONE YEAR AFTER THE EFFECTIVE DATE OF THIS DOCUMENT, DECISIONS CONCERNING THE REMEDIATION OF CONTAMINATED SOILS, TAILINGS, AND GROUND WATER IN THE AREA BELOW POND 1, PENDING EVALUATION OF VARIOUS WET- AND DRY-CLOSURE ALTERNATIVES AND A PUBLIC REVIEW.

#### **OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT**

ALTERNATIVE 3+3A REDUCES OR ELIMINATES THOSE RISKS TO HUMAN HEALTH AND THE ENVIRONMENT AT THIS OPERABLE UNIT WHICH ARE WITHIN THE SCOPE OF THIS RECORD OF DECISION.

POND STABILITY IS ADDRESSED BY PROTECTING THE PONDS AGAINST BOTH THE MAXIMUM CREDIBLE EARTHQUAKE AND ONE-HALF OF THE PROBABLE MAXIMUM FLOOD. ONLY UNDER EXTREME FLOODING CONDITIONS WOULD THE STABILITY OF THE POND BERMS BE IN QUESTION. PROTECTION OF THE POND BERMS WOULD CONTINUE FOR AS LONG AS THE BERMS ARE PROPERLY MAINTAINED AND REPAIRED.

ALTERNATIVE 3+3A WILL IMPROVE SURFACE WATER QUALITY BY COMPLETELY UPGRADING THE EXISTING POND TREATMENT SYSTEM TO PROVIDE TREATMENT FOR ALL FLOWS UP TO 3,300 CFS OR 13,000 ACRE-Feet (THE ESTIMATED PEAK FLOW AND VOLUME, RESPECTIVELY, OF THE 100-YEAR FLOOD), BY REMOVING TAILINGS FROM ALONG THE BYPASS, AND BY RAISING THE BERMS FOR PONDS 2 AND 3. POND 2 WILL BE INCREASED IN VOLUME, REDUCING THE PROBLEM OF RESUSPENSION OF SEDIMENTS DURING HIGH WINDS AND FLOW RATES. WITH THE UPGRADED TREATMENT SYSTEM, MOST OF THE SURFACE WATER QUALITY VIOLATIONS, WHICH NOW OCCUR, SHOULD BE AVOIDABLE.

ALL FLOOD FLOWS UP TO 3,300 CFS WILL BE ROUTED THROUGH THE POND SYSTEM, WHICH WILL RESULT IN REMOVAL OF THE MAJORITY OF THE SUSPENDED PARTICLES. THUS, ALTERNATIVE 3+3A WILL SUBSTANTIALLY REDUCE THE POTENTIAL FOR FUTURE RECONTAMINATION OF THE BYPASS BY SETTLED TAILINGS AND REDUCE THE CONTINUED TRANSPORT OF TAILINGS INTO THE CLARK FORK RIVER.

CONTAMINATED GROUND WATER MOVING FROM THE SITE WILL BE COLLECTED FROM POND 1 AND BELOW. IT WILL THEN BE PUMPED TO THE POND 3 INLET FOR TREATMENT IN THE POND SYSTEM. THIS WILL REDUCE THE DISCHARGE OF METALS LOADING INTO THE CLARK FORK RIVER AND SHOULD ENABLE COMPLIANCE WITH PRIMARY MCLS FOR GROUNDWATER AT THE SELECTED COMPLIANCE POINT.

DRY-CLOSURE OF POND 1, WHICH INCLUDES DEWATERING, COVERING AND REVEGETATION OF TAILINGS AND CONTAMINATED SOILS, WILL EFFECTIVELY ISOLATE THEM FROM DIRECT CONTACT AND LIMIT THEIR MOBILITY. THE CAP WILL PROVIDE A BARRIER AGAINST INGESTION, INHALATION, AND RUNOFF. AS LONG AS THE CAP IS MAINTAINED, THE MATERIAL WILL BE SAFE FROM RELEASES DUE TO EROSION OF THE CAP. CAPPING THE MATERIAL IN POND 1 WILL NOT, HOWEVER, REDUCE THE TOXICITY, VOLUME, OR PERSISTENCE OF THE MATERIAL.

FLOODING THE TAILINGS DEPOSITS AND CONTAMINATED SOILS IN THE DRY PORTIONS OF POND 2 WILL REDUCE THE POTENTIAL FOR EXPOSURES TO THESE MATERIALS, ALTHOUGH THE EXPOSED TAILINGS ABOVE POND 3 WILL NOT BE ADDRESSED UNTIL FINAL CLOSURE OF THE PONDS.

ALL OF THE COMPONENTS OF ALTERNATIVE 3+3A ARE TECHNICALLY FEASIBLE. WITH THE APPROPRIATE DESIGN, CONSTRUCTION, OPERATION, AND MAINTENANCE, THE COMPONENTS OF ALTERNATIVE 3+3A WILL RELIABLY REDUCE THE RISKS FOR WHICH THEY ARE PROPOSED. ANY INCREASED RISKS TO THE SURROUNDING ENVIRONMENT AND COMMUNITY DURING IMPLEMENTATION CAN BE KEPT TO A MINIMUM WITH APPROPRIATE CONTAINMENT AND CONSTRUCTION SAFETY MEASURES.

#### **COMPLIANCE WITH ARARS**

WITHIN THE BOUNDARIES DEFINED BELOW, ALTERNATIVE 3+3A SHOULD RESULT IN COMPLIANCE WITH ALL THE STATE AND FEDERAL ARARS IDENTIFIED FOR THE WARM SPRINGS PONDS OPERABLE UNIT.

THE ACTIONS PROPOSED FOR ALTERNATIVE 3+3A MEET THE MONTANA ARARS FOR PROTECTING THE POND SYSTEM AGAINST ONE-HALF OF THE PROBABLE MAXIMUM FLOOD AND THE MAXIMUM CREDIBLE EARTHQUAKE. PROVIDING FLOOD DETENTION WITHIN THE POND SYSTEM AND THE UPGRADING OF THE POND TREATMENT SYSTEM SHOULD RESULT IN EFFLUENT COMPLIANCE WITH AMBIENT AND POINT SOURCE DISCHARGE SURFACE WATER QUALITY STANDARDS FOR ALL FLOWS UP TO 3,300 CFS, THE ESTIMATED PEAK FLOW OF THE 100-YEAR FLOOD.

ALTERNATIVE 3+3A SHOULD COMPLY WITH MONTANA GROUND WATER STANDARDS, AND WOULD SATISFY MONTANA'S REQUIREMENTS FOR FLOODPLAIN MANAGEMENT. EXCAVATING AND MOVING TAILINGS DEPOSITS AND CONTAMINATED SOILS FROM THE MILL-WILLOW BYPASS TO DRY PORTIONS OF POND 3 PRIOR TO CAPPING WILL COMPLY WITH STATE AND FEDERAL SITING CRITERIA FOR SOLID AND HAZARDOUS WASTE DISPOSAL AND CAN BE DONE SO AS TO SELECTED RCRA REQUIREMENTS FOR CLOSURE OF A HAZARDOUS WASTE MANAGEMENT FACILITY.

FLOODING THE TAILINGS DEPOSITS AND CONTAMINATED SOILS IN POND 2 WILL REDUCE THE RISKS IDENTIFIED IN THE PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT AND MEET THE REMEDIAL OBJECTIVES ESTABLISHED FOR THE OPERABLE UNIT. A COMPLETE SUMMARY OF THIS ALTERNATIVE'S COMPLIANCE WITH THE STATE AND FEDERAL ARARS IS PRESENTED IN TABLE 5.

THE ACTIONS PROPOSED IN ALTERNATIVE 3+3A COULD RESULT IN ADVERSE EFFECTS ON WETLANDS, ENDANGERED SPECIES, AND HISTORICAL RESOURCES. TO MITIGATE THESE POTENTIAL IMPACTS, ADDITIONAL CONSULTATION WITH STATE AND FEDERAL RESOURCE AGENCIES WILL BE REQUIRED DURING IMPLEMENTATION OF THIS INTERIM REMEDY.

#### **LONG-TERM EFFECTIVENESS AND PERMANENCE**

ALTERNATIVE 3+3A ADDRESSES ALL OF THE IDENTIFIED RISKS AT THE SITE BY USING MEASURES INTENDED TO LIMIT OR REMOVE THE RISKS. THE PRIMARY RISK AT THE SITE, THE RELEASE OF 19 MILLION CUBIC YARDS OF METAL-CONTAMINATED TAILINGS LOCATED IN THE TREATMENT PONDS, WILL BE ADDRESSED BY PROTECTING THE POND BERMS AGAINST FAILURE DUE TO A FULL MAXIMUM CREDIBLE EARTHQUAKE AND ONE-HALF OF THE PROBABLE MAXIMUM FLOOD. THIS WILL ADDRESS THE THREAT OF POND FAILURE IN ALL BUT EXTREME CASES AND THIS ASPECT OF THE REMEDY IS PERMANENT AND EFFECTIVE OVER THE LONG TERM.

RESIDUAL RISKS WILL RESULT FROM THE CONTINUED EXISTENCE OF THE 19 MILLION CUBIC YARDS OF SEDIMENTS AND SLUDGE IN THE POND SYSTEM ALTHOUGH THOSE RISKS WILL BE REDUCED TO A LOW LEVEL. THE SEDIMENTS IN THE PONDS MAY STILL BE RELEASED TO THE ENVIRONMENT IN EITHER DISSOLVED OR SUSPENDED FORM UNDER EXTREME CONDITIONS. THIS INCLUDES NOT ONLY THE SLUDGES PRESENTLY IN THE PONDS, BUT ALSO ALL THE EXCAVATED SOILS AND TAILINGS FROM AROUND THE SITE THAT WILL BE PLACED IN POND 1 OR POND 3 PRIOR TO CAPPING.

BECAUSE THE MATERIAL BENEATH THE CAP WILL BE UNTREATED, MAINTENANCE AND PERIODIC INSPECTION OF THE POND 1 AND POND 3 CAPS WILL BE NECESSARY. MAINTENANCE ACTIVITIES WILL BE DIRECTED AT PREVENTING EROSION OR DETERIORATION OF THE CAP. PERIODIC INSPECTION AND MAINTENANCE OF THE STABILIZED POND BERMS WILL ALSO BE NECESSARY TO ENSURE CONTINUED PROTECTION.

CONTINUED MAINTENANCE OF THE GROUND WATER INTERCEPTION AND PUMP SYSTEM WILL BE NECESSARY. BY DRYING POND 1, RATHER THAN WET CLOSING IT, THIS OPERATION MAINTENANCE PERIOD IS EXPECTED TO BE SHORTER AND LESS COMPLICATED.

#### **REDUCTION OF TOXICITY, MOBILITY, AND VOLUME, THROUGH TREATMENT**

PROTECTING THE POND BERMS AGAINST FAILURE DUE TO A MAXIMUM CREDIBLE EARTHQUAKE AND ONE-HALF OF THE PROBABLE MAXIMUM FLOOD WILL SUBSTANTIALLY REDUCE THE POTENTIAL MOBILITY OF THE SLUDGES IN THE PONDS, ALTHOUGH THIS WILL NOT AFFECT THEIR VOLUME, PERSISTENCE, OR TOXICITY. ONLY IN THE EXTREME CASE OF FLOODING ABOVE THE DESIGN FLOODS FOR ALTERNATIVE 3+3A WOULD THE CURRENT CONTAINMENT OF THE POND BOTTOM SEDIMENTS BE AFFECTED.

ONSITE DISPOSAL OF EXCAVATED SOILS AND TAILINGS WITHIN PONDS 1 AND 3, DESIGNED TO MEET SELECTED RCRA REQUIREMENTS WILL REDUCE THE MOBILITY OF THOSE MATERIALS AND WILL PREVENT DIRECT HUMAN CONTACT. THE MATERIALS WILL BE TAKEN FROM CURRENTLY EXPOSED AREAS ALONG THE BYPASS. THE TAILINGS DEPOSITS AND CONTAMINATED SOILS IN POND 2 WILL BE COVERED BY WATER, BUT THE NATURALLY DEPOSITED TAILINGS ABOVE POND 3 WILL REMAIN EXPOSED UNTIL FINAL CLOSURE OF THE PONDS. THE POND BOTTOM SEDIMENTS IN PONDS 2 AND 3 WILL REMAIN COVERED BY WATER BUT WILL NOT BE COMPLETELY IMMOBILIZED AGAINST WIND AND WATER ACTION.

THE TOXICITY, VOLUME, PERSISTENCE, AND PROPENSITY TO BIOACCUMULATE OF THE POND BOTTOM SEDIMENTS AND THE TAILINGS DEPOSITS AND CONTAMINATED SOILS WILL NOT BE ALTERED BY THE PROPOSED ACTIONS OF ALTERNATIVE 3+3A. TO DATE, NO FEASIBLE TECHNOLOGY EXISTS WHICH WILL PROVIDE EFFECTIVE TREATMENT OF WASTES PRESENT AT THIS OPERABLE UNIT.

THE FLOOD DETENTION CAPACITY WILL ADDRESS THE THREAT RESULTING FROM FLOODS, THE TRANSPORT OF TAILINGS THROUGH THE SYSTEM AND INTO THE CLARK FORK BASIN, BY ENSURING THAT ALL FLOWS THROUGH THE REACH, UP TO THE 100-YEAR FLOOD, ARE AT LEAST TREATED FOR SUSPENDED SOLIDS.

FLOWS IN EXCESS OF 3,300 CFS WILL BYPASS THE POND SYSTEM AND NOT BE TREATED FOR EITHER SUSPENDED OR DISSOLVED METALS. THIS MAY LEAD TO SHORT-TERM WATER QUALITY EXCEEDENCES IN THE EFFLUENT FROM THE OPERABLE UNIT DURING HIGH FLOWS, BUT IT WILL PROBABLY NOT HAVE A LONG-TERM IMPACT ON THE OPERABLE UNIT.

#### **SHORT-TERM EFFECTIVENESS**

IT WILL TAKE APPROXIMATELY TWO CONSTRUCTION SEASONS TO PROTECT THE POND BERMS AGAINST A MAXIMUM CREDIBLE EARTHQUAKE AND ONE HALF OF THE PROBABLE MAXIMUM FLOOD. DURING THAT TIME, THE PROTECTIVENESS PROVIDED FOR THE DOWNSTREAM COMMUNITY OF WARM SPRINGS AND THE ENVIRONMENT WILL DECREASE. THE OVERALL LEVEL OF PROTECTIVENESS OF ALTERNATIVE 3+3A WILL NOT BE ATTAINED UNTIL CONSTRUCTION IS COMPLETED. THE POTENTIAL FOR INCREASED RISK TO EITHER THE COMMUNITY OR THE ENVIRONMENT DURING THE BERM STABILIZATION PROCESS IS LIMITED. REMEDIATION CONTRACTORS MAY BE AT RISK FROM DIRECT CONTACT AND INHALATION OF CONTAMINANTS DURING FOUNDATION EXCAVATION AND ASSOCIATED TASKS. THESE RISKS WILL BE CONTROLLED BY USING PROTECTIVE EQUIPMENT AS NECESSARY.

RISKS TO THE REMEDIATION CONTRACTORS WILL BE LIMITED TO STANDARD CONSTRUCTION RISKS ASSOCIATED WITH SIMILAR PROJECTS. THE DIVERSION AND INLET STRUCTURES WILL BE CONSTRUCTED IN THE CONTAMINATED STREAM CHANNEL. PRECAUTIONS WILL BE REQUIRED TO AVOID EXCESSIVE ADDITIONAL CONTAMINATION OF THE CREEK FLOWS DURING CONSTRUCTION OF THESE FEATURES.

#### **IMPLEMENTABILITY**

PROTECTING THE POND BERMS AGAINST A MAXIMUM CREDIBLE EARTHQUAKE AND ONE-HALF OF THE PROBABLE MAXIMUM FLOOD IS FEASIBLE. THE CURRENT UNCERTAINTIES INVOLVE THE EXISTENCE OF SUITABLE FOUNDATION MATERIAL DOWNSTREAM OF THE TOES OF THE EXISTING BERMS, THE NATURE OF THE UPSTREAM SLOPES, AND THE ACTUAL VALUE OF THE MAXIMUM CREDIBLE EARTHQUAKE. PRELIMINARY INVESTIGATIONS INDICATE THAT THE BASE MATERIAL BENEATH THE SURFACE SOILS WILL BE ADEQUATE, BUT THIS WILL HAVE TO BE VERIFIED DURING THE DESIGN PHASE. THE MATERIALS AND CONSTRUCTION OF THE UPSTREAM SLOPES, AND THE MAXIMUM CREDIBLE EARTHQUAKE ALSO WILL HAVE TO BE DETERMINED DURING THE DESIGN PHASE.

A REVISED MONTANA POLLUTION DISCHARGE ELIMINATION SYSTEM PERMIT TO DISCHARGE WATER FROM THE TREATMENT SYSTEM INTO THE CLARK FORK RIVER WILL BE REQUIRED AND THE DISCHARGE STANDARDS ARE EXPECTED TO BE MET.

#### **COMMUNITY AND STATE ACCEPTANCE**

THIS REMEDY WAS DESIGNED TO MEET THE COMMUNITY CONCERNS EXPRESSED DURING THE COMMENT PERIOD. THE STATE HAS BEEN ACTIVELY INVOLVED WITH THE DEVELOPMENT OF THIS ALTERNATIVE, AND GENERALLY AGREES WITH ITS SELECTION.

#### **#SPA**

##### **SUMMARY OF THE PREFERRED ALTERNATIVE**

IN SUMMARY, THE PREFERRED ALTERNATIVE SATISFIES THE STATUTORY PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT AS A PRINCIPAL ELEMENT TO REDUCE THE TOXICITY, MOBILITY, OR VOLUME OF CONTAMINATION AT THE SITE TO THE MAXIMUM EXTENT PRACTICABLE. WITH THE COMPREHENSIVE UPGRADE OF THE CURRENT POND TREATMENT SYSTEM, BOTH SURFACE AND GROUND WATER WILL BE TREATED AND THEIR TOXICITY WILL BE REDUCED.

THE PREFERRED ALTERNATIVE WILL ATTAIN FEDERAL AND STATE REQUIREMENTS THAT ARE APPLICABLE OR RELEVANT AND APPROPRIATE FOR THE SITE WITH MINOR EXCEPTIONS: STATE AMBIENT WATER CONCENTRATIONS OF TOXIC OR DELETERIOUS SUBSTANCES TO PROTECT PUBLIC HEALTH FROM INGESTION OF CONTAMINATED WATER AND FISH FOR ARSENIC AND MERCURY REQUIRE A WAIVER BASED UPON TECHNICAL IMPRACTICABILITY AND UPON THE FACT THAT THIS IS AN INTERIM REMEDY. THE ARSENIC STANDARD FOR WATER AND FISH INGESTION IS 2.2 NANOGRAMS PER LITER AND THE MERCURY STANDARD IS 144 NANOGRAMS PER LITER. IT IS NOT TECHNICALLY FEASIBLE TO TREAT WATER TO THOSE LEVELS AT THIS TIME. IN ADDITION, ARSENIC CANNOT BE DETECTED AT 2.2 NANOGRAMS PER LITER WITH SAMPLING AND DETECTION METHODS CURRENTLY AVAILABLE. BECAUSE IT IS NOT POSSIBLE TO TREAT OR TO DETERMINE COMPLIANCE WITH THESE STANDARDS, AND BECAUSE

THIS REMEDY IS AN INTERIM CLEANUP ACTION, THESE REQUIREMENTS ARE WAIVED. IN ADDITION, SHOULD THE AREAS WITHIN THE POND BERMS BE CONSIDERED WITHIN THE 100-YEAR FLOODPLAIN, REQUIREMENTS PROHIBITING DISPOSAL OF SOLID WASTE WITHIN THE FLOODPLAIN ARE HEREBY WAIVED.

BASED UPON THE INFORMATION AVAILABLE AT THIS TIME, THE STATE AND EPA BELIEVE THAT THE SELECTED REMEDY WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, WILL COMPLY WITH FEDERAL AND STATE ARARS, WILL BE COST-EFFECTIVE, AND WILL UTILIZE PERMANENT SOLUTIONS AND TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT POSSIBLE., RECOGNIZING THE SCOPE OF THIS INTERIM CLEANUP ACTION.

#### **#STD**

#### **STATUTORY DETERMINATIONS**

UNDER THEIR LEGAL AUTHORITIES, THE EPA AND MDHES HAVE THE PRIMARY RESPONSIBILITY AT SUPERFUND SITES TO UNDERTAKE REMEDIAL ACTIONS THAT ACHIEVE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. IN ADDITION, SECTION 121 OF CERCLA ESTABLISHES THAT, THE SELECTED REMEDIAL ACTION MUST COMPLY WITH APPLICABLE OR RELEVANT AND APPROPRIATE ENVIRONMENTAL STANDARDS ESTABLISHED UNDER FEDERAL AND STATE ENVIRONMENTAL LAWS UNLESS A STATUTORY WAIVER IS JUSTIFIED. THE SELECTED REMEDY ALSO MUST BE COST-EFFECTIVE AND UTILIZE PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICAL. THE STATUTE ALSO INCLUDES A PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT THAT PERMANENTLY AND SIGNIFICANTLY REDUCE THE VOLUME, TOXICITY, OR MOBILITY OF HAZARDOUS WASTES AS THEIR PRINCIPAL ELEMENT. THE FOLLOWING SECTIONS DISCUSS HOW THE SELECTED REMEDY MEETS THESE STATUTORY REQUIREMENTS.

#### **PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT**

THE SELECTED REMEDIES FOR THE VARIOUS CONTAMINANT SOURCES ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, WITHIN THE SCOPE OF THIS INTERIM ACTION. THEY WILL MEET THE ARARS IDENTIFIED FOR THE OPERABLE UNIT AND REDUCE THE RISKS IDENTIFIED IN THE PHEA TO ACCEPTABLE LEVELS.

#### **COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)**

FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS HAVE BEEN DETERMINED. THE SELECTED REMEDY WILL COMPLY WITH MOST APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS. HOWEVER, THREE CHEMICAL- AND LOCATION-SPECIFIC ARARS PERTAINING TO WATER QUALITY STANDARDS AND POTENTIAL SOLID WASTE DISPOSAL REQUIREMENTS WILL BE WAIVED.

#### **WAIVERS AND PROMULGATED STANDARDS**

FEDERAL LAW RECOGNIZES THERE MAY BE INSTANCES IN WHICH ARARS CANNOT BE MET WITH RESPECT TO REMEDIAL ACTIONS ONSITE. IT, THEREFORE, IDENTIFIED SIX CIRCUMSTANCES UNDER WHICH ARARS MAY BE WAIVED. HOWEVER, OTHER STATUTORY REQUIREMENTS -- SPECIFICALLY, THE REQUIREMENT THAT REMEDIES BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT-- CANNOT BE WAIVED. WAIVERS OCCUR AS THE EXCEPTION, NOT THE RULE. WAIVERS ARE APPROPRIATE IF:

- THE REMEDIAL ACTION SELECTED IS AN INTERIM REMEDY AND ONLY PART OF A TOTAL REMEDIAL ACTION THAT WILL ATTAIN ARARS.
- COMPLIANCE WITH ARARS AT THE SITE WOULD RESULT IN GREATER RISK TO HUMAN HEALTH AND THE ENVIRONMENT THAN ALTERNATIVE OPTIONS.
- COMPLIANCE WITH ARARS IS TECHNICALLY IMPRACTICABLE, FROM AN ENGINEERING PERSPECTIVE.
- THE REMEDIAL ACTIONS SELECTED WILL ATTAIN AN EQUIVALENT STANDARD OF PERFORMANCE, ALTHOUGH ARARS ARE NOT MET.
- WITH RESPECT TO STATE ARARS, THE STATE HAS NOT CONSISTENTLY APPLIED ARARS IN SIMILAR CIRCUMSTANCES AT OTHER REMEDIAL ACTIONS WITHIN THE STATE.
- IN THE CASE OF FUND-FINANCED REMEDIAL ACTIONS, FINANCIAL RESTRICTIONS WITHIN THE SUPERFUND PROGRAM REQUIRE FUND-BALANCING SUCH THAT SATISFACTIONS OF ARARS AT THE SITE MUST GIVE WAY TO A GREATER NEED FOR PROTECTION OF PUBLIC HEALTH AND WELFARE AND THE ENVIRONMENT AT OTHER SITES.

THE FEASIBILITY STUDY, WHICH PROVIDES A DETAILED ANALYSIS OF THE REMEDIAL ACTION ALTERNATIVES, IDENTIFIES HOW EACH ALTERNATIVE COMPLIES WITH ARARS. IF AN ARAR WOULD NOT BE SATISFIED, THEN A WAIVER MAY BE REQUIRED, BASED ON THE INTERIM NATURE OF THIS ACTION AND THE TECHNICAL INFEASIBILITY OF MEETING THOSE STANDARDS. SEE SECTION 4.0 OF THE ROD AND THE ARARS LIST. THERE IS THE POSSIBILITY THAT THE AREA WITHIN PONDS 2 AND 3 TO THE 100 YEAR FLOOD FLOW EVENT MAY BE CONSIDERED PART OF THE 100 YEAR FLOOD PLAIN. IF SO, THE ARAR PROHIBITING DISPOSAL OF SOLID WASTE WITHIN THE 100 YEAR FLOOD PLAIN IS WAIVED ON THE SAME BASIS.

#### **COST-EFFECTIVENESS**

THE SELECTED REMEDIAL ALTERNATIVES ARE COST-EFFECTIVE OPTIONS FOR CLEANUP OF THE WARM SPRINGS PONDS. THIS DETERMINATION IS BASED ON THE COST AND OVERALL EFFECTIVENESS OF THE SELECTED REMEDY WHEN VIEWED IN LIGHT OF THE COST AND OVERALL EFFECTIVENESS OF OTHER ALTERNATIVES.

#### **UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE**

THE SELECTED REMEDY SATISFIES THE STATUTORY PREFERENCE FOR UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE. TREATMENT OF CONTAMINATED WATER IS AN ELEMENT OF THE SELECTED ALTERNATIVE. IMPLEMENTATION OF THE SELECTED ALTERNATIVE. OTHER FORMS OF TREATMENT ARE NOT YET TECHNICALLY FEASIBLE OR PRACTICABLE AT THIS TIME. IMPLEMENTATION OF THE SELECTED ALTERNATIVE WILL DECREASE THE CONCENTRATIONS OF CONTAMINATION SOURCES.

#### **DOCUMENTATION OF SIGNIFICANT CHANGES TO COMPONENTS OF THE SELECTED REMEDY**

SECTION 117(B) OF CERCLA REQUIRES DOCUMENTATION AND EXPLANATION OF ANY SIGNIFICANT CHANGE FROM THE PREFERRED ALTERNATIVE ORIGINALLY PRESENTED IN THE PROPOSED PLAN. THE REMEDY SELECTED IN THIS RECORD OF DECISION DOES, IN FACT, REFLECT SIGNIFICANT CHANGES TO THE ORIGINALLY PREFERRED ALTERNATIVE. THEREFORE, IN ACCORDANCE WITH SPECIFIC REQUIREMENTS OF SUPERFUND GUIDANCE (OWSER DIRECTIVE 9335.3.02)(10), THE ORIGINALLY PREFERRED ALTERNATIVE WILL BE IDENTIFIED, THE SIGNIFICANT CHANGES DESCRIBED, AND THE REASONS FOR THE CHANGES EXPLAINED.

#### **THE ORIGINALLY PREFERRED REMEDY**

THE WARM SPRINGS PONDS PROPOSED PLAN (OCTOBER, 1989)(11) DESCRIBED SIX CLEANUP ALTERNATIVES. THE PREFERRED ALTERNATIVE, ALTERNATIVE 3, MAY BE SUMMARIZED AS FOLLOWS:

- ALLOW THE PONDS TO REMAIN IN PLACE; POND 3 WOULD CONTINUE TO FUNCTION AS A TREATMENT POND;
- RAISE AND STRENGTHEN ALL THREE POND BERMS TO PROTECT AGAINST DARN FAILURE IN THE EVENT OF MAJOR EARTHQUAKES OR FLOODS;
- CONSTRUCT NEW INLET AND HYDRAULIC STRUCTURES TO PREVENT DEBRIS FROM PLUGGING THE POND 3 INLET AND TO SAFELY ROUTE FLOWS IN EXCESS OF 600 CFS AROUND THE PONDS.
- CONSTRUCT AN UPSTREAM SEDIMENT SETTLING BASIN CAPABLE OF STORING UP TO 2,000 ACRE FEET OF FLOOD WATERS, WITH HYDRAULIC STRUCTURES TO METER THE WATER INTO POND 3 FOR TREATMENT;
- COMPREHENSIVELY UPGRADE THE TREATMENT CAPABILITY OF POND 3, INCLUDING CONSTRUCTION OF A BERM ACROSS THE POND TO PREVENT FLOWS FROM SHORT-CIRCUITING.

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(10) OSWER DIRECTIVE 9335.3-02, NOVEMBER, 1989, EPA/540/G-89-007, INTERIM FINAL GUIDANCE ON PREPARING SUPERFUND DECISION DOCUMENTS

(11) MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES AND UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, 1989. WARM SPRINGS PONDS PROPOSED PLAN, SILVER BOW CREEK SUPERFUND SITE REPORT.

- REMOVE ALL TAILINGS AND CONTAMINATED SOILS IN THE MILL-WILLOW BYPASS AND CONSOLIDATE THEM OVER EXISTING DRY TAILINGS AND SOILS BEHIND THE POND 1 BERM;
- RECONSTRUCT THE MILL-WILLOW BYPASS CHANNEL AND ARMOR THE NORTH-SOUTH BERMS OF ALL THREE PONDS TO WITHSTAND FRACTIONS OF THE PROBABLE MAXIMUM FLOOD (0.2, 0.3 AND 0.5 PMF FOR PONDS 1,2 AND 3, RESPECTIVELY);
- FLOOD (WET-CLOSE) OR EXCAVATE, CONSOLIDATE AND CAP (DRY-CLOSE) ALL EXPOSED TAILINGS AND CONTAMINATED SOILS WITH ARSENIC OR METALS CONCENTRATIONS EXCEEDING THE PRESCRIBED HEALTH-BASED ACTION LEVELS;
- CONSTRUCT GROUND WATER INTERCEPTION TRENCHES WITHIN THE BELOW POND 1 TO PREVENT CONTAMINATED GROUND WATER FROM ENTERING THE CLARK FORK RIVER AND PUMP THE COLLECTED WATER UP TO POND 3 FOR TREATMENT; AND
- EXCAVATE TAILINGS AND CONTAMINATED SOILS BELOW THE POND 1 BERM (LARGELY WITHIN THE ORIGINAL SILVER BOW CHANNEL), CONSOLIDATE AND CAP THEM BEHIND THE POND 1 BERM, AD DRY-CLOSE POND 1.

#### **SIGNIFICANT DIFFERENCES BETWEEN THE ORIGINALLY PREFERRED ALTERNATIVE AND SELECTED REMEDY**

THE REMEDY SELECTED IN THIS RECORD OF DECISION DIFFERS FROM THE ORIGINALLY PREFERRED ALTERNATIVE IN THE FOLLOWING RESPECTS:

- THE UPSTREAM SEDIMENT SETTLING BASIN WILL NOT BE CONSTRUCTED. INSTEAD, FLOOD FLOWS UP TO THE 100-YEAR EVENT WILL BE ROUTED INTO POND 3;
- POND 2 WILL BE RETAINED AS A TREATMENT POND, AS OPPOSED TO SIMPLY BEING WET-CLOSED;
- THE BERMS OF ALL THREE PONDS WILL BE RAISED, STRENGTHENED, AND THEIR NORTH-SOUTH ASPECTS ARMORED, TO WITHSTAND ONE-HALF OF THE ESTIMATED PROBABLE MAXIMUM FLOOD (70,000 CFS), AS OPPOSED TO LESS PROTECTIVE FRACTIONS OF THE PMF FOR PONDS 1 AND 2(0.2 AND 0.3 PMF, RESPECTIVELY);
- COMPREHENSIVE UPGRADING OF THE TREATMENT CAPABILITY OF POND 3 WILL NOT INCLUDE CONSTRUCTION OF A BERM ACROSS THE POND. INSTEAD, BIOASSAY TESTS WILL BE CONDUCTED TO EVALUATE THE EFFECT OF RESUSPENDED BOTTOM SEDIMENTS ON AQUATIC SPECIES. IF EFFECTS ARE OBSERVED, MEASURES OTHER THAN A BERM CAN BE INCORPORATED AS A COMPONENT UPGRADE.
- TWO ASPECTS OF THE DECISION ARE DEFERRED. A FINAL CLEANUP LEVEL FOR SOIL CONTAMINANTS WILL BE SELECTED AT A LATER DATE. ONCE THIS DECISION IS MADE, ADDITIONAL CLEANUP OF SOILS, SEDIMENTS, AND TAILINGS MAY BE REQUIRED, ESPECIALLY BELOW POND 1. THE DECISION ON FINAL DISPOSITION OF PONDS 2 AND 3 IS ALSO DEFERRED, UNTIL UPSTREAM CLEANUP DECISIONS ARE MADE AND THERE IS NO LONGER A NEED FOR USE OF THE PONDS AS WATER TREATMENT FACILITIES.

#### **REASONS FOR SIGNIFICANT CHANGES**

THE MOST PROMINENT DIFFERENCE BETWEEN THE ORIGINALLY PREFERRED REMEDY AND THE SELECTED REMEDY IS THE ELIMINATION OF THE UPSTREAM SEDIMENT SETTLING BASIN. IN FACT, THAT CHANGE IS PERHAPS THE ONLY SIGNIFICANT DIFFERENCE BETWEEN THE TWO CLEANUP APPROACHES; THE OTHER DIFFERENCES SUMMARIZED ABOVE ARE CONSEQUENCES OF THE DECISION TO ROUTE FLOODS UP TO THE 100-YEAR EVENT THROUGH THE POND SYSTEM. THEIR EXPECTED PERFORMANCE IN RELATION TO THEIR PREDECESSOR COMPONENTS AND IN RELATION TO THE NINE CRITERIA SPECIFIED BY THE NCP IS THOROUGHLY EVALUATED AND DESCRIBED IN SECTION 8.0, COMPARATIVE ANALYSIS OF THE ALTERNATIVES.

THE RATIONALE FOR ELIMINATING THE UPSTREAM SEDIMENT SETTLING BASIN IS EXPLAINED IN THE DECLARATION (PAGE 1-5) AND DOCUMENTED IN THE RESPONSIVENESS SUMMARY. BRIEFLY, THE CHANGES WERE MADE IN RESPONSE TO PUBLIC OPPOSITION TO ANOTHER CONTAMINATED POND IN THE VICINITY OF THE OPPORTUNITY TAILINGS PONDS OR THE TOWN OF OPPORTUNITY.

