PROJECT TITLE: Developing a Recycling Plan in a New York City Elementary School

TEAM MEMBERS: Miriam N. Ward & Blake Wells

FACULTY ADVISOR: Vasil Diyamandoglu

SUBMITTED: December 20, 2011

Submitted in Partial Fulfillment of the
Master of Science in Sustainability Degree

The City College of New York
Grove School of Engineering

APPROVALS

Faculty Advisor:

Name: Vasil Diyamandoglu, PhD., Assistant Professor, Dept. of Civil Engineering, CCNY

Signature: [S/S Vasil Diyamandoglu]

Date: 5 January 2012

Program Director:

Name: Latif M. Jiji

Signature: [S/S Latif M. Jiji]

Date: 5 January 2012
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapters</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Abstract</td>
<td>3</td>
</tr>
<tr>
<td>II. Project Statement and Objectives</td>
<td>3</td>
</tr>
<tr>
<td>III. Introduction</td>
<td>4</td>
</tr>
<tr>
<td>IV. Literature Review</td>
<td>8</td>
</tr>
<tr>
<td>V. Procedure</td>
<td>31</td>
</tr>
<tr>
<td>VI. Results</td>
<td>41</td>
</tr>
<tr>
<td>VII. Conclusions</td>
<td>48</td>
</tr>
<tr>
<td>VIII. Recommendations for Future Work</td>
<td>53</td>
</tr>
<tr>
<td>IX. Acknowledgements</td>
<td>54</td>
</tr>
<tr>
<td>X. References</td>
<td>55</td>
</tr>
<tr>
<td>XI. Appendices</td>
<td>61</td>
</tr>
<tr>
<td>A. Flow Charts</td>
<td>62</td>
</tr>
<tr>
<td>B. Case Studies</td>
<td>67</td>
</tr>
<tr>
<td>C. Maps</td>
<td>82</td>
</tr>
<tr>
<td>D. Logistical Planning</td>
<td>89</td>
</tr>
<tr>
<td>E. Publications</td>
<td>91</td>
</tr>
<tr>
<td>F. Waste Audit</td>
<td>110</td>
</tr>
</tbody>
</table>
I. Abstract

New York City provides many of the educational tools to integrate responsible waste management into elementary school operations, yet implementation has fallen short. To address this endemic shortcoming, this project assisted in the development and implementation of a recycling program in a local school. After identifying an elementary school looking to build a recycling program, extensive effort was put into developing a relationship with personnel and building the internal support required to change habits. To assess existing habits, a waste audit was conducted, material flows were calculated, and the habits of the custodial staff, faculty, and students were documented. The existing diversion rate was found to be significantly below municipal mandates. From this analysis, a recycling plan was developed, which takes into consideration major waste flows and social barriers. In addition to a purchasing and deployment plan, maps and flow diagrams were used to communicate the necessary changes in behavior. A follow-up waste audit was conducted to gauge the success of the recycling plan after implementation. From the lessons learned, successful techniques and recommendations for New York City school waste management were created.

II. Project Statement and Objectives

A. Background

The first twelve years of school are a crucial period for the development of character, values, and habits. Surveys have shown that despite a proliferation of information about recycling, many adults remain confused about how to properly and efficiently recycle. 1 This underscores the importance of immersing students at a formative period in their lives in a well-conceived recycling program. With a plethora of potentially positive learning experiences, school management is beginning to emphasize responsible waste management as a priority. Unfortunately, implementation within New York City schools has not kept pace. With growing waste management costs, stressed financial resources and unmet legal mandates, the underperformance of school recycling programs requires systematic investigation.

B. Project Description and Objectives

This project was designed to work with a local New York City elementary school to plan, implement and evaluate a recycling program. It focused on a school that currently lacks a functioning program, but wishes to develop one. The challenge was to devise a comprehensive, low technology, economically feasible recycling program suited to a particular context and to work with teachers and administrators to implement the program. Formulating a new program required identifying the reasons recycling programs have failed in the past and investigating successful models and programs. Conducting a waste audit to document the existing waste management practices identified existing failings and created a baseline for comparison.

The objective was to create a functioning recycling plan that works within the needs of an existing school. The staff implemented the plan with assistance as requested. To quantitatively evaluate the

1 Ipsos Public Affairs 2011
recycling plan and to identify the impact on waste disposal behavior, another waste audit was conducted after implementation. From this data, potential areas of improvement, as well as successful resource management techniques were pinpointed.

C. Scope

The scope of the project was limited by many factors due to the constraints of actual implementation. While looking for a school, the search was limited to schools within the five boroughs with approximately 500 students. The school chosen is a high-performance charter Elementary School, Kindergarten through Grade 4, which is part of a multi-school campus. The recycling plan developed was limited to facilities operated by the administration of the school in focus, which left cafeteria and recreation facilities outside the scope of this plan. With a set completion date for the study, the follow-up waste audit was conducted shortly after implementation. It documents significant improvements in source separation as well as the difficulties in changing habits. The recommendations developed address the needs of the particular school and focus on areas of institutional support that would benefit from restructuring. While this study creates a useful benchmark for evaluating participation in different areas it also shows a continued need to monitor and support this type of program.

III. Introduction

Sustainability supports the integration of economic, environmental and social concerns into a unified framework for responsible decision-making and marks a fundamental shift in policy towards a long-term agenda. To be successfully implemented, governance that is transparent and held accountable for the results of municipal programs must support sustainability. PlaNYC, New York City's bold effort to support the quality of life for all New Yorkers while cultivating long-term growth, has excelled due to explicit goals with metrics to measure progress. Unfortunately, solid waste goals have consistently underperformed without obvious steps to remedy the problem. The generation of waste in whole sectors goes undocumented and current plans do not address the root of the problem. This study focused on recycling programs in schools, which do not yet have official indicators to measure performance. The relationship between documentation and performance is explored as a tool to change habit.

A foundation in intergenerational equity aligns sustainable principals with the values that support the public education system. While some aspects of sustainability are already represented in the New York City school system, environmental resource management and recycling participation has fallen short. Programs that bolster education and support responsible long-term financial and environmental decisions represent important investments into the future of New York City.

A. Necessity for this Study

i. Recycling and Sustainability

Recycling promotes sustainable consumption and production practices, resulting in valuable economic and environmental benefits. Source separation is uniquely suited to an urban context as
the logistics can be integrated into daily routines, and it represents one of the few ways for students to steward responsible resource consumption within an urban setting. Studies have shown that early childhood education in sustainability must be rooted in local context for it to be meaningful and have impact on behaviors.\(^2\) Therefore, managed school recycling programs reinforce recycling habits and integrate sustainable education into daily activity. In addition, recycling education helps connect resources to consumption, which could influence future source reduction.\(^3\)

Implementing a recycling program not only shapes current waste management, it also has the potential to influence and improve recycling performance for many years to come. Educating students about recycling reflects a solid waste management strategy to impact long-term behavior.\(^4\) In an urban environment, recycling is a low cost, low-technology means to apply values and principals vital to the future of our planet. Education in sustainability increases students’ capacity to address environmental concerns now and empowers students to become stewards of their community.\(^5\) Recycling is a natural fit with existing education agendas both ethically and practically. As stated by UNESCO (1997), “Education, in short, is humanity’s best hope and most effective means in the quest to achieve sustainable development.”\(^6\)

ii. **Environmental Education**

Educating children on sustainable choices through a recycling program empowers them to address pressing environmental issues. With action-based initiatives, recycling programs support both general education and environmentally driven agendas. A well-developed environmental education program has the potential to develop communications, teamwork and problem-solving skills and is therefore important towards developing good citizens.\(^7\) Education on environmental concerns that foster solutions through collaboration has the potential to facilitate active community engagement. To have the greatest impact, local context should determine how sustainability is incorporated into lessons.\(^8\) In an urban environment, recycling can augment environmental education and awareness while developing a deeper understanding of sustainability through a collaborative effort.

iii. **Sustainability as Habit**

For sustainability to move outside of a conceptual framework, it must become integrated into habits that guide daily actions.\(^9\) Recycling programs in schools provide students with the opportunity to implement sustainable principals within daily routines and empower young people with knowledge and experience to actively contribute to a sustainable future. Fostering responsible citizens, who understand behavioral choices as the basis for sustainable implementation, provides a vital method to invest in the future. Recycling provides a path to

---

\(^2\) Samuelsson and Kaga 2008, 12  
\(^3\) Evans 2000  
\(^4\) Ibid  
\(^5\) Sales et al. 2006, 198  
\(^6\) UNESCO 1997, 18  
\(^7\) Smith et al. 1997, 3  
\(^8\) Samuelsson and Kaga 2008, 15  
\(^9\) Qumuge 2008, 81
actively participate in the creation of a sustainable society, through concrete choices grounded in familiar activities.

iv. Recycling in New York City

New York City’s recycling rates indicate gross underperformance when compared to other progressive environmental agendas. According to a 2011 study by Siemens, which analyzed the environmental performance of 27 major US and Canadian cities, New York City is rated first for transportation, but sixteenth for waste management. This represents a necessary area for improvement and investment. Redirecting waste to be recycled in New York City also addresses pressing local environmental issues, as New York City cannot manage waste for landfills independently. While paper recycling occurs in local processing facilities, all other waste has a much farther journey. With the closure of Fresh Kills Landfill in 2001, New York City exports its waste to be landfilled to several out-of-state areas including Philadelphia’s northern suburbs. Landfill space has become more valuable as it has become scarcer. Older landfills in New York State have been closing, leaving disposal to newer landfills that have more stringent regulations, greater upfront investments, and higher operating costs. Utilization of out-of-state landfills and increasing tipping fees will force communities to explore innovative management tactics in order to control solid waste in the future. Policymakers fully recognize that with declining landfill space, every effort should be made to reduce, reuse, recycle, and recover materials to avert landfilling.

New York City has taken steps to improve its waste management practices. The Department of Sanitation of New York (DSNY) recently completed marine transfer stations that have increased the recycling tonnage capacity. As diversion levels have underperformed and do not meet official mandates, different techniques must be utilized to improve participation levels. Enacting multiple waste management techniques will create an integrated system to more effectively manage waste and efficiently process material. This entails addressing the multiple sources and the different methodologies required to encourage appropriate disposal options including source separation when reduction and reuse options have been exhausted.

B. Quantification

Quantification of waste is a necessary step towards managing disposal and developing effective policy. Common descriptors used to clarify areas of quantification are waste generation, contamination, participation and diversion.

---

10 Navarro 2011
11 Siemens 2011, 6
13 Fernandez 2009
14 Johnson 2000
15 Moy et al. 2008, 1
16 Ibid
17 DSNY 2006, “Comprehensive Solid Waste Management Plan”
18 Clarke et al. 1999, 127
Waste generation is the act of creating material that is no longer desired and therefore does not have value in its current form. These materials are therefore gathered for disposal. Waste generation rate refers to the amount of materials produced by a group of individuals over a given period of time. The rate can be calculated for the amount diverted, disposed, or produced without necessarily indicating end processing. Waste generation is expressed as mass per population producing waste per time interval.

Contamination refers to the amount of material improperly disposed of based on local waste management regulations. Contamination of potentially recyclable material within the waste stream for general disposal increases the amount of processing due to extra handling. High levels of contamination may prevent this material from being properly processed, which increases the adverse environmental impact of disposal and the amount of labor and cost required to prepare this material for processing.

Participation in a recycling program refers to the percentage of a certain group that correctly source separates recyclable materials from non-recyclable materials as required by the next step in the waste management process. Participation rates can be used to assess the success of a recycling program as a whole or of individual components. In the case of a school, participation rates can be calculated for students, custodial staff, classrooms or offices. Participation quantifies the value of a recycling program, signifying social engagement and potentially assigns responsibility for non-compliance.

Diversion rates quantify the results of overall waste management practices as a percentage of waste that is kept from landfilling and indicates the effectiveness of a reuse and recycling program. Diversion rates can be calculated based on the total amount that would have gone to landfill or as a comparison with what has been disposed of previously. The data needed for these statistics is gathered through a waste audit that specifically examines waste disposal patterns. Diversion rates however can be deceiving if more information is not provided. While New York City diverts nearly half of its solid waste from landfills, most of this material is excavated dirt and rubble from construction sites. It is therefore important to indicate what materials are diverted and the capture rate for materials that should be source separated from the waste stream. Recycling rates are also useful benchmarks for quantifying the progress made when implementing a recycling program. The diverted recyclables may also translate to solid refuse reduction, which has specific environmental and financial implication based on location.

C. Solid Waste Management

The term recycling is used to describe the act of separating a material from the waste stream headed for landfill or other processing so that this material may be processed and recomposed into a useful new material to create a product. Materials diverted from the landfill are recovered to have another function, which may or may not be similar to its original function and appearance. Recycling programs increase the amount of materials available for reuse and therefore potentially avert the consumption and extraction of virgin materials.

19 Navarro 2011
Some municipalities utilize a commingled waste collection program that places the responsibility for separation on a Materials Recovery Facility (MRF). While commingled waste does not require any separation by residents, commingled recyclable collection requires only the separation of recyclables from general waste without differentiating the type of recyclable material. Commingled collection requires costly processing and large facilities for sorting. In October 2010, New York City Mayor Michael Bloomberg broke ground on a new Sims Metal Management Municipal Recycling MRF in the South Brooklyn Marine Terminal. The facility is intended to handle all of New York City's metal, glass, and plastic recycling, but residents must continue to separate these items from general solid waste. Source separated recycling programs require the waste generator to take responsibility for separating recyclables prior to pickup, which requires more complicated transportation logistics and suffers from increased contamination issues. Although recycling is technically the process of remanufacturing used material into a new form in an industrial setting, the term has been coopted to indicate the act of source separation based on popular usage.

Recycling materials and reducing waste has the potential to reduce waste management costs and to increase the lifespan of existing landfills. An effective waste management plan includes the highest possible diversion rate away from landfills with minimal transportation and environmental impact. The system of getting waste on a path to diversion is vital to increasing participation. An efficient waste management system must pinpoint the weak links and strengthen these connections. Recycling recovers materials to be used again and averts pollution. As landfill space has become more precious, recycling has become more important. Proper waste management requires an understanding of the composition of the waste stream and how it was generated. Waste management strategies therefore must be based on composition, which reflects where it was generated, the local market, and management options.

IV. Literature Review

The literature review identified principals to help in the development of a recycling program that will work with available resources and restrictions, with an awareness of initiatives that have proven to be successful. The review began with recommended procedures to generate flow charts that show the structure of the project staging. The analysis of past studies involved visualizing the process of information into a diagram. In each case, a specific formula for implementation was investigated and developed. Consistent aspects required for the implementation of a recycling plan were emphasized during the quantitative review. Past recycling efforts in New York City schools, as well as the laws and history that would guide the project, were also reviewed. Finally, literature to identify the failings and successes of recycling programs was used to identify trends and support the analysis.

---

20 Recycling Today 2010
21 Navarro 2011
22 Acurio et al. 1997, 4
23 Vega et al. 2008, S21
A. Flow Charts

While researching successful school recycling programs nationwide, underlying patterns were exposed with regards to the logistical planning and maintenance of various plans. Through the use of flow charts, institutional recommendations were organized and trends interpreted for structural similarities. [Appendix A] From these flow charts, four main phases were identified as minimal areas required for a successful recycling program: Catalyst, Administrative, Implementation, and Maintenance. The order of deployment was consistent throughout the recommendations. These aspects are required to create a tailored recycling program, which justifies expenditure and investment through quantitative results.

