



Advanced Disposal Services, Inc.  
Blue Ridge Landfill  
2700 Winchester Road  
Irvine, KY 40336

606-723-5552

November 17, 2017

Mr. Jeffrey A. Cummins  
Director, Division of Enforcement  
Kentucky Energy and Environment Cabinet  
Department for Environmental Protection

Re: Response to Blue Ridge Landfill Corrective Action Plan – Cabinet Comments Dated October 13, 2017

Dear Mr. Cummins:

This letter and the attachment are submitted on behalf of Advanced Disposal Services Blue Ridge Landfill, Inc., in accordance with the Agreed Order No. DWM-160048. This letter contains the response to the Kentucky Energy and Environmental Cabinet's (EEC) second set of comments (dated October 13, 2017, and received October 23, 2017) on the Corrective Action Plan (CAP), which is required as part of the Agreed Order. The associated revised CAP is attached.

**EEC Comment #1:**

"There is no final compliance date specified in the CAP as required by paragraph 19 (e) of the agreed order. The final compliance date is the date Blue Ridge anticipates completing all remedial actions listed in the CAP. Please provide a final compliance date in accordance with the agreed order."

*Response #1:*

Blue Ridge Landfill proposes that the final compliance date will be the date the EEC issues its final approval of the permit modifications to the facility's Solid Waste Permit necessary to implement the CAP. The contents of the permit modification are detailed in several of the responses below and include additional sampling and analysis, enhanced landfill cover, and modifications to the landfill gas extraction system. These modifications would propose milestone dates for interim compliance with sampling and monitoring, which would include a reduced frequency or extended monitoring period, depending on the results. The EEC's final approval of the permit modifications, many of which will continue for the life of the facility, will make the operational changes legally binding and, therefore, fulfill the purpose of the CAP, including interim and final compliance.

**EEC Comment #2:**

"In response to cabinet comment 3 requesting monitoring for radionuclides for groundwater, surface water, and leachate, ADS proposes to work with the cabinet to develop a Radionuclide Sampling Plan. The groundwater sampling plan proposed in the August 28, 2017 submission that includes monitoring for groundwater (quarterly at all groundwater monitoring well locations presumably for a year then monitoring of two downgradient wells-MW-13 and MW-15R on a semi-annual basis) for radionuclides is acceptable. The broader Sampling Plan must also include sampling of leachate and the two underdrains at the landfill for radionuclides on at least a semi-annual basis as these locations would provide more timely data points to determine if there are any resultant impacts from the BES waste. See comment 3

below. The cabinet recognizes the importance of determining background radioactivity levels in groundwater for the site, given the fact that the New Albany Shale has been demonstrated through screening to have naturally occurring radioactivity levels of Ra-226 and Ra-228. Further, it is important to establish the background activity levels and the ranges of activity in groundwater in order to use the data to determine potential future impacts from the BES waste. However, please note that in order to determine truly representative background levels in groundwater, a comparison must be made of the monitoring results from upgradient wells related to downgradient wells. Also, any changes to the groundwater monitoring requirements will need to be incorporated as amendments to the solid waste landfill permit."

*Response #2:*

Blue Ridge Landfill will develop a Radionuclide Sampling/Analysis Plan for additional monitoring of the groundwater and surface water and will seek regulatory approval of this plan through the permit modification process. Additionally, Blue Ridge landfill will submit an addendum to the existing Groundwater Assessment Report submitted in 2016, outlining the proposed radionuclide monitoring and frequency. However, because of the presence of naturally occurring radioactivity in *in situ* soil and the surrounding bedrock used as cover material, Blue Ridge Landfill cannot agree to include leachate monitoring in the sampling plan. Blue Ridge Landfill is not aware of any testing or monitoring procedure that can distinguish the radioactivity emitted from naturally occurring cover materials (soil and rock) from radioactivity that may be emitted from the BES Waste material. Accordingly, Blue Ridge Landfill believes that any leachate testing results would be inconclusive, ambiguous, and would not provide value in this remedial process. Should circumstances change, the EEC could use the permit modification process to address those changes.

**EEC Comment #3:**

**"Section 4.2.1 Remediation Alternative 1: Closure-in-Place and Monitoring.** In Section 2.1 Blue Ridge Landfill Overview, it is stated that the landfill operations are expected to continue until 2034 (unless an expansion is approved under the solid waste permit). In order to reduce potential exposure to workers and others to the BES waste during the active disposal life of the landfill, it is important to comply with the primary radiation safety principle 'As Low as Reasonably Achievable' (ALARA), which in essence means to make every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical. In order to ensure this level of protectiveness related to the BES waste, the cabinet requires an Interim Remedial Measures Plan (IRMP) be developed and implemented. The IRMP should include at a minimum: 1) a proposal for placing an additional low-permeable layer (clay, geosynthetic or a combination thereof) over the BES wastes (including a minimum 30-yard buffer around the waste area) as an interim measure to prevent surface water infiltration; 2) procedures for ensuring the BES waste remains covered and undisturbed until closure; 3) a plan for routine monitoring of leachate and the underdrains for radionuclides; 4) prohibiting recirculation of leachate at the landfill, and 5) procedures for notification of the City of Irvine Waste Water Treatment Plant if levels of radioactivity are found in leachate exceeding an action level and a plan for its proper handling and disposal. A radiation worker training and safety program must also be developed and implemented to meet the requirements of pending regulations by CHFS and 902 KAR 100:019."

*Response #3:*

Blue Ridge Landfill will submit the Interim Remedial Measures Plan as part of the permit modification processes referenced in Responses #1 and #2 above. This plan will address all aspects of Comment #3, with the following exception: because Blue Ridge Landfill will not conduct additional leachate monitoring (based on the reasons outlined in Response #2), this plan will not include provisions for leachate monitoring and wastewater treatment plant notifications. It is important to note that Blue Ridge Landfill does plan to include underdrain monitoring as part of the Radionuclide Sampling/Analysis Plan, and, therefore, the underdrain monitoring will be addressed as requested in Comment #3.

With regard to item 5 concerning notification to the City of Irvine Waste Water Treatment Plant, Blue Ridge Landfill's permit prohibits the contribution of "any radioactive wastes or isotopes of such half-life or concentrations as may exceed limits established by applicable State or Federal Regulations." US EPA (2015 "*Radionuclides in Drinking Water*") states "there are no current federal regulations concerning the disposal of radionuclides to the sewer." Similarly, Kentucky does not have regulations restricting the discharge of radionuclides to the sewer system. Because neither state nor federal regulations establish limits on the concentrations of radionuclides that may be discharged to a wastewater treatment plant through a sewer connection, we conducted further research to identify guidance relevant to the Blue Ridge Landfill.

