Coal Combustion Residuals Plan for E.W. Brown Station

PPL companies

Generation Planning & Analysis
May 2011

Table of Contents

1.0 Executive Summary

Kentucky Utilities Company's ("KU's") E.W. Brown Generating Station ("Brown") produces three primary coal combustion residuals ("CCR"): bottom ash, fly ash, and gypsum. The ash is currently stored in Brown's Auxiliary Pond ("Aux Pond"). The gypsum is currently being used in the expansion of the Aux Pond but will start being stored in the Aux Pond in 2012. The Aux Pond is expected to reach full capacity in 2015, creating a need for additional CCR management solutions.

On June 21, 2010, the EPA issued a proposed ruling to establish federal guidelines for CCR storage. It is expected that the Main Pond will not meet the proposed regulations. Therefore, KU has stopped construction of the Main Pond and is proposing to construct a landfill in its place to be in service in 2014.

In developing Brown's revised CCR storage plan, five options were reviewed. Two options were determined to be infeasible under the anticipated environmental regulations. The three remaining options were further evaluated to determine the least cost plan. These options are summarized as follows:

- **Case A:** The first landfill option stops construction of the Main Pond Starter Dike immediately, completes the expansion of the Aux Pond to 900 feet by 2012, and converts the Main Pond to a dry landfill by 2014.
- **Case B:** The second landfill option continues the construction of the Main Pond Starter Dike, continues the expansion of the Aux Pond by 2014, and converts the Main Pond to a landfill by 2016.
- **Offsite Landfill:** The third option is for stopping all construction of onsite storage facilities immediately and for a contractor to haul away all CCR for storage in an offsite commercial landfill.

The least cost option for the long-term storage needs at Brown is the first landfill option (Case A) with an onsite landfill in service in 2014. The present value of revenue requirement ("PVRR") of this case is $23 million lower than the second onsite landfill option (Case B) and is $80 million lower than the offsite disposal option.

2.0 Background

The Brown station is located in Mercer County, Kentucky and comprises three coal-fired generating units and seven gas-fired combustion turbines. The total net summer capacity for the three coal units is 683 MW. A flue gas desulfurization ("FGD") system was commissioned in 2010 to control SO_2 emissions from the three coal units. Bottom ash and fly ash are produced as byproducts of burning coal and are currently stored in the Aux Pond. Gypsum is produced as a chemical byproduct of using limestone reagent to remove sulfur dioxide from flue gas with the FGD system. Brown's gypsum is currently being used in the Aux Pond expansion and will be stored in the Aux Pond until a new long-term option is available.

The original CCR storage plan at Brown included

- a phased expansion of the Main Pond and
- a phased construction of the Aux Pond for interim storage of CCR during the Main Pond expansion and for storage of bottom ash once the Main Pond was to be available.

Environmental cost recovery ("ECR") treatment for the first phase of Brown's on-site storage plan was approved by the Kentucky Public Service Commission ("Commission") on June 20, 2005, as Project 20 in Case No. 2004-00426. This phase included raising the elevation of Brown's Main Pond to 902 feet and raising the elevation of the Aux Pond to 880 feet. The second phase was approved on December 23, 2009, as Project 29 in Case No. 2009-00197, and included expanding the Aux Pond to an elevation of 900 feet and expanding the Main Pond to 912 feet.

The Main Pond was removed from service in September 2008 to facilitate construction of the approved Phase I elevation of 902 feet which was scheduled for completion in 2010. The Aux Pond was completed to the approved Phase I elevation of 880 feet in 2008 and has been accepting fly ash and bottom ash since its completion. The second phase of construction, designated Aux Pond elevation 900', is currently ongoing and will expand the Aux Pond to the final design elevation. This second phase commenced in June 2010 and was originally planned to reach completion in mid-2013.

On June 21, 2010, the EPA issued a proposed CCR ruling to establish federal guidelines for CCR storage. These new regulations are expected to result in the possible need to either discontinue the current plans for the Main Pond or to modify its design to comply with the proposed regulations. The specific impacts of the proposed regulations to Brown's CCR plan are detailed in Exhibit JNV-4. Given the potential new requirements, new alternatives for dry landfill disposal of Brown's CCR were developed. The evaluation of these options is discussed herein.

