A RENEWABLE ENERGY PLAN FOR THE

OAK GROVE SANITARY LANDFILL IN

WINDER, GEORGIA

by

TRACY L. HAMBRICK

(Under the Direction of JOHN "JACK" CROWLEY)

ABSTRACT

Oak Grove Sanitary Landfill in Winder, Georgia is already refining its landfill gas (LFG) and sending it through the natural gas pipeline. This is more economic and better for the environment than simply flaring off the excess. This paper proposes using the landfill to phase in ground-mounted solar panels on the cap of the adjacent, closed Speedway Landfill, and then onto the already closed south and west portions Oak Grove. Then adding a solar cap to the south and west sides as Oak Grove closes and more ground-mounted solar on top. Additional ground-mounted panels can be added as more sections of the landfill close. As our population increases there is a growing demand for energy production, and the need to find clean ways to produce energy is more important than ever. Producing energy with solar panels would produce long-term income on land that cannot be developed and allow ongoing funding to buy additional solar panels to be phased in.

INDEX WORDS: landfill gas, solar installation, Oak Grove Sanitary Landfill, Winder, Georgia, GA, energy planning

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by

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Master's of Environmental Planning and Design, University of Georgia, 2011

BSES, University of Georgia, 2004

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF ENVIRONMENTAL PLANNING AND DESIGN

ATHENS, GEORGIA

2011

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by

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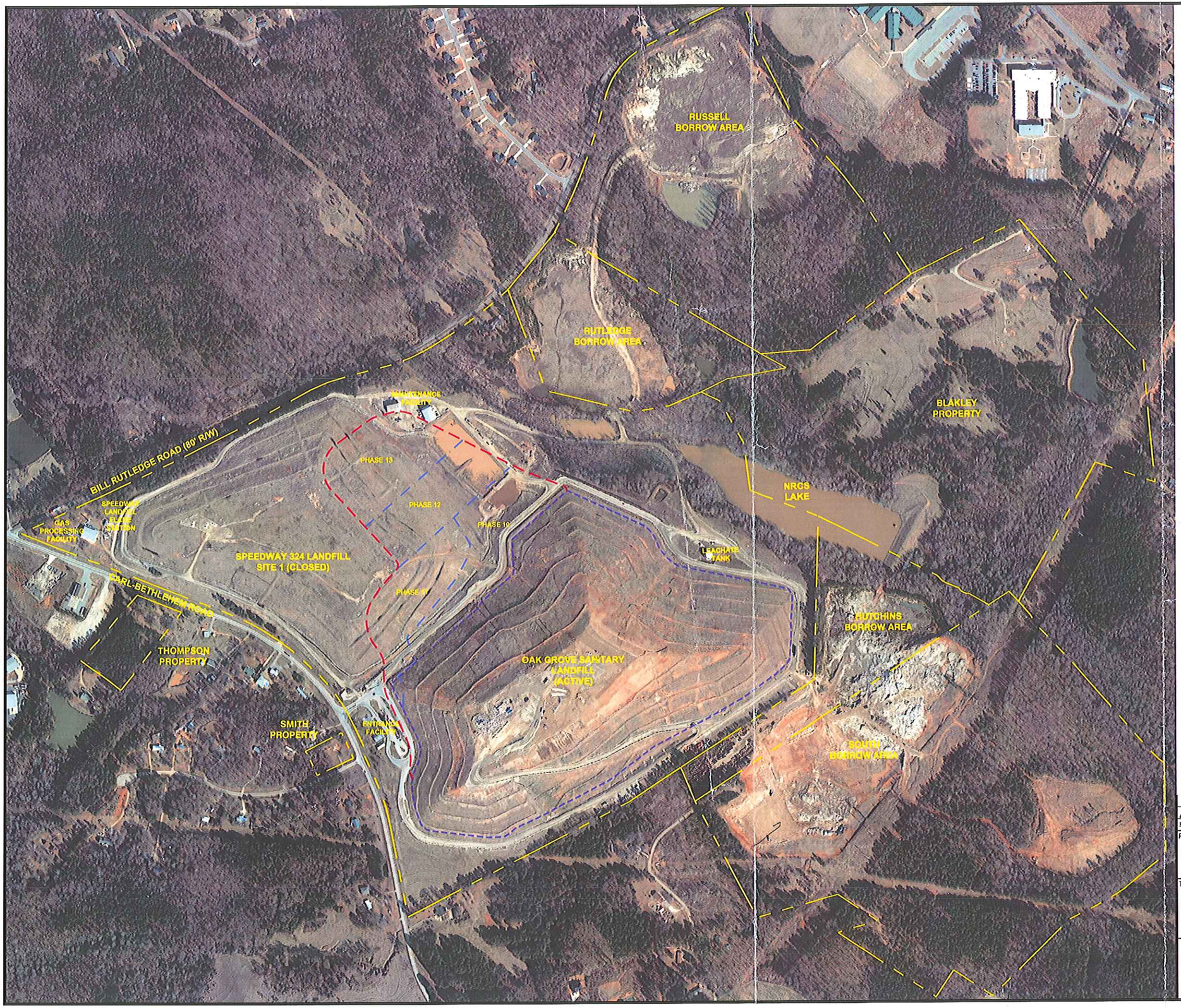

LEGEND

- PROPERTY BOUNDARY
- LIMITS OF WASTE
- LIMITS OF EXPANSION WASTE
- PHASE BOUNDARIES

REFERENCES

1. AERIAL PHOTOGRAPH OBTAINED FROM HENDERSON AERIAL SURVEYS, INC DATED 02/13/11.

600 0 600
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW
1	–	–	–	–		

PROJECT
REPUBLIC SERVICES OF GEORGIA, LP
OAK GROVE SANITARY LANDFILL
BARROW COUNTY, GEORGIA

TITLE
CURRENT YEAR'S AERIAL PHOTO

Golder Associates
Atlanta, Georgia

PROJECT No.	11390019.2		FILE No.	11390019A01	
DESIGN	–	–	SCALE	AS SHOWN	REV. –
CADD	CCP	04/11			
CHECK	BG	04/11		1	
REVIEW	KSB	04/11			

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CHAPTER 1

STAKEHOLDER BACKGROUND

Oak Grove Sanitary Landfill is located at 967 Carl Bethlehem Road, Winder, GA 30680, just to the east of University Parkway (GA 316). Oak Grove is located adjacent to the now-closed Speedway Landfill. Speedway was originally owned by Louis Cooper then bought by Mid-America which was then purchased by Republic Services, the current owner. Oak Grove is the landfill for Barrow County and is "permitted by the State of Georgia to accept household, commercial, and industrial waste, construction and demolition debris, land clearing materials as well as contaminated soils asbestos, sludge, and other pre-approved non-hazardous wastes" (United Waste). Next is the company history and information for the local power company for whom this project will provide power, Jackson EMC.

This history and information about Jackson EMC is important as it shows how Jackson EMC has evolved from a rural energy provider founded on more traditional ways of producing energy to the company that is welcoming green energy production. Jackson EMC provides electricity to rural Barrow and Hall counties. According to Mark Zoller, Commercial/Industrial Marketing Engineer at Jackson EMC, EMCs were founded after the depression when it was considered too expensive to extend electrical service beyond the density of cities. After the Depression, private electric power companies were not interested in building power lines and providing electrical service to the rural communities because it was not economical to build a power line for a couple of homes within several miles, so the private power companies chose not

to do so. In 1935 the Rural Electrification Act was passed which offered below-market interest rates to private companies as an incentive to expand service to rural areas. This was not enough incentive so in 1936 the Act was amended which provided federal money to private citizens that would operate a non-profit systems and offer wholesale power to these rural areas. The result was the Rural Electrification Administration, which was the clearinghouse for engineers and accountants for the rural providers. This system worked and provided many rural areas with electricity the private companies would not have bothered to provide. During World War II the money for the program was halted, but the program still continued. Further legislation designated that power companies were assigned territories and that competing companies could not infringe on another's territory. (Jackson EMC)

Jackson EMC does not generate its own power. Oglethorpe Power Corporation provides fifty-four percent and 47% is purchased from the open market. Of the 54% provided by Oglethorpe Power, 9% is provided by Plant Hatch (nuclear), 12.6% is from Plant Vogel (nuclear), 17.2% is from Plant Scherer (coal), and 8.0% is from Plant Wansely. The remainder is provided through natural gas, biomass, and hydropower. Zoller said that using Oak Grove Landfill's LFG while phasing in solar panels would be an ideal way to provide green power to Jackson EMC and its customers." (M. Zoller, personal communication, March 2011)

CHAPTER 2

CASE STUDIES

Seminole Road Landfill is located at 4203 Clevemont Road, Ellenwood, GA 30294. Seminole Road Landfill is a waste to energy facility that uses its landfill gas to power Caterpillar generators and produce electricity that is then fed directly to the grid. SCS Energy designed the 3.2 Mwh landfill gas to natural gas refinement and electrical production system for DeKalb County. From information provided by Caterpillar, "The Seminole Road Landfill is the second-largest permitted, municipal solid-waste landfill in Georgia. Located in DeKalb County, the 1,800 tons of refuse the landfill accepts each day consists predominantly of residential solid waste. Through the natural process of bacterial decomposition of organic material contained in the landfill, a 50/50 mix of methane and carbon dioxide is produced as a byproduct.

The DeKalb County Seminole Road Landfill "Green Energy" Project was designed to meet the need of Georgia Power (a subsidiary of Southern Company) and generate revenue for DeKalb County, Georgia, from the sale of green power to the local electric power utility grid. Cat® generator sets and switchgear provide electric power for DeKalb County under contract to Georgia Power to help the utility meet its requirements to offer green power from renewable energy sources to consumers. Green power can be described as electricity produced in an environmentally friendly manner, from renewable resources. Sources that include the sun, wind, and, in this project, methane generated from the natural decomposition of municipal solid waste in a landfill that is used to fuel low-emission electric power generator sets.

Methane gas from the Seminole Road Landfill is captured to fuel the power system. Using Cat generator sets and switchgear, the electric power generated is then metered and fed into the local Georgia Power utility grid to be resold as green power to residential and commercial customers. The project not only generates revenue for DeKalb County, but it also produces electric power from methane that previously had been "flared," or burned off to the atmosphere.