Sampling conducted by the Commonwealth of Kentucky on leachate from the Blue Ridge Landfill in February 10, 2016 shows that radium-226 (Ra-226) and radium-228 (Ra-228) were below the minimum detectable concentration.<sup>1</sup> (See Exhibit A). The Nuclear Regulatory Commission has promulgated radionuclide standards for licensed nuclear facilities that discharge to sanitary sewers. See 10 C.F.R. § 20.1003; § 2003 (2015) these regulations set forth a standard of 600 pCi/L for Ra-226 and Ra-228 relating to discharges to sanitary sewer systems at nuclear facilities. These standards, however, do not apply to the Blue Ridge Landfill. Additionally, the NRC "determined that there was no widespread public health or safety concern due to potential radiation exposures associated with the handling, beneficial use, and disposal of sewage sludge." (See 70 Fed. Reg. 68,350 Nov. 10, 2005). The NRC's technical survey showed that "the most significant levels of radioactive materials in publicly owned treatment works (POTWs) are attributable to naturally occurring radioactive material (NORM)," not to manmade radiation. *Id.* at 68,351.

In sum, (1) there is no enforceable standard limiting the concentration of radionuclides from a landfill to a waste water treatment plant; (2) the only available data on Ra-226 and RA-228 in leachate at the Blue Ridge Landfill are non-detect measurements; and (3) the main source of radionuclides in sewage sludge is from NORM. Consequently, given the minor amount of radionuclides (if any) in the BES Waste material in proportion to the total amount of waste mass in the landfill, the high probability that any radionuclides would be naturally occurring, and the lack of an enforceable discharge standard, we do not believe leachate testing is required to satisfy Blue Ridge Landfill's permit with the Irvine Municipal Utilities.

**EEC Comment #4:**

**"Section 4.2.1 Remediation Alternative 1: Closure-in-Place and Monitoring.** In this section and in other portions of the CAP, an 'enhanced cap' is proposed to be placed over the BES waste as part of the final cover system when the landfill closes. The purpose of the enhanced cap, consisting of a low-permeability geo-synthetic clay liner (GCL) will be to further reduce long-term infiltration of surface water into the BES wastes. The cabinet agrees with the proposal to design and place the enhanced cap as outlined above in accordance with the updated pending regulatory requirements in 401 KAR 48:090 and 902 KAR 100:180, Section 6(2) (a). ADS must ensure that the construction methods and specifications for the additional low-permeability liner are consistent with the pending regulations. Financial assurance for the enhanced cap and additional monitoring must be provided pursuant to the closure care requirements in 401 KAR 48:310."

*Response #4:*

Blue Ridge Landfill proposes to conduct additional monitoring of the groundwater beginning during the first quarter of 2018. This additional monitoring will be conducted over the operating life of the landfill

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<sup>1</sup> The concentration of Ra-226 was 524 pCi/L, below the MDA of 558 pCi/l and the concentration of Ra-228 was 60.1 pCi/L, below the MDA of 106 pCi/L. This means all that can be said about the Ra-226 result is that it is below 524 pCi/L and all that can be said about the Ra-228 result is that it is below 60.1 pCi/L.

and may be reduced over time based on the additional monitoring results. An outlined schedule is provided in Response 7B and will be further detailed in the minor permit modification. Blue Ridge Landfill does not believe long-term monitoring, extending beyond the current post-closure period, would be necessary. Based on the current operating life of the facility, the post-closure period will not end until 2064. In the unlikely event that radioactivity is identified in the groundwater and surface water as a result of the BES Waste, and it is determined additional monitoring activities are warranted, a plan for additional long-term monitoring will be developed, including any additional financial assurance.

**EEC Comment #5:**

"In response to cabinet comment 8 which related to the likelihood of radon in the landfill gas that is extracted and used to generate electricity on-site, and the potential for contamination in condensate that is collected from cooling of landfill gas, ADS proposes to relocate the existing landfill gas extraction wells in the BES waste area to other areas of the landfill and prohibit drilling extraction wells in the BES waste area. The proposed modifications will require amending the solid waste permit, and would reduce potential exposure to workers in future drilling of gas extraction wells in the area. However, moving the existing landfill gas extraction wells from the BES Waste area will not reduce the landfill gas generation from that area, and does not address potentially radon-contaminated methane gas, which could be released into the atmosphere. As an option, the extraction wells could remain in the BES Waste area, and the methane gas monitored for radon contamination. In addition, the leachate, including the condensate from the cooled landfill gas, should be monitored for radionuclides (see comment 3)."

*Response #5:*

Blue Ridge Landfill will modify the design of the landfill gas extraction system to avoid future extraction well installation or other disturbances within the BES Waste disposal area. Depending on the efficiency of the modified design (*i.e.*, if the standard 150-ft radius of influence cannot be achieved), Blue Ridge Landfill may propose the addition of surface extraction infrastructure for landfill gas. The potential infrastructure would be located immediately below the final cover system but above the BES Waste. The modified landfill gas system design will be included in the permit modification to be submitted to EEC, as referenced above.

**EEC Comment #6:**

"**Section 6.6 Implementability.** Other issues related to the logistics of implementation of Remedial Alternative 2 (Excavate and Redispose BES waste) which should be considered include whether there may be temporary disruptions of routine waste disposal of MSW from Estill, Madison and other surrounding counties during the removal operation, and the likelihood of additional heavy truck traffic at BRL and in the vicinity of BRL from trucks hauling BES waste out while trucks are hauling MSW to the landfill. Please provide an assessment of these potential impacts."

*Response #6:*

Blue Ridge Landfill agrees that logistical issues would cause significant implementability challenges for Remediation Alternative 2 (Excavate and Redispose BES Waste). The CAP includes a discussion of trucks needed to complete Remediation Alternative 2. The average trucks per day (24 trucks per day for more than 90 days) are provided in Table 4.3 and the total travel miles (more than 1.5 million miles) are provided in Table 6.4 of the CAP. Blue Ridge Landfill also considered the on-site and off-site injury and fatality risks associated with increased truck traffic that would be required to implement Remediation Alternative 2 (see Section 6.5.2, Table 6.4, and Attachment D) and addressed the damage to roadways in Section 6.5.3. In addition, Sections 6.5.2 and 6.6 of the CAP text have been updated to reflect potential disruptions of routine municipal solid waste (MSW) disposal at the Blue Ridge Landfill, an increase in local traffic and its potential disruption to a local school, and increased truck hauling impacts.