ADDITIONALLY, AN ALTERNATIVE PROPOSAL PRESENTED BY THE POTENTIALLY RESPONSIBLE PARTY, ARCO, WAS DETERMINED BY THE EPA AND STATE TO BE AN ACCEPTABLE REMEDY FOR STORAGE AND TREATMENT OF FLOWS UP TO THE 100-YEAR FLOOD. IT OBTIATES THE NEED FOR THE UPSTREAM IMPOUNDMENT AND IT OFFERS THE

ADDITIONAL ADVANTAGES OF IMPROVED TREATMENT. OF DISSOLVED METALS IN FLOOD WATERS AND KEEPING CONTAMINANTS WITHIN THE EXISTING BOUNDARIES OF THE OPERABLE UNIT. THIS DETAILED PROPOSAL IS PART OF THE ADMINISTRATIVE RECORD FOR THE SITE, AND IS REFERENCED IN THE PROPOSED PLAN. THE EPA HAS DETERMINED THESE CHANGES ARE SIGNIFICANT; HOWEVER, A REVISED PROPOSED PLAN OR RENEWED PUBLIC COMMENT PERIOD IS NOT REQUIRED. GUIDANCE (OSWER DIRECTIVE 9335 .3-02) (12) STATES:

"IF THE SIGNIFICANT CHANGE TO A COMPONENT OF THE ALTERNATIVE COULD HAVE BEEN REASONABLY ANTICIPATED BY THE PUBLIC, THE LEAD AGENCY NEED ONLY DOCUMENT THE SIGNIFICANT CHANGE IN THE DECISION SUMMARY". IN THIS INSTANCE, A MAJORITY OF THE PUBLIC REQUESTED THE CHANGE, FULLY AWARE THAT THE ELIMINATION OF THE UPSTREAM IMPOUNDMENT WOULD NECESSITATE ROUTING OF FLOOD FLOWS INTO THE POND SYSTEM.

THE DECISION TO DEFER CERTAIN ASPECTS OF THE CLEANUP DOES NOT SIGNIFICANTLY CHANGE THOSE ASPECTS OF CLEANUP WHICH ARE SELECTED IN THIS RECORD OF DECISION. THEREFORE, THERE IS NO NEED TO SUBMIT A REVISED PROPOSED PLAN TO ADDRESS THIS DECISION.

FINALLY, IT SHOULD BE RECOGNIZED THAT THESE CHANGES ARE THE PRODUCT OF A CONSTRUCTIVE DIALOGUE WITH BOTH THE PUBLIC AND THE POTENTIALLY RESPONSIBLE PARTY, WHICH RETAINS OWNERSHIP OF THE PONDS AND HAS EXTENSIVE EXPERIENCE IN OPERATING THEM AS AN EFFECTIVE WATER TREATMENT FACILITY. THE SELECTED REMEDY FORMULATED AND EVALUATED IN THIS RECORD OF DECISION BLENDS THE REMEDIAL ACTION PLANS OF THE REGULATORY AGENCIES AND THE POTENTIALLY RESPONSIBLE PARTY, AND IT IS SUPPORTED BY THE PUBLIC.

#RS

## RESPONSIVENESS SUMMARY

### PART A - PUBLIC COMMENTS

#### RESPONSES TO PUBLIC COMMENTS, AN OVERVIEW

THIS RESPONSIVENESS SUMMARY FOR THE WARM SPRINGS PONDS OPERABLE UNIT OF THE SILVER BOW CREEK SITE WAS PREPARED TO DOCUMENT AND RESPOND TO THE ISSUES AND COMMENTS RAISED BY THE PUBLIC REGARDING THE FEASIBILITY STUDY (FS) AND THE PROPOSED PLAN FOR THE OPERABLE UNIT.

A REMEDIAL INVESTIGATION (RI) AND A PUBLIC HEALTH AND ENVIRONMENTAL ASSESSMENT (PHEA) FOR THE OPERABLE UNIT HAVE BEEN COMPLETED. THE RI AND THE PHEA EXAMINED THE HUMAN HEALTH AND ENVIRONMENTAL RISKS POSED BY THE OPERABLE UNIT.

THE FS DEVELOPED A SET OF REMEDIAL ALTERNATIVES REPRESENTING A RANGE OF APPROACHES TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT FROM THE RISKS IDENTIFIED IN THE RI AND PHEA. THIS RANGE OF ALTERNATIVES WAS PRESENTED TO THE PUBLIC BY THE RELEASE OF THE FEASIBILITY STUDY REPORT. THE PROPOSED PLAN DETAILING THE REMEDIAL APPROACH FAVORED BY THE MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES (MDHES) AND EPA, WAS RELEASED AT THE SAME TIME AS THE FS. WHILE THE FS WAS BEING DEVELOPED, ARCO PREPARED A FEASIBILITY-LEVEL STUDY OF ITS OWN PROPOSAL, IDENTIFIED AS ALTERNATIVE 3A ARCO PRESENTED THIS ALTERNATIVE TO THE AGENCIES AND THE PUBLIC AT NUMEROUS MEETINGS AND PUBLIC PRESENTATIONS. THE AGENCIES HAVE CONDUCTED A FOCUSED TECHNICAL REVIEW OF ARCO'S PROPOSAL (CH2M HILL 1990). THAT REVIEW IS PART OF THE ADMINISTRATIVE RECORD.

THE PUBLIC COMMENT PERIOD FOR THE FS AND PROPOSED PLAN BEGAN IN NOVEMBER 1989 WITH THE RELEASE OF THE TWO DOCUMENTS. THE COMMENT PERIOD WAS EXTENDED ONCE AND RAN UNTIL THE END OF JANUARY 1990. PUBLIC REACTION, AS EXPRESSED AT THE PUBLIC MEETINGS AND IN THE PUBLIC COMMENT PERIOD FOR THE PS AND PROPOSED PLAN BEGAN IN NOVEMBER 1989 WITH THE RELEASE OF THE TWO DOCUMENTS. THE COMMENT PERIOD WAS EXTENDED ONCE AND RAN UNTIL THE END OF JANUARY 1990. PUBLIC REACTION, AS EXPRESSED AT THE PUBLIC MEETINGS AND IN WRITTEN COMMENTS, INCLUDED MANY QUESTIONS ABOUT HOW THE PREFERRED ALTERNATIVE WOULD WORK, CONCERNS ABOUT THE IMPACTS OF THE REMEDIATION, SUGGESTIONS FOR MODIFYING THE PROPOSED PLAN, AND REQUESTS THAT THE REMEDIATION BEGIN AS SOON AS POSSIBLE. STATE AND LOCAL AGENCIES ALSO RESPONDED TO THE PROPOSED PLAN. THEIR COMMENTS INCLUDED ADDITIONAL QUESTIONS AND SUGGESTED MODIFICATIONS TO THE PROPOSED PLAN.

SEVERAL CONCEPTS CAME UP REPEATEDLY IN THE PUBLIC'S COMMENTS. MANY COMMENTERS SUGGESTED THAT THE CONTAMINATED SEDIMENTS IN THE PONDS (APPROXIMATELY 19 MILLION CUBIC YARDS) WOULD HAVE TO BE REMOVED FROM THE FLOODPLAIN BEFORE THE CLEANUP COULD BE CONSIDERED A PERMANENT REMEDIATION. SEVERAL COMMENTERS POINTED OUT THAT ONE FEATURE OF THE PROPOSED PLAN, DIVERTING THE FLOWS IN MILL AND WILLOW CREEKS INTO THE POND SYSTEM FOR TREATMENT, WOULD HAVE NEGATIVE IMPACTS ON THE FISHERIES IN THOSE CREEKS AND THE UPPER CLARK FORK RIVER. MANY COMMENTERS EXPRESSED CONCERNS ABOUT THE POSSIBILITY OF CONSTRUCTING A SETTLING BASIN IN THE LOCATION CONSIDERED IN THE PS. SEVERAL COMMENTERS EXPRESSED CONCERNS THAT THE PROPOSED PLAN WOULD NOT DO ENOUGH TO PROVIDE TREATMENT FOR THE CONTAMINATED WATER IN SILVER BOW CREEK, AND SEVERAL OF THESE STATED THAT THE GOAL SHOULD BE TO TREAT ALL FLOWS IN SILVER BOW CREEK, UP TO THE FLOWS OF A 100-YEAR FLOOD, TO MEET THE AQUATIC CRITERIA AT ALL TIMES. THE SELECTED REMEDY ADDRESSES ALL OF THESE CONCERNS AS ADDRESSED BELOW.

ARCO SUBMITTED AS COMMENTS ON THE PS ITS OWN PLAN 3A AND DETAILED TECHNICAL COMMENTS ON PS REPORT. ARCO'S COMMENTS ON THE PS WERE EXTENSIVE ON ALMOST EVERY SECTION, AND REPEATEDLY ARGUED FOR THE ALTERNATE PROPOSAL THEY HAD SUBMITTED.

THE RESPONSIVENESS SUMMARY CONTAINS EPA'S AND MDHES' RESPONSES TO COMMENTS RECEIVED FROM THE PUBLIC. ADDRESSED ARE ORAL COMMENTS RECEIVED AT THE PUBLIC HEARING WRITTEN COMMENTS FROM INDIVIDUAL CITIZENS AND PRIVATE ORGANIZATIONS AND WRITTEN COMMENTS FROM VARIOUS GOVERNMENT ENTITIES. BECAUSE MANY OF THE COMMENTS ADDRESSED SIMILAR ISSUES, THE COMMENTS WERE CONSOLIDATED AND SUMMARIZED. A LISTING OF EACH COMMENTER IS INCLUDED AS ATTACHMENT III-A TO THIS RESPONSIVENESS SUMMARY. ALSO INCLUDED IS A CROSS-REFERENCE OF INDIVIDUAL COMMENTERS AGAINST THE SUMMARIZED COMMENTS THAT ARE RESPONDED TO. BY UTILIZING THIS CROSS-REFERENCE, EACH COMMENTER SHOULD BE ABLE TO LOCATE HIS/HER COMMENT AND THE AGENCY RESPONSE.

THE COMMENTS RECEIVED FROM ARCO WERE VOLUMINOUS AND COMPREHENSIVE. THEY ADDRESSED EACH INDIVIDUAL SECTION OF THE FS POINT BY POINT. ACCORDINGLY, THE RESPONSES TO ARCO'S COMMENTS ARE SEPARATED FROM THE PUBLIC COMMENTS AND THE RESPONSES FOLLOW THE FORMAT OF ARCO'S COMMENTS.

ALL COMMENTS, WHETHER THE PUBLIC'S OR ARCO'S, WERE CONSIDERED FULLY, AND ADJUSTMENTS TO THE PROPOSED PLAN WERE MADE IN RESPONSE TO THE PUBLIC COMMENTS AND ARCO COMMENTS.

## **RESPONSES TO PUBLIC COMMENTS**

### **GENERAL COMMENTS**

#### OVERALL REMEDIATION APPROACH

THE AGENCIES RECEIVED NUMEROUS COMMENTS AND RECOMMENDATIONS THAT DEALT WITH THE RELATIONSHIP BETWEEN THE WARM SPRINGS PONDS (WSP) REMEDIATION AND THE OTHER CLARK FORK RIVER SUPERFUND SITES AND OPERABLE UNITS, AND WITH THE GOALS AND OBJECTIVES OF WSP REMEDIATION. SEVERAL COMMENTERS (LETTERS 1, 56, 65, 91, 126, 127, 129, 144, 154, 157) MADE GENERAL REQUESTS THAT VIGOROUS EFFORTS BE MADE TOWARD CLEANING UP THE CLARK FORK RIVER. THREE COMMENTERS (LETTERS 101, 108, 126) NOTED THAT CLEAR GOALS AND OBJECTIVES SHOULD BE DEVELOPED FOR THE ENTIRE CLARK FORK SUPERFUND SITE, THAT WATER QUALITY AND HEALTH RISKS SHOULD BE CONTROLLING FACTORS IN THE GOALS, THAT THE WARM SPRINGS PONDS PROPOSALS MUST BE EVALUATED WITH RESPECT TO THESE OVERALL GOALS, AND THAT DIVIDING THE CLARK FORK SITES INTO SUBUNITS APPEARS TO HAVE FOSTERED UNEVEN PROGRESS. THE SAME COMMENTERS ADDED THAT THE OVERALL SITE NEEDS MORE COORDINATION. NUMEROUS OTHER COMMENTERS (LETTERS 4, 45, 55, 57, 68, 84, 85, 86, 89, 92, 101, 105, 107, 108, 111, 119, 124, 139, 143, 151; TESTIMONY A-2, A-9, A-12, A-15, A-16, B-6, B-10, M-3, M-9, M-10) ALSO RECOMMENDED THAT THE AGENCIES BEGIN CLEANUP ACTIVITIES AT THE SOURCES UPSTREAM OF THE WSP.

RESPONSE: MDHES AND THE US ENVIRONMENTAL PROTECTION AGENCY (EPA) ARE AGGRESSIVELY PURSUING CLEANUP OF THE CLARK FORK RIVER SUPERFUND SITES. THE OVERALL SITE CLEANUP IS COORDINATED BY EPA. THE AGENCIES' STRATEGY FOR THE CLEANUP WORK IS DESCRIBED IN THE CLARK FORK SUPERFUND MASTER PLAN. THE MOST RECENT REVISION OF THE MASTER PLAN IS SCHEDULED FOR FINAL RELEASE IN OCTOBER 1990. BECAUSE OF THE SIZE AND EXTENT OF PROBLEMS IN THE CLARK FORK BASIN, IT WAS NECESSARY THAT THE SITE BE BROKEN INTO SMALLER UNITS FOR STUDY.

THE AGENCIES DECIDED TO PUT THE WARM SPRINGS PONDS CLEANUP AHEAD OF THE UPSTREAM SILVER BOW CREEK OPERABLE UNITS BECAUSE OF THE POTENTIAL FOR CATASTROPHIC FAILURE OF THE POND BERMS DURING FLOODS OR EARTHQUAKES. A CATASTROPHIC FAILURE WOULD RESULT IN A RELEASE TO THE CLARK FORK RIVER OF AT LEAST A PORTION OF THE 19 MILLION CUBIC YARDS OF TAILINGS AND SLUDGES CURRENTLY IN THE PONDS. THIS TYPE OF FAILURE WOULD RESULT IN SIGNIFICANT DAMAGE TO THE CLARK FORK RIVER. THIS SEQUENCING WILL MAKE IT NECESSARY TO READDRESS THE ULTIMATE DISPOSITION OF THE PONDS WHEN UPSTREAM SILVER BOW CREEK IS REMEDIATED, BUT INITIAL ACTION ON THE PONDS COULD NOT BE DELAYED.

CLEANUP AT OTHER PARTS OF THE SILVER BOW CREEK SITE AND AT OTHER SITES IN THE CLARK FORK BASIN IS BEING MOVED ALONG AS FAST AS THE SUPERFUND PROCESS WILL ALLOW. WARM SPRINGS PONDS IS JUST ONE OF THE 25 OPERABLE UNITS THAT REQUIRE STUDY AND CLEANUP IN THE CLARK FORK BASIN. THESE ARE ALL COMPLEX UNITS THAT REQUIRE ACTION, AND IT WILL TAKE TIME TO ADDRESS ALL OF THEM. ADDITIONAL INFORMATION ON THE SCHEDULE FOR THE SITE-WIDE CLEANUP IS IN THE CLARK FORK SUPERFUND MASTER PLAN.

ONE OF THE OVERALL GOALS FOR CLEANUP OF THE BASIN IS TO ACHIEVE WATER QUALITY STANDARDS FOR THE SURFACE-WATER BODIES WITHIN THE BASIN. THE SELECTED REMEDY WILL ACHIEVE THIS GOAL FOR WATER ENTERING THE CLARK FORK RIVER FROM SILVER BOW, MILL AND WILLOW CREEKS, UNTIL UPSTREAM CLEANUP ACTIONS RESULT IN WATER QUALITY STANDARD COMPLIANCE IN THOSE STREAMS.

ONE COMMENTER (LETTER 151) STATED THAT MDHES AND EPA SHOULD RECOGNIZE THE NEED FOR A PHASED RESPONSE AT THE WARM SPRINGS PONDS, IN WHICH THE PONDS CAN SERVE ON AN INTERIM BASIS AS A TREATMENT SYSTEM FOR SILVER BOW CREEK UNTIL THE UPSTREAM SOURCES ARE CLEANED UP. ONCE THAT IS ACHIEVED, A FINAL REMEDY COULD BE CHOSEN FOR WARM SPRINGS PONDS.

RESPONSE: THE GOALS AND OBJECTIVES FOR THE CLEANUP OF THE WARM SPRINGS PONDS ARE DESCRIBED IN DETAIL IN CHAPTERS 3 AND 5 OF THE PS AND IN THE ROD. PROTECTION OF HUMAN HEALTH AND MEETING AMBIENT WATER QUALITY STANDARDS IN THE UPPER CLARK FORK RIVER ARE TWO OF THE REMEDIAL OBJECTIVES.

THE CLEANUP AT WARM SPRINGS PONDS IS BEING PHASED IN A MANNER CONSISTENT WITH THAT REQUESTED BY THE COMMENTER. REMEDIATION IS PROGRESSING RAPIDLY WITH ACTION AT THE MILL-WILLOW BYPASS UNDER WAY DURING THE 1990 CONSTRUCTION SEASON. TAILINGS ARE BEING REMOVED FROM THE BYPASS, AND THE WESTERN BERMS OF THE PONDS ARE BEING STRENGTHENED TO WITHSTAND THE MAXIMUM CREDIBLE EARTHQUAKE (MCE) AND DESIGN FLOODS AS PART OF THIS ACTION. THE CLEANUP OF THE REMAINDER OF THE REMAINING WARM SPRINGS PONDS AREA WILL FOLLOW THE MILL-WILLOW BYPASS REMOVAL.

THE ROD FOR THIS OPERABLE UNIT IS AN INTERIM ROD. THE SELECTED REMEDIES WILL NECESSARILY REMAIN IN PLACE UNTIL SUCH TIME THAT THE UPSTREAM CONTAMINATION SOURCES AND DEPOSITIONS ALONG SILVER BOW CREEK ARE REMEDIATED AND THERE IS NO LONGER A NEED TO TREAT SILVER BOW CREEK WATERS. AT THAT TIME THE ULTIMATE DISPOSITION OF THE WARM SPRINGS PONDS WILL BE DETERMINED.

ONE COMMENT (LETTER 129) SUGGESTED THAT THE AGENCIES KEEP WORKING ON INCREMENTS THAT SHOW ACTION AT THE SITE, SUCH AS THE REMOVAL AND RENOVATION OF THE MILL-WILLOW BYPASS AND THE EXPERIMENTAL RESEEDING OF STREAMSIDE TAILINGS.

RESPONSE: ACTION WILL CONTINUE IN THESE AREAS. AS INDICATED ABOVE REMOVAL OF THE TAILINGS IN THE MILL-WILLOW BYPASS AND STRENGTHENING OF THE WESTERN BERMS IN THE BYPASS ARE UNDERWAY DURING THIS CONSTRUCTION SEASON. WORK ON DEVELOPING METHODS TO REVEGETATE STREAMSIDE TAILINGS IS CONTINUING UNDER THE STREAMSIDE TAILINGS AND REVEGETATION STUDY. IT IS THE GOAL OF MDHES AND EPA TO CONTINUE TO MOVE THE CLEANUP OF THESE SITES ALONG AS RAPIDLY AS POSSIBLE.

SEVERAL COMMENTERS (LETTERS 24, 27, 29, 41, 44, 55, 57; TESTIMONY A-2, A-16) SUGGESTED THAT SUPERFUND REMEDIATION EFFORTS SHOULD BE CONCERNED MORE WITH IMPACTS ON PEOPLE THAN WITH IMPACTS ON FISH AND WILDLIFE.

RESPONSE: REMEDIATION STRATEGIES MUST ADDRESS THE IMPACTS OF SITE CONTAMINATION ON PEOPLE AND IMPACTS ON THE ENVIRONMENT. THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY DEALT WITH BOTH. THE SELECTED REMEDY IS THOUGHT TO BE PROTECTIVE OF BOTH PUBLIC HEALTH AND THE ENVIRONMENT.

#### REMEDICATION SCHEDULE.

MANY COMMENTERS (LETTERS 48, 56, 68, 70, 91, 96, 97, 98, 100, 109, 112, 114, 116, 118, 119, 122, 123, 125, 131, 132, 134, 135, 139, 142, 146, 147, 149, 151, 153, 154, 155, 159, 161; TESTIMONY B-2, B-4, M-1, M-5, M-10) RECOMMENDED THAT WORK SHOULD START AS SOON AS POSSIBLE, AND NO LATER THAN THE CONSTRUCTION SEASON OF 1990. ONE COMMENTER (LETTER 139) RECOMMENDED THAT THE MILL-WILLOW BYPASS RECEIVE IMMEDIATE ATTENTION TO PREVENT A FISHKILL IN 1990. ONE COMMENTER (LETTER 151) RECOMMENDED SPECIFICALLY THAT THE UPGRADING OF THE POND TREATMENT SYSTEM, BERM STABILIZATION, AND REMOVAL OF TAILINGS FROM THE MILL-WILLOW BYPASS BE SEGREGATED FROM DEVELOPMENT OF FLOOD CONTROL ALTERNATIVES AND THAT WORK SHOULD BEGIN ON THE UPGRADING, STABILIZATION, AND REMOVAL ACTIVITIES THIS CONSTRUCTION SEASON. THE COMMENTER FURTHER RECOMMENDED THAT THIS WORK SHOULD PROCEED DURING 1990 UNDER A UNILATERAL ORDER IF NEGOTIATIONS WITH ARCO ARE UNABLE TO PRODUCE AN ACCEPTABLE CONSENT ORDER, AND THAT THE STABILIZATION AND REMOVAL ACTIVITIES SHOULD UTILIZE THE MOST CONSERVATIVE AND PROTECTIVE DESIGN CRITERIA. TWO COMMENTERS (LETTERS 139, 154) THOUGHT THAT CONSTRUCTION OF IMPROVEMENTS UPSTREAM OF THE PONDS SHOULD BEGIN IMMEDIATELY.

RESPONSE: MDHES AND EPA AGREE THAT AS MUCH WORK AS POSSIBLE SHOULD BEGIN DURING THE 1990 CONSTRUCTION SEASON. A CONSENT ORDER WAS SIGNED BY EPA AND ARCO IN JULY TO ALLOW FOR REMOVAL OF TAILINGS FROM THE MILL-WILLOW BYPASS AND REINFORCEMENT OF THE WESTERN BERMS OF PONDS 2 AND 3 FOR EARTHQUAKE AND FLOOD PROTECTION. IT WAS DECIDED BY THE AGENCIES THAT ONLY THAT AMOUNT OF WORK COULD BE REASONABLY COMPLETED BY THE END OF THE 1990 CONSTRUCTION SEASON. BY THE END OF THIS SEASON, HOWEVER, ANY THREAT OF FISHKILLS BEING CAUSED BY TAILINGS IN THE MILL-WILLOW BYPASS WILL BE VIRTUALLY ELIMINATED AND THE POTENTIAL FOR CATASTROPHIC FAILURE OF THE PONDS DUE TO FLOODS AND EARTHQUAKES WILL BE SUBSTANTIALLY REDUCED.

THE AGENCIES INTEND TO EXPEDITE AND PHASE THE REMEDIAL DESIGN OF THIS PROJECT IN ORDER THAT CONSTRUCTION ACTIVITIES CAN CONTINUE SMOOTHLY DURING THE 1991 CONSTRUCTION SEASON. IT IS PRESENTLY EXPECTED THAT THE REMAINING BERM IMPROVEMENTS FOR EARTHQUAKE AND FLOOD PROTECTION AND THE INLET/OUTLET STRUCTURE AND TREATMENT IMPROVEMENTS FOR POND 3 WILL BE UNDERTAKEN AT THAT TIME. THE SPECIFIC SCHEDULE OF THE FUTURE REMEDIATION ACTIVITIES WILL BE DETERMINED IN THE REMEDIAL DESIGN. AS DISCUSSED IN DETAIL IN THE FOLLOWING SECTION, THE PUBLIC WILL BE KEPT INFORMED ABOUT ALL ELEMENTS OF THE PROPOSED REMEDIATION.

THE SCHEDULE FOR REMEDIATION OF CONTAMINATION DEPOSITION ALONG SILVER BOW CREEK AND IN BUTTE WILL PROCEED AS DESCRIBED IN THE CLARK FORK SUPERFUND MASTER PLAN. WHILE THE AGENCIES AGREE THAT REMEDIATION UPSTREAM OF THE PONDS SHOULD BEGIN AS SOON AS POSSIBLE, THERE REMAINS THE NEED TO CONTINUE EVALUATION OF ALTERNATIVE REMEDIATION APPROACHES BEFORE PLANS FOR UPSTREAM REMEDIATION CAN BE FINALIZED. THOSE ACTIVITIES, WHICH ARE PROCEEDING, ARE OUTLINED IN THE CLARK FORK SUPERFUND MASTER PLAN.

ANOTHER COMMENTER (LETTER 119) STATED THAT DESIGN ASSUMPTIONS CONCERNING THE PREDICTION THAT THE TAILINGS ALONG SILVER BOW CREEK AND PROBLEMS AT THE BERKELEY PIT WILL BE CLEANED UP IN 30 YEARS APPEAR TO BE UNREALISTIC, SINCE IT TOOK OVER 100-YEARS TO CREATE THE SITUATION. THE COMMENTER FURTHER SUGGESTED THAT THE AGENCIES ADDRESS THE POSSIBILITY OF STRETCHING OUT THE CLEANUP IN THE OPERABLE UNIT UP TO 100 YEARS, AND PROVIDING FLOOD PROTECTION FOR THE PONDS DURING THE INTERIM, BASED ON RISKS OF FAILURES AND ACCEPTABLE OCCURRENCES OF FLOODS ROUTING AROUND THE PONDS WITHOUT TREATMENT. ANOTHER COMMENTER (LETTER 93) SUGGESTED THAT THE AGENCIES CONCENTRATE ON DEVELOPING AN ADEQUATE SOLUTION OVER A LONG PERIOD.

RESPONSE: THERE IS NO REASON THAT IT SHOULD TAKE AS LONG TO CLEAN UP THE CONTAMINATION AS WAS SPENT CREATING IT. IT IS THE GOAL OF BOTH MDHES AND EPA TO HAVE THESE SOURCES OF CONTAMINATION REMEDIATED WITHIN THE 30-YEAR TIME FRAME. WITH RESPECT TO THE STRETCHING OUT THE WARM SPRINGS PONDS CLEANUP OVER 100 YEARS, THE AGENCIES BELIEVE THAT A MORE IMMEDIATE APPROACH TO THE HAZARDS PRESENTED BY THE PONDS IS NECESSARY. LEAVING THE BERMS UNPROTECTED, OR ONLY PARTIALLY PROTECTED FOR SEVERAL DECADES, WHILE THE UPSTREAM CONTAMINANTS ARE REMEDIATED, IS NOT AN ACCEPTABLE APPROACH.

#### INTERIM VS. PERMANENT REMEDIES

NUMEROUS COMMENTERS (LETTERS 53, 64, 65, 68, 69, 73, 74, 75, 78, 89, 92, 96, 97, 98, 100, 101, 106, 107, 108, 109, 112, 115, 116, 117, 118, 123, 124, 126, 128, 129, 130, 131, 133, 135, 136, 138, 140, 142, 143, 146, 147, 149, 151, 152, 159; TESTIMONY A-15, M-5, M-7, M-8, M-9, M-10, M-11, M-13, M-15) STATED THAT BOTH MDHES/EPA'S AND ARCO'S PROPOSALS FOR REMEDIATION OF THE WARM SPRINGS PONDS ARE INTERIM REMEDIES AND THAT, ALTHOUGH THESE REMEDIES ARE NEEDED NOW, PERMANENT CLEANUP UP OF THE SITES BETWEEN BUTTE AND WARM SPRINGS PONDS ARE NEEDED BEFORE MAKING A FINAL DECISION ON WARM SPRINGS PONDS.

RESPONSE: MDHES AND EPA RECOGNIZE THAT THE CURRENT PROPOSAL FOR WARM SPRINGS PONDS IS AN INTERIM REMEDY. THE FINAL DECISION ON THE CLEANUP OF THE PONDS 2 AND 3 WILL BE DELAYED AT LEAST 5 YEARS. AT THAT TIME, THE DEGREE OF CLEANUP ON SILVER BOW CREEK WILL BE ASSESSED AND, IF THE CLEANUP HAS PROGRESSED FAR ENOUGH, ALTERNATIVES FOR THE FINAL DISPOSITION OF THE PONDS WILL BE PRESENTED TO THE PUBLIC.

ALL STUDIES TO DATE HAVE INDICATED THAT PERMANENT TREATMENT OR TOTAL REMOVAL OF THE POND SEDIMENTS ARE NOT LIKELY TO BE THE MOST DESIRABLE PERMANENT SOLUTION. CERCLA REQUIRES EPA TO RELY ON TREATMENT OF WASTES TO REDUCE THEIR TOXICITY, MOBILITY, AND VOLUME WHENEVER PRACTICABLE IN ORDER TO ACHIEVE PERMANENT REMEDIES. HOWEVER, THE RI/FS GUIDANCE DOCUMENT RECOGNIZES THAT PERMANENT TREATMENT SOLUTIONS MAY NOT BE PRACTICABLE FOR HIGH VOLUME WASTE SITES SUCH AS MINING SITES. THE VOLUMES OF WASTES CAN BE SO LARGE THAT TREATMENT OF THE WASTES IS NOT FEASIBLE. AN IN SITU TREATMENT-BASED ALTERNATIVE WAS DEVELOPED IN THE FS TO ALLOW THE PUBLIC AND THE AGENCIES TO GAUGE THE COSTS OF TREATMENT-BASED APPROACHES FOR THE VOLUMES OF WASTES THAT EXIST AT WARM SPRINGS PONDS. THE RESULTS INDICATE THAT EVEN FOR IN SITU TREATMENT, WHICH IS OFTEN LESS EXPENSIVE AND QUICKER THAN TREATMENT APPROACHES REQUIRING EXCAVATION, THE TIME AND COSTS INVOLVED ARE NOT REASONABLE. IN SHORT, THE PROSPECTS FOR A TREATMENT-BASED PERMANENT SOLUTION TO THE WASTES IN THE PONDS ARE NOT GOOD, EVEN SEVERAL YEARS FROM NOW ONCE THE UPSTREAM AREAS HAVE BEEN REMEDIATED. HOWEVER, IF AT THAT TIME NEW TREATMENT PROCESSES HAVE BECOME AVAILABLE THAT OFFER SOME PROMISE FOR TREATING THE NEARLY 19 MILLION CUBIC YARDS OF WASTES AT THIS OPERABLE UNIT, THOSE OPTIONS CAN BE EXPLORED.

THE FUTURE POTENTIAL FOR MOVING THE SEDIMENTS TO ANOTHER LOCATION IS ALSO NOT PROMISING. EPA AND ARCO ARE PRESENTLY CONDUCTING A STUDY TO SITE A RCRA-EQUIVALENT WASTE REPOSITORY FACILITY IN THE ANACONDA AREA. HOWEVER, THE TECHNICAL DIFFICULTIES OF TRYING TO REMOVE 19 MILLION CUBIC YARDS OF CONTAMINATED MATERIALS AND SAFELY TRANSPORT THEM TO A DISPOSAL FACILITY IS DAUNTING. SUCH A REPOSITORY FACILITY FOR THESE WASTES WOULD ALSO REQUIRE CONTINUING OPERATION, MAINTENANCE, AND MONITORING, AND WOULD BE A CONTINUING THREAT TO GROUNDWATER. IN ADDITION, SUCH A FACILITY WOULD BE NO MORE PERMANENT THAN AN UPGRADED POND SYSTEM. IT MAY WELL BE THAT AN

UPGRADED POND SYSTEM IS THE SAFEST, MOST COST-EFFECTIVE, AND ENVIRONMENTALLY SOUND PERMANENT REMEDIATION OF THE SITE.

ANOTHER COMMENTER (LETTER 119) THOUGHT THAT THE REMEDIATION SHOULD BE "FOR POSTERITY." THIS MEANS THAT THE PROPOSED STRUCTURES SHOULD BE FREE FROM HYDROLOGIC AND GEOLOGIC HAZARDS AND SHOULD BE MAINTENANCE FREE FOR AT LEAST 1,000 YEARS. THE COMMENTER STATED THAT IF THE SEDIMENTS ARE LEFT IN THE POND SYSTEM, THE CRITERIA COULD NOT BE MET. HE ALSO NOTED THAT THE MEASURES PROPOSED IN THE FS WOULD REQUIRE PERIODIC MAINTENANCE TO ENSURE THAT THEY CONTINUE TO PROVIDE ADEQUATE PROTECTION.

RESPONSE: EPA AND MDHES RECOGNIZE THAT MAINTENANCE WILL BE REQUIRED ON THE BERMS AND THEIR ASSOCIATED FLOOD PROTECTION. BUDGETARY COSTS FOR OPERATION AND MAINTENANCE SHOWN IN CHAPTER 8 OF THE FEASIBILITY STUDY INCLUDE ALLOWANCES FOR BERM AND FLOOD PROTECTION MAINTENANCE. MAINTENANCE OF THE VARIOUS STRUCTURES WILL LIKELY BE THE RESPONSIBILITY OF ARCO. REQUIREMENTS FOR MAINTENANCE WILL BE INCLUDED IN THE RECORD OF DECISION, AND WILL BE MORE FULLY DEVELOPED IN THE REMEDIAL DESIGN/REMEDIAL ACTION (RD/PA) PHASE. IT WOULD BE PROHIBITIVELY EXPENSIVE TO DESIGN AND CONSTRUCT ENGINEERING STRUCTURES THAT WOULD LAST 1,000 YEARS WITHOUT MAINTENANCE. REGARDLESS OF THE FINAL DISPOSITION OF THE WARM SPRINGS PONDS SEDIMENTS, SOME MAINTENANCE WILL BE REQUIRED. EVEN IF THE SEDIMENTS ARE REMOVED AND DISPOSED OF OUTSIDE THE FLOODPLAIN, SOME MAINTENANCE ON ITEMS SUCH AS CONTAMINANT BERMS, LINERS, CAPS, LANDSCAPING, ETC., WILL BE REQUIRED.

THREE COMMENTERS (LETTERS 101, 108, 126) STATED THAT PROVISIONS MUST BE CLEARLY SPELLED OUT CONCERNING WHAT HAPPENS AFTER REMEDIATION, IF THE STANDARDS ARE VIOLATED, AND WHO WILL PAY THE BILLS FOR ANY NECESSARY ADDITIONAL REMEDIAL MEASURES. SIX COMMENTERS (LETTERS 11, 20, 34, 39, 43, 86) ASKED ABOUT LIABILITY INSURANCE TO REQUIRE THAT THE CLEANUP IS DONE CORRECTLY. ONE COMMENTER (TESTIMONY B-4) NOTED THAT ARCO WILL REMAIN LIABLE EVEN AFTER A REMEDY IS IN PLACE. ANOTHER COMMENTER (TESTIMONY M-13) SUGGESTED THAT ARCO BE REQUIRED TO ESTABLISH A TRUST FUND TO COVER THE COSTS OF FUTURE IMPROVEMENTS TO THE REMEDIAL ACTION THAT MAY BE REQUIRED.

RESPONSE: THE PROVISIONS OF CERCLA (THE SUPERFUND ACT) ARE VERY SPECIFIC IN TERMS OF FINANCIAL LIABILITY. IN THIS CASE, ARCO IS RESPONSIBLE FOR PAYING FOR ALL NECESSARY REMEDIAL ACTIONS, NOW AND IN THE FUTURE.

