# FEASIBILITY STUDY REPORT

# HARRISON ROAD AND MILLMAR ROAD
# DROSS WQARF SITE
# TUCSON, ARIZONA

March 14, 2018

*Prepared for:*

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
1110 West Washington Street
Phoenix, Arizona 85007

HGC Contract Number: ADEQ14-077537

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# EXECUTIVE SUMMARY

This Feasibility Study (FS) report for the Harrison Road and Millmar Road Dross (HMD) Water Quality Assurance Revolving Fund (WQARF) Registry site (Site) in Tucson, Arizona, presents the development and evaluation of a proposed remedy. The FS was conducted pursuant to Arizona Administrative Code (AAC) R18-16-407(C); because the proposed remedy addresses soils and non-soil materials that have not and will not impact groundwater, an alternatives screening analysis was not required.

This FS report describes the rationale for selecting the proposed remedy for the HMD Site in consideration of the Remedial Investigation (RI); the best available scientific information regarding remedial methods and technologies; and a written analysis of the proposed remedy's consistency with Arizona Revised Statutes (ARS) § 49-282.06, including a brief explanation of the comparison criteria under AAC R18-16-407(H)(3).

The Site is located on the east side of the City of Tucson and was originally comprised of two aluminum dross piles: the Harrison Millmar Dross-East pile (HMD-East) and the Harrison Millmar Dross-West pile (HMD-West). Multiple private residences are located on the Site. Harrison Hills wash is an ephemeral stream located along the western edge of the Site immediately adjacent to HMD-West.

Contaminants of concern at the Site include the metals aluminum, antimony, arsenic, cadmium, copper, lead and nickel at levels above Arizona residential soil remediation levels (rSRLs). The primary potential for exposures were through inhalation or incidental ingestion of wind-blown dross particles and direct handling of the dross that might result in dermal adsorption or incidental ingestion.

The three remediation areas are: 1) the HMD-West pile, including the East Berm of the Harrison Hills wash channel; 2) the HMD-East main pile; and 3) the HMD-East East Tail. The FS demonstrates that the proposed remedy: 1) is designed to prevent human exposure to hazardous substances consistent with the soil remediation standards; 2) is selected based on best judgment and practices of engineering, geology or hydrogeology; and 3) will achieve the ADEQ remedial objectives.

During Early Response Action (ERA) activities in 2016, the majority of HMD-West was consolidated onto HMD-East; all apparent dross material from the East Berm of the Harrison Hills wash was consolidated onto HMD-East; the East Berm was reconstructed and armored with

rip-rap; and impacted soil was removed from around a residential parcel and also consolidated onto HMD-East.

The proposed remedy for the Site is consolidation of dross material and installation of an engineered cap. The HMD-East engineered cap remedy was selected based on its ability to eliminate the direct contact and inhalation exposure pathways, to prevent COC migration from the HMD-East footprint by wind or water, to improve Site aesthetics and safety for residents, and to protect groundwater quality.

The HMD-East cap and HMD-West parcels will require a Declaration of Environmental Use Restriction.

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AAC | Arizona Administrative Code |
| ADEQ | Arizona Department of Environmental Quality |
| ARS | Arizona Revised Statutes |
| bgs | below ground surface |
| COC | Contaminant of Concern |
| EPA | United States Environmental Protection Agency |
| ERA | Early Response Action |
| FS | Feasibility study |
| ft | feet / foot |
| $ft^2$ | square feet |
| HGC | Hydro Geo Chem, Inc. |
| HMD | Harrison Rd and Millmar Rd Dross |
| HMD-East | HMD East Pile |
| HMD-West | HMD West Pile |
| mg/kg | milligrams per kilogram |
| RI | Remedial Investigation |
| RO | Remedial Objective |
| rSRL | Residential Soil Remediation Levels |
| TCLP | Toxicity Characteristic Leaching Procedure |
| WQARF | Water Quality Assurance Revolving Fund |
| XRF | X-Ray Fluorescence |

# 1. INTRODUCTION

This Feasibility Study (FS) report presents the proposed remedy for the Harrison Road and Millmar Road Dross (HMD) Water Quality Assurance Revolving Fund (WQARF) Registry Site (Site). Hydro Geo Chem, Inc. (HGC) has prepared this FS report on behalf of the Arizona Department of Environmental Quality (ADEQ) under the Arizona Superfund Response Action Contract No. 14-077537. The FS was conducted pursuant to Arizona Administrative Code (AAC) R18-16-407.

The purpose of the FS is to develop and evaluate a proposed remedy that is capable of achieving the Remedial Objectives (ROs) for the Site while meeting the requirements of Arizona Revised Statutes (ARS) §49-282.06. The FS addresses the impacts to soils within the Site boundary, as detailed in the Remedial Investigation (RI) report (HGC, 2017), and relies on data and information from the RI. Because the proposed remedy addresses soils and non-soil materials that have not and will not impact groundwater, an alternatives screening analysis was not required, pursuant to AAC R18-16-407(C).

# 2. SITE BACKGROUND

## 2.1 Site Description

The Site, shown in Figure 1, is located on the east side of the City of Tucson (COT), south of East Millmar Road, east of the Harrison Hills Wash, west of the private driveway of 9880 East Millmar Road and north of the Pantano Vista Mobile Home Park.

The Site was originally comprised of two aluminum dross piles (see Figures 1 and 2): the Harrison Millmar Dross-East pile (HMD-East) located on parcel 136-31-0159 (9880 E. Millmar Rd; Property C), and the Harrison Millmar Dross-West pile (HMD-West) located on parcels 136-31-0130 (no address; Property A) and 136-31-0140 (9696 E. Millmar Rd; Property B). Surrounding soils impacted above Arizona residential SRLs (rSRLs) are considered part of the study area. Concentrations of contaminants of concern (COCs) at the Site represented an unacceptable risk to public health, welfare, or the environment because of potential exposure through inhalation and ingestion of wind-blown dross dust, as well as dermal contact with dross. During Early Response Action (ERA) activities, the majority of HMD-West was consolidated onto HMD-East (HGC, 2016b).

Soils at the site have been affected by metals including aluminum, antimony, arsenic, cadmium, copper, lead and nickel at levels above rSRLs. These metals are the primary COCs at the Site. The study area encompasses approximately 20 acres including the Site; surrounding areas on Properties A, B and C; and parcel 136-31-0160 (9886 E. Millmar Rd; Property D) (Figure 1). Several private residences are located on Properties B, C and D. Multiple exempt groundwater wells are present in the Site vicinity. Harrison Hills Wash is located along the western edge of the Site immediately adjacent to HMD-West. Harrison Hills Wash is ephemeral, with peak discharge between 500 to 1,000 cubic feet per second (cfs) (ADEQ, 2016). Surface water flow is to the north.

ERA activities, including the removal of all apparent dross material from the East Berm of the Harrison Hills wash and armoring of the reconstructed East Berm with rip-rap, have reduced the potential for floodwaters to interact with dross materials, as has the burial of remaining HMD-West dross materials beneath two feet (ft) of clean fill.

## 2.2 Site Chronology

This section outlines a general chronology of events for the Site:

**1960s:** Dross is emplaced at the Site (Toeroek, 2017).

**1988:** Two downgradient wells are sampled by ADEQ; no metals exceed AWQS (ADEQ, 1989b). Arizona Department of Health Services (ADHS) collects samples of dross from HMD-East for metals analysis, finding aluminum, cadmium, copper, lead and thallium above rSRLs (ADHS, 1988). ADEQ conducts soil sampling on land surrounding HMD-East; the only metal measured above its rSRL is thallium, at two locations (ADEQ, 1989a).

