

## Aspen Engineering & Environmental Services

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December 6, 2013

Matt Morales, P.E.  
Project Manager  
211 West Aspen Avenue  
Flagstaff, AZ 86001

Dear Mr. Morales:

Aspen Engineering & Environmental Services (AEES) has drafted a proposal in regards to the future project at Cinder Lake Landfill titled "Re-Sequencing Cell D." The proposal addresses the understanding of the project, the work to be completed, the schedule of the project and the cost of services. The proposal has been completed with the knowledge that AEES has gathered throughout the semester (September 2013-December 2013).

On behalf of AEES, we thank you for your cooperation, and we hope that you are pleased with the submittal.

Sincerely,

Shayla Woodhouse, Project Manager  
ShaylaWoodhouse@nau.edu

Enclosed: Proposal

December 6, 2013



## **CINDER LAKE LANDFILL RE-SEQUENCING CELL D**

**Prepared for:  
Matt Morales, Project Manager  
Cinder Lake Landfill  
Flagstaff, AZ**

**Prepared by:  
Aspen Engineering & Environmental Services**

**Saleh AlAzmi  
Coral Martz  
Shayla Woodhouse**

# TABLE OF CONTENTS

<b>1.0 Project Understanding</b>	<b>1</b>
1.1 Project Description.....	1
1.2 Project Statement.....	1
1.3 Project Background.....	1-2
1.4 Stakeholders.....	3
<b>2.0 Project Scope</b>	<b>3</b>
2.1 Literature Review.....	3
2.1.1 Impacts.....	3
2.1.2 Regulations.....	3
2.1.3 State of the Art Review (SOTA).....	4
2.2 Landfill Mining.....	4
2.2.1 Staging.....	4
2.2.2 Processing.....	4
2.3 Landfill Excavation.....	4
2.3.1 Staging.....	4
2.4 Health & Safety Plan.....	5
2.4.1 Gas & Air Monitoring.....	5
2.4.2 Safety.....	5
2.5 Project Cost Estimate.....	5
2.6 Documentation Deliverables.....	5
2.7 Exclusions.....	6
<b>3.0 Project Schedule</b>	<b>6</b>
<b>4.0 Cost of Engineering Services</b>	<b>7</b>
4.1 Cost of Engineering Services.....	7
4.2 Overhead Costs.....	7
4.2.1 Travel Expenses.....	7
<b>5.0 Conclusion</b>	<b>8</b>
<b>6.0 Appendix</b>	<b>8</b>
<b>7.0 References</b>	<b>8</b>

## TABLE OF FIGURES

<i>Figure 1: Cinder Lake Landfill, Flagstaff, AZ.....</i>	<i>2</i>
<i>Figure 2: Cells (Sequence) at Cinder Lake Landfill.....</i>	<i>2</i>
<i>Figure 3: Project Schedule.....</i>	<i>6</i>
<i>Figure 4: Figure 4: Design of future Cell D.....</i>	<i>8</i>
<i>Table 1: Cost of Engineering Services.....</i>	<i>7</i>

## 1.0 Project Understanding

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### 1.1 Project Description

The City of Flagstaff Cinder Lake Landfill is proposing a re-sequencing of Cell D. According to Matt Morales, “the re-sequencing of Cell D will expand the available airspace for future waste in Cell D”, potentially saving the City of Flagstaff millions of dollars. The current design depth in Cell D is approximately 20-ft. The landfill operations are currently restricted to remaining below the tree line to sustain a certain aesthetic appeal within the community. The restriction on waste elevation makes the possibility of expanding the volume, by increasing the depth, a highly valued project. The expansion of Cell D, by area, will also create more usable space for future waste by changing the current non-uniform shape. (See Appendix A, Figure 4 for the proposed design of the future Cell D). The project also has the potential to save money spent in future landfill cover because the mined materials has the potential to be processed as a cover material which could reduce the need to purchase materials. It is estimated that Cinder Lake Landfill will run out of soil cover material 19 years prior to its expected closure in 2050. It is anticipated that a portion of the municipal solid waste in Cell C has the potential to be reused as cover material. In addition to more space and cover material, the excavation of Cell D will provide valuable rock that can be sold for construction and other purposes. In all, the re-sequencing of Cell D has the potential to save millions of dollars for the City of Flagstaff.

### 1.2 Project Statement

Cinder Lake Landfill requires a plan for landfill mining and excavation to achieve the design of the future Cell D.

