Towson University

Environmental Science and Studies Senior Seminar

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Baltimore County Government Greenhouse Gas Inventory for 2012

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Key to Acronyms/Symbols

CH_4	Methane
CO_2	Carbon Dioxide
EPA	United States Environmental Protection Agency
eCO_2	equivalent Carbon Dioxide
FY	Fiscal Year
GHG	Greenhouse Gas
GWP	Global Warming Potential
PJM	Interconnection, a Regional Transmission Org

Abstract

This report is a follow up assessment to a greenhouse gas inventory conducted by Towson graduate student Patricia Brady for Baltimore County Government's greenhouse gas emissions between 2002 and 2006. The inventory accounts for emissions including carbon dioxide, methane, and nitrous oxides and converted the emissions into the measurement of equivalent CO_2 in metric tons for simplicity and comparison purposes (Brady, 2008).

There are two main purposes of this inventory. First, is to assess whether the county government has successfully met former County CEO Jim Smith's goal to reduce government greenhouse gas emissions 10% by 2012. Second, to help government officials and policy makers address sources of high GHG emissions so they can be targeted with emission reduction strategies.

This inventory looked at emissions from a range of sectors for 2011 and 2012 fiscal years. Sectors include emissions from buildings, traffic/streetlights, wastewater and solid waste treatment, employee commute, and government vehicle fleets.

I. Background

Maryland is located in the Middle Atlantic Region of the United States. With an area of 9770 square miles, it has the 42nd largest land area in the United States. Baltimore County, located in the north central part of the state, with an area of almost 600 square miles is the third largest of twenty-three counties in Maryland. The county seat is in Towson and there are no incorporated municipalities.

II. The Greenhouse Gas Effect/Anthropogenic Climate Change

The climate is the measure of the average variation in the temperature, wind, rainfall, and other meteorological variables in a geographic region over time. The Earth's climate results from complex interactions among the Sun, atmosphere, land surface, oceans and biosphere, based on physical laws of thermodynamics and conservation of mass and energy. The Sun is the main driver of the Earth's climate, but its energy is unevenly distributed over the Earth due to the tilt of the Earth's axis of rotation. The angle of rotation causes the tropics to receive more incoming solar radiation than the poles, and oceans and the atmosphere work to transfer this heat toward the poles. The rotation and shape of the planet, trade winds and ocean currents act in together to distribute the heat outwards and the cooler denser wind toward the equator in large convection currents. Through evaporation and precipitation the oceans and atmosphere exchange heat, water, CO_2 and other gases. This complex exchange of mass and energy help determine the overall climate.

Most of the Sun's energy reaches us in the form of short wavelength energy in the visible/ultraviolet spectrums. As it reaches the atmosphere portion of the Sun's energy is reflected by the outwards. Another portion is absorbed by the greenhouse gases in the atmosphere before it reaches

the surface. The surface itself absorbs some of the energy, and reradiates it back out into space as infrared radiation. However, some of this infrared radiation is absorbed by GHGs and re-radiated back to Earth. This outgoing radiation being trapped within our atmosphere is the greenhouse gas effect. Over the past century, Earth's average temperature has risen by 1.4°F, and is projected to rise anywhere between 2 to 11.5°F over the next hundred years (US EPA, 2014). Since 1993, global sea level has raised 2.9±.4mm per year (NOAA, 2014).

The EPA recognizes four main greenhouse gases: CO_2, CH_4, N_2O, and F-gases (EPA, 2014). The greenhouse gases effect on the overall warming of the atmosphere depends on two main factors: their Global Warming Potential (GWP), which is the measure of how much heat a GHG traps in the atmosphere relative to CO_2 (EPA, 2014) and how long the gases remain in the atmosphere. CO_2 has the lowest warming potential, while the F-gases have the highest.

The Intergovernmental Panel on Climate Change is the chief international body appointed by the United Nations to assess the effects of anthropogenic climate change (ACC). It is a renowned scientific body whose focus of research is on the understanding of climate change using all available environmental and socio-economic metrics. The analysis presented by the IPCC is designed to provide balanced and neutral scientific information to policy makers (IPCC, 2013). Recent reports show that cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond and that most aspects of climate change will persist for many centuries even if emissions of CO2 are stopped (Twelth Session Working Group I, 2013). The Earth's climate will change throughout the future, but the impact of ACC on the future climate can still be largely influenced by the actions of our legislators.

III. GHG Inventory Scopes

The GHG emissions of any entity can be classified into three scopes based on the type of sources (EPA , 2014) (Stephen Russell, 2010). Scope one emissions are **direct** emissions from county activities. This includes building heating, vehicle fleet, and methane emissions from county run landfills. Scope two emissions are **indirect** emissions that are from purchased electricity. Scope three emissions are indirect emissions that are **not** owned or controlled by the entity, but are still influenced by its existence, such as the employee commuting fleet. All three of the above listed scopes contribute to the concentration of GHG's in the atmosphere and all scopes have the potential for reduction through different policy initiatives.

IV. Buildings

Building a successful inventory for the county government requires recognition of the emissions generated by the energy use of government operated buildings. Total emissions in metric tons of carbon dioxide have been calculated and analysis of emissions from more than 140 government buildings. Buildings require a considerable amount of energy and the results of the calculations reveal whether emission reduction strategies have been fruitful in this sector and where improvement can occur.

Data Collection

The building energy use data of Baltimore County's Government was provided by Janet Stiepler of the Property Management division. The energy usage covers fiscal years 2011 and 2012, measured from July 1st to June 30th every year. This inventory excludes the emissions exhausted from libraries, public schools, and community colleges as these reside under different jurisdictions.

There were 141 buildings operating in 2011 and 146 operating in 2012. Energy was provided by electricity, natural gas, and oil and the buildings used at least one if not all of these resources to support their energy needs. (Appendix I)

For comparison and simplicity purposes all emissions were converted into equivalent carbon dioxide (eCO_2). Equivalent carbon dioxide quantities were calculated for kilowatt hours and natural gas thermals through the EPA's Greenhouse Gas Equivalencies Calculator available for public use on the EPA's official website (EPA, 2014).The EPA's established conversion for oil thermals conversion is 0.43 metric tons CO_2/barrel. The oil data was provided in gallons and was converted to barrels using the US standard of 42 gallons of oil equals one barrel of oil.

	KWH	Gas Thermals	Barrels of Oil	Total eCO_2
Buildings 2011	63,365,683	2,383,689	8,161	60,865
Buildings 2012	33,369,393	989,132	3,369	30,241

Table 1. Expresses the totals for each energy source for FY 2011-2012.

Year	Emissions in eCO_2
2002	38,995
2003	39,588
2004	39,836
2005	40,234
2006	39,629

Table 2. Displays the calculated emissions for each year of the prior government inventory conducted by Pat Brady.

Discussion

The 2002-2006 Greenhouse Gas Inventory conducted for the government indexed 104 government-operated buildings. During this time many buildings were leased and no longer in use for governmental purposes in 2011 and 2012. Several new buildings have also come online since the original inventory. Additionally, several of the buildings used in the old and new inventory were remodeled, a handful rebuilt, and dozens were modified in some way that makes it difficult to compare emissions between the original and new inventory in terms of eCO_2 emissions per area of building space.

There is an 85 building overlap between the list of buildings used in the original inventory and the list for the current study, and there is no building size equivalencies between the lists of buildings used in the original study and the provided current list thus rendering any comparison using these parameters meaningless.