**1992:** Pima County Department of Environmental Quality (PDEQ) collects one x-ray fluorescence spectrometer (XRF) measurement and one dross sample at HMD-East. The XRF reports arsenic, antimony, cadmium, copper and lead above rSRLs, and an aluminum content of 23.2 percent; laboratory results indicate aluminum, arsenic, antimony, cadmium, copper and lead are above rSRLs (PDEQ, 1992).

**2015-2016:** PI activities are conducted at the Site by ADEQ and HGC (ADEQ, 2016; HGC, 2016a).

**2016:** ERA activities are conducted at the Site by ADEQ and HGC (HGC, 2016b). ERA activities consisted of excavating shallow contaminated materials from Property A (HMD-West and East Berm) and Property B, consolidating them on HMD-East (Property C) beneath a temporary cover, and backfilling excavated areas.

**2017:** The Site is added to the WQARF Registry on April 3, 2017. Remedial action activities are conducted at the Site by ADEQ and HGC. The draft RI report is completed on November 10, 2017. Notice to the public of a 30-day opportunity to comment on the draft RI report was given on November 15, 2017. No public comments are received and the RI report is finalized on December 20, 2017 (HGC, 2017). Notice of availability of the final RI report and the FS Work Plan (ADEQ, 2017b) is made on December 26, 2017.

## 2.3 Physiographic Setting

Detailed descriptions of the geology, hydrogeology and climate for this area are provided in the RI Report (HGC, 2017).

## 2.4 Nature and Extent of Contamination

Contamination at the Site is related to aluminum dross and associated salt cake (HGC, 2017).

### 2.4.1 Contaminants of Concern

The primary COCs for the Site include the metals aluminum, antimony, arsenic, cadmium, copper, lead and nickel in soils at levels above Arizona rSRLs.

### 2.4.2 Nature of Contamination

The dross material itself is relatively immobile. The associated aluminum salt cake is an ash-like material that is subject to physical transport by water and wind erosion. Soils associated with the dross contain contaminants transferred from the dross material by leaching and weathering. Sediment transport with runoff from the dross piles can redistribute contaminants to adjacent surficial soils. Direct transport of dissolved contaminants leached from the dross material in runoff is unlikely to be of consequence due to the typically short durations of rain events producing surface runoff and kinetic limitations on contaminant dissolution from the dross. Sediment transport is reflected by the observed elevated metals concentrations in soil to the north of HMD-East pile.

### 2.4.3 Extent of Contamination

The RI (HGC, 2017) investigated and detailed the nature and extent of contamination at the Site. The dross was primarily in two piles on the east and west parts of the Site. The extent of the contamination is contained in the areas shown on Figure 2. The contaminated area associated with the HMD-East dross pile on Property C was the largest, measuring approximately 60,000 square feet ($ft^2$); the area of contamination associated with the HMD-West dross pile on Properties A and B was smaller, measuring approximately 47,000 $ft^2$. The area of Property B south of the HMD-West pile is also impacted. Dross chunks were also found within the Harrison Hills wash and elevated metals concentrations in soil were found north of the HMD-East pile on Property D, presumably transported by stormwater in both areas.

The residence on the western portion of Property B was built on top of significant dross material (Toeroek, 2017). Historical aerial imagery suggests that development of this property, which includes a residence together with structures and land areas associated with horse husbandry, occurred in the late 1960s and has remained relatively unchanged since 1972 (NETROnline, 2016).

No contamination was observed immediately surrounding the two residences on Properties C and D. Significant contamination was observed across the western portion of Property B, though not immediately surrounding the residence located in this area. During the ERA excavation on Property B, subsurface COC contamination on this property was found to be more extensive than indicated by surface contamination. The HMD-East pile does not appear to have historically extended to the south onto the area currently developed as the Pantano Vista Mobile Home Park (MHP) (Toeroek, 2017).

Based on available private well data, there have been no groundwater impacts from Site contaminants. While minimum groundwater protection levels are exceeded for several of the site COCs, no leaching to groundwater at the Site has been found or is suspected. The potential for contaminant leaching and migration to groundwater at the Site in the future is low. Depth to groundwater in the vicinity is approximately 280 ft below ground surface (bgs) (COT, 2017a; 2017b). Groundwater recharge is not significant in the Site vicinity; average annual standardized potential evapotranspiration for the Tucson basin exceeds precipitation by a factor of about six (Brown, 2005). This indicates that net soil moisture fluxes are upward.

# 3. FEASIBILITY STUDY SCOPING

The proposed remedy for the Site addresses contaminated soil and non-soil materials that have not and will not impact waters of the state. Therefore, pursuant to AAC R18-16-407(C), the FS does not require an alternatives analysis.

## 3.1 Regulatory Requirements

The proposed remedy must:

- be designed to prevent human exposure to hazardous substances consistent with the soil remediation standards adopted pursuant to ARS 49-152 through achievement of pre-determined residential SRLs in AAC R18-7-205;
- be selected based on best judgment and practices of engineering, geology or hydrogeology; and
- achieve the ROs for the Site.

In accordance with AAC R18-16-407, this FS report describes the reasons for selecting the proposed remedy considering:

- data and land use information collected during the Remedial Investigation (RI);
- the best available scientific information concerning available remedial methods and technologies;
- a written analysis explaining how the remedy is consistent with ARS §49-282.06, namely that it is reasonable, necessary, cost effective and technically feasible; and
- a brief explanation of the comparison criteria under AAC R18-16-407(H)(3), including evaluation of practicability, evaluation of risk, evaluation of cost and evaluation of benefit.

## 3.2 Remediation Areas

### 3.2.1 HMD-West

The first remediation area defined for the FS is the HMD-West pile, including the East Berm of the Harrison Hills wash channel (Figure 3). The HMD-West pile was the result of initial dross emplacement in the 1960s, as well as regrading of dross material into former swales. In 2016, ERA activities addressed contamination of this remediation area; a detailed discussion of these activities and a photographic log are presented in the Early Response Action Report (HGC, 2016b).

The HMD-West pile and surrounding impacted areas were selected as a remediation area due to the presence of dross contamination at or near the surface, including surrounding a residence on Property B and in the East Berm of the Harrison Hills wash channel, potentially in contact with periodic flood flows. XRF measurement and confirmatory sampling results collected at HMD-West during the PI and ERA indicated that aluminum, antimony, cadmium, copper and lead commonly exceeded the applicable rSRLs by factors of up to about 10; nickel was less commonly detected above the rSRL. Composite samples collected from the HMD-West pile, the East Berm and Property B south of the HMD-West pile were found to be characteristically hazardous based on Toxicity Characteristic Leaching Procedure (TCLP) analysis. The HMD-West remediation area covered about 47,000 $ft^2$.

### 3.2.2 HMD-East Main Pile

The second remediation area defined for this FS is the HMD-East main pile (main pile). The footprint of the main pile is presented on Figure 2. The main pile was the result of initial dross emplacement in the 1960s.

The HMD-East main pile was selected as a remediation area because it contains the majority of Site dross contamination remaining at the surface or at depths shallower than two ft bgs. XRF measurement and confirmatory sampling results collected on the main pile during the PI indicated that aluminum, antimony, cadmium, copper and lead commonly exceeded the applicable rSRLs by factors of up to about 10; nickel was less commonly detected above the rSRL. Composite samples collected from the main pile were found to be characteristically hazardous based on TCLP analysis. Included in the HMD-East main pile remediation area were any impacted soils along the margins of the main pile. The HMD-East main pile remediation area covered about 53,000 $ft^2$, and extended as much as about 8 ft above the surrounding grade prior to remedy activities.