Originally commissioned and put on line on October 12, 2006, the Seminole Road Landfill Project taps the existing source of methane in the landfill through a process designed and installed by the county. Initially, pipes are inserted up to 120 feet into the landfill to provide a point of release for the landfill gases. A slight vacuum is then applied in the pipe to draw the gases into and up through it to the pre-treatment facility, where the methane is collected and treated for use as fuel in the generator sets.

At most municipal solid-waste landfills, all of the methane and carbon dioxide mixture is destroyed in a gas collection and control system or utility flare. However, at the Seminole Road Landfill, at least two-thirds of the methane that would ordinarily be piped to the flare station is redirected to the fuel pre-treatment system and then ultimately to the generator facility. The remaining one-third of the methane is stored in reserve to compensate for any fluctuations in methane quantity or content and thereby ensure continuous electric power output. At the generator facility, two 20-cylinder Cat G3520C engines run continuously, burning the extracted methane, while any remaining gases are sent to the flare station to be safely burned off. Together, these Cat generator sets produce 3.2 megawatts of electricity per hour, which is sent through Cat switchgear to Georgia Power's River Road Substation. From the substation, residential and commercial Green Energy subscribers purchase electricity in 100-kilowatt-per-

hour blocks each month. Cat switchgear was installed after the first phase of construction as the first step in expanding the facility, and plans are currently being finalized for permitting a third generator set as early as 2009. (This will be added as more production due to the increase of landfill disposal areas that are producing methane. The methane plant and new flare will be installed due to the increase in methane.)

According to Michaell Bever, senior sales engineer for Yancey Power Systems, the strength of the Cat product was a significant factor in DeKalb County's selection of Caterpillar® equipment for the project. "The Cat G3520C generator sets are unique in the industry in offering high power density. This means that they produce a very high output of electric power per square foot of space," explained Bever, who assisted in the project's contract, design, and development. "When you add in their low nitrogen oxide (NOx) emissions and cost-competitive initial price and operating expenses, it's clear they were the perfect fit for this project." This observation is echoed by Billy Malone, an assistant director with the DeKalb County Sanitation Division who led development and execution of the project. "Cat got the NOx emission levels way down for us. The NOx emission limit allowed by our Georgia Environmental Protection Division permit for each engine is 0.5 g/bhp-hr, and the two Cat engines currently emit 0.26 and 0.24 of total NOx—half of our permitted total NOx emission cap," said Malone.

The Seminole Road Landfill Project has proven to be an overwhelming success in generating green power. According to Stan Meiburg, EPA deputy regional administrator, the Seminole Road Landfill Project will offset fossil fuel greenhouse gas emissions of 17,100 metric tons of carbon dioxide equivalents per year—the equivalent of removing emissions from 3,300 vehicles on the nation's roads, reducing oil consumption by 40,000 barrels, or planting 4,700 acres of forest. "This project allows DeKalb County to take an otherwise wasted source of

energy and use it to generate electricity, which benefits the environment and area residents through lower emissions," said Meiburg.

In fact, landfill gas is the only renewable form of energy that directly reduces the amount of pollution released into the atmosphere. Moreover, the Cat generator sets are industry leading low-emission units that produce power from a fuel source while emitting minimal levels of volatile organic compounds (VOCs).

The Seminole Road Landfill Project has generated more than just electric power. The $5 million project generates revenues of approximately $100,000 per month for DeKalb County through the sale of green energy to Georgia Power. The landfill is expected to close in 2071, but it should continue yielding sufficient levels of methane for the project through 2100. "Last year was our first full year of production, and we were able to attain an average generator set availability of over 91 percent," said Malone. "We were under contract with Georgia Power to produce 22,500 MW, and we met that goal." To place this output in perspective, Malone notes that the two Cat generator sets, producing a combined 3.2 MW of electric power per hour, are generating enough electric power for approximately 2,500 homes. "This facility is a win-win for all parties—DeKalb County, Georgia Power, and the local residents," concludes Bever.

County, state, and federal officials held the official ribbon-cutting for the Seminole Road Power Project on December 8, 2006, concluding almost two years of efforts by county officials to participate in Georgia Power's alternative energy program. The utility has agreed to buy electric power from the county at higher rates than the cost of power generated from fossil fuels. The ten-year agreement will recoup the county's capital outlay of $5 million in less than five years, Malone said. Any profit thereafter will be used to further reduce sanitation rates for

DeKalb County Sanitation customers, he adds. "We don't receive any general tax revenues for our solid waste operations," explains Malone, referring to DeKalb County's funding structure for its Sanitation Division. "Therefore, the extra revenues that we generate through this plant help offset any of the cost that we would otherwise have to charge our customers for sanitation services." And beyond the plant's revenue stream that is helping reduce sanitation costs for DeKalb County, Malone points out one final added benefit: preserving U. S. jobs. "We're pleased that we were able to use an American-made engine," said Malone, referring to the Cat generators. "We know that other manufacturers outside of the United States make similar engines that burn methane to make electricity. It was good to have a Cat engine, designed from the ground up to run on methane, that has proven itself to be up to the task." (Caterpillar)

Plant Operator Dan Posey elaborated, "DeKalb County purchased the building and equipment and then contracted SCS to develop the project to the approved specifications. The generators went online October 12, 2006. The landfill produces roughly 2,700 cubic feet per minute (cfm) of landfill gas. The gas is then refined to remove organics and water. Then the methane is further refined to separate it from carbon dioxide and other organic contaminates before being fed to the Caterpillar generators. The engines use about 500-550 cfm of methane per engine and the rest is flared. The generators produce 3.2 MW per hour but the amount varies due to fluctuations. Generally, there is 96% availability. As touched on above, under their current contract Georgia Power pays approximately $.07-$.08 for the energy produced. A contract with Georgia Power is renegotiated as the previous one expires.

Georgia Power also built transmission lines from the site, which is a large expense that Seminole did not have to shoulder. Early estimates show that the site has enough landfill gas to last until 2100. There are currently no plans to add solar panels to the cap. (D. Posey, Personal Communication, March 2011)

Figure 2 -Educational kiosk detailing landfill equipment

Figure 3-Graphic showing how the gas is extracted from the landfill

Figure 4-Example of a knockout pot where condensate is removed

Figure 5-Example of a LFG well-head

Figure 6-Map detailing LFG wells and pipelines

Figure 7-Seminole Road Landfill was traditionally closed.

That's a lot of grass to mow!

Figure 8-The building where the energy production is housed

Figure 9-Additional moisture is removed from the gas before it enters the building

Figure 10-The energy facility is set up for educational tours for clients and school children

Figure 11-Timeline poster showing the evolution of the landfill to energy production

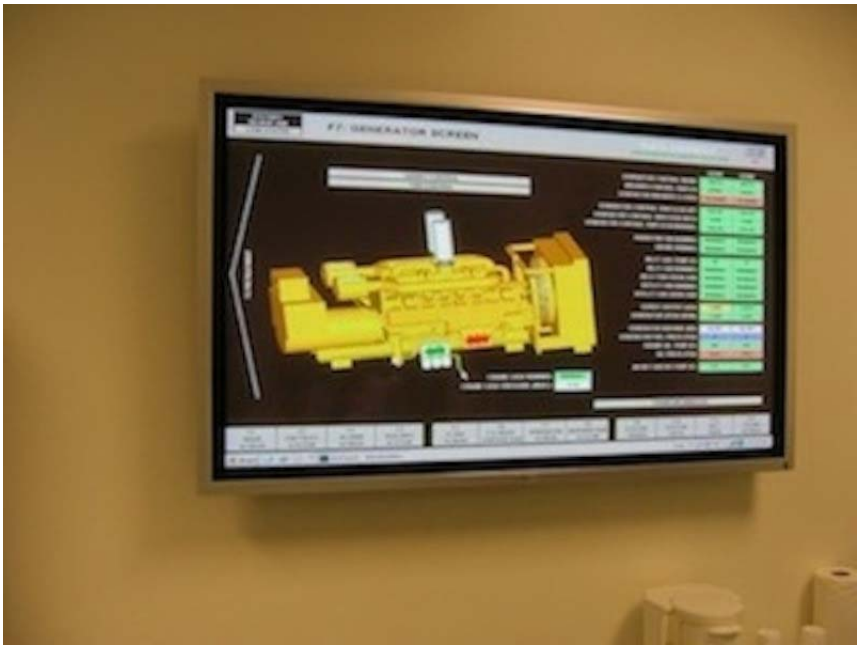


Figure 12-A large TV shows what the operator sees on his computer screen. Each detail of the operation can be pulled up on the computer and viewed for maintenance or if there is a problem.

Figure 13-One of the two Caterpillar generators.

Figure 14-Now the LFG is electricity.

Figure 15-And it is transferred to these transmission lines for distribution

Hickory Ridge Landfill

Hickory Ridge Landfill at 3330 Moreland Ave., Conley, GA, opened towards the end of 1992. In December of 2008 it ceased active operation but it still accepts some waste as the cap is being installed. Hickory Ridge has 48 closed acres of landfill with10 acres of solar panels installed on a thermoplastic polyolefin (TPO) cap. TPO is a heat-weldable plastic that is used as a roofing material on flat roofs. Developed by Carlisle Geomembranes, the TPO has 6,984 flexible solar panels from Uni-Solar welded to the material from the factory. The membrane is then just unrolled and installed on the west and south-facing slopes at the site exactly as you would a roof by workers who are roofers by trade. Each seam is hot welded and marked by the worker with his name and the date and then, after it is inspected, it is marked showing that it passed inspection and that worker signs his name. Extruded wire races that protect the wires coming from the panels are also welded to the membrane. According to Carlisle, the membrane and solar system is just as cost effective over a 30-year period as a traditional clay cap.