The existing data reveal that 2012 supported the lowest equivalent carbon dioxide emissions and 2011 created the most. This is interesting as the 2012 ultimate low emissions point was reached despite that there is a 21% increase in square feet area of building space from the 2002-2006 data to 2012.

What is particularly interesting is the drastic change in emissions from the 2006 to 2011 data and then significant decrease from 2011 and 2012. It is likely that perhaps some “smart” energy actions were taken to improve the energy use efficiency of these buildings. Janet Stiepler has been contacted regarding information about this reduction and her response is pending.

Suggestions

A plausible policy option to continue reducing emissions may be to set (or continue to set) goals for these buildings to replace all energy consuming appliances with the latest energy efficient technology within the next five years or so. If such a plan for reducing emissions is established it is recommended that the plan is monitored and modified as needed. The EPA states that implementing energy efficient appliances can save money in the long run. In 2011, the government spent $7,945,337.13 in energy and $3,876,435.88 in 2012. This difference of $4,068,901.25 shows that some form of energy reduction techniques has led to significant energy use savings. This number does not account for money that may have been spent to upgrade the buildings to function more energy efficiently.

Smart meters for electricity use could also help reduce emissions, such as the ones provided by the state's largest electricity provider, BGE (BGE, 2014). Tracking energy use within buildings is the first step to being able to identify and address areas of waste, such as faulty insulation on older buildings, or the lights being left on after hours. Cost-benefit analysis of different systems could very well show a net decrease in both emissions and energy costs exceeding the initial installation and maintenance costs. Considering the "close" relationship with BGE and the state government and their ever-increasing rates, the energy provider would surely love to assist with providing low-cost monitoring to the county government.

V. Government Fleet

Transportation accounts for 28% of all greenhouse gas emissions in the United States, which is staggering given that this sector only accounted for 10% of U.S emissions in 1990 (U.S. Environmental Protection Agency, 2013). Government fleets in particular account for the largest fleet in the United States, deploying over 4 million vehicles. The size of government fleets provides a great potential to reduce greenhouse gas emissions through comprehensive policy and regulation.

Data Collection

Vehicles emissions for the entire government fleet were obtained by acquiring total gallons of fuel purchased, including both diesel and gasoline. Data for the latter were provided by Donald Evans, Management Analyst at Vehicle Operations and Maintenance (VOM). In order to calculate eCO_2 of gallons of gasoline purchased, the parameter (gallons purchased) was entered into EPAs greenhouse gas equivalencies calculator. The EPAs calculator, however, did not have a diesel fuel equivalency so an earlier report of Emission Facts was used (Office of Transportation and Air Quality, 2005). It was found that the equivalent CO_2 emissions of diesel fuel was 22.2 pounds/gallon compared to 19.6 pounds/gallon for conventional gasoline (Table 3).

EPA Calculation	
1 Gallon of Gasoline	2,421 grams x 0.99 x (44/12) = 8,788 grams = 8.8 kg/gallon = 19.4 pounds/gallon (EPA Emission Facts)
1 Gallon of Diesel	0,084 grams = 10.1 kg/gallon = 22.2 pounds/gallon (EPA Emission Facts)

Table 3: shows the EPA conversion for a gallon of fuel to CO_2 emissions.

Results

Results for fuel use and carbon emissions from Baltimore County vehicles are given in Table 4. When looking at the entry in table 4 for diesel it shows the trend that has been taking place for diesel consumption. In the first year from 2010 to 2011, diesel consumption dropped 16,791 gallons, and then dropped another 72,925 gallons between 2011 and 2012. Overall, this is very impressive in terms of a county-wide GHG emission decrease. This demonstrates an observed drop of diesel fuel was by around 90,000 gallons and with a commensurate reduction of 903 metric tons of carbon dioxide.

Gasoline consumption increased from 2010 to 2011 by approximately 3,500 gallons and with it came 30 metric tons of additional CO_2 emissions. A decrease in consumption between 2011 and 2012 was a sharp, approximately 74,000 gallons. This was also able to make up for the increase of CO_2 emission between the years of 2010-2011 by decreasing it by 490 metric tons.

Fuel Transaction Summary Report			
(VOM, Baltimore County, MD)			
Sorted by Fuel Type			
01/01/2010 TO 12/31/2012			
2012	Purchased (gal)	CO_2 (lbs)	CO_2 (metric tons)
Diesel Totals:	888,261.31	19,719,401	8,945
Gasoline Totals:	1,768,274.24	34,304,520	15,720
TOTALS:	2,656,535.55	54,023,921	24,665
2011			
Diesel Totals:	961,186.24	21,338,335	9,679
Gasoline Totals:	1,842,189.29	35,738,472	16,211
TOTALS:	2,803,375.53	57,076,807	25,889
2010			
Diesel Totals:	977,977.62	21,711,103	9,848
Gasoline Totals:	1,838,772.33	35,672,183	16,181
TOTALS:	2,816,749.95	57,383,286	26,028

Table 4: This is the Fuel Transaction Summary Report on diesel and gasoline. This chart reports the number of gallons of both fuel types, the pounds of CO_2 and Metric tons of CO_2.

Discussion

The EPA has also established a set of guidelines called Transportation Control Measures (TCM) which are designed to be used by city planners, local transportation managers, city councils, local government authorities, etc. "When properly implemented, TCMs can reduce demand for fuels, decrease GHG emissions, local and regional air pollutants, and reduce infrastructure and travel costs for the community, residents, and local businesses" (United States Environmental Protection Agency, 2011). They act as a framework for policy makers in local governments to feasibly and efficiently reduce GHG emissions from the transportation sector. TCM's include but are not limited to shared ride projects, bicycle and pedestrian projects, and intelligent transportation systems. The city of Santa Monica, California is one actor who has implemented several TCMs-ridesharing and parking cash out (EPA 2011). The city developed these initiatives in order to reduce vehicle congestion and emissions. There are many programs in which the Baltimore County Government can emulate that have successfully reduced transportation GHG emissions. As is seen with many of these successes, they are cost efficient and typically yield a full financial return within several years.

Looking at all the consumption of fuel by Baltimore County Government Fleet between the years of 2010 and 2012, there has been a declining trend. There has been a decrease of CO_2 emissions by ~1,400 metric tons and an overall gallon consumption decrease by 160,214 gal. However, the number of gallons used this year was ~2.66 million and is equivalent to over four full-sized Olympic swimming pools (figure 1). The trend is moving in the right direction, but faster and more efficient methods need to be devised before Maryland's security as a whole becomes threatened.

Suggestions

There are several changes that can be made in order to reduce the emissions of government fleet vehicles. The most common solution is to create a provision requiring that a certain percentage of the vehicle fleet be completely electric by a future date. The decrease in CO_2 emissions depends on the emissions from the electricity source, however, it would still represent an overall net reduction in emissions. Another benefit of this solution is that the government would not need a radical change to infrastructure, only a few electric charging stations would be necessary around government buildings since most of the transportation that occurs is in short distances. In California, the Local Government EV Fleet National Demonstration Project has been granted $2.8 million from the Metropolitan Transportation Commission which will be used to deploy 90 electric vehicles for use in a broad range of functions, plus all necessary infrastructures such as charging stations (Bay Area Climate Collaborative, 2010). This plan is projected to save $500,000 in fuel cost and 1.5 million pounds of eCO_2 over a span of five years (Bay Area Climate Collaborative, 2010). The latter exhibits that a paltry investment in electric vehicles can have a profound effect on GHG emissions and save money along the way.