### 3.2.3 HMD-East East Tail

The third remediation area defined for this FS is the HMD-East East Tail (East Tail). The footprint of the East Tail is presented on Figure 3. The East Tail was an area of consolidated dross and dross-contaminated soil immediately southeast of the main pile, and less vertically extensive than the main pile. The East Tail area was used as a dump site for yard waste, scrap metal and scrap lumber by the property owner since the emplacement of dross in the 1960s.

The HMD-East East Tail was selected as a remediation area because it contained additional surficial or near-surficial dross contamination. XRF measurement and confirmatory sampling results collected on the East Tail during the PI found antimony, cadmium, copper, lead and

manganese concentrations exceeding the applicable rSRLs at some locations. A composite sample collected from the East Tail was found to be characteristically hazardous based on TCLP analysis. Dross contamination at the East Tail was less vertically extensive than at the main pile, with a remediation area of about 7,000 $ft^2$.

## 3.3 Remedial Objectives

The RI report (HGC, 2017) identified present and reasonably foreseeable uses of land that have been or could be impacted by the contamination as low-density residential and small-scale agricultural. The ROs prepared by ADEQ for land use at the Site are (ADEQ, 2017a):

> To restore soil conditions to the remediation standards for residential use specified in AAC R18-7-203 (specifically background remediation standards prescribed in R18-7-204, predetermined remediation standards prescribed in R18-7-205, or site specific remediation standards prescribed in R18-7-206) that are applicable to the hazardous substances identified. This action is needed for the present time and for as long as the level of contamination in the soil on the property threatens the use as a residential property.

The predetermined residential SRLs (rSRLs) were determined to be appropriate for the remedy given the current and anticipated future land uses. As prescribed in AAC R18-7-206, remediation in the form of surface soil removal and replacement has minimized exposures. The remedy is consistent with the land use identified by the landowners in the Land and Water Use Study, as prescribed in AAC R18-16-406(G). The ROs are met because the exposure pathways have been prevented by an engineering control, in this case a clean soil cap. However, a DEUR is required to ensure that the engineering control is maintained, pursuant to ARS § 49-152(C).

# 4. IDENTIFICATION AND SELECTION OF REMEDIAL MEASURES

## 4.1 Remedy Selection Criteria and Site Assumptions

The FS phase of the WQARF process evaluates specific remedial measures and strategies required to meet the established ROs. The proposed remedy must be compatible with land use of the Site, and therefore also must be both effective on a short-term basis and acceptable for use during future potential development of the property. Pursuant to AAC R18-16-407(C), the proposed remedy must be developed based on the best available scientific information concerning applicable remedial technologies, using best engineering, geological or hydrogeological judgment, following the scientific standards of practice in those fields.

Evaluation of the proposed remedy includes application of the comparison criteria set forth in AAC R18-16-407(H)(3), namely evaluation of practicability, evaluation of risk, evaluation of cost, and evaluation of benefit. Information synthesized in the evaluation of the proposed remedy also includes the RI report (HGC, 2017) and a remedy analysis consistent with ARS § 49-282.06. The remedy analysis considers whether the remedy is reasonable, necessary, cost-effective and technically feasible.

The assumptions regarding the Site used during the remedy selection process included:

- The primary modes of migration for dross contamination are runoff and wind transport of particulates;
- Exposure to dross material and dross-contaminated soils at the surface includes dermal adsorption or incidental ingestion from direct contact, or inhalation and incidental ingestion from wind-blown particulates;
- Potential health risks related to dross material and dross-contaminated soils can be reduced or eliminated by preventing exposure;
- Groundwater and surface water are not currently impacted, and are unlikely to be impacted in the future, by dross material and dross-contaminated soils; and
- Soils and non-soil materials in the remediation areas are characteristically hazardous, and thus expensive to transport and dispose of off-Site.

## 4.2 Engineering, Geologic and Hydrogeologic Standards

The proposed remedy, selected based upon best judgement and standards of practice, considered the following information.

### 4.2.1 Transport and Exposure Pathways

The dross material *per se* is relatively immobile, while the associated aluminum salt cake is an ash-like material subject to physical transport by water and wind erosion. Dross-contaminated soils contain COCs transferred from the dross material by leaching and weathering. The RI indicated that migration of dross material and dross contamination had been minimal since it was emplaced in the 1960s. Dross impacts observed at the surface and at depth were limited to the areas where dross was dumped, or immediately adjacent to these areas. As described in the RI report (HGC, 2017), prior to the ERA, the potential for generation of wind-blown dust from the dross material was high. Residents occupying the Site properties, as well as off-site residents, could be exposed to COCs by incidental ingestion or dermal contact through direct contact with dross material, and inhalation or incidental ingestion of airborne particulates. Some dross impacts were found in the East Berm of the Harrison Hills Wash near the HMD-West Pile, but no significant impacts were observed in the wash downstream of the Site. However, dross material in the East Berm was potentially in contact with periodic flows in the Harrison Hills Wash.

Due to ERA activities in the HMD-West area, the potential for exposure through direct contact with the contaminants was eliminated and no complete exposure pathway remained. The excavation of the East Berm removed dross material completely from contact with periodic flow in the Harrison Hills Wash channel, and the reconstruction of the East Berm with clean fill armored with rip-rap and seeded with native vegetation presented a significant barrier between flow in the wash and the HMD-West dross material remaining at depth.

After completion of the ERA, the remaining complete exposure pathways for Site COCs were through direct contact with dross material and dross-contaminated soils at HMD-East, including the main pile under the interim cover of six to nine inches of clean fill and the East Tail at or near the surface, and through airborne particulates. The proposed remedy aimed to eliminate these exposure pathways.

### 4.2.2 Best Available Remedial Methods & Technology

Various lines of research have explored the possibility of remediating dross materials by reprocessing them to extract metals (e.g. David and Kopac, 2012; Davies et al., 2008; Gil and Korili, 2015; Hwang et al., 2006; Tsakiridis, 2012; Tsakiridis et al., 2013). These methods require relatively pure dross material; specialized equipment; large quantities of energy, water and/or reagent; and extensive pre- and post-processing of dross material. They also may still generate a hazardous by-product that requires disposal. As a result these remediation methods were considered physically and financially impractical for the Site. Similarly, off-site disposal of

dross material and dross-contaminated soils would have been prohibitively expensive due to the characteristically hazardous nature of these materials.

Based on experience gained during ERA activities, consolidation and capping of dross material and dross-contaminated soils was determined to be the best available remedial method for the remediation areas not addressed (HMD-East main pile and East Tail) during the ERA. The proposed remedy was expected to eliminate the remaining exposure pathway at HMD-East, with a Declaration of Environmental Use Restriction (DEUR) required pursuant to ARS § 49-152(C) and providing for maintenance of the capped remediation areas to prevent the soil cap material from being breached in the future. Therefore, the proposed remedy was selected as the remedial method offering the best combination of cost and risk mitigation.

### 4.2.3 Regulatory Consistency Analysis

The proposed remedy was evaluated with respect to its consistency with ARS § 49-282.06, which dictates that remedial actions must:

- assure the protection of public health and welfare and the environment;
- provide for the control, management or cleanup of the hazardous substances in order to allow maximum beneficial use of the waters of the state; and
- be reasonable, necessary, cost-effective and technically feasible.

