BULL RUN FOSSIL PLANT CCR DISPOSAL ALTERNATIVE SITE SCREENING ANALYSIS

Anderson County, Tennessee

Rev 0

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1.0 INTRODUCTION

1.1 Project Background

The Tennessee Valley Authority's (TVA's) Bull Run Fossil Plant (BRF) is an 870 MW coal-fired generating station located near Clinton, Tennessee (Figure 1-1). BRF was constructed between 1962 and 1967. When operating at full capacity, BRF consumes 7,300 tons of coal daily in a single generating unit and produces approximately 560,000 cubic yards of coal combustion residuals (CCRs) a year. The CCRs are currently managed in various dry stacks, wet stacks, and ponds. In September 2012, TVA decided to construct a mechanical dewatering facility at BRF to support future dry stacking operations. This facility is currently under construction and will allow TVA to manage bottom ash and gypsum in dry form. Fly ash generated at BRF is already being handled and stored on a dry basis and current estimates by TVA indicate that existing storage capacity for dry stack CCRs at BRF is projected to be expended within 10 years.

TVA is planning to design a landfill to accommodate the requirement for additional storage capacity. With a generation rate of approximately 240,000 cubic yards per year of ash (bottom and fly ash) and 318,000 cubic yards per year of gypsum, approximately 11.1 million cubic yards of disposal capacity is desired for the 20 year comprehensive disposal plan. In accordance with TVA policy and the provisions of the National Environmental Policy Act of 1969 (NEPA), TVA intends to prepare an environmental impact statement (EIS) to address the continued disposal of CCRs from BRF.

Selection of a location for CCR disposal should consider a variety of factors, including existing site conditions and potential impacts to the human and natural environments. TVA is considering 11 alternative site locations for CCR disposal, which are explained in more detail in Section 2. This report provides an analysis of each alternative and documents their anticipated environmental impacts. Findings from this report are intended to assist TVA with the decision-making process with regard to which alternatives should be carried forward in the EIS analysis.

1.2 Project Purpose and Need

To meet its need for 20 years of dry, CCR storage capacity, TVA proposes to expand its current capacity for managing CCRs at BRF by constructing a new dry landfill on TVA property adjacent to BRF. BRF has state-of-the-art air pollution controls and is one of the coal plants that TVA plans to continue operating in the future. Construction of a dry landfill will provide additional CCR management capacity that will enable TVA to continue operations at BRF and would be consistent with TVA's commitment to convert wet CCR management systems to dry systems. This also would support TVA's compliance with the U.S. Environmental Protection Agency (EPA)'s recently issued CCR Rule.

The purpose of this Site Screening Analysis is analyze the potential alternative sites for CCR disposal.

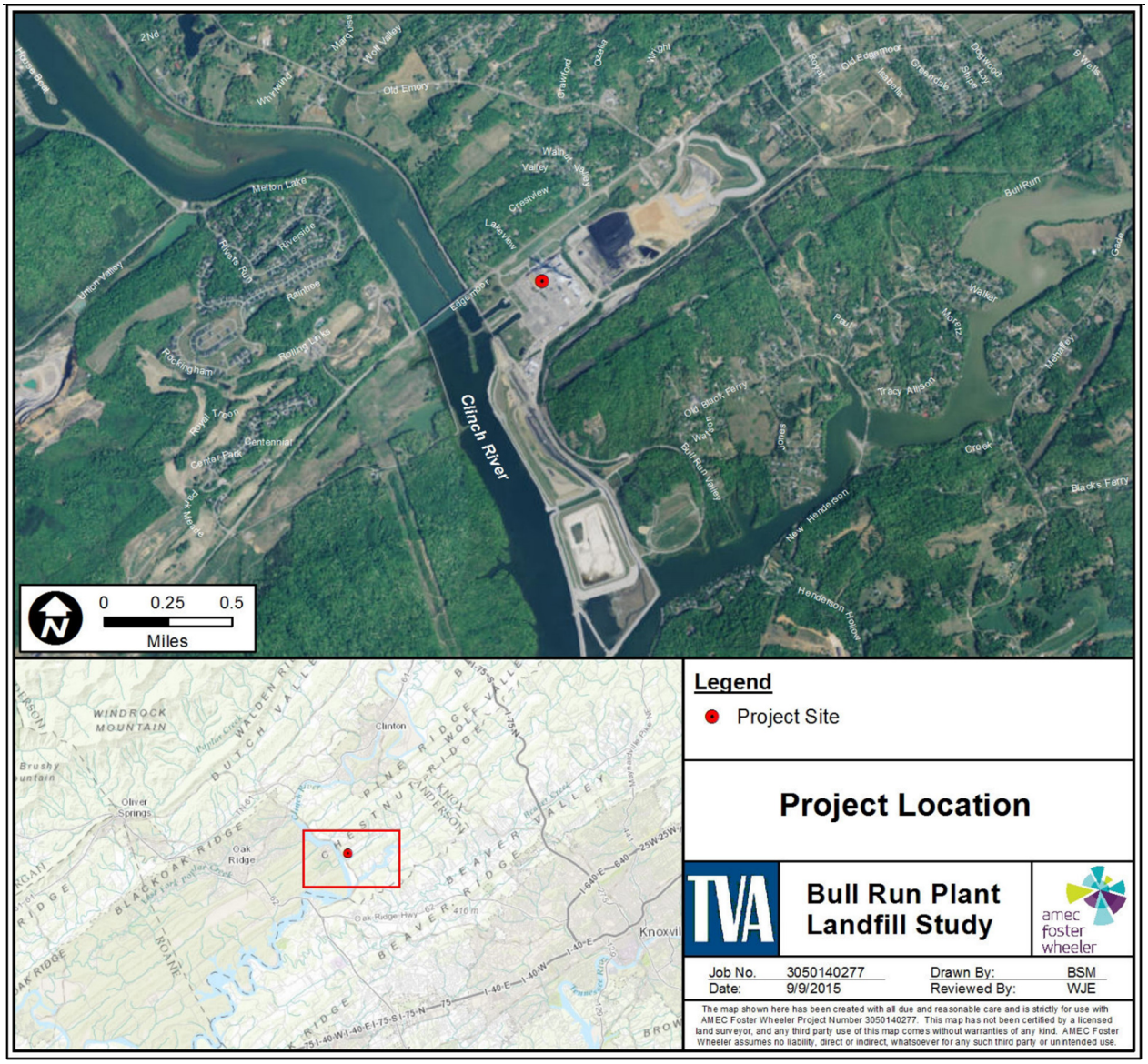

Figure 1-1. BRF Project Location

2.0 METHODOLOGY

2.1 Environmental Constraints

In the context of the alternative analysis, constraints are considered to be those issues that correlate to factors important in environmental impact assessment, engineering feasibility, and/or the efficiency of transporting the material. Examples of environmental factors considered include:

- Air quality
- Streams and Wetlands
- Floodplains
- Groundwater
- Geology
- Sensitive Species
- Vegetation
- Parks and Natural Areas
- Soils and Prime Farmland
- Land Use
- Zoning
- Hazardous Waste
- Cultural Resources
- Environmental Justice Considerations
- Visual

Constrains related to engineering feasibility and transportation include:

- Fill Area
- Distance to Source Material
- Method of Transportation
- Existing Infrastructure

Constraint information was developed by acquiring and consolidating information from a variety of available public sources including: National Resources Conservation Service (NRCS), US Fish and Wildlife Service (USFWS), EPA, Federal Emergency Management Agency (FEMA), US Geological Survey (USGS), US Census Bureau (USCB), National Register of Historic Places (NRHP), and US Army Corps of Engineers (USACE). This information was augmented with data acquired from other agencies including National Wetland Inventory (NWI) maps, NRCS prime and unique farmland soils, FEMA floodplain and floodway mapping, updated land use and zoning maps, and updated parcel information.

2.2 Previous Site Analysis

In 2011, TVA performed a Siting Study to evaluate suitable sites within a 20-mile radius study area that could potentially be developed for dry CCR disposal. A multi-stage suitability analysis that identified areas of opportunity and constraint, and then directly compared the resultant potential sites, was used to compare possible sites within the 20-mile radius project study area as illustrated in Figure 2-1. This initial step of the study (Step 1A,) incorporated several tasks, including establishment of the limits of the study area based on TVA input, identification of exclusionary criteria, and the establishment of potential candidate areas based on a screening level evaluation. During Step 1A, area screening and geographic information system (GIS)

analysis was performed resulting in the development of an exclusionary criteria map. Exclusionary criteria included 100-year floodplains and proximity to major water bodies. The second step established a "score" for each candidate area that allowed for the direct comparison of the potential areas (Step 1B). At the completion of Step 1, seven off-site candidate landfill alternatives, and three on-site/near site alternatives were agreed upon for further evaluation. Those alternatives are carried forward in this report and discussed in more detail below.

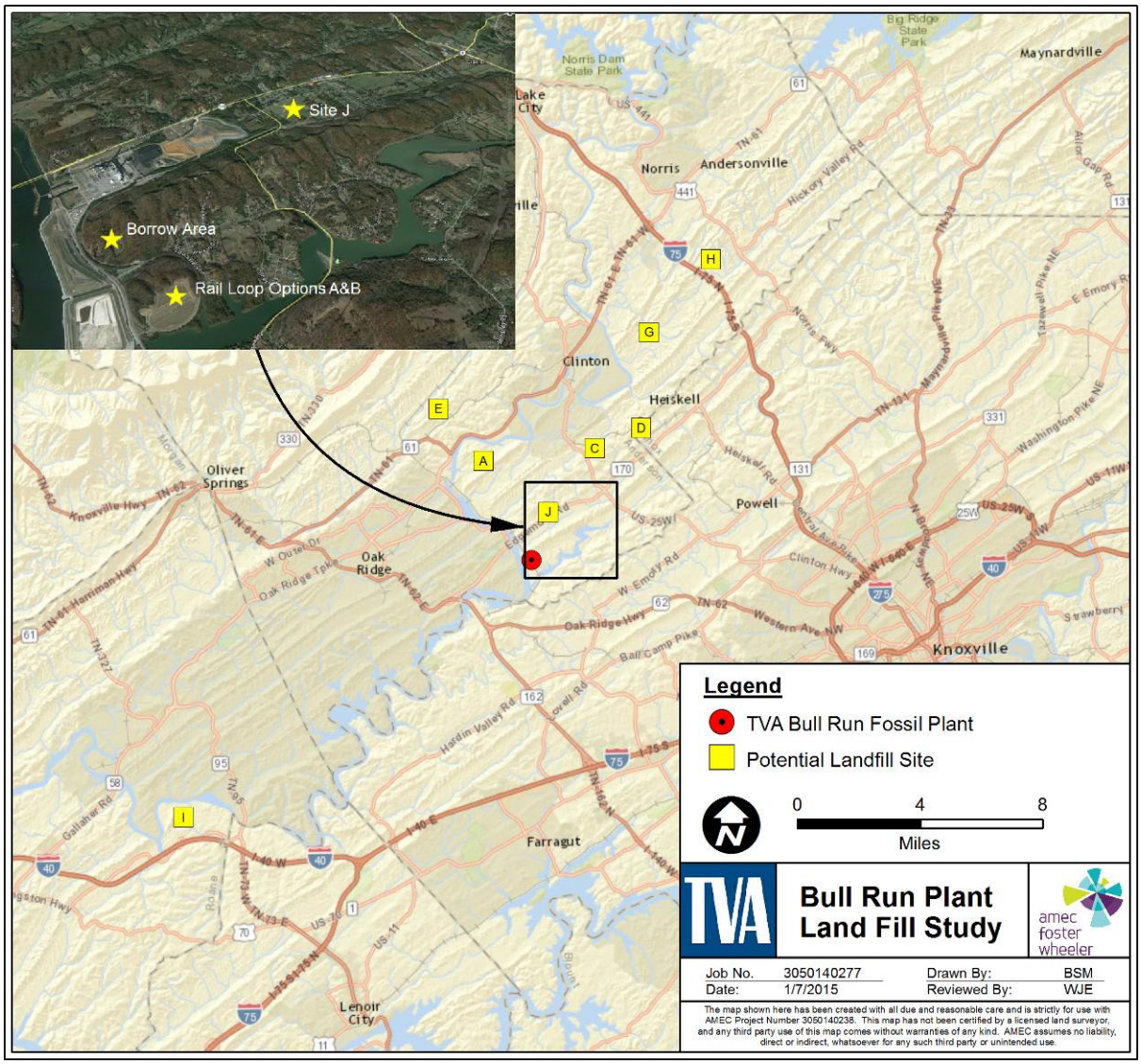

Figure 2-1. Alternative Sites Considered in Prior Siting Study

3.0 SITE ALTERNATIVES

3.1 Sites Eliminated from Further Consideration

Two potential on-site locations, the Rail Loop and Borrow Area (see Figure 2-1) were identified and considered in the initial siting study, but were eliminated from extensive consideration in this analysis. The Rail Loop area is located on the BRF property, east of the existing ash pond complex. The conceptual landfill footprint design of 23 acres would potentially provide 1.6 million cubic yards of storage capacity, yielding an estimated 3 years of landfill life[1]. The facility could potentially be developed in two phases, with the second phase providing an additional 18 acres of area and an additional 1.4 million cubic yards of storage, yielding an additional 3 years of landfill life. The Borrow Area is also located on BRF property. The conceptual landfill footprint design of 65 acres would potentially provide 6.0 million cubic yards of storage capacity, yielding an estimated 12 years of landfill life.

The Rail Loop site contains a spring and an existing ash dredge cell that has been accepted as closed by the state of Tennessee and contains areas of very steep terrain which may lead to stability concerns. Similarly, the Borrow Area site also has very steep terrain with stability concerns. Additionally, this area drains to an existing wetland and development of the site would result in potential environmental impacts to this resource. Both the Rail Loop site and the existing Borrow Area also would be very visible to the public with both sites being constructed on areas of higher elevation than the surrounding land with minimal natural screening. For these reasons, these two on-site alternatives are considered not feasible and are eliminated from further consideration.

According to the Tennessee Department of Conservation (TDEC) website (TDEC, 2015), there are 36 Class I permitted landfills in the state. Two of these landfills are located in nearby counties, the Alcoa/Maryville/Blount County Landfill and the Loudon County Landfill. However, these landfills are located greater than 30 miles from BRF and were eliminated from further consideration due to the environmental impacts and additional costs related to transportation of CCRs to these facilities.

3.2 Sites Retained for Analysis

A brief summary of each of the site alternatives retained for further analysis is presented below. This summary describes general characteristics of each site with respect to size, location, topographic position, depth to bedrock and potential need for relocation of transmission lines. Seven locations (Sites A, C, D, E, G, H, I) are located off-site and one location (Site J) is located near BRF. The location of BRF relative to all the potential landfill sites is shown in Figure 3-1. Environmental features of each site are shown on Appendix A.

[1] Note, estimates of landfill capacity and lifespan for each alternate site were derived from the prior siting study (URS 2012).

3.2.1 Site A

Site A is located approximately 4.5 miles northwest of BRF in Anderson County and encompasses 157 acres. The conceptual landfill footprint design of 120 acres would potentially provide 14.2 million cubic yards of storage capacity, yielding an estimated 28 years of landfill life with no expansion potential. The site is located in an area of steep topography (topographic relief is approximately 200 ft). The depth to rock is an estimated 60.5 inches. Development of this site would not require relocation of any transmission towers.

3.2.2 Site C

Site C is located approximately 4.6 miles northeast of BRF in Anderson County and encompasses 162 acres. The conceptual landfill footprint design of 116 acres would potentially provide 19.0 million cubic yards of storage capacity, yielding an estimated 38 years of landfill life with some expansion potential. The site is located in an area of moderately steep topography. The depth to rock is an estimated 63.1 inches. Development of this site would require relocation of one transmission line and five transmission towers.

3.2.3 Site D

Site D is located approximately 6.0 miles northeast of BRF and encompasses 153 acres. The site spans the border between Anderson and Knox counties. The conceptual landfill footprint design of 108 acres would potentially provide 12.1 million cubic yards of storage capacity, yielding an estimated 24 years of landfill life with no expansion potential. The site is located in an area of moderately steep topography (topographic relief of approximately 220 ft). The depth to rock is an estimated 60.8 inches. Development of this site would not require relocation of any transmission towers.

3.2.4 Site E

Site E is located approximately 7.5 miles northwest of BRF in Anderson County and encompasses 133 acres. The conceptual landfill footprint design of 112 acres would potentially provide 13.1 million cubic yards of storage capacity, yielding an estimated 26 years of landfill life with a large expansion potential. The site is located in an area of moderate topographic relief (approximately 160 ft). The depth to rock is an estimated 62.8 inches. Development of this site would not require relocation of any transmission towers.

3.2.5 Site G

Site G is located approximately 9.3 miles northeast of BRF in Anderson County and encompasses 138 acres. The conceptual landfill footprint design of 110 acres would potentially provide 16.1 million cubic yards of storage capacity, yielding an estimated 26 years of landfill life with a large expansion potential. The site is located in an area of moderately steep topography (site relief of approximately 280 ft). The depth to rock is an estimated 34.2 inches. Development of this site would not require relocation of any transmission towers.