**EEC Comment #7A:**

**"Section 6.7 Cost. Table 6.6. Attachment E.** For Remedial Alternative 1 (Closure-in-Place and Monitoring), the estimate must include:

1. Development and implementation of the Interim Remedial Measures Plan (IRMP) referenced in Comment 3 including:
  - a. Design and construction costs for the IRMP liner.
  - b. Cost of routine monitoring for radionuclides in groundwater, leachate and underdrains and contingency disposal costs in the event leachate is contaminated with radionuclides and would need to be disposed at an alternate facility other than the WWTP.
2. Financial Assurance Costs for the enhanced cap and long-term monitoring."

*Response #7A:*

The cost estimate (see Section 6.7, Table 6.6, and Attachment E) has been updated to include the IRMP liner and routine monitoring.

**EEC Comment #7B:**

**"Section 6.7 Cost. Table 6.6. Attachment E.** For Remedial Alternative 2 (Excavate and Redispose BES Waste), the cost estimate for remedy implementation must include:

1. Additional project management costs if work is required to be conducted under radiation health and safety protocols with oversight by a certified health physicist. At a minimum, excavations of BES waste with material at these levels entails potential worker exposure and contamination that requires protective measures including: radiation hazard safety training for workers, protective clothing, personnel monitoring devices if radiation levels are such that a worker may exceed 100 mrem per year, monitoring of workers and equipment to assure absence of surface contamination, and initial air monitoring for particulate and radon levels to determine need for ongoing air monitoring during excavation work.
2. Stormwater controls to prevent contaminant migration during removal.
3. Air monitoring and potential mitigation measures (use of enzymes, deodorizers, *etc.*) to address nuisance odors and other potentially harmful gases, including hydrogen sulfide and methane, during the excavation."

*Response #7B:*

Blue Ridge Landfill will develop a permit modification that will include the items listed below.

1. A modification to the Environmental Monitoring Plan to include the following:
  - i. Additional underdrain and groundwater monitoring (including the tentative schedule outlined below):
    1. Groundwater and underdrain baseline testing – 2018.
    2. Additional routine monitoring of the groundwater and underdrains – 2019-2023.
    3. Five years of additional monitoring of the groundwater and underdrains (reduced to five based on the routine monitoring results) – 2028-2034.
    4. Annual additional monitoring to continue through end of the post-closure care period if elevated results are identified.

- ii. The Final Cover Plan to include the enhanced final cover system. The proposed enhanced final cover will reduce infiltration from approximately 1 inch per acre per year to <math><1/2</math> inch per acre per year. Estimating an enhanced final cover area of 4 acres, this would reduce infiltration on an annual basis from 27,000 gallons to less than 13,000 gallons in that area.
- iii. The landfill gas extraction system, to avoid future installation into the BES Waste and the possible addition of surface infrastructure.

Blue Ridge Landfill agrees that costs for Remediation Alternative 2 should include appropriate health and safety and engineering controls described above. To account for these factors, we added a line item in our detailed cost estimate calculations table for Remediation Alternative 2 in Attachment E. The additional cost was calculated by applying a cost adjustment factor as outlined in Appendix B of US EPA and US ACE (2000), an industry-standard method for cost estimation. The cost adjustment factor includes personal protective equipment, additional health and safety professionals, training, health and safety-related monitoring equipment (*e.g.*, air monitoring for particulates or personal radiation monitors), and engineering controls (*e.g.*, stormwater management). The calculation assumed light work-modified Level D protection, as provided in the updated Attachment E. Section 6.7 of the CAP was revised accordingly.

**EEC Comment #8:**

**"Section 6.7 Cost. Table 6.6. Attachment E.** A 7.0% annual discount rate was used to calculate the net present value of future costs based on a USEPA and USACE reference from 2000. The rate may not be realistic at the current time. It may be more appropriate to use a more recent discount rate utilized by the U.S. Office of Management and Budget (OMB) of 1.7 to 2.7% in order to ensure the project costs are not underfunded."

*Response #8:*

We used a representative discount rate of 7% provided in US EPA and US ACE (2000, p. 4-4), "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study," which is a typical industry standard used to develop cost estimates for remedial action alternatives. To address EEC's concerns, we conducted a sensitivity analysis of costs using 2% and 10% discount rates. The sensitivity analysis only applied to Remediation Alternative 1, because no incremental costs are associated with future operation and maintenance (O&M) activities in Remediation Alternative 2 (see Attachment E). The results of this sensitivity analysis indicated that incremental costs of \$470,800 and \$463,000 are expected for the 2% and 10% discount rates, respectively, compared to \$464,900 using the 7% discount rate.

**EEC Comment #9:**

**"Section 6.7 Cost. Attachment E.** Under Remediation Alternative 1: Closure-in-Place and Monitoring, the future monitoring costs are projected for a timeframe of 30 years, typical for post-closure monitoring of solid waste landfills. However, due to the presence of the BES waste, which includes radionuclides with very long half-lives, monitoring costs should be estimated for a minimum of 100 years, consistent with the maximum period controls can be relied upon per 902 KAR 100:022 Section 27."

*Response #9:*

Blue Ridge Landfill reaffirms that the current financial assurances and post-closure monitoring period are adequate and sufficient. In the unlikely event that additional or longer-term measures are needed based on the results of the Radionuclide Sampling/Analysis Plan, Blue Ridge Landfill will adjust the post-closure monitoring period and financial assurances at that time.

**EEC Comment #10:**

**"Section 6.7 Cost. Attachment E.** Section 4.0 includes estimated disposal cost (quoted from a third party provided by ADS) in a commercial hazardous waste landfill at \$1,585,200 for 39,630 cubic yards. Is this the Mostoller Landfill in Pennsylvania? Also, Section 4.1 has the cost itemized as 'Landfill Non-hazardous Solid Bulk Waste.' Please clarify the description in the chart."

*Response #10:*

The estimated disposal cost was for BES Waste to be re-disposed of at the Mostoller Landfill, a facility operated by ADS that is permitted to accept waste containing technologically enhanced naturally occurring radioactive material (TENORM). The cost of \$1,585,200 for 39,630 yards in Attachment E pertains to hauling costs for the BES Waste quoted to ADS by a third party. There are no costs for disposal of the BES Waste at the Mostoller Landfill because ADS also operates that facility. Sections 4.0 and 4.1 of the table for "Remediation Alternative 2: Excavate and Redispose BES Waste" in Attachment E have been updated for clarity.