3.0 Process and Methodology

KU and Louisville Gas and Electric Company (collectively "the Companies") develop a least-reasonable-cost plan for meeting the CCR storage needs at each generating station based on the information available at the time of the planning, including information concerning applicable environmental requirements. The process of identifying the plan consists of the three following primary tasks which are performed by several departments within the Companies.

- Needs assessment
- Development of alternatives
- Comparison of alternatives

CCR storage needs are defined by comparing the available storage capacity to the forecast of CCR production. The Project Engineering department and the applicable generating station are responsible for providing an estimate of remaining capacity.

The planned life of the storage facilities is based on CCR production forecast, which is developed by Generation Planning for all stations as a function of the expected coal usage for each unit. The Companies compile information regarding the cost of generation for each unit (e.g., fuel, variable operating and maintenance ("O&M") expenses, and emission costs), a description of the generation capabilities of each unit (e.g., capacity, heat rate curve, commitment parameters, emission rates, availability schedules), a load forecast, the market price of electricity, and the volumetric ability (transfer capability) to access the market. All of this information is brought together in the PROSYM software, which is used to model the economic operation of the Companies' generating system.[1] The projected coal usage data provided by this model is checked for reasonableness by comparing the results to historical data.

The Project Engineering department develops alternatives for onsite CCR storage solutions and their associated costs. Any alternatives for offsite disposal such as beneficial reuse or offsite landfill disposal are provided by each generating station's staff and a CCR team focused on exploring alternatives for byproduct storage. The cash flows for selected options are summarized and provided to Generation Planning for evaluation.

The Generation Planning department evaluates the storage and disposal options received from Project Engineering to determine the PVRR associated with the capital expenditures and O&M expenses of each option. This analysis is performed using the Capital Expenditure Recovery module of the Strategist software model.[2]

4.0 Needs Assessment

As of April 2010, the remaining available capacity of the Aux Pond is 272 thousand cubic yards ("KCY").[3] Completion of the second phase of the Aux Pond is expected to increase its capacity by 1,095 KCY in December 2011. The Aux Pond's remaining capacity was estimated by forecasting the CCR production of ash and gypsum at Brown. The quantity of ash produced at Brown is estimated at a coal specification of 12% ash by weight of the total quantity of coal

[1] The PROSYM model has formed the foundation of prior analyses involving certificates of convenience and necessity for new generating plants, environmental cost recovery for pollution control equipment, and the fuel adjustment clause.

[2] Strategist is a proprietary resource planning computer model. The Capital Expenditure Recovery module is used to quantify the revenue requirements impact associated with capital projects.

[3] Current storage capacities are provided to Generation Planning by Project Engineering based on bathymetric surveys. Based on expected coal burn, Generation Planning forecasts that by the end of 2011, the remaining capacity of the Aux Pond will be 176 KCY, excluding the Phase II expansion.

used, or approximately 12 tons of ash per 100 tons of coal. Converting to volumetric measurement, assuming ash production consists of 80% fly ash and 20% bottom ash, approximately 11 cubic yards ("CY") of total ash is produced per 100 tons of coal. These values are based on Brown's switch to high-sulfur coal in 2011.

The chemical reaction by which gypsum is produced results in a net gypsum production of approximately 18% by weight of the total quantity of coal used,[4] or approximately 18 tons of gypsum per 100 tons of coal. Converting to volumetric measurement, approximately 15 CY of dry-stored gypsum is produced per 100 tons of coal.

Table 1 shows the forecasted CCR production for Brown. The relatively low gypsum production in 2011 is due to the expectation to burn low-sulfur coal through 2011 to conclude a low-sulfur fuel contract. The lower sulfur content results in less gypsum produced.

Table 2 shows the associated quantities of coal forecasted to be burned at Brown, and contains the historical quantities of coal burned as a comparison to the forecast. The forecasted generation and the resulting coal usage at Brown correspond to an average capacity factor of approximately 40 - 45% before the anticipated retirements in 2016 of the coal units at the Cane Run, Green River, and Tyrone stations. After these retirements, Brown's capacity factor is forecasted to increase to approximately 60 - 70%. Variances in load or unexpected outages could result in future CCR production variances and changes to the long-term CCR storage plan at Brown.