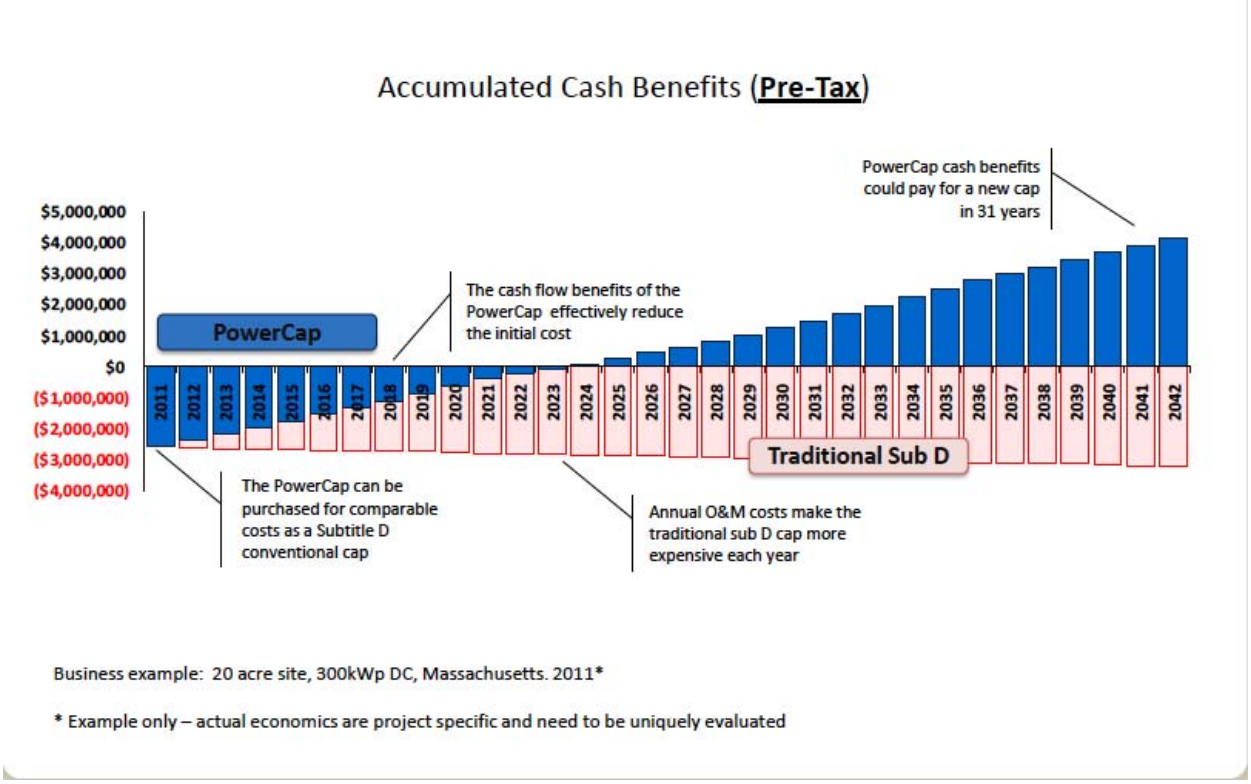


Figure 16-Graphic from Carlisle Energy showing the rate of return for Power Cap

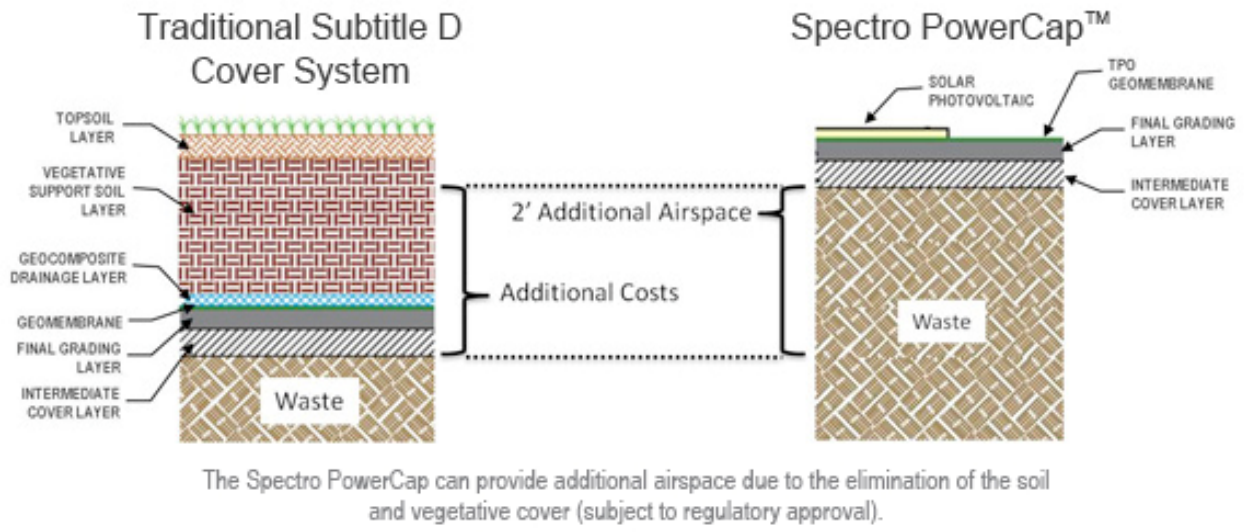


Figure 17-Graphic from Carlisle Energy showing traditional vs. Power Cap landfill closure

The site contains two closed landfills. The smaller of the two at the south end of the site is capped with TPO with no solar panels. The larger landfill to the north of the site is still accepting some waste as the workers install the TPO and solar panels on the closed south and west sides and work their way back. According to information published by Republic Services, Hickory Ridge Landfill has 10 acres or solar, equal to 1 megawatt of energy (which is enough to power approximately 224 homes). "Each solar collection strip is approximately 15 inches wide by 18 feet long. The strips can be applied side-by-side or end-to-end, which allows greater freedom in designing grid layouts that maximize the hours of sunlight exposure throughout the year." The project costs $5 million but $2 million of that comes from a grant provided by Georgia Environmental Finance Authority (GEFA). The first project of this kind was installed on Republic Service's Tessman Road Landfill in San Antonio, Texas. That project, completed in 2009, was only a 135-kilowatt installation and is still operational. A presentation given by Carlisle Energy estimated the costs of the solar cap to be $150,000/acre but those familiar with the project estimate that it is closer to $200,000/acre. (Republic, Online)) Hickory Ridge is currently only flaring their LFG but construction has started on a LFG facility located on-site.

Figure 18-A model showing Hickory Grove's TPO and solar closure

Figure 19-The plan sheets showing the solar layout

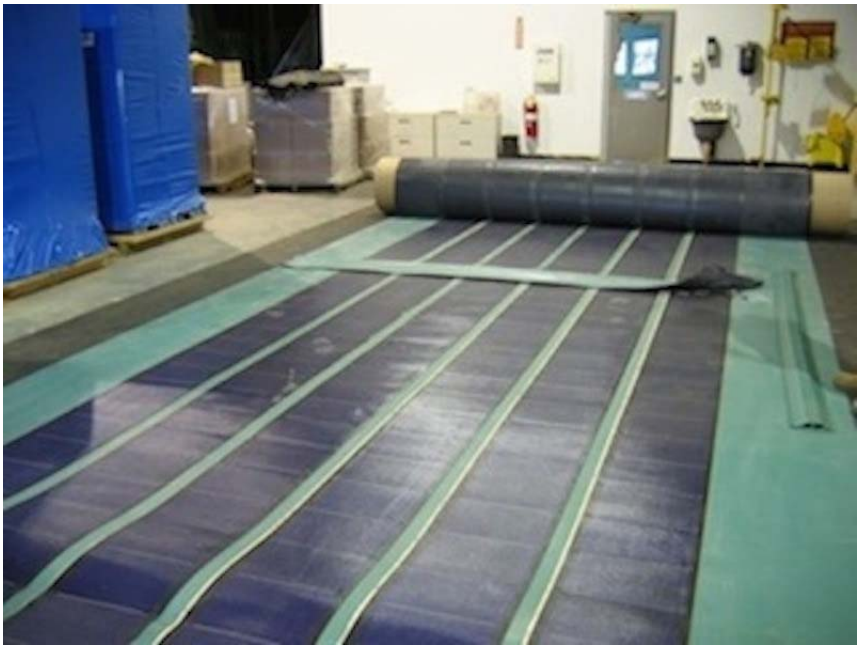


Figure 20-Carlisle Energy's TPO with Uni-Solar flexible solar panels comes pre-made from their factory.

Figure 21-A close-up of the panel wiring. The wiring is protected by wire races.

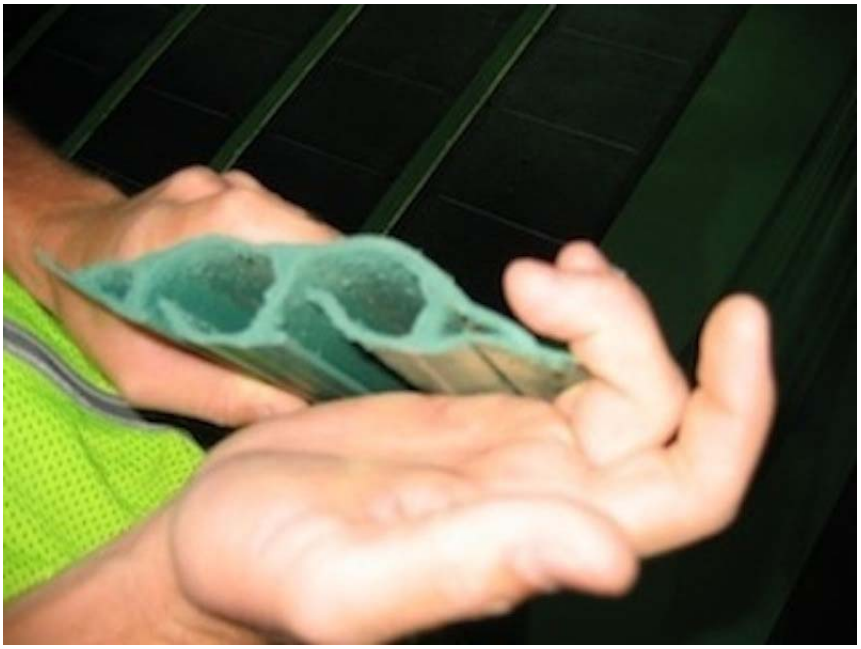


Figure 22-A close-up of the wire races that run the length of the panels to protect the wires.

Figure 23-The installed TPO and solar panels on Hickory Ridge

Figure 24-Another TPO closure at Hickory Ridge without solar panels. This landfill has some shading from surrounding trees making it not ideal for solar.

Figure 25-As with flat roofing, each installer numbers and signs the area he installed.