The proposed remedy assured the protection of public health and welfare and the environment by eliminating the direct contact and inhalation exposure pathways at HMD-East, consistent with implementation of remedial activities at HMD-West. The risk assessment conducted during the RI (HGC, 2017) found that no complete exposure pathway would remain after implementation of the remedy. As this is an engineering control, pursuant to ACC R18-7-208, a DEUR shall be recorded to abate any residual risk associated with the excavated and/or capped areas of the Site should the soil cap material be breached.

Runoff from the HMD-East pile and vicinity was previously unlikely to reach any surface water (in particular the Harrison Hills wash channel), and is even less so since the construction of the engineered cap. As maintenance of the cap is to be performed, future runoff from this area is also unlikely to contain COCs derived from dross in the form of suspended solids. As described in Section 2.4, COCs in dross material and associated contaminated soils are unlikely to be highly soluble in natural waters, have not historically impacted groundwater at the Site, and are unlikely to do so in the future, particularly following implementation of the proposed remedy, which

increased the fraction of rainwater that evaporates before coming into contact with these materials.

The proposed remedy was necessary because of the risks to public health and welfare and the environment described in Section 2.4. The proposed remedy was cost-effective because it avoids off-Site disposal of hazardous material, instead abandoning these materials in place or at HMD-East at depths of at least two ft bgs. The proposed remedy was reasonable and technically feasible because it employed basic excavation and grade construction techniques. A more detailed analysis of the proposed remedy with respect to these characteristics is provided in Section 5.3 below.

# 5. PROPOSED REMEDY

This section presents the proposed remedy along with an analysis of its consistency with ARS §49-282.06, its ability to achieve the ROs, and its performance under the comparison criteria listed in AAC R18-16-407(H)(3). This section will also outline how the proposed remedy prevents human exposure to hazardous substances, specifying the metric against which this was measured.

Implementation of remedial activities at the Site began with the ERA at HMD-West in 2016. A detailed discussion of ERA activities, including a photographic log, is provided in HGC (2016b).

## 5.1 Proposed Remedy

Consolidation of dross material, installation of an engineered cap is the proposed remedy for the Site, based upon best engineering judgment. The HMD-East engineered cap remedy was selected based on its ability to eliminate the direct contact and inhalation exposure pathways, to prevent COC migration from the HMD-East footprint by wind or water, to improve Site aesthetics and safety for residents, and to protect groundwater quality. As this is an engineering control, recording of a DEUR on the relevant areas of the parcels will be required.

## 5.2 Consolidation of Dross Material

The HMD-West area became the priority for ERA activities due to the presence of dross contamination surrounding a residence on Property B and in the East Berm of the Harrison Hills wash channel. During the ERA (HGC, 2016b), roughly 4,100 cubic yards (6,420 tons) of apparently contiguous dross contamination present on the surface at the HMD-West pile and in the subsurface up to two ft bgs at the East Berm, the HMD-West pile and Property B, was removed and spread, compacted and graded on the HMD-East main pile (Figure 3). The footprint of the main pile remained largely the same during this process, and stable slopes were maintained at the pile edges as the pile gained height. At the conclusion of ERA activities, a temporary cap consisting of six to nine inches of clean fill material was compacted onto the consolidated HMD-East main pile; the temporary cap is visible as the light-colored area at HMD-East on Figure 3. The temporary cap was not intended to provide long-term control of the risks presented by dross contamination at HMD-East.

Prior to engineered cap construction on the HMD-East main pile, dross-impacted materials from the HMD-East margins and the East Tail were consolidated onto the HMD-East main pile in areas not covered by the temporary cap. The goal of this excavation was to completely remove dross material to a depth of 2 ft bgs from the East Tail, the portion of HMD-East closest to a

residence on Property C. The footprint of the East Tail excavation is shown on Figure 3. XRF measurements and confirmatory soil sampling were conducted to guide the extent of the excavation and to determine COC impacts remaining at depth (Figure 2). The results of these measurements are provided in the RI report (HGC, 2017).

Dross material and dross-contaminated soil excavated from the East Tail was stockpiled on the southeastern portion of the HMD-East main pile and used to bring the surface of this portion of the pile up to roughly the same grade as the rest of HMD-East. Surficial dross material along the south, west, north and northeast margins of the HMD-East main pile, likely derived from erosion, were scraped back onto the main pile. The excavated areas (East Tail and main pile margins) were then backfilled to the previously existing grade with clean fill material imported from off-Site and compacted in six-inch lifts.

In the interim between consolidation of dross material and construction of the engineered cap, a six-inch temporary cover of clean fill material was emplaced on the southeastern portion of the HMD-East pile where excavated material was stockpiled. To the extent possible, clean fill material was scattered atop those limited areas of dross contamination left in place along the southern margin of the East Tail, where access was limited by overhead powerlines and the footer of the MHP retaining wall. Upon completion of backfill, the East Tail area was hand broadcast-seeded with a native seed mix, chained and watered. Figure 2 presents the approximate extent of surficial dross-impacted soils (denoted in pink) remaining in this area.

## 5.3 Engineered Cap Design and Construction

### 5.3.1 Engineering Design

A topographic survey of the HMD-East pile was necessary prior to installation of the engineered cap to provide a detailed picture of existing drainage at HMD-East, and to inform the design of the engineered cap and the quantity and placement of imported material required for the engineered cap.

The engineered cap design has the following features:

- On the eastern, southern and western sides of the pile, side slopes with a more gradual gradient than was previously present on the dross pile, cross-ripped to retard surface flow;
- On the northern side slope, where historically the most severe surface runoff was observed, a rock apron consisting of six- to 12-inch rip-rap overlying a geotextile fabric atop clean fill material;

- A 1 percent grade to the north and an inverse crown along the long axis (south-north) of the main body of the dross pile, to prevent pooling of precipitation on the pile, and to funnel the majority of runoff of precipitation incident on the upper surface of the soil cap to the rock apron;
- A soil cap thickness of at least two ft, compacted in one ft lifts (to 85 to 90 percent of maximum dry density), to retain infiltrating moisture for a period long enough to maximize evapotranspiration; and
- Organic material worked into the upper six inches to one ft of the cap material, and native seed mix broadcast-seeded across the cap.

The final engineered cap design was provided in the Grading and Drainage Plan as part of the RI (HGC, 2017).

### 5.3.2 Cap Construction

To complete implementation of the proposed remedy at HMD-West, excavated areas including the HMD-West pile and the Property B excavation (Figure 3) were backfilled to the previously existing grade using clean fill material compacted in one ft lifts. The HMD-West pile surface finish was graded to provide northerly drainage, parallel to the Harrison Hills wash channel, rather than towards the wash channel. The East Berm was reconstructed in the same manner, with a surface finish providing a more prominent topographic barrier to inflow into the wash from the HMD-East pile area than was previously present. The reconstructed East Berm was armored with 8-12 inch rip-rap to limit incision by storm flows. Details pertaining to cap construction at HMD-West are provided in HGC (2016b).