AFTER THE ISSUANCE OF THE RECORD OF DECISION, A MONITORING PLAN WILL BE DEVELOPED. THE PROVISIONS OF THE MONITORING AND COMPLIANCE PLAN WILL BE VERY SPECIFIC IN TERMS OF LOCATIONS, PARAMETERS, TYPES OF ANALYSES, STANDARDS TO BE MET, AND REPORTING REQUIREMENTS. IN ADDITION, PENALTIES CAN BE IMPOSED BY EPA FOR VIOLATIONS OF THE COMPLIANCE REQUIREMENTS.

IT SHOULD ALSO BE NOTED THAT THE PROVISIONS OF CERCLA REQUIRE PERIODIC REVIEWS AT 5-YEAR INTERVALS FOR REMEDIAL ACTIONS THAT LEAVE WASTES IN PLACE. THESE REVIEWS WILL EXAMINE IN DETAIL THE PERFORMANCE OF THE REMEDIATION IN MEETING THE GOALS ESTABLISHED BY THE RECORD OF DECISION. IF THE GOALS ARE NOT BEING MET, FURTHER ACTIONS MAY BE REQUIRED IN THE FUTURE AND WOULD BE PAID FOR BY THE RESPONSIBLE PARTY. IN ANY ENFORCEMENT ACTION, THE RESPONSIBLE PARTY WILL BE REQUIRED TO DEMONSTRATE ASSURANCES OF FINANCIAL CAPABILITY. THOSE ASSURANCES MAY INCLUDE THE ESTABLISHMENT OF TRUST FUNDS OR BONDS.

#### PUBLIC PARTICIPATION.

NUMEROUS COMMENTERS (LETTERS 3, 12, 14, 15, 17, 19, 20, 23, 26, 28, 34, 35, 36, 40, 49, 60, 76, 78, 81, 87, 89, 96, 100, 101, 105, 108, 110, 113, 118, 123, 126, 129, 131, 138, 139, 151, 159; TESTIMONY A-2, A-S, A-6, A-7, A-8, A-12, A-14, A-15, B-4, B-8, B-10, M-5, M-7, M-8, M-10, M-11, M-12, M-16) EXPRESSED A DESIRE FOR BETTER PUBLIC INVOLVEMENT AND GREATER COOPERATION AMONG THE AGENCIES, LOCAL GOVERNMENTAL AND ELECTED OFFICIALS, AND LOCAL CITIZENS AND PUBLIC INTEREST GROUPS DURING THE SUPERFUND PROCESS. SOME INDICATED THAT ANACONDA/DEER LODGE COUNTY SHOULD BE INVOLVED IN THE DECISION-MAKING PROCESS. MANY OF THESE COMMENTERS FORMALLY REQUESTED AN EXTENSION OF THE PUBLIC COMMENT PERIOD. ANOTHER COMMENTER (LETTER 151) STATED THAT THE PUBLIC PARTICIPATION PROCESS FOLLOWED FOR THE WARM SPRINGS PONDS FS WAS FLAWED BECAUSE IT DID NOT GIVE THE PUBLIC AN OPPORTUNITY TO PARTICIPATE IN THE SCOPING OF ALTERNATIVES, AND RECOMMENDED THAT THE AGENCIES USE AN APPROACH SIMILAR TO THAT FOLLOWED UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA). ONE COMMENTER (LETTER 138) INTERPRETED THE CERCLA GUIDELINES TO NOT ALLOW PUBLIC AGENCIES TO DISCLOSE CLEANUP ALTERNATIVES TO THE PUBLIC BEFORE THEY HAVE BEEN APPROVED AND SCREENED BY EPA. ONE COMMENTER (LETTER 150) STATED THAT THE AGENCIES DID A GOOD JOB IN KEEPING

THE PUBLIC INFORMED.

RESPONSE: A SHORT DESCRIPTION OF THE PUBLIC INVOLVEMENT PROGRAM FOR THE WARM SPRINGS PONDS OPERABLE UNIT IS PROVIDED IN THE ROD. ALTHOUGH THE PUBLIC PARTICIPATION PROCESS FOLLOWED FOR THE WSP FS WAS IN COMPLIANCE WITH ALL REQUIREMENTS OF THE NATIONAL CONTINGENCY PLAN (NCP), IT IS OBVIOUS THAT ADDITIONAL EFFORTS ARE NEEDED TO FACILITATE INCREASED INVOLVEMENT OF LOCAL CITIZENS EARLY IN THE PROCESS. THE AGENCIES ARE STRIVING TO INVOLVE ALL APPROPRIATE PARTIES AND AGENCIES IN FUTURE ACTIVITIES AT WARM SPRINGS PONDS AND AT OTHER SITES IN THE CLARK FORK BASIN.

PUBLIC INVOLVEMENT IN THE MILL-WILLOW BYPASS REMOVAL ACTION IS REPRESENTATIVE OF THIS EFFORT. A SCOPING MEETING ON THE MILL-WILLOW BYPASS AND OTHER ISSUES WAS HELD ON FEBRUARY 6, 1990, WITH PARTICIPATION BY EPA, MDHES AND OTHER STATE AGENCIES, VARIOUS CITY AND COUNTY REPRESENTATIVES, AND PUBLIC INTEREST GROUP REPRESENTATIVES. PUBLIC MEETINGS WERE HELD AT FAIRMONT AND MISSOULA ON FEBRUARY 27 AND 28, 1990, RESPECTIVELY, TO GATHER INPUT FROM THE GENERAL PUBLIC ON THE MILL-WILLOW BYPASS ACTIVITIES AND OTHER ACTIONS PLANNED BY THE AGENCIES AND ARCO. ONCE THE MILL-WILLOW BYPASS REMOVAL PLANS WERE MORE FULLY DEVELOPED, THREE MORE PUBLIC MEETINGS WERE HELD (IN ANACONDA, DEER LODGE, AND MISSOULA) IN LATE MAY. NUMEROUS COORDINATION MEETINGS INVOLVING LOCAL GOVERNMENT OFFICIALS, REPRESENTATIVES OF INTERESTED STATE AGENCIES (SUCH AS THE DEPARTMENT OF FISH, WILDLIFE, AND PARKS AND THE MDHES WATER QUALITY BUREAU), AND PUBLIC INTEREST GROUPS WERE HELD IN PREPARATION FOR THIS SUMMER'S REMOVAL ACTION. ACTIVE EFFORTS TO INVOLVE THE PUBLIC WILL CONTINUE AT WARM SPRINGS PONDS AND THE OTHER CLARK FORK BASIN SITES.

ALTHOUGH PRESENTATION OF THE ALTERNATIVES AND PROPOSED PLAN ARE MANDATED BY THE NCP TO OCCUR AT THE CONCLUSION OF THE PREPARATION OF THE FEASIBILITY STUDY AND PROPOSED PLAN, THERE IS NOTHING IN THE GUIDELINES TO PRECLUDE PUBLIC INVOLVEMENT AT AN EARLIER STAGE. IN FACT, SUCH INVOLVEMENT IS ENCOURAGED. AS DISCUSSED ABOVE, EPA AND MDHES ARE MAKING STRONG EFFORTS TO INCREASE EARLY PUBLIC INVOLVEMENT. SPECIFIC ELEMENTS ABOUT HOW AND WHEN THE PUBLIC CAN BE INVOLVED ARE MADE ON A SITE-BY-SITE BASIS AND ARE INCLUDED IN THE SITE'S COMMUNITY RELATIONS PLAN. IN ALL CASES, THE PUBLIC IS INVOLVED WHEN THE PUBLIC DRAFT FEASIBILITY STUDY AND PROPOSED PLAN ARE COMPLETED, AND PUBLIC COMMENT IS TAKEN AND CONSIDERED AT THAT TIME.

THE PUBLIC COMMENT PERIOD FOR THIS PROJECT WAS EXTENDED FOR AN ADDITIONAL ONE MONTH. THE NUMBER OF COMMENTS RECEIVED IS A GOOD INDICATION OF THE SUCCESS OF EXTENDING THE COMMENT PERIOD.

ARCO COMMENTED AT THE PUBLIC HEARINGS (TESTIMONY A-3, B-3, M-6) THAT IT HAD NOT BEEN GIVEN THE OPPORTUNITY TO BE INVOLVED THROUGHOUT THE WARM SPRINGS RI/FS PROCESS. OTHER COMMENTERS (LETTERS 60, 87; TESTIMONY B-8) STATED THAT ARCO SHOULD HAVE BEEN GIVEN THE OPPORTUNITY TO PARTICIPATE.

RESPONSE: EPA AND MDHES AGREE THAT RESPONSIBLE PARTIES MUST BE INCLUDED IN THE RI/FS PROCESS. ARCO HAS NOT BEEN EXCLUDED FROM THE CERCLA PROCESS AT THE WARM SPRINGS PONDS. WHEN CERCLA ACTIVITIES BEGAN ON THE SILVER BOW CREEK SITE (WARM SPRINGS PONDS ARE A PART OF THIS SITE), ARCO WAS OFFERED THE OPPORTUNITY TO CONDUCT THE ACTIVITIES AT THE SITE. ARCO DECLINED THAT OFFER. AS A RESULT, THE AGENCIES CONDUCTED THE RI/FS STUDIES AT WSP. ARCO WAS GIVEN THE OPPORTUNITY TO COMMENT ON ALL STUDIES CONDUCTED AT THE SITE AND ALL DOCUMENTS PRODUCED, AND HAS COMMENTED FORMALLY TO THE AGENCIES ON MOST OF THE SITE ACTIVITIES. RECENTLY, ARCO HAS BEEN MORE RECEPTIVE TO OFFERS TO CONDUCT THE VARIOUS SUPERFUND ACTIVITIES UNDER AGENCY OVERSIGHT AND, IN FACT, IS PRESENTLY CONDUCTING MANY STUDIES AND ACTIVITIES, UNDER AGENCY ENFORCEMENT SUPERVISION, ON CLARK FORK SUPERFUND SITES. THE REMOVAL ACTION AT THE MILL-WILLOW BYPASS AND THE BERM IMPROVEMENTS FOR EARTHQUAKE AND FLOOD PROTECTION THIS SUMMER ARE BEING UNDERTAKEN BY ARCO.

ONE COMMENTER (LETTER 46) ASKED ABOUT THE STATUS OF THE PROPOSAL TO BRING AN EPA OFFICE TO BUTTE?

RESPONSE: AN EPA OFFICE HAS BEEN SET UP IN BUTTE AND IS LOCATED IN THE BUTTE-SILVER BOW CITY-COUNTY BUILDING.

#### MISCELLANEOUS GENERAL COMMENTS.

TWO COMMENTERS (LETTERS 52, 70) STATED THAT ALL CONTRACTORS AND THEIR EMPLOYEES SHOULD BE REQUIRED TO COMPLY WITH 29 CFR PART 1910. THE SAME COMMENTERS RECOMMENDED THAT EPA AND MDHES IMPLEMENT RULES ENSURING ALL CONTRACTORS PAY THE PREVAILING WAGES FOR WORK PERFORMED AND THAT LOCALLY-TRAINED PERSONNEL BE EMPLOYED TO REMEDIATE THE ENVIRONMENTAL HAZARDS AT THE WARM SPRINGS PONDS.

RESPONSE: 29 CFR PART 1910 SPECIFIES REQUIREMENTS FOR EMPLOYEE HEALTH AND SAFETY TRAINING AND EMPLOYEE PROTECTION PROGRAMS FOR WORK ON HAZARDOUS WASTE SITES. IT IS AN OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) REQUIREMENT. SINCE IT IS EXPECTED THAT ARCO AND ITS CONTRACTORS WILL BE CONDUCTING THE REMEDIATION, ARCO WILL BE REQUIRED TO HAVE ITS EMPLOYEES AND CONTRACTORS MEET THIS APPLICABLE OSHA REQUIREMENT.

IF ARCO IMPLEMENTS THE REMEDY AT WARM SPRINGS PONDS, IT WILL BE UP TO ARCO TO DECIDE WHICH CONTRACTORS WILL CONDUCT AND PERFORM THE WORK. ARCO'S WORK BEING PERFORMED UNDER THE MILL-WILLOW BYPASS REMOVAL THIS SUMMER HAS UTILIZED LOCAL CONTRACTORS AND EMPLOYEES FROM LOCAL UNIONS. IF EPA IMPLEMENTS THE SELECTED REMEDY, THEN SPECIFIC FEDERAL REGULATIONS REGARDING THE HIRING OF CONTRACTORS AND WORKERS WILL APPLY.

ANOTHER COMMENTER (LETTER 50) WONDERED WHY AN OUT-OF-STATE COMPANY (CH2M HILL) WAS HIRED TO DRILL THE MONITORING WELLS AT WARM SPRINGS PONDS FOR APPROXIMATELY \$1.4 MILLION. WILL THEY JUST LEAVE THE STATE AFTER THE WORK IS DONE? WOULDN'T A MONTANA WELL DRILLER BE CHEAPER?

RESPONSE: CH2M HILL WAS SELECTED TO CONDUCT THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDIES (RI/FS) FOR THE SILVER BOW CREEK SITE, WHICH INCLUDES THE WARM SPRINGS PONDS, BASED ON THE RESULTS OF THE COMPETITIVE PROCUREMENT PROCESS CONDUCTED BY MDHES. THE COST FOR THE WORK INCLUDED MANY ACTIVITIES IN ADDITION TO DRILLING WELLS. THESE ACTIVITIES INCLUDED SAMPLING OF SOILS, TAILINGS, SURFACE WATER AND GROUNDWATER, CONDUCTING TREATABILITY TESTS, DEVELOPING A FLOOD MODEL, PREPARING THE REMEDIAL INVESTIGATION, PUBLIC HEALTH AND ENDANGERMENT ASSESSMENT, AND THE FS REPORT.

MUCH OF THE WORK CONDUCTED AS PART OF THIS PROJECT WAS CONDUCTED BY LOCAL SUBCONTRACTORS. THE DRILLER USED AT WARM SPRINGS PONDS WAS O'KEEFE DRILLING OF BUTTE.

ONE COMMENTER (TESTIMONY A-8) STATED THAT THE FS NEEDED TO LOOK AT MORE ALTERNATIVES, AND THAT THE ALTERNATIVES NEED TO BE EVALUATED IN MORE DETAIL.

RESPONSE: IN RESPONSE TO THE COMMENTS FROM THE PUBLIC AND ARCO ON THE FS AND PROPOSED PLAN, THE AGENCIES HAVE EVALUATED AND CONSIDERED ALTERNATIVES NOT SPECIFICALLY ADDRESSED IN DETAIL IN THE FS. THE SELECTED REMEDY IS A COMBINATION OF ELEMENTS OF SEVERAL ALTERNATIVES. THE LEVEL OF ENGINEERING DETAIL IN THE FS IS CONSISTENT WITH THAT REQUIRED TO COMPLETE A FULL, FEASIBILITY-LEVEL EVALUATION OF ALTERNATIVES. DETAILED ENGINEERING ANALYSES WILL BE PART OF THE REMEDIAL DESIGN PHASE OF THIS PROJECT.

THREE COMMENTERS (LETTERS 46, 63, TESTIMONY A-4) STATED THAT TOO MANY STUDIES HAD BEEN DONE ALREADY ON THE SILVER BOW CREEK AND CLARK FORK BASIN SUPERFUND SITES, AND THAT THESE STUDIES HAVE BEEN A WASTE OF TIME AND MONEY.

RESPONSE: CERCLA REQUIRES THAT EPA INVESTIGATE AND DEVELOP REMEDIAL ACTIONS THAT ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AND ARE PERMANENT AND COST EFFECTIVE TO THE EXTENT POSSIBLE. RESPONSIBLE PARTIES ARE REQUIRED TO PAY FOR OR REIMBURSE EPA FOR ALL CLEANUP INVESTIGATIONS AND ACTIONS. IT WOULD BE INAPPROPRIATE TO UNDERTAKE LARGE, MULTI-MILLION DOLLAR CLEANUP ACTIONS WITHOUT SUBSTANTIAL DETAILED INVESTIGATIONS TO DETERMINE EFFECTIVE REMEDIATION APPROACHES.

ONE COMMENT (LETTER 113) RECOMMENDED SUPERFUND FUNDING BE DIRECTED TO LANDOWNERS FOR CONSERVATION EFFORTS ON THEIR LAND. ANOTHER COMMENTER (LETTER 130) THOUGHT THAT MONIES SHOULD BE GIVEN TO DEAR LODGE COUNTY AS COMPENSATION FOR THEIR LOST ECONOMIC POTENTIAL.

RESPONSE: SUPERFUND MONIES CANNOT BE USED FOR PAYMENTS TO LANDOWNERS FOR CONSERVATION EFFORTS. REMEDIES FOR CLEANUP OF EXISTING CONTAMINATION CAN BE IMPLEMENTED ON PRIVATE, NON-PRP LANDS, HOWEVER. THIS WORK WOULD BE PAID FOR BUT EITHER THE PARTY RESPONSIBLE FOR THE CONTAMINATION OR BY EPA COMPENSATION FOR LOST ECONOMIC POTENTIAL OF CONTAMINATED AREAS COULD NOT COME FROM CERCLA (SUPERFUND) FUNDS, BUT WOULD HAVE TO BE OBTAINED IN SEPARATE ACTION FROM THOSE PARTIES RESPONSIBLE FOR THE CONTAMINATION.

ONE COMMENT (LETTER 155) REQUESTED NOTICE OF THE APPROVED CLEANUP PLAN WHEN IT WAS COMPLETED.

RESPONSE: THE RECORD OF DECISION (ROD) STATES EPA'S DECISION ON THE CLEANUP METHODS TO BE IMPLEMENTED AT WARM SPRINGS PONDS. THIS HAS BEEN PREPARED AFTER REVIEWING ALL PUBLIC COMMENTS AND RECONSIDERING THE VARIOUS POSSIBLE REMEDIATION ALTERNATIVES. A PUBLIC NOTICE WILL BE ISSUED

REGARDING THE AVAILABILITY OF THIS ROD AND RESPONSIVENESS SUMMARY TO THE PUBLIC.

ONE COMMENTER (LETTER 101) ENCOURAGED EVERYONE TO HELP THE AGENCIES TO ATTRACT AND KEEP THE QUALITY OF PERSONNEL AND THE COMMITMENT OF RESOURCES NEEDED TO MOVE THROUGH THE CLEANUP PROCESS.

RESPONSE: MDHES AND EPA AGREE.

THREE COMMENTERS (LETTERS 25, 26, 41) OPPOSED THE CONCEPT OF REMOVING TOPSOIL FROM PASTURE LAND FOR RECLAMATION WORK AT WARM SPRINGS PONDS.

RESPONSE: THE NEED FOR TOPSOIL DURING THE REMEDIATION IS DISCUSSED IN THE FS. MUCH OF THE TOPSOIL REQUIRED WILL LARGELY COME FROM AREAS WITHIN THE OPERABLE UNIT. IT WOULD NOT BE REASONABLE TO STRIP ACRES OF PASTURE LAND OF THEIR TOPSOIL TO PROVIDE THE SOIL NEEDED. INSTEAD, POORER SOILS THAT CAN BE AMENDED TO SERVE AS COVER SOIL WILL BE USED WHEREVER POSSIBLE. SOURCES OF SUITABLE SOILS AND THE AMENDMENTS NECESSARY TO MAKE THEM WORK FOR THE INTENDED PURPOSES WILL BE EXPLORED DURING THE REMEDIAL DESIGN PHASE OF THE PROJECT.

ONE COMMENTER (LETTER 48) EXPRESSED SUPPORT FOR THE ARCO BERMING PROJECT DOWNSTREAM OF THE WARM SPRINGS PONDS.

RESPONSE: THE REFERENCED BERMING WORK WAS DONE BY ARCO UNDER ORDER FROM MDHES IN AN EFFORT TO ALLEVIATE FUTURE FISHKILLS IN THE UPPER CLARK FORK RIVER. THAT WORK IS BEING DONE DOWNSTREAM OF THE WARM SPRINGS PONDS OPERABLE UNIT AND HAS THEREFORE NOT BEEN ADDRESSED IN THIS FS OR ROD.

ONE COMMENTER (LETTER 3) ASKED IF THE ARSENIC ON SMELTER HILL IS BEING STORED TEMPORARILY OR PERMANENTLY. ANOTHER COMMENTER (TESTIMONY A-1) SUGGESTED THAT THE AGENCIES INVESTIGATE BERYLLIUM SITES IN THE OPPORTUNITY PONDS. ANOTHER COMMENTER (LETTER 86) RECOMMENDED KEEPING WATER IN THE OPPORTUNITY PONDS TO REDUCE DUST.

RESPONSE: CLEANUP STUDIES AT THE ANACONDA SMELTER SITE, INCLUDING THE OPPORTUNITY PONDS AND SMELTER HILL, ARE ONGOING. NO FINAL CLEANUP DECISION HAS BEEN MADE TO DATE. THE PROBLEMS OF FUGITIVE DUST, GROUNDWATER CONTAMINATION, AND BERYLLIUM DISPOSAL WILL BE ADDRESSED AS PART OF THESE ACTIVITIES. WHILE THESE STUDIES ARE ONGOING, ACTIONS HAVE BEEN TAKEN TO REDUCE DUST FROM THE PONDS. THESE ACTIVITIES HAVE INCLUDED PUTTING A LAYER OF LIMESTONE ON THE SURFACE OF THE DRY PORTIONS OF THE PONDS.

## **SITE CHARACTERIZATION AND PROBLEM DESCRIPTION**

### GROUNDWATER

ONE COMMENTER (LETTER 67) STATED THAT THE SUPERFUND INVESTIGATIONS OF THE WARM SPRINGS PONDS MAY UNDERESTIMATE THE CURRENT AMOUNT OF GROUNDWATER THAT DISCHARGES FROM THE WARM SPRINGS PONDS TO THE MILL-WILLOW BYPASS AND THE CLARK FORK RIVER AND THEREFORE MINIMIZE THE IMPORTANCE OF THE CONTAMINANTS THIS GROUNDWATER CONTAINS. BASED ON THE DATA PRESENTED IN THE PHASE I AND II REMEDIAL INVESTIGATION (RI) REPORTS, GROUNDWATER CONTRIBUTES A SUBSTANTIAL PORTION OF THE FLOW AND CONTAMINANT LOAD TO THE RIVER DURING LOW FLOW PERIODS. EXCEPT FOR A TRENCH, WHICH MAY INTERCEPT A FRACTION OF THE FLOW IN ONE AREA, NO REMEDIATION IS PLANNED.

USING DATA FROM THE PHASE I AND PHASE II RI REPORTS, THE COMMENTER STATES THAT THE COMBINED CALCULATED GROUNDWATER INFLOW TO THE UPPER BYPASS FROM THE EAST AND WEST IS PROBABLY SOMEWHAT GREATER THAN 3.4 CFS AND THAT THE INFLOW FROM THE LOWER BYPASS, THOUGH MORE DIFFICULT TO ESTIMATE, MAY BE CLOSE TO 3.8 CFS. THE TOTAL GROUNDWATER DISCHARGE TO THE ENTIRE MILL-WILLOW BYPASS COULD BE AS HIGH AS 7.5 CFS. NONE OF THE WARM SPRINGS PONDS STUDIES RECOGNIZE THAT MAGNITUDE OF GROUNDWATER DISCHARGE.

THE COMMENT ALSO NOTES THAT CONTAMINANT LOADS IN SURFACE WATER INCREASE THROUGH THE BYPASS AND UPPER CLARK FORK AND THAT THE MOST LIKELY SOURCE OF COPPER AND ZINC CONTAMINANTS IS THE GROUNDWATER PLUME DOWNGRAIENT OF POND 1. GROUNDWATER IN THIS AREA HAS HIGH SULFATE AND ZINC CONCENTRATIONS.

TO SUMMARIZE, CONTAMINATED GROUNDWATER EMANATING FROM THE PONDS DISCHARGES METALS AND SULFATE TO THE BYPASS AND RIVER AND EXACERBATES THE POOR AQUATIC LIFE CONDITIONS IN THE RIVER DURING LOW FLOW PERIODS.

RESPONSE: GROUNDWATER INFLOW RATES WERE ESTIMATED FOR VARIOUS REACHES OF THE MILL-WILLOW BYPASS USING BOTH DIRECT ANALYTICAL CALCULATIONS AND EMPIRICAL METHODS. BECAUSE DIRECT ANALYTICAL CALCULATIONS OF GROUNDWATER INFLOW TO THE BYPASS REQUIRE USE OF NUMEROUS ASSUMPTIONS, EPA AND MDHES CONTEND THAT INFLOW ESTIMATES USING EMPIRICAL METHODS ARE MORE REPRESENTATIVE OF SITE CONDITIONS.

DISCHARGE WAS MEASURED IN THE UPPER MILL-WILLOW BYPASS DURING JULY 1988, WHEN SURFACE WATER IN THE MILL-WILLOW BYPASS WAS DIVERTED INTO THE UPPER END OF POND 3. MEASUREMENTS OF FLOW BELOW THE DIVERSION POINT WERE CONSIDERED TO BE THE MOST ACCURATE MEANS OF DETERMINING THE RATE OF GROUNDWATER INFLOW TO THE BYPASS CHANNEL, BECAUSE ALL WATER FLOWING IN THE BYPASS CHANNEL AT THE TIME WAS DERIVED FROM GROUNDWATER SEEPAGE. DISCHARGE MEASUREMENTS COMPLETED AT FOUR LOCATIONS ALONG THE BYPASS BELOW THE POINT OF DIVERSION TO MIDWAY ALONG POND 2 INDICATED THE TOTAL SEEPAGE RATE TO THE MILL-WILLOW BYPASS WAS 2.57 CFS. THE AVERAGE GAIN IN SURFACE FLOW BETWEEN STATIONS SS-18 AND SS-25 DURING LOW FLOW MEASUREMENTS WAS 2.4 CFS. BASED ON THESE DATA, THE COMBINED RATE OF GROUNDWATER INFLOW TO THE CHANNEL FROM THE EAST AND WEST WAS APPROXIMATELY 0.18 CFS PER 1,000 FEET OF BYPASS CHANNEL. EXTRAPOLATING THESE UNIT INFLOW RATES TO THE ENTIRE BYPASS FROM SS-18 TO THE NORTHWEST CORNER OF POND 1 RESULTS IN A TOTAL GROUNDWATER INFLOW RATE TO THE BYPASS OF APPROXIMATELY 3.7 CFS. THE AGENCIES BELIEVE THIS INFLOW RATE IS CONSERVATIVE AND IS A MUCH BETTER CHARACTERIZATION OF SITE CONDITIONS THAN THE 7.5 CFS PRESENTED BY THE COMMENTER.

THE PURPOSE IN COMPLETING GROUNDWATER INFLOW CALCULATIONS (BOTH EMPIRICAL AND ANALYTICAL) FOR THE MILL-WILLOW BYPASS WAS TO PROVIDE REASONABLE ESTIMATES OF INFLOW QUANTITY FOR USE DURING THE FS IN EVALUATING CONSTRUCTION OF A GROUNDWATER INTERCEPTION DRAIN ALONG THE ENTIRE REACH OF THE BYPASS. CONSTRUCTION OF THIS TYPE OF INTERCEPTION DRAIN WAS EVALUATED TO DETERMINE THE FEASIBILITY OF: 1) INTERCEPTING GROUNDWATER EMANATING FROM THE WARM SPRINGS PONDS AND THE OPPORTUNITY PONDS BEFORE THE GROUNDWATER ENTERS THE MILL-WILLOW BYPASS, AND; 2) MAINTAINING GROUNDWATER LEVELS AT AN ELEVATION BELOW THE BASE OF TAILINGS LOCATED ADJACENT TO THE BYPASS.

SUBSEQUENT DATA COLLECTED AT THE SITE INDICATED THAT GROUNDWATER INFLOW TO THE BYPASS DOES NOT EXCEED MAXIMUM CONTAMINANT LEVELS OR GOLD BOOK AQUATIC STANDARDS. DATA TO SUPPORT THIS CONCLUSION WERE COLLECTED PRIMARILY IN CONJUNCTION WITH SURFACE WATER SAMPLING COMPLETED AT THREE LOCATIONS IN THE BYPASS CHANNEL DURING JULY 1988, WHEN MILL AND WILLOW CREEKS WERE DIVERTED INTO POND 3. SAMPLES COLLECTED AT THAT TIME FROM SAMPLING SITES SS-18C, SS-18C1, AND SS-18D ESSENTIALLY REPRESENTED GROUNDWATER SEEPING INTO THE BYPASS CHANNEL. ANALYTICAL RESULTS OF THOSE SAMPLES INDICATED THAT ALL PARAMETERS ANALYZED WERE BELOW GOLD BOOK STANDARDS. BECAUSE FRESHWATER AQUATIC CRITERIA ARE BASED ON ACID-SOLUBLE ANALYSES, USE OF DISSOLVED CADMIUM CONCENTRATIONS RANGING FROM 5.8 TO 6.4 UG/L MEASURED AT SAMPLING STATIONS SS-18C, SS-18C1, AND SS-18D, IN EVALUATING EXCEEDANCES OF CHRONIC AND ACUTE WATER QUALITY CRITERIA IS NOT APPROPRIATE. IN ADDITION, CONCENTRATIONS OF METALS MEASURED IN SAMPLES OBTAINED FROM MONITORING WELLS LOCATED ADJACENT TO THE MILL-WILLOW BYPASS ARE LESS THAN GOLD BOOK STANDARDS. BECAUSE OF THESE DATA, IT BECAME APPARENT THAT INTERCEPTION OF GROUNDWATER INFLOW TO THE BYPASS CHANNEL WAS UNNECESSARY IN MEETING ARARS ESTABLISHED FOR THE OPERABLE UNIT.

GROUNDWATER INFLOW TO THE CLARK FORK RIVER BETWEEN POND 1 AND PERKINS BRIDGE (SS-29) WAS NOT CALCULATED OR PRESENTED IN THE PHASE II RI. THE VALUES CITED BY THE COMMENTER AS INFLOW TO THE BYPASS IN THIS REACH OF THE BYPASS (1.8 AND 3.8 CFS) ARE ACTUALLY ESTIMATES OF THE GROUNDWATER FLUX IN THE SHALLOW SAND AND GRAVEL AQUIFER BENEATH THE POND 1 BERM. IT IS UNKNOWN WHAT PORTION OF THE GROUNDWATER MOVING BENEATH THE POND 1 BERM ACTUALLY SURFACES IN THE CLARK FORK RIVER SOUTH OF PERKINS LANE BRIDGE.

HOWEVER, SURFACE WATER QUALITY DATA COLLECTED DURING THE PHASE I RI DO NOT SHOW A MEASURABLE INCREASE OF COPPER AND ZINC AT SS-29, AS COMPARED TO UPSTREAM SITES SS-25, SS-28, AND PS-12, EVEN DURING LOW FLOW PERIODS WHEN THE LARGEST IMPACTS FROM GROUNDWATER INFLOWS SHOULD BE REALIZED IN THE STREAM. IN ADDITION, GROUNDWATER SAMPLES OBTAINED FROM MONITORING WELLS LOCATED DOWNGRADIENT OF POND 1 NEAR THE CLARK FORK RIVER EXHIBITED COPPER AND ZINC CONCENTRATIONS WELL BELOW THAT MEASURED IN THE CLARK FORK RIVER.

THE SAME COMMENTER (LETTER 67) NOTES THAT WELL COMPLETION LOGS FOR WELLS WSP-GW-17, 18S, 18D, 19S, AND 19D AND WSP-PW-01 ARE NOT IN THE PHASE II RI, SO A COMPLETE ANALYSIS OF THE GROUNDWATER INVESTIGATION COULD NOT BE DONE.

RESPONSE: THESE LOGS WERE INADVERTENTLY OMITTED FROM THE PHASE II RI. WELL COMPLETION LOGS FOR THESE WELLS HAVE BEEN ADDED TO THE AGENCIES' RESPONSE TO ARCO'S COMMENTS ON THE PHASE II RI,

WHICH IS PART OF THE ADMINISTRATIVE RECORD.

IN ADDITION, LETTER 67 STATES THAT WELL DEVELOPMENT FOR MOST OBSERVATIONS WELLS WAS INADEQUATE BECAUSE THE FINAL WATER PRODUCED FROM THE WELLS WAS NOT CLEAR. WELLS COMPLETED IN SANDS AND GRAVELS, SUCH AS THOSE ENCOUNTERED IN THE AREA, CAN BE DEVELOPED TO PRODUCE CLEAR WATER, BUT IT CAN TAKE LONGER THAN THE 10 TO 85 MINUTES SPENT AT EACH WELL. MEASURED TRACE-METAL CONCENTRATIONS IN TURBID WATER SAMPLES FROM WELLS THAT HAVE BEEN INADEQUATELY DEVELOPED OR PURGED MAY NOT BE REPRESENTATIVE OF ACTUAL LEVELS IN GROUNDWATER.

RESPONSE: WELL DEVELOPMENT FOLLOWING MONITORING WELL INSTALLATION USING HAND-LIFT PUMPS, SURGE BLOCKS, AND BAILERS WAS THE INITIAL STEP IN ENSURING REPRESENTATIVE FORMATION WATER WAS OBTAINED FOR LABORATORY ANALYSIS. PRIOR TO OBTAINING A SAMPLE FROM EACH MONITORING WELL DURING EACH SAMPLING EPISODE, WATER IN THE WELL WAS EVACUATED UNTIL RELATIVELY CLEAR, SAND-FREE WATER WAS OBTAINED. WELL EVACUATION WAS CONTINUED WHILE THE EVACUATED WATER WAS MONITORED FOR FIELD PARAMETERS INCLUDING TEMPERATURE, SPECIFIC CONDUCTIVITY, AND PH. WHEN MEASUREMENTS OF THESE FIELD PARAMETERS WERE WITHIN 5 PERCENT FOR THREE CONSECUTIVE SAMPLES OF THE EVACUATION WATER, THE WELL WAS DEEMED READY FOR SAMPLING. THIS PROCESS SOMETIMES RESULTED IN AN ADDITIONAL 1 TO 1.5 HOURS OF DEVELOPMENT TIME FOR PARTICULARLY TURBID WELLS.

ALL SAMPLES COLLECTED FOR METALS ANALYSIS WERE FIELD-FILTERED WITH A 0.45(U) FILTER TO REMOVE ANY RESIDUAL TURBIDITY PRIOR TO PRESERVING THE SAMPLES WITH NITRIC ACID. THIS PROCEDURE WAS CONSISTENT WITH THE PROJECT SAMPLING AND ANALYSIS PLAN AND IS STANDARD PRACTICE FOR PREPARING WATER SAMPLES FOR DISSOLVED METALS ANALYSIS.

THE SAME COMMENTER (LETTER 67) DESCRIBES THE MAP OF THE EXTENT OF GROUNDWATER CONTAMINATION AS INCOMPLETE BECAUSE THE BOUNDARIES OF THE PLUME EITHER STOP AT THE BOUNDARIES OF THE OPERABLE UNIT OR AT THE MILL-WILLOW BYPASS AND THE CLARK FORK RIVER. THE PLUME PROBABLY EXTENDS BEYOND THESE BOUNDARIES. THESE STREAMS MAY BE A GROUNDWATER DIVIDE AND, THEREFORE, LIMIT FURTHER MIGRATION OF THE PLUME AS THE RI INVESTIGATIONS SEEM TO ASSUME, BUT THIS HAS NOT BEEN DOCUMENTED. A COMPLETE RISK ASSESSMENT CANNOT BE DONE WITHOUT KNOWLEDGE OF THE FULL EXTENT OF THE PLUME.