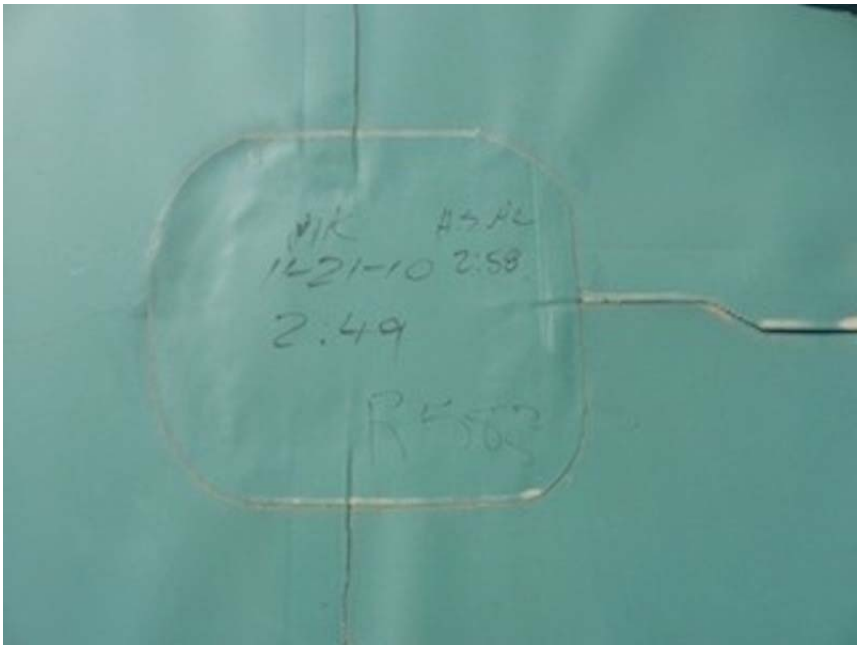


Figure 26-Each seam is signed by the installer and then signed by the person that inspects the seam.

Figure 27-Workers installing the solar TPO. The machine to the left is digging a trench to tuck in the TPO so it is wind resistant.

Figure 28-Another view of the installation.

Figure 29-A trench waiting to tuck in its TPO

Figure 30-Preparing the slope for installation

Figure 31-The top of Hickory Ridge Landfill. They are still accepting some waste while the solar installation continues below.

Figure 32-Pick A Part salvage car sales as viewed from the top of Hickory Ridge.

Figure 33-It is very windy on top of the landfills. This shows dust blowing off the top. You can see the non-solar TPO closure in the distance.

Figure 34-The view from the other side standing on top of the landfill. You can see the dust blowing off the top.

Figure 35-Another side of Hickory Ridge. Live Oak Landfill is in the distance.

Figure 36-Looking down the TPO. Atlanta Hartsfield Airport is in the distance.

Figure 37-A view of Atlanta from the top of Hickory Ridge.

Figure 38-The LFG set-up at Hickory Ridge. The gas is currently not being used for energy. It is flared off through the flare at the rear of the photo.

Figure 39-A full view of the flare

Figure 40-There are plans to install a LFG energy plant and this will be its location, right next to the flare operation.

Figure 41-Right across from the flare you can see where an earlier section of Hickory Ridge was closed using the traditional method. The TPO cap portion is in the far left of the photo.

CHAPTER 3

OAK GROVE LANDFILL-EXISTING

Oak Grove Sanitary Landfill, owned by Republic Services, is located at 967 Carl-Bethlehem Rd. in Winder, GA. The 540 total acre site encompasses the 48.3-acre Speedway landfill, which was closed in 1997, and the 107.3-acre Oak Grove Landfill, 35 acres of which is already capped. The rest of the acreage is wetlands, borrow pits, infrastructure, and buffer areas. Currently Oak Grove contains 72.5 acres of waste. Phase 10 (see Figure 68), a doubled-lined landfill, is under construction and will be ready to receive waste when the active landfill is full and closed. In the eastern corner of the property is the landfill gas to natural gas production facility.

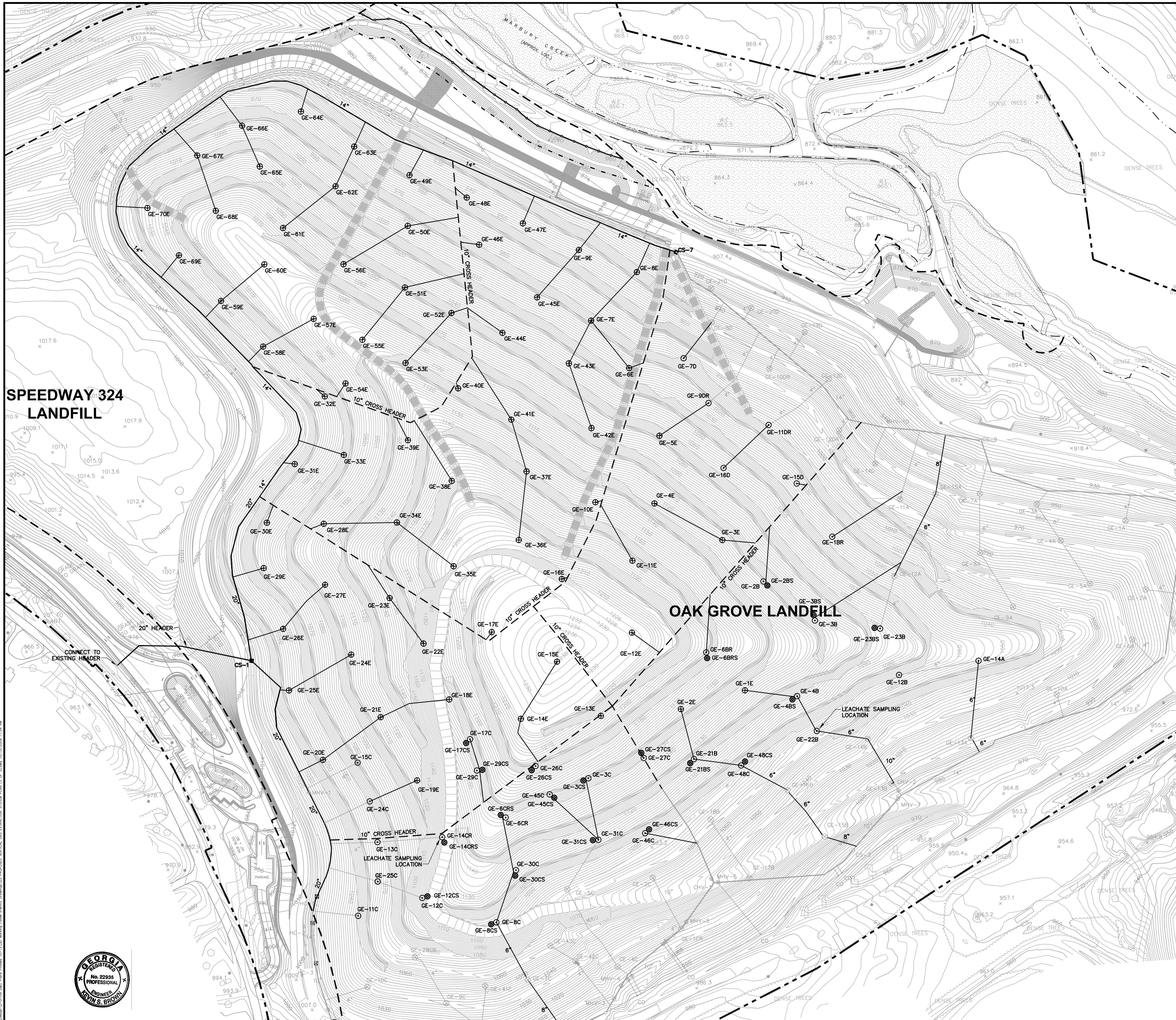
Landfill gas (LFG) is formed from the anaerobic digestion of organic matter in the landfill. According to Stephen Constable, the landfill gas from Oak Grove is composed of approximately 55% methane (CH4), 40.6 carbon dioxide (CO2), 3.2% nitrogen (N), 91% oxygen (O2), and the rest is water and organic compounds. Since methane is considered an emission, it must be either flared off or refined so that it does not enter the atmosphere in its current state. Speedway's LFG contains a lower amount of methane and is considered to be a lower quality than Oak Grove's so it is simply flared off. The gas is collected via a network of wells drilled into the landfill and the gas is routed to the refinery through a pipeline (see Figure 42). Future

plans are to use the northernmost lines of Oak Grove's LFG to power an evaporator to remove leachate and use Speedway's LFG in the refinery to make up the difference, but that will be addressed in the Additional Ideas section on page 53.

Renewable Solutions Group built the refinery in 2009, the first high BTU, LFG to gas facility. It cost $17 million for the installation, 16 replacement wells on the landfill, and 4.5 miles of pipeline to connect with the gas line to Buford. Soon after the plant was constructed, Renewable Solutions Group defaulted on the construction loan so the plant ownership went to Archer Capitol Bank. They hired SCS Energy Services to run the plant and they are currently running the facility. SCS runs the facility and Republic Services is paid a portion of the total gas shipped. The plant is designed to handle 4,000 standard cubic feet per minute (scfm) but its current max is only 2,600. This is due to the lack of supply from the landfill. Seminole Rd.'s landfill gas to energy plant is able to supply a lot of energy to the grid because the landfill itself is much larger and therefore is able to supply more LFG.

Typically, Oak Grove's landfill gas to energy plant runs 24-hours a day to supply a continuous flow of natural gas to the distributor in Buford. The plant runs at about 80% efficiency whereas Seminole Road runs at about 96% efficiency. Currently, the only use for LFG on site is for the thermal oxidizer used by the plant. The rest is shipped through the pipeline. As previously discussed, the LFG is pulled from the landfill though wells and the pipeline using flares and blowers at the plant. The flare pulls the gas from the landfill and then the gas goes from to the flare to the blowers. Next, the gas goes through two knockout pots to remove the moisture. This water is treated as leachate and sent to Oak Grove's leachate collection tank where it is shipped to Tucker for processing. Then to the gas goes to a refrigeration skid to remove more moisture and its temperature is brought down to 37 degrees

Fahrenheit. After that it goes to the main compressors. There are three compressors; two run continuously and the third is a spare in case one of the compressors needs repair. After the gas leaves the compressors it goes to the medal skid where the impurities, such as CO2 and N are removed. The impurities are sent to a thermal oxidizer where they are incinerated. Finally the gas goes to the sales gas compressor where it is compressed to 500 pounds per square inch (PSI) and sent down the pipeline. According to SCS Energy, the maintenance on the wells costs more than they make. Natural gas prices are traded on the open market so they fluctuate with the market prices. If the natural gas was used as compressed natural gas (CNG) in Republic's vehicles in place of diesel fuel or used to produce energy like Seminole Road, the cost/benefit may be higher. (S. Constable & T. Laraway, Personal Communication, March 2011) This will be addressed further in the Additional Ideas section on page 53.



