ADEQ Arizona Department of Environmental Quality

FACT SHEET

ARIZONA POLLUTANT DISCHARGE ELIMINATION SYSTEM (AZPDES)

This document gives pertinent information concerning the reissuance of the AZPDES permit listed below. This facility is a mining operation and is considered to be a major facility under the NPDES program. The effluent limitations contained in this permit will maintain the Water Quality Standards listed in Arizona Administrative Code (A.A.C.) R18-11-101 *et seq*. This permit is proposed to be issued for a period of 5 years.

I. PERMITTEE INFORMATION	
Permittee's Name:	South32 Hermosa Inc. (South32)
Permittee's Mailing Address:	1860 East River Road, Suite 200 Tucson, AZ 85718
Facility Name:	January Mine Hermosa Project
Facility Address or Location:	749 Harshaw Road Patagonia, AZ 85624
County:	Santa Cruz
Contact Person(s): Phone/e-mail address	Brent Musslewhite, Director—Environment and Permitting (520) 485-1300/Brent.Musslewhite@south32.net
AZPDES Permit Number:	AZ0026387
Inventory Number:	512453
LTF Number:	95353
South32 Limited is a mining company organized under Australian law. In 2018, South32 Limited purchased Arizona Minerals, Inc. ("AMI") as a wholly owned subsidiary licensed to conduct business in the United States and Arizona. On February 2, 2023, AMI changed its name to South32 Hermosa, Inc ("South32"). ADEQ was notified of the name change on February 14, 2023 and updated the permit accordingly.	

II. STATUS OF PERMIT(s)	
AZPDES permit applied for:	Renewal
Date application received:	July 11, 2022
Date application was determined administratively complete:	July 26, 2022
Previous permit expiration date:	January 7, 2023 (administratively continued)

208 Consistency:

In accordance with A.A.C. R18-9-A903(6), a permit cannot be issued for any discharge inconsistent with a plan or plan amendment approved under section 208(b) of the Clean Water Act.

208 Plan consistency is not required for industrial facilities.

South32 Hermosa Inc. has the following permits issued by ADEQ applicable to the January Mine Hermosa Project:

Type of Permit		
Aquifer Protection Permit (APP)	P-512235	Regulates discharges to the local aquifer
Multi-Sector General Permit (MSGP)	AZMSG-81380	Regulates stormwater discharge

Voluntary Remediation Program:

A number of updates to the January Mine Hermosa Project site were completed under ADEQ's Voluntary Remediation Program (VRP).

Prior to the purchase of AMI by South32 Limited, AMI committed to environmental corrective actions needed on the site to address an ADEQ-issued notice of violation dated October 10, 2014, relating to the previous site owner's Multi-Sector General Stormwater Permit for discharges to waters of the United States. In accordance with the VRP Site Code 505143-02, South32 acquired a Multi-Sector General Stormwater Permit, developed a Stormwater Pollution Prevention Plan (SWPPP) to address and manage stormwater discharges from the Trench Camp Mine Property (January Mine, Norton Mine, and Trench Camp Mine Claims) and developed a Remediation Work Plan to effectively manage and treat the January Adit Mine Water and drainage from the historic tailing storage facilities.

Originally, AMI's remediation approach involved the construction of a passive treatment system for treatment of the January Adit mine water and historic tailing drainage. In 2016, AMI constructed a small-scale pilot passive treatment system, which operated for 24 weeks and was adjusted accordingly, as analytical testing dictated, to ensure the system effectively treated the impacted inflows. Also, during this time AMI worked to improve the stormwater management system through the construction and reconstruction of the site stormwater diversion network to prevent commingling of impacted stormwater with unimpacted stormwater. AMI also implemented measures to ensure January Adit mine water and historic tailings drainage are not discharged into Alum Gulch. It placed additional soil cover on and reseeded areas of the historic tailings and waste rock where needed to minimize stormwater contact with exposed tailings or waste rock. On October 19, 2016, AMI submitted a Remediation Work Plan to VRP based on a passive treatment system that would effectively treat the impacted water from the January Adit and historic tailings. This Work Plan was public noticed on October 21 and 28, 2016 for 45 days.

On January 24, 2017, AMI notified the VRP that it has decided to pursue an active water treatment system instead of a passive water treatment system. The active water treatment plant combined with placing the historic tailings onto a liner system provides for a more robust remediation Work Plan. The previous 2016 Work Plan did not contemplate placing the historic tailings on a liner system. On April 27, 2017 AMI submitted its Work Plan to VRP, which was public noticed on May 5 and 12, 2017 for 45 days. The remediation outlined in the 2017 Work Plan was completed in 2019.

In April 2019, AMI, now owned by South32 Limited, submitted a Work Plan to remove sediment from the historic passive treatment wetland system, which was formerly used to treat mine drainage from January Adit. The Work Plan consisted of sampling clean backfill, building an access road, removing vegetation and former treatment structure,

excavation, confirmation sampling, disposal of contaminated sediment, backfilling, and revegetation. The Work Plan was public noticed April 12, 2019 for 45 days.

Any water discharged from Outfall 001 or Outfall 002 as a result of VRP activities is subject to the effluent limitations listed in the permit for each outfall in Part.I.A.

III. GENERAL FACILITY INFORMATION	
Type of Facility:	Polymetallic mineral deposit mining operation
Facility Location Description:	5 miles south of Patagonia, AZ
Facility Background and Nature of Facility Discharge:	Some of the historical mining operations are on property previously owned by ASARCO LLC (ASARCO). An AZPDES permit was previously issued for this site to ASARCO (AZ0025054) on December 1, 2003, for discharges of treated mine drainage to Middle Alum Gulch from a constructed wetland treatment system at two locations. The wetland treatment system was unable to achieve the applicable water quality standards, and permit AZ0025054 was not renewed. The wetland treatment system will be excavated to remove contaminated soil and replaced with backfill and vegetation; this project started November 6, 2023. South32 now uses an active water treatment plant (see Voluntary Remediation Program section above). AMI acquired portions of the former ASARCO property and engaged in remediation of historic site activities under ADEQ's VRP (see Voluntary Remediation Program section above). Activities include capturing and treating mine influenced water from historic workings associated with January Adit, moving historic tailings onto a new lined tailings storage facility, and capturing and treating the water collected in the underdrain collection pond or UDCP. After acquiring the property, AMI applied for AZPDES permit coverage on May 19, 2017. Discharge from WTP1 was authorized in the initial 2018 AZPDES permit. WTP1 treats mine drainage water from historic workings associated with January Adit. January Adit itself is plugged; South32 pumps and treats water from the historic workings associated with January Adit. WTP1 also treats stormwater, and drainage collected from the Tailings Storage Facility (TSF) in the underdrain collection pond (UDCP). As explained above, AMI was then purchased by South32 Limited later in 2018, and AMI was renamed South32 Hermosa Inc. ("South32") in February 2023. To date, WTP1 has not discharged effluent to Upper Alum Gulch; all water has been reused on site. South32 plans to continue to reuse water treated by WTP1 onsite, but 100% reuse onsite may not be possible at all times, particularly after precipitation events increase the volume of water flowing to the UDCP. If 100% reuse is not possible, effluent from WTP1 may be discharged from Outfall 001 to Upper Alum Gulch or routed to WTP2 (see New Source Considerations Section below for allowable discharges). Since issuance of the 2018 permit, WTP1 was

	upgraded to provide additional removal of total dissolved solids (TDS), sulfates, and selenium (see Applicable Treatment Processes below). South32 is conducting exploration activities to more fully assess the economic and technical viability of mining the underground polymetallic mineral deposit (primarily targeting zinc, lead, silver and manganese). This will be accomplished largely through advancement of exploration shafts/declines, which will necessitate pumping and treating water from the local aquifer in the vicinity of the shafts/declines to allow for their safe advancement. This water is routed to water treatment plant 2 (WTP2). Discharge from WTP2 was authorized in a 2021 modification to the 2018 permit. WTP2 is designed primarily to treat water from depressurization wells, underground dewatering pumps, and operational water services. Additional inflows of water to WTP2 could include water from the UDCP and historic works associated with January Adit, as well as treated water from WTP1. Stormwater, operational water (including but not limited to drilling water, core cutting water, vehicle wash water, etc.) if not used onsite for other purposes, can also be routed to WTP2 for treatment. After treatment, water from WTP2 is reused on site or discharged from Outfall 002 to Lower Harshaw Creek. In August 2023, WTP2 became operational and South32 began discharging to Lower Harshaw Creek (see average flow per discharge).
Applicable Treatment Processes:	**WTP1:** WTP1 uses four steps for treatment. In step 1, suspended solids (metals) are removed through the addition of ferric compounds, flocculant, and reagents (and with pH adjustment, if required). Ultrafiltration is used to further clarify the solution. In step 2, the sulfate concentration is reduced using nanofiltration (NF) and precipitation (using ferric chloride and lime). In step 3, the selenium is reduced using a selenium electroreduction circuit (ERC) with an iron anode. In step 4, the feed from the ERC is then blended with the NF permeate, resulting in a blended water with reduced sulfate and selenium levels. The treated water can be directed to the moving bed biological reactor (MBBR) to oxidize ammonia (if present). Treated water will be reused on site, discharged from Outfall 001 to Upper Alum Gulch, or routed to WTP2 for further treatment. WTP1 will produce residual solids composed of fine particles of minerals removed from the water during treatment. They are not classified as either rock or tailings. The solid residuals will be clarified from solution, filtered (i.e. dewatered by filter press), and deposited at the geomembrane-lined Tailing Storage Facility (TSF), as authorized by the facility's APP. **WTP2:** WTP2 will use a two-step treatment process. Treatment techniques consist of total suspended solid (TSS) and metals removal circuit, sand ballasted clarification, multimedia filtration, thickener, sludge filter press, and fluid management systems. Step 1 treatment removes suspended solids through the addition of ferric compounds, flocculant, and reagents (and with pH adjustment, if required), and clarification to precipitate metals (including selenium) and

	separate solids. Step 2 uses ion exchange and electro reduction to remove selenite from the water treated by Step 1. Treated water from Step 2 will be reused on site as needed or piped about 700 feet to the east and discharged through an energy dissipater at Outfall 002 to prevent erosion and scouring. Outfall 002 includes an armored diversion berm to direct flow to Lower Harshaw Creek. WTP2 will produce solid residuals composed of fine particles of minerals removed from the water during treatment. They are not classified as either rock or tailings. The solid residuals will be clarified from solution, dewatered by filter press, and deposited at the geomembrane-lined Tailing Storage Facility (TSF), as authorized in the facility's APP.
Average flow per discharge:	No discharge has occurred from Outfall 001. Discharge data is available for Outfall 002 for August 2023. Discharge from Outfall 002 occurred on August 30 and 31, 2023; the discharge averaged 0.1255 MGD. WTP1 (Outfall 001) is designed to treat and discharge up to 0.172 million gallons per day (MGD). WTP2 (Outfall 002) is designed to treat and discharge up to 6.48 MGD. The highest flow rate from Outfall 002 is expected to occur in the first years of exploration activities, with flows declining over time.
Continuous or intermittent discharge:	Outfall 001 (Upper Alum Gulch): Intermittent Outfall 002 (Lower Harshaw Creek): Continuous
Discharge pattern summary:	Discharge from Outfall 001 will only occur when South32 Hermosa Inc. is unable to reuse all water treated by WTP1 on-site. Discharge from Outfall 002 is expected to occur on a continuous basis.

