

# STATEWIDE INVENTORY OF UTAH'S SIGNIFICANT MINE WASTE FEATURES

by

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## CONTENTS

INTRODUCTION .....	1
METHODOLOGY.....	1
IMPORTANT CONSIDERATIONS.....	2
EXPLANATION OF DATABASE FIELDS.....	3
ACKNOWLEDGMENTS .....	8
REFERENCES .....	8
BIBLIOGRAPHY .....	8

## TABLES

Table 1. Definitions of mine waste feature types.....	7
Table 2. Feature degree of certainty definitions.....	7

## GEODATABASE

[https://ugspub.nr.utah.gov/publications/data\\_series/ds-8/ds-8.zip](https://ugspub.nr.utah.gov/publications/data_series/ds-8/ds-8.zip)

## INTRODUCTION

The Utah Mine Waste Inventory (UMWI) is a geodatabase of significant mine waste features with an area greater than 2000 m<sup>2</sup> in Utah that includes information on spatial extent and geologic character of these features. Mine waste consists of rock and other geological materials remaining after the mining process and may contain minerals that, though potentially valuable today, were not economically or technologically viable to recover at the time of mining (e.g., Vitti and Arnold, 2022). In Utah, mining has been active since the mid-1800s and mine waste features are found in all counties of the state, though not all features meet the threshold of significance established for inclusion in this report. Interest is growing in extracting these important resources from existing mine waste, which can reduce the need to open new mines.

The Utah Geological Survey (UGS) has developed a baseline inventory of significant mine waste features to inform scientific, economic, environmental, and policy discussions. This data series release is designed to offer a starting point for understanding mine waste distribution and composition across the state. The UMWI includes a link to a geodatabase that is available for download at [https://ugspub.nr.utah.gov/publications/data\\_series/ds-8/ds-8.zip](https://ugspub.nr.utah.gov/publications/data_series/ds-8/ds-8.zip) and this data can also be viewed on the Utah Mineral Resources interactive map at [geology.utah.gov/apps/blm\\_mineral](http://geology.utah.gov/apps/blm_mineral). This study assessed, identified, and attributed various characteristics of mine waste features associated with metallic mineral deposits within the state of Utah. The focus on waste resulting from metallic mineral mining is due to the higher likelihood of byproduct recovery in the waste. Industrial minerals such as sand and gravel were not included in this inventory. Bulk commodities such as phosphate, potash, and iron were included. Mineral evaporation ponds were excluded. Energy minerals such as coal, bitumen, and uranium were also included. Data provided includes mapped extents of significant (>2000 m<sup>2</sup>) mine waste features associated with historical or current metallic mineral mining, any known information about the source and type of mine waste, and any available information about potential mineral commodities associated with the mine waste feature. The inventory utilizes data from previous publications on Utah's mining districts and mineral occurrences (Krahulec, 2018; Utah Geological Survey, 2023; U.S. Geological Survey, 2026), as well as various satellite imagery services. This database represents a snapshot in time; environmental conditions or site configurations may have changed significantly since the date of original data and imagery collection.

The UMWI data does not present any resource or mineral potential assessment of mine waste features, nor do they imply that minerals are economically or technically recoverable; as such, this report makes no recommendation of action on any site. The detailed metallurgical, compositional, and feasibility studies required to determine any actual resource potential at a given site are beyond the scope of this inventory. These data are intended for regional-scale analysis and are not a substitute for site-specific field investigations or professional geological engineering evaluations. The data are preliminary and primarily derived through desktop mapping. Although effort has been made to ensure the quality of the data, the data are provided "as is." The spatial accuracy and attribute data are limited by the resolution of the source imagery and historical records. Therefore, this dataset should not be used for site-specific engineering, legal, or land-title purposes.

## METHODOLOGY

The UMWI polygons, which represent the mapped extents of the mine waste features, were manually digitized within ArcPro. Mine waste features were located by searching for environmental disturbances associated with known mining and mineral occurrences. Various satellite imagery basemaps captured from 2021 to 2025 with resolutions ranging from 0.15 to 1 meter were used to define and digitize the boundaries of the mine waste features greater than 2000 m<sup>2</sup> for significance. The UMWI utilized the Environmental Systems Research Institute, Inc. (ESRI) products to build the geodatabase. UMWI was compiled using ArcGIS Pro version 3.6.0 and ArcGIS Online (AGOL). The UMWI polygon layer is projected in the North American Datum of 1983 UTM Zone 12 (NAD83\_Z12). All mine waste polygons' geographic centroid coordinates were geometrically calculated and populated with latitude and longitude of the World Geodetic System 1984 (WGS84) and the easting and northing of the NAD83\_Z12.

