

**PINAL CREEK WQARF SITE**  
**Site Registry Report**  
**Globe-Miami, Gila County, Arizona**

**SITE DESCRIPTION:**

The Pinal Creek Water Quality Assurance Revolving Fund (WQARF) Site is located in Gila County in and around the towns and communities of Globe, Miami, Claypool, and Wheatfields, and includes the Cyprus Miami Mine (formerly the Inspiration Mine), the BHP Copper, Inc.-Miami Mine (aka the Miami Unit), the BHP Copper Cities Mine (aka the Copper Cities Unit), the BHP Solitude Tailings, and the BHP Old Dominion Mine, as well as any off-site areas of soil, stream sediment, groundwater and/or surface water contamination. Contamination is found in the alluvial aquifer of Bloody Tanks Wash-Miami Wash-Pinal Creek, locally in the regional Gila Conglomerate aquifer, in the perennial reach of Pinal Creek proper, and on-site at the various mines. Contamination generally consists of groundwater and/or surface water impacted by acidity and heavy metals (i.e., acid mine drainage). Soil and stream sediment contamination is also locally present within the Site. The site lies in the Pinal Creek watershed, which is located in the Salt River Lakes Sub-Basin of the Salt River Basin.

Depth to groundwater within the site ranges from just a few feet below the surface along the alluvial aquifer of Bloody Tanks Wash-Miami Wash-Pinal Creek to greater than a hundred feet in upland areas of the site. Regional groundwater flow is generally to the north, and parallels the surface drainage of Pinal Creek and the major tributaries to Pinal Creek. Locally, the groundwater flow direction can be quite variable.

Pinal Creek is located (see attached site map) in east-central Arizona in the Globe-Miami mining district. Bloody Tanks Wash, Miami Wash, Russell Gulch and upper and lower Pinal Creek are the major stream drainages in the mining district. Most of the length of the Bloody Tanks Wash is bordered on the north by open pit mines, production facilities, leach dumps, waste rock dumps, and tailings piles. The City of Miami straddles the lower half of Bloody Tanks Wash. Miami Wash drains northward from Bloody Tanks Wash until it joins Pinal Creek. Tailings piles border the west bank of Miami Wash for its entire length. Upper Pinal Creek flows through the town of Globe and is bordered on the east by the Old Dominion Mine and other inactive mines in the Globe Hills. Below Miami Wash, Pinal Creek flows to the north where it discharges into the Salt River just upstream of Roosevelt Lake.

The boundary of the Pinal Creek WQARF Site is based on the degree and extent of known groundwater, surface water and/or soil contamination and the location of the known and potential sources, primarily tailings/waste piles and process solution impoundments. Upgradient groundwater well samples (USGS-10, BT-66, OXBR-3, BLBR-6 and CCN) define the site boundary in the upland areas of the site. The extent of contamination in the alluvial aquifer of Bloody Tanks Wash-Pinal Creek-Miami Wash is defined by numerous wells throughout the basin (not shown on site map) and by ten well profiles (Reppy Avenue (RA), Rod Plant (RP), Ragus Road (RR), Nugget Wash, Wheatfields, Sunflower Ranch, Leading Edge, M, LPC, and the See Ranch profiles). Near the Old Dominion Mine

in upper Pinal Creek, the extent of contamination is defined by surface water samples (OD-2W, OD-3W, OD-4W) and soil (stream sediment) samples (SS-3, SS-7). The furthestmost downstream contamination is defined by surface water sampling conducted at the ADEQ/USGS Fixed Monitoring Stations located on Pinal Creek at Inspiration Dam (also a stream gaging station), on the Salt River at the Highway 288 bridge (also a stream gaging station), and at the USGS Monitoring Station on Pinal Creek near the Setka Ranch.

#### SITE HISTORY:

Mining and mineral processing began in the Globe-Miami area in 1878 with the discovery of silver ore in the Globe Hills. By 1893 copper had replaced silver as the main commodity produced in the district, and continues to be today. Significant amounts of lead, zinc, manganese, gold, and silver have also been produced over the years in the district.