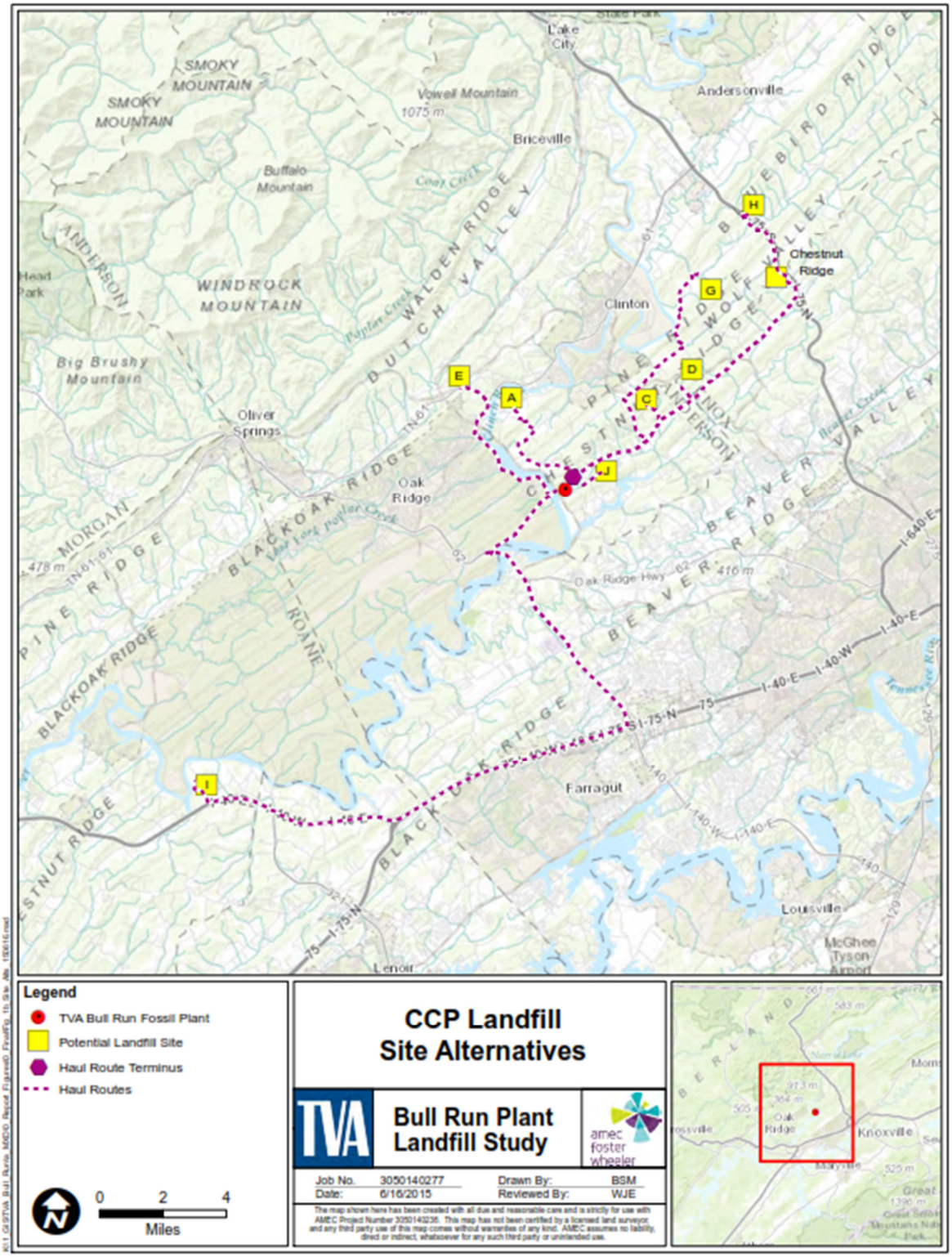

Figure 3-1. CCR Landfill Alternative Sites Retained for Analysis

3.2.6 Site H

Site H is located approximately 14.5 miles northeast of BRF in Anderson County and encompasses 158 acres. The conceptual landfill footprint design of 112 acres would potentially provide 16.7 million cubic yards of storage capacity, yielding an estimated 33 years of landfill life with some expansion potential. The site is located in an area of steep topography (site relief is approximately 400 ft). The depth to rock is an estimated 25.1 inches. Development of this site would not require relocation of any transmission towers.

3.2.7 Site I

Site I is located approximately 26.2 miles southwest of BRF in Roane County and encompasses 141 acres. The conceptual landfill footprint design of 120 acres would potentially provide 21.3 million cubic yards of storage capacity, yielding an estimated 42 years of landfill life and has expansion potential. The site is located in an area of moderately steep topography (site relief is approximately 300 ft). The depth to rock is an estimated 29.3 inches. Development of this site would not require relocation of transmission towers.

3.2.8 Site J

Site J is located approximately 0.4 miles east of BRF in Anderson County and encompasses 144 acres. The conceptual landfill footprint design of 54 acres would potentially provide 6.6 million cubic yards of storage capacity, yielding an estimated 12 years of landfill life with no expansion potential. The site is located in an area of limited topographic relief (approximately 40 ft). The depth to rock is an estimated 60 inches. Development of this site would require relocation of three transmission lines and eight transmission towers. Construction at this site would also include construction of a dedicated on-site haul road to convey CCRs from the plant to the landfill. This road would be constructed on the BRF site next to an existing railroad track, and environmental impacts are anticipated to be minimal.

3.2.9 Chestnut Ridge Landfill

In addition to the alternatives considered in the prior siting study, this analysis also considered off-site transport of CCRs to the existing Chestnut Ridge Landfill. The Chestnut Ridge Sanitary Landfill is a Class 1 Municipal Solid Waste Facility, which means that it is permitted to handle non-hazardous municipal solid wastes such as household wastes, approved special wastes, and commercial wastes. The landfill is owned and operated by Waste Management of Tennessee and serves the Knoxville metro area and central Tennessee. The landfill is located approximately 12 miles northeast of BRF and encompasses 166 acres. Capacity at this landfill can be expanded to accommodate TVA's requirement for 20 years of storage of CCRs generated at BRF[2].

[2] Based on email correspondence with Waste Management Corporation, August 19, 2015.

The Chestnut Ridge site is an existing landfill and many of the siting criteria analyzed in this document would not apply, therefore the comparative analysis provided in this report is limited to the evaluation of transportation of CCR from BRF to Chestnut Ridge.

A summary of the general characteristics of each of the alternative disposal sites is provided in Table 3-1.

Table 3-1. Summary of Alternative CCR Disposal Sites

Site Name	Driving Distance from BRF	Approximate Landfill Acreage	Estimated Capacity (Million CY) [1]	Estimated Life (Years)[1]	Retained for Analysis
A	4.5	120	14.2	28	Y
C	4.6	116	19.0	38	Y
D	6.0	108	12.1	24	Y
E	7.5	112	13.1	26	Y
G	9.3	110	16.1	32	Y
H	14.5	112	16.7	33	Y
I	26.2	120	21.3	42	Y
J	0.4	54	6.6	12	Y
Rail Loop	On-Site	23	3.0	6	N
Borrow Area	On-Site	65	6.0	12	N
Chestnut Ridge	12.0	166		40+	Y

[1]Source: URS 2012a

3.3 Alternative Evaluation and Ranking

Analysis of alternatives consisted of a two-step process that entailed the compilation of quantitative constraint information for each of the alternatives followed by a qualitative rank scoring process. Quantitative information for each of the alternatives is summarized in Appendix B. The conclusions in Appendix B resulted from a process of deriving numeric or narrative data to reflect the extent of potentially impacted resources either on site or in the immediate vicinity of each alternative. While actual resource impact values are not available for this screening level analysis, “indicator” values in Appendix B were derived for each alternative that could be used to assess probable magnitude of effects. For example, potential noise-related effects are summarized by compiling the number of noise sensitive receptors (residences, parks, etc.) within a distance of 500 ft of the landfill and the proposed roadway haul routes. Likewise, in the absence of site-specific evaluations of habitat suitability for endangered species, potential effects to this resource were summarized by compiling recorded data regarding the occurrence of sensitive species, distance from the site, and acreage of potentially suitable on-site habitat (e.g., forested areas for northern long-eared bat). Similar surrogate indicators were used for other resources as summarized in Appendix B.

Alternative analyses also included considerations of potential impacts associated with off-site transport of CCR on receptors along the haul routes (primarily noise, air quality, and Environmental Justice considerations). While four off-site alternatives were considered to have

the potential for transport of CCR via rail or barge, the effects of these alternative transport modes was not evaluated.

As part of the second step in the process, each resource factor was evaluated using professional judgement that synthesized the quantitative indicator data to determine relative impact for the purposes of ranking each alternative landfill site.

For the purposes of this analysis, impacts were assessed and a general scale ranging from 1 to 5 was developed. This scale is as follows:

1- Zero to low adverse impact, moderate benefit
2- Low to moderate adverse impact, low to moderate benefit
3- Moderate adverse impact, low benefit
4- Moderate to high adverse impact, minimal to low benefit
5- High adverse impact, no benefit

The ranking assigned to each resource category is supported by quantitative and qualitative assessment provided in the body of this document. Table 8-1 provides a summary of the site rankings and Appendix C sets forth detailed resource specific rankings.

4.0 IMPACTS TO THE NATURAL ENVIRONMENT

4.1 Streams

As a result of exclusionary criteria applied in the previous Siting Study, all of the alternatives considered in this analysis are located at distances greater than 200 ft from a major water body, the Clinch River. Indicators used to determine the potential impact to stream resources included the number of streams within a site, the length of those streams within the waste limit boundary, and proximity to the Clinch River.

Non-major waterbodies (i.e., streams) are located within most of the proposed site boundaries. To construct a landfill on these sites, a Clean Water Act Section 404 permit from the USACE coupled with authorization of a Water Quality Certification (Section 401) from TDEC would have to be obtained. Therefore, the level of potential impact at each of the alternatives sites was determined based on the costs and level of effort needed to obtain the Section 401/404 authorizations.

- Site A does not have a stream running through it; however, it is located the closest to the Clinch River. There would be no to low unavoidable adverse impacts, assuming Best Management Practices would be used to minimize impacts to the river.
- Both Sites D and E have less than 1,000 ft of streams within the waste limit boundaries, which could be permitted through the Nationwide Permit Program. Therefore, these sites are considered to have a low to moderate adverse impact to streams.
- Sites C, H, and J each have over 1,000 ft of streams within their waste limit boundaries. These sites are considered to have a moderate adverse impact due to the larger total length of stream impact and the potential greater requirement for mitigation.

- Sites G and I have the greatest length of streams within the sites and would pose the most difficulty in obtaining Section 401/404 authorizations. Additionally, the stream that traverses Site G may have to be re-routed as the headwaters are located outside of the site.

4.2 Wetlands

Wetlands are those areas inundated by surface water or groundwater such that vegetation adapted to saturated soil conditions is prevalent. Examples include swamps, marshes, bogs, and wet meadows. Wetland fringe areas are also found along the edges of most watercourses and impounded waters (both natural and man-made). Wetland habitat provides valuable public benefits including flood/erosion control, water quality improvement, wildlife habitat, and recreation opportunities.

There are no NWI mapped forested, emergent, scrub/shrub wetland resources within any of the site boundaries. NWI mapped wetland resources are limited to open water features at Sites D, E, H, I, and J. As with streams, the magnitude of impact to wetlands is related to the ability to permit the fill of the wetlands under the USACE Nationwide Permit Program, which has a limit of 0.5 acre.

- Sites A, C, and G do not have any wetland resources within the site boundary. Additionally, Sites D, E, and H are expected to have less than the 0.5 acre of on-site wetlands which is expected to reduce the permitting complexity for these sites. Therefore, these sites are considered to have little to no adverse impacts to wetlands.
- Site J would impact slightly more than 0.5 acre of wetlands. Overall impacts to wetlands with this alternative therefore, are considered to be low.
- Site I has a moderately large impoundment (6.5 acres) that is mapped as a wetland and represents the largest total area of impacted wetlands. While much of this resource is open water and is more aquatic habitat than wetland, it represents a resource not evident on other alternative sites. Additionally, this wetland is located adjacent to a stream and would likely provide higher habitat quality to aquatic plants and animals. Therefore, this site is considered to have a moderate impact on wetlands.

4.3 Sensitive Species

The Endangered Species Act (ESA) provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered in the United States or elsewhere. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize federally listed species or their designated critical habitat.

There are no recorded observations of threatened or endangered species or designated critical habitat located within the boundaries of any alternative sites. Records of sensitive species within a 10-mile radius around each site are limited to five animal and one plant species: gray bat, Indiana bat, golden winged warbler, smoky shrew, Allegheny woodrat, and Appalachian bugbane. Therefore, the potential for each alternative to impact known threatened or endangered species was measured based on the potential for loss of potentially suitable habitat

(i.e. bat summer roost habitat) and indirect impacts (off-site). Factors considered in this analysis included the amount of potential bat roost habitat affected within a site, distance to the nearest critical habitat, and distance to the nearest previously recorded threatened and endangered species.

Overall, the distance to the nearest critical habitat or previously recorded threatened or endangered species did not vary significantly between the sites. Additionally, while there is some variation within the total acres of potential bat roost habitat (forest) within each site, given that the land cover in the region containing all of these sites is largely forested, TVA's likely commitment to seasonal roost tree removal restrictions, the loss of trees lost due to the construction of a site is not have an adverse impact on the species. Therefore, all of the sites were considered to have a low to moderate potential to impact listed species.

4.4 Managed Areas

For this study, managed areas are defined as wildlife management areas and public lands managed by TVA. There are no publicly managed areas within any of the proposed site alternatives, and therefore, there would be no direct adverse impact to managed areas for any of the alternatives. However, Site I is located approximately one-half mile from Oak Ridge State Wildlife Management Area, which is used for hunting and wildlife viewing. Increased traffic and other visual and noise impacts may have a low to moderate adverse impact to visitors utilizing the wildlife site. The other site alternatives were located three or more miles from the nearest managed area, therefore no adverse impacts are anticipated.

4.5 Wildlife and Vegetation Communities

The potential for the proposed site alternatives to impact terrestrial resources, including wildlife and vegetation communities, can be determined by mapping the current land cover types. If a proposed site contains higher quality habitat, such as forests, the loss of that vegetation would also have a correspondingly greater impact on resident and migratory wildlife.

- Vegetation land cover at each of the alternative sites is predominately forested, with the exception of Site E, which is pasture/hay. Therefore, Site E was considered to have a low impact to terrestrial communities.
- Sites D, G, and J had relatively small areas of forested cover, therefore were ranked as having low to moderate impacts.
- Sites A, C, H, and I are composed of predominately forested cover and are expected to contain a higher diversity of plant and animal communities. Therefore, these sites were considered to have a moderate impact on terrestrial resources.

4.6 Air Quality

The Clean Air Act regulates the emission of air pollutants and, through its implementing regulations, establishes National Ambient Air Quality Standards (NAAQS) for several "criteria" pollutants that are designed to protect the public health and welfare with an ample margin of

safety. The criteria pollutants are carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone, particulate matter (PM10 and PM2.5), and sulfur dioxide (SO_2).

Specified geographic areas are designated as attainment, nonattainment or unclassifiable for specific NAAQS. Areas with ambient concentrations of criteria pollutants exceeding the NAAQS are designated as nonattainment areas, and new emissions sources to be located in or near these areas are subject to more stringent air permitting requirements.

BRF and most of the alternative sites are located in Anderson County, Tennessee which is a nonattainment area for PM-2.5 and 8-hour ozone. Part of Site D is located in Knox County, which is also included in a nonattainment area for PM-2.5 and 8-hr ozone. Site I is located in Roane County, which is currently in attainment for all NAAQS, except for the PM 2.5 standard.

Construction of any of the proposed landfill sites could result in impacts to air quality. Land clearing, site preparation, and vehicular traffic over unpaved roads and the construction site can result in the emission of fugitive dust. Air quality impacts associated with construction would be localized and temporary, and depend on both man-made factors (intensity of activity, control measures, etc.) and natural factors such as wind speed and direction, soil moisture, etc.

Air quality impacts associated with operation of any of the landfill sites would primarily be attributed to wind erosion from the disposal site and fugitive emissions related to transporting and handling of the CCR from BRF to the selected site. Wind erosion from the active landfill would be controlled in accordance with USEPA's dust management requirements and would be similar for any of the proposed landfill sites. However, off-site landfill alternatives will require the transport of CCRs either by truck, rail, or barge. Fugitive dust may be emitted during the loading of CCRs into trucks and the transport of the material to the landfill. Therefore, sites that are located at greater distances from BRF and that pass through more developed areas are less desirable as there is a greater chance to impact residences or other sensitive receptors along the routes.

The amount of fugitive dust generated at each of the alternatives sites is considered to be the same since they would have similar construction and operational phases. In general, fugitive dust generated from construction activities would have a minor, temporary impact on off-site air quality as most emissions would be deposited within the site boundary. Therefore, the air quality impacts are measured by the number of sensitive receptors (i.e., residences) within 200 ft of the haul routes and the distance between the closest residences and the waste limits of the landfill. Measures to minimize fugitive dust associated with transportation and operation would be employed as needed. Therefore, none of the proposed sites are expected to result in high unavoidable adverse air quality impacts.

- At Site I the nearest residence is located approximately 1,100 ft from the waste limits and there are 29 residences within 200 ft of the 25.7 mile haul route. Consequently, there would be low unavoidable adverse air quality impacts for this site.
- Although the nearest residence is located approximately 500 ft from the limits of the landfill for Site J, there would be no residences within 200 ft of the haul road. Therefore, this site is considered to have a low to moderate adverse impact on air quality.

- Sites E and G are located 475 ft and 524 ft (respectively) from the nearest residence. Additionally, there are 58 to 80 residences within 200 ft of the proposed haul routes for Sites E and G, respectively. Site H is located at a much greater distance from the nearest residence, but there are 109 residences located along the 13-mile haul route. Similarly, there are 101 residences within 200 ft of the proposed haul route to Chestnut Ridge. Based on the number of residential receptors in close proximity to the site and haul routes, each of these sites are considered to have a moderate adverse air quality impact.
- Sites A, C, and D are each located within 200 ft of a residence and are characterized by having between 37 and 65 residences along the proposed haul routes. Because of the greater proximity of residences to the immediate site and the moderate number of residential receptors along haul routes, these sites are considered to have a moderate to high adverse air quality impact.

4.7 Noise

Sound is the physical disturbance in a medium, such as air, that is capable of being detected by the human ear. Sound waves in the air are caused by variations in pressure above and below the static value of atmospheric pressure. Noise can be described as unwanted sound. Defining characteristics of noise include sound level (amplitude), frequency (pitch), and duration. Each of these characteristics plays a role in determining a noise's intrusiveness and level of impact on a "noise receptor", or any person or object that hears or is affected by noise. Sensitive noise receptors include residences, churches, cemeteries, schools, and parks.

Sound levels are described on a logarithmic decibel scale, reflecting the relative way in which the ear perceives differences in sound energy levels. A sound level that is 10 decibels (dB) higher than another would normally be perceived as twice as loud while a sound level that is 20 dB higher than another would be perceived as four times as loud. Under laboratory conditions, the healthy human ear can detect a change in sound level as small as 1 dB. Under most non-laboratory conditions, the typical human ear can detect changes of about 3 dB.

Given that the human ear cannot perceive all pitches or frequencies in the sound range, noise measurements are typically weighted to correspond to the limits of human hearing. This adjusted unit of measure is known as the A-weighted decibel, or the dBA. A scale weighting reflects the fact that a human ear hears poorly in the lower octave-bands. It emphasizes the noise levels in the higher frequency bands heard more efficiently by the ear and discounts the lower frequency bands.