Increasing the average fuel economy for fleet vehicles is another possible solution and probably more feasible than increasing the portion of electric vehicles because there is no need for any change to infrastructure. The state of Illinois has implemented an Alternate Fuels Rebate Program which offers rebates to anyone using E85 or biodiesel fuels, for purchasing an alternate fuel vehicle, or for converting a vehicle using conventional fuel to alternative fuel (Illinois Green Fleets, 2014). This would allow the government more autonomy when it comes to reducing greenhouse gas emissions from their vehicle fleet. A plan could include a variable transportation portfolio such as the combination of electric vehicles, hybrid vehicles, ethanol run vehicles, etc.

VI. Employee Commute

Employees traveling to work generate a substantial amount of greenhouse gases. When emissions are produced by the Baltimore County Government off government property, excluding electricity production, are considered scope three emissions. In order to include scope three emissions for Baltimore County Government, in the greenhouse emissions report, the total amount of employee commute miles driven was estimated.

Data Collection

To estimate the amount of emissions used in the employee commute sector, a survey was made online using SurveyMonkey. The survey was sent to Ayla Haig at the Department of Environment Protection and Sustainably. She sent the survey to approximately 650 Baltimore County employees of the Department of Environmental Protection and Sustainability, Department of Public Works, the Department of Planning, and the Department of Recreation and Parks. In total there were 213 people who took the survey for a response rate of 32.77%. Overall, this was a suitable amount of responses. By selecting a wider array of people across four different departments in the Baltimore County Government, we left out the possible bias of only surveying the Baltimore County Office of Sustainability. The workers in this department may have been more prone to choose sustainable ways of transport to work.

We limited the survey to five questions to a brief five questions. The questions we asked were:

1) What is your typical method of travel to work?
2) What type of fuel do you use for your commute?
3) What is your estimated miles per gallon (mpg) of the vehicle you drive to work?
4) How far is your commute to work on a daily bases? (one way and in miles?)

5) Not including daily commuting, on average, how many miles per month do you drive your personal vehicle on work related business (e.g., travel to meetings, site visits, etc.)

The survey results were extrapolated to represent all 7,248 county employees (estimation from Baltimore County Government Human Resources.) To find the yearly total of days worked, we found that Federal and State employees typically have 10 holidays per year with an 11th one occurring every 4th year (for the Presidential Inauguration).

Results

Using an online survey proved to be an efficient way to contact a wide array of employees. The results of the survey indicated that 90.4% drive alone, 0.2% use Mass Transit, 0.5% walk/bike, and 8.9% carpool. Since walk/bike doesn't produce GHGs, those miles were deducted from the total. The average round-trip daily commute for a Baltimore County Government worker came out to be 33.38 miles. This number was used to help determine the number of miles traveled by those who drive alone. The number who responded that they drove alone, 187, was then multiplied by 34. The number 34 came from dividing the total number of Baltimore County Government workers by the amount of respondents of the survey. This produced a response count for the entire Baltimore County Government who drive alone. This total count number was then multiplied by the 33.38 miles and by 251 (number of work days in a year). The same sequence was used to determine miles driven for those who carpool and use mass transit. The difference is an added division at the end. Both carpool and mass transit have their own occupancy factors (10 for mass transit, 2.5 for carpooling). For example, if there are 100,000 miles from employees' mass transit commute and the occupancy factor on a bus is 10, then only 1/10 of those emissions are attributed to each rider. Therefore, only 10,000 miles are counted towards the total employee mass transit miles.

$$\text{Total Miles for Commuters} = 0.904 \times \#\text{ of employees} \times 33.38 \frac{\text{mi}}{\text{day}} \times 251 \text{ days}$$

Figure 2: Calculation used to determine total mileage for commuters.

The total annual mileage was calculated by adding two different numbers. The first number, 54,836,497.10, came from adding up the yearly mile totals from those who drive alone, carpool, and use mass transit. The second number, 8,453,197, came from the survey question on how many miles the employees drive for work purposes, outside of the daily commute, on a monthly basis. We did a similar calculation with this number by multiplying the average miles to this question, 97.19, by the total number of workers. The logic behind this is that the question asks about commute outside of work so everybody would be driving. We then took that number and multiplied it by 12 for how many months in a year. Add this number with the total round-trip miles that the entire Baltimore Country Government travels to work in a year and you have the total yearly miles driven by Baltimore County Government employees for work purposes. The total miles was then divided by the average miles-per-gallon (MPG) of those who responded to the survey (25.28) to obtain the total yearly gallons of gasoline consumed by Baltimore County Government employees. The total yearly gasoline consumption by Baltimore County Government employees was calculated to equal 2,645,529.77 gallons. Using this number, multiplied by 0.00892, gave an equivalent of 23598.13 eCO_2 being expelled. The decimal number (0.00892) is the eCO_2 multiplication factor for a single gallon of gasoline burned.

Discussion and Suggestions

In order to reduce emissions in the employee commute sector, employees must have incentives to emit less greenhouse gases. This could be by encouraging carpooling. By adding close parking spaces specifically for people who carpool, employees would want to carpool in order to get a better space.

Another way to reduce emissions would be to encourage vehicles have less emissions. One way would be to install charging stations for electric vehicles. This would enable an employee with an electric vehicle to travel to and from work all year without burning any gas. If employees see a bigger benefit instead of just the amount of gas they pay for at the pump, emissions will most likely decrease.

VII. Wastewater and Solid Waste

Wastewater that is treated in the county would be a Scope I emission (and therefore accounted in the total energy bill above), Baltimore County sends a considerable amount of its wastewater for treatment in Baltimore City. Accounting for the energy to pump this wastewater through the treatment facility is a Scope III emission. Solid waste falls under Scope I emissions. Together these factors represent a significant proportion of total GHG emissions. Both the wastewater and solid waste sections attempt to quantify the costs associated with waste treatment and disposal that Baltimore County government is directly responsible for. Water sanitation and waste disposal are essential for county government buildings and therefore need to be quantified in terms of their impact on the environment. The complete greenhouse gas costs of these services are calculated in this portion of the inventory.

Water use is one of the largest greenhouse gas emitting sectors of the Baltimore county government. The many chemicals and compounds used to treat waste water and runoff all have an

economic cost associated with them. In addition, it cost energy to pump water to wastewater treatment plants and this energy use has eCO_2 values as well. Baltimore County treats only a small portion of the wastewater its citizens generate. The Patapsco Wastewater plant treats roughly a third (about 34.5%) of the wastewater produced in the county. The remainder of the water is pumped into the city treatment plant at the Back River Wastewater treatment plant run by the Baltimore City Government. This wastewater no longer being in the county does not absolve the county government from the greenhouse gas emissions associated with this water. In the following section waste water data from both the city and county treatment facilities is quantified and calculated to determine the eCO_2 value associated with the clean water many take for granted.

Data Collection

Emissions from the Wastewater Sector are based on number of gallons pumped annually. The 817,455 residence of Baltimore County generate an average of 60 billion gallons of wastewater a year. There are two separate systems for handling waste water and storm water, but during heavy rainfall events, storm water flows into the sewer system and is pumped to the treatment plant. This type of system is known as combined sewer system in which generally both water sources are segregated, however, during times of inundation the storm water flows into the larger diameter wastewater pipes. Rainfall amounts were far above the Maryland average of 41.72 in. In 2011 rainfall was higher, 60.39 in. due largely to Hurricane Irene. This tropical storm dumped an average of 9.5 in of rain across Maryland in the month of August. This increase in rainfall is reflected in the rise in number of gallons pumped. As for 2013 and 2012, (33.01 in., 37.44 in.) rainfall was under the average for Maryland.

