Impact of Single Stream Collection of Recyclable Materials on the Quality of Fiber Coming to Wisconsin Paper Mills

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Abstract-
Single stream collection of recyclable materials is undergoing significant growth nationwide. Increased amounts of material collected, increased participation by residents and reduced collection costs are driving communities to adopt single stream collection schemes. While collection efficiencies increase, additional costs are moved downstream to the Material Recycling Facilities and the end users of the reclaimed materials. The recycling facilities generally need to add additional equipment to improve the separation of contaminants, particularly broken glass. If separation procedures do not provide adequate separation, then the end user must contend with increased amounts of unusable material. This study reviews the issues surrounding single stream collection and assesses the impacts that single stream collection could have on the quality of recycled fiber going to Wisconsin paper mills. The broadest impact will likely be on the overall cost and availability of fiber in the future. Wisconsin operations most likely affected by the quality of fiber will be those facilities that currently use mixed and brown grades of recycled fiber. Recommendations for lessening the potential adverse impacts of single stream collection are included along with a bibliography of single stream collection literature.
Introduction

There is continuing interest and emphasis on recycling as a way of conserving resources. Efforts to increase the amounts of material being recycled are evident on the national, state and local level. A somewhat controversial method for collecting recyclable materials was started in California and is now being employed in many places across the United States. Single stream collection for recycling is a curbside collection system that allows residents to place all recyclable material in one container, all mixed together. Since inception in California, municipalities and Material Recycling Facilities (MRFs) are switching to single stream collection to collect their recyclables. Advocates and opponents of single stream recycling state both advantages and disadvantages of single stream collection. Single stream collection is taking hold in Wisconsin. Earlier reports of contaminants in reclaimed fiber from single stream MRFs have raised concerns at paper mills. Many paper and paperboard mills in Wisconsin depend upon recycled fiber for their feedstock. Contamination by glass and plastic are the major concerns with fiber from single stream collection systems. There are ways that contamination levels from single stream recycling can be reduced at both the MRF and the mill. These methods will help to reduce the problems associated with single stream recycling. This report provides some of the background and issues associated with single stream collection of recyclables. It also provides references to best practices for single stream systems that lead to increased fiber quality and reduced contaminants.

Recycling Materials – Improved Resource Management

Curbside collection of recyclable materials is a relatively new activity (1). A major factor in the interest and growth of programs to collect recyclable materials is the realization that it is more economical to reprocess paper, plastics, metals and glass than to make these products from virgin materials. Also there are increasing concerns about the amounts of materials being placed in landfills. Since the late 1980’s, emphasis on recycling has been supported by federal, state and local legislation such that more than 23,000 communities now have recycling programs (2). Wisconsin State Law requires residents to recycle paper, paperboard, magazines, office paper, metal/glass/plastic containers, lead-acid batteries, and yard waste among other things (3). Since each Wisconsin resident annually generates on average 1,628 pounds of municipal waste (3), collecting and recycling this material is a major activity of county and community agencies. Initially, most residential recycling programs depended upon drop-off sites or curbside collection. In both instances the separation of materials by type was done by the resident either at the drop-off site or at the curb. For curbside collection, the resident was required to separate the recyclables and place them in different containers at the curb. Collection was then made by vehicles that had separate compartments for each type of recyclable. This system allowed for a relatively simple
Material Recycling Facility (MRF). In some communities collection of recyclables was combined with trash collection.

With the emphasis on recycling of the materials, both the number of communities collecting materials and the amounts of materials collected have increased significantly. The United States Environmental Protection Agency (EPA) periodically issues reports on the Municipal Solid Waste (MSW) generated in the United States. In their 2005 report (issued October 2006, (4)), they indicated that of the 245.7 million tons of MSW generated, 58.4 million tons were recycled. The composition of the MSW included paper and paperboard products (34.2%), yard trimmings (13.1%), food scraps (11.9%), plastics (11.8%), metals (7.6%), and glass (5.2%). Rubber, leather and textiles (7.3%), wood (5.7%) and Other (3.4%) were the other categories of MSW. Of the materials that are routinely recycled, paper in the form of newspaper as well as other paper products like magazines and periodicals, paperboard, and printing papers make up the largest percentage of collected materials. According to the EPA report, 84 million tons of paper and paperboard products ended up in MSW and 42 million tons were recycled for a 50% recovery rate.