The first phase identified, Catalyst, is used to gain staff support and create internal momentum. The second, Administrative, describes the legwork to properly support and develop a program. The third, Implementation, addresses the actual process of changing behavior and encompasses some aspects of logistical planning, which typically happen concurrently. The final phase, Maintenance, includes evaluation and assessment with a return to planning and implementation if the program is underperforming. To create this framework, multiple sources were referenced. As education sources were found to lack rigor and a scientific framework for decision-making, other sources were consulted to develop a broader understanding. Advice was culled both from school, institutional and workplace recommendations to gain a more rigorous approach to allow for scientific quantification. The Pennsylvania Environmental Protection Agency (EPA) was consulted for the clarity of information presented. [Appendix A1] In addition, Los Angeles County recommendations [Appendix A2] and a case study from a successful program in a Los Angeles elementary school were reviewed. [Appendix A3]

In the development of the flow diagrams, it was discovered that the first aspect required to set-up a recycling program is a strong catalyst to enlist the engagement of affected parties. The Catalyst must build internal interest and support so that a recycling program will have enough momentum to overcome difficulties to be brought into fruition. In the case of the 9th street Elementary Recycling Program in Los Angeles, this came in the form of the California Waste Management Act of 1989, which requires a 50% waste diversion goal. The catalyst behind the act, the political will necessary to prioritize recycling within a school, represents a larger social catalyst behind the program. Legal obligation represents only one means towards enacting a successful recycling program. Community outreach is also identified as a means towards building momentum. The benefits of a program must be clearly stated to build support and garner involvement. Advertising and educating participants to the benefits of a recycling program is necessary to maintain the support of constituents. In addition, an internal group within the school should be enlisted to maintain interest and further propagate the project. The administrative staff should support the vision before administrative involvement has begun, as there may be an initial financial outlay. Finally, the custodial staff must be addressed directly and not as an afterthought. Their engagement is vital towards restructuring the flow of waste.

---

24 Los Angeles County Department of Public Works 2011, 6
After the Catalyst is in place and has had time to motivate all parties in the waste flow path, the Administrative phase can begin. This stage takes place before an actual recycling program is implemented and makes sure resources will be deployed as needed. For a project to gain direction, a central person or Recycling Coordinator is needed to lead the project. The role of this person should be in their job description, as it requires time and commitment. This person must have a genuine interest in sustainability, should believe in the importance of responsible solid waste management, and must be willing to work with all constituents in the development and implementation of a recycling plan. After a Recycling Coordinator has been assigned, a task force should be formed to assist in initial development. The task force should include interested parties affected by school operations, each of whom increases the potential effectiveness of the actual recycling plan. Each member of the team helps to ensure practical logistical planning, engagement of those affected, and participation at all levels. Forming a coalition of interested parties also makes sure that the administration supports the project, so it is not discarded for more pressing issues.

The next step within the Administrative responsibilities is to decide what materials will be recycled. This requires ascertaining the composition of the waste stream for planning what will be recycled and what accommodations must be made to change the flow of waste. Although often ignored in school planning, the waste audit is representative of one of the standard waste management practices. Actually examining waste and performing a waste audit has resulted in data that contradict commonly held beliefs of waste disposal habits. Waste streams in schools are assumed to be primarily paper waste. While this may generally be the case, recommendations were found to be cursory and prescriptive as the results were assumed without investigative evaluation. A waste audit was not considered necessary in all school recommendations, but was recommended for institutional planning.

Once decisions regarding the desired changes in waste flow have been made, decisions regarding the implementation of this plan are required. Implementation, putting established goals and changes into action, requires extensive planning to allow for a smooth transition. Much of the planning should anticipate what students are likely to do wrong. Bin labeling and deployment, which require the acquisition of supplies as well as logistical planning for the custodial staff, are required for a clear, easily understood deployment. Revised procurement reflects a means to extend the impact of the plan and is suggested to create an integrated solid waste management plan that goes past recycling and considers source reduction.

Having all of this logistical planning in place however is not enough. Students require a final push in motivation as well as assistance from staff to put these changes into action. Engaging people at multiple levels is vital towards gaining interest and engagement. A kick-off campaign can consist of staff meetings, school bulletins, campus assemblies, and contests. Student involvement and enthusiasm is vital towards connecting behavior with values. A coordinated campaign to educate the students and reinforce changes in habit is necessary even in recycling programs that are limited in scope.

25 Thompson and Green 2005, 10
26 Rathje 1991, 118
The final identified stage, *Maintenance*, allows for a reexamination of the recycling program and supports continual reinforcement needed for a long-term project. Recycling programs require ongoing effort and resources to maintain. Publicizing results is recommended as a means of maintaining participation along with student education efforts. Another waste audit is recommended to provide a qualitative examination to connect efforts with actual results. Given the number of individuals involved with waste generation, disposal, separation, collection, storage, transfer transport, and processing, there are many opportunities for recycled waste not to be properly handled. Quality control is necessary to address incorrect handling. Evaluating and adjusting personnel represents a required step to turning a socially responsible activity into a serious building maintenance operation. It is important that the recycling program become a part of standard operation and is not limited to the relatively brief period of implementation.

### B. Case Studies

The case studies initially focused on schools with similar demographics, grades K-4, and approximately 500 students. After a reasonable amount of quantitative data was collected from similar programs, the criteria were broadened for case studies with more qualitative value. Creating a basis for comparison with various data collection standards presented an ongoing difficulty. A valuation system was created to score various programs and compare the case studies. While not polished enough to be usable for policy implementation, the scoring system helped to further break down the various components and techniques needed to develop a successful recycling program.

#### i. Black Mountain Elementary School: Cave Creek, AZ


Black Mountain Elementary School (BMES) is located in Cave Creek, Arizona. This example was chosen for the detail and quality of the waste audit data collected and available publically. BMES has 560 students and serves a student body between Kindergarten and Grade 5. This program is notable for the documentation of the waste stream performed by the students, as well as the involvement of students at all other stages. The catalyst for this program came with the availability of funds from the Arizona Department of Environmental Quality. Deployment was staged by grade, with 5th graders beginning in mid-November and Kindergarten and 1st graders beginning a month later. This allowed for the older student to practice their recycling guidelines before explaining them to younger children. Responsibility for the plan was distributed throughout the grades. The oldest students took responsibility for labeling and distributing two recycling containers per classroom and explaining the recycling process to the younger students. The 4th and 5th graders recorded the results of their daily waste collection, while the recycling club measured K-3 and other areas. Measurements of the waste continued until the end of the school year in June. Distinctions were made between food, plastic, paper, glass, and other waste, and data were organized by grade level. Afterwards, the data were posted online. There is no indication that data have been collected after this time.

---

27 Black Mountain Elementary School
A full write-up of the plan and a tabulation of the data were conducted. [Appendix B1] While the plan itself was relatively straightforward, the data analysis yielded a few interesting insights. There was a trend towards increased paper usage in older students and in particular classrooms, suggesting that the extra paper is due to teacher dissemination. Plastic recycling did not have as high of a participation rate and was occasionally implemented later and ended earlier. This is interpreted as a sign that plastic wastes were deemed secondary to the recycling program, whereas paper was essential. While the administrative offices had more diverse waste streams, they were also less engaged in the program, as shown by lower participation rates. Unfortunately, the principal’s office operated as an exemption to the recycling program and not as a model for other staff to emulate.

While the environmental impact of this program was calculated, [Appendix B1] the importance is not merely through the environmental benefits of what was recycled. Engaging the students with an environmental issue and empowering them to take action is perhaps the most important aspect. This program must however be combined with environmental lessons to help students tie recycling into the larger environmental picture. In addition, the enthusiasm of the ‘green team’ could be built upon to expand the ambition of the program to address a larger area of sustainable operations. The success of the team to mobilize was not fully engaged and did not build momentum in successive years.

There were a number of aspects that were found to be lacking in the BMES recycling program. While the recycling program excelled in engaging students, it struggled to have full participation from the staff, which may have contributed to the inconsistent diversion rates. The follow-up waste audit indicates that while recycling levels may have been satisfactory, waste produced did not decrease, which suggests that source reduction has not been adequately addressed. While the ownership of the plan by the student body in this recycling program is the strongest aspect, having students in control of the plan effectively disengaged the staff. Administrative offices set a lower standard for their contribution by not attempting to recycle plastic in areas where the waste audit indicated it would be helpful. The limited involvement of faculty potentially limited the program’s ability to influence all areas of school operations. The lack of commitment by the administration also reflects a lack of perceived incentive.

Another problem that arose from a student driven plan was the lack of adaptation to the needs of the special education class. A program that asks more of the staff and incorporates their ideas would be a more successful option. Individuals familiar with the needs of special groups should be incorporated into the process. Developing and implementing a program may have the enormous benefit of encouraging stewardship in a few students, but larger gains can be made environmentally and educationally through the involvement of a more representative sampling of school functions. The data and analysis on the Black Mountain Elementary School program can be found in Appendix B1.
ii. Deane-Porter Elementary School: Rumson, NJ


Deane-Porter Elementary School, located in Rumson, New Jersey, is a K-3 school comprised of 500 students with 30 staff. In 2006, a new recycling program was instituted with the assistance of the District Recycling Coordinators over a ten-month period with three distinct phases of implementation, which occurred both concurrently and separately. The stated goal of the recycling program, which is based on district experience and expectations, was to capture 50% of the recyclable materials in the waste stream. The Deane-Porter Elementary School case study is unique to this sampling as the authors of the present study had direct contact with the county official who conducted the waste audit and monitored implementation of a new recycling program.

After meeting with the principal in March 2006, the solid waste management consulting team made a presentation to the faculty and the students titled “A School Recycling Program” as part of the first phase to be implemented. This phase performed the function of a catalyst and was specifically geared towards getting the participation of the students and staff to be involved in a recycling plan. Source separation through recycling, proper labeling and personal involvement are stressed.

The next phase involved assessing the status of the current waste management system and bin deployment and redeploying resources. The custodial staff was responsible for taking an inventory of the trash and recycling containers throughout the building to assess whether the bin collection in place was adequate. The custodial staff indicated a number of problems with the existing waste management system, which was confirmed through a walk-through examination. Each classroom had one container for collecting trash only, making the separation of recyclables impossible. While some of the offices did have multiple types of containers for waste and recyclables, the materials were not consistently separated, nor were the bins consistently labeled. In addition, the custodians reported that the students were not properly source separating the materials even when bins were provided. A visual examination of the waste pickup area confirmed that the waste was comingled with recyclables. A few aspects of the waste management system were however properly deployed by Monmouth County standards. In the cafeteria and other open spaces within the school, bins were clearly labeled and accessible. Basic changes were made to the bins as was necessary for the success of the recycling program. Monmouth County specifically supplies schools with recycling containers for soda bottles to increase the visibility of the recycling program. This phase was fully implemented seven months after the new recycling program began.

Phase three involved performing a waste audit three months later, in January 2007, to assess the performance of the recently implemented waste management plan. The waste audit occurred over five consecutive days and involved inspecting bins and waste disposal at the end of each school day. Waste capacity was calculated based on the total weekly capacity for storage. In this case, waste is picked up daily from a four cubic yard container, yielding a maximum waste generation capacity of 20 cubic yards per week. Waste generation was found to be on average 70% of total capacity for a weekly waste generation of 14 cubic yards. On average, 45% of the materials in the waste could have been set aside to be recycled. With a diversion rate of 100%, the waste audit indicated that 20
tons of recyclable material could be recovered, at a yearly savings of $1,400 per year. While the school was doing a good job recovering cardboard, bottles and cans, the recovery of recyclable paper needed to be improved. The amount of waste that was being properly managed and diverted from landfilling prior to any changes in waste management was not stated within the report.

From the underperformance indicated by the waste audit a number of recommendations were made to improve the lack of participation and increase paper diversion rates. A Recycling Coordinator was recommended to handle issues and concerns and to disseminate information. This person would be responsible for maintaining open lines of communication between the different individuals and coordinate the educational aspects of the program. The administration’s primary responsibility is to support the school’s solid waste management program and the Recycling Coordinator. In addition, the administration should disseminate information and expectations to the staff, while setting an example for the staff. Teachers are responsible for monitoring their classrooms for correct disposal, guiding students to properly source separate, and raising any concerns to the Recycling Coordinator. Students are encouraged to establish a group to support the waste management program. The student group can monitor the program through periodic waste audits, raise awareness about waste management, and organize collection events. A faculty member or parent would function as guidance counselor for the group.

Other recommendations focused on implementation and logistics. The custodial staff should ensure that recyclable materials are kept separate from the waste stream. In addition, the custodians should communicate excessive contamination, lack of storage space, or waste pickup problems to the Recycling Coordinator. The bins themselves should be easily identified and color-coded. Blue is suggested for recycling containers and gray, brown, or black for trash. Each classroom should have one container for waste and one container for mixed paper that are easily accessible and near one another. Faculty rooms should have containers available to separate all the different waste streams. Cafeteria recommendations focused on using large containers for soda bottle collection next to the general waste bins. Two different bin deployments are recommended for office space. The first option is for each station to have one container for waste and one for mixed paper, with an additional centrally located container for bottles and cans. The second option is to have one area designated for waste management where all the bins are located.

Many of these recommendations are similar to those found in the compilation of the flow charts. Perhaps most notably, these recommendations were made after it was documented that the school had not reached their waste diversion goals. As Monmouth County does not have an Administrative phase, the underperformance in this area was evident during the waste audit and was reflected in the recommendations. The custodial staff was encouraged to perform quality control in the form of reporting to the Recycling Coordinator. The recommendations take advantage of a hierarchy of management within the school. None of the recommendations are mandatory, but the waste diversion results are enforceable. This report can be used for comparison to assess the future performance of the school. As a case study, the waste audit provided a baseline to develop a waste audit and analysis methodology. The report however only detailed part of the recycling program.

---

28 Brown et al. 2007
development and had limited information on the efficacy and importance of the different recommendations. A summary of the pertinent calculation can be found in Appendix B2.

iii. Green Schools Program: Seattle, WA

[http://your.kingcounty.gov/solidwaste/greenschools/index.asp]

The King County Green Schools Program in Seattle, Washington is available to any K-12 program, public or private. There are 400 eligible schools in 11 school districts that can participate in this program. These schools receive technical assistance and limited funding to improve the environmental impact of their operations. Green Schools seeks to encourage schools and districts within King County to use resources responsibly and become engaged in environmental issues through a voluntary program. As part of this broad vision, the schools are empowered to implement and expand solid waste management programs that reduce waste and increase recycling diversion.

The program has three levels of implementation. The school must meet the criteria of each level to successively build the program. After a level has been achieved, the school and district receive recognition for their involvement. To participate in the program, a responsible party fills out an application detailing the improvement to be made in the waste management program with the potential barriers to implementation. A program representative helps to set up the new program with specific advice on implementing and maintaining a waste management program. Completing a program level involves fulfilling a checklist with prescribed components.

Level One establishes the base of the Green School Program. As part of a base for responsible facilities management, Level One focuses on waste reduction, recycling, and hazardous waste management, where appropriate. Reuse and recycling was chosen as a central component as a means of addressing natural resource depletion, pollution, landfill gas emissions, and garbage disposal costs. The first step of the program involves building a green team from either within the school or the school district to meet on a monthly basis. A school-based team should involve at least two staff members from any part of school operations, interested students, as well as possible parental involvement. A district-based team should include someone familiar with facilities operations, an individual with management experience, and any other affected parties. Level One sets the foundation for the environmental program and enlists students to lead the efforts. Hazardous waste management is considered a standard part of Level One implementation. After a program has achieved Level One, a summary of the school’s environmental program is posted on the King County Green Schools Program website. This phase is intended to reduce waste through the diversion of recyclables and a reduction in resources consumed. Typically, schools complete Level One in one year.

29 King County 2011, “Green Schools Program”
30 Ibid 2010, “Program benefits and assistance”
31 Ibid, “Getting Started”
32 Ibid 2011, “How it Works”
34 Ibid 2010, “Frequently Asked Questions”
36 Pfarr 2010
Level Two focuses on energy conservation, while maintaining the programs established during Level One. In addition, at least one solid waste management practice must be added to reach Level Two. To reach Level Three, water conservation must be addressed and another solid waste management practice must be integrated into the management plan. Other categories that address education, responsible purchasing, transportation, and other aspects regarding environmentally responsible management have been developed and can be added to a school's portfolio of projects, but will not increase the achievement level of the school. These programs allow the Green Team to further expand their influence and scope of their mandate and help to change the culture within a school. A number of schools have participated in previous years, but no longer maintain the level of the program previously achieved. The voluntary nature of the program makes it expansive and encouraging, although it lacks universal application. The Green Schools Program was chosen as an example of a successful urban initiative that has a clear program with quantifiable data to prove success. Innovative agendas are needed to encourage people to participate in a recycling program. The Green Schools program has proven that providing the structure for organizing a group of people around an issue spurs innovation and has demonstrable results.