RESPONSE: THE INTENT OF FIGURE 2-19 WAS TO PROVIDE THE READER WITH A FEEL FOR THE EXTENT OF GROUNDWATER CONTAMINATION AS RELATED TO IRON, MANGANESE, AND SULFATE CONCENTRATIONS WITHIN AND DIRECTLY ADJACENT TO THE WARM SPRINGS PONDS OPERABLE UNIT. SEPARATE STUDIES OF THE ANACONDA SMELTER-OPPORTUNITY PONDS SITE AND THE CLARK FORK RIVER ARE BEING CONDUCTED TO CHARACTERIZE GROUNDWATER QUALITY WEST OF THE MILL-WILLOW BYPASS AND NORTH OF THE WARM SPRINGS PONDS, RESPECTIVELY. COMBINING DATA FROM THE THREE STUDIES WOULD LIKELY INDICATE THAT THE REGIONAL EXTENT OF THE GROUNDWATER CONTAMINANT PLUME (ASSOCIATED WITH RELATIVELY HIGH CONCENTRATIONS OF IRON, MANGANESE, AND SULFATE) IS GREATER THAN THAT DEPICTED ON FIGURE 2-19. THE RISK ASSESSMENT FOR THE WARM SPRINGS PONDS OPERABLE UNIT WAS COMPLETED FOR THE OPERABLE UNIT ITSELF; FUTURE RISK ASSESSMENTS WILL INVESTIGATE OTHER COMPONENTS OF THE UPPER CLARK FORK BASIN CERCLA SITES.

FINALLY, LETTER 67 NOTES THAT INTERCONNECTIONS BETWEEN THE SHALLOW AND DEEP AQUIFERS MAY BE MORE SIGNIFICANT THAN THE RI REPORTS INDICATE. SAMPLES FROM NESTED WELLS WSP-GW-7 AND 15 ALONG THE BYPASS AND WSP-GW-10 NEAR POND 1 SHOW THAT SULFATE CONCENTRATIONS ARE HIGHER IN THE DEEPER AQUIFER THAN THE SHALLOW AQUIFER. MANGANESE IS ALSO PRESENT IN THE DEEPER AQUIFER'S PLUME. IT APPEARS THAT THE PLUME IN THE DEEPER AQUIFER HAS NOT DEVELOPED AS FULLY AS IN THE SHALLOW AQUIFER, BUT GIVEN SUFFICIENT TIME, IT COULD.

RESPONSE: ARARS ESTABLISHED FOR GROUNDWATER AT THE WARM SPRINGS PONDS OPERABLE UNIT INCLUDE PRIMARY MAXIMUM CONTAMINANT LEVELS. SULFATE AND MANGANESE ARE NOT INCLUDED IN THESE STANDARDS AND, AS SUCH, ARE NOT ADDRESSED IN REMEDIAL ALTERNATIVES ASSOCIATED WITH THE FS.

THE OCCURRENCE OF THESE PARAMETERS IN THE DEEPER AQUIFER IN THE VICINITY OF THE MILL-WILLOW BYPASS AND POND 1 IS CONSISTENT WITH THE PRESENCE OF RELATIVELY HIGH SULFATE AND MANGANESE CONCENTRATIONS IN GROUNDWATER SYSTEMS IN THE VICINITY OF THE OPPORTUNITY PONDS. THIS SUGGESTS THAT THE DISTRIBUTION AND OCCURRENCE OF SULFATE AND MANGANESE IN THE GROUNDWATER ENVIRONMENT IS MORE REGIONAL AND IS PROBABLY A RESULT OF MULTIPLE CONTAMINANT SOURCES AND PATHWAYS OF CONTAMINANT MOVEMENT.

## TAILINGS AND SEDIMENTS

ONE COMMENTER (LETTER 72) STATES THAT THE FS NOTES ON PAGE 2-30 THAT SEVEN SAMPLES OF TAILINGS DEPOSITS WERE COLLECTED IN THE AREAS ABOVE POND 3 AND BELOW POND 1 AND TESTED FOR EP TOXICITY. NONE OF THE SAMPLES FAILED THE TEST. THE COMMENT STATES THAT THE FACT THAT THE SAMPLES DID NOT FAIL THE EP TOXICITY TEST DOES NOT ADEQUATELY INDICATE THEIR HAZARD TO THE ENVIRONMENT. THE COMMENT SUGGESTS THAT THE SAMPLES SHOULD BE TESTED BY "BULK SEDIMENT AND ELUTRIATE BIOASSAY TESTING."

RESPONSE: THE PARAGRAPH DISCUSSED IN THIS COMMENT WAS NOT INTENDED TO IMPLY THAT THE TAILINGS AND CONTAMINATED SOILS DEPOSITS DO NOT PRESENT A THREAT TO THE ENVIRONMENT SIMPLY BECAUSE THEY DO NOT FAIL THE EP TOXICITY TEST. IT IS FAIRLY STANDARD IN A REMEDIAL INVESTIGATION TO TEST VARIOUS WASTES BY THIS TEST, AS ONE INDICATION OF WHETHER THE HAZARDOUS WASTE MANAGEMENT REGULATIONS SHOULD BE CONSIDERED OR FOLLOWED IN TREATING, STORING, OR DISPOSING OF THE WASTES. THE INDICATED PARAGRAPH MERELY REPORTS THE RESULTS OF TESTING THE MATERIALS BY THIS STANDARD TEST.

THE TWO TYPES OF TEST SUGGESTED IN THE COMMENT ARE NOT FURTHER DESCRIBED. IT IS NOT CLEAR WHAT SPECIFIC TESTS ARE BEING RECOMMENDED OR HOW THE RESULTS FROM SUCH TESTS COULD BE USED TO DETERMINE CLEANUP LEVELS FOR TAILINGS AND SOILS. NUMEROUS SAMPLES OF TAILINGS HAVE BEEN ANALYZED FOR METALS CONTENT. THE RESULTING DATA HAVE BEEN USED IN DEVELOPING REMEDIATION ALTERNATIVES FOR THESE MATERIALS.

ONE COMMENTER (LETTER 3) ASKED HOW THE ESTIMATE OF 19 MILLION CUBIC YARDS OF SEDIMENTS IN THE PONDS WAS MADE.

RESPONSE: THE VOLUME OF POND BOTTOM SEDIMENTS (APPROXIMATELY 19 MILLION CUBIC YARDS), AS PRESENTED IN TABLE 2-2 OF THE FS, WAS CALCULATED USING DATA COLLECTED DURING THE PHASE I REMEDIAL INVESTIGATION AND THE PHASE II REMEDIAL INVESTIGATION AT THE WARM SPRINGS PONDS OPERABLE UNIT. THESE DATA INCLUDED BOTTOM SEDIMENT THICKNESS INFORMATION COLLECTED DURING BOTTOM SEDIMENT SAMPLING ACTIVITIES AT ABOUT 45 LOCATIONS WITHIN THE THREE PONDS AND DATA DEVELOPED TO PREPARE A BATHYMETRIC MAP OF THE POND BOTTOM SURFACE. THE BASE OF THE POND BOTTOM SEDIMENTS WAS DEFINED AS THE CONTACT BETWEEN FINE-GRAINED SEDIMENTS AND NATIVE MATERIAL. NATIVE MATERIAL AT THE WARM SPRINGS PONDS WAS TYPICALLY EITHER PEAT OR COARSE-GRAINED SAND AND GRAVEL.

ONE COMMENTER (LETTER 154) STATED THAT THE ANNUAL SEDIMENT LOADS AND THE SEDIMENT LOADS FROM SMALLER FLOOD EVENTS IN WARM SPRINGS CREEK ARE MORE SIGNIFICANT THAN THE SEDIMENT LOADS FROM LARGER EVENTS AND SHOULD BE ADDRESSED IN THE FS.

RESPONSE: THE ACCUMULATION OF SEDIMENTS IN THE WARM SPRINGS PONDS WAS USED TO ESTIMATE AN AVERAGE ANNUAL SEDIMENT LOADING TO THE PONDS. THE PURPOSE OF THE FLUVIAL-12 BEDLOAD SEDIMENT TRANSPORT STUDY WAS TO DETERMINE POTENTIAL EROSION OF BANK AND FLOODPLAIN TAILINGS SEDIMENTS FROM SILVER BOW CREEK DURING FLOOD EVENTS. EROSION OF TAILINGS WAS EXPECTED TO BE INSIGNIFICANT FOR FLOW RANGES UP TO NEARLY BANKFULL (ESTIMATED AT ABOUT 500 CFS OR A 2- TO 5-YEAR FLOOD EVENT). SINCE MOST OF THE BEDLOAD TOXIC SEDIMENT TRANSPORT WOULD ONLY OCCUR IN MAJOR FLOOD EVENTS, THE TREATMENT AND CONTAINMENT SYSTEM WAS DESIGNED CONSIDERING THE PEAK FLOW AND VOLUME OF THE 100-YEAR FLOOD.

TOTAL SEDIMENT REACHING THE PONDS, AS PRESENTED IN THIS COMMENT, IS DEFINED QUITE DIFFERENTLY. TOTAL SEDIMENT INCLUDES BOTH SUSPENDED LOAD AND BEDLOAD FROM ALL SOURCES AND FLOW RANGES. A LARGE QUANTITY OF SUSPENDED LOAD ORIGINATES FROM "NATURAL" FOREST AND RANGELAND EROSION. THIS TOTAL LOAD IS WHAT THE COMMENTER IS DESCRIBING WITH THE ANALYSIS OF USGS FLOW AND SEDIMENT DATA. TOTAL SEDIMENT LOAD TRANSPORT WOULD BE EXPECTED TO GREATLY INCREASE FOR FLOWS ABOVE THE 90TH PERCENTILE FLOW DURATION EXCEEDANCE, SINCE MOST OF THE ANNUAL FLOWS IN THAT RANGE REPRESENT OVERLAND SPRING SNOWMELT RUNOFF FROM FOREST AND RANGELAND. PEAK FLOOD FLOWS, IN THE 10-YEAR TO 100-YEAR RANGE, ARE ABOVE THE 99TH PERCENTILE ON A FLOW-DURATION EXCEEDANCE CURVE.

## SURFACE WATERS

ONE COMMENTER (LETTER 72) POINTS OUT THE CORRELATION (NOTED IN THE FS) BETWEEN PH VALUES AND HIGHER DISSOLVED METALS LEVELS IN THE STREAMS. THE COMMENTER NOTES THAT COPPER TOXICITY VARIES WITH PH AND THAT THE INTERACTION BETWEEN ALUMINUM AND LOW PH MAY POSE A SIGNIFICANT HAZARD TO AQUATIC FAUNA AT THE CONCENTRATIONS DETECTED IN THE SURFACE WATER AT THE SITE.

RESPONSE: EPA AND MDHES AGREE THAT COPPER TOXICITY VARIES. THE AGENCIES FEEL THAT ALKALINITY PLAYS A SOMEWHAT MORE IMPORTANT ROLE IN THE TOXICITY OF COPPER, AS EVIDENCED BY THE DEPENDENCE OF THE FRESHWATER AMBIENT WATER QUALITY CRITERION TO ALKALINITY (ALKALINITY IS GENERALLY CONSIDERED EQUAL TO CARBONATE HARDNESS), BUT NOT PH. THE COPPER ION IS COMPLEXED BY ANIONS, WHICH, IN TURN, AFFECTS THE TOXICITY OF COPPER. AT LOWER ALKALINITY, COPPER IS GENERALLY MORE TOXIC.

A SIGNIFICANT VOLUME OF RECENT LITERATURE HAS DISCUSSED THE ASSOCIATION OF LOW PH (BELOW 5.2) AND EXTREME ALUMINUM TOXICITY. THE AGENCIES BELIEVE THAT IF THE CRITERION OF PH IS MET, THE TOXICITY OF ALUMINUM CAN BE CONTROLLED.

ALUMINUM WAS ANALYZED IN SAMPLES TAKEN FROM THREE SAMPLING STATIONS DURING THE SPRING 1986 HIGH FLOW EVENT. THE PH RANGE DURING THIS SAMPLING EVENT WAS FROM A LOW OF 6.5 TO A HIGH OF 9.5. THE MAXIMUM CONCENTRATION OF DISSOLVED ALUMINUM AT EACH SAMPLING STATION DID NOT EXCEED THE ACUTE AMBIENT WATER QUALITY CRITERION OF 760 UG/L. AT THE TWO SAMPLING STATIONS WHERE ONLY TWO SAMPLES WERE TAKEN (OUTFLOW FROM POND 3 AND MILL-WILLOW BYPASS), THE CONCENTRATIONS OF DISSOLVED ALUMINUM EXCEEDED THE CHRONIC CRITERION OF 87 UG/L (AVERAGES OF 97 AND 139 UG/L). THE CHRONIC CRITERION WAS NOT EXCEEDED AT THE SAMPLING STATION WITH 12 SAMPLING EVENTS (AVERAGE OF 67 UG/L AT THE INFLOW TO THE PONDS). TOTAL ALUMINUM CONCENTRATIONS EXCEEDED BOTH ACUTE AND CHRONIC CRITERIA AT THE MILL-WILLOW BYPASS SAMPLING STATION AND CHRONIC CRITERIA AT THE INFLOW TO THE PONDS AND WITHIN THE PONDS.

THE POTENTIAL EXISTS FOR A HAZARD TO AQUATIC FAUNA FROM ALUMINUM TOXICITY, AS SEVERAL SAMPLING EVENTS DID DETECT ALUMINUM AT CONCENTRATIONS GREATER THAN THE ACUTE CRITERION.

SEVERAL COMMENTERS (TESTIMONY M-1, M-2, M-3) EXPRESSED GENERAL CONCERN OVER FISHKILLS IN THE CLARK FORK RIVER. ONE COMMENT (LETTER 138) NOTED THAT THE JULY 1989 FISHKILL WAS CAUSED NOT ONLY BY THE TAILINGS IN THE MILL-WILLOW BYPASS, BUT ALSO BY THE STREAMSIDE TAILINGS DOWNSTREAM OF THE WARM SPRINGS PONDS. ANOTHER COMMENTER (LETTER 3) ASKED WHY FISHKILLS OCCUR IF FISH CAN LIVE IN THE PONDS. ARCO (TESTIMONY A-3, B-3, M-6) RECOGNIZED THE PROBLEM OF FISHKILLS, BUT STATED THAT, ON THE WHOLE, FISH AND WILDLIFE IN THE WARM SPRINGS PONDS OPERABLE UNIT ARE HEALTHY AND ABUNDANT.

RESPONSE: THE AGENCIES SHARE EVERYONE'S CONCERN OVER FISHKILLS IN THE CLARK FORK RIVER. THE FISHKILLS ARE THOUGHT TO BE THE RESULT OF SHOCK LOADINGS OF WATERS IN THE MILL-WILLOW BYPASS AND UPPER CLARK FORK RIVER WITH HIGHLY SOLUBLE METAL SALTS DURING SUMMER THUNDERSTORM EVENTS AFTER EXTENDED DRY SPELLS. THE PROBLEM EXISTS BECAUSE OF THE EXPOSED TAILINGS SLICKENS FOUND WITHIN THE BYPASS CHANNEL AND ALONG THE UPPER CLARK FORK BANKS, NOT WITHIN THE PONDS. THE FISH IN THE PONDS ARE NOT SUBJECTED TO THE EXTREMELY HIGH CONCENTRATIONS OF METALS THAT CAUSE THE FISHKILLS. FOR A FULL DISCUSSION OF THE CAUSES OF THE FISHKILLS, SEE CHAPTER 4 OF THE FS.

IT IS RECOGNIZED THAT TAILINGS DOWNSTREAM OF THE WARM SPRINGS PONDS CONTRIBUTED TO THE JULY 1989 FISHKILL THAT EXTENDED DOWNSTREAM TO DEER LODGE. TEMPORARY CONTROL OF THE DOWNSTREAM TAILINGS IS BEING ADDRESSED THROUGH ARCO'S BERMING PROJECT, BUT LONG-TERM SOLUTIONS WILL BE DEVELOPED IN THE CLARK FORK RIVER REMEDIAL INVESTIGATION AND FEASIBILITY STUDY. IT IS UNDERSTOOD THAT ACTIONS AT THE MILL-WILLOW BYPASS ALONG THE WARM SPRINGS PONDS WILL NOT SOLVE THE FISHKILL PROBLEMS FOR THOSE CASES WHERE THE TAILINGS BELOW THE PONDS ARE THE CAUSE OF THE FISHKILLS.

THE AGENCIES AGREE THAT TERRESTRIAL AND AQUATIC LIFE APPEAR TO BE PRODUCTIVE AND IMPROVING FROM PAST YEARS. HOWEVER, IMPACTS TO TERRESTRIAL ORGANISMS ARE DIFFICULT TO DETERMINE UNLESS THEY ARE ACUTE OR CUMULATIVE. THERE REMAINS THE POTENTIAL FOR CHRONIC EFFECTS ON INDIVIDUALS ORGANISMS. CHRONIC AQUATIC LIFE CRITERIA HAVE BEEN AND CONTINUE TO BE EXCEEDED FOR SELECTED CONTAMINANTS.

#### **RISK ASSESSMENT**

TWO COMMENTERS CRITICIZED THE ENVIRONMENTAL RISK ASSESSMENT. ONE COMMENTER (LETTER 154) THOUGHT THAT THE ECOSYSTEM ANALYSIS WAS CASUAL, AD HOC, AND WITHOUT A GUIDING PLAN, AND THAT ECOSYSTEM TECHNIQUES HAVE NOT BEEN APPLIED. THAT SAME COMMENTER AND OTHERS (LETTERS 101, 108, 126) ADDED THAT DOWNSTREAM ECOLOGICAL RISKS OF TOXIC METAL SEDIMENTS IN THE CLARK FORK RIVER SHOULD BE EVALUATED. SEVERAL COMMENTS SUGGESTED THAT THE AGENCIES CONDUCT AN INCREMENTAL RISK ASSESSMENT IN DEVELOPING DAM SAFETY ARARS.

RESPONSE: A DETAILED ECOSYSTEM ANALYSIS HAS NOT BEEN CONDUCTED AT THE WARM SPRINGS PONDS. AT THE TIME THE INVESTIGATIONS WERE CONDUCTED FOR WARM SPRINGS PONDS, AN FULL ECOSYSTEM ANALYSIS WAS NOT A REQUIREMENT IN THE CERCLA PROCESS. THE AGENCIES DO NOT AGREE WITH THE COMMENTER THAT THE ECOSYSTEM ANALYSIS IS INADEQUATE. SAMPLING OF KEY RECEPTORS, INCLUDING FISH AND WATERFOWL, HAS BEEN CONDUCTED. ADDITIONALLY A SURVEY OF ALL LITERATURE ON MACROINVERTEBRATES FROM BUTTE TO DEER LODGE AND AN ANALYSIS OF ALGAE AND VEGETATION WERE CONDUCTED. WHILE THE SAMPLING PROGRAM AT THE WARM SPRINGS PONDS WAS NOT DESIGNED TO QUANTITATIVELY ANSWER QUESTIONS ON THE ENVIRONMENTAL HEALTH OF THE POND SYSTEM, THE DATA OBTAINED CAN AND HAVE BEEN USED TO QUALITATIVELY DETERMINE RISK TO THE ECOSYSTEM.

ECOSYSTEM ASSESSMENTS TO DETERMINE THE EFFECTS OF CONTAMINATION ARE DIFFICULT TO UNDERTAKE AND TIME CONSUMING. IT IS OFTEN DIFFICULT TO SEPARATE THE NATURAL INTERACTIONS AND CYCLES IN THE ENVIRONMENT FROM THE EFFECTS OF CONTAMINATION, UNLESS ACUTE EFFECTS CAN BE SEEN. ACUTE EFFECTS ARE RARELY SEEN AND EVEN WHEN THEY ARE (E.G., THE KESTERSON RESERVOIR NATURAL SELENIUM CONTAMINATION PROBLEM) THE INTERACTIONS AND RIPPLE-THROUGH EFFECT ON THE ECOSYSTEM ARE MOSTLY HYPOTHESIZED AND CAN RARELY BE SHOWN THROUGH QUANTITATIVE SAMPLING AS CAUSE-AND-EFFECT.

THE DOWNSTREAM ECOSYSTEM WAS NOT IGNORED IN THE ASSESSMENT OF ECOLOGICAL RISK. ONLY QUALITATIVE STATEMENTS COULD BE MADE AS DATA WITH WHICH TO MODEL THE EFFECTS OF A MASSIVE RELEASE OF TAILINGS DO NOT EXIT. THE ASSESSMENT WAS CONDUCTED ACCORDING TO EPA GUIDELINES AVAILABLE AT THE TIME THE REPORT WAS PREPARED TO MEET THE REQUIREMENTS OF CERCLA. WHILE A MORE DETAILED RISK ASSESSMENT MAY BE NECESSARY, IT WILL BE PREPARED IN THE FUTURE AS PART OF OTHER OPERABLE UNITS.

THOSE COMMENTS REGARDING AN INCREMENTAL RISK ASSESSMENT FOR DAM SAFETY DESIGN ARE ADDRESSED IN THE NEXT SECTION UNDER DAM SAFETY ARARS.

#### ARARS AND CLEANUP STANDARDS

ONE COMMENTER (LETTER 111) THOUGHT THAT THE WORDING IN THE PROPOSED PLAN IS INDEFINITE ABOUT MEETING MDHES AND FEDERAL ARARS AND REDUCING RISKS.

RESPONSE: CERCLA REQUIRES ANY REMEDIAL ACTION TO PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, AND TO COMPLY WITH ARARS UNLESS AN APPROPRIATE WAIVER IS INVOKED. THE SELECTED REMEDY, DOCUMENTED IN THIS ROD, MEETS THESE CRITERIA. ANY LANGUAGE IN THE PROPOSED PLAN THAT SUGGESTS ANY OTHER INTERPRETATION WAS NOT INTENDED.

#### SURFACE WATER QUALITY ARARS.

NUMEROUS COMMENTERS (LETTERS 53, 64, 65, 66, 69, 73, 74, 75, 77, 89, 97, 98, 99, 101, 102, 104, 106, 107, 108, 109, 111, 112, 115, 116, 118, 121, 122, 123, 126, 128, 131, 132, 133, 134, 135, 138, 139, 142, 143, 144, 145, 146, 147, 151, 153, 154, 155, 159, 162; TESTIMONY A-15, M-1, M-3, M-4, MS, M-7, M-8, M-9, M-10, M-11, M-13, M-15) RECOMMENDED REQUIRING REMEDIATION OF THE PONDS TO RESULT IN GOLD BOOK (FEDERAL AMBIENT WATER QUALITY CRITERIA, AWQC) VALUES BEING MET IN THE CLARK FORK RIVER AND THE MILL-WILLOW BYPASS. MANY OF THESE COMMENTERS STATED THAT THE APPROPRIATE GOAL SHOULD BE TO PREVENT ALL EXCEEDANCES OF GOLD BOOK CRITERIA UP TO THE 100-YEAR FLOOD LEVEL UNTIL UPSTREAM SOURCES ARE CLEANED UP, AND THEN FOR ALL FLOWS AFTER THAT. SEVERAL THOUGHT THAT GOLD BOOK CRITERIA SHOULD BE MET FOR ALL FLOODS AND AT ALL TIMES.

RESPONSE: ALTHOUGH THE TERM "GOLD BOOK" WAS NOT USED IN CHAPTER 4 OF THE FS FOR STATING THE GOALS FOR THE OPERABLE UNIT, THE WATER QUALITY CRITERIA CITED ARE THE GOLD BOOK AWQC. THESE CRITERIA WERE ADOPTED AS STANDARDS BY THE STATE. REMEDIATION OF THE WARM SPRING PONDS ALONE CANNOT GUARANTEE THAT THE STANDARDS WILL BE MET IN THE CLARK FORK RIVER, EVEN AT THE HEADWATERS OF THE RIVER. WARM SPRINGS CREEK AND THE CLARK FORK RIVER ITSELF ARE ALSO CONTAMINATED, AND WILL HAVE TO BE CLEANED UP BEFORE THE WATER QUALITY IN THE CLARK FORK CAN BE ASSURED. HOWEVER, THE SELECTED REMEDY WILL MODIFY THE POND SYSTEM IN ORDER TO ACHIEVE THE GOLD BOOK STANDARDS UNDER NORMAL CONDITIONS FOR THE WATER LEAVING THE OPERABLE UNIT, AND THIS WILL GO A LONG WAY TOWARD IMPROVING THE WATER QUALITY IN THE RIVER.

THE AMBIENT WATER QUALITY REGULATIONS DO NOT ADDRESS THE CONCEPT OF MEETING THE WATER QUALITY STANDARDS DURING MAJOR FLOODS. ON THE CONTRARY, THE REGULATIONS ALLOW FOR PERIODIC EXCEEDANCES OF THE STANDARDS: AS OFTEN AS ONCE IN A 3-YEAR PERIOD, THE 4-DAY AVERAGE CAN EXCEED THE STANDARDS WITHOUT BEING CONSIDERED A VIOLATION. HOWEVER, THE SELECTED REMEDY WILL TREAT FLOWS TO THE 100-YEAR FLOOD AND WATER LEAVING THE OPERABLE UNIT SHOULD MEET THESE STANDARDS.

IT IS IMPORTANT TO NOTE THAT THE STANDARDS ARE PROBABLY LESS LIKELY TO BE EXCEEDED DURING LARGE FLOODS THAN DURING SMALL RUNOFF EVENTS. THE MAXIMUM CONCENTRATIONS OF METALS IN THE BYPASS ARE SEEN WHEN A SHORT, BUT INTENSE, THUNDERSTORM RINSES THE SOLUBLE METAL SALTS OFF THE TAILINGS DEPOSITS AND INTO THE BYPASS WITH A MINIMUM AMOUNT OF DILUTION. THIS IS WHAT HAS CAUSED FISHKILLS. LARGE FLOODS ARE UNLIKELY, NEAR THEIR PEAK FLOWS, TO EXCEED THE STANDARDS. THE REASON FOR THIS IS SIMPLE: THERE IS TOO MUCH WATER AND TOO LITTLE READILY AVAILABLE CONTAMINANTS.

METALS LEVELS THAT WOULD BE SEEN IN THE RIVER, UNDER ALL THE POSSIBLE FLOOD SCENARIOS UP TO 100-YEAR FLOODS, CANNOT BE PREDICTED WITH ACCURACY. MODELS TO DEAL WITH A CONTAMINATION SITUATION AS COMPLEX AS THAT ALONG SILVER BOW CREEK DO NOT EXIST. MODELS WOULD HAVE TO BE DEVELOPED, AND CONSIDERABLE DATA WOULD HAVE TO BE COLLECTED TO CALIBRATE THE MODELS. THIS WOULD DELAY CLEANUP FOR YEARS, AND IT IS NOT CERTAIN THAT A MODEL SATISFACTORY TO ALL PARTIES COULD BE DEVELOPED. INSTEAD OF ATTEMPTING TO MODEL AND UNDERSTAND THE CONTAMINATION OF THE CREEK WATER UNDER ANY AND ALL FLOW CONDITIONS, THE PS TOOK THE APPROACH OF IDENTIFYING MAJOR CONTRIBUTIONS TO THE CONTAMINATION AND THEN DEVELOPING SYSTEMS TO TREAT A WIDE RANGE OF FLOWS. IN THIS WAY, WHATEVER THE DETAILS OF THE RUNOFF EVENT AND THE RESULTING CONTAMINATION, THE TREATMENT SYSTEM WOULD BE ABLE TO PROVIDE TREATMENT AND PROTECTION FOR THE CLARK FORK RIVER.

THE WATER WITHIN THE PONDS ARE NOT PART OF ANY RIVER OR CREEK, AND ARE NOT COVERED BY THE STATE'S WATER QUALITY STANDARDS. THEREFORE, THOSE STANDARDS ARE NOT APPLICABLE TO THE PONDS THEMSELVES. NEVERTHELESS, THE REMEDY MUST BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, INCLUDING THE ENVIRONMENT WITHIN THE PONDS. THE ROD REQUIRES THAT EXPOSED CONTAMINANTS AND TAILINGS WITHIN THE PONDS WILL BE FLOODED OR COVERED AND REVEGETATED. THIS WILL PROTECT THE ECOSYSTEM WITHIN THE PONDS, AND SUPPORT THE FISH AND WILDLIFE POPULATION WHICH ALREADY EXIST THERE.

THE AGENCIES BELIEVE THAT THE METHODS PROPOSED IN THE ROD FOR TREATING FLOOD FLOWS ARE ADEQUATE AND REASONABLE AND THAT SUCH TREATMENT WOULD ENABLE THE WATER QUALITY AT THE COMPLIANCE POINT TO MEET THE GOLD BOOK STANDARDS AT NEARLY ALL TIMES.

ONE COMMENTER (LETTER 67) RECOMMENDED THAT THE PROPOSED COMPLIANCE POINT FOR THE WARM SPRINGS PONDS OPERABLE UNIT BE LOCATED NEAR THE CURRENT BEGINNING POINT OF THE CLARK FORK RIVER (FIG. 5-1, CH2M HILL, 1989B). AS NOTED ELSEWHERE IN THESE COMMENTS AND IN THE FS (NOTE 4, FIG. 6-1, CH2M HILL, 1989B), CONTAMINATED GROUNDWATER DISCHARGES TO THE CLARK FORK RIVER. THEREFORE, IT MAY BE ADVISABLE TO RELOCATE THE COMPLIANCE POINT FAR ENOUGH DOWNSTREAM TO ENSURE INTERCEPTION OF THE OPERABLE UNIT'S ENTIRE CURRENT AND FUTURE GROUNDWATER PLUME.

RESPONSE: THE PRECISE LOCATIONS OF THE COMPLIANCE POINTS FOR GROUNDWATER AND SURFACE WATER ARE DESCRIBED IN THE ROD. THE COMPLIANCE AREA ILLUSTRATED ON FIGURE 5-1 IS ACCURATE. THESE COMPLIANCE POINTS WILL ENSURE PROTECTION OF THE AQUIFER AND THE CLARK FORK RIVER.

WITH RESPECT TO THE FS'S PROPOSED WAIVER OF THE AMBIENT WATER QUALITY STANDARD FOR MERCURY, ONE COMMENTER (LETTER 72) RECOMMENDED AN ADDITIONAL MECHANISM FOR DETERMINING WHETHER MERCURY IS ADVERSELY AFFECTING THE ENVIRONMENT WITHIN THE WARM SPRINGS PONDS. THE COMMENTER SUGGESTED THAT THE TISSUES OF FISH FROM POND 3 BE PERIODICALLY ANALYZED FOR MERCURY AND OTHER HEAVY METALS TO DETERMINE IF THE SELECTED REMEDIAL ACTION IS REDUCING THE THREAT THAT THESE SUBSTANCES POSE TO PUBLIC HEALTH AND THE ENVIRONMENT.

RESPONSE: ANALYZING TISSUE FROM FISH IN POND 3 WOULD PROVIDE MORE INFORMATION ON THE DEGREE OF CLEANUP ON SILVER BOW CREEK THAN WARM SPRINGS PONDS. THE GOAL OF THE IMPROVEMENT OF THE TREATMENT IN THE PONDS IS TO HAVE THE EFFLUENT OF THE PONDS MEET AMBIENT WATER QUALITY STANDARDS, NOT THE WATER IN THE POND SYSTEM. TISSUE FROM FISH DOWNSTREAM OF THE PONDS COULD BE ANALYZED, BUT IT MAY BE DIFFICULT TO ISOLATE IMPACTS OF WARM SPRINGS PONDS FROM OTHER SOURCES OF CONTAMINATION, SUCH AS WARM SPRINGS CREEK. ANALYZING TISSUE FROM FISH IN POND 3 MIGHT PROVIDE USEFUL INFORMATION ON THE IMPACTS TO THE FISH, BUT IT MAY NOT PROVIDE SPECIFIC INFORMATION ON THE SUCCESS OF THE WARM SPRINGS PONDS REMEDIATION.

ONE COMMENTER (LETTER 111) THOUGHT THAT THE STANDARDS FOR ARSENIC AND MERCURY SHOULD BE MAINTAINED AT BELOW DETECTION LEVELS.

RESPONSE: EPA BELIEVES THAT THE WAIVER OF THE MERCURY AND ARSENIC STANDARDS IS APPROPRIATE, GIVEN THE DETECTION LIMITS FOR BOTH CONTAMINANTS AND THE INABILITY OF CURRENT TECHNOLOGY TO

ACHIEVE THESE STANDARDS. THE REPLACEMENT STANDARDS ARE STILL VERY LOW, AND ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, BASED UPON CURRENTLY AVAILABLE INFORMATION.

#### DAM SAFETY ARARS FOR EARTHQUAKE AND FLOOD PROTECTION.

TWO COMMENTERS (LETTERS 119, 151) STATED THAT MDHES SHOULD HAVE APPLIED THE MDNRC DAM SAFETY REGULATIONS BASED ON THE TOTAL VOLUME OF WATER AND SEDIMENTS IN THE PONDS AND ON THE BASIS OF TREATING THE ENTIRE POND SYSTEM AS ONE POND. USING THE IMPLIED VALUE OF THE STORED CONTENTS OF THE TOTAL POND SYSTEM (WATER AND SEDIMENTS), THE LEVEL OF PROTECTION FOR THE PONDS SHOULD BE 0.75 PROBABLE MAXIMUM FLOOD (PMF) FOR ALL 3 OF THE PONDS. NUMEROUS COMMENTERS (LETTERS 45, 79, 89, 91, 93, 97, 98, 99, 100, 101, 102, 104, 106, 108, 111, 114, 116, 118, 122, 123, 125, 126, 131, 132, 134, 138, 142, 143, 145, 149, 151, 152, 153, 157, 161; TESTIMONY A-15) ADDED THAT THE REMEDY SHOULD ASSURE THAT ALL SEDIMENTS REMAIN CONTAINED IN THE PONDS UP TO THE MAXIMUM CREDIBLE EARTHQUAKE (MCE) AND HALF OF THE PROBABLE MAXIMUM FLOOD (0.5 PMF) OR GREATER. OTHER COMMENTERS (LETTERS 106, 116, 118, 119, 123, 135, 136, 140, 143, 145, 147, 149, 151, 159, 161; TESTIMONY A-15, M-3, M-5, M-11, M-13) SUGGESTED THAT THE AGENCIES PERFORM A RISK ANALYSIS TO DETERMINE THE APPROPRIATE LEVEL OF PROTECTION FOR THE PONDS. THEY FURTHER STATED THAT ALL PONDS SHOULD BE PROTECTED EQUALLY, AND THE PROTECTION SHOULD BE CONSERVATIVE.