Table 1: CCR Production Forecast

CCR Production Forecast (KCY – wet storage)			
	Bottom Ash	**Fly Ash**	**Gypsum**
2011	26	106	87
2012	32	127	226
2013	35	139	248
2014	34	135	240
2015	35	138	246
2016	43	172	307
2017	46	184	327
2018	46	186	330
2019	45	180	320
2020	48	192	341

[4] Fuel specification assumptions include SO_2 content of approximately 5.85 lb/MMBtu and heat content of 22.4 MMBtu/ton.

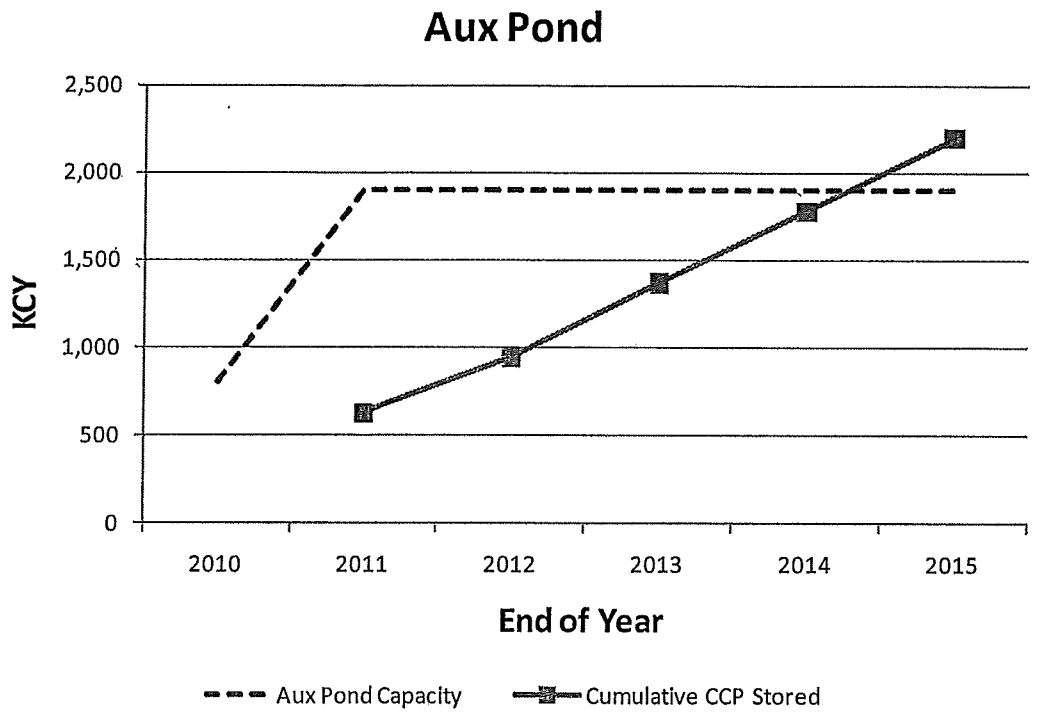
Table 2: Brown Coal Usage (Million Tons)

Brown Coal Usage *(M Tons)*	
Historical	
2006	1.5
2007	1.7
2008	1.8
2009	1.1
2010	1.3
Forecast	
2011	1.1
2012	1.3
2013	1.4
2014	1.3
2015	1.4
2016	1.7
2017	1.8
2018	1.8
2019	1.8
2020	1.9

Figure 1 demonstrates that the Aux Pond is expected to reach full capacity in 2015, with the following assumptions:

- The April 2011 forecast for CCR production
- Onsite beneficial reuse of all gypsum produced until May 2012
- No additional onsite capacity available at the Main Pond site
- No offsite CCR storage or reuse
- The Aux Pond Phase II expansion to 900' is completed in 2011

Figure 1: Aux Pond Capacity



5.0 Development of Alternatives

As a result of the EPA's proposed CCR Ruling, Project Engineering reevaluated long-term onsite CCR storage at Brown as discussed in Exhibit JNV-2. Of the four onsite options considered, two options were determined to be infeasible. Plans for the two remaining options for onsite landfills to replace the main pond were developed for further financial evaluation. In addition, an offsite alternative was compared to the onsite options. These three options are summarized as follows:

- **Case A** – Discontinue construction of the Main Pond Starter Dike, complete construction of the Aux Pond 900', and construct a dry landfill to be in service in 2014.
- **Case B** – Continue construction of the Main Pond Starter Dike and Aux Pond 900' per the original design. Once the CCR Ruling becomes effective, take the Main Pond out of service to construct a landfill over the Main Pond Starter Dike to be in service in 2016.
- **Off-Site Storage** - As an alternative to constructing onsite storage facilities, the offsite storage option represents the projected costs ($28/ton) of hiring a third-party contactor to haul all CCR produced offsite for disposal in a landfill.

6.0 Comparison of Alternatives

The Brown station has three viable alternatives for CCR disposal: Landfill Case A, Landfill Case B, and Offsite Storage. A PVRR evaluation of each of these alternatives was completed.

The capital and O&M costs for Cases A and B were provided by the Project Engineering group as detailed in Exhibit JNV-2. The O&M expenses for Offsite Storage are based on estimated costs for CCR disposal in an offsite landfill as shown in Table 3. Appendix 1 shows detailed assumptions for financial inputs and CCR characteristics. Appendix 2 shows the capital and O&M costs for each alternative.

Table 3: Off-site Disposal Cost

	$ per ton (2011)
Excavating and Loading	$1.82
Tipping Fee	$20.01
Hauling	$6.06
Total	$27.88

Table 4 shows that the PVRR for Case A is the least cost. The PVRR for Case B is $23 million greater than that of Case A. The PVRR for offsite storage is $80 million greater than that of the Case A. Appendix 3 shows the annual revenue requirements associated with each alternative.

Table 4: PVRR Comparison

2010 million $	Case A	Case B	Offsite Disposal
PVRR	130	153	250
Delta to Least Cost Case	Least Cost	23	80

7.0 Recommendation

The needs assessment demonstrates a need for additional CCR storage capacity at the Brown station by 2015. Analysis of the onsite and offsite storage options demonstrates that a completion of the Aux Pond expansion to elevation 900 feet that was part of the original 2005 ECR plan is advisable. And it is recommended to immediately begin converting the Main Pond to an onsite landfill to begin service in 2014 to allow for long-term CCR storage at Brown while complying with anticipated environmental regulations in a least cost manner.

The entire phased landfill Case A is more cost-effective than the delayed Main Pond conversion of Case B and offsite disposal. This plan will provide Brown with sufficient capacity to store CCR through 2031, with the potential to modify the future phases to accommodate changes in the CCR production forecast.

8.0 Appendices

8.1 Appendix 1 - Analysis Assumptions

Study Period: 2010-2031 for O&M costs impacts; 2010 through the book life of final project phase for capital costs

The revenue requirements associated with capital costs are determined via the Capital Expenditure and Recovery module of the Strategist production and capital costing software. To completely account for capital projects costs over their lifetime, the revenue requirements associated with new capital projects were extended through the end of their book life beyond the study period as needed.

Capital and O&M costs associated with the addition of new environmental projects will be recovered through the ECR mechanism.

Financial data

- Discount rate: 6.70%
- Income tax rate: 38.9%
- Insurance rate: 0.07%
- Property tax rate: 0.15 %
- Percentage of debt in capital structure: 47.13%
- Debt interest rate/weighted cost of debt: 3.76%
- Return on equity: 10.63%
- Aux Pond 900' capital book life: 17-20 years
- Landfill phase average book life, Case A: 11 years
- Landfill phase average book life, Case B: 9 years
- All CCR storage projects tax life: 20 years
- Annual capital escalation rate: 6%
- Annual O&M escalation rate: 3%
- Overhead: 3.5%

CCR Specifications Assumptions

- Coal % ash: 12%
- Bottom ash % of total ash: 20%
- CCR % moisture for hauling: 15%
- Density

Tons/CY	**Bottom Ash**	**Fly Ash**	**Gypsum**
Wet Storage	0.945	0.945	1.0125
Dry Storage	1.215	1.080	1.242

