

Civil and Environmental Engineering



# Emerald Isle Mine Preliminary Assessment & Site Investigation

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Client: Bureau of Land Management  
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Technical/Grading Advisor: Dr. Bridget Bero

# Introduction & Project Purpose

- *Purpose:* preliminary assessment and site investigation (PA/SI) of the Emerald Isle Mine in Northwest Arizona.



Figure 1: Open Pit

# Location

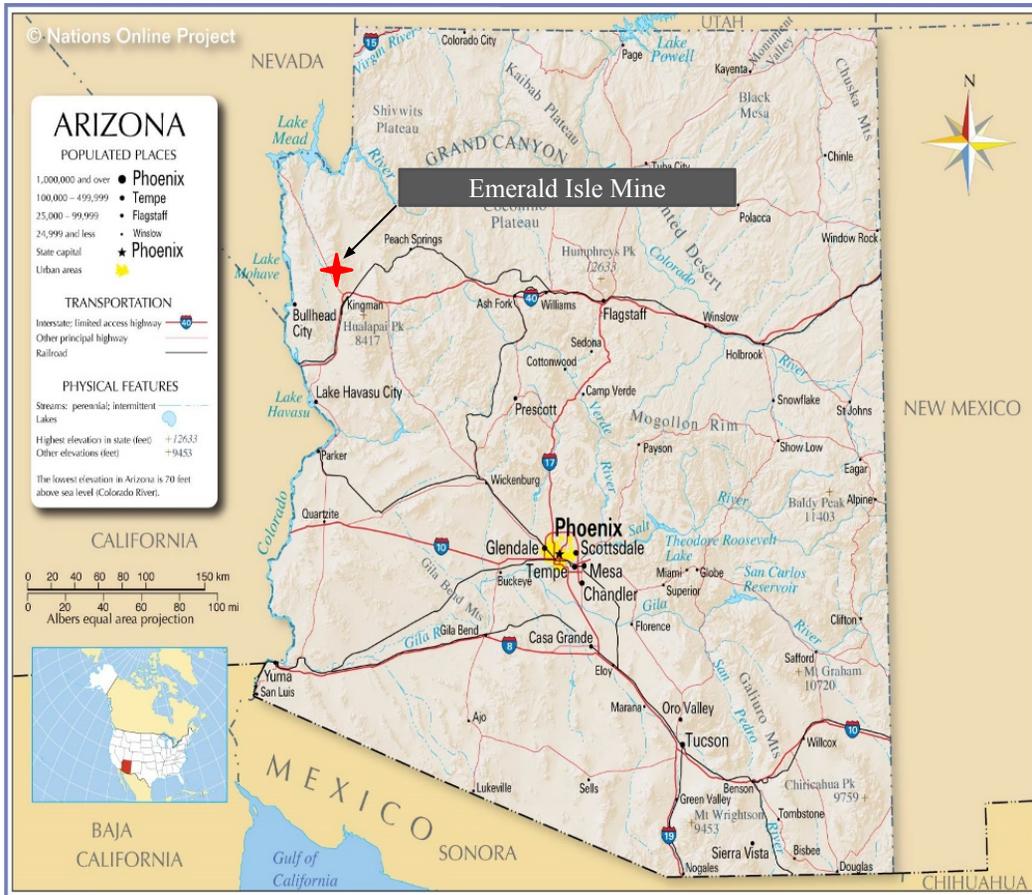


Figure 2: State Map [1]