New Source Considerations

ADEQ drafted the permit, fact sheet, and response to comments for the January Mine Hermosa Project with consideration of the Arizona Court of Appeals' decision in *San Carlos Apache Tribe v. State of Arizona* (the "*San Carlos* decision"). On June 27, 2024, the Arizona Supreme Court issued an opinion reversing the Court of Appeals' new source and TMDL analyses in the *San Carlos* decision. After review of the Arizona Supreme Court ruling, ADEQ has determined that the permit continues to meet the requirements of the Clean Water Act and is protective of human health and the environment. While this decision provides South32 with other discharge options, the permit was not revised in response to the decision. In order to change the discharges authorized by this permit, South32 would be required to submit a permit modification. ADEQ's response to comments was updated to reflect the Arizona Supreme Court decision.

Outfall 001 – Upper Alum Gulch

Alum Gulch (all three segments) has an EPA-approved TMDL for cadmium, copper, pH, and zinc. Middle Alum Gulch was listed as impaired for lead in 2022. (See Receiving Water Section below for more detail.)

On July 7, 2023, South32 submitted a letter notifying ADEQ that South32 is no longer seeking approval at this time to discharge from Outfall 001 a) tailings storage seepage or runoff once dry stack tailings from a future mill are added to the existing tailings storage facility, or b) water from new shafts or declines advanced at the site to further ongoing exploration and potential future production. ADEQ revised the permit accordingly.

For Outfall 001 to Upper Alum Gulch, South32 seeks only to discharge mine drainage associated with the historic mine sources (that have been remediated). This permit authorizes the discharge of water from historic sources only to

Alum Gulch. Historic sources are defined as predating December 3, 1982, which is the date the effluent limitation guidelines were promulgated, and thus cannot be new sources. Per 33 U.S.C. § 1316 (a)(2) and 40 CFR Part 122.2, a new source "means any building, structure, facility, or installation from which there is or may be a 'discharge of pollutants,' the construction of which commenced: (a) After promulgation of standards of performance under section 306 of CWA which are applicable to such source, or (b) After proposal of standards of performance in accordance with section 306 of CWA which are applicable to such source, but only if the standards are promulgated in accordance with section 306 within 120 days of their proposal." Effluent limitation guidelines applicable to ore mining and dressing, 40 CFR Part 440, Subpart J were promulgated on December 3, 1982. Therefore, any sources of discharge that predate December 3, 1982 must be considered existing sources. Historic means anything that predates December 3, 1982.

Water from the following sources may be discharged to Upper Alum Gulch per Part I.A.1. of the permit:

- Drainage water from historic workings associated with January Adit
- Drainage water from historic tailings
- Stormwater to which effluent limitation guidelines are not applicable

Thus, the only allowable sources of discharge from Outfall 001 to Upper Alum Gulch are treated mine drainage water from historic workings associated with January Adit, drainage from historic dry stack tailings, which predate the effluent limitation guidelines promulgated on December 3, 1982 and are existing sources, whether or not mixed with stormwater.

The effluent limitation guidelines (ELGs) were compared with water quality-based effluent limitations (WQBELs). For all parameters with ELGs, the WQBELs were more stringent than the ELGs. See Numeric Water Quality Standards section below.

Outfall 002 – Lower Harshaw Creek

A new source analysis is not needed for Lower Harshaw Creek for the following reasons:

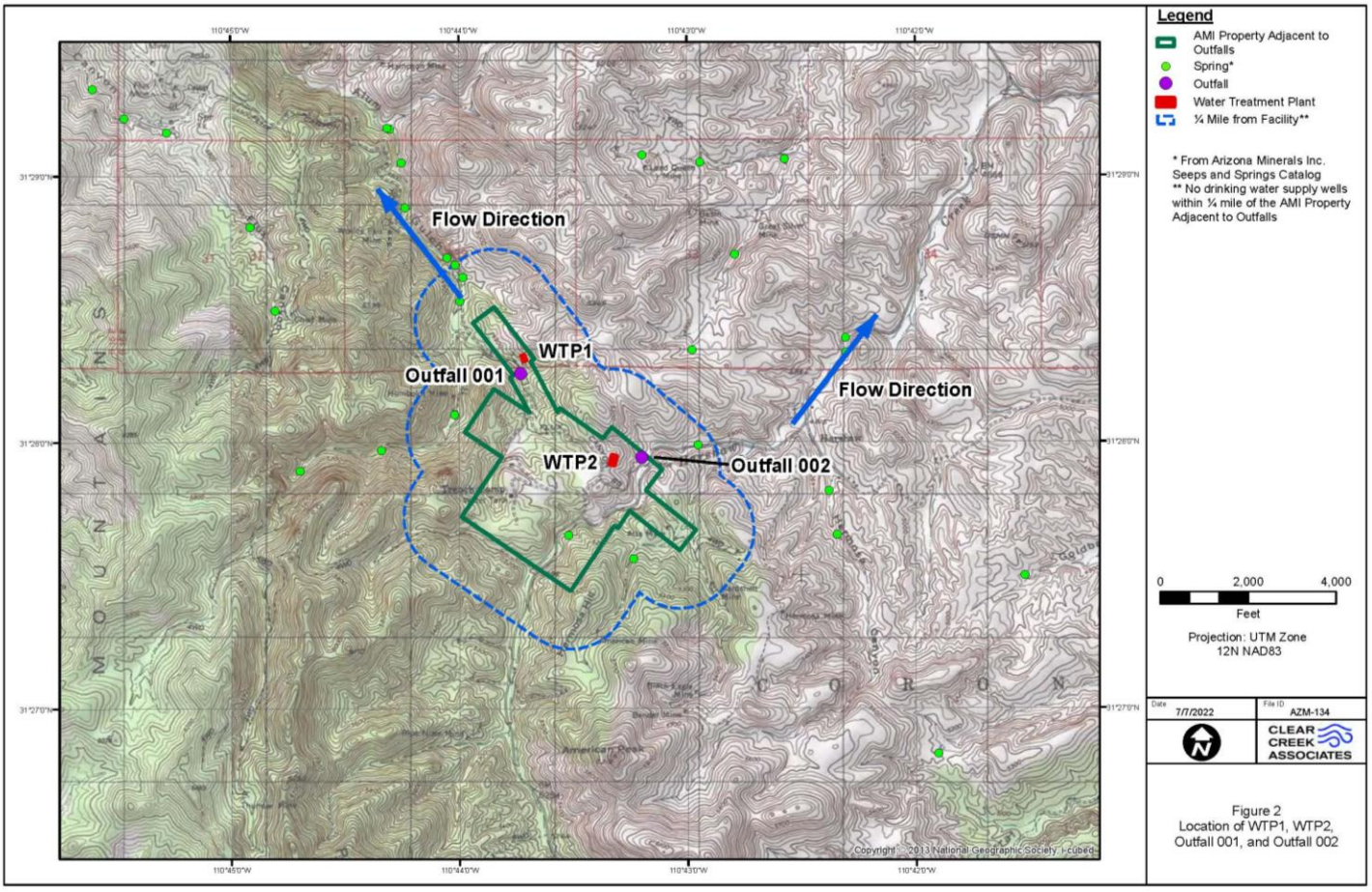
1. Lower Harshaw Creek is not impaired, and therefore, there is no new source prohibition for discharges to Lower Harshaw Creek. Upper Harshaw Creek has an EPA-approved TMDL for copper and pH. The discharge from January Mine Hermosa Project will be downstream of the segment covered by the TMDL. (See Receiving Water Section below for more detail.)
2. The WQBELs established in the permit are more stringent than the new source performance standards (see Numeric Water Quality Standards section below).

Therefore, determining if January Mine Hermosa Project is a new or existing source would have no impact on the permit limitations and conditions for discharges to Lower Harshaw Creek.

Lower Harshaw Creek is not included on the Clean Water Act 303(d) list, i.e., it is not impaired. The Draft 2024 Clean Water Act Assessment does not include Lower Harshaw Creek on the 303(d) list. Upper Harshaw Creek is impaired for copper and pH. The discharge from Outfall 002 is downstream of the impairment and the discharge would not impact the water quality of Upper Harshaw Creek. See Receiving Water Section for more information.

Authorized discharges from Outfall 002 to Lower Harshaw Creek include treated mine drainage water, drainage from historic and non-historic dry stack tailings, groundwater, core cutting water, drilling water, and stormwater.

Map of Facility:

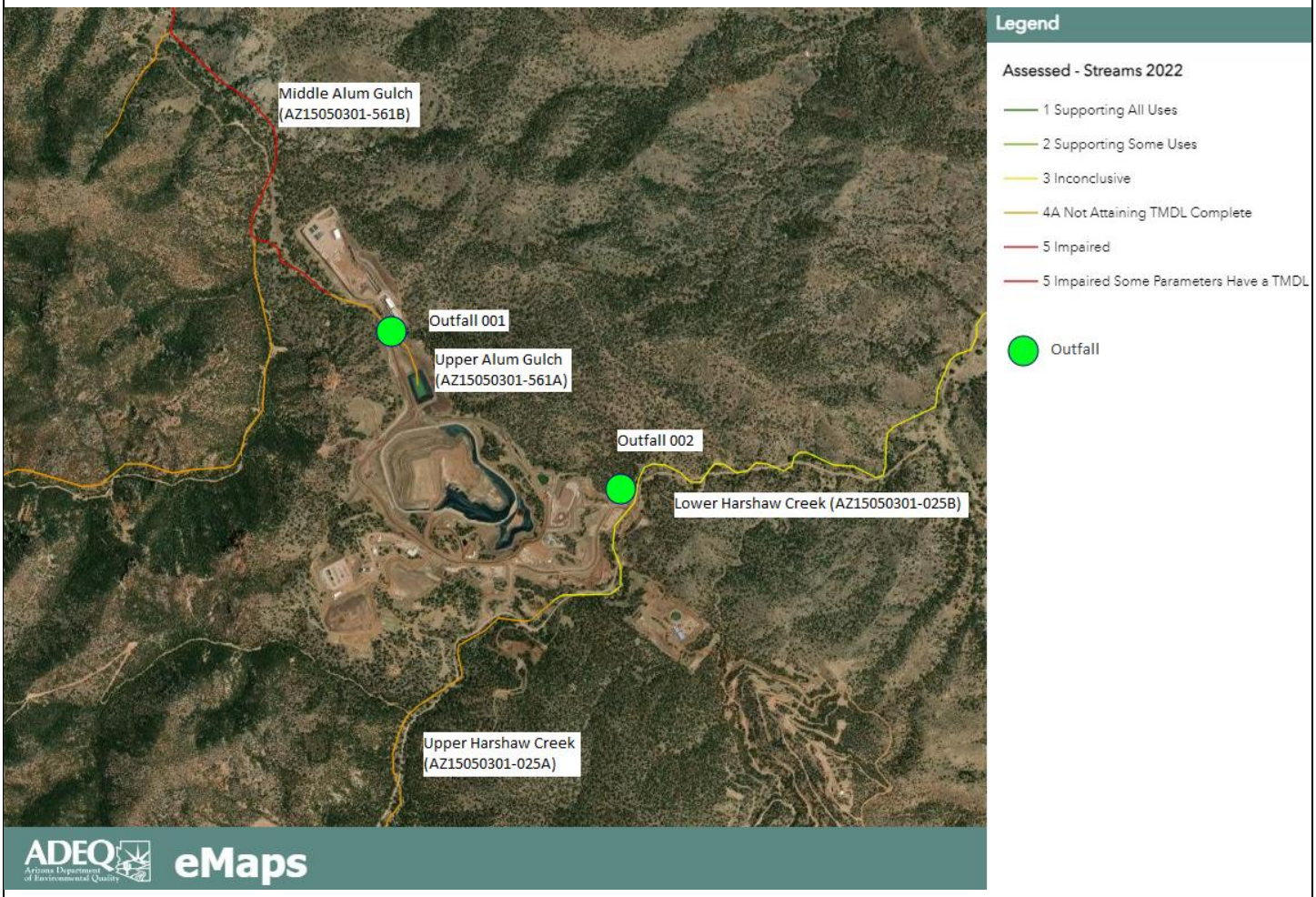


IV. RECEIVING WATER

The State of Arizona has adopted water quality standards to protect the designated uses of its surface waters. Streams have been divided into segments and designated uses assigned to these segments. The water quality standards vary by designated use depending on the level of protection required to maintain that use.