The day-night sound level (Ldn) is the 24-hr equivalent noise level with a 10-dBA correction penalty for the hours between 10 p.m. and 7 a.m. to account for the increased annoyance during this period and the fact that most people are more sensitive to noise while they are sleeping. USEPA (1974) guidelines recommend that Ldn not exceed 55 dBA for outdoor residential areas. In Anderson County, allowable noise levels vary depending on the zoning district. Residential (R-1) districts have the most stringent regulations and cannot exceed 60 dBA during the daytime hours or 55 dBA during the night, measured at the closest adjacent property line.

Noise impacts from construction would be temporary and generally limited to the selected landfill site, whereas noise emissions from operations may be expected to be on-going at both the proposed landfill site and along associated haul routes. Based on guidelines used for measuring highway related noise, operation-related noise impacts were evaluated on the number of noise sensitive receptors within 500 ft of the limits of each landfill and the proposed haul routes.

- There are only 27 noise sensitive receptors within 500 ft of Site J. Additionally, this site would utilize an on-site haul route that would not impact any receptors. Therefore, this site would have a low adverse impact.
- Construction and operation at Site A and its associated haul routes would potentially impact 113 noise sensitive receptors. Consequently, this site is expected to result in a low to moderate noise impact.
- Noise emissions from Sites C and E and their associated haul routes would potentially impact 206 and 225 receptors (respectively) and are considered to have a moderate to high noise impact.
- There are 250 to 286 noise sensitive receptors potentially impacted by noise associated with Sites D and I, respectively. These sites were therefore considered to have a moderate to high noise impact.
- There are over 340 noise sensitive receptors within 500 ft of the site or associated haul routes for Sites G, H, and Chestnut Ridge. Due to the high number of receptors near each of these sites, they are considered to have a high unavoidable adverse impact.

4.8 Hazardous Waste

A review of EPA GIS databases and web services using NEPAssist (USEPA 2015b) indicated that there are no Resource Conservation and Recovery Act (RCRA) listed sites, toxic releases, Superfund, Brownfield, sites listed on the Radiation Information Database (RADInfo), or Toxic Substances Control Act (TSCA) sites within limits of any of the proposed alternatives. The current BRF plant is listed as a TSCA location and the Chestnut Ridge Landfill is a RCRA site. None of the sites would involve the acquisition of land potentially containing special or hazardous waste. As a result, ranking of hazardous waste liability concerns associated with land acquisition was considered low for all sites.

4.9 Visual Environment

This assessment provides a review of the visual attributes of existing scenery, along with the anticipated attributes resulting from the proposed action. Visual resources are evaluated based on a number of factors including existing landscape character and scenic integrity. Landscape character is an overall visual and cultural impression of landscape attributes and scenic integrity is based on the degree of visual unity and wholeness of the natural landscape character. The varied combinations of natural features and human alterations both shape landscape character and help define their scenic importance. The subjective perceptions of a landscape's aesthetic quality (scenic attractiveness) and sense of place is dependent on where and how it is viewed.

Visual impacts may be expected to occur as a result of the introduction of a structure or facility that is not consistent with the existing viewshed. Quantification of this impact also considered distance to the nearest park and residences within 1,000 ft of the landfill.

- Sites G, and I are located at a sufficient distance away from parks, natural areas, and residences that the visual impact is little to none.
- Sites C, D, E are not located within a viewshed of a park or natural area, however they are within 1,000 ft of a low number (15 to 30) of residences. Consequently, the change in the landscape character would be small and impact to the visual resource would be low.
- While Site J is located in an area that currently includes industrial development, it is also located in close proximity to a large number of residences (167 residences within 1,000 ft). Consequently, while the change in the landscape character would be small given the composition of the existing landscape, the scenic quality for the residences in the foreground would be diminished as the proposed landfill would be visible to these residents. The implementation of mitigative measures, such as a landscape screen or a berm would minimize this impact. Therefore, the impact of this alternative would be moderate.
- Site H is not located within a viewshed of a park or natural area, and the site is not within 1,000 ft of a large number of residents. However, the site would be readily visible to travelers using the adjacent interstate and would have a moderate impact to the visual resource.
- Site A is located across the Clinch River from Gibbs Ferry Park and would be visible to park users. This is considered to be a moderate to high impact to the viewshed of users of the park.

4.10 Prime Farmland

The 1981 Farmland Protection Policy Act and its implementing regulations (7 Code of Federal Regulations [CFR] Part 658) require all federal agencies to evaluate impacts to prime and unique farmland prior to permanently converting land to a use incompatible with agriculture. Prime farmland soils have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. These characteristics allow prime farmland soils to produce the highest yields with minimal expenditure of energy and economic resources.

The assessment of prime farmland impacts is independent of existing land uses and measures the impact to areas suitable for agricultural production, whether or not these soils are currently in agricultural production. Therefore, the higher the amount of prime farmland that would be converted to landfill use, the higher the impact to potential agricultural land.

Most of the site alternatives include low amounts of soils considered to be prime farmland or farmland of statewide importance. Prime farmland soils comprise approximately 48 acres of Site D. Prime farmland soils comprise 14 acres of Site I and 13 acres on Site J. Prime farmland soils on the remaining sites ranges from 6.4 acres on Site H to two acres on site G. There are no prime farmland soils on Site C.

- Sites A, C, E, G, and H would have little to no impact on prime farmland.

- Site I and J would have a low to moderate impact on prime farmland soils
- Site D would have a moderate impact on prime farmland.

4.11 Floodplains

As a federal agency, TVA is subject to the requirements of Executive Order (EO) 11988, Floodplain Management. The objective of EO 11988 is "…to avoid to the extent possible the long- and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (United States Water Resources Council 1978). The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances. The EO requires that agencies avoid the 100-year floodplain unless there is no practicable alternative.

As part of the initial Siting Study floodplains were considered an exclusion criterion and as such, all alternatives were located outside of established 100-year floodplain boundaries. Therefore, each of the alternative locations in this site screening analysis would avoid impacts to floodplains.

5.0 GEOLOGIC CONDITIONS

The geology of a selected site can help to determine the extent to which a particular site is susceptible to subsurface fracturing and faulting. To support this analysis geologic features of the alternative sites and potential for faulting were evaluated using Rogers (1993). Potential for subsurface fracturing and faulting is related to both the bedrock geology and the karst features such as sinkholes, caves, and springs. Ideally, a geologically preferred site would have high geologic stability and low karst conduit potential.

The 2011 Siting Study (URS 2012a) included an investigation of the suitability of the bedrock geology underlying each landfill site. The study concluded that the Ordovician formations were less suitable for landfill development as these formations are expressed near the ground surface within a series of anticlines and synclines, which have axes generally oriented southwest to northeast across the study area. Dip directions of the formations are generally perpendicular to the anticline/syncline axes. The Ordovician Holston Formation was identified as the least suitable geologic formation due to the Holston Formation's propensity for shallow soils, pinnacled bedrock surface, karst solution features, and low suitability description provided in a previous report describing sanitary landfill sites in Tennessee (TDEC 1972).

The more suitable areas tended to be located in underlying Cambrian and overlying Pennsylvanian to Silurian age formations. Like the aforementioned Ordovician formations, these formations are expressed near the ground surface adjacent to and following the same southeast to northwest strike and dip orientation within the orientations of anticlines and synclines. The Pennsylvanian age Slatesville Shale was identified as the most suitable geologic condition due to its sufficient thickness and moderate topographic relief. Three Cambrian age formations, identified as the Rome Formation, Pumpkin Valley Shale and Nolichucky Shale,

were slightly less suitable than the Slatesville Shale. These formations are of sufficient thickness, have a generally low permeability and generally favorable suitability descriptions in the 1972 report.

5.1 Karst Conduit Potential

Karst conduit potential at each site was evaluated for each site (URS 2012a). The occurrence of karst conditions at a given site represents a notable concern for landfill integrity and would require supplemental engineering measures to reduce risk. Those sites located on geologic formations with low suitability (i.e. Ordovician Formations), were considered having a higher karst conduit potential. For this analysis an increasing karst conduit potential corresponds to an increasingly negative adverse effect of karst on site suitability.

- Sites G, H and I were all considered to be less susceptible to karst conduit flow and were therefore evaluated to have a low potential adverse impact from karst.
- The formation beneath Site J is considered somewhat susceptible to karst conduit flow, however there are no springs or sinkholes mapped in the vicinity. As a result, Site J was considered to have a low to moderate adverse impact from karst.
- Site C was evaluated and considered to be moderately susceptible to karst conduit flow
- Formations beneath Sites D and E are described as generally susceptible to karst conduit flow, and resulted in a ranking of moderate to high adverse impact from karst.
- The formations beneath Site A may be susceptible to karst conduit flow and there are karst conditions in the vicinity of the site. Consequently, this site was considered to be highly impacted by potential karst conditions.

5.2 Geologic Stability

The geologic stability of the alternate sites was considered to vary from low to moderately high. Sites with high stability generally have low topographic relief and formations are considered geologically stable and are therefore considered to be more favorable for landfill development. Conversely, sites with lower stability are those with relatively high to average topographic relief (approximately 200 ft), and that have sinkholes located proximate to the site.

- Site J is considered to have the highest geologic stability.
- Sites C, G, and I are considered moderately stable.
- Sites D, E and H are considered to be moderately stable geologically.
- Site A is ranked lowest in terms of geological stability as the topographic relief is average and there are sizable sinkholes mapped immediately south of the site which could indicate elevated potential for locally large voids beneath the sites.

5.3 Sinkholes and Caves

Sinkholes and caves are karst features that expand on the karst conduit evaluation factor described above as their occurrence is direct evidence of instability and reduced geologic integrity. Among the sites evaluated, there is a small sinkhole included within the limits of Site E (0.003 acre). The presence of this sinkhole on the site reflects a moderate adverse suitability of this site.

There are no sinkholes, caves or springs within any of the other landfill limits.

5.4 Groundwater

Groundwater resources include public water supply wells, sole-source source aquifers, and sinking streams. Within Anderson County the Cambrian-Ordovician Carbonate aquifer is the primary aquifer supplying potable water (Webbers 2000). While localized isolated residences may be expected to withdraw potable water from groundwater, none of the site alternatives coincide with recognized sole-source aquifers or community water supply wells. Consequently potential impacts to these important groundwater features is expected to be low for all alternatives.

5.5 Seismic Zones

There are no faults within most of the site boundaries. Sites E and I have some thrust faults that are considered to be very old and dormant (Rogers 1993). Consequently, they are not considered to represent an important factor in site suitability. As a result, seismic zones were evaluated to have a low adverse impact on suitability.

5.6 Mines and Mineral Resources

There are no mine shafts or previously mined lands within any of the site alternatives. As a result, mines and mineral resources were evaluated to have a low adverse impact on suitability.

6.0 IMPACTS TO THE HUMAN ENVIRONMENT

6.1 Land Use

The land use in the region encompassing all of the alternative sites is mostly undeveloped with some isolated, sparsely developed areas. The greatest impacts, therefore, would be expected at locations determined to be the most inconsistent with the current land use. Sites with adjacent land uses that include industrial use or heavy development would be more consistent with a proposed landfill. For example, Site I is located just north of the Roane Regional Business and Technical Park and Site J is located adjacent to BRF. A landfill built in these areas would be considered to be more consistent with existing land uses than at sites adjacent to residential or parkland uses.

- Site J is located adjacent to an industrial use, BRF. However, because the site is not currently developed for industrial use, the impact on land use is considered to be moderate.
- Site I is located adjacent to an existing light industrial park, but is currently used for farming and surrounded by rural residential development. Consequently, this site is considered to have a moderate to high impact on land use.
- Sites A, C, D, E, G and H are not adjacent to an existing industrial use and impacts to land use are considered to be high.

All landfill sites would have to comply with state and county siting requirements which are described in Section 6.2. In addition, the State of Tennessee has adopted the Jackson Law (Tennessee Code Annotated § 68-211-706) which allows counties in Tennessee that have adopted the law to veto a new landfill based upon eight criteria. If a county adopts this law, it provides that no new construction can be initiated for a landfill without the approval of the county legislative body unless the landfill only accepts waste generated by its owner and all such waste is generated in the same county as the landfill. Anderson and Knox counties have both adopted the Jackson Law. Therefore, since alternative sites A, C, E, G, H, and J are located in Anderson County, these sites would be exempt from the Jackson Law because the landfill would be a private landfill (not open to the public) and receive waste solely generated within the same county (Anderson) by its owner (TVA). However, a portion of Site D is located in Knox County and this site would be subject to the provisions of the Jackson Law since the waste would be generated in Anderson County. Per the TDEC website, Roane County has not adopted the Jackson Law (TDEC 2015b), and therefore the provisions of the Jackson Law would not apply to Site I.

6.2 Zoning

Landfills in the state of Tennessee are regulated by the TDEC Division of Solid Waste Management. A coal ash landfill would be required to obtain a Solid Waste Class II Disposal Permit from TDEC. Once the preferred landfill site is selected, TVA would take necessary actions to obtain the necessary permits. Construction of the landfill would adhere to the provisions outlined in the TDEC Rule Chapter 0400-11-01-.02, Solid Waste Storage Processing and Disposal Facilities. Specific buffer zone standards identified in the rule note that all fill areas must be, at a minimum:

- 100 ft from all property lines
- 500 ft from all residences, unless the owner of the residential property agrees to a shorter distance

As a federal agency, TVA is not subject to state and local zoning laws; nevertheless, TVA considers applicable zoning regulations for the purpose of analyzing impacts. Zoning ordinances for Anderson, Knox and Roane counties do not identify conditions specific to coal ash, or solid waste landfills, but do provide conditions that must be met to allow a sanitary landfill.

Most of the proposed landfill sites are located in Anderson County, where landfills are permitted in the Environmental Industrial (I-3) District, which allows for heavy industrial uses. Landfills are permitted in this district as a special exception following a review by the board of Zoning Appeals. Siting requirements identified in the Anderson County Zoning Ordinance for sanitary landfills include:

- The site must be a minimum of 50 acres,
- Landfill operations shall be no closer than 2,000 ft from any residence, school, or church,
- A 100-foot wide buffer composed of dense evergreen plantings must be provided along all outside boundaries to obstruct vision of landfill operations, and
- Landfills must be located on a public road with at least a 50-foot right of way and pavement width of at least 26 ft.

Site D is located in both Knox and Anderson counties. Coal ash landfills or solid waste landfills are not listed as a permitted use in any district in Knox County. Sanitary landfills are identified as a use permitted on review in the (LI) Light Industrial Zone and the (I) Industrial Zone. Siting standards identified in the Knox County Zoning Ordinance for sanitary landfills include:

- The site shall be located at least 500 ft from all residences, unless the owner(s) of the residential property agree to a shorter distance,
- The site shall be located at least 1,000 ft from a residentially zoned area,
- The site shall be at least 2,500 ft from existing public schools, public recreational areas (public parks, recreation centers, athletic fields, or similar areas available to the general public for recreational uses), or public swimming pools,
- The site shall be at least 1,000 ft upgradient for all wells or springs used a as source of drinking water by humans or livestock,
- The site shall be at least 200 ft from the normal boundaries of springs, streams, lakes or other bodies of water other than those associated with the facility, and
- The fill area shall be at least 200 ft from all property lines, public roads, and the site boundary.

According to the Roane County Regional Zoning Regulations (April 2013), a coal ash landfill would be permitted in a (1-3C) Landfill District. No additional regulations are provided in the ordinance.

Most of the proposed sites are zoned for rural, suburban residential, or agricultural uses. For purposes of this screening, landfill sites that are adjacent to industrial facilities (Site J), as well as those that do not have any residentially zoned land adjacent or nearby (Sites G and H) are considered more favorable than those sites which are zoned for residential use or are proximate to residentially zoned land.

- Site J is located adjacent to an area zoned for industrial use (including an existing CCR landfill), residential areas and a church facility. Consequently, this site was considered to have a low to moderate adverse rating for zoning.
- Zoning for Site I could not be determined from readily available information. However parcel data indicates that this site is primarily used for farming. This site is adjacent to the Roane Regional Business and Technical Park that is planned for warehouse, distribution and office

facilities. Given the uncertainty surrounding this site, relative to the other sites, this site was considered to have a moderate adverse impact ranking for zoning.

- A, C, D, E, G and H are not located near an industrially zoned area. These sites have a moderate to high adverse impact ranking for zoning.
- Site D is not located near an industrially zoned area. In addition, a portion of this site is located in Knox County and therefore it may be subject to provisions of the Jackson Law. Consequently this site has a high adverse impact ranking on zoning and the potential for landfill development.

6.3 Displacements

The analysis of impacts associated with displacements considers residential, commercial, and utility displacements separately as compensation for each of these properties is unique.

Construction of any of the potential new landfill sites would require acquisition of residential properties. The numbers of residences acquired for the site alternatives ranges from none to 22. Potential magnitude of impact is considered in the context of other large land acquisition projects (e.g. highway development or airport expansion) in which residential or commercial displacements may total 100 or more.

- Construction of Sites E, G, H, and I would not require residential displacements.
- In 2013, TVA purchased approximately 166 acres adjacent to the BRF to expand the plant boundary for potential future CCR storage. Thirty-one purchased properties included at least a dwelling, a garage, or an out-building, some of which remained on the properties when TVA took ownership. To protect public health and safety TVA demolished approximately 46 structures on these properties. (TVA 2013). Therefore, use of Site J for the proposed landfill would not require any additional displacements.
- Sites A, C and D would displace 1-5 residences. Consequently, these sites were considered to have a low impact on residential displacements.

None of the sites would require displacement of a commercial property.

Utility impacts were also considered under this criterion. This evaluation considers the length of transmission lines or pipelines and the number of transmission towers that would need to be relocated for each alternate site. A higher number of utility relocations would result in a greater magnitude of impacts in the form of costs to TVA and the utility company. Utility relocations are generally associated with ease of constructability and therefore none of the sites were considered to have high unavoidable adverse impacts.

- Sites A, D, E, G, and I would not require the relocation of utilities.
- Site H would require the relocation of 920 ft of transmission line and one tower.
- Site C would require the relocation of 2,500 ft of transmission line and five towers.
- Site J would require the relocation of a total of 7,744 ft of transmission line and eight towers.

6.4 Property Acquisition

This factor evaluates the potential effect of the acquisition of real property and as such includes those that do not result in residential or commercial displacements. A lower number was considered desirable as this indicates that fewer property owners would be impacted.

- TVA recently acquired 166 acres adjacent to BRF and therefore no landowners would be affected.
- Acquisition of Sites E, G, and H impact 9 to 12 parcels.
- Acquisition of Sites A, C and I impact 20 to 26 parcels.
- Acquisition of Site D would impact 29 parcels.