For many years, the American Forest and Paper Association (AF&PA) has strongly supported recycling of paper products and has set a goal of recycling 55% of all paper by 2012 (5). The AF&PA annually provides information on the recovery and reuse of paper and board products. The figures for 2006 indicate that the US recycles about 53% of paper (53.4 million tons) (6), which is up from 50% in 2000 and 39% in 1993. Old corrugated containers (OCC) and newspaper (ONP) are the types of paper with the highest recovery and use rate with a recovery of 76% (25 million tons) for OCC and 72% (9.6 million tons) for ONP in 2006. The major use of OCC (60.2%) is in producing new containerboard. Similarly the major use of ONP (33.6%) is in producing new newsprint. The second largest outlet for these recovered fibers is now the export market (20.7% and 26.3% respectively) (6). This is an area of concern for domestic users of recycled fiber as exports have increased significantly in the last ten years driving up the price and reducing the availability of recycled fiber. Even though there is reasonable recovery of paper, of the 100 million tons of paper and board produced in the U.S., 35.6 million tons ended in landfills in 2006 (6).

According to the AF&PA, 86% of Americans have access to curbside or drop-off recycling programs (2). Not surprisingly, states with the highest curbside access tend to be the more populous states, while those with the lowest tend to be states with low population densities. According to this source, 43% of Wisconsin residents have access to curbside recycling and 100% have access to drop-off (2).
**Single Stream Recycling**

Single stream recycling refers to a recycling collection system where all recyclables are mixed together prior to collection. Paper, magazines, corrugated board, bottles, glass, plastic and cans are all placed in one container for collection. This is in contrast to more traditional recycling programs where the materials are separated at the curbside and the different materials are placed in separate compartments of the collection vehicle. Curbside separation collection generally entails some inefficiencies in collection as on any given collection run, one compartment of the vehicle will fill before the others and this will necessitate that the vehicle drive to the recycling center and unload before returning to finish the collection route.

With single stream recycling, the mixed recyclables are put into a vehicle with a single compartment. With all recyclables in one compartment this optimizes payloads, reduces costs and allows for compaction. The vehicle does not need to return to the MRF until the vehicle is full. This reduces fuel costs and driving time. More time is spent collecting material and less is spent driving to and from the MRF.

Single stream collection became popular in California in the 1990s, but it has now spread across the country. According to AF&PA only 11% of the population with access to curbside collection had service by single stream collection in 2000. By 2005, 27% of Americans had access to single stream programs (2). Single stream recycling programs in the U.S. are on the rise as cities seek to lower collection costs.

**Advantages of Single Stream Recycling**

A major factor in the increase of single stream collection systems is the reduced collection costs. Because most single stream collection systems use a single container for all of the recyclables, it is possible to automate the collection by having trucks fitted with robotic arms that can grab the curbside container and empty it into the collection vehicle. This reduces the amount of labor involved and may reduce the time it takes to collect the materials. A number of studies of single stream collection have indicated that moving to single stream collection encourages an increase in the number of households that recycle materials as well as increase the amounts of material that are recycled (1,7,8). These studies also indicated that the size of the recycle container influenced the amounts of material collected. In general, the larger the container the more material was recycled.

The increases in the amounts of material collected can be significant and in some instances are in excess of 20% (1, 7). In Virginia Beach, Virginia recycling participation increased from 50% with a multi-stream system to 75% participation with a single stream system that utilized a 95-gallon container (9).
Switching to single stream collection offers the opportunity to move to fully automated collection. Uniform containers are distributed to residents. These containers generally are large wheeled carts that allow the residents to place their recyclables curbside by rolling the containers to the curb. Collection vehicles are fitted with a robotic arm that lifts and empties the container into the truck and then resets the empty container at curbside. Because there is no manual handling of the carts, there is only a need for a driver of the vehicle and the driver does not have to get out of the vehicle to collect the recyclables. This reduces labor costs as well as worker injuries and the attendant worker’s compensation issues. Because the truck can collect material until it is full, it only returns to the MRF in a fully loaded state thereby maximizing transportation efficiencies.

If the same type of wheeled cart is used for disposal of trash, the vehicle/driver can make a second collection run to pick up the trash. In a number of communities, the collection vehicle passes through the neighborhood in the morning collecting the recyclables. After delivering all the recyclables to the MRF, the vehicle goes back over the same route and picks up the trash and takes it to the landfill.