A group editable feature class service layer published to AGOL was used to build out the inventory simultaneously among five GIS analysts. GIS analysts were assigned mining districts, prioritized based on the total production dollar value of a given area, to inventory potential mine waste features via satellite imagery basemaps. Imagery from the 3D Elevation Program (3DEP) Bare Earth Digital Elevation Model (DEM) Dynamic Service (1 meter) (U.S. Geological Survey, 2024), the Utah Hexagon licensed imagery (15-centimeter) (Utah Geospatial Resource Center, 2024), the Utah NAIP 2021 (0.6-meter) (U.S. Department of Agriculture, 2021), and ESRI World Imagery (0.5-meter; ESRI, 2025) aided in identifying environmental changes to the land throughout time and varied seasons.

Information from the Utah Mineral Occurrence System (UMOS) database (Utah Geological Survey, 2023) provided filtering criteria to isolate occurrences associated with metallic minerals, as opposed to industrial and energy minerals, to focus on sites with the highest likelihood of critical mineral enrichment. As a first pass, the UMWI polygons were characterized by citing the nearest spatial UMOS point(s) information. However, mine waste features are often complex and multi-generational, and this study acknowledges that mine waste features may incorporate waste from multiple point sources, including mines, mills, smelters, etc. Reasonable attempts were made to associate mine waste features with point sources, especially those in larger historical mining districts where records exist that detail various waste streams. For the larger, complex, and multi-generational mining districts such as Bingham, Tintic, Lisbon Valley, etc., further work is likely needed to refine point source information for the mine waste features.

The naming schema for each mine waste polygon uses the host mining district and numerically numbers them, e.g., Bingham0001, Bingham0002, etc. Polygons outside of mining districts were assigned to the closest mining district, or named after the county, e.g., SanJuan0001, SanJuan0002, etc.

Python code was run on the mine waste polygons to parse out and transpose element commodities listed in the Major\_Commodity, Minor\_Commodity, and Occurrence\_Commodity fields of the database into the specific commodity field of the UMWI database, e.g., *Major\_Commodity: AU, FE* transposed data to *AU field: Major, FE field: Major*. Feature degree of certainty refers to the confidence level of information associated with a feature such as mapped extent, source information, and commodity data. Features with confidence level ranked at 0 were based exclusively on interpretation of satellite imagery. Features with confidence level ranked with 1 were based on satellite imagery and informal data (such as internal UGS datasets), but we did not research whether publicly available documentation exists. Features with confidence level ranked 2 were classified in publicly available documentation. Features with confidence level ranked 3 were known to be accurate by a subject matter expert and were visited by a UGS staff member.

The volume calculations were derived from a tool provided by the U.S. Geological Survey (USGS) (Jones et al., 2026). The volume estimates for each mine waste polygon are reported in cubic meters (m<sup>3</sup>). The tool estimates a volume based on the mean thickness and area of each feature. The inputs include a 10-m DEM derived from The National Map Download (v2.0) from <https://apps.nationalmap.gov/downloader/> and the polygon mine waste features. The mean thickness is calculated through the equation (DEM \* [Maximum Height - Minimum Height]) / Maximum Distance where Maximum Distance is the distance from the perimeter to the pixel furthest from the perimeter inside the polygon. The mean thickness and area are then multiplied to calculate the volume.

## IMPORTANT CONSIDERATIONS

Digitizing mine waste through remote sensing and aerial imagery presents several technical challenges, such as distinguishing mine waste accumulations from surface disturbance or distinguishing historical mine waste piles from piles that naturally occur from weathering of soft rock units like shale. Additionally, decades of remediation of mine waste across the state often makes features difficult to distinguish.

To maintain a consistent baseline, mine waste features were only digitized where clear topographic accumulation was visible; areas showing only surface disturbance or historical remediation were not included in this stage of the inventory. In this study, mine waste accumulation is defined as features showing distinct vertical relief or stacked geometry relative to the natural grade (e.g., waste rock piles, tailings embankments, or heap leach pads). In districts like Marysvale and Stockton, small, high-density piles that occurred in tight clusters were included as a single feature. Surface disturbance was defined in this project as land that has been cleared, graded, or historically impacted but lacks a discernable "pile" structure. Remediation was also a common reason mine waste accumulations could not be determined in areas of historical mining. In districts such as Park City, remediation has spread waste thin or integrated it into the local soil profile. While these areas indicate a history of mine waste, they were excluded from this stage of the inventory.