**Additional Item**

The results of the well survey performed in the downgradient vicinity of the landfill are attached (see Exhibit B). No additional wells were identified based on the survey.

Please contact me at (724) 244-9511 or at [joseph.santangelo@advanceddisposal.com](mailto:joseph.santangelo@advanceddisposal.com) should you have any further questions or comments.

Sincerely;



Joseph Santangelo  
Environmental Compliance Manager  
Advanced Disposal – Blue Ridge Landfill

**Exhibit A**

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# ER\_FAIRMONTBRIN\_03-07-16

03/04/2016 - 03/04/2016

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/L	Uncertainty	MDA	Code	Method
BB01267	FAIRMONT_BRINE_Processing_Concrete_Basin_Setting_Tank	3/4/16	Sludge						
				Bi-214	994000	37200	2670	=	GAMMA
				Pb-214	995000	41700	4350	=	GAMMA
				Ra-226	950000	67600	43000	=	GAMMA
				Ra-228	207000	7150	5450	=	GAMMA

Results are reported using the activity concentrations from the peak associated with radium-226 (Ra-226) due to the fact that bismuth-214 (Bi-214) and lead-214 (Pb-214) are not in secular equilibrium with Ra-226 even after allowing each sample to sit sealed for 21 days. These activity concentration results could be slightly elevated due to the interference from uranium-235 (U-235) which contributes slightly to a peak in the same area as the Ra-226 peak. Given that these samples are being used to make public health decisions, the decision was made to err on the side of reporting potentially higher activity concentrations for Ra-226 rather than potentially lower activity concentrations.

*Stephanie C Buck*

04/08/16

Code:  
 "U" Less than MDA or greater than MDA with high counting uncertainty.  
 "U\*" Analyte not detected. Activity based on software calculation, not identified peak(s).  
 "=" No qualifier necessary  
 "J" Value is estimated.  
 "R" Not useable for intended purpose

Friday, April 8, 2016

ER\_BLUERIDGE\_LF\_03-07-16

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/g	Uncertainty	03/04/2016 - 03/04/2016		
							MDA	Code	Method
BB01255	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	125	5.23	2.10	=	GAMMA
				Pb-214	131	5.64	2.24	=	GAMMA
				Ra-226	131	11.2	20.7	=	GAMMA
				Ra-228	96.6	3.78	3.18	=	GAMMA
BB01256	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	5.37	0.306	0.321	=	GAMMA
				Pb-214	5.69	0.297	0.354	=	GAMMA
				Ra-226	9.78	1.22	2.76	=	GAMMA
				Ra-228	1.57	0.164	0.600	=	GAMMA
BB01257	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	1.02	0.0868	0.177	=	GAMMA
				Pb-214	1.09	0.0786	0.165	=	GAMMA
				Ra-226	2.34	0.529	1.53	=	GAMMA
				Ra-228	1.57	0.119	0.307	=	GAMMA
BB01258	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	3.05	0.214	0.402	=	GAMMA
				Pb-214	3.36	0.202	0.280	=	GAMMA
				Ra-226	6.21	0.965	2.43	=	GAMMA
				Ra-228	1.62	0.167	0.582	=	GAMMA

# ER\_BLUERIDGE\_LF\_03-07-16

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/g	Uncertainty	03/04/2016 - 03/04/2016		Method
							MDA	Code	
BB01259	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	150	6.21	2.35	=	GAMMA
				Pb-214	156	6.67	2.50	=	GAMMA
				Ra-226	166	13.6	22.5	=	GAMMA
				Ra-228	114	4.39	3.39	=	GAMMA
BB01260	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	64.6	2.67	1.12	=	GAMMA
				Pb-214	65.5	2.81	1.08	=	GAMMA
				Ra-226	71.4	5.90	10.2	=	GAMMA
				Ra-228	48.4	1.88	1.59	=	GAMMA
BB01261	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	5.49	0.309	0.301	=	GAMMA
				Pb-214	5.90	0.305	0.334	=	GAMMA
				Ra-226	10.3	1.27	2.68	=	GAMMA
				Ra-228	1.41	0.164	0.697	=	GAMMA
BB01262	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	3.83	0.246	0.267	=	GAMMA
				Pb-214	4.34	0.275	0.269	=	GAMMA
				Ra-226	7.23	1.17	2.44	=	GAMMA
				Ra-228	1.17	0.149	0.555	=	GAMMA

ER\_BLUERIDGE\_LF\_03-07-16

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/g	Uncertainty	03/04/2016 - 03/04/2016		
							MDA	Code	Method
BB01263	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	4.86	0.415	0.515	=	GAMMA
				Pb-214	5.60	0.426	0.522	=	GAMMA
				Ra-226	7.32	1.77	4.41	=	GAMMA
				Ra-228	1.80	0.292	1.10	=	GAMMA
BB01264	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	1.01	0.0685	0.128	=	GAMMA
				Pb-214	1.10	0.0742	0.169	=	GAMMA
				Ra-226	2.77	0.479	1.34	=	GAMMA
				Ra-228	1.61	0.0948	0.282	=	GAMMA
BB01265	BLUE_RIDGE_LANDFILL_Retention_Pond	3/4/16	SURFACE WATER	Bi-214	2.38	10.6	46.9	U	GAMMA
				Pb-214	16.1	29.5	51.6	U	GAMMA
				Ra-226	174	138	487	U	GAMMA
				Ra-228	33.8	47.3	81.3	U	GAMMA
BB01266	BLUE_RIDGE_LANDFILL_Retention_Pond	3/4/16	SURFACE WATER	Bi-214	30.5	28.5	57.5	U	GAMMA
				Pb-214	38.0	27.4	59.0	U	GAMMA
				Ra-226	584	246	544	U*	GAMMA
				Ra-228	11.3	51.6	95.2	U	GAMMA

*Scott*

# ER\_BLUERIDGE\_LF\_03-07-16

03/04/2016 - 03/04/2016

LAB #	Location	Collection Date Matrix	Analysis Type	Value pCi/L	Uncertainty	MDA	Code	Method
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Results are reported using the activity concentrations from the peak associated with radium-226 (Ra-226) due to the fact that bismuth-214 (Bi-214) and lead-214 (Pb-214) are not in secular equilibrium with Ra-226 even after allowing each sample to sit sealed for 21 days. These activity concentration results could be slightly elevated due to the interference from uranium-235 (U-235) which contributes slightly to a peak in the same area as the Ra-226 peak. Given that these samples are being used to make public health decisions, the decision was made to err on the side of reporting potentially higher activity concentrations for Ra-226 rather than potentially lower activity concentrations.