8.2 Appendix 2 - Annual Cash Flows

E.W. Brown Landfill - Case A

	Annual Cash Flows ($ thousands)									
	Capital						O&M			Total Cash Flows
	Aux Pond	Landfill				Total Capital	Gypsum Dewatering	Landfill	Total O&M	
		Phase 1	Phase 2	Phase 3	Final Cap					
2010	2,743	2,018	-	-	-	4,761	250	-	250	5,011
2011	8,393	5,869	-	-	-	14,262	515	-	515	14,777
2012	-	26,722	-	-	-	26,722	-	-	-	26,722
2013	-	24,064	-	-	-	24,064	-	-	-	24,064
2014	-	-	-	-	-	-	563	2,251	2,814	2,814
2015	-	-	-	-	-	-	580	2,319	2,898	2,898
2016	-	-	-	-	-	-	597	2,388	2,985	2,985
2017	-	-	-	-	-	-	615	2,460	3,075	3,075
2018	-	-	9,321	-	-	9,321	633	2,534	3,167	12,488
2019	-	-	899	-	-	899	652	2,610	3,262	4,161
2020	-	-	-	-	-	-	672	2,688	3,360	3,360
2021	-	-	-	-	-	-	692	2,768	3,461	3,461
2022	-	-	-	-	-	-	713	2,852	3,564	3,564
2023	-	-	-	18,434	-	18,434	734	2,937	3,671	22,105
2024	-	-	-	1,203	-	1,203	756	3,025	3,781	4,985
2025	-	-	-	-	-	-	779	3,116	3,895	3,895
2026	-	-	-	-	-	-	802	3,209	4,012	4,012
2027	-	-	-	-	-	-	826	3,306	4,132	4,132
2028	-	-	-	-	-	-	851	3,405	4,256	4,256
2029	-	-	-	-	-	-	877	3,507	4,384	4,384
2030	-	-	-	-	-	-	903	3,612	4,515	4,515
2031	-	-	-	-	2,714	2,714	930	3,721	4,651	7,365
Total	11,136	58,674	10,220	19,637	2,714	102,382	13,942	52,706	66,648	169,029

Exhibit E

E.W. Brown Landfill - Case B

	Annual Cash Flows ($ thousands)									
	Capital						O&M			Total Cash Flows
	Aux Pond	Landfill				Total Capital	Gypsum Dewatering	Landfill	Total O&M	
		Phase 1	Phase 2	Phase 3	Final Cap					
2010	1,708	13,352	-	-	-	15,059	250	-	250	15,309
2011	2,907	-	-	-	-	2,907	515	-	515	3,422
2012	3,082	523	-	-	-	3,605	530	-	530	4,136
2013	4,499	6,287	-	-	-	10,786	546	-	546	11,333
2014	-	31,135	-	-	-	31,135	-	-	-	31,135
2015	-	31,387	-	-	-	31,387	-	-	-	31,387
2016	-	-	-	-	-	-	597	2,388	2,985	2,985
2017	-	-	-	-	-	-	615	2,460	3,075	3,075
2018	-	-	-	-	-	-	633	2,534	3,167	3,167
2019	-	-	-	-	-	-	652	2,610	3,262	3,262
2020	-	-	16,476	-	-	16,476	672	2,688	3,360	19,836
2021	-	-	1,132	-	-	1,132	692	2,768	3,461	4,592
2022	-	-	-	-	-	-	713	2,852	3,564	3,564
2023	-	-	-	-	-	-	734	2,937	3,671	3,671
2024	-	-	-	-	-	-	756	3,025	3,781	3,781
2025	-	-	-	24,727	-	24,727	779	3,116	3,895	28,622
2026	-	-	-	1,514	-	1,514	802	3,209	4,012	5,526
2027	-	-	-	-	-	-	826	3,306	4,132	4,132
2028	-	-	-	-	-	-	851	3,405	4,256	4,256
2029	-	-	-	-	-	-	877	3,507	4,384	4,384
2030	-	-	-	-	-	-	903	3,612	4,515	4,515
2031	-	-	-	-	2,280	2,280	930	3,721	4,651	6,931
Total	12,196	82,684	17,608	26,242	2,280	141,009	13,876	48,137	62,013	203,022