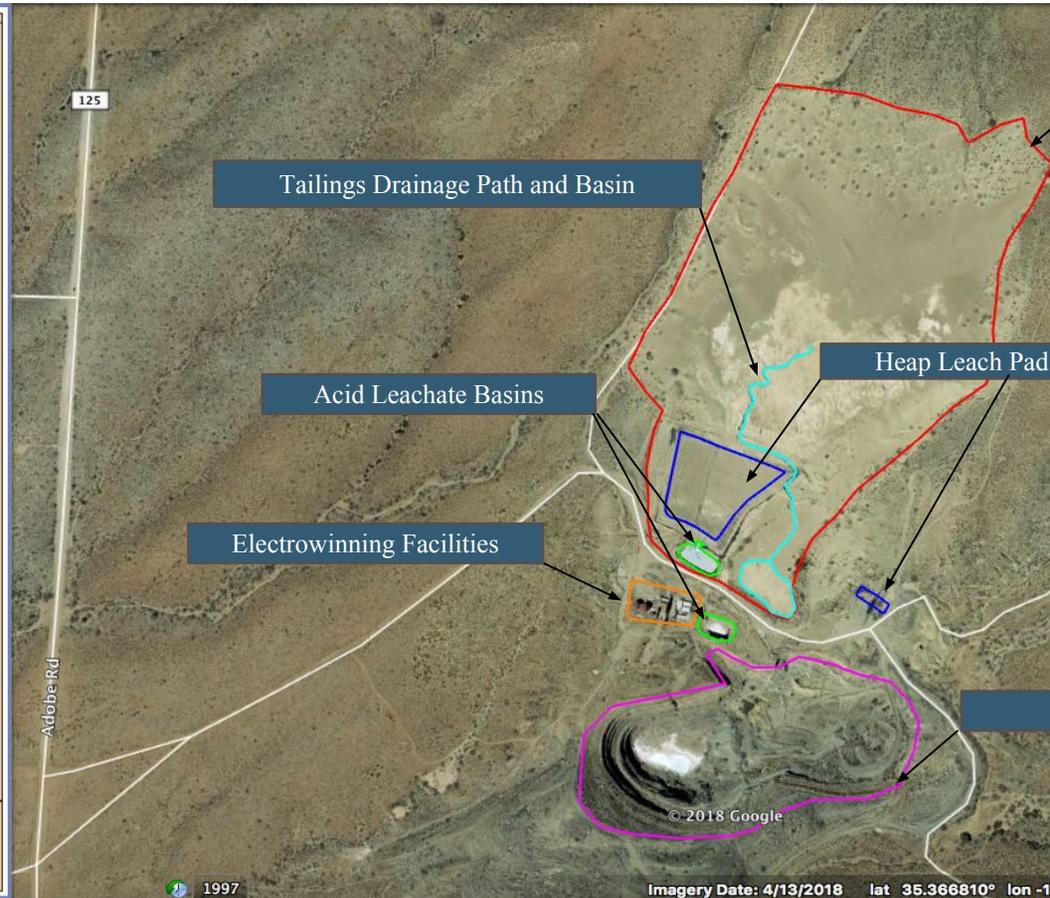


Figure 3: Emerald Isle Map

# Task 1: Work Plan

- 1.1: Sampling Analysis Plan (SAP)
- 1.2: Health and Safety Plan (HASP)