The largest producing and longest-lived copper mines in the district are the Inspiration Consolidated Copper Co. - Inspiration Mine (now the Cyprus Miami Mine - 1912 to present), the Old Dominion Mine (1881 to 1931), the Miami Copper Co. - Miami Mine (now the BHP Miami Unit - 1907 to present), the Miami Copper Co. - Copper Cities Mine (now the BHP Copper Cities Unit - 1951 to 1982), the Bluebird Mine (early 1960's to present - now part of the Cyprus Miami Mine), and the Oxhide Mine (1966 to present - now part of the Cyprus Miami Mine). Copper ores have been extracted from both underground and open pit mines, and have been processed on site using leaching, gravity milling, flotation milling, smelting, solvent extraction-electrowinning, and electrolytic refining technologies.

On July 28, 1986, the U.S. Environmental Protection Agency (EPA) issued a finding of Violation and Order under the Clean Water Act to the Inspiration Consolidated Copper Company (ICCCo.) for discharges of acidic process solutions from Webster Lake (a large process solution impoundment) to Miami Wash and for acidic, metal-contaminated groundwater surfacing near the confluence of Miami Wash and Pinal Creek. On May 8, 1989, the Pinal Creek Site was placed on the WQARF Priority List. On May 17, 1990, the Pinal Creek Group was formed (which consists of Inspiration Consolidated Copper Co., Cyprus Miami Mining Corp., and BHP Copper, Inc.) to voluntarily conduct remedial investigations and undertake remedial actions at the site.

The acid-metal groundwater contaminant plume has been moving downgradient for at least 60 years, and contaminants from the neutralized portion of the plume have been present since at least the early 1940's in the perennial reach of Pinal Creek. Groundwater contamination in the Miami Wash area has been documented as far back as the 1930's. Currently, surface water sampling conducted by the U.S. Geological Survey at the head of the perennial flow of Pinal Creek has documented a trend of decreasing pH and increasing metals levels (especially manganese, but also cadmium and nickel) over the last few years.

Releases of contaminants have occurred from all of the major mining sites from a variety of different sources, including, but not limited to, process solution impoundments, tailings piles, leach dumps,

various spills, and as storm water runoff from waste and tailings piles. Erosion of waste piles, especially tailings piles, has also resulted in the release of contaminants to water courses. Particulate fallout of wind-blown tailings and from several copper smelters in the area has also contributed to the spread of contamination at the site.

The Remedial Action Plan (RAP) for the Pinal Creek site was designed in three phases: Phase I Site Investigation/Interim Remedial Action; Phase II Risk Assessment/Remedial Goals Investigation; and Phase III Feasibility Study.

#### Phase I Site Investigation/Interim Remedial Action:

The Phase I study included a remedial investigation into the degree and extent of groundwater and surface water contamination in off-site areas impacted by mining operations and was conducted by the Pinal Creek Group. Phase I also included a proposed remedial pumping plan (Interim Remedial Action Plan or Interim RAP) designed to reduce the acidity of the plume and to retard the movement of the acid-metal plume front to prevent it from breaking through to the perennial surface flow of Pinal Creek. Production wells were installed in Webster Gulch, Kiser Basin/Miami Wash, at the Fodera pump station, and at Sunflower Ranch. Pumping of contaminated groundwater was proposed in the Interim RAP at 1000 gallons per minute (gpm) from Kiser Basin/Miami Wash area and 600 gpm from the Fodera/Sunflower Ranch wellfield, on an annual average. Between 1100 and 1300 gpm of the contaminated groundwater was treated at the BHP Copper Cities Unit - Diamond H Pit until the closure of the BHP Pinto Valley Mine concentrator in February 1998, where the treated water was stored for solids settling prior to reuse in mining operations. Remedial water is currently being reused and stored at the BHP and Cyprus mining facilities. The Phase I Site Investigation/Interim Remedial Action Plan was approved by ADEQ on May 14, 1990.