6.5 Farmland Impacts

Areas that are currently classified as having pasture and hay land cover were considered to be farmed land. Impacts to farmed land were assessed by determining the farmed land within each landfill site that would be converted to landfill use for each alternative. Although areas of land currently farmed would be impacted under any of the landfill sites, none of the impacts are considered to be high given the nature of land use in the area and the relatively small amount of pasture and hayland that would be converted to landfill use for each alternative. None of the site alternatives would result in farm severances.

- Minimal to no acres of pasture and hayland would be converted to landfill use for sites C, H, and I. Consequently, impacts to farmland from these alternatives is low.
- Between 17 to 32 acres pasture and hayland (low to moderate impact) would be converted for sites A, D, G and J.
- Site E is predominately classified as hay and pasture. A total of 97 acres of pasture and hay would be converted to landfill use and is considered to be a moderate impact.

6.6 Public and Semi Public Lands

Public and semi-public lands includes land uses that serve the surrounding community such as health care facilities, churches, cemeteries and schools This factor evaluates the potential effect landfill operations would have on the ability of the community to access and utilize these facilities. There are no churches, cemeteries, schools located approximately 234 feet from Site E and there is a church and cemetery located approximately 545 feet from Site J. Although access to these facilities will be maintained, there may be some impact to ease of movement to these facilities during construction and operation of the landfill.

6.7 Cultural Resources

Federal agencies are required by the National Historic Preservation Act and by NEPA to consider the possible effects of their proposed actions (“undertakings”) on historic properties (generally, “cultural resources”). Cultural resources include, but are not limited to: prehistoric and historic archaeological sites, districts, buildings, structures, and objects; and locations of important historic events that lack material evidence of those events. Cultural resources that are listed, or considered eligible for listing on NRHP maintained by the National Park Service, are called historic properties. To be included or considered eligible for inclusion in the NRHP, a

cultural resource must possess integrity of location, design, setting, materials, workmanship, feeling, and association. It must also be associated with important historical events; or associated with the lives of significant historic persons; or embody distinctive characteristics of a type, period, or method of construction or represent the work of a master, or have high artistic value; or yield information important in history or prehistory. Evaluation of potential impacts to this resource included use of previously developed information regarding previously recorded archaeological sites, an updated search to identify potential NRHP-listed properties, and an evaluation of landscape potential for undiscovered archaeological resources by a senior archaeologist. Additionally, this review considered the results of a Phase I archaeological survey conducted at Site J (TVA 2013).

None of the proposed sites would impact a listed NRHP-listed Historic Property.

- Site J was surveyed for archaeological or architectural properties as part of the Environmental Assessment completed in 2013 (TVA 2013). There were no archaeological or architectural properties listed on, or eligible for, inclusion in the found on the site.
- Site C has a low probability to contain archaeological sites based on a high degree of slope and a low number of streams in the project area. Potential impact to cultural resources from this alternative are therefore, considered to be low.
- Sites D and E are considered to have a low to moderate probability to contain archaeological sites. For Site D this is based on the presence of Old Chestnut Ridge Road in the project area, whereas for Site E this is indicated by the presence of historic development, probably circa mid-19th to 20th century.
- Sites A and G has a moderate probability to contain archaeological resources based on well drained soils and the project area being well watered. Additionally, Site A is located near the Clinch River. Potential impacts to cultural resources from these alternatives are considered to be moderate.
- Sites H and I have a high probability to contain archaeological sites based on well drained soils, the project area being well watered, and the presence of a previously identified archaeological sites located adjacent to the boundary of the project areas. Potential impacts to cultural resources from these alternatives is considered to be moderate.

6.8 Environmental Justice

On February 11, 1994, President Clinton signed EO 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low income Populations. EO 12898 mandates some federal-executive agencies to consider Environmental Justice (EJ) as part of the NEPA. EJ has been defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income (USEPA 2015a) and ensures that minority and low income populations do not bear disproportionately high and adverse human health or environmental effects from federal programs, policies, and activities. Although TVA is not one of the agencies subject to this order, TVA routinely considers environmental justice impacts as part of the project decision-making process.

Guidance for addressing EJ is provided by the CEQ's Environmental Justice Guidance under the National Environmental Policy Act (CEQ 1997). The CEQ defines minority as any race and

ethnicity, as classified by the USCB, as: Black or African American; American Indian or Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; some other race (not mentioned above); two or more races; or a race whose ethnicity is Hispanic or Latino (CEQ 1997). Low income populations are based on annual-statistical poverty thresholds also defined by the US Census Bureau.

Identification of minority populations requires analysis of individual race and ethnicity classifications as well as comparisons of all minority populations in the region. Minority populations exist if either of the following conditions is met:

- The minority population of the impacted area exceeds 50 percent of the total population.
- The ratio of minority population is meaningfully greater (i.e., greater than or equal to 20 percent) than the minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ 1997).

Low-income populations are those with incomes that are less than the poverty level (CEQ, 1997). The 2015 Health and Human Services Poverty Guidelines states that, an annual household income of $24,250 for a family of four is the poverty threshold. For an individual, an annual income of $11,770 or less is below the poverty threshold. A low-income population is identified if either of the following two conditions are met:

- The low income population exceeds 50 percent of the total number of households.
- The ratio of low income population significantly exceeds (i.e., greater than or equal to 20 percent) the appropriate geographic area of analysis.

For this assessment two geographic areas of analysis (i.e., census block group and county) were used to determine potential EJ populations. Potentially affected communities were defined as any census block group that contained any of the proposed landfill sites or along the haul routes used to transport waste to any of the proposed landfill sites. Demographic data by block group were then compared to county-wide data specifically, Anderson, Knox, Loudon, and Roane Counties. Total minority populations (i.e., all non-white racial groups combined and Hispanic or Latino) comprise between 0 to 24.0 percent of the population of the block groups studied. A single minority population based on block group analysis was identified (see Appendix A) approximately one mile west of the proposed haul route to Site E. Given the distance of the haul route to this population, no adverse impacts are expected to any minority population.

The percentages of households within each block group living below the poverty threshold ranged from 6.0 to 36.0 percent. However, households in the block group that contains Site A were 26 percent above Anderson County's (the corresponding county) household poverty rate and households within the block group that includes Site G, were 36 percent above Anderson County's (the corresponding county) household poverty rate. This particular block group contains 397 households of which 143 (36.0 percent) are living below the poverty threshold. Therefore, this block group contains a potential EJ population. No block groups had low-income populations that exceeded 50 percent of the total population in the given block group. Locations of potential EJ populations relative to the proposed landfill sites and haul roads are included in Appendix A.

In accordance with EO 12898, agencies should consider the potential for disproportionate impacts to low income or minority populations resulting from multiple or cumulative exposure to human health or environmental hazards in the affected population. Disproportionately high and adverse human health or environmental effects occur when the risk or rate of exposure to an environmental hazard or an impact or risk of an impact on the natural or physical environment for a minority or low-income population is significant (as defined by NEPA) and appreciably exceeds the impact level for the general population or for another appropriate comparison group (CEQ 1997). Measures to minimize impacts that are implemented during construction and operation of the landfill (such as dust suppression and erosion control measures) will minimize impacts to potential EJ populations. In addition, opportunities would likely be provided to residents with some construction phase employment, thereby providing potential positive impacts to area low income and minority populations. Therefore, none of the potential impacts to EJ populations is considered to be a high adverse impact, no benefit.

None of the other 32 block groups representing the landfill sites and haul roads met the criteria as EJ populations. However, because income information is not available at the block level, smaller populations, such as the trailer parks near Sites C, D, G and J, may not be identified as an EJ population. It is probable that persons in these areas should also be considered as a potential sensitive low income population subject to EJ considerations.

- EJ populations or other sensitive low income populations were not identified near or along the haul routes to Sites E and I. Potential effects to EJ populations from these other alternatives are therefore considered to be low.
- Two areas that may contain a sensitive low income population subject to EJ considerations were preliminarily identified along the haul routes to Sites C, D, and Chestnut Ridge. Potential effects to these populations are therefore considered to be moderate for these alternatives.
- Potential EJ populations were identified along the haul route to Site H. Potential effects to these populations are therefore considered to be moderate.
- One area that may contain a sensitive low income population subject to EJ considerations was identified to the north of Site J. These residents may experience visual impacts and noise impacts as a result of landfill operation. However, this population is buffered from the proposed site by some distance and these impacts could be mitigated by various measures such as construction of a berm, noise barrier, or landscape screen. The haul road would be constructed on-site at an even greater distance from the potential EJ population and is not expected to result in adverse effects to local EJ populations. Potential effects to this population is therefore considered to be moderate to high.
- Potential EJ populations were identified within the block group containing sites A and G. Potential effects to these populations are therefore considered to be moderate to high.

6.9 Economic Impacts

Construction of all of the new landfill sites would result in employment impacts. Employment impacts are measured by jobs lost and jobs generated by the proposed action. None of the alternative sites would displace any major employers and therefore there would be no job

losses. However, construction of any of the landfill sites would result in a temporary positive impact on employment due to the direct use of construction labor.

Secondary employment impacts may also be expected with each alternative site. These impacts are attributable to multiplier effects associated with the capital acquisition of materials and services to support the construction activity. However, as construction costs have not been developed for any of the alternatives at this stage, the benefit cannot be measured. All proposed landfill development site alternatives are considered to have a moderate positive economic benefit due to the expenditure of capital and the potential for construction phase employment. By comparison, Chestnut Ridge would not result in construction related economic impacts and is therefore considered to have a minimal to low economic benefit.

7.0 ENGINEERING CONSIDERATIONS

Major elements of the design and construction of the landfill will be identified for the preferred alternative site. For the purposes of this screening study, the following factors related to landfill development on each site were reviewed.

7.1 Site Capacity

BRF has limited capacity for additional CCR disposal on-site, and within 5 to 7 years, BRF will need additional options for disposal. TVA has determined that approximately 11.1 million cubic yards of disposal capacity is desired for the 13 to 15 year comprehensive disposal plan. Therefore, given the existing capacity, approximately 6 million cubic yards of additional capacity would need to be provided with any of the proposed disposal alternatives. All of the proposed alternatives would provide the necessary capacity to meet objectives of TVAs disposal plan.

7.2 Slope/Soil Stability

The stability of soils on a site is also an important factor to consider for CCR storage suitability. The soil erodibility factor (K-factor) is the susceptibility of soil particles to detachment and transport by rainfall and runoff. While texture is the principal factor affecting the K-factor score, the structure, organic matter, and permeability also contribute to erodibility. The soil erodibility factor ranges in value from 0.02 to 0.69, where a highly-erodible soil is considered to have a K-factor score greater than 0.40. These soils have a high silt content and are easily detached, tend to crust, and are characterized by high runoff rates. It is expected that site soils will be stockpiled and used for landfill cover or berm construction. Therefore, highly erodible soils are not preferred for CCR storage locations.

Soils on the site were assessed to evaluate the suitability of the site for landfill construction. The measure of stability in this category was based on the percent of highly erodible soils on each site as development on highly erodible soils can be unstable. However, the presence of highly erodible soils does not preclude landfill development, but would require special design considerations. The percentage of the site areas that are categorized as having highly erodible soils varies greatly between the alternatives. Sites G and I have the lowest amount with zero

acres. Site H has the highest percentage (60 percent) of the area categorized as highly erodible soils, while Sites A and C also have more than half their area (53 and 55 percent, respectively).

- Highly erodible soils on Sites D, G and I would present no adverse impact to landfill development.
- Highly erodible soils on sites E would present a low to moderate adverse impact to landfill development.
- Highly erodible soils on Sites A, C, H and J would present a moderate impact to landfill development and would require special management and design measures.

7.3 Distance to BRF

Operationally, it is preferred that any CCR landfill be located as close as practical to the source of CCR generation. Transport of CCR to an off-site landfill utilizing public roads has the potential to present a safety issue as additional trucks carrying CCR would be added to the roadways that serve the potential landfill sites. Potential haul routes from BRF to the landfill sites as shown in Figure 3-1 were identified by a traffic engineer with an assumption of the most direct route given consideration of roadway type and function.

While not specifically evaluated in this section, it is recognized that the transport of CCR materials by truck would result in some deterioration of the roadway surface. This impact would be minor on roadways designed to accommodate heavy trucks, however pavement conditions would deteriorate along some of the local narrow roads. However, without specific pavement information, this impact could not be quantified.

- Site J is located within 1 mile of BRF and CCRs would not be transported on a public roadway. Instead, CCRs would be transported via a private access road constructed by TVA. Therefore there would be a low operational impact on safety.
- Sites A, C, D and E are all located within approximately seven miles of BRF and transport to these facilities would result in a low to moderate impact.

  The proposed haul route to Site E primarily utilizes well developed roadways which are designed to accommodate truck traffic (i.e. SR 170, Melton Lake Greenway, and the Oak Ridge Turnpike). However, over half of the haul route to Site A would be along two-lane roadways with a narrow shoulder, or no shoulder, which represents a potential safety issue. The proposed haul route utilizes Lost Ridge Road for 1.11 miles. Lost Ridge Road is a winding narrow roadway with hairpin turns along the proposed route. In contrast, Sites C and D primarily utilize more of SR 170 resulting in less use of narrower local roads. Site C utilizes 0.76 miles and Site D utilizes approximately 1.03 miles of a narrow roadway with little to no shoulder.

- Sites G, H and Chestnut Ridge are located between 9 and13 miles from BRF. Transport of CCR to these sites would present a moderate adverse impact.

  The haul route to the Chestnut Ridge landfill would primarily utilize SR 170 and Fleenor Mill Road, which currently support landfill traffic. The proposed haul route to Site H utilizes the

Chestnut Ridge route, but it also encompasses approximately an additional 2.93 miles of haul route beyond the Chestnut Ridge landfill location. Of the total mileage of the Site H haul route, 2.03 miles are on narrow, two lane road with little to no shoulder. In addition the route to Site H requires a sharp turn onto Crow Lane, which is narrow and not striped. Approximately 3.46 miles of the haul route to Site G incorporates a two lane roadway with little or no shoulder.

- Site I is located the farthest from BRF; however, the route to this site primarily utilizes interstate or major arterial roadways. Therefore, transport of materials to this site would result in a moderate to high adverse impact.

7.4 Traffic Operations

The potential haul routes were evaluated for the effects of transport of CCR to each of the landfill sites. This evaluation included a qualitative analysis of the effect on the level of service of the roadways on the anticipated haul routes. At this stage of the evaluation of alternatives, there were no detailed level of service analyses prepared. The analysis assumed 30 round trips per day were needed to transport CCR to off-site locations (based on the maximum capacity of all CCR products and standard dump volume per day). Given this relatively low number of total trucks per day, the qualitative evaluation concluded that there would be a low impact on traffic operations for all of the off-site locations. There would be no impact to traffic operations associated with Site J as the haul route to this site does not use public roads.

However, Sites E and I require trucks leaving BRF to turn left onto SR 170. For all other sites, trucks leaving BRF would turn right onto SR 170. The left turns required to access Sites E and I are less desirable from a safety standpoint. During the peak hours of traffic flow, trucks would experience increased difficulty turning out of BRF onto SR 170. The addition of these trucks to the traffic flow could result in degradation of safety to other motorists who would be forced to navigate around these additional trucks turning onto SR 170. These left turn movements would result in a moderate impact to traffic operations.

7.5 Transportation and Disposal Cost

Transport of CCR materials from BRF to any of the proposed landfill sites would represent an additional operation cost to the project. In order to estimate cost of transport, a haul rate of $140 dollars per hour (cost of dump truck and operator) was assumed. The cost to transport CCR material was estimated based on the length of haul route, and the calculated travel time from BRF to each of the landfill sites (based on an assessment of posted speeds, road widths and road alignments).

Some travel delay was assumed to occur where a truck would need to make a turn or pass through a major intersection. For example, a delay of 50 seconds was assumed at all signalized intersections, and 20 seconds at all unsignalized intersections where a truck would need to slow down to make a turn from one road to another. These delays were factored into the total travel time along each haul route. The assumptions did not account for typical peak hour delays or delays due to isolated incidents. Peak hour delays are known to occur along

Edgemoor Road (SR 170). It has been reported that westbound traffic backs up east of Melton Lake Drive on SR 170 onto the Clinch River Bridge. This type of delay would affect the haul routes to Sites E and I. Delays are also known to occur on the approach to SR 62 and on the merge from SR 162 to I-40 and vice versa. These types of delays would affect the haul route to Site I. None of these delays were factored into the haul route cost analysis.

Trucking costs increase with distance traveled; therefore, relatively longer distances may not be desirable or feasible from a cost perspective. Assuming an average 14-year disposal plan, lifetime transportation project costs for Site J were estimated to be approximately $1.8M, whereas lifetime costs for other alternatives were estimated to range from approximately $5.4M to $21.2M.

In addition to transportation-related costs, it is also noted that Chestnut Ridge is a privately-owned landfill that would also incur costs related to a tipping fee to dispose of CCR materials. Tipping fees have been estimated at approximately $75 per ton of ash. This fee, together with the transportation cost would elevate the cost of this alternative significantly.

- Site J is located within 1 mile of BRF and CCPs would not be transported on a public roadway. Therefore, there would be a low hauling cost associated with transport of CCR material to this site compared to the hauling costs to the other sites.
- Sites A, C and D are located within approximately 10 miles from BRF and transport of CCR materials would represent a low to moderate hauling cost compared to the other sites.
- Site E is also located within approximately 10 miles from BRF. However, transport costs to this site would also be impacted due to congestion across the bridge that is experienced during peak periods. Transport of CCR materials to this site would represent a moderate transportation cost compared to the other sites.
- Sites G and H, are located between 10 and 14 miles from BRF, which results in a relatively moderate to high transportation cost.
- Site I is located over 25 miles from BRF and the hauling cost associated with trucking CCR materials to this site is relatively high compared to the other sites. Additionally, as mentioned above, this route typically experiences delays at the interchanges along SR 62 and I-40. These delays are not factored into the transportation cost for Site I; therefore, the estimated transportation costs are assumed to be higher than reported.
- Chestnut Ridge is located between 10 and 14 miles from BRF, which results in a relatively moderate transportation cost, however tipping fees associated with this alternative would increase the off-site disposal cost significantly.