To calculate total energy used from pumping wastewater, data from both the Patapsco Wastewater treatment plant and the Back River wastewater treatment plant was needed. To determine

the counties energy use the number of gallons pumped to the city to be treated is multiplied by the cities energy use over their wastewater pumped, as shown in figure 3 below.

$$2011\ County\ kWh = 2011\ county\ pumped\ (gal)\ X\ \left(\frac{2011\ City\ kWh}{2011\ City\ pumped\ (gal)}\right)$$

Figure 3: formula used to determine energy usage in kWh at the Patapsco and Back River treatment plants.

The solid waste used in this report is defined as refuse produced in county run buildings. This would be generally office waste such as papers, plastics, and food with the occasional electronic device. The unit by which solid waste is measured is tons per year which is a consistent unit across most governmental bodies. Waste information used for the purposes of this GHG inventory are estimations. Waste tonnage is not tracked for institutional customers therefore the estimations of waste tonnage was derived by taking the average of two methods for waste generation in office buildings described by New York Department of Sanitation. These two methods are as follows.

Method 1 $\left(\frac{.03\ lbs\ X\ weeks\ X\ ft2\ office\ space}{2000}\right)$

Method 2 $\left(\frac{13\ lbs\ Xemployee\ X\ weeks}{2000}\right)$

Figure 4: Calculation methods for solid waste emissions in metric tons/year

We use 52 weeks to generate annual waste data for the purposes of this inventory.

Results

In fiscal year 2011 the Patapsco plant treated 22,006.1 billion gallons of wastewater which resulted in 29.9 million kWh of energy used. In year, 2012 the treatment was reduced to 20,238.3 billion gallons which brought about a decrease of .9 million kWh from the previous year's total. 2013 brought about a small increase to 22. 612.1 million gallons of wastewater treated with an energy use of 29.5

million kWh. In 2011 Baltimore County sent 44.5 billion gallons to be treated in Baltimore City. This number decreased in 2012 to 38 billion gallons pumped. The information for 2013 is not available yet, however, this report will be amended when it does. Table 5 displays only the counties energy use associated with treatment in the city plant.

	County energy use in kWh
FY 2011	44.5 bil gal* (80,434,306 kWH/ 48,999 mil gal)
	73,047,481 kWh
FY 2012	38 bil gal *(79,323,808 kWh/ 53,264 mil gal)
	56,591,782 KWh

Table 5: Baltimore County energy use (kWh).

The numbers above state that in 2011 the county used 73 million kWh to treat its waste water and that the energy use declined in 2012 to 56.5 million kWh. This difference can be partially attributed to the large rainfall event of hurricane Irene during the month of August in 2011. Based on the trend seen in the data one would expect that during fiscal year 2013 the number of gallons pumped would increase when compared to 2012 data but still be smaller than 2011 data. When adding the values in the graph above with the counties energy use at their Patapsco plant the final electrical use is 102,947,481 kWh for the year 2011 and 85,591,782 kWh for year 2012. Using the EPA's conversion factor of .0007 (metric tons eCO_2/kWh) we can determine the greenhouse gas impact of clean water. In 2011 72,063.23 metric tons of eCO_2 where generated. During the following year this number was reduced to 59,914.24 metric tons of eCO_2. It is clear that this sector is one of the largest emitter of GHG in County Operations but it also demonstrates that emissions reductions are achievable by decreasing volume of water pumped. The County may want to further investigate the feasibility of decreasing waste water volume to help met their goals for reductions.

The two methods for determining solid waste resulted in very similar answers. These results are displayed in the chart below.

Two methods of determining waste from government buildings
Method 1
(.03lb * weeks) * sq ft of office space) / 2000
(.03 * 52 * 3749377) /2000
=
2924.514 tons/year
Method 2
(13lb * employee * weeks)/2000
(13 *7248 * 52) /2000
=
2449.824 tons/year

Table 6: Waste calculations found from the two described methods in metric tons per year.

The 3,749,377 ft^2 of office space is an estimate based on current building data. The number recorded is a total in tons of waste sent to a refuse area. As displayed in the table, the first method estimates a larger number in tons than does the second method. It is difficult to determine which of these methods is most accurate because both are using similar data. We opted to take and average these two values together to get 2687.169 tons of solid waste for fiscal year 2013. With regards to solid waste, the greenhouse gas that contributes most is methane. We chose to use a coefficient of 2.136 to calculate eCO_2 for paper products in a standard landfill. To calculate eCO_2 we took tons of solid waste and multiplied it by the eCO_2 coefficient. We can safely say that Baltimore County buildings emit 5739.793 tons of eCO_2 from their solid waste refuse facilities.

Additionally there is an environmental cost associated with transporting this refuse to its final resting place. Most of the trash collection is performed by refuse hauler contractors that are appointed by the county but use county diesel fuel in their vehicles. These vehicles used 598,661 gallons of diesel fuel in year 2012. The county owns a fleet of trucks and these where used through the year generating an additional 2,356 gallons of diesel used. Once the refuse is deposited at the Easter Sanitary Landfill (ESL) operated by Baltimore county additional machines are used to move this refuse around in order

for it to be treated properly. These machines used 100,133 gallons of diesel and 54 gallons of gasoline in 2012. Some refuse is not sent to ESL and is sent to the BRESCO (Wheelabrator) & Harford Waste to Energy (HWTE) plants to be burned in order to generate electricity. This transportation comes at the cost of 30,303 gallons of diesel fuel. In total the county uses 731,453 gallons of diesel and 54 gallons of gasoline. Using the EPA's conversion factor of 22.2 and 19.6 for diesel and gas respectively we get a total of 22,293,815 lbs. of eCO_2 emitted.

The solid waste itself does represent greenhouse gas emission, but the fuel used by the trucks that transport refuse and recyclables is counted in the County government inventory. There is one landfill site in Baltimore County, called the Eastern Sanitary Landfill (ESL). Since this landfill is owned and operated by Baltimore County Solid Waste, the fuel used by this facility was counted toward this GHG inventory. The vehicles that collect household trash and recyclable items are not owned by the county government, this task is performed by contractors appointed by the County. These contractual refuse haulers use County diesel for their vehicles.

	2011 (gals)	2012 (gals)
Landfill (diesel)	599,088	598,661
Recycling (diesel)	1,761	2,356
Waste-to-Energy (diesel)	85,124	30,303
ESL (diesel)	97,224	100,133
ESL (gasoline)	419	54

Table 7: County GHG emissions for 2012 from vehicles servicing solid waste removal.

Source	Calculations	Tons of eCO_2
Landfill hauling	598,661 (gallons diesel) *22.2	13,290,274.2 tons
Recycling trucks	2,356 (gallons diesel) * 22.2	52,303.2 tons
ESL (Eastern Sanitary Landfill)	100,133 (gallons diesel) * 22.2 54 (gallons gasoline) * 19.6	2,222,952.6 tons 1,058.4 tons
Trash disposal (Waste to Energy)	30,303 (gallons diesel) * 22.2	6,727,226.6 tons
Total eCO_2 emitted:		**22,293,815 tons**

Table 7: Total county GHG emissions for 2012 by source in tons of eCO_2.