*Stephanie C Buck*

04/08/16

Code:  
 "U" Less than MDA or greater than MDA with high counting uncertainty.  
 "U\*" Analyte not detected. Activity based on software calculation, not identified peak(s).  
 "=" No qualifier necessary  
 "J" Value is estimated.  
 "R" Not useable for intended purpose

Friday, April 8, 2016

# ER\_BRINE\_DRY\_03-07-16

03/04/2016 - 03/04/2016

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/g	Uncertainty	MDA	Code	Method
BB01930	FAIRMONT_BRINE_Processing_Concrete_Basin_Settling_Tank_Dried	3/4/16	Sludge	Bi-214	1810	67.7	5.02	=	GAMMA
				Pb-214	1880	77.5	7.68	=	GAMMA
				Ra-226	2040	141	72.0	=	GAMMA
				Ra-228	433	14.7	11.1	=	GAMMA

This sample when dried became a very light, fine powder. This may be of concern for its distribution in the environment.

*Stephanie C Busck*

04/08/16

Results are reported using the activity concentrations from the peak associated with radium.226 (Ra226) due to the fact that bismuth.214 (Bi214) and lead.214 (Pb214) are not in secular equilibrium with Ra226 even after allowing each sample to sit sealed for 21 days. These activity concentration results could be slightly elevated due to the interference from uranium.235 (U235) which contributes slightly to a peak in the same area as the Ra226 peak. Given that these samples are being used to make public health decisions, the decision was made to err on the side of reporting potentially higher activity concentrations for Ra226 rather than potentially lower activity concentrations.

*Stephanie C Busck*

04/08/16

Code:

"U" Less than MDA or greater than MDA with high counting uncertainty.

"U\*" Analyte not detected. Activity based on software calculation, not identified peak(s).

"=" No qualifier necessary

"J" Value is estimated.

"R" Not useable for intended purpose

Friday, April 8, 2016

# ER\_BLUERIDGE\_LF\_02-12-16

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/L	Uncertainty	02/10/2016 - 02/10/2016		
							MDA	Code	Method
BB01216	BLUE_RIDGE_LANDFILL Leachate Tank	2/10/16	Leachate						
				Bi-214	31.2	28.7	58.2	U	GAMMA
				Pb-214	30.2	27.9	59.0	U	GAMMA
				Ra-226	524	254	558	U	GAMMA
				Ra-228	60.1	50.4	106	U	GAMMA
				Gross Alpha	37.52	23.40	26.58	U	GFPC
				Gross Beta	646.80	26.92	41.77	=	GFPC

Results are reported using the activity concentrations from the peak associated with radium-226 (Ra-226) due to the fact that bismuth-214 (Bi-214) and lead-214 (Pb-214) are not in secular equilibrium with Ra-226 even after allowing each sample to sit sealed for 21 days. These activity concentration results could be slightly elevated due to the interference from uranium-235 (U-235) which contributes slightly to a peak in the same area as the Ra-226 peak. Given that these samples are being used to make public health decisions, the decision was made to err on the side of reporting potentially higher activity concentrations for Ra-226 rather than potentially lower activity concentrations.

*Stephanie C Buck*

04/08/16

**Code:**

"U" Less than MDA or greater than MDA with high counting uncertainty.

"U\*" Analyte not detected. Activity based on software calculation, not identified peak(s).

"=" No qualifier necessary

"J" Value is estimated.

"R" Not useable for intended purpose

Friday, April 8, 2016

# ER\_BLUERIDGE\_LF\_02-12-16

02/10/2016 - 02/10/2016

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/g	Uncertainty	MDA	Code	Method
BB01268	BLUE_RIDGE_LANDFILL_Soil	2/10/16	soil	Bi-214	3.66	0.194	0.226	=	GAMMA
				Pb-214	4.05	0.202	0.251	=	GAMMA
				Ra-226	7.55	0.855	1.95	=	GAMMA
				Ra-228	1.65	0.129	0.419	=	GAMMA

Results are reported using the activity concentrations from the peak associated with radium-226 (Ra-226) due to the fact that bismuth-214 (Bi-214) and lead-214 (Pb-214) are not in secular equilibrium with Ra-226 even after allowing each sample to sit sealed for 21 days. These activity concentration results could be slightly elevated due to the interference from uranium-235 (U-235) which contributes slightly to a peak in the same area as the Ra-226 peak. Given that these samples are being used to make public health decisions, the decision was made to err on the side of reporting potentially higher activity concentrations for Ra-226 rather than potentially lower activity concentrations.

*Stephanie C Buck*

04/08/16

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Friday, April 8, 2016



# ER\_BLUERIDGE\_LF\_02-12-16

02/10/2016 - 02/10/2016

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/g	Uncertainty	MDA	Code	Method
BB01268	BLUE_RIDGE_LANDFILL_Soil	2/10/16	soil						
				Bi-214	3.66	0.194	0.226	=	GAMMA
				Pb-214	4.05	0.202	0.251	=	GAMMA
				Ra-226	7.55	0.855	1.95	=	GAMMA
				Ra-228	1.65	0.129	0.419	=	GAMMA

Results are reported using the activity concentrations from the peak associated with radium-226 (Ra-226) due to the fact that bismuth-214 (Bi-214) and lead-214 (Pb-214) are not in secular equilibrium with Ra-226 even after allowing each sample to sit sealed for 21 days. These activity concentration results could be slightly elevated due to the interference from uranium-235 (U-235) which contributes slightly to a peak in the same area as the Ra-226 peak. Given that these samples are being used to make public health decisions, the decision was made to err on the side of reporting potentially higher activity concentrations for Ra-226 rather than potentially lower activity concentrations.

*Stephanie C Buck*

04/08/16

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Friday, April 8, 2016

# ER\_BLUERIDGE\_LF\_02-12-16

02/10/2016 - 02/10/2016

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/L	Uncertainty	MDA	Code	Method
BB01216	BLUE_RIDGE_LANDFILL Leachate Tank	2/10/16	Leachate						
				Bi-214	31.2	28.7	58.2	U	GAMMA
				Pb-214	30.2	27.9	59.0	U	GAMMA
				Ra-226	524	254	558	U	GAMMA
				Ra-228	60.1	50.4	106	U	GAMMA
				Gross Alpha	37.52	23.40	26.58	U	GFPC
				Gross Beta	646.80	26.92	41.77	=	GFPC

Code:  
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Results are reported using the activity concentrations from the peak associated with radium-226 (Ra-226) due to the fact that bismuth-214 (Bi-214) and lead-214 (Pb-214) are not in secular equilibrium with Ra-226 even after allowing each sample to sit sealed for 21 days. These activity concentration results could be slightly elevated due to the interference from uranium-235 (U-235) which contributes slightly to a peak in the same area as the Ra-226 peak. Given that these samples are being used to make public health decisions, the decision was made to err on the side of reporting potentially higher activity concentrations for Ra-226 rather than potentially lower activity concentrations.