I HAVE REVIEWED THE INFORMATION PRESENTED ON THIS DRAWING, AND IN MY PROFESSIONAL OPINION, ALL CONTAINMENT STRUCTURES ARE DESIGNED TO RESIST A MAXIMUM HORIZONTAL GROUND ACCELERATION OF 0.12g IN 250 YEARS.

LEGEND

- PROPERTY BOUNDARY – LIMITS OF SITE SUITABILITY
- EXISTING CONTOUR
- 100 YEAR FLOOD PLAIN BOUNDARY
- WETLANDS
- PROPOSED EXPANSION LIMIT OF WASTE
- PROPOSED BUFFER LIMITS
- 500' RESIDENCE/WELL BUFFER
- 100' MARBURY CREEK BUFFER
- 150' IMPERVIOUS BUFFER
- EXISTING HEADER (NO MODIFICATION)
- NEW HEADER
- EXISTING WELL (NO MODIFICATION)
- NEW VERTICAL WELL TO BE INSTALLED
- VERTICAL WELL TO BE EXTENDED DURING THE EXPANSION
- SUPPLEMENTAL WELL
- EXISTING CONDENSATE SUMP

NOTES

1. HORIZONTAL WELLS WITH VERTICAL VENTS WILL REPLACE EXISTING VERTICAL WELLS ALONG THE INTERMEDIATE SLOPE. THESE WILL BE INSTALLED AS WASTE PLACEMENT PROGRESSES. THESE WELLS ARE SHOWN ON SHEET G2.

2. STORMWATER MANAGEMENT STRUCTURES ARE NOT SHOWN ON THIS PLAN FOR CLARITY.

3. LATERAL PIPE SIZES WILL BE DETERMINED PRIOR TO CONSTRUCTION.

4. THE LOCATION OF VERTICAL & HORIZONTAL EXTRACTION WELLS MAY BE REVISED PENDING ACTUAL FIELD CONDITIONS. SPACING SHOWN IS BASED ON TYPICAL SPACING AND DETAILED CALCULATIONS WILL BE PROVIDED ON THE FACILITY'S GCCS PERMIT.

5. HORIZONTAL EXTRACTION WELLS ARE NOT SHOWN FOR CLARITY. REFER TO SHEET G2 FOR DETAILS.

6. THE EXISTING SPEEDWAY LANDFILL WASTE LIMITS HAS BEEN ESTIMATED BASED ON VARIOUS SITE STUDIES, AS INCLUDED IN THE SUPPLEMENTAL INFORMATION REPORT BY GOLDER ASSOCIATES DATED APRIL 2005, AND THE EXISTING TOPOGRAPHY DATED APRIL 2008. THIS LIMIT WILL BE VERIFIED PRIOR TO CONSTRUCTION OF EACH PHASE OF THE EXPANSION.

REFERENCES

1. EXISTING TOPOGRAPHY BASED ON AERIAL PHOTOGRAPHY DATED APRIL 2008.

2. SITE BOUNDARY BASED ON SURVEY BY BORDERS & ASSOCIATES, WINDER, GA. AND SURVEYS OF ADDITIONAL PARCELS BY DESIGN PROJECT SURVEYORS.

SCALE 100 0 100 200 FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW
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PROJECT

OAK GROVE SANITARY LANDFILL
BARROW COUNTY, GEORGIA

TITLE

PROPOSED VERTICAL GAS EXTRACTION SYSTEM PLAN (3 OF 3)

Golder Associates
Atlanta, Georgia

PROJECT No.	0733625.003	
DESIGN	CCP	05/09
CADD	CCP	05/09
CHECK	CMM	05/09
REVIEW	KSB	05/09

FILE No. G3 PROPOSED VERTICAL GAS EXTRACTION SYSTEM PLAN (3 OF 3)

SCALE AS SHOWN | REV. –

G3

Figure 43-A busy day on top of Oak Grove Landfill.

Figure 44-Another view of the operation

Figure 45-A view of the next phase of Oak Grove. That portion will be double-lined.

Figure 46-A view of Speedway Landfill from the top of Oak Grove. This will be part of Phase One of the Renewable Energy Plan.

Figure 47-From the top of Oak Grove, you can see some of Winder' s public schools.

Figure 48-Another view of the view from Oak Grove. Stone Mountain is in the distance.

Figure 49-Retired borrow pit located at the north of the site. This land is being allowed to naturalize.

Figure 50-A sedimentation pond located near the borrow pit. This can be allowed to become a wetland and then sold as wetland credits.

Figure 51-Another view of the borrow area well on its way towards becoming a natural area again.

Figure 52-The beautiful wetlands located between Oak Grove and the borrow pits to the north. A lot of wildlife was present.

Figure 53-Another view of the wetlands. You can see how close they are to the access road but remain in perfect health.

Figure 54-Construction on the next phase of the landfill.

Figure 55-The liners await installation.

Figure 56-The view of Oak Grove from Speedway.

Figure 57-The side of Oak Grove. You can see the well-heads and signage.

Figure 58-Oak Grove's flare.

Figure 59-The outside of Oak Grove's LFG operation.

Figure 60-Cooling for the compressors

Figure 61-Where the LFG enters the building to be refined to methane

Figure 62-Inside the plant. The compressors are on the left.

Figure 63-Another view of the compressors. It is difficult to obtain a clear picture as the noise from the machines shakes the camera.

Figure 64-The impurities are removed

Figure 65-The gas gets ready to go down the distribution line.

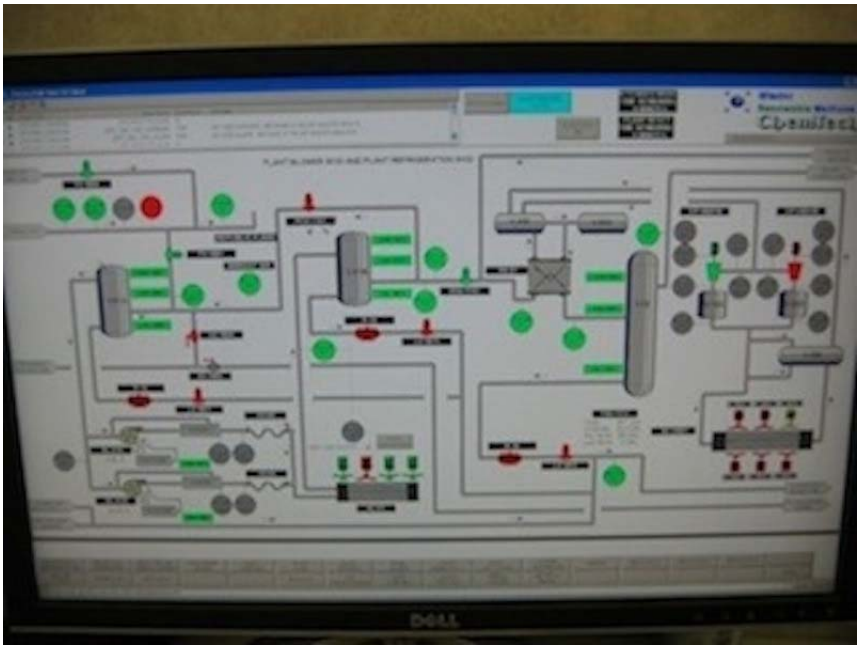


Figure 66-Oak Grove has a computer system similar to Seminole Road that shows very detailed pictures of the entire operation

CHAPTER 4

OAK GROVE LANDFILL'S RENEWABLE ENERGY PLAN

Traditionally, as a landfill closes it is covered with a cap comprised of layers of soil, vegetation and a geomembrane. The purpose of the cap is to keep landfill gases from escaping while keeping out as much moisture as possible. Nothing is allowed to penetrate the cap since this would allow moisture in and gases to escape. For this reason, landfills are developmental dead zones. Placing solar panels on the landfill, either ground-mounted or on a thermoplastic polyolefin (TPO) cover, is an opportunity for the landfill owner to earn money and tax credits on land that cannot be developed while supplying green energy to the power grid or using the energy to power the LFG plant.

This renewable energy plan proposed here will be built in phases (Figure 67). The first phase would install ground-mounted solar on the top and south side of Speedway up to the buffer zone, and the closed south/southwest side of Oak Grove. In order to mount the solar panels on the top and sides of the cap, concrete footings or blocks would be needed to secure the panels to the cap and minimize shifting as the landfill settled. Susanne Fischer-Quinn of Mage Solar in Dublin, GA estimated that a complete system that includes their Mage Solar Powertec modules, inverters and complete balance of system (BOS) would be vary from $4.50 to $6.00/kW depending on the installation choice. Currently the terrain on the top of Speedway is undulating.

Before placing footings and mounting the panels, the top of Speedway would need to be graded with a 3% slope to the South to even the surface and allow for drainage. This would allow for the panels to be mounted uniformly across the cap while providing drainage for storm water run-off. After the cap is re-graded, some of the well-heads would have to be raised at a cost of $800 apiece. Even with leaving room for future expansions of Oak Grove, this grading would allow for 10-12 acres of land on which solar panels would be mounted. Speedway has more land available on top of the landfill because, at the time it was closed, landfills did not become the large hill shapes they are today. It is flatter and less tall than Oak Grove. The panels on top of Speedway would be mounted facing south and angled to 33º to allow for maximum exposure to the sun. The panels on the sides of Speedway and Oak Grove should be mounted as closely to 33º as possible, but as Hickory Ridge has made evident, the panels would still be effective at a steeper incline.

The next phase would occur when the currently active portion of Oak Grove is closed. It is recommended that it be closed with the Carlisle Energy solar cap and then more ground-mounted solar be placed on the top. The panels on top, again, would face south and be angled to 33º. Oak Grove was not designed with future solar installation in mind so its top will only have about 4 acres of land on which to mount the panels until the next phases close. As the future phases of Oak Grove their tops will be level with the active Oak Grove top and so more ground-mounted solar panels could be installed. TPO could be used to close the landfills but, since there would be no more south/southwest slopes, the solar cap would not be used.

