



SK Geotechnical Company

# Landfill Liner

---

Authors: Ali Alrashed, Nayf Alotaibi, Joe Atkinson, and Xiaoyi Tan

4/28/2016

# Introduction

- **Project Purpose:** Create a liner for Cinder Lake Landfill, utilizing waste materials entering the waste stream.
- **Project Location:** Approximately 12 miles Northeast of Flagstaff on Highway 89.
- **Landfill liner:** Municipal landfill liner. 40 CFR, 258.

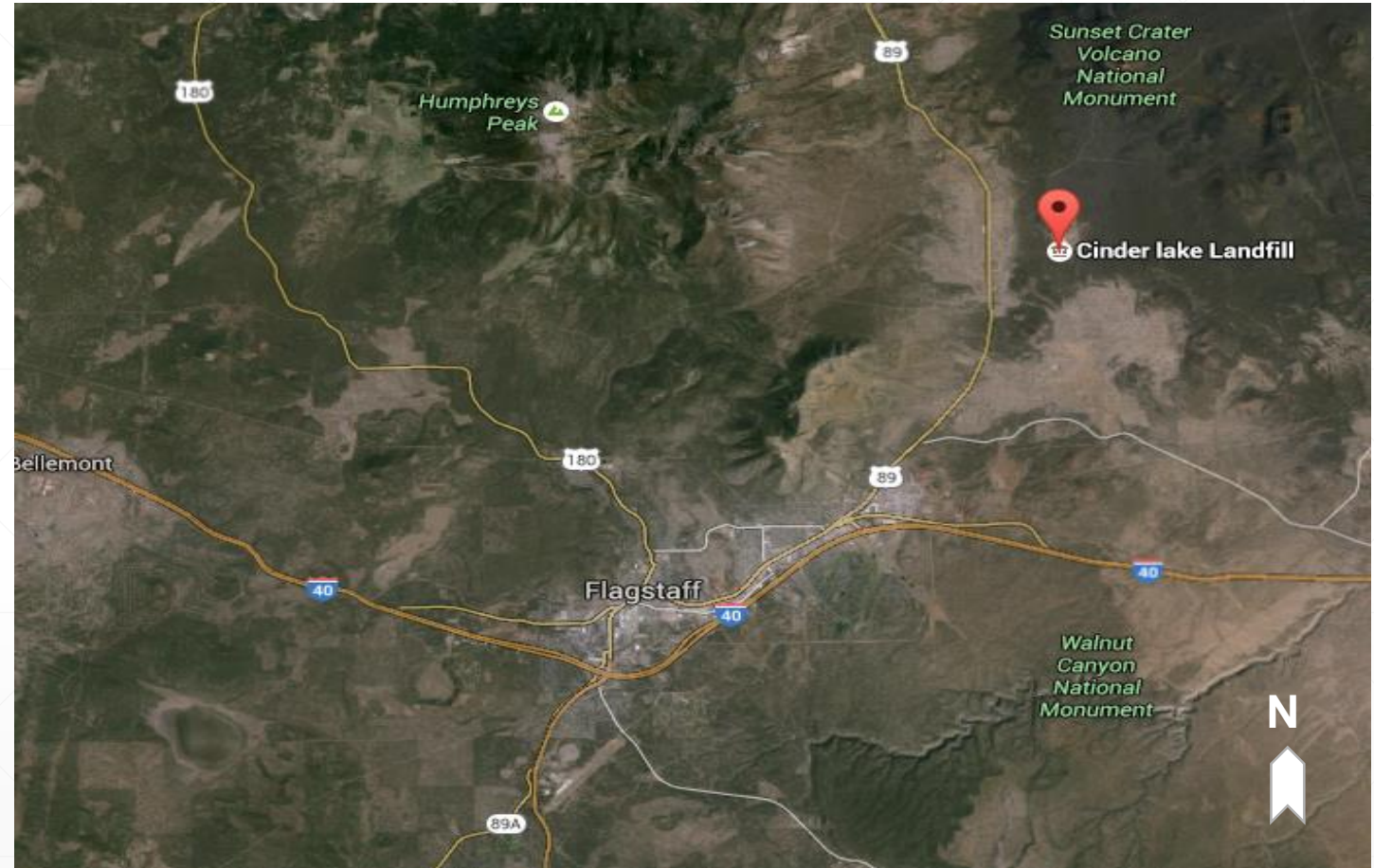


Figure 1: Cinder Lake Landfill Site Location [1]

# Current Project Status

- Cinder Lake Landfill is a 343-acre municipal solid waste landfill [2].
- The landfill accepts household, commercial, and institutional waste [2].
- The landfill receives approximately 279 tons of waste per day [2].
- The landfill serves approximately 17,000 residential and commercial units [2].
- The landfill grinds green waste, and wood waste to use them as an alternative daily cover [2].