### 1.3 Project Background

Cinder Lake Landfill is a 343-acre municipal solid waste landfill located in East Flagstaff, Arizona. Figure 1 is a map of the landfill relative to Flagstaff. The landfill serves Flagstaff and the 75-mile radius around the city. The landfill was historically used as a dumpsite, and then it became a municipal solid waste landfill. Because the aquifer is approximately 1600-feet below the ground surface, the landfill was permitted and authorized to operate without leachate collection and control systems in the active disposal area and has remained unlined. Of the 343-acre landfill, approximately 110 acres are currently being used as active disposal areas (Cell A, B, and C). Cells D and E are borrow pits that provide cover material for the active disposal areas. Figure 2 shows the location of each cell (sequence). Cell D is to be re-sequenced and prepared as a future disposal area. Cell D has been excavated to a design depth of approximately 20-feet. Based off sample drillings from the cell area, provided by Speedie and Associates, the City of Flagstaff Cinder Lake Landfill determined that it is possible to excavate an additional 30-feet. Cell D has a current area of 33-acres. Beneath the current depth lies volcanic rock. The majority of Cell D is a borrow pit, however the South Thumb (portion of Cell D) of the cell contains municipal solid waste. Cell C is known to contain municipal solid waste and reconstruction

debris including trees, wood, concrete, and rebar. However, it must be assumed that the cell contains municipal solid waste.

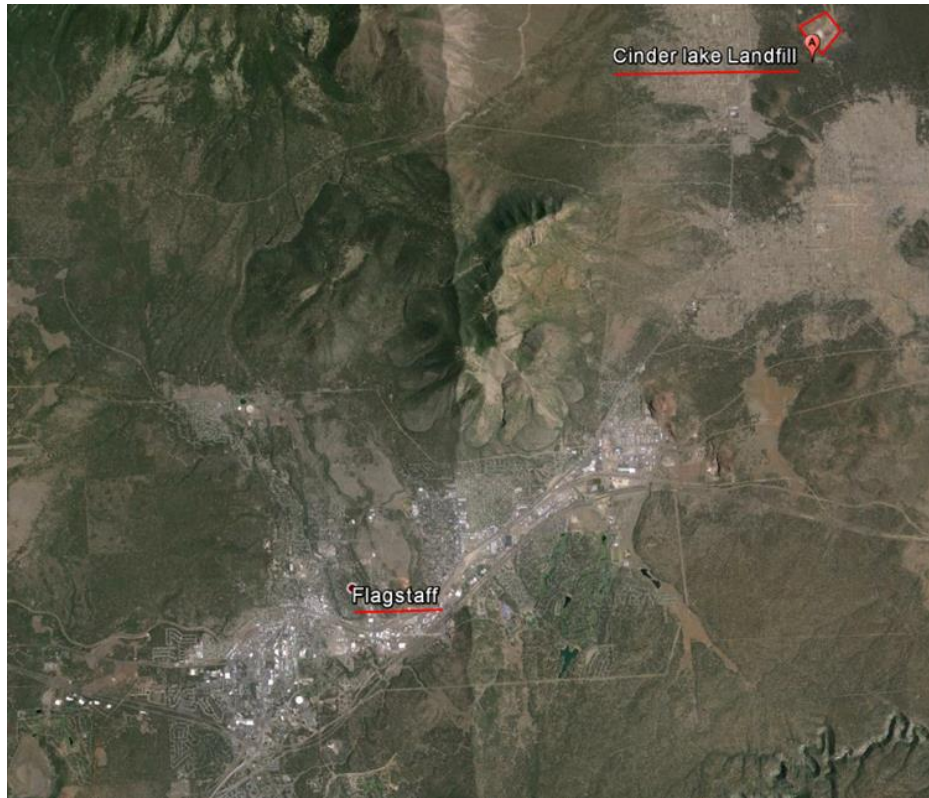


Figure 1: Cinder Lake Landfill, Flagstaff, AZ. (Google Maps)