7.6 Availability of Cover Soil

This criterion was measured by evaluating the potential for soils on the site to be available for use as a landfill cover. A site that would have adequate cover soil would be preferable as it would not be necessary to haul cover material from a borrow site to the proposed landfill site. Preliminary estimates indicate that the proposed landfill would need two feet of cap system cover soil. For this screening analysis the estimate of availability of cover soil is based on the depth to bedrock at each site. Depth to rock at all of the sites exceeds two feet, therefore adverse impacts associated with this criterion do not exceed the moderate level.

- Depth to rock at Sites A, C, D, E, and J are all approximately 5-ft, therefore there would be a low to moderate impact.
- The bedrock at Sites G, H, and I is much closer to the surface and there is only 2-2.5 ft of cover soil available. Therefore, there would be a moderate impact at these sites.

7.7 Alternate Forms of Transport of CCRs

According to the 2011 Siting Study, rail transport of CCR could be used at Site E and, given their proximity to the river, CCR could be transported to Sites A, G and I by barge. Although these options are desirable from an operational standpoint, impacts associated with these options are not evaluated at this screening level given limited available information at this time.

8.0 CONCLUSIONS

Each of the proposed landfill sites were evaluated against the resource factors related to four general categories, (1) Natural Environment; (2) Geology; (3) Human Environment; and (4) Engineering and Transportation Considerations. The purpose of this analysis is determine the sites that should be carried over for further analysis.

Each of the resource factors were evaluated using professional judgement that synthesized the quantitative indicator data to determine relative impact for the purposes of ranking each alternative landfill site. Considerations of the magnitude of potential impact and significance based on resource sensitivity and context was used to develop an appropriate range of rank scores applied to the alternatives under review for each resource category. For example, for impacts to stream resources the scoring used a full range of values (1 to 5) to appropriately reflect the range of potential impact (0 to approximately 3,200 feet) and the importance of this resource as it relates to the considerations of significance (permit type [Nationwide vs. Individual Section 404 permit], and the burden to demonstrate maximum avoidance and minimization under provisions of Section 404(b)(1)). In contrast, the prime farmland impact magnitude ranged from 0 to approximately 48 acres. However, because this range is not expected to exceed significance thresholds, the rank scoring adopted a range of 1 to 3 to appropriately reflect both magnitude and relative importance of impact. Indicator data are presented in Appendix B and detailed rank scoring results are presented in Appendix C. Table 8-1 provides a general summary of the aggregate rank scoring by resource category.

Table 8-1. Score of Alternative CCR Disposal Sites

Evaluation Criteria	Site A	Site C	Site D	Site E	Site G	Site H	Site I	Site J	Chestnut Ridge
Natural Environment	21	22	23	18	23	24	24	20	17
Geology	13	9	11	13	7	8	7	7	6
Human Environment	28	26	28	24	26	25	21	23	16
Engineering/ Transportation	12	12	10	13	14	16	17	9	13
Total	**74**	**69**	**72**	**68**	**70**	**73**	**69**	**59**	**52**

Note: Based on the analysis summarized in Appendix B, lower scores are more desirable.

Alternative Site A has relatively high impacts on social and economic factors including land use and potential EJ issues. In addition, this site would have the greatest relative impact to geologic and human environment factors. Therefore this site is not recommended to be carried forward for further study.

Alternative Site C has relatively high impacts on natural and human environment factors including air quality and land use. This site has geologic limitations associated with karst conduit potential and a higher percentage of highly erodible soils within the site area. Therefore this site is not recommended to be carried forward for further study.

Alternative Site D has relatively high impacts to air quality and noise due to the high number of residents near the site and along the haul route. This site also include geologic concerns associated with karst conduit potential and the high percentage of highly erodible soils within the site area. Additionally, since the site is partially located in Knox County, it may be subject to the Jackson Law. Overall, this site is ranked as being relatively unfavorable due to geology and having relatively high impacts to human environment. For these reasons, this site is not recommended to be carried forward for further study.

Alternative Site E, has relatively high impacts associated with geologic constraints, largely driven by its karst conduit potential and sinkhole within the site area. Additionally, this site is predominately covered in farmland and would have the greatest impact on farm operations. Although the rank score for this site is similar to Site C, this is the only site with a sinkhole located within the proposed landfill boundary. Additionally, the left turn leaving BRF to merge into traffic crossing the Clinch River bridge would result in safety concerns and bridge would increase the transportation cost of the project. Therefore this site is not recommended to be carried forward for further study.

Alternative Site G has a relatively low score for geological considerations, it has relatively high impacts to the natural environment, especially streams and sensitive noise receptors. There is a potential EJ population that may be impacted and the haul route could impact a high number of adjacent residential receptors. In addition, approximately 3.5 miles of the haul route to Site G

incorporates a two lane roadway with little or no shoulder which presents a potential safety issue. For these reasons, this site is not recommended to be carried forward for further study.

Alternative Site H has relatively high potential impact to the natural environment and has little benefit from an engineering and transportation perspective. The site is located relatively far away from BRF, therefore has higher impacts associated with residential receptors along the haul road. Additionally, the current land cover at the site is almost all forested with a stream, therefore the site would have relatively high impacts to natural resources. Therefore this site is not recommended to be carried forward.

Alternative Site I has relatively low scores for geologic considerations and impacts to the human environment. This site has relatively higher impacts to the natural environment due to the stream and wetland located within the site area. While the site is located the furthest away from BRF, most of the haul route would be located along the interstate, therefore there are fewer residential receptors along the haul route. Additionally, there would be a relatively small number of displacements associated with this site alternative. Additionally, the left turn leaving BRF to merge into traffic crossing the Clinch River bridge coupled with the distance from BRF would result in safety concerns and bridge would increase the transportation cost of the project. Therefore, this site is not recommended to be carried forward for further study.

The Chestnut Ridge landfill is an existing, permitted landfill, therefore there would be no new impacts to the natural or human environment and has sufficient capacity to meet the need for 20 years of storage of CCRs from BRF. The primary impacts identified for this screening analysis are related to the cost associated with transportation of CCRs from BRF to the site. Therefore, this site is recommended to be carried forward for further study.

Alternative Site J is located adjacent to BRF and would have lower impacts associated with the hauling of CCRs. Use of this site, in conjunction with existing onsite storage capacity at BRF would meet the need for the estimated 20 years of storage of CCRs from BRF. The site has favorable geologic conditions. Additionally, development and operation of the site would result in relatively low impacts on the natural environment However, the site is relatively close to existing residential developments and would result in some potential, but mitigable, impacts to EJ populations. Therefore, this site is recommended to be carried forward for further study.