Receiving Water (Federal):	Outfall 001: The Water of the U.S. Protected Surface Water (WOTUS PSW) for the outfall is Upper Alum Gulch. (Waterbody ID: AZ15050301-561A). Upper Alum Gulch is from Headwaters to 31°28'20'' N, 110°43'51'' W. Outfall 002: The Water of the U.S. Protected Surface Water (WOTUS PSW) for the outfall is Lower Harshaw Creek (Waterbody ID: AZ15050301-025B). Lower Harshaw Creek is from 31°27'43.9'' N, 110°43'21.1'' W to Sonoita Creek at 31°32'35.91" N, 110°44'45.12" W. These WOTUS PSWs have designated uses listed in Arizona Administrative Code Title 18, Chapter 11, Article 1, Appendix B, see explanation of designated uses below.

Receiving Water Map



River Basin:	Santa Cruz River Basin
Outfall Location(s):	Outfall 001: Township 23 S, Range 16 E, Section 5 Latitude 31° 28’ 15” N, Longitude 110° 43’ 43” W Outfall 002: Township 23 S, Range 16 E, Section 4 Latitude 31° 27’ 57” N, Longitude 110° 43’ 12” W
Designated uses for Alum Gulch:	Upper Alum Gulch (Outfall 001): • Aquatic and Wildlife ephemeral (A&We) • Partial Body Contact (PBC) • Agricultural Livestock watering (AgL) ADEQ assessed designated uses downstream of the point of discharge to ensure the downstream designated uses are protected as well.

	The segment of Middle Alum Gulch (From 31°28'20''/110°43'51'' to 31°29'17''/110°44'25''; Waterbody ID: AZ15050301-561B) that is 0.17 miles downstream of Outfall 001 has different designated uses than the segment of Upper Alum Gulch where Outfall 001 is located. The downstream designated uses are Aquatic and Wildlife warm water (A&Ww), Full Body Contact (FBC), Fish Consumption (FC), Agricultural Livestock watering (AgL). In 2017, AMI submitted a technical memorandum to define the Pollutant Management Area (PMA) for discharges from WTP1 to Alum Gulch as a part of their Aquifer Protection Permit (APP) application (see Appendix A). The technical memorandum estimated the discharge from WTP1 to Upper Alum Gulch would reach a distance of 1.22 miles downstream. This means the discharge from WTP1 has the potential to reach Middle Alum Gulch, which has different designated uses than Upper Alum Gulch. Therefore, those downstream designated uses for Middle Alum Gulch, which are the most stringent designated uses, are being applied in determining effluent limitations for discharges to Upper Alum Gulch (Outfall 001): • Aquatic and Wildlife warm water (A&Ww) • Full Body Contact (FBC) • Fish Consumption (FC) • Agricultural Livestock watering (AgL)
Designated uses for Lower Harshaw Creek:	Lower Harshaw Creek (Outfall 002): • Aquatic and Wildlife ephemeral (A&We) • Partial Body Contact (PBC) • Agricultural Livestock watering (AgL) ADEQ assessed designated uses downstream of the point of discharge to ensure the downstream designated uses are protected as well. The designated uses of Harshaw Creek are the same for all segments of the creek. Harshaw Creek flows to Upper Sonoita Creek (AZ15050301-013A, Headwaters to the Town of Patagonia WWTP outfall at 31°32'25"/110°45'31"). Upper Sonoita Creek has the same designated uses as Lower Harshaw Creek. Because there is no difference in downstream designated uses, the designated uses of Lower Harshaw Creek are protective of downstream waters. Per A.A.C. R18-11-113(D), the water quality standards that apply to effluent-dependent waters (EDWs) will be applied to derive discharge limitations for any point source discharge of wastewater to an ephemeral water. The AZPDES permit includes discharge limitations and monitoring requirements designed to achieve compliance with A&Wedw standards at Outfall 002. Therefore, the following uses are being applied in determining effluent limitations for discharges to Lower Harshaw Creek (Outfall 002): • Aquatic and Wildlife effluent dependent water (A&Wedw) • Partial Body Contact (PBC) • Agricultural Livestock watering (AgL)

Is the receiving water on the 303(d) list?	The entirety of Alum Gulch was listed as impaired for cadmium, copper, low pH, and zinc. A Total Maximum Daily Load (TMDL) was completed and approved in June 2003. The TMDL considered passive seepage from the January Adit through the previous wetland treatment system to Alum Gulch. This permit applies the waste load allocations (WLAs) of the seepage to the discharge from Outfall 001 when the WLAs are the most stringent limits (see Numeric Water Quality Standards and TMDL sections). Middle Alum Gulch was listed as impaired for lead in 2022. The segment of Lower Harshaw Creek to which South32 discharges is not on the 303(d) list and there are no TMDL issues associated. Upper Harshaw Creek (Waterbody ID: AZ15050301-025A) has a TMDL for copper and pH; this segment is upstream of Outfall 002. ADEQ continues to monitor and assess surface waters across Arizona, including Alum Gulch and Harshaw Creek. The assessment decisions for Alum Gulch and Harshaw Creek are explained in Appendix A to the 2022 Clean Water Act Assessment. The 2024 Clean Water Act Assessment is currently in draft form. The public comment period for the Assessment was from June 28, 2023 through September 11, 2023. There are no new impairments for any segments of Alum Gulch or Harshaw Creek in the draft 2024 Assessment. ADEQ is currently working on finalizing the 2024 Assessment. The 2026 Assessment is currently accepting data and includes data collected from July 1, 2019, to June 30, 2024. Data can be submitted directly to the EPA's water quality portal. See https://www.epa.gov/waterdata/water-quality-data for more information.
Given the uses stated above, the applicable narrative water quality criteria are described in A.A.C. R18-11-108, and the applicable numeric water quality criteria are listed in A.A.C. R18-11-109 and in Appendix A thereof. There are two criteria for the Aquatic and Wildlife uses, acute and chronic. In developing AZPDES permits, the standards for all applicable designated uses are compared and limits that will protect for all applicable designated uses are developed based on the criteria.	

V. DESCRIPTION OF DISCHARGE

No discharges have yet occurred from Outfall 001; therefore, effluent monitoring data are not available for Outfall 001.

One pH measurement is available for Outfall 002:

Parameters	Units	Maximum Daily Discharge Concentration
pH	S.U.	7.1

VI. STATUS OF COMPLIANCE WITH THE EXISTING AZPDES PERMIT

Date of Most Recent Inspection:	09/28/2023. This was a routine inspection for compliance with the AZPDES individual permit. No alleged deficiencies were noted during the course of the inspection. No ADEQ action will result from this inspection.

Discharge Monitoring Reports (DMR) Reviewed:	08/2021 - 08/2023
Notice(s) of Violation (NOV) Issued:	None
NOVs Closed:	N/A
Formal Enforcement Action(s):	None

VII. PROPOSED PERMIT CHANGES

The following table lists the major changes from the previous permit in this permit.

Parameter	Existing Permit	Proposed permit	Reason for change
Noncompliance Reporting Hotline	(602) 771-2330.	Noncompliance resulting in imminent threat to human health or the environment must be reported to (602) 771-2330, while all other noncompliance must be reported to (602) 771-1440.	Routing emergency calls to the emergency hotline, but all other calls to a non-emergency number.
Allowable discharges from Outfall 001	Not applicable.	Per Part I.A.1.b. of the permit, the only allowable discharges from Outfall 001 are drainage water from historic workings associated with January Adit, drainage water from historic tailings, and stormwater. "Historic" is defined in Appendix A. Part B.	ADEQ added the discharge restrictions in Part I.A.1.b. based on the July 7, 2023 letter from South32 (see New Source Considerations section).
Use of Metal Translators to Calculate Total Recoverable Permit Limits from Dissolved Criteria (Applicable to Cadmium, Chromium VI, Copper, Lead, Mercury, Nickel, Silver, and Zinc).	No metal translators were used. Assumed the ratio of dissolved to total recoverable is 1 to 1 for all metals with water quality criteria expressed as dissolved.	WQBELs and ALs were converted from dissolved to total recoverable using the default metal translators from the EPA's *The Metals Translator: Guidance for Calculating A Total Recoverable Permit Limit from A Dissolved Criterion.*	New procedure for ADEQ to incorporate default metal translators when calculating total recoverable WQBELs and ALs from dissolved criteria.

Effluent Limitations	Separate acute and chronic limits based on duration of discharge for Outfall 001. Limits set regardless of duration of discharge for Outfall 002.	Limits set regardless of duration of discharge from Outfalls 001 and 002.	Permit limits were developed for acute-only criteria pursuant to A.A.C. R18-11-113(E) for discharges from Outfall 001 that were short-term and infrequent. This provision of the A.A.C. is only applicable to A&Wedw standards. The A&Ww, FBC, FC and AgL designated uses assigned to Middle Alum Gulch, which is shortly downstream of Outfall 001, are used to develop permit effluent limits for discharges from Outfall 001. Therefore, ADEQ has chosen to apply both acute and chronic criteria to all discharges from Outfall 001, regardless of duration or frequency in this permit renewal. Limits from Outfall 002 continue to consider both acute and chronic criteria.
Sample type for Chromium VI and Cyanide	8-hour composite.	Discrete.	Parameters are not conducive to composite sampling.
Sampling frequency for Cadmium, Copper, Hardness, Lead, Mercury, Total suspended solids (TSS), and Zinc.	1x/Quarter	1x/Month	Re-assessment of monitoring frequency based on the type of facility, the design capacity, and the type of pollutants being monitored. ADEQ believes monthly sampling for parameters in Tables 1.a. and 1.b. will provide sufficient data to ensure discharge meets surface water quality standards.
Mass-based Limitations	Concentration-based limitations only.	Concentration-based and mass-based limitations.	Mass limits have been added to the permit to ensure protection of the receiving waters. See Technology-based Effluent Limitations, Numeric Water Quality Standards, and TMDL sections below.