The culture in Seattle that has made this program successful reflects a strong commitment to sustainability, but also a different attitude towards recycling. As of 2007, Seattle was recycling 44% of its trash, compared to a national average of 30%. For a while, Seattle’s recycling rate fell due to growing apathy. The recovery of the recycling program in Seattle however makes it an appropriate example for New York City to learn from, as it has recently seen its recycling rates fall. Improved participation rates can be attributed to an increase in public interest as well as restructured incentives. Seattle increased its recycling rate by 2.7% between 2004 and 2005 through the use of fines for commercial violators and not collecting trash for residences in violation. While New York City seeks similar hikes in improvement, its ability to fine or otherwise motivate violators severely limits DSNY’s ability to facilitate participation. Seattle’s recycling program is reinforced by recycling and waste bins deployed on the street in tandem, something New York City has not done, which confuses residents and counteracts the recycling message.

A number of aspects of this program are different than New York City’s recycling program. The main difference is the program levels, which provide a path to recognition in addition to possible awards. Green Schools also mandates the formation of a green team, while New York City relies upon a single Recycling Coordinator to move a recycling project forward. Like New York City, schools are provided with recycling stickers, but Green Schools are also reimbursed up to $200 for recycling bins. The token resources available to school for bins, which are not available in New York City, help to enlist engagement in the initiative. The Green Schools program is based on utilizing recycling as part of a larger sustainable agenda that allow for recycling to be tied to educational topics. The Seattle program shows a successful organizing framework that does not

37 Pfarr 2010
38 Suttibak and Nitivattananon 2008, 55
39 Kennedy 2007
40 Ibid
42 Grzeskowiak 2007
43 Navarro 2011
unduly burden outside waste recycling personnel and allows for personal ownership. Green Schools encourage quantitative and qualitative results that allow schools to showcase their strengths and to internally structure their own resources.

iv. Case Study Scoring

The scoring system attempted to organize the many different recycling plan models into an organizational framework. It also provides a quick checklist to ascertain the extensiveness of a recycling program. The scoring system was organized into four main categories: Catalyst, Administrative, Implementation, and Results. Each of these categories is further broken into actionable initiatives, with projects and characteristics that help to ensure success. A total of 19 schools were given scorecards under this framework. Maintenance was split between the implementation section and the results. The scoring within the checklist portion adds up to 100 points. Although briefly described, many of the specific changes remain broadly defined in the rubric as their development is based on the conditions and policy within different schools. The checklist equalizes different elements and allows for multiple ways towards successful implementation. It is also biased towards the formation of a new program that needs multiple means of deployment to change habits. The total percentage trash and the total recycling rate that is diverted from general waste are added to this score to create a final score.

The Catalyst was given a value of 11 points within the scoring system. The program affiliation is identified to indicate the larger institutional support that helps shape the program. Voluntary programs were given a higher value than mandatory programs as these programs were judged to have a stronger base of existing support within the school. The impetus behind a recycling program was given more weight than the affiliation of the program. Different elements will shape the strength of the catalyst towards enlisting support. Legal, social or cultural, environmental, or financial factors all contribute to the development of a successful catalyst. The final aspect that determines the success of the catalyst was the support provided by outside sources that help to overcome initial resistance. Support can be provided through materials and supplies, technical or information based, financial, or through trained personnel.

Within the scoring framework, the Administrative phase is worth 25 points. The first step in the administrative phase is the formation of a recycling team. The Recycling Coordinator and a diverse task force form the base of a recycling team. The Coordinator is most effective when they are interested in working with all constituents as a consensus builder who purposely gets the input of those affected by their decisions. The role of the Coordinator should be in the job description as this is a position that requires time and commitment. The Coordinator should set waste management goals for the next year, which will then help to shape the development of an actual plan. An initial financial allocation at their disposal will also help in gaining support and building momentum. This person will also be responsible for financial decisions to support the recycling plan developed. The task force that will support the Recycling Coordinator and assist in development is strengthened by the diversity of the participants. The involvement of the administration, community members, custodial staff, an educator, as well as students will improve the effectiveness of the recycling team.
Planning to change the material flow is worth 16 of the 25 points available in the Administrative phase. It has been weighted to have greater importance than the recycling team during the Administrative phase, which accounts for the other 9 points. This has been done to recognize the importance of source reduction and waste documentation in a recycling program. The waste audit allows for an assessment of the existing conditions. Three different strategies have been given value in the waste audit: characterization of the waste stream, determining source points, and identifying high volume materials deserving of special attention. The largest subcategory is the ordering, which addresses source reduction, reuse, and recycling planning prior to procurement. Determining which materials to be reduced, reused, or recycled represents one step towards actually planning how these changes will happen. One strategy is to identify potential substitutions for materials. Other changes relate to transportation, cafeteria, or staff/classroom use. Another strategy is to revise the procurement procedure to change how future products are determined. This method has the benefit of implementing a long-term change that allows for revisiting material flow. The flow logistics identify changes after material has been discarded and is still within the control of the administration. Illustrating the proposed flow represents another planning tool that can be created to support planning. Changes can be made that accommodate recycling storage and a new waste pickup schedule representative of increased recycling and decreased trash for both the custodial staff and the vendor who collects the waste outside the school. End use planning may also be used for materials that can still be put to productive use through on-site reuse, off-site reuse, or donation to charity.

The majority of the scoring is given to the actual Implementation of the plan, which is worth 54 points. There are three major subcategories within the Implementation phase: education, logistics, and participation. Participation represents the largest category and is used to gain involvement and maintain enthusiasm. Education, while a part of gaining participation, has been separated into its own subcategory due to its importance. Methods of integration could be straightforward through conservation, composting, reuse, or recycling lessons. Other programs expressed the importance of the waste management program through integration into biology, geography, economy, and history lessons. The varieties of integration is school specific, but were listed separately to illustrate the variety of options which express the depth of involvement and ownership by the staff.

There are multiple means towards enlisting the involvement of those affected by the plan and this should be considered part of the implementation plan. A kick-off campaign can be used to enlist initial interest and spread awareness of the changes planned for in the Administrative phase. The kick-off campaign can include displays, the dissemination of tips or instructions, activities, or interactive events. Less specific school events can take place at different times of the year and are geared towards enlisting long-term involvement as well as addressing shorter-term needs of waste management. This can be in the form of an end of the year clean out, pledges, activities, school trips, invited speakers, games or other campaigns. An outreach or participation program can involve the community and those not directly impacted by school operations. Government and parental involvement can also be enlisted. Individual student participation may come in the form of a campaign to gain community involvement, volunteering, or enlisting the students to label bins appropriately. Students can also lead an educational campaign through classroom presentations,
flyers on bulletin boards, web presentation or other student projects that allow students to express what they have learned. Student organizations can take an active role in participating and presenting the program to other students through group presentations, monitoring, intercom announcements or the creation of promotional material. Staff participation can come through active involvement, events planning, seminars, and specific planning for staff areas. Multiple means of involvement were scored to express the multiple forms of involvement that a recycling program can take and to value the role these programs have in building a successful initiative.

Bin deployment was a central part of the logistics needed for implementation. Bins should be properly labeled, of an appropriate size and shape, and conveniently located. Bins can also be made from reused containers and preferably should convey the usage through the design. New technology allowed for an expansion of how the program was implemented and represents a form of source reduction. Monitoring the program was another means of implementing the program over a long term. Monitoring could take the form of small waste audits performed on a regular basis or a large follow-up waste audit. Maintenance is a natural step to flow from the implementation. It allows for an evaluation to examine the program including the bin deployment and flow logistics that have actually taken place. Quality control measures, adjusting personnel, and reexamining the ordering and the materials that are handled in the school are all possible maintenance measures.

The Results of the program are worth 10 points, as recycling programs take years to fully realize their potential and this scoring system is weighted towards developing a program. Waste reduction was worth the same as the public relations aspect. The garbage reduction assessment was complicated due to the difficulties in comparing different methods of quantification. As many of the reports are self-reporting, the numbers shared are public relations tools that highlight a site-specific accomplishment. The methods valued were based partially on the case studies that were used to create the scoring system. Cafeteria garbage recycling and waste reduction were heavily weighted in this system, as many schools specifically addressed food waste and source separation. The participation rate improvement was also included as a measure to gauge the success of a recycling program. Total waste averted from landfill yearly was reported in the form indicated by the school district, as it was used to calculate the value of other scores. The results of the program were used in public relations through either advertising or awards. The awards were given from both within the school or as part of a larger program. The advertising came in the form of publicizing financial savings or quantifiable results assessed during the waste audit. Announcements were made both inside and outside of the school.

Data given by different schools were used to calculate waste reduction based on different measurements, which makes comparison difficult. In some cases, the data were collected on site based on volume, while others were based on weight. When the information was available, the total recycling rate and the total garbage reduction after one year were calculated. This number was added to the score given by the checklist. This was done to augment the recycling programs scoring, as more established programs with high levels of recycling may not need as many implementation and administrative techniques. The downside of the self-reporting system is that recycling rates worth acknowledging were released as a public relations tool, and programs that
underachieve are not held accountable for the results of their program. A breakdown of the scoring system interspersed with the text can be found in Appendix B3, followed by the scorecards created through the scoring system.

C. New York City Recycling Laws

In 1987, images of a New York City garbage barge haplessly traveling up and down the East Coast looking to unload its cargo originally propelled municipalities around the country to implement recycling programs.\(^\text{44}\) That same year, New York State issued a solid waste management plan that looked to reduce waste generation and required local municipalities to institute a recycling program.\(^\text{45}\) General Municipal Law (GMU), Article 6, Section 120 AA, mandated that all municipalities within the state of New York had to adopt source separation and segregation of recyclable or reusable materials by September 1, 1992.\(^\text{46}\) The law specifically addresses material for which an economic market exists regardless of the cost of recycling. Since that time, New York City recycling laws and programs have been implemented to fulfill mandates set by New York State law.

With the passage of Local Law 19 (LL 19) in 1989, a voluntary recycling program in New York City became mandatory.\(^\text{47}\) LL 19 mandated that the City promote and support the recovery of materials for recycling for the purpose of cycling them back into the economy by residences, institutions, and businesses.\(^\text{48}\) Residential, commercial, and institutional facilities are mandated to separate certain recyclable materials from trash to prevent materials being sent to a landfill. The law also designates what materials are considered recyclable and defines the responsibilities of those involved. The Department of Sanitation of New York (DSNY) then developed the methods of implementation and enforcement to support these mandates.\(^\text{49}\)

Curbside collection was slowly phased in through Local Law 59, for the collection of paper, cardboard, metal, glass, and plastic by April 15, 2000.\(^\text{50}\) Residents, city agencies, and non-profit institutions place materials for recycling in clear bags along the curb at prescribed DSNY pickup times. These materials are then brought on trucks partitioned to keep material separate, to the appropriate processing facility. Paper and cardboard are grouped, as are metal, glass, and plastic (MGP). Between July 2002 and April 2004, collection of glass and plastic was suspended and collection was reduced from weekly to every other week due to 9/11 related budget cutbacks.\(^\text{51}\) As the market for these recyclables still existed, this move was not permissible within New York State recycling mandates and recycling programs were eventually restored. Although changes in collection procedure created confusion, by 2005 recycling rates were back to previous levels.\(^\text{52}\)

\(^{44}\) Kennedy 2007  
\(^{45}\) Waste Management World 2010  
\(^{46}\) NYS Department of Environmental Protection 2011, “Recycling and Composting”  
\(^{47}\) NYC WasteLess 2011, “History of NYC Recycling”  
\(^{48}\) Ibid, “NYC Recycling Law”  
\(^{49}\) NYC WasteLess 2011, “NYC Recycling Law”  
\(^{50}\) Ibid  
\(^{51}\) Hall 2004  
\(^{52}\) NYC WasteLess 2011, “History of NYC Recycling”
Diversion rates were still below mandates in 2006 when the Comprehensive Solid Waste Management Plan (SWMP) created a more equitable waste disposal system, which minimized some of the negative environmental impacts associated with waste disposal within New York City. The Office of Recycling Outreach and Education (OROE), which operates out of GrowNYC, was created as part of the SWMP. The OROE was set-up to address accusations that the city had not achieved high enough diversion rates and had therefore not achieved satisfactory results and must redeploy its education efforts. Of specific note, the education office works with recycling coordinators to develop plans that are community specific. With the OROE in place, DSNY has set a non-binding 25% curbside diversion rate goal by 2007 and 70% for combined municipal and commercial waste by the year 2015. The high diversion rate goal is potentially feasible due to the high amounts of excavation fill and construction debris that is already reused.

In recent years, the city has moved backwards away from meeting its recycling quotas. In 2001, DSNY was recycling 23% of the materials collected, yet by 2011 that figure has dropped to 15%. The government has however been working towards increasing recycling rates and expanding participation. In 2010, an updated plan with ambitious mandates titled “Beyond Waste: A Sustainable Material Management Strategy” was approved. It requires that the average amount of waste disposed by New Yorkers decrease from 4.1 to 0.6 lbs. per day. PlaNYC, which serves both state mandates and local policy ambitions, has set an ambitious diversion rate goal of 75% for all waste produced in the city by 2030, to decrease the environmental, social, and financial burden currently placed by waste disposal. PlaNYC specifically sets four solid waste agendas that will help meet the diversion goal and provides 13 initiatives to support these agendas. None of the agendas, initiatives, or steps outlined is tied to benchmarks or indicators to evaluate performance or development at a more refined level. Therefore, each initiative is reliant on programs that define their own metrics for performance.

To support the ambitious agendas laid out in PlaNYC and New York State law, a bill was passed in 2010 by the New York City Council, which significantly expanded residential recycling for the first time in 20 years. The legislation calls for schools and other city agencies to improve recycling rates and fund recycling studies. Local Law 41 of 2010 requires the Department of Education to designate a Sustainability Coordinator to define and implement a recycling plan in all school programs that are serviced by DSNY. This individual must be responsible for labeling bins and submitting waste reduction, reuse, and recycling plans with an annual implementation plan to DSNY. Local Law 36 mandates the same policies for other City Agencies. PlaNYC sees government

---

54 Grzeskowiak 2007
55 Grzeskowiak 2007
56 Carlson 2007
57 Navarro 2011
58 NYS Department of Environmental Conservation 2011
59 PlaNYC 2011, 138
60 Ursery 2010
61 Ibid
62 NYCWasteless 2011, “NYC Agency and Institution Recycling Law (Including Non-profits and Schools)”
63 Ibid, “NYC Recycling Law”
agencies as leading waste reduction efforts by setting an example for both organization and individuals. To support this goal, Initiative 13 of PlaNYC calls for the improvement of government institution diversion rates to reduce the solid waste footprint of city operations. The city has plans to institute internal goals and has laid plans to recognize exceptional participation and to compile best practices to present methods and tools that will enable compliance. There are no calls to monitor the results of school recycling programs or to develop metrics to quantify participation.

D. New York City Recycling Data

New York City produces upwards of 14 million tons of waste per year; while half of this is recycled, most of the material is dirt produced from the construction industry. To export the 3.3 million tons of waste collected by DSNY, the city spends $300 million dollars each year. Recycling diversion rates in the City are not separated by sector. Instead, an aggregate goal diversion rate for all waste collection by DSNY is set. The City lacks data about the generation of commercial waste that is handled by private contractors, which are outside of the public sector data collection.

New York City residents and institutions have been unable to meet recycling mandates in the past. Officials report that less than half of the materials that could be recycled are properly source-separated by residents. Large multifamily buildings and confusion about recycling laws are partially to blame. Residents often struggle to recycle due to lack of storage or sorting space, a problem that is being addressed by proposals to require space for bin storage in new residential construction. The designation of space is necessary to keep recyclables separate from general waste. Inconsistent messages about recycling collection with a lack of recycling containers on the street and inadequate support from city agencies have reinforced this poor performance. With proper separation, one-third of the residential waste stream could be diverted with current collection standards.