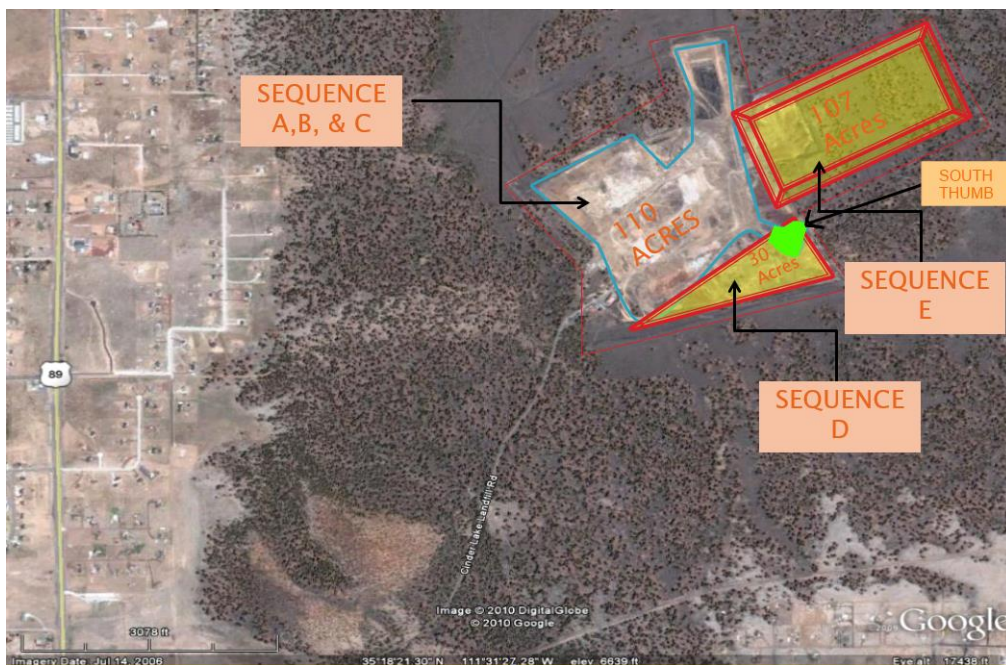


Figure 2: Cells (Sequence) at Cinder Lake Landfill.

## **1.4 Stakeholders**

Stakeholders for the Cinder Lake Landfill are the City of Flagstaff and customers of the landfill. The City of Flagstaff owns and operates the Cinder Lake Landfill. The customers of Cinder Lake Landfill include residents and companies in the surrounding area. Aspen Engineering & Environmental Services will be in communication with their client, Matt Morales, Project Manager for the City of Flagstaff Cinder Lake Landfill, when addressing any problems or needs of the project.

## **2.0 Project Scope**

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The project scope includes six major tasks: literature review, landfill mining, excavation, health and safety plan, cost estimate and project documentation. These tasks incorporate various needs of Cell D, Cell C, and the South Thumb. Each major task is followed by additional subtasks.

### **2.1 Literature Review**

AEES will conduct research regarding the impacts and regulations that will influence the design project of re-sequencing Cell D. The collected information will allow the team to develop requirements and constraints for the project.

#### **2.1.1 Impacts**

The impacts of the design include the environmental impacts and the impacts on customers of Cinder Lake Landfill. The environmental impacts will consist of groundwater, soil and air. The customer impacts will include the residents of Flagstaff, industries and commercial businesses. This project will also entail economic impacts towards the city of Flagstaff. The re-sequencing of Cell D will create more space for future trash and save the city money in the future. The social, cultural and political impacts will also be considered.

#### **2.1.2 Standards & Regulations**

Cinder Lake Landfill is an operation under the control of the City of Flagstaff. The landfill is overseen by the City of Flagstaff and the State of Arizona. It is necessary to ensure that the re-sequencing of Cell D is satisfying all state and federal regulations. The regulations that must be addressed in the design include Environmental Protection Agency (EPA), Code of Federal Regulations (CFRs), Stormwater Pollution Prevention Plan, City of Flagstaff, Arizona Department of Environmental Quality (ADEQ), Arizona Administrative Code (AAC), Arizona Revised Statutes (ARS), the Resources Conservation and Recovery Act (RCRA) and Occupational Safety and Health Administrative (OSHA).

### **2.1.3 State of the Art Technical Review**

A State of the Art review will be conducted by AEES. Books, journals, reports, public documents and scholarly articles will be utilized to gather information regarding landfill mining, excavation equipment, sorting equipment and material processing.

## **2.2 Landfill Mining Plan**

The municipal solid waste (MSW) must be excavated from the South Thumb (portion of Cell D) and from a portion of Cell C in order to expand Cell D. The process of mining the municipal solid waste from Cell C and the South Thumb is a primary technical need.

### **2.2.1 Staging Plan**

The staging of the landfill mining will include the details necessary to perform optimal processing. The positioning of supplies, construction equipment and vehicles will be determined in staging. The details of the staging consist of the consideration of safety regulations, and the location of hazardous waste.