Mercury and Lead	For Outfall 001, limits were based on TBELs (technology-based effluent limitations which are derived from effluent limitation guidelines). For Outfall 002, limits were based on WQBELs.	Limits for Outfall 001 and Outfall 002 are both based on WQBELs.	WQBELs were calculated for all parameters with effluent limitation guidelines (ELGs). The WQBELs were compared with the TBELs, then the more stringent was applied. See Numeric Water Quality Standards section below for information. This change is consistent with the 2021 permit modification which incorporated WQBELs into the discharge limitations for Outfall 002.
Assessment Levels (ALs)	Expressed as a single concentration value.	Expressed as a monthly average and daily maximum.	Assessment Levels are calculated using the same method as WQBELs and are expressed as monthly and daily values.
Discharge Characterization Testing	Not required.	Required.	In the event the facility does not discharge during the life of the permit, DC sampling will provide data for ADEQ to analyze potential impacts from the discharges to applicable surface water quality standards.
Notification Requirement for First Discharge from Outfall 001	Not included.	Required by Part IV.C of permit.	ADEQ will be made aware if discharge to Upper Alum Gulch begins occurring.
Waters of the United States (WOTUS)	Not defined.	Definition included in Appendix A. Part B.	Definition added for clarity.

Anti-backsliding considerations — "Anti-backsliding" refers to statutory (Section 402(o) of the Clean Water Act) and regulatory (40 CFR 122.44(l)) requirements that prohibit the renewal, reissuance, or modification of an existing NPDES permit that contains effluent limits, permit conditions, or standards that are less stringent than those established in the previous permit. The rules and statutes do identify exceptions to these circumstances where backsliding is acceptable. This permit has been reviewed and drafted with consideration of anti-backsliding concerns.

No limits have been removed from the permit. Limits are retained in the permit for parameters where reasonable potential (RP) for an exceedance of a standard continues to exist or is indeterminate. In these cases, limits will be recalculated using the most current Arizona Water Quality Standards (WQS). If less stringent limits result due to a change in the WQS then backsliding is allowed in accordance with 303(d)(4) if the new limits are consistent with antidegradation requirements and the receiving water is in attainment of the new standard; see Section XII for information regarding antidegradation requirements.

No limits are less stringent due to a change in the WQS in this permit.

The following limits are less stringent due to the use of default metal translators for dissolved metals:

- Outfall 001: copper.

- Outfall 002: cadmium, copper, lead, and zinc.

This is considered allowable backsliding in accordance with 303(d)(4). Lower Harshaw Creek (Outfall 002) is in attainment of the WQS for these parameters and the new limits are consistent with antidegradation requirements. While Alum Gulch is not in attainment of the WQS for these parameters, the new limits fulfill the requirements of the TMDL. Therefore, the cumulative effects of the new permit limits and the TMDL assures the attainment of the WQS. See Antidegradation Section below for more information.

Changes to Initial Version of Fact Sheet, Permit, and Response to Comments

This permit was initially granted on March 9, 2023; at that time, ADEQ's understanding was that the *San Carlos Apache Tribe v. State of Arizona* decision was not precedential. ADEQ's understanding changed after the permit was issued, and ADEQ determined the *San Carlos* decision is precedential. Accordingly, ADEQ withdrew the decision to grant this permit on June 6, 2023 to update the permit, fact sheet, and response to comments to consider the *San Carlos* decision. The permit application continued to be processed under its original licensing time-frame per A.A.C R18-1. A summary of the key updates from the March 9, 2023 versions of the fact sheet, permit, and response to comments appears below.

On June 27, 2024, the Arizona Supreme Court issued its opinion in *San Carlos Apache Tribe v. State of Arizona* case, vacating the Court of Appeals' new source and TMDL analyses. . Following the decision, ADEQ updated the fact sheet, permit and response to comments to reflect the Arizona Supreme Court ruling. Fact Sheet:

- More details added throughout the fact sheet including but not limited to the following sections:
  - Voluntary Remediation Program
  - Facility Background and Nature of Facility Discharge
  - New Source Considerations
  - Receiving Water
  - Numeric Water Quality Standards
  - TMDL
  - Antidegradation
  - Public Comment Period
  - Public Hearing
- A consideration of the effects of the *San Carlos Apache Tribe v. State of Arizona* decision on this permit, which was updated on July 2, 2024 to reflect the Arizona Supreme Court ruling.
- Effluent hardness data was provided for Outfall 001 and explained in the fact sheet.
- Minor edits to correct typos, provide clarity, etc.

Permit:

- More detail regarding allowable discharges added to cover page and Part I.A.
- Mass-based limits have been added for both Outfall 001 and 002.
- Notification Requirement for First Discharge from Outfall 001 (Part IV.C.)
- Definition of "historic" added to Appendix A. Part B: Definitions.
- Update to WOTUS definition in Appendix A. Part B: Definitions
- Minor edits to correct typos, provide clarity, etc.

VIII. DETERMINATION OF EFFLUENT LIMITATIONS and ASSESSMENT LEVELS

When determining what parameters need monitoring and/or limits included in the permit, both technology-based limits and water quality-based limits were compared and the more stringent limits applied.

Technology-based Limitations: As outlined in 40 CFR Part 440:

The regulations found at 40 CFR Part 440, Subpart J require that mines that produce copper, lead, zinc, gold, silver, or molybdenum bearing ores, or any combination of these ores from open-pit or underground operations achieve specified treatment standards for Total Suspended Solids (TSS), pH, cadmium, copper, lead, mercury, and zinc based on the type of treatment technology available.

40 CFR 440.103(a) and 440.102(a) establishes discharge limitations applicable to mine drainage for the best available technology economically achievable (BAT) and the best practicable control technology currently available (BPT) for existing sources. 40 CFR 440.104(a) established the discharge limitations applicable to mine drainage for the best available demonstrated technology (BADT) for new source performance standards (NSPS). The NSPS limitations are the same as the combined BPT and BAT limitations. Therefore, the same technology-based effluent limitations apply regardless of whether the discharge is a new source or existing source:

Parameter	Maximum for any 1 day	Average of daily values for 30 consecutive days
Copper	0.30 mg/L	0.15 mg/L
Zinc	1.5 mg/L	0.75 mg/L
Lead	0.6 mg/L	0.3 mg/L
Mercury	0.002 mg/L	0.001 mg/L
Cadmium	0.10 mg/L	0.05 mg/L
Total Suspended Solids (TSS)	30.0 mg/L	20.0 mg/L
pH	Within the range of 6.0 to 9.0	Within the range of 6.0 to 9.0

There are no other applicable technology-based effluent limitations for Outfall 001 and Outfall 002 beyond the limitations on the discharge of process wastewater as specified in 40 CFR 440.102(c), 40 CFR 440.102(d), 40 CFR 440.103(c), and 40 CFR 440.103(d). All of the parameters listed above will be limited by a water quality-based effluent limitation or a wasteload allocation from a TMDL (described below) as these limitations are more stringent than the technology-based limitations.

Numeric Water Quality Standards: As outlined in A.A.C. R18-11-109 and Appendix A:

Per 40 CFR 122.44(d)(1)(ii), (iii) and (iv), discharge limits must be included in the permit for parameters with "reasonable potential" (RP), that is, those known to be or expected to be present in the effluent at a level that could potentially cause any applicable numeric water quality standard to be exceeded. RP refers to an analysis, based on the statistical calculations using the data submitted or consideration of other factors, to determine whether the discharge may exceed the Water Quality Standards. The procedures used to determine RP are outlined in the *Technical Support Document for Water Quality-based Toxics Control (TSD)* (EPA/505/2-90-001). In most cases, the highest reported value for a parameter is multiplied by a factor (determined from the variability of the data and number of samples) to determine a "highest estimated value". This value is then compared to the lowest applicable Water Quality Standard for the receiving water. If the value is greater than the standard, RP exists and a water quality-based effluent limitation (WQBEL) is required in the permit for that parameter. RP may also be determined from BPJ based on knowledge of the treatment facilities and other factors. The basis for the RP determination for each parameter with a WQBEL is shown in the table below.

No discharges occurred from either Outfall 001 or Outfall 002 at the time of the permit application submittal. Discharge data for pH and flow are available for Outfall 002 from August 2023. Therefore, since limited effluent (discharge) data are available, the Permittee has characterized the influent and treatment processes at WTP1 and WTP2 to show that numeric water quality standards will be met. The water quality for effluent from WTP1 and WTP2 are characterized by examination of the influent to each WTP, the performance of similar treatment plants, and the

results of treatability studies for WTP1 and WTP2. Assessment levels have been set for some parameters due to the absence of data. See Assessment Levels Section below.

As explained in the Technology-Based Limitations section above, there are effluent limitation guidelines for cadmium, copper, lead, mercury, and zinc. EPA's NPDES Permit Writer's Manual, Section 6.2.2.1 states, “A permit writer can determine whether the TBELs are sufficiently protective by either proceeding to calculate WQBELs as described in section 6.4 below and comparing them to the TBELs or by assuming that the maximum daily TBEL calculated is the maximum discharge concentration in the water quality assessments described in section 6.3 below." WQBELs were calculated for these parameters and compared to the effluent limitation guidelines. For both Outfall 001 and Outfall 002, the WQBELs were more stringent than the effluent limitation guidelines. For Outfall 001, the mass limits from the WQBELs were also compared to the mass-based WLAs from the Alum Gulch TMDL and the most stringent mass limits were included in the permit (see TMDL Section below).

RP could not be calculated for potential pollutants that are subject to numeric water quality standards because there is not yet discharge data available. Instead of WQBELs, assessment levels (ALs) were established for Trace Substances (Table 2.a and 2.b in the permit). ALs and relatively frequent monitoring are necessary for these parameters because they are commonly present in effluents at variable concentrations and at a level that could exceed the applicable water quality criteria for them. (See discussion under “Assessment Levels” below for further details.) For a number of other pollutants, Discharge Characterization (DC) monitoring is required at a lesser frequency and without established ALs or numeric limits (Table 4. in the permit). (See discussion under “Discharge Characterization” below for further details.)

The proposed permit limits were established using a methodology developed by EPA. Long Term Averages (LTA) were calculated for each designated use and the lowest LTA was used to calculate the average monthly limit (AML) and maximum daily limit (MDL) necessary to protect all uses. This methodology takes into account criteria, effluent variability, and the number of observations taken to determine compliance with the limit and is described in Chapter 5 of the TSD. Limits based on A&W criteria were developed using the “two-value steady state wasteload allocation” described on page 99 of the TSD. When the limit is based on human health criteria, the monthly average was set at the level of the applicable standard and a daily maximum limit was determined as specified in Section 5.4.4 of the TSD.

TMDL:

The 2003 Alum Gulch TMDL established chronic waste load allocations (WLAs) for cadmium, copper, zinc, and pH for the January Adit at a baseflow discharge of 0.04 cfs (only passive seepage from January Adit was considered during development of the 2003 TMDL). The WLAs appear in the table below next to the maximum daily mass limitation from the WQBEL calculations described above:

Parameter	Waste Load Allocation (g/day)	Maximum daily mass WQBEL (g/day)
Cadmium (total)	3.9	7.8
Copper (total)	11	33
Zinc (total)	2,000	252
H+ (pH)	0.000025	n/a

For cadmium and copper, the WLA is more stringent than the WQBEL. The WLA is set as the maximum daily mass limit for cadmium and copper in the permit. For zinc, the WQBEL is more stringent than the WLA. The mass limits in the permit for zinc are WQBELs. In addition to mass limits, the permit includes WQBELs for the concentration limits for all the above parameters.