*Stephanie C Busck*

04/08/16

Friday, April 8, 2016

# ER\_BLUERIDGE\_LF\_03-07-16

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/g	Uncertainty	03/04/2016 - 03/04/2016		Method
							MDA	Code	
BB01255	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL						
				Bi-214	125	5.23	2.10	=	GAMMA
				Pb-214	131	5.64	2.24	=	GAMMA
				Ra-226	131	11.2	20.7	=	GAMMA
				Ra-228	96.6	3.78	3.18	=	GAMMA
BB01256	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL						
				Bi-214	5.37	0.306	0.321	=	GAMMA
				Pb-214	5.69	0.297	0.354	=	GAMMA
				Ra-226	9.78	1.22	2.76	=	GAMMA
				Ra-228	1.57	0.164	0.600	=	GAMMA
BB01257	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL						
				Bi-214	1.02	0.0868	0.177	=	GAMMA
				Pb-214	1.09	0.0786	0.165	=	GAMMA
				Ra-226	2.34	0.529	1.53	=	GAMMA
				Ra-228	1.57	0.119	0.307	=	GAMMA
BB01258	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL						
				Bi-214	3.05	0.214	0.402	=	GAMMA
				Pb-214	3.36	0.202	0.280	=	GAMMA
				Ra-226	6.21	0.965	2.43	=	GAMMA
				Ra-228	1.62	0.167	0.582	=	GAMMA

# ER\_BLUERIDGE\_LF\_03-07-16

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/g	Uncertainty	03/04/2016 - 03/04/2016		
							MDA	Code	Method
BB01259	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	150	6.21	2.35	=	GAMMA
				Pb-214	156	6.67	2.50	=	GAMMA
				Ra-226	166	13.6	22.5	=	GAMMA
				Ra-228	114	4.39	3.39	=	GAMMA
BB01260	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	64.6	2.67	1.12	=	GAMMA
				Pb-214	65.5	2.81	1.08	=	GAMMA
				Ra-226	71.4	5.90	10.2	=	GAMMA
				Ra-228	48.4	1.88	1.59	=	GAMMA
BB01261	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	5.49	0.309	0.301	=	GAMMA
				Pb-214	5.90	0.305	0.334	=	GAMMA
				Ra-226	10.3	1.27	2.68	=	GAMMA
				Ra-228	1.41	0.164	0.697	=	GAMMA
BB01262	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	3.83	0.246	0.267	=	GAMMA
				Pb-214	4.34	0.275	0.269	=	GAMMA
				Ra-226	7.23	1.17	2.44	=	GAMMA
				Ra-228	1.17	0.149	0.555	=	GAMMA

# ER\_BLUERIDGE\_LF\_03-07-16

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/g	Uncertainty	03/04/2016 - 03/04/2016		
							MDA	Code	Method
BB01263	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	4.86	0.415	0.515	=	GAMMA
				Pb-214	5.60	0.426	0.522	=	GAMMA
				Ra-226	7.32	1.77	4.41	=	GAMMA
				Ra-228	1.80	0.292	1.10	=	GAMMA
BB01264	BLUE_RIDGE_LANDFILL_Soil	3/4/16	SOIL	Bi-214	1.01	0.0685	0.128	=	GAMMA
				Pb-214	1.10	0.0742	0.169	=	GAMMA
				Ra-226	2.77	0.479	1.34	=	GAMMA
				Ra-228	1.61	0.0948	0.282	=	GAMMA
BB01265	BLUE_RIDGE_LANDFILL_Retention_Pond	3/4/16	SURFACE WATER	Bi-214	2.38	10.6	46.9	U	GAMMA
				Pb-214	16.1	29.5	51.6	U	GAMMA
				Ra-226	174	138	487	U	GAMMA
				Ra-228	33.8	47.3	81.3	U	GAMMA
BB01266	BLUE_RIDGE_LANDFILL_Retention_Pond	3/4/16	SURFACE WATER	Bi-214	30.5	28.5	57.5	U	GAMMA
				Pb-214	38.0	27.4	59.0	U	GAMMA
				Ra-226	584	246	544	U*	GAMMA
				Ra-228	11.3	51.6	95.2	U	GAMMA

# ER\_BLUERIDGE\_LF\_03-07-16

03/04/2016 - 03/04/2016

LAB #	Location	Collection Date Matrix	Analysis Type	Value pCi/L	Uncertainty	MDA	Code	Method
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Results are reported using the activity concentrations from the peak associated with radium-226 (Ra-226) due to the fact that bismuth-214 (Bi-214) and lead-214 (Pb-214) are not in secular equilibrium with Ra-226 even after allowing each sample to sit sealed for 21 days. These activity concentration results could be slightly elevated due to the interference from uranium-235 (U-235) which contributes slightly to a peak in the same area as the Ra-226 peak. Given that these samples are being used to make public health decisions, the decision was made to err on the side of reporting potentially higher activity concentrations for Ra-226 rather than potentially lower activity concentrations.

*Stephanie C Buck*

04/08/16

Code:

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Friday, April 8, 2016

ER\_BRINE\_DRY\_03-07-16

03/04/2016 - 03/04/2016

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/g	Uncertainty	MDA	Code	Method
BB01930	FAIRMONT_BRINE_Processing_Concrete_Basin_Setting_Tank_Dried	3/4/16	Sludge						
				Bi-214	1810	67.7	5.02	=	GAMMA
				Pb-214	1880	77.5	7.68	=	GAMMA
				Ra-226	2040	141	72.0	=	GAMMA
				Ra-228	433	14.7	11.1	=	GAMMA

This sample when dried became a very light, fine powder. This may be of concern for its distribution in the environment.

*Stephanie C Buck*

04/08/16

Results are reported using the activity concentrations from the peak associated with radium.226 (Ra226) due to the fact that bismuth.214 (Bi214) and lead.214 (Pb214) are not in secular equilibrium with Ra226 even after allowing each sample to sit sealed for 21 days. These activity concentration results could be slightly elevated due to the interference from uranium.235 (U235) which contributes slightly to a peak in the same area as the Ra226 peak. Given that these samples are being used to make public health decisions, the decision was made to err on the side of reporting potentially higher activity concentrations for Ra226 rather than potentially lower activity concentrations.