# Current Project Status Contd.

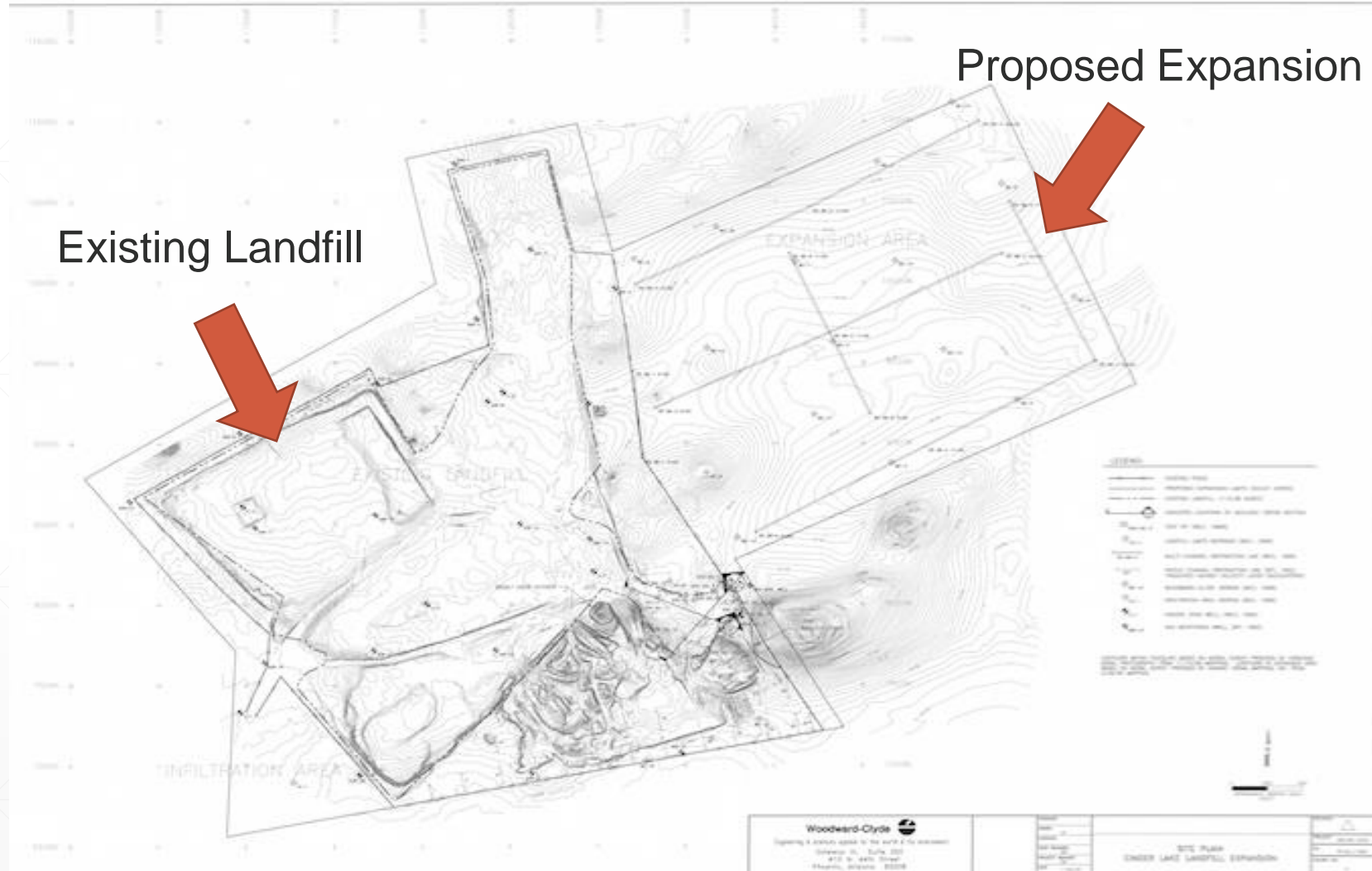


Figure 2: Cinder Lake Landfill Site [2]

# Technical Background

## Technical Background:

- Alternate liner will reduce materials entering the waste stream.
- Liner based on the design criteria from 40 CFR, 258 [3].
- Consists of 5 components:
  1. Lime.
  2. Soil.
  3. Fly Ash.
  4. Paper Millings (PPS).
  5. Polymers.