RESPONSE: EPA AND MDHES HAVE RECONSIDERED THE USE OF VARYING LEVELS OF PROTECTION FOR THE PONDS AND CONCLUDED THAT IT IS MORE REASONABLE, AND IN COMPLIANCE WITH THE APPLICABLE LAW, TO PROVIDE ALL 3 PONDS WITH THE SAME LEVEL OF PROTECTION. CONSEQUENTLY, THE SELECTED ALTERNATIVE WILL INCLUDE PROTECTION OF ALL 3 PONDS TO WITHSTAND A 0.5 PMF. THE AGENCIES DO NOT BELIEVE THAT THERE IS REASON TO PROTECT THE PONDS TO A GREATER LEVEL THAN THIS. THE SPECIFIED LEVEL OF EARTHQUAKE PROTECTION IS TO THE MCE.

IN ORDER TO CONDUCT A QUANTITATIVE HAZARD/RISK ASSESSMENT FOR THE POND SYSTEM, A MODEL WOULD NEED TO BE DEVELOPED THAT WOULD SIMULATE THE VARIOUS FAILURE SCENARIOS UNDER DIFFERENT FLOOD FLOWS AT THE PONDS. ADDITIONALLY, A MODEL TO PREDICT THE TRANSPORT OF THE MOBILIZED SEDIMENTS AND THEIR DEPOSITION DOWNSTREAM ON THE CLARK FORK RIVER WOULD ALSO HAVE TO BE DEVELOPED. IT IS UNLIKELY THAT MODELS COULD BE DEVELOPED THAT WOULD ACCURATELY PREDICT THE ENVIRONMENTAL, HUMAN HEALTH, AND ECONOMIC DAMAGE CAUSED BY THESE EVENTS IN THE FLOOD RANGES OF INTEREST, 0.5 TO 1.0 PMF.

IN DEVELOPING AN APPROPRIATE LEVEL OF PROTECTION, NOT ONLY THE DAMAGE CAUSED BY THE EVENT, BUT ALSO THE PROBABILITY OF THE EVENT OCCURRING, IS IMPORTANT. ALTHOUGH NO SPECIFIC FREQUENCY OF OCCURRENCE IS ESTABLISHED FOR THE PMF OR FRACTIONS OF THE PMF, THE PROBABILITY OF FLOWS GREATER THAN 70,000 CFS OCCURRING ON SILVER BOW CREEK IS EXTREMELY SMALL.

ONE COMMENTER (LETTER 138) WAS NOT CLEAR WHETHER THE DESIGN STANDARDS WOULD PROTECT AGAINST FLOODING IN SILVER BOW CREEK, MILL AND WILLOW CREEKS, OR THE THREE DRAINAGES COMBINED.

RESPONSE: THE DESIGN FLOODS PRESENTED IN THE FS INCLUDE FLOWS FROM ALL THREE DRAINAGES COMBINED FOR AREAS BELOW THE CONFLUENCE OF SILVER BOW CREEK AND MILL-WILLOW CREEKS. THESE ARE THE FLOOD FLOWS ON WHICH THE 0.5 PMF PROTECTION IS BASED.

#### SOILS CLEANUP ACTION LEVELS.

ONE COMMENTER (LETTER 72) RECOMMENDED THAT ACTION LEVELS FOR COPPER, CADMIUM, AND ZINC IN CONTAMINATED SOILS AND TAILINGS NEED TO BE SET BASED ON AQUATIC LIFE EXPOSURE.

RESPONSE: IT IS RECOGNIZED THAT ACTION LEVELS FOR COPPER, CADMIUM, AND ZINC WOULD BE DESIRABLE FOR SOILS AND TAILINGS THAT LIE WITHIN THE MILL-WILLOW BYPASS. IT IS VERY DIFFICULT, HOWEVER, TO DEVELOP CLEANUP CRITERIA FOR SOILS BASED ON A DIRECT RELATIONSHIP BETWEEN AMBIENT WATER QUALITY CRITERIA AND METAL CONCENTRATIONS IN SOILS.

THE MASS OF METALS AVAILABLE FROM TAILINGS AND CONTAMINATED SOILS IS DEPENDENT ON A NUMBER OF FACTORS INCLUDING THE MASS OF METALS IN THE MATERIAL, THE METALLIC COMPOUNDS THEMSELVES, THE RATE OF SULFIDE OXIDATION, THE RATE OF TRANSPORT OF METALS TO THE SURFACE OF THE TAILINGS, THE MASS OF TAILINGS, AND THE TIME ELAPSED SINCE THE PREVIOUSLY ACCUMULATED SURFACE SALTS WERE WASHED AWAY DURING A PRECIPITATION EVENT. ADDITIONALLY, THE INTENSITY OF A PRECIPITATION EVENT AND THE SURFACE WATER FLOW RATE WILL IMPACT THE METALS CONCENTRATION IN THE SURFACE WATER.

BECAUSE OF THE DIFFICULTY IN ESTABLISHING MEANINGFUL SOIL CLEANUP CONCENTRATIONS BASED UPON AQUATIC STANDARDS, A MORE DIRECT APPROACH WAS TAKEN FOR THE INITIAL REMOVAL ACTION IN THE MILL-WILLOW BYPASS. THE DEPTH OF COPPER, CADMIUM, AND ZINC MIGRATION FROM THE TAILINGS WAS DETERMINED BY SCREENING SAMPLING, AND WAS CONFIRMED TO BE CONSISTENTLY CORRELATED WITH VISUAL STAINING OF CONTAMINATED SOILS. THE AMOUNT OF TAILINGS AND CONTAMINATED SOILS TO BE REMOVED OR OTHERWISE CONTROLLED WAS ESTABLISHED BASED ON VISUAL IDENTIFICATION, CORRELATED WITH TARGET METAL CONCENTRATIONS DEVELOPED FROM EVALUATING THE METAL CONCENTRATIONS IN THE SOIL PROFILE, AND SUBJECT TO CONFIRMATION SAMPLING AND ANALYSES. WHILE THE FINAL CONFIRMATION SAMPLING HAS NOT BEEN COMPLETED, PRELIMINARY RESULTS INDICATE THAT THIS APPROACH HAS RESULTED IN CLEANUP TO BACKGROUND LEVELS IN THE BYPASS.

AS STATED IN THE ROD, A FINAL ACTION LEVEL FOR SOILS CLEANUP AND ACCOMPANYING ADDITIONAL CLEANUP MEASURES WILL BE DETERMINED AT A LATER DATE. THE ACTION NUMBER WILL BE BASED ON HUMAN HEALTH THREATS. EPA BELIEVES THAT SUCH A NUMBER WILL ALSO PROVIDE ADEQUATE PROTECTION FOR THE ENVIRONMENT. THE ULTIMATE CHECK ON THIS WILL BE THE REQUIREMENT THAT SURFACE WATER STANDARDS BE MET AT THE POINT OF COMPLIANCE.

#### **IDENTIFICATION AND EVALUATION OF ALTERNATIVES**

THE MAJORITY OF THE COMMENTS RECEIVED ON THE FEASIBILITY STUDY DEALT WITH THE IDENTIFICATION, SELECTION, AND EVALUATION OF ALTERNATIVE REMEDIATION APPROACHES. TO MORE EASILY UNDERSTAND THE COMMENTS THEMSELVES, AND THE AGENCIES' CONSIDERATION OF AND RESPONSE TO THOSE COMMENTS, THEY HAVE BEEN GROUPED INTO 15 SUBJECT AREAS. SOME OF THESE DEAL WITH REMEDIATION ALTERNATIVES IN GENERAL, MUCH AS THE MEDIA SPECIFIC ACTIONS IN THE FS WERE PRESENTED. OTHER COMMENTS RELATE TO SPECIFIC ALTERNATIVES, EITHER PRESENTED IN THE FS OR FOUND ELSEWHERE.

#### **FLOOD MODELING STUDIES.**

SEVERAL COMMENTS QUESTIONED THE ESTIMATES OF VARIOUS FLOOD EVENTS THAT HAVE BEEN DEVELOPED AS PART OF THE SILVER BOW CREEK SUPERFUND STUDIES. EPA AND MDHES PREPARED A FLOOD MODELING STUDY THAT UTILIZED HISTORICAL METEOROLOGICAL AND HYDROLOGICAL DATA AND SEVERAL COMPUTER MODELS TO ESTIMATE THE INTENSITY AND DURATION OF VARIOUS POTENTIAL FLOOD EVENTS. ARCO COUNTERED WITH OTHER ESTIMATES BASED ON DIFFERENT ASSUMPTIONS AND MODELING APPROACHES.

ONE COMMENTER (LETTER 119) THOUGHT THE METHODOLOGY FOR CALCULATING THE PMF WAS INACCURATE AND IMPRECISE. ANOTHER COMMENTER (TESTIMONY M-10) SUGGESTED THAT, SINCE MDHES AND ARCO DISAGREE ON THE MAGNITUDE OF THE VARIOUS FLOODS, A THIRD PARTY, SUCH AS THE UNITED STATES GEOLOGICAL SURVEY (USGS), SHOULD PERFORM AN INDEPENDENT EVALUATION OF THE FLOOD MODELING.

**RESPONSE:** USGS WAS CONSULTED FOR AN INDEPENDENT EVALUATION OF THE FLOOD MODELING. USGS EVALUATED THE 100-YEAR EVENT AND CONCLUDED THAT THE PEAK DISCHARGE FOR THIS EVENT FOR SILVER BOW CREEK ABOVE THE MILL-WILLOW CONFLUENCE SHOULD BE 3,910 CUBIC FEET PER SECOND (CFS), WHICH IS CLOSER TO THE 4,000 CFS ESTIMATED BY MDHES THAN THE 3,300 CFS ESTIMATED BY ARCO. THE USGS ALSO STATED THAT THE ASSUMPTIONS AND SELECTION OF MODEL PARAMETERS USED IN THE MDHES MODELING YIELDED RESULTS THAT ARE WELL CALIBRATED FOR USE IN THE UPPER CLARK FORK BASIN.

USGS ALSO STATED THAT BOTH THE MDHES MODEL AND THE ARCO MODEL MAY HAVE OVERESTIMATED THE VOLUME OF THE 100-YEAR FLOOD. BOTH MODELS PREDICTED A TOTAL 5-DAY VOLUME OF APPROXIMATELY 13,000 ACRE-FEET. THE MOST IMPORTANT PARAMETER OF THE 100-YEAR FLOOD IS THE DESIGN VOLUME OF RUNOFF BECAUSE IT GOVERNS THE AMOUNT OF FLOW TO BE TREATED. FOR DESIGN PURPOSES, THE AGENCIES HAVE DECIDED TO USE 3,300 CFS AS THE PEAK DESIGN FLOW FOR THE POND 3 INTAKE STRUCTURE AND 13,000 ACRE-FEET AS THE DESIGN VOLUME FOR THE POND 3 UPGRADE. FOR MORE DETAIL, PLEASE REFER TO THE RESPONSES TO ARCO COMMENTS ON SECTION 4.1.1 OF THE FS.

ALTHOUGH USGS DIDN'T REVIEW THE MODELING OF THE PMF CALCULATIONS, THE SAME HYDROLOGIC MODEL USED BY MDHES FOR THE 100-YEAR EVENT WAS ALSO USED TO CALCULATE THE PROBABLE MAXIMUM FLOOD (PMF). THUS, THE AGENCIES BELIEVE THAT THE PMF MODELING IS APPROPRIATE AND DEFENSIBLE. AS DISCUSSED IN THE FLOOD MODELING STUDY PREPARED BY CH2M HILL, THE PMF DEPENDS ON A NUMBER OF ASSUMPTIONS. THEY INCLUDE FUTURE CLIMATIC CONDITIONS, PRECIPITATION EVENT CHARACTERISTICS, ANTECEDENT PRECIPITATION, GROUND CONDITIONS, AND HYDRAULIC CHANNEL CHARACTERISTICS. EVEN THOUGH IT IS IMPOSSIBLE TO SUBSTANTIATE THESE ASSUMPTIONS EXACTLY, THEY CAN REASONABLY BE STUDIED AND ESTIMATES CAN BE MADE FROM HISTORIC RECORDS. THE FLOOD MODELING STUDY USED A CALIBRATED PRECIPITATION VS. RUNOFF MODEL (HEC-1) TO CALCULATE FLOW VALUES FOR VARIOUS FREQUENCY FLOODS.

THIS MODEL WAS CALIBRATED USING EXISTING RECORDED RAINFALL AND CORRESPONDING RUNOFF DATA. PUBLICATIONS EXIST THAT PRESENT METHODS FOR CALCULATING PROBABLE MAXIMUM PRECIPITATION (PMP) FOR A GIVEN AREA. SINCE THE SILVER BOW CREEK DRAINAGE IS LOCATED ALONG THE CONTINENTAL DIVIDE, THERE ARE TWO PUBLICATIONS WHICH COVER THE DRAINAGE FOR COMPUTATION OF PMP. THESE ARE PUBLISHED BY NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION AND ARE HYDROMETEOROLOGICAL REPORT NO. 43 AND 55A. PROBABLE MAXIMUM PRECIPITATION, AS CALCULATED USING THE ABOVE REPORTS, WAS INPUT TO THE CALIBRATED HEC-1 MODEL TO CALCULATE RUNOFF DURING A PMP. THIS CALCULATION PRODUCED A RANGE OF POSSIBLE VALUES OF THE PMF, 129,000 CFS TO 201,000 CFS. THE AGENCIES HAVE ADOPTED A PMF OF 140,000 CFS FOR DESIGN PURPOSES.

ONE COMMENTER (LETTER 78) STATED THAT THE PS SHOULD CONSIDER A SIMULTANEOUS FLOOD ON WARM SPRINGS CREEK AND SILVER BOW CREEK, AND ITS IMPACT ON POND 1.

RESPONSE: THE 100-YEAR FLOOD, AS CALCULATED FOR THE CLARK FORK RIVER DOWNSTREAM OF WARM SPRINGS CREEK IN THE FLOOD MODELING STUDY, INCLUDED THE CONTRIBUTION OF WARM SPRINGS CREEK. THE FLOOD MODELING STUDY USED STREAMFLOW RECORDS RECORDED WITHIN THE ENTIRE SILVER BOW CREEK BASIN AND ALSO THOSE DRAINAGES UPSTREAM OF THE GAGE ON THE CLARK FORK RIVER AT DEER LODGE. HISTORICAL FLOODS WERE USED AS CALIBRATION FOR THE HYDROLOGIC MODEL CONSTRUCTED FOR THE ENTIRE DRAINAGE UPSTREAM OF DEER LODGE INCLUDING WARM SPRINGS CREEK AND SILVER BOW CREEK. FLOOD FLOWS DO OCCUR SIMULTANEOUSLY, BUT DUE TO DIFFERING BASIN HYDROLOGY AND FLOOD-PRODUCING MECHANISMS, THE 100-YEAR FLOOD WOULD LIKELY NOT OCCUR AT THE SAME TIME ON BOTH WARM SPRINGS CREEK AND SILVER BOW CREEK.

ONE COMMENTER (LETTER 47) WAS CONCERNED THAT CH2M HILL COULD NOT PROVIDE THE INFORMATION AT A PUBLIC MEETING THAT 27 PERCENT OF THE ANNUAL FLOW IN THE SILVER BOW CREEK WATERSHED COMES FROM MILL AND WILLOW CREEKS.

RESPONSE: THE INFORMATION ON THE ANNUAL FLOW FROM MILL AND WILLOW CREEKS WAS DETERMINED AS PART OF THE SILVER BOW CREEK FLOOD MODELING STUDY CONDUCTED BY CH2M HILL. THE CH2M HILL REPRESENTATIVE AT THE ANACONDA PUBLIC MEETING ON NOVEMBER 9, 1989, STATED THAT, ALTHOUGH HE COULD NOT RECALL THE EXACT FIGURE, HE ESTIMATED THAT IT WAS BETWEEN 20 AND 25 PERCENT, BUT WOULD NEED TO CHECK THE REPORTS TO RESPOND WITH THE PRECISE VALUE.

#### FLOOD CONTROL AND FLOOD TREATMENT ALTERNATIVES.

SEVERAL COMMENTS WERE CONCERNED WITH THE ISSUE OF HOW TO EFFECTIVELY CONTROL AND TREAT THE SEDIMENT-LADEN WATERS ASSOCIATED WITH FLOOD EVENTS. NUMEROUS COMMENTERS (LETTERS 5, 53, 64, 66, 69, 72, 73, 74, 82, 92, 97, 98, 99, 101, 102, 104, 106, 107, 108, 109, 111, 112, 115, 116, 120, 121, 122, 126, 128, 131, 132, 133, 134, 135, 138, 139, 142, 143, 144, 145, 146, 147, 151, 153, 154, 155, 159, 161; TESTIMONY A-15, M-1, M-3, M-7, M-8, M-9, M-10, M-11, M-13, M-15) RECOMMENDED THAT SOME OR ALL OF THOSE SILVER BOW CREEK FLOWS THAT ARE NOW DIVERTED TO THE MILL-WILLOW BYPASS BE CONTROLLED AND TREATED BECAUSE THEY ARE ASSOCIATED WITH EROSION EVENTS AND CONTAIN HIGHER THAN AVERAGE LOADINGS OF CONTAMINATED SEDIMENTS. MOST COMMENTERS SUGGESTED FULL TREATMENT OF UP TO THE 100-YEAR FLOOD. SEVERAL SUGGESTED TREATING EVEN GREATER FLOOD FLOWS. THREE COMMENTERS (LETTER 101, 108, 126) FURTHER STATED THAT WATER QUALITY CRITERIA VIOLATIONS SHOULD NOT BE ALLOWED, EVEN DURING FLOODS, AND THAT ROUTING THE FLOOD FLOWS THROUGH THE POND SYSTEM WILL NOT BE EFFECTIVE BECAUSE THE DETENTION TIMES DURING FLOODS WOULD BE TOO SHORT. THE COMMENT SUPPORTED THE CONCEPT OF AN UPSTREAM IMPOUNDMENT TO METER FLOWS INTO THE POND SYSTEM.

RESPONSE: THE HIGH FLOWS MENTIONED ARE THOSE ASSOCIATED WITH LARGE FLOODS. AT PRESENT, THE POND SYSTEM IS ABLE TO PROVIDE SEDIMENTATION AND TREATMENT FOR FLOWS THAT ARE LESS THAN APPROXIMATELY 600 CFS, THE PEAK DISCHARGE OF THE 2- TO 3-YEAR FLOOD. UNDER ALTERNATIVE 3 IN THE FS (THE STATE'S PROPOSED PLAN), THE UPSTREAM IMPOUNDMENT WOULD DETAIN MOST OF THE FLOWS ASSOCIATED WITH THE 100-YEAR FLOOD AND REMOVE THE MAJORITY OF THE SEDIMENTS IN SUCH FLOWS. IT APPEARS THAT THE FLOOD WATERS WOULD NOT REQUIRE FURTHER TREATMENT IN THE PONDS ONCE THEY HAD PASSED THROUGH THE SETTLING BASIN AND WOULD NOT POSE A THREAT TO THE CLARK FORK RIVER.

UNDER THE ROD'S SELECTED REMEDY PONDS 2 AND 3 IMPROVEMENTS WILL BE IMPLEMENTED TO ENABLE THE POND SYSTEM TO HOLD AND TREAT ADEQUATELY THE DESIGN VOLUME OF THE 100-YEAR FLOOD. FOR MORE DISCUSSION ON THE DEVELOPMENT OF THE DESIGN CRITERIA, PLEASE REFER TO THE RESPONSE TO ARCO'S COMMENT NO. 3 ON THE FS SECTION 4.1.1.

ONE COMMENT (LETTER 104) RECOMMENDED THAT A SEDIMENT SURVEY BE DONE AND CORRELATED WITH HISTORIC FLOOD AMOUNTS IN ORDER TO PROJECT REQUIRED STORAGE CAPACITY OF THE WARM SPRINGS PONDS TO HELP DETERMINE THEIR POTENTIAL FOR USE IN CONTROLLING FLOOD EVENTS.

RESPONSE: QUALITATIVE AND EMPIRICAL REGIONAL DATA FROM OTHER SEDIMENT SURVEYS AND STUDIES OF MASS LOADING FROM STREAMSIDE DEPOSITS AND UPLAND AREAS ALONG WITH SEDIMENT TRANSPORT (SEDIMENT AND BEDLOAD) ARE USED TO ESTIMATE REASONABLE RANGES OF SEDIMENT INFLOW TO THE PROJECT AREA. SHORT-TERM MONITORING AND SEDIMENT SURVEYS ARE NOT CONSIDERED REPRESENTATIVE OF LONG-TERM TRENDS DUE TO THE CHANGES IN UPSTREAM SOURCES (E.G., RAW TAILINGS AND THE WEED CONCENTRATOR FLOWS ARE NO LONGER DISCHARGED DIRECTLY TO SILVER BOW CREEK). MONITORING OF SEDIMENTS SHOULD BE INCLUDED IN THE MONITORING PLAN (TO BE PREPARED DURING REMEDIAL DESIGN) TO EVALUATE THE LONG-TERM PROJECT PERFORMANCE AND TO IDENTIFY ANY ADDITIONAL MAINTENANCE REQUIREMENTS.

ANOTHER COMMENTER (LETTER 154) STATED THAT AN UNKNOWN FRACTION OF SUSPENDED SEDIMENT WILL BE CARRIED THROUGH THE TREATMENT SYSTEM UNDER HIGH FLOWS AND WILL NEVER SETTLE OUT, AND THAT TREATABILITY STUDIES INDICATE THAT LIME PRECIPITATION MAY NOT BE AN EFFECTIVE TREATMENT TECHNIQUE DURING FLOOD EVENTS, GIVEN THE LARGE SURFACE-TO-VOLUME RATIO AND WIND-GENERATED MIXING.

RESPONSE: THE AGENCIES ACKNOWLEDGE THAT TURBID WATER MAY BE RELEASED DURING HIGH FLOW CONDITIONS, AND THE REMOVAL EFFICIENCY OF POND 3 WILL LIKELY BE REDUCED COMPARED TO NORMAL FLOW CONDITIONS. HOWEVER, WITH CAREFUL DESIGN AND OPERATION, IT WILL BE POSSIBLE TO UPGRADE THE CURRENT TREATMENT SYSTEM TO PROVIDE ADEQUATE TREATMENT FOR ALL BUT EXTREME FLOWS.

LIME TREATMENT WAS SELECTED AS THE BEST AVAILABLE METHOD FOR TREATING THE LARGE VOLUME OF WATER ENTERING THE POND SYSTEM. THE CONCEPTUAL DESIGN OF ALTERNATIVE 3 WAS BASED ON PROVIDING TREATMENT FOR 600 CFS, THE DESIGN MAXIMUM FLOW INTO THE PONDS. THE LAB-SCALE TREATABILITY STUDIES IDENTIFIED IN THE COMMENTER'S TEXT EVALUATED ONLY THE REMOVAL EFFICIENCY PROVIDED BY METAL HYDROXIDE PRECIPITATION. ADDITIONAL METALS REMOVAL WOULD BE PROVIDED BY BIO-UPTAKE, CALCITE COPRECIPITATION, AND THE SETTLING OF SUSPENDED SOLIDS. IN ORDER TO PREVENT ADVERSE EFFECTS TO AQUATIC LIFE, THE SYSTEM'S PH WOULD BE KEPT BETWEEN 7.5 AND 9.0.

ONE COMMENTER (LETTER 95) SUGGESTED THAT FLOOD FLOWS UPSTREAM OF POND 3 BE DIVERTED INTO THE OPPORTUNITY PONDS.

RESPONSE: THE WARM SPRINGS PONDS SYSTEM IS ALREADY IN PLACE FOR THE PURPOSE OF TREATING THE WATERS OF SILVER BOW CREEK. UTILIZING THE EXISTING PONDS IS A MUCH MORE DIRECT AND COST-EFFECTIVE APPROACH TO HANDLING SILVER BOW CREEK FLOODS THAN BUILDING A NEW SYSTEM TO DIVERT THE FLOOD WATERS INTO THE OPPORTUNITY PONDS. REMEDIATION OF THE OPPORTUNITY PONDS IS BEING STUDIED AS PART OF THE ANACONDA SMELTER SUPERFUND SITE.

#### PROPOSED UPSTREAM IMPOUNDMENT.

A LARGE NUMBER OF THE PUBLIC COMMENTS WERE OPPOSED TO THE AGENCIES' PREFERRED PLAN BECAUSE OF THE UPSTREAM IMPOUNDMENT OR SETTLING BASIN THAT IT INCLUDED. THE OPPOSITION OF MOST OF THE COMMENTERS (LETTERS 2, 3, 7, 8, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 47, 48, 49, 51, 55, 57, 58, 60, 76, 78, 80, 81, 83, 85, 86, 87, 105, 130, 148, 158; TESTIMONY A-1, A-2, A-6, A-7, A-9, A-10, A-11, A-14, A-16, B-3, B-5, B-6, B-9) WAS BASED ON PERCEIVED IMPACTS OF THE IMPOUNDMENT ON LAND, GROUNDWATER, GARDENS, PROPERTY VALUES, COUNTY TAX BASE, ADJACENT LANDS, PUBLIC HEALTH, AND ENVIRONMENTAL AESTHETICS AFFECTING TOURISM. ONE COMMENTER (LETTER 8) ALSO THOUGHT IT WOULD TAKE TOO LONG TO ACQUIRE THE LAND FOR THE IMPOUNDMENT.

RESPONSE: EPA AND MDHES AGREE THAT THE SETTLING BASIN WOULD HAVE SOME NEGATIVE IMPACTS AT THE LOCATION EXAMINED IN THE FS. IN LIGHT OF THE OVERWHELMING PUBLIC OPPOSITION TO THE UPSTREAM IMPOUNDMENT AND CAREFUL REVIEW OF THE POSSIBILITY OF TREATING MAJOR FLOOD EVENTS IN THE WARM SPRINGS PONDS SYSTEM (AFTER EXTENSIVE CAPACITY AND TREATMENT MODIFICATIONS), THE SELECTED REMEDY DOES NOT INCLUDE THE UPSTREAM IMPOUNDMENT. IF MONITORING DURING THE FIRST YEARS OF OPERATION OF THE SELECTED REMEDY REVEALS INADEQUACIES IN THE TREATMENT AND FLOOD HANDLING CAPABILITIES OF THE POND SYSTEM, THEN THE AGENCIES WILL HAVE TO RECONSIDER THE NEED FOR AN UPSTREAM IMPOUNDMENT.

ONE COMMENTER ASKED FOR CLARIFICATION REGARDING THE LOCATION OF THE PROPOSED 2,000 ACRE-FOOT UPSTREAM IMPOUNDMENT.

RESPONSE: THE UPSTREAM IMPOUNDMENT WOULD HAVE BEEN LOCATED JUST SOUTH OF MONTANA HIGHWAY 1 AND WEST OF SILVER BOW CREEK. ITS LOCATION WAS SHOWN ON FIGURES 7-10 AND 7-16 OF THE FS.

ONE COMMENTER (LETTERS 7, 49) SENT TWO LETTERS OPPOSED TO AN 8,000-ACRE-FOOT IMPOUNDMENT BECAUSE THAT WOULD BE OVERSIZED FOR POTENTIAL FLOODS IN THIS AREA.

RESPONSE: THE SILVER BOW CREEK FLOOD MODELING STUDY (CH2M HILL NOVEMBER 30, 1989) WAS BASED ON A COMPREHENSIVE ANALYSIS OF HISTORICAL FLOOD AND PRECIPITATION EVENTS FOR THE SILVER BOW CREEK DRAINAGE AREA. AS PART OF THE STUDY, A PRECIPITATION-RUNOFF COMPUTER MODEL WAS CALIBRATED USING RECORDED RAINFALL AND SNOWMELT ZONES VS. RECORDED STREAMFLOW EVENTS. USING THIS CALIBRATED MODEL AND STATISTICS ON PRECIPITATION/SNOWMELT FREQUENCY, THE CALIBRATED PRECIPITATION/RUNOFF MODEL CALCULATED THE 100-YEAR 5-DAY FLOOD VOLUME AS 13,000 ACRE-FEET FOR SILVER BOW CREEK ABOVE THE MILL-WILLOW CREEK CONFLUENCE. THE 8,000 ACRE-FEET SIZE WAS DETERMINED USING AN INFLOW-OUTFLOW MASS BALANCE ANALYSIS BASED ON THE STORM HYDROGRAPH.

ANOTHER COMMENT (LETTER 154) NOTED THAT A 2,000 ACRE-FOOT UPSTREAM IMPOUNDMENT WOULD NOT EVEN CONTAIN THE FLOOD VOLUMES FROM A 10-YEAR EVENT IN SILVER BOW CREEK. THE COMMENTER ADDED THAT, AS A SETTLING BASIN, THE IMPOUNDMENT'S EFFECTIVENESS WOULD ALSO BE IN QUESTION SINCE IT WOULD NOT BEGIN TO DIVERT SILVER BOW CREEK FLOWS UNTIL THEY REACH 600 CFS. AT 600 CFS, SILVER BOW CREEK WOULD ALREADY BE CARRYING A SUBSTANTIAL SEDIMENT LOAD. BECAUSE OF THESE FACTORS, THE COMMENTER SUGGESTED THAT ALTERNATIVE 3 COULD NOT MEET THE WATER QUALITY STANDARDS.

RESPONSE: EPA AND MDHES AGREE THAT A 2,000 ACRE-FOOT IMPOUNDMENT WOULD LIKELY NOT BE ABLE TO TOTALLY RETAIN A 10-YEAR EVENT IN SILVER BOW CREEK. AS NOTED IN CHAPTER 7 OF THE FS, THE SMALLER IMPOUNDMENT WAS ANALYZED TO DETERMINE THE EFFICIENCY OF SETTLING THE ENTRAINED SEDIMENTS AS A COMPARISON AGAINST THE STORAGE MODE OF THE 8,000 ACRE-FOOT IMPOUNDMENT. PRELIMINARY ESTIMATES INDICATED THAT THE SMALLER IMPOUNDMENT WAS ONLY ABOUT 5 PERCENT LESS EFFICIENT AS A SETTLING BASIN THAN THE LARGER IMPOUNDMENT. THE FACT THAT EITHER IMPOUNDMENT WOULD NOT DIVERT FLOWS LESS THAN 600 CFS DOES NOT MEAN THAT THESE FLOWS WOULD GO UNTREATED. FLOWS BELOW 600 CFS WOULD STILL BE DIVERTED INTO POND 3 FOR TREATMENT, INCLUDING SETTLING. PRELIMINARY CALCULATIONS, HOWEVER, INDICATE THAT THE STANDARDS FOR DISSOLVED METALS WOULD LIKELY BE MET WITH THE ORIGINAL PREFERRED ALTERNATIVE DURING FLOOD EVENTS IN THE 10- TO 100-YEAR RANGE.

THE SELECTED REMEDY INCLUDES NEITHER THE 2,000 ACRE-FEET OR THE 8,000 ACRE-FEET UPSTREAM SETTLING BASINS. IT WILL, HOWEVER, USE THE UPGRADED EXITING POND SYSTEM TO RETAIN AND TREAT THE FULL 100-YEAR FLOOD FLOWS.

TWO COMMENTERS (LETTERS 5, 82) EXPRESSED CONCERNS ABOUT THE LOCATION OF THE SETTLING BASIN IN THE FLOODWAY, STATING THAT IT SHOULD BE PROTECTED TO WITHSTAND A 100-YEAR FLOOD.

RESPONSE: THE UPSTREAM SETTLING BASIN, AS DEVELOPED IN THE FS, WAS TO BE PROTECTED FROM A 0.5 PMF, A FLOOD MANY TIMES GREATER THAN A 100-YEAR FLOOD.

ANOTHER COMMENTER (LETTER 72) SUGGESTED LOOKING INTO THE FEASIBILITY OF PROVIDING LIME TREATMENT TO RUNOFF ENTERING OR EXITING THE UPSTREAM IMPOUNDMENT.

RESPONSE: THIS CONCEPT WAS EXPLORED DURING THE INITIAL PHASES OF THE FS, BUT WAS NOT CARRIED FURTHER BECAUSE REDUNDANCY OF TREATMENT FACILITIES WAS NOT DETERMINED TO BE COST-EFFECTIVE. IN ADDITION, THE UPSTREAM IMPOUNDMENTS WERE PROPOSED FOR TEMPORARY STORAGE AND PHYSICAL SETTLING ONLY. THEY WERE NOT DESIGNED TO HAVE THE DETENTION TIMES NECESSARY FOR EFFECTIVE CHEMICAL TREATMENT.

NUMEROUS COMMENTERS (LETTERS 56, 64, 66, 68, 69, 73, 74, 75, 90, 99, 101, 107, 108, 112, 113, 115, 116, 119, 120, 122, 125, 126, 128, 131, 134, 135, 138, 144, 145, 146, 150, 151, 154, 156, 160, 161; TESTIMONY A-2, A-7, A-10, A-14, M-3, M-13) THOUGHT THAT OTHER UPSTREAM FLOOD CONTROL DAMS IN THE UPPER DRAINAGES OF THE CLARK FORK BASIN SHOULD HAVE BEEN EVALUATED DURING THE FS. THEY SUGGESTED THAT FLOOD CONTROL DAMS WOULD REDUCE THE MAGNITUDE OF MAJOR FLOODS, WOULD REDUCE THE SEDIMENT TRANSPORT, AND COULD BE USED TO AUGMENT RECREATIONAL OPPORTUNITIES IN THE AREA.

RESPONSE: EPA AND MDHES DID CONSIDER THE POSSIBILITY OF CONSTRUCTING FLOOD CONTROL DAMS ON THE TRIBUTARIES OF SILVER BOW CREEK DURING THE FS. PRELIMINARY LOCATIONS WERE IDENTIFIED ON SILVER BOW CREEK, BROWNS GULCH, FLINT CREEK, PERDEE CREEK, HOMESTEAD CREEK, WHITECRAFT GULCH, AND GERMAN GULCH. THERE WERE SEVERAL REASONS FOR NOT PURSUING THIS CONCEPT FURTHER FOR THE WARM

SPRINGS PONDS FS.