The advantage of using TPO to cap the landfills is that it keeps out 100% of water while keeping gases inside the landfill. This would mean no more leachate would come from the areas closed with TPO. It costs $.11 a gallon to treat leachate and it must be hauled to Tucker, GA to

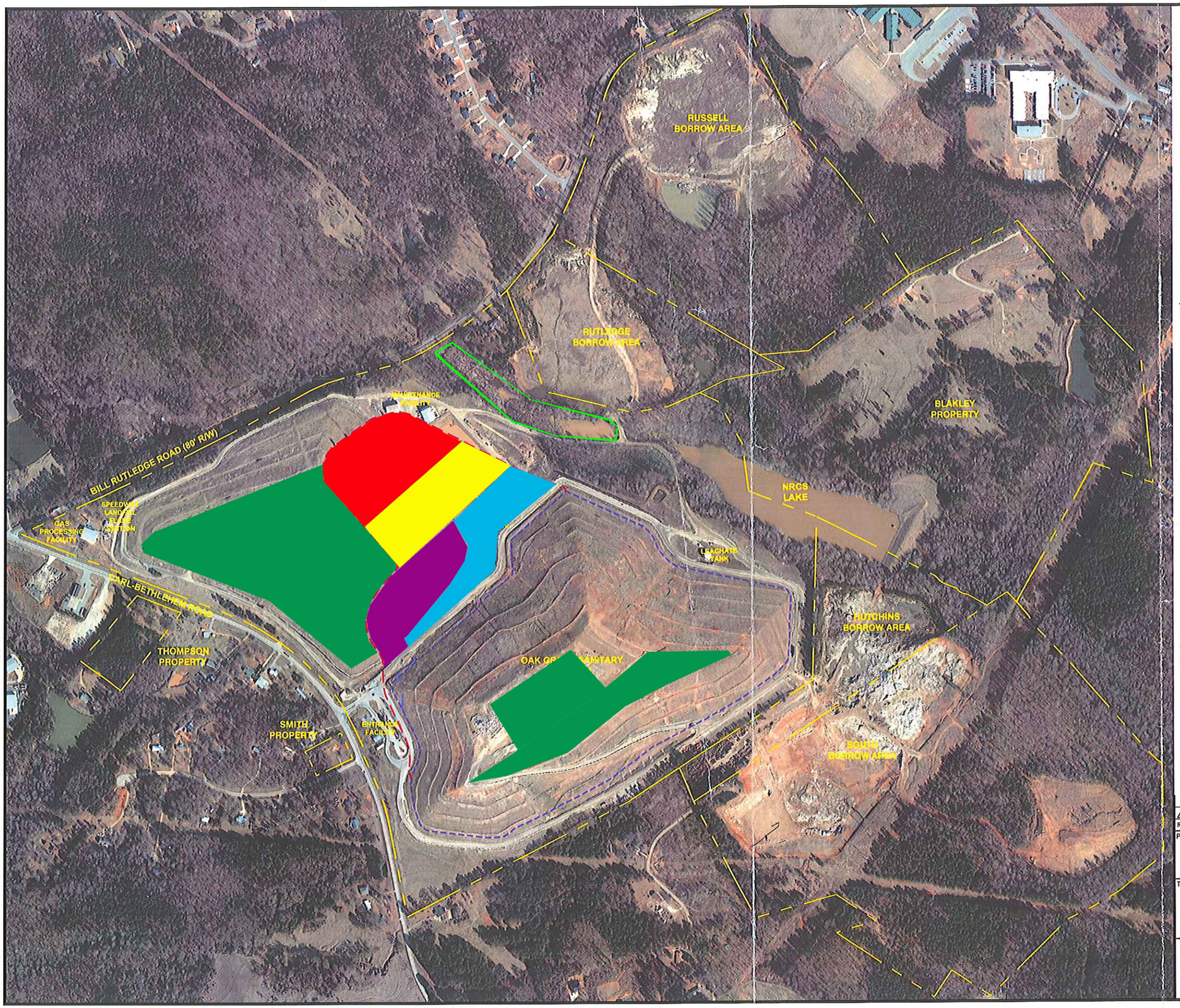
be treated so this would be an expense that a TPO cap would reduce. The downside is that a TPO cap means that 100% of storm water would run off the cap. The already closed portion of Oak Grove is currently not designed to handle that amount of run-off so it, and the buffer area around the landfill would need to be redesigned to handle the water. A pipe system that allowed for some infiltration at the location while routing the majority of it to the wetlands would be one option. There are 15-20 acres of wetlands at the north end of the landfills as well as additional sites that could be used for overflow.

This project of integrating solar panels across the top of already closed and future closed land on the landfill would only be limited by how much money Republic Services wanted to invest in the project. The total closed area of landfill that would be available for solar installations would be 86.77 acres. This area includes the already closed Speedway Landfill. The installed cost of Mage solar panels with inverters would be between $4.50 and $6.00 per watt. Jackson EMC has offered to pay $.08 per kilowatt-hour (kWh). Early coordination with Oglethorpe Power Company indicated that they would provide connections to the nearby transmission lines if Republic decides to sell the energy rather than use it or sell the excess if they do. This means that each 180-watt panel would need to be on-line 19 to 26 years with 8 hours of sunlight per day to depreciate the cost. The panels would be placed in a solid row, long side up, along the top of the closed landfill. The area of Mage Powertec Plus 180 5 ME is 31.81" by 62.20". To find the area occupied by each panel including spacing between the rows to allow for shading, use the formula [5.18 * cos(33) * 2.65] + [5.637 * 2.65] = 11.51 + 14.9 = 25.76 square feet, where 5.18 and 2.65 is the area of the panel in feet, 33 is the angle of the panel in relation to the ground, and 5.637 is the spacing.. This means that Republic could install 1,690 Mage Powertec Plus 180 5 ME panels per acre at a cost of $1,268,900 to $1,825,200 per acre. If

solar panels were placed at maximum spacing over the entire available area of 86.77 acres there would be 146,641 panels providing 26.40 megawatts of energy. The total cost would be from $110,102,453 to $158,372,604. A portion of this cost would be recouped the following tax seasons in the form of tax credits.

PANEL COST/WATT	COST TO RAISE WELL-HEADS	WATTS PROVIDED PER PANEL	TOTAL ACREAGE AVAILABLE	TOTAL COST & BENEFIT
$4.50-$6.00 (estimate)	$800 each approximately 10	180	86.77ac	$110,102,453-$158,372,604 26.40 megawatts

The tax credits granted to corporations that install renewable energy projects make the investment more appealing. According to the Department of Energy, Republic Services already qualifies for a Renewable Energy Tax Credit of 30% for their current LFG capture system, of which they are not currently taking advantage. For solar installations they would be eligible for a 35% tax credit from the Georgia taxes (capped at 2.5 million for 2011, 5 million for 2013, 2014, and 2015) and 30% Federal tax credit with a cap of $1,500 per 0.5kW. (Dsire, online) Republic may also be eligible for an American Recovery and Reinvestment Act grant. Since Jackson EMC would not take the renewable energy credits (RECs) this would mean another tax credit of one cent per kilowatt-hour for Republic. Georgia Power pays $.17 per kilowatt-hour but retains the renewable energy credits. Finally, Republic could claim accelerated depreciation on the solar equipment. The solar panels would still be 80% efficient after 20 years and would continue to earn money for Republic Services well into the future on land that otherwise would just cost them money for maintenance.



LEGEND

- PROPERTY BOUNDARY
- LIMITS OF WASTE
- LIMITS OF EXPANSION WASTE
- PHASE BOUNDARIES

SOLAR PHASES-TO FOLLOW THE LANDFILL CLOSURES

- PHASE I
- PHASE II
- PHASE III
- PHASE IV
- PHASE V
- WETLANDS

REFERENCES

1. AERIAL PHOTOGRAPH OBTAINED FROM HENDERSON AERIAL SURVEYS, INC DATED 02/13/11.

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SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW
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PROJECT
REPUBLIC SERVICES OF GEORGIA, LP
OAK GROVE SANITARY LANDFILL
BARROW COUNTY, GEORGIA

TITLE
CURRENT YEAR'S AERIAL PHOTO

Golder Associates
Atlanta, Georgia

PROJECT No.		11390019.2	FILE No.	11390019A01
DESIGN	–	–	SCALE AS SHOWN	REV. –
CADD	CCP	04/11		
CHECK	BG	04/11		1
REVIEW	KSB	04/11		

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CHAPTER 5

ADDITIONAL IDEAS

In addition to earning money by placing solar panels on their closed landfill, Republic could also earn some money by conserving and maintaining their wetlands and sell the credits. Oak Grove has about 15 acres of wetlands located to the north of the landfill. Since the land would not be developed anyway, wetland credits would be an excellent way to earn money from the property. The Environmental Protection Agency describes wetland credits as, "A mitigation bank is a wetland, stream, or other aquatic resource area that has been restored, established, enhanced, or (in certain circumstances) preserved for the purpose of providing compensation for unavoidable impacts to aquatic resources permitted under Section 404 or a similar state or local wetland regulation. A mitigation bank may be created when a government agency, corporation, nonprofit organization, or other entity undertakes these activities under a formal agreement with a regulatory agency. Mitigation banks have four distinct components:

- The bank site: the physical acreage restored, established, enhanced, or preserved;
- The bank instrument: the formal agreement between the bank owners and regulators establishing liability, performance standards, management and monitoring requirements, and the terms of bank credit approval;
- The Interagency Review Team (IRT): the interagency team that provides regulatory review, approval, and oversight of the bank; and
- The service area: the geographic area in which permitted impacts can be compensated for at a given bank.

The value of a bank is defined in "compensatory mitigation credits." A bank's instrument identifies the number of credits available for sale and requires the use of ecological assessment techniques to certify that those credits provide the required ecological functions. Although most mitigation banks are designed to compensate only for impacts to various wetland types, some banks have been developed to compensate specifically for impacts to streams (i.e., stream mitigation banks).

Mitigation banks are a form of "third-party" compensatory mitigation, in which the responsibility for compensatory mitigation implementation and success is assumed by a party other than the permittee. This transfer of liability has been a very attractive feature for Section 404 permit-holders, who would otherwise be responsible for the design, construction, monitoring, ecological success, and long-term protection of the site." (EPA, Online) Republic would be paid to conserve their wetlands that would have remained wetlands anyway. There is additional land at the borrow pits that may be turned into wetlands if the wetland credits proved to be lucrative though they are on higher ground and maintaining them may be more difficult that those already present.