Discussion and Suggestions

Waste management is an important component to County governments. Trash is always being generated, and the volume of trash will likely increase as population continues to grow. Local governments need to figure out what to do with solid waste, where to put it, and make decisions to reduce greenhouse gas emissions generated by facilities and the vehicles that transport garbage. A large amount of fossil fuels are used for moving refuse from its point of origin to its final destination. This is why mitigation is needed in the waste management sector. One example of mitigation in waste management would be to use more fuel efficient vehicles to transport waste. Not only will this reduce the amount of greenhouse gasses coming from these vehicles, but it would save money for the Baltimore County government because less fuel would be needed to take refuse where it needs to go. Another way to mitigate GHG emissions in this sector would be to send more trash to facilities that burn trash for generating electricity. If more waste gets sent to such a facility, it means less waste being sent to landfills. This method of generating electricity would mean less fossil fuels being burned to meet energy demands.

V. Final Data

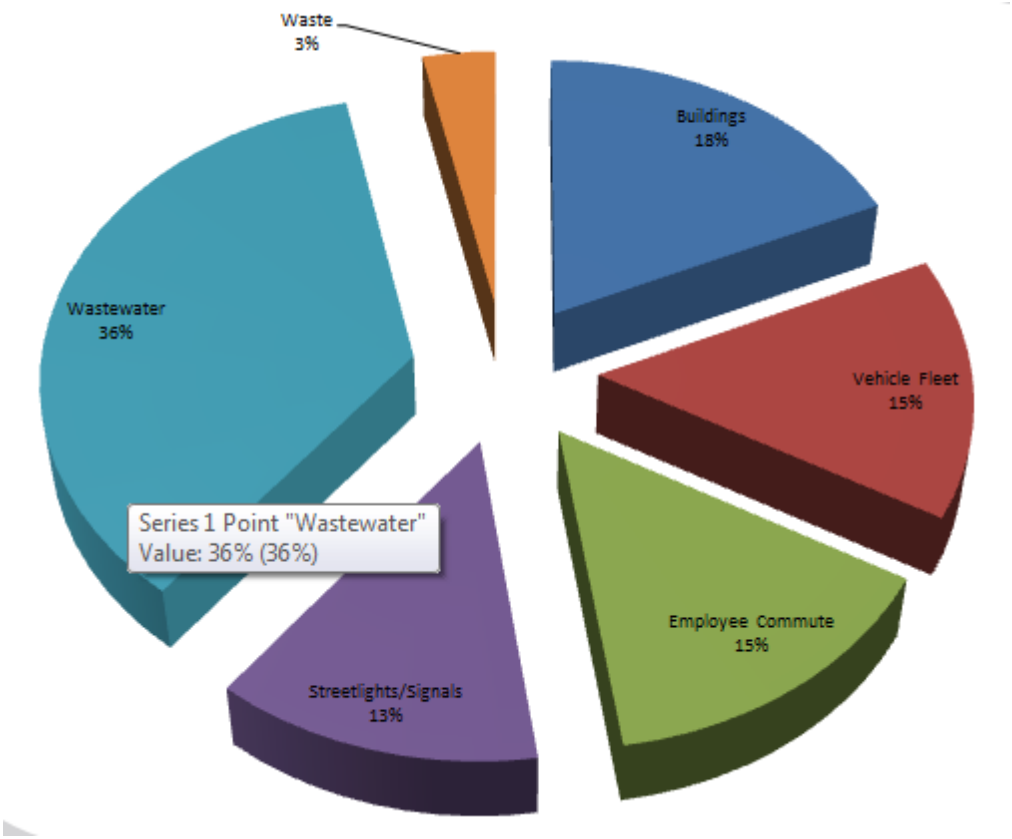

Figure 5: Graphical display of emissions by source.

Year 2012	Annual Usage	Tons eCO2	%
Buildings	33,671,477 kwH	30,465	18%
Vehicle Fleet	2,656,535 (Gallons of fuel)	24,665	15%
Employee Commute	2,733,837 (Gallons of fuel)	24,304	15%
Streetlights/Signals	30,510,000 kwH	21,526	13%
Wastewater	60 billion gallons	59,914	36%
Solid Waste	2687 tons	5,739	3%
Govt. Emissions		166,613	100%

Table 8: shows total emissions in both absolute numbers and percentages.

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Appendix

I. Raw building Data provided by Janet Stiepler for 2011-2012

2011

Building Number	Building Name	Total BldgSqFt	Oil Gal	Gas Therms	Elec KWH	Total Cost
645	Agricultural Center	14700	1842.8	0	139500	16097.32
258	Animal Control Division Main Office / Kennel	11680	5071	0	119072	22083.48
781	Arbutus Community Center	9000	0	339	62760	5424.46
784	Arbutus Senior Center (New)	16500	0	349	63400	5507.13
470	Ateaze Senior Center	35140	0	27269	294000	50525.5222
467	Back River Community Center and Storage Building	36025	7883	0	101466	28022.54
302	Banneker Center	13050	0	8874	223900	27983.2839
535	Banneker Museum	6046	0	2318	131400	12959.9445
395	Bengies Community Center	2824	1865	0	24200	6711.13
862	Bloomsbury Community Center and Storage Building	57000	0	46488	955382	116326.5717
264	Brady Avenue Utilities Building	16420	0	7862	202800	23730.7771
14	Brooklandville Fire Station - Station # 14	10748	0	9229	131540	18798.2343
77	Bykota Senior Center	51133	28900	1128	545500	116569.1002
982	Carver Annex	14364	0	6318	65945	10717.0049
934	Catonsville Fire Station - Station # 4 / Councilman's Office	3993	0	8348	112929	16384.305
504	Catonsville Senior Center	20932	0	18974	353876	45417.7444
902	Central Alarmers / County Council Dist 6 Office	5075	0	3107	40765	6076.3951
35	Chase Fire Station - Station # 54	9900	6028	0	131100	25702.82
297	Chesterwood Maintenance Shop (County Ride)	2830	538	0	0	1308.69
661	Cockeysville P.A.L. Center	3623	0	1810	48394	5503.2422
97	Cockeysville Police - Precinct #7	8242	0	7259	222646	24525.6119
940	Cockeysville Senior Center	9392	0	1791	133300	12291.5989
932	County Courts Building	351097	0	167780	8316000	800481.92
930	County Office Bldg	113554	28805	1837	1539200	201919.5839
929	Courthouse	147130	38738	2628	1788200	249735.0187
95	Detention Center / Expansion	494559	70213	304841	10926500	1328981.174

295	Double Rock Maint. Shop	4679	0	0	124500	10260.33
217	Drumcastle Center	179316	0	-90	4876200	387815.013
967	Dulaney Senior High School - Rec n Parks (Mnt. Access. Bld.)	500	0	0	8867	726.34
829	Dundalk Community Center (09 renovation)	42193	0	47834	954900	117048.7279
6	Dundalk Fire Station - Station # 6	12023	0	7137	148500	18746.8786
222	Dundalk Health Center	3700	1386	0	75047	9663.7
224	Eastern Family Resource Center	53944	0	81961	1646600	198511.044
262	Eastern Regional Park Community Center and Pavilion	9000	0	3891	251500	24543.6164
637	Eastern Sanitary Landfill Maint Bldg.	9656	0	0	180992	14871.23
571	Eastern Sanitary Landfill Scalehouse	943	2501	0	59056	10937.81
15	Eastview Fire Station - Station # 15	11284	0	13245	0	11747.3579
918	Edgemere Fire Station - Station # 9	13655	0	8400	188600	22647.5346
64	Edgemere Senior Center & Pavilion	12052	0	7908	149200	19212.0558
7	Essex Fire Station - Station # 7	10458	0	8248	99600	15298.8315
225	Essex Health Center	6000	0	2281	77083	8294.1605
99	Essex Police - Precinct # 11	16000	0	5159	312257	30300.0963
250	Essex Senior Center (COOLING CENTER)	12407	0	7960	181374	21932.7529
68	Essex Service / Repair Shop - V.O.M.	2550	0	1904	36471	4806.4034
472	Essex Utilities Yard	2285	2184	0	30932	7850.59
847	Essex WIC Program	1539	0	313	20678	1974.2045
924	Fleming Center /Pavilion/Storage - (Reconstructed 2000)	12939	0	10018	176052	23212.383
267	Franklin Fire Station #56	9000	3942.3	0	82300	16570.35
266	Franklin Police - Precinct #3	24370	14749	0	623300	86990.69
851	Fullerton Community Building	9000	0	4450	84700	11234.427
966	Fullerton Elementary School - Rec n Parks (Field Lighting)	2400	0	0	44600	3654.54
8	Fullerton Fire Station - Station # 8	9297	0	9937	115100	18319.7749
809	Fullerton Utilities Engineering And Regulation	9870	0	19509	439600	71724.7675
806	Fullerton Utilities Pumping Division	23190	0	20892	450900	52699.9113
19	Garrison Fire Station - Station # 19	8996	0	8944	108600	16982.9174
40	Glen Arm Maintenance Facility	201500	0	90049	1937600	230627.3301