The pH value is calculated from the WLA as follows:

$$pH = -\log[H+]$$

Where H+ is the concentration in moles. Since the atomic weight of hydrogen is one, 1 mole equates very closely to 1 mg/L. Using the WLA in mg/L (0.000000038 mg/L H+), the resulting pH is 7.4. Unlike other parameters where more stringent is inherently more protective, pH requirements should be evaluated based on environmental impact. Requiring a slightly basic discharge may be harmful to the ecosystem of Alum Gulch. The pH measurement from 00PATW-17, considered a natural background site, was 5.8 S.U., suggesting the pH of Alum Gulch may be naturally low. Therefore, the WQBEL for pH (6.5-9.0 S.U.) remains in the permit and ensures the discharge for WTP1 meets WQS.

Mixing Zone

The limits in this permit were determined without the use of a mixing zone. Arizona state water quality rules require that water quality standards be achieved without mixing zones unless the permittee applies for and is approved for a mixing zone. Since a mixing zone was not applied for or granted, all water quality criteria are applied at end-of-pipe.

Assessment Levels (ALs)

ALs are listed in Part I.B of the permit. An AL differs from a discharge limit in that an exceedance of an AL is not a permit violation. Instead, ALs serve as triggers, alerting the permitting authority when there is cause for re-evaluation of RP for exceeding a water quality standard, which may result in new permit limitations. The AL numeric values also serve to advise the permittee of the analytical sensitivity needed for meaningful data collection. Trace substance monitoring is required when there is uncertain RP (based on non-detect values or limited datasets) or a need to collect additional data or monitor treatment efficacy on some minimal basis. A reopener clause is included in the permit should future monitoring data indicate water quality standards are being exceeded.

The requirement to monitor for these parameters is included in the permit according to A.A.C. R18-11-104(C) and Appendix A. ALs listed for each parameter were calculated in the same manner that a limit would have been calculated (see Numeric Water Quality Standards Section above).

Hardness

The permittee is required to sample hardness as $CaCO_3$ at the same time the trace metals are sampled because the water quality standards for some metals are calculated using the water hardness values.

South32 provided effluent hardness data for WTP1 on July 18, 2023. The effluent hardness ranged from 743 mg/L to 1040 mg/L. Therefore, a hardness value of 400 mg/L (the maximum allowable hardness value that can be used to

calculate standards, per Title 18, Chapter 11, Article 1, Appendix B, footnote d(ii)) was used to calculate the applicable water quality standards and any assessment levels or limits for the hardness dependent metals (cadmium, copper, lead, nickel, silver and zinc) for Outfall 001 (Upper Alum Gulch).

No hardness data is available yet for WTP2. The hardness of the influent that will be treated by WTP2 was estimated by South32 to range from 258-340 mg/L. Therefore, a hardness value of 258 mg/L (the lower range of the estimated WTP2 influent hardness) was used to calculate the applicable water quality standards and any assessment levels or limits for the hardness dependent metals (cadmium, copper, lead, nickel, silver and zinc) for Outfall 002 (Lower Harshaw Creek). The designers of WTP2 verified that the treatment process at WTP2 will cause no significant change to the hardness of the water being treated.

Whole Effluent Toxicity (WET)

WET testing is required in the permit (Parts I.C and III) to evaluate the discharge according to the narrative toxic standard in A.A.C. R18-11-108(A)(5), as well as whether the discharge has RP for WET per 40 CFR 122.44(d)(iv).

WET testing for chronic and/or acute toxicity is required. The requirement to conduct chronic toxicity testing is contingent upon the frequency or duration of discharges. Since completion of the chronic WET test requires a minimum of three samples be taken for renewals, the chronic WET test is not required during any given monitoring period in which the discharge does not occur over seven consecutive calendar days and is not repeated more frequently than every thirty days.

WET testing for toxicity shall be conducted using the following three surrogate species:

- *Ceriodaphnia dubia* (water flea) – for evaluating toxicity to invertebrates
- *Pimephales promelas* (fathead minnow) – for evaluating toxicity to vertebrates
- *Pseudokirchneriella subcapitata* (formerly known as *Selenastrum capricornutum or Raphidocelis subcapitata)* (a green algae) – for evaluating toxicity to plant life

ADEQ does not have a numeric standard for Whole Effluent Toxicity. However, ADEQ adopted the EPA recommended chronic toxicity benchmark of 1.0 Toxic Unit-Chronic (TUc) for a four-day exposure period. Using this benchmark, the limitations and/or action levels for WET included in the permit were calculated in accordance with the methods specified in the *TSD*. The species chosen for WET testing are as recommended in the *TSD* and in *Regions 9 & 10 Guidance for Implementing Whole Effluent Toxicity Testing Programs*.

An exceedance of a limit or action level will trigger follow-up testing to determine if effluent toxicity is persistent. If toxicity above a limit or action level is found in a follow-up test, the permittee will be required to conduct a Toxicity Reduction Evaluation (TRE) and possibly a Toxicity Identification Evaluation (TIE) to identify the source of toxicity and reduce toxicity. These conditions are required to ensure that toxicants are not discharged in amounts that are toxic to organisms [A.A.C. R18-11-108(A)(5)]. A reopener clause is included in accordance with 40 CFR Parts 122 and 124 and AAC R18-9-B906.

The permit requires 8-hour composite samples be collected for WET testing. An 8-hour composite sample type was chosen over the suggested 24-hour composite for WET testing in order to have consistency with the type of sample required for other parameters requiring monitoring in this permit. WET sampling must coincide with testing for all the parameters in Parts I.A and B of the permit, when testing of those parameters is required, to aid in the determination of the cause of toxicity if toxicity is detected. Additional procedural requirements for the WET test are included in the proposed permit.

The required WET monitoring frequency for this facility is consistent with the WET testing frequency required for facilities with a similar design flow. The permit requires WET test results to be reported on discharge monitoring reports and submittal of the full WET lab report to ADEQ.

Discharge characterization (DC)

In addition to monitoring for parameters assigned either a limit or an AL, sampling is required to assess the presence of pollutants in the effluent at certain minimum frequencies for additional suites of parameters, whether the facility is discharging or not. This monitoring is specified in Table 4. Discharge Characterization Testing—General Chemistry, Selected Metals, Trace Substances, and WET.

NOTE: Some parameters listed in Table 4. are also listed in Tables 1.a., 1.b., 2.a., or 2.b. In this case, the data from monitoring under Tables 1.a., 1.b., 2.a., or 2.b. may be used to satisfy the requirements of Table 4., provided the specified sample types are the same. In the event the facility does not discharge to a Protected Surface Water during the life of the permit, DC monitoring of representative samples of the effluent is still required.

The purpose of DC monitoring is to characterize the effluent and determine if the parameters of concern are present in the discharge and at what levels. This monitoring will be used to assess RP per 40 CFR 122.44(d)(1)(iii)). DC monitoring is required in accordance with 40 CFR 122.43(a), 40 CFR 122.44(i), and 40 CFR 122.48(b) as well as A.R.S. §49-203(A)(7). If pollutants are noted at levels of concern during the permit term, this permit may also be reopened to add related limits or conditions.

Permit Limitations and Monitoring Requirements

Tables 1 and 2 of the fact sheet summarize the parameters that are limited in the permit and the rationale for that decision. Also included are the parameters that require monitoring without any limitations or that have not been included in the permit at all and the basis for those decisions. The corresponding monitoring requirements are shown for each parameter. In general, the regulatory basis for monitoring requirements is per 40 CFR §122.44(i) *Monitoring requirements,* and 40 CFR §122.48(b), *Required monitoring*; all of which have been adopted by reference in A.A.C. R18-9-A905, *AZPDES Program Standards*.

Table 1. Permit limitations and monitoring requirements for Outfall 001 (Upper Alum Gulch).

Parameter	Lowest Standard/Designated Use	Maximum Daily Value	No. of Samples	Estimated Maximum Value	RP Determination	Proposed Monitoring Requirement/Rationale (1)
Flow	- - -	- - -	- - -	- - -	- - -	Discharge flow is to be monitored on a continual basis using a flow meter.
pH (2)	Minimum: 6.5 Maximum: 9.0 A&Ww and FBC A.A.C. R18-11-109(B) Minimum: 6.0 Maximum: 9.0 Technology-based limits 40 CFR 440.102	No Data	0	N/A	WQBEL or TBEL is always applicable.	pH is to be monitored using a discrete sample of the effluent and a WQBEL is set. 40 CFR Part 136 specifies that grab samples must be collected for pH. At least one sample must coincide with WET testing to aid in the determination of the cause of toxicity if toxicity is detected.
Temperature	R18-11-109C the discharge shall not cause an increase in the ambient water temperature. A&Ww: no more than 3.0°C	No Data	0	N/A	N/A	Discharge temperature is to be monitored for discharge characterization by discrete sample. 40 CFR Part 136 specifies that discrete samples must be collected for temperature. Temperature sampling must also coincide with ammonia sampling when required.
Total Suspended Solids (TSS)	Monthly Average: 20 mg/L Daily Maximum: 30 mg/L Technology-based limits 40 CFR 440.102	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required and a TBEL remains in the permit.
Antimony	30 µg/L A&Ww chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Arsenic	30 µg/L FBC	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Barium	98,000 µg/L FBC	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Beryllium	5.3 µg/L A&Ww chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Boron	186,667 µg/L FBC	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.

Table 1. Permit limitations and monitoring requirements for Outfall 001 (Upper Alum Gulch).

Parameter	Lowest Standard/Designated Use	Maximum Daily Value	No. of Samples	Estimated Maximum Value	RP Determination	Proposed Monitoring Requirement/Rationale (1)
Cadmium (2)	6.2 µg/L A&Ww chronic 0.0039 kg/day (6.0 µg/L) WLA assigned in 2003 Alum Gulch TMDL 0.05 mg/L 30-day average 0.10 mg/L daily maximum Technology-based limits 40 CFR 440.103(a)	No Data	0	N/A	N/A	Monitoring with limits required. The mass limit is the 2003 Alum Gulch TMDL WLA.
Chromium (Total)	1000 µg/L AgL	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Chromium VI	11 µg/L A&Ww chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Copper (2)	29 µg/L A&Ww chronic 0.011 kg/day (32 µg/L) WLA assigned in 2003 Alum Gulch TMDL 0.15 mg/L 30-day average 0.30 mg/L daily maximum Technology-based limits 40 CFR 440.103(a)	No Data	0	N/A	N/A	Monitoring with limits is required. The mass limit is the 2003 Alum Gulch TMDL WLA.
Cyanide (as free cyanide)	9.7 µg/L A&Ww chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Hardness	No applicable standard. Hardness is used to determine standards for specific metal parameters.	1,040 mg/L	10	N/A	N/A	The effluent hardness data ranged from 743 mg/L to 1040 mg/L. Therefore, a hardness value of 400 mg/L (the maximum allowable hardness value that can be used to calculate standards, per Title 18, Chapter 11, Article 1, Appendix B, footnote d(ii)) was used to calculate the applicable limits for the hardness dependent metals. Monitoring for hardness is required whenever monitoring for hardness dependent metals is required.