9.0 REFERENCES

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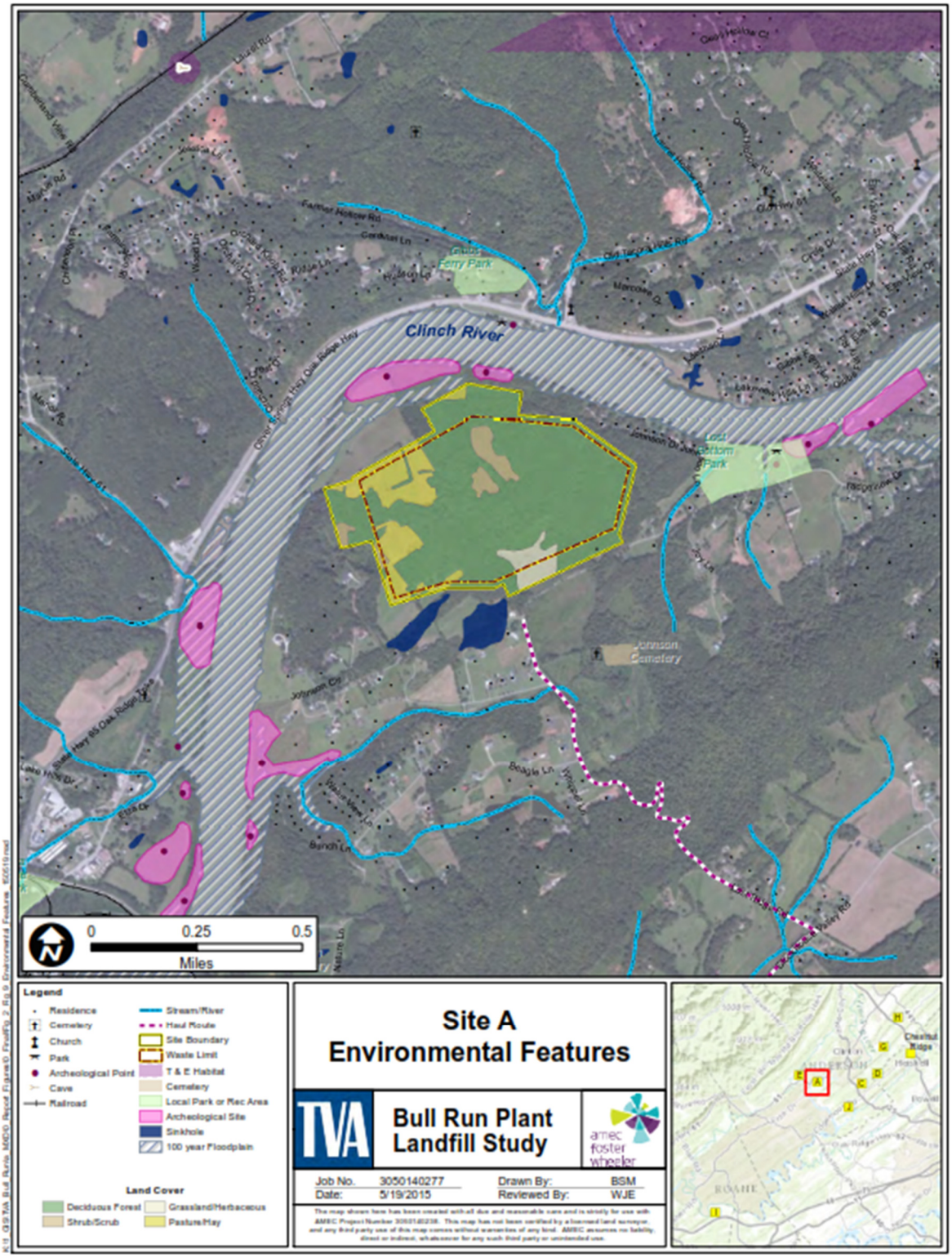
APPENDIX A:
Environmental Features at Alternative Sites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Lost Bottom Park
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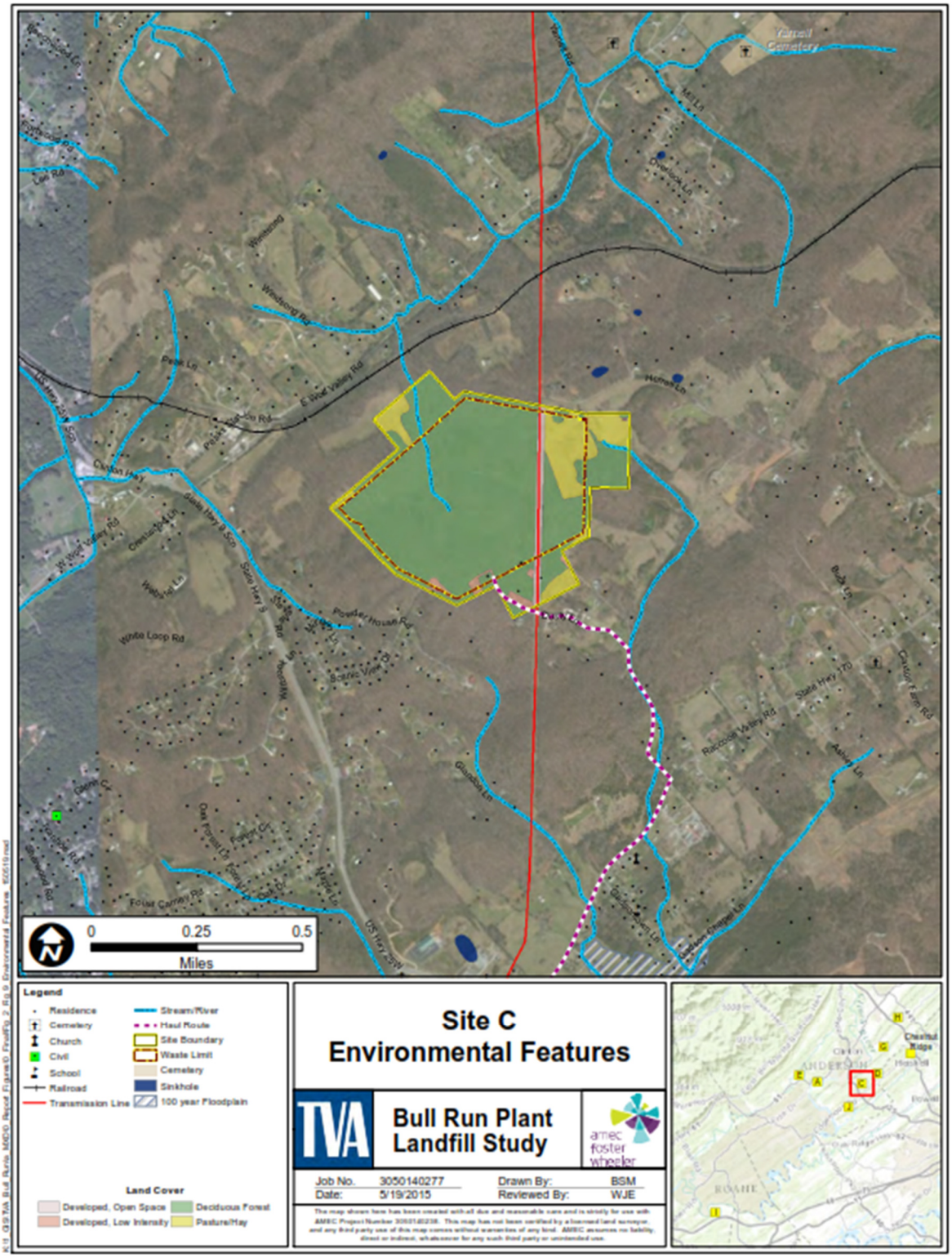
Miles
Legend
Residence
Cemetery
Church
Park
Archeological Point
Cave
Railroad
Stream/River
Haul Route
Site Boundary
Waste Limit
T & E Habitat
Cemetery
Local Park or Rec Area
Archeological Site
Sinkhole
100 year Floodplain
Land Cover
Deciduous Forest
Grassland/Herbaceous
Shrub/Scrub
Pasture/Hay
Site A
Environmental Features
TVA
Bull Run Plant
Landfill Study
amec foster wheeler
Job No. 3050140277
Date: 5/19/2015
Drawn By: BSM
Reviewed By: WJE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Miles
Legend
Residence
Cemetery
Church
Civil
School
Railroad
Transmission Line
Stream/River
Haul Route
Site Boundary
Waste Limit
Cemetery
Sinkhole
100 year Floodplain
Land Cover
Developed, Open Space
Developed, Low Intensity
Deciduous Forest
Pasture/Hay
Site C
Environmental Features
TVA
Bull Run Plant
Landfill Study
amec foster wheeler
Job No. 3050140277
Date: 5/19/2015
Drawn By: BSM
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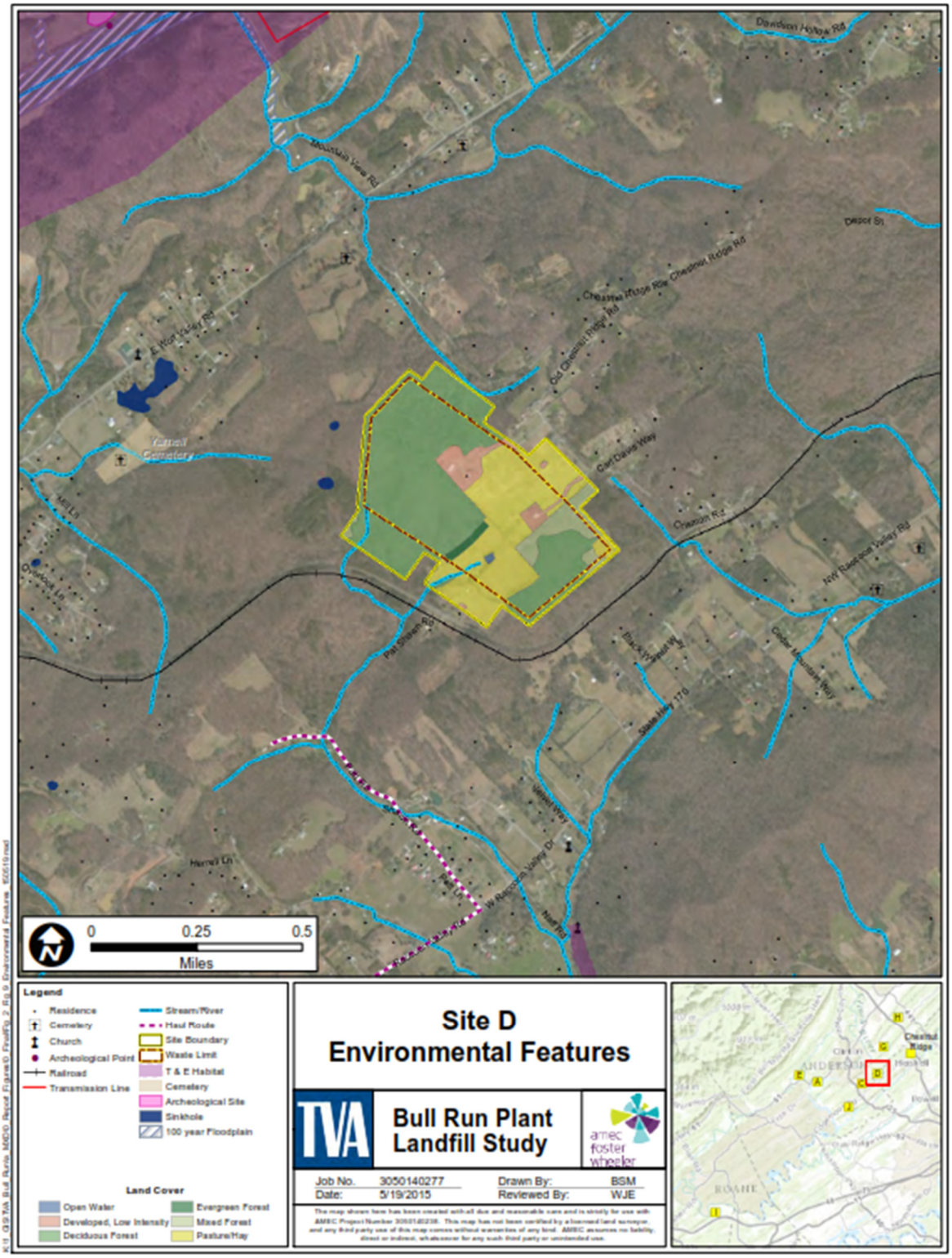
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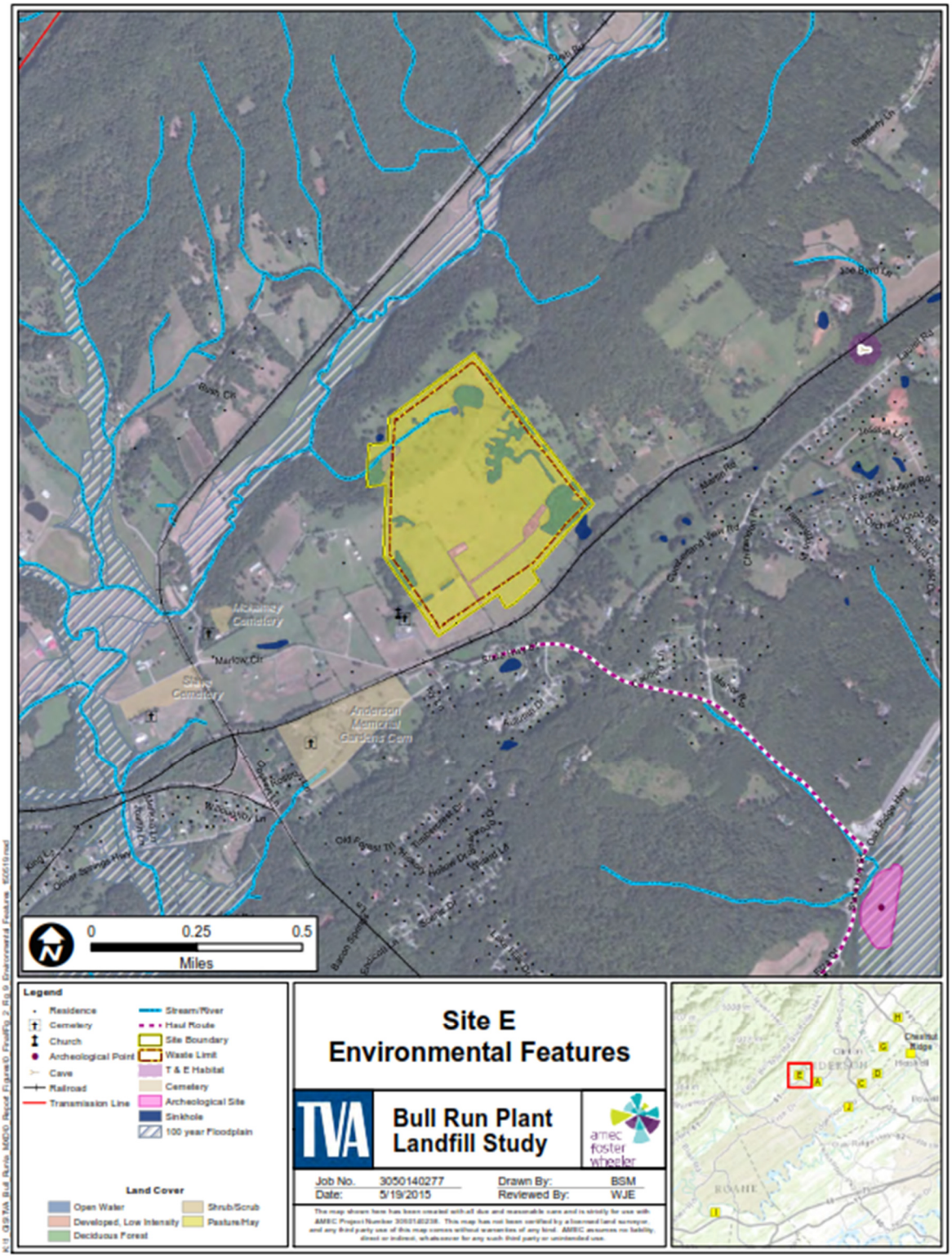
Miles
Legend
Residence
Cemetery
Church
Archeological Point
Railroad
Transmission Line
Stream/River
Haul Route
Site Boundary
Waste Limit
T & E Habitat
Cemetery
Archeological Site
Sinkhole
100 year Floodplain
Land Cover
Open Water
Developed, Low Intensity
Deciduous Forest
Evergreen Forest
Mixed Forest
Pasture/Hay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Church
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Cave
Railroad
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Site Boundary
Waste Limit
T & E Habitat
Cemetery
Archeological Site
Sinkhole
100 year Floodplain
Land Cover
Open Water
Developed, Low Intensity
Deciduous Forest
Shrub/Scrub
Pasture/Hay
Site E
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Landfill Study
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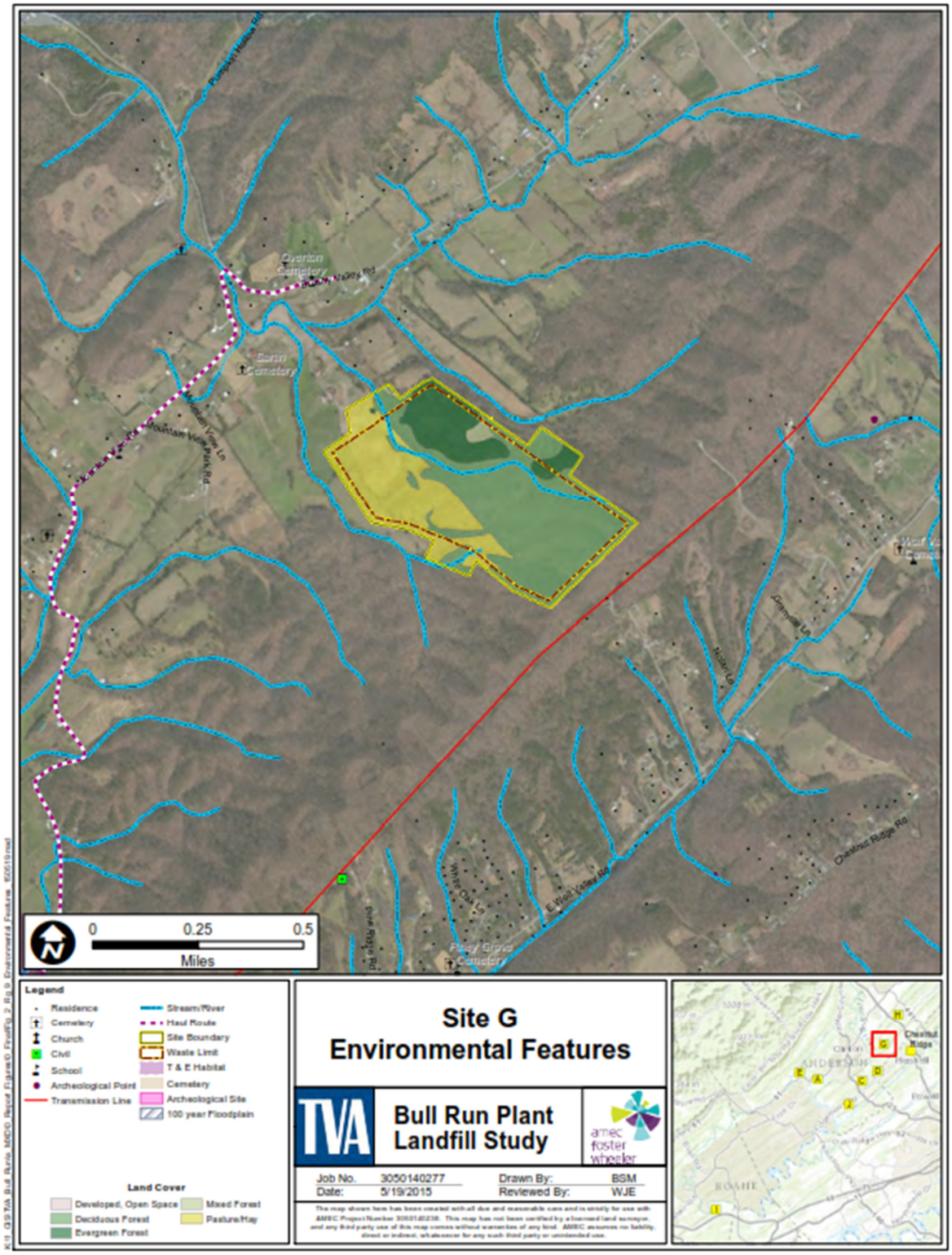
Reviewed By: WJE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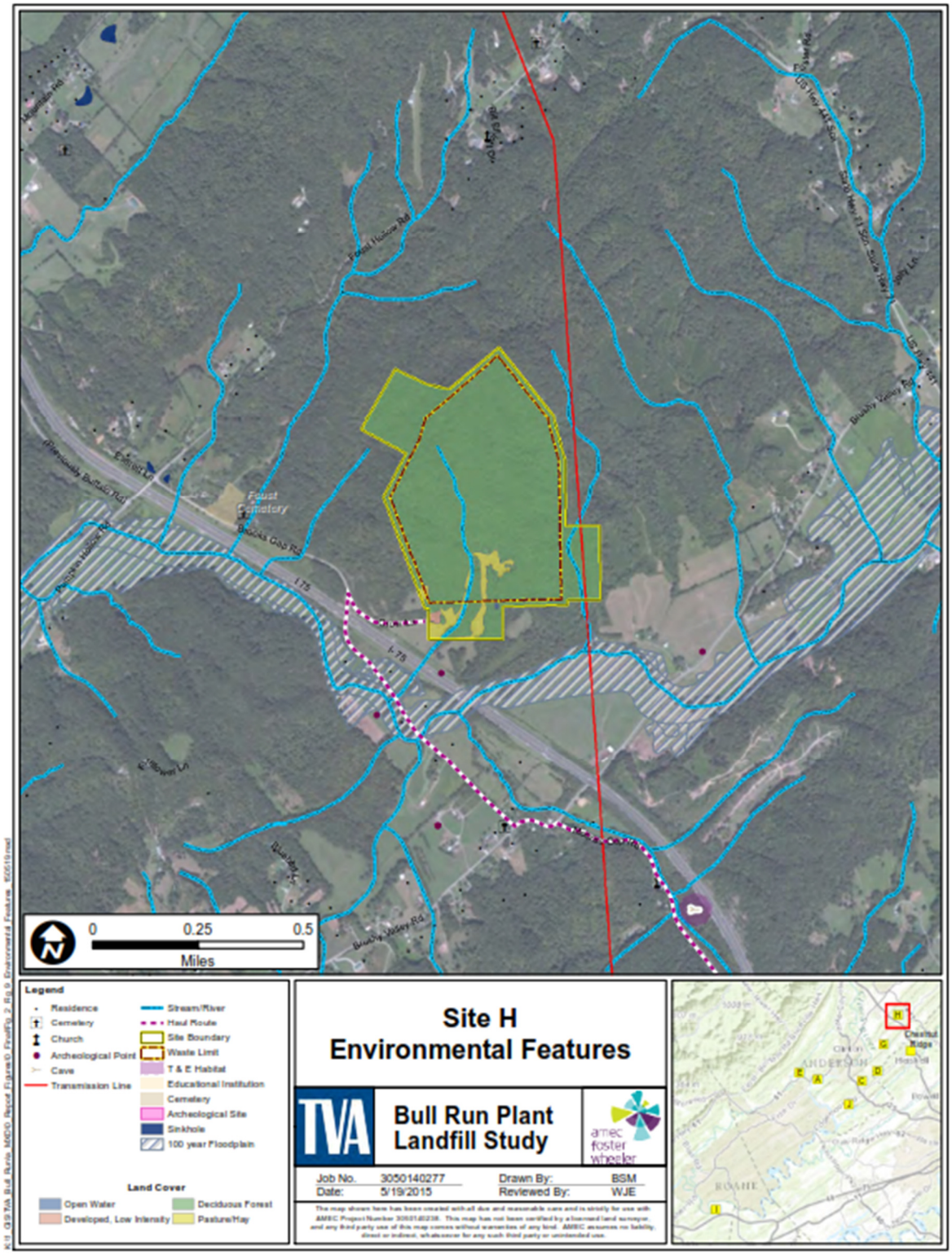
Legend
Residence
Cemetery
Church
Civil
School
Archeological Point
Transmission Line
Stream/River
Haul Route
Site Boundary
Waste Limit
T & E Habitat
Cemetery
Archeological Site
100 year Floodplain
Land Cover
Developed, Open Space
Deciduous Forest
Evergreen Forest
Mixed Forest
Pasture/Hay
Overton Cemetery
Sorrin Cemetery
Pleasant Valley Rd
Chestnut Ridge Rd
E West Valley Rd
Pleasant Ridge Rd
Pleasant Valley Park Rd
Pleasant Valley Ln
Pumpkin Hollow Rd
Amanda Ln
Rosser Ln
White Oak Ln
Pleasant Grove Cemetery
Chestnut Ridge
ANDERSON
ROANE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Cave
Transmission Line
Stream/River
Haul Route
Site Boundary
Waste Limit
T & E Habitat
Educational Institution
Cemetery
Archeological Site
Sinkhole
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Land Cover
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Developed, Low Intensity
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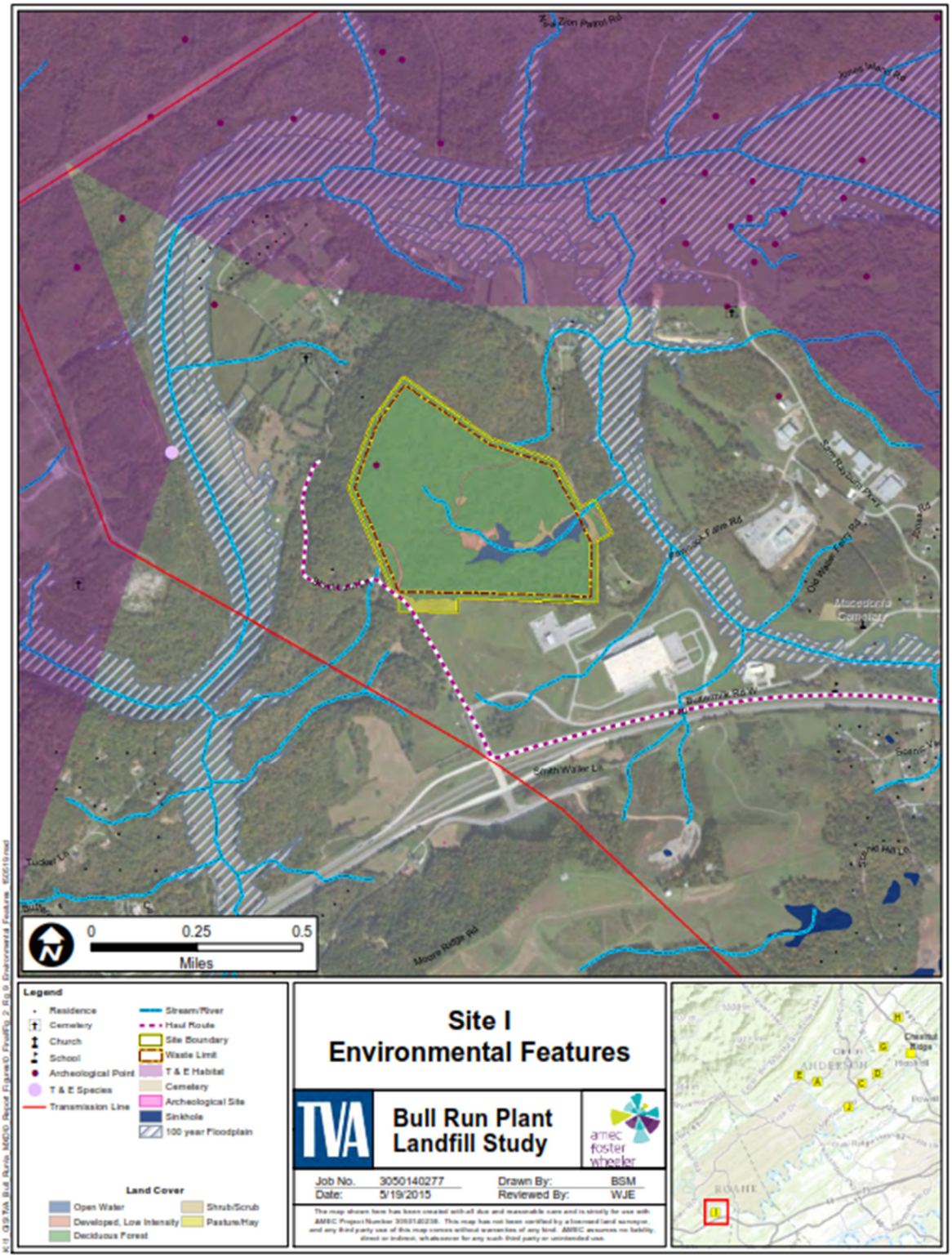
Pasture/Hay
Foust Cemetery
Foust Hollow Rd
Bucks Gap Rd
Bluby Valley Rd
I-75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Waste Limit
T & E Habitat
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Sinkhole
100 year Floodplain
Land Cover
Open Water
Developed, Low Intensity
Deciduous Forest
Shrub/Scrub
Pasture/Hay
Site I
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Bull Run Plant
Landfill Study
amec foster wheeler
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Date: 5/19/2015
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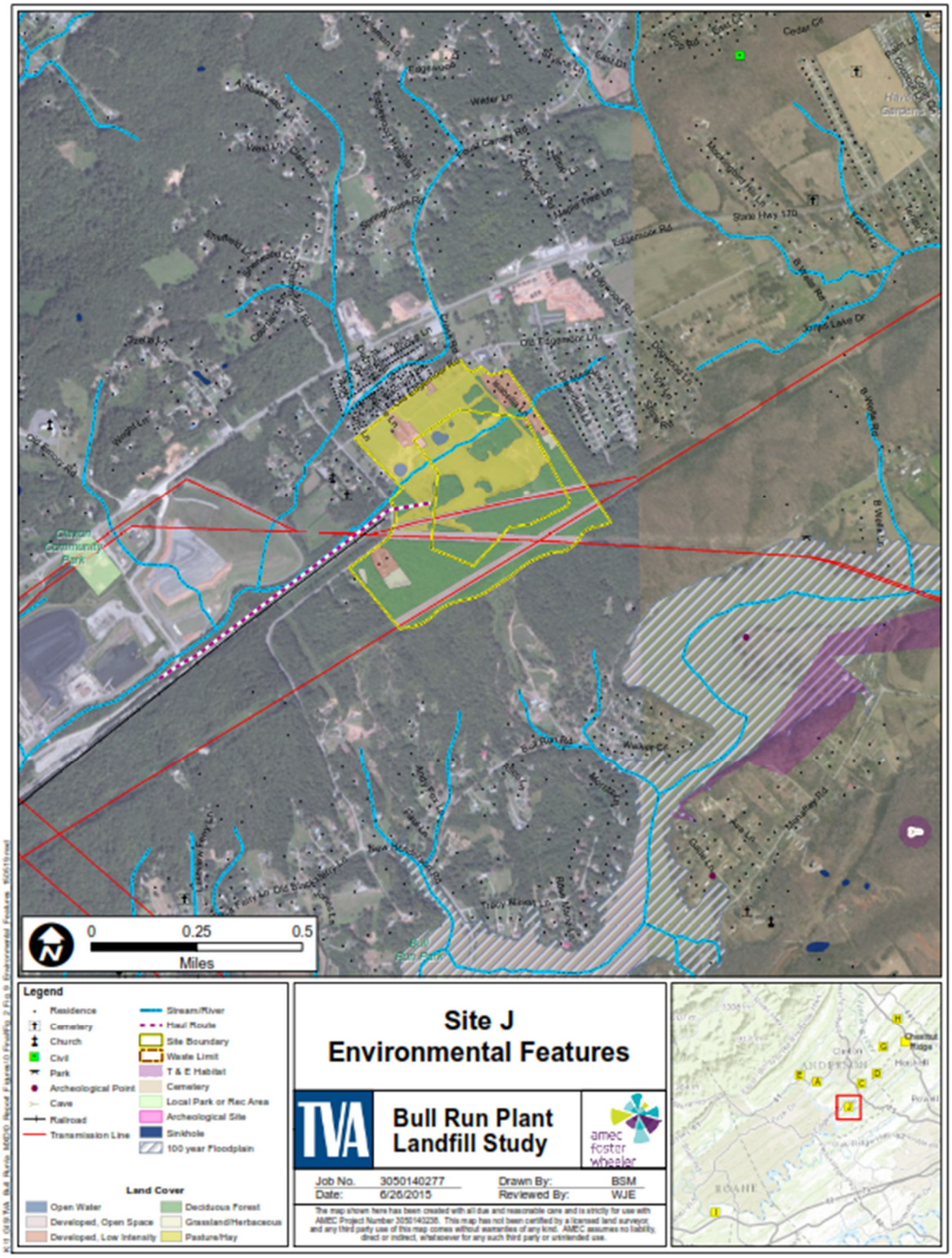
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Cave
Railroad
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Haul Route
Site Boundary
Waste Limit
T & E Habitat
Cemetery
Local Park or Rec Area
Archeological Site
Sinkhole
100 year Floodplain
Land Cover
Open Water
Developed, Open Space
Developed, Low Intensity
Deciduous Forest
Grassland/Herbaceous
Pasture/Hay
Site J
Environmental Features
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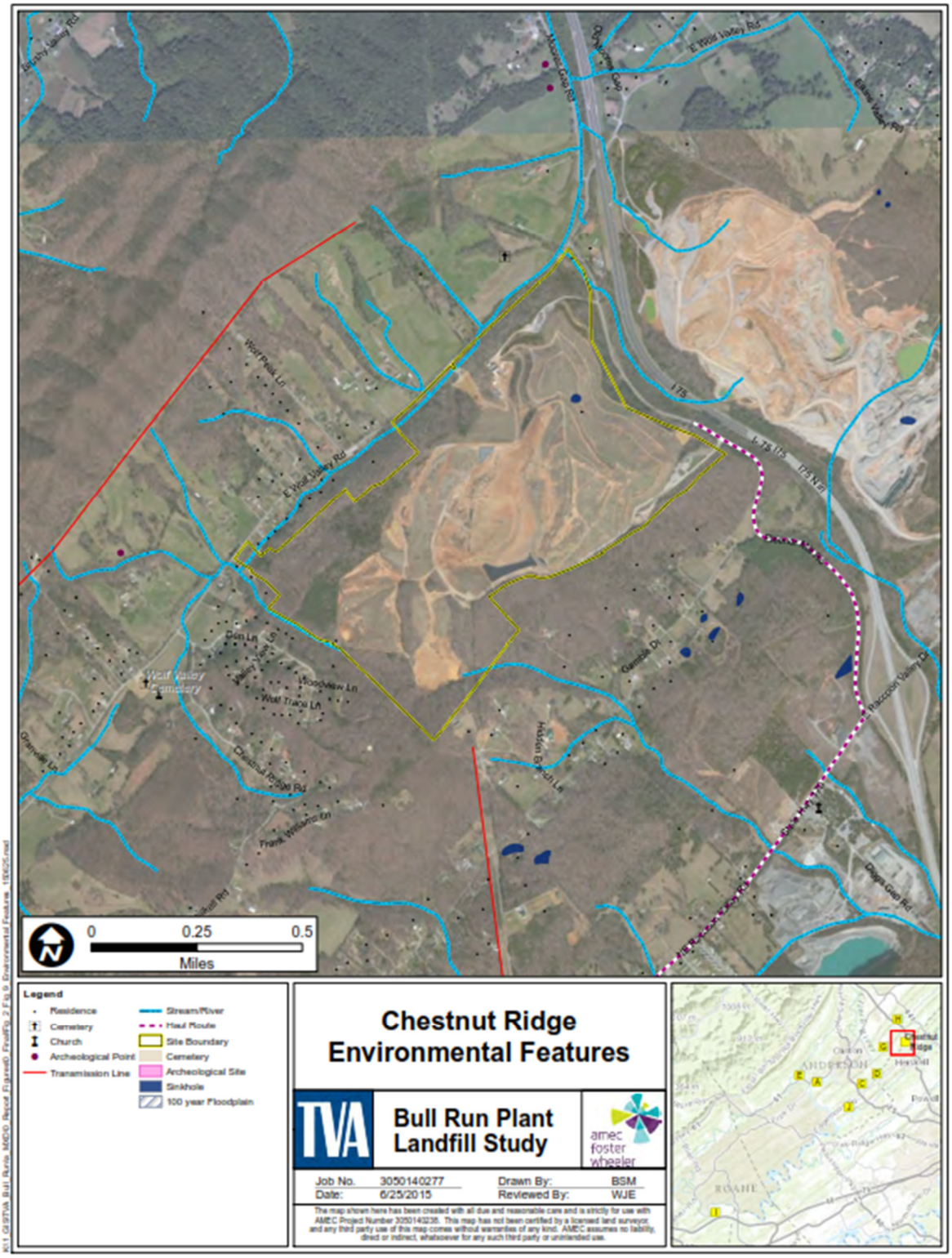
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Reviewed By: WJE
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Archeological Point
Transmission Line
Stream/River
Haul Route
Site Boundary
Cemetery
Archeological Site
Sinkhole
100 year Floodplain
I-75
Wolf Valley Cemetery
Wolf Peak Ln
E Wolf Valley Rd
Woodview Ln
Wolf Trace Ln
Chestnut Ridge Rd
Frank Williams Dr
Hickson Branch Ln
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Raccoon Valley Dr
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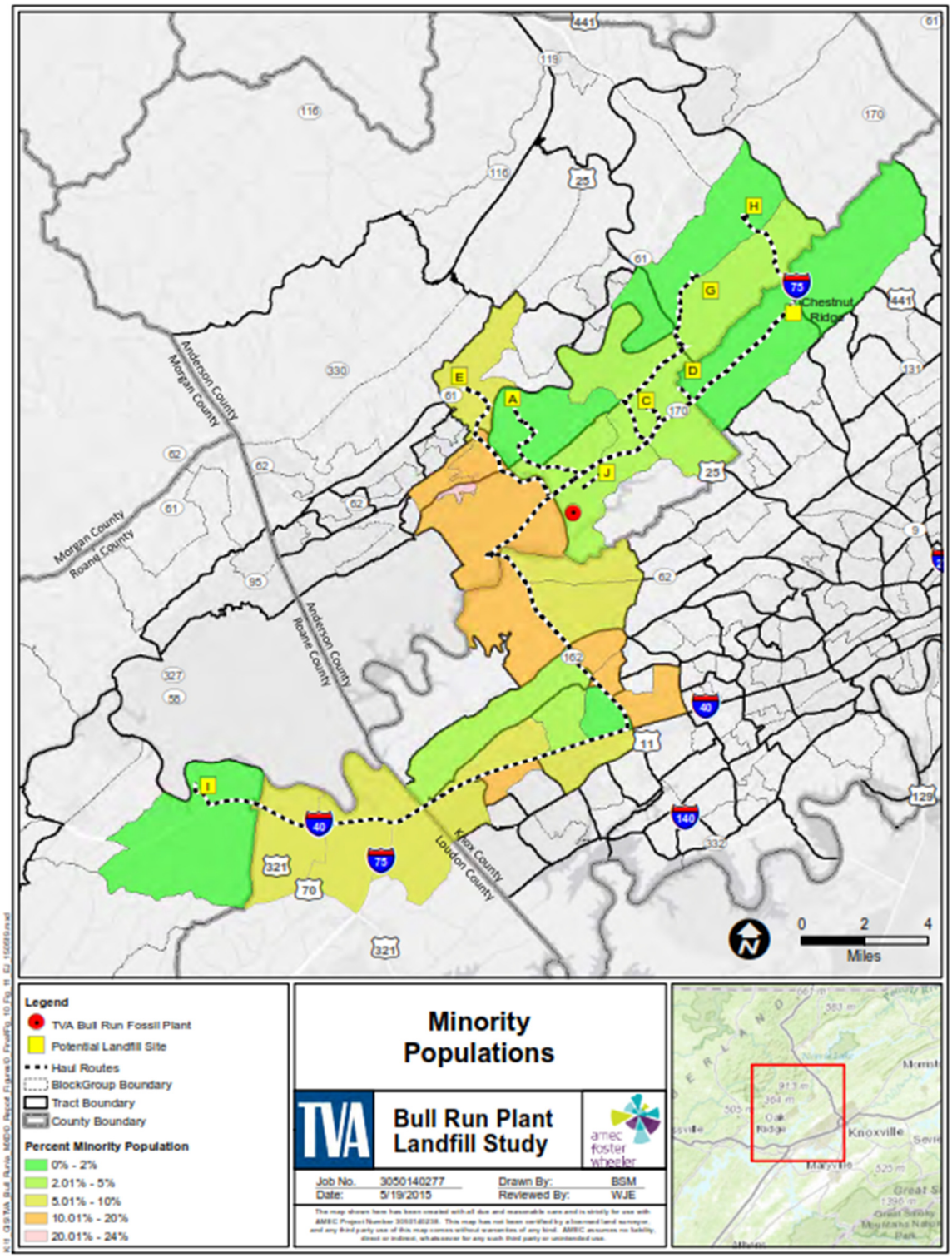
Clayborne Gap
Elkins Valley Rd