16	Golden Ring Fire Station - Station # 16	9286	0	8808	102600	16264.2929
772	Gunpowder Falls Community Center (Mt. Vista Park)	8265	2643.5	0	128800	17158.68
396	Halethorpe Community Center/ Pavilions (2)	2260	1830	0	7410	5175
5	Halethorpe Fire Station - Station # 5	12962	0	8078	91842	14643.1494
853	Hannah More Center	25275	0	35241	515300	70258.6774
613	Highway Shop - Brady Avenue (Shop 1/ Districts 13 & 1)	6500	0	4180	72640	9739.9195
604	Highway Shop - Clarks Lane (Shop 3 / Districts 3 & 4)	2827	3042.4	0	63632	12657.27
905	Highway Shop - Emala Avenue (Shop 8 / District 15)	2310	0	3339	111909	12591.9207
607	Highway Shop - Graystone Road (Shop 4-3 / District 7 & 10)	2925	2225	0	65800	10818.52
611	Highway Shop - Hydes Road (Shop 7-2 / District 11)	2116	2339	0	50560	9840.92
584	Highway Shop - Longview (New)	2800	0	0	75171	6174.68
606	Highway Shop - Middletown Road (Shop 4-2 / District 6)	1892	2452	0	78440	12411.14
614	Highway Shop - Perry Road (Shop 7-1 / District 14)	3060	0	2773	57100	7597.9242
605	Highway Shop - Ridge Road (Shop 4-1 / District 5)	2793	0	0	10619	873.15
202	Highway Shop - Sparrows Point / Rec.Pks. Main.	7194	0	7147	154600	18722.1191
602	Highway Shop - Windsor Mill Road (Shop 2 / Districts 1 & 2)	6100	0	4026	114640	13519.5295
11	Hillendale Fire Station - Station # 11	10226	0	8291	98800	20995.2221
76	Hillendale P.A.L. Center	7154	0	3516	61567	7969.3651
816	Holt Park Arts Center/Main House (102 McCormick Ave)	1942	0	0	27621	2266.42
271	Honeygo Run Regional Park / Community Center	13140	2885.7	0	237995	26897.4
50	Human Resources- Allegheny Annex	16551	0	6537	227300	24306.9659
59	Hunt Valley Facility - Gilroy	83850	0	27889	1158800	122061.2155
591	Inverness Community Center	9000	0	5090	112100	16285.8251
906	Inwood Maintenance Shop	11096	0	5431	110570	13834.9715
692	Jacksonville Community/Senior Center	14700	0	0	75700	6245.25
595	Jefferson Office Building	91920	0	28528	1060200	112182.6719
293	Kingsville Athletic Fields/Pavilion	1400	0	0	93789	7687.48
227	Lansdowne Health Center (Baltimore Highlands)	7106	0	5322	100198	13320.4934
585	Lansdowne P.A.L. Center (07/20/05)	9324	0	0	51750	4255.56
751	Lansdowne Senior Center (COOLING CENTER)	5552	0	3847	78500	9976.6429
878	Liberty Center/Randallstown Plaza	39000	0	9590	111000	21131.64

989	Liberty Family Resource/Senior Center	31865	0	6063	558300	51130.7969
243	Liberty FRC Annex	5992	0	0	133500	11596.56
991	Liberty Service / Repair Shop - V.O.M.Randallstown Service Center	4514	0	6213	56632	9943.7374
320	Loch Raven Center	37492	26712.4	0	235750	89370.13
410	Loch Raven Fishing Center - Comfort Station/Park Office	1504	0	0	49790	4087.67
394	Loreley Community Building	2767	0	1175	22262	3618.72
251	Mars Estates PAL Center	7082	0	3406	51800	7157.6879
84	Marshy Point Nature Center	9840	0	0	192230	17632.96
38	Medic Unit # 58 - Back River Neck	1736	0	0	36896	3035.67
12	Middle River Fire Station - Station # 12	10365	0	7107	88680	14071.3314
780	North Point Government Center / Police	124985	576400	2868	1744200	286473.94
782	Northeast Regional Recreation Center (Perring Racquet Club)	90000	5652	43931	801400	116474.6531
938	Oregon Ridge Nature Center	5332	724	0	41530	5169.45
399	Oregon Ridge Ski Lodge	5630	1494	6021	61443	13818.3645
922	Overlea Community Building / Fullerton Pavilion/Storage	4351	0	1736	33592	4217.1438
761	Overlea Senior Center	5552	0	5479	106900	13719.8126
762	Parkton Fire Station - Statio #60	10560	5725.7	0	140320	25772.7
460	Parkville Center-Rec Parks/Senior Ctr. (COOLING CENTER)	49229	0	30118	391000	57998.2679
589	Parkville Fire Station (09/15/05)	9000	0	5938	100280	13387.5416
592	Parkville Police Station	17628	0	17041	496280	55619.2824
20	Perry Hall Fire Station - Station # 55	12284	0	9243	131300	18785.5918
87	Pikesville Fire Station #2 (New)	14744	0	5424	114000	14306.8757
593	Pikesville Police Station	17628	0	17642	498600	55421.25
919	Pikesville Senior Center/Library	15633	0	2332	342600	30088.6865
474	Pikesville Service Center	1582	2605	0	17218	7886.13
594	Police Aviation Hangar (5/06)	10000	0	4378	123840	13988.6297
92	Police Pistol Range	11932	0	11366	148034	22020.3989
994	Public Safety Building	211308	0	842963	6778800	1136359.163
263	Public Works Training Academy	4800	819	0	68277	7648.68
965	Randallstown Community Center	58000	0	25884	1311400	128708.0282