Environmental factors further complicate desktop mapping from aerial imagery. In arid, shaley environments like Temple Mountain or the San Rafael River district, low-contrast lithology and deep shadows make it nearly impossible to systematically identify small, historical piles that have been subject to decades of natural weathering and erosion. Consequently, mine waste in districts impacted by these effects may be under-represented in the current geodatabase.

Utah is home to several world class mining districts, such as Bingham Canyon, Iron Springs, and Tintic, all of which hosted significant mining activity spanning nearly a century, and two of which have or had recent mining activity (Bingham

Canyon and Iron Mountain, respectively). Mapping the evolution of waste features in long-lived districts with active mining, exploration, and modern land development requires exhaustive site-specific historical research that was outside the scope of this study. Therefore, digitized features were limited to those identifiable in modern aerial imagery and supported by UMOS or other UGS publications.

Lastly, mine waste is not always located at the point of extraction. While mine waste features were attributed to the nearest reasonable UMOS point, they may contain material from multiple sources. As this study provides a “desktop-only” snapshot and does not include site-specific research on mining history, ore transport, and processing, it cannot be taken as a definitive representation of the material in a given mine waste feature. In complex districts like Tintic where transport, stockpiling, and waste from multiple mines were commonly mixed, multiple UMOS features were included in the attributes to provide the most accurate estimate of contributing sources based on available data.

## EXPLANATION OF DATABASE FIELDS

<b>Feature ID</b>	A unique alpha-numeric value assigned to each feature using the mining district a feature was drawn in, e.g., MiningDistrict0001, MiningDistrict0002, MiningDistrict0003, etc. If a polygon was too far away from a mining district, the feature ID listed the county the polygon was digitized in, e.g., SanJuan0001, SanJuan0002, SanJuan0003, etc.
<b>Probable Waste Source</b>	The probable waste source of a feature, often the name of the nearest known mine, smelter, mill or UMOS point.
<b>Mining District</b>	The accepted name of the metallic mineral mining district is based on the definitions of Krahulec (2018). “N/A” is used where a site lies outside of an established mining district.
<b>County</b>	The name of the county in Utah where the feature is located.
<b>Feature Type</b>	The type of waste feature if known. Mine waste feature type definitions are explained in Table 1.
<b>Feature Degree of Certainty</b>	The degree of certainty for the attribution of the feature type. Definitions of degree of certainty are explained in Table 2.
<b>Calculated Volume Cubic Meters</b>	Calculated volume units are those associated with the Vol_Cal (Volume Calculation) field. The volume calculations were derived from a tool provided by the USGS (Jones et al., 2026). The volume estimates for each mine waste pile are reported in cubic meters.
<b>Feature Area Square Meters</b>	Generated by ArcPro, this field denotes the calculated square meter area of the polygon.
<b>Major Commodity</b>	Best estimation of major commodities associated with the mine waste feature. No guarantee is made that these commodities occur in the mine waste feature. Up to five commodities are listed by commodity code.
<b>Minor Commodity</b>	Best estimation of minor commodities or byproducts associated with the mine waste feature. No guarantee is made that these commodities occur in the mine waste feature. Up to five commodities are listed by commodity code.
<b>Occurrence Commodity</b>	Best estimation of commodities present but not produced at the time of mining associated with the mine waste feature. Often used for commodities present in trace or sub-economic quantities. No guarantee is made that these commodities occur in the mine waste feature.

<b>AG</b>	The presence of silver as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>AL3</b>	The presence of alunite as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>AS</b>	The presence of arsenic as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>AU</b>	The presence of gold as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>BA</b>	The presence of barium/barite as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>BE</b>	The presence of beryllium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>BI</b>	The presence of bismuth as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>BIT</b>	The presence of Gilsonite®/solid hydrocarbons as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>C</b>	The presence of carbon as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>CA</b>	The presence of calcium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>CD</b>	The presence of cadmium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>CO</b>	The presence of cobalt as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>COA</b>	The presence of coal as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>CU</b>	The presence of copper as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>F</b>	The presence of fluorine/fluorite as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>FE</b>	The presence of iron as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>GA</b>	The presence of gallium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>GE</b>	The presence of germanium as a major commodity, minor commodity, or known occurrence within the mine waste feature.

<b>HG</b>	The presence of mercury as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>IN</b>	The presence of indium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>K</b>	The presence of potassium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>LI</b>	The presence of lithium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>MG</b>	The presence of magnesium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>MN</b>	The presence of manganese as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>MO</b>	The presence of molybdenum as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>NI</b>	The presence of nickel as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>P</b>	The presence of phosphate as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>PB</b>	The presence of lead as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>PD</b>	The presence of palladium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>PT</b>	The presence of platinum as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>RE</b>	The presence of rhenium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>REE</b>	The presence of rare earth elements (REE) as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>S</b>	The presence of sulfur as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>SB</b>	The presence of antimony as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>SC</b>	The presence of scandium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>SE</b>	The presence of selenium as a major commodity, minor commodity, or known occurrence within the mine waste feature.

