Overview

The Solid Waste Plan provides Leadership with a general overview of the Solid Waste program along with justification for capital expenditures over the next five-years.
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Executive Summary

In 2014, Flagstaff City Council (Council) adopted a set of goals for the community as follows:

To provide sustainable and equitable public facilities, services, and infrastructure in an efficient and effective manner to serve all population areas and demographics.

The City of Flagstaff Solid Waste Section (Solid Waste) responded by proposing a comprehensive Solid Waste Plan (SWP) in July 2015. The SWP goals continue to revolve around the most relevant drivers of Council policy and regulatory compliance. Therefore, any proposed changes or additions to the program should be carefully vetted.

Solid Waste offers a wide range of residential and commercial municipal solid waste (MSW) services within the boundaries of Flagstaff. In addition, limited trash services are offered to Coconino County residents and businesses.

While the financial outlook for Solid Waste remains fair, staff continuously adjusts projections based on environmental regulations and market trends. With approximately 30-years of available airspace remaining at Cinder Lake Landfill (CLL), the facility is the only regional landfill within the County. CLL is also considered one of the most valuable City assets. One of the key components of its success has been attributed to maintaining low operational costs over the past 60 years. However, in 2022 the facility will begin to realize considerable expenditures in the development of future cells ($5 million) and infrastructure ($8 million). Cell development includes upgrades such as leachate collection and landfill gas collection. This also ensures that the facility can achieve the goals of the Flagstaff Carbon Neutrality Plan. Infrastructure includes installation of electrical, water, and roadway improvements, which are necessary to maintain a consistent level of service and maintain regulatory compliance.

MSW disposal volumes typically parallel the Consumer Price Index (CPI). However, since 2017 disposal has been inversely proportional to the CPI; in other words, while the CPI has been waning over, revenues remained steady within Solid Waste. The effects COVID-19 have also presented many unforeseen circumstances; residents are generating and disposing of more MSW. While this has helped maintain revenues, it also has increased the costs to operate specialized services such as the Bulky Trash program.

Increasing waste diversion remains a priority for Solid Waste and Sustainability alike. However, the state of the recycling industry remains in flux due to the Chinese ban on importation of recycled goods and the current shipping crisis. Staff will continue monitoring these factors with the cooperation of Norton Environmental. In the meantime, staff will continue exploring its options in anticipation of the 2023 expiration of the Norton contract.

Solid Waste to provide an exemplary level of service that Flagstaff and the County have come to rely on. Yet staff remains sensitive to market trends and other factors affected by the pandemic.
1 Operations Summary
Section 1 provides an overview of current services and the opportunities for growth within Solid Waste Section (Solid Waste). Solid Waste currently maintains the following operations:

Figure 1-Solid Waste Organization Chart

1.1 Collections
Commercial and residential trash collection is conducted on a weekly basis by 28 employees. They are listed as follows:

Table 1-Collections Employees

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collections Manager</td>
<td>1</td>
</tr>
<tr>
<td>Collections Supervisor</td>
<td>2</td>
</tr>
<tr>
<td>Collections Lead Worker</td>
<td>2</td>
</tr>
<tr>
<td>Operators</td>
<td>24</td>
</tr>
</tbody>
</table>
Residential Trash
The residential trash collection program is responsible for servicing approximately 19,000 homes weekly. Currently, the City is divided into 5 sections, or routes. Service days are Monday through Friday. The 5 operators who collect these areas work 8-hour shifts, Monday through Friday. In 2018, Council approved a 7.5% annual rate increase for residential trash collection through 2023.

Bulky Trash/Wood waste
This program is responsible for the curbside collection of household bulky items as well as tree limbs, yard waste, etc. The work is performed by 2 trucks with 2 operators each (3 Trucks beginning late in 21-22). The trucks are loaded with an articulated loader, purchased in FY 09/10. The loader increased productivity and efficiencies by capturing of this green waste, which provides a source of Alternative Daily Cover (ADC) for Cinder Lake Landfill.

Commercial Trash
The Commercial Collections program collects trash from commercial businesses, apartments, and town homes. The operation runs 6 days per week. The operators work 10-hr shifts with staggered days to provide route coverage and meet customer service expectations. Since 2015, Arizona Senate Bill 1079 prohibited municipalities from excluding private solid waste haulers to enter the multifamily residential properties. At this point, the bill has only slightly affected the City commercial trash services. However as more multi-family housing is coming online there is potential that the City may lose out on valuable contracts in the future. In 2018 City Council approved a 3% one-time rate increase on commercial trash collection. This did not demonstrate any noticeable decrease in customer accounts.