18	Randallstown Fire Station - Station # 18	8740	0	0	274700	23050.79
241	Reisterstown Regional Park/Comfort Station	1435	0	0	174000	16479.47
4	Rosedale Senior Center	7533	0	637	131500	11293.1851
231	Scotts Branch P.A.L. Center	6700	0	3079	53600	7171.2676
628	Seven Oaks Senior Center	7755	0	0	199000	17157.04
126	Shady Spring P.A.L.	6700	0	5386	69100	10143.6767
150	Sherwood House / Garage (Park Offices)	7106	4124	0	33479	12773.64
265	South East Regional Recreation Center	22800	0	5153	208800	21608.7811
203	Sparrows Point Fire Sta. #57& Fire Rescue Academy	11552	0	7338	159100	19173.8825
596	Stembridge Community Center/Police Substation	16000	0	2957	124800	13265.2526
17	Texas Fire Station - Station # 17	10234	0	10934	125600	19507.0489
404	Texas Pest House	861	0	0	24656	2026.3
1	Towson Fire Station - Station # 1 / Hwy Shop Bosley Ave.	23600	0	25691	218800	46425.3732
172	Towson Health Center / Loch Raven Mini Library	14001	0	7524	150000	19097.4064
206	Towson Police - Precinct #6	17628	0	15232	492900	53777.8211
913	Vehicle Operations & Maintenance / Central Garage	30396	0	53036	390800	76529.61
393	Victory Villa Community Building	9400	4316	0	56236	15564
391	Victory Villa Senior Center	6801	0	0	180932	15120.43
763	Watersedge Community Center (Concrete Homes)	9000	0	3323	105520	11481.4362
13	Westview Fire Station - Station # 13	12024	0	10962	108280	18500.0009
21	White Marsh Police - Precinct # 9	23082	0	14780	481600	52068.8296
496	WIC Program - Chartley SC (Leased 8/29/03)	1672	0	294	20537	1932.5403
101	Wilkens Police - Precinct #1	10231	0	7284	206898	23258.4362
130	Willow Grove / Nature House (Merrick House) and Spring HouseNature House	3224	0	0	36020	2961.77
219	Winfield P.A.L. Center	6700	0	3602	55200	7485.7027
274	Woodlawn Community / Senior Center	12900	691	7118	148000	19331.7631
392	Woodlawn Community Building (Stone Bldg.)	2082	2033	0	9126	5692.08
3	Woodlawn Fire Station - Station # 3	19538	0	13462	175100	26388.4994
923	Woodlawn Health Center / Library	4060	0	0	50451	4715.14
100	Woodlawn Police -Precinct # 2	29075	0	22234	484100	59023.0083

846	Woodlawn WIC Program (Not used after 05/23/11)	1975	0	0	36200	2971.68
127	Woodmoor P.A.L.	6700	0	5681	79900	11194.7129
845	Young Parent Support Center	4308	0	2346	83627	8876.7159

2012

Building Number	Building Name	Total BldgSqFt	Oil Gal	Gas Therms	Elec KWH	Total Cost
645	Agricultural Center	14700	0	0	143500	12308
258	Animal Control Division Main Office / Kennel	11680	2780	0	60961	13447.9
781	Arbutus Community Center	9000	0	588	67600	6111.35
784	Arbutus Senior Center (New)	16500	0	355	42280	3773.65
470	Ateaze Senior Center	35140	0	5092	167700	17876.9
467	Back River Community Center and Storage Building	36025	3593	0	50640	15342.19
302	Banneker Center	13050	0	1907	122100	13387.53
535	Banneker Museum	6046	0	251	56700	4990.17
395	Bengies Community Center	2824	859	0	16509	4020.36
862	Bloomsbury Community Center and Storage Building	57000	0	10848	443943	45245.29
264	Brady Avenue Utilities Building	16420	0	1408	90200	8525.83
14	Brooklandville Fire Station - Station # 14	10748	0	2459	63640	7084.58
77	Bykota Senior Center	51133	14421	459	239200	63681.29
982	Carver Annex	14364	0	2141	31683	4298.81
934	Catonsville Fire Station - Station # 4 / Councilman's Office	3993	0	2062	60628	6612.55
504	Catonsville Senior Center	20932	0	4062	188280	18849.39
902	Central Alarmers / County Council Dist 6 Office	5075	0	563	18993	1989.82
35	Chase Fire Station - Station # 54	9900	2604	0	61900	13090.34
297	Chesterwood Maintenance Shop (County Ride)	2830	502	0	0	1492.2
661	Cockeysville P.A.L. Center	3623	0	356	28500	2722.02
97	Cockeysville Police - Precinct #7	8242	0	1687	116865	11421.3
940	Cockeysville Senior Center	9392	0	997	62200	5999.37
932	County Courts Building	351097	0	53850	3567200	338541.01
930	County Office Bldg	113554	6553	803	730300	84152.3
929	Courthouse	147130	13247	1248	903245	118292.66
95	Detention Center / Expansion	494559	36008	212008	6092580	765544.48
295	Double Rock Maint. Shop	4679	0	0	22700	1780.3
217	Drumcastle Center	179316	0	5	2495400	204699.95
967	Dulaney Senior High School - Rec n Parks (Mnt. Access. Bld.)	500	0	0	3003	255.85

829	Dundalk Community Center (09 renovation)	42193	0	17025	600700	62319.67
6	Dundalk Fire Station - Station # 6	12023	0	1231	72100	7155.52
222	Dundalk Health Center	3700	606	0	29646	4580.83
224	Eastern Family Resource Center	53944	0	37957	919300	103109.71
262	Eastern Regional Park Community Center and Pavilion	9000	0	421	180100	15658.95
637	Eastern Sanitary Landfill Maint Bldg.	9656	0	0	74048	6195.99
571	Eastern Sanitary Landfill Scalehouse	943	2907	0	18619	10198.82
15	Eastview Fire Station - Station # 15	11284	0	2827	0	2063.06
918	Edgemere Fire Station - Station # 9	13655	0	1513	118600	11361.61
64	Edgemere Senior Center & Pavilion	12052	0	1958	91900	9113.15
7	Essex Fire Station - Station # 7	10458	0	1489	68500	6867.8
225	Essex Health Center	6000	0	246	41585	3762.58
99	Essex Police - Precinct # 11	16000	0	1916	179453	16606.33
250	Essex Senior Center (COOLING CENTER)	12407	0	1553	102021	9744.76
68	Essex Service / Repair Shop - V.O.M.	2550	0	259	24065	2181.91
472	Essex Utilities Yard	2285	2714	0	21089	4613.32
847	Essex WIC Program	1539	0	7	12434	1066.03
924	Fleming Center /Pavilion/Storage - (Reconstructed 2000)	12939	0	1111	100743	9516.31
267	Franklin Fire Station #56	9000	300.2	0	41000	4213.5
266	Franklin Police - Precinct #3	24370	8517	0	326300	53287.5
851	Fullerton Community Building	9000	0	573	42900	4326.7
966	Fullerton Elementary School - Rec n Parks (Field Lighting)	2400	0	0	32700	2724.3
8	Fullerton Fire Station - Station # 8	9297	0	1738	56600	6024.35
809	Fullerton Utilities Engineering And Regulation	9870	0	4668	283000	42599.79
806	Fullerton Utilities Pumping Division	23190	0	10335	235000	26353.13
19	Garrison Fire Station - Station # 19	8996	0	1908	53800	5765.12
40	Glen Arm Maintenance Facility	201500	0	18963	806400	78279.09
16	Golden Ring Fire Station - Station # 16	9286	0	1661	55920	6079.88
772	Gunpowder Falls Community Center (Mt. Vista Park)	8265	575.2	0	79300	8114.94
396	Halethorpe Community Center/ Pavilions (2)	2260	1179	0	3993	3838.84
5	Halethorpe Fire Station - Station # 5	12962	0	1972	50770	5599.66
853	Hannah More Center	25275	0	2701	248500	22782.04
613	Highway Shop - Brady Avenue (Shop 1/ Districts 13 & 1)	6500	0	-558	27120	1934.95
604	Highway Shop - Clarks Lane (Shop 3 / Districts 3 & 4)	2827	1511.9	0	25933	6389
905	Highway Shop - Emala Avenue (Shop 8 / District 15)	2310	0	298	51727	4579.36
607	Highway Shop - Graystone Road (Shop 4-3 / District 7 & 10)	2925	795	0	26920	4613.82