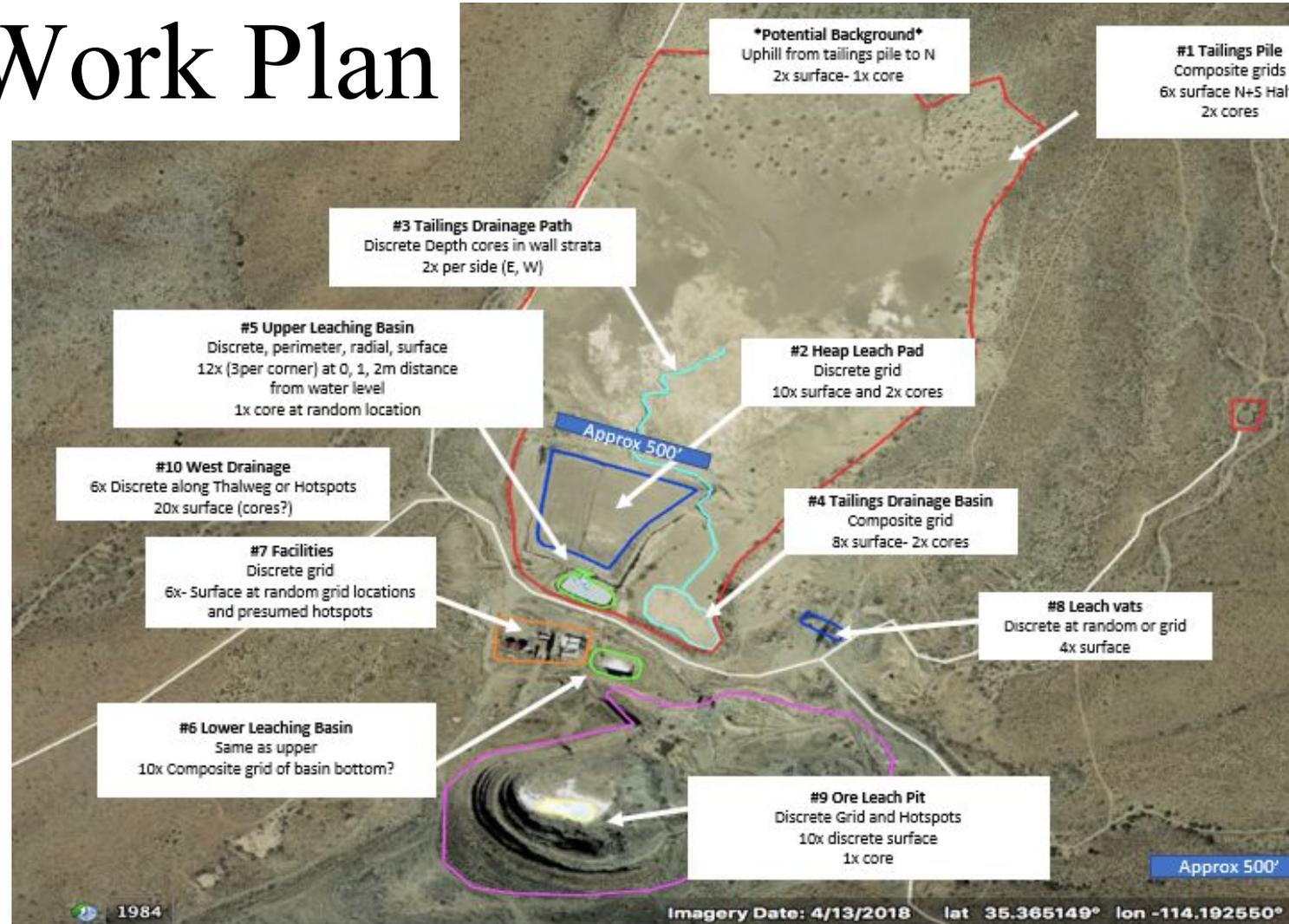


Figure 4: Decision Unit Map

# Task 2: Field Investigation

- Sampling will be done in accordance with the Work Plan



Figure 6: Tailings

Figure 5: Empty Leach Pit [6]

# Task 3: Analysis

- 3.1: Dry and Sieve the Samples
- 3.2: X-Ray Fluorescence (XRF) Analysis
- 3.3: Contaminant of Concern Determination
- 3.4: Acid Digestion of Soil and Sample Preparation
- 3.5: ICP-MS Analysis
- 3.6: Correlation of ICP-MS/XRF Data



Figure 7: Handheld XRF



Figure 8: ICP-MS

# Task 4: Risk Assessment

- 4.1: Human Health Risk Assessment (HHRA)
  - 4.3.1: Determine Exposure Point Concentrations
  - 4.3.2: Toxicity Assessment
  - 4.1.3: Exposure Assessment
  - 4.1.4: Risk Calculations

- 4.2: Ecological Risk Assessment
  - 4.2.1: Characterization of Ecology
  - 4.2.2: Toxicity Assessment
  - 4.2.3: Exposure Assessment
  - 4.2.4: Risk Characterization