During the construction of the engineered cap at HMD-East, the engineering design plans were used to survey in the emplacement of cap materials. The engineered cap was constructed by emplacing approximately 2 ft of clean fill material over the entire HMD-East main pile, with compaction and grading throughout the process, to generate a soil cap as described in Section 5.3.1. The previously-placed temporary soil covers increased the total cap thickness to greater than 2 ft over a large portion of the main pile. A rock apron was constructed on the northern slope of the main pile by laying geotextile fabric and 8-12 inch rip-rap. Organic topsoil was blended with a mixture of native grass seed within the upper portion of the cap material and the entire cap was watered to set the cap materials in place and to establish the seed.

An as-built diagram of the final engineered cap and the rock apron is provided as Figure 4. The approximate extent of dross-impacted soils that will remain under the HMD-East and East Tail cap is shown in Figure 2.

## 5.4 Achievement of Remedial Objectives

Pursuant to AAC R18-16-407(C), the proposed remedy for the Site must address the contaminated soil in a manner that achieves compliance with ARS §49-282.06 and will achieve the ROs for the use of the property. The ROs (ADEQ, 2017a) for land use at the Site are presented in Section 3.3. Compliance is being achieved by remediating to residential SRLs, rather than to levels based on a site-specific human health risk assessment.

Prior to remedial activities, dross material and dross-impacted soils at HMD-West and HMD-East exceeded rSRLs for aluminum (76,000 mg/kg), antimony (31 mg/kg), arsenic (10 mg/kg), cadmium (39 mg/kg), copper (3,100 mg/kg), lead (400 mg/kg) and nickel (1,600 mg/kg). The ERA and HMD-East remedial activities bury any such material under a minimum two ft of clean, imported fill material. This provides a two ft buffer between typical residential activities conducted at the surface and contamination, mitigating risk from the direct exposure pathway. Current and future residents of the Site properties will be made aware of the presence and extent of contamination at depth, so that they can avoid digging or other activities in the Site area that could expose dross material and dross-impacted soils. The two ft cap of clean material mitigates the exposure risks present by migration of contamination in airborne particulates by shielding contaminated materials from wind.

The long-term achievement of ROs will be contingent upon proper maintenance of the proposed remedy. Annual maintenance, as required by a DEUR, will maintain surface soil concentrations of COCs below rSRLs and provide for the continued, safe use of the Site properties.

## 5.5 Consistency with Current and Future Land and Water Use

The zoning for the Site is established, with no foreseeable changes to zoning in the future (HGC, 2017). Currently, zoning at the Site is low-density residential and small-scale agricultural. The ERA and HMD-East cap remedial actions are consistent with this zoning because they mitigate exposure risks reasonably expected under low-density residential and small-scale agricultural land use. Current and future residents of the Site properties will be made aware of the presence and extent of contamination at depth, so that they may avoid exposing or disturbing these materials.

Because waters of the state are not impacted or threatened to be impacted by contamination at the Site, the consistency of the proposed remedy with current and future water use is not required to be evaluated. Nonetheless, it is worth noting that the proposed remedy is protective of waters of the state. No groundwater impacts were observed at or immediately downgradient of the Site during the RI (HGC, 2017), and future groundwater impacts are considered very unlikely

(Section 2.4). The proposed remedy provides an evaporative barrier between precipitation and COC contamination, facilitating the evaporation of precipitation before it infiltrates to the depth of contamination. Therefore, the proposed remedial action is consistent with current groundwater use in private wells at and near the Site, and with future development of groundwater resources.

In addition, the proposed remedy provides a clean surface and controlled drainage that makes it unlikely for surface runoff from HMD-East to contain dissolved or suspended COCs, or for it to reach nearby wash channels. Implementation of the ERA at HMD-West removed dross materials and dross contamination from potential contact with flood flows in the Harrison Hills wash channel, and constructed an armored berm that guards against incision of the channel into capped contamination at HMD-West.

## 5.6 Consistency with Statute

### 5.6.1 ARS §49-282.06

Remedial actions, pursuant to ARS §49-282.06, shall: 1) be protective of public health, welfare and the environment; and 2) be reasonable, necessary, cost-effective and technically feasible. These requirements applied to the proposed remedy are detailed below.

#### *Protectiveness*

The proposed remedy is protective of human health in that it directly addresses potential exposure. Proposed remedy implementation has reduced concentrations for all COCs below rSRLs from the soil surface to approximately 2 ft bgs, and therefore reduced the current and future risk to human health. The proposed remedy is protective in the long term by reducing the footprint of dross material and dross-impacted soil through substantial consolidation into a single dross pile, and limiting migration of dross contamination dissolved or suspended in runoff and as airborne particulates.

#### *Reasonableness*

The proposed remedial action was reasonable for this Site as it focuses on addressing the contaminated media of concern and physically prevents contact with and migration of COCs. The proposed remedial action relied on readily available equipment and commonly used construction techniques. The proposed remedial action left the Site properties in the same or better state than before remedial action from the practical perspective of the residents.

### *Necessity*

Remedial action at this Site was necessary due to the presence of soil COC concentrations above residential SRLs that presented direct contact and possibly inhalation hazards for residents of the Site properties and adjacent areas. The direct contact exposure pathway was well characterized during the RI; the inhalation exposure pathway was not characterized, but was also addressed by the proposed remedy. Prior to ERA activities, residents of the Site properties were routinely at risk of exposure during normal activities.

### *Cost Effectiveness*

The proposed remedy was cost-effective for the Site. Excavation, consolidation and capping were relatively inexpensive options. As described in Section 4.2.2, more aggressive potential remedial options, such as soil stabilization, chemical or physical extraction of COCs, or off-Site disposal of hazardous material, would be many times more expensive due to additional costs in materials, energy, time and fees. Because HMD-East material failed the TCLP for the RCRA 8 metals, disposal likely would have entailed hauling excavated material to the US Ecology Hazardous Waste Disposal landfill in Beatty, Nevada, incurring high transportation as well as disposal costs.

### *Technical Feasibility*

Soil removal and capping was considered technically feasible and was technically the simplest remedy available. Because of the small footprint of the consolidated dross pile and the clear ROs, the design work was relatively straightforward. The construction work was accomplished with widely used heavy equipment and readily available fill and finish materials.

## 5.6.2 Comparison Criteria Under AAC R18-16-407(H)(3)

### *Evaluation of Practicability*

As described in Section 5.6.1, the proposed remedy was both reasonable and technically feasible using commonplace construction and grading techniques to physically isolate COCs at HMD-East and minimize costs. In the short term, the proposed remedy will prevent residents of the Site properties from coming into direct contact with COCs during the course of normal activities and use of the properties. In the long term, the proposed remedy will prevent dross material and dross-impacted soil at the HMD-East pile from migrating off-Site by dissolution or suspension in runoff or by wind transport of particulates.

The long-term effectiveness of the proposed remedy is contingent on the annual maintenance regime under the DEUR. This will address the potential for erosion of cap material to expose capped dross material and dross-impacted soil. Eventually, the cap will be further stabilized by vegetation growth and provide long-term and reliable direct contact and inhalation exposure risk mitigation.

### *Evaluation of Risk*

The RI identified the primary exposure pathways to be through direct contact with dross material or dross-impacted soils, leading to dermal adsorption or incidental ingestion, and through inhalation and incidental ingestion of wind-blown particulates derived from these materials. ERA activities effectively eliminated these exposure pathways at HMD-West, and also mitigated the risk of dross material and dross-impacted soils entering and migrating via the Harrison Hills wash channel.

The proposed remedy expanded risk mitigation to HMD-East, creating a physical barrier that prevents direct contact with COCs, eliminating this exposure pathway. The proposed remedy will also eliminate the exposure pathway represented by potential wind-blown particulates containing COCs.