Exhibit E

Off-Site Landfill Option

	Annual Cash Flows ($ thousands)	
	Capital	O&M
2010	-	3,960
2011	-	6,974
2012	-	12,750
2013	-	14,417
2014	-	14,385
2015	-	15,156
2016	-	19,487
2017	-	21,399
2018	-	22,261
2019	-	22,218
2020	-	24,363
2021	-	26,387
2022	-	27,047
2023	-	28,549
2024	-	30,280
2025	-	32,787
2026	-	32,151
2027	-	35,381
2028	-	36,194
2029	-	38,842
2030	-	38,218
2031	-	41,942
Total	-	**545,148**

8.3 Appendix 3 - Revenue Requirements

E.W. Brown Landfill - Case A

	Annual Revenue Requirements ($ thousands)									
	Capital						O&M			Total
	Aux	Landfill				Total	Gypsum	Landfill	Total	Revenue
	Pond	Phase 1	Phase 2	Phase 3	Final Cap	Capital	Dewatering		O&M	Requirements
2010	244	179	-	-	-	423	250	-	250	673
2011	1,158	701	-	-	-	1,859	515	-	515	2,374
2012	1,680	3,076	-	-	-	4,755	-	-	-	4,755
2013	1,611	5,214	-	-	-	6,825	-	-	-	6,825
2014	1,544	11,226	-	-	-	12,771	563	2,251	2,814	15,584
2015	1,480	10,712	-	-	-	12,192	580	2,319	2,898	15,090
2016	1,418	10,210	-	-	-	11,628	597	2,388	2,985	14,613
2017	1,357	9,721	-	-	-	11,078	615	2,460	3,075	14,152
2018	1,298	9,242	828	-	-	11,368	633	2,534	3,167	14,535
2019	1,240	8,773	908	-	-	10,922	652	2,610	3,262	14,183
2020	1,183	8,313	1,960	-	-	11,456	672	2,688	3,360	14,816
2021	1,126	7,863	1,870	-	-	10,858	692	2,768	3,461	14,319
2022	1,068	7,413	1,782	-	-	10,264	713	2,852	3,564	13,828
2023	1,011	6,964	1,697	1,638	-	11,309	734	2,937	3,671	14,981
2024	953	6,432	1,613	1,745	-	10,743	756	3,025	3,781	14,525
2025	896	892	1,531	3,767	-	7,087	779	3,116	3,895	10,982
2026	839	787	1,451	3,594	-	6,671	802	3,209	4,012	10,683
2027	781	682	1,372	3,426	-	6,262	826	3,306	4,132	10,394
2028	724	577	1,294	3,261	-	5,856	851	3,405	4,256	10,113
2029	666	472	1,215	3,101	-	5,455	877	3,507	4,384	9,839
2030	582	367	1,123	2,943	-	5,015	903	3,612	4,515	9,530
2031	7	262	156	2,789	241	3,456	930	3,721	4,651	8,107
2032	0	158	138	2,638	513	3,446	-	-	-	3,446
2033	0	52	120	2,487	490	3,149	-	-	-	3,149
2034	-	-	101	2,336	467	2,904	-	-	-	2,904
2035	-	-	83	2,158	445	2,685	-	-	-	2,685
2036	-	-	64	301	423	788	-	-	-	788
2037	-	-	46	265	401	713	-	-	-	713
2038	-	-	28	230	380	638	-	-	-	638
2039	-	-	9	194	360	563	-	-	-	563
2040	-	-	-	159	339	498	-	-	-	498
2041	-	-	-	124	319	442	-	-	-	442
2042	-	-	-	88	294	383	-	-	-	383
2043	-	-	-	53	40	93	-	-	-	93
2044	-	-	-	18	35	53	-	-	-	53
2045	-	-	-	-	31	31	-	-	-	31
2046	-	-	-	-	26	26	-	-	-	26
2047	-	-	-	-	21	21	-	-	-	21
2048	-	-	-	-	17	17	-	-	-	17
2049	-	-	-	-	12	12	-	-	-	12
2050	-	-	-	-	7	7	-	-	-	7
2051	-	-	-	-	2	2	-	-	-	2
2010 PVRR	13,635	66,297	7,916	11,022	894	99,763	6,620	23,549	30,169	129,932