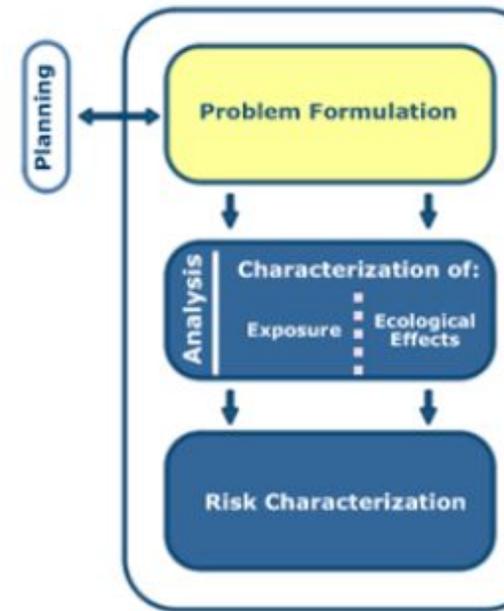


Figure 10: Ecological Risk Assessment

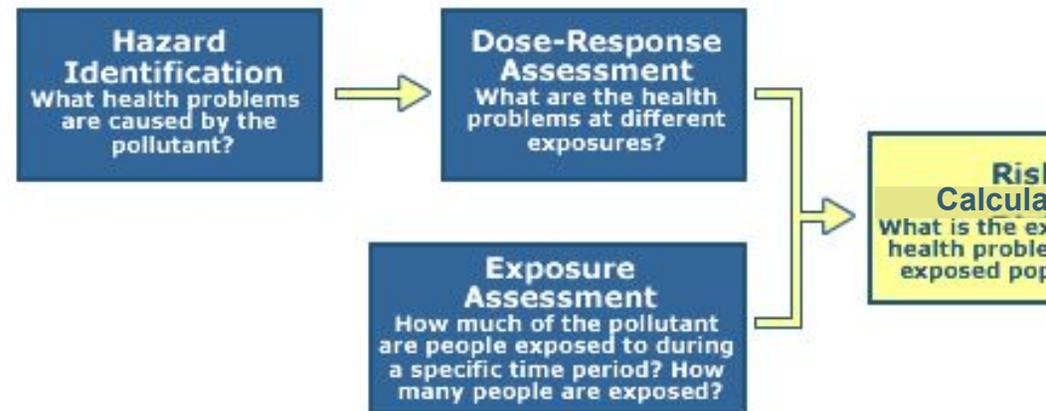


Figure 9: Human Health Risk Assessment Flowchart [5]

# Task 5: Impacts

- Environmental
- Economic
- Social
  - Recreational users
  - Health



Figure 11: Pregnant Leachate Pond [6]



Figure 12: Tailings canyon [6]

# Task 6: Project Management

- 6.1: Meetings
  - Client
  - Technical Advisor/Grading Instructor
  - Team
- 6.2: Scheduling and Resource Management
- 6.3: Project Deliverables
  - 30% Report and Presentation
    - Task 3.1 - Drying and Sieving of Soil
  - 60% Report and Presentation
    - Task 3.5 - XRF and ICP-MS Correlation
  - 90% Report and Presentation
    - Task 5.0 - Project Impacts
  - Final Report - PA/SI
  - Presentation
  - Website