- THE DRAINAGES ARE GENERALLY STEEP, WHICH MEANS THAT RELATIVELY HIGH DAMS WOULD BE REQUIRED (GENERALLY 80 TO 200 FEET HIGH), AND THAT THE STORAGE CAPACITY GAINED BY CONSTRUCTION OF THE DAMS WOULD NOT BE GREAT COMPARED TO EITHER THE EXPENSE OF BUILDING THEM OR THE HAZARDS THEY WOULD REPRESENT.
- THE STRUCTURES WOULD ALL BE ON-CHANNEL DAMS, UNLIKE THE OFF-CHANNEL IMPOUNDMENTS CONSIDERED IN THE FS. BECAUSE THEY WOULD BE ON-CHANNEL DAMS, EACH WOULD HAVE TO BE CONSTRUCTED WITH A PMF OR PARTIAL PMF SPILLWAY FOR PROTECTION AGAINST FAILURE DURING MAJOR FLOODS. THESE SPILLWAYS ARE VERY EXPENSIVE STRUCTURES, AND WOULD ADD CONSIDERABLY TO THE COST OF CONSTRUCTION.
- THE NUMBER OF DAMS THAT WOULD HAVE TO BE BUILT TO ACHIEVE THE PURPOSE (MODERATING FLOOD FLOWS ON SILVER BOW CREEK) SEEMED UNREASONABLE. PROBABLY AS MANY AS SIX DAMS WOULD HAVE TO BE BUILT TO PARTIALLY CONTROL FLOOD FLOWS ON SILVER BOW CREEK. MAINTAINING AND OPERATING SO MANY DAMS WOULD BE A VERY EXPENSIVE UNDERTAKING THAT WOULD HAVE TO BE FUNDED AND MONITORED FOR THE INDEFINITE FUTURE. THIS IS NOT IN KEEPING WITH THE SENSE OF PERMANENCE REQUIRED FOR REMEDIAL ACTIONS UNDER SUPERFUND.
- SOME OF THE DAMS PROBABLY COULD NOT BE BUILT DUE TO THE ADVERSE ENVIRONMENTAL AND OTHER IMPACTS ASSOCIATED WITH THEIR CONSTRUCTION. FOR INSTANCE, THE POSSIBILITY OF CONSTRUCTING A DAM ON SILVER BOW CREEK, IN THE CANYON AREA NEAR THE CONFLUENCE WITH GERMAN GULCH, WOULD LIKELY NOT BE FEASIBLE (AT LEAST FOR THE LIMITED PURPOSE OF FLOOD MODERATION) BECAUSE OF THE NEED TO RELOCATE TWO RAILROAD LINES AND A POWER TRANSMISSION LINE, AND BECAUSE OF THE ADVERSE ENVIRONMENTAL IMPACTS THAT SUCH A FACILITY WOULD CAUSE.
- TO GAIN THE MAXIMUM FLOOD-CONTROL CAPACITY FROM THESE DAMS, THEY WOULD HAVE TO BE KEPT EMPTY MOST OF THE TIME. THIS WOULD SEVERELY LIMIT THEIR USEFULNESS AS WATER STORAGE OR RECREATIONAL RESERVOIRS.
- SOME OF THE RESERVOIRS WOULD EVENTUALLY COLLECT CONTAMINATED SEDIMENTS. THIS WOULD BE PARTICULARLY TRUE OF A RESERVOIR ON SILVER BOW CREEK. THE SEDIMENTS WOULD HAVE TO BE CLEANED OUT OF THE RESERVOIRS, OR THEY WOULD BECOME SOURCES OF ACUTE RELEASES OF CONTAMINANTS TO THE CREEK AND POSSIBLY CAUSE FISHKILLS, MUCH AS THE TAILINGS ALONG THE MILL-WILLOW BYPASS CURRENTLY DO.

ONE COMMENTER (LETTER 72) NOTED THAT THE UPSTREAM IMPOUNDMENT WOULD SETTLE OUT ONLY THE LARGER PARTICLE SIZES IN THE SEDIMENTS CARRIED BY FLOOD FLOWS. IT IS SUSPECTED THAT THE SMALLER PARTICLE SIZES (WHICH WOULD NOT SETTLE OUT) CARRY PROPORTIONATELY MORE METALS THAN THE LARGER SEDIMENT SIZES. THE POTENTIAL SEDIMENT TOXICITY TO AQUATIC ORGANISMS FROM THESE SMALLER SEDIMENT SIZES SHOULD BE EVALUATED MORE THOROUGHLY.

RESPONSE: THE AGENCIES AGREE THAT IT WOULD BE DESIRABLE TO EVALUATE THE TOXICITY OF FLOOD SEDIMENTS MORE THOROUGHLY. UNFORTUNATELY, IT IS DIFFICULT TO DETERMINE THE TOXICITY WITHOUT EXPERIENCING AND SAMPLING AN ACTUAL FLOOD EVENT OF SUFFICIENT MAGNITUDE TO YIELD MEANINGFUL RESULTS.

FLOOD PROTECTION OF POND BERMS.

FOUR COMMENTERS (LETTERS 62, 111, 119, 140) RECOMMENDED THAT THE HYDROLOGIC STANDARD FOR EMERGENCY AND PRINCIPAL SPILLWAYS, CONTAINED IN THE DAM SAFETY AND ADMINISTRATION RULES UNDER SECTION 36.14.502, NOT BE USED AS THE SOLE CRITERIA IN THE SELECTION OF THE DESIGN FLOOD, DUE TO THE HAZARDOUS NATURE OF THE MATERIAL STORED IN THE DAMS. NUMEROUS COMMENTERS (LETTERS 53, 56, 62, 64, 66, 68, 69, 73, 74, 75, 90, 91, 97, 101, 102, 104, 106, 108, 109, 114, 115, 116, 119, 121, 122, 126, 128, 131, 132, 134, 135, 136, 138, 142, 143, 145, 146, 149, 151, 152, 153, 157, 158, 159; TESTIMONY A-7, A-14, A-15, M-1, M-2, M-3, M-7, M-10, M-13, M-15) MADE GENERAL STATEMENTS THAT THE POND PROTECTION SHOULD BE CONSERVATIVELY DESIGNED. SEVERAL SPECIFICALLY STATED THAT THE LEVEL OF PROTECTION SHOULD BE 0.5 PMF OR THE FULL PMF. SEVERAL OF THE COMMENTERS RECOMMENDED THAT THE STUDY INCLUDE A RISK ANALYSIS OF POSSIBLE DAM FAILURE AND OFFER RATIONALE FOR SELECTION OF THE DESIGN FLOOD EVENT.

RESPONSE: MDHES AND EPA RECOGNIZE THAT THE DAM SAFETY AND ADMINISTRATION RULES REPRESENT A MINIMUM LEVEL OF PROTECTION REQUIRED FOR THE WARM SPRINGS PONDS. THE LEVEL OF PROTECTION REQUIRED, BASED ON THESE RULES, CONSIDERS THAT THESE ARE HIGH HAZARD DAMS WITH THE POTENTIAL FOR LOSS OF LIFE DOWNSTREAM DUE TO FLOODING IN THE EVENT OF A DAM FAILURE. THE AGENCIES HAVE DECIDED TO NOT USE VARYING LEVELS OF PROTECTION, BUT RATHER TO PROTECT THE ENTIRE SET OF POND BERMS ALONG THE MAJOR FLOOD ROUTE, THE MILL-WILLOW BYPASS, TO A PEAK FLOOD DISCHARGE OF 70,000 CUBIC FEET PER SECOND (CFS). THIS LEVEL OF PROTECTION IS EQUIVALENT TO PROTECTION FROM THE 0.5 PMF FOR THE ENTIRE POND SYSTEM.

WHILE IT MIGHT BE DESIRABLE TO CONDUCT A FULL INCREMENTAL RISK ASSESSMENT OF POSSIBLE DAM FAILURE EVENTS IN AN ATTEMPT TO DETERMINE THE MOST COST-EFFECTIVE LEVEL OF DAM PROTECTION, THE AGENCIES FEEL THAT SUCH A STUDY WOULD BE TOO COSTLY, TAKE TOO LONG, AND WOULD LIKELY NOT PROVIDE DEFINITIVE ENOUGH ANSWERS REGARDING EXPECTED RISK. IT WAS FELT THAT USING A CONSERVATIVE NUMBER BASED ON DNRC DAM SAFETY REQUIREMENTS WAS THE PROPER APPROACH.

THE SELECTED REMEDY INCLUDES MEASURES TO PROTECT THE POND BERMS FROM FAILURE EVEN IN LARGE FLOODS, UP TO A 0.5 PMF. THE PONDS WOULD NOT FAIL IN FLOODS UP TO THIS LEVEL AND THEREFORE WOULD NOT ADD TO THE DAMAGE THAT WOULD RESULT FROM ANY FLOOD OF LESS THAN 0.5 PMF. IF A LARGER FLOOD, SUCH AS A FULL PMF, DID OCCUR, AND DAMAGED THE PONDS, THE AMOUNT OF WATER RELEASED BY THE FAILURE OF THE PONDS WOULD BE SMALL COMPARED TO THE SIZE OF THE FLOOD. IT'S PROBABLE THAT THE DOWNSTREAM COMMUNITIES WOULD BE MUCH MORE AFFECTED BY THE FLOOD ITSELF THAN BY THE FAILURE OF THE PONDS.

ONE COMMENTER (LETTER 119) THOUGHT THAT TWENTY MILLION DOLLARS COULD BE TRIMMED FROM THE STATE'S PREFERRED ALTERNATIVE BY DESIGNING TO SUBSTANTIALLY LOWER STANDARDS THAN THE FRACTIONAL PMFS LISTED. THE MONEY SAVED COULD BE APPLIED TO ULTIMATE REMOVAL OF THE SEDIMENTS FROM THE FLOODPLAIN. ON THE OTHER HAND, ANOTHER COMMENTER (LETTER 101) THOUGHT THAT THE FLOOD-PROTECTION MEASURES NEEDED TO BE SIGNIFICANTLY MORE STRINGENT THAN THOSE PROPOSED AND SHOULD BE BASED ON THE HAZARDS AND COSTS ASSOCIATED WITH CATASTROPHIC RELEASE OF TOXIC MATERIALS. THIS COMMENTER STATED THAT THE FLOOD PROTECTION COSTS MUST BE COMPARED WITH REMOVAL TO A REPOSITORY OUTSIDE THE FLOODPLAIN.

RESPONSE: THE ARARS FOR FLOOD PROTECTION AND EARTHQUAKE STABILITY WERE DETERMINED BASED ON THE ANTICIPATED RISKS ASSOCIATED WITH CATASTROPHIC RELEASE OF SEDIMENTS FROM THE PONDS. EVEN IF IT WAS KNOWN THAT THE SEDIMENTS WOULD BE REMOVED WITHIN A GIVEN TIME FRAME (SAY 30 YEARS) THE RISK OF CATASTROPHIC FAILURE IN ANY GIVEN YEAR WOULD REMAIN THE SAME. THUS, DESIGNS WOULD STILL HAVE TO BE PERFORMED TO THE LEVEL OF PROTECTION AS DETERMINED BY THE ARARS ANALYSIS.

THE COSTS FOR PROVIDING ADEQUATE FLOOD PROTECTION FOR THE WARM SPRINGS PONDS ARE SUBSTANTIALLY LESS THAN THE COSTS TO REMOVE THE SEDIMENTS FROM THE FLOODPLAIN. THE COSTS FOR RAISING THE BERMS AND ARMORING THEM AGAINST THE DESIGNATED FLOODS ARE ESTIMATED AT ABOUT \$13.5 MILLION. THE COSTS TO REMOVE AND DISPOSE OF THE POND MATERIALS TO A REPOSITORY OUTSIDE THE FLOODPLAIN WOULD BE APPROXIMATELY \$400 TO \$500 MILLION, USING CONVENTIONAL EXCAVATE-AND-HAUL TECHNIQUES.

ONE COMMENT (LETTER 160) THOUGHT THE FS SHOULD HAVE CONSIDERED AN OPTION FOR FLOOD AND EARTHQUAKE PROTECTION THAT WOULD ENTAIL DRIVING PILES (30 TO 60 FEET IN LENGTH) THROUGH THE CENTER OF THE BERMS ON 18- TO 24-INCH CENTERS. THEN, IF THE BERMS DID GIVE WAY, THE SEDIMENTS WOULD BE RETAINED BEHIND THE PILES.

RESPONSE: THIS CONCEPT WAS NOT CONSIDERED BECAUSE IT WOULD BE MUCH MORE EXPENSIVE THAN BERM MODIFICATIONS (FLATTENING THE DOWNSTREAM SLOPES AND RIPRAP ARMORING) IN PROTECTING AGAINST FLOODS AND EARTHQUAKES. IT WOULD NOT PROVIDE ANY GREATER PROTECTION AGAINST FLOODING AND, WITHOUT VERY SPECIAL DESIGNS, MIGHT NOT PROVIDE AS MUCH PROTECTION AGAINST EARTHQUAKES.

ONE COMMENT (LETTER 138) STATED THAT THE COLLECTION SYSTEM DESIGNED TO ROUTE EASTSIDE RUNOFF AROUND THE POND SYSTEM SHOULD BE DESIGNED TO PREVENT, TO THE EXTENT POSSIBLE, SEDIMENT FROM ENTERING THE CLARK FORK RIVER.

RESPONSE: THE BERM/CHANNEL SYSTEM ALONG THE EAST SIDE OF THE PONDS WOULD BE DESIGNED TO PREVENT OVERTOPPING OF THE BERMS DURING FLOOD EVENTS IN THE EASTERN HILLS. THE NATURAL SEDIMENTS CARRIED BY RUNOFF FROM THE EASTERN HILLS WILL ENTER THE CLARK FORK RIVER UNABATED, EXACTLY AS WOULD OCCUR UNDER NATURAL CONDITIONS IF THE WARM SPRINGS PONDS WERE NOT IN PLACE. THESE SEDIMENTS ARE NOT BELIEVED TO BE CONTAMINATED.

## EARTHQUAKE PROTECTION OF PONDS.

NUMEROUS COMMENTERS (LETTERS 45, 53, 56, 62, 64, 66, 68, 69, 73, 74, 75, 90, 91, 97, 98, 99, 102, 104, 106, 109, 114, 115, 116, 119, 120, 122, 125, 126, 128, 131, 132, 134, 135, 138, 142, 143, 145, 146, 149, 151, 153, 157, 158, 159, 160; TESTIMONY A-7, A-14, A-15, M-1, M-3, M-7, M-15) STATED THAT THE POND BERMS SHOULD INCORPORATE THE MOST CONSERVATIVE DESIGN POSSIBLE FOR EARTHQUAKE PROTECTION.

RESPONSE: THE AGENCIES AGREE. THE SELECTED REMEDY PROVIDES PROTECTION OF THE BERMS FROM THE MAXIMUM CREDIBLE EARTHQUAKE (MCE).

ONE COMMENTER (LETTERS 47, 158) SAID THE CROSS-SECTIONAL VIEW OF THE PROPOSED BERM MODIFICATIONS DOES NOT SHOW ANY INCREASE IN HEIGHT. IN ADDITION, SOME OF THE EXISTING BERMS HAVE DOWNSTREAM SLOPES OF 2.25 TO 1. FLATTENING THE DOWNSTREAM SLOPES TO 2.5 TO 1 DOES NOT PROVIDE MUCH ADDITIONAL STRENGTH.

RESPONSE: THE ORIGINAL MDHES PROPOSED PLAN INCLUDED INCREASING BERM HEIGHTS ALONG THE MILL-WILLOW BYPASS. FIGURES 7-1 AND 7-2 OF THE FS SHOW THE INTENT TO ADD THAT ADDITIONAL HEIGHT. IN ADDITION, THE ROD'S SELECTED REMEDY INCLUDES THE ARCO CONCEPT OF TREATING MAJOR FLOOD EVENTS IN THE POND SYSTEM. THIS ALTERNATIVE REQUIRES SUBSTANTIAL RAISING OF ALL OF THE POND 2 AND 3 BERMS FOR INCREASED FLOOD STORAGE AND TREATMENT CAPACITY. DEPENDING UPON LOCATION, THE DOWNSTREAM SLOPES OF THE EXISTING BERMS VARY FROM APPROXIMATELY 1.75:1 TO MORE THAN 2.5:1. THE SEISMIC ANALYSIS WAS PRELIMINARY IN NATURE AND RECOMMENDED A MINIMUM OF 2.5:1 FOR COST-ESTIMATING PURPOSES. A DETAILED SEISMIC STABILITY ANALYSIS WILL BE PERFORMED DURING THE FINAL DESIGN. THE CONFIGURATION AND SLOPE OF THE BERM STABILIZATION (TO WITHSTAND THE MCE) WILL BE OPTIMIZED AT THAT TIME BASED UPON SITE-SPECIFIC INFORMATION. DNRC DAM SAFETY ENGINEERS HAVE REVIEWED THE DESIGNS OF THE BERMS ALONG THE MILL-WILLOW BYPASS AND HAVE FOUND THEM TO BE APPROPRIATE FOR MCE PROTECTION.

ONE COMMENTER (LETTER 138) STATED THAT THE SIPHONS CROSSING UNDER THE MILL-WILLOW BYPASS FROM THE OPPORTUNITY SYSTEM SHOULD MEET EARTHQUAKE AND FLOOD PROTECTION STANDARDS TO PREVENT RELEASE OF CONTAMINANTS INTO THE CLARK FORK.

RESPONSE: THE SIPHONS FROM THE OPPORTUNITY PONDS NO LONGER CARRY SUBSTANTIAL FLOWS, EXCEPT DURING LOCAL RAINFALL EVENTS. HOWEVER, DURING THESE EVENTS, CONTAMINATION DUE TO A BREACHING OF THE SIPHON PIPELINES IS POSSIBLE. THE AGENCIES AGREE THAT THE SIPHONS SHOULD BE EVALUATED FOR EARTHQUAKE AND FLOOD STABILITY. THIS EVALUATION WILL BE PERFORMED DURING REMEDIAL DESIGN.

## TAILINGS REMOVAL AND DISPOSAL OPTIONS.

NUMEROUS COMMENTERS (LETTERS 9, 56, 64, 66, 68, 69, 73, 74, 75, 78, 79, 90, 93, 97, 98, 99, 101, 102, 103, 106, 107, 108, 109, 114, 115, 116, 117, 119, 120, 121, 125, 126, 132, 133, 134, 135, 138, 140, 142, 143, 144, 145, 146, 149, 151, 152, 154, 155, 159, 161; TESTIMONY A-15, M-3, MS, M-8, M-9, M-10, M-11, M-14, M-15) STATED THAT THE AGENCIES SHOULD FIND A SITE OUTSIDE THE FLOODPLAIN, SUCH AS SMELTER HILL IN ANACONDA, FOR DISPOSAL OF TAILINGS AND SHOULD REEVALUATE THE ALTERNATIVE OF REMOVING THE WARM SPRINGS PONDS TAILINGS TO THAT DISPOSAL SITE. MANY OF THE COMMENTERS THOUGHT THAT THE CONTAMINATED MATERIALS CURRENTLY CONTAINED IN THE WARM SPRINGS PONDS SHOULD BE REMOVED FROM THE FLOODPLAIN FOLLOWING PERMANENT CLEANUP OF UPSTREAM SITES, WHEN THE WARM SPRINGS PONDS ARE NO LONGER NEEDED TO TREAT SILVER BOW CREEK WATERS.

RESPONSE: BECAUSE OF THE UPSTREAM CONTAMINATION ON SILVER BOW CREEK, THE PONDS MUST REMAIN IN PLACE TO TREAT THE CREEK TO REDUCE CONTAMINATION OF THE CLARK FORK RIVER UNTIL THE UPSTREAM SOURCES ARE CLEANED UP. THE CURRENT REMEDY FOR WARM SPRINGS PONDS IS INTERIM, AND THE ULTIMATE DISPOSITION OF THE PONDS WILL BE ADDRESSED AS CLEANUP OF SILVER BOW CREEK PROGRESSES.

REMOVAL OF ALL CONTAMINATED MATERIALS FROM THE SILVER BOW CREEK FLOODPLAIN, WITH DISPOSAL AT A LOCAL REPOSITORY, WAS CONSIDERED DURING THE SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS IN CHAPTER 6. IT WAS SCREENED FROM FURTHER CONSIDERATION AT THAT TIME BECAUSE OF VERY HIGH COSTS. THE AGENCIES' PRELIMINARY ANALYSIS INDICATED THAT CONVENTIONAL EXCAVATION, TRANSPORT, AND DISPOSAL OF THE 19,000,000 CUBIC YARDS OF CONTAMINATED MATERIALS (USING OVER-THE-ROAD TRANSPORT VEHICLES) WOULD COST APPROXIMATELY \$400 TO \$500 MILLION IN ADDITION, LOCATING A PERMANENT REPOSITORY FOR THIS VOLUME OF MATERIAL WOULD BE DIFFICULT. FOR EXAMPLE, IF THE MATERIALS WERE PILED 30 FEET DEEP, IT WOULD REQUIRE A STORAGE AREA OF APPROXIMATELY 600 ACRES. IT MAY BE

DIFFICULT TO FIND A SUITABLE STORAGE AREA THIS SIZE WITHIN REASONABLE DISTANCE OF THE WARM SPRINGS PONDS THAT WOULD BE ACCEPTABLE TO ALL PARTIES CONCERNED.

THREE COMMENTS (LETTERS 58, 88, 124) RECOMMEND THAT THE MINE WASTES IN THE PONDS BE REMOVED AND DISPOSED OF IN THE MINED-OUT AREAS OR IN THE BERKELEY PIT. TWO OF THE COMMENTERS (LETTERS 88, 124) THOUGHT THAT THE AGENCIES SHOULD HAVE CONSIDERED AN ALTERNATIVE WHICH WOULD USE A SLURRY PIPELINE TO PUMP THE CONTAMINATED SEDIMENTS BACK TO THE BERKELEY PIT NEAR BUTTE. THE CONTAMINATED WATER NOW SLOWLY FLOODING THE BERKELEY PIT COULD BE USED FOR MAKEUP WATER FOR THE SLURRY PIPELINE. THIS ALTERNATIVE WOULD PROVIDE A PERMANENT REPOSITORY FOR THE WASTES, RESOLVE THE FUTURE PROBLEM OF DISPOSAL OF THE BERKELEY PIT WATERS, AND ALLOW A CENTRAL LOCATION FOR METALLURGICAL OR CHEMICAL REMOVAL OF THE HEAVY METALS IN BOTH THE WARM SPRINGS WASTES AND BERKELEY PIT WATERS.

RESPONSE: THIS IS A POTENTIALLY VIABLE ALTERNATIVE FOR ULTIMATE DISPOSAL OF THE WARM SPRINGS PONDS SEDIMENTS. HOWEVER, UNTIL THE SOURCES OF CONTAMINATION UPSTREAM OF THE PONDS ARE ELIMINATED, THE WARM SPRINGS PONDS MUST REMAIN IN OPERATION TO REMOVE SEDIMENTS AND METALS. IT WOULD NOT BE ADVISABLE TO BEGIN THE SLURRY PUMPING OPERATION UNTIL THE PONDS ARE TAKEN OUT OF SERVICE AS A TREATMENT SYSTEM. THE PRIMARY REASON IS THAT THE SLURRY OPERATION WOULD REQUIRE DREDGING THE POND BOTTOM SEDIMENTS, LIKELY RESULTING IN CONSIDERABLE RESUSPENSION OF SEDIMENTS. IT WOULD BE BETTER TO WAIT UNTIL THE PONDS NO LONGER DISCHARGE TO THE CLARK FORK RIVER BEFORE BEGINNING THIS OPERATION.

THE COSTS FOR DREDGING AND PUMPING THE WARM SPRINGS SLUDGES TO THE BERKELEY PIT WOULD BE SUBSTANTIAL. VERY PRELIMINARY COST ESTIMATES INDICATE CAPITAL COSTS OF \$30 TO \$50 MILLION WITH OPERATION AND MAINTENANCE COSTS OF \$2 TO \$3 MILLION PER YEAR. IF A 12-INCH PIPELINE WERE EMPLOYED, IT WOULD REQUIRE APPROXIMATELY 8 TO 10 YEARS OF AROUND-THE-CLOCK OPERATION TO PUMP THE 19 MILLION CUBIC YARDS OF MATERIAL TO THE BERKELEY PIT.

TWO IMPORTANT FEATURES OF THIS CONCEPT SHOULD BE POINTED OUT.

- THE USE OF A SECOND PIPELINE TO ALLOW USE OF BERKELEY PIT WATERS AS MAKEUP WATER FOR THE SLURRY OPERATION IS NOT ADVISABLE. THE BERKELEY PIT WATERS ARE VERY ACIDIC, WITH PH OF 1 TO 2. NOT ONLY IS THIS TYPE OF WATER HIGHLY CORROSIVE TO PUMPS AND PIPELINES, BUT ITS USE AS MAKEUP WATER TO SLURRY THE POND SLUDGES WOULD LIKELY RESULT IN REDISSOLUTION OF THE METALS. IT IS LIKELY THAT THE BERKELEY PIT WATERS WILL EVENTUALLY HAVE TO BE TREATED; THUS, THE RE-DISSOLVED METALS WOULD HAVE TO BE REMOVED AT THAT TIME.
- THE MAKEUP WATER FOR THE SLURRY WOULD MOST LIKELY COME FROM SILVER BOW CREEK IN THE VICINITY OF THE WARM SPRINGS PONDS. BECAUSE OF WATER RIGHTS ISSUES, THE WATER WOULD HAVE TO BE RETURNED TO SILVER BOW CREEK AT THE BERKELEY PIT AFTER THE SLURRY OPERATION. THIS WOULD REQUIRE A DEWATERING OPERATION AND LIKELY A TREATMENT PLANT FOR THE SUPERNATANT PRIOR TO DISCHARGE TO SILVER BOW CREEK.

ONE COMMENT (LETTER 119) STATED THAT REMOVAL OF THE SEDIMENTS FROM THE FLOODPLAIN TO A NEARBY DISPOSAL SITE COULD BE DONE ECONOMICALLY (\$3.00/CUBIC YARD) IF DONE OVER A PERIOD OF YEARS UTILIZING AN EFFICIENT TRANSPORT SYSTEM SUCH AS A SLURRY PIPELINE. THE CONSTRUCTION OF THIS SYSTEM SHOULD BE DEFERRED UNTIL AFTER THE UPSTREAM CONTAMINATION SOURCES ARE CLEANED UP, SINCE THE WARM SPRINGS PONDS WILL BE NEEDED UNTIL THEN. HOWEVER, IF THE MONEY FOR THE REMOVAL AND DISPOSAL SYSTEM WERE INVESTED TODAY, THE INTEREST EARNED COULD SUBSTANTIALLY REDUCE THE INVESTMENT REQUIRED WHEN THE SYSTEM IS PLACED IN OPERATION.

RESPONSE: IF IT IS DECIDED IN THE FUTURE TO REMOVE THE SEDIMENTS FROM THE PONDS, THE AGENCIES AGREE THAT SOME FORM OF SLURRY PIPELINE WOULD LIKELY BE A MORE COST-EFFECTIVE TRANSPORT SYSTEM THAN A CONVENTIONAL EXCAVATE AND HAUL SYSTEM. THE POND SEDIMENTS CAN LIKELY BE DREDGED, SLURRIED, AND TRANSPORTED FOR COSTS SIMILAR TO THE \$3.00/CUBIC YARD (1990 DOLLARS) NOTED, DEPENDING UPON THE PIPELINE LENGTH. HOWEVER, SUBSTANTIAL OTHER, COSTS WOULD BE INCURRED. THERE IS SOME DOUBT AS TO WHETHER A FEASIBLE AND ACCEPTABLE REPOSITORY CAN BE LOCATED OUTSIDE OF A FLOODPLAIN WITHIN REASONABLE DISTANCE OF THE WARM SPRINGS PONDS. IF A REPOSITORY CAN BE LOCATED, THE COSTS TO DEVELOP, CONSTRUCT, AND THEN ULTIMATELY CAP, CLOSE, AND MONITOR THE REPOSITORY WOULD ALSO HAVE TO BE CONSIDERED.

EPA AND MDHES AGREE THAT IF THE APPROPRIATE FUNDS TO DEVELOP THESE FACILITIES WERE INVESTED TODAY, IT WOULD BE LIKELY THAT THE INTEREST EARNED WOULD REDUCE THE INVESTMENT REQUIRED WHEN THE FACILITIES ARE BUILT. HOWEVER, THE RESPONSIBILITY FOR FUNDING THE OVERALL SILVER BOW CREEK REMEDIATION EFFORTS RESTS WITH ARCO AND OTHER PRPS. THE INVESTMENT AND FINANCING DECISIONS WILL BE THEIRS.

SEVERAL COMMENTS DEALT WITH THE AGENCIES' PROPOSAL TO LEAVE THE TAILINGS IN PLACE WITHIN THE PRESENT WARM SPRINGS PONDS SYSTEM. ONE COMMENT (LETTER 79) WAS OPPOSED TO DISPOSAL OF CONTAMINATED MATERIALS IN POND 1 DUE TO THE POTENTIAL FOR CONTAMINATION OF THE CLARK FORK RIVER.

RESPONSE: POND 1 ALREADY CONTAINS ALMOST 3 MILLION CUBIC YARDS OF TAILINGS AND OTHER CONTAMINATED MATERIALS. THE PROPOSED PLAN WOULD ADD ANOTHER 290,000 CUBIC YARDS, OR ABOUT AN ADDITIONAL 10 PERCENT OVER WHAT IS ALREADY THERE. THE POND WOULD BE DRAINED AND COVERED WITH A LOW PERMEABILITY CAP THAT WOULD KEEP RAIN AND SNOW FROM PENETRATING INTO THE WASTES. THIS WOULD RESULT IN A LARGE REDUCTION IN THE POTENTIAL FOR POND 1 TO LEACH CONTAMINATION INTO THE GROUNDWATER AND SURFACE WATER, AS IT CURRENTLY DOES. THE POND WILL ALSO BE STABILIZED TO PROTECT AGAINST EARTHQUAKE AND FLOOD EVENTS. THIS WILL RESULT IN A VERY SECURE AND STABLE DISPOSAL AREA.

THE PLANS FOR CLEANING UP THE MILL-WILLOW BYPASS THIS SUMMER INCLUDE PLACING THE EXCAVATED MATERIALS INTO SUITABLE DRY AREAS OF POND 3, THUS REDUCING THE AMOUNT OF MATERIAL THAT WILL EVENTUALLY BE PLACED IN POND 1.

#### TAILINGS RECLAMATION AND REPROCESSING OPTIONS.

NUMEROUS COMMENTERS (LETTERS 6, 64, 66, 68, 69, 71, 73, 74, 75, 88, 99, 100, 102, 103, 107, 109, 115, 116, 117, 120, 123, 124, 128, 134, 140, 143, 145, 146, 151, 155, 159, 161, 162; TESTIMONY A-15, B-5, M-1, M-3) THOUGHT THE AGENCIES SHOULD HAVE INCLUDED ALTERNATIVES EVALUATING ADDITIONAL TREATMENT TECHNOLOGIES FOR HAZARDOUS WASTES AT THE WARM SPRINGS PONDS, INCLUDING ALTERNATIVES EMPLOYING PROVEN OR INNOVATIVE TECHNOLOGIES TO EXTRACT AND RECYCLE MINERALS FROM WASTES IN THE PONDS.

RESPONSE: MEDIA SPECIFIC ACTIONS FOR TREATING THE SEDIMENTS FROM THE PONDS AND EXTRACTING MINERALS FROM THEM WERE INCLUDED IN THE PRELIMINARY ALTERNATIVES SCREENING OF THE FS. THESE ALTERNATIVES WERE SCREENED OUT EARLY IN THE PROCESS BECAUSE THEY WERE NOT FOUND TO BE FEASIBLE, APPROPRIATE, OR ECONOMICAL. METALS RECOVERY FROM THE POND SEDIMENTS WOULD NOT BE ECONOMICALLY VIABLE, WOULD DO LITTLE TO REDUCE THE AMOUNT OF WASTES TO BE DISPOSED OF, AND COULD POSE CONSIDERABLE THREATS TO THE ENVIRONMENT. METALS RECOVERY, EVEN FROM NORMAL ORE, IS EXPENSIVE AND DIFFICULT, AND POSES NUMEROUS POTENTIAL THREATS TO THE ENVIRONMENT. THE WASTES IN THE PONDS CONTAIN MUCH LOWER LEVELS OF METALS THAN EVEN THE POOREST QUALITY USABLE ORES; THEY ARE THE WASTES LEFT OVER AFTER THE METALS HAVE BEEN REMOVED. PROCESSING THESE WASTES TO EXTRACT THE REMAINING METALS, AS A MEANS TO REDUCE THEIR TOXICITY, WOULD NOT BE COST-EFFECTIVE BY TODAY'S STANDARDS. MUCH LESS EXPENSIVE (BUT STILL VERY EXPENSIVE) TREATMENT METHODS ARE AVAILABLE TO REDUCE THE ENVIRONMENTAL THREAT POSED BY THE POND BOTTOM SEDIMENTS, SUCH AS SOLIDIFICATION. IF TECHNOLOGY IN THE FUTURE ALLOWS FOR RECOVERY OF THE METALS FROM THE SEDIMENTS, RECOVERY WOULD BE REEVALUATED AT THAT TIME.

TWO COMMENTS (LETTERS 113, 139) STATED THAT THE AGENCIES SHOULD CONTINUE TO RESEARCH, AND IMPLEMENT WHERE POSSIBLE, REVEGETATION APPROACHES. ONE THOUGHT THAT THE SCHAFFER AND ASSOCIATES PILOT PROGRAM FOR NEUTRALIZING THE TAILINGS HOLDS PROMISE FOR CURING THE PROBLEM RATHER THAN JUST MOVING IT.

RESPONSE: THE PILOT PROGRAM DESCRIBED IN THE COMMENT IS BASED ON TECHNOLOGY DEVELOPED IN AN ONGOING 3-YEAR PROGRAM THAT HAS BEEN CONDUCTED BY MDHES AT THE SILVER BOW CREEK SITE TO DEVELOP INNOVATIVE CLEANUP METHODS FOR THE SITE. IT IS APPLICABLE TO EXPOSED TAILINGS DEPOSITS UNDER CERTAIN CONDITIONS, BUT WOULD NOT BE USEFUL TO TREAT THE POND BOTTOM SEDIMENTS. IT IS ALSO NOT BY ITSELF CAPABLE OF PREVENTING RELEASE OF THE 19 MILLION CUBIC YARDS OF SEDIMENT IN THE PONDS DURING FLOOD OR EARTHQUAKE EVENTS. IT WOULD THEREFORE BE NECESSARY TO INCORPORATE METHODS OTHER THAN NEUTRALIZATION AND REVEGETATION TO REDUCE THE RISK OF A LOSS OF THE POND BOTTOM SEDIMENTS.

FOR THE WSP OPERABLE UNIT, REVEGETATION OF EXPOSED TAILINGS AREAS AND OF THE DISPOSAL UNITS WILL BE UNDERTAKEN. IF THE APPROACHES DESCRIBED ABOVE HAVE APPLICATION IN THIS REVEGETATION EFFORT, THEY CAN BE INCORPORATED DURING THE REMEDIAL DESIGN PHASE.

## USE OF THE PONDS FOR TREATMENT.

SEVERAL COMMENTS (LETTER 138) DEAL WITH THE CAPABILITY OF THE PONDS TO PROVIDE ADEQUATE TREATMENT OF SUSPENDED AND DISSOLVED METALS TO MEET THE DESIRED WATER QUALITY CRITERIA AT THE DISCHARGE POINT FROM POND 2. ONE COMMENT NOTES THAT HIGH LEVELS OF METALS HAVE BEEN MEASURED IN THE DISCHARGE, PARTICULARLY IN THE WINTER AND SPRING. THE SAME COMMENTER, AND ANOTHER (LETTER 115), ALSO STATED THAT REMEDIATION OF THE PONDS SHOULD ADDRESS PROBLEMS ASSOCIATED WITH THE SHORT CIRCUITING IN THE WINTER AND WIND ACTION DURING THE ICE-FREE PERIOD THAT ARE THOUGHT TO RESUSPEND SEDIMENTS AND CONTRIBUTE TO METALS LOADING IN THE CLARK FORK RIVER.