Residential Bin Maintenance
This program is responsible for the delivery, pick-up, cleaning, and repair of residential curbside containers. Other duties include special events, collection of white goods (weekly), collection of move-in boxes, pre-baled cardboard, pick up and disposal of dead animals from Flagstaff’s streets (dogs, cats, skunks, deer, etc.), snow removal when needed, and the operation of all solid waste collection vehicles when needed. The position may respond to customer “emergencies” after hours or on weekends.

Commercial Bin Maintenance
This program is responsible for all commercial and roll off container deliveries, repairs, painting and cleaning. Other duties include welding, fabrication, and design, delivery and pick up of temporary bins, repairs and fabrication of gates, enclosures, etc. The position has a high degree of interaction with internal and external customers daily and is a large factor in customer satisfaction and retention. Both bin maintenance programs respond to customer requests within 24-hours, and we typically can provide same-day service. The position is also required to operate solid waste collection vehicles when needed.

Hoist & Haul (Roll Off)
This program services commercial and residential customers with a variety of needs. Construction materials, clean ups, grocery store and food service compactors (including NAU and Flagstaff Medical Center), recycling, and glass recycling drop off locations are all a part of this program. The program currently has 2 assigned operators who operate Monday through Friday, with some Saturday collections by request. The operators work a 5-day, 8-hour schedule in the fall and winter months when activity is slower. During the busier seasons they work 10-hour days.
Residential Recycling and Commercial Recycling
The residential curbside recycling program operates much like the residential trash program, with approximately 19,000 homes to service Monday through Friday. The commercial recycle program also operates like the commercial trash program and trucks operate from Monday through Friday.

From a global perspective, the recycled waste industry has been turned on its head over the past several years. In July 2017, the Chinese Ministry of Ecology and Environment (MEE) announced that as of January 1, 2018, they would no longer accept contaminated paper/cardboard and plastic.

In response, the EPA announced that it would work to establish national recycling goals based around a set of measures which are as follows:

- Reduce Contamination in Recycling
- Make Our Recycling Processing System More Efficient
- Strengthen the Markets for Recycled Materials

As of January 1, 2021, the Chinese Ministry of Ecology and Environment no longer allows solid waste (recycling or otherwise) to be imported into the country (Recycling, 2020). China’s ban on the import of solid waste works in concert with the Basel Convention, which seeks to control exports and imports of most plastic scrap and waste from 187 different countries (EPA, Unknown). The United States is not currently signed onto the Basel Convention, which complicates the potential export of plastics to countries that could otherwise recycle the material in an ethical manner.

These series of events will require the industry and the nation to determine what it is willing to sacrifice for recycling to become more effective. However, the bottom line is that recycling to become financially more successful endeavor, the bulleted items (listed above) need to be reinforced with additional measures. One such measure includes the establishment of regional recycle facilities. These facilities sort thousands of tons per day while providing a more efficient methods for guaranteeing feedstock to industries that thrive on recycled goods. The contract with Norton Environmental expires in 2023, and our preliminary studies conclude that it is far more beneficial to ship recyclable goods to regional sorting facilities than it is to upgrade the existing MRF. Therefore, staff has been directed by council to weigh the cost and benefit to sending similar recyclable waste to regional facilities in the Phoenix Metropolitan area.

Glass Collection
In addition to the four city glass drop-off sites and CLL, Collections offers glass collection to residential customers on a subscription basis ($4.74/month).

Administration
The administrative staff handles all dispatch and phone calls from the public. In addition, they provide support in accounting and book-keeping for the program. Administrative staff are posted at the Core Services Yard and CLL Scalehouse.

1.2 Cinder Lake Landfill
Cinder Lake Landfill (CLL) is the only permitted landfill within Coconino County, AZ. The facility is open to the public 6-days a week throughout the year from 7:00am to 4:30pm Monday thru Friday and 7:00am to 4:00pm Saturday. In 2021 the landfill accepted approximately 115,000 tons. The daily disposal rate is approximately 370 tons per day.
City residents can dispose of bulky items (non-construction debris) for free, while County residents are charged a rate of $20 per load (must be under 1 ton of waste). Otherwise, the tipping fee is $45.75 per ton (includes a $2.50/ton charge for the City Environmental Services Fund and a $0.25/ton tax for the Arizona Department of Environmental Quality).