The proposed remedy was designed to shed water and resist erosion. The proposed remedy also created an evaporative barrier of clean material above the contaminated material, capitalizing on the warm and dry regional climate to facilitate the evaporation of most rainfall prior to infiltration into contaminated materials. Combined with the chemical properties of the COCs and the thickness of the vadose zone, this allows the proposed remedy to be protective of groundwater quality in the long-term.

Current small-scale agricultural activities are not conducted on the HMD-East area, and do not involve cultivation or digging. Current and future residents of the Site properties will be made aware of the presence and extent of contamination at depth, so that they may avoid exposing or disturbing these materials. Pursuant to AAC R18-16-406(G), the remedy selected is consistent with the current and future land use identified by the current landowners and is appropriate for the Site.

Due to accessibility issues such as the presence of overhead powerlines and the MHP retaining wall footer, there are small areas of known dross contamination that remain at the surface on the south side of HMD-East, between the dross pile and the MHP retaining wall, following implementation of the proposed remedy (Figure 2). Dross contamination at these areas remains subject to physical transport by wind and runoff. However, these areas are sheltered by the

retaining wall and by fairly heavy vegetation, which stabilizes these materials against erosion. In addition, the topography is quite flat in this area, and runoff will be contained between the rise of the HMD-East pile and the barrier of the MHP retaining wall. Available data indicate that residual health risk associated with these areas is minimal with COC concentrations exceeding rSRLs present in less than 10 percent of samples (HGC, 2017).

### *Evaluation of Cost*

#### *Capital Cost*

The proposed remedy entailed excavating dross material and dross-impacted soil from the East Tail and the margins of the main pile, and consolidating them onto the main pile. Subsequently, a topographic survey was conducted at HMD-East and used as the basis for the design of an engineered cap. Finally, clean fill material, rip-rap, topsoil, native seed and geotextile were imported and used in the construction and grading of the final cap at the main pile.

The HMD-East cap and previous ERA implementation incurred a cost totaling $783,100 (Table 1). This capital cost associated with the proposed remedy is likely an order of magnitude lower than the cost that would be associated with excavating, transporting and disposing of characteristically hazardous material from HMD-East. Implementing a more aggressive remediation technique, such as chemical extraction of COCs from dross material and contaminated soils, would also entail extensive costs in planning, pilot testing, implementation, and waste management that would exceed the capital cost of the proposed remedy.

The proposed remedy addresses soils and non-soil materials that have not and will not impact groundwater, and does not impact current or future groundwater use practices at the Site and vicinity.

#### *DEUR Cost*

The DEUR will document the institutional and engineering controls associated with the proposed remedy. The DEUR will run with the area of the land associated with this proposed remedy and will ensure that current and future property owners are aware of contamination on the Site. The DEUR will also allow for ADEQ to take any necessary actions to ensure that engineering or institutional controls are maintained throughout the life of the DEUR.

Pursuant to AAC R18-7-604, DEUR fees apply to properties using an engineering control without groundwater monitoring. For properties using an engineering control without groundwater monitoring, a total of $5,450 in one-time fees apply. An additional $660 per year in

fees is available for ongoing activities for a period not to exceed 30 years. For the HMD Site, a DEUR will be placed on the HMD-East capped area of parcel 136-31-0150 and on the HMD-West areas of parcels 136-31-0130 and 136-31-0140 (as shown on Figure 2). A total of $25,250 in fees is available for each parcel over 30 years, accounting for one-time and annual fees, totaling $75,750 for the site.

### *Evaluation of Benefit*

The primary benefit of the proposed remedy is the immediate elimination of the direct exposure and inhalation exposure pathways at the Site. Concentrations of COCs in dross materials and impacted soils at the Site exceeded rSRLs, and these materials are characteristically hazardous. The proposed remedy creates a physical barrier to these exposure pathways, and also prevents migration of contamination as wind-blown particulates or dissolved or suspended solids in surface runoff.

The proposed remedy is designed to shed water and resist erosion, and will make impact to groundwater even less likely. The proposed remedy creates an evaporative barrier of clean material above the contaminated material, capitalizing on the warm and dry regional climate to facilitate the evaporation of most rainfall prior to infiltration into contaminated materials. Combined with the chemical properties of the COCs and the thickness of the vadose zone, this will allow the proposed remedy to be protective of groundwater quality in the long-term.

The proposed remedy also benefits Site residents by improving the aesthetics of the Site, creating a clean finish that will be seeded with native vegetation, and removing from the surface unsightly dross material as well as accumulated yard waste that was present at the East Tail. The proposed remedy also benefits current land use at the Site, which consists of low-density residential and small-scale agricultural uses, by expanding that portion of the property which is available for use. Land use is not expected to change at the Site, but continuation of current use patterns will be enhanced for the same reasons.

# 6. COMMUNITY INVOLVEMENT

As the proposed remedy for the Site was completed within 180 days of WQARF registry listing, pursuant to ARS §49-287.03, a community involvement plan and other community involvement activities, including creation of a Community Advisory Board as described in AAC R18-16-404(C), were not required. However, ADEQ did provide general notice to land owners who might be liable prior to proceeding with the RI.

A FS Work Plan (FS WP) (ADEQ, 2017b) was developed, pursuant to AAC R18-16-407(B). A notice of availability of the FS WP, pursuant to AAC R18-16-406(F), was posted on December 26, 2017.

ADEQ is responsible for the selection of the remedy for the Site based on the RI and FS Reports. The Proposed Remedial Action Plan (PRAP) will summarize the proposed remedy, including estimated costs, and be issued for public comment after the FS Report is finalized.

Remedy selection will be documented in a Record of Decision (ROD) that will include a response summary of any comments received during the PRAP public comment period. This FS Report forms the basis for the selection of the remedy for the Site and will provide the information necessary to support the development of the ROD.

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# 8. LIMITATIONS

The opinions and recommendations presented in this report are based upon the scope of services and information obtained through the performance of the services, within the schedule and budget as agreed upon by HGC and ADEQ. Results of any investigations, tests, or findings presented in this report apply solely to conditions existing at the time that HGC performed investigative work and are inherently based on and limited to the available data and the extent of the investigation activities. The content and level of detail reflected in this document, including cost components, are as specifically directed by ADEQ and HGC makes no representation of its completeness. No representation, warranty, or guarantee, express or implied, is intended or given. HGC makes no representation as to the accuracy or completeness of any information provided by other parties not under contract to HGC to the extent that HGC relied upon that information. Figures produced by other contractors have been presented "as is" in this report using HGC's logo and with the source referenced appropriately. HGC makes no representations regarding the accuracy of the depicted data in those figures. This report is expressly for the sole and exclusive use of ADEQ and for the particular purpose that it was intended. Reuse of this report, or any portion thereof, for other than its intended purpose, or if modified, or if used by third parties, shall be at the sole risk of the user.