RESPONSE: THE AGENCIES AGREE THAT THE FINAL POND CONFIGURATION MUST BE ABLE TO PROVIDE TREATMENT THAT WILL MEET THE APPROPRIATE DISCHARGE REQUIREMENTS. THE AGENCIES' ORIGINAL PROPOSED PLAN CONTAINED ELEMENTS, INCLUDING THE UPSTREAM SETTLING BASIN, IMPROVED LIMING FACILITIES, AND THE CONSTRUCTION OF A BERM ACROSS PART OF POND 3, TO ALLEVIATE TREATMENT PROBLEMS. THE SELECTED REMEDY INCLUDES A MORE COMPREHENSIVE UPGRADE OF BOTH PONDS 2 AND 3, AND IS THOUGHT TO ADEQUATELY ADDRESS CONCERNS OVER POND RETENTION TIME, SEDIMENT RESUSPENSION, LIME ADDITION, AND TREATMENT CAPABILITIES IN GENERAL, WITHOUT THE NEED FOR THE UPSTREAM IMPOUNDMENT. THE ROD CONTAINS PROVISIONS TO CONTINUE TO INVESTIGATE RESUSPENSION ISSUES. IF IT IS SHOWN THAT RESUSPENSION MAY CAUSE SIGNIFICANT WATER QUALITY VIOLATIONS, ADDITIONAL REMEDIAL MEASURES WILL BE REQUIRED.

ONE COMMENTER (LETTER 72) RECOMMENDED THE CONSIDERATION OF A NEW POND IMMEDIATELY SOUTH OF POND 3, STATING THAT A NEW POND WOULD REDUCE THE EXTENSIVE MODIFICATION REQUIRED FOR THE INLET STRUCTURE; AVOID THE NEED TO CHANNELIZE SILVER BOW CREEK WITHIN THE DRY AREAS OF POND 3; COVER THE CONTAMINATED SOILS AND TAILINGS IN THE DRY AREAS OF POND 3; AND INCREASE THE POND CAPACITY BY 70 PERCENT.

RESPONSE: THE MEDIA-SPECIFIC ACTIONS (FS CHAPTER 7) WERE DEVELOPED TO PROVIDE A RANGE OF OPTIONS TO BE COMBINED INTO ALTERNATIVES (CHAPTER 8). A NEW POND IN THE DRY AREAS WITHIN THE POND 3 BERMS WAS CONSIDERED IN MEDIA-SPECIFIC ACTION 5C. IN THE FS, IT WAS NOT INCLUDED IN THE PREFERRED ALTERNATIVE (ALTERNATIVE 3), BECAUSE IT WOULD NOT BE AS COST-EFFECTIVE IN DEALING WITH THE PROBLEMS.

THE SELECTED REMEDY INCLUDES MAJOR IMPROVEMENTS TO PONDS 2 AND 3. THIS PLAN INCLUDES ELEMENTS THAT WILL ACCOMPLISH ALL OF THE MODIFICATIONS INCLUDED IN THE COMMENT. A NEW INLET STRUCTURE WILL BE BUILT. MOST OF THE EXISTING EXPOSED CONTAMINATED SOILS AND TAILINGS IN THE DRY AREAS OF POND 3 WOULD EITHER BE CAPPED AS PART OF THE TAILINGS DISPOSAL AREA, OR FLOODED BY THE NEW POND 3 NORMAL POOL. THE POND CAPACITY WOULD BE INCREASED TO HANDLE AND TREAT THE 100-YEAR FLOOD EVENT.

ONE COMMENTER (LETTER 138) STATED THAT THE AREA IN POND 3 SOUTH OF THE PROPOSED NEW BAFFLE IS VERY SHALLOW AND THAT THE BAFFLE MAY NOT BE EFFECTIVE AT PREVENTING SHORT CIRCUITING DURING WINTER MONTHS.

RESPONSE: THE PROPOSED BERM WAS INTENDED TO PREVENT SHORT CIRCUITING ACROSS THE MAIN PORTION OF THE POND BY FORCING THE WATER TO TRAVEL THROUGH THE BERM OPENING ON THE EASTERN SIDE OF THE POND. THIS WOULD EXTEND THE MINIMUM FLOW PATH THROUGH THE POND DURING ALL SEASONS. IT SHOULD ALSO BE NOTED THAT THE SELECTED REMEDY DOES NOT INCLUDE THIS BAFFLE, BUT RATHER DEPENDS ON INCREASED OPERATING CAPACITY AND GREATER RETENTION TIMES TO INSURE THAT THE DISCHARGE FROM THE POND SYSTEM MEETS THE DISCHARGE CRITERIA.

ONE COMMENTER (LETTER 154) WOULD LIKE TO HAVE SEEN TREATABILITY TESTS CONDUCTED ON SITE TO MORE CLOSELY REPRESENT THE AREA/VOLUME RATIO OF THE PONDS, AMBIENT WEATHER CONDITIONS, AND USED SILVER BOW CREEK WATER DURING HIGH FLOW AND LOW FLOW PERIODS. ADDITIONALLY, OTHER INTERACTIONS BETWEEN THE SILVER BOW CREEK SEDIMENTS AND THE TREATMENT PROCESS SHOULD HAVE BEEN CHARACTERIZED.

RESPONSE: THE TREATABILITY STUDY CONDUCTED IN CONJUNCTION WITH THE PHASE II REMEDIAL INVESTIGATION WAS DESIGNED TO EVALUATE THE PHYSICAL AND CHEMICAL PARAMETERS THAT MUST BE CONTROLLED TO MAXIMIZE METAL REMOVAL IN A PH-CONTROLLED SETTLING-TYPE SYSTEM. THE WATER USED IN THE "WINTER" TESTS WAS ACTUAL WATER FROM SILVER BOW CREEK AND DID CONTAIN NATIVE SUSPENDED SEDIMENT FROM THE CREEK. IT WAS RECOGNIZED IN THE PLANNING STAGES THAT IN SITU TESTS WOULD PROVIDE ADDITIONAL INFORMATION ON THE TREATMENT/SETTLING MECHANISMS IN THE PONDS; HOWEVER, IT WAS FELT THAT IT WOULD BE MORE PRUDENT TO CONDUCT THESE TESTS DURING THE REMEDIAL DESIGN PHASE IF NECESSARY.

## GROUNDWATER TREATMENT ALTERNATIVES.

SEVERAL COMMENTERS (LETTERS 53, 60, 82, 101, 108, 126, 133, 135, 147, 151, 154, 155; TESTIMONY A-7, A-14, M-4) NOTED A GENERAL CONCERN THAT THE SELECTED REMEDIATION BE PROTECTIVE OF GROUNDWATER IN THE OPERABLE UNIT. ONE COMMENT (LETTER 138) RECOMMENDED THAT THE FINAL REMEDY SHOULD PREVENT CONTAMINATED GROUNDWATER FROM CAUSING SURFACE WATER EXCEEDANCES OF GOLD BOOK STANDARDS.

RESPONSE: THE SHALLOW AQUIFER BELOW POND 1 HAS BEEN CONTAMINATED OVER THE YEARS BY METALS AND OTHER CONTAMINANTS FROM THE POND SYSTEM. THE TRENCH BELOW POND 1 WOULD BE DESIGNED TO CUT OFF THE SOURCE OF CONTAMINATION FOR THIS AQUIFER (SEE MSA 11 AND 12 IN CHAPTER 7 OF THE FS). A PORTION OF THE EXISTING CONTAMINATED GROUNDWATER WILL CONTINUE TO MIGRATE DOWNGRAIENT TOWARD THE CLARK FORK RIVER. HOWEVER, MEASUREMENTS MADE DURING THE REMEDIAL INVESTIGATION DETECTED NO IMPACT TO THE WATER QUALITY OF THE CLARK FORK RIVER AS A RESULT OF THE CONTAMINATED GROUNDWATER. GROUNDWATER INPUT INTO THE CLARK FORK RIVER WILL NOT BE SUFFICIENT TO CAUSE EXCEEDANCES OF THE GOLD BOOK STANDARDS IN THE FUTURE. BACKGROUND INFORMATION ON THE GROUNDWATER SITUATION BELOW POND 1 CAN BE FOUND IN THE RESPONSE TO COMMENTS ON THE GROUNDWATER PORTION OF THE SITE CHARACTERIZATION AND PROBLEM DESCRIPTION SECTION OF THIS RESPONSIVENESS SUMMARY.

ONE COMMENTER (LETTER 67) RAISED SEVERAL CONCERNS REGARDING THE IMPACT OF THE PROPOSED ALTERNATIVE ON GROUNDWATER FLOWS AND CONTAMINATION AT THE SITE AND ON THE PROPOSED METHOD OF GROUNDWATER TREATMENT. THE FIRST SET OF COMMENTS DEALT WITH THE PROPOSED CONSTRUCTION OF A TRENCH TO INTERCEPT CONTAMINATED GROUNDWATER DOWNGRAIENT OF POND 1. THE DESIGN OF THE PROPOSED TRENCH RAISED THE FOLLOWING CONCERNS:

- A. THE TRENCH WILL PROBABLY NOT BE DEEP ENOUGH TO INTERCEPT ALL GROUNDWATER FLOW.
- B. A GROUNDWATER FLOW MODEL WAS ALSO DEVELOPED TO DETERMINE THE EFFECTIVENESS OF A TRENCH AND TO ESTIMATE THE FLOW RATE INTO THE TRENCH. THIS MODELING EFFORT HAS SEVERAL DEFICIENCIES.
- C. IF THE OPEN TRENCH IS NOT CLEANED REGULARLY, IT WILL QUICKLY BEGIN TO FILL WITH VEGETATION, WINDBLOWN DIRT, AND SLOUGHED SIDEWALL MATERIAL. OBVIOUSLY, IF THE TRENCH STARTS TO FILL, ITS EFFECTIVENESS WILL BE REDUCED.
- D. THE TRENCH WILL INTERCEPT ONLY THAT PART OF THE EXISTING GROUNDWATER PLUME NEAR THE TRENCH. SOME CURRENTLY CONTAMINATED GROUNDWATER WILL CONTINUE TO FLOW TOWARD THE MILL-WILLOW BYPASS AND CLARK FORK.
- E. THE TRENCH MAY DEWATER TAILINGS CONTAINED IN POND 1, THEREBY, CAUSING RELEASE OF METALS.

RESPONSE: MODELING EFFORTS RELATED TO EVALUATING THE FEASIBILITY OF A GROUNDWATER INTERCEPTION TRENCH BELOW POND 1 WERE NOT INTENDED TO PROVIDE ALL THE INFORMATION NECESSARY FOR FINAL DESIGN OF THE TRENCH. OBVIOUSLY, ADDITIONAL INFORMATION WILL BE NECESSARY TO ADDRESS THE VARIABILITY OF THE AQUIFER ALONG THE ENTIRE LENGTH OF THE POND 1 BERM, IF THIS TECHNOLOGY IS INCORPORATED INTO THE FINAL REMEDIATION AT THE SITE. THE CALCULATIONS AND FLOW MODELS PRESENTED IN FS WERE PERFORMED TO PRELIMINARILY DETERMINE IF CONSTRUCTION OF THIS TYPE OF TRENCH IS TECHNICALLY FEASIBLE AND TO ESTIMATE COSTS.

THE AGENCIES REALIZE THE PRESUMED AQUITARD IS NOT CONSISTENTLY AT A DEPTH LESS THAN 20 FEET BELOW GROUND SURFACE IN THE AREA BELOW POND 1. IN FACT, THE LATERAL CONTINUITY OF THE PRESUMED AQUITARD IS UNKNOWN. HOWEVER, BASED ON GROUNDWATER QUALITY DATA COLLECTED FROM DUAL-COMPLETED MONITORING WELLS AND PAIRED MONITORING WELLS LOCATED NORTH OF POND 1, GROUNDWATER QUALITY IMPROVES MARKEDLY IN WELLS COMPLETED DEEPER THAN ABOUT 15 FEET BELOW GROUND SURFACE. BECAUSE THE HIGHEST METALS CONCENTRATIONS WERE MEASURED IN SAMPLES COLLECTED FROM WELLS COMPLETED IN THE UPPER 15 FEET OF THE AQUIFER, IT IS PRESUMED THAT MOST, IF NOT ALL, GROUNDWATER THAT EXCEEDS FEDERAL PRIMARY DRINKING WATER STANDARDS (THE ARAR FOR GROUNDWATER) WOULD BE CAPTURED BY AN INTERCEPTION TRENCH AS PRESENTED. IN ADDITION, DEPENDING ON THE VERTICAL PERMEABILITY OF SEDIMENTS BELOW POND 1, THE INTERCEPTION TRENCH IS EXPECTED TO ACT AS A GROUNDWATER DISCHARGE AREA WHERE GROUNDWATER AT SOME DEPTH BELOW THE TRENCH WILL MIGRATE INTO THE TRENCH.

GROUNDWATER FLOW IN THE AREA BELOW POND 1 WAS MODELED TO: (1) ESTIMATE CONSERVATIVE VALUES OF GROUNDWATER INFLOW TO THE TRENCH; (2) ESTIMATE THE EFFECTIVE DISTANCE DOWNGRADIENT FROM THE TRENCH AT WHICH GROUNDWATER WOULD BE CAPTURED; AND (3) ESTIMATE THE TIME IT WOULD TAKE TO CAPTURE DEGRADED GROUNDWATER BELOW THE TRENCH. THE INITIAL MODEL WAS EXECUTED USING HYDRAULIC CONDUCTIVITY VALUES CALCULATED FROM SLUG TEST DATA. THE MODEL WAS REVISED AFTER A PUMPING TEST WAS PERFORMED IN A SPECIALLY DESIGNED WELL LOCATED BELOW THE POND 1 BERM. HYDRAULIC CONDUCTIVITY VALUES DERIVED FROM THE PUMPING TEST DATA INDICATED HYDRAULIC CONDUCTIVITY VALUES BASED ON PUMPING TEST DATA WERE APPROXIMATELY TWICE AS HIGH IN THE SHALLOW SAND AND GRAVEL AQUIFER AS THOSE DERIVED FROM SLUG TEST DATA IN THE AREA BELOW POND 1. THEREFORE, GROUNDWATER INFLOW RATES TO THE INTERCEPTION TRENCH WERE ADJUSTED TO RATES RANGING FROM APPROXIMATELY 2.2 TO 4.6 CFS.

WELLS WERE USED TO SIMULATE THE TRENCH BECAUSE THIS METHOD WAS THE MOST APPLICABLE FOR THE GROUNDWATER FLOW MODEL USED (PRICKETT LONNQUIST AQUIFER SIMULATION MODEL, PLASM). MDHES AGREES THAT A MORE REPRESENTATIVE MODEL WOULD INCLUDE SIMULATING THE TRENCH AS A DRAIN. ANY FUTURE MODELING ACTIVITIES ARE EXPECTED TO BE COMPLETED TO PROVIDE SUFFICIENT INFORMATION TO SUPPORT REMEDIAL DESIGN OF THE INTERCEPTION TRENCH. THESE MODELING ACTIVITIES MAY INCLUDE USING THE USGS MODFLOW GROUNDWATER FLOW MODEL (OR AN EQUIVALENT MODEL) THAT WILL ALLOW SIMULATING THE INTERCEPTION TRENCH AS A DRAIN. SIMULATING INFLOW TO THE TRENCH USING A SERIES OF WELLS DOES NOT CHANGE THE RESULTANT OPINION OFFERED REGARDING THE FEASIBILITY OF SUCH A SYSTEM.

A CONSTANT HEAD BOUNDARY WAS USED TO SIMULATE GROUNDWATER INFLOW FROM THE TERTIARY HILLS TO THE EAST TO PROVIDE CONSERVATIVE ESTIMATES OF GROUNDWATER INFLOW TO THE INTERCEPTION TRENCH. A MORE REPRESENTATIVE BOUNDARY WOULD LIKELY INCLUDE A CONSTANT FLUX BOUNDARY THAT WOULD RESULT IN LOWER GROUNDWATER INFLOW RATES TO THE INTERCEPTION TRENCH. THE FLOW MODEL WAS PERFORMED TO PROVIDE CONSERVATIVE ESTIMATES OF GROUNDWATER INFLOW TO THE INTERCEPTION TRENCH TO EVALUATE THE TECHNICAL FEASIBILITY OF SUCH A TRENCH. THE USE OF A CONSTANT HEAD BOUNDARY TO REPRESENT INFLOW FROM THE TERTIARY HILLS TO THE EAST DOES NOT AFFECT THE ANALYSIS OF THE FEASIBILITY OF IMPLEMENTING THE INTERCEPTION TRENCH BELOW POND 1.

DESIGN CHARACTERISTICS OF THE INTERCEPTION TRENCH WILL BE ADDRESSED DURING REMEDIAL DESIGN. OF COURSE, AN OPEN TRENCH WOULD ACCUMULATE SILT AND DEBRIS. INTERCEPTION TRENCHES ARE COMMONLY USED THROUGHOUT THE WORLD; ENGINEERED CONTROLS DESIGNED INTO THE TRENCH WILL INHIBIT SILTATION OF THE DRAIN. THE TRENCH WILL REQUIRE PERIODIC MAINTENANCE TO REMOVE SOIL AND DEBRIS. THE COSTS OF THIS MAINTENANCE ARE INCLUDED IN THE COST ESTIMATES IN CHAPTER 8.

THE AGENCIES RECOGNIZE THAT A PORTION OF THE DEGRADED GROUNDWATER CURRENTLY IDENTIFIED BELOW POND 1 WILL CONTINUE TO MIGRATE DOWNGRADIENT TOWARD THE CLARK FORK RIVER. THE IMPACT OF INFLOW OF GROUNDWATER FROM THIS AREA ON THE CLARK FORK RIVER IS NOT GREAT. THE CALCULATED TIME FOR GROUNDWATER, WHICH EXCEEDS PRIMARY MAXIMUM CONTAMINANT LEVELS AND WHICH IS LOCATED BEYOND THE INFLUENCE OF THE INTERCEPTION TRENCH, TO MIGRATE INTO THE CLARK FORK RIVER IS LESS THAN 10 YEARS. IT IS EXPECTED THAT THIS GROUNDWATER WOULD NOT MOVE AS A SLUG AS OTHER INFLUENCES ON THE CHEMISTRY OF THIS WATER WOULD BE OPERATIVE ALONG ITS FLOW PATH (E.G., DILUTION, ADSORPTION, DISPERSION).

ADDITIONALLY, THE COMMENTER (LETTER 67) EXPRESSED CONCERN OVER THE IMPACT ON GROUNDWATER FROM DEWATERING PRESENTLY IMMOBILIZED TAILINGS AND POND BOTTOM SEDIMENTS. IMPORTANT QUESTIONS POSED INCLUDED:

A. WHAT WILL BE THE EFFECT OF DEWATERING TAILINGS AND CONTAMINATED SEDIMENTS THAT ARE CURRENTLY IMMOBILIZED IN THE REDUCED CONDITIONS OF POND BOTTOMS? OXIDATION OF THESE MATERIALS COULD LEAD TO LARGE RELEASES OF METALS. AS DESIGNED, THE GROUNDWATER TRENCH PLANNED FOR THE INTERIOR OF POND 1 WILL DEWATER TAILINGS. THIS ACTION WILL ALLOW OXIDATION AND MOBILIZATION OF THE REDUCED METALS IN SEDIMENTS THAT HAVE COLLECTED IN POND 1. AS SHOWN FOR THE TAILINGS IN THE OPPORTUNITY PONDS, THE MOBILIZATION OF METALS CAN BE SUBSTANTIAL WHEN METAL-RICH SEDIMENTS CHANGE FROM REDUCED TO OXIDIZED CONDITIONS. THE EXTENT OF THIS MOBILIZATION SHOULD BE QUANTIFIED AND ITS EFFECT UNDERSTOOD. THE TRENCH BELOW THE POND 1 BERM MAY ALSO DEWATER CONTAMINATED SEDIMENTS CAUSING A SIMILAR MOBILIZATION OF METALS.

B. WHAT WILL THE GROUNDWATER PLUME IN BOTH THE SHALLOW AND DEEP AQUIFERS BE IN THE FUTURE? WHAT CONTAMINANTS WILL THEY CONTAIN? WILL THE AQUIFER'S NEUTRALIZATION AND METAL ATTENUATION CAPACITIES BE EXHAUSTED AT SOME POINT? THESE ISSUES HAVE NOT BEEN ADDRESSED.

RESPONSE: GROUNDWATER INTERCEPTION TECHNOLOGIES PRESENTED IN THE FS WERE EVALUATED WITH RESPECT TO THE POTENTIAL FOR INCREASING METALS MOBILITY BY CHANGING THE METALS SOURCE ENVIRONMENT FROM REDUCING TO OXIDIZING CONDITIONS. THE PRIMARY METALS SOURCE AREAS OF CONCERN INCLUDE POND 1 AND THE AREA BELOW POND 1. THE PROPOSED GROUNDWATER INTERCEPTION TRENCHES WOULD INTERCEPT SEEPAGE FROM POND 2 INTO POND 1 AND SEEPAGE FROM POND 1 INTO THE AREA BELOW POND 1. ALL INTERCEPTED WATER WILL BE PUMPED BACK TO POND 3 FOR TREATMENT. THIS SYSTEM WAS DESIGNED IN CONSIDERATION OF THE POSSIBILITY OF METALS RELEASES DUE TO CHANGES IN THE GEOCHEMICAL ENVIRONMENT OF THE BOTTOM SEDIMENTS IN POND 1 CAUSED BY DEWATERING. THE PROPOSED SYSTEM WILL EFFECTIVELY INTERCEPT AND TREAT METALS-CONTAMINATED GROUNDWATER WITHIN THIS PORTION OF THE OPERABLE UNIT AND WILL ALLOW FOR DRY CLOSURE OF POND 1. THEREFORE, DEFINITIVE CHARACTERIZATION OF THE GEOCHEMICAL FATE OF THIS COMPONENT OF THE AREA'S GROUNDWATER SYSTEM IS UNNECESSARY.

SEVERAL MODELS OF DEWATERED TAILINGS AND THE POTENTIAL METALS PRODUCTION OF THESE AREAS ARE PRESENT BOTH WITHIN THE WARM SPRINGS PONDS OPERABLE UNIT AND THE ENTIRE SILVER BOW CREEK CERCLA SITE. THE BEST EXAMPLE OF THE LONG-TERM FATE OF METALS PRODUCTION IN A DEWATERED TAILINGS ENVIRONMENT IS THE WESTERN PORTION OF POND 1 AND THE AREA IMMEDIATELY BELOW THE POND 1 BERM IN THIS AREA. THE WESTERN PORTION OF POND 1 HAS BEEN DEWATERED FOR MANY YEARS; WATER LEVELS HAVE DROPPED BELOW THE BASE OF THE BOTTOM SEDIMENTS ACCUMULATED IN THE POND. METALS CONCENTRATIONS IN GROUNDWATER IN THE WESTERN PORTION OF POND 1 AND IN THE AREA BELOW (DOWNGRADIENT OF) THIS AREA ARE RELATIVELY LOW WITH NO MEASURED EXCEEDANCES OF MAXIMUM CONTAMINANT LEVELS. OTHER EXAMPLES OF DEWATERED TAILINGS AREAS EXHIBITING RELATIVELY LOW METALS CONCENTRATIONS IN SUBJACENT GROUNDWATER HAVE BEEN IDENTIFIED IN RAMSAY FLATS NEAR RAMSAY.

DRY CLOSURE OF POND 1 WITH A LOW PERMEABILITY CAP WOULD SERVE TO REDUCE VERTICAL INFILTRATION OF PRECIPITATION RECHARGE TO THE UNDERLYING GROUNDWATER SYSTEM THIS WILL FURTHER REDUCE THE POTENTIAL FOR METALS MIGRATION VERTICALLY INTO THE AREA'S GROUNDWATER SYSTEM.

THE ANTICIPATED EXTENT OF THE METALS PLUME, WHICH EXCEEDS MAXIMUM CONTAMINANT LEVELS IN THE AREA BELOW POND 1 FOLLOWING CONSTRUCTION OF THE GROUNDWATER INTERCEPTION TRENCH, WILL LIKELY NOT EXTEND DOWNGRADIENT OF THE INTERCEPTION TRENCH AFTER THE SYSTEM REACHES EQUILIBRIUM. THIS ASSUMES THAT THE AQUITARD SEPARATING THE UPPER SAND AND GRAVEL AQUIFER AND THE UNDERLYING SAND AQUIFER IS RELATIVELY CONSISTENT IN THE AREA AND THAT THE INTERCEPTION TRENCH IS CAPABLE OF INTERCEPTING MOST OR ALL OF THE SHALLOW GROUNDWATER SYSTEM. ANY CONTAMINANTS THAT ARE NOT INTERCEPTED BY THE TRENCH WILL ENTER A RELATIVELY GOOD QUALITY GROUNDWATER ENVIRONMENT DOWNGRADIENT OF THE TRENCH RECHARGED WITH WATER FROM THE FOOTHILLS EAST OF THE SITE AND BY THE MILL-WILLOW BYPASS TO THE WEST.

THE ISSUE THE COMMENTER RAISES ABOUT THE NEUTRALIZATION AND METAL ATTENUATION CAPACITIES OF THE AQUIFER IN THE AREA BELOW POND 1 IS A MOOT POINT GIVEN THAT THE PROPOSED GROUNDWATER INTERCEPTION TRENCHES WILL HYDRAULICALLY CAPTURE METALS-CONTAMINATED GROUNDWATER. EPA AND MDHES BELIEVE THAT CONTROLLING THE HYDRAULICS OF THE SYSTEM WILL SERVE TO CONTROL THE CHEMISTRY.

THE COMMENTER (LETTER 67) ALSO WAS CONCERNED OVER THE IMPACT OF THE PROPOSED PLAN ON THE GROUNDWATER IN THE MILL-WILLOW BYPASS AREA. THE COMMENT STATES THAT CONSIDERATION SHOULD BE GIVEN TO THE POST-REMEDATION GROUNDWATER GRADIENT FROM THE WARM SPRINGS PONDS TO THE MILL-WILLOW BYPASS. IF THE WATER LEVEL IN POND 3 IS INCREASED AND THE ELEVATION OF THE BYPASS IS LOWERED BY EXCAVATION OF CONTAMINATED AND BORROW MATERIAL, GROUNDWATER DISCHARGE TO THE BYPASS WILL LIKELY INCREASE. FURTHERMORE, IF MILL AND WILLOW CREEKS ARE DIVERTED INTO POND 3, NO SURFACE WATER (EXCEPT DURING LARGE FLOOD EVENTS) WOULD ENTER THE BYPASS UPSTREAM OF THE NEW POND 3 OUTLET, AND, THEREFORE, THE FS ASSUMES THAT THE UPPER BYPASS WILL BE DRY. IT IS PROBABLE THAT THE BYPASS WILL RECEIVE CONTAMINATED GROUNDWATER DISCHARGE FROM THE WARM SPRINGS AND OPPORTUNITY PONDS. WITH NO SURFACE WATER ENTERING TO DILUTE THE INFLOW FROM GROUNDWATER, WATER QUALITY IN THE REMEDIATED UPPER BYPASS WILL LIKELY BE CONSIDERABLY WORSE THAN IT IS NOW.

RESPONSE: IT IS PROBABLE THAT INCREASED GROUNDWATER INFLOW TO THE MILL-WILLOW BYPASS WILL BE REALIZED IF THE WATER ELEVATION IN POND 3 IS RAISED AND IF THE BYPASS CHANNEL IS EXCAVATED TO A GREATER DEPTH. UNTIL SUCH TIME AS CONTAMINATION SOURCES IN MILL AND WILLOW CREEKS ARE REMOVED, IT IS LIKELY THAT ONE OR BOTH OF THESE CREEKS WILL TYPICALLY BE DIVERTED INTO POND 3 FOR TREATMENT. IF BOTH STREAMS ARE DIVERTED INTO THE PONDS, THEN GROUNDWATER INFLOW WILL BE THE ONLY FLOW SOURCE IN THE MILL-WILLOW BYPASS. THIS FLOW HAS BEEN ESTIMATED TO BE 1 TO 5 CFS DURING THE BYPASS REMOVAL THIS SUMMER. THE QUALITY OF THIS INFLOW, HOWEVER, IS NOT EXPECTED TO BE POOR. AN OPPORTUNITY PRESENTED ITSELF DURING THE PHASE II RI TO EMPIRICALLY DETERMINE THE QUANTITY AND QUALITY OF GROUNDWATER INFLOW TO THE BYPASS. WATER IN THE MILL-WILLOW BYPASS WAS

DIVERTED INTO POND 3 VIA THE NORTHERN CHANNEL CONNECTING THE OPPORTUNITY POND DISCHARGES WITH POND 3 DURING JULY, 1988. SYNOPTIC FLOW MEASUREMENTS WERE MADE IN THE MILL-WILLOW BYPASS CHANNEL BELOW THE POINT OF DIVERSION TO THE POINT WHERE THE WILDLIFE PONDS DISCHARGE INTO THE BYPASS CHANNEL. SAMPLES OF WATER FLOWING IN THIS REACH OF THE BYPASS WERE ALSO COLLECTED IN CONJUNCTION WITH FLOW MEASUREMENTS. ANALYTICAL RESULTS FROM THESE SAMPLES INDICATE THAT THE WATER DID NOT EXCEED EITHER CHRONIC OR ACUTE AMBIENT WATER QUALITY CRITERIA NOR DID IT EXCEED ANY PRIMARY DRINKING WATER QUALITY CRITERIA. DATA FROM THIS SYNOPTIC FLOW MEASUREMENT EPISODE ARE CONTAINED IN THE PHASE II RI DATA SUMMARY REPORT. DUE TO CONSTRUCTION ACTIVITIES ONGOING IN THE BYPASS CHANNEL, IT IS NOT POSSIBLE TO DIRECTLY MEASURE THE TYPICAL QUALITY OF THE GROUNDWATER INFLOW AT THIS TIME.

ANOTHER COMMENTER (TESTIMONY M-7) STATED THAT IT WAS UNCLEAR WHERE THE CONTAMINATION OF THE SECOND-LEVEL AQUIFER IS COMING FROM, AND ASKED FOR MORE ASSURANCE THAT THE LOCATION AND SOURCE OF CONTAMINATION CAN BE FOUND AND THE CONTAMINATION CLEANED UP.

RESPONSE: THE PRIMARY CHEMICAL CONTAMINANTS IN THE DEEPER AQUIFER ARE SULFATE AND MANGANESE. THESE PARAMETERS ARE NOT GENERALLY ASSOCIATED WITH THE POTENTIAL SOURCES AT THE WARM SPRINGS PONDS. THE OCCURRENCE OF THESE PARAMETERS IN THE DEEPER AQUIFER IS CONSISTENT WITH THE PRESENCE OF RELATIVELY HIGH CONCENTRATIONS OF SULFATE AND MANGANESE IN THE GROUNDWATER IN THE VICINITY OF THE OPPORTUNITY PONDS.

THIS SUGGESTS THAT THE SULFATE AND MANGANESE OCCURRENCE IS MORE REGIONAL IN NATURE AND IS PROBABLY THE RESULT OF MULTIPLE CONTAMINANT SOURCES AND PATHWAYS OF CONTAMINANT MOVEMENT.

IT SHOULD BE NOTED THAT THE ARARS ESTABLISHED FOR GROUNDWATER AT THE WARM SPRINGS PONDS OPERABLE UNIT DO NOT INCLUDE MANGANESE AND SULFATE SINCE THESE PARAMETERS ARE NOT INCLUDED IN THE PRIMARY MAXIMUM CONTAMINANT LEVELS ESTABLISHED FOR DRINKING WATER. THE SULFATE AND MANGANESE CONTAMINATION SHOULD BE ADDRESSED AS PART OF THE ANACONDA SUPERFUND SITE.

#### COSTS OF ALTERNATIVES.

FOUR COMMENTERS (LETTERS 58, 107, 111, 136) FELT THAT COST SEEMED TO BE THE DRIVING FORCE IN THE SELECTION OF THE PREFERRED ALTERNATIVE, AND RECOMMENDED THAT THE AGENCIES SHOULD SELECT A CONSERVATIVELY PROTECTIVE REMEDY REGARDLESS OF COST. FIVE OTHER COMMENTERS (LETTERS 101, 108, 126, 137, 154) THOUGHT THAT A FULL COST-BENEFIT ANALYSIS SHOULD BE PERFORMED TO EVALUATE THE ALTERNATIVES. SEVERAL OTHER COMMENTERS (LETTERS 11,26,34,43) SUPPORTED ARCO'S PLAN BECAUSE IT WAS THOUGHT TO ACCOMPLISH THE DESIRED REMEDIATION AT SUBSTANTIALLY LESS COST.

RESPONSE: COST IS ONLY ONE OF THE FACTORS USED IN THE SELECTION OF THE PREFERRED ALTERNATIVE. THE SELECTION OF THE PREFERRED ALTERNATIVE WAS MADE BASED ON ALL NINE OF THE CRITERIA REQUIRED BY SUPERFUND. THESE CRITERIA INCLUDE: OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT; COMPLIANCE WITH ARARS (APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, I.E., LAWS THAT HAVE A BEARING ON THE CLEANUP); LONG-TERM EFFECTIVENESS AND PERMANENCE; REDUCTION OF TOXICITY, MOBILITY, AND VOLUME; SHORT-TERM EFFECTIVENESS; IMPLEMENTABILITY; COST; COMMUNITY ACCEPTANCE; AND STATE ACCEPTANCE. BY USING THESE CRITERIA, THE RELATIVE BENEFITS OF EACH OF THE ALTERNATIVES CAN BE COMPARED TO THE COST OF EACH ALTERNATIVE. IT IS BEYOND THE SCOPE OF THE FEASIBILITY STUDY TO CONDUCT A FORMAL COST-BENEFIT ANALYSIS OF THE ALTERNATIVES.

ONE COMMENTER (LETTER 137) SUGGESTED THAT THE EVALUATION OF ALTERNATIVES NEEDS TO TAKE INTO ACCOUNT THE COSTS OF DAMAGE TO NATURAL RESOURCES CAUSED BY THE CONTAMINATION.

RESPONSE: THE ROD AND SELECTED REMEDY ARE UNDERTAKEN PURSUANT TO SECTION 106 OF CERCLA FOR THE PURPOSE OF PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT. NATURAL RESOURCES DAMAGE ASSESSMENT ISSUES ARE BEING DEALT WITH UNDER A SEPARATE PROCESS BY FEDERAL AND STATE NATURAL RESOURCE TRUSTEES.

#### **MILL-WILLOW BYPASS ISSUES.**

THE PREFERRED PLAN OF THE FS WOULD DIVERT MILL AND WILLOW CREEKS INTO THE POND SYSTEM FOR TREATMENT. THIS RAISED CONCERNS IN SEVERAL AREAS. ONE COMMENTER (LETTER 46) STATED THAT THE PREFERRED ALTERNATIVE WOULD INVOLVE A 27 PERCENT INCREASE IN THE CAPACITY OF POND 3 AND WOULD, THEREFORE, INCREASE THE POTENTIAL FOR BREACHING THE POND. SEVERAL COMMENTERS (LETTERS 8, 46, 47, 48, 49, 51, 87, 115, 158; TESTIMONY A-2, A-7) EXPRESSED CONCERN THAT DIVERTING MILL AND

WILLOW CREEKS INTO THE POND SYSTEM WOULD ELIMINATE THE FISHERIES ON THE UPPER PORTION OF THE CREEKS AND THE UPPER CLARK FORK RIVER. ANOTHER COMMENT (LETTERS 78, 138, 151; TESTIMONY M-10, M-14) STATED THAT THE SOURCES OF THE CONTAMINANTS IN MILL AND WILLOW CREEKS SHOULD BE IDENTIFIED AND ELIMINATED AS A PART OF THE WARM SPRINGS PONDS OPERABLE UNIT, AND THAT UNTIL THE SOURCES ARE IDENTIFIED AND ELIMINATED, MILL AND WILLOW CREEKS SHOULD BE ROUTED INTO THE POND SYSTEM. ONE COMMENTER (TESTIMONY A-14) SUGGESTED POSSIBLY DIVERTING MILL AND WILLOW CREEKS INTO THE BYPASS ONLY DURING THE HIGH FLOW SEASON, AND LETTING THEM BYPASS THE PONDS AT OTHER TIMES.