### **2.2.2 Processing Plan**

AEES will produce a plan for sorting the waste. AEES will determine the materials and equipment to perform the landfill mining. The process of landfill mining encompasses the sorting of waste, which may be reused, recycled or deposited back to the landfill. The excavated waste will also be separated by size of materials, hazardous waste, unknown materials, etc. The soil will also be screened for materials and contaminants. In order to determine the proper processing for the landfill mining, the extensive research performed by AEES will be taken into consideration. It is assumed that hazardous waste is present in the Cell C and the South Thumb, therefore a detailed processing plan for hazardous waste must be developed.

## **2.3 Excavation Plan**

AEES will need to determine an excavation plan for Cell D to an approximated depth of 50 feet. The excavation plan will only consist of the staging and there is no current waste in Cell D to process.

### **2.3.1 Staging Plan**

The staging for the excavation of Cell D includes the necessary location and means of equipment for excavating the cell to a deeper elevation. The placement of processing cover material onsite will also be recognized, but not a deliverable by AEES. The processing for excavation will not be done through AEES.



## **2.4 Health and Safety Plan**

The team will provide a gas monitoring and air quality plan. This plan is to ensure the safety of the workers and take environmental precautions.

### **2.4.1 Gas and Air Monitoring**

**Gas Emissions-** Landfill mining Cell D and the South Thumb may release various gases. AEES will suggest a monitoring plan to record the gases released from the cells. A prediction of gases that will be released from the landfill will also be conducted by AEES.

**Air Emissions-** Along with gas monitoring, the air quality during the landfill mining process must be controlled. An air quality plan will be developed by AEES, along with chemical compounds and dust that will pose an environmental impact.

### **2.4.2 Safety**

Safety protocols must be developed to ensure the safety of workers performing the mining of MSW and excavation of rock material. The proper handling techniques of hazardous waste will be necessary for worker safety.

## **2.5 Project Cost Estimate**

An estimated cost for the design will be completed by AEES. A thorough cost analysis will be calculated to determine the return on investment of the project. The cost analysis will address the cost of the project, the potential income of selling excavated materials, and the money being saved due to the reduced need for buying cover material. The project engineer will utilize skills with engineering economics to determine the estimated cost. The estimated expenses are the cost of equipment that will be needed for excavation, blasting and drilling of Cell D. Landfill mining equipment will be an expense for landfill mining Cell C. Proper storage of waste, including hazardous waste, will be an expense to the project as well. These expenses will be analyzed against the income and earnings of the new landfill. These earnings include the profit of selling the excavated rock and material to local companies.

## **2.6 Documentation Deliverables**

AEES will perform a series of documentation throughout the duration of their project. The design report, design presentation and website will be produced at a phase of 50 percent completion and the 100 percent completion.

## 2.7 Exclusions

Exclusions to the project include processing the excavated and mined materials to make a daily cover. The processing for the excavation for Cell D and drafting the design for future Cell D will also be out of scope for the design plan.

## 3.0 Project Schedule

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AEES has determined a proposed timeline for the completion of each task. This timeline will ensure that the project remains on a reasonable schedule given that no unexpected issues arise. All effort will be given to remain within the timeline set for tasks. The literature review, landfill mining plan, excavation plan, and health and safety plan, and budget tasks are described in the Project Scope section. The design report and presentation at 50 percent completion are deliverables that will be prepared and presented when the project is about halfway done. The final design documents, including the report and presentation, will be a compilation of the plan and procedure developed for landfill mining, excavation and safety. The first task, literature review, must be completed prior to beginning all subsequent tasks. Preparing the plans for landfill mining, excavation, and health and safety are not dependent on each other, and therefore have flexible timelines. These three tasks must however, be completed prior to the formation of the overall project budget. The final design documents can be started prior to the completion of the previous tasks, but the completion of the final design documents is dependent on the completion of all previous tasks.

## 4.0 Cost of Engineering Services

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The services provided by AEES, stated in the scope of services and including travel expenses, will be provided at a total cost of \$111,708. Table 1 provides a summary of the cost of services and expenses.