# Stakeholders

The stakeholders of the project are:

- The City of Flagstaff.
- Technical Advisor: Gerjen Slim, Lab Manager.
- Client: Mr. Matt Morales, Senior Project Manager.
- Customers who use Cinder Lake Landfill.



# Technical Considerations and Potential Challenges

The designed landfill liner is required to meet the following criteria:

- Primary criteria: Hydraulic Permeability.
- Secondary criteria: Shear Strength and Proctor Compaction.
- EPA design regulations.

## Potential Challenges:

- Quality Assurance (QA), and Quality Control (QC).
- Material quality and characteristics.
- Mixture continuously changing.

# Scope of Services

## 1.0 Health and Safety Protocols

1.1 Safety Protocol for Fly Ash.

1.2 Safety Protocol for PPS.

1.3 Safety Protocol for Polymers.

1.4 Personal Safety.

Deliverable: Lab Safety Certification for all members.

## 2.0 Material Preparation

2.1 Fly Ash preparation.

2.2 PPS preparation.

2.3 Polymers preparation.

2.4 Soil preparation.

2.5 Lime preparation.

Deliverable: Lab hours log.



# Scope of Services

## 3.0 Materials Testing

3.1 Compaction test.

3.2 Permeability test.

Deliverables: Data collection.

## 4.0 Data Analysis

Deliverable: Data spreadsheets.

## 5.0 Project Management

5.1 Team meetings.

5.2 TA meetings.

5.3 Website.

5.4 50% report.

5.5 Final report.

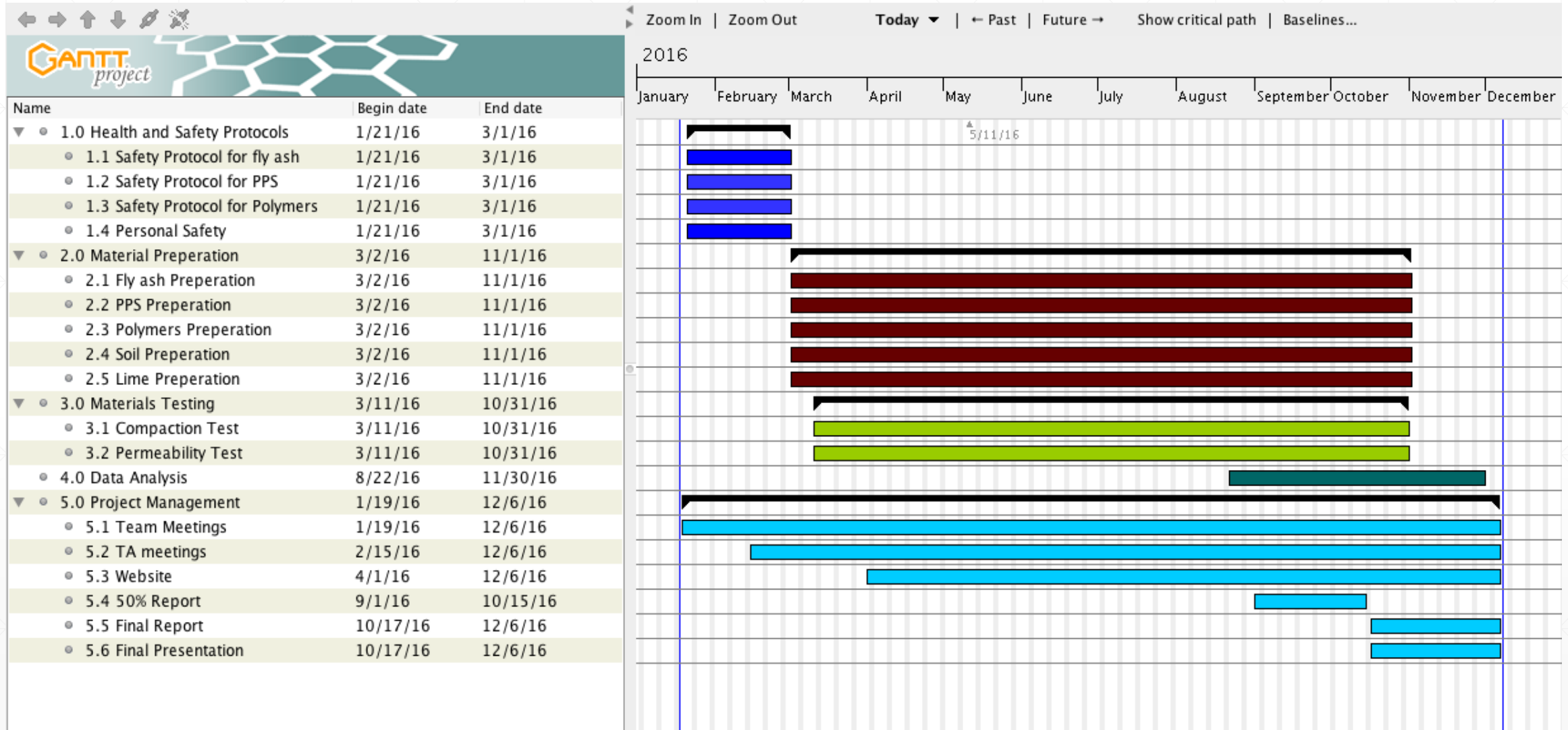
5.6 Final presentation.