There is also a County residential drop-off site at CLL where residents can bring recyclable waste products (paper, cardboard, metal, glass, and plastic). We also provide free wood chips for all residents to haul on their own.

CLL has 12 employees on the payroll as follows:

**Table 2-Landfill Employees**

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager</td>
<td>1 Full time Landfill Manager</td>
</tr>
<tr>
<td>Scalehouse</td>
<td>2 Full time and 1 part time employee</td>
</tr>
<tr>
<td>Operations</td>
<td>All Full Time Employees-1 Supervisor, 1 Lead Worker, 4 Operators</td>
</tr>
<tr>
<td>Project Management</td>
<td>2 Full time employees</td>
</tr>
</tbody>
</table>

Since 2017 the number of customers entered Cinder Lake Landfill have increased over thirty percent, yet staffing has remained the same-. Although the scalehouse has become more automated since then, customer tracking and load checks adds a significant burden for Administrative Specialists on a daily basis. In 2022 we will continue to monitor trends of customers so that we can determine if additional staffing is warranted.

**Figure 2-Customer Count at Cinder Lake Landfill (5 years)**

The increased customer count at CLL has not shown to be a direct burden beyond the scalehouse. However, the number of programs has increased the workload for our Operators. This is especially true in the diversion areas (Green Waste, Wood Waste, Concrete, Metal Pile, and Refrigerator Evacuation Area). The wood waste and green waste processing are especially time-consuming operation that requires monitoring on a weekly basis.
1.2.1 Hazardous Product Center
The Hazardous Product Center (HPC) accepts approximately 207 tons of household waste from County and City residents every year. This waste includes approximately 70 tons of paint, 65 tons of electronic waste and televisions, 7 tons of batteries, and 41 tons of other household hazardous chemicals. This waste is sent to vendors who recycle or repurpose these waste streams.

![Waste Percentage Breakdown](image)

Figure 3-Waste Characterization at HPC

Table 3-HPC Employees

<table>
<thead>
<tr>
<th>Title</th>
<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Program Specialist</td>
<td>1 full time employee</td>
</tr>
<tr>
<td>Environmental Assistant</td>
<td>2 full time employees</td>
</tr>
</tbody>
</table>

2 Other Programs Supported by Solid Waste
The Solid Waste program provides ancillary benefits to programs within the City limits and beyond. The following activities or programs are just some of the examples of support the program provides the following services:

**County Cleanup Days**
Each year from late May thru early June, the County issues a one-time voucher to County residents allowing them to dispose of MSW at no charge. Because the County tracks customer usage during this time, the project requires an increased level of administrative support from CLL.

**Free public mulch**
The public is free to pick up wood chips at the City Public Works Yard and CLL. The mulch is provided by various contractors who occasionally dispose of clean wood chips. The wood chip pile is maintained by CLL staff throughout the year.

**Sustainability and Environmental Management Section**
Projects that receive (or have received) direct support from Solid Waste include the following:

- Promotional mailings for recycling
- Manpower for collection and cleanup wildcat dump sites
• Public service events involving a community cleanup day

All other SEMS related events involving the need for solid waste and recycle bins

Flagstaff Fire Department Fuels Management Program
CLL has provided multiple levels of service for the fuels-reduction throughout the past. After tree thinning, CLL allows customers to bring processed wood chips to the site at no charge. The wood chips are mixed with paper millings for ADC.

3 Infrastructure
Operational expenditures in Solid Waste have traditionally been scheduled around fleet rotation and minor capital expenditures, and while fleet capital is still an active part of the conversation, much of the focus has turned to larger capital projects (MRF Transition, Landfill Road, and Sequence D).

3.1 Collections Program
Budget projections- Collections staff has budgeted flat for FY22, with minor adjustments between line items and overtime projections to account for position vacancies, fuel costs and Fleet Services rate adjustments. Residential collections are expected to increase the coming years especially in high density in-fill areas for student housing. Staff completed a rate study for Collections. An increase in the residential monthly trash bills were justified to accommodate the $5 million expenditures (approximately $300,000 per year) for the Core Services Yard. New transitions away from local recycle efforts will be explored through the MRF transition discussed in the section below.