The Wisconsin Department of Natural Resources (DNR) has published a list of frequently asked questions about single stream collection along with the answers (10). Among the advantages cited by the DNR for single stream collection were: reduced sorting effort on the part of residents, reduced collection costs, greater fleet flexibility as single compartment collection vehicles can be used for both recycle collection and collection of trash (not simultaneously), and more paper grades can be collected including magazines, junk mail and mixed residential papers.

**Disadvantages of Single Stream Recycling**

The DNR (10) also listed some of the disadvantages of single stream collection. These include: initial capital costs for new carts, collection vehicles, processing equipment and education of residents about what and how to recycle. They also noted that single stream collection can lead to increased processing costs as well as degradation in the quality of materials obtained from recycling. In addition, the amounts of “residuals” might increase. Residuals are those materials that might be recyclable, but cannot be easily separated or are materials that are contaminated with materials that inhibit/prohibit their use in recycled products. Residuals normally are disposed of in landfills along with trash. Examples of residuals include broken, mixed color glass, non-recyclable plastics, and paper products contaminated with food residue.

All end users of recycled materials from single stream sources have concerns about reduced quality of the materials they buy. Along with the reduced quality is the issue of contamination and increased residuals that end up going to landfill. The end users have to pay for the residuals as they come
into their plant and then have to pay to get rid of them in addition to the costs associated with reduced amounts of raw materials. In a study conducted for the St. Paul, Minnesota area (11), a survey of end users cited the following with regard to contamination concerns from single stream collection systems. For plastics recyclers, the most common and worrisome contaminants were glass and metal. For the glass recyclers, there has been a decrease in the amounts of color separated glass cullet and a significant increase in low value mixed colored glass. For paper mills the most issues related to plastic film/bags, glass and unacceptable paper grades.

**Single Stream/Commingled Collection**

Although the concept of single stream collection is simple, there are many variants practiced. A key to success is tailoring the entire process to fit the needs of the community, the collector/processors and the users of the recycled materials. It is necessary to ensure that all parties involved in the process derive some benefit. While it has been demonstrated that moving to single stream can reduce collection costs, the attendant increase in the costs for separation and end use of the recycled materials have generally been shown to result in an overall increase in cost to recycle materials. Initial studies indicated that the costs for moving to single stream could increase overall costs by as much as $33 per ton (12). These studies included the costs of disposing of the unusable “residuals” that ended up at the paper mill, the plastic recycler or the glass recycler.

Communities considering moving to single stream/commingled need to recognize that it is very difficult to modify collection and separation equipment used in curbside separation systems to adequately deal with single stream/commingled recyclables. Collection and separation equipment needs to be designed to reduce the breakage of glass. Initially, many MRFs confronted with commingled materials depended upon manual separation to pick out the glass. This typically is inadequate, particularly if there is significant glass breakage occurring prior to the refuse getting to the sorting line. In addition to being labor intensive, there is considerable worker hazard associated with manual sort.

The American Forest & Paper Association conducted a study that looked at the impact that single stream collection had on recycling operations compared to a dual stream collection. The conclusion of the study showed the following. Overall system-wide expenses, which included costs for collection, processing at the MRF, and mill utilization, resulted in decrease of value of $3/ton for the paper collected in single stream programs. While curbside collection costs tended to be about $10 to $20/ton lower for single stream programs, sorting/separation costs at the MRF were $5 to $15/ton more for single stream programs compared to the dual stream system. Mills using the outputs of these facilities incurred operating and maintenance cost increases of $5 to $13/ton (13). These operating and maintenance costs
included equipment maintenance costs, as well as sorting and disposal of contaminants found in the paper bales.

For some paper mills the most troublesome contaminant is glass. A newsprint mill using recycled fiber as their main source of fiber reported (14) that glass and other abrasive contaminants contributed to a 300% increase in maintenance costs as a result of increased wear on equipment. They also indicated that increased residuals in the incoming fiber caused an increase in pulper rejects and the combined effects of lower quality, maintenance and residuals resulted in increased costs of $2.5 million per year to the mill.

For some printing and fine paper mills the issue of unacceptable paper grades inhibits/prevents the use of fiber from single stream systems. For many types of paper used in the printing and writing area it is not permissible to have any significant groundwood content. Groundwood pulp is typically made from wood through mechanical processes rather than chemical processes. Since most newsprint and some grades of commonly used paper contain groundwood, mills that produce high grade printing and writing papers cannot use fiber from single stream sources in these grades as much of the paper collected in single stream systems is newsprint.