**TABLE**

# TABLE 1
## Costs for Proposed Remedy
## Harrison Rd Millmar Rd Dross WQARF Site, Tucson, Arizona

| | Implementation Costs | Reporting Costs[a] | DEUR Fees[b] | Total Cost |
|---|---|---|---|---|
| **ERA (HMD-West and Property B)** | | | | |
| Soil Removal/Consolidation and Backfill - Property B | *$245,700* | -- | -- | -- |
| Soil Removal/Consolidation, Backfill, HMD-West | *$70,500* | -- | -- | -- |
| Soil Removal/Consolidation, Backfill, East Berm | *$121,200* | -- | -- | -- |
| **ERA SubTotal** | $437,400 | $17,380 | $50,500 | $505,280 |
| **Proposed Remedy (HMD-East cap)** | | | | |
| Remedial Cap Design HMD-East | *$14,600* | -- | -- | -- |
| Soil Removal/Consolidation and Backfill - East Tail | *$57,200* | -- | -- | -- |
| Construction/ Cap Installation - HMD-East | *$273,900* | -- | -- | -- |
| **HMD-East Remedy SubTotal** | $345,700 | $51,887 | $25,250 | $422,837 |
| **REMEDIAL ACTION TOTAL** | $783,100 | $69,267 | $75,750 | $928,117 |

*Notes:*

[a] *ERA reporting includes a technical report. HMD-East remedy reporting includes a RI report, FS report and PRAP.*

[b] *DEUR (declaration of environmental use restriction) fees include one-time and annual fees, based on a 30-year program (present value), for the HMD-East capped area of parcel 136-31-0150 and on the HMD-West areas of parcels 136-31-0130 and 136-31-0140.*

**FIGURES**


Spatial Reference: NAD 1983 UTM Zone 12N
Data: ESRI, DigitalGlobe, USDA, USGS, Pima County
Imagery Date: February 2017

Study area parcels with ID

HMD Site

0 500 1,000

SCALE IN FEET

N

HYDRO GEO CHEM, INC.

**SITE LOCATION MAP**
**HARRISON ROAD & MILLMAR ROAD DROSS SITE**

| Approved | Date | Author | Date | File Name | Figure |
|---|---|---|---|---|---|
| AJB | 7/27/17 | GEM | 7/27/17 | 2015053074G | 1 |

Spatial Reference: NAD 1983 UTM Zone 12N
Imagery: Pima Association of Governments (2015)

approximate extent of dross-impacted soil remaining under soil cover and backfill

approximate extent of surficial dross-impacted soils (pre-excavation)

approximate extent of surficial dross- impacted soils (post-excavation) covered with clean fill and seeded with native vegetation

Note: rSRL = residential Soil Remediation Level Results for aluminum, arsenic, antimony, cadmium, copper, lead and nickel are shown.

Moderate exceedances of arsenic rSRL were not considered dross contamination.

0 100 200

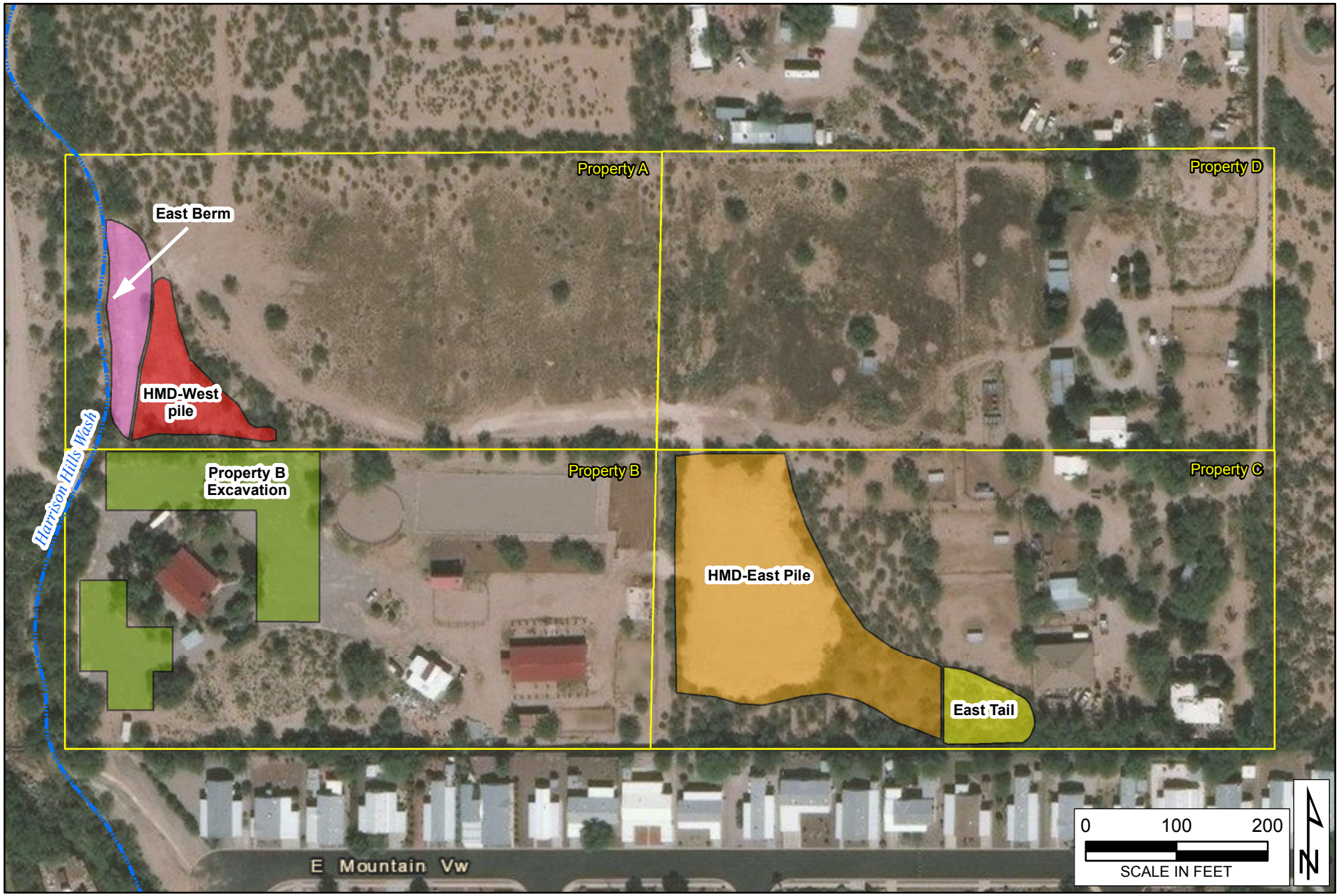
APPROXIMATE SCALE IN FEET

N

HYDRO GEO CHEM, INC.

PRE-EXCAVATION AND POST-EXCAVATION EXTENT OF DROSS CONTAMINATION
HARRISON ROAD & MILLMAR ROAD DROSS SITE

| Approved | Date | File | Figure |
|---|---|---|---|
| AJB | 10/23/17 | 2015053124G | 2 |




Spatial Reference: NAD 1983 UTM Zone 12N
Data: ESRI, DigitalGlobe, USDA, USGS, Pima County

- Study area parcels with ID
- Property B ERA excavation and cap footprint
- East Berm excavation and rebuild footprint
- HMD-West Pile ERA excavation and cap footprint
- East Tail proposed remedy excavation and cap footprint
- HMD-East proposed remedy engineered cover footprint