Table 1. Permit limitations and monitoring requirements for Outfall 001 (Upper Alum Gulch).

Parameter	Lowest Standard/Designated Use	Maximum Daily Value	No. of Samples	Estimated Maximum Value	RP Determination	Proposed Monitoring Requirement/Rationale (1)
Hydrogen sulfide	2 µg/L A&Ww chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring is required for sulfides as an indicator parameter for hydrogen sulfide. If sulfides are detected, monitoring for hydrogen sulfide is required for the remainder of the permit term.
Iron	1,000 ug/L A&Ww chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Lead (2)	10.94 µg/L A&Ww chronic 0.3 mg/L 30-day average 0.6 mg/L daily maximum Technology-based limits 40 CFR 440.103(a)	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required and a WQBEL is set.
Mercury	0.01 µg/L A&Ww chronic 0.001 mg/L 30-day average 0.002 mg/L daily maximum Technology-based limits 40 CFR 440.103(a)	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required and a WQBEL is set.
Nickel (2)	168 µg/L A&Ww chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Selenium	2 µg/L A&Ww chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Silver (2)	35 µg/L A&Ww acute	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Sulfides	No applicable standard	No Data	0	N/A	N/A	Indicator parameter for hydrogen sulfide. Monitoring for discharge characterization required. If sulfides are detected, monitoring for hydrogen sulfide is required for the remainder of the permit term.
Thallium	7.2 µg/L FC	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.

Table 1. Permit limitations and monitoring requirements for Outfall 001 (Upper Alum Gulch).

Parameter	Lowest Standard/Designated Use		Maximum Daily Value	No. of Samples	Estimated Maximum Value	RP Determination	Proposed Monitoring Requirement/Rationale (1)
Zinc (2)	379 µg/L A&Ww acute and chronic 2 kg/day (3,000 µg/L) WLA assigned in 2003 Alum Gulch TMDL 0.75 mg/L 30-day average 1.5 mg/L daily maximum Technology-based limits 40 CFR 440.103(a)		No Data	0	N/A	N/A	Monitoring with limits is required. The WQBEL mass limits are more stringent than the 2003 Alum Gulch TMDL WLA.
Whole Effluent Toxicity (WET)	No toxicity (A.A.C. R18-11-108(A) (6)	Pseudo-kirchneriella subcapitata (3)	No Data	0	RP Indeterminate (No Data)	RP Indeterminate (No Data) (4)	Monitoring required and an action level is set.
		Pimephales promelas	No Data	0	N/A	RP Indeterminate (No Data) (4)	Monitoring required and an action level is set.
		Ceriodaphnia dubia	No Data	0	N/A	RP Indeterminate (No Data) (4)	Monitoring required and an action level is set.

Footnotes:

1. The monitoring frequencies are as specified in the permit.
2 Hardness-dependent metal - the standard is for this parameter is based on the average hardness value of the effluent or receiving water as indicated above.
3 Formerly known as *Selenastrum capricornutum or Raphidocelis subcapitata.*
4 Monitoring with ALs or Action Levels always required for these parameters unless RP exists and limits are set.

Table 2. Permit limitations and monitoring requirements for Outfall 002 (Lower Harshaw Creek).

Parameter	Lowest Standard/Designated Use	Maximum Daily Value	No. of Samples	Estimated Maximum Value	RP Determination	Proposed Monitoring Requirement/Rationale (1)
Flow	- - -	- - -	- - -	- - -	- - -	Discharge flow is to be monitored on a continual basis using a flow meter.
pH (2)	Minimum: 6.5 Maximum: 9.0 A&Ww and PBC A.A.C. R18-11-109(B) Minimum: 6.0 Maximum: 9.0 Technology-based limits 40 CFR 440.102	7.1	1	N/A	WQBEL or TBEL is always applicable.	pH is to be monitored using a discrete sample of the effluent and a WQBEL is set. 40 CFR Part 136 specifies that grab samples must be collected for pH. At least one sample must coincide with WET testing to aid in the determination of the cause of toxicity if toxicity is detected. pH sampling must also coincide with ammonia sampling when required.
Temperature	R18-11-109C the discharge shall not cause an increase in the ambient water temperature. A&Wedw: no more than 3.0°C	No Data	0	N/A	N/A	Discharge temperature is to be monitored for discharge characterization by discrete sample. 40 CFR Part 136 specifies that discrete samples must be collected for temperature. Temperature sampling must also coincide with ammonia sampling when required.
Total Suspended Solids (TSS)	Monthly Average: 20 mg/L Daily Maximum: 30 mg/L Technology-based limits 40 CFR 440.102	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required and a TBEL remains in the permit.
Antimony	600 µg/L A&Wedw chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Arsenic	150 µg/L A&Wedw chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Barium	98,000 µg/L PBC	No Data	0	N/A	RP Indeterminate	Monitoring required at an assessment level and for discharge characterization.
Beryllium	5.3 µg/L A&Wedw chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Boron	186,667 µg/L PBC	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.

Table 2. Permit limitations and monitoring requirements for Outfall 002 (Lower Harshaw Creek).

Parameter	Lowest Standard/Designated Use	Maximum Daily Value	No. of Samples	Estimated Maximum Value	RP Determination	Proposed Monitoring Requirement/Rationale (1)
Cadmium (2)	4.5 µg/L A&Wedw chronic 0.05 mg/L 30-day average 0.10 mg/L daily maximum Technology-based limits 40 CFR 440.103(a)	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required and a WQBEL remains in the permit.
Chromium (Total)	1,000 µg/L AgL	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Chromium VI	11 µg/L A&Wedw chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Copper (2)	20 µg/L A&Wedw chronic 0.15 mg/L 30-day average 0.30 mg/L daily maximum Technology-based limits 40 CFR 440.103(a)	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required and a WQBEL remains in the permit.
Cyanide (as free cyanide)	9.7 µg/L A&Wedw chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Hardness	No applicable standard. Hardness is used to determine standards for specific metal parameters.	No Data	0	N/A	N/A	A&W standards for cadmium, chromium III, copper, lead, nickel, silver and zinc used for RP determinations were based on t the lower range of estimated WTP2 influent hardness of 258 mg/L as $CaCO_3$. Monitoring for hardness is required whenever monitoring for hardness dependent metals is required.
Hydrogen sulfide	2 µg/L A&Wedw chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring is required for sulfides as an indicator parameter for hydrogen sulfide. If sulfides are detected, monitoring for hydrogen sulfide is required for the remainder of the permit term.
Iron	1,000 ug/L A&Wedw chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.

Table 2. Permit limitations and monitoring requirements for Outfall 002 (Lower Harshaw Creek).

Parameter	Lowest Standard/Designated Use	Maximum Daily Value	No. of Samples	Estimated Maximum Value	RP Determination	Proposed Monitoring Requirement/Rationale (1)
Lead (2)	6.94 µg/L A&Wedw chronic 0.3 mg/L 30-day average 0.6 mg/L daily maximum Technology-based limits 40 CFR 440.103(a)	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required and a WQBEL remains in the permit.
Mercury	0.01 µg/L A&Wedw chronic 0.001 mg/L 30-day average 0.002 mg/L daily maximum Technology-based limits 40 CFR 440.103(a)	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required and a WQBEL remains in the permit.
Nickel (2)	116 µg/L A&Wedw chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Selenium	2 µg/L A&Wedw chronic	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Silver (2)	16 µg/L A&Wedw acute	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Sulfides	No applicable standard	No Data	0	N/A	N/A	Indicator parameter for hydrogen sulfide. Monitoring required. If sulfides are detected, monitoring for hydrogen sulfide is required for the remainder of the permit term.
Thallium	75 µg/L PBC	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required at an assessment level and for discharge characterization.
Zinc (2)	262 µg/L A&Wedw acute and chronic 0.75 mg/L 30-day average 1.5 mg/L daily maximum Technology-based limits 40 CFR 440.103(a)	No Data	0	N/A	RP Indeterminate (No Data)	Monitoring required and a WQBEL remains in the permit.

Table 2. Permit limitations and monitoring requirements for Outfall 002 (Lower Harshaw Creek).

Parameter	Lowest Standard/Designated Use		Maximum Daily Value	No. of Samples	Estimated Maximum Value	RP Determination	Proposed Monitoring Requirement/Rationale (1)
Whole Effluent Toxicity (WET)	No toxicity (A.A.C. R18-11-108(A) (6)	*Pseudo-kirchneriella subcapitata (3)*	No Data	0	N/A	RP Indeterminate (No Data) (4)	Monitoring required and an action level is set.
		Pimephales promelas	No Data	0	N/A	RP Indeterminate (No Data) (4)	Monitoring required and an action level is set.
		Ceriodaphnia dubia	No Data	0	N/A	RP Indeterminate (No Data) (4)	Monitoring required and an action level is set.

Footnotes:

1. The monitoring frequencies are as specified in the permit.
2. Hardness-dependent metal - the standard is for this parameter is based on the average hardness value of the effluent or receiving water as indicated above.
3. Formerly known as *Selenastrum capricornutum or Raphidocelis subcapitata.*
4. Monitoring with ALs or Action Levels always required for these parameters unless RP exists and limits are set.

VIII. NARRATIVE WATER QUALITY STANDARDS

All narrative limitations in A.A.C. R18-11-108 that are applicable to the receiving water are included in Part I, Section E of the permit.

IX. MONITORING AND REPORTING REQUIREMENTS (Part II of Permit)

Section 308 of the Clean Water Act and 40 CFR Part 122.44(i) require that monitoring be included in permits to determine compliance with effluent limitations. Additionally, monitoring may be required to gather data for future effluent limitations or to monitor effluent impacts on receiving water quality.

Monitoring frequencies are based on the nature and effect of the pollutant, as well as a determination of the minimum sampling necessary to adequately monitor the facility's performance. Monitoring frequencies for some parameters may be reduced in subsequent permits if all monitoring requirements have been met and the limits or ALs for those parameters have not been exceeded during the first permit term.

For the purposes of this permit, an "8-hour composite" sample has been defined as a flow-proportioned mixture of two or more discrete samples (aliquots) obtained at equal time intervals over an 8-hour period (if only two samples are collected, they should be taken approximately 8 hours apart). The volume of each aliquot shall be directly proportional to the discharge flow rate at the time of sampling.

These criteria for composite sampling are included in order to obtain samples that are representative of the discharge given the potential variability in the duration, frequency and magnitude of discharges from this facility.

Discrete (i.e., grab) samples are specified in the permit for parameters that for varying reasons are not amenable to compositing.

Monitoring locations are specified in the permit (Part I.A and Part II.A) in order to ensure that representative samples of the effluent are consistently obtained.

The requirements in the permit pertaining to Part II, Monitoring and Reporting, are included to ensure that the monitoring data submitted under this permit is accurate in accordance with 40 CFR 122.41(e). The permittee has the responsibility to determine that all data collected for purposes of this permit meet the requirements specified in this permit and is collected, analyzed, and properly reported to ADEQ.