Evolution of equipment and handling procedures for commingled materials has been rapid. New collection vehicles have been designed to reduce glass breakage (11, 15) and separation equipment has evolved to provide more efficient separation of materials (7, 16, and 17). State of the art MRFs now can incorporate glass sorting systems that can sort glass by color, thereby significantly increasing the value of the reclaimed glass.

The concerns and issues surrounding broken glass contaminants in the paper and plastic streams have led some communities to develop single stream collection systems minus glass. In these instances, glass is either collected separately (which should be termed a dual stream system) or is collected at drop-off points. One interesting note is that more than 50% of the glass containers used in the U.S. are beer bottles (18). Glass beverage containers make up a significant percentage of the glass ending up in MSW. States that have bottle deposit laws have found much less glass in their recycle streams (19). In Senate hearings conducted in 2002, it was stated that in bottle deposit states, the recycle rate for deposit beverage containers was 422 beverage containers per capita, while in non-deposit states it was 127 beverage containers per capita. The hearings further noted that of the eight states with the highest recycle rate of municipal solid waste, six have a bottle deposit regulation (20).

Single Stream Collection Status in Wisconsin

Several communities in Wisconsin use single steam collection to manage their recyclables. Most of these are located in south central Wisconsin (10). There are currently only a few MRFs equipped to
process single stream recyclables. Ashwaubenon has recently switched to single-stream collection and will be the first in the Green Bay area to switch to the new recycling system (21). Several other communities are looking to switch to single stream recycling to lower overall collection costs.

**Previous Work on Single Stream Collection**

Numerous studies have been conducted with single stream systems to determine cost, efficiencies and overall utility (see 11, 18, and 22). It is difficult to compare the results of these studies as many of the parameters such as collection vehicles, separation equipment, and education of the populace vary considerably. What is clear is that overall collection costs tend to go down. At least one study indicates this could be as much as $10 per ton of material collected. This results from increased efficiency and reduced labor costs. What is also clear from the studies is that while collection costs decrease, separation costs at the MRF and costs to the end user are likely to increase.

A study conducted by Eureka Recycling for the Saint Paul Neighborhood Energy Consortium (22) looked at a number of scenarios for collecting recyclables. These included: curbside separation by resident, two stream commingled bins, two stream commingled carts, two stream commingled & household organics (garbage), and single stream carts. While collection costs were lower for single stream relative to source separated ($51 per ton versus $60 per ton for source separated), the processing costs and percent material loss (residuals/unusable material) were significantly higher for the single stream situation. Overall, the Eureka study indicated that the net costs per ton for collecting and separating materials (after applying the revenue obtained from the recycled materials) would be $45 for the source separated materials and $78 per ton for the single stream. This may represent a high estimate for costs for single stream as more recent work (23, 24) indicates less of a cost differential between single stream and more conventional collection systems.

Nonetheless it is clear that cost savings in the collection side will be offset by added costs in the downstream parts of the process. If significant investment in separation equipment is made, the quality of the product going to the end user will have greater value. If the MRF does not absorb the costs associated with installation of modern, efficient separation equipment, then the savings from collection will be offset by the reduced quality and increased residuals that the end user will need to handle.

More recent work shows that by employing appropriate separation equipment, the quality of materials coming from a single stream collection system can come close to the quality of source separated materials (11, 17). A key is having the right equipment to use throughout the process. Collection methods that reduce/eliminate glass breakage should be employed, automated systems for separating materials should be used and appropriate equipment at the end user needs to be installed to prevent damage to processing equipment in the event of an upset.
One of the largest processors of single stream material in the country is Waste Management. They were one of the first companies to move to single stream collection/processing of recyclables. On their corporate website they indicate that single stream collection has resulted in up to a 30% increase in the amount of material collected. They also indicate that the volume of material processed in their single stream facilities has gone “from about 722,000 tons in 2002 to more than 1.5 million tons in 2005” (25).

**Concerns of Paper Mills**

Broken glass is one of the biggest concerns for paper mills. Broken glass shards mixed in with the collected and processed fibers can create tremendous problems for the mills that use the fiber. Glass can damage equipment in the paper mill and can raise safety concerns.

Residual pieces plastic film from bags or other plastic products can also be a problem for the paper maker. Traditional papermaking systems have a hard time handling/removing these contaminants. Having any contaminants mixed in with the paper increases the chance of the finished product to not meet the required quality levels.

Even if the mill is able to remove these contaminants before they get into the system, they will have to dispose of them in some way. This usually means sending them to a landfill. In addition to paying for material they cannot use, they have to pay the tipping fees to dispose of the materials. Depending on the size of the mill and the amount of recycled fiber they use, this can amount to several tons per day sent to the landfill.

Paper mills are also starting to take notice of the growth of the paper industry in China. They fear that China may start buying up large quantities of both virgin fiber and the best quality recycled fiber. This will lower the amount of quality fiber available to paper mills in the United States. Domestic paper mills also are worried that China may start accepting lower quality fiber. This may lead to recyclers lowering their fiber output standards, which may pressure domestic paper mills to accept the lower quality fiber.

**Current Recycle Use at Paper Mills in Wisconsin**

There are quite a few operations in Wisconsin that use recycled fiber. In addition to paper, tissue and board mills that use recycled fiber, there are a number of operations that process reclaimed fiber and then sell it to paper mills. For the purpose of this study the emphasis is on the papermaking operations that produce tissue, paper and board products.

Wisconsin is the tissue manufacturing capital of the world with more tissue output than any other state. A significant portion of the tissue produced contains recycled fiber. Discussions with some of these facilities indicated that the concerns about future supply of reclaimed fiber were more directed at the
increased cost and availability of fiber. Increased pressure on recycled fiber supplies are coming from overseas primarily from China and India. According to the AF&PA the amounts of fiber being exported have grown 20% since 2000 and the expectation is that this increase in demand will continue (6). This affects the price and availability of recycled fiber in U.S.

Interviews with some Wisconsin tissue operations revealed a number important factors influencing the concerns about recycled fiber from single stream collection. For operations that produce consumer tissue products, the majority of their recycled fiber comes from non-municipal waste streams. Recycled fiber from commercial reclamations such as mixed office waste or other higher grades of recycled fiber provide a major source of recycled fiber for these operations. Their need for bleached kraft fibers to produce white tissue and towel products puts their needs outside of recycled fiber from municipal collection.

At least one tissue producer has been using reclaimed fiber in their products well before recycling became a national issue. This producer has developed proprietary processes and equipment to separate and remove contaminants from collected recyclables. While glass and plastic film contamination are areas of concern, their technologies enable them to use fiber from sources that other mills might reject. The concern about supply and availability resulting from increased market demand is, however an issue.

One mill interviewed stated that they were concerned about storing fiber from single stream collection facilities. They were concerned that the fiber may be contaminated with organic material, such as food, which would possibly lead to an increase of rodents and other vermin in the mill. It could also provide for bacterial contamination of the process and the products as well as posing risks for mill personnel. The mill was also concerned about the organic material degrading the fiber causing it to be of lesser quality.

The area of tissue manufacture that might be most directly influenced by single stream collection would be the commercial tissue market. These are the tissue products sold to hotels, restaurants and most places that have public restrooms. Historically some of these products have used lower grades of recycled fiber including ONP. With less “pure” ONP available, it is likely that material from single stream sources will be offered to mills. As indicated earlier, the separation technology employed by the MRF has a significant impact on the level of residuals ending up with the fiber. Nonetheless, there is the possibility that some mills will see increased amounts of unusable and deleterious material coming in with the fiber. Fortunately technology in the form of screens and cleaners are available and can be installed to handle most of these contaminants, however if a mill currently does not have these in place, they will need to expend capital to insure continued quality of their products.

It is likely that the paper operations feeling the greatest impact from the move to single stream will be mills that produce “brown” products. These are the board, liner and corrugated mills that have
depended on relatively clean supplies of reclaimed corrugated box material. Fibers obtained from boxes and corrugated tend to produce products with higher strength than fibers from newsprint or other recycled papers, so there are some concerns about being able to maintain strength and quality targets with fibers from single stream systems. Of at least similar proportions are the concerns about the amounts of unusable materials coming in the fiber. The amounts of plastic and glass that will need to be separated and then separately disposed of are a concern for at least some of the mills producing recycled liner and corrugated. While a number of the mills currently using lower grade supplies of fiber have equipment in place to separate these contaminants, those that don’t will need to invest in this equipment.

Operations that would be most impacted by single stream would be newsprint mills that use large amounts of ONP. Newsprint is one of the major outlets for recycled fiber and these mills historically consumed separated ONP. Pure streams of ONP will become less available as single stream collection spreads. These mills will have to install new equipment and modify their papermaking processes to maintain quality standards. According to the Center for Paper Business and Industry Studies (CPBIS), there are no newsprint mills in Wisconsin. Nonetheless, impacts on paper operations in other states may be felt in the state.

**Conclusion and Recommendations**

Single stream collection of recyclables will continue to grow. For any community considering going to single stream they need to make certain that each entity in the chain, from resident to end user of the recyclable material will benefit. Both the collector and the processor need to invest in new equipment to make single stream efficient. Carts, vehicles and an incentive to do curbside surveillance to ensure that non compliant recyclable materials and contaminants do not end up in the carts are the responsibility of the collector and they need to have an incentive to invest and maintain their equipment and process. The processors also need to invest in new and more efficient separation equipment. Although in some instances a partial manual sort may make sense, for large MRFs it is likely a requirement to invest in automated sorting equipment. This equipment is expensive and is sensitive to economy of scale. It is unlikely that a small operation would be able to afford this sorting equipment. Fortunately, new equipment for collection and processing is being developed at a rapid pace. Recent articles have highlighted equipment and procedures that would ease the transition from traditional collection methods to single stream (11, 15, 16, and 17).

The end user of the reclaimed materials must also have some incentive. They should not have to deal with a significant decline in quality with attendant increases in residuals and unusable material. The advantage that the end user might realize would be an increase in availability without significant increases in costs.
If structured correctly, a single stream collection system will increase participation on the part of the residents with regard to the number of residents participating and the amounts of recyclables collected per household. This will mean increased amounts of material coming to the MRF resulting in greater revenue for the MRF and increased amounts of quality material provided to the paper mill, plastic/metal/glass recyclers.

Probably of most importance is the engagement of the community in instituting a single stream system. While education of the residents as to what can and cannot be included with commingled recyclables is an important piece, some communities have gone further in providing incentives for participation. Many communities have instituted a Pay As You Throw (PAYT) program along with moving to single stream (1, 26). PAYT charges residents for excess amounts of material ending up as trash. A typical PAYT system would charge a set amount for a particular volume of trash, a bag or specific size bin for example. If more than a bag or bin were set out, the resident would be charged an extra amount for that collection period. The incentive is to drive the recyclables into the recycle stream.

Another community provides redeemable coupons based on the amounts of recyclables collected from a particular residence (7, 27). This provides a direct and immediate feedback to the community members.

It is critical to determine what will work in a specific community. If residents are not conscientious in including only things that truly are recyclable the system will not work. Likewise the system will not work if people do not include all recyclables in the stream. If the system is a true single stream collection, then efforts must be made to prevent glass breakage in the curbside delivery, collection and sorting process. For the resident it means not breaking the glass as they put it in the containers. For the collectors, it means not breaking the glass as it is dumped into the vehicle or is subsequently handled on delivery to the MRF. For the MRF they need to minimize breakage as the glass moves through the system. Knowledge, equipment, processes and procedures are known that can make single stream collection of recyclables a successful operation, but if any part of the process is neglected, the results will not meet expectations.

**Impacts on Wisconsin Paper Mills**

- Impacts of single stream collection will be greater for those mills that currently use ONP, recovered corrugated/board and mixed papers as part of their furnish. These are mills that typically produce board or corrugated and commercial tissue products. Although improvements in separation of contaminants by MRFs will help to control and reduce residuals, it is likely that mills using these reclaimed materials will need to deal with at least some increase in residuals.
Impacts on tissue mills producing premium, white tissue products will mainly be affected by price and availability of fiber. These operations will continue to use recycled fiber containing large percentages of office waste and printing papers that typically would not be collected from residential sources.

Increases in the demands for fiber from overseas will influence the price and availability of fiber for all paper operations in Wisconsin.

**Recommendations**

- Thoroughly evaluate the community needs and resources before deciding to move to single stream collection
- Make certain that the entities responsible for collection, separation and reuse are included in the dialogue and ensure there is an incentive for each part of the chain
- Develop a program to engage and provide incentives to residents beyond just reduction in collection costs
- Consider going to a single stream minus glass if it makes sense – this could make smaller operations more feasible

Since inception, single stream recycling has sparked considerable controversy and consternation in the recycling world. While there are advantages and disadvantages to single stream, the likelihood is that it will continue to spread. Single stream collection has come to Wisconsin and the paper mills in Wisconsin are concerned with regard to the cost, availability and quality of future fiber supplies. Careful planning and execution must be done to ensure that single stream collection does not adversely affect the Wisconsin economy.

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