3.1.1 MRF Transition
Upon evaluation of future operation options presented by staff, the Flagstaff City Council has given direction to proceed with the transition of the MRF into a transfer station for the purpose of shipping collected residential, commercial and drop-off recyclables to a private or public sector MRF. Staff is in the preliminary stages of analyzing the steps necessary to proceed with this action. In FY 23 we propose to hire a qualified consultant to provide the necessary design and logistics for the transition. A budgeted amount of $200,000 is proposed for the design.

3.2 Landfill Program
Over the past 10 years CLL has planned for large infrastructure upgrades. The remainder of Section 3 addresses these.

3.2.1 Landfill Road
Landfill Road (Road), also known as Forest Road 6010, is under the jurisdiction of the Coconino National Forest, Flagstaff Ranger District (Forest Service) and has been the primary access route to Cinder Lake Landfill (Landfill) since 1965. Recent structural evaluations of the Road conclude that the existing pavement is in irreparable condition. Staff approached the Forest Service with a proposal to realign and rebuild the Road. However, to proceed with the formal review process, the Forest Service has initiated an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) guidelines. Staff is currently working with a Resource Consultant (EnviroSystems Management Inc.) and an Engineering Consultant (Shephard Westnitzer, Inc.) to develop a comprehensive application for NEPA review.
Preliminary designs indicate the extension of power, in addition to utility improvements will cost the City approximately $8.8 million. We are evaluating ways to value engineer costs in many respects. For example, rather than tapping into Doney Park Water, we are evaluating the feasibility of constructing an on-site well. The projected costs are estimated between $1.2 million and $1.8 million. By tapping into our own water source, considerable financial advantages could be realized in the long-term.

3.2.1.1 Roadway Drainage Improvements, and Traffic Control
Asphalt pavement along Landfill Road (Road) is nearing its useful life and is beyond salvage (Speedie and Associates, 2017). The right of way is under the jurisdiction of the Forest Service. While the City was granted the use of the Road under a Forest Service Special Use Permit (SUP), the SUP has been expired for many years. The Road is maintained under a joint agreement between the County and the City. However, it does not meet the federal standards of the Highway Safety Act and the Manual on Uniform Traffic Control Devices (MUTCD). Redesign of the Road requires widening to accommodate additional shoulder widths, drainage, side-slopes, and overhead/underground utilities. The projected costs for roadway, drainage improvements, and traffic control are estimated to be $2.5 million. However, before any improvements can take place the project requires review by the Forest Service under National Environmental Policy Act (NEPA). The process is currently underway and is to be completed by July 2022. Landfill staff is currently contracted with EnviroSystems Inc. to carry the permit through the approval process.

3.2.1.2 Power and Telecommunications
Currently CLL has single-phase power on site. In FY 2012, CLL used approximately 89,000 kWh of power, which cost approximately $14,000. This is a relatively small amount of consumption given the full potential of future demand at CLL. For instance, considerations for water (see below) require a reliable source of 3-phase power. If we had 3-phase power, we would also have the capacity to install a crane in the Maintenance Building. Landfill gas extraction systems, if they become necessary, would also require blowers to be installed at CLL. The only source of 3-phase power comes from the east side of Highway 89. Arizona Public Service (APS) is currently in the process of designing the pole configuration from the highway to CLL. APS is also included in the NEPA review with the Forest Service. Initial estimates for the powerline are approximately $1.7 million.

While it may be in the best interest of CLL to consider installing telecommunications in the same overhead line, the initial price tag ($88k) is not worth the cost considering that the current source of communications (microwave from Mount Elden to City Hall), costs us $2,400 annually and would be approximately $12k to replace.

3.2.2 Water
Currently CLL relies on bi-weekly deliveries of potable water for its domestic needs. In the future, it will be necessary to have a reliable source water for fire and dust suppression. A six-inch diameter waterline could be extended 1.6 miles from to an existing tee to CLL. However, Doney Park Water production rates do not provide enough pressure to suit the needs of the daily operations, therefore a booster pump and storage tank(s) would be necessary to provide reliable volume of water to the facility. The projected cost for the waterline would be approximately $1.5 million (includes $750,000 for the meter and control systems). If we consider digging our own well at Cinder Lake Landfill, it may outweigh the cost for installation of a Doney Park waterline. In 2019, a Feasibility Study for Well Siting and New Water Source(s) (Four Corners Environmental, Inc., 2019) provided a cost matrix for four options for future water supply use at the landfill: 1) water hauling, 2), Doney Park Water tap, 3) water pipeline to Wildcat
Hill Water Reclamation Plant, and 4) on-site water source (well). The result of the investigation compared the costs of each option over the next 35 years and clearly showed that the most cost-effective option for the landfill is option 4 (on-site well). As mentioned above, staff is looking at the on-site well as a potential option. We currently are contracted with Tata and Howard to complete an evaluation for well sites, including geophysical studies, and to develop preliminary design concepts for supporting infrastructure. If the locations prove feasible then we may elect to develop an RFP/RFQ for well construction.

3.2.3 Sequence D
In spring, 2021 Staff solicited Requests for Qualifications (RSOQ) to qualified contractors for excavating and processing large volumes (approximately 240,000 cubic yards) of aggregate in Sequence D. Phase I was awarded to Rummel Construction, Inc. The project resulted in excavation of over 85,000 cubic yards of rock and soil. In addition, access roads, drainage, and a water storage pond was constructed.

Photos of before and after are shown in the Figures below.

Figure 4-Construction in Sequence D prior to Phase I

Figure 5-Construction in Sequence D subsequent to Phase I
Phase II includes the excavation of approximately 200,000 cubic yards of rock and soil (to be verified by the CLL consultant). In addition, Phase II design services will be contracted to Tetra Tech BAS. The design will include considerations for final excavation depth, geotechnical, and liner design. At this point the anticipated costs for excavation are projected to be $4 million over 5 years.

4 Regulatory Compliance at CLL
Landfill compliance at CLL typically comes with a fixed annual cost to the program (unless unforeseen exceedances occur). There are two Project Managers in Solid Waste that manage employee training, environmental monitoring, and reporting activities for CLL. The remainder of this section addresses any pertinent environmental considerations that could affect the operation.

4.1 Environmental Standards for Municipal Solid Waste Landfills
The provisions of 40 CFR Part 60, Subpart XXX (Formerly WWW) apply to all landfills. In 2016, the EPA proposed revisions to the 1996 rules for lowering the thresholds for EG’s. The 1996 rules required GCCS to be installed for landfills that exceed 50 Metric Tons per year (MT/yr) of Non-Methane Organic Compounds (NMOC). However, the revisions lowered those emissions to 34 MT/yr.

The samples from 2021 indicate that Cinder Lake Landfill is at 20.4 MT/yr, well below the 34 MT threshold. Based on projected disposal rates CLL will have peak gas production at 32 MT/yr in 2045 (Tetra Tech BAS, 2018). It should be noted that the current gas emission rates are based on an unlined landfill. When we move into the lined expansion cells (Sequences D and E), higher concentrations of NMOC’s and methane are likely to be captured in those cells. While this does not pose any immediate concern, it is certainly something to be aware of in future budget discussions.

The Title V Air Quality Permit is due in 2022 and be extended for five years. ADEQ has received our application for submittal and is currently conducting review. The permit is due at the end of June 2022. We do not foresee any major changes in the permit status over the next five-year period.

5 FY-23 Budget

5.1 General Discussion of Solid Waste Program
The budget demonstrates a balance between responsible fiscal policy and environmental stewardship over the next five years. Solid Waste disposal trends are typically reflective of consumer spending habits and thereby have historically followed the Consumer Price Index (CPI). However, since 2017 disposal rates did not trend along with the CPI (Figure 2). The deviation from the CPI in 2020 is likely attributed to COVID-19. As a result, citizens took-on more home projects while quarantining. However, in 2021 we started to note some consistency in the CPI along with disposal rates. Naturally, these homeowner projects bring construction debris to CLL. We will continue to monitor potential anomalies, but our projections show that the Solid Waste fund will remain financially solvent into 2022.
Figure 6-Cinder Lake Landfill Disposal Trends vs. CPI

The variability in disposal tonnage from 2017 through 2021 is something that we are adept in adjusting for. Nevertheless, a baseline budget is still required to accommodate capital expenditures necessary for maintaining minimum operational standards. This baseline budget is ranked on the following conditions:

1) Will the budget allow staff to run the Solid Waste with the necessary facilities, machinery, and equipment while keeping the operation safe and in compliance?
2) What affect does the expenditure have on our ability to keep the unrestricted fund balance within 10% of our total revenues?

In 2017 staff hired R3, a well-respected industry expert, to assess whether a rate increase was necessary given the imminent capital improvement projects ($8.8 million) and fleet capital needs ($8.3 million). The result of the study indicated that rate increases in the following categories were deemed vital to maintain financial integrity:

- Residential Trash and Recycling Service-7.5% increase each year for 5-years
- Landfill Fees-one 3% increase
- Commercial Trash and Recycling Service-one 3% increase
- Hoist and Haul Service-one 3% increase

The approved rate-increase ensured the Section would have sufficient revenue to meet their operational, capital, and debt service obligations as shown in Figure 3.
A timeline of all expenditures is represented in Figure 4. It’s worth noting that the infrastructure needs of Cinder Lake Landfill, more specifically rebuilding Landfill Road, will be the biggest one-time expenditure in program history. The initial estimate of $8.8 million was based on conservative assumptions. However, staff continues working with consultants to refine costs based on the most realistic construction costs.

Newly proposed capital expenditures for FY 23 include the replacement of netting along the north side of Cell B. The cost for this project is estimated at $60 thousand. A portion of the net is currently starting to rip will likely need to be replaced as soon as the FY23 budget starts (July 2022). In FY 24, staff recommends a new array of permanent litter fencing on the northeast portion of CLL. This would entail permanent steel poles and nets at a minimum height of 25 feet. The projected cost for construction is currently estimated at $900k.

The results of the study will be published by spring 2022. The proposed Collections budget items for FY 23 include:

- Replacement of 4 American LaFrance Side Loaders-$300k each
- Landfill compactor wheel replacement $45k
- Incorporation of a soil screening machine ($250k)
- Watertank pump for dust abatement-$75k
- New netting for the litter fence-$60k
- Annual set-aside for Landfill closure (on going)-$100k
- Portable tarps for daily cover of the landfill-$15k
- Stormwater infrastructure-$10k
- Annual aerial survey-$10k
Figure 8-Five-Year Projection of Capital Expenditures

SOLID WASTE PROGRAM PROPOSED 5-YEAR PLAN
6 Other Projects Outlined in the 5-Year Plan

Five disposal cells are labeled in the existing design as Cells A through E (Figure 8). Cells A, B, and C (110 acres) contain MSW since 1965. Even though Cells A, B, and C are not lined, the landfill was permitted to continue placing MSW until the final design elevations are achieved. Subsequently, they will have to be finished with a cap that falls within regulatory guidelines. Cells A, B, and C will last another 5 to 7 years (depending on growth rates). Expanding the operation to Cells D and E (136 acres) will require design and construction of an approved liner.

Figure 9-Map of Sequences at CLL

6.1 Landfill Gas Collection and Control Systems

The City of Flagstaff Sustainability Division, in collaboration with Solid Waste, published the Flagstaff Carbon Neutrality Plan (City of Flagstaff, 2021). The report provides the path for integration of landfill gas collection and control at Cinder Lake Landfill.

The limitation capturing landfill gas in Sequence B through C has been attributed to the fact that neither cells have a cap nor liner. Capturing gas in a non-containerized landfill can be costly and challenging. Most of the costs stem from the maintenance of the landfill gas collection and control system. Changing atmospheric pressure within the non-containerized cells would require a technician to continuously adjust valves and blower speeds to maintain the most efficient combustion of landfill gas (methane). And although the closure of Sequences B and C will not occur for 3 to 5 years, those cells cannot be completely capped until we finish the adjacent portions of future Sequences D and E. Partial capping will still limit our ability to pull 100% of the gas from those cells. From a regulatory standpoint, we are also well-below the thresholds that would require us to install a gas collection and control system (see
Section 4). Therefore it is in the best interest of the City to defer financial investment of landfill gas collection systems in Sequences D and E to maintain maximum efficiency. In the meantime we will continue to investigate beneficial uses in landfill gas collection.

In 2013 CLL investigated the beneficial uses of landfill gas for alternative fuel vehicles utilizing compressed natural gas (CNG) (Geosyntec Consultants, 2013). The study determined that there was a potential benefit in converting certain fleet over to CNG, with the contingency that all fleet vehicles would be stored at Cinder Lake Landfill. An additional consideration is that CNG vehicles have not been sufficiently engineered for elevations above 5,000 feet and horsepower loss at elevations 7,000 feet can be as much as 25% (Center, 2012).

6.2 Excavation of Sequence E
The CLL Solid Waste Facility Plan acts as the guiding construction document and prescribes excavation depths within the future expansion areas (Sequence D and E). The depths established by the engineer of record were based on the elevations for marginally rippable (extractable) rock, as determined by drillers’ logs and geophysical surveys. The engineer assumed that the desirable method of excavation was through mechanical removal by bulldozers and excavators with minimal blasting (Woodwasrd-Clyde Consultants, 1996). Since that time there have been additional sampling efforts that provide more discrete classification of the rock below Cinder Lake Landfill ([Speedie and Associates, 2013], [Amec Foster Wheeler, 2016] [Amec Foster Wheeler, 2017]). These studies have been essential in justifying excavation costs in Cell D. As excavation is currently underway in Cell D, we will continue to investigate the possibility of increasing the design depth within Sequence E. Thus far we have been able to conclude that excavation depths may be extended as much as fifty feet below the design elevation. Excavation of such magnitude would still be at least ten years into the future. Therefore additional research (i.e. soil balance and feasibility study for drilling and blasting) would need to be conducted when this project becomes more practical.

6.3 Alternative Daily Cover (ADC) Sources
Throughout the solid waste industry, landfills are searching for beneficial reuses of readily available sources of construction and demolition debris (Bratkovich, 2014). While grinding and pulverizing of debris such as wood and concrete is a costly endeavor, it can potentially conserve landfill airspace while providing a reliable resource for operational cover material. We know that there is currently a soil deficit of up to 2.8 million cubic yards at CLL (based on 2057 closure year). In this case, we estimate that soil reserves will be depleted by 2041. Therefore, it is in the best interest of the facility to continually explore other cover resources for the facility.

For seventeen years paper millings from SCA Tissue (Flagstaff) were used as ADC. However, in June 2017 SCA closed operations. Although paper millings are no longer imported, there is still approximately 2-years of the material stockpiled at CLL. We also use the grinder to divert as much green waste and lumber as possible for mixed use with paper millings. While we recognize the grinding operation as a benefit for the “greater good”, the cost of grinding wood debris costs over $250/hour.
When we discovered that paper millings would no longer be available, staff implemented portable tarps into the daily cover operation (see Figure below). They are laid down at the end of the day and removed the following morning, thereby keeping the facility in environmental compliance while saving airspace.

![Image of Paper Millings Stockpile Location](image1)

**Figure 10-Paper Millings Stockpile Location**

Since the tarps have been implemented in 2019, there has been an average airspace savings of 9,700 cubic yards (approximately 16-days of added airspace per year). If tarps continue to be used, enough airspace will be realized to provide an additional two years before soil depletion occurs. Conversely, we have seen higher rates of soil cover since 2017. The reason for the increase is that soil cover is that cells are being constructed on the outer slopes of the landfill, where soil is required. This typically means that cells will have to be covered on 3 to 5 sides, depending on the geometry. We will likely continue to see this soil usage until we move into future expansion areas.

![Image of Landfill tarps as ADC](image2)

**Figure 11-Landfill tarps as ADC**

Figure 8 provides insight to cover usage trends versus trash disposal at Cinder Lake Landfill. We see the consistent decrease in the use of paper millings since 2018. Since the tarps have been implemented in 2019, there has been an average airspace savings of 9,700 cubic yards (approximately 16-days of added airspace per year). If tarps continue to be used, enough airspace will be realized to provide an additional two years before soil depletion occurs. Conversely, we have seen higher rates of soil cover since 2017. The reason for the increase is that soil cover is that cells are being constructed on the outer slopes of the landfill, where soil is required. This typically means that cells will have to be covered on 3 to 5 sides, depending on the geometry. We will likely continue to see this soil usage until we move into future expansion areas.
Figure 12-Cover usage vs trash disposal. Disposal doesn’t include Reconstruction Debris.

Staff is always on the lookout for other sources of ADC. For instance, since 2012 CLL received an average of 2,700 tons of reconstruction debris (concrete, block, and steel), the bulk consists of soil, concrete, and other crushable material. Ironically reconstruction debris is required to be covered with valuable soil. Meanwhile we’ve assessed the value of the airspace in recon is worth approximately $11.38/cy (based on previous studies where we tracked the manpower used to cover the reconstruction debris).

In response, staff initiated a pilot study in 2019 to accept clean (no trash or dirt), non-structural concrete for a 2-year period. During that time we stockpiled approximately 500 tons (1,000 cy) of clean concrete. However, at that rate it would take a minimum of 10 years to collect enough material (10,000 cy) to warrant crushing for daily cover. Therefore, the costs to crush clean concrete outweighed the benefits of such minor airspace savings over time. We simply needed a faster payback period. Since changing the policy to allow structural concrete (concrete with rebar), we’ve received significantly higher volumes of material (approximately 5,700 cy as of August 2021).

Figure 13-Clean concrete stockpile
While the stockpile of crushable concrete continues to grow, we still need to capture more readily available soil that could otherwise be used for cover. In addition most of the reconstruction debris arrive with mixed with soil, rock, and concrete. Yet we currently have no means of segregating the materials. Therefore in FY 23 we are recommending the integration of a medium-scale scalping operation into the program. The intent is to remove the most amount of oversize material (6 inches or greater) in the fastest and cheapest manner possible. Staff reviewed costs for implementing machinery capable of segregating larger debris. We concluded the cost of recovering soil and crushable concrete today still outweighs the cost of importing soil in the future. Medium-scale mobile scalping machines (see figure below) can process up to 100 tons per hour and provide readily available soil with the use of a screener shaker and conveyor belt.

![Figure 14-Typical Screener Scalper (Sandvik QE 141)](image)

A machine of this size could also be capable of capturing other materials worthy of diversion such as asphalt pavement. Additionally, a mobile screener would benefit the daily operations in segregating large volumes of material in our borrow pit.

7 Municipal Solid Waste Diversion

Staff is working with SEMS to prepare a plan for increasing diversion of MSW from the waste stream. The plan, also known as the Rethink Waste Plan, has a great deal of momentum within SEMS and Council. Therefore, staff is assisting SEMS to develop long-term initiatives that are intended to act as a framework for developing financially sustainable programs and services to increase material diversion and prevent waste (City of Flagstaff, AZ, 2017). As part of the Rethink Waste Plan, staff intends to roll out a pilot of the volumetric pricing program (often called Pay-As-You-Throw), which offers smaller trash cart size options that would be available for a lower price. Potential savings provide an incentive for households to reduce the amount of trash they throw away. This program was identified as a key strategy to reduce waste and increase recycling. While volumetric pricing does not have major long-term costs associated with it, it does take significant one-time infrastructure investment to purchase various cart sizes and maintain inventory.

Staff is also beginning to plan the possibility of installing a solar array on the capped portion of the landfill in approximately 2025. No budget has been identified in the five-year plan, as this will be highly dependent on both the cost and transition to future cells over time.
8 Conclusion and Recommendations

The framework of the Solid Waste Section demonstrates a multitude of services that are offered within the community. The financial outlook for the program remains optimistic, and staff will continue to make necessary adjustments as the local and regional economy changes over time. Environmental compliance is also essential to assuring the program remains a viable disposal option in the region for years to come.

The recycle industry is still in a state of flux, the hardship will be felt down to a local level until measures can be taken to transport the goods to a regional sorting facility. And plans for revamping the MRF into a transfer station will be on the table.

Management remains committed to balancing fiscal responsibility and environmental stewardship for the City and the region. Staff expects that the SWP will be a mechanism for management to communicate how it intends to achieve this balance over coming years. And although the economy still appears to be favorable for FY 22 and FY23, the Solid Waste program will continue investigating where efficiencies can be realized. One of the more pivotal projects in FY 23 will be the integration of an on-site well. We know that the upfront capital costs are significant. However, significant savings will be realized in a short period of time. Other relevant projects. Staff have also recommended methods to recapture soil that would otherwise be buried in the landfill and we recommend diverting concrete and soil with the integration of a mobile scalper.

Over the past few years, staff has been addressing the need for replacement of Landfill Road. and landfill staff is committed to collaborating with the Forest Service through the NEPA process. We anticipate the permit being approved (Notice of Final Decision) in summer 2022 and begin construction in spring 2023.

In accordance with the Flagstaff Carbon Neutrality Plan, staff is carefully in timing the integration of future landfill gas collection and control systems. With no liner nor cap, there is little practicality in successfully capturing gas from the existing cells. However, future cells should be developed with landfill gas in mind.

As CLL nears capacity in its existing cells, landfill expansion into Sequence D has become a relevant project. Phase I excavation (summer 2021) provided valuable metrics for the transition into Phase II. We anticipate that the first portion of Phase II (excavation) will be underway in summer 2022.

Staff will make every effort to continue offering the level of service that the Citizens of Flagstaff and Coconino County have come to expect, and we will continue to monitor and adjust to the disposal trends in Flagstaff and the surrounding community.
9 References