Table 1: Cost of Engineering Services

1.0 Personnel	Person	Hours	Rate, \$/hr	Cost, \$
	Senior Engineer	472	104	48,935
	Engineer	600	69	41,290
	Engineer in Training	360	48	17,250
	AA	120	34	4,138
	Total Personnel	1552		111,612
2.0 Travel	Local Meetings			
	12 mtgs*20mi/mtg	\$0.40/mi		96
3.0 Total				111,708

### 4.1 Cost of Engineering Services

The cost of personnel was determined based on salary and the estimated hours each employee will work on this project. The employees will work various hours on the project; these employees include: senior engineer, engineer, engineer in training, and administrative assistant. The senior engineer will oversee the development of the re-sequencing plan and procedure as well as be the primary author of the design documents. The engineer will oversee the literature review, assist in preparing the design documents, and the primary party developing the plans for landfill mining, excavation and safety. The engineer in training will assist the senior engineer and engineer in research, development of plans, and design document preparation. The administrative assistant will be managing the organization of all work related to this project, assisting in correspondence and communication with the client and other related parties, and review documents prepared by the engineers.

### 4.2 Overhead Costs

The cost of business operations for AEES is included in the personnel cost. The overhead costs include rent, electricity, telephone operations, taxes, etc.

#### 4.2.1 Travel Expenses

The employees of AEES will travel to various meetings around the town of Flagstaff for the project. The cost of the company vehicle will be calculated including maintenance, gas and insurance.

## 5.0 Conclusion

Overall, Cinder Lake Landfill is in need of a new cell for future waste. Cell D will provide this future space, and AEES will aid in the desing by creating a plan for landfill mining, a plan for excavation and a health and saftey plan. These plans will be used as an aid for the future construction of Cell D. AEES is excited to create a relationship with Cinder Lake Landfill, and their client, Matt Morales.

## 6.0 Appendix

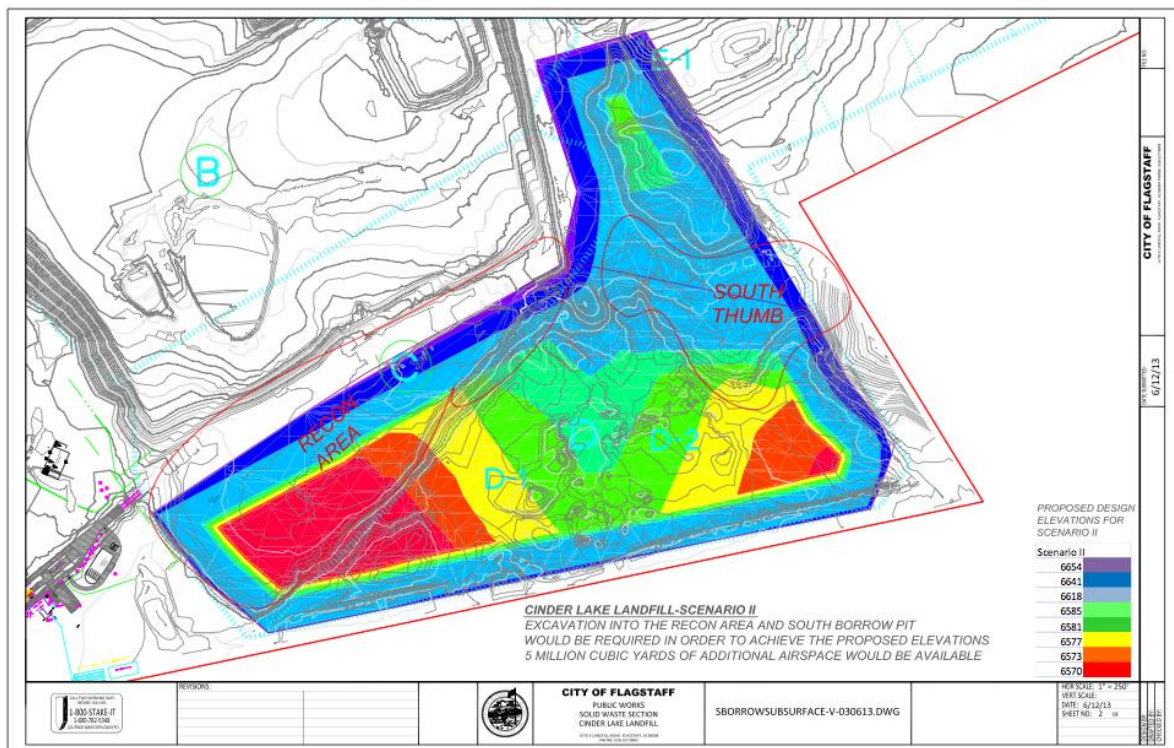


Figure 4: Design of future Cell D, including a portion of Cell C and the South Thumb.

## 7.0 References

Speedie and Associates. "Report on Subgrade Investigation." Phoenix: 2013.