The permit (Part II.A.3) requires the permittee to keep a Quality Assurance (QA) manual at the facility, describing sample collection and analysis processes; the required elements of the QA manual are outlined.

Reporting requirements for monitoring results are detailed in Part II, Section B of the permit, including completion and submittal of Discharge Monitoring Reports (DMRs) and AZPDES Flow Record forms.

The permittee is responsible for conducting all required monitoring and reporting the results to ADEQ on DMRs or as otherwise specified in the permit.

Electronic reporting

The US EPA has published a final regulation that requires electronic reporting and sharing of Clean Water Act National Pollutant Discharge Elimination System (NPDES) program information instead of the current paper-based reporting (Federal Register, Vol. 80, No. 204, October 22, 2015). Beginning December 21, 2016 (one year after the effective date of the regulation), the Federal rule required permittees to make electronic submittals of any monitoring reports and forms called for in their permits. ADEQ has created an online portal called myDEQ that allows users to submit their discharge monitoring reports and other applicable reports required in the permit.

Requirements for retention of monitoring records are detailed in Part II.C.3 of the permit.

XI. SPECIAL CONDITIONS (Part IV in Permit)

Permit Reopener

This permit may be modified based on newly available information; to add conditions or limits to address demonstrated effluent toxicity; to implement any EPA-approved new Arizona water quality standard; or to re-evaluate reasonable potential (RP), if assessment levels in this permit are exceeded [A.A.C. R18-9-B906 and 40 CFR Part 122.62 (a) and (b)].

Translator Study

The permittee may perform a translator study on one or more metals for which effluent limits are established in this permit to demonstrate what portion of metal in the effluent will be present in dissolved form in the receiving water. A translator study measures concurrently the concentration of total and dissolved metal in the same effluent sample. Effluent hardness must also be measured during the study. The permittee must submit a sampling analysis plan to ADEQ for approval prior to collecting samples for the study. The permittee may submit the results of the study to ADEQ and request a permit modification. ADEQ may review the study and may use the study results to modify total recoverable effluent limits for the metal(s) addressed in the translator study through a permit modification. Modifying an effluent limit based on the results of an approved translator study will not be considered anti-backsliding.

Notification Requirement for First Discharge from Outfall 001

1. South32 Hermosa Inc. shall notify ADEQ the first time discharge from Outfall 001 occurs.
2. The notification shall be provided to AZPDES@azdeq.gov.
3. The notification shall provide the date the first discharge occurred.
4. The notification shall be provided to ADEQ within 5 days of the discharge occurring.

XII. ANTIDEGRADATION

Antidegradation rules have been established under A.A.C. R18-11-107 to ensure that existing surface water quality is maintained and protected. Upper Alum Gulch, Middle Alum Gulch, and Lower Harshaw Creek are intermittent waters. Therefore, the discharges from the January Mine Hermosa Project will be to waters which receive Tier 1 antidegradation protection per A.A.C. R18-11-107.01(A). Per A.A.C. R18-11-107.01(A)(3), Tier 1 antidegradation review requirements are satisfied for a point-source discharge regulated under an individual AZPDES permit to an ephemeral water, effluent dependent water, intermittent water, or a canal listed in Appendix B, if water quality-based effluent limitations designed to achieve compliance with applicable surface water quality standards are established in the permit and technology-based requirements of the Clean Water Act for the point source discharge are met.

Effluent quality limitations and monitoring requirements have been established under the proposed permit to ensure that the discharge will meet the applicable water quality standards in the receiving waters. As long as the permittee maintains consistent compliance with these provisions, the designated uses of the receiving water will be presumed protected, and the facility will be deemed to meet currently applicable antidegradation requirements under A.A.C. R18-11-107.

The discharge to Lower Harshaw Creek will be routed through an energy dissipater at Outfall 002 to prevent erosion and scouring in Harshaw Creek. The applicable narrative limitations from A.A.C. R18-11-108 are included in Part I, Section E of the permit to protect both Alum Gulch and Harshaw Creek.

XIII. STANDARD CONDITIONS

Conditions applicable to all NPDES permits in accordance with 40 CFR, Part 122 are attached as an appendix to this permit.

XIV. ADMINISTRATIVE INFORMATION

Public Notice (A.A.C. R18-9-A907)

The public notice is the vehicle for informing all interested parties and members of the general public of the contents of a draft AZPDES permit or other significant action with respect to an AZPDES permit or application. The basic intent of this requirement is to ensure that all interested parties have an opportunity to comment on significant actions of the permitting agency with respect to a permit application or permit. This permit will be public noticed in a local newspaper after a pre-notice review by the applicant and other affected agencies.

Public Comment Period (A.A.C. R18-9-A908)

Rules require that permits be public noticed in a newspaper of general circulation within the area affected by the facility or activity and provide a minimum of 30 calendar days for interested parties to respond in writing to ADEQ. After the closing of the public comment period, ADEQ is required to respond to all significant comments at the time a final permit decision is reached or at the same time a final permit is actually issued.

The public comment period for this permit opened on November 8, 2022 and closed on December 14, 2022. ADEQ subsequently made changes to the permit and fact sheet. An additional public comment period opened on November 28, 2023 and closed on January 12, 2024.

ADEQ received some comment letters outside of the public comment period. ADEQ reached out to the individuals who wrote these comment letters to notify them of the upcoming public notice.

Comments were received during the 30-day public comment period. See the Response to Public Comments document for more detail.

Public Hearing (A.A.C R18-9-A908(B))

A public hearing was held on December 12, 2022. A public hearing was held on January 11, 2024.

EPA Review (A.A.C. R18-9-A908(C)

A copy of this permit and any revisions made to this draft as a result of public comments received will be sent to EPA Region 9 for review. If EPA objects to a provision of the draft, ADEQ will not issue the permit until the objection is resolved.

XV. ADDITIONAL INFORMATION

Additional information relating to this proposed permit may be obtained from:

Arizona Department of Environmental Quality
Water Quality Division – Surface Water Permits Unit
Attn: Rachel Heinz
1110 West Washington Street
Phoenix, Arizona 85007

Or by contacting Rachel Heinz at (602) 771 – 0180 or by e-mail at heinz.rachel@azdeq.gov.

XVI. INFORMATION SOURCES

While developing effluent limitations, monitoring requirements, and special conditions for the permit, the following information sources were used:

1. AZPDES Permit Application Form(s) 1 and 2C received July 11, 2022, along with supporting data, facility diagram, and maps submitted by the applicant with the application forms.
2. Supplemental information to the application received by ADEQ on July 26, 2022, July 7, 2023, and July 18, 2023.
3. ADEQ files on January Mine Hermosa Project.
4. ADEQ Geographic Information System (GIS) Web site.
5. ADEQ site visit to the facility on August 5, 2022.
6. Discharge monitoring reports (DMRs) submitted by South32.
7. Inspection report from routine inspection conducted on September 27, 2023.
8. Total Maximum Daily Load For: Upper Alum Gulch, Sonoita Creek Basin, Santa Cruz River Watershed, Coronado National Forest near Patagonia, Santa Cruz County, Arizona. HUC 15050301-561A. Parameters: Cadmium, Copper, Zinc, and Acidity. June 30, 2003.
9. Arizona Administrative Code (AAC) Title 18, Chapter 11, Article 1, *Water Quality Standards for Surface Waters,* adopted December 31, 2016.
10. A.A.C. Title 18, Chapter 9, Article 9. *Arizona Pollutant Discharge Elimination System* rules.
11. Code of Federal Regulations (CFR) Title 40:

    Part 122, *EPA Administered Permit Programs: The National Pollutant Discharge Elimination System.*

    Part 124, *Procedures for Decision Making*.

    Part 440. *Ore Mining and Dressing Point Source Category*.
12. EPA Technical Support Document for Water Quality-based Toxics Control dated March 1991.
13. *Regions 9 & 10 Guidance for Implementing Whole Effluent Toxicity Testing Programs*, US EPA, May 31, 1996.
14. *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA /821-R-02-013).
15. U.S. EPA NPDES Permit Writers' Manual, September 2010.

16. *The Metals Translator: Guidance For Calculating A Total Recoverable Permit Limit From A Dissolved Criterion,* US EPA, June 1996.

17. Water Treatment Plant Release – Pollutant Management Area Evaluation. Ecological Resource Consultants, Inc., May 18, 2017.

Appendix A.

Ecological Resource Consultants, Inc.
35715 US Hwy. 40, Suite D204 ~ Evergreen, CO ~ 80439 ~ (303) 679-4820

Technical Memorandum

Date: **May 18, 2017**

To: **Johnny Pappas, Arizona Minerals, Inc.**

Cc: **Greg Hess and Alison Jones, Clear Creek Associates**

From: **Troy Thompson**

Re: **Water Treatment Plant Release – Pollutant Management Area Evaluation**

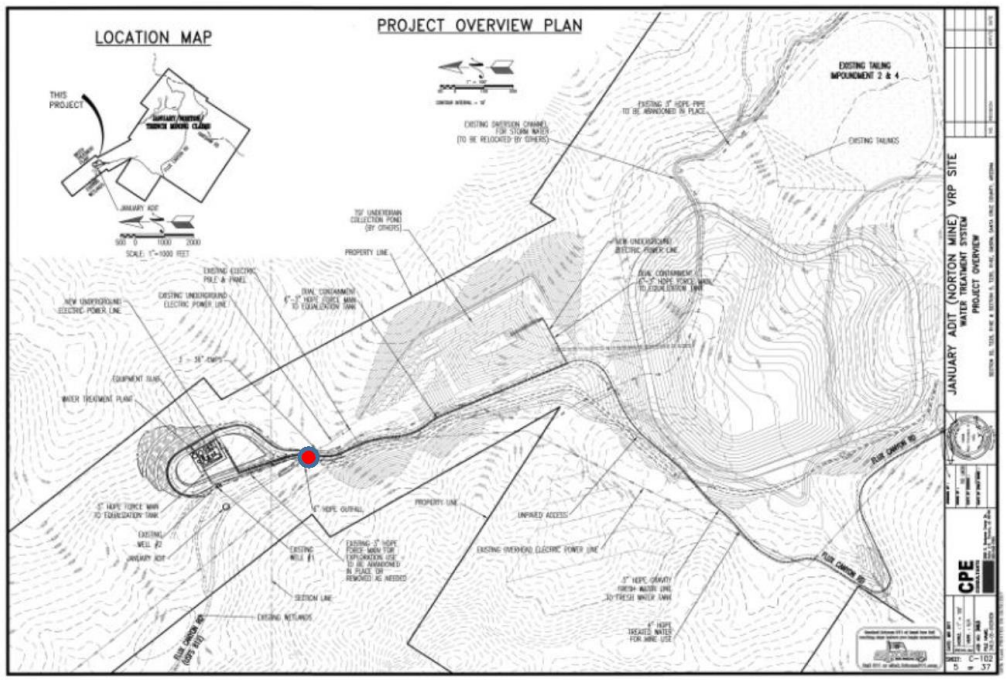
Introduction

As a component of permitting, Arizona Minerals, Inc. (AMI) needed to define the anticipated maximum extent that releases of treated water from its planned water treatment facility to define the Pollutant Management Area (PMA). Ecological Resource Consultants, Inc. (ERC) completed an evaluation to determine the anticipated extent of this zone. The analysis included an evaluation of treatment releases, infiltration capacity of the receiving streambed and hydraulics of the receiving water. Site conditions, assumptions used for the assessment, calculations methods and results are presented herein.