Minority Populations
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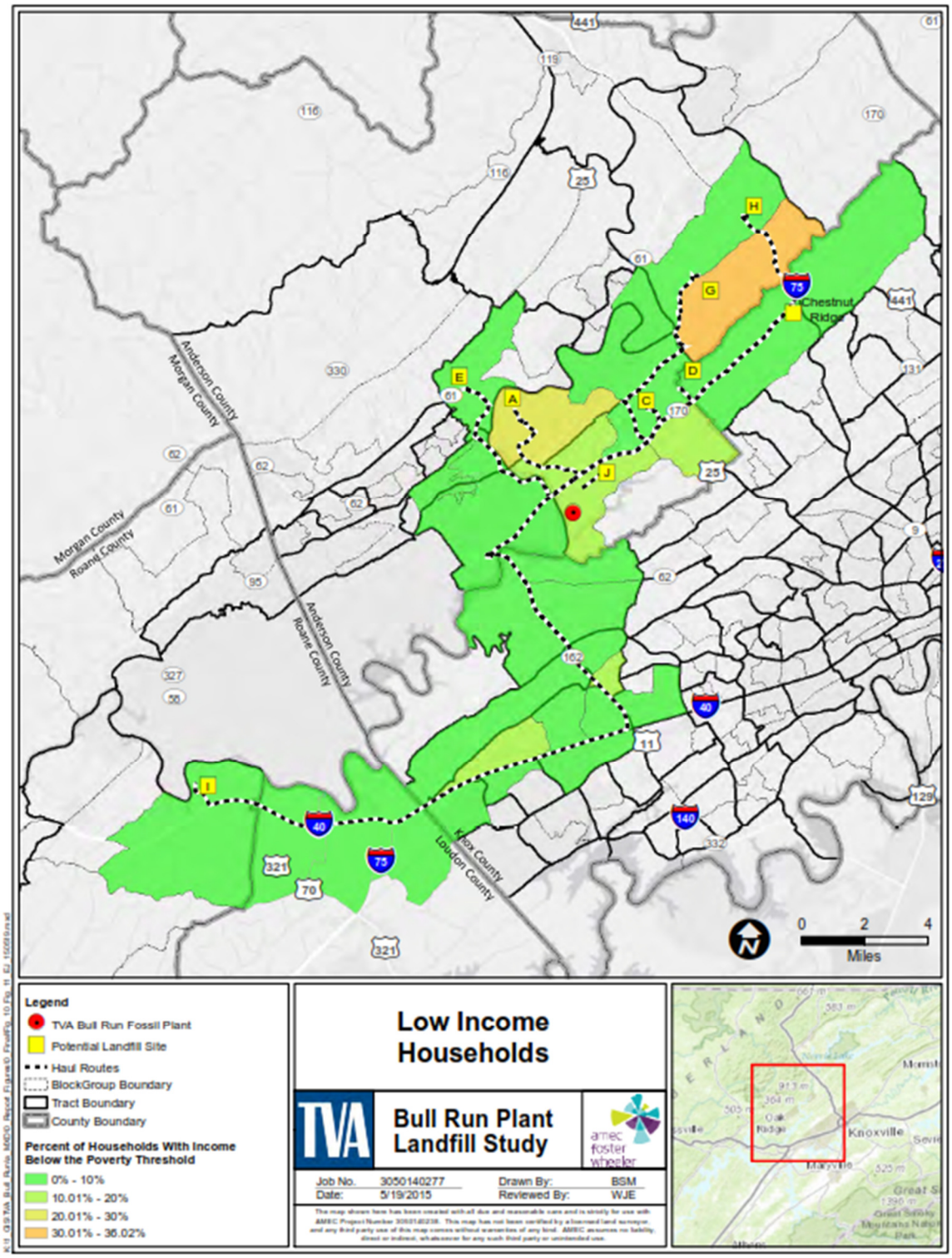
TVA
amec foster wheeler
Job No. 3050140277
Date: 5/19/2015
Drawn By: BSM
Reviewed By: WJE
Legend
TVA Bull Run Fossil Plant
Potential Landfill Site
Haul Routes
BlockGroup Boundary
Tract Boundary
County Boundary
Percent Minority Population
0% - 2%
2.01% - 5%
5.01% - 10%
10.01% - 20%
20.01% - 24%
Anderson County
Morgan County
Roane County
Knox County
Loudon County
Chestnut Ridge
Knoxville
Maryville
0 2 4
Miles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BlockGroup Boundary
Tract Boundary
County Boundary
Percent of Households With Income Below the Poverty Threshold
0% - 10%
10.01% - 20%
20.01% - 30%
30.01% - 36.02%
Job No. 3050140277
Date: 5/19/2015
Drawn By: BSM
Reviewed By: WJE
Anderson County
Morgan County
Roane County
Knox County
Loudon County
Chestnut Ridge
Knoxville
Maryville
0 2 4
Miles

APPENDIX B:
Quantitative Indicator Data

Appendix B: Quantitative Indicator Data

EVALUATION CRITERION	DEFINITION/ CLARIFICATION / METHOD OF MEASUREMENT	INDICATORS	SITE									COMMENTS
			Site A	Site C	Site D	Site E	Site G	Site H	Site I	Site J	Chestnut Ridge	
1.0 NATURAL ENVIRONMENT												
1.1 - Streams	Potential for impact on streams.	Number of streams impacted	0	2	2	1	2	2	1	1		Greater numbers are not desirable
		No. streams crossed (haul routes)	0	0	0	2	0	1	2	0		Greater numbers are not desirable
		Proximity to major waterbody (Clinch River) (ft)	330	9700	5300	5440	6800	19800	1500	7600		Closer proximity is not desrirable.
		Length of stream within waste limit (ft)	0	1,057	272	830	3,226	2,082	2,473	1,175		Longer lengths are not desirable
1.2 - Wetlands	Potential for filling of wetlands.	Acres of PUB/ Open Water resources	0	0	0.25	0.22	0	0.01	6.55	0.61		Greater numbers are not desirable
		Acres of PFO/PEM/PSS resources	0	0	0	0	0	0	0	0		
1.3 - Sensitive Species	Potential to impact known T&E species and critical habitat.	Length to nearest critical habitat (ft)	4163.4	4967.9	3774.7	3711.9	5988.0	3866.1	1001.9	3066.7		Greater numbers are not desirable
		Bat roost tree habitat affected within site (ac)	122	132	96	18	76	150	126	60.78		Greater numbers are not desirable
		Distance to nearest previously recorded T&E species (ft)	52,731 Gray bat	0	52,268 Indiana bat	52,260 Golden Winged Warbler	39,693 Indiana Bat	27,924 Indiana Bat	2,241 Appalachian Bugbane	51,231		Closer proximity is not desrirable.
		Distance to known bald eagle nests	NA	NA	NA	NA	NA	NA	NA	NA	NA	Closer proximity is not desrirable.
		Number of listed species in vicinity	1 Gray Bat	0	1 Indiana Bat	1 Golden Winged Warbler	2 Indiana Bat and Smoky Shrew	2 Indiana Bat and Allegheny Woodrat	2 Gray Bat and Appalachian Bugbane	1 Gray Bat		Greater numbers are not desirable
1.4 - Managed Areas	Potential to impact known publicly managed areas.	Distance to nearest managed area (ft)	4.57	6.42	8.12	4.86	6.08	3.48	0.52	3.89	NA	Greater numbers are not desirable
1.5 - Vegetation/Wildlife	Potential to impact vegetated cover types including: forests, prairies, or other vegetated areas of significance.	Area of forest cover impacted (ac)	94.56	102.27	63.86	12.93	77.28	109.14	108.56	22.56		Larger areas are not desirable.
		Area of open water impacted (ac)	0	0	0.25	0.22	0	0.01	6.55	0.61		Larger areas are not desirable.
		Area of grassland/herbaceous cover impacted (ac)	3.31	0	0	0	0	0	0	0.1		
		Area of pasture/hay cover impacted (ac)	16.5	9.39	30.99	96.65	31.64	3.29	0	24.96		
		Area of scrub/shrub cover impacted (ac)	5.94	0	0	0.23	0	0	1.85	0		Larger areas are not desirable.
		Natural areas impacted (ac)	0	0	0	0	0	0	0	0		Larger areas are not desirable.
1.6 - Air Quality	Potential for impact on air quality. Consideration of fugutive emissions near residential areas.	Site in attainment area (Y/N)	N	N	N	N	N	N	N	N		
		Proximity of site to residential areas (feet)	211	188	198	475	524	1,072	1,098	525		Closer proximities are not desirable. Note: Distance measured from the waste limit to the closest residence.
		No. of residences within 200 ft of haul road	37	50	65	58	80	109	29	0	101	Closer proximities are not desirable. Note: Distance measured from the waste limit to the closest residence.
1.7 - Noise	Impact on sensitive noise receptors (e.g., residence, church, school, library).	No. receptors w/i 500 ft of landfill site and w/in 500 ft of roadway used to transport CCR	113	206	250	225	342	363	286	27	341	Greater numbers are not desirable
1.8 - Hazardous Waste	Consider costs and liabilities incurred from the acquisition of sites potentially containing special / hazardous wastes.	Number of potential special/hazardous waste sites lands to be acquired for landfill	0	0	0	0	0	0	0	0	0	Greater numbers are not desirable
1.9 - Visual Environment	Effects from potential CCR landfill on existing visual environment.	Distance to nearest park/natural area	765	15,579	14,712	6,623	111,774	21,786	30,070	2,847		Shorter lengths are not desirable
		Number of residences within 1,000 ft	23	26	19	15	8	1	6	167		Shorter lengths are not desirable
1.10 - Prime Farmland	Conversion of prime and unique farmland and farmland of statewide or local importance.	Area of prime farmland and farmland of statewide importance impacted (acres)	3.8	0	47.6	4.3	2	6.4	14.5	12.8		Larger areas are not desirable
1.11 - Tennessee NRCS Lands and Century Farms	Impacts to Natural Resources Conservation Program (NRCS) Lands and Century Farms	Number of NRCS program lands impacted										Data not available
		Number of Century Farms impacted										Data not available
1.12 - Floodplains	Potential impacts to FEMA floodplains	Acres of fill in floodplains	0	0	0	0	0	0	0	0		Greater numbers are not desirable