*Stephanie C Buck*

04/08/16

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 "U" Less than MDA or greater than MDA with high counting uncertainty.  
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 "R" Not useable for intended purpose

Friday, April 8, 2016

ER\_FAIRMONTBRIN\_03-07-16

03/04/2016 - 03/04/2016

LAB #	Location	Collection Date	Matrix	Analysis Type	Value pCi/L	Uncertainty	MDA	Code	Method
BB01267	FAIRMONT_BRINE_Processing_Concrete_Basin_Setting_Tank	3/4/16	Sludge						
				Bi-214	994000	37200	2670	=	GAMMA
				Pb-214	995000	41700	4350	=	GAMMA
				Ra-226	950000	67600	43000	=	GAMMA
				Ra-228	207000	7150	5450	=	GAMMA

Results are reported using the activity concentrations from the peak associated with radium-226 (Ra-226) due to the fact that bismuth-214 (Bi-214) and lead-214 (Pb-214) are not in secular equilibrium with Ra-226 even after allowing each sample to sit sealed for 21 days. These activity concentration results could be slightly elevated due to the interference from uranium-235 (U-235) which contributes slightly to a peak in the same area as the Ra-226 peak. Given that these samples are being used to make public health decisions, the decision was made to err on the side of reporting potentially higher activity concentrations for Ra-226 rather than potentially lower activity concentrations.

*Stephanie C Buck*

04/08/16


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 "R" Not useable for intended purpose

Friday, April 8, 2016



**Exhibit B**

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**Date:** 11/15/2017  
**To:** Jay Warzinski, Joseph Santangelo – Advanced Disposal Services  
**CC:**   
**From:** Kari Wallover – Cornerstone Environmental Group  
**Subject:** Blue Ridge Groundwater Users Survey  
**Project No.:** 170068

---

Cornerstone Environmental Group, LLC, on behalf of Advanced Disposal Services, conducted a groundwater users inventory study to verify the validity of the 1992 water well and spring survey results, and to identify any new wells and residents located downgradient of the Blue Ridge landfill. A map created with information obtained from the Estill County Property Valuation Authority (PVA) has been attached identifying the area of focus for the groundwater users inventory. To ensure that all residents and wells were thoroughly identified, the survey was conducted within a one mile radius of the permitted waste area in the downgradient (northwest) direction (see attached map).

A team of Cornerstone personnel canvassed the above mentioned area in attempt to obtain the following information from residents/properties:

- Resident Name
  - Resident Address
  - Resident Telephone Number
  - Type of Groundwater Source (Dug Well, Drilled Well, Cistern, Spring, City Water)
  - Surface Water Use and Purpose of Use
  - Well Information: Date Drilled, Total Depth of Well, Depth to Top of Water, Casing Depth, Top of Well Elevation, if pump is located within well, if well is sealed, Elevation of Spring, and Type of Rock
  - Size of Household
-

- Water Use
- Approximate Yield
- Quality Problems: Such as iron, sulfur, manganese, or muddy
- Quantity Problems
- Well treatment
- Permission to Sample Well
- Any additional, applicable comments from resident

In efforts to obtain as much information as possible, Cornerstone Environmental Group made multiple efforts to obtain the above information both in person and remotely (telephone, mail). If a resident was not at their residence during the field canvassing, a letter was left at the residence outlining Cornerstone's contact information and a summary of above information needed from the resident.

According to the supplied Estill County Property Valuation Administrator, eighty-three (83) parcels in total exist within the downgradient area of interest. Each of these parcels were visited during the groundwater user inventory by Cornerstone personnel. All residents were attempted to be contacted in person at their dwelling. As stated above, if a resident was not in their dwelling at the time of the survey, the above outlined letter was left on their property. Any letters sent back to Cornerstone have their information recorded in the groundwater user inventory database. All addresses without a dwelling were deemed parcels only, and no letter was left at the address. However, owners of those parcels within the downgradient area were attempted to be contacted and entered into the groundwater user inventory database. All information gathered during the survey can be found in the included inventory spreadsheet. No new wells were found during the groundwater user inventory survey.

The wells of primary attention in closest proximity to the downgradient direction of the landfill are wells 36, 37, and 64 (located at property locations 32 and 33). Owners at PVA property locations 32 and 33 were contacted in person. As seen on the included survey map and 1992 well source map, well locations 36, 37, and 64 were presumed to exist on or near these properties. The owner of PVA lot 32 stated there was no well on his property. The owner of PVA lot 33 stated that there had been a well on his property but several years ago he had filled the well with rock to prevent anyone from falling down into the well. He/his family have owned the property for a number of years. Given the owner's

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description it is Cornerstone's opinion that well 64 is that same well, just located in a different place due to a different person locating it. No other wells were located in the vicinity, thus well 64 was the only well located of the three wells of primary attention.

All confirmations of well locations can be found on the supplemental spreadsheet included with this narrative.