RESPONSE: EPA AND MDHES ARE EVALUATING THE NEED TO ROUTE MILL AND WILLOW CREEKS INTO THE POND SYSTEM. IN CONJUNCTION WITH THE MILL-WILLOW BYPASS REMOVAL ACTION, ARCO HAS BEGUN INVESTIGATING THE SOURCES OF CONTAMINATION ON MILL AND WILLOW CREEKS. IT WAS HOPED THAT DISCRETE SOURCES OF CONTAMINATION COULD BE IDENTIFIED AND READILY REMOVED. SAMPLING TO DATE THIS SUMMER HAS NOT CONFIRMED THAT HOPE, ALTHOUGH IT HAS BEEN DISCOVERED THAT PERHAPS MILL CREEK CAN BE BYPASSED WITHOUT TREATMENT THROUGH THE PONDS. THE AGENCIES WOULD PREFER THAT OPTION OVER ROUTING MILL AND WILLOW CREEKS INTO POND 3. THIS WOULD PRESERVE FISHERIES HABITAT IN THE BYPASS AND STILL MEET WATER QUALITY ARARS FOR THE SITE.

THE DIVERSION OF MILL AND WILLOW CREEKS INTO THE WARM SPRINGS PONDS WOULD INCREASE THE AVERAGE ANNUAL FLOW INTO THE PONDS. IT WOULD NOT, HOWEVER, INCREASE THE POTENTIAL FOR BREACHING THE POND BERMS. THE FLOW INTO THE PONDS WOULD BE REGULATED BY THE CAPACITY OF THE INLET STRUCTURE. FLOWS ABOVE THAT CAPACITY WOULD BE ROUTED INTO THE MILL WILLOW BYPASS AND WOULD NOT ENTER THE PONDS. THUS, THERE IS NO INCREASED POTENTIAL FOR BREACHING THE POND BERMS.

NUMEROUS COMMENTERS (LETTERS 64, 66, 68, 69, 73, 74, 75, 87, 90, 98, 99, 107, 109, 117, 119, 120, 121, 128, 131, 132, 135, 139, 142, 143, 144, 145, 146, 151, 155, 157, 158, 159, 160, 161; TESTIMONY A-7, A-13, A-14, A-15, M-5, M-10) RECOMMENDED REMOVAL OF TAILINGS FROM THE MILL-WILLOW BYPASS DURING 1990 TO PREVENT FUTURE FISHKILLS.

RESPONSE: THE AGENCIES AGREE. REMOVAL OF THE MILL-WILLOW BYPASS TAILINGS IS CURRENTLY UNDERWAY UNDER AN ADMINISTRATIVE ORDER ON CONSENT SIGNED BY EPA AND ARCO IN JULY 1990.

ONE COMMENTER (LETTER 72) RECOMMENDS THAT THE AGENCIES CONSIDER BUFFERING LOW PH DURING STORM EVENTS AT SEVERAL POINTS IN THE OPERABLE UNIT TO HELP PREVENT FUTURE FISHKILLS AND REDUCE METALS MIGRATION IN THE UPPER CLARK FORK RIVER. BUFFERING HIGH FLOWS IN THE MILL-WILLOW BYPASS COULD BE A MEANS TO AVOID FUTURE FISHKILLS.

RESPONSE: BUFFERING PH IS NOT A COMPLETE SOLUTION TO EITHER THE FISHKILL OR THE METALS MIGRATION PROBLEM. LOW PH HAS LITTLE TO DO DIRECTLY WITH THE FISHKILL PROBLEM, WHICH IS CAUSED BY DISSOLUTION OF WATER-SOLUBLE METAL SALTS FROM THE SURFACE OF TAILINGS DEPOSITS. THE SALTS ARE NOT DISSOLVED BY LOW PH WATER IN THE CHANNEL, BUT BY RAINWATER; THE SALTS ARE HIGHLY SOLUBLE EVEN IN NEUTRAL WATER.

STOPPING THE MIGRATION OF METALS CONTAMINANTS TO THE CLARK FORK RIVER REQUIRES MORE THAN PH ADJUSTMENTS. THE METALS MUST BE REMOVED FROM THE FLOWS AND DEPOSITED SOMEWHERE. THAT IS THE FUNCTION OF THE POND TREATMENT SYSTEM, WHICH OPERATES ON THE BASIS OF PHYSICAL SETTLING, CHEMICAL TREATMENT (PH ADJUSTMENT), AND BIOLOGICAL TREATMENT TO REMOVE THE METAL CONTAMINANTS FROM THE FLOWS.

LIME TREATMENT AT VARIOUS POINTS IN THE OPERABLE UNIT IS NOT THOUGHT TO BE NECESSARY. THE FLOW MANAGEMENT AND TREATMENT SYSTEM INCLUDED IN THE SELECTED REMEDY WOULD BE ABLE TO TREAT ALL FLOWS THAT REQUIRE TREATMENT, UP TO A 100-YEAR FLOOD. TIME TREATMENT CANNOT BE USED AS A QUICK FIX AT VARIOUS STAGES IN THE FLOW MANAGEMENT AND TREATMENT PROCESS. LIME TREATMENT RELIES ON THE SLOW FORMATION AND SETTLING OF PARTICLES OF INSOLUBLE METAL HYDROXIDES, AND CAN ONLY BE SUCCESSFUL IN A QUIESCENT SYSTEM WITH A LONG RESIDENCE TIME, SUCH AS PROVIDED BY POND 3.

AVOIDING FUTURE FISHKILLS IS AN IMPORTANT GOAL. THE AGENCIES BELIEVE THAT THE ONGOING MILL-WILLOW BYPASS REMOVAL AND THIS ROD WILL ADEQUATELY ADDRESS THE FISHKILL PROBLEM WITHOUT THE NEED TO BUFFER PH LEVELS IN THE BYPASS. BY REMOVING THE TAILINGS AND CONTAMINATED SOILS FROM THE BYPASS AND ISOLATING THE BYPASS FROM SILVER BOW CREEK FLOWS EXCEPT DURING LARGE FLOODS, THE FISHKILL PROBLEM IN THE BYPASS SHOULD BE SOLVED.

SEVERAL COMMENTS (LETTERS 72, 95, 138) SUGGESTED THAT THE REMEDIAL MEASURES, ESPECIALLY ALONG THE MILL-WILLOW BYPASS, BE DESIGNED TO INCLUDE WILDLIFE ENHANCING FEATURES, SUCH AS IMPROVING

THE BYPASS HABITAT FOR TROUT SPAWNING AND REARING.

RESPONSE: THE FS DID NOT SPECIFICALLY ADDRESS METHODS TO IMPROVE THE FISHERIES IN THE MILL-WILLOW BYPASS. THE PRIMARY GOAL OF THE CLEANUP IN THE BYPASS IS TO ELIMINATE THE SOURCES OF CONTAMINATION THAT CAUSE THE FISHKILLS. FISH HABITAT IMPROVEMENTS WOULD BE DESIRABLE AND MAY BE INCORPORATED BY ARCO IN THE FINAL DESIGN, EITHER TO ADDRESS COMPLIANCE WITH ARARS OR TO ADDRESS NATURAL RESOURCE DAMAGE CLAIMS.

WETLANDS AND WILDLIFE HABITAT.

TWO COMMENTERS (LETTERS 63, 138) RECOMMENDED THAT THE AGENCIES GIVE GREATER CONSIDERATION TO THE NEED FOR AND VALUE OF WETLANDS AT THE WARM SPRINGS PONDS. ANOTHER COMMENTER (LETTER 72) THOUGHT THAT THE RISKS OF DEVELOPING WETLANDS BELOW POND 1 OUTWEIGHED THE BENEFITS BECAUSE THE WETLANDS WOULD NOT REMOVE HEAVY METALS, AND IN FACT, MIGHT LEAD TO RECONTAMINATION OF AREAS THAT WILL HAVE BEEN REMEDIATED. IN ADDITION, THE PROPOSED PERIODIC REMOVAL OF CONTAMINATED REVEGETATION WOULD DISRUPT THE FUNCTIONING OF THE WETLAND AND LOWER ITS USEFULNESS TO WILDLIFE.

RESPONSE: EPA AND MDHES DO RECOGNIZE THE VALUE OF WETLANDS IN THE WARM SPRINGS PONDS AREA. THE PREFERRED ALTERNATIVE PROPOSED BY MDHES AND EPA WOULD, ON BALANCE, CREATE ADDITIONAL WETLANDS. ALTHOUGH SOME WETLANDS WOULD BE ELIMINATED IN THE POND 1 AREA, ADDITIONAL WETLANDS WOULD BE CREATED IN POND 2. THE DEVELOPMENT OR REMOVAL OF WETLANDS MUST BE ADDRESSED IN CONJUNCTION WITH OTHER CONCERNS, SUCH AS PREVENTION OF GROUNDWATER CONTAMINATION AND PROTECTION OF HUMAN HEALTH. THE REMOVAL OF THE WETLANDS IN THE POND 1 AREA WILL HELP TO REDUCE THE GROUNDWATER CONTAMINATION UNDERNEATH AND DOWNGRADIENT OF POND 1.

AS FINAL DESIGN PLANS ARE PREPARED BY ARCO FOR THE REMEDIATION OF WARM SPRINGS PONDS, EPA AND MDHES WILL WORK WITH ARCO TO IDENTIFY POTENTIAL OPPORTUNITIES FOR WETLANDS THAT ARE CONSISTENT WITH THE REQUIREMENTS FOR THE SITE CLEANUP. THE AGENCIES AND ARCO ARE CONSIDERING A WETLANDS SYSTEM FOR THE AREA BELOW POND 1 THAT WOULD BE USED TO TREAT GROUNDWATER FOR METALS REMOVAL. WHILE METALS DO NOT BIODEGRADE, THEY WOULD BE ASSIMILATED BY THE AQUATIC VEGETATION IN THE WETLAND. BY PERIODICALLY HARVESTING THE VEGETATION, METALS LEVELS IN THE BIOMASS CAN BE KEPT BELOW TOXIC LEVELS. DISCHARGE FROM THE WETLAND WOULD MEET THE APPROPRIATE DISCHARGE STANDARDS FOR THE OPERABLE UNIT.

THE PRIMARY PURPOSE FOR THE WETLANDS WOULD BE TO PROVIDE TREATMENT FOR CONTAMINATED GROUNDWATER. IMPROVEMENTS TO WILDLIFE HABITAT WOULD BE A SECONDARY BENEFIT. ONCE ESTABLISHED, THE WETLANDS WOULD BE EXPECTED TO OPERATE IN A FASHION SIMILAR TO THE UPPER PORTION OF POND 2 WITH LARGE AREAS OF VEGETATION AND WILDLIFE HABITAT.

NUMEROUS COMMENTERS SUGGESTED THAT THE REMEDIATION PLANS INCLUDE ELEMENTS THAT IMPROVE WILDLIFE HABITAT AT THE PONDS. SEVERAL COMMENTERS (LETTERS 45, 47, 77, 78, 87, 95, 104, 114, 148, 158; TESTIMONY A-13, B-2, B-7) STATED THAT THE PONDS ARE AN EXCELLENT WATERFOWL AND FISHERIES HABITAT AND THAT THIS SHOULD BE CONSIDERED BEFORE DECISIONS ARE MADE ABOUT POND REMOVAL AND DRY CAPPING. ANOTHER COMMENTER (LETTER 139) RECOMMENDED THAT THE FINAL REMEDIATION PLAN INCLUDE PROVISIONS FOR SEVERAL "HOG HOLE" SIZE PONDS TO OVERWINTER LARGE FISH SIMILAR TO THOSE IN PONDS 2 AND 3. FINALLY, ONE COMMENTER (LETTER 61) CRITICIZED THE PROPOSED PLAN BECAUSE IT "DOES NOTHING FOR WILDLIFE AND FISH."

RESPONSE: THE CERCLA REMEDIATION PROCESS DOES NOT ALLOW FUNDING SPECIFICALLY FOR MEASURES TO ENHANCE WILDLIFE AND FISHERIES HABITAT. THE PRIMARY PURPOSES OF PROPOSED REMEDIAL ACTIONS ARE TO PROVIDE LONG-TERM PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT. TO ACCOMPLISH THIS, THE SELECTED REMEDY WILL REDUCE THE RISK OF CATASTROPHIC FAILURE OF THE POND SYSTEM AND IMPROVE WATER QUALITY IN THE CLARK FORK THROUGH A VARIETY OF MEASURES.

ONLY POND 1 IS BEING CONSIDERED FOR DRY CLOSURE. IT IS THE PRIMARY SOURCE OF THE GROUNDWATER CONTAMINATION, AND FOR THIS REASON, NEEDS TO BE DRY CLOSED. THE PRIMARY FISHERIES AND WATERFOWL HABITATS ARE LOCATED IN PONDS 2 AND 3. THE ONLY SIGNIFICANT ALTERATION TO THESE HABITATS UNDER THE SELECTED REMEDY WOULD ENTAIL THE FLOODING OF THE PORTIONS OF POND 2 THAT ARE CURRENTLY DRY. THIS FLOODING WOULD INCREASE WATERFOWL HABITAT.

ONE COMMENTER (LETTER 130) THOUGHT THAT MONIES SHOULD BE GIVEN TO THE DEPARTMENT OF FISH, WILDLIFE AND PARKS TO PURCHASE OR ENHANCE WILDLIFE AND PUBLIC RECREATION AREAS.

RESPONSE: COMPENSATION FOR CONTAMINATED AREAS COULD NOT COME FROM CERCLA FUNDS (SUPERFUND), BUT WOULD HAVE TO BE OBTAINED IN A SEPARATE ACTION FROM THOSE PARTIES RESPONSIBLE FOR THE CONTAMINATION. COMPENSATION FOR IMPACTS TO NATURAL RESOURCES COULD ALSO BE ADDRESSED SEPARATELY FROM SUPERFUND UNDER THE NATURAL RESOURCE DAMAGE CLAIMS AGAINST THOSE PARTIES RESPONSIBLE FOR THE ENVIRONMENTAL DAMAGE.

STATEMENTS OF PREFERENCE FOR ALTERNATIVES.

ONE COMMENTER (LETTER 150) STATED A PREFERENCE FOR ALTERNATIVE 1, WHICH INCLUDED IN-PLACE SOLIDIFICATION OF ALL TAILINGS, CONTAMINATED SEDIMENTS, AND SLUDGES, BECAUSE IT COULD BE CONSIDERED A PERMANENT REMEDY.

RESPONSE: ALTERNATIVE 1 WAS INCLUDED IN THE FS BECAUSE THE CERCLA STATUTES REQUIRE CONSIDERATION OF ALTERNATIVES THAT UTILIZE TREATMENT TO REDUCE TOXICITY, MOBILITY, AND VOLUME OF CONTAMINATION. TREATMENT ALTERNATIVES ARE TO BE GIVEN PREFERENCE AS LONG AS COSTS ARE NOT EXCESSIVE. ALTERNATIVE 1 WAS INCLUDED TO PROVIDE A TREATMENT ALTERNATIVE FOR COMPARISON PURPOSES. THE ESTIMATED COSTS OF ALTERNATIVE 1, AT OVER \$1.6 BILLION, ARE CONSIDERED EXCESSIVE WHEN COMPARED AGAINST ITS RELATIVE BENEFITS (SEE CHAPTER 8 OF THE FS FOR THE COMPARISON OF ALTERNATIVES).

SEVERAL COMMENTERS (LETTERS 68, 79, 115, 131, 138, 153; TESTIMONY M-2, M-4) STATED OPPOSITION TO ALTERNATIVE 3 BECAUSE THEY THOUGHT IT INADEQUATELY DEALT WITH THE POSSIBILITY OF DOWNSTREAM CONTAMINATION DUE TO FLOODS. THESE COMMENTERS SUPPORTED ALTERNATIVE 2, WHICH INCLUDED AN 8,000-ACRE-FOOT UPSTREAM IMPOUNDMENT FOR FLOOD CONTROL AND TREATMENT. LETTER 138 NOTED THE NEED TO IMPLEMENT A REMEDY THAT WILL ENSURE ATTAINMENT OF EPA GOLD BOOK CRITERIA IN THE CLARK FORK RIVER UP TO THE 100-YEAR FLOOD EVENT.

RESPONSE: BY CAPTURING NEARLY THE ENTIRE VOLUME OF THE 100-YEAR FLOOD IN POND 3 AND PROVIDING TREATMENT THROUGH LIMING AND SETTLING, THE SELECTED REMEDY IS THOUGHT TO PROVIDE ADEQUATE PROTECTION FROM POSSIBLE CONTAMINATION OF THE CLARK FORK RIVER DUE TO FLOODING.

EPA AND MDHES AGREE THAT ACHIEVING GOLD BOOK STANDARDS UP TO THE 100-YEAR FLOOD IS A DESIRABLE GOAL, AND WILL RESULT IN COMPLIANCE WITH ARARS. THE PRIMARY GOAL CAPTURING THE 100-YEAR FLOOD EVENT IS TO LIMIT SEDIMENT TRANSPORT FROM SILVER BOW CREEK THROUGH THE MILL-WILLOW BYPASS TO THE CLARK FORK RIVER. THIS GOAL IS TO PREVENT RECONTAMINATION OF THE BYPASS AND TO LIMIT THE FUTURE DEGRADATION OF THE CLARK FORK RIVER BY CONTINUED DEPOSITION OF TAILINGS.

IN CONJUNCTION WITH OPPOSITION TO THE UPSTREAM IMPOUNDMENT COMPONENT OF ALTERNATIVE 3, NUMEROUS COMMENTERS (LETTERS 8, 11, 18, 22, 26, 34, 35, 39, 43, 48, 54, 59, 60, 63, 71, 77, 87, 94, 148, 160; TESTIMONY A-I, A-3, A-4, A-6, A-11, B-3, M-6) EXPRESSED SUPPORT FOR ARCO PLAN 3A OR A SIMILAR APPROACH THAT WOULD INCLUDE MANY OF THE PLAN 3A COMPONENTS, SUCH AS RAISING THE POND 3 DIKES, ADDING IMPROVED INTAKE STRUCTURES TO POND 3, AND IMPROVING WETLANDS, FISHERIES, AND WILDLIFE HABITAT. ONE COMMENTER (LETTER 95) STATED A PREFERENCE FOR THE ARCO PLAN WITH MINOR MODIFICATIONS.

RESPONSE: EPA AND MDHES HAVE CONSIDERED ARCO'S PLAN AND HAVE DECIDED TO INCORPORATE SOME OF ARCO'S SUGGESTIONS INTO THE FINAL REMEDY. THE ROD PROVIDES A COMPLETE DESCRIPTION OF THE NEW REMEDY, INCLUDING THOSE ELEMENTS THAT COME FROM ARCO'S PLAN.

SEVERAL COMMENTERS (LETTERS 78, 139) FELT THAT THE RI/FS SHOULD HAVE STUDIED AN ALTERNATIVE SIMILAR TO ARCO'S PLAN, BUT NOTED THAT, SINCE ARCO RELEASED THEIR PLAN INDEPENDENTLY, THERE IS NO EASY WAY TO FAIRLY COMPARE COSTS, ETC. FOR EXAMPLE, SINCE THE ARCO PLAN USES DIFFERENT ASSUMPTIONS THAN THE MDHES PLAN FOR 100-YEAR FLOOD, AND NEITHER INCLUDES WARM SPRINGS CREEK IN THEIR FLOOD PROJECTIONS, IT IS DIFFICULT TO COMPARE THE RELATIVE MERITS OF THE APPROACHES.

RESPONSE: MANY OF THE COMPONENTS IN ARCO'S PLAN WERE INCLUDED IN ALTERNATIVES DEVELOPED IN THE RI/FS. HOWEVER, THE METHOD OF TREATING THE 100-YEAR FLOOD, AS PROPOSED BY ARCO, WAS NOT INCLUDED IN THE RI/FS.

THE FACT THAT ARCO USED DIFFERENT DESIGN ASSUMPTIONS DOES MAKE IT MORE DIFFICULT TO COMPARE THE TWO PLANS. THE FLOOD MODELING STUDY USED IN THE PREPARATION OF THE RI/FS DID CALCULATE THE 100-YEAR FLOOD ON WARM SPRINGS CREEK. THE FLOWS FROM WARM SPRINGS CREEK WERE NOT INCLUDED AS PART OF THE FLOW AT THE INLET TO THE POND SYSTEM SIMPLY BECAUSE THEY JOIN THE MILL-WILLOW BYPASS

BELOW THE POND SYSTEM.

A FOCUSED EVALUATION OF ARCO'S PLAN WAS CONDUCTED BY EPA AND MDHES AND IT PART OF THE ADMINISTRATIVE RECORD. HIS ANALYSIS ENABLED THE AGENCIES TO DEVISE AND SELECT THE REMEDY DESCRIBED IN THE ROD, WHICH COMBINES PORTIONS OF THE ORIGINAL PROPOSED PLAN AND ARCO'S PLAN.

MONITORING AND LONG-TERM MAINTENANCE.

SEVERAL COMMENTERS (LETTER 101, 108, 126, 138) NOTED THAT THE FS DOES NOT INCLUDE FUTURE MONITORING PLANS, AND EXPRESSED AN INTEREST IN REVIEWING THE MONITORING PLAN WHEN IT IS DEVELOPED. TWO COMMENTERS (TESTIMONY M-9, M-10) RECOMMENDED THAT THE AGENCIES ESTABLISH FLOW MEASUREMENT STATIONS UPSTREAM AND DOWNSTREAM OF THE PONDS AND THAT A COMPREHENSIVE MONITORING PROGRAM BE DEVELOPED TO GAUGE THE EFFECTIVENESS OF THE PROPOSED ALTERNATIVES.

RESPONSE: MONITORING PLANS ARE GENERALLY NOT DEVELOPED IN THE FEASIBILITY STUDY. THESE PLANS ARE NORMALLY DEVELOPED DURING THE REMEDIAL DESIGN PHASE AFTER THE DECISION IS MADE CONCERNING WHICH ALTERNATIVE WILL BE IMPLEMENTED. THE PUBLIC WILL HAVE AN OPPORTUNITY TO REVIEW AND COMMENT ON THE DRAFT OF THE PROPOSED MONITORING PLANS ONCE THEY ARE DEVELOPED.

THE FS DID CONSIDER THE NEED FOR MONITORING, AND THE OPERATIONS AND MAINTENANCE COST ESTIMATES INCLUDE ALLOWANCES FOR SUCH MONITORING. EPA AND MDHES AGREE THAT FLOW MEASUREMENT STATIONS ARE DESIRABLE FOR FUTURE MONITORING. FLOW MEASUREMENT STATIONS (INCLUDING WATER QUALITY MONITORING) WILL LIKELY BE PART OF THE LONG-TERMS MONITORING PROGRAM TO BE SPELLED OUT IN THE MONITORING PLAN. IT SHOULD BE NOTED THAT THE USGS DID MAINTAIN A GAGING STATION (NO. 12323750) ON THE MILL-WILLOW BYPASS JUST UPSTREAM FROM THE CONFLUENCE WITH WARM SPRINGS CREEK. THIS GAGING STATION WAS MAINTAINED FROM APRIL 1972 THROUGH SEPTEMBER 1979, AND DATA FROM THIS STATION WERE USED IN THE PREPARATION OF THE FS.

ONE COMMENT (LETTERS 136, 146, 147, 148) ASKED WHO WILL BE RESPONSIBLE FOR COSTS ASSOCIATED WITH REPLACEMENT OR MAINTENANCE OF THE PONDS IN THE FUTURE?

RESPONSE: ARCO WILL PROBABLY BE RESPONSIBLE FOR THESE COSTS.

**MISCELLANEOUS COMMENTS REGARDING ALTERNATIVES.**

ONE COMMENTER (LETTER 154) THOUGHT IT APPEARED THAT CATAclySMIC EVENTS HAD RECEIVED MORE ATTENTION IN THE FS THAN THE SLOWER EROSIONAL PROCESSES WHICH "PLAY A LARGER ROLE IN THE TRANSPORT AND ENRICHMENT OF TOXIC METALS IN DOWNSTREAM ENVIRONMENTS."

RESPONSE: THE FS ADDRESSES BOTH THE CATAclySMIC EVENTS AND THE SLOWER YEAR-TO-YEAR PROCESSES THAT TEND TO ADD UP TO SIGNIFICANT MOVEMENT OF CONTAMINANTS. THE ALTERNATIVES DEVELOPED ADDRESS BOTH TYPES OF PROCESSES. THE POND TREATMENT SYSTEM, IF UPGRADED AND PROPERLY OPERATED, WILL PROVIDE A VALUABLE BARRIER TO THE EROSIONAL PROCESSES THAT COULD EVENTUALLY CARRY THE MAJORITY OF THE TAILINGS REMAINING ALONG SILVER BOW CREEK TO THE CLARK FORK RIVER.

TABLE 1

## SUMMARY OF AREAS AND VOLUMES OF CONTAMINATED MEDIA

	AREA (ACRES)	VOLUME (ACRE- FEET) (CUBIC YARD)	
POND BOTTOM SEDIMENTS			
POND 1			
EXPOSED SEDIMENTS	59	455	734,000
VEGETATED/SUBMERGED SEDIMENTS	225	1340	2,156,000
	284	1,795	2,890,000
POND 2			
EXPOSED SEDIMENTS	155	800	1,300,000
VEGETATED/SUBMERGED SEDIMENTS	347	2,230	3,590,000
	502	3,030	4,890,000
POND 3			
SUBMERGED SEDIMENTS	665	6,903	11,180,000
TOTAL POND BOTTOM SEDIMENTS	1,451	11,755	18,960,000
SURFACE WATER			
SILVER BOW CREEK (A)			
MILL AND WILLOW CREEK (B)			
TAILINGS DEPOSITS AND CONTAMINATED SOIL			
MILL-WILLOW BYPASS (C)			
EXPOSED TAILING	21	47	75,800
VEGETATED TAILING & CONTAMINATED SOIL	33	80	130,000
	54	127	205,800
AREA ABOVE POND 3			
EXPOSED TAILINGS	22	56	90,300
VEGETATED TAILINGS & CONTAMINATED SOIL	268	700	1,130,000
	290	756	1,220,300
AREA BELOW POND 1			
EXPOSED TAILINGS	17	48	77,400
VEGETATED TAILINGS & CONTAMINATED SOIL	59	246	397,000
	76	294	474,400

GROUND WATER (D)

AREA OF CONTAMINATED AQUIFER BENEATH &  
DOWNGRAIENT OF POND 1 180

NOTE:

- (A) FLOW RANGES FROM 28-112 CFS (73 CFS AVERAGE). DATA COLLECTION FROM MARCH 1985 TO AUGUST 1985.
- (B) FLOW RANGES FROM 3-87 CFS (27 CFS AVERAGE). DATA COLLECTED FROM DECEMBER 1984 TO AUGUST 1985.
- (C) INSERT MILL-WILLOW BYPASS TAILINGS AND CONTAMINATED SOIL ARE BEING REMOVED BY AN EXPEDITED ACTION SCHEDULE FOR COMPLETION IN NOVEMBER 1990.
- (D) EXCEEDENCES OF PRIMARY MAXIMUM CONTAMINANT LEVELS FOR ARSENIC AND CADMIUM.

**TABLE 2**  
**GROUND WATER QUALITY DATA SUMMARY**  
**WARM SPRINGS PONDS OPERABLE UNIT**

PARAMETER	MAXIMUM CONCEN- TRATION (A)	MINIMUM CONCEN- TRATION (A)	AVERAGE CONCEN- TRATION (A)	NUMBER OF SAMPLES	MAXIMUM CONTAMINANT LEVEL (A) (MONTANA GROUND WATER REGULATIONS)
UPGRADIENT MONITORING WELLS					
ARSENIC	6.8	2.6	4.3	8	50 (B)
CADMIUM	7.0	LT 5.0	3.4	8	10 (B)
COPPER	9.7	6.1	5.8	8	1,000 (C)
LEAD	1.2	LT 1.0	.84	8	50 (B)
MANGANESE	22.0	LT 3.0	7.3	8	50 (C)
ZINC	21.2	4.7	10.3	7	5,000 (C)
IRON	28.0	LT 15.0	19	8	300 (C)
SULFATE (MG/L)	68.0	23	49	8	250 (C)
MILL-WILLOW BYPASS (SHALLOW WELLS)					
ARSENIC	41.0	LT 2.0	9.2	10	50 (B)
CADMIUM	11.7	LT 5.0	3.7	10	10 (B)
COPPER	15.0	LT 6.0	4.6	10	1,000 (C)
LEAD	18.0	LT 1.0	2.5	10	50 (B)
MANGANESE	14,500	45	4,755	10	50 (C)
ZINC	1,250	12.7	265	10	5,000 (C)
IRON	4,000	25.0	805	10	300 (C)
SULFATE (MG/L)	1,130	60.0	563	10	250 (C)
MILL-WILLOW BYPASS (DEEP WELLS)					
ARSENIC	LT 2.0	LT 2.0	1.1	8	50 (B)
CADMIUM	5.2	LT 5.0	2.9	8	10 (B)
COPPER	7.1	LT 6.0	4.0	8	1,000 (C)
LEAD	2.0	LT 1.0	1.1	8	50 (B)
MANGANESE	8,550	7.0	2,121	8	50 (C)
ZINC	38.0	6.2	22.2	8	5,000 (C)
IRON	70	LT 15	33	8	300 (C)
SULFATE (MG/L)	1,060	92.0	494	8	250 (C)
DOWNGRADIANT OF POND 1 (SHALLOW WELLS)					
ARSENIC	197.0	LT 2.0	28.0	14	50 (B)
CADMIUM	12.7	LT 5.0	3.6	14	10 (B)
COPPER	15.9	LT 6.0	5.8	14	1,000 (C)
LEAD	LT 2.0	LT 1.0	2.0	14	50 (B)
MANGANESE	31,600	309	10,297	14	50 (C)
ZINC	253	16.3	89.0	14	5,000 (C)
IRON	80,900	45	16,220	14	300 (C)
SULFATE (MG/L)	1,620	250	950	14	250 (C)

DOWNGRADIENT OF POND 1 (DEEP WELLS)

ARSENIC	LT 3.0	LT 2.0	1.0	13	50 (B)
CADMIUM	8.4	LT 5.0	4.3	13	10 (B)
COPPER	LT 8.0	LT 6.0	3.5	13	1,000 (C)
LEAD	LT 2.0	LT 1.0	.8	13	50 (B)
MANGANESE	4,460	3.0	577	13	50 (C)
ZINC	43	6.2	19.8	13	5,000 (C)
IRO	409	LT 15	52	13	300 (C)
SULFATE (MG/L)	1,150	55	531	13	250 (C)

(A) ALL VALUES IN UG/L UNLESS OTHERWISE NOTED.

(B) PRIMARY STANDARD (BASED ON HEALTH CRITERIA).

(C) SECONDARY STANDARD (BASED ON SUITABILITY CRITERIA).

NOTES:

1. UPGRADIENT WELLS INCLUDE WSP-GW-01,06, AND 09 (FIGURE 2-8).
2. SHALLOW WELLS ARE GENERALLY LESS THAN 15 FEET DEEP; DEEP WELLS ARE GENERALLY 25 TO 40 FEET DEEP.
3. MILL-WILLOW SHALLOW WELLS INCLUDE WSP-GW-07S, 08S, 15S, 16S, AND 17 (FIGURE 2-8).
4. MILL-WILLOW DEEP WELLS INCLUDE WSP-GS-07D, 08D, 15D, AND 16D (FIGURE 2-8).
5. SHALLOW WELLS DOWNGRADIENT OF POND 1 INCLUDE WSP-GW-02S, 03S, 05, 12S, 13S, 14S, AND 19S (FIGURE 2-8).
6. DEEP WELL DOWNGRADIENT OF POND 1 INCLUDE WSP-GW-02D, 03D, 04, 12D, 13D, 14D, AND 19D (FIGURE 2-8).
7. AVERAGE VALUES CALCULATED USING ONE-HALF DETECTION LIMIT, WHEN APPLICABLE. JANUARY AND MAY 1988 DATA.
8. ADDITIONAL MAXIMUM CONTAMINANT LEVELS ARE: MERCURY AND COMPOUNDS: 2; NITRATE: 10,000; SELENIUM AND COMPOUNDS: 10; AND SILVER 50.

**TABLE 3**  
**RELATIONSHIP OF SITE PROBLEMS TO REMEDIAL ACTION OBJECTIVES**

PROBLEMS	OBJECTIVES
POND BOTTOM SEDIMENTS	
POND INTEGRITY -- FLOODS	PREVENT THE RELEASE OF THE POND SEDIMENTS FROM DESIGN FLOODS AND EARTHQUAKES
POND INTEGRITY -- EARTHQUAKES	
SURFACE WATER	
FISHKILLS	MEET AMBIENT WATER QUALITY STANDARDS FOR AQUATIC LIFE AT THE IDENTIFIED COMPLIANCE POINT.
METAL LOADS IN THE FLOWS OF MILL, WILLOW, AND SILVER BOW CREEKS	PREVENT INGESTION ABOVE MAXIMUM CONTAMINANT LEVELS AND ESTABLISHED REFERENCE DOSES FOR COPPER, IRON, ZINC, AND CADMIUM. ALSO PREVENT INGESTION OF WATER CONTAINING ARSENIC IN CONCENTRATIONS THAT WOULD CAUSE AN EXCESS CANCER RISK GREATER THAN (10 <sup>-4</sup> ) TO (10 <sup>-7</sup> )
EROSION OF TAILINGS IN THE MILL-WILLOW BYPASS INTO THE CLARK FORK RIVER	REDUCE THE POTENTIAL FOR TAILING IN THE MILL-WILLOW BYPASS TO REACH THE CLARK FORK RIVER
TRANSPORT OF TAILINGS FROM UPSTREAM REACHES OF SILVER BOW CREEK TO THE CLARK FORK RIVER DURING FLOODS AND OTHER HIGH FLOW EVENTS	REDUCE THE POTENTIAL FOR TAILINGS IN UPSTREAM AREAS OF SILVER BOW CREEK TO REACH THE CLARK FORK RIVER
TAILINGS DEPOSITS AND CONTAMINATED SOILS	
HUMAN AND ENVIRONMENTAL EXPOSURE TO SURFACE CONTAMINATION	REDUCE THE POTENTIAL FOR HUMAN EXPOSURE TO EXPOSED TAILINGS AND OTHER SURFACE CONTAMINATION TO SATISFY ACCEPTABLE INTAKE CRITERIA
GROUND WATER	
CONTAMINATED GROUNDWATER IN THE POND 1 AREA	REDUCE THE METALS CONTAMINATION IN THE GROUNDWATER DOWNGRAIENT OF THE PONDS TO ACHIEVE COMPLIANCE WITH MAXIMUM CONTAMINANT LEVELS