Leachate from the landfill, which is water that has filtered through the landfill and must be captured and treated, is expensive to treat. It must be collected and trucked to Tucker, Georgia to be treated. The cost of this is $.11 per gallon not counting the damage to the environment caused by trucking the leachate miles away. A reasonable solution Oak Grove would like to incorporate is to install an evaporator next to the leachate tank and power it by diverting some of the untreated LFG to the evaporator. The evaporator would require 15 million British Thermal Units (BTUs) to run. In order to make up the difference in gas that ordinarily would have been shipped down the pipeline, Republic would tie the gas lines from Speedways'

LFG to Oak Grove's. Currently, Speedways' gas is not processed to natural gas, just flared off. Treating the leachate on-site would remove the cost of paying to ship and treat it. Treating it using existing LFG as fuel means there would be no need to purchase energy to run the evaporator. Also, Republic could investigate bioremediating the leachate through wetlands. A study conducted in Sweden indicated that willows and reeds would be particularly useful in cleaning toxins from the water. (Randerson, Online) If the landfill's current open section and future closed sections were closed using TPO then there would be no water infiltration in those areas so there would be a reduction of leachate to be treated.

Another energy project that could be implemented would be to turn the high BTU plant into a fueling station for Republic's fleet of garbage trucks. Very little retrofitting would need to be completed to make the change and the benefits would be enormous. Instead of paying to fuel their fleet of 120 trucks with diesel fuel they would use gas they already have. Also, the benefit to the environment would be sizable. They would even qualify for additional grants and tax credits that would help offset the costs of building the fueling station. For example, Congestion Mitigation and Air Quality Improvement Program grants are awarded to alternative fuel projects in the interest of improving air quality in areas that are out of compliance from air quality regulations. Since these are Federal funds that are distributed to the state's Department of Transportation Republic would need a local sponsor, City of Winder for example. (FHWA, Online) Tax credits would be similar to those earned from the solar installation, and would be an additional incentive to build the fueling station. There may be additional credits from environmental agencies due to the reduction of carbon and pollutants released by using a cleaner fuel.

A Waste Management landfill in Altamont, California recently unveiled their LFG to landfill natural gas (LNG) fueling plant. "On November 2, 2009, WM officially opened a high-tech fuel plant that demonstrates the viability of landfill gas (LFG) as an alternative transportation fuel. Each day, the plant processes 3 million cubic feet of LFG, yielding 13,000 gallons of liquefied natural gas (LNG) that will fuel 300 garbage trucks. The plant is one of the largest LFG-to-LNG plants in the world and will supply 4 million gallons of LNG per year. The project's opening follows nearly 10 years of research and development between WM and project partner Linde North America. Linde built the plant based on technology patented by the Gas Research Institute. WM and Linde expect the project to demonstrate and validate the technology and its positive environmental impact.

Using LNG in WM garbage trucks replaces the need for about 2.5 million gallons of diesel fuel per year. Considering greenhouse gas emissions from production to consumption, LFG-to-LNG emits about one-seventh of the greenhouse emissions of diesel fuel, resulting in a very low-carbon transportation fuel. In addition, the LNG-powered garbage trucks emit significantly less particulate matter and nitrogen oxides.

The $15.5 million project meets California directives to advance biomass as a transportation fuel and to reduce the state's greenhouse gas emissions by 25 percent by 2020. Thus, four state agencies committed up to $2.4 million to this project. The project is expected to reduce carbon dioxide emissions by 30,000 tons per year." (EPA, Online) Since Oak Grove already has the operation in place it would be a simple retrofit to make it a filling station so the trucks could refill in the same site where they drop off their loads.

CHAPTER 6

CONCLUSION

Georgia landfills are certainly contenders in the renewable energy production race. Hickory Ridge Landfill closed their landfill with TPO and 10 acres of that is fitted with flexible solar panels. This set-up will produce approximately 1.3 megawatts of energy on a site that would otherwise be worthless. Seminole Road Landfill is using their landfill gas to power generators that produce 3.2 megawatts per hour. If Seminole was not using their LFG it would have to be flared off and wasted.

Oak Grove Sanitary Landfill in Winder, Georgia is already earning money by refining its landfill gas (LFG) and sending it through the natural gas pipeline. They would eventually earn additional income by phasing in ground-mounted solar panels on the cap of the adjacent, closed Speedway Landfill and then onto the already closed south and west portions Oak Grove. Then adding a solar cap to the south and west sides as Oak Grove closes and more ground-mounted solar on top. Additional ground-mounted panels can be added as more sections of the landfill close. Producing energy with solar panels would produce long-term income on land that cannot be developed and allow ongoing funding to buy additional solar panels to be phased in. Conserving on-site wetlands and then selling the wetlands credits would be another means of income using land that would not be developed.

Treating leachate on-site using a LFG powered evaporator or using the wetlands to bioremediate would eliminate expensive shipping and treatment. Finally, converting the LFG plant from distribution to fueling station would eliminate the enormous cost of fueling a fleet of trucks with diesel. This conversion would also be better for the environment as natural gas is much cleaner than diesel fuel. All of these improvements are economically and environmentally responsible. This plan and ideas are immediately implementable and can be applied to any landfill site.

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Republic Services Company Background

Republic Services, which currently owns Oak Grove, according to their company's website is "… a leading provider of services in the domestic, non-hazardous solid waste industry. [They] provide non-hazardous solid waste collection services for commercial, industrial, municipal, and residential customers in 40 states and Puerto Rico. Republic serves millions of residential customers under terms of contracts with more than 2,800 municipalities for waste collection and recycling services. [They] also serve some commercial customers throughout [their] expansive service area. Since incorporation, Republic Services has been committed to the essential components of integrated solid waste management services: collection, recycling, composting, transfer and disposal. Each division of Republic Services is dedicated to preserving the environment while providing the most cost-effective programs for solid waste collection and disposal. Very few companies can equal the operational capabilities, financial stability, capital resources, broad experience, geographic dispersion, integrated infrastructure, or transfer expertise that Republic Services brings to a project. *Collection Services* [They] provide solid waste collection services to commercial, industrial, municipal and residential customers in 40 states through 348 collection companies. In 2010, 76.2% of our revenue was derived from collection services consisting of approximately 35% from services provided to municipal and residential customers, 40% from services provided to commercial customers and 25% from services provided to industrial and other customers. Our residential collection operations involve the curbside collection of refuse from small containers into collection vehicles for transport to

transfer stations or directly to landfills. Residential solid waste collection services are typically performed under contracts with municipalities, which we generally secure by competitive bid and which give our company exclusive rights to service all or a portion of the homes in their respective jurisdictions. These contracts or franchises usually range in duration from one to five years, although some of our exclusive franchises are for significantly longer periods. Residential solid waste collection services may also be performed on a subscription basis, in which individual households contract directly with our company. The fees received for subscription residential collection are based primarily on market factors, frequency and type of service, the distance to the disposal facility and cost of disposal. In general, subscription residential collection fees are paid quarterly in advance by the residential customers receiving the service. In [their] commercial and industrial collection operations, we supply our customers with waste containers of varying sizes. We also rent compactors to large waste generators. Commercial collection services are generally performed under one- to three-year service agreements, and fees are determined by such considerations as:

- market factors,
- collection frequency,
- type of equipment furnished,
- the type and volume or weight of the waste collected,
- the distance to the disposal facility and
- the cost of disposal.

We rent waste containers to construction sites and also provide waste collection services to industrial and construction facilities on a contractual basis with terms generally ranging from a single pickup to one year or longer. We collect the containers or compacted waste and transport

the waste either to a landfill or a transfer station for disposal. At the transfer stations that we own, we deposit waste, as do other private haulers and municipal haulers, for compaction and transfer to trailers for transport to disposal sites or recycling facilities. Also, we currently provide recycling services in certain markets. These services include the curbside collection of residential recyclable materials and the provision of a variety of recycling services to commercial and industrial customers. *Disposal Services* As of December 31, 2010, we owned or operated

193 landfills." The solar cap technology proposed by this paper and currently being installed on Republic-owned landfill, Hickory Ridge, which will be described later, can be expanded across all 193 Republic landfills. "The in-place capacity of our landfills is subject to change based on engineering factors, requirements of regulatory authorities and the ability to expand our sites successfully. Some of our landfills accept non-hazardous special waste, including utility ash, asbestos and contaminated soils. Most of our existing landfill sites have the potential for expanded disposal capacity beyond the currently permitted acreage. We monitor the availability of permitted disposal capacity at each of our landfills and evaluate whether to pursue expansion at a given landfill based on estimated future waste volumes and prices, market needs, remaining capacity and likelihood of obtaining an expansion. To satisfy future disposal demand, we are currently seeking to expand permitted capacity at certain of our landfills, although no assurances can be made that all future expansions will be permitted as designed. *Other Services* We have 76

materials recovery facilities (MRFs) and other recycling operations, which assist us in fulfilling obligations under long-term municipal contracts for residential collection services. These facilities primarily sort recyclable paper, aluminum, glass and other materials. Most of these recyclable materials are internally collected by our residential collection operations. In some

areas, we receive commercial and industrial solid waste that is sorted at our facilities into recyclable materials and non-recyclable waste. The recyclable materials are salvaged, repackaged and sold to third parties. Non-recyclable waste is disposed of at landfills or incinerators." (Republic, Online)

Jackson EMC Company History

From Jackson EMC's website, "Seventy years ago, a handful of Northeast Georgia business and community leaders shared a common vision and belief in a better life. Together, they rallied their neighbors to form an electric cooperative, a new type of venture made available to rural America under the Rural Electrification Administration (REA) by the Roosevelt Administration.

In 1936, local Department of Agriculture extension agent, J.W. Jackson, called upon members of the community to attend meetings to hear about electricity on the farm. In his Jackson Herald column, Jackson announced plans for meetings, saying, "We are having a wonderful response to this program. We are anxious to see every home in Jackson County have electricity. This will mean more for the farm women of our county than anything else we could do for them."

At civic club and school district meetings, the idea of building and owning an electric cooperative was debated. In an act of sheer faith, local residents put down $5 – a pretty significant sum at that time – for membership in an organization that did not yet exist, for a service many did not know how to use and some had never seen.