While the updated recycling laws ask for an implementation plan and provide agencies with a number of features to install a recycling plan, they do not actually document the efficacy of these recycling programs. In PlaNYC, the city clearly acknowledges that lack of information is impeding the development of policy. Initiative 10 of the PlaNYC Solid Waste plan seeks to improve efficiency by improving solid waste management data for commercial waste. The increased information will be used to create recommendations to improve diversion rates and decrease negative impacts. Information on commercial waste is currently anecdotally related to the city and hard data is not

64 PlaNYC 2011, 138
65 Ibid, 137
66 PlaNYC 2011, 139
67 Navarro 2011
68 PlaNYC 2011, 137
69 Navarro 2011
70 Ibid
71 PlaNYC 2011, 140
72 Ibid, 139
73 Ibid, 137
74 Ibid, 144
publically available. Initiative 13 addresses governmental agency diversion rates. Individual buildings and agencies do not track the waste generated and the city is therefore unable to measure, monitor, or otherwise quantify the solid waste footprint. To address this, a pilot program that measures solid waste generation will develop baseline information creating a benchmark and opportunities for improvement.

At the municipal level, the decision to recycle and what method to use is driven by legal mandates, financial costs, as well as social pressure to offer government services. The city has previously funded studies to improve the performance of recyclable diversion in the city. A waste audit was conducted to determine actual waste composition and the potential to recover recyclables from a mixed-waste collection system. The pilot study indicated that mixed waste processing is not economically feasible given the significant cost of processing and the negligible savings associated with the additional recovered recyclable material. This study confirmed that source separated recyclables are the only economically viable option in New York City. Increasing the capture rate could only be accomplished through higher levels of participation or increasing the percentage of materials that can be diverted.

Lack of incentive to support a recycling program may limit institutional desire and mandates to enforce participation. While recycling is commonly thought to save money, the logistics of recyclable collection do not necessarily make this the case. The low volume of recyclables to solid waste leads to a curbside system whose high cost makes it ineffective. A higher diversion rate would lower the cost of recycling per ton. It is clear that higher recycling rates are needed to yield a direct financial benefit to waste management operators. Currently, the cost per ton of diversion is more expensive than the cost per ton of landfilling. This is due to the cost of additional separation and processing. Increasing consolidation in the waste collection industry has previously resulted in fewer recyclable haulers, which limited competitive pricing, increasing the cost to divert recyclables. While legal mandates require a municipal recycling system, high costs limit the motivation to support expansion, which would reduce the cost per ton and improve the competitiveness of existing collection.

E. Past Recycling Efforts in New York City Schools

Since 1992, when New York City became legally mandated to support recycling, the Department of Sanitation Bureau of Waste Prevention, Reuse and Recycling (BWPRR) has been responsible for planning, implementing, and evaluating DSNY’s recycling and waste management programs. To this end, the BWPRR distributes promotional literature and engages schools and city agencies to

---

75 Ibid
76 PlaNYC 2011, 145
77 Ibid
78 Navarro 2011
80 Carlson 2007
81 Bohm et al. 2010, 870
82 Johnson 2000,
improve their recycling performance.\textsuperscript{83} The BWPRR works in conjunction with other city agencies to increase the participation rates through greater awareness and integration into other programs.

The push to integrate recycling into the New York City educational curriculum is a 21\textsuperscript{st} century development. The creation of the recycling curriculum began with a citywide Science Coordinators Conference held jointly with the Board of Education’s Office of Instructional Publications and the BWPRR in April 1998.\textsuperscript{84} Suggestions and feedback on how to shape the recycling curriculum were gathered. In January 2000, the BWPRR began creating an educational manual to allow educators to integrate recycling into existing lesson plans.\textsuperscript{85} This material became the \textit{RRR (Reduce, Reuse, Recycle) You Ready?} and \textit{The NYC Teachers’ RRRResource Kit}. These include recycling information and promotional material in addition to material for lesson plans that encourage active student participation.\textsuperscript{86} Any school can order this material free of charge. Prior to creating this material, the BWPRR targeted only school administrators and custodians.\textsuperscript{87} Integrating recycling into the curriculum and enlisting teacher involvement was done after the poor participation of previous efforts was acknowledged and the need for a resulting change in strategy was identified.

By 2001, the educational materials developed by BWPRR were available to educators. In 2002, the Golden Apple Awards were instituted to enlist school involvement at all grade levels K-12 and promote waste reuse, recycling, and reduction.\textsuperscript{88} These awards are given to waste management programs that integrate recycling into the curriculum and utilize applied learning.\textsuperscript{89} Resulting entries into the competition are presented in a narrative format that expresses the qualitative performance of a recycling program. That same year, the mayoral Department of Education (DOE) replaced the Board of Education (BOE).\textsuperscript{90} The initiatives begun under BOE shifted to the DOE. To support recycling efforts through the dissemination of information and access to resources, the New York City WasteLess website was launched in 2004.\textsuperscript{91}

Education on recycling is central to improving diversion rates.\textsuperscript{92} As public schools directly interface with 1.1 million children, they represent a direct avenue towards improving the solid waste footprint of a large waste stream and residential recycling.\textsuperscript{93} The lackluster participation of schools has been a focus of both city council discussion and more recently initiatives to address the problem. John Shea, the chief executive officer of the Division of School Facilities (DSF) for the New York City DOE stated in 2010, “Schools had a reputation for not following Local Law 19.”\textsuperscript{94} To address this endemic problem, a recycling committee was formed. After examining the problem,
this unit was restructured to address sustainability with recycling as a part.\textsuperscript{95} Recent updates to LL 19 now require every classroom to include a recycling receptacle.\textsuperscript{96}

In 2011, the Department of Education in conjunction with the United Federation of Teachers launched a Sustainability Coordinator training session to educate administrators about management of school recycling programs. This initiative fulfills newly set obligations by New York City to increase citywide recycling rates and school participation. DSF has set an ambitious goal of 1:1 garbage to recycling ratio based on bag count.\textsuperscript{97} To achieve this, clear bags have been mandated and Sustainability Coordinators have been charged with the ambiguous task of looking for items to be recycled.\textsuperscript{98} By 2013, all public schools must have a Sustainability Coordinator, who will develop and implement a recycling program.\textsuperscript{99} While New York City schools are legally mandated to recycle, actual documentation of participation rates are not conducted, nor planned.

The results of the sustainability program have shown success when applied to areas that have clear incentives and benchmarks to indicate progress. To directly apply changes in usage, the Department of Citywide Administrative Services (DCAS) is funding the custodial staff to receive sustainability training. Each borough will have a Deputy Director of Optimization who will work with each school’s sustainability coordinator, principal, custodial, and maintenance staff to apply these changes.\textsuperscript{100} Energy savings programs have already shown great success, although the divide in who pays for energy and who is responsible for utilizing it initially complicated implementation. Resolving this problem required interdepartmental collaboration.\textsuperscript{101} The concerted effort to lower energy in schools has been shown to be successful through documented energy reduction, providing a clear indicator of progress. This program could be used to guide the development of a recycling program with quantifiable results.

F. The Golden Apple Awards

In New York City, schools that are successful in initiating programs to raise awareness about environmental issues can apply for the Golden Apple Awards.\textsuperscript{102} There are three contests that can be entered: Trash Masters! Super Recyclers, Trash Masters! Reduce & Reuse Challenge, and Trash Masters! Team Up to Clean Up. Each award is divided into categories by school type: Elementary, Intermediate, and High School. Submissions are accepted for any or all three contests. A panel of judges, comprised of environmental educators and government officials, selects winners for each award from each of the five boroughs in each school type for a total of 45 possible winners per year. Additional commendations include the NYC Compost Project Golden Shovel and the New York Restoration Project Rose Award. These are selected from the Golden Apple Award submissions. Winning schools receive certificates and other gifts for students and staff. In 2011, due to a lack of

\begin{flushleft}
\textsuperscript{95} Ibid
\textsuperscript{96} Ibid
\textsuperscript{97} Zimmerman 2010, “Sustainability”
\textsuperscript{98} Ibid
\textsuperscript{99} PlaNYC 2011, 415
\textsuperscript{100} Zimmerman 2010, “Finding”
\textsuperscript{101} Ibid, “Coordination”
\textsuperscript{102} NYCWasteless 2011, “Golden Apple Awards”
\end{flushleft}
submissions that meet minimum score requirements, only nine schools received a Golden Apple Award. Brooklyn took home the most with three awards. There were no High Schools awarded and schools in the Bronx were similarly absent.

The Super Recyclers award focuses on successful school recycling programs. Winning schools have gone above and beyond simply complying with New York City recycling regulations by involving the entire school in recycling education and participation. Submissions require documentation of full program implementation, from planning to results. Success stories along with failures should be included so that others may learn from various methodologies. Submissions from past winners often highlight success through pictures rather than data. Judging a winner typically gets reduced to viewing a photo album with captions. Of the winning submissions posted on the New York City WasteLess website, none included a successful waste audit or had data on past or current recycling rates.

The Reduce & Reuse Challenge is focused on limiting the amount of waste generated in schools. Submissions must include methods for implementation such as targeted waste stream, reduction techniques, student involvement, program promotion, collaboration, and educational components. Successes and failures should also be noted, as well as how applicable the approach might be at other schools. A unique component to this award’s rubric is the measurement of success. Submissions must describe how the improvement was measured and what impact was had on the community. The best use of data is P.S. 89’s 2011 submission, which includes a reduction from 8-12 bags of garbage to 2-4 bags of garbage per day once they switched from Styrofoam trays to compostable sugarcane trays for lunch. The new trays were stacked and composted by a local farm. Other submissions were comprised of photo collages without a standard by which to judge improvement.

The Team Up to Clean Up award is given to schools that have shown a commitment to caring for their community and raising awareness of their environmental impact. Past winners have completed cleanup, beautification, or reclamation projects that improve the community. Exemplary projects may receive the Rose Award from Bette Midler’s New York Restoration Project, which has promoted community involvement for 20 years prior to being incorporated into this initiative. Winners of this honor receive a consultation and supplies to help put a restoration plan into action. Submissions require the same basic information as other award categories along with pictures of the site before and after the restoration project. Most applications for this award are made in addition to efforts for the previous award categories.

The New York City Golden Apple Awards recognize schools that are making an effort to increase environmental awareness. The small number of awards given each year is evidence of a miscommunication between New York City WasteLess and eligible schools or lack of incentives to participate. Awards for success are limited, aside from a certification of recognition, which has not effective motivation. The winning entries are often vague and consist of scanned student work or photo albums of staged scenarios of students recycling milk cartons. Some are littered with typos

104 Badaracco Padgett 2002
while others are simply handwritten. Although intentions are well, this awards program has not created the desired amount of interest in implementing or documenting a recycling program.

Award programs have however been successfully used in other school districts to increase environmental awareness through multi-disciplinary activities. Unfortunately, awards do not reflect the actual physical impact of behavior changes. Without quantification, an unsuccessful recycling program could be awarded when the environmental impact is negligible. These types of programs promote hands-on participation, which increases the likelihood that the message is taken home and influences a wider sphere of behaviors. Awards provide a venue for high achieving schools to raise money and gain publicity, but allow for a limited number of schools to be acknowledged for their efforts. As such, it does not provide milestones for achievement nor does it present a formula with realistic expectations. It is commendable to distribute these honors to schools that are making a difference, but it is clear that New York City is well behind other parts of the nation where Golden Apple Award winners would be considered the standard in schools.

G. Lessons Learned

i. Catalyst

One of the themes of successful recycling programs comes through the motivation, or the Catalyst, which has a direct bearing on the ambition and the results. In Lee County, FL, a recycling program that shifted the financial benefits of recycling from the school district to the schools experienced success through the higher motivation and participation of the faculty. This program resulted in numerous successes and advertised results in the form of money saved and reinvested in the school. A powerful financial incentive provided the catalyst to begin and maintain a recycling program. The quantifiable results are a testament to the strength of finances to motivate behavior. For schools or districts that are responsible for the cost of waste management, the money saved from recycling becomes representative of success. As the disposal of waste is quantitatively assessed in the disposal process, areas of the country that have experienced financial benefits due to recycling also report on the waste tonnage.

Environmentally sensitive areas of the country also were found to have more ambitious recycling agendas as part of a sustainable vision. One example, The San Diego Jewish Academy (SDJA), pursued an ambitious zero-waste agenda. Motivated by its location in an environmentally sensitive wetland, the administration wanted to responsibly manage materials reuse and compost in addition to recycling. The 85% reduction in solid waste produced is related to the broad vision of the program, which addresses the many different solid waste flows and integrates into lesson planning. While the location of the school and the ambitious goals of the administrative staff go beyond what could be expected in New York City schools, lessons for planning in New York City can still be culled. The Director of Operations of SDJA states that such ambitious plans take a number of

105 Evans 2000
106 Evans 2000
107 Caylor 1998
108 Badaracco and Weitzel 2002
109 Ibid
years to implement as an educational process.\textsuperscript{110} This educational process is not just for the students, but also the faculty and staff.

Higher participation rates are found in schools that integrate recycling into a sustainable education agenda to which recycling becomes a tool to apply the belief system that has been cultivated. Areas of the country known for more progressive environmental agendas as in King County, WA were found to have better recycling statistics that integrate accountability with action. More impressive recycling efforts were found in schools that incorporated recycling as part of a comprehensive sustainable vision. If educators believe recycling programs to be superfluous, they will discard these lessons in favor of preparing their students to perform well on standardized tests.\textsuperscript{111} To remedy this, lessons on recycling should recognize the motivation of educators and must integrate performance-testing standards into recycling lessons.\textsuperscript{112} The numerous examples of lesson types for recycling integration address the time constraints of educators while tying larger ideas to daily behavior. Lesson integration supports the larger impact a school recycling program can have to improve waste management in the larger community and in the future.

\textbf{ii. Administrative}

Administrative components must also be in place for a recycling program to succeed. Strong leadership, administrative support, and clear policy must be in place to support it.\textsuperscript{113} Poor internal communications and the misallocation of bins to places that were not visible or easily used resulted in low participation and low awareness of the recycling program.\textsuperscript{114} The logistics portion was not necessary in all of the recycling programs, as many of the programs were revamps of existing programs that underperformed for other reasons. Barriers to invest in sustainable projects include lack of money, time, and commitment.\textsuperscript{115} For the administrative phase to be successful, the commitment of the administrative staff must already be in place.

Source reduction should play a part in the planning of a recycling program as consumption factors also affect the waste stream. Consumption varies based on convenience, the attitude of the user, perceptions of more pressing issues, concern for the environment, as well as operational challenges that limit implementation.\textsuperscript{116} Planning for behavior changes must also consider the consumption factors that drive waste disposal. Waste reduction should be addressed as part of the larger vision for sustainable management, of which recycling is a part.

Creating multiple opportunities for participation and different levels of involvement helps to ensure the continuity of a sustainable initiative.\textsuperscript{117} Implementing a recycling program may require multiple participants based on the multiple roles that are required to successfully develop a recycling program. The first role requires researching material impacts and making decisions

\textsuperscript{110} Badaracco and Weitzel 2002
\textsuperscript{111} Smith et al. 1997, 3
\textsuperscript{112} Ibid
\textsuperscript{113} Zhang et al. 2011, 1608
\textsuperscript{114} Ibid, 1612
\textsuperscript{115} Ibid, 1607
\textsuperscript{116} Gunton and Williams 2007, 314
\textsuperscript{117} Thompson and Green 2005, 13
considering environmental impact. This individual should be able to either supervise or perform implementation. Finally, a coordinator must monitor implementation and make changes as required. This individual need not be culled from a specific existing position within a school but should be involved with daily operations. The weakness of the Monmouth County program as implemented was the lack of engagement with the staff and students in determining how the program took shape. At Black Mountain Elementary School, the lack of administrative support undermined efficacy. One method of building engagement with the students as well as the faculty was particularly successful. The creation of a recycling team, also known as a ‘Green Team’ is one of the most important determinants of success and longevity of a recycling program. Although important, the designation of a Recycling Coordinator is not enough to build a successful recycling program.

Waste audits were rarely conducted when not recommended by the institution guiding the development of a recycling program. Lack of characterization of waste suggests the need to document waste composition to generate the necessary data to formulate better management strategies. The waste management literature consistently reinforced the importance of waste audits in the development of a new program.

iii. Implementation

Changing attitudes and behavior is fundamental to implementing a recycling plan. Recycling plans not only change attitudes so individuals are open to breaking habits, they also smooth and facilitate this transition. The most successful plans remove situational barriers, provide information on how to properly recycle, and set goals that increase awareness and motivate participants. Other factors also influence whether students choose to participate in a recycling program. Level of awareness, parental behaviors and influence, community interconnectivity, concern for the environment, perception of ability to make a difference, effort required, and perceived effort on the part of the other affected parties all contribute to participation rates. A recycling program must be deployed to change attitudes first and behavior second with an awareness of the impediments to implementation.

The success of a recycling program depends not only on the participation and diversion rate, but also on the efficiency of a program, which will be shaped by the time commitment of those involved. This can be expressed as the benefit to cost ratio, which in this case is the cost of processing per ton. The cost of implementing a plan, when the school does not financially benefit is primarily one of time. Effectiveness will be based on the time it takes to break habits and establish new routines as well as time to coordinate new logistics. For a recycling plan to be successfully implemented it must be time efficient for those involved especially the custodial staff. Material

118 Verbanas 1997
119 Ibid
120 Armijo de Vega et al. 2008, S22
121 Gunton and Williams 2007, 312
122 Ibid
123 Ibid, 313
124 Suttibak and Nitivattananon 2008, 46
costs therefore are a subset that improve effectiveness and reduce the time required for implementation.

iv. Maintenance

The maintenance of a recycling program is vital to its long-term success. Advertising helps to ensure the long-term interest and commitment of those involved. In programs that have been successfully implemented, it is often expressed through statistics representative of staff experience with minimal published introspection or quantitative analysis. Visible results, which offer public relation benefits, are often touted as well. Schools may be hesitant to advertise recycling rates when diversion rates are dismally low. Except in cases where a recycling or ‘green team’ of interested students was formed and monitored recycling, a legal impetus was required to document progress in the form of a waste audit. No case of a waste audit undertaken internally through the school without student involvement or mandates from an organizing body was identified. The underperformance of previous awards winners highlights the need to collect data on performance to hold schools to a higher standard and to properly incentivize involvement.

v. Application

Some of the fundamental aspects identified in the literature review are not considered standard to New York City recycling programs. The use of recycling teams, which establish a coalition of people to draw on collective strengths, is not mandatory in New York City. Instead, a lone Sustainability Coordinator has been created. The use of a working group has not been cultivated. Seattle has had success with fines for non-compliance, a strategy that is not used in New York City. In addition, while new construction in New York City is required to mandate storage space for recyclables, the same is not true for school construction. While the literature suggests that internal momentum must be cultivated in a school to enlist involvement, the strategy is only partially being deployed in New York City. Administrative involvement is not being cultivated, nor has a catalyst to cultivate interest and involvement been identified.

H. Scope of Research

The scope of research changed over the course of the project as needed to inform the development and implementation of a proposal. The initial research focused on developing a framework to structure a recycling plan. [Appendix A] Next, a series of case studies focused on the analysis of schools that collected quantifiable data on the results of a recycling program. [Appendix B] The final set correlated a program with demonstrable results with the various aspects of a recycling program that had been identified over the course of the review. [Appendix B2] Over the course of research, 21 schools were reviewed as well as three institutional recommendations. The scale of the literature review was due to the paucity of programs with published scientific data collection and the lack of rigor in the presentation and collection of much of the work. The outstanding exception to this was the King County Green School program, whose ambitious program and documentation provided a wealth of information as programs were correlated with data. Research into existing programs within New York City was limited by demands for quantitative data. While not the focus of the research, factors that shape successful recycling program incentives, such as the
financial implications of recycling in New York City, were briefly researched, but the depth was limited.

V. Procedure

A. Materials and Methods

After identifying an appropriate school, the team developed a program for research, development, implementation, and reevaluation that spanned a period of one year. After researching current practice and meeting with knowledgeable practitioners in the local community, a thorough examination of existing conditions was conducted. A waste audit was necessary to benchmark the type and volume of existing waste streams as well as current recycling procedures. The team worked with the Director of School Operations (Kit Brauer) and the Student Services Manager (Colleen Place) to find the most agreeable methods to implement a successful recycling program.

The required materials for a recycling program included some elements already in place, as well as others that were absent. A waste bin and a recycle bin with labels in each classroom represent existing material that was available but improperly deployed. The waste within the bins of Achievement First classrooms and the waste disposed of on the curb of P.S. 296 for local refuse collection became the basis of data collection. To augment the visual inspection of bags, a Metro 46504704 Analog Bath Scale was used to measure the weight. Latex gloves were used to handle the sealed plastic bags on the street. The conditions of the school were documented with photography as well as architectural drawings that place oversized symbols of the bin deployment on a floor plan of the school layout. The floor plan was developed from existing diagrams, general classroom measurements taken with a measuring tape, and physical observations.

B. Meetings with Recycling Professionals

i. Outreach Specialist for New York City Department of Sanitation

The Department of Sanitation of New York (DSNY) has for years been responsible for the New York City schools recycling program. In recent years the DSNY has used a website to distribute copious amounts of material intended to help schools recycle. In spite of this and other efforts, recycling in New York City schools has underperformed when compared to other communities and organizations. Many factors, such as inadequate knowledge, poor communication, larger policy blunders, and bureaucratic malaise, have contributed to an inability to change behaviors that interfere with the achievement of recycling goals.

On April 15, 2011 the team met with Mr. Glen Nison, the Outreach Specialist at DSNY, to gain his perspective on the role DSNY plays in helping schools to recycle. Mr. Nison prepared a detailed presentation on the current policy for recycling in New York City and in schools specifically. He provided the standard recycling and waste pickup schedule for New York City schools. Trash is collected at the end of every school day. On Monday, Wednesday, and Thursday mixed paper and cardboard are collected. On Tuesday and Friday plastic and metal recyclables are collected. On Wednesday morning, plastic and metal recyclables are collected as part of the weekly neighborhood
pickup, as well. Given this information, storage should not be an issue and can usually be found within the school. Recycling collection within the school may need to be aligned with the DSNY collection schedule, if storage is an issue. Recycling left out on the wrong day may be picked up erroneously and discarded as waste. Leaving recyclables on the curb until their proper pickup day could be considered as a disposal option since DSNY is reluctant to leverage fines against schools for mismanagement of waste, but recyclables must remain in a pile separate from the general waste. However, inclement weather could compromise the recyclability of paper. When recyclables become properly disposed of, the recycling truck may not stop for collection out of habit. If this does not happen, the school can call 311 to report a missed pick up, which will alert DSNY to a change in disposal habits.

In New York City, any material that contains more than 50% metal can be recycled. Plastic containers or jugs should be recycled regardless of the number on the bottom, although numbers 1 and 2 are most commonly recycled. Up to 10% contamination of the recyclables is acceptable in disposal. In the cafeteria, a beverage slop bucket with a strainer to catch straws is necessary for milk carton recycling. New York City does not mandate the type of containers used to collect recyclables, nor does it provide funding for containers. A bag is not required in individual recycling containers. The school can use labels provided by DSNY, utilize another source, or have students create their own as part of an art contest. The custodial staff should also be made aware that hazardous material pickup can be arranged through 311 or an appointment can be scheduled online.

One successful technique for increasing source separation came through a Bloomberg administration policy; remove garbage cans from individual desks and only have recycle bins within arm’s length. Central garbage stations replace the smaller ones, aiding in waste collection and requiring more thought when waste is generated. The recycling stream in offices becomes more pure when it is not treated as waste collected nightly. Recycling collection can be decreased to the necessary amount, encouraging waste to be disposed of properly to avoid odorous consequences.

**ii. Monmouth County Assistant District Recycling Coordinator**

On March 18, 2011, the team met with James Brown, the Assistant District Recycling Coordinator for Monmouth County. The interview was scheduled to gain insight into a functional recycling program within the Northeast region. Mr. Brown provided a number of tools to set-up a waste audit. In addition to providing a report on a program that he audited and set-up, he gave many useful suggestions. When doing a school audit, he dedicates a week to performing inspections. He performs a visual inspection of all the containers used as part of the schools’ solid waste management program. He notes the type of container and the size in different locations to assess capacity. The pickup schedule is also recorded. A walk-through inspection is performed at the end of the day for one week. During this time, the volume of the containers is recorded. For elementary school programs, he suggested including a 4th grade class in the audit as part of a lesson and allow them to record information, encouraging interest in waste management. The students can then continue recycling efforts by conducting their own waste audit once a month as a fun exercise to make sure teachers and students are participating in source separation.
Although some facilities house multiple schools, Mr. Brown stated that the waste audit should document the waste stream for the entire building, even when creating a plan for an individual school. He thought it is vital to know the total waste being generated in the building as a baseline, even if the other waste streams in the building will not be affected. To document cafeteria waste and waste generated at the other school, he suggested asking the custodians to count how many bags of trash they dispose of in a week. Preferably, the origin of each bag (classroom, administrative, or cafeteria) will be noted. In addition to counting the bags, he proposed weighing a bag as a sample, but did not think this was necessary. He stated that on average the garbage would weigh 155-lbs/cubic yard. In his experience, garbage is typically comprised of 30% recyclables, with paper comprising the largest recyclable waste stream. He suggested opening a couple of the bags to do a sampling of composition and estimate percentages.

When setting up a program, convenience is the most important aspect because simplified logistics increase effectiveness. In his opinion, typical practice is “when in doubt, throw it out.” Garbage and recycling containers must be placed next to each other because no extra effort will be made to recycle. At least two containers are needed in every classroom – mixed garbage and paper. Their location should be equally convenient for students and the teacher. A third bin should be located for comingled recyclables (bottles/cans) in common areas and faculty workspaces, since students are typically not permitted to have drinks in the classroom.

Regarding the participation of custodians, he noted that it would take a bit of effort to get them onboard. With programs that need to be refreshed, teachers tend to blame the custodians for dumping all waste together and custodians tend to blame the teachers for not source separating waste to begin with. To overcome this problem, both parties must agree to cooperate, therefore no one will be blamed. He stated that state law supersedes any issues regarding custodial contracts and that knowing the law in New York State will be essential to convincing the custodians to change habits.

In New Jersey, recycling laws mandate participation. Mr. Brown is able to levy a fine up to $5,000 per violation when a school does not comply. Some schools can in fact increase revenues by selling recycled materials. He stated that paper is currently bought for $45/ton. Even if the school does not pay for waste collection, someone will benefit from recycling. Other cost savings can be realized by reducing the number of collection days or amount of waste generated.

iii. New York City Sustainability Coordinator Training

At the end of the 2010-2011 school year, the Department of Education (DOE) along with the United Federation of Teachers (UFT) held the 1st annual Sustainability Coordinator Training. Three sessions were offered and assigned according to school district. One team member attended the first session on May 20, 2011. The workshop was designed to give teachers and school administrators an opportunity to learn about energy saving tips, waste management strategies, and organizations available to help become a more sustainable school. Sessions were organized into topics on Energy, Recycling, Curriculum, and Ecology.
The New York City DOE website describes Sustainability Coordinators as those appointed by the principal to be responsible for sustainability activities at school. Duties require the ability to “consult with representatives within the school, including principal, food services and custodial staff, and wherever possible, parents and students, in developing and implementing all of the sustainability initiatives in the school.” Ongoing responsibilities include the development and implementation of a Sustainability Plan, ensuring that students are cooperating with recycling rules, initiate sustainable curriculum developments, and to utilize the Energy Star Portfolio Manager to help with energy conservation. The Sustainability Plan shall include, at a minimum, a School Recycling and Waste Reduction Plan within the DSNY recycling rules.

The first session highlighted ways for schools to save energy. Lily Shames, Director of Green Building Projects for Association for Energy Affordability’s Green New Construction Group, advised against blocking air vents, to utilize day lighting, and to unplug electrical equipment when not in use overnight and on weekends. She stressed involving students as energy monitors. Sustainability Coordinators were encouraged to utilize the Energy Star Portfolio Manager on the DOE website for benchmarking and tracking improvements. Ronnie Aroesty, President of Junior Energy, promoted his organization, which works to educate kids about energy efficiency and offers curriculum for teachers.

The second session focused on recycling in schools. The Outreach Specialist for DSNY, Glen Nison, presented materials from DSNY about what and how to recycle. He stressed the important fact that every school is required, by law, to recycle. All waste needs to be collected in clear bags in order for collection workers to be able to judge its content during pickup. Waxed or plastic coated paper, soft or soiled paper, and hardcover books cannot be recycled. Plastic yogurt containers, take-out trays, and plastic lids/caps cannot be recycled, but bottles, jugs, and milk cartons can be recycled. Anything that is more than 50% metal is also recyclable. Mr. Nison’s presentation ran longer than his allotted time, therefore information on how to set-up a recycling program was quickly noted. He did, however, stress the importance of involving custodians for successful recycling.

Robbie Lock spoke on behalf of GrowNYC, a non-profit organization founded in 1970, following the creation of Earth Day, to improve the quality of life in New York City through environmental programs. He reported on environmental issues affecting quality of life such as air quality, traffic, and noise. His speech centered on tips for a successful recycling program in schools. The advice included providing clearly labeled bins, talking with faculty, custodians, and students, making recycling part of everyday activities, finding ways to reduce waste, and recognizing leaders to share success. To increase the rate of success, recycling must happen at the beginning of the year. Faculty meetings need to inform teachers and custodians to make sure everyone is on the same page about source separation and collection routines. Cafeteria recycling can be made into an event that is fun for students. A consistent location for bins is vital to reinforcing habits and adults are expected to lead by example for students to follow. Successful recycling stories can be submitted for publication on the GrowNYC website.

---

125 NYC Department of Education 2011, “About the Sustainability Team”
126 GrowNYC 2011, “About GrowNYC ”
The third training session provided information on incorporating sustainability into project-based curriculum. The Green Design Lab offers help to schools that want to start a greening program. They work with 30 new schools each year providing a full-time worker one to two days per week to help with school-wide greening projects free of charge. Michael Seymour and Cristi Lagos, teachers at M.S. 88 in Park Slope, Brooklyn, spoke about a case study of sustainability curriculum at their school. Planning for the curriculum was project-based and focused on systems thinking. They used the school as a community space for social action by starting with individuals. Students conducted waste audits on plastics use within the school and on bag use in local stores. Their actions helped to educate customers about the advantages of reusable bags.

The information provided at the Sustainability Coordinator training session was comprehensive and encouraging. Many in attendance had no idea what it meant to be a Sustainability Coordinator, but left excited with opportunities and methods to get their school on the right path. The strategies and tools provided gave a base to build upon, allowing the Sustainability Coordinator to modify for individual needs. It would have helped to see more specific success stories and learn about what made them successful. While the tone was positive throughout, barriers to ideal implementation and troubleshooting options should have been addressed so that when an obstacle was met, one will be aware of methods to correctly address the issue. Holding this training session was a step in the right direction towards increasing the awareness and participation of environmentalism in New York City schools.

C. Identifying a Local School

i. Research Site

The project started with the intension of enlisting a local school within New York City that currently had no formal recycling program. Ideal size was determined to be 500 students, a size that was large enough to be a challenge, but still manageable. The team aimed for a younger demographic to more easily enlist involvement. Through a chance encounter on a train, one of the team members met Stacey Park, the Principal of Achievement First Elementary School in Bushwick, Brooklyn, NY. The school had no current plan for recycling, but was ready to start one. Alternative schools throughout the New York City area were contacted to gauge interest in participating in the study, but responses were limited. Achievement First met the standards of the team and the project progressed. Working with a charter school in a multi-school building allowed the project to address issues that are particular to New York City. The space constraints imposed by operations are representative of the difficulties faced in many urban schools.

ii. Background

Achievement First Bushwick Elementary School is a charter public school for Kindergarten through Grade 4 located in Bushwick, Brooklyn. The school opened in 2006 as part of the Achievement First Charter Management Organization (CMO) that operates 19 schools throughout New Haven, Bridgeport and Hartford, CT, as well as Brooklyn, NY.127 The stated goal of the CMO is to close the

127 Achievement First 2011, “About”
achievement gap between high-income suburban students and low-income urban students with the hope of sending more of their students on to higher education. Within Achievement First, 100% of the student body is African-American or Hispanic and 75% qualify for free or reduced lunch. This school has the largest Hispanic population within the Achievement First network. Many staff members are bilingual and all material sent home is in both Spanish and English. The school hosts a yearly potluck dinner and other enrichment activities including martial arts, drama and dance clubs, and a chorus. The school also partners with local arts organizations for activities.

During the 2010-2011 school year, there were 423 students and 45 faculty members. As a charter school, Achievement First is partially funded by the state, but must raise the rest of its operating budget from donations. Schools in the Achievement First network start with only one grade and add an additional grade each year until the school has reached its full size, allowing students who start with Achievement First in Kindergarten to stay with the new school over the course of their elementary education. During the time of expansion they require donations, but are self-sufficient once fully formed. Achievement First recently reached its full size in 2010 with the addition of the 4th grade class.

For the past four years, the school has been located on the third floor of P.S. 296. Children with special needs are integrated into all of the classrooms. Including I.S. 296, which is part of Public School District 32, 125 Covert Street houses over 1,000 students. There are two other schools within P.S. 296. The larger of the two schools is I.S. 296, which has over 500 students. Another smaller charter school with fewer than 30 students is also located within the building. The first floor of the building contains the gym, administrative offices, and the cafeteria. The schools also share a playground, basketball court, and custodial facilities.

D. Initial Visit to Achievement First

i. Existing Conditions

On February 28, 2011, the team visited Achievement First for a meeting with Kit Brauer, the Director of School Operations (DSO). He provided information on school logistics and common practices. He commented that paper was the largest waste stream and could probably be handled more responsibly. In addition to tactics already in use, such as two-sided printing and laminating printed material for long-term use, proper source separation could be improved. Mr. Brauer makes purchasing decisions through an account with Staples®. The school does not pay for waste disposal as it is the responsibility of the building, therefore direct savings could not be realized through better waste management. The floor plan for Achievement First operations with programmatic labels is available in Appendix C.

ii. Classrooms

Initial impressions revealed some of the features necessary for a recycling program. Achievement First classrooms typically had two 13-quart bins differentiated by color; black for garbage and blue for recycling. A few classrooms had larger 30-gallon bins, but the custodian has complained that

128 Ibid, "Make a Donation"
these are too heavy to collect and so prefers the smaller containers, which are under capacity. There were some 41-quart mid-sized containers in classrooms that did not have the standard 13-quart bin. A visual inspection revealed that the vast majority of recyclable materials were discarded together with garbage. This observation was reinforced by the data collected during the first waste audit. [Appendix F1]

A visual inspection revealed that the waste generated in the classrooms, as with the larger school as a whole, is overwhelmingly paper. Students receive large packets of homework every week, in addition to weekly newsletters for parents, which add to the amount of paper waste generated. Aluminum tins used for distribution of daily snacks were often stuffed into waste bins of inadequate size. Overflowing garbage containers prevented source separation and required garbage and recycling within the classrooms to be collected daily as a single stream of waste. Teachers had given up on enforcing source separation in classrooms due to observations of custodians mixing all waste during collection. The principal and staff have observed custodians dumping the recycling bins into garbage bags. This awareness has stopped all recycling efforts within the school on the part of the administration. This behavior had caused a negative feedback loop that led to all materials being disposed of as trash.

For class instruction, white boards have replaced chalkboards and some posters that were generated from cardstock. These changes were facilitated by an awareness of the waste generated, and are part of general trends in schools to improve air quality and to modernize operations. Large posters are still created on cardstock and laminated for longer term mounting within the classroom. The limited amount of organic waste that is generated in the classroom is due to restrictions on food outside of the cafeteria. The team was not given initial access to the Music room and the Art room.

iii. Staff Room

The Staff Room operates as a break room for teachers. During the initial visit, the team was able to assess and document current conditions. The room is equipped with two refrigerators, a sink, table, and chairs. There is also a microwave and coffee maker. The sink is inadequately sized and is easily clogged. The room is stocked with disposable cups, plastic-ware, and paper products for cutlery. All purchases are made from Staples® and alternative buying suggestions are more likely to be integrated if available through Staples®. A list of regular purchases was requested.

iv. Administration and Stock Room

The administrative rooms, including the principal’s office, and the stock room also have a primarily paper-based waste stream due to the constant amount of information being printed and distributed. As in the Staff Room, product choices could be more sustainable, but facilities have not been set-up to encourage such behaviors. Recycling bins are undersized and require better labeling. The Stock Room includes printers, Xerox machines, and many large spools of construction paper. On the day the team visited, it had been used to distribute a catered lunch. Students in the adjoining school are a bit older; therefore they travel between classrooms by themselves. This
room happens to be located at a necessary passing point and is thus less desirable than other rooms.

v. Cafeteria

Cafeteria policy is based on New York City guidelines, which have been mandated and are therefore outside of any individual school’s control. As required by the city, if a student enters the lunch line they must take three items: milk, fruit, and a main course. All food is served on a Styrofoam tray. Styrofoam comprises a large amount of the volume of waste and is not recyclable. The amount of organic waste is significant, as the students must take these three items if they enter the lunch line. There is no option for organic compost; therefore the food waste is disposed of at a cost to the city. Recycling bins were prominent due to their size, but their location was not stationary. Proper disposal of sorted waste was not being adhered to. There was no signage to direct or encourage students to participate in appropriate waste disposal and source separation.

vi. Custodians

As outsiders to the school system, engaging the custodians in a dialogue is complicated by their employment through a different financial institution. Building operations, not specific to Achievement First, are not under the supervision of the principal for whom this plan is developed. The custodians service the building and are therefore less interested in the differences between individual schools. They are also unionized and must follow contractual obligations as well as constraints. Storage of recyclable materials was identified as a perpetual problem. Garbage is picked-up on a daily basis, while recyclables are picked-up less often. This incentivizes the disposal of recyclables as garbage, as custodians must not block egress or otherwise create fire hazards. As soon as garbage bags are filled, they are taken outside for collection by DSNY, regardless of the pickup schedule. Cardboard boxes seemed to be the only recyclable material collected and kept separate from the rest of the waste stream, but it is unclear how consistent this effort is on the part of the custodial staff.

E. Waste Audit

i. Data Collection

Two waste audits were conducted for data collection. Waste Audit 1 occurred over five days from May 2-13, 2011. Data from Waste Audit 1 was used to formulate a custom made recycling plan for Achievement First. Waste Audit 2 occurred over five days from October 31-November 4, 2011, two and a half months into the new school year and after implementation of a recycling plan. The waste audit is intended to quantitatively document existing conditions as well as qualify the actual impacts based on results. A map of the current layout of Achievement First was created during the waste audit as well. Size and location of bins within each room was notated, along with the use for each classroom (i.e. grade level, subject). The map was augmented with a flow diagram to follow the path of waste from creation to disposal. [Appendix C]

Data was obtained through visual observations, weighing of sampled material, and discussions with custodians about the average amount of waste generated. The composition and the volume of
waste in classroom bins were monitored to accurately size bins and identify waste streams common for each grade level and faculty offices. A percentage was estimated for the content and amount of each waste stream found in classroom bins. Notating the intended use for each bin revealed whether or not classrooms were properly source separating before custodial collection. The data was classified as paper, plastic, aluminum, and general waste (other).

Bags of waste exiting the building were analyzed before pickup by the local sanitation truck. Three days of Waste Audit 1 were spent weighing and characterizing bags by the curb. Each day, six bags were classified by volume and composition for a total of 18 bags. Location was estimated by content or by information conveyed from custodians. The data was consolidated to highlight recyclables (MGP), paper, organic matter, Styrofoam, cardboard, and general waste (other).

Head custodian Matthew Naughtin estimated that 65 bags of waste were generated each day; 10 from Achievement First, 25 from the rest of the school, and 30 from the cafeteria. With this data, a baseline of the waste creation for Achievement First was interpolated. The volume, weight, composition, and contamination rates of recycling were also documented, as well as the logistics involved with waste collection and material deliveries. The team’s presence in the school over a period of days included several conversations with the staff, which was vital to preparing the school for changing behavior.

ii. Analysis

Recording the waste content in bins within each classroom proved to be the most specific way of estimating waste generation exclusively from Achievement First. Contents and volume of each bin was notated to accurately gauge the type and amount of waste being created strictly from Achievement First. A breakdown of waste streams was calculated for each grade level as well as faculty areas using Microsoft Excel. [Appendix F1] The data were analyzed to show each waste stream as a percentage of the whole to find the greatest area for improvement. Volume-to-Weight conversion factors from the US EPA\footnote{United States Environmental Protection Agency 2006} were utilized to estimate the approximate weight (lbs) of waste streams for each bin and bag inspected. Further analysis shows the content of waste disposed in either a blue or black bin to prove that waste was not being properly source separated. [Appendix F1]

Observations of bins within the classrooms provided the best image of waste generation and recycling habits. Bin content was categorized as paper, aluminum, plastic, or trash. Types of materials found in classroom waste bins included aluminum, cardboard, food, napkins, office paper, paper plates, paper towels, plastic bags, plastic bottles, other plastic containers, Styrofoam cups, and tissues. A consistent waste stream found in classrooms of all grade levels was an aluminum tray used for student’s snack time. Teachers stuffed these large trays into either bin causing waste to overflow, as they did not have an alternative disposal option. No grade level displayed proper source separation. The Music Room had 100% paper in the proper blue bin, but the other two black bins contained all paper waste as well. School averages display an almost even distribution of

\footnote{United States Environmental Protection Agency 2006}
trash and paper in the black waste bins, designated for trash only (48% trash, 46% paper). Blue recycling bins contained more paper than trash, but also served as the main disposal site for aluminum and plastic, proving the need for a third bin to house MGP waste in some areas (35% trash, 44% paper, 10% aluminum, 11% plastic).

Analyzing bags of waste placed on the curb for DSNY pickup provided a picture of how waste was handled once it left the classroom. Despite the large amount of paper generated in classrooms, none of the bags observed had an acceptable rate of contamination under 10%. All bags were mixed with other types of garbage rendering them useless for recycling purposes. Some paper waste was not properly contained in a bag and subsequently spread down the city block creating unnecessary litter. Bags from the kitchen were also found to contain entirely MGP waste, but were not distinguished from the general waste pile or placed curbside on the proper collection day. The only paper products deemed recyclables were the office paper and cardboard. The only MGP deemed recyclables were the aluminum and plastic bottles. All other waste was considered general trash.

By volume, the average waste analyzed at Achievement First on May 2, 2011 shows 39% trash, 45% paper, 9% aluminum, and 7% plastic. By weight the average waste analyzed shows 32% trash, 63% paper, 3% aluminum, and 2% plastic. [Appendix F1] By both volume and weight, the largest waste stream is paper. Very little plastic was found in classrooms, but there was some in the Faculty/Staff rooms, indicating a third bin for MGP waste could be utilized. The aluminum waste stream was representative of the trays that afternoon snacks are delivered in. Their size sometimes consumed the majority of the bin, causing other waste to overflow. Other sources of aluminum were virtually non-existent.

Based on the location of garbage bags on the curb, responsibility for separating MGP and paper recyclables was not being properly performed, nor were recyclables left out for pickup on the proper night. The only recyclable waste stream being separated was cardboard. Cardboard boxes were found broken down, tied together, and stored onsite until their correct day of disposal. Some bags containing metal, glass, and plastic recyclables from the kitchen were properly sorted, but placed on the curb each night with all other garbage. All other recyclables from the cafeteria and classrooms were comingleing with general waste to a point of unacceptable contamination by DSNY standards. [Appendix F1]

iii. Limitations

Despite the success of data collection and analysis, there were limitations to the study. As Achievement First is one school within a larger building that houses three schools, it was difficult to separate the larger waste stream in order to only analyze waste coming from the interested school. The custodians work for the building, not any particular school, and therefore treat all waste the same by throwing it to the curb each night. Initial data on weighed bags is assumed to be representative of the building as a whole and similar for all classrooms. Another limitation to the building situation is that common areas are shared, such as the cafeteria and gymnasium. The team was able to document this waste only in part, but was unable to have an effect on these larger areas, as it would have required participation from all parties, which is outside of the scope of this project.
Time was also a legitimate limitation to the study. Limited resources restricted a full-time commitment to the school and an intricate analysis of all waste streams was not attainable. The team had to work around the custodian’s schedule, which may vary from day to day. Collection sometimes occurred in the middle of the day, when needed, for classrooms generating more daily waste.

VI. Results

A. The Recycling Plan

The recycling plan was developed with the staff of Achievement First to work within the constraints and strengths of their management preferences. Reasonable staff commitments and physical requirements were developed through conversations with the administration. The schedule for implementation, which was used to stage deployment, was developed with the school administration to work within existing commitments. Flow logistics, ordering, policy, and bin location with appropriate labeling were developed and presented through maps, diagrams and a project timeline as part of a comprehensive report to guide implementation. Two months prior to scheduled implementation, the administration was provided with a detailed recycling and logistical plan for material purchasing and deployment. This included an inventory of current supplies with necessary purchases, a map with logistics, and potential storage locations. The potential logistical pitfalls were addressed as well as the practicality of all aspects of the proposal. A timeline to readdress the sustainability of his material purchases while staying within a specified budget were also provided. A meeting with the DSO took place on June 17, 2011 in which the entire recycling plan was discussed and confirmed. [Appendix E3]

The deployment plan to educate the staff and give them tools to educate their students involved ordering educational materials from BWPRR. The implementation included general recommendations on resources to support integration as well as suggestions on reasonable limitations to ensure that procedural management did not distract from the curriculum. Bin location and labeling to maximize participation were also addressed. During deployment, the team met with the staff in the beginning of the semester to explain the new procedures, labeling, and their role. A point was also made to equate specific material decisions with relatable environmental equivalences. Talking points for operational changes required of the custodial staff were also developed for the Director of School Operations. Extensive drawings, diagrams and charts were created to guide implementation.

Methods of waste reduction, such as the preferential purchase of materials with recycled content, were developed and proposed but were not implemented. Changes in material ordering represent a means to close the loop on resource consumption and disposal. The rejection of this component indicates that recycling behavior has not been successfully tied into a sustainable management framework.
i. Critical Path

In order to visualize the flow of materials through the school and assign a degree of responsibility for each phase, a critical path was developed for the Director of School Operations. [Appendix E3] This chart specifically documents the major material flows within the exclusive use of Achievement First operations. Materials enter when they are delivered from either Staples® or Red Rabbit. Staples® is responsible for the bulk of supplies and typically deliver on Tuesday, Wednesday, and Thursday, unless an immediate order is placed. Dissemination goes to the supply room, resource room, or administrative offices depending on use. Packaging must be properly disposed of and cardboard boxes must be broken down for recycling. The boxes are to be piled in the pickup area near the waste exit. Paper used in classrooms and offices is to be disposed of in the blue bins designated for paper waste. Non-recyclables and organic waste is to be disposed of in gray or black bins designated for general waste.

Red Rabbit brings the classroom snacks and delivers on Tuesday, Wednesday, and Thursday. Snacks are delivered in aluminum tins. Part of the recycling plan makes teachers responsible for taking the aluminum trays to either the Teacher Resource Room or the Staff Room. Both locations should have large bins for metal, glass, and plastic recycling. Since students are not allowed to have drinks in the classroom, it is not necessary to have MGP bins in every room, but a location to dispose of these containers is necessary.

Waste is to be collected daily with a dual-bin collection unit. The non-recyclable materials are to be placed on the curb for disposal every day, Monday-Friday. Paper recycling will be stored on site Tuesday and Friday and be set out for curbside pickup on Monday, Wednesday, and Thursday. Metal, glass, and plastic waste will be stored on site Monday, Wednesday, and Thursday and be set out for curbside pickup on Tuesday and Friday. An existing critical path of material flow was also created to describe the existing management of waste.

ii. Responsibilities

To ensure that recyclable materials are diverted as mandated by law, various checkpoints are needed for waste to be sent to the appropriate venue. Recyclables must be disposed of separate from waste that has no potential use, and must remain apart through the duration of the school’s waste handling responsibilities. Waste must not be mixed with recyclable collection to get recyclables with a low enough contamination rate. This straightforward goal is difficult to achieve due to the multiple steps of handling and the numerous opportunities for improper handling. To address this, checkpoints are needed where different individuals are assigned responsibility and can be held accountable. The chain of responsibility must also be established within the school and methods of addressing inconsistencies must be developed and applied.

Accomplishing the goals set forth in the proposed recycling plan requires multiple parties to participate and maintain active responsibilities. The CCNY team took responsibility for documenting the existing conditions, performing a waste audit to characterize the waste stream and frequent purchases, developing a plan with attainable goals, and conveying that plan to necessary faculty and staff. If the goals set forth in the recycling plan were not met in the follow-up
As Director of School Operations at Achievement First, Kit Brauer serves as the Sustainability Coordinator. His input and participation is vital to the success of the program. He is responsible for conscientiously sourcing the budget with sustainable products in mind, asking suppliers about environmentally friendly options, and ordering the proper labels and signage from WasteLess NYC to be placed on bins. He is also responsible for conveying recycling expectations to the head custodians and monitoring whether proper waste disposal habits are maintained. It is his duty to reinforce proper recycling habits of teachers and students. If there are any problems with classrooms not source separating or custodians compiling all waste together to dispose of nightly, then Mr. Brauer is the responsible party to address the situation. Instituting a sustainability plan is not a one-time job. It requires consistent maintenance.

The teachers and administrative staff maintain the responsibility of reinforcing proper recycling habits throughout the school. Participation of a new recycling program should be publicized to parents via newsletter. Reminders can be sent to all teachers and staff about what and how to recycle, ideally by email to limit paper waste. Teachers have the added responsibility of conveying the recycling message to students in an interactive way. Educational materials available from DSNY and DOE can be utilized. Teachers must constantly monitor waste bins to ensure proper recycling habits in the classroom. With their guidance, students should become responsible for source separating their waste in the classroom. Teachers were also assigned the task of bringing aluminum snack trays to the Staff Break Room for recycling.

Custodians maintain a large amount of responsibility in order for the goals of the recycling plan to be met. Collection of waste must remain separate as long as teachers and students are properly source separating. The separate recyclables will need to be stored on days that they are not picked up curbside. Otherwise, collection of recyclable material from classrooms should be delayed until the proper pickup day. Adherence to the recycling pickup schedule is crucial. Cardboard boxes need to be flattened and tied into bundles no more than 18” thick and left outside only on Monday, Wednesday, or Friday night, when there is a paper-recycling pickup. For hazardous materials, custodians are responsible for calling 311 to arrange pickup. Custodial participation is a vital step to make sure materials are sent to the proper recycling facilities.

To monitor whether the custodial staff is properly separating waste, delineation of piles curbside was recommended. [Appendix E3] The physical separation will convey to DSNY what materials are intended for which pick-up and will allow the Recycling Coordinator to quickly assess whether the custodians are disposing waste properly.

### iii. Bin Deployment

Due to insufficient funds required to support a new recycling system, the first step was to redeploy existing resources. Updating the recycling system requires an inventory to limit financial expenditures. An inventory of the bins to assess stocks and redeploy materials based on consistency and cohesion was conducted. Properly sizing bins based on existing conditions as
opposed to prescribed ideals provides a more realistic starting point for changing behaviors. While bins were redeployed, the delivery of additional bins several weeks later from Pratt Industries increased the waste disposal storage capacity in classrooms and changed the resources available for the recycling program. The bins, with an oversized physical presence, were vital towards emphasizing the expected change in habits. While the wide base makes disposal easy, it may complicate the logistics of collection. In addition, the cardboard bins were lined with plastic, which was unnecessary for paper disposal.

After analyzing the current bin deployment, it was clear there was some confusion about what and where to recycle. The recycling plan includes a schedule for where the current bins need to be redistributed in order to provide each room with a waste bin and a paper recycling bin that is sized for the habits of different teachers and age groups. A total of 12 extra bins were needed. In every room, a paper-recycling bin must be placed next to the waste bin. Consistency is key for maximum participation. The Teacher Resource Room and Staff Room shall also contain a metal, glass, and plastics recycling bin for beverage containers and the aluminum snack trays. Proper signage on all bins is necessary to inform users of the type of material that is acceptable for recycling. A list of labels and supporting material to order from DSNY was provided. Bathrooms will only be supplied with a large waste bin, as paper towel waste is not recyclable.

A multi-bin collection system that allows recyclables and waste to be collected at the same time was also recommended after inspecting the custodial collection habits. Purchasing a new custodial bin is the largest financial outlay, but is vital to enlist custodial involvement. The collection system must be convenient for it to be implemented. The use of a two-bin cart will also prevent accidental waste mingling, and establishes that proper recycling collection is an expected part of daily routines. Most importantly, the two-bin system works with the custodians existing collection habits, which were already the most efficient path. This cart represents a necessary financial outlay.

B. In a visit the day before the fall semester, two months after a finalized plan had been proposed, it was discovered that none of the bins had been redeployed and no new bins had been ordered. The team took the responsibility of moving bins to their proper placement and providing a list of the number and type of bins to be ordered and where they needed to be placed. Upon a visit two months into the fall semester, the team learned that Pratt Industries had delivered cardboard recycling bins, specifically designed for paper collection. All but a handful of rooms were equipped with these new paper collection units with more to be delivered. No new bins were ordered and with the delivery of cardboard bins no additional capacity was necessary.

Response from Faculty/Custodians

On October 14, 2011, two months into the new school year, a short presentation was given to the teachers on the importance of recycling and what is to be expected of them for a successful recycling program. Many were enthusiastic about the recent recycling efforts, but some were skeptical of the custodial participation. Just a few days earlier, one teacher observed a custodian dumping all paper waste in with the general garbage during his collection route. Others chimed in with concerns about what happens to the material once it is properly sorted in the classroom. They
were assured that if they did their part in the classroom, the custodians would cooperate during disposal. As of the time of the final waste audit, the custodial staff had not adapted their pickup routine.

A few weeks earlier, Pratt Industries delivered large cardboard containers (approx. 18” x 15” x 21”) for paper recycling in classrooms. The cubes have removal tops with rectangular slots the size of a sheet of paper. Achievement First did not request the new cardboard containers. The containers are large enough to hold a great deal of paper (approx. 18” x 15.5” x 21”), which allows for custodians to only pick up paper waste once per week. With the new containers and an understanding that custodians would collect waste once a week, the administration did not feel that the dual-bin collection cart is necessary for the custodians. Paper will be picked up from the classrooms Tuesday night and taken directly to the curb for recycling Wednesday morning. The custodians were under the impression that paper-recycling pickup only occurs on Wednesday, but material from DSNY was provided to show the schedule of multiple pickups throughout the week.

When asked about the MGP recycling containers, the idea was dismissed. The administration rejected the implementation of two MGP recycling bins in teacher workspaces and had not talked to custodians about this waste stream. They wish to implement the plan slowly and only focus on paper recycling for the time being. The snacks for classrooms are no longer delivered from Red Rabbit in aluminum trays, thus eliminating the large amount of aluminum in the waste stream. One teacher (science) has taken it upon herself to collect bottles and cans outside of her classroom door for recycling on her personal time.

Prior to reorganizing the bins, the DSO expressed that the custodial staff did not like using the large waste collection containers as they became difficult to empty when full. The cardboard containers risk the same problem of becoming filled past a comfortable disposal weight. As the custodial staff believed erroneously that recycling was collected only once a week, they were motivated to collect frequently as one collection per week was impractical. The custodial staff did not know the pickup schedule for the school recycling truck or even about its existence. This level of miscommunication is obviously unacceptable and indicates poor communication between DSNY and the custodial staff at this facility. The bigger issue is perhaps that DSNY does not have any means of knowing if the school is even aware of its legal waste management obligations and services available to them.

Physical separation of waste is also needed to prevent confusion, share information, and affirm habits. The most common form of physical separation is the different bins for waste disposal and recycling disposal. The bins were successful in soliciting the involvement of users as their design also conveyed usage. The bins did not however enlist the custodians to collect waste towards recycling and therefore did not solve the recycling problem; it did however decrease the number of dysfunctional aspects. Once the difference in bin function became emphasized by more than just a color difference, diversion rates increased dramatically.

### C. Post-Implementation Waste Audit

On Monday, October 31, 2011, the team arrived at Achievement First at 3:00pm. The intent was to log the waste generated in classroom bins at the end of the school day. Unfortunately, waste had
already been collected in the majority of rooms. Bins had very little content, if any, so the team decided to arrive earlier the next day to collect more accurate data. A short consultation with the administrative staff ensured that everything was being implemented as planned and there was no miscommunication with custodians. The team then weighed bags of waste outside on the curb and classified their content. Seven bags were analyzed and recorded. [Appendix F2] Some were filled completely with paper despite the fact that paper was intended to be recycled only on Tuesday night. Data may have been skewed due to the Halloween holiday resulting in an increase of waste generation.

On Tuesday, November 1, 2011, the team arrived at 12:00pm to analyze waste bin content. Bin location within the classrooms was also notated on the floor plan. Overwhelmingly, source separation between paper and other waste was being adhered to in nearly all classrooms. Pratt had delivered more paper recycling containers, but two rooms were still lacking (Room 324 and 353). The team found more waste in bins than the previous day, although paper bins were not very full. A teacher in Room 309 commented that her paper bin was full on Monday afternoon, but empty Tuesday morning; indicating that the night custodian had collected it Monday night. The team expected to find full paper bins with a week’s worth of material, but many had only a few sheets of paper in them. While recording data in the Teacher Resource Room, one staff member noticed a cardboard pizza box in the trash bin and asked, “Are you writing down that there’s cardboard in here? This should be in the recycling bin, shouldn’t it? It’s not very dirty. We’re trying!” It was then moved to the proper recycling container. The aluminum classroom snack trays had been eliminated in the new school year, therefore the aluminum waste stream was virtually non-existent and bins were not clogged with the oversized trays. Three more bags found outside on the curb were weighed and classified as well. [Appendix F2]

On Wednesday, November 2, 2011, the team arrived at 3:00pm to collect data on garbage bags set out for collection on the curb. Bags thought to have originated from Achievement First classrooms were sought. Examining the print on paper waste identified them to be from elementary classrooms. Four bags were located, all of which contained 80% or more of recyclable paper. One other bag was analyzed, although its origin could not be determined.

The fourth day of the waste audit, November 3, 2011, was spent analyzing the content of waste in classrooms bins again. The team arrived at 12:00pm to have access during lunchtime. Source separation of recyclable paper apart from general waste was being consistently adhered to. Paper bins contained slightly more waste than was found on Tuesday. The only aluminum was found in a waste bin the Principal/DSO office and the only recyclable plastic was found in a 4th grade classroom and the Staff Break Room.

The team spoke briefly with head custodian Matthew Naughtin. He affirmed that all recyclable material is only picked up on Wednesday morning around 8:00am. To his knowledge, general waste is picked up two times per day on Monday, Wednesday, and Friday, and once per day on Tuesday and Thursday. He claimed to have spoken with a DSNY official approximately six weeks prior asking for more recycling pickups, but they could not accommodate his request. The cafeteria and kitchen waste is not sorted and all considered to be garbage. On-site storage of recyclables is not considered to be an option because of food remnants and the potential for infestation. He
estimated that the building produces 65 bags of waste per day: 10 from Achievement First, 25 from the rest of the school, and 30 from the cafeteria. Mr. Naughtin was unaware of the recycling study taking place at Achievement First.

The final day of the waste audit, Friday, November 4, 2011 was spent collecting additional data on waste set for collection on the curb outside of the school. At 5:00pm, four bags were classified, weighed, and recorded. Three were determined to be from Achievement First; one from the Staff Room, one from a classroom, and one mixed from the bathroom and a classroom. The additional bag was from the kitchen as it contained 90% aluminum tins and 10% plastic containers, both used for containing food products. There were approximately 55 bags of waste on the curb.

The post-implementation waste audit data show that source separation is occurring in the classrooms. The poorest performing places that had contamination between bins occurred in the Faculty/Staff Rooms and the Art Room. The only place that had non-recyclable paper in the paper bin was in the Teacher Resource Room. Other sources of contamination occurred when recyclable paper was disposed of in the general waste bin. Recyclable plastic was found in one 4th grade classroom and the Staff Break Room, while recyclable aluminum was found in the Principal/DSO office. [Appendix F2]

D. Barriers to Ideal Implementation

The ambitious academic goals set forth at Achievement First unfortunately usurp the ability to implement sustainable management. The role and responsibility of the newly developed Sustainability Coordinator position had not been functionally developed during the time of this study. Lack of commitment to oversee the implementation of a full-scale recycling plan was evident when the responsibilities for the project were passed along to the Student Services Manager halfway through the project and merely a few weeks after her hiring. Consistency is key to successful results, not only with bin placement, but also the managing director of sustainability initiatives.

The custodial staff presented a unique set of challenges as well. Being that they are employees of the entire building, not strictly Achievement First, it was difficult to convince them to update procedures for waste collection. Since their job takes place after hours and between three different institutions, proper oversight must come from the Head Custodian. Changing habits is a process, which must be addressed in both implementation and maintenance. Custodial staff must be made aware that waste separation and recycling is standard and expected.

Lack of initiative within the staff and a lack of connection between the team and the staff did not foster ownership of this program. The development of the plan was limited by the lack of engagement with staff. The worst recycling rates were found in faculty offices. The administrative order allowed for the teachers to easily implement directives from the administrative staff, but the faculty was unable or unwilling to participate. This indicates that they have to be actively engaged to participate in the future.

The use of labeling is a communication tool that was underutilized in the waste management process. At the time of the waste audit, the use of labels was limited to only a few bins, some of
which were improperly labeled. The cardboard bins came pre-labeled, thereby circumventing the need for labeling from the staff. If not for the convenient donation of cardboard containers from Pratt for paper recycling, it is unclear whether or not the administrative staff would have taken any steps to implement the recycling plan before the new school year. Labels were not ordered from DSNY, new bins were not acquired, and the dual-bin collection unit for custodians was not obtained. Additionally, a third bin for MGP waste in faculty areas was rejected as unnecessary.

VII. Conclusions

A. The Recycling Plan

There were many challenges and setbacks in actually implementing a recycling program at Achievement First. One of the main challenges was maintaining a relationship with administrators within the school and trying to shape operations as an outsider not involved with daily operations. Trying to build internal motivation to change habits and take the steps to facilitate source separation poses a difficult problem without a concrete catalyst to motivate the people affected. The recycling plan was only able to gain traction when faculty took responsibility for the plan and no longer expected an outside group to make it happen. Building internal awareness through information and education and creating a sense of urgency is vital to success.

The implementation of the recycling program was far different than what was prescribed in the recycling plan. Some aspects were rejected in collaboration with the staff and some were simply not followed through on. Reuse options were rejected in favor of the larger waste streams that were being improperly handled and illegally disposed of. Other parts of the plan, developed in collaboration with the staff, were not implemented in full or in part for various reasons. The dual-bin collection system was rejected as unnecessary.

While there was resistance in changing habits and difficulties inspiring action, the plan was however successfully implemented in part. A few techniques that were successful have been highlighted. Difficulties in the recycling program have been analyzed using the catalyst, administrative, implementation and maintenance.

B. Tools and Strategies

i. Catalyst

For the recycling to be implemented successfully, a catalyst is required to remove the existing social barriers and re-establish habits. The strength of successful recycling plans is directly related to the level of motivation and actors behind the program. Lack of incentive to set-up a functional recycling plan that demonstrably increases diversion rates presents a major obstacle to increasing the effectiveness of recycling efforts. The major motivators available to inspire recycling plans are not present and must be developed. The financial incentive available in other townships is not available as there is not profit to share, nor is DSNY inclined to fine schools that fail to recycle. A culture that expects recycling has not been developed. This is not insurmountable as cultural expectations and habits can develop over time with municipal goals as has happened in Seattle.
Incentives must be changed for participation to improve. Initiative 3 in PlaNYC calls for recycling to be incentivized; this initiative must be functionally developed to extend to school operations. This can be in the form of fines for non-compliance in egregious cases. Without the financial tools available to other communities, school staffs lack financial incentives to participate in a recycling program and outside officials lack the ability impel schools to follow recycling law. Using an outside party, such a BWPRR, to inspire a recycling program requires a large time commitment to be effective. Therefore, more attention should be spent on inspiring and assisting people within a school to start a recycling program. The use of financial incentives may be appealing for time management of outside waste management personnel, but must be paired with educational priorities.

ii. Administrative

Trying to influence the behavior of others requires time to learn about the reasons why methods were formed and communicating goals directly with all participants. Assisting schools to implement a program will take a time commitment more than New York City has given in the past. Schools must feel that they have a partner in a Recycling Coordinator, as recycling must be a part of building management that supports overall institutional goals.

Waste audits provide a vital tool to assess school recycling performance and to assign responsibility for underperformance. Quantifying waste disposal habits is a vital component to quality control. Regular waste audits, conducted twice a year and published in a publically available website, are vital to reshaping a culture that is dismissive of waste management. The auxiliary benefit of conducting the waste audit involves taking time to experience the character of the school and increase awareness within the staff to the agenda. As such, they are necessary for a group not involved in daily school operations to change behavior. The waste audit made clear which aspects were dysfunctional and how to divide responsibility. In a dysfunctional system, a diagnostic tool must be employed to decipher the disconnections to prevent any one party from unfairly taking responsibility for a problem they are unable to remedy alone.

A culture of transparency and honesty must be cultivated by open reporting and regular waste audits. The first step to engaging schools given the current structure is to advertise current participation rates through waste audits with publically available results. Goals with concrete plans from underperforming schools for the next fiscal year must then be developed. Most importantly, the waste audit gives a point of comparison to judge the efficacy of a program after implementation. Unusual waste streams with large environmental impact may be ignored, as they are considered inconsequential if a waste audit is not performed. There are many potential benefits to performing a waste audit that require a detailed inspection and consideration of existing conditions. New York City must take a realistic and open inventory of the waste stream generated by schools if it is going to address the problem.

---

130 PlaNYC 2011, 137
iii. The role of the Sustainability Coordinator and the responsibilities and checkpoints for this position must be functionally developed. The literature review clearly showed that the designation of a sustainability team, which involves a teacher, an administrator, and an individual responsible for school operations, is vital in the development of a recycling plan. Conducting this study questioned whether a Sustainability Coordinator has the knowledge, experience, or training to successfully engage the school to implement a recycling program. The current program does not require the school to engage their staff and instead relies on top-down implementation. This is not what the literature or waste audit has shown to be effective. A coordinator must reach out to work with the different priorities within a school, the formation of a recycling team ensure that this will happen. The Sustainability Coordinator must supervise implementation and perform a consulting role, in a position that requires team involvement. This person must have a high level of energy and understand lack of participation as a symptom of the many priorities within a school.

Implementation

While the team was able to locate space in the building for recyclables, the use of this space was rejected and was not implemented by the custodial staff. The space that contained recyclables previously was being used for paper recycling and may be adequate once the custodial staff understands the pickup schedule. If however the level of diversion increases through the participation of the other schools in the building, a designated area for overflow will be necessary. In its current location, recycling storage must be limited to allow for safe egress in the event of an emergency.

Storage space for recyclables must be available on days when recyclables are not supposed to be placed on the curb for collection. In an urban area, this space must be designated to allow for compliance with both fire code and recycling law. The municipal collection system unintentionally prioritizes the disposal of waste through daily collection. Although necessary due to organic decomposition, this encourages the disposal of all materials as trash. The waste pickup system must provide or designate recyclable storage space if pickup for recyclables is provided less frequently than general waste.

Some of the problems that affect multi-family residential buildings in New York City are the same as the ones faced by local schools. Architectural design for future buildings should include designated temporary storage for recyclables. The first priority must be for paper, as damaged material is considered unsuitable for recycling when exposed to inclement weather. Recycling logistics should be treated as a necessary function, and should be considered in the programming and design development portion of plan layout. Waste logistics should be planned into space planning with pathways and storage that require the least amount of effort to utilize. As it is vital to work with custodial routines, a dual collection bin with space for storing a larger unit must also be available. Unless collection of all recyclables by DSNY is increased to every day, storage of recyclables is a necessity in New York City school design and tools that are available to custodial staff. Initiative 4 calls for recycling to be made easier and more convenient; mandating school storage for recyclables and planning space designation with waste flow logistics serves this intent.

\[131^\text{PlaNYC 2011, 137}\]
iv. Maintenance

The initial disposal bin inspections establish the first level of responsibility by measuring generator disposal habits and diversion rates. The bin inspections also document the custodial pickup schedule. As bin inspections are an irregular occurrence, it is important for the custodial staff to be able to report on poor diversion and contamination that interferes with their ability to keep waste and recyclables separate. Bag inspection post collection is another area vital towards ensuring proper separation. If the bins have not been inspected, then the source of any bag contamination cannot be properly traced. Inspection at the initial site of waste disposal and on the curb for municipal pickup is vital towards maintaining an open dialogue between the faculty and the custodial staff to identify underperformance.

The maintenance of the recycling plan in both this instance and citywide proposals has not been functionally developed. Current regulation only requests information on plans to implement a recycling program, but does not require documentation of actual performance. While improved access to recycling performance information is planned for local community boards, no such plans exist for schools. The waste audit reviews the waste management at different stages and pinpoints where failures are happening and who can correct them. This basic information is needed to understand the potential problems with the tools to address it. Given the high achievement demands within New York City schools, measuring progress is necessary to gauge success and motivate participation.

On-street labeling was also recommended in planning, but was not implemented by the school. This labeling was dismissed as either unnecessary or not within city guidelines. The combining of waste piles on the curb prevents assessing whether the custodial staff was properly disposing of waste in a timely manner. It also increases the workload of DSNY collectors to ascertain the intended path for disposal. The sidewalk space legitimately used for waste disposal should be labeled to ensure that intended material flows are communicated to DSNY. This allows the city to address improper waste management through a productive dialogue. Separated disposal, visible to the public, also allows for teachers or community members to report when schools are not meeting their legal obligations. Checkpoints that show whether responsibility has been taken are vital to integrating recycling expectations into daily routine.

C. Summation

The level of dysfunction was surprisingly large at the times this study was conducted. The low levels of participation are underreported and the structure of incentives has not been functionally developed. The actors involved must regard recycling as having some level of importance for behavioral patterning to be implemented. The plan was implemented within a framework of highly committed professionals that are wary of waste management distracting from educational goals. Given that education is the primary function of a school, this must be remedied for recycling to not be given short shrift. As long as recycling is seen as competitive with educational goals, then all efforts are rightly dismissed.
A functional website is not translating to measurable results nor is it inspiring involvement. It is only one of many tools that should be used to deliver information, but cannot perform the function of a catalyst. The WasteLess website is very clear that K-12 Schools are required to recycle. The administrators within Achievement First were unaware of these mandates. New York City must look to other school systems and learn from successful programs. The reporting system in Seattle is suggested as it allows for the open and honest exchange of data and informed decision-making with demonstrable results, not photo essays. Furthermore, New York City Recycling Coordinators are not actively engaging professionals who have experienced success. The formation of community organizers for each bureau may help to support the current program. The current situation is enabled by a lack of reporting and a dearth of support for existing professionals. This has underpinned an erroneous perception that the current situation is intractable.

There exists a cultural issue where the staff is unwilling to set waste management as a priority within school operations. Recycling is not only unenforced, it is unknown to participants that such a law exists. The staff needs training on how to manage daily operations and maintenance, as well as tools to monitor and evaluate performance. A single Recycling Coordinator will not remedy the problem; a team is required. Finally, the lack of communication between different groups to remedy issues with recycling is apparent. The cumulative effect is for all groups to be frustrated and disempowered. As part of a larger educational focus on the importance of sustainability, a recycling program can create opportunities for education that address tangible issues.

School recycling programs create the opportunity to connect consumption and behavior choices with the hidden consequences of modern material flows that are often ignored. For a recycling program to be successfully implemented the faculty must see the importance of integrating sustainability into daily operations. Recycling programs create the opportunity to relate daily behaviors with impacts, a vital understanding in an urban environment. With no other incentive outside of good will and other fuzzy goals, this project should rightly be dismissed in a high-pressure environment. Recycling programs must begin to be recognized as progressive education agendas that prioritize personal responsibility, initiative, leadership, stewardship, and good citizen development.

Sustainability happens on the smallest of scales and, perhaps perniciously, it cannot be deployed through big gestures. While organizations have the unique ability to engage people directly, individual involvement is required to catalyze institutional change. Sustainability works on many levels, but does not work if it is ignorant of the importance of individual involvement. School recycling programs must relate back to a sustainable framework based on a shared belief in intergenerational equity and establishing habits important to responsible stewardship. The scale of the problem is a reflection of the scale of the opportunity to deploy a targeted education program that is both personal development and civic investment. It is only with the tools to diagnose the existing causes of failure that the root of failed recycling programs can be diagnosed. A successful recycling program must be backed by the collection of quantifiable data that generates indicators to evaluate success and affirms responsibility.

132 Suttibak and Nitivattananon 2008, 55
VIII. Recommendations for Future Work

A. Suggestions for Greater Efficiency

As the study indicates, there currently exists a high level of dysfunction and underachievement in waste diversion rates. A large-scale waste audit of New York City schools is recommended to assess the current recycling initiatives. It is recommended that the budget to improve recycling efforts could be developed from waste diversion expectations from specific implementation measures. Furthermore, leading Recycling Coordinators need a better awareness of successful programs and initiatives. An implicit understanding that existing policy has failed to fulfill legal mandates and must therefore be redeveloped is needed. The reporting structure is undeveloped and the recycling efforts in schools reflect this. As schools have a large paper waste stream that can be processed in a local facility, the potential exists to decrease the cost of the waste stream through increased collection yields and lower levels of contamination. A study that investigates how to maximize collection and value through direct school incentives is suggested.

B. New York City Schools

Direct financial benefit to the city is limited until diversion rates are increased and responsible waste management is best implemented to fulfill legal mandates. While current plans take steps to remedy some of the causes of dysfunction, they do not address the whole problem. Since the culture in schools has not yet embraced the importance of recycling, these programs can be supported as part of a sustainable vision. The benefits of implementing a recycling program exist within all areas of sustainable paradigms and therefore cannot be reduced to one area. Economic benefits grow as landfill space becomes more expensive, separation is more accurate, flow is more consistent, and the city can negotiate better fees for selling materials for recycling. Environmental benefits to recycling can be quantified using widely available tools. The social impact of recycling is viewed as the most significant to school administrators and thus deserves attention. As New York City schools do not directly pay the cost of recycling and landfilling, the economic imperative to recycle does not exist within the education system. In fact, as schools are responsible for time management and held accountable to test scores, there is a disincentive to utilize staff time to support the development of well-rounded citizens.

Within waste management professionals familiar with recycling in New York City schools, there is frustration in the low participation and paltry diversion rates. New York City has conducted waste audits in the past, but these have looked at overall residential waste pickup, which was not school specific. The lack of scientific data in documenting waste flows limits assessments on the impact of recycling programs. Recycling efforts were fragmented by different school districts, which are led by individuals with varying knowledge, skill sets, and prior success. The lack of accountability and direct incentives is a major hindrance to implementation. While many programs are in place throughout the country, the effectiveness of existing programs and the performance of new ones are not documented with rigor in the vast majority of cases. Assessing performance is a fundamental part of logistical planning and must be embraced as a means to document the level of dysfunction to determine resources to invest and to address the problem in a meaningful way. School recycling programs represent a targeted public education campaign that will allow the city
to directly influence 1.1 million residents to engage the citizenry to meet waste management goals. Formulating a plan to meet legal mandates must include benchmarks, indicators, and metrics which demand school recycling rates to be documented and investigated.

C. Methodology in Hindsight

A main issue that guided initial development was probing what the team could offer that a school could not get through existing services provided by the BWPRR. Initially, a waste audit and an individualized plan that worked with the schools needs were sought. However, the role the team played became more important. The school was allowed to build internal support by working within their timeline and the team was willing to accept the limitation set forth by the administration. The study helped motivate the staff and maintained focus on the issue through multiple site visits. This level of involvement required by an outside group to motivate internal changes had not been anticipated. Gaining the support of the staff to make additional effort through the extensive planning and waste audit is perhaps the largest accomplishment achieved. This would not have happened through existing recycling support.

The application of institutional waste management protocol created a methodology for investigation that was outside typical school waste management practice. This created the basis for a scientific investigation that developed benchmarks of performance and indicators to measure progress. For implementation in a system where the catalyst has not been functionally developed, the most important step was looking outside New York City for examples of successful waste management recycling systems. From this, more successful municipal, district, and school approaches were found, investigated, and used to redevelop a recycling plan. Some aspects were not pursued as aggressively as was necessary for full success in implementation. A more involved recycling program, including other sustainability planning and more sustainably sourced material, was initially attempted. Unfortunately, a waste committee was rejected by the administrative staff as unnecessary. In retrospect, this was a necessary aspect that impacted the effectiveness of the final proposal.

IX. Acknowledgements

Special thanks to Principal Stacy Park, Director of School Operations Kit Brauer, Student Services Manager Colleen Place, Chief Custodial Engineer Matthew Naughtin, and the staff at Achievement First for generously providing access to their school, allowing the team to inspect operations and taking the time to implement them. Thank you also to Assistant District Recycling Coordinator for Monmouth County James Brown and Outreach Specialist at DSNY Glen Nison for their insight into school waste management practice and the important role municipal recycling coordinators play. Thanks to Ozgem Ornektekkin for allowing the team to attend the Sustainability Conference training. Special thanks to the faculty advisor Vasil Diyamandoglu.
X. References


Brown, James, Fran Metzger and James Mellish, 2007. “Dean-Porter School.” Unpublished technical report. Monmouth County, NJ: County Office of Solid Waste and Recycling, April 9. A copy of this article is in the student’s possession and may be consulted by contacting the student at email@me.edu.


http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/FACTS/ComRec.htm

http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/FACTS/Comrec2.htm

http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/facts/skolrec.htm

http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/school/school_guide.htm


http://www.scire.com/recycle/bmes_recycles/plan.html

http://www.scire.com/recycle/nature_recycles/


XI. Appendices

A. Flow Charts
   1. Pennsylvania EPA Advice
   2. LA School Cafeteria Plan
   3. 9th Street Elementary Recycling Program, LAUSD
   4. Flow Chart Citations

B. Case Studies
   1. Black Mountain Elementary School
   2. Monmouth County
   3. Scoring

C. Maps
   1. 3rd Floor: Programmatic Diagram
   2. 3rd Floor: Existing Conditions
   3. 3rd Floor: Existing Logistics
   4. 3rd Floor: Proposed Conditions
   5. 3rd Floor: Final Conditions
   6. 1st Floor: Existing Conditions & Logistics
   7. 1st Floor: Proposed Conditions & Logistics

D. Logistical Planning
   1. Existing Critical Path
   2. Proposed Critical Path

E. Publications
   1. Finding a School
   2. School Expectations
   3. The Recycling Plan

F. Waste Audit
   1. Existing
   2. After implementation
   3. Analysis