Water Treatment and Releases

A water treatment plant (WTP) will be utilized to treat contact water that is encountered at the mine that cannot be utilized. A water balance was completed to estimate the amount of excess water that would require treatment (ERC 2017). Results of the water balance were used to establish that the WTP will be designed to have a maximum treatment capacity of 120 gallons per minute (gpm). Releases from the WTP are predicted to range from 0 gpm to 120 gpm with an average release rate on the order of 80-90 gpm. Water released from the WTP will meet State surface water standards and numeric Aquifer Water Quality Standards. To define the PMA, the maximum WTP capacity of 120 gpm was used. Treated water will be conveyed from the WTP to the its discharge point along Alum Gulch. **Figure 1** is a general overview plan of the site with the release point identified by the red circle.

Figure 1 – WTP Release Point Location



Alum Gulch Conditions

The upstream portion of Alum Gulch is impaired due to total and dissolved cadmium, copper, zinc as well as acidity (ADEQ 2007). Based on ADEQ's 2007 evaluation Alum Gulch was classified as an intermittent stream from the January Adit downstream for approximately two miles to a point that is approximately 800 meters downstream of the World's Fair Mine. Alum Gulch was classified as ephemeral for areas upstream of the January Adit and from the point 800 meters downstream of the World's Fair Mine to its confluence with Sonoita Creek (ADEQ 2007). The 2007 report states that baseflows in the intermittent reach were evaluated in 2003 and ranged from 0.001 to 3 cubic feet per second (cfs) at various locations along the intermittent reach. The January Adit and the World's Fair Mine are the only observed constant drainages in the Alum Gulch Watershed (ADEQ 2007).

Alum Gulch, from the January Adit downstream to approximately ½ miles below the confluence with Humboldt Canyon, was evaluated by ERC in April of 2017 and was classified as an ephemeral stream. At the time of ERC's evaluation, the stream was dry along its bed with only isolated areas where localized seeps provided a surface expression of water. In all areas where seeps were identified, the area of moist soil was very limited in extent as water was observed to infiltrate back into the ground surface within feet of the seep. ERC's observations in April are similar to conditions observed throughout the year and surface water is typically observed throughout the stream in response to larger precipitation events

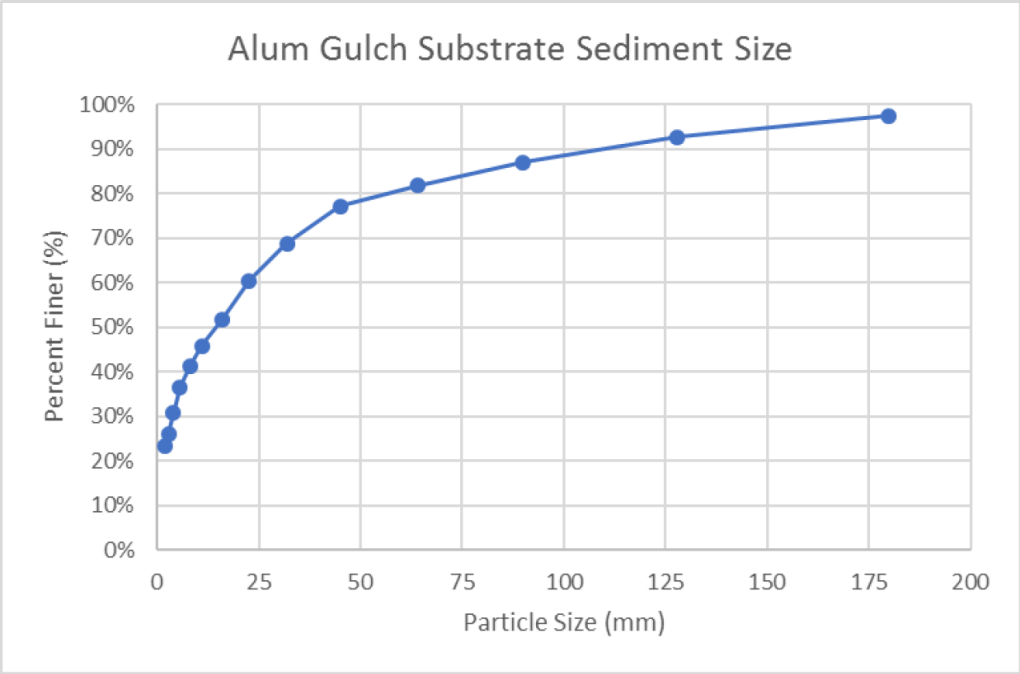
(personal communications 2017). ERC's field observations and recent experience of AMI are different than previous field evaluations in that prior work characterized Alum Gulch below the January Adit as an intermittent stream whereas current conditions suggest the stream is ephemeral.

The difference between previous and current assessments is believed to be the result of management of the January Adit. At the time of the previous ADEQ assessments, the January Adit was observed to be the only constant source of water upstream of the World's Fair Mine and the adit defined the upstream extent of the intermittent stream segment. AMI is currently managing groundwater levels such that the January Adit is no longer discharging. As AMI moves forward with its mine plan, the January Adit will no longer release to Alum Gulch and the only releases will be from the water treatment plant. The removal of the adit release from Alum Gulch therefore appears to be the reason the stream has transitioned from intermittent to ephemeral.

Sediment Sampling

As a part of ERC's field investigation, sediment sampling was conducted to evaluate substrate conditions. Sampling was completed using Wohlman Pebble Counts following methods outlined in Bunte and Abt (Bunte and Abt 2001). Sampling was completed in the streambed downstream of Humboldt Canyon at 31°28'28" North, 110°44'1" West at an elevation of approximately 4840 feet above mean sea level (amsl). A total of 192 particles were sampled and the D_{50} of the material was found to be about 15 millimeters, which is a gravel. The material was field classified as a well graded gravel with sands and cobbles. The finer material was observed to be dominated by sands with minimal clay or silt material present; it was free draining. The resulting gradation curve is provided in **Figure 2**.

Figure 2 – Gradation Curve for Alum Gulch Substrate



Infiltration rates for the bed material were estimated using the observed soil types and standard published rates. For the purpose of this analysis a conservative rate of 0.9 inches per hour or 1.8 feet per day was selected.

Calculation of Stream Distance

In order to estimate the length of stream that would be wetted due to WTP releases of 120 gpm, ERC first calculated the surface area. Surface area can be calculated directly based on the discharge rate from the WTP and the streambed infiltration. The peak WTP release rate of 120 gpm equates to a flow rate of 23,143 cubic feet per day. Dividing this flow rate by the infiltration capacity of 1.8 feet per day results in an area of 12,857 square feet.

In order to estimate the distance from the release WTP release point needed to provide approximately 13,000 square feet of wetted channel perimeter, ERC completed a hydraulic assessment of the stream. The relationship between flow and wetted perimeter in Alum Gulch was estimated based on the Manning's Equation. For calculations, a Manning's N value of 0.15 was selected. This high value was used as it reflects the relatively high flow resistance that occurs for low flows. With flows on the order of 120 gpm, flows will be confined to a small section of the overall streambed. ERC assumed a triangular

channel with 10:1 side slopes for our evaluation. A longitudinal slope of 5.8% was used in the evaluation. Based on the Manning's N value and the channel geometry, a relationship between flow and wetted perimeter was obtained. This relationship is provided on **Table 1**.

Table 1 – Relationship between Flow Rate and Wetted Perimeter in Alum Gulch

Flow (gpm)	Wetted Perimeter (ft)
120	2.9
110	2.8
100	2.7
90	2.6
80	2.5
70	2.3
60	2.2
50	2
40	1.9
30	1.7
20	1.5
15	1.3
10	1.1
8	1
5	0.9
3	0.7
1	0.5

Water released from the WTP would be a maximum of 120 gpm near the release point and decrease in the downstream direction as infiltration acted to reduce the remaining surface flows. Table 1 indicates that for a flow range of 1 to 120 gpm, the wetted perimeter remains nearly constant and only changes by less than 2.5 feet. Given how little the wetted perimeter is expected to reduce as flows move in the downstream direction, an average flow wetted perimeter of 2 feet was used.

Using an average wetted perimeter of 2 feet, the distance below the WTP discharge point where water is expected to remain on the surface was determined by dividing 12,857 square feet by 2 feet to obtain an estimate of about 6,430 feet or 1.22 miles.

Comparison of Results

In an attempt to validate the calculated results, ERC utilized information from the TMDL report as a data point for comparison. While the TMDL report was written to evaluate a different condition, it does provide information that is useful when estimating the distance that flows can be expected to remain at the surface through this section of Alum Gulch.

Two pieces of information from the TMDL study that are pertinent to this evaluation are the flow rates observed in Alum Gulch and the aerial extent of Alum Gulch that was determined to be intermittent. From a flow standpoint, the report indicates that flow rates in Alum Gulch were observed to range from

0.001 to 3 cfs. The report also states that Alum Gulch is an intermittent stream from the January Adit for approximately 2 miles downstream (ADEQ 2007).

The maximum release from the WTP is 120 gpm, which equates to approximately 0.27 cfs, which is within the range and on the lower end of flows observed by the ADEQ. For a WTP release rate of 120 gpm ERC is estimating that water would remain at the surface for approximately 1.2 miles. This is about 60% of the approximately 2-mile area that the ADEQ determined to be intermittent with the observed flows of up to 3 cfs. Given that the WTP release rate is at the lower end of the flow rates evaluated by ADEQ and the stream distance that ERC calculated where water will be observed at the surface is about 60% of the stream length determined to be intermittent by ADEQ, the results of our calculations are consistent with past field observations.

Conclusions

The purpose of this evaluation was to estimate the length of the Pollutant Management Area (PMA) in Alum Gulch that would result from planned WTP releases. The evaluation considered peak WTP release rates, conditions of the streambed and hydraulic properties of the channel to estimate the distance of expected surface flows. Using a peak WTP flow rate of 120 gpm the maximum extent of the PMA was estimated to be approximately 1.22 miles.

Calculated results were then compared to past evaluations of Alum Gulch that were completed for TMDL evaluations. These past studies suggest that with flows in Alum Gulch as high as 3 cfs, an approximately 2-mile stretch of the stream has intermittent flows, downstream of this point Alum Gulch was found to be ephemeral. We believe these past observations lend credibility to the calculated 1.22 mile length of the PMA from the WTP discharge point.

References

Arizona Department of Environmental Quality (ADEQ). 2007. TMDL Implementation Plan for Cadmium, Copper, Zinc and Acidity – Alum Gulch HUC #15050301-561A & B. Publication No. OFR 07-03. March.

Bunte, Kristin and Abt, Steven. 2001. Sampling Surface and Subsurface Particle-Size Distributions in Wadable Gravel- and Cobble-Bed Streams for Analyses in Sediment Transport, Hydraulics, and Streambed Monitoring. Rocky Mountain Research Station, Forest Service, United States Department of Agriculture. May.

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Personal Communications. 2017. Johnny Pappas, Arizona Minerals, Inc. May.