611	Highway Shop - Hydes Road (Shop 7-2 / District 11)	2116	772	0	23200	4257.57
584	Highway Shop - Longview (New)	2800	0	0	31742	2655.01
606	Highway Shop - Middletown Road (Shop 4-2 / District 6)	1892	1352	0	32240	6730.98
614	Highway Shop - Perry Road (Shop 7-1 / District 14)	3060	0	304	25000	2554.63
605	Highway Shop - Ridge Road (Shop 4-1 / District 5)	2793	0	0	3359	281.2
202	Highway Shop - Sparrows Point / Rec.Pks. Main.	7194	0	806	73700	6752.4
602	Highway Shop - Windsor Mill Road (Shop 2 / Districts 1 & 2)	6100	0	562	46360	4264.5
11	Hillendale Fire Station - Station # 11	10226	0	2333	54920	6289.47
76	Hillendale P.A.L. Center	7154	0	772	28464	2910.9
816	Holt Park Arts Center/Main House (102 McCormick Ave)	1942	0	0	13260	1112.23
271	Honeygo Run Regional Park / Community Center	13140	0	0	138398	13698.71
50	Human Resources- Allegheny Annex	16551	0	1265	132600	12270.49
59	Hunt Valley Facility - Gilroy	83850	0	5554	558700	51358.79
591	Inverness Community Center	9000	0	1017	57200	6477.64
906	Inwood Maintenance Shop	11096	0	1438	43380	4540.86
692	Jacksonville Community/Senior Center	14700	0	0	73300	6246.2
595	Jefferson Office Building	91920	0	8009	493800	48023.96
293	Kingsville Athletic Fields/Pavilion	1400	0	0	64609	5450.6
227	Lansdowne Health Center (Baltimore Highlands)	7106	0	1761	56282	6158.81
585	Lansdowne P.A.L. Center (07/20/05)	9324	0	0	17400	1430.85
751	Lansdowne Senior Center (COOLING CENTER)	5552	0	776	37000	3732.45
878	Liberty Center/Randallstown Plaza	39000	0	2930	156300	14925.73
989	Liberty Family Resource/Senior Center	31865	0	1652	266800	24429.04
243	Liberty FRC Annex	5992	0	0	42500	3860.43
991	Liberty Service / Repair Shop - V.O.M.Randallstown Service Center	4514	0	1366	23307	2847.71
320	Loch Raven Center	37492	8643.5	0	189800	43105.16
410	Loch Raven Fishing Center - Comfort Station/Park Office	1504	0	0	20450	1711.1
394	Loreley Community Building	2767	0	0	7756	678.16
251	Mars Estates PAL Center	7082	0	903	32500	3343.73
84	Marshy Point Nature Center	9840	0	0	84021	7092.92
38	Medic Unit # 58 - Back River Neck	1736	0	0	10803	892.26
12	Middle River Fire Station - Station # 12	10365	0	1463	57200	5967.34
780	North Point Government Center / Police	124985	21602	1145	1168800	161982.44
782	Northeast Regional Recreation Center (Perring Racquet Club)	90000	924	8991	316500	35502.68
938	Oregon Ridge Nature Center	5332	1008	0	19460	4624.13
399	Oregon Ridge Ski Lodge	5630	29	1121	30793	3403.77

922	Overlea Community Building / Fullerton Pavilion/Storage	4351	0	270	19669	1832.19
761	Overlea Senior Center	5552	0	1126	54300	5377.8
762	Parkton Fire Station - Statio #60	10560	0	0	54560	4602.64
460	Parkville Center-Rec Parks/Senior Ctr. (COOLING CENTER)	49229	0	6024	180400	19552.64
589	Parkville Fire Station (09/15/05)	9000	0	1160	46320	4659.24
592	Parkville Police Station	17628	0	5667	265120	27050.92
20	Perry Hall Fire Station - Station # 55	12284	0	1493	70500	7100.88
87	Pikesville Fire Station #2 (New)	14744	0	823	66800	6488.31
593	Pikesville Police Station	17628	0	8074	267600	28294.8
919	Pikesville Senior Center/Library	15633	0	446	170600	14771.7
474	Pikesville Service Center	1582	1983	0	6562	3566.81
594	Police Aviation Hangar (5/06)	10000	0	488	53880	4887.42
92	Police Pistol Range	11932	0	1733	65465	6655.07
994	Public Safety Building	211308	0	439071	3721200	556368.63
263	Public Works Training Academy	4800	0	0	33248	2734.22
965	Randallstown Community Center	58000	0	7254	603700	55258.84
18	Randallstown Fire Station - Station # 18	8740	0	0	109000	9141.8
241	Reisterstown Regional Park/Comfort Station	1435	0	0	90400	10363.84
4	Rosedale Senior Center	7533	0	192	68400	5778.13
231	Scotts Branch P.A.L. Center	6700	0	900	31100	3323.33
628	Seven Oaks Senior Center	7755	0	0	78300	6950.1
126	Shady Spring P.A.L.	6700	0	576	43700	4027.92
150	Sherwood House / Garage (Park Offices)	7106	1901	0	15337	6945.2
265	South East Regional Recreation Center	22800	0	558	103100	9149.04
203	Sparrows Point Fire Sta. #57& Fire Rescue Academy	11552	0	1416	81300	7818.63
596	Stembridge Community Center/Police Substation	16000	0	305	66400	5812.3
17	Texas Fire Station - Station # 17	10234	0	2643	61100	6904.82
404	Texas Pest House	861	0	0	11487	959.75
1	Towson Fire Station - Station # 1 / Hwy Shop Bosley Ave.	23600	0	6531	98200	14896.45
172	Towson Health Center / Loch Raven Mini Library	14001	0	1669	71800	7151.24
206	Towson Police - Precinct #6	17628	0	6682	268700	27471.27
913	Vehicle Operations & Maintenance / Central Garage	30396	0	12682	192300	24521.46
393	Victory Villa Community Building	9400	2150	0	32606	9423.86
391	Victory Villa Senior Center	6801	0	0	64820	5737.85
763	Watersedge Community Center (Concrete Homes)	9000	0	289	49720	4434.67
13	Westview Fire Station - Station # 13	12024	0	3265	46840	6318.92
21	White Marsh Police - Precinct # 9	23082	0	4845	256200	25134.0

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496	WIC Program - Chartley SC (Leased 8/29/03)	1672	0	116	10093	931.85
101	Wilkens Police - Precinct #1	10231	0	1739	103712	10194.71
130	Willow Grove / Nature House (Merrick House) and Spring HouseNature House	3224	0	0	13120	1075.58
219	Winfield P.A.L. Center	6700	0	851	25900	2753.34
274	Woodlawn Community / Senior Center	12900	0	1732	78400	7834.2
392	Woodlawn Community Building (Stone Bldg.)	2082	1456	0	4651	4719.22
3	Woodlawn Fire Station - Station # 3	19538	0	2491	82200	8843.81
923	Woodlawn Health Center / Library	4060	0	0	23981	2175.75
100	Woodlawn Police -Precinct # 2	29075	0	5671	247200	25216.4
127	Woodmoor P.A.L.	6700	0	1157	35400	3765.13
845	Young Parent Support Center	4308	0	219	42946	3813.47