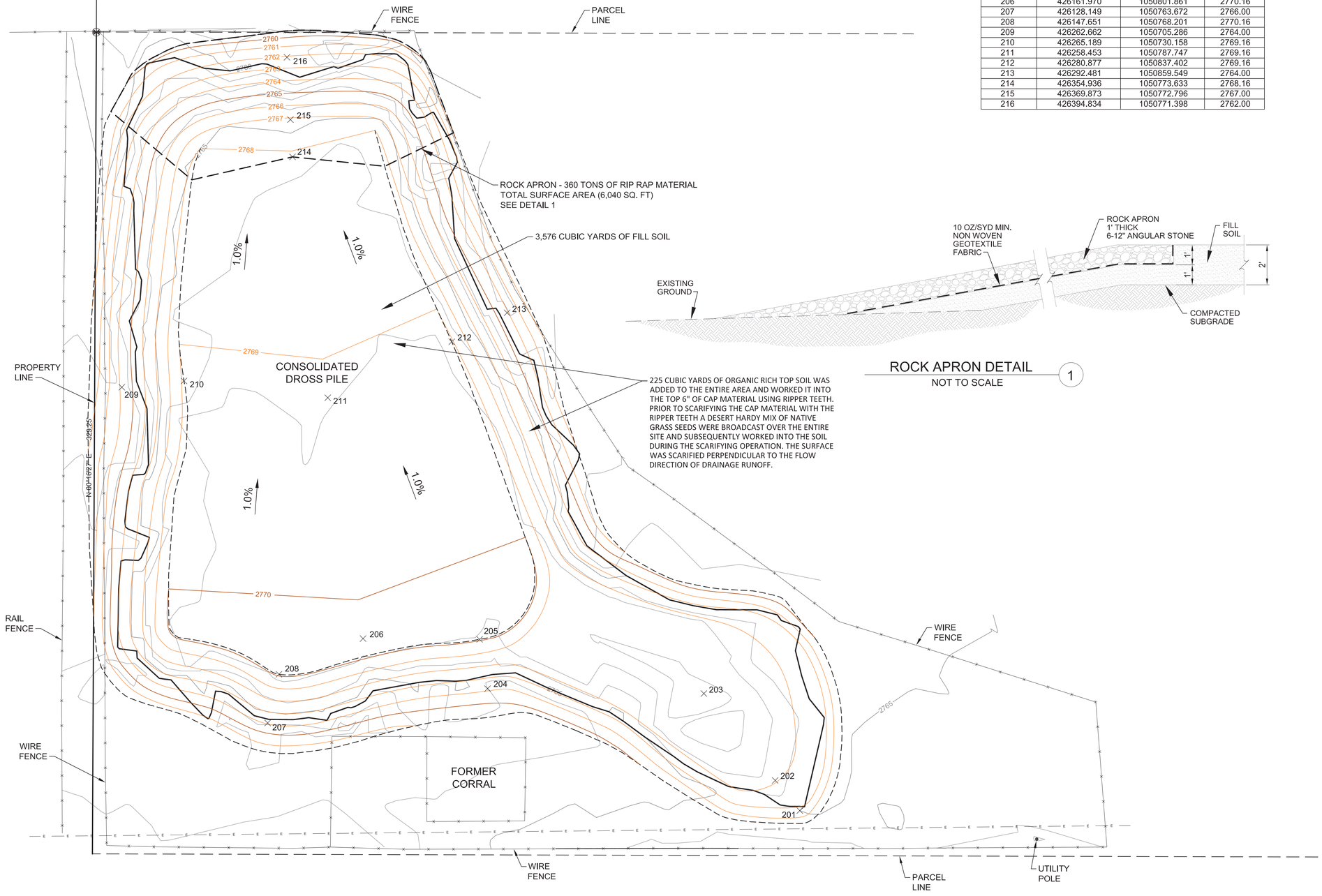
HYDRO GEO CHEM, INC.

**EXTENT OF EXCAVATION AND COVER AREAS**
**HARRISON ROAD & MILLMAR ROAD DROSS SITE**

| Approved | Date | Author | Date | File Name | Figure |
|---|---|---|---|---|---|
| AJB | 9/13/17 | GEM | 9/13/17 | 2015053112G | 3 |

## Top of Cover Point Table

| Point No. | Northing | Easting | Elevation |
|---|---|---|---|
| 201 | 426093.055 | 1050976.778 | 2767.00 |
| 202 | 426105.117 | 1050966.890 | 2768.00 |
| 203 | 426139.951 | 1050938.336 | 2768.00 |
| 204 | 426141.920 | 1050851.705 | 2766.00 |
| 205 | 426161.672 | 1050848.547 | 2770.16 |
| 206 | 426161.970 | 1050801.861 | 2770.16 |
| 207 | 426128.149 | 1050763.672 | 2766.00 |
| 208 | 426147.651 | 1050768.201 | 2770.16 |
| 209 | 426262.662 | 1050705.286 | 2764.00 |
| 210 | 426265.189 | 1050730.158 | 2769.16 |
| 211 | 426258.453 | 1050787.747 | 2769.16 |
| 212 | 426280.877 | 1050837.402 | 2769.16 |
| 213 | 426292.481 | 1050859.549 | 2764.00 |
| 214 | 426354.936 | 1050773.633 | 2768.16 |
| 215 | 426369.873 | 1050772.796 | 2767.00 |
| 216 | 426394.834 | 1050771.398 | 2762.00 |







ROCK APRON DETAIL 1
NOT TO SCALE

| NO. | DATE | BY | REVISION |
|---|---|---|---|
| | | | |

BASE SURVEY:
BY: RES LAND SURVEYS, INC.
DATED: APRIL 14, 2017

LEGEND

- FOUND SURVEY MONUMENT
- PARCEL LINE
- PROPERTY LINE
- FENCE
- ELECTRICAL LINE
- 2386 EXISTING 2017 CONTOUR
- 2386 COVER CONTOUR
- SLOPE BREAK
- LIMITS OF DROSS PILE
- ROCK APRON

N

0' 20' 40'
SCALE IN FEET
CONTOUR INTERVAL - 1 FOOT

NOTES:

1. PLACE FILL SOIL IN LIFTS NOT TO EXCEED 12-INCHES IN THICKNESS.
2. LIGHTLY COMPACT FILL SOIL TO 85 TO 90 PERCENT OF MAXIMUM DRY DENSITY AS PER STANDARD PROCTOR TEST.
3. UNIFORMLY GRADE THE SURFACE OF THE FILL SOIL. PROVIDE A SMOOTH TRANSITION BETWEEN ABRUPT CHANGES IN SLOPE.
4. PROVIDE A SMOOTH TRANSITION FROM FILL SOIL SURFACE TO ROCK APRON.
5. ANY ORGANIC MATERIAL IS TO BE WORKED INTO THE TOP 6 TO 12 INCHES OF FILL SOIL.
6. FINISHED SURFACE TO BE ROUGHENED BY ROLLING WITH KNOBBY-TIRED EQUIPMENT.
7. SCARIFY THE SURFACE OF SIDESLOPES BY CROSS RIPPING PARALLEL TO THE GROUND SURFACE.

| SIGNATURE | | DATE |
|---|---|---|
| PROJECT ENGR: | J. PECK | |
| PROJECT MGR: | AJB | |
| CLIENT: | ADEQ | |
| | | |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51 W. WETMORE ROAD
SUITE 101
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website; www.hgcinc.com


# AS-BUILT TOP OF COVER CONDITIONS

HMD EAST PILE
TUCSON, ARIZONA

ARIZONA DEPARTMENT OF ENVIROMENTAL QUALITY
HMD EAST PILE
400 West Congress Street
Tucson, AZ 85701
(520) 628-6733

| DESIGNED BY: | DRAFTED BY: | CHECKED BY: |
|---|---|---|
| JGP | TML | JGP |

| DATE: | FILE: |
|---|---|
| 6/17/2017 | MDS_003.dwg |
| PROJECT NO.: 2015053.40 | CONTRACT: ADEQ14-077537 |

DRAWING: