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TECHNICAL MEMORANDUM NO. 4

DATE: May 22, 2015

TO: Jeff Coles, Recycling and Trash Collection Director
City of Fayetteville, AR

FROM: Robin Mitchell, Project Manager

SUBJ: **Operational Assessment**

PROJ #: 173-00.00

Kessler Consulting, Inc. (KCI) was contracted by the City of Fayetteville, Arkansas (City) to assist in developing a Solid Waste Reduction, Diversion, and Recycling Master Plan (Plan). One of the initial steps was to conduct an operational assessment of the Recycling and Trash Collection Division (Division) and its collection, processing, and transfer operations. The purpose of this technical memorandum is to provide the results and findings of this assessment. Background information regarding the City's existing solid waste management system is provided in Technical Memorandum No. 3 and, therefore, is not repeated in this memorandum.

1. Introduction

The operational assessment was conducted in three parts: 1) advance data request and review, 2) two-person physical site visit, and 3) follow-up analysis of data and observations.

In advance of the site visit, KCI developed a request for information from Division staff. The information was used to conduct various preliminary analyses and stress tests in order for KCI to better understand the breadth and width of the Division's scope of services. Data requested was typical of other assessments KCI has conducted and the Division's cooperation in its timely completion was greatly appreciated.

Using the tonnage data, vehicle specifications, personnel information, and customer counts provided, KCI determined that the service levels being provided were reasonable for the equipment and staffing levels described. Further analysis would be conducted during and following the site visit, but having this data in advance allowed KCI to evaluate the reasonableness of the Division's system and to develop a strategic approach for the in-person assessment so that KCI staff time was maximized while in Fayetteville.

KCI conducted a site visit from January 19-23, 2015 to meet with Division staff to discuss the existing system, inspect equipment and facilities, and observe active collection operations. This visit provided first-hand insight into the operation. It allowed KCI staff to view and understand the culture among the collection staff, to verify the advance data collected, and to better understand the level of efficiency at which the Division operated. Various tasks performed during this visit included the following:

- Validation of previously requested data.
- Group meetings with Division staff to discuss roles, responsibilities, issues facing the Division, and existing operations.
- Interviews with operational staff including Managers, Supervisors, and frontline personnel.
- Collection of route audit-based data from Division records and on-route observations.
- Observations of transfer station, compost, and recycling processing operations.
- Compilation of baseline findings.
- Identification and review of system elements and program components.

Based on these activities, KCI evaluated the Division's current operations and developed recommendations for consideration. The following sections outline KCI's observations and discusses the Division's strengths, weaknesses, and opportunities. They include the Division's overall organization, collection services, Transfer Station and Material Recovery Facility operations, composting operations, and fleet services.

2. Organization

Division staff appears to function very effectively together. The staff consists of 57 full-time equivalent (FTE) employees as shown in Table 1. Average tenure for the Division is impressive at slightly more than 10 years (10.6) per employee. A consistent work force with longevity lends itself to high levels of service, low frequency rate of accidents and injuries, and limited misuse and abuse to equipment. All are the case within the Division.

Table 1: Division of Labor

Department	FTEs
Administration	5
Residential	10
Commercial	11.5
Drop Box	2.5
Transfer Station	2.5
Recycling	18.5
Composting	7

KCI conducted a number of meetings, both individually and as a group, during which employees proved to be knowledgeable, confident, and capable at their assigned duties. There is a general willingness to learn and share among the employees at every level and open communication was a standard during the KCI site visit. The Division strongly encourages its employees to grow and learn with a goal of constant improvement across the organization.

The Division's management team has been largely promoted from within the organization. In some cases, this can lead to leadership roles being filled by underqualified former frontline employees, but this is not the case in the Division. Not only are the Division's supervisors and managers well-versed in their jobs, they have a solid understanding of current solid waste events of other progressive cities across the country, and they possess the critical thinking skills necessary to make positive change a priority. Over the course of KCI's week-long visit, every employee understood the purpose of the project and was fully accommodating to provide any requested information. They

approached the visit enthusiastically, offered opinions open and freely, and accepted feedback willingly.

Leadership should focus on maintaining its positive work atmosphere. The Division appears to foster a culture of happiness among its employees. High morale and job satisfaction will have a large payoff for the organization; positive employees are more dedicated and produce better results. As the Division has demonstrated, the foundation for maintaining high morale is effective communication and cooperation from management.

The Division places an emphasis on delivering a high level of service with its employees. No service requires a greater commitment from employees than residential curbside recycling. These one-person route employees perform the duties of driver and processor, sorting recyclables into eight categories, curbside. The Division has adopted a program whereby every new employee starts as a residential recycling driver. In fact, most of the current supervisors started their careers with the Division as residential recycling drivers. As a result of this ground-up process, a service work ethic and commitment to the job proliferates through the organization.

Beyond promoting employees from within, the Division also regularly rotates its route drivers among different routes. This is considered an industry best practice that, despite the best efforts in many organizations, is never actually implemented. Having a team of drivers that have route knowledge beyond that of their assigned route is invaluable and the Division has managed to ensure that drivers constantly learn other routes and remain stimulated despite the repetitive nature of waste and recyclables collection. It is highly recommended that this practice continues and is expanded as needed.

3. Collection Services

The Division provides comprehensive collection service for its residents and businesses. Curbside service is provided to residential customers, frontend-load container service is provided to businesses, and roll-off container and compactor service is provided to larger commercial and industrial customers. All systems collect both garbage and recyclables; additionally yard and bulky waste collection is provided to residents. Table 2 summarizes the types and number of routes operating daily to better visualize the distribution of assets across collection days.

Table 2: Route Matrix

Route Type	Number of Operating Routes						Route Days
	Mon	Tue	Wed	Thu	Fri	Sat	
Residential Garbage	6	7	7	7	N/A	N/A	27
Residential Recycling	10	10	10	10	N/A	N/A	40
Residential Yard Waste	2	2	2	2	N/A	N/A	8
Residential Bulk Waste	as needed	as needed	as needed	as needed	as needed	N/A	
Commercial Garbage (FEL)	6	6	6	6	6	2	32
Commercial Recycling (FEL)	1	1	1	1	1	N/A	5
Roll-off/Industrial	as needed	as needed	as needed	as needed	as needed	as needed	

FEL = Frontend-load

3.1. Residential Garbage

Despite many cities in the South opting to provide twice-weekly residential garbage collection, the Division performs once-weekly collection. This progressive measure creates a leaner operational structure with fewer resource requirements, and has proven to be satisfactory to residents. In addition, the City has a pay-as-you-throw (PAYT) program in which residents choose between three cart sizes and pay a service fee based on the size selected. This is also a progressive program that encourages waste reduction and recycling.

Residential employees are scheduled for 10-hours, 4 days per week (Monday through Thursday). Fridays are reserved for weeks with holiday service interruption when collection occurs one day later. A drawback to a 4-day work week is providing recovery service (i.e., missed or late set-out pickups). Currently the Division utilizes its commercial crews on Friday to assist with residential service calls. This shift in responsibility is sometimes perceived as "having to do someone else's job" and could lead to animosity between employee groups. This was not evident during our site visit, but it would be prudent to clearly define job responsibilities by allocating some portion of a Friday crew member's time to residential recovery service.

The Division utilizes automated side-load (ASL) collection vehicles and 95-gallon roll-carts for its curbside residential collection. The Division is divided into 27 routes; six on Monday and seven on each of the other three collection days. Based on account information provided by staff, route size currently averages 672 residential accounts per route, which does not include commercial roll-cart customers. Based on the number of residential and commercial roll-carts in service as of October 2014, route size averages 817 roll-carts per route.[1] Based on KCI's knowledge of the City and approximate density of residential units, an opportunity may exist to increase route size. More detailed analysis using a route optimization process would be needed to confirm and quantify this opportunity.

KCI conducted a route audit during the site visit to identify any items that might impact the efficient running of the operation. During the ride-along audit, the driver was interviewed and work activities observed. Information gained during the route audit was consistent with information provided by staff, as well as through other on-site observations conducted by KCI. The driver was positive in his demeanor, took service and safety very seriously, and was diligent in tracking extra bag set-outs for billing purposes.

KCI did identify a need for route planning assistance. Over time, routes evolve and shift as new homes are added and waste generation patterns change. When drivers make decisions on-route regarding collection patterns without planning or optimization assistance, they find themselves driving through areas that have already been serviced or are forced to back up on-route to change direction. Both of these activities were observed by KCI, as well as multiple trucks serving the same neighborhoods.

Prior to the inception of computer-based optimization, route planning was typically a time-consuming process where lead drivers or supervisors used maps and highlighters to identify route paths. Figure 1 illustrates an example of hand-drawn routes from another city. Figure 2 provides an example of a modern route optimization system that uses algorithms to route vehicles in order to limit driven miles while also balancing generation rates, truck volume, and collection time.

[1] This figure includes unit counts provided by Division staff of 21,308 residential roll-carts and 751 commercial roll-carts. Some customers have more than one roll-cart.

Supervisors acknowledged that access to route optimization tools could improve the Division's operation. KCI can assist the Division with its route optimization efforts either as a service bureau conducting the optimization or as a software provider, trainer, and support mechanism.

Figure 1: Example of Hand-Drawn Routing

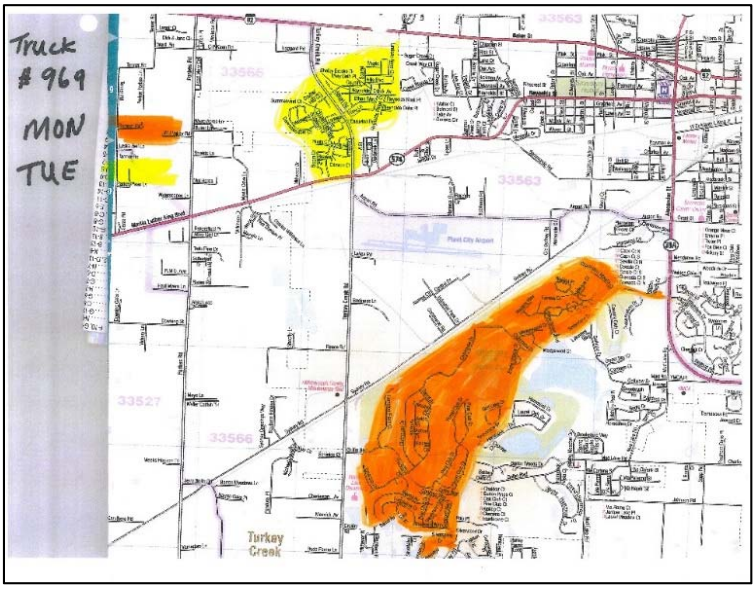
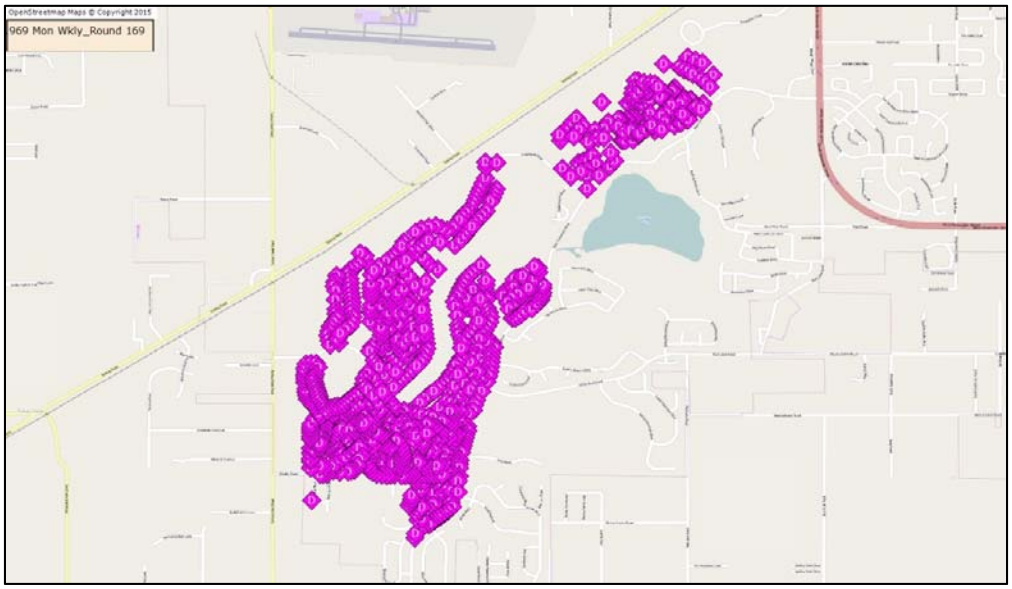


Figure 2: Example of Computerized Route Optimization

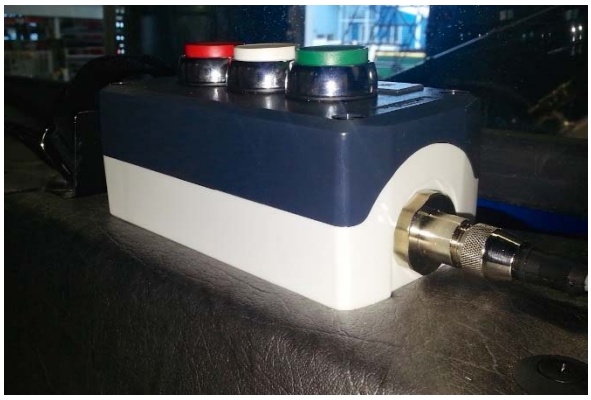


Generally, KCI found that residential garbage collection operators are proficient with the use of their assigned ASL collection vehicle and utilize the vehicle as the manufacturer intended. The units observed operated mechanically as designed. As noted earlier, drivers were observed diligently tracking bags placed outside of carts for the City's additional charge program, but drivers are required to manually track this information. KCI believes that the application of on-vehicle Radio

Frequency Identification tools (RFID) and automated vehicle location (AVL) systems can enhance this process by making it more efficient while improving accuracy.

KCI has designed RFID systems that associate assigned roll-carts to residential addresses, verifies collection service, and allows for driver input to collect relevant data that applies to that address or residential account. Such a system could be used to identify extra bags placed outside the roll-cart to the address with a button push (Figure 3) at the time of collection, sending that information electronically to the administrative office for customer billing.

Figure 3: RFID Driver Input Buttons



Once garbage routes are complete, waste is delivered to the City's Transfer Station on Happy Hollow Road. Because of the Transfer Station design, storage capacity, and throughput, waste delivery can be delayed at times. This delay forces drivers to park vehicles for extended periods of time in order to wait until transfer trailers are available and waste can be trans-loaded. Transfer operations are discussed later in the report, but improvements in design will reduce downtime.

3.2. Residential Recyclables

Residential recyclables are manually collected curbside using 18-gallon bins where drivers sort materials into eight separate compartments in the collection vehicle. Separating recyclables is required because of the material processing system currently in place. Recyclables are delivered to the City's Material Recovery Facility (MRF), adjacent to its transfer station, where materials are tipped separately and stored until baling. Operations staff are eager to explore other potential processing options because of the opportunity to improve collection efficiencies.

On route, drivers are required to remove lids from bins, which can be difficult at times and slows the collection process. Drivers estimate that less than half of the bins at the curb have lids in place when they arrive. Lidded bins help limit blowing items and litter while keeping fiber materials dry during inclement weather. They serve a limited purpose, especially when half the residents do not use

them; therefore, the City should consider their continued viability. As a result of single stream processing, the industry has generally shifted to roll-carts with integrated lids for recyclables.

The collection and curbside sorting of recyclables is a time-consuming process. Drivers spend more time sorting materials into truck compartments than they do actually driving. As a result, recycling route sizes are considerably smaller (average of 454 households per route) than their garbage counterparts (672 households per route) despite set-out rates being lower than on garbage routes. Because of smaller route sizes, more vehicles are required to service recycling routes. Compared to the 27 scheduled garbage routes, recycling requires 40 separate routes across the same 4 collection days.

Division staff monitors recycling set-out rates each fall by manually recording the number of households setting out recycling bins on each route during a 3-week period. Table 3 averages the percentage of households on each route that set out recyclables weekly from October 20-November 6, 2014. According to this data, the recycling set-out percentages ranged from a low of 49 percent (Thursday Route 30) to a high of 99 percent (Thursday Route 38), with an overall average of 68 percent.

Table 3: Average Daily Recycling Set-Out Percentages by Route

Route Number	Monday	Tuesday	Wednesday	Thursday
30	81%	55%	53%	49%
31	62%	79%	59%	77%
32	82%	61%	55%	63%
33	69%	74%	71%	62%
34	87%	52%	58%	53%
35	70%	69%	78%	79%
36	81%	62%	68%	63%
37	73%	64%	73%	54%
38	78%	80%	66%	99%
39	69%	58%	50%	67%
Average	**68%**			

These averages are indicative of a well-received program with high participation; however, based on KCI's experience, a set-out rate of 99 percent seems exceedingly high. Even if 99 percent of residents on the route participate in recycling, it is unlikely that all would place recyclables curbside each and every week. Manually recording set-out data can be challenging because of inconsistencies in methodology and variables effecting human behavior such as driving distractions, multi-tasking, and the perception of real or perceived project objectives. RFID technology can also be used to collect and analyze this type of field data and can be adapted to curbside bins or roll-carts, although the majority of new programs are cart-based. KCI has worked with data management software and hardware providers, as well as collection vehicle manufacturers, to help develop tools and systems to make field data collection more accurate and reliable.

Because of the collection vehicle (Kann CurbSorter) design and the required separation of recyclables, a lengthy sequence of events occurs when tipping at the MRF. Each of the eight commodities must be emptied separately into its corresponding bunker or container. Fiber

materials, including cardboard, newspaper, and mixed paper, are tipped and stored inside the building. Containers, including aluminum cans, tin and steel cans, glass, and two types of plastics (PET and HDPE), are emptied into 40-yard roll-off containers for transfer at a later time.

The baling facility is not conducive to vehicle reposition, and space is also constrained when bunkers are full of material. Drivers have to essentially turn the vehicle around inside the small building in order to tip materials in or near the appropriate material bunker. Typically a supervisor, in the role of spotter, assists drivers with vehicle positioning and verifying materials have been fully discharged. Compartment partitions within the vehicle body frequently become dislodged and commodities can be accidently mixed on the tipping floor. Although it is a time-consuming process, supervisors, through careful observation, attempt to prevent this cross-contamination.

Table 4 lists the cycle times, in seconds, to empty each recyclable material. A total of 486 seconds (8.1 minutes) was required to empty the vehicle, not including time required to reposition the vehicle between each tipping area or to move the vehicle from inside the building to the container unloading area, approximately 500 feet to the rear of the MRF.

Table 4: Recorded Times to Tip Various Recyclable Materials

Material	Time (seconds)
Cardboard	79
Newspaper	53
Mixed Paper	67
Aluminum	53
Tin/Steel	56
Glass	61
PET	42
HDPE	75
Total	**486**

Despite the time-consuming curb-sorting of recyclables and the additional time necessary to keep the 8 streams of recyclables separated for processing at the MRF, the residential program continues to grow. The Division regularly receives orders for new curbside bin deliveries, including 300 new bin orders during the week prior to the KCI site visit. Staff delivered more than 50 bins each day that week to residents.

As part of the master planning process, KCI will be evaluating options for enhancing recovery of recyclables. As part of this analysis, we will consider how alternative programs might also improve the efficiency and cost-effectiveness of the Division's collection and material processing operations.

3.3. Commercial Collection

The City provides commercial collection service for both garbage and recyclable materials to more than 4,000 commercial customer accounts. These accounts include the following service types:

- Commercial waste cart
- Commercial waste dumpster
- Multi and individual meter multi-family complexes
- Drop box
- Cardboard and paper dumpster
- Commercial recycling bin
- Commercial glass cart
- Multi-family recycling roll-off

Commercial service is provided using a variety of container and vehicle types in order to accommodate the specific needs of the individual customer and the volumes and types of materials generated. The Division is diversified and provides the same service levels and types as that of a typical private hauler using container sizes ranging from a roll-cart to a 40 yard roll-off container. The majority of commercial service is provided using frontend-load (FEL) "dumpster" style containers.

KCI reviewed and analyzed commercial dumpster service data provided by Division staff. The Division utilizes seven FEL vehicles Monday through Friday and two on Saturdays. Six of the seven routes collect garbage, while one unit collects cardboard five days each week. The two Saturday routes collect garbage at customer locations that typically require six day collection or have a specific need for a Saturday pickup. The Division does not collect on Sundays. Table 5 provides metrics for the Division's commercial FEL garbage collection routes.

Table 5: Commercial Frontend-Load Route Metrics (Garbage)

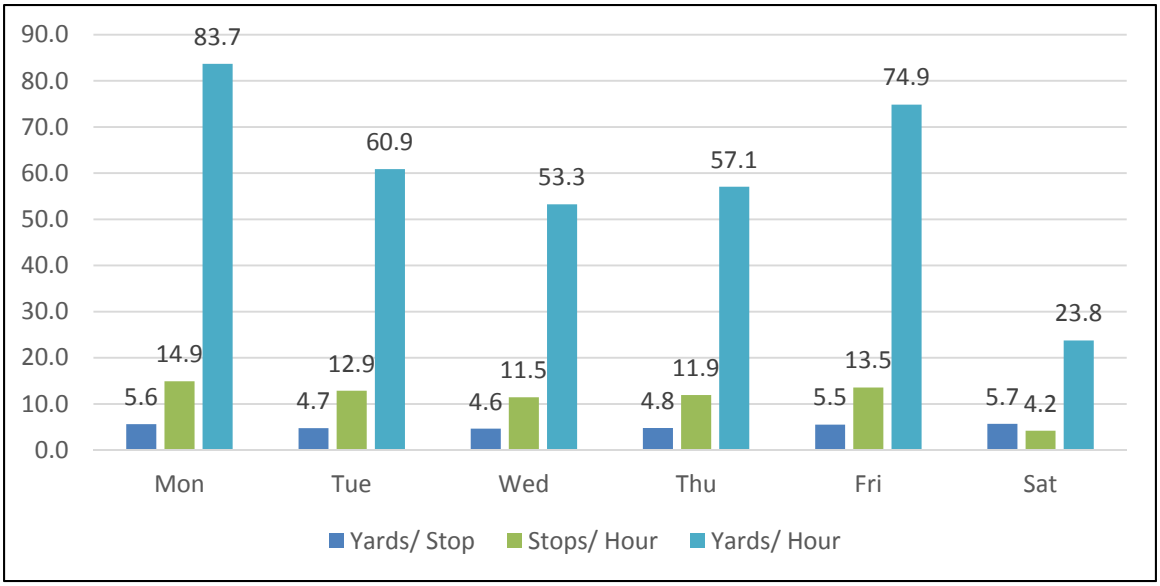
Day	# Routes	Total Stops/ Day	Total Yards/ Day	Average Yards/ Route	Stops/ Route	Yards/ Stop	Stops/ Hour	Yards/ Hour
Mon	6	715	4017	670	119	5.6	14.9	83.7
Tue	6	617	2922	487	103	4.7	12.9	60.9
Wed	6	550	2556	426	92	4.6	11.5	53.3
Thu	6	573	2739	457	96	4.8	11.9	57.1
Fri	6	650	3593	599	108	5.5	13.5	74.9
Sat	2	67	380	190	34	5.7	4.2	23.8

The data in Table 5 is consistent with a commercial customer base where levels of service are regularly maintained for efficient operations. Routes are relatively balanced throughout the week with the highest total yards scheduled on Mondays and Fridays and only essential work is scheduled for Saturday. Although this surge is common on Mondays and Fridays in other programs KCI has reviewed and is typical throughout the industry, the second test for identifying efficient commercial collection is the average number of yards per stop or lift.

The Division averages 5.1 cubic yards per stop for all garbage routes and all days of collection with the average being greater than 5.5 on Mondays, Fridays, and Saturdays. Yards per stop or lift should be above a weekly average of 5.0 with a goal of 5.5 or greater. In most of KCI's collection assessments, we identify operations with an average yards per lift well below 5.0 and as a result a wholesale program revision and re-route is necessary to improve efficiencies and asset utilization. That is not the case with the Division and KCI conducted a deeper level analysis to explore potential savings opportunities.

Figure 4 graphically illustrates the commercial collection workload throughout an average week. As noted above, the Division has clearly demonstrated that bigger containers are successfully being utilized on Mondays, Fridays, and Saturdays when the yards per stop average 5.5 compared to a weekly average of 5.1. The stops per hour indicate that productivity increases on Mondays and Fridays as well. This is typical of a greater workload for the same scheduled hours, and indicates a demonstrated performance metric that can be established as an attainable goal for container size and production rates.

Figure 4: Weekly Commercial Front-Load Workload Analysis (Garbage)



This figure illustrates a possible improvement opportunity, albeit incremental, on Tuesdays, Wednesdays, and Thursdays. An increase in the average yards on these midweek days from 4.7 to 5.1 (average for the week) will result in 132 fewer pickups required to collect the same amount of yardage. That represents the elimination of at least one route day each week, and possibly more considering the average route size is 92 stops per route. Increasing the average container size (yards/lift) further to 5.5 (Monday, Friday, Saturday average) has the potential to eliminate nearly 3 (2.7) route days weekly. Using a standard industry figure of $80 per hour for FEL vehicle operating costs and 8.0 hours per work day, this adjustment alone would result in an estimated savings of $90,000 annually. Further analysis of this type can be conducted for other days and individual routes and a greater level of detail and accuracy can be found through route optimization tools.

During the site visit, KCI conducted a route audit of the commercial cardboard FEL collection route, which confirmed a number of the advance data assumptions. On Wednesday, January 21, 2015, KCI

observed the complete second load of the route starting at 6:09 AM and finishing at 9:35 AM. The first load is designated as office paper and the second load is designated as cardboard (OCC). Table 6 is a matrix of route performance metrics collected. KCI observed a productive, safe, collection system where stops averaged 7 yards per lift. The Division has made efforts to pick up the largest containers possible as infrequently as possible, which is a best management practice.

KCI evaluated the time portion of the on-route metrics and identified that time between customers (3 minutes, 37 seconds) was higher than expected. This indicates that customers are approximately 0.68 miles apart (at a standard 25 MPH), illustrating a possible opportunity for route optimization by improving customer density. However, a detailed study of customers serviced for each day of collection would be needed to estimate the savings opportunity.

Table 6: Cardboard Route Metrics

Total Container Yards:	246
Average Container Size (yards^3):	7.0
Average pounds per loose yard^3:	21.4
Stops per Route Hour:	10.2
Yards per Route Hour:	71.7
Route Hours including Disposal (hh:mm):	3.43
Time to and from Route (hh:mm):	0:11
Total Time @ Customers (hh:mm:ss):	1:08:08
Average Time @ Customers (hh:mm:ss):	0:01:57
Time between Customers (hh:mm:ss):	0:03:37
Disposal and Trip Time per Customer (hh:mm:ss):	00:00:53
Total Time per Customer (hh:mm:ss):	00:06:45

Based on route observations, KCI also recommends the Division implement an "Arms Stowed While Traveling" (ASWT) policy for FEL operators. In an arms down position, the driver's vision is obstructed and the loading mechanism defeats certain safety features of the truck chassis (e.g., the arm blocks the front bumper).

Early generation FEL vehicles could not travel between customers with ASWT because early designs did not provide for a legal height condition (under 13 feet, 6 inches). The industry standards group ANSI and its mobile equipment committee, of which KCI is a member, establishes the safety protocols and equipment designs used by haulers in the U.S. Based on reviews of incidents involving FEL arms in the work position (down), ANSI identified the need for a ASWT design and manufacturers complied. Standard commercial FEL bodies manufactured in the last 15 years have been designed to allow for ASWT.

For units that are still in service that do not meet an ASWT design, internal safety policies were developed to allow for unobstructed views while traveling. These Arms Above Windshield (AAW) policies include measuring overall height of loading systems, identifying safe positions for arms while traveling, and training operators on the practice. Figure 5 depicts an arms down position compared to ASWT and AAW.

Figure 5: Arms Down, Arms Up While Traveling, and Arms Above Windshiled Positions[2]

Arms Down (While Working)

Arms Stowed While Traveling (ASWT)

Arms Above Windshield (AAW)

KCI can assist with the development or review of this policy, which should include a review of overall height of all Division FEL vehicles in both the work and stowed positions, an evaluation of what policy (ASWT or AAW) applies to which vehicle, corresponding driver training, and follow-up observations and enforcement.

KCI also audited the once-weekly commercial glass collection route on January 21, 2015 and observed a total of 14 stops encompassing 17 carts and 4 rear-load dumpsters. From start to finish, the route took 1.5 hours. The route serviced just over nine stops per hour; a productive figure for rear-load systems; however, customer participation might not warrant a dedicated route and specialized container system. Glass is the only material type currently utilizing rear-load containers, and inventory of and maintenance for this container type supports very few customers.

The Division has since modified its glass collection program and now utilizes only roll-carts, which are serviced on Mondays using the spare ASL vehicle that is not utilized for a residential garbage route that day of the week. The master planning project will further evaluate glass recovery rates, future recycling policies, and processing options.

3.4. Roll-Off Collection

Roll-off service is a much smaller segment of the Division's commercial collection business. The system utilizes two trucks to service temporary and permanent roll-off containers. The Division competes with the four private haulers the City has franchised to provide and service roll-off containers greater than 20 cubic yards. The City currently does not have access to customer activity for the private haulers.

[2] Arms Up Photo: http://orlando.ebayclassifieds.com. ASWT Photo: http://www.municipalequipment.com/sanitation.html. AAW Photo: http://en.wikipedia.org/wiki/Garbage_truck.

In addition to servicing open-top and compactor commercial accounts, the roll-off system also supports the City's recycling drop-off program, where residents and businesses can deliver recyclable materials to partitioned containers staged at two community recycling sites, Ozark Natural Foods, and several (currently six) multi-family complexes throughout the City. These recycling roll-offs are hauled to the City's MRF where the separate commodities are emptied into storage bunkers in much the same way the curbside recycling trucks are emptied.

Most days, one of the roll-off trucks is available for use by the MRF staff. These three staff members rotate driving responsibilities and, throughout the day, utilize the roll-off truck to move the 40- and 50-yard roll-offs, used for onsite storage of recyclables at the MRF, to the baler.

Because roll-off service represents a smaller segment of the Division's collection operation, KCI did not conduct a field-level route audit. KCI did, however, meet with Maury Nelson, Commercial Sales Representative, to discuss other details of the roll-off system. The Commercial Sales Representative is responsible for conducting telephone and in-person sales calls for both commercial FEL and roll-off work. Because roll-off service is primarily an on-call business, the majority of Maury's time is spent on roll-off service, either talking with customers or dispatching drivers.

The Division should consider shifting roll-off dispatch responsibilities to an operational supervisor or dispatcher rather than a sales representative. Operational supervisors or dispatchers can better manage and coordinate operations-related resources. The ability to quickly reassign drivers, respond to equipment breakdowns, or manage emergency situations such as accidents or injuries is critical. Roll-off drivers were observed in the sales office looking for work or trying to obtain additional customer guidance from the Sales Representative. The sales order should be booked and documented, and then subsequently forwarded to operations for the work to be completed. This provides an internal check and balance process and frees up time to allow sales staff to generate additional business opportunities.

Temporary roll-off pricing includes no rental charges for the first month. If the container is not emptied after the first 30 days, a $3.00 per day rental fee assessed. A best industry practice is to base rental on container availability. As containers become less available due to use, rental fees should increase to encourage containers to be emptied and/or removed. A rule of thumb is free rental for the first week or two and a per day rental fee for periods after that, unless the container is emptied, at which point the rental resets. Shortening the current rental period by two weeks would result in additional rental revenue or, more importantly, an increase in available container inventory.

Also discussed was the possibility of expanding roll-off service to Springdale. The City would need to acquire a permit and pay a fee to operate, but staff indicates that capacity is available to serve the area. The Northwest Arkansas market area is currently in flux with the recent acquisition of Deffenbaugh by Waste Management. The merged companies reportedly will be forced to divest assets in the area because it may be viewed as monopolistic. This market shift could create an opportunity for the Division to grow its business; however, City decision-makers should decide if business development is a role they want to play and whether they want to undertake these efforts.

Furthermore, there could be an increase in competition in a solid waste market shift where companies divest and acquire assets. This increase could create an unstable condition for the City if it were to invest in additional assets or resources for a Springdale expansion.

Division staff also mentioned the lack of construction and demolition (C&D) debris recycling opportunities in the local market area. Although this will be further addressed in the forthcoming planning work, it is important to note that the Sales Representative believes that a C&D recycling processing option could create a competitive opportunity for future roll-off sales.

3.5. General Route Observations

On route, KCI observed that curbside recycling, residential garbage, and commercial collection is productive. Drivers provide a high quality, safe service to the City's customers. They each demonstrated their ability to safely and properly operate the vehicle, had good knowledge of their route, and were positive about the work they do and the Division they work in.

Once off-route however, KCI noted that drivers have a fair amount of downtime prior to clocking out each day. One reason for this downtime is the time required to tip, both because of delays and congestion at the Transfer Station and the involved tipping procedure at the MRF. This is discussed later in the report. Other factors contributing to downtime may include proper route sizing, availability of other work beyond regularly scheduled routes, and employee versatility and cross-training.

KCI's scope did not include a detailed route-by-route analysis, but data provided by the Division lead us to believe that route sizes could be increased. On average, residential routes are scheduled to service approximately 817 roll-carts per day. This varies based on day of the week, route density, and scheduled service days. However, by increasing the average route size by 125 homes, less than one hour of on-route time, the Division could eliminate an estimated four route days, or one collection vehicle and driver. There may be mitigating factors KCI is unaware of that could prevent this from occurring, but the exercise should be explored. This route adjustment does not take into consideration the opportunity for route optimization discussed earlier, which can further contribute to operational improvements. This same exercise should also be reviewed for commercial FEL and curbside recycling where other opportunities may exist.

4. Transfer Station and MRF Operation

The City's Transfer Station, located at the Happy Hollow Road complex, is approximately 15,000 square feet. It is divided in half, with one side serving as a transfer station for garbage disposal and the other side housing the City's MRF, which is essentially a bailing operation rather than a true materials processing operation. The facility is operated by Division staff and long-haul truck transfer of waste and recyclables is subcontracted.

The tipping floor for waste is approximately 7,500 square feet. Two vehicles, and sometimes three, can be emptied simultaneously. The space available is limited but adequate provided that the surge of waste is managed properly and consistently trans-loaded throughout the day. Limited space is available for any amount of waste storage or surge capacity.

One of the unloading bays is typically dedicated for "hand unload" vehicles, i.e., those customers who haul their own materials and whose vehicles do not self-dump. The process to empty these vehicles is time-consuming and can also present safety issues. Customers are physically walking on the tip floor and manually lifting and moving waste from the vehicle to the station floor.

Personal protective equipment (PPE) was not consistently observed in use by hand-unloaders. A PPE policy should be developed and enforced for anyone that utilizes the Transfer Station. Additionally, it is a best industry practice to reduce unnecessary persons from being outside of vehicles at disposal facilities, especially the untrained public. Transfer station tipping floors are considered high-risk environments. They typically have poor lighting, wet surfaces, high levels of noise, and large equipment operating with limited operator visibility. The City's Transfer Station is consistent with these conditions.

The remaining bays are reserved for the unloading of self-dumping vehicles, including the Division's vehicles. In a typical push pit configuration, similar to the City's facility, self-unloading vehicles back straight to the rear and empty their loads from the rear of the building to the front. KCI observed the loader operator directing Division drivers to tip their loads from right to left, horizontally across the rear of the station floor. It was time-consuming for the driver to position the vehicle in this fashion, and waste was then blocking the length of the loading pit. When asked why, staff indicated that it was more conducive to trans-loading because the waste was arranged to more easily load trailers. At other times, trucks were observed unloading rear to front.

Based on KCI's experience, the wheel loader used to trans-load garbage was somewhat undersized, and may contribute to the need for more precise load positioning by delivering drivers. A smaller loader requires significantly more time to move material as compared to a larger machine, and positioning waste closer to the final delivery point could be considered a time-saver.

Staff indicated that waste movement and station operations depend heavily on the availability of transfer trailers. The City's operating permit requires that all waste be trans-loaded by the close of

business daily. Waste Management (WM) is contracted to provide transport services, which they subcontract to a third party. This same operator services other WM locations with the same resources forcing the Division to halt transfer operations while waiting for transfer trucks to arrive.

As noted earlier in the collection section, drivers have notable downtime when returning from routes. One of the contributing factors is having to wait to unload their vehicles because of either tipping floor delays or insufficient transfer trailers. Drivers queue their vehicles and then wait in the break room until they can tip their trucks. Depending on trailer availability, these delays could be lengthy at times.

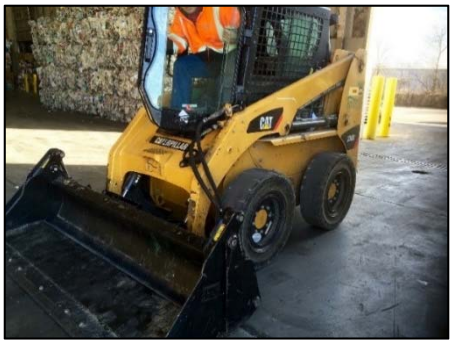
Overall, the operation is well run for a small facility. The building's size is constraining, as are the permit requirements, machine size, and the fact that inexperienced, hand-unloading vehicle drivers share the tipping floor with high-capacity, mechanized waste collection vehicles. The biggest limitation, however, is the availability of transfer trailers.

The City's service contract with WM requires the contractor to "provide an adequate number of vehicles, trailers and back up equipment … to insure the daily systematic and orderly performance of all services specified in the contract within the required time frame." (Section 2(b)) The Division should conduct a waste surge analysis to identify peak times for inbound materials, as well as the pattern of the outbound flow of waste. The Division should let WM know what time transfer trailers are to be delivered so that inbound and outbound flows are better aligned. A trailer should be ready to back in when a full one pulls out, even if it requires WM to commit more resources. This change will positively impact collection operations by reducing driver downtime caused by delays in tipping.

The MRF portion of the building is comprised of material storage bunkers, bale storage areas, an infeed conveyor, and an eight-year-old, two-ram baler. The facility bales clean recyclable materials delivered from the City's curbside collection program, drop-off program, and commercial routes. Three employees rotate operating the baler, skid steer loader, and roll-off truck to produce high-quality, mill-ready product.

Operators have been experiencing downtime with both the baler and infeed conveyor. KCI conducted ancillary research and provided Division staff with preliminary pricing for replacing the conveyor. The baler could be considered slow compared to the newest models currently available and the movement of materials from the various roll-off containers on site is time-consuming. Material, from the point of generation to the final bale, is handled multiple times as a result of the source separated collection program. The Division would benefit from adding hydraulic grapple tines to the skid steer loader bucket. This type of tool increases loader operator production and is versatile for floor sorting of materials (see Figure 6).