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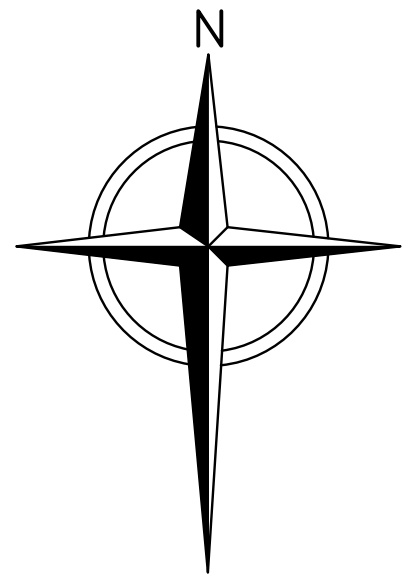
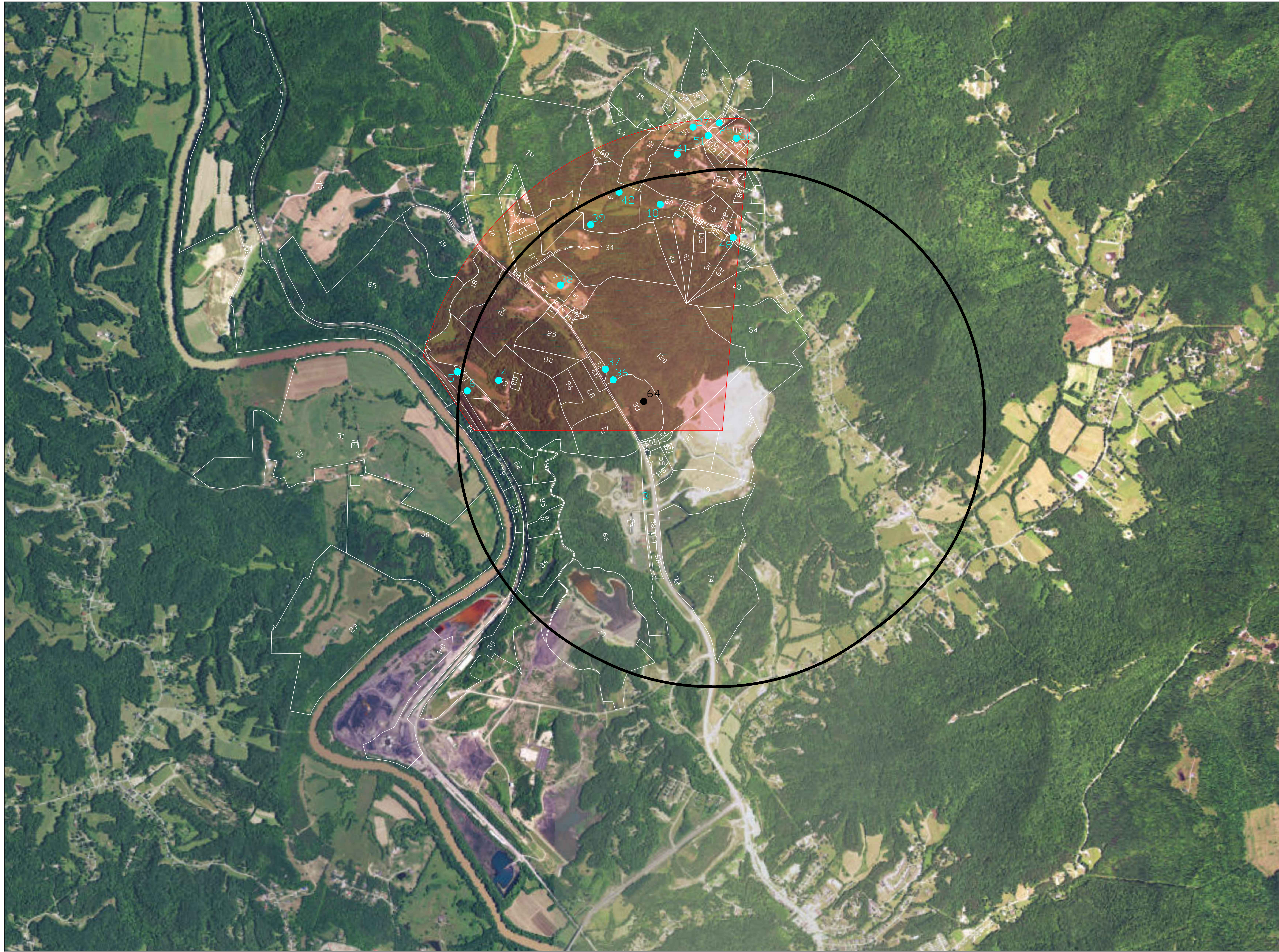
## SURROUNDING WELL INFORMATION

Well ID	Survey Information
4	Owner not available, letter left at location. Well location unconfirmed
5	Owner not available, letter left at location. Well location unconfirmed
6	Owner not available, letter left at location. Well location unconfirmed
36	Not found, told by owner this well no longer existed.
37	Not found, told by owner this well no longer existed.
38	Owner not available, letter left at location. Nearby resident stated no well present. Well location unconfirmed.
39	Owner not available, letter left at location. Well location unconfirmed
42	Owner not available, letter left at location. Well location unconfirmed
18	Owner not available, letter left at location. Well location unconfirmed
48	PVA property owner #73 had active hand-dug well on property. It is Cornerstone's assumption this is Well #48.
41	Owner not available, letter left at location. Well location unconfirmed
27	Owner not available, letter left at location. Well location unconfirmed
51	Owner not available, letter left at location. Well location unconfirmed
25	Owner not available, letter left at location. Well location unconfirmed
50	Nearby owner indicated resident used city water, and no nearby well on property.
64	Property owner stated this well has been filled in by rock.

### Notes:

- No new wells found during groundwater user inventory survey.
- Property Owner of Parcel #72 stated a well existed on the Parcel #72 at one time, but was filled in years ago.
- Property Owner of Parcel #34 stated the resident has a cistern on their property. Contact information was recorded.

1" = 1/2" 0" 1"  
 File: X:\PROJECTS\BLUE RIDGE\170068 - GENERAL ENGINEERING SERVICES\DWG\PROJECT DRAWINGS\IR Groundwater User Inventory - Flood.dwg Layout: Map2 User: GAG\BRIUF Nov 02, 2017 - 4:09pm



**LEGEND**

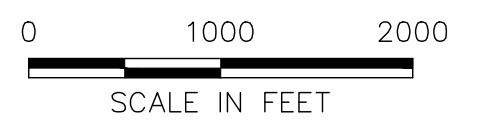
- PROPERTY LINE
- 45 PARCEL ID
- DOWNGRADIENT AREA
- 45 DOWNGRADIENT WELLS
- 64 DOWNGRADIENT WATER SUPPLY WELL
- ONE-MILE RADIUS

**NOTE:**

1. All site features and locations are based from GIS information provided by Estill County PVA.
2. Downgradient well locations identified from the Residential Water Supply Wells and Springs map prepared August 1992, approved March 31, 1995. Supplemental narratives address confirmation status of each of these wells as of the date of this survey.

**SOURCES:**

1. Rust Environment & Infrastructure, Inc 1992a.



REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY
1	8/24/17					

**cornerstone**  
environmental

PREPARED BY:  
CORNERSTONE ENVIRONMENTAL GROUP, LLC

This drawing represents intellectual property of Cornerstone Environmental Group LLC. Any modification to the original by other than Cornerstone Environmental Group LLC personnel violates its original purpose and as such it remains the property of Cornerstone Environmental Group LLC. It will not be held liable for any changes made to this document without express written consent of the originator.

ADVANCED DISPOSAL SERVICES  
BLUE RIDGE LANDFILL  
IRVINE, KENTUCKY

**PROPERTY MAP**

SHEET NO.  
**1**

PROJECT NO.  
170068