Figure 13: SPNG Company Logo

# Exclusions

- Remediation Alternatives
- Hydrology and Water Sampling



Figure 14  
Leachate

# Project Schedule

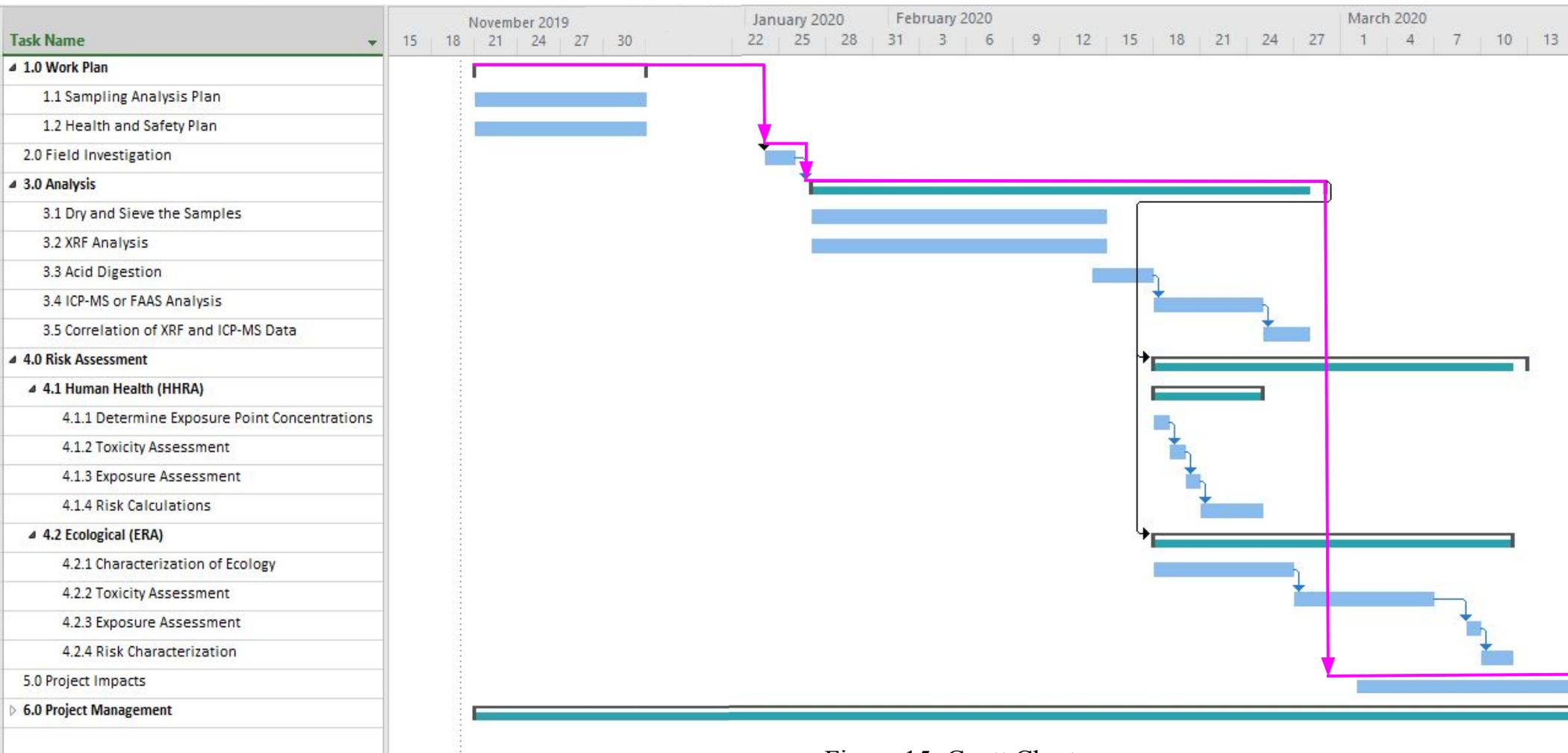


Figure 15: Gantt Chart

Table 1: Staffing Overview

# Staffing Plan

- Personnel and Titles
- Personal Qualifications
- Total Estimation of Work
- Staffing Summary

| Task   | PE (hrs)   | EIT (hrs)  | LAB (hrs)  |
|--|------------|------------|------------|
| <b>TASK 1: Work Plan</b>                                 |            |            |            |
| 1.1 Sampling Analysis Plan (SAP)                         | 8          | 24         | 12         |
| 1.2 Health and Safety Plan (HASP)                        | 8          | 24         | 12         |
| <b>TASK 2.0: Field Investigation</b>                     | 16         | 16         | 16         |
| <b>TASK 3.0: Analysis</b>                                |            |            |            |
| 3.1 Dry and Sieve the Samples                            | 2          | 4          | 12         |
| 3.2: X-Ray Fluorescence (XRF) Analysis                   | 4          | 20         | 40         |
| 3.3: Acid Digestion of Soil and Sample Prep              | 1          | 4          | 10         |
| 3.4 ICP-MS or FAAS Analysis                              | 2          | 8          | 16         |
| 3.5: Correlation of ICP/FAA and XRF/FAA Data             | 1          | 2          | 8          |
| <b>TASK 4.0: Risk Assessment</b>                         |            |            |            |
| 4.1: Human Health Risk Assessment                        |            |            |            |
| 4.1.1: Determine Exposure Point Concentrations           | 1          | 6          |            |
| 4.1.2: Toxicity Assessment                               | 1          | 6          |            |
| 4.1.3: Exposure Assessment                               | 1          | 6          |            |
| 4.1.4: Risk Calculations                                 | 1          | 6          |            |
| 4.2: Ecological Risk Assessment                          |            |            |            |
| 4.2.1: Characterization of Ecology                       | 4          | 12         |            |
| 4.2.2: Toxicity Assessment                               | 4          | 12         |            |
| 4.2.3: Exposure Assessment                               | 2          | 6          |            |
| 4.2.4: Risk Characterization                             | 2          | 6          |            |
| <b>TASK 5.0: Project Impacts</b>                         | 4          | 8          | 4          |
| <b>TASK 6.0: Project Management</b>                      |            |            |            |
| 6.1: Meetings  |            |            |            |
| 6.1.1: Client Meetings                                   | 4          | 16         | 8          |
| 6.1.2: Technical Advisor and Grading Instructor Meetings | 4          | 16         | 8          |
| 6.1.3: Team Meetings                                     | 16         | 32         | 32         |
| 6.2: Scheduling and Resource Management                  | 8          | 16         | 8          |
| 6.3: Project Deliverables                                |            |            |            |
| 6.3.1: 30% Report and Presentation                       | 4          | 16         | 8          |
| 6.3.2: 60% Report and Presentation                       | 4          | 16         | 8          |
| 6.3.3: 90% Report and Website                            | 2          | 8          | 16         |
| 6.3.4: PA/SI Final Report                                | 2          | 8          | 4          |
| 6.3.5: Final Presentation                                | 2          | 8          | 4          |
| 6.3.6: Final Website                                     | 2          | 8          | 16         |
| <b>TOTALS (hrs)</b>                                      | <b>110</b> | <b>314</b> | <b>242</b> |