Figure 6: Existing Skid Steer Bucket and Recommended Grapple Attachment



5. Composting Operations

KCI conducted the site visit in January. While the facility appeared to be in good working order, further observation may be warranted at other times of the year, such as the spring and summer, when higher material volumes and more putrescible materials such as grass clippings are generated.

Yard waste, the sole feedstock, is ground at the adjacent drop-off property and transferred onto the active composting pad for the duration of the process. The pad itself is newer concrete with an area of approximately 3.1 acres and able to accommodate more than 20 230-foot windrows. The Division's windrow turning machine is very effective at maintaining well-structured windrows. During the site visit, the facility was at capacity and was waiting until finished compost is screened and removed before accepting newly-ground materials.

Division personnel reportedly monitor temperatures on a daily basis. Because the facility currently composts only yard waste, daily temperature monitoring is typically not necessary. Two to three times weekly is sufficient to monitor the yard waste composting process.

The composting process takes approximately six months to complete the cycle from windrow construction to curing, although the duration varies across each windrow. The facility is not sufficiently sized to handle all yard waste currently collected and processed by the Division. The six-month compost cycle is causing a backlog of yard waste at the grinding site.

The Division successfully piloted the composting of food waste from grocery stores, but reached a point where the Arkansas Department of Environmental Quality required the City to either modify its permit or discontinue the process. At the time, the decision was made to discontinue operations because of the small volume being collected.

Composting facility operations and future composting options will be further evaluated as part of the master planning process. However, KCI offers several recommendations. In an effort to reduce compost operating costs and to help minimize the potential for malodors, KCI recommends

conducting a pilot test of the Modified Static Aerated Pile (MSAP) composting method. This method utilizes a specialized inoculant and reduces the turning frequency significantly. In addition to less turning, more consistent temperatures, and a reduction in odor, the method is also well-suited for facilities that handle highly putrescible materials like food residuals. KCI can immediately assist the Division with establishing an MSAP pilot and providing access to inoculant materials.

KCI further recommends that the Division incorporate food waste collection and processing as part of the pilot. Because the City controls its own collection system, a pilot food residuals recovery program at select supermarkets, institutions, and/or restaurants could be quickly implemented. While the additional material will increase the volume composted, the addition of more nitrogenous organics materials can reduce the composting time, thereby enabling the facility to handle more yard waste.

6. Fleet Services

The Division's fleet is comprised of 51 pieces of equipment, including 38 collection trucks and various ancillary equipment. Of the Division's collection equipment trucks, 32 are considered frontline units and 6 are classified as spares. Table 7 provides key metrics of the vehicle fleet.

The ratios of frontline to spares are within appropriate ranges, with high-maintenance equipment types (e.g., ASL) having higher ratios than low-maintenance vehicles. The overall spare ratio (19 percent) is slightly above average because vehicle types are not interchangeable across service types. At this time, KCI does not recommend revising spare ratios. Should a roll-cart program for recycling be introduced, a greater number of routed ASLs will be required, which can be interchanged with its residential garbage counterparts and the ASL spare ratio can be addressed.

Table 7: Collection Vehicle Fleet Metrics

Vehicle Type	Total Quantity	Routed Vehicles	Spare Ratio	Average Age	Useful Life (years)	Average Monthly Fleet Cost	Average Monthly Fuel Cost	Average In Service Date
Automated Side Loader	9	7	29%	2.7	7 - 9	$ 661.37	$ 1,147	8/7/2012
Manual Curb-Sort Recycle	12	10	20%	6.4	10 - 12	$ 704.12	$ 565	10/29/2008
Commercial Front-Load	9	7	29%	2.7	8 - 10	$ 1,047.59	$ 1,017	8/1/2012
Roll-off	3	2	50%	5.1	10 - 12	$ 840.50	$ 896	3/1/2010
Container Delivery	1	1	0%	6.7	10 - 12	$ 406.13	$ 372	7/24/2008
Flat Deck/Claw	1	1	0%	6.6	10 - 12	$ 295.98	$ 352	8/25/2008
Van Body & Lift Gate Pickup	2	2	0%	4.6	10 - 12	$ 148.92	$ 200	9/14/2010
Total Collection Fleet:	37	30	23%	4.4				11/9/2010

The collection fleet has an average age of less than five years, which is a sign that vehicle replacement is occurring as planned or even slightly ahead of schedule. This is a result of five ASL vehicles being replaced in the same year (2013) and five commercial FEL vehicles being replaced in the previous two years. In most cases, the reason for replacing the majority of a vehicle type in the same year is a program change such as converting to roll-cart service. When feasible and over time, these replacements should begin to be spread back out for a more balanced capital replacement program.

In general, KCI recommends a replacement schedule of 8-10 years for FEL vehicles; 7-9 years for ASL vehicles; and 10-12 years for rear-load, roll-off, manual curb-sort recycling, and support vehicles.

Prior to replacing any vehicle, the unit should be reviewed to determine if maintenance expenses are tracking as planned. If a unit falls below the average spending for similar vehicle type, the useful life might be extended. On the other hand, high maintenance expenses are an indicator that a unit might need to be replaced sooner than planned. Should the situation of early replacement arise, an examination of vehicle procurement specifications, warranty, and driver misuse and abuse should be conducted to prevent a reoccurrence.

Based on KCI's experience, the Division's average monthly maintenance costs for ASL vehicles is below average. This is likely due to the average age being less than three years, but could also be an indication of a lack of preventative maintenance, either on the daily operator-serviceable items (arms and lifters) or the fleet-serviceable items (chassis, motor, etc.). ASL units are high-duty cycle machines that require significant preventative maintenance by both the drivers and Fleet Services. KCI did not conduct a unit-by-unit analysis, but as a general rule, average monthly costs for an FEL vehicle should not exceed that of an ASL for a similarly aged fleet, and FEL costs appeared to be in line with average use.

Currently, nearly all of the residential manual curb-sort recycling trucks are 2006 or 2007 models and are, therefore, approaching the end of their useful lives. If possible, it may be in the Division's best interest to postpone their replacement until future potential programmatic changes are evaluated. A program change, such as a transition to roll-carts and automation, will have a significant impact on new vehicle specifications and unit quantities.

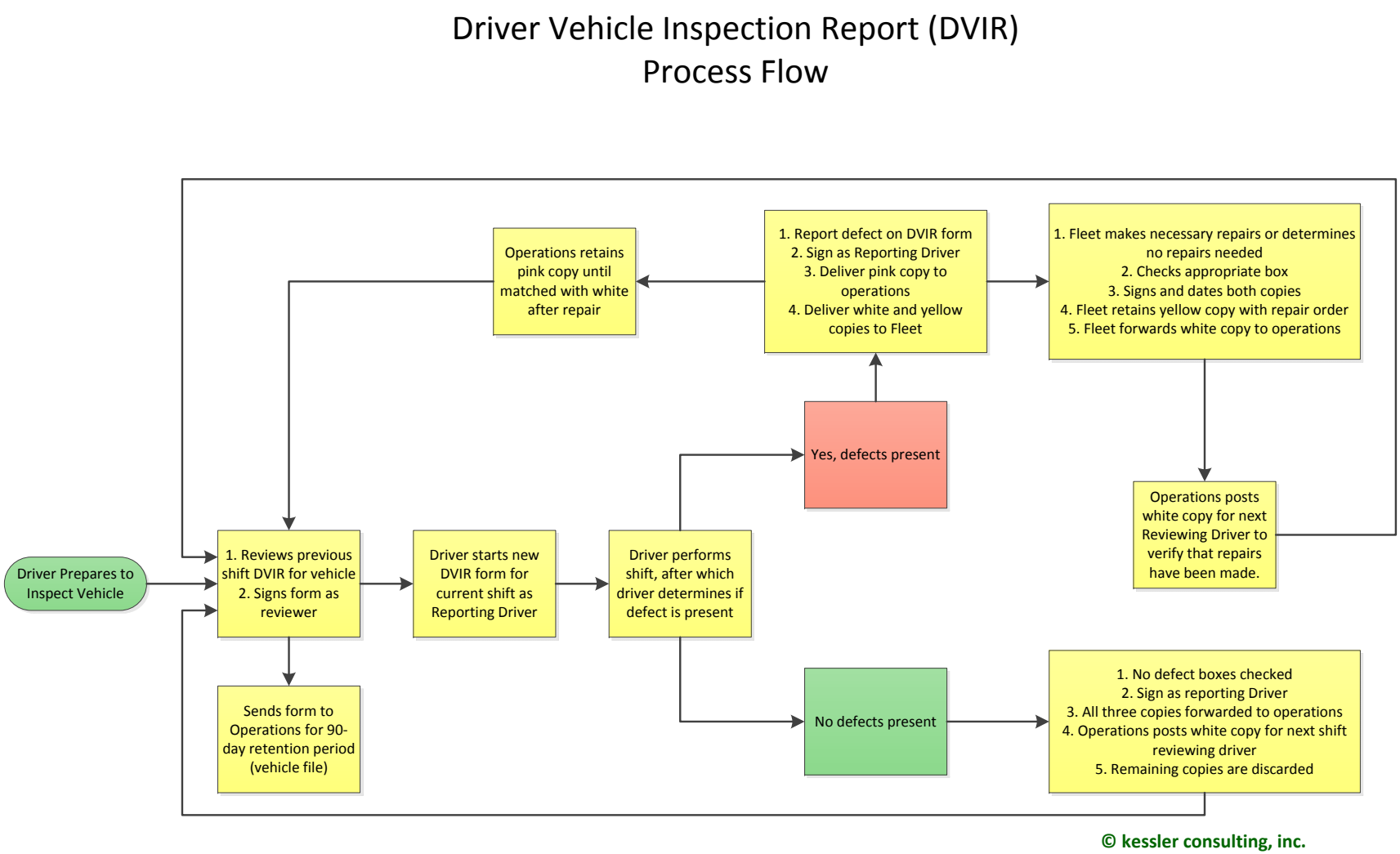
KCI conducted interviews with the Fleet Superintendent and his staff in an attempt to identify any issues or concerns they may be having with the Division. The Division has an excellent working relationship with its Fleet Repair Facility (Fleet). The two organizations have an open communication process that is necessary to maintain acceptable levels of vehicle downtime. According to Fleet, the Division's workers have become much more diligent in caring for their vehicles in recent years, with drivers reporting problems at the conclusion of their routes.

The clear reason for Fleet's ability to maintain the Division's vehicles is its night shift. Maintenance ideally occurs when vehicles are not normally in use. The availability of a vehicle for maintenance service should not be contingent on having surplus equipment or high spare ratios, which would require significant capital investment for those extra vehicles.

Fleet has reported some indications that not all drivers are thoroughly inspecting vehicles before and after each route. This is evident by small problems that have gone unnoticed and have subsequently grown into larger issues. KCI noted that a robust Driver Vehicle Inspection Report (DVIR) policy was not in place. Although drivers are required to inspect their vehicles and document any necessary repairs, supervisors confirmed the process was inconsistent and needed attention.

Solid waste drivers are required by the U.S. Department of Transportation to complete a DVIR every day. This document indicates that the driver has conducted both a pre- and post-trip safety inspection of the vehicle and authorizes that the vehicle is safe to operate. Figure 7 illustrates the DVIR process and how the reporting driver, reviewing driver, and Fleet Services communicate for vehicle roadworthiness. An example of the three-part DVIR form, as well the inspection procedure, is attached. All defects should be corrected prior to departure. Most defects identified by drivers can be repaired by the Fleet Services night shift in advance of the next route day.

Figure 7: Driver Vehicle Inspection Report Process Flow



7. Conclusion

The Division's solid waste operation is a well-run, cohesive operation. Employee morale is high and is demonstrated through considerable department longevity. The Division has developed and implemented a number of best practices seen in other high-performing solid waste organizations, including developing employee career paths through promotion from within, cross-training, and continuing education through industry training and events. The Division's equipment is in good working order and replacement cycles are adhered to. Following is a list of items KCI believes the Division should consider for incremental system improvement. We are available to assist with any of these items or any additional technical assistance the Division may require.

All Collection Services

- Consider route optimization tools for more efficient collection, reduced driven miles, and possible route reductions.
- Review and reduce any unnecessary downtime. Delays at the Transfer Station are a key contributor to this downtime, which are addressed below.
- Implement a more standardized Driver Vehicle Inspection Report (DVIR) process.

Residential Collection

- Consider Radio Frequency Identification (RFID) tools and Automated Vehicle Location (AVL) service verification systems to manage assets, improve customer service, automate extra bag billing, monitor recycling participation, and target recycling education and outreach efforts.
- Continue to aggressively promote growth of the recycling program by promoting bin distribution and other education and outreach efforts.
- Delay replacement of compartmentalized curb-sort recycling vehicles until KCI has completed the Master Plan work and a decision has been made regarding future recyclables collection and processing. If such a delay might jeopardize the safety or integrity of collection operations, then KCI recommends exploring the feasibility of leasing vehicles in the interim.
- Conduct a single stream recycling pilot program to better evaluate the operational and financial implications specific to Fayetteville.

Commercial Collection

- Continue to focus on the highest possible average yards per lift.
- Develop and implement an Arms Stowed While Traveling (ASWT) Safety Policy.

Roll-Off Collection

- Shift dispatch from sales to operations.
- Review container rental policy and adjust based on current inventories.

Transfer Station and MRF

- Develop and implement a Personal Protection Equipment policy.

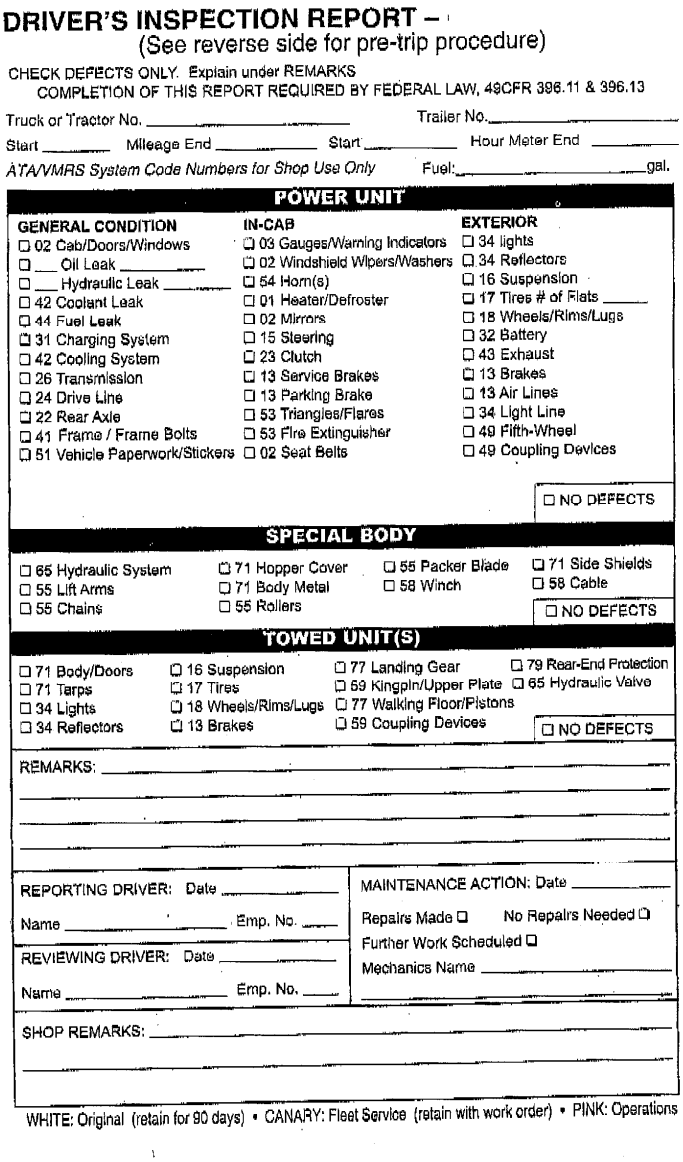
- Conduct a waste surge analysis to identify peak times for inbound materials and the pattern of outbound waste flow. Based on the results, specify times that Waste Management should deliver transfer trailers so that inbound and outbound flows are better aligned.
- Designate a transfer operator or route driver to empty all trucks queued to dump rather than having a number of drivers waiting to unload. Drivers could rotate throughout the week.
- Consider an alternative hand-unload area to eliminate these vehicles from the tip floor.
- If hand-unload vehicles are shifted away from tip floor, the Division can consider acquisition of a larger wheel loader for more efficient waste movement.
- Consider acquisition of a grapple for the skid steer loader.

Compost Operations

- Reduce daily temperature monitoring of yard waste to two or three times weekly.
- Conduct a pilot to test the Modified Static Aerated Pile (MSAP) composting method to significantly reduce the turning frequency and minimize the potential for malodors. Incorporate food residuals recovery into the pilot program, focusing on supermarkets, institutions, and/or restaurants. The addition of food waste will increase the volume composted and add more nitrogenous organics materials to reduce the composting time and increase throughput.

Broader programmatic, infrastructure, and policy opportunities will be further explored and evaluated as the master planning project proceeds. The various options being evaluated will have operational implications. For example, residential recycling program modifications have the potential to alter collection and processing efficiencies. Likewise, exploring C&D debris recycling opportunities has the potential to reduce disposal costs and expand the roll-off service sector. The recommendations outlined above are intended to provide the City with more immediate suggestions for enhancing the efficiency and cost-effectiveness of current operations, as well as to pilot certain program changes that are under consideration.

Appendix A – Driver Vehicle Inspection Form



DRIVER'S INSPECTION REPORT –
(See reverse side for pre-trip procedure)

CHECK DEFECTS ONLY. Explain under REMARKS
COMPLETION OF THIS REPORT REQUIRED BY FEDERAL LAW, 49CFR 396.11 & 396.13

Truck or Tractor No. _____ Trailer No. _____

Start _____ Mileage End _____ Start _____ Hour Meter End _____

ATA/VMRS System Code Numbers for Shop Use Only Fuel: _____ gal.

POWER UNIT

GENERAL CONDITION	IN-CAB	EXTERIOR
☐ 02 Cab/Doors/Windows	☐ 03 Gauges/Warning Indicators	☐ 34 lights
☐ ___ Oil Leak _____	☐ 02 Windshield Wipers/Washers	☐ 34 Reflectors
☐ ___ Hydraulic Leak _____	☐ 54 Horn(s)	☐ 16 Suspension
☐ 42 Coolant Leak	☐ 01 Heater/Defroster	☐ 17 Tires # of Flats _____
☐ 44 Fuel Leak	☐ 02 Mirrors	☐ 18 Wheels/Rims/Lugs
☐ 31 Charging System	☐ 15 Steering	☐ 32 Battery
☐ 42 Cooling System	☐ 23 Clutch	☐ 43 Exhaust
☐ 26 Transmission	☐ 13 Service Brakes	☐ 13 Brakes
☐ 24 Drive Line	☐ 13 Parking Brake	☐ 13 Air Lines
☐ 22 Rear Axle	☐ 53 Triangles/Flares	☐ 34 Light Line
☐ 41 Frame / Frame Bolts	☐ 53 Fire Extinguisher	☐ 49 Fifth-Wheel
☐ 51 Vehicle Paperwork/Stickers	☐ 02 Seat Belts	☐ 49 Coupling Devices

☐ NO DEFECTS

SPECIAL BODY

☐ 65 Hydraulic System	☐ 71 Hopper Cover	☐ 55 Packer Blade	☐ 71 Side Shields
☐ 55 Lift Arms	☐ 71 Body Metal	☐ 58 Winch	☐ 58 Cable
☐ 55 Chains	☐ 55 Rollers		

☐ NO DEFECTS

TOWED UNIT(S)

☐ 71 Body/Doors	☐ 16 Suspension	☐ 77 Landing Gear	☐ 79 Rear-End Protection
☐ 71 Tarps	☐ 17 Tires	☐ 59 Kingpin/Upper Plate	☐ 65 Hydraulic Valve
☐ 34 Lights	☐ 18 Wheels/Rims/Lugs	☐ 77 Walking Floor/Pistons	
☐ 34 Reflectors	☐ 13 Brakes	☐ 59 Coupling Devices	

☐ NO DEFECTS

REMARKS: _____

REPORTING DRIVER: Date _____
Name _____ Emp. No. ____

REVIEWING DRIVER: Date _____
Name _____ Emp. No. ____

MAINTENANCE ACTION: Date _____
Repairs Made ☐ No Repairs Needed ☐
Further Work Scheduled ☐
Mechanics Name _____

SHOP REMARKS: _____

WHITE: Original (retain for 90 days) • CANARY: Fleet Service (retain with work order) • PINK: Operations

DVIR Form Instructions (reverse of form)

1. Approaching vehicle note general condition. Look for leakage of water, fuel or lubricants under vehicle.
2. Under hood check water and crankcase oil levels. Check fan and compressor belts for cracks and excessive slack and wear. Note general condition of engine space.
3. Start engine and set at fast idle for warm-up. Check for abnormal engine noise. Check gauges for normal readings (pilot lights, if equipped), <LOW AIR> warning should operate if air pressure is below 60 pounds. Anti-lock warning light should light briefly and then go out (vehicles with operable anti-lock).
4. Check emergency equipment, horn(s), and windshield wipers. Turn on all lights including 4-way flasher switch for turn signals. Check steering wheel action.
5. Leave cab to check headlights and turn signals. Switch headlights on and check both beams, then turn off headlights only. Leave all other lights on.
6. Check front clearance and identification lights.
7. Check left and right front wheels, tires, lugs or studs. Check for leaks around hubs.
8. Check right side of cab, door, mirrors, etc. and check lights and reflectors along right side as inspection progresses.
9. Check right rear tractor tires, wheels, lugs or studs. Note any thrown lubricant.
10. Check trailer light and brake lines for secure connections. Be sure manual petcocks are open. Be sure lines are properly secured to prevent entangling or chafing.
11. Check hook-up: fifth-wheel, jaws, release lever on tractor-trailer, pintle hook, towbar, safety chains, converter gear on full-trailer unit (if applicable).
12. Check right trailer tires, wheels, lugs or studs. Check for thrown lubricant (if applicable).
13. Check rear of body, mud flaps, rear light (clearance and identification, stop, tail, turn signals), rear reflectors, rear end protection.
14. Check left trailer tires, wheels, lugs or studs. Check lights and reflectors on left side as inspection progresses.
15. Check left rear tractor tires, wheels, lugs or studs. Check for thrown lubricant.
16. Re-enter cab. Re-check all gauges. Air pressure should be at maximum.
17. Check parking brake.
18. With fully-charged system, check air brakes as follows:
    a. Be sure Trailer Air Supply valve is “in” and that trailer brake air system(s) are charged. Apply and release brakes with treadle valve (if applicable).
    b. Pull out Trailer Air Supply valve to check manual application of trailer brakes.
    c. Reduce air pressure by rapid application and release of treadle foot valve. “LOW AIR” warning should operate when primary needle reaches 60 psi. Brake should apply automatically when secondary needle reaches a point between 45 and 20 psi.
    d. Recharge trailer air system to check for leaks. With engine idling, apply treadle foot valve and hold for 1 minute. After initial drop of 5-10 psi, air pressure should not drop more than 4 psi. If audible leaks or rapid pressure drop are noted, have repairs made before departure.
19. Turn-off 4-way flasher and actuate left and right turn signals. Proper operation of turn signals can be ascertained by checking front ones.
20. Make a test stop before leaving yard. Drain air tanks daily. Check tires twice daily or every 100 miles.

Use DVIR form to report vehicle condition at end of run.