Appendix B: Quantitative Indicator Data

EVALUATION CRITERION	DEFINITION/ CLARIFICATION / METHOD OF MEASUREMENT	INDICATORS	SITE									COMMENTS
			Site A	Site C	Site D	Site E	Site G	Site H	Site I	Site J	Chestnut Ridge	
2.0 GEOLOGY												
2.1 - Karst Conduit Potential	Impacts to geological formations susceptible to subsurface fracturing and faulting (low suitability).	Area of impact to geological formations with low suitability (i.e. Ordovician Formations) (acres)	2	5	4	4	9	8	8	6		Larger areas on unsuitable geologic formations are not desirable. Low score is least desirable
2.2 - Geologic Stability	Based on topographic relief and surface features	Subjective Scale-based on terrain and surface features (sinkholes) that may indicate instability.	3	6	5	5	7	5	7	9		Low score is least desirable.
2.3 - Sinkholes and Caves	Impacts to sinkholes and potential for conduit flow; impacts to caves; impacts to springs	Acres of sinkholes in limits of disturbance	0	0	0	0.002876	0	0	0	0		Greater numbers are not desirable.
		Proximity to cave openings (feet)	5,204	14,171	8,185	3,912	8,348	4,066	10,096	5,435		Closer proximities are not desirable.
		Number of known springs impacted	0	0	0	0	0	0	0	0		Greater numbers are not desirable.
2.4 - Ground Water Resources	Impacts to recharge areas, sole-source aquifers.	Number of public water supply wells impacted	0	0	0	0	0	0	0	0		Greater numbers are not desirable.
		Number of sole-source aquifers impacted										Greater numbers are not desirable.
		Number of sinking streams impacted	0	0	0	0	0	0	0	0		Greater numbers are not desirable.
2.5 - Seismic Zones	Impacts to known fault zones.	Number of faults crossed by proposed CCR storage site	0	0	0	1	0	0	1	0		Greater numbers are not desirable.
2.6 - Mines and Mineral Resources	Proximity of corridor to mine shafts and potential impacts to existing mines and potential mineral resources.	Number of mine shafts impacted	0	0	0	0	0	0	0	0		Greater numbers are not desirable.
		Length (feet) through previously mined lands	0	0	0	0	0	0	0	0		Longer lengths are not desirable.
3.0 HUMAN ENVIRONMENT												
3.1 - Land Use	Evaluate the consistency of the CCR storage site with existing land uses.	Proximity to exsiting commericial/indstrial uses.	5	5	5	5	5	5	3	3	1	1. Site is currently industrial 3. Site is adjacent to industrial land uses 5. Site not adjacent to industrial uses
	Location (County/City)	Is the site located in Anderson County.	Anderson	Anderson	Anderson and Knox	Anderson	Anderson	Anderson	Roane	Anderson		Site in Anderson County is preferred as it wouldn't be subject to the Jackson Law.
3.2 - Zoning	Evaluate the compatibility of proposed site with current zoning.	Current and surrounding zoning as it relates to the foreseeable impact of landfill construction.	3	3	3	3	3	3	2	1	1	1. Site is currently zoned as industrial 2. Site is adjacent to similar use, moderate potential for rezoning 3. Site not adjacent to similar use, low potential for rezoninng
		Compatible with state buffer zone standards?	No	No	No	No	Yes	Yes	No	Yes	Yes	Per TN Solid Waste Processing ad Disposal Rule 0400-11-01-.04
3.3 - Displacements	Residential	Number of residential displacements.	1	5	2	0	0	0	0	0		Greater numbers are not desirable.
	Commercial/Industrial	Number of commercial displacements.	0	0	0	0	0	0	0	0		Greater numbers are not desirable.
	Utilities	Length of transmission lines or pipelines relocated.	0	2,500	0	0	0	920	0	7,744		Greater numbers are not desirable.
		Number of major towers relocated	0	5	0	0	0	1	0	8		
3.4 - Property Acquisition	Private property acquisition required for development of the CCR storage site.	Property acquisition (acres).	157.3	162.0	151.6	133.3	138.1	157.5	141.4	0		Greater numbers are not desirable.
		Number of parcels affected.	21	26	29	9	12	9	20	0		Greater numbers are not desirable.
3.5 - Farmland Impacts	Identify impact to farm operations.	Acres of farmed area converted (pasture).	17	9	31	97	32	3	0	25		Larger areas are not desirable.
		Number of farm severences.	0	0	0	0	0	0	0	0		Greater numbers are not desirable.
3.6 - Public/Semi-Public Lands	Effects to public/semi-public land uses (i.e., churches, special interest groups, schools, etc.).	No. within site.	0	0	0	0	0	0	0	0		Greater numbers are not desirable.
		Distance to nearest church	1,209	3,424	2,812	248	1,590	2,637	3,323	545		Smaller distances are not desirable.
		Distance to nearest cemetery	1,150	3,797	1,565	234	1,398	1,756	1,137	554		
		Distance to nearest school	7,858	5,264	8,158	6,651	10,631	4,943	21,966	7,081		
		Distance to nearest hospital	19,278	38,861	41,433	16,908	51,770	>55,000	>55,000	30,249		
3.7 - Cultural Resources	Effects on NRHP sites or sites likely to be NRHP eligible archeological sites and historical architectural sites.	Number of recorded NRHP sites within alternative boundary.	0	0	0	0	0	0	0	0		Greater numbers are not desirable.
		Number of known archeological sites within site boundary.	0	0	0	0	0	0	1	0		Greater numbers are not desirable.
		Area of impact to high potential archaeological areas (e.g. floodplain terraces) (acre)										Longer distances are not desirable.
3.8 - Community Cohesion	Effects to neighborhoods and communities in the vicinity of the proposed CCR storage site	Number of established neighborhoods affected.	0	0	0	0	0	0	0	0		Greater numbers are not desirable.
3.9 - Environmental Justice	Effects to minority and low-income populations in the vicinity of the proposed CCR storage site	Site located with identified EJ Census block group	Yes	No	No	No	Yes	No	No	No		"Yes" is not desirable
		Other potential sensitive populations adjacent to or along proposed haul routes subject to EJ considerations	0	2	2	0	2	0	0	1		Greater numbers are not desirable.
3.10 - Economic Impacts	Short term employment and tax impacts	Total jobs (direct employment)	NA	NA	NA	NA	NA	NA	NA	NA		Loss of employment is not desirable.
		Tax impacts [property tax and tax equivalent payments ($)]	NA	NA	NA	NA	NA	NA	NA	NA		Higher tax impact is not desirable.

Appendix B: Quantitative Indicator Data

EVALUATION CRITERION	DEFINITION/ CLARIFICATION / METHOD OF MEASUREMENT	INDICATORS	SITE									COMMENTS
			Site A	Site C	Site D	Site E	Site G	Site H	Site I	Site J	Chestnut Ridge	
4.0 ENGINEEERING / TRANSPORTATION												
4.1 - Site Capacity	Is the size of the parcel adequate for anticipated CCR Storage requirements?	Site boundary size (acres)	157	162	153	133	138	158	141	144		
		Fill area size (ac)	120	116	108	112	110	112	120	54		
		Landfill site capacity in million cubic yards	14.2	19	12.1	13.1	16.1	16.7	21.3	6.6		Additional capacity required is 6 million cubic yards
		Expansion Potential	No	Yes	No	Yes	Yes	Yes	Yes	No		
		Potential CCR capacity (years)	28	38	24	26	32	33	42	12		Additional capacity required is 12 years
4.2 - Slope / Soil Stability	Assess the existing slopes to determine if soils on site are stable for CCR storage construction.	% of highly-erodible soils on site	52.8	55.1	6.9	24.5	0.0	59.8	0.0	41.8		Steeper slopes are not desirable; highly erodible soils not desirable.
4.3 - Distance to BRF	Evaluate the distance from BRF to the proposed CCR disposal site to and assess the characteristics of the road network between the two. Determine potential risks associate with transport of CCR on public roadways.	Over-road travel distance between BRF and the proposed site (miles)	4.8	4.2	5.7	6.8	10.3	13.1	25.6	1.2	10.1	Longer distances are not desirable.
4.4 - Traffic Operations	Evaluate the effects on Level of Service along the haul route to the proposed site.	Change in traffic volume on public roadways that would affect the level of service along the haul route (vehicles per day)	30	30	30	30	30	30	30	0		Greater traffic increases have potential to lower the level of service; thus they are less desirable.
4.5 - Potential for Rail	Is rail used to transport CCR from BRF to the proposed site?	Potential for rail transport?	No	No	No	Yes	No	No	No	No		Dependence on rail is not as desirable due to cost.
4.6 - Potential for Barge	Is barge used to transport CCR from BRF to the proposed site?	Potential for barge transport?	Yes	No	No	No	Yes	No	Yes	No		Dependence on barge is not as desirable and introduces more risk due to potential spills directly in the river.
4.7 -Transportation Cost	What is the estimated operational costs of transporting CCR materials by truck?	Round Trip Travel Time (min)	19.0	15.0	20.6	26.0	37.0	46.0	59.2	5.0	30.4	Larger numbers are not desirable.
		Travel Time per day (hrs)-Based on 30 trips/day	9.5	7.5	10.3	13.0	18.5	23.0	29.6	2.5	15.2	Larger numbers are not desirable.
		Daily Haul Cost	$1,330.0	$1,050.0	$1,442.0	$1,820.0	$2,590.0	$3,220.0	$4,144.0	$350.0	$2,128.0	Larger numbers are not desirable.
4.8 - Availability of Cover Soil	Potential rock excavation	Depth to rock (in)	60.5	63.1	61.8	62.8	34.2	25.1	29.3	60.0		Smaller numbers are not desirable
	Is there a suitable amount of cover soil on site to provide a landfill cover?	Volume of cover soil (cu yd); need for borrow material; haul distance from borrow site	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	The need for a borrow site is not as desirable.

APPENDIX C:
Qualitative Rank Scoring

Appendix C: Qualitative Ranking Scoring

EVALUATION CRITERION	DEFINITION/ CLARIFICATION / METHOD OF MEASUREMENT	SITE								
		Site A	Site C	Site D	Site E	Site G	Site H	Site I	Site J	Chestnut Ridge
1.0 NATURAL ENVIRONMENT										
1.1 - Streams	Potential for impact on streams.	1	3	2	2	5	3	4	3	1
1.2 - Wetlands	Potential for filling of wetlands.	1	1	1	1	1	1	3	2	1
1.3 - Sensitive Species	Potential to impact known T&E species and critical habitat.	2	2	2	2	2	2	2	2	1
1.4 - Managed Areas	Potential to impact known publicly managed areas.	1	1	1	1	1	1	2	1	1
1.5 - Vegetation/Wildlife	Potential to impact vegetated cover types including: forests, prairies, or other vegetated areas of significance.	3	3	2	1	2	3	3	2	1
1.6 - Air Quality	Potential for impact on air quality. Consideration of fugutive emissions near residential areas.	4	4	4	3	3	3	1	2	3
1.7 - Noise	Impact on sensitive noise receptors (e.g., residence, church, school, library).	2	3	4	3	5	5	4	1	5
1.8 - Hazardous Waste	Consider costs and liabilities incurred from the acquisition of sites potentially containing special / hazardous wastes.	1	1	1	1	1	1	1	1	1
1.9 - Visual Environment	Effects from potential CCR landfill on existing visual environment.	4	2	2	2	1	3	1	3	1
1.10 - Prime Farmland	Conversion of prime and unique farmland and farmland of statewide or local importance.	1	1	3	1	1	1	2	2	1
1.12 - Floodplains	Potential impacts to FEMA floodplains	1	1	1	1	1	1	1	1	1
Natural Environment Totals		**21**	**22**	**23**	**18**	**23**	**24**	**24**	**20**	**17**
2.0 GEOLOGY										
2.1 - Karst Conduit Potential	Impacts to geological formations susceptible to subsurface fracturing and faulting (low suitability).	5	3	4	4	1	1	1	2	1
2.2 - Geologic Stability	Based on topographic relief and surface features	4	2	3	3	2	3	2	1	1
2.3 - Sinkholes and Caves	Impacts to sinkholes and potential for conduit flow; impacts to caves; impacts to springs	1	1	1	3	1	1	1	1	1
2.4 - Ground Water Resources	Impacts to recharge areas, sole-source aquifers.	1	1	1	1	1	1	1	1	1
2.5 - Seismic Zones	Impacts to known fault zones.	1	1	1	1	1	1	1	1	1
2.6 - Mines and Mineral Resources	Proximity of corridor to mine shafts and potential impacts to existing mines and potential mineral resources.	1	1	1	1	1	1	1	1	1
Geology Totals		**13**	**9**	**11**	**13**	**7**	**8**	**7**	**7**	**6**
3.0 HUMAN ENVIRONMENT										
3.1 - Land Use	Evaluate the consistency of the CCR storage site with existing land uses.	5	5	5	5	5	5	4	3	1
3.2 - Zoning	Evaluate the compatibility of proposed site with current zoning.	4	4	5	4	4	4	3	2	1

Appendix C: Qualitative Ranking Scoring

EVALUATION CRITERION	DEFINITION/ CLARIFICATION / METHOD OF MEASUREMENT	SITE								
		Site A	Site C	Site D	Site E	Site G	Site H	Site I	Site J	Chestnut Ridge
3.3 - Displacements	Residential	2	2	2	1	1	1	1	1	1
	Commercial/Industrial	1	1	1	1	1	1	1	1	1
	Utilities	1	3	1	1	1	2	1	4	1
3.4 - Property Acquisition	Impact of property acquisition	3	3	4	2	2	2	3	1	1
3.5 - Farmland Impacts	Impact on farm acreage and operations	2	1	2	3	2	1	1	2	1
3.6 - Public/Semi-Public Lands	Effects to public/semi-public land uses (i.e., churches, special interest groups, schools, etc.).	1	1	1	2	1	1	1	2	1
3.7 - Cultural Resources	Effects on NRHP sites or sites likely to be NRHP eligible archeological sites and historical architectural sites.	3	1	2	2	3	3	3	1	1
3.8 - Community Cohesion	Effects to neighborhoods and communities in the vicinity of the proposed CCR storage site	1	1	1	1	1	1	1	1	1
3.9 - Environmental Justice	Effects to minority and low-income populations in the vicinity of the proposed CCR storage site	4	3	3	1	4	3	1	4	3
3.10 - Economic Impacts	Short term employment and tax impacts	1	1	1	1	1	1	1	1	3
Human Environment Totals		**28**	**26**	**28**	**24**	**26**	**25**	**21**	**23**	**16**
4.0 ENGINEEERING / TRANSPORTATION										
4.1 - Site Capacity	Is the size of the parcel adequate for anticipated CCR Storage requirements?	1	1	1	1	1	1	1	1	1
4.2 - Slope / Soil Stability	Assess the existing slopes to determine if soils on site are stable for CCR storage construction.	3	3	1	2	1	3	1	3	1
4.3 - Distance to BRF	Evaluate the distance from BRF to the proposed CCR disposal site to and assess the characteristics of the road network between the two. Determine potential risks associate with transport of CCR on public roadways.	2	2	2	2	3	3	4	1	3
4.4 - Traffic Operations	Evaluate the effects on Level of Service along the haul route to the proposed site.	2	2	2	3	2	2	3	1	2
4.7 - Transportation Cost	Daily haul cost to transport CCR materials from BRF (based on truck travel time and tipping costs)?	2	2	2	3	4	4	5	1	5
4.8 - Availability of Cover Soil	Is there a suitable amount of cover soil on site to provide landfill cover?	2	2	2	2	3	3	3	2	1
Engineering / Transportation Totals		**12**	**12**	**10**	**13**	**14**	**16**	**17**	**9**	**13**
Total Site Scores		**74**	**69**	**72**	**68**	**70**	**73**	**69**	**59**	**52**

Score Definitions:
1: No to low unavoidable adverse impact, moderate benefit
2: Low to moderate adverse impact, low to moderate benefit
3: Adverse impact moderate, low benefit
4: Moderate to high adverse impact, minimal to low benefit
5: High unavoidable adverse impact, no benefit