Exhibit E

CCR Plan for E.W. Brown Station
May 2011

E.W. Brown Landfill - Case B

	Annual Revenue Requirements ($ thousands)									
	Capital						O&M			Total
	Aux	Landfill				Total	Gypsum		Total	Revenue
	Pond	Phase 1	Phase 2	Phase 3	Final Cap	Capital	Dewatering	Landfill	O&M	Requirements
2010	152	1,186	-	-	-	1,338	250	-	250	1,588
2011	515	1,186	-	-	-	1,702	515	-	515	2,217
2012	965	1,233	-	-	-	2,198	530	-	530	2,728
2013	1,543	1,792	-	-	-	3,334	546	-	546	3,881
2014	1,810	4,558	-	-	-	6,368	-	-	-	6,368
2015	1,734	7,347	-	-	-	9,082	-	-	-	9,082
2016	1,661	17,585	-	-	-	19,246	597	2,388	2,985	22,231
2017	1,590	16,746	-	-	-	18,336	615	2,460	3,075	21,410
2018	1,521	15,925	-	-	-	17,446	633	2,534	3,167	20,613
2019	1,453	15,122	-	-	-	16,575	652	2,610	3,262	19,837
2020	1,387	14,334	1,464	-	-	17,186	672	2,688	3,360	20,545
2021	1,322	13,561	1,565	-	-	16,448	692	2,768	3,461	19,908
2022	1,256	12,802	3,717	-	-	17,775	713	2,852	3,564	21,339
2023	1,191	12,054	3,539	-	-	16,785	734	2,937	3,671	20,456
2024	1,126	11,214	3,366	-	-	15,706	756	3,025	3,781	19,487
2025	1,060	1,591	3,197	2,197	-	8,045	779	3,116	3,895	11,940
2026	995	1,439	3,030	2,332	-	7,796	802	3,209	4,012	11,808
2027	929	1,288	2,867	5,539	-	10,624	826	3,306	4,132	14,756
2028	864	1,136	2,706	5,276	-	9,982	851	3,405	4,256	14,239
2029	799	985	2,549	5,017	-	9,349	877	3,507	4,384	13,733
2030	705	833	2,371	4,765	-	8,674	903	3,612	4,515	13,189
2031	30	682	333	4,517	203	5,764	930	3,721	4,651	10,415
2032	14	530	301	4,273	475	5,594	-	-	-	5,594
2033	4	379	269	4,034	452	5,138	-	-	-	5,138
2034	-	227	238	3,799	430	4,694	-	-	-	4,694
2035	-	76	206	3,534	408	4,224	-	-	-	4,224
2036	-	-	174	496	387	1,058	-	-	-	1,058
2037	-	-	143	449	366	958	-	-	-	958
2038	-	-	111	402	346	859	-	-	-	859
2039	-	-	79	354	326	759	-	-	-	759
2040	-	-	48	307	303	658	-	-	-	658
2041	-	-	16	260	42	317	-	-	-	317
2042	-	-	-	213	38	250	-	-	-	250
2043	-	-	-	165	34	199	-	-	-	199
2044	-	-	-	118	30	148	-	-	-	148
2045	-	-	-	71	26	97	-	-	-	97
2046	-	-	-	24	22	45	-	-	-	45
2047	-	-	-	-	18	18	-	-	-	18
2048	-	-	-	-	14	14	-	-	-	14
2049	-	-	-	-	10	10	-	-	-	10
2050	-	-	-	-	6	6	-	-	-	6
2051	-	-	-	-	2	2	-	-	-	2
2010 PVRR	13,939	86,740	11,993	12,931	750	126,353	6,682	20,136	26,818	153,171

Exhibit E

Off-Site Landfill Option

	Annual Revenue Requirements($ thousands)	
	Capital	O&M
2010	-	3,960
2011	-	6,974
2012	-	12,750
2013	-	14,417
2014	-	14,385
2015	-	15,156
2016	-	19,487
2017	-	21,399
2018	-	22,261
2019	-	22,218
2020	-	24,363
2021	-	26,387
2022	-	27,047
2023	-	28,549
2024	-	30,280
2025	-	32,787
2026	-	32,151
2027	-	35,381
2028	-	36,194
2029	-	38,842
2030	-	38,218
2031	-	41,942
PVRR	-	249,968