Table 2: Cost of Engineering Services

# Cost of Engineering Services

- Personnel Costs
- Travel Costs
- Supplies & Lab Fees

| 1.0 Personnel   | Classification   | Hours/Quantity                  | Rate, \$/hr                           |
|-----------------|--|---------------------------------|---------------------------------------|
|                 | PE   | 110                             | 195                                   |
|                 | EIT  | 314                             | 67                                    |
|                 | LAB TECH   | 242                             | 48                                    |
|                 | TOTAL  | 666                             |                                       |
| 2.0 Travel      |  |                                 |                                       |
|                 | Mileage, 1 trip  | 652                             | \$0.58/mile                           |
|                 | Hotel Rooms in Kingman   | 3 Rooms for 1 Night             | \$94/room,night                       |
|                 | Meals  | 7 persons, 2 days               | \$55/day/person                       |
| 3.0 Supplies    |  |                                 |                                       |
|                 | Ziplocks   | 4                               | \$18/152 count<br>Freezer Bag, Gallon |
|                 | Lab Disposable Gloves  | 4                               | \$10/100 ct. box                      |
|                 | 1 1/2" X 5' Plastic Liner for Auger/Samples                              | 8 (= 40 1 ft tubes)             | \$4/liner                             |
|                 | Buckets  | 15                              | \$3.25/bucket                         |
|                 | Sample Marker Flags  | Bundle of 100                   | \$8/bundle                            |
|                 | Garbage Bags   | 55 Gallon, 80 Count, heavy duty | \$24/Box                              |
|                 | Trowels  | 7                               | \$10/trowel                           |
|                 | Pens   | box of 36                       | \$7/box                               |
|                 | Tape Measure   | 7                               | \$8 each                              |
|                 | Water  | 2.5 Gallon Jug (x7)             | \$3/jug                               |
|                 | GPS Unit Rental  | 7                               | \$20/day                              |
|                 | Lab Notebooks  | Individual                      |                                       |
| Chemistry Lab   | Acid Digestion Reagents/Materials + ICP-MS Analysis (including reagents) | 20 Samples                      | \$50/sample                           |
| CENE Lab Access | Soil Sieving   | 7 days                          | \$100/day                             |
| ENE Lab Use     | XRF Analysis   | 7 days                          | \$100/day                             |
| 5.0 TOTAL       |  |                                 |                                       |

# References

- [1] <https://www.mapsofworld.com/usa/states/arizona/arizona-map.html>
- [2] [https://www.forestry-suppliers.com/product\\_pages/products.php?mi=31171&itemnu=67351](https://www.forestry-suppliers.com/product_pages/products.php?mi=31171&itemnu=67351)
- [3] <https://www.azom.com/equipment-details.aspx?EquipID=444>
- [4] [txscientific.com/icp-ms-x-series-c69.aspx](http://txscientific.com/icp-ms-x-series-c69.aspx)
- [5] <https://nepis.epa.gov/Exe/ZyPDF.cgi/20012GDU.PDF?Dockey=20012GDU.PDF>
- [6] Sydney Adamonis