<b>SIL</b>	The presence of silica as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>SN</b>	The presence of tin as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>SR</b>	The presence of strontium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>TE</b>	The presence of tellurium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>TI</b>	The presence of titanium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>U</b>	The presence of uranium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>V</b>	The presence of vanadium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>W</b>	The presence of tungsten as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>WOL</b>	The presence of wollastonite as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>Y</b>	The presence of yttrium as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>ZN</b>	The presence of zinc as a major commodity, minor commodity, or known occurrence within the mine waste feature.
<b>Centroid_Lat_WGS84</b>	The latitude centroid coordinate, calculated by the geometry of the feature. Provided in decimal degrees, using World Geodetic System 1984 (WGS84).
<b>Centroid_Long_WGS84</b>	The longitude centroid coordinate of the polygon, calculated by the geometry of the feature. Provided in decimal degrees using World Geodetic System 1984 (WGS84).
<b>Centroid_Easting_NAD83_Z13</b>	Refers to the east-west centroid coordinate within a specific map projection that uses the North American Datum of 1983 UTM Zone 12 (NAD83_UTM_Z12) as its reference framework.
<b>Centroid_Northing_NAD83_Z12</b>	Refers to the north-south centroid coordinate within a specific map projection that uses the North American Datum of 1983 UTM Zone 12 (NAD83_UTM_Z12) as its reference framework.

**Table 1.** Definitions of mine waste feature types.

<b>Feature type descriptions</b>	<b>Definition of mine waste type</b>
Leach pile - heap	A process in hydrometallurgy by which a lixiviant is added to broken ore heaped on the surface.
Mine dump	A pile of material excavated from a mine and then transported and dumped in a heap or pile at or near a mine opening or open pit. Also called a waste dump, heap, pile, or spoil pile.
Ore stockpile/storage	A location where ore materials are stored as piles after being removed from the mine and before being processed. The material is then transported to a process plant or site.
Other	Other feature types. Used where a description is reported in the Remarks field.
Overburden pile	Barren rock material, either loose or consolidated, overlying a mineral deposit that was removed prior to mining.
Slag pile	A pile of slag (waste from the smelting of ore.)
Tailings - dry stack	Tailings features that are placed and compacted in a mound that is concurrently reclaimed with native soil and vegetation.
Tailings - mill	The gangue and other refuse material resulting from the washing, concentration, or treatment of ground ore.
Tailings - pond	An area closed at the lower end by a constraining wall or dam into which tailings and mineral processing waste that contain a high proportion of water are deposited. The pond is generally impounded with a dam, referred to as a tailings dam. Also known as tailings impoundments, or tailings storage facilities.
Tailings - undifferentiated	The gangue and other refuse material resulting from the washing, concentration, or other treatment of ground ores. Also called slimes, tails, refuse, and leach residue. Generally differentiated from mine dumps on topographic maps by label only.
Unknown	There is a high degree of certainty that this is a mine waste feature, but the feature is not classified in publicly available documentation.
Waste rock stockpile	Rock or ore that has been mined and stockpiled for later use. Identified as a waste rock stockpile, or waste stockpile in literature.
<b>Coal feature types</b>	
Power plant ash pile	Post-incineration power plant waste.
Coal mine waste pile	Coal mining byproduct; mostly non-coal rock (e.g., sandstone and shale) derived from mining slopes between coal seams.
Wash plant waste pile	Rock waste derived from "washing" coal ore.
Loadout	Potential waste locations where coal was loaded onto trains for transport to power plants. Savage loadout is the only active coal loadout; Wildcat is not used for coal anymore. While there may be waste piles near historical loadouts, they are likely reclaimed.

**Table 2.** Feature degree of certainty definitions.

<b>Feature Degree of Certainty</b>	
0	Features with confidence levels ranked 0 were based exclusively on interpretation of satellite imagery.
1	Features with confidence levels ranked 1 were based on satellite imagery and informal data (such as internal UGS datasets), but the UGS did not research whether publicly available documentation exists.
2	Features with confidence levels ranked 2 were classified in publicly available documentation (UGS, USGS datasets).
3	Features with confidence levels ranked 3 were known to be accurate by a subject matter expert and were visited by a UGS staff member.

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