The Interim RAP has resulted in the removal of approximately 15,000 metric tons of heavy metals (measured as iron, copper, cadmium, manganese, and zinc removed) and more than 5.8 billion gallons of contaminated groundwater from the alluvial aquifer. Although the Interim RAP has retarded movement of the acid-metal plume, monitoring conducted by the PCG and the U.S. Geological Survey has documented increasing levels of some metals (zinc, manganese, cadmium) and decreasing pH (increased acidity) at the beginning of perennial flow in Pinal Creek. Because of this, the PCG is implementing an accelerated remedial action to install a treatment plant, barrier wellfield, and a pumping and pipeline system in lower Pinal Creek to prevent further degradation of Pinal Creek water quality due to the surfacing of the groundwater contaminant plume.

#### **Phase II Risk Assessment and Remedial Goals Investigation:**

Parametrix, Inc., on behalf of the PCG, conducted a human-health and an ecological-health risk assessment of the Pinal Creek Site. The risk assessments were reviewed by several government agencies, including the Arizona Department of Health Services and the Arizona Game and Fish Department, and were approved by ADEQ on August 5, 1994.

The Ecological Risk Assessment determined that no chemicals evaluated pose risk of adverse effects to aquatic life or wildlife in the Salt River below perennial Pinal Creek and in the eastern arm of Roosevelt Lake. Only three chemicals (manganese, cobalt, and aluminum) pose potential risk to aquatic life or wildlife along the perennial reach of Pinal Creek. The results of the Ecological Risk Assessment, in conjunction with any applicable water quality standards, will be used to determine cleanup levels for manganese, cobalt, and aluminum.

The Human Health Risk Assessment determined that no chemicals evaluated currently pose the potential for health effects from exposure to surface water or sediments in perennial Pinal Creek, Salt River, and Roosevelt Lake. All of the estimates of potential carcinogenic risk were within or below the range of carcinogenic risks deemed acceptable by the U.S. Environmental Protection Agency.

#### Phase III Feasibility Study:

In May 1997 the PCG submitted the Feasibility Study Report and Recommended Remedial Action Plan (FS) for the Pinal Creek WQARF Site, which proposed several remedial alternatives for the cleanup of the site along with a recommended remedial action which generally consists of chemical treatment of contaminated groundwater, subsurface barriers to control/capture groundwater and source control options at the various mining facilities. The FS is currently under review.

#### Source Investigation/Source Control:

Source investigations have been conducted at the Cyprus and BHP mine facilities. Numerous source controls have also been implemented at the mining facilities within the Site since 1986, and many more will be implemented in the future under the oversight of the ADEQ WQARF and Aquifer Protection Permit Programs.

Source controls implemented at the Inspiration/Cyprus facilities include the draining of Webster Lake and Ellison Pond, upgrades to leach collection and processing facilities in Live Oak Gulch, upgrades to the leaching plant, acid plant and smelter facilities, and revegetation of the side slopes of several tailings piles. Source controls implemented at the BHP facilities include an ongoing removal and reprocessing of the Miami No.2 Tailings, installation of storm water diversion channels and a collection pond at the Miami No.2 Tailings, and application of a dust suppressant to the south facing slope of the Miami No.2 Tailings. BHP is also implementing a Supplemental Environmental Project (SEP) under the Clean Water Act that will result in the capping of tailings and waste rock piles at the Old Dominion Mine site.

#### PUBLIC & ENVIRONMENTAL HEALTH:

The environmental impacts at this site include groundwater and surface water contaminated with acidity, metals, sulfate and high levels of total dissolved solids. Acid-metal contamination in the shallow alluvial aquifer has been detected at locations ranging from the upper portion of Bloody Tanks Wash all the way to lower Pinal Creek, a distance of about 10 miles. Acid-metal contamination is also found locally in the Gila Conglomerate aquifer. Neutralized groundwater high in dissolved solids and sulfate occurs

throughout the site, and locally in the Gila Conglomerate aquifer. Numerous private, public, and industrial supply wells have been contaminated over the years with metals, sulfate, acidity and high levels of dissolved solids in the Miami and Wheatfields area.

Metals that are present in groundwater at levels that exceed drinking water standards, health-based guidelines, or are elevated above background levels include iron, manganese, copper, cobalt, nickel, zinc, cadmium, beryllium, aluminum, and chromium. Elevated levels of sulfate, total dissolved solids, fluoride, strontium, hardness (calcium + magnesium) and sodium are also present, and may exceed applicable primary drinking water standards (fluoride), secondary drinking water standards (sulfate, total dissolved solids), or health-based guidelines (sulfate).

High levels of dissolved solids and sulfate have been present in the perennial flow of lower Pinal Creek since the 1930's. Intermittent violations of surface water quality standards for some metals have been documented since the 1970's. The beginning of the perennial reach of Pinal Creek currently has nearly continuous violations of water quality standards for manganese and zinc, and less frequently for pH and other metals (copper, cadmium). The intermittent and ephemeral reaches of Pinal Creek, Miami Wash, and Bloody Tanks Wash have also been impacted by acidic runoff, eroded tailings, and surfacing acidic groundwater in the past. Acidic runoff and the erosion of tailings from the Old Dominion Mine site have been documented and have resulted in surface water and groundwater contamination. Sampling by the USGS at a gaging station on the Salt River just below the confluence with Pinal Creek has documented an increasing trend in manganese concentrations. High levels of dissolved manganese in perennial Pinal Creek have resulted in the formation of a black crust of manganese oxide minerals known as *manganocrete* in and on the stream sediments of lower Pinal Creek that inhibits biologic activity in the stream bed (in conjunction with the high levels of dissolved manganese in the water).

Groundwater from the alluvial aquifer within the site is generally not used. However, some private use does occur of neutralized water that is low in metals (and meets primary drinking water standards), but high in dissolved solids, for livestock watering, watering gardens or other vegetation, and for domestic use. Locally, some private wells in the Gila Conglomerate aquifer contain high levels of dissolved solids which are used for domestic and other purposes. Water provided by the City of Globe and the Arizona Water Co. to residents of Globe, Miami, and Claypool comes from the Gila Conglomerate aquifer, from outside the WQARF site, or is blended to meet secondary water quality standards. Several supply wells owned by the Arizona Water Co. have been contaminated over the years and some blending of water from the alluvial and Gila aquifers has occurred in the past.

The PCG has implemented a well testing and replacement program for the owners/users of private wells in the Pinal Creek Site. The PCG offers free well testing of any private well that may have been impacted by groundwater contamination, and depending on the results of the testing, a free replacement well installed deep within the Gila Conglomerate aquifer that is free of contamination. The PCG will also be implementing routine monitoring of replacement wells or monitor wells in the Gila Conglomerate aquifer. To date, the PCG has tested hundreds of wells in upper Bloody Tanks Wash, the Wheatfields area, and along lower Pinal Creek, and installed 18 replacement wells in the Wheatfields area at no cost to the owners/users.

Additional studies into stream sediment and soil contamination will be conducted in the future, which may reveal other impacts or areas requiring remedial action. Metals which have been detected in stream sediments above background levels include copper, zinc, lead, arsenic, and manganese.

#### ELIGIBILITY & EVALUATION (E&E) SCORE:

Based on the most current information, the current E&E score is 97.

#### LIMITATIONS:

This Site Registry Report (SRR) is based upon information available as of the date shown. The SRR is intended as a historical document meeting the public notification requirements of ARS § 49-287.01 (B) and (D). Site boundaries depicted on the attached Site Boundary Maps represent ADEQ's interpretation of data available at the time the maps were constructed. The maps are intended to provide the public with basic information as to the estimated geographic extent of known contamination as of the date of the SRR. The actual extent of contamination may be different. Therefore the geographic boundaries for this site may change in the future as new information becomes available.

An updated SRR and associated Site Boundary Map will not be issued. As new information becomes available it will be made available for public review through placement in the public file.

Documents pertaining to the Pinal Creek Site can be viewed at the Arizona Department of Environmental Quality's offices at 3033 North Central Avenue, Phoenix, Arizona 85012. In addition, a repository of key documents is maintained at the Miami Memorial Library, 1052 Adonis, Miami, Arizona 85539, telephone: (520) 473-4403. The U.S. Geological Survey (USGS) maintains a web site home page (<http://www.daztcn.wr.usgs.gov/pinal/index.html>) dedicated to the investigations conducted by the USGS in the Pinal Creek watershed. The Pinal Creek Group maintains a web site (<http://www.pinalcreekgroup.com>) relating to clean up activities at the Pinal Creek WQARF Site.