The group's first application to the REA for a loan to construct a cooperative electric distribution system was rejected. It would take them nearly two years of work on a totally voluntary basis — completing surveys, gathering statistics, providing documentation and drawing up blueprints — before they received approval for what was designated Georgia 83

Jackson. In 1938, the cooperative was chartered as Jackson Electric Membership Corporation (EMC) — Jackson for the county in which they incorporated and EMC as required by the Georgia General Assembly.

Bylaws adopted in 1938 at the cooperative's first board meeting described the organization's purpose. "The aim of Jackson EMC is to make electric energy available to its members at the lowest cost consistent with sound economy and good management." And while we have added other power-related products and services over the years to increase the benefit of the cooperative to its members, our basic goal remains the same, our commitment to our members unchanged.

On a chilly January day in 1939, the founders of Jackson Electric Membership Corporation broke ground in Jefferson for construction of the first leg of an electric distribution system that would bring light to the farms of rural Banks, Barrow, Clarke, Franklin, Gwinnett, Hall, Jackson and Madison counties.

Power was turned on for the first time in April of that same year. The first items the new customers bought were electric irons that replaced the six pound cast irons they had been heating on wood stoves, and radios that ended the isolation of life on the farm.

On the farm, the new lines brought power for light, feeding, grinding and mixing, shellers, elevators, silage cutters, automatic feeding machines for poultry and livestock, spraying and irrigation, brooders, milking machines and refrigeration. It allowed farmers to produce more and produce better quality, which enabled them to earn more.

In 1940, after Jackson EMC's first full year of operation, we had served nearly 2,000 meters and sold almost 600,000 kWh of electricity. We had more than $500,000 in plant assets, had nearly 680 miles of energized wire, two substations and nine employees.

The poultry industry began growing dramatically in the 1950s, and a large number of poultry houses were constructed and wired. Jackson EMC offered incentives to growers who installed electric brooders to help pay wiring costs. During that time, the U.S. Army Corps of Engineers dammed the Chattahoochee River, creating Lake Sidney Lanier and paving the way for a new type of development in the area – recreation.

By 1960, 98% of homes and businesses in the cooperative's service area had electricity. Outside of the growing poultry industry, Jackson EMC's commercial and industrial customers were few and mainly light industries, such as rock quarries. That was about to change.

The turning point, courtesy of the Federal-Aid Highway Act of 1956, was the completion of Interstate 85 in the mid-1960s. By the end of the decade, Jackson EMC would see a growing number of industries, including a carpet mill, mobile home plant, garment manufacturer and freezer company, spring up in Hall and Gwinnett counties. The opening of the Gwinnett Interstate Industrial Park brought companies like J.I. Case Tractor, Panasonic Corporation and Adcom Metals. The transportation corridor attracted truck stops and motels to its exits.

At 30 years old, Jackson EMC had experienced steady, if relatively slow growth. It was now serving an additional 24,641 meters — an average of about 820 new meters a year. It had added $10.9 million in assets, nearly 3,000 miles of energized wire, and 13 substations.

The early 70s saw double-digit inflation across the United States. The cost of goods doubled and tripled. Supply shortages began, including coal and oil. As a result of the supply shortages and the resulting dramatic increases in wholesale power cost, utilities across the country were forced to raise customer rates. In response, 39 of Georgia's EMCs, including Jackson, formed Oglethorpe EMC, as their own generation and transmission supplier. Oglethorpe would invest in transmission lines and purchase interests in generation plants to give the EMCs some control over wholesale power costs for the first time.

The recession deferred the promise of development created by I-85. When business growth did occur during these years, it was mainly in the form of small commercial operations – restaurants, convenience stores, hotels, and bank branch offices.

But, after ten years of recession, boom times were right around the corner. An indicator had been the 128% increase in Gwinnett County population between 1970 and 1980, accounting for 57% of new Jackson EMC meters. The cooperative broke ground on a new headquarters facility in Jefferson — its first in 20 years — to handle the growth in membership in anticipation of more growth to come.

The end of the recession was like a match to kindling for Gwinnett County. It would make a name for itself in the 1980s as the fastest growing county in the nation. Nearly 70% of all new Jackson EMC accounts during that period were in Gwinnett, and the county remains home to more than half of all Jackson EMC accounts.

Major commercial and industrial growth in Jackson EMC's service area began in the early 1980s, particularly in Gwinnett and Hall counties. Jackson EMC saw record numbers of new commercial and industrial accounts, a 63% increase in just five years. Companies like

Rockwell International, Scientific Atlanta, Micromeritics, Glidden Paint, Duracell, National Steel, Carmet, Kubota, Peachtree Tooling, Nikon, Abbott Laboratories, Oki Electric and Quadram moved into the area and selected the cooperative as their power provider. Gwinnett Place Mall replaced a farm at the intersection of I-85 and Pleasant Hill Road, attracting other commercial development to the vicinity.

Jackson EMC responded to the growth. New district facilities were built in Lawrenceville. A new data processing system was installed, adding billing flexibility and making customer billing histories available 24 hours a day.

Improvements for commercial and industrial customers with critical and/or intensive power requirements included new substations, loop feeds, dedicated circuits, concrete encasement of primary feeders and exclusive use telephone lines, all to guarantee service reliability. Uninterruptible power source systems were introduced. The first commercial/industrial going into the 1990s, Jackson EMC continued to see record growth averaging between 6,000 and 8,000 new meters each year. Commercial and industrial accounts continued to grow, and so did competition for those accounts. In 1995, the cooperative sharpened its competitive edge by offering price, service and satisfaction guarantees that hinged on low rates, swift outage restoration and power quality. That same year brought a new focus on customer service and satisfaction. Just four years later, Jackson EMC was signing 100% of customer choice loads in its service area. Continuing to build the benefits of cooperative membership, Jackson EMC formed a joint venture with Walton EMC in 1998 to create EMC Security, a subsidiary that would offer both residential and commercial security products and services.

In its second 30 years, Jackson EMC served an additional 114,773 meters, averaging more than 3,800 new meters a year — four times the average annual number added from 1939 to 1969. It added $523 million in assets, more than 8,250 miles of energized wire and 44 substations. And it sold nearly 4 billion more kilowatt hours of electricity annually. The cooperative tripled in size in the 20 years from 1980 to 2000.

Jackson EMC started the new millennium with a long-range plan to support future growth by converting 12kV distribution lines to 25kV, and constructing six new substations. And it capped that plan with new 15-year strategic power agreements to ensure future demand is met at affordable prices.

The sophistication and technical requirements of many of its new commercial and industrial accounts, like Haverty's Eastern Distribution Center and the Gwinnett Civic Arena, demand a constant source of quality, reliable power. The cooperative has constructed a distribution network of underground lines and substations that assure these customers of a reliable power supply.

A new billing system, new automated call distribution system, new mapping system and Call Center are building on the cooperative's history of improving customer service. The level of service provided is evident in the 90% customer satisfaction ratings the cooperative consistently receives, and demonstrated in the 2002 "East Region Cooperative of the Year" and 2004 "Cooperative of the Year" awards received from Wal-Mart Stores, Inc.

As development in Gwinnett County has slowed somewhat, growth in Barrow, Hall and Jackson counties has picked up speed. In just the last five years, the number of meters the cooperative serves has increased 21%, with a 28% increase in the number of commercial/industrial meters.

Our commitment remains the same today as when it was set down at the first board meeting; to provide power to our members at the lowest possible price consistent with sound economy and good management. And in the bargain, we are proud to provide the power to improve lives — both lives at work and lives at home." (Jackson EMC)

Jackson EMC already offers its customers "green power" as a choice of how their energy is produced. The power is sold in blocks of 1,000 KwH for $25. According to Zoller, their green power is currently provided through biomass and low impact hydropower. From EMC's website, "Jackson EMC members who are concerned about the environment may purchase "green energy" — electricity created from renewable resources such as biomass, solar and wind energy.

Our cooperative is one of 38 Georgia electric cooperatives to form GreenPower EMC, a nonprofit cooperative dedicated to helping preserve natural resources. GreenPower EMC contracts for electricity generated by renewable resources, offsetting energy that would otherwise be purchased from traditional sources. We are proud to be among those EMCs offering our members subscriptions to Green Power.

Jackson EMC residential members may purchase a 150-kilowatt-hour block of green energy on a first come-first-served basis. Members who sign up for Green Power will notice an additional $4.50 charge on their bill each month, or 3 cents per kilowatt-hour, to cover the added

expense of generating from a green source. The cost to help the environment is just 15 cents a day – a small investment that will reap tremendous dividends for many years to come.

Additionally, many businesses evaluate a company's eco-friendliness when selecting a business partner. Many of our members have their own environmental objectives, some that require a business partner's support. Jackson EMC commercial customers can participate in green power through our commercial green power rider. Contact a member of the Commercial/Industrial marketing team for details.

Georgia's electric cooperatives are generating power from two landfill sites, our first renewable energy projects, using methane gas that would otherwise simply be burned off. We're also generating power from a low impact hydropower facility. Those three projects have generated more than 141 million kilowatt-hours of electricity since 2003 — enough to supply about 12,049 homes or light 1,308,356 100-watt light bulbs for a year.

In addition, we will purchase 20 megawatts of electricity from the state's first poultry litter-to-energy operation when it comes on line. And, we have constructed a 60-meter-tall wind assessment tower in Floyd County to investigate the potential for wind generation as we continue the quest to add renewable energy generating capacity.

Green Power is also giving something back to the community. Part of the cost of each Green Power kilowatt-hour generated goes into a research and development fund, a portion of which has been used to fund the Sun Power for Schools program. Through the program, participating schools around the state will receive photovoltaic and metering equipment that will enable students to study solar power generation and incorporate their unit's output data in classroom projects." (Jackson EMC, Online)

Total # Meters Served – 205,530 **Total kWh** - 354,280,949

# Meters Served per County		kWh Used
Gwinnett County	104,014	167,048,320
Hall County	40,403	76,465,974
Jackson County	20,385	45,416,865
Barrow County	17,645	32,028,871
Madison County	10,368	13,496,985
Clarke County	5,359	8,735,953
Banks County	4,972	8,005,058
Lumpkin County	2,152	2,791,369
Franklin County	86	107,486
Oglethorpe County	135	282,161

Residential Customers - 185,425

Commercial & Industrial Customers -20,105

Total Number Regular Employees - 430

kWh Sales past 12 months – 5,169,993,954

Total Miles Energized - 13,501

System Demand (8/07) - 1,220 MW