# Exclusions

The following tasks are excluded from this project:

- The team will not implement the final liner design.
- The team will not conduct Shear Strength tests.
- The team will not conduct California Bearing Ratio tests.

# Project Schedule



# Staff and Cost

*Table 1: Positions and their codes*

<b>Classification</b>	<b>Code</b>
<b>Development Engineer</b>	<b>DENG</b>
<b>Research Engineer</b>	<b>RENG</b>
<b>Lab Technician</b>	<b>LAB</b>
<b>Engineering Intern</b>	<b>INT</b>

# Staff and Cost Contd.

Table 2: Total Required Hours

Tasks	DENG (hours)	RENG (hours)	LAB (hours)	INT (hours)
1.0 Researching	30	30		20
2.0 Health and Safety Protocols		12		
3.0 Materials Preparation		2	40	
4.0 Materials Testing		3	300	
5.0 Reporting Data	30		60	
6.0 Project Management	10	60	30	40
Subtotal	70	107	430	60
<b>Total Hours = 667</b>				

# Staff and Cost Contd.

Table 3: Total Personnel Costs

Position	Classification	Hours	Rate, \$/hr.	Cost
Development Engineer	DENG	70	165	\$11,550.00
Research Engineer	RENG	106	90	\$9,540.00
Lab Assistant	LAB	430	60	\$25,800.00
Engineering Intern	INT	60	30	\$1,800.00
	Total personnel expenses			\$48,690.00
	Lab rental	240 days	\$30/day	\$7,200.00
Total		\$55,890.00		



# References

[1] Google Maps.

[2] “Cinder Lake Landfill,” AEES, 2012, [Online]. Available: [http://cefns.nau.edu/capstone/projects/CENE/2014/Landfill-Cell-D/Documents/CENE\\_486\\_Cell\\_D\\_Final\\_Report.pdf](http://cefns.nau.edu/capstone/projects/CENE/2014/Landfill-Cell-D/Documents/CENE_486_Cell_D_Final_Report.pdf). [Accessed: 20 April 2016].

[3] “Closure Criteria,” U.S Government Publishing Office, 2016, [Online]. Available: [http://www.ecfr.gov/cgi-bin/text-idx?SID=b67b217c1e8767c774a3aa0ff9bff80c&mc=true&node=se40.25.258\\_160&rgn=div8](http://www.ecfr.gov/cgi-bin/text-idx?SID=b67b217c1e8767c774a3aa0ff9bff80c&mc=true&node=se40.25.258_160&rgn=div8). [Accessed: 20